GLOBAL KIOSK OF HIGHER EDUCATION & SCHOLARSHIP: High Performance Research & Education Network, E-Library Access, Scholarly Collaboration and Other Transforming Services for Developing World Universities

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Abstract

- **Nations around the world is building** **Research and Communication Networks** **(RENs) to modernize their higher education infrastructure into a new networked university model. REN is also a great opportunity for developing world universities. Indeed it can be a great equalizer in the** **digital divide** **of higher education sector. This talk presents how digital educational services such as modern digital library consortium, low cost ubiquitous conferencing those can arrest the knowledge access crisis in the developing world including in Bangladesh.**
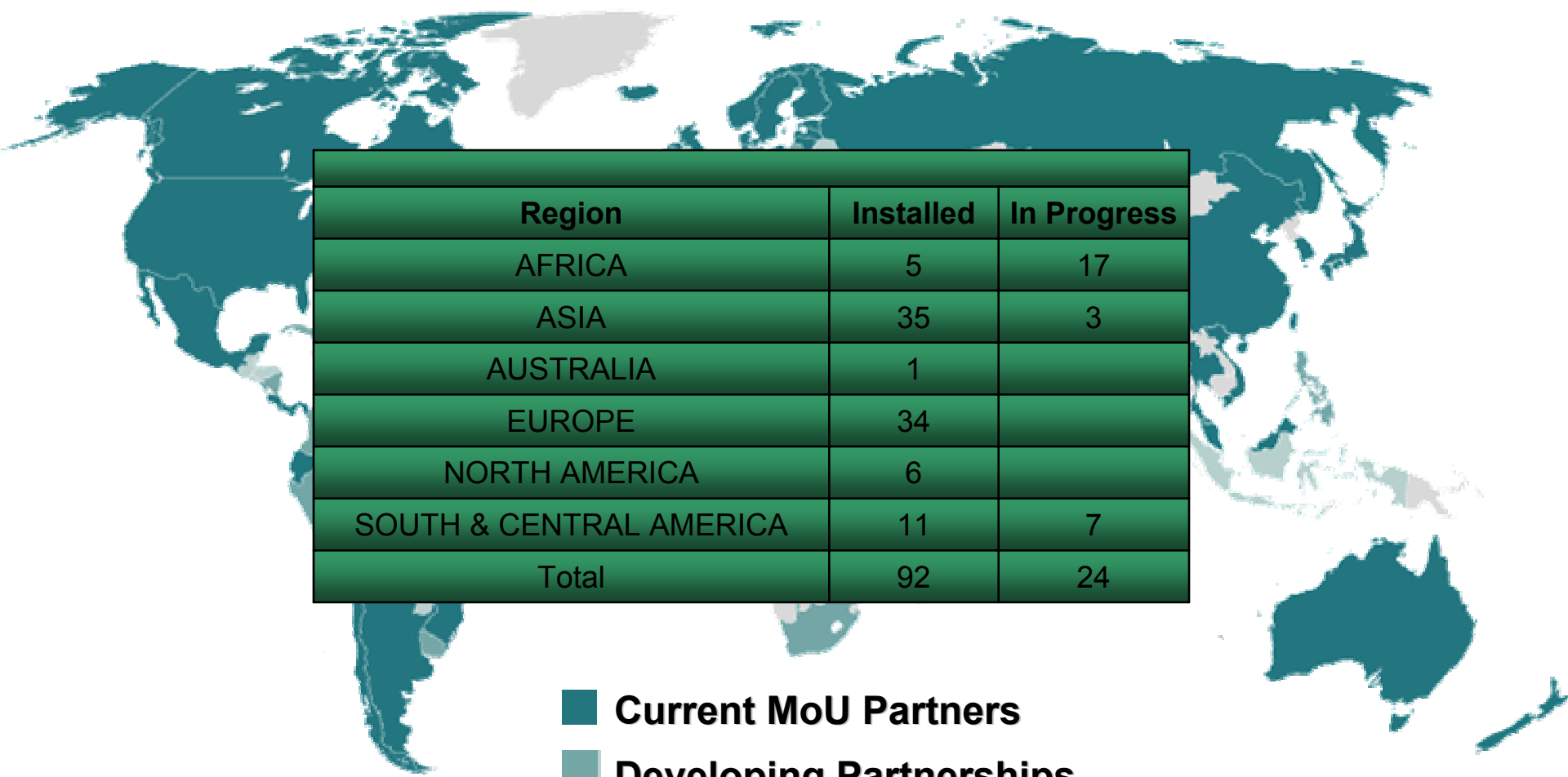
Universities in Transition

- Mission- **"facilitation of learning".**

- Learning Tools: Make available all the tools necessary for learning to the learner and the teacher (books, journals, laboratories)

- Meeting Place of Ideas: Provide a stimulating and safe environment for the quest for new ideas. It fosters dialogue based on intellectual merit and free from all other prejudice and fear (academic freedom).

- The above is the only known formal institutional means to harvest human knowledge

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.

REN A World Phenomenon

Region	Installed	In Progress
AFRICA	5	17
ASIA	35	3
AUSTRALIA	1	
EUROPE	34	
NORTH AMERICA	6	
SOUTH & CENTRAL AMERICA	11	7
Total	92	24

Current MoU Partners

Developing Partnerships

Related Efforts in Formation

Internet2 International Partners

Europe-Middle East
ARNES (Slovenia)
BELNET (Belgium)
CARNET (Croatia)
CESnet (Czech Republic)
DANTE (Europe)
DFN-Verein (Germany)
FCCN (Portugal)
GARR (Italy)
GIP-RENATER (France)
GRNET (Greece)
HEAnet (Ireland)
HUNGARNET (Hungary)
Israel-IUCC (Israel)
NORDUnet (Nordic Countries)
POL-34 (Poland)
Qatar Foundation (Qatar)
RedIRIS (Spain)
RESTENA (Luxemburg)
RIPN (Russia)
SANET (Slovakia)
Stichting SURF (Netherlands)
SWITCH (Switzerland)
JISC, UKERNA (United Kingdom)

Asia-Pacific
AAIREP (Australia)
APAN (Asia-Pacific)
ANF (Korea)
CERNET, CSTNET, NSFCNET (China)
JAIRC (Japan)
JUCC (Hong Kong)
SingAREN (Singapore)
NECTEC / UNINET(Thailand)
TANet2 (Taiwan)
NGI-NZ (New Zealand)
TERENA (Europe)
MyREN (Malaysia)

Asia-Pacific
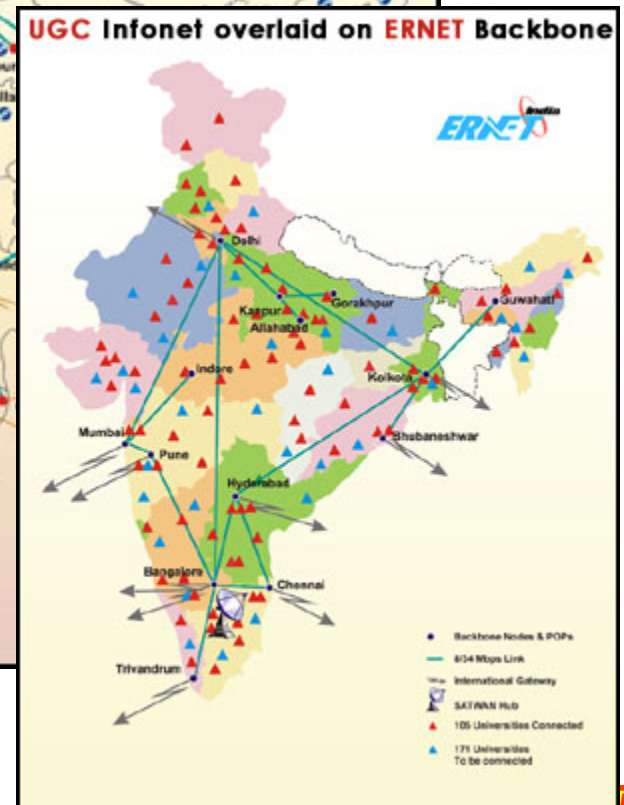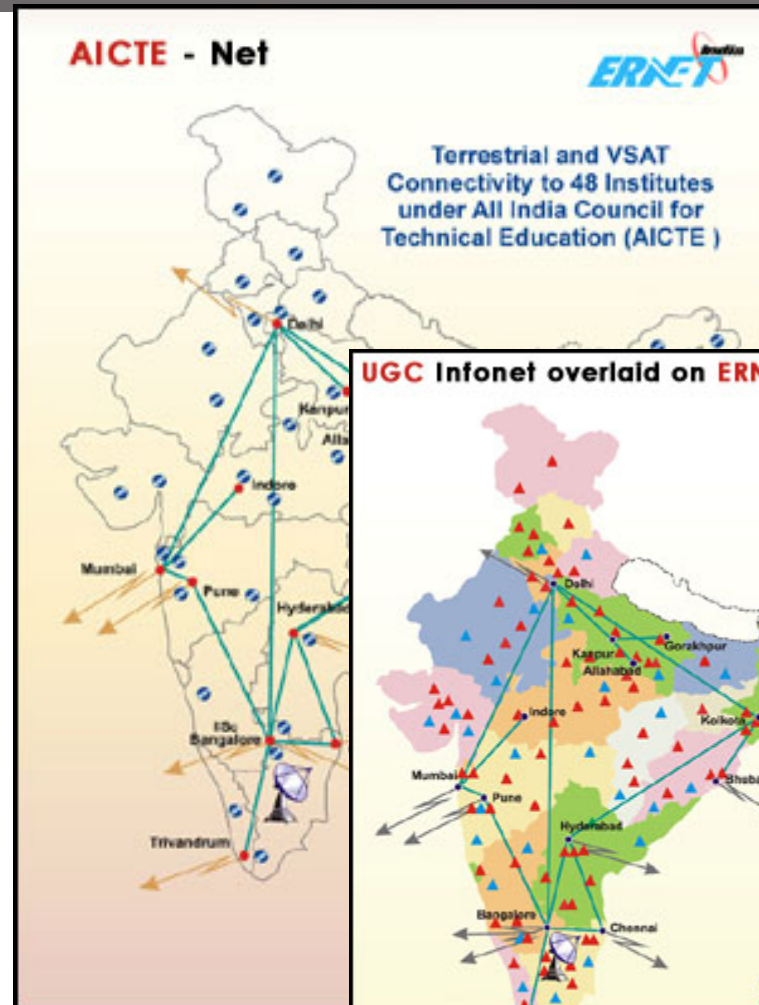MCIT [EUN/ENSTINET] (Egypt)
TENET (South Africa)

Americas
CANARIE (Canada)
CLARA (Latin America & Caribbean)
CEDIA (Ecuador)
CNTI (Venezuela)
CR2Net (Costa Rica)
CUDI (Mexico)
REUNA (Chile)
RETINA (Argentina)
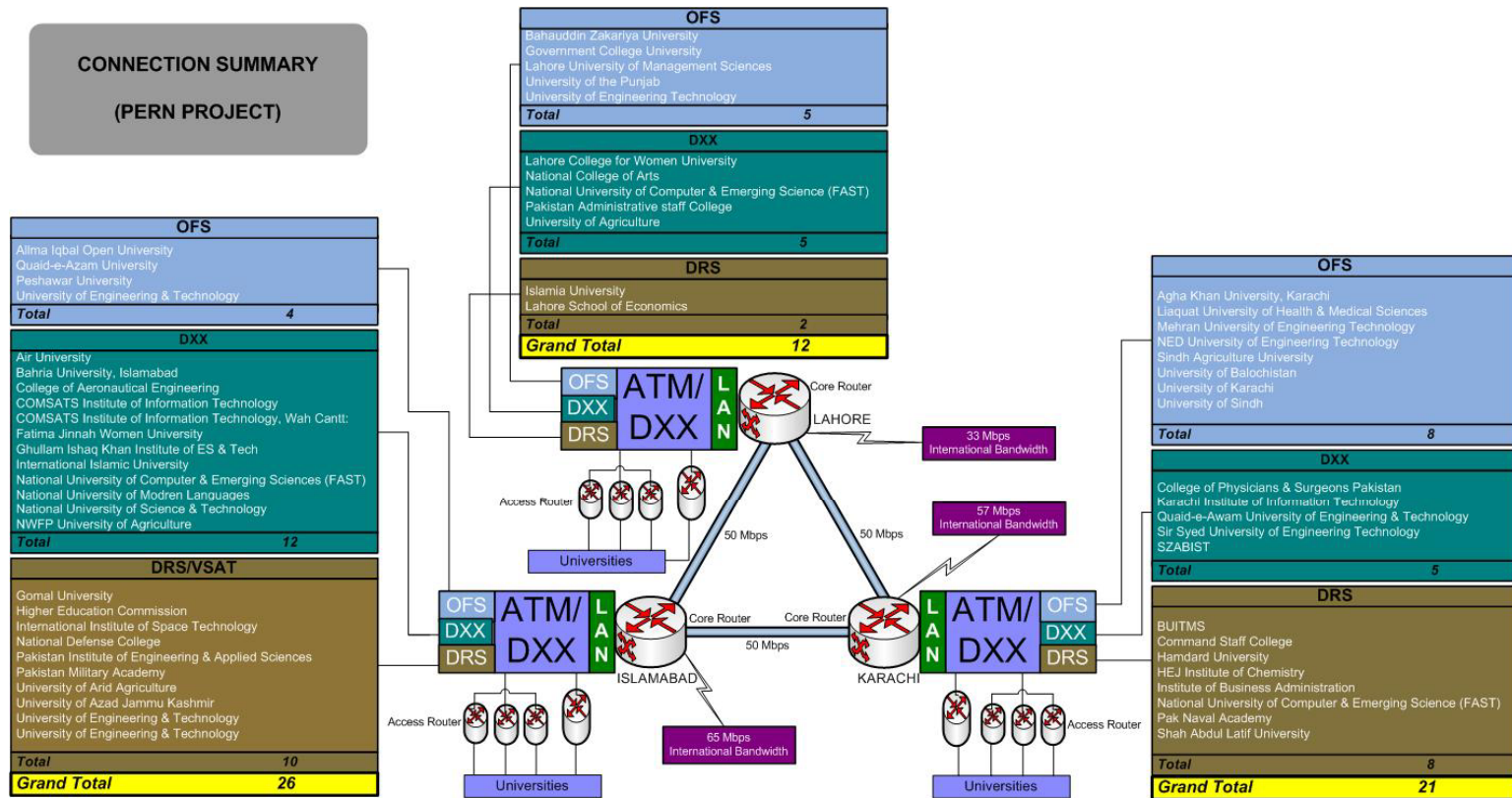RNP [FAPESP] (Brazil)
SENACYT (Panama)

Abilene International Network Peers

1 October 2005
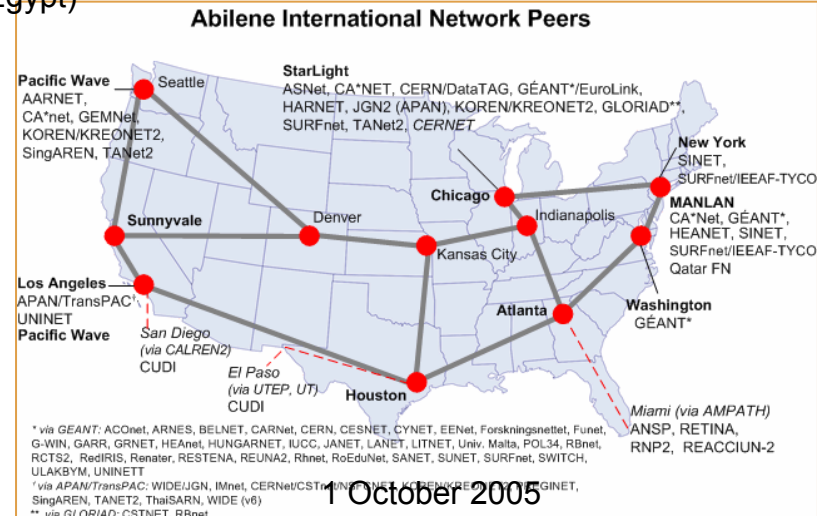
ERNET: India

- **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.

AICTE - Net

ERNET

Terrestrial and VSAT Connectivity to 48 Institutes under All India Council for Technical Education (AICTE)

UGC Infonet overlaid on ERNET Backbone

ERNET

Backbone Nodes & POPs
8/34 Mbps Link
International Gateway
SATWAN HUb
105 Universities Connected
171 Universities To be connected

PERN: Pakistan (www.pern.edu.pk)

LEARN: Sri Lanka

- 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 grwon 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.

"if you think education is expensive try ignorance"

-Derek Bok,
-President Emeritus, Harvard

Connection Policy

- All NRENs connect universities, research institutes and, with few exceptions, institutes of higher education.

- Many NRENs also connect secondary and primary institutions, though there are great differences in policy.

- Some NRENs connect government departments that have a relation to research and education, etc.

- Network Operating Centers
- Training
- Network Monitoring and Measurement
- Certificate Server
- Bandwidth on Demand/ Premium I
- Federated Authorization & Authentication Infrastructure (AAI)
- EduRoam© a facility that provides roaming access for university users to wireless networks.

Legend:
- 2006
- 2007

Categories:
- NRENs that operate a CA
- NRENs with a federation
- NRENs connected to eduroam
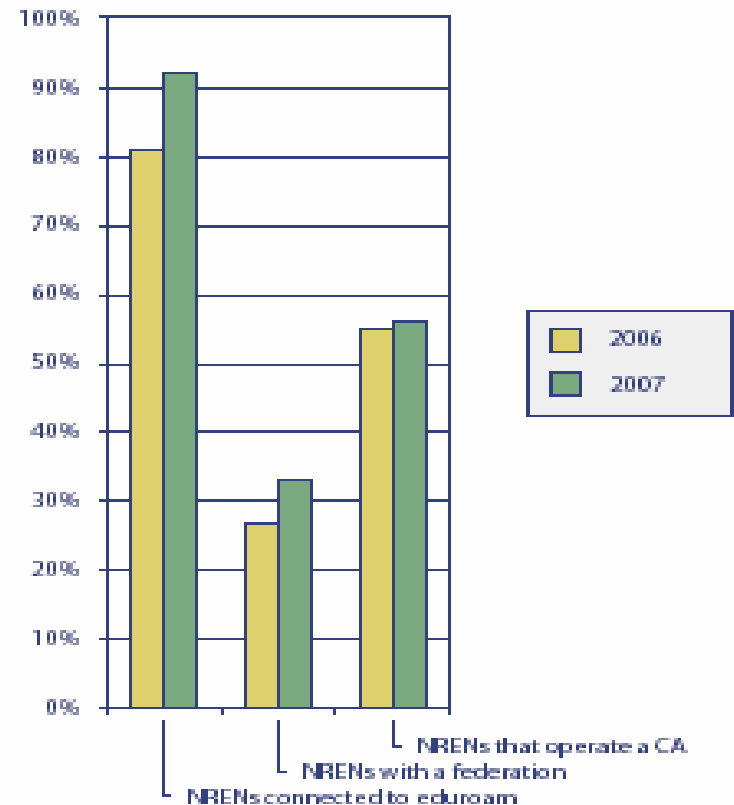
REN Services & Applications

RENs are spearheading a new generation of advanced applications and services.

Federated Authorization & Authentication

- Shibboleth, a project of Internet2/MACE, is developing architectures, policy structures, practical technologies, and an open source implementation to support inter-institutional sharing of web resources subject to access controls.
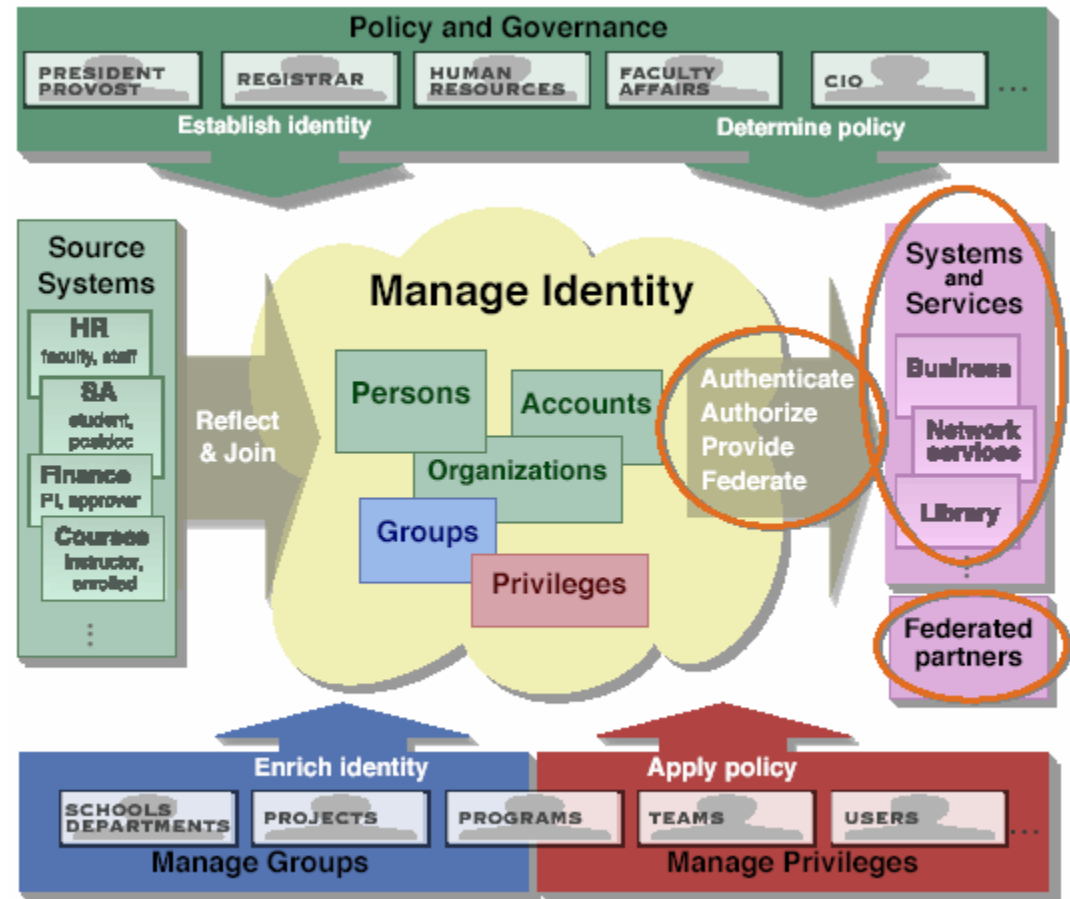
Cross Campus IP Telephony

- Now that IP telephony and its protocols are becoming more mature and products more manageable, NRENs are starting to deploy it.

- 56% of the NRENs in the EU/EFTA countries are running an IP telephony deployment, while about 30% of the NRENs in other countries are running one.

- NEXT: NRENs will begin exchanging IP telephony traffic- extending global direct dial and virtual phones; currently IP telephony peering architectures are being defined and operators are not yet ready to support it

| Country	NREN	Running IP Telephony?	Pilot Services?	Interconnection of IP Telephony?
EU/EFTA Countries				
Austria	ACOnet	no		
Belgium	BELNET	yes		no
Bulgaria	BREN	no		
Cyprus	CYNET	no		no
Czech Republic	CESNET	yes	sip.edu	yes
Denmark	UNI·C	no		
Estonia	EENet	yes		no
Finland	Funet	no		no
France	RENATER	yes		
Germany	DFN	no		
Greece	GRNET	yes	nrenum.net,sip.edu	no
Hungary	NIIF/HUNGARNET	yes	nrenum.net	yes
Iceland	RHnet	no		no
Ireland	HEAnet	no		
Italy	GARR	yes	nrenum.net	no
Latvia	LATNET	no		
Lithuania	LITNET	yes		no
Luxembourg	RESTENA	yes		no
Malta	CSC	no		
Netherlands	SURFnet	yes	nrenum.net,sip.edu	yes
Norway	UNINETT	yes	sip.edu	yes
Poland	PIONIER	yes		
Portugal	FCCN	yes		no
Romania	RoEduNet	yes		no
Slovakia	SANET	yes	nrenum.net	yes

Country	NREN	Running IP Telephony?	Pilot Services?	Interconnection of IP Telephony?
EU/EFTA Countries				
Slovenia	ARNES	no		no
Spain	RedIRIS	no	nrenum.net	no
Sweden	SUNET	yes		
Switzerland	SWITCH	yes	sip.edu	no
United Kingdom	JANET(UK)	yes		
Other Countries				
Algeria	CERIST	no		
Azerbaijan	AzNET	no		no
Croatia	CARNet	yes		yes
Georgia	GRENA	no		
Israel	IUCC	no		no
Macedonia	MARNet	no		
Moldova	RENAM	no		no
Montenegro	MREN	no		no
Morocco	MARWAN	no		
Russia	RBNet/RUNNet	no		
Serbia	AMRES	no		
Turkey	ULAKBIM	yes		no
Ukraine	URAN	no		

Tele-Operation of Remote Equipment

- Computerized excavation backhoe
- Remotely operated, used in hazardous situations.
- Quality of Service is Guaranteed

North Carolina State University

Realistic, Life-Sized, 3D Tele-Immersion

Advanced Network & Services, Brown University, University of North Carolina, University of Pennsylvania

http://www.cs.unc.edu/Research/stc/office/
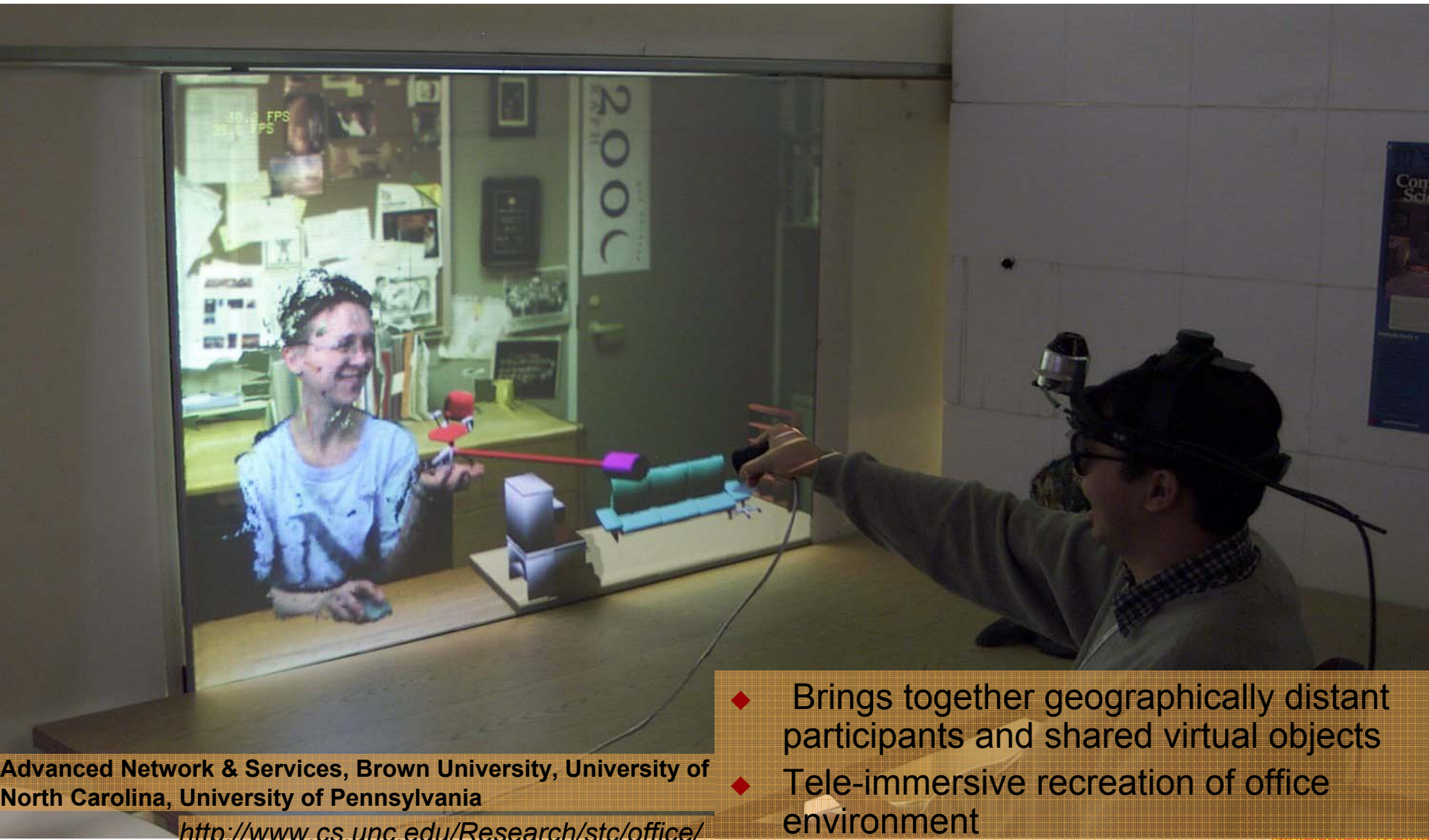
- ◆ Brings together geographically distant participants and shared virtual objects
- ◆ Tele-immersive recreation of office environment

Grid Application in RENs

| Country	NREN	High-energy Physics	Other Physics	Computational Chemistry	Other Chemistry	Biomedical	Astroscience	Earth Science	Climatology	Arts and Humanities
EU/EFTA Countries										
Austria	ACOnet	now	-	-	-	now	now	now	now	
Belgium	BELNET	now	now	now	-	now	-	now	now	-
Bulgaria	BREN	now	now	planned	planned	now	-	-	-	-
Cyprus	CYNET	planned	planned	-	-	now	-	now	now	now
Czech Republic	CESNET	now	now	now	now	planned	now	planned	-	-
Denmark	UNI•C	planned	-	-	-	planned	-	-	-	
Estonia	EENet	now	now	now	now	now	planned	-	planned	planned
Finland	Funet	now	now	now	planned	now	now	planned	planned	-
France	RENATER									
Germany	DFN	now	-	-	-	-	now	now	now	now
Greece	GRNET	now	now	now	-	now	now	now	now	now
Hungary	NIIF/HUNGARNET	now	now	now	now	now	now	now	planned	
Ireland	HEAnet	now	now	now	now	now	now	now	now	-
Italy	GARR	now	now	now	now	now	now	now	planned	planned
Latvia	LATNET	-	now	-	planned	planned	planned	-	-	
Lithuania	LITNET	now	now	-	-	planned	planned	now	-	now
Malta	CSC	planned				now		planned		
Netherlands	SURFnet	now	now	-	-	planned	now	-	planned	-
Norway	UNINETT	now	planned	planned	-	-	planned	planned	planned	-
Poland	PIONIER	now	now	now	-	now	now	now	now	now
Portugal	FCCN	planned				planned	planned		planned	
Romania	RoEduNet	planned	planned	planned	-	-	-	-	planned	planned
Slovenia	ARNES	now								
Spain	RedIRIS	now	now	now	now	now	now	now	now	planned

- Currently 85% of EU RENS are running Grid and it will be 100% by next 2 years.
- Not only High Energy Physics, the use is expanding in other areas as well.

Tele Surgery
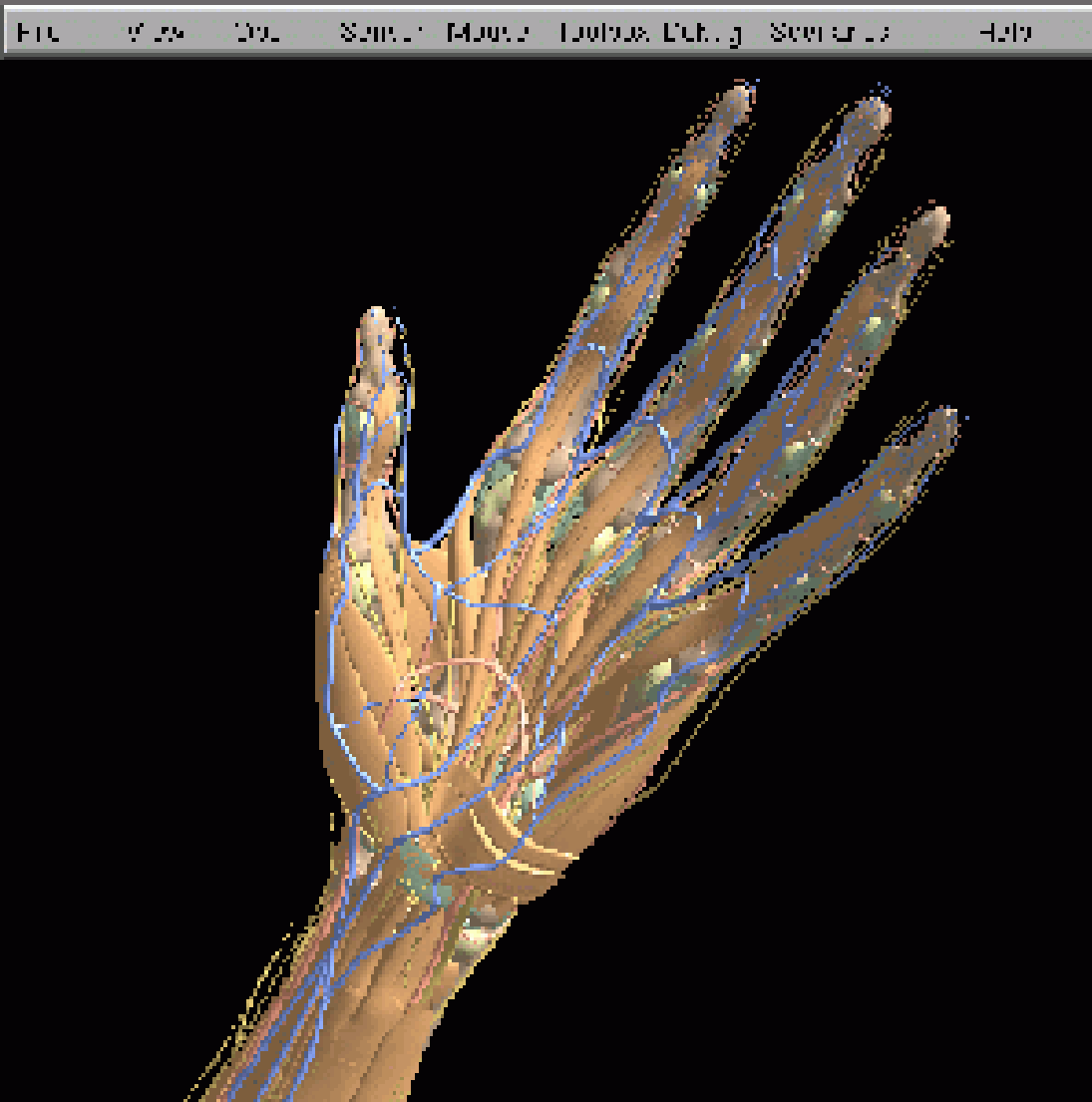
California Orthopaedic Research Network

- High bandwidth human interaction
- Low latency virtual reality
- Reliable access to computational resources
- Secure retrieval of medical images and data

Source:
Parvati Dev
Stanford

New Instruments for Astronomy
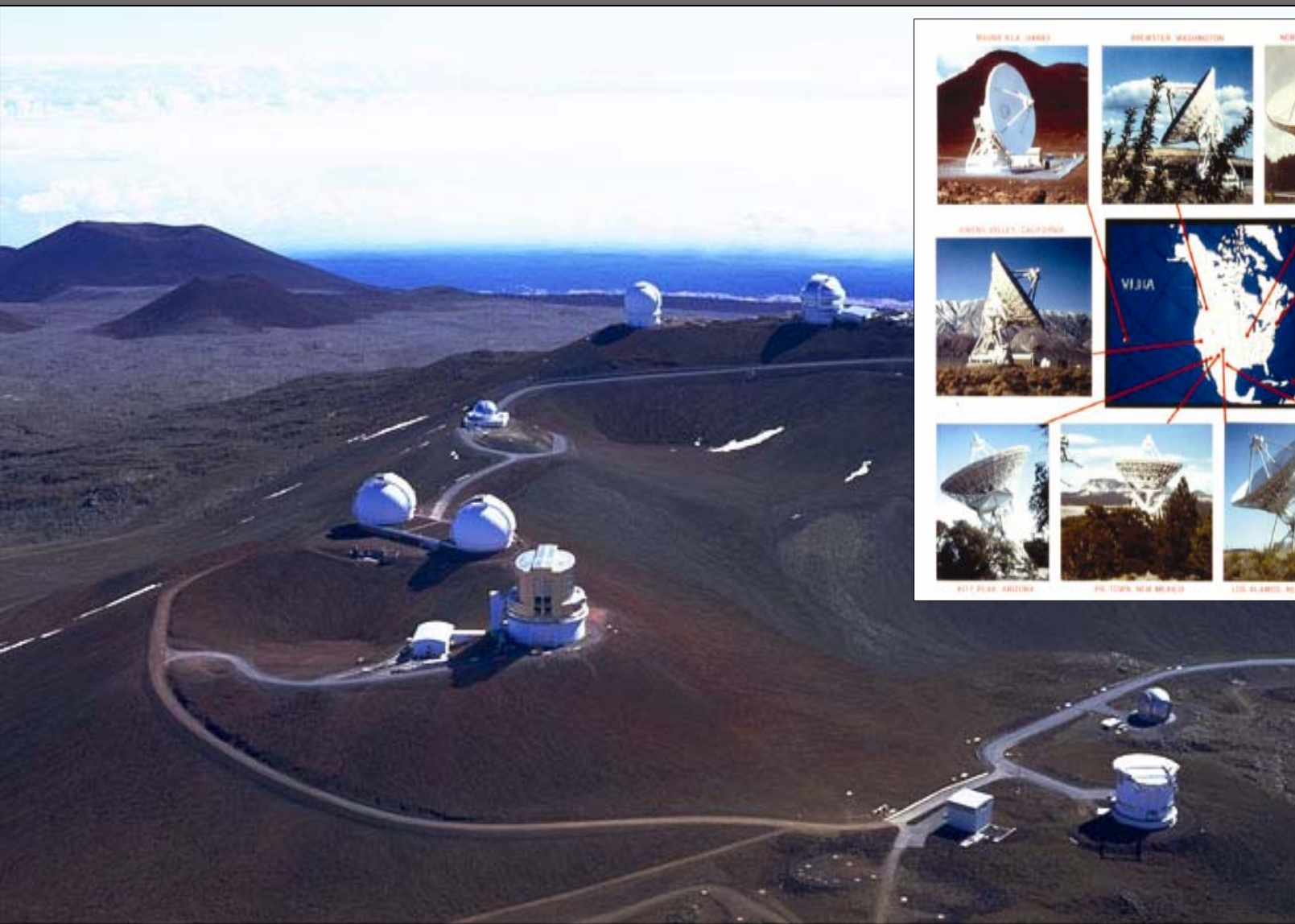
Undersea Oceanography

Images National Geographic

REN & Developing World

Connecting Developing World..

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

APAN: Asian Higher Education Highway Map

- APAN: Asia-Pacific Advanced Network
- Partner in TransPAC link
- Several national networks moving to 10Gbps
- APAN network made up of country-owned point2point links contributed to APAN
- Trans Eurasia and Trans Pacific connectivity increasing

Khan, ICCIT, Dhaka, 2007
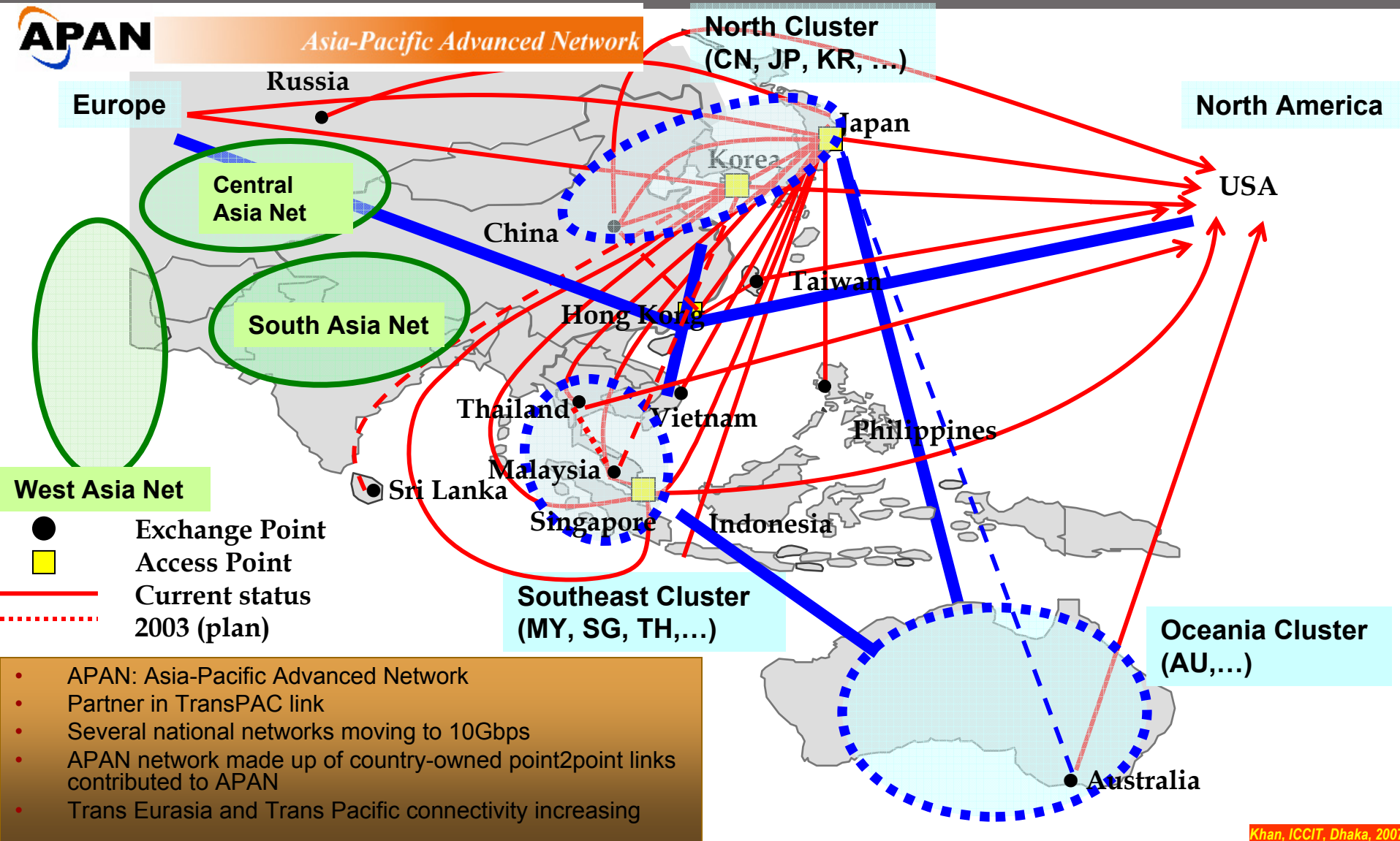
- The latest fiber now will connect South Asia with South East Asia RENs.
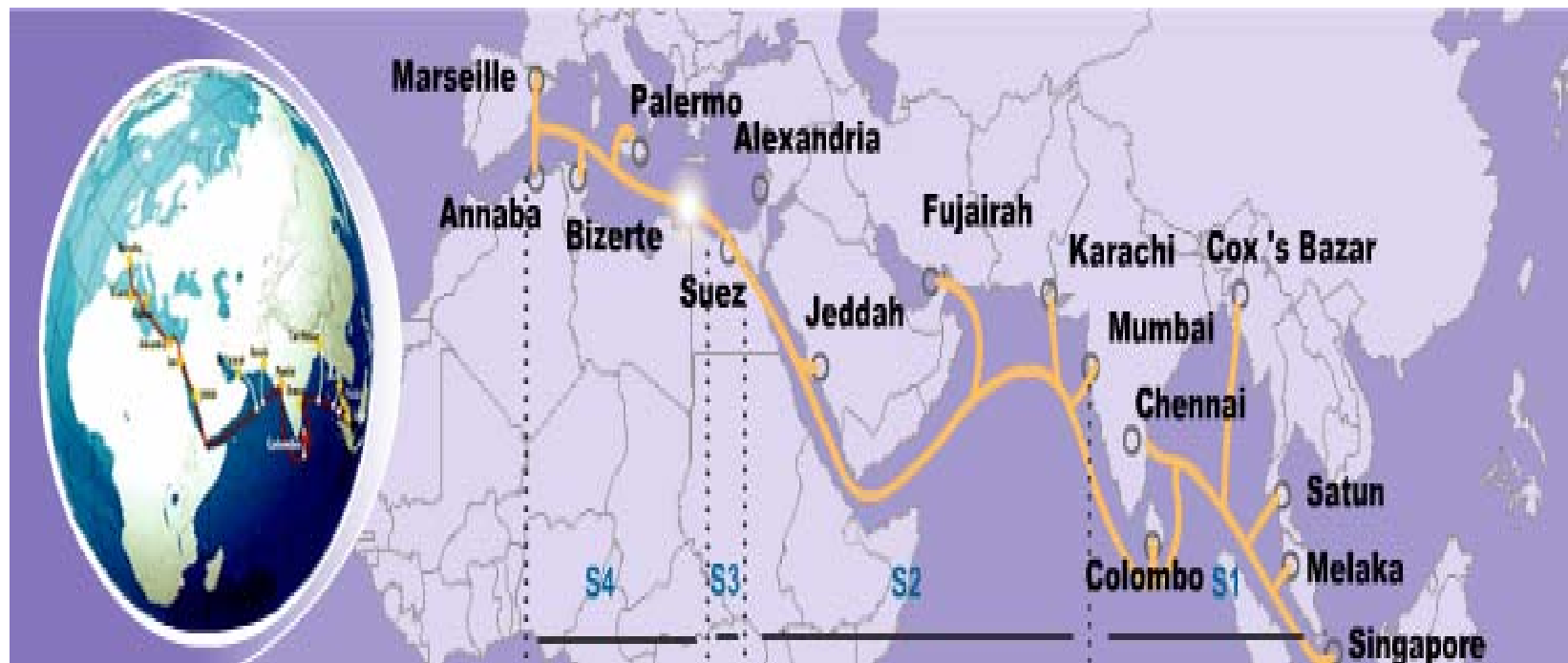
Latin America Higher Education Highways Map

▪During last 3 years, several firms have been building optical fiber rings in LA&C

▪Significant projects underway

•Opening exciting and new possibilities for cooperation in advanced technological and scientific applications
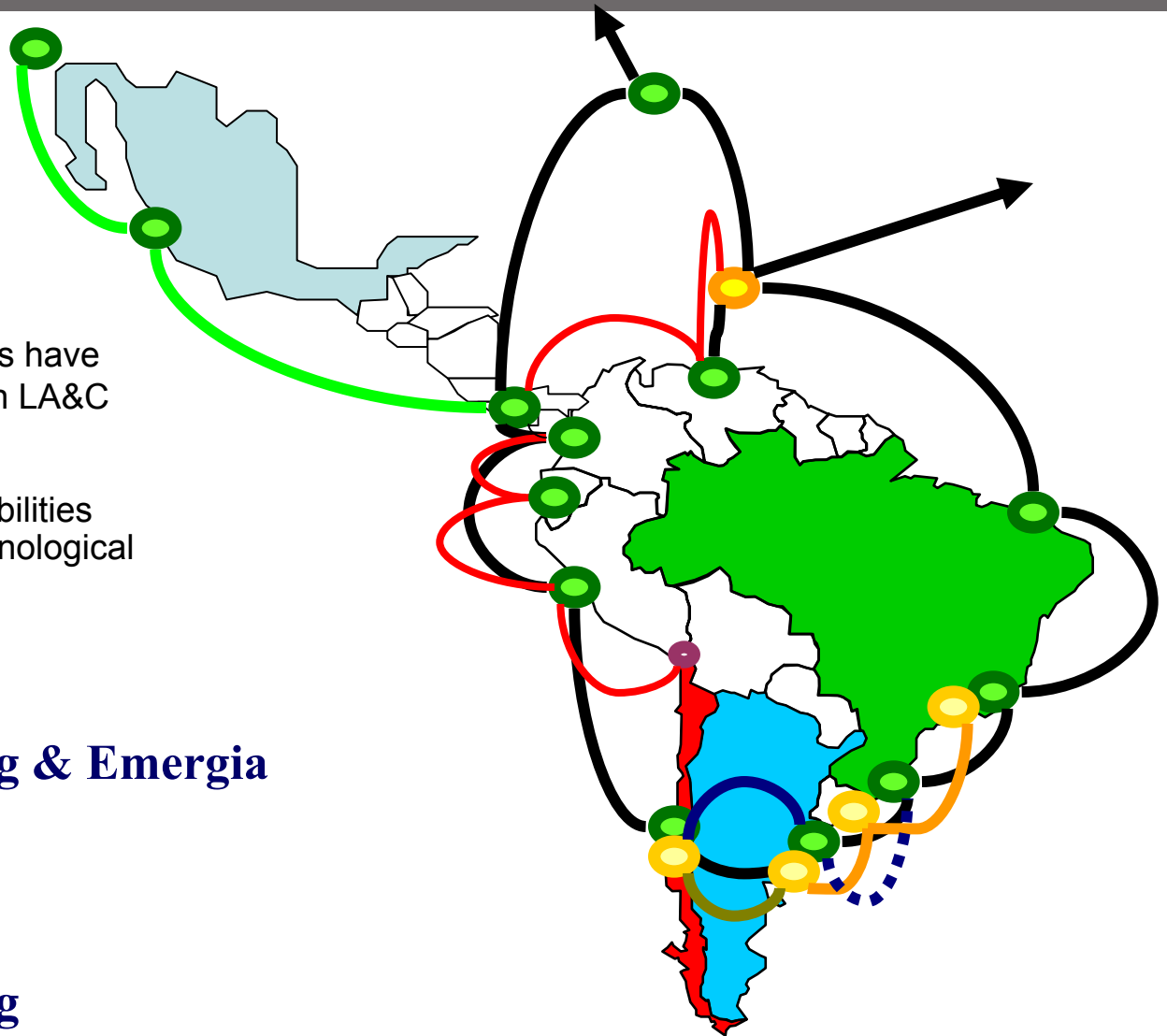
Panamerican
Global Crossing & Emergia
ImpSat
Transandino
UniSur
Global Crossing

Africa: The Left out continent..

- No dedicated R&E network connectivity from African continent
- Some national inter-university connections:
  - South Africa: Tertiary Education Network (TENET) *http://www.tenet.ac.za/*
  - Egypt: Egyptian Universities Network (EUN) *http://www.frcu.eun.eg/*
  - Morocco: Maroc Wide Area Network (MARWAN) *http://www.marwan.ac.ma/*

National Institutes of Health MIMcom project

- Satellite connectivity to malaria research sites in Ghana, Kenya, Tanzania *http://www.nlm.nih.gov/mimcom/locations.html*

Enabler REN Services

While developed world is marching ahead REN can also be used by developing world universities in their ways..

Future of Research & Higher Education

- 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 with 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.

Digital Divide & Basic Edge Services

- A developing world university can benefit more from RENs and specially from its consortium model.

- Many developing world institutions does not have even basic internet services (email for UG, user web-pages).

- A REN can provide cost-effective ways to rapidly bridge the digital divide:

  - Federated perpetual email.
  - Content hosting
  - Digital library access.
  - Publishing services/ Journal centers
  - National ICT desk & Training

"But...there is a growing digital divide between those who have access to the digital economy and the Internet and those who don't, and that divide exists along the lines of education, income, region and race.... The very information technology driving this new economy gives us the tools to ensure that no one gets left behind...."
-Bill Clinton, 1999

Cost Cutting Services and Applications

- National Digital Library Consortium.
- National Content Repository.
- UGC Hosted Digital Campus.
- National Courseware Repository.
- E-Learning/ Distance Education.
- Ubiquitous Conferencing.
- Laboratory Scheduling & Sharing.
- Cross-Institutional Degree Programs.

A look at REN Services:
Federated Digital Library

Grand Digital Libraries

- Grand projects are now underway to digitize all available books that mankind possess. Some estimate as much as 10 million books will be soon freely available on our desktops in few years.

- Some of the most valuable resources used to be available only to the limited scholars in the developed world. But now one can 'scroll' the intricate details of original **Diamond Sutra-**which its original printer Wang Jie "reverently made for universal free distribution on behalf of his two parents" in 868 AD, or literally 'turn' the pages of **Sultan Bayber's magnificent Quran** (digital library of British Library, 2005). Materials now can be made universally available irrespective of constraints of time and distance.

The library connects us with the insight and knowledge, painfully extracted from Nature, of the greatest minds that ever were, with the best teachers, drawn from the entire planet and from all our history, to instruct us without tiring, and to inspire us to make our own contribution to the collective knowledge of the human species. I think the health of our civilization, the depth of our awareness about the underpinnings of our culture and our concern for the future can all be tested by how well we support our libraries.
— Cosmos
Carl SAGAN

Anywhere Anytime Access to Precious Resources

- A copy of the **Diamond Sutra**, found sealed in a cave in China in the early 20th century, is the oldest known printed book, with a date of 868.[1]

- "Buddha has finished his daily walk with the monks to gather offerings of food and sits down to rest. One of the more senior monks, Subhuti, comes forth and asks the Buddha a question.

- What proceeds from there is a lengthy dialogue.. The Buddha is trying to help Subhuti unlearn his preconceived, and limited, notions of what reality is, the nature of Enlightenment, and compassion..

Digital Library Consortium

- Some of the publishers are very large organization. A federated approach provides higher education community leverage to negotiate better rates for contents.

- Avoid paying duplicate subscription for the same journals by multiple institutions.

- The REN provides fast access to the vast amount of digital education resources which are available worldwide- but can not be accessed otherwise.

- Information property is fast becoming a major commodity in 21st century. communities needs to maintain indigenous expertise to safe guard its financial and strategic rights and interests in this new world. National digital library will help in nurturing this safeguard.

Digital Library Consortium Models

- ## Developed World/ USA & Europe
  - Initiated by States, University consortium. (OhioLINK USA)
  - Major libraries are building electronic confederations from state sponsorship, to save and expand into new service.

- ## Developing World/ INDIA, Pakistan
  - Initiated by UGC/HEC
  - Only opportunity to reduce digital divide.
  - Huge capital saving initiative when most countries are facing rapid expansion of costly higher education need.

OhioLINK: Digital Library Alliance

- The Ohio Library and Information Network (OhioLINK) is a consortium of Ohio's college and university libraries and the State Library of Ohio. Serving more than 600,000 students, faculty, and staff and researchers at 85 institutions. OhioLINK serves faculty,

- Membership:
    - 17 public universities
    - 23 community/technical colleges
    - 44 private colleges
    - State Library System of Ohio.

- Assets:
    - Campus-based electronic library systems,
    - The OhioLINK Central Site and
    - Internet resources

- Six main electronic services:
  - A library catalog
  - Research databases
  - A multi-publisher electronic journal center
  - A digital media center
  - A growing collection of e-books, and
  - Electronic theses and dissertations center.

OhioLINK Library Catalog

- More than 44.8 million library items.
- More than 9.67 million unique master records from its 85 institutions..
- Supports more than 4,500 simultaneous users.
- Also available to outside users via the Internet.
- Offers user-initiated, non-mediated online borrowing through its statewide library catalog.
- Students and faculty have the ability to request items electronically while searching the catalog.
- Provides a delivery service among member institutions to speed the exchange of library items.
- Users can create portal to receive alert etc.

OhioLINK Research Databases

- OhioLINK offers more than 100 <u>electronic research databases</u>, including full-text resources covering many academic areas at varying levels of detail.

- Generally, the user can find out which OhioLINK members possess copies of the cited journal or link to the relevant full-text article.

- OhioLINK's electronic full-text resources include online dictionaries, literature, and journal articles.

- Access to the research databases is restricted to valid patrons at OhioLINK member institutions.

- OhioLINK <u>Electronic Journal Center</u>, a massive collection of full-text research journals.

- The EJC contains more than 6,400 scholarly journal titles from 80+ publishers across a wide range of disciplines.

- More than 4.68 million articles are downloaded each year from the EJC, with a total of more than 19.2 million articles downloaded since its inception.

Library & Digital Divide [1]

Table-1 Some National University Libraries Around South Asia			
Institution	**Books**	**Serials**	**DL**
Jauharlal Nehru University, India	500,000	800	Yes
Bombay University, India	700,000	n/a	Yes
Chepauk Library, Madras University, India	509,263	642	Yes
Calcutta University, India	800,000	795	Yes
Punjub University, Pakistan	442,300	N/A	Yes
LUMS, Pakistan	52,000	325	Yes
Quaid-i-Azam University, Pakistan	195,000	276	Yes
University of Colombo, Sri Lanka	400,000	970	Yes
Tribhuvan University, Nepal	n/a	n/a	No
Royal University of Bhutan	n/a	n/a	No
University of Malaya Library, Malaysia	1,239,749	3631	Yes
Maldives has no University	X	x	x
Dhaka University, Bangladesh	550,000	250	No

Library & Digital Divide [2]

- Potential benefits of digital libraries are more pronounced for the libraries of the developing countries.

- An average US university spends about US$ 5 million in journals and periodicals, about US$ 2 million in monographs. It has about 3-8 million books and subscribes about 22,500 serials, and it adds about 30,000 books per year [2]. These are astronomical figures (20-150 times more) compared to the ability of most university in the developing world. For developing world the cost of collection and archiving of traditional print media is becoming prohibitively expensive. Particularly, hard hit areas are cost of periodicals and technological journals. Many libraries are rapidly shrinking.

- Digital content reduces the cost to a library by a factor of ten [3]. A Federated model further shrinks the cost per institution. It seems developing countries can benefit more from the digital library technology. Digital technology might be the only way to narrow this access gap.

- **Connect the Supercomputers (and all other computing resources) on RENs!**

Expected Evolution of Grid

Country/Wide Area Service Grids
•Grid service infrastructure
•Issues below on a regional, national and global scale.

Distributed/Partner Grid
•Distributed enterprise, campus, metro environment
•Introduces inclusion of partner companies.
•Policy management, security, multi-site load balancing
•Increased CPU sensitivity to network latency.

Enterprise and Interdepartmental Grids
•Interdepartmental authentication policy, security, accounting.
•Additional features like load balancing.
•Distributed CPU coordination.

Cluster "Grids:
•Job scheduling and queueing on top of cluster servers

Inter-Grids
Long-term

Extra-Grids
Mid-term

Intra-Grids
Short-term

Clusters
Today

Value

Time

Arts & Humanities Unique Performance Events

In human rich developing world, there is perhaps lesser need of robotic doctors! Good quality students are available abundantly. Rather advanced medical knowledge and know how can move over the wire the other way.

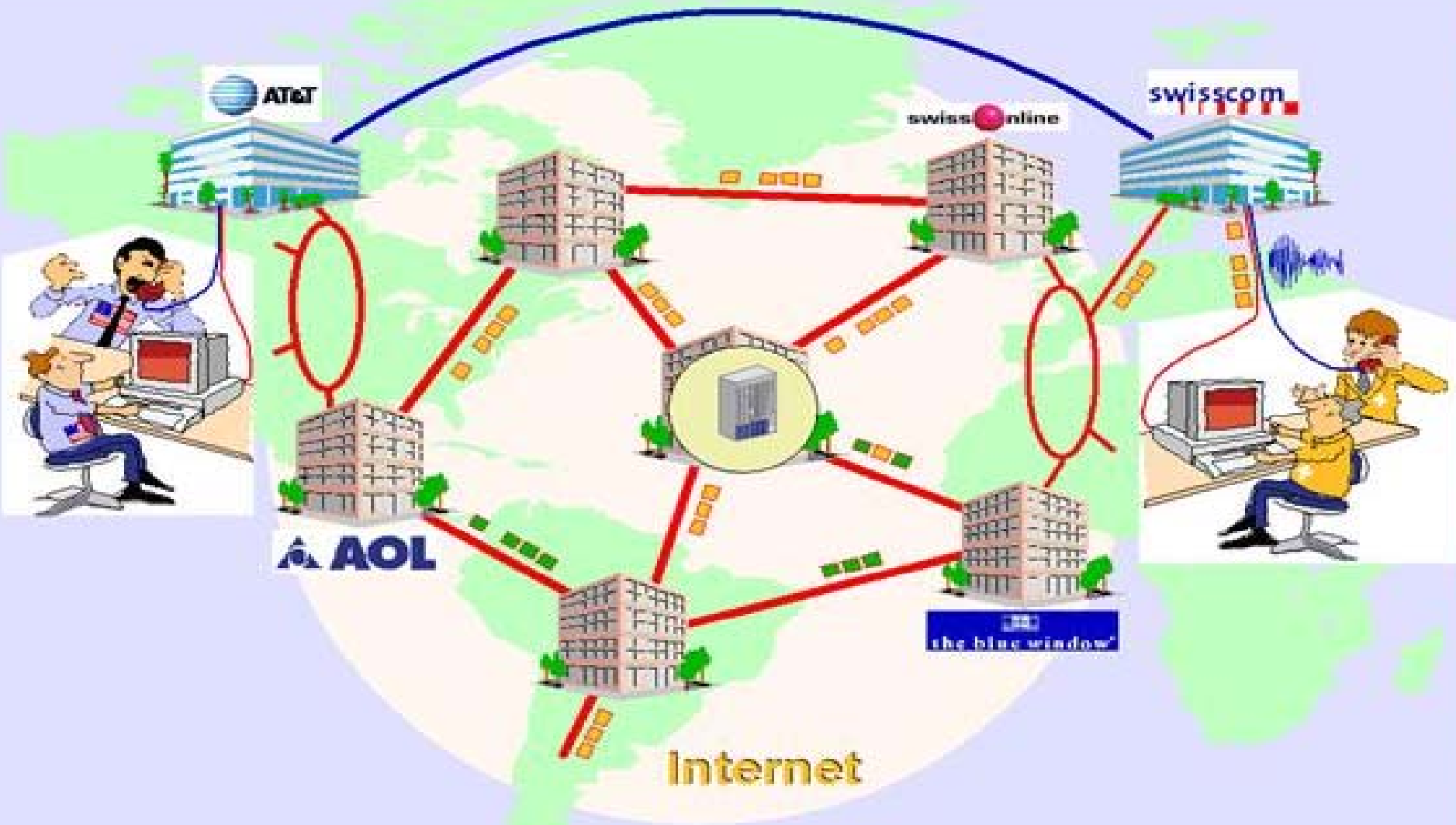- ◆ 3-D visualization of complex anatomical structures.

- ◆ Participants use ImmersaDesk™ systems to interact with 3-D anatomical model.

http://www.sbhis.uic.edu/vrml/Research/PelvicFloor/PelvicFloor.htm

University of Illinois at Chicago

Networked Higher Education
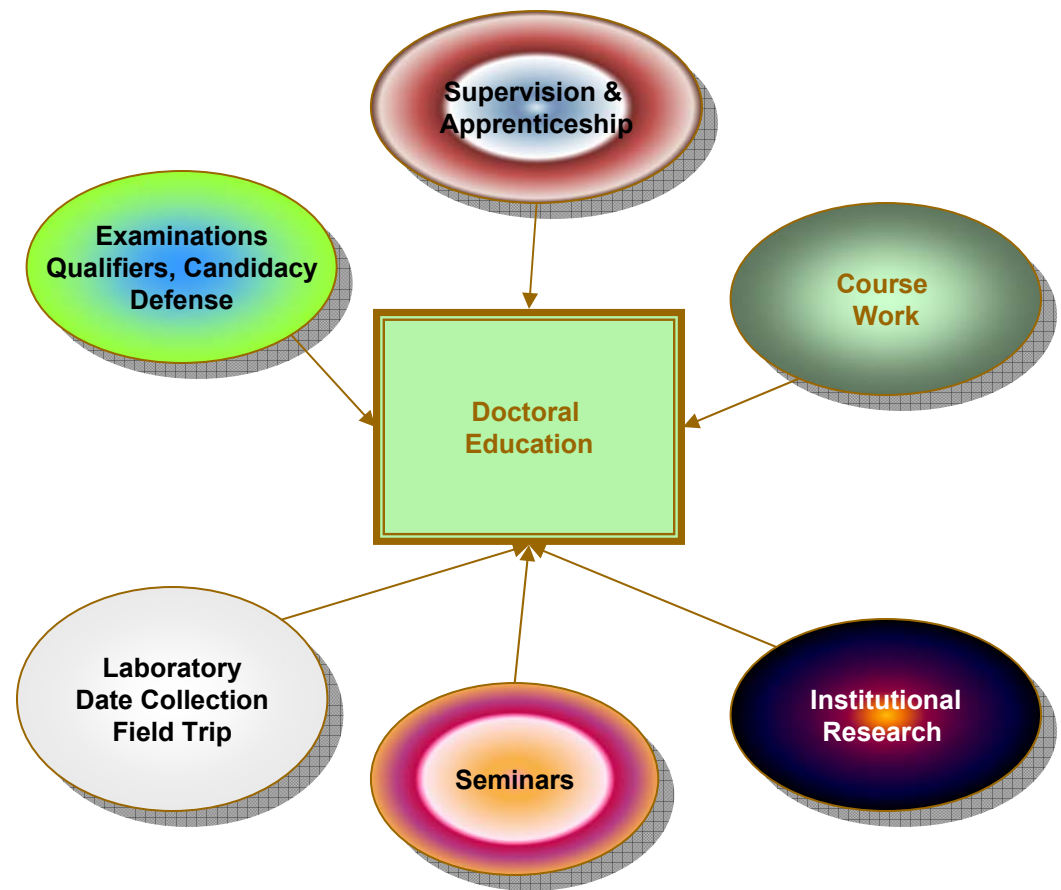
- Shift from student mobility to program and provider mobility—numbers of students seeking education in foreign countries still increasing, but more emphasis placed on delivering quality academic courses and programs to students in home countries

Category	Forms and Conditions of Mobility		
	Development Cooperation	Educational Linkages	Commercial Trade
People Students Professors/scholars Researchers/ Experts/consultants		Semester/year abroad Full degrees Field/research work Internships Sabbaticals Consulting	
Programs Course, program sub-degree, degree, post graduate		Twinning Franchised Articulated/ Validated Joint/Double Award Online/Distance	
Providers Institutions Organizations Companies		Branch Campus Virtual University Merger/Acquisition Independent Institutions	
Projects Academic projects Services		Research Curriculum Capacity Building Educational services	

COURAGE: Consortium of Universities for Research and Advancement of Graduate Education

- Peer-to-peer institutional mentorship for strengthening of curriculum and special degree programs.

- Multi-campus doctoral degree program working on problems of global relevance.

- Advanced special-topic course pool with faculty/expert teaming.

- Co-operative doctoral supervising by pooling experts from multiple campuses.

- Multinational research grant activity.

- Institutional bridge.

Supervision & Apprenticeship

Examinations Qualifiers, Candidacy Defense

Course Work

Doctoral Education

Laboratory Date Collection Field Trip

Seminars

Institutional Research

- Developing world universities must place strategic high priority on ICT & networking infrastructure to connect scholars, scientists, and researchers both internally and internationally to keep its higher education system at-par with the world.

  - However, ICT itself is not the goal it's a means to build a world-class technologically capable country.

- Higher Education not only Trade School
  - Don't be just the laborer but be the leader.
  - Go for the cream.
    - Use ICT to turn higher education system into an "industrial engine" to mass produce the top engineers, doctors, high skilled human capital for the world.

- Claim Back Lost Leadership in Many Areas
  - Environment?
  - Agriculture?
  - Developmental economics?
  - Digital archives for Islamic treasures?
  - Bengali treasure?
  - Asia-Pacific bio-diversity archive?

Bangladesh Perspective

BERNET Initiatives

- Bangladesh Education and Research Network (BERNET) proposed in 1997 and connected 2 with radio-links and 5 more universities with dialup links.

- BANSLINK..

- Both fell apart soon!

- BUET acquired its own VSAT and DU got BTTB as ISP… others on their own??

Fig: Organization of BERNET (using Radio Link).
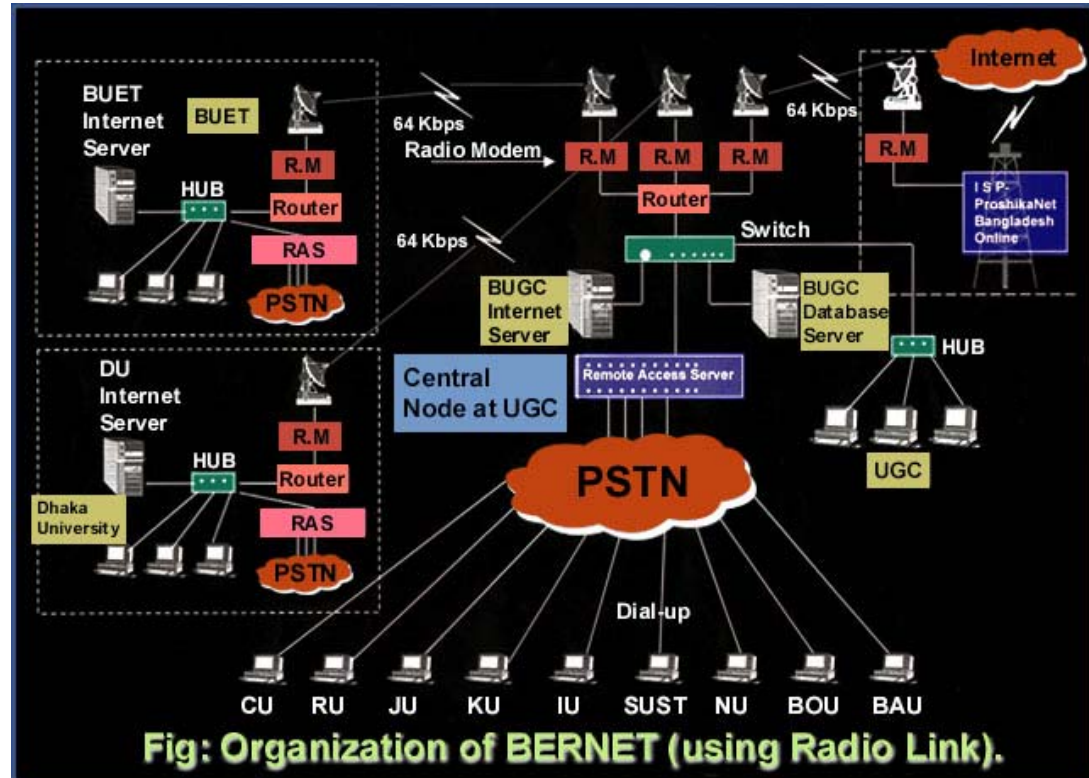
South Asia

Table-2 REN & HEI in South Asia [6,8]			
Country	**HEI**	**REN**	**DLC**
India	320 (university only)	ERNET	YES
Pakistan	110	PERN	YES
Bangladesh	104		
Myanmar	50	E-EDUCATION WAN	
Sri Lanka	27	LEARN	YES
Afghanistan	18		
Nepal	5		
Bhutan	1		
Maldives	0		

Universities

Students Distribution in HEIs

Legend:
- Public Universities — 10%
- Priv. & Int. Universities — 4%
- National University — 38%
- Kamil Maddrassas — 8%
- Open University — 40%
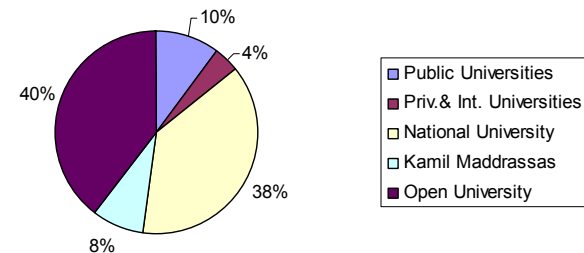
Table-3 Various Types of HEIs in Bangladesh		
Types	**Institutions**	**Students**
Public Universities [1]	19	112,327
Private & International Universities [1]	54	46,080
Public Medical & Dental Colleges [2]	14	
Private Medical & Dental Colleges	17	
Total Conventional R&D Universities	**104**	**158407**
National University Public & Private Colleges [1]	1596	416,646
Other Collages Affiliated with Public Universities [1]	1548	
Kamil Maddrassas [2]	147	92,000
Open University (National, Regional & Local Centers) [2]	1013	437,489
Planned Public Universities [1]	9	
Total	**4417**	**1104542**

R&D Institutions

Table-4 Advanced Research Institutions (ARI)	
Type of R&D Institutions	**Number**
Research Institute/Center-Agriculture	15
Research Institute/Center-Biology	7
Research Institute/Center-Energy	5
Research Institute/Center-Engineering	14
Research Institute/Center-Medical	15
Research Institute/Center-Weather	2
Research Academy	3
ARI Admintrative Centers	10
Collections-Major Library (Non-University)	7
Collections-Museum	8
Other Institutes & Centers	6
Total	**92**

Prime Application: Digital Libraries

- The libraries are completely at lost in the face of journal and text book pricing.

- The serial unit cost has increased by 188% between 1982 and 2004 at 2.5 times faster than the CPI inflation index. Western research university libraries kept up by doubling their budget [2]. But, in Bangladesh the universities simply dropped their subscriptions. For example, BAU reportedly dropped the number of titles from 700 to 200 between 1974 and 2005.

- None of the public (larger) universities have digital library access (3 projects underway).

- None could even afford the relatively low cost IEEE/ ACM type professional organization owned journals/ proceedings.

Collections in the Public Universities
(all but 2 have 10,000+ records)

Collection in Private University Libraries
(with 5000+ records)
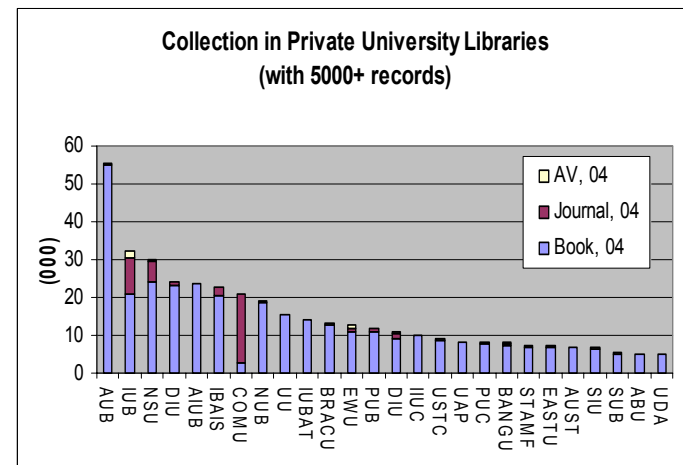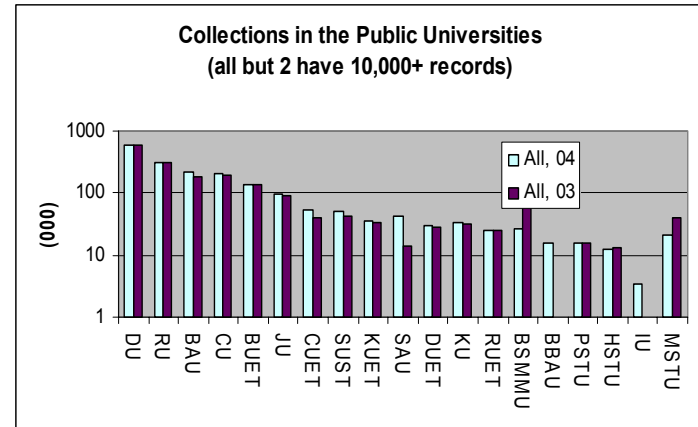
DLC for Bangladesh

- Both private and public universities should co-operate.

- Digital Library will be one of the master service over REN.

- UGC needs to provide the critical and visionary leadership.

  - UGC traditionally played minimalist role. Interestingly, now is the time and this is the cause to play an exceptional role. In consortium organization UGC need to be the prime mover, while the implementation and details can be shifted to distributed centers.

- Non initiative can be as detrimental to the nation as the SEA-ME-WE3 miss of 1990's, which put the country's back by a decade.

Suggestion: Bangladesh E-Library

- Build a Electronic Library Consortium which can provide electronic access to majority of Bangladeshi Universities.

- Organization model: consortium. Make it self-sustainable, member and UGC subscription driven.

  - For implementation choose non-profit entities comprising of professional/full-time and well-trained technologists and librarians.

  - Same for its operation. But create business processes so that ever it remains adaptive and receptive to members.

  - Looks complex? working model is available in too many countries!

DLC: Points to Remember

- Power of Consortium = Size of Network^2:
  - Include all or as many institutions as possible even if in phases. Avoid balkanization by few.
  - Include more people- think beyond the box- students, teachers, researchers, staff, even parents, community members, who else? (all will eventually contribute back in its sustainability).

- Success = Access x Access x Access
  - Just a storefront will not bring customers. The road to the store is equally important for digital libraries.
  - Service have to reach at ultimate end to end-user.
  - Should be accessible to a valid users from anywhere be it classroom, office, department, desktop, home, or abroad. (i.e. REN is vital).

DLC: Resource Priorities

- Resource is always limited.

- Contract immediately the vast amount of journals, contents, digital libraries around the world which are already available free or nominal costs to non-profit educational use. (list available at other RENs)

- Buy some even if it is expensive. Focus on most demanded, the ones which are already available, and the ones most sharable. Find a revenue model to pool money based of institutional need. Negotiate hard.

- For local content NOW is the most important time. Do not miss enlisting local proceedings/ journals those will come out in 2009 and onward.

- For PAST local contents work backward (most recent past year first) only if it **sharable by multiple member** institutions or it has **world class** value.

- Supersede the last rule if somebody else is willing to fund cataloguing.

- Avoid costly digitization and/or cataloguing when its digitized versions may already be available.

- Most international cooperation partners will shy-away if your ICT infrastructure is antiquated.

- Digital isolation will be extremely costly for high-ed institutions will eat away the core competency of the country.

Acknowledgements

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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

Thank you!