Grid Sites in China

On Behalf of IHEP-CC

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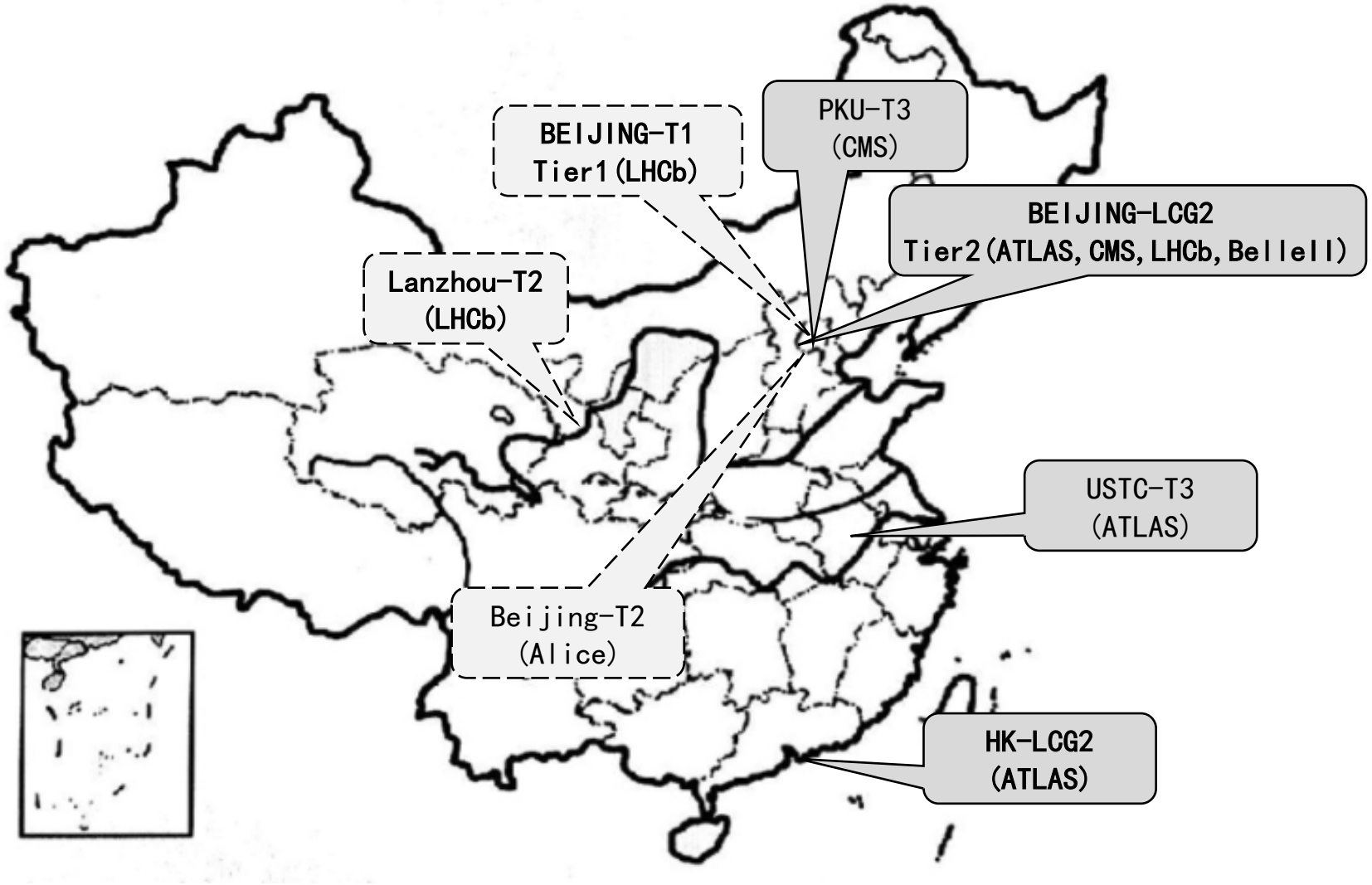
Outline

Overview of Grid Sites in China (1/2)

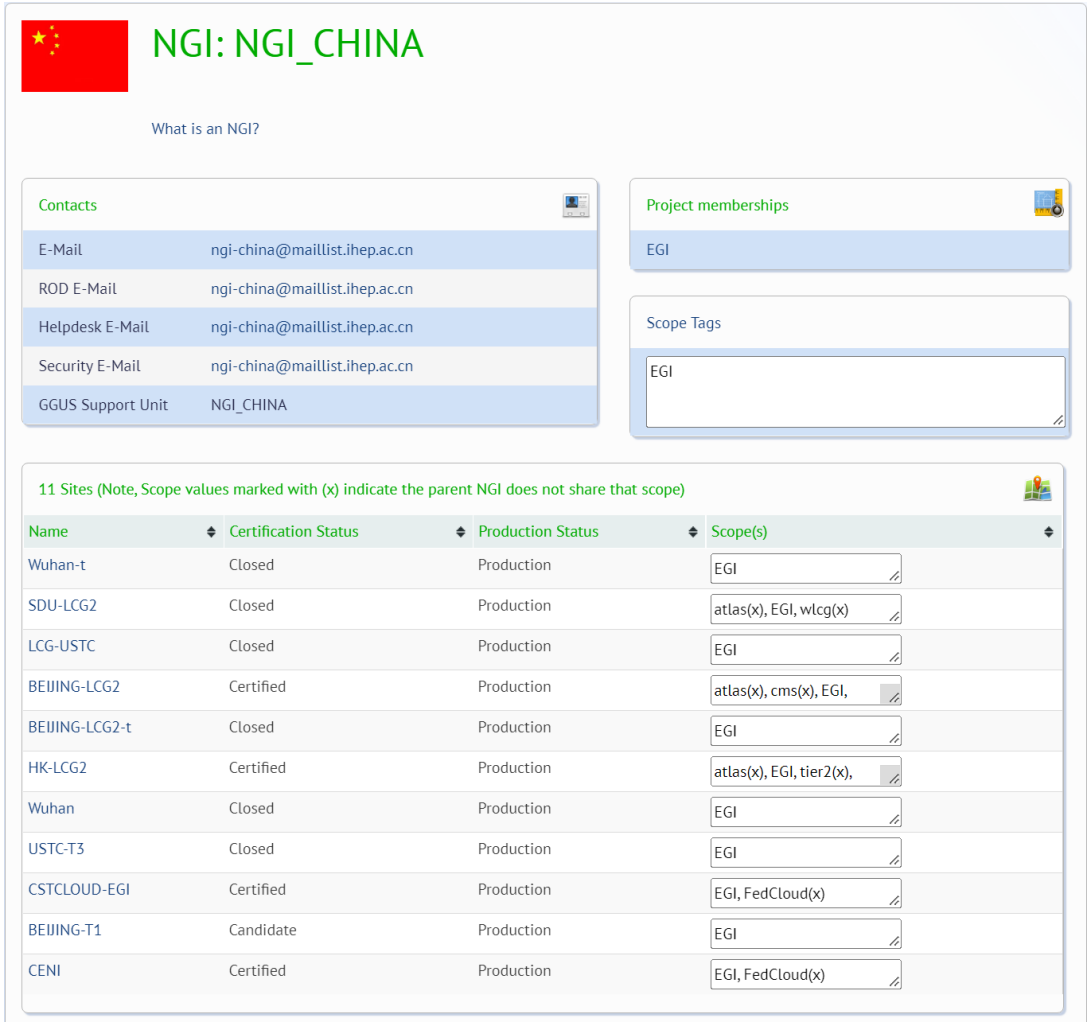
- Chinese WLCG site history
  - **2006:** IHEP signs the Memorandum of Cooperation with WLCG for ATLAS and CMS Tier-2 sites
  - **2018:** LHCb Beijing Tier-2 site deployed at IHEP
  - **2020:** BelleII Tier-2 site was built at IHEP
  - **2023:** Construction starts for LHCb Tier-1 site and Alice Tier-2 sites at IHEP
  - **2024:** LHCb Beijing Tier-1 goes into production
  - **2024:** Alice Tier-2 goes into production

Overview of WLCG Sites in China (2/2)



EGI - NGI_CHINA

- NGI_CHINA was founded in 2014
- Resource Centers involved in NGI_CHINA
  - BEIJING-T1 (WLCG Tier-1)
  - BEIJING-LCG2 (WLCG Tier-2)
  - HK-LCG2 (WLCG Tier-2)
  - CSTCLOUD-EGI (EGI)
  - CENI (EGI)



NGI: NGI_CHINA

What is an NGI?

Contacts	
E-Mail	ngi-china@maillist.ihep.ac.cn
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Helpdesk E-Mail	ngi-china@maillist.ihep.ac.cn
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GGUS Support Unit	NGI_CHINA

Project memberships: EGI

Scope Tags: EGI

11 Sites (Note, Scope values marked with (x) indicate the parent NGI does not share that scope)

Name	Certification Status	Production Status	Scope(s)
Wuhan-t	Closed	Production	EGI
SDU-LCG2	Closed	Production	atlas(x), EGI, wlcg(x)
LCG-USTC	Closed	Production	EGI
BEIJING-LCG2	Certified	Production	atlas(x), cms(x), EGI,
BEIJING-LCG2-t	Closed	Production	EGI
HK-LCG2	Certified	Production	atlas(x), EGI, tier2(x),
Wuhan	Closed	Production	EGI
USTC-T3	Closed	Production	EGI
CSTCLOUD-EGI	Certified	Production	EGI, FedCloud(x)
BEIJING-T1	Candidate	Production	EGI
CENI	Certified	Production	EGI, FedCloud(x)

Webpage of NGI_CHINA

International Network Upgrade

- International network link is upgraded to 100Gbps in 2023
  - CSTNET (CNIC), GEANT, CERN and CN-IHEP collaborated on the upgrade
  - LHCOPN: not less than 20Gbps
    - CSTNET：20Gbps
    - GEANT：more than 20Gbps promised
  - LHCONE: more than 20Gbps
    - IHEP is the main network user of CSTNET

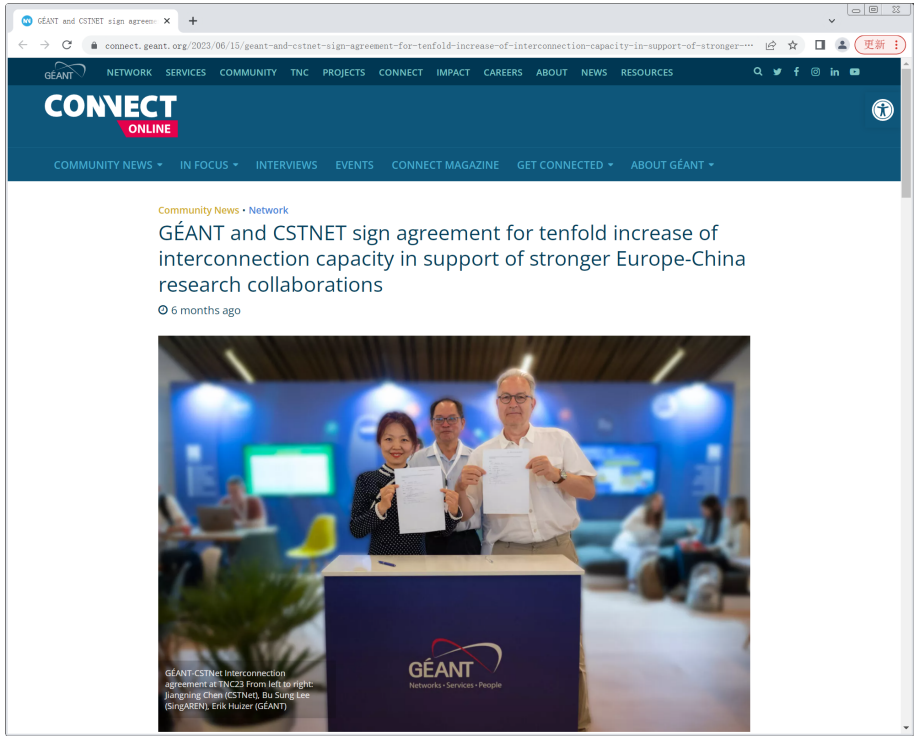
International network connection of IHEP

Network Performance Test

- Time line of the 100Gbps network link creation for IHEP
  - **07/06/2023 :** CSTNET and GEANT signed an agreement to increase the interconnection capacity by tenfold
  - **13/07/2023:** CSTNET 100G Europe Link became operational
  - **15/12/2023:** IHEP-LHCOPN was ready
- Network Performance Test
  - JUNO data transferred
    - Data transferred between IHEP and INFN, IN2P3 based on LHCONE
    - Max speed reached to 50.9Gbps
  - Iperf3 test
    - Iperf3 test conducted between IHEP and CERN based on LHCOPN
    - Max speed reached to 30Gbps
  - Network Latency: ~210ms

Juno data transfer between IHEP and INFN, IN2P3

Iper3 Test between IHEP and CERN

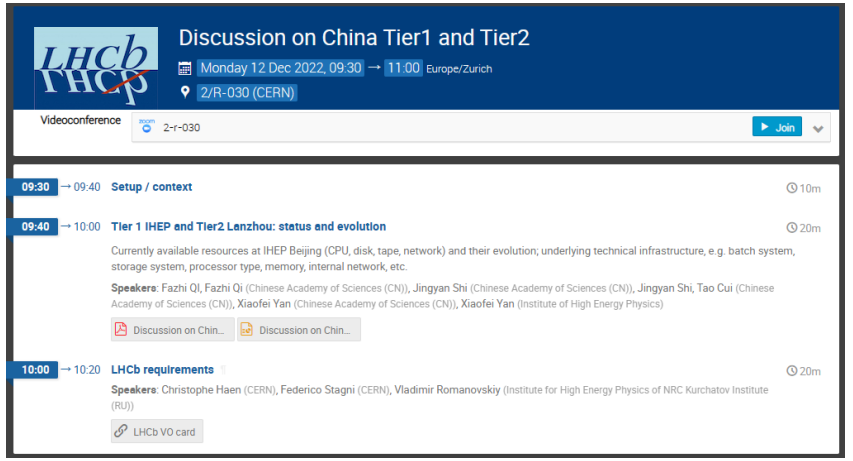


Agreement signed between CSTNET and GEANT

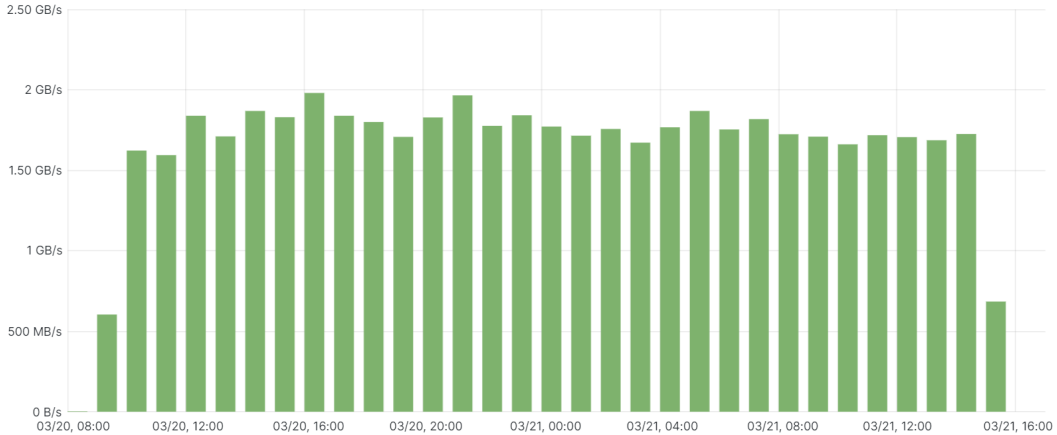
Outline

Construction and Resource of LHCb Beijing Tier-1 Site

- Construction
  - **Oct. 2023:** Chinese LHCb collaboration and CC-IHEP decided to construct Tier-1 Site for LHCb
  - **Dec. 2023**: Discussed and received the approval from WLCG
  - **Feb. 2024:** Construction completed
- Resource provided for LHCb Beijing Tier-1
  - Computing:
    - 40 worker nodes (Intel & AMD) with 3216 CPU cores: 67,000 HepScore
  - Disk storage
    - 4 sets of storage array provide 3.2 PB
  - Tape storage:
    - 4 drivers (IBM) and 170 tapes with 3PB
  - Network equipment and management server:
    - 6 switches, 1 router, 2 band cards and 10 servers
- First data challenge has been done
  - 189TB data was transferred into IHEP Site in ~2 days
  - Average transfer speed is about 1.55GB/s (Max is 1.98)
  - Transfer efficiency is close to 100%



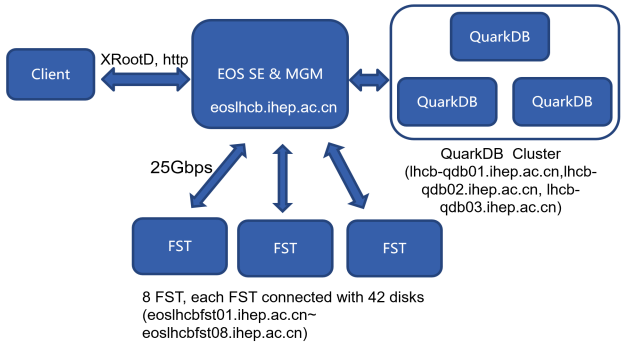
International network connection of IHEP

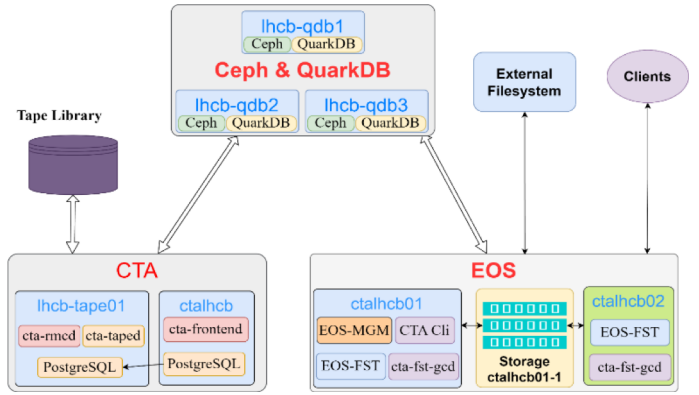


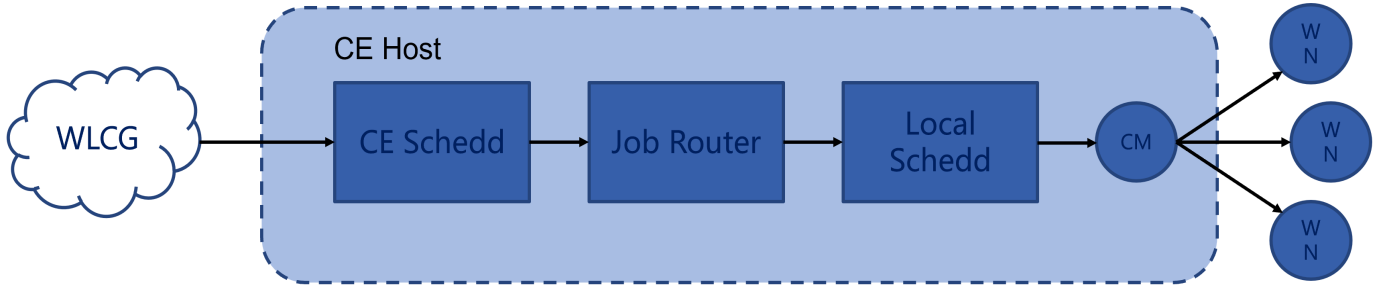
Network traffic of the first data challenge

Software of LHCb Beijing Tier-1 Site

- Disk storage: EOS
  - services: QuarkDB, MGM, FST
  - protocol: xrootd and http
- Tape storage: EOS & EOS-CTA
  - Protocols: xrootd and http(s)
  - Authentication: SCI-Token and GSI
- CE: HTCondor-CE & HTCondor
  - Support for SCIToken and GSI
- Other middle software
  - Argus, BDII, APEL



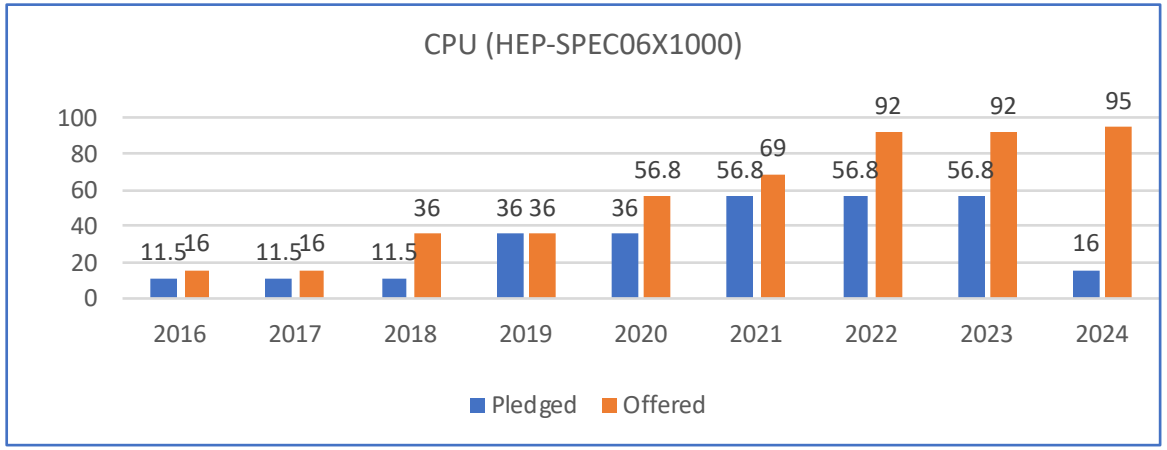


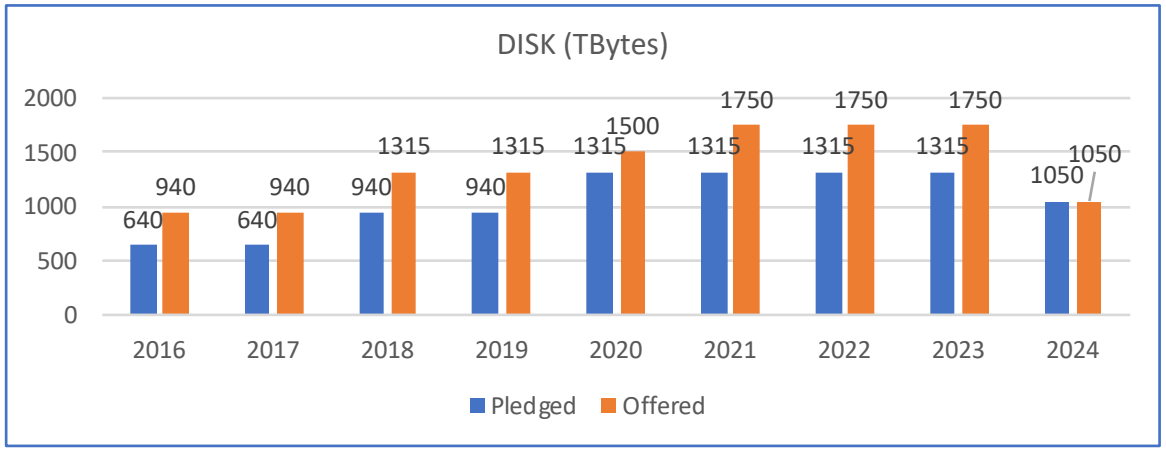


Outline

Chinese Tier-2 Site Federation

- CPU: 4472 cores with 95,000 HepScore
  - AMD 9654: 1152 Cores
  - Intel Golden 6338: 1280 Cores
  - Intel Golden 6140: 1152 Cores
  - Intel E5-2680V3: 696 Cores
  - Intel X5650: 192 Cores
- CE & Batch: HTCondorCE & HTCondor
- VO: ATLAS, CMS, LHCb, BELLEII, JUNO, CEPC
- Storage: 1050TB
  - 4TB * 24 slots with Raid 6, 5 Array boxes
  - DELL MD3860 8TB * 60 slots
  - DELL ME4084 10TB * 42 slots
  - DELL ME4084 12TB * 84 slots





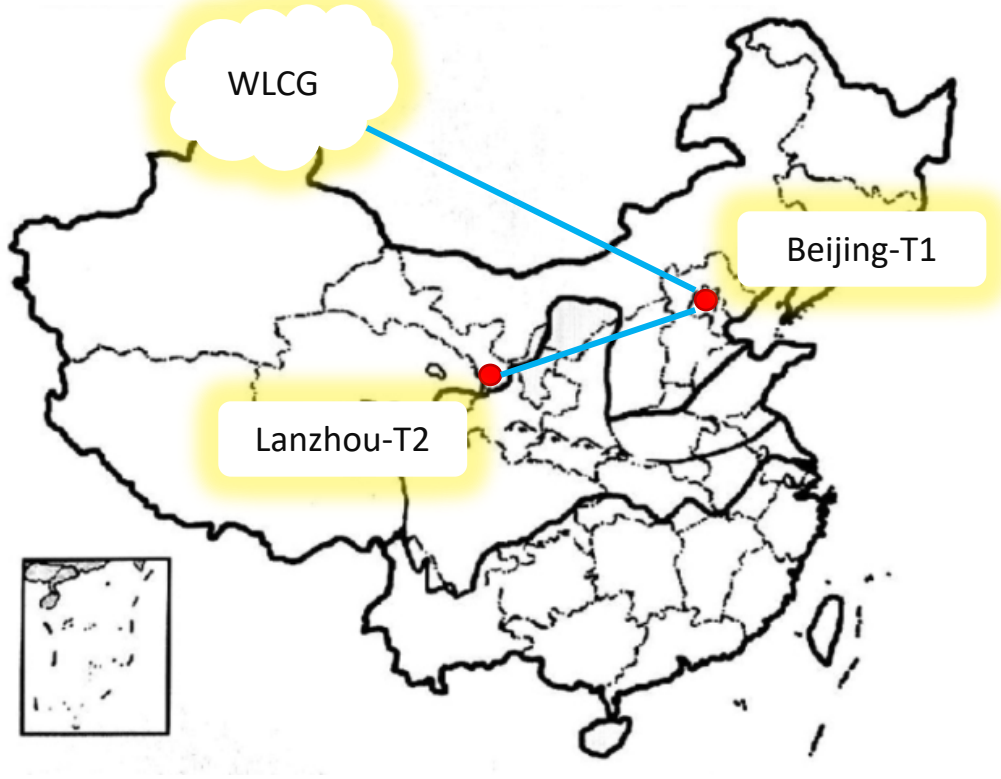
Computing and Storage Pledge of BEIJING LCG Tier- 2

New Budget for ATLAS and CMS

- New budget for ATLAS and CMS Beijing Tier-2 site
  - Total budget: RMB 3Milliion
  - Allocation:
    - CPU：60,000 HepScore
    - Disk storage：2.5PB
- Upgrade timeline
  - The upgrade of ATLAS and CMS Beijing Tier-2 will be completed in 2024

New Tier-2 Site for LHCb at Lanzhou University

- Construction started in Oct. 2023
  - ~3500 CPU cores with 77,000 HepScore
  - ~3PB Disk Storage
  - Dedicated 2Gbps link between IHEP and Lanzhou Univ.
- Progress
  - Hardware installation completed
  - Network link established
  - Software deployment will be started in April
- Jointly maintained by CC-IHEP and Lanzhou Univ.
  - Hardware maintenance: Lanzhou Univ.
  - Software deployment and maintenance: CC-IHEP



Lanzhou Univ. LHCb Tier-2 Site

New Tier-2 Site for Alice is Under construction

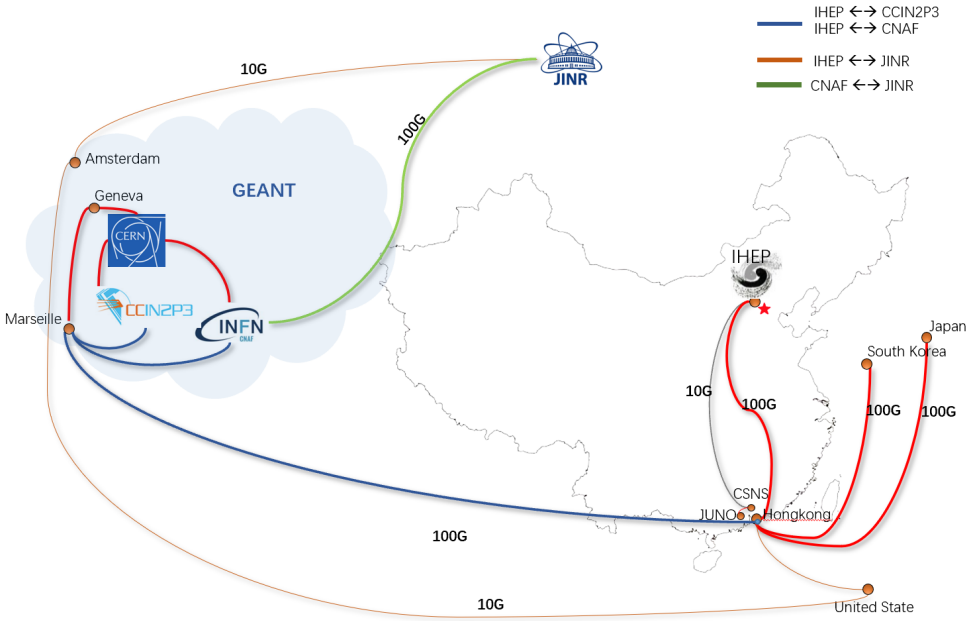
- Chinse Alice collaboration would like to build Tier-2
  - Discussed with CC-IHEP in Dec. 2023
    - The Alice Tier-2 to be built at IHEP
    - CC-IHEP to be responsible for the overall maintenance
- Current Status
  - Hardware procurement in progress
    - 1152 CPU cores with 30,600 HepScore
    - 840TB disk storage
- Expected Production: Aim for production in 2024

Outline

JUNO at IHEP

- JUNO: Jiangmen Underground Neutrino Observatory
  - To be in production in 2024
- Grid Computing started since 2018,
  - Includes INFN, CC-IN2P3, JINR, IHEP, for JUNO Production and raw data transfer.
- Grid computing platform at IHEP:
  - **DIRAC system with IHEP-extensions**
    - monitoring, production system and job-submission API
  - Shared middleware and infrastructures: FTS3, VOMS, TPC, etc.
- Software deployed at IHEP:
  - **Storage**: EOS, Lustre on disk, EOS-CTA on tape.
  - **Computing**: HTCondor on x86, Slurm on ARM and GPU.
  - **Network**: 10Gbps(From JUNO-onsite to IHEP), 100Gbs(From IHEP to GEANT).
- Data Challenge 1:
  - 12th ~ 26th Feb 2024, corresponding to WLCG DC24.
  - Pressure transfer (500-1000 Mbps) with 4-8 times throughput than JUNO design.
  - IHEP -> CNAF/IN2P3 transfer worked well, almost no failure.
    IHEP->JINR is bad and always get stuck.

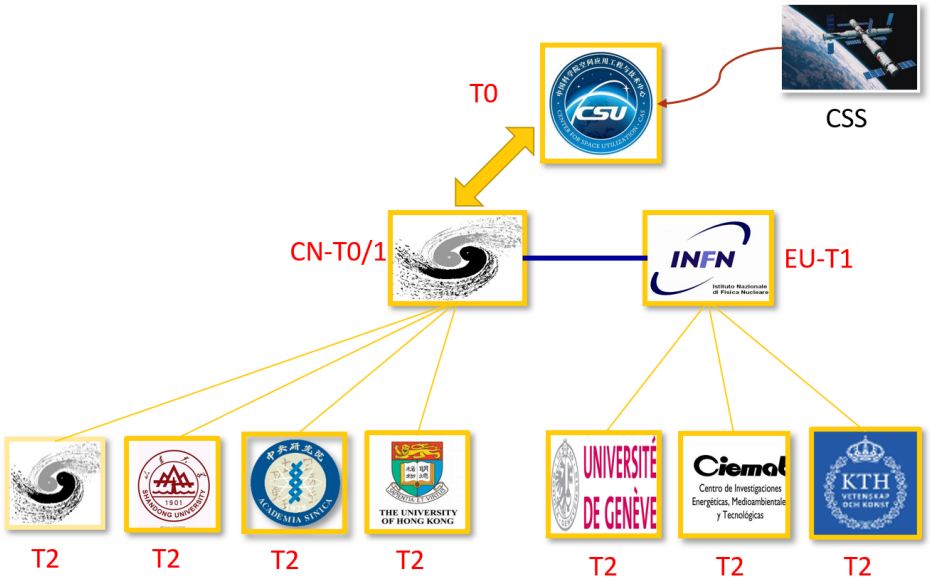
Sites	Resources in 2024		
	CPU (KHS06)	Disk (PB)	Tape (PB)
IHEP	180	8	4
CNAF	20	3	1
IN2P3	15	0.2	2
JINR	120	10	10



JUNO International Link

HERD & CEPC Plan at IHEP

- HERD and CEPC is under construction
  - **HERD:** High Energy Radiation Detection Facility
  - **CEPC:** Circular Electron Positron Collider
- HERD: To be in production in 2027
  - Storage requirements: 45.5 PB in 10 year
  - Computing requirement: >13000 CPUs in 10 years
  - Computing model:
    - Two Tier-1 sites run at China and Europe
    - Several Tier-2 sites disperse across China and Europe
    - Computing system: DIRAC + dHTC(HTC&HPC)
    - Data storage and transfer management: Rucio.
- CEPC: At the very beginning, everything is in design
  - Distributed Computing System: DIRAC + Rucio integration in developing.
  - Infrastructure and middleware: IAM, FTS3, etc.



Computing Model of HERD

Summary

- The establishment of WLCG sites in China started in 2006 and has since undergone continuous upgrade
- The construction of LHCb Beijing Tier-1 sites is progressing smoothly
- CC-IHEP takes responsibility of most of the LHC experiments grid sites in China
- Grid computing is utilized for the experiments led by IHEP

Thank you !

Question?