Tata Institute of Fundamental Research
टाटा मूलभूत अनुसंधान संस्थान

Batch System at TIFR

The 6th Asian Tier Center Forum

Krabi, Thailand

Nov 21 - 24, 2022

Puneet Kumar Patel, Brij Kishor Jashal, Kajari Mazumdar, Gobinda Majumder

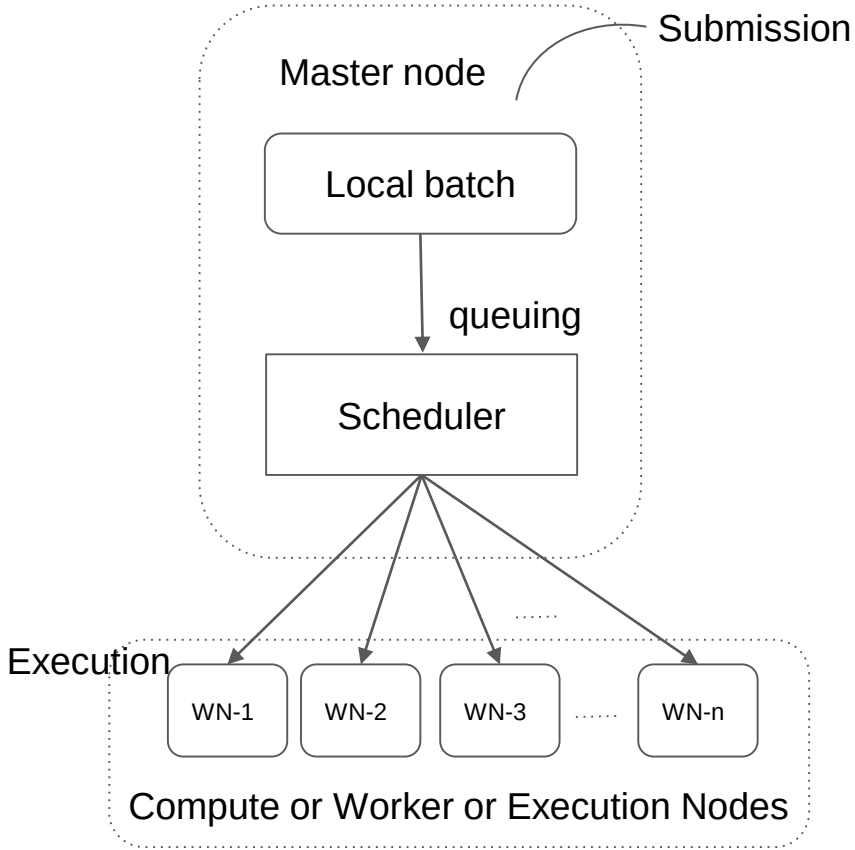
Highlights

- Basic Understanding - Introduction
- Evolution of batch system at TIFR
- Why HTCondor
- HTCondor Versions and experiences
- Future Activity

Introduction

What is Batch System and need ?

- Submitting and controlling the tasks
- Having single or multiple queuing facility
- Categories the queues based upon group or attributes of resources



Evolution of Batch System at TIFR

Year	CPU (HT enabled)	Workload Manager		Operating System
2009	150	Torque / PBS	**Available from:** gLite	SL3
2010	240	Torque / PBS	gLite	SL4
2011	275	Torque / PBS	gLite	
2012	300	Torque / PBS	gLite	
2013	300	Torque / PBS	gLite	
2014	600	CREAM-CE	gLite	SL5
2015	650	CREAM-CE	gLite	
2016	1200	CREAM-CE	gLite	
2017	1400	Condor-8.6.2 and HTCondorCE-3.1.x	https://htcondor.org/ or https://batchdocs.web.cern.ch/index.html	SL6 / CentOS6
2018	2000	Condor-8.6.2 and HTCondorCE-3.1.x		
2019	3000	Condor-8.8.8 and HTCondorCE-3.4.x		
2020	5000	Condor-8.8.8 and HTCondorCE-3.4.x		SL7 / CentOS7
2021	14000 (active 3.3K)	Condor-8.8.8 and HTCondorCE-3.4.x		
2022	14000 (active 3.3K)	Condor-9.0.16 and HTCondorCE-5.1.5 Condor-9.0.17 and HTCondorCE-5.1.6		

* Version of the software may differ with respect to year and OS in this table

source: wikipedia

- We were fortunate to start with stable versions of gLite in 2009
- Torque is no longer open-source
- Suggestion was to upgrade with min. LTS version 9.0.5 in 2022

Why HTCondor ?

Reasons of migration from CREAM to HTCondor

- Support of CREAM-CE ended in 2020
- Around 90 WLCG sites had CREAM-Ce – most of them migrated to HTCondor
- Open-source and free under the Apache License 2.0, used in HPC and HTC
- Can be used for any purpose, free to distribute and modify as per the terms of the license
- No concern of royalty
- Can handle sequential and parallel jobs with different universe i.e. vanilla, local, grid etc.
- Able to talk to different batch system i.e. Torque/PBS, LSF, SGE, Slurm and different resources i.e. grid and cloud
- Widely deployed in universities, labs, financial sector, animation industries, grid computing, WLCG etc.

New Sites need to do

- Uses of WLCG tokens instead of GSI authentication
- Version 8.8.8 does not support token authentication
- Sites have to go with package: HTCondor>=9.0.5 and HTCondorCE>=5.0.0

HTCondor Versions: features

version 8.6.x released on Jan, 2017

- scalability upto 200K slots in one pool
- Introduced docker job universe
- IPv6 support enabled
- Encryption of job execution directory
- checkpoint support in Vanila universe
- SELinux compatible
- Integration HTCondor and singularity

…… and many more

For more details like, features and bug fix, you may refer the release notes:
https://htcondor.readthedocs.io/en/v8_8/version-history/stable-release-series-86.html#version-8-6-0

HTCondor Versions: features, cont..

version 9.0.x released on Apr, 2021

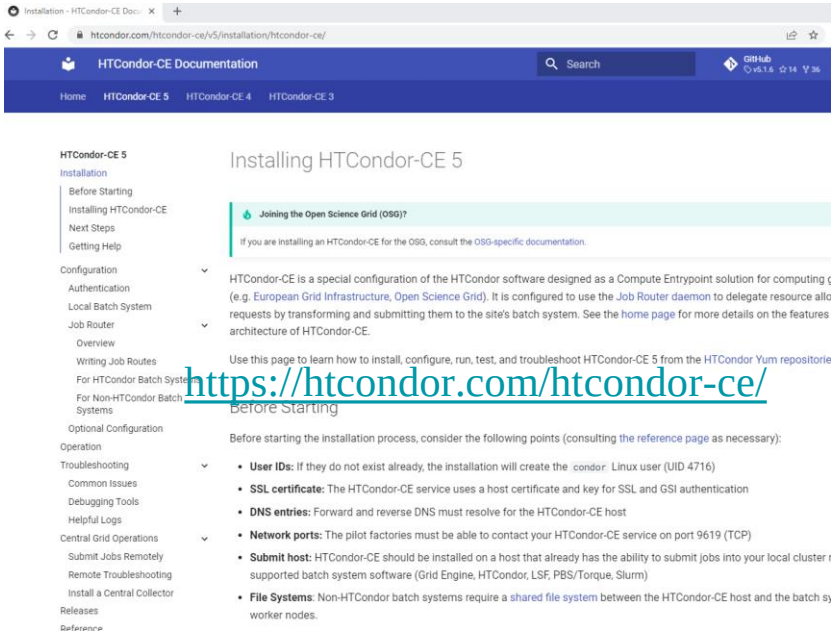
- IDTOKEN has been included
- GPU discovery tools have been added
- SciTokens mapping failures more prominent in the daemon logs
- Singularity jobs mount under /tmp and /var/tmp under the scratch directory, not in tmpfs
- Increased the length of the password generated from 14 to 32 char. for Windows

…. and many more

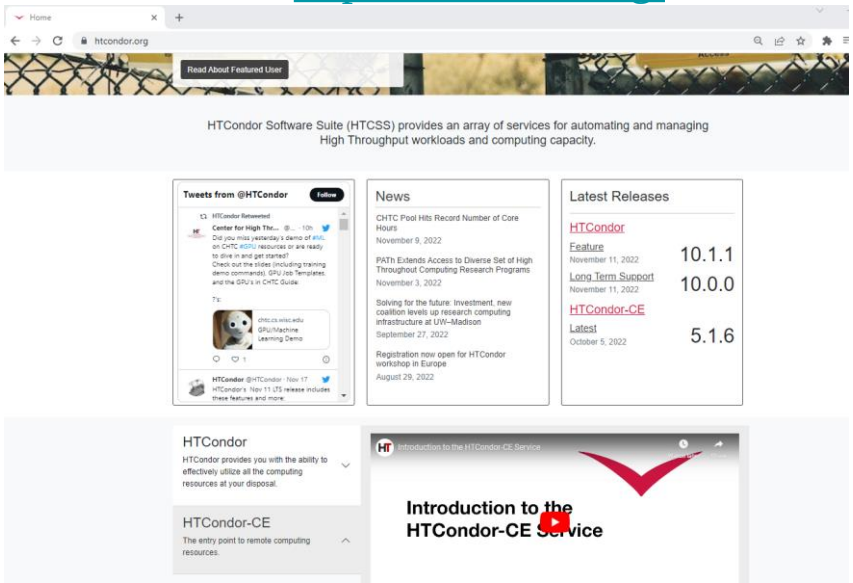
For more details like, features and bug fix, you may refer the release notes: https://htcondor.readthedocs.io/en/latest/version-history/stable-release-series-90.html#version-9-0-0

HTCondor Installation sources

https://htcondor.org/



https://htcondor.com/htcondor-ce/



In Addition, refer:

https://batchdocs.web.cern.ch/ and

https://htcondor.readthedocs.io/en/latest/version-history/stable-release-series-90.html#:~:text=HTCondor%20version%209.0.,released%20on%20September%2029%2C%20202

Packages and services

Head Node:

```
# rpm -qa |grep condor
htcondor-release-9.0-2.el7.noarch
htcondor-ce-5.1.6-1.el7.noarch
htcondor-ce-client-5.1.6-1.el7.noarch
htcondor-ce-condor-5.1.6-1.el7.noarch
condor-9.0.17-1.el7.x86_64
condor-procd-9.0.17-1.el7.x86_64
condor-externals-9.0.17-1.el7.x86_64
condor-classads-9.0.17-1.el7.x86_64
python2-condor-9.0.17-1.el7.x86_64
python3-condor-9.0.17-1.el7.x86_64
```

```
# start condor service (HN)
systemctl start condor
systemctl enable condor
systemctl start condor-ce
systemctl enable condor-ce
```

start / stop / restart
enable / disable

Worker Node:

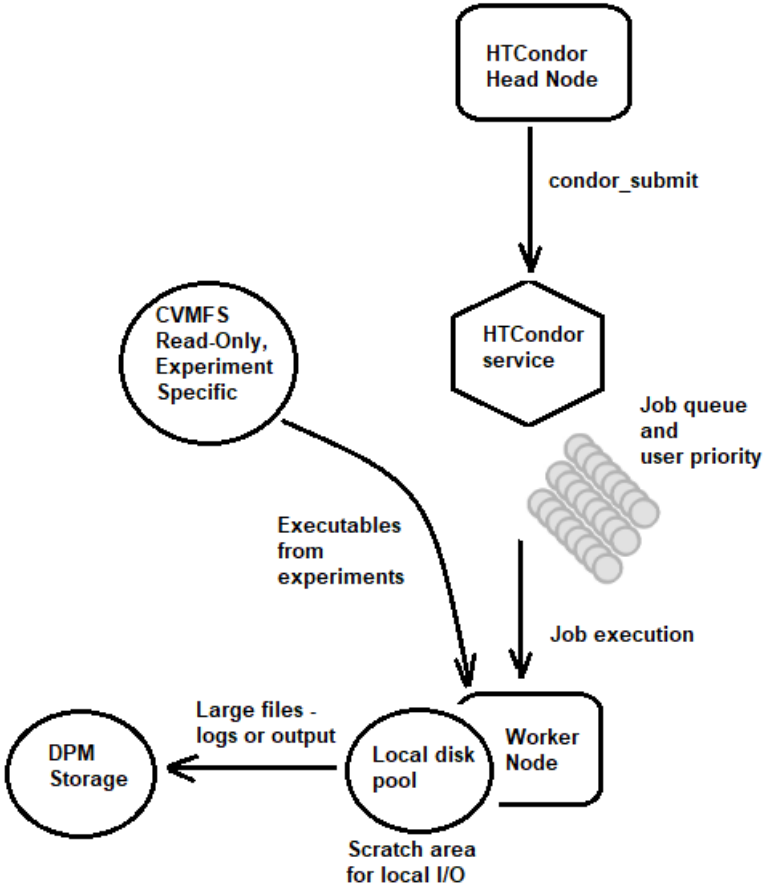
```
# rpm -qa |grep condor
htcondor-release-9.0-2.el7.noarch
condor-9.0.17-1.el7.x86_64
condor-procd-9.0.17-1.el7.x86_64
condor-externals-9.0.17-1.el7.x86_64
condor-classads-9.0.17-1.el7.x86_64
python2-condor-9.0.17-1.el7.x86_64
python3-condor-9.0.17-1.el7.x86_64
```

```
# start condor service (WN)
systemctl start condor
systemctl enable condor
```

Local Data flow

open firewall port for condor (both HN and WN)
firewall-cmd --permanent --add-port=9619/tcp
firewall-cmd --permanent --add-port=9618/tcp
firewall-cmd --permanent --add-port=9618/udp

Imp. packages (HN + WN)
CVMFS , ~~Singularity~~ Apptainer



Folder and files view

Configuration location: /etc/condor-ce/ and /etc/condor/

Htcondor 8.6.x series

HTCondor-CE configuration

```
total 6
-rw-r--r--. 1 ppatel zh 3057 May 24 12:38 condor_config
-rw-r--r--. 1 ppatel zh  773 May 24 12:38 condor_mapfile
drwxr-xr-x. 2 ppatel zh 2048 May 24 12:38 config.d
```

HTCondor configuration

```
total 11
-rw-r--r--. 1 ppatel zh 3704 May 24 12:38 condor_config
-rw-r--r--. 1 ppatel zh  856 May 24 12:38 condor_config.local
-rw-r--r--. 1 ppatel zh  764 May 24 12:38 condor_ssh_to_job_sshd_config_template
drwxr-xr-x. 2 ppatel zh 2048 May 24 12:38 config.d
drwxr-xr-x. 2 ppatel zh 2048 May 24 12:38 ganglia.d
-rw-------. 1 ppatel zh  256 May 24 12:38 pool_password
```

Htcondor 9.0.x series

```
[root@condor-ce01 condor-ce]# pwd
/etc/condor-ce
[root@condor-ce01 condor-ce]# ls -l
total 20
-rw-r--r-- 1 root   root   3006 Oct  6 02:39 condor_config
-rw-r--r-- 1 root   root    709 Oct  6 02:39 condor_mapfile
drwxr-xr-x 2 root   root   4096 Nov 10 15:05 config.d
drwxr-xr-x 2 root   root    140 Nov 10 15:05 mapfiles.d
drwx------ 2 root   root     18 Oct  6 02:53 passwords.d
drwx------ 2 condor condor   27 Oct  6 02:53 tokens.d
-rw-r--r-- 1 root   root    616 Oct  6 02:39 uid_acct_group.map
-rw-r--r-- 1 root   root    681 Oct  6 02:39 x509_acct_group.map
[root@condor-ce01 condor-ce]#
```

```
[root@condor-ce01 condor]# pwd
/etc/condor
[root@condor-ce01 condor]# ls -l
total 16
-rw-r--r-- 1 root root 4153 Sep 30 03:09 condor_config
-rw-r--r-- 1 root root  857 Aug  8 11:55 condor_config.local
lrwxrwxrwx 1 root root   61 Oct  6 10:43 condor_ssh_to_job_sshd_c
drwxr-xr-x 2 root root  333 Nov 10 15:05 config.d
drwxr-xr-x 2 root root   32 Oct  6 10:43 ganglia.d
drwx------ 2 root root   18 Sep 30 03:12 passwords.d
-rw------- 1 root root   15 Aug  8 12:34 pool_password
drwx------ 2 root root   27 Sep 30 03:12 tokens.d
[root@condor-ce01 condor]#
```

Logs view

- No difference in log location, whether it is 8.a.b OR 9.c.d series

```
[root@condor-ce01 condor-ce]# pwd
/var/log/condor-ce
[root@condor-ce01 condor-ce]# ls -l
total 3947504
-rw-r--r-- 1 condor condor  2542936 Nov 18 08:59 AuditLog
-rw-r--r-- 1 condor condor 12041861 Nov 18 05:30 AuditPayloadLog.202
-rw-r--r-- 1 condor condor 29381141 Aug 21 05:30 AuditPayloadLog.old
-rw-r--r-- 1 root   root      62770 Apr 19  2022 CEViewLog
-rw-r--r-- 1 condor condor  8276903 Nov 18 08:59 CollectorLog
-rw-r--r-- 1 condor condor 10485906 Nov 18 04:22 CollectorLog.old
-rw-r--r-- 1 condor condor  2169690 Apr 19  2022 GangliadLog
-rw-r--r-- 1 condor condor  7076122 Nov 18 08:59 JobRouterLog
-rw-r--r-- 1 condor condor 10486018 Nov 16 01:16 JobRouterLog.old
-rw-r--r-- 1 root   root      34350 Nov 10 15:05 KernelTuning.log
-rw-r--r-- 1 condor condor  1143756 Nov 17 16:05 MasterLog
-rw-r--r-- 1 condor condor 10485938 Aug  2 17:22 MasterLog.old
-rw-r--r-- 1 root   root     622730 Nov 18 08:59 ProcLog
-rw-r--r-- 1 root   root    1000160 Nov 17 02:26 ProcLog.old
-rw-r--r-- 1 condor condor  2577984 Nov 18 08:59 SchedLog
-rw-r--r-- 1 condor condor 10485898 Nov 18 08:38 SchedLog.old
-rw-r--r-- 1 condor condor    22096 Nov 18 08:55 SharedPortLog
-rw-r--r-- 1 condor condor 10485913 Nov 18 05:40 SharedPortLog.old
-rw-r--r-- 1 condor condor  3019257 Nov 18 08:58 transfer_history
-rw-r--r-- 1 condor condor  5000217 Nov 14 22:35 transfer_history.ol
drwxrwxrwt 2 condor condor        6 Oct  6 02:53 user
```

```
[root@condor-ce01 condor]# pwd
/var/log/condor
[root@condor-ce01 condor]# ls -l
total 3976844
-rw-r--r--  1 condor condor  75168757 Nov 18 08:57 CollectorLog
-rw-r--r--  1 condor condor 104857923 May  3  2022 CollectorLog.20220503T13
-rw-r--r--  1 condor condor 104857816 May 20 04:34 CollectorLog.20220520T04
-rw-r--r--  1 condor condor 104857751 Jun 14 06:35 CollectorLog.20220614T06
-rw-r--r--  1 condor condor 104857769 Jun 24 11:20 CollectorLog.20220624T11
-rw-r--r--  1 condor condor 104857840 Jul 15 19:36 CollectorLog.20220715T19
-rw-r--r--  1 condor condor 104858163 Aug  9 00:57 CollectorLog.20220809T00
-rw-r--r--  1 condor condor 104858444 Aug 29 19:20 CollectorLog.20220829T19
-rw-r--r--  1 condor condor 104858087 Sep 21 12:32 CollectorLog.20220921T12
-rw-r--r--  1 condor condor 104857825 Oct 12 04:06 CollectorLog.20221012T04
-rw-r--r--  1 condor condor 104858004 Nov  4 05:37 CollectorLog.20221104T05
-rw-r--r--  1 condor condor  68063809 Nov 18 08:53 DefragLog
-rw-r--r--  1 condor condor 104857824 Oct 14 03:30 DefragLog.20221014T03302
-rw-r--r--  1 condor condor   4324905 Nov 18 08:57 GangliadLog
-rw-r--r--  1 condor condor  10485922 Nov  9 17:55 GangliadLog.old
-rw-r--r--. 1 root   root       34071 Oct 15 21:17 KernelTuning.log
-rw-r--r--. 1 condor condor    248895 Nov 17 22:18 MasterLog
-rw-r--r--  1 condor condor   8895991 Nov 18 08:57 MatchLog
-rw-r--r--  1 condor condor  10485992 Nov  9 08:35 MatchLog.old
```

CE: /var/log/condor-ce

Local batch: /var/log/condor

Troubleshootings while setup

- Started condor upgradation on T3_IN_TIFRCondor
  - Suggestion was to install LTS release 9.0.5 - minimal
  - Later on, went for new stable release 9.0.15

more details for upgradation from 8.8.8 to 9.0.15 can follow ggus - 156370

- Disabled GSI submission and enabled token

User mapping issue:

03/28/22 12:32:17 [97263] GAHP[116261] -> '39' 'F' '125021.0' 'ERROR: Failed to submit job. SCHEDD:2:Setting owner to "cmspilot", which is not a valid user account'

03/28/22 16:36:46 DC_AUTHENTICATE: authentication of <169.228.38.36:2862> **did not result in a valid mapped user name**, which is required for this command (1112 QMGMT_WRITE_CMD), **so aborting.**

condor_ping with SCITOKENS works for pilots, but it was not working for other tests

- Earlier mapping:

  SCITOKENS /^https\:\/\/cms\-auth\.web\.cern\.ch\/,08ca855e\-d715\-410e\-a6ff\-ad77306e1763$/ lcgadmin

- New entries:

  SCITOKENS /^https\:\/\/cms-auth.web.cern.ch\/,08ca855e-d715-410e-a6ff-ad77306e1763$/ samjob
  SCITOKENS /^https\:\/\/cms-auth.web.cern.ch\/,bad55f4e-602c-4e8d-a5c5-bd8ffb762113$/ cmsjob
  SCITOKENS /^https\:\/\/cms-auth.web.cern.ch\/,490a9a36-0268-4070-8813-65af031be5a3$/ cmsjob
  SCITOKENS /^https\:\/\/cms-auth.web.cern.ch\/,07f75a9a-bb78-4735-938b-7e61b2b62d5c$/ cmsjob
  SCITOKENS /^https\:\/\/cms-auth.web.cern.ch\/,efbed8c1-f9a7-4063-92f7-f89c04ce04a3$/ cmsjob

Troubleshootings while setup cont...

- Jobs were aborted, all went to HeldJobs state after staying 30 min. at IdleJobs state
- Pilots were landing to CE which indicated that, there was no problem on the CE but the local batch system

Earlier:

GSI ".*,\/cms\/Role=pilot.*" cmsjob@indiacms.res.in
GSI ".*,\/cms\/Role=lcgadmin.*" samjob@indiacms.res.in
GSI ".*,\/ops\/Role=NULL.*" opsjob@indiacms.res.in
GSI (.*) GSS_ASSIST_GRIDMAP
GSI "(/CN=[-.A-Za-z0-9/=]+)" \1@unmapped.opensciencegrid.org
CLAIMTOBE .* anonymous@claimtobe
FS (.*) \1

Now:

GSI /.*,\/ops\/Role=NULL.*/ opsjob@indiacms.res.in
GSI /(.*)/ GSS_ASSIST_GRIDMAP
GSI /(/CN=[-.A-Za-z0-9/=]+)/ \1@unmapped.opensciencegrid.org
CLAIMTOBE /(.*)/ anonymous@claimtobe
FS /(.*)/ \1

Troubleshootings while setup cont...

- Thoroughly followed sequential updates and documents
- SAM tests try token submission first and fall back to x509 in case of failure.

07/27/22 10:13:06 (cid:12735) Command=QMGMT_WRITE_CMD, peer=<188.184.81.101:36854> 07/27/22 10:13:06 (cid:12735) **AuthMethod=SCITOKENS, AuthId=https://cms-auth.web.cern.ch/,08ca855e-d715-410e-a6ff-ad77306e1763, CondorId=samjob@indiacms.res.in**

07/27/22 10:14:30 (cid:12743) proxy full fqan: 07/27/22 10:14:30 (cid:12745) Command=DELEGATE_GSI_CRED_SCHEDD, peer=<169.228.38.43:25665>

07/27/22 10:14:30 (cid:12745) **AuthMethod=SCITOKENS, AuthId=https://cms-auth.web.cern.ch/,bad55f4e-602c-4e8d-a5c5-bd8ffb762113, CondorId=cmsjob@indiacms.res.in**

Authentication with SciToken is successful

new Scitokens test has been added

Status of SAM tests

- Tokens are fine along with other tests

- ARGO tests are also running – from EGI
- Keeping track of AR status
- These are short duration tests – less than 10 min.
- Job frequency - every 15 min.

condor-ce01.indiacms.res.in

State	Service	Icons	Status detail	Age	Checked	Perf-O-Meter
OK	org.cms.CONDOR-Ping-/cms-ce-token		OK - Scitokens authentication succeeded	2022-11-09 02:01:53	48 m	
OK	org.cms.WN-analysis-/cms /Role=lcgadmin		wn105.indiacms.res.in: OK	2022-11-12 15:48:34	17 m	
OK	org.cms.WN-basic-/cms/Role=lcgadmin		wn105.indiacms.res.in: OK	2022-10-27 18:00:38	17 m	
OK	org.cms.WN-cvmfs-/cms/Role=lcgadmin		wn105.indiacms.res.in: OK, cvmfs vers 2.10.0 (probe 1.3-pre2)	2022-11-14 19:19:33	17 m	
OK	org.cms.WN-env-/cms/Role=lcgadmin		wn105.indiacms.res.in: OK	2022-11-07 18:46:55	17 m	
OK	org.cms.WN-frontier-/cms /Role=lcgadmin		wn105.indiacms.res.in: OK	2022-11-12 [illegible]	17 m	
OK	org.cms.WN-isolation-/cms /Role=lcgadmin		wn105.indiacms.res.in: OK	2022-10-27 18:00:38	17 m	
OK	org.cms.WN-mc-/cms/Role=lcgadmin		wn105.indiacms.res.in: OK	92 m	17 m	
OK	org.cms.WN-squid-/cms/Role=lcgadmin		wn105.indiacms.res.in: OK	2022-10-27 18:00:38	17 m	
OK	org.cms.WN-xrootd-access-/cms /Role=lcgadmin		wn105.indiacms.res.in: OK	2022-10-27 18:00:38	17 m	
OK	org.cms.WN-xrootd-fallback-/cms /Role=lcgadmin		wn105.indiacms.res.in: OK	2022-11-12 00:18:31	17 m	
OK	org.sam.CONDOR-JobState-/cms /Role=lcgadmin		OK - Job was successfully submitted (110416)	2022-10-27 17:45:36	160 s	
OK	org.sam.CONDOR-JobSubmit-/cms /Role=lcgadmin		OK - Job successfully completed	2022-11-02 23:46:14	17 m	

T2_IN_TIFR

Service Status Details For Host 'condor-ce01.indiacms.res.in'

ARGO Tests for T2

Limit Results: 100

Host	Service	Status	Last Check	Duration	Attempt	Status Information
condor-ce01.indiacms.res.in	argo.HTCondorCE-CertValidity	OK	11-16-2022 14:29:16	31d 15h 27m 48s	1/2	OK - HTCondorCE certificate valid until Apr 6 05:42:07 2023 UTC (expires in 140 days)
	ch.cern.HTCondorCE-JobState-ops	OK	11-17-2022 05:09:30	13d 7h 47m 46s	1/2	OK - Job was successfully submitted (121091)
	ch.cern.HTCondorCE-JobSubmit-ops	OK	11-17-2022 04:09:46	2d 6h 47m 13s	1/2	OK - Job successfully completed

Month	2022-07		2022-08		2022-09		2022-10		2022-11	
	Av	Re	Av	Re	Av	Re	Av	Re	Av	Re
org.opensciencegrid.htcondorce	100	100	100	100	99.55	99.55	95.01	98.14	99.45	99.45
SRM	100	100	100	100	100	100	92.13	93.52	100	100
webdav	99.91	99.91	100	100	100	100	92.25	93.63	100	100
	Av	Re	Av	Re	Av	Re	Av	Re	Av	Re

https://egi.ui.argo.grnet.gr/egi/report-ar-group-details/Critical/SITES/INDIACMS-TIFR

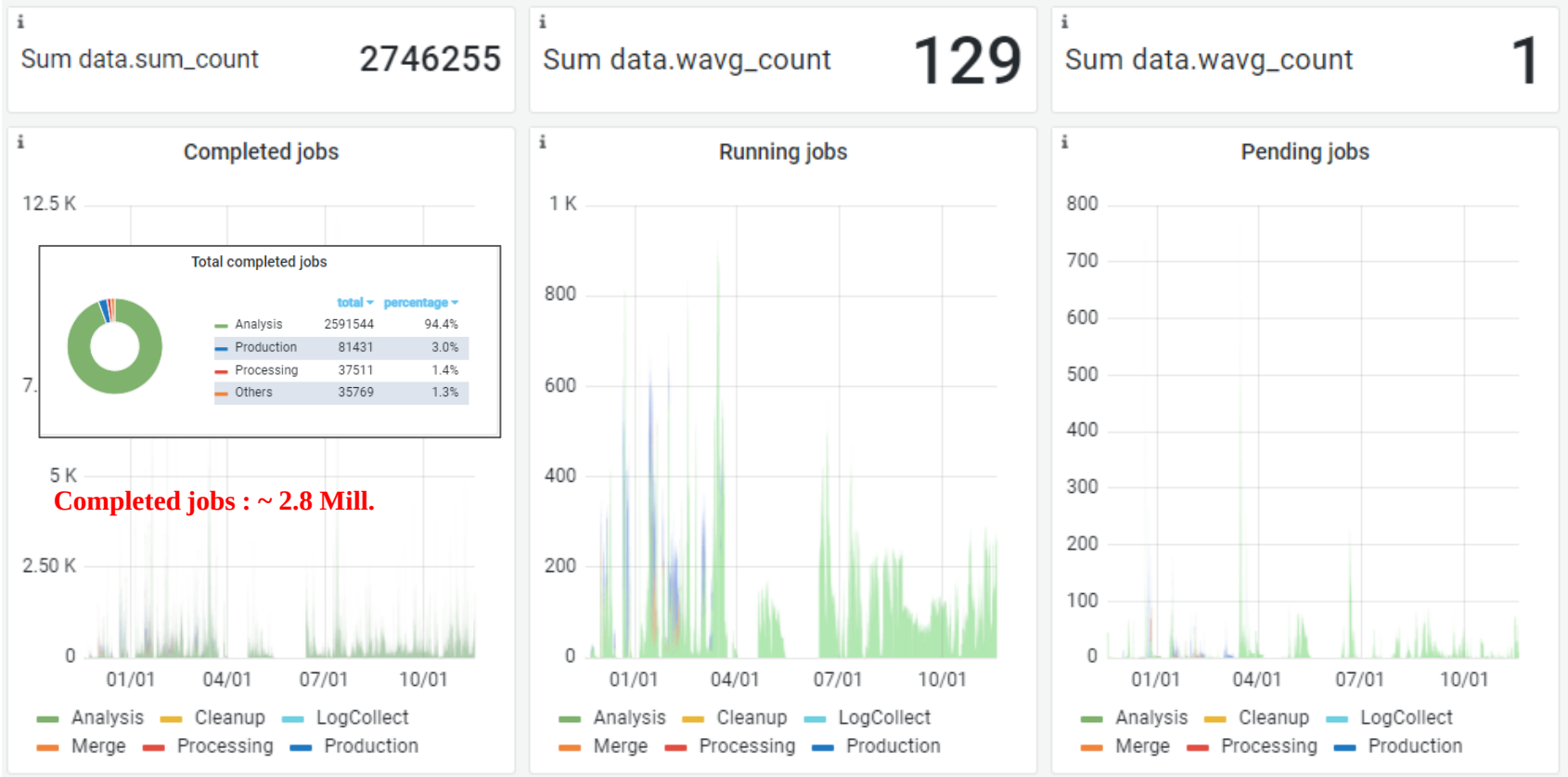
cream-ce02.indiacms.res.in

State	Service	Icons	Status detail	Age	Checked	Perf-O-Meter
OK	org.cms.CONDOR-Ping-/cms-ce-token		OK - Scitokens authentication succeeded	2022-11-03 22:01:22	49 m	
OK	org.cms.WN-analysis-/cms /Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:33:01	17 m	
OK	org.cms.WN-basic-/cms/Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.cms.WN-cvmfs-/cms/Role=lcgadmin		wn239.indiacms.res.in: OK, cvmfs vers 2.10.0 (probe 1.3-pre2)	37 h	17 m	
OK	org.cms.WN-env-/cms/Role=lcgadmin		wn239.indiacms.res.in: OK	2022-10-27 18:15:54	17 m	
OK	org.cms.WN-frontier-/cms /Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.cms.WN-isolation-/cms /Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.cms.WN-mc-/cms/Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.cms.WN-squid-/cms/Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.cms.WN-xrootd-access-/cms /Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:33:01	17 m	
OK	org.cms.WN-xrootd-fallback-/cms /Role=lcgadmin		wn239.indiacms.res.in: OK	2022-11-10 11:03:01	17 m	
OK	org.sam.CONDOR-JobState-/cms /Role=lcgadmin		OK - Job was successfully submitted (110420)	2022-10-27 18:00:52	158 s	
OK	org.sam.CONDOR-JobSubmit-/cms /Role=lcgadmin		OK - Job successfully completed	2022-10-27 18:15:54	17 m	

T3_IN_TIFRCloud

Job status

Data displayed for 1 yr. (Dec 2021 to Nov 2022)



Future Activity

- Plan to enable 90% or max. possible of existing cores with the 11TR of additional cooling from new two in-Row cooling units
- Enable local monitoring graphs on Ganglia (currently using - Grafana by CERN)
- Plan to utilize available feature of **apel** package which is available and integrated with htcondor for accounting (existing APEL services are running in independent node)

Thank you !

puneet.patel@tifr.res.in
puneet.kumar.patel@cern.ch