dispatch                                                    G. Camarillo
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                                                                     ZTE
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# Media State under Preconditions in the Session Initiation Protocol (SIP)

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## Abstract

In this document, we describe how a UAS (User Agent Server) involved in a session modification can explicitly signal the point where the new session parameters start being used. Explicitly signalling such a change in the session parameters can be useful so that network intermediaries such as B2BUAs (Back-to-back User Agents) have a clear picture of the session's state at every point.

## Status of this Memo



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## 1. Introduction

The preconditions mechanism in SIP [RFC3261], as specified in RFC 3312 [RFC3312] and RFC 4032 [RFC4032], was designed to allow UAs to reach a common view on the state of the preconditions for a media session. The UAs perform offer/answer exchanges updating each other on the status of their preconditions so that session establishment (in the case of an initial INVITE request) or session modification (in the case of a re-INVITE) can proceed. Once all mandatory preconditions are met, the UAS can proceed with the session establishment or the session modification.

## 2. Starting Using the Media Parameters Subject to Preconditions

Preconditions are stream specific. That is, they apply to the media parameters to be used in a media stream. When the mandatory preconditions for a media stream are met, the UAs can start using the media parameters that were subject to the preconditions.

However, the fact that the UAs can start using the new media parameters does not mean that they need to start using them immediately. When preconditions are used, the UAS decides when to start using them. During a session establishment, the UAS can wait for using the media parameters until the callee starts being alerted or until the callee accepts the session. During a session modification, the UAS can wait until the callee accepts the changes to the session.

The preconditions specifications do not mandate UAs to perform a new offer/answer exchange when the new media parameters start being used. The UAS starts using them and the UAC discovers that the new media parameters are in use at the media level. In a session modification, the UAC stops using the old media parameters at that point.

Discovering when the new media parameters start being used at the media level saves an additional offer/answer exchange. However, network intermediaries such as B2BUAs will not know what the current state of the media session is. Therefore, UASs in environments where intermediaries that require knowledge of the current media state of the session may be present should consider performing such additional offer/answer exchanges. The examples in the following section illustrate this point.

Note that ICE faced the same issue when it was being designed. ICE was originally designed in a similar way as the preconditions mechanism. That is, endpoints were supposed to agree on the addresses to use for the session at the media level. ICE was

eventually redesigned in order to have more explicit signalling (i.e., offer/answer exchanges) about what addresses were being used at the media level.

## 3. Examples

```
UAC                                          UAS

 |                                            |
 |-------------(1) INVITE SDP1--------------->|
 |                                            |
 |<------------(2) 200 OK SDP2----------------|
 |                                            |
 |------------------(3) ACK------------------>|
 |                                            |
 |                                            |
 |-------------(4) INVITE SDP3--------------->|
 |                                            |
 |<------(5) 183 Session Progress SDP4--------|
 |  ***                                 ***   |
 |--*R*-----------(6) PRACK-------------*R*-->|
 |  *E*                                 *E*   |
 |<-*S*-------(7) 200 OK (PRACK)--------*S*---|
 |  *E*                                 *E*   |
 |  *R*                                 *R*   |
 |  *V*                                 *V*   |
 |  *A*                                 *A*   |
 |  *T*                                 *T*   |
 |  *I*                                 *I*   |
 |  *O*                                 *O*   |
 |  *N*                                 *N*   |
 |  ***                                 ***   |
 |  ***                                       |
 |  ***                                       |
 |-------------(8) UPDATE SDP5--------------->|
 |                                            |
 |<--------(9) 200 OK (UPDATE) SDP6-----------|
 |                                            |
 |<-----------(10) UPDATE SDP7----------------|
 |                                            |
 |--------(11) 200 OK (UPDATE) SDP8---------->|
 |                                            |
 |                                            |
 |<-----------(12) UPDATE SDP9----------------|
 |                                            |
 |--------(13) 200 OK (UPDATE) SDP10--------->|
 |                                            |
 |<-----------(14) 200 OK (INVITE)------------|
 |                                            |
 |------------------(15) ACK----------------->|
 |                                            |
```

Acceptance of a video stream by the user

The UAs perform an offer/answer exchange to establish an audio only session:

```
SDP1:
   m=audio 30000 RTP/AVP 0
   c=IN IP4 192.0.2.1

SDP2:
   m=audio 31000 RTP/AVP 0
   c=IN IP4 192.0.2.5
```

At a later point, the UAC sends a re-INVITE (4) in order to change the IP address where it receives the audio stream to a new IP address and add a video stream to the session. Both media streams are subject to preconditions.

```
SDP3:
   m=audio 30000 RTP/AVP 0
   c=IN IP4 192.0.2.2
   a=curr:qos e2e none
   a=des:qos mandatory e2e sendrecv
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.2
   a=curr:qos e2e none
   a=des:qos mandatory e2e sendrecv

SDP4
   m=audio 31000 RTP/AVP 0
   c=IN IP4 192.0.2.5
   a=curr:qos e2e none
   a=des:qos mandatory e2e sendrecv
   a=conf:qos e2e recv
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.5
   a=curr:qos e2e none
   a=des:qos mandatory e2e sendrecv
   a=conf:qos e2e recv
```

When the UAC finishes resource reservations in its 'send' direction, it sends an UPDATE request (8) indicating so.

```
SDP5:
   m=audio 30000 RTP/AVP 0
   c=IN IP4 192.0.2.2
   a=curr:qos e2e send
   a=des:qos mandatory e2e sendrecv
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.2
   a=curr:qos e2e send
   a=des:qos mandatory e2e sendrecv
```

In its response to the UPDATE request (9), the UAS indicates that all preconditions for both media streams are met.

```
SDP6
   m=audio 31000 RTP/AVP 0
   c=IN IP4 192.0.2.5
   a=curr:qos e2e sendrecv
   a=des:qos mandatory e2e sendrecv
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.5
   a=curr:qos e2e sendrecv
   a=des:qos mandatory e2e sendrecv
```

The UAS is configured to automatically accept changes in IP addresses.  Therefore, it starts using the new remote IP address for the audio stream.  In order to explicitly signal this at the SIP level, the UAS sends an UPDATE request (10) removing the preconditions from the audio stream.  This indicates that the audio stream is now in use.

```
SDP7
   m=audio 31000 RTP/AVP 0
   c=IN IP4 192.0.2.5
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.5
   a=curr:qos e2e sendrecv
   a=des:qos mandatory e2e sendrecv
```

```
SDP8:
   m=audio 30000 RTP/AVP 0
   c=IN IP4 192.0.2.2
   m=video 30002 RTP/AVP 31
   c=IN IP4 192.0.2.2
   a=curr:qos e2e send
   a=des:qos mandatory e2e sendrecv
```

When the callee finally accepts the addition of the video stream, the UAS sends an UPDATE request (12) indicating that the video stream is

now in use.

```
         SDP9
            m=audio 31000 RTP/AVP 0
            c=IN IP4 192.0.2.5
            m=video 30002 RTP/AVP 31
            c=IN IP4 192.0.2.5

         SDP10:
            m=audio 30000 RTP/AVP 0
            c=IN IP4 192.0.2.2
            m=video 30002 RTP/AVP 31
            c=IN IP4 192.0.2.2
```

## 4. Tradeoff between Being Bandwidth Efficient and Having Explicit Signalling

In order to have explicit SIP signalling about the media-level state, UAs need to perform more offer/answer exchanges. Those offer/answer exchanges consume bandwidth. For instance, in the previous example, the price to pay for having explicit SIP signalling was the last two UPDATE transactions. UAs should consider this tradeoff when deciding how to behave in a particular network setting.

## 5. Security Considerations

This document does not introduce any new security issues. Security issues related to preconditions are discussed in RFC 3312 [RFC3312] and RFC 4032 [RFC4032].

## 6. IANA Considerations

There are no IANA actions associated with this document.

## 7. Acknowledgements

Paul Kyzivat, Christer Holmberg, and Yang Gao provided useful ideas on the topics discussed in this document.

## 8. Normative References

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## Authors' Addresses

Gonzalo Camarillo
Ericsson
Hirsalantie 11
Jorvas  02420
Finland

Email: Gonzalo.Camarillo@ericsson.com

Jouni Maenpaa
Ericsson
Hirsalantie 11
Jorvas  02420
Finland

Email: Jouni.Maenpaa@ericsson.com

Gao Yang
ZTE
China

Email: gao.yang2@zte.com.cn