Status of JUNO distributed computing

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14th JUNO collaboration meeting

2019.7.25

Task force and data center meetings

- Task force for distributed computing has been set up since last collaboration meeting
  - Test and improve services and protocols in distributed infrastructure
  - Look at the design to adjust where it is needed
- Junodatacenter@maillist.ihep.ac.cn is created
  - About 20 people registered
  - Contact: Xiaomei Zhang Giuseppe Andronico
- Juno data center computing meeting each month
  - Section for **JUNO Data center computing meeting** is created in Indico

Sites joined

- Six sites have already joined in distributed computing
  - IN2P3, IHEP, JINR, Padovana, CNAF
  - CE types: cloud, cluster, grid
  - SE types: dCache, StoRM
  - MSU plans to join soon
- Total Resources joined: ~600CPU cores

Resources: ~600CPU cores

Site	SiteType		MaskStatus	CE-Test	SE-Test	Storage Usage(%)	Efficiency(%)	Max Jobs
GRID.IN2P3.fr	GRID		Active	OK	OK	53	100	100
CLUSTER.IHEP-CON...	CLUSTER		Active	OK	OK	62.6	100	48
CLOUD.JINRONE.ru	CLOUD		Active	OK	OK	40.7	100	10
CLOUD.IHEPCLOUD...	CLOUD		Active	OK	OK	62.6	100	200
CLOUD.INFN-PADO...	CLOUD		Active	Bad			0	50
GRID.INFN-CNAF.it	GRID		Active	OK	OK	4.4	100	200

Sites monitoring

- Monitoring Dashboard has been developed and give a quick view of site status
  - Available in “site status monitor” from DIRAC web portal
  - Regular tests each hour for each CE and SE
    - Basic WMS job submission, SE download and upload, CE access
  - Status of all the jobs including user jobs and test jobs collected

SAM Information - GRID.IN2P3.fr

ElementName	ElementType	Status	WMS	SE	Access
IN2P3-DCACHE	StorageElement	OK		OK	OK
cccreamceli09.in2p3.fr	ComputingElement	OK	OK		OK
cccreamceli10.in2p3.fr	ComputingElement	OK	OK		OK

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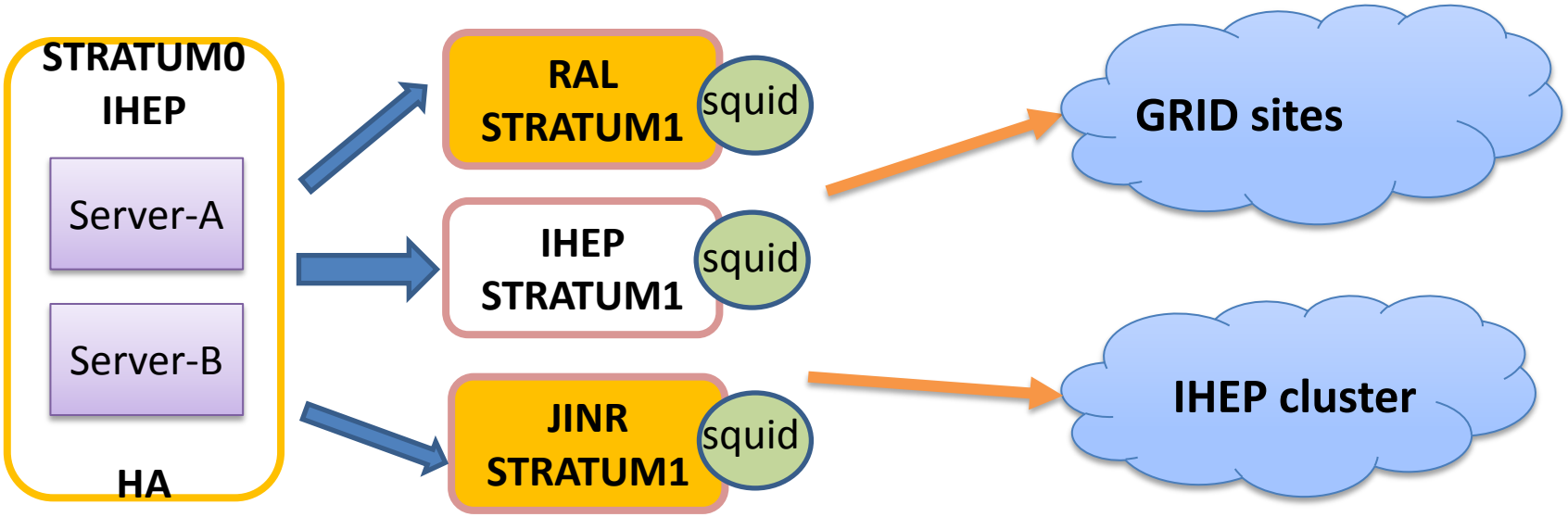
CVMFS(1)

- CERNVM File System （CVMFS） is used for deployment of JUNO software around the world
  - With CVMFS client installed, JUNO software can be easily seen and used in /cvmfs/juno.ihep.ac.cn wherever you are
- The first version of JUNO software is installed
  - /cvmfs/juno.ihep.ac.cn/sl6_amd64_gcc44/J17v1r1/
  - Contact: Lin Tao (need more versions to install)
- Client status
  - CVMFS client has been installed in the WNs or VMs of four sites
  - JUNO real jobs have been sent and proved it is working in all sites

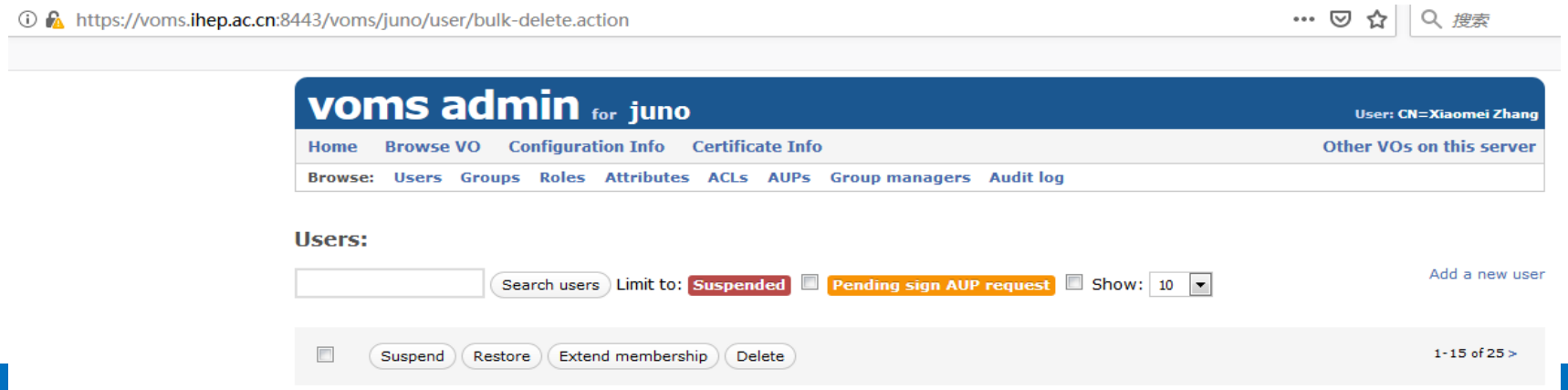
CVMFS(2)

- Server status
  - CVMFS stratum0 in IHEP
  - CVMFS stratum1 in RAL and IN2P3
  - CNAF stratum1 is on the way (firewall problem)
  - Each site has a squid server installed



VOMS and VOMS replicas (1)

- Virtual Organization Membership Service
  - Provide authentication for JUNO members to use resources in distributed env
  - Contact: Xiaomei Zhang
- The JUNO main VOMS is in IHEP:
  - https://voms.ihep.ac.cn:8443/voms/juno/
  - Now about 25 people registered in VOMS

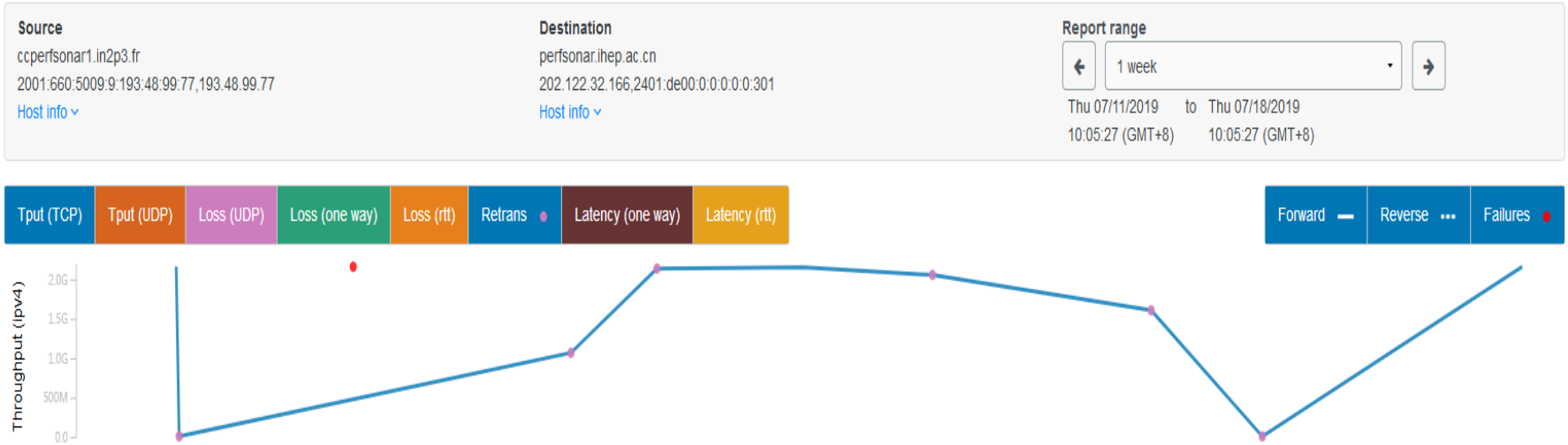


VOMS and VOMS replicas (2)

- VOMS info has been configured correctly in JUNO grid sites and related services
- JINR VOMS replicas has been created for backup and redundancy
  - https://lcgvoms02.jinr.ru:8443/voms/juno/configuration/configuration.action
  - A complete replica of IHEP VOMS
- Sites are required to add JINR replicas in UI configuration
  - Add jinr voms information to your grid env: /etc/vomses and /etc/grid-security/vomsdir
    - "juno" "lcgvoms02.jinr.ru" "15008" "/C=RU/O=RDIG/OU=hosts/OU=jinr.ru/CN=lcgvoms02.jinr.ru" "juno“
    - “/C=RU/O=RDIG/OU=hosts/OU=jinr.ru/CN=lcgvoms02.jinr.ru /C=RU/O=RDIG/CN=Russian Data-Intensive Grid CA”
  - It will be used when user initialize his cert

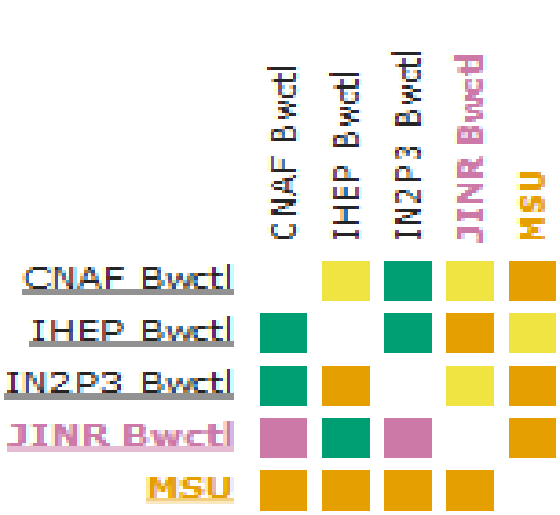
Network and perfsonar monitoring

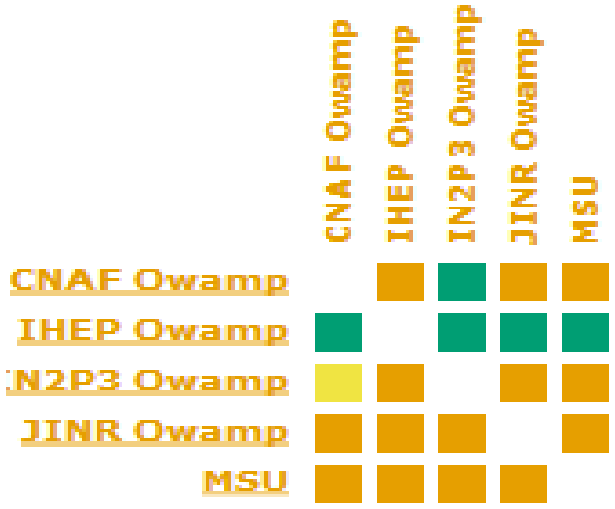
- Perfsonar monitoring dashboard has been set up
  - http://netdash.ihep.ac.cn/maddash-webui/
  - Contact: Zhihui Sun(sunzh@ihep.ac.cn)
- Network status such as bandwidth, packet loss, latency can be seen from the dashboard



Network and perfsonar monitoring

- A global view of network status distinguished with colors
  - Four parts: IPv4,IPv6, bandwidth, package loss and latency
- Next step is to integrate monitoring to DIRAC



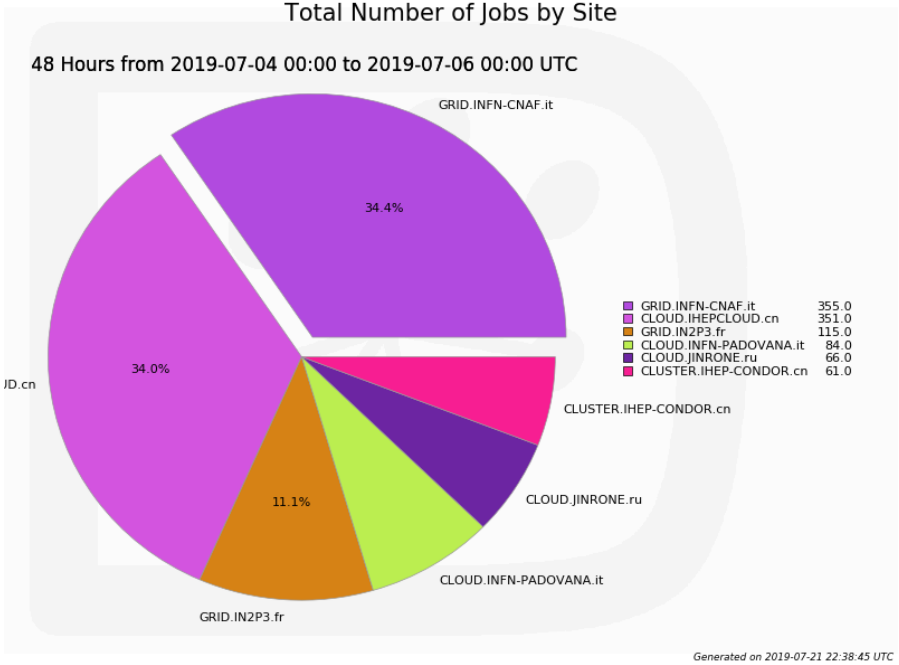


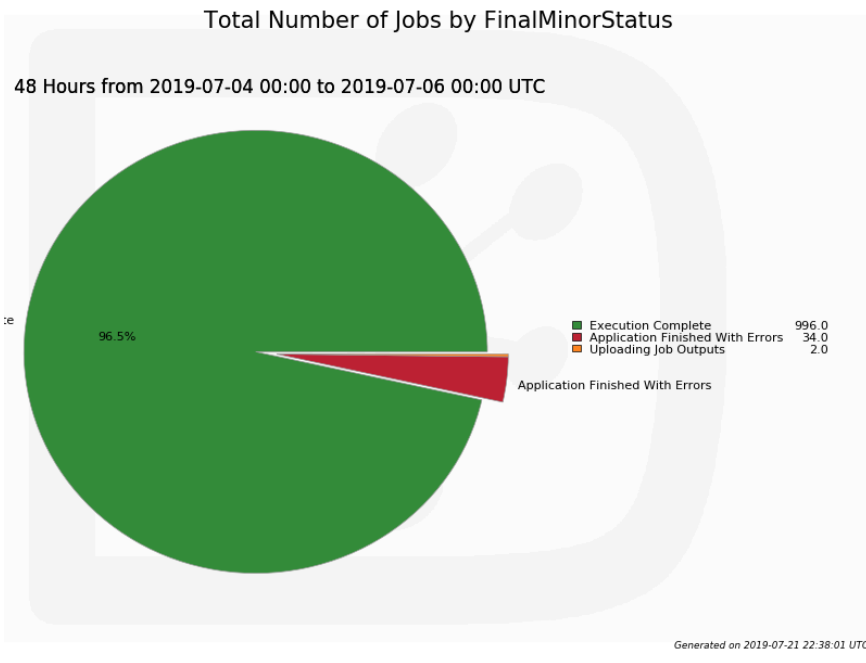
JUNO job env set-up for sites

- OS env provided by sites are different for JUNO jobs to run
  - SL6, SL7, with minor version……
- Two measures have been taken to make sure the consistency of running env for JUNO
  - Singularity provides a unique OS for grid and cluster sites
  - Common libraries are added to the CVMFS to avoid missing basic libraries in sites
    - /cvmfs/juno.ihep.ac.cn/sl6_amd64_gcc44/common/lib

JUNO jobs tests in sites

- The JUNO jobs are running well in all the current sites
  - About 1000 JUNO MC simulation jobs are done in sites, 96% success rate
  - Use JUNO positron MC simulation as an example





File catalogue

- Replicate catalogue has been set up to provide a global view of data in distributed environment
- Metadata catalogue is used to define datasets
- Areas are separated for official data and user data in the catalogue
  - Owned by Juno_production group for official data
  - Owned by Juno_user group for user data

```
FC:/juno>ls -l
drwxrwxr-x 0 zhaoxh  juno_production 0 2019-05-07 07:51:06 TransferData
drwxrwxr-x 0 zhangxm juno_production 0 2019-05-07 07:51:40 lustre
drwxrwxr-x 0 yant    juno_user       0 2019-05-07 07:45:52 test
drwxrwxr-x 0 suob    juno_user       0 2019-07-21 03:37:21 user
```

Tests on Data management

- Export and share raw data of JUNO to collaborations with SE and File Catalogue
  - /junofs/PmtCharacterization/container_data/Measurements_DAQ/ required by JINR group to replicate to JINR
  - ~11TB, >800,000 files
- Tests case1:
  - Mount the lustre directory /junofs/PmtCharacterization to our StoRM SE as a backend
  - With SRM, you can download raw data anywhere with grid UI and cert srm://storm.ihep.ac.cn:8444/juno/lustre/junofs/PmtCharacterization/

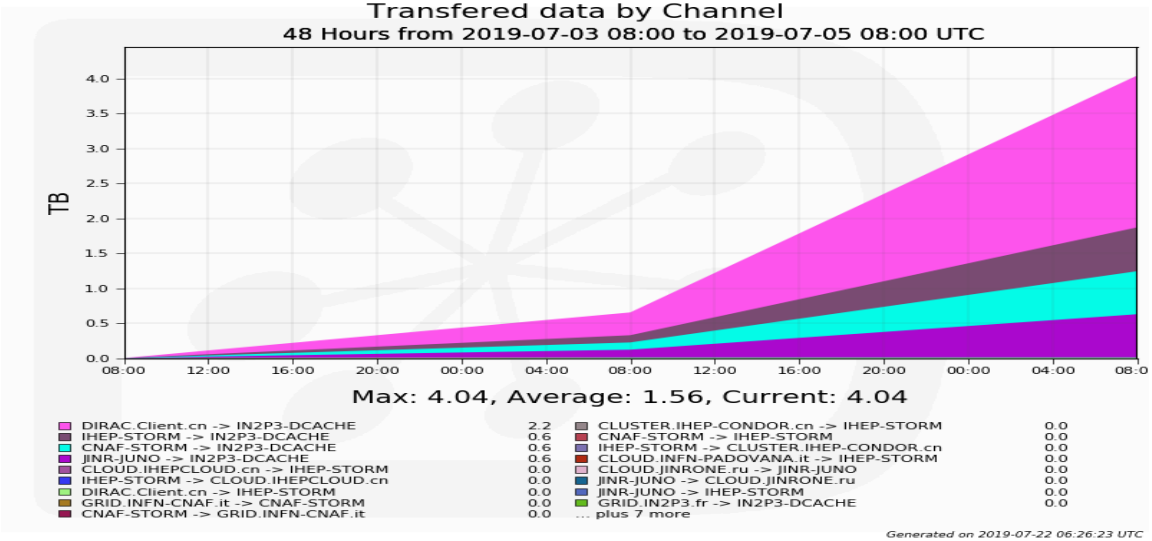
Tests on Data management

- Test case2:
  - Register data into File Catalogue
- Test case3:
  - Data replicas can be tracked with LFN after transfers
  - You can get data with LFN wherever data is located

```
FC:/juno/lustre/junofs/PmtCharacterization/container_data/Meassurements_DAQ/mass385/gain_Iteration_0>replicas PA1811-5
003_127_MCP_867_0_part4.dat
lfn: /juno/lustre/junofs/PmtCharacterization/container_data/Meassurements_DAQ/mass385/gain_Iteration_0/PA1811-5003_127
_MCP_867_0_part4.dat
CNAF-STORM      srm://storm-fe-ams.cr.cnaf.infn.it:8444/srm/managerv2?SFN=/juno/storm/dirac/juno/lustre/junofs/PmtChar
acterization/container_data/Meassurements_DAQ/mass385/gain_Iteration_0/PA1811-5003_127_MCP_867_0_part4.dat
IHEP-STORM      srm://storm.ihep.ac.cn:8444/srm/managerv2?SFN=//juno/lustre/junofs/PmtCharacterization/container_data/
Meassurements_DAQ/mass385/gain_Iteration_0/PA1811-5003_127_MCP_867_0_part4.dat
JINR-JUNO       srm://lxse-dc01.jinr.ru:8443/srm/managerv2?SFN=/pnfs/jinr.ru/data/juno/dirac/juno/lustre/junofs/PmtCh
racterization/container_data/Meassurements_DAQ/mass385/gain_Iteration_0/PA1811-5003_127_MCP_867_0_part4.dat
```

Tests on Data management

- Test case4:
  - All the output data of user jobs can be registered into File Catalogue
    - Default directory: /juno/user/
  - The output data of test jobs have been successfully written to SE and also been registered in File Catalogue



How to use JUNO distributed computing

- Set up JUNO DIRAC env first
  - CVMFS client (available in lxslc):

    Source /cvmfs/dcomputing.ihep.ac.cn/dirac/DIRAC_Client/v0r18/bashrc
  - Install your own client: http://dirac-code.ihep.ac.cn/juno/install/installJUNODIRAC.sh
- Two ways
  - Command line: submit jobs and manage data, check status of site, jobs and data
  - Web portal: check status of site, jobs and data

How to submit a JUNO job

- Single job submission
  - You can use DIRAC command line or API
  - http://dirac-code.ihep.ac.cn/juno/install/examples.tgz
- Single Juno job submission
  - An example: /cvmfs/dcomputing.ihep.ac.cn/dirac/IHEPDIRAC/Examples/juno/detsim
  - More details seen in Joao's talk on "How to use DIRAC to submit jobs from user's point of view"

How to submit a JUNO job

- Massive user jobs submission
  - Normally users need to submit and manage a bunch of jobs (tasks)
  - To ease usage of grid and massive job management, tool is being developed and tested
    - Plan to release before next collaboration meeting
  - This tool will take care of the whole jobs life cycle automatically
    - Create, Split, Submit, Run, Output data Transfer back and Register, Status check, Resubmit……
- Massive production jobs submission – Juno production system
  - In design and under development
  - Some details in “Bulk transfer in JUNO production system”

Conclusion

- Task force of data centers for JUNO distributed computing has been set up
- A lot of progress have been made since last collaboration meeting
- Tests using JUNO MC jobs and raw data have been done
- The system is ready for users to try
- Massive user job submission tool and JUNO production system would be our next focus