

# Introduction of AI PaaS network environment of KREONET based on ScienceDMZ and activities

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14th Feb 2019

National Institute of Supercomputing & Networking

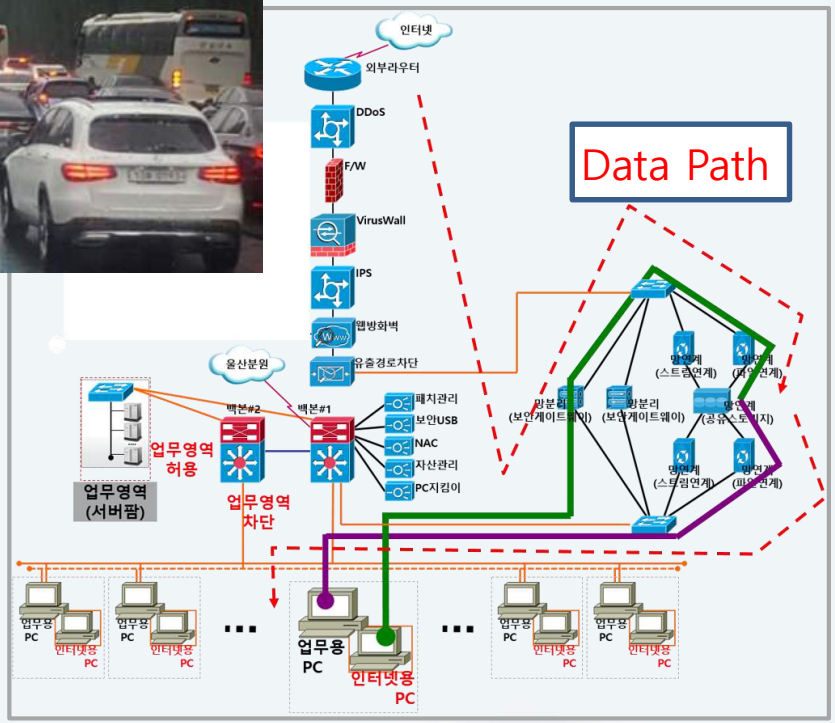
# Big Data Super Highway = ScienceDMZ

KiSTi Korea Institute of Science and Technology Information

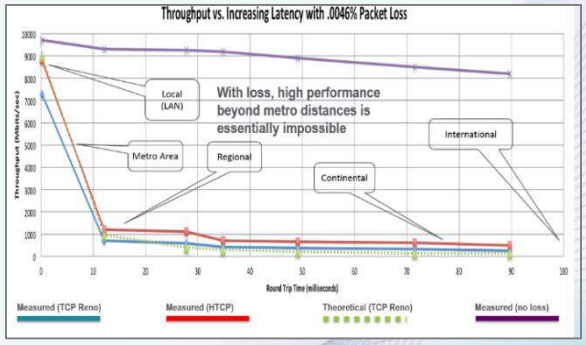
## Network Environmrent changes for Peta scale data transfer



Current Research Network aspect of Data Intensive Science




7 steps for Security




0.0046% Packet loss makes huge performance down

# Global Leading Group : ScienceDMZ

Korea Institute of Science and Technology Information

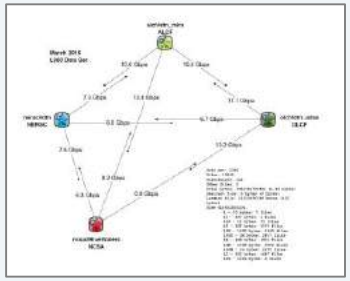
## US Research & Education Network based on ScienceDMZ

| 2012-2015 | 2015-2020 | 2017 - |
|---|---|---|
| CCNIE | PRP | NRP |
| Institute and University network Upgrade for big data transfer | Pacific Research Platform(PRP) – Create Big data freeway by global lambda networking | Nation wide scale for US |

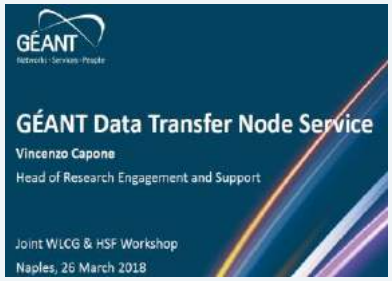
### ScienceDMZ Case Study




**US/CENIC**
PRP Proejct, connecting Science Big Data sources with ScienceDMZ (Calit2)



**US/ESNET**
ESNet connecting Supercomputers with ScienceDMZ (ESNet)




**Europe/GEANT**
EU trying to Implement ScienceDMZ on GEANT



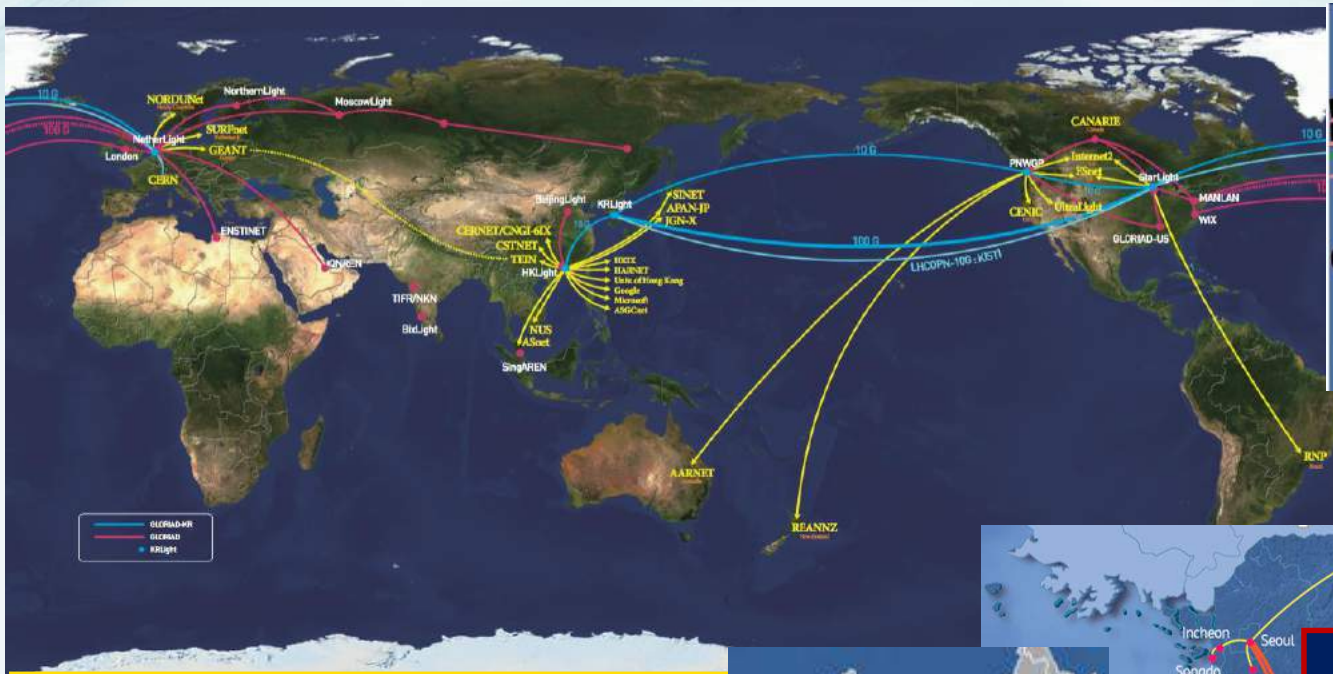

**US/NCAR**
ESNet trying to integrate ScienceDMZ to NCAR RDA (ESNet)

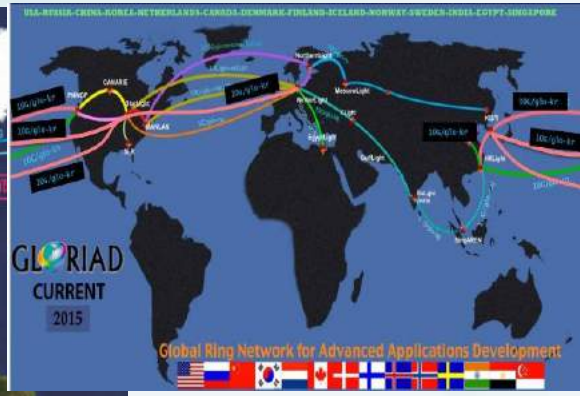


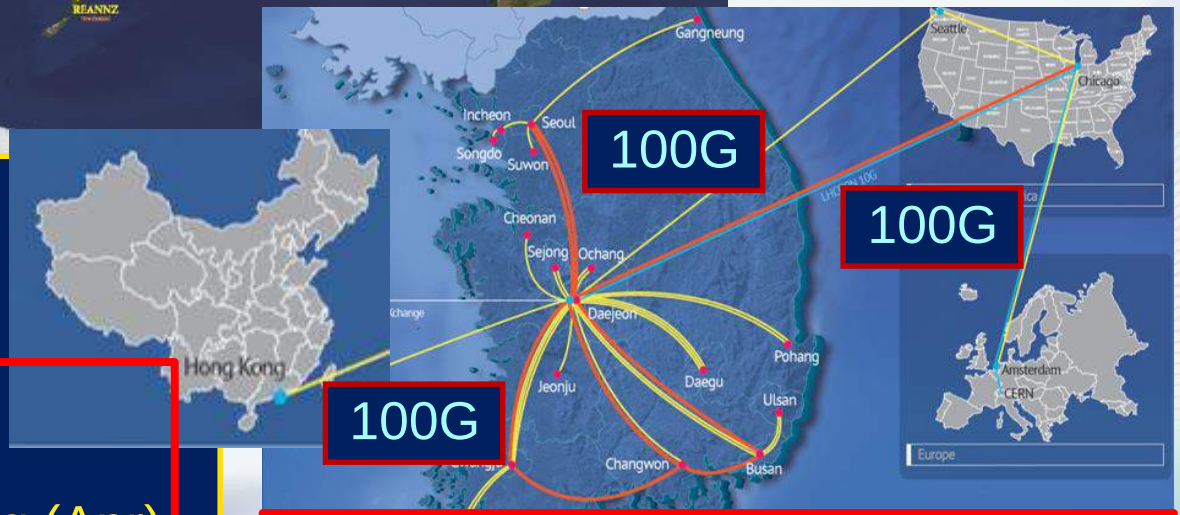

**US/Fermilab**
DTN as a Service for BigData Express(iCAIR)

# KREONET2 & GLORIAD-Kr & SDN Deployment (KREONET-S)

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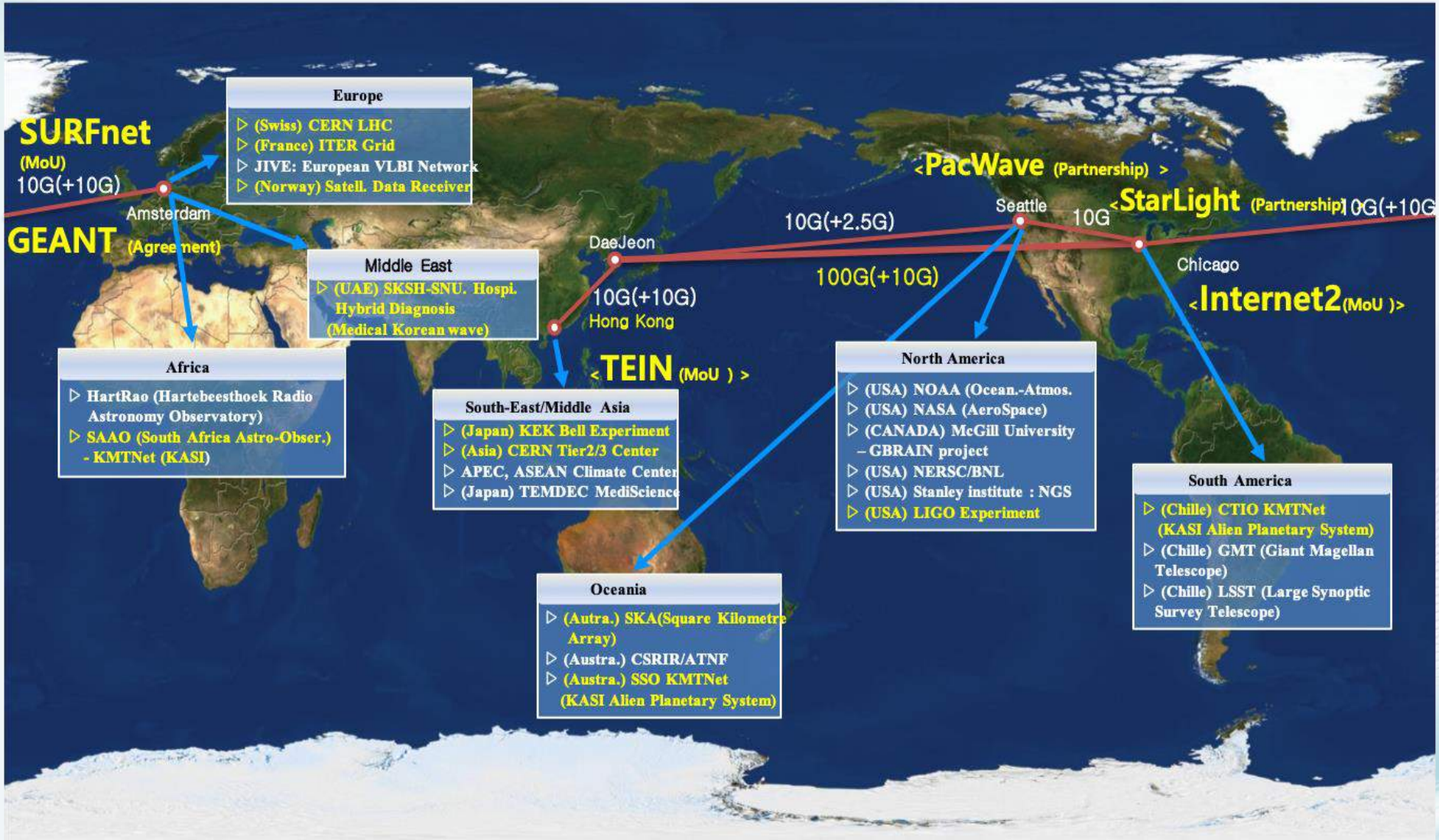




## Highlights of KREONET

1. 100G from Daejon to Chicago/StarLight
2. SDN-WAN Connection to Chicago/StarLight, Add Seattle and Hongkong (Apr)
3. 100G Ring linking major cities
4. 17 GigaPoPs with 1G, 10G or 40G

**Additional 100G from Daejeon to Seattle and Hongkong early 2019**

# GLOBAL Research Network & Collaboration



# KISTI ScienceDMZs

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- **KISTI ScienceDMZ**
  - Two types DTNs (SDN/L3 based)
    - **100G** : International & Giant Group Research & Study
    - **10~40G** : Domestic Scientific Research Group / **~1G** : Normal User (Fionette)
  - Participated in 1st PRP Workshop since 2015 & 1st NRP Workshop since 2017




- **Deploy ScienceDMZ and Activites**
  - Domestic
    - Focus on **Giant Group Research & Study(Data-Intensive Science)** areas
    - Examples : K*GENOME, GENOME RDC, LSST, HEP(CMS, ALICE), SDO, HPC, GSDC, KSTAR, KBSI TEM, eKVN etc.
    - Especially, eKVN(Korea eVLBI) and **LSST deploy 100G connection (KASI)**
    - **Deploy KISTI New Supercomputer with a DTN Cluster on 100G**
    - **Dark Matter research using astronomical/particle big data on ScienceDMZ**
  - International
    - Participate in PRP, NRP, APRP
    - Asia PRP : Collaboration with APAN members for Deploy and use ScienceDMZ
    - Participate in **'Peta Scale DTN Project'**



























# Giant Group Research & Study

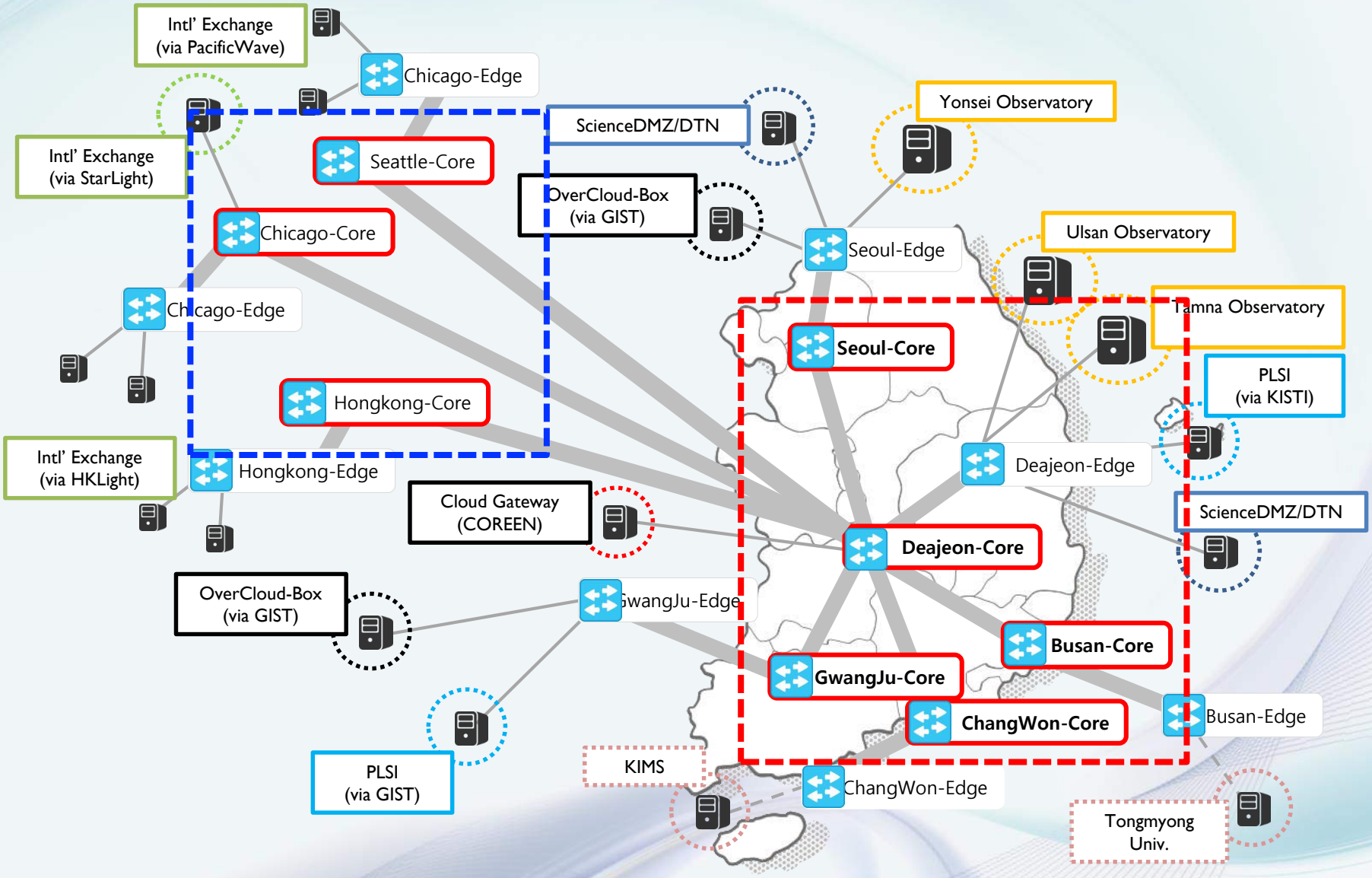
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- **KREONET Members of Giant Group Research & Study**
- **Enabling ScienceDMZ step by step from 2016**

| 연구분야 | 기관 | 연구내용/연구망 역활 | 연구망 속도 |
|---|---|---|---|
| 고에너지물리 (LHC) | 서울대학교 격자게이지 이론연구단 외 14개 기관 | - 입자가속기 중심의 실험데이터를 국내연구진의 글로벌 전송/활용 | 1G-10G |
| 천문우주 (Astronomy) | 천문연구원, 국토지리정보연구원(전파망원경센터) | - 울산, 세종, 제주, 서울에 구축된 전파망원경 관측 데이터의 상관센터 중심의 데이터 공유 | 100G-40G |
| | 천문연구원(SDO) | - NASA 태양위성 관측 이미지를 글로벌 전송 및 국내 우주기상센터간 전송 | 10G |
| | 천문연구원(SKA, LSST) | - 칠레, 남아프리카공화국 에 위치한 광시야 망원경 관측 데이터의 공유 | 10G |
| 게놈/바이오 (Genome/Bio) | 서울대병원 CMI센터외 8개 기관 | - ICGC 유전체 데이터 중심 RDC센터 구축 | 10G |
| 기상기후 (Weather/Climate) | 기상청외 5개 기관 | - 기상청 슈퍼컴퓨터 및 기상데이터 공유 및 연구 활용 | 1G-40G |
| KSTAR (Fusion Research) | NFRI외 3개 기관 | - KSTAR를 활용한 데이터 저장 및 연구활용 | 100G |
| 기초연구 관측장비 (Basic Science & Survey) | 기초연구원 | - 대형현미경으로 관찰된 고해상도이미지 및 데이터 전송 | 10G |
| 연구/교육 (Research & Education) | 부산대학교외 5개기관 | - 데이터, 계산자원, 저장자원의 연계를 통한 대규모 인력교육(원격) | 1G-10G |
| 건설 건축 | KOCED-CI(1,2차 실험센터) | - 지진실험 등 대규모 건설/건축 실험장비를 활용한 연구 및 교육 | 1G |
| 국내 가속기 | 포항가속기센터(4세대) | - 포항가속기센터에서 연간 실험/발생되는 데이터의 공유 | 10G |

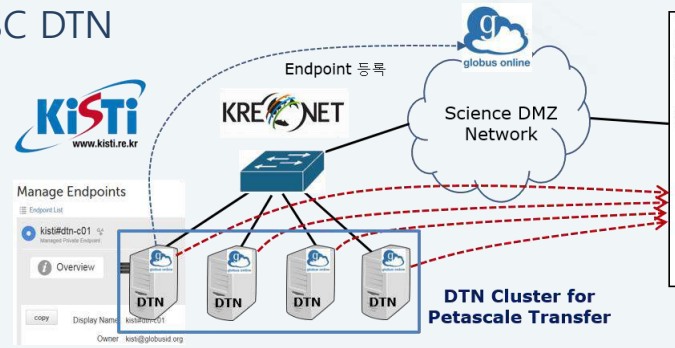
# SDN status of KREONET(Intl' & Domestic)

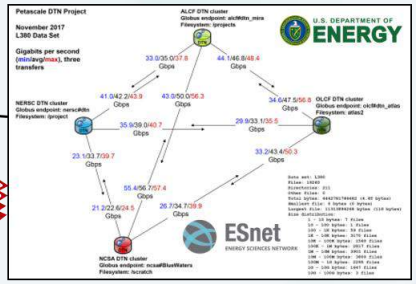
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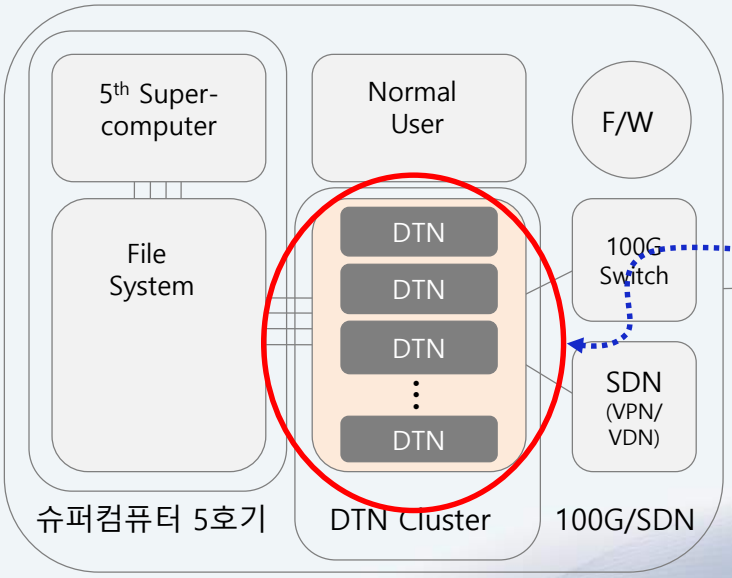
# ScienceDMZ Architecture for HPC
## (Collaboration with NERSC & Esnet)

- **ScienceDMZ for KISTI 5th Supercomputer**
  - Dedicated DTN connection with NERSC DTN
- **Peta Scale DTN transfer Project**
  - DTN Cluster on 100GE
- **Globus Online**
  - GridFTP

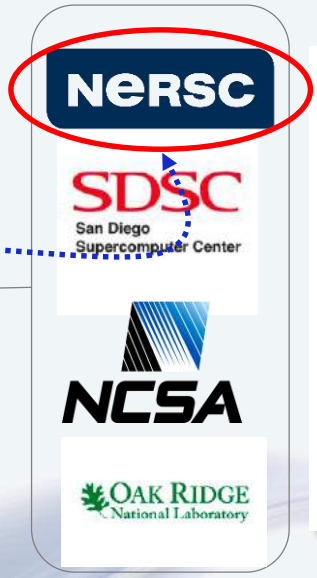


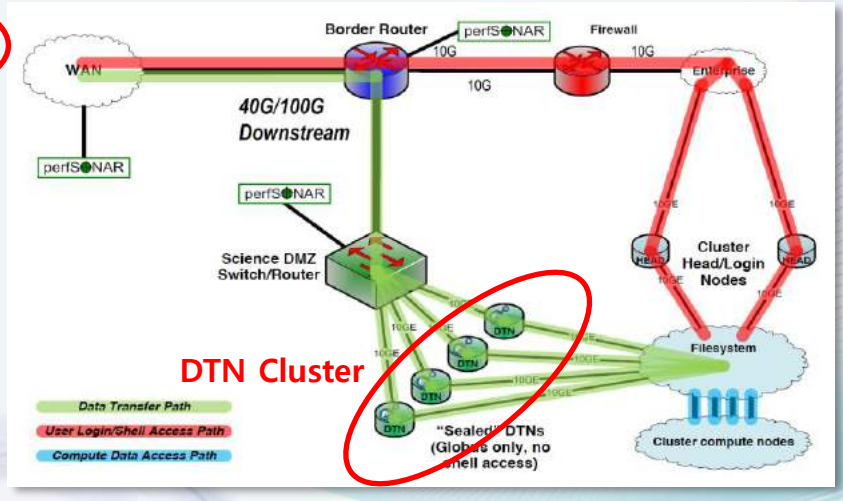

**Participate in Peta Scale transfer environment**




**Peta Scale transfer environment over KISTI 5th Supercomputer**

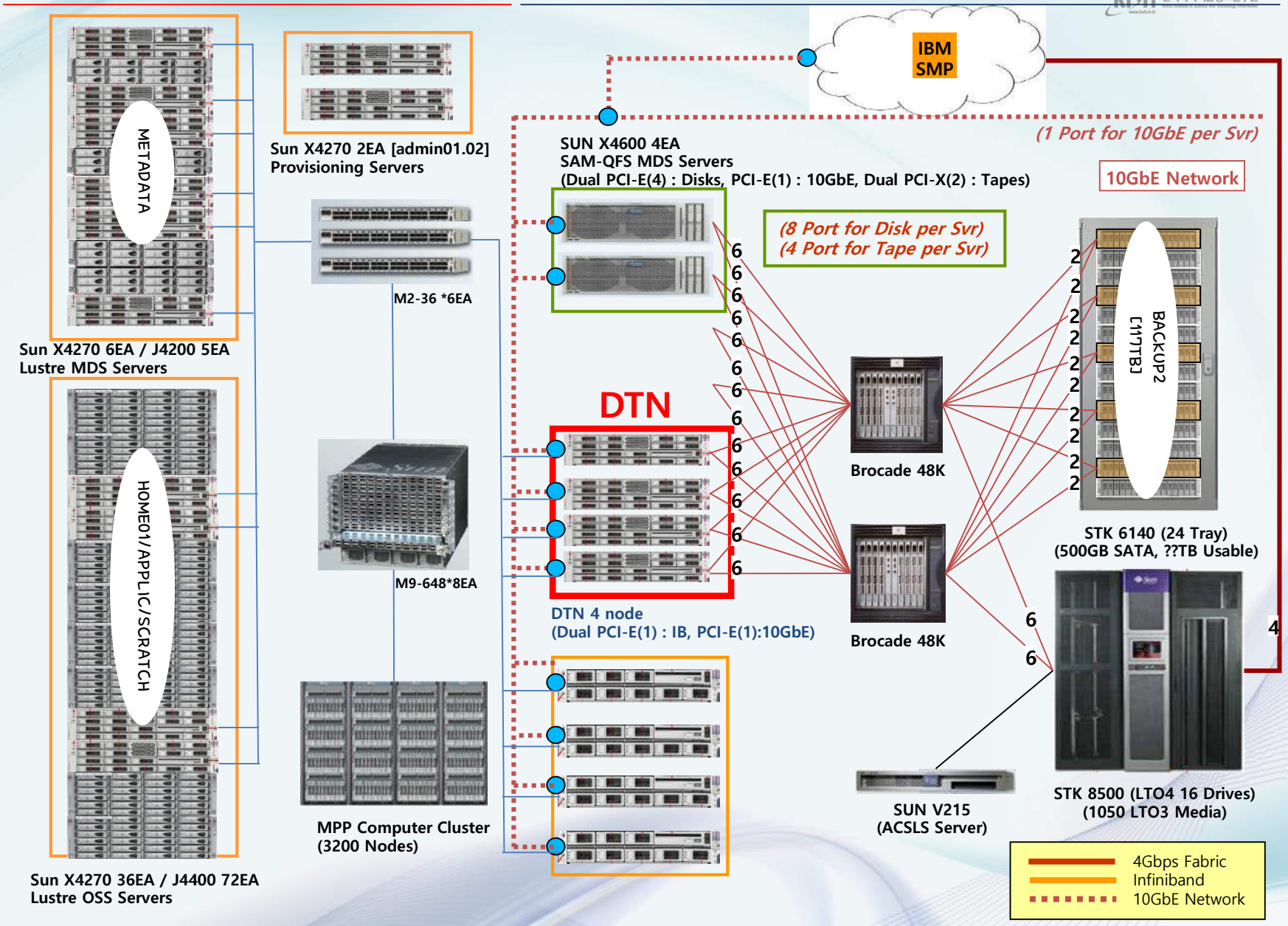



**Collaboration with NERSC ScienceDMZ**




**ScienceDMZ architecture for HPC**

# KISTI Supercomputer architecture with DTN



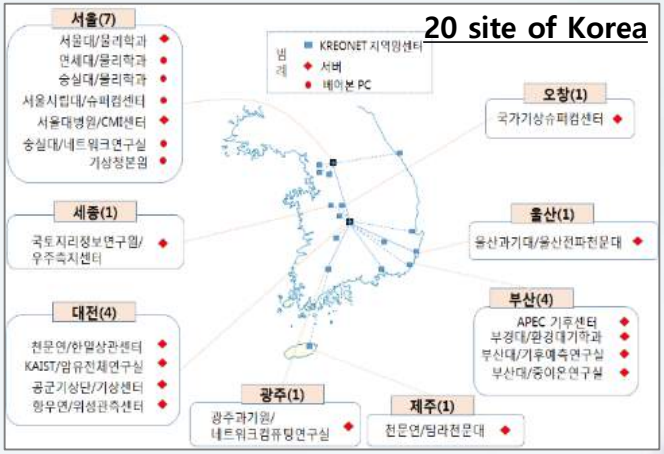
# ScienceDMZ Deploy for domestic (2018)

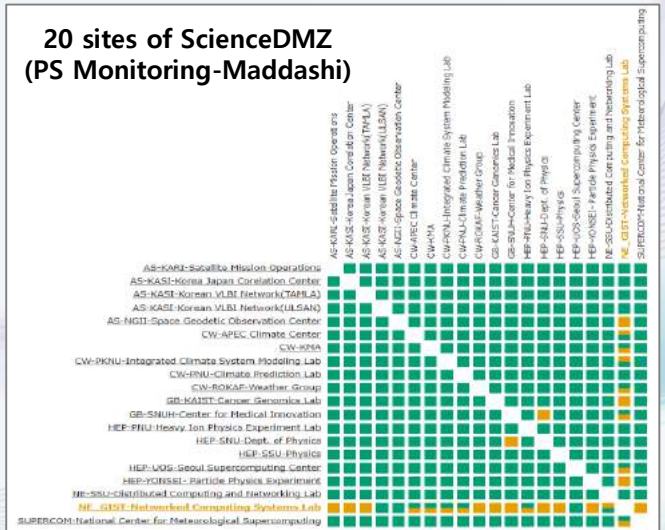
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- **2018 : Domestic ScienceDMZ 20 sites setup complete**
- **2019 : ScienceDMZ 50 sites plan of deploy**

- 최대 전송성능 보장(SDMZ화) 구축 대상기관 선정 완료
  → 연구우수성, 지역별 대상 기관 선정 : 서울(7). 대전(4), 부산(3), 광주(1), 오창(1), 포항(1), 제주(1), 세종(1), 대구(1)
  → 고에너지물리, 기상기후, 천문우주(KVN, SDO), KSTAR, Genome, 기상청 슈퍼컴활용 커뮤니티 대상
- ScienceDMZ 시스템 구축 및 실시간 성능 측정 시스템 구축

| | Institute & University | Bandwidth | Location | Guarantee Performance |
|---|---|---|---|---|
| 20 Target Sites | 서울대 | 10G | 서울 | 90%이상 |
| | 연세대 | 10G | 서울 | 90%이상 |
| | 숭실대 | 1G | 서울 | 90%이상 |
| | 부경대 | 1G | 부산 | 90%이상 |
| | 국가기상슈퍼컴센터 | 10G | 오창 | 90%이상 |
| | 광주과기원 | 10G | 광주 | 90%이상 |
| | 경북대 | 1G | 대구 | 90%이상 |
| | 우주측지센터 | 1G | 세종 | 90%이상 |
| | 포항공대 | 1G | 포항 | 90%이상 |
| | 천문연 탐라천문대 | 10G | 제주 | 90%이상 |
| | 천문연 상관센터 | 10G | 대전 | 90%이상 |
| | 부산대 | 1G | 부산 | 90%이상 |
| | APCC | 1G | 부산 | 90%이상 |
| | 핵융합연구소 | 10G | 대전 | 90%이상 |
| | 서울대병원 CMI | 10G | 서울 | 90%이상 |
| | KAIST | 10G | 대전 | 90%이상 |
| | 천문연 연세천문대 | 10G | 서울 | 90%이상 |
| | 천문연 울산천문대 | 10G | 울산 | 90%이상 |



# LSST
## Large Synoptic Survey Telescope: potential usage case of the DTN

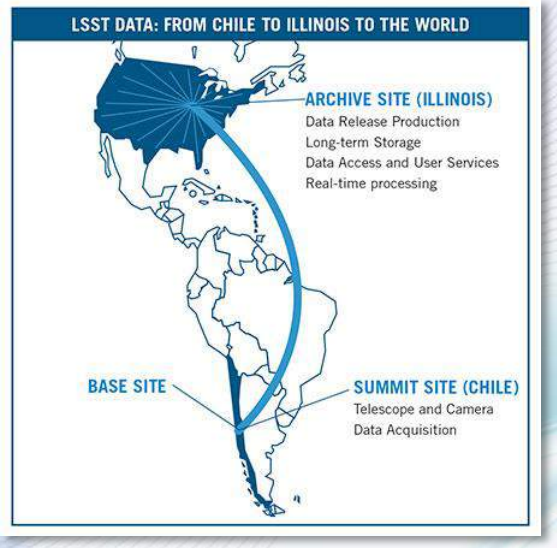
한국천문연구원
Korea Astronomy & Space Science Institute

- **LSST (Large Synoptic Survey Telescope; http://lsst.org)**
  - 10-year (2022 ~ 2032) survey of Southern Sky supported by DOE, NSF, international contributors, and private donors.
  - Production of raw data about at a rate of 15TB~30TB per night.
  - **0.5Exabyte is expected around 2032**.
  - NCSA is in charge of processing, archiving, and serving the data.
  - Engineering “First Light: anticipated in 2019
  - Science “First Light “ in 2021



- **KASI** (Korea Astronomy and Space Science Institute) is one of the international contributors **on behalf of the LSST Korea** (http://lsst.kasi.re.kr).

- KASI – Deployment of ScienceDMZ and PRP



# ScienceDMZ for LSST in KASI

## Data Volume of ~ 30TB per night

- Data size : 0.5Exabyte for imaging (over 50PB for the catalog DB)

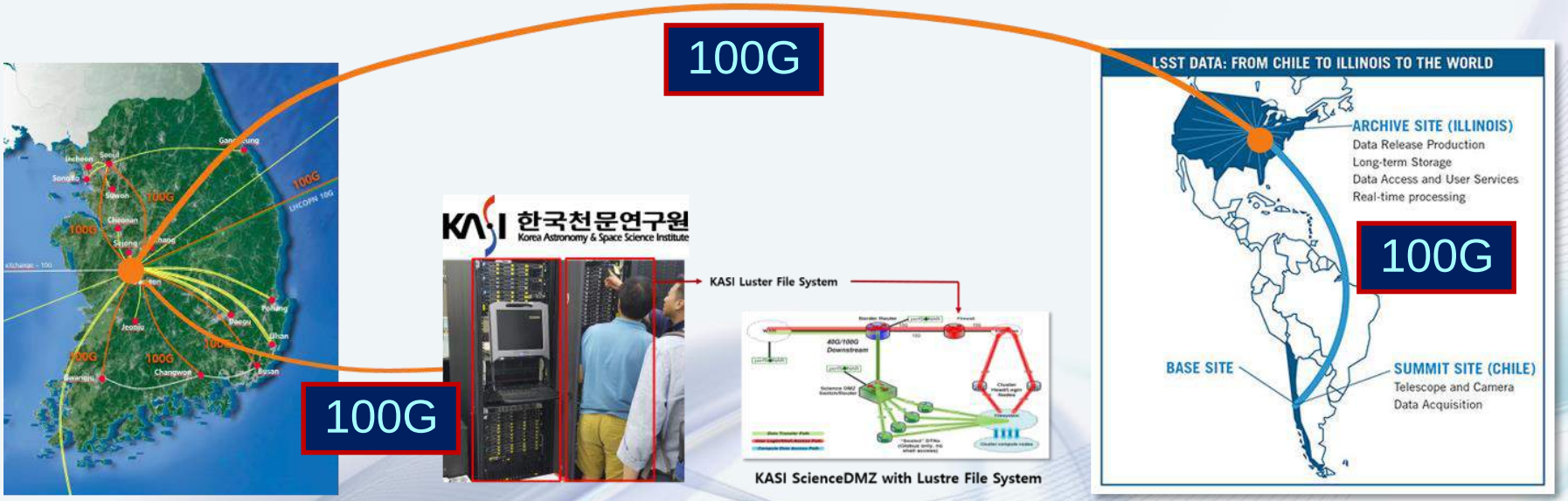
## The LSST Network requirements

- High demand end-to-end applications like LSST require that all networks in the path support **QoS and Programmability**

- **Each 12.7GB data set** (6.4GB picture + 6.3GB metadata) **must be transmitted to the U.S. in 5 seconds** and **Database synchronization**, etc.

## LSST data (part of data set) transfer from Chile and NCSA(US) to KASI

- LSST data transfer demonstration at SC18 (Nov)






Home

SC '18

Tools

Fast Data Transfer (FDT)

CMS PhEDEx

MonALISA

OpenDaylight

Partners

Research Organizations

Industry

Archives

SC '16

SC '15

SC '14

SC '12

SC '11

SC '10

SC '09

SC '08

# Global Petascale to Exascale Science Workflows Accelerated by Next Generation Software Defined Network Architectures and Applications

## Caltech's High Energy Physics (HEP) and Network Teams Collaborate with Partners to Break New Ground

### *Building the Next Generation Software Defined Network (SDN) Cyber-Architectures and Applications for High Energy Physics, Astrophysics and Exascale Science*

***Pasadena, California, November 2018*** — During the 2018 Network Research Exhibition (NRE) at the Supercomputing 2018 Conference (SC18) in Dallas earlier this month, Caltech together with university, laboratory, network and industry partners demonstrated the latest developments toward an SDN-driven Next Generation Integrated Architecture (NGenIA) for high energy physics and other global data intensive science domains. While the initial focus on the largest global science program now underway, at CERN's Large Hadron Collider (LHC) and at 170 computing and storage facilities around the world, and the future Large Synoptic Survey Telescope (LSST) program, now under construction in La Serena, Chile, the methods and developments are widely applicable to many data intensive disciplines.

Some of the key partners who supported the Caltech demonstrations at SC18 include 2CRSI, AmLight/FIU, Arista Networks, CENIC, CERN, Century Link, Ciena, Colorado State, Dell, ESnet, Echostreams, Fermilab, IBM, Intel, Internet2, KISTI, LBNL, Maryland, Mellanox, Michigan, MREN, NCSA, Northeastern, Pacific Northwest Gigapop, Pacific Wave, the Pacific Research Platform, SCinet, SURFnet, Starlight/iCAIR, TIFR Mumbai, Tongi University, UCLA, USC, UCSD, and Yale.

# SC18 Demo - LSST Data Flows to KISTI and KASI 1/2

During the course of the LSST and AmLight SC18 demonstrations, data from the telescope site in Chile arrived via AmLight at both the KISTI and Caltech booths in Dallas, where it was mirrored and carried across SCinet, Starlight, KRLight and KREONet2 to DTNs at KISTI and KASI in Korea, as shown in the figure below. Using Caltech's Fast Data Transfer (FDT) application, **throughputs of 58 Gbps were achieved across the 60 Gbps path from the telescope site to the KISTI booth**, and **a remarkable 99.7 Gbps on the 100 Gbps path between Dallas and Daejeon.**
(http://supercomputing.caltech.edu/SC18/)

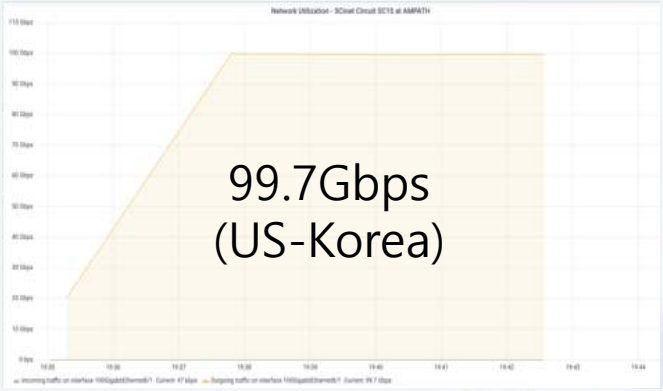


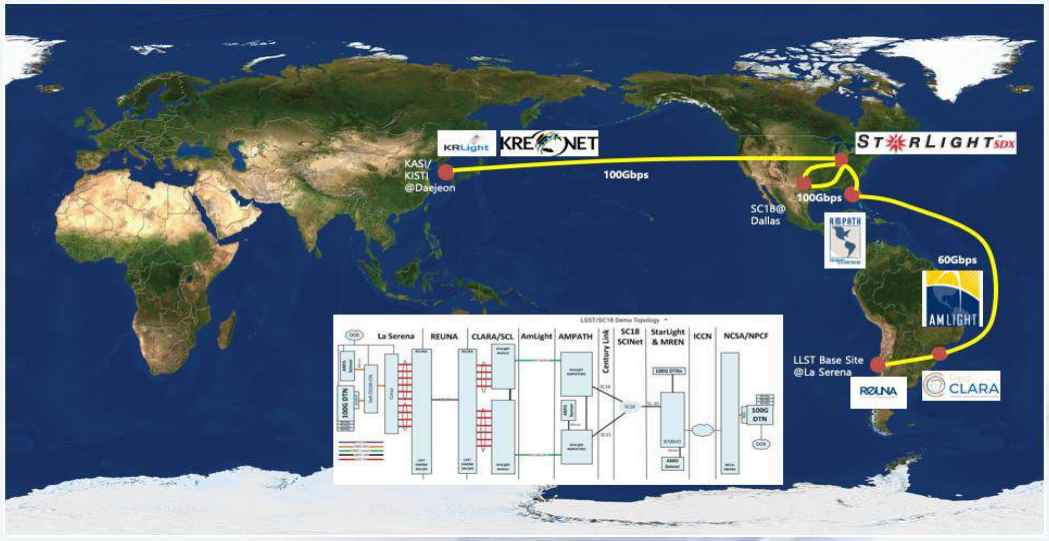

**Data flow paths among the LSST telescope site, the KISTI and Caltech booths, and KISTI and KASI in Korea during the SC18 demonstrations**

# SC18 Demo - LSST Data Flows to KISTI and KASI 2/2

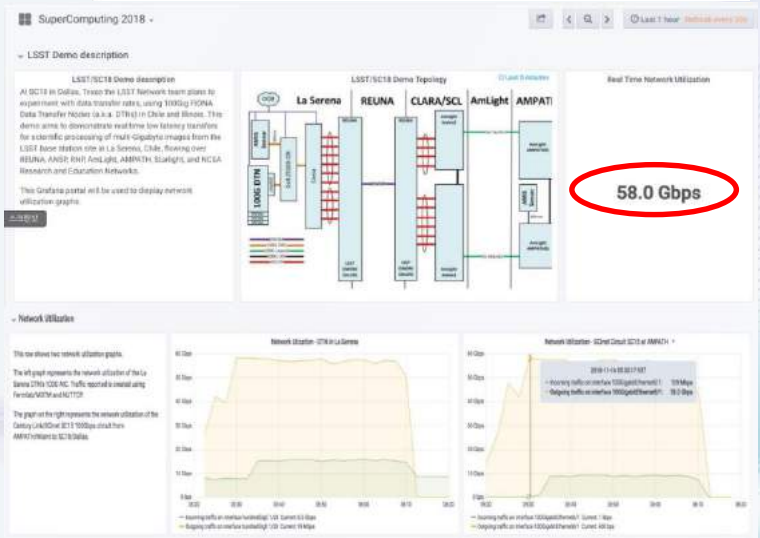
- **LSST Data Flows to KISTI/KASI**
  - Through 3 Continental (South/North America and Asia)
  - Data Path :
    - Chile(La Serena)-US(AmPATH/FL-Dalla(SC18)-KOREA(KISTI/KASI)
  - Performance : 58Gbps/60Gbps

- US-Korea Data Flows on 100G
  - Data Path : Dallas(SC18) - KISTI/KASI
  - Performance : 99.7Gbps/100Gbps



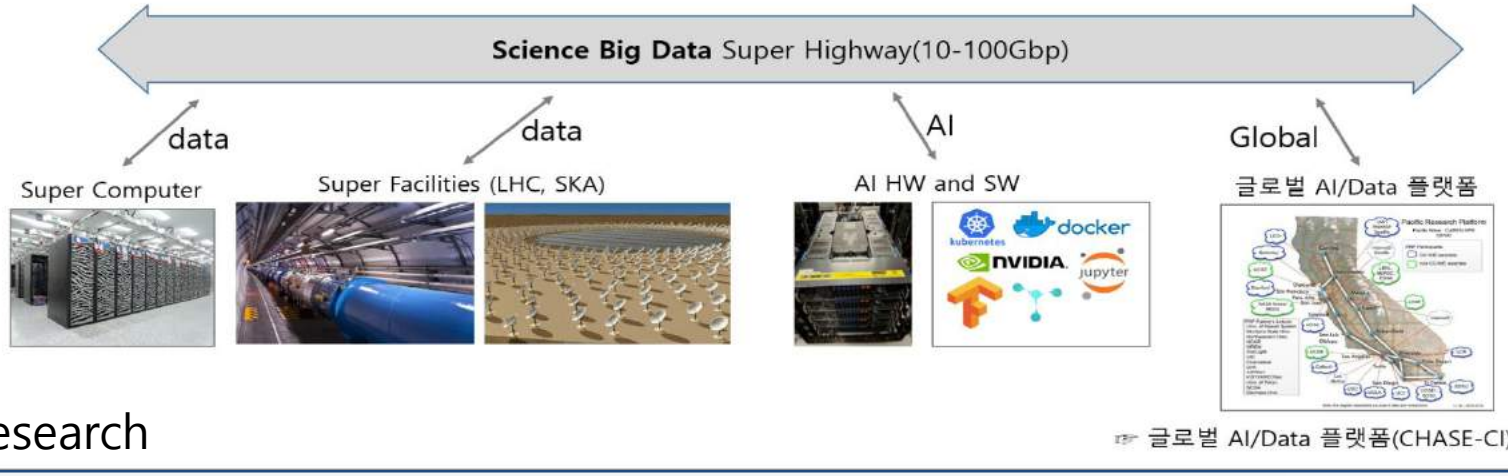

LSST Data Flow topology

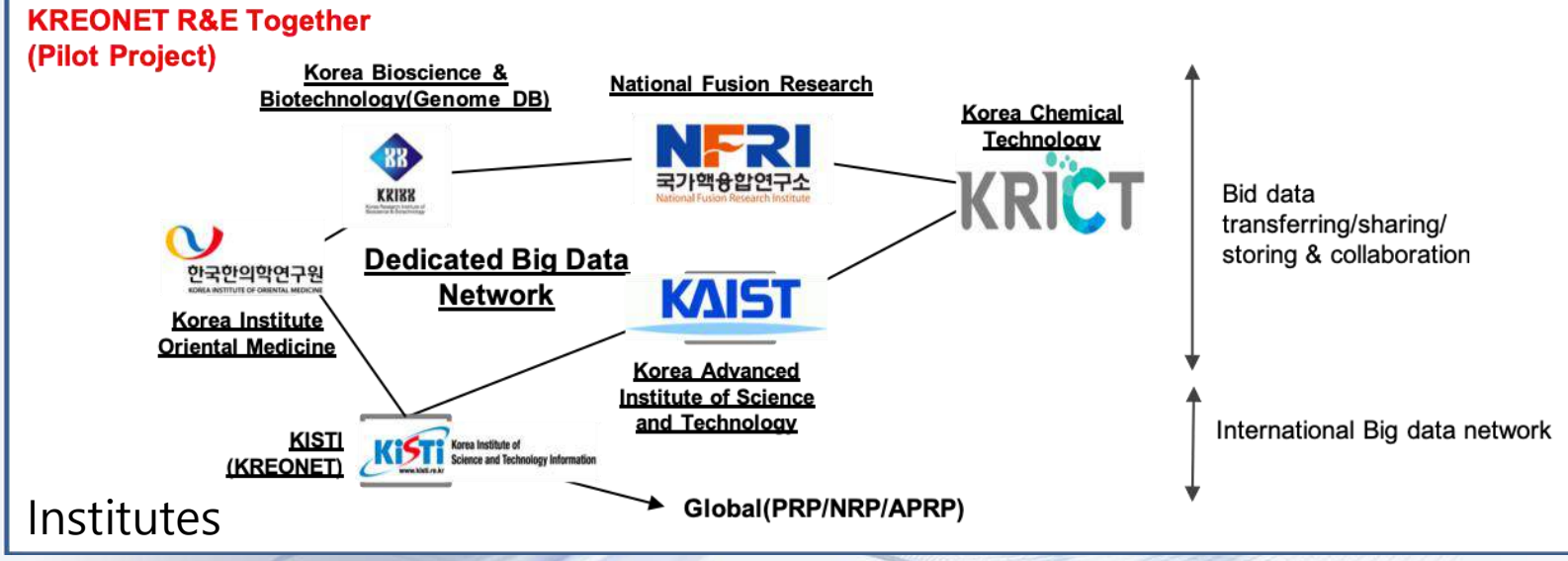



LSST performance from Grafana

# R&E Together Pilot Project on KREONET

- **Create Big data freeway pilot project at Korea**
- **Collaboration with National Institute and University**
  **(5 National Research Institute & 1 University)**






**Contact**
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