

[MS-SIP]: Session Initiation Protocol Extensions

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1 Introduction

This document describes Microsoft extensions to the **Session Initiation Protocol (SIP)**. SIP is used by terminals to establish, modify, and terminate multimedia sessions or calls. SIP is specified in [\[RFC3261\]](#), [\[RFC3262\]](#), [\[RFC3263\]](#), and [\[RFC3863\]](#).

Microsoft has added extensions for NTLM/Kerberos Authentication, for presence, for optimization of **subscriptions**, and for **notifications** and contact management. These extensions are used by Microsoft Windows® Messenger and the Real-Time Communications (RTC) Client API.

1.1 Glossary

The following terms are defined in [\[MS-GLOS\]](#):

access control entry (ACE)
access control list (ACL)
Active Directory
client
directory service (DS)
domain
endpoint
fully qualified domain name (FQDN)
ISO/OSI reference model
Kerberos
Key Distribution Center (KDC)
NT LAN Manager (NTLM) Authentication Protocol
proxy
security association (SA)
server
service principal name (SPN)
Transport Layer Security (TLS)
user agent

The following terms are specific to this document:

200 OK: A **response** to indicate that the **request** has succeeded.

403 Forbidden: A **response** to indicate that the **server** understood the **request** but is refusing to fulfill it. Authorization will not help, and the **request** SHOULD NOT be repeated.

Best Effort NOTIFY (BENOTIFY): A **SIP method** defined by Session Initiation Protocol Extensions that is used to send **notifications** to a subscriber. **BENOTIFY** is similar to **NOTIFY** but does not require the recipient of the **request** to send a **SIP response**.

dialog: A peer-to-peer **SIP** relationship between two **user agents** that persists for some time. A **dialog** is established by **SIP messages** (for example, a 2xx **response** to an **INVITE request**). A **dialog** is identified by a call identifier, a local tag, and a remote tag.

event package: An additional specification that defines a set of state information to be reported by a notifier to a subscriber. Event packages also define further syntax and semantics based on the framework (defined by this document) that is required to convey such state information.

final response: A **SIP response** that terminates a **SIP transaction** as opposed to a provisional **response** that does not. All 2xx, 3xx, 4xx, 5xx, and 6xx **responses** are final.

INVITE: A **SIP method** used to invite a user or a service to participate in a session.

notification: The act of a notifier sending a **NOTIFY** message to a subscriber to inform the subscriber of the state of a resource.

NOTIFY: The **NOTIFY** method is used to notify a **SIP** element that an event that has been requested by an earlier **SUBSCRIBE** method has occurred. It may also provide further details about the event.

peer to peer (P2P): An Internet-based networking option in which two or more computers connect directly to each other to communicate and share files without use of a central **server**.

presence entity (presentity): An entity that provides presence information to a presence service.

Presence Information Data Format (PIDF): A common data format defined in [\[RFC3863\]](#) to exchange presence information.

presence user agent (PUA): A **presence user agent (PUA)** manipulates presence information for a **presence entity (presentity)**.

REGISTER: A **SIP method** used by the **SIP client** to register its address with a **SIP server**.

SERVICE: A **SIP method** defined by Session Initiation Protocol Extensions used by the **client** to request a service from the **server**.

Session Initiation Protocol (SIP): An application-layer control (signaling) protocol for creating, modifying, and terminating sessions with one or more participants. **SIP** is defined in [\[RFC3261\]](#).

Simple Object Access Protocol (SOAP): Lightweight XML-based protocol for exchange of information in a decentralized, distributed environment.

SIP client (client): Any network **client** that sends **SIP requests** and receives **SIP responses**. **Clients** may or may not interact directly with a human user. **User agent clients (UACs)** and **proxies** are **clients**.

SIP element: Any entity that understands **SIP**.

SIP header (header): A component of a **SIP message** that conveys information about the **SIP message**. It is structured as a sequence of **header** fields.

SIP message: Data sent between **SIP** elements as part of the protocol. **SIP messages** are either **requests** or **responses**.

SIP method: The method is the primary function that a **SIP request** is meant to invoke on a **UAS**. The method is carried in the **request** message itself. Example methods are **INVITE** and **BYE**.

SIP registrar (registrar): A **server** that accepts **REGISTER requests** and places the information it receives from those **requests** into the location service for the **domain** it handles.

SIP request (request): A **SIP message** sent from a **UAC** to a **UAS** for the purpose of invoking a particular operation.

SIP response (response): A **SIP message** sent from a **UAS** to a **UAC**, indicating the status of a **request** sent from the **UAC** to the **UAS**.

SIP transaction: A **SIP transaction** occurs between a **UAC** and a **UAS**. The **SIP transaction** comprises all messages from the first **request** sent from the **UAC** to the **UAS** up to a **final response** (non-1xx) sent from the **UAS** to the **UAC**. If the **request** is **INVITE**, and the **final response** is a non-2xx, the **SIP transaction** also includes an ACK to the **response**. The ACK for a 2xx **response** to an **INVITE request** is a separate **SIP transaction**.

SOAP envelope: The outermost element item of a **SOAP message**.

SOAP message: The basic unit of communication between **SOAP** nodes.

SUBSCRIBE: A **SIP method** that is used to request asynchronous **notification** of an event (or a set of events) at a later time.

subscription: The end result of an act of a **SIP element** sending a **SUBSCRIBE** request.

Transmission Control Protocol (TCP): A connection-oriented protocol within TCP/IP that corresponds to the transport layer in the **ISO/OSI reference model** and offers reliable delivery of data. See also **ISO/OSI reference model**.

user agent client (UAC): A **user agent client (UAC)** is a logical entity that creates a new **request**, and then uses the **client** transaction state machinery to send it. The role of **UAC** lasts only for the duration of that transaction. In other words, if a piece of software initiates a **request**, it acts as a **UAC** for the duration of that transaction. If it receives a **request** later, it assumes the role of a **user agent server** for the processing of that transaction.

user agent server (UAS): A **user agent server (UAS)** is a logical entity that generates a **response** to a **SIP request**. The **response** accepts, rejects, or redirects the **request**. This role lasts only for the duration of that transaction. In other words, if a piece of software responds to a **request**, it acts as a **UAS** for the duration of that transaction. If it generates a **request** later, it assumes the role of a **user agent client (UAC)** for the processing of that transaction.

User Datagram Protocol (UDP): The connectionless protocol within TCP/IP that corresponds to the transport layer in the **ISO/OSI reference model** and does not offer reliable delivery of data. See also **ISO/OSI reference model**.

Uniform Resource Identifier (URI): A compact string of characters for identifying an abstract or physical resource.

watcher: An entity that requests presence information on a **presentity** from the presence service.

XPIDF: A data format for presence using XML (for more information, see [\[DATAFORMATXML\]](#)).

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as specified in [\[RFC2119\]](#). All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We

will assist you in finding the relevant information. Please check the archive site, <http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624>, as an additional source.

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1.3 Overview

Session Initiation Protocol Extensions is an extension of the original Session Initiation Protocol (SIP), as specified in [\[RFC3261\]](#).

Session Initiation Protocol Extensions defines NTLM/Kerberos authentication extensions to support client/server authentication and message signatures. These extensions are described in detail in section [3.1](#).

Session Initiation Protocol Extensions also adds a number of extensions to SIMPLE-based presence, as specified in [\[RFC3261\]](#), [\[RFC3265\]](#), and [\[RFC3863\]](#). These extensions are briefly described below and are defined further in section [3](#).

Many of the extensions have been designed to reduce the number of subscription and notification messages exchanged between the **client** and the **server**. One such extension is the capability to subscribe for the presence of a number of contacts in a single subscription. The **client** can send a batched **SUBSCRIBE** request to create such a subscription. The server sends the presence information of all the contacts in the batched subscription in a single **NOTIFY request**. This is useful when a client needs to subscribe for presence of all the contacts in the user's contact list.

Another extension that helps reduce the number of messages between the server and client is the piggyback notification. The server can send the presence information immediately in the **final response** to the SUBSCRIBE request, thus obviating the need to send a separate NOTIFY. Any further changes are conveyed using a NOTIFY.

A **BENOTIFY** request is similar to a NOTIFY request and is used by the server to send updates about any changes to the presence state. The only difference is that the client does not need to send a **SIP response** to a BENOTIFY request. Because the server does not need to wait for a response, the load on the server can be reduced.

Auto-Extension of subscriptions is an extension defined to reduce the frequency of the client refreshing a subscription. The client refreshes a subscription after an interval negotiated with the server. With this extension, any notification sent by the server to the client resets the subscription refresh timer. After a notification, the client needs to wait for the negotiated interval before it can refresh the subscription. Another notification during this time can again reset the timer. This extension reduces the number of SUBSCRIBE requests sent by the client to refresh a subscription.

Microsoft also has made extensions to the **Presence Information Data Format (PIDF)**. The enhanced format is called msrtc.pidf and is documented in section [2.2.1](#). The msrtc.pidf format is used only in the client/server mode. The client uses a setPresence **SOAP** request carried in the body of a **SERVICE** request to set or update its own presence information. For more information on the SOAP protocol, see [\[SOAP1.1\]](#), [\[SOAP1.2-1/2007\]](#), and [\[SOAP1.2-2/2007\]](#). The counterpart to the setPresence SOAP request is a getPresence SOAP request. This acts as a means to poll for presence rather than subscribing to presence. It is meant as a lightweight alternative to a presence

SUBSCRIBE request when only presence for a single entity is needed and only that presence information for a one-time immediate purpose is needed.

Session Initiation Protocol Extensions uses the **XPIDF** format to exchange presence information when the **endpoints** are acting in **peer-to-peer (P2P)** mode. The XPIDF format was introduced in an IETF draft but was never standardized as an RFC. The details of the format and the schema are included in appendix [C](#). Session Initiation Protocol Extensions also has made some extensions to the XPIDF format (see section [2](#)).

Finally, Session Initiation Protocol Extensions includes protocol enhancements for contact management operations such as adding or deleting a contact or a group, and setting **access control lists (ACLs)** for viewing and establishing communication with a presence. All of these operations can be done by sending SOAP requests carried within the body of a SERVICE request.

1.4 Relationship to Other Protocols

SIP extensions depend on the Session Initiation Protocol (SIP). The Session Initiation Protocol Extensions defines additional SIP primitives and XML schema to support various extensions specified in this document. In addition, the Session Initiation Protocol Extensions defines some authentication extensions that make use of [\[MS-NLMP\]](#) and **Kerberos** protocols. For more information on XML, see [\[XML10\]](#), [\[XMLNS\]](#), and [\[XMLSCHEMA\]](#).

The Session Initiation Protocol Extensions is invoked as an extension of the Session Initiation Protocol (SIP). The Session Initiation Protocol Extensions depends on all the protocols on which the SIP specification depends.

1.5 Prerequisites/Preconditions

The Session Initiation Protocol Extensions assumes that both the SIP clients and the server support the Session Initiation Protocol (SIP). The prerequisites for the Session Initiation Protocol Extensions are the same as the prerequisites for SIP.

1.6 Applicability Statement

The Session Initiation Protocol Extensions is applicable when both the SIP clients and the server support the Session Initiation Protocol (SIP) and want to utilize one or more of the enhancements offered by SIP extensions.

1.7 Versioning and Capability Negotiation

Session Initiation Protocol (SIP) extensions do not have protocol versioning. Instead, explicit capability negotiation is done as specified in this section by using the Supported **header** to indicate support of various features. Using the Supported header is the standard SIP mechanism of doing capability negotiation.

1.8 Vendor-Extensible Fields

There are no vendor-extensible fields specific to the Session Initiation Protocol Extensions. Standard extension mechanisms of the Session Initiation Protocol (SIP) may be used by vendors as needed.

1.9 Standards Assignments

None.

2 Messages

The following sections specify how Session Initiation Protocol Extensions messages are transported and Session Initiation Protocol Extensions message syntax.

2.1 Transport

Microsoft extensions to the Session Initiation Protocol (SIP) do not introduce a new transport to exchange messages but these extensions can be used with any transport that is used by SIP. **SIP messages** can be transported over **UDP, TCP, or TLS**.

2.2 Message Syntax

Microsoft extensions to the Session Initiation Protocol (SIP) do not introduce a new message format. They rely on the SIP message format, as specified in [\[RFC3261\]](#) section 7. The Session Initiation Protocol Extensions does define a new format for the Presence Document (see section [2.2.1](#)).

2.2.1 text/xml+msrtc.pidf Presence Document Format

These extensions support a nonstandard Presence Document Format that has a number of enhancements, such as the capability to carry device capabilities and the capability to support multiple devices for a single user. A user can log on by using multiple devices. Each device presents its presence information to the server. The XML instance containing presence information submitted to the server is called the Presence Document. When retrieving presence information for a user, the server not only returns the Presence Document from every device, but it also determines the overall presence of the user. This XML instance returned by the server is called the Aggregated Presence Document.

Some of the key elements and attributes are defined as follows:

- **presentity**

The element contains the overall aggregated availability and activity of a user, as well as the availability and activity of all endpoints of the user. The uri attribute specifies the sip entity that this element is describing.
- **epid**

This attribute can appear in the availability element, the activity element, or a devicePresence element. When used in the availability and activity elements inside the presentity element, the epid identifies the availability and activity for the most active endpoint. When used in the devicePresence element, the epid advertises the availability and identifies the activity for a specific endpoint. This value is a hexadecimal string no longer than 16 bytes in length. This epid value is the same endpoint identifier value used to identify a specific SIP endpoint.
- **ageOfPresence**

The ageOfPresence attribute appears in a devicePresence element. This is the number of seconds since the device last updated its presence information.
- **availability**

The purpose of availability is to indicate if the user can receive a call. The availability element has an aggregate attribute that represents the availability of a user on a device. The aggregate attribute is processed by the server as being within a range that has a span of 100 (the class

code). Note that within the XML sent by the client, the client does not specify the class code, but rather, the actual value. The server interprets the values as being within the following classes.

Class code	Server interpretation
000-099	The user cannot receive calls.
100-199	The user may be online; however, availability is unknown until a call is attempted. A cell phone gateway typically uses this setting.
200-299	The user has a device that is currently connected and it can receive calls.
300-399	The user is in proximity of a device that can receive calls.

Rather than a hard-coded enumeration, a numeric value is used. This makes it easy to compare the availability that is sent by two different **user agents**. For example, the higher the availability, the more available the user.

- activity

The purpose of activity is not to indicate if a user can receive a call, but rather, to indicate to **watchers** how likely the user is to want to be disturbed. The activity element has an attribute aggregate that contains a numeric value that defines the activity of the user.

Activity code	Server interpretation
000-099	There is no information about the activity of the user.
100-149	The user is away.
150-199	The user is out to lunch.
200-299	The user is idle.
300-399	The user will be right back.
400-499	The user is active.
500-599	The user is already participating in a communications session.
600-699	The user is busy.
700-799	The user is away.
800-999	The user is active.

Rather than a hard-coded enumeration, a numeric value is used. This makes it easy to compare the availability sent by two different user agents.

- note

This attribute in the activity element can be used by the client to store a string that indicates the user's status on the device.

- userInfo

This element is used for storing persisted presence information for a user. This information is stored by the server and is available regardless of the device to which a user is logged on or even whether the user is logged on at all. Any valid XML can be stored on the server. The server enforces a limit of 1,024 characters on the size of the element body, where the entire element body is treated as a single string.

The Presence Document is described by the XML schema in Appendix [B](#).

Note that the schema defines two different versions of the Presence Document:

- A version that is published by the client using a setPresence request.
- A version that is generated by the server and sent in a NOTIFY or BENOTIFY request to the watcher containing the aggregation of the various presence information published by the 1+ devices of the user.

The aggregated Presence Document describes a user's availability on all its devices as well as an overall aggregated presence. This is the document published by the server to anyone obtaining the presence of a particular user. The availability and activity elements in the aggregated Presence Document indicate the availability and activity information from the most available device of the user. The server MAY also include the displayName, email, and phoneNumber of the user in the aggregated Presence Document.

2.2.2 SIP Extensions to XPIDF Presence Document Format

The Session Initiation Protocol (SIP) allows the SIP endpoints to communicate in a P2P mode without requiring an SIP server. The endpoints can also subscribe for presence information and send notifications carrying such information in a P2P manner. Session Initiation Protocol (SIP) extensions use the XPIDF format to exchange presence information when the endpoints are acting in P2P mode.

The XPIDF format was introduced in an IETF draft but was never standardized as an RFC. The details of the format and the schema are included in Appendix [C](#).

The Session Initiation Protocol Extensions introduces some extensions to the XPIDF format that are described as follows:

1. The Session Initiation Protocol Extensions defines a new element "display" as a subelement of a presence element. The "display" element has the attribute "name" that is a suggested name to identify a contact from other contacts in the client's contact list.
2. The Session Initiation Protocol Extensions defines a new element, "msnsubstatus", as a subelement of address element. This element indicates the availability of the user. The "msnsubstatus" element has the attribute "substatus" that can have the following values: unknown, away, online, idle, busy, berightback, onthephone, or outtolunch. The interpretation of these values is as follows:

msnsubstatus	Server interpretation
unknown	There is no information about the activity of the user.
away	User is away.
online	User is active and available for communication.
idle	User is idle.
busy	User is busy.

msnsubstatus	Server interpretation
berightback	User will be right back.
onthephone	User is on the phone.
outtolunch	User is out to lunch.

2.2.3 application/vnd-microsoft-roaming-acls+xml Document Format

Session Initiation Protocol Extensions support retrieving the ACL list from the server in the form of an XML document. The ACL document contains a list of **access control entries (ACEs)**. An ACE is a set of three attributes:

1. Type

Type defines what the access control entry (ACE) applies to. A type value of ALL indicates that the ACE applies to all users. A type value of DOMAIN indicates that the ACE applies to all users on a **domain**. The domain is specified by the mask field. For example, if type is DOMAIN, and mask is "contoso.com", the ACE applies to "sip:user1@sip.contoso.com" and "sip:user@contoso.com" but not to "sip:user3@example.com". A type value of USER implies that the ACE applies to a specific user specified by the mask field.

2. Mask

A user **URI** or DNS domain to which the ACE applies.

3. Rights

The rights associated with this ACE. This is represented as a list of characters. Each position in the list represents a right. The character in that position represents the value of that right. Four values are defined.

Value	Right
A	Allow
D	Deny
P	Prompt
B	Block (Polite blocking)

Session Initiation Protocol Extensions uses two characters for the Rights field. The first one specifies the right to view the presence of a user, and the second one defines the right to communicate with a user. The client **MUST** enforce the right to communicate. The server **MUST** enforce the right to view presence information.

An example NOTIFY message for the roaming ACL data follows.

```
<ACLlist deltaNum="282" >
  <userACL>
    <ace type="USER" mask="sip:user2@machine2.example.com" rights="AA"/>
    <ace type="USER" mask="sip:user3@machine2.example.com" rights="BA"/>
    <ace type="USER" mask="sip:user4@machine2.example.com" rights="PA"/>
    <ace type="USER" mask="sip:user5@machine2.example.com" rights="AA"/>
  </userACL>
</ACLlist>
```



```
<ace type="USER" mask="sip:user6@machine2.example.com" rights="AA"/>
</userACL>
</ACLlist>
```

Note The deltaNum attribute in the ACLlist element. This is a monotonically increasing sequence number provided by the server that the client uses to ensure that its local copy is in sync with the server. The initial value should be nonzero and is generally one.

2.2.4 Contacts/Groups Document Formats

2.2.4.1 application/vnd-microsoft-roaming-contacts+xml Document Format

Session Initiation Protocol Extensions support retrieving the contact list from the server in the form of an XML document. The server can return the full contact list, or a partial contact list. Both lists use basic building blocks of contact and group elements.

1. group

The group element contains three attributes:

- id: A nonnegative integer that uniquely identifies the group.
- name: The name of the group.
- externalURI: A URI pointing to auxiliary resources for the group. For example, the externalURI can point to an LDAP URI that contains the list of contacts.

2. contact

The contact element contains the following attributes:

- uri: SIP URI of the contact.
- name: Name of the contact.
- groups: A space-separated string of IDs for the groups to which this contact belongs.
- subscribed: A Boolean indicating whether this contact is merely stored as an offline contact, or whether the client should subscribe to its presence.
- externalURI: A URI pointing to auxiliary resources for the group. For example, the externalURI can point to an LDAP URI that contains the list of contacts.

The contact element can also contain an optional contactExtension element. The contactExtension element can be any generic XML.

3. contactDelta

The contactDelta element represents a partial contact list containing only the changes in contacts and groups information from the last contact list notification. The contactDelta element contains a choice of 6 elements:

- addedGroup: Takes the same form as the group element. This element shows the group that was added.

- **modifiedGroup**: Takes the same form as the group element. This element shows the group that was modified.
- **deletedGroup**: Contains only a required id attribute. The id attribute identifies the group that was deleted.
- **addedContact**: Takes the same form as the contact element. This element shows the contact that was added.
- **modifiedContact**: Takes the same form as the contact element. This element shows the contact that was modified.
- **deletedContact**: Contains only a required uri attribute. The uri attribute identifies the contact that was deleted.

The **contactDelta** element also contains two required attributes. The **deltaNum** nonnegative integer attribute is the updated sequence number for the contact list after the changes take place. The **prevDeltaNum** nonnegative integer attribute is the previous sequence number for the contact list before the changes take place.

2.2.4.2 Contacts/Groups Management Document Formats

Session Initiation Protocol Extensions support modification to the contact list. These primitives are defined as SOAP elements and are sent to the server by using a **SERVICE** request. Session Initiation Protocol Extensions support the following primitives:

1. **setContact**

The **setContact** primitive is used for adding a new contact or modifying an existing contact. It contains the following elements:

- **uri**: The sip URI of the contact.
- **displayName**: The name of the contact.
- **groups**: A space-separated string of IDs for the groups to which this contact belongs.
- **subscribed**: A Boolean that indicates whether this contact is merely stored as an offline contact or whether the client should subscribe to its presence.
- **externalURI**: A URI that points to auxiliary information for this contact. For example, the **externalURI** can point to an LDAP URI that contains the information for this contact. This element is optional.
- **contactExtension**: This element can be any generic XML. This element can be used to store any additional application extension information about a contact. This element is optional.

2. **deleteContact**

The **deleteContact** primitive is used for deleting an existing contact. It contains the **URI** element, which identifies the sip URI of the contact to be deleted.

3. **addGroup/modifyGroup**

The **addGroup** primitive is used to add a new group. The **modifyGroup** primitive is used to modify an existing group. These primitives contain the following elements:

- **groupID**: A nonnegative integer that is used as the identifier of the group.

- name: The name of the group.
- externalURI: A URI that points to auxiliary information about the group. This element is optional.

4. deleteGroup

The deleteGroup primitive is used for deleting an existing group. It contains the groupID of the group to be deleted.

Each primitive must also include the deltaNum element. This nonnegative integer element is used as a sequence number for the contact/group management view, and each primitive must include the deltaNum equal to the current sequence number.

2.3 Directory Service Schema Elements

This protocol MAY access the **directory service** schema class and attributes listed in the following table and include them in the presence document. For the syntactic specifications of the following class or class/attribute pairs, refer to Active Directory Domain Services (AD DS) in [\[MS-ADA1\]](#), [\[MS-ADA2\]](#), [\[MS-ADA3\]](#), and [\[MS-ADSC\]](#).

Class	Attribute
User	displayName email

3 Protocol Details

The following sections specify details of Session Initiation Protocol Extensions, including abstract data models, message processing rules, and the SIP client and server roles.

3.1 NTLM/Kerberos Authentication Extensions Details

Session Initiation Protocol Extensions implements a proprietary Kerberos and **NT LAN Manager (NTLM) Authentication Protocol** authentication mechanism that is used by the client for client-to-server authentication and signing of messages. For more information on Kerberos, see [\[MS-KILE\]](#). Encryption (privacy) is provided by Transport Layer Security (TLS) and is not explicitly covered by this authentication mechanism.

Authentication is broken down into two phases. In the first phase, a **security association (SA)** is established between the client and the server. In the second phase, the client and server use the existing SA to sign messages that they send and to verify the messages they receive. Unauthenticated messages from a client SHOULD NOT be accepted by the server. The exact message exchange in the first phase differs depending on whether NTLM or Kerberos authentication is used.

During the NTLM SA establishment phase, a three-way handshake occurs between the client and the server:

1. The client sends a request with no credential or authentication information. The server responds to that request with a 401 or 407, indicating that it supports NTLM and Kerberos and requires authentication.
2. The client reissues the request, indicating its preference for NTLM authentication. The server responds with an appropriate challenge in a 401 or 407.
3. The client reissues the request with a response to the server's challenge. The server processes the request and responds (including its signature for the response).
4. The SA is now established on both the client and server, and subsequent messages between the client and server are signed.

During the Kerberos SA establishment phase, a two-way handshake occurs between the client and the server:

1. The client sends a request with no credential or authentication information. The server responds to that request with a 401 or 407, indicating that it supports NTLM and Kerberos and requires authentication.
2. The client requests a Kerberos ticket for the server, and reissues the request with this encoded Kerberos ticket information.
3. The server processes the request and responds (including its signature for the response).
4. The SA is now established on both the client and server, and subsequent messages between the client and server are signed.

The primary distinction between NTLM and Kerberos is the need for connectivity to the domain controller. In Kerberos, the client must request a Kerberos ticket from the **Key Distribution Center (KDC)**, which is a process that resides on the domain controller. In NTLM, the server verifies the client's NTLM credentials by contacting the domain controller. This difference allows clients that do

not have connectivity to the domain controller to authenticate with the server using NTLM authentication, and it is the main reason for supporting NTLM in addition to the more secure and standard Kerberos authentication.

3.1.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this specification.

The client can use a *LastSnumReceived* integer parameter for each SA to store the value of the last *snum* received from the server. This is used to provide replay protection.

The client can also use two integer parameters, *SnumWindowLow* and *SnumWindowHigh*, to mark the upper and lower values for the sliding window used by the client to allow pipelining of requests while providing replay protection. *SnumWindowLow* and *SnumWindowHigh* can be initialized to 1 and 256, respectively, for a 256-size sliding window.

Note The preceding conceptual data can be implemented by using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.1.2 Timers

No timers are required other than the timers specified in [\[RFC3261\]](#).

3.1.3 Initialization

No initialization is required beyond the initialization that is specified in [\[RFC3261\]](#).

3.1.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#).

3.1.4.1 Initiating the Login Sequence

The client initiates the login sequence by sending a **REGISTER** request without any credentials, as suggested in [\[RFC3261\]](#). If the REGISTER request is challenged by a server request for NTLM Authentication Protocol or Kerberos authentication, the client then resends the REGISTER request with credentials. This step also establishes an SA between the client and the server that is used to sign any future messages.

3.1.4.2 Sending a SIP Message

Before sending a message, the sender MUST generate a message signature or checksum that it will send with the message so that the receiver can authenticate the message. The client and the server SHOULD use the same algorithm to generate message signatures. The Microsoft implementation uses the `GSS_GetMIC()` and `GSS_VerifyMIC()` implementations of the NTLM or Kerberos security service provider interface to compute and verify a signature. For more information on NTLM `GSS_GetMIC()` and `GSS_VerifyMIC()`, see [\[MS-NLMP\]](#) section 3.1.4. For more information on Kerberos `GSS_GetMIC()` and `GSS_VerifyMIC` implementation, see [\[RFC1964\]](#) section 1.2.

The client MUST use the following values in order and enclosed by angle brackets to construct a secure buffer that is then used to compute the message signature:

1. Authentication method (for example, "NTLM" or "Kerberos")
2. Crand for client or srand for server
3. Cnum for client or snum for server
4. Realm
5. Targetname
6. Call ID
7. CSeq#
8. CSeq method
9. From URL
10. From Tag
11. To Tag
12. Expires (optional)
13. Response code (responses only)

The only difference from the client signature is the use of a server-generated SALT (srand) and sequence number (snum) rather than the client-generated SALT (crand) and sequence number (cnum).

Note Even though some parameter values are case-insensitive, these values must be used as they appear in the message when performing the signature computation.

For optional fields, such as **Expires**, an empty set of angle brackets (<>) is included in the buffer to sign when those headers do not exist in the SIP message.

The response code is only part of the signature computation for responses and is not part of the signature for requests. An empty set of angle brackets (<>) is not included in the buffer to sign for requests.

The client places the message signature in the response parameter of the Proxy-Authorization: header. The server places the signature in the *rspauth* parameter of the Proxy-Authentication-Info: header.

As an example, the following message,

```
SUBSCRIBE sip:samtest1@pstntest.rtmp.selfhost.corp.microsoft.com SIP/2.0
Via: SIP/2.0/TCP 172.24.34.1:16577
Max-Forwards: 70
From: <sip:samtest1@pstntest.rtmp.selfhost.corp.microsoft.com>;
    tag=82249b57436d4aa39ec38afa968fa994;
    epid=bd0238d966
To: <sip:samtest1@pstntest.rtmp.selfhost.corp.microsoft.com>
Call-ID: 72558074992e4f2cafb48c6e44b90a0c
CSeq: 1 SUBSCRIBE
```

```
Contact:
  <sip:samtest1@pstntest.rtmp.selfhost.corp.microsoft.com:16577;
    maddr=172.24.34.1;transport=tcp>;
  proxy=replace
User-Agent: RTC/1.3
Event: vnd-microsoft-roaming-contacts
Accept: application/vnd-microsoft-roaming-contacts+xml
Supported: com.microsoft.autoextend
Supported: ms-benotify
Proxy-Require: ms-benotify
Supported: ms-piggyback-first-notify
Proxy-Authorization:
  NTLM qop="auth",
  realm="SIP Communications Service",
  opaque="9C55D687",
  crand="009139df",
  cnum="1",
  targetname="pstn.pstntest.rtmp.selfhost.corp.microsoft.com",
  response="0100000039623537c854b2e8ca6a203e"
Content-Length: 0
```

would result in the following signature buffer (line breaks not included).

```
<NTLM>
<009139df >
<1>
< SIP Communications Service>
< pstn.pstntest.rtmp.selfhost.corp.microsoft.com >
<72558074992e4f2cafb48c6e44b90a0c >
<1>
<SUBSCRIBE>
< sip:samtest1@pstntest.rtmp.selfhost.corp.microsoft.com >
<82249b57436d4aa39ec38afa968fa994>
```

Note The signature computed for the preceding example is "0100000039623537c854b2e8ca6a203e", which is included in the response parameter of the Proxy-Authorization header.

For Kerberos, the buffer for signature computation is formed in a manner similar to what is shown in the preceding NTLM example. The only differences are that the first element in the signature buffer is <Kerberos> instead of <NTLM> and that Kerberos GSS-GetMIC() is used to compute the signature.

3.1.5 Message Processing Events and Sequencing Rules

Except as specified in the following section, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.1.5.1 Overview of Authentication Protocol Elements

The server issues an authentication challenge by using either a 401 or 407 response to a SIP request. The client SHOULD be capable of processing either response. The server uses the following SIP headers as part of this authentication scheme.

SIP header	Purpose	Where used
Date	Indicates current server time. Used by the client to detect clock skew, which can cause authentication to fail. Client and server clocks must be synchronized to within 15 minutes for the NTLM Authentication Protocol and to within 5 minutes for Kerberos.	401 or 407 response
Proxy-Authenticate	Carries the challenge issued by a proxy . One for each authentication scheme (NTLM and Kerberos) that the proxy supports.	407 response
Proxy-Authentication-Info	Carries the proxy signature for a message.	Authenticated SIP message
Proxy-Authorization	Allows the client to identify itself (or its user) to a proxy that requires authentication. Carries the client response to challenge as well as the signature for the message.	SIP message
WWW-Authenticate	Carries the challenge issued by a server. One for each authentication scheme (NTLM and Kerberos) that the server supports.	401 response
Authentication-Info	Carries the server signature for a message.	Authenticated SIP message
Authorization	Allows the client to identify itself (or its user) to a server that requires authentication. Carries the client response to challenge as well as the signature for the message. One for each SA that the client has established with the server.	SIP message

The protocol information that is used during the SA establishment phase differs from the information that is used after an SA is established. During the establishment phase, the *gssapi-data* parameter carries the bulk of the credential information. The realm parameter provides additional context information.

After an SA is established, the *srand*, *crand*, *cnum*, *snum*, and *opaque* parameters are used in the signing of requests and responses. Those signatures are carried in the *response* and *rspauth* parameters. Parameter values are never escaped, and parameter names are case-insensitive. The order of parameters in a header is not significant.

The following table gives an overview of the parameters used in Proxy-Authenticate, Proxy-Authorization, and Proxy-Authentication-Info headers in the SIP messages. The "When" column indicates the phase in which the parameter is used: Establishment or Signing.

Parameter	Where	Creator	When	Used for
Realm	Authenticate Authorization Auth Info	Server	ES	Identifies which set of credentials the user should supply. Also used by the client to determine which SA is used to sign a message. The Realm value is case-sensitive. The default value is "SIP Communications Service".
Epid	From	Client	ES	Identifies a unique endpoint for the user. Used by the server to determine the correct SA to use for signing an outgoing response. An <i>epid</i> MUST be present.

Parameter	Where	Creator	When	Used for
Epid	To	Server	ES	Identifies a unique endpoint for the user. Used by the server to determine the correct SA to use for signing an outgoing request. An <i>epid</i> MUST be present.
Targetname	Authenticate Authorization Auth Info	Server	ES	Identifies the server for this SA. Contains the FQDN of the server for NTLM and the SPN of the server for Kerberos.
Opaque	Authenticate Authorization Auth Info	Server	ES	Identifies the SA on the server.
Qop	Authenticate Authorization Auth Info	Client Server	ES	Quality of Protection (auth only, no integrity protection).
Crand	Authorization	Client	S	Identifies the SALT that is used in the signature. An 8-character hexadecimal digit string.
Crum	Authorization	Client	S	Identifies the sequence number that is used in the signature for replay protection. A 32-bit unsigned value that starts at 1.
Srand	Auth Info	Server	S	Identifies the SALT that is used in the signature. An 8-character hexadecimal digit string.
Snum	Auth Info	Server	S	Identifies the sequence number that is used in the signature for replay protection. A 32-bit unsigned number that starts at 1.
gssapi-data	Authenticate Authorization	Client Server	E	Exchanges credential information for establishing an SA.
Response	Authorization	Client	S	Carries the client signature.
Rspauth	Auth Info	Server	S	Carries the server signature.

For each SA, the client MUST keep track of the snum values that are used by the server when signing messages with this SA. The client also tracks the last snum value that is received for this SA. The client MUST maintain a sliding window to track the snum values that are used by the server for this SA. The initial range of this window is 1 to 256, and is adjusted as messages are received. (The size of this window is 256.) This means that the server can issue as many as 256 simultaneous requests before waiting for a response from the client. The purpose of maintaining this sliding window is to provide replay protection while allowing pipelining of requests for performance reasons.

When a signed message arrives at the client, the client MUST validate the signature and extract the snum value:

If the snum value is higher than the last snum received, the client shifts the window up so that the window now spans from [snum - 256 to snum]. The client also marks this snum as having been used.

If the snum value is lower than the last snum received and is within the active window, the client checks whether this value has been seen before. Previously seen values are rejected as a replay. Replayed requests and responses are dropped. New values are marked as having been used.

If the snum value is lower than the last snum received and is outside the active window, the client MUST drop the message.

3.1.5.2 Verifying Message Signature for Incoming Messages

After receiving a SIP message, the receiver MUST verify the message signature by using GSS_VerifyMIC(). If the signature verification fails, the message MUST be discarded.

3.1.5.3 proxy=replace Extension for Firewall Traversal

Session Initiation Protocol Extensions introduces a new header parameter, proxy=replace, to enable firewall traversal for the Session Initiation Protocol (SIP) channel. This parameter tells the outbound proxy to replace the contact information in the contact header with its own, enabling other clients/servers to reach the client using the proxy's IP address, even if the client is behind a firewall. The client SHOULD include a header parameter proxy=replace in the "Contact" header if it wants to enable this extension. The client SHOULD also include a maddr URI parameter containing its IP address. The outbound proxy SHOULD replace the IP address in the maddr parameter with its own IP address if the *proxy=replace header* parameter is present. Any entity receiving this contact header SHOULD send any new requests to the new IP address in the maddr parameter, which is the IP address of the proxy. The proxy SHOULD then route this request to the client.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Presence Extensions Details

The Session Initiation Protocol Extensions introduces several extensions to enhance presence. These include the new Presence Document Format, msrtc.pidf (see section [2.2.1](#)), extensions to XPIDF format (see section [2.2.2](#)), a new **SIP method**, SERVICE, to set and get presence information, and the setPresence and getPresence SOAP requests.

The Session Initiation Protocol (SIP) allows SIP endpoints to communicate in a P2P mode without requiring a SIP server. The endpoints can also subscribe for presence information and send notifications carrying such information in a P2P manner. Session Initiation Protocol (SIP) extensions use the XPIDF format to exchange presence information when the endpoints are acting in P2P mode. The msrtc.pidf format is used in the client/server mode.

The client can publish its presence to the server by sending a setPresence SOAP request inside the body of a SERVICE method. The client can use the setPresence request only to set the logged in user's presence. A user cannot publish presence on behalf of another user. The server sends a **200 OK** SIP response to indicate that the setPresence request was successful.

There are two ways for the client to obtain another user's presence information. If the client just needs a one-time snapshot of the presence information, it SHOULD send a getPresence SOAP request to the server to do so. This can be useful for Web pages that need to show the presence

state of a user on a transient basis. The advantage of using a `getPresence` request is that it does not consume a lot of resources on the server.

If the client wants to continue getting updates when the presence information changes, it SHOULD subscribe for it by sending a `SUBSCRIBE` request to the server. The `SUBSCRIBE` request creates a **dialog**, and as long as the dialog is kept alive, the server MUST send presence updates in `NOTIFY` or `BENOTIFY` requests. This mode of operation can be useful for getting presence information of the users in the client's contact list.

In the P2P mode, no server is used to exchange presence information, and clients can directly create subscriptions between themselves. The `setPresence` and `getPresence` requests are not valid in P2P mode. The client can send a `SUBSCRIBE` request to the user it wants to subscribe to create a subscription. The other client can send `NOTIFY` with Presence Documents in XPIDF format to send initial presence information and any updates.

SIP Proxies and **Registrars** should send an immediate 200 response status code to any `SUBSCRIBE` messages before forwarding the message, and should not forward responses to any `SUBSCRIBE` messages. The 200 status code MUST only indicate successful receipt of the request, instead of acceptance of the subscription. The response MUST be sent immediately to ensure that no state information about a SIP client can be derived from any delays in the process. A `SUBSCRIBE` request SHOULD then be sent to the requested client for processing.

If a SIP client is offline, the SIP Proxy or Registrar MUST immediately send a 200 status code in response and queue the `SUBSCRIBE` request for a suitable time-out period. A recommended value of this time-out is 180 seconds. Further `SUBSCRIBE` requests SHOULD update the time-out value. If the end node comes online before the time-out period expires, then the `SUBSCRIBE` request should be forwarded to it.

A SIP Proxy or Registrar must never send a 600 status code in response to a `SUBSCRIBE` request.

When a SIP client receives a `SUBSCRIBE` request, it MUST immediately respond with a 200 status code that only indicates successful receipt of the request, not any presence information. If the request is accepted, then a `NOTIFY` transaction should be created and sent. Otherwise, no message should be sent in response.

These extensions are optional. An implementation may support them.

3.2.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this specification.

The server MAY use a BOOLEAN flag, `MSRTCPresenceSupported`, for each registering client to track whether the client supports the presence extensions described in this section.

Note The preceding conceptual data can be implemented using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.2.2 Timers

No timers are required other than the timers specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.2.3 Initialization

The client SHOULD be registered with the server before publishing or subscribing to presence information. This is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.2.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#). When the user logs in, the client subscribes to the presence information of the contacts using a batched SUBSCRIBE request.

3.2.4.1 Indicating Support for Presence Extensions

The Session Initiation Protocol Extensions defines a new header to indicate support for Session Initiation Protocol (SIP) extensions for presence. The client SHOULD insert the following header in its REGISTER requests as part of the login sequence.

```
Supported: com.microsoft.msrtc.presence
```

This header indicates to the server that the client understands the Session Initiation Protocol (SIP) extensions for presence, notably its support for the setPresence SOAP request and text/xml+msrtc.pidf presence document format (see section [2.2.1](#)). The server assumes that a client that inserts this header in its first REGISTER request will subsequently send a setPresence request to set its presence state. Failure to do so will cause the server to show the client as offline after a short period of time. The exact interval SHOULD be a configurable parameter on the server and may be set to a suitable value between 3 minutes and 15 minutes.

3.2.4.2 Setting Presence for Self User (setPresence SERVICE Request)

The client uses a SOAP request, carried in the body of a SERVICE request, to set or update its own presence information. This is done at least once (during login) and whenever the presence state of the user changes. The setPresence SOAP request is the trigger for the server to generate NOTIFY requests to the watchers of this user. An example setPresence request looks like the following.

```
SERVICE sip:user@tradewind.com
SIP/2.0 Via: SIP/2.0/TLS 157.56.65.142:3485 Max-Forwards: 70
From: "Bob" <sip:user@tradewind.com >;
    tag=263b894bb94d444b801fc070cd8c403a;
    epid=a892397901
To: < sip:user@tradewind.com >
Call-ID: 157892a29f7e44199693e2a1e48fdd98
CSeq: 3 SERVICE
Contact:
    < sip:user@tradewind.com:3485;
        maddr=157.56.65.142;
        transport=tls>;
        proxy=replace
User-Agent:
    RTC/1.3.5315 (Messenger 5.1.0530)
Proxy-Authorization:
    NTLM qop="auth",
    realm="SIP Communications Service",
    opaque="bfaf9a7c",
    crand="84e2891d",
    cnum="8",
```

```

    targetname="tradewind.com",
    response="0100000038393462892479edd2994f63"
Content-Type: application/SOAP+xml
Content-Length:

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:setPresence xmlns:m="http://schemas.microsoft.com/winrtc/2002/11/sip">
      <m:presentity m:uri="sip:sip:user@tradewind.com">
        <m:availability m:aggregate="300" m:description="online"/>
        <m:activity m:aggregate="400" m:description="Active"/>
        <deviceName
          xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence"
          name="USER-DESKTOP"/>
        <rtc:devicedata
          xmlns:rtc="http://schemas.microsoft.com/2002/09/sip/client/presence"
          namespace="rtcService">
          &lt;![CDATA[
            <caps>
              <renders_gif/>
              <renders_isf/>
            </caps>]]&gt;
        </rtc:devicedata>
      </m:presentity>
    </m:setPresence>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

The SERVICE method is used to carry a variety of SOAP requests between the client and the server. The body of the request identifies the specific SOAP method that is being invoked. In this case, the "m:setPresence" string indicates that this is a setPresence request. The uri attribute on the **presentity** element indicates the user whose presence is being set and MUST match the To and From header URIs. The remaining content of the setPresence body is a text/xml+msrtc.pidf Presence Document. Note the namespace of the XML document that must match exactly for the server to recognize this SOAP request.

3.2.4.3 Subscribing to a User's Presence Information

The client can subscribe to a user's presence information by sending a SUBSCRIBE request with the request URI set to that user's SIP URI. In the client/server mode, this request creates a subscription on the client and the server. In the P2P mode, the subscription is created on both clients. The presence information is sent back in the 200 OK to the SUBSCRIBE if piggyback notification extension is enabled. Otherwise, it is sent in a NOTIFY or BENOTIFY request. Any further updates to presence are sent using NOTIFY or BENOTIFY requests.

3.2.4.4 Getting Presence Information of Another User (getPresence SERVICE Request)

The counterpart to the setPresence SOAP request is a getPresence SOAP request. This acts as a means to poll for presence rather than subscribing to presence. It is meant as a lightweight alternative to a presence SUBSCRIBE request when only presence for a single entity is needed and only that presence information for a one-time immediate purpose is needed.

```
SERVICE sip:target@tradewind.com SIP/2.0
```

```
Via: SIP/2.0/TLS 157.56.65.142:3485
Max-Forwards: 70
From: "Bob" <sip:user@tradewind.com>;
    tag=9aa9609ba6684c40bc8ec2917979c586;epid=a892397901
To: <sip:target@tradewind.com>
Call-ID: 875bb758890e436492cb83d300c33564
CSeq: 1 SERVICE
Contact: <sip:user@tradewind.com:3485;
    maddr=157.56.65.142;transport=tls>;proxy=replace
User-Agent: RTC/1.3.5315 (Messenger 5.1.0530)
Proxy-Authorization: NTLM qop="auth",
    realm="SIP Communications Service",
    opaque="bfaf9a7c", crand="ffaf4afc",
    cnum="42", targetname="tradewind.com",
    response="01000000363039624edf6834d2994f63"
Content-Type: application/SOAP+xml
Content-Length:
<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:getPresence
      xmlns:m=
        "http://schemas.microsoft.com/winrtc/2002/11/sip">
      <presence uri="sip:target@tradewind.com"/>
    </m:getPresence>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Note The `m:getPresence` element indicates that this is a `getPresence` SOAP request. Also note the XML namespace that is used; it must be matched exactly. The Request-URI, the To header URI, and the `uri` attribute of the `getPresence` element indicate the user from which presence information is wanted. Note that presence ACLs are enforced for `getPresence` requests as well; if the user is blocked from seeing the target user's presence, the `getPresence` request may return a **403 Forbidden** SIP response.

3.2.5 Message Processing Events and Sequencing Rules

Except as specified in the following section, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

The following event is specified in this section:

- [Processing Response to a `getPresence` SERVICE Request](#)

3.2.5.1 Processing Response to a `getPresence` SERVICE Request

The client SHOULD receive the Presence Document in the body of the 200 OK response to the SERVICE request. The client SHOULD parse the Presence Document as if it was received inside a NOTIFY method.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

3.3 Batched SUBSCRIBE and NOTIFY Extension Details

Session Initiation Protocol Extensions uses the SUBSCRIBE and NOTIFY mechanism, as specified in [\[RFC3265\]](#), to accept subscriptions for and send presence updates on members of the user's contact list.

Session Initiation Protocol Extensions defines additional optimizations of that basic SUBSCRIBE and NOTIFY mechanism to reduce message overhead associated with presence. The first such extension is the batched SUBSCRIBE mechanism. This mechanism allows the client to subscribe to a list of contacts at once rather than send an individual SUBSCRIBE for each contact.

This extension is optional. An implementation may support it.

3.3.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this specification.

The client MAY use a Boolean flag, `BatchSubscribeEnabled`, for each subscription to track whether batched SUBSCRIBE/NOTIFY requests are supported.

The server MAY also use a similar Boolean flag, `BatchSubscribeEnabled`, for each subscription to track whether batched SUBSCRIBE/NOTIFY requests are supported.

The server MAY also have a configurable parameter, `MaxNumberOfContacts`, per user to keep track of the limit on how many contacts that user may have.

Note that the preceding conceptual data can be implemented by using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.3.2 Timers

No timers are required other than the timers specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.3.3 Initialization

The client SHOULD be registered with the server before sending a batched SUBSCRIBE request. This is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.3.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.3.4.1 Sending a Batched SUBSCRIBE Request

The client can subscribe to presence information of a list of contacts by sending a batched SUBSCRIBE request to the server. This is typically done after the client has logged in to the server by sending a REGISTER request. The batched SUBSCRIBE request is a SUBSCRIBE request with the

body of the request containing the contact URIs of interest. A typical batched SUBSCRIBE is constructed similar to the following example.

```
SUBSCRIBE
sip:watcher@tradewind.com SIP/2.0
Via: SIP/2.0/TLS 157.56.65.142:3485
Max-Forwards: 70
From: "Bob" <sip:watcher@tradewind.com>;
      tag=4dcbf313b0ee4d;epid=a892397901
To: <sip:watcher@tradewind.com>
Call-ID: dba8c92428b241ccb233e5d1a59135e2
CSeq: 1 SUBSCRIBE
Contact:
  <sip:watcher@tradewind.com:3485;
  maddr=157.56.65.142;
  transport="tls">;
  proxy=replace
User-Agent: RTC/1.3
Event: presence
Accept:
  application/rlmi+xml,
  text/xml+msrtc.pidf,
  multipart/related
Supported: com.microsoft.autoextend
Supported: ms-benotify
Proxy-Require: ms-benotify
Supported: ms-piggyback-first-notify
Require: adhoclist
Supported: eventlist
Proxy-Authorization:
  NTLM qop="auth",
  realm="SIP Communications Service",
  opaque="bfaf9a7c",
  crand="8c93c137",
  cnum="5",
  targetname="tradewind.com",
  response="0100000066333133cfcfdde1d2994f63"
Content-Type: application/adrl+xml
Content-Length: ...
<adhoclist uri="sip:watcher@tradewind.com"
  name="sip:watcher@tradewind.com">
  <create>
    <resource uri="sip:contact1@tradewind.com"/>
    <resource uri="sip:contact2@tradewind.com"/>
    <resource uri="sip:contact3@tradewind.com"/>
    <resource uri="sip:contact4@tradewind.com"/>
    <resource
  </create>
</adhoclist>
```

Refer to the adhoclist node in the preceding example. The Supported, Require, and Proxy-Require headers indicate support for a variety of presence extensions that are described in the following sections. The Accept header indicates that the client is capable of receiving (in response to the SUBSCRIBE) a multipart MIME (for more information, see [RFC13411](#)) specification that contains a list of users (application/rlmi+xml) and their associated Presence Documents (text/xml+msrtc.pidf).

The Require: adhoclist and Supported: eventlist headers indicate support specifically for the batched SUBSCRIBE mechanism (both are needed to enable this feature).

The Content-Type (application/adrl+xml) indicates that this SUBSCRIBE request carries an XML body that contains the list of contacts of interest.

Note that the Request-URI as well as the To and From headers all carry the SIP URI of the watcher.

The content of the SUBSCRIBE request itself is straightforward. It is described by the following XML schema. The schema allows the client to define a list as well as modify an existing list established by a previous SUBSCRIBE request in the same SIP dialog. The list is flat, containing one entry per contact that the watcher receives presence updates for. The size of the list SHOULD be bounded by the maximum number of contacts per user setting on the server. The server may limit the maximum number of contacts that a user can have. The implementation SHOULD permit an administrator to configure this limit based on the needs of the users in a deployment, by some means outside of this specification. A reasonable value for this limit may be between 100 and 250. The server SHOULD reject any batched SUBSCRIBE request that contains more contacts than this limit.

```
<?xml version="1.0" ?>
<xs:schema id="batch subscribe" version="2.0"
  elementFormDefault="qualified"
  targetNamespace="urn:ietf:params:xml:ns:adrl"
  xmlns:tns="urn:ietf:params:xml:ns:adrl"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ct="http://schemas.microsoft.com/sip/types">

  <xs:annotation>
    <xs:documentation>
      Live Communications Server 2005 supports an extension to the
      SIP SUBSCRIBE request to allow subscribing to the presence
      of multiple users at the same time. This is called the Batch
      Subscribe request. The body of the Batch Subscribe request
      conforms to the schema specified here. Note that this schema
      is different from the adhoclist schema specified in the
      internet draft.
    </xs:documentation>
  </xs:annotation>

  <xs:import namespace="http://schemas.microsoft.com/sip/types"
    schemaLocation="common.xsd" />

  <xs:complexType name="resource">
    <xs:attribute name="uri" type="ct:sipURI" use="required" />
    <xs:anyAttribute namespace="##any" processContents="lax" />
  </xs:complexType>

  <xs:complexType name="roster">
    <xs:sequence>
      <xs:element name="resource" type="tns:resource" minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax" />
  </xs:complexType>

  <xs:complexType name="adhoclist">
    <xs:sequence>
      <xs:choice>
        <xs:annotation>
          <xs:documentation>
```

A Batch Subscribe request can specify one of three operations: create, add or delete.

- A create operation creates a new batch subscription on the server
- An add operation adds entries to an existing batch subscription
- A delete operation deletes entries from a batch subscription

Entries in a batch subscription consist of SIP URIs of users to whom presence subscriptions are created.

```
</xs:documentation>
</xs:annotation>

<xs:element name="create" type="tns:roster" />
<xs:element name="add" type="tns:roster" />
<xs:element name="delete" type="tns:roster" />
</xs:choice>

<xs:any namespace="##any" processContents="lax"
  minOccurs="0" maxOccurs="unbounded" />
</xs:sequence>

<xs:attribute name="uri" type="ct:sipURI" use="required" />

<xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:element name="ad hoclist" type="tns:ad hoclist" />
</xs:schema>
```

3.3.5 Message Processing Events and Sequencing Rules

Except as specified in the following section, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

The following events are specified in this section:

- [Receiving a NOTIFY Response to a Batched SUBSCRIBE Request](#)
- [Receiving a Failure Response to a Batched SUBSCRIBE Request](#)

3.3.5.1 Receiving a NOTIFY Response to a Batched SUBSCRIBE Request

On receiving a NOTIFY SIP response to a batched SUBSCRIBE request, the client parses the response and retrieves the presence information for all contacts.

A typical NOTIFY SIP response to a batched subscription appears in the following example. Note that it is a multipart MIME body containing both a list of contacts and the presence state for each of those contacts.

```
From: "Bob" <sip:watcher@tradewind.com>;
  tag=4dcbf313b0ee4dd68fdfae2d851facf2;
  epid=a892397901
To: <sip:watcher@tradewind.com>;
  tag=ee697d7f2d8dc2b899014154efb57a4c;
Call-ID: dba8c92428b241ccb233e5d1a59135e2
```

```

CSeq: 1 SUBSCRIBE
Expires: 23903
Content-Type:
  multipart/related;
  type="application/rlmi+xml";start=resourceList;
  boundary=50UBfW7LSCVltggUPe5z Content-Length:
Require: eventlist
Event: presence subscription-state: active;expires=23903
Supported: com.microsoft.autoextend,
  ms-piggyback-first-notify,
  ms-benotify

--50UBfW7LSCVltggUPe5z
Content-Transfer-Encoding: binary
Content-ID: resourceList
Content-Type: application/rlmi+xml

<list xmlns="urn:ietf:params:xml:ns:rlmi"
  uri="sip:watcher@tradewind.com"
  version="1" fullState="true" >
  <resource uri="sip:contact1@tradewind.com" >
    <instance id="0" state="active"
      cid="contact1@tradewind.com" />
  </resource>
  <resource uri="sip:contact2@tradewind.com" >
    <instance id="0" state="active"
      cid="contact2@tradewind.com" />
  </resource>
  <resource uri="sip:contact3@tradewind.com" >
    <instance id="0" state="active"
      cid="contact3@tradewind.com" />
  </resource>
</list>

--50UBfW7LSCVltggUPe5z
Content-Transfer-Encoding: binary
Content-ID: contact1@tradewind.com
Content-Type: text/xml+msrtc.pidf
<presence uri="contact1@tradewind.com" >
  <availability aggregate="300" description="" epid="8bfb9f3f24" />
  <activity aggregate="500" description="" epid="8bfb9f3f24" />
  <displayName displayName="Dave" />
  <email email="contact1@tradewind.com" />
  <phoneNumber label="" number="555-5555" />
  <devices>
    <devicePresence epid="8bfb9f3f24" ageOfPresence="315" >
      <availability aggregate="300" description="online" />
      <activity aggregate="500" description="In Call" />
      <deviceName name="DESKTOP"
        xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence">
      </deviceName>
    <rtc:devicedata namespace="rtcService"
      xmlns:rtc="http://schemas.microsoft.com/2002/09/sip/client/presence">
      <![CDATA[
        <caps><renders_gif/><renders_isf/></caps>
      ]>
    </rtc:devicedata>
  </devicePresence>
</devices>

```

```

</presentity>

--50UBfW7LSCVltggUPe5z
Content-Transfer-Encoding: binary
Content-ID: contact2@tradewind.com
Content-Type: text/xml+msrtc.pidf
<presentity uri="contact2@tradewind.com" >
  <availability aggregate="300" description="" epid="43a34cb1f7"/>
  <activity aggregate="200" description="" epid="43a34cb1f7" />
  <displayName displayName="Joe" />
  <email email="contact2@tradewind.com" />
  <phoneNumber label="" number="666-6666" />
  <devices>
    <devicePresence epid="43a34cb1f7" ageOfPresence="3301" >
      <availability aggregate="300" description="online" />
      <activity aggregate="200" description="Idle" />
      <deviceName name="DESKTOP"
        xmlns=http://schemas.microsoft.com/2002/09/sip/client/presence">
    </deviceName>
      <rtc:devicedata namespace="rtcService"
        xmlns:rtc=
          http://schemas.microsoft.com/2002/09/sip/client/presence" >
        &lt;![CDATA[
          <caps><renders_gif/><renders_isf/></caps>
        ]&gt;
      </rtc:devicedata>
    </devicePresence>
  </devices>
</presentity>

--50UBfW7LSCVltggUPe5z
Content-Transfer-Encoding: binary
Content-ID: contact3@tradewind.com
Content-Type: text/xml+msrtc.pidf
<presentity uri="contact3@tradewind.com" >
  <availability aggregate="300"
    description="" epid="0e7e556112"/>
  <activity aggregate="400"
    description="" epid="0e7e556112" />
  <displayName displayName="Tim" />
  <email email="contact3@tradewind.com" />
  <phoneNumber label="" number="777-7777" />
  <devices>
    <devicePresence epid="0e7e556112"
      ageOfPresence="3617" >
      <availability aggregate="300"
        description="online" />
      <activity aggregate="400"
        description="Active" />
      <deviceName name="DESKTOP"
        xmlns=
          "http://schemas.microsoft.com/2002/09/sip/client/presence">
    </deviceName>
      <rtc:devicedata
        namespace="rtcService"
        xmlns:rtc=
          "http://schemas.microsoft.com/2002/09/sip/client/presence">
        &lt;![CDATA[
          <caps><renders_gif/><renders_isf/></caps>
        ]&gt;
      </rtc:devicedata>
    </devicePresence>
  </devices>
</presentity>

```

```
    ]]&gt;  
    </rtc:devicedata>  
  </devicePresence>  
</devices>  
</presence>  
--50UBfW7LSCVltggUPe5z--
```

The boundary string (--50UBfW7LSCVltggUPe5z) is used to delimit the parts of the multipart body. The first part is a list expressed in XML format that contains one entry for every Presence Document (contact) carried in the remainder of the body. Each entry of the list has a SIP URI of the contact as well as a content-id (the cid attribute) that corresponds to the Content-ID header of the subsequent MIME part that contains the Presence Document for that contact. The list acts as an index to the remaining content of the notification.

The remaining parts are Presence Documents in text/xml+msrtc.pidf format, as specified in section [2.2.1](#).

The batched SUBSCRIBE/NOTIFY supports versioning and partial notifications. The version number and a flag—indicating whether this notification contains information for the complete contact list or just a subset—are defined in the list portion of the body. The client SHOULD ignore out-of-order CSeq for NOTIFY/BENOTIFY requests for batched subscriptions and rely on the version number instead.

3.3.5.2 Receiving a Failure Response to a Batched SUBSCRIBE Request

If the server does not support batched SUBSCRIBE and NOTIFY requests, it will send a failure response to the batched SUBSCRIBE request. The client MAY set the BatchSubscribeEnabled flag to false and fall back to sending individual SUBSCRIBE requests for each of the contacts.

3.3.6 Timer Events

None.

3.3.7 Other Local Events

None.

3.4 Piggyback Notification in 200 OK Response Details

As a performance optimization, Session Initiation Protocol Extensions introduces a mechanism whereby the content of the first NOTIFY request that is normally sent in the SIP response to a SUBSCRIBE request may actually be carried in the SUBSCRIBE 200 OK response itself. This is referred to as piggybacking.

The benefit of this extension is in saving the traffic of the first NOTIFY request and its subsequent 200 OK response on the wire, reducing the total number of messages that must be processed as part of the usual login sequence for the client.

Note This extension may be used independently or in conjunction with the batched SUBSCRIBE mechanism defined previously.

This extension is optional. An implementation may support it.

3.4.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this specification.

The client MAY use a Boolean flag, `PiggybackNotifyEnabled`, for each subscription to track whether piggyback NOTIFY is supported for that subscription.

The server MAY also use a similar Boolean flag, `PiggybackNotifyEnabled`, for each subscription to track whether piggyback NOTIFY is supported for that subscription.

Note that the preceding conceptual data can be implemented by using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.4.2 Timers

No additional timers are required other than the timers specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.4.3 Initialization

The client SHOULD be registered with the server before indicating support for piggyback NOTIFY in a SUBSCRIBE request. This is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.4.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.4.4.1 Indicating Support for Piggyback Notification

The client can indicate support for this extension to the server by including the following header in the SUBSCRIBE request.

```
Supported: ms-piggyback-first-notify
```

3.4.5 Message Processing Events and Sequencing Rules

Except as specified in the following section, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

The following event is specified in this section:

- [Receiving a Piggyback Notification in 200 OK](#)

3.4.5.1 Receiving a Piggyback Notification in a 200 OK

If the server supports piggyback NOTIFY requests, it sends the content that is typically placed in the first NOTIFY request within the 200 OK SIP response to the SUBSCRIBE request. The content of the 200 OK response to the SUBSCRIBE request matches the content type that the client specified in the

Accept header of the SUBSCRIBE. The server signals support for the piggyback extension in a similar header in the 200 OK response to the SUBSCRIBE.

Supported: ms-piggyback-first-notify

When the client receives the 200 OK SIP response to the SUBSCRIBE request, it SHOULD check whether the preceding header is included in the 200 OK. If it is, the client MAY set the PiggybackNotifyEnabled flag to true, handle this 200 OK response as though it had received a separate NOTIFY request, and parse the content to obtain the presence information.

The first NOTIFY request that the server sends is then delayed until an actual change in presence occurs.

3.4.6 Timer Events

None.

3.4.7 Other Local Events

None.

3.5 Best Effort NOTIFY (BENOTIFY) Extension Details

Session Initiation Protocol Extensions introduces a variant of the regular NOTIFY request that is known as Best Effort NOTIFY (BENOTIFY). The only difference between a BENOTIFY request and a NOTIFY request is that a BENOTIFY request is never responded to: the client never sends a SIP response to a BENOTIFY request, and the server ignores any response to a BENOTIFY request. The advantage of this approach is that it removes unneeded responses from the wire. The disadvantage is that information about the client request is subsequently unavailable.

Note This extension can be enabled independently or together with the batched SUBSCRIBE mechanism.

This extension is optional. An implementation may support it.

3.5.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this specification.

The client MAY use a Boolean flag, BENOTIFYEnabled, for each subscription to track whether BENOTIFY is enabled for that subscription.

The server MAY also use a similar Boolean flag, BENOTIFYEnabled, for each subscription to track whether BENOTIFY is enabled for that subscription.

Note The preceding conceptual data can be implemented by using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.5.1.1 Indicating Support for BENOTIFY

The client signals support for the BENOTIFY mechanism by inserting two headers in the SUBSCRIBE request.

```
Supported: ms-benotify
Proxy-Require: ms-benotify
```

The Proxy-Require header ensures that any intermediate SIP proxy that does not understand this extension and that expects a SIP response to every SIP request to maintain proper **SIP transaction** state will reject the initial subscription at which time the client can resend the SUBSCRIBE minus these headers and disable the BENOTIFY mechanism for this subscription.

3.5.2 Timers

No additional timers are required other than the timers specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.5.3 Initialization

The client SHOULD be registered with the server before sending a SUBSCRIBE request indicating support for BENOTIFY. This is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.5.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.5.5 Message Processing Events and Sequencing Rules

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

The following events are specified in this section:

- [Receiving a Failure Response to SUBSCRIBE](#)
- [Receiving a Success Response to SUBSCRIBE](#)
- [Receiving a BENOTIFY](#)

3.5.5.1 Receiving a Failure Response to SUBSCRIBE

If the client receives a failure response to the SUBSCRIBE request because an intermediate proxy did not support the BENOTIFY extension, it MAY set the BENOTIFYEnabled flag to false and resend the SUBSCRIBE request without the supported:ms-benotify and proxy-require:ms-benotify headers. In this case, the BENOTIFY extension is disabled.

3.5.5.2 Receiving a Success Response to SUBSCRIBE

When a client receives a success response (that is, a 200 OK to the SUBSCRIBE request), it MAY determine whether the server supports BENOTIFY. In a 200 OK response to a SUBSCRIBE request, the server indicates whether it supports BENOTIFY for this client by including the following header:

Supported: ms-benotify

If the preceding header is present in 200 OK, the client MAY set the BENOTIFYEnabled flag to true.

The server MAY choose not to enable BENOTIFY for clients that are known to have unreliable network connectivity. The client SHOULD also be prepared to handle regular NOTIFY requests.

3.5.5.3 Receiving a BENOTIFY Request

On receiving a BENOTIFY request, the client MUST NOT send back a SIP response. The server MUST ignore responses it receives to a BENOTIFY request. The client SHOULD process the content of a BENOTIFY request in a manner identical to the way in which it processes a NOTIFY request.

3.5.6 Timer Events

None.

3.5.7 Other Local Events

None.

3.6 Auto-Extension of Subscriptions Details

As another performance optimization, Session Initiation Protocol Extensions introduce auto-extension of the expiration time of a subscription. Normally with [\[RFC3265\]](#), the client must resend the SUBSCRIBE periodically to refresh the presence subscription. With the auto-extension mechanism, this subscription is automatically refreshed (using the expires value from the initial SUBSCRIBE) whenever a NOTIFY request is sent for this subscription. The client may still need to re-SUBSCRIBE if no NOTIFY traffic is received for the subscription; but this is typically not the case.

This extension is optional. An implementation may support it.

3.6.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this specification.

The client MAY use a Boolean flag, `AutoExtendSubscriptionExpireTimerEnabled`, for each subscription to indicate whether or not auto-extension of that subscription is enabled.

The server MAY also use a similar Boolean flag, `AutoExtendSubscriptionExpireTimerEnabled`, for each subscription to indicate whether or not auto-extension of that subscription is enabled.

Note The preceding conceptual data can be implemented using a variety of techniques. An implementation is at liberty to implement such data in any way convenient.

3.6.2 Timers

Beyond what is specified in [\[RFC3261\]](#) and [\[RFC3265\]](#), the following timer is required.

- `SubscriptionExpireTimer`

Timer to track when a subscription expires. The client SHOULD refresh the subscription before the timer expires. A subscription can be refreshed by sending a SUBSCRIBE request on the dialog established by the first SUBSCRIBE request that resulted in creation of the subscription.

3.6.3 Initialization

The client SHOULD be registered with the server before sending a SUBSCRIBE request with auto-extension support. This is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.6.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.6.4.1 Indicating Support for Auto-Extension of Subscriptions

Support for the auto-extension mechanism is signaled in a header inserted in the SUBSCRIBE request by the client.

```
Supported: com.microsoft.autoextend
```

This header indicates to the server that the client supports the auto-extension mechanism.

3.6.5 Message Processing Events and Sequencing Rules

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

The following events are specified in this section:

- [Receiving a 200 OK Response to SUBSCRIBE](#)
- [Receiving a NOTIFY](#)

3.6.5.1 Receiving a 200 OK Response to SUBSCRIBE

When a client receives a 200 OK success response to the SUBSCRIBE request, it SHOULD determine whether the server supports auto-extension by looking for the Supported: com.microsoft.autoextend header in the response that is sent by the server. If the server supports the extension, it SHOULD indicate this in the 200 OK response by using the following header.

```
Supported: com.microsoft.autoextend
```

The client MAY set the AutoExtendSubscriptionExpireTimerEnabled flag to True if the preceding header is present in the SIP response; otherwise, the client sets the flag to False. If the flag is set to True, the client and the server are ready to auto-extend the subscriptions after they receive a notification. The client operation is explained in section [3.6.5.2](#).

3.6.5.2 Receiving a NOTIFY Request

If the client and server have successfully negotiated the auto-extension for this subscription and the `AutoExtendSubscriptionExpireTimerEnabled` flag is set to true, the client SHOULD reset the SUBSCRIBE expiry timer when it receives a NOTIFY request.

The client SHOULD also reset this timer in a similar manner after it receives any subsequent NOTIFY requests.

3.6.6 Timer Events

None.

3.6.7 Other Local Events

None.

3.7 Contact Management Extensions Details

These extensions support contact management. A client can store on the server a list of contacts with which the client frequently communicates, and can retrieve and subsequently manage this list. The client can also organize the contacts into self-defined groups, storing the list of groups and their membership on the server, and can retrieve and manage the list. This section defines the Session Initiation Protocol (SIP) extensions for adding, deleting, or modifying a contact or a group.

The server can return two types of contact and group lists (see the following). These lists are returned by the server in NOTIFY and BENOTIFY requests, which are generated by the server, or are returned in the body of a 200 OK response (also called a piggyback notify).

1. Full List

A complete list of all contacts and their associated groups. This list is returned from the server in a SIP response to a SUBSCRIBE for the event `vnd-microsoft-roaming-contact`.

The Full List is a list of groups that is followed by a list of contacts. Groups are uniquely numbered. The particular numbering sequence is not persisted and may vary from one transmission to the next. Contacts are cross-referenced against groups by using group ID numbers. Contacts must be in at least one group.

2. Delta List

A list that contains a subset of contacts and associated groups that were either added, modified, or deleted from the Full List. This list is returned from the server in response to any of the following: `SetContact`, `DeleteContact`, `DeleteGroup`, or `ModifyGroup` SERVICE operations.

A Delta List is a list of groups that were added or modified, followed by a list of contacts that were added or modified, followed by a list of groups that were deleted, and finally, followed by a list of contacts that were deleted.

The server maintains a single nonnegative integer version number for the contact/group list of every user. Any time the user performs an operation that modifies the user contact/group list, the version number is incremented.

The version number is returned to the client in the contact list, allowing the client to determine whether it has the most up-to-date information, and to refresh the contact/group list if its state (as seen by the server) needs synchronization. If the client delta number requires synchronization with

the server, it can obtain the current value by subscribing to the vnd-microsoft-roaming-contact event and by looking at the deltaNum attribute of the contactList element in the body of the notification data. The notification data is received in the 200 OK SIP response; or in a separate NOTIFY or BENOTIFY request from the server.

The client can update the contact/group list by sending setContact, deleteContact, modifyGroup, and deleteGroup SOAP requests that are carried in the body of SIP SERVICE requests to the server. The server indicates completion of these requests by sending a SIP response to the SERVICE request.

The contact management extensions are optional. An implementation may support them.

3.7.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this specification.

The client uses the following suggested data structures to facilitate implementation of the contact management extensions:

- Contact: A data structure to represent a contact for the user. A contact is uniquely identified by a URI and may have other properties, such as its display name and the groups to which it belongs.
- Contact List: A list data structure to store all contacts of the user.
- Group: A data structure to represent a group of contacts for the user. A group is uniquely identified by its name. The data structure should include references to the set of contacts that belong to this group.
- Group List: A list data structure to store all the groups for the user.
- Access Control List (ACL): A list data structure to store the access control entries for the user.

The server can use the preceding suggested data structures to store this data for each user who is assigned to this server.

The server can also have a configurable parameter *MaxNumberOfContacts* for each user to keep track of the limit for how many contacts a specific user has.

In addition, both the client and the server should maintain a single nonnegative integer version number for the contact/group list. The client should maintain this version number for the user and the server should have the version number as an attribute for each user who subscribes to the server for the contact/group list. Anytime the user performs an operation that modifies his contact/group list, the version number is incremented by 1. The server should return this version number to the client in the contact list. The version number allows the client to determine if it has the most up-to-date information and to refresh the contact/group list if its state, as seen by the server, is out-of-sync.

The client and the server should also maintain a separate nonnegative integer version number for the ACL list. The client should maintain this version number for the user and the server should have the version number as an attribute for each user who subscribes to the server for the ACL list. Anytime the user performs an operation that modifies their ACL list, the version number is incremented by 1. The server should return this version number to the client along with the ACL list. The version number allows the client to determine if it has the most up-to-date information and to refresh the ACL list if its state, as seen by the server, is out-of-sync.

Note The preceding conceptual data can be implemented by using a variety of techniques. An implementation can implement this data in any way that is convenient.

3.7.2 Timers

There are no additional timers required beyond what is specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.7.3 Initialization

The client SHOULD be registered with the server before retrieving the contact list or performing any contact management operations. Registration is done by sending a REGISTER request to the server, as specified in [\[RFC3261\]](#).

3.7.4 Higher-Layer Triggered Events

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.7.4.1 Subscribing to the Contact/Group List

A client retrieves its contact list and learns of changes to the contact list (made by other clients for this user) through a subscription. The client subscribes to the roaming contact list by sending a SUBSCRIBE request for the vnd-microsoft-roaming-contact event. An example SUBSCRIBE request is as follows.

```
SUBSCRIBE sip:user@tradewind.com SIP/2.0
Via: SIP/2.0/TLS 157.56.65.142:3485
Max-Forwards: 70
From: <sip:user@tradewind.com >;
    tag=51a7d2afbea6420a98d9c7629dacb811;epid=a892397901
To: <sip:user@tradewind.com >
Call-ID: f1c446dc3df340edb144a6e6471abf7b
CSeq: 1 SUBSCRIBE
Contact: <sip:user@tradewind.com:3485;
    maddr=157.56.65.142;transport=tls>;proxy=replace
User-Agent: RTC/1.3

Event: vnd-microsoft-roaming-contacts
Accept: application/vnd-microsoft-roaming-contacts+xml

Supported: com.microsoft.autoextend
Supported: ms-benotify
Proxy-Require: ms-benotify
Supported: ms-piggyback-first-notify
Proxy-Authorization: NTLM qop="auth",
    realm="SIP Communications Service",
    opaque="bfaf9a7c", crand="67b72300",
    cnum="1", targetname="tradewind.com",
    response="0100000064326166c2bdf103d2994f63"
Content-Length: 0
```

Note The Request-URI, To URI, and From URI are all the SIP URIs of the user that is requesting a contact list. The "Event: vnd-microsoft-roaming-contacts" header identifies that this is a roaming contact list subscription. The Accept header contains the only supported content-type for this roaming contact list. The remaining supported and proxy-require headers are described in more detail in the Presence Document.

The full or delta contact/group list is returned by the server in NOTIFY and BENOTIFY requests, or in the body of a 200 OK response (also called a "piggyback notify"). See section [3.7.5.2](#).

3.7.4.2 Subscribing for the ACL

The access control list (ACL) is stored at the server and the client can obtain the ACL after it is registered with the server by using a SUBSCRIBE request. The client sends a SUBSCRIBE with an Event: type of vnd-microsoft-roaming-ACL and an Accept: header with application/vnd-microsoft-roaming-acls+xml. Each device on which the user logs in SHOULD subscribe to this event. The notifications for this **event package** contain the ACL for the user. The initial notification carries the complete ACL, and any changes are conveyed in subsequent notifications. This allows changes made by one device for a user to be communicated to all other devices for the user maintaining a consistent ACL across all devices. The server SHOULD maintain a database to hold the master copy of this ACL list, which all devices sync to at login time.

3.7.4.3 Add/Modify/Delete Contact

Adding, modifying, or deleting a contact is done through setContact and deleteContact SOAP requests carried within a SIP SERVICE verb from the client to the server. Note that in all of these SERVICE requests, the To URI, From URI, and Request-URI are the SIP URI of the user (not the contact). The associated XML schema for these common operations is specified in appendix [E](#).

The server indicates that a setContact or a deleteContact request was successful by sending a 200 OK response to the SERVICE request.

3.7.4.4 Add/Modify/Delete Group

Similarly to managing contacts, managing groups within the contact list is done through modifyGroup, and deleteGroup SOAP requests carried in a SIP SERVICE request from the client to the server. Groups are identified in these requests by an integer (1-63). A contact may belong to one or more groups. Every contact belongs to group #1 by default. This is the default group created automatically by the server, and MUST NOT be created or deleted by the user.

Before a group can be deleted, all contacts must be removed from the group by using DeleteContact operations. The associated XML schema for these operations is specified in section [10](#).

The server indicates that a modifyGroup request or a deleteGroup request was successful by sending a 200 OK response to the SERVICE request.

3.7.5 Message Processing Events and Sequencing Rules

Except as specified in the following sections, the rules for message processing are as specified in [\[RFC3261\]](#) and [\[RFC3265\]](#).

3.7.5.1 Setting ACEs for a Contact

Adding a contact is usually accompanied by a setACE operation to allow that contact to view user presence and communicate with the user.

This is done by using an ACL that is associated with each user object stored in the server database. The ACL is composed of access control entries (ACEs), which are two character strings that encode the permissions attributed to a certain URI relative to a given user. The From URI for an SIP **INVITE** request or a SIP SUBSCRIBE request is compared against the ACL for the user in the To header to determine whether or not the request is to be allowed. This comparison occurs in two different places. The server MUST enforce the presence (SUBSCRIBE) portion of the ACE. The client

MUST enforce the session initiation (INVITE) portion of the ACE. Finally, note that the ACE comparison can take one of three forms: it can apply to all URIs, it can apply to a specific SIP URI, or it can apply to a specific SIP domain.

3.7.5.2 Receiving the Contact List from the Server

The server responds by sending the contact list in a notification. The initial notification is the full contact list. Subsequent notifications are partial notifications containing only the delta from the last notification. The version number ("deltaNum") allows the client to keep in sync with the version stored on the server. In the following example, the contact list is piggybacked on the 200 OK to the SUBSCRIBE. For piggybacking information, see section [3.4](#).

```
SIP/2.0 200 OK
Contact: <sip:tradewind.com:5061;transport=tls;ms-fe="fe.tradewind.com">
Content-Length: 4558
Via: SIP/2.0/TLS 157.56.65.142:3485;
    received=10.10.10.6; ms-received-port=29047;
    ms-received-cid=6c41700
From: <sip:user@tradewind.com>;
    tag=51a7d2afbea6420a98d9c7629dacb811; epid=a892397901
To: <sip:user@tradewind.com="" tag=ee697d7f2d8dc2b899014154efb57a4c
Call-ID: f1c446dc3df340edb144a6e6471abf7b
CSeq: 1 SUBSCRIBE
Expires: 39743
Content-Type: application/vnd-microsoft-roaming-contacts+xml
Event: vnd-microsoft-roaming-contacts
subscription-state: active;expires=39743
Supported: com.microsoft.autoextend, ms-piggyback-first-notify, ms-benotify
<contactList deltaNum="685" >
  <group id="1" name="" externalURI="" />
  <group id="2" name="Team" externalURI="" />
  <group id="3" name="External" externalURI="" />
  <contact uri="contact1@tradewind.com" name=""
    groups="1 3 " subscribed="true" externalURI="" />
  <contact uri="contact2@tradewind.com " name=""
    groups="1 2 " subscribed="true" externalURI="" />
  <contact uri="contact3@tradewind.com " name=""
    groups="1 " subscribed="true" externalURI="" />
  <contact uri="contact4@tradewind.com " name=""
    groups="1 " subscribed="true" externalURI="" />
</contactList>
```

3.7.5.3 Receiving the ACL from the Server

On receiving the ACL from the server in NOTIFY and BENOTIFY requests or in a piggybacked notification, the client SHOULD process it and store all ACEs locally. On receiving any subsequent notifications containing changes to the ACL, the client SHOULD update its local copy.

3.7.6 Timer Events

None.

3.7.7 Other Local Events

None.

4 Protocol Examples

The following sections describe several operations as used in common scenarios to illustrate the function of Session Initiation Protocol Extensions.

4.1 Registration with Kerberos

The following flow outlines how the Kerberos authentication mechanism works during the registration process. At this point in time, the client discovers its outbound proxy and initializes an SA (or context) with it.

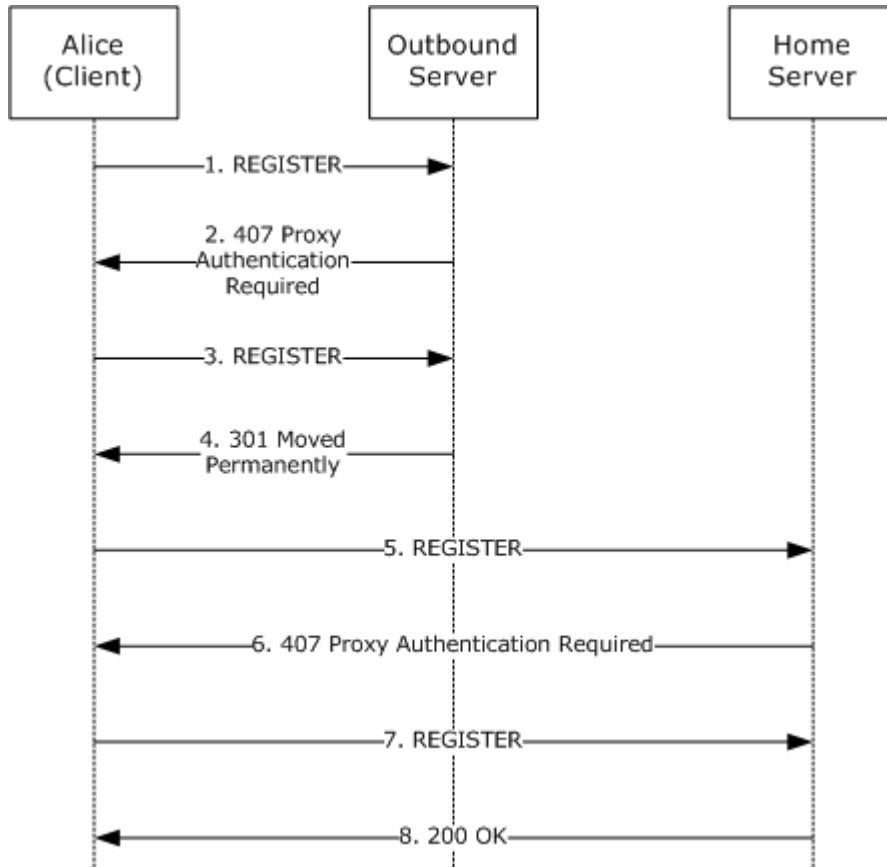


Figure 1: Kerberos registration flow

The fundamental difference between the NTLM Authentication Protocol and Kerberos is the way in which the client answers a challenge from the server. With Kerberos, the client first acquires a Kerberos ticket from the KDC (**Active Directory**) for the specific server that is issuing the challenge. The server is identified by an SPN containing a fully qualified domain name (FQDN). The SPN must be of the form `sip/<FQDN>`. The SPN for a challenge is carried in the `targetname` parameter in the `Proxy-Authenticate:` header of the challenge.

1. Alice's client sends a REGISTER request with no credentials (no `Proxy-Authorization:` header) to the outbound server it selected.

```
REGISTER sip:registrar.contoso.com SIP/2.0
```



```
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bK7
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:Alice@contoso.com
Call-ID: 123213@Alicel.contoso.com
CSeq: 12345 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Contact: "Alice" sip:Alice@Alicel.contoso.com
Content-Length: 0
```

The *epid* parameter on the From: header uniquely identifies this particular endpoint for the user. The server uses this value in subsequent messages to determine the SA with which to sign the message.

2. Authentication is enabled at the outbound server, and it challenges Alice's client. The server indicates support for NTLM and Kerberos in the challenge.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS Alicel.contoso.com;branch=z9hG4bK7
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:Alice@contoso.com>;tag=5564566
Call-ID: 123213@Alicel.contoso.com
CSeq: 12345 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: Kerberos realm="Contoso RTC Service Provider",
    targetname="sip/hs1.contoso.com", qop="auth"
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
    targetname="hs1.contoso.com", qop="auth"
Content-Length: 0
```

The *targetname* parameter carries the SPN for this proxy for Kerberos and the FQDN of the proxy for NTLM. The actual contents of this parameter must be meaningful for this proxy but are opaque to other proxies and the client. It is merely a unique string for correlation of the message header to an SA. Two Proxy-Authenticate: headers are present, indicating the server's capability to do one of Kerberos or NTLM.

The proxy inserts a Date: header in the 407 challenge to allow the client to detect clock skew between the client and server. Both NTLM 2.0 and Kerberos 5.0 require synchronization of the client and server clocks. Clock skew can cause authentication to fail even with valid credentials. The presence of the Date: header allows the client to log this condition and the administrator to correct the deviation.

3. The client acquires a Kerberos ticket for the server indicated in the *targetname* parameter of the Kerberos Proxy-Authenticate: header. The client reissues the request with a Proxy-Authorization: header containing the encoded Kerberos ticket.

```
REGISTER sip:registrar.contoso.com SIP/2.0
Via: SIP/2.0/TLS Alicel.contoso.com;branch=z9hG4bK9
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:Alice@contoso.com
Call-ID: 123213@Alicel.contoso.com
CSeq: 12346 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: Kerberos realm="Contoso RTC Service Provider",
```

```
targetname="sip/hs1.contoso.com", qop="auth", gssapi-data="34fcdf9345345"
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The Cseq number has been incremented. The Call-ID and epid remain the same.

The *targetname* parameter echoes the value of the targetname parameter in the previous Proxy-Authenticate: header. The gssapi-data parameter contains the Kerberos ticket information. The choice of Kerberos authentication is indicated by the scheme (Kerberos) as the first token in the header.

4. On reception of the REGISTER request, the outbound server authenticates the user with the information in the Proxy-Authorization: header. Authentication succeeds, and an SA is created in the outbound server for Alice's client.

The Director then redirects the REGISTER request to point the client at the appropriate home server for this user. The redirect response is signed, using the newly established SA between the client and this proxy.

```
SIP/2.0 301 Moved Permanently
Via: SIP/2.0/TLS Alice1.contoso.com;branch=z9hG4bK9
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:Alice@contoso.com
Call-ID: 123213@Alice1.contoso.com
CSeq: 12346 REGISTER
Proxy-Authentication-Info:
  Kerberos realm="Contoso RTC Service Provider",
  targetname="sip/hs1.contoso.com", qop="auth", opaque="ACDC123",
  srand="3453453", snum=1, rspauth="23423acfdee2"
Contact: sip:hs2.contoso.com
Content-Length: 0
```

The Proxy-Authentication-Info: header carries the signature for this SIP message. The snum is set to 1 as this is the first message signed with the newly established SA. The srand parameter contains the (random) SALT value used by the server to generate the signature. The opaque parameter contains a unique token for this newly established SA.

5. The client receives the redirect response, verifies the signature using the now complete SA for the outbound proxy, and reissues the REGISTER request to its proper home server.

```
REGISTER sip:hs2.contoso.com SIP/2.0
Via: SIP/2.0/TLS Alice1.contoso.com;branch=z9hG4bKa
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:Alice@contoso.com
Call-ID: 123213@Alice1.contoso.com
CSeq: 12347 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Contact: "Alice" sip:Alice@Alice1.contoso.com
Content-Length: 0
```

The client will replace its current outbound proxy with the proxy indicated in the Contact: header of the 301 response. The REGISTER request is sent to this new outbound proxy (the user's true

home server). Because no SA exists yet with this new outbound proxy, no Proxy-Authorization: header is present in the request.

6. Alice's home server receives the REGISTER request and issues a challenge, indicating support for NTLM and Kerberos.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS Alicel.contoso.com;branch=z9hG4bKa
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:Alice@contoso.com>;tag=8823488
Call-ID: 123213@Alicel.contoso.com
CSeq: 12347 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: Kerberos realm="Contoso RTC Service Provider",
    targetname="sip/hs2.contoso.com", qop="auth"
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
    targetname="hs2.contoso.com", qop="auth"
Content-Length: 0
```

The *targetname* parameter for Kerberos contains the SPN for Alice's home server. The two Proxy-Authenticate: headers indicate support for Kerberos and NTLM, respectively. The Realm is the same as for HS1 because they fall under the same protection space. This means the client will use the same credentials in responding to HS2's challenge.

7. Alice's client receives the challenge, selects Kerberos authentication, and reissues the REGISTER request to her home server. The client will acquire a Kerberos ticket for HS2 and include this information in the *gssapi-data* parameter of the Proxy-Authorization: header.

```
REGISTER sip:hs2.contoso.com SIP/2.0
Via: SIP/2.0/TLS Alicel.contoso.com;branch=z9hG4bKc
From: Alice <sip:Alice@contoso.com>;
    tag=354354535;
    epid=6534555
To: Alice sip:Alice@contoso.com
Call-ID: 123213@Alicel.contoso.com
CSeq: 12348 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: Kerberos realm=Contoso RTC Service Provider,
    targetname=sip/hs2.contoso.com,
    qop=auth, gssapi-data=8234934234,
    opaque=CDEF1245
Contact: Alice sip:alice@allicel.contoso.com
Content-Length: 0
```

The Cseq: number is incremented. The Call-ID and epid remain the same. The Proxy-Authorization: header indicates support for Kerberos authentication.

8. Alice's home server receives the REGISTER request, verifies the Kerberos ticket, and processes the REGISTER request. The SA between Alice's home server and Alice's client is now complete. The server responds to the REGISTER request and signs the response using the newly completed SA. The *epid* parameter from the From: header is saved as part of the registration information for Alice. This value will be inserted in the To: header of subsequent requests that are forwarded to Alice via her home server (registrar).

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS Alice1.contoso.com;branch=z9hG4bKc
From: "Alice" <sip:Alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:Alice@contoso.com>;tag=8823488
Call-ID: 123213@Alice1.contoso.com
CSeq: 12348 REGISTER
Expires: 3600
Proxy-Authentication-Info:
    Kerberos realm="Contoso RTC Service Provider",
    targetname="sip/hs2.contoso.com", qop="auth",
    opaque="CDEF1245", rspauth="fefeacdd", srand=98984345, snum=1
Contact: "Alice" sip:Alice@Alice1.contoso.com
Content-Length: 0
```

The *epid* parameter on the From: header is used by the server to determine how to sign this response (find the SA). The signature for this response is carried in the *rspauth* parameter of the Proxy-Authentication-Info: header. The *opaque* parameter indicates the newly established SA. Because this is the first signed message from HS2 to the client, the *snum* parameter is set to 1.

4.2 Registration with NTLM

The following call flow outlines how the NTLM Authentication Protocol authentication mechanism works.

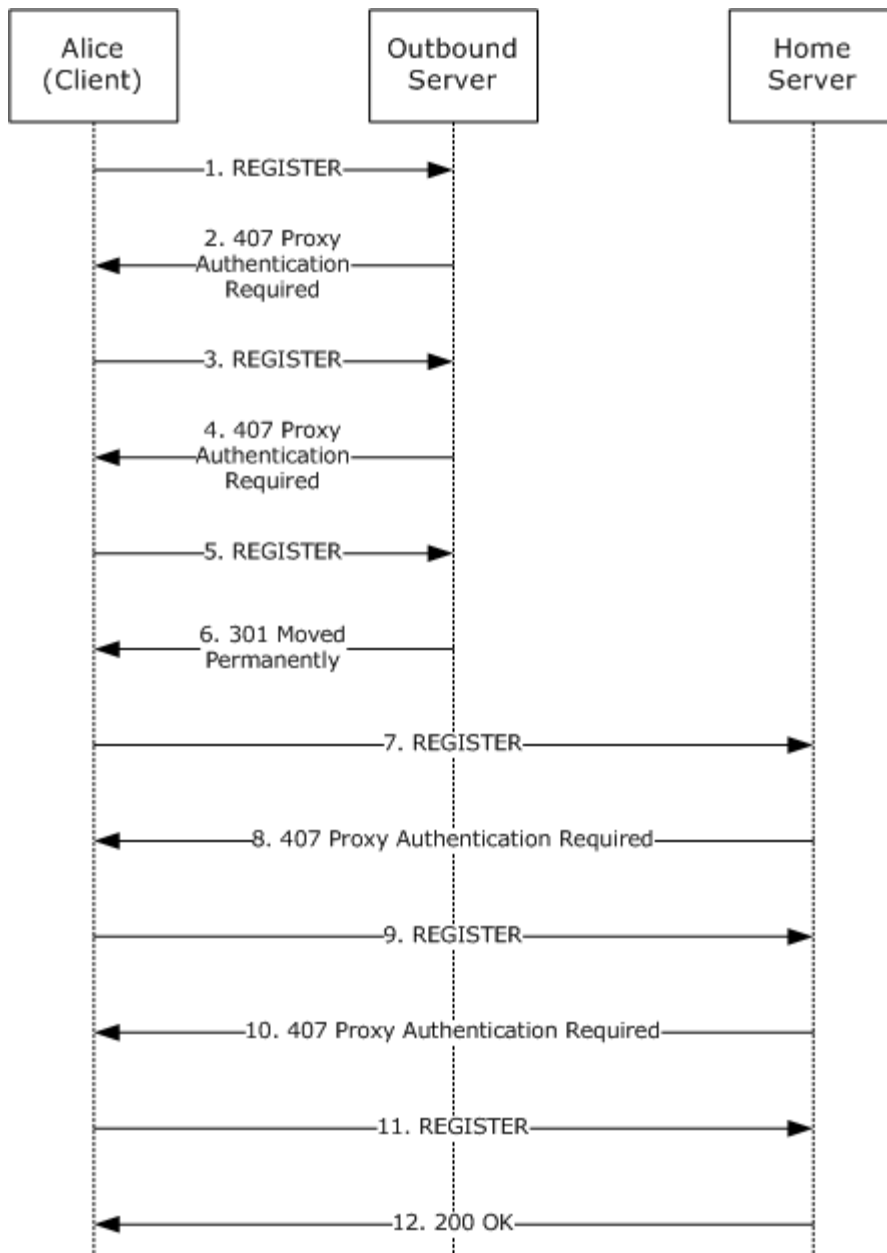


Figure 2: NTLM registration flow

1. Alice's client sends a REGISTER request with no credentials (no Proxy-Authorization: header) to the server.

```

REGISTER sip:registrar.contoso.com SIP/2.0
Via: SIP/2.0/TLS alice1.contoso.com;branch=z9hG4bK7
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12345 REGISTER
  
```

```
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The epid parameter on the From: header uniquely identifies this particular endpoint for the user. The server will use this value in subsequent messages to determine the SA with which to sign the message.

2. Authentication is enabled at the outbound server, and it challenges Alice's client. The server indicates support for NTLM and Kerberos in the challenge.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS alice1.contoso.com;branch=z9hG4bK7
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:alice@contoso.com>;tag=5564566
Call-ID: 123213@alice1.contoso.com
CSeq: 12345 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: Kerberos realm="Contoso RTC Service Provider",
    targetname="sip/hs1.contoso.com", qop="auth"
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
    targetname="hs1.contoso.com", qop="auth"
Content-Length: 0
```

The targetname parameter carries the FQDN for this proxy for NTLM and the SPN of the proxy for Kerberos. The actual content of this parameter must be meaningful for this proxy but is opaque to other proxies and the client. It is merely a unique string for correlation of the message header to an SA. Three Proxy-Authenticate: headers are present, indicating the server's capability to do one of Kerberos or NTLM.

The proxy inserts a Date: header in the 407 challenge to allow the client to detect clock skew between the client and server. Both NTLM 2.0 and Kerberos 5.0 require synchronization of the client and server clocks. Clock skew can cause authentication to fail even with valid credentials. The presence of the Date: header allows the client to log this condition and the administrator to correct the deviation.

3. The client reissues the REGISTER request, indicating support for NTLM authentication.

```
REGISTER sip:registrar.contoso.com SIP/2.0
Via: SIP/2.0/TLS alice1.contoso.com;branch=z9hG4bK8
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12346 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: NTLM realm="Contoso RTC Service Provider",
    targetname="hs1.contoso.com",qop="auth",gssapi-data=""
    Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The Cseq number has been incremented. The Call-ID and epid remain the same.

The targetname parameter echoes the value of the targetname parameter in the previous Proxy-Authenticate: header. The empty gssapi-data parameter indicates that no credentials (password) are being sent in this header. The choice of NTLM authentication is indicated by the scheme (NTLM) as the first token in the header.

4. The outbound server responds with a 407 containing a Proxy-Authenticate: header, which includes the NTLM challenge.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bK8
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:alice@contoso.com>;tag=5564566
Call-ID: 123213@alice1.contoso.com
CSeq: 12346 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
    targetname="hsl.contoso.com", qop="auth",
    gssapi-data ="345435acdecbba", opaque="ACDC123"
Content-Length: 0
```

The gssapi-data parameter carries the challenge. The opaque parameter serves as an index to the (incomplete) SA state on the proxy.

5. Alice's client reissues the REGISTER request with a response to the outbound server's challenge.

```
REGISTER sip:registrar.contoso.com SIP/2.0
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bK9
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12347 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: NTLM realm="Contoso RTC Service Provider",
    targetname="hsl.contoso.com", qop="auth",
    gssapi-data="34fcdf9345345", opaque="ACDC123"
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The Cseq number has been incremented. The Call-ID and epid remain the same. The gssapi-data parameter carries the client's response to the challenge. The opaque parameter is echoed from the previous challenge.

6. On reception of the REGISTER request, the outbound server authenticates the user with the information in the Proxy-Authorization: header. Authentication succeeds, and a SA is created in the outbound server for Alice's client.

The outbound server then redirects the REGISTER request to point the client at the appropriate home server for this user. The redirect response is signed, using the newly established SA between the client and this proxy.

```
SIP/2.0 301 Moved Permanently
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bK9
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
```

```
Call-ID: 123213@alice1.contoso.com
CSeq: 12347 REGISTER
Proxy-Authentication-Info: NTLM realm="Contoso RTC Service Provider",
  targetname="hs1.contoso.com", qop="auth", opaque="ACDC123",
  srand="3453453", snum=1, rspauth="23423acfdee2"
Contact: sip:hs2.contoso.com
Content-Length: 0
```

The Proxy-Authentication-Info: header carries the signature for this SIP message. The snum is set to 1 because this is the first message signed with the newly established SA. The srand parameter contains the (random) SALT value used by the server to generate the signature.

7. The client receives the redirect response, verifies the signature using the now complete SA for the outbound proxy, and reissues the REGISTER request to its proper home server.

```
REGISTER sip:hs2.contoso.com SIP/2.0
Via: SIP/2.0/TLS alice1.contoso.com;branch=z9hG4bKa
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12348 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The client will replace its current outbound proxy with the proxy indicated in the Contact: header of the 301 response. The REGISTER request is sent to this new outbound proxy (the user's true home server). Since no SA exists yet with this new outbound proxy, no Proxy-Authenticate: header is present in the request.

8. Alice's home server receives the REGISTER request and issues a challenge, indicating support for NTLM and Kerberos authentication.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS alice1.contoso.com;branch=z9hG4bKa
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:alice@contoso.com>;tag=8823488
Call-ID: 123213@alice1.contoso.com
CSeq: 12348 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: Kerberos realm="Contoso RTC Service Provider",
  targetname="hs2.contoso.com", qop="auth"
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
  targetname="hs2.contoso.com", qop="auth"
Content-Length: 0
```

The targetname parameter contains the FQDN for Alice's home server. The two Proxy-Authenticate: headers indicate support for Kerberos and NTLM, respectively. The Realm is the same as for HS1 because they fall under the same protection space. This means the client will use the same credentials in responding to HS2's challenge.

9. Alice's client receives the challenge, selects NTLM authentication, and reissues the REGISTER request to her home server.


```
REGISTER sip:hs2.contoso.com SIP/2.0
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bKb
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12349 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: NTLM realm="Contoso RTC Service Provider",
    targetname="hs2.contoso.com",qop="auth",gssapi-data=""
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The Cseq: number is incremented. The Call-ID and epid remain the same. The Proxy-Authorization: header indicates support for NTLM authentication.

10. Alice's home server receives the REGISTER request and issues an appropriate NTLM challenge.

```
SIP/2.0 407 Proxy Authentication Required
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bKb
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:alice@contoso.com>;tag=8823488
Call-ID: 123213@alice1.contoso.com
CSeq: 12349 REGISTER
Date: Sat, 13 Nov 2010 23:29:00 GMT
Proxy-Authenticate: NTLM realm="Contoso RTC Service Provider",
    targetname="hs2.contoso.com", qop="auth",
    opaque="CDEF1245", gssapi-data="dfd345435d"
Content-Length: 0
```

The gssapi-data parameter contains the NTLM challenge. The opaque parameter identifies the (incomplete) SA on Alice's home server.

11. Alice's client responds to the challenge from Alice's home server by reissuing the REGISTER request.

```
REGISTER sip:hs2.contoso.com SIP/2.0
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bKc
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" sip:alice@contoso.com
Call-ID: 123213@alice1.contoso.com
CSeq: 12350 REGISTER
Max-Forwards: 70
User-Agent: Windows RTC/1.1.2600
Proxy-Authorization: NTLM realm="Contoso RTC Service Provider",
    targetname="hs2.contoso.com",qop="auth",
    gssapi-data="8234934234", opaque="CDEF1245"
Contact: "Alice" sip:alice@alice1.contoso.com
Content-Length: 0
```

The CSeq number is incremented. The Call-ID remains the same. The opaque parameter is echoed from the server's challenge. The gssapi-data parameter carries the response to the server's challenge.

12. Alice's home server receives the REGISTER request, verifies the response to its challenge, and processes the REGISTER request. The SA between Alice's home server and Alice's client is now complete. The server responds to the REGISTER request and signs the response using the newly completed SA. The epid parameter from the From: header is saved as part of the registration information for Alice. This value will be inserted in the To: header of subsequent requests that are forwarded to Alice via her home server (registrar).

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS alicel.contoso.com;branch=z9hG4bKc
From: "Alice" <sip:alice@contoso.com>;tag=354354535;epid=6534555
To: "Alice" <sip:alice@contoso.com>;tag=8823488
Call-ID: 123213@alicel.contoso.com
CSeq: 12350 REGISTER
Expires: 3600
Proxy-Authentication-Info: NTLM realm="Contoso RTC Service Provider",
    targetname="hs2.contoso.com", qop="auth", opaque="CDEF1245",
    rspauth="fefeacdd", srand=98984345, snum=1
Contact: "Alice" sip:alice@alicel.contoso.com
Content-Length: 0
```

The epid parameter on the From: header is used by the server to determine how to sign this response (find the SA). The signature for this response is carried in the rspauth parameter of the Proxy-Authentication-Info: header.

4.3 Batched SUBSCRIBE and Piggybacked NOTIFY Example

This example shows the use of a batched SUBSCRIBE request by the client to subscribe for presence information of multiple contacts with a single subscription. It also shows how the server returns the presence information as a piggybacked notification within the 200 OK response to the SUBSCRIBE request.



Figure 3: Batched SUBSCRIBE request and piggybacked NOTIFY example

The client sends a batched SUBSCRIBE request to subscribe for presence information of two other users: user2 and user3. The content-type of the SUBSCRIBE request is application/adrl+xml, and the xml body includes user2 and user3 URIs in the list of resources to subscribe to. Note that the SUBSCRIBE request also includes the Supported: ms-piggyback-first-notify header, indicating that the client supports piggybacked NOTIFY requests.

```
SUBSCRIBE sip:user1@server.contoso.com SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:14383
Max-Forwards: 70
From: "User 1" <sip:user1@server.contoso.com>
;tag=90ee61ca61c643f9b80c582e3d3e5aae;epid=f540d58d81
```

```

To: sip:user1@server.contoso.com
Call-ID: fb80bc9af4974421b96cebd16ea599f2
CSeq: 1 SUBSCRIBE
Contact:
  <sip:user1@server.contoso.com:14383;
    maddr=11.22.33.44;transport="tcp">
;proxy=replace
User-Agent: RTC/1.3
Event: presence
Accept:
  application/rlmi+xml,text/xml+msrtc.pidf,multipart/related
Supported: com.microsoft.autoextend
Supported: ms-benotify
Proxy-Require: ms-benotify
Supported: ms-piggyback-first-notify
Require: adhoclist
Supported: eventlist
Proxy-Authorization: Kerberos qop="auth", realm="SIP
  Communications Service", opaque="1CF1F9E0", crand="541f0209",
  cnum="5", targetname="sip/server.contoso.com",
  response="602306092a864886f71201020201011100
  ffffffff066ded2537aaae51fb4e69ca00ea6b20"
Content-Type: application/adrl+xml
Content-Length: 334
<adhoclist xmlns="urn:ietf:params:xml:ns:adrl"
  uri="sip:user1@server.contoso.com"
  name="sip:user1@server.contoso.com">
  <create xmlns="">
    <resource uri="sip:user2@server.contoso.com" />
    <resource uri="sip:user3@server.contoso.com" />
  </create>
</adhoclist>

```

The server accepts the SUBSCRIBE request by sending a 200 OK. In this example, the server supports piggybacked NOTIFY and includes the Supported: ms-piggyback-first-notify header in the 200 OK response. The multipart body of the 200 OK contains the batched Presence Documents for user2 and user3. If the server did not support piggybacked NOTIFY, the same body would have been sent in a separate NOTIFY instead.

```

SIP/2.0 200 OK
Authentication-Info:
  Kerberos rspauth="602306092A864886F71201020201011100
    FFFFFFFF6B2C6E2C3D68634CD116221CDDF5C40",
    srand="0AEB0220", snum="7", opaque="1CF1F9E0", qop="auth",
    targetname="sip/server.contoso.com",
    realm="SIP Communications Service"
Contact: sip:server.contoso.com;transport=tcp
Content-Length: 1672
Via: SIP/2.0/TCP 11.22.33.44:14383;
  ms-received-port=1624;ms-received-cid=12c00
From: "User 1" <sip:user1@server.contoso.com>
  ;tag=90ee61ca61c643f9b80c582e3d3e5aae;epid=f540d58d81
To: <sip:user1@server.contoso.com>
  ;tag=A53585F7
Call-ID: fb80bc9af4974421b96cebd16ea599f2
CSeq: 1 SUBSCRIBE

```

```

Expires: 24767
Require: eventlist
Content-Type: multipart/related; type="application/rlmi+xml";
  start=resourceList; boundary=e7904a528704417c9a90297d24081f8e
Event: presence
subscription-state: active;expires=24767
ms-piggyback-cseq: 1
Supported: com.microsoft.autoextend, ms-piggyback-first-notify,
  ms-benotify
--e7904a528704417c9a90297d24081f8e
Content-Transfer-Encoding: binary
Content-ID: resourceList
Content-Type: application/rlmi+xml
<list xmlns="urn:ietf:params:xml:ns:rlmi"
  uri="sip:user1@server.contoso.com"
  version="0" fullState="true">
  <resource uri="sip:user2@server.contoso.com">
    <instance id="0" state="active"
      cid="user2@server.contoso.com" />
  </resource>
  <resource uri="sip:user3@server.contoso.com">
    <instance id="0" state="active"
      cid="user3@server.contoso.com" />
  </resource>
</list>
--e7904a528704417c9a90297d24081f8e
Content-Transfer-Encoding: binary
Content-ID: user2@server.contoso.com
Content-Type: text/xml+msrtc.pidf
<presentity uri="user2@server.contoso.com"
  xmlns="http://schemas.microsoft.com/2002/09/sip/presence"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
  <availability aggregate="0" description="" />
  <activity aggregate="0" description="" />
  <displayName displayName="User 2" />
</presentity>
--e7904a528704417c9a90297d24081f8e
Content-Transfer-Encoding: binary
Content-ID: user3@server.contoso.com
Content-Type: text/xml+msrtc.pidf
<presentity uri="user3@server.contoso.com"
  xmlns="http://schemas.microsoft.com/2002/09/sip/presence"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
  <availability aggregate="0" description="" />
  <activity aggregate="0" description="" />
  <displayName displayName="User 3" />
</presentity>
--e7904a528704417c9a90297d24081f8e--

```

4.4 Best Effort NOTIFY Example

This example demonstrates the use of a BENOTIFY request to eliminate the need for the client to send a response to the notifications sent by the server.

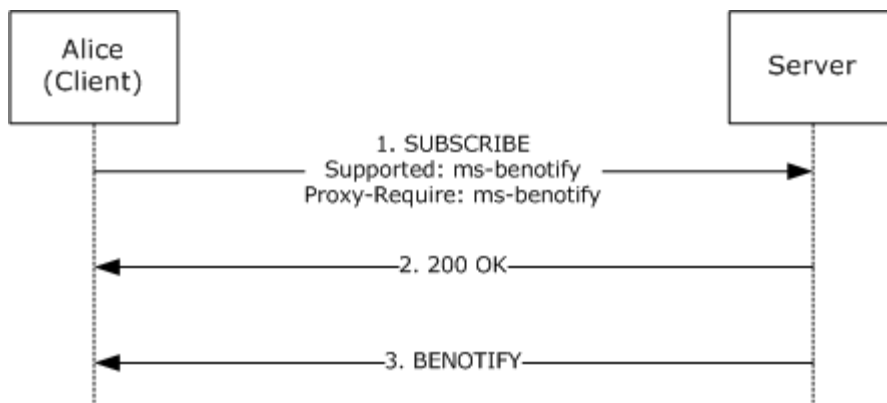


Figure 4: BENOTIFY request example

Notice that in the previous example, the client includes the `Supported: ms-benotify` and `Proxy-Require: ms-benotify` headers in the SUBSCRIBE request. The 200 OK response also includes the `Supported: ms-benotify` header, indicating that the server also supports BENOTIFY. The client SHOULD now be ready to receive BENOTIFY messages from the server.

When the presence information of the user's clients is subscribed to changes, the server sends an update to the client by using a BENOTIFY message. The BENOTIFY is similar to a NOTIFY except that the client does not send a response to the BENOTIFY request.

```

BENOTIFY sip:11.22.33.44:1677;transport=tcp;
  ms-received-cid=13000 SIP/2.0
Authentication-Info: Kerberos
  rspauth="602306092A864886F71201020201011100
          FFFFFFFFDD5FE865F40D223A53244106E693F3D",
          srand="8C489988", snum="13", opaque="B23769DD",
          qop="auth", targetname="sip/server.contoso.com",
          realm="SIP Communications Service"
Via: SIP/2.0/TCP 10.196.50.15;branch=z9hG4bK50867967.8D409A15;
  branched=FALSE
Max-Forwards: 70
Content-Length: 1127
From: <sip:user2@server.contoso.com>
  ;tag=DD35C0B2
To: <sip:user2@server.contoso.com>
  ;tag=9c4ef27513d24eb9be781420407b2a87;epid=62ccbeb808
Call-ID: 91c6c88de3c04d5180d9a2e1434a18dd
CSeq: 2 BENOTIFY
Require: eventlist
Content-Type: text/xml+msrtc.pidf
Event: presence
subscription-state: active;expires=28367
<presentity uri="user1@server.contoso.com"
  xmlns="http://schemas.microsoft.com/2002/09/sip/presence"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <availability aggregate="300" description=""
    epid="03640fc59f" />
  <activity aggregate="400" description=""
    epid="03640fc59f" />
  <displayName displayName="User 1" />
  <devices>
    <devicePresence epid="03640fc59f" ageOfPresence="30"

```

```

    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:m="http://schemas.microsoft.com/winrtc/2002/11/sip">
<availability aggregate="300" description="online" />
<activity aggregate="400" description="Active"
    note="Note: I am online" />
    <email email="someone@microsoft.com"
xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence">
    </email>
    <deviceName
        name="HOSTNAME"
xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence">
    </deviceName>
    <rtc:devicedata
        namespace="rtcsample"
xmlns:rtc="http://schemas.microsoft.com/2002/09/sip/client/presence">
        &lt;![CDATA[<applicationname>RTC Sample</applicationdata>]]&gt;
    </rtc:devicedata>
    </devicePresence>
</devices>
</presence>

```

4.5 setPresence Example

This example demonstrates the use of the setPresence request.

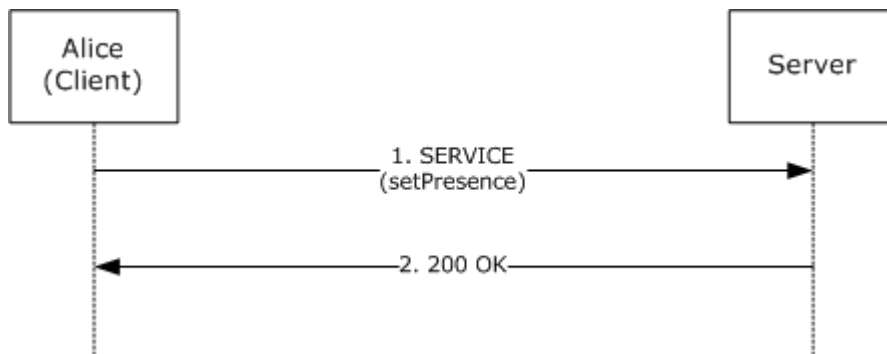


Figure 5: Example of a setPresence request

The client sends a SERVICE request to the server to update its presence information stored at the server. Any other clients subscribing to the presence of this client are then notified of the change by the server, which uses a NOTIFY or BENOTIFY request.

```

SERVICE sip:user2@server.contoso.com SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:14423
Max-Forwards: 70
From: "User 2" <sip:user2@server.contoso.com>
    ;tag=04bc6b4751344d05a8ae1c357e5b7ad1;epid=62ccbeb808
To: sip:user2@server.contoso.com
Call-ID: a61392c00bc14f74a1ef3293242e902a
CSeq: 1 SERVICE
Contact: <sip:user2@server.contoso.com:14423;maddr=11.22.33.44;
    transport="tcp">
    ;proxy=replace
User-Agent: RTC/1.3.5369

```

```

Proxy-Authorization: Kerberos qop="auth", realm="SIP
Communications Service", opaque="B23769DD", crand="134ce932",
cnum="5", targetname="sip/server.contoso.com",
response="602306092a864886f71201020201011100
          ffffffff95b096c3a5d25aalbb814c785aaa4957"
Content-Type: application/SOAP+xml
Content-Length: 822
<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:setPresence
      xmlns:m="http://schemas.microsoft.com/winrtc/2002/11/sip">
      <m:presentity m:uri="sip:user2@server.contoso.com">
        <m:availability m:aggregate="300"
          m:description="online" />
        <m:activity m:aggregate="400" m:description="Active"
          m:note="Note: I am online" />
        <email
          xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence"
          email="someone@microsoft.com" />
        <deviceName
          xmlns="http://schemas.microsoft.com/2002/09/sip/client/presence"
          name="HOSTNAME" />
        <rtc:devicedata
          xmlns:rtc="http://schemas.microsoft.com/2002/09/sip/client/presence"
          namespace="rtcsample">
          &lt;![CDATA[<applicationname>RTC Sample</applicationdata>]]&gt;
        </rtc:devicedata>
      </m:presentity>
    </m:setPresence>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

The server responds to the SERVICE request with a 200 OK to indicate that the request was successfully processed by the server.

```

SIP/2.0 200 OK
Authentication-Info:
Kerberos rspauth="602306092A864886F71201020201011100
                FFFFFFFF6AD66F99AD4B9143B76C025FE19FC23",
                srand="060568FB", snum="6", opaque="B23769DD", qop="auth",
                targetname="sip/server.contoso.com",
                realm="SIP Communications Service"
Via: SIP/2.0/TCP 11.22.33.44:14423;ms-received-port=1677;
    ms-received-cid=13000
From: "User 2"<sip:user2@server.contoso.com>
    ;tag=04bc6b4751344d05a8ae1c357e5b7ad1;epid=62ccbeb808
To: <sip:user2@server.contoso.com>
    ;tag=07BC9BC862C48C8F4FE7756322318F0A
Call-ID: a61392c00bc14f74a1ef3293242e902a
CSeq: 1 SERVICE
Content-Length: 0

```

4.6 AddContact Example

This example demonstrates an AddContact request sent by the client to the server to add a contact to its contact list.

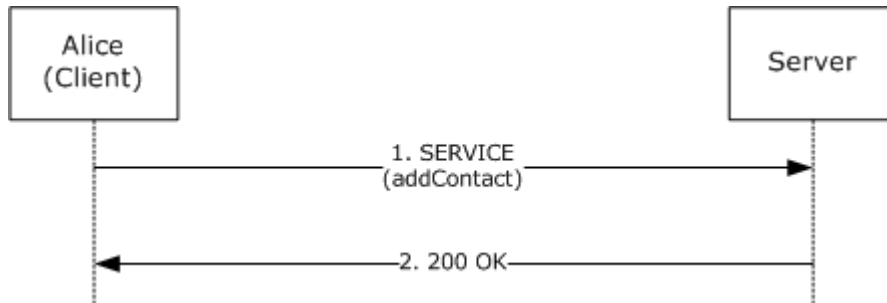


Figure 6: AddContact request example

The client sends a SERVICE request with a SOAP envelope/xml envelope in the body. The `m:setContact` element indicates to the server that this request is for adding or modifying a contact. The xml contains the display name and URI of the contact that is being added along with any groups of which this contact is a member and whether the client is subscribed for presence information of this contact.

```
SERVICE sip:server.contoso.com;transport=tcp SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:13684
Max-Forwards: 70
From: <sip:user1@server.contoso.com>
;tag=e6b525fb274245a0b61ddb877b7d0b9;epid=df527db094
To: <sip:user1@server.contoso.com>
;tag=01C341BA
Call-ID: b7c3b37ba4144a39a9bc82c224147f0c
CSeq: 2 SERVICE
Contact: <sip:user1@server.contoso.com:13684;maddr=11.22.33.44;
transport="tcp">
;proxy=replace
User-Agent: RTC/1.3.5369
Proxy-Authorization: Kerberos gop="auth", realm="SIP
Communications Service", opaque="C71765D4", crand="d48aaa37",
cnum="6", targetname="sip/server.contoso.com",
response="602306092a864886f71201020201011100
ffffffffe25204ecf3fb4be0326639f5ee6f0f44"
Content-Type: application/soap+xml
Content-Length: 407
<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<m:setContact
xmlns:m="http://schemas.microsoft.com/winrtc/2002/11/sip">
<m:displayName>buddy 1</m:displayName>
<m:groups />
<m:subscribed>>true</m:subscribed>
<m:URI>sip:user4@server.contoso.com</m:URI>
<m:externalURI />
<m:deltaNum>12</m:deltaNum>
</m:setContact>
</SOAP-ENV:Body>
```



```
</SOAP-ENV:Envelope>
```

The server responds to the SERVICE request with a 200 OK to indicate that the AddContact request was successful. The 200 OK response does not have a body.

```
SIP/2.0 200 OK
Authentication-Info:
  Kerberos rspauth="602306092A864886F71201020201011100
    FFFFFFFF545C705C4485BF958371C44ACFE31E3",
    srand="669CF161", snum="7", opaque="C71765D4", qop="auth",
    targetname="sip/server.contoso.com",
    realm="SIP Communications Service"
Via: SIP/2.0/TCP 11.22.33.44:13684;ms-received-port=1558;
  ms-received-cid=12a00
From: <sip:user1@server.contoso.com>;
  tag=e6b525fb274245a0b61ddb877b7d0b9;epid=df527db094
To: <sip:user1@server.contoso.com>;tag=01C341BA
Call-ID: b7c3b37ba4144a39a9bc82c224147f0c
CSeq: 2 SERVICE
Content-Length: 0
```

4.7 DeleteContact Example

This example demonstrates a DeleteContact request sent by the client to the server to delete a contact from its contact list.

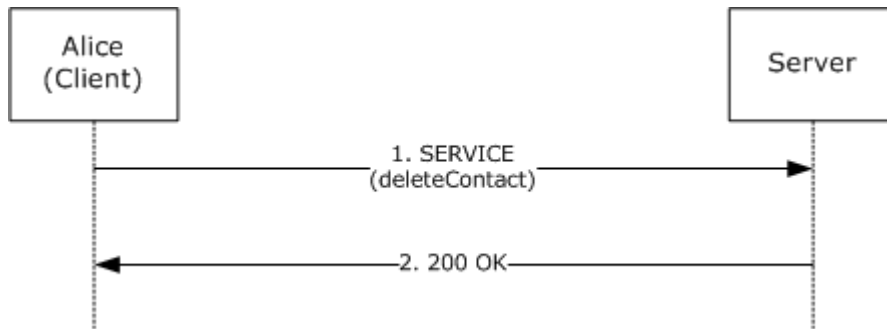


Figure 7: DeleteContact request example

The client sends a SERVICE request with a SOAP envelope/xml envelope in the body. The `m:deleteContact` element indicates to the server that this request is for deleting a contact. The xml contains the URI of the contact that is being deleted. There is no need to specify any other properties of the contact because a contact can be uniquely identified by the URI.

```
SERVICE sip:server.contoso.com;transport=tcp SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:13684
Max-Forwards: 70
From: <sip:user1@server.contoso.com>
  ;tag=e6b525fb274245a0b61ddb877b7d0b9;epid=df527db094
To: <sip:user1@server.contoso.com>
  ;tag=01C341BA
Call-ID: b7c3b37ba4144a39a9bc82c224147f0c
CSeq: 5 SERVICE
Contact: <sip:user1@server.contoso.com:13684;maddr=11.22.33.44;
```

```

        transport="tcp">
;proxy=replace
User-Agent: RTC/1.3.5369
Proxy-Authorization: Kerberos qop="auth", realm="SIP
Communications Service", opaque="C71765D4", crand="7435fe84",
cnum="12", targetname="sip/server.contoso.com",
response="602306092a864886f71201020201011100
ffffff7eba7f0331d6d9673f8bec24c9d4e389"
Content-Type: application/SOAP+xml
Content-Length: 315
<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<m:deleteContact
xmlns:m="http://schemas.microsoft.com/winrttc/2002/11/sip">
<m:URI>sip:user4@server.contoso.com</m:URI>
<m:deltaNum>15</m:deltaNum>
</m:deleteContact>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

The server responds to the SERVICE request with a 200 OK to indicate that the DeleteContact request was successful. The 200 OK response does not have a body.

```

SIP/2.0 200 OK
Authentication-Info: Kerberos
rspauth="602306092A864886F71201020201011100
FFFFFFFF7C224F0AC87E91DFE9D4A49F974961E9",
srand="03254599", snum="16", opaque="C71765D4", qop="auth",
targetname="sip/server.contoso.com",
realm="SIP Communications Service"
Via: SIP/2.0/TCP 11.22.33.44:13684;
ms-received-port=1558;ms-received-cid=12a00
From: <sip:user1@server.contoso.com>
;tag=e6b525fb274245a0b61ddb8e877b7d0b9;epid=df527db094
To: <sip:user1@server.contoso.com>
;tag=01C341BA
Call-ID: b7c3b37ba4144a39a9bc82c224147f0c
CSeq: 5 SERVICE
Content-Length: 0

```

4.8 AddGroup Example

This example demonstrates an AddGroup request that is sent by the client to the server to add a group to the list of groups for this client.

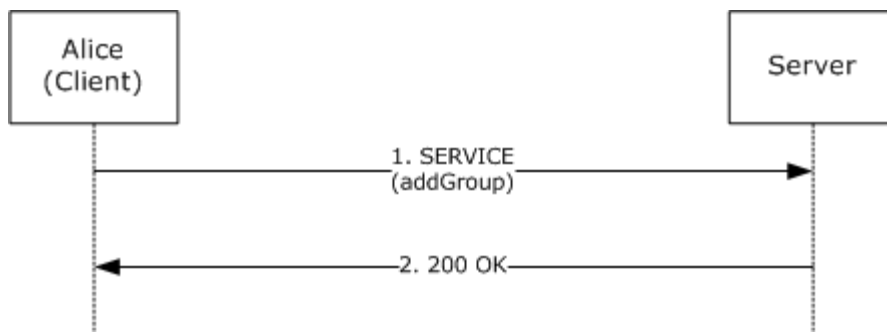


Figure 8: AddGroup request example

The client sends a SERVICE request with a SOAP envelope/xml envelope in the body. The m:addGroup element indicates to the server that this request is for adding a group. The XML contains the name of the group, which is "Friends" in this case.

```

SERVICE sip:server.contoso.com;transport=tcp SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:14383
Max-Forwards: 70
From: <sip:user1@server.contoso.com>
;tag=c3c995d890e144b2aa7f2bd38c424a51;epid=f540d58d81
To: <sip:user1@server.contoso.com>
;tag=5FDD7BA7
Call-ID: f34928e3852c434a85a1f3c0e1e8a449
CSeq: 2 SERVICE
Contact: <sip:user1@server.contoso.com:14383;
maddr=11.22.33.44;transport="tcp">
;proxy=replace
User-Agent: RTC/1.3.5369
Proxy-Authorization: Kerberos qop="auth",
realm="SIP Communications Service", opaque="1CF1F9E0",
crand="2daa2825", cnum="7", targetname="sip/server.contoso.com",
response="602306092a864886f71201020201011100
fffffffb0dd9fa33c820618ea9ff577dcb659b8"
Content-Type: application/SOAP+xml
Content-Length: 281

<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<m:addGroup
xmlns:m="http://schemas.microsoft.com/winrt/2002/11/sip">
<m:name>Friends</m:name>
<m:externalURI />
<m:deltaNum>16</m:deltaNum>
</m:addGroup>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
  
```

The server responds to the SERVICE request with a 200 OK to indicate that the AddGroup request was successful. The 200 OK response may or may not have a body.

```

SIP/2.0 200 OK
Authentication-Info: Kerberos
    rspauth="602306092A864886F71201020201011100
        FFFFFFFF18134184AFDFDDE2B92BA96B6B8318F9",
    srand="A8D0D0FF", snum="8", opaque="1CF1F9E0", qop="auth",
    targetname="sip/server.contoso.com",
    realm="SIP Communications Service"
Content-Length: 250
Via: SIP/2.0/TCP 11.22.33.44:14383;ms-received-port=1624;
    ms-received-cid=12c00
From: <sip:user1@server.contoso.com>
    ;tag=c3c995d890e144b2aa7f2bd38c424a51;epid=f540d58d81
To: <sip:user1@server.contoso.com>
    ;tag=5FDD7BA7
Call-ID: f34928e3852c434a85a1f3c0e1e8a449
CSeq: 2 SERVICE
Content-Type: application/SOAP+xml
<SOAP-ENV:Envelope
    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:addGroup
        xmlns:m="http://schemas.microsoft.com/winrttc/2002/11/sip">
      <m:groupID>1</m:groupID>
    </m:addGroup>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

4.9 DeleteGroup Example

This example demonstrates a DeleteGroup request sent by the client to the server to delete a group from the list of groups for this client.

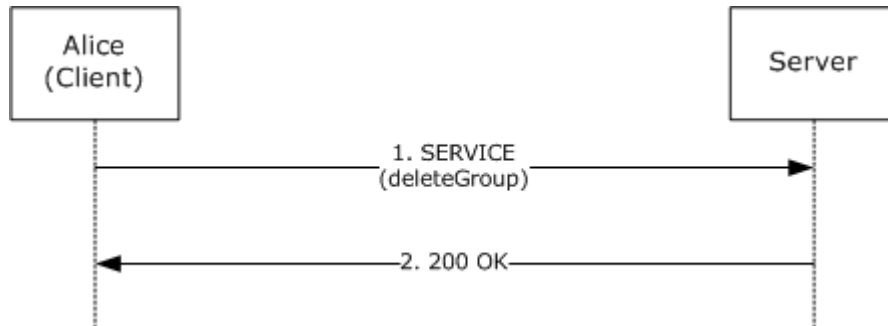


Figure 9: DeleteGroup request example

The client sends a SERVICE request with a SOAP envelope/xml envelope in the body. The m:deleteGroup element indicates to the server that this request is for deleting a group. The XML contains the name of the group to be removed, which is "Friends" in this case.

```

SERVICE sip:server.contoso.com;transport=tcp SIP/2.0
Via: SIP/2.0/TCP 11.22.33.44:14383
Max-Forwards: 70
From: <sip:user1@server.contoso.com>
    ;tag=c3c995d890e144b2aa7f2bd38c424a51;epid=f540d58d81

```

```

To: <sip:user1@server.contoso.com>
;tag=5FDD7BA7
Call-ID: f34928e3852c434a85a1f3c0e1e8a449
CSeq: 3 SERVICE
Contact: <sip:user1@server.contoso.com:14383;
maddr=11.22.33.44;transport="tcp">
;proxy=replace
User-Agent: RTC/1.3.5369
Proxy-Authorization: Kerberos qop="auth", realm="SIP
Communications Service", opaque="1CF1F9E0", crand="277c6fef",
cnum="8", targetname="sip/server.contoso.com",
response="602306092a864886f71201020201011100
ffffffff41d25b4ea77c777cc8045e47de492d38"
Content-Type: application/SOAP+xml
Content-Length: 271
<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<m:deleteGroup
xmlns:m="http://schemas.microsoft.com/winrttc/2002/11/sip">
<m:groupID>1</m:groupID>
<m:deltaNum>17</m:deltaNum>
</m:deleteGroup>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

The server responds to the SERVICE request with a 200 OK to indicate that the AddContact request was successful. The 200 OK response does not have a body.

```

SIP/2.0 200 OK
Authentication-Info: Kerberos
rspauth="602306092A864886F71201020201011100
FFFFFFFFE25AF790F3790A7E416A443414ED5AE8", srand="15FE0D01",
snum="10", opaque="1CF1F9E0", qop="auth",
targetname="sip/server.contoso.com",
realm="SIP Communications Service"
Via: SIP/2.0/TCP 11.22.33.44:14383;ms-received-port=1624;
ms-received-cid=12c00
From: <sip:user1@server.contoso.com>
;tag=c3c995d890e144b2aa7f2bd38c424a51;epid=f540d58d81
To: <sip:user1@server.contoso.com>
;tag=5FDD7BA7
Call-ID: f34928e3852c434a85a1f3c0e1e8a449
CSeq: 3 SERVICE
Content-Length: 0

```

4.10 setACE Example

This example demonstrates a setACE request sent by the client to the server to add a contact to its contact list.

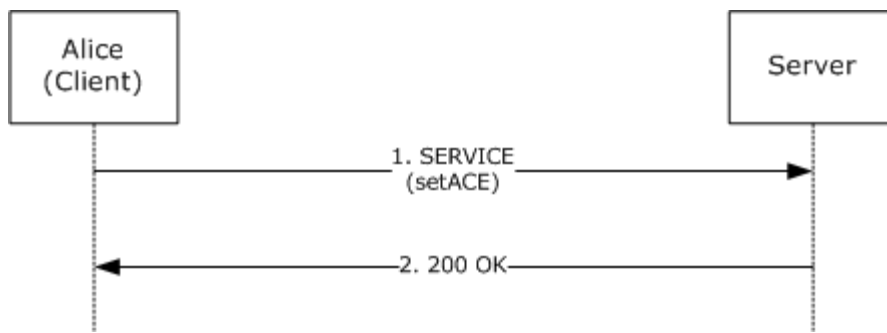


Figure 10: setACE request example

The client sends a SERVICE request with a SOAP envelope/XML envelope in the body. The m:setACE element indicates to the server that this request is for setting an ACE. The XML contains the ACE type, the URI of the user/domain to which the ACE applies, rights defined by the ACE, and a version number.

```

SERVICE sip:server.contoso.com;transport=tcp SIP/2.0
Via: SIP/2.0/TCP 172.24.34.1:15950
Max-Forwards: 70
From: <sip:user1@server.contoso.com>;
    tag=0d71f68a88014f0485a2635cb7c83bc5;epid=bd0238d966
To: <sip:user1@server.contoso.com>;tag=6A6C5447
Call-ID: d934123784404081b0042c4075520f32
CSeq: 40 SERVICE
Contact: sip:user1@server.contoso.com:15950;
    maddr=172.24.34.1;transport=tcp>;proxy=replace
User-Agent: RTC/1.3.5470 (Messenger 5.1.0680)
Proxy-Authorization: NTLM qop="auth", realm="SIP Communications
    Service", opaque="8F8C803E", crand="bac716ec", cnum="12",
    targetname="server.contoso.com",
    response="0100000066363861cf249229af0f9ad1"
Content-Type: application/SOAP+xml
Content-Length: 327

<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<m:setACE xmlns:m="http://schemas.microsoft.com/winrtc/2002/11/sip">
<m:type>USER</m:type>
<m:mask>sip:user3@server.contoso.com</m:mask>
<m:rights>AA</m:rights>
<m:deltaNum>2</m:deltaNum>
</m:setACE>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
  
```

The server responds to the SERVICE request with a 200 OK to indicate that the AddContact request was successful. The 200 OK response does not have a body.

```

SIP/2.0 200 OK
Authentication-Info: NTLM rspauth="0100000000000000E82E2E0BAF0F9AD1",
    srand="EAA5A52F", snum="14", opaque="8F8C803E", qop="auth",
    targetname="server.contoso.com", realm="SIP Communications Service"
  
```

```

Via: SIP/2.0/TCP 172.24.34.1:15950;ms-received-port=3947;
    ms-received-cid=1400
From: <sip:user1@server.contoso.com>;
    tag=0d71f68a88014f0485a2635cb7c83bc5;epid=bd0238d966
To: <sip:user1@server.contoso.com>;tag=6A6C5447
Call-ID: d934123784404081b0042c4075520f32
CSeq: 40 SERVICE
Content-Length: 0

```

4.11 P2P Subscription and XPIDF Presence Format Example

This example demonstrates how XPIDF format can be used in a P2P presence subscription.

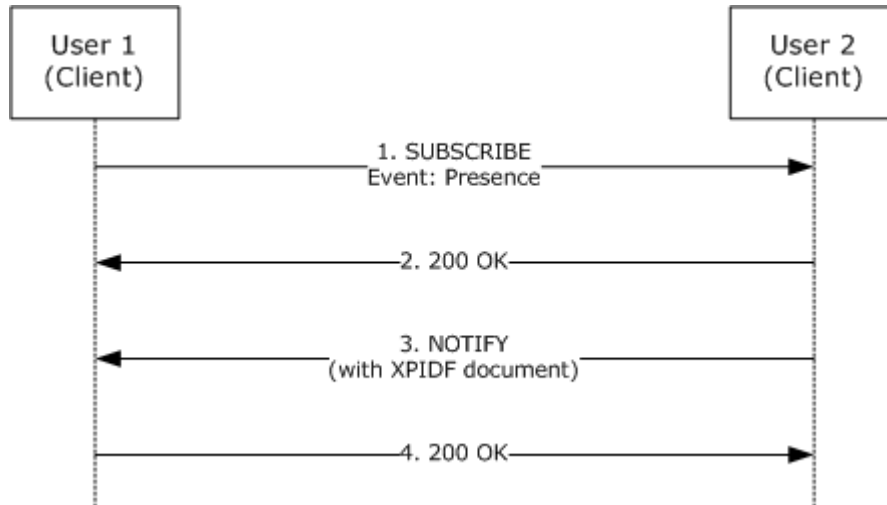


Figure 11: P2P subscription and XPIDF presence format example

User1 sends a SUBSCRIBE request to user2 to create a subscription for the presence event-package. This is indicated by the Event: presence header in the SUBSCRIBE request. The Accept header indicates that user1 accepts the XPIDF Presence Document format.

```

SUBSCRIBE sip:user2@193.12.62.199 SIP/2.0
Via: SIP/2.0/UDP 193.12.63.150:13695
Max-Forwards: 70
From: "user1" <sip:host1>;tag=12e78ca4-85f7-4094-bbdf-e8e819188ae6
To: <sip:user2@193.12.62.199>
Call-ID: 21824beb-0ee4-4953-ad36-745a0614a0e9@193.12.63.150
CSeq: 1 SUBSCRIBE
Contact: <sip:193.12.63.150:13695>
User-Agent: Windows RTC/1.2
Event: presence
Accept: application/xpidf+xml
Content-Length: 0

```

User2 sends a 200 OK response to indicate that the SUBSCRIBE request has been accepted. The 200 OK response does not have a body.

```
SIP/2.0 200 OK
```

```
From: "user1" <sip:host1>;tag=12e78ca4-85f7-4094-bbdf-e8e819188ae6
To: <sip:user2@193.12.62.199>;tag=112040_T193.12.62.199
Call-ID: 21824beb-0ee4-4953-ad36-745a0614a0e9@193.12.63.150
CSeq: 1 SUBSCRIBE
Via: SIP/2.0/UDP 193.12.63.150:13695
Expires: 28800
Content-Length: 0
```

User2 then sends a NOTIFY request to user1 to communicate its presence state, which is online in this example. The body of the NOTIFY request is an XML in the XPIDF format. The XML includes the presentity whose presence information is being communicated, the address element representing a particular endpoint for the presentity and the presence status for that endpoint.

```
NOTIFY sip:193.12.63.150:13695 SIP/2.0
From: <sip:user2@193.12.62.199>;tag=112040_T193.12.62.199
To: "user1" <sip:host1>;tag=12e78ca4-85f7-4094-bbdf-e8e819188ae6
Call-ID: 21824beb-0ee4-4953-ad36-745a0614a0e9@193.12.63.150
CSeq: 2 NOTIFY
Via: SIP/2.0/UDP 193.12.62.199
Content-Length: 356
Contact: sip:user2@193.12.62.199
Event: presence
Content-Type: application/xpidf+xml
```

```
<?xml version="1.0"?>
<!DOCTYPE presence
  PUBLIC "-//IETF//DTD RFCxxxx XPIDF 1.0//EN" "xpidf.dtd">
<presence>
<presentity uri="sip:user2@193.12.62.199;method=SUBSCIRBE"/>
<atom id="1002">
<address uri="sip:user2@193.12.62.199 priority="0.600000">
  <status status="open"/>
  <msnstatus substatus="online"/>
</address>
</atom>
</presence>
```

User1 acknowledges the receipt of the notification by sending a 200 OK response. The 200 OK response does not have a body.

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP 193.12.62.199
From: <sip:user1@193.12.62.199>;tag=112040_T193.12.62.199
To: "user2" <sip:host2>;tag=12e78ca4-85f7-4094-bbdf-e8e819188ae6
Call-ID: 21824beb-0ee4-4953-ad36-745a0614a0e9@193.12.63.150
CSeq: 2 NOTIFY
User-Agent: Windows RTC/1.2
Content-Length: 0
```


5 Security

The following sections specify security considerations for implementers of Session Initiation Protocol Extensions.

5.1 Security Considerations for Implementers

The Microsoft extensions defined in this specification do not require any special security considerations beyond what is natively defined for the Session Initiation Protocol (SIP).

5.2 Index of Security Parameters

None.

6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs:

- Microsoft Windows® 2000 operating system Service Pack 4 (SP4)
- Windows® XP operating system
- Windows Server® 2003 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms SHOULD or SHOULD NOT implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term MAY implies that the product does not follow the prescription.

7 Appendix B: Full text/xml+msrtc.pidf Presence Document Format

```
<?xml version="1.0" ?>
<xs:schema id="presence" version="2.0"
  targetNamespace="http://schemas.microsoft.com/09/2002/sip/presence"
  xmlns:tns="http://schemas.microsoft.com/09/2002/sip/presence"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ct="http://schemas.microsoft.com/sip/types">

  <xs:annotation>
    <xs:documentation>
      Live Communications Server 2005 provides Instant Messaging
      and presence capabilities amongst users in an enterprise. A
      user can login using multiple devices. Each device presents
      its presence information to the server. The XML instance
      containing presence submitted to the server is called the
      Presence Document. When retrieving presence information for
      a user, the server not only returns the presence document
      from every device, but it also determines the overall presence
      of the user. This XML instance returned by the server is
      called the Aggregated Presence Document.

      This schema describes the structure of both the Presence
      Document consumed by the server as well as the Aggregated
      Presence Document generated by the server.
    </xs:documentation>
  </xs:annotation>

  <xs:import namespace="http://schemas.microsoft.com/sip/types"
    schemaLocation="common.xsd" />

  <!-- Common Types -->

  <xs:simpleType name="aggregate">
    <xs:restriction base="xs:nonNegativeInteger">
      <xs:minInclusive value="0" />
      <xs:maxInclusive value="999" />
    </xs:restriction>
  </xs:simpleType>

  <xs:simpleType name="epid">
    <xs:annotation>
      <xs:documentation>
        Each device of a user is uniquely identified by its epid.
        This value cannot exceed 16 bytes.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:token" />
  </xs:simpleType>

  <xs:simpleType name="ageOfPresence">
    <xs:annotation>
      <xs:documentation>
        This is the number of seconds since the device last updated
        its presence information
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:nonNegativeInteger" />
  </xs:simpleType>
```

```

</xs:simpleType>

<xs:complexType name="availability">
  <xs:annotation>
    <xs:documentation>
      The purpose of availability is to indicate whether the user
      can receive a call.
    </xs:documentation>
  </xs:annotation>

  <xs:attribute
    name="aggregate" type="tns:aggregate" use="required" >
    <xs:annotation>
      <xs:documentation>
        The value of the aggregate attribute defines the
        availability of a user on a device. The aggregate values
        are processed by the server as being within a range that
        has a span of 100 (class code). The server interprets
        the values as falling within the following classes (with
        their corresponding interpretations):

        000-099
          The user cannot receive calls.
        100-199
          The user may be online but availability is unknown
          until a call is attempted. A cell phone gateway would
          typically use this setting.
        200-299
          The user has a device that is currently connected and
          can receive calls.
        300-399
          The user is in the proximity of a device that can
          receive calls.

        Rather than using a hard-coded enumeration a numeric
        value is value. This makes it easy to compare the
        availability sent by two different PUAs.
      </xs:documentation>
    </xs:annotation>
  </xs:attribute>

  <xs:attribute name="description" type="xs:string" >
    <xs:annotation>
      <xs:documentation>
        The server always returns an empty string in the
        aggregated presence document.
      </xs:documentation>
    </xs:annotation>
  </xs:attribute>

  <xs:attribute name="epid" type="tns:epid" />
</xs:complexType>

<xs:complexType name="activity">
  <xs:annotation>
    <xs:documentation>
      The purpose of activity is to indicate not whether a user
      can receive a call, but rather, to indicate to watchers
      how likely the user is to want to be disturbed.
    </xs:documentation>
  </xs:annotation>

```

```

    </xs:documentation>
</xs:annotation>

<xs:attribute name="aggregate"
              type="tns:aggregate" use="required" >
  <xs:annotation>
    <xs:documentation>
      000 - 099      There is no information about the
                    activity of the user
      100 - 149     The user is away
      150 - 199     The user is out to lunch
      200 - 299     The user is idle
      300 - 399     The user will be right back
      400 - 499     The user is active
      500 - 599     The user is already participating in a
                    communications session
      600 - 699     The user is busy
      700 - 799     The user is away
      800 - 999     The user is active

      Rather than using a hard-coded enumeration a numeric value
      is value. This makes it easy to compare the activity sent
      by two different PUAs.
    </xs:documentation>
  </xs:annotation>
</xs:attribute>

<xs:attribute name="description" type="xs:string" >
  <xs:annotation>
    <xs:documentation>
      The server always returns an empty string in the aggregated
      presence document.
    </xs:documentation>
  </xs:annotation>
</xs:attribute>

<xs:attribute name="epid" type="tns:epid" />

<xs:attribute name="note" type="xs:string" >
  <xs:annotation>
    <xs:documentation>
      This attribute can be used by the client to store a string
      indicating the user's status on the device.
    </xs:documentation>
  </xs:annotation>
</xs:attribute>
</xs:complexType>

<xs:complexType name="userInfo">
  <xs:annotation>
    <xs:documentation>
      This element is used for storing persisted presence
      information for a user. This information is stored by the
      server and is available regardless of the device a user is
      logged in and / or whether the user is logged in or not. Any
      valid XML can be stored by the client. The server enforces a
      limit of 1024 characters on the size of the element body,
      where the entire element body is treated as a single string.
    </xs:documentation>
  </xs:annotation>

```

```

</xs:annotation>

<xs:sequence>
  <xs:any namespace="##any" processContents="lax"
    minOccurs="0" maxOccurs="unbounded" />
</xs:sequence>
</xs:complexType>

<xs:group name="presenceDocInfo">
  <xs:sequence>
    <xs:element name="availability" type="tns:availability" />
    <xs:element name="activity" type="tns:activity" />
    <xs:element name="userInfo" type="tns:userInfo" />

    <xs:any
      namespace="##any"
      processContents="lax"
      minOccurs="0"
      maxOccurs="unbounded" />
  </xs:sequence>
</xs:group>

<!-- Presence document consumed by the server -->

<xs:complexType name="presenceDoc">
  <xs:annotation>
    <xs:documentation>
      The containing element and its contents are collectively
      called the presence document. The document describes a
      user's availability on a particular device. This is the
      document sent from a Presence User Agent that intends to
      publish its presence.
    </xs:documentation>
  </xs:annotation>

  <xs:sequence>
    <xs:group ref="tns:presenceDocInfo" />
  </xs:sequence>

  <xs:attribute name="uri" type="ct:sipURI" use="required" />
</xs:complexType>

<!-- Aggregated Presence document generated by the server -->

<xs:complexType name="aggregatedPresenceDoc">
  <xs:annotation>
    <xs:documentation>
      The containing element and its contents are collectively
      called the aggregated presence document. The document
      describes a user's availability on all its devices as well
      as an overall aggregated presence. This is the document
      published by the server to anyone obtaining the presence of
      a particular user.
    </xs:documentation>
  </xs:annotation>

  <xs:sequence>
    <xs:element name="availability" type="tns:availability" >
      <xs:annotation>

```

```

    <xs:documentation>
      This is the availability information from the most
      available device.
    </xs:documentation>
  </xs:annotation>
</xs:element>

<xs:element name="activity" type="tns:activity" >
  <xs:annotation>
    <xs:documentation>
      This is the activity information from
      the most available device.
    </xs:documentation>
  </xs:annotation>
</xs:element>

<xs:element name="displayName" >
  <xs:complexType>
    <xs:attribute name="displayName" type="ct:displayName" />
  </xs:complexType>
</xs:element>

<xs:element name="email">
  <xs:complexType>
    <xs:attribute name="email" type="ct:email" />
  </xs:complexType>
</xs:element>

<xs:element name="phoneNumber">
  <xs:complexType>
    <xs:attribute
      name="label"
      type="xs:string"
      use="required">
      <xs:annotation>
        <xs:documentation>
          This string is always empty.
        </xs:documentation>
      </xs:annotation>
    </xs:attribute>

    <xs:attribute
      name="number"
      type="ct:phone"
      use="required" />
  </xs:complexType>
</xs:element>

<xs:element
  name="userInfo"
  type="tns:userInfo" />

<xs:element name="devices">
  <xs:complexType>
    <xs:sequence>
      <xs:element
        name="devicePresence"
        maxOccurs="unbounded" >
        <xs:complexType>

```

```
<xs:sequence>
  <xs:group ref="tns:presenceDocInfo" />
</xs:sequence>

  <xs:attribute name="epid" type="tns:epid" />
  <xs:attribute name="ageOfPresence"
    type="tns:ageOfPresence"
    use="required" />
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>

  <xs:attribute name="uri" type="ct:sipURI" use="required"/>
</xs:complexType>

  <xs:element name="presentity" type="tns:aggregatedPresenceDoc"/>
</xs:schema>
```


8 Appendix C: XPIDF Presence Document Format

The XPIDF Presence Document always contains the top-level element "presence", which indicates that the remainder of the document contains presence information.

```
<!ELEMENT presence (presentity, atom*, display?)>
```

The first subelement of the presence element is the "presentity" element, which identifies the presentity for whom the presence data is being reported.

```
<!ELEMENT presentity (#PCDATA)>
<!ATTLIST presentity uri CDATA #REQUIRED>
```

The presentity tag has a single mandatory attribute, uri, which gives the address of the presentity. The content of the presentity tag is parsed character data giving a human-readable name.

Following the presentity tag within the presence tag is a list of atoms.

Atoms are structured as a collection of addresses. These can either be communications addresses, represented by URLs, or a postal address.

```
<!ELEMENT atom (postal?, address*)>
<!ATTLIST atom atomid CDATA #REQUIRED
            expires CDATA #IMPLIED>
```

The atom element has the mandatory attribute "id", the unique identifier for the group, and the optional attribute "expires", which indicates the time after which the presence data should be considered invalid. The expiration time is expressed as an integral number of seconds since January 1, 1970, 00:00 UTC.

A postal address is indicated by the "postal" element, and consists of freeform text:

```
<!ELEMENT postal (#PCDATA)>
```

It may contain XML markup from some external namespace, as described previously.

Communications addresses are described by the "address" element.

```
<!ELEMENT address (status | class | duplex | feature | note |
                 mobility | msnsubstatus )*>
<!ATTLIST address uri CDATA #REQUIRED
                 priority CDATA #IMPLIED>
```

The "address" element has a single mandatory attribute, uri, which gives the URI of the communications address being described. It also has an optional attribute "priority". The priority tag contains an integer that indicates the relative preference of this address over other addresses. It is a floating-point value between 0 and 1, with 1 being the highest preference.

Within the address tag, several subtags are defined to specify characteristics of the communications address. These tags have the following meanings:

- status

An indicator meant for machine consumption that indicates the status of this communications address. Valid values are "open", which means communications can be attempted to this address, "closed", which means communications cannot be attempted, and "inuse", which means communications is currently being actively used with the entity receiving the Presence Document. For example, if an instant messaging URL is placed in the uri attribute of the address, and the status is "inuse", this means that the user sending the updated Presence Document is currently typing an instant message to the recipient of the Presence Document.

This enables a recent feature on MSN, which allows the user to see when the recipient of the user's instant message is currently typing a reply to it.

```
<!ELEMENT status EMPTY>
  <!ATTLIST status status (open|closed|inuse) #REQUIRED>
```

- class

This tag contains either the value "business" or "personal", indicating whether the address is for business or nonbusiness use. There can be only one class tag per address.

```
<!ELEMENT class EMPTY>
  <!ATTLIST class class (business|personal) #REQUIRED>
```

- duplex

The duplex tag contains one of the values "full", "half", "send-only", or "receive-only". It indicates whether the address can be used for communications in one direction, the other direction, or both. For example, a page would be considered receive-only. There can only be one duplex tag per address.

```
<!ELEMENT duplex EMPTY>
  <!ATTLIST duplex duplex (full|half|send-only|receive-only) #REQUIRED>
```

- feature

The feature tag lists features specific to that communications means. For voice addresses, defined values include "voice-mail" and "attendant". There can be more than one feature tag per address.

```
<!ELEMENT feature EMPTY>
  <!ATTLIST feature feature (voicemail|attendant) #REQUIRED>
```

- mobility

The mobility tag indicates whether the terminal with the given communications address is moving around ("mobile") or fixed ("fixed"). There can be only a single mobility tag per address.

```
<!ELEMENT mobility EMPTY>
  <!ATTLIST mobility mobility (fixed|mobile) #REQUIRED>
```

- note

Contains freeform text meant for display to the user, indicating some kind of information about the communications address. There can only be one note tag per address. The note tag may contain XML data from a properly qualified external XML namespace.

```
<!ELEMENT note (#PCDATA)>
```

- msnsbstatus

Provides supplementary status information. The following values are defined: "unknown", "away", "online", "idle", "busy", "berightback", "onthephone", "outtolunch".

```
<!ELEMENT msnsbstatus EMPTY>
<!ATTLIST msnsbstatus
  (unknown|away|online|idle|busy|berightback|onthephone|outtolunch)
  #REQUIRED>
```

A PIDF document that appears as a top-level XML document is identified with the formal public identifier "[-//IETF//DTD RFCxxxx XPIDF 1.0//EN](#)". If this document is published as an RFC, "xxxx" will be replaced by the RFC number. PIDF documents have the MIME type "application/xpidf+xml".

Note that the URIs specifying XML namespaces are only globally unique names; they do not have to reference any particular actual object. The URI of a canonical source of this specification meets the requirement of being globally unique, and is also useful to document the format.

```
<!ELEMENT display EMPTY>
<!ATTLIST display name CDATA #REQUIRED>
```

Following the atom tag within the presence tag, there can be a display tag. The display tag has a single required attribute to specify the display name.

The DTD of XPIDF is shown below:

```
<?xml version="1.0" encoding="UTF-8" ?>
<!ELEMENT presence (presentity, atom*, display?)>

<!ELEMENT presentity (#PCDATA)>
<!ATTLIST presentity uri CDATA #REQUIRED>
<!ELEMENT atom (postal?, address*)>
<!ATTLIST atom atomid CDATA #REQUIRED
  expires CDATA #IMPLIED>
<!ELEMENT postal (#PCDATA)>
<!ELEMENT address (status | class | duplex | feature | note |
  mobility | msnsbstatus )*>
<!ATTLIST address uri CDATA #REQUIRED
  priority CDATA #IMPLIED>
<!ELEMENT status EMPTY>
<!ATTLIST status status (open|closed|inuse) #REQUIRED>
<!ELEMENT class EMPTY>
<!ATTLIST class class (business|personal) #REQUIRED>
```

```
<!ELEMENT duplex EMPTY>
<!ATTLIST duplex duplex
    (full|half|send-only|receive-only) #REQUIRED>
<!ELEMENT feature EMPTY>
<!ATTLIST feature feature (voicemail|attendant) #REQUIRED>
<!ELEMENT mobility EMPTY>
<!ATTLIST mobility mobility (fixed|mobile) #REQUIRED>
<!ELEMENT note (#PCDATA)>
  <!ELEMENT msnsubstatus EMPTY>
  <!ATTLIST msnsubstatus
    (unknown|away|online|idle|busy|berightback|onthephone|outtolunch)
    #REQUIRED>
  <!ELEMENT display EMPTY>
  <!ATTLIST display name CDATA #REQUIRED>
```

9 Appendix D: ACL XML Schema

```
<?xml version="1.0" ?>
<xsd:schema id="acl"
targetNamespace="http://schemas.microsoft.com/sip/acl/"
xmlns="http://schemas.microsoft.com/sip/acl/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">

  <xsd:annotation>
    <xsd:documentation>
      Type definition for Access Control Lists
    </xsd:documentation>
  </xsd:annotation>

  <!-- - - -
  ACEs

  An ACE is a set of three attributes:
  type scopes what the ACE applies to
  mask a user URI or DNS domain
  rights the rights associated with this ACE
-->
  <xsd:complexType name="ace">
    <xsd:attribute name="type" type="acetype" use="required"/>
    <xsd:attribute name="mask" type="acemask" use="optional"/>
    <xsd:attribute name="rights"
      type="rightsmask"
      use="optional"
      default="AA"/>
  </xsd:complexType>

  <!-- - - - - -
  An ace can be scoped to:

  ALL
  Applies to all users.Mask is not used.

  DOMAIN
  Matches a domain specified in mask.
  For example, if mask is "microsoft.com" then
  "sip:user1@redmond.microsoft.com" and
  "sip:user2@microsoft.com"
  match, but "sip:user3@example.com" doesn't match.

  USER
  Matches a specific user. For example,mask could be
  "sip:user3@microsoft.com".

-->

  <xsd:simpleType name="acetype">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="ALL" />
      <xsd:enumeration value="USER" />
      <xsd:enumeration value="DOMAIN" />
    </xsd:restriction>
  </xsd:simpleType>
```

```

<!-- - -
An acemask is only used when the acetype is USER or DOMAIN.
-->

<xsd:simpleType name="acemask">
  <xsd:union memberTypes="domainmask xsd:anyURI" />
</xsd:simpleType>

<!-- - - - - -
A domain is a set of one or more pairs of
label+ pairs.
For example "redmond.microsoft.com." and "microsoft.com.".
SIP:roberbr@redmond.microsoft.com would match either of these.
SIP:roberbr@southpacific.microsoft.com would
only match "microsoft.com."
-->
<xsd:simpleType name="domainmask">
  <xsd:restriction base="xsd:string">
    <xsd:pattern value="[\w+\.]*\w+\.?" />
    <xsd:minLength value="2"/>
    <xsd:maxLength value="255"/>
  </xsd:restriction>
</xsd:simpleType>

<!-- - -
The Rights mask.
-->

<xsd:simpleType name="rightsmask">

  <!--
This is a list of characters. Each position in the list
represents a Right. The character in that position represents
the value of that right. Additional rights can be added to the
end of the string in future versions.

A = Allow
D = Deny
P = Prompt
B = Block (Polite blocking)

Incoming_ \
Presence_ |
         \|
         ||
         AA
         AD
         PA
         PD
         DA
         DD
         BA
         BD
         -->

  <xsd:restriction base="xsd:string">
    <xsd:pattern value="(A|P|D|B) (A|D)" />
  </xsd:restriction>

```

```
</xsd:simpleType>

<!-- - - - - -
ACLs
- - - - - -->
<xsd:complexType name="acl">
  <xsd:sequence>
    <xsd:element name="ace" type="ace" minOccurs="0"
      maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="aclList">
  <xsd:sequence>
    <xsd:element name="userACL" type="acl" minOccurs="0"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:element name="ACLlist" type="aclList"/>
</xsd:schema>
```

10 Appendix E: Contact Management Schema

10.1 Contact Schema

```
<?xml version="1.0" ?>
<xs:schema id="contact"
  version="2.0"
  targetNamespace="http://schemas.microsoft.com/sip/types"
  xmlns:tns="http://schemas.microsoft.com/sip/types"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:annotation>
    <xs:documentation>
      Live Communications Server 2005 provides Instant Messaging
      capabilities among users in an enterprise. Users can store
      a list of contacts that they frequently communicate with on
      the server and retrieve / manage this list from any machine
      from which they log on to the service. This schema specifies
      the structure of XML instances containing contact-related
      data returned by the server.

      The server can return two types of contact lists.
      1. Full List - A full list of all contacts and their
      associated groups.
      2. Delta List - A list containing a subset of contacts and
      associated groups that were added, modified, or deleted
      from the Full List.

      List (1) is returned from the server in response to a SUBSCRIBE
      for the event vnd-microsoft-roaming-contact.
      List (2) is returned from the server in response to any of the
      SetContact, DeleteContact, DeleteGroup, or
      ModifyGroup SERVICE operations.

      These lists are returned by the server in NOTIFY / BENOTIFY
      requests generated by the server or in the body of a 200 OK
      response (also called as a "piggy-back notify").

      A Full List is a list of groups followed by a list of
      contacts. Groups are uniquely numbered. The particular
      numbering sequence is not persisted and may vary from one
      transmission to the next. Contacts are cross-referenced
      against groups using group ID numbers. Contacts must be
      in at least one group.

      A Delta List is a list of groups that were added and / or
      modified, followed by a list of contacts that were added
      and / or modified, followed by a list of groups that were
      deleted and finally followed by a list of contacts that
      were deleted.
    </xs:documentation>
  </xs:annotation>

  <xs:include schemaLocation="common.xsd" />

  <!-- ***** Common Types ***** -->
```



```

<xs:simpleType name="groupID">
  <xs:annotation>
    <xs:documentation>
      This is a number assigned by a server to identify a group.
      This number can be uniquely used to associate a contact
      with a group.
    </xs:documentation>
  </xs:annotation>

  <xs:restriction base="xs:nonNegativeInteger">
    <xs:minInclusive value="0" />
    <xs:maxInclusive value="64" />
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="groupList">
  <xs:restriction>
    <xs:list itemType="groupID" />
    <xs:maxLength value="64" />
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="groupName">
  <xs:annotation>
    <xs:documentation>
      The length of this string cannot exceed 256 bytes.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string" />
</xs:simpleType>

<xs:simpleType name="contactName">
  <xs:annotation>
    <xs:documentation>
      The length of this string cannot exceed 256 bytes.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string" />
</xs:simpleType>

<xs:simpleType name="externalUri">
  <xs:restriction base="xs:string">
    <xs:annotation>
      <xs:documentation>
        Any string that points to an external resource. The
        server enforces that the raw representation of this
        string cannot exceed 1024 bytes.
      </xs:documentation>
    </xs:annotation>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="contactDeltaNum">
  <xs:annotation>
    <xs:documentation>
      The server maintains a single non-negative integer version
      number for the contact / group list of every user. Anytime
      the user performs an operation that modifies his

```

```

        contact / group list, the version number gets incremented.
        The version number is returned to the client in the contact
        list allowing the client to determine if it has the most
        up-to-date information and to refresh the contact / group
        list if its state, as seen by the server, is out-of-sync.
        If the client's delta number is out-of-sync with the server,
        it can obtain the current value by subscribing to the
        vnd-microsoft-roaming-contact event and looking at the
        deltaNum attribute of the contactList element in the body
        of the notification data. The notification data will be
        received in the 200 OK response or in a separate NOTIFY or
        BENOTIFY request from the server.
    </xs:documentation>
</xs:annotation>
<xs:restriction base="xs:nonNegativeInteger" />
</xs:simpleType>

<xs:complexType name="group">
    <xs:attribute name="id" type="tns:groupID" use="required" />
    <xs:attribute name="name" type="tns:groupName" use="required" />

    <xs:attribute name="externalURI" type="tns:externalUri">
        <xs:annotation>
            <xs:documentation>
                An external URI is a list of contacts that is stored
                elsewhere. For example this may point to a location in an
                LDAP directory.
            </xs:documentation>
        </xs:annotation>
    </xs:attribute>
</xs:complexType>

<xs:complexType name="contactExtension">
    <xs:annotation>
        <xs:documentation>
            This element is provided for extensibility. Any valid XML
            can be stored by the client. The server enforces a limit
            of 1024 bytes on the size of the element body, where the
            entire element body is treated as a single string.
        </xs:documentation>
    </xs:annotation>

    <xs:sequence>
        <xs:any namespace="##any"
            processContents="lax"
            minOccurs="0"
            maxOccurs="unbounded" />
    </xs:sequence>
</xs:complexType>

<xs:complexType name="contact">
    <xs:sequence>
        <xs:element name="contactExtension"
            type="tns:contactExtension"
            minOccurs="0" maxOccurs="1" />
    </xs:sequence>

    <xs:attribute name="uri" type="tns:sipURI" use="required" />
    <xs:attribute name="name" type="tns:contactName" />

```

```

<xs:attribute name="groups" type="tns:groupList" default="0" />
<xs:attribute name="subscribed" type="xs:boolean"
  default="true">
  <xs:annotation>
    <xs:documentation>
      This attribute specifies whether the client subscribes
      to this contact's presence.
    </xs:documentation>
  </xs:annotation>
</xs:attribute>

<xs:attribute name="externalURI" type="tns:externalUri">
  <xs:annotation>
    <xs:documentation>
      Perhaps the contact is from the Outlook address book, an
      LDAP directory, or some other external source. A URL can
      be stored to obtain more information about this contact.
    </xs:documentation>
  </xs:annotation>
</xs:attribute>
</xs:complexType>

<!-- ***** Full List ***** -->

<xs:complexType name="fullContactList">
  <xs:sequence>
    <xs:element name="group" type="tns:group" minOccurs="0"
      maxOccurs="64" />
    <xs:element name="contact" type="tns:contact" minOccurs="0"
      maxOccurs="unbounded" />
    <xs:annotation>
      <xs:documentation>
        Although the schema allows for an unbounded number of
        contacts, the administrator can configure a server to
        disallow more than a certain number of contacts.
      </xs:documentation>
    </xs:annotation>
  </xs:sequence>

  <xs:attribute name="deltaNum" type="tns:contactDeltaNum"
    use="required" />
</xs:complexType>

<xs:element name="contactList" type="tns:fullContactList" />

<!-- ***** Delta List ***** -->

<xs:complexType name="deltaContactList">
  <xs:choice>
    <xs:element name="addedGroup" type="tns:group" />
    <xs:element name="modifiedGroup" type="tns:group" />
    <xs:element name="addedContact" type="tns:contact" />
    <xs:element name="modifiedContact" type="tns:contact" />

    <xs:element name="deletedGroup">
      <xs:complexType>

```

```

        <xs:attribute name="id" type="tns:groupID"
                    use="required" />
    </xs:complexType>
</xs:element>

    <xs:element name="deletedContact">
        <xs:complexType>
            <xs:attribute name="uri" type="tns:sipURI"
                        use="required" />
        </xs:complexType>
    </xs:element>
</xs:choice>

    <xs:attribute name="deltaNum" type="tns:contactDeltaNum"
                use="required" >
    <xs:annotation>
        <xs:documentation>
            The value of this attribute is the new delta number
            after the SERVICE operation was performed.
        </xs:documentation>
    </xs:annotation>
</xs:attribute>

    <xs:attribute name="prevDeltaNum" type="tns:contactDeltaNum"
                use="required" >
    <xs:annotation>
        <xs:documentation>
            The value of this attribute equals the value of the
            delta number specified in the SERVICE operation.
        </xs:documentation>
    </xs:annotation>
</xs:attribute>
</xs:complexType>

    <xs:element name="contactDelta" type="tns:deltaContactList" />
</xs:schema>

```

10.2 SetContact Schema

```

<?xml version="1.0" ?>
<xs:schema id="SetContact" version="2.0"
            elementFormDefault="qualified"
            targetNamespace="http://schemas.microsoft.com/sip/types/setcontact/"
            xmlns:tns="http://schemas.microsoft.com/sip/types/setcontact/"
            xmlns:ct="http://schemas.microsoft.com/sip/types"
            xmlns:xs="http://www.w3.org/2001/XMLSchema">

    <xs:import namespace="http://schemas.microsoft.com/sip/types"
                schemaLocation="contact.xsd" />

    <xs:annotation>
        <xs:documentation>
            Users can add contacts to their contact list by sending a
            SIP SERVICE request to their Live Communications Server.
            The content of this SERVICE request is a SOAP request. The
            body of the SOAP request contains an XML instance conforming

```

```

    to the structure specified in this schema.
  </xs:documentation>
</xs:annotation>

<xs:complexType name="SetContact">
  <xs:sequence>
    <xs:element name="displayName" type="ct:contactName" />
    <xs:element name="groups" type="ct:groupList" />
    <xs:element name="subscribed" type="xs:boolean" />
    <xs:element name="URI" type="ct:sipURI" />
    <xs:element name="externalURI" type="ct:externalUri"
      minOccurs="0" />

    <xs:element name="deltaNum" type="ct:contactDeltaNum" >
      <xs:annotation>
        <xs:documentation>
          This value must match the current delta number
          stored by the server.
        </xs:documentation>
      </xs:annotation>
    </xs:element>

    <xs:element name="contactExtension" type="tns:contactExtension"
      minOccurs="0" />
  </xs:sequence>
</xs:complexType>

  <xs:element name="setContact" type="tns:SetContact" />
</xs:schema>

```

10.3 ModifyGroup Schema

```

<?xml version="1.0" ?>
<xs:schema id="ModifyGroup" version="2.0"
  elementFormDefault="qualified"
  targetNamespace=
    "http://schemas.microsoft.com/sip/types/modifygroup/"
  xmlns:tns="http://schemas.microsoft.com/sip/types/modifygroup/"
  xmlns:ct="http://schemas.microsoft.com/sip/types"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:import namespace="http://schemas.microsoft.com/sip/types"
    schemaLocation="contact.xsd" />

  <xs:annotation>
    <xs:documentation>
      Users can add a new group or modify the name of an existing
      group by sending a SIP SERVICE request to their Live
      Communications Server. The content of this SERVICE request
      is a SOAP request. The body of the SOAP request contains
      an XML instance conforming to the structure specified in
      this schema.
    </xs:documentation>
  </xs:annotation>

  <xs:complexType name="ModifyGroup">
    <xs:sequence>

```

```

<xs:element name="groupID" type="ct:groupID" />
<xs:element name="name" type="ct:groupName" />
<xs:element name="externalURI" type="ct:externalUri"
  minOccurs="0" />

<xs:element name="deltaNum" type="ct:contactDeltaNum" >
  <xs:annotation>
    <xs:documentation>
      This value must match the current delta number
      stored by the server.
    </xs:documentation>
  </xs:annotation>
</xs:element>

</xs:sequence>
</xs:complexType>

<xs:element name="modifyGroup" type="tns:ModifyGroup" />
<xs:element name="addGroup" type="tns:ModifyGroup" />
</xs:schema>

```

10.4 DeleteContact Schema

```

<?xml version="1.0" ?>
<xs:schema id="DeleteContact" version="2.0"
  elementFormDefault="qualified"
  targetNamespace=
    "http://schemas.microsoft.com/sip/types/deletecontact/"
  xmlns:tns=
    "http://schemas.microsoft.com/sip/types/deletecontact/"
  xmlns:ct="http://schemas.microsoft.com/sip/types"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:import namespace="http://schemas.microsoft.com/sip/types"
    schemaLocation="contact.xsd" />

  <xs:annotation>
    <xs:documentation>
      Users can delete contacts from their contact list by sending a
      SIP SERVICE request to their Live Communications Server.
      The content of this SERVICE request is a SOAP request. The
      body of the SOAP request contains an XML instance conforming
      to the structure specified in this schema.
    </xs:documentation>
  </xs:annotation>

  <xs:complexType name="DeleteContact">
    <xs:sequence>
      <xs:element name="URI" type="ct:sipURI" />
    </xs:sequence>
  </xs:complexType>

  <xs:element name="deleteContact" type="tns>DeleteContact" />
</xs:schema>

```

10.5 DeleteGroup Schema

```
<?xml version="1.0" ?
<xs:schema id="DeleteGroup" version="2.0"
  elementFormDefault="qualified"
  targetNamespace=
    "http://schemas.microsoft.com/sip/types/deletegroup/"
  xmlns:tns="http://schemas.microsoft.com/sip/types/deletegroup/"
  xmlns:ct="http://schemas.microsoft.com/sip/types"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:import namespace="http://schemas.microsoft.com/sip/types"
    schemaLocation="contact.xsd" />
<xs:annotation>
  <xs:documentation>
    Users can delete existing groups by sending a SIP SERVICE
    request to their Live Communications Server. The content of
    this SERVICE request is a SOAP request. The body of the SOAP
    request contains an XML instance conforming to the structure
    specified in this schema.

    NOTE: Before a group can be deleted all contacts must be
    removed from the group using DeleteContact operations.
  </xs:documentation>
</xs:annotation>

<xs:complexType name="DeleteGroup">
  <xs:sequence>
    <xs:element name="groupID" type="ct:groupID" />

    <xs:element name="deltaNum" type="ct:contactDeltaNum" >
      <xs:annotation>
        <xs:documentation>
          This value must match the current delta number
          stored by the server.
        </xs:documentation>
      </xs:annotation>
    </xs:element>

  </xs:sequence>
</xs:complexType>

  <xs:element name="deleteGroup" type="tns>DeleteGroup" />
</xs:schema>
```

11 Appendix F : common.xsd

```
<?xml version="1.0" ?>
<xs:schema id="contact" version="2.0"
  targetNamespace="http://schemas.microsoft.com/sip/types"
  xmlns:tns="http://schemas.microsoft.com/sip/types"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:simpleType name="adAttribute">
    <xs:restriction base="xs:token">
      <xs:minLength value="1" />
      <xs:pattern value="\w+" />
    </xs:restriction>
  </xs:simpleType>

  <xs:simpleType name="sipURI">
    <xs:annotation>
      <xs:documentation>
        The format of a SIP URI is sip:user@host. The user portion
        of the URI is treated as case-sensitive while the host portion
        is treated as case-insensitive.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:anyURI">
      <xs:maxLength value="454" />
      <xs:pattern value="sip:\w+@\w+" />
    </xs:restriction>
  </xs:simpleType>

  <xs:simpleType name="displayName">
    <xs:annotation>
      <xs:documentation>
        This value is retrieved by the server from the Active Directory
        'displayName' attribute on the user object.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="tns:adAttribute" />
  </xs:simpleType>

  <xs:simpleType name="email">
    <xs:annotation>
      <xs:documentation>
        This value is retrieved by the server from the Active Directory
        'mail' attribute on the user object.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="tns:adAttribute" />
  </xs:simpleType>

  <xs:simpleType name="phone">
    <xs:annotation>
      <xs:documentation>
        This value is retrieved by the server from the Active Directory
        'telephoneNumber' attribute on the user object.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="tns:adAttribute" />
  </xs:simpleType>
```



```

<xs:simpleType name="title">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'title' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />
</xs:simpleType>

<xs:simpleType name="office">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'physicalDeliveryOfficeName' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />
</xs:simpleType>

<xs:simpleType name="company">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'company' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />
</xs:simpleType>

<xs:simpleType name="city">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'l' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />
</xs:simpleType>

<xs:simpleType name="state">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'st' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />
</xs:simpleType>

<xs:simpleType name="country">
  <xs:annotation>
    <xs:documentation>
      This value is retrieved by the server from the Active Directory
      'c' attribute on the user object.
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="tns:adAttribute" />

```

```
</xs:simpleType>  
</xs:schema>
```

12 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

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