Considerations for RAMS Scenarios
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Abstract

The Rapid Acquisition of Multicast RTP Sessions (RAMS) solution is a method based on RTP and RTCP protocol family that enables an RTP receiver to rapidly acquire and start usefully consuming the RTP
multicast data. Upon a request from the RTP receiver, an auxiliary
unicast RTP retransmission session is set up between a retransmission
server and the RTP receiver, over which the reference information
about the new multicast stream the RTP receiver is about to join is
transmitted at an accelerated pace. This often precedes, but may
also accompany, the multicast stream itself. When there is only one
multicast stream to be acquired, the RAMS solution works in a
straightforward manner. However, when there are two or more
multicast streams to be acquired from the same or different multicast
RTP sessions, care should be taken to configure each RAMS
appropriately. This document provides example scenarios and make
practical recommendations.

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1. Introduction

The Rapid Acquisition of Multicast RTP Sessions (RAMS) solution is a method based on RTP and RTCP protocol family that enables an RTP receiver to rapidly acquire and start usefully consuming the RTP multicast data. Through an auxiliary unicast RTP retransmission session [RFC4588], the RTP receiver receives a reference information about the new multicast stream it is about to join. This often precedes, but may also accompany, the multicast stream itself. The RAMS solution is documented in detail in [I-D.ietf-avt-rapid-acquisition-for-rtp].

To focus on the protocol details, the RAMS specification [I-D.ietf-avt-rapid-acquisition-for-rtp] has only considered the simplest case, which is that the RTP receiver acquires only one multicast stream at a time. However, there are many applications where a multicast RTP session may have two or more multicast streams associated with it. There are also cases, where an RTP receiver may be interested in acquiring one or more multicast streams from multiple multicast RTP sessions. In scenarios where multiple RAMS sessions will be simultaneously run by the RTP receiver, care should be taken to coordinate them. In this document, we provide scenarios from real-life deployments and make recommendations.

2. Requirements Notation

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 [RFC2119].

3. Background

In the following, we assume that there are two RTP streams (1 and 2) that are somehow associated with each other. These could be audio and video elementary streams for the same TV channel, or they could be an MPEG2-TS stream and its Forward Error Correction (FEC) stream.

It is important to note that a source-specific multicast (SSM) session is defined by its (distribution) source address and (destination) multicast group and there can be only one feedback target per SSM session [I-D.ietf-avt-rtcpssm]. So, if the RTP streams are distributed by different sources or over different multicast groups, they have to be in different SSM sessions. Different SSM sessions may share the same feedback target address and/or port.
Different multicast RTP streams can be transmitted in the same RTP session (i.e., in a single UDP flow). This is called SSRC multiplexing. In this case, (de)multiplexing is done at the SSRC level. Alternatively, different multicast RTP streams can be transmitted in different RTP sessions (i.e., in different UDP flows), which is called session multiplexing. In practice, there are different deployment models for each multiplexing scheme.

It is also important to note that two different media streams with different clock rates should use different SSRCs or RTP sessions to avoid complications in RTCP reports. Some of the fields in RAMS messages depend on the clock rate. Thus, in a single RTP session, RTP streams carrying payloads with different clock rates should have different SSRCs. Since RTP streams in the same RTP session but with different SSRCs do not share the sequence numbering, each stream needs to be acquired individually.

In the following, only the relevant portions of the SDP descriptions [RFC4566] will be provided.

4. Illustrative Scenarios

4.1. Scenario #1

This is the scenario for session multiplexing where RTP streams 1 and 2 are transmitted over different multicast groups. A practical use case is where the first and second SSM session carries the primary video stream and its associated FEC stream, respectively.

We run an individual RAMS session for each RTP stream that we want to rapidly acquire. These RAMS sessions MAY run in parallel. If they are, the RTP receiver needs to pay attention to using the shared bandwidth appropriately among different RAMS sessions. Note that there may be different feedback targets for these two SSM sessions. If that is the case, RTP streams 1 and 2 may have the same SSRC value. However, if both SSM sessions use the same transport address (IP address and port) for their feedback targets (as shown in the SDP below), the SSRCs of the RTP streams 1 and 2 MUST be different from each other to avoid any ambiguity in the RAMS requests.
Note that the destination ports in the above SDP do not matter, and they could be the same or different.

4.2. Scenario #2

This is the scenario for session multiplexing where RTP streams 1 and 2 are transmitted over the same multicast group with different destination ports. A practical use case is where the SSM session carries the primary video and audio streams, each destined to a different port.

Similar to scenario #1, we run individual RAMS sessions for each RTP stream that we want to rapidly acquire. Compared to the previous scenario, the only difference is that in this case the join times for both streams need to be coordinated as they are on the same multicast session.

Note that the destination ports in the above SDP MUST be distinct per [I-D.ietf-mmusic-rfc3388bis].

If RTP streams 1 and 2 share the same distribution source, then there is only one SSM session, which means that there can be only one feedback target. This requires RTP streams 1 and 2 to have their own unique SSRC values (as shown in the SDP above). If RTP streams 1 and 2 do not share the same distribution source, meaning that their
respective SSM sessions may use different feedback target transport addresses, then their SSRC values do not have to be different from each other.

4.3. Scenario #3

This is the scenario for SSRC multiplexing where both RTP streams are transmitted over the same multicast group to the same destination port. This is a less practical scenario but it could be used where the SSM session carries the primary video and audio streams, destined to the same port.

Similar to scenario #2, we run individual RAMS sessions and the join time needs to be coordinated. In this case, there is only one distribution source and the destination multicast address is shared. Thus, there is only one SSM session and one feedback target.

m=video 40000 RTP/AVP 96 97
c=IN IP4 233.252.0.1/127
a=rtcp:41001 IN IP4 192.0.2.1
a=ssrc:1 cname:rtp1@example.com
a=ssrc:2 cname:rtp2@example.com
a=mid:Channel1

4.4. Scenario #4

This is the scenario for payload-type multiplexing.

In this case, instead of two, we have only one RTP stream (and one RTP session) carrying both payload types (e.g., media payload and its FEC data). While this scheme is permissible per [RFC3550], it has several drawbacks. For example, RTP packets carrying different payload formats will share the same sequence numbering space, and the retransmission and RAMS operations will not be able to be applied based on the payload type. For other drawbacks and details, see Section 5.2 of [RFC3550].

5. Feedback Target and SSRC Signaling Issues

The RAMS protocol uses the common packet format from [RFC4585], which has a field to signal the media source SSRC. Thus, currently we require the RAMS Request messages to have this field properly filled. The SSRCs for the RTP streams can be signaled out-of-band in the SDP, or could be learned from the RTP packets once the transmission starts. In our scenario, the latter cannot be used.

Signaling the media source SSRC value will help the feedback target
correctly identify the RTP stream to be acquired. If a feedback target is serving multiple SSM sessions on a particular port, all the RTP streams in these SSM sessions MUST have a unique SSRC value. Otherwise, the feedback target cannot discern the incoming RTCP feedback messages.

If there are no provisions to assign unique SSRC values to the RTP streams in a deployment, the feedback target transport addresses MUST be assigned appropriately. Unique feedback target addresses can be used without any issues if the deployment only covers scenario #1. Using unique feedback target transport addresses may or may not be sufficient in scenario #2. In scenario #3, there is one feedback target. Thus, SSRCs must be unique among the RTP streams that a particular feedback target (IP address and port) is responsible for.

6. FEC during RAMS and Bandwidth Issues

Suppose that RTP stream 1 denotes the primary video stream that has a bitrate of 10 Mbps and RTP stream 2 denotes the FEC stream that has a bitrate of 1 Mbps. Also assume that the RTP receiver knows that it can receive data at a maximum bitrate of 22 Mbps. SDP can specify the bitrate ("b=" line in Kbps) of each media session (per "m=" line).

6.1. Scenario #1

This is the scenario for session multiplexing where RTP streams 1 and 2 are transmitted over different multicast groups.

This is the preferred deployment model for FEC. Having FEC in a different multicast group provides flexibility for both RTP receivers that are not FEC capable or the ones that are not willing to receive FEC during the RAMS session.
If the RTP receiver does not want to receive FEC until the acquisition of the primary video stream is completed, the total available bandwidth can be used for faster acquisition of the primary video stream. In this case, the RTP receiver may request a Max Receive Bitrate of 22 Mbps in the RAMS Request message. Once RAMS has been completed, the RTP receiver MAY join the FEC multicast session, if desired.

If the RTP receiver wants to rapidly acquire both primary and FEC streams, it needs to allocate the total bandwidth among the two RAMS sessions and indicate individual Max Receive Bitrate values in each respective RAMS Request message. Since less bandwidth will be used to acquire the primary video stream, the acquisition of the primary video session will take a longer time on the average.

While the RTP receiver can update the Max Receive Bitrate values during the course of the RAMS session, this approach is more error-prone due to the possibility of losing the update messages.

6.2. Scenario #2

This is the scenario for session multiplexing where RTP streams 1 and 2 are transmitted over the same multicast group with different destination ports.

a=group:FEC-XR RTP1 RTP2
m=video 40000 RTP/AVP 96
c=IN IP4 233.252.0.1/127
a=rtpmap:96 MP2T/90000
b=TIAS:10000
a=mid:RTP1
m=application 40001 RTP/AVP 97
c=IN IP4 233.252.0.2/127
a=rtpmap:97 1d-interleaved-parityfec/90000
b=TIAS:1000
a=mid:RTP2
Similar to scenario #1, the RTP receiver can first ask for RAMS for the primary video stream at the full receive bitrate. But, upon the multicast join, the available bandwidth for the burst drops to 11 Mbps instead of 12 Mbps. Regardless of whether FEC is desired or not by the RTP receiver, its bitrate needs to be taken into account once the RTP receiver joins the multicast.

If the RTP receiver wants to rapidly acquire both primary and FEC streams, the same conditions explained for scenario #1 apply. The only difference from scenario #1 is that here the join time is the same for both the primary video and FEC streams.

6.3. Scenario #3

This is the scenario for SSRC multiplexing where both RTP streams are transmitted over the same multicast group to the same destination port.

```
m=video 40000 RTP/AVP 96 97
c=IN IP4 233.252.0.1/127
a=rtpmap:96 MP2T/90000
a=rtpmap:97 1d-interleaved-parityfec/90000
b=TIAS:11000
a=mid:Channel1
```

This is similar to scenario #2. However, since we cannot explicitly specify the bitrates for the primary and FEC streams, the RTP receiver may request to rapidly acquire both streams in parallel. In this case, two separate RAMS Request messages have to be sent by the RTP receiver to the feedback target.

Note that based on the "a=fmtp" line for the FEC stream, it may be possible to infer the bitrate of this FEC stream and set the Max Receive Bitrate value accordingly.

7. Security Considerations

TBD.

8. IANA Considerations

There are no IANA considerations in this document.

9. References
9.1. Normative References

[I-D.ietf-avt-rapid-acquisition-for-rtp]
Steeg, B., Begen, A., Caenegem, T., and Z. Vax, "Unicast-Based Rapid Acquisition of Multicast RTP Sessions", draft-ietf-avt-rapid-acquisition-for-rtp-03 (work in progress), September 2009.


[I-D.ietf-avt-rtcpsam]

9.2. Informative References

[I-D.ietf-mmusic-rfc3388bis]
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