An on Demand IPv4/IPv6 Multicast Translator

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1. INTRODUCTION
INTRODUCTION

- Context transition to IPv6
  - IPv4/IPv6 nodes
  - only IPv4 nodes
  - only IPv6 nodes

- Mechanism for direct communication between IPv4 and IPv6 nodes

- Unicast - dual-stack servers

- Multicast - source streams to both IPv4 and IPv6 group

- Translation device on the path between the source and destination
2. EXISTING PROPOSALS
EXISTING PROPOSALS

- **Transport Relay Translator (TRT)**
  - “An IPv6-to-IPv4 Transport Relay Translator” RFC 3142 2001
  - only TCP => unicast

- **Stateless IP/ICMP Translation Algorithm (SIIT)**
  - RFC 2765 E. Nordmark 2000
  - IPv4 embedded IPv6 address 0::ffff:0:a.b.c.d => unicast

- **Multicast translation mechanisms:**
  - Multicast Translator Proxying (MTP)
  - UNINETT
    - “An IPv4-IPv6 Multicast Gateway” S. Venass 2003
MTP-MULTICAST TRANSLATOR PROXY

**Uses:**
- IGMP – Internet Group Management Protocol for IPv4
- MLD – Multicast Listener Discovery for IPv6
- "IPv4-compatible" IPv6 multicast group address
  \[ ffxy::IPv4multicast_address/96 \]

**Two translation modes:**
- gateway
- header conversion router

**Disadvantages**
- configuration by the domain administrator
- only small-scale networks
UNINETT

**Uses:**

- IGMP – Internet Group Management Protocol for IPv4
- MLD – Multicast Listener Discovery for IPv6
- "IPv4-compatible" IPv6 multicast group address
  \[ffxy::IPv4multicast_address/96\]
- PIM-SM (Protocol Independent Multicast – Sparse Mode) for IPv6

**Translates SAP/SDP (Session Announcement Protocol / Session Description Protocol) messages**

**Disadvantages:**

- IPv6 multicast is translated even if there are no IPv4 receivers for it
3. TRANSLATOR ARCHITECTURE
TRANSLATOR ARCHITECTURE

**Uses:**
- IGMP – Internet Group Management Protocol for IPv4
- MLD – Multicast Listener Discovery for IPv6
- PIM-SM for both IPv6 and IPv4 domains

**Multicast address:**
- "IPv4-compatible" IPv6 multicast group address
- arbitrary mappings between IPv4-IPv6 group addresses

**SAP/SDP messages are also translated**

**Translator location:**
- on the edge between IPv4/IPv6 domains
- on the same link as the RP (Rendezvous Point)
TRANSLATOR ARCHITECTURE

IPv6 Domain

Multicast IPv6 data

SAP/SDP

IPv4 Domain

Multicast IPv4 data

SAP/SDP

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4. IMPLEMENTATION DETAILS
IMPLEMENTATION DETAILS

Separate modules:

- IPv4 to IPv6 translation
- IPv6 to IPv4 translation
- can be used independently
- bidirectional translation requires the use of both modules
  - on the same node
  - on different nodes => fault tolerance

Implementation under Windows OS using Microsoft Visual Studio 2005

Windows service functionality
IMPLEMENTATION DETAILS

IPv6 translator

```
static class Program

setupserver64

Installer

public partial class service64 : ServiceBase

Thread

public void verifyClient()

Thread

public void receivesendUDP()

Thread

public void receivesendSAP()
```
IMPLEMENTATION DETAILS

IPv4 translator

IPv4 multicast \(\rightarrow\) IPv4 SAP/SDP \(\rightarrow\) Translator

IPv6 multicast \(\rightarrow\) IPv6 SAP/SDP \(\rightarrow\) Translator

IPv6 Client

IPv6 Client \(\rightarrow\) ICMPv6 \(\rightarrow\) Router DR

Manager

Monitor

PIM-SM Message Generator

PIM-SM Join/Prune

PIM

Packet Analyzer
5. CONFIGURATION ISSUES
CONFIGURATION ISSUES

Configuration file *fisierod.conf*

(Configuration file of the service. Do not change the order of the parameters)

IPv6 local address: 2001::1:3
IPv6 multicast address: FF0E::4444
IPv4 local address: 172.10.1.3
IPv4 multicast address: 233.11.11.11
IPv6 Port: 4444
IPv4 Port: 5555
IPv6 SAP address: FF0E::2:7FFE
IPv4 SAP address: 224.2.127.254
SAP Port: 9875
PIM address: 224.0.0.13
PIM Listener Port: 3333
6. TEST ARCHITECTURE
TEST ARCHITECTURE

IPv6 to IPv4 translator testbed
- two IPv4 PIM-SM routers with XORP (eXtensible Open Router Platform)
- VLC Media Player to send multicast content
- Wireshark 0.99.6 for traffic capture

Correct translation checked by comparing original IPv6 packet with IPv4 packet for:
- multicast data
- SAP/SDP messages

Similar testbed for IPv4 to IPv6 translation
TEST ARCHITECTURE

IPv6 Domain

Multicast source

FF0E::4444

2001::1/3/120

IPv6 -> IPv4
TRANSLATOR

IPv4 Domain

RP

172.10.1.1/24

172.10.1.2/24

172.10.1.3/24

172.10.2.1/24

172.10.2.2/24

233.11.11.11

SAP/SDP

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7. TRANSLATION DELAY
Translation delay = the time elapsed from the moment a packet is received by the translator to the moment the packet is sent using a different IP version.

Average values:
- IPv6 to IPv4
  - multicast data 0.598 ms
  - SAP/SDP messages 0.604 ms
- IPv4 to IPv6
  - multicast data 0.987 ms
  - SAP/SDP messages 2.023 ms

Difference between the two cases due to the use of two separate software modules.
8. CONCLUSION
CONCLUSION

- New on demand translation mechanism
  - design
  - implementation
- Translation is started only on demand if IPv4/IPv6 receivers request it
- Windows implementation, previous proposal were implemented under Linux/FreeBSD
- Translation delay was determined
  - slight differences between the two software modules
  - values are negligible