

Status Report on KISTI's Computing Activities

Apr. 22, 2024

KISTI Global Science experimental Data hub Center
Kujin Cho, Heejun Yoon

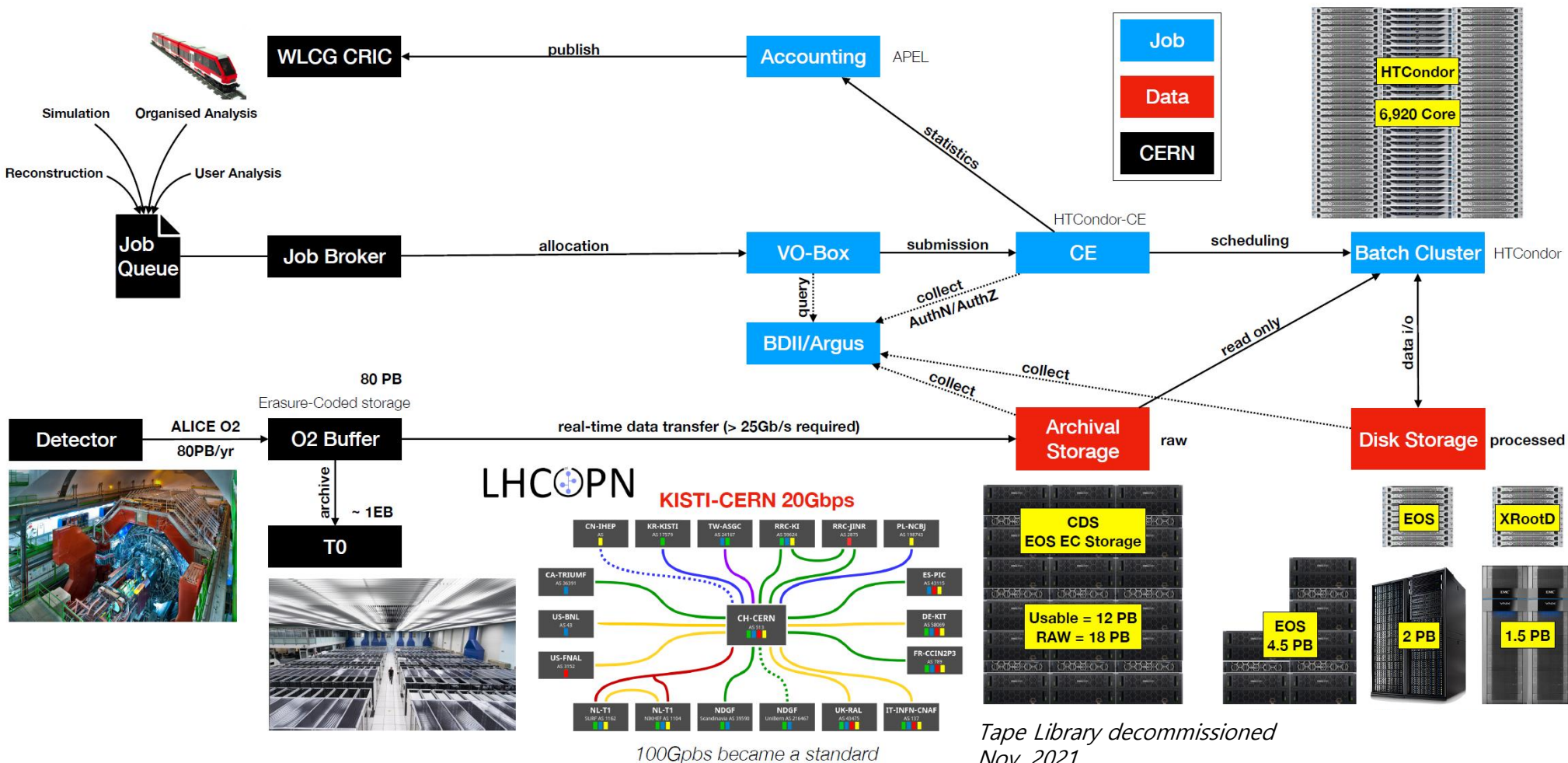
CONTENTS

- 01 WLCG Tier-1
- 02 WLCG Tier-2
- 03 Pledges and Collaboration
- 04 Summary



WLCG Tier-1

6,920 Job slots, 20PB Storage, 20Gbps dedicated link for OPN



Tape Library decommissioned
Nov. 2021
⇒ Disk based Archiving
System (CDS)

KISTI Tier-1 has been providing reliable and stable service

- 1.1% Contribution to Total(T0+T1+T2) ALICE Computing

- Current CPU commitment 72kHS23)

60 node X 32 core

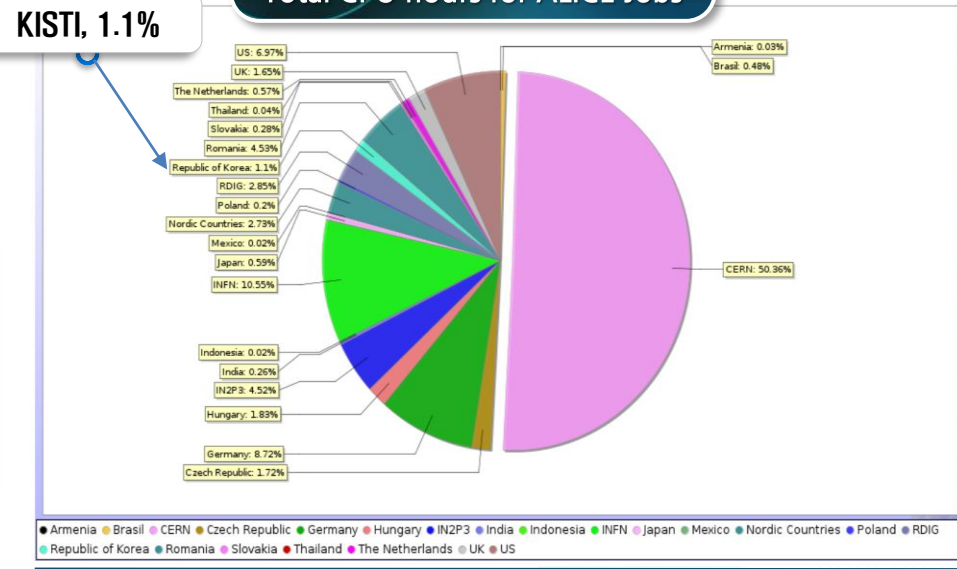
25 node X 40 core

25 node X 160 core

= Max 6,920 concurrent jobs

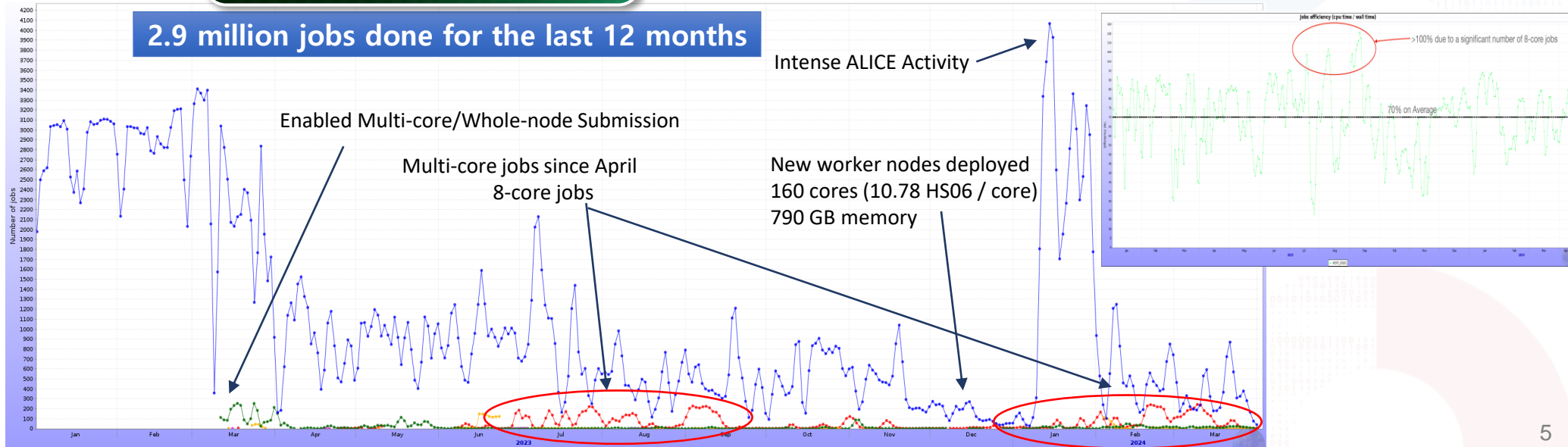
- 2024 pledge: 63kHS23.

Total CPU hours for ALICE Jobs



Active Jobs in KISTI_GSDC

2.9 million jobs done for the last 12 months



DISK (8,000 TB) / CDS-Tapeless Archiving (12,000 TB)

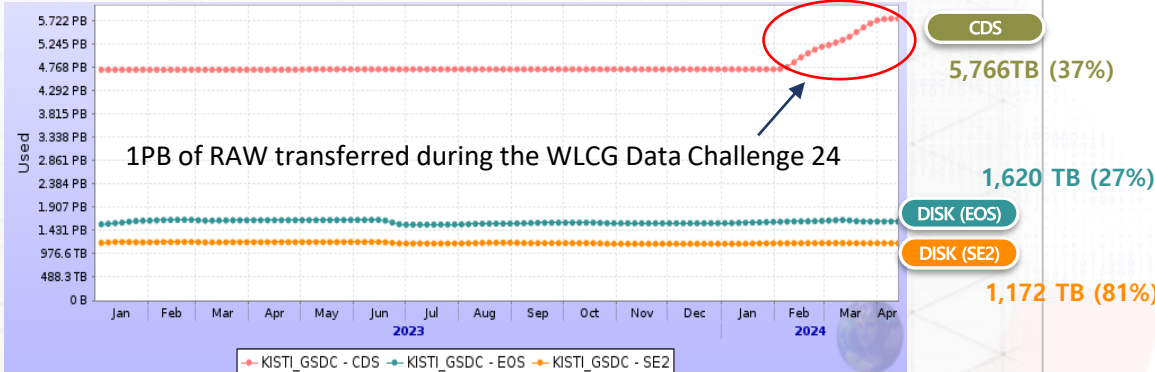
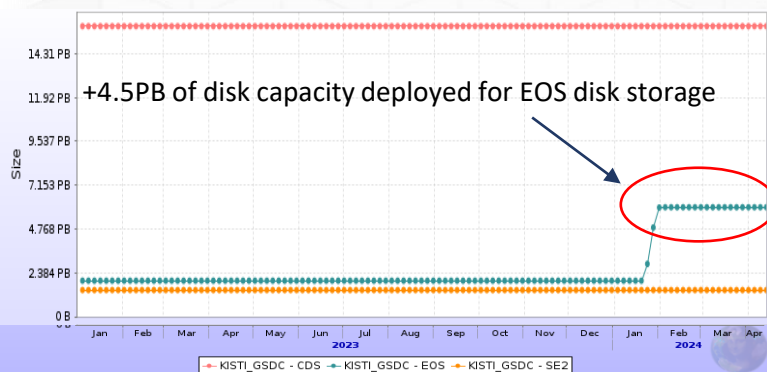
- DISK (SE2)** ○ XRootD based data handling (1,500 TB)
- 1 redirector + 5 storage nodes
- DISK (EOS)** ○ EOS based data handling (6,500 TB)
- 2 MGMs (duplexing) + 5 FSTs (storage nodes)
- CDS** ○ EOS based Custodial Disk Storage (12,000 TB)
- 3 MGMs (HA) + 18 FSTs (12+4 RAIN, 2 spares)

Usage 1,172 TB, 81% Read Availability 98.85% Write Availability 98.23%

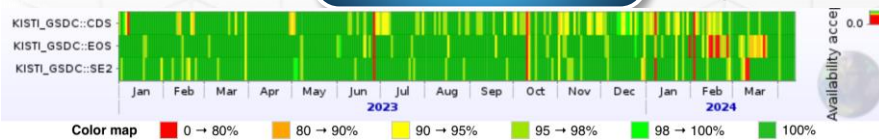
Usage 1,620 TB, 27% Read Availability 97.98% Write Availability 98.77%

Usage 5,766 TB, 37% Read Availability 97.90% Write Availability 97.87%

Storage status for last 12 months



Disk Reading



Disk Writing



Statistics

Link name	Data			Individual results of reading tests			Overall Availability
	Starts	Ends		Successful	Failed	Success ratio	
KISTI_GSDC::CDS	31 Dec 2022 23:01	13 Apr 2024 03:21		11090	243	97.86%	97.90%
KISTI_GSDC::EOS	31 Dec 2022 23:17	13 Apr 2024 03:37		11017	236	97.90%	97.98%
KISTI_GSDC::SE2	31 Dec 2022 23:11	13 Apr 2024 03:31		11145	132	98.83%	98.85%

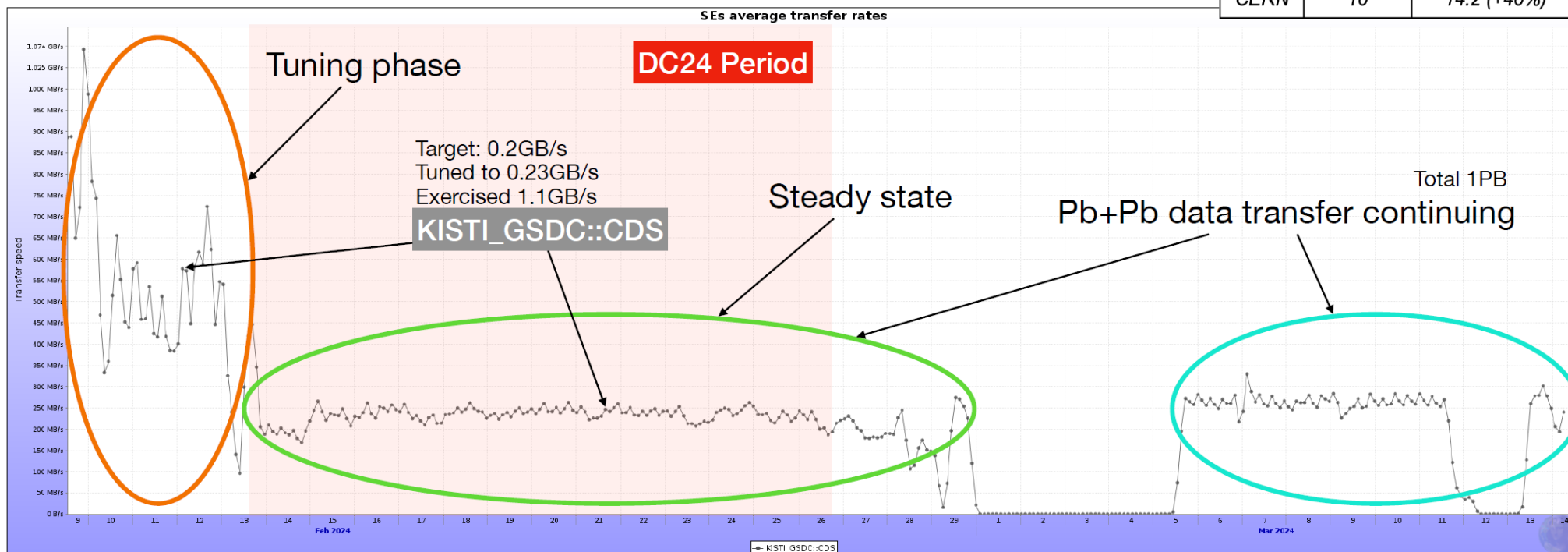
Statistics

Link name	Data			Individual results of writing tests			Overall Availability
	Starts	Ends		Successful	Failed	Success ratio	
KISTI_GSDC::CDS	31 Dec 2022 23:01	13 Apr 2024 03:21		11094	243	97.86%	97.87%
KISTI_GSDC::EOS	31 Dec 2022 23:17	13 Apr 2024 03:37		11114	140	98.76%	98.77%
KISTI_GSDC::SE2	31 Dec 2022 23:10	13 Apr 2024 03:31		11074	206	98.17%	98.23%

WLCG Data Challenge 24 CDS Participation as a Tape

- Transfer of real Pb+Pb data collected in 2023, 34PB in total
- 1PB of data being transferred after the challenge, ETA end of March

Centre	Target rate GB/s	Average achieved GB/s
CNAF	0.8	0.98 (+20%)
IN2P3	0.4	0.6 (+40%)
KISTI	0.2	0.25 (+22%)
GridKA	0.6	1.12 (+90%)
NDGF	0.3	0.35 (+15%)
NL-T1	0.1	0.25 (+150%)
RAL	0.1	0.58 (+500%)
CERN	10	14.2 (+40%)



Keeping top most quality of services

	Reliability		Availability	
	Overall in 2023	~Mar. 2024	Overall in 2023	~Mar. 2024
ALICE	97.3%	97%	97.3%	97%

Monthly target of WLCG : 97%

Participating in WLCG operation meeting every week,
closely collaborating with WLCG members

Monthly Availability (%)

	2023												2024	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Availability	98	97	99	100	98	94*	98	98	99	98	95**	97	97	97

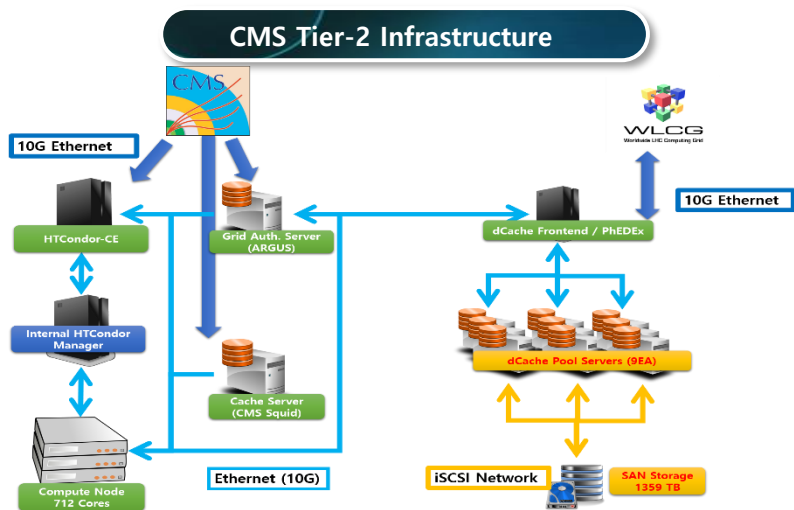
- $Reliability = \frac{T_{up}}{T_{up} + (T_{DOWN} - T_{SCHED_DOWN})}$
- $Availability = \frac{T_{up}}{T_{up} + T_{DOWN}}$

* the scheduled downtime for network security vulnerability check

** Network Issues: Misconfiguration on LHCOPN backup link has affected the site availability
- Close collaboration with the KREONet service team to address the issue



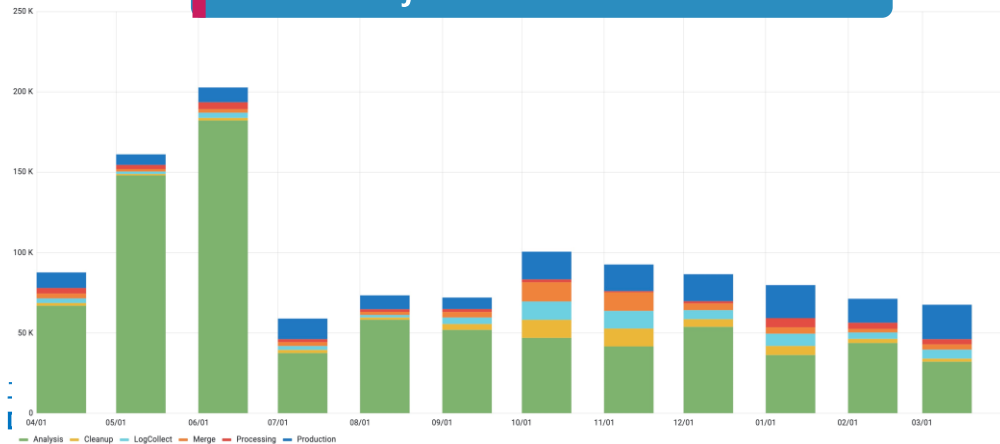
WLCG Tier-2



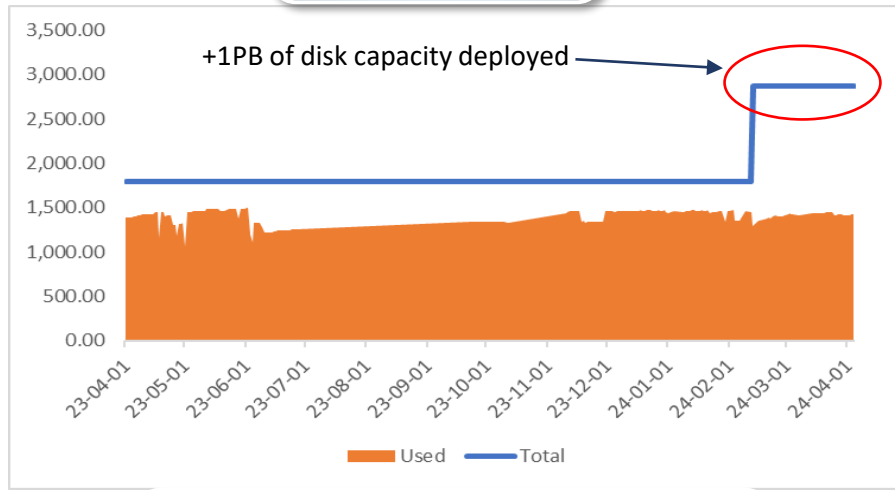
Computing: 1,424 cores (~15kHS23)
 2024 pledge: ~24kHS23
 (Computing) New workers (1,920 cores) will be deployed

Job Activities

1.15 million jobs in the last 12 months



Storage Usage



Disk: 2,800TB (Usage 1,428TB / 49.8%)
 2024 pledge: 1,800TB

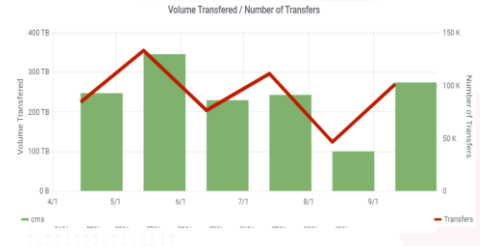
Data Transmission

KISTI Tier-2 Data Link

Src_exp_site/Dst_exp_site	T2_KR_KISTI
TO_CH_CERN	61%
T1_DE_KIT	67%
T1_ES_PIC	73%
T1_FR_CG2P3	72%
T1_IT_CNAF	73%
T1_RU_JINR	72%
T1_UK_BAL	58%
T1_US_FNAL	83%
T2_AT_Vienna	62%
T2_BE_IJHE	62%

- Tier-0 link : 1
- Tier-1 link : 7
- Tier-2 link : 46
- Tier-3 link : 5

Data Traffic →
 Total : 681TB
 Average : 68TB / month



WLCG Tier-2 Service Availability / Reliability

서비스	Reliability		Availability	
	Overall in 2023	~Apr. 2024	Overall in 2023	~Apr. 2024
ALICE	97.84%	97.95%	97.82%	97.95%

Monthly target of WLCG : 95%

Site	Availability ↓	Reliability
T2_US_Wisconsin	99.55%	99.55%
T2_CH_CERN	99.31%	99.31%
T2_UK_London_IC	99.12%	99.12%
T2_TW_NCHC	99.10%	99.10%
T2_DE_RWTH	99.07%	99.07%
T2_US_Nebraska	99.06%	99.06%
T2_CN_Beijing	99.05%	99.05%
T2_AT_Vienna	99.04%	99.04%
T2_BE_IHE	98.98%	98.98%
T2_RU_JINR	98.95%	98.95%
T2_IT_Legnaro	98.79%	98.79%
T2_FL_HIP	98.67%	98.67%
T2_IT_Bari	98.13%	98.13%
T2_PL_Swierk	98.05%	98.16%
T2_ES_CIEMAT	98.00%	98.00%
T2_KR_KISTI	97.95%	97.95%
T2_HU_Budapest	97.32%	97.32%
T2_RU_LINR	97.11%	97.11%
T2_US_Purdue	96.97%	96.97%
T2_UK_SGrid_RALPP	96.72%	96.93%
T2_BR_SPRACE	96.06%	96.06%
T2_US_UCSD	95.91%	95.91%
T2_US_Vanderbilt	95.66%	95.66%
T2_US_Caltech	95.32%	95.32%
T2_CH_CSCS	95.27%	96.29%
T2_DE_DESY	95.05%	95.05%
T2_PT_NCG_Lisbon	94.01%	94.01%
T2_IT_Rome	93.89%	94.89%
T2_RU_IHEP	93.71%	93.71%
T2_US_MIT	93.24%	93.24%
T2_PL_Cyfronet	91.93%	91.93%
T2_FR_IPHC	91.92%	92.26%
T2_EE_Estonia	91.68%	92.10%
T2_US_Florida	89.02%	90.47%
T2_UK_London_Brunel	88.24%	88.24%
T2_IN_TIFR	87.36%	90.68%
T2_BE_UCL	86.93%	93.74%
T2_FR_GRIF	86.32%	86.32%
T2_UA_KIPT	86.05%	97.21%
T2_RU_ITEP	85.91%	86.28%
T2_IT_Pisa	78.48%	78.48%
T2_ES_IFCA	76.04%	76.04%
T2_BR_UERJ	69.42%	69.42%
T2_TR_METU	48.06%	48.11%
T2_UK_SGrid_Bristol	23.92%	23.92%
T2_PK_NCP	0.37%	0.37%

Tier-1/2 pledges & Asia Tier Center Forum

Tier-1 pledge: 10% Contribution to ALICE Tier-1 Computing

	ALICE Tier-1 Resources (C-RSG Recomm.)		KISTI Tier-1 requirements (10% contribution)		KISTI Tier-1 Pledges	
	2024	2025	2024	2025	2024 (installed)	2025 (planned)
CPU	630kHS23	690kHS23	63kHS23	69kHS23	72kHS23 (6,920cores)	72kHS06 (6,920cores)
Disk	71.5PB	79PB	7.15PB	7.9PB	8PB	8PB
Tape	107PB	123PB	10.7 PB	12.3 PB	12PB	12PB

○ KISTI Tier-1 Pledges for 2024

- (Pledges) CPU: 60kHS23, Disk: 6.7PB, Tape: 12PB
- (Deployment) **CPU: 72kHS23, Disk: 8PB, Tape: 12PB**

Installed	2021	2022	2023	2024
CPU (cores)	3,880	3,880	3,880	6,920
Disk (TB)	4,500	4,500	6,500	8,000
Tape (TB)	12,000	12,000	12,000	12,000

Tier-2 pledge

	CMS Tier-2 Resources (C-RSG Recomm.)		KISTI Tier-2 Pledges		
	2024	2025	2024 (installed)	2024 (planned)	2025 (planned)
CPU	1,600kHS23	1,900kHS23	17kHS06 (1,424cores) (1.1%)	24kHS23 (2,088cores) (1.26%)	24kHS06 (2,088cores) (1.5%)
Disk	149PB	175PB	2.8PB (1.88%)	2.8PB (1.88%)	2.8PB (1.88%)

○ KISTI Tier-2 Pledges for 2024

- (Pledges) CPU: 24kHS23, Disk: 1.8PB
- (Deployment) **CPU: 17kHS23, Disk: 2.8PB**

(CPU) New 12 workers(1,920 threads) to be deployed this year and to replace old HW

(Disk) 1PB of Disks added early this year (1.8PB -> 2.8PB)

* Tier-2 pledge target: 2% of CMS Tier-2 requirements
Incremental strategy due to budget limit

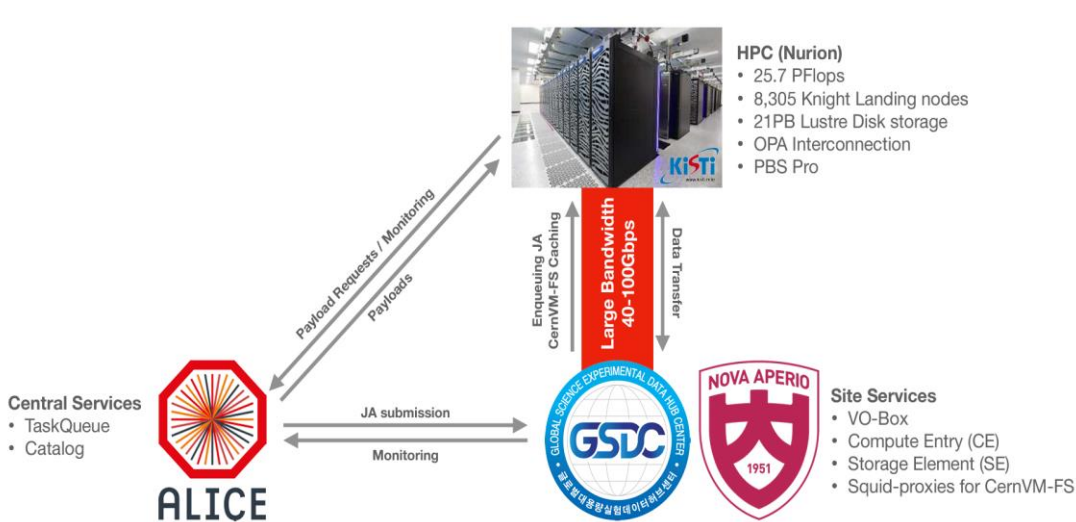
KISTI (Korea Institute of Science and Technology Information)

- Government-funded research institute founded in 1961 for national information services and Supercomputing
- National Supercomputing Center
 - Nurion (Cray CS500 system): 25.7 PFlops, ranked 11th of Top500 (2018) ⇒ 46th (Nov 2022)
 - * New HPC System will be deployed in 2024 or early 2025, 600PFlops (Top 10 ranking target)
 - Neuron - GPU system, 1.24 PFlops
 - KREONet/KREONet2 - National/International R&E network

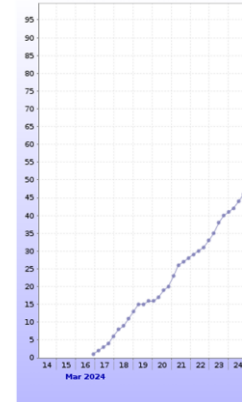


KISTI HPC testbed for ALICE experiment

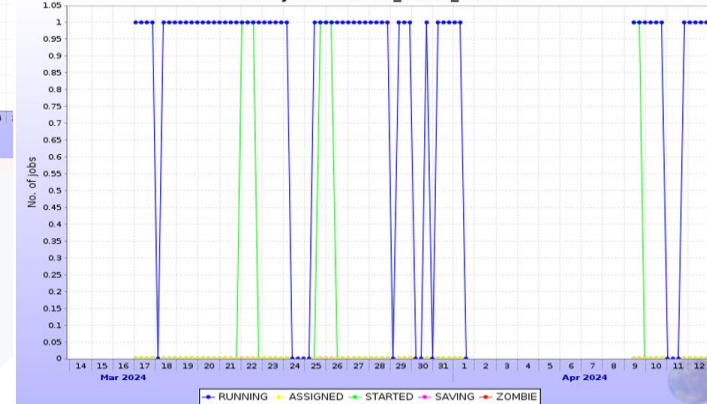
- Collaboration with KISTI Nurion Team & CBNU (a member of KoALICE)



Done jobs in KISTI_GSDC_Nurion



Active jobs in KISTI_GSDC_Nurion



Governance to solve common issues and troubles faced by Asian Tier centers



- **Jeju island, Korea**
 - co-hosted by KISTI GSDC, KREONet, SUT
 - 1-3 November 2023
- **40 registered participants** (15 institutes from 8 nations)
 - CERN, ASGC(TW), BRIN(ID), IHEP(CN), Hiroshima U., ICEPP(JP), KEK(JP), KISTI(KR), Rajamangala U.(TH), SUT(TH), TIFR, VECC(IN)
- Status and updates on Asian sites(8 sites), experiments(ALICE, BelleII, LIGO), and networking(LHCONE), Special sessions for HPC/AI
- Discussions on ideas or ways to support each individual site and collective activities in Asia
 - Developing support models towards a strong collaboration in the region to cope with challenges
- **It provides a place where the Asian sites can share and discuss any issues to resolve in a collective way**





ALICE Tier-1/Tier-2 Workshop in Seoul

ALICE

16-18 Apr 2024
Hotel President
Asia/Seoul timezone

- Overview
- Registration
- Time Table
- Participant List
- Payment of workshop fee
- Videoconference
- Accommodation
- Travel Information and venue
- Lunches, Social event & Excursion
- Photos
- Organizers e-mail
- alice-kisti-t12-workshop

The Eleventh Annual ALICE Tier-1/Tier-2 Workshop will be co-hosted by the Korea Institute of Science and Technology Information and the Korean Society for High Energy Physics in the capital of South Korea, Seoul.



- **Seoul, Korea**
 - co-hosted by KISTI GSDC and KSHEP
 - 16-18 April 2024
- **45 registered participants** (15 institutes from 12 nations)
 - CERN, GSI(DE), Wigner center(HU), INFN(IT), LBNL, Oak Ridge NL(US), NPI(CZ), Pavol Jozef Safarik Univ.(SK), Univ. de Sao Paulo (BR) Univ. Politehnica of Bucharest, Western Norway Univ, CBNU, KISTI(KR)
- **Status and updates on Tier-1/Tier-2 sites, Assessment of ALICE Grid operations, middleware(jAliEn), storage capacity**



Evolution of jAliEn after 3 years of intensive operation	Cosmin Grigoras	31st Floor "Mozart Hall", Hotel President	11:30 - 12:00
Job pilot features and job isolation	Maksim Melnik Storev	31st Floor "Mozart Hall", Hotel President	12:00 - 12:30
System tools for payload control	Marta Bertran Ferrer	31st Floor "Mozart Hall", Hotel President	12:30 - 13:00
Lunch break			
The jAliEn job optimizer	Haukon Andre Reme-Ness	31st Floor "Mozart Hall", Hotel President	14:30 - 15:00
The long list of jAliEn optimizers	Jom-Are Klubbien Flaten	31st Floor "Mozart Hall", Hotel President	15:00 - 15:30
ALICE computing resources - processing plans and requirements	Stefano Plano	31st Floor "Mozart Hall", Hotel President	15:30 - 16:00
Coffee break			
The Site Sonar Tool for Infrastructure Monitoring & Dynamic Job Matching (R)	Katana Wijethunga	31st Floor "Mozart Hall", Hotel President	16:30 - 17:00
KISTI - operations and resources planning	Sang Un Ahn	31st Floor "Mozart Hall", Hotel President	17:00 - 17:20
Czech T2 - operations and resources planning	Dagmar Adamova	31st Floor "Mozart Hall", Hotel President	17:20 - 17:40

The streamlined T1 at LBNL - project proposal	Itali Chakrabarti	31st Floor "Mozart Hall", Hotel President	10:00 - 10:30
Performance MPC integration and operation	Segev Weisz	31st Floor "Mozart Hall", Hotel President	10:30 - 11:00
Coffee break			
The ALICE O2 reconstruction and analysis software	Guido Estève	31st Floor "Mozart Hall", Hotel President	11:00 - 11:30
The GSI Analysis Facility - one year of operation under analysis load	Muhammad Ali Turay	31st Floor "Mozart Hall", Hotel President	12:10 - 12:40
NDMSPC - EOS and N Dimensional Analysis with ROOT, Enhanced by Web Interface and VR Visualization	Martin Vokac	31st Floor "Mozart Hall", Hotel President	12:40 - 13:00
Lunch break			
Nurion MPC integration	Hyeonji Yu	31st Floor "Mozart Hall", Hotel President	14:30 - 15:00
Future of the KISTI MPC	Dr. Teyoung Hong	31st Floor "Mozart Hall", Hotel President	15:00 - 15:30
KREONET and Korean NPEN status and evolution	Dr. Baesong Cho	31st Floor "Mozart Hall", Hotel President	15:30 - 16:00
Coffee break			
Site services - migration to B-cores and single nodes, WLCG services and tokens (R)	Maurice Lemaire	31st Floor "Mozart Hall", Hotel President	16:30 - 17:00

US sites - operations and resources planning	Itali Chakrabarti	31st Floor "Mozart Hall", Hotel President	10:00 - 10:20
SAMPA (Brazil) - operation and resources planning	Ricardo Romao Da Silva	31st Floor "Mozart Hall", Hotel President	10:20 - 10:40
CERN's role in WLCG Security Operations	Jose Carlos Luna Duran et al.	31st Floor "Mozart Hall", Hotel President	10:40 - 11:00
Coffee break			
Introduction to Linux Forensics	Jose Carlos Luna Duran et al.	31st Floor "Mozart Hall", Hotel President	11:00 - 11:30
Lunch break			
Closeout			
31st Floor "Mozart Hall", Hotel President 12:50 - 13:00			

- KISTI-GSDC is a datacenter for data-intensive fundamental research by providing necessary computing power, storage and services
- KISTI Tier-1 for ALICE is running **stable and fully functional**, providing high quality of services.
 - New and powerful machines were deployed to meet CPU and Storage pledges
 - Tier-1 pledges have contributed about 10% of all ALICE Tier-1 requirements.
 - Successful participation to WLCG DC24 in early this year
- Tier-2 for CMS have been **operating without critical issues**
 - New and powerful machines were deployed to meet CPU and Storage pledges
 - Tier-2 pledges will be gradually expanded to reach the target (2% of all CMS Tier-2 resources).
- KISTI HPC Project has conducted in collaboration with a KoALICE member and KISTI Nurion Team
 - Successful jobs have been observed since March this year
- **Experience and knowledge from operating WLCG Tier-1 and 2** has been transferred to **support domestic research area** and has helped to improve research activities.

과학기술인프라, 데이터로
세상을 바꾸는 **KiSTi**

Thank You

