IHEP Tier 1 Report

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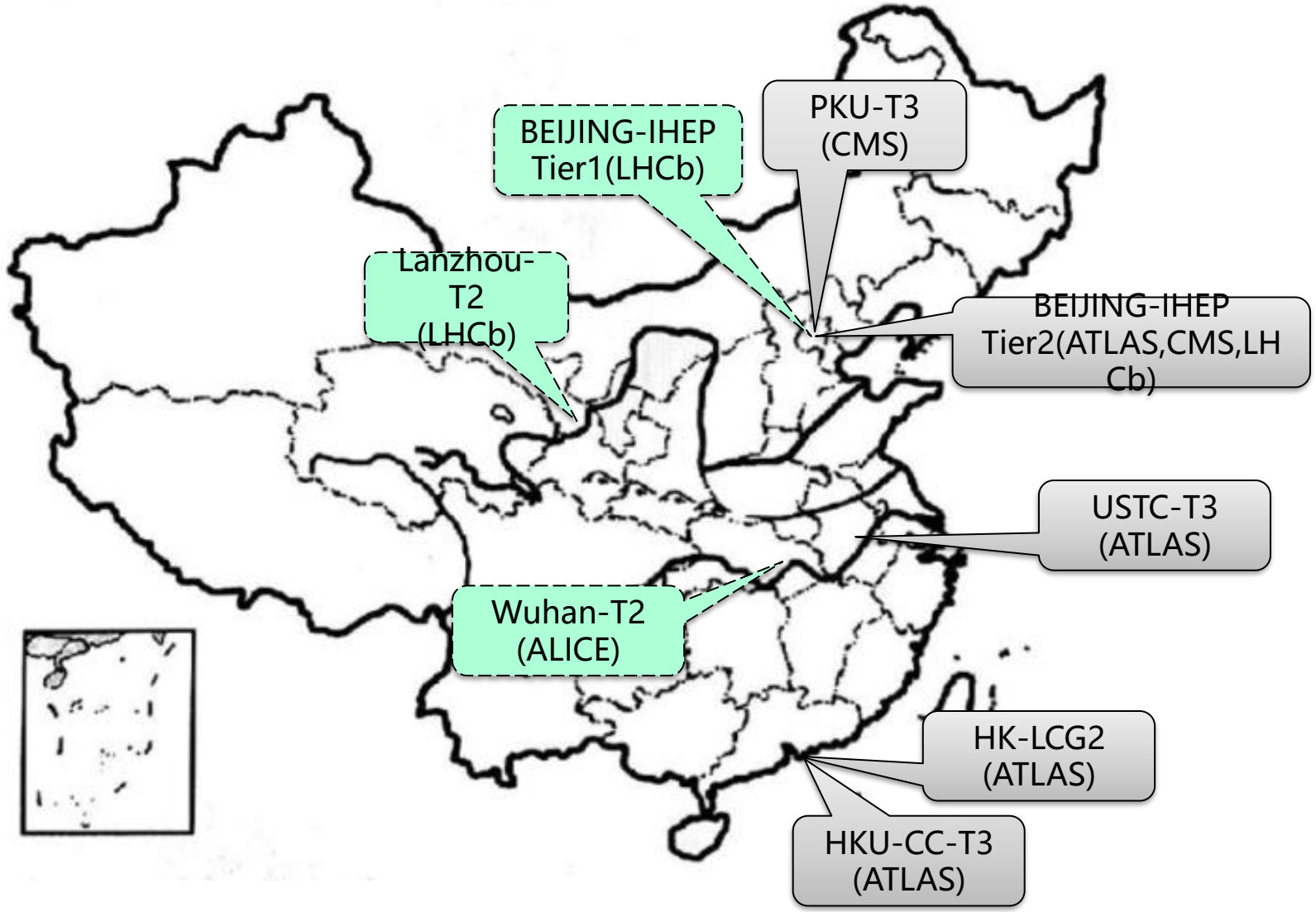
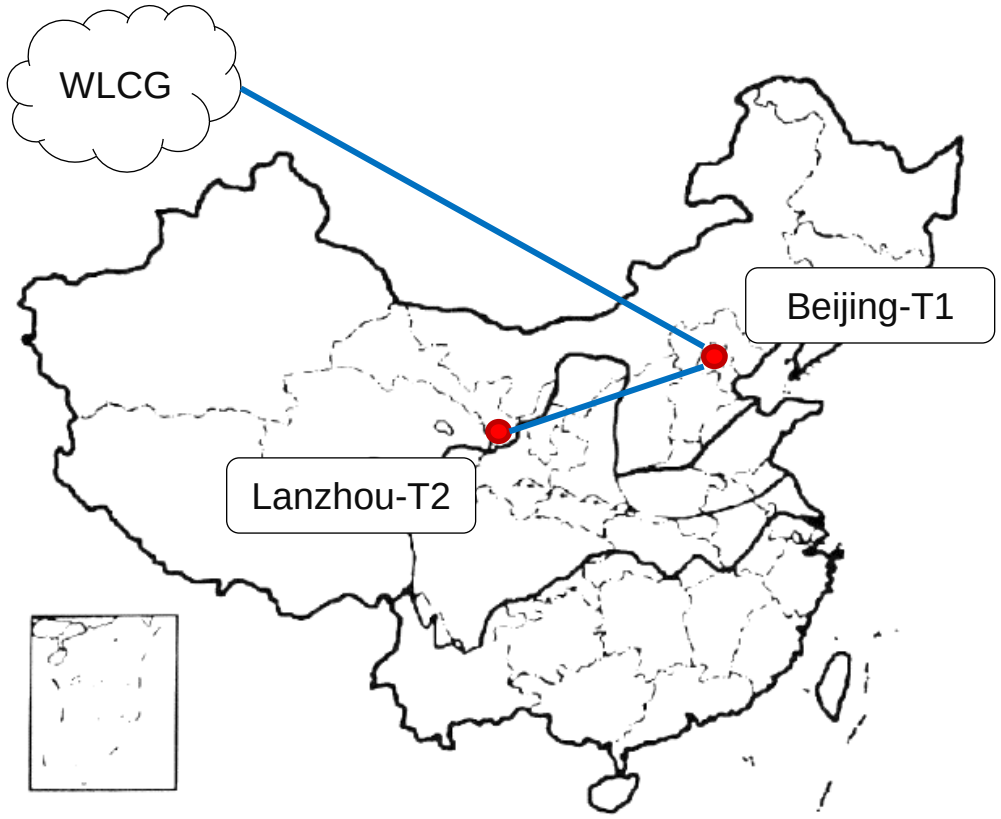
Current Status of WLCG in China-Mainland

- Tier2 sites
  - BEIJING-IHEP
  - Atlas CMS and LHCb
- Tier3 sites
  - PKU-T3,USTC-T3
- Sites under developing
  - Tier1: IHEP-LHCb-T1
  - Tier2: Lanzhou-T2
  - Tier2: Wuhan-T2



Proposed LHCb Tier1 Site @IHEP

- The LHCb Tier-2 site at IHEP is proposed to be upgraded to a Tier-1 site.
- A new LHCb Tier-2 site will be built at Lanzhou University (LZU).
- Add all new Tier-1/2 sites into CN-IHEP Federation for WLCG (or changes to a new name?).
  - All the WLCG sites in China-mainland are supported by IHEPCC
  - CSTNet willing to be a member of the Federation

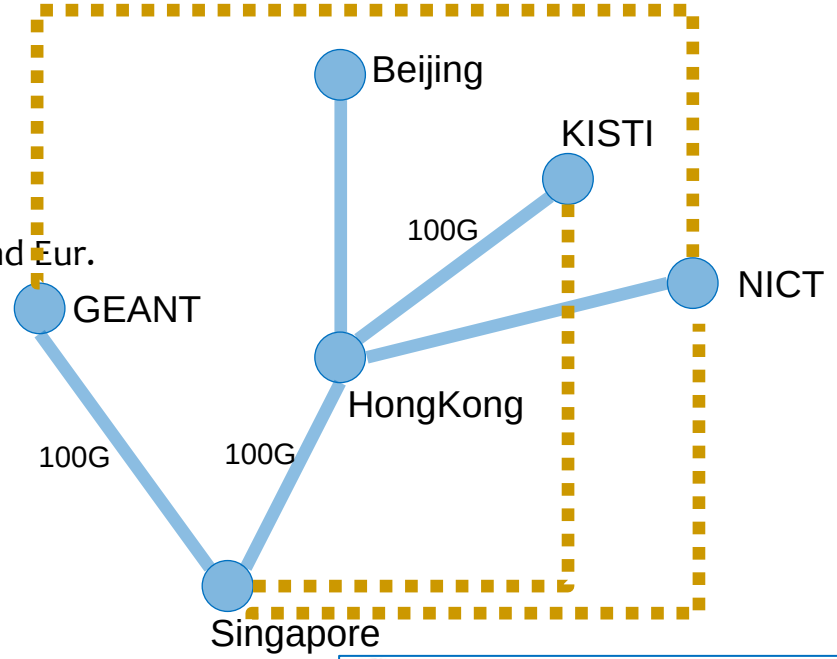


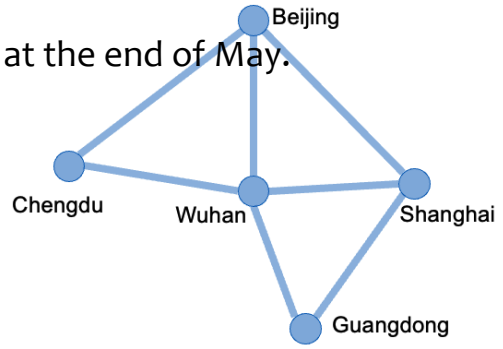
Resources (computing & storage)

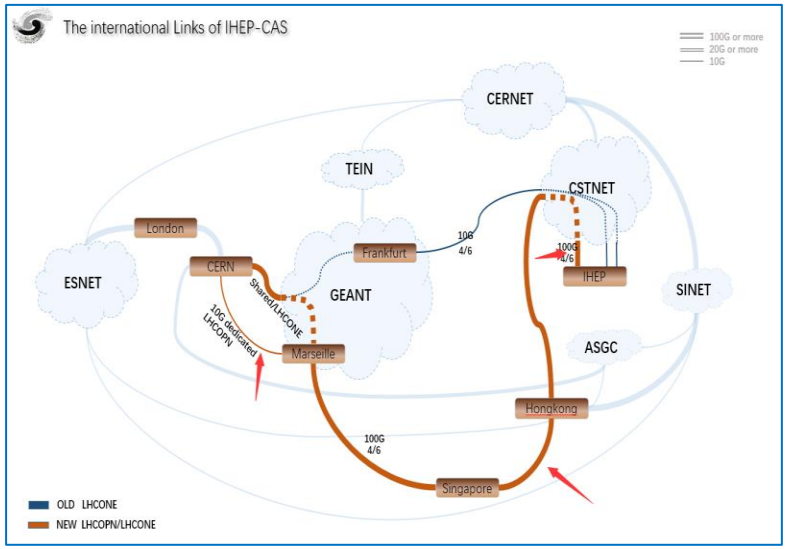
- Tier-1 at IHEP, initial resources will be ready in the first half year of 2023.
  - ~3000 CPU cores, Intel Xeon Platinum 8352Y (~10.79% of Tier-1s),
  - ~3.2PB disk storage, DELL PowerVault ME484 (~6.28% of Tier-1s),
  - Lenovo TS4500 Tape Library, LTO9 Drives and Tapes.
- New Tier-2 site will be built at LZU in 2023.
  - ~3500 CPU cores,
  - ~3PB Disk Storage,
  - A dedicated 2Gbps link between IHEP and LZU.

Resources (network resources)

- CSTNet is the internet service provider for IHEP
- International links
  - New connection will be launched to improve the bandwidth Between China and Eur.
  - CSTNet **– Beijing –Hongkong** – Singapore – Marseille - Geant
  - All the connections will be 100Gbps at the end of Apr.
- LHCONE
  - Old ： IHEP – CSTNET – GEANT(10G) – Frankfurt – CERN
  - New: IHEP – CSTNET – Singapore – Marseille – CERN
- LHCOPN
  - A new deliciated link will be launched between CERN and GEANT(Marseille) for LHCb T1 @IHEP
  - IHEP – CSTNET – Singapore – Marseille – CERN, hopefully be ready at the end of May.
- Domestic links
  - All the domestic connections will be upgraded from 10G to 100G
  - Ready at the end of 2023

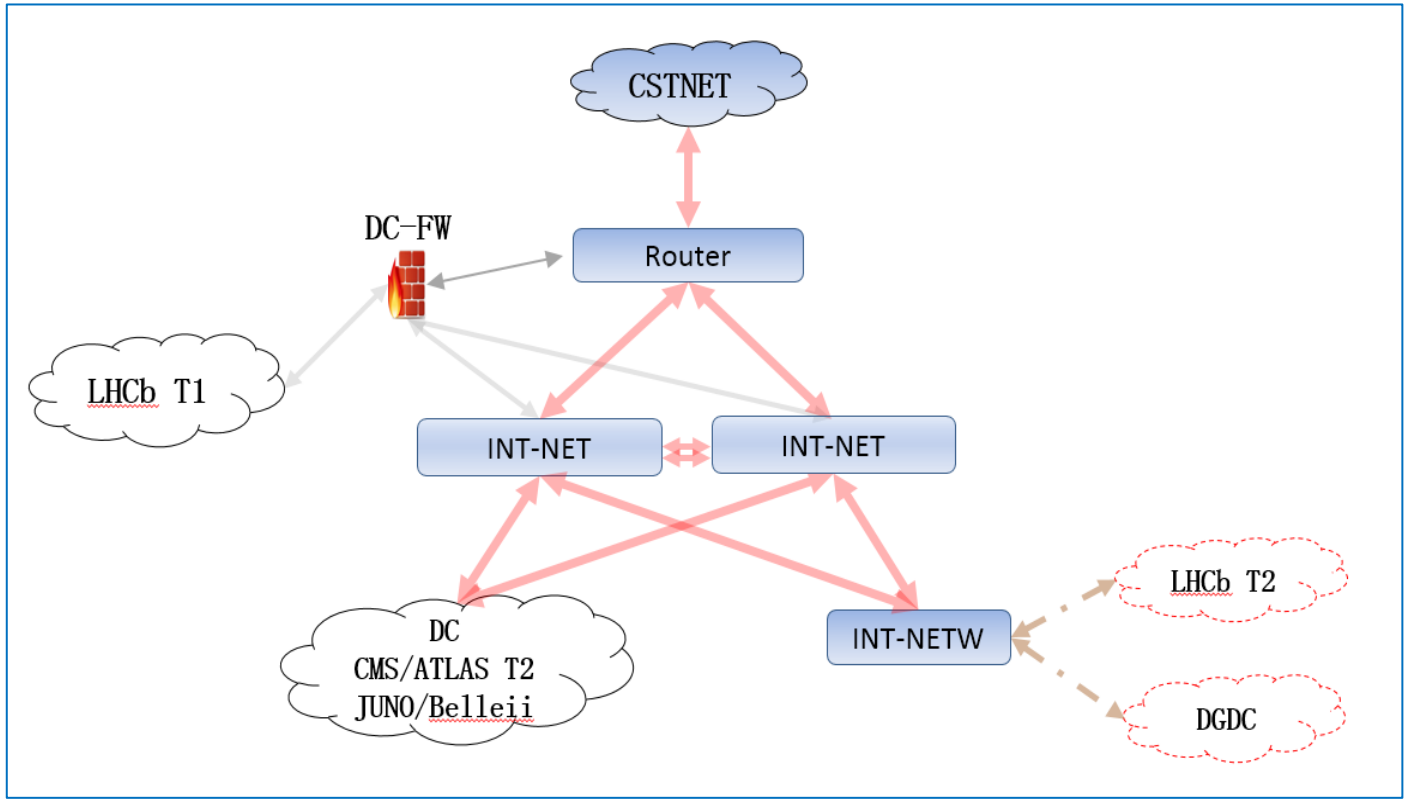






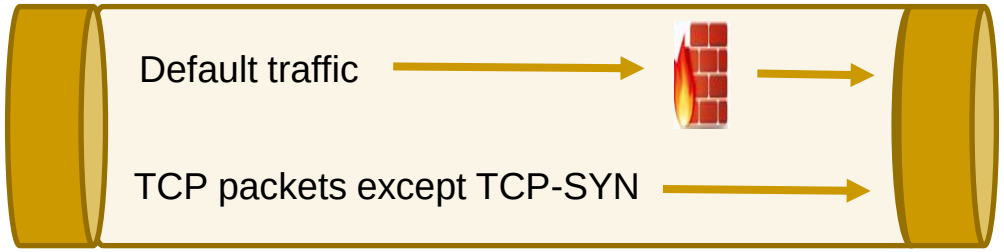
Resources (local network @IHEP)

- Current Status
  - IHEP to CSTNET
    - 100G, Dual Stack, Ready
  - Local Backbone
    - INT-NET to Router 2*10G -> 2*100G
    - DC to INT-NET 2*40G-> 2*100G
    - Ready at the end of May
  - Lanzhou LHCb Tier 2
    - LZU to IHEP 2Gb ready
  - DGDC
    - 10G ready



Security policy under 100G

- Traffic bypass firewall
  - Firewall is the traffic bottleneck
  - All or part of the trusted scientific traffic (LHCONE/LHCOPN) needs to be bypassed
- Traffic bypass based on TCP-flags
  - 95% traffic use TCP protocol
  - Bypass policy
    - Default traffic pass through the firewall in both direction by Route-map policy
    - The TCP packets except TCP-SYN bypass firewall
    - Tiny traffic pass through firewall and security defend is effective



- Application examples
  - INT-NET-WAN Firewall, Protection for DGDC, CSNS, Lanzhou LHCb Tier2 and JUNO
  - Suitable for big data transmission

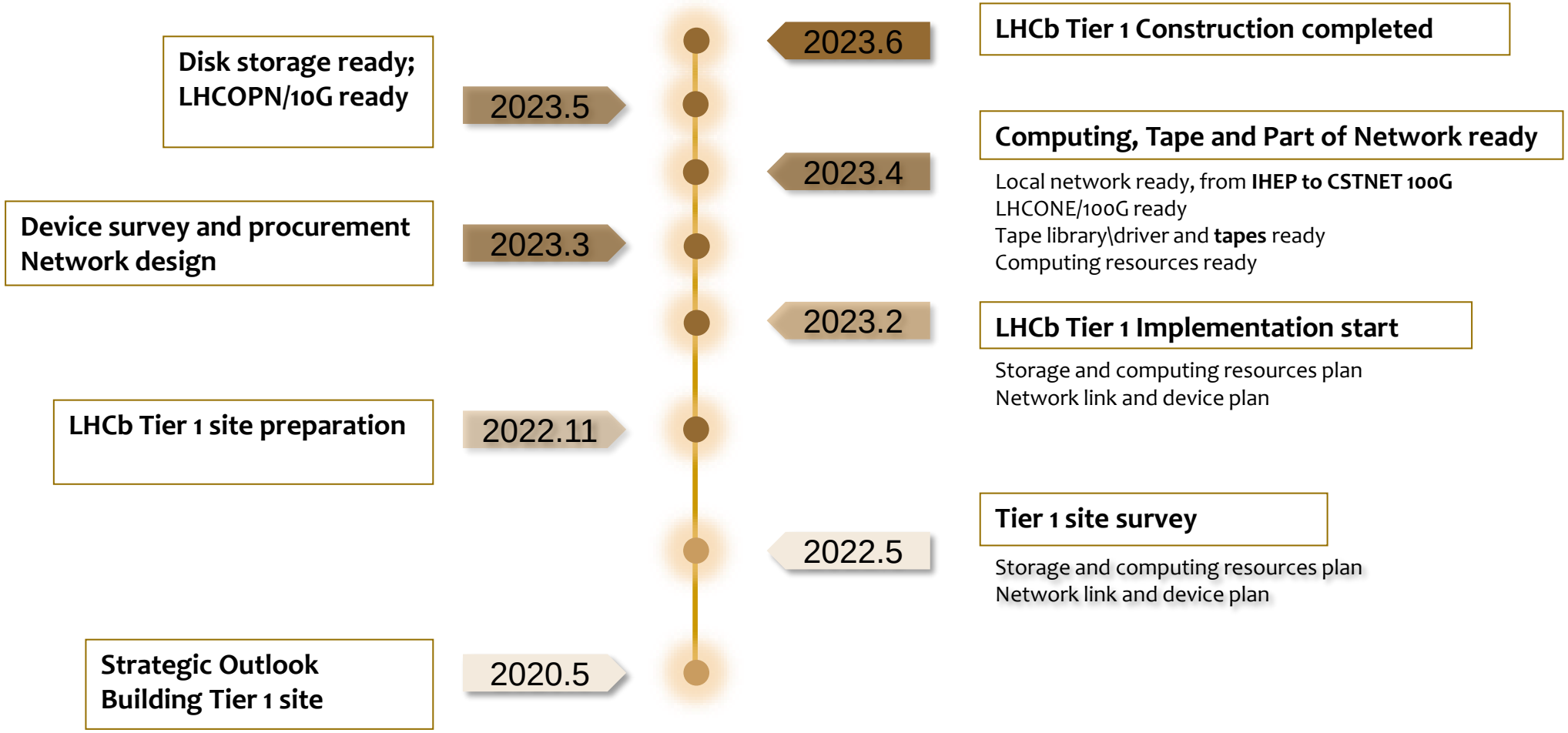
Data Challenge Plan

- According to LHCb computing model, the throughput for real data transfers to IHEP 0.9GB/s, plus an estimated 10% for simulated data
- Plan a data challenge in spring 2023 (determined in February's WLCG MB meeting)
  - Based on the evolution of the site, network infrastructure and the LHCb data taking plans
  - Target is 1GB/s -> 1.25GB/s with minimal contingency
  - The data challenge will be repeated if the target is not met (probably after the end of 2023 data taking)
- Tape reading will be also tested during the 2023/2024 EYETS
  - Target including contingency could be also 1.25GB/s (expected throughput is 0.9GB/s at least)
- Current status for data challenge
  - EOS and CTA testbeds have been built by the end of March (ready for functional tests)
  - Network links are under deploying as plan
  - Spring data challenge would be started in May

Progress of Site Construction

- Hardware procurement
  - 59.5k HS06 (3216 CPU cores) computing capacity has been ready by the end of March
    - target to 55k HS06 (3000 CPU cores)
  - Disk storage devices are under purchasing and will arrive in May (expected 3.2PB storage space)
    - Later than the preliminary plan due to the strict procurement approval process in PKU
  - Tape library and 4 Tape drives have been ready in 2022 and 170 LTO9 Tapes are under purchasing
    - 3PB tape storage space will be provided in the first round procurement and the other 7PB will be added as the need of LHCb data taking
  - 10 management servers arrived on this Tuesday
    - More servers could be added as the actual needs
- Grid services
  - Storage endpoints for test have been ready, supporting xrootd and http protocol
    - EOS for disk storage and EOS&CTA for tape storage
  - CE and other services will be deployed after the management servers are available
    - HTCondorCE, HTCondor, Argus, APEL, BDII, …

LHCb Tier 1 @IHEP Timeline



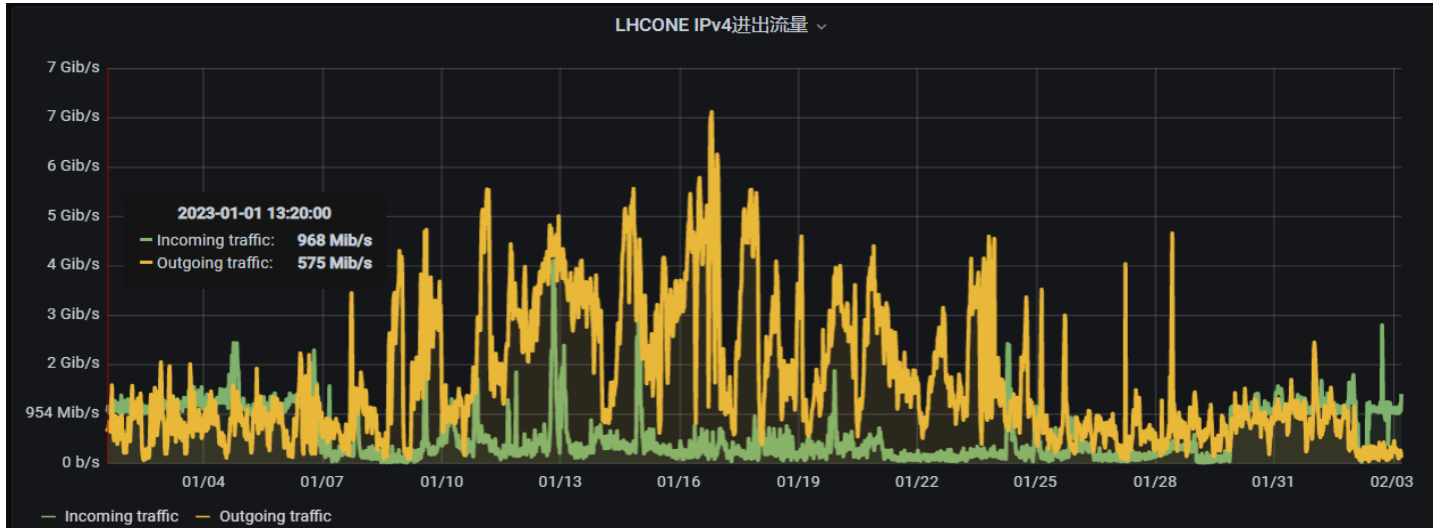
Summary

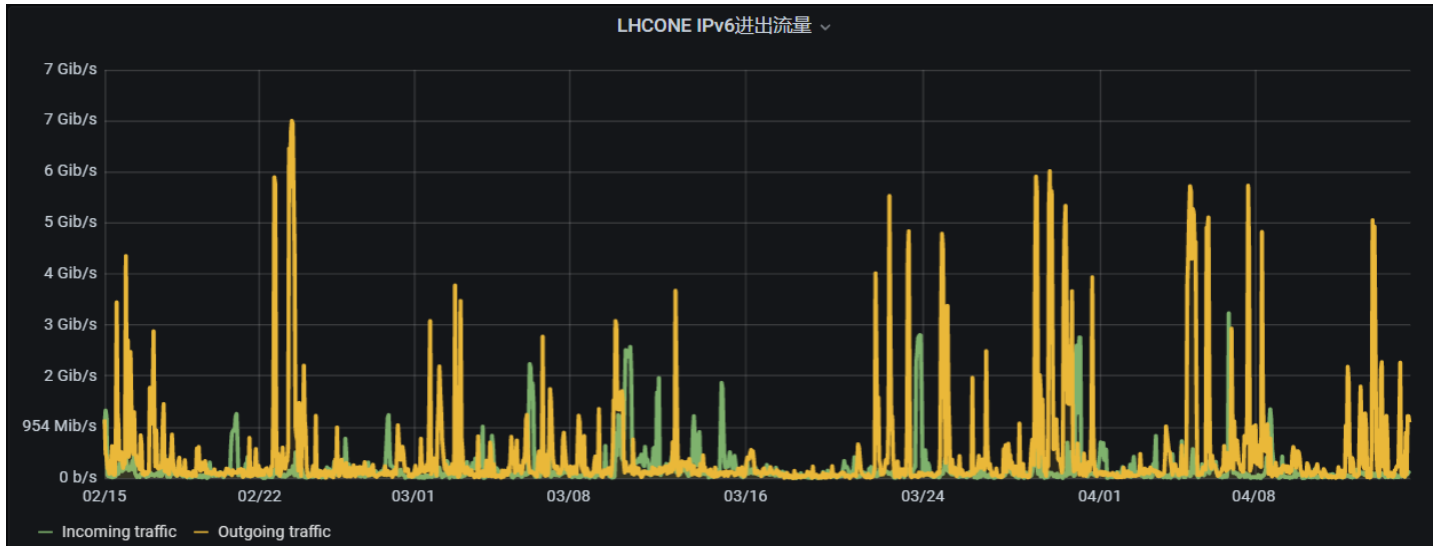
- LHCONE link will be upgraded to 100G at the end of Apr.
- LHCOPN link to CERN will be ready at the end of May
- IHEP LHCb Tier 1 site will be ready at the end of June
- New challenges not only for computing and storage, but also for network, to deploy and maintain the new T1 site

Thanks!

LHCONE traffic

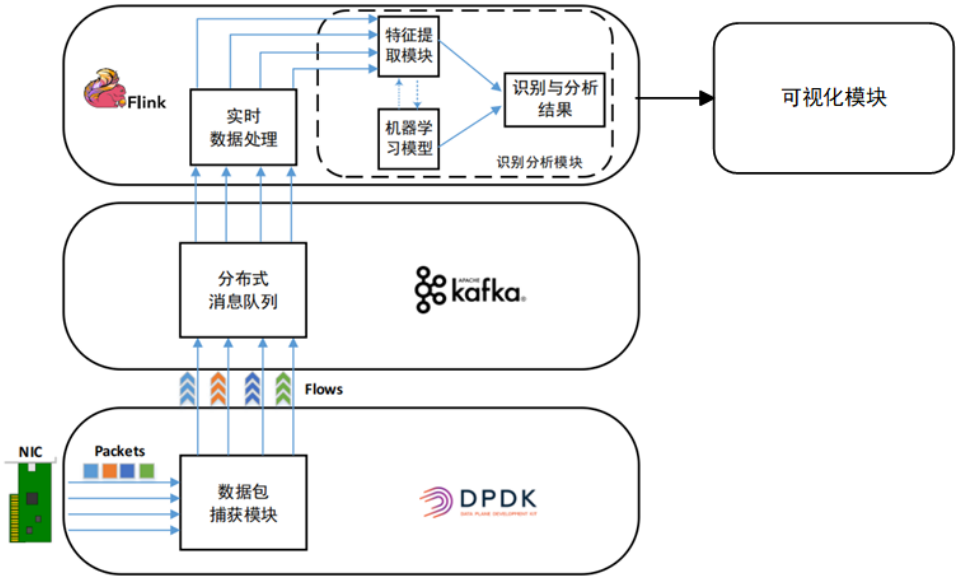
- Last 6 months
  - IPv4
    - Large traffic in January
  - IPv6
    - Short term high traffic from February to April
    - IPv6: ~38%
- Plan
  - DNSv6 will be deployed by the end of Aug





Pre research of Traffic quality monitor

- Traffic quality monitor based on tcp session analysis
  - Passive, unilateral TCP session analysis
  - Obtain the health status of the path and end devices
  - DPDK –Kafka – Flink – Deep learning
  -
- Preliminary work
  - Based on nmap
  - WLCG traffic analysis
  - Traffic summary
  - Big traffic top 10




```
time:2023-04-11 00:21:40      summary from 2023-04-05 to 2023-04-11

---WLCG sum--IPv4/6-----------------------------------GB
 ALTAS      : in:                1701 ot:               10800
 CMS        : in:                2856 ot:               11757
 LHCb       : in:                 499 ot:               11172
 BelleII    : in:                  30 ot:                4883
 Login      : in:                1683 ot:                3578
 JUNO       : in:                 566 ot:                 837
 Storm      : in:                1102 ot:                1159
 DCFW       : in:                5568 ot:                1069
 AMS        : in:               23612 ot:               17010
 Perfsonar  : in:                1141 ot:                 516

---DC sum--Total--------------------------------------GB
 IPv4       : in:               57448 ot:               54448
 IPv6       : in:                7054 ot:               19753
 IPv4/(4+6): in:                0.89 ot:                0.73
```

time	ip	ins	ots
2023-04-06 19:11:00	2401:de00:0002:0033:0000:0000:0000:0033	2023611	87205
2023-04-06 19:12:00	2401:de00:0002:0033:0000:0000:0000:0033	1934611	45866
2023-04-06 19:55:00	2401:de00:0002:0033:0000:0000:0000:0032	1826694	166668
2023-04-06 19:54:00	2401:de00:0002:0033:0000:0000:0000:0032	1822451	153310

Progressing – Team&Fundings

Current Status

- IHEP grid computing team (7 persons with 7*0.5 FTE)
  - Each site has a site administrator who is responsible for the first-line issue
- Services at WLCG sites (3 persons are arranged to handle the different middleware related to grid sites)
  - HTCondor-CE, DPM, SAM test, APEL, BDII, …
- IHEP CC has a 47-persons team to provide the second-line technical support for WLCG sites
- We are providing technology support to several Chinese sites, especially when the site started building
  - CSTCloud, HK-LCG2, USTC, PKU, LZU

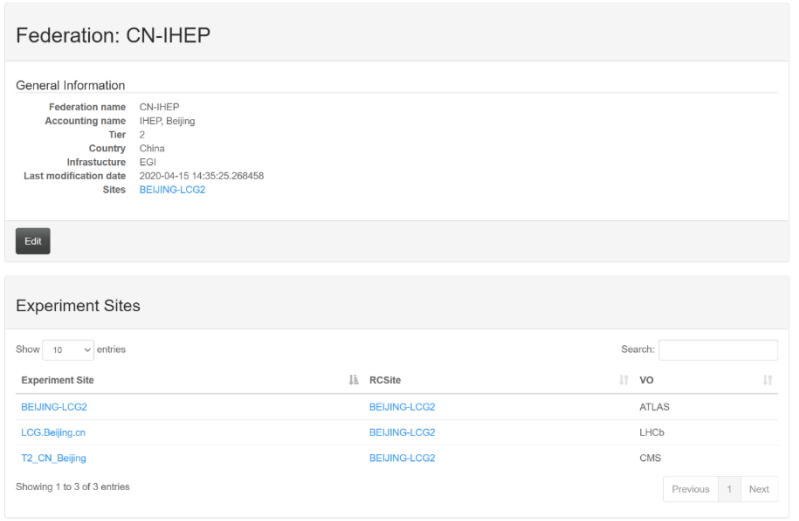
Plans

- At least 2 FTE will be added into grid computing team
- Fundings are provided by LHCb Chinese collaboration and IHEP CC
  - LHCb Chinese collaboration has promised to provide fundings for sustainably running

Discussions

- Possibility of the resources at IHEP branch sites be part of Beijing Tier 1 (2k~3k cores)
  - The typical case is Dongguan Data Center
    - X86-arch： 19.6k CPU cores
    - ARM-arch： 9.6k CPU cores
    - GPU： 80 Tesla V100 cards
    - Disk Storage： 6PB
    - Network: 10 Gbps bandwidth between Beijing and Dongguan

- Federation Updates
  - Multiple institutes cooperates to run WLCG sites in China
    - IHEP/CNIC/LZU/CCNU/...
  - CN-IHEP Federation -> WLCG China Federation?



- How to sign MoU when running T1 and T2 in parallel?
  - One Tier1 MoU and one Tier2-Federation MoU