Introduction to Asia Region Research Platform & Related work

(APAN APRP, A3 Project, KRP)

KISTI/KREONET
Jeonghoon Moon
15th Sep. 2025

Contents

APAN APRP WG

[1] APAN 59th Yokohama Meeting
[2] APAN 60th Hongkong Meeting

APAN APRP(Asia-Pacific Research Platform) WG

- **Since 2018 APRP WG initiated at APAN 45th Meeting 2018 in Singapore**
  APRP – Asia Pacific Research Platform Working Group
  APAN meeting held 2 times in a year

- **Objectives**
  APRP WG develops technologies to provide data-intensive science (AI, Bio, Climate/Weather, Agriculture) environments and various computing resources by linking distributed HPC systems and establishing a stable big data highway system based on NREN in the big data era, and promotes related research collaboration in the Asian region.
  - Promote **Distributed & Shared HPC ecosystem in the Asia-Pacific**.
  - Engage **APAN members and ASEAN countries**
  - Towards the setting up an **Asia Pacific Research Platform (APRP)** and **become a part of a Global Research Platform**

- **Executive member**
  Chair : Jeonghoon Moon, KISTI, Korea
  Co-Chair : Andrew Howard, NCI, Australia
  Secretary : Asif Khan, Qatar Univ. Qatar

- **Asi@Connect 5th Call project by TEIN*CC**
  Title : A High bandwidth distributed HPC (1st April 2022 – 31st July 2023)

- **A3 Foresight Program Project by A3 Countries NRF (Korea-China-Japan)**
  Title : Data Sharing Infrastructure across Northeast-Asia Supercomputing Centers for Open Science (1st Aug. 2024 – 31st Jul. 2029, 5 Years)

APAN 59th APRP Sessions@Yokohama, Japan

- **Session Information**
  - Session 1: Keynote Speech and Technical Part, Chair: Jeonghoon Moon, 0900 – 1030
  - Session 2: Application and Country Update Part, Chair: Jeonghoon Moon, 1100 – 1230
  - Session 3: Panel Discussion - Data Sharing Infrastructure across Northeast-Asia Supercomputing Centers for Open Science, Moderate: Jeonghoon Moon, 1530-1700

- **Summary of session**
  - 5th (Wed) March, 2025, 3 Sessions, Room 415
  - 12 Presentations from 8 countries
  - Around 24 attendees in person and around 12 remote attendees

- **Main Topics**
  - Wireless communications, Data transfer for inter data centers
  - ScienceDMZ and DTN, AI Science & Bio Science with HPC, Data Storm
  - **NRP experience and Gene edit/scissors research**
  - **Research Platform for Agriculture, Shared Storage System**
  - Multi-Domain big data transfer, New HPC construction project
  - Update NCI, KRP, APRP & etc

59 APAN YOKOHAMA

Detail Session information

• Session 1

1.Kiwook Kim(KISTI/KR) - Wireless & Data transfer for inter data centers

2.Susumu Date(Osaka Univ./JP) - Introduction and current status of ONION and RED ONION project based on ScienceDMZ

3.Ghulam Mujtaba(Sukkur-IBA Uni./PK) - AI and Distributed HPC

4.Vincenzo Capone(GEANT/UK) - Navigating through the data storm

5.Seungmin Kim(Yonsei Medical College/KR) - Experiences from the National Research Platform: Innovations and Challenges of Scientific Workloads

6.Jeonghoon Moon(KISTI/KR) - Asia Pacific Research Platform Activities and Related Work & Korea, China, Japan A3 Foresight Project

• Session 2

1.Andrew Howard(NCI/AU) - Update of NCI

2.Kihyeon Kim(KISTI/KR) - Agricultural high bandwidth distributed HPC platform

3.Nor Asilah(UPM/MY) - UPM's new HPC plan and future works

4.Kaneyama Hidetomo(RIKEN/JP) - HPCI Shared Storage System using the Gfarm Network-Filesystem

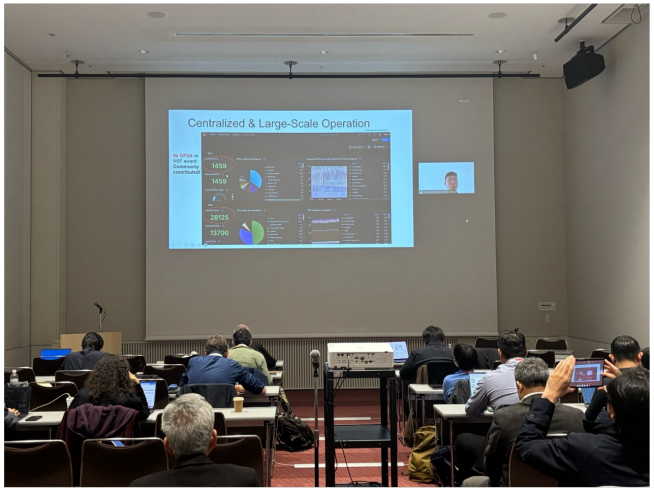
5.Xianwei Zhang (NSCC-GZ/CH) - Multi-domain big data transfer through the supercomputer center

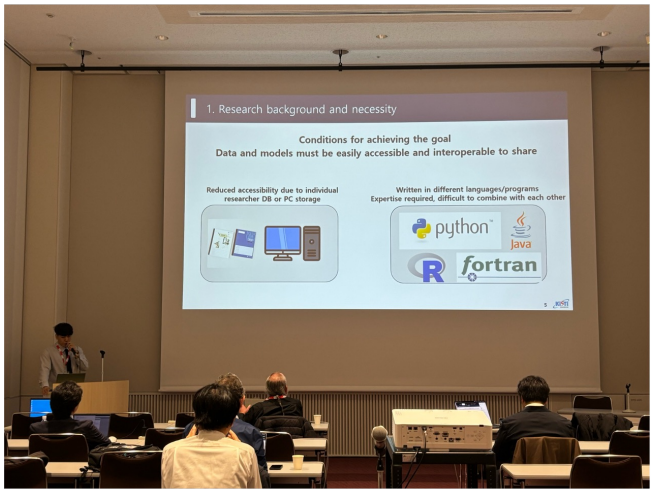
6.Elif Naz BİNGÖL AKSOY(Beykoz Ins./Tur)/Asif Khan(Qatar Univ./MY) - The Role of High-Performance Computing in Bioinformatics

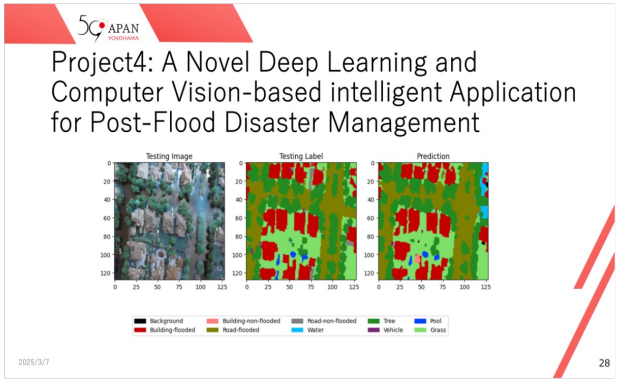
• Session 3

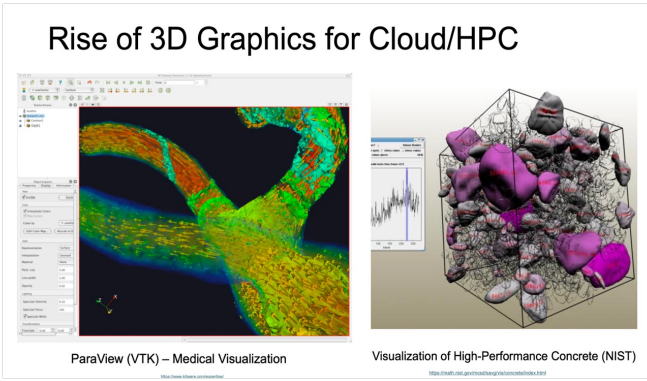
1. **International collaboration with HPC infrastructure**
   Moderator: Jeonghoon Moon (KISTI/KR)
   Panel: Kaneyama Hidetomo(Riken/JP), Susumu Date (Osaka Univ./JP), Xianwei Zhang (NSCC-G/CH)

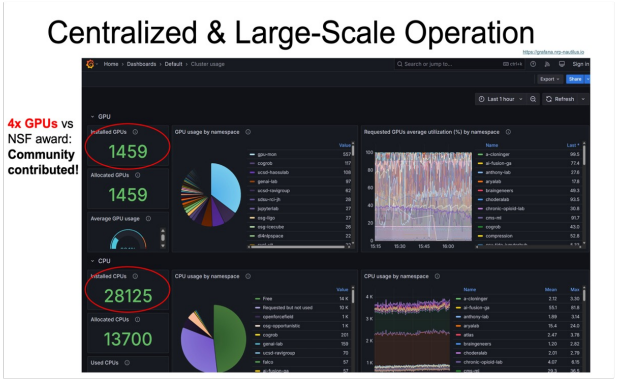
Activities & Presentations

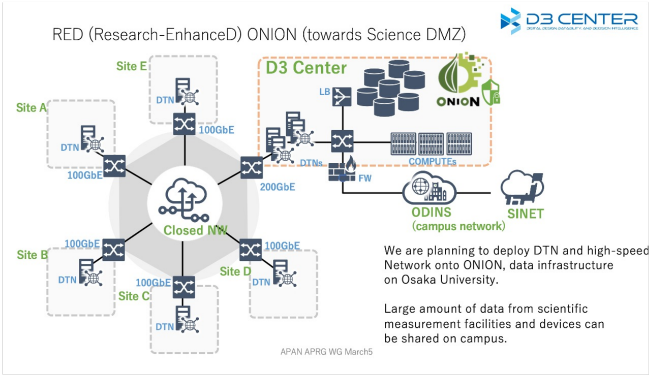


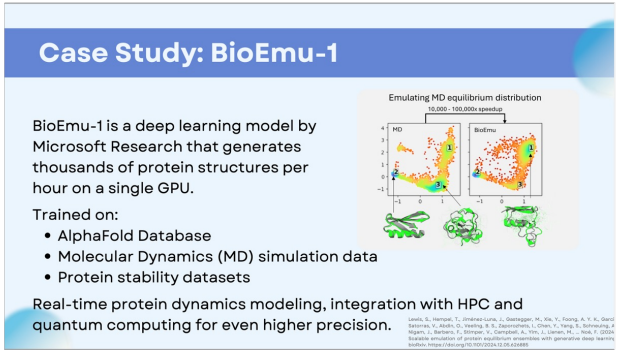


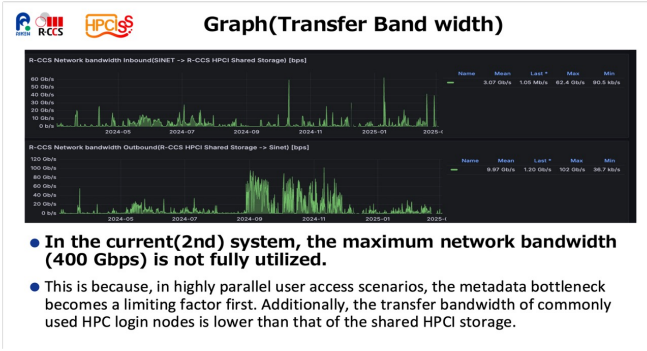












APAN YOKOHAMA

- **Session Information**
  - Session 1: Technical and Application1 Part, Chair: Jeonghoon Moon, 0845-1015
  - Session 2: Application2 and Country Update Part, Chair: Andre Howard, 1045-1215
  - Session 3: Data Sharing Infrastructure across Northeast-Asia Supercomputing Open Science, Moderate: Jeonghoon Moon, 1515-1645

- **Summary of session**
  - 29th (Tue) July, 2025, 1 Sesson, Salon III & IV
  - 30th (Wed) July, 2025, 2 Sessions, Room 415
  - 14 Presentations from 6 countries

- **Main Topics**
  - Wireless communications, Data transfer for inter data centers
  - High-speed Data Transfer Service
  - Genome Editing and Bioinformatics
  - **Building HPC infrastructure for ASEAN**
  - **New HPC construction project**
  - Update NCI, KRP, APRP & etc

APAN 60 JUCC
HONG KONG

APRP WG Session Program

Session 1: 30th July, Wed, 0845-1015, Beijing Time(GMT+08:00), Chair: Jeonghoon Moon

Venue: Salon III & IV, Mezzanine Floor - Grand Hyatt Hotel, HK

1. Jeonghoon Moon(KISTI/KR) - Introduction of APRP WG(5min)
2. Kiwook Kim(KISTI/KR) - Wireless and Inter Data Center(15min)
3. Susume Date(Osaka University/JP) - Status report of RED ONION project towards High-speed Data Transfer Service at the University of Osaka
4. Nor Asilah(UPM/MY) - New HPC at UPM in Malaysia(15min)
5. Seunghae Kim(KISTI/KR) Building HPC Infrastructure and HPC Capacity for ASEAN Data Utilization(15min)
6. Jeonghoon Moon(KISTI/KR) – APRP WG Activities a& A3 Project & KRP(10min)

Session 2: 30th July, Wed, 1045-1215, Beijing Time(GMT+08:00), Chair: Andrew Howard
Venue: Salon III & IV, Mezzanine Floor - Grand Hyatt Hotel, HK

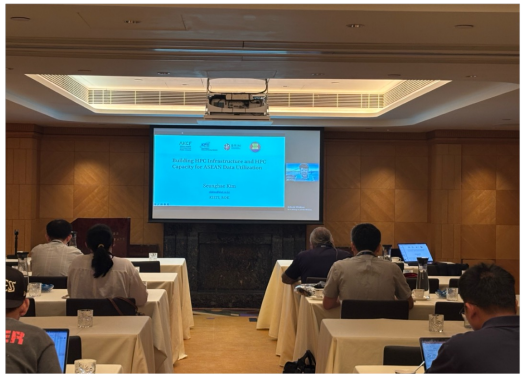
1. Andrew Howard(NCI/AU) - NCI Update(15min)
2. Kihyeon Kim(KISTI/KR - Research Platform for Agriculture(15min)
3. Kaneyama Hidetomo(Riken/JP) - Big data file system(15min)
4. Seungmin Kim(Yeonsei University/KR) - Research Platform for Medical
5. Xinawei Zhang(NSCC-GZ/CH) - Distributed HPC in China(15min)
6. Veerachai Tanpipat(HII/ThaiREN/TH) - Forest & AI(15min)

Session3 - International Open Science infrastructure for Northeast Asia region

29th July, 1515-1645 at Grand III & IV Mezzanine Floor - Grand Hyatt Hotel, HK

Moderate: Jeonghoon Moon (KISTI/KR)

Activities & Presentations



APRP WG@APAN60th Hongkong Meeting, Japan, 30th July, 2025

Asia-Pacific Research Platform(APRP) WG Activities & Related work (C.J.K Project & KRP)

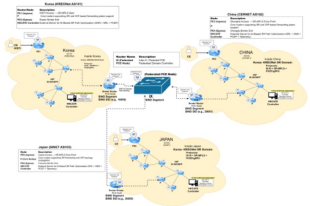
KISTI/KREONET
Jeonghoon Moon
30th July 2025

補足: AI Storage

- IBM
  - Expanded Metadata(label/tags) management platform (e.g. Starfish) that includes other storage environments using AFM.
    - Starfish is metadata management service, however using Cloud Service(stored metadata in US cloud)
  - Multi-protocol/storage ⇔ Multi-protocol access enabled via GPFS (cache)

AI-based networking methods

- **AI-based network intelligence at KREONET**
  - Research for the application of an AI-based coordination model centered around the HECATE controller, a special-purpose decision-making engine designed to manage real-time network behavior in KREONET.



Abstraction of China-Japan-Korea network with HECATE-based networking applied

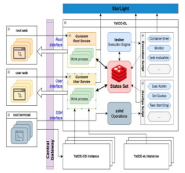
YATCC-OL: ONLINE SUPPORT

Core capabilities
- Unified scheduling and real-time monitoring
- Modular integration: AI/HPC/Research tasks
- Billing, quota, monitering, access control

Runtime architecture and service mode
- High concurrency support on StarLight
- Isolation and reliability
- Control flow and data flow separation

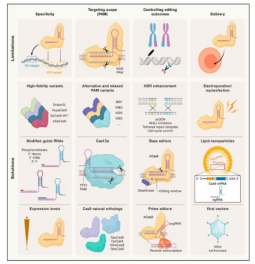
User support
- Administrators (Jupyter / Terminal): DevOps
- Users: job submission, resource viewing ...

YatCC-OL Stress Testing on TH-XY



Limitations and Solutions of Genome Editing

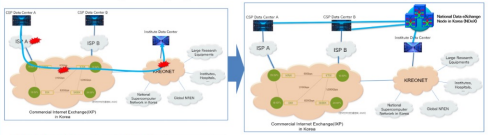
- **Off-target editing**: CRISPR-Cas9 may edit other genomic DNA locations than the target sequence
- **Uneven** levels of CRISPR-Cas9 **activities** across target sequences
- **Dependence** on a specific sequence within the target
- **Delivery** to the target organ or tissue
- Solving these issues with **bioinformatics** and **artificial intelligence**!



Pacesa, M., Pelea, O. & Jinek, M. Past, present, and future of CRISPR genome editing technologies. Cell 187, 1076–1100 (2024).

At the last APRP sessions…

- Introduced KISTI NDeX project
  : Data Exchange Network Structure Dedicated to Big Research Data
  - Reduce IXP burden by large amounts of research data traffic
  - Solve the difficulty of sharing large amounts of research data between public and private sectors

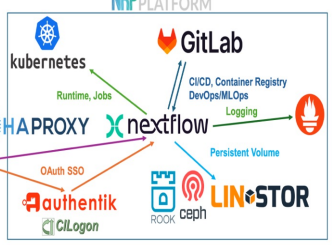


TCP before BBR | TCP BBR

- and also introduced BBR and BBR.Swift
  - One of the latest TCP congestion control algorithms developed by Google TCP BBR team
  - Used by: Google Cloud Platform, Youtube, and Linux 4.9 implementation

Source: "TCP BBR congestion control comes to GCP – your Internet just got faster", Neal Cardwell(Google Cloud) et al., 2017.

Schematic



APAN60 HONG KONG
HONG KONG | 28 JULY – 1 AUGUST 2025

YONSEI UNIVERSITY | NRP NATIONAL RESEARCH PLATFORM

Genome Editing and Bioinformatics
— The Role of Research Platforms —

60th Meeting of the Asia Pacific Advanced Network (APAN60)
Asia Pacific Research Platform (APRP) WG Session 2

Seungmin Kim
ehf (at) yonsei.ac.kr
Yonsei University College of Medicine, Republic of Korea

APAN60 JUCC HONG KONG

A3 Foresight Program Project

[1] Consortium of A3 countries
[2] Data Sharing Infrastructure across Northeast-Asia Supercomputing Centers for Open Science
[3] 1st Year and 2nd Year

- **Overview of A3 Foresight Program Project**
  - **Main Title**
    - Data Sharing Infrastructure across Northeast-Asia Supercomputing Centers for Open Science
  - **Participants Countries and institutes:**
    - Korea: KREONET/KISTI
    - China: NSCC-GZ, Sun Yat-Sen Univ.
    - Japan: R-CCS/RIKEN, Osaka Univ.
  - **Duration :** Aug. 2024 – Jul. 2029 (5 Years)
  - **Budget :** Korea(300,000$), China(562,000$) , Japan(347,000$),

The A3 Team

NSCC-GZ, Sun Yat-sen University

- PI: Yutong Lu 卢宇彤
- Professor, Director

R-CCS, RIKEN

- PI: Hidetomo Kaneyama 金山 秀智
- Expert Technician

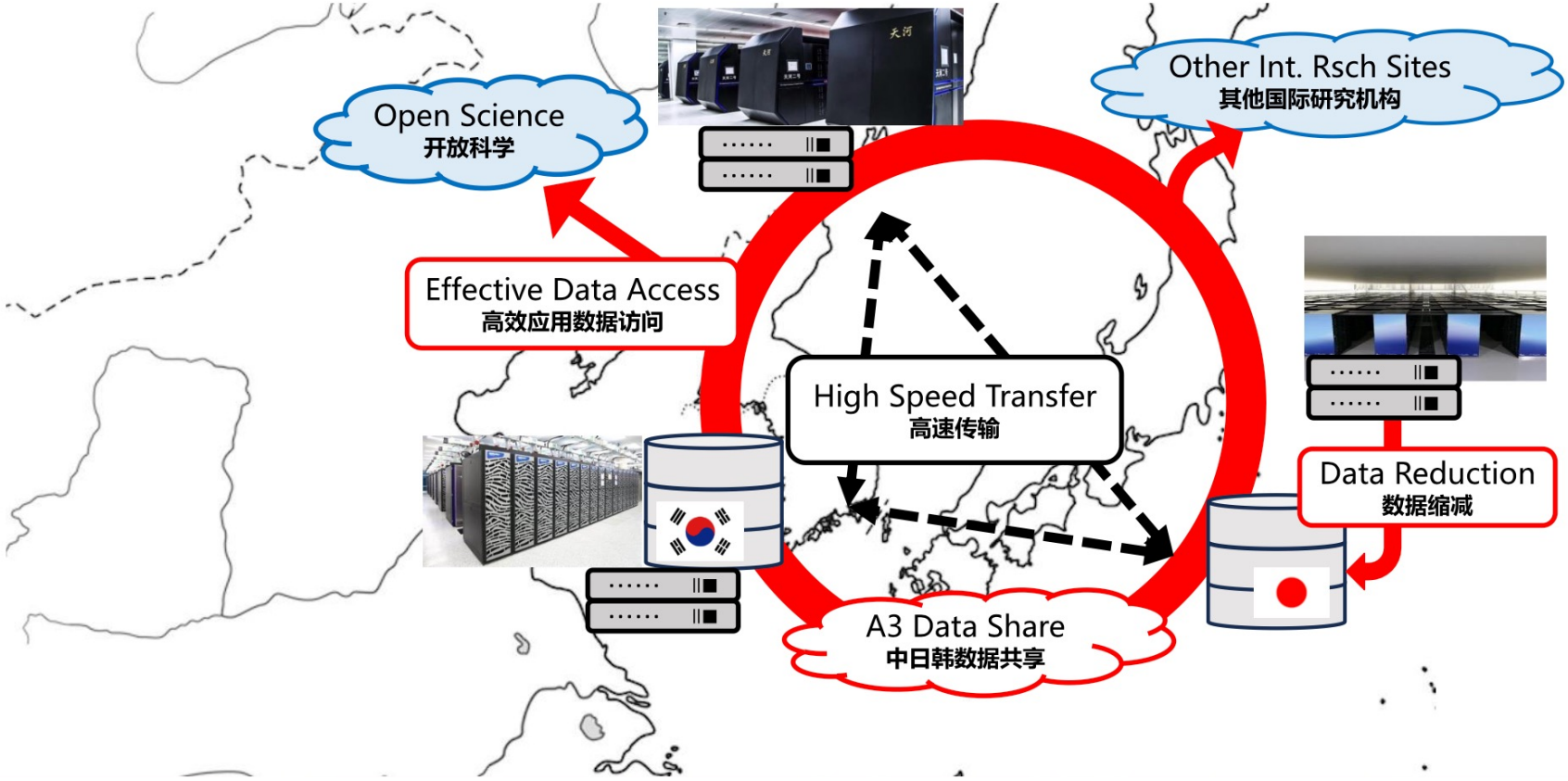
KISTI

- PI: Jeonghoon Moon 문정훈
- Principal Researcher

Goal of A3 Foresight Project

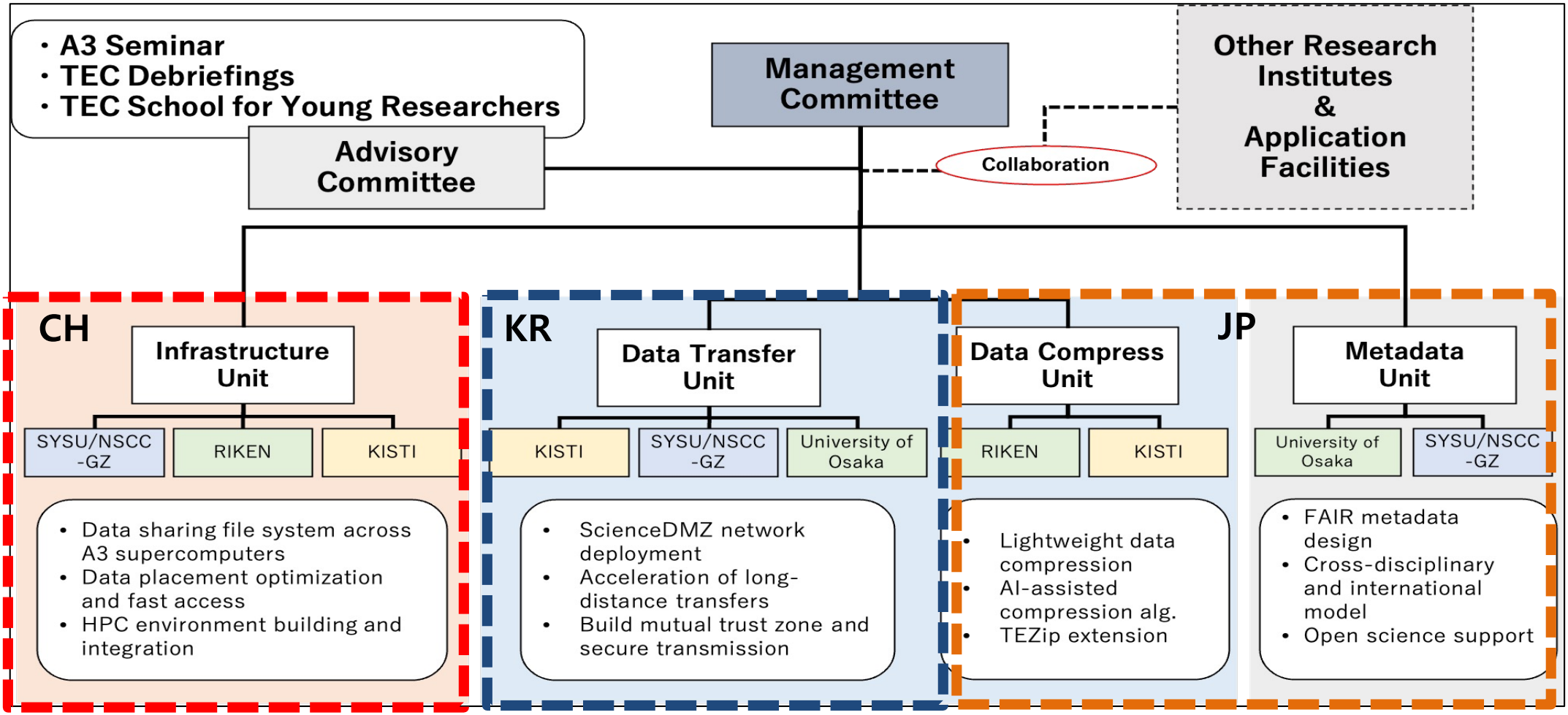
Goal: According to the Boundless advancement of science and technology through LLM (Large-Scale Language Model) and Advancement of science and technology without boundaries through open science, **this project aims to lead the development of an advanced research environment (system and element technology) for the utilization and sharing of research data and to establish an infrastructure for sharing advanced research data among Korea, China, and Japan.**

Data Sharing Infrastructure across Northeast-Asia Supercomputing Centers for Open Science



Strategies – 4 Units

- **Strategies (Divide into 4 Units)**
  - Unit 1: Infrastructure Unit (Leading by China: NSCC-GZ , KISTI, RIKEN)
  - Unit 2: Data Transfer Unit (Leading by Korea: KISTI, NSCC-GZ, Osaka Univ)
  - Unit 3: Data Compress Unit (Leading by Japan: RIKEN, KISTI)
  - Unit 4: Metadata Unit (Leading by Japan: Osaka Univ., NSCC-GZ)



1st Year summary

- **Objectives:**
  - Establish a **cooperative framework** among participating nations: Korea, China and Japan.
  - Identify other key stakeholders, research institutions, and universities and invite them to participate in this project and workshops.
  - Conduct **preliminary research** to understand the current state of data-sharing infrastructures and open science challenges.
  - Organize the **1st annual workshop** to initiate dialogue, share research objectives, and gather input for infrastructure design

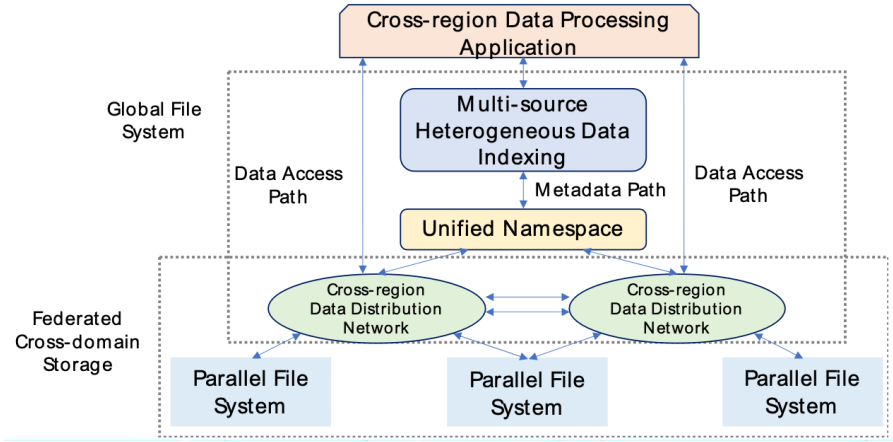
- **Deliverables:**
  - A comprehensive **report** outlining the current data-sharing landscape and initial strategy for infrastructure development.
  - Establishment of **communication** channels and protocols among partner institutions.

1st Workshop of A3 Project at Dec 2024, Guangzhou, China

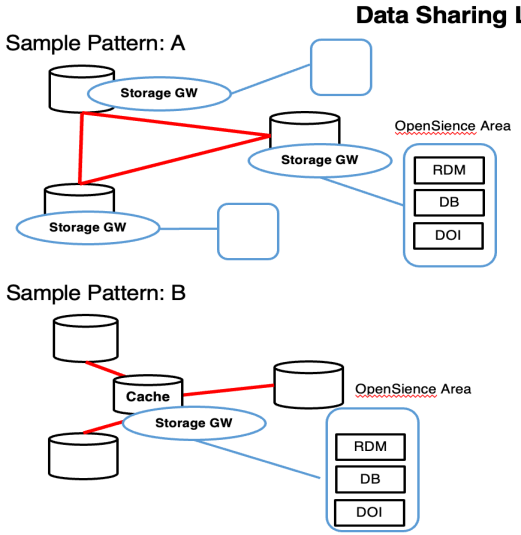
1st Year Deliverables

• Data Space Management Infrastrcture

- Abstract out the heterogeneous storage resources & design federated cross-region storage service architecture



• Data Sharing Layer

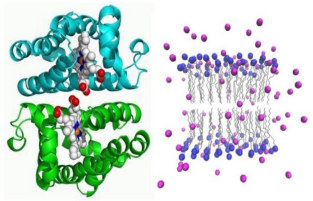


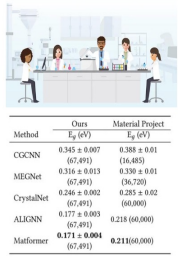
■ Data Sharing Layer
Need to data shared software
(e.g.: globus/starfish)
Opensouce Software:
RUCIO
- https://rucio.cern.ch
iRODS
- https://github.com/irods/irods
Gfarm(this is network filesystem)
- https://github.com/oss-tsukuba/gfarm

■ Storage GW Layer
Need to Multiprotocol Access(from user)
S3 → Another Protocol
- Ceph Object Gateway
- Minio Storage GW mode
POSIX → Another Protocol
- dCache(https://www.dcache.org/)

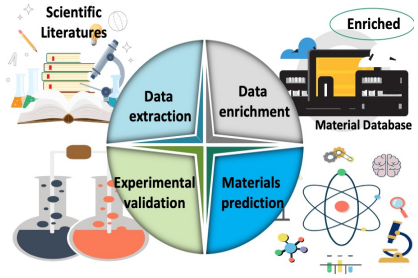
• Application Support

- HPC-AI ensemble for materials
- Establishment workflow for application

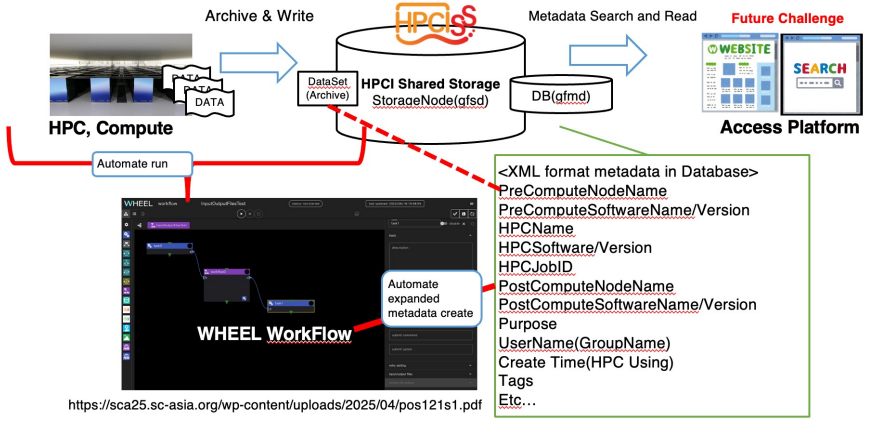




Method	Ours E_g (eV)	Material Project E_g (eV)
CGCNN	0.345 ± 0.007 (67,491)	0.388 ± 0.01 (16,485)
MEGNet	0.316 ± 0.013 (67,491)	0.330 ± 0.01 (36,720)
CrystalNet	0.246 ± 0.002 (67,491)	0.285 ± 0.02 (60,000)
ALIGNN	0.177 ± 0.003 (67,491)	0.218 (60,000)
Matformer	**0.171 ± 0.0004** (67,491)	**0.211**(60,000)



• Workflow Tools with Auto attention metadata



<XML format metadata in Database>
PreComputeNodeName
PreComputeSoftwareName/Version
HPCName
HPCSoftware/Version
HPCJobID
PostComputeNodeName
PostComputeSoftwareName/Version
Purpose
UserName(GroupName)
Create Time(HPC Using)
Tags
Etc…

https://sca25.sc-asia.org/wp-content/uploads/2025/04/pos121s1.pdf

2nd Year Plan

- **Objectives:**
  - Start the **survey and development of elemental technologies** such as file systems, high-speed data transfer, and data compression.
  - **Identify key metadata for data sharing** between Korea, China and Japan within research domains in the project.
  - Host the **second annual workshop** to present technological progress, discuss challenges, and refine strategies based on feedback.
  - Initiate **capacity-building programs, including Tec schools** (e.g. RIKEN Summer School) and specialized workshops for young researchers.

- **Deliverables:**
  - **Prototypes** of the key technological components.
  - A **report** on the progress of capacity-building initiatives and a plan for the following years.

- **2nd Annual Workshop**
  - Workshop will be held during SCA/HPCAsia 2026 (26th - 29th, Osaka, Japan)

Korea Research Platform & Activities

[1] Korea Research Platform (KRP) Status
[2] Related Research 1 – AI Based Research Network for A3 Countries
[3] Related Research 2 – Environment/Climate/Weather & Disaster
[4] Related Research 3 – Genome Editing & Bioinformatics

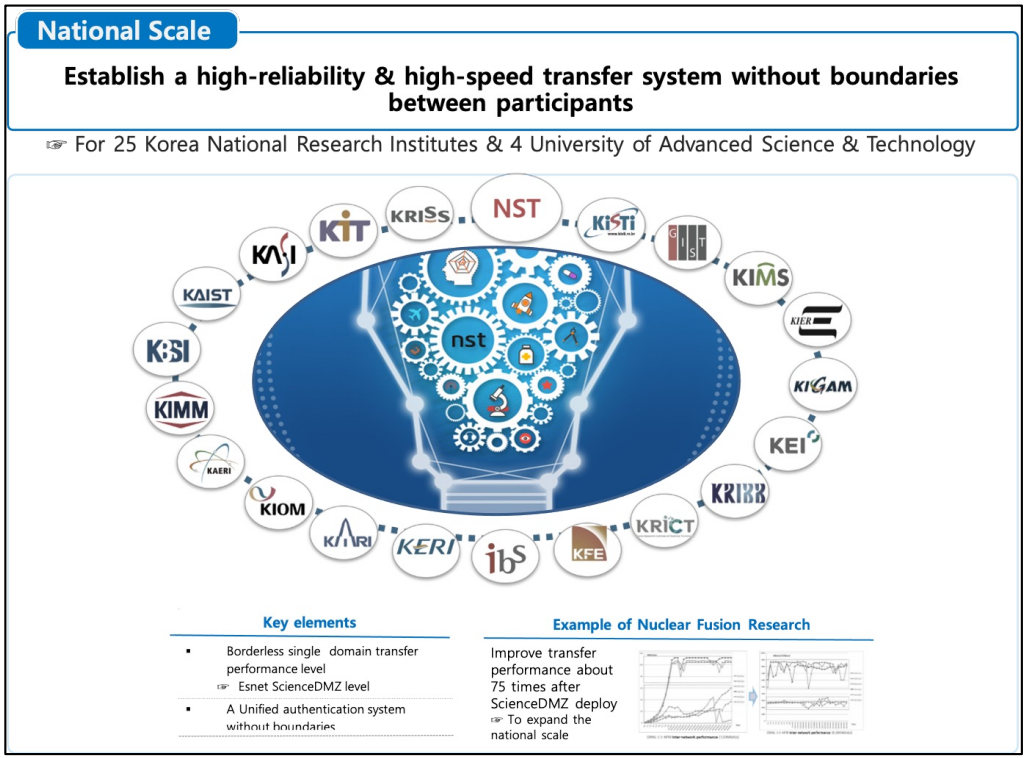
Korea Research Platform (KRP) Status

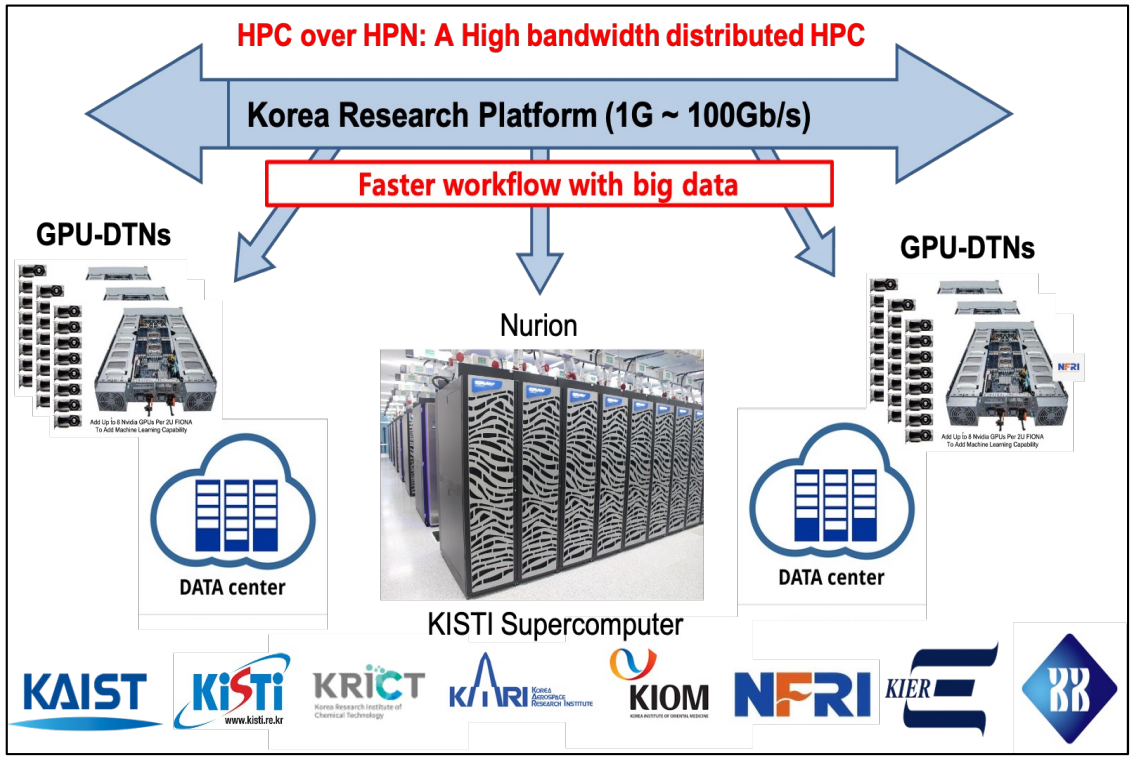
- Since 2015, Global partner of PRP project
- Since 2018, Leading of APAN APRP WG
- Since 2021, Expanding to 7 Korea National Research Institute
- Since 2022, Asi@Connect Project/TENI*CC for international
- Since 2024, A3 ForeSight Program Project by A3 NRF

"Establish a high-reliability & high-speed transfer system without boundaries between participants"

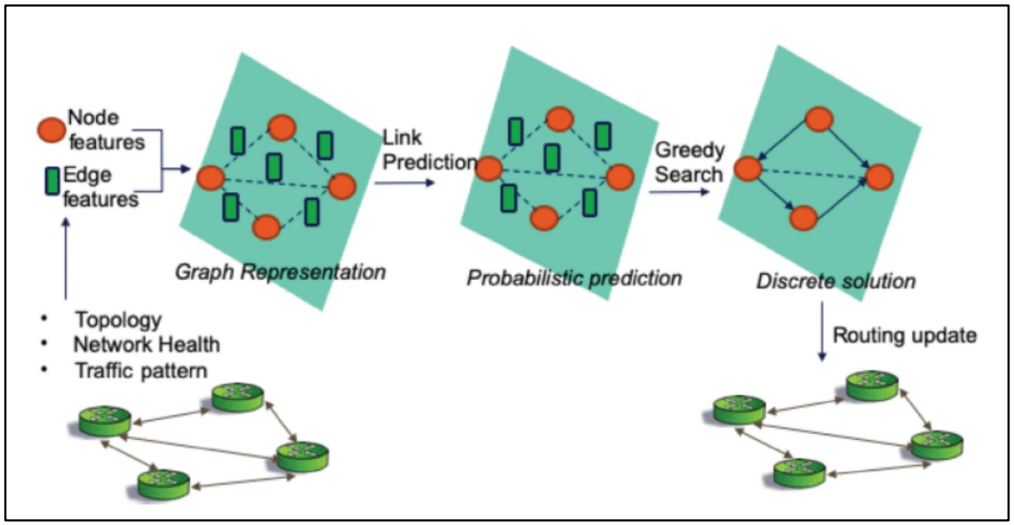
- Korea Research Platform expanding to National Research Institutes & Universities -

- HPC(Supercomputer, Cloud, Storage) over HPN and global federation -

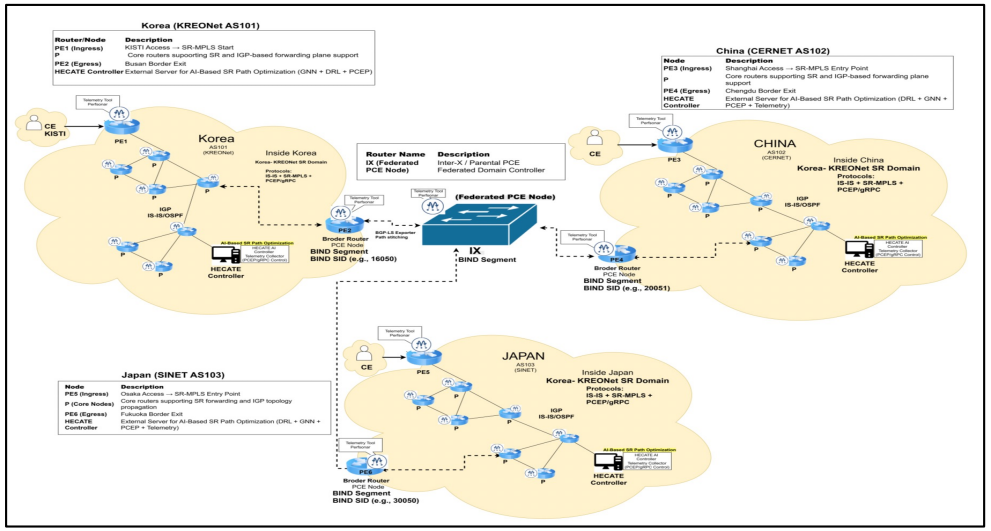




- **Joint AI-based networking for the K-C-J high-performance connectivity**
  - Provides scalability and high resilience for next-generation scientific networking in Northeast Asia.
  - Supports latency-sensitive applications(Large-scale data transfers, LHC data flows, Virtual collaboration tools)
  - Ensures domain sovereignty, cross-border interoperability, and robust performance in changing network environments.



GNN and DRL workflow of HECATE

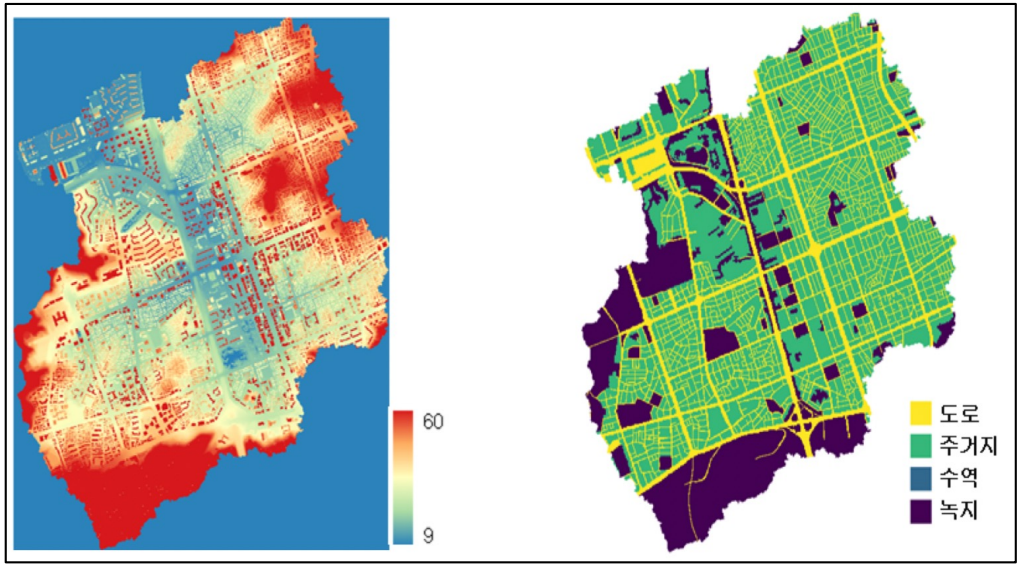


Abstract diagram of the Korea-China-Japan network using HECATE-based networking.

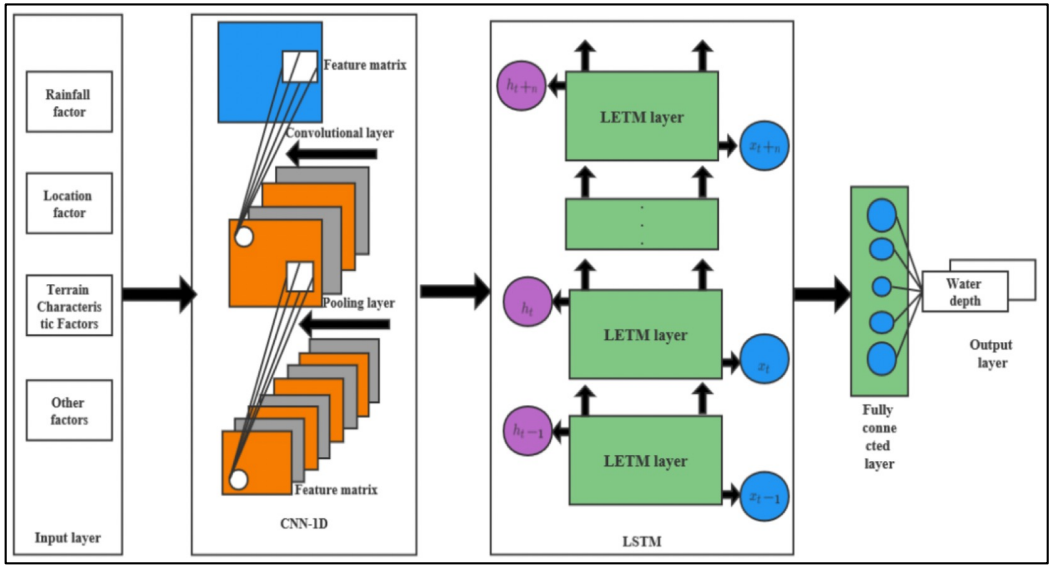
제주대학교 JEJU NATIONAL UNIVERSITY

KiSTi www.kisti.re.kr
Korea Institute of Science and Technology Information

- **Data Utilization Trends in the Weather and Disaster Areas**
  - Analysis for Data Size and Level, Forecasting Future Needs
  - Models and Utilization Technologies for R&D and Analysis,
  - AI Utilization Technologies
  - Analysis of IT Requirements in the Weather and Disaster Areas



Example data for urban flooding surface flow analysis



Structure of the neural network combining CNN and LSTM

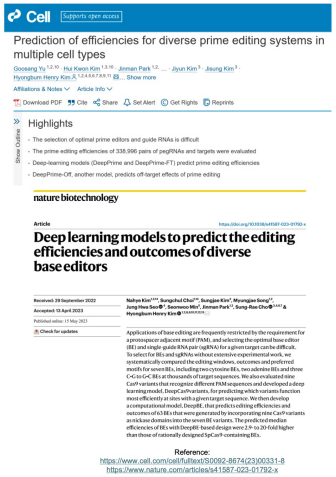
KEI 한국환경연구원 Korea Environment Institute

KiSTi www.kisti.re.kr Korea Institute of Science and Technology Information

- **High Performance Research Platform for Genome & Bioinformatics**
  - Tentative title: Establishment of a high-performance collaborative research platform dedicated to medical research for gene scissors and bioinformatics
  - Participants Engineering : Yonsei Medical University, KISTI

Use Case: CRISPR Gene Editing

- Yonsei Genome Editing Laboratory (PI: Prof. Dr. Hyongbum Henry Kim)
- Large-scale high-throughput **deep-learning-based design of CRISPR gene editors**
- Published in Cell, Nature Biotechnology, Nature Methods, etc.
- **Predicting the efficiency and activity** of gene editors without lab experimentation; unforeseen scalability with time/cost savings
- Structural design of gene editors and utilizing large language models to analyze gene editors


Cell Supports open access

Prediction of efficiencies for diverse prime editing systems in multiple cell types

Highlights

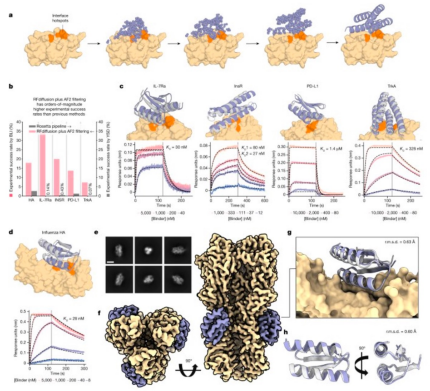
nature biotechnology

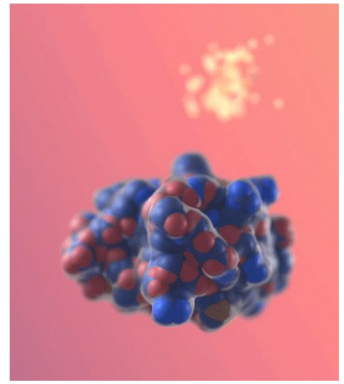
Article

Deep learning models to predict the editing efficiencies and outcomes of diverse base editors

Reference:
https://www.cell.com/cell/fulltext/S0092-8674(23)00331-8
https://www.nature.com/articles/s41587-023-01792-x

AI-Based Protein Generation





University of Washington, RFDiffusion

Reference:
https://www.nature.com/articles/s41586-023-06415-8
https://www.bakerlab.org/2023/03/30/rf-diffusion-now-free-and-open-source/

Source from Seungmin Kim, Yonsei University, College of Medicine

연세대학교 의과대학
YONSEI UNIVERSITY
COLLEGE OF MEDICINE

KiSTi
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Korea Institute of
Science and Technology Information

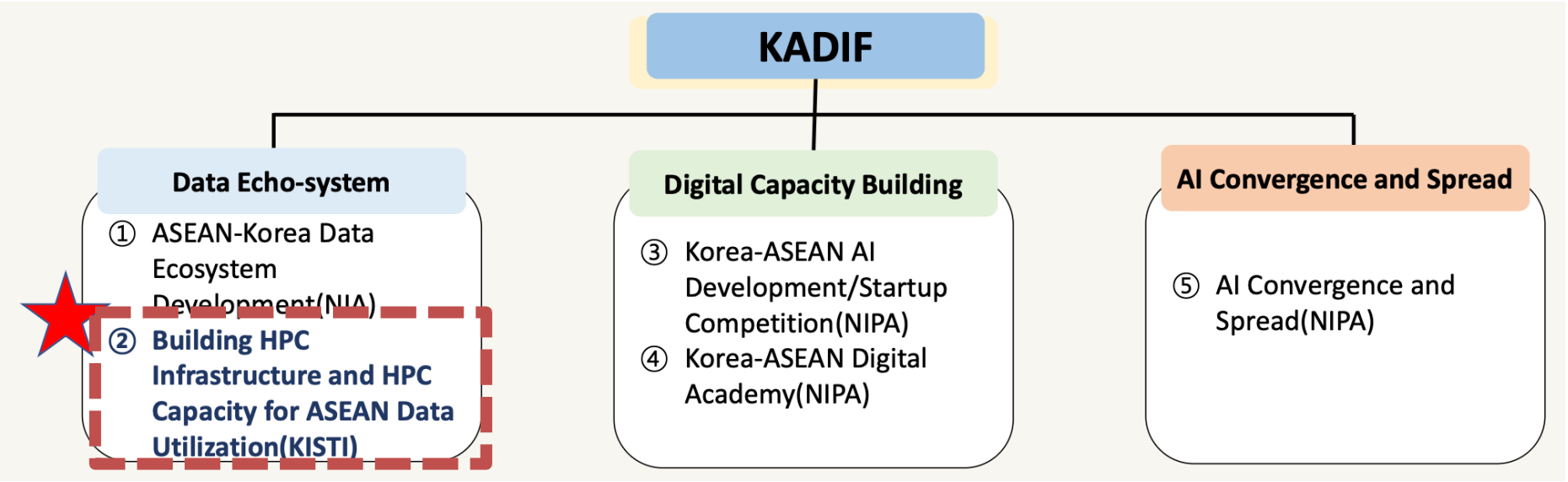
ASEAN – Korea HPC Project

[1] Overview of the project
(Title: Building HPC Infrastructure and HPC Capacity for ASEAN Data Utilization)
[2] Architecture and Infrastructure

ASEAN – Korea HPC Project by KADIF Background

- **KADIF: KOREA ASEAN Digital Innovation Flagship Project**
- **Background**
  - To promote closer co-operation and shared prosperity in the digital and science & technology sectors of the ASEAN-ROK.
  - Contribute US$30 million over 5 years funded by the ASEAN-KOREA Cooperation Fund

- **Need of HPC and AI infra in ASEAN**
  - Enhanced capability for massive data processing and analysis
  - Technological support for advanced Science research and development
  - Promote economic growth and drive digital innovation
  - Provide high-performance computing for solving complex problems
  - Strengthen industrial competitiveness through AI and big data utilization



Summary of Project

- **Title: Building HPC Infrastructure and HPC Capacity for ASEAN Data Utilization**
  - Main goal: To Build HPC-based Data utilization infrastructure to reinforce ASEAN member states(AMS) strengthen their digital competencies

  - Final endorsed: Sep 11 , 2024

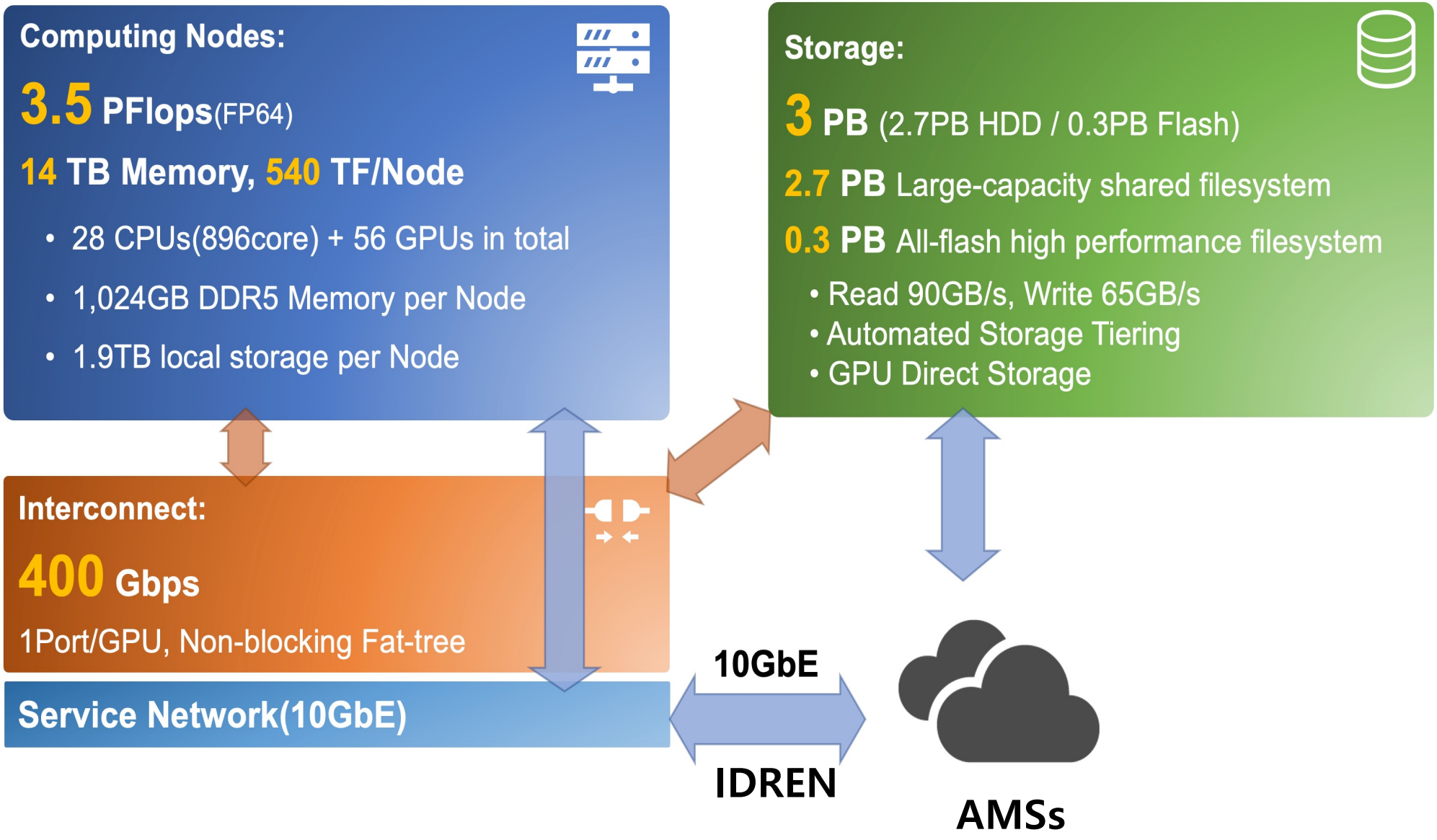
  - Duration: 4 years (Sep 2024 – Sep 2028)

  - Fund: Financed by ASEAN-KOREA Cooperation Fund(AKCF)

  - Budget: USD 10 Million

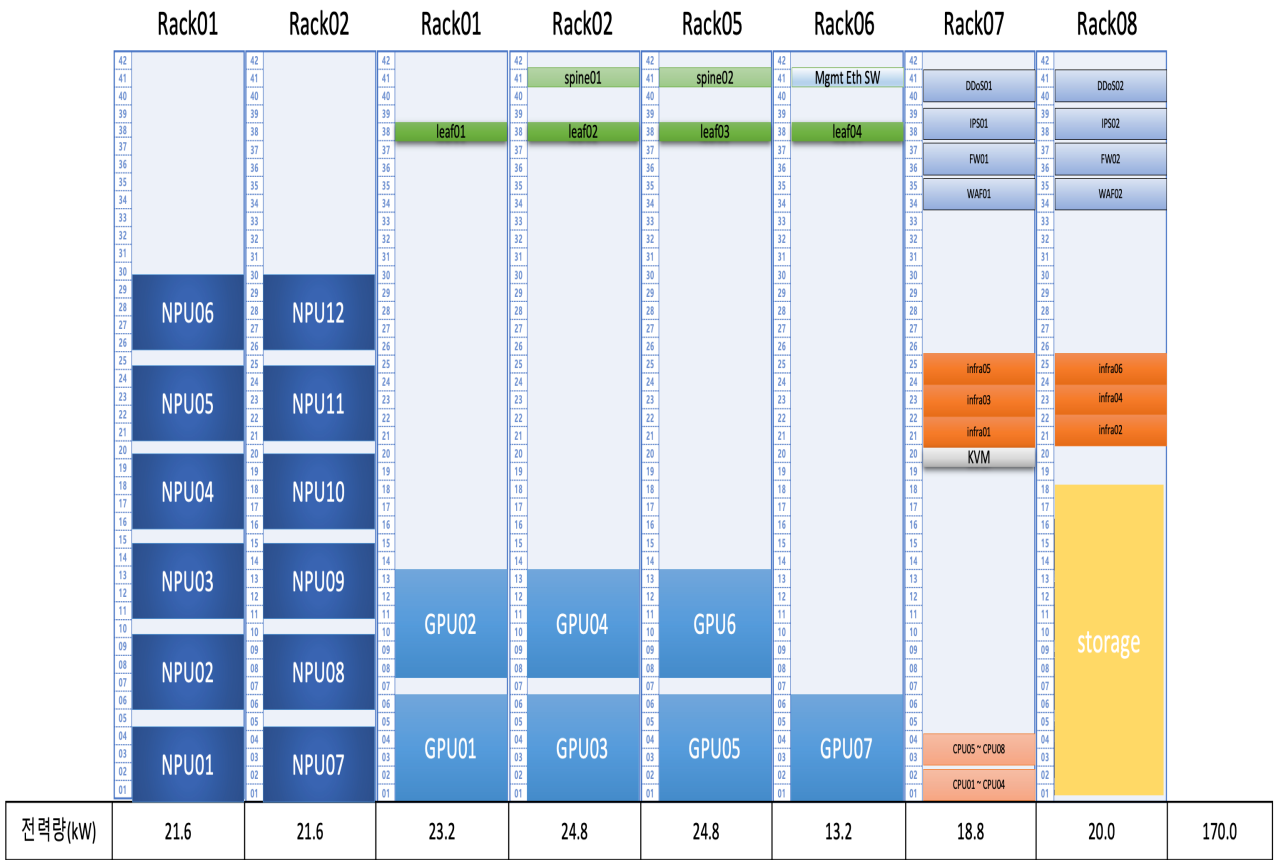
Goal of System with GPU

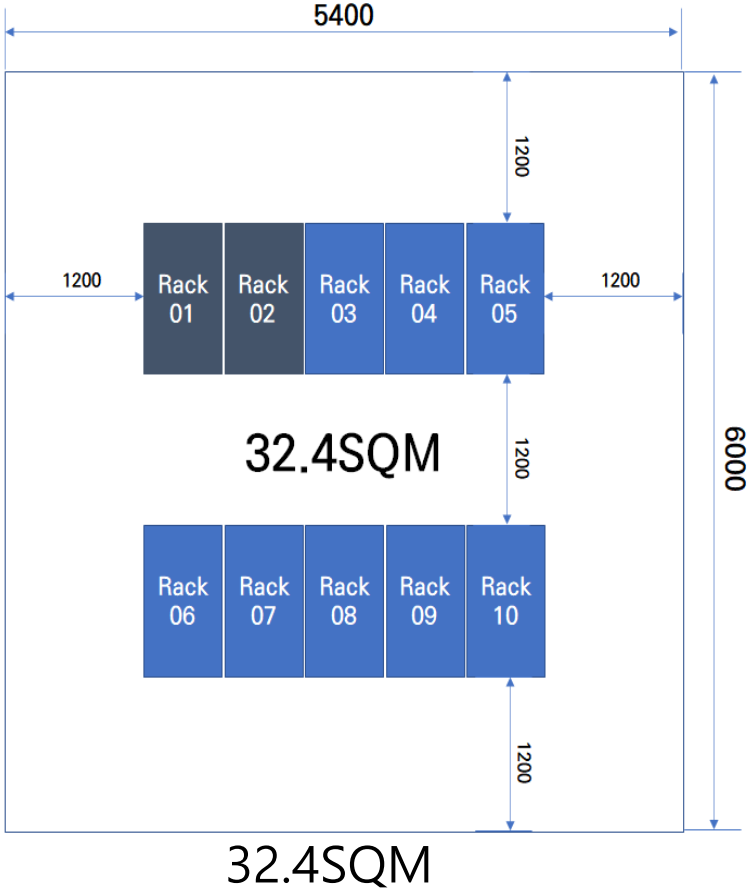
BRIN Data Center



Building HPC Infrastructure with BRIN, Indonesia

- Minimum 8 racks are required for HPC(GPU,NPU, Infra) systems, Storage, Security equipment, etc.
- Total power consumption is 180kW
- System weight is approximately 3,600Kg
- Floor space is 32.4sqm, cooling capacity is over 60RT.





Conclusion

Future plan & Conclusion

- **APAN APRP WG**
  - Expansion of participating countries and institutions
  - New funding sources for upgrading the current APRP system
  - Technical support for system maintenance and collaboration

- **A3 Foresight Program Project**
  - Building a prototype for international distributed HPC
  - Collaboration with Korea, China, Japan
  - Expand computing resource utilization

- **HPC over HPN & KRP**
  - Expansion and joint establishment of applied research through collaboration with the National Research Institute
  - Dedicated support for applied research areas
  - Establishment of scientific workflow on the Research Platform Environment

- **Extension for 3rd party research areas**
  - Climate & Weather change research areas
  - Utilize Smart Agriculture/Environmental Research
  - Cloud computing & Wireless communication

THANK YOU