R&E Networking of TAIWAN

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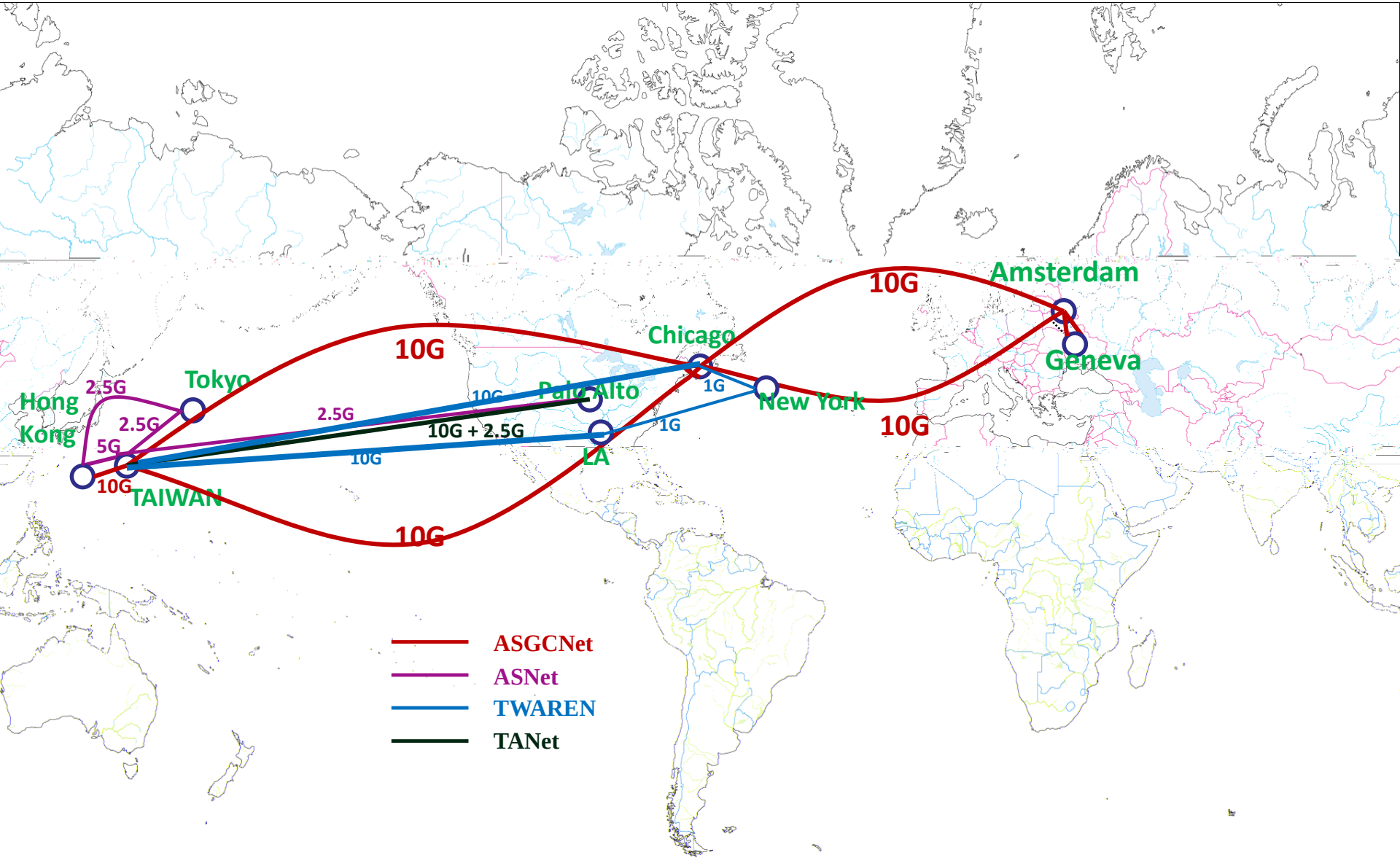
APAN42
HK
1 Aug. 2016

Research & Education Network on Taiwan

- Innovative Science drive the Research Infrastructure
- Education need the General Network Service
- Ministry of Education (TANet), NCHC (TWAREN) & Academia Sinica (ASNet/ASGCNet) collaboratively provide the international & domestic backbone service

TAIWAN Global R&E Network



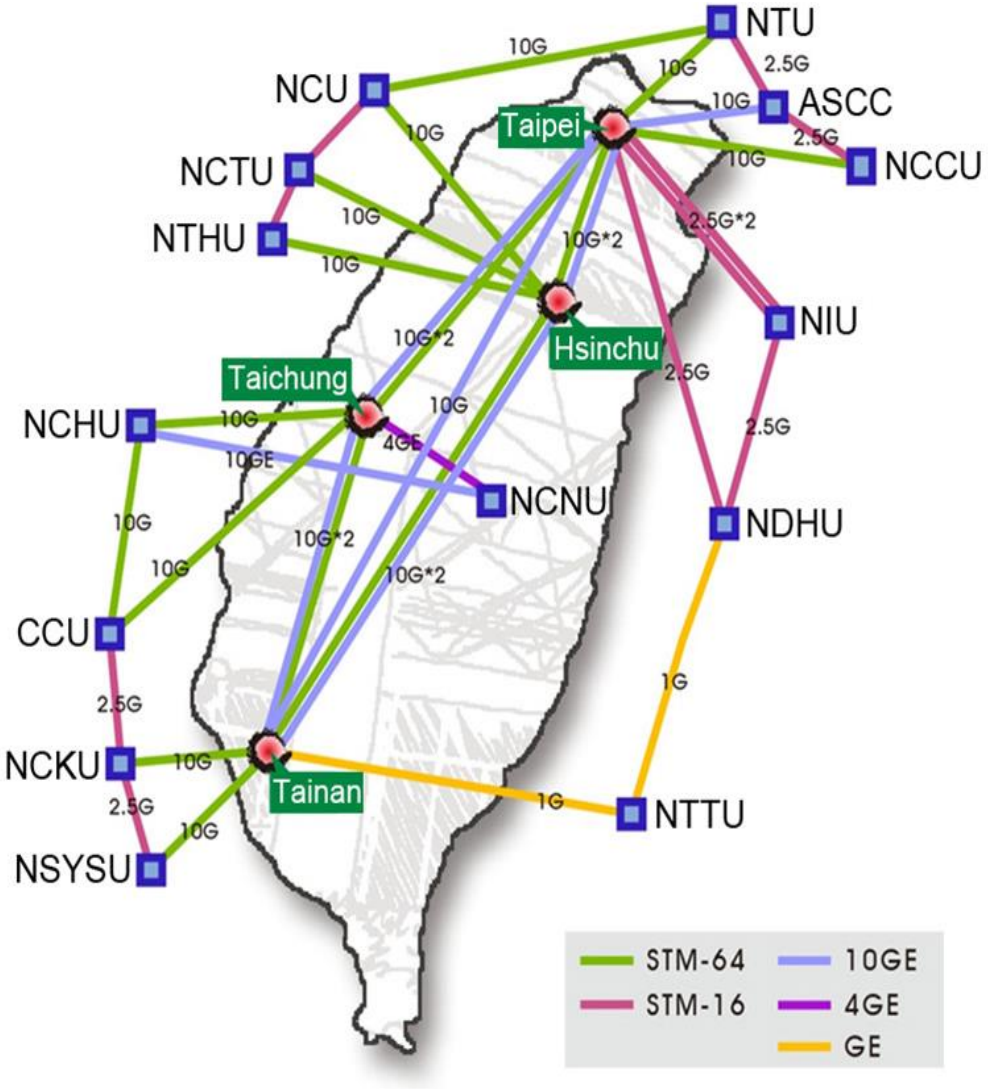
TANet

TANet's main purpose is to support teaching research activities in schools and research institutes throughout the nation by providing a medium for sharing resources and providing opportunities for cooperation.

TANet's network structure is made up of 3 layers

- National Backbone Network
- Area Networks
- Campus Networks

TANet & TWAREN Domestic Backbone



- For research network, academic network (TANet) and optical testbed.
- With L1/L2/L3 high availability, high performance and multiple services.
- First-class services of 99.9% availability.

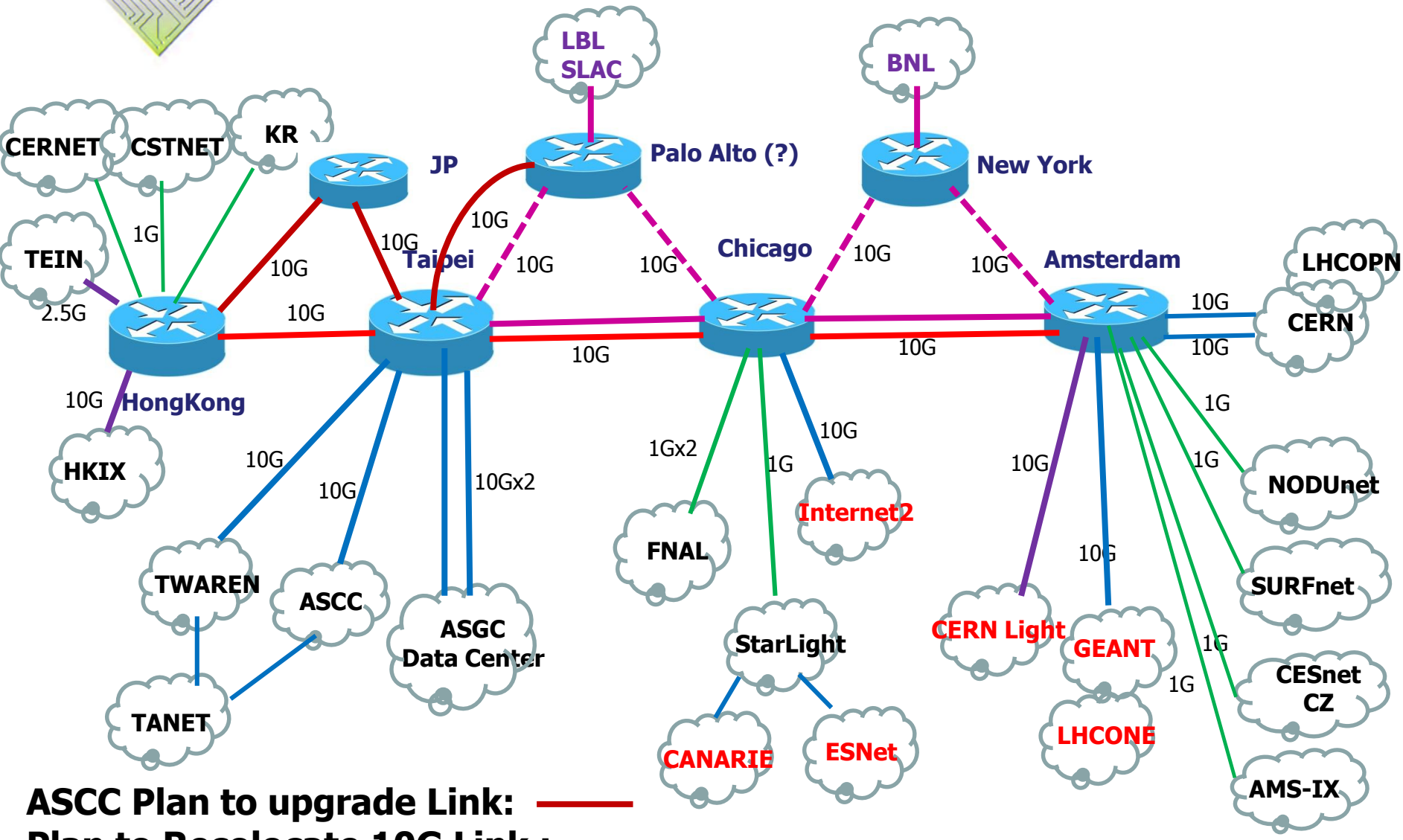
Backbone Architecture

Core Node 4

GigaPOP 13

Backbone BW 20G

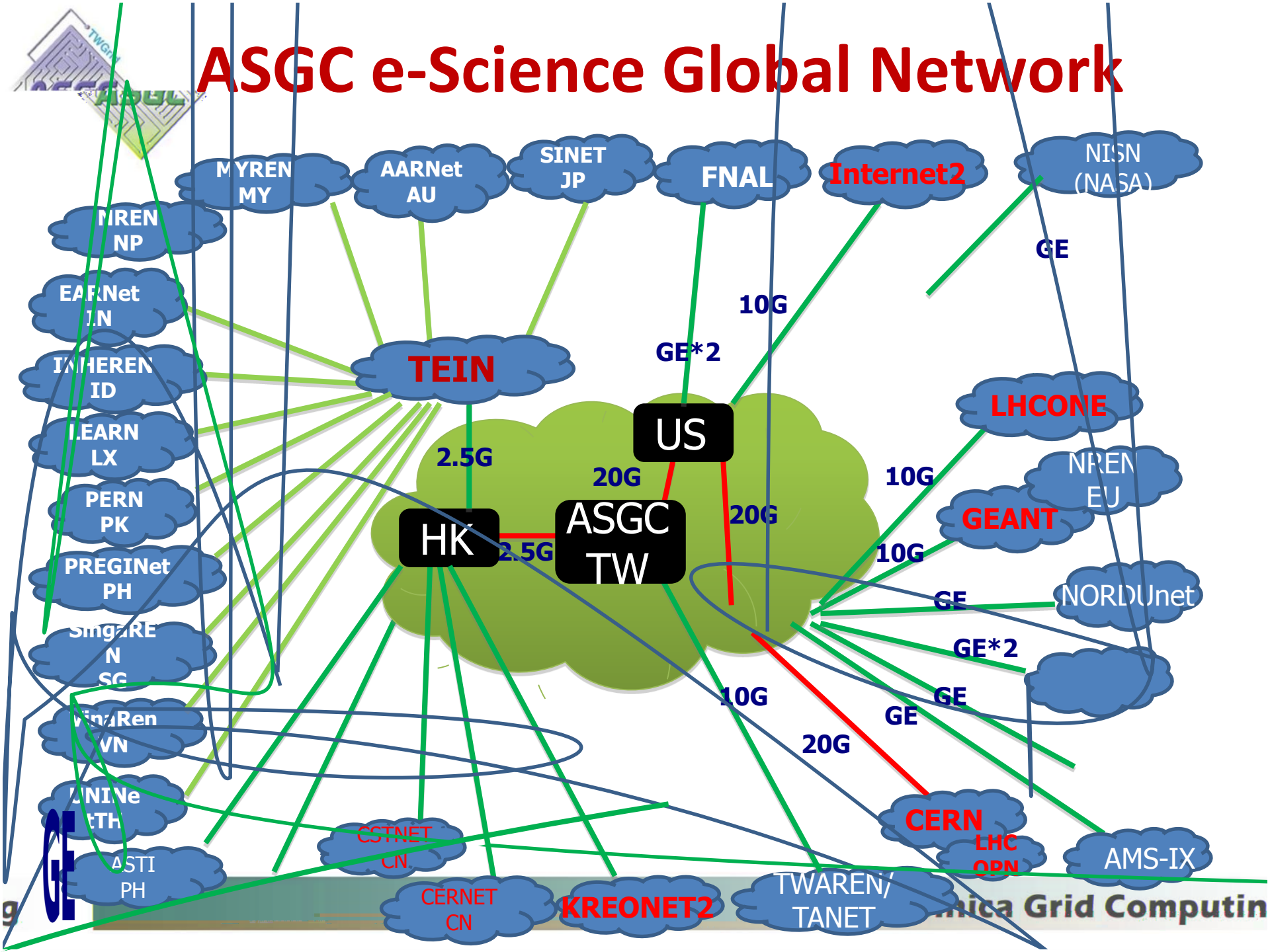
ASGCNet International Network



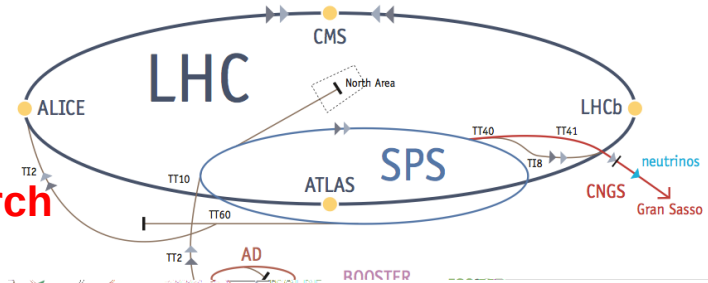
ASCC Plan to upgrade Link: ——

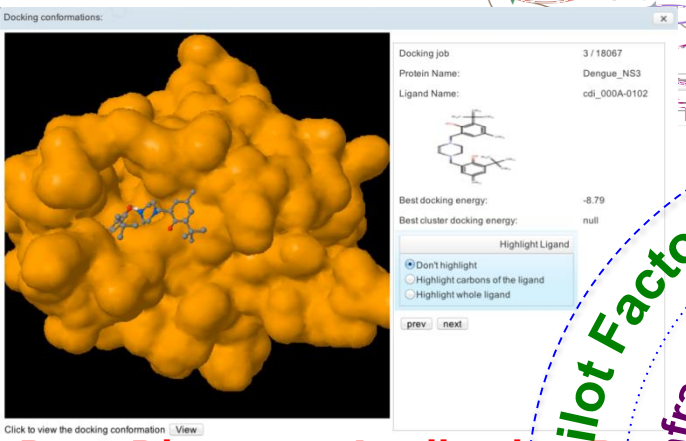
Plan to Recolocate 10G Link : - - - - -

ASGC e-Science Global Network



Higgs Search



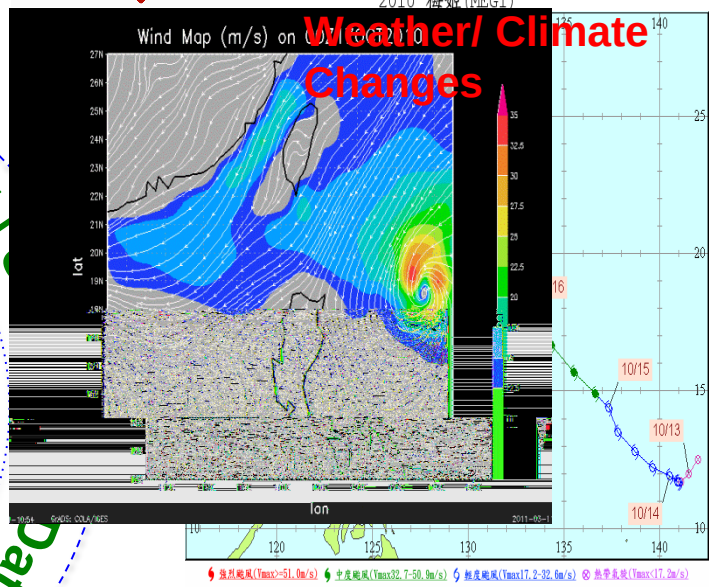


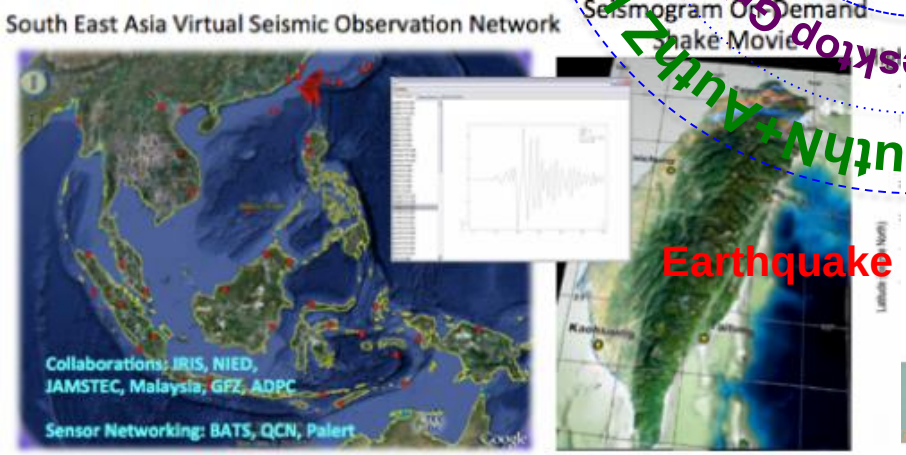
Drug Discovery Application Portal

Pilot Factory | Distributed Cloud | Infrastructure as a Service (IaaS) | Service Grid (SG) | Desktop Grid (DG) | AuthN+AuthZ Infra. | Data Services |

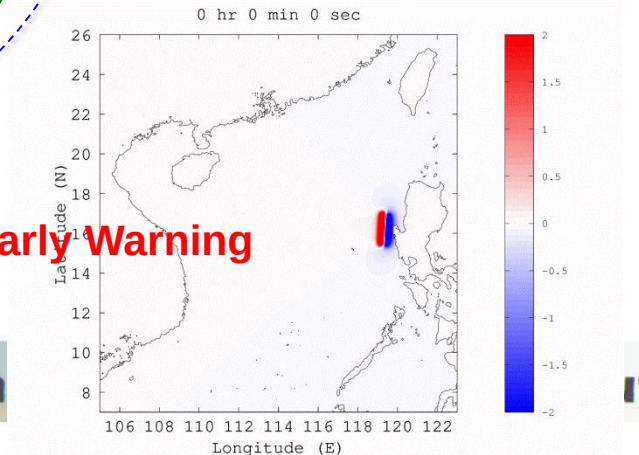
Distributed Computing Infrastructure (HW, SW, Networking)

Weather/ Climate Changes

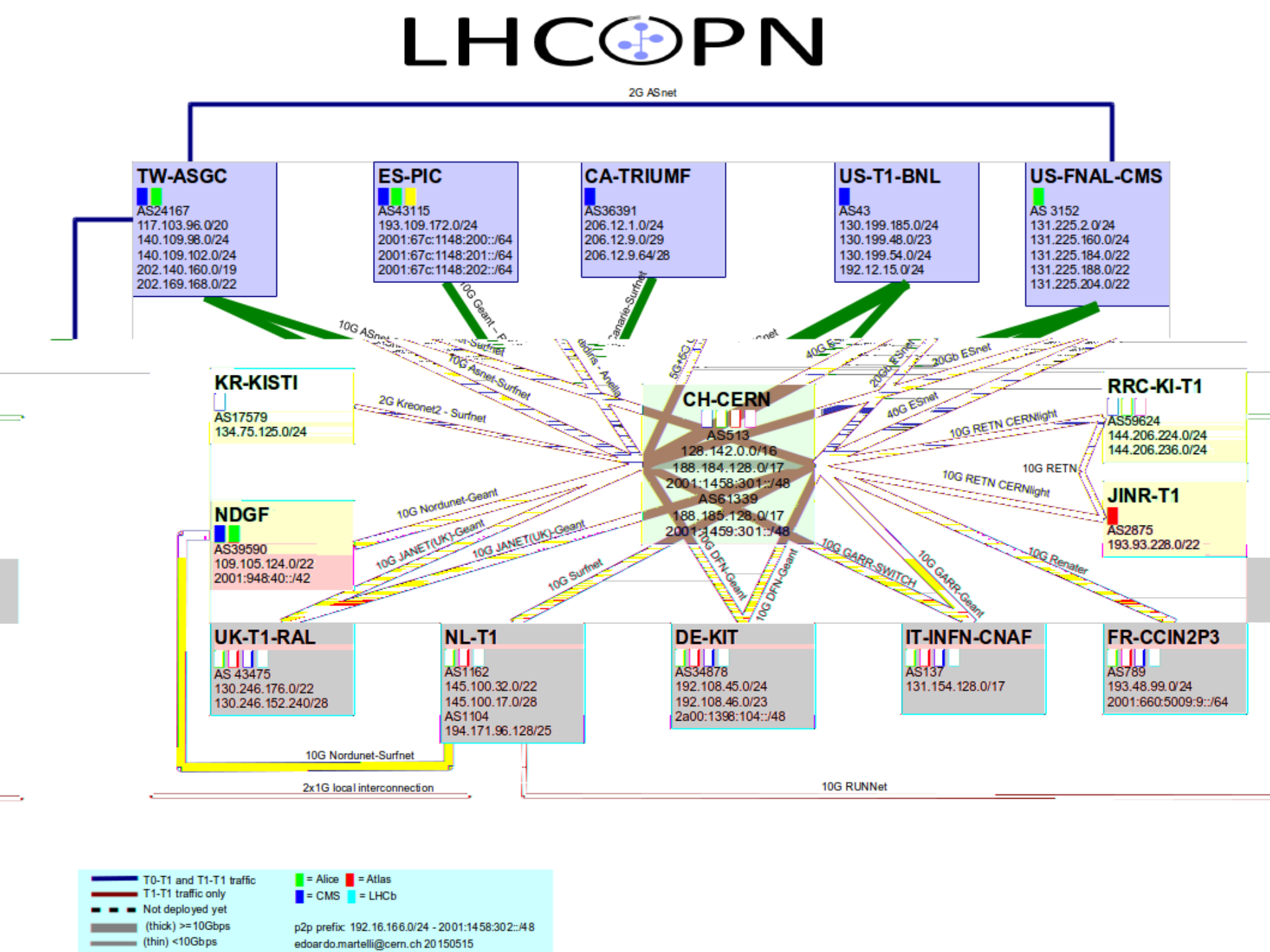


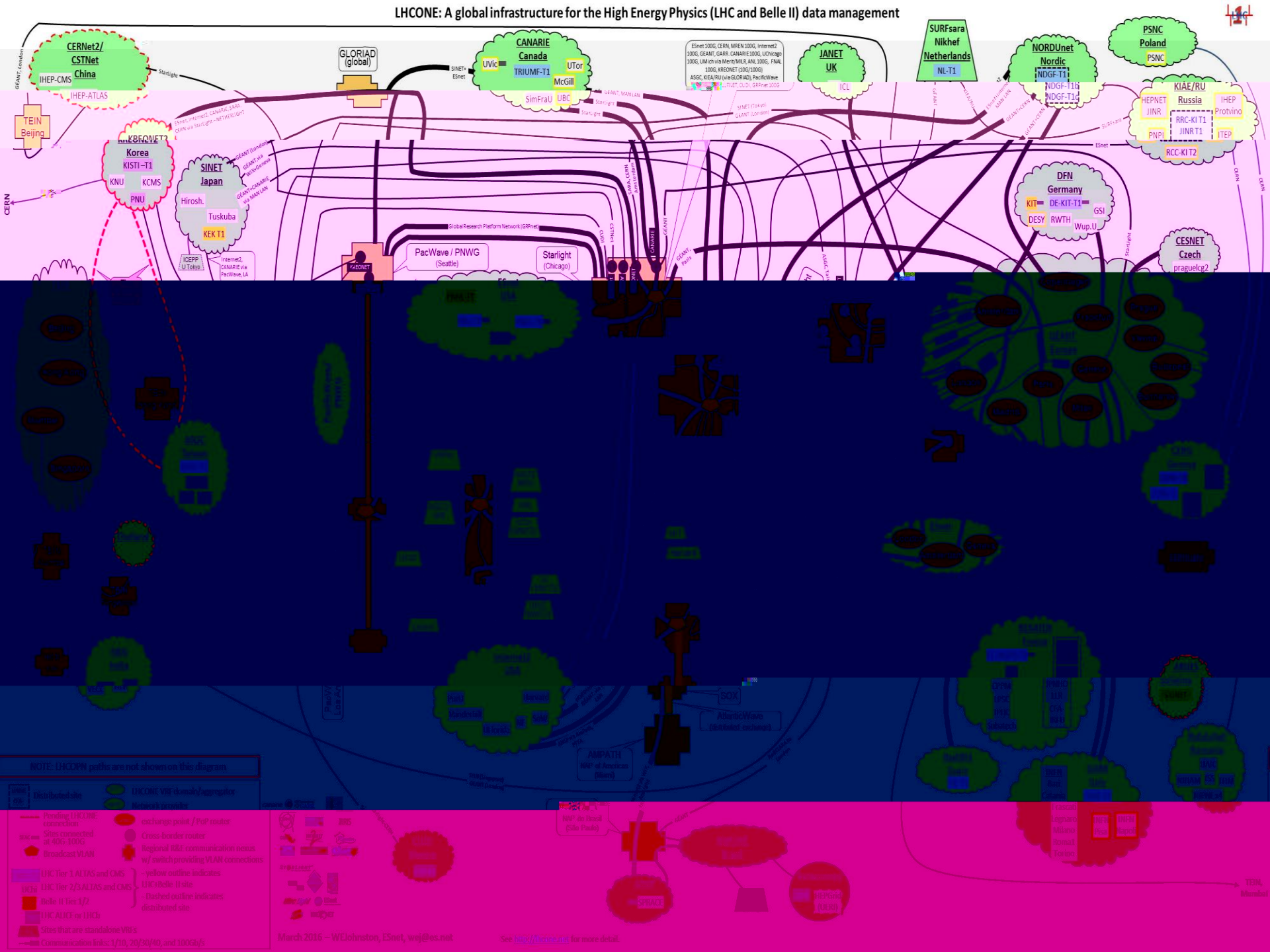


Earthquake and Tsunami Early Warning



ASGC LHCOPN/LHCONE

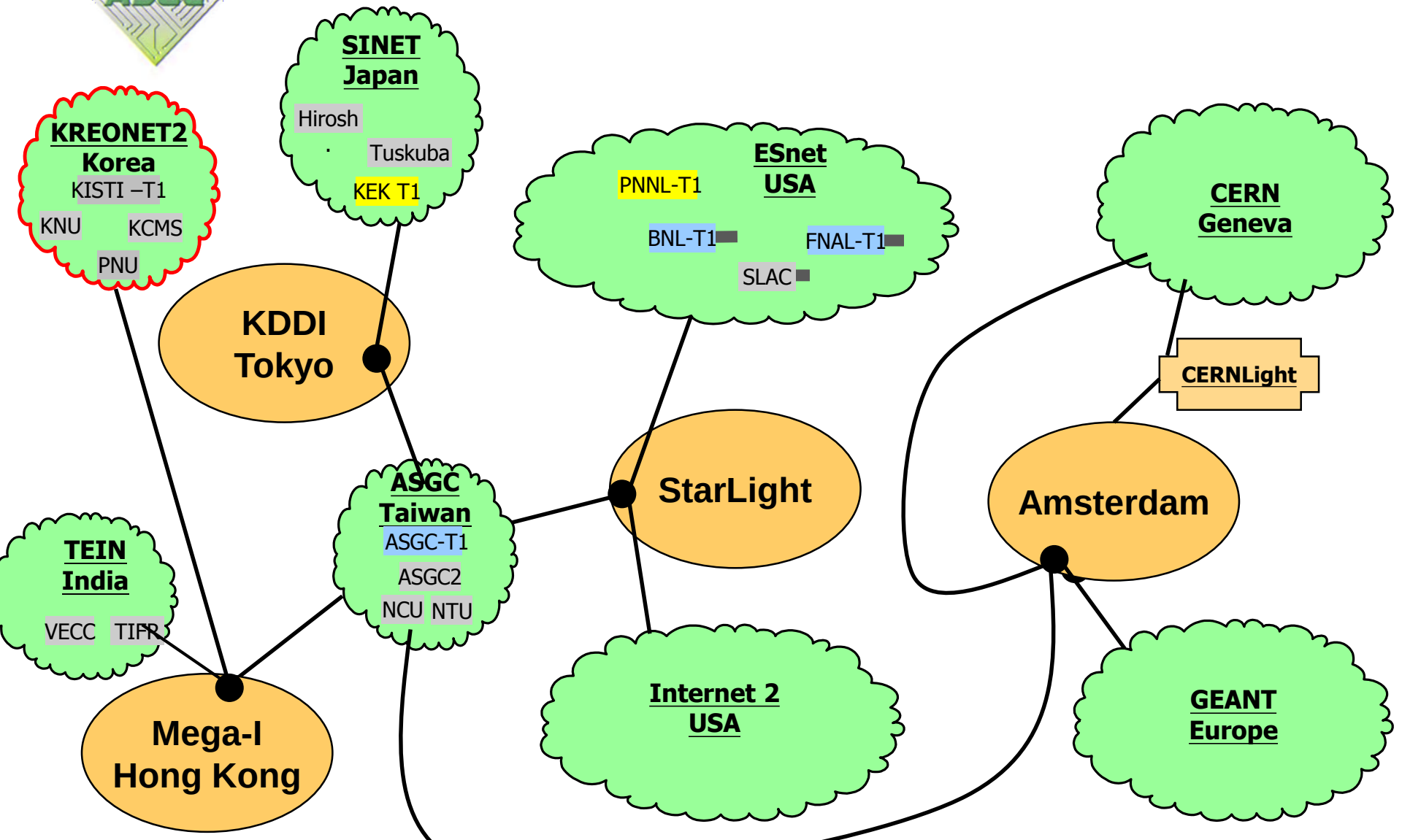

LHCOPN
2G ASnet
TW-ASGC
AS24167
117.103.96.0/20
140.109.98.0/24
140.109.102.0/24
202.140.160.0/19
202.169.168.0/22
ES-PIC
AS43115
193.109.172.0/24
2001:67c:1148:200::/64
2001:67c:1148:201::/64
2001:67c:1148:202::/64
CA-TRIUMF
AS36391
206.12.1.0/24
206.12.9.0/29
206.12.9.64/28
US-T1-BNL
AS43
130.199.185.0/24
130.199.48.0/23
130.199.54.0/24
192.12.15.0/24
US-FNAL-CMS
AS 3152
131.225.2.0/24
131.225.160.0/24
131.225.184.0/22
131.225.188.0/22
131.225.204.0/22
10G Geant - Surfnet
10G Canarie-Surfnet
10G ASnet-Surfnet
40G ESnet
20Gb ESnet
40G ESnet
10G RETN CERNlight
10G RETN
10G RETN CERNlight
10G Renater
KR-KISTI
AS17579
134.75.125.0/24
2G Kreonet2 - Surfnet
CH-CERN
AS513
128.142.0.0/16
188.184.128.0/17
2001:1458:301::/48
AS61339
188.185.128.0/17
2001:1459:301::/48
RRC-KI-T1
AS59624
144.206.224.0/24
144.206.236.0/24
JINR-T1
AS2875
193.93.228.0/22
NDGF
AS39590
109.105.124.0/22
2001:948:40::/42
10G Nordunet-Geant
10G JANET(UK)-Geant
10G JANET(UK)-Geant
10G Surfnet
10G DFN-Geant
10G DFN-Geant
10G GARR-SWITCH
10G GARR-Geant
UK-T1-RAL
AS 43475
130.246.176.0/22
130.246.152.240/28
NL-T1
AS1162
145.100.32.0/22
145.100.17.0/28
AS1104
194.171.96.128/25
DE-KIT
AS34878
192.108.45.0/24
192.108.46.0/23
2a00:1398:104::/48
IT-INFN-CNAF
AS137
131.154.128.0/17
FR-CCIN2P3
AS789
193.48.99.0/24
2001:660:5009:9::/64
10G Nordunet-Surfnet
2x1G local interconnection
10G RUNNet
T0-T1 and T1-T1 traffic
T1-T1 traffic only
Not deployed yet
(thick) >=10Gbps
(thin) <10Gbps
= Alice
= Atlas
= CMS
= LHCb
p2p prefix: 192.16.166.0/24 - 2001:1458:302::/48
edoardo.martelli@cern.ch 20150515


LHCONE: A global infrastructure for the High Energy Physics (LHC and Belle II) data management
CERNet2/ CSTNet China
IHEP-CMS
IHEP-ATLAS
GLORIAD (global)
CANARIE Canada
UVic
TRIUMF-T1
UTor
McGill
SimFraU
UBC
JANET UK
ICL
SURFsara Nikhef Netherlands
NL-T1
NORDUnet Nordic
NDGF-T1
NDGF-T1c
NDGF-T1c
PSNC Poland
PSNC
KIAE/RU
Russia
HEPNET
JINR
IHEP
Protvino
RRC-KI T1
JINR T1
PNPI
ITEP
RCC-KI T2
TEIN Beijing
KREONET2 Korea
KISTI –T1
KNU
KCMS
PNU
SINET Japan
Hirosh.
Tuskuba
KEK T1
ICEPP U Tokyo
DFN Germany
KIT
DE-KIT-T1
GSI
DESY
RWTH
Wup.U
CESNET Czech
praguelcg2
PacWave / PNWG (Seattle)
Starlight (Chicago)
Global Research Platform Network (GRPnet)
CERN
ESnet
GÉANT
CANARIE
NOTE: LHCOPN paths are not shown on this diagram
Distributed site
LHCONE VRF domain/aggregator
Network provider
Pending LHCONE connection
Sites connected at 40G+ 100G
Broadcast VLAN
LHC Tier 1 ATLAS and CMS
LHC Tier 2/3 ATLAS and CMS
Belle II Tier 1/2
LHC ALICE or LHCb
Sites that are standalone VRFs
Communication links: 1/10, 20/30/40, and 100Gb/s
exchange point / PoP router
Cross border router
Regional R&E communication nexus w/ switch providing VLAN connections
- yellow outline indicates LHCBelle II site
- Dashed outline indicates distributed site
March 2016 – WEJohnston, ESnet, wej@es.net
See http://lhcone.net for more detail.

LHC Network Challenges in Asia

- Routing Complexity
  - BGP peering can be realized among NRENs, if agreed bilaterally
  - Symmetry/Asymmetry routing
  - APAN backbone committee could address to the routing policy
- Network Performance
  - TCP Throughput <= TCPWinSize/RTT
  - Asian TierXs must tune server and client TCP kernel parameters to get better throughput
- LHCONE L3VPN could help resolving the application traffic

ASGC LHCONE VRF Plan



Thanks!