

Network Working Group  
Request for Comments: 4032  
Updates: 3312  
Category: Standards Track

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March 2005

## Update to the Session Initiation Protocol (SIP) Preconditions Framework

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### Abstract

This document updates RFC 3312, which defines the framework for preconditions in SIP. We provide guidelines for authors of new precondition types and describe how to use SIP preconditions in situations that involve session mobility.

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## 1. Introduction

RFC 3312 [3] defines the framework for SIP [2] preconditions, which is a generic framework that allows SIP UAs (User Agents) to suspend the establishment of a session until a set of preconditions are met. Although only Quality of Service (QoS) preconditions have been defined so far, this framework supports different types of preconditions. (QoS preconditions are defined by RFC 3312 as well).

This document updates RFC 3312, provides guidelines for authors of new precondition types and explains which topics they need to discuss when defining them. In addition, it updates some of the procedures in RFC 3312 for using SIP preconditions in situations that involve session mobility as described below.

RFC 3312 focuses on media sessions that do not move around. That is, media is sent between the same end-points throughout the duration of the session. Nevertheless, media sessions established by SIP are not always static.

SIP offers mechanisms to provide session mobility, namely re-INVITES and UPDATES [5]. While existing implementations of RFC 3312 can probably handle session mobility, there is a need to explicitly point out the issues involved and make a slight update on some of the procedures defined there in. With the updated procedures defined in this document, messages carrying precondition information become more explicit about the current status of the preconditions.

Specifically, we now allow answers to downgrade current status values (this was disallowed by RFC 3312). We consider moving an existing stream to a new location as equivalent to establishing a new stream. Therefore, answers moving streams to new locations set all the current status values in their answers to "No" and start a new precondition negotiation from scratch.

## 2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in BCP 14, RFC 2119 [1] and indicate requirement levels for compliant implementations.

### 3. Defining New Precondition Types

Specifications defining new precondition types need to discuss the topics described in this section. Having clear definitions of new precondition types is essential to ensure interoperability among different implementations.

#### 3.1. Precondition Type Tag

New precondition types MUST have an associated precondition type tag (e.g., "qos" is the tag for QoS preconditions). Authors of new preconditions MUST register new precondition types and their tags with the IANA by following the instructions in Section 15 of RFC 3312.

#### 3.2. Status Type

RFC 3312 defines two status types: end-to-end and segmented. Specifications defining new precondition types MUST indicate which status applies to the new precondition. New preconditions can use only one status type or both. For example, the QoS preconditions defined in RFC 3312 can use both.

#### 3.3. Precondition Strength

RFC 3312 defines optional and mandatory preconditions. Specifications defining new precondition types MUST describe whether or not optional preconditions are applicable, and in case they are, what is the expected behavior of a UA on reception of optional preconditions.

#### 3.4. Suspending and Resuming Session Establishment

Section 6 of RFC 3312 describes the behavior of UAs from the moment session establishment is suspended, due to a set of preconditions, until it is resumed when these preconditions are met. In general, the called user is not alerted until the preconditions are met.

In addition to not alerting the user, each precondition type MUST define any extra actions UAs should perform or refrain from performing when session establishment is suspended. The behavior of media streams during session suspension is therefore part of the definition of a particular precondition type. Some precondition

types may allow media streams to send and receive packets during session suspension; others may not. Consequently, the following paragraph from RFC 3312 only applies to QoS preconditions:

While session establishment is suspended, user agents SHOULD not send any data over any media stream. In the case of RTP, neither RTP nor RTCP packets are sent.

To clarify the previous paragraph, the control messages used to establish connections in connection-oriented transport protocols (e.g., TCP SYNs) are not affected by the previous rule. So, user agents follow standard rules (e.g., the SDP 'setup' attribute [7]) to decide when to establish the connection, regardless of QoS preconditions.

New precondition types MUST also describe the behaviour of UAs on reception of a re-INVITE or an UPDATE with preconditions for an ongoing session.

#### 4. Issues Related to Session Mobility

Section 5 of RFC 3312 describes how to use SIP [2] preconditions with the offer/answer model [4]. RFC 3312 gives a set of rules that allow a user agent to communicate changes in the current status of the preconditions to the remote user agent.

The idea is that a given user agent knows about the current status of some part of the preconditions (e.g., send direction of the QoS precondition) through local information (e.g., an RSVP RESV is received indicating that resource reservation was successful). The UAC (User Agent Client) informs the UAS (User Agent Server) about changes in the current status by sending an offer to the UAS. The UAS, in turn, could (if needed) send an offer to the UAC informing it about the status of the part of the preconditions the UAS has local information about.

Note, however, that UASs do not usually send updates about the current status to the UAC because UASs are the ones resuming session establishment when all the preconditions are met. Therefore, rather than performing an offer/answer exchange to inform the UAC that all the preconditions are met, they simply send a 180 (Ringing) response indicating that session establishment has been resumed.

While RFC 3312 allows updating current status information using the methods described above, it does not allow downgrading current status values in answers, as shown in the third row of Table 3 of RFC 3312. Figure 1 shows how performing such a downgrade in an answer would sometimes be needed.

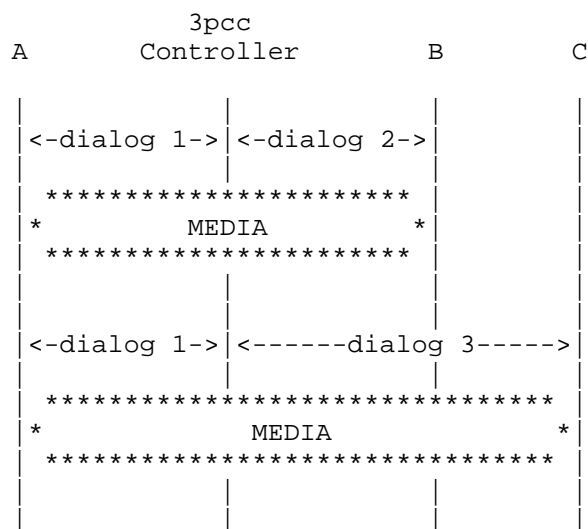


Figure 1: Session mobility using 3pcc

The 3pcc (Third Party Call Control) [6] controller in Figure 1 has established a session between A and B using dialog 1 towards A and dialog 2 towards B. At that point, the controller wants A to have a session with C instead of B. To transfer A to C (configuration shown at the bottom of Figure 1), the controller sends an empty (no offer) re-INVITE to A. Since A does not know that the session will be moved, its offer in the 200 OK states that the current status of the media stream in the send direction is "Yes". After contacting C establishing dialog 3, the controller sends back an answer to A. This answer contains a new destination for the media (C) and should have downgraded the current status of the media stream to "No", since there is no reservation of resources between A and C.

#### 4.1. Update to RFC 3312

Below is a set of new rules that update RFC 3312 to address the issues above.

The rule below applies to offerers moving a media stream to a new address:

When a stream is being moved to a new transport address, the offerer MUST set all current status values about which it does not have local information about to "No".

Note that for streams using segmented status (as opposed to end-to-end status), the fact that the address for the media stream at the local segment changes may or may not affect the status of preconditions at the remote segment. However, moving an existing stream to a new location, from the preconditions point of view, is like establishing a new stream. Therefore, it is appropriate to set all the current status values to "No" and start a new precondition negotiation from scratch.

The updated table and rules below apply to an answerer that is moving a media stream. The offerer was not aware of the move when it generated the offer.

Table 3 of RFC 3312 needs to be updated to allow answerers to downgrade current status values. The following table shows the result.

Transac status table    Local status table    New values transac./local

no	no	no/no
yes	yes	yes/yes
yes	no	depends on local info
no	yes	depends on local info

An answerer MUST downgrade the current status values received in the offer if it has local information about them or if the media stream is being moved to a new transport address.

Note that for streams using segmented status, the address change at the answerer may or may not affect the status of the preconditions at the offerer's segment. However, as stated above, moving an existing stream to a new location, from the preconditions point of view, is like establishing a new stream. Therefore, it is appropriate to set all the current status values to "No" and start a new precondition negotiation from scratch.

The new table below applies to an offerer that receives an answer that updates or downgrades its local status tables.

Offerers should update their local status tables when they receive an answer as shown in the following table.

Transac. status table	Local status table	New value	Local Status
no	no	no	
yes	yes	yes	
yes	no	yes	
no	yes	no	

#### 4.2. Desired Status

The desired status that a UA wants for a media stream after the stream is moved to a new transport address may be different than the desired status negotiated for the stream originally. A UA, for instance, may require mandatory QoS over a low bandwidth link but be satisfied with optional QoS when the stream is moved to a high bandwidth link.

If the new desired status is higher than the previous one (e.g., optional to mandatory), the UA, following RFC 3312 procedures, may upgrade its desired status in an offer or in an answer. If the new desired status is lower than the previous one (i.e., mandatory to optional), the UA, following RFC 3312 procedures as well, may downgrade its desired status only in an offer (i.e., not in an answer.)

#### 5. Security Considerations

An attacker adding preconditions to a session description or modifying existing preconditions could prevent establishment of sessions. An attacker removing preconditions from a session description could force sessions to be established without meeting mandatory preconditions.

Thus, it is strongly RECOMMENDED that integrity protection be applied to the SDP session descriptions. S/MIME is the natural choice to provide such end-to-end integrity protection, as described in RFC 3261 [2].

#### 6. IANA Considerations

The IANA registration requirements for the preconditions framework are defined in RFC 3312. Any new preconditions are governed by the IANA Considerations there.

## 7. Acknowledgement

Dave Oran and Allison Mankin provided useful comments on this document.

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## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

