                RSVP over ATM Implementation Guidelines

Status of this Memo

Copyright Notice

Abstract

   This memo presents specific implementation guidelines for running
   RSVP over ATM switched virtual circuits (SVCs). The general problem
   is discussed in [6]. Implementation requirements are discussed in
   [2]. Integrated Services to ATM service mappings are covered in [3].
   The full set of documents present the background and information
   needed to implement Integrated Services and RSVP over ATM.

1. Introduction

   This memo discusses running IP over ATM in an environment where SVCs
   are used to support QoS flows and RSVP is used as the internet level
   QoS signaling protocol. It applies when using CLIP/ION, LANE2.0 and
   MPOA methods for supporting IP over ATM. The general issues related
   to running RSVP[4] over ATM have been covered in several papers
   including [6] and other earlier work. This document is intended as a
   companion to [6,2] and as a guide to implementers. The reader should
   be familiar with both documents.

   This document provides a recommended set of functionality for
   implementations using ATM UNI3.x and 4.0, while allowing for more
   sophisticated approaches. We expect some vendors to additionally
   provide some of the more sophisticated approaches described in [6],
   and some networks to only make use of such approaches. The
   recommended set of functionality is defined to ensure predictability
   and interoperability between different implementations. Requirements
   for RSVP over ATM implementations are provided in [2].

This document uses the same terms and assumption stated in [2].
Additionally, 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 [5].

2. Implementation Recommendations

This section provides implementation guidelines for implementation of
RSVP over ATM. Several recommendations are common for all, RSVP
sessions, both unicast and multicast. There are also recommendations
that are unique to unicast and multicast session types.

2.1 RSVP Message VC Usage

The general issues related to which VC should be used for RSVP
messages is covered in [6]. It discussed several implementation
options including: mixed control and data, single control VC per
session, single control VC multiplexed among sessions, and multiple
VCs multiplexed among sessions. QoS for control VCs was also
discussed. The general discussion is not repeated here and [6]
should be reviewed for detailed information.

RSVP over ATM implementations SHOULD send RSVP control (messages)
over the best effort data path, see figure 1. It is permissible to
allow a user to override this behavior. The stated approach
minimizes VC requirements since the best effort data path will need
to exist in order for RSVP sessions to be established and in order
for RSVP reservations to be initiated. The specific best effort
paths that will be used by RSVP are: for unicast, the same VC used to
reach the unicast destination; and for multicast, the same VC that is
used for best effort traffic destined to the IP multicast group.
Note that for multicast there may be another best effort VC that is
used to carry session data traffic, i.e., for data that is both in
the multicast group and matching a sessions protocol and port.

```
                      Data Flow ==========>

                       QoS VCs
       +-----+    -------------->    +----+
       |     |  -------------->      |    |
       | Src |                       | R1 |
       |     |    Best Effort VC(s)  |    |
       +-----+  <----------------->  +----+
                 /\
                 ||
                 ||
               RSVP Control
               Messages
```
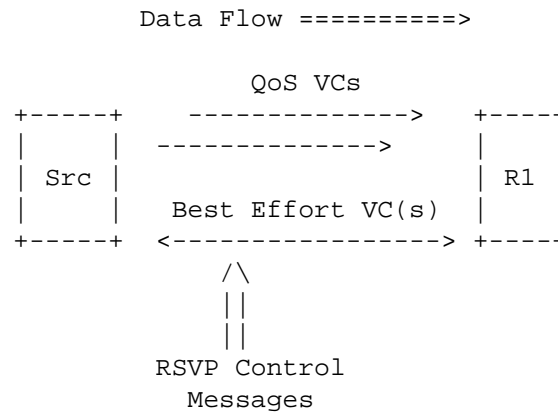
Figure 1: RSVP Control Message VC Usage

   The disadvantage of this approach is that best effort VCs may not
   provide the reliability that RSVP needs. However the best effort
   path is expected to satisfy RSVP reliability requirements in most
   networks. Especially since RSVP allows for a certain amount of packet
   loss without any loss of state synchronization.

2.2 Aggregation

   As discussed in [6], data associated with multiple RSVP sessions can
   be sent using the same shared VCs. Implementation of such
   "aggregation" models is still a matter for research. Therefore, RSVP
   over ATM implementations SHOULD use independent VCs for each RSVP
   reservation.

2.3 Short-Cuts

   Short-cuts allow ATM attached routers and hosts to directly establish
   point-to-point VCs across LIS boundaries, i.e., the VC end-points are
   on different IP subnets. Short-cut support for unicast traffic has
   been defined in [7] and [1]. The ability for short-cuts and RSVP to
   interoperate has been raised as a general question. The area of
   concern is the ability to handle asymmetric short-cuts. Specifically
   how RSVP can handle the case where a downstream short-cut may not
   have a matching upstream short-cut. In this case, which is shown in
   figure 2, PATH and RESV messages following different paths.

```
                          _____
                         /       \
           +-------- /  Router  \ <-------+
           |         \         /          |       <....... RESVs Follow
           |          _____/           |               Hop-by-hop Path
           |                              |
           |                              |
           V              QoS VCs         |
        +-----+     =============>   +----+
        |     |     =============>   |    |
        | Src |                      | R1 |
        |     |     Best Effort VC(s)|    |
        +-----+     <===============> +----+

                    /\
                    ::                     Data Paths:
                    ::                     ----> Hop-by-hop (routed)
              PATHs and Data               ====> Short-cut
             Follow Short-cut
                   Path
```
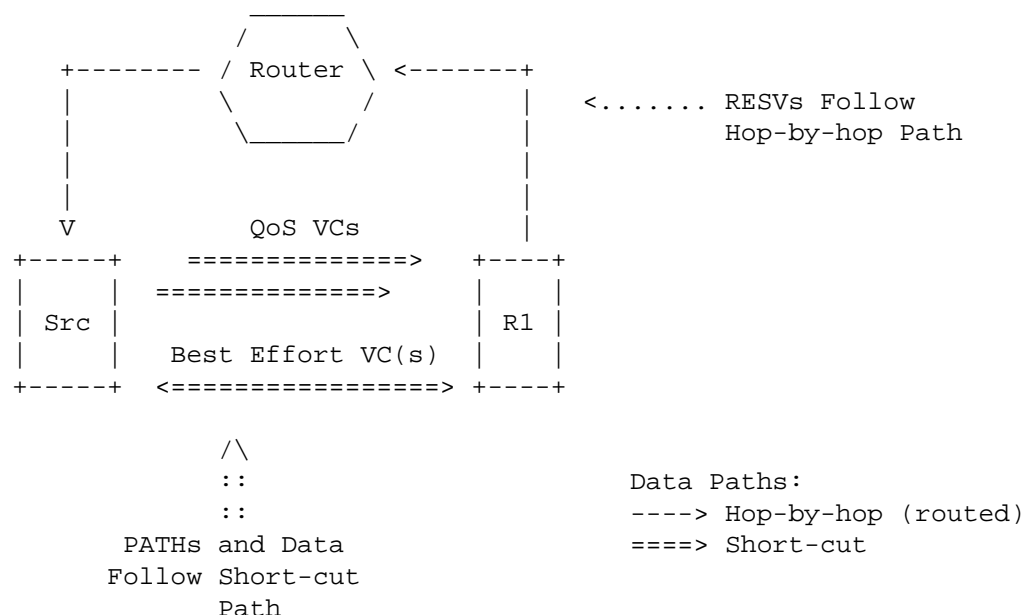
             Figure 2: Asymmetric RSVP Message Forwarding With ATM Short-Cuts

   Examination of RSVP shows that the protocol already includes
   mechanisms that allows support of the asymmetric paths. The
   mechanism is the same one used to support RESV messages arriving at
   the wrong router and the wrong interface. RSVP messages are only
   processed when they arrive at the proper interface. When messages
   arrive on the wrong interface, they are forwarded by RSVP. The
   proper interface is indicated in the NHOP object of the message. So,
   existing RSVP mechanisms will support the asymmetric paths that can
   occur when using short-cuts.

   The short-cut model of VC establishment still poses several issues
   when running with RSVP. The major issues are dealing with established
   best effort short-cuts, when to establish short-cuts, and QoS only
   short-cuts. These issues will need to be addressed by RSVP
   implementations.

   The key issue to be addressed by RSVP over ATM implementations is
   when to establish a short-cut for a QoS data flow. RSVP over ATM
   implementations SHOULD simply follow best effort traffic. When a
   short-cut has been established for best effort traffic to a
   destination or next-hop, that same end-point SHOULD be used when
   setting up RSVP triggered VCs for QoS traffic to the same destination
   or next-hop. This will happen naturally when PATH messages are
   forwarded over the best effort short-cut. Note that in this

approach, when best effort short-cuts are never established, RSVP
triggered QoS short-cuts will also never be established.

2.4 Data VC Management for Heterogeneous Sessions

   Heterogeneous sessions can only occur with multicast RSVP sessions.
   The issues relating to data VC management of heterogeneous sessions
   are covered in detail in [6] and are not repeated in this document.
   In summary, heterogeneity occurs when receivers request different
   levels of QoS within a single session and also when some receivers do
   not request any QoS. Both types of heterogeneity are shown in figure
   3.

```
                                 +----+
                       +------> | R1 |
                       |         +----+
                       |
                       |         +----+
      +-----+ -----+    +--> | R2 |
      |     | ---------+     +----+         Receiver Request Types:
      | Src |                                ---->  QoS 1 and QoS 2
      |     | .........+     +----+         ....>  Best-Effort
      +-----+ .....+    +..> | R3 |
               :           +----+
            /\  :
            ||  :          +----+
            ||  +......> | R4 |
            ||            +----+
           Single
        IP Mulicast
          Group
```
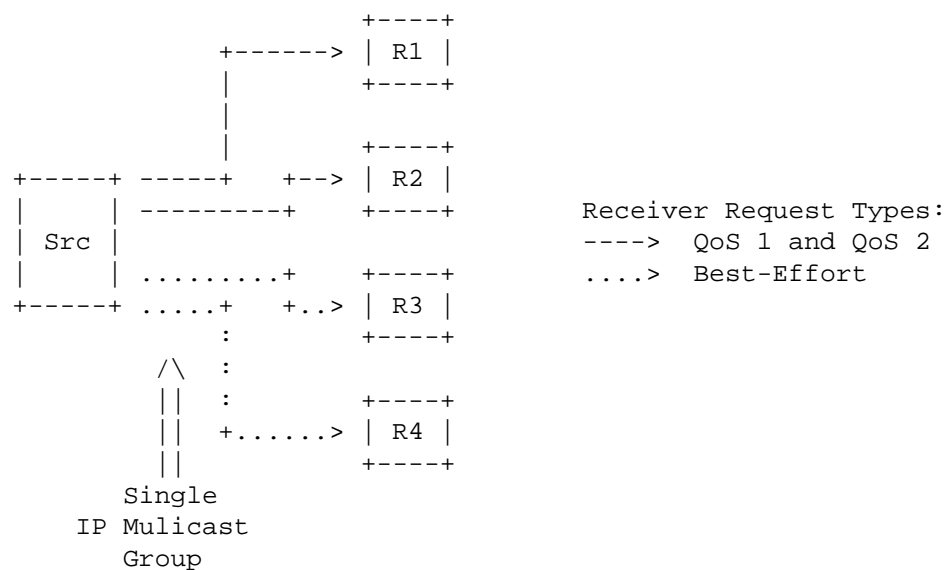
                    Figure 3: Types of Multicast Receivers

   [6] provides four models for dealing with heterogeneity: full
   heterogeneity, limited heterogeneity, homogeneous, and modified
   homogeneous models. The key issue to be addressed by an
   implementation is providing requested QoS downstream. One of, or some
   combination of, the discussed models [6] may be used to provide the
   requested QoS. Unfortunately, none of the described models is the
   right answer for all cases. For some networks, e.g. public WANs, it
   is likely that the limited heterogeneous model or a hybrid limited-
   full heterogeneous model will be desired. In other networks, e.g.
   LANs, it is likely that a the modified homogeneous model will be
   desired.

   Since there is not one model that satisfies all cases,
   implementations SHOULD implement one of either the limited
   heterogeneity model or the modified homogeneous model.
   Implementations SHOULD support both approaches and provide the
   ability to select which method is actually used, but are not required
   to do so.

3. Security Considerations

   The same considerations stated in [4] and [8] apply to this document.
   There are no additional security issues raised in this document.

4. Acknowledgments

   This work is based on earlier drafts and comments from the ISSLL
   working group. The author would like to acknowledge their
   contribution, most notably Steve Berson who coauthored one of the
   drafts.

5. Author's Address

   Lou Berger
   FORE Systems
   1595 Spring Hill Road
   5th Floor
   Vienna, VA 22182

   Phone: +1 703-245-4527
   EMail: lberger@fore.com

REFERENCES

   [1] The ATM Forum, "MPOA Baseline Version 1", May 1997.

   [2] Berger, L., "RSVP over ATM Implementation Requirements",
       RFC 2380, August 1998.

   [3] Borden, M., and M. Garrett, "Interoperation of Controlled-Load
       and Guaranteed-Service with ATM", RFC 2381, August 1998.

   [4] Braden, R., Zhang, L., Berson, S., Herzog, S., and S. Jamin,
       "Resource ReSerVation Protocol (RSVP) -- Version 1 Functional
       Specification", RFC 2205, September 1997.

   [5] Bradner, S., "Key words for use in RFCs to Indicate Requirement
       Levels", BCP 14, RFC 2119, March 1997.

   [6] Crawley, E., Berger, L., Berson, S., Baker, F., Borden, M., and
       J. Krawczyk, "A Framework for Integrated Services and RSVP over
       ATM", RFC 2382, August 1998.

   [7] Luciani, J., Katz, D., Piscitello, D., and B. Cole, "NBMA Next
       Hop Resolution Protocol (NHRP)", RFC 2332, April 1998.

   [8] Perez, M., Liaw, F., Grossman, D., Mankin, A., Hoffman, E., and
       A. Malis, "ATM Signalling Support for IP over ATM", RFC 1755,
       February 1995.

Full Copyright Statement

   Copyright (C) The Internet Society (1998). All Rights Reserved.

   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 is provided on an
   "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING
   TASK FORCE DISCLAIMS 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.