The 6NET Project

A narrow view on the project

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Contents

Contents

- A short introduction to 6NET (4)
  - A look at the 6NET partners and network (2 slides)
  - A quick glance at 6NET work packages (2)

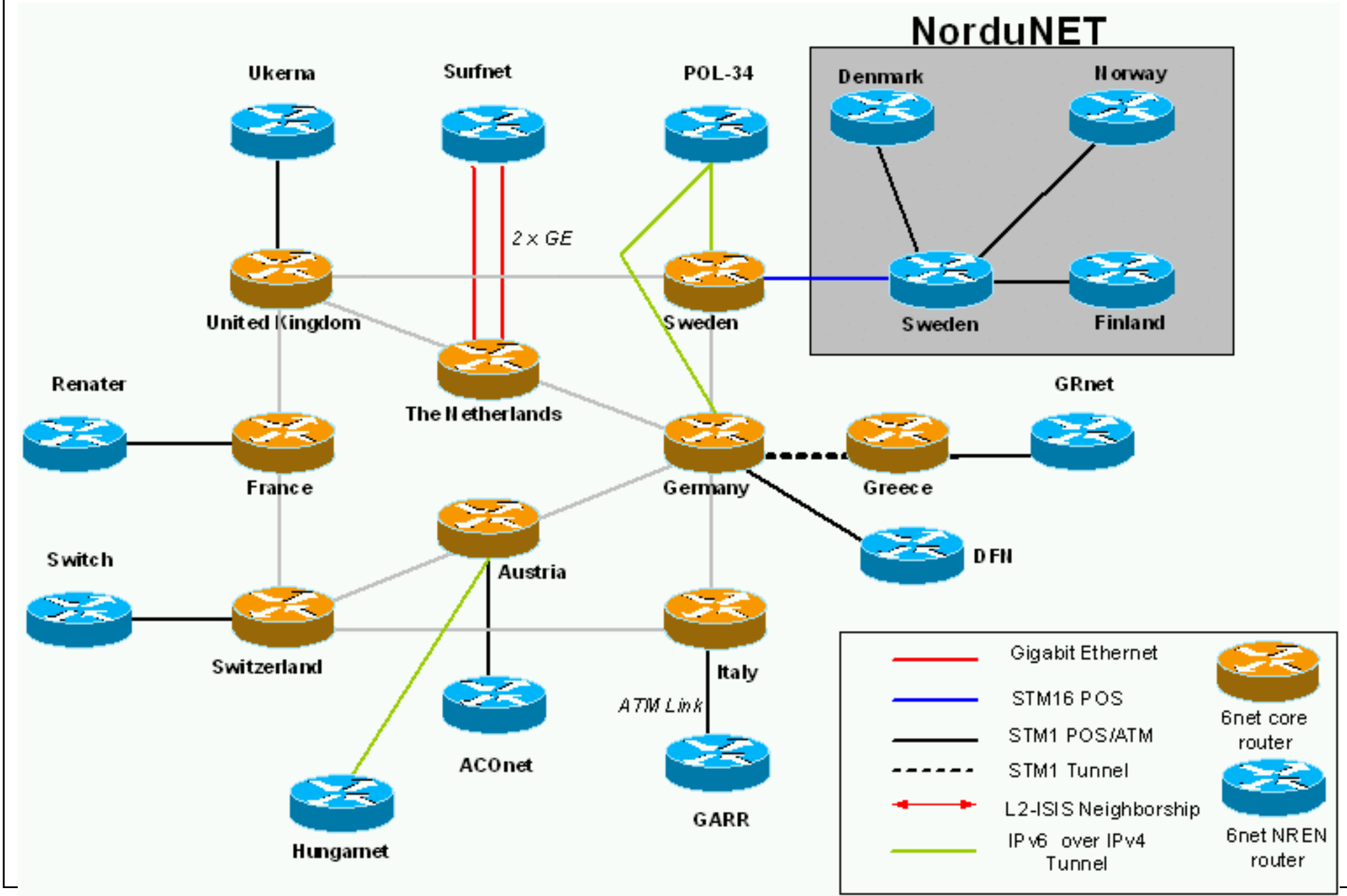
- Some experiences from 6NET (8)
  - IPv6 network management (1)
  - Application transition from IPv4 to IPv6 (1)
  - IPv6 deployment in research networks (1)
  - 6bone: From Playground to Production (1)
  - IPv6 multicast deployment (4)

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, Forskningsnettet, Uninett from NORDUnet
  - Academic

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

- 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 implemented
    - 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 a network like this?
    - 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
  - 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
- 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?
    - Which address should be used to identify the end-point?
  - Simple client/server apps are easier, luckily

6bone: From Playground to Production

6bone: From Playground to Production

- IPv6 deployment was kickstarted by 6bone
  - 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 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: make 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 little 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:**1**20:**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
  - The core network is multicast-enabled
  - Unicast/multicast separation handled by the use of MBGP
    - (i.e. advertising only multicast routes is possible)