XORP MLD/IGMP Daemon

Version 0.1

XORP Project
International Computer Science Institute
Berkeley, CA 94704, USA
feedback@xorp.org

December 11, 2002

1 Introduction

1.1 Overview

This document provides an overview of the XORP MLD/IGMP [2, 3] Routing Daemon. It is intended to provide a starting point for software developers who wish to modify this software.

A router running MLD/IGMP interacts with other MLD/IGMP routers and multicast members, and keeps state about local multicast membership information.

The chosen architecture for our MLD/IGMP implementation emphasizes on correctness and extensibility rather than high performance or minimal memory footprint. Typically, the amount of state kept by MLD/IGMP is relatively small. Further, the multicast routing performance does not depend on the MLD/IGMP performance, therefore it is not necessary to optimize the implementation. Only if it turns out that there are performance issues with MLD/IGMP, we should try to optimize those parts of the implementation which are the bottleneck.

Currently (December 2002), the MLD and IGMP implementation is based on the specification in the following documents:

- RFC 2710: Multicast Listener Discovery for IPv6, Version 1
- RFC 2236: Internet Group Management Protocol, Version 2

In the future there will be support for IGMPv3 and MLDv2.

1.2 Acronyms

Acronyms used in this document:

- **MFEA**: **M**ulticast **F**orwarding **E**ngine **A**bstraction
- **MLD/IGMP**: **M**ulticast **L**istener **D**iscovery/**I**nternet **G**roup **M**anagement **P**rotocol
- **PIM-SM**: **P**rotocol **I**ndependent **M**ulticast–**S**parse **M**ode

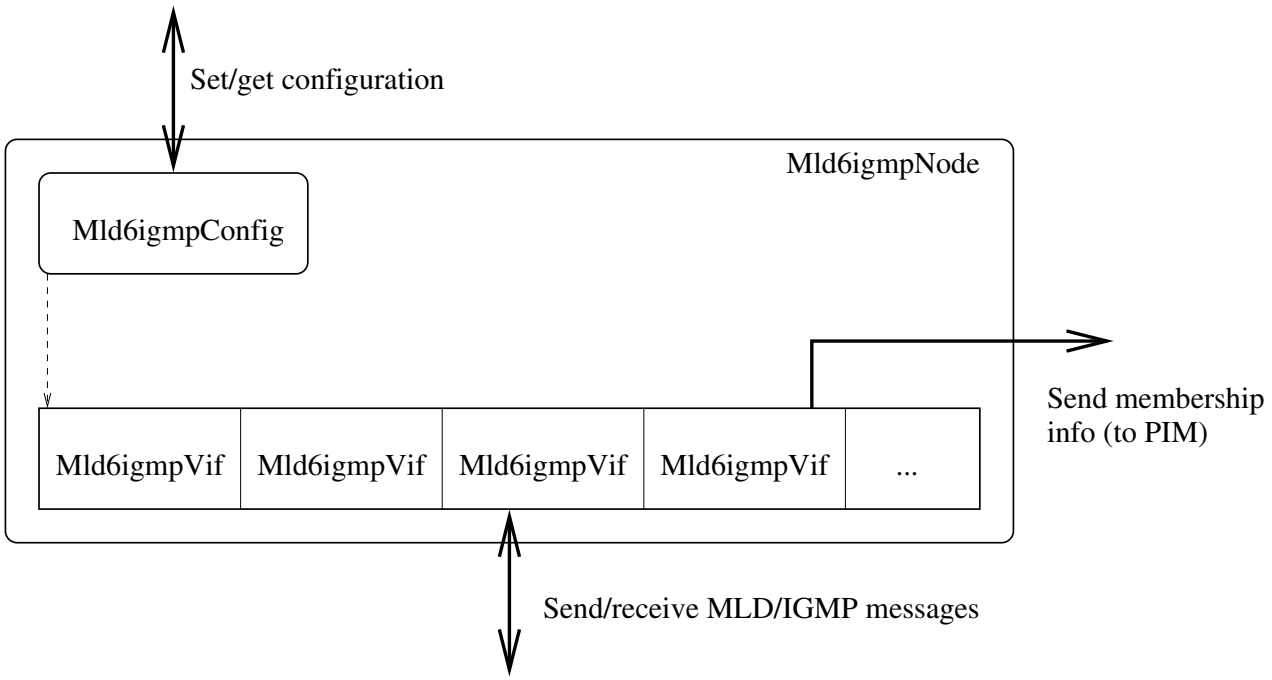

Figure 1: MLD/IGMP design overview

1.3 MLD/IGMP Design Architecture Overview

Figure 1 gives a general overview of the MLD/IGMP components. For each component there is a C++ class with exactly the same name. The main components are briefly described below:

- **Mld6igmpNode:** a representation of a single MLD/IGMP routing unit (*e.g.,* a virtual MLD/IGMP router). Typically, there would be a single Mld6igmpNode per multicast router.
- **Mld6igmpVif:** MLD/IGMP-specific virtual interface that is used for sending and receiving MLD/IGMP control messages.
- **Mld6igmpConfig:** contains MLD/IGMP-specific configuration.

Those components are described in details in Section 2. For information about the interaction between the MLD/IGMP and other modules see [1].

2 Components Description

2.1 Mld6igmpNode Description

Mld6igmpNode is a representation of a single MLD/IGMP routing unit (*e.g.,* a virtual MLD/IGMP router). Typically, there would be a single Mld6igmpNode per multicast router. However, in some cases a multicast router may have more than one routing unit. For example, it could have one Mld6igmpNode for IPv4, and another one for IPv6 multicast routing. Further, if we want to run MLD/IGMP in a simulation environment, each multicast router within that simulation will be represented by a single Mld6igmpNode.

From a developer's point of view, Mld6igmpNode contains the front-end interface to interact with the MLD/IGMP routing unit, as well as all the state related to that unit. For example, Mld6igmpNode contains the methods to start/stop or configure MLD/IGMP, or to send/receive MLD/IGMP control messages to/from the routing unit. Those methods are described in the following files:

- `mld6igmp/mld6igmp_node.hh`
- `libproto/proto_node.hh`
- `libproto/proto_unit.hh`

Mld6igmpNode itself does not implement the mechanisms to communicate with other routing units (*e.g.,* to send or receive control packets to/from the network), or to perform other MLD/IGMP-independent operations such as join a multicast routing group. Those mechanisms are outside the scope of Mld6igmpNode, and must be implemented separately.

Mld6igmpNode contains several pure virtual methods (*e.g.,* `join_multicast_group()` that is used to join a multicast group on an interface) that must be implemented by a class that inherits Mld6igmpNode. For example, XrlMld6igmpNode is a class that uses Mld6igmpNode as a base class, and that implements XRL-based communication mechanisms between Mld6igmpNode and other XORP components such as the MFEA and PIM modules.

By default, Mld6igmpNode is disabled; therefore it must be explicitly enabled, and then started.

2.2 Mld6igmpVif Description

Mld6igmpVif is a MLD/IGMP-specific virtual interface that is used for sending and receiving MLD/IGMP control messages. It includes the methods for processing and composing MLD/IGMP control messages, as well as various state per interface (*e.g.,* the multicast group membership on an interface).

Typically, there would be one Mld6igmpVif virtual interface for each interface on the router: physical interfaces, tunnels, and the loopback interface. Not all virtual interfaces will be used by MLD/IGMP; for example, all interfaces that are not multicast capable, and the loopback interface will be ignored for multicast routing.

Typically, from developer's point of view, all interaction with Mld6igmpNode would be through Mld6igmpNode [1].

The public interface for Mld6igmpVif contains the methods to manipulate a virtual interface. Those methods are to start/stop/enable/disable a virtual interface, or to configure it. Those methods are described in the following files:

- `mld6igmp/mld6igmp_vif.hh`
- `libxorp/vif.hh`
- `libproto/proto_unit.hh`

Mld6igmpVif contains state such as group membership information about local members (a list of objects of class MemberQuery), and information about the current MLD/IGMP querier. Also, all of the MLD/IGMP-specific methods for parsing or constructing MLD/IGMP control messages when a MLD/IGMP packet is received or sent are implemented as methods to Mld6igmpVif. The parsing or construction of each message type is implemented in files `mld6_proto.cc` and `igmp_proto.cc` for MLD and IGMP respectively.

By default, each Mld6igmpVif is disabled; therefore it must be explicitly enabled, and then started.

[1] Note that on few occasions in the current implementation (December 2002) XrlMld6igmpNode for simplicity uses direct access to Mld6igmpVif.

2.3 Mld6igmpConfig Description

Mld6igmpConfig handles the MLD/IGMP-specific configuration [2]. This configuration is used to configure the following units:

- Mld6igmpVif: protocol version, membership query related options and timer values, etc.

A Modification History

- December 11, 2002: Version 0.1 completed.

References

[1] XORP Multicast Routing Design Architecture. XORP technical document. http://www.xorp.org/.

[2] Steve Deering, Bill Fenner, and Brian Haberman. Multicast Listener Discovery (MLD) for IPv6. Request For Comments (RFC) 2710, October 1999. http://www.ietf.org/rfc.html.

[3] W. Fenner. Internet Group Management Protocol, Version 2. Request For Comments (RFC) 2236, November 1997. http://www.ietf.org/rfc.html.

[2] Note that currently (December 2002), Mld6igmpConfig is not implemented; rather, all state is kept into Mld6igmpNode instead.