Setting Up and Financing National Research and Education Networks

Objective of this Note

This Note is targeted at academic and research institutions that are planning to start, or are in the process of starting National Research and Education Networks (NRENs) in their countries. It gives a quick insight into the motivation, setting up, and financing of NRENs.

The Note has been developed by the UbuntuNet Alliance for Research and Education Networking as part of a set of tools to support the growth of REN activity in the continent with the intent of empowering and creating global equity for Africa-based educationists and researchers.[1]

I. What is an NREN?

NRENs are education and research collaborations at the national level that are facilitated by high speed broadband connections among partner universities and research institutions. The general purpose of NRENs is to bring different universities and research institutions together to attain economies of scale for large volume procurements of bandwidth and equipment, sharing of human knowledge, content, facilities and networking resources, and lobbying policy makers and regulators. Specifically, NRENs:

- Provide members with stable high-speed transport networks; separating academic traffic from commercial (commodity) traffic; and there by creating non-commercial networks for research and education and fast links between member campuses;
- Ensure that advanced networking traffic is not disabled by congestion from commodity-type traffic
- Create connectivity to other research and education networks worldwide;
- Create a community of education and research network actors to facilitate the exchange of experience and knowledge on diverse networking issues;
- Encourage broad participation of member institutions in sharing content such as library and learning materials;
- Promote research into high performance network technologies and develop next-generation networking and applications in research and higher education.

NRENs involve institutions that work together towards building non-commercial networks for research and education; establishing peering agreement with other research and education networks; and establishing transit agreements with large regional networks like *Géant. NREN member should be academic and research institutions. Benefit is often extended to non-commercial institutions that support education and research, like teaching hospitals, national libraries, and museums.*

---

[1] We acknowledge with thanks and appreciation the role that has been played by Dr Duncan Martin, Dr Lishan Adam, Mr Victor Kyalo, and Dr F F Tusubira in the development of these notes.

II. How are NRENs established?

NRENs can emerge in many ways depending on local circumstances. For example, NRENs can be established to purchase bandwidth at discounts by forming a "bandwidth consortium"; or to lobby government and regulators to relax licensing conditions of VSATs; or enable NRENs to own and operate fiber networks. Other NRENs are triggered by the desire to establish connectivity and share content among existing human networks – for example library associations.

In general, there are some common steps that university leaders, policy makers and those who are trying to establish and sustain NRENs should follow. The key steps are listed below:

1. **Getting the Leadership and Commitments Right**

Successful NRENs depend on an initial exercise of leadership by the founding institutions and agreements between academic and research institutions to collaborate to share networks and resources. Leadership and willingness are critical for getting buy-in from all actors, fostering inter-institutional collaboration, securing political and regulatory support from the government, and mobilizing resources.

The collaboration between NRENs should be achieved at university leaders' levels (Vice Chancellors and Deputy Vice Chancellors; Rectors and Vice Rectors; Presidents and Vice Presidents). Key to this stage is the specific individual (champion) identified to lead the process: The champion must be a committed and dedicated agent of change with the social engineering skills to create buy-in, confidence, and success. The operational relationships with user campuses should along ***normal customer-supplier*** lines

2. **Establishing an Institutional and a Governance Framework**

Once the leadership and commitment hurdle is addressed, a team led by the champion needs to be established to drive the NREN agenda forward, in particular at the early stages of NREN formation. Further deployment of an NREN involves the following institutional and governance development steps:

i. **Establishing a Board of Directors of the NREN**. Members of the Board of Directors need to be selected on the basis of their experience and what they are able to offer the NREN. The Board members should be experts rather than representatives of the participating academic institutions. The IT directors who are supposed to be customers of the NRENs should not be members of the Board due to the anticipated conflict of interest.

ii. **Setting up and staffing of a Secretariat.** The NREN is a service body, thus its secretariat should be small. The Secretariat often comprises a motivated executive director, a technical director and additional staff that handle administration and accounting.

iii. **Developing relationships with the public and private sector institutions and donor agencies.** Close collaboration with policy makers, regulators, the private sector, service providers and donor agencies (these are respectively responsible for development of

national policy and regulations, building the national backbone infrastructure, and funding academic networks) is critical for the successful implementation of the NREN. NRENs should establish ongoing dialogue with policy makers and regulators to address network ownership, cost and availability challenges. NRENs need to work with Internet registries such as AfriNic to secure Autonomous Systems Numbers (ASNs) and independent IP address space[2]. ASNs help to uniquely identify academic institutions and NRENs and also enable the separation of academic from commercial traffic

iv. **Developing a business plan for NREN.** A business plan that covers services provided to users, costs and price baskets for different services is necessary for a sustainable operation of NREN. Membership fees should cover operating costs (bandwidth and normal overhead costs). Other costs such as capital expenditure for equipment and capacity building costs may be met through government and donor funding.

3. Securing High Speed Bandwidth

Building advanced networking infrastructure is the priority task of NRENs. The approach to achieving this is normally a business decision: what is the most cost-effective way of delivering services to member institutions within the agreed service levels?

Securing high speed bandwidth can be achieved by:

i. **Building own infrastructure:** In countries where the regulations allow, NRENs can build their own networks. This would involve laying own fiber and provisioning necessary transmission equipment or deploying wireless systems such as microwave links. The NREN can operate and manage this infrastructure by itself or outsource the operation and management to service providers.
ii. **Leasing the infrastructure:** The NREN can lease existing but unused infrastructure like dark fiber from telecommunications providers or other entities such as electricity, gas or rail companies. In this case, the NREN could provide its own transmission equipment. The leased infrastructure can be operated by the NREN or outsource operations to an independent operator.
iii. **Purchasing managed services:** The NREN can lease fiber or microwave and satellite links from the telecommunications providers owning all transmission equipment;
iv. **Purchasing capacity:** The NREN can purchase capacity or bandwidth from service providers between two or more points. In this case, the NREN network is acts as a Virtual Private Network.

4. Promotion of Resource Sharing among Members

The ultimate goal of a National Research and Education Network should be establishing a robust academic research and education network that facilitates the sharing of content among its members. This implies the need for establishing a strong driving link between the university research and teaching strategies and the NREN strategy, building the capacities of members in optimizing network resources for sharing learning resources.

---

[2] Autonomous systems numbers and IP addresses are discussed in Document UA 152 and UA 153 in this series of Notes.

5. Establishing Regional and International Connection

NRENs need to develop peering and transit agreements with other national and regional research and education networks to facilitate global reach to other research and education networks and the resources different academic institutions. International collaboration is also essential for accessing expensive and/or unique research facilities located in other countries, and promoting global research co-operation.

III. How are NRENs Funded?

There are three main sources of NREN funding: Government, Donors and NREN member contributions. A long term business model that demonstrates operational sustainability of the NREN is critical to the securing of support from all funding agencies.

  i.   Government funding is usually provided through one or more ministries, departments or other such bodies responsible for education, science, technology, telecommunications or research.
 ii.   Donor funding includes funding from bi-lateral and multi-lateral development organization, public and private foundations, non governmental organizations (NGOs) and private industry. Government and donor funding is critical in the initial phase of establishing the NREN and acquiring the physical network. After the initial phase, funding is also required to continuously upgrade and extend the physical network and develop new services.
iii.   Member fees, on the other hand, are critical for running and sustaining the NREN. These fees come in the form of annual contributions that include membership fees and payments for services such as national, regional and international access; training; and consulting.

Experience shows that NRENs need to mix central government and donor funding and member payments based on circumstances and capacity of the institutions to pay for services. Payments from member institutions should cover operating costs (bandwidth and normal overhead costs). Other costs such as capital expenditure for equipment and capacity building cost can be met through government and donor funding. It is also important to position NRENs as providing a public good so that they benefit from universal access funds.

IV. Conclusion

NRENs have become essential for the advancement of research, science and education to maintain competitiveness. While this note has given the key steps in establishing NRENs, it is not claimed to be a comprehensive source. UbuntuNet Alliance recommends that in addition to other literature in the public domain, NRENs in formation should get in touch with established NRENs in order to benefit from the real lessons learnt through both successes and failures.