KRLight Updates

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Contents

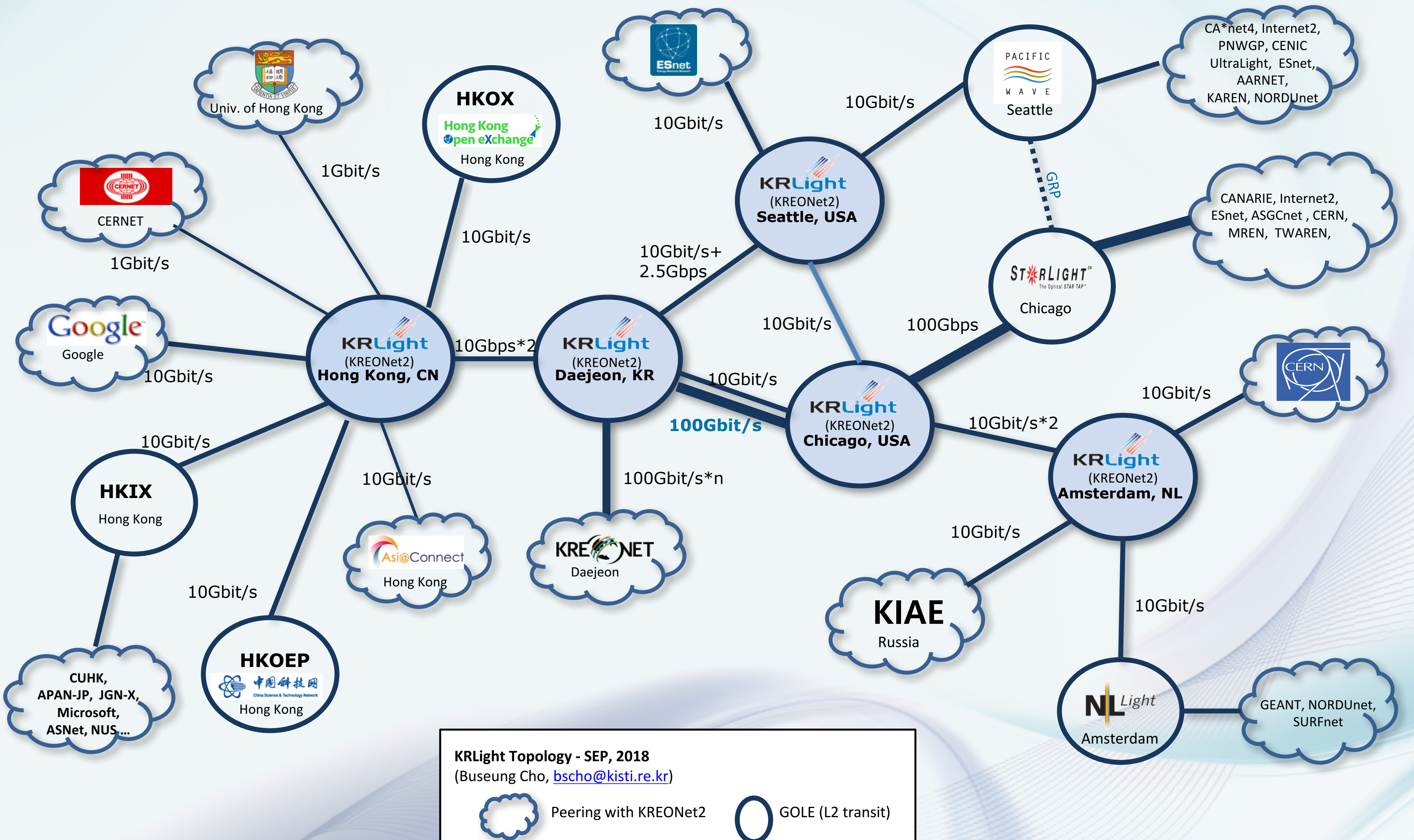
- KRLight Infra. and Connectivity
- KREONET/KRLight Project
  - LHCOPN/LHCONE, KREONET-S, Science DMZ/DTN Activities, etc.
- Upgrade Plan and summary

KRLight

- **GLIF Open Lightpath Exchange (GOLE)**, managed and operated by KISTI
- Transcontinental GOLE: Asia – North America – (Europe)
- Distributed GOLE (co-located with other GOLE in GLIF): Daejeon/KR, Hong Kong/CN, Seattle/US, Chicago/US, Amsterdam/NL
- Directly connected to Pacific Wave, StarLight, NetherLight, HKOEP, CERN in GLIF Communities and HKOX, HK-IX, etc.
- **KRLight Multi-layered Architecture**
  - KRLight Layer 0/1 Lambda Layer : Point-to-Point (P2P) Service
  - KRLight Layer 2 Advanced Ethernet Layer : P2P, P2M, MP
    - VLAN, QinQ, Jumboframe at least 9018
  - KRLight Layer 3 IP Layer
    - Dedicate AS number for KRLight : AS17579 (KREONet2)
    - IPv4/IPv6, IP MTU at least 9000, ACL
    - perfSONAR, DTN, …

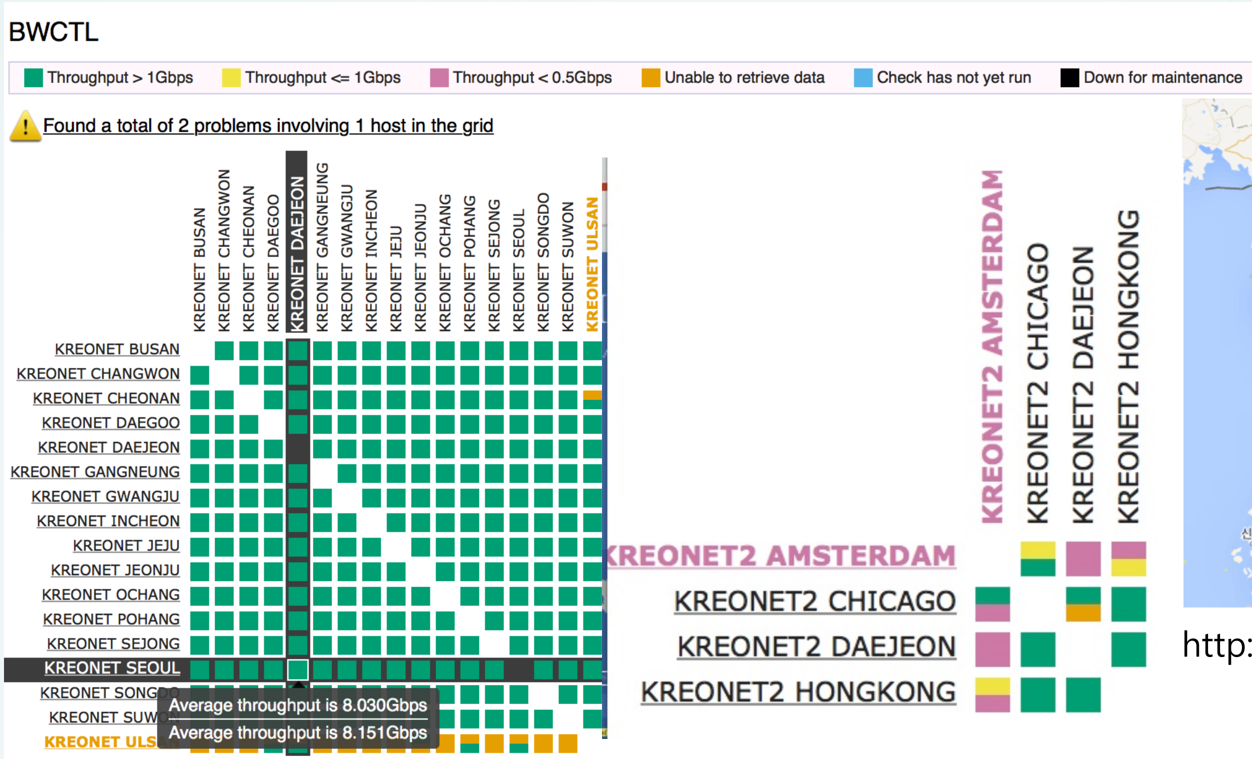
KiSTi 한국과학기술정보연구원

KRLight, Distributed Open Lightpath eXchange-Korea



KREONET/KREONet2 PerfSONAR and Maddash

- Installed in 17 domestic nodes and 4 international nodes



http://stats.es.net/ServicesDirectory/

- 100Gbps perfSONAR in Daejeon, Hong Kong, Seattle and Chicago in this month

KREONET: National Science and Research Network, Korea

- KREONET (Korea Research Environment Open Network), AS1237
- Korea's National Science & Research Network, managed and operated by KISTI since 1988
- Core Member of GLORIAD project since 2005
- As the Advanced Research Network in **"Utilization and Promotion of National Supercomputing Act"** (implemented in 2011 in Korea)
- 17 Domestic Regional GigaPoPs and 4 International GigaPoPs
- **200 connected R&E organizations : National Research Institute and Lab, University**, University Hospital, Research Institute of Company, library, etc.
- 365*24 NOC (Network Operation Center) Service
- Linking internet exchanges (KT, SKB, Sejoing Telecom) and Clouds (Amazon , Microsoft)
- L1 Lightpath, L2 Carrier Ethernet Service, L3 R&E IP service, VDN based on KREONET-S

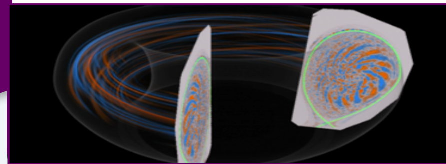

MAP OF KREONET 2018
KOREA RESEARCH ENVIRONMENT OPEN NETWORK
Seattle
Chicago
United States of America
100G
LHCOPN 10G
Amsterdam
CERN
Europe
Gangneung
Seoul
Incheon
Songdo
Suwon
100G
Cheonan
100G
Sejong
Ochang
IX
Internet eXchange – 10G
Daejeon
Pohang
Daegu
Ulsan
Jeonju
100G
100G
100G
Gwangju
Changwon
Busan
Hong Kong
China
Jeju
10G
100G
KREONET POP
KRLIGHT POP

KISTI 한국과학기술정보연구원

Enabling Science Discovery

- New particle, "Higgs" in CERN LHC
- Gravitational Wave in LIGO

High Energy Physics & Fusion Energy Science



Bio/Genome Research & Medical Science

Astronomy & Climate Changes

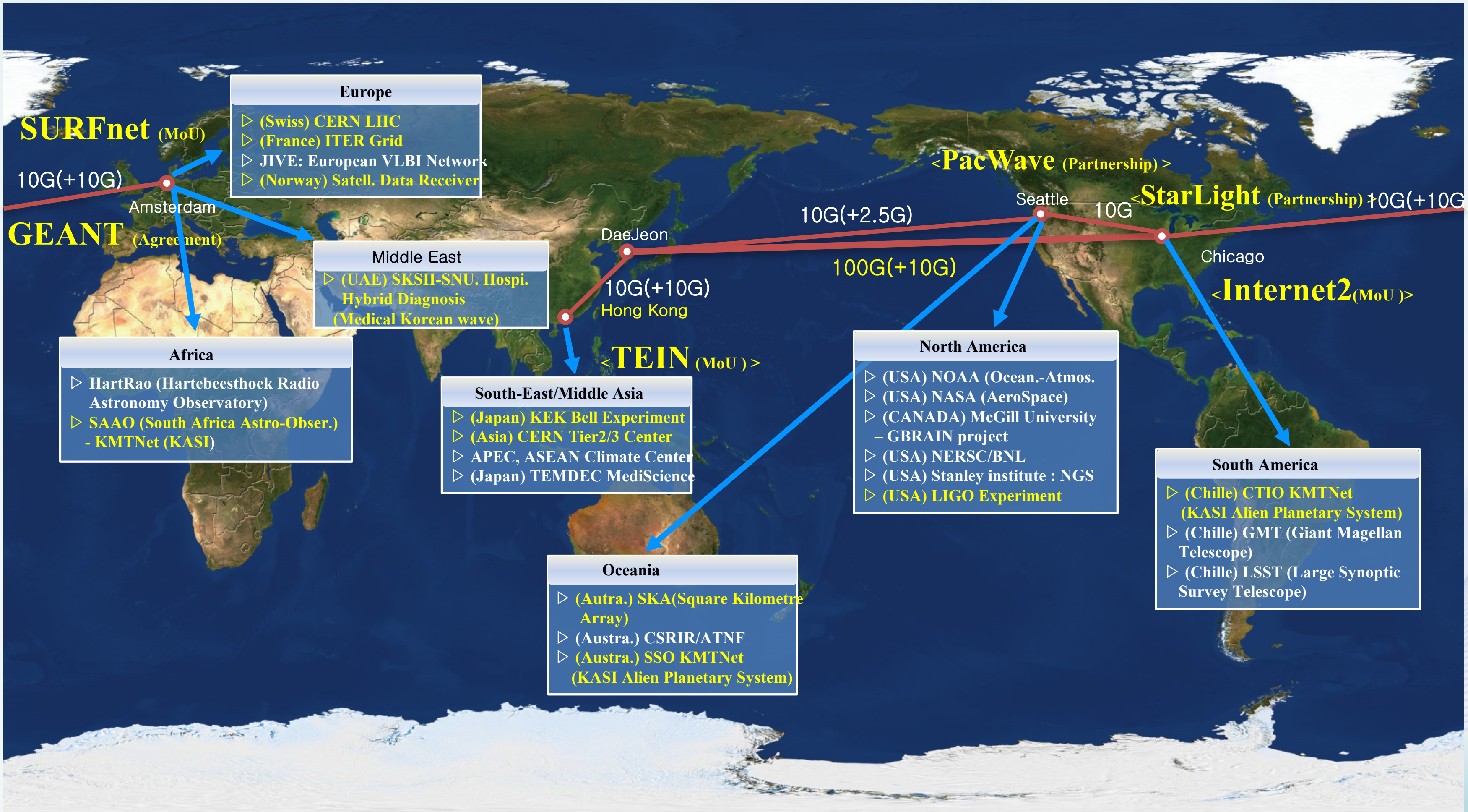
KREONET

Advanced Scientific Computing Research

Education & e-Culture

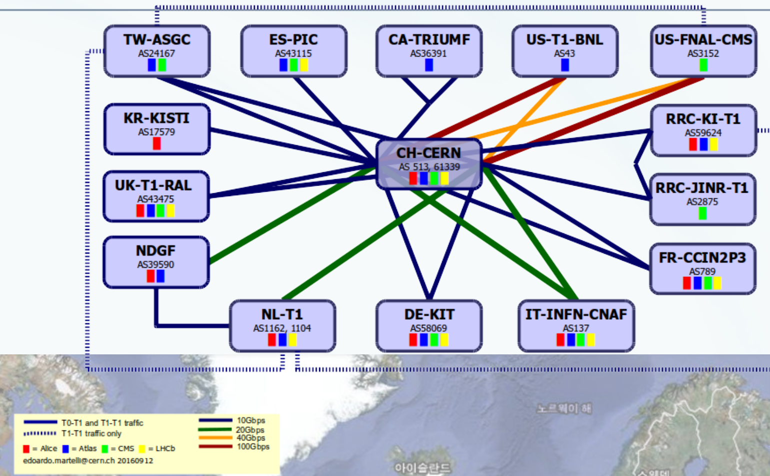
Future Internet & Construction

GLOBAL Research Network & Collaboration



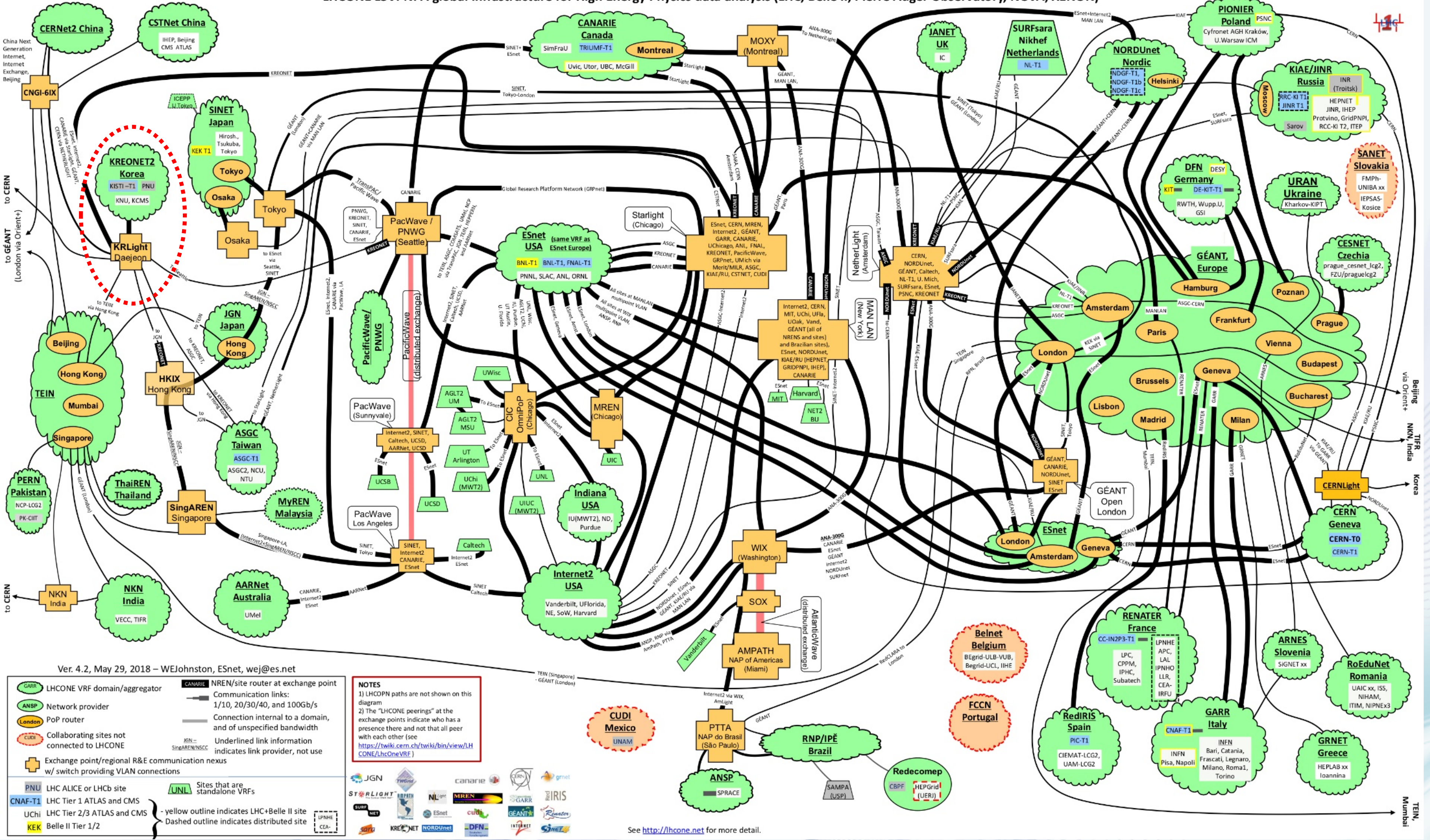
LHCOPN (GSDC/KISTI ~ CERN)

LHC Optical Private Network



LHCONE

LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOvA, XENON)

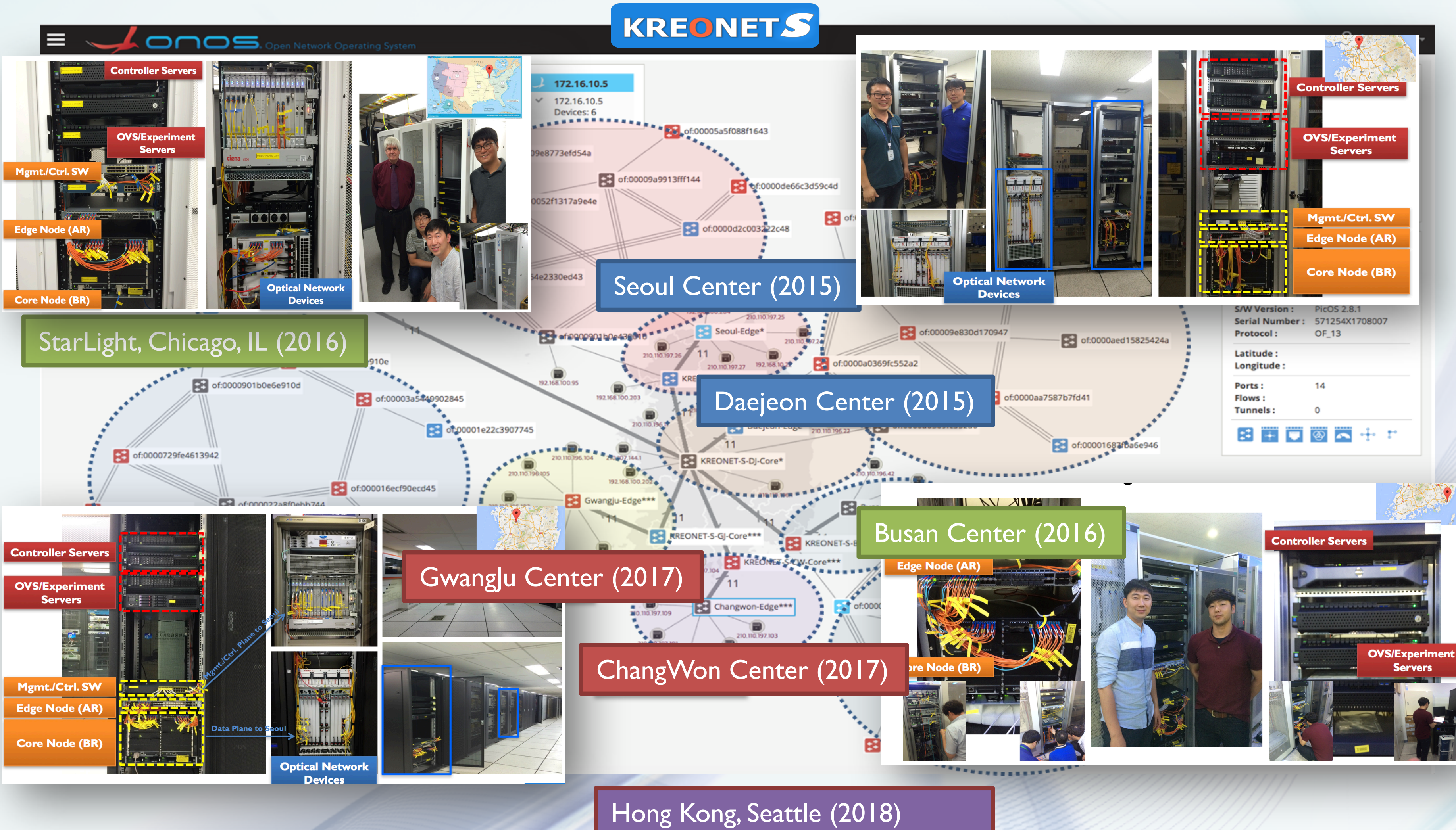


KREONET Softwarization (KREONET SD-WAN)

- **Goals**
  - The First and Only Production **SDN-WAN for Advanced R&E Community on KREONET** in Korea
  - Reliable Software-based Network Operations and New User Services & Experiences, beyond Legacy Networking
- **Principal Building Blocks**
  - Users: Advanced R&E Community (HPC, HEP, Astronomy, ..) for Now
  - Apps & Services (NB): **VDN** 1.1.3, (virtual) ScienceDMZ, etc.
  - Control Plane: **ONOS** 1.11.1 (Loon Release)
    - KISTI as ONOS collaborator, ambassador and brigade member, ONOS/CORD WG member@SDN/NFV Forum
  - Data Plane (SB): **OpenFlow** 1.3, Stratum/P4, TL1, NETCONF, etc.
    - Core/Edge OF Devices in SEO, DJ, BS, GJ, CW, and Chicago, IL.

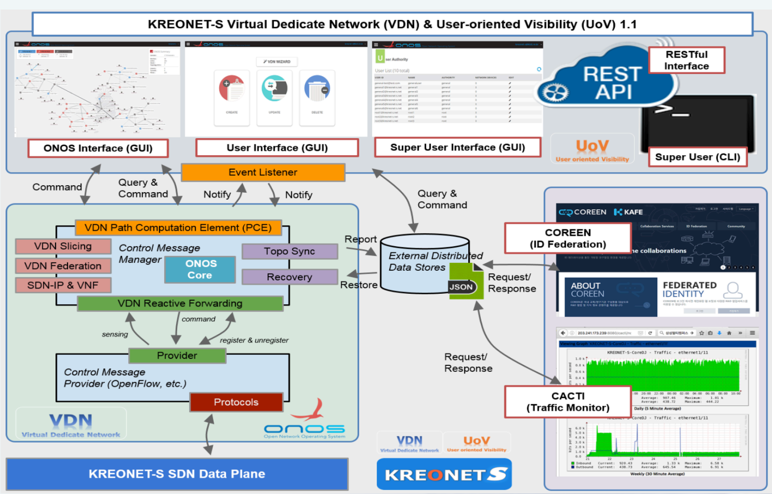
KREONET-S Infrastructure

- 2015-2018 : Deployed in 8 Locations in Korea, China and USA, OF 1.3-based



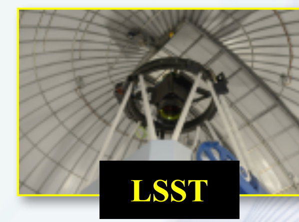
KREONET-S Virtual Networking

- **Designs & Core Functionalities (VDN 1.1.3)**
  - Dynamic On-demand Virtual Network Slicing and Management
  - Logically Isolated Group Networks w/ High Performance (~100Gbps)
  - Event (e.g., link up/down) Detection & Recovery
  - New Virtual Network Functions: vNAC and vDHCPONOS-based
  - Virtual Network Federation between Inter-Domain SDNs
  - User-oriented Virtual Network Visibility & *Interoperable REST-APIs*



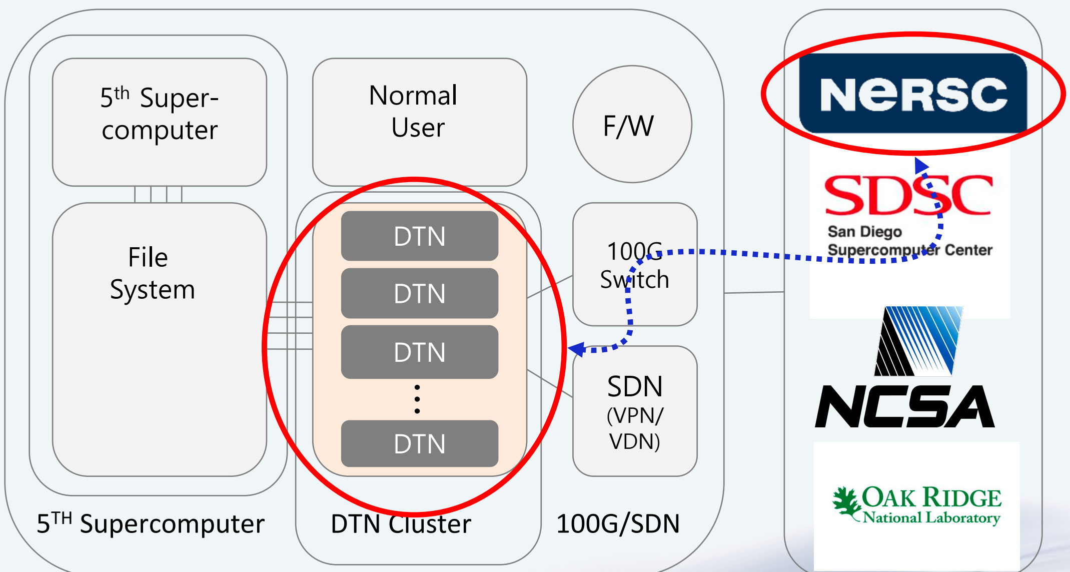
KISTI's Science DMZ Activities for Data Intensive Science

- **Focus on Data-Intensive Science Community in Korea**
  - Bio/Genome (K*GENOME, GENOME RDC), Astronomy (e-VLBI, SDO, KMTnet, LSST), High Energy Physics (CERN LHC Alice Tier1, CMS Tier2/3), Fusion Energy (KSTAR/NFRI), Climate Change (National Center for Meteorological Supercomputer, APEC Climate Center) etc.
- 100G last-mile connection supports by KREONET
  - KASI (astronomy), KSTAR/NFRI (fusion energy)
- **Science Engagement** : Technical support and Training
- International Participation and Collaboration to PRP & NRP
- Global partnership and leadership in Asia : **Asia PRP** with Australia and Singapore
- Participate in SC18 Network Research Exhibition
- **100G DTN directly connected to KRLight**



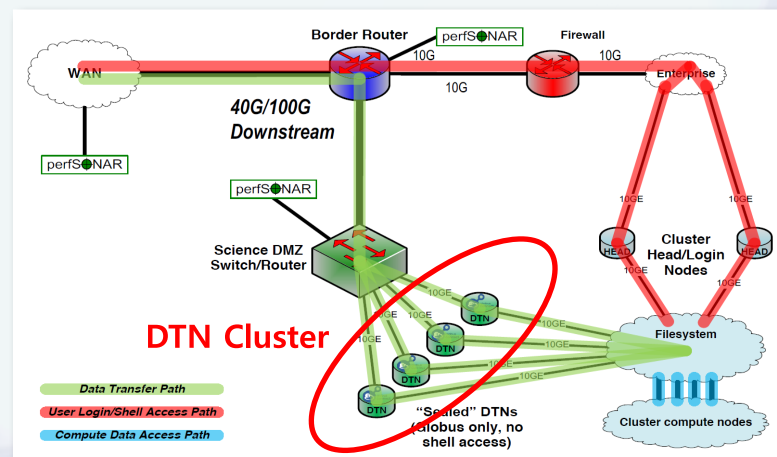
Science DMZ for National Supercomputer, HPC

- **Building Science DMZ and DTN for KISTI 5th Generation Supercomputer (25.7 petaflops)**
- **Participation for the PetaScale DTN transfer Project**
  - **DTN Cluster with 100G**
  - **Globus Online**



Peta Scale transfer environment over KISTI 5th Generation Supercomputer

Collaboration with NERSC Science DMZ

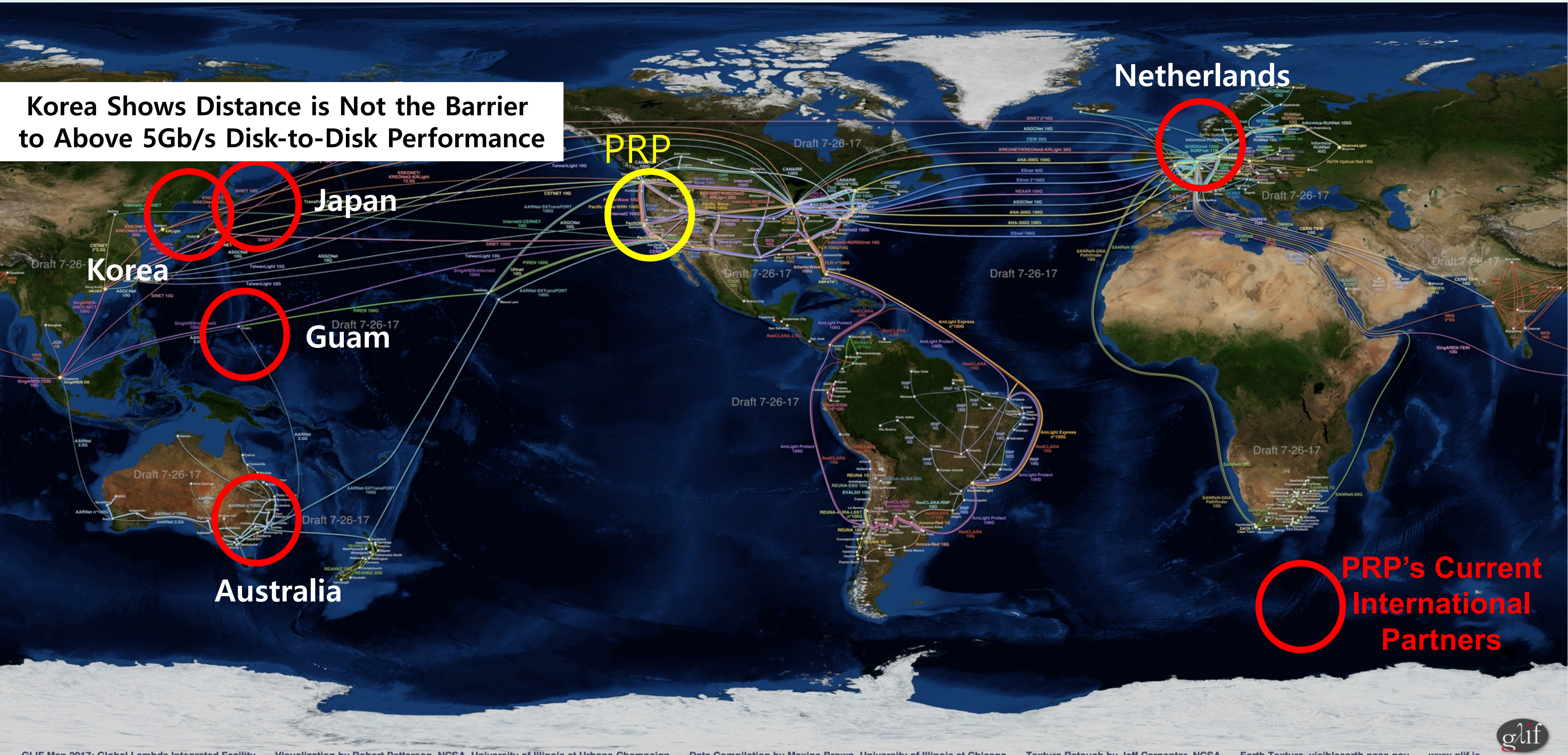


Science DMZ architecture for HPC

PRP/NRP and KISTI/KRLight Science DMZ

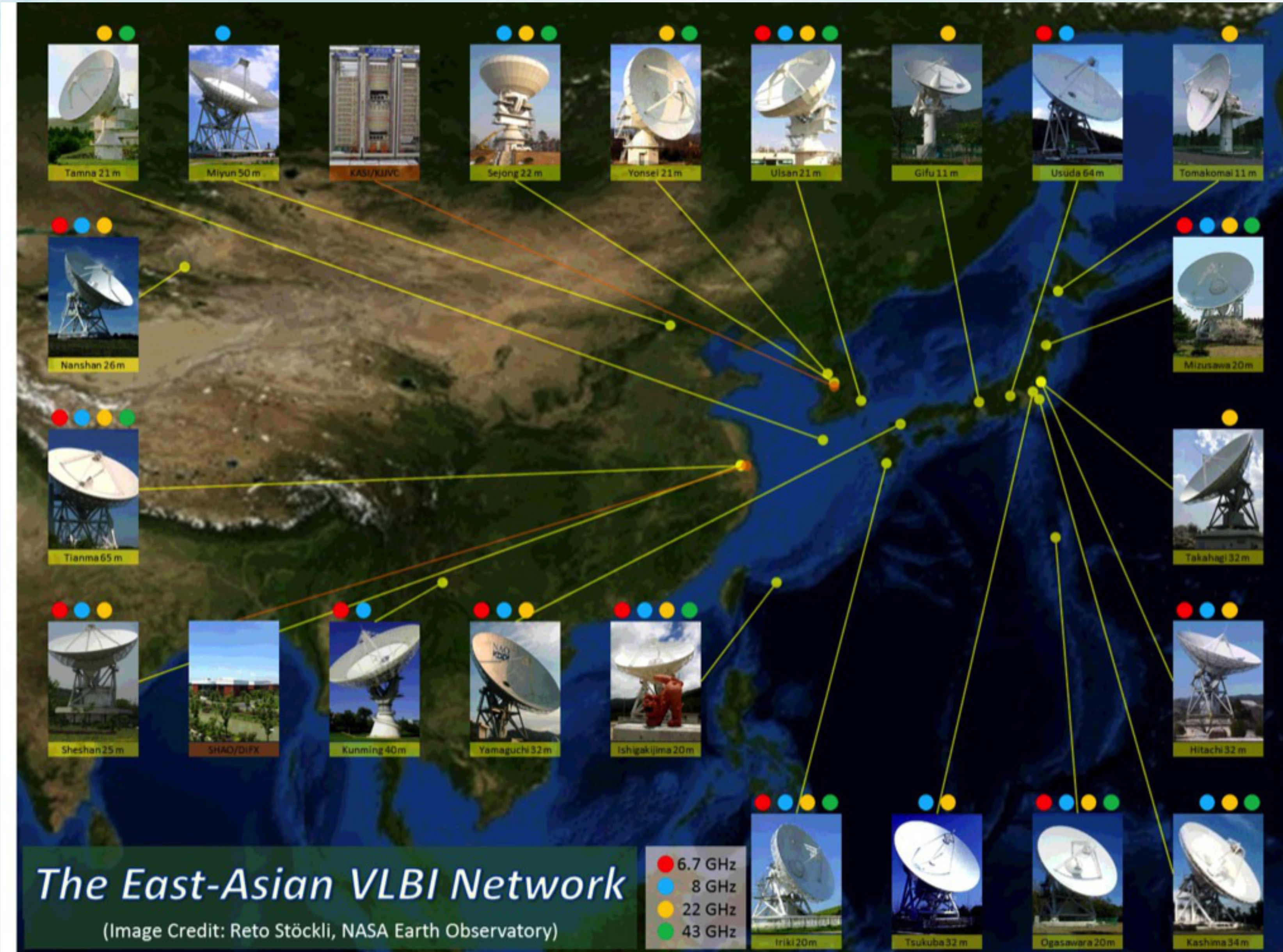
Expanding to the Global Research Platform
Via CENIC/Pacific Wave, Internet2, and International Links

Korea Institute of Science and Technology Information



Source: Larry Smarr(Calit2), 2nd NRP Workshop@Bozeman 2018

Data Intensive Science : The East-Asian VLBI

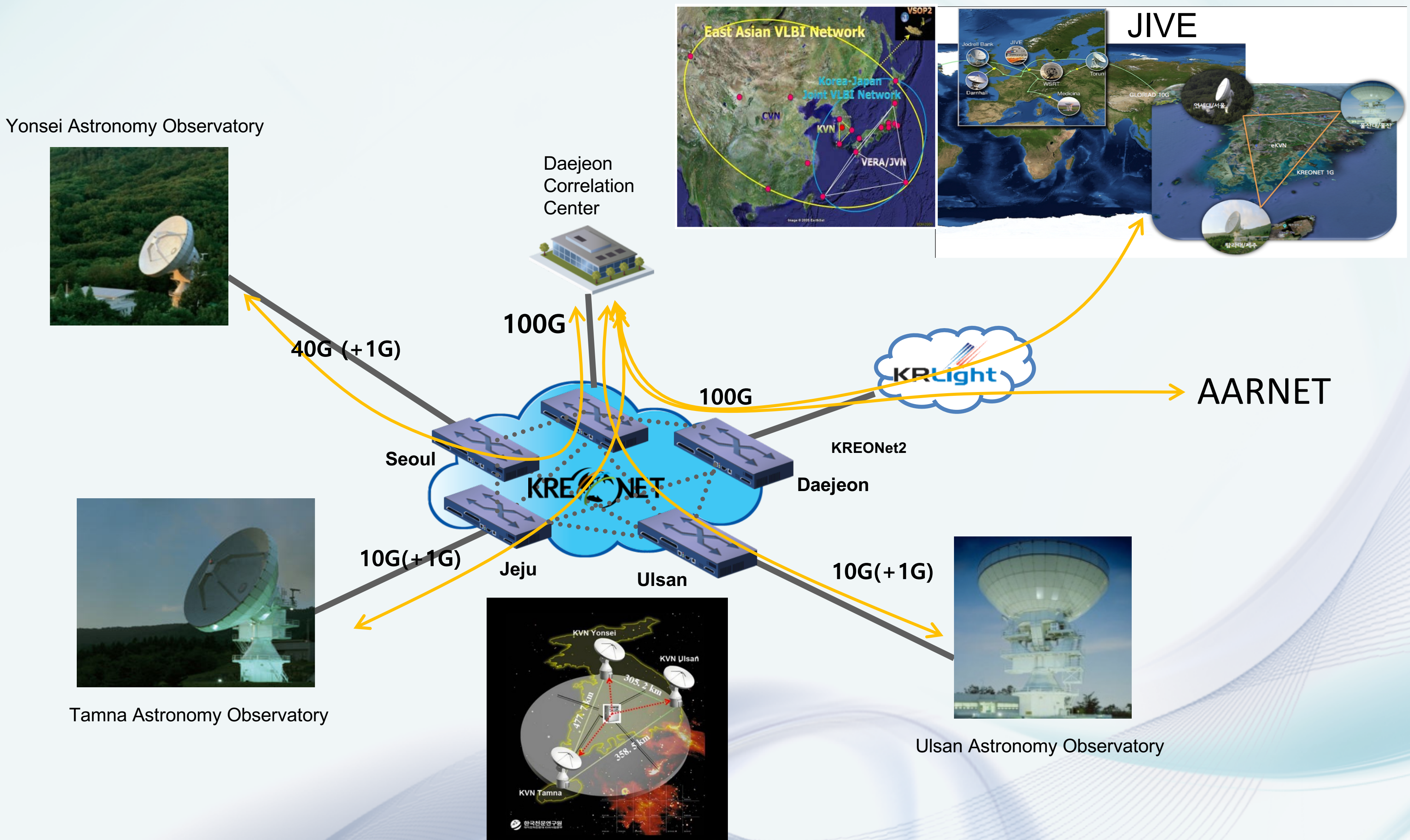


Official announcement for operating the East-Asian VLBI among Korea, Japan and China

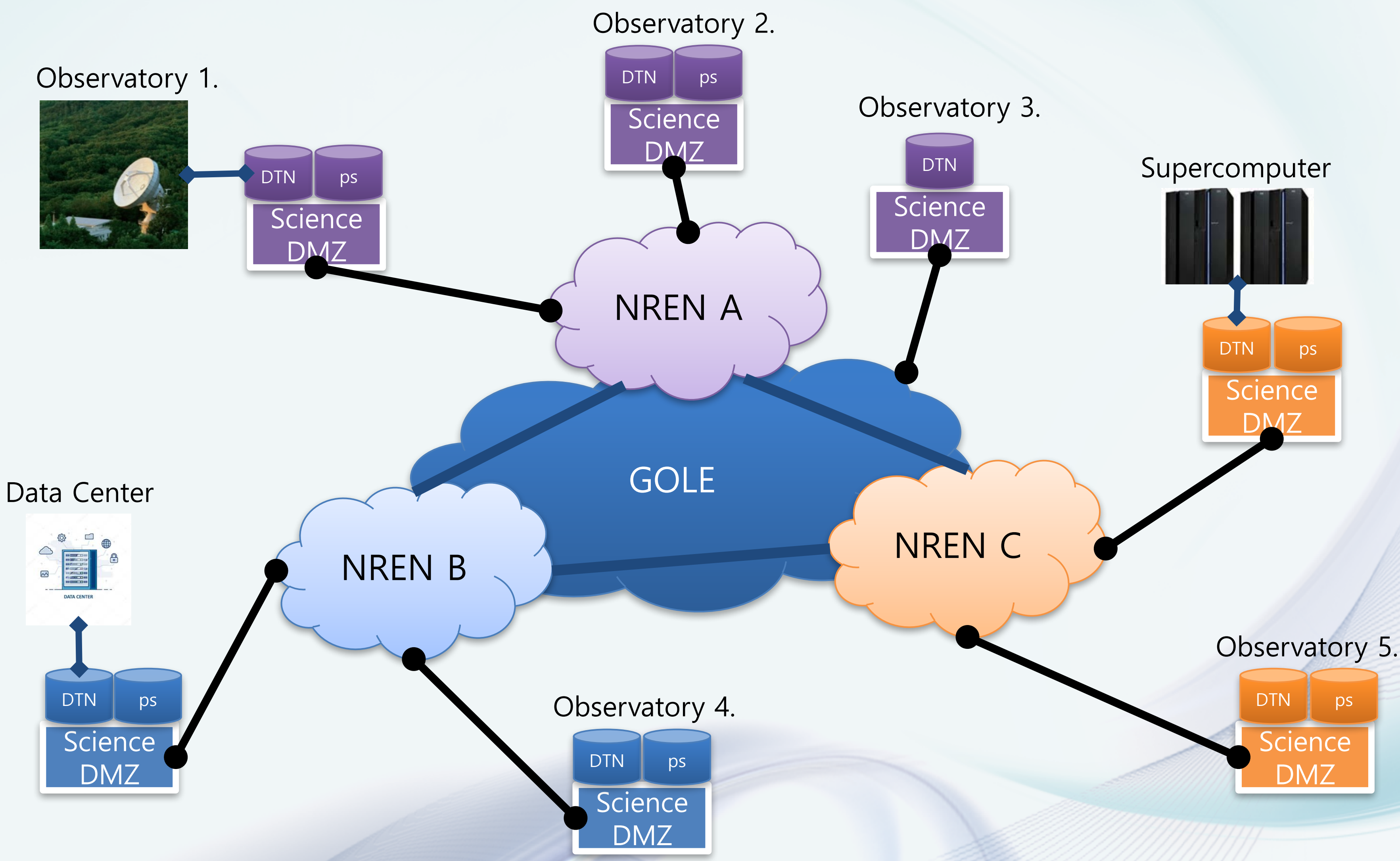
@Pyoungchang, 6 September 2018

e-KVN (e-VLBI Network in Korea)

- e-KVN: Korean e-VLBI(electronic Very Long Baseline Interferometry) Network



Optimized (Network) Research Platform for e-VLBI



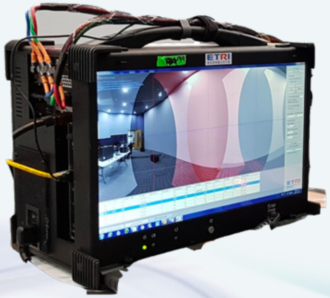
World first intercontinental UWV transmission

- 360° media delivery with ultra high quality based on MPEG OMAF
  - OMAF improves the quality of 360° media per same unit bandwidth through a packing process which results in bandwidth consumption reduction
  - Real-time stitching of 4K captured video for live streaming
- OMAF delivery over MPEG MMT for live streaming
  - MMT minimizes delivery delay of OMAF based 360° media
  - Smooth and seamless switching of streams

Amsterdam Arena

IBC and Korea

Two sets of 3x4K camera systems



4Kx4K or 8Kx2K

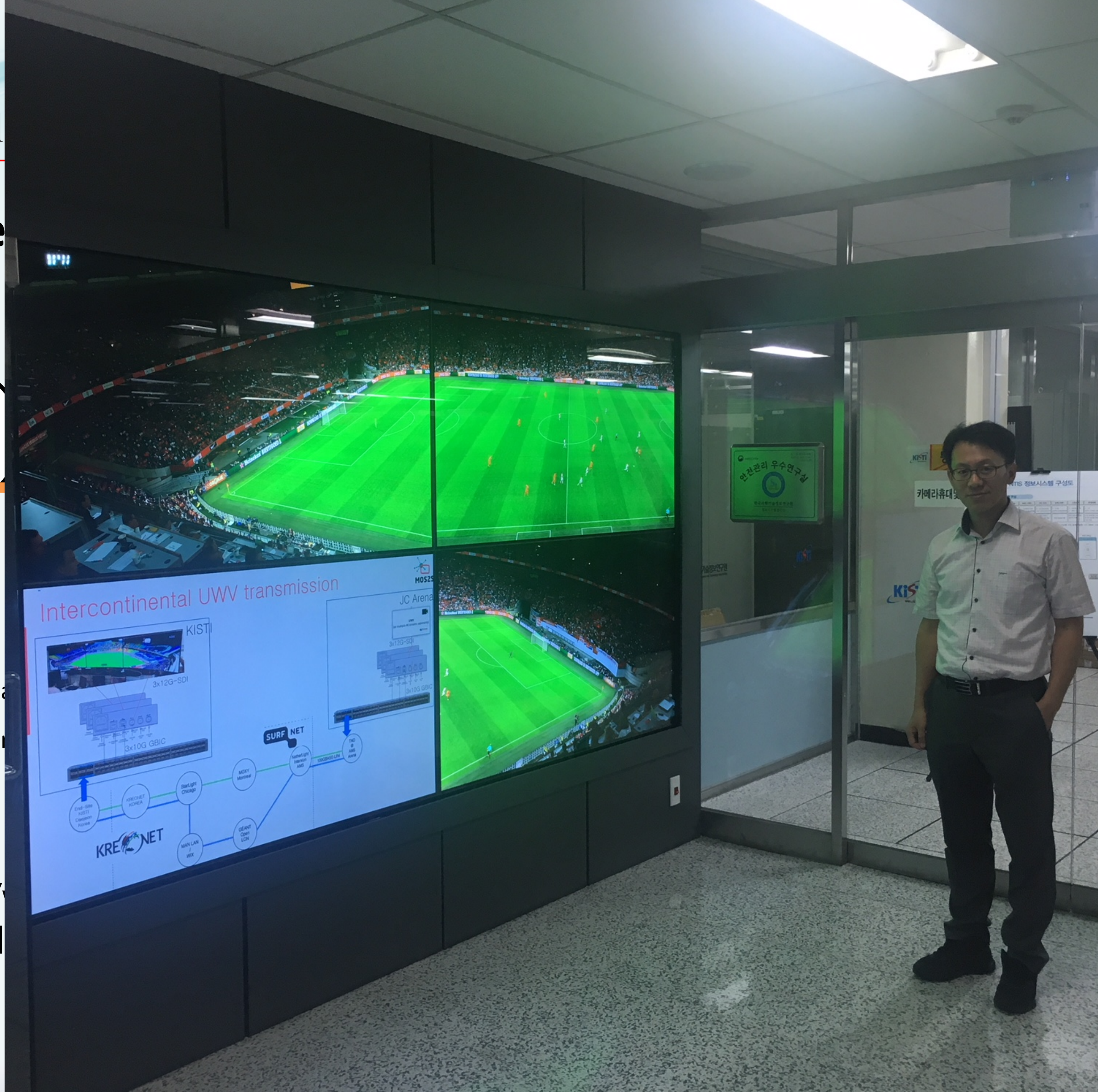
via Three 12G-SDIs

ETRI real-time stitching system

World

Daeje vork

KISTI
Daejeon



TNO
AMS
@Arena

- Prima
- Secon

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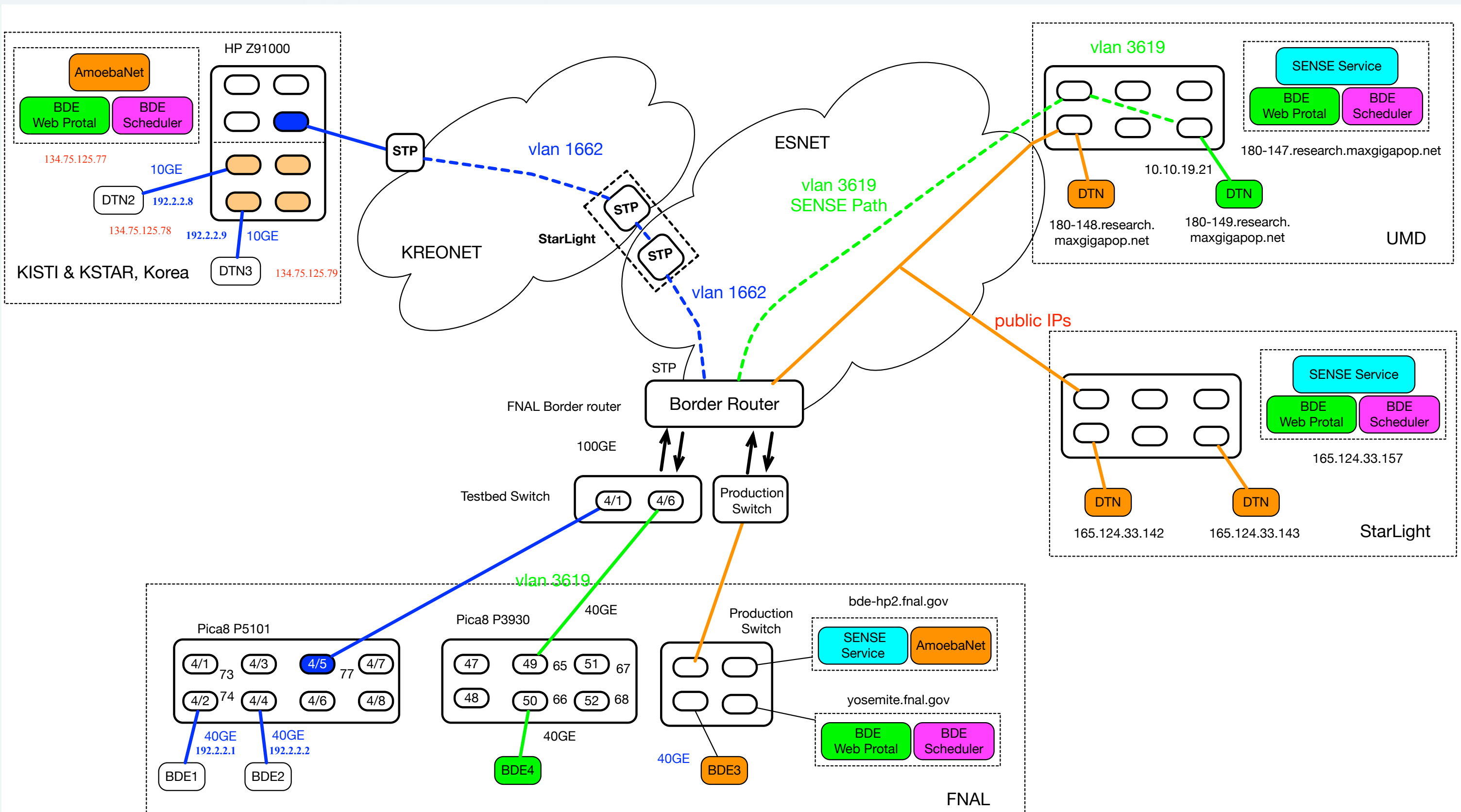
Participation for the SC18 Network Research Exhibition (1)

- **“Global Petascale to Exascale Science Workflows Accelerated by Next Generation SDN Architectures and Applications” led by Harvey Newman**
  - KISTI Focus on **real LSST data** from Chile to real user of Korea via US KASI (Korea Astronomy and Space Science Institute), one of the international contributors on behalf of the LSST Korea with 100G DTN at KASI and KISTI in Daejeon (Working on a scenario)

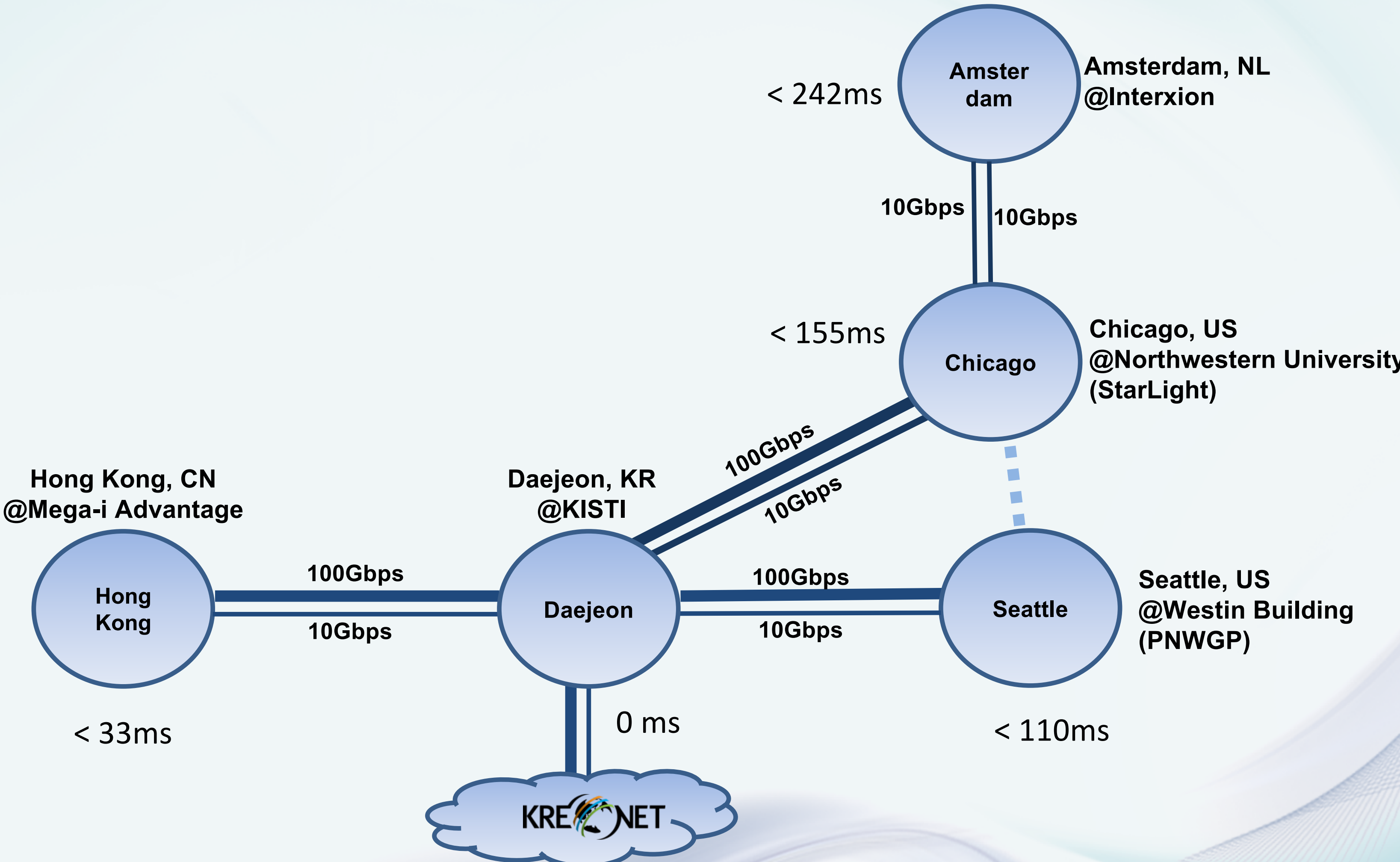
KREONET KASI LSST: Chile via StarLight/SC18

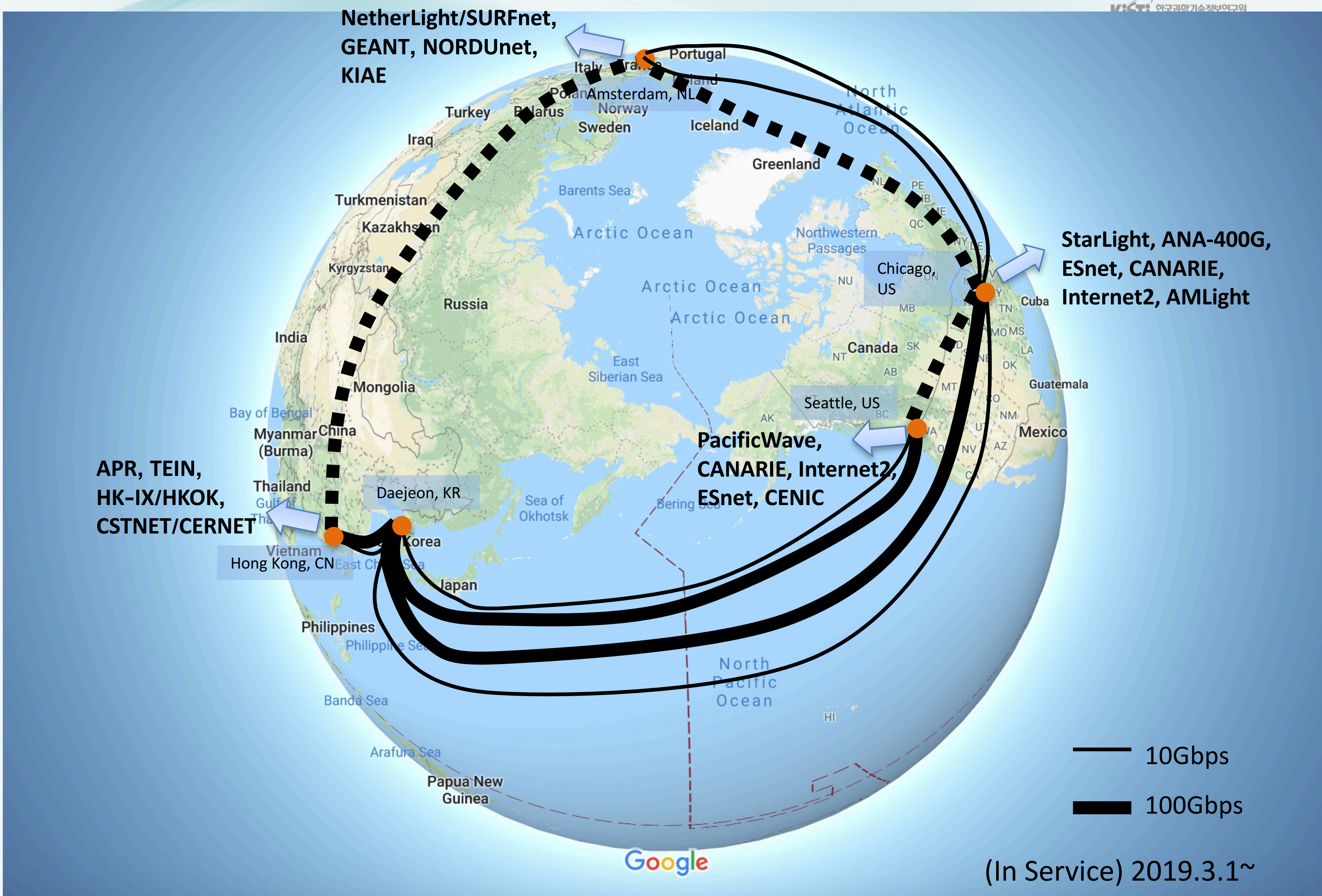
Participation for the SC18 Network Research Exhibition (2)

- **“Providing Programmable Data Streaming to Large Computational Sciences” led by Wenji Wu, FNAL**
  - Partners: FNAL, ORNL, PPPL, iCAIR, KISTI, KSTAR/NFRI



Upgrade Plan of KRLight/KREONet2 international circuit




NetherLight/SURFnet,
GEANT, NORDUnet,
KIAE
Amsterdam, NL
StarLight, ANA-400G,
ESnet, CANARIE,
Internet2, AMLight
Chicago, US
Seattle, US
PacificWave,
CANARIE, Internet2,
ESnet, CENIC
APR, TEIN,
HK-IX/HKOK,
CSTNET/CERNET
Hong Kong, CN
Daejeon, KR
10Gbps
100Gbps
(In Service) 2019.3.1~

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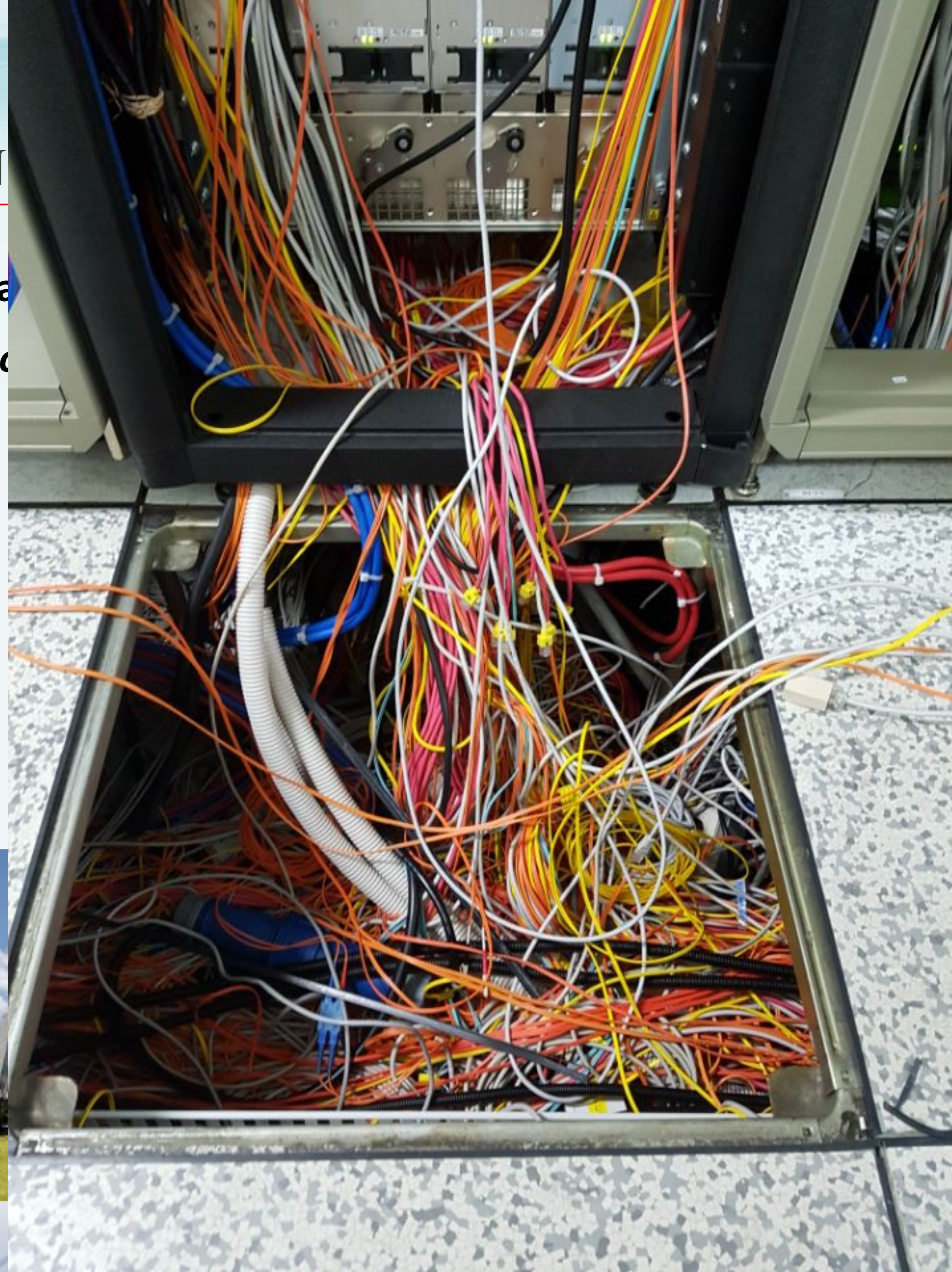
KRLight fa

30 years c



floor at KISTI's

g next year

APAN 47th Meeting & APRICOT 2019

@Daejeon Convention Center, Daejeon, South Korea

18 - 28 February 2019

APAN

APRICOT 2019

APNIC 47

Summary

- **KRLight Global Science Gateway for Data Intensive Science**
  - Nature and History of the Universe : **CERN LHC, LSST, SKA and eVLBI**
  - Human Genome Project (Exabyte Data)
  - Earth Science & Climate data, Supercomputer networking etc.
- **Optimized Research Platform for Data Intensive Science**
  - Science DMZ, Data Transfer Node, PerfSONAR, Science Engagement
- **New KRLight Infrastructure and Services**
  - 100Gbps lambdas from Daejeon to Hong Kong, Seattle and Chicago
  - 100Gbps enabled perfSONAR, Data Transfer Node
  - Continue to directly support data intensive science communities
- **Collaboration with global partners to global science super-highway**
  - 100Gbps inter-continental or inter-national circuit widely deployed
  - Partnership with **GLIF**, ANA, APR, APAN Communities

Thank you

KBS
국립대구과학관
APCC
KIAS 고등과학원
NFRI 국가핵융합연구소
NANO 나노종합기술원
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NRF 한국연구재단
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KASI 한국천문연구원
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한국행정연구원
한국화학연구원

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