

# Global Open Exchange Points and Research and Education Networking Futures

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## Abstract

Work is underway to develop a set of principles that are intended to guide the interconnection of national and regional research and education networks. These principles have the concept of a Global Open Exchange Points as a foundational element for interconnection of research and education networks. While this work is not yet fully developed, the Author encourages the African research and education community to consider whether the African community would like to identify opportunities for developing one or more Global Open Exchange points on the African Continent.

**Keywords:** Global Network Architecture, Global Open Exchange Points, Peering, Research and Education Networking

## 1. Introduction

In September, 2012 a group of Chief Executives Officers of a number of National Research and Education Networks (NRENs) met in Geneva, Switzerland to discuss common problems and challenges. One of four challenges that were identified included a lack of global strategy for coordinating the interconnection of national and regional research and education networks.

### 2.1 NREN CEO Forum

A self identified set of Chief Executive Officers of National and Regional Research and Education Networks have been meeting to identify common problems and challenges. This group is called the NREN CEO Forum and is modelled on the G20 Leaders Summit. As of this writing (November 2014), the NREN CEO Forum consists of the Chief Executive Officers of AARNet (Australia), CANARIE (Canada), CERNET (China), CUDI (Mexico), DANTE (Europe), DFN (Germany), Internet2 (USA), Janet (UK), NORDUnet (European Nordics), REANNZ (New Zealand), RedCLARA (Latin America), RENATER (France), RNP (Brazil), SURFnet (The Netherlands), and the UbuntuNet Alliance (Southern and Eastern Africa).

In a meeting in Geneva in 2012, this group identified 4 challenges, including challenges with the global coordination of the interconnection between National and Regional research and education networks. The NREN CEO Forum formed a group called the Global Network Architecture working group. This working group was charged with drafting a blueprint for

the interconnection for the interconnection of global research and education networks, with a view on the 10-year timeframe.

## **2.2 Global Network Architecture Technical Group**

The Global Network Architecture (GNA) Technical Group has been charged by the NREN CEO Forum to describe an inclusive next generation inter-continental research and education network infrastructure with a 10-year view. This work has been ongoing since early 2013 with an initial document by Xing Li (CERNET) and Jim Williams (Internet2).

It is important to highlight that the GNA is not a network. It is framework architecture for advanced, cohesive, global research and education networking and service delivery. By setting a framework for cohesive global networking, it is hoped that the existing network projects will choose to upgrade their networks to be compatible with GNA and then interconnect and/or contribute them to the GNA.

Discussions inside the GNA group has led to a global network architecture model that consists of a powerful intercontinental transmission substrate, consisting of

- Global Open Exchange Points (GXPs)
- High-bandwidth transmission pipes (running between GXPs)

The GXPs in this architecture model have two major functions:

- Attachment points for the high-bandwidth circuits of the substrate
- Connection points for the Regional and National R&E Networks that are part of and make use of the GNA infrastructure

The GNA has described a vision that has at least two GXPs per continent or region. These GXPs are to be chosen by each region's research and education network organizations, taking the intercontinental fibre optic paths into account. Figure 1 outlines an artist impression of a possible GNA architecture. Please note that the network and landing points shown have not been selected by any of the potential partners, including those in the African research and education networking community. Please view this as a conceptual example that does not indicate specific circuits or landing points.



Figure 1 Conceptual Example of GNA Architecture

The GXPs are envisioned to be different from traditional Internet Exchange points in that they are focused on intercontinental and regional exchange of traffic rather than local exchange of traffic. It is anticipated that GXPs will frequently be an extension of an existing Internet Exchange, assuming that the existing Internet Exchange is willing to make the feature extensions to meet the ultimate requirements of a GXP. These features are still under discussion, but will most likely include at least the following:

- Exchange of general purpose unicast and multicast IPv4 and IPv6 traffic
- Peering exchange with commercial providers
- Ability to provision layer 1 or layer 2 (optical path or VLANs) through the exchange to support specific research and education activities
- Have the capability to support network research, including supporting research-based Software Defined Networking (SDN) slices for research activities.

## 2. Impacts on the Region

Much of the existing work on both the CEO Forum and the Global Network Architecture working group has happened without significant input from emerging regions. This has put the UbuntuNet region at a disadvantage in terms of providing feedback, but most importantly, has not allowed the region to consider the impacts of the work or what specific actions the region may want to take in response to the work.

Currently, African research and education networks purchase circuits to Europe to exchange traffic with both the commercial Internet and global research and education community. African research and education network operators can potentially change the paradigm so that other research and education networks pay to get to Africa rather than having Africa pay to get to them. If there were some well defined and properly architected GXPs on the African

continent, it is likely that other research and education network entities will install circuits to those GXPs to support science activities on the continent.

As the community considers the possibilities of one or more GXPs on the continent, it is critical to pick a location with a number of undersea fibre cables land. Multiple cables are required to provide competition, reliability, and choice for getting access to the GXP. In examining the undersea fibre cable maps of Africa, one can find a number of possible opportunities where multiple undersea cables land in a single location. Based on the Telegeography Submarine Cable map, there appear to be 17 cable landing stations in African that land 3 or more cables.

A final note about the selection of GXP locations, it is important that the GXPs be able to be associated with science projects that are global in interest that would make it attractive for outside research and education funding entities to be willing to install high bandwidth connections to the GXP.

### 3. Summary

Without action by the African research and education networking community, the status quo will remain in force and the African community will have to continue to pay to get to the global research and education network fabric. The author encourages the community to develop a number of Africa-based GXPs in order to provide an opportunity for other research and education networks to provide funding to connect the African research and education community to the rest of the world.

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### Biography

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