

KEK Site Report

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Introduction to KEK

➤ KEK covers a wide range of accelerator-based sciences, making full use of the electron machine in Tsukuba and the proton machine in Tokai, such as:

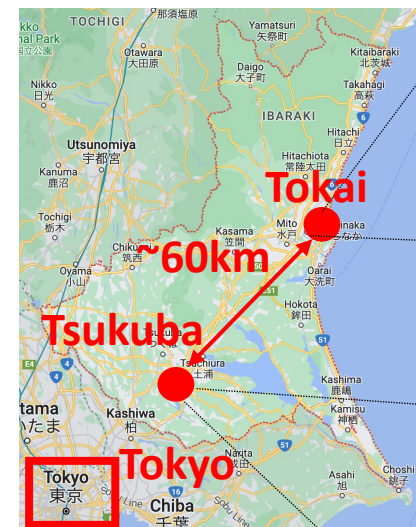
➤ **SuperKEKB/BelleII experiment**

➤ B-factory experiment to precisely measure the parameters of the weak interaction and discover new physics

➤ **J-PARC**

➤ Hadron hall: Particle and nuclear physics with fixed-target

➤ Neutrino facility: Neutrino beamline for T2K experiment and upgrade program for Hyper-Kamiokande



J-PARC (co-operated by KEK and JAEA)



SuperKEKB, Photon factory, etc

Central computing system (KEKCC)

➤ KEKCC@Tsukuba is a **leased system** that is replaced every 4-5 years

- Current KEKCC started operations in Sep, 2020
- Linux cluster (LSF) + storage system (GPFS/HSM)
- Grid system (ARC-CE, StoRM, etc)

➤ CPU: 15,200 cores

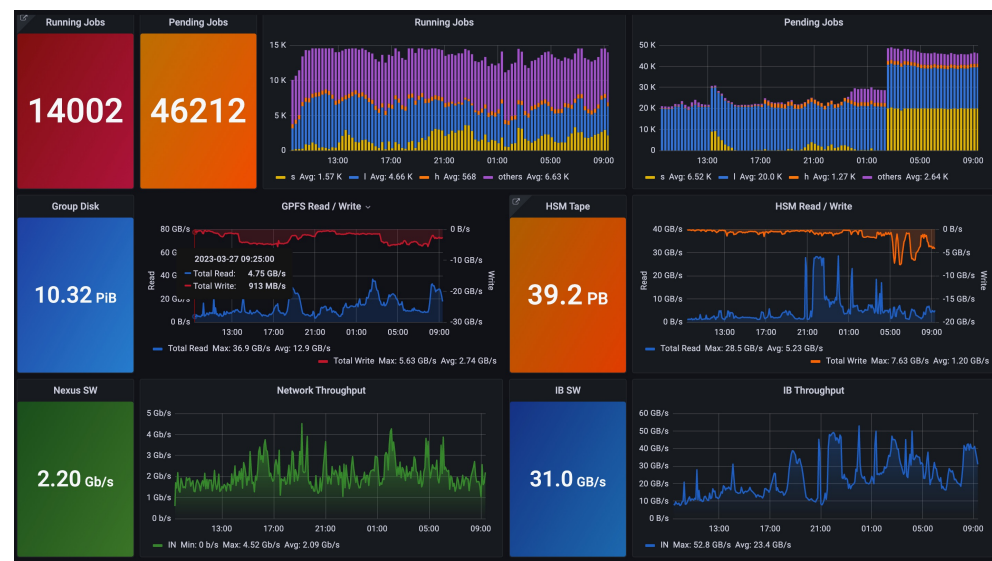
- Intel Xeon Gold 6230 2.1Ghz, 380 nodes

➤ Disk: 25.5PB

- 17PB: GPFS for user groups
- 8.5PB: GPFS-HPSS interface (GHI) as HSM cache

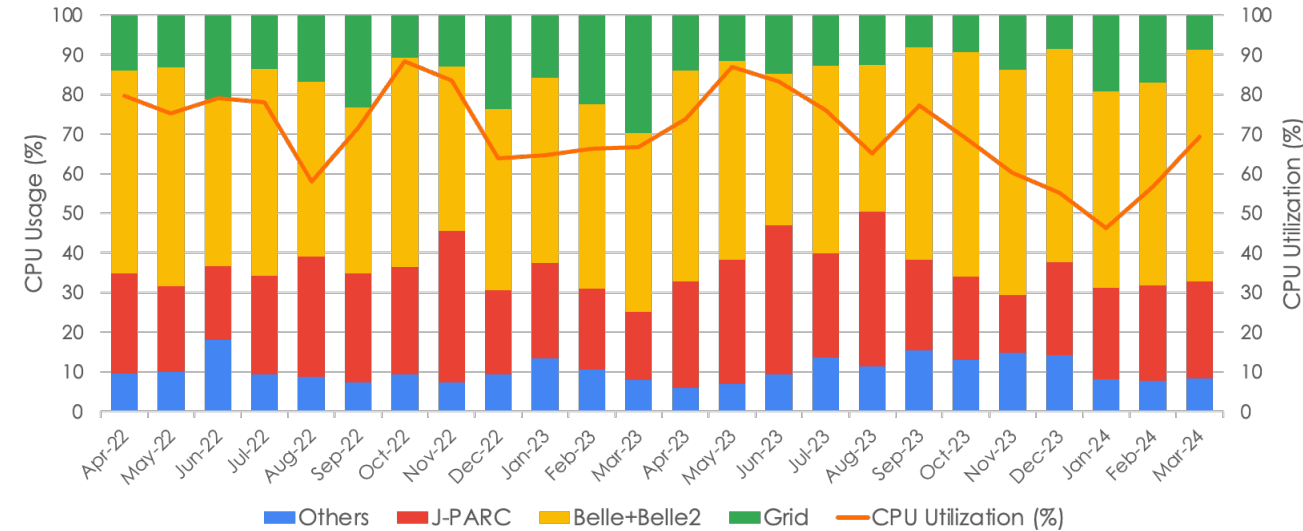
➤ Tape: 100PB as maximum capacity

Monitoring dashboard

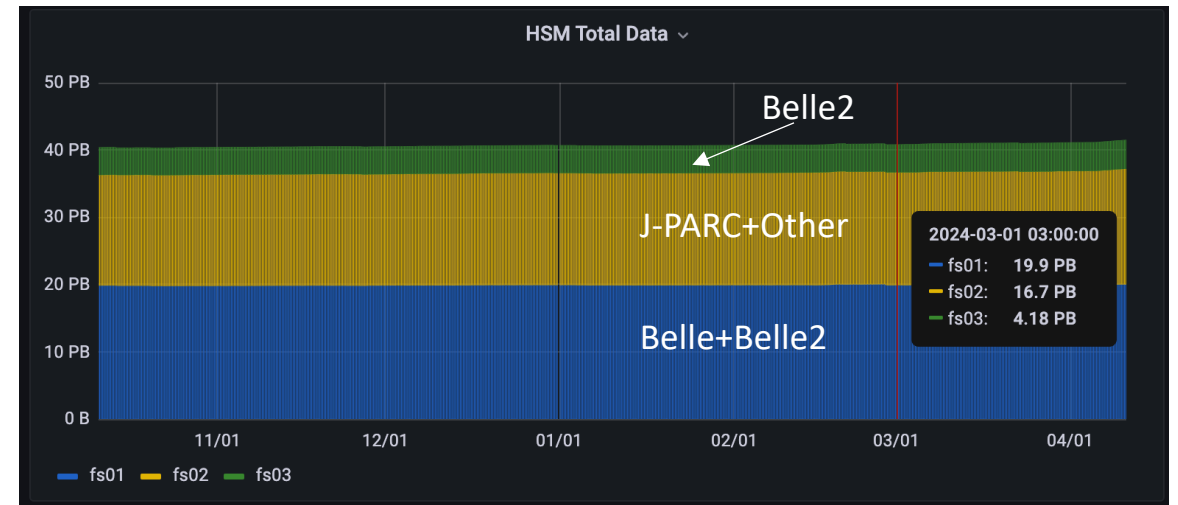


Resource utilization

CPU usage

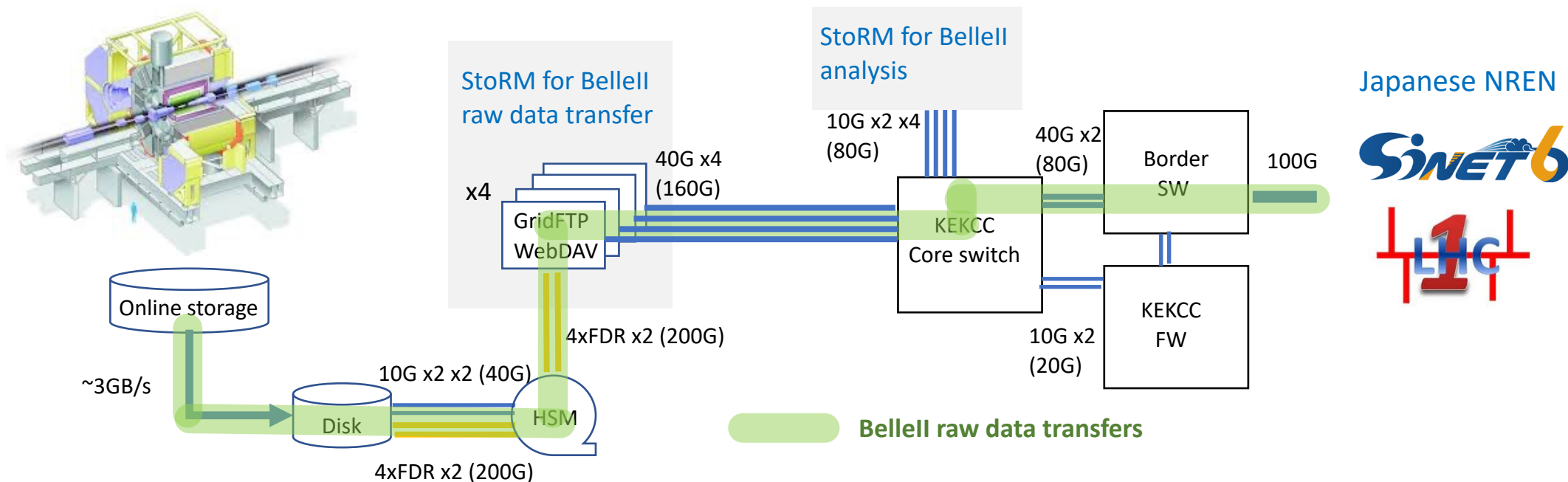


Tape usage



- CPU resources are well utilized
 - Belle+BelleII experiments (local batch system) use a large proportion of the resources
- Tape usage reached ~40PB

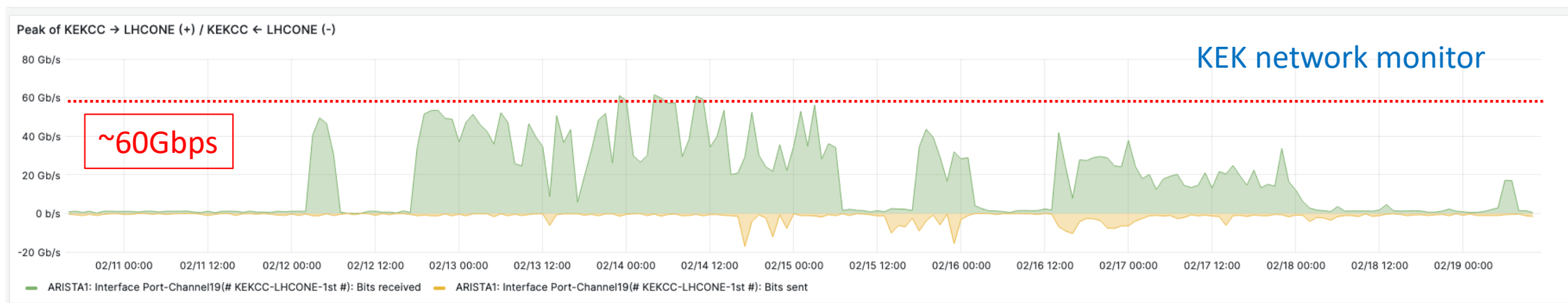
BelleII raw data transfers



- BelleII raw data transfers are one of main missions of KEKCC (Grid system)
 - Separated StoRM instances from analysis activities and other Vos
 - Multiple StoRM instances to ensure the transfer capability (Max. 80 Gbps)
 - The data are distributed to other RAW data centers via SINET

DC24

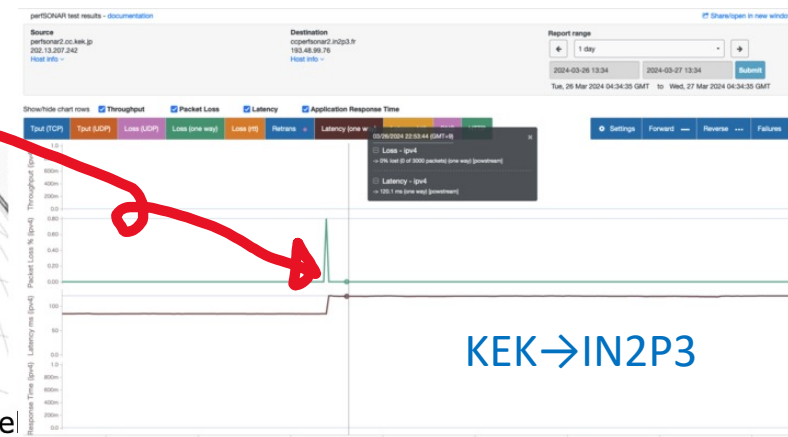
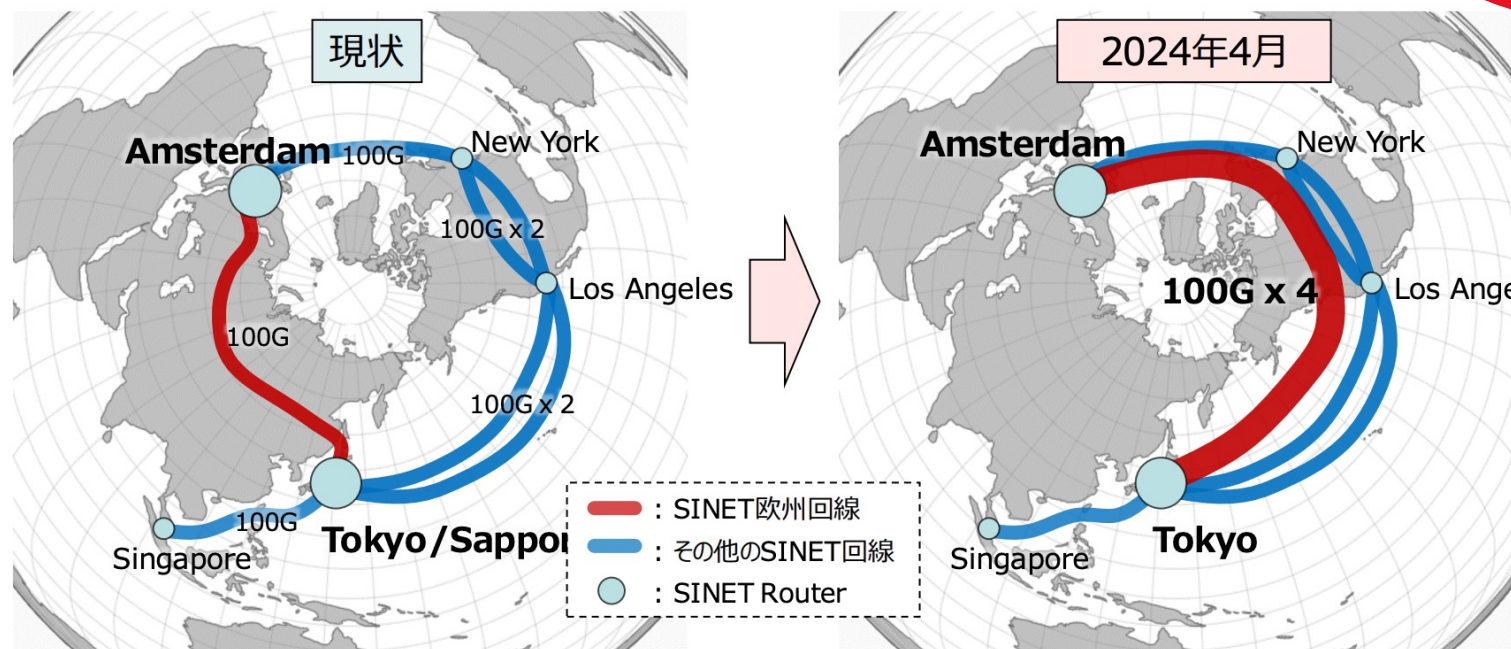
- Traffic from KEKCC to RAW data centers:



- There were no issues from the KEKCC operations point of view
 - (DC24 was performed before the upgrade of SINET for Europe)

International networks

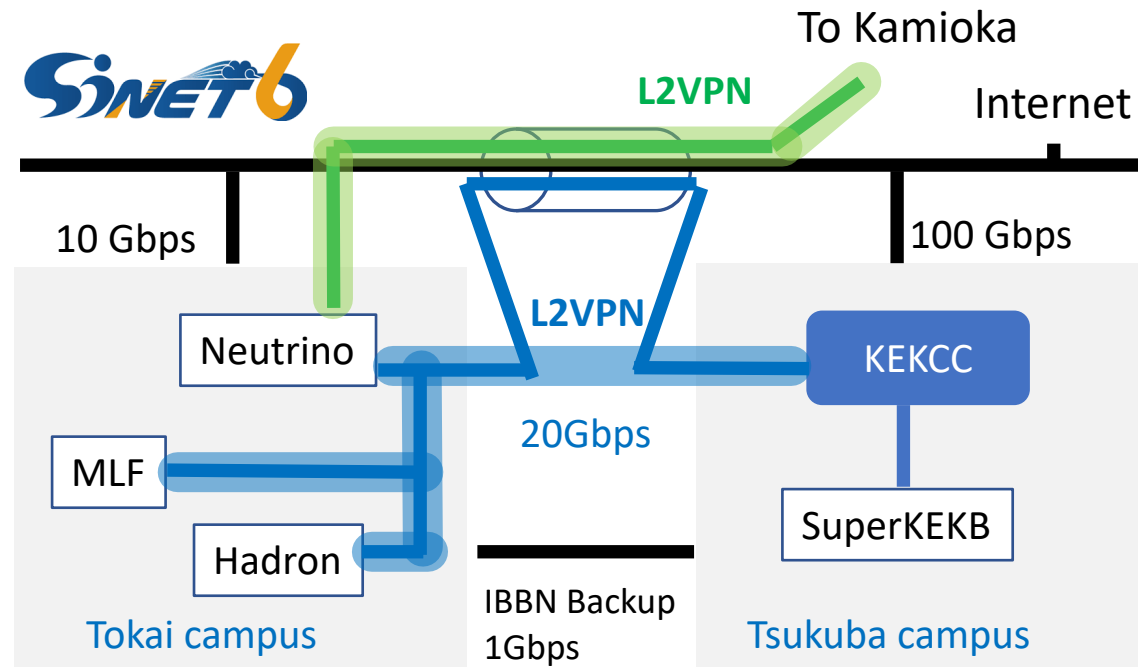
- SINET for EU: 100Gbps via Russia → **400Gbps via US** (April 2024)
 - RTT increased from ~150ms to ~240ms (confirmed by Perfosonar)
 - (No intermediate routers to reduce latency)



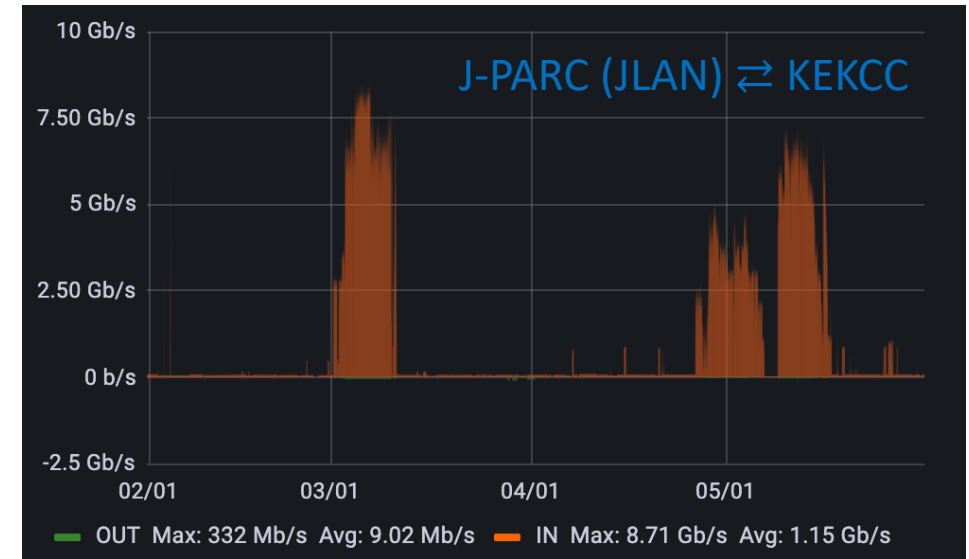
KEK and ICEPP(ATLAS) share the same VRF

[SINET openforum](#) (Japanese)

J-PARC data transfers



IBBN: Ibaraki Broad Band Network
hosted by Ibaraki prefecture



- Experimental data produced in J-PARC are transferred to KEKCC via SINET L2VPN (20 Gbps)
- Timing information of the neutrino beam to Kamioka

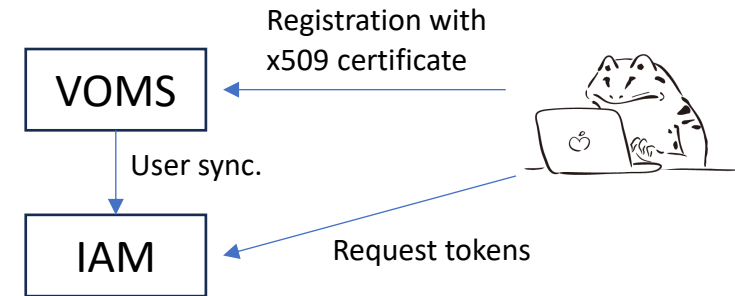
Next KEKCC system

- Next system will be launched Sep. 2024
 - CPU: 15k cores → 12k cores, but core performance improves by more than 30%
 - RHEL Academic Site Subscription

	KEKCC 2020	KEKCC 2024
CPU Server	Lenovo SD530	Lenovo SR645v3
CPU	Xeon Gold 6230 (20cx2/node)	AMD EPYC 9654 (96cx2/node)
CPU cores	14,720 + 480 (work server)	12,096 + 512 (work server)
OS	CentOS 7	RedHat EL9
IB	Mellanox 4xEDR	Mellanox HDR100
Disk Storage	IBM Elastic Storage System	IBM Elastic Storage System
Disk Capacity	25.5 PB (8.5 PB for HSM)	30 PB (10 PB for HSM)
Tape Drive	IBM TS1160 x72	IBM TS1160 x70
Tape Speed	20TB/vol, 400 MB/s	20TB/vol, 400 MB/s
Tape max capacity	100 PB	120 PB

Token migration

- IAM instances have been deployed for BelleII (with limited users)
 - Currently, user information is synchronized with VOMS



- **Need to establish a registration procedure of IAM without X.509 user certificate after terminating VOMS**

- We think that ID federation is essential because there are many KEK collaborators
- GakuNin (学認) based on Shibboleth is a Japanese academic ID federation
 - GakuNin can federate with eduGAIN
- We try to deploy a GakuNin IdP based on a trusted DB within KEK
 - 2024 summer is target



Summary

- KEKCC and Grid systems are well in operations
 - International network (SINET) to EU is now routed via US
 - Next KEKCC procurement has been completed and the system will start in Sep. 2024
- Toward getting ready for token-based environment
 - Need to establish a registration procedure to IAM without x509 user certificate
 - Trying to deploy GakuNin IdP within KEK