





Competitive Edge of NREN and Financial Sustainability

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Initial Name Educational Intranet
Sponsors MoST-IT&T (Rs. 149.064 M)

PTCL R&D Fund (Rs. 148.936 M)

Executors NTC and PTCL

Second Name Pakistan Education Network (PEN)

Landmarks	Date
Concept Conceived	December 2001
Presented before ECNEC	January 2002
PC-1 Proposal Preparation	February 2002
Revised PC-1 Submitted	August 2002
Renamed as PEN & Approved	November 2002



Landmarks	Date
Inauguration	December 2002
Final Name given on	March 2003
O&M transferred to NTC	March 2003
PERN transferred from MoST to HEC	April 2003
1st Upgraded by NTC	September 2004

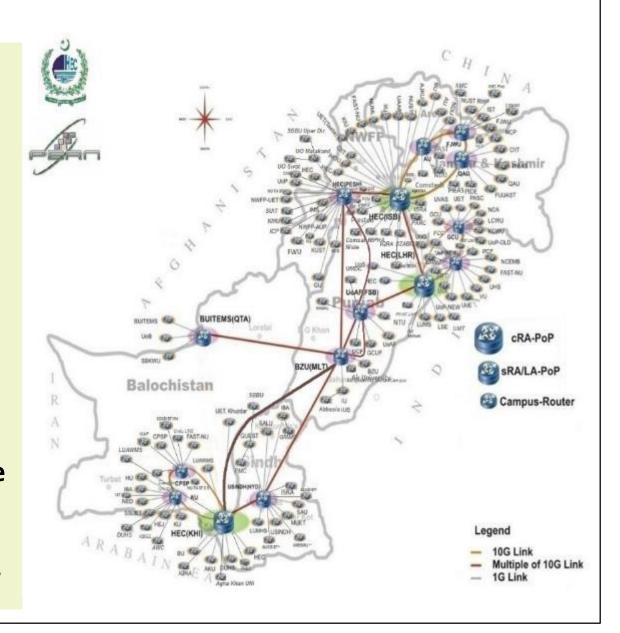
Developments in PERN2

CURRENT STATUS

- 270 Universities\ Colleges connected in 48 Cities
 - 179Main Campuses
 - 72 Sub Campuses
 - 21 HED Punjab Government Colleges
 - 8 HEC Khyber Pakhtunkhwa Colleges
- 25 Gbps Internet Bandwidth
- 23 POPs in HEC / Universities
- **9** Gbps of Core Intranet Bandwidth Utilization
- IPLC capacity of **1** Gbps with avg. utilization of **800** Mbps

PERN3 by 2019-23:

- Establishment of 4oGbps/ 10oGbps Backbone
- Up-gradation of Campus equipment with 10Gbps Support
- footing in New cities of the country 48 to 60+
- Managed SOC Services for Universities



PERN brief Overview

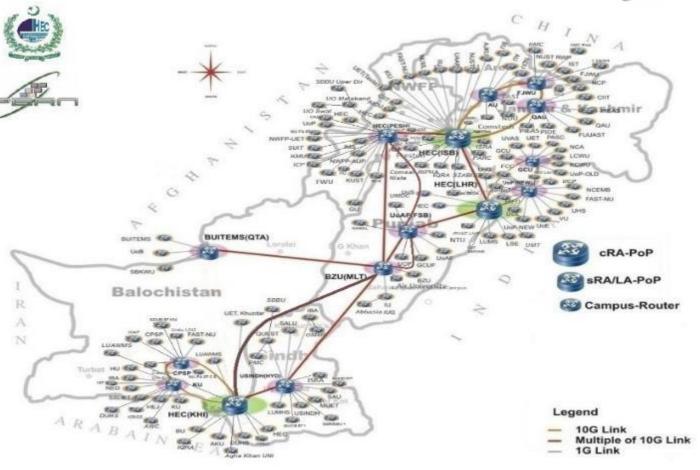
- IP MPLS (L2/L3 VPN)
- IPv6, IPv4/6 Multicast
- BGP, IPLC Connectivity
- 10 G Inter Connectivity
- 01 Gbps last mile Connectivity10 G Metro Rings at three Major Cities
- 23 PoP sites, 12 established in different universities

179 Main Universities Campuses

Including public and Private

72 Sub Campus of Universities

50 Colleges across Pakistan



Presence at 48 Cities of Pakistan

Competitive Edge Over ISP's

PERN Network Strength

- IPv6 enabled
- Ipv4 source based routing
- Dual Stack
- Multihoming
- 90% Leased Fiber Coverage
- DWDM based Network
- Any Cast routing
- ❖ 100% CIR Bandwidth
- Core Availability 99.9%
- less Delay Avg 15ms (300 nodes)
- MPLS enabled (Each node is 3 hop away)
- 20Mb intranet charge but no restriction 01G limit
- Dynamic Configuration for R&E requirement
- Extended NMS service
- Backup links with a very minimal cost

Internet Traffic

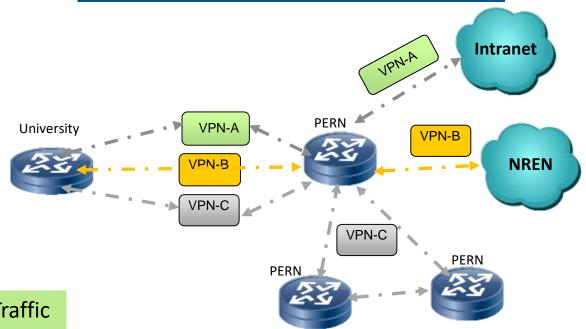
VPN-B

NREN via TEIN (VC, Grid , cluster , telemedicine ., e-agriculture , e-culture

VPN-C

Intranet Traffic (Video Conf, Interuniversity, Cloud, IP Phones, VDI, SEIM etc.

Dedicated public and private IPv4 & IPv6 pools inter & intra routing



National & Regional Data Centers



Peshawar

Islamabad



<LHR-HEC-PRR-PE-NE80E>dis ver
Huawei Versatile Routing Platform Software
VRP (R) software, Version 5.50 (V300R003C02B608)
Copyright (C) 2000-2008 Huawei Technologies Co., Ltd.
Quidway NetEngine 80E uptime is 3681 days, 23 hours, 41 minutes



<u>E</u> Uptime Institute

HEC Cloud Data Center



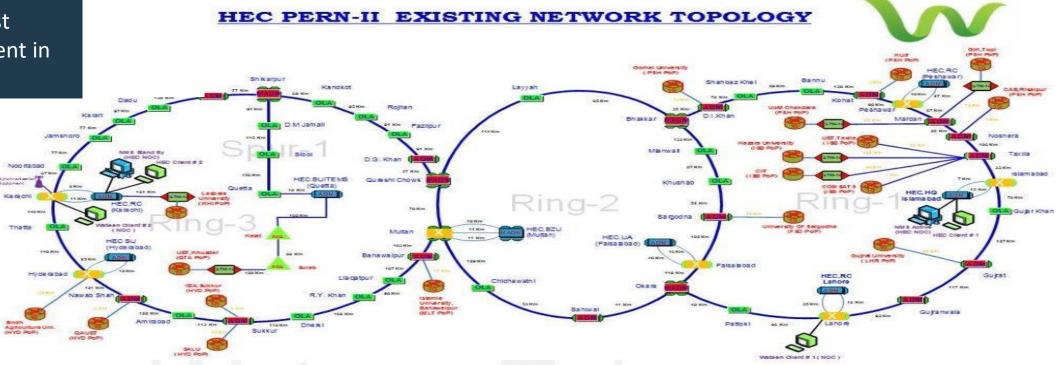
Total No of cores	20,000
Total Storage capacity	20PB
No of RAM	300 TB
Total No of Cloud Hosts	4000 - 6000
Total Virtual Desktop	100,000
No of racks	36



PERN DWDM Network



One of the Largest DWDM Deployment in Pakistan



Dedicated DWDM Network (end to end switching) Leased Fiber over 8000 Km 10 G backbone 01 G dedicated Last mile Maintain SLA upto 99.7 %

This Year Core will be up gradaded 40G and Last Mile will Up graded 10G

Rings will be further Bi-Furcated for Segments to improve the SLA up to **99.8** %

Market Competitive Edge



- Only Research & Education Network In Pakistan
- Tariff bundled with Educational Services
- Strategic Alignment with Vision of Higher Education
- Bulk Procurement helps to offer the prices at feasible charges
- ❖ Supports Network settings based on R&E requirements
- Economy of Scale Projects which include Public Private partnerships to help the Institutions to build their ICT infrastructure.

❖ International Collaboration with NREN's as well as different Consortiums for development of R&E activities













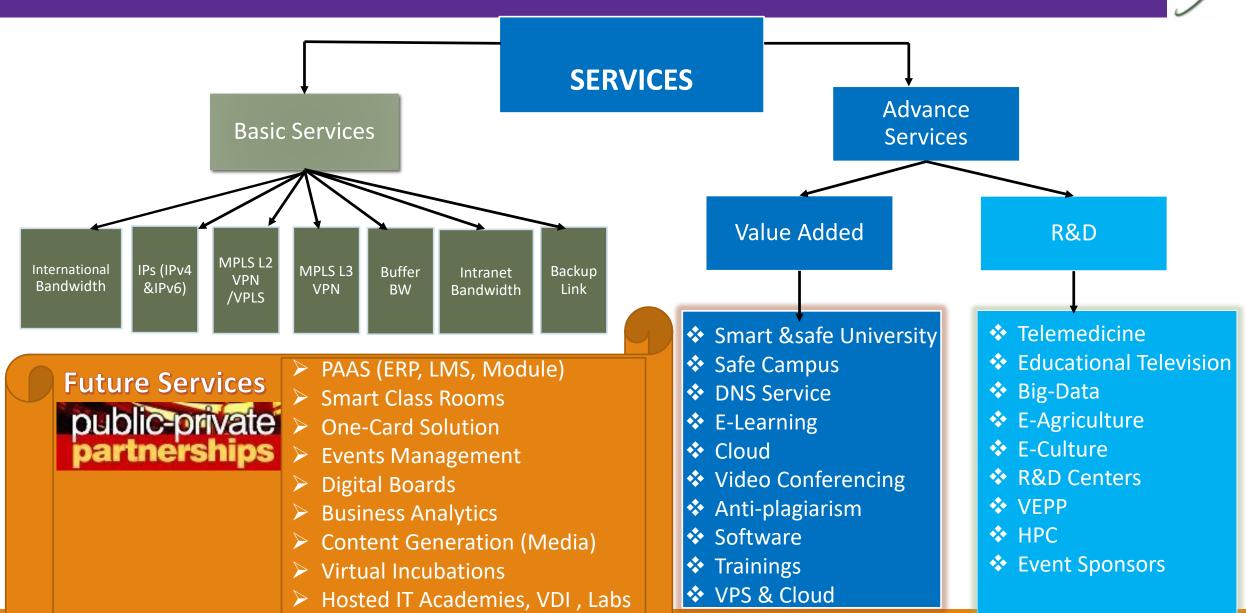






PERN Services





National Video Conferencing Network (NVCN)



Region	Total Sites
Regional Centers	11
Federal	13
Punjab	24
Sindh	19
КРК	19
Baluchistan	6
АЈК	4
Gilgit Baltistan	1
Affiliated Colleges	50
Total	154







Virtual Education Project Pakistan



Total Events

			TOTAL EV	ents			(
			PhD.				Grand
Year	Conference	Lecture	Defense	Seminar	Training	Workshop	Total
2006	2	2					4
2007	6	160		2		1	169
2008	10	90		1	12	1	114
2009	9	60			7	3	79
2010	17	98	22	8	36	29	210
2011	28	295	34	11	20	35	423
2012	8	379	57	21	21	57	543
2013	8	361	67	26	12	55	529
2014	15	373	94	21	2	19	524
2015	25	469	102	11	16	17	640
2016	17	400	107	19	16	24	583
2017	16	348	33	22	3	17	439
2018		49		1			50
Grand	161	3084	516	143	145	258	4307
Total	101	3004	310	173	173	230	7507



Telemedicine Over PERN



Promotion of e-health

Workshops conducted on Upper GI
Laparoscopic and Hernia Surgeries as well as
Emergency Telemedicine Response
Lectures on Minimal Invasive Surgeries
Connected 03 Cancer hospitals i.e. PIEAS,
CENAR & AMC

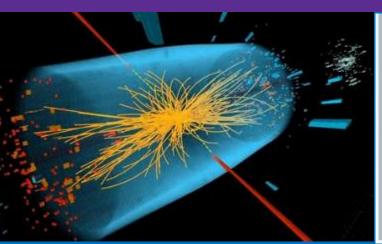
PERN & Society of Surgeons

Joining hands for the promotion of Telehealth in Pakistan





HPC Over PERN



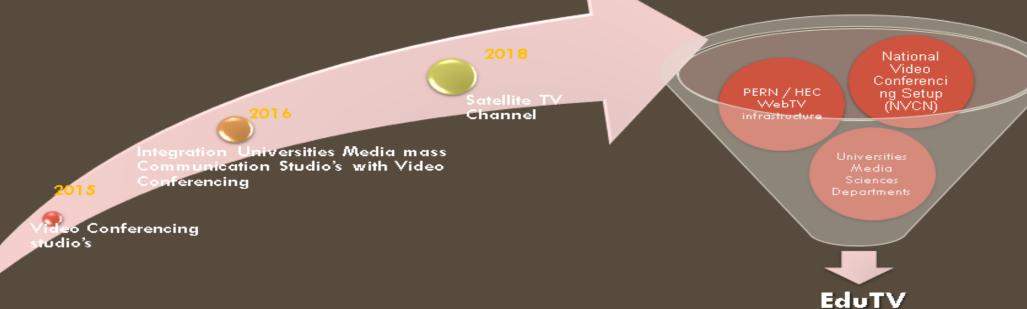
generate, good internet connectivity is vital. PERN and TEIN have helped experimental high-energy physicists within Pakistan to access this data by providing affordable, reliable connectivity. As well as helping build our knowledge, by using this data around 30 graduate students have been able to complete research work, increasing our capacity and skills within Pakistan.

Prof. Hafeez Hoorani, Director Research of National Center for Physics, Pakistan

Higher Education Television (edutv.hec.gov.pk)



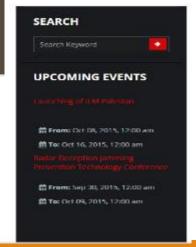
TRANSITIONAL WAY TO RUN TV CHANNEL











Imagine Cup – Pakistan Drive Summary



Universities Participated

Microsoft with HEC's collaboration and guidance visited multiple campuses to evangelize Imagine Cup this year!

Multiple Cities visit

Including remote ones, such as Quetta, Sukkur, Jamshoro ...

Imagine Cup and EduTV







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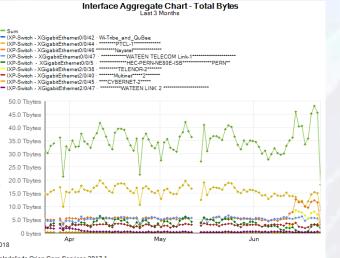


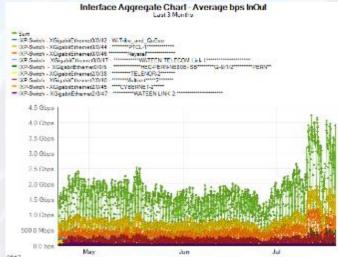


Pakistan's 1st Internet Exchange Point (PKIX) hosted by PERN

Overview

- Pakistan's First Internet Exchange Point has been inaugurated in the premises of HEC
- Nine Carriers are part of PKIX so far, namely, Wateen, Telenor, PERN, WiTribe, Qubee, Nayatel, Cybernet, Multinet and PTCL
- PKIX hosting in HEC shows confidence of Pakistan Telecommunication Authority and National Telecom Carriers on the commitment of HEC.







Statistics

- PKIX is functional with 100% uptime since January 2019.
- Average Consolidated Traffic Rate up to 6 Gbps.
- Average Traffic Volume Per day up to 3.4 TBytes.
- The 2nd Internet Exchange Point hosted in HEC Karachi Data Center is operational 02 months before.











Infrastructure as Service



Full Blanket Wi-Fi Coverage

Over 36000+ concurrent Users



EduRoam Enabled



Safe Campus IP Surveillance Camera

Over 7000+ Cameras with Centralize Backups

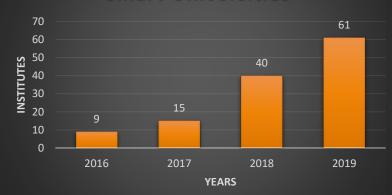


Safe Campus Deployment

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

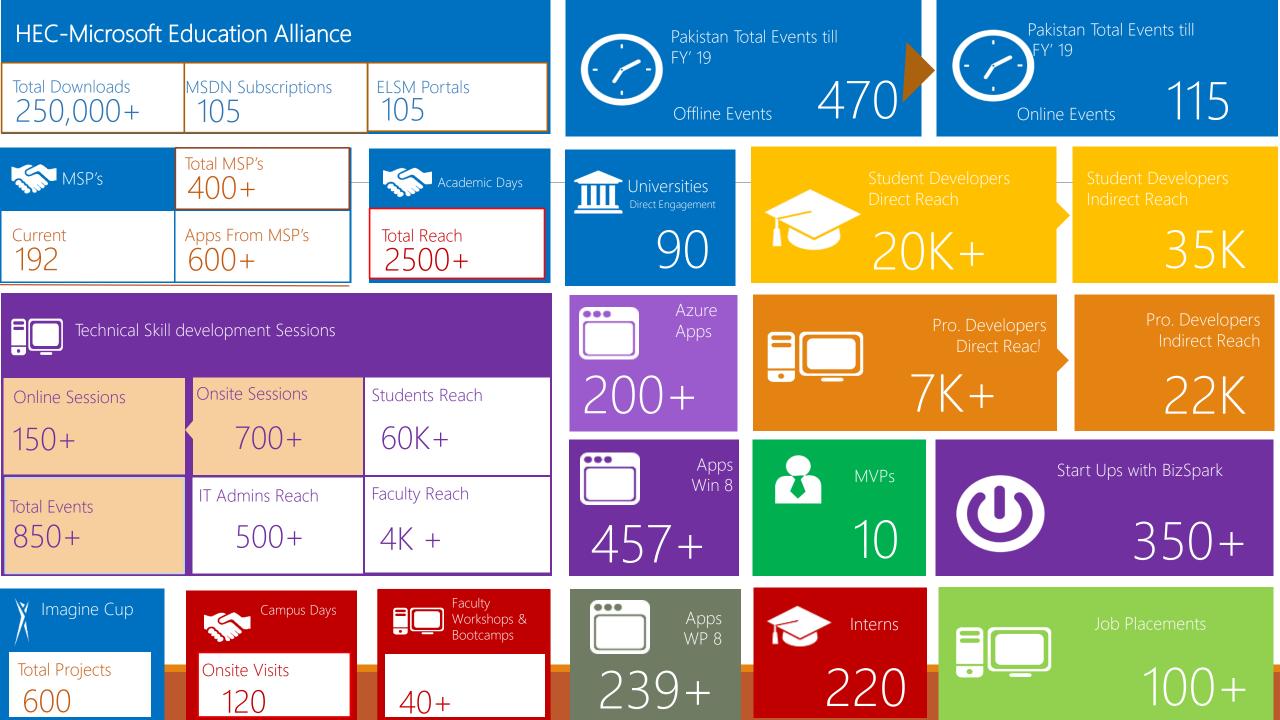






Camera Installed under Safe Campus





Collaborations with TEIN/ APAN ,Regional **NRENs and Principle**































PERN Financial Model

NRENS Financial Models

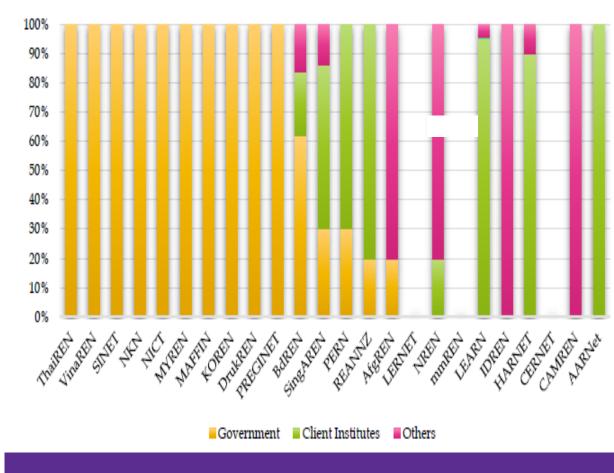


	COMMERCIAL	CLIENT INSTITUTION	GOWPUBLIC BODIES	OTHER EU	OTHER
Aconet					
AMRES					
ARNES					
AzScienceNet					
BASNET					
Beinet					
CARNet					
CESNET					
CYNET					
DelC					
DFN					
EENet					
FCCN					
Funet					
GARR					
GRENA					
GRNET					
HEAnet					
TUCC					
LITNET					
MREN					
KIFÜ/(NIIF)					
RedIRIS					
RENAM					
RENATER					
RESTENA					
RoEduNet					
SANET					
SUNET					
SURFnet					
SWITCH					
ULAKBIM					
UNINETT					
URAN					

LESS THAN 25 %

25% TO 75%

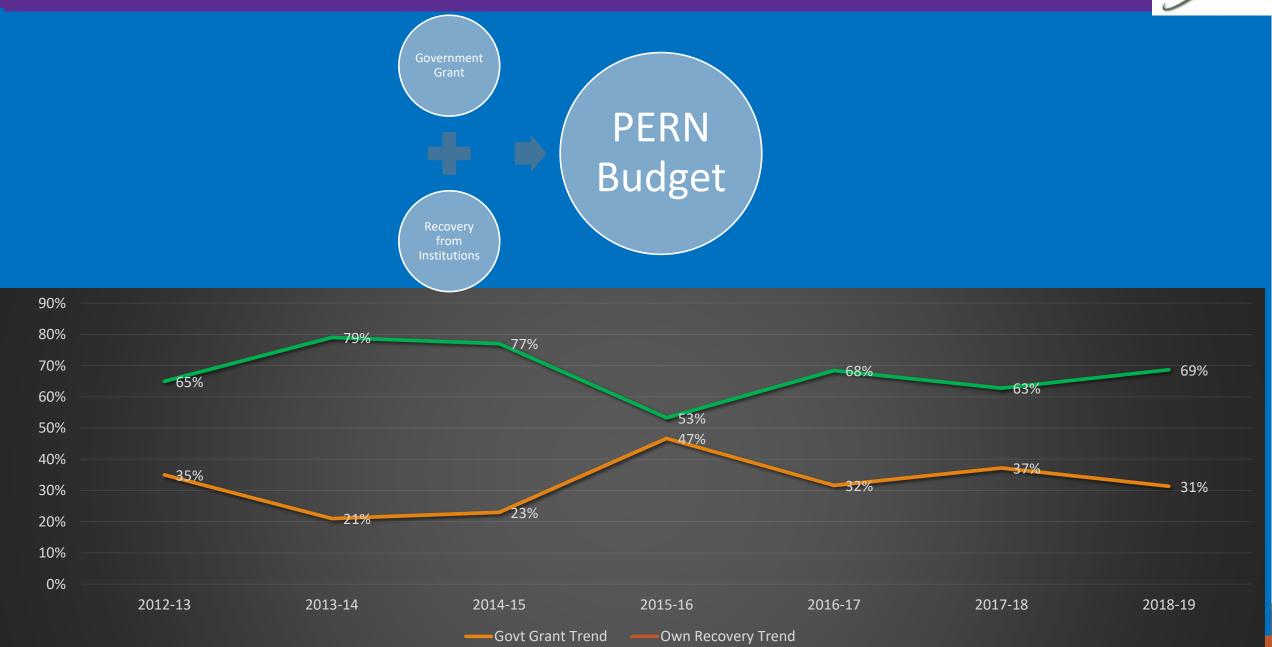
OVER 75%



Source: Geant & Asi@Connect Compendium for National Research and Education Networks in Asia-Pacific

PERN Financial Model

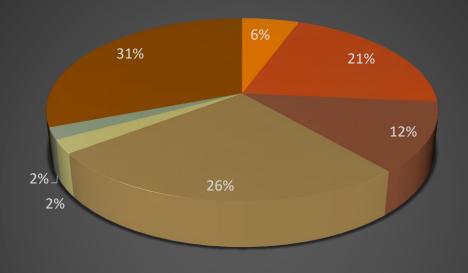




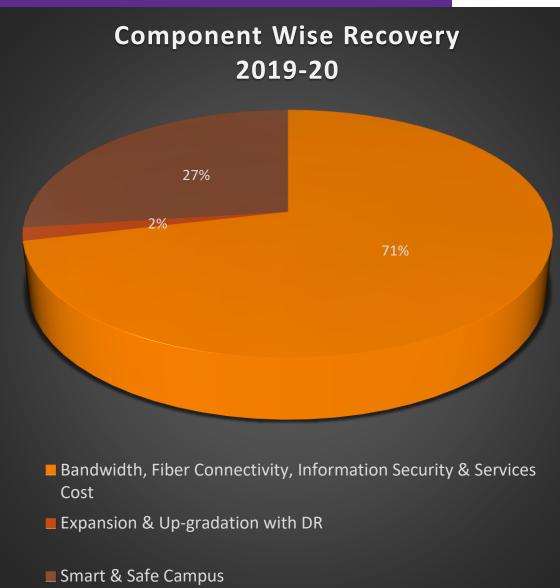
Major Cost and Recovery Drivers for PERN





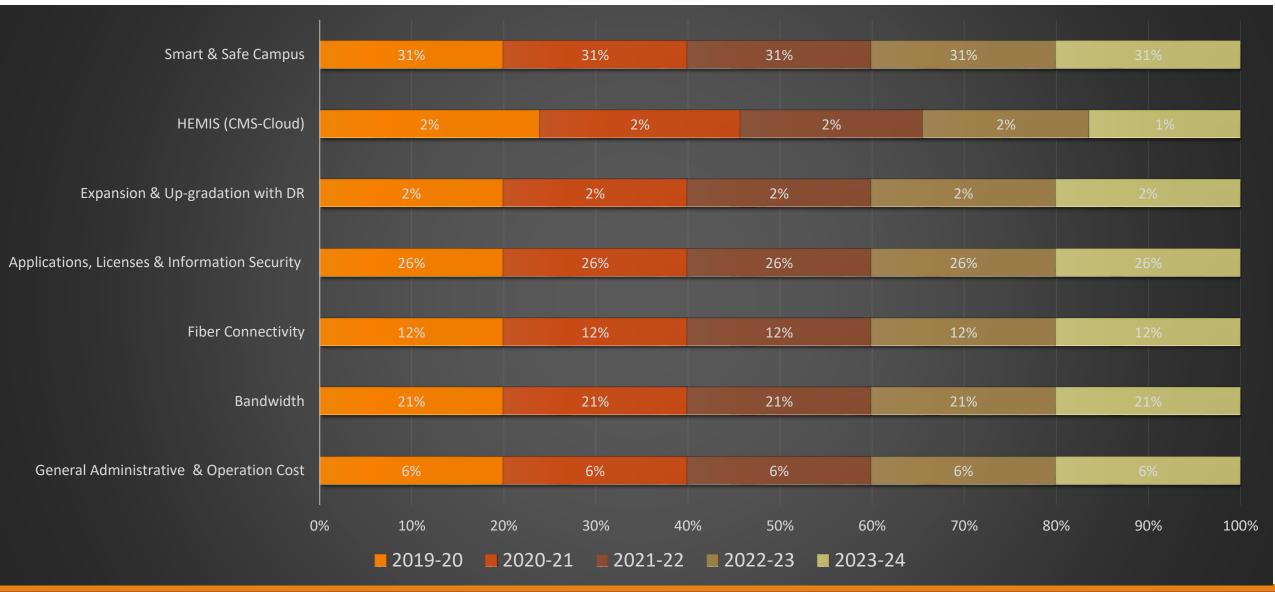


- General Administrative & Operation Cost
- Bandwidth
- Fiber Connectivity
- Applications, Licenses & Information Security
- Expansion & Up-gradation with DR
- HEMIS (CMS-Cloud)
- Smart & Safe Campus



Overall Cost Weightage of Cost (2019-24)





PERN Tariff Offered partner Institutes



Digital Packaged Resources							
	Base Package Cost		P-1	P-2	P-3	P-4	
	Bandwith	Minimum	Min	Min	Min	Min	
	Slabs	Maximum	Max	Max	Max	Max	
		Public	\$	\$	\$	\$	
ഥ	International Bandwidth	W Category	\$	\$	\$	\$	
\sim		Private	\$	\$	\$	\$	
L X	Intranet Bandwidth	\$	\$	\$	\$		
TARR	IPv4 Address	\$	\$	\$	\$		
	IPv6 Address	Promotionally Free for Limited Time					
	Digital Library (Base Resources)	Inclusive					
APPLICABLE	Network Consultancy & Technical Su	Inclusive					
	Turnitin Software/Services	\$	\$	\$	\$		
	Video Conferencing (SLA)	\$	\$	\$	\$		
	Trainings	Local (3 Trainings/Year)	25% PERN	50% PERN	Inclusive Inclusiv	Inclusivo	
			Contribution	Contribution		iliciusive	
		Foreign (1 Training/Year)	ng/Year) N/A	50% PERN	75% PERN	Inclusive	
		roreign (1 manning/fear)		Contribution	Contribution		
	Collaborative Research Project over		(\$5,000)	(\$10,000)	(\$15,000)	Inclusive	
	PERN (upto \$20,000/Year)		(73,000)	(710,000)	(713,000)	IIICIGSIVC	
	PERN Workshops/Seminars/Confere when applied)	(\$2,500)	(\$5,000)	(\$7,500)	Inclusive		
	International Relevant Certification ((\$1,000)	(\$2,000)	(\$3,000)	Inclusive		

PERN Tariff Offered partner Institutes



l Software Unified iication for staff and dents	Per CALs/Mailbox Charges	\$	\$	\$	\$	
l Soft Unifii icatii staff dents	CALs/MailBoxes		250	500	1000	2500
ed Ini y, ;	Student Licenses/Faculty License	2500/83	5000/166	10000/333	25000/833	
٦ ٥ -						
Services	Back uplink (Beyond standard PERN SLA i.e. 99%) (define metro and long-haul SLA)-Minimum 20 MB/Site/Month		\$	\$	\$	\$
<u> </u>	Extended LAN (Layer 2 VPN)		10 Mb @ 100\$/MB/Month			
Š	40 M		\$	\$		\$
7	Additional Intranet	60 Mbps	\$	\$		\$
<u>e</u>	Bandwidth (Layer 3) 100 Mbps		\$	\$		\$
Added	Nationwide Multicast Services		15\$/2-IP/Month			
ď	International Multicast Services National Multilink International Multilink		As per requirement			
O			As per requirement/Survey			
Value			200% of international Bandwidth rates/day			
>	Additional Buffer Bandwidth	As per requirement @ 15\$/Mbps/Day				
W-Category Eligible for Publ	ic funding are entitled for 50%	% rebate in diff	fferential amount of base package and service plan			

W-Category Eligible for Public funding are entitled for 50% rebate in differential amount of base package and service plan international bandwidth cost.

Recommendations for Sustainable Models

Proposed Model for Financial Sustainability



Government Support



Public Private Partner Ship



Trust based Membership

Government body, Hybrid Governance & Financial Sustenance



- ❖ Government body, Hybrid Governance & Financial Sustenance
 - Capex for Core and end site funded by Government (PC1s , world bank , EU , Recurring Grants)
 - Opex for Core and end site charge from the institutes

Pros

- Part of Government Entity (Ministry of Education/IT / HEC /UGC)
- Governance model will be Hybrid
- Capex through Investment from the Government
- Subsidize model can be followed to include low budget institutions
- Recovery model could be fixed or dynamic
- Equitable Cost Sharing Model
- ❖ Alignment / support with MTDF, Government initiatives, Allocation of Research fundings

Cons

- Dependencies on the Government as single source
- Sustenance will be determined by national economy
- With the expansion government Share need to increase

Public Private Partnerships



- ❖ Government body, Hybrid Governance & Public –Private partnership for Financial Sustainability
 - * Capex for Core and end site funded through Government as well as public private partnerships
 - Opex for Core and end site charge from the institutes
- Pros
 - ❖ Part of Government Entity (Ministry of Education/IT / HEC /UGC)
 - Governance model will be Hybrid
 - Economy of scale projects
 - Create opportunities for public private partnership and successful business model can contribute to national exchequer
 - * Equitable Cost sharing model among institutions
- Cons
 - ***** Long term investments
 - Market sustainability
 - * Recovery model may not be much flexible for low budget institutions

Members Trust based



- ❖ Trust / Independent body, Hybrid Governance & Trust base
 - Membership fee will be charged on monthly basis
 - Opex for Core and end site charge from the institutes
- Pros
 - Independent funding from the members
 - Members becomes major stakeholders
 - ❖ Independent entity with its own financial rules , Development Plans , Investments

***** Cons

- Fix funding model
- Members trust
- Institutions as members?
- Market competition (Other ISPs, Government Agencies)
- Might require Endowments Funds
- Allocation of Government Research Funding
- Power Delegation responsibilities
- ❖ Separate HR for administration, Billing, auditing, external audits, legal etc.

Thanks