

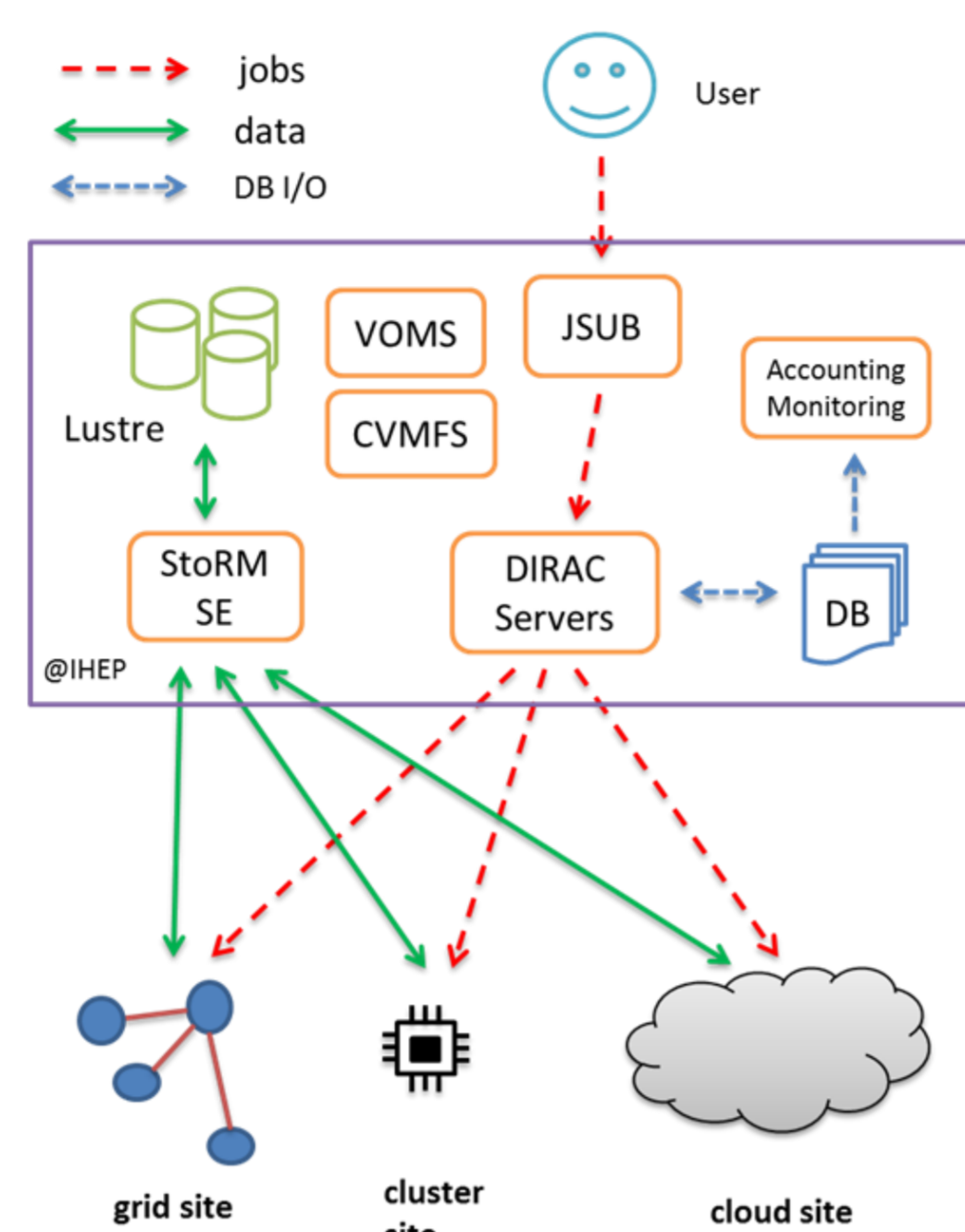
Application of StoRM+Lustre storage system in IHEP's distributed computing

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Introduction

- The distributed computing system in IHEP is based on DIRAC middleware.
- It was built since 2012 originally for data production of BESIII experiment.
- In 2014, it was extended to support multi VO. Several HEP experiments such as CEPC and JUNO are joined.
- Currently, it integrates about 2000 CPU cores and 500 TB storage contributed by 16 distributed sites.
- These sites are of four types: cluster, grid, cloud and volunteer computing.
- The system architecture is shown in figure on right side.
- In this system, StoRM+Lustre plays as a central storage for small remote sites to get input data from IHEP and upload output data to Lustre storage in IHEP.



Deploy StoRM+Lustre

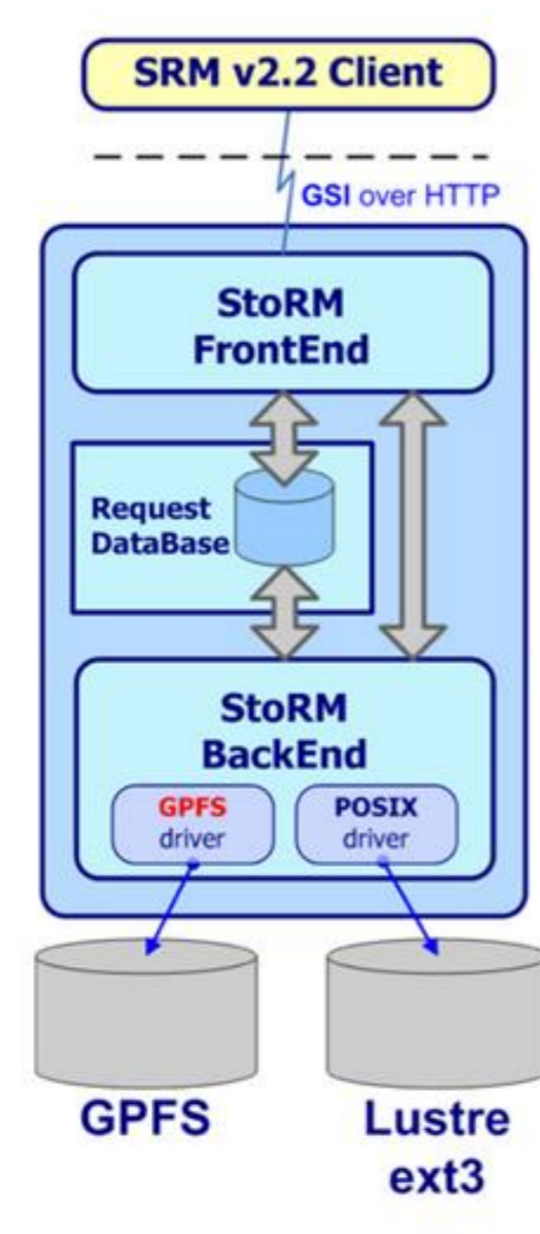
- As show in the first figure, StoRM plays as a role of frontend to the grid environment, while Lustre as a backend of local accessible massive and high-performance storage.
- Users feel a nearly unified storage interface.
- Both local and remote users/jobs exchange data with Lustre storage essentially, without manually data movement between a grid SE and local storage system.
- Moreover, this architecture can be used to expose physics data in local storage to remote sites.

Motivation

- Several kinds of storage elements (SE) are used in IHEP's distributed computing environment, such as dCache, BeStMan and StoRM.
- In IHEP central site, a dCache SE with 128 TB storage capacity served as central grid storage since 2012.
- The local Lustre storage at IHEP hosts about 4PB data for above experiments.
- Physics data, such as randomtrg data and DST data are uploaded to this dCache SE manually and transferred to remote SEs.
- Output data of jobs are uploaded to dCache SE by job wrapper, and then downloaded to local Lustre storage by end user.
- We wish to integrate local and grid storage easily and make the data production more automatically.

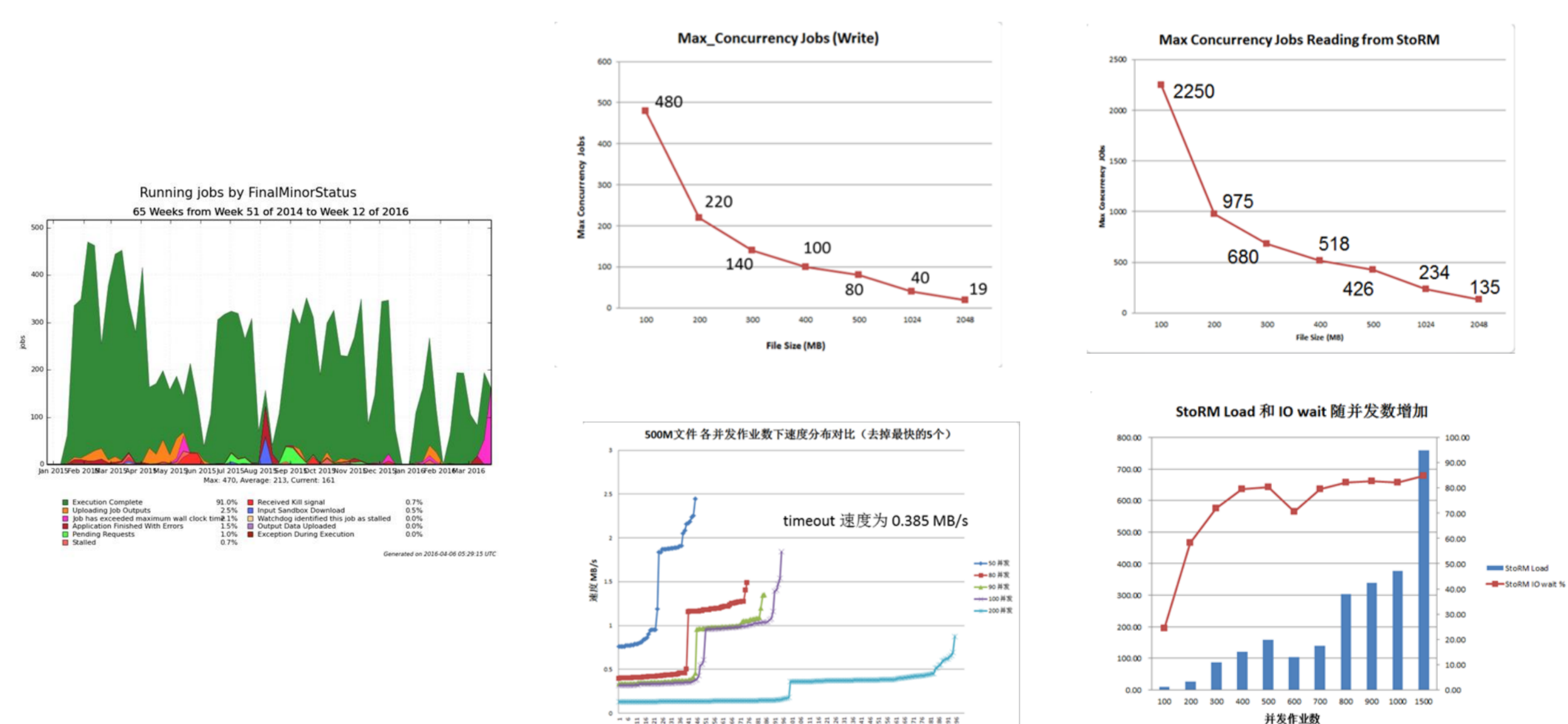
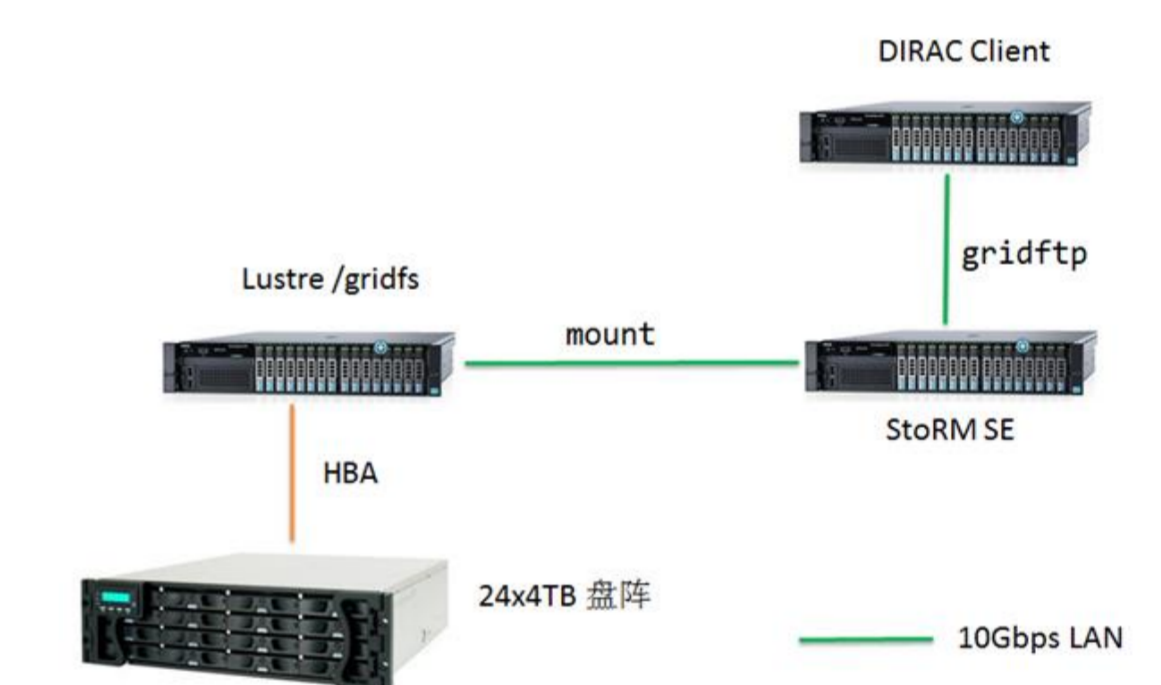
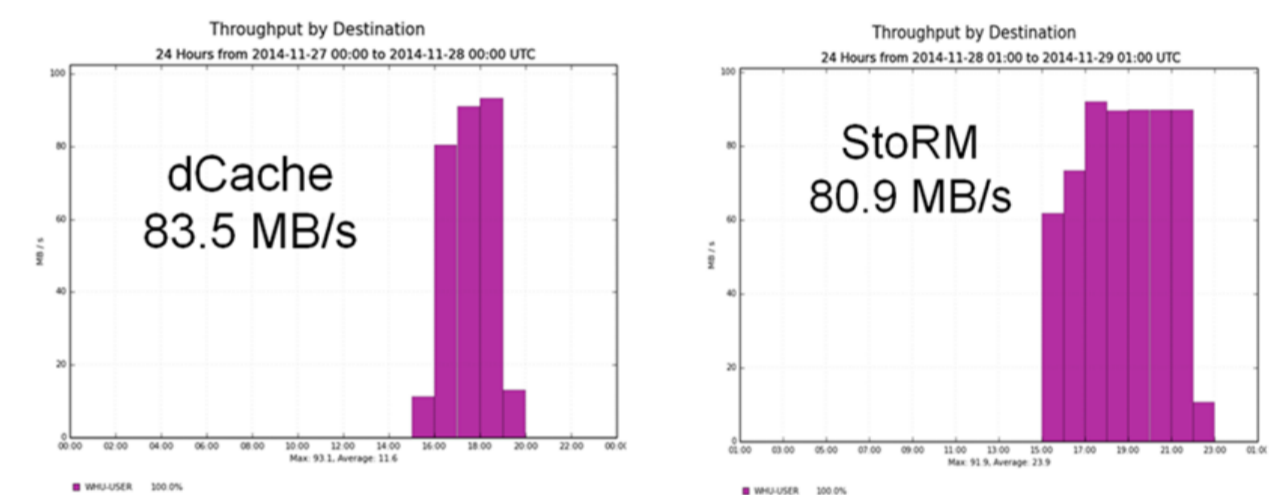
Why we choose StoRM

- Storage Resources Manager (StoRM) is a lightweight, scalable, flexible and SRMv2 compliant storage resource manager for disk based storage system.
- It works on each POSIX file systems, and can take advantage of high performance storage systems based on cluster file systems like Lustre.
- StoRM support both standard grid access and direct access on data, and it relies on the underlying file system structure to identify the physical data position, instead of querying any databases.



Performance Test

- The first figure is a comparison of dCache and StoRM in WAN data transferring.
- The configuration of the testing platform for concurrent job pressure test is shown in the second figure.
- The testing result is shown in fig. 3-6, from which we know some bottlenecks when the number of concurrent jobs is increasing.
- The final figures shows the production jobs running status since 2015. StoRM+Lustre runs stable in this production.



Summary

- In this poster, we introduced the architecture of IHEP distributed computing and explained the motivation of using StoRM+Lustre storage system.
- We performed several test, which proved that StoRM+Lustre is suitable for current data production tasks.
- This storage system is in production since Jan. 2015. And it's shown that it runs stable and plays an importance role in IHEP's data production and data exchange between sites.



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