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NRENs – Collaborations towards Success

Special Interest Group on Emerging NRENs

Forum for:

- Sharing information about current initiatives
- Sharing challenges, opportunities and successes
- Discussing possible roles for the Internet2 community

Regional Interest Groups

- Caribbean
- South Asia
- Middle East
- Sub-Saharan Africa
- Central Asia
- Pacific Islands

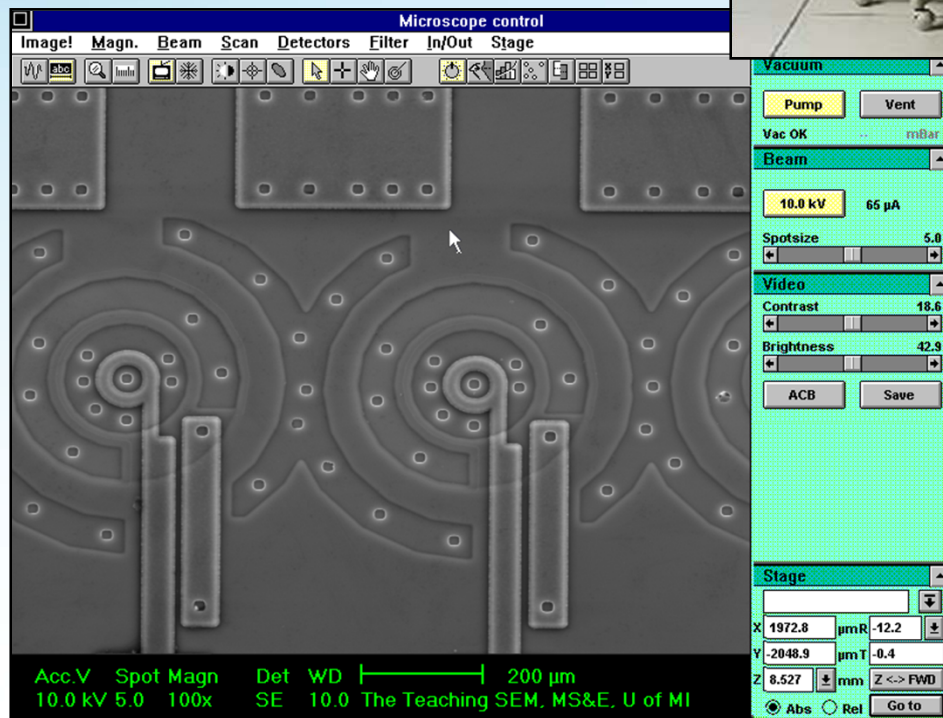
What are National Research and Education Networks (NRENs)?

- Interconnect a country's higher education institutions
 - Often include government research institutions, primary and secondary schools, libraries, hospitals, museums, other public institutions
- Provide a dedicated network
 - Separate from the commercial Internet
 - With dedicated connections to other countries' NRENs

Why NRENs?

- Pool demand, resources, expertise of the research and education community
- Optimize network infrastructure for particular needs of research, teaching, learning
 - Keep traffic local
 - Provide uncongested bandwidth
 - Provides services like multicast to support multi-way video-conferencing
- Universities developed the first World Wide Web
 - When www commercialized in 1995, universities quickly found themselves without sufficient bandwidth
 - In US, solution was the formation of Internet2

Sharing scarce educational, research resources



Expensive resources can be shared between institutions, across distance

- Laboratory instruments
- Computers
- Databases
- Library materials

INTERNET

Why not the commercial Internet?

- Access to the commercial Internet for education and research institutions is important
 - NRENs can pool demand, provide access to the commercial Internet at 'bulk buy' rates
- Commercial Internet goal is to make money
 - Serve many with common-denominator capabilities
 - Optimize capacity for profit
- NRENs who control and build their own network:
 - Optimize capacity (bandwidth utilization), topology (latency), services for needs of research, teaching, learning
 - Deploy capabilities the commercial Internet hasn't yet deployed or isn't interested in deploying

How are NRENs organized and what do they do?

- Broad range of organizational models
 - Universities and other R&E institutions as members, not-for-profit organization
 - Funding models vary
 - Government-funded through Ministry of Higher Education, Science & Technology or ICT
 - Self-funded by member universities
 - See the TERENA Compendium for organizational detail on tens of NRENs
 - <http://www.terena.org/compendium>

NRENs around the World

Africa

Sub-Saharan Africa (UbuntuNet)
Ghana
Kenya (KENET)
Malawi (MAREN)
South Africa (TENET)
Uganda (RENU)

East Asia & Pacific

Asia (APAN)
South&East Asia (TEIN2)
Australia (AARNET)
China (CERNET,CSTNET,NSFCNET)
Fiji (USP-SUVA)
Hong Kong (HARNET)
Indonesia (ITB)
Japan (SINET, WIDE, JGN2)
Korea (KOREN, KREONET2)
Malaysia (MYREN)
New Zealand (KAREN)
Philippines (PREGINET)
Singapore (SingAREN)
Taiwan (TANet2, ASNet)
Thailand (UNINET, ThaiSARN)
Vietnam (VINAREN)

Europe & Central Asia

Europe (GEANT2)
Armenia (ARENA)
Austria (ACOnet)
Belgium (BELNET)
Croatia (CARNet)
Czech Rep. (CESNET)
Cyprus (CYNET)
Denmark
(Forskningsnettet)
Estonia (EENet)
Finland (Funet)
France (Renater)
Georgia (GRENA)
Germany (G-WIN)
Greece (GRNET)
Hungary (HUNGARNET)
Iceland (RHnet)
Ireland (HEAnet)
Italy (GARR)
Kazakhstan (KAZRENA)
Latvia (LATNET)
Lithuania (LITNET)
Luxembourg (RESTENA)
Malta (Univ. Malta)
Netherlands (SURFnet)
Norway (UNINETT)
Poland (PIONIER)
Portugal (RCTS2)
Romania (RoEduNet)
Russia (RBnet, RUNNET)
Slovakia (SANET)
Slovenia (ARNES)
Spain (RedIRIS)
Sweden (SUNET)
Switzerland (SWITCH)
United Kingdom
(JANET)
Tajikistan (TARENA)
Turkey (ULAKBIM)
Uzbekistan (UZSCI)

Mid-East & N.Africa

Algeria (ARN)
Egypt (EUN/ENSTINET)
Israel (IUCC)
Jordan (JUNET)
Lebanon (NCSR)
Morocco (MARWAN)
Palestinian Terr. (PadI2)
Qatar (Qatar FN)
Syria (HIAST)
Tunisia (MRST)
U.A.E. (ANKABUT)

Americas

Latin America (redCLARA)
Argentina (RETINA)
Bolivia (ADSIB)
Brazil (RNP2/ANSP)
Canada (CA*net)
Chile (REUNA)
Colombia (RENATA)
Costa Rica (CR2Net)
Ecuador (CEDIA)
El Salvador (RAICES)
Guatemala (RAGIE)
Honduras (UNITEC)
Mexico (Red-CUDI)
Nicaragua (RENIA)
Panama (RedCyT)
Paraguay (ARANDU)
Peru (RAAP)
United States (Internet2)
Uruguay (RAU2)
Venezuela (REACCIUN2)

South Asia

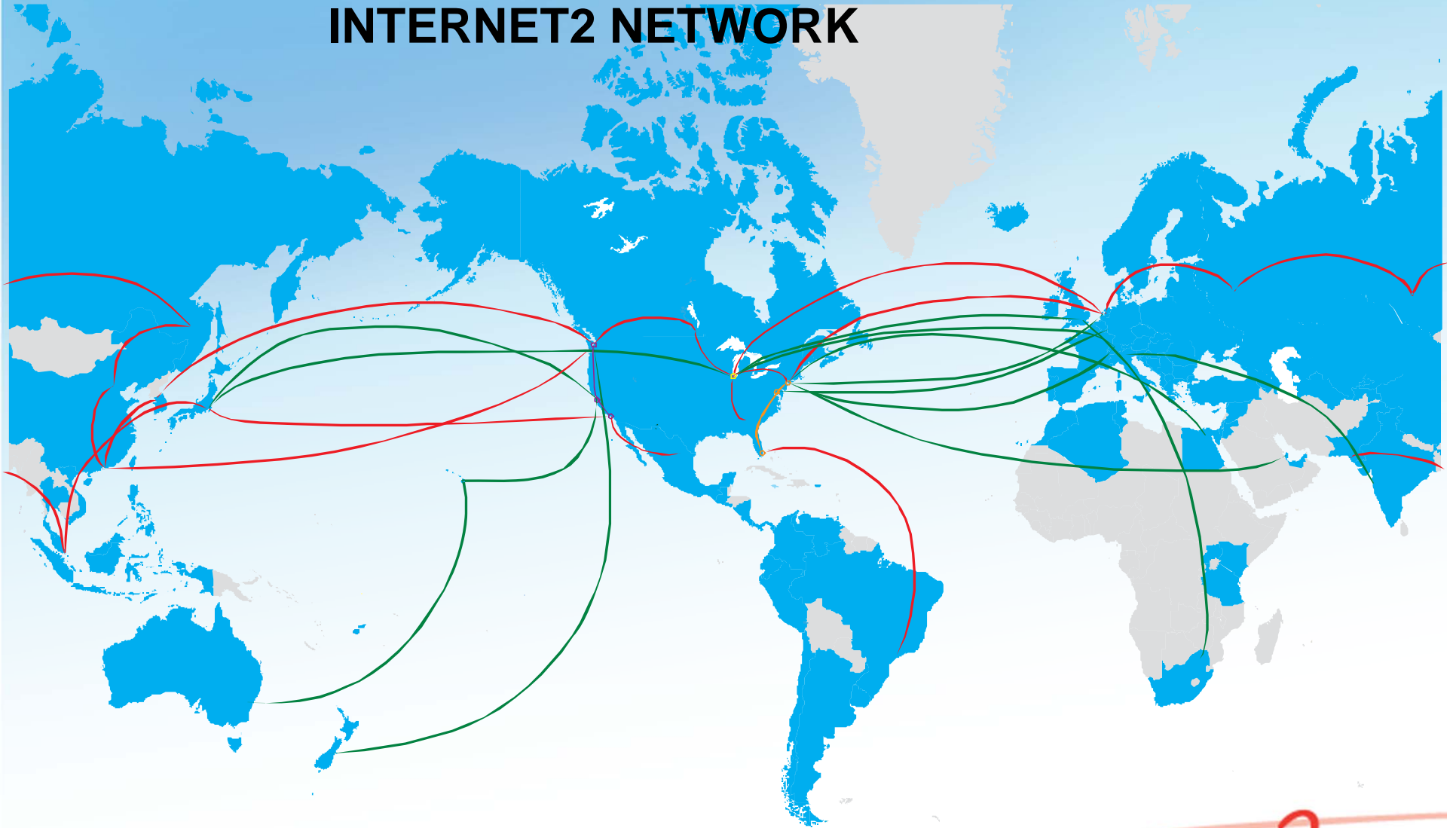
India (ERNET)
Nepal (NREN)
Pakistan (PERN)
Sri Lanka (LEARN)



How does the Internet2 Network connect with other NRENs around the world?

- Internet2 Network presence almost* completely within borders of US currently
 - *Internet2 has two 10Gbps links -- one from New York to London, the second New York to Paris – used to support dynamic circuit networking development with GEANT community
 - Internet2 maintains no equipment in London or Paris , connecting into GEANT switching equipment there
- The Internet2 Network utilizes:
 - Other NREN links to US (connect via US-based Exchange Points)
 - NSF-funded IRNC links from US to specific regions/networks

THE INTERNATIONAL REACH OF THE INTERNET2 NETWORK



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Global R&E Network Fabric

- Increasingly regional collaboration
 - GEANT, redCLARA, EUMEDCONNECT, TEIN3, APAN, UbuntuNet
 - Interconnectivity between continental regions
 - Aggregates demand for inter-continental (undersea) capacity
 - Promotes intra-regional connectivity
- Very liberal transit policies between R&E networks
 - Internet2 since ~2000 provides free transit to all non-US R&E network peers
 - GEANT provides Internet2 transit to India (ERNet), EUMEDConnect, UbuntuNet, Silk, etc.

Projects NRENs are involved in

- FCC Rural Health Care Pilot program
 - Extend broadband to rural America
 - Support physician-patient consultation, distance education, medical data management, and medical record exchanges

<http://www.internet2.edu/health/>
- Large Hadron Collider
 - High definition video conference between scientists in Louisiana and Geneva
 - Using Internet2 large amounts of data will be transferred and analysed by scientists around the world
- DRAGON
 - Dynamic Resource Allocation via GMPLS Optical Networks
 - aims to leverage the emergence and maturing of optical network technologies to develop and demonstrate the power and flexibility of a "hybrid" packet and circuit switched network infrastructure
 - Collaboration of 13 geographically separated organisations

<http://dragon.maxgigapop.net/twiki/bin/view/DRAGON/WebHome>

Medical Research

- T@LEMED
 - Introduces an e-health model to the provision of health services in strongly underserved regions in Colombia and Brazil
 - In Brazil, 2 hospitals provide medical advice to 8 other rural hospitals
 - Transportable telemedicine workstation integrating a portable PC, telecommunications, and a light portable 3D ultrasound
- Remote Medical Education using DVTS (Digital Video Transport)
 - Live surgery demonstrations between Japan and Korea
 - Multipoint demonstration: Japan, Korea, China
 - Robotic surgery and GI endoscopy: Beijing, Seoul, Sydney, UC Irvine, Hawaii

Arts Production Workshop

- Annual workshop where members of the performing arts community learn and share technologies and techniques used for performing arts over advanced networking
- In August 2009, hosted at Music Conservatory of Trieste, Italy
- Looks at technologies that enable artists from across the world to perform together
 - New World Symphony - distance learning program for musicians
 - EchoDamp - multi-channel audio mixer and echo controller designed primarily for the High-Bandwidth Musical Videoteleconference environment <http://echodamp.com/index.html>
 - LOLA - the low latency A/V communication tool for network musical performance

<http://www.internet2.edu/arts/>

World Digital Library

- Makes available on the Internet, free of charge and in multilingual format, significant primary materials from countries and cultures around the world.
- Principal objectives:
 - Promote international and intercultural understanding
 - Expand the volume and variety of cultural content on the Internet
 - Provide resources for educators, scholars, and general audiences
 - Build capacity in partner institutions to narrow the digital divide within and between countries.
- Joint project between UNESCO and US Library of Congress
- Launched with content from more than 25 institutions

World Digital Library

The screenshot displays the World Digital Library website interface. At the top left is the logo for the World Digital Library, featuring a globe icon and the text "WORLD DIGITAL LIBRARY". To the right of the logo is a "LANGUAGE" dropdown menu set to "English". Further right is a "BROWSE" section with links for "Place", "Time", "Topic", "Type of Item", and "Institution". On the far right is a "SEARCH" input field.

The main content area features a world map with several regional callouts, each showing a count of items and a small representative image:

- NORTH AMERICA**: + 137 Items (Image: A landscape with a building)
- LATIN AMERICA AND THE CARIBBEAN**: + 318 Items (Image: A portrait of a woman)
- EUROPE**: + 384 Items (Image: A map of Europe)
- MIDDLE EAST AND NORTH AFRICA**: + 177 Items (Image: A manuscript page)
- AFRICA**: + 120 Items (Image: A map of Africa)
- CENTRAL AND SOUTH ASIA**: + 65 Items (Image: A manuscript page)
- SOUTHEAST ASIA**: + 49 Items (Image: A manuscript page)
- EAST ASIA**: + 99 Items (Image: A portrait of a person)
- OCEANIA AND THE PACIFIC**: + 30 Items (Image: A map of Oceania)

At the bottom of the map area is a horizontal timeline with the following periods: 8000 - 499, 500 - 1499, 1500 - 1699, 1700 - 1799, 1800 - 1849, 1850 - 1899, 1900 - 1949, and 1950 +. A purple bar highlights the period "8000 BC - 2009 AD / View all 1211".

<http://www.wdl.org/en/>

Middleware Initiatives

- Focus on developing interoperable identity and access management infrastructures for research and higher education
- Initiative's work includes developing tools, roadmaps, software, practices, standards, and education
- Grouper™ Groups Management Toolkit
 - Used to manage group memberships across applications and track information such as campus affiliations or roles
- MACE-DIR
 - Directory schemas
- Shibboleth®
 - Federated Single Sign-On Software
 - Open-source web single sign-on and federating software

Saudi NREN

- Saudi Academic Research and Innovations Network (SARI net)
- Official announcement soon
 - Concurrent with the launch of the NREN portal
 - Portal presents all available
 - Services
 - Projects
 - Forums for every disciplines (Events, News, Polls, Publications, and Background)
 - Provide dedicated bandwidth for applications

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