The 6NET Project

A narrow view on the project

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6NET in Short

Overview
- 3 year EU IST project started in January 2002
- A large project, 18M EUR budget, 35 partners

Main objectives
- Install and operate an international IPv6 pilot network
- Test and evaluate IPv6 migration strategies
- Introduce and test new IPv6 services and applications
- Collaborate with other IPv6 activities and the IETF
- Promote IPv6 technology

Partners
- Industry
  - IBM, Cisco, NTT, others
- National Research Networks
  - Almost every NREN from Europe
  - Funet, Forskningsnettet, Uninett from NORDUnet
- Academic
  - 3 from the UK, 3 from France, 2 from Finland, others
6NET Core Topology

[Diagram of 6NET Core Topology with various nodes and connections representing countries and networks, such as UK, France, Germany, etc.]
6NET Activities

6NET Activities 1/2

- WP1 - Build & operate the network
  - Build network, test software, tune routing policies

- WP2 - IPv4/6 co-existence and migration
  - Site and ISP cookbooks, list of open IPv6 issues

- WP3 - Basic network services
  - DNS, DHCP, Routing Registries, multicast routing, AAA

- WP4 - Application & service support
  - Mobile IP, IPv6 WLAN, VPN’s, QoS, Multihoming
6NET Activities

6NET Activities 2/2

- **WP5 - IPv6 application trials**
  - Videoconf and streaming, gaming, GRIDs, edge services, etc.

- **WP6 - Network management architecture & tools**
  - Trial mgmt tools, write network management cookbook, others

- **WP7 - Dissemination and use of results**
  - Workshops, newsletters, presentations, ...
Experiences

6NET Experiences

Note
- There is no time go through all of the work
- So, a couple of different experiences are chosen
  ▶ By personal interests and diversity, hence the narrow view :-)

Some selected experiences
- IPv6 network management
- Application transition from IPv4 to IPv6
- IPv6 deployment in research networks
- 6bone: from playground to production
- IPv6 multicast deployment
IPv6 Network management

- **SNMP with IPv6**
  - SNMP transport over IPv6 poorly available
    - but not really necessary, as long as IPv4 is available
  - SNMP IPv6 MIB’s are few, poorly defined and not implemented
    - e.g., typically not easy to get the amount of IPv6 traffic on an IPv4/IPv6 interface

- **Network Management Systems don’t support IPv6**
  - Ciscoworks, Openview, etc.
  - But who is using them anyway in academic networks?
    - maybe more relevant in enterprises

- **Many small open-source management support IPv6**
  - Survey and report by WP6, see www.6net.org
  - "Mix and match and glue with perl and shell scripts"
IPv6 Deployment in NRENs

6NET experiences

- The deployments gave insight and sped up IPv6 plans in NRENs
- People started really looking into deploying IPv6
- Collaboration of 35 partners, information sharing
  - What works, what doesn’t, etc.
  - A very useful forum to exchange knowledge

The result

- GEANT offering "production" IPv6 transit
- Dual-stack backbones are becoming more and more common
- More often than not, the customer demand sets the pace
  - E.g., typically few customers want IPv6, or are capable of native dual-stack access

Tim Chown will likely tell us more :-)

IPv6 Deployment in NRENs
Application Transition from IPv4 to IPv6

- Enabling IPv4 apps to use IPv6 if available
  - Two ways to approach the problem
  - "Driven by new IPv6 apps"
    - Focus on new, different kind of apps which are easier with IPv6
    - Chicken-and-egg problem unless such apps would become commonplace soon
  - "Convert existing apps"
    - Focus on making the apps we currently use IPv6-capable
  - The latter is the most often preferred model
    - Otherwise there would be even lower traffic volume in IPv6 backbones

- Porting applications is not a trivial task
  - Changes in Socket API are simple enough, but..
  - Often need to redesign functions slightly
  - Especially difficult for multiparty applications
    - Participants from IPv4, participants from IPv6?
  - Simple client/server apps are easier, luckily
IPv6 deployment was kickstarted by 6bone in ~1996
- Lots of tunnels built on top of IPv4
- Many sites have (had) dozens of tunnels to other sites
- The traffic patterns could be very unoptimal
  - Unless you had lots of tunnels, causing lots of tunnels being built :-(

IPv6 deployment is moving towards real deployment
- Dual-stack backbones; good quality
- IPv6 connectivity follows physical connectivity
- However, we need more commercial transit providers offering IPv6

It is difficult to get rid of 6bone’ish practices
- Cannot separate completely, would cause two IPv6 Internets?
- Trying to align global policies doesn’t seem to work
  - Tried for a year or so, with little success
- The 6bone past is dragging us down
IPv6 Multicast Deployment

First impression

- Shouldn’t be any more difficult than IPv4 multicast?
- Wrong!
- Interdomain ASM (see below) not specified!

Multicast models

- Any Source Multicast (ASM): the classic model
  - "Many to many or one to many multicast"
  - Focusing on it here
- Source-specific Multicast (SSM): the newer model
  - "One to many multicast"
  - A much simpler model
  - However, requires support in hosts, routers, switches, and applications.
IPv6 Multicast Implementation

IPv6 Multicast ASM Implementation Status

- **Hosts and applications**
  - OK
    - Conferencing with participants from both IPv4/IPv6 multicast (+maybe unicast)?
    - (Not a multicast-specific issue, consider peer-to-peer networks)

- **Switches**
  - No MLD snooping, either flooded to all ports or discarded
  - Not a problem in pilot networks
    - But flooding could saturate even 100 Mbit/s LAN’s if heavy multicast (DVTS?) was used
    - Workaround: use VLAN’s to create dedicated, smaller LAN’s if this is a problem

- **Routers**
  - Shipping for about 6 months in Juniper
  - Cisco started/starting to ship in some software trains about now
  - Only limited mainstream implementation otherwise
  - Issue: sometimes only a few features implemented
  - Issue: may not work with all interfaces or platforms
IPv6 Multicast Ideas

- "Embedded RP" proposal
  - We need to know the RP for the multicast group
  - Idea in a 6NET meeting: encode it to the group address!
    - Very simple example: ff7e:120:2001:708::<group>
    - Results in group ff7e:120:2001:708::<group>, RP 2001:708::1
  - Implemented and works
    - If interested, see draft-savola-mboned-mcast-rpaddr-03.txt
  - Some resistance, mainly political and/or architectural

- Multicast gateway/translator (by Stig Venaas)
  - Enables IPv4 <-> IPv6 multicast translation
  - Implemented and being used

- IPv6 multicast/unicast reflectors (by K. Kabassanov)
  - Enables (automatic) unicast <-> multicast conversions

- IPv6 multicast beacon
  - Testing the sending and receiving multicast
  - http://beaconserver.m6bone.pl
IPv6 Multicast Testbeds

IPv6 Multicast Testbeds

- M6bone (www.m6bone.net)
  - Led by Renater
  - Dozens of participants from all over the globe
  - One PIM-SM domain, about one RP
  - IPv6 multicast not available between the participants
    - Tunnelled topology
    - FreeBSD, Cisco and other routers
    - Unicast/multicast topologies not congruent, so RPF checks fail, must run global RIPng for more specific routes.
    - Gave birth to M6NET

- M6NET
  - "Multicast-enabled 6NET", already about done
  - The core network is multicast-enabled
  - Unicast/multicast separation handled by the use of MBGP
    - (i.e. advertising only multicast routes is possible)
Conclusions

- 6NET has kicked off a lot of IPv6 related work
- IPv6 deployment in NREN’s has sped up
- 6NET has been a good forum for information sharing

Comments, questions, ...?