

NRENs: Access Pathways to Global Knowledge

- for Education, Science, and Innovation

Michael Foley

A decorative banner at the bottom of the slide features two golden pyramids on a blue sky background. The text "e-AGE 2017" is centered in orange.

e-AGE 2017

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

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WORLD BANK EDUCATION, TECHNOLOGY & INNOVATION
SABER-ICT Technical Paper Series

The Role and Status of National Research and Education Networks (NRENs) in Africa

Michael Foley
2016

<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**



DIGITAL DIVIDENDS

OVERVIEW

The internet promotes
inclusion,
efficiency,
and
innovation

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

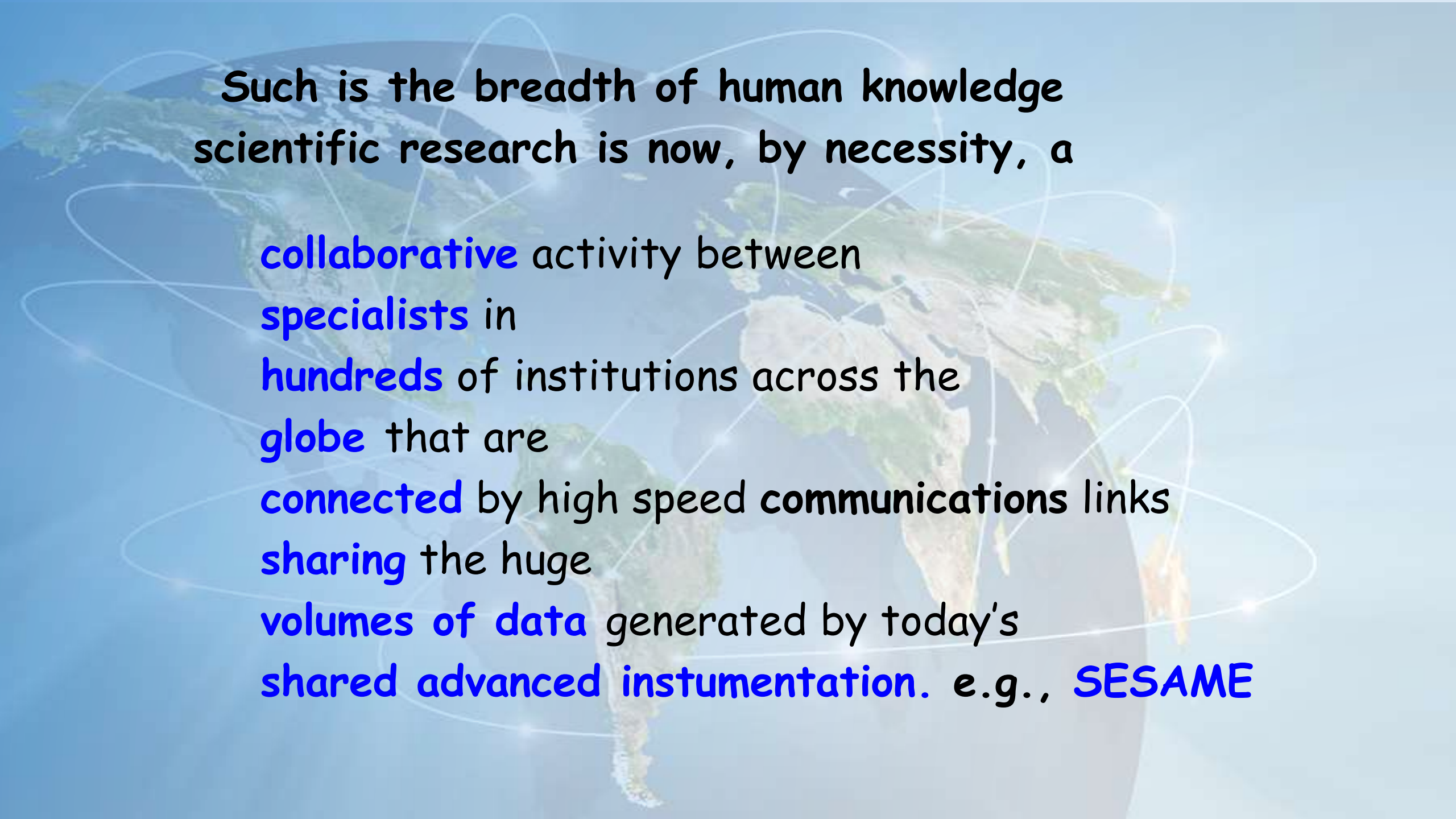
authors
in an LHC

research paper on
The Higgs Boson



CERN

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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?



e-AGE 2017

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?

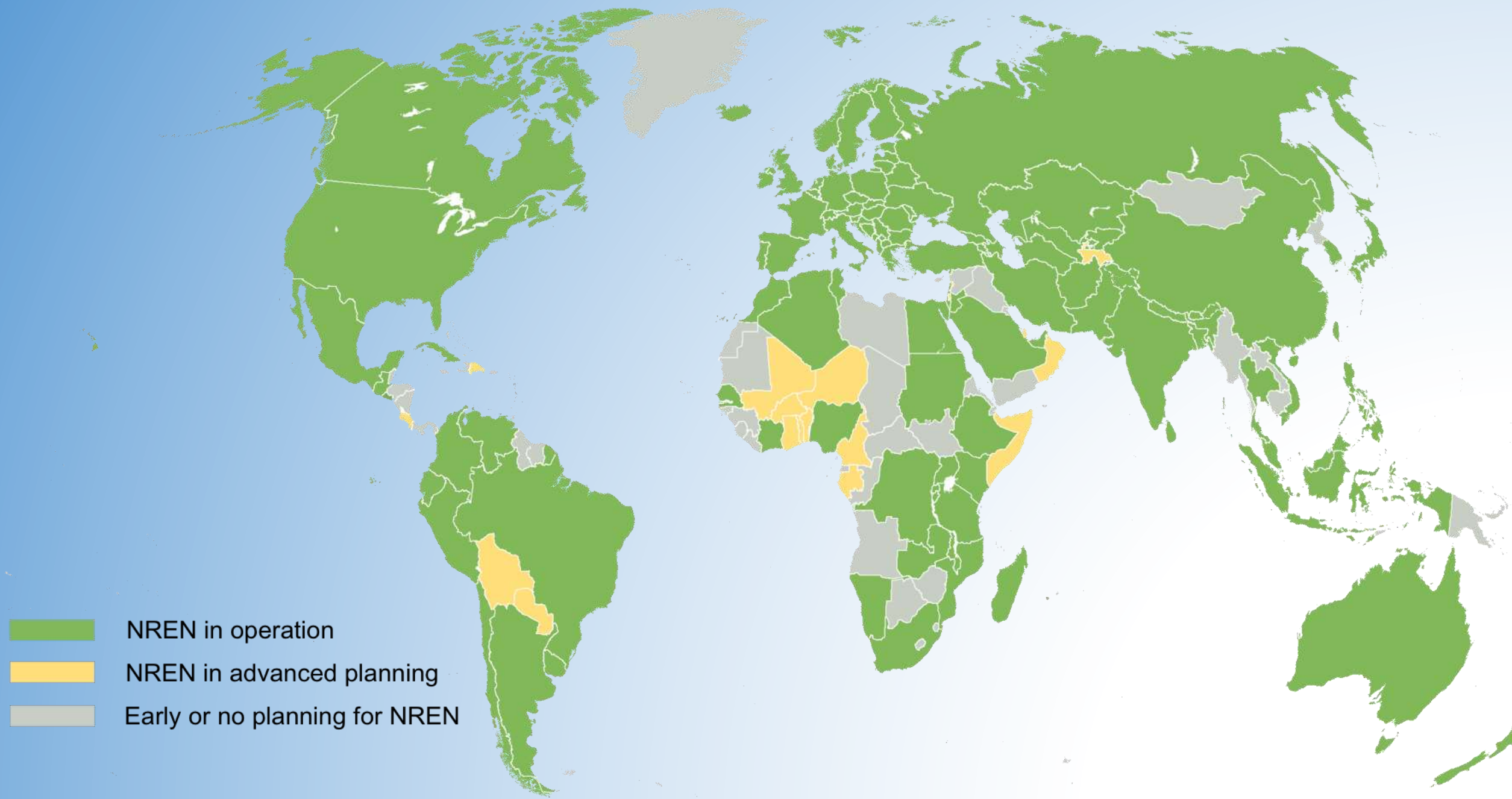
or through an agency to manage it?

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)





- NREN in operation
- NREN in advanced planning
- Early or no planning for 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

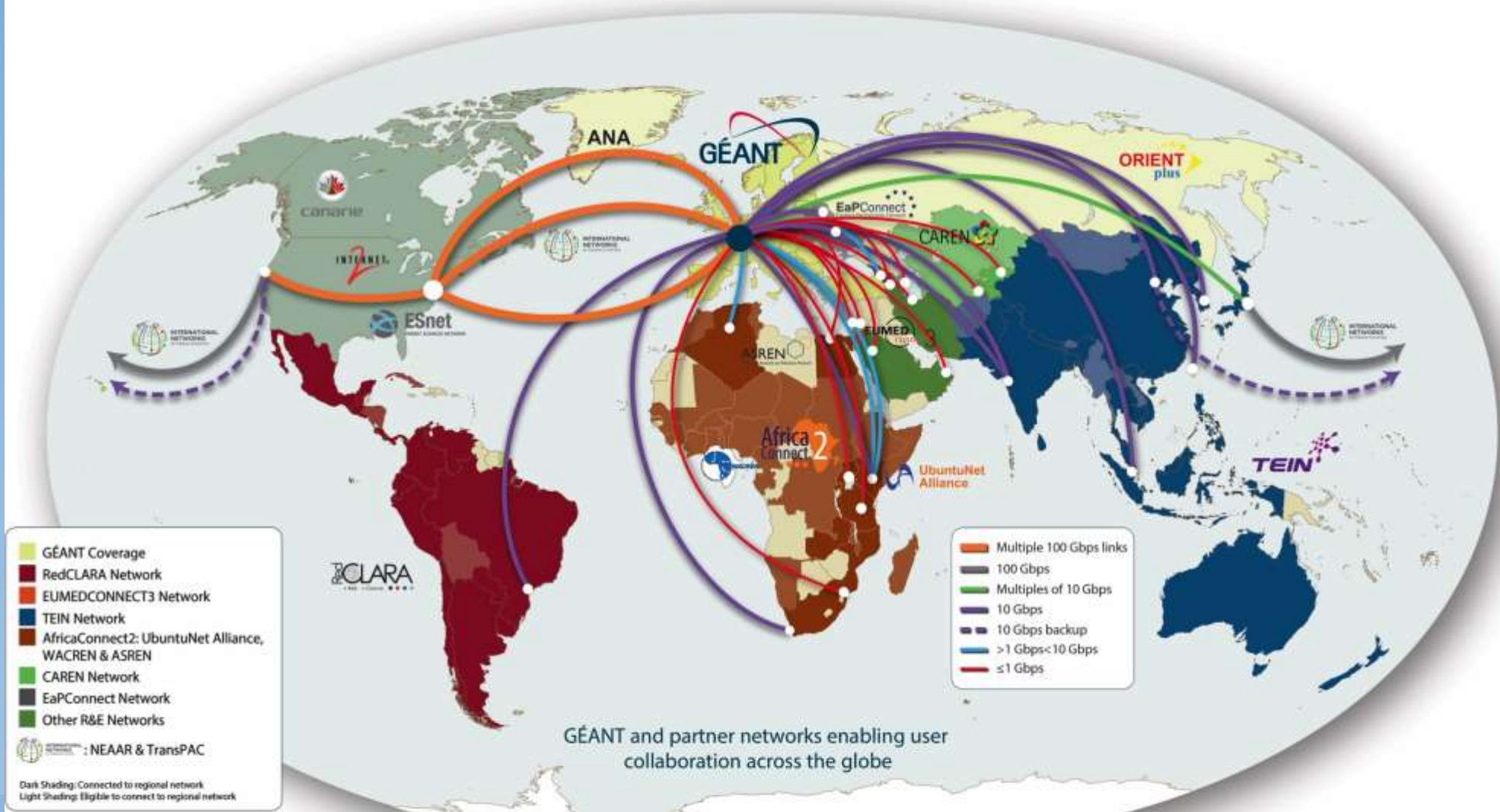
These services are developed by a global community of NRENs

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>



- GÉANT Coverage
 - RedCLARA Network
 - EUMEDCONNECT3 Network
 - TEIN Network
 - AfricaConnect2: UbuntuNet Alliance, WACREN & ASREN
 - CAREN Network
 - EaPConnect Network
 - Other R&E Networks
 -  : NEAAR & TransPAC
- Dark Shading: Connected to regional network
Light Shading: Eligible to connect to regional network

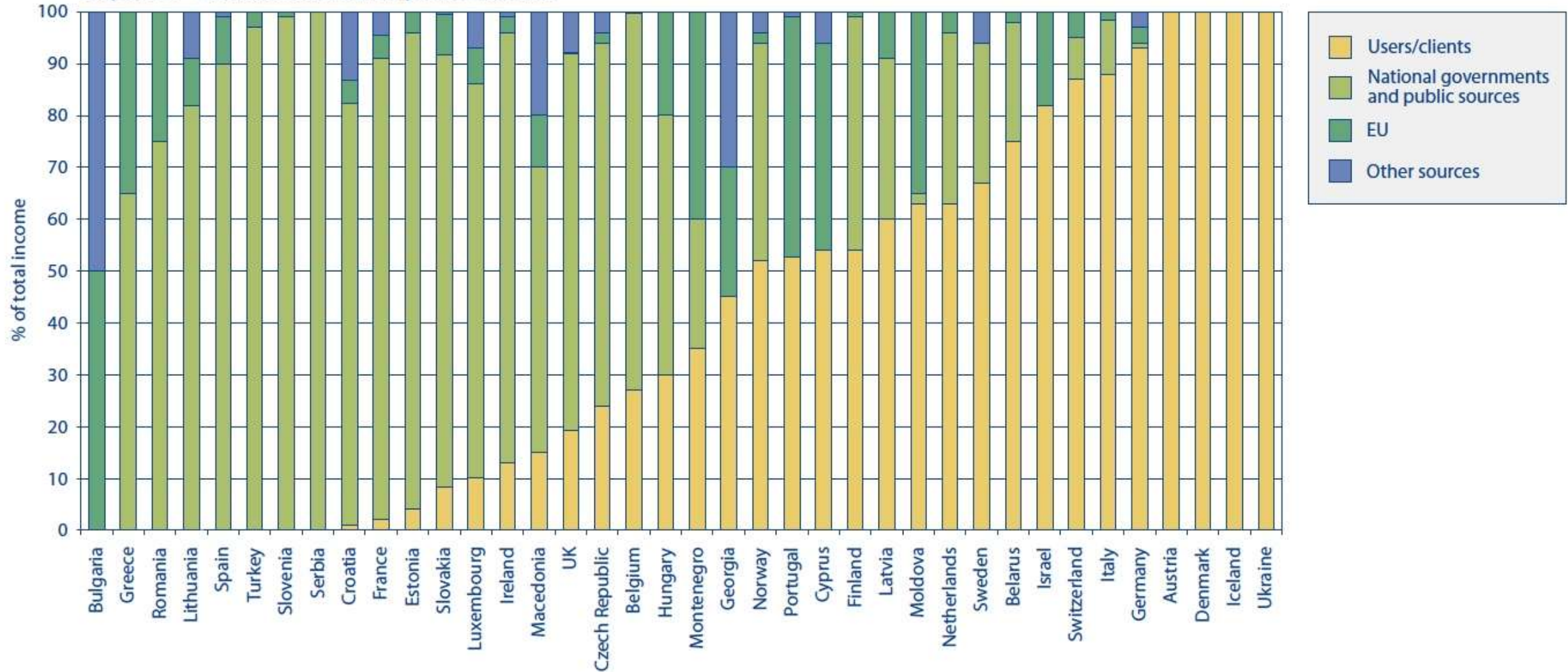
- Multiple 100 Gbps links
- 100 Gbps
- Multiples of 10 Gbps
- 10 Gbps
- 10 Gbps backup
- >1 Gbps < 10 Gbps
- ≤1 Gbps

GÉANT and partner networks enabling user collaboration across the globe

August 2017

Financing models – European examples

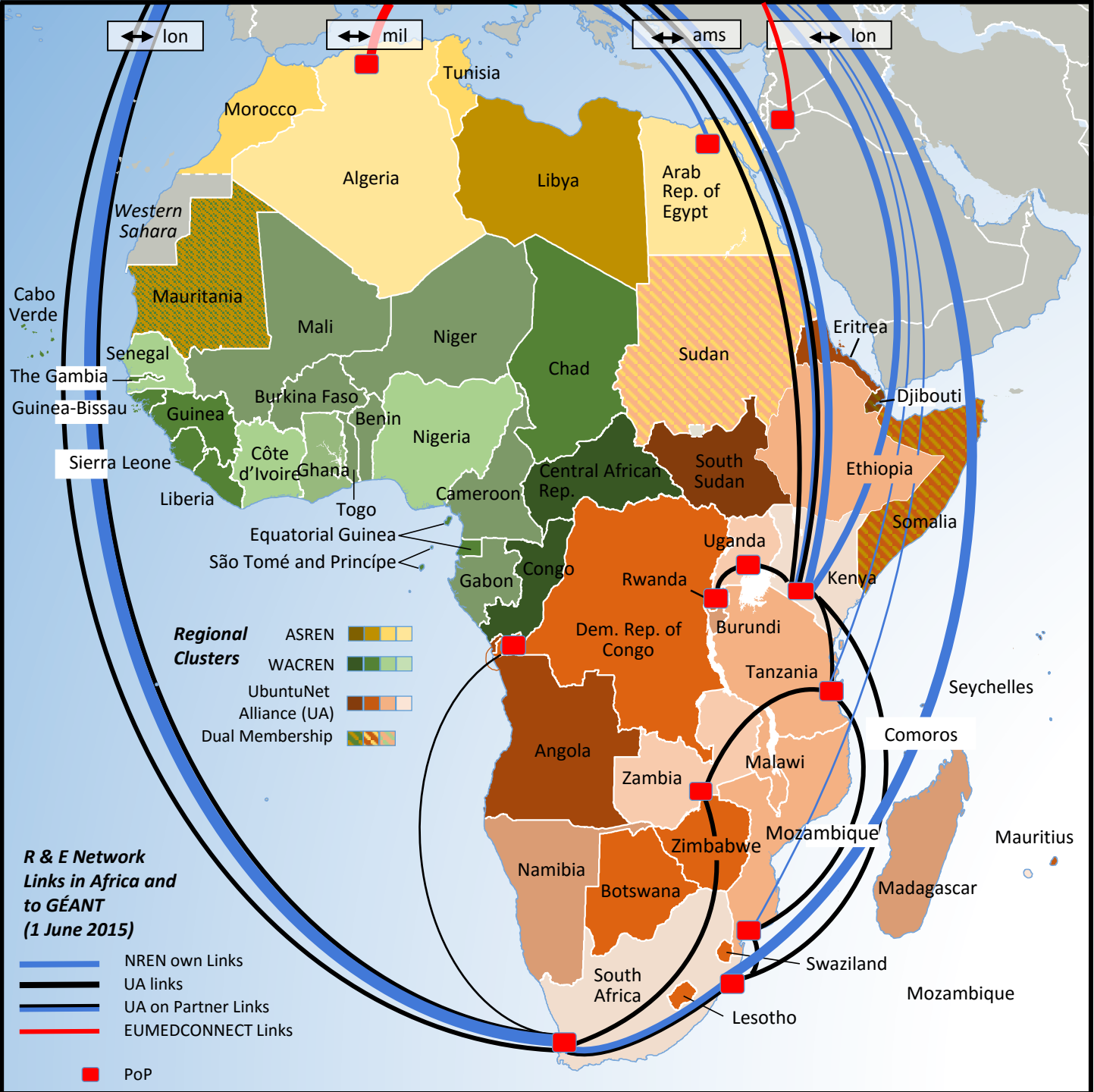
Graph 7.4.1 – Income sources, GÉANT partner countries



Governance models

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

June 2015

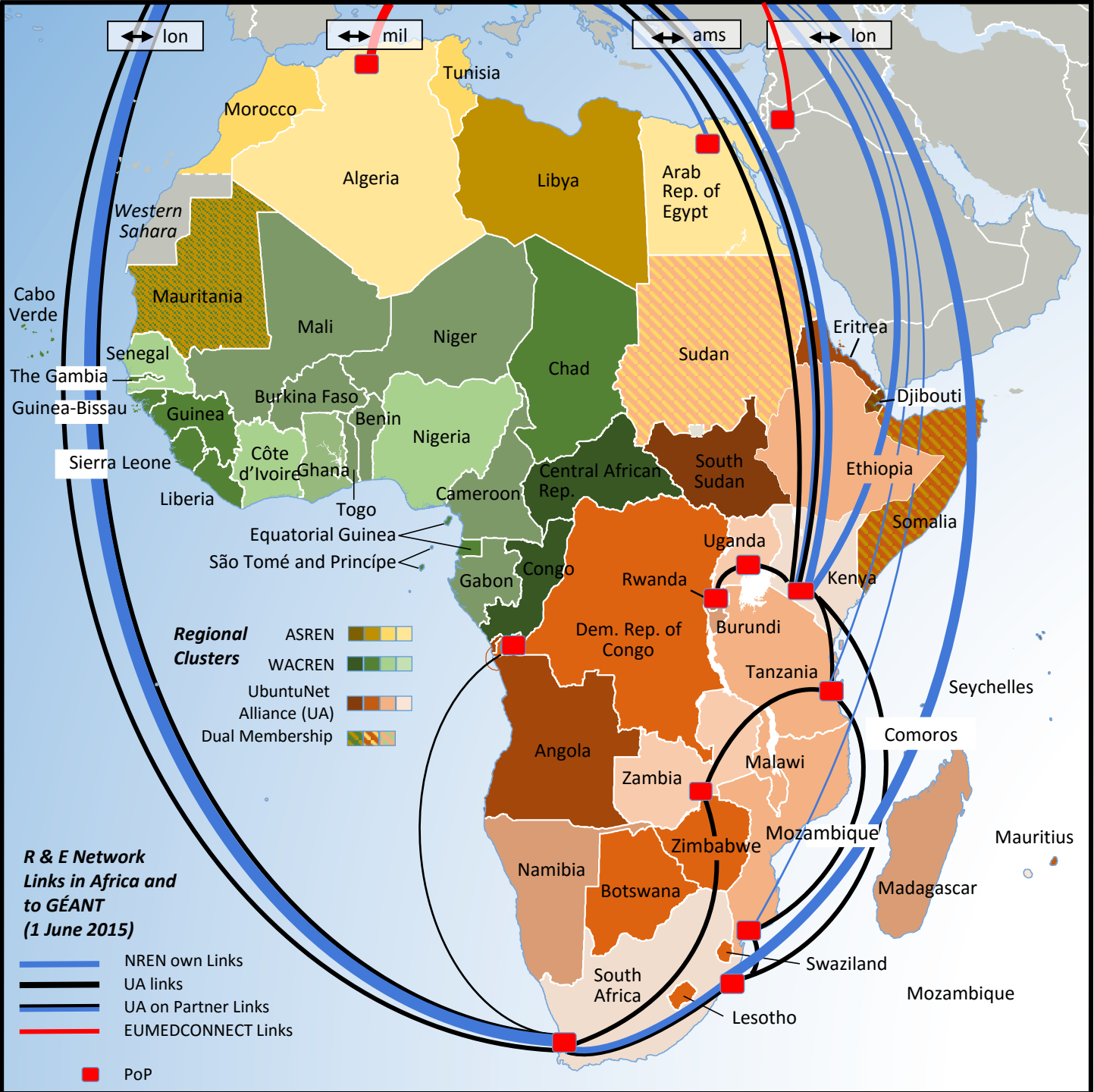


Seven Levels of NREN development

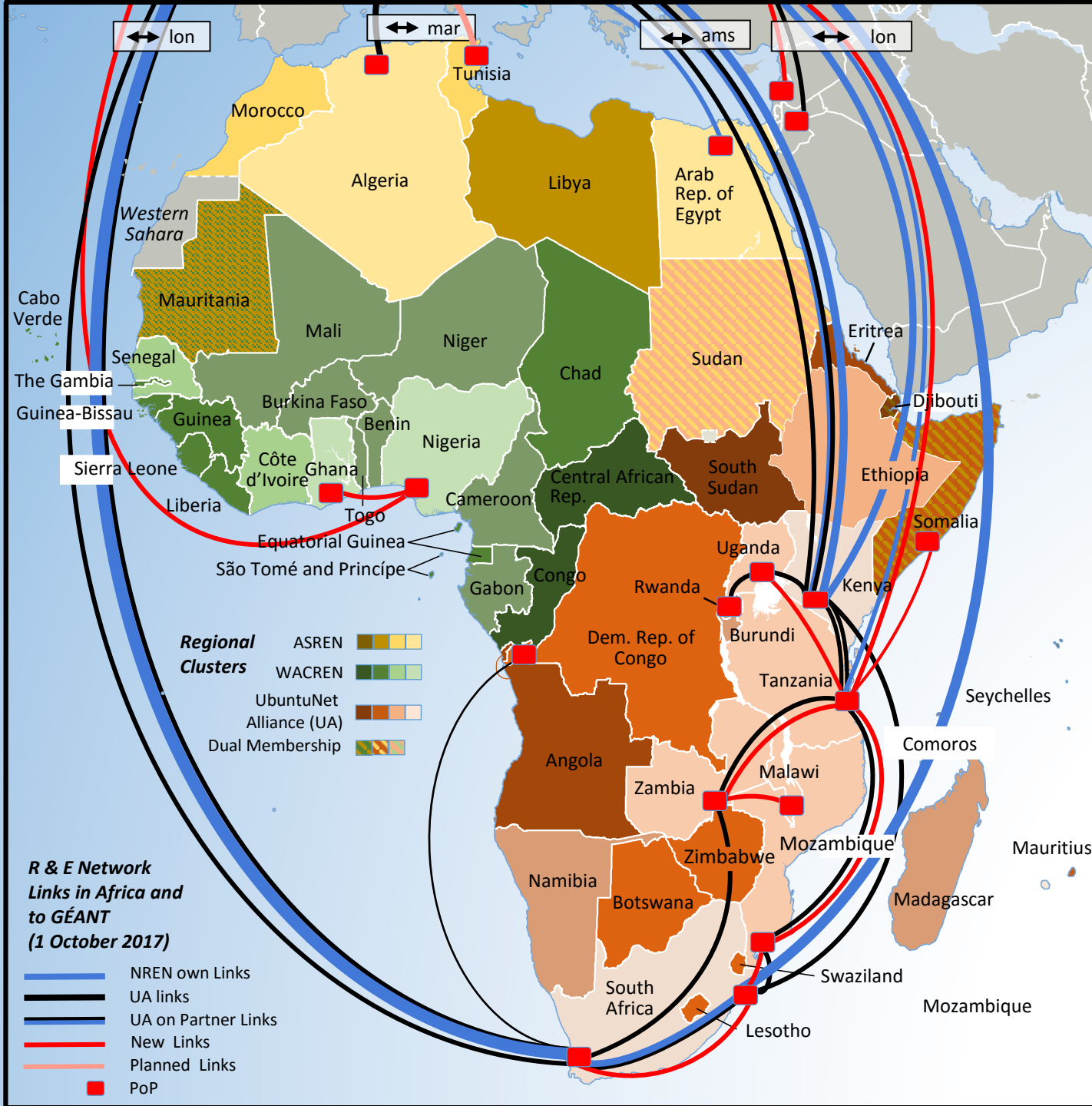
Capability Maturity Model *(Duncan Greaves of TENET)*

- 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.

June
2015



Oct.
2017



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

The background of the slide features a dark blue gradient. On the left side, there is a silhouette of a person in profile, holding up a smartphone with the screen lit. In the lower center and right, there are several other smaller silhouettes of people, some also holding up their phones, creating a sense of a group or community. The overall mood is technological and forward-looking.

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?'

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!

- NREN in operation
- NREN in advanced planning
- Early or no planning for NREN

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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