IPv6 Experiences and Challenges

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Overview

- Basic IPv6 experiences and challenges
- IPv6 multicast
- Ideas for collaboration

IPv6 experiences and challenges

- We deployed native IPv6 in our backbone, in a large international test network (6NET), and international connectivity for many years
  - That was easy but not much use yet
- IPv6 usage increases slowly, now the university in Trondheim are deploying it to everyone, including student homes
- We currently don't have sufficient monitoring of IPv6, e.g. how much use
  - Poor support in router, now building our own probes
- Monitoring IPv6 can be even harder if tunneling or transition techniques are used
- IPv6 extension header issues
  - Some routers/firewalls only look at next-header field in basic header (cannot identify e.g. fragmented UDP packets)
  - Checking packets with many extension headers is often done in software and is slow. May be used for Denial of Service attacks?
  - Source routing can be abused

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IPv6 host and network management

- We want to do dual-stack (v4 and v6) without doubling amount of work
- Should avoid maintaining access lists on routers or firewalls separately
- Should monitor that services are available with both IPv4 and IPv6
- How to maintain DNS with use of stateless address autoconfig
- Some problems seen with hosts accidentally sending router advertisements and breaking network connectivity for everyone on the local network
  - May also be done on purpose to hijack traffic
- Will consider DHCPv6, but still rely on router advertisements for default routes

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IPv6 multicast

- IPv6 multicast and UNINETT
- IPv4 – IPv6 multicast gateway
- ssmping
- Multicast monitoring and management

IPv6 multicast and UNINETT

- UNINETT and other NORDUnet partners participated in the European 6NET project, and has been involved in IPv6 multicast for several years
  - 6NET deployed native IPv6 multicast in 2003, including SSM/ASM and embedded-RP
- Native IPv6 multicast connectivity via NORDUnet to GEANT, Abilene etc. Connectivity to many other places via M6Bone and tunnels
  - Embedded-RP needed for scalable interdomain IPv6 multicast
  - Can native IPv6 multicast from NORDUnet to China be done? I think TEIN2 does or plans to support IPv6 multicast
- Several sites with IPv6 multicast connectivity
- Developed tools like v4-v6 gateway and ssmping

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IPv4 – IPv6 multicast gateway

- IPv4 – IPv6 multicast gateway developed at UNINETT
- Translates between IPv4 and IPv6 multicast
- Depends on PIM-SM. Can be deployed and used by an entire IPv6 PIM domain with no modifications to any other software
- IPv4 multicast space embedded into IPv6
  - Uses a /96 IPv6-prefix. Last 32 bits are the IPv4 address
- IPv4 and IPv6 multicast trees joined at gateway
- Gateway is IPv4 leaf node and also IPv6 RP for the /96 prefix
- Has been deployed several places and has been in use for several years
- Example usage:
  - Places all over the world multicast session can be received with
  - vic 224.2.172.238/51482
  - vic ff7e:d40:2001:660:3001:4001:224.2.172.238/51482
  - vic ff7e:d40:2001:660:3001:4001:e002:acee/51482
- We also have a simpler solution for statically relaying specific groups

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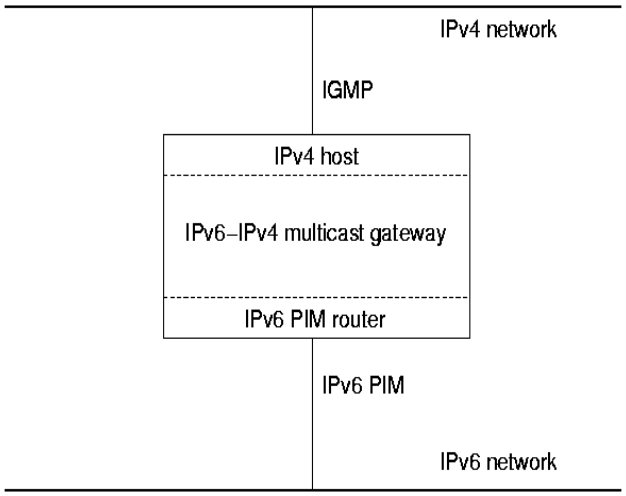
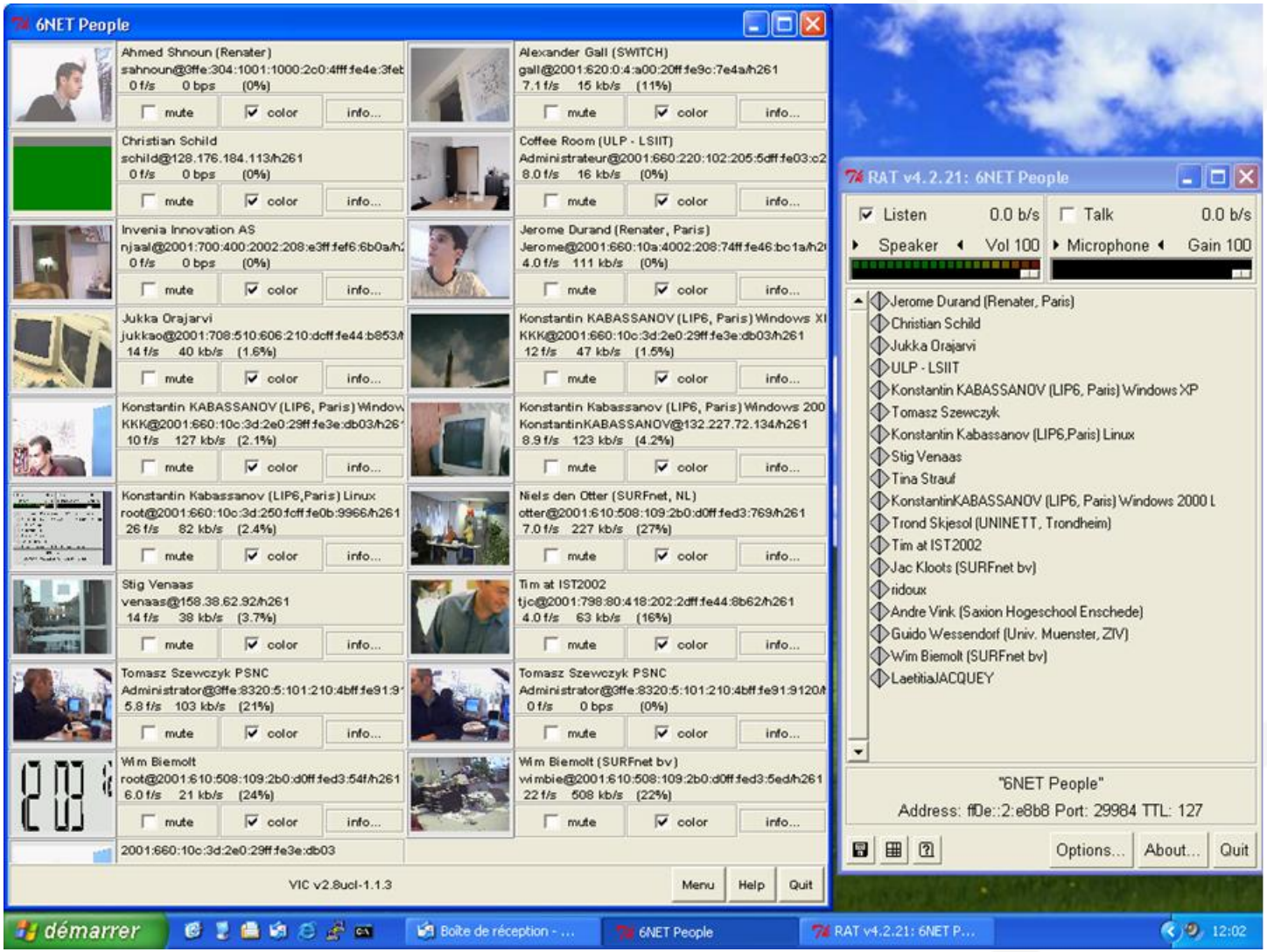
IPv4 - IPv6 multicast gateway



- In IPv4 the gateway is a multicast host using IGMP
- In IPv6 the gateway is a PIM router and RP for the /96 prefix

vic/rat session on M6Bone with gateway



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ssmping

- A tool for testing multicast connectivity
- Behavior is a bit like normal ping
- A server must run ssmpingd
- A client can ping a server by sending unicast ssmping query
- Server replies with both unicast and multicast ssmping replies
- In this way a client can check that it receives SSM from the server
  - And also parameters like delay, number of router hops etc.
- A similar tool called asmping has also been developed

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Example ssmping output

```
-bash-3.00$ ssmping -c 5 -4 ssmping.uninett.no
ssmping joined (S,G) = (158.38.62.21,232.43.211.234)
pinging S from 129.241.210.1
  unicast from 158.38.62.21, seq=0 dist=15 time=72.874 ms
  unicast from 158.38.62.21, seq=1 dist=15 time=72.663 ms
multicast from 158.38.62.21, seq=1 dist=9 time=76.502 ms
  unicast from 158.38.62.21, seq=2 dist=15 time=72.056 ms
multicast from 158.38.62.21, seq=2 dist=9 time=73.556 ms
  unicast from 158.38.62.21, seq=3 dist=15 time=72.232 ms
multicast from 158.38.62.21, seq=3 dist=9 time=73.579 ms
  unicast from 158.38.62.21, seq=4 dist=15 time=72.513 ms
multicast from 158.38.62.21, seq=4 dist=9 time=73.256 ms

--- 158.38.62.21 ssmping statistics ---
5 packets transmitted, time 5004 ms
unicast:
   5 packets received, 0% packet loss
   rtt min/avg/max/std-dev = 72.056/72.467/72.874/0.415 ms
multicast:
   4 packets received, 20% packet loss
      0% loss since first multicast packet received (after 1077 ms)
   rtt min/avg/max/std-dev = 73.256/74.223/76.502/1.335 ms
-bash-3.00$
```


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Multicast monitoring and management

- Debugging interdomain multicast
  - Often impossible to identify/locate problem when in another domain
    - Need access to routers
  - We are developing a solution based on each domain having an agent that can provide limited information on multicast state in the domain's routers
    - The agent will query routers using e.g. SNMP
  - Further, a debugging tool run by end-user or NOC might locate problem by querying the agents of the domains between source and receiver
    - Will look at ways of authorising agent access
- Multicast tracing, mtrace or some similar alternatives
- We need tools to better show multicast usage, number of receivers etc.

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Ideas for collaboration

- Establish IPv6 multicast connectivity between sites in China and UNINETT
  - Test connectivity with monitoring/test tools
  - Test applications with real content
  - Can we find some interesting content and real users?
- Look for ways to improve monitoring and management of multicast
  - See previous slide for some ideas
- DHCPv6
  - Implementation testing
  - How to use together with DHCPv4 in dual-stack networks
  - We have done some work

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