Cases of Research and Education Network (REN) Initiatives: BDREN and A New Era in Bangladesh Higher Education

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“Knowledge will forever govern ignorance, and a people who mean to be their own governors must arm themselves with the power which knowledge gives.”

— James Madison
ICT and Universities

- ICT used to be an auxiliary service for universities in the 1990’s.
- In 2000’s it became an essential limb.
- In 2005 it is becoming the central artery in the running of modern universities.
- Almost all the countries in the world have adopted REN as the centerpiece of their information and communication technology (ICT) plan for higher education.
- Now about 92 countries around the world have REN-- 25+ more are building.
- The concept is marching further forward. Countries worldwide are now forming mega REN alliances of continental proportion with a vision of creating a world community of universities—a grand kiosk of higher education and scholarship.
• Internet Connectivity is vital for the survival of any modern educational institution.

• For Bangladesh we need a fresh thinking about the direction of ICT infrastructure for all our universities.

• The objective of this UGC initiative is to provide state-of-the-art internet connectivity to all universities of Bangladesh via establishing an Research and Education Network (REN).

• The network will be at par with all our neighbors.
Abstract

- In a silent revolution (started roughly around year 2000) 100 countries around the world have built advanced Research and Communication Networks (RENs). Now a global dream is being pursued further crossconnecting national RENs creating an unprecedented advanced global REN- aiming towards a global kiosk of innovation and scholarship.

- This three part talk presents the progress and state of the emerging Global REN, a glimpse of the new generation applications on the horizon, and their implications for nations- for sure which is poised to change the higher education landscape as we know it today.
REN A World Phenomenon

<table>
<thead>
<tr>
<th>Region</th>
<th>Installed</th>
<th>In Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICA</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>ASIA</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>EUROPE</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>NORTH AMERICA</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>SOUTH &amp; CENTRAL AMERICA</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

- **Current MoU Partners**
- **Developing Partnerships**
- **Related Efforts in Formation**
ERNET: India

- Collection of several consortiums over ERNET infrastructure
  - UGC-infonet
  - AICTE-Net
  - Indian Council for Agriculture Research-Net

- Organizes INFILIB Digital Library.

- Has several other content development projects.
PERN: Pakistan

**CONNECTION SUMMARY (PERN PROJECT)**

### OFS
- Aligarh Muslim University
- Qarshi University
- Panjab University
- University of Engineering & Technology

**Total** 4

### DXX
- Aligarh Muslim University
- Bahria University, Multan
- College of Aeronautical Engineering
- COMSATS Institute of Information Technology
- Quaid-i-Azam University
- Government College University
- National University of Computer & Emerging Sciences (FAST)
- Pakistan Maritime Institute
- University of Agriculture
- University of Agriculture

**Total** 12

### DRS/VSAT
- Aligarh Muslim University
- Higher Education Commission
- International Institute of Space Technology
- National Defence College
- Pakistan Institute of Engineering & Applied Sciences
- Pakistan Military Academy
- University of Agriculture
- University of Agriculture

**Total** 10

**Grand Total** 26
The Lanka Education And Research Network is the NREN (National Research and Education Network) of Sri Lanka, which interconnects Educational and Research institutions across the country.

The LEARN project commenced in 1990. The first service provided was LEARNmail, the first e-mail service in Sri Lanka, which was operated by the Department of Computer Science and Engineering, University of Moratuwa. This service provided educational and research institutions with dial-up e-mail service. This was supported by the Computer and Information Technology Council (CINTEC), and Lanka Academic Network (LAcNet), and maintained by a dedicated group of volunteers in Sri Lanka and abroad.

The first LEARN network interconnecting three sites with 64kbps links was established in 1994. Since then the LEARN network has grown rapidly to its current state, interconnecting 24 sites with link speeds ranging from 128kbps to multiple 2Mbps links. The establishment of 2Mbps links to 8 sites with the financial support of Sida/SAREC has been a major milestone in this path.

LEARN is currently in the process of upgrading the link bandwidths to 16 of its sites to 10Mbps over optical fiber. Several links have already been upgraded, and the remaining links will be upgraded by June 2007. This upgrade was made possible with the World Bank funded IRQUE Project providing funds for 10 of the 16 links.
### Where is Bangladesh?

<table>
<thead>
<tr>
<th>Country</th>
<th>NREN</th>
<th>Status</th>
<th>Ownership, legal status</th>
<th>Website</th>
<th>APAN Memb er</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td><strong>Bangladesh Research &amp; Education Network (BDREN)</strong></td>
<td>??</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td><strong>Royal University of Bhutan</strong></td>
<td>active</td>
<td>RUB owned</td>
<td></td>
<td>no</td>
</tr>
<tr>
<td>India</td>
<td><strong>Education &amp; Research Network (ERNET)</strong></td>
<td>active</td>
<td>DIT owned, registered soc.</td>
<td><a href="http://www.ernet.in">www.ernet.in</a></td>
<td>primary</td>
</tr>
<tr>
<td>Nepal</td>
<td><strong>Nepal Research &amp; Education Network (NREN)</strong></td>
<td>active</td>
<td>Member based, registered nfp</td>
<td><a href="http://www.nren.net.np">www.nren.net.np</a></td>
<td>associate</td>
</tr>
<tr>
<td>Pakistan</td>
<td><strong>Pakistan Education &amp; Research Network (PERN)</strong></td>
<td>active</td>
<td>HEC Pakistan no sep legal entity</td>
<td><a href="http://www.pern.edu.pk">www.pern.edu.pk</a></td>
<td>primary</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td><strong>Lanka Education And Research Network (LEARN)</strong></td>
<td>active</td>
<td>working towards</td>
<td><a href="http://www.ac.lk">www.ac.lk</a></td>
<td>primary</td>
</tr>
</tbody>
</table>

Khan, ICCIT, Khulna, 2008
<table>
<thead>
<tr>
<th>Network</th>
<th>Name</th>
<th>Region</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>APAN</td>
<td>Asia-Pacific Advanced Network</td>
<td>All Asia</td>
<td>All Asia</td>
</tr>
<tr>
<td>TEIN2</td>
<td>Trans-Eurasia Information Network</td>
<td>Asia Pacific</td>
<td>Australia, China, Indonesia, Korea, Malaysia, The Phillipines, Thailand and Vietnam with Europe</td>
</tr>
<tr>
<td>EUMEDCONNECT</td>
<td>Europe and Mediterranean Education Network Connect</td>
<td>Mediterranean</td>
<td>Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, The Palestinian Authority, Syria, Tunisia and Turkey</td>
</tr>
<tr>
<td>Nordunet</td>
<td>The Nordic Internet Highway to Research and Education Networks</td>
<td>Nordic Europe</td>
<td>Denmark, Finland, Iceland, Norway and Sweden</td>
</tr>
<tr>
<td>GEANT2</td>
<td>Network for Southeast Europe</td>
<td>All Europe</td>
<td>30 RENS from all Europe</td>
</tr>
<tr>
<td>ALICE</td>
<td>America Latina Interconectada Con Europa</td>
<td>Latin America</td>
<td>Argentina, Brasil, Chile, Costa Rica, Guatemala, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela, Bolivia, Columbia, Honduras, Nicaragua, Cuba, El Salvador, and Ecuador</td>
</tr>
<tr>
<td>ERNESAA</td>
<td>The Educational Research Network in East and Southern Africa</td>
<td>East and Southern Africa</td>
<td>Botswana, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe</td>
</tr>
<tr>
<td>ERNWACA</td>
<td>The Education Research Network for West and Central Africa</td>
<td>West and Central Africa</td>
<td>Benin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Mali, Nigeria, Senegal, Sierra Leone and Togo</td>
</tr>
</tbody>
</table>
• 31 countries connecting
• Operated by DANTE
• 10 Gbps core backbone
  • Connectors at 10Gbps(2) and below
• Total of 4x2.5Gbps + 2x1Gbps across Atlantic (DANTE & EuroLink provided)
Europe – International connectivity

REF: Report on present status of international connectivity in Europe and to other continents, From SERENATE – Study into European Research and Education Networking As Targeted by eEurope, http://www.serenate.org/publications/d6-serenate.pdf

Khan, ICCIT, Khulna, 2008
Connections APAN to US
- Currently 2xOC12 Tokyo – Seattle, Tokyo - Chicago
- Upgrading to 2.5Gbps Tokyo – Los Angeles and 2x1GbE Tokyo - Chicago
- Funded by NSF and Japanese government

SRC: http://www.transpac.org
APAN: Asia-Pacific Advanced Network

- APAN: Asia-Pacific Advanced Network
- Partner in TransPAC link
- Several national networks moving to 10Gbps
- APAN network made up of country-owned point-to-point links contributed to APAN
- Trans Eurasia and Trans Pacific connectivity increasing
Bangladesh Research & Education Network
### BDREN at a Glance

<table>
<thead>
<tr>
<th>Participants:</th>
<th>All 26 public universities, all 16 public medical and dental colleges, 53 private universities, 30 private medical and dental colleges and selected research institutions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current capacity without REN:</td>
<td>0-4 mbps/university on the average.</td>
</tr>
<tr>
<td>Planned REN Capacity:</td>
<td>50-100 mbps university to REN.</td>
</tr>
<tr>
<td>Backbone Speed:</td>
<td>1 Gbps- 10 Gbps core.</td>
</tr>
<tr>
<td>Estimated 5 year Budget:</td>
<td>$21 million with recurring cost recovery and capital accumulation in equipment and fiber ownership at the end of 5 years.</td>
</tr>
<tr>
<td>Technology:</td>
<td>Giga Bit Ethernet, CWDM &amp; switched IP/MPLS</td>
</tr>
<tr>
<td>Other Features:</td>
<td>Fundamentally changes countries higher education landscape via ICT competency. Significantly levels off the internal and external digital divide.</td>
</tr>
</tbody>
</table>
Preliminary Dhaka Backbone (Just a sketch!)

Other Flanks of Bangladesh/ National BDREN backbone

Dhaka Core Backbone
Dark Fiber, 1-10G Backbone

Bangladesh IX
TEIN3 POP

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• REN Members

• All 26 public universities.

• All 53 private universities.

• All 16+30 private and public medical & dental colleges.

• Selected research institutions.
International Connectivity: TEIN2 (South East Asia)

Beneficiaries:
- The People’s Republic of China (CN)
- The Republic of Indonesia (ID)
- Malaysia (MY)
- The Republic of the Philippines (PH)
- The Kingdom of Thailand (TH)
- The Socialist Republic of Vietnam (VN)

Non-Beneficiaries:
- Japan (JP)
- The Republic of Korea (KR)
- The Republic of Singapore (SG)
- Australia (through its NREN AARNet)
<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Route</th>
<th>Length</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMW-4</td>
<td>2006</td>
<td>France-Singapore</td>
<td>~20,000km</td>
<td>Initial 80Gb/s upgrades to 1,280Gb/s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(UK via terrestrial)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FARICE-1</td>
<td>2004</td>
<td>Iceland-Paroos - Scotland</td>
<td>~1,400km</td>
<td>20Gb/s before upgrades</td>
</tr>
<tr>
<td>SMW-3</td>
<td>1998</td>
<td>Germany via UK to Australia</td>
<td>~38,000km</td>
<td>In the range 55Gb/s to 160Gb/s</td>
</tr>
<tr>
<td>(back up SMW4)</td>
<td></td>
<td>and Japan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLAG Europe - Asia</td>
<td>1997</td>
<td>UK - Japan</td>
<td>~27,000km</td>
<td>In the range 10Gb/s to 80Gb/s</td>
</tr>
<tr>
<td>CANTAT-3</td>
<td>1994 to 2006</td>
<td>Canada to Europe</td>
<td>~7,100km</td>
<td>28p* 2.5Gb/s regenerated</td>
</tr>
</tbody>
</table>

* Indicates regenerators.
Transeurasia Information Network Initiative Proposed South Asia Integration Plan [1]

Option 1

South Asia

- Bhutan PoP
  - 45Mbps

- Bangladesh PoP
  - 155Mbps (TEIN3 SAE)

- Nepal PoP
  - 155Mbps (TEIN3 SAE)
  - 45Mbps (TEIN3 SAE)

East Asia PoP

- India PoP
  - 155Mbps

- Sri Lanka PoP
  - 622Mbps (TEIN3 SAE)

- Pakistan PoP
  - 45Mbps

- GEANT2 PoP
  - 2.5Gbps

- 2.5Gbps (TEIN3 GEANT2)
- 622Mbps (TEIN3 SAE)
- 155Mbps (TEIN3 SAE)
- 45Mbps (TEIN3 SAE)
- funded by others

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South Asia Integration Plan [1]

Another option

- Bhutan PoP
- Pakistan PoP
- Bangladesh PoP
- India PoP
- Nepal PoP
- Sri Lanka PoP
- GEANT2 PoP
- East Asia PoP

- 2.5Gbps (TEIN3 GEANT2)
- 622Mbps (TEIN3 SAE)
- 155Mbps (TEIN3 SAE)
- 45Mbps (TEIN3 SAE)

funded by others

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BDREN Consortium

Board of Trustee
(VC’s of public and private universities)

*Technical Advisory Committee
(Researchers & Engineers)

SIG-1
(Network)

SIG-2
(Applications)

SIG-3
(Others..)

*Chief Executive Officer (CEO)

Training & Event Officer

Chief Operations Officer (COO)

*Contract Officer

*Accounts Officer

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<table>
<thead>
<tr>
<th>Board of Trustee</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chairperson, UGC</td>
<td>Chairman</td>
</tr>
<tr>
<td>Member, UGC</td>
<td>Member</td>
</tr>
<tr>
<td>Member, UGC</td>
<td>Member</td>
</tr>
<tr>
<td>5 VC*s from Public Universities (By rotation)</td>
<td>Member</td>
</tr>
<tr>
<td>3 VCs* from Private Universities (By rotation)</td>
<td>Member</td>
</tr>
<tr>
<td>Joint Secretary, Ministry of Education</td>
<td>Member</td>
</tr>
<tr>
<td>3 Inductees selected by the other trustees</td>
<td>Members</td>
</tr>
<tr>
<td>Chief Executive Officer</td>
<td>Member Secretary</td>
</tr>
</tbody>
</table>
## Technical Advisory Committee

<table>
<thead>
<tr>
<th>Role</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member () UGC</td>
<td>Chairman</td>
</tr>
<tr>
<td>5 Representatives from Public Universities</td>
<td>Member</td>
</tr>
<tr>
<td>3 Representative from Private Universities</td>
<td>Member</td>
</tr>
<tr>
<td>3 Technical Expert Inductees (from SIGs, related industries, or</td>
<td>Members</td>
</tr>
<tr>
<td>research organizations)</td>
<td></td>
</tr>
<tr>
<td>Representative, BTRC</td>
<td>Member</td>
</tr>
<tr>
<td>Deputy Director, ICT+BDREN, UGC</td>
<td>Member</td>
</tr>
<tr>
<td>Chief Executive Officer</td>
<td>Member Secretary</td>
</tr>
<tr>
<td>Chief Operating Office</td>
<td>Member</td>
</tr>
</tbody>
</table>
Most well run RENs have managed to provide more bandwidth and higher quality internet access at lower cost. The saving comes from the following:

(a) It applies bulk buying power to get better rate from data service providers.

(b) In addition, the research and educational part of the traffic is carried at no-cost via global RENs between all member universities in the world. Without a REN this part of the traffic has to travel over commodity internet at commercial rate.

(c) Its non-profit mode of operation.

RENs routinely receive technology funding to perform advanced ICT experiments and tests.
Typical Funding Model

- A **membership subscription** to the consortium to cover most recurring costs (Bandwidth, salary etc.)

- Capital investment is provided by public sources (higher education authority, ministry of science & technology, technology funds, ministry of telecommunications, etc.)

- All universities thus benefits from the **public capital funding**.
Cost Share in RENs

• Members also contribute in kind to keep the costs down- for example the space for NOC, POPs, etc.

• Faculty members, researchers, network engineers from the university community participate and guide the technology direction.

• A valuable research test-bed for pioneering works. Can be used by the faculty members and researchers to test various new technologies, protocols, applications.
Responsibilities shared by the Universities

• Universities themselves must maintain and upgrade their campus network in the light of affordable bandwidth provided by REN.

• It's not only the campus network, universities must ensure programs so that its' students and faculty can use the high level of internet capacity afforded by the initiative.
• No university, organization, national or regional body can succeed in isolation.

• Advanced Internet will be the key infrastructure component of an University.

• REN is needed to cope up with the advanced applications and systems being deployed/ envisioned by the current world university community. Universities without REN will be increasingly out of touch.

• RENs will enable advanced collaboration between researchers, scholars, research groups in a much more meaningful way across nations breeding new ideas.
Few Issues..

You too might be pondering!
Issue (1)

- Should we do it Small (with few central universities) or Big (including all)?
  - Should we limit the benefits to Dhaka?
  - Perhaps the people outside Dhaka needs connectivity more than those in Dhaka.
  - Can BD handle such a big project?
  - Economy of scale (worldwide trend).

- Answer: Be **all inclusive** but do phased lighting.
• **Can we afford to delay it?**

  • Bangladesh is already the last to do it in South Asia!
  • Still Long way to go…
  • Many other critical services (like Digital Library) depends on it and waiting..
  • Most RENs are already in 2\textsuperscript{nd}/3\textsuperscript{rd} generation.
  • We could have- if we were to start in 2005!

• Answer: It's **already too late**!
• Should Private Universities be included?

• All students - rich or poor, are equal to the country. The society has responsibility to the entire future generation.
• Bulk of the cost is for reaching outside Dhaka. Very few private universities are there.
• Education should reach to citizens living in regional towns. Not the citizens have to travel to Dhaka.

• Answer: Private universities must pass on the saving from this national investment to the students.
• **Can one university do it?**

  • No example exists where one university did that for a country the size of Bangladesh.
  • Network by definition needs all’s participation- big and small. A network cannot be built out of one member.
  • Top universities naturally to assume more leadership and contributed more advanced expertise.

• **Answer:** [Consortium](#).
• The Internet penetration in Bangladesh is one of the lowest in the world.

• However, the case of Bangladesh is peculiar. There is fiber abundance - but the vast part of the country is in IT darkness.

• Popularly believed reason is the late arrival of international linkage. Yet after the submarine cable - a much complex reason is now evident. It is the distribution failure within the country.
• The current capacity distribution failure within the country is so alarming that data communication prices are 3-5 times higher than its immediate neighbors whereas a public resource like PGCB fiber remains vastly unutilized.

• Bangladesh is apparently an interesting case of artificial “famine” of data communication. The government must act so that fiber assets paid by public money is put to use.

• Fiber itself has a lifetime of 25 years. Any unused capacity is the waste of solemn public investment.
The Opportunity

• A partnership between public fiber owner PGCB and REN can fundamentally change the situation.

• Data communication can be made available at all corners of the country specially to the disadvantaged 80% areas of the country.

• REN is a strategic infrastructure seeding that will assuage the digital divide within the country (divide within divide).

• The PGCB (Dark Fiber)/ BDREN can be one of the seminal partnership for data communication history of Bangladesh.
Conclusions

• It’s a technology project of the decade for Bangladesh Higher Education.

• Young generation of faculty and experts should lead the project.

• There are plenty of challenges for every one to contribute and participate.

• Avoid dividing issues such as private vs. public universities, top-vs. new universities. There are bigger national and international battles to win with much bigger payoffs for everyone.
References

1. TEIN3 South Asia Feasibility Study (WP5) Report, David West & George McLaughlin, December 2008.

2. Network MAPS provided by the NRENs.

3. TERENA, Trans European Research and Education Networking Association, Compendium of NRENs, 2008.


