GSDC Activities for Scientific Computing

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for KISTI-GSDC Team

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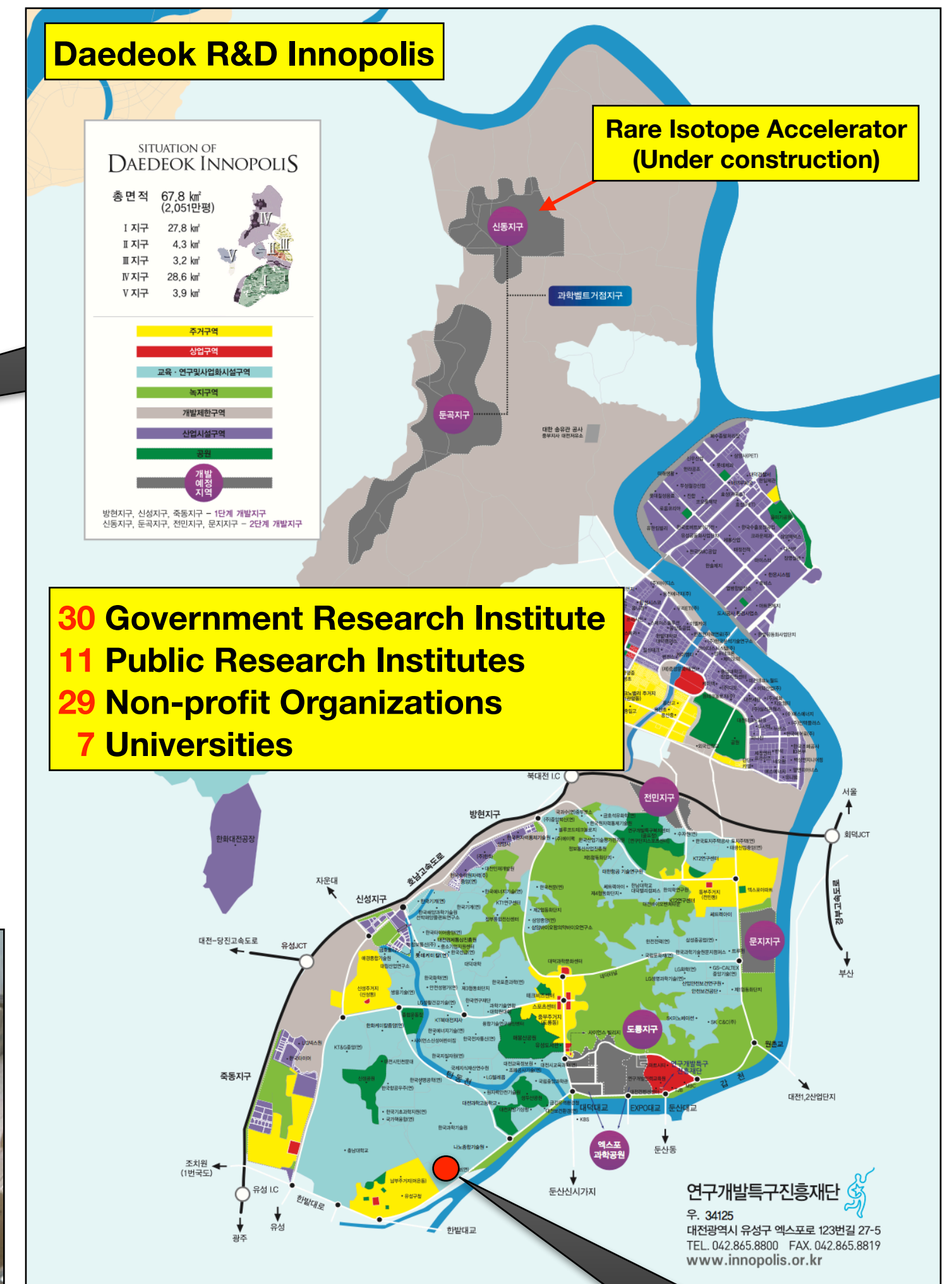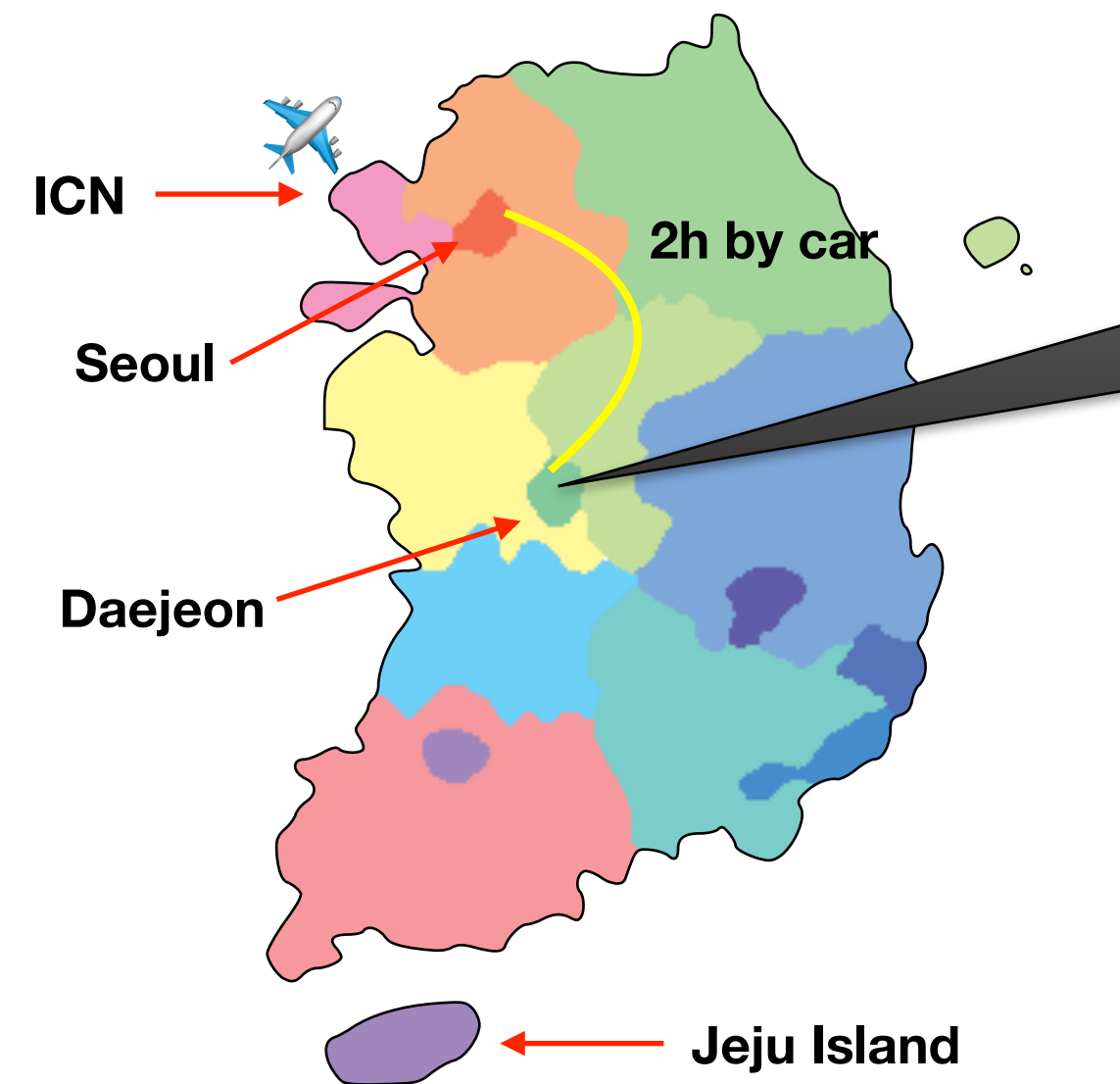# Introduction

KISTI GSDC를 소개합니다.

KISTI

Korea Institute of Science and Technology Information

- Government-funded research institute founded in 1962 for national Information Service and Supercomputing

- **National Supercomputing Center**

  - Tachyon II system (~307.4 TFlops at peak), ranked 14th of Top500 (2009)

  - **New system coming this year (~18 PFlops at peak)**

  - **KREONet** - National R&E network

Map of South Korea

ICN

Seoul

2h by car

Daejeon

Jeju Island

Daedeok R&D Innopolis

Rare Isotope Accelerator (Under construction)

30 Government Research Institute
11 Public Research Institutes
29 Non-profit Organizations
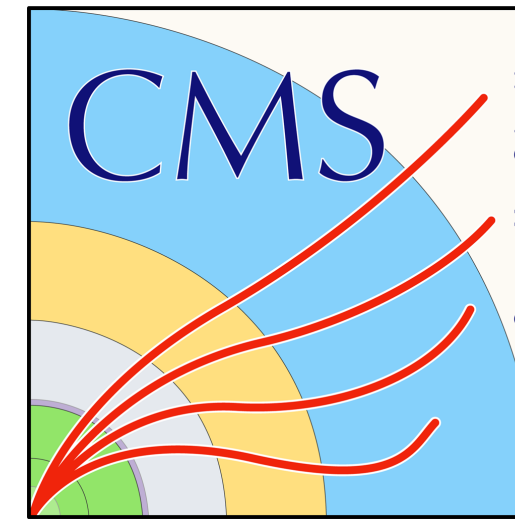**7 Universities**

Tachyon II

KREONET

GSDC

Global Science experimental Data hub Center

- Government-funded project, started in 2009 to **promote Korean fundamental research through providing computing power and data storage**

- **Datacenter for data-intensive fundamental research**

  - 16 staff: system administration, experiment support, external-relation, management and planning
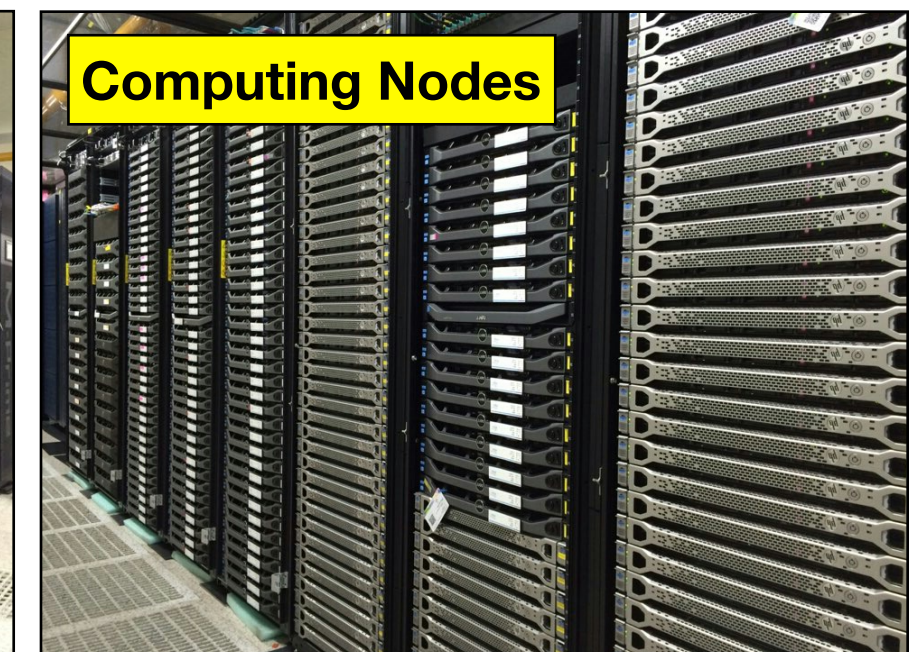
Experiment Support

Heavy-Ion Physics
WLCG Tier-1
(CPU) 3,500 cores / (DISK) 1,500 TB / (TAPE) 3,000 TB
Tier-3 (KIAF) : (CPU) 200 cores / (DISK) 300 TB

Elementary Particle Physics
Tier-3 : (CPU) 1,000 cores / (DISK) 600 TB
WLCG Tier-2 (2017)
(CPU) 1,000 cores / (DISK) 800 TB

Astrophysics
LDG Tier-3
(CPU) 800 cores / (DISK) 600 TB
LDG Tier-2 (TBD)

Medical Science
(CPU) 360 cores / (DISK) 600 TB

Elementary Particle Physics
B2G Tier-2
(CPU) 300 cores / (DISK) 100 TB

Neutrino Physics
RAW data storage
(CPU) 360 cores / (DISK) 700 TB

Structural Biology (TEM)
(CPU) 300 cores / (DISK) 500 TB
Trial Service

3-4 more domestic experiments under preparation
e.g. volcanic hazard mitigation, brain research, disease control, etc.

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WLCG Tier-1 Status

WLCG Tier-1 Requirements

Resources

`Network` LHCOPN - Provide a dedicated optical connection to CERN with (currently) 10Gb/s for T0-T1 and T1-T1 traffic + backup
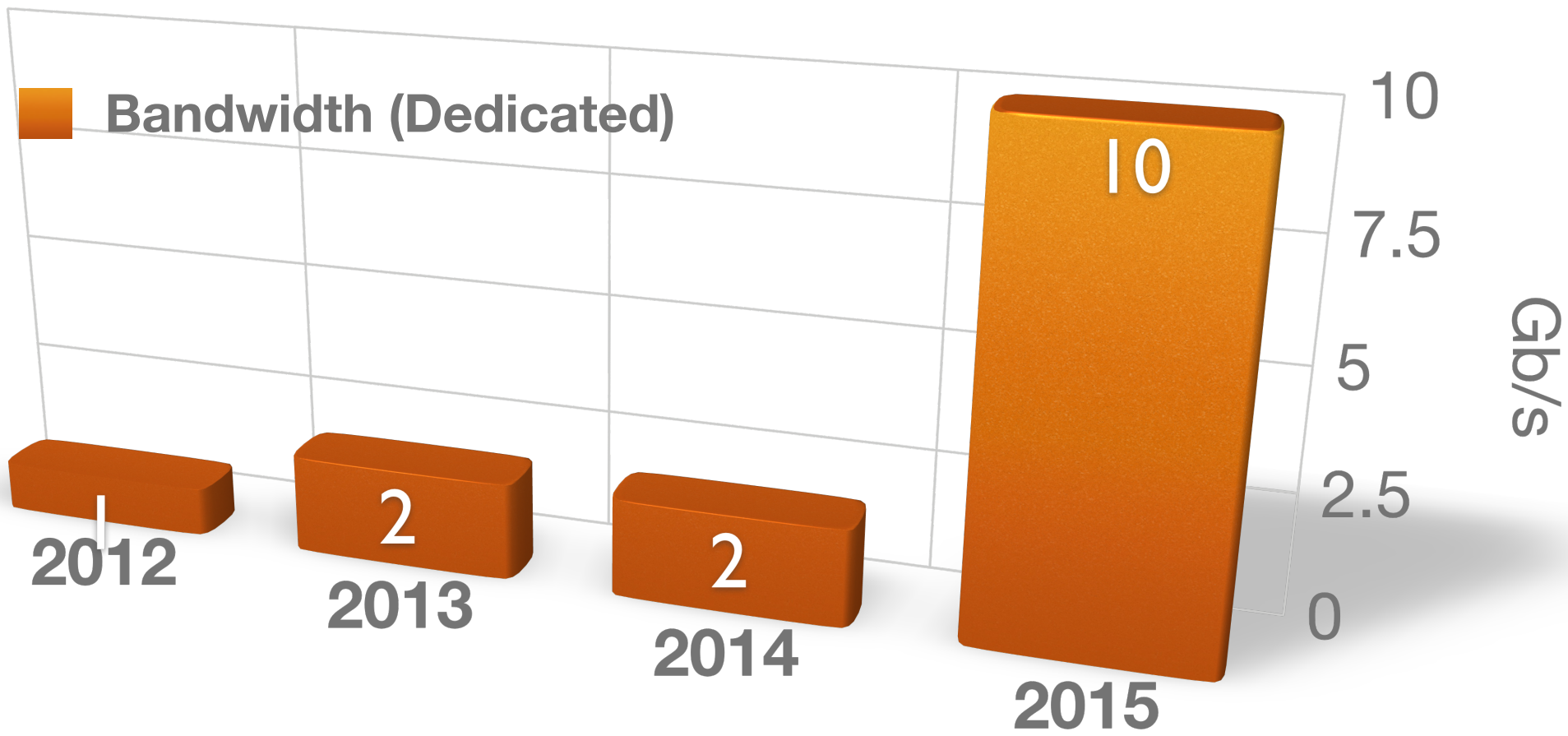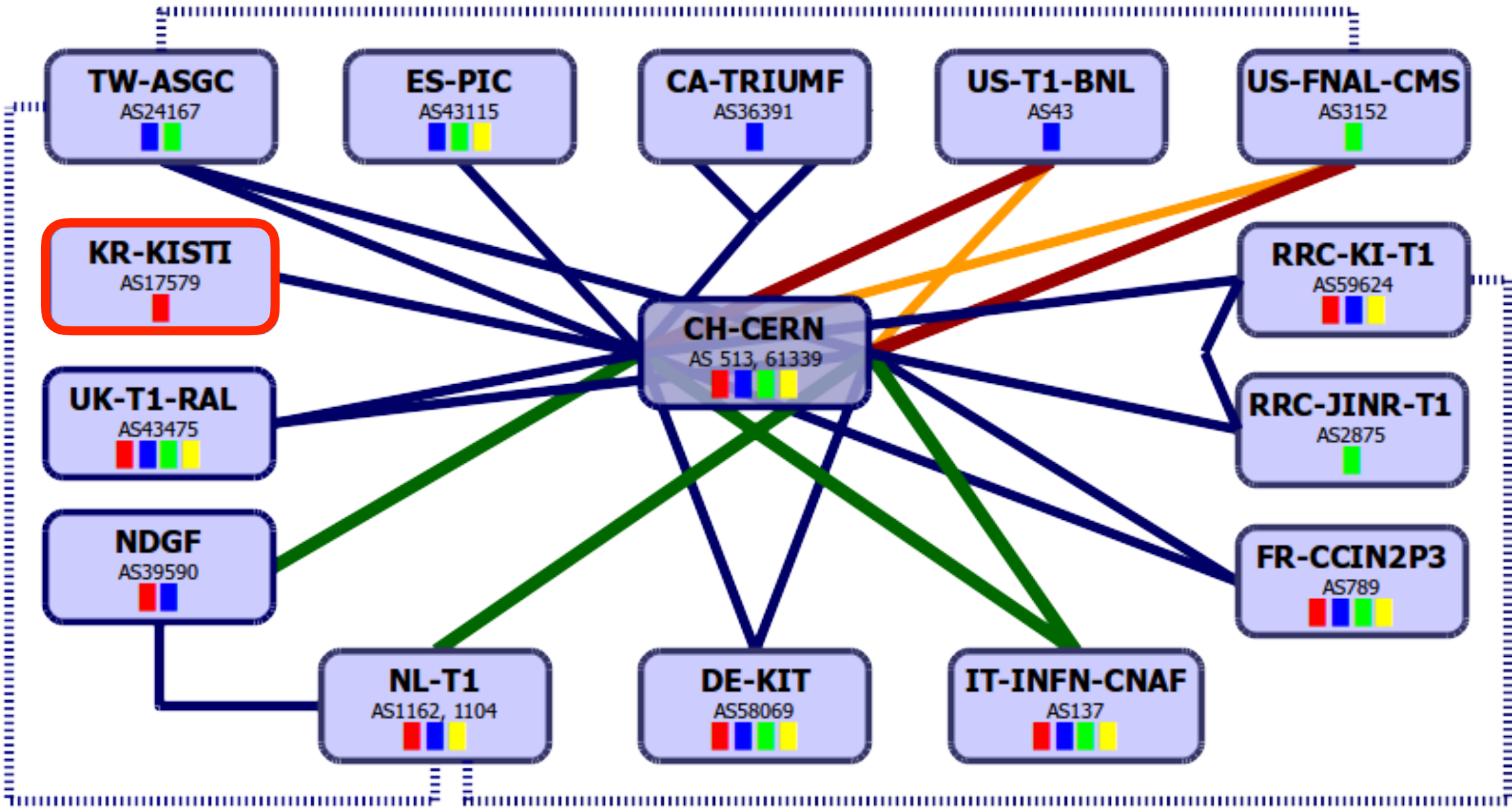· LHCONE - Provide a practical solution for T1-T2 traffic (to be discussed with experiment)

`Pledges` CPU & DISK - Provide typically 10% of global total T1 requirement of experiment (absolute minimum 5% approved by C-RRB)
· TAPE - Provide sufficient capacity to store its share of raw data of experiment and demonstrate the capability of accepting a copy of raw data

Services

· Should integrate with WLCG monitoring framework
· Availability/Reliability : >99% during data-taking, >97% at minimum (based on WLCG MoU)
  · On-call support required for key services
· Should interface with WLCG accounting services
· Should support a number of T2 sites
  · Technical support and acting as a data source according to the computing model of experiment

LHCOPN

TW-ASGC AS24167	**ES-PIC** AS43115	**CA-TRIUMF** AS36391	**US-T1-BNL** AS43	**US-FNAL-CMS** AS3152

KR-KISTI AS17579

RRC-KI-T1 AS59624

CH-CERN AS 513, 61339

UK-T1-RAL AS43475

RRC-JINR-T1 AS2875

NDGF AS39590

FR-CCIN2P3 AS789

NL-T1 AS1162, 1104

DE-KIT AS58069

IT-INFN-CNAF AS137

Legend:
- T0-T1 and T1-T1 traffic
- T1-T1 traffic only
- = Alice = Atlas = CMS = LHCb
- 10Gbps
- 20Gbps
- 40Gbps
- 100Gbps

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Bandwidth (Dedicated)

2012 — 2013: 2 — 2014: 2 — 2015: 10

Gb/s scale: 0, 2.5, 5, 7.5, 10

10Gb/s upgrade plan submitted to WLCG in Nov 2013
However, budget eventually secured in 2015 after the global cut (~10%) in 2014

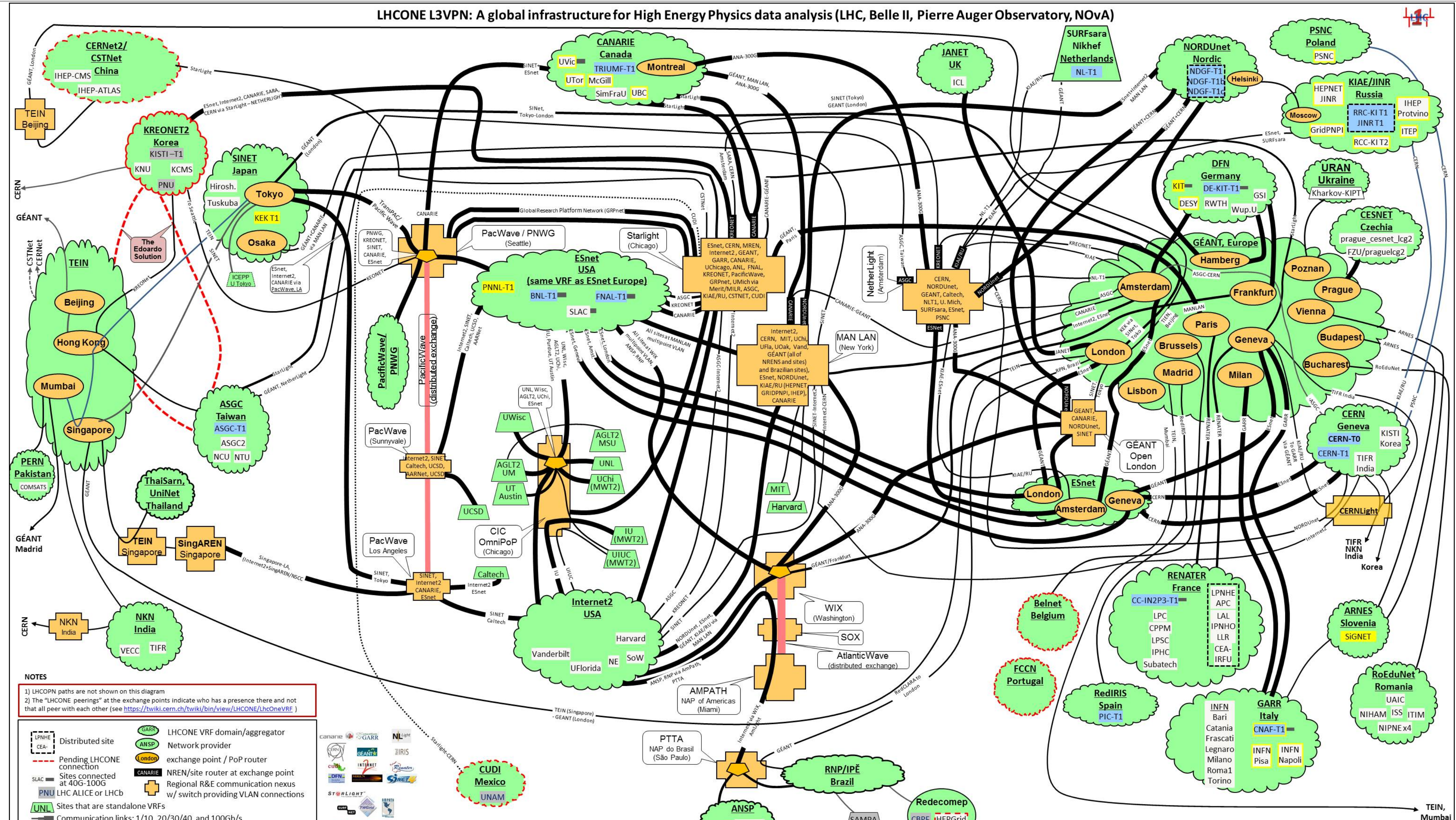**10Gb/s bandwidth upgrade timely done in April 2015
just before the start of LHC RUN2 data-taking**

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LHCONE

LHCONE Map (v3.4)
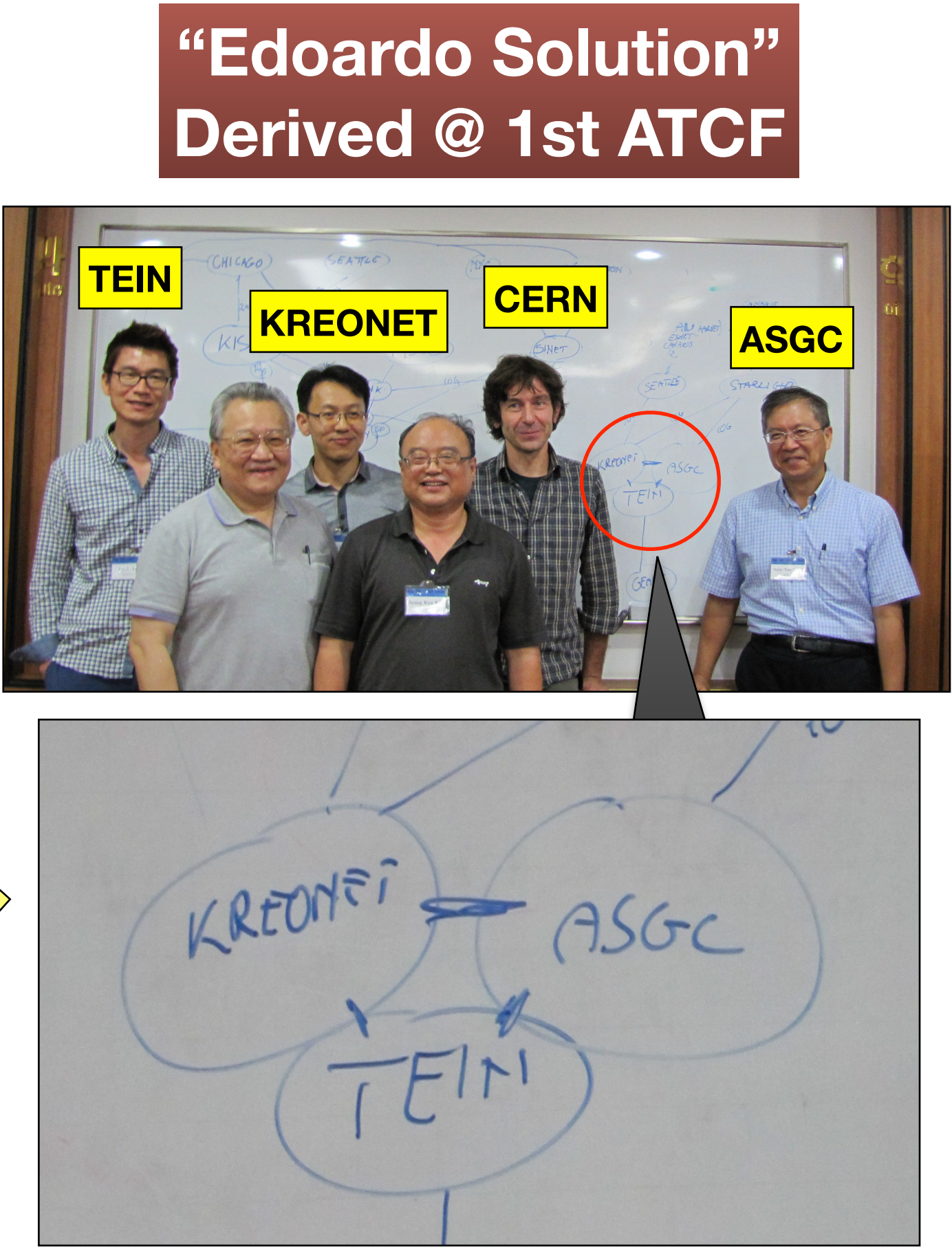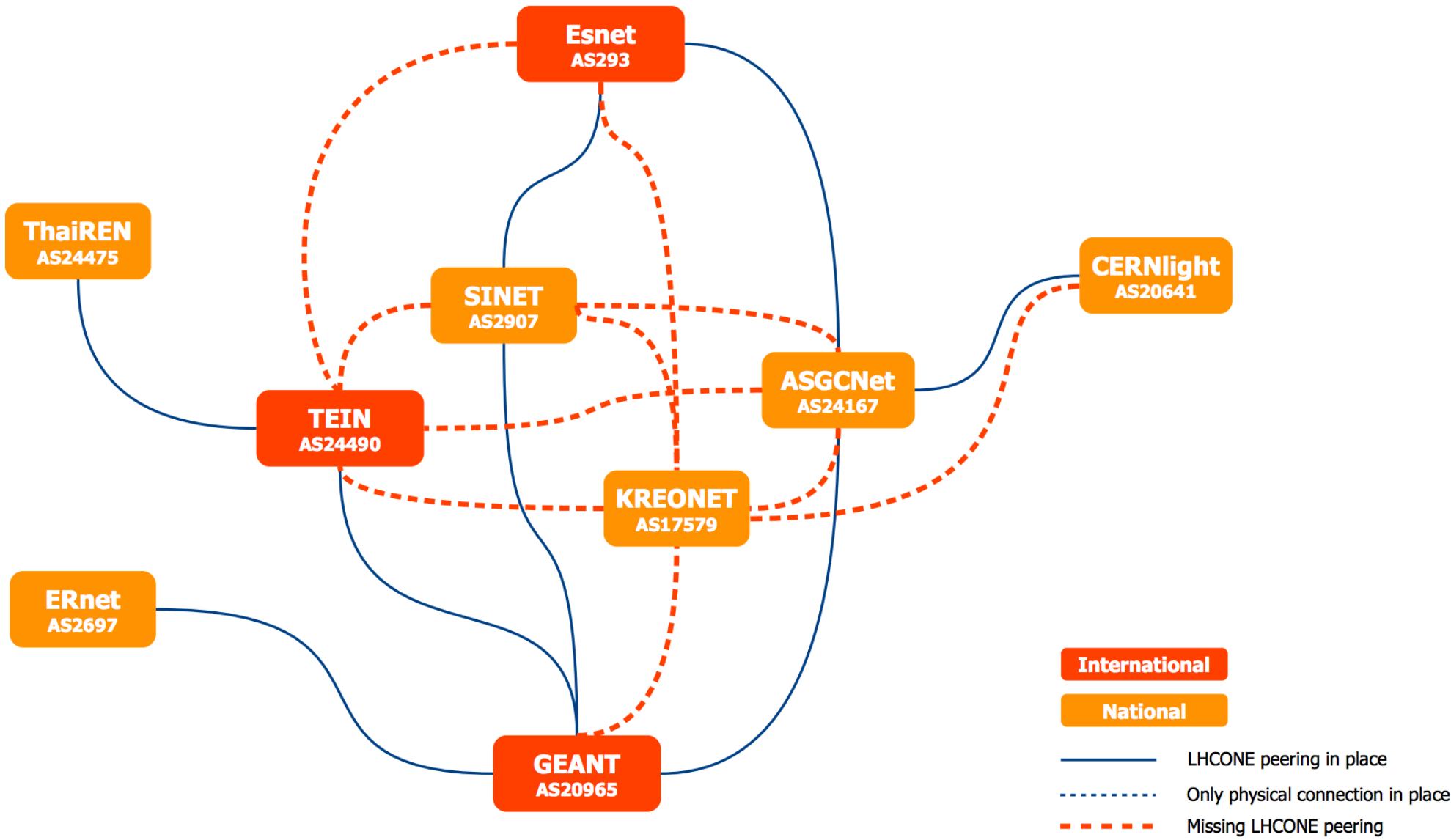William Johnston, ESNET

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

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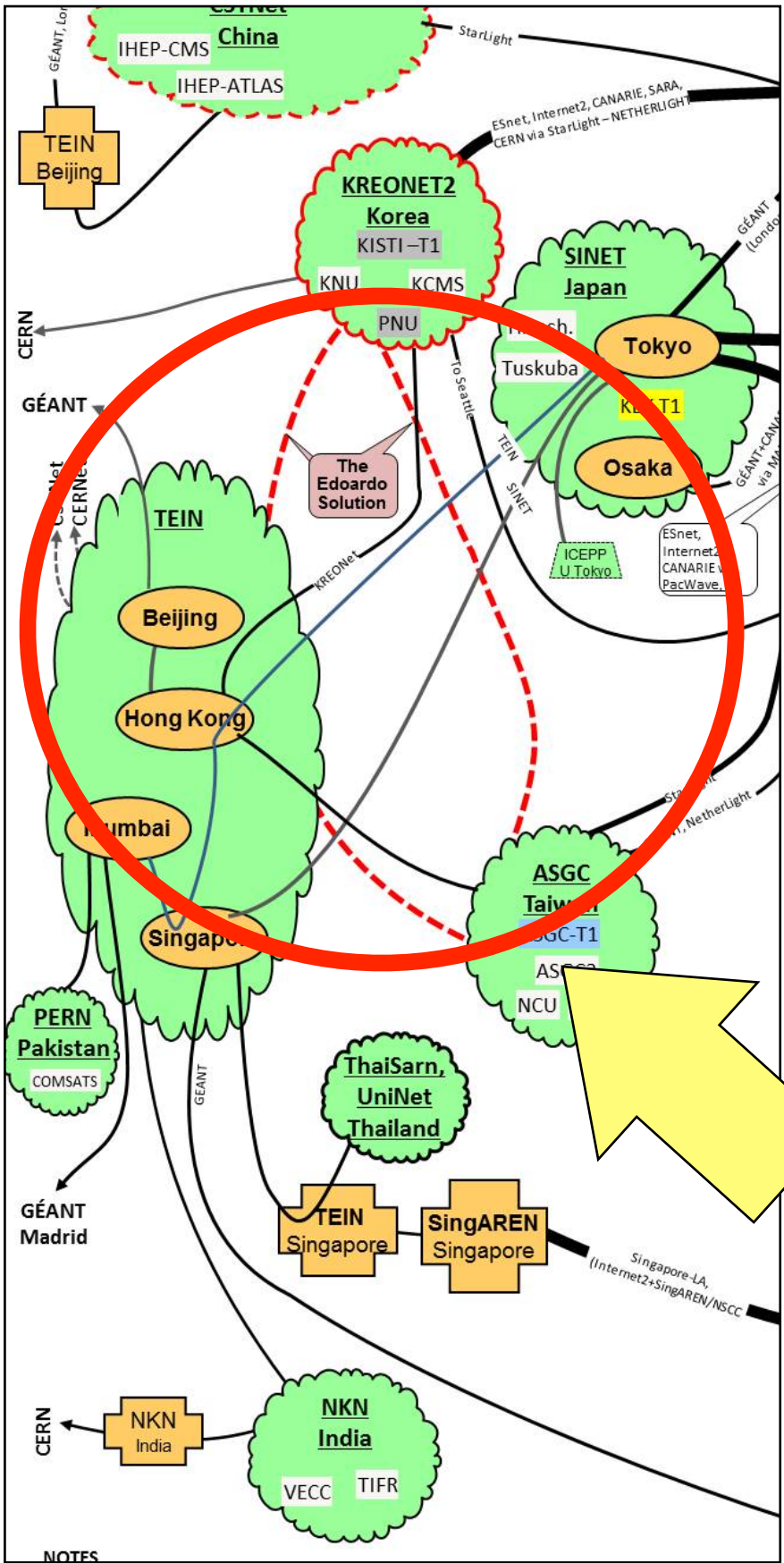
LHCONE in Asia

A part of LHCONE Map (v3.4)
William Johnston, ESNET

**"Edoardo Solution"
Derived @ 1st ATCF**

TEIN · KREONET · CERN · ASGC

In the context of LHCONE VRF

Missing connections

LHCONE Update @ 2nd ATCF
Edoardo Martelli, CERN

A long journey is expected for consolidation of network environment in Asia

Asia Tier Center Forum

1st ATCF @ KISTI, Sep 2015

- Started to discuss how the connectivity among Asian sites can be improved practically
- Participation of Asian sites as well as Network experts from CERN, ESnet, GÉANT, TEIN, KREONet
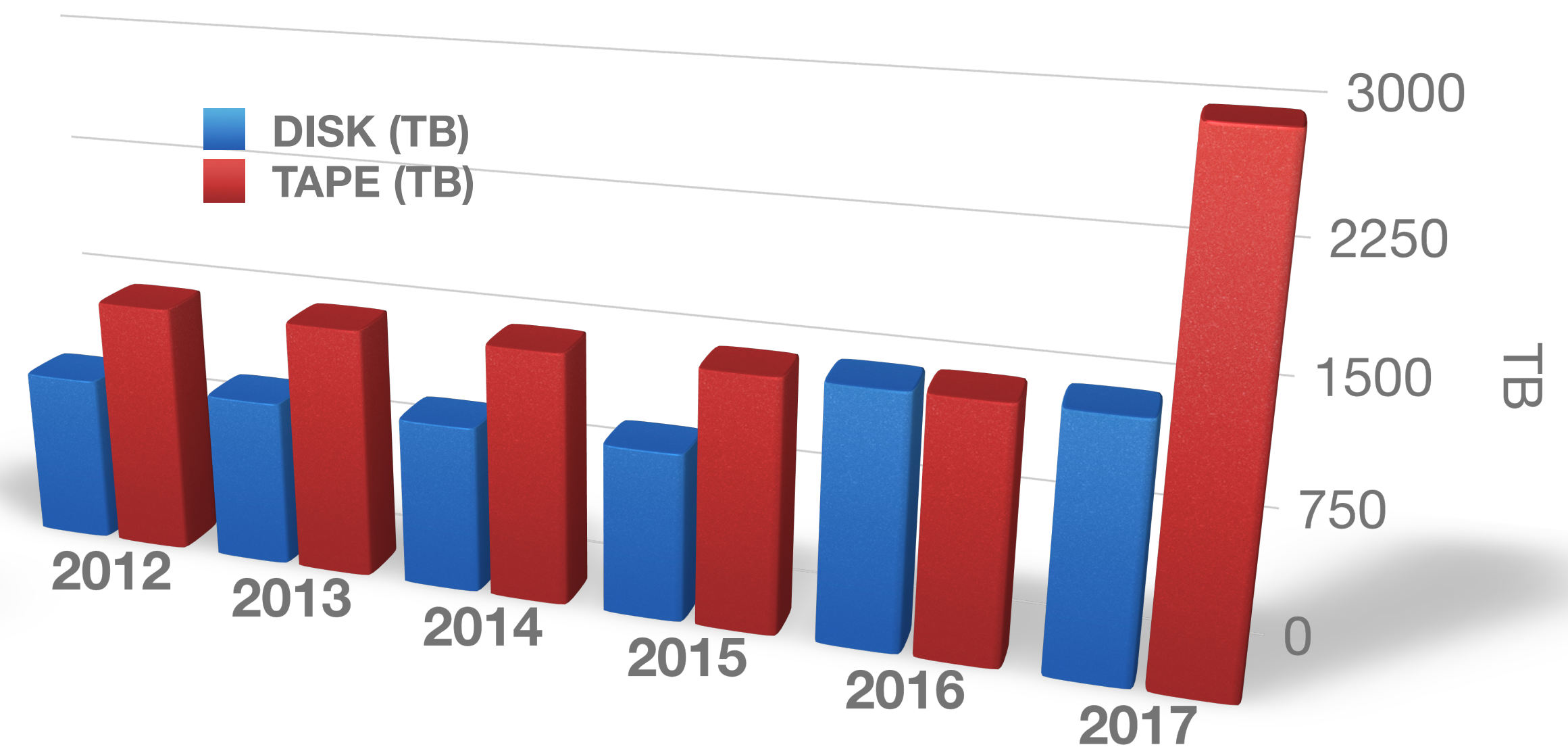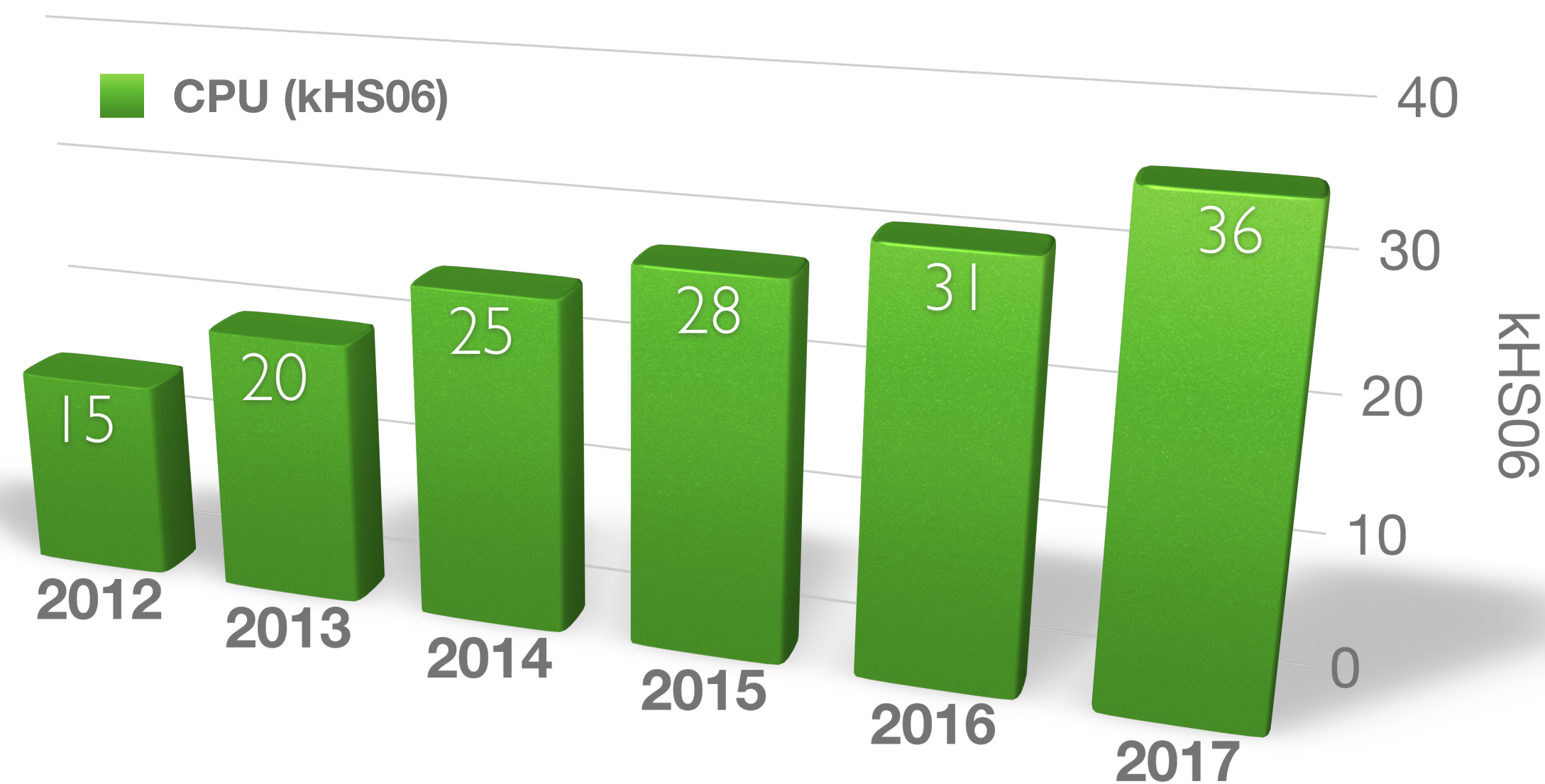
2nd ATCF @ SUT, Nov 2016

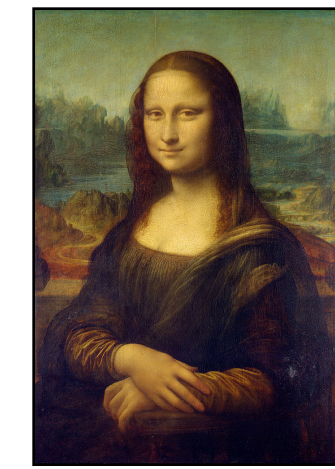We keep tracking the status of connectivity improvement through Asia Tier Center Forum

Asia Tier Center Forum report will be given at WLCG GDB on Wednesday

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Resource Pledges

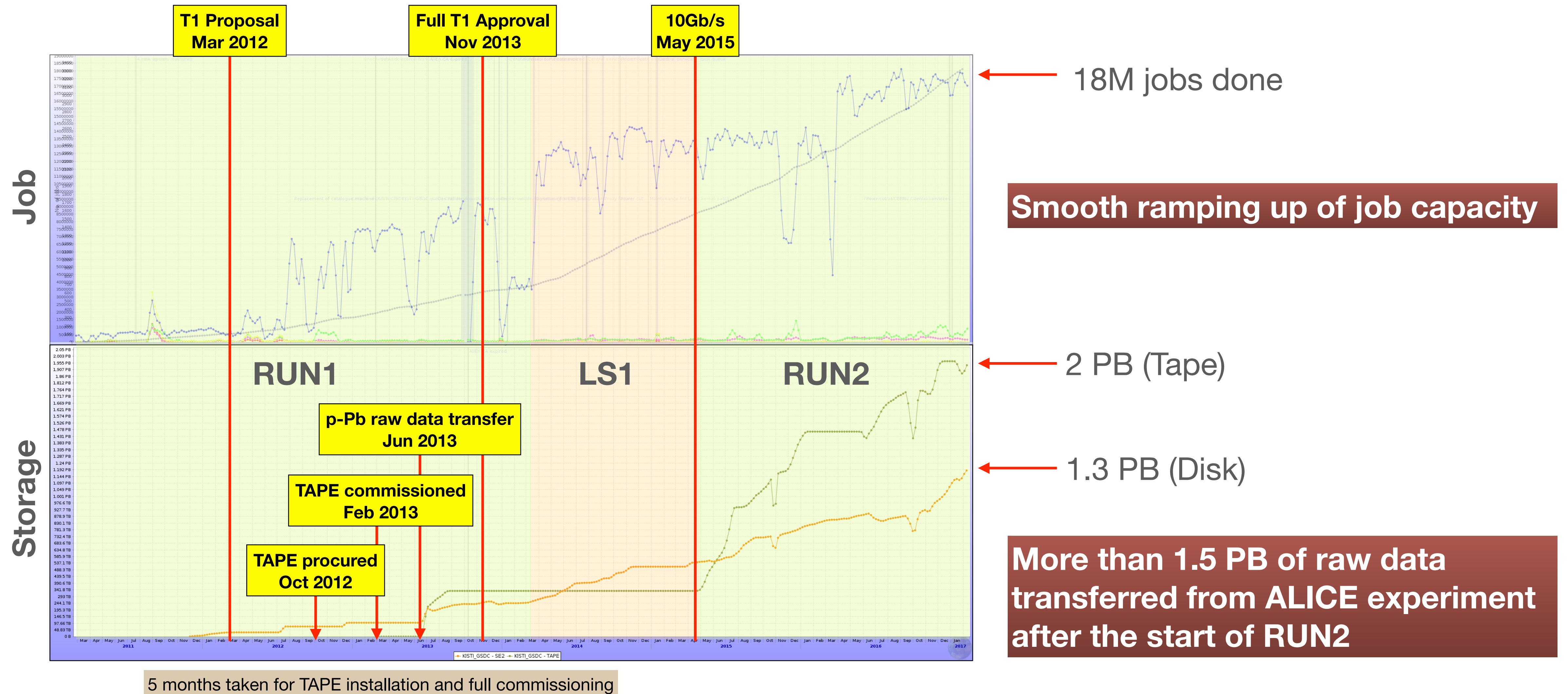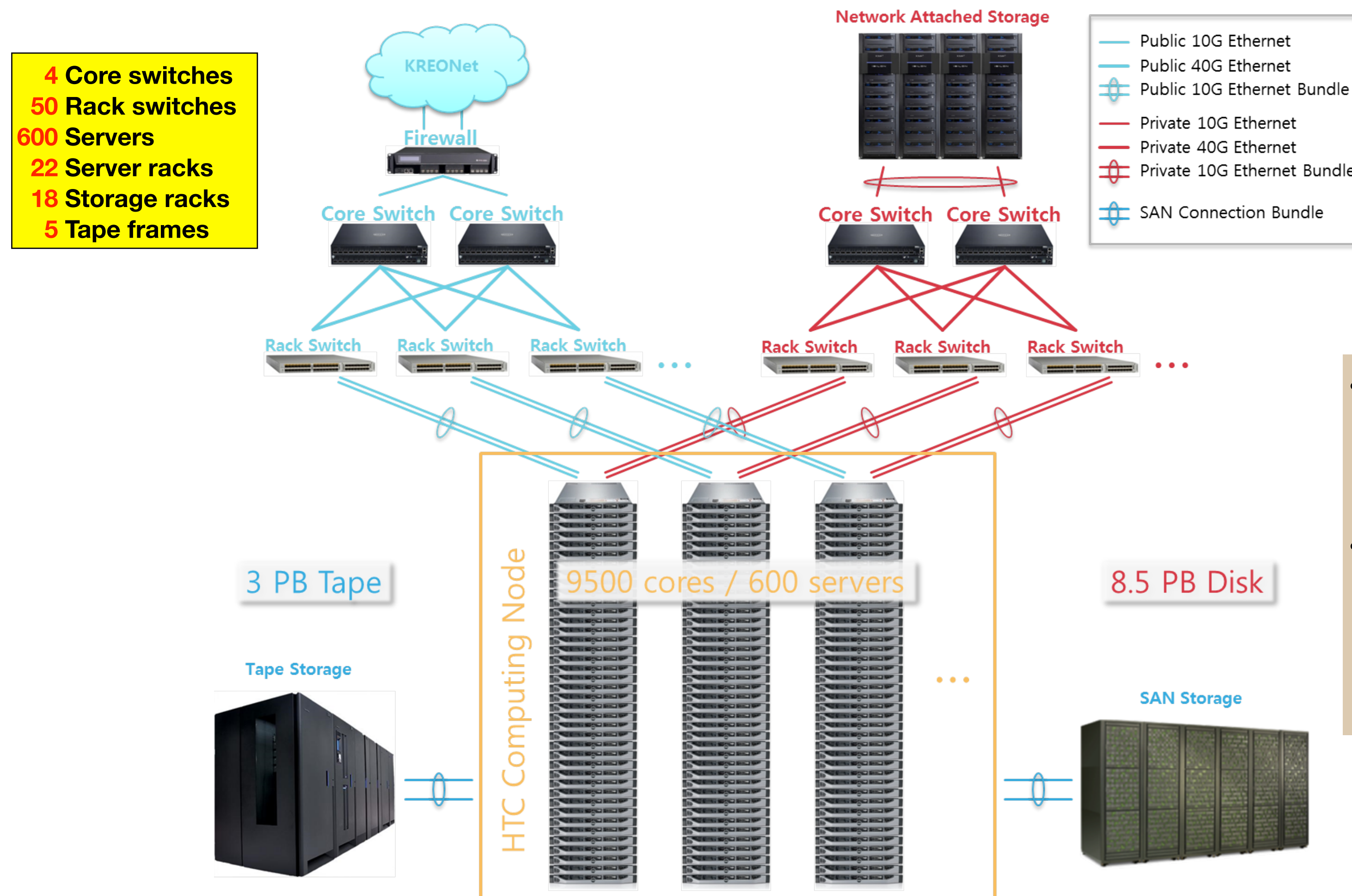|	2012	2013	2014	2015	2016	2017
CPU (cores)	1,500	1,800	2,500	2,500	3,500	3,800

- Tape capacity has been doubled recently
- More disk will be placed to fulfill the increase requirement (20-30%) for RUN2

Resource Usage

T1 Proposal Mar 2012

Full T1 Approval Nov 2013

10Gb/s May 2015

18M jobs done

Smooth ramping up of job capacity

Job

RUN1   LS1   RUN2

2 PB (Tape)

p-Pb raw data transfer Jun 2013

TAPE commissioned Feb 2013

1.3 PB (Disk)

Storage

TAPE procured Oct 2012

More than 1.5 PB of raw data transferred from ALICE experiment after the start of RUN2

KISTI_GSDC - SE2   KISTI_GSDC - TAPE

5 months taken for TAPE installation and full commissioning

System Architecture

4 Core switches
50 Rack switches
600 Servers
22 Server racks
18 Storage racks
5 Tape frames

KREONet

Firewall

Core Switch Core Switch

Network Attached Storage

Core Switch Core Switch

Public 10G Ethernet
Public 40G Ethernet
Public 10G Ethernet Bundle
Private 10G Ethernet
Private 40G Ethernet
Private 10G Ethernet Bundle
SAN Connection Bundle

Rack Switch Rack Switch Rack Switch . . .   Rack Switch Rack Switch Rack Switch . . .

3 PB Tape

HTC Computing Node

9500 cores / 600 servers

8.5 PB Disk

Tape Storage

SAN Storage

- System architecture has been evolved to **remove single failure point** as much as possible
- Also in order to recover the key T1 services promptly, provisioning automation has been built based on the various open-source toolsets

Design for new system architecture based on Container is on-going

Availability/Reliability

- 99.3% availability and reliability achieved in 2016

- Key services are clustered, e.g. CE, squid, xrootd, etc.

- 24h 7/7 monitoring and on-call shift for prompt service recovery

- Well organized maintenance to reduce downtime as much as possible
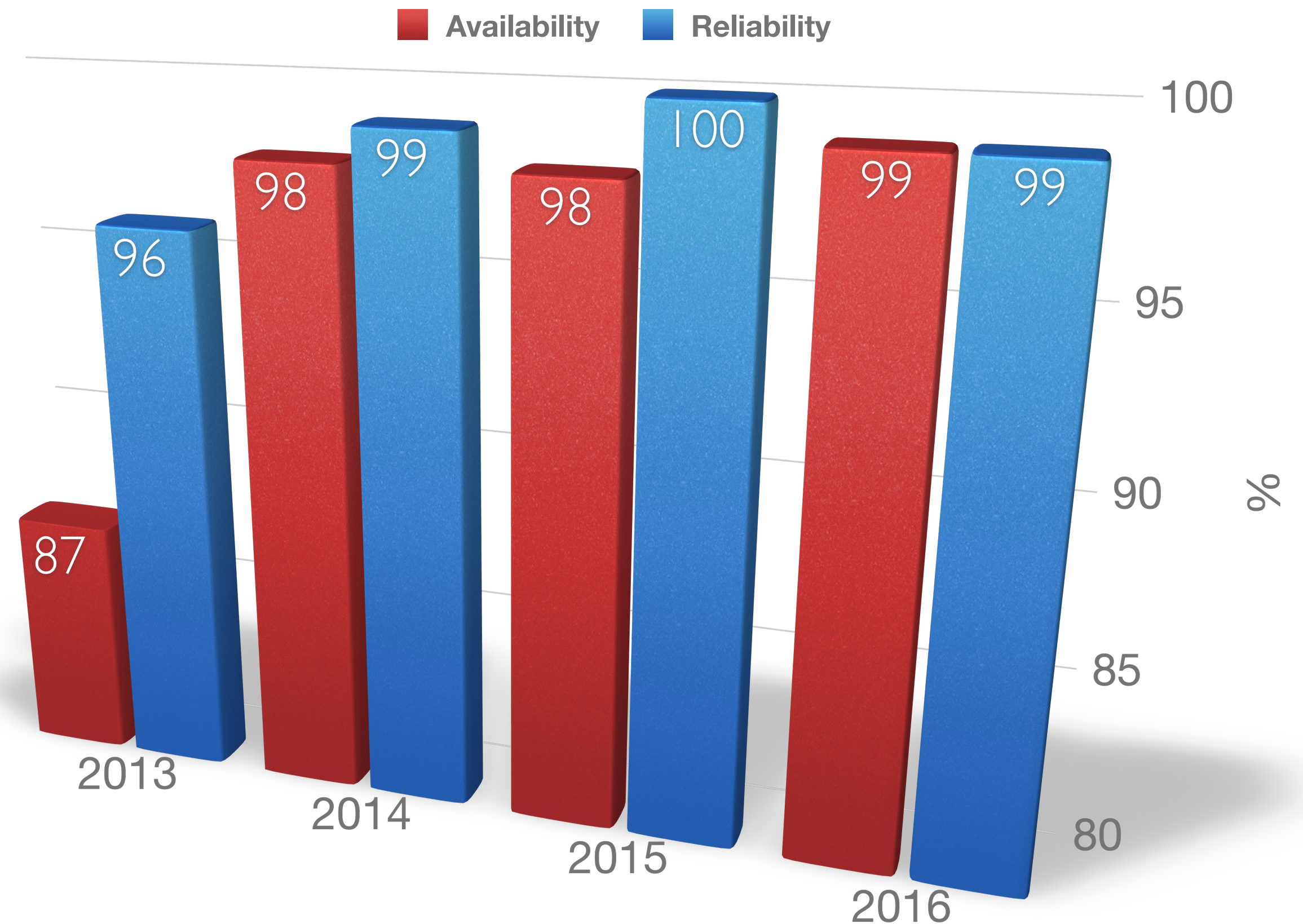
Other activities

KISTI CA

- KISTI GRID CA v2.0

  - Subject: C=KR, O=KISTI, O=GRID, CN=KISTI Grid Certificate Authority

  - Valid from Jul 12, 2007 until **Aug 1, 2017 (less than 5 months left for the renewal)**

  - Signature algorithm: **SHA2** (Key size: 2048 bits)

- Online repository: http://ca.grid

Issued certificates

New CP/CPS under review

Current status of KISTI CA was reported at APGrid PMA Meeting yesterday

User certs

- Kyungpook National Univ.
- Chonnam National Univ.
- Seoul National Univ.
- Soongsil Univ.
- Hanyang Univ.
- Univ. of Seoul

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
☑ CA Management Transfer Meeting	18.10.2016										
☑ CA Management Transfer				10.01.2017							
☑ Internal CP/CPS Revision					17.02.2017						
☑ Review request to APGrid PMA					21.02.2017						
☐ Review & feedback (multiple rounds expected)											
☐ Generate new ROOT CA and publish onto repository											
☐ Re-issue certificates with new ROOT CA											
☐ Revoke certificates signed by old ROOT CA											

Milestones for ROOT CA Renewal
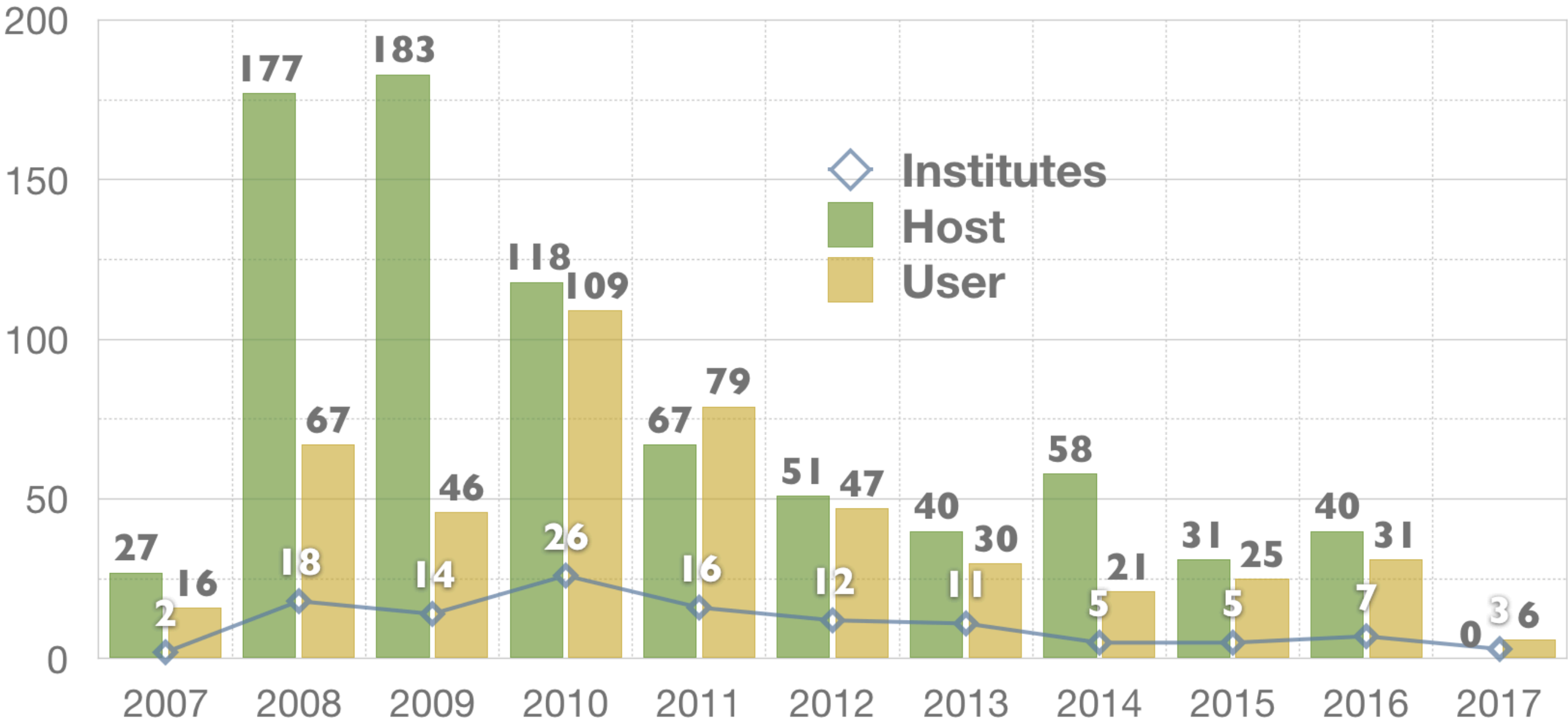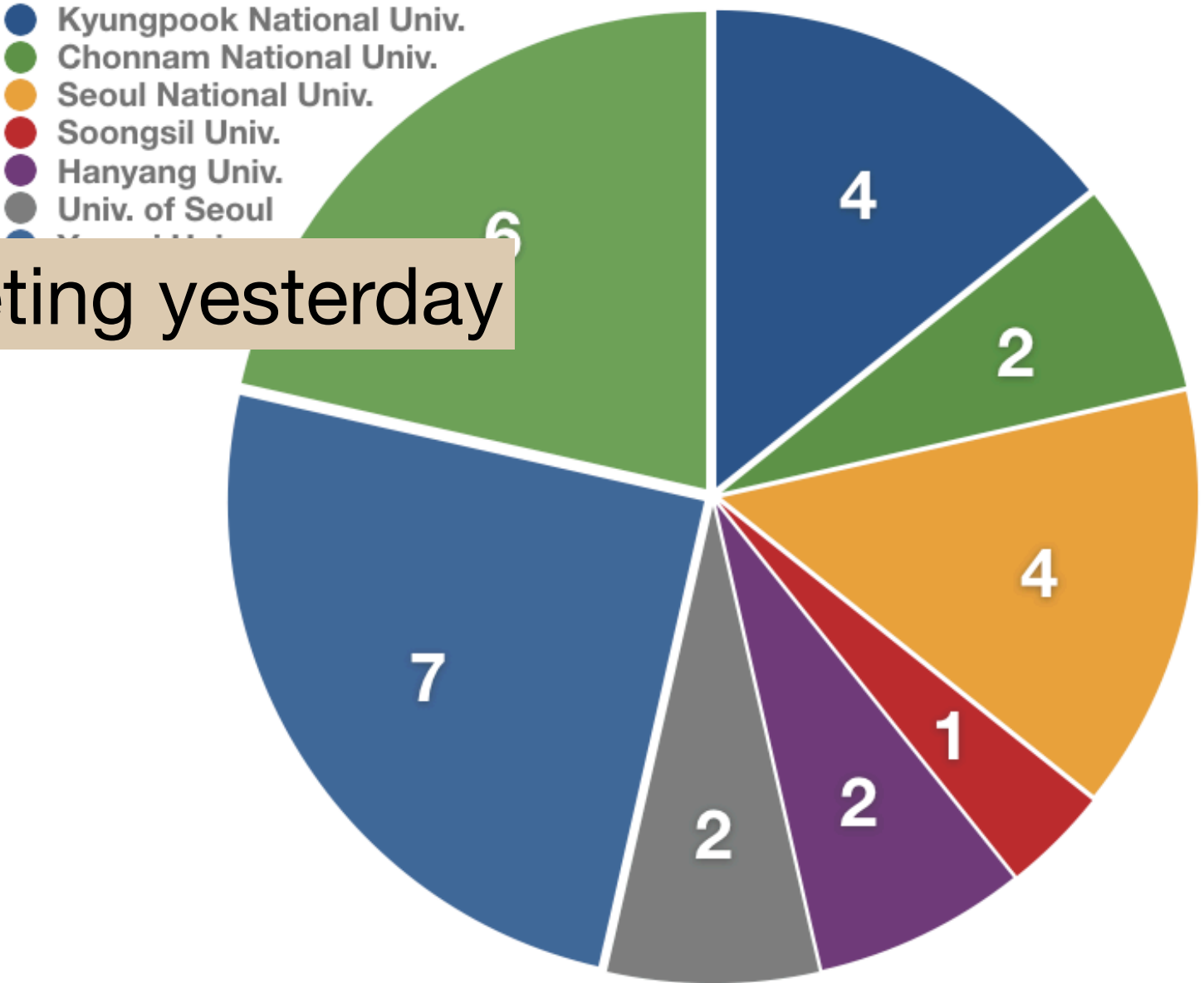
GSDC School

- Computing school for Korean (under-)graduate students, post-docs and researchers from fundamental research as well as computer science

- Targeting whom requires some knowledge of computing for their research, and whom wants to learn some insight on the applications of computing technologies

- Gives practical examples on High Throughput Computing, Data management, Network, Security

Contribution to train cross-field experts
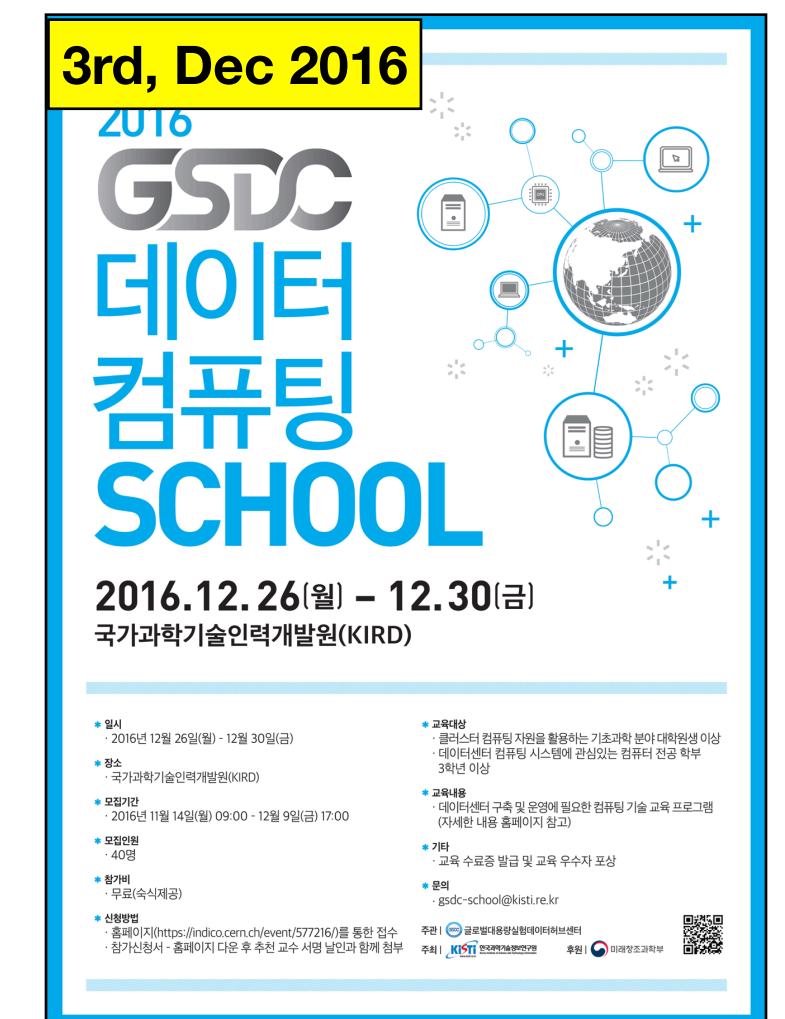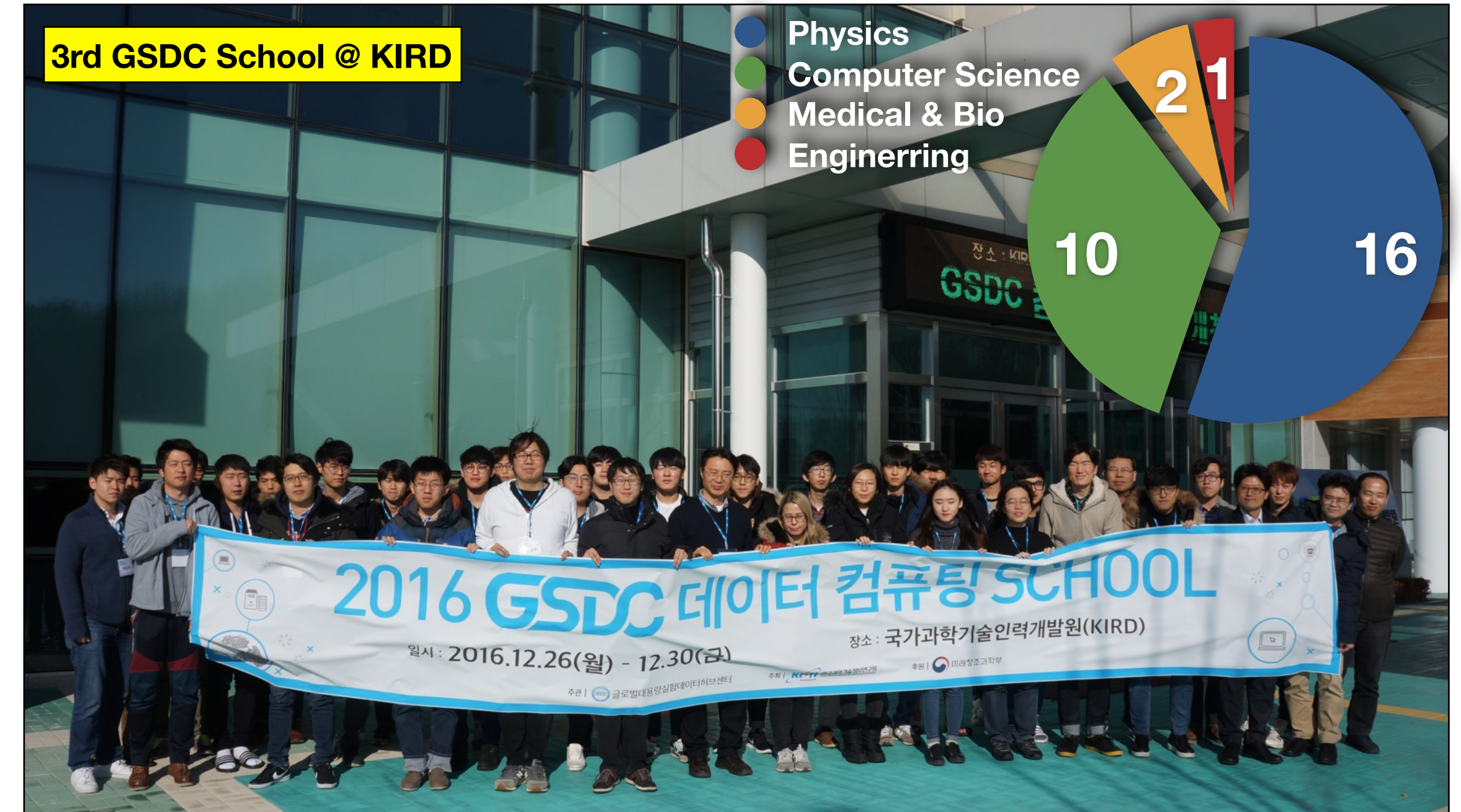
GSDc Promoting Science

Thank you