NRENs: Access Pathways to Global Knowledge
- for Education, Science, and Innovation

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A User of technology and communications (ICT) to improve the Quality of and Access to Education and Research
The Role and Status of National Research and Education Networks (NRENs) in Africa

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https://casefornrens.geant.org
What are NRENs?
What do they do?
Why do we need them?
What’s so special about them?
What is government’s role?
It’s a Digital world

Transformation
Paradigm shift
Revolution
A Challenge

What’s the benefit?
What’s the impact?
What about quality?

It’s a fact! It’s not going away. So let’s ask:

- **How** can we use it with **quality** and **equal access**
The internet promotes inclusion, efficiency, and innovation.

This 2013 World Press Photo of the Year shows migrants crowding the night shore of Djibouti City in an attempt to capture inexpensive cellphone signals from neighboring Somalia. © John Stanmeyer/National Geographic Creative.
What do scientists do? How do they work?

Our clichés don’t apply anymore

It’s about measurement, modeling, calculations – billions per second, sharing resources and pooling expertise
Scientific discovery is complex.

Hyper Specialization

What’s the record for the number of citations in a single research paper?

5,154 authors in an LHC research paper on The Higgs Boson.
Such is the breadth of human knowledge scientific research is now, by necessity, a collaborative activity between specialists in hundreds of institutions across the globe that are connected by high speed communications links sharing the huge volumes of data generated by today’s shared advanced instrumentation. e.g., SESAME
If you are not connected
You will be excluded
That’s Research – so what about Education, the ‘E’ in NREN?
Teaching and Learning in a Digital Age – 9 Trends

1. Mobile and the smartphone are making technology universal.
2. Bring your own device (BYOD).
3. 'Blended' learning for all.
4. Educators as managers/mentors and the 'flipped classroom'.
5. Availability of Open Educational Resources (OERs).
6. Redesigning learning spaces.
7. Your data is in the cloud, accessible everywhere.
8. Learning is research.
9. Connectivity is presumed.
We can agree; Internet and connectivity are vital for science and for education, the engines of innovation.

But how do we organize that? A free-for-all in the market? or through an agency to manage it?

An agency that comes from the IT community of the universities, that is trusted by them, and that is not profit motivated. Let’s call it a:

National Research and Education Network (NREN)
What is an NREN?

1. A high performance communications network
   - owned and operated for and by the education and research community of a country.

2. The organization that operates that network and provides an array of services unique to Research and Education
   - constituted either as: a consortium of members, a dedicated agency, a company, an NGO, or other legal entity. Generally not-for-profit.
What does an NREN do?

An NREN is not about Infrastructure: It is about services

Its primary service is to lease capacity on fibre infrastructure to provide connectivity to its institutional clients. In this sense it’s like an ISP, but its bandwidth offering is not shared, like an ISP’s is.
Other services

- Security: spam screening, anti-spoofing measures, and so on
- An e-mail service for all members’ constituents, faculty, and students
- Videoconferencing bridging, recording, streaming
- Hosting a higher education management information system (HEMIS)
- Managing learning management systems (LMSs) such as Moodle or Blackboard
- Access to Digital Library sources and electronic journals
- Web hosting and data storage and archives if required
- Multimedia content repository
- Connect e-science resources such as telescopes, sensor networks, accelerators, supercomputers
- Bandwidth on demand
- Computing power
- Mirroring of content from outside the NREN network
- Cloud services
- Campus networking advisory services
- Capacity-building workshops
The NREN’s real value added is its **advanced** and **unique** services, including **middleware** services

- **Authentication and Authorization Infrastructure (AAI):**
  - eduroam, eduGAIN, Shibboleth, single sign-on (SSO) federated access
  - e-science gateways

- **Grid computing middleware**

- **Dedicated point-to-point internet protocol (IP) circuits for special applications**

These are the services that differentiate it from a commercial ISP
These services are developed by a global community of NRENs

A global ‘currency’, providing inclusion to the global academic ‘club’

Facilitates:

• Participation and collaboration in research
• Access to digital libraries/journals/databases
• Sharing of expensive instrumentation
• Ending exclusion and academic isolation

Case for NRENs: https://casefornrens.geant.org
At the Heart of Global Research and Education Networking

GÉANT

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Financing models – European examples
Governance models

Whatever model is chosen it is vital that the academic community feels that it has 'Ownership'
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R & E Network Links in Africa and to GÉANT (1 June 2015)

- NREN own Links
- UA links
- UA on Partner Links
- EUMEDCONNECT Links
- PoP
Seven Levels of NREN development
Capability Maturity Model (Duncan Greaves of TENET)

Level 0: No NREN and no awareness of the need.
Level 1: No NREN but a diffused consciousness of the benefits.
Level 2: No NREN but a more structured conversation regarding one.
Level 3: No actual NREN but a formal commitment to proceed is achieved.
Level 4: A formal NREN organization with services is established.
Level 5: First REN to REN international links are established.
Level 6: The NREN begins to offer REN-specific advanced services.
Challenges

- Vested interest of incumbent Telcos/ISPs (potential loss of revenue)
- Lack of competition (high cost)
- Lack of, or unaffordable terrestrial/submarine infrastructure
- Lack of, or unaffordable in-country infrastructure
- Insufficient government commitment
- Inadequate (too much/too little) regulation
- No cohesive user base or mechanisms to support their formation
- Readiness of the universities - the faculty and the campus network
“To get the most out of the digital revolution, countries also need to work on the “analog complements”—by strengthening regulations that ensure competition among businesses, by adapting workers’ skills to the demands of the new economy, and by ensuring that institutions are accountable.”
How to make it happen - the enabling environment

It’s mostly ‘analogue’ – the human factor

The laws of the land are not laws of nature; People made them up, and people can change them.

We need to ask the right questions;
- not ‘is the proposed NREN sustainable?’
  but
- ‘how can we make it sustainable?’
What can Government do?

1. Enlightened regulatory policy – encourage competition but recognise the public good nature of NRENs.
2. Support establishment and funding of NREN and legislate to enable it to operate.
3. Seek donor funding if necessary.
4. Allow duty-free importation of equipment for NREN and campus nets.
5. Provide operator’s license within agreed AUPs.
6. Promote the adoption of ICTs in education.
What can Development partners do?

Direct financing – directly for the NREN or as part of other education or research projects, preferably grants (maybe a joint large Trust Fund for NRENs?)

Be realistic about the impact that NRENs can have.

Do not burden them with evaluations over which they have no control.

• Advisory Services to governments using the credibility of the organization
• Knowledge exchanges – see is believing. Visits to other NRENs (SERENE)
• Capacity building - training programs and internships (NSRC)
What can Higher Education institutions do?

1. **Collaborate** for connectivity while competing for students and funding - it’s in their common interest to pool demand and create a critical mass

2. Establish, staff, and fund a **campus network**

3. Encourage the **digital literacy** of staff and support the **champions of innovation**
What can NRENs do?

1. Ensure your services are advanced and unique to what NRENs offer
2. Invest in capacity building of staff to keep the competitive edge
3. Listen to your stakeholders in the universities
4. Be open to collaborate with commercial partners who can provide commodity services
5. Future is mobile - need to find ways to integrate mobile connectivity.
6. Expand the use of dark fibre - where you have the expertise
7. Cloud services - provide them or act as broker
Thank you!

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Implications for NRENs

Recommendations from the ASPIRE report 2013

1. ISPs can offer many of the services demanded by clients of NRENs - the NREN needs to customize and tailor services.
2. NRENs can aggregate demand from clients and from government.
3. NRENs are part of the academic IT community - it can build on trust.
4. Specialized services a competitive advantage; eduroam, SSO, AAI etc.
5. Be ready to collaborate with ISPs and other commercial services.
6. Future is mobile - need to find ways to integrate mobile connectivity.
7. Expand the use of dark fibre
8. Cloud services - provide them or act as broker