Operations Policy defines the way Operations, Administration, and Management of PERN shall be performed in order to offer quality services to the academic and research community.

Operations Policy

Pakistan Education & Research Network (PERN)

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1 GENERAL

Pakistan Education and Research Network (PERN) is a part of the overall vision and objectives of IT Action Plan of Government of Pakistan which was launched by the then Minister of Science & Technology. At the time of its inception, the project was jointly financed by the Ministry of Science & Technology, Government of Pakistan and PTCL (Pakistan Telecommunication Company Limited) Research & Development Funds. The network was designed by PTCL and handed over to NTC (National Telecommunication Corporation) for operations and maintenance, however it was managed by Higher Education Commission of Pakistan.

PERN focuses on collaborative research, knowledge sharing, resource sharing and distance learning by connecting people through the use of intranet and internet resources. It offers true packet switched network which is required for research and collaboration in areas like VoIP, grid computing, high energy physics, telemedicine, research related video and image exchange, enterprise level video conferencing.

PERN is a highly resilient network and the availability is ensured through a dedicated NOC which provides network operations and services on 24x7x365 basis. PERN provides special services like dedicated R&E link, 1Gbps intranet connectivity to each university/ institute, MPLS Layer3 VPN, MPLS Layer2 VPN (VLL-PWE3), VPLS, IPv4 Multicast, IPv6 Multicast, Transit AS and also ordinary services like Internet, IPv4, IPv6, Reverse DNS, Network Monitoring Services etc.

2 BACKGROUND

The project is aimed towards establishing an integral part of the overall education system of the country and is designed to interlink all public/ private sector higher education institutes (HEIs) registered with Higher Education Commission, Pakistan and other organizations/ institutes having relevance to education and research. The interconnectivity of all these organizations/ institutes will empower its users in establishing integrated data banks, collaboration for research and development, and uplifting the overall standard of teaching, learning, and research across the country as per the international norms.

Initially, the network was comprised of a backbone network connecting main hub locations in Islamabad, Lahore and Karachi. From these main hub, radial spur circuits were extended to numerous higher education institutes throughout the country. However in 2006, second phase of the project was launched by Higher Education Commission as "PERN 2" with an aim to transform the network as per international practices; whereby the network is designed, developed, operated, maintained, and managed by the partner institutions. For this, the PERN2 was designed to establish PoPs (Point of Presence) within the selected higher education institutions across the country and other institutions in vicinity are served through these PoPs in radial spurs. Moreover, in metro cities and per the needs, the network comprise of more than one PoP connected through fiber ring.

PERN2 at present comprised of three (03) Core Regional Access [cRA-PoPs] and five (05) Sub Regional Access [sRA-PoPs] interconnected through more than 6,200 Km of dark-fiber currently providing a core capacity of 10Gbps through DWDM transmission network. In metro cities, there are seven (07) Local Access [LA-PoPs] which are interconnected through more than 500 Km of metro fiber rings providing a capacity of 10Gbps through metro Ethernet technology. However, six (06) Aggregation [A-PoPs] are established through more than 400 Km of dark-fiber providing a capacity of 1Gbps primarily through SDH transmission network.

3 DEFINITIONS

3.1 **PERN** is the acronym of the **Pakistan Education & Research Network**. The revolutionary Pakistan Education & Research Network (PERN) is a nationwide educational communicational network connecting premier education and research institutes; and providing high-speed R&E, intranet as well as internet bandwidth across the country and to international networks.

3.2 **PERN Principal** is referred as the Higher Education Commission of Pakistan being the custodian of PERN.

3.3 **PERN services** are all those network and application services available to partner organizations on PERN infrastructure.

3.4 **PERN resources** are all those tangible and intangible assets, hardware equipment and software tools, as well as human workforce, involved in operating the PERN infrastructure and PERN services.

3.5 **NRENs** are National Research & Education Networks of countries around the world, e.g. MyREN (Malaysia), KOREN (Korea), UKERNA (UK), AARNET (Australia), Internet2 (USA), etc.

3.6 **Consortium of NRENs** is a network of NRENs interconnected to form a large community for collaboration for education and research, e.g. TEIN (TransEurasia Information Network), GEANT (Pan-European Advanced Network), etc.

3.7 **Partner Organization** refers to all organizations getting R&E services from PERN and contributing towards sustainability of this network.

3.8 **HEIs** refer to higher education institutions both public and private sector universities, centers of excellence, affiliated colleges, degree/ postgraduate colleges, etc.

3.9 **Last Mile Connection** is a connectivity between organization and nearest circuit termination point to take the traffic further to PERN aggregation points or host organization.

3.10 **International traffic** is the traffic between the PERN and any other international Public network (Internet).

3.11 **R&E traffic** of the NRENs is the traffic between the PERN and any other NRENs or network of NRENs of the world.

3.12 **Packaged Digital Resources** are a set of services provided by PERN to its users for example digital library, Video conferencing etc.

4 PURPOSE OF DOCUMENT

The purpose of this document is to provide guidelines to the operations team, administration, and management of PERN and PERN Principal on the matters relating to PERN operations. This document defines the strategies and approaches in order to ensure quality services to academic and research community of Pakistan. It also addresses some of the technical design and architectural approaches of PERN which it requires in order to be at par with other such NRENs in both developing and developed world.

5 NETWORK OPERATIONS

After the establishment of PERN2 facility by Government of Pakistan through a public sector development project, Higher Education Commission has been given the mandate of providing internet, intranet, and R&E connectivity as well as bandwidth to meet the emerging academic and research needs of the higher education institutions of Pakistan. Higher education institutions are being facilitated with advanced networking services at highly subsidized rates which remains incomparable to any commercial telecommunication operators in Pakistan.

The specialized networking services and technologies make PERN the only network which offer a network for research and research on network simultaneously. Such hallmark has only been possible by following international practices and standards for a national research and education network. Amongst the practices are to capitalize on the best available infrastructure and services in the country and consolidate them within one dedicated network, flexible enough to meet the advanced networking requirements of research and academic community.

5.1 Network Operation Center (NOC)

5.1.1 PERN shall maintain a national primary NOC offering services on 24/7 basis, with a provision to have a secondary NOC at least with 16/7 service availability.

5.1.2 PERN shall outsource most of the critical operational services, e.g. network maintenance, transmission system, power backup maintenance, etc. backed up by strong Service Level Agreement (SLA), however administer and manage the PERN.

5.1.3 PERN shall provide space and conducive operation environment for the Operation teams, including PERN staff and resident engineers of other vendors to whom various services are outsourced.

5.1.4 In order to offer 24/7 services to the PERN Partner Organizations, following services shall be maintained at the Network Operation Centers (NOCs);

      a) Independent Network Connectivity
      b) Wall mounted display (i.e. LCD/ LED) for PERN2 nodes monitoring

c) Seating space of Three (03) level support

d) Workstations for all staff

e) Servers for network monitoring

f) Network Management Software(s)

g) Glass partitioned space for PERN2 facilities

h) Help Desk facilities supported by Trouble Ticketing

i) Customer Relationship Management Software

j) Phones on the Desk

k) Microsoft Office Communicator/ Lync

l) UAN – 111 11 PERN

5.2 Point-of-Presence across the country

5.2.1 PERN shall maintain as many PoPs across the country as practically possible at various levels depending upon the needs.

5.2.2 Four (04) levels or types of PoPs shall be maintained as per the high level design of PERN, i.e.

a) cRA-PoP: Core Regional Access Point-of-Presence is at the top level and represent the core network router covering the whole region.

b) sRA-PoP: Sub Regional Access Point-of-Presence also operates at regional level but covers relatively smaller number of organizations and region as well.

c) LA-PoP: Local Access Point-of-Presence supports cRA-PoP in the core region, however this normally setup in metro-cities

d) A-PoP: Aggregation Point-of-Presence facilitates fewer organizations in vicinity.

5.2.3 Any level of PoP may be upgraded to give status of one level above depending upon number of organizations being served from the PoP.

5.2.4 New PoPs may also be established, if the need arises, as determined by PERN.

5.2.5 Any PERN node may be upgraded as a PoP with required services (e.g. UPS, GenSet, etc.), should there are requests from organizations in vicinity for PERN connectivity.

5.2.6 Each PoP may be manned by a resident engineer to address the operations related issues locally and within the defined time limits as per SLA.

5.3 Engagement of Consultants

5.3.1 PERN may engage individual consultants either self-employed or provided by consulting firms to supplement its operational requirements pertaining to specialized areas, such as Network Security Auditing, Business Tariff Planning, Network modernization , NREN Research Strategies, etc.

5.4 Service Provider

5.4.1 PERN shall maintain multiple service providers for various activities/ domains which have been outsourced to other vendors. Following services have been outsourced for various domain(s) relating to PERN Operations to this date;

    a) Network monitoring and maintenance

    b) Fiber leasing: Metro, Long-haul, and Spurs

    c) Transmission system

    d) HVAC and Power backup maintenance, etc.

5.4.2 Selection of service providers shall be governed by Public Procurement Rules 2004 (revised), however appropriate mode/ method (e.g. open competitive bidding, pre-qualification, alternate method of procurement, etc.) shall be opted based on nature of procurement.

5.5 Upstream Bandwidth Provider

5.5.1 Bandwidth requirements of Partner Organization shall be determined by a simple formula, i.e. No. of nodes x broadband capacity (i.e. 256 kbps) x adjustment factor (60%), and shall be used for planning and commissioning purposes.

5.5.2 PERN to govern the competitiveness of rates among upstream bandwidth providers shall maintain the acquired services from multiple operators as recommended by technical committee, that is, Internet bandwidth shall be acquired from at least two (02) upstream bandwidth providers to maintain high availability and load balancing through redundant links.

5.5.3 Internet bandwidth shall be acquired from those upstream bandwidth providers only, who possesses their own landing stating in Pakistan since intermediary networks may cause delays and compromise on quality services.

5.5.4 For the procurement of internet bandwidth, either open competitive international bidding or negotiated tender based on PTA endorsement for own landing station shall be followed.

5.5.5 PERN shall maintain nearly equal bandwidth from the two (02) or more upstream bandwidth providers as to minimize failover situation and load balancing thereof.

5.5.6 PERN to minimize the impact on users caused due to failover situation with one connection and/ or if PERN experiences network attacks (e.g. DDOS, Virus, etc), shall maintain at least 20% additional bandwidth of overall allocated bandwidth to avoid oversubscription and/ or in an eventuality of additional bandwidth requirements.

5.5.7 Internet bandwidth is acquired from upstream bandwidth providers in bulk to benefit from volume discounts. Internet bandwidth shall be acquired in 1Gbps or any possible denominator(s), for further distribution to Partner Organization(s).

5.5.8 Internet bandwidth rates (per Mbps) shall be negotiated between the upstream

bandwidth providers, and shall be kept nearly equal, provided the bandwidth acquisition from them are equal as well. Alternately the rates may vary.

5.5.9 PERN connectivity to international NRENs or Consortium of NRENs, like TEIN, GEANT, Internet2, etc. for R&E traffic shall be managed through TEIN*CC.

6 DEVELOPMENT, EXPANSION & MANAGEMENT

PERN aims to extend its services to a larger academic and research community working towards to socio-economic development of the country. For this, PERN has followed and continues to grow across all regions and levels across Pakistan, as part of its development and expansion plans.

6.1 Connectivity to Additional Organizations

6.1.1 PERN shall maintain prequalified service providers for providing and maintaining last mile connectivity to Organizations.

6.1.2 PERN shall assess the viability of connectivity to requesting organization and the medium to provide connectivity for which survey may be done through prequalified service providers.

6.1.3 Requesting organization may be provided connectivity using wireless of managed capacity medium initially on interim basis through some other operator(s) till the fiber connectivity is provisioned, if applicable.

6.2 Strengthening existing NOCs, PoPs and connectivity

6.2.1 PERN shall strengthen its both Network Operation Centers (NOCs) (i.e. primary NON in Islamabad and secondary NOC in Karachi), in order to offer quality services to academic and research community as per international norms, by introducing;
   a) New software(s) for network monitoring and management;
   b) Expanding NOC area to accommodate more staff for enhanced operations;
   c) Matrix screen display for multiple views of network and traffic weather maps
   d) Improvements in services as maintained at NOCs as per international norms.

6.2.2 PERN shall maintain as well as strengthen its PoPs at all levels, in context of power backup systems (both GenSet and UPSs), civil works, network cabling & labeling, etc.

6.2.3 PERN shall ensure redundant optical fiber links (preferably fiber rings) at all its PoPs to ensure high availability to PoPs as well as Organizations connecting to these PoPs.

6.2.4 Existing PERN node(s), i.e. PERN Partner Organization, may be upgraded to act as PERN PoP in situations where additional links to organizations are to be established.

7 FINANCIAL MANAGEMENT

PERN policies and service plans vows to offer cost effective and reliable services covering not only internet, intranet, and R&E bandwidth but other allied services, which can only be ensured with proper service delivery and effective financial management of PERN.

7.1 **PERN Budgeting (Income & Expenditure)**

7.1.1 PERN shall maintain its separate annual recurring budget under higher education sectoral programs/ budget which is maintained by Higher Education Commission.

7.1.2 PERN annual budget shall have following lines items at minimum as income;

a) Carry forward from previous fiscal year

b) Government grant as subsidy

c) Income from Organizations for current fiscal year

d) Income from Organizations for outstanding amount, if any.

e) Organizations' contribution towards any special programs of them.

7.1.3 PERN annual budget shall also have expenditure budget line items as follow;

a) General Administrative Costs

b) General Operations Costs

c) Active Equipment O&M Costs

d) Bandwidth Costs

e) Fiber Connectivity Costs

f) Applications & Services Costs

g) Network & Information Security

h) Expansion & Upgradation with DR Costs

i) Special Program Costs

7.2 **PERN Billing & Payments**

7.2.1 PERN shall maintain cost sharing model, towards PERN Operations & Maintenance costs as per PERN budget expenditure, that is,

a) Fifty percent (50%) contribution from Partner Organizations and remaining as Government subsidy through HEC budget.

b) Special Program Costs shall however be dealt with by the policy devised for the purpose.

7.2.2 PERN shall invoice all Partner Organization against the PERN Services as per the applicable PERN Subscription Plan of Packaged Digital Resources.

7.2.3 Excess amount received beyond 50% contribution (if any) from PERN Partner Organizations shall be accommodated in promotion of collaborative research and capacity building funds as offered through PERN Subscription Plan(s).

7.2.4 Invoices shall be sent to Partner Organizations on quarterly basis for advance payment to PERN Principal.

a) Payments received from the PERN Partner Organizations shall be credited to PERN Income account, i.e. PERN Recoveries.

b) Any other income relating to PERN, like SLA penalties, liquidated damages under

contract, etc. shall be credited to PERN Income account, i.e. PERN Recoveries.

7.2.5 Waiver to payments (either limited or extended time) against PERN Services may be given to government organizations with the approval of Principal Accounting Officer.

8 RESEARCH & COLLABORATIONS

PERN has been setup primarily for the promotion of research and collaboration in areas like high energy physics, telemedicine, VoIP, grid computing, IPv6 research test bed, research related video and images exchange, enterprise level video conferencing, etc. Researchers and academicians at PERN Partner Organizations are connected to international research and education communities across Asia-Pacific, in Europe through GÉANT, and in Americas through Internet2, Canarie, RedClara and through PERN can initiate and/ or participate in joint research projects. PERN therefore encourages the researchers from the Partner Organizations to enter into collaboration with other researchers within the institution, with other HEIs, research institutions and business or industry, where the partnerships serve to complement and enhance the purpose of PERN.

8.1 Promotion of Research & Collaboration

8.1.1 PERN shall participate as an active member in regional as well as global initiatives, viz. Asia-Pacific Advanced Network (APAN), TransEurasia Information Network (TEIN), Internet2, Pan-Islamic Research & Education Network (PIREN), and others.

8.1.2 PERN shall encourage and support joint research and collaborative projects over PERN, through memorandum/ document of understandings (MoUs/ DoUs) signed,

a) amongst the PERN Partner Organizations.
b) between PERN Partner Organizations and international institutions/ bodies.

8.1.3 PERN shall establish ties through MoUs/ DoUs with other international institutions, NRENs and Consortium of NRENs.

8.2 Funding Support for Research & Collaboration

8.2.1 PERN shall support and contribute through membership fee and/ or project participation share for its active participation in global NRENs arena.

8.2.2 PERN shall provide funds as per the provision available in PERN Subscription Plan(s),

a) for research projects jointly submitted by at least two (02) PERN Partner Organizations and/ or international institutions.
b) towards training(s) and certification(s) of PERN Partner Organizations as to build institutional capacities helping network-based research and collaborations.

9 REVISION IN POLICY

This policy shall be regularly reviewed for possible revision, if deem necessary, in any eventuality in PERN infrastructure, resources and services. Amended texts shall be approved by the PERN Principal and shall be made publically available.