



The 6NET Project

A narrow view on the project

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6NET in Short

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

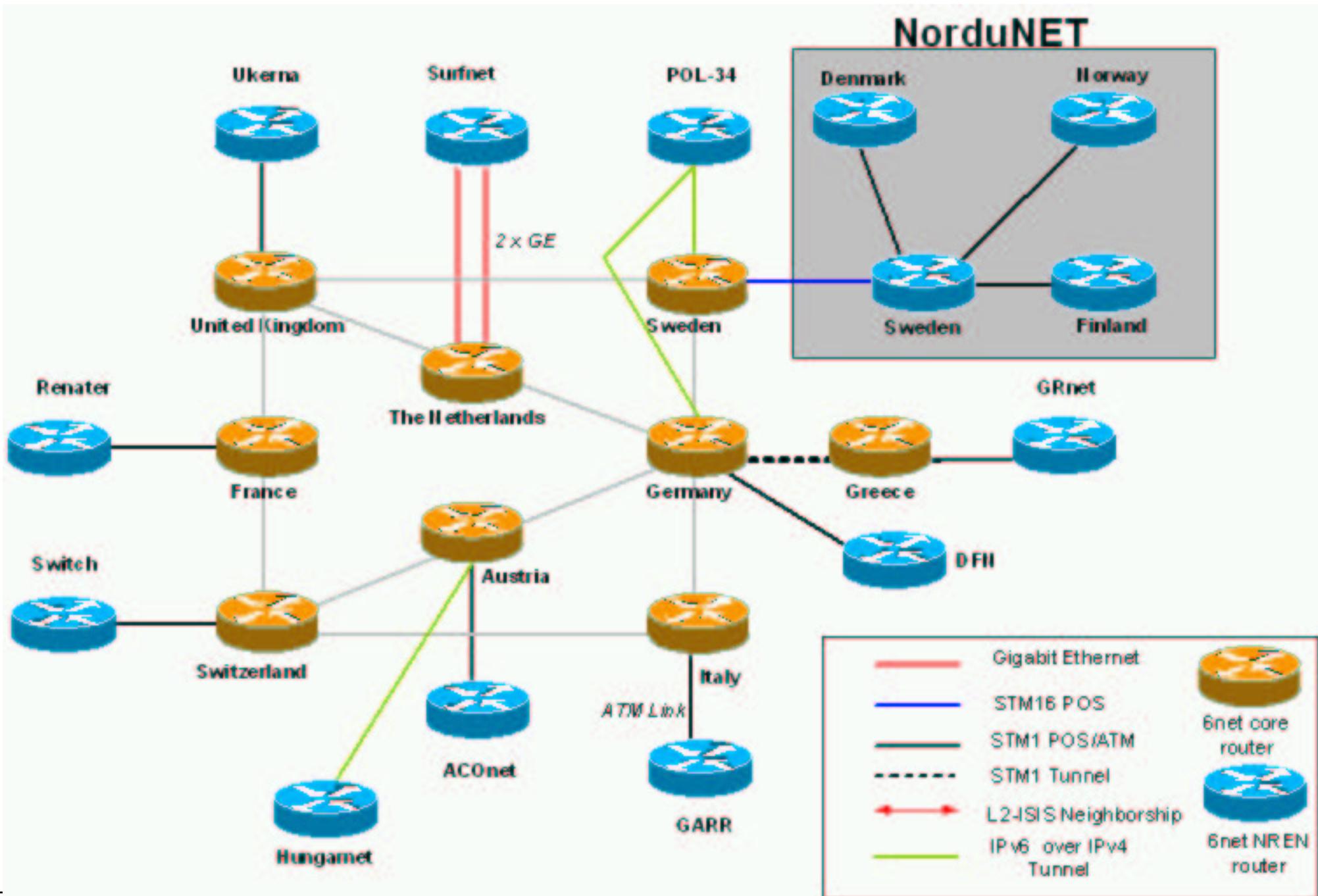
○ National Research Networks

- Almost every NREN from Europe
- Funet, Forskningsnett, Uninett from NORDUnet

○ Academic

- 3 from the UK, 3 from France, 2 from Finland, others

6NET Core Topology



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

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

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 :-)

Application Transition

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

6bone: From Playground to Production

6bone: From Playground to Production

- 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

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

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
 - Tunneled 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

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, ...?