Pakistan Research & Education Network (PERN)

Updates 2015-16

Overview & Vision

- Pakistan's National Education & Research Network.
- Digital Dedicated Communication Network interlinking 250+ Public & Private Sector Universities, colleges and hospitals in Pakistan.
- Vision to enhance the Education & Research capabilities among the students of Pakistan.
- Provide integration of data banks, collaboration for research and development activities and up-gradation of teaching and learning skills.
- Connected to other NREN

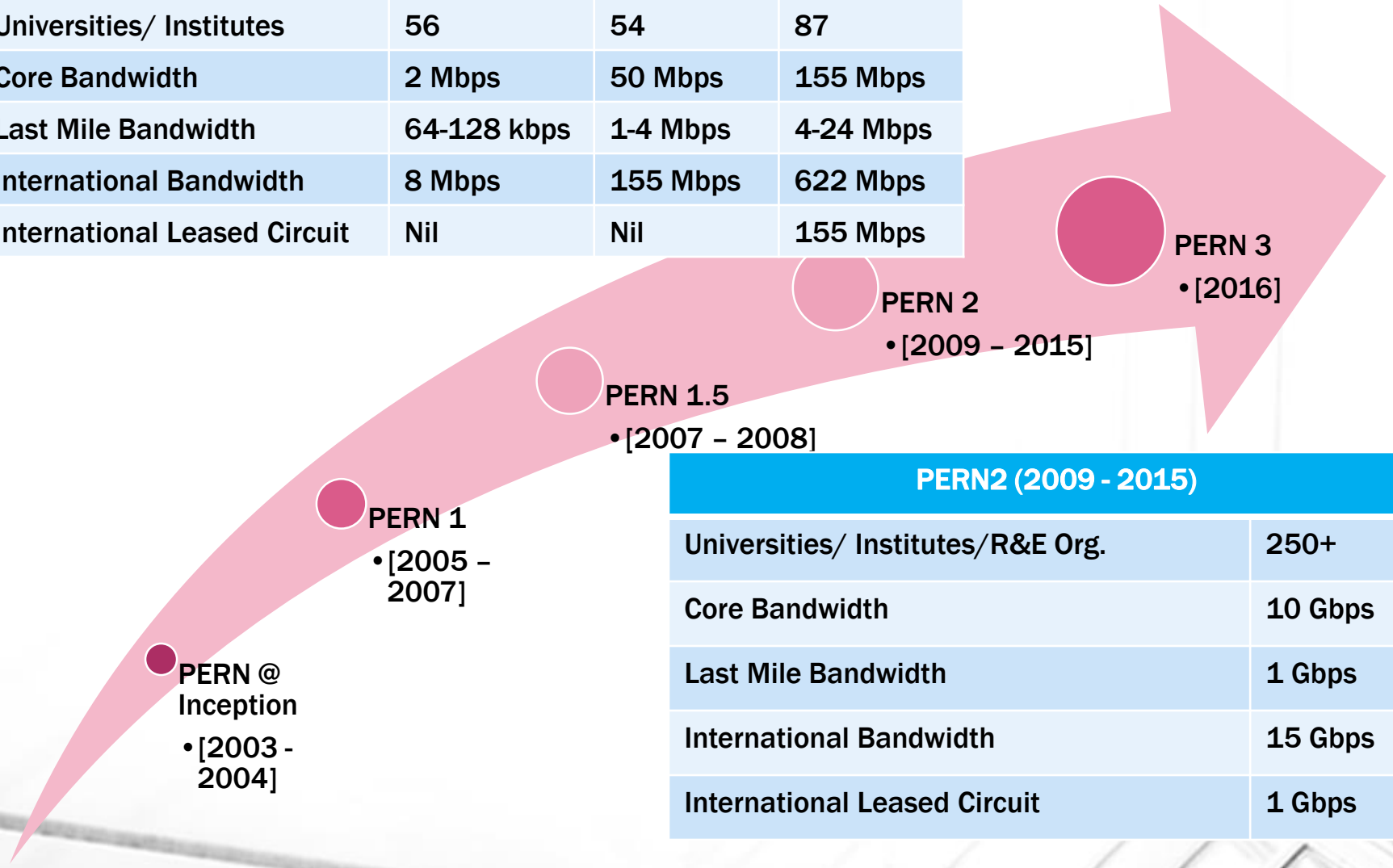
PERN 2 Overviews Contd

PERN2 Network Overview & Transmission Services Overview

- Network up-gradation through
  - Three (3) Regional Access PoPs
  - Seven (07) Local Access Pops
  - Five (05) Sub Regional Access
  - Eight (08) Aggregated PoPs
- 10Gbps metro rings in Karachi, Lahore & Islamabad
- 1Gbps Last miles
- 15Gbps Commodity internet bandwidth
- 1Gbps Link with TEIN

PERN Evolution

PERN Growth			
	2003	2005	2008
Universities/ Institutes	56	54	87
Core Bandwidth	2 Mbps	50 Mbps	155 Mbps
Last Mile Bandwidth	64-128 kbps	1-4 Mbps	4-24 Mbps
International Bandwidth	8 Mbps	155 Mbps	622 Mbps
International Leased Circuit	Nil	Nil	155 Mbps



PERN2 (2009 - 2015)	
Universities/ Institutes/R&E Org.	250+
Core Bandwidth	10 Gbps
Last Mile Bandwidth	1 Gbps
International Bandwidth	15 Gbps
International Leased Circuit	1 Gbps

PERN-2 High Level Design

23- PoP
250-Uni

Legend

- 10G Link
- 1G Link
- **Multiple of 10G Link (Planned on Long Haul)**
- **1G Link (Planned on Long Haul)**

cRA-POP

sRA/LA-POP

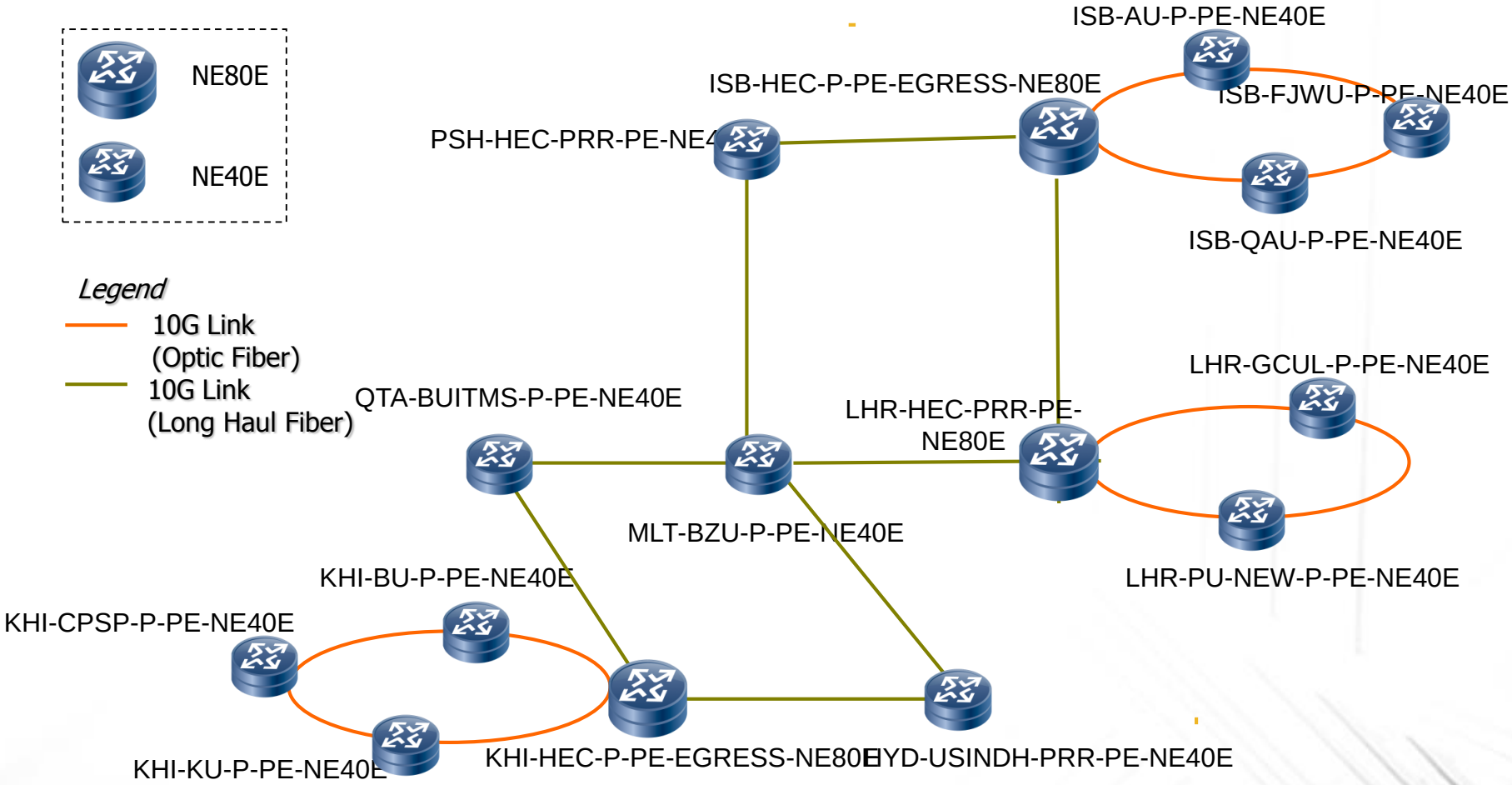
A-PoP

Campus

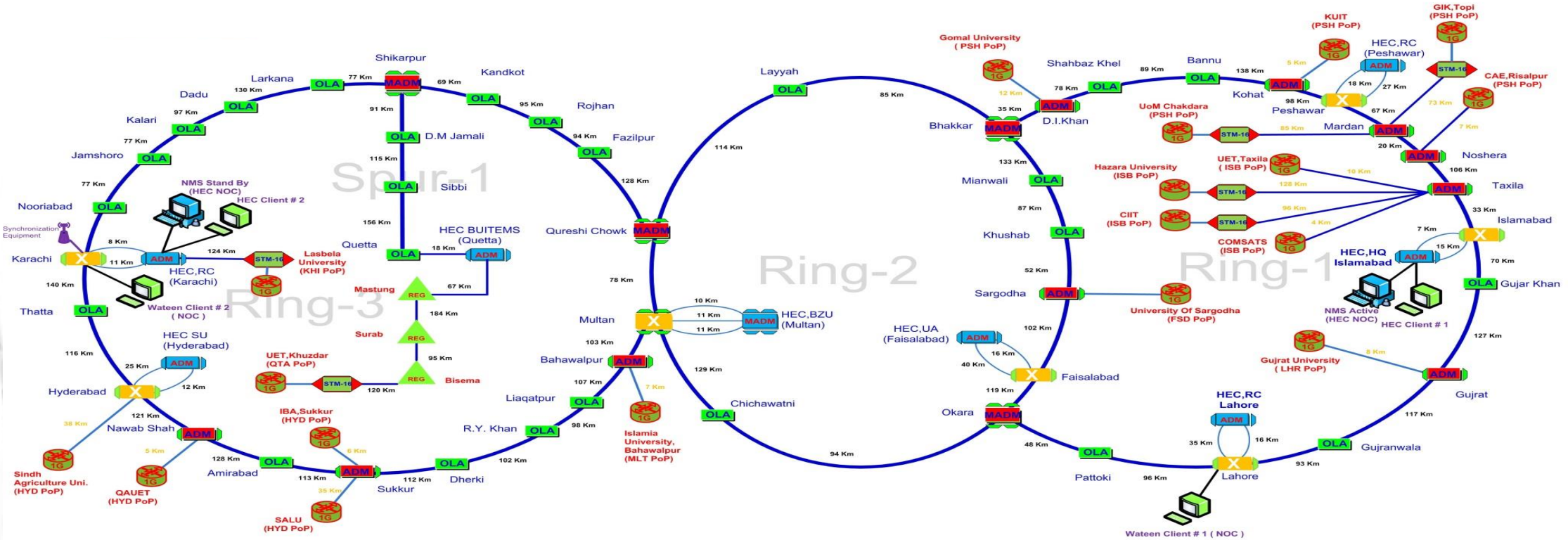
Punjab Degree Colleges

HEC(ISB)
HEC(PESH)
HEC(LHR)
AUF(FSB)
BZU(MLT)
BUITMS(QTA)
HEC(KHI)
USINDH(HYD)
CPSP
KU
IU(BWP)
BZU(SHW)
PU(GJW)
GCUL
PU-NEW
SU, SGD
QUEST, NWS
SMBBMU, Lrk
IBA, Suk
GPD College, DGK
NUST H-12
CE&ME
MCS
NUST
IST
NUML
IIU
FAST
AIOU
HU
BU NDU
QAU
AUP
PU
IMS
UET
GU
KUST
UOM
CoAE
GIK
PMA
HEC
NCP
CIITI
PIES
FUUAST
FJWU
PASC
NCA
LCWU
KCW
Uop-OLD
UVAS
GCU
NCOEIMB
CIIT
UOL
UHS
UOE
LSE
LUMS
UMT
UOA
NTU
UOG
GCU
UOB
SBKWU
BUITEMS
UET, Khuz
GMMC
BZU
QUCET
SZABIST
SBBU
PMU
SALU
SAU
LUMHS
MUET
AWC
BUMDC
ZU
DSU
IoBM
SZABIST
IU
LU
ICAP
FAST-CS
FAST
HU
IBA
NED
SSUET
HEJ
DUHS, Ojha
Habib
AKU
DUHS
PNEC
BU
HEC
KASHMIR
BALTISTAN
LADAKH
CHAGAI
KHARAN
MAKRAN
KALAT
ZHOB
ARABIAN SEA
332 km

10GE Backbone Network

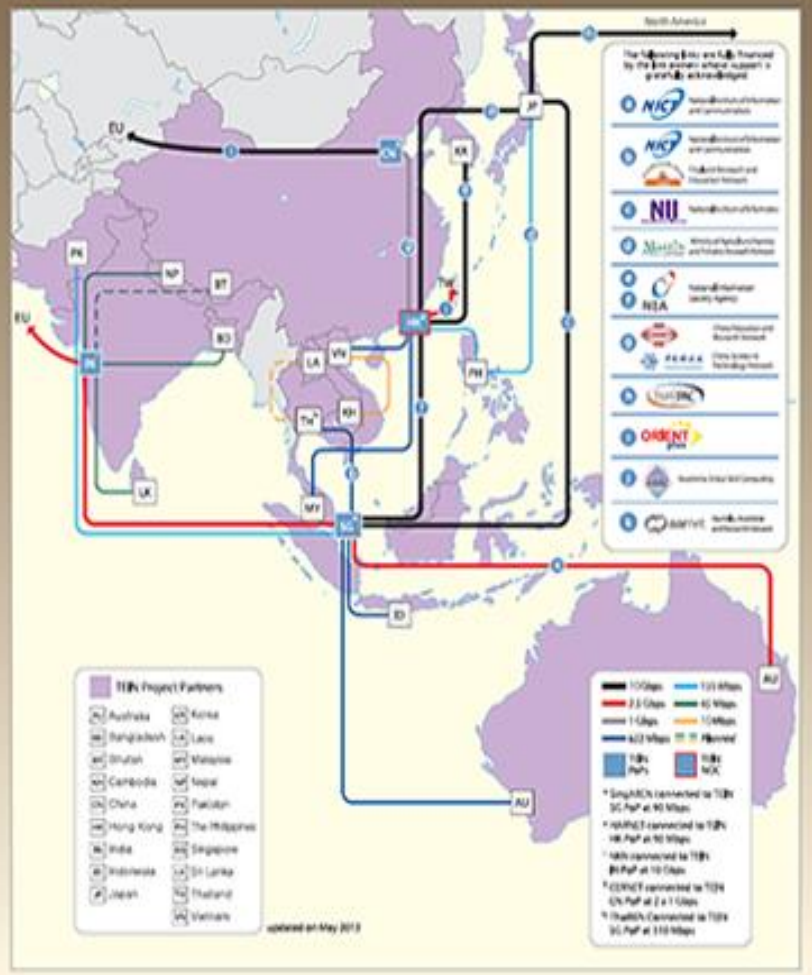


PERN2 Long Haul Network



PERN International Linkages

TEIN4 Network Diagram



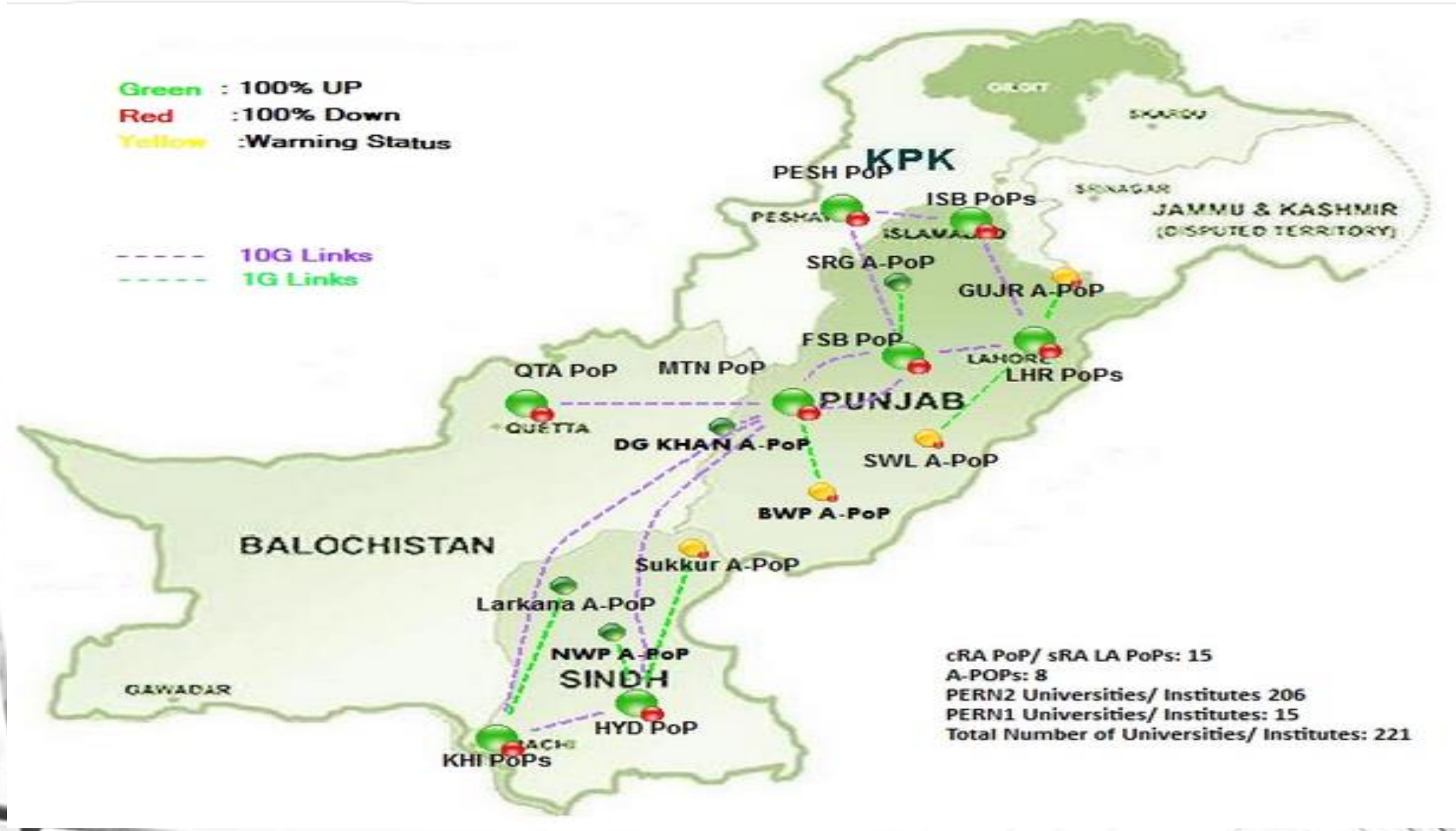
TEIN4

1. High Speed Dedicated NREN Network without Congestion.
2. Reduced number of Hops to International HEI.
3. Initially 155Mbps link upgraded to 1Gbps in 2014-15

PERN Network Management System

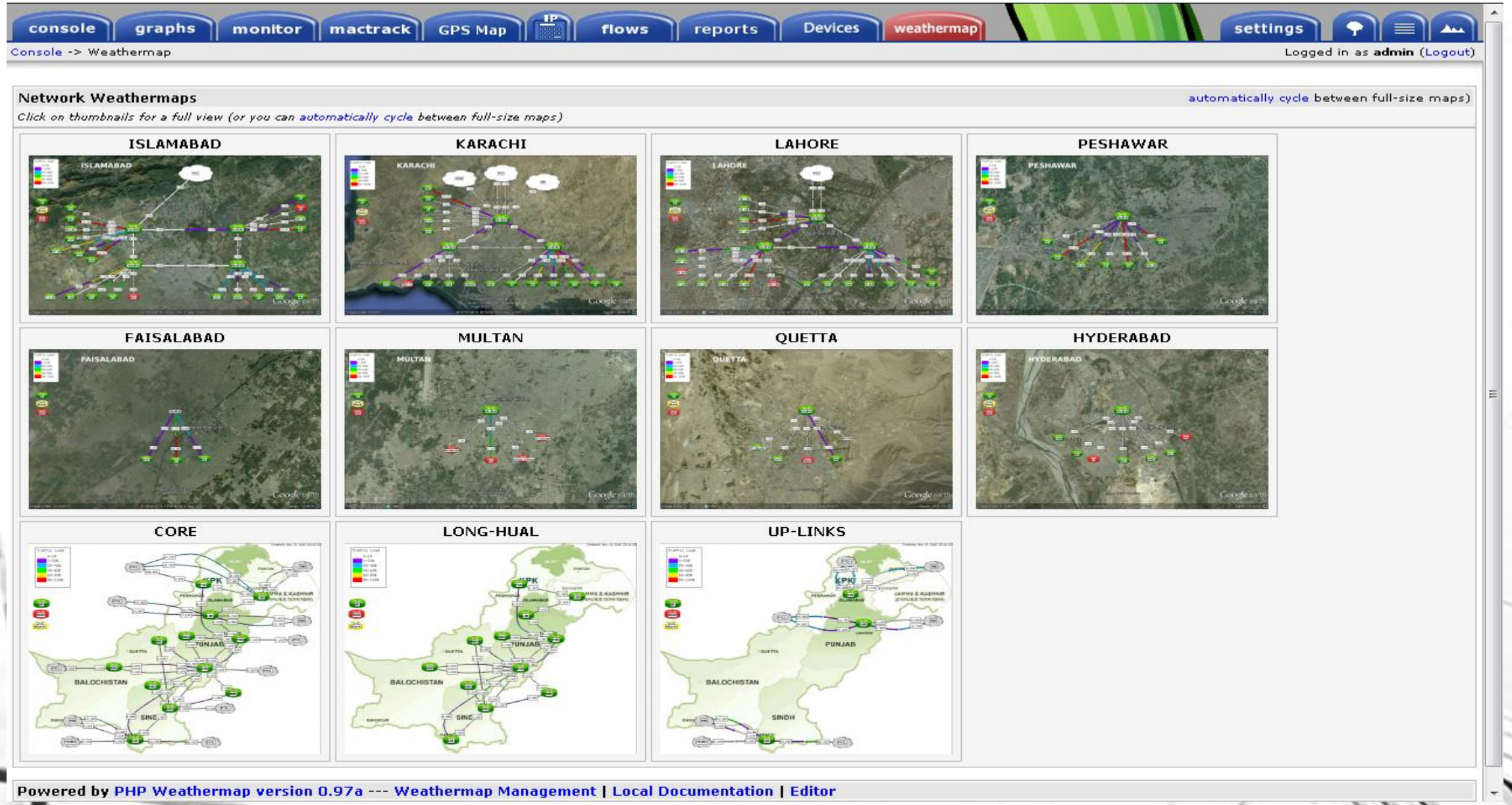
- 24 X 7 Monitoring
- NMS
  - Orion Solar winds NMS
  - Cacti
  - Huawei DMS (Cloud)
  - Huawei U2000 (DWDM monitoring)
  - Cisco Prime (Smart Universities)
- Web Access to Universities / Engineers
- npm.hec.gov.pk

Solarwinds NPM (PERN Network View)

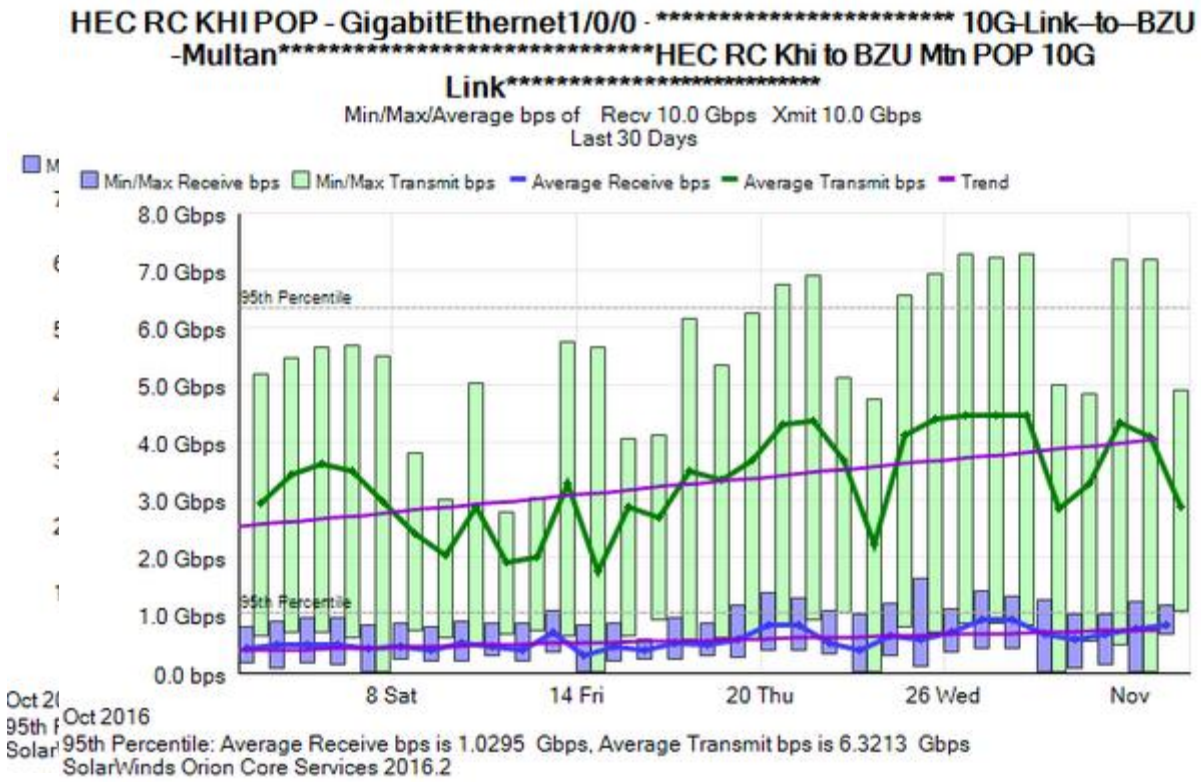


Cacti (Weather Map of PERN LongHaul)

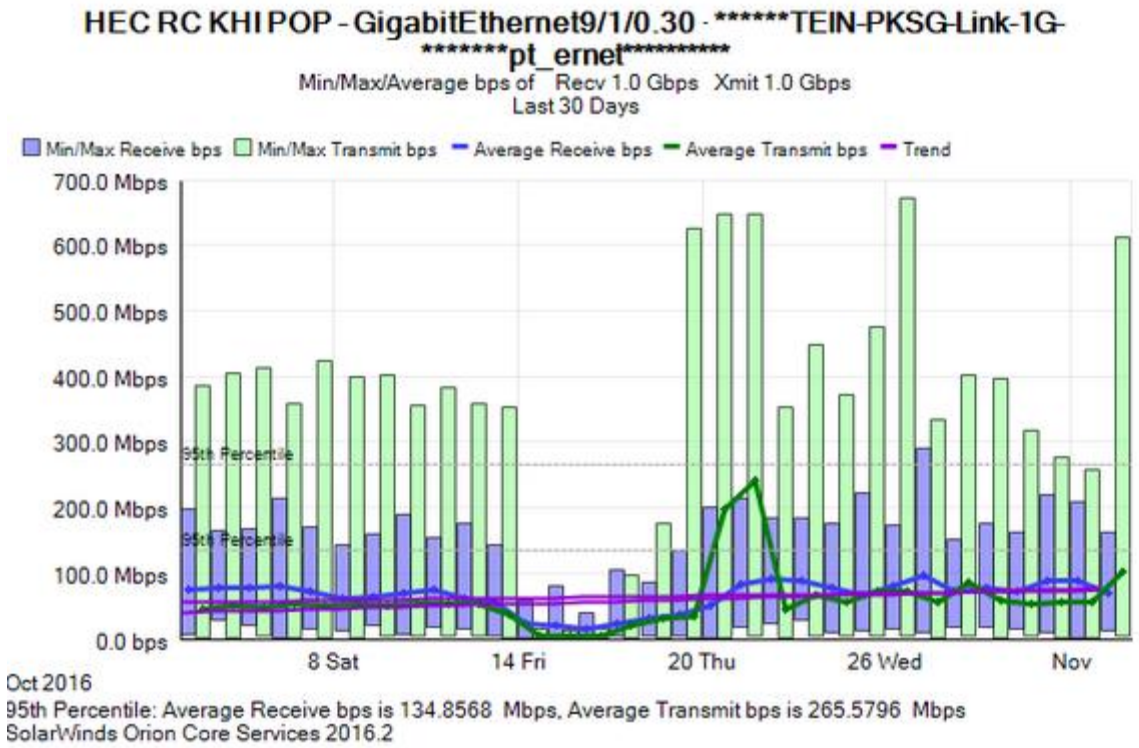
Cacti (PERN Network Weather Maps)



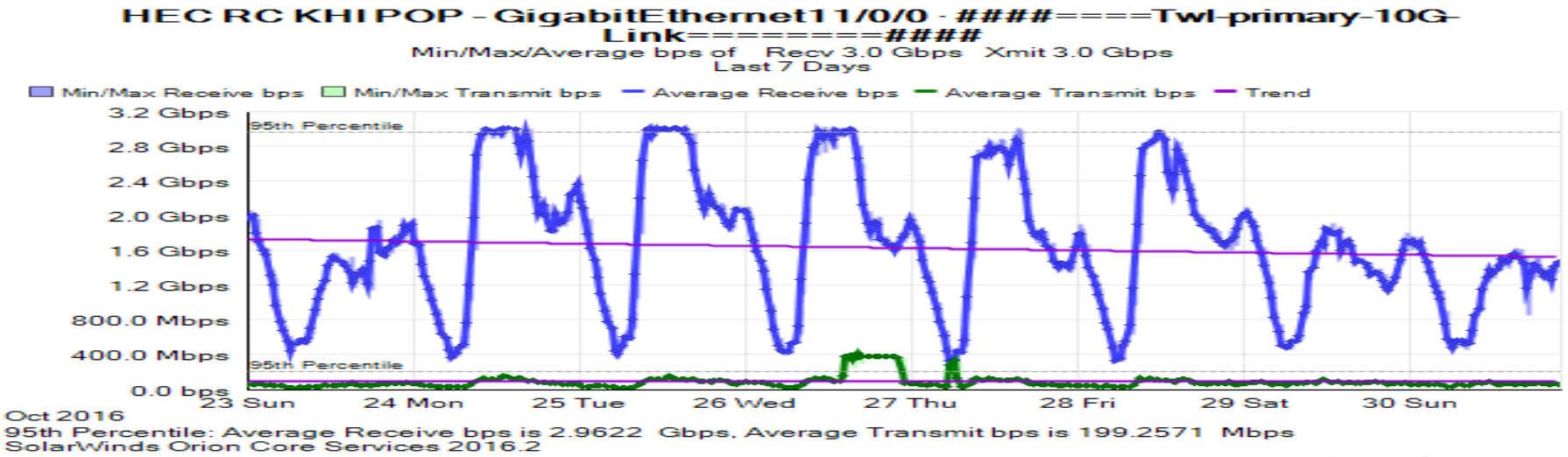
Traffic on 10G LongHaul (30 days)

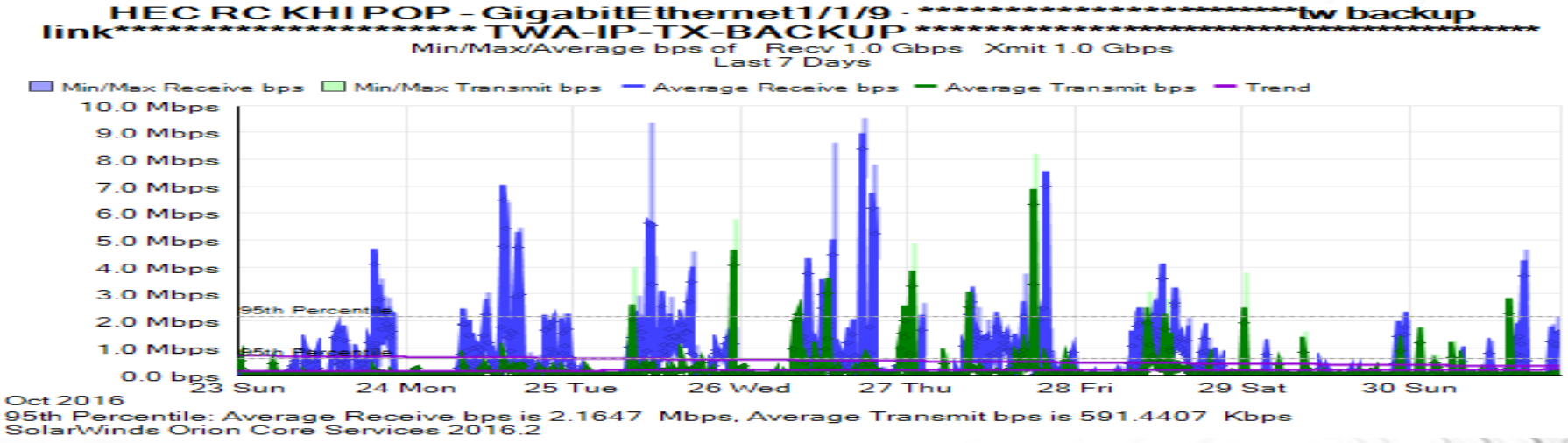


TEIN IPLC Traffic (30 days)

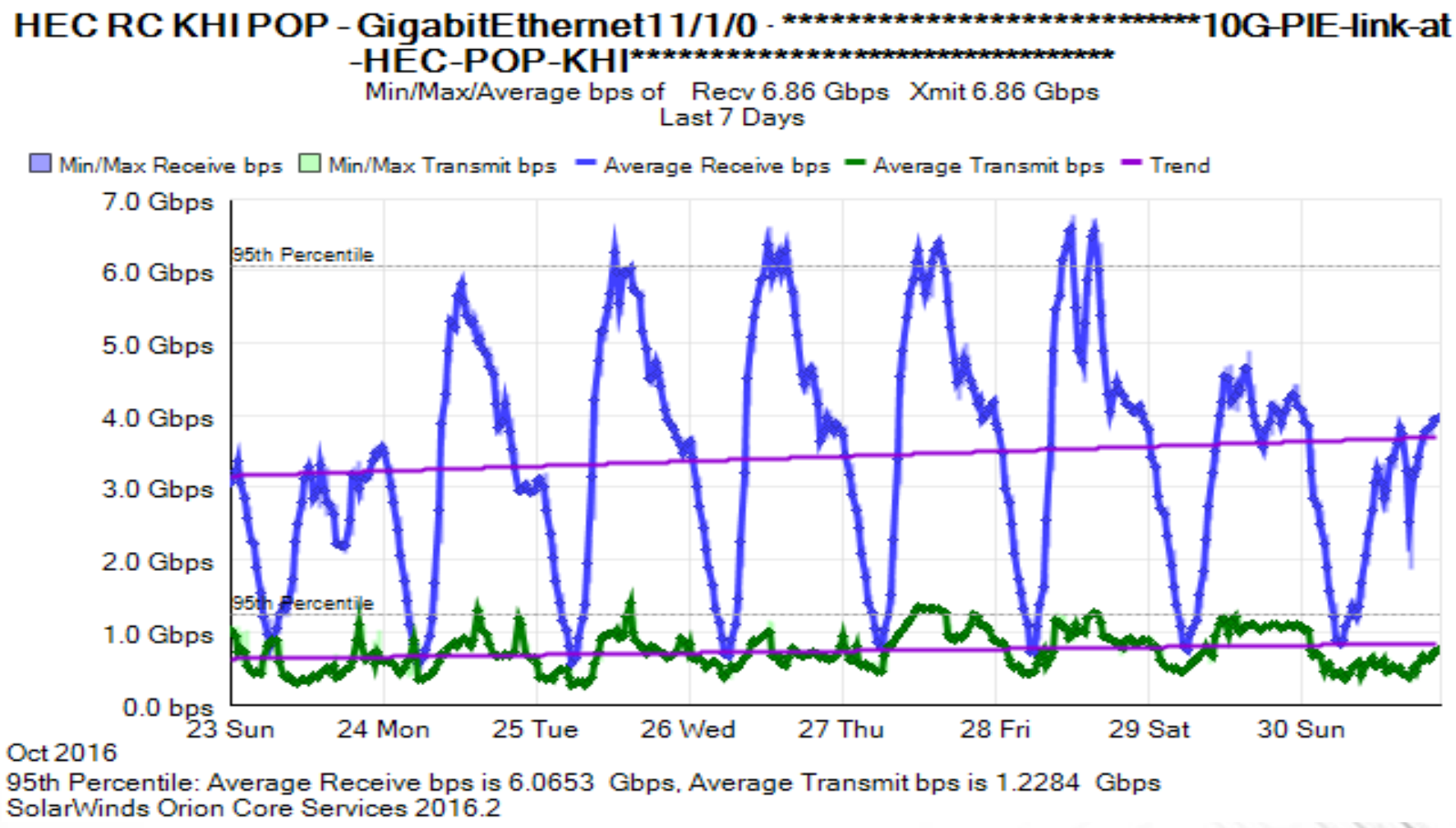


Internet Bandwidth TW Karachi

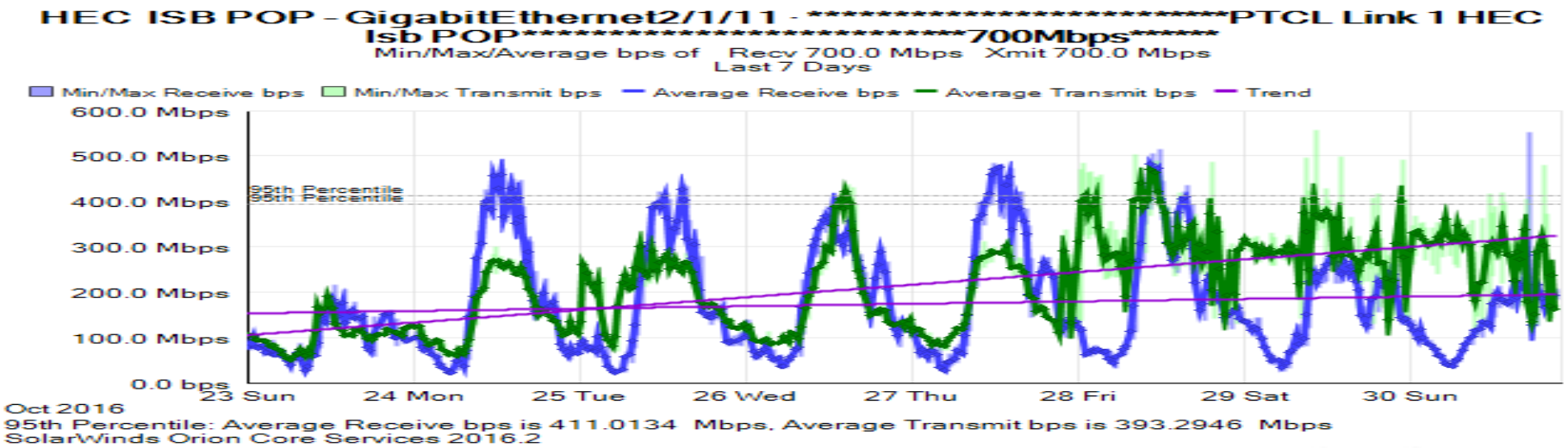


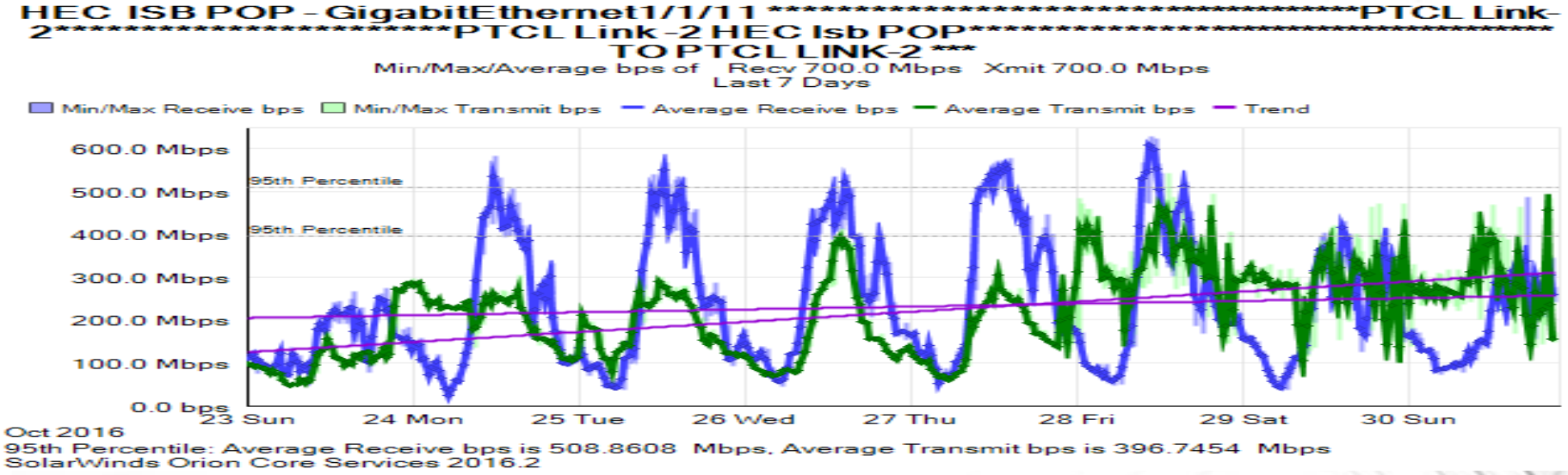


Internet Bandwidth PTCL Karachi

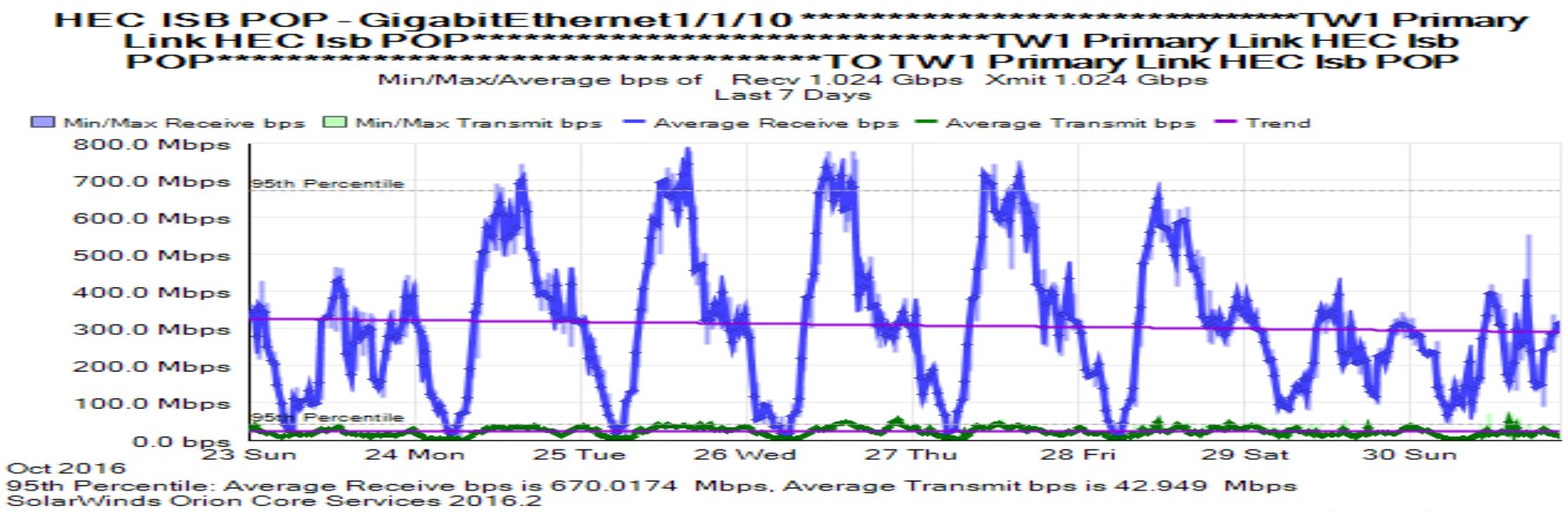


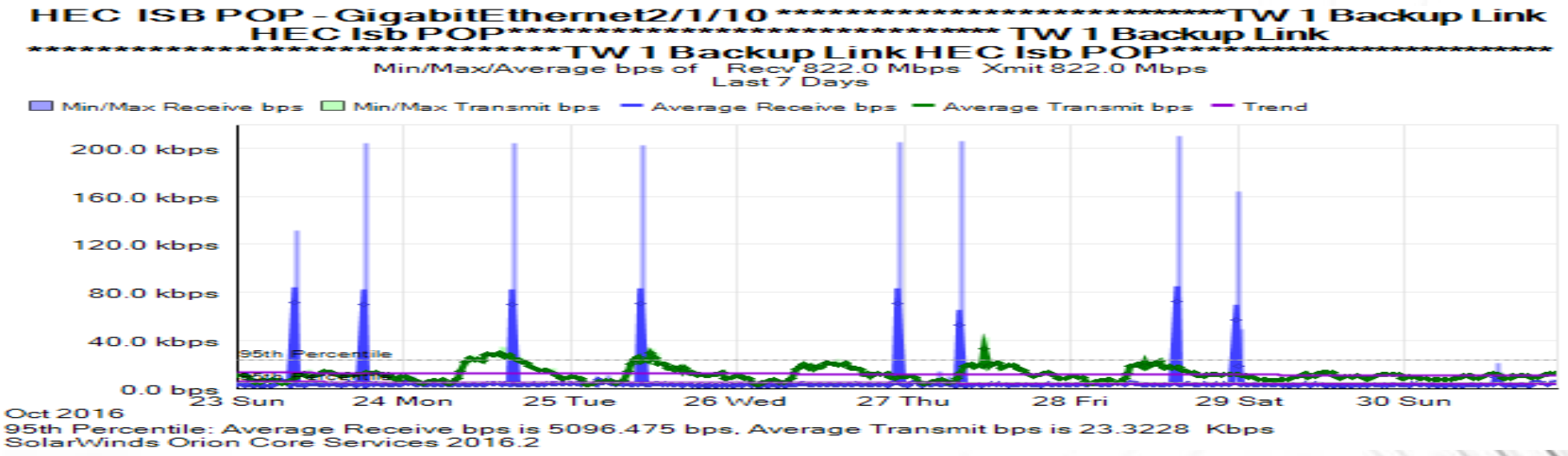
Internet Bandwidth PTCL ISB



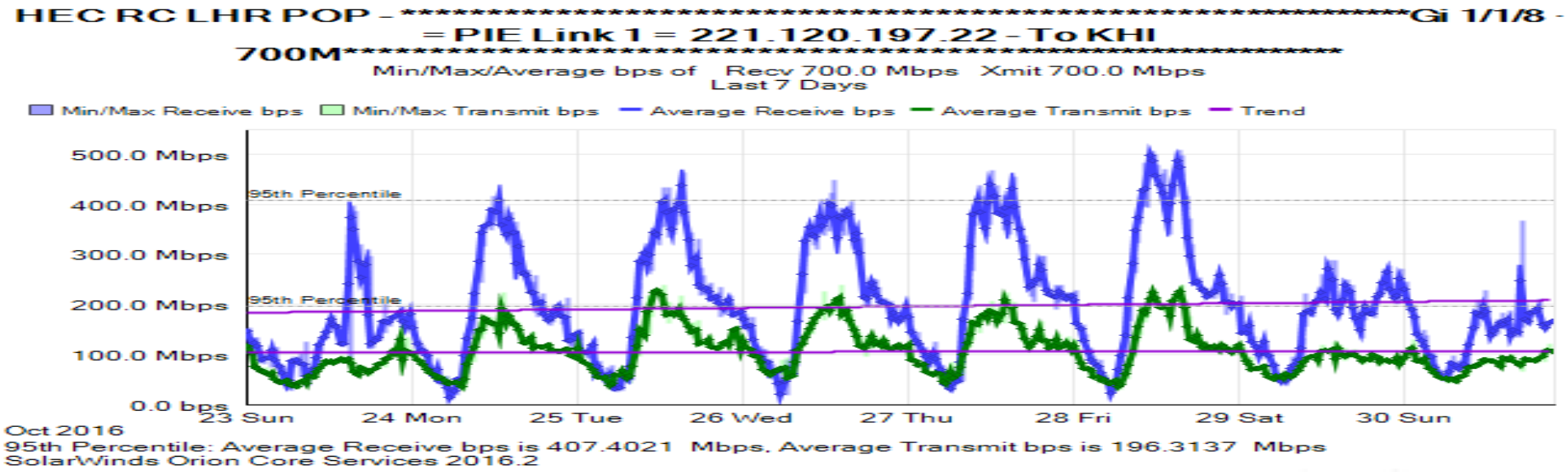


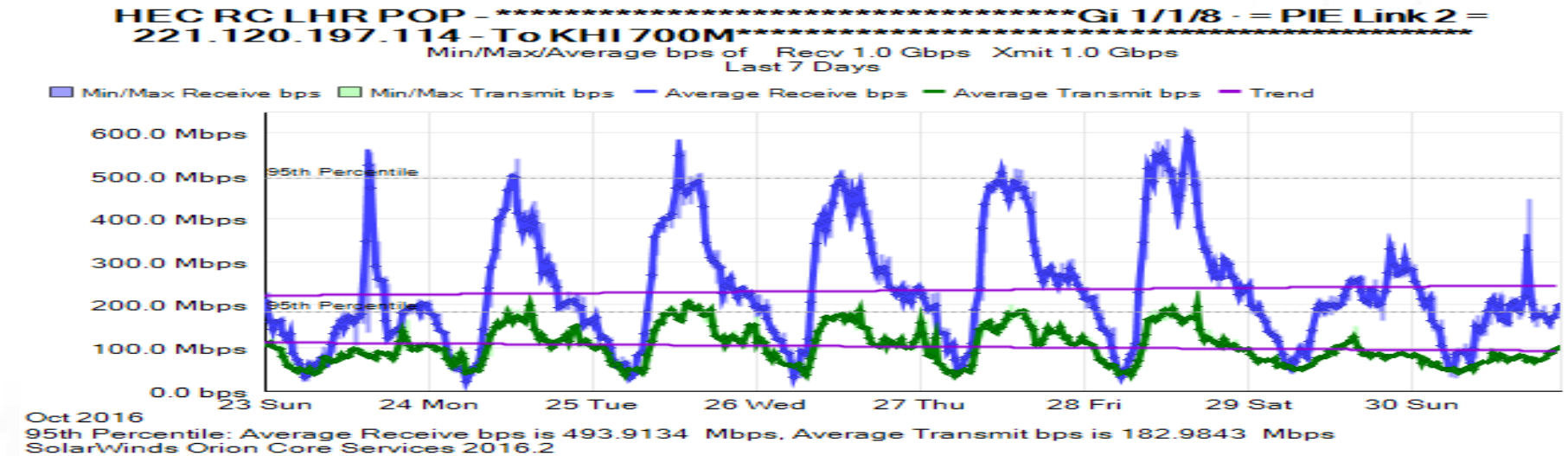
Internet Bandwidth TW ISB



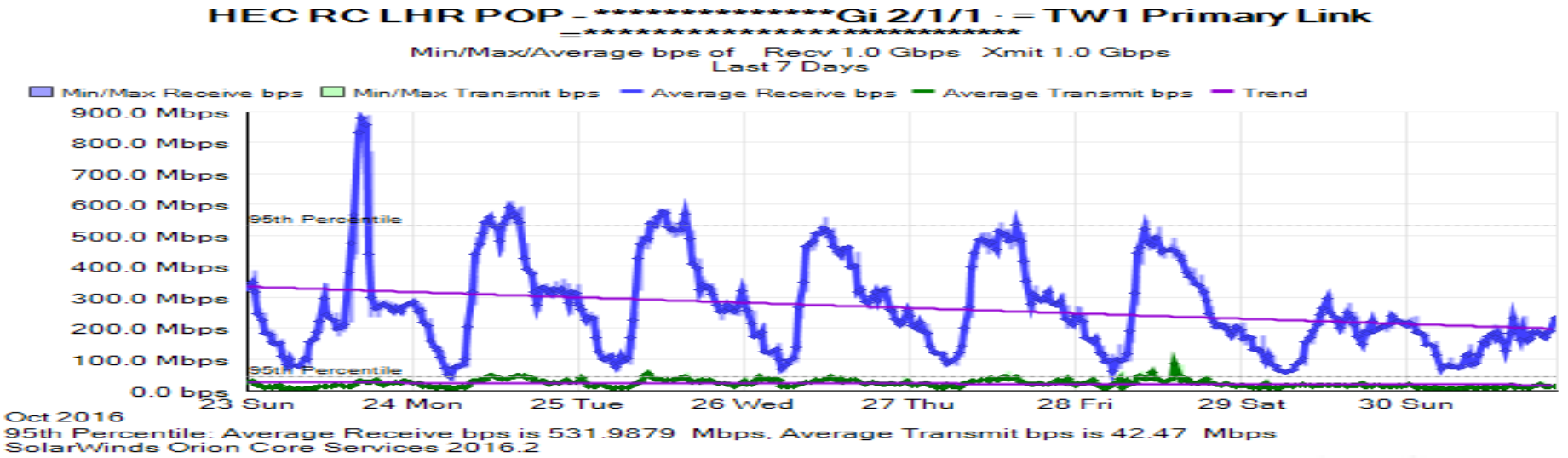


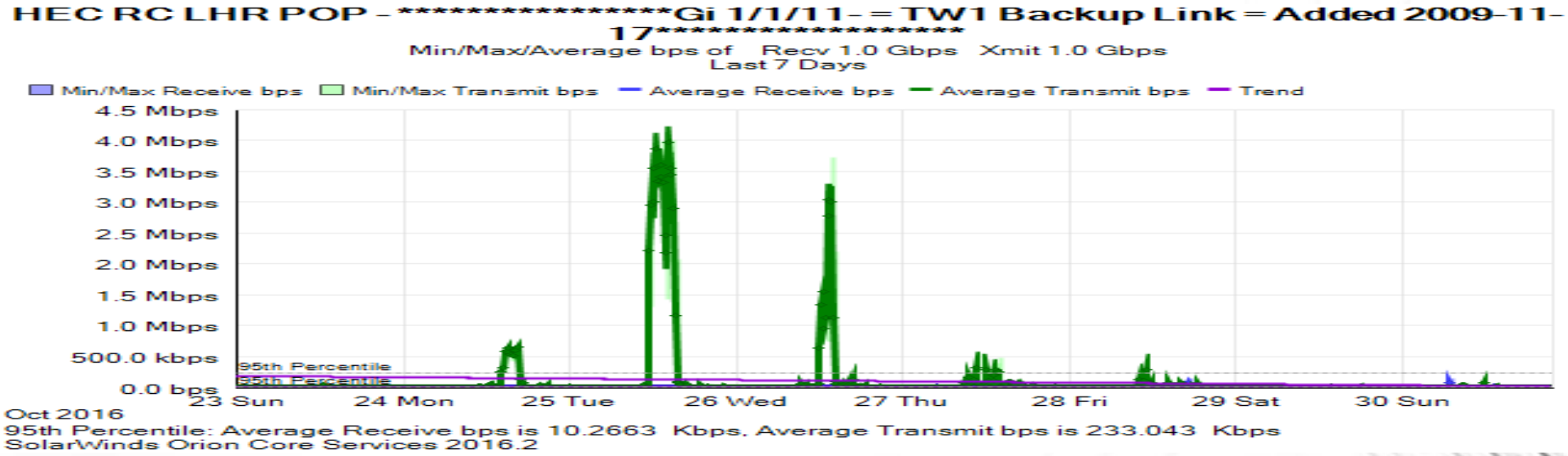
Internet Bandwidth PTCL Lhr





Internet Bandwidth TW Lhr

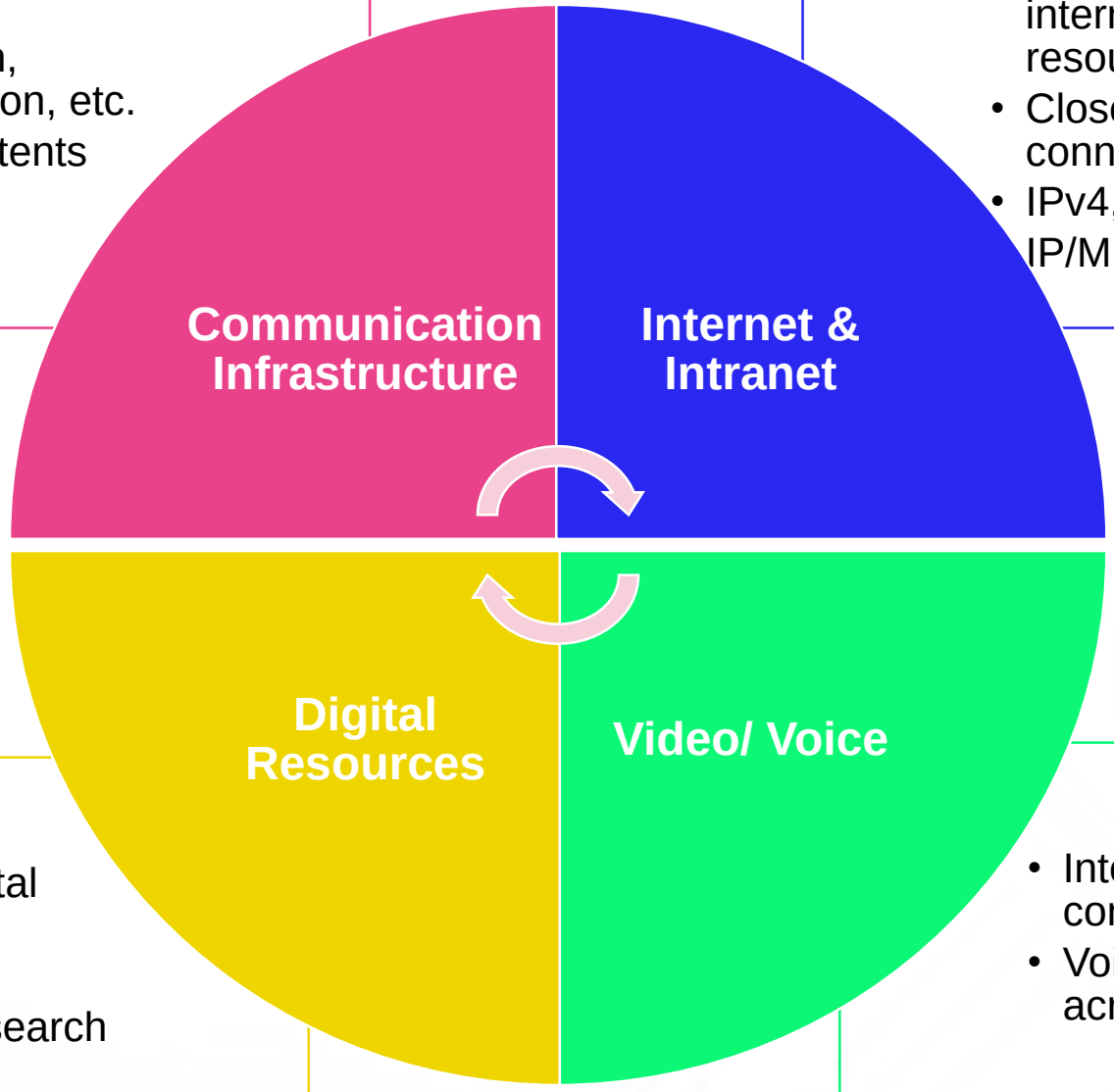




Services Offered through PERN-2

- Scientific research, viz. Grids, simulation, computation, etc.
- Local contents hosting

- Access to international digital resources
- Closed loop secure connectivity
- IPv4, v6 IP/MPLS



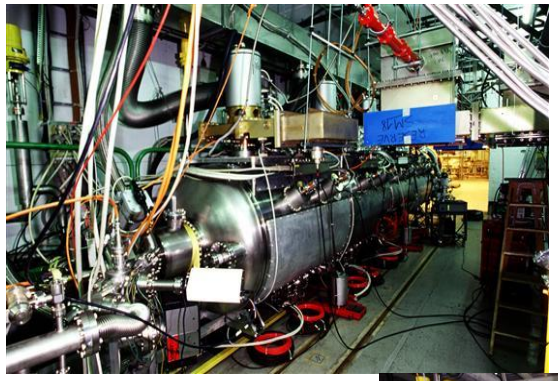
- National Digital Library
- E-Books
- Pakistan Research Repository

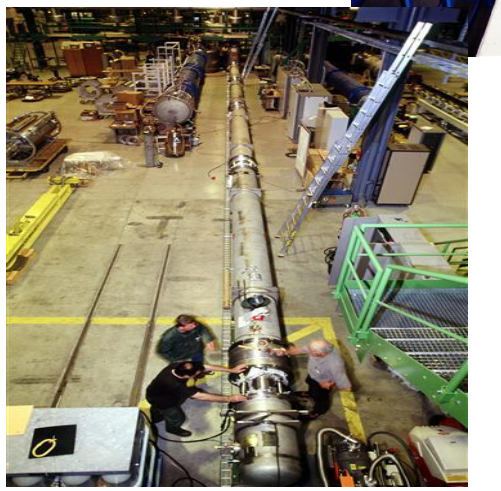
- Interactive video conferencing
- Voice over IP across HEIs

CERN (LHC) Project

- There are stringent requirements for computing at LHC. To exploit the full physics potential of LHC data in comprehensive manner, NCP required Linux based PC farms, data storage capacity in 100s of terabyte and excellent network connectivity

- To equip NCP with excellent network connectivity PERN2 has dedicated TEIN-PK link completely.





National Video Conferencing Network setup in HEI's

Region	Total Sites
Regional Centers	11
Federal	13
Punjab	24
Sindh	19
KPK	19
Baluchistan	6
AJK	4
Gilgit Baltistan	1
Total	93

Telemedicine over PERN

- From the Operation Theater facility of Holy Family Hospital Rawalpindi
  - Live surgeries on Advanced Upper G.I. Laparoscopy.
- The medical graduates and the doctors' participation

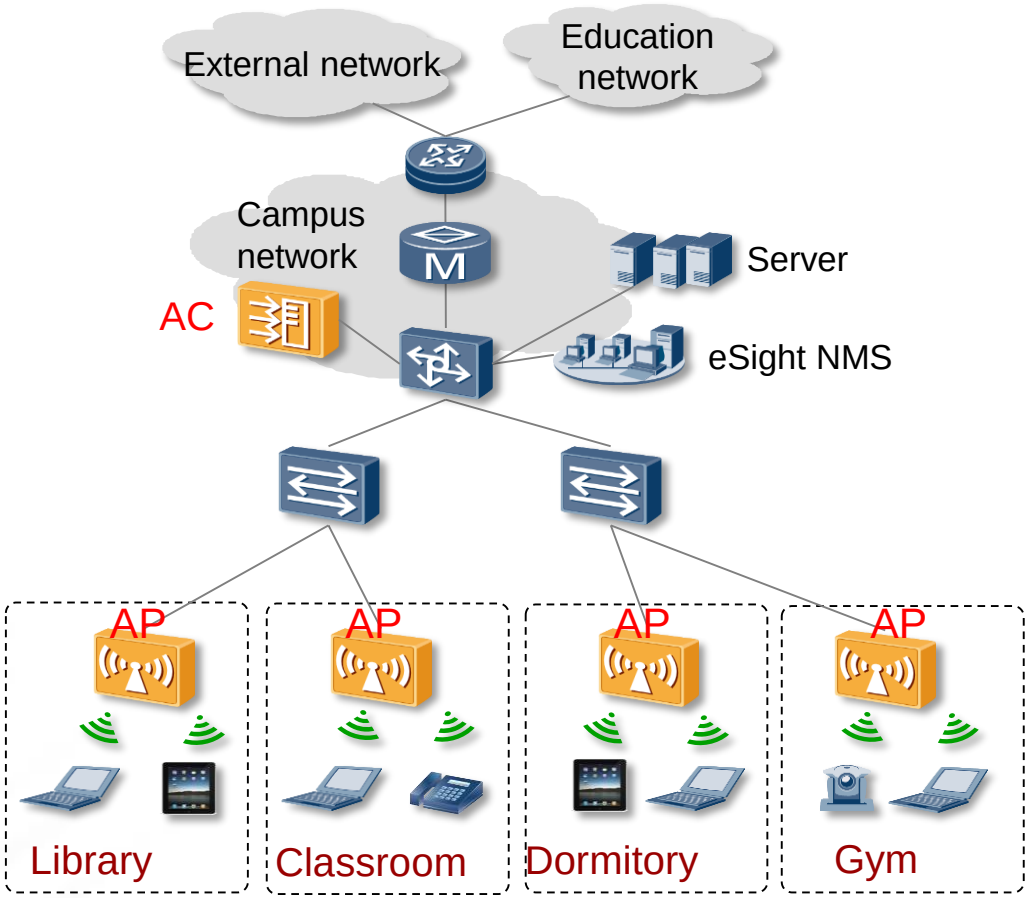
Agriculture Field Research

- Showcasing research and development activities being performed. Live from
  - Jambar Farm House of UVAS, HEJ Karachi
  - PIEAS Operation Theater
  - Khairpur University Botanical Farm
  - Gomal University research laboratory
- Live and interactive video sessions were conducted directly from the research facilities

Education Alliance with Microsoft

- Microsoft Academic Days @ Universities
- Students Skills Development Program
- Training of Technical Staff
- Azure Sharepoint SQL & Office365 Training for faculty & staff
- Imagine Cup

Smart Campus (Blanket WIFI Coverage)



Multiple authentication and encryption technologies ensure secure access of Wi-Fi terminals to eliminate security threats from the source. Wireless networks can reach the same security level as that of wired networks.

eduroam

aarnet
Australia's Academic and Research Network

HEC Cloud Data Center Highlights

Total No of cores	20,000
Total Storage capacity	20PB
RAM Capacity	300 TB
Total No Cloud V-Hosts	4000
Total Virtual Desktop	100,000
No of racks	36

This data center will be hosting the following services.

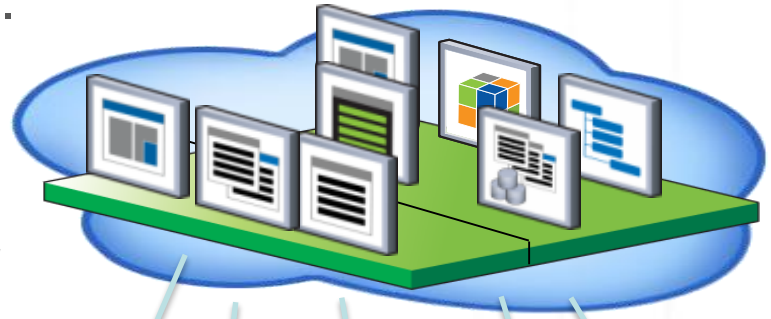
- Virtual Data Centers (VDC)
- Virtual Desktop Infrastructure (VDI)
- Safe Campus Central Solution and Central Survillance
- Unified Communication and Shared Services
- Storage as a Service
- Training as a Service

VDI: Post-PC era: Cloud Desktop

- Cloud computing lead desktop to “post-PC era”. The separation of desktop and terminal solves challenges.

Local storage, computing and applications migrate to cloud data center.

PCs are replaced by kinds of terminals



Smartphone PC Thin Client Laptop iPad

Cloud Desktop:

- On-demand
- High security
- High efficiency
- High availability
- Low TCO
- .....

Cloud Computing

Scenario
- Provides storage space leasing based on cloud services
- Provides massive resource pools to enterprise customers for data storage and sharing

Highlights
- Compatible with multiple applications
- Seamless capacity expansion
- E2E data security

Benefits
- Unlimited scalability on demand
- Free from maintenance
- Cross-regional data backup

Safe Campus Solution

- Real-time monitoring
- Video Query
- Remote patrol
- Remote Intercom
- Remote alarm

Campus Monitoring Centre

watching the screen in real time

Campus Police agencies monitor real-time video

Parents can keep abreast of the situation of students in school

Dicated public safety network

INTERNET

LAN

Building group

Teaching Building

Gates

Floor Channel

School wall

Parking

Smart Class Room

recorded for VoD

real-time interactions

live streamed and

Extending Real Classroom Experience

Content Development

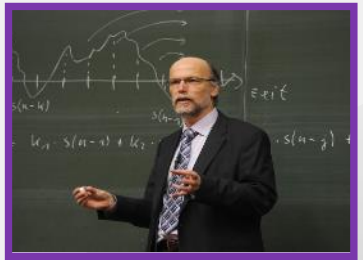
Distance Learning

Sub-campus Connect

Real-time interaction among universities, providing immersive experience.

Departments Faculty Sharing

Interaction between departments with data exchanging on the same curriculum.



Extend Visiting Faculty

Distance instruction among universities. Academic seminars between universities.

Remote Interactive Students

Access real time class from remote place though internet. Routine education.

Content Development

Automatic recording and uploading. No need to transcode.

Distance Learning Students - VOD

No more DVDs and deliveries, enjoy more latest recorded high quality lectures.

Feedback

Student can feedback on recorded lectures and marking on content quality.

Education Equity

Innovative Education

Online Learning

Distance Education

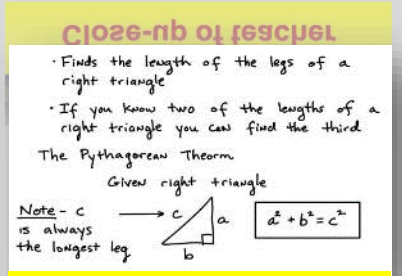
Between eClassrooms - Immersive Experience and Real-time Interaction

Main classroom

Automatic tracking and directing during the teaching process

Close-up of teacher

Panoramic view of the students



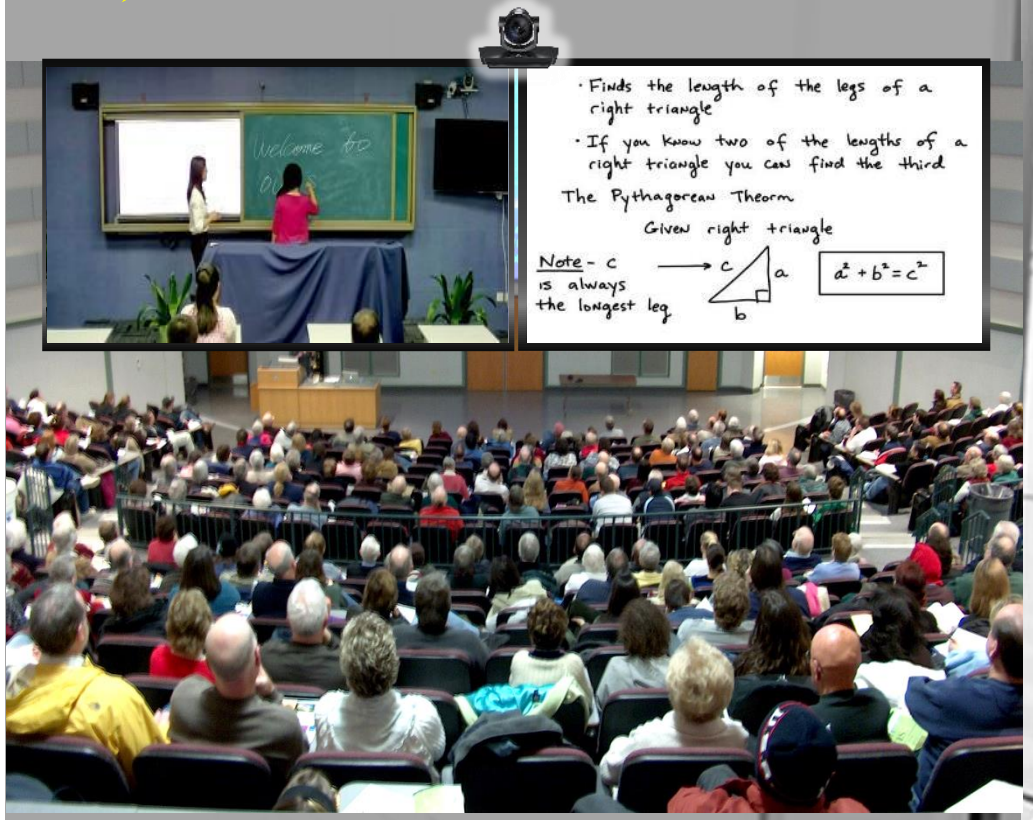
Courseware on IDB

Panoramic view of the platform

Branch classroom View

IDB collaboration

Branch classroom

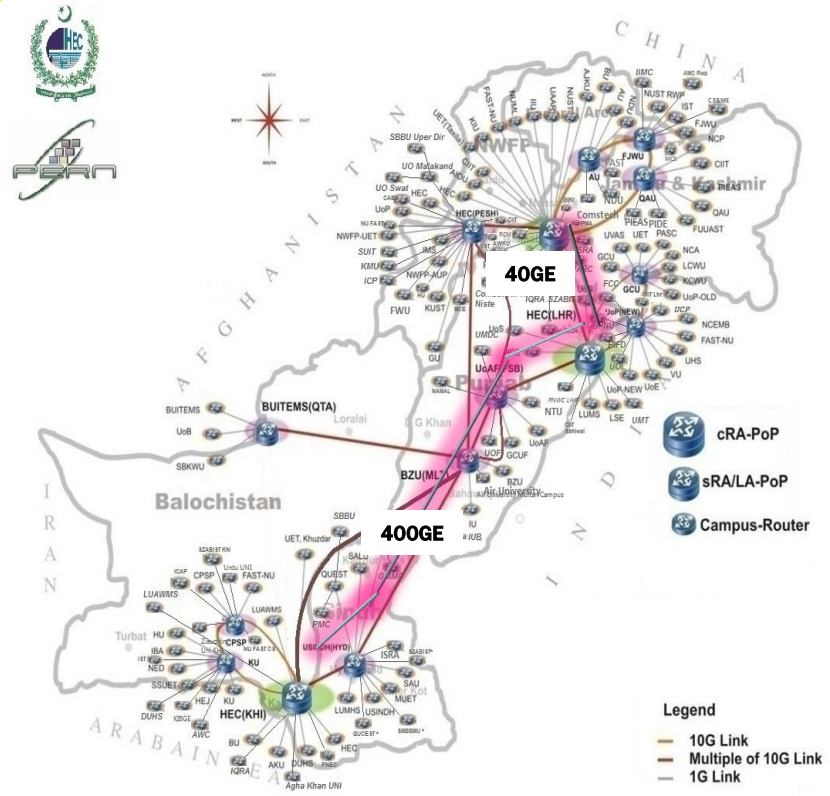


Interactive Learning System

- ✓ Automatic Tracking
- ✓ Intelligent Directing
- ✓ Real Class Experience
- ✓ Real-time Interaction

Expansion Plans:PERN3

Ready to transform 40GE Core



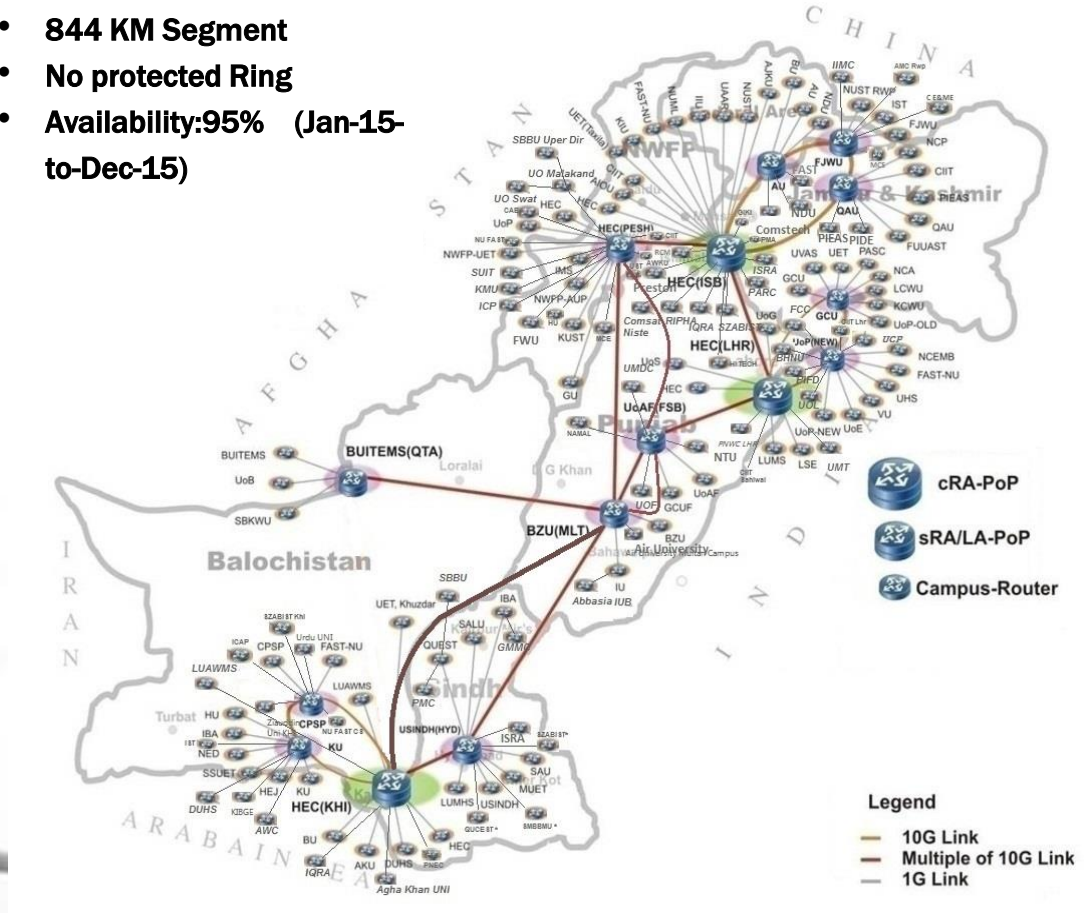
- Planned to transform 40GE Core in parallel to existing 10GE core. Interlinking Six (6) major cites.
- 10GE last mile Media to access sites.
- Last Mile Media from Karakorum (KIU) to GAWADAR (Turbat University)
- A high speed multi-gigabit 40GE/100GE dedicated network for universities/ institutes/research centers/ Colleges of Pakistan.
- A network addressing the limitations of existing network in terms of Bandwidth, Network Availability, coverage etc.
- Rolling out emerging technologies for today's and future bandwidth-hungry applications and research i.e VDI, Cloud Services, Smart Class Rooms, Smart Wi-Fi setup

- Currently working M/s HUAWEI Technologies on Routing & Transmission (DWDM)

Addition of Quetta –Dl khan segment (RING-4)

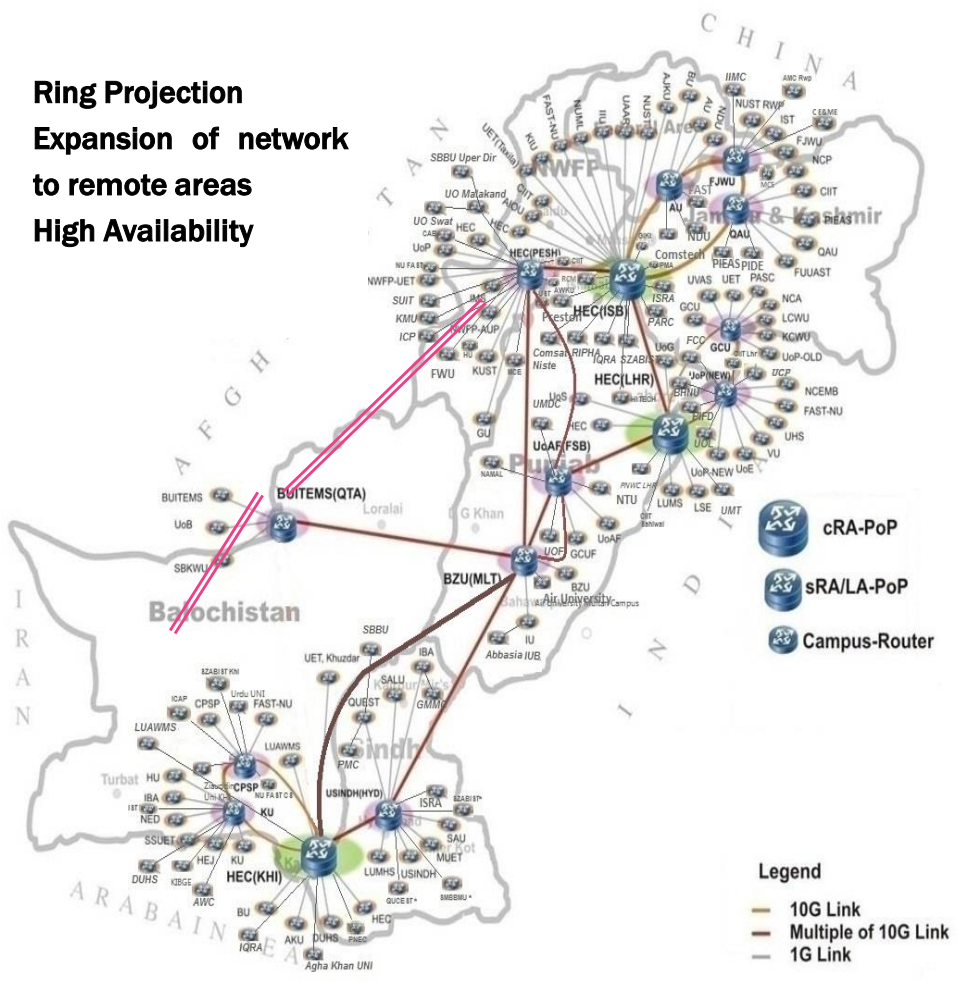
Current Design

- Quetta – MLT
- 844 KM Segment
- No protected Ring
- Availability:95% (Jan-15-to-Dec-15)



New Design

- Ring Projection
- Expansion of network to remote areas
- High Availability




Thank You