Asi@Connect

Updates on TEIN Networks

- Asi@Connect Project -

Daejeon, Korea

30 January 2018

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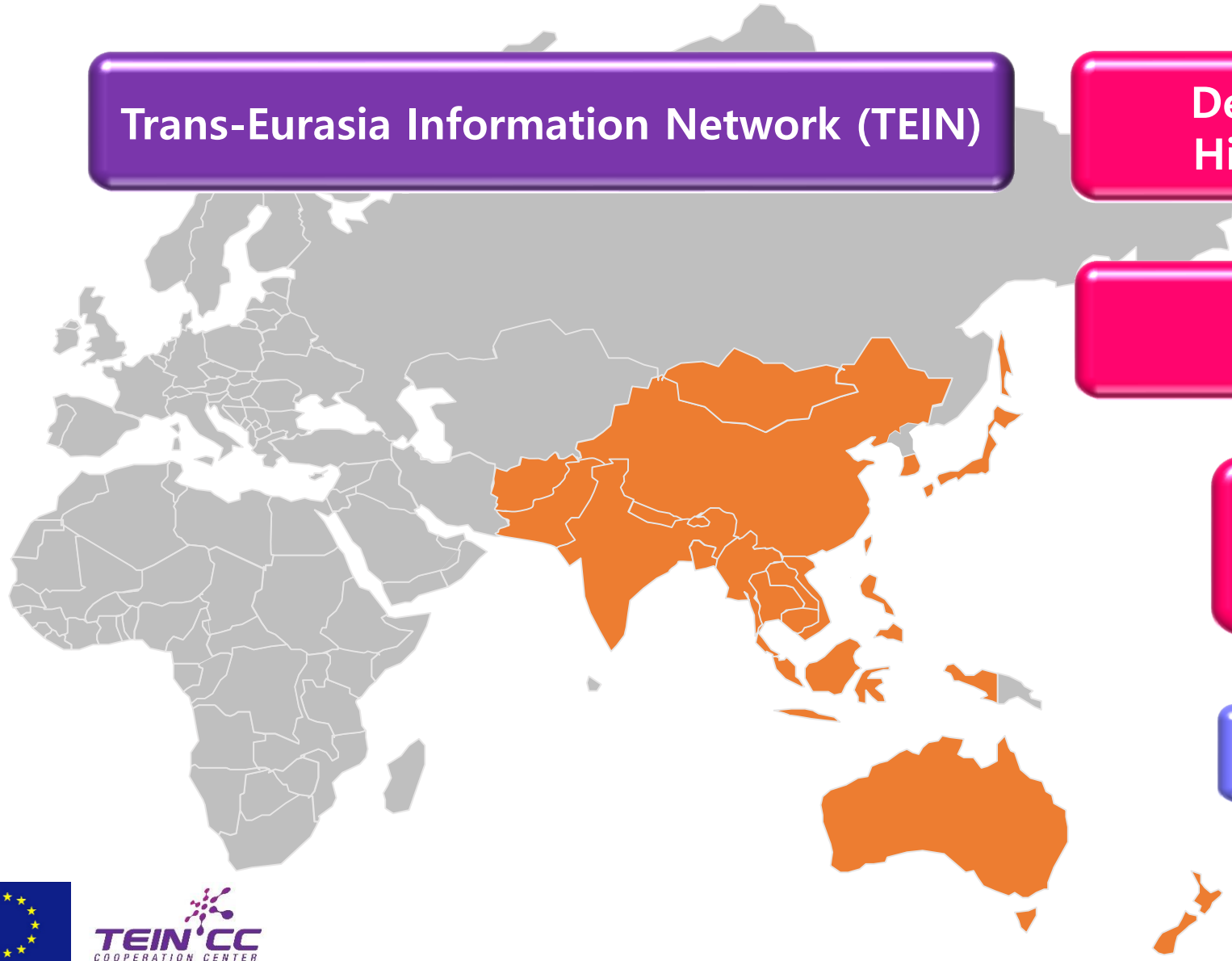
Executive Officer

TEIN* Cooperation Center

TEIN CC COOPERATION CENTER

The Next Phase of TEIN: Asi@Connect

Asi@Connect



Trans-Eurasia Information Network (TEIN)

Dedicated High-Capacity & High-Quality R&E Network

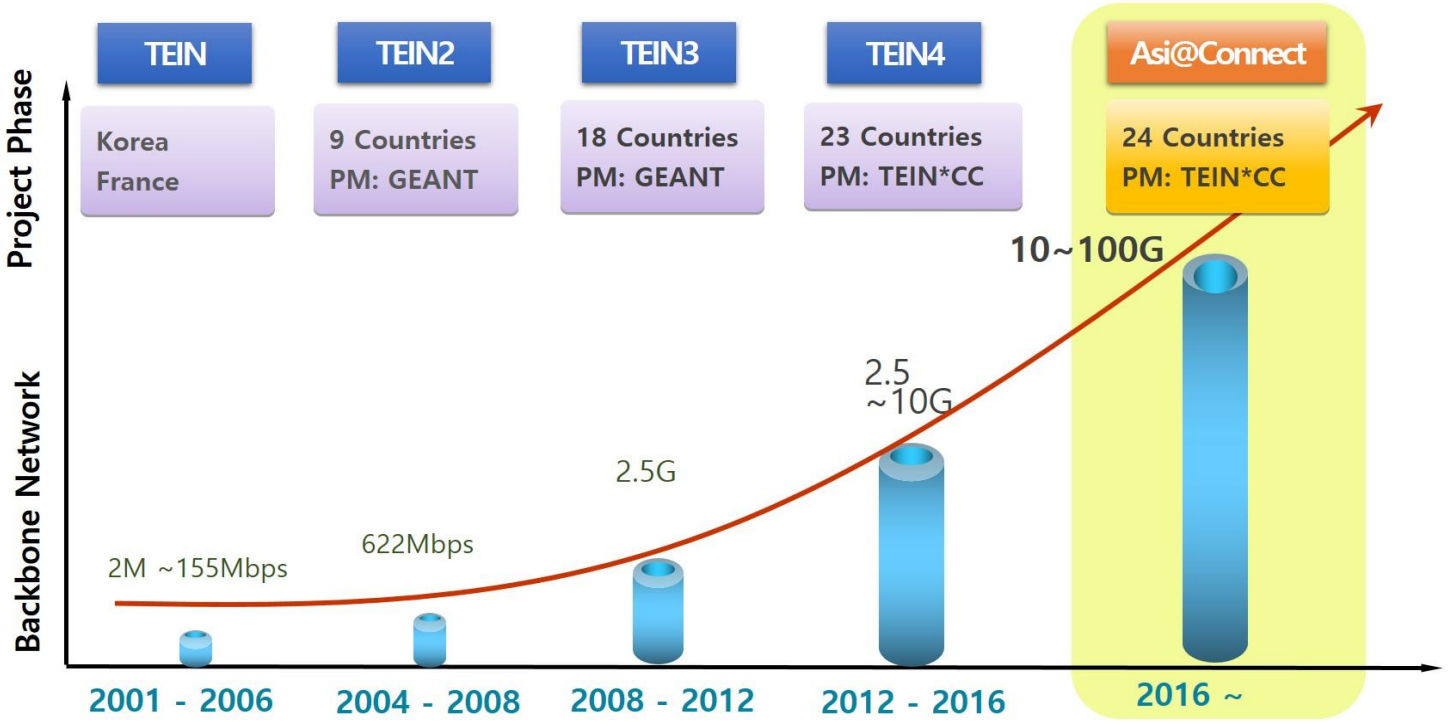
27 NRENs covers 24 countries/economies

Global R&E Collaboration & Capacity building development

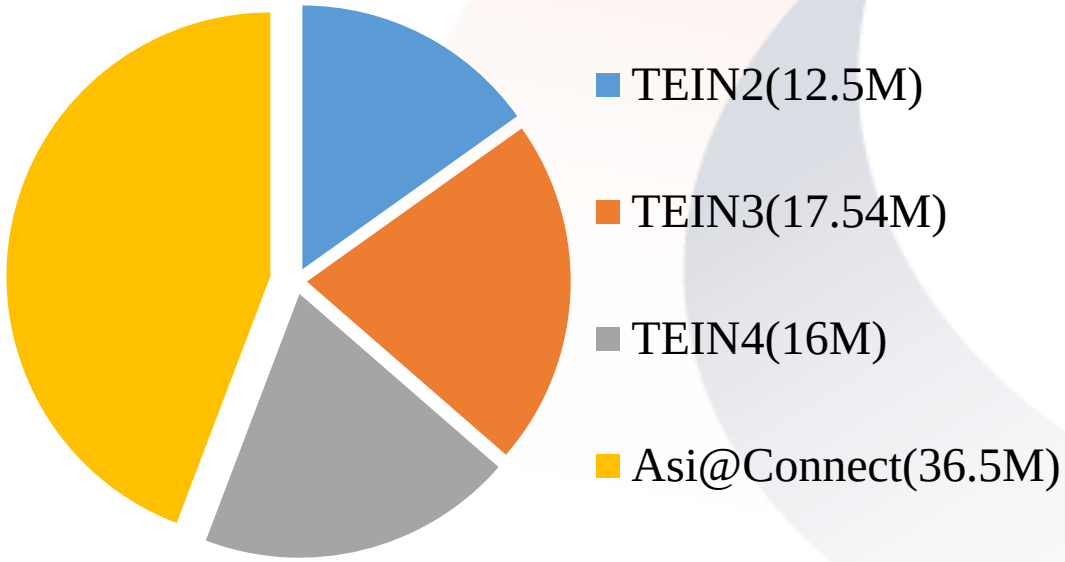
UN SDG Goals

TEIN CC COOPERATION CENTER

TEIN evolution



Funding of TEIN and Asi@Connect (Euros)



Asi@Connect

What Is Asi@Connect?

The EU-funded Asi@Connect project provides a dedicated region high capacity and high quality internet network, Trans Eurasia Information Network(TEIN), for research and education (R&E) communities across Asia-Pacific and Europe, and leverages e-infrastructures developed for public service projects.

Collaborative development

Students, academics and researchers benefit from extensive global collaboration opportunities through Asi @Connect programs, which foster knowledge sharing and capacity development.

Connecting partners faster

One of the most successful ASEM initiatives to support ICT infrastructures and R&E communities through more effective, faster and powerful dedicated internet connections across the Asia-Pacific and with Europe.

Global societal benefits

TEIN supports applications with a high societal impact, such as tele-medicine, earth observation and agricultural research based on global cooperation.

Over the last 5 years, with the development of local network infrastructure and international interconnections, TEIN has more than doubled the traffic and bandwidth.

Possibilities with **Asi@Connect**

TEIN CC COOPERATION CENTER

Asi@Connect Grant Contract (ACA 2016/376-562)

- Asi@Connect project is funded on the basis of the successful outcomes of the previous TEIN projects.
  - 60-month (Sep. 2016 ~ Aug. 2021)
  - jointly funded by the EC and Asian partners' countries/economies
    - ✓ 20M € from EC with other co-funding from the partners
    - ✓ total estimated funding is around 36.5M Euros.
  - provide and further develop a dedicated regional high capacity, high quality Internet connectivity using TEIN network, also leverage the e-infrastructure for public service projects.

Asi@Connect Grant Contract (ACA 2016/376-562)

❖ Asi@Connect Project Partners (24 countries/ecomomies)

Afghanistan	· Afghanistan Research and Education Network (AfgREN)
Australia	· Australia's Academic and Research Network (AARNET)
Bangladesh	· University Grants Commission (BdREN)
Bhutan	· Department of Information Technology and Telecom (DITT)
Cambodia	· Institute of Technology of Cambodia (CamREN)
China	· China Education and Research Network (CERNET) · China Science and Technology Network (CSTNET)
Hong Kong	· The Hong Kong Academic and Research NETwork (HARNET)
India	· National Knowledge Network (NKN)
Indonesia	· Institut Teknologi Bandung (ITB)
Japan	· National Institute of Information and Communications (MAFFIN) · National Institute of Informatics (NICT) · Ministry of Agriculture, Forestry and Fisheries Research Network (NII)
Korea	· National Information Society Agency (NIA)
Laos	· Lao Education and Research Network (LERNET)
Malaysia	· Malaysian Research and Education Network (MYREN)
Mongolia	· ErdemNET (ErdemNet)
Myanmar	· Yangon University (Computer Science Dept. NREN) (mmREN)
Nepal	· Nepal Research and Education Network (NREN)
New Zealand	· Research and Education Advanced network New Zealand (REANNZ)
Pakistan	· Pakistan Education and Research Network (PERN)
Phillippines	· Advanced Science and Technology Institute (ASTI)
Singapore	· Singapore Advanced Research & Education Network (SingAREN)
Sri Lanka	· Lanka Education and Research Network (LEARN)
Taiwan	· Academia Sinica Grid Computing (ASGC)
Thailand	· Thailand Research Education Network Association (ThaiREN)
Vietnam	· National Agency for Science and Technology Information (NASATI)

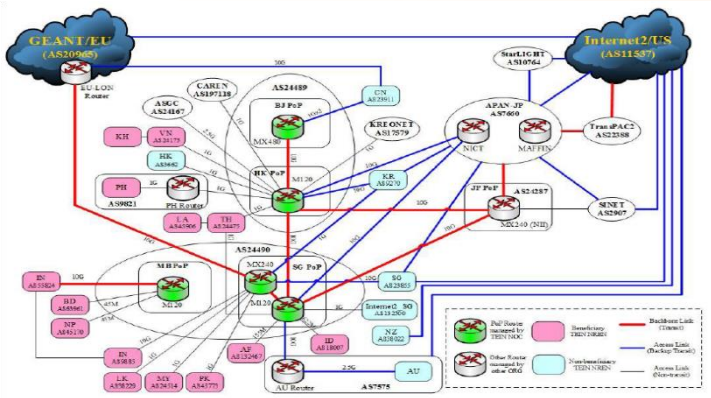
Asi@Connect Grant Contract (ACA 2016/376-562)

❖ Specific Objectives

- ➢ to provide and further develop a dedicated regional high capacity, high quality Internet connectivity network for research and higher education,
- ➢ leveraging the e-infrastructure developed for public service projects.

❖ (6) Work Packages (WPs)

- ➢ **WP1:** Network Procurement and Management
- ➢ **WP2:** Capacity development of developing country NRENs
- ➢ **WP3:** Research and Education Network Design & Operations and associated capacity development
- ➢ **WP4:** Deployment of specialized network products, services and applications and associated capacity development
- ➢ **WP5:** Promoting Asi@Connect-enabled research and education collaboration for societal benefit
- ➢ **WP6:** Helping to bridge the digital divide in developing countries

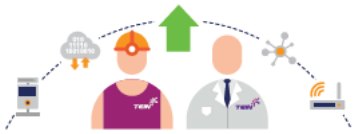


Capacity Building Program

Training Activities
Asi@Connect workshops and training programs support capacity building of NREN engineers and administrative staff.

Campus Network Design
Well-developed campus network infrastructure allows universities to connect to their National Research and Education Network (NREN) and to local Internet Exchange Points.

Advanced ICT Technology



Asi@Connect enables researchers and engineers to develop and deliver innovative network technologies such as future internet to make the network environment more reliable, compatible and sustainable.

e-Science

Researchers and institutions collaborate on a range of subjects in natural science: Particle Physics such as Large Hadron Collider (LHC), Nuclear Fusion Science (NIFS), computational lenses, and grid computing.

Earth Observation

Asi@Connect underpins the real-time data exchange through computing systems for climate and weather prediction.

People in remote rural areas benefit from high resolution regional prediction systems which provide faster and more accurate forecasts.

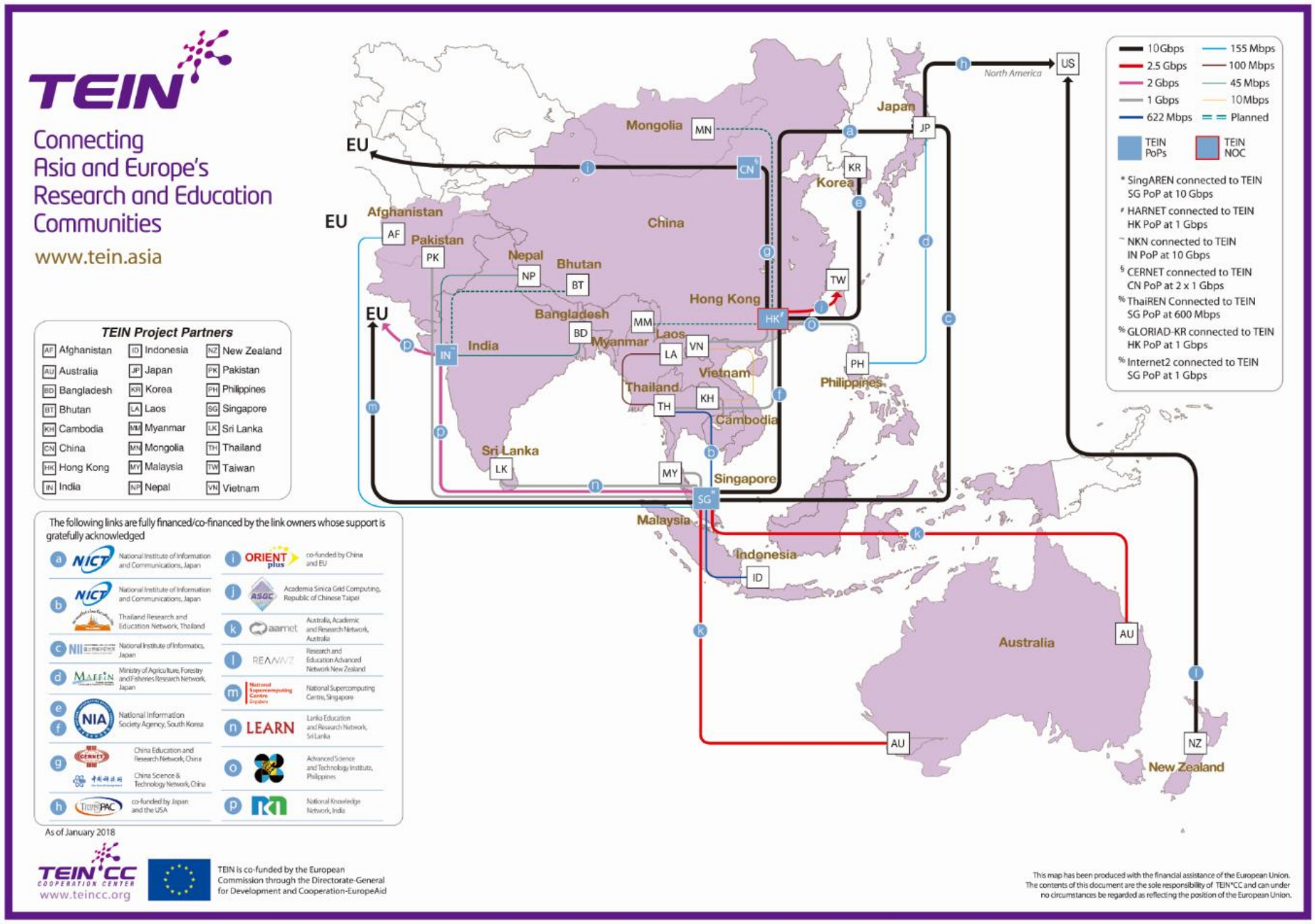
Tele-medicine

Medical doctors and experts share experiences and knowledge for epidemic disease prevention & better public health service.

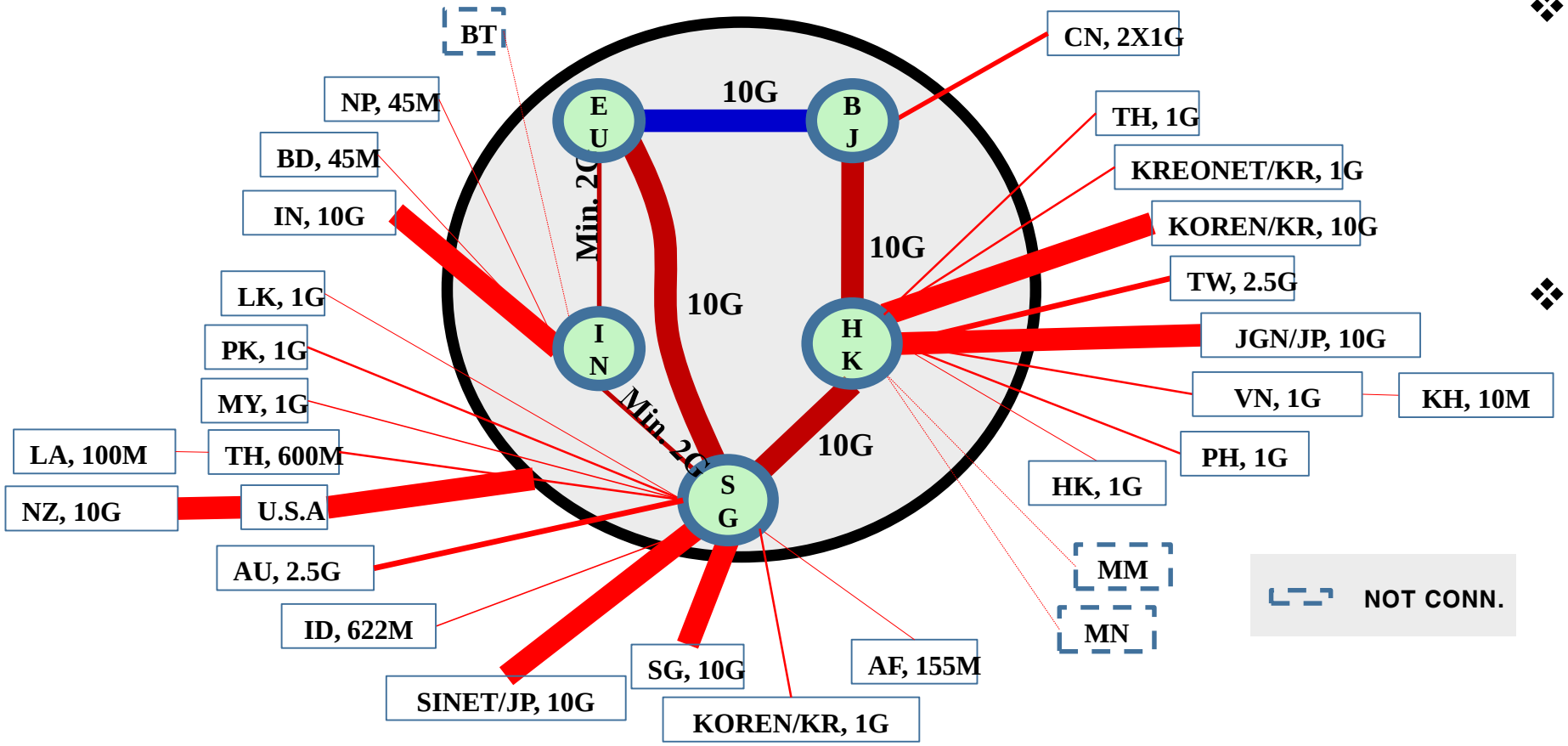
Asi@Connect provides high-quality network connectivity for supporting live surgery and tele-surgical training.

TEIN Network Topology (as of Jan. 2018)

- **TEIN Backbones**
  - SG-MB-EU 2Gbps
  - SG-EU 10Gbps
  - BJ-EU 10Gbps
  - JP-HK 10Gbps, JP-SG 10Gbps
  - HK-SG 10Gbps
- **4 TEIN PoPs and an associate**
  - BJ, HK, SG, MB, (Tokyo)
- **24 Partners**
  - 21 connected and upgraded bandwidths
  - 3 not yet connected (BT, MM, MN)
  - Still need many helps in LDCs
- **Users**
  - More than 55 M users



TEIN Network Topology (as of Jan. 2018)



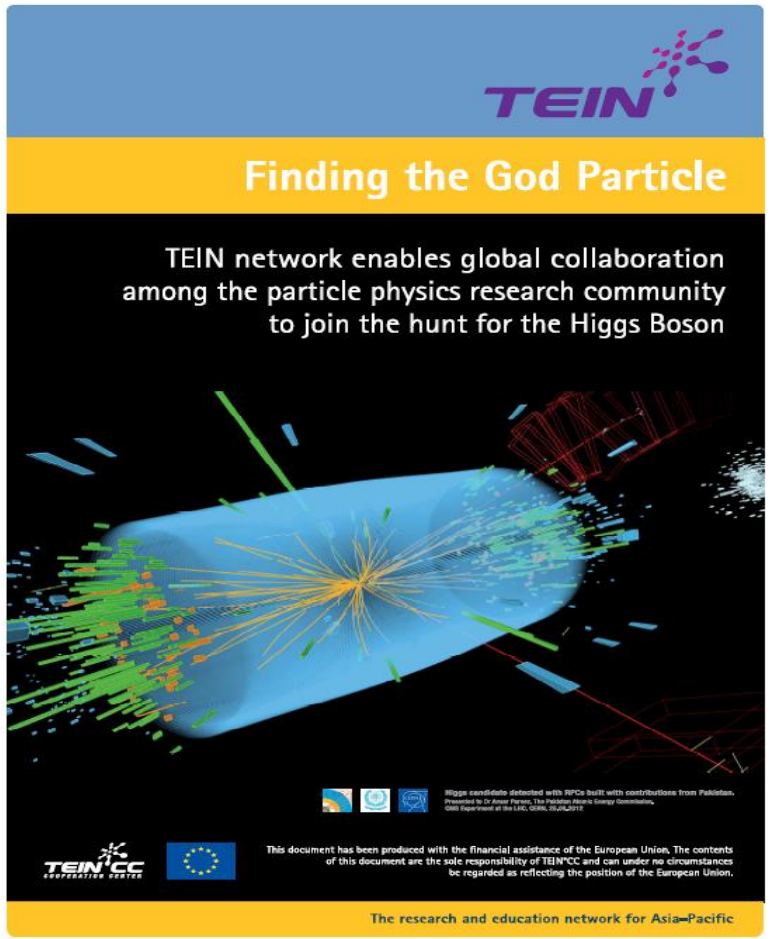
❖ Backbone

- ➢ Feasibility check on 100G upgrade between SG and EU (~ June. 2018)

❖ Access

- ➢ Completion of procurement tender for TEIN Access Connectivity (~ June. 2018)
  - ✓ Malaysia, Indonesia, Vietnam, etc.

Case Study : High Energy Physics – Pakistan



CASE STUDY

TEIN Global collaboration

Particle Physics:
Global collaboration to find the God Particle

The TEIN network enables researchers in Pakistan to join the hunt

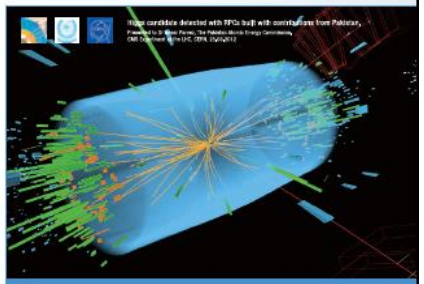
Through CERN's Large Hadron Collider (LHC) experiment, the global particle (or high-energy) physics community is helping us better understand the fundamental laws of nature. Collaboration is at the heart of the LHC project with researchers from across the globe, including those at Pakistan's National Center for Physics (NCP), involved in this ground-breaking experiment. High speed research networks, such as TEIN in Asia-Pacific and its European counterpart GÉANT, are essential to underpin this collaboration, enabling sharing of the petabytes of data created at the LHC, allowing physicists to work together, wherever they are based.

The hunt for the Higgs Boson

Particle physics focuses on the study of the smallest sub-atomic particles and how they interact. At the forefront of research is the Large Hadron Collider (LHC), the world's largest scientific experiment. Located at CERN in Switzerland, it aims to answer some of the most important questions in particle physics by measuring high speed collisions between particles in its 27km long tunnel. In particular the experiment aimed to discover the elusive Higgs Boson, or God Particle, which is a key component of the Standard Model theory that is believed to explain how the 'Big Bang' created the universe. In July 2012, CERN researchers announced that they had found the Higgs Boson after analysing 2012 data from the LHC.(François Englert and Peter W. Higgs were awarded the Nobel Prize for Physics in 2013 for their theoretical discovery of the God Particle)

Globalising high energy physics

The scale of the LHC research spans the world, involving thousands of researchers in different countries who collaborate to build the infrastructure and analyse the enormous volume of data that the LHC's experiments produce. Research networks, such as the Pakistan Education and Research Network (PERN), TEIN in Asia-Pacific and GÉANT in Europe, are central to this collaboration.



The Challenge :

Enable particle physicists in Pakistan to collaborate with the global community and participate in the Large Hadron Collider (LHC) experiment.

The Solution :

By connecting Pakistan's national research and education network to Europe, the high speed TEIN network links the country's scientists to the world, enabling them to analyse LHC data and share their findings with colleagues in other countries.

Key Benefits :

By enabling research and learning Pakistan's national research network PERN and the regional TEIN network support the developing Pakistani particle physics community, providing the connectivity needed to increase its size and knowledge through high speed global collaboration.

GÉANT

The research and education network for Asia-Pacific

Pakistan is a leading member of the global particle physics research community, and boasts Nobel Prize winning scientist amongst its researchers. It has been heavily involved in the LHC, with scientists working together with their counterparts at CERN on the initiative's such as Compact Muon Solenoid (CMS), ALICE and ATLAS experiments.

For CMS, Pakistan built the magnet feet, contributed to the tracker alignment, and created and installed 320 Resistive Plate Chambers (RPCs). The country has also built mechanical components for the ATLAS experiment and a team of Pakistani engineers and technicians is working in the LHC tunnel, helping to increase performance further for future experiments.

Additionally, young and aspiring physicists at the NCP in Pakistan are heavily involved in the analysis of LHC experimental data and the discovery of the Higgs Boson. This participation in global collaboration is helping to accelerate the training of Pakistani research scientists, by enabling graduate students to connect with the worldwide scientific community and work together with other scientists on the challenging questions, without needing to leave the country.

Lto R : M.D.Jafar, Tanseel Murtaza, Saqib Haleem, Hafeez Hoorani, Rolf Heuer, Hamid Saleem, Asaim Fasih, Fawad Saeed, Sajid Ali, Kamran Ahmad, Manaoor Sheikh

> Building on the legacy of Nobel Prize Winner Abdus Salam, Pakistan has, over the past 20 years, successfully invested in building a small but active and competitive High-Energy Physics community that has made important contributions and is well integrated into several CERN activities. The CERN-Pakistan co-operation was pioneered on the CMS experiment at the LHC, and has expanded continuously to include the ALICE and ATLAS experiments as well as co-operation on accelerator technology, making Pakistan a significant partner for CERN.
>
> *Dr. Rolf Heuer, Director General of CERN*

> Without access to LHC data all our efforts to collaborate with CERN will be futile. Given the amount of data LHC can generate, good internet connectivity is vital. PERN and TEIN have helped experimental high-energy physicists within Pakistan to access this data by providing affordable, reliable connectivity. As well as helping build our knowledge, by using this data around 30 graduate students have been able to complete research work, increasing our capacity and skills within Pakistan.
>
> *Prof. Hafeez Hoorani, Director Research of National Center for Physics, Pakistan*

The Trans-EurAsia Information Network (TEIN) project began in 2000 and is now in its fourth phase, TEIN4, managed by TEIN*CC. The project has created a high speed network in Asia-Pacific that links local NRENs together, and provides direct connectivity to GÉANT, the pan-European research network, creating a gateway for global collaboration.

Collaboration powered by global research networks

The LHC generates over 30 petabytes of data every year. This requires the power of high speed research and education networks, working together, to distribute it around the globe and to enable scientists to collaborate on its analysis. Research networks are also vital to educating graduate students and helping to increase the Pakistani particle physics community. This benefits the entire nation and creates a foundation for future growth and scientific excellence.

To transmit data from the LHC to the NCP in Pakistan, it travels across dedicated connections from CERN via the GÉANT network to TEIN. From there a high speed connection routes information to PERN and then to the NCP. The combination of capacity, reliability and high speed research and education networks makes this global collaboration possible, benefiting the entire particle physics community now and in the future.

For more information:

TEIN: www.tein4.net, www.teincc.org
GÉANT: www.geant.net
PERN: www.pern.edu.pk
National Center for Physics www.ncp.edu.pk
CERN: home.web.cern.ch

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TEIN*CC COOPERATION CENTER

Case Study : High Energy Physics – Thailand

CASE STUDY

Particle Physics

Global collaboration to study the physics of strongly interacting matter

TEIN network enables Thai researchers to participate in Large Hadron Collider experiments

One of CERN's aims with the Large Hadron Collider (LHC) is to help the global particle (high-energy) physics community better understand the fundamental laws of nature. As part of this researchers from around the world are heavily involved in LHC experiments, with this global community including Thai particle physics researchers at Suranaree University of Technology (SUT) in Nakhon Ratchasima. They are participating actively in LHC experiments through the high-speed research network of TEIN, sharing their resources and working seamlessly across borders.

Enabling global particle physics research

One of the key LHC experiments is ALICE (A Large Ion Collider Experiment), a heavy-ion detector that is dedicated to studying the physics of strongly interacting matter, called quark-gluon plasma, at extreme energy densities. Eight Asian countries (Bangladesh, China, India, Indonesia, Japan, Korea, Pakistan, and Thailand) are participating in the ALICE collaboration.

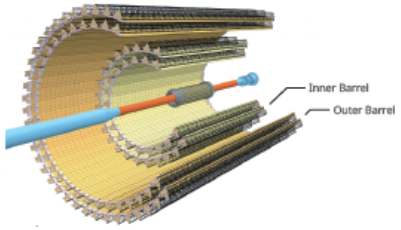
Thailand is a full member of the ALICE collaboration with researchers actively involved in the Inner Tracking System (ITS) upgrade project for ALICE. The main goal of ITS is to improve the detection efficiency of ALICE, enabling it to cover currently inaccessible low transverse momentum particles, and thus gain sufficient measurements to properly study their behavior. ITS is scheduled to be completed before the next Large Hadron Collider Run 3 in the year 2020.

SUT is one of the five founding members of the National e-Science infrastructure consortium of Thailand. As well as its work on ITS, the consortium's mission was to set up an ALICE Tier 2 center at SUT. This is connected to other Thai research institutes through the Inter-University Network (UniNet) and Thailand Research and Education Network (ThaiREN).

"Our strategy was to form a consortium of research institutes in Thailand working together to address different aspects of the project," said Dr. Chinorat Kobdaj, Experimental Particle Physics Group, Center of Excellence in High Energy and Astrophysics, Suranaree University of Technology. "While we have excellent support and dedicated bandwidth within Thailand, we required similar high-speed, high-capacity links to collaborate with colleagues at CERN and across Asia."

To achieve this international collaboration, the researchers rely on Asi@Connect, which provides the Trans-Eurasia Information Network(TEIN), a dedicated regional high capacity and high quality internet network for research and education, and also leverages the e-infrastructure developed for public sector projects. The successor project to TEIN4, Asi@Connect now connects Asian researchers to each other and with their counterparts in Europe via direct links to the pan-European GÉANT network.

Thanks to the TEIN network, researchers will be able to work with colleagues at CERN, and with the ALICE Tier 1 center at the Global Science Experimental Data Hub Center (GSDC) at the Korea Institute of Science and Technology Information (KISTI).



The new Inner Tracking System (ITS) for ALICE

WLCG signing ceremony between CERN and consortium of Thai institutes on 10 Oct 2013

The map shows the responsibilities divided among Thai institutes

The Challenge

While the ThaiREN and UniNet networks connect institutes at high speed within the country, the consortium knew that accessing sufficient international bandwidth and capacity was vital to the success of the collaboration, particularly as the upcoming Large Hadron Collider Open Network Environment (LHCONE) has stringent requirements in terms of network bandwidth.

The Solution

Using the TEIN network enables the researchers both to link to Europe, and to the ALICE Tier 1 center in Korea, providing sufficient bandwidth for Thai physicists to analyze ALICE data and share their findings with colleagues in Asia-Pacific and worldwide.

Key Benefits

Collaboration and analysis will be dramatically faster through the TEIN network. The project also has wider benefits. It is enabling local students and researchers to work with their peers in the international scientific community, increasing technology transfer and building capacity, while stimulating greater public interest in related fields, such as proton therapy cancer treatment.

Trans-Eurasia Information Network

TEIN is the regional research and education (R&E) network connecting scientists and researchers across the Asia-Pacific region and globally. Co-funded by the EU and Asian partners, and managed by TEIN*CC, the network began operating in 2000 and now is available through the Asi@Connect project.

Quotes

> Using TEIN enables Thai physicists to collaborate closely with colleagues in Europe and the rest of Asia, helping them become actively involved in LHC experiments that are improving our understanding of the fundamental laws of physics.

> Involvement in this project is driving greater interest in physics within Thailand and is inspiring young and talented students by enabling them to interact with their peers in the global community.

For more information

Asi@Connect : www.tein.asia **GÉANT** : www.geant.net **UNINET** : www.uni.net.th **ThaiREN** : www.thairen.net.th **SUT** : www.sut.ac.th

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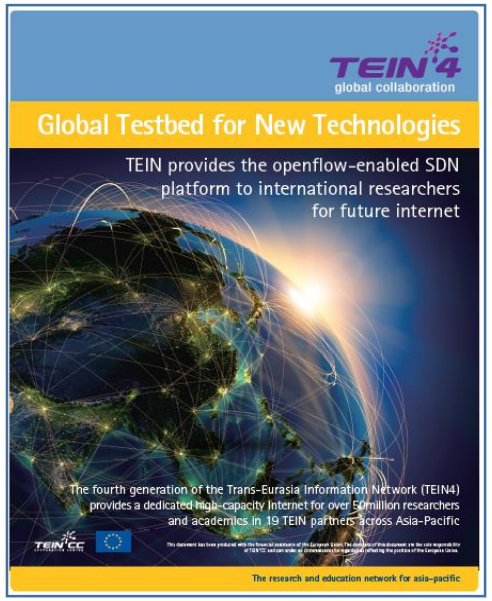
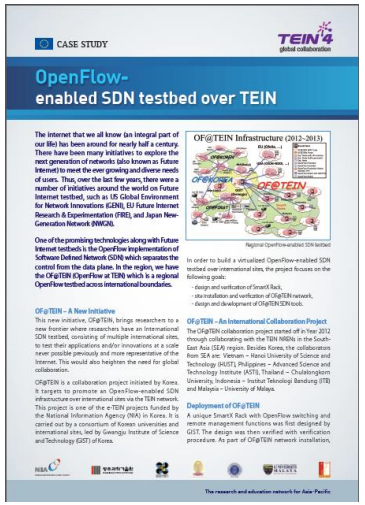
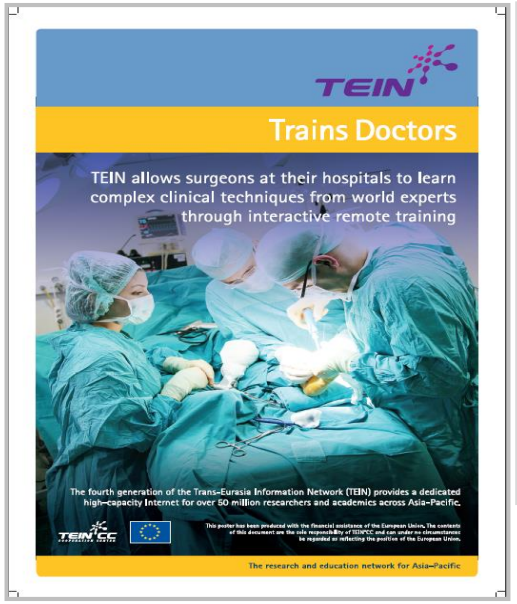
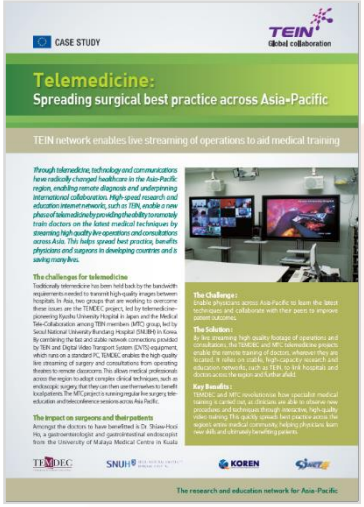
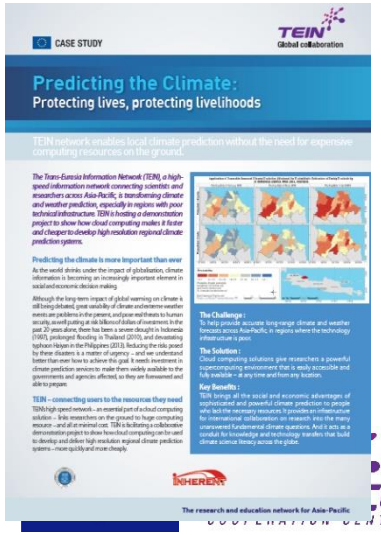
Other Case Studies and Posters

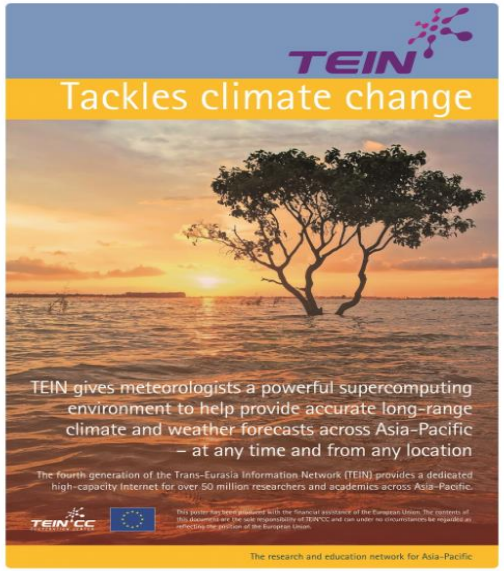


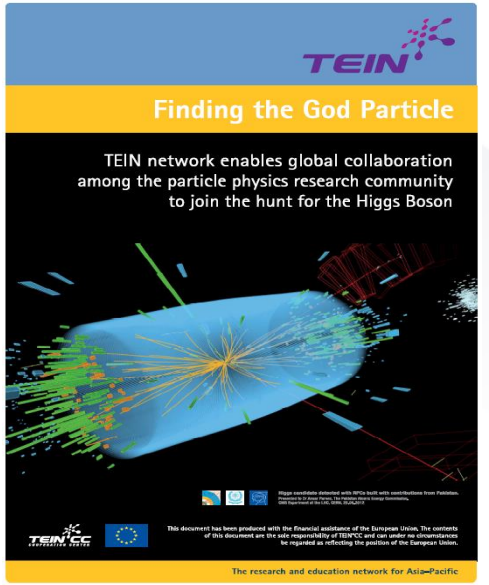






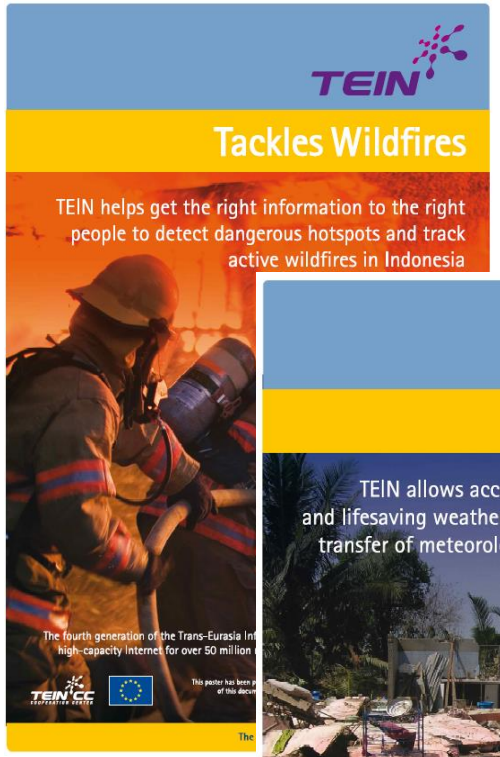


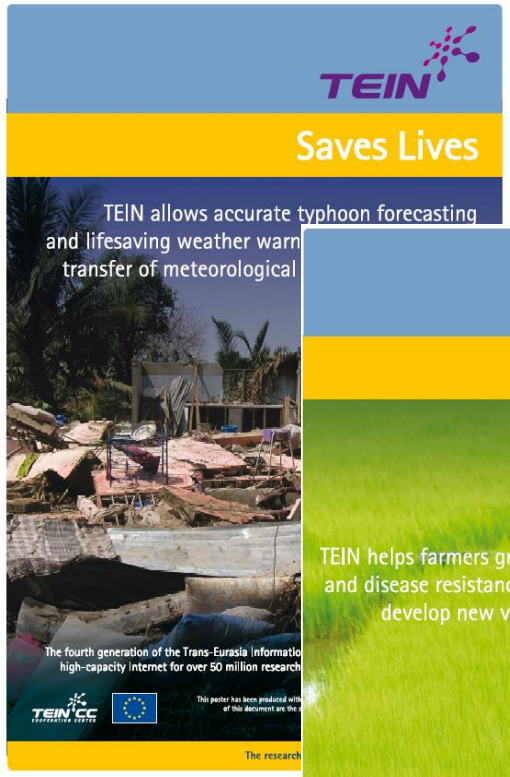


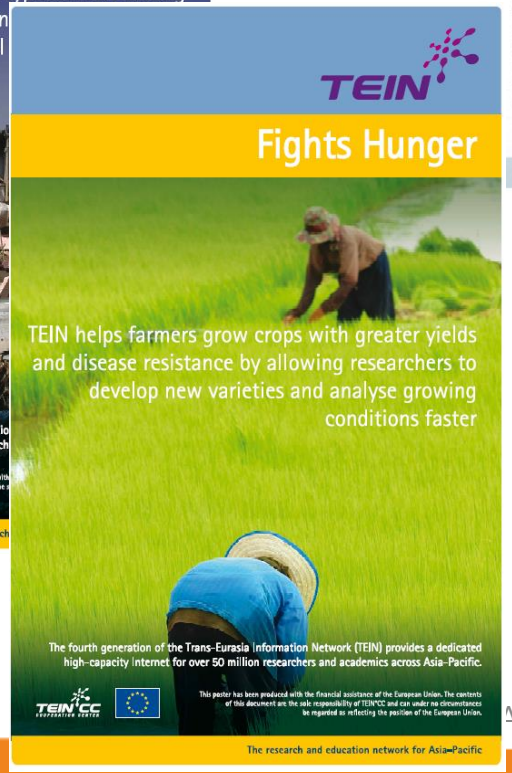


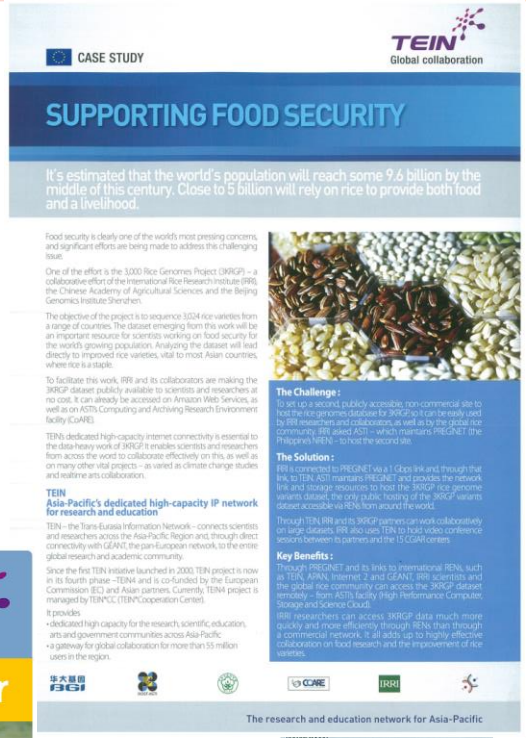
Other Case Studies and Posters

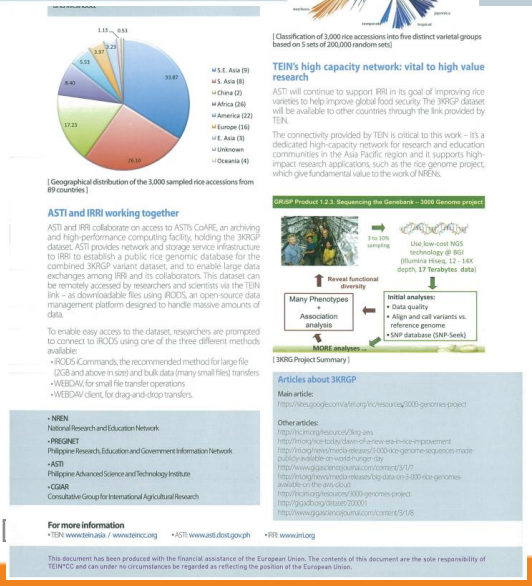
Asi@Connect

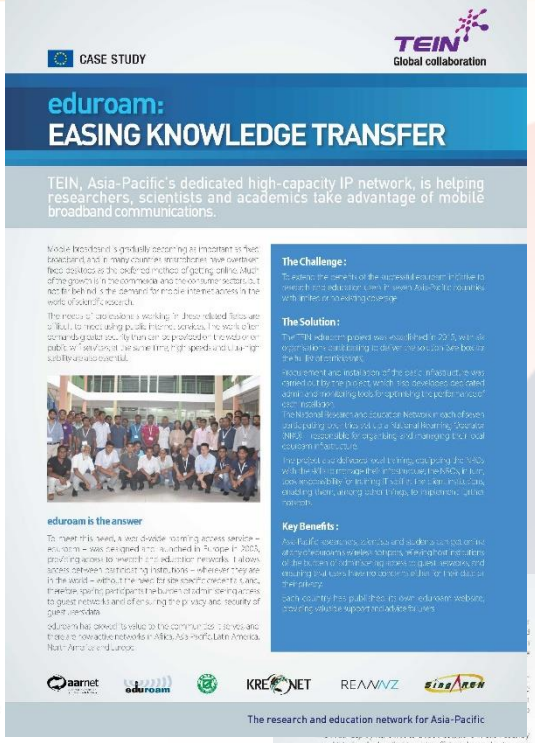












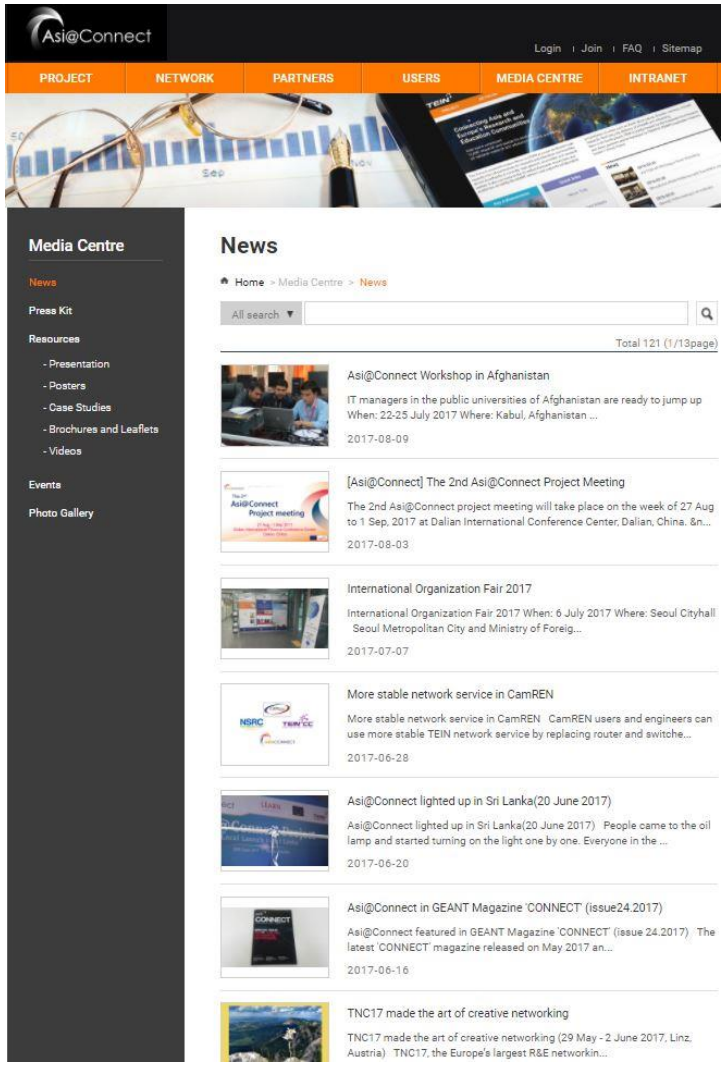
❖ Snapshots on carried out programs

SANOG29

AF Capacity Development

BD Campus Network

Website (www.tein.asia), Facebook & Twitter



@AsiaConnectProject

@AsiaConnectNews

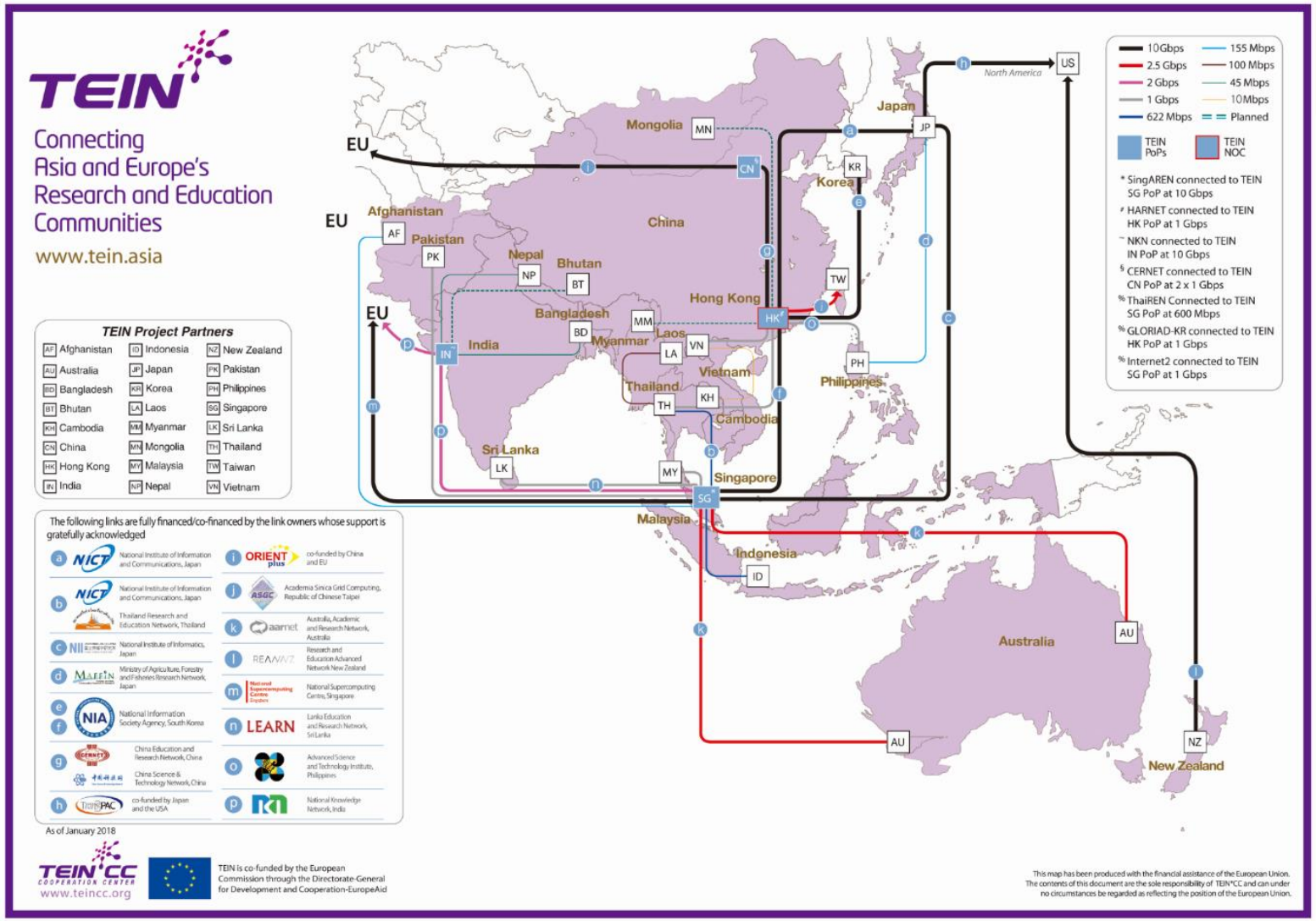
Status of LHCONE

❖ Implementation Complete

- ➢TEIN backbone
  (including link to Europe 10G)
- ➢ThaiREN, Thailand
- ➢CERNET/CGI-6IX, China
- ➢KREONET, Korea
- ➢JGN, Japan

❖Candidates

- ➢MyREN, Malaysia
- ➢PERN, Pakistan



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This project is co-funded by The European Union

This project is implemented By TEIN*CC

TEIN*CC: www.teincc.org, Asi@Connect Project: www.tein.asia