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RSVP over ATM Implementation Guidelines

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Abstract

This note presents specific implementation guidelines for running RSVP over ATM switched virtual circuits (SVCs). The general problem is discussed in [8]. Implementation requirements are discussed in [3]. Integrated Services to ATM service mappings are covered in [6]. The full set of documents present the background and information needed to implement Integrated Services and RSVP over ATM.

1 Introduction

This note 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[7] over ATM have been covered in several papers including [8, 4, 2, 5]. This document is intended as a companion to [8, 3] and as a guide to implementers. The reader should be familiar with both documents.

This document will provide 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 [8], 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 [3].

This document uses the same terms and assumption stated in [3].

2 Implementation Recommendations

This section provides implementation guidelines for implementation of RSVP over ATM. Several recommendations are common for all, both unicast and multicast, RSVP sessions. 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 [8]. 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 [8] 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.

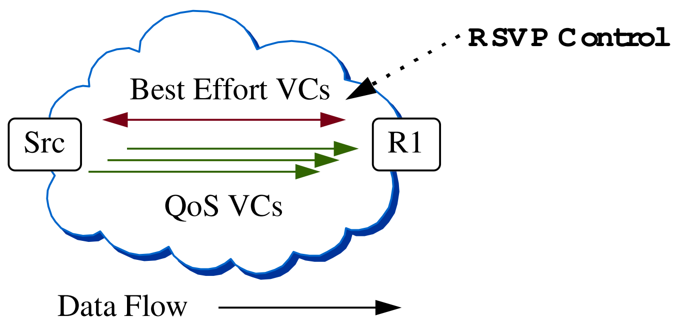

Figure 1: RSVP Control Message VC Usage

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 [8], data associated with multiple RSVP sessions could 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 sub-nets. Short-cut support for unicast traffic has been defined in [9] 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.

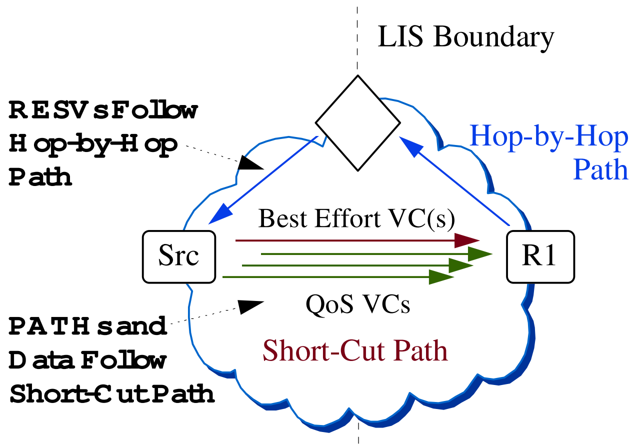

Figure 2: Asymmetric RSVP Message Forwarding With ATM Short-Cuts

Examination of RSVP shows that the protocol already includes mechanisms that allows support of short-cuts. The mechanism is the same one used to support RESV messages arriving at the wrong router and the wrong interface. The key aspect of this mechanism is RSVP only processing messages that arrive at the proper interface and RSVP forwarding of messages that arrive on the wrong interface. The proper interface is indicated in the NHOP object of the message. So, existing RSVP mechanisms will support asymmetric paths.

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 any RSVP over ATM solution 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 [8] and are not repeated. 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.

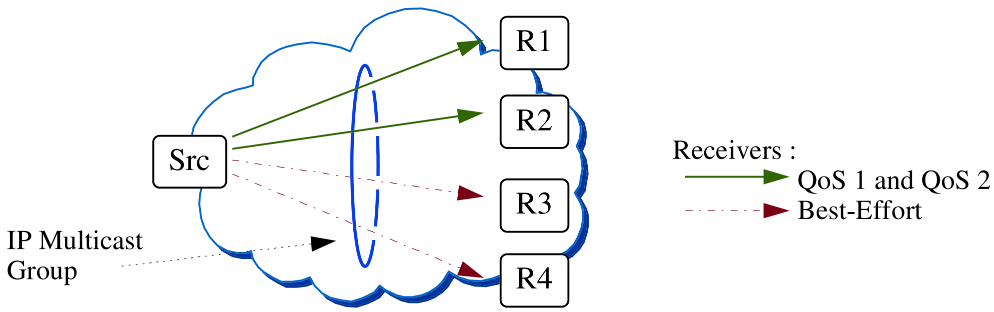

Figure 3: Types of Multicast Receivers

[8] 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 [8] may be used to provide 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

The same considerations stated in [7] and [10] apply to this document. There are no additional security issues raised in this document.

4 Acknowledgments

This work is based on earlier drafts [2, 4] and comments from the ISSLL working group. The author would like to acknowledge their contribution, most notably Steve Berson who coauthored [4].

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