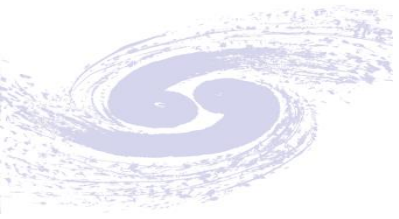


Experience in Running Grid Site

Xiaofei Yan, Xiaomei Zhang, Tian Yan, Xiaowei Jiang , Wei Zheng

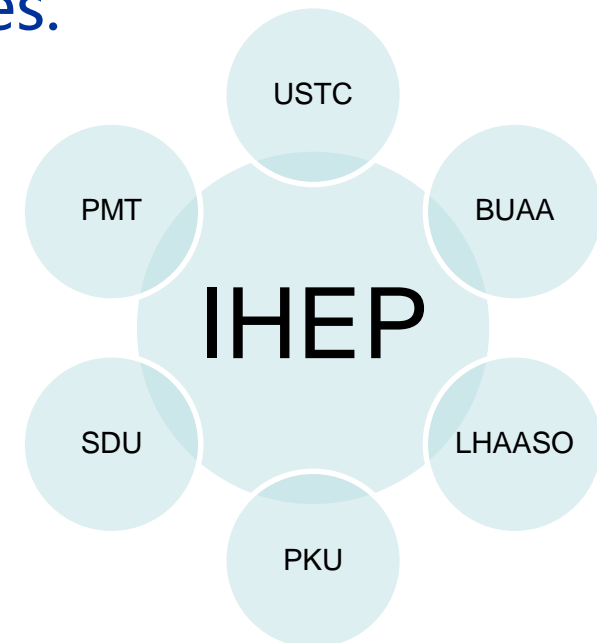
Computing Center, Institute of High Energy Physics
(IHEP-CC)

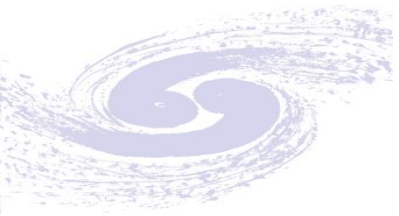
15/10/2019



Motivations

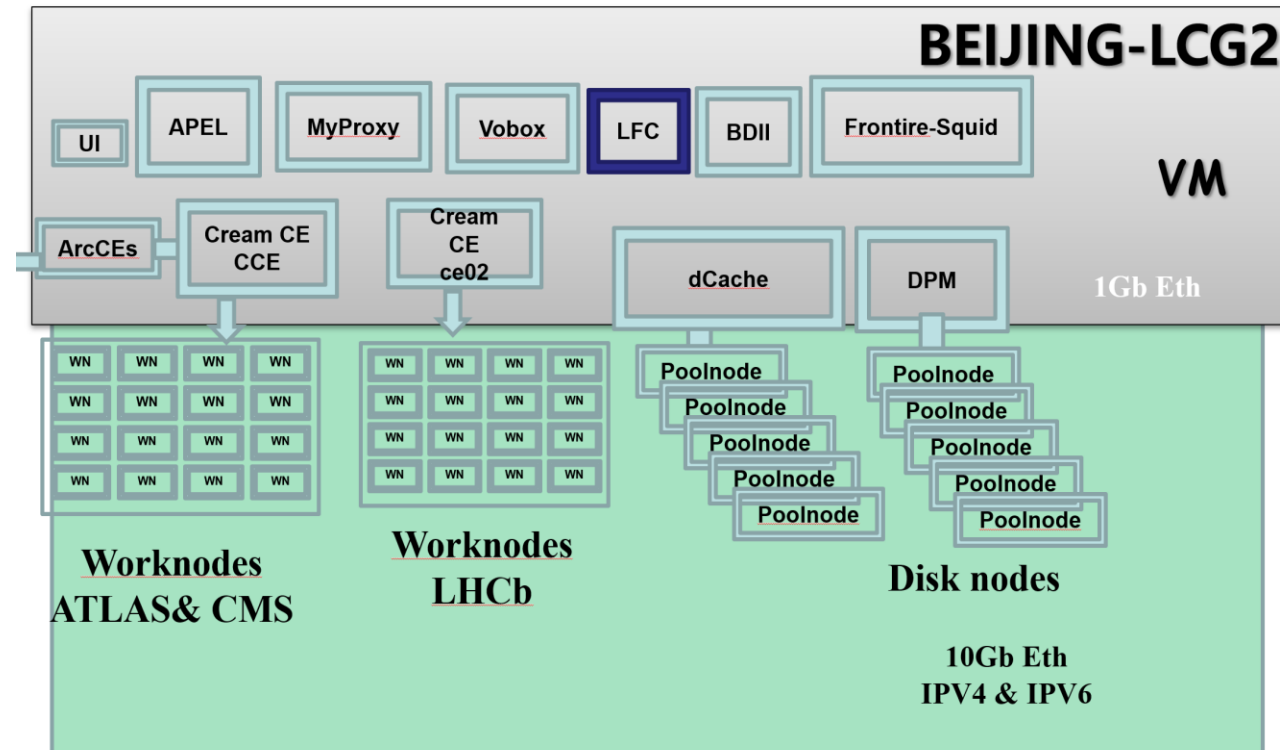
- More Institutes & Universities join LHC or HEP computing in China.
- Small site and lack of experience of grid computing
- Limit manpower to maintenance Tier2 or Tier3 site.
- Network not good enough between Laboratories.

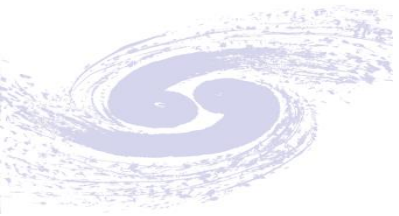




Grid site Deployment and configuration.

- No straightforward task to finish the grid site deployment.
- Many components and services to be configured.
- Many ways to deployment WLCG site.
 - Manual, YAIM, Quattor, Puppet, Ansible ...
- ...
- Current status
 - More and more puppet module available.





Deployment and Configuration

- Foreman integrated with Puppet
- Provisioning
- Configuration management
- Patch/errata management
- Git for configuration version control

The screenshot displays the Foreman web interface. The top navigation bar includes the Foreman logo, 'Default Organization', and 'Default Location'. A sidebar on the left contains menu items: Monitor, Hosts, Configure, Infrastructure, and Administer. The main content area is titled 'Overview' and features a search bar and a 'Filter...' dropdown. The page is generated at 'Oct 09, 04:47 PM' and includes 'Manage' and 'Documentation' buttons.

Run Distribution Chart

Minutes Ago	Number Of Clients
30	300
27	320
24	380
21	370
18	300
15	300
12	320
9	380
6	370
3	180

Latest Events

Host	A	R	F	FR	S	P
ccsrn.ihep.ac.cn	2	0	0	0	0	0
lhmtk8s03.lhaaso.ihe...	0	0	0	0	63	0
lhmtk8s02.lhaaso.ihe...	0	0	0	0	63	0
tplhaaso03.ihep.ac.cn	1	0	1	0	0	0
lhmtk8s03.lhaaso.ihe...	0	0	0	0	63	0
lhmtk8s02.lhaaso.ihe...	0	0	0	0	63	0
lxslc612.ihep.ac.cn	0	0	3	0	2	0
lhmtk8s03.lhaaso.ihe...	0	0	0	0	63	0
lhmtk8s02.lhaaso.ihe...	0	0	0	0	63	0

Host Configuration Chart

70% OK

Host Configuration Status

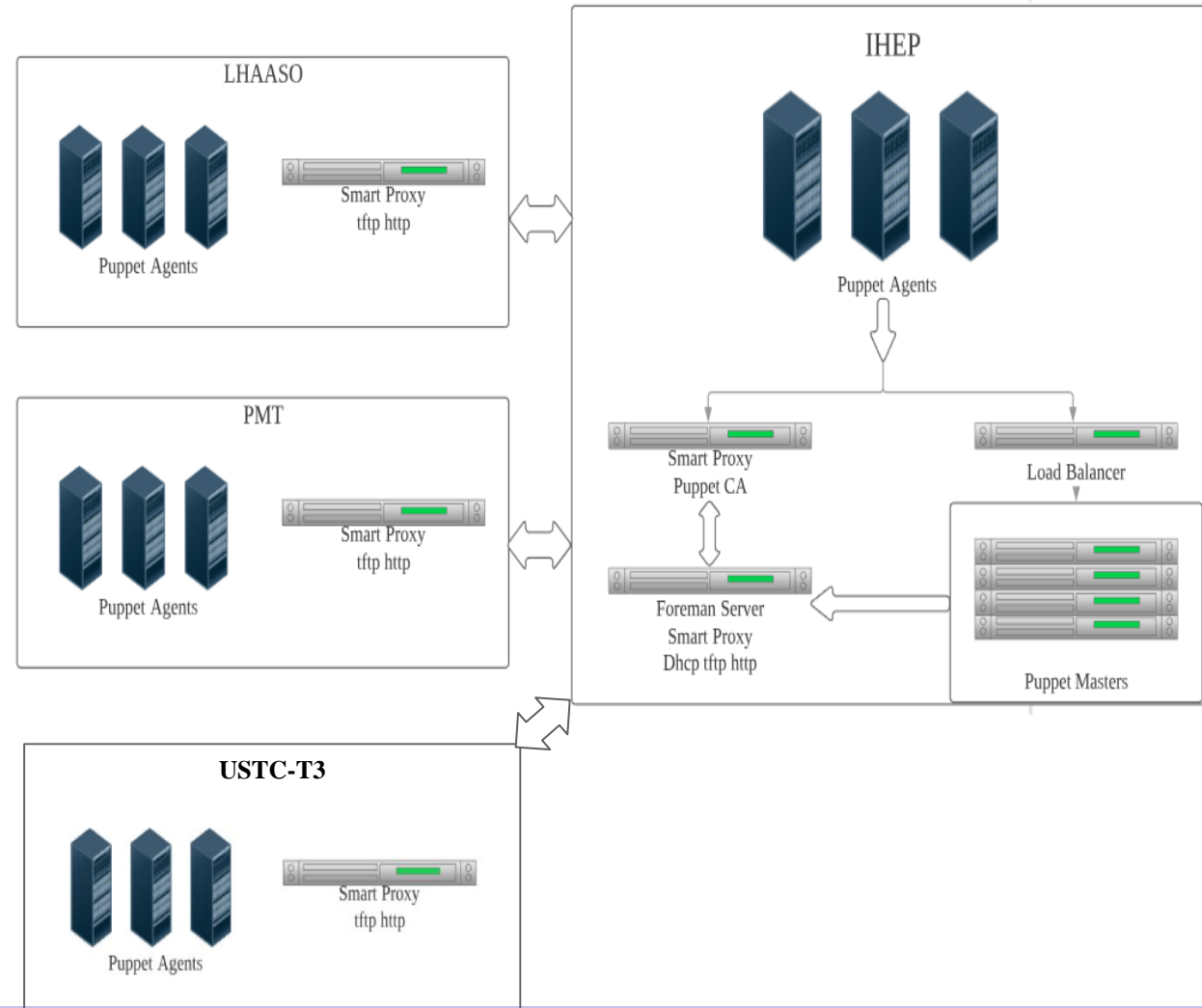
Hosts that had performed modifications without error	9
Hosts in error state	14
Good host reports in the last 30 minutes	1400
Hosts that had pending changes	0
Out of sync hosts	411
Hosts with no reports	172
Hosts with alerts disabled	0

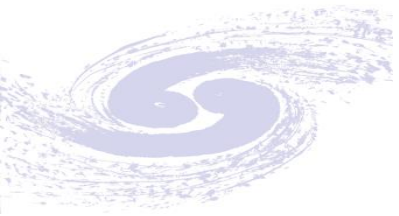
Total Hosts: 2006



Foreman & Puppet deployment at IHEP

- Distributed deployment puppet and foreman
- Central Foreman server(1 node)
 - Foreman dashboard
 - Haproxy, port 8140(load balancer)
 - Foreman proxy
 - DHCP, tftp-server, Puppet
- Puppet master(2 nodes)
- Puppet CA
 - Foreman proxy, Puppet ca server
- Remote Foreman-proxy
 - tftp-server
 - http





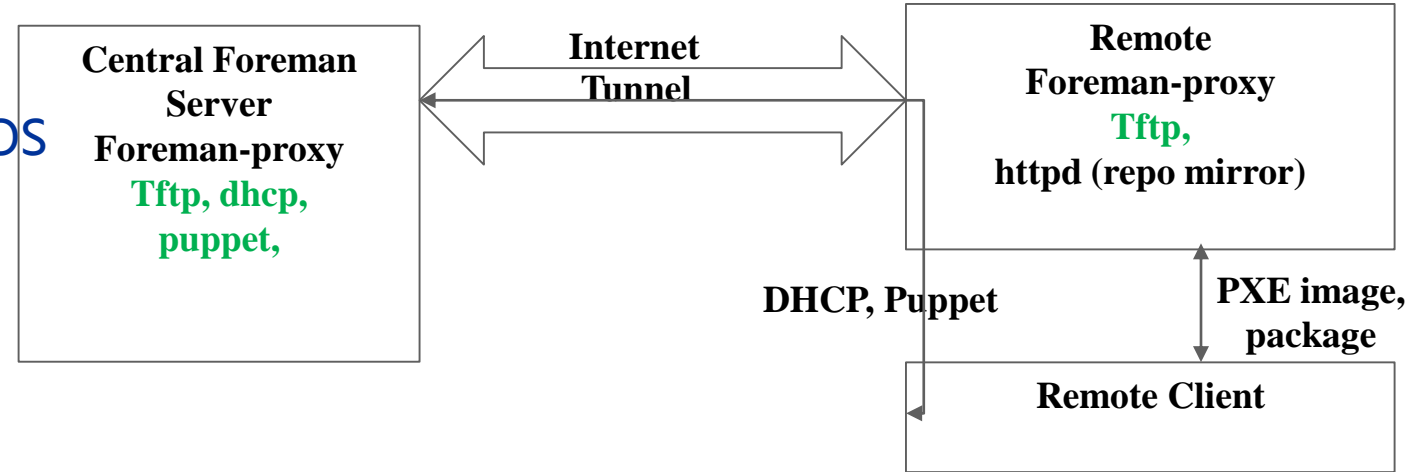
Distributed foreman servers

Motivations:

- Network is not good enough to complete OS installation.
- Tftp transfer failed through internet.

Solutions:

- Add tftp server at each remote site.
- Control tftp-server by foreman-proxy.
- Add local mirror server



Smart Proxies

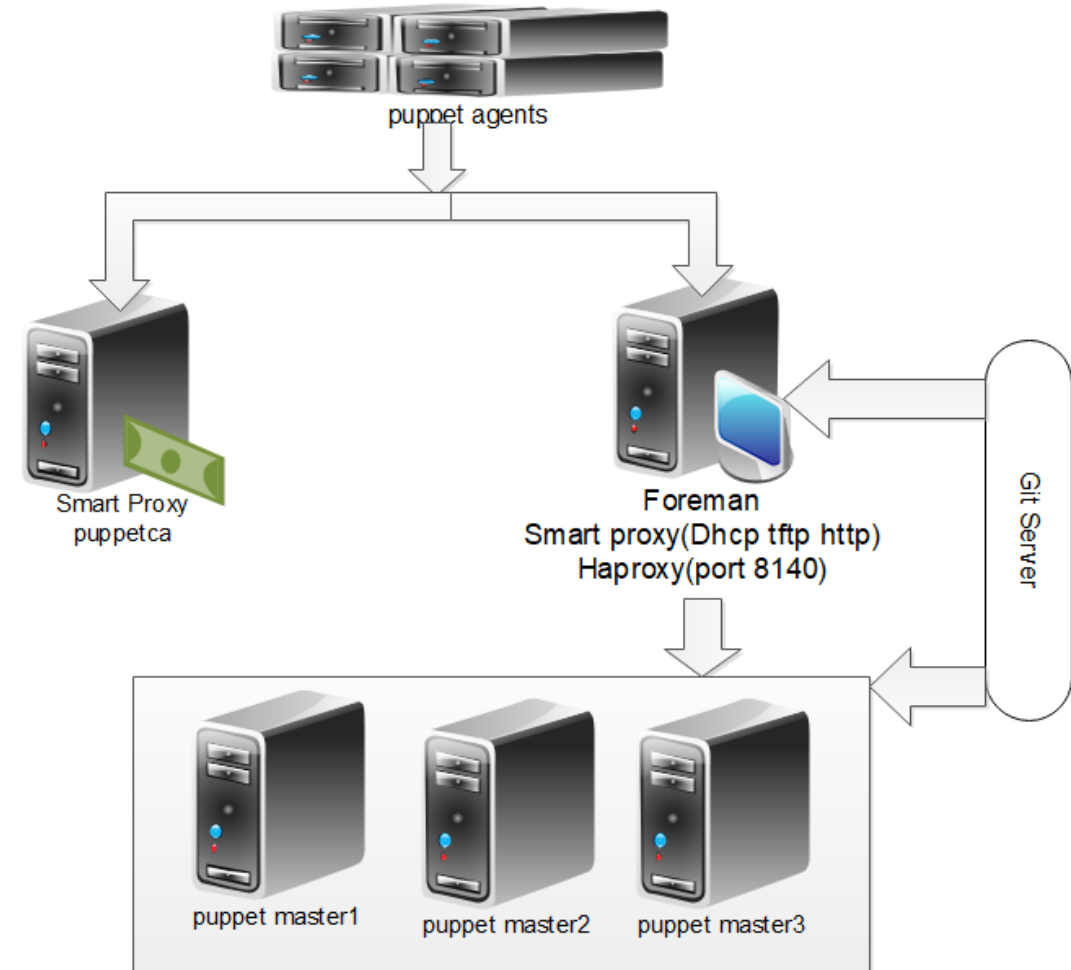
Filter ... x Q Search [v] Create Smart Proxy Documentation

Name	Locations	Organizations	Features	Status	Actions
alicpt	Default Location	Default Organizat...	TFTP	⊗	Edit v
netmanager.lhaa...	Default Location	Default Organizat...	TFTP	⊙	Edit v
pptca.ihep.ac.cn	Default Location	Default Organizat...	Puppet CA	⊙	Edit v
xman.ihep.ac.cn	Default Location	Default Organizat...	DHCP, Puppet, and TFTP	⊙	Edit v

300 ^ per page 1-4 of 4 << < 1 of 1 > >>

Load balanced Puppet masters

- Centralizing the certificate authority
 - Separated Puppet CA managed by foreman
- Setup `dns_alt_names` for Puppet master
- Create new certificate for puppet master with `dns_alt_names`
- Haproxy 'mode=tcp'



Load balanced puppet master

■ Optimization:

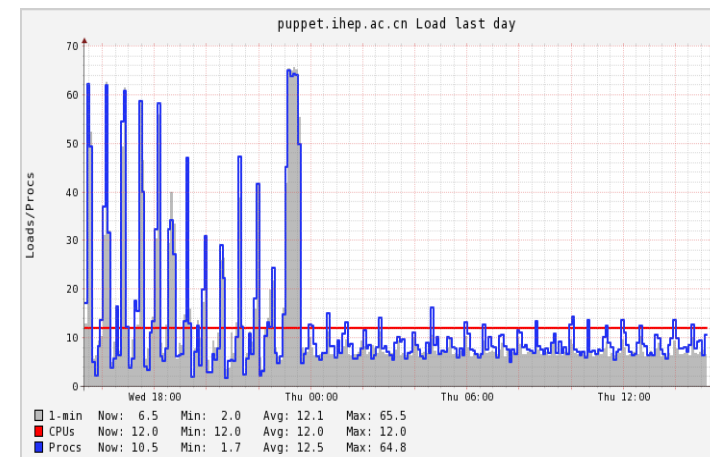
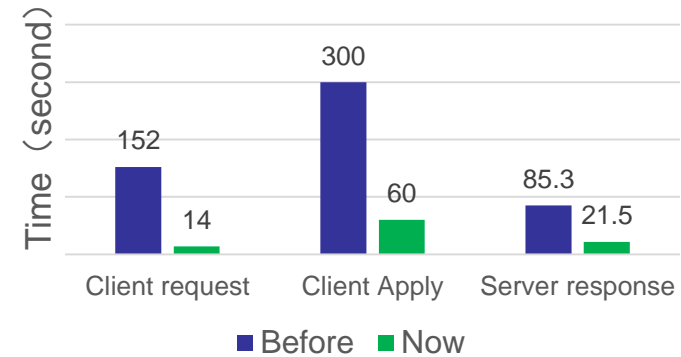
- Use RAM disk for puppet modules
 - Optimize puppet module read speed
- SSD disk for foreman database
- Use rpm meta package instead of puppet package resource
- Optimize apache parameters
- Puppet client 'splay=true'
 - Puppet master CPU load lower and smoothly than before

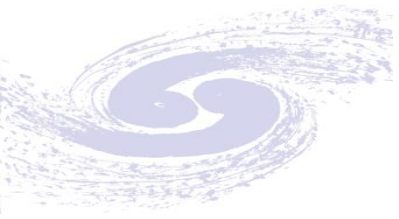
■ 6 times faster than before

■ Support more clients and more resource

- Client Refresh interval 900s(15m)

Optimize Result





Puppet modules for Grid site

- Lots of EGI grid services have puppet modules to install and configuration.
- Useful links:
 - <http://repository.egi.eu/2016/10/07/all-umd-4-products/> EGI UMD component
 - <http://forge.puppet.com> Puppet modules
 - <https://github.com/cernops> Cern puppet modules
 - <https://github.com/HEP-Puppet> Puppet modules for EGI
- Our puppet manifest to use EGI puppet modules
 - <https://github.com/yyxfei/emiconfig>

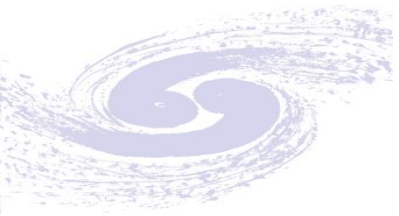


One example to use puppet modules

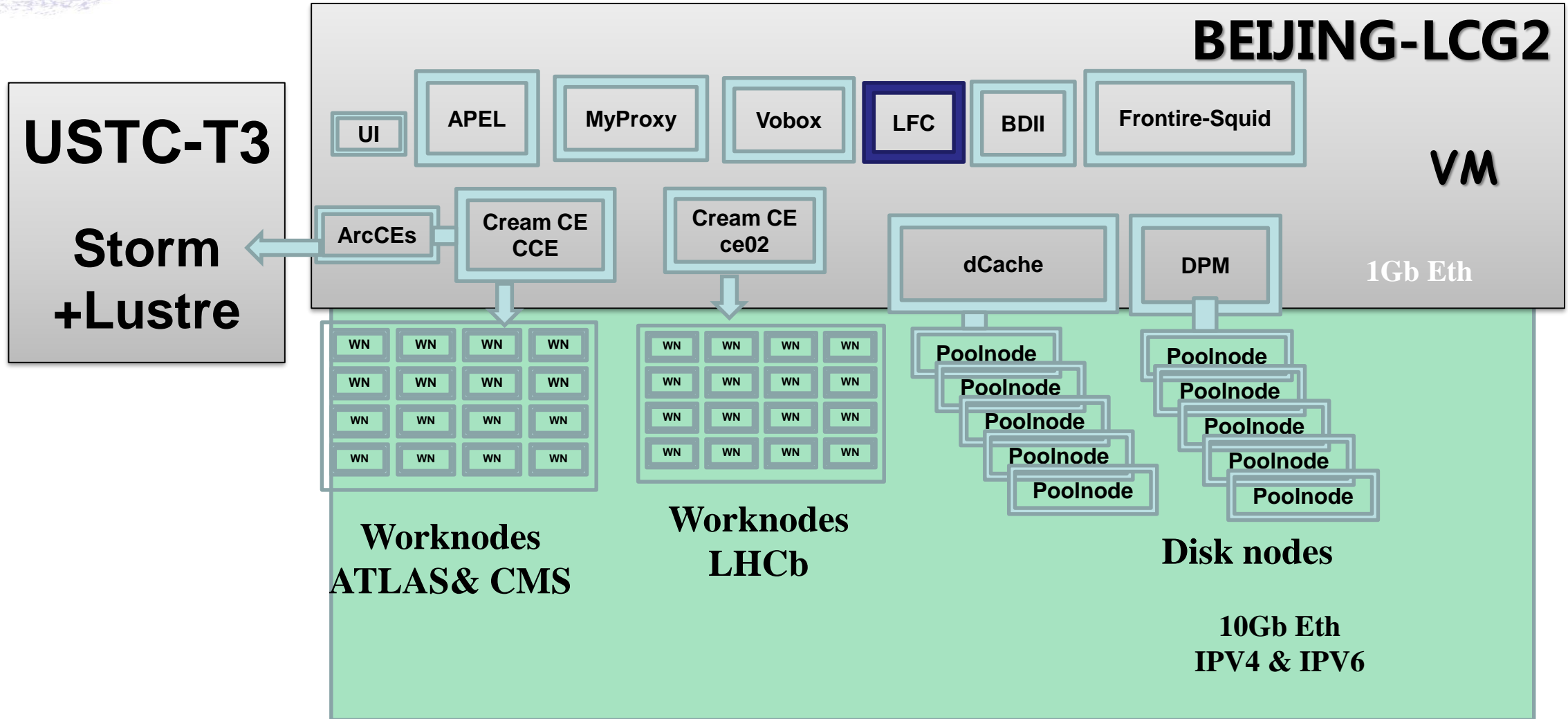
- Puppet installation and configuration for DPM:
 - <https://twiki.cern.ch/twiki/bin/view/DPM/DpmSetupPuppetInstallation>
- DPM Puppet module installation:
 - puppet module install lcgdm-dpm
- Write your own manifest:

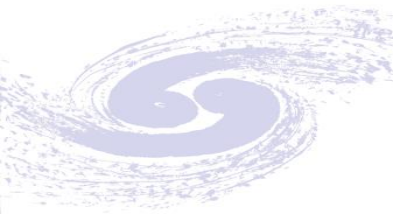
```
class{"dpm::headnode":
  localdomain => 'cern.ch',
  db_user      => 'dpmdbuser',
  db_pass     => 'PASS',
  db_host     => 'localhost',
  disk_nodes  => ['dpm-disk01.cern.ch'],
  local_db    => true,
  mysql_root_pass => 'MYSQLROOT',
  token_password => 'kwoMyvcusgdbyyws6gfcxhntkLoh8jilwivnive1',
  xrootd_sharedkey => 'A32T064CHARACTERA32T064CHARACTER',
  site_name   => 'CNR_DPM_TEST',
  volist      => [dteam, lhcb],
  new_installation => true,
  pools      => ['mypool:100M'],
  filesystems => ["mypool:${fqdn}:/srv/dpm/01"],
}
```

```
class{'dpm::disknode':
  headnode_fqdn => "HEADNODE",
  disk_nodes    => ['${::fqdn}'],
  localdomain   => 'cern.ch',
  token_password => 'TOKEN_PASSWORD',
  xrootd_sharedkey => 'A32T064CHARACTERKEYTESTTESTTESTTEST',
  volist        => [dteam, lhcb],
  mountpoints   => ['/data', '/data/01'],
}
```



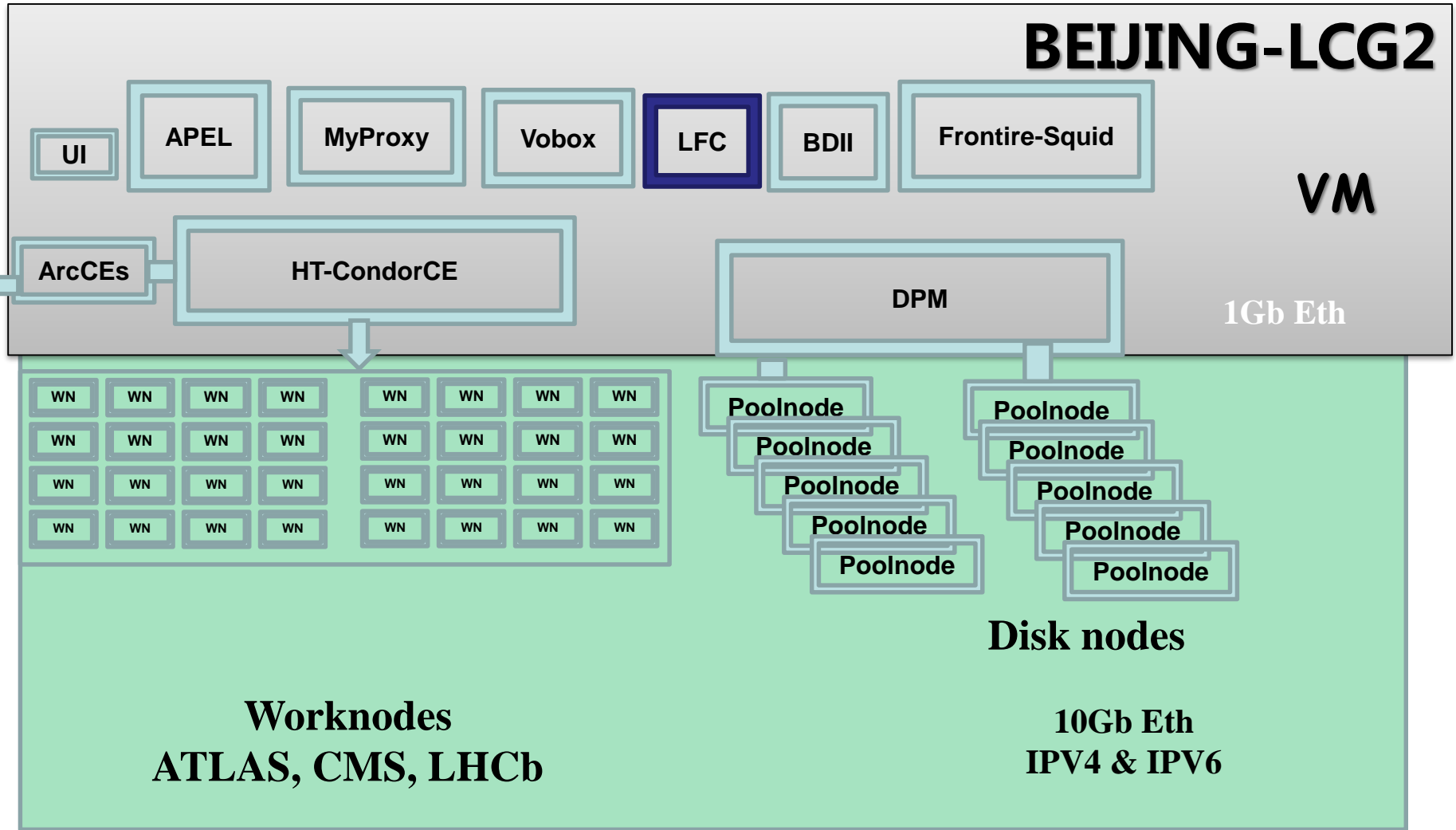
Introduce BEIJING-LCG2 Site Services

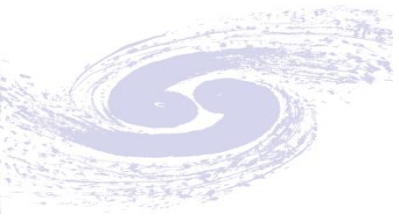




Introduce BEIJING-LCG2 Site Services

USTC-T3
Storm
+Lustre



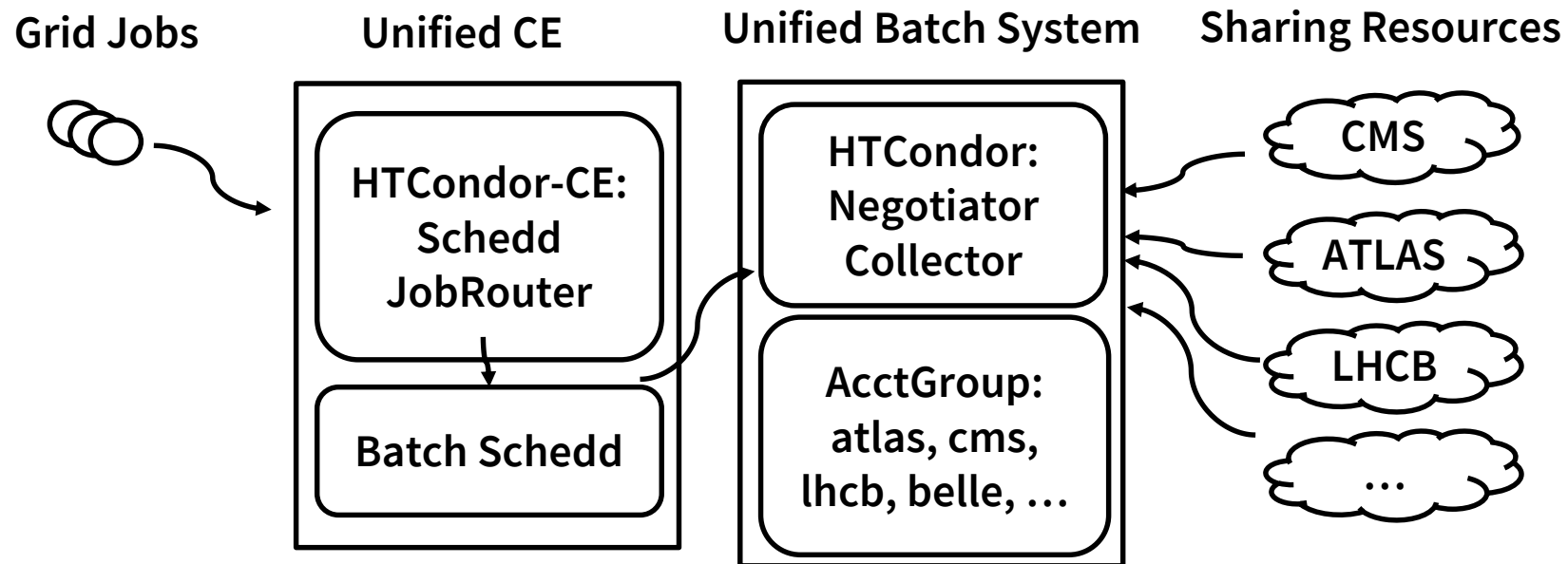


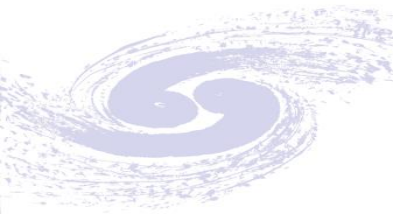
CE : Replacing with HTCondor-CE (1)

■ Motivation

- Cream CE would be unsupported at the end of 2020
- Unify both of CE (CreamCE) and Batch system (PBS) to HTCondor based

■ Expected Structure





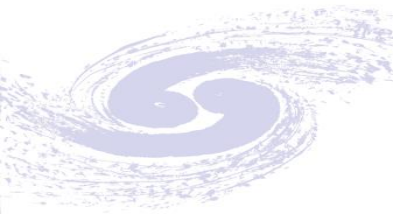
CE : Replacing with HTCondor-CE (2)

■ Aim to be:

- Providing a unified CE and Batch System for all the Tier2s
- Sharing all the resources in a unified pool, matching resources by accounting_group

■ Under testing

- Deployed with the puppet module got from Ben Jones (**Thanks, Ben!**)
- Changed all the configuration to our locals: Argus, Certificate, Batch System, ...
- Take some time on dealing with the authentication (now the authentication works, but stuck in routing jobs to batch system)



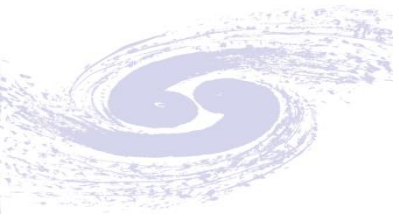
Trouble shooting

■ Low performance of NFS between WN and CE

- Issue:
 - High R/W rate and IOPS .
 - High I/O wait.
 - High Job failure rate.
- Reason
 - SATA disk with Low performance.
 - Low Network bandwidth(1Gb)
 - LHCb job working space locate on shared nfs.

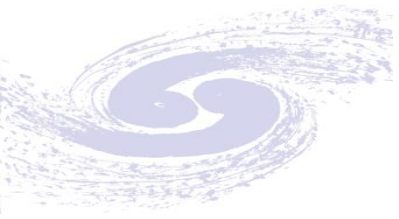
● Solution

- Replace from SATA disk to SSD disk.
- Upgrade NIC card to 10Gb
- Switch job working space to local disk.



DOMA-TPC Test

- One DPM test node to join DOMA-TPC test.
- Issues:
 - Host certificate no SAN describing the FQDN of the endpoint.
 - Solution: request new certificate with FQDN SAN.
 - Puppet can not set parameter `:ns_macaroon_secret`
 - Solution: using hiera
- Migrate Production DPM node to DOMA-TPC test.
 - DPM version 1.13.
 - Enable DOME and gridftp redirect.
 - Publish accounting information



Grid Monitoring and Accounting

- SAM-Nagios <https://argo-mon.egi.eu/nagios/>
- ATLAS: <http://wlcg-sam-atlas.cern.ch/>
- CMS: <http://wlcg-sam-cms.cern.ch/>
- ...
- Grafana: <https://monit-grafana.cern.ch/>
- Accounting: <https://accounting.egi.eu/>

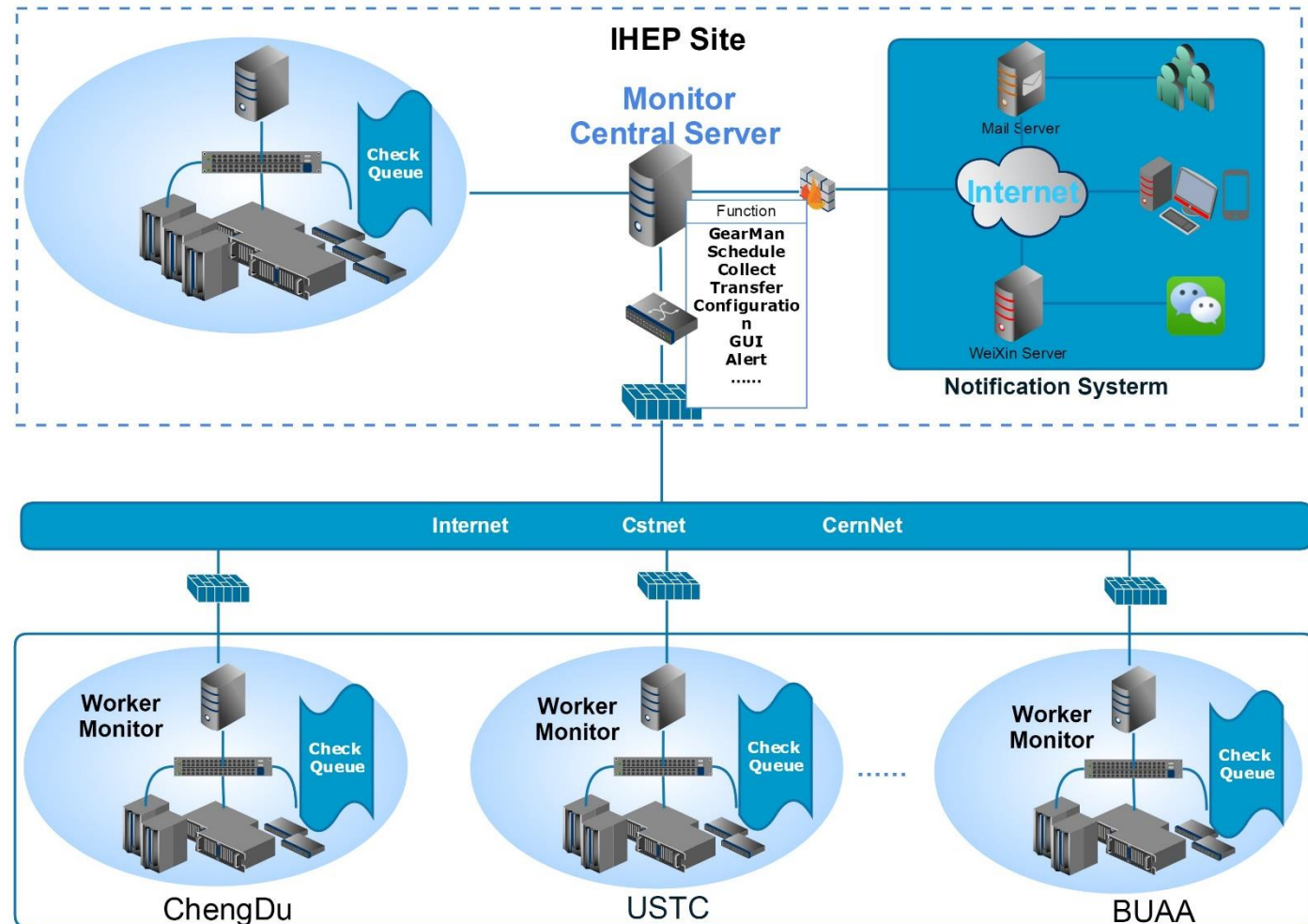
Local Monitoring (Distribute Nagios)

Central Site: IHEP

- Nagios V4 integrate with Mod_gearman
- Receive all sites Info from the central site
- 2 worker nodes run 10 workers
 - Load balance between worker nodes
 - 13000+ services checked

Remote Sites: Chengdu,.....

- Reports Sites Info to central site
- 1 worker node 5 workers at each site





Local Monitoring (Nagios Dashboard)

NMS

Current Status

Quick Search:

Tactical Overview

Hosts

Services

Host Groups

Problems

Monitor Analysis

Distributed Site

Reports

System

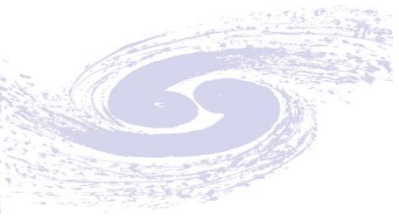
Current Network Status
 Last Updated: Sat Nov 12 17:05:53 CST 2016
 Updated every 90 seconds
 Logged in as zhengw

View Service Status Detail For All Host Groups
 View Host Status Detail For All Host Groups
 View Status Overview For All Host Groups
 View Status Grid For All Host Groups

Monitor Site	Host Status Totals				Service Status Totals				
	Up	Down	Unreachable	Pending	Ok	Warning	Unknown	Critical	Pending
IHEP-CC	1385	2	0	1	15614	3	8	32	0
CloudComputing : 胡床宝	207	0	0	0	1619	0	0	0	0
USTC : 郑伟	0	78	0	0	0	0	0	156	0
BUAA : 颜田	15	0	0	0	95	3	0	0	0
Chengdu : 郑伟	36	0	0	0	178	0	2	0	0

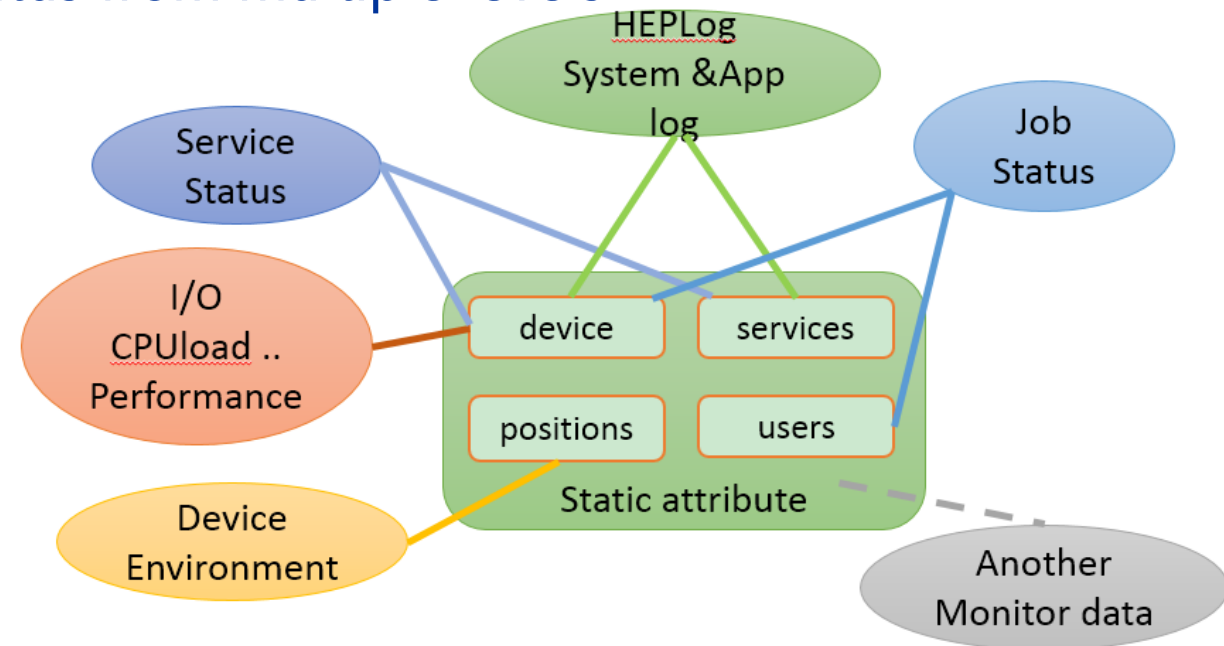
Status Summary For All Host Groups

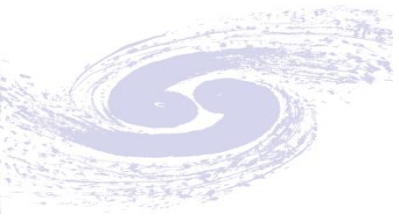
Host Group	Host Status Summary	Service Status Summary
AMS CWS HXMT节点负责人, 闫晓飞 (AMS-Servers)	151 UP	1689 OK 1 WARNING: 1 Unhandled
AWS计算节点负责人, 系统组值班人员 (AWS-servers)	43 UP	580 OK
BES3数据库服务器 (BES3_DB_SERVER)	5 UP	5 OK
bws dbws计算节点负责人, 系统组值班人员 (BWS-Servers)	477 UP 1 DOWN: 1 Unhandled	6670 OK 2 UNKNOWN: 2 Unhandled 15 CRITICAL: 1 Unhandled 14 on Problem Hosts 1 Disabled
备份服务器-姚秋玲 (Bak-Servers)	9 UP	25 OK
BIO计算节点负责人系统组值班人员 (Bio-servers)	29 UP	290 OK
计算中心节点cac ccib map nano负责人, 系统组值班人员 (CC-Servers)	46 UP	399 OK
云计算服务器-崔涛 (Cloud-Servers)	9 UP	10 OK
DWS计算节点负责人, 系统组值班人员 (DWS-Servers)	106 UP	1378 OK
数据服务器-负责人,杜国红,杨毅 (Data-Servers)	10 UP	14 OK 1 CRITICAL: 1 Unhandled
GPU负责人,文硕频6067 (GPU-Servers)	123 UP 1 DOWN: 1 Unhandled	1512 OK 3 UNKNOWN: 3 Unhandled 13 CRITICAL: 13 on Problem Hosts
存储服务器 (GRASS-Servers)	16 UP	49 OK 1 CRITICAL: 1 Unhandled
负责人,系统组值班人员 (Gluster-Servers)	13 UP	78 OK
高能所网格节点 lwn cac (IHEP-Grid)	67 UP	446 OK
江门计算机节点 (JNWS-Servers)	102 UP	488 OK
登录节点负责人,杜国红,杨毅 (Login-Servers)	66 UP	731 OK 1 WARNING: 1 Unhandled 3 UNKNOWN: 3 Unhandled



Monitoring and Accounting

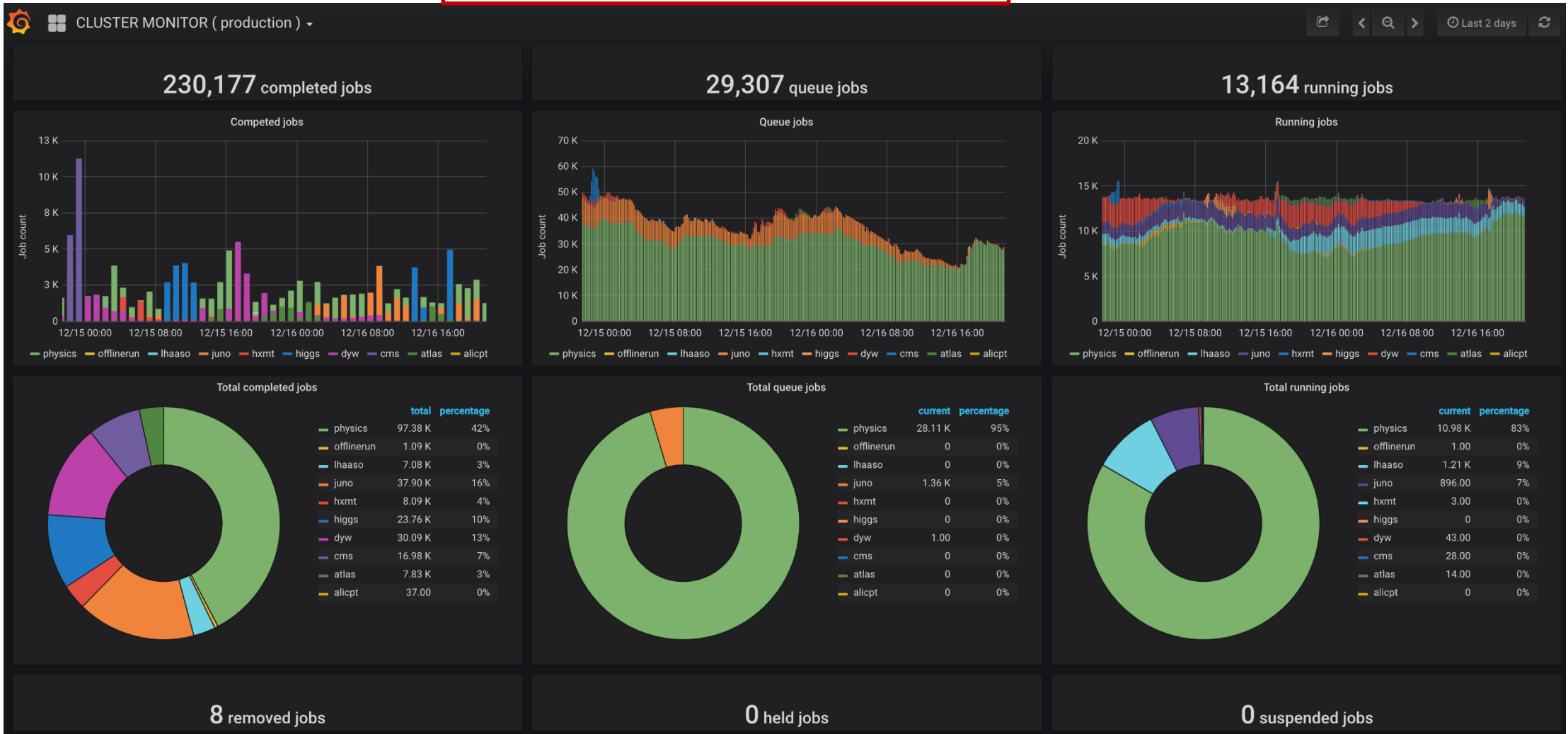
- Integration of the multiple monitoring data
- Improve the availability of computing cluster
- Correlation among the monitoring sources
- Analyze various sources monitoring data
- Unified display system, provides health status from multiple levels
- Show the trend of error and abnormality.





Computing Resource Usage

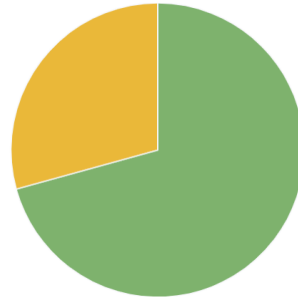
Resource Usage: 95.8%





BEIJING-LCG2 pbs status

complete jobs count distribute by stat

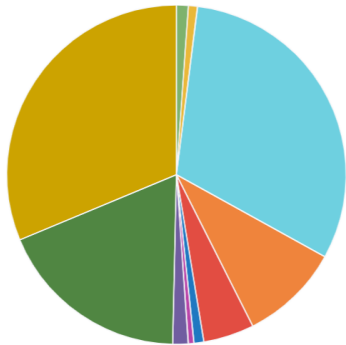


total	
E	68.4 K
D	28.3 K

pbsjob -

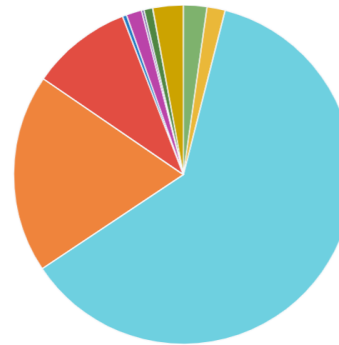


complete jobs count distribute by group



total	
ops	772
lhcbprd	592
lhcbpil	21.2 K
enmr	6.52 K
cmssgm	3.31 K
cmspil	644
bio	368
atlassgm	1.000 K
atlasprd	12.57 K
atlaspil	21.4 K

complete jobs count distribute by user



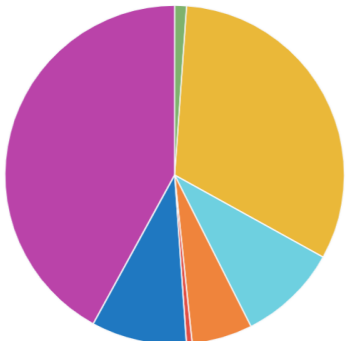
total	
ops040	772
lhcbprd026	592
lhcbpil049	21.2 K
enmr048	6.52 K
cmssgm003	3.31 K
cmspil028	137
cmspil009	507
bio040	84
bio014	284
atlassgm002	1.000 K

jobslot.keyword

1
12
1
1
1
1
12
1
1
1
1
1
1
1

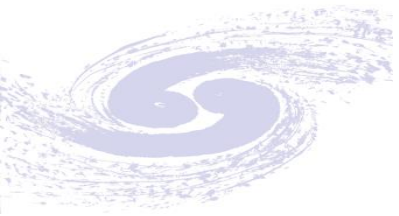
submit and s

complete jobs count distribute by queue



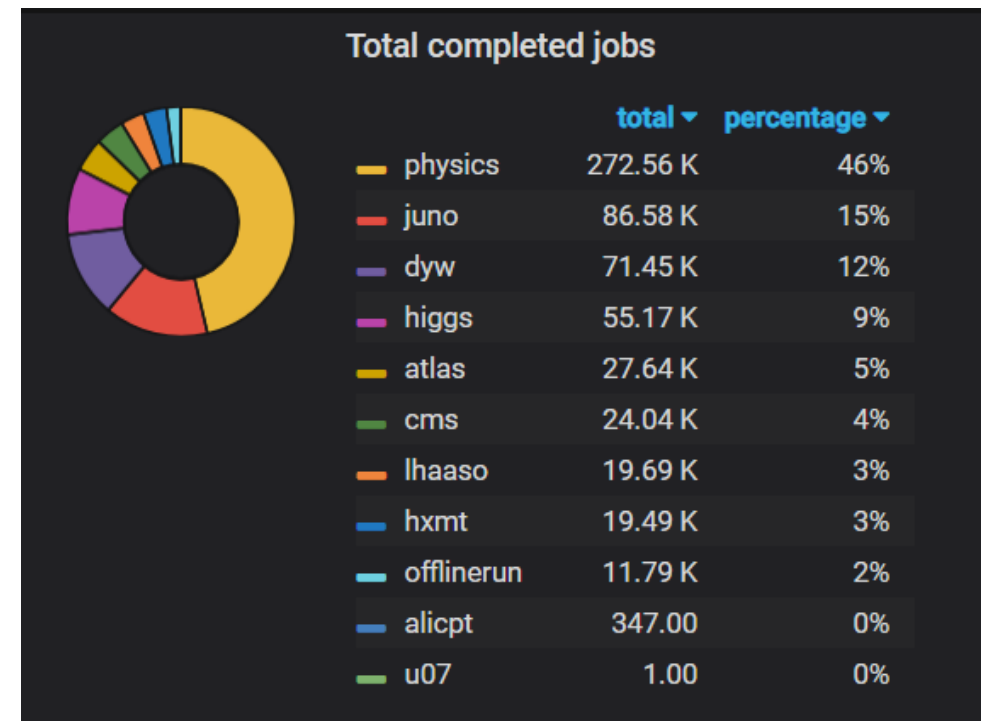
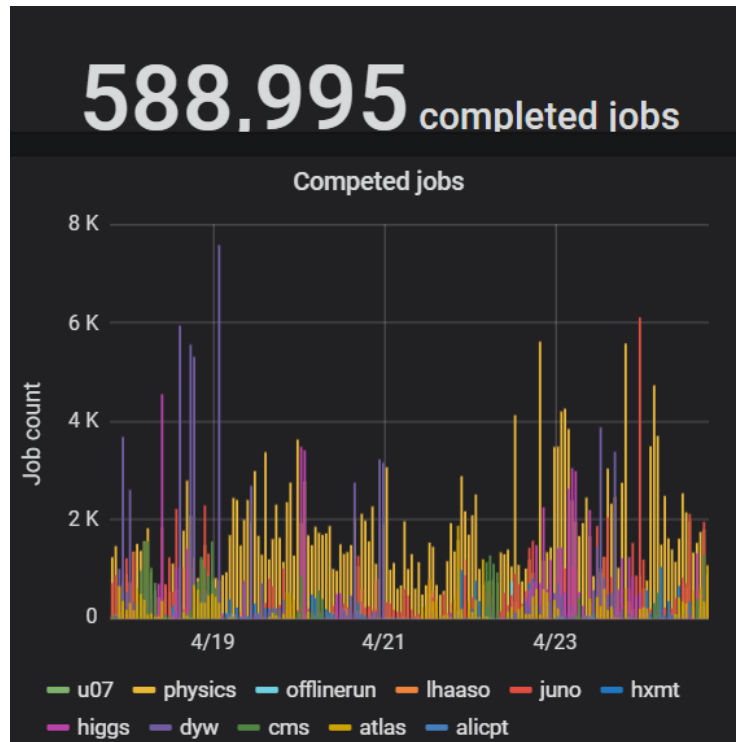
total	
ops	772
lhcb	21.8 K
enmr.eu	6.52 K
cms	3.95 K
biomed	368
atlascore	6.22 K
atlas	28.8 K

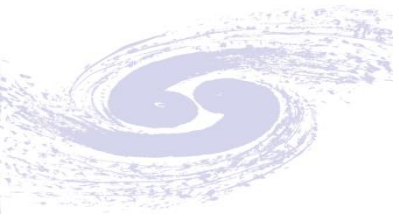




Monitoring & Accounting dashboard

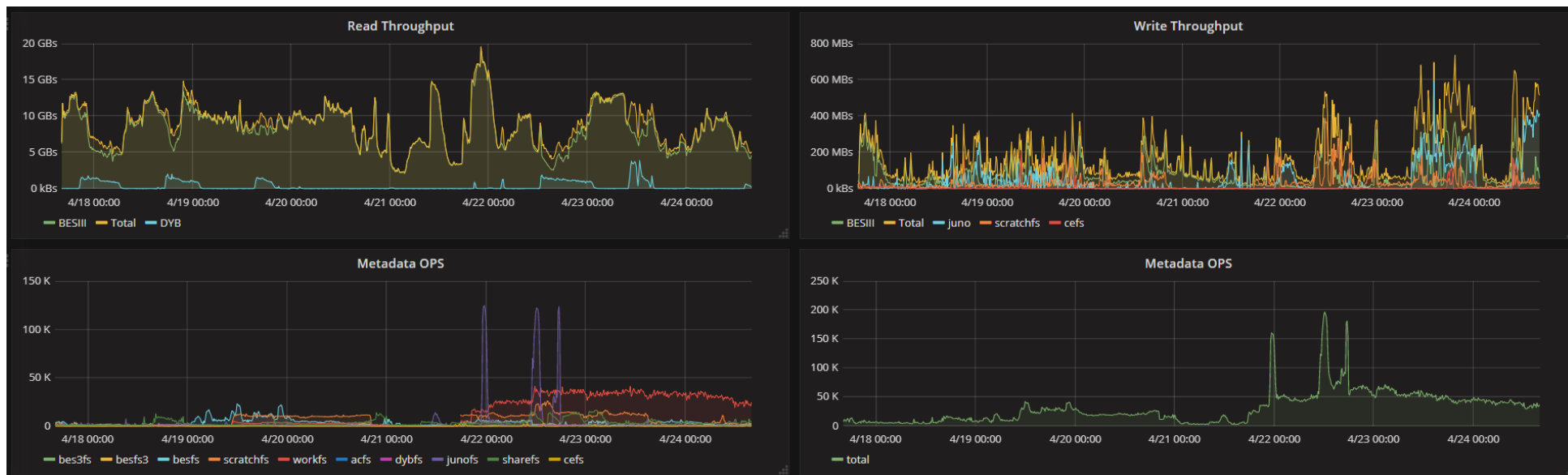
■ HTCondor accounting

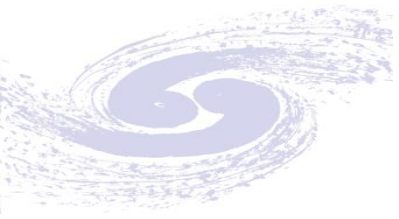




Monitoring & Accounting dashboard

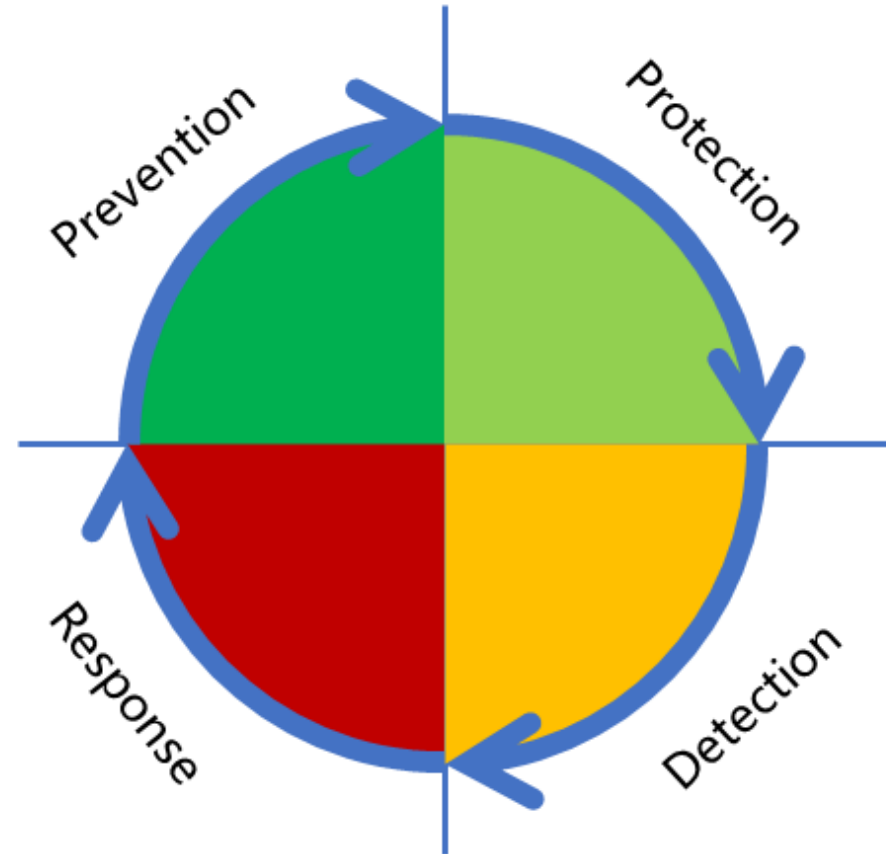
■ Lustre file system monitoring and Accounting



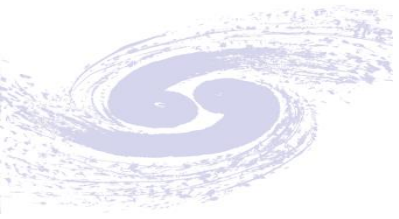


Security

- **Prevention**
 - awareness & training
 - policy review
 - assessment and audit
- **Protection**
 - Firewall, WAF, etc
 - vulnerability scan and fix up
 - block malicious IP and URLs
- **Detection**
 - traffic and logs analysis
 - threat intelligence
 - commercial IDS/SOC
- **Response**
 - incident response

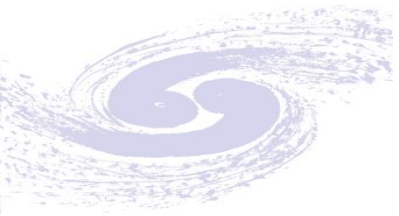


Cybersecurity Risk Control Model



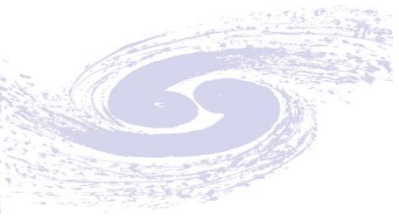
Security

- China Cyber Security Federation For HEP(CSFHEP)
 - cooperated to deal with security incident
 - share threat information, technology and expertise
 - help site system administrators with workshops/trainings
 - communicate/cooperate with HEP security teams outside China, and security teams outside HEP community



Locations of Members





Thanks!