Audio/Video Transport Core Maintenance Working Group R. van Brandenburg
Internet Draft H.M. Stokking
Intended status: Standards Track M.O. van Deventer
Expires: September 2011 O.A. Niamut
F.A. Walraven
TNO Netherlands
I. Vaishnavi
CWI Netherlands
F. Boronat
M. Montagud
Universidad Politecnica de Valencia
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RTCP for inter-destination media synchronization
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Abstract

This document gives information on an RTCP Packet Type and RTCP XR Block Type including associated SDP parameters for inter-destination media synchronization (IDMS). The RTCP XR Block Type, registered with IANA based on an ETSI specification, is used to collect media play-out information from participants in a group playing-out (watching, listening, etc.) a specific RTP media stream. The RTCP packet type specified by this document is used to distribute a summary of the collected information so that the participants can synchronize play-out.

Typical applications for IDMS are social TV, shared service control (i.e. applications where two or more geographically separated users are watching a media stream together), distance learning, network quiz shows, multi-playing online games, etc.

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1. Introduction

1.1. Inter-destination Media Synchronization

Inter-destination media synchronization (IDMS) refers to the play-out of media streams at two or more geographically distributed locations in a temporally synchronized manner. It can be applied to both unicast and multicast media streams and can be applied to any type and/or combination of streaming media, such as audio, video and text (subtitles). [Boronat2009] provides an overview of technologies and algorithms for IDMS.

IDMS requires the exchange of information on media receipt and playout times. It may also require signaling for the initiation and maintenance of IDMS sessions and groups.

The presented RTCP specification for IDMS is independent of the used synchronization algorithm, which is out-of-scope of this document.

1.2. Applicability of RTCP to IDMS

Currently, most multimedia applications make use of RTP and RTCP [RFC3550]. RTP (Real-time Transport Protocol) provides end-to-end network transport functions suitable for applications requiring real-time data transport, such as audio, video or data, over multicast or unicast network services. The timestamps and sequence number mechanisms provided by RTP are very useful to reconstruct the original media timing, reorder and detect some packet loss at the receiver side.

The data transport is augmented by a control protocol (RTCP) to allow monitoring of the data delivery in a manner that is scalable to large multicast networks, and to provide minimal control and identification functionality.

RTP receivers and senders provide reception quality feedback by sending out RTCP Receiver Report (RR) and Sender Report (SR) packets [RFC3550] respectively, which may be augmented by eXtended Reports (XR) [RFC3611]. Thus, the feedback reporting features provided by RTCP make QoS monitoring possible and can be used for troubleshooting and fault tolerance management in multicast distribution services such as IPTV.

These protocols are intended to be tailored through modification and/or additions in order to include profile-specific information required by particular applications, and the guidelines on doing so are specified in [RFC5968].

IDMS involves the collection, summarizing and distribution of RTP packet arrival and play-out times. As information on RTP packet arrival times and play-out times can be considered reception quality feedback information, RTCP becomes a promising candidate for carrying out IDMS, which may facilitate implementation in typical multimedia applications.

1.3. Applicability of SDP to IDMS

RTCP XR [RFC3611] defines the Extended Report (XR) packet type for the RTP Control Protocol (RTCP), and defines how the use of XR packets can be signaled by an application using the Session Description Protocol (SDP) [RFC4566].

SDP signaling is used to set up and maintain a synchronization group between Synchronization Clients (SCs). This document describes two SDP parameters for doing this, one for the RTCP XR block type and one for the new RTCP packet type.

This document also allows for a receiver to indicate a used clock source for synchronizing the receiver clock used in the IDMS session. This is also done using an SDP parameter, which is described in this document.

1.4. This document and ETSI TISPAN

ETSI TISPAN [TS 183 063] has specified architecture and protocol for IDMS using RTCP XR exchange and SDP signaling.

2. Terminology

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 [RFC2119] and indicate requirement levels for compliant implementations.

3. Overview of IDMS operation

This section provides a brief example of how the IDMS RTCP functionality is used. The section is tutorial in nature and does not contain any normative statements.

```
          Alice's  . . . . . . .tv:abc.com . . . . . . . . . Bob's
          TV (SC)                (MSAS)                  Laptop (SC)
            |                       |                          |
            |      Media Session    |                          |
            |<=====================>|                          |
            |            Invite(URL,Sync-group ID)             |
            |------------------------------------------------->|
            |                       |   Media Session Set-up   |
            |                       |<========================>|
            |                       |                          |
            |                 Call set-up                      |
            |<================================================>|
            |                       |                          |
            |       RTP Packet      |        RTP Packet        |
            |<----------------------|------------------------->|
            |      RR + IDMS XR     |                          |
            |---------------------->|       RR + IDMS XR       |
            |                       |<-------------------------|
            |    RTCP IDMS packet   |     RTCP IDMS packet     |
            |<----------------------|------------------------->|
            |                       |                          |
```

Alice is watching TV in her living room. At some point she sees that a football game of Bob's favorite team is on. She sends him an invite to watch the program together. Embedded in the invitation is the link to the media server and a unique sync-group identifier.

Bob, who is also at home, receives the invite on his laptop. He accepts Alice's invitation and the RTP client on his laptop sets up a session to the media server. A VoIP connection to Alice's TV is also set up, so that Alice and Bob can talk while watching the program.

As is common with RTP, both the RTP client in Alice's TV as well as the one in Bob's laptop send periodic RTCP Receiver Reports (RR) to the media server. However, in order to make sure Alice and Bob see the events in the football game at the same time, their clients also periodically send an IDMS XR block to the MSAS function of the media server. Included in the XR blocks are timestamps on when both Alice and Bob have received (or played out) a particular RTP packet.

The MSAS function in the media server calculates a reference client from the received IDMS XR blocks (e.g. by selecting whichever client received the packet the latest as the reference client). It then sends an RTCP IDMS packet containing the play-out information of this reference client to both Alice and Bob.

In this case Bob has the slowest connection and the reference client therefore includes a delay similar to the one experienced by Bob. Upon reception of this information, Alice's RTP client can choose what to do with this information. In this case it decreases its play-out rate temporarily until it matches with the reference client play-out (and thus matches Bob's play-out). Another option for Alice's TV would be to simply pause playback until it catches up. The exact implementation of the synchronization algorithm is up to the client.

Upon reception of the reference client RTCP IDMS packet, Bob's client does not have to do anything since it is already synchronized to the reference client (since it is based on Bob's delay). Note that other synchronization algorithms may introduce even more delay than the one experienced by the most delayed client, e.g. to account for delay variations, for new clients joining an existing synchronization group, etc.

4. Inter-destination media synchronization use cases

Social TV is the combination of media content consumption by two or more users at different devices and locations and real-time communication between those users.

An example of Social TV, is when two or more users are watching the same television broadcast at different devices and locations, while communicating with each other using text, audio and/or video.

A skew in the media play-out of the two or more users can have adverse effects on their experience. A well-known use case here is one friend experiencing a goal in a football match well before or after other friend(s). Thus IDMS is required to provide play-out synchronization.

Another example of Social TV is Shared Service Control, where two or more users experience some content-on-demand together, while sharing the trick-play controls (play, pause, fast forward, rewind) of the content on demand.

Similar to the previous use case, without IDMS, differences in play-out speed and the effect of transit delay of trick-play control signals would desynchronize content play-out.

5. Architecture for inter-destination media synchronization

The architecture for IDMS, which is based on a sync-maestro architecture [Boronat2009], is sketched below. The Synchronization Client (SC) and Media Synchronization Application Server (MSAS)

entities are shown as additional functionality for the RTP receiver and sender respectively.

It should be noted that a master/slave type of architecture is also supported by having one of the SC devices also act as an MSAS. In this case the MSAS functionality is thus embedded in an RTP receiver instead of an RTP sender.

```
+------------------------+        +------------------------+
|                        |  SR +  |                        |
|      RTP Receiver      |  RTCP  |       RTP Sender       |
|                        |  IDMS  |                        |
|  +------------------+  | <----- |  +------------------+  |
|  |                  |  |        |  |                  |  |
|  | Synchronization  |  |        |  |      Media       |  |
|  |      Client      |  |        |  | Synchronization  |  |
|  |       (SC)       |  |        |  |   Application    |  |
|  |                  |  |        |  |      Server      |  |
|  |                  |  | RR+XR  |  |      (MSAS)      |  |
|  |                  |  | -----> |  |                  |  |
|  +------------------+  |        |  +------------------+  |
|                        |        |                        |
+------------------------+        +------------------------+
```

5.1. Media Synchronization Application Server (MSAS)

An MSAS collects RTP packet arrival times and play-out times from one or more SC(s) in a synchronization group. The MSAS summarizes and distributes this information to the SCs in the synchronization group as synchronization settings, e.g. by determining the SC with the most lagged play-out and using its reported RTP packet arrival time and play-out time as a summary.

5.2. Synchronization Client (SC)

An SC reports RTP packet arrival times and play-out times of a media stream. It can receive summaries of such information, and use that to adjust its play-out buffer.

5.3. Communication between MSAS and SCs

Two different message types are used for the communication between MSAS and SCs. For the SC->MSAS message containing the play-out information of a particular client, an RTCP XR Block Type is used (see Section 6). For the MSAS->SC message containing the synchronization settings instructions, a new RTCP Packet Type is defined in Section 7.

6. RTCP XR Block Type for IDMS

This section describes the RTCP XR Block Type for reporting IDMS information on an RTP media stream. Its definition is based on [RFC3611]. The RTCP XR is used to provide feedback information on receipt times and presentation times of RTP packets to e.g. a Sender [RFC3611], a Feedback Target [RFC5760] or a Third Party Monitor [RFC3611].

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|V=2|P| Resrv   |   PT=XR=207   |             length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     SSRC of packet sender                     |
+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
|     BT=12     | SPST  |Resrv|P|         block length=7        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     PT      |                Resrv                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Media Stream Correlation Identifier              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     SSRC of media source                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Packet Received NTP timestamp, most significant word     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Packet Received NTP timestamp, least significant word    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Packet Received RTP timestamp                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Packet Presented NTP timestamp                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The first 64 bits form the header of the RTCP XR, as defined in [RFC3611]. The SSRC of packet sender identifies the sender of the specific RTCP packet.

The IDMS report block consists of 7 32-bit words, with the following fields:

Block Type (BT): 8 bits. It identifies the block format. Its value SHALL be set to 12.

Synchronization Packet Sender Type (SPST): 4 bits. This field identifies the role of the packet sender for this specific eXtended Report. It can have the following values:

SPST=0 Reserved For future use.

SPST=1 The packet sender is an SC. It uses this XR to report synchronization status information. Timestamps relate to the SC input.

SPST=2 This setting is reserved in order to preserve compatibility with ETSI TISPAN [TS 183 063]. See section 12. for more information.

SPST=3-15 Reserved For future use.

Reserved bits (Resrv): 3 bits. These bits are reserved for future definition. In the absence of such a definition, the bits in this field MUST be set to zero and MUST be ignored by the receiver.

Packet Presented NTP timestamp flag (P): 1 bit. Bit set to 1 if the Packet Presented NTP timestamp field contains a value, 0 if it is empty. If this flag is set to zero, then the Packet Presented NTP timestamp shall not be inspected.

Block Length: 16 bits. This field indicates the length of the block in 32 bit words and shall be set to 7, as this RTCP Block Type has a fixed length.

Payload Type (PT): 7 bits. This field identifies the format of the media payload, according to [RFC3551]. The media payload is associated with an RTP timestamp clock rate. This clock rate provides the time base for the RTP timestamp counter.

Reserved bits (Resrv): 25 bits. These bits are reserved for future use and shall be set to 0.

Media Stream Correlation Identifier: 32 bits. This identifier is used to correlate synchronized media streams. The value 0 (all bits are set "0") indicates that this field is empty. The value 2^32-1 (all bits are set "1") is reserved for future use. If the RTCP Packet Sender is an SC (SPST=1), then the Media Stream Correlation Identifier maps on the SyncGroupId to which the SC belongs.

SSRC: 32 bits. The SSRC of the media source shall be set to the value of the SSRC identifier carried in the RTP header [RFC3550] of the RTP packet to which the XR relates.

Packet Received NTP timestamp: 64 bits. This timestamp reflects the wall clock time at the moment of arrival of the first octet of the RTP packet to which the XR relates. It is formatted based on the NTP timestamp format as specified in [RFC5905]. See section 8 for more information on how this field is set.

Packet Received RTP timestamp: 32 bits. This timestamp has the value of the RTP time stamp carried in the RTP header [RFC3550] of the RTP packet to which the XR relates.

Packet Presented NTP timestamp: 32 bits. This timestamp reflects the wall clock time at the moment the data contained in the first octet of the associated RTP packet is presented to the user. It is based on the time format used by NTP and consists of the least significant 16 bits of the NTP seconds part and the most significant 16 bits of the NTP fractional second part. If this field is empty, then it SHALL be set to 0 and the Packet Presented NTP timestamp flag (P) SHALL be set to 0.

7. RTCP Packet Type for IDMS (IDMS report)

This section specifies the RTCP Packet Type for indicating synchronization settings instructions to a receiver of the RTP media stream. Its definition is based on [RFC3550].

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|V=2|P| Resrv   |     PT=TBD    |             length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     SSRC of packet sender                     |
+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
|                     SSRC of media source                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Media Stream Correlation Identifier              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Packet Received NTP timestamp, most significant word     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Packet Received NTP timestamp, least significant word    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Packet Received RTP timestamp                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Packet Presented NTP timestamp                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The first 64 bits form the header of the RTCP Packet Type, as defined in [RFC3550]. The SSRC of packet sender identifies the sender of the specific RTCP packet.

The RTCP IDMS packet consists of 6 32-bit words, with the following fields:

SSRC: 32 bits. The SSRC of the media source shall be set to the value of the SSRC identifier carried in the RTP header [RFC3550] of the RTP packet to which the RTCP IDMS packet relates.

Media Stream Correlation Identifier: 32 bits. This identifier is used to correlate synchronized media streams. The value 0 (all bits are set "0") indicates that this field is empty. The value 2^32-1 (all bits are set "1") is reserved for future use. The Media Stream Correlation Identifier maps on the SyncGroupId of the group to which this packet is sent.

Packet Received NTP timestamp: 64 bits. This timestamp reflects the wall clock time at the reference client at the moment it received the first octet of the RTP packet to which this packet relates. It can be used by the synchronization algorithm on the receiving SC to set the required playout delay. The timestamp is formatted based on the NTP timestamp format as specified in [RFC5905]. See section 8 for more information on how this field is set.

Packet Received RTP timestamp: 32 bits. This timestamp has the value of the RTP time stamp carried in the RTP header [RFC3550] of the RTP packet to which the XR relates.

Packet Presented NTP timestamp: 32 bits. This timestamp reflects the wall clock time at the reference client at the moment it presented the data contained in the first octet of the associated RTP packet to the user. It is based on the time format used by NTP and consists of the least significant 16 bits of the NTP seconds part and the most significant 16 bits of the NTP fractional second part. If this field is empty, then it SHALL be set to 0. This field MAY be left empty if none or only one of the receivers reported on presentation timestamps.

8. Timing and NTP Considerations

To achieve IDMS, the different receivers involved need synchronized clocks as a common timeline for synchronization. Depending on the synchronization accuracy required, different clock synchronization methods can be used. For social TV, synchronization accuracy should be achieved in order of hundreds of milliseconds. In that case, correct use of NTP on receivers will in most situations achieve the required accuracy. As a guideline, to deal with clock drift of receivers, receivers should synchronize their clocks at the beginning of a synchronized session.

IDMS may be used for other purposes, such as synchronization of multiple television outputs in a single physical location, or for the synchronization of different networked speakers throughout a house.

Because of the stringent synchronization requirements for achieving good audio, a high accuracy will be needed. In this case, NTP usage may not be sufficient. Either a local NTP server could be setup, or some other more accurate clock synchronization mechanism could be used, such as using GPS time or the Precision Time Protocol [IEEE-1588].

In this document, a new SDP parameter is introduced to signal the clock synchronization source or sources used or able to be used (see section 10). An SC can indicate which synchronization source is being used at the moment and the last time the SC synchronized with this source. An SC can also indicate any other synchronization sources available to it. This allows multiple SCs in an IDMS session to use the same or a similar clock synchronization source for their session.

Applications performing IDMS may or may not be able to choose a synchronization method for the system clock. How applications deal with this is up to the implementation. The application might control the system clock, or it might use a separate application clock or even a separate IDMS session clock. It might also report on the system clock and the synchronization method used, without being able to change it.

9. SDP Parameter for RTCP XR IDMS Block Type

The SDP parameter sync-group is used to signal the use of the RTCP XR block for inter-destination media synchronization. It is also used to carry an identifier for the synchronization group to which clients belong or will belong. This SDP parameter extends rtcp-xr-attrib as follows, using Augmented Backus-Naur Form [RFC5234].

```
rtcp-xr-attrib = "a=" "rtcp-xr" ":" [xr-format *(SP xr-format)] CRLF
; Original definition from [RFC3611], section 5.1

xr-format =/ grp-sync ; Extending xr-format for inter-destination
media synchronization

grp-sync = "grp-sync" [",sync-group=" SyncGroupId]

SyncGroupId = 1*DIGIT ; Numerical value from 0 till 4294967295

DIGIT = %x30-39
```

SyncGroupId is a 32-bit unsigned integer in network byte order and represented in decimal. SyncGroupId identifies a group of SCs for IDMS. It maps on the Media Stream Correlation Identifier as described in sections 6 and 7. The value SyncGroupId=0 represents an empty

SyncGroupId. The value 4294967295 (2^32-1) is reserved for future use.

The following is an example of the SDP attribute for IDMS

```
a=rtcp-xr:grp-sync,sync-group=42
```

10. SDP Parameter for RTCP IDMS Packet Type

The SDP parameter rtcp-idms is used to signal the use of the RTCP IDMS Packet Type for IDMS. It is also used to carry an identifier for the synchronization group to which clients belong or will belong. The SDP parameter is used as a media-level attribute during session setup. This SDP parameter is defined as follows, using Augmented Backus-Naur Form [RFC5234].

```
rtcp-idms  = "a=" "rtcp-idms" ":" [sync-grp] CRLF

sync-grp   = "sync-group=" SyncGroupId

SyncGroupId = 1*DIGIT ; Numerical value from 0 till 4294967295

DIGIT     = %x30-39
```

SyncGroupId is a 32-bit unsigned integer in network byte order and represented in decimal. SyncGroupId identifies a group of SCs for IDMS. The value SyncGroupId=0 represents an empty SyncGroupId. The value 4294967295 (2^32-1) is reserved for future use.

The following is an example of the SDP attribute for IDMS.

```
a=rtcp-idms:sync-group=42
```

11. SDP parameter for clock source

The SDP parameter clocksource is used to signal the source for clock synchronization. This SDP parameter is specified as follows, using Augmented Backus-Naur Form [RFC5234].

```
clocksource = "a=" "clocksource" ":" source SP [last-synced] CRLF

source      = local / ntp / gps / gal / ptp

local       = "local"

ntp        = "ntp" ["=" ntp-server]

ntp-server     =  host [ ":" port ]
```

```
host           =  hostname / IPv4address / IPv6reference

hostname       =  *( domainlabel "." ) toplabel [ "." ]

domainlabel    =  alphanum

                / alphanum *( alphanum / "-" ) alphanum

toplabel       =  ALPHA / ALPHA *( alphanum / "-" ) alphanum

IPv4address    =  1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT

IPv6reference  =  "[" IPv6address "]"

IPv6address    =  hexpart [ ":" IPv4address ]

hexpart        =  hexseq / hexseq "::" [ hexseq ] / "::" [ hexseq ]

hexseq         =  hex4 *( ":" hex4)

hex4           =  1*4HEXDIG

port           =  1*DIGIT

gps        = "gps"

gal        = "gal"

ptp        = "ptp" ["=" ptp-id]

ptp-id      = 1*alphanum

last-synced   = date SP time

date          =  2DIGIT "-" 2DIGIT "-" 4DIGIT

                 ; day month year (e.g., 02-06-1982)

time           =  2DIGIT ":" 2DIGIT ":" 2DIGIT

                 ; 00:00:00 - 23:59:59

alphanum     =  ALPHA / DIGIT

EXAMPLE

a=clocksource:ntp=139.63.192.5:123 19-02-2011 21:03:20
```

A client MAY include this attribute multiple times. If multiple time synchronization sources were used in the past, the client MUST only report the 'last synced' parameter on the latest synchronization performed. If a client supports a specific synchronization method, but does not know any sources to use for synchronization, it SHOULD indicate the method without specifying the source. A client MAY indicate itself as source if it is a clock synchronization source, but it SHOULD do so using a publicly reachable address.

The parameter can be used as both a session or media level attribute. It will normally be a session level parameter, since it is not directly media-related. In case of IDMS however, it can be used in conjunction with the rtcp-idms SDP parameter, and then it SHOULD be used as a media-level parameter as well.

The meaning of 'local' is that no clock synchronization is performed.

The 'last synced' parameter is used as an indication for the receiver of the parameter on the accuracy of the clock. If the indicated last synchronization time is very recent, this is an indication that the clock can be trusted to be accurate, given the method of clock synchronization used. If the indicated last synchronization time is longer ago or in the future, either the clock synchronization has been performed long ago, or the clock is synchronized to an incorrect synchronization source. Either way, this shows that the clock used can not be trusted to be accurate.

12. Compatibility with ETSI TISPAN

As described in section 1.4, ETSI TISPAN has also described a mechanism for IDMS in [TS 183 063]. One of the main differences between the TISPAN document and this document is the fact that the TISPAN solution uses an RTPC XR block for both the SC->MSAS message as well as for the MSAS->SC message (by selecting different SPST-types), while this document specifies a new RTCP Packet Type for the MSAS->SC message.

In order to maintain backward-compatibility, the RTCP XR block used for SC->MSAS signaling specified in this document is fully compatible with the TISPAN defined XR block.

For the MSAS->SC signaling, it is recommended to use the RTCP IDMS Packet Type defined in this document. The TISPAN XR block with SPST=2 MAY be used for purposes of compatibility with the TISPAN solution, but MUST NOT be used if all nodes involved support the new RTCP IDMS Packet Type.

The above means that the IANA registry contains two SDP parameters for the MSAS->SC signaling; one for the ETSI TISPAN solution and one for the IETF solution. This also means that if all elements in the SDP negotiation support the IETF solution they SHOULD use the new RTCP IDMS Packet Type.

13. Operational Considerations

On Echo Cancellation:

In the case of social TV: If the two locations have a "side channel" audio conference so the viewers can talk about what they are watching, this may cause an audio problem that will not be solved by just applying IDMS. The audio output of the television of one viewer will pass through the audio conference, and arrive at the second viewer out of sync with the television output of that second viewer. Different methods can be used to deal with this effect, e.g. using directional microphones to prevent this or applying echo cancellation to filter out the unwanted audio signals.

On Reception vs. Presentation Timing:

A receiver can report on different timing events, i.e. on packet arrival times and on playout times. A receiver SHALL report on arrival times and a receiver MAY report on playout times. RTP packet arrival times are relatively easy to report on. Normally, the processing and play-out of the same media stream by different receivers will take roughly the same amount of time. By synchronizing on packet arrival times, you may loose some accuracy, but it will be adequate for many applications, such as social TV. Also, if the receivers are in some way controlled, e.g. having the same buffer settings and decoding times, high accuracy can be achieved. However, if all receivers in a synchronization session have the ability to report on, and thus synchronize on, actual playout times, or packet presentation times, this may be more accurate. It is up to applications and implementations of this RTCP extension whether to implement and use this.

14. Security Considerations

The specified RTCP XR Block Type in this document is used to collect, summarize and distribute information on packet reception- and playout -times of streaming media. The information may be used to orchestrate the media play-out at multiple devices.

Errors in the information, either accidental or malicious, may lead to undesired behavior. For example, if one device erroneously reports a two-hour delayed play-out, then another device in the same

synchronization group could decide to delay its play-out by two hours as well, in order to keep its play-out synchronized. A user would likely interpret this two hour delay as a malfunctioning service.

Therefore, the application logic of both Synchronization Clients and Media Synchronization Application Servers should check for inconsistent information. Differences in play-out time exceeding configured limits (e.g. more than ten seconds) could be an indication of such inconsistent information.

No new mechanisms are introduced in this document to ensure confidentiality. Encryption procedures, such as those being suggested for a Secure RTP (SRTP) at the time that this document was written, can be used when confidentiality is a concern to end hosts.

15. IANA Considerations

New RTCP Packet Types and RTCP XR Block Types are subject to IANA registration. For general guidelines on IANA considerations for RTCP XR, refer to [RFC3611].

[TS 183 063] assigns the block type value 12 in the RTCP XR Block Type Registry to "Inter-destination Media Synchronization Block". [TS 183 063] also registers the SDP [RFC4566] parameter "grp-sync" for the "rtcp-xr" attribute in the RTCP XR SDP Parameters Registry.

Further, this document defines a new RTCP packet type called IDMS report. This new packet type is registered with the IANA registry of RTP parameters, based on the specification in section 7.

Further, this document defines a new SDP parameter "rtcp-idms" within the existing IANA registry of SDP Parameters.

The SDP attribute "rtcp-idms" defined by this document is registered with the IANA registry of SDP Parameters as follows:

SDP Attribute ("att-field"):

Attribute name: rtcp-idms

Long form: RTCP report block for IDMS

Type of name: att-field

Type of attribute: media level

Subject to charset: no

Purpose: see sections 7 and 10 of this document

Reference: this document

Values: see this document

Further, this document defines a new SDP attribute, "clocksource", within the existing IANA registry of SDP Parameters.

The SDP attribute "clocksource" defined by this document is registered with the IANA registry of SDP Parameters as follows:

SDP Attribute ("att-field"):

Attribute name: clocksource

Long form: clock synchronization source

Type of name: att-field

Type of attribute: session level

Subject to charset: no

Purpose: see sections 8 and 11 of this document

Reference: this document

Values: see this document and registrations below

The attribute has an extensible parameter field and therefore a registry for these parameters is required. This document creates an IANA registry called the Clocksource Source Parameters Registry. It contains the five parameters defined in Section 11: "local", "ntp", "gps", "gal" and "ptp".

16. Conclusions

This document describes the RTCP XR block type for IDMS, the RTCP IDMS report and the associated SDP parameters for inter-destination media synchronization. It also describes an SDP parameter for indicating which source is used for synchronizing a (systems) (wall) clock.

17. References

17.1. Normative References

[RFC5234] Crocker, D. and Overell, P., "Augmented BNF for Syntax Specifications: ABNF", RFC 5234, January 2008.

[RFC3550] Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications", RFC 3550, July 2003.

[RFC3551] Schulzrinne, H. and Casner S., "RTP Profile for Audio and Video Conferences with Minimal Control", RFC 3551, July 2003

[RFC3611] Friedman, T. "RTP Control Protocol Extended Reports (RTCP XR)", RFC 3611, November 2003.

[RFC4566] Handley, M., "SDP: Session Description Protocol", RFC 4566, July 2006.

[RFC5576] Lennox, J., "Source-Specific Media Attributes in the Session Description Protocol (SDP)", RFC 5576, June 2009.

[RFC5905] Mills, D., "Network Time Protocol Version 4: Protocol and Algorithms Specification", RFC 5905, June 2010.

[RFC5968] Ott, J., Guidelines on Extending the RTP Control Protocol (RTCP), September 2010.

[TS 183 063] ETSI TISPAN, "IMS-based IPTV stage 3 specification", TS 183 063 v3.4.1, June 2010.

17.2. Informative References

[Boronat2009] Boronat, F., et al, "Multimedia group and inter-stream synchronization techniques: A comparative study", Elsevier Information Systems 34 (2009), pp. 108-131

[IEEE-1588] IEEE Standards Association, "1588-2008 - IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems", 2008

Authors' Addresses

Ray van Brandenburg
TNO
Brassersplein 2, Delft, the Netherlands

Phone: +31 88 86 63609
Email: ray.vanbrandenburg@tno.nl

Hans M. Stokking
TNO
Brassersplein 2, Delft, the Netherlands

Phone: +31 88 86 67278
Email: hans.stokking@tno.nl

M. Oskar van Deventer
TNO
Brassersplein 2, Delft, the Netherlands

Phone: +31 88 86 67078
Email: oskar.vandeventer@tno.nl

Omar A. Niamut
TNO
Brassersplein 2, Delft, the Netherlands

Phone: +31 88 86 67218
Email: omar.niamut@tno.nl

Fabian A. Walraven
TNO
Brassersplein 2, Delft, the Netherlands

Phone: +31 88 86 67722
Email: fabian.walraven@tno.nl

Ishan Vaishnavi
CWI
Science Park 123, Amsterdam, the Netherlands

Phone: +31 20 592 4323
Email: i.vaishnavi@cwi.nl

Fernando Boronat
IGIC Institute, Universidad Politecnica de Valencia-Campus de Gandia
C/ Paraninfo, 1, Grao de Gandia, 46730, Valencia, Spain

Phone: +34 962 849 341
Email: fboronat@dcom.upv.es

Mario Montagud
IGIC Institute, Universidad Politecnica de Valencia-Campus de Gandia
C/ Paraninfo, 1, Grao de Gandia, 46730, Valencia, Spain

Phone: +34 962 849 341
Email: mamontor@posgrado.upv.es