Introduction to
JUNO Distributed Computing

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On behalf of JUNO DCI group

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Based on Xiaomei Zhang slides

Content

❖ Why need Distributed Computing Infrastructure (DCI)?

❖ How does DCI work?

❖ General rule to use DCI

Why need distributed computing?

❖ JUNO is an international experiment, and resources are provided from several data centers around the world

  ● IN2P3, IHEP, JINR, CNAF, SDU……..

❖ How to use resources in these distributed data centers?

❖ How to access and share data among these distributed data centers?

Site	SiteType	MaskStatus
GRID.IN2P3.fr	GRID	🟩 Active
CLUSTER.SDU.cn	CLUSTER	🟩 Active
CLOUD.IHEPCLOUD.cn	CLOUD	🟩 Active
GRID.IHEP.cn	GRID	🟩 Active
CLOUD.INFN-PADOVAN...	CLOUD	🟩 Active
GRID.JINR-CONDOR.ru	GRID	🟩 Active
GRID.INFN-CNAF.it	GRID	🟩 Active

DCI (Distributed Computing Infrastructure) provides solutions

DCI is a system which can integrate heterogeneous resources，hide complexity from users, and provide a simple way for users to use distributed resources with

❖ Global "ID" to identify each user

❖ Unique interface for job submission and data access

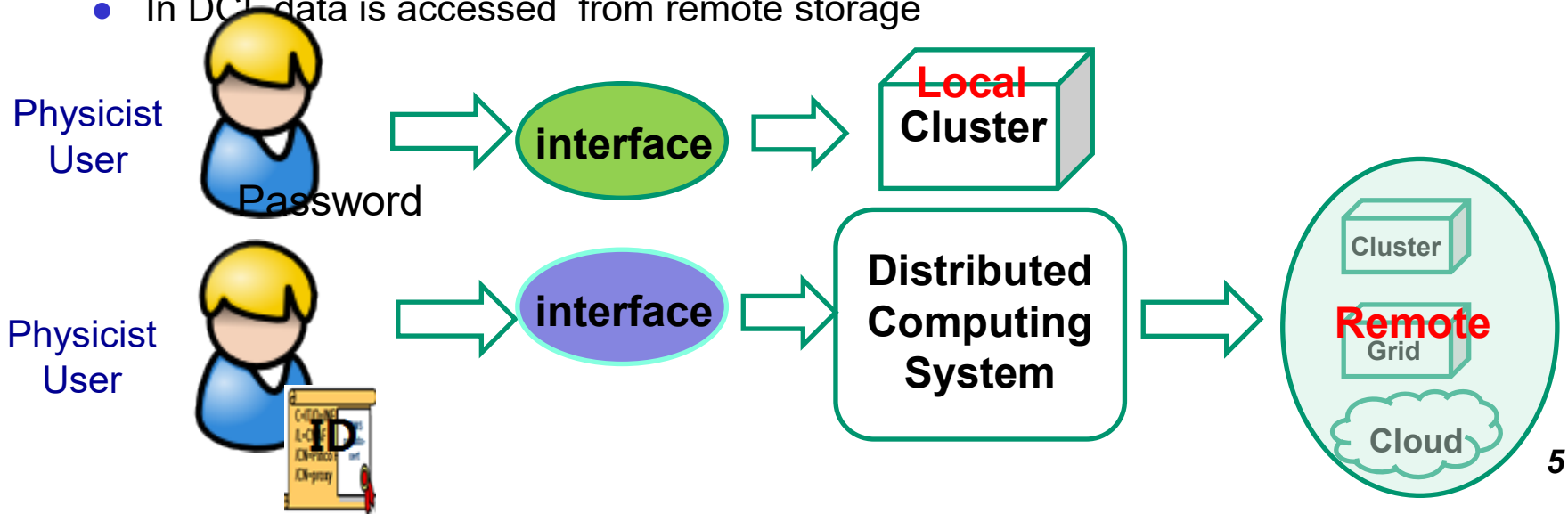This tutorial is going to tell you how to get global "ID" and how to use the interface

Physicist User → ID → interface → Distributed Computing System → Cluster, Grid, Cloud, SE
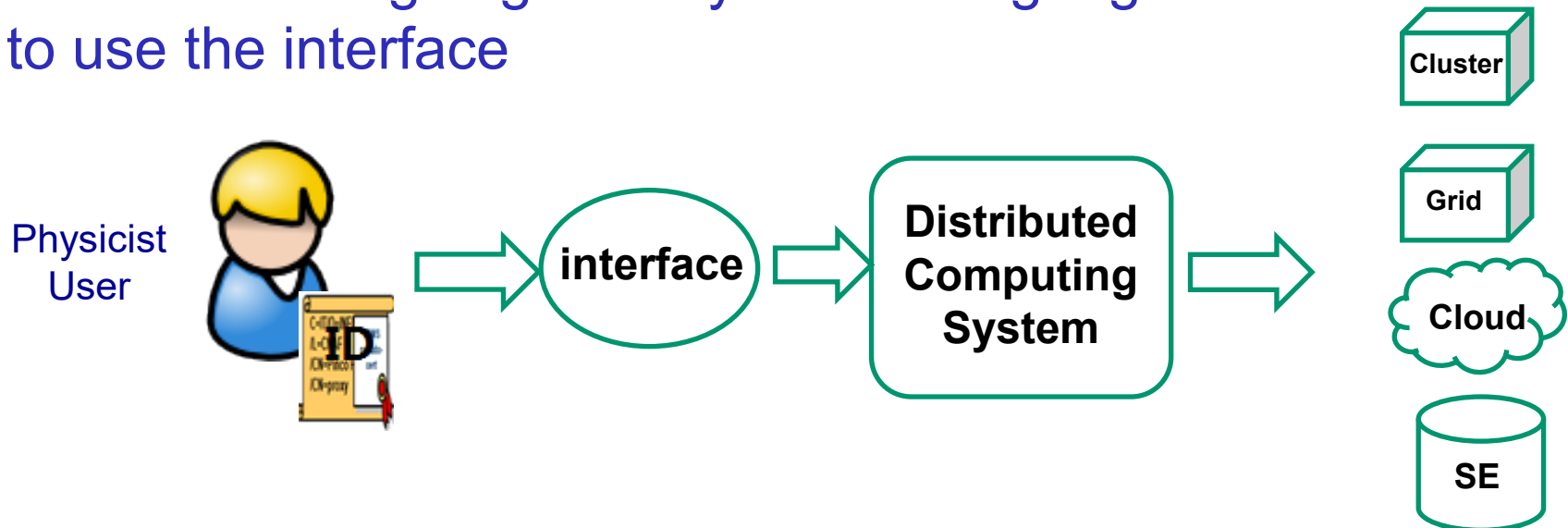
DCI vs. local cluster

- ❖ **Similar procedure**
  - Need authentication to tell the system who you are
    - DCI: "ID" (proxy certificate) ; Cluster: Account/password
  - Interface or commands to submit jobs or access data
    - Jobs: JSUB vs. Hep_Sub, Data: DFC vs. local
  - Access JUNO software from CVMFS
- ❖ **Differences in interface or commands**
 - In DCI, jobs are running in remote resources
  - In DCI, data is accessed from remote storage

Physicist User

Password

Physicist User

ID

interface → ~~Local~~ **Cluster**

interface → **Distributed Computing System** → **Remote** Cluster Grid Cloud

How does DCI accept you ?

❖ **Global authority and authentication system in DCI**

- User "ID" (proxy certificate) which consists of "X509 cert info" + "VOMS info"
  - X509 certificate – user identify info
  - VOMS – the experiment (VO) users belong to
- All the systems and services in DCI can identify "ID" and do translations between "ID" and local accounts
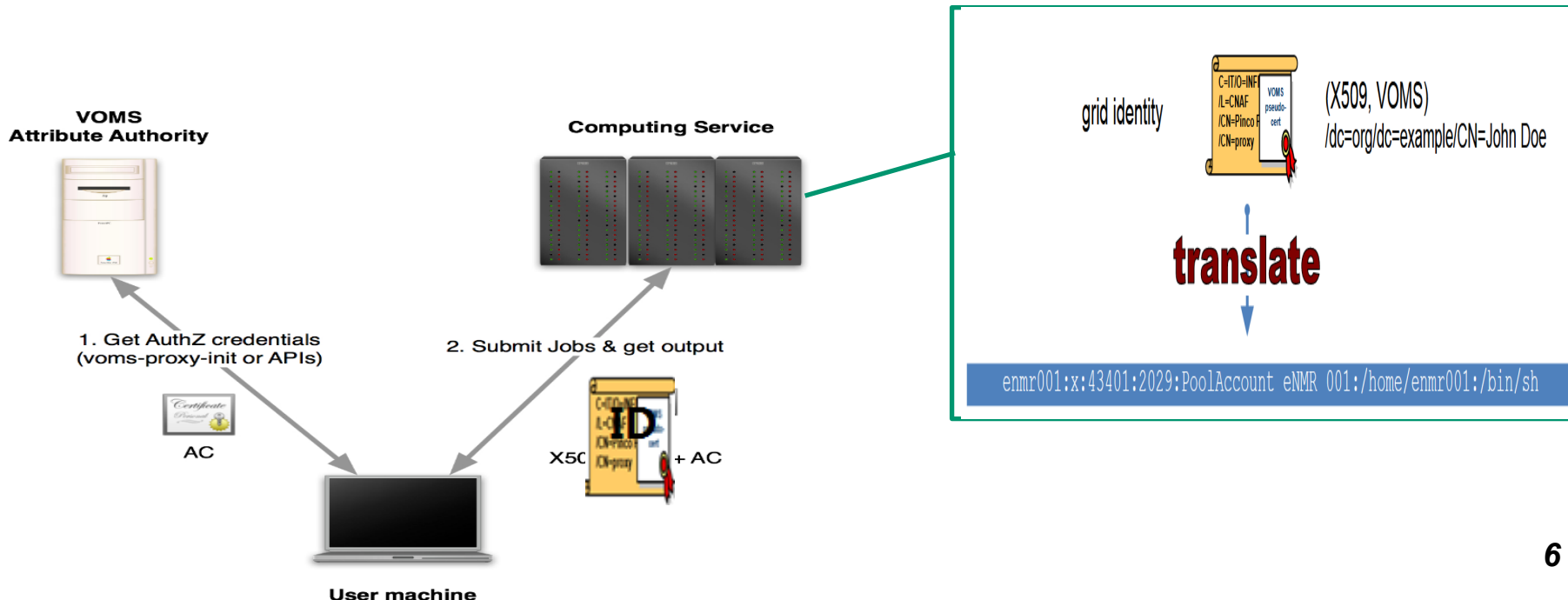
How does DCI run your jobs?

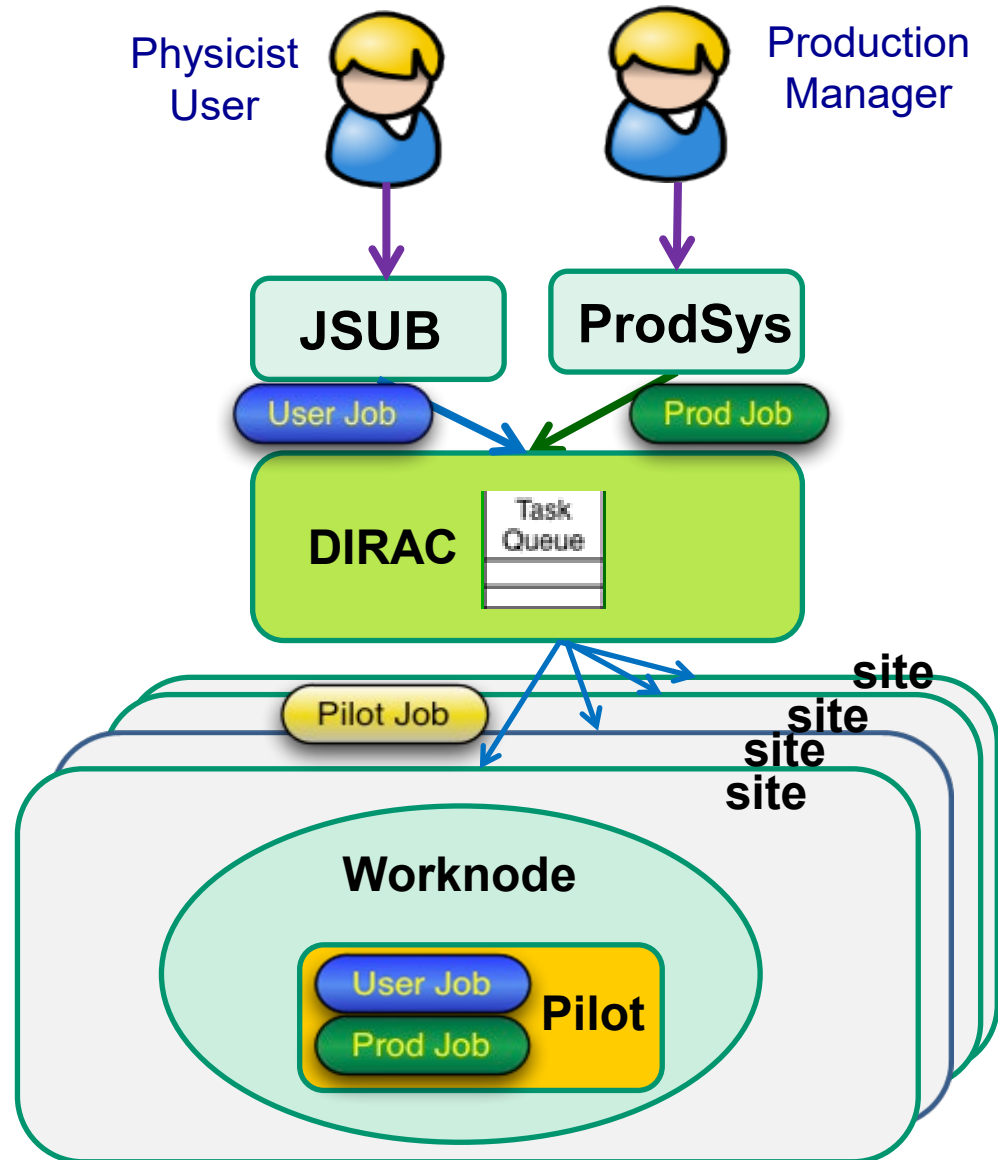- ❖ **JSUB and Production System (ProdSys)**

  - Provide **interface** for physicist user or prod groups to split and submit tasks to DCI

- ❖ **DIRAC**

  - **Interware** between jobs and resources

  - Interface with local schedulers in each sites

  - Receive jobs and schedule jobs to proper resources with pilot scheme
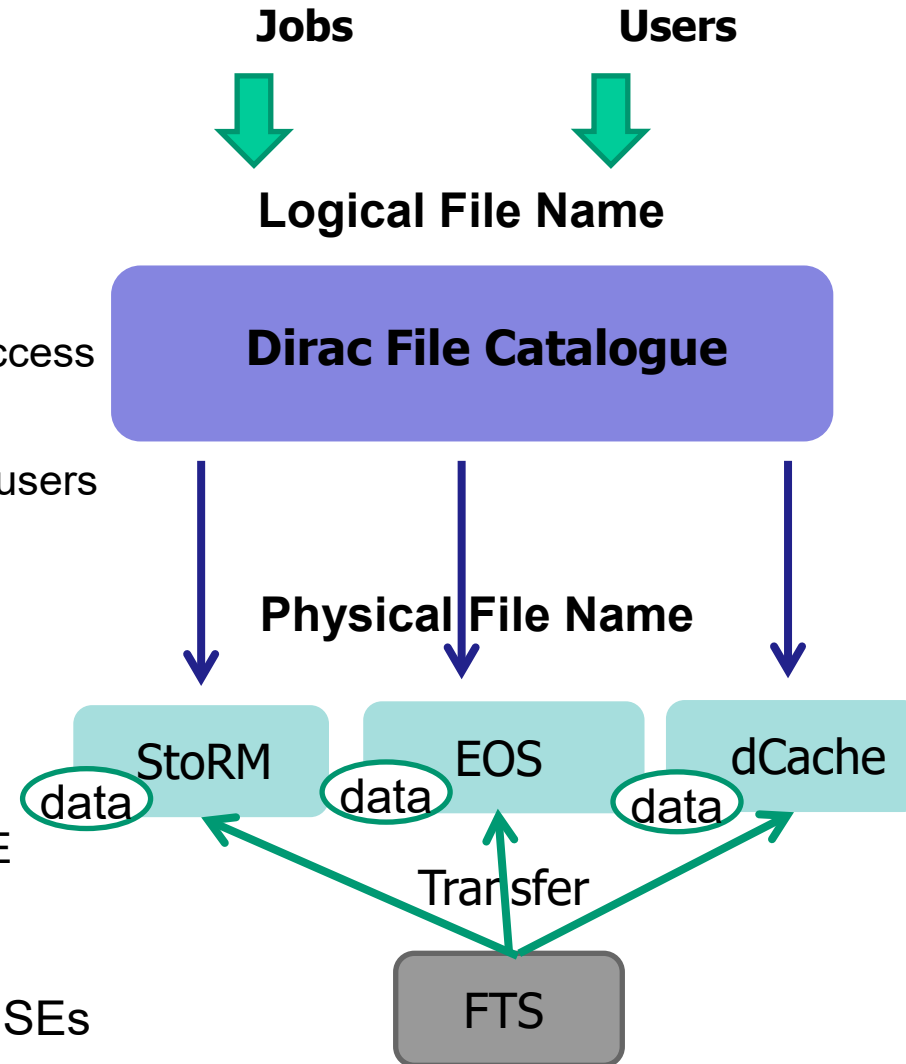
- ❖ **Resource in sites**

  - Jobs reach and run in work nodes just as local computing do

How do you use data in DCI?

❖ **In distributed computing environment, data is located in different data centers**

- Data can't be accessed locally

❖ **Dirac File Catalogue** (DFC)

- Interface with different SEs

- Provide a global view and an **interface** to access remote data in a way similar to local data

- With LFN, data locations are transparent to users

❖ **SE** （Storage Element）

- File system where data is stored, with grid protocols for data movements between SEs

- Same files can have copies in > 1 SE

- Normally users don't need to directly visit SE

❖ **FTS (File Transfer System)**

- Help massive data replication between SEs

Jobs   **Users**

Logical File Name

Dirac File Catalogue

Physical File Name

StoRM   EOS   dCache

data   data   data

Transfer

FTS

Resources in JUNO distributed computing

❖ Current total CPU cores ~3000 cores, storage ~3PB

❖ Resources continue to grow

Sites	CPU (cores)	Storage (TB)
CNAF	400	620
IN2P3	210	44
JINR	2000	600
IHEP	560	2000
Padovana	100	
SDU	50	
Total	3270	3264

Official and individual usage

❖ Two user cases with different tools and interface

❖ Official production uses ProdSys (Production System)

- MC production need to share among groups or across different data centers

- Larger scale, standard pattern, need more storage space

❖ Individual usage uses JSUB

- Individual simulation, reconstruction or analysis

- Small scale, more flexible, can be customized

❖ All output is available via DFC

❖ In some sites such as IHEP, output available in your local cluster might also be directly accessible without DCI credentials

How to prepare DCI environment?

❖ Before using JSUB or Prod system and accessing DFC, DCI client environment is needed

❖ The DCI client is available in IHEP CVMFS (/cvmfs/dcomputing.ihep.ac.cn) (Recommended)

- In login nodes with CVMFS clients installed, you can directly set up DCI environment
  - source /cvmfs/dcomputing.ihep.ac.cn/dirac/IHEPDIRAC/v0r2-dev11/bashrc

❖ Another way is to install DCI client in your own machine

- The install script is available to download from this link:
  - http://dirac-code.ihep.ac.cn/juno/install/installJUNODIRAC.sh

How to apply official production?

❖ Official production is taken care by production group or DCI group

- Need space negotiation and resource priority

❖ User can apply productions in IHEP Gitlab

- Create a Gitlab issue (http://code.ihep.ac.cn/vpj/scripts/-/issues)

- User can provide production requirements, physics parameters, total event size, data centers to share data, etc

- Any problems, contact production group or distributed computing group

orv@tsinghua.edu.cn @orv · 2 months ago   Owner   ☺ 💬 ⋮

I reproduce Gulio's scripts here

```
#!/bin/bash
source /cvmfs/juno.ihep.ac.cn/centos7_amd64_gcc830/Pre-Release/J20v2r0-Pre2/setup.sh

python $TUTORIALROOT/share/tut_detsim.py --no-gdml --evtmax 25 --seed 774 --output Atmo-detsim-1.root --user-
python $TUTORIALROOT/share/tut_det2elec.py --input Atmo-detsim-1.root --output Atmo-elecsim-1.root --user-out
python $TUTORIALROOT/share/tut_elec2calib.py --evtmax -1 --input Atmo-elecsim-1.root --output Atmo-calib-1.ro
```

The CNAF files are in
/storage/gpfs_data/juno/junofs/production/public/users/sgiulio/GENIEv3_00_06/gstroot/atmo_numu_nue_LS_0-
30GeV_flat_10M.gst.root

Procedure for individual users

❖ Get Grid Certificate and join JUNO VO

❖ Set up DCI environment and prepare proxy with cert

❖ Use JSUB to create and submit jobs to the DCI

❖ Check job status from JSUB or DIRAC web portal

❖ Output is available from DFC

This tutorial will focus on how use DCI for a single researcher

Arguments covered

❖ Prerequisites

- How to apply X509 cert and join JUNO VOMS membership

❖ Job submission

- How to create and submit jobs with JSUB

❖ Data usage

- How to deal with data in DCI environment

Contact

❖ Any problems, please contact us:

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