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High-performance Research and Education Networks in Support of Digital Libraries in the Middle East:

The role of Internet2 and other National Research and Education Networks (NRENs) in supporting international research, teaching and learning collaboration

The role of National Research and Education Networks (NRENs)

Higher education and research institutions were some of the first to connect to the early Internet. Indeed, the academic community was (and continues to be) the home for much of the research and development that created the technologies the Internet is based upon. Today, many countries have established dedicated, high-performance national research and education networks (NRENs) in order to support the needs of research, teaching and learning. These typically national-scale networks interconnect universities and research centers separately from the commercial Internet providing un-congested, high-speed, advanced communications capabilities.

Internet2, a not-for-profit organization of over 200 U.S. universities working in partnership with industry and government, has established such a national-scale, dedicated, high-performance network interconnecting universities, research centers and schools in the United States. Similar organizations exist in the countries of Europe, Asia and Latin America. A growing number of NRENs exist in the countries of northern Africa and around the Mediterranean, including in Egypt.

The global research and education network infrastructure

New links between NRENs and regional and continental-scale research and education networks have created a global web of connectivity among research and education institutions. This infrastructure provides dedicated, high-performance network capabilities not only within a country, but between research and educational institutions located in different parts of the world. A typical NREN today needs to connect into only one or two other NRENs to reach the entire global set of NRENs.

Currently, the research and education networks of Egypt are connected to both the European research and education network, called GEANT and Internet2's Abilene backbone network. Through their connections to GEANT and Abilene, the research and education networks of Egypt (EUN, ENSTINET, ENERGI) have access to NRENs in over 70 countries.

Other countries in the Middle East and North Africa also have or are establishing NRENs. Countries with existing networks include: Algeria, Israel, Jordan, Lebanon, Morocco, the Palestinian Authority, Qatar, Syria, and Tunisia while activity is emerging in Bahrain, Iraq, Kuwait, Oman, and the UAE. Many of the countries in the Mediterranean region are currently interconnected via the European-funded EUMEDCONNECT project, which also provides connectivity to the European GEANT network.

Support for research, teaching and learning

NRENs are dedicated to serving the research, teaching, learning and often clinical needs of their members. Because of this mandate, they can be optimized to support the unique network needs of specific communities. For example, connectivity can be configured to support the needs of high energy and nuclear physicists who move extremely large datasets from key facilities (like CERN in Geneva) to multiple centers and universities where data processing is done and scientific discovery takes place. Supporting the required bandwidth, specialized transport protocols and other advanced technologies required by this scientific community is not easy on today's commercial Internet and often is impossible. NRENs are supporting this community's needs today.

Beyond the sciences there are equally (and perhaps more) demanding needs for network infrastructure. Performing arts education in the United States is increasingly enhanced through the use of extremely high quality audio and video delivered over research and education networks. For example, the University of Oklahoma and others now routinely uses high-quality digital video (DV) over internet protocol (IP) to conduct auditions for prospective students and provide interactive, remote instruction by master musicians for their existing students. The New World Symphony, a teaching orchestra in Miami, Florida, routinely brings composers and guest conductors into the orchestra's rehearsals via their Internet2 network connection.

Likewise, digital libraries and the increasingly complex digitized objects they hold are taking advantage of NREN networks, both to provide access to items that would otherwise not be accessible via a commercial internet connection and to use the network to collaborate amongst them with high-quality video and audio conferencing. Beyond network infrastructure, many NRENs are developing and deploying software to facilitate more secure access to resources stored in digital libraries. For example, the National Science Digital Library (NSDL), a project funded by the US National Science Foundation, is using Shibboleth, a software tool and framework developed by the Internet2 community, to permit secure, privacy-protecting authenticated access to its holdings. Increasingly, NRENs in Europe, Australia and elsewhere are adopting Shibboleth as a foundation for their national authentication and authorization infrastructures. Just as they interconnected their networks, a number of NRENs are working together to interconnect their respective authentication and authorization infrastructures, allowing researchers to securely access computational facilities, scientific instruments, digital libraries and data sets located at institutions around the world.

The case for NRENs

NRENs are a vital element of a country's national higher education and research enterprise. Many countries regard these networks as a critical component of their e-Science (UK) or Cyberinfrastructure (US) initiatives (along with computational facilities, scientific instruments, software and other elements). The European Commission has called both the pan-European GEANT network and the individual NRENs of the European countries a "fundamental building block" of the European Research Area. The recent declaration from the second World Summit on the Information Society included a commitment to "*promoting the development of advanced research networks*, at national, regional and international levels, in order to improve collaboration in science, technology and higher education."

Beyond the advanced, high-performance network capabilities they provide to research and education institutions, NRENs provide a framework for collaboration between institutions building new technologies and applications utilizing network infrastructure. For example, the Internet2 community has over 50 working groups, special interest groups and task forces bringing together users and developers from areas as diverse as orthopedic surgery to archaeology to network research topics such as quality of service. Similar working groups exist in NRENs around the world and many groups are collaborating internationally with one another.

NRENs provide a strong voice for the research and education community in the future development of Internet technology and infrastructure. Many NRENs have moved away from buying packaged telecommunications services from traditional telecom companies to building their own underlying transport infrastructure and buying their own fiber, optical and electronics equipment. Through this process NRENs and their member universities and research centers have gained leverage with the telecommunications industry and provided themselves with capabilities that the telecommunications market was not yet ready to provide. In many cases, this in turn has helped drive forward the availability of new network technologies to the broader marketplace.

A Digital Library of the Middle East, NRENs, the Bibliotheca Alexandrina and Internet2

We believe a great opportunity is currently available - to utilize and motivate the further development of research and education network infrastructure in the Middle East in the support of digital libraries. With access to the global research and education network infrastructure through their respective NRENs, researchers, faculty and students around the world would have access to the resources of digital libraries in the Middle East. Likewise, the digital libraries may link to resources at institutions in the US and elsewhere, complementing their existing holdings.

Much work will be needed amongst institutions engaged in digital library work to continue the development of software, frameworks and other elements necessary to support a true digital library of the Middle East. This collaboration among countries would be facilitated by access to high-quality video and audio conferencing over the global research and education network infrastructure for interactive collaboration.

Internet2 and the research and education networks of Egypt established a working partnership in April of 2005. The Egyptian partnership is led by MCIT with EUN and ENSTINET as the key networking organizations. We understand that MCIT expects to connect the Bibliotheca Alexandrina to the joint network infrastructure project – ENERGI. As part of this agreement we have also committed to working together to facilitate the development and use of new applications over our respective networks, building a framework that can support digital library collaboration between US and Egyptian institutions.

Internet2 has and continues to develop partnerships with other countries in the region. Working with emerging NREN partners in the region, with the European efforts to support build-out of network infrastructure in the region, and others (such as the World Bank, an Internet2 member organization), we hope to see an advanced, high-performance network environment available to research and education institutions across the Middle East.

For Further Information

Internet2: http://www.internet2.edu
Internet2 international partnerships: http://international.internet2.edu

Egyptian NRENs: http://www.frcu.eun.eg and http://www.sti.sci.eg

Links to other NRENs in the Middle East and North Africa region:
Algerian NREN: http://www.arn.dz/
NREN in Morocco: http://www.marwan.ma/
Palestinian Authority: http://www.gcc.gov.ps/application/home/main.php?cmd=main
Israeli NREN: http://www.iucc.ac.il/
Jordan: http://www.junet.edu.jo/
Tunisian NREN: http://www.tunisiaonline.com/internet/networks.html
Lebanon: http://www.cnrs.edu.lb/
Qatar: http://www.qf.edu.qa/

EUMEDCONNECT project: http://www.eumedconnect.net
GEANT: http://www.geant2.net

Information and data about NRENs in the greater European region:
http://www.terena.nl/compendium/

Internet2 working groups and special interest groups:
http://www.internet2.edu/working-groups.html