

Introduction to Korea Research Platform

KISTI/KREONET
Jeonghoon Moon
9th Oct 2023





1. Background KREONET

- Introduction of KREONET

2. Related Projects

- Smart Agriculture
- Smart Decision-making system
- Smart Hospital development project

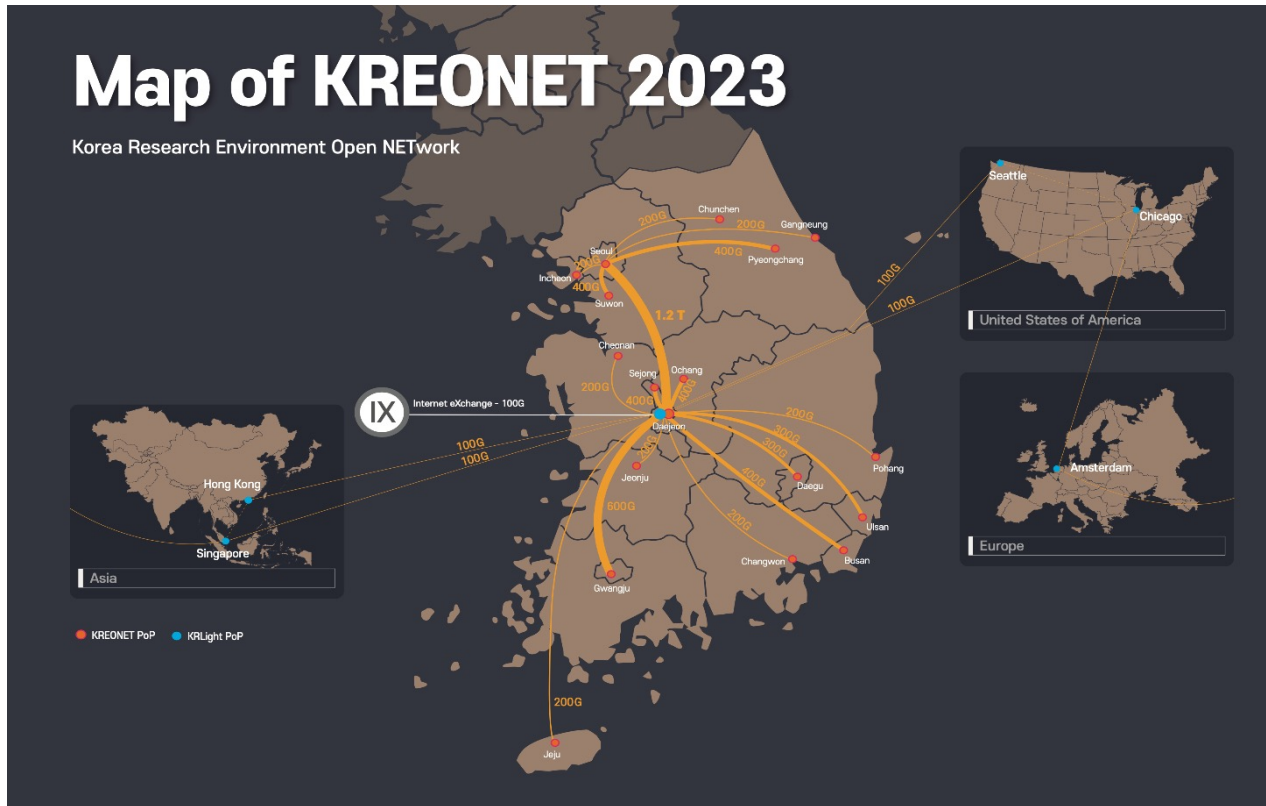
3. Korea Research Platform

- KRP
- HPC over HPN
- Current KRP platform status

4. Conclusion

Background KREONET

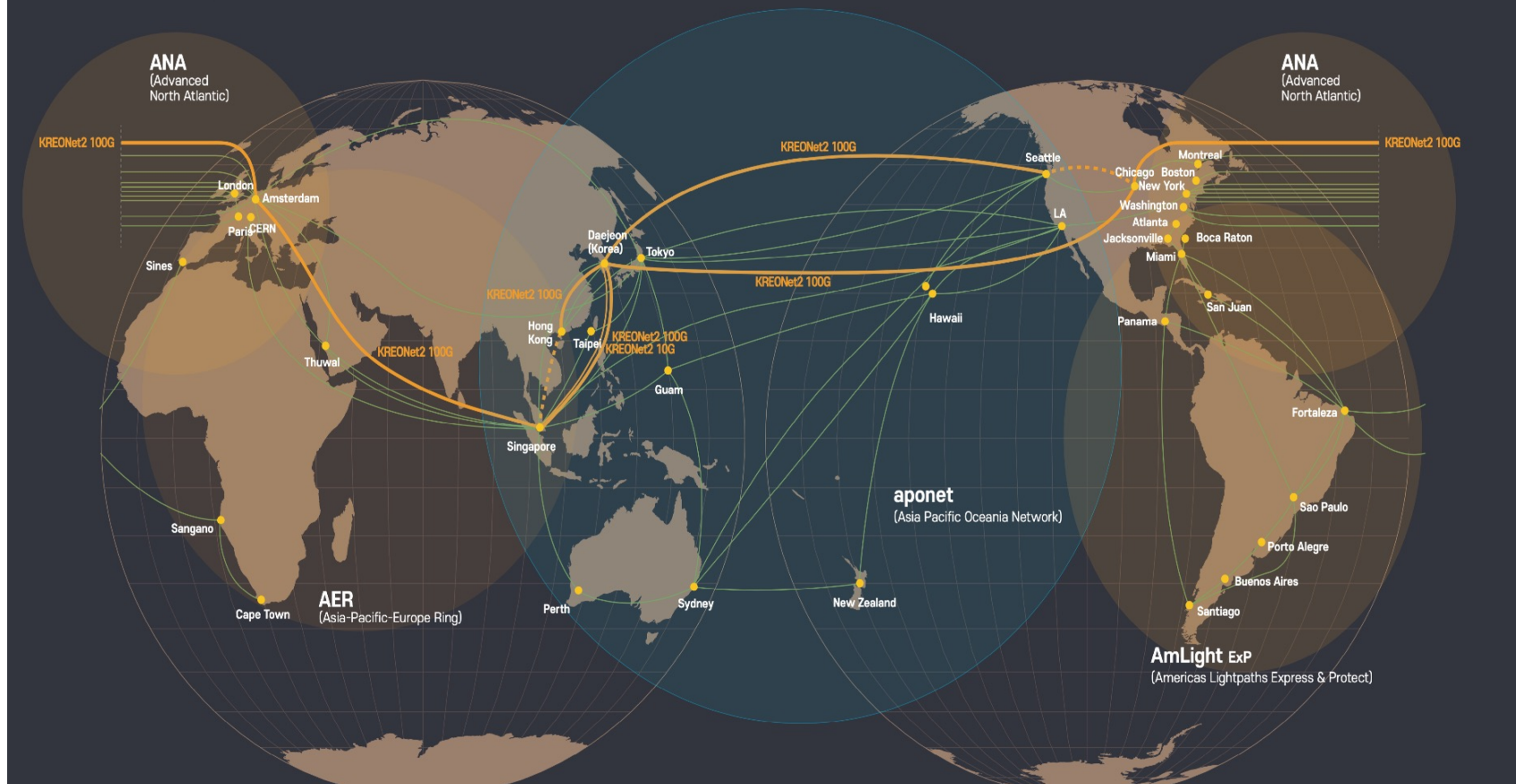
[1] Introduction of KREONET

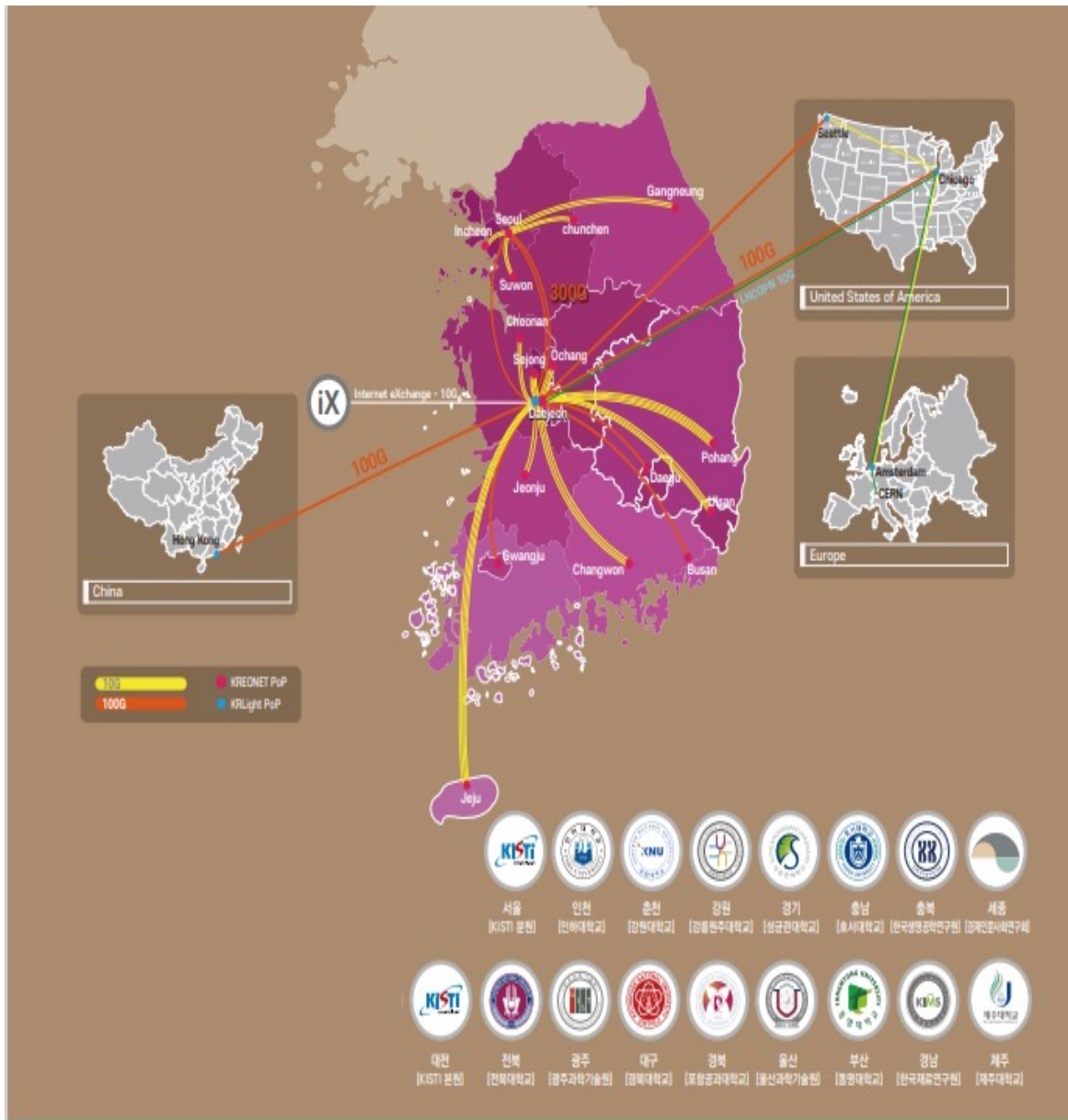


- **Max 1.2Tbps Backbone and 17 local gigapops for domestic**
 - Among Seoul, Daejeon, Kwangjoo, Busan, Daegu: 200Gbps
- **100Gbps 5 Gigapops for international**
 - Hongkong, Seattle, Chicargo, Amsterdam, Singapore
- KREONET-NOC, 24*365 Operating service
- Domestic IX (KT, SKB, Sejong Telecom) and International GIX (2G) connection service, COGENT(10G, Seattle)
- Connection for Commercial and public Cloud service
- 203 member of Institutes (over 0.5 million member)

- GLORIAD, Since 2005

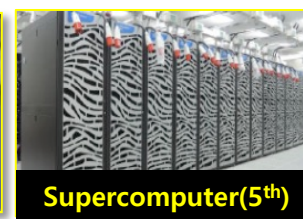
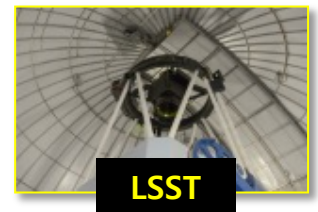
Map of KREONET2 2023





No.	Local Center	Institute
1	Daegu	KNU
2	Kyungki	SKKU(Suwon Campus)
3	Busan	TMU(동명대학교)
4	Sejong	NRC(경제인문사회연구회)
5	Incheon	Inha Univ.
6	Kyungbook	Postech
7	Kyungnam	KIMS
8	Kwangjuu	GIST
9	Kangwon	GWNU
10	Chungnam	Hoseo Univ.
11	Chuncheon	Kangwon Univ.
12	Ulsan	UNIST
13	Jeonbuk	JBNU
14	Jeju	Jeju Univ.
15	Chungbook	KRIBB(Ochang Branch)
16	Daejeon	KISTI Main
17	Seoul	KISTI Branch

AREA	Institutes	Contents	Bandwidth
High Energy Physics	Seoul National University and 14 Institutes (서울대학교 격자게이지 이론연구단 외 14개 기관)	- 입자가속기 중심의 실험데이터를 국내연구진의 글로벌 전송/활용	1G-10G
Astronomy Space	Korea Astronomy and Space Science (천문연구원, 국토지리정보연구원(전파망원경센터))	- 울산, 세종, 제주, 서울에 구축된 전파망원경 관측 데이터의 상관센터 중심의 데이터 공유	100G-40G
	Korea Astronomy and Space Science 천문연구원(SDO)	- NASA 태양위성 관측 이미지를 글로벌 전송 및 국내 우주기상센터간 전송	10G
	Korea Astronomy and Space Science 천문연구원(SKA, LSST)	- 칠레, 남아프리카공화국 에 위치한 광시야 망원경 관측 데이터의 공유	10G
Genome/Bio	Seoul National University Hospital and 8 Institutes 서울대병원 CMI센터외 8개 기관	- ICGC 유전체 데이터 중심 RDC센터 구축	10G
Meteorology	The National Weather Service and 5 Institutes (기상청외 5개 기관)	- 기상청 슈퍼컴퓨터 및 기상데이터 공유 및 연구 활용	1G-40G
KSTAR	National Fusion Research Institutes NFRI외 3개 기관	- KSTAR를 활용한 데이터 저장 및 연구활용	100G
Basic Science Facility (기초연구 관측장비)	Institute of Basic Science (기초연구원)	- 대형현미경으로 관찰된 고해상도이미지 및 데이터 전송	10G
Education	Pusan University and 5 Institute (부산대학교외 5개기관)	- 데이터, 계산자원, 저장자원의 연계를 통한 대규모 인력교육(원격)	1G-10G
Building Construction	KOCED-CI(1,2차 실험센터)	- 지진실험 등 대규모 건설/건축 실험장비를 활용한 연구 및 교육	1G
Particle Accelerator	Pohang Accelerator (포항가속기센터(4세대))	- 포항가속기센터에서 연간 실험/발생되는 데이터의 공유	10G



Korea Research Platform

- [1] Korea Research Platform
- [2] HPC over HPN
- [3] Current KRP platform status

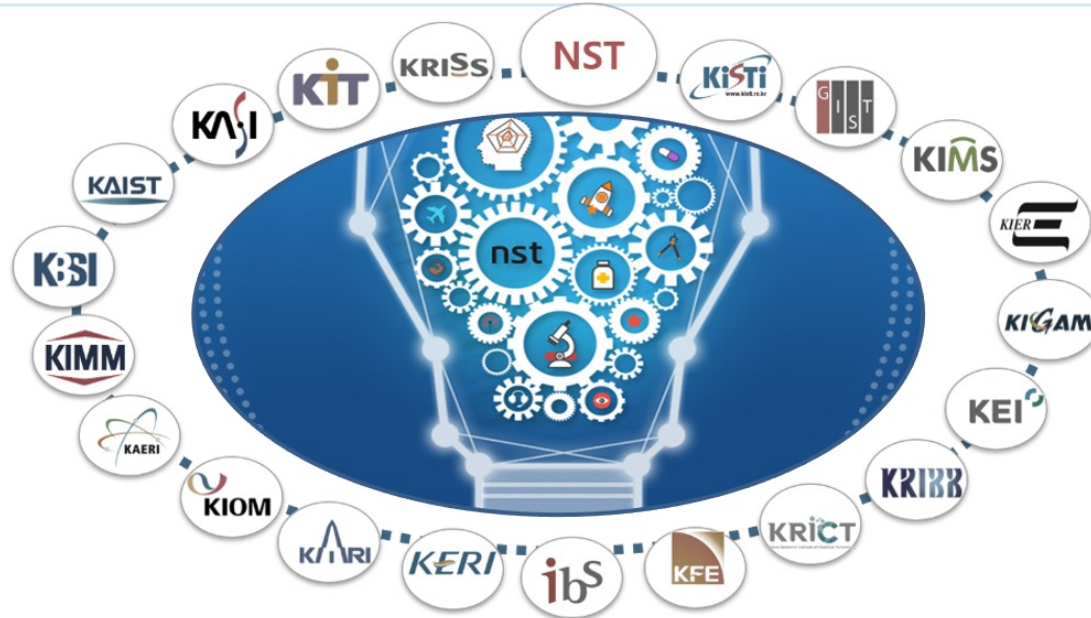


- Since 2015, Global partner of PRP project
- Since 2018, Leading of APAN APRP WG
- Since 2021, Expanding to 25 Korea National Research Institute

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

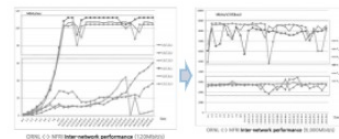


Key elements

- Borderless single domain transfer performance level
 - ☞ Esetnet 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



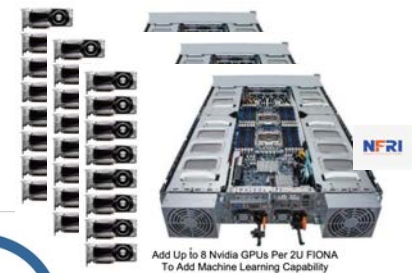
DATA center

Nurion



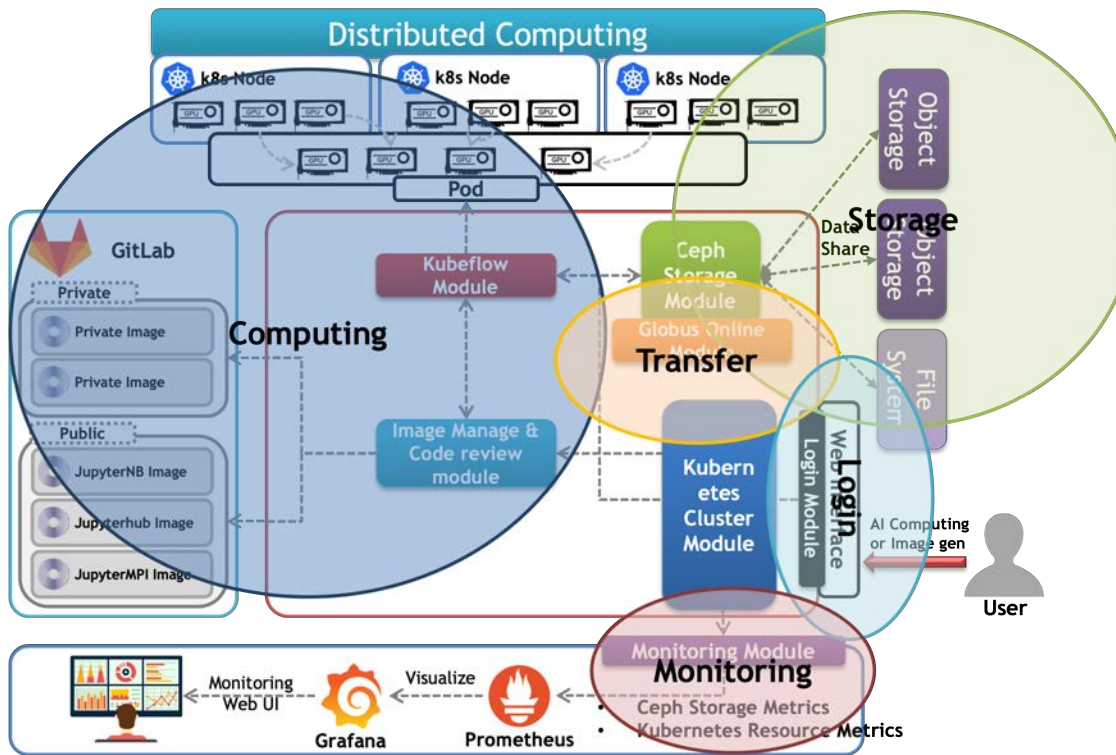
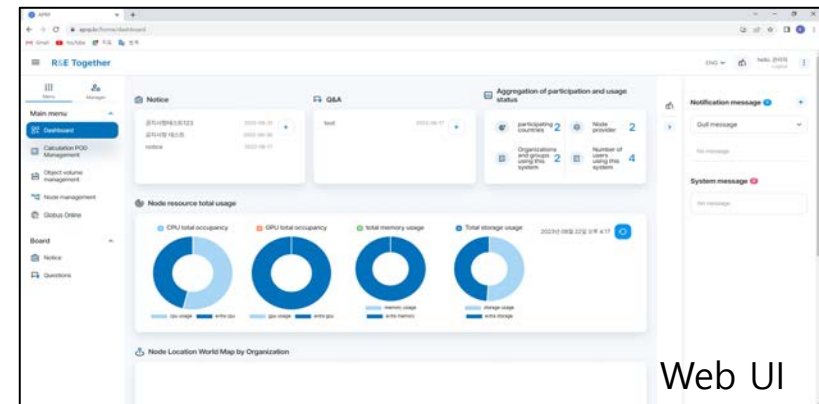
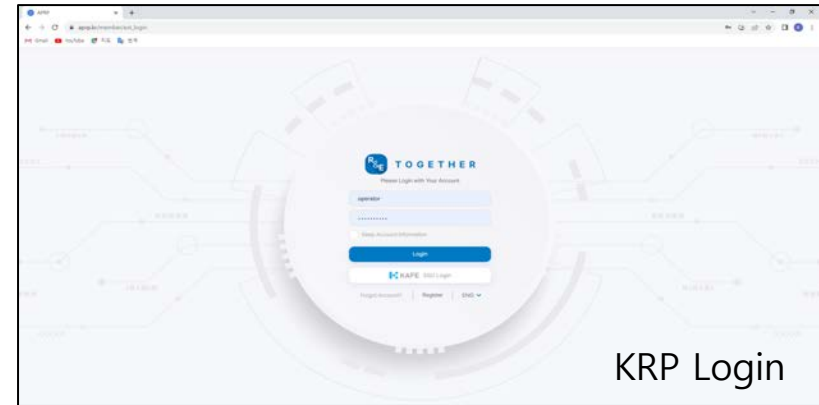
KISTI Supercomputer

GPU-DTNs

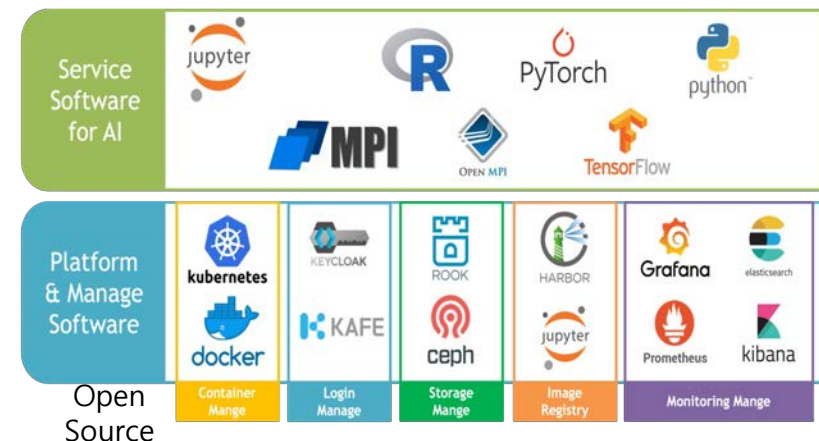


DATA center

- **Korea Research Platform**
 - Several prototype KRPs
 - GPU intensive, CPU intensive, Storage intensive type
- **Applications**
 - Analysis of Urban flooding by LSTM
 - Analysis of Solar Visual data by High intensive GPU(Astronomy)
 - Several distributed computing task based on AI & GPU



Platform Architecture



Related Project

- [1] Smart Agriculture
- [2] Smart decision-making system
- [3] Smart Hospital development project



1. 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



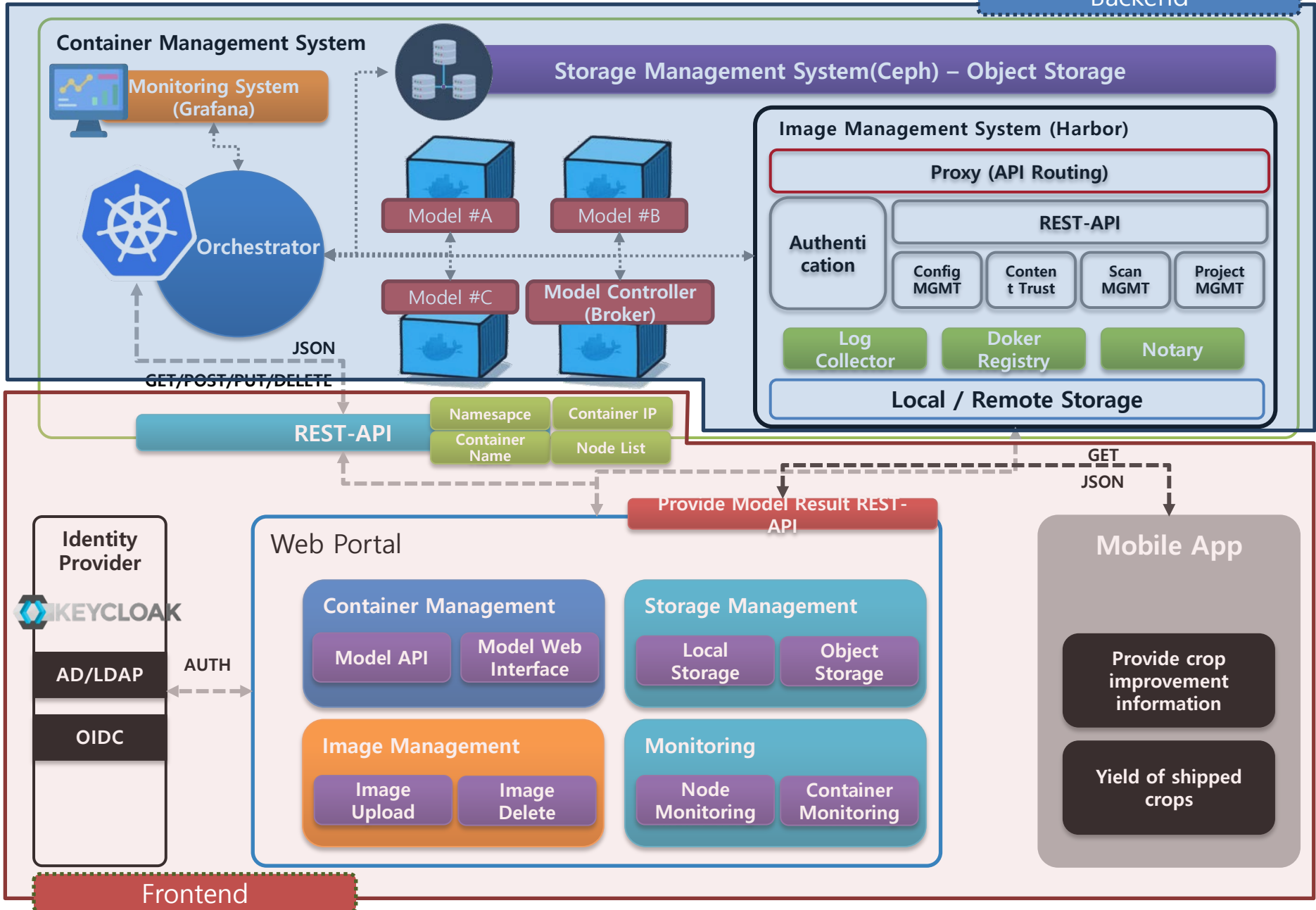
Korea Institute of
Science and Technology Information

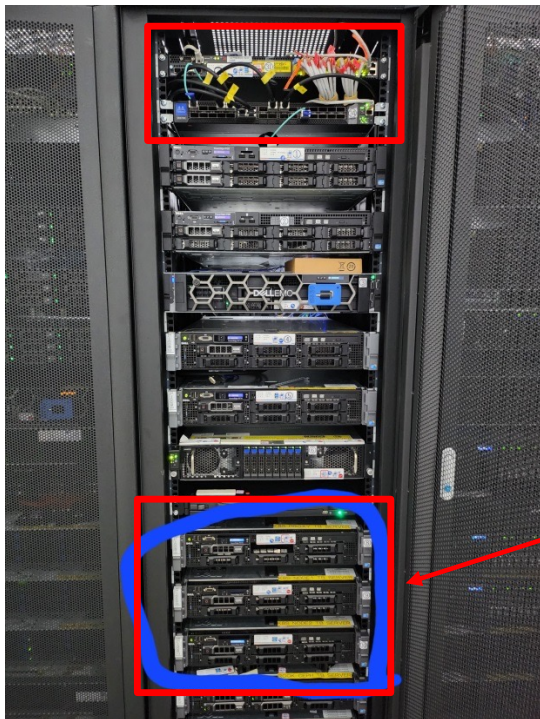


농촌진흥청

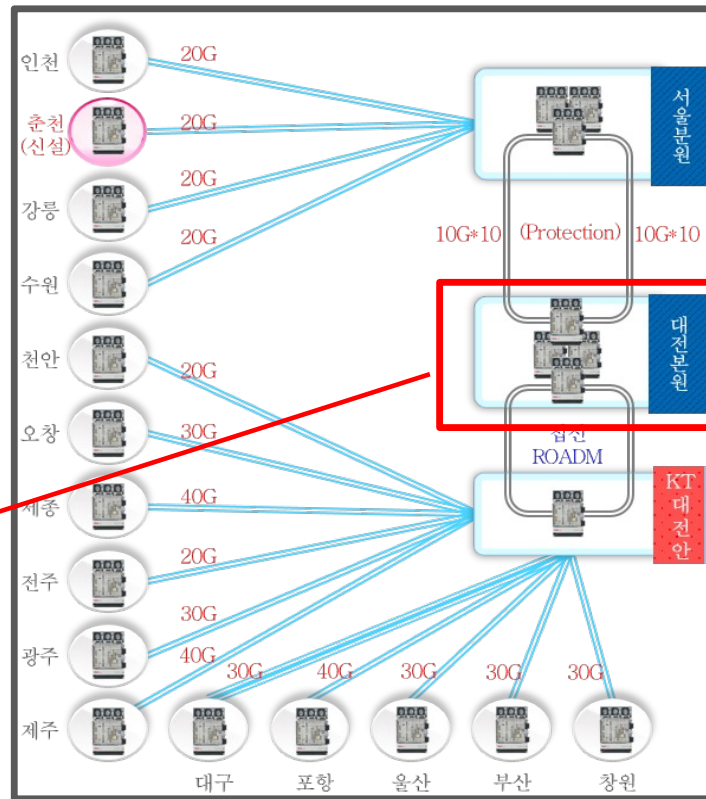
Rural Development Administration

Backend

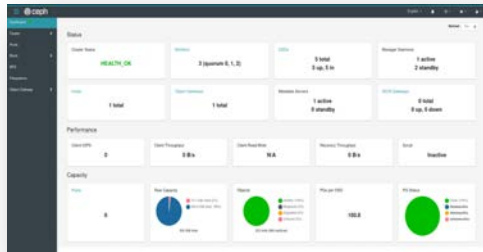




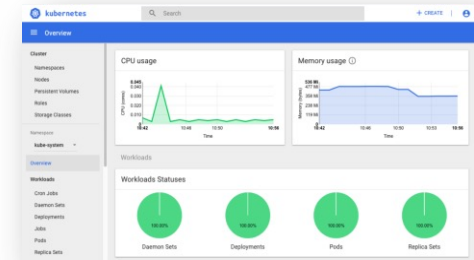
- 3 DELL R710 server, Network switch (CPU 12core, Memory 72GB, 1G NIC)
- 1 Gygabyte storage server (CPU 104core, Memory 256GB, 1G NIC, DISK 6.4TB)



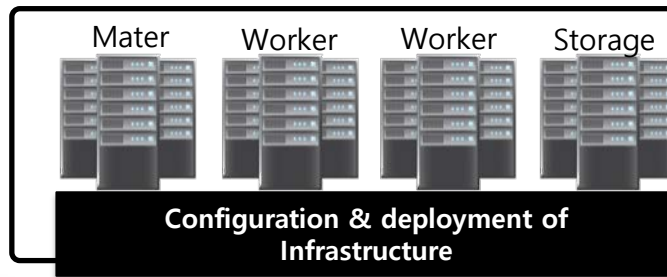
Infrastructure pilot construction
Seoul-Junju through high-speed connection available by KREONET



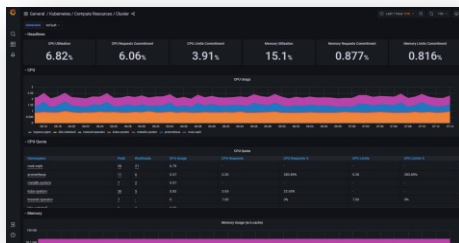
Storage management system (Ceph)



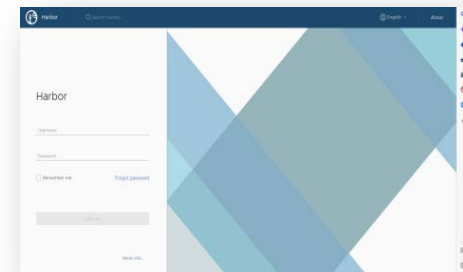
Container management system(K8S)



```
[root@rne-master1 ~]# kubectl get nodes
NAME          STATUS    ROLES
ceph-node     Ready    <none>
rne-kist1     Ready    <none>
rne-kisti2    Ready    <none>
rne-master1   Ready    control-plane,master
```



Cluster resource monitoring system (Prometheus & Grafana)

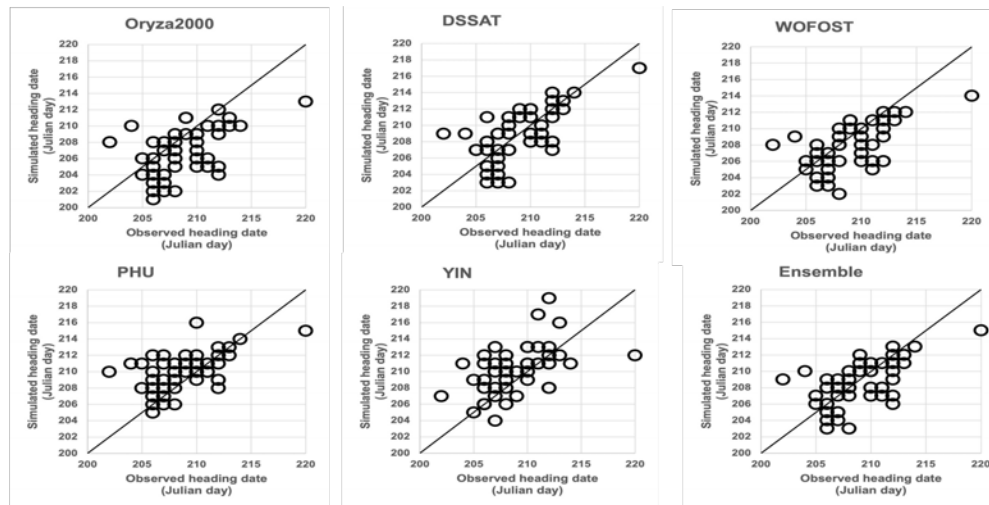


Model API management system (Harbor)

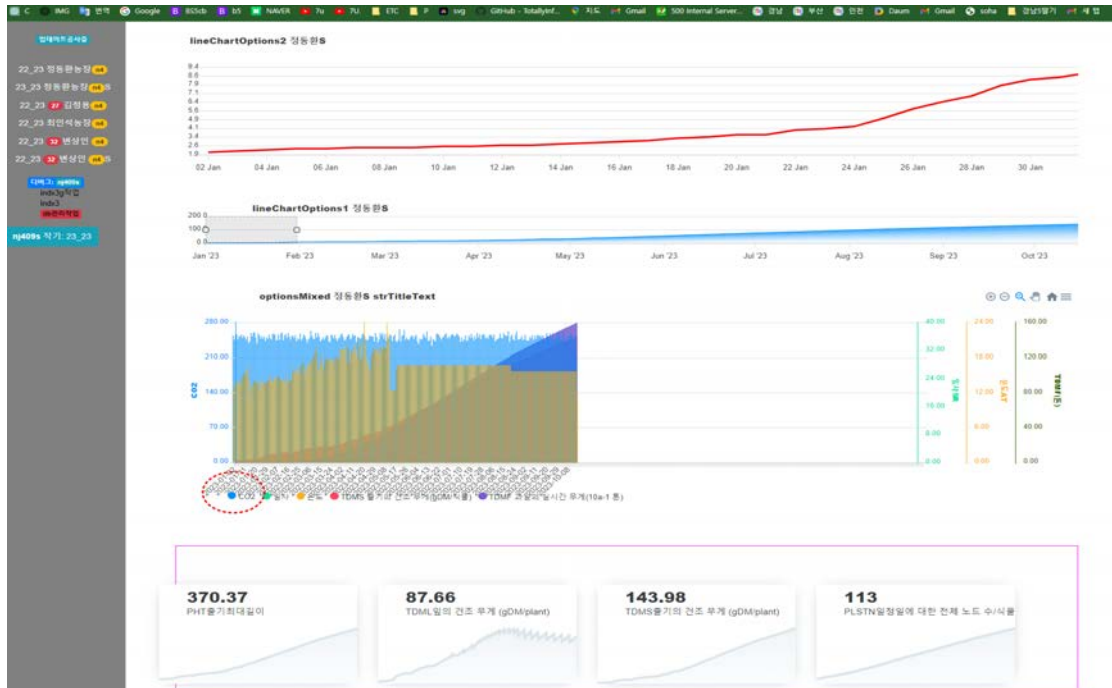
- Development of API for ensemble prediction of rice planting season
- Rice harvesting season prediction results: individual models and ensemble



	Oryza2000	WOFOST	DSSAT	PHU	YIN	Ensemble
철원	2.8 ₂	2.6 ₁	3.1 ₃	3.5 ₆	3.1 ₃	3.1 ₃
춘천	3.6 ₆	2.8 ₃	2.3 ₁	3.3 ₄	3.3 ₄	2.6 ₂
강릉	4.2 ₅	3.5 ₄	1.8 ₁	2.7 ₃	4.2 ₅	2.4 ₂
화성	3.8 ₆	2.5 ₄	2.3 ₃	1.7 ₁	3.7 ₅	2.1 ₂
안동	3.8 ₆	3.2 ₄	3.4 ₅	3.0 ₂	2.5 ₁	3.1 ₃



- Tomato growth prediction (service testing in progress)





2. Korea Environment Institute Project grant Dec 2022

- Title : Establish an integrated impact assessment platform and build an ensemble of multi-climate scenarios based on the new climate regime (AR6)
- 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





3. 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

KREONET Giant Group Researches

[1] Astronomy, HEP, Weather & Climate, Genome & Bio, KSTAR, TEM

Institute/University

- KASI, Ulsan Univ., Yeonsei Univ., KIAS, Chungbuk Univ.
- SDO, SDSS, KVN, KMTNET

Network Resource /Technology

- Between Radio Telescope : 10-40G Carrier Ethernet
- Data Center(Daejeon): 100G
- SDO Data Center: 10G
- KMTNET 10G

Activities

- eKVN Data Transfer (3 Radio Telescope, Yeonsei Univ. Tamra Univ. Ulsan Univ.)
- Observation Data for international : Chile, Australia, Optical Telescope remote operation/ Observation data transfer



Institute/University

- SNU, Korea Univ., Sejong Univ., GSDC/KISTI, KNU, UOS, Busan Univ., Youngkwang Nuclear Generating Station, Hanyang Univ., Soosil Univ.
- CMS, ALICE

Network Resource /Technology

- LHCOPN(10G/GSDC -to- CERN)
- LHCONE (VRF)
- Youngkwang Nuclear Generating Station Detector (10G)
- GRID Computing (KNU/10G)

Activities

- Tier 0-Tier1-Tier2 Data Transfer
- KEK(JP)
- CMS, ALICE. Collaboration
- STAR-PROJECT (Busan Univ.)



Institute/University

- KMA, KMA Supercomputing Center(Ochang), Busan Univ., PKNU, KBS Disaster Broadcasting Center, KAERI, APEC Climate Center

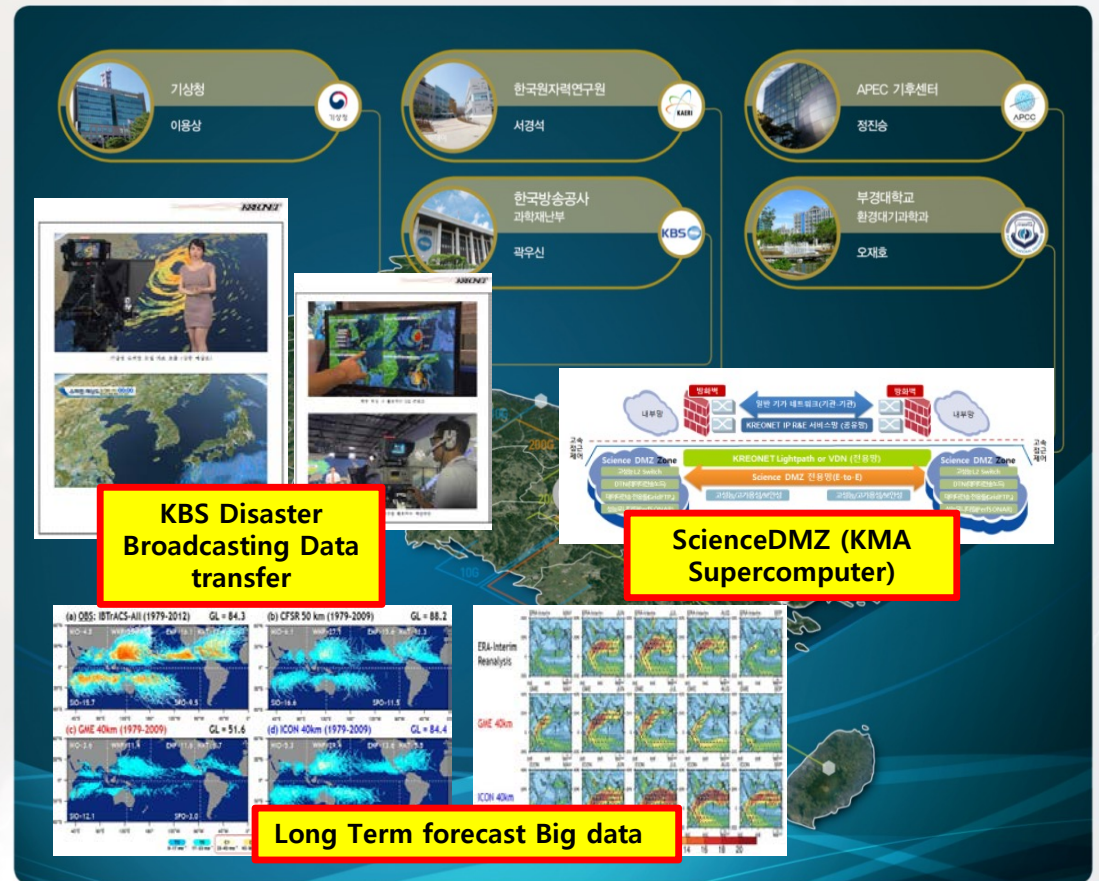
Network Resource /Technology

- SCIENCEDMZ
- : KMA Supercomputing Center (10G)
 - APCC, Busan Univ., PKNU
- KMA(HQ)-Weather Group of R.O.K Air Force(1G)
- KBS Disaster Broadcasting(1G)

Activities

- SCIENCEDMZ
- : KMA Supercomputing Center(10G)
 - APCC, Busan Univ., PKNU
- KMA(HQ)-Weather Group of R.O.K Air Force(1G)

기상/기후 첨단연구기관



Institute/University

- SNU Hospital, Kangbuk SNU Hospital, Iwa Univ. Hospital, Seoul Health College, SNU, SNU-CMI, NCC, KOBIC, CODA, Hanyang Univ, UNIST, Soongsil Univ

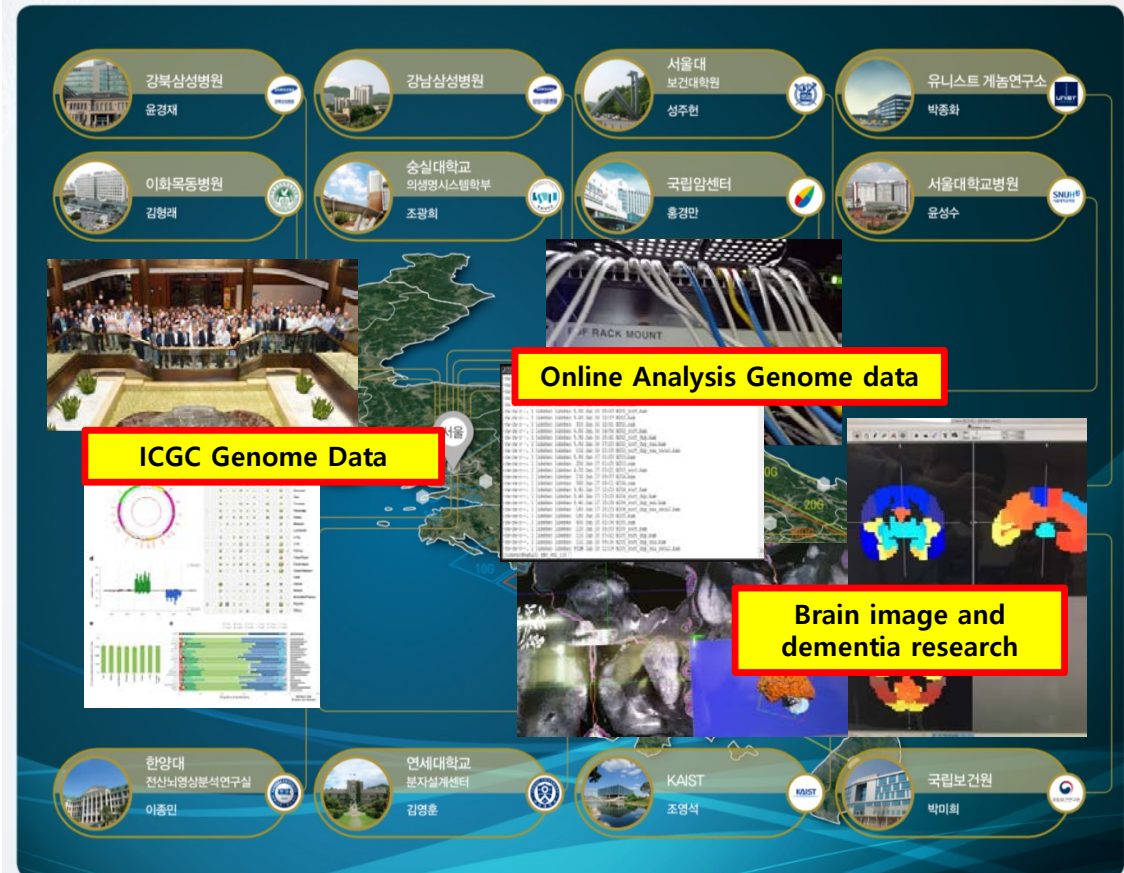
Network Resource /Technology

- SCienceDMZ (SNU CMI/10G)
- Quantum encryption communication (CODA-KOBIC)
- ICGC Data Storage share network (6 Institutes 1G/VLAN)

Activities

- WGS/ICGC Genome data transfer
- Patients Privacy Protect and share environment
- TB Genome data support for RDC

게놈/바이오 첨단연구기관



Institute/University

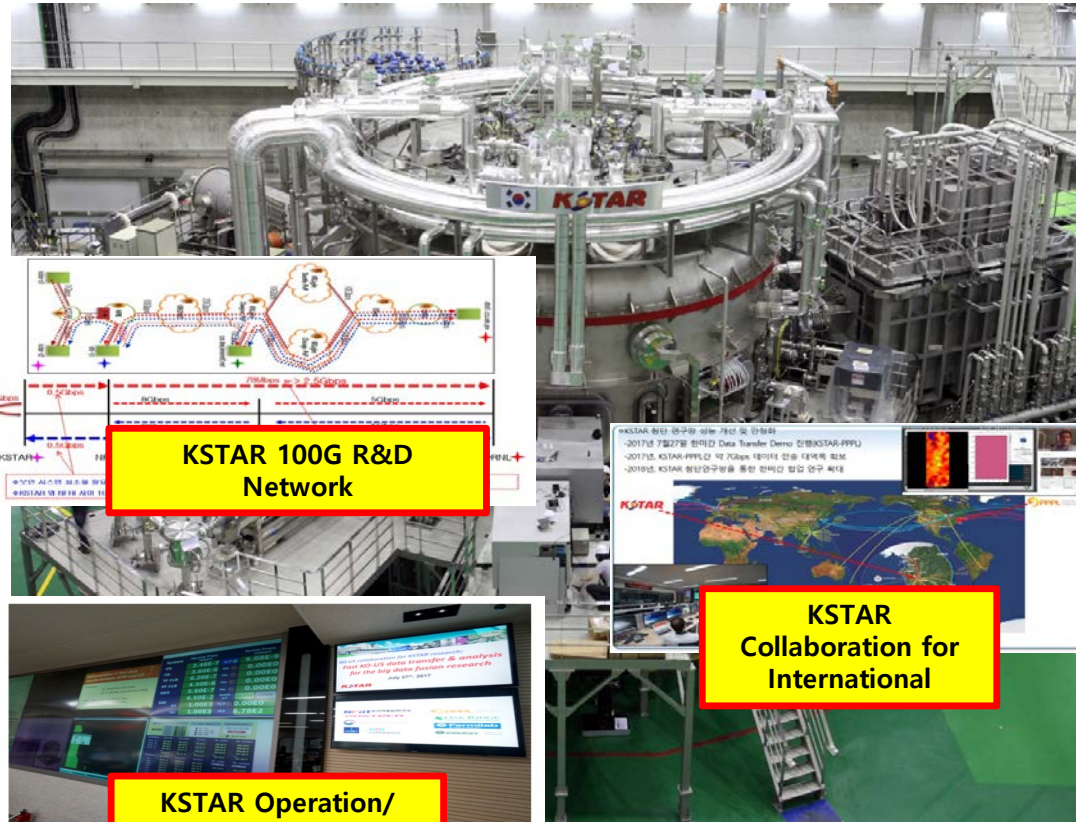
KTAR/NFRI(Nation Fusion Research Institute)

Network Resource /Technology

KTAR (100G)
100G Real time performance monitoring System(PerfSONAR-100G)
100G DIRECT PATH

Activities

KSTAR Big data collaborative research (Kr-US)
Real time remote data analysis



지난 7월 27일, 국가핵융합연구소에서는 한-미 간 빅데이터 고속 전송 시연이 진행되었다.

Institute/University

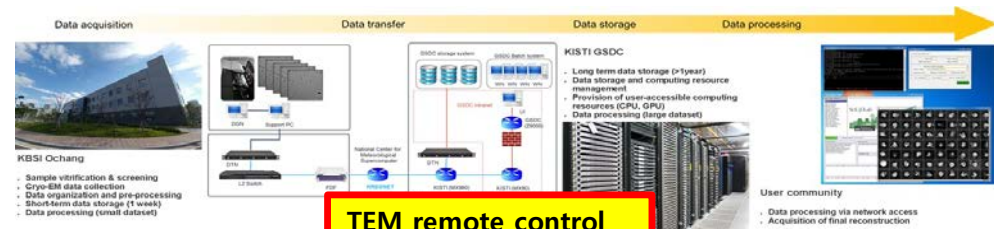
- KBSI/TEM , KISTI/GSDC

Network Resource /Technology

- KBSI/TEM – GSDC 10G Light Path (LP over WDM)
- ScienceDMZ 10G

Activities

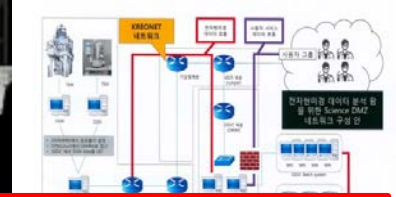
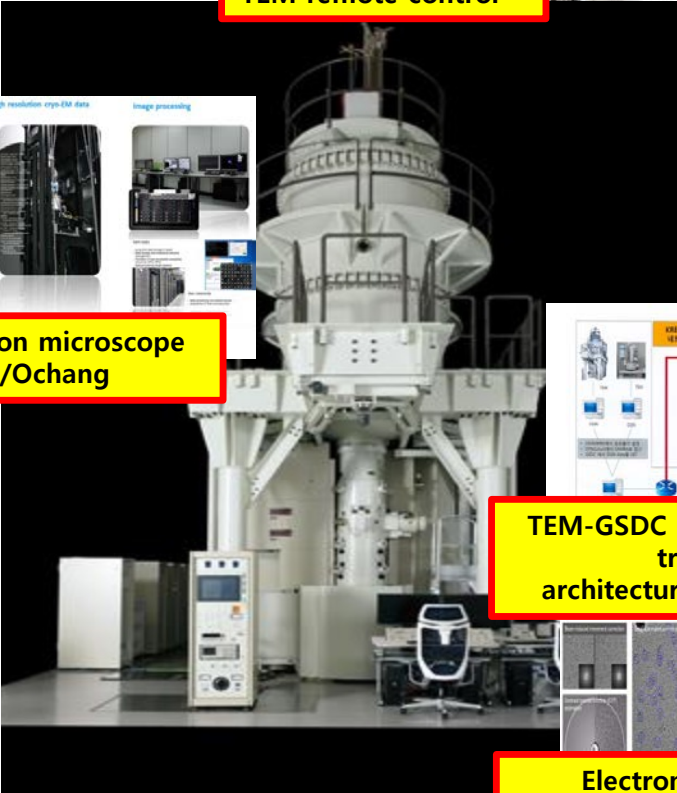
- Experiment/Observation data
- Remote access/remote observation/support



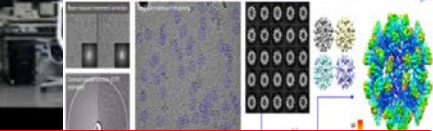
TEM remote control



Electron microscope /Ochang



TEM-GSDC Large scale data transfer architecture(ScienceDMZ)



Electron microscope Experiment/Data

Conclusion



- **HPC over HPN**
 - Expansion and joint establishment of applied research fields through strengthening collaboration with government-funded research institutes
 - Discussion on ways to jointly utilize insufficient GPU computing resources in the field of artificial intelligence
 - Strengthening international collaboration research by expanding international big data transmission
- **Extension for 3rd party research areas**
 - Smart Agriculture
 - Environmental research on climate change
 - Cloud computing & Wireless communication

