

# **NRENs: Access Pathways to Global Knowledge**

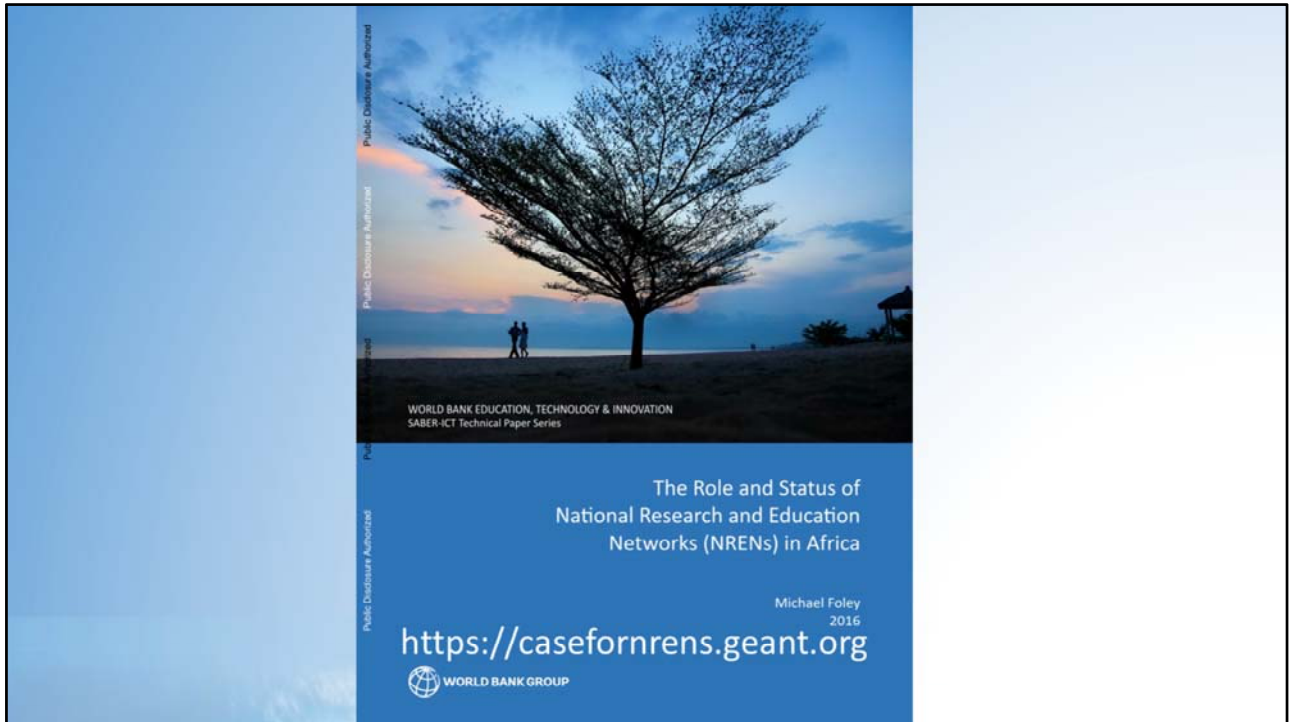
*- for Education, Science, and Innovation*

Michael Foley

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A User of  
technology and communications (ICT)  
to improve  
the Quality of and Access to  
Education and Research

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What are NRENs?

What do they do?

Why do we need them?

What's so special about them?

What is government's role?



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## 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**

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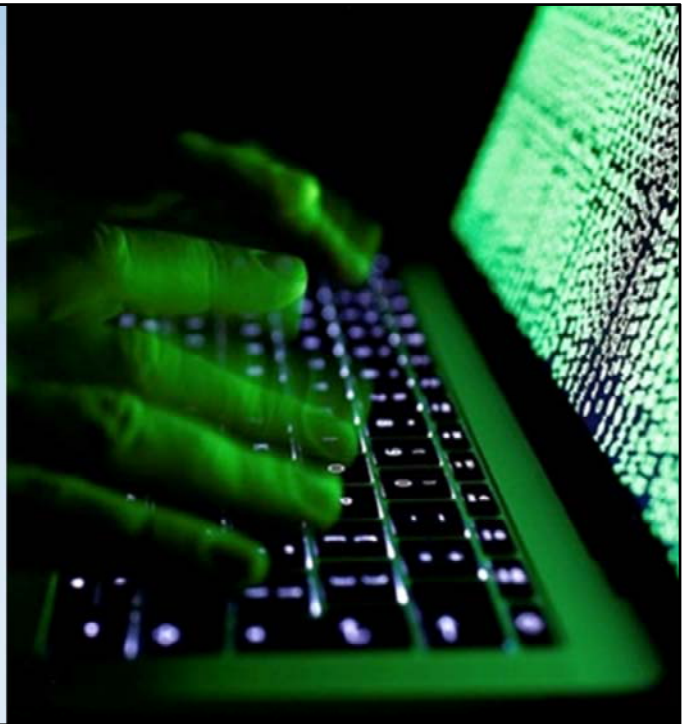


This 2013 World Press Photo of the Year shows migrants crowding the night shore of Djibouti City in an attempt to capture inexpensive cellphone signals from neighboring Somalia. © John Stanmeyer/National Geographic Creative.

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



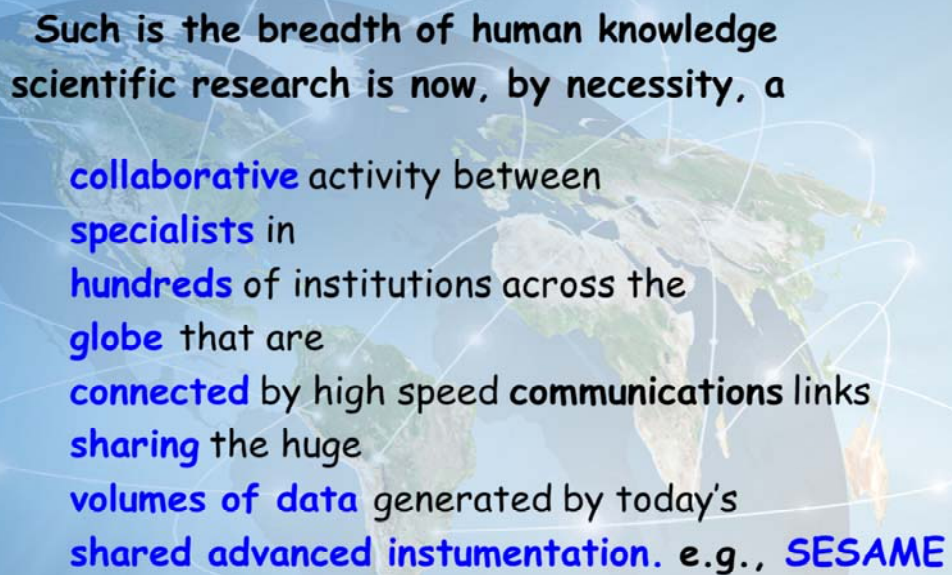
CERN

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No one person knows it all anymore, not even in their chosen profession. There is too much to handle and everything is specialized.

Hyper specialization now, so everything is in teams. No lonely prof in his or her lab.





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**

It's not just a nice thing to do, to collaborate across borders – it is essential by the sheer complexity of the subject matter.  
Example SESAME Synchrotron in Jordan. Congratulations. ASREN has a big role here



**That's Research - so what about Education, the 'E' in NREN?**



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## 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.



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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?

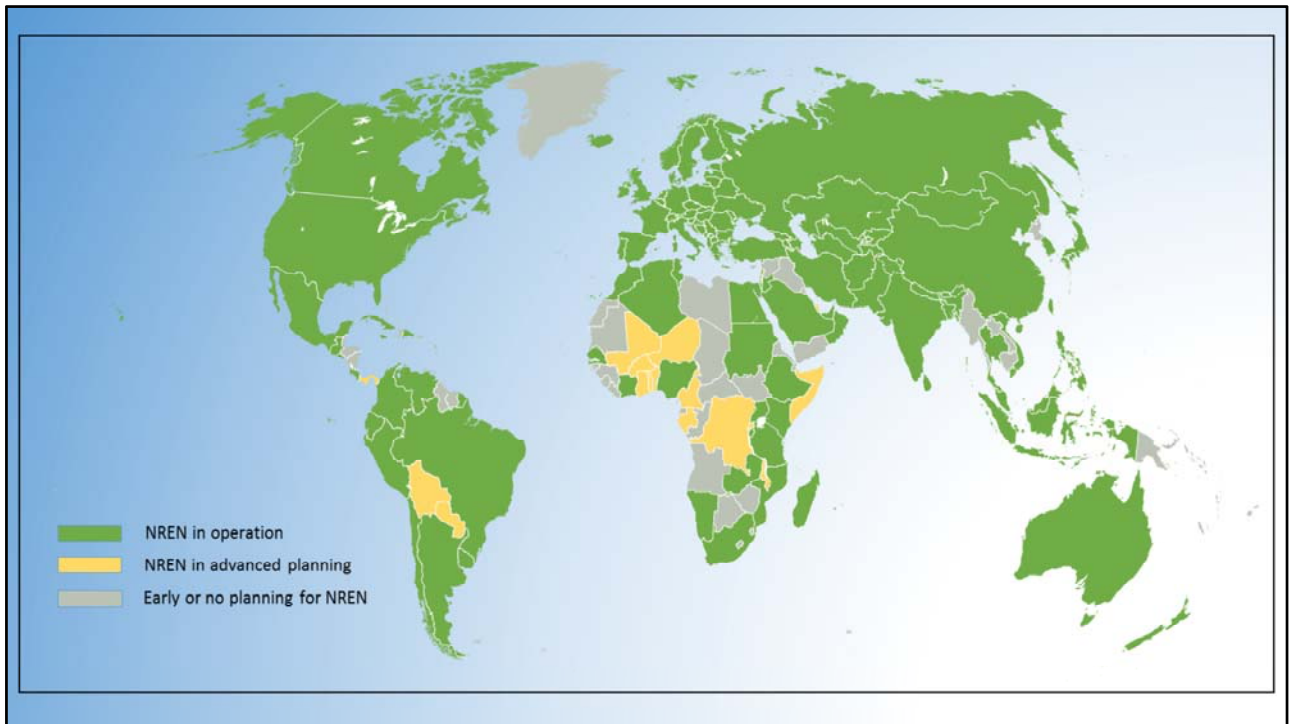
*An agency that comes from the IT community of  
the universities, that is trusted by them, and that is not  
profit motivated.*

*Let's call it a;*

**National Research and Education Network (NREN)**



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## At the Heart of Global Research and Education Networking



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## 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.

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## 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.



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Donors often say – we don't do infrastructure – NRENs are about services on infrastructure. They don't normally own fibre.  
Not only but it starts with this function and adds services, getting more sophisticated as it goes.

## 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

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**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**



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## **These services are developed by a global community of NRENs**

A global 'currency', providing inclusion to the global academic 'club'

### **Facilitates:**

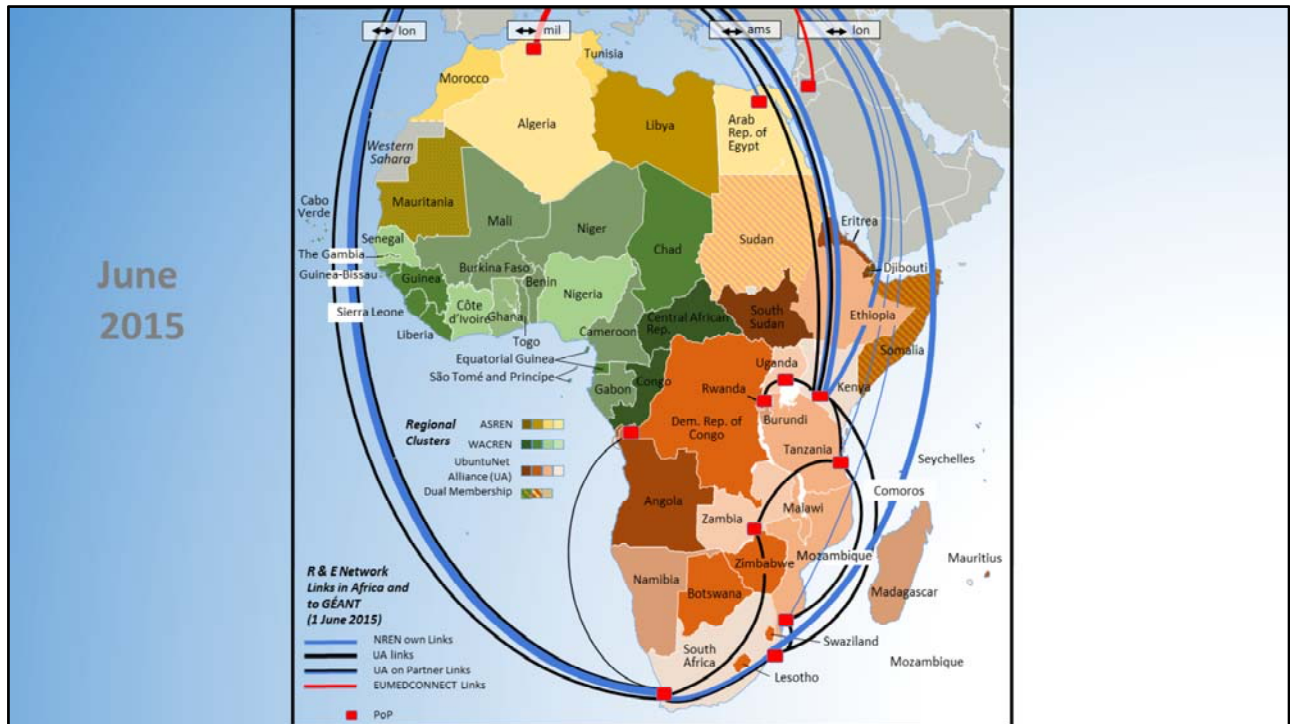
- Participation and collaboration in research
- Access to digital libraries/journals/databases
- Sharing of expensive instrumentation
- Ending exclusion and academic isolation

Case for NRENs: <https://casefornrens.geant.org>

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They are a global 'currency' that provides a gateway for your country's students and professors to the Wealth of knowledge and collaboration potential that Is the world's higher education institutions.

Finally - Inclusion again The Afghan Minister of Education - Peace







## **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.

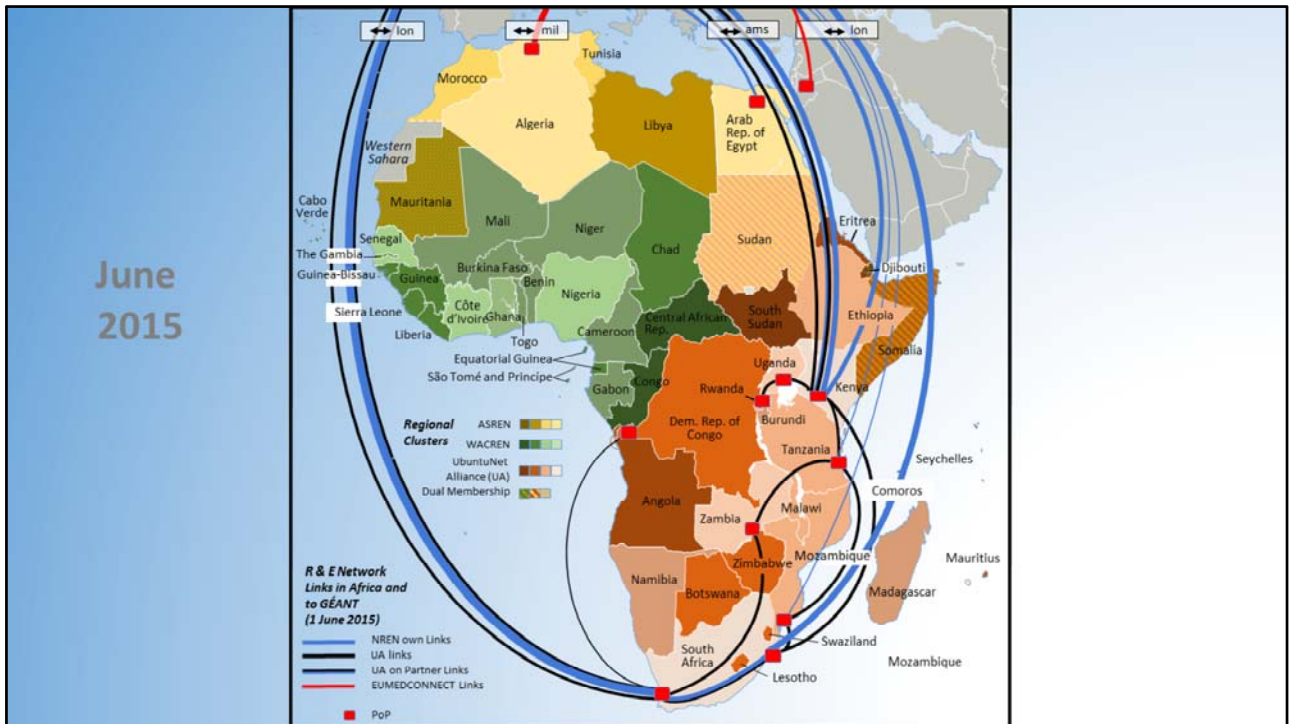
Level 2: No NREN but a more structured conversation regarding one.

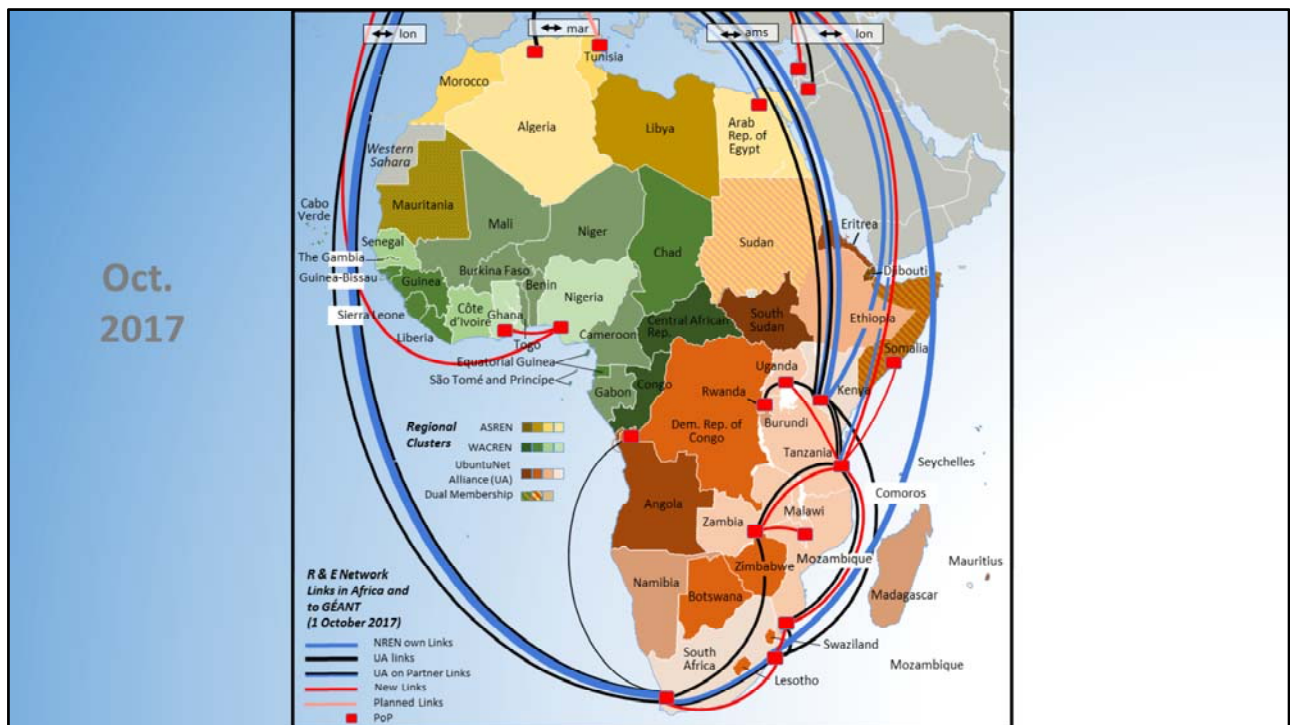
Level 3: No actual NREN but a formal commitment to proceed is achieved.

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.





And AfricaConnect2 - we get Ghana and Nigeria connected to the PoP in London, but other countries in West Africa, especially Francophone countries, are struggling – dealing with the challenges of pricing and regulatory issues I will talk about next. East and Southern Africa consolidate their international connections with new links and Malawi are connected for the first time. So too is Somalia, also an ASREN member. AfricaConnect3 will, yes, I say will, consolidate even more and it will include North Africa.



## Challenges

- Vested interest of incumbent Telcos/ISPs (potential loss of revenue)
- Lack of competition (high cost)
- Lack of, or unaffordable terrestrial/submarine 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

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Some of the challenges. A lot of it down to policy, and policy is analogue. The first four are about cost of infrastructure.  
Next slide.....



# DIGITAL DIVIDENDS

## OVERVIEW

“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?'

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## 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.

The footer features a light blue background with a white sky and two golden pyramids. The text 'e-AGE 2017' is centered in a bold, orange font.

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## 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)



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## 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**

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## 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

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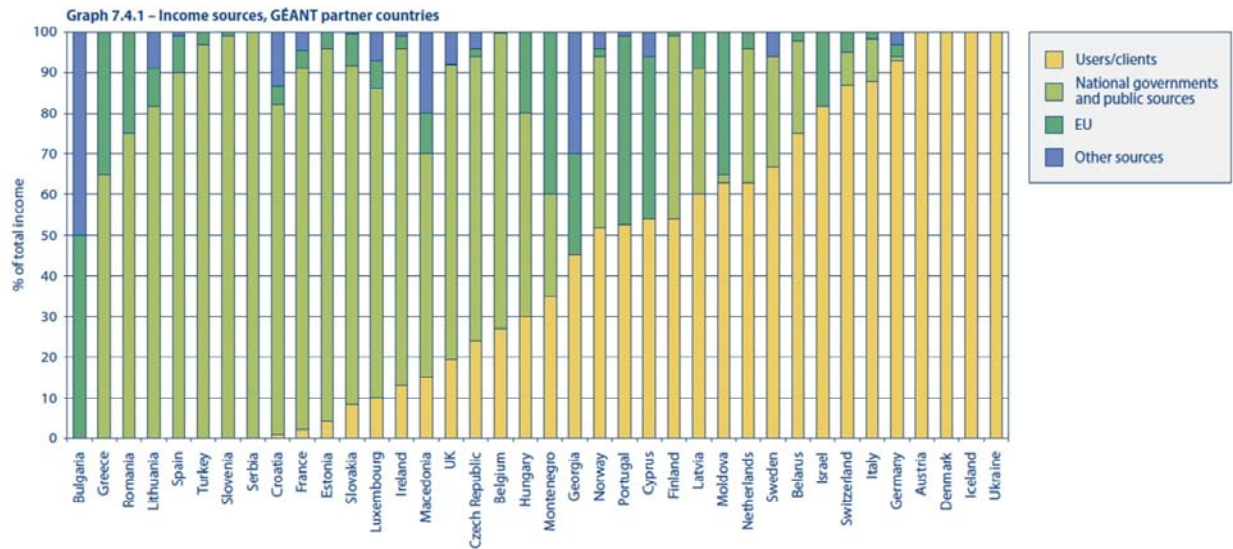








## Financing models – European examples



## Governance models

Whatever model is chosen  
it is vital that  
the academic community feels  
that it has  
'Ownership'

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The question of Governance is equally complex.  
The bottom line is that the academic community should feel ownership – board majority for instance

## 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



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