



Chinese Contribution to the Distributed Computing of LHCb



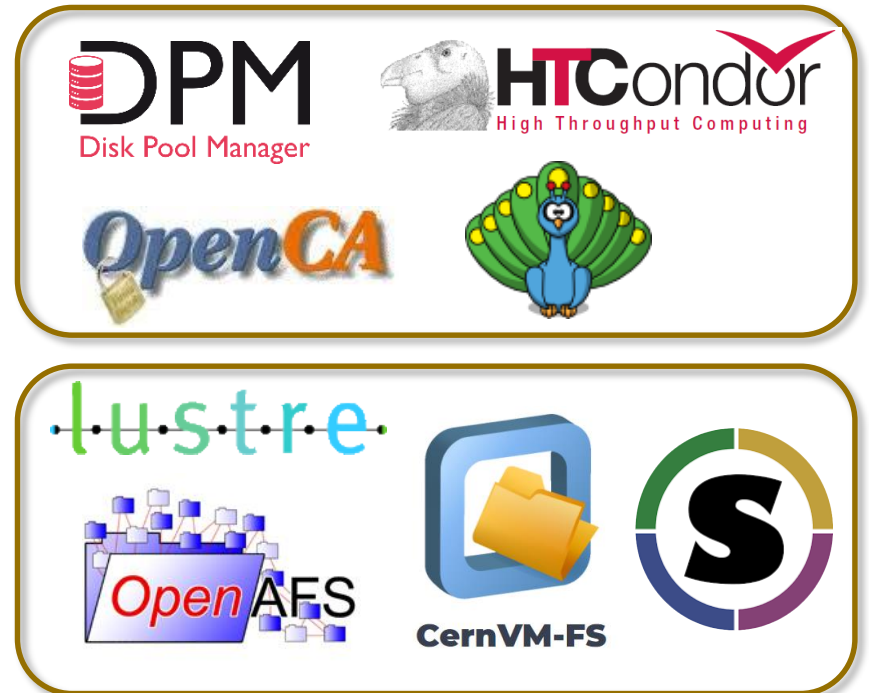
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on behalf of the LHCb Chinese groups
on behalf of Computing Center at IHEP
CLHCP 2020, 2020.11.06

OUTLINE

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- ❖ Summary

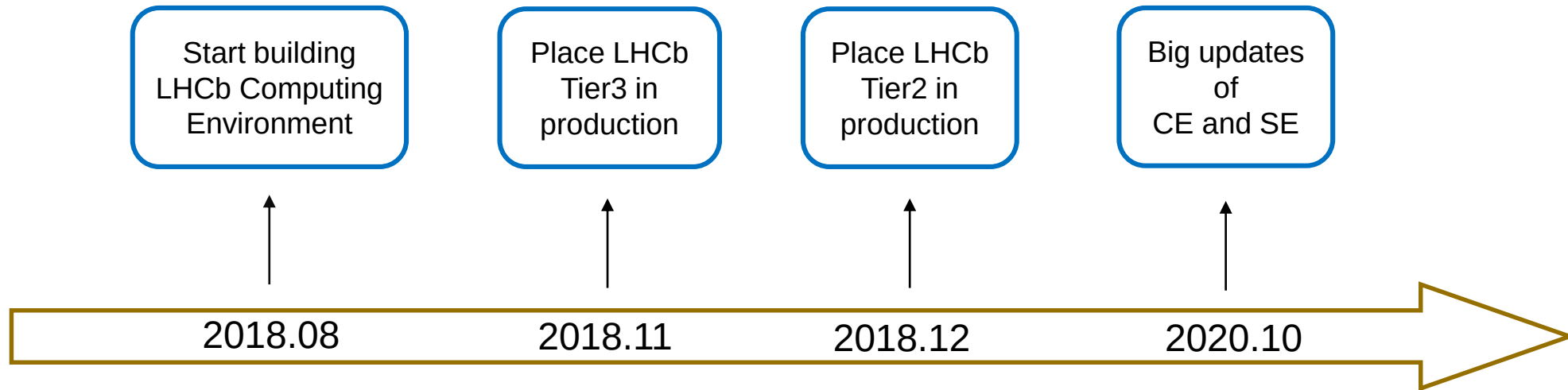
Overview

- ❖ LHCb computing environment in China consists of two parts
 - WLCG Tier2 Site
 - WLCG Tier3 Site (Local computing cluster)
- ❖ The two parts are developed with different technology stacks
- ❖ WLCG Tier 2 Site
 - HTCondor-CE & HTCondor for computing element
 - DPM for storage element
 - OpenCA & Argus for authentication
- ❖ Local computing cluster (Tier 3)
 - HTCondor for batch system
 - Lustre for local storage; AFS for home storage



Timeline of Deployment

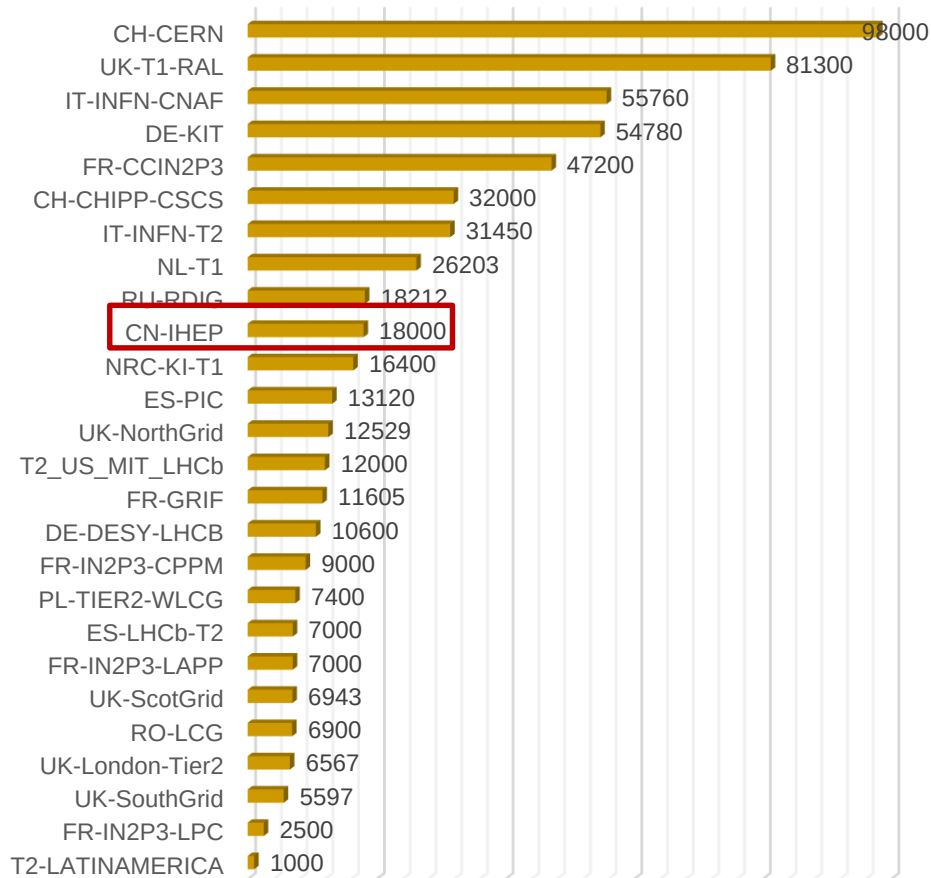
- ❖ LHCb Computing Environment in China started since 2018



Contribution Pledge of LHCb Beijing Site

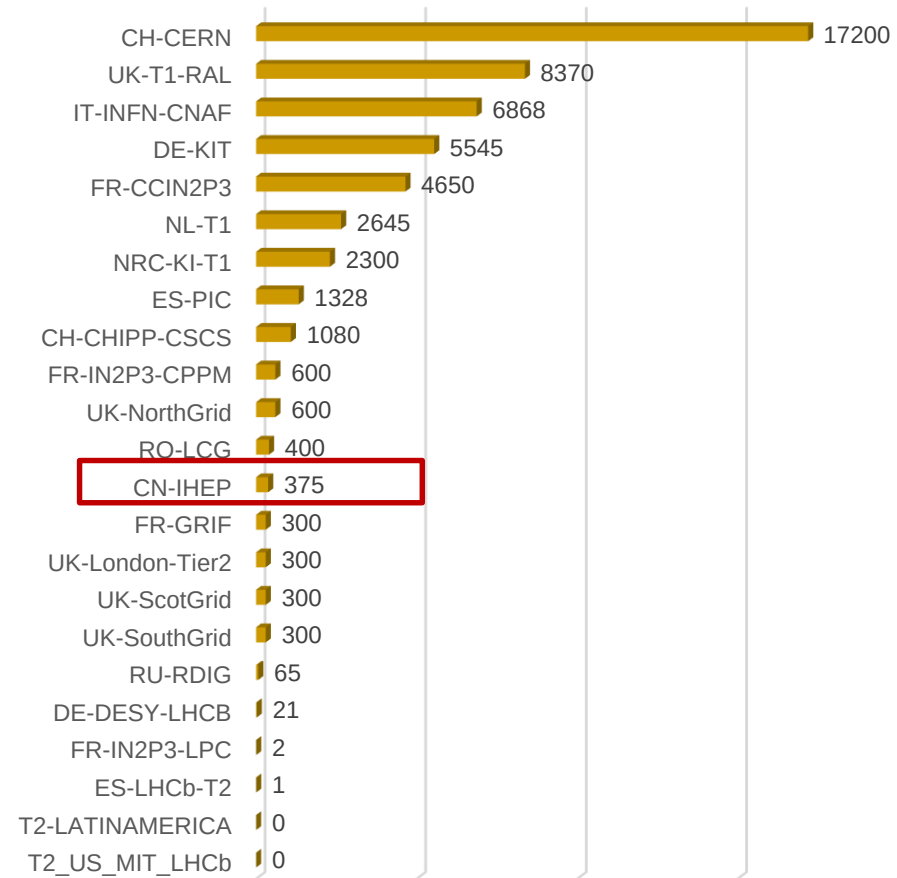
❖ Computing Capacity (CPU Pledge)

- 18000 HS06 (about 3% in LHCb VO)



❖ Storage Capacity (Disk Pledge)

- 375 TB Disk Space



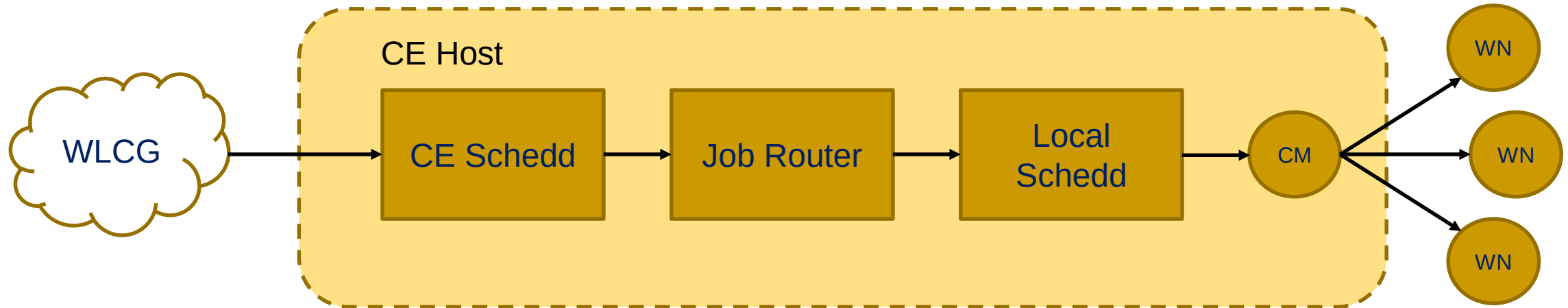
LHCb Tier2 Site – Computing Element

❖ Resources

- 1008 cpu cores
- 28 worker nodes

❖ Migration of Computing Element

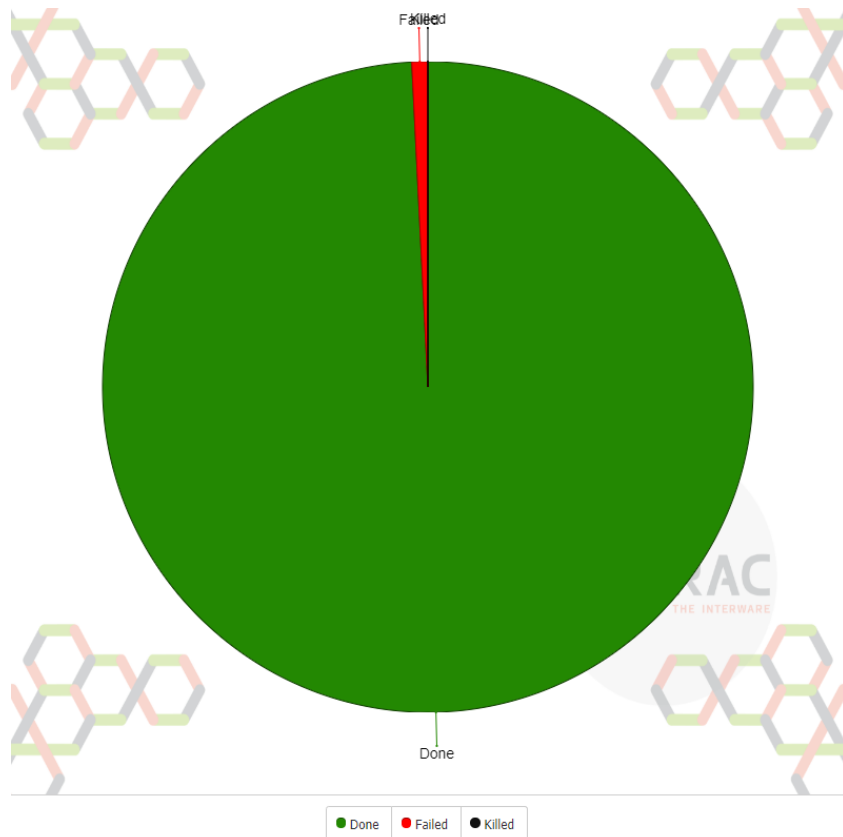
- Migration from CreamCE & PBS to HTCondor-CE & HTCondor
- New CE performs well on scalability and be friendly for maintenance



LHCb Tier2 Site – Job Statistics (Jan-Oct of 2020)

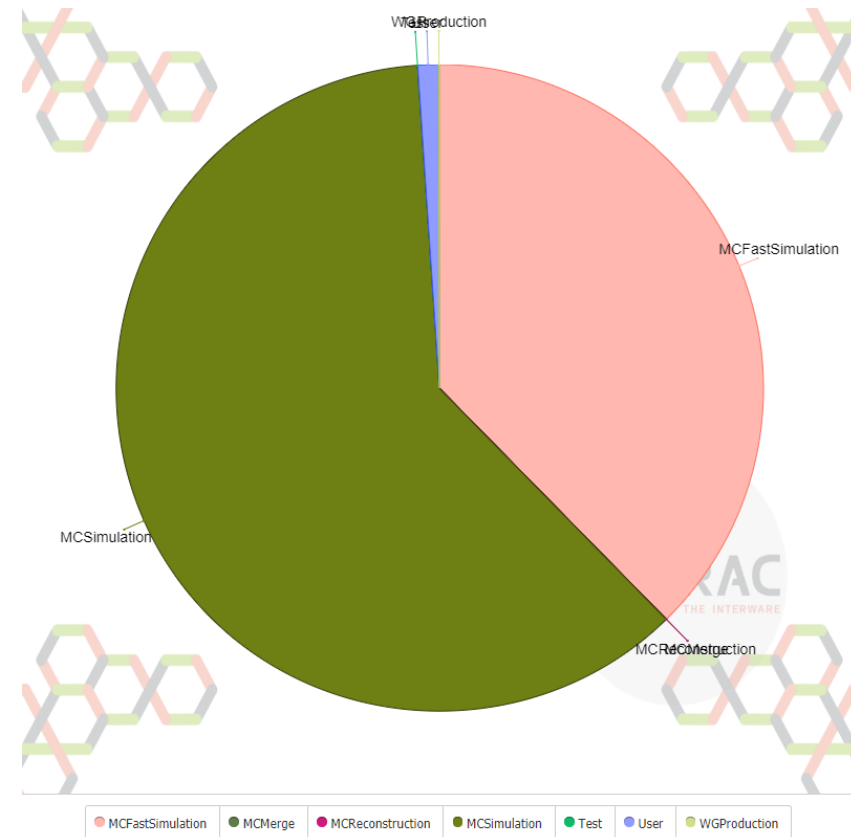
❖ Completion Jobs

- Total number: 119,751 jobs
- The success rate: 99.2%



❖ Job Types

- Most of jobs are MC Simulation
- Few of jobs are user's analysis job



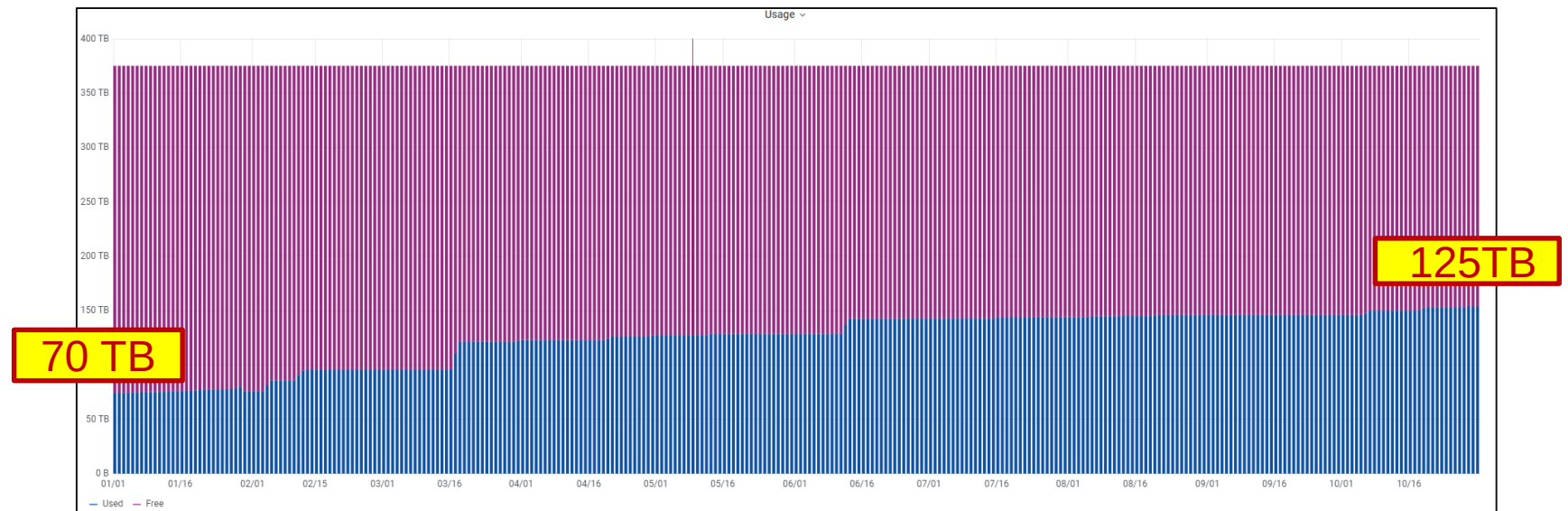
LHCb Tier2 Site – Storage Element

❖ DPM Upgrade

- The upgraded version is 1.14
- The new version has a good support for TPC
- WLCG is recommending the site to replace the SRM protocol

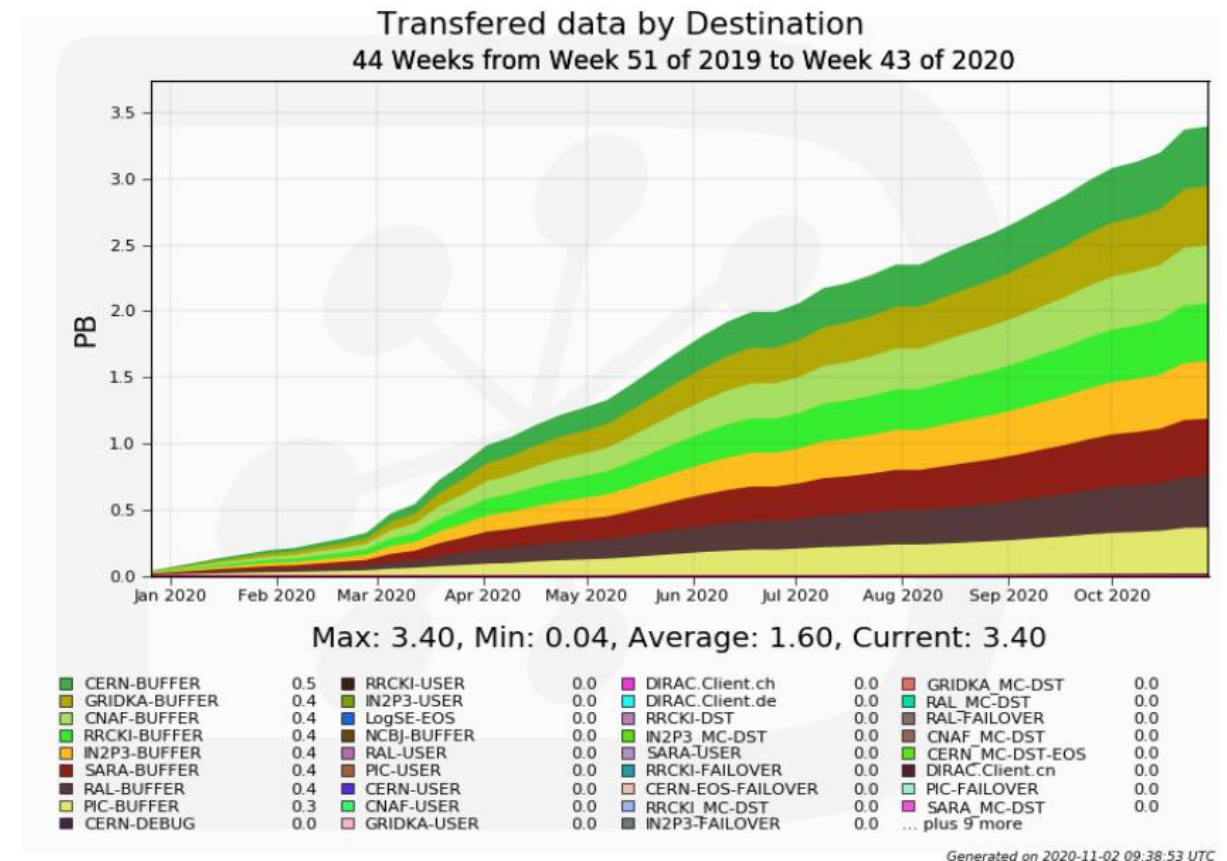
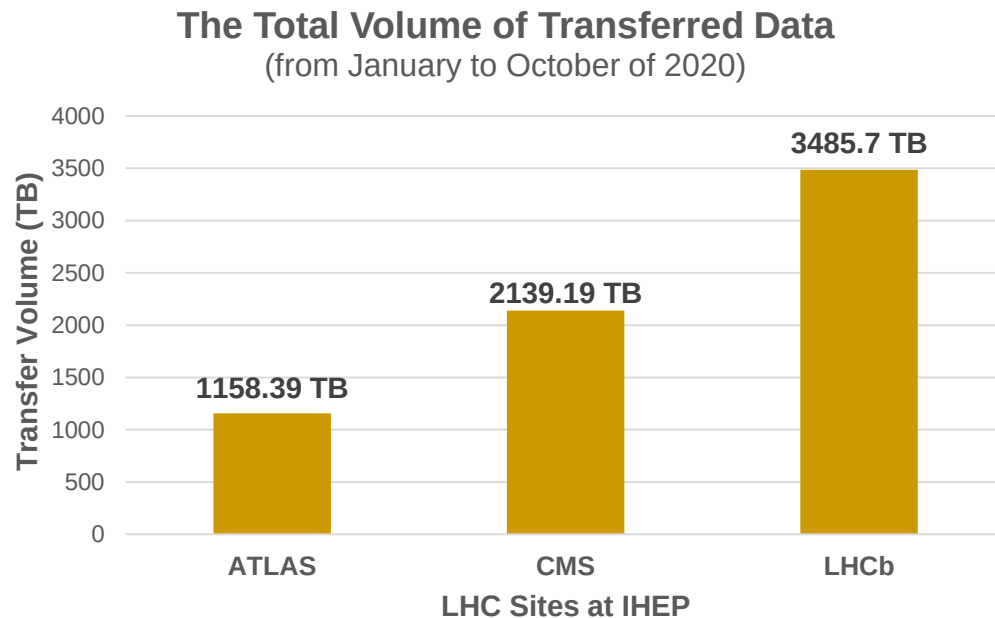
❖ Storage Space

- 375 TB in total
- 125 TB used
- 150 TB available

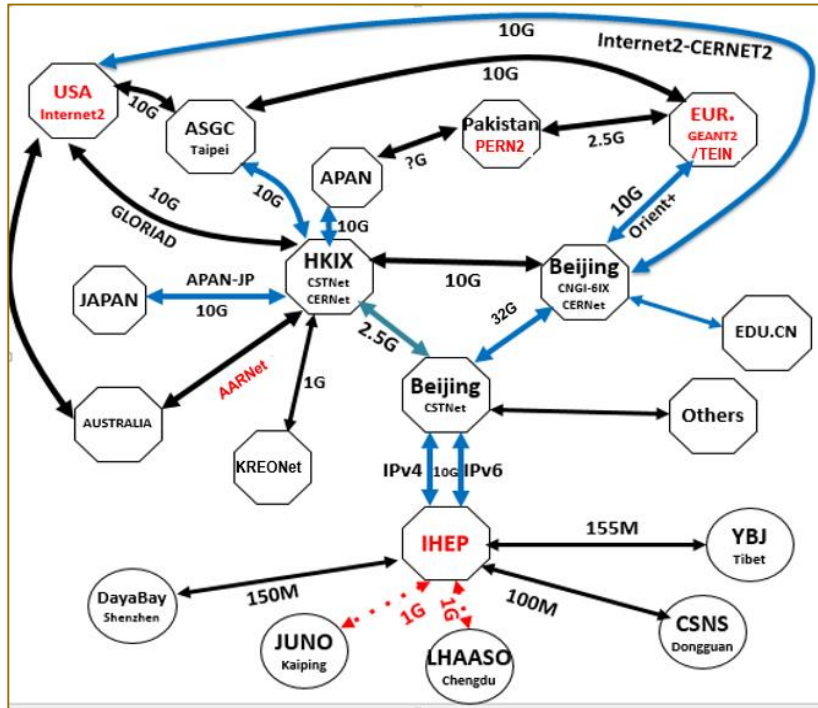


LHCb Tier2 Site – Data Transfer

- ❖ The transfer volume is big
 - E.g. 3.4 PB data was transferred out from LHCb Beijing site between Jan & Oct.
- ❖ Total volume transferred
 - Including transfer Out and transfer In



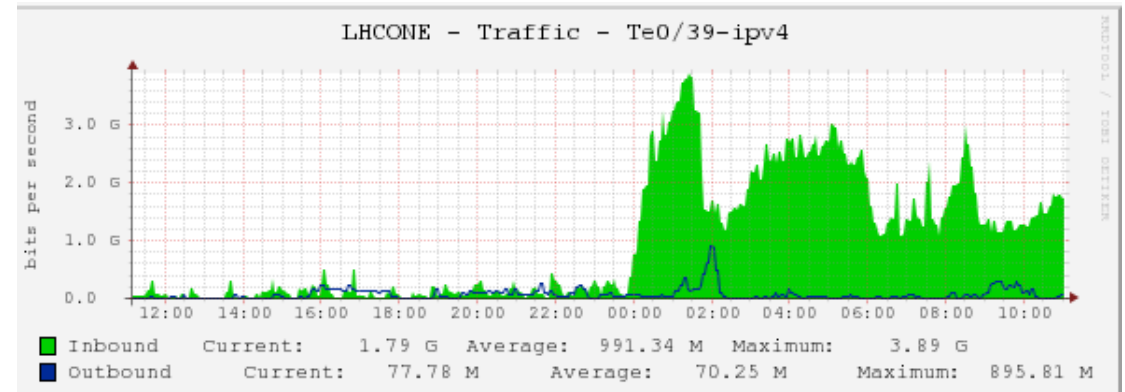
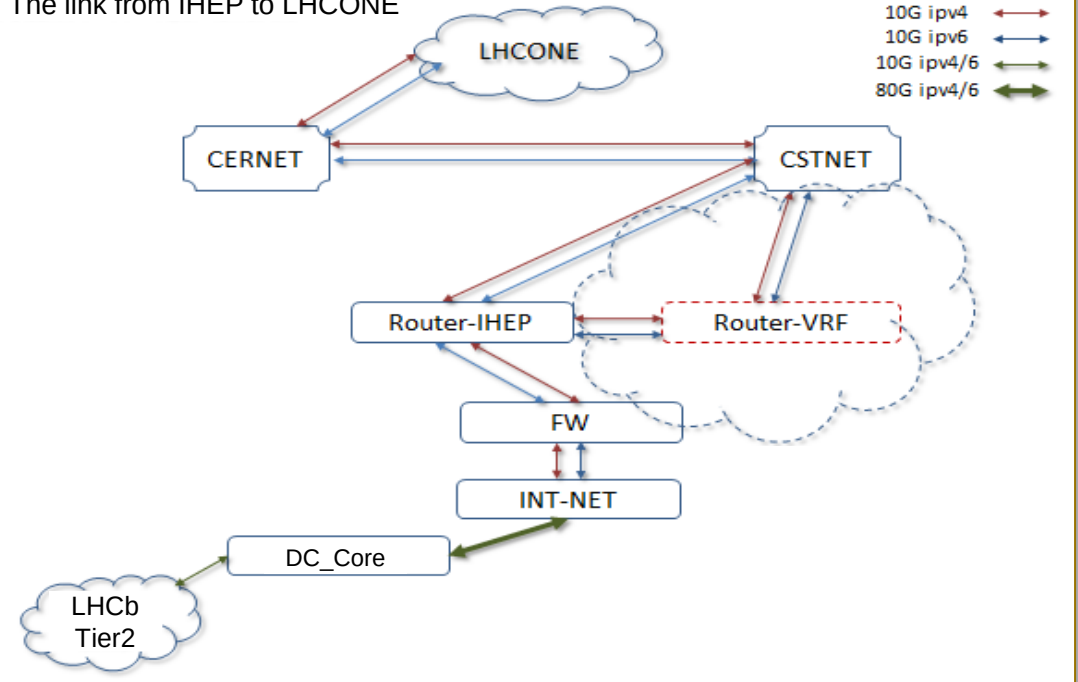
LHCb Tier2 Site – Network



❖ WAN

- IHEP-EUR.: 10Gbps
- IHEP-USA: 10Gbps
- IHEP-Asia.: 2.5Gbps
- IHEP-Domestic Univ.: 10Gbps
- LHCONE: IPv4(10Gbps)+IPv6(10Gbps)

The link from IHEP to LHCONE



LHCb Tier2 Site - Authentication

❖ VOMS

- Virtual Organization Management Service
- IHEP has a client to synchronize the VOMS info

❖ OpenCA

- IHEP has a dedicated CA server
- Report the approved certificate to the global server
- Fetch all updated certificate from the global server

❖ Argus

- Used to authenticate the certificate to access into other services (CE/SE/...)
- Map the certificate to a local user

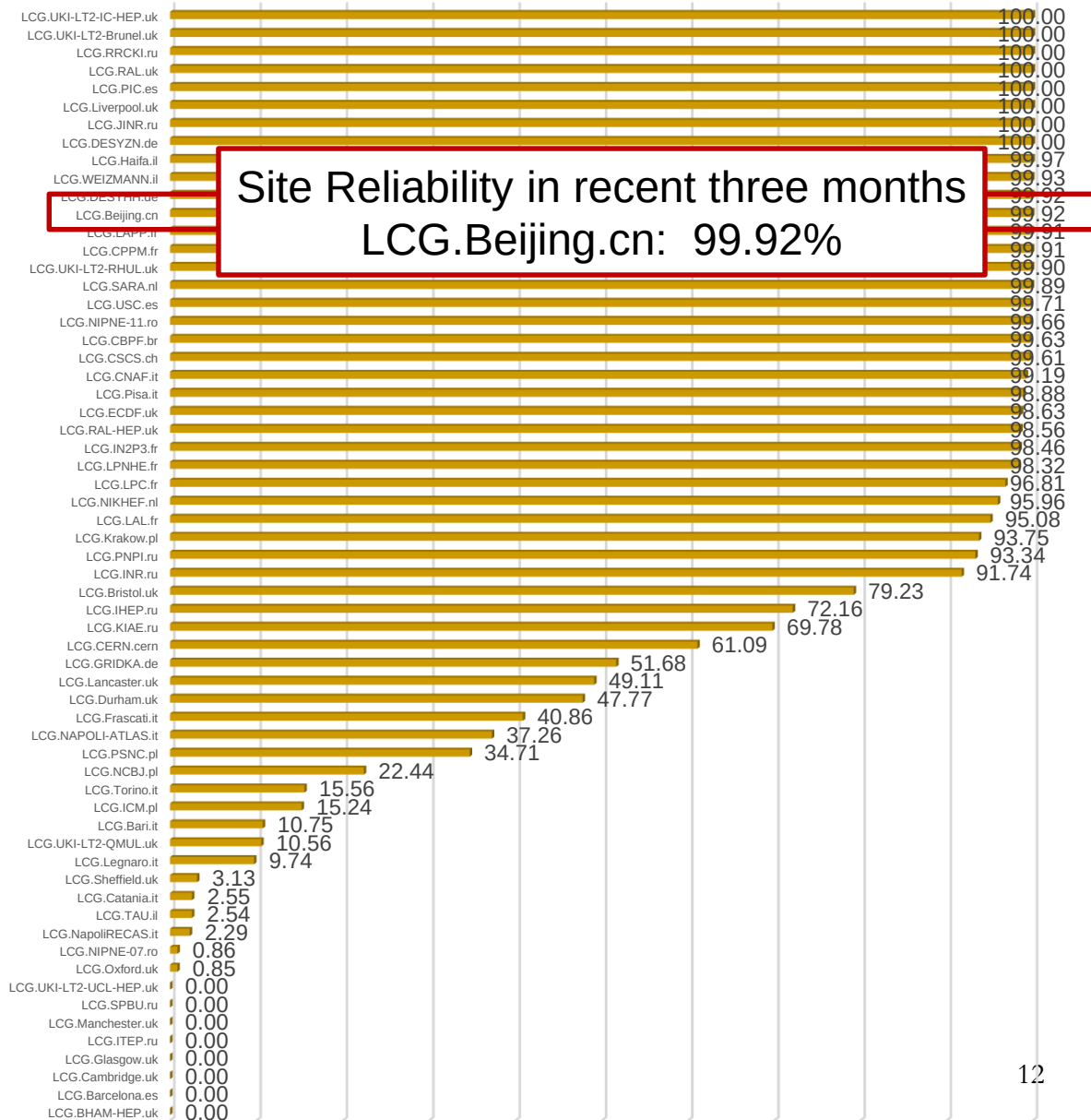
LHCb Tier2 Site - Maintenance

❖ Manpower (IHEP CC Grid Team)

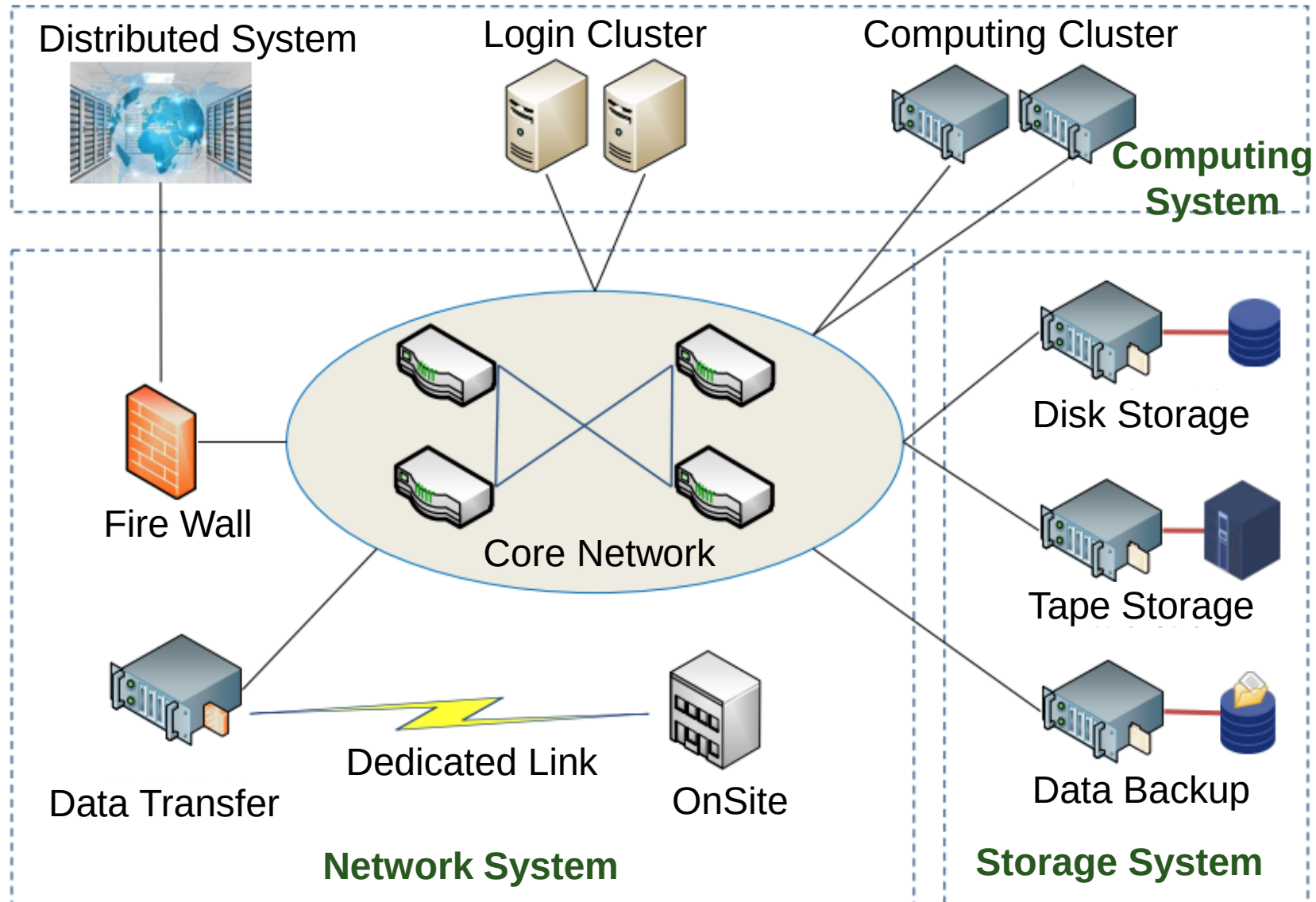
- 5 persons with part-time work
- CE/SE/Network/infrastructure/...

❖ Main maintenance updates in 2020

- CE: move to HTCondor-CE & HTCondor
- SE: Upgrade DPM version to 1.14
- OS: Upgrade to CentOS 7



LHCb Tier3 Site



LHCb Tier3 Site – Computing Status

❖ Resource

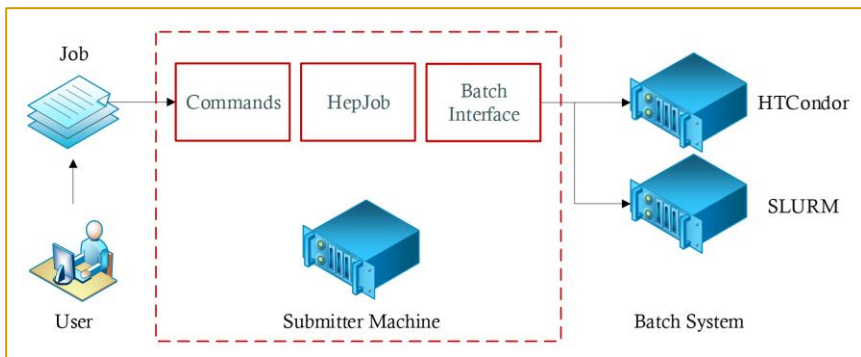
- 72 CPU cores, 2 worker nodes

❖ Batch System

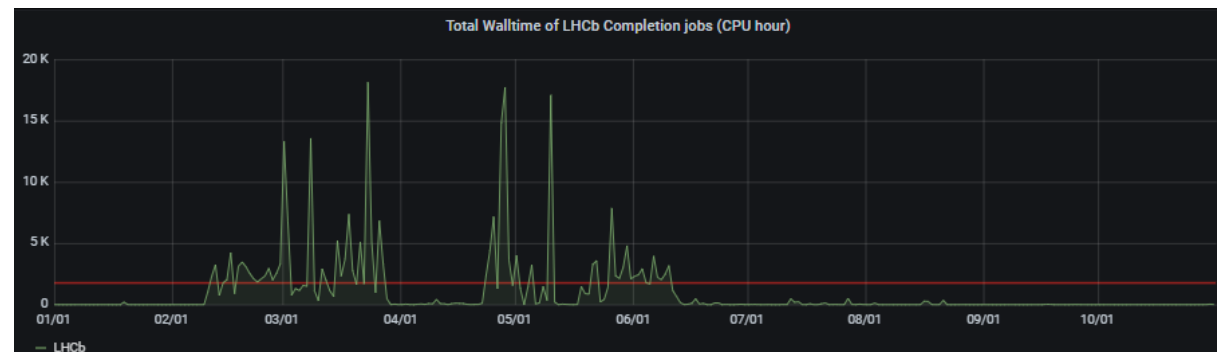
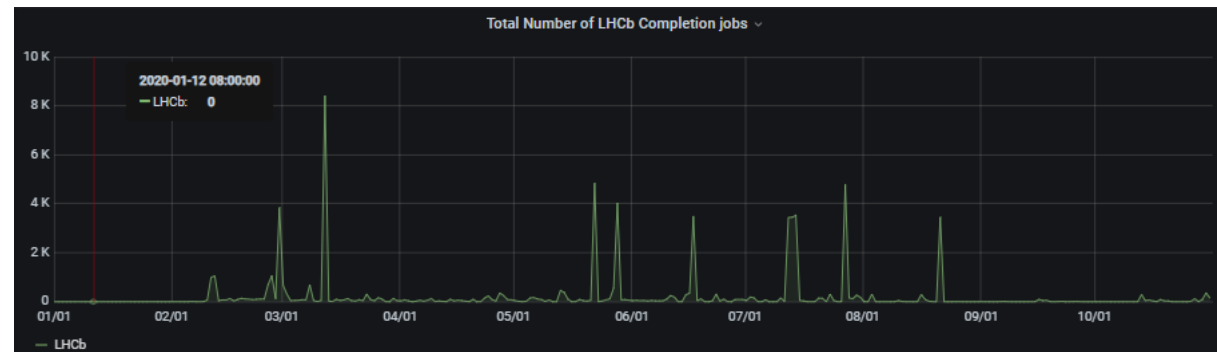
- Based on HTCondor

❖ HepJob

- Simplify the interactions
- Control the scheduling behaviors



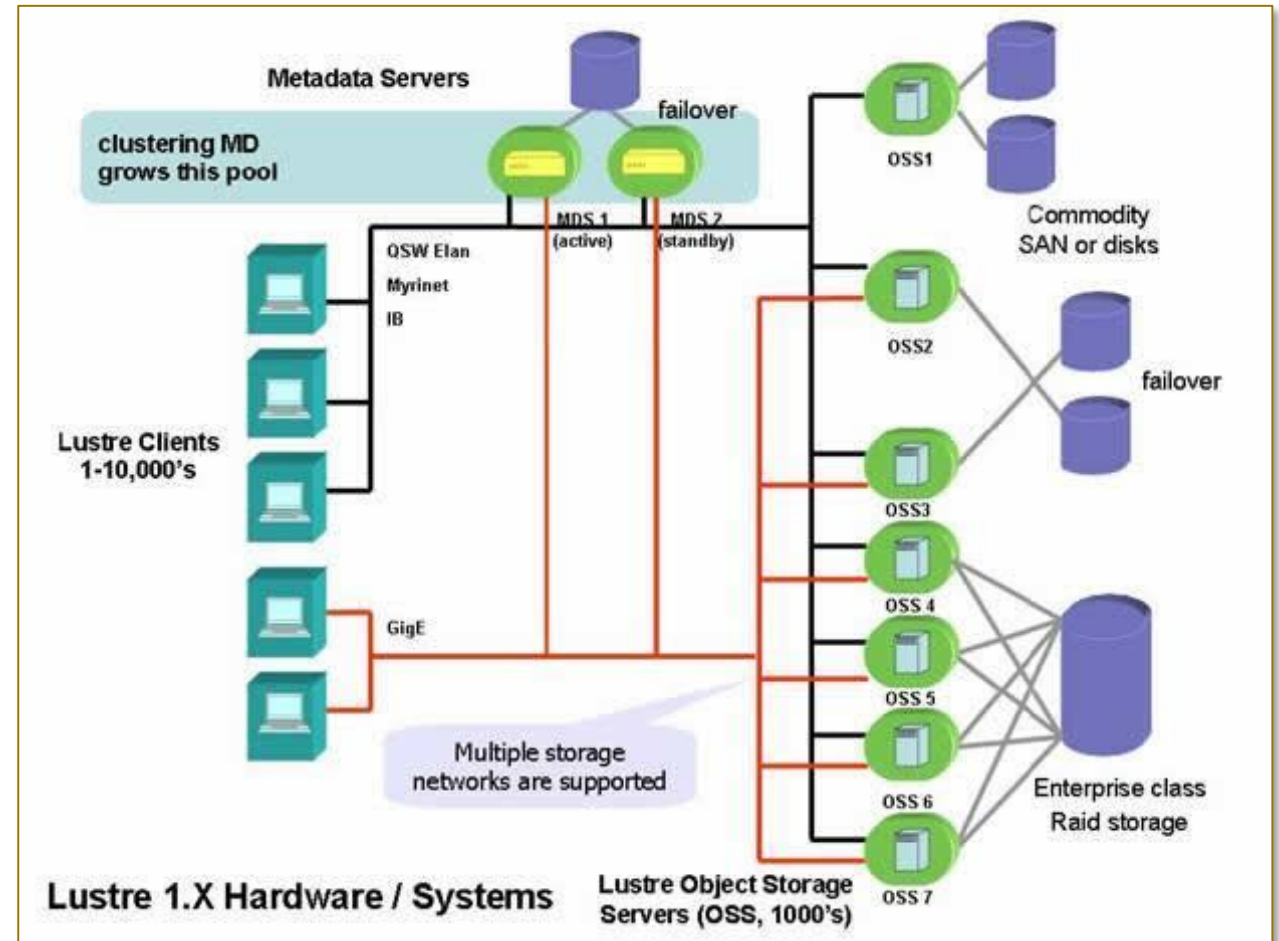
❖ Job Statistics



❖ Contribute resources to IHEP Cluster

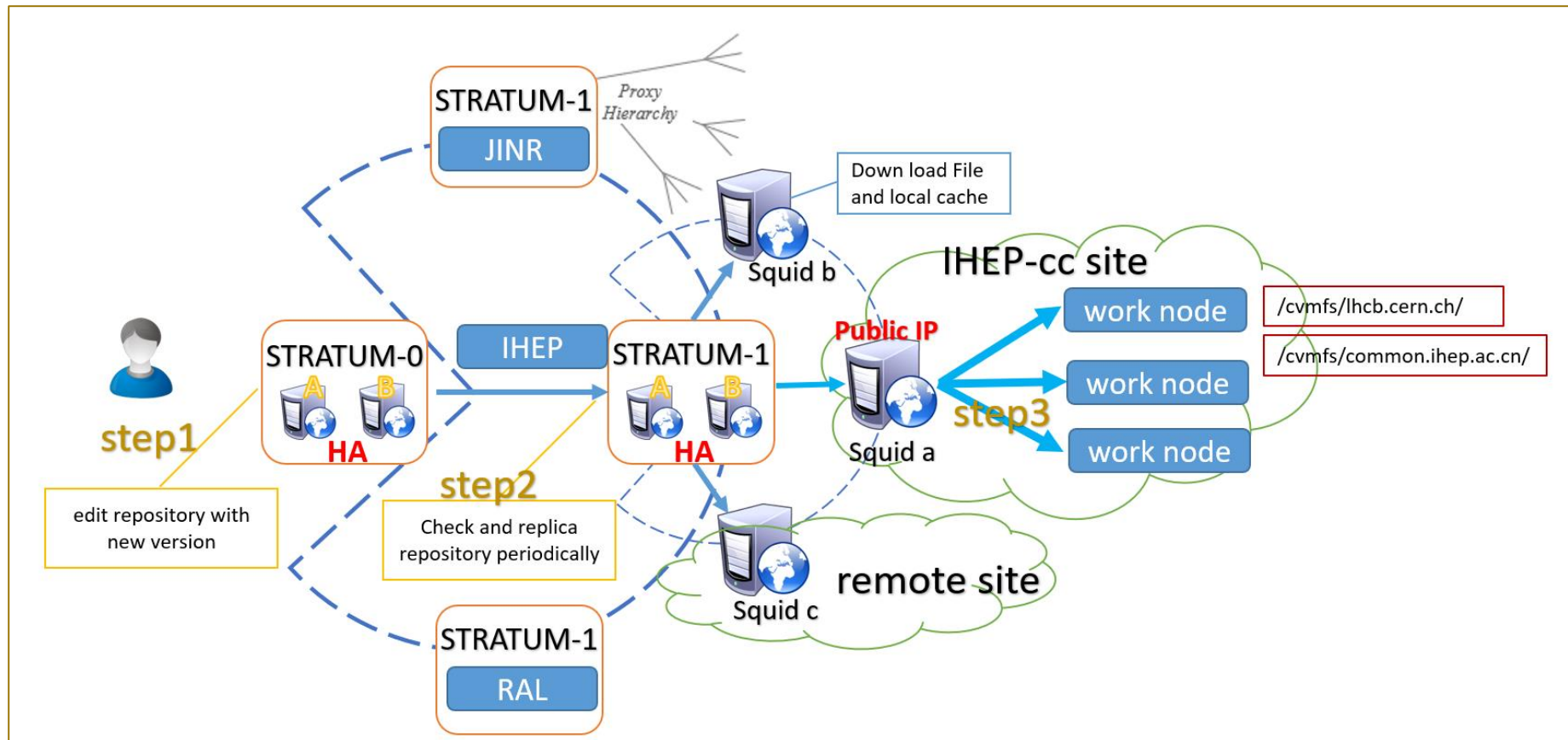
LHCb Tier3 Site - Storage

- ❖ Lustre
 - A shared file system
 - Main storage solution at IHEP
- ❖ LHCb local storage
 - Total space: 327.2TB
 - Used space: 2.2TB
 - Available space: 304.4TB
- ❖ Sufficient available storage space



Software Environment (CVMFS)

- ❖ IHEP has our own STRATUM and Squid servers
 - Periodically download the software repository from WLCG CVMFS servers
 - Manage our own software repository



Summary

- ❖ LHCb Beijing Sites have continuously contributed computing capacity and storage capacity to LCG for nearly 2 years.
- ❖ Basically, LHCb Beijing Sites are under a good maintenance. Site reliability is ranking above average, sometimes on the top.
- ❖ Site Maintainers continue to improve their technology skills to make LHCb Beijing sites more powerful and stable.
- ❖ Many Thanks to all the colleagues and friends of LHCb

Thanks!