



PingER Deployment for PERN Performance Monitoring

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PERN



- Pakistan Education and Research Network
 - Established – 2002
 - Connects 103 universities across Pakistan over 10Gig Fibre Optics links



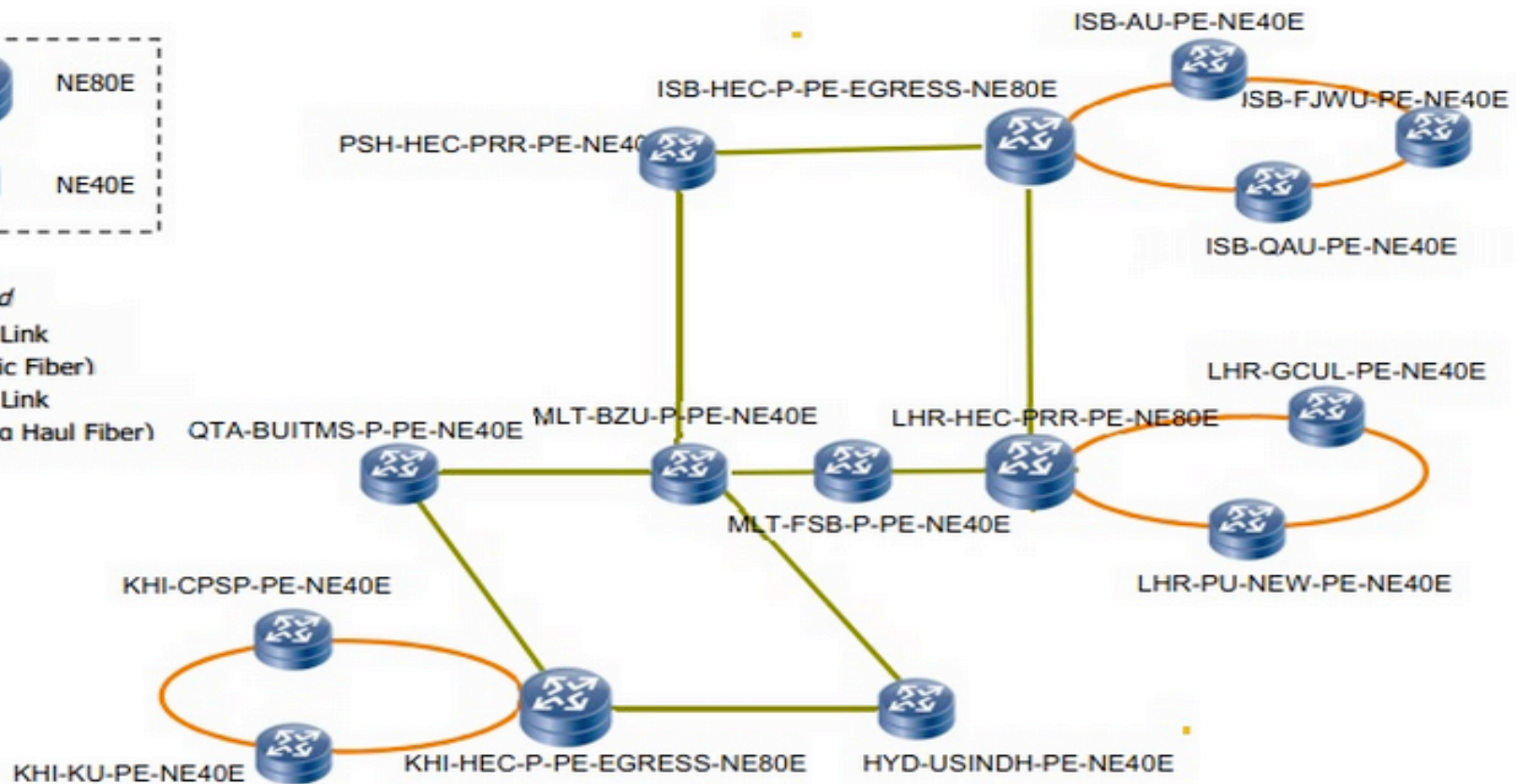
PERN Design



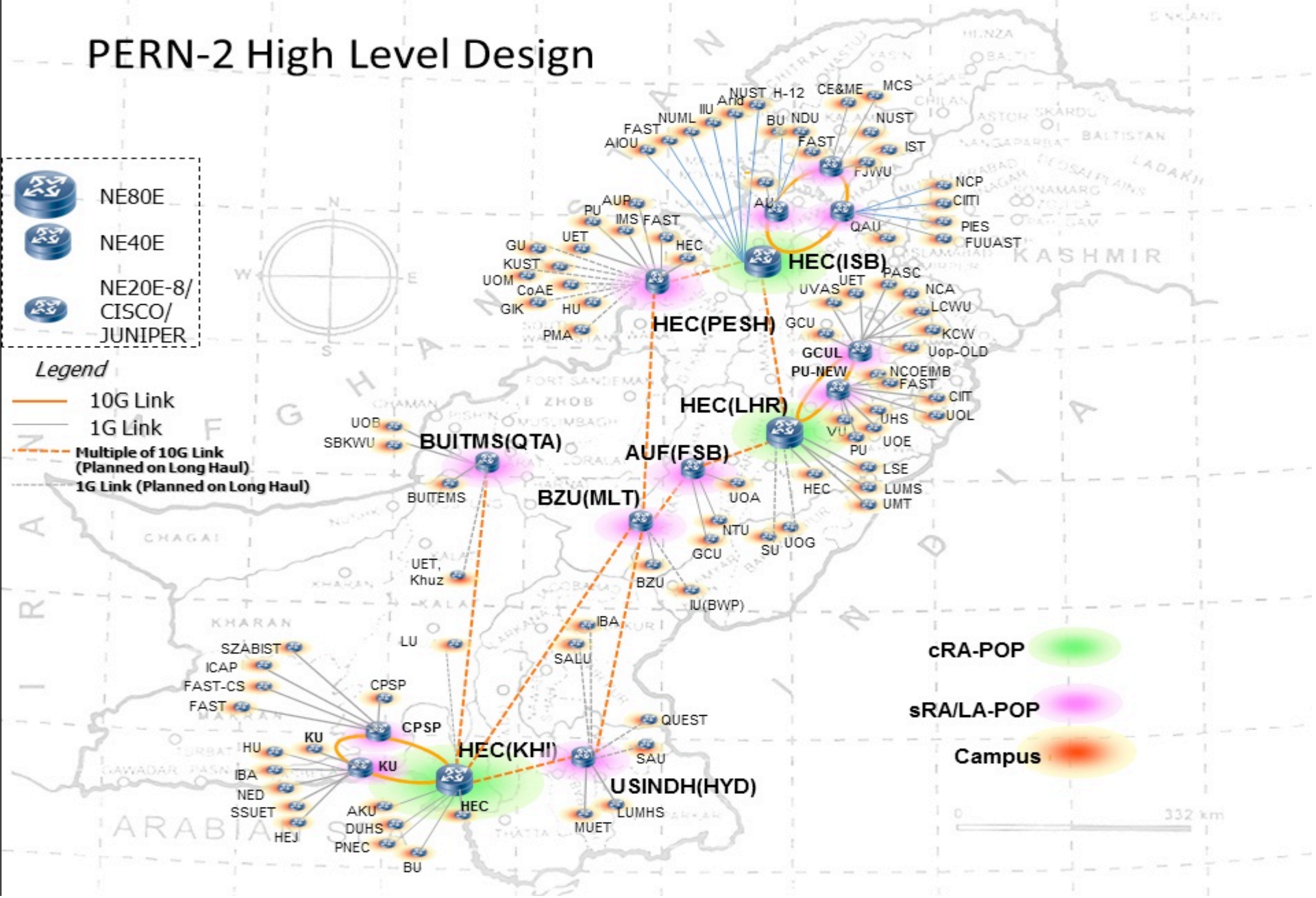
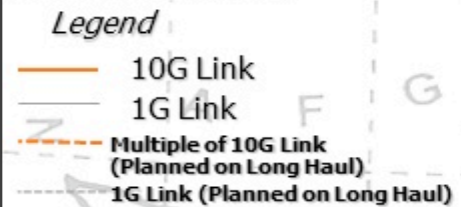
Core network



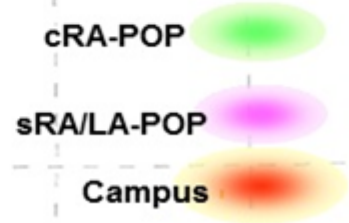
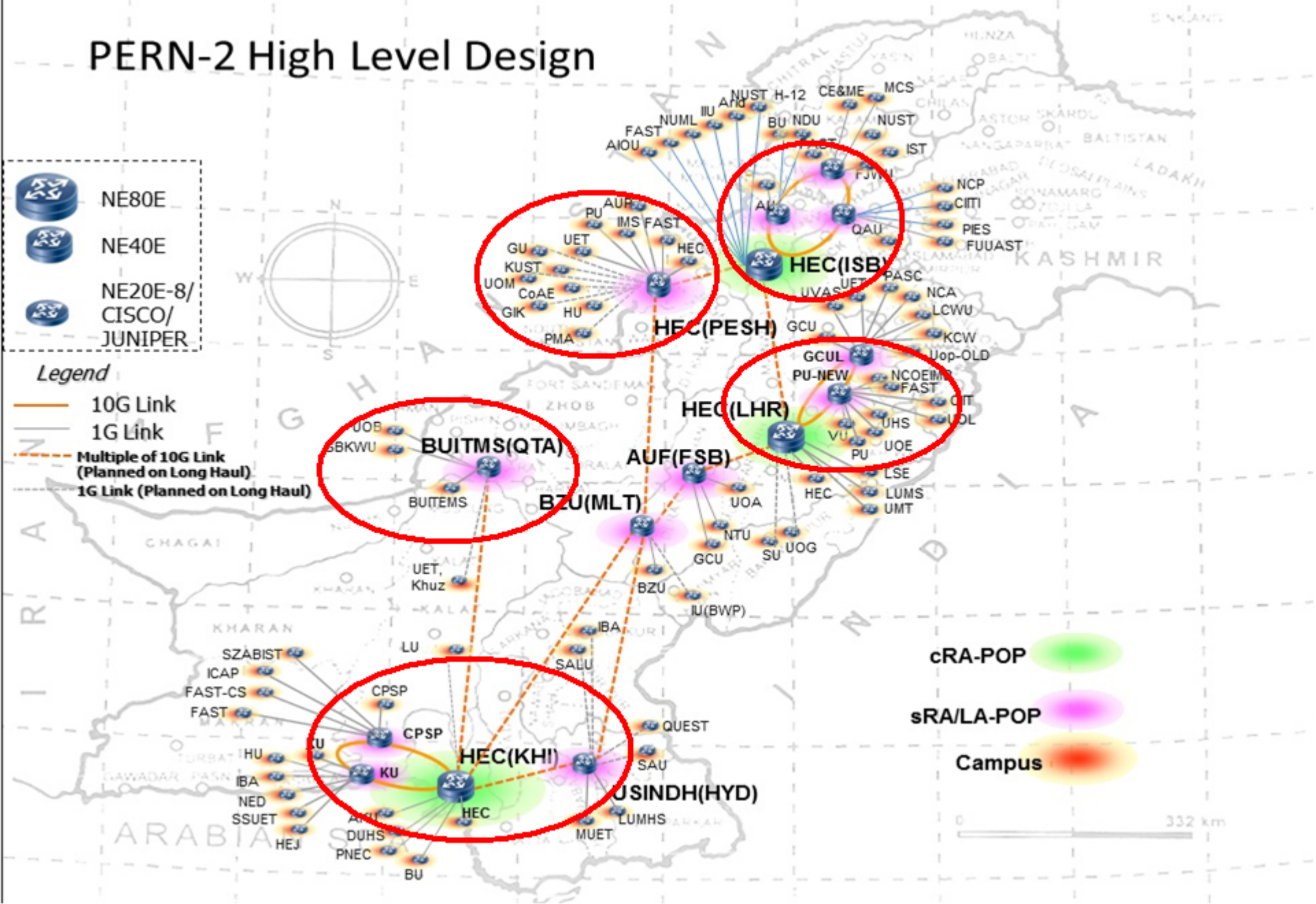
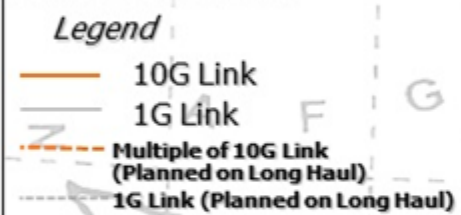
- Legend**
- 10G Link (Optic Fiber)
 - 10G Link (Long Haul Fiber)



PERN-2 High Level Design

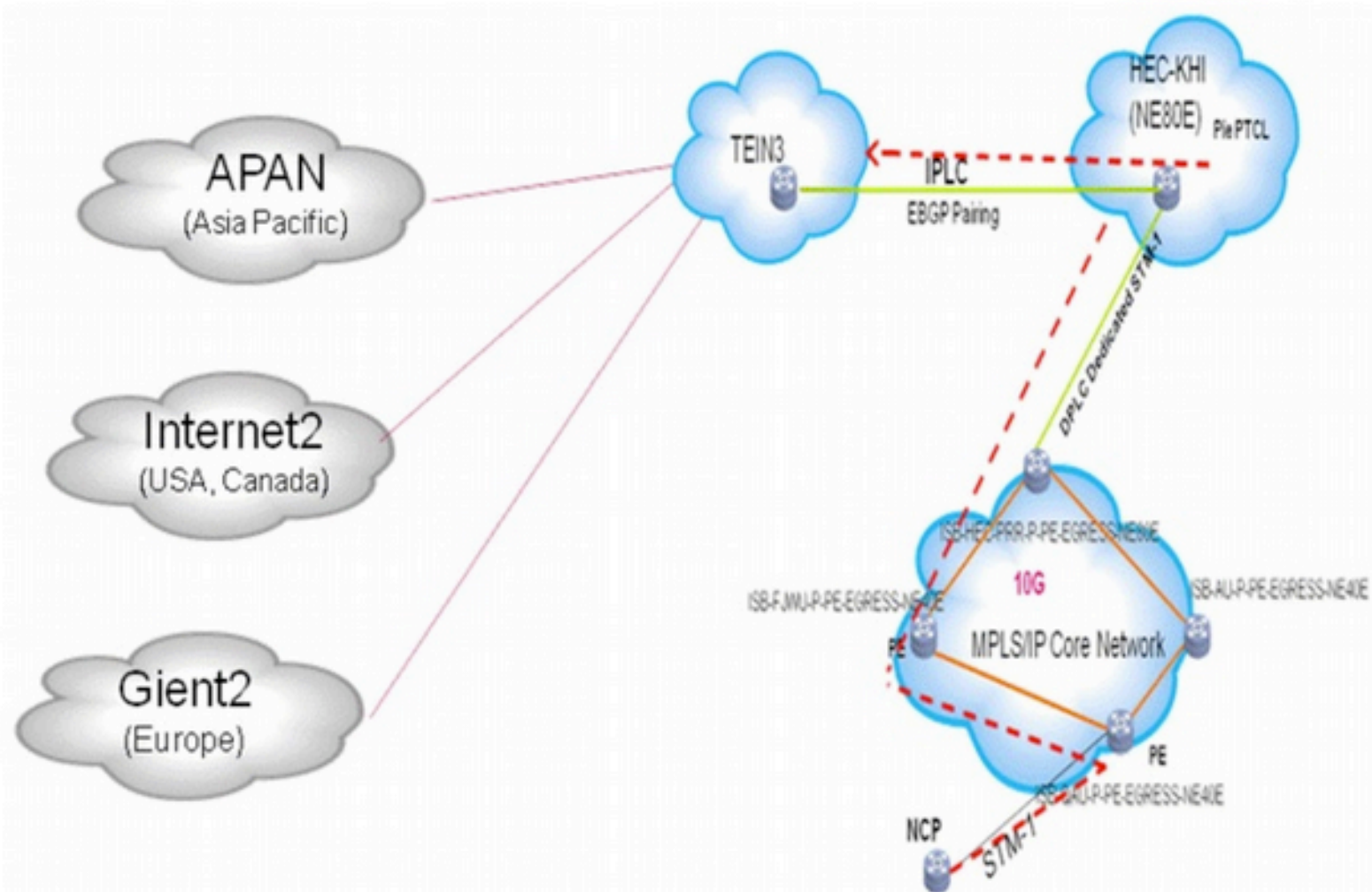


PERN-2 High Level Design





PERN International Connectivity





PERN & PingER

- Deployment started in 2008
 - 60 Monitoring nodes
 - Collected data is analyzed on daily, weekly and monthly basis
 - Reported to HEC – Pk on monthly basis

Pinger – critical issues identification



- Along with a number of minor issues, PingER has helped HEC rectify at least three major issues
 - Poor performance of particular last hop links
 - This was leading to poor performance during video conferencing and online lecturing
 - Power issues resulting in limited end-user connectivity
 - Requirement of switching gateway within Pakistan



Switching Gateway Requirement

How was Problem Identified



- **HEC-Lahore: `pingelhr.pern.edu.pk` (111.68.105.97)**
 - HEC-PoP Node, Pakistan
- **HEC-Quetta: `pingeqta.pern.edu.pk` (121.52.157.157)**
 - HEC-PoP Node, Pakistan
- Intercity RTT Values for PERN are less than 50mSec
- For above pair, the observed values average at 144mSec

| 12Oct01 | 12Oct02 | 12Oct03 | 12Oct04 | 12Oct05 | 12Oct06 | 12Oct07 |
|---------|---------|---------|---------|---------|---------|---------|
| 129.242 | 150.577 | 111.217 | 95.162 | 156.649 | 147.620 | 145.343 |

Traceroute Server Log



Traceroute From HEC-Lahore to 121.52.157.157 (HEC-Qta)

| Hop | City/Country | RTT |
|----------------------------------------------------------------------|-------------------|-------------------|
| 1 lhr-hec.gov.pk (111.68.105.97) | Lahore | 0.650 ms |
| 2 172.31.252.145 (172.31.252.145) | Private | 0.591 ms |
| 3 tw21-static61.tw1.com (117.20.21.61) | Transworld Lahore | 6.892 ms |
| 4 tw255-static101.tw1.com (110.93.255.101) | Transworld Pak | 24.875 ms |
| 5 tw255-static6.tw1.com (110.93.255.6) | Transworld Pak | 35.380 ms |
| 6 212.73.253.73 (212.73.253.73) | France | 129.257 ms |
| 7 ae-4-5.bar1.Marseille1.Level3.net (4.69.151.9) | USA | 130.805 ms |
| 8 ae-3-4.edge2.Marseille1.Level3.net (4.69.143.254) | USA | 129.935 ms |
| 9 213.242.115.6 (213.242.115.6) | UK | 129.890 ms |
| 10 static-10GE-KHI494-P01-KHI494-SWB.pie.net.pk (202.125.128.157) | Pak | 133.642 ms |
| 11 rwp44.pie.net.pk (221.120.251.42) | Islamabad | 144.168 ms |
| 12 rwp44.pie.net.pk (221.120.251.45) | Islamabad | 143.565 ms |
| 13 khi77.pie.net.pk (221.120.205.194) | Karachi | 144.608 ms |
| 14 sbkwu.edu.pk (121.52.157.157) | Quetta | 144.561 ms |

Traceroute Log for Lhr-Khi Pair



| Traceroute from HEC-Lahore to 111.68.108.11 (Khi-PoP) | |
|-------------------------------------------------------|-----------|
| Hop | RTT |
| 1 lhr-hec.gov.pk (111.68.105.97) | 0.548 ms |
| 2 172.31.252.145 (172.31.252.145) | 0.508 ms |
| 3 tw21-static61.tw1.com (117.20.21.61) | 6.805 ms |
| 4 tw255-static101.tw1.com (110.93.255.101) | 32.522 ms |
| 5 tw255-static6.tw1.com (110.93.255.6) | 36.273 ms |
| 6 tw129-static238.tw1.com (119.63.129.238) | 21.044 ms |
| 7 172.31.253.2 (172.31.253.2) | 25.341 ms |
| 8 khi-hec.gov.pk (111.68.108.11) | 22.969 ms |

Problem?



- Transworld, Pakistan and PTCL are two ISPs, providing inter-city links for PERN at present.
- For transfer of traffic from on network to the other, Switching gateway located in France is being used.
- Significant delays for traffic

Solution?



- HEC – IT division has initiated the case for Pakistan Switching Gateway
- Shall benefit PERN in short term
 - PERN will soon switch to dedicated inter-city links
- Long term benefit for all ISPs and People of Pakistan
- NUST will host the gateway, as a neutral venue
 - Opens huge possibility of training and hands on experience for graduates of NUST

Conclusion



- Archiving facility of PingER and facility of analysis of previously stored data is a strong feature
 - Provides detailed view of how the links, network and user experience has evolved
 - Helps identify the issues