UBUNTUNET ALLIANCE FOR RESEARCH AND EDUCATION NETWORKING

Note on the termination in Europe of NRENs' submarine cable circuits

8 October 2009

Very Important message!

Several Member NRENs of UbuntuNet are in the process of securing submarine cable capacity to Europe. Below are essential do's and don'ts to ensure that high-speed capacity to Europe will enable the NREN to function as a real NREN and not just as an ISP.

The UbuntuNet Alliance plays an essential role in this message. UbuntuNet is the recognized Regional REN for Eastern and Southern Africa, and operates a gateway in Telecity, London, via which Member NRENs can secure both global REN connectivity and global commodity connectivity.

Here are the messages!

When Member NRENs of UbuntuNet purchase capacity on submarine cables to Europe:

(a) Telecity, London is the place at which the purchased capacity should terminate in Europe, because that is where the NREN can connect to and receive both REN connectivity and commodity Internet connectivity services from UbuntuNet;

(b) The NREN should NOT purchase Internet connectivity (Layer 3) from the cable provider, but only transport connectivity (Layer 2), with terminations at the NREN's own router in Africa and at the UbuntuNet router in Telecity, London; and

(c) The NREN should operate its own border router at its home node and exchange BGP route announcements (via the submarine cable) with the UbuntuNet router at Telecity, London.

An NREN that does not arrange matters as specified above will be unable to function as an NREN. It will be no more than an ISP and its participating institutions will not enjoy REN connectivity.

In Internet practice, what distinguishes NRENs?

Organisationally, what distinguishes bona-fide NRENs (National Research and Education Networks) from general ISPs is the NRENs' mission to serve exclusively, and on a not-for-profit basis, the Internet connectivity needs of the noncommercial research and education institutions of their respective countries. To interconnect with other RENs, an NREN's organisational bona-fides must be acceptable to its "upstream" regional REN.

However this note is not about the organisational side of being an NREN, but about what distinguishes NRENs from general ISPs in internetworking practice.

In practice, the bona fide NREN operates a direct Internet interconnection with a recognized *regional* research and education network, through which the NREN enjoys *REN connectivity* globally - i.e. high-speed Internet connectivity via routes between the World's RENs with other universities and research campus networks worldwide.

*NB. UbuntuNet offers **global REN connectivity** to member NRENs that connect to UbuntuNet's router at Telecity, London.*

In addition to REN connectivity, NRENs often provide general Internet connectivity (also known as commodity Internet connectivity) to their participating institutions. They may do so via service agreements with one or more commercial ISPs and/or with their upstream regional RENs.

Within Telecity, UbuntuNet interconnects directly with and purchases general Internet transit from NTT, which is one of the largest top-tier ISPs with a global footprint. In addition, also at Telecity, through membership of the London Internet Exchange (LINX), UbuntuNet has settlement-free peering arrangements with some 200 large ISPs.

*NB. UbuntuNet offers **global commodity Internet connectivity** to member NRENs that connect to UbuntuNet's router at Telecity, London.*

Example: TENET secures global REN connectivity for its participating institutions exclusively through its interconnection with UbuntuNet in Telecity, London. In addition, TENET provides its participating institutions with commodity Internet connectivity (a) with South African ISPs via peering and transit interconnections with ISPs at the Johannesburg and Cape Town Internet Exchanges, and (b) worldwide via its interconnection with UbuntuNet in Telecity, London.

How Internet interconnections work

Internet interconnections between networks (including RENs and commercial ISPs) function at the so-called *Internet Layer* (Layer 3; IP packet routing), completely independently of the natures of the underlying transport layer (Layer 2; SDH, Ethernet, ATM,..) or the physical layer (Layer 1; copper, fibre, wireless,..).

Internet interconnections between networks occur between pairs of routers operated by the interconnecting networks. Such routers are referred to as *border routers* because they manage the traffic flows between networks managed by different parties. Such pairs of border routers maintain a BGP (Border Gateway Protocol) session between themselves, by means of which they exchange route announcements with each other, and they receive and forward Internet packets between themselves in accordance with these route announcements.

Importantly, when two RENs exchange route announcements, neither REN ever announces to the other REN a route that it has learned from a border router of a commodity ISP or other non-REN operator. This is a key tenet of REN Internet practice, and ensures that the Global REN remains dedicated to traffic passing between bona-fide NRENs.

Example: Géant and UbuntuNet, as European and African regional RENs respectively, exchange route announcements and the corresponding IP traffic with each other at their border routers in Telecity, London.

By agreement, UbuntuNet announces to Géant routes, via UbuntuNet and via its member NRENs, to all campus networks of all UbuntuNet's participating NRENs. Likewise, by agreement, Géant announces to UbuntuNet routes to campus networks of all regional and national RENs worldwide. Géant's routers learns these routes via their interconnections with other regional RENs such as Internet2 (USA), CANRIE (Canada), AARNet (Australia), TEIN2 (Far East) and many others.

Precondition: having a Network identity – ASNs

Any network operator, including any NREN, which manages its own routers and wants to interconnect and exchange route announcements with other networks via BGP must have its own unique network identity. Network identities are represented in route announcements by so-called Autonomous System Numbers (ASNs). For example, UbuntuNet's ASN is 36944; TENET's is 2018.

ASN's are assigned to network operators by the Regional Internet Registries to ensure the uniqueness of such assignments. African NRENs can apply to AfriNIC for an ASN.

Precondition: having your own IP addresses

The routes announced by a border router are either routes that it has itself "learned" from other border routers or are routes to nodes in its own network that it originates. For example, routes to the IP prefixes of campus networks of Kenyan universities originate within TENET's ASN and become included in the routing tables of border routers everywhere ultimately thanks to KENET's announcing them. By contrast, UbuntuNet learns these routes from KENET, and onward announces them in London to Géant, which in turn onward announces them to other regional RENs.

To originate route announcements to an IP prefix requires the permission of the party to whom that Prefix is assigned. Often campus networks are numbered with (use IP addresses made available by) a commercial ISP that provides Internet services to the institution. Those ISPs, in their BGP route announcements, originate routes to such campuses, and will not allow the NREN to also originate routes in its BGP route announcements. That is why it is important for the campus networks of any NREN's member institutions to be numbered with IP addresses that AfriNIC has assigned either to the institution itself or to the NREN.