Update of cloud deployment status at KEK
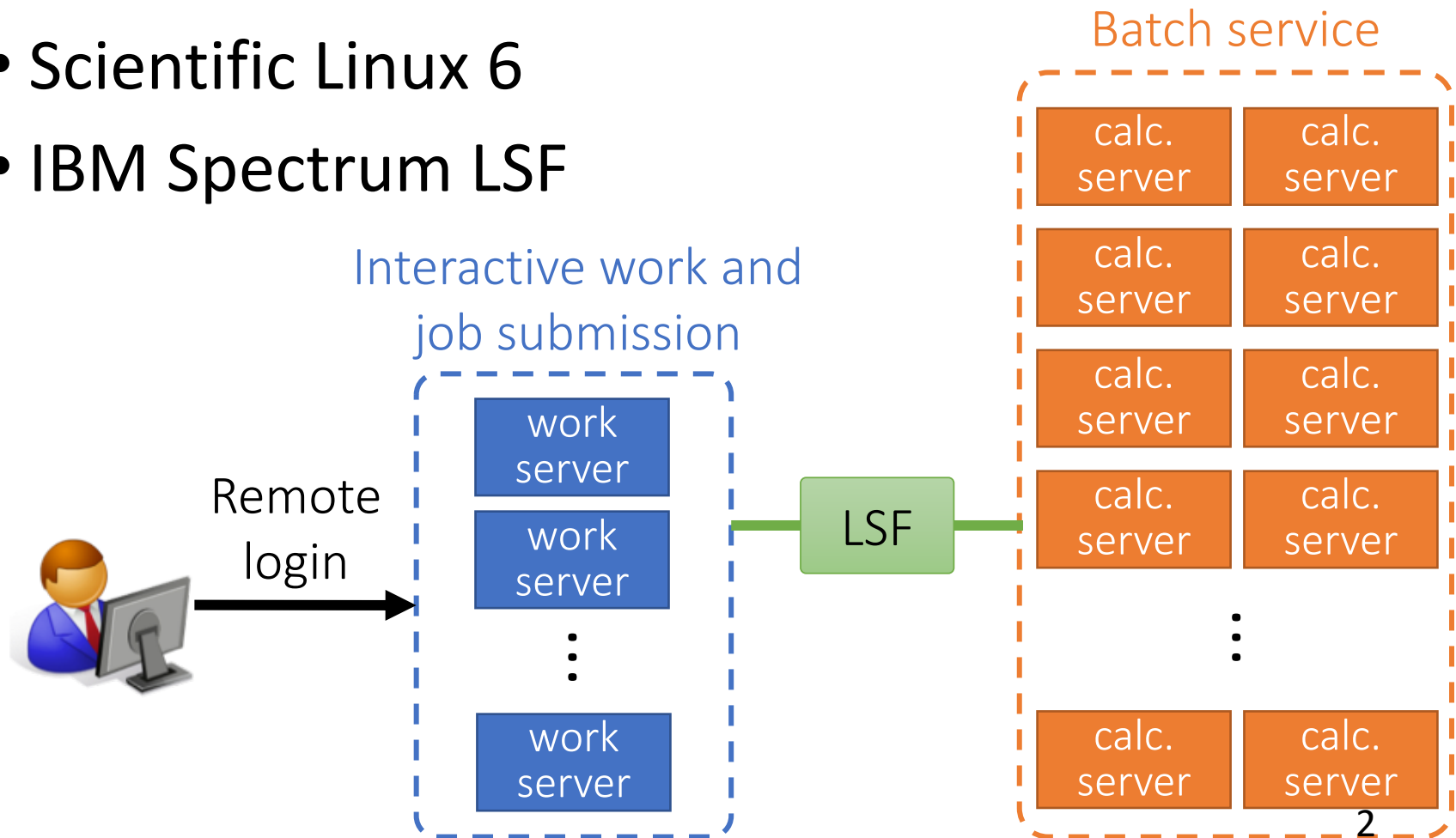
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13th February, 2018

Background: KEK Linux Cluster

- 10000 CPU cores
- Scientific Linux 6
- IBM Spectrum LSF

Background: Need Workload Management for Different Groups

- Requirements on specific system
    - Develop an application on the other OS.
    - Test for newer OS/Libraries.
    - Stick to old OS.

- Efficient management of limited resources

➡ Take advantage of Cloud computing

IBM Cloud Manager with OpenStack (CMO) [1]

- CMO
  - IBM Cloud software based on OpenStack
- Additional features:
  - Simplified service portal
  - IBM Platform Resource Scheduler
    - Policy based VM deployment / reallocation.
  - Simplified Cloud deployment by Chef

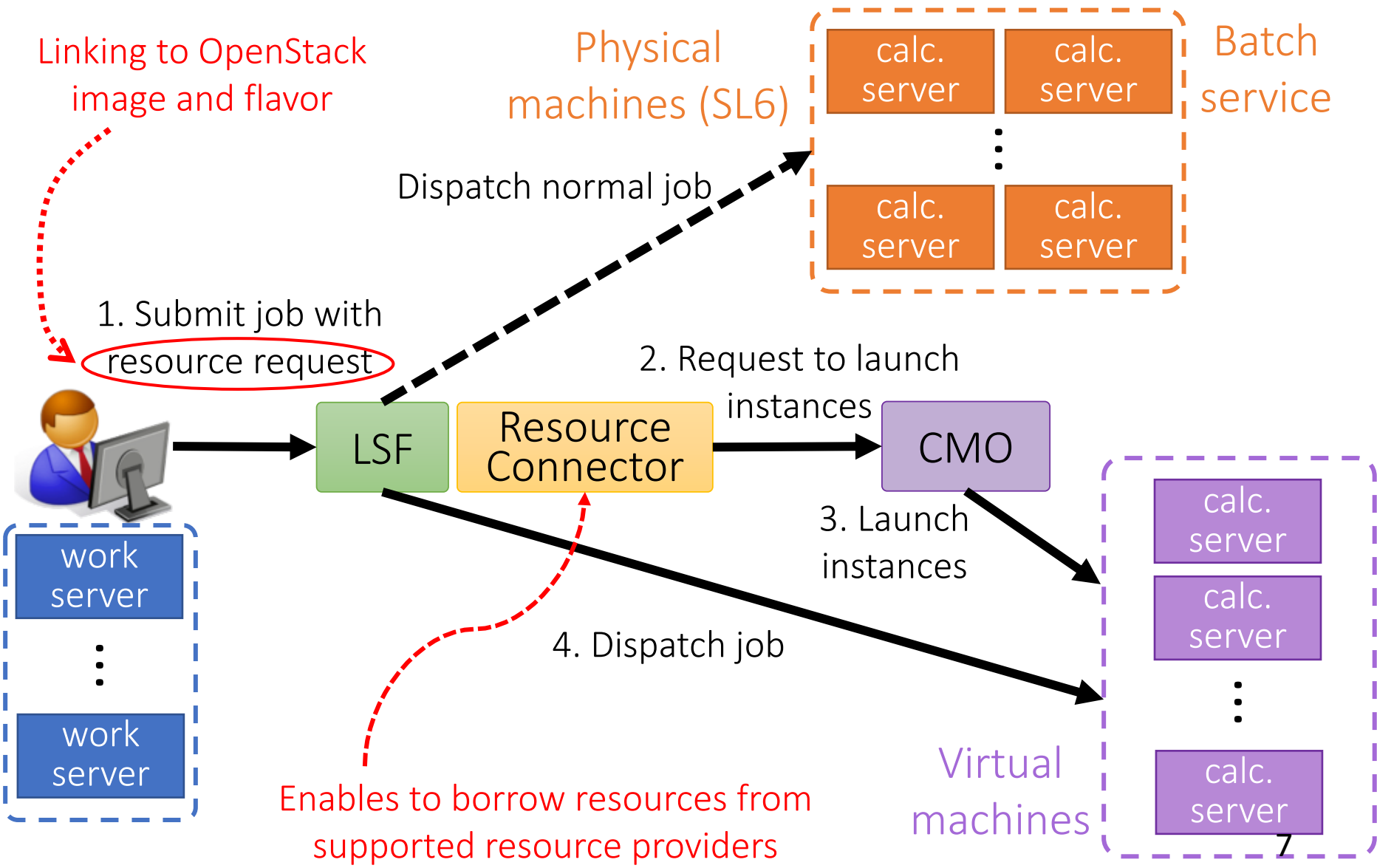[1] https://www.ibm.com/support/knowledgecenter/en/SST55W
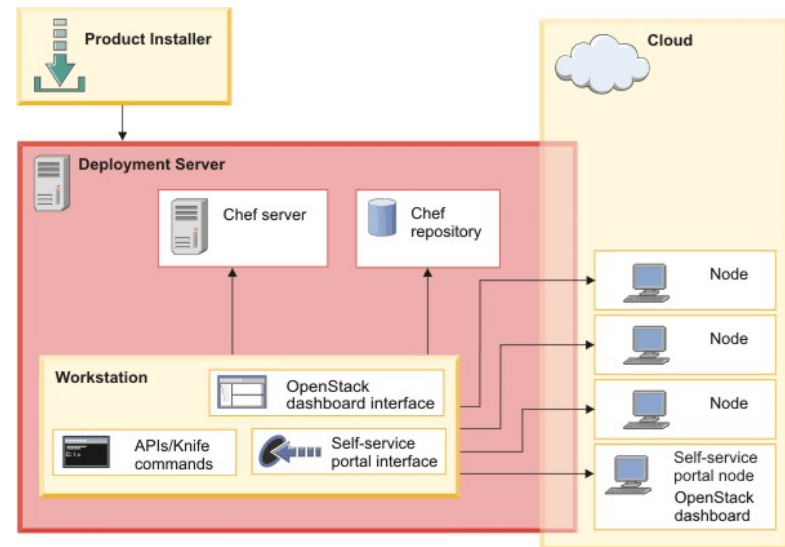
CMO Deployment at KEK

- OpenStack version
  - Kilo: The latest version supported by CMO

- Used OpenStack components
  - Keystone (Identity)
  - Nova (Compute)
  - Glance (Image Storage)
  - Horizon (Dashboard)
  - Neutron (Networking)

- Compute nodes
  - Scientific Linux 7
  - KVM
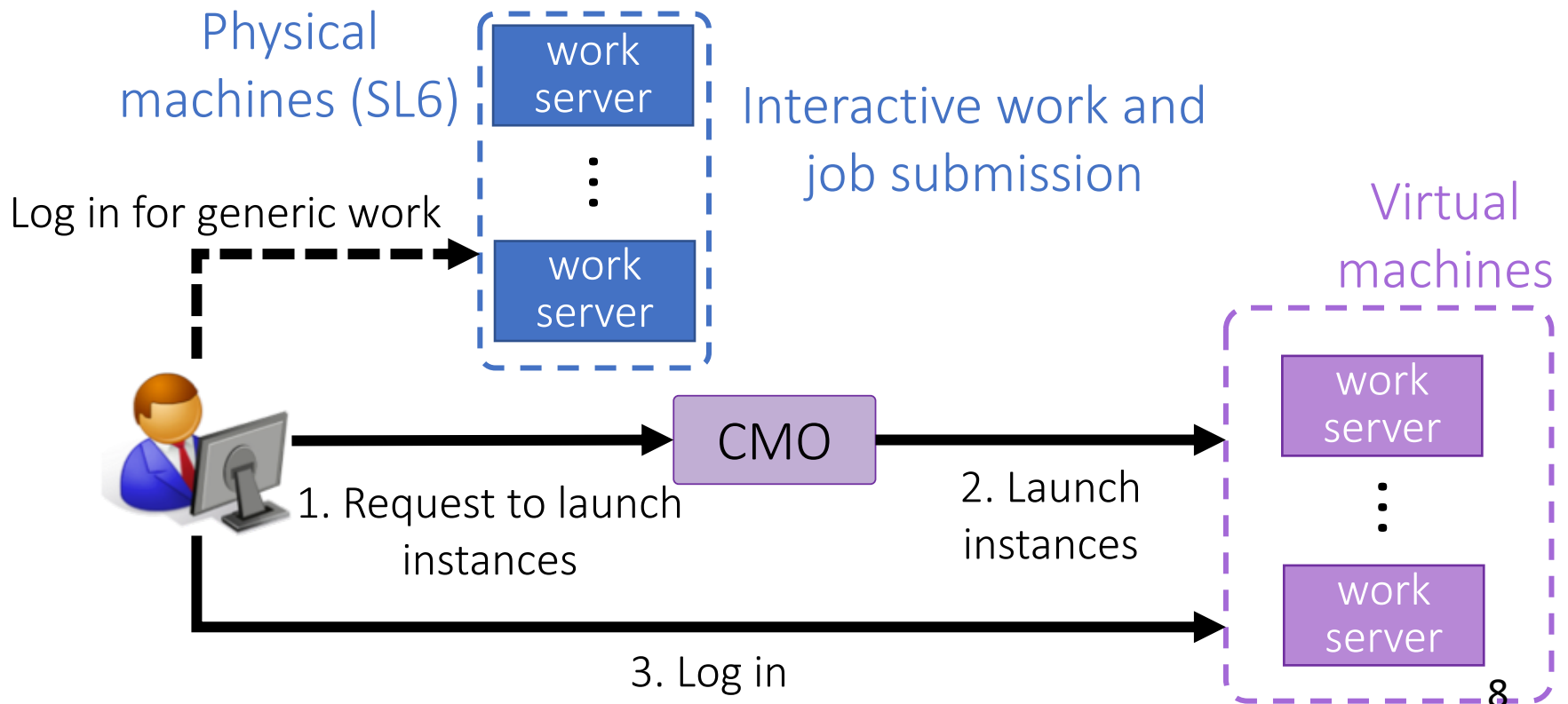 - 75 CPU cores

The Cloud Covers 2 Use Cases

- Batch integration
  - LSF + OpenStack
  - Prepares requested data analysis environment triggered by job submission.
- Self-service provisioning
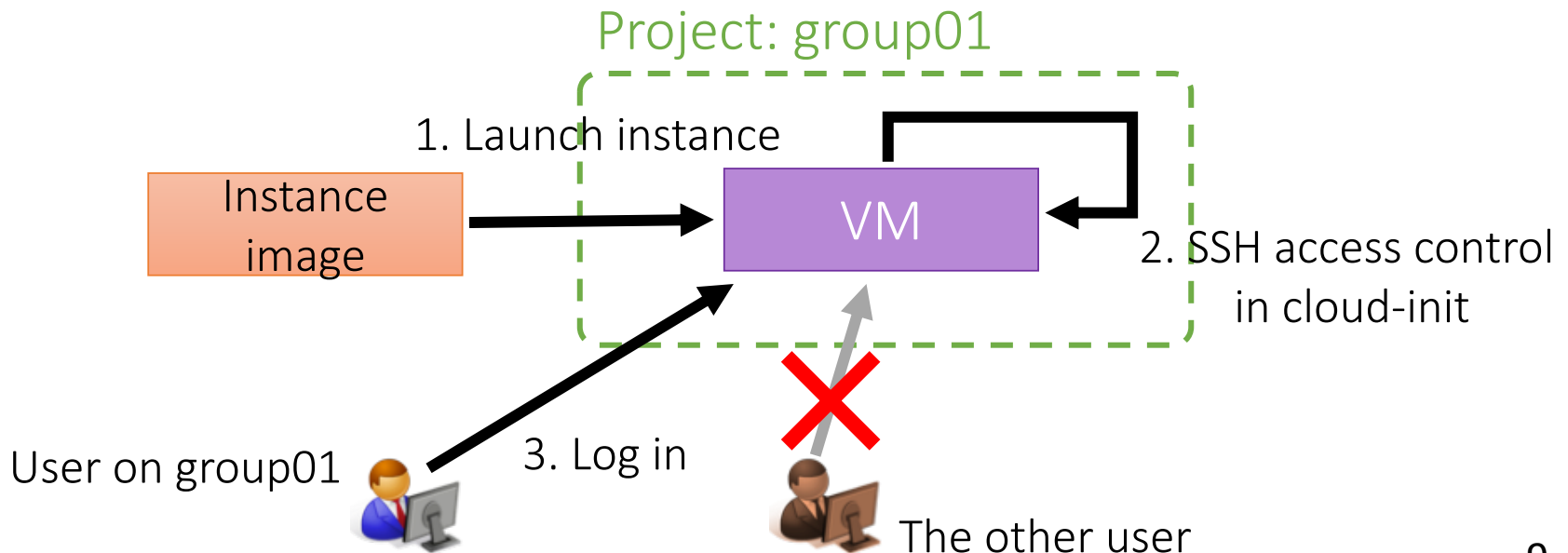 - Provides customizable servers for experimental groups.

Batch Integration

Linking to OpenStack image and flavor

Physical machines (SL6)

Batch service

calc. server   calc. server

calc. server   calc. server

Dispatch normal job

1. Submit job with resource request

2. Request to launch instances

LSF   Resource Connector   CMO

work server

work server

3. Launch instances

4. Dispatch job

Enables to borrow resources from supported resource providers

Virtual machines

calc. server

calc. server

calc. server

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Self-Service Provisioning

- Provide Simplified Service Portal.
- Control allowed actions by OpenStack role.

Physical machines (SL6)

work server

⋮

work server

Interactive work and job submission

Log in for generic work

Virtual machines

work server

⋮

work server

1. Request to launch instances
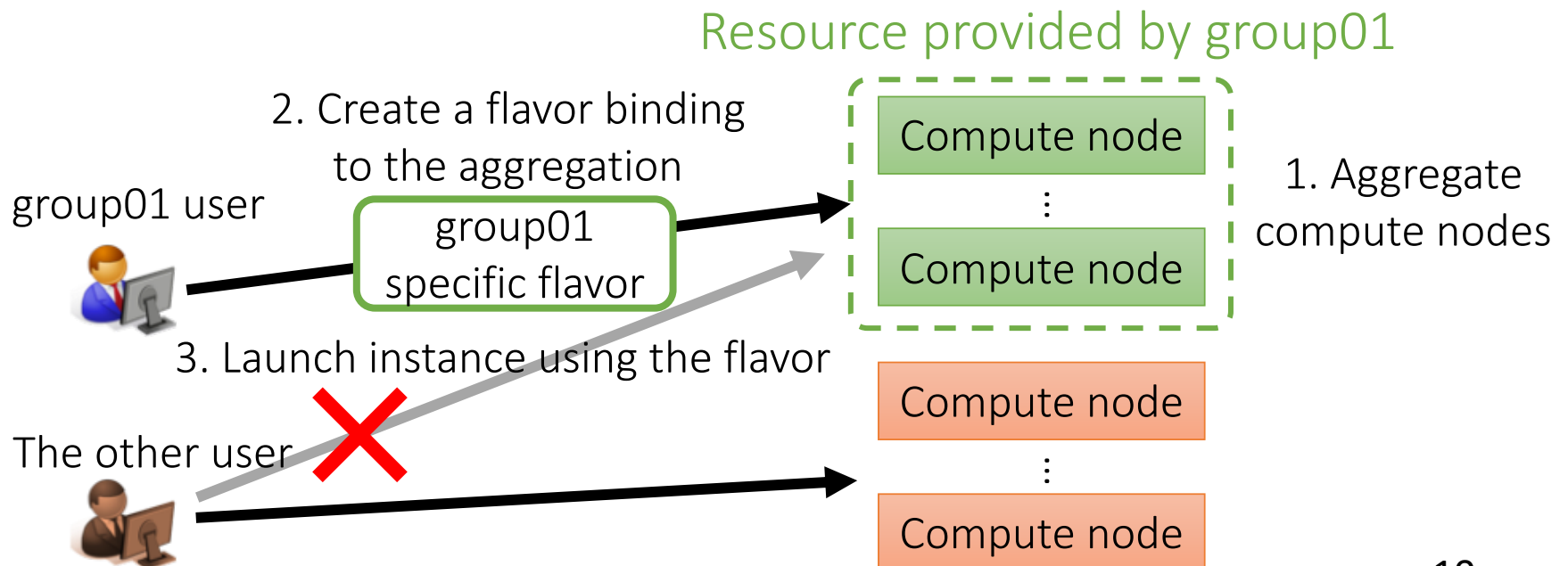
CMO

2. Launch instances

3. Log in

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Group based Management: SSH Access Control

- OpenStack project is mapped to Linux group.
- Instance in a project only allows SSH access from users on the project.

Project: group01

1. Launch instance

Instance image

VM

2. SSH access control in cloud-init

User on group01

3. Log in

The other user

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Group based Management: Launch Instances on Specific Nodes

- Plan to partially deploy physical servers provided by a group as compute nodes.
  - The resource is only for the group.
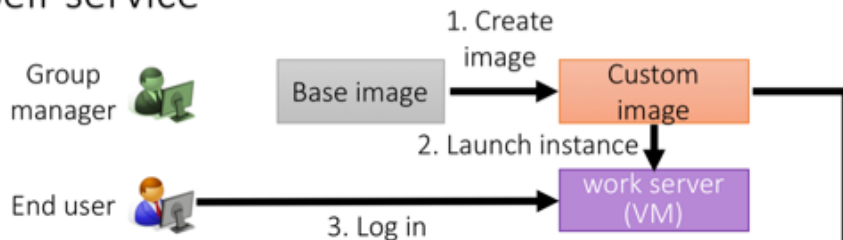- Use "Host Aggregate" feature.

Resource provided by group01

2. Create a flavor binding to the aggregation

group01 user

group01 specific flavor

1. Aggregate compute nodes

Compute node

⋮

Compute node

3. Launch instance using the flavor

The other user

Compute node

⋮

Compute node

Current Status

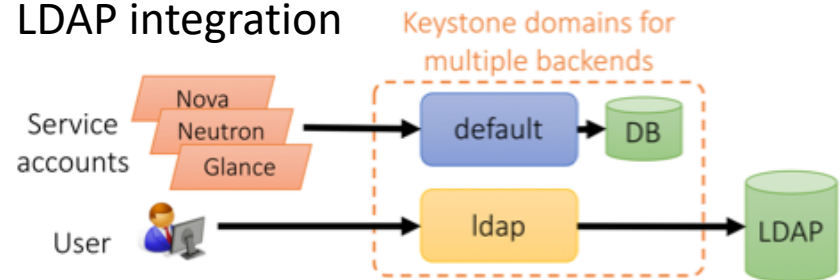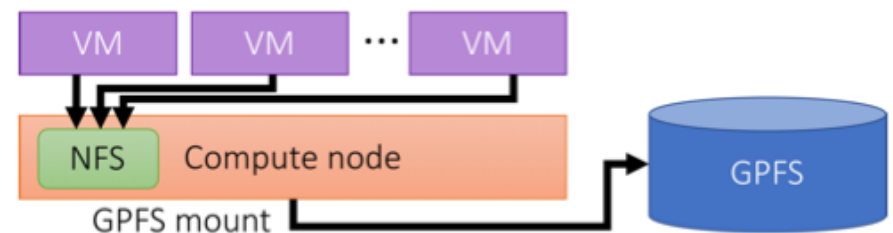| Work item	Status
Integrate with existing systems (LDAP, GPFS)	Done
Implement group based management (SSH access & resource)	Done
Use common images for self-service and batch integrated service	WIP
Test the both services by cloud admins	WIP
Test by group managers	Being started

Use common image

• Self-service

Group manager

Base image → 1. Create image → Custom image

2. Launch instance → work server (VM)

End user → 3. Log in → work server (VM)

• Batch integrated cloud

End user → Submit job → LSF → Distach → calc. server (VM)

Add LSF configuration

LDAP integration

Keystone domains for multiple backends

Service accounts — Nova, Neutron, Glance → default → DB

User → ldap → LDAP

GPFS integration
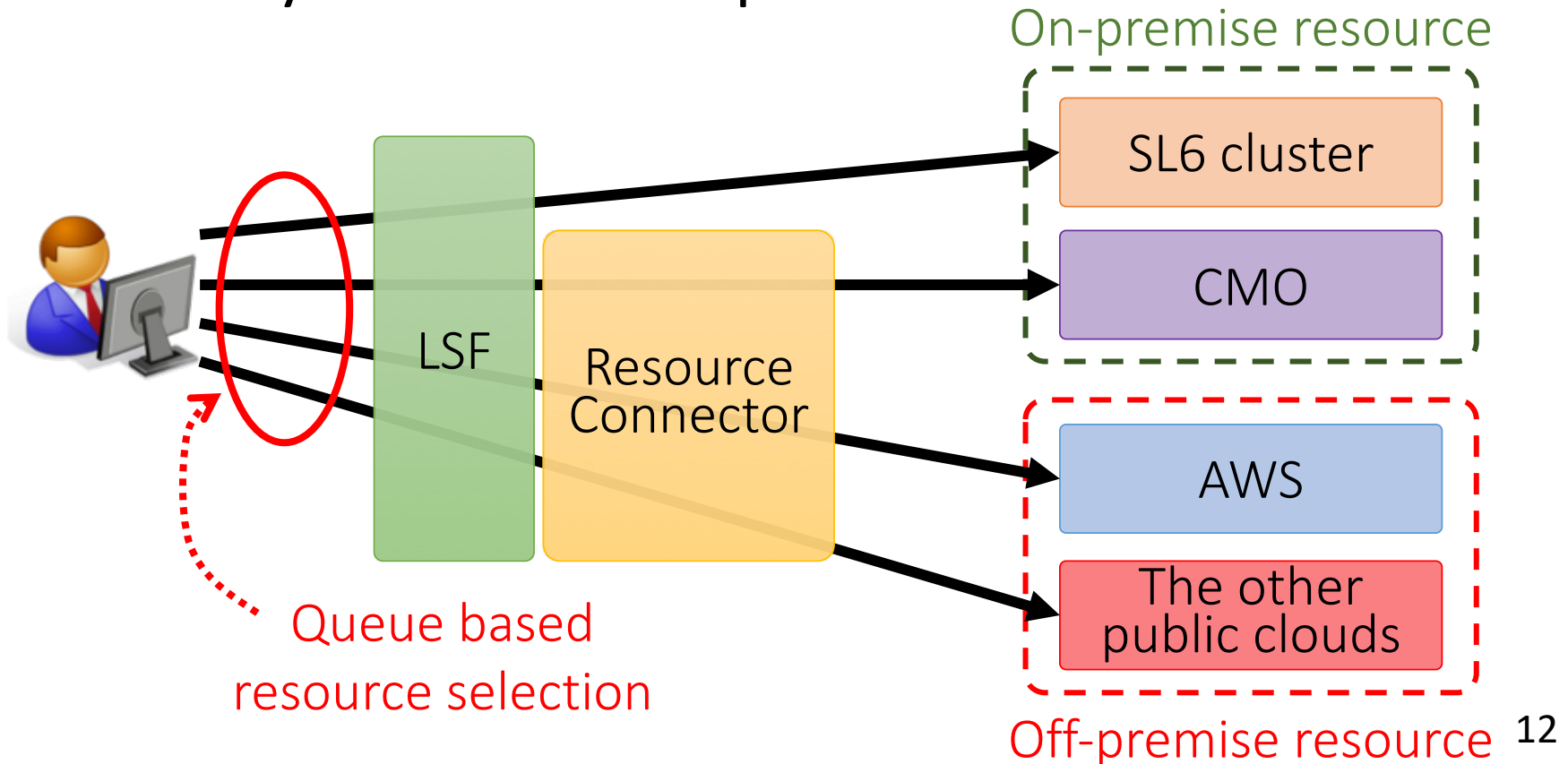
VM   VM   ···   VM

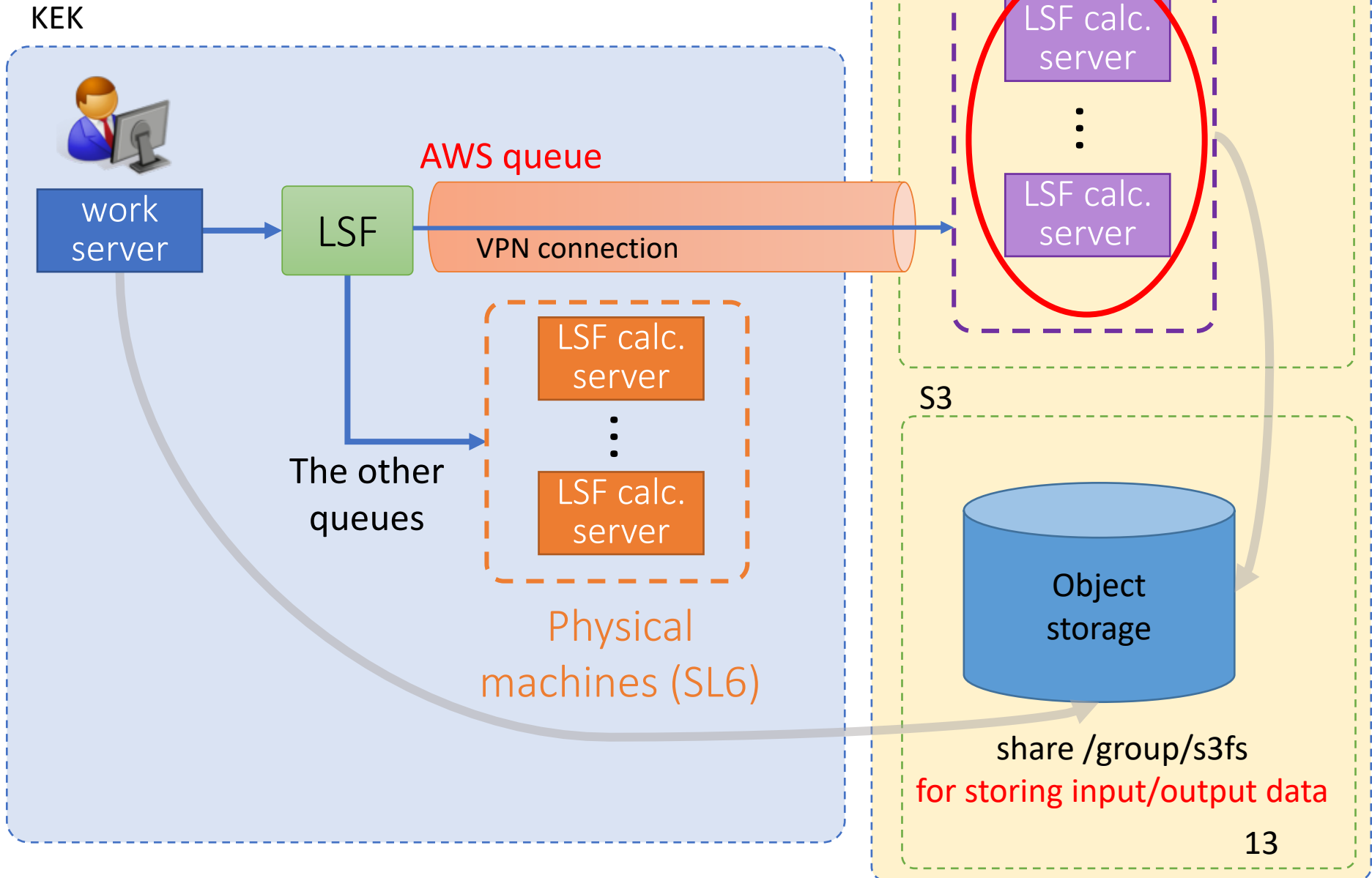NFS   Compute node → GPFS

GPFS mount

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Integration of Batch service and Public Clouds
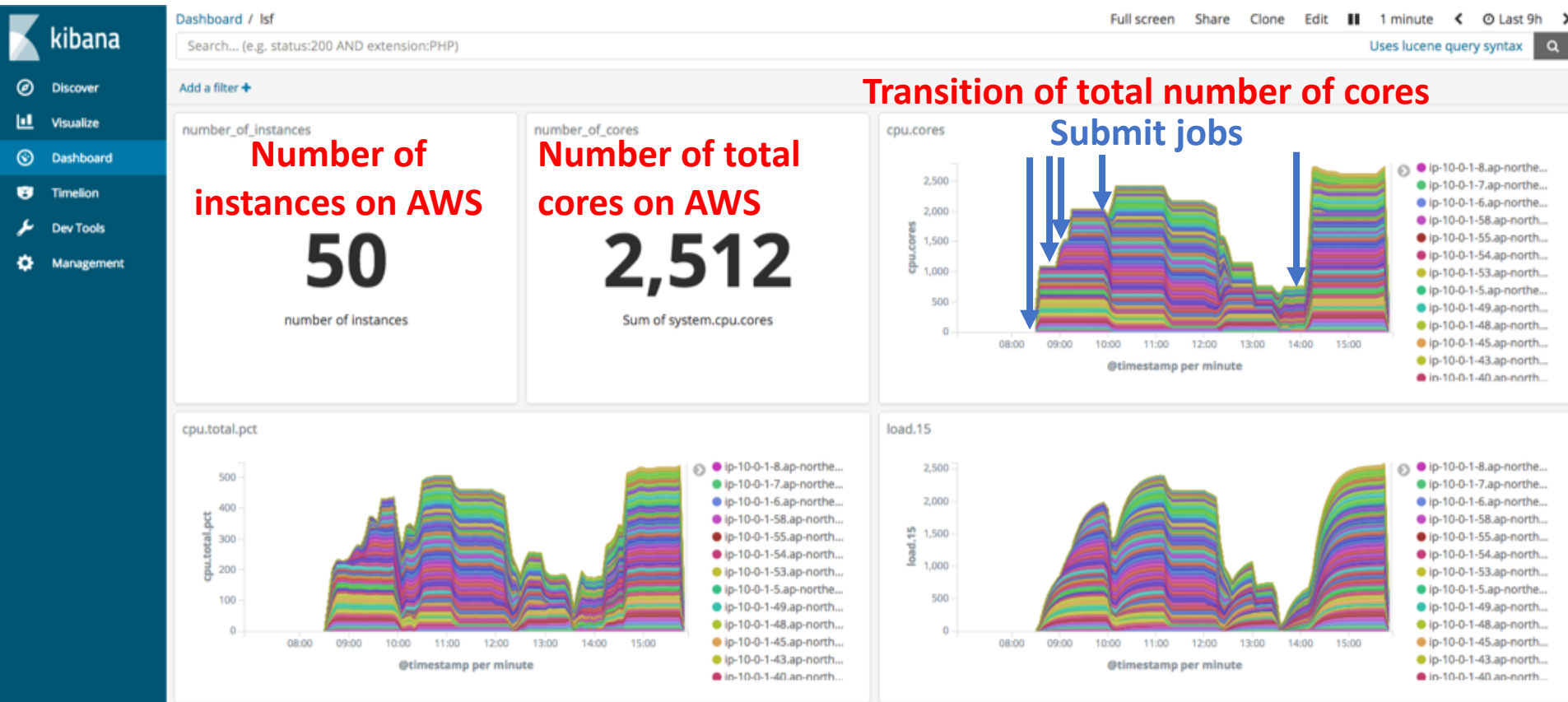
- Supplement the shortage of existing resource.
- Add temporal resource for intensive data analysis in a certain period.

On-premise resource

| LSF | Resource Connector |

SL6 cluster

CMO

AWS

The other public clouds

Queue based resource selection

Off-premise resource

Integration with AWS

KEK

work server

LSF

AWS queue

VPN connection

The other queues

Physical machines (SL6)

LSF calc. server

⋮

LSF calc. server

AWS

EC2

Launched on demand

LSF calc. server

⋮

LSF calc. server

S3

Object storage

share /group/s3fs
for storing input/output data

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Available resource Transition on AWS
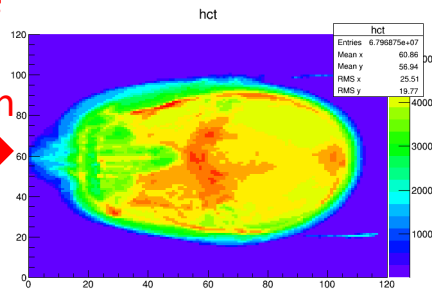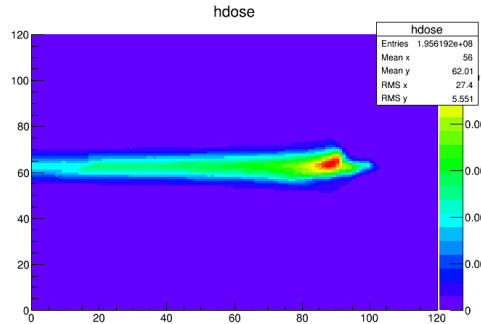

* Cloud resources used in this work was provided in the Demonstration Experiment of Cloud Use conducted by National Institute of Informatics (NII) Japan (FY2017).

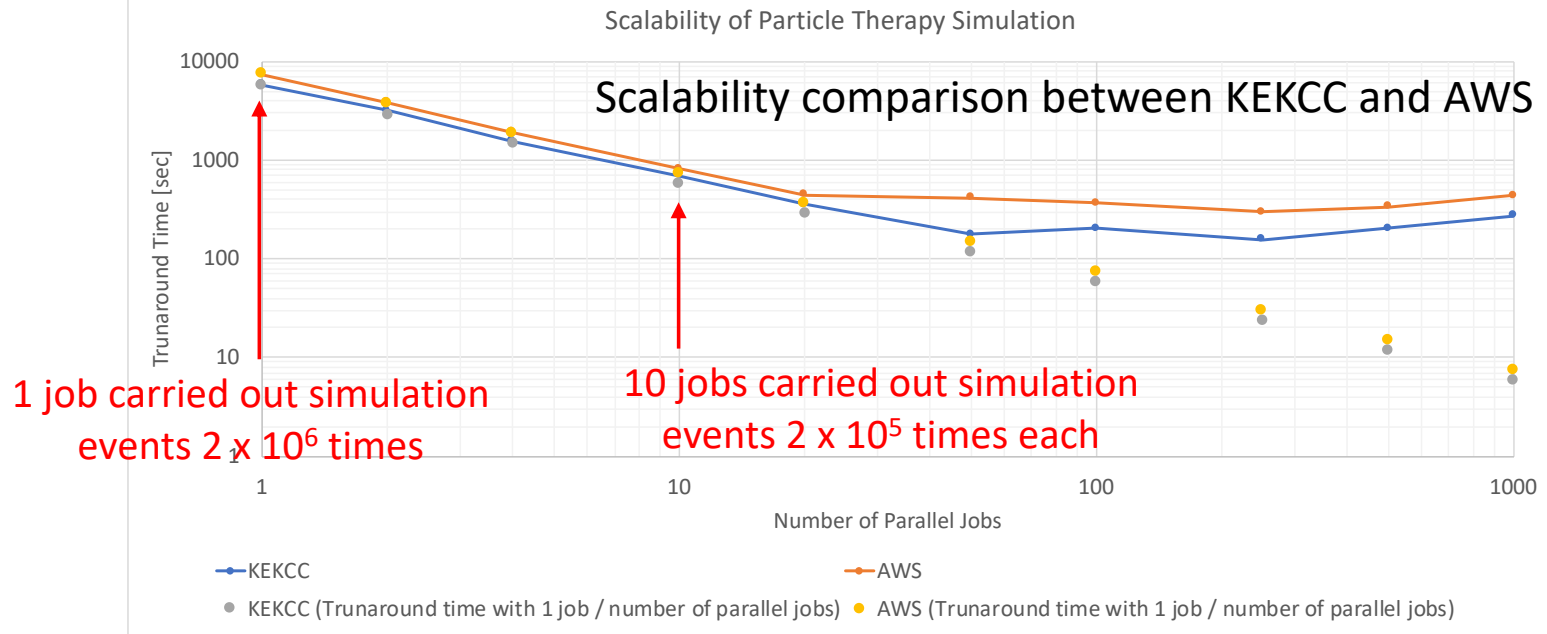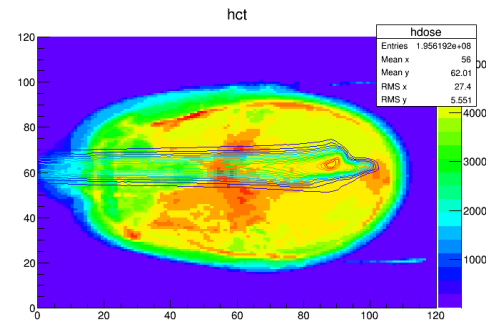# Example: Submission of Geant4 based Particle Therapy Simulation Jobs

Particle beam direction →

Mass density distribution generated by input CT data

Simulated dose distribution

Scalability of Particle Therapy Simulation

Scalability comparison between KEKCC and AWS

1 job carried out simulation events 2 x 10^6 times

10 jobs carried out simulation events 2 x 10^5 times each

Trunaround Time [sec]

Number of Parallel Jobs

—●— KEKCC —●— AWS
● KEKCC (Trunaround time with 1 job / number of parallel jobs) ● AWS (Trunaround time with 1 job / number of parallel jobs)

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Summary

- CMO based Cloud service at KEK is now test phase.

- Our Cloud will cover 2 use cases:
  - Batch integration
  - Self-service provisioning

- Group based SSH access control and resource allocation have been implemented.

- We have succeeded to integrate batch service with public clouds for more flexible workload management.