IPv6 Multicast

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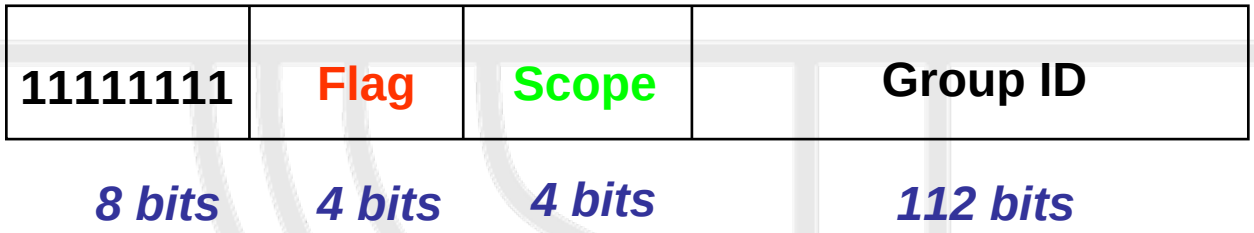
Overview

- IPv6 and multicast
- Multicast addresses
- Current IPv6 multicast deployment
- Embedded-RP and SSM
- IPv4 – IPv6 multicast gateway
- Applications and content

IPv6 and multicast

- Multicast is not new
  - Been around a long time for IPv4
  - Never really succeeded
- What's different with IPv6?
  - IPv6 requires all hosts and routers to support link-local multicast
    - And layer-2 multicast must work
  - Well defined scoping architecture
  - Better methods for allocating addresses
    - Avoid risk of different sessions using same group
  - Most IPv6 multicast routers don't need any special configuration
    - SSM working with no special configuration
    - Embedded-RP allows learning of Rendezvous Point with no configuration
  - Few NAT boxes support multicast
    - No NAT with IPv6
  - Multicast makes it easy to deliver content to large number of users
    - No additional infrastructure needed for replication
    - A broadband user can easily send to any number of receivers

Multicast Addresses



FF00::/8 addresses are multicast addresses

Flag bits: 0 R P T

T = 0 *permanent addresses (managed by IANA)*

T = 1 *transient multicast addresses*

- **P = 1** *derived from unicast prefix (RFC3306)*
  - **R = 1** *embedded RP addresses (RFC3956)*

Scope

0 : Reserved
1 : Interface-local
2 : Link-local
3 : Subnet-local
4 : Admin-local
5 : Site-local
8 : Organization-local
E : Global
F : Reserved

Allocation of group adresses

- **Unicast prefix based addresses (RFC 3306)**
  Flag : 0RPT

11111111	flag	scp	reserved	plen	Network prefix	Group ID
8 bits	4	4	8 bits	8	64 bits	32 bits

  - Flag : 0RPT
    - P=0 → Not prefix based address
    - P=1 → Prefix based address
    - If P=1, then T=1
  - Reserved : 0
  - Plen : number of bits used from unicast prefix
  - Prefix bits not from prefix should be 0
  - Ex: prefix 2001:660::/32 (RENATER)
    adresse FF3E:20:2001:660:0:0:1234:abcd

M6Bone

- An IPv6 Multicast test network (not for unicast)
- Established in July 2001 by Aristote association, G6 and RENATER
- Today more than 50 sites from four continents are connected

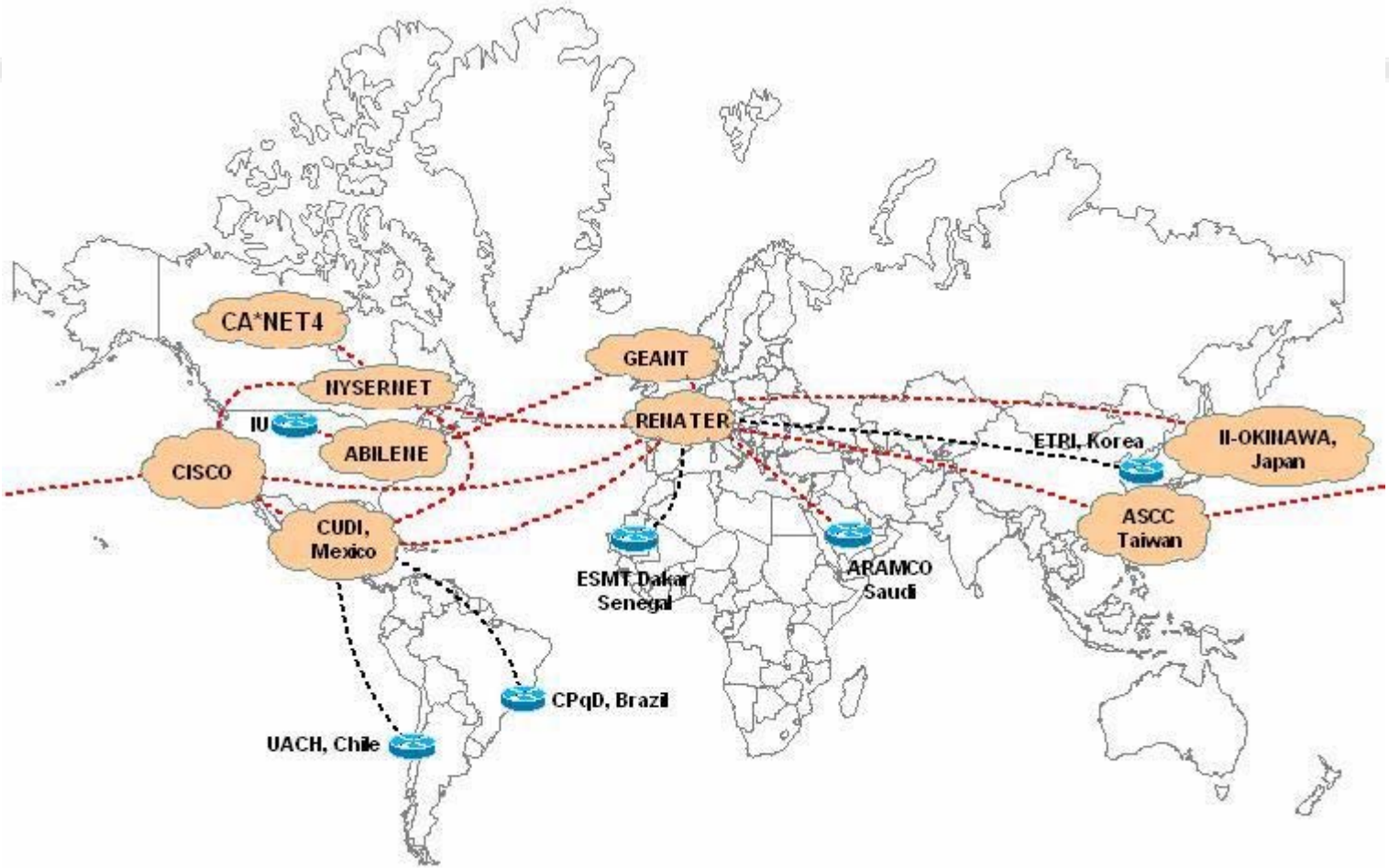
Goals

- To offer IPv6 Multicast connectivity to interested sites
- Test software and hardware related to IPv6 multicast
- Through deployment and use, learn about IPv6 multicast issues
- Offer the necessary infrastructure for IPv6 multicast applications
- To be used for conferencing and seminar distribution

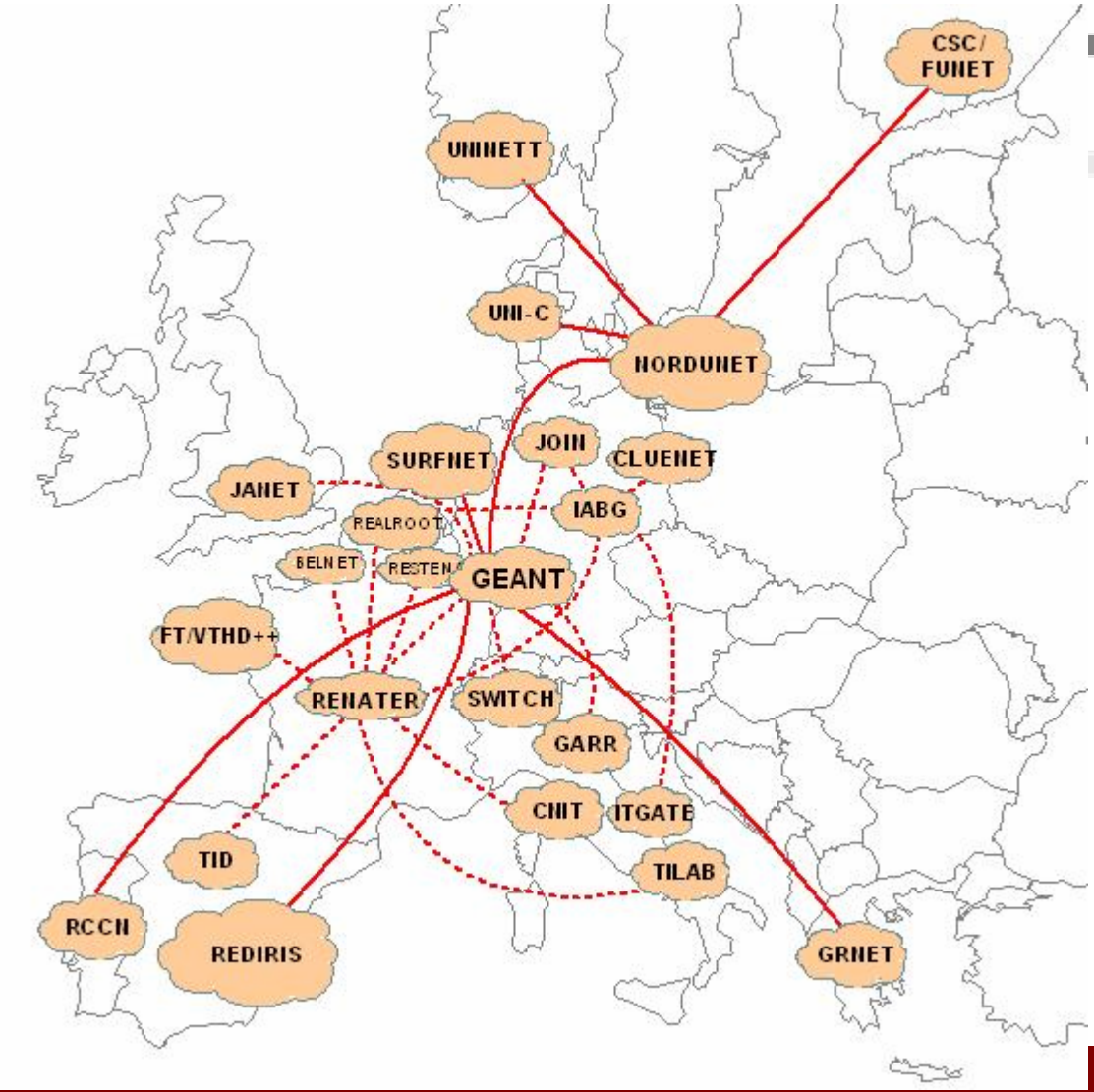
Contact info

- Web site at http://www.m6bone.net/
- May also contact m6bone-team@renater.fr
- Mailing list m6bone@ml.renater.fr
  - More than 130 active and experienced people

M6Bone – The World



M6Bone – Europe



M6Bone – The World

Many sites in Taiwan connected to M6Bone via ASCC

Map by ASCC

M6Bone – not just a testbed

- A nice environment for deploying and testing new ideas
- Many people interested in helping with tests and collaborating
- People implementing and testing new applications
- People implementing new protocols. E.g. source discovery for SSM and alternatives to SAP/sdr (session discovery)
- People testing out solutions for Mobile IPv6 and multicast
- Mailing list and also IRC channel for discussing ideas
- I will later discuss a couple of projects I'm involved in that are used on the M6Bone

IPv6 multicast availability

- For experimenting with IPv6 multicast you may want to set up multicast tunnel to M6Bone
- ASCC may provide you connectivity in Taiwan
  - I haven't checked with them
- In Europe GEANT and NORDUnet provides native IPv6 multicast throughout their networks connecting many NRNs to the M6Bone.
- In the US, Abilene provides IPv6 multicast connectivity
- Cisco and Juniper have IPv6 multicast in official images for most of their platforms
- IPv6 multicast routing also available for *BSD and Linux
  - Linux is still a bit experimental
  - Several implementations, e.g. pim6sd and Xorp (www.xorp.org)
  - MRD6, pure userspace IPv6 PIM implementation for Linux

Embedded-RP

- For IPv6 there is something called Embedded-RP (RFC 3956)
- It defines a specific way to create multicast group addresses where the RP address is encoded into the group address
  - An embedded-RP address starts with ff70::/12
  - Flags value of 7 means embedded-RP
  - E.g. ff7e:140:2001:700:f000:100:1234:beac has the RP 2001:700:f000:100::1
- Only a new way to map from group to RP. The main point is that it allows for a large number of RPs that can be practically anywhere in the Internet. They do not need to be preconfigured in the routers, routers automatically use the right RP
- Someone hosting or initiating a multicast session can pick a group address with their RP address encoded inside
- Everyone joining or sending to their session will then use their RP

Source Specific Multicast (SSM)

- SSM is easier to understand and deploy than ASM
  - Much simpler than ASM, no RPs, no switching between shared and shortest path trees
- SSM good for broadcasting etc with one single source
  - Rogue sources will not disturb the transmission
- Video conferencing etc with multiple sources can also be done
- Source discovery needs to be done at application level
  - Simple with one fixed source
  - Much more complex with many dynamic sources
- Supported by previously mentioned multicast networks, but requires host and routers to support MLDv2 and applications must use SSM API (RFC 3678)
- Main problem now is lack of applications

ssmping

- A tool for testing SSM connectivity
- Behaviour 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.
  - Supports both IPv4 and IPv6
- See http://www.venaas.no/multicast/ssmping/ for more info

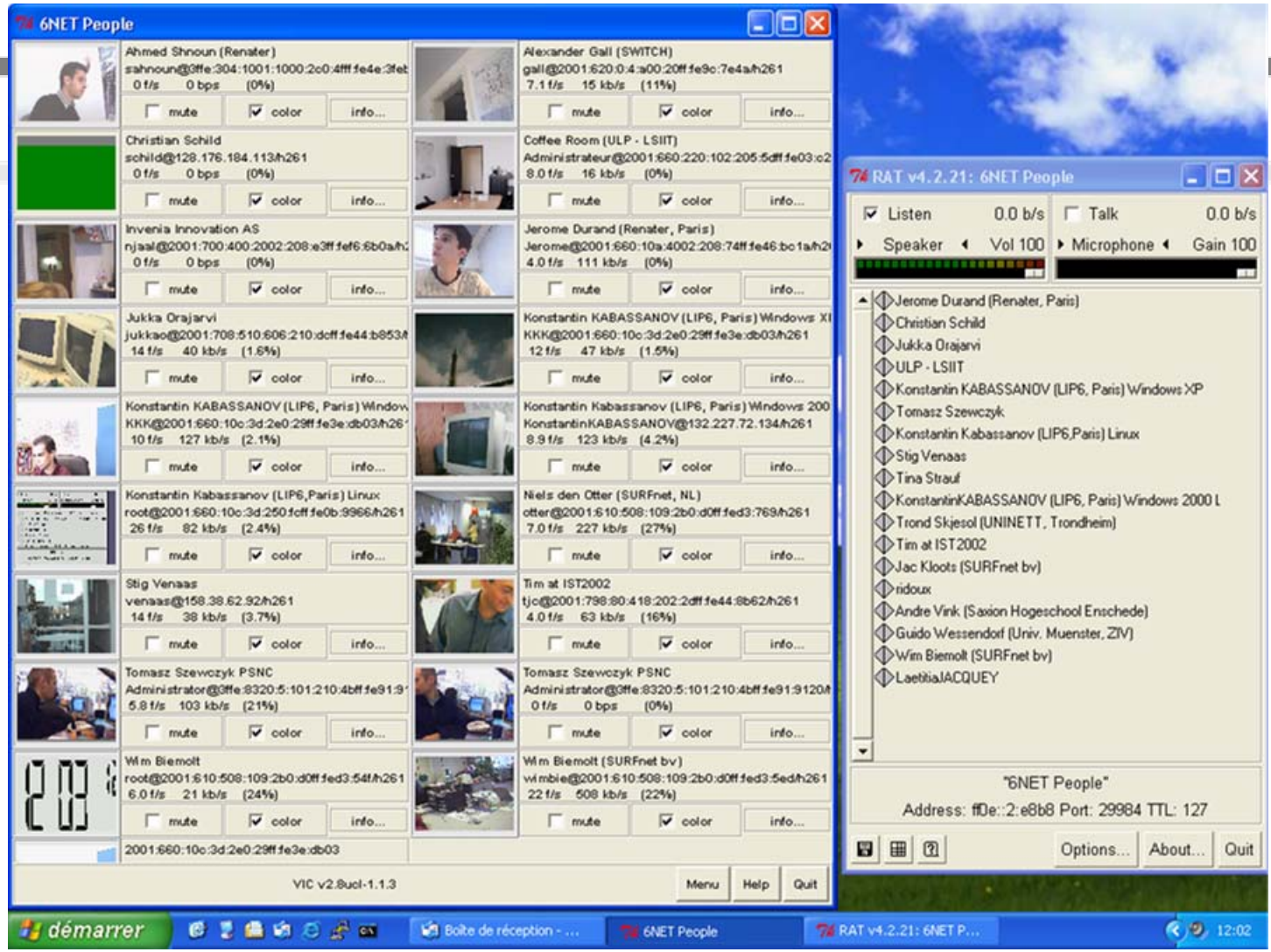
IPv4 - IPv6 multicast gateway

- Translates between IPv4 and IPv6 multicast
- Might be placed at border between IPv4-only and IPv6-only networks
- 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
- Gateway is IPv6 RP for the /96 prefix
- Now deployed in Renater with prefix ff7e:d40:2001:660:3001:4001::/96
- Anyone on the M6Bone can use it, we will try it later today
- 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

Multicast capable applications

- Mbone tools, vic/rat etc
  - IPv6 multicast conferencing applications
  - http://www-mice.cs.ucl.ac.uk/multimedia/software/
- VideoLAN
  - Video streaming, also IPv6 multicast. Server and client
  - Many operating systems, both Windows and UNIX
  - http://www.videolan.org/
- DVTS http://www.sfc.wide.ad.jp/DVTS/
  - Streaming DV over RTP over IPv4/IPv6
  - DV devices using Firewire can be connected to two different machines and you can stream video between them over the Internet
- Mad flute
  - Streaming of files using multicast (IPv4/IPv6 ASM/SSM)
  - Linux and Windows (not totally sure about *BSD status)
  - http://www.atm.tut.fi/mad/

vic/rat session on M6Bone



Conclusions

- IPv6 multicast is available today
  - Many routers and all hosts support it
  - You can connect to M6Bone to reach others
  - Some applications available, need more
- Many people are working actively on IPv6 multicast testing, deployment, R&D
  - Join the M6Bone mailing list or contact me if interested in working on this
    - http://www.m6bone.net/ or sv@ecs.soton.ac.uk