الجامعــــة الإسلاميــــة للتكنولوجيا
UNIVERSITE ISLAMIQUE DE TECHNOLOGIE
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PROJECT NAME: *Investigating the existing IT infrastructure of polytechnic institutes of Bangladesh and potentiality to get connected with Bangladesh Research and Education Network (BDREN).*

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Declaration

This thesis contains no material which has been accepted for the award to the candidate of any degree or diploma, except where due reference is made in the text of the thesis.

To the best of our knowledge the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Dedication

I dedicate this piece of work to my family and friends whose priceless support and encouragement have led to the completion of my course despite being thousands of miles away from them

-**Md. Ariful Islam**

I dedicate my work to my family and many friends. A special feeling of gratitude to my loving parents, brothers and sisters whose words of encouragement are always with me. I also dedicate this work to my many friends and everyone who have supported me throughout the process. I will always appreciate all they have done.

- **Md. Tofael Alam Siddiquee**

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Chapter 1

1.1 Introduction

Bangladesh is a developing country of the modern era. As the world is moving forward, Bangladesh has also got the flow of it. As a result many technical institutions are established here under the maintenance of government as well as private personalities. Though technology is very much available to the western world, we are still lagging behind due to our illiteracy. We didn't know about modern technology which can change our destiny. The condition is so worsened that some of the university can't provide Internet facility. We all know that ours is an age of Internet. Except this we cannot think of our development. Though some initiatives have been taken so far, it is not done in a properly managed way. So, we are not getting the advantage of latest initiatives. For developing IT infrastructure, Research and Education(R&E) is very much important. In Bangladesh this thing is done by BDREN under the supervision of UGC.

Among the South Asian countries, Bangladesh has taken the initiatives at last. But the initiatives are so slow that we couldn't see it's outcome. To provide better outcomes we need to think in a managed way. For this our solution is BDREN and it's proper and disciplined use throughout the country. If we implement this, our country will be one of the most successful countries in the world.

1.2 Goals of the project

> ➢ To establish a network among all government polytechnic institutes and provide high speed internet facility.
> ➢ To increase the quality of Technical education
> ➢ Internet Connectivity is vital for the survival of any modern educational institution. To connect all polytechnics with Bangladesh Research and Education Network (BDREN) to meet the needs of academics, teachers, and students who need to share information and facilities
> ➢ Improve access to national and international research networks and knowledge resources

1.3 Objectives of the project

> ➢ To establish a national network among all government polytechnics for interconnecting key scientific and engineering education institutions at national, regional and international levels
> ➢ To provide a low cost communication platform with adequate bandwidth and high service level
> ➢ To provide low cost access to national research networks and knowledge resources
> ➢ To support replication, dissemination and scale up of local innovations and research results
> ➢ To provide data center services for the participating institutions

- ➤ To build a sustainable model for sharing of infrastructures and computing resources
- ➤ To introduce a platform for knowledge management and exchange

Chapter 2

2.1 Problem of polytechnic institutes in Bangladesh

- ➤ No existing Network facility in Bangladesh polytechnic institutes, other than few private campus networks and institute specific ISP contracts.
- ➤ Inadequate collaboration and knowledge exchange between academic institutions, research stations and private sector.
- ➤ Government polytechnic institutions have no access to national and international knowledge resources and academic networks.
- ➤ They use only low bandwidth modem based or telephone line based broadband internet.
- ➤ The students of the polytechnics are only depends on the limited syllabus, they cannot access for more knowledge and information relevant trade or technology.
- ➤ Thought the students of the polytechnic institutes have relevant subject on internet technology and communication engineering but they cannot get the opportunity to access internet.

2.2 Government polytechnic institutes in Bangladesh

There are 51 government polytechnic institutes in Bangladesh. Most of them are near of city area.

SL	Name	District
1	Bangladesh Institute of Glass & Ceramic	Dhaka
2	Bangladesh Institute of Marine Technology	Narayanganj
3	Bangladesh Survey Institute	Comilla
4	Bangladesh Sweden Polytechnic Institute	Chittagong
5	Barguna Polytechnic Institute	Barguna
6	Barisal Polytechnic Institute	Barisal
7	Bhola Polytechnic Institute	Bhola
8	Bogra Polytechnic Institute	Bogra
9	Brahmanbaria Polytechnic Institute	Brahmanbaria
10	Chandpur Polytechnic Institute	Chandpur
11	Chapinawabganj Polytechnic Institute	Nawabganj
12	Chittagong Mohila Polytechnic Institute	Chittagong
13	Chittagong Polytechnic Institute	Chittagong
14	Comilla Polytechnic Institute	Comilla
15	Cox's Bazar Polytechnic Institute	Cox's Bazar
16	Dhaka Mohila Polytechnic Institute	Dhaka
17	Dhaka Polytechnic Institute	Dhaka
18	Dinajpur Polytechnic Institute	Dinajpur
19	Engineering and Survey Institute	Rajshahi
20	Faridpur Polytechnic Institute	Faridpur
21	Feni Computer Institute	Feni
22	Feni Polytechnic Institute	Feni
23	Gopalganj Polytechnic Institute	Gopalganj
24	Graphic Arts Institute	Dhaka
25	Habigonj Polytechnic Institute	Habiganj
26	Jessore Polytechnic Institute	Jessore
27	Jhenidah Polytechnic Institute	Jhenaidah
28	Khulna Mohila Polytechnic Institute	Khulna

29	Khulna Polytechnic Institute	Khulna
30	Kishorganj Polytechnic Institute	Kishoreganj
31	Kurigram Polytechnic Institute	Kurigram
32	Kushtia Polytechnic Institute	Kushtia
33	Lakshimpur Polytechnic Institute	Lakshmipur
34	Magura Polytechnic Institute	Magura
35	Moulvibazar Polytechnic Institute	Maulvibazar
36	Munshiganj Polytechnic Institute	Munshiganj
37	Mymensingh Polytechnic Institute	Mymensingh
38	Naogaon Polytechnic Institute	Naogaon
39	Narshindi Polytechnic Institute	Narsingdi
40	Pabna Polytechnic Institute	Pabna
41	Patuakhali Polytechnic Institute	Patuakhali
42	Rajshahi Mohila Polytechnic Institute	Rajshahi
43	Rajshahi Polytechnic Institute	Rajshahi
44	Rangpur Polytechnic Institute	Rangpur
45	Satkhira Polytechnic Institute	Jessore
46	Shariatpur Polytechnic Institute	Shariatpur
47	Sherpur Polytechnic Institute	Sherpur
48	Sirajgonj Polytechnic Institute	Sirajganj
49	Sylhet Polytechnic Institute	Sylhet
50	Tangail Polytechnic Institute	Tangail
51	Thakurgaon Polytechnic Institute	Thakurgaon

2.3 Statistics for the network infrastructure of some polytechnics

Here is statistics of some polytechnics as a representative of others:

2.3.1 Technical specification of the IT infrastructure of Dhaka polytechnic Institute

Name	Quantity	Specification
Computer LAB	4	Two Hardware and network LAB, One Programming LAB and One other
Computer	70(Running)	All are desktop, LAN and wireless connected
Server	1	All computer are connected with server by switch
Switch	10	4pcs are used in LAB
Router	3	Not used in network, for LAB test only
Cable	---	C5 and C6 cable
Bandwidth	1mbps	But student cannot access normally
Internet provider	----	Banglalion WiMAX

All departments are centrally connected via LAN. They are sharing resource by FTP server.

2.3.2 Technical specification of the IT infrastructure of Tangail polytechnic Institute

Name	Quantity	Specification
Computer LAB	3	One Hardware and network LAB, One Programming LAB and One other
Computer	50(Running)	All are desktop, LAN connected
Server	1	All computer are connected with server by switch
Switch	5	4pcs are used in LAB
Router	2	Not used in network, for LAB test only
Cable	---	C5 and C6 cable
Bandwidth	----	Students need permission to access internet
Internet provider	----	BTCL

2.3.3 Technical specification of the IT infrastructure of Mymenshing polytechnic Institute

Name	Quantity	Specification
Computer LAB	3	One Hardware and network LAB, One Programming LAB and One other
Computer	80(Running)	All are desktop, LAN connected
Server	1	All computer are connected with server by switch
Switch	7	5pcs are used in LAB
Router	1	Running
Cable	---	C5 and C6 cable
Bandwidth	----	Students need permission to access internet
Internet provider	----	BTCL

2.3.4 How it attains overall development of polytechnics:

From the above statistics we can view that in every institutions many networking facilities are provided. Connecting through BDREN we can make the best use of the resources which are provided by the govt. Moreover students and teachers can be able to learn and teach themselves. This will create a great revolution to our overall improvement. By helping others people can be help themselves. In this way we can be able to upward in our modern development.

2.4 What sort of plan we are proposing to improve our condition using BDREN:

As we have a lot of educational institutions, our first task is to connected among themselves so that they can help themselves and can be able to use high speed net facilities. As sharing facilities are provided, people can be very much concerned about the latest technological changes. There can be some sort of technical zones like medical, engineering, and agricultural through which specific interested students can take help from the expertise. Suppose some students can't know about programming. Some other university students can help them with the shared resources. They can upload lecture slides, tutorials, suggestions which can be used by students. It saves valuable time and money. We all know about distance learning. Using this our students can be able to taste best things. Using video conferencing we can remove the distance and make everything as close as possible.

Another thing is latest book facility. In university to know and to get clear concept about a thing we need to study a lot of books. These are not cheap. Through BDREN we can share latest books so that students have no option to look back.

2.4.1 How to achieve this using BDREN:

It is a huge task to provide service to the whole country. We mentioned that we have a lot of universities to be connected. It is not possible to do all the things over night. As a solution of the thing we try to focus on only to some specific field. We will try to explain about the improvements of polytechnics and TSC who are the worst sufferers.

Chapter 3

3.1 Understanding the Research and Education Networks:

Research and Education(R&E) networks are primarily designed to meet the needs of researchers, academics, teachers and students who need to share information and facilities. All around the world, R&E networks cost effectively provide the networking power to the researchers who need to innovate and collaborate.

It is a concept of European Commission for supporting regional networks. They provide network facility which is very much necessary in the modern days. They provide this sort of facility in Asia Pacific zone with minimum conditions. Under their guidance India, Pakistan, Srilanka and all South Asian country except Bangladesh became successful. They have their own NREN facility with managed functionalities.

The concept of NREN facility is not only to provide network facility but also to provide some resource sharing facility which is very much efficient and worthful. They provide some latest facilities like audio, video conferencing, resource sharing and good communication settings.

Bangladesh is not a rich country. It is still struggling against illiteracy. Though it is a over populated country, few people know about technology even they don't know about Internet. People have curiosity about Internet and they are confused whether it is harmful or not. Government has invested a lot of money to eradicate this illiteracy. But all efforts of govt. is going in vein because of proper handling. Now consider the scenario of our technical institutions. Are they becoming fit for

the struggle of the modern educated world? We have so many public, private higher level educational institutions. So far we have 26 public universities, 16 public medical and dental colleges, 53 private universities, 30 private medical and dental colleges . Moreover we have 49 public polytechnics, more than 300 private polytechnics, technical school and college (TSC) in every district. In every level of higher studies there is no alternative of knowledge sharing which is done in developed countries. We are bereft of this sort sharing facility. Think about medical science, new, new things are created in every part of the world. For being coped up with this new things, our doctors need to be updated with this change. But the question is whether our doctors are getting the scope to update themselves or not. If we search in our medical sectors, we will see that they are far lagging behind. That is why there is no value of their certificate to the modern world. They have potential to improve themselves but they can't do that because of facility.

Now consider second scenario like IT sector. As our country is capital oriented, maximum people are trying to move Dhaka. Some facilities are provided here but are they sufficient? Consider some private institutions, they didn't use LAN. People get connected to the Internet with broad band connection and with the help of mobile operators. But they are too expensive to use for the students. Students need good and updated books which are very much costly and some are not possible to buy. So students are again lagging far behind in case of learning updating things of their perspective field of interest. As there is no good communication among universities, they don't know about one another's improvements. So, they neither compete nor help themselves. Even the students can't able to know the achievements of some students which can be very much motivating to themselves. We have potentials but we can't show as the scarcity of available resources. It is not true that all students will do better in every walks of

life. All students will do better only when they altogether help themselves. But doing this they should need some sort of good communication facilities. Besides other part of the country, the condition of Dhaka is much better. So, what about outside Dhaka?

Condition is very much worsened in rural areas. Though govt. has established educational institutions spending a lot of money and still they are spending. Like the city there is no facility of high speed broad band connectivity. Even they can't use the facility of mobile operators as because of the bad network connectivity. So is there any solution? Every year we are getting a lot of educated engineers, doctors, graduates. But are they really qualified to fit for the overall country's development. They are helping but if they become more updated with the modern facilities, they can make drastic change to our overall development.

Now consider our polytechnics and TSC, They are the worst sufferers. They are still studying the old things which can't help them to fight with the world. They are passing 4 years in there but it is seemed that all their times are a kind of wastage. For example a cse guy, passing out but don't know how to use Internet. They even don't know about email facilities. So this ages how to think about those sorts of people? So what to do. We are accepting this as our fortune or fight against the previous curse. As a people of modern age, we need to look forward to get rid of this great problem. Here BDREN shows the sign of hope. As this functionality is successful in some countries, we think that we can also be successful using this functionality.

There is particular interest in understanding the benefits that research and education networking brings to its users, its funders and to individual/member

institutions. This article provides some background information on R&E Networks- what they are, their origins, what drives their creation in the first place and the benefits they confer. A panel of DANTE (Delivery of Advanced Network Technology to Europe) people got together to shed some light on these important questions. They are Paul Maurice (GÉANT Senior Communications Officer), Helga Spitaler (Marketing Officer for TEIN3, EUMEDCONNECT2 and CAREN), David West (Project Manager for TEIN3, EUMEDCONNECT2 and CAREN), Michael Enrico (Network Planning Manager), Richard Hughes-Jones (Technical Customer Support Manager), John Chevers (Partner Relations Manager), Tom Fryer (International Relations Officer) and Domenico Vicinanza (Project Support Officer). This article draws heavily from above peoples' opinions, a review of existing R&E Networks' activities in North America, Australia, Europe and Africa coupled with the authors own knowledge and experiences of R&E Networks development in Asia.

3.2 What are Research and Education (R&E) networks and why are they so important?

R&E networks are high-speed data-communications networks that are independent of the commercial internet and are dedicated to meeting the needs of the academic and research communities. They allow researchers, teachers and students to share information electronically in a reliable and timely fashion and to work together effectively.

Researchers and students use the most advanced tools, techniques and applications to exchange and process often very high volumes of time-critical data quickly and

efficiently. They rely on the network to provide greater speeds, timely delivery and a very high level of resilience. Connections must be reliable and deliver defined and predictable speeds and quality of service. Dedicated R&E networks are designed to provide this essential capacity, reliability and flexibility.

"To improve the way we deal with disease, disasters and other natural challenges, we need to understand more about our world - how it works and how it's changing. If we're going to make life better for people, we have to learn to share our knowledge and our skills. The answer lies in working together effectively. R&E networking is important because it provides a platform that enables better cooperation, collaboration and integration within and between geographically dispersed research and education communities.

3.3 Who uses R&E networks?

R&E networks are primarily designed to meet the needs of researchers, academics, teachers and students who need to share information and facilities. Each country decides which groups will benefit from its national R&E network and many choose to extend connectivity and services to libraries, hospitals, laboratories and government organizations to enable tele-medicine and other interactive online services.

3.4 How are R&E networks organized?

The GÉANT network covers Europe and has high-speed links to regional networks in other parts of the world including RedCLARA in Latin America, TEIN3 in Asia-Pacific, CAREN in Central Asia, EUMEDCONNECT2 in North Africa and the Middle East and the UbuntuNet Alliance in Southern and Eastern Africa. GÉANT also connects to US (Internet 2) and Canadian R&E networks in North America, to China and to networks in other major research countries including Japan, Russia and India.

"You can think about R&E networks at three levels. Within a country, a national research and education network (NREN) links together some or all of the universities, research institutions, schools, hospitals and museums. This allows each institution to benefit from access to increased bandwidth and to share services and applications, working collaboratively on projects of national interest and concern. At the second level, NRENs join together to form regional R&E networks, greatly enhancing the opportunities for working together on health, climate or environmental issues of concern to more than just one country. There are now regional R&E networks covering most of the globe. At the final level, regional R&E networks are connected together to create new opportunities for large scale and collaborative global research. Access to the global R&E network fabric allows any student or researcher to connect to and work with any other, wherever they are in the world."

3.5 R&E networks providers

NRENs are not-for-profit organizations and are usually supported by public expenditure in each country. They provide R&E networks at a national level and co-operate to form regional level networks. NRENs fund their own in-country costs, contribute to the costs of the regional network they are part of and pay their share of global networking costs. In Europe, the GÉANT network links national R&E networks serving 40 million users in 40 countries and is managed by DANTE. DANTE is a non-profit organization, co-funded by European NRENs and the European Commission, and it works in partnership with NRENs to plan, build and operate R&E networks and to connect regional R&E networks to one another and to GÉANT.

The European Commission has also been instrumental in supporting the establishment of regional networks in other parts of the world, by co-financing projects to set up and operate regional R&E networks in co-operation with the NRENs in the region and transfer technical knowhow to help develop the skills necessary to sustain the programs in the longer term. TEIN3, CAREN and EUMEDCONNECT2 are current examples of this approach, with DANTE acting as project manager on behalf of the EC; RedCLARA is another successful example which has already become self-sufficient."

3.6 What technical features do R&E networks offer?

R&E networks are specially designed to meet the more demanding requirements of research projects. They avoid the congestion, delays, interruptions and limitations caused by overbooking and competing traffic on public internet services. R&E networks guarantee dedicated capacity and end-to-end support for time-critical research applications.

R&E networks deliver faster speeds and higher capacities in a more stable environment. This allows researchers and students to use data-intensive and time-critical applications such as large file transfers, computer modeling and simulations, application sharing, remote instrumentation and visualization as well as videoconferencing. R&E networks offer better quality connections, with far fewer delays, low packet loss, latency and jitter and the network is continuously monitored to ensure optimum performance.

3.7 What are the benefits of R&E networking for users?

New knowledge and understanding flows from successful research. The more closely researchers work together, the more quickly they can answer questions and find new approaches to resolve all kinds of problems. R&E networks make it easy to share information and knowledge that can improve many different aspects of our lives.

R&E networks are designed for research, not for gaming or online shopping. Research rarely comes in standard packages and a project's data collection, transfer and processing needs will vary throughout its lifecycle. With R&E networks, you decide what you need. Flexibility and scalability are built into services and applications that are designed by researchers, for researchers. You get a network you can rely on. R&E networks provide the bandwidth and reliability that large-scale and time-critical projects depend on. Because many R&E networks offer dedicated capacity, the bandwidth you need is guaranteed to be available over a resilient and uncontested network and you can reconfigure or re-scale easily to meet your changing needs.

3.8 What are the benefits of R&E networking for funders?

Research is our key to innovation. We rely on the scientific and academic community to make new discoveries and provide new insights that will help to improve people's lives. The European Community envisages a 'European Research Area' - a border-free research zone
that can make Europe the world's most dynamic and competitive knowledge economy by promoting innovation. By providing common access to the best technological tools, minds and resources, R&E networks around the world enable each place of learning to play its full part in addressing issues of concern to local, national, regional and global communities.

New users of R&E networks quickly see the benefits of increased bandwidth and new services. And the national governments that generally fund R&E networking gain immediate benefits too. For funders, cost clarity and control are always key

issues. R&E networking gives better visibility and predictability of both operating and investment costs and provides effective monitoring and reporting on actual performance. Through economies of scale, R&E networking offers a viable alternative to commercial internet services. In many developing countries, such as Vietnam, the combined purchasing power of regional networks has significantly opened up telecoms monopolies.

As well as improving cost effectiveness, R&E networks provide greater access to better services for more students and researchers and help to fulfill national education objectives. In developing countries, establishing an R&E network provides a framework for delivering on the United Nations anti-poverty Millennium Development Goals.

The benefits flow from the 'Economies of Scale1' that becomes achievable when you work together. In the same way that it makes sense for a country's institutions to take a common path to improve efficiency, it makes sense for countries to share the costs of regional and global networks.

Although it is not their main purpose, real economic and business benefits can also flow from setting up an NREN. Research networks can help boost a region's competitive standing and GDP by helping to retain the most talented researchers, securing the major investments made in educating and training them. R&E networks also help researchers play a fuller part on the world stage. An educated, more highly skilled workforce, backed by world-class networks is also more likely to attract interest and further investment from commercial sources.

Procuring networks and services on a national basis means bringing the benefits of collective purchasing power to institutions and universities. Using a similar

approach to deliver value for investment, DANTE, in conjunction with the NRENs, provides and manages R&E network connectivity within and between regions across the globe. Centralized network management, training, promotion, project management and support costs provide economies of scale and help reduce the need for expensive specialist staff in many 1 'Economies of Scale', in microeconomics, refers to the cost advantages that a business obtains due to expansion. There are factors that cause a producer's average cost per unit to fall as the scale of output is increased. "Economies of scale" is a long run concept and refers to reductions in unit cost as the size of a facility and the usage levels of other inputs increase locations.

Costs for all these common services are identified and apportioned between NRENs who pay an annual subscription.

Experience gained from R&E networking can provide a commercially-independent source of advice and guidance for governments to call on, aiding national policy discussions on use of ICT. Because R&E networks employ leading-edge technologies and techniques, best practice learned here can form a blueprint for networking in other sectors. R&E networking also allows you to play a fuller part in the global community. An individual institution – even an individual country – can find it hard to make its voice heard on the world stage. Affiliation to the R&E community gives every country a seat and a voice in an active and participative global forum.

To understand the value that R&E networks can bring, it's worth looking again at why the European Union (EU) has been so actively involved. The EU is the prime investor in GÉANT, which it sees as fundamental to its vision of the European

Research Area (ERA). The ERA is a border-free zone for research that encourages the development of excellence and coordinated research activity. GÉANT is also a key component of the EU's Lisbon Strategy, which aims to make Europe the world's most dynamic and competitive knowledge economy by promoting innovation. R&E networks are also fundamental to Europe's 'Digital Agenda' – the strategy to create a flourishing digital economy by 2020.

New research environments drive up productivity, improve the quality of the science performed and create synergies between dispersed research groups. GÉANT has helped to deliver the EU's European Information Society 2010 initiative helping to boost innovation and investment in ICT and establish an inclusive European information society that improves the quality of public services as well as quality of life. R&E networking is also crucial to the EU's 'Europe of Knowledge 2020' vision for university-based research and innovation.

If I had to sum it up in a sentence, I'd say that R&E networks cost effectively provide the networking power researchers need and give a single point of focus for closer control of your resources.

3.9 How are R&E networking costs decided?

Network technologies offer economies of scale that make the best performance and services affordable to everyone, but calculating and allocating network costs is complex.

In coming up with prices for NRENs participating in regional networking programs, not only circuit prices - which may vary widely between regions and countries - but also equipment and day-to-day running and support costs, including training, maintenance, repair and network management have to be taken into account and then shared between the NREN partners. In regional programs run by DANTE which are always managed on a not-for-profit basis, the EC typically bears a significant portion of these costs.

Like-for-like comparisons with public internet services are difficult to make. Generally speaking, by co-operating all members of the regional network benefit from the economies of scale. Although circuit costs vary considerably from place to place around the world, one of the advantages of regional projects is that they enable the highs and lows of circuit prices in individual countries to be smoothed across the members. For NRENs in developing countries this means more generous capacity and far higher quality of service than commercial providers can offer at the same price."

By contrast, in Western Europe which has been deregulated for many years, so much fiber has been laid down by commercial operators that aggressive price competition is common. National and regional R&E networks typically re-tender

every two to three years to take advantage of the competitive markets. Over the last 15 to 20 years we have found that the economies of scale gained by working co-operatively generally lead to benefits for all partners, while providing the congestion-free private internet service that is designed for and dedicated to all members of the research and education community.

3.10 What are the benefits of R&E networking for technical staff and decision-makers in individual institutions?

Taking a networking approach relieves many of the burdens that local administrators and technical staff routinely face, freeing them to concentrate on other activities that can add more value.

Applications run smoother and better and your users really notice the difference. The World Bank used the TEIN3 network to hub videoconferencing across the region for a global distance learning event and participants remarked on the higher quality sound and vision from those connected to R&E networks compared with those on standard links. That was much more than just a cosmetic change.

For local decision-makers, taking a network approach simplifies much of the usual complexity. Having an agreed strategic direction and a future-proofed operating platform helps to ensure that only compatible and interoperable investments are made. You gain cost clarity too - development planning and upgrade costs are managed centrally as are training, maintenance and support. Budgeting becomes simpler as running costs are predictable and recovered in an annual subscription.

3.11 In summary, what are the key uses and benefits of R&E networking?

R&E networks are primarily designed to meet the needs of researchers, academics, teachers and students who need to share information and facilities. All around the world, R&E networks cost effectively provide the networking power to the researchers who need to innovate and collaborate.

R&E networks are designed for research, not for gaming or online shopping. Flexibility and scalability are built into services and applications that are designed by researchers, for researchers. Individuals, institutions, countries, regions and society as a whole all stand to gain considerably from the further development and growth of world-class research enabled by world-class R&E networking.

Chapter 4: The Bangladesh Initiative

4.1 Background

University Grants Commission (UGC) of Bangladesh, On behalf of the Ministry of Education (MoE), is currently implementing the Bangladesh Research and Education Network (BDREN) under HEQEP with assistance from World Bank. It will be a high performance data Communications network providing connectivity among education and research institutions in both public and private sectors.

BDREN with its multi-gigabit capability aims to connect all universities, research institutions, libraries, laboratories, healthcare and agricultural institutions across the country and to support geographically dispersed academics, scientists and researchers with reliable access to high-end computing, simulation tools and datasets. With a view to implementing the BDREN backbone, recently UGC has made an IRU contract with Power Grid Company of Bangladesh (PGCB) Ltd. for its country-wide OPGW network. Backbone network of BDREN will be designed based on this optical fiber. BDREN will also be connected with other regional and trans-continental Research and Education Networks (RENs)(e.g., TEIN3). It will link the faculties and students of Bangladesh to the global academic community and learning resources.

BDREN will eventually be operated by a Non-profit Trust organization with a

board of trustees consisting of representatives from the universities/user communities, UGC, MoE and other members co-opted for their expertise and position in relevant organizations.

4.2 BDREN Objectives

- Building and operating a high bandwidth high availability secure network;

- Delivering networking excellence capitalizing on the latest technological development in networking, such as NGN, and hybrid technologies;

- Providing cost-effective & best in class Applications and Services 'through economies of scale';

- Connecting to International RENs, such as APAN, TEIN3, Internet2, Geant2 and participating to other world-wide NRENs associations, initiatives and forums;

- Attracting NRB scientists, engineers and researchers working in different disciplines from all over the world;

- Ensuring financial sustainability; and

- Fostering an innovative & stimulating work environment.

4.2 BDREN Vision

"To be an enabler for excellence in Research and Education by strengthening the quality of research, education, innovation and strategic collaboration in home and abroad"

4.3 BDREN Mission

- Provide efficient communication and dissemination of information within the education and research communities;
- Accelerate the development of the knowledge and information society;
- Strengthen Bangladesh's position as a recognized regional leader for research, education and development.

4.3.1 Driving Innovative Applications on BDREN

When the powerful network links through BDREN will be in place, researchers across country and Asia-Pacific will be participating in world-class collaborative research projects in areas such as radio-astronomy, distributed (grid) computing, telemedicine, climatology, crop research etc. Some of the avenues are described below for more clarity of the BDREN.

• Research Collaboration Bangladesh does not have enough resources to go through a trial and error method in adopting technology for the development in

education, economic research, agriculture, weather forecasting, e-commerce, etc. To make a collaborative research with various universities those have on demand technology can meet the growth of our quality research capability. Research collaboration refers to associated working of researchers to achieve a common goal. Research collaboration will offer several benefits such as intellectual championship, joint development of skills, effective transfer of knowledge and the improvement of potential visibility of researches. Recently, collaboration is prevalent in the research industry due to the increasing cost of conducting research, increased specialization demand and the growing significance of interdisciplinary studies.

4.3.2 Resource Sharing amongst Universities

The dawn of the twenty-first century came with a digital revolution and economic globalization. National Research and Education Networks have effort to develop and use ICT to foster institutional collaboration among and between administrative and academic communities. Lack of Internet access has denied Bangladeshi universities the latest research information, web-based learning, opportunities to be part of international research teams, and the ability to connect scattered campuses with video conferencing. To access university e-Library and e-Journals, sharing computer servers, numerical workstations, testing equipment's etc. through using this BDREN can overcome this demand.

4.3.3 High-Quality International Education

To face the challenges of globalization, raising the quality of our higher education to world standard is very important. The education system in Bangladesh is improving day by day to establish international standard education. Education institutes must have high speed internet access and rich educational resources to

meet the high-quality education. The set of activities that have successfully stimulated young-student interest in Science & Technology are science Olympiads - national and international contests in IT, mathematics and sciences such as computer programming, mathematical problem- solving, biology, chemistry, physics and agro-technology etc. Besides improving science visibility and teaching at all levels, these activities among and between educational institutes have been useful in many countries for discovering and cultivating young talents.

4.3.4 E-Learning through Virtual Classroom

 E-Learning constitutes an "electronically - based" tutorial, More simply, learning online or through CD/DVD type coursework rather than in a traditional classroom. In a short sense the use of technologies in learning opportunities is defined as e-Learning. Via live video links students can attend lectures held thousands of miles away. Similarly, virtual discussion session around specific topics through a series of talks streamed over BDREN and TEIN3 from various sites in home and abroad.

4.3.5 Tele-Medicine

The use of medical information exchanged from one site to another via electronic communications for the health and education of the patient or healthcare provider and for the purpose of improving patient care. Telemedicine includes consultative, diagnostic, and treatment services. Medical Universities connected to BDREN assists trainee surgeons throughout world to adopt complex clinical techniques, such as endoscopic surgery, by supporting interactive tele-surgical training. Enabled by the fast and stable network connection provided by BDREN, Digital Video Transfer System (DVTS) will permit high-quality streaming of a live surgery event in near-real time from an operating theatre to a remote classroom. By facilitating interaction with world famous medical teams, BDREN and TEIN3 give

an additional boost to the dissemination of best medical practice across the continents.

4.3.6 Crop Research and Agro-technology

Rice is the lifeline of Bangladesh and most of Asia. However, climate change and an ever-expanding population threaten food security not only in the region but elsewhere in the world. The main objective of the International Rice Research Institute (IRRI) in the Philippines is to help farmers improve their yields and thus sustain their livelihoods – a mission that calls for joint efforts across the globe and for high-performance networks, such as TEIN3, to facilitate data-intensive collaborative research. For instance, IRRI scientists join forces with their colleagues in other parts of the world to develop resilient, "climate-proof" crop varieties, a collaboration that requires the exchange of vast genomic datasets as well as the transfer of high-resolution geographic information system (GIS) data for vegetation analysis and yield forecast. BDREN will provide support to our scientists to these endeavors.

4.3.7 Socio-Economic Sciences

The international grid project demonstrates how an intercontinental network infrastructure can help social scientists to understand global market dynamics. Using grid technologies deployed over BDREN and TEIN3, researchers in Bangladesh can analyze distributed market data and use the results to develop predictive models of consumer behavior and upgrade them.

4.3.8 Disaster Warning and Weather Forecasting

The 2004 tsunami across the Asia-Pacific and subsequent natural disasters in Bangladesh have highlighted the need to improve hazard evaluation and early-

warning systems. BDREN along with TEIN3 will play a key role in the timely transmission of global meteorological data, which will permit faster local weather forecasting. In May 2009, for instance, reduced delays in the transfer of data from the German weather bureau to its counterpart in the Philippines, via the GÉANT and TEIN3 networks, resulted in correctly predicting the path of typhoon Emong, thus allowing timely, accurate and, ultimately, life-saving weather warnings to be given to the public. Thus by using BDREN, Bangladesh may predict some disaster and save life from natural calamity.

4.3.9 Post-Disaster/Earthquake Relief Efforts

In the aftermath of the catastrophic earthquake in Sichuan province in May 2008, researchers at the European Commission Joint Research Centre in Italy used the TEIN3 link to transfer high-resolution images of the stricken region to their colleagues in China to aid post-disaster reconstruction. Similarly, Bangladesh can do the same thing using the benefit of BDREN which will be connected to the TEIN3.

Chapter 5: BDREN Services

5.1 BDREN Basic Services

5.1.1 Generic Services

Internet, Intranet, Network Management Views, e-Mail, Messaging Gateways, Caching Gateways, Domain Name System, Web Hosting, Voice over IP, Multipoint Control Unit (MCU) Services, Video Portals, SMS Gateway, Co-Location Services, Video Streaming etc

5.1.2 Community Services

Shared Storage, e-Mail List Software Application, Authentication Service, EVO, Session Initiation Protocol (SIP), Collaboration Service, Content Delivery Service, International Collaborations with USA-EU-Bangladesh Grid etc

5.2 Network Operation Centre (NOC)

The BDREN Network Operation Centre (NOC), located at University Grants Commission of Bangladesh (UGC) in Dhaka, is the central management and technical operations for BDREN. It is the primary work space for BDREN engineers that utilize to monitor, manage and troubleshoot problems on its country-wide network. BDREN NOC offers oversight of problems, configuration and change management, network security, performance and policy monitoring, reporting, quality assurance, scheduling, and documentation by utilizing sophisticated network management, monitoring and analysis tools. BDREN NOC provides a structured environment that effectively coordinates operational activities with all participants and vendors related to the function of the network. The NOC provides one-stop centre facility for BDREN users, including:

- Manage helpdesk service to address and manage technical enquiries and issues

- Monitor traffic health status and utilization rate Ensuring continuous operation of servers and services
- Manage faults and incidents - single trouble ticket centre
- Provide technical assistance including application and services support to BDREN users
- Multipoint Video Conferencing service for BDREN users
- Manage and host web applications including BDREN website
- Assistance and Coordination of Programs, Meetings, Distance Learning
- Service hour : 7x24 hours
- 24 * 7 online chat support
- 24 * 7 phone support available

5.2 BDREN application

The BDREN Data Centre located at University Grants Commission of Bangladesh (UGC) in Dhaka is the central management and technical operations for BDREN. The BDREN Data Centre will provides one-stop centre facility for BDREN users, including:

- Dedicated Server Hosting
- Cloud Server Hosting
- Co-location Services
- SAP/ERP Services
- Backup Services
- Remote Database Support and Services
- Email Server Hosting
- 24 * 7 NOC Support and Services
- 24 * 7 L3 level support team availability to resolve service related issues
- 24 * 7 online access to monitor services and latency
- R & D to for consistent improvement and growth

5.3 Countrywide Virtual Classroom

BDREN is a platform for delivering effective distance education where teachers and students can interact in real time. This is especially significant in a country like Bangladesh where access to education is limited by factors such as geography, lack of infrastructure facilities etc. The network enables co-sharing of information such as classroom lectures, presentations and handouts among different institutions.

5.4 Virtual Library

The Virtual Library involving sharing of journals, books and research papers across different institutions, is a natural application for BDREN.

5.5 Sharing of Computing Resources

High-performance computing is critical for national security, industrial productivity, and advances in science and engineering. The network enables a large number of institutions to access high-performance computing to conduct advanced research in areas such as weather monitoring, earthquake engineering and other computationally intensive fields.

5.5.1 Grid Computing

BDREN has the capability to handle high bandwidth with low latency and provision to overlay grid computing. Some of the grid based applications are climate change/global warming, science projects like Large Hadron Collider (LHC) and ITER. BDREN will be the platform to realize many such innovative applications.

5.5.2 Network Technology Test-Bed

BDREN provides test-bed for testing and validation of services before they are made available to the production (commercial) network. BDREN will also provide an opportunity to test new hardware & software, vendor interoperability etc.

5.5.3E-Governance

BDREN acts as a super highway for integrating e-Governance infrastructure such as government data centers and networks. BDREN will provide bulk data transfer facility required for e-Governance applications.

Chapter 6: Joining BDREN

Joining the BDREN community involves becoming a member of BDREN and connecting to BDREN.

6.1 Become a BDREN Member

The first step in joining BDREN is to become a BDREN member. Its membership is open to all Public and Private Universities, Research and Innovation organizations that support them. Make sure you familiarize yourself with our BDREN membership categories, Network Access Policy and Acceptable Use Policy to determine:

- whether you are eligible to join
- what category applies to you
- your member benefits and expectations
- what you can use BDREN for
- membership fees

It is important that you contact us early on in your exploratory and decision making process. We will be able to help you understand what category you fit into and what this means for you.

6.2 Decide How You will Connect to BDREN

By default, all public universities are eligible to be connected to BDREN with free of cost and they must have to pay membership fee and specified bandwidth charges. But all private universities and organizations need to think about how you are going to connect to BDREN. One of the key differences in accessing BDREN is that unlike standard commercial networks, you need to get to BDREN. In other words, it is the responsibility of the private university member to arrange, manage and fund a network connection from their site to the nearest BDREN Point of Presence (PoP).

CONSIDER CONNECTION COSTS FOR PRIVATE UNIVERSITIES

In addition to the annual membership fee and bandwidth charges, there are commonly three cost components to a BDREN connection:

- Last mile circuit
- Edge router, support and maintenance
- One off connection charge

More detail on these costs is provided per connection type.

CONNECTION OPTIONS

The connection options available to you depend on the type of organization you are, and have been designed to ensure you get the best BDREN experience for your organization.

Chapter 7: Member Categories and Fees

BDREN membership is open to universities, research and innovation organizations in Bangladesh.

7.2 Categories of Membership

Membership to and use of BDREN is governed by our Network Access and Acceptable Use policies. Our member list shows you the current local BDREN community. Contact BDREN if you're not sure what membership category you fit into.

7.3 MEMBER

BDREN Members are the foundation of our community. These education and research organizations are spearheading the use and development of technology to accelerate their activities. The Member category includes:

1. Member - This is open to both public and private universities, and to Research Institutes who are undertaking or providing both education and research services.
2. Associate Member- This is opened to research institutions who don't provide education but involved in research works only.

7.4 PARTNER

Partners are usually private businesses that have a role in providing, coordinating or administering education or research. There are three classes of Partner:

1. Research and Education Partner - organizations (other than Members, Associates and Content and Service Providers) that are provide research, education, training or teaching services
2. Technology Partner - organizations conducting technology trials or pilots with BDREN members

7.5 CONTENT AND SERVICE PROVIDER

Content and Service Providers are any private business that wishes to provide content or services to BDREN members. What these organizations can do and access on BDREN is governed by our Content and Service Provider Policy.

Membership Fees and Bandwidth Charges

BDREN is a not-for-profit organization. Membership fees and bandwidth charges are invested in the operation and development of BDREN, services for our members and the efficient running of BDREN. Your contribution is complemented by UGC/Government/Donor investment.

The BDREN membership fee differs depending on your member type. Members will be invoiced by BDREN for their fees quarterly. The following fee structure may be applicable to its members:

Membership Fee (in BDT)	Bandwidth Charge (in BDT/MBPS/Month)	Value-added Service Charges(in BDT)	Other Charges
To be decided by the Trust	6,000 (it is start up but it will be finalized by the Trust)	To be decided by the Trust	To be decided by the Trust

Chapter 8: BDREN Network Infrastructure

8.1 Initial Phase Network

Initially BDREN connected six universities, University Grants Commission of Bangladesh (UGC) and Ministry of Education and providing them 45Mbps bandwidth link of TIEN3 and 60Mbps bandwidth link of BTCL. The connected Institutions are:

- University Grants Commission of Bangladesh(UGC)
- Dhaka University (DU)
- Bangladesh University of Engineering Technology (BUET)
- Bangabandhu Sheikh Mujib Medical University (BSMMU)
- Jahangirnagar University (JU)
- Sher-e-Bangla Agricultural University (SAU)
- North South University (NSU)
- Ministry of Education (MoE)
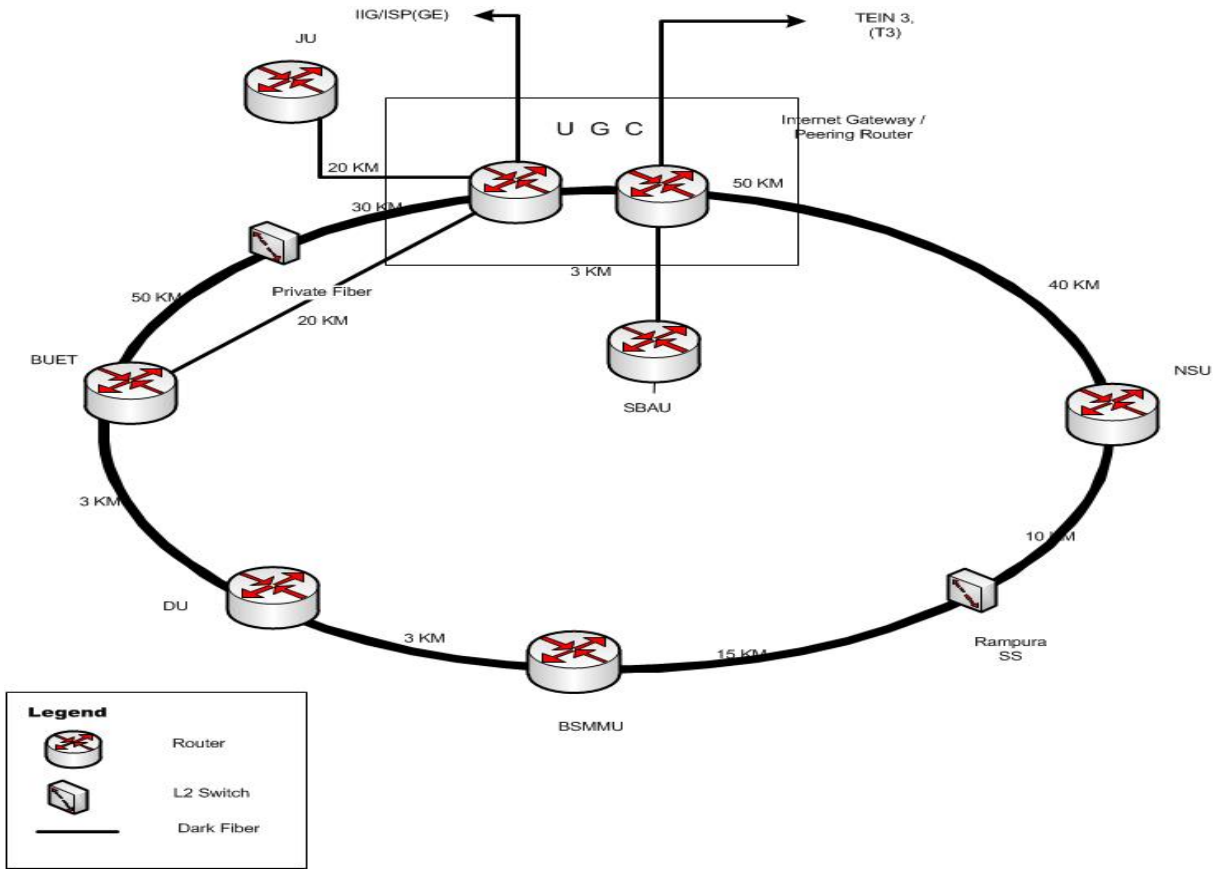
Initial phase diagram

Preliminary Dhaka Backbone (Just a sketch!)
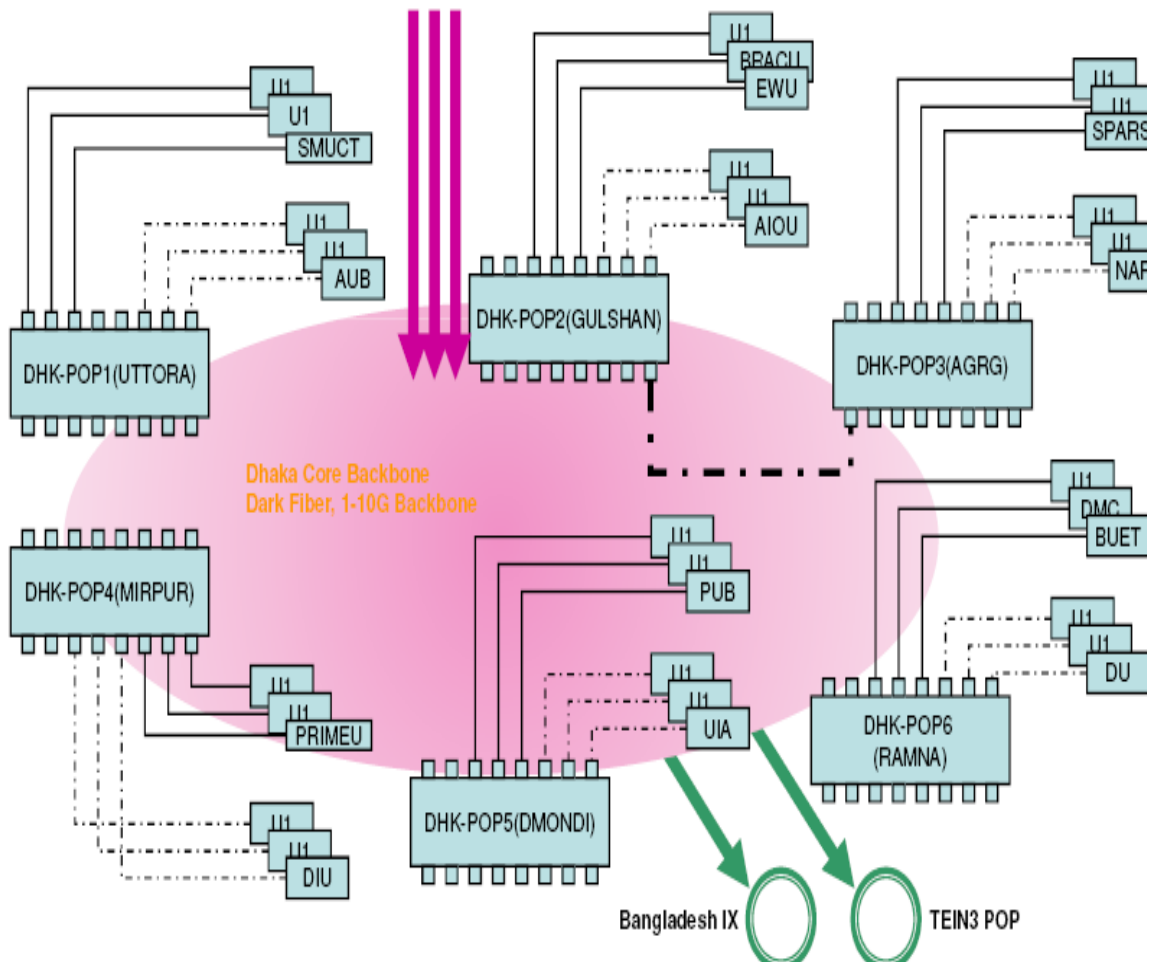
8.2 Domestic Network

BDREN currently connects six universities and research institutions throughout Bangladesh, via a nationwide IP backbone at 45Mbps capacity. With more bandwidth intensive applications and greater user demand, it is envisaged that BDREN will evolve from the current 45Mbps backbone to a larger scale network in the following phase. BDREN backbone is versatile to support all types of traffic. Our researchers are running and operating various applications such as video conferencing, digital video transport system (DVTS), data computing, and visualization/image modeling and e-learning. Therefore, it is important for BDREN to continue to deliver the quality performance required by the research communities.

Members are connected to BDREN via their respective access link, which can either be a fiber link or microwave link. The access connection varies according to the user's requirements. BDREN connectivity is centralized at BDREN Network Operation Centre (NOC) located in Dhaka.

## Point Of Presence Diagram:
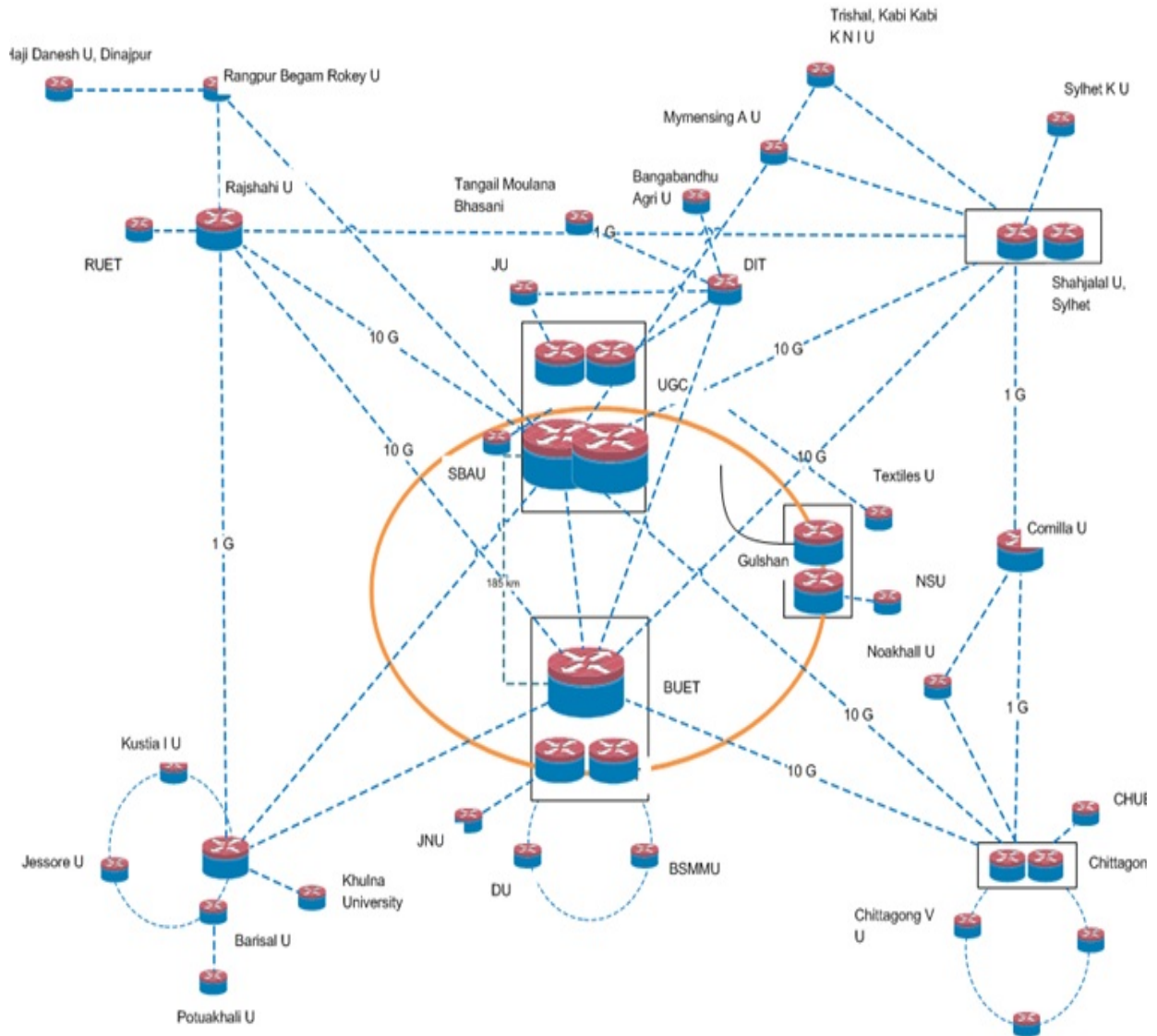
Chapter 9: International Network

BDREN is connected to several international research communities in Asia Pacific, Europe and North America, via the Trans-Eurasia Information Network 3 (TEIN3) and Internet2. The connectivity coverage includes Malaysia, China, South Korea, Japan, Thailand, Vietnam, Philippines, Singapore, Indonesia, Australia, Europe and the United States. Researchers connected to BDREN are able to communicate and collaborate with their counterparts overseas over the virtual work space at improved network performance and lower network latency.
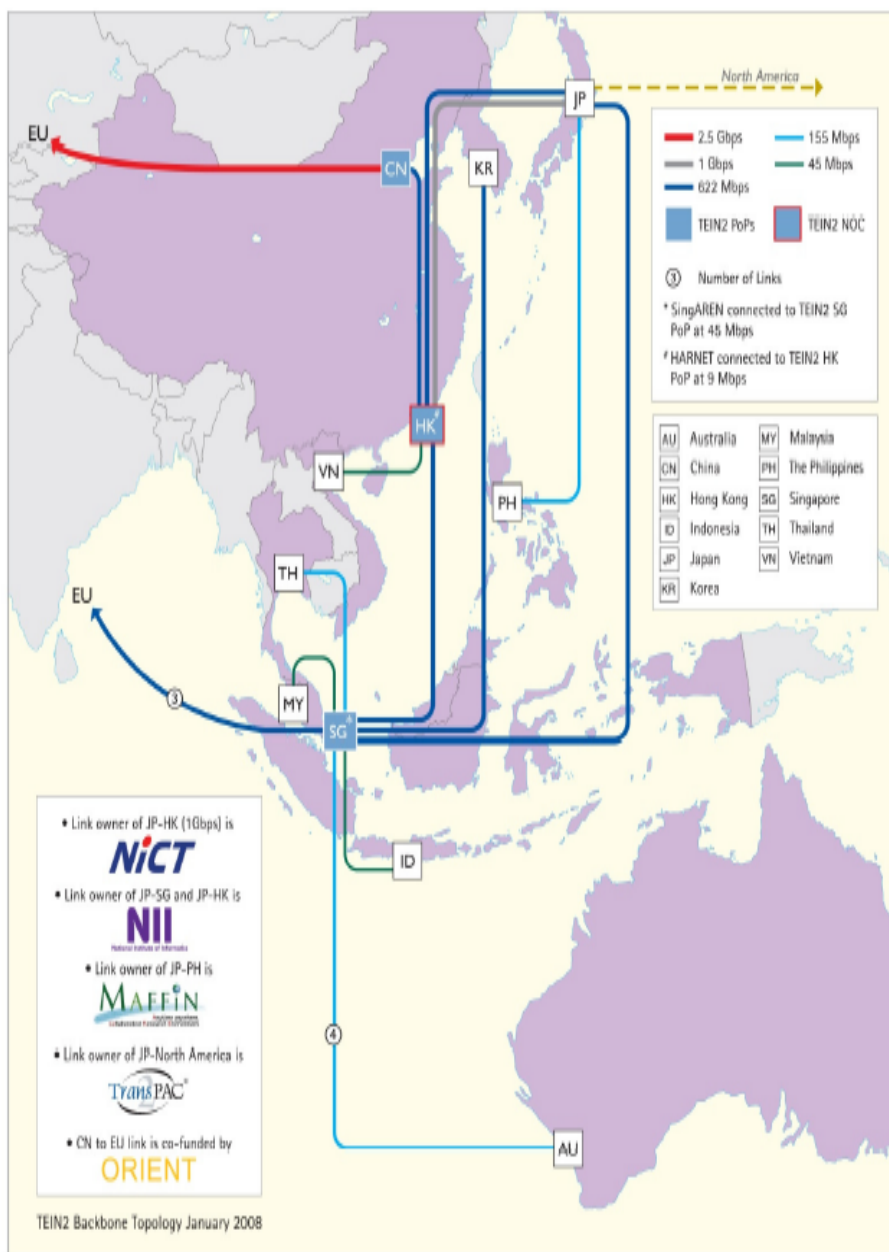
Diagram 1: International Network Diagram

Asia-Pacific Backbone Topology
by funding source
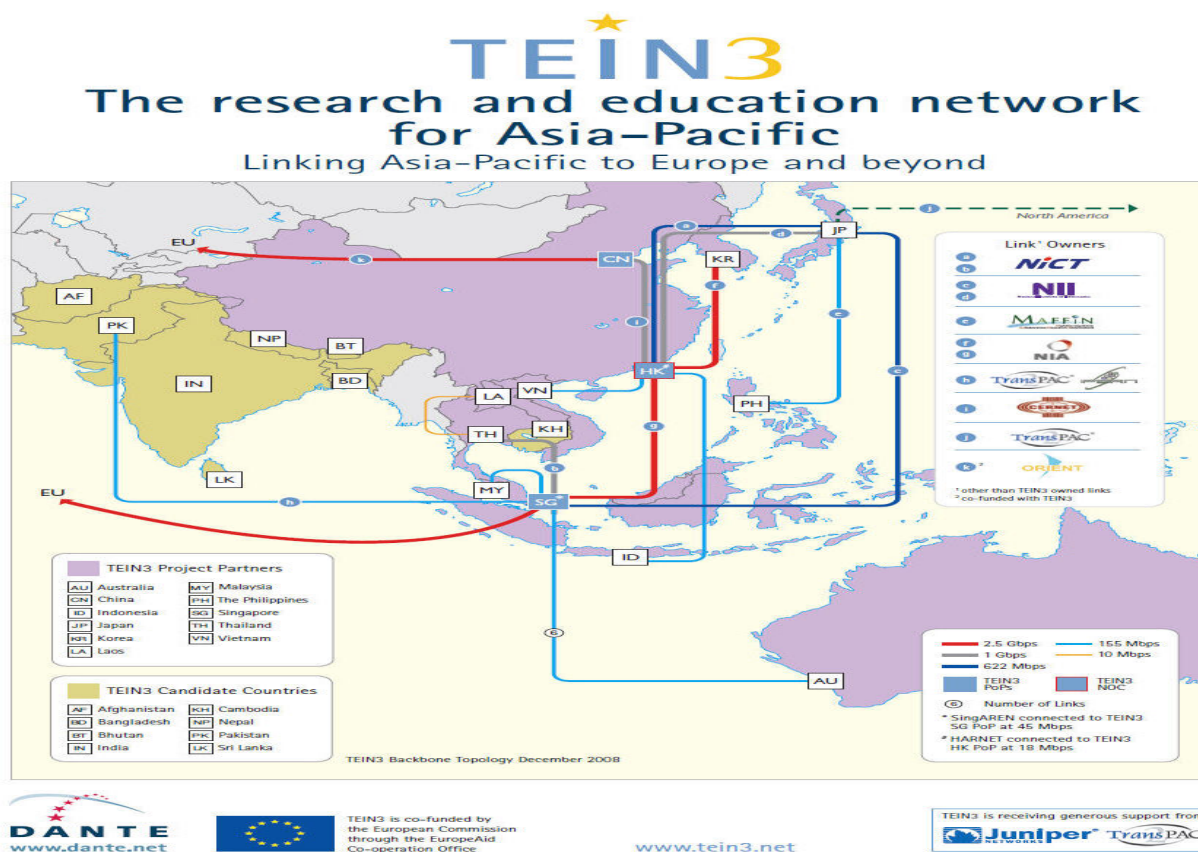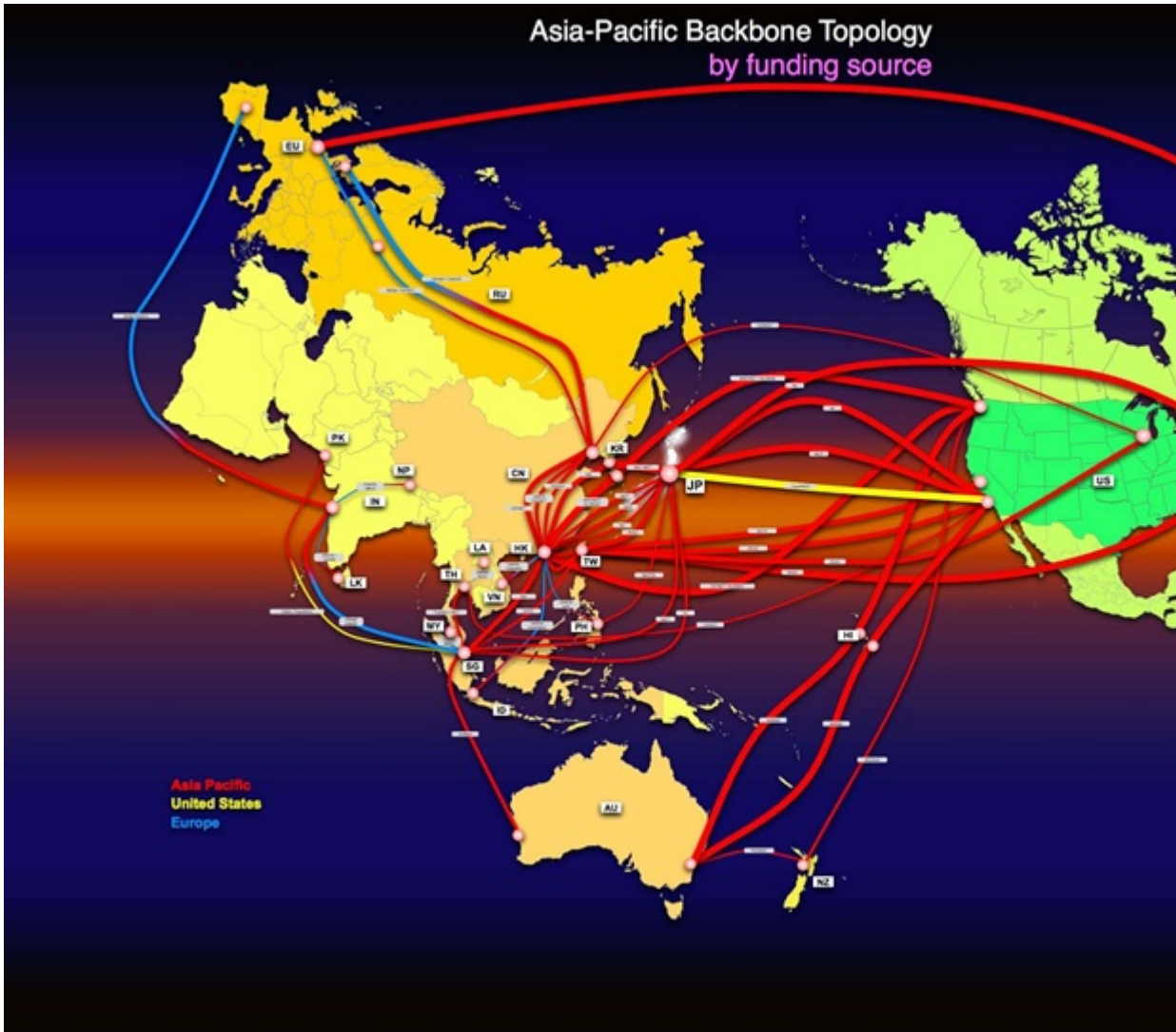
International Connectivity: Asia Pacific Backbone

Asia-Pacific Backbone Topology
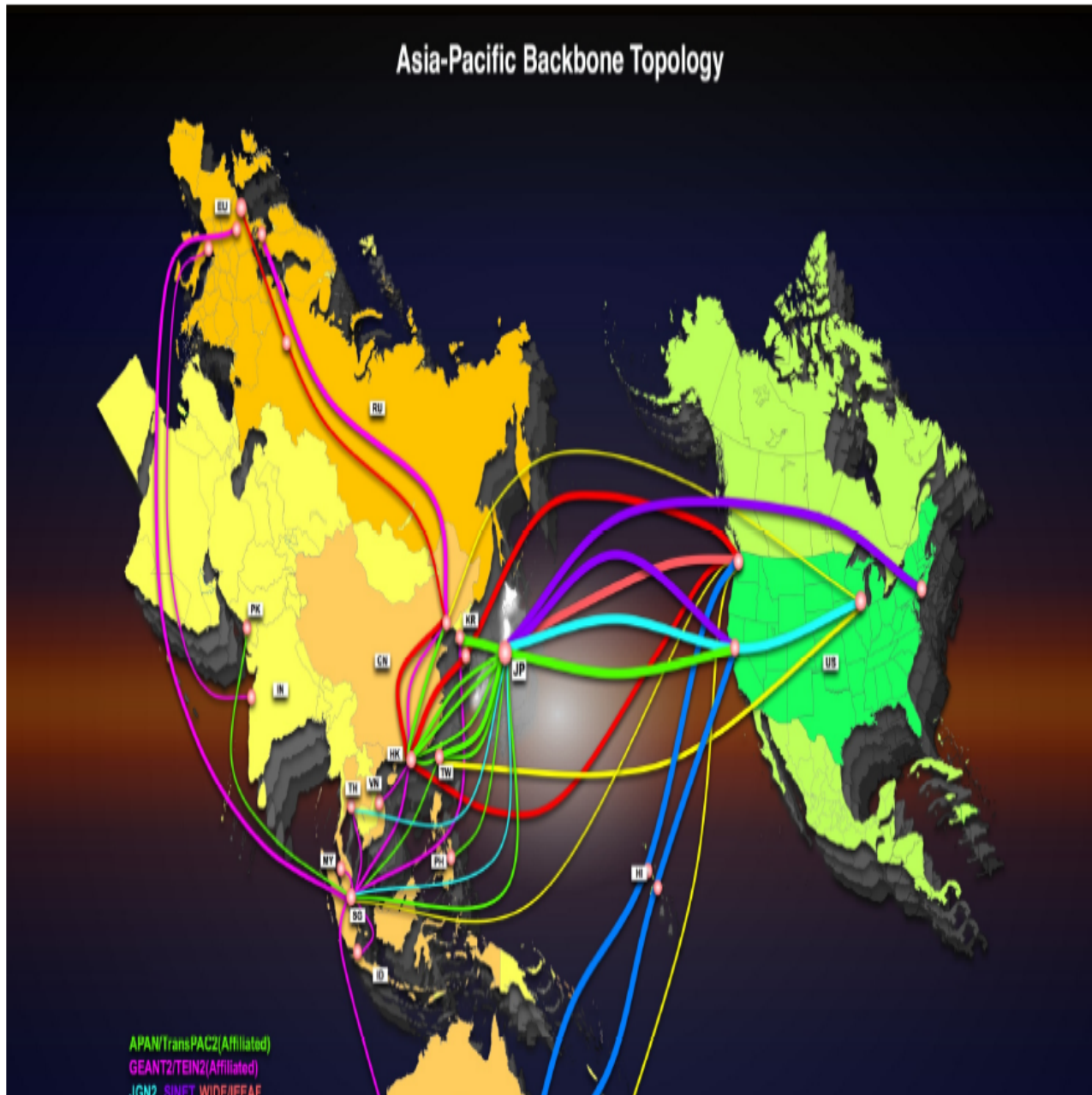
# International Connectivity: TEIN2 (South East Asia)

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)
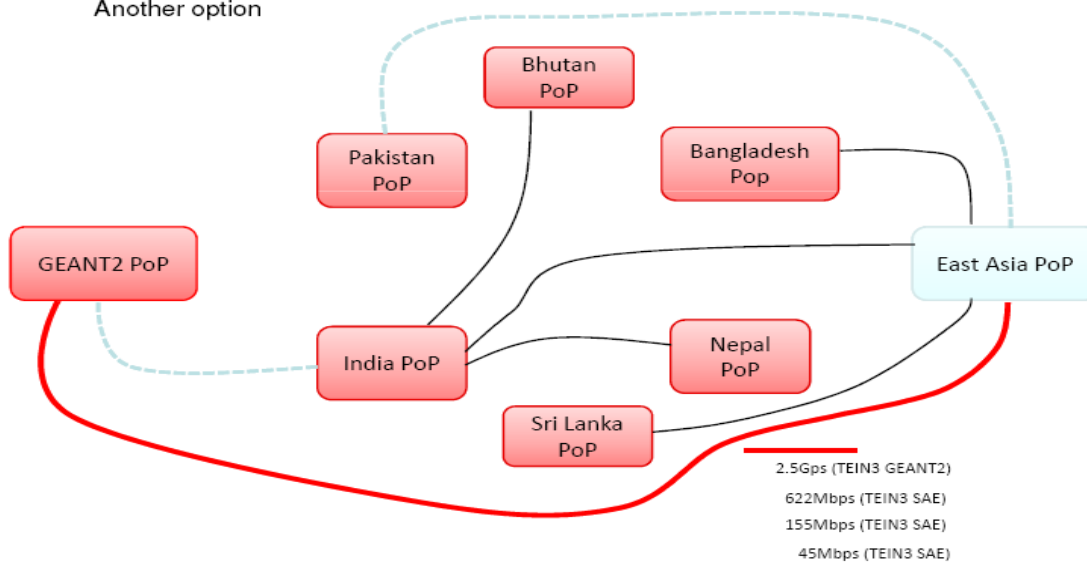The Republic of Singapore (SG)
Australia (through its NREN AARNet)

Transeurasia Information Network Initiative Proposed South Asia Integration Plan [1]

Option 1

2.5Gps (TEIN3 GEANT2)
622Mbps (TEIN3 SAE)
155Mbps (TEIN3 SAE)
45Mbps (TEIN3 SAE)
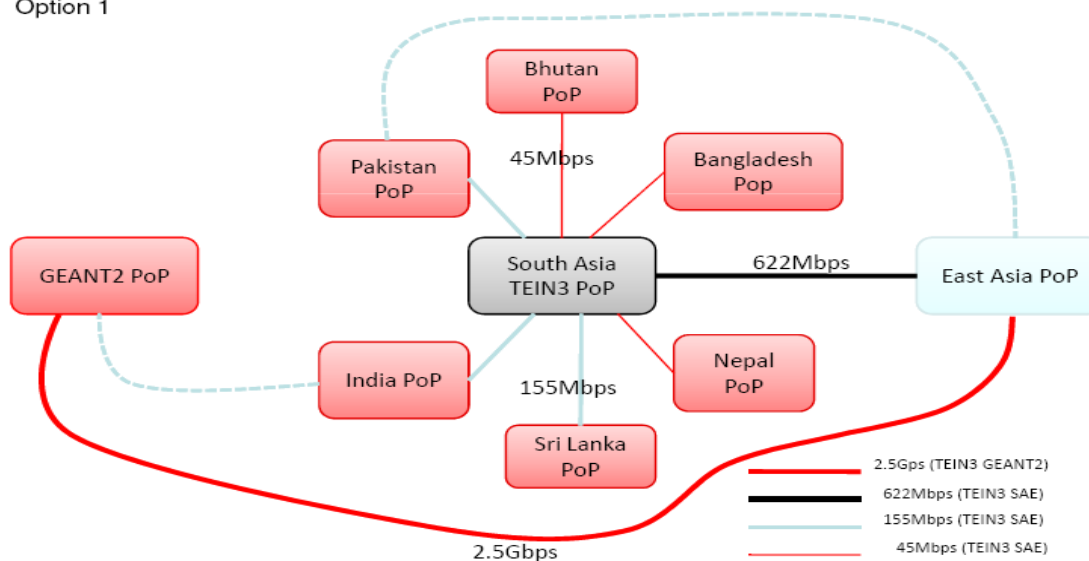
South Asia Integration Plan [1]

Another option

2.5Gps (TEIN3 GEANT2)
622Mbps (TEIN3 SAE)
155Mbps (TEIN3 SAE)
45Mbps (TEIN3 SAE)

Conclusion:

There presents a lot of differences than that of the past. Things are changing only because of the technology. With the help of technology, we can change our fortune. In case of learning, using technology is very much important and crucial. Here BDREN stands for us. It shows hope so that we can look forward. Connecting with networks doesn't mean connecting with a single man hence a community and in the broader outlook to the whole universe. Thus we can see the world within our eyes. So to say using BDREN, we will be sure to be successful to raise our head with dignity among the strong and developing countries.

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