# DIRAC for IHEP distributed computing

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2th Virtual DIRAC User Workshop

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# What is IHEPDIRAC for

- **The IHEP Distributed Computing built on DIRAC is used for three experiments**

  - JUNO : Jiangmen Underground Neutrino Observatory

  - BESIII : Beijing Spectrometer III at BEPCII

  - CEPC : Circular Electron Positron Collider

- **Support Monte Carlo production and data transfer, also for reconstruction and user analysis**

  - **Most of efforts on JUNO which will start data-taking in 2023 because of limited manpower**

BESIII (Beijing Spectrometer III at BEPCII)

JUNO (Jiangmen Underground Neutrino Observatory)

CEPC (Circular Electron Positron Collider)

# DIRAC set-up in IHEP 1/2

- The current production is v7r1p30
  - Three servers
    - One master server in physical machine
      - Silver 4116(2.10 GHz) with 48 cores, 128GB memory, 4x2T disk
      - OS: CentOS7
      - Hold all the services
    - Two slave servers in virtual machine ( in JINR and in IHEP)
      - 8 cores, 16GB memory
      - Configuration server + WebAppDIRAC with Nginx (in IHEP)
      - Configuration server (in JINR)

# DIRAC set-up in IHEP 2/2

- Plans
  - Try to understand and prepare the pressure, especially caused by parallel data replication tasks
    - Already met some performance problems, eg Transformation Manager
    - Worry about the coming Raw data transfers + MC production data transfers together in current setup
  - Try to improve monitoring on services and agents to track and predict  bottlenecks
  - Plan to add one or more physical servers for the setup to duplicate some services if necessary

# Migration to python3

- The testbed set up with v7.3.20 in python3

- In migration to python3
  - IHEPDIRAC in python3 is published on pypi
  - Client with version v7r2 is installed
  - Server with version v7r3 is installed
  - Next step is to try with python3 pilot and do the testing

# The DIRAC functionalities used (1)

- Most of DIRAC functionalities have been used
  - **Workload management system**
    - Integrate HTCondorCE, ARCCE, SLURM……
    - Integrate cloud with **VMDIRAC**
  - **Data management system**
    - **DIRAC File Catalog (DFC)** for both metadata and replica catalog
      - 4.6Million replicas, ~700TB files
  - **Transformation system**
    - MC simulation and raw data reconstruction
  - **TS+RMS+FTS**3
    - Bulk data replications

# The DIRAC functionalities used (2)

- **Monitoring and Accounting system**
- **Resource Status System** with extension to monitor site status and usage
- **Multi-VO** to support three experiments in one instance
- **SingularityCE** to give a unique environment for sites
- **PoolCE and tag feature** to support GPU resource and multi-core jobs

- Still need time to elaborate usage of critical functionalities for real production

# DIRAC functionalities not used

- Interested, but lack of time, will have a try after "play" well with functionalities required or add manpower
  - Production System (have own interface)
  - Central Logging System
  - Message Queue System
  - Workflow
- Not needed so far
  - Storage Management System
    - Depend on site choices
    - Currently use dCache, EOS, StORM, not DIRAC SE

# Do you have a DIRAC extension? 1/2

- **We have IHEPDIRAC extension , no new things since last workshop**
  - IHEP production system
    - Tools and scripts for MC productions and bulk transfers
    - Eg. create production, reset failed, delete intermediate files….
  - Site status monitoring
    - Extension to RSS
    - Add routine SAM tests with experiment standard jobs
    - Use data in DB to establish dashboard with ElasticSearch and kibana

Dashboard with ES/Kibana
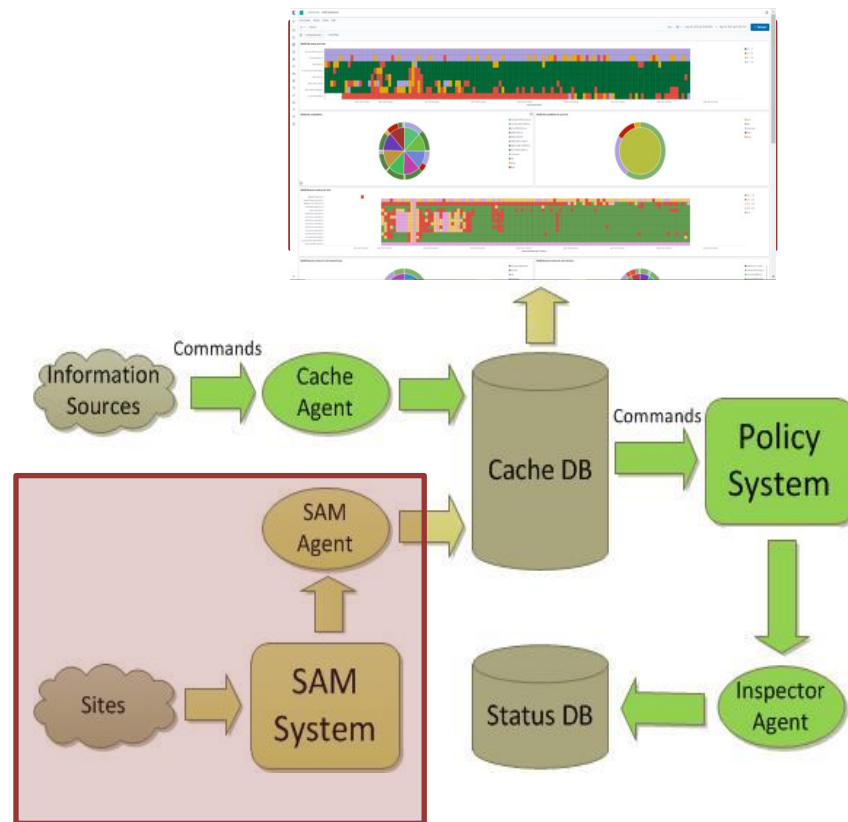
# Do you have a DIRAC extension? 2/2

- Monitor, summarize and operate individual user analysis tasks
  - Collect statistic info of use tasks in one page
  - Provide reschedule and delete in one command
  - Be used together with user submission tools

# Do you think some of it could become part of the vanilla projects?

- Most are experiment-specific
- Site status monitor can be an additional part of RSS
  - Regularly send SAM tests
  - Dashboard with ElasticSearch+Kibana

# What is your biggest frustration with DIRAC?

- Generally happy with DIRAC
- Some desired features on operations
  - Better understand "stalled" or "killed by watchdog" jobs
    - Maybe specification of memory usage of user jobs or more clear reasons in pilot log? more detailed pilot and job monitoring would help?
  - Get warned of or better understand the problems of critical services and agents
    - Not easy to know the problem when an agent get stuck without error in the log
    - Not easy to understand SSL timeout when services looks fine

# add one feature to DIRAC, what is it?

- Automatic warning or operation features on the parameters and problems of services and agents
  - Based on analysis of data from DIRAC DBs
  - Eg. establish connection of job or data information with system  or service parameters to predict service or system bottleneck or help dynamically tune right parameters

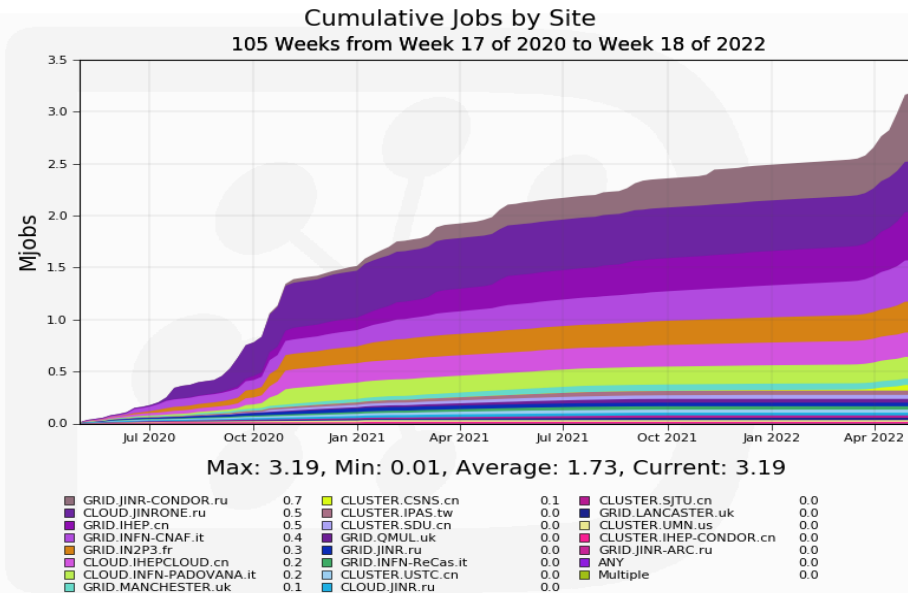# Any notable operations incident in the last year?

- RequestExecutingAgent got stuck sometimes when some data replication transformations were ongoing
  - No errors found in the log of the agent before stuck
  - Restarting can recover it
  - Not clear what happened

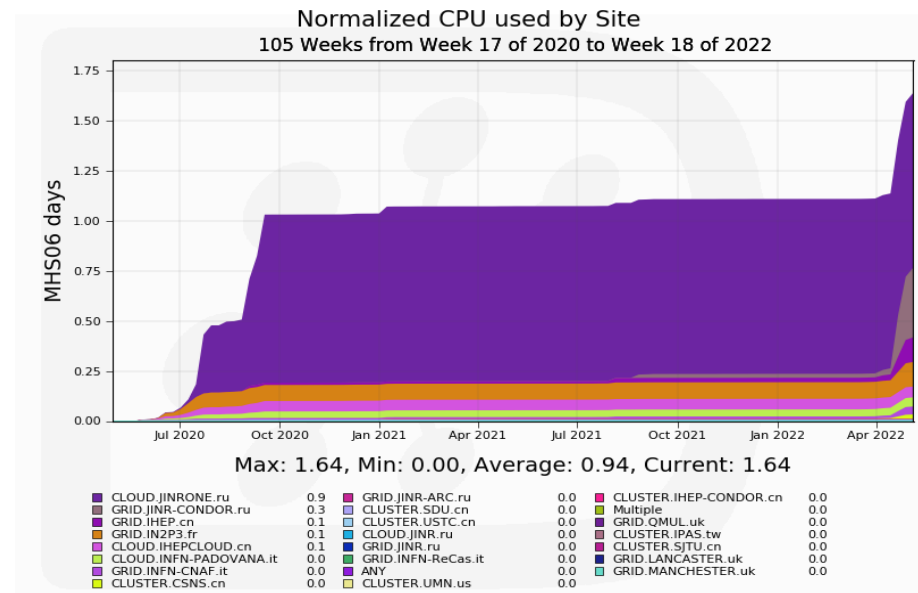# How would you rate the communication?

- Nothing complained with communication
- New forum in Github is good to me, convenient to ask and clear answer
- Try to be in BiLD meeting every time
- Haven't got time to hackathon, but think it is useful
- Suggest to have a convenient place to collect or report on problems or unclear places on documents

# DIRAC usage in last two years 1/3

- DIRAC is used in the following activities in the last two years
  - MC production
  - Data transfers from IHEP to outside
- There are ~3M jobs done in DIRAC and Normalized CPU usage is 1.64MHS06 days for the last two years

- The first MC productions operated by the JUNO production group using transformation started this April
  - Generally OK besides some performance problems mentioned above



Running jobs by Site
17 Days from 2022-04-20 to 2022-05-07

Max: 4,950, Min: 0.91, Average: 1,849, Current: 66.6

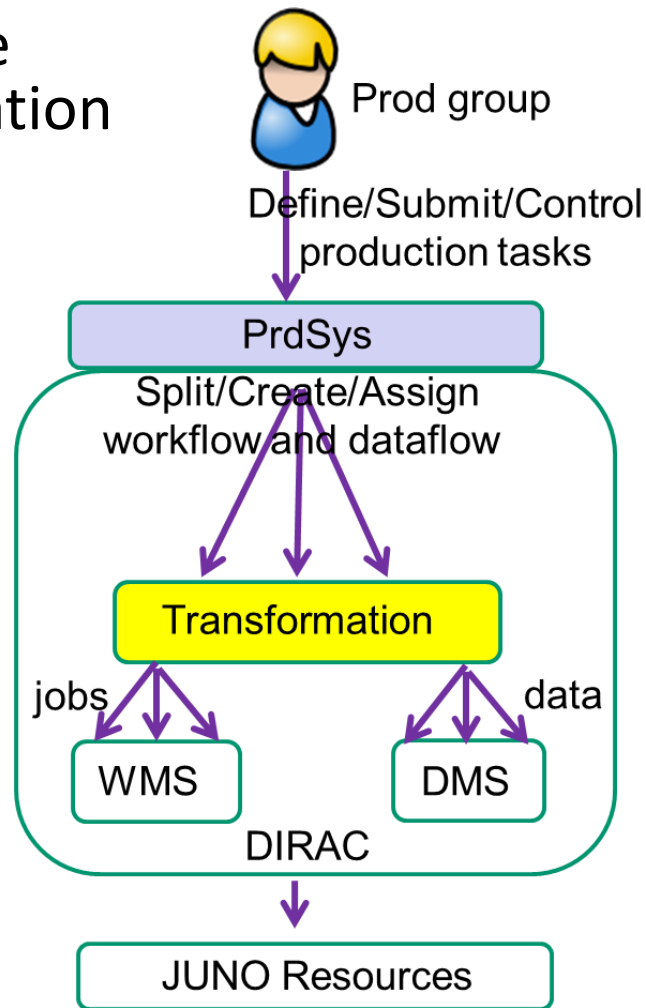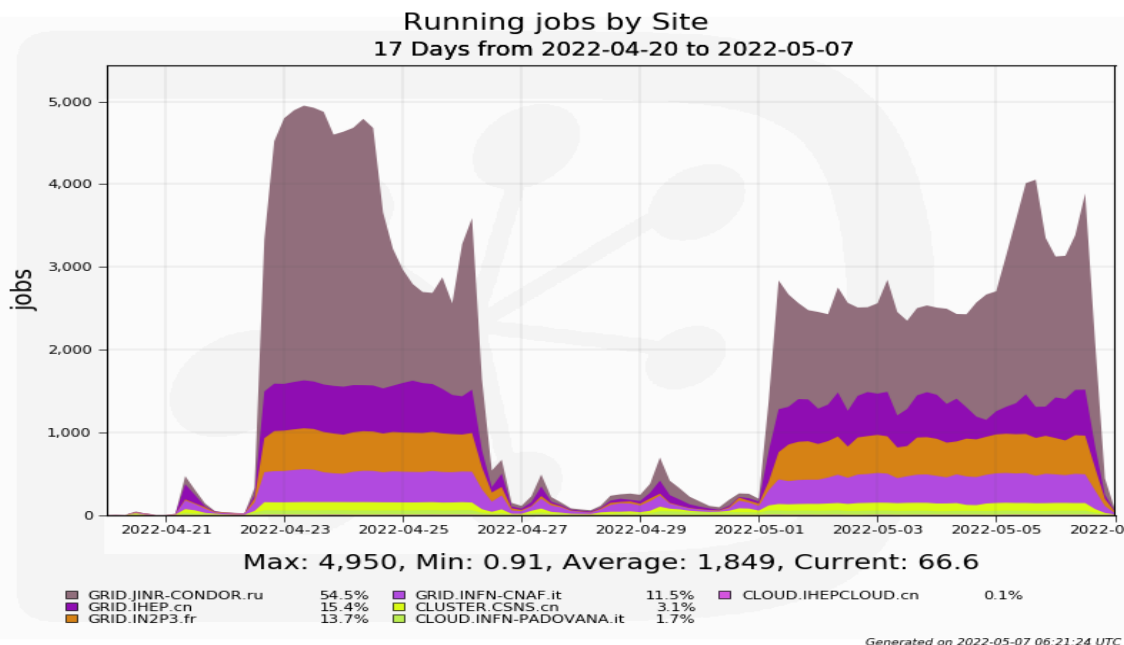| | | | | | |
|---|---|---|---|---|---|
| GRID.JINR-CONDOR.ru | 54.5% | GRID.INFN-CNAF.it | 11.5% | CLOUD.IHEPCLOUD.cn | 0.1% |
| GRID.IHEP.cn | 15.4% | CLUSTER.CSNS.cn | 3.1% | | |
| GRID.IN2P3.fr | 13.7% | CLOUD.INFN-PADOVANA.it | 1.7% | | |

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# DIRAC usage in last two years 3/3

- Transfers through FTS3 with DIRAC DMS are 1.2PB, which is doubled since last workshop
- The maximum speed can reach 7.5Gb/s



Transfered data by Channel
105 Weeks from Week 17 of 2020 to Week 18 of 2022

Max: 1.20, Average: 0.48, Current: 1.20



Throughput by Channel
48 Hours from 2022-01-06 00:00 to 2022-01-08 00:00 UTC

Max: 746, Average: 86.9, Current: 26.8
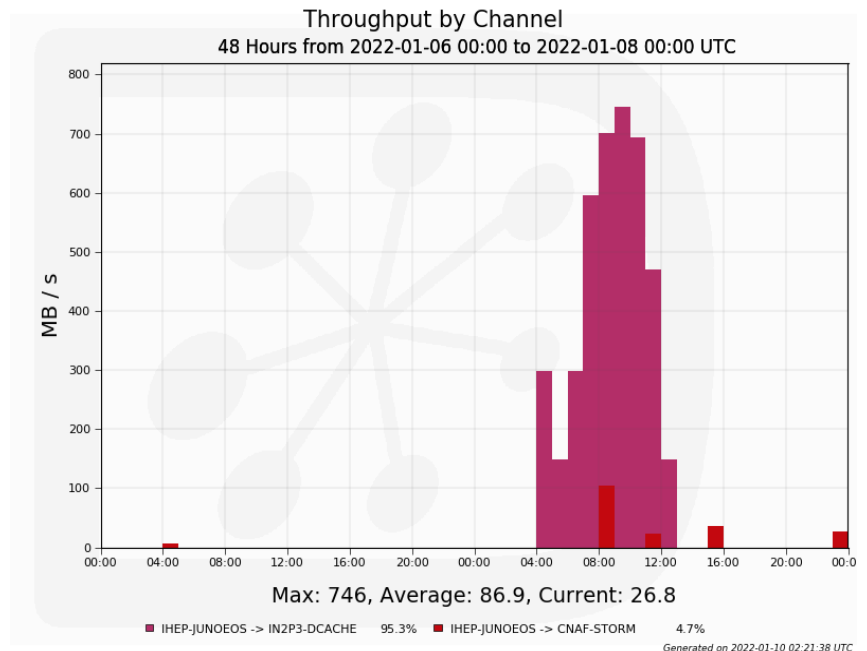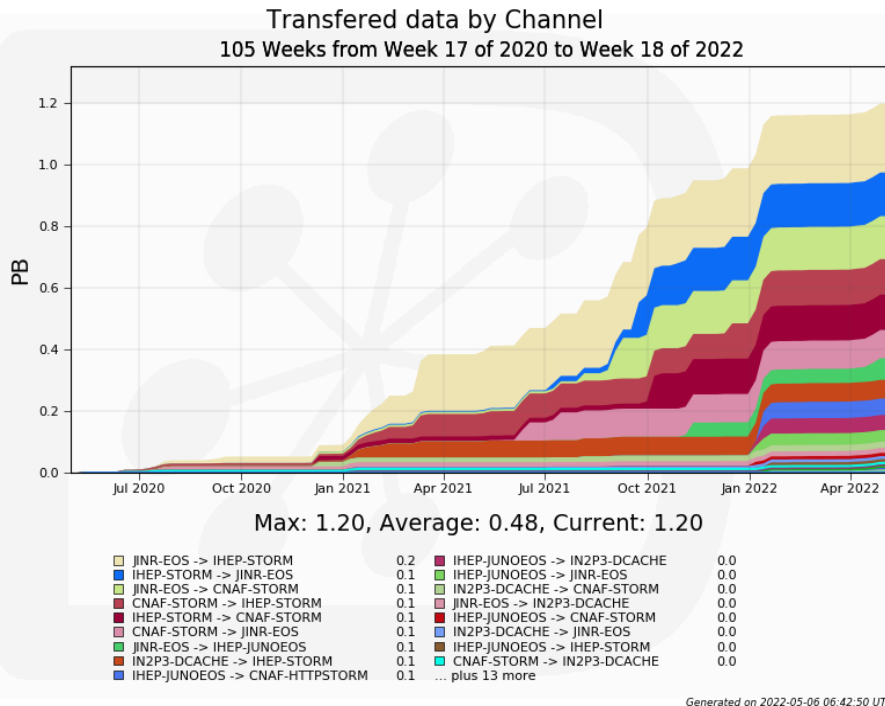
# Summary and plan

- Generally happy with DIRAC functionalities, still need time to explore full capability of them

- With increased resource and usage, will put more efforts on service performance and bottleneck

- Complete migration to python3 and prepare for migration to token authentication

- Thank for help from DIRAC developers and communities!

- Happy to be in the DIRAC family!

# research assistant and postdoc positions are opening for IHEPDIRAC

- The annual salary is competitive to Europe

- If you are interested or know such candidates, please contact me (zhangxm@ihep.ac.cn)

- More details can refer to: https://inspirehep.net/jobs/2051835