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IP Multicast Requirements for a Network Address (and port) Translator (NAT)
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Status of this Memo

Abstract

This document specifies requirements for a Network Address (and port) Translator (NAT) that supports Any Source IP Multicast or Source-Specific IP Multicast. An IP multicast-capable NAT device that adheres to the requirements of this document can optimize the operation of IP multicast applications that are generally unaware of IP multicast NAT devices.

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1. Introduction

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In order for IP multicast applications to function well over NATs, multicast UDP must work as seamlessly as unicast UDP. However, NATs have little consistency in IP multicast operation which results in inconsistent user experiences and failed IP multicast operation.
This document targets requirements intended to enable correct operations of Any Source Multicast and Source-Specific Multicast in devices running IGMP proxy routing and NAT and without applying NAT to IP multicast group addresses. This profile of functionality is the expected best practice for residential access routers, small branch routers, or similar deployments.
Most of the principles outlined in this document do also apply when using protocols other than IGMP, such as PIM-SM, or when performing NAT between multiple "inside" interfaces, but explicit consideration for these cases is outside the scope of this document.
This document describes the behavior of a device that functions as a NAT for unicast flows and also forwards IP multicast traffic in either direction ('inside' to 'outside', or 'outside' to 'inside'). This allows a host 'inside' the NAT to both receive multicast traffic and to source multicast traffic. Hosts on the 'inside' interface(s) of a NAT indicate their interest in receiving an IP multicast flow by sending an IGMP message to their local interface. An IP multicast-capable NAT will see that IGMP message (IGMPv1 (Deering, S., “Host extensions for IP multicasting,” August 1989.) [RFC1112], IGMPv2 (Fenner, W., “Internet Group Management Protocol, Version 2,” November 1997.) [RFC2236], IGMPv3 (Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, “Internet Group Management Protocol, Version 3,”

October 2002.) [RFC3376]), possibly perform some functions on that IGMP message, and forward it to its upstream router. This causes the upstream router to send that IP multicast traffic to the NAT, which forwards it to those inside segment(s) with host(s) that had previously sent IGMP messages for that IP multicast traffic.
Out of scope of this document are PIM-SM (Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas, “Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised),” August 2006.) [RFC4601] and IPv6 (Deering, S. and R. Hinden, “Internet Protocol, Version 6 (IPv6) Specification,” December 1998.) [RFC2460]. The IGMP Proxy devices that are scoped in this document do not forward PIM-SM. IPv6 is out of scope because NAT is not considered necessary with IPv6. This document is a companion document to "NAT Behavioral Requirements for Unicast UDP" (Audet, F. and C. Jennings, “Network Address Translation (NAT) Behavioral Requirements for Unicast UDP,” January 2007.) [RFC4787].

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2. Terminology Used in this Document

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The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 (Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels,” March 1997.) [RFC2119].
In this document, the term "NAT" applies to both Network Address and Port Translator (NAPT) as well as a NAT that does not translate ports. The term 'inside' refers to the interface(s) on a NAT which contain hosts that wish to source or receive IP multicast traffic. The term 'outside' refers to the interface(s) the NAT forwards IGMP membership messages to, and where the NAT routes IP multicast traffic that originates from hosts on its 'inside' interface.

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3. Background

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When a NAT isn't used, a host might be connected to the Internet in a configuration such as this:

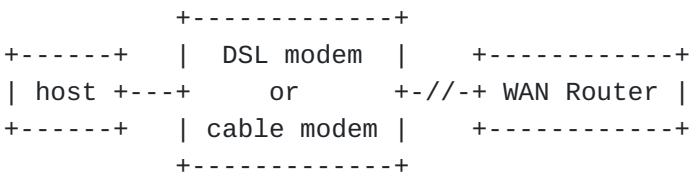

Figure 1: Network without NAT'ing IGMP Proxy

If instead of a single host as shown in Figure 1 (Network without NAT'ing IGMP Proxy), one or more LANs with potentially multiple hosts are to be connected, with the same type of service termination on the DSL or cable modem, a NAT device is added as shown in Figure 2 (Network with NATing IGMP Proxy). This device in general perform routing and NAT functions such that it does look like a single host towards the DSL/ cable modem.

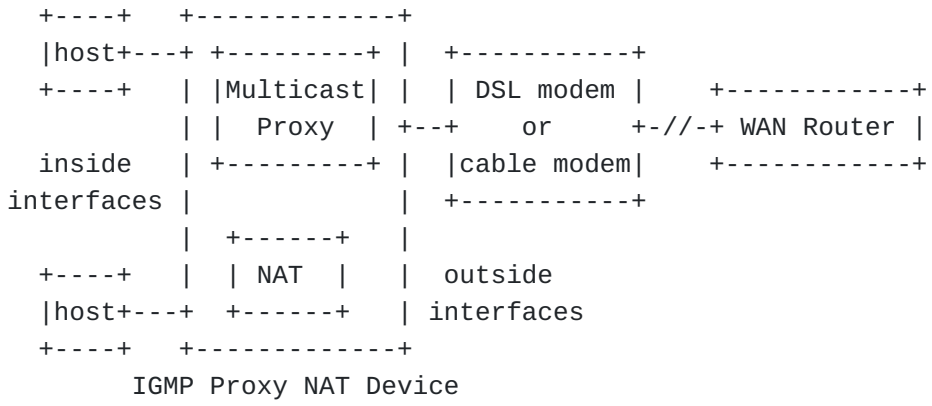

Figure 2: Network with NATing IGMP Proxy

In IP multicast, IGMP is the protocol used by hosts, such as the one shown in Figure 1 (Network without NAT'ing IGMP Proxy). For the NAT device in Figure 2 (Network with NATing IGMP Proxy) to look like the single host for IP multicast services towards the DSL/cable modem and to forward IP multicast traffic from and to the multiple hosts in the picture, it needs to perform so called "IGMP Proxying" (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605] -- but within the context of also performing NAT. NAT is not covered by [RFC4605] (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based

Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.). Adding NAT to IGMP proxying does not need to change the processing of the IGMP messages as defined in RFC4605:

> IGMP messages are never logically forwarded by the IGMP proxying device, but rather sourced or received by it. In general, receipt of IGMP messages by the device updates the device's IGMP state. The updated state changes the device's forwarding of multicast messages or triggers the sending of IGMP messages. "Forwarding" of IGMP protocol messages may thus only happen implicitly by implementation optimizations that create shortcuts in this machinery.

This specifically means that IGMP protocol packets sent by the NAT device will always use IP address of the interface (inside or outside) from which they are sent, but because those packets are logically "sourced" and not "forwarded", NAT does not have any impact into this. Unlike unicast flows, packets with a multicast destination IP address do not have their destination IP address or destination port changed by a NAT. However, their source IP address (and source UDP port, in some cases with a NAPT) is changed if the packet goes from an 'inside' interface of a NAT to the 'outside' interface of a NAT -- similar to the behavior of a unicast packet across those same interfaces.
Adding NAT to IGMP proxying does change the processing of IP multicast data packets forwarded across the IGMP proxying device as described in the following sections. These changes do actually simplify the ability to deploy IGMP proxying over a device that does NOT perform NAT.
With an IGMP Proxy NAT Device, IP multicast data traffic sourced from hosts on the inside is NATed such that it will look like being sourced from a directly connected host to the WAN router, thus eliminating all non-standard PIM-SM concerns/configurations described in section 3.2 of [RFC4605] (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.).

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4. Requirements

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4.1. NAT'ing IP Multicast Data Packets

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4.1.1. Receiving Multicast Data Packets

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REQ-1:

> For IP multicast packets that are forwarded to a host(s) on its inside interface(s), a NAT MUST NOT modify the destination IP address or destination port of the packets.

If a NAT were to modify the destination IP or port addresses, the NAT would also need to modify session announcements (e.g., electronic program guides, SAP) and session establishment and control (e.g., SIP, RTSP) messages. Such modifications of application messages is not considered a best practice. Furthermore, a NAT'ed multi-homed network would need to coordinate such rewriting between its NATs.

REQ-2: A NAT MUST forward IP multicast UDP datagrams from its 'outside' interface to multicast receivers on its 'inside' interface(s).

REQ-3: A NAT SHOULD forward IP multicast non-UDP protocols (e.g., PGM (Speakman, T., Crowcroft, J., Gemmell, J., Farinacci, D., Lin, S., Leshchiner, D., Luby, M., Montgomery, T., Rizzo, L., Tweedly, A., Bhaskar, N., Edmonstone, R., Sumanasekera, R., and L. Vicisano, "PGM Reliable Transport Protocol Specification," December 2001.) [RFC3208], RSVP (Braden, B., Zhang, L., Berson, S., Herzog, S., and S. Jamin, "Resource ReSerVation Protocol (RSVP) -- Version 1 Functional Specification," September 1997.) [RFC2205]) from its 'outside' interface to IP multicast receivers on its inside interface(s).

4.1.2. Sending Multicast Data Packets

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The following requirement is normal NAT behavior for unicast packets, as described in [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.), and extended here to provide support for IP multicast senders behind the NAT.

REQ-4: A NAT MUST modify the source IP address of packets that arrive from an 'inside' interface towards the 'outside' interface so that those packets use the NAT's 'outside' IP address(es).

> **a:** If the NAT also performs port translation (that is, it is a NAPT), the NAT MUST also create a mapping to allow responses to that IP multicast packet to be received by the appropriate host. For Any Source Multicast, also see Section 4.3 (Any Source Multicast Transmitters).

b:

To allow hosts to learn the NAT's 'outside' interface address, the NAT MUST have "Endpoint-Independent Mapping" behavior (REQ-1 of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.)) no matter if the destination IP address is a unicast address or an IP multicast address.

c: If the NAT has multiple public IP addresses, the NAT SHOULD have address pooling behavior of "Paired" (as described in section 4.1 of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.)) for its IP multicast mappings as well as for its unicast UDP mappings. This allows a multicast source to discover the NAT's public IP address using a unicast address discovery mechanism (e.g., [I-D.ietf-mmusic-ice] (Rosenberg, J., "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols," October 2007.)) and communicate that discovered IP address to a multicast receiver.

REQ-5: A NAT MUST forward IP multicast UDP datagrams from its 'inside' interface(s) to its 'outside' interface.

a: NATs which support the above requirement MUST also provide a configuration option to disable this feature. Otherwise, a multihomed network would cause duplicate instances of the multicast data traffic on the public network.

As many NATs are located adjacent to bandwidth-constrained access links, it is important that IP multicast senders communicating with IP multicast receivers behind the NAT not have their flows consume bandwidth on the access link. This is accomplished by applications using administratively scoped IP addresses. Similarly, link-local multicast traffic isn't supposed to be routed off the local network.

REQ-6: The NAT's default configuration MUST NOT forward administratively scoped IP multicast traffic (239.0.0.0/8) [RFC2365] (Meyer, D., "Administratively Scoped IP Multicast," July 1998.) from its 'inside' interface(s) to its 'outside' interface.

REQ-7: The NAT MUST NOT forward Local Network Control Block (224.0.0/24) (Albanna, Z., Almeroth, K., Meyer, D., and M. Schipper, "IANA Guidelines for IPv4 Multicast Address Assignments," August 2001.) [RFC3171] (also known as "link-local

multicast") traffic from its 'inside' interface(s) to its 'outside' interface.

4.2. IGMP Version Support

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REQ-8: A NAT MAY support IGMPv1 (although IGMPv1 is considered obsolete).

REQ-9: A NAT MUST support IGMPv2.

REQ-10: A NAT SHOULD support IGMPv3.

4.2.1. IGMPv1 or IGMPv2

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For IGMPv1 and IGMPv2, a NAT can successfully operate by merely forwarding IGMP membership reports and queries between the interested hosts (on its internal interface) towards its external interface.

REQ-11: If a NAT supports IGMPv1 and/or IGMPv2 (but not IGMPv3), the NAT MAY simply receive IGMP membership reports on the inside interface, NAT them, and relay the IGMP membership report, and do the same function in the opposite direction to the IGMP listeners. That is, the NAT does not need to do any aggregation of IGMP messages.

a: If a NAT relays IGMPv1 or IGMPv2 messages in this manner, it MUST NOT decrement the TTL of the IGMP messages, as they are already sent with TTL=1.

b: However, it is RECOMMENDED that such a NAT implement IGMP/MLD Proxying (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605], because IGMP aggregation provides a useful optimization.

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4.2.2. IGMPv3

When a IGMPv3 proxying device receives an IGMP membership on an inside interface, it creates its own IGMP proxying membership state and its own IGMP forwarding table. It then creates an independent IGMP membership report on its outside interface reporting the IP multicast groups/channels -- but there is no direct relationship or "forwarding" of IGMP membership reports or queries across the interfaces. The NAT device will subsequently receive a IP multicast data packet on the 'outside' interface and forward the IP multicast packet to the 'inside' interface(s) based on its IGMP forwarding table.
By performing NAT on IGMPv3 membership reports, the membership reports appear to originate from a single IGMPv3 reporter instead of different reporters. Because IGMPv3 has different types of membership reports differentiating between status (IS_INCLUDE, IS_EXCLUDE) and change indication (e.g., TO_INCLUDE, TO_EXCLUDE), if a NAT were to interleave reports from two or more reporters (joining and leaving the same groups) the NAT would create a sequence of packets that are not compliant with an IGMPv3 reporter (Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, “Internet Group Management Protocol, Version 3,” October 2002.) [RFC3376]. For this reason, the following requirements are specified:

> **REQ-12:** If a NAT supports IGMPv3, the NAT MUST implement IGMP/MLD Proxying (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605]. Such compliance causes the NAT to aggregate the IGMPv3 membership reports and report only the aggregated information upstream.
>
> **REQ-13:** If a NAT supports IGMPv3, the NAT MUST implement Source-Specific Multicast for IP (Holbrook, H. and B. Cain, “Source-Specific Multicast for IP,” August 2006.) [RFC4607] and IGMPv3/MLDv2 for SSM (Holbrook, H., Cain, B., and B. Haberman, “Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast,” August 2006.) [RFC4604].

Failure to implement IGMP aggregation ([RFC4605] (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.)) will cause undesired temporary black holing of IP multicast traffic. For example, consider two hosts behind the same NAT. If one host is joining a session at the same time another is leaving the session, and the NAT were to merely relay the join and leave upstream, the session will be terminated, and the join and leave announcements would not comply with section 5 of [RFC3376]

(Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, "Internet Group Management Protocol, Version 3," October 2002.).

4.3. Any Source Multicast Transmitters

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Any Source Multicast (ASM) uses the IP addresses in the 224/8 through 231/8, and 233/8 through 239/8 range [IANA-ALLOC] (Internet Assigned Numbers Authority, "Internet Multicast Addresses," .).
When a host both receives an ASM stream and sends traffic into it, using RTP (Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications," July 2003.) [RFC3550], there is a potential problem if a NAT merely followed the requirements of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.). The problem is that RTP uses the source transport address (source IP address and source UDP port) and the RTP/RTCP SSRC value to identify session members. If a session member sees the same SSRC arrive from a different transport address, that session member will perform RTP collision detection (section 8.2 of [RFC3550] (Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications," July 2003.)). If a NAT merely followed the requirements of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.) and timed out a UDP session after 2 minutes of inactivity and RTCP receiver reports are sent less often than every 2 minutes, RTP collision detection would be performed by other session members sharing the same SSRC, complicating diagnostic tools and potentially interfering with jitter buffer algorithms. This situation can occur, for example, with an IP multicast group of approximately 300 members with a normal 50Kbps audio RTP stream. Source-Specific Multicast does not need this long timer because application feedback reports are unicast (rather than IP multicast) and identifiers, rather than IP addresses and UDP ports, are used to identify a specific IP multicast receiver (e.g., [I-D.ietf-avt-rtcpssm] (Ott, J. and J. Chesterfield, "RTCP Extensions for Single-Source Multicast Sessions with Unicast Feedback," November 2009.).

> **REQ-14:** If a host on the inside interface of a NAT belongs to an Any Source Multicast host group and the host sends a UDP packet to the same group, the NAT SHOULD have a UDP mapping timer of 60 minutes for that mapping.

a:

This UDP mapping SHOULD be destroyed when the host leaves that host group. The NAT is aware of this through receipt of an IGMP message from the host.

b: If a NAT has exhausted its resources, the NAT MAY time out that mapping before 60 minutes have elapsed, but this is discouraged. Note that even in a situation with resource exhaustion, a NAT is still required to follow the minimum mapping duration of 2 minutes (REQ-5 of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.)).

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5. Requirements Summary

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This section summarizes the requirements.

REQ-1: For IP multicast packets that are forwarded to a host(s) on its inside interface(s), a NAT MUST NOT modify the destination IP address or destination port of the packets.

REQ-2: A NAT MUST forward IP multicast UDP datagrams from its 'outside' interface to multicast receivers on its 'inside' interface(s).

REQ-3: A NAT SHOULD forward IP multicast non-UDP protocols (e.g., PGM (Speakman, T., Crowcroft, J., Gemmell, J., Farinacci, D., Lin, S., Leshchiner, D., Luby, M., Montgomery, T., Rizzo, L., Tweedly, A., Bhaskar, N., Edmonstone, R., Sumanasekera, R., and L. Vicisano, "PGM Reliable Transport Protocol Specification," December 2001.) [RFC3208], RSVP (Braden, B., Zhang, L., Berson, S., Herzog, S., and S. Jamin, "Resource ReSerVation Protocol (RSVP) -- Version 1 Functional Specification," September 1997.) [RFC2205]) from its 'outside' interface to IP multicast receivers on its inside interface(s).

REQ-4: A NAT MUST modify the source IP address of packets that arrive from an 'inside' interface towards the 'outside' interface so that those packets use the NAT's 'outside' IP address(es).

a: If the NAT also performs port translation (that is, it is a NAPT), the NAT MUST also create a mapping to allow responses to that IP multicast packet to be received by the appropriate host. For Any Source Multicast, also see Section 4.3 (Any Source Multicast Transmitters).

b:

To allow hosts to learn the NAT's 'outside' interface address, the NAT MUST have "Endpoint-Independent Mapping" behavior (REQ-1 of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.)) no matter if the destination IP address is a unicast address or an IP multicast address.

c: If the NAT has multiple public IP addresses, the NAT SHOULD have address pooling behavior of "Paired" (as described in section 4.1 of [RFC4787] (Audet, F. and C. Jennings, "Network Address Translation (NAT) Behavioral Requirements for Unicast UDP," January 2007.)) for its IP multicast mappings as well as for its unicast UDP mappings. This allows a multicast source to discover the NAT's public IP address using a unicast address discovery mechanism (e.g., [I-D.ietf-mmusic-ice] (Rosenberg, J., "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols," October 2007.)) and communicate that discovered IP address to a multicast receiver.

REQ-5: A NAT MUST forward IP multicast UDP datagrams from its 'inside' interface(s) to its 'outside' interface.

a: NATs which support the above requirement MUST also provide a configuration option to disable this feature. Otherwise, a multihomed network would cause duplicate instances of the multicast data traffic on the public network.

REQ-6: The NAT's default configuration MUST NOT forward administratively scoped IP multicast traffic (239.0.0.0/8) [RFC2365] (Meyer, D., "Administratively Scoped IP Multicast," July 1998.) from its 'inside' interface(s) to its 'outside' interface.

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REQ-8: A NAT MAY support IGMPv1 (although IGMPv1 is considered obsolete).

REQ-9: A NAT MUST support IGMPv2.

REQ-10: A NAT SHOULD support IGMPv3.

REQ-11:

If a NAT supports IGMPv1 and/or IGMPv2 (but not IGMPv3), the NAT MAY simply receive IGMP membership reports on the inside interface, NAT them, and relay the IGMP membership report, and do the same function in the opposite direction to the IGMP listeners. That is, the NAT does not need to do any aggregation of IGMP messages.

a: If a NAT relays IGMPv1 or IGMPv2 messages in this manner, it MUST NOT decrement the TTL of the IGMP messages, as they are already sent with TTL=1.

b: However, it is RECOMMENDED that such a NAT implement IGMP/MLD Proxying (Fenner, B., He, H., Haberman, B., and H. Sandick, "Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605], because IGMP aggregation provides a useful optimization.

REQ-12: If a NAT supports IGMPv3, the NAT MUST implement IGMP/MLD Proxying (Fenner, B., He, H., Haberman, B., and H. Sandick, "Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605]. Such compliance causes the NAT to aggregate the IGMPv3 membership reports and report only the aggregated information upstream.

REQ-13: If a NAT supports IGMPv3, the NAT MUST implement Source-Specific Multicast for IP (Holbrook, H. and B. Cain, "Source-Specific Multicast for IP,” August 2006.) [RFC4607] and IGMPv3/MLDv2 for SSM (Holbrook, H., Cain, B., and B. Haberman, "Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast,” August 2006.) [RFC4604].

REQ-14: If a host on the inside interface of a NAT belongs to an Any Source Multicast host group and the host sends a UDP packet to the same group, the NAT SHOULD have a UDP mapping timer of 60 minutes for that mapping.

a: This UDP mapping SHOULD be destroyed when the host leaves that host group. The NAT is aware of this through receipt of an IGMP message from the host.

b: If a NAT has exhausted its resources, the NAT MAY time out that mapping before 60 minutes have elapsed, but this is discouraged. Note that even in a situation with resource exhaustion, a NAT is still required to follow the minimum mapping duration of 2 minutes (REQ-5 of [RFC4787] (Audet,

> F. and C. Jennings, “Network Address Translation (NAT) Behavioral Requirements for Unicast UDP,” January 2007.)).

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6. Security Considerations

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The Security Considerations sections of IGMPv3 (Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, “Internet Group Management Protocol, Version 3,” October 2002.) [RFC3376] and IGMP Proxying (Fenner, B., He, H., Haberman, B., and H. Sandick, “Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying"),” August 2006.) [RFC4605] apply to a device complying with this document.
When a host is using RTP and participating in an Any Source Multicast session, the host's periodic RTCP receiver reports cause the NAT to create a mapping. When the group size is less than approximately 300, the RTCP reports are sent frequently enough that a NAT's mapping will always be kept open. When the group size is larger than approximately 300, the RTCP reports are sent less frequently. The recommendation in Section 4.3 (Any Source Multicast Transmitters) causes the NAT mapping to be kept open for the duration of the host's participation in that IP multicast session no matter the size of the multicast host or periodicity of the host's RTCP transmissions.

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7. IANA Considerations

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This document does not require any IANA registrations.

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8. Acknowledgments

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9. References

9.1. Normative References

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9.2. Informational References

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Appendix A. Application Considerations

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SSM requires listeners to know the SSM channel (S,G), which is comprised of the IP source address (S) and the IP multicast group (G). An SSM source needs to communicate its IP address in its SSM session establishment message (e.g., in its Session Description Protocol (SDP) [RFC4566] (Handley, M., Jacobson, V., and C. Perkins, “SDP: Session

Description Protocol," July 2006.)). When the SSM sender is behind a NAT and the SSM receiver(s) are on the other side of that NAT, the SSM sender will need to determine its IP source address relevant to the SSM receivers; generally, this will be the 'outside' IP address of the NAT. This 'outside' address needs to be included in the SSM session establishment message (e.g., SDP) so that listeners on the 'outside' of the NAT can receive the SSM channel.

If there are SSM listeners on both the 'outside' and 'inside' of the NAT, it may be valuable to consider using ICE (Rosenberg, J., "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols," October 2007.) [I-D.ietf-mmusic-ice] in the session advertisement; the full scope of the interaction between SSM and ICE is beyond the scope of this document.

If multiple SSM sources on the inside of a NAT choose the same multicast group address, those sources are uniquely identifiable because their IP addresses are unique. However, if their multicast traffic is NAT'ed and sent on the NAT's public interface, the traffic from those individual sources is no longer uniquely identifiable. This will cause problems for multicast receivers which will see an intermixing of traffic from those sources. Resolution of this issue is left for future study. In the meantime, applications that source SSM multicast traffic are encouraged to allow the user to modify the multicast SSM address so that users can avoid this problem if that application is placed behind a NAT.

A multicast source that wants its traffic to not traverse a router (e.g., leave a home network) may find it useful to send traffic with IP TTL=1. Both ASM and SSM sources may find this useful.

As many NATs use the same private address space (e.g., 192.168.0.0/16, [RFC1918] (Rekhter, Y., Moskowitz, R., Karrenberg, D., Groot, G., and E. Lear, "Address Allocation for Private Internets," February 1996.)), RTP stacks are encouraged to generate CNAMEs properly (see end of Section 6.5.1 of [RFC3550] (Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications," July 2003.).)

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