Status Report of Taiwan PanDA

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Academia Sinca Grid Computing

PanDA workshop at UT Arlington

04 September 2013

1

Status Report of Taiwan PanDA

- ASGC Distributed Cloud OS
- PanDA deployment in ASGC, Taiwan
- Status of AMS computing support
- Status of support of other user/application groups
  - Users of Institute of Physics; IoP
  - Users of Institute of Earth Science; IES
- Distributed Service deployment
- Future plan
  - AMS production support
  - PanDA-DEFT & JEDI deployment in Taiwan
  - PanDA Rucio integration

ASGC Distributed Cloud OS

Strategies

- **Leverage our successful experience as a Tier-1 center of the international collaboration project World-wide LHC Computing Grid (WLCG) in developing distributed cloud computing operating system (DiCOS) to support high energy physics research which is based on analysis of centrally generated big data.**

- **We will help design smart data center and apply DiCOS to support researches in other fields of science in Academia Sinica and in collaborating universities or institutions in order to make DiCOS a user driven platform for big data analytics.**
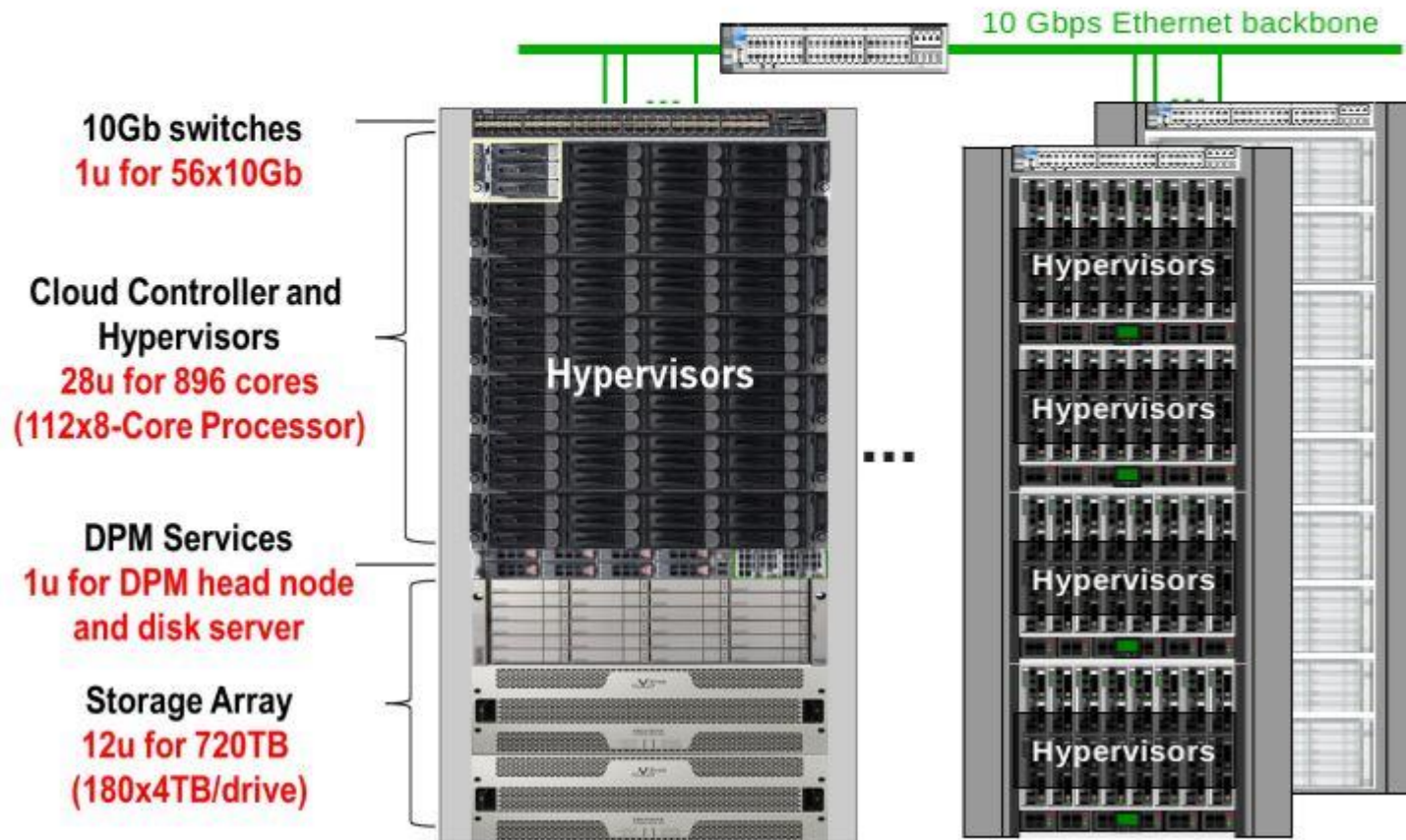
DiCOS: ASGC Distributed Cloud OS

Key Technologies

1. **Smart data center: power and thermal efficiency; intelligent monitoring and control; modulized design for low cost and high scalability**

2. **Fast networking technology: low latency network card, low latency switch and low latency router. Fast software switching backed by parallel computing.**

3. **Fast random access data base system supporting distributed data management of DiCOS.**

4. **Distributed cloud operating system.**

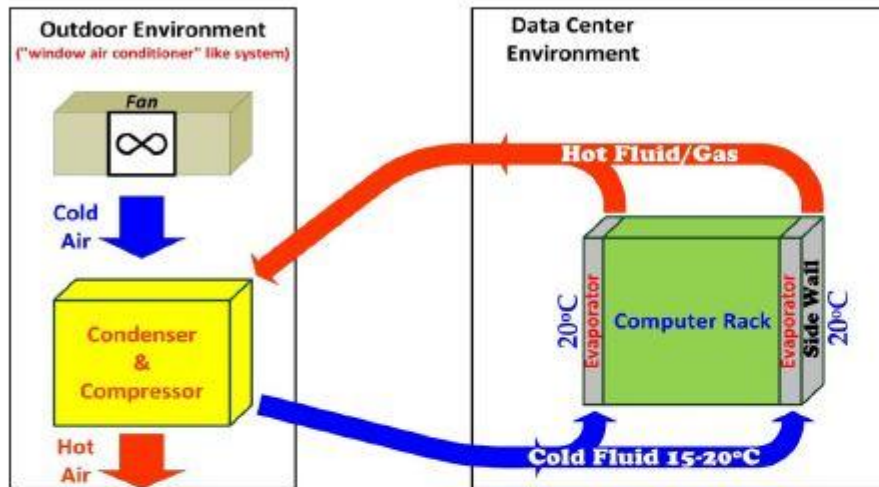# ASGC Distributed Cloud OS

A Scalable Architecture

- IaaS and PaaS over a grid of data centers
- System components occupy only 2 nodes for a single data center

10 Gbps Ethernet backbone

10Gb switches
1u for 56x10Gb

Cloud Controller and Hypervisors
28u for 896 cores
(112x8-Core Processor)

DPM Services
1u for DPM head node and disk server

Storage Array
12u for 720TB
(180x4TB/drive)

Hypervisors

ASGC Distributed Cloud OS

Fanless Single Rack Cloud Center

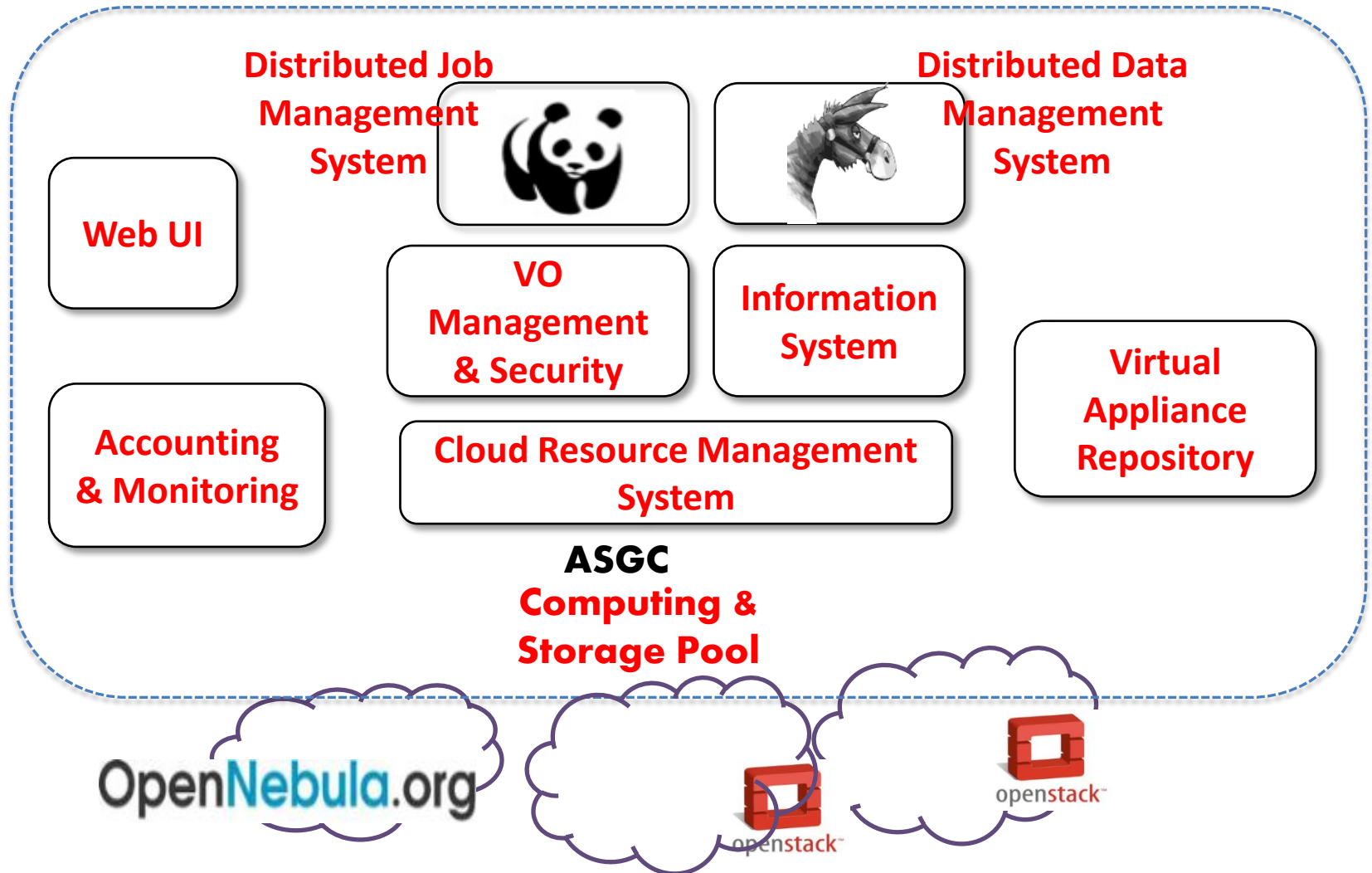Distributed Cloud Operating System (DiCOS) Developed in Collaboration with CERN

- **No fan = No noise.**
- **High power usage efficiency:**
  - **PUE 1.2 (4.5 : 1) tested with ambient T ~ 25°C**

DiCOS: ASGC Distributed Cloud OS
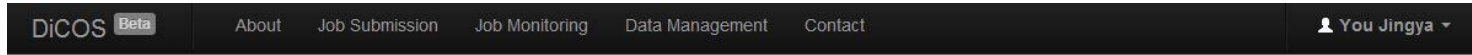
Other Institute

NCU

RCEC

IOP

IES

Other Resources

Computing & Storage Pool
CERN

openstack

Computing & Storage Pool
Commercial Resources

Intelligent Data Staging

Pull Job

Job Submission

Web UI

Distributed Job Management System

Distributed Data Management System

VO Management & Security

Information System

Accounting & Monitoring

Cloud Resource Management System

Virtual Appliance Repository

ASGC

Computing & Storage Pool

OpenNebula.org

openstack

7

ASGC Distributed Cloud OS

Distributed Job Management System

Distributed Data Management System

Web UI

VO Management & Security

Information System

Virtual Appliance Repository

Accounting & Monitoring

Cloud Resource Management System

ASGC Computing & Storage Pool

OpenNebula.org

openstack

openstack

PanDA Deployment in ASGC

- Job Management Framework
  - PanDA-Server and Oracle DB
  - Support VO of AMS and TWGrid
  - PanDA Pilots support Rucio data registration and other functionalities
- Data Management Framework
  - Rucio-Server and SQLite(moving to MySQL now)
- Monitoring
  - PanDA Monitoring
- Web User Interface
  - DiCOS Web Server(Django), SQLite
  - Job Submission, Monitoring and DDM by Rucio
- Cloud with PanDA Pilots

Web UI for Job & Data Management

- http://dicos.grid.sinica.edu.tw

Data Management

Job Submission

Web UI for Job & Data Management

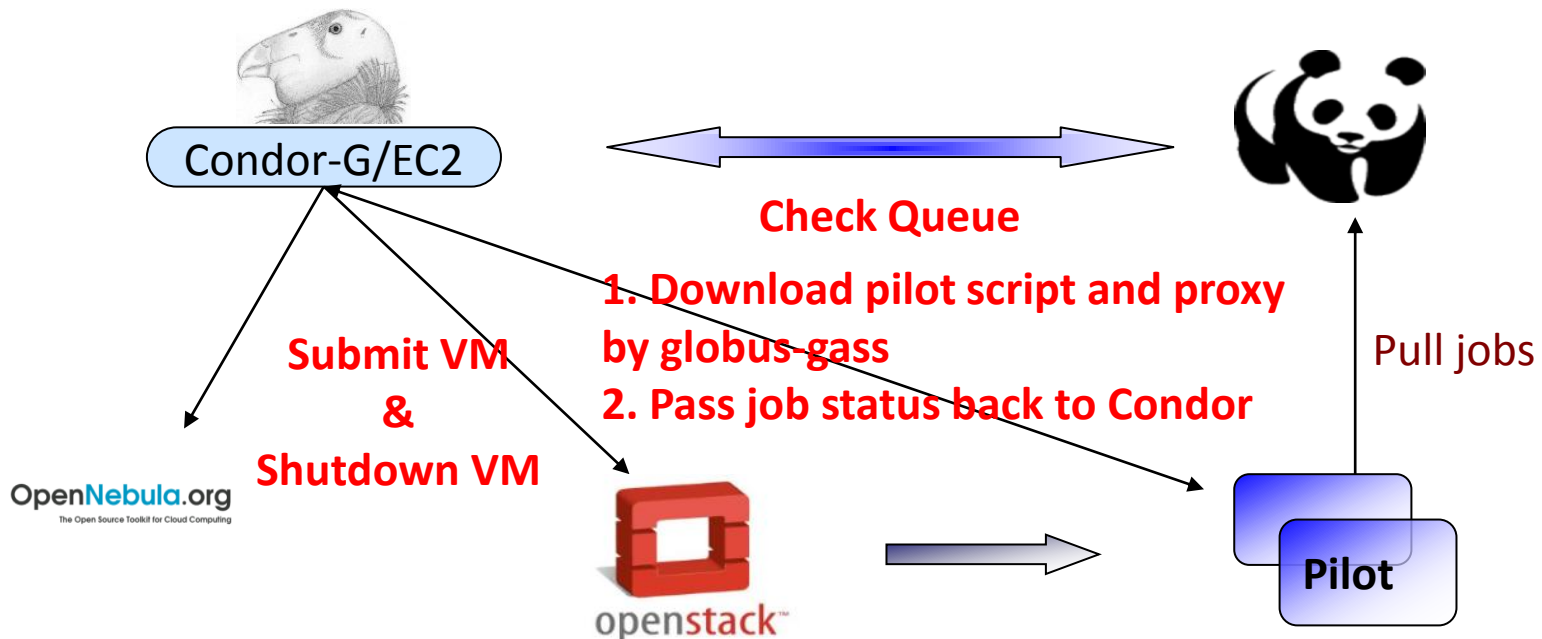- http://dicos.grid.sinica.edu.tw
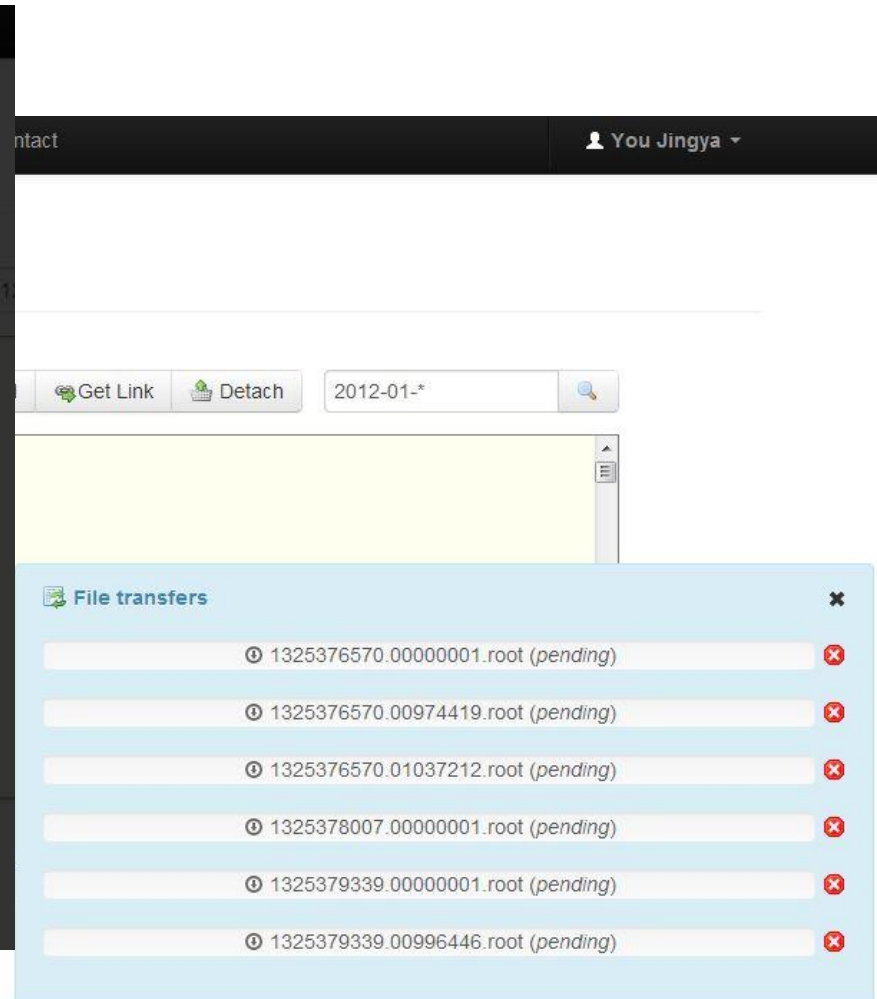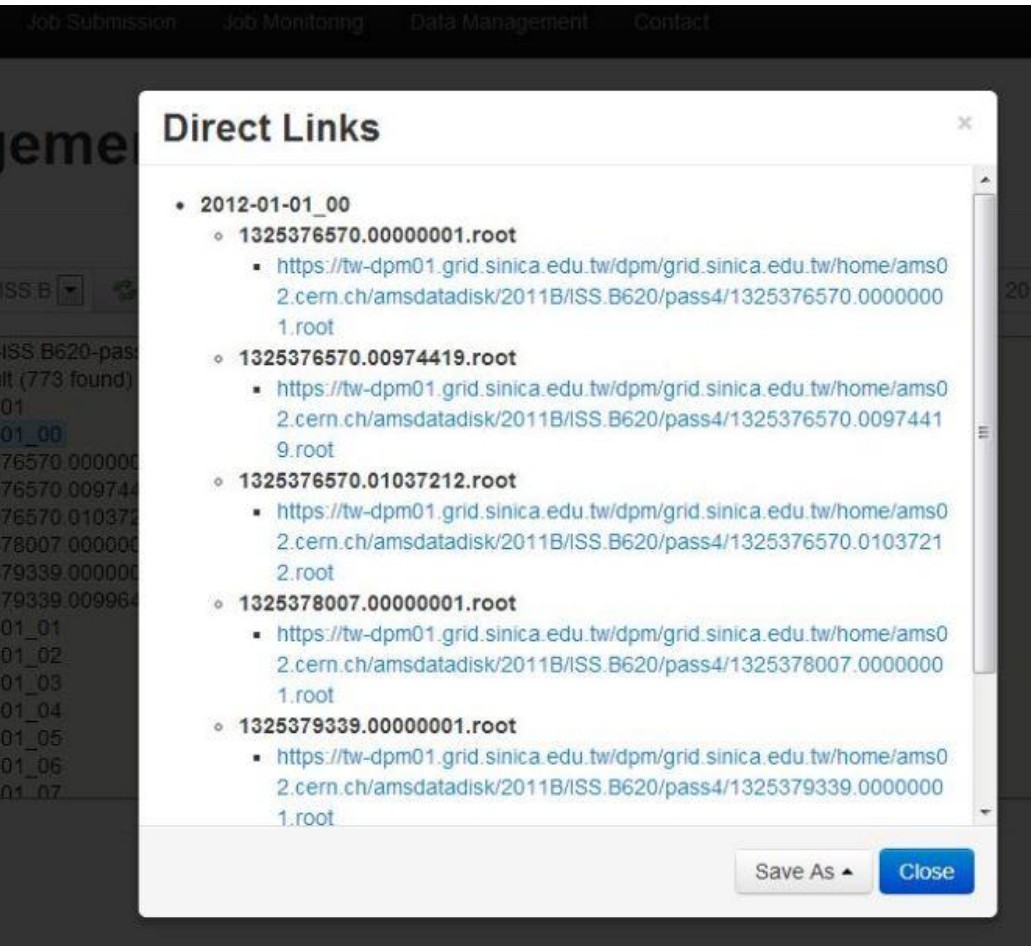

Data Management

Cloud with PanDA Pilot

- Pilot submitted by Condor through EC2 interface to each cloud controller
- Mission-oriented virtual machine
  - Only running while jobs are active in PanDA queue
  - Auto-terminate while job is over

Condor-G/EC2

Check Queue

1. Download pilot script and proxy by globus-gass

2. Pass job status back to Condor
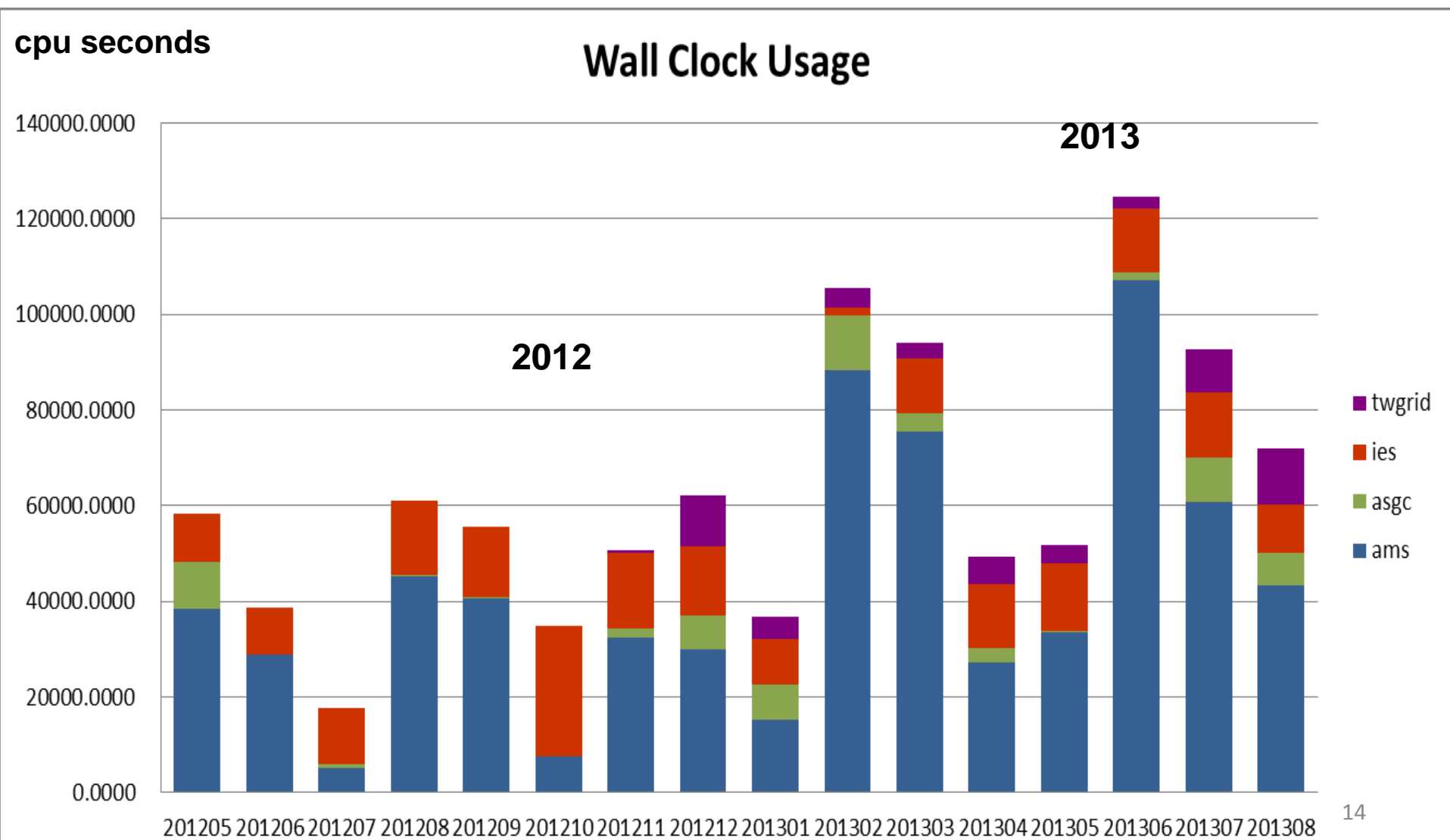
Submit VM & Shutdown VM

Pull jobs

Pilot

AMS Computing Support using PanDA

- Total AMS Jobs running from Oct. 2012 till now is around 810,944

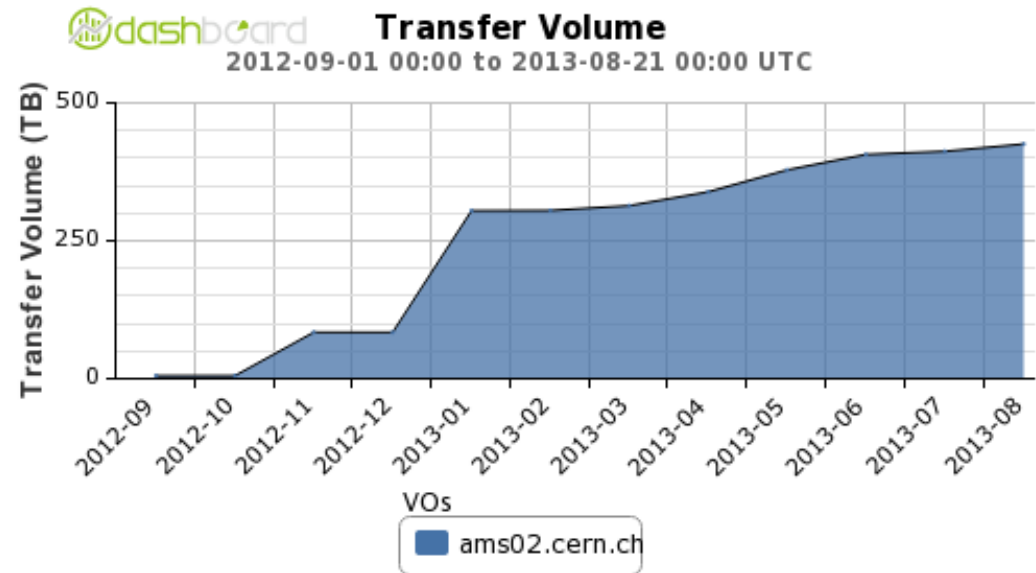- AMS Computing Usage in ASGC Cloud from Apr. to Aug. 2013
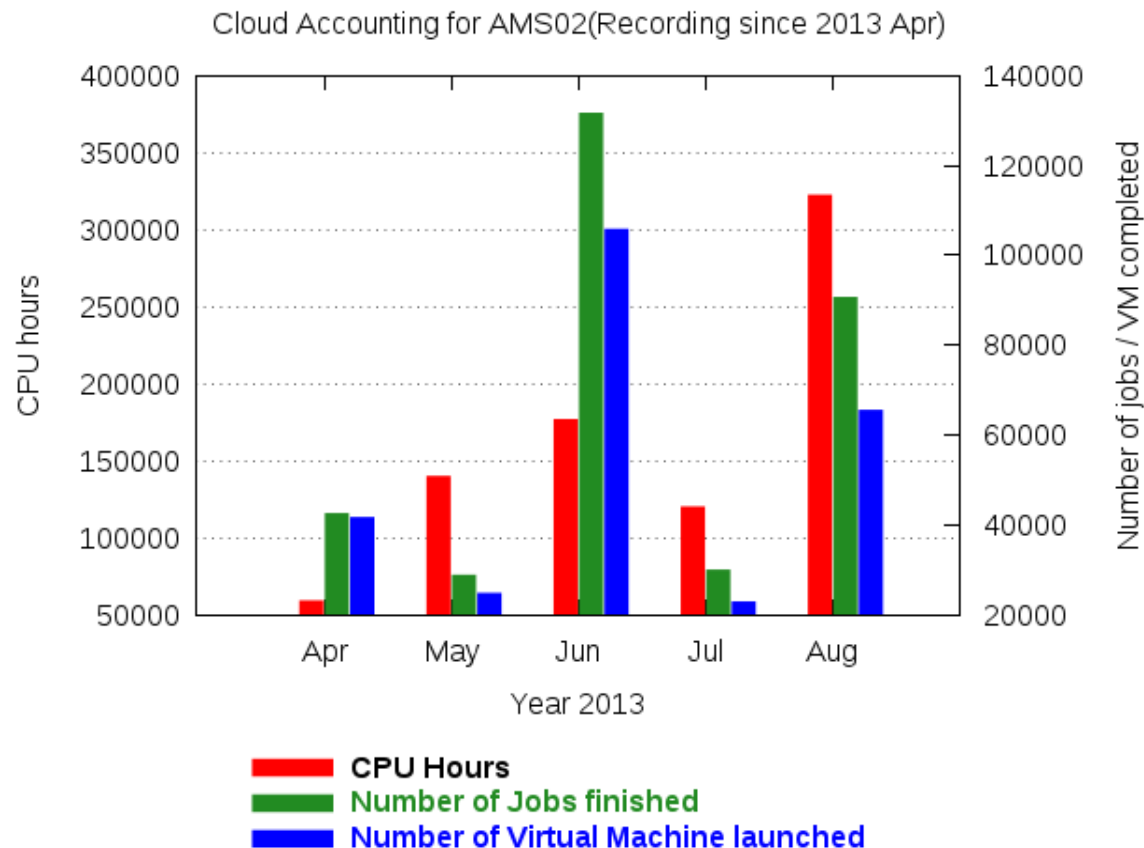
AMS Computing at one of the HPC Cluster
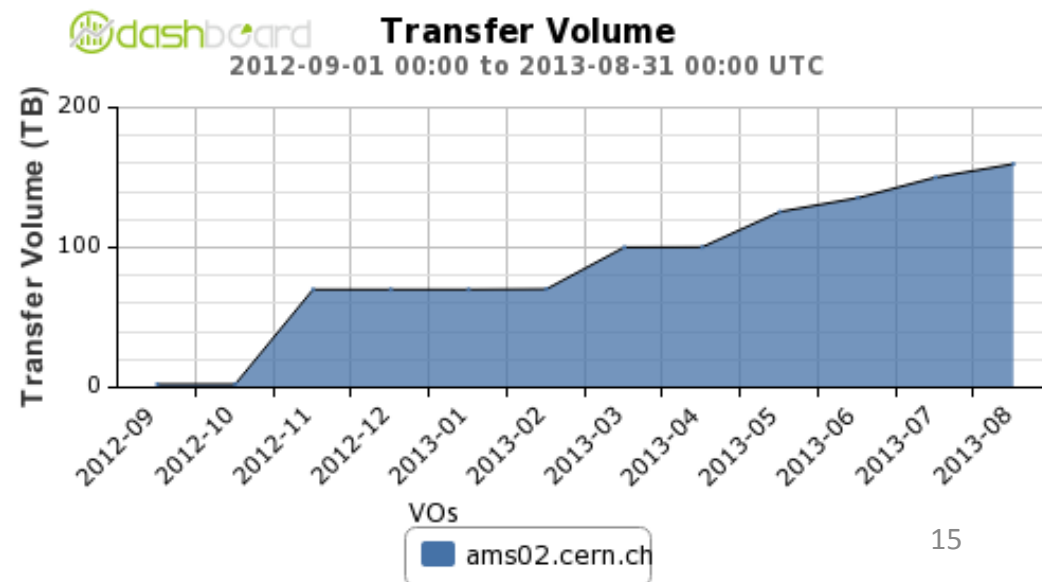
596,388 jobs completed using 576,113 CPU-hours

AMS Transfer Statistics

CERN to TW

- **File Transfer Service via GRID**
- **SRM endpoints at CERN and TW**
- **Duration: Sep. 2012 – Aug. 2013**
- **CERN to TW**
  - **Volume: 423.654TB**
  - **Number of File: 598,815**
- **TW to CERN**
  - **Volume: 158.979TB**
  - **Number of File: 91,097**

TW to CERN

AMS Transfer Compared to ATLAS

CERN to TW

- **File Transfer Service via GRID**
- **SRM endpoints at CERN and TW**
- **Duration: Sep. 2012 – Aug. 2013**
- **CERN to TW**

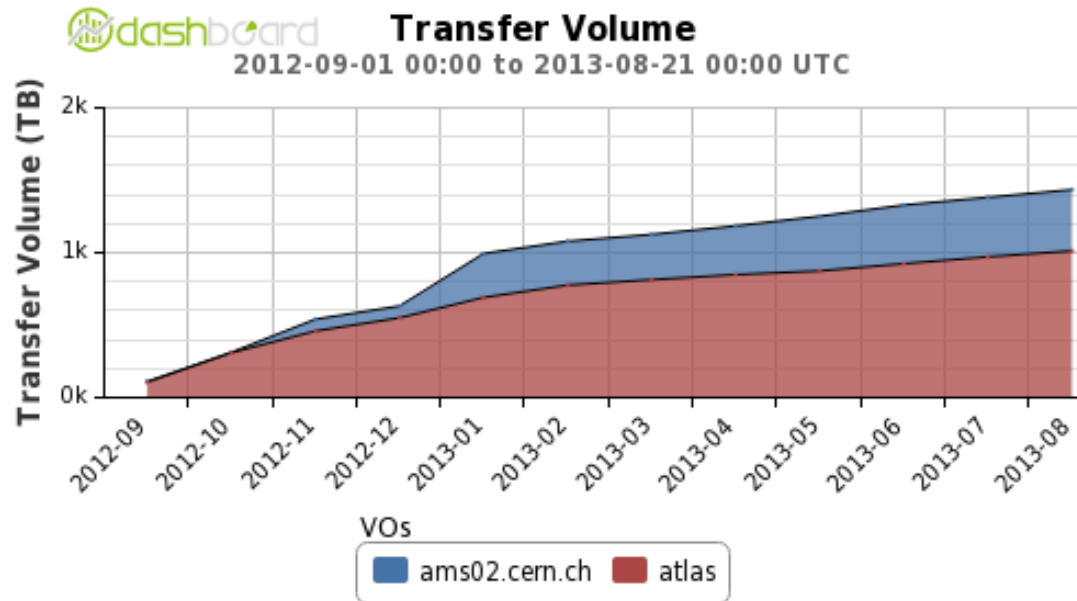 **Total Volume: 1427.738TB**

  AMS: 423.654TB

 **ATLAS: 1,004.085TB**

  Total Number of File: 3,201,572

  AMS: 598,815

  ATLAS: 2,602,757

dashboard **Transfer Volume**
2012-09-01 00:00 to 2013-08-21 00:00 UTC

VOs

ams02.cern.ch   atlas
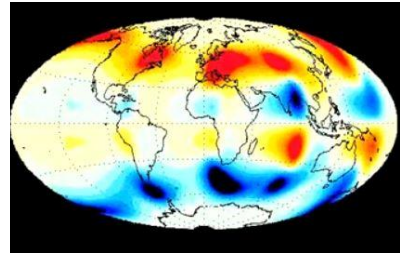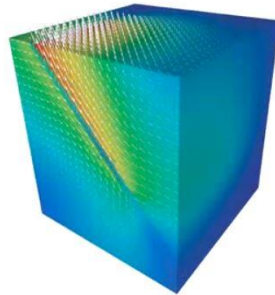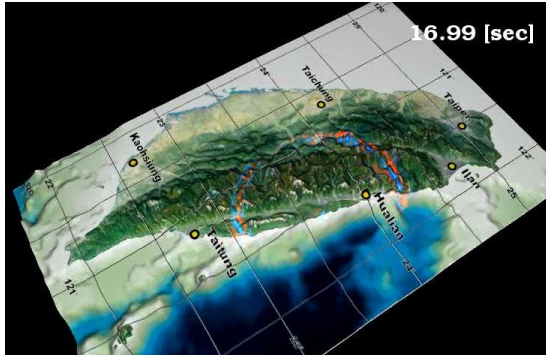
Other Applications Support using PanDA

- Application Support in various research groups as below
  - Other HEP research groups (App: GMC(geant4))
  - Polymer Physics & Biomacromolecule physics
    - Computer simulations, Serial computing & batch submission
  - Earth science, Climate changes
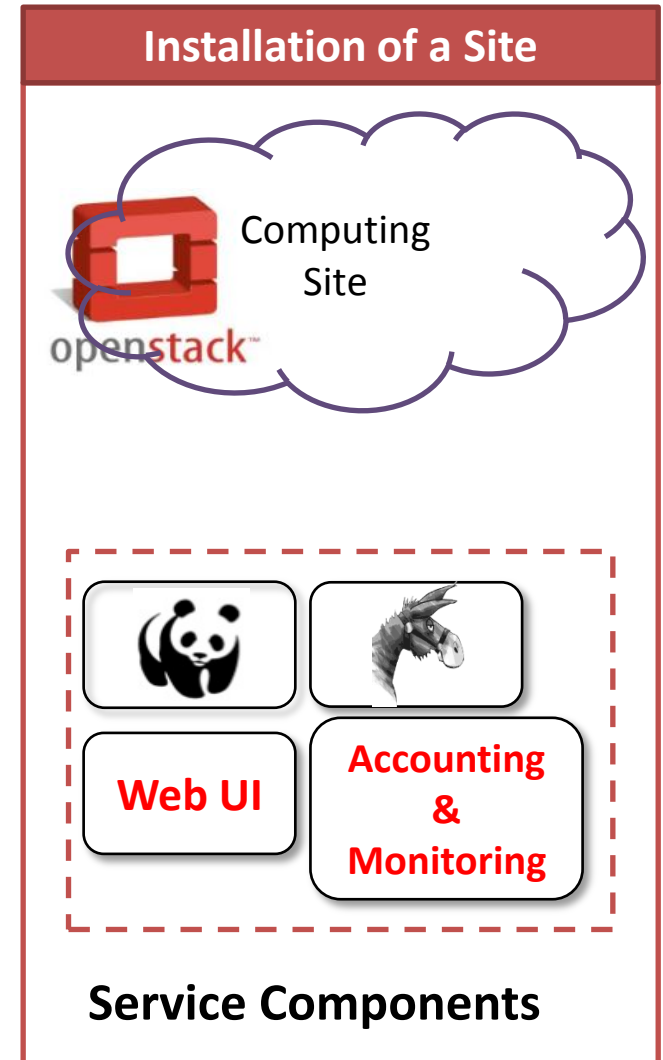   - MPI & OpenMP (App: gemb(x))

17
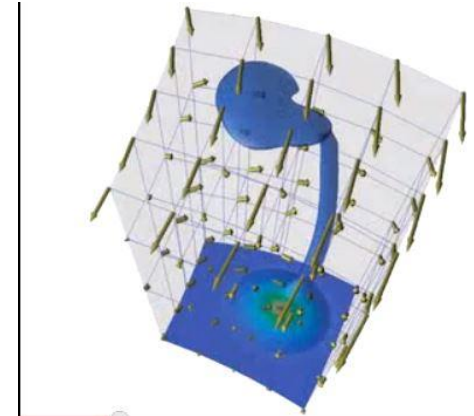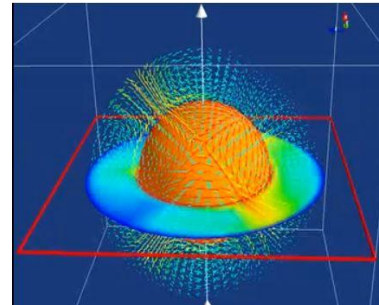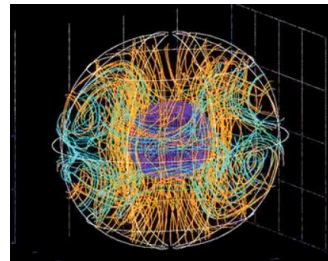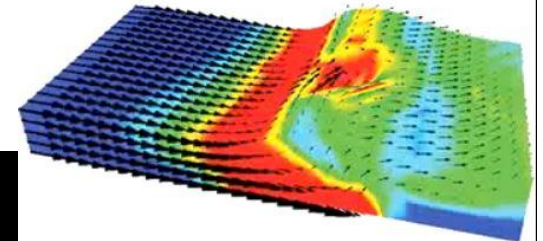
Other Applications Support using PanDA

- Compiling -> Porting -> Testing -> Running
  - Co-work with users in various applications
  - Transformation script in each application/research group is required
  - Moving them from local cluster to grid
- Jobs Accounting of Other Applications
  - Total Jobs: 108
- Emerging Requirements
  - Customization of runGenerator (transformation script) for each application/groups
  - Intermediate result check during jobs are running
  - Data sharing policy is different in each research groups
  - Monitoring requirements
    - Tasks/jobs management
    - Computing efficiency and performance …etc

Plan of Distributed Service Deployment

- **Standalone Installation of Each Remote Site**
  - Independent or Centralized?
  - High Availability Service and DB Syncronization
- **Resources Integration for Academia Sinica campus and remote sites**
  - Support High Energy Physics research
  - Support researches in other fields of science in Academia Sinica
  - Collaborate with other universities or institutions
- **User-driven**
  - User priority of local and remote sites
  - Data locality
  - Reduce loading of data transfer

Installation of a Site

Computing Site

openstack™

Web UI

Accounting & Monitoring

Service Components

Distributed Service Deployment

NCU

Remote Site (National Central University)

Web UI

Accounting & Monitoring

ASGC

ASGC

Web UI

Accounting & Monitoring

IoP

IES

IES

Academia Sinica

Remote Site

NDHU
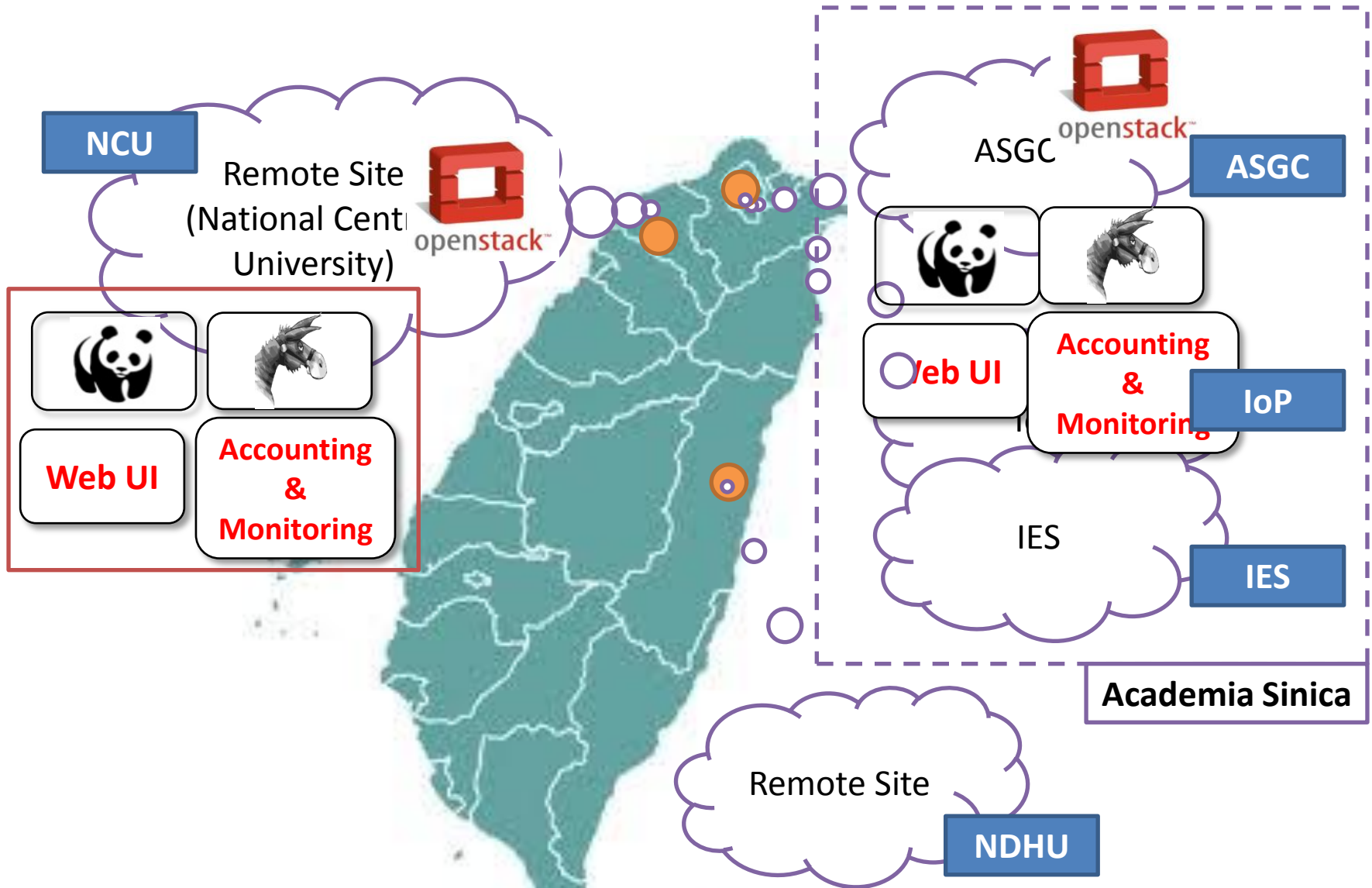
Current Workflow of AMS Production

OracleDB Jobs/events/Status

- Query DB for available and remaining jobs
- Update DB for jobs applied and which site owns those jobs

- Update job and data file status

AMS Validation System

AMS Remote Client (Perl CGI)

- Apply jobs
- Job scripts are sent to site's email account

- Validation

AMS Storage for Production

Remote Sites

- Upload data file to CERN Castor
- Upload journal to specific place in CERN machine

- Run jobs & completing jobs
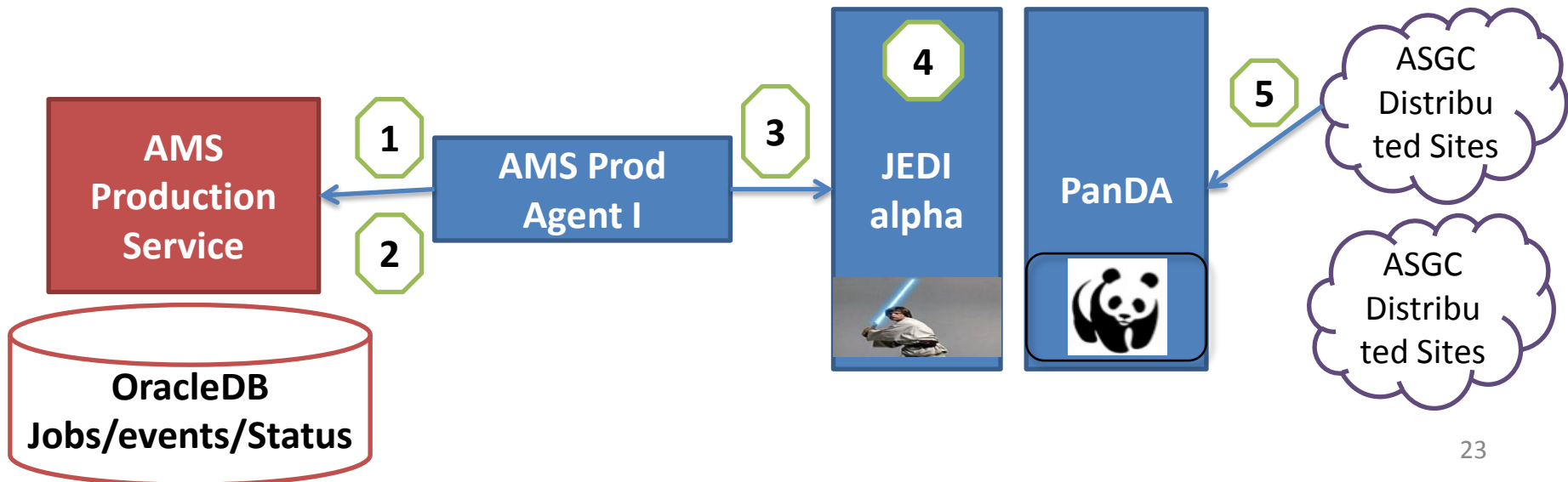
AMS Production Service

21

Plan of AMS Production Support

Plan of AMS Production Support

- AMS Prod Agent I
  1. Check available jobs
  2. Obtain jobs from email(currently) and in specific format from Production DB(future)
  3. Submit Task to JEDI and generate jobs to PanDA
  4. AMS job brokerage in JEDI
  5. Sites poll jobs from PanDA queues and run jobs

Plan of AMS Production Support

- ## AMS Prod Agent II

  6. Get results and transfer to CERN by FTS when jobs are finished
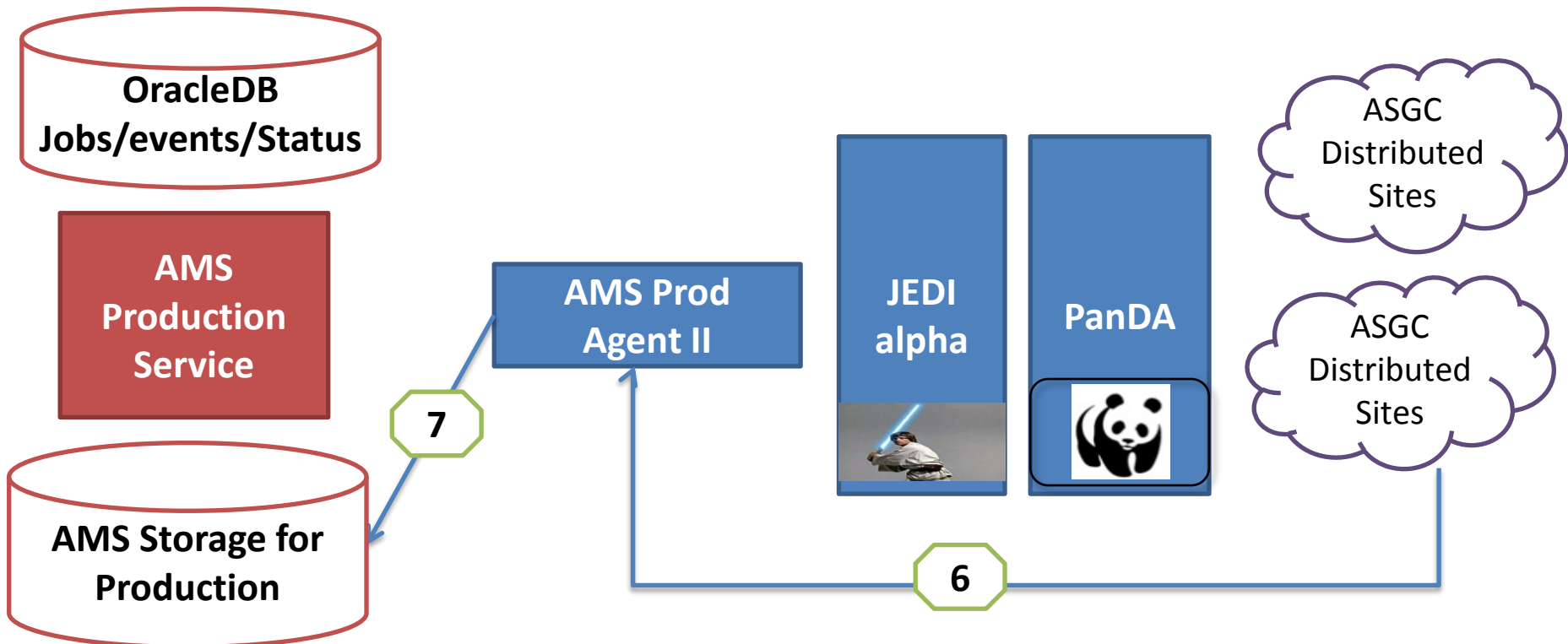
Plan of AMS Production Support

- AMS Prod Manager
  1. Validation of the results
  2. Update jobs status in AMS Production DB if possible in the future
  3. AMS production manager will be able to check jobs status through AMS Prod Manager Service (integrate with DEFT?)
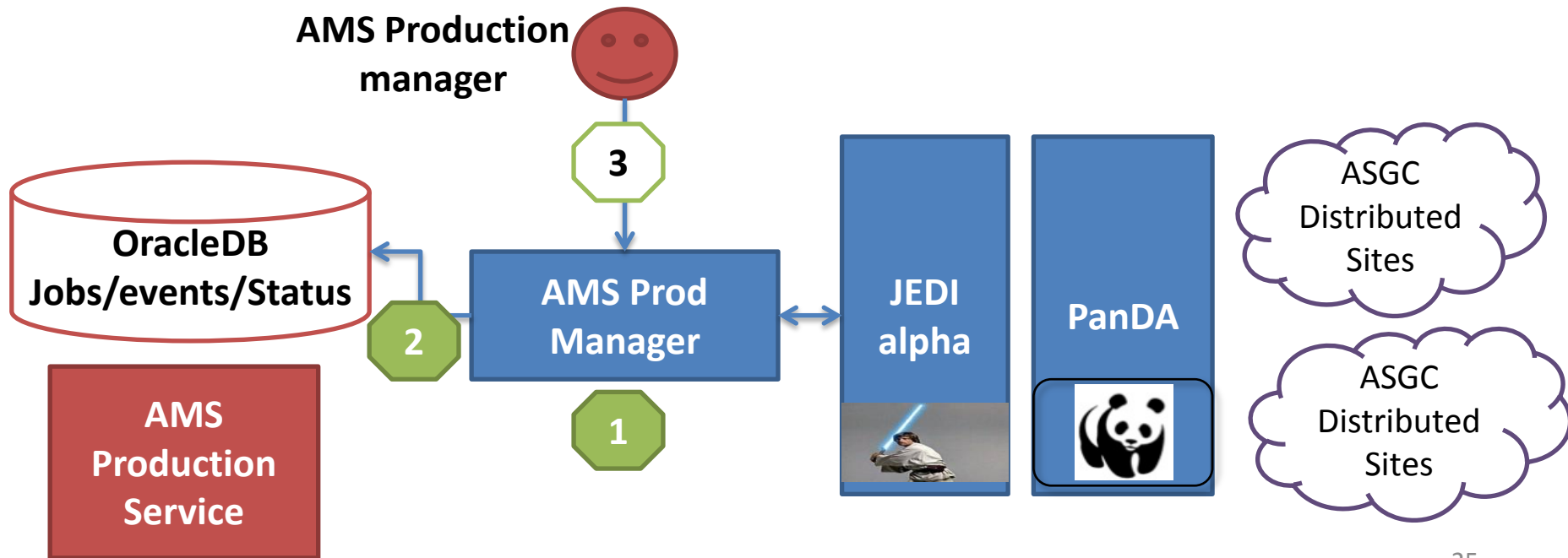
Future Plan of PanDA Integration

To-Do

- Monitoring for PanDA & Rucio
- Single Sign On (WebUI+PanDA+Rucio)
- Web UI & command line interface
- Integration of PanDA +JEDI+DEFT and PanDA+Rucio
  - Job brokerage in JEDI for different VO
  - Enable Rucio DDM in JEDI
- VO plugins of Pilots for AMS & TWGrid
- Resources management (by AGIS?)
- Accountings of VO, working groups and applications
- Migration to SL6

Q?

Invitation

ASGC would be happy to host next PanDA workshop or meeting if there's a chance!