Campus Network Best Practices: RENs Around the World

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Research and Education Networks

• Some Terminology
  – Research and Education = R&E
  – Research and Education Networks = REN
  – National REN = NREN

• Globally, the REN connectivity is very complex and very difficult to understand
REN Characteristics

• High bandwidth networks
  – 10G backbones with 40G and 100G coming
  – Research typically needs uncongested networks
    • Which means many RENs are lightly used with lots of unused capacity (we call it headroom)

• Low latency
  – Terrestrial fiber

• Open Networks with no filtering
  – Firewalls can make it hard for ad-hoc activities
REN Ecosystem

• A layered model
  – Global Connectivity
  – Regional RENs
  – National Research and Education Networks
  – All users are connected at the campus network level
    • No scientist is connected directly to a National Network. They are all connected to campus or enterprise networks
REN Topics

- A look at the Global and Regional REN environment
- A closer look at USA RENs
- How does this relate to South Asia
- NREN IP Transport Models
- Technical Requirements for campus networks and NRENs
Global REN Connections

• Connect Regional or National networks together
• Tend to be longer, more expensive circuits
• Not always well coordinated
• Routing policies often inconsistent
• Always are peering networks
For further information regarding the international programs of Internet2, visit http://internet2.edu/international or contact Heather Byes, International Relations Director, international@internet2.edu.
A listing of networks reachable via the Internet2 Network is found on the back of this page.
Regional REN Connections

• Most regional networks have funding from European Union
  – EUMedConnect
  – TEIN/TEIN2/TEIN3
  – GEANT
  – ALICE/ALICE2 – RedCLARA
  – AfricaConnect/Ubuntunet
Planned Backbone Topology by the end of 2010. GÉANT is operated by DANTE on behalf of Europe's NRENs.
The South Asia REN Picture

- APAN
- VinaREN
- ThaiREN
- GEANT
- Internet2

University Member

UNIVERSITY OF OREGON

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NREN Models of Service

• Two basic models:
  1. Peering network
     • Exchange traffic between members
     • Provide international connections (GEANT, etc)
     • Can peer with a local commercial exchange (Google, local ISPs, etc)
  2. REN provides all Internet connectivity
     • REN is the ISP
     • In this case, REN also provides peering network
NREN as Peering Network

Myanmar REN

Internet Service Provider #1

Internet Service Provider #2

University

University

University

TEIN

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NREN as ISP

Internet Service Provider #1

Internet Service Provider #2

TEIN

University

Myanmar REN

University

University
Implications for Universities

- If NREN is a Peering Network
  - Each University still has their own ISP
  - Each University connects to NREN
  - The two connections are hard to manage

- If NREN provides all Internet connectivity
  - Simplest for campus members
  - Treats NREN as Internet Service Provider
  - Only one connection to manage
NREN as a Peering Network

• Easiest to implement from a political perspective.
  – The Internet Service Providers like this approach because they keep many customers
  – Often the legal and regulatory environment allows this use without licensing and/or the license is easier to get

• However, there are problems with this approach
NREN as a Peering Network

• Universities now have two connections
  – How do they decide which one to use?
• Three approaches:
  1. Get provider independent IP address, autonomous system number, and run BGP
  2. Get routes from NREN and run special software and configuration on a NAT box
  3. Split campus network into NREN and Internet
• What do we find around the world?
NRENs Around the World

• Most NRENs act as the Internet Service Provider

• For those that do Peering Only
  – Advanced regions: they do the right thing and have Provider Independent IP addresses, ASN, and run BGP. This works fine.
  – Less advanced regions: they split their campus and the NREN becomes a video conferencing network.

• What kind of network will you build here?
What to do in Myanmar?

• MPT will need to be involved with the International connection to TEIN
• Will REN serve Universities from all Ministries?
• Will the REN be operated by MPT or by Universities?
  – If Universities, which University or Ministry should lead?
• NSRC can provide training on building NREN
Questions/Discussion?