

Network Working Group  
Internet Draft  
Expiration Date: August 2005  
Category: Informational

M. Christensen  
Thrane & Thrane  
K. Kimball  
Hewlett-Packard  
F. Solensky  
Calix Networks  
February 2005

Considerations for IGMP and MLD Snooping Switches  
<[draft-ietf-magma-snoop-12.txt](#)>

## Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#) [[RFC2026](#)].

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/lid-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

By submitting this Internet-Draft, we certify that any applicable patent or other IPR claims of which we are aware have been disclosed, or will be disclosed, and any of which we become aware will be disclosed, in accordance with [RFC 3668](#) [IPR].

## Copyright Notice

Copyright (C) The Internet Society (2005). All rights reserved.

## Abstract

This memo describes the recommendations for IGMP- and MLD-snooping switches. These are based on best current practices for IGMPv2,

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

with further considerations for IGMPv3- and MLDv2-snooping. Additional areas of relevance, such as link layer topology changes and Ethernet-specific encapsulation issues, are also considered.

## 1. Introduction

The IEEE bridge standard [[BRIDGE](#)] specifies how LAN packets are 'bridged', or as is more commonly used today, switched between LAN segments. The operation of a switch with respect to multicast packets can be summarized as follows. When processing a packet whose destination MAC address is a multicast address, the switch will forward a copy of the packet into each of the remaining network interfaces that are in the forwarding state in accordance with [[BRIDGE](#)]. The spanning tree algorithm ensures that the application of this rule at every switch in the network will make the packet accessible to all nodes connected to the network.

This behaviour works well for broadcast packets that are intended to be seen or processed by all connected nodes. In the case of multicast packets, however, this approach could lead to less efficient use of network bandwidth, particularly when the packet is intended for only a small number of nodes. Packets will be flooded into network segments where no node has any interest in receiving the packet. While nodes will rarely incur any processing overhead to filter packets addressed to unrequested group addresses, they are unable to transmit new packets onto the shared media for the period of time that the multicast packet is flooded. In general, significant bandwidth can be wasted by flooding.

In recent years, a number of commercial vendors have introduced products described as "IGMP snooping switches" to the market. These devices do not adhere to the conceptual model that provides the strict separation of functionality between different communications layers in the ISO model, and instead utilize information in the upper level protocol headers as factors to be considered in processing at the lower levels. This is analogous to the manner in which a router can act as a firewall by looking into the transport protocol's header before allowing a packet to be forwarded to its destination address.

In the case of IP multicast traffic, an IGMP snooping switch provides the benefit of conserving bandwidth on those segments of

the network where no node has expressed interest in receiving packets addressed to the group address. This is in contrast to normal switch behavior where multicast traffic is typically forwarded on all interfaces.

Many switch datasheets state support for IGMP snooping, but no recommendations for this exist today. It is the authors' hope that the information presented in this draft will supply this foundation.

The recommendations presented here are based on the following information sources: The IGMP specifications [[RFC1112](#)], [[RFC2236](#)] and [[IGMPv3](#)], vendor-supplied technical documents [[CISCO](#)], bug reports [[MSOFT](#)], discussions with people involved in the design of IGMP snooping switches, MAGMA mailing list discussions, and on replies by switch vendors to an implementation questionnaire.

Interoperability issues that arise between different versions of IGMP are not the focus of this document. Interested readers are directed to [[IGMPv3](#)] for a thorough description of problem areas.

The suggestions in this document are based on IGMP, which applies only to IPv4. For IPv6, Multicast Listener Discovery [[MLD](#)] must be used instead. Because MLD is based on IGMP, we do not repeat the entire description and recommendations for MLD snooping switches. Instead, we point out the few cases where there are differences from IGMP.

Note that the IGMP snooping function should apply only to IPv4 multicasts. Other multicast packets, such as IPv6, might be suppressed by IGMP snooping if additional care is not taken in the implementation as mentioned in the recommendations section. It is desired not to restrict the flow of non-IPv4 multicasts other than to the degree which would happen as a result of regular bridging functions. Likewise, MLD snooping switches are discouraged from using topological information learned from IPv6 traffic to alter the forwarding of IPv4 multicast packets.

## [2.](#) IGMP Snooping Recommendations

The following sections list the recommendations for an IGMP snooping switch. The recommendation is stated and is supplemented by a description of a possible implementation approach. All implementation discussions are examples only and there may well be other ways to achieve the same functionality.

## [2.1.](#) Forwarding rules

The IGMP snooping functionality is separated into a control section (IGMP forwarding) and a data section (Data forwarding).

### [2.1.1.](#) IGMP Forwarding Rules

- 1) A snooping switch should forward IGMP Membership Reports only to those ports where multicast routers are attached. Alternatively stated: a snooping switch should not forward IGMP Membership Reports to ports on which only hosts are attached. An administrative control may be provided to override this restriction, allowing the report messages to be flooded to other ports.

This is the main IGMP snooping functionality for the control path.

Sending membership reports to other hosts can result, for IGMPv1 and IGMPv2, in unintentionally preventing a host from joining a specific multicast group.

When an IGMPv1 or IGMPv2 host receives a membership report for a group address that it is intending to join, the host will suppress its own membership report for the same group. This join or message suppression is a requirement for IGMPv1 and IGMPv2 hosts. However, if a switch does not receive a membership report from the host it will not forward multicast data to it.

This is not a problem in an IGMPv3-only network because there is no suppression of IGMP Membership reports.

The administrative control allows IGMP Membership Report

messages to be processed by network monitoring equipment such as packet analyzers or port replicators.

The switch supporting IGMP snooping must maintain a list of multicast routers and the ports on which they are attached. This list can be constructed in any combination of the following ways:

- a) This list should be built by the snooping switch sending Multicast Router Solicitation messages as described in IGMP Multicast Router Discovery [[MRDISC](#)]. It may also snoop Multicast Router Advertisement messages sent by and to other nodes.
- b) The arrival port for IGMP Queries (sent by multicast routers) where the source address is not 0.0.0.0.

The 0.0.0.0 address represents a special case where the switch is proxying IGMP Queries for faster network

convergence, but is not itself the Querier. The switch does not use its own IP address (even if it has one), because this would cause the Queries to be seen as coming from a newly elected Querier. The 0.0.0.0 address is used to indicate that the Query packets are NOT from a multicast router.

- c) Ports explicitly configured by management to be IGMP-forwarding ports, in addition to or instead of any of the above methods to detect router ports.
- 2) IGMP networks may include devices which implement "proxy-reporting", in which reports received from downstream hosts are summarized and used to build internal membership states. Such proxy-reporting devices may use the all-zeros address when forwarding any summarized reports upstream. For this reason, IGMP membership reports received by the snooping switch must not be rejected because of a source IP address of 0.0.0.0.
  - 3) The switch that supports IGMP snooping must flood all unrecognized IGMP messages to all other ports and must not attempt to make use of any information beyond the end of the

network layer header.

In addition, earlier versions of IGMP should interpret IGMP fields as defined for their versions and must not alter these fields when forwarding the message. When generating new messages, a given IGMP version should set fields to the appropriate values for its own version. If any fields are reserved or otherwise undefined for a given IGMP version, the fields should be ignored when parsing the message and must be set to zeroes when new messages are generated by implementations of that IGMP version. An exception may occur if the switch is performing a spoofing function, and is aware of the settings for new or reserved fields that would be required to correctly spoof for a different IGMP version.

The reason to worry about these trivialities is that IGMPv3 overloads the old IGMP query message using the same type number (0x11) but with an extended header. Therefore there is a risk that IGMPv3 queries may be interpreted as older version queries by, for example, IGMPv2 snooping switches. This has already been reported [[IETF56](#)] and is discussed in [section 2.2](#).

- 4) An IGMP snooping switch should be aware of link layer topology changes caused by Spanning Tree operation. When a port is enabled or disabled by Spanning Tree, a General Query may be

sent on all active non-router ports in order to reduce network convergence time. Non-Querier switches should be aware of whether the Querier is in IGMPv3 mode. If so, the switch should not spoof any General Queries unless it is able to send an IGMPv3 Query that adheres to the most recent information sent by the true Querier. In no case should a switch introduce a spoofed IGMPv2 Query into an IGMPv3 network, as this may create excessive network disruption.

If the switch is not the Querier, it should use the 'all-zeros' IP Source Address in these proxy queries (even though some hosts may elect to not process queries with a 0.0.0.0 IP Source Address). When such proxy queries are received, they must not be included in the Querier election process.

- 5) An IGMP snooping switch must not make use of information in IGMP packets where the IP or IGMP headers have checksum or integrity errors. The switch should not flood such packets but if it does, it should also take some note of the event (i.e., increment a counter). These errors and their processing are further discussed in [[IGMPv3](#)], [[MLD](#)] and [[MLDv2](#)].
- 6) The snooping switch must not rely exclusively on the appearance of IGMP Group Leave announcements to determine when entries should be removed from the forwarding table. It should implement a membership timeout mechanism such as the router-side functionality of the IGMP protocol as described in the IGMP and MLD specifications (See Normative Reference section for IGMPv1-3 and MLDv1-2) on all its non-router ports. This timeout value should be configurable.

### [2.1.2](#). Data Forwarding Rules

- 1) Packets with a destination IP address outside 224.0.0.X which are not IGMP should be forwarded according to group-based port membership tables and must also be forwarded on router ports.

This is the main IGMP snooping functionality for the data path.

One approach that an implementation could take would be to maintain separate membership and multicast router tables in software and then "merge" these tables into a forwarding cache.

- 2) Packets with a destination IP (DIP) address in the 224.0.0.X range which are not IGMP must be forwarded on all ports.

This recommendation is based on fact that many host systems do

not send Join IP multicast addresses in this range before sending or listening to IP multicast packets. Furthermore, since the 224.0.0.X address range is defined as link-local (not to be routed) it seems unnecessary to keep state for each address in this range. Additionally, some routers operate in the 224.0.0.X address range without issuing IGMP Joins, and these applications would break if the switch were to prune them due to not having seen a Join Group message from the router.

- 3) An unregistered packet is defined as an IPv4 multicast packet with a destination address which does not match any of the groups announced in earlier IGMP Membership Reports.

If a switch receives an unregistered packet, it must forward that packet on all ports to which an IGMP router is attached. A switch may default to forwarding unregistered packets on all ports. Switches that do not forward unregistered packets to all ports must include a configuration option to force the flooding of unregistered packets on specified ports.

In an environment where IGMPv3 hosts are mixed with snooping switches that do not yet support IGMPv3, the switch's failure to flood unregistered streams could prevent v3 hosts from receiving their traffic. Alternatively, in environments where the snooping switch supports all of the IGMP versions that are present, flooding unregistered streams may cause IGMP hosts to be overwhelmed by multicast traffic, even to the point of not receiving Queries and failing to issue new membership reports for their own groups.

It is encouraged that snooping switches at least recognize and process IGMPv3 Join Reports, even if this processing is limited to the behavior for IGMPv2 Joins, i.e., is done without considering any additional "include source" or "exclude source" filtering. When IGMPv3 Joins are not recognized, a snooping switch may incorrectly prune off the unregistered data streams for the groups (as noted above); alternatively, it may fail to add in forwarding to any new IGMPv3 hosts if the group has previously been joined as IGMPv2 (because the data stream is seen as already having been registered).

- 4) All non-IPv4 multicast packets should continue to be flooded out all remaining ports in the forwarding state as per normal IEEE bridging operations.

This recommendation is a result of the fact that groups made up of IPv4 hosts and IPv6 hosts are completely separate and distinct groups. As a result, information gleaned from the



applicable when forming the topology between members of an IPv6 group.

- 5) IGMP snooping switches may maintain forwarding tables based on either MAC addresses or IP addresses. If a switch supports both types of forwarding tables then the default behavior should be to use IP addresses. IP address based forwarding is preferred because the mapping between IP multicast addresses and link-layer multicast addresses is ambiguous. In the case of Ethernet, there is a multiplicity of 1 Ethernet address to 32 IP addresses [[RFC1112](#)].
- 6) Switches which rely on information in the IP header should verify that the IP header checksum is correct. If the checksum fails, the information in the packet must not be incorporated into the forwarding table. Further, the packet should be discarded.
- 7) When IGMPv3 "include source" and "exclude source" membership reports are received on shared segments, the switch needs to forward the superset of all received membership reports onto the shared segment. Forwarding of traffic from a particular source S to a group G must happen if at least one host on the shared segment reports an IGMPv3 membership of the type INCLUDE(G, Slist1) or EXCLUDE(G, Slist2) where S is an element of Slist1 and not an element of Slist2.

The practical implementation of the (G,S1,S2,...) based data forwarding tables are not within the scope of this document. However, one possibility is to maintain two (G,S) forwarding lists: one for the INCLUDE filter where a match of a specific (G,S) is a requirement before forwarding will happen, and one for the EXCLUDE filter where a match of a specific (G,S) will result in no forwarding.

## [2.2.](#) IGMP snooping-related problems

A special problem arises in networks consisting of IGMPv3 routers as well as IGMPv2 and IGMPv3 hosts interconnected by an IGMPv2 snooping switch as recently reported [[IETF56](#)]. The router will continue to maintain IGMPv3 even in the presence of IGMPv2 hosts, and thus the network will not converge on IGMPv2. But it is likely that the IGMPv2 snooping switch will not recognize or process the IGMPv3 membership reports. Groups for these unrecognized reports will then either be flooded (with all of the problems that may

create for hosts in a network with a heavy multicast load) or pruned by the snooping switch.

Therefore, it is recommended that in such a network, the multicast router be configured to use IGMPv2. If this is not possible, and if the snooping switch cannot recognize and process the IGMPv3 membership reports, it is instead recommended that the switch's IGMP snooping functionality be disabled, as there is no clear solution to this problem.

### [3.](#) IPv6 Considerations

In order to avoid confusion, the previous discussions have been based on the IGMP protocol which only applies to IPv4 multicast. In the case of IPv6 most of the above discussions are still valid with a few exceptions which we will describe here.

The control and data forwarding rules in the IGMP section can, with a few considerations, also be applied to MLD. This means that the basic functionality of intercepting MLD packets, and building membership lists and multicast router lists, is the same as for IGMP.

In IPv6, the data forwarding rules are more straight forward because MLD is mandated for addresses with scope 2 (link-scope) or greater. The only exception is the address FF02::1 which is the all hosts link-scope address for which MLD messages are never sent. Packets with the all hosts link-scope address should be forwarded on all ports.

MLD messages are also not sent regarding groups with addresses in the range FF00::/15 (which encompasses both the reserved FF00::/16 and node-local FF01::/16 IPv6 address spaces). These addresses should never appear in packets on the link.

Equivalent to the IPv4 behaviors regarding the null IP Source address, MLD membership reports must not be rejected by an MLD snooping switch because of an unspecified IP source address (::). Additionally, if a non-Querier switch spoofs any General Queries (as addressed in [Section 2.1](#) above, for Spanning Tree topology changes), the switch should use the null IP source address (::) when sending said queries. When such proxy queries are received, they must not be included in the Querier election process.

The three major differences between IPv4 and IPv6 in relation to

multicast are:

- The IPv6 protocol for multicast group maintenance is called Multicast Listener Discovery [[MLDv2](#)]. MLDv2 uses ICMPv6 message types instead of IGMP message types.
- The RFCs [[IPV6-ETHER](#)] and [[IPV6-FDDI](#)] describe how 24 of the 128 bit DIP address are used to form the 48 bit DMAC addresses for multicast groups, while [[IPV6-TOKEN](#)] describes the mapping for token ring DMAC addresses by using three low-order bits. The specification [[IPV6-1394](#)] makes use of a 6 bit channel number.
- Multicast router discovery is accomplished using Neighbor Discovery Protocol [[NDP](#)] for IPv6. NDP uses ICMPv6 message types.

The IPv6 packet header does not include a checksum field. Nevertheless, the switch should detect other packet integrity issues such as address version and payload length consistencies if possible. When the snooping switch detects such an error, it must not include information from the corresponding packet in the MLD forwarding table. The forwarding code should instead drop the packet and take further reasonable actions as advocated above.

The fact that MLDv2 is using ICMPv6 adds new requirements to a snooping switch because ICMPv6 has multiple uses aside from MLD. This means that it is no longer sufficient to detect that the next-header field of the IP header is ICMPv6 in order to identify packets relevant for MLD snooping. A software-based implementation which treats all ICMPv6 packets as candidates for MLD snooping could easily fill its receive queue and bog down the CPU with irrelevant packets. This would prevent the snooping functionality from performing its intended purpose and the non-MLD packets destined for other hosts could be lost.

A solution is either to require that the snooping switch looks further into the packets, or to be able to detect a multicast DMAC address in conjunction with ICMPv6. The first solution is desirable when a configuration option allows the administrator to specify which ICMPv6 message types should trigger a CPU redirect and which should not. The reason is that a hardcoding of message

types is inflexible for the introduction of new message types. The second solution introduces the risk that new protocols which use ICMPv6 and multicast DMAC addresses could be incorrectly identified as MLD. It is suggested that solution one is preferred when the configuration option is provided. If this is not the case, then the implementor should seriously consider making it available since Neighbor Discovery messages would be among those that fall into this false positive case and are vital for the operational integrity of IPv6 networks.

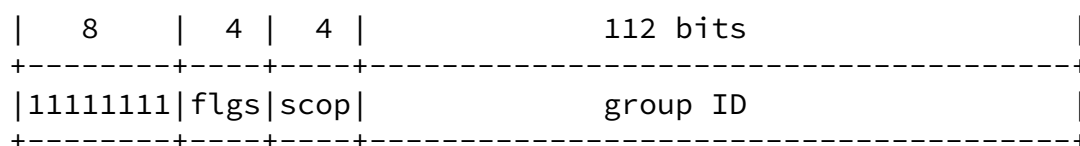
RFC DRAFT

## Considerations for IGMP and MLD Snooping Switches

February 2005

The mapping from IP multicast addresses to multicast DMAC addresses introduces a potentially enormous overlap. The structure of an IPv6 multicast address is shown in the figure below. As a result, there are  $2^{112-32}$ , or more than  $1.2e24$  unique DIP addresses which map into a single DMAC address in Ethernet and FDDI. This should be compared to  $2^5$  in the case of IPv4.

Initial allocation of IPv6 multicast addresses as described in [RFC3307], however, cover only the lower 32 bits of group ID. While this reduces the problem of address ambiguity to group IDs with different flag and scope values for now, it should be noted that the allocation policy may change in the future. Because of the potential overlap it is recommended that IPv6 address based forwarding is preferred to MAC address based forwarding.



#### 4. IGMP Questionnaire

As part of this work the following questions were asked both on the MAGMA discussion list and sent to known switch vendors implementing IGMP snooping. The individual contributions have been anonymized upon request and do not necessarily apply to all of the vendors' products.

The questions were:

Q1 Does your switches perform IGMP Join aggregation? In other

words, are IGMP joins intercepted, absorbed by the hardware/software so that only one Join is forwarded to the querier?

- Q2 Is multicast forwarding based on MAC addresses? Would datagrams addressed to multicast IP addresses 224.1.2.3 and 239.129.2.3 be forwarded on the same ports-groups?
- Q3 Is it possible to forward multicast datagrams based on IP addresses (not routed)? In other words, could 224.1.2.3 and 239.129.2.3 be forwarded on different port-groups with unaltered TTL?
- Q4 Are multicast datagrams within the range 224.0.0.1 to 224.0.0.255 forwarded on all ports whether or not IGMP Joins have been sent?

Christensen, Kimball, Solensky

[Page 11]

---

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

- Q5 Are multicast frames within the MAC address range 01:00:5E:00:00:01 to 01:00:5E:00:00:FF forwarded on all ports whether or not IGMP joins have been sent?
- Q6 Does your switch support forwarding to ports on which IP multicast routers are attached in addition to the ports where IGMP Joins have been received?
- Q7 Is your IGMP snooping functionality fully implemented in hardware?
- Q8 Is your IGMP snooping functionality partly software implemented?
- Q9 Can topology changes (for example spanning tree configuration changes) be detected by the IGMP snooping functionality so that for example new queries can be sent or tables can be updated to ensure robustness?

The answers were:

```
-----+-----+
|           Switch Vendor           |
-----+-----+-----+-----+-----+-----+-----+
```

	1	2	3	4	5	6
-----+-----+-----+-----+-----+-----+						
Q1 Join aggregation	x	x	x		x	x
Q2 Layer-2 forwarding	x	x	x	x	(1)	
Q3 Layer-3 forwarding	(1)		(1)		(1)	x
Q4 224.0.0.X aware	(1)	x	(1)	(2)	x	x
Q5 01:00:5e:00:00:XX aware	x	x	x	(2)	x	x
Q6 Mcast router list	x	x	x	x	x	x
Q7 Hardware implemented						
Q8 Software assisted	x	x	x	x	x	x
Q9 Topology change aware	x	x	x	x		(2)
-----+-----+-----+-----+-----+-----+						

x Means that the answer was Yes.

(1) In some products (typically high-end) Yes; in others No.

(2) Not at the time that the questionnaire was received  
but expected in the near future.

## Revision History

[To RFC Editor: This section is to be removed at publication time]

Christensen, Kimball, Solensky

[Page 12]

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

This section, while incomplete, is provided as a convenience to the working group members. It will be removed when the document is released in its final form.

[draft-ietf-magma-snoop-12.txt](#): January 2005

Editorial changes only:

Update document references and author address; IPR and disclaimer statements to adhere to [RFC3668](#) requirements.

[draft-ietf-magma-snoop-11.txt](#): April 2004

Editorial changes only:

Remove reference to IGMP/MLD Proxy ([draft-ietf-magma-proxy-06.txt](#)) to avoid perception of content dependency.

Updated references to reflect current revisions, author address.

[draft-ietf-magma-snoop-10.txt](#): October 2003

The changes in this version are the result of the IESG review.

Substantial comments

The security considerations section was found a little too brief. It has now been extended.

Editorial Changes

Removed reference [RFC2375](#), using [RFC3307](#) instead. New author address information.

[draft-ietf-magma-snoop-09.txt](#): August 2003

The changes in this version are the result of the AD review following the WG chair review.

Substantial comments

There were no substantial technical comments, but a list of suggested wordings and clarifications to improve the readability and RFC conformance of the draft.

Reference in Abstract removed. Improved wording in Introduction.

Christensen, Kimball, Solensky

[Page 13]

---

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

Improved wording in recommendations section, clarified integrity checking for IPv6, removed security issues which were really IGMP/MLD security issues.

Editorial Changes

Author information changes, TOC added, fixed a wrong indentation following [section 5](#).

[draft-ietf-magma-snoop-08.txt](#): June 2003

The changes in this version are the result of the WG chair review following the second WG last call. The last call itself did not result in further comments.

#### Substantial comments

Requirements have now been replaced with Recommendations throughout the draft, which is more appropriate for an Informational draft.

Clarifications regarding the overloading of the IGMP query message in [section 2.1.1](#).

Clarification regarding the data forwarding in the case of INCLUDE/EXCLUDE filters.

More detail added on the special case of Source IP address 0.0.0.0.

#### Editorial Changes

Moved Data Forwarding recommendation up as first bullet as it really is the main recommendation.

Added a more suitable reference for the Thaler briefing at the 56'th IETF meeting. Hopefully it will become a valid link sometime soon.

Moved reference to [RFC2375](#) to the Informative section.

[draft-ietf-magma-snoop-07.txt](#): May 2003

The current version reflects comments made at the 56'th IETF meeting and from the previous WG last call. The majority of changes appear in sections [2.1](#) and [2.2](#), and even the changes here are in reality not substantial.

#### Substantial comments

[Section 2.1.1](#).(4): Changed wording for IGMP forwarding section on when spoofing of General Queries should occur.



Added description of how to avoid IGMP version incompatibility problems when doing said spoofing.

[Section 2.1.2.\(3\)](#): Clarification of incompatibility problems in mixed IGMPv2 and IGMPv3 networks. Added recommendation for switches to implement some level of IGMPv3 Join recognition to reduce these problems.

[Section 2.2](#): Advice following the briefing [[IETF56](#)], that in some cases disabling IGMP snooping functionality is the only 'solution'

[Section 6](#), IPv6 Considerations: added descriptions of behavior involving the IPv6 version of the null IP Source Address (to parallel the IPv4 behaviors).

Added reference to [[IGMPv3](#)] in stead of [PROXY] for group membership maintenance and timeout.

#### Editorial Changes

Really minor stuff such as change of authors email address, addition of references, draft name increment and date changes.

[draft-ietf-magma-snoop-06.txt](#): March 2003

Changes in response to comments made during WG last call and assessment by the WG chairs:

#### Substantial comments

Clarification in IGMP forwarding section on the acceptance of membership reports with source IP address 0.0.0.0 as being a switch recommendation.

[Section 2.1.1.\(4\)](#): Allow the router port to be excluded from the General Query messages

[Section 2.1.1.\(6\)](#): Replace description of timing out older entries with a reference to IGMP/MLD Proxying.

[Section 2.1.2.\(3\)](#): Replaced description of timeout mechanism with a reference to IGMP/MLD.

[Section 2.1.2.](#)(4) Expanded rationale to discourage leaking info between IPv4 and IPv6 groups.

[Section 3](#): more strongly encourage the use of a configuration option for selection of ICMPv6 message types.

Editorial comments.

Hyphenation problem resolved for groff by setting then ms HY register to zero, disabling all forms for the entire document

("hy 0" and ".nr" worked only as far as the following ms macro).

Sections moved around - again - to comply with rfc2223bis-03 draft. Added copyright notice after memo status. Removed table of contents as the draft is fairly short. Corrected a reference typo.

[Section 2.1.2.](#)(3): Requirement and rationale broken into separate paragraphs.

Added references to other IPv6 encapsulation documents,

Corrected estimates for MAC address collisions for Ethernet and FDDI: both specification take the low-order four (not six) bytes from the IPv6 group addresses.

[draft-ietf-magma-snoop-05.txt](#): January 2003

Changes in wording of IGMP forwarding rule 6) and Data forwarding rule 7). Corrections in the references section.

Apart from above, no substantial changes has occurred in the document. Several editorial changes, however, have been made to comply with the rfc editors requirements:

References splitted in normative and informative sections, other related references added.

Abstract shortened.

Changed all occurances of MUST, MAY etc. to lowercase to reflect that this is not a standards track document.

Sections moved around so they appear in the required order.

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

[draft-ietf-magma-snoop-04.txt](#): November 2002

Editorial changes only.

[draft-ietf-magma-snoop-03.txt](#): October 2002

IGMP Forwarding rules:

Add references to and become consistant with the current  
IGMP proxy draft,

Unrecognized IGMP packets should not be ignored because  
"mbz" fields are not zero since packets from future  
versions are expected to maintain consistency.

Corrections related to IGMP Querier election process.

Add clarification to how lists of router ports may be  
assembled.

Data Forwarding rules:

Added discussion of the problems for different IGMP  
environments in choosing whether to flood or to prune  
unregistered multicasts.

Added refinements for how to handle NON-IPv4 multicasts,  
to keep IGMP-snooping functionality from interfering with  
IPv6 and other multicast traffic. Any filtering for non-  
IPv4 multicasts should be based on bridge behavior and  
not IGMP snooping behavior.

IGMP snooping related problems:

Fixed description of interoperability issues in  
environments with v3 routers and hosts, and v2 snooping  
switches.

Added discussion of the IGMPv3 "include source" and  
"exclude source" options, and the inability to support  
them on shared segments.

IPv6 Considerations:

Clarifications regarding address ranges FF00::, FF01::  
and all hosts FF02::1 in relation to data forwarding.

[draft-ietf-magma-snoop-02.txt](#): June 2002

Status section removes document history; moved into this  
section instead.

Christensen, Kimball, Solensky

[Page 17]

---

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

Introduction restores text from the -00 revision that  
describes snooping and its goals

IGMP flooding rules eased, allowing management option to  
broaden beyond "routers only".

Removed a should/MAY inconsistency between IPv4 Forwarding and  
IPv6 processing of checksums.

IGMP Forwarding Rules: clarify text describing processing of  
non-zero reserved fields.

Data Forwarding Rules, item 3 is changed from "MUST forward to  
all ports" to "MAY"; item 4 default changes from "MUST" to  
"should use network addresses".

Added two sets of additional responses to the questionnaire  
and text indicating that responses don't cover all products.

Removed (commented out) description of IPR issues: IESG is  
aware of them.

[draft-ietf-magma-snoop-01.txt](#): January 2002

Extensive restructuring of the original text.

[draft-ietf-idmr-snoop-01.txt](#): 2001

Added several descriptions of cases where IGMP snooping  
implementations face problems. Also added several network  
topology figures.

[draft-ietf-idmr-snoop-00.txt](#): 2001

Initial snooping draft. An overview of IGMP snooping and the problems to be solved.

## 5. References

### 5.1. Normative References

- [BRIDGE] IEEE 802.1D, "Media Access Control (MAC) Bridges"
- [IGMPv3] Cain, B., "Internet Group Management Protocol, Version 3", [RFC3376](#), October 2002.

Christensen, Kimball, Solensky

[Page 18]

---

RFC DRAFT	Considerations for IGMP and MLD Snooping Switches	February 2005
-----------	--	---------------

- [IPV6-1394] Fujisawa, K. and Onoe, A., "Transmission of IPv6 Packets over IEEE 1394 Networks", [RFC3146](#), October 2001.
- [IPV6-ETHER] Crawford, M., "Transmission of IPv6 Packets over Ethernet Networks", [RFC2464](#), December 1998.
- [IPV6-FDDI] Crawford, M., "Transmission of IPv6 Packets over FDDI Networks", [RFC2467](#), December 1998.
- [IPV6-TOKEN] Crawford, M., Narten, T. and Thomas, S., "Transmission of IPv6 Packets over Token Ring Networks", [RFC2470](#), December 1998.
- [MLD] Deering, S., Fenner, B. and Haberman, B. "Multicast Listener Discovery (MLD) for IPv6", [RFC2710](#), October 1999.
- [MLDv2] Vida, R. and Costa, L., "Multicast Listener Discovery Version 2 (MLDv2) for IPv6", [RFC3810](#), June 2004.
- [MRDISC] Haberman, B. and Martin, J. "Multicast Router Discovery", [draft-ietf-magma-mrdisc-03.txt](#), September 2004.
- [NDP] Narten, T., Nordmark, E. and Simpson, W., "Neighbor

Discovery for IP Version 6 {IPv6}", [RFC2461](#), December 1998.

[RFC1112] Deering, S., "Host Extensions for IP Multicasting", [RFC1112](#), August 1989.

[RFC2236] Fenner, W., "Internet Group Management Protocol, Version 2", [RFC2236](#), November 1997.

[RFC3307] Haberman, B., "Allocation Guidelines for IPv6 Multicast Addresses", [RFC3307](#), August 2002.

[RFC3668] Bradner, S., "Intellectual Property Rights in IETF Technology", [RFC3668](#), February 2004.

## [5.2.](#) Informative References

[CISCO]  
Cisco Tech Notes, "Multicast In a Campus Network: CGMP and IGMP snooping", <http://www.cisco.com/warp/public/473/22.html>

Christensen, Kimball, Solensky

[Page 19]

---

RFC DRAFT	Considerations for IGMP and MLD Snooping Switches	February 2005
-----------	--	---------------

[IANA] Internet Assigned Numbers Authority, "Internet Multicast Addresses",  
<http://www.iana.org/assignments/multicast-addresses>

[IETF56] Briefing by Dave Thaler, Microsoft, presented to the MAGMA WG at the 56'th IETF meeting in San Francisco,  
<http://www.ietf.org/proceedings/03mar/index.html>

[MSOFT] Microsoft support article Q223136, "Some LAN Switches with IGMP Snooping Stop Forwarding Multicast Packets on RRAS Startup",  
<http://support.microsoft.com/support/articles/Q223/1/36.ASP>

## [6.](#) Security Considerations

Under normal network operation, the snooping switch is expected to

improve overall network performance by limiting the scope of multicast flooding to a smaller portion of the local network. In the event of forged IGMP messages, the benefits of using a snooping switch might be reduced or eliminated.

Security considerations for IGMPv3 at the network layer of the protocol stack are described in [[IGMPv3](#)]. The introduction of IGMP snooping functionality does not alter the handling of multicast packets by the router as it does not make use of link layer information.

There are, however, changes in the way that the IGMP snooping switch handles multicast packets within the local network. In particular:

- A Query message with a forged source address which is less than that of the current Querier could cause snooping switches to forward subsequent Membership reports to the wrong network interface. It is for this reason that IGMP Membership Reports should be sent to all multicast routers as well as the current Querier.
- It is possible for a host on the local network to generate Current-State Report Messages that would cause the switch to incorrectly believe that there is a multicast listener on the same network segment as the originator of the forged message. This will cause unrequested multicast packets to be forwarded into the network segments between the source and the router. If the router requires that all Multicast Report messages be

authenticated as described in section 9.4 of [[IGMPv3](#)], it will discard the forged Report message from the host inside the network in the same way that it would discard one which originates from a remote location. It is worth noting that if the router accepts unauthenticated Report messages by virtue of them having arrived over a network interface associated with the internal network, investigating the affected network segments will quickly narrow the search for the source of the forged messages.

- As noted in [[IGMPv3](#)], there is little motivation for an attacker to forge a Membership report message since joining a

group is generally an unprivileged operation. The sender of the forged Membership report will be the only recipient of the multicast traffic to that group. This is in contrast to a shared LAN segment (HUB) or network without snooping switches, where all other hosts on the same segment would be unable to transmit when the network segment is flooding the unwanted traffic.

The worst case result for each attack would remove the performance improvements that the snooping functionality would otherwise provide. It would, however, be no worse than that experienced on a network with switches that do not perform multicast snooping.

## [7.](#) Acknowledgements

We would like to thank Martin Bak, Les Bell, Yiqun Cai, Ben Carter, Paul Congdon, Toerless Eckert, Bill Fenner, Brian Haberman, Edward Hilquist, Hugh Holbrook, Kevin Humphries, Isidor Kouvelas, Pekka Savola, Suzuki Shinsuke, Jaff Thomas, Rolland Vida, and Margaret Wasserman for comments and suggestions on this document.

Furthermore, the following companies are acknowledged for their contributions: 3Com, Alcatel, Cisco Systems, Enterasys Networks, Hewlett-Packard, Vitesse Semiconductor Corporation, Thrane & Thrane. The ordering of these names do not necessarily correspond to the column numbers in the response table.

## [8.](#) Authors' Addresses

Morten Jagd Christensen  
Thrane & Thrane  
Lundtoftegaardsvej 93 D



2800 Lyngby  
DENMARK  
email: mjc@tt.dk

Karen Kimball  
Hewlett-Packard  
8000 Foothills Blvd.  
Roseville, CA 95747  
USA  
email: karen.kimball@hp.com

Frank Solensky  
Calix Networks  
43 Nanog Park  
Acton, MA 01720  
USA  
email: frank.solensky@calix.com

#### 9. IETF IPR Statement

"The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in [\[RFC-2026\]](#). Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat."

#### 10. Full Copyright Statement

Copyright (C) The Internet Society (2005). This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

## MLD Snooping Switches

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement:

Funding for the RFC Editor function is currently provided by the Internet Society.

RFC DRAFT

Considerations for IGMP and  
MLD Snooping Switches

February 2005

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">2.</a>	IGMP Snooping Recommendations . . . . .	<a href="#">3</a>
<a href="#">2.1.</a>	Forwarding rules . . . . .	<a href="#">3</a>
<a href="#">2.1.1.</a>	IGMP Forwarding Rules . . . . .	<a href="#">4</a>
<a href="#">2.1.2.</a>	Data Forwarding Rules . . . . .	<a href="#">6</a>
<a href="#">2.2.</a>	IGMP snooping-related problems . . . . .	<a href="#">8</a>
<a href="#">3.</a>	IPv6 Considerations . . . . .	<a href="#">9</a>
<a href="#">4.</a>	IGMP Questionnaire . . . . .	<a href="#">11</a>
<a href="#">4.</a>	Revision History . . . . .	<a href="#">12</a>
<a href="#">5.</a>	References . . . . .	<a href="#">18</a>
<a href="#">5.1.</a>	Normative References . . . . .	<a href="#">18</a>
<a href="#">5.2.</a>	Informative References . . . . .	<a href="#">19</a>
<a href="#">6.</a>	Security Considerations . . . . .	<a href="#">20</a>
<a href="#">7.</a>	Acknowledgements . . . . .	<a href="#">21</a>
<a href="#">8.</a>	Author's Addresses . . . . .	<a href="#">21</a>
<a href="#">9.</a>	IETF IPR Statement . . . . .	<a href="#">22</a>
<a href="#">10.</a>	Full Copyright Statement . . . . .	<a href="#">22</a>

[To RFC Editor: The TOC page is to be moved to page 2 at  
publication time ]

[To RFC Editor: Page renumbering in TOC and in document will be  
necessary ]

