

# The Asia Pacific & Korea Research Platforms: An Overview

KISTI/KREONET  
Jeonghoon Moon  
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## **1. Asia Pacific Research Platform/ in APAN**

- APAN APRP WG
- Asi@Connect Project

## **2. Korea Research Platform**

- Current Status

## **3. New Challenges**

- Related Project

## **4. Conclusion**

# Asia Pacific Research Platform

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[1] APAN APRP WG

[2] Asi@Connect Project

- **Since 2018 APRP WG initiated at APAN 45<sup>th</sup> 2018 in Singapore**  
APRP – Asia Pacific Research Platform Working Group  
APAN meeting held 2 times in a year
- **Objectives**  
The goal is to share 'xRP' experience with the members and to propose the establishment of an APRP which will be part of the GRP (Global Research Platform).
  - Promote **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**
- **Target**  
Academia and Industry
- **Executive member**  
Chair : Jeonghoon Moon, KISTI, Korea  
Co-Chair : Andrew Howard, NCI, Australia  
Secretary : Asif Khan, Perdana Univ. Malaysia
- **Asi@Connect 5th Call project by TEIN\*CC**  
Title : A High bandwidth distributed HPC (1<sup>st</sup> April 2022 – 31<sup>st</sup> March 2023)



- **Since 2018 APRP WG initiated at APAN 45<sup>th</sup> 2018 in Singapore**

2018: 45 <sup>th</sup> – Singapore (Singapore),	46 <sup>th</sup> – Auckland (New Zealand)
2019: 47 <sup>th</sup> – Daejeon (Korea),	48 <sup>th</sup> – Putrajaya (Malaysia)
2020: 49 <sup>th</sup> – Kathumandu (Nepal_Cancel),	50 <sup>th</sup> – Hongkong (Hongkong)
2021: 51 <sup>st</sup> – Islamabad (Pakistan),	52 <sup>nd</sup> – Jakarta (Indonesia)
2022: 53 <sup>rd</sup> – Bangladesh (Bangladesh),	54 <sup>th</sup> – Jinan (China)
<b>2023: 55<sup>th</sup> – Kathumandu (Nepal) coming 3<sup>rd</sup> week in March</b>	

**Total 9 times held WG meeting and 18 sessions**

- **APRP WG Scale**

Every 2 sessions, & average 12 presenters from 8 countries of Asia region

Average participant before COVID-19 offline is around 30 ~ 40

Average participant after COVID-19 online is around 50 ~ 60

From 2023, APRP WG held as a hybrid

- **Challenges**

Grant Asi@Connect project

- **Trends shift**

Big data super-highway (Required NRENs upgrade in Asia)

→ Building a platform (Lack of IT infrastructure in Asia)

→ Applying 3<sup>rd</sup> party applications (Weather/Climate, Environment, Agriculture(Smart Farm), AI, Bio-Informatics, Cloud, etc)



## Asi@Connect Project

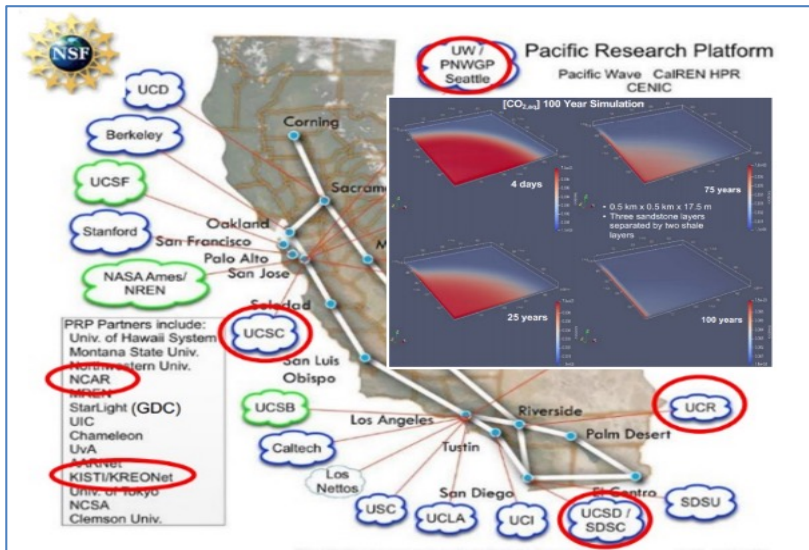
Asi@Connect provides dedicated high-capacity internet connectivity for research and education communities across Asia-Pacific; operating at speeds of up to 10 Gbps, it currently interconnects universities and research centres in 21 countries/economies across the region. It also connects to the 50 million European researchers and academics served by the GÉANT network and supports collaborative programmes in areas such as Earth observation, disaster warning, climate research, food security, delivery of e-health and e-learning. (Trans-Eurasia Information Network (TEIN) programme by EU funding which called Asi@Connect 1<sup>st</sup> – 5<sup>th</sup> call)

## Overview of APRP Project

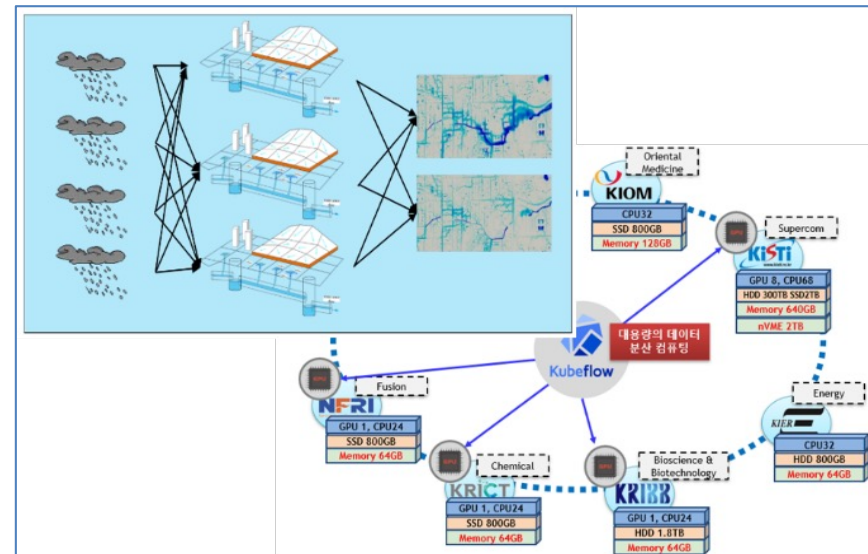
- **Title : Building a high bandwidth distributed HPC**
- **Work Package : WP4**
- **Participants : Korea, Australia, Malaysia, Pakistan**
- **Duration : 1<sup>st</sup> April 2022 – 31<sup>st</sup> July 2023**
- **Budget : 150K Euro**
- **Lead & Co-applicant :**
  - Jeonghoon Moon : Korea Institute of Science and Information Technology(KISTI)/KR
  - Andrew Howard: National Computational Infrastructure(NCI)/AU
  - Mohammad Asif Khan : Perdana University/MY
  - Nor Asilah Wati Abdul Hamid : University Putra Malaysia(UPM)/MY
  - Syed Asif Raza Shah : Sukkur IBA University(SIBAU)/PK



- Increasing big data → Required high throughput/capacity network → Big data super highway
- Lack of IT infrastructure → Computing resources → Distributed/Shared HPC
- Linked ScienceDMZs : Research Platform + Kubernetes = High bandwidth distributed HPC



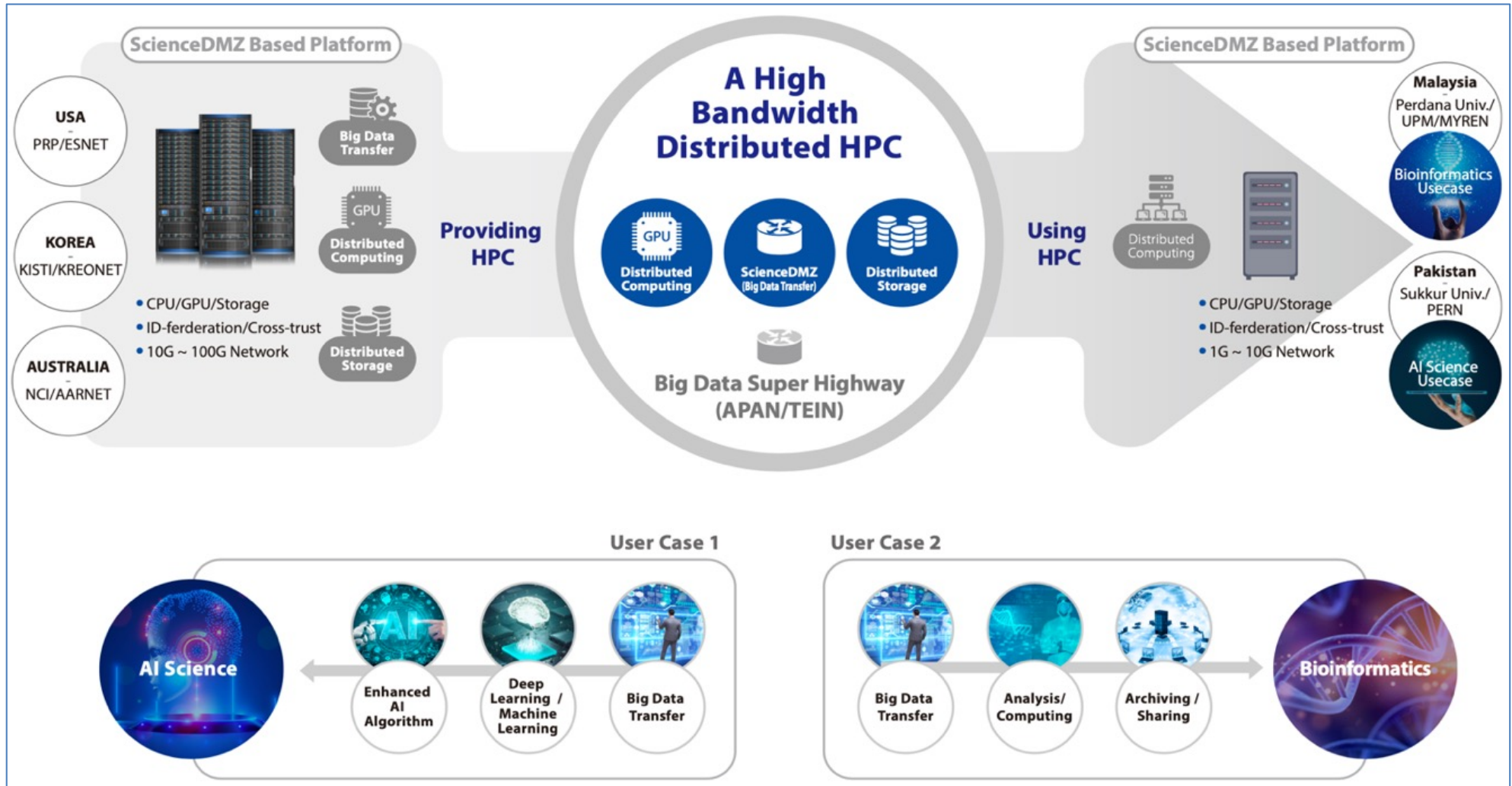
**Example1:** Using distributed computing resources over US NSF funded PRP and Computing for analysis of CO2 sequestration



**Example2:** Using distributed computing resources and LSTM data over Korea government project for climate analysis by KRP

PRP → NRP → GRP → APRP → Asi@Connect project

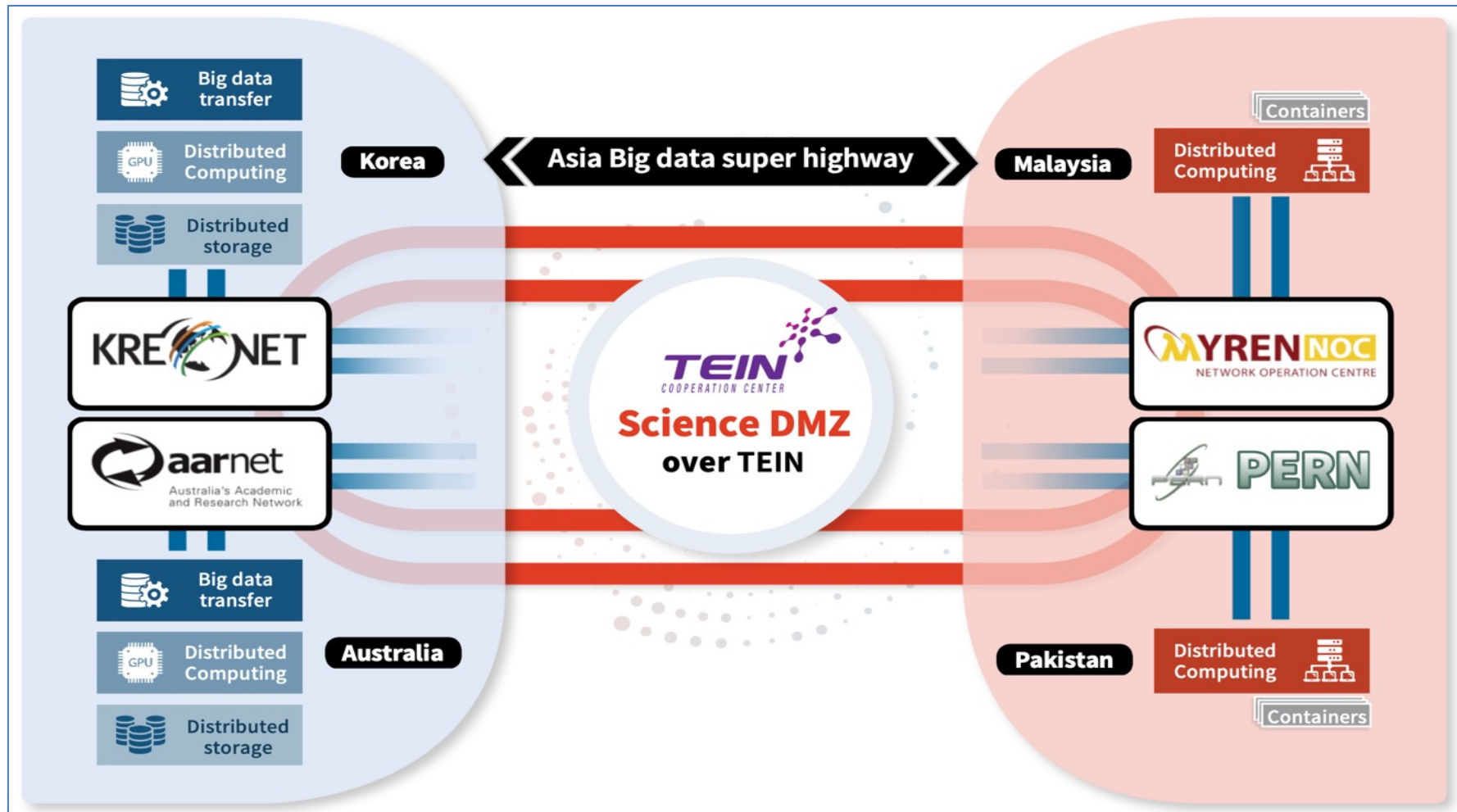
- ScienceDMZ-based high bandwidth networking architecture (participating countries via TEIN)
- Interconnect available computing recourses in a distributed environment
- Resource of computing servers will be managed by container cloud technology





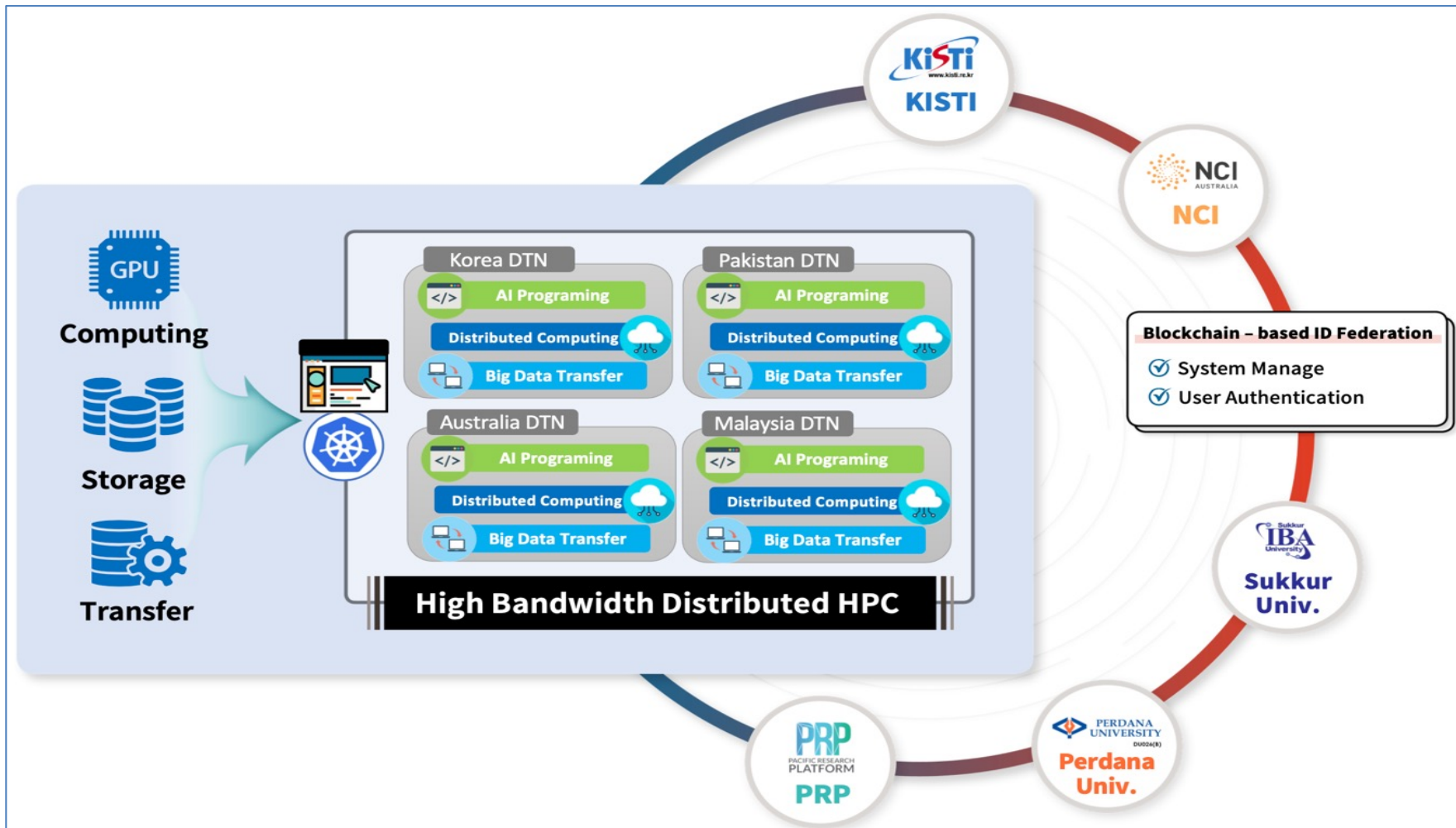
- **Activity1: Building a big data super-highway based on TEIN**
  - KREONET(KR), AARNet(AU), MYREN(MY), PERN(PK)
  - Deploy ScienceDMZ/DTN
  - Big data transfer via ScienceDMZs
- **Activity2: Building a distributed HPC platform**
  - Research Platform by Kubernetes based on container
  - CPU/GPU/Memory and Storage
- **Activity3: Presenting pilot use cases**
  - Bio-Science (MY)
  - AI-Science (PK)

- **Activity1: Building a big data super-highway based on TEIN**
  - Interconnecting participant NRENs via TEIN
  - Installing DTN at each participant institutes (ScienceDMZ)
  - Measuring the ScienceDMZ using a monitoring system (PerfSONAR)

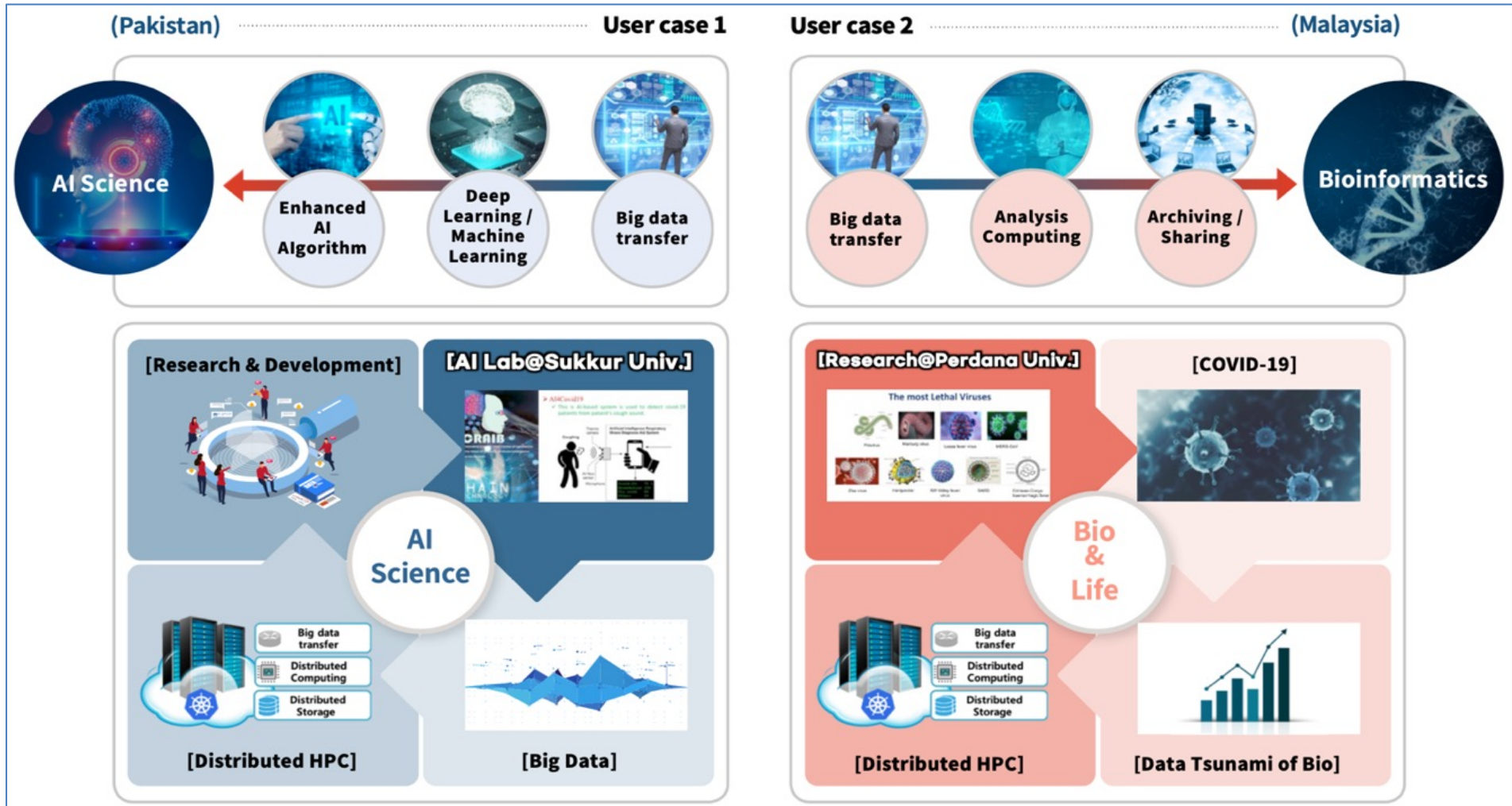


- **Activity 2: Building a distributed HPC platform**

- Building a platform to manage CPU/GPU computing resources, including storage by Kubernetes
- Building block-chain based ID federation
- Building an easy user interface

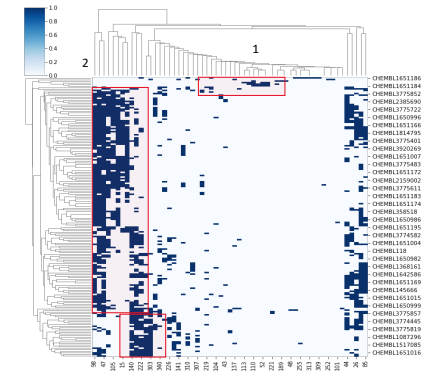
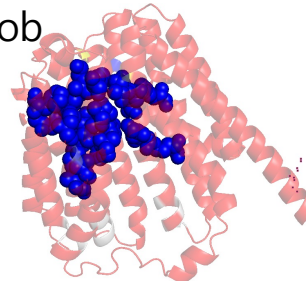


- **Activity 3: Presenting pilot application use-cases**
  - Bioinformatics-based Science use-cases
  - AI-based Science use-cases



## Activity 3: Presenting pilot application use-cases

- Bio-Science use-cases by Asif Khan(Perdana Univ. Malaysia and Turkey)
  - Applying High-Performance Computing in Drug Discovery and Molecular Simulation
  - Multiple sequence alignment (MSA) of large number of sequences on HPC
- AI-Science use-cases by Asif Raza (Sukkur-IBA Univ. Pakistan)
  - Multiple object tracking for aerial view images
  - Distributed training(MNIST), Running Distributed MPI job



Molecular Simulation: Binding Residues & Characteristics for 47-PHE, 19-ILE, 98-ARG, 140-PHE, 23-ILE, 22-VAL

1M sequences, with 1.5 TB RAM, 100 CPUs 1 hour by RefAligner

**Headway lane detection : objects history**

```

1660975669.0507231 Worker 0: training step 10045 done (global step: 19007)
1660975669.0513114 Worker 0: training step 10046 done (global step: 19008)
1660975669.0556311 Worker 0: training step 10047 done (global step: 19009)
1660975669.0912324 Worker 0: training step 10048 done (global step: 19000)
1660975669.0943574 Worker 0: training step 10048 done (global step: 19002)
1660975669.0975909 Worker 0: training step 10050 done (global step: 19044)
1660975669.0012043 Worker 0: training step 10051 done (global step: 19043)
1660975669.9041174 Worker 0: training step 10052 done (global step: 19048)
1660975669.9060892 Worker 0: training step 10053 done (global step: 20000)
    
```

NAME	READY	STATUS	RESTARTS	AGE	IP
host-mnist-for-22-test-pp-0	1/1	Running	0	9e	192.168.68.258
host-mnist-for-22-test-work-0	1/1	Running	0	9e	192.168.68.248
host-mnist-for-22-test-work-1	1/1	Running	0	9e	192.168.68.247

**Distributed Training Completed**

NAME	READY	STATUS	RESTARTS	AGE	IP
host-gates	1/1	Running	0	2m18s	192.168.68.258
host-mnist-for-22-test-pp-0	1/1	Completed	0	2m18s	192.168.68.258
host-mnist-for-22-test-work-0	1/1	Completed	0	2m18s	192.168.68.248
host-mnist-for-22-test-work-1	1/1	Completed	0	2m18s	192.168.68.247

Multiple Object Tracking for Aerial View Images



# KRP – Korea Research Platform

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- [1] Current Status
- [2] Related Projects

- Since 2015, Global partner of PRP project
- Since 2018, Leading of APAN APRP WG
- Since 2021, Expanding to 25 Korea National Research Institute

## National Scale

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

☞ For 25 Korea National Research Institutes & 4 University of Advanced Science & Technology

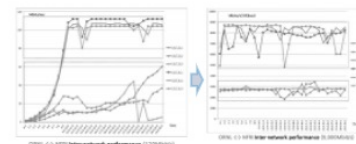


### Key elements

- Borderless single domain transfer performance level
  - ☞ Eset ScienceDMZ level
- A Unified authentication system without boundaries

### Example of Nuclear Fusion Research

Improve transfer performance about 75 times after ScienceDMZ deploy  
 ☞ To expand the national scale



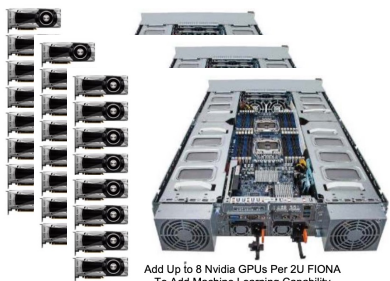
- Korea Research Platform expanding to 25 National Research Institutes
- HPC(Supercomputer, Cloud, Storage) over HPN and global federation

## HPC over HPN: A High bandwidth distributed HPC

Korea Research Platform (1G ~ 100Gb/s)

Faster workflow with big data

GPU-DTNs



Add Up to 8 Nvidia GPUs Per 2U FIONA To Add Machine Learning Capability



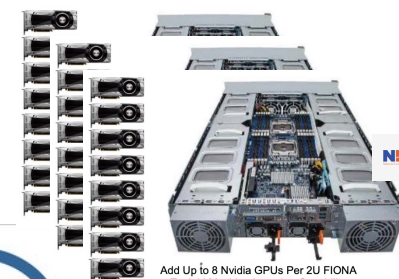
DATA center

Nurion



KISTI Supercomputer

GPU-DTNs



Add Up to 8 Nvidia GPUs Per 2U FIONA To Add Machine Learning Capability



DATA center



# New Challenge

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[1] Related Projects in Korea

## 1. Smart Hospital development project (Grant Sept 2022)

- Title : The Construction of patient-tailored, hyper-personalized digital medical ecosystem based on Omni-verse platform
- Participants: 20 Institutes, Hospital, and Company (Koryo Anam General Hospital, LG Electronics, Kakao, KISTI, KHNP and etc)
- Total budget: About 15M\$(8 years)
- KISTI: 1.8M\$ (8 years)
- Research contents (KISTI/KREONET part)
  - Big data super-highway for inter-hospital and Human & Genome data centers
  - High speed wireless communication inter/intra smart hospital
  - IT Technologies for Smart Hospital



고려대학교의료원  
KOREA UNIVERSITY MEDICINE



kakao



Korea Institute of  
Science and Technology Information



KHNP  
KOREA HYDRO & NUCLEAR POWER CO., LTD

## 2. Korea Rural Development Administration project (Grant March 2022)

- Title: Development of integrated linkage system for agricultural big data and utilization model
- Participants: Seoul National Univ., KISTI
- Total Budget: About 450,000\$(3years)
- KISTI: 150,000\$(For 3years)
- Research Contents (KISTI/KREONET part)
  - Agriculture big data transfer
  - Running Crop model on the Research Platform (Using CPU & GPU)
  - Establishment Research Platform for end-user(Farmer) & developer(Agriculture Researcher)



서울대학교 농업생명과학대학  
College of Agriculture and Life Sciences



Korea Institute of  
Science and Technology Information



농촌진흥청

Rural Development Administration

## 1. Korea Environment Institute Project grant Dec 2022

- Title : Establishment and development of a Smart decision-making system based on diverse environment model
- Participants: KEI, KISTI, Several Commercial Company
- KISTI budget : About 1M\$(for 3-4years)
- Research contents (KISTI/KREONET part)
  - Building a Container based Research Platform & Ceph storage
  - Building a Distributed Research Platform based on Multi-Institutional HPC(Weather, Agriculture, Environment Institutes and statistical data)
  - Operation of various models on the Research Platform



## 1. APRP WG in APAN

- Enhancement APAN APRP WG
- Collaboration with related WG(Agriculture, Medical and Cloud) in APAN
- Finding new project after Asi@Connect project

## 2. Deploy Research Platform to Asia region and Korea Domestic Part

- Enhancement KRP to Asia areas through the TEIN project
- Expanding to 25 National Research Institute
- For AI & High performance computing environment

## 3. New Challenge

- Expanding to Disaster(Urban flooding) and AI Education areas
- Expanding to Wireless (5G and 6G)

