Implementing XMPP Multi-User Chat for UPnP Cloud

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1 Introduction to Multi-User Chat (MUC)

This document describes an application of XMPP Multi-User Chat protocol for devices and control points supporting UPnP 2.0 UCA capabilities. Multi-User Chat or MUC is a well-known application of XMPP. Originally named "groupchat" when XMPP was still "Jabber", it is now a standards track XEP of the XMPP Standards Foundation, specifically [XEP0045]. A natural extension of presence and instant messaging, the typical use case enables the following scenario:

- let's discuss a specific subject, or "chat",
- by creating a digital (XMPP) meeting place or "**Room**" for the chat,
- and inviting interested "users" to the **Room** for the chat,
- while moderating the "chat", if desired, including the teardown of the **Room**.
- In the scenario above, the "chat" typically involves a broadcast of textual information - in a <**message**> stanza of type "**groupchat**" - to all occupants of a **Room** via sending the stanza directly to the **Room** **JID**.

Although, the specific chat messaging is not central to the UPnP™ *Cloud* use-case the mechanisms for managing **Room**s and **Room** invitations can be leveraged to enable compelling experiences such as virtual sharing **Room**s, or - to recast the above scenario -

- let's share some family videos,
- by creating a virtual "Family" **Room** for the sharing,
- and inviting two UCA TVs (UCCD MediaRenderers [MR3]) and a NAS (UCCD MediaServer [MS4]) to the "Family" **Room**,
- and playing the content with a UCC-CP (the moderator) to both TVs from the NAS.
- Thus, the purpose of this document is to show the details of how UCA and XMPP MUC can be combined to realize the virtual **Room** sharing scenario.

1.1 Audience

The reader is assumed to be familiar with UPnP Device Architecture 2.0 [UDA] and specifically Annex C or "UPnP Cloud". The following Acronyms, Terms and Definitions also apply:

1.1.1 Acronyms

Table 1-1: Acronyms

Acronym	Description
MUC	Multi-User Chat
UCA	UPnP Cloud Annex
UCC	UPnP Cloud Capable
UCC-CP	UPnP Cloud Capable Control Point
UCCD	UPnP Cloud Capable Device
UCCD-M	UPnP Cloud Capable Device [Mobile]
UCS	UPnP Cloud Server
XMPP	Extensible Messaging and Presence Protocol

1.1.2 General Cloud Terms and Definitions

Cloud, in the context of UPnP, is the logical domain, not in the user's home(s), where their UCODs, UCCDs and UCC-CPs connect, their UCBSs execute, and their cloud based content resides.

Domain is a scoped access to a subset of all available cloud devices, services and users.

Account is a domain in the cloud consisting of a username and a credential. Also, the account can contain ancillary information such as address, telephone number, email information and possibly transactional information such as credit card information. An extended concept of an account is the combination of devices, services and users registered or interacting with the account.

User, in the context of UPnP cloud, is a uniquely identifiable participant that interacts with the UPnP cloud ecosystem. A user can be an account owner or participant and can be associated with multiple *Cloud Account*s.

Login is an identification process that allows a specific user to access their *Cloud Account* by confirming their username and credential. Login can also refer to the act of starting an active session with the *Cloud Account*. The login can be automated once initial login succeeds. Some minimal behavior equivalent to UPnP Public Role [DP] could be identified.

Owner is a user that has management rights over an account (or group) and the devices, services, and users allowed access within that account.

Home, in the context of UPnP cloud, is the logical network(s) or LAN(s) where a user's UHOD and CPDevs are connected.

UPnP Cloud Capable (UCC) means that the device or control point (CP) is capable of interaction with UPnP Cloud Based Services.

Invitation is the initiation part of registering a device, service, or user to a *Cloud Account* or cloud group.

Invited User is a user from a *Cloud Account* that has been invited to have access to devices and services in a different *Cloud Account*. The devices and services access can be granted with a per-device, per-group, or per-service granularity.

1.1.3 Device and Control Point Terms and Definitions

UPnP Cloud Capable Control Point (UCC-CP) is a control point (CP) that can interact with UCCDs, UCODs, and UCOSs directly. Note that a UCC-CP is not a UCCD.

Invited Device is a device from a *Cloud Account* that has received an invitation to be registered to a different *Cloud Account*.

1.1.4 Multi-User Chat Terms and Definitions

The following are from [XEP0045] and have been localized for UCA usage.

Affiliation - A long-lived association or connection with a **Room**; the possible **Affiliation**s are "**owner**", "**admin**", "**member**", and "**outcast**" (naturally it is also possible to have no **Affiliation**); **Affiliation** is distinct from **Role**. An **Affiliation** lasts across a user's visits to a **Room**.

MUC is the Multi-User Chat Protocol defined by [XEP0045].

Role - is a temporary position or privilege level within a Room, distinct from a user's long-lived Affiliation with the Room; the possible Roles are "moderator", "participant", and "visitor" (it is also possible to have no defined Role). A Role lasts only for the duration of an occupant's visit to a Room. Note that this Role is distinct from Role as defined by [DP].

Room is a virtual space that users (and device) figuratively enter in order to participate in real-time, text-based conferencing (and in the UCA case data sharing) with other users (UCC-CPs and UCCDs).

Room ID The localpart of a Room JID, which might be opaque and thus lack meaning for human users; contrast with Room Name.

Room JID The <Room@service> address of a Room.

Room Name A user-friendly, natural-language name for a Room, configured by the Room owner and presented in Service Discovery queries; contrast with Room ID.

Room Nickname The resourcepart of an Occupant JID; this is the "friendly name" by which an occupant is known in the Room.

1.2 Notation

For readability purposes this document uses fonts as in [UDA] to indicate specific protocol components or:

- Strings that are to be taken literally are enclosed in “`double quotes`”.
- Words that are emphasized are printed in *italic*.
- Keywords that are defined by the UPnP Working Committee are printed using the *forum* character style.
- Keywords that are defined by the UPnP Device Architecture are printed using the **arch** character style.
- Keywords that are defined specific to the UPnP Device Architecture Annex C are printed using **UCA** character style.
- Keywords that are defined specific to XMPP are printed using **XMPP** character style.
- Keywords that are defined by a vendor are printed in *Vendor* style.
- A double colon delimiter, “::”, signifies a hierarchical parent-child (parent::child) relationship between the two objects separated by the double colon. This delimiter is used in multiple contexts, for example: Service::Action(), Action()::Argument, parentProperty::childProperty.
- Example text will be in `green courier new` with a shaded background (not necessarily gray)[1].

Additionally, clarifying text is sometimes included. There are two general forms:

1) Extracts from relevant XMPP specification indicated by an XEP or RFC reference followed by text enclosed in a box (see below).

From XEP or RFC Extracted relevant text from XEP or RFC goes here.

2) Implementation warnings shown as a "caution sign symbol" with explanatory text (see below).

[1] Note: example text can contain whitespace and line feeds to improve readability.

CAUTION!	Implementation caution goes here.

1.3 The MUC Scenarios

In this document, two general scenarios are described along with their suggested implementation. In the first scenario, only UCCDs and UCC-CPs from the same *Cloud Account* (`jeffrey@mycloud.org`) interact in a **`Room`**; in the second scenario, UCCDs and UCC-CPs, from a different, second account (`mary@theircloud.org`), are added to the **`Room`**. In both cases, the basic XMPP MUC mechanisms will remain the same.

In the single user scenario the basic MUC call flow is as follows: 1) Discovery a MUC Service, 2) Create a **`Room`**, 3) Configure the **`Room`**, 4) Send invitations to the UCCD (or UCC-CPs) needed in the **`Room`**, 5) Accept the invitations (with `PASSWORD`), 6) Conduct UPnP sessions within the **`Room`** via **`participant`**-to-**`participant`** <**`iq`**> stanzas, 7) send events to the **`Room`** via <**`message`**> stanzas of **`type`** "**`groupchat`**", 8) Tear-down (or Destroy) the **`Room`** if the session is over and not intended to be a persistent experience.

In the multi-user scenario, the main difference is that during the invitation steps, a UCC-CP of the other user is invited to the **`Room`** and then given additional privileges. This allows that UCC-CP to then invite its own UCCDs to the **`Room`**.

The suggested implementations will also take a conservative approach towards security and privacy. This is achieved primarily by limiting Room privileges and device nicknaming. The two scenarios are illustrated at a high level in Figure 1-1 and 1-2 respectively. For illustration purposes it is assumed that the MUC Service is co-located with the UCS.

Figure 1-1: Single User MUC Scenario (`jeffrey@mycloud.org`)

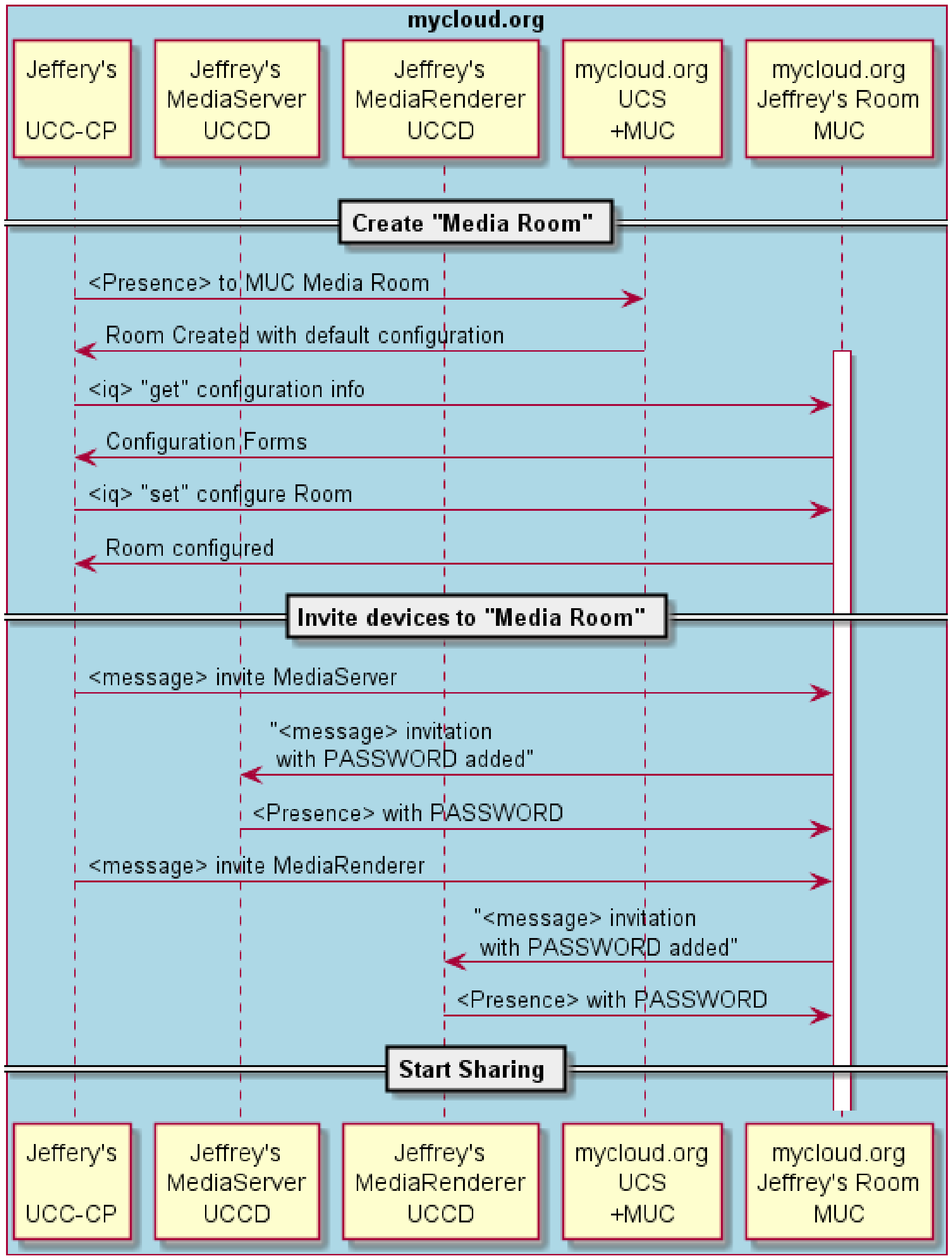
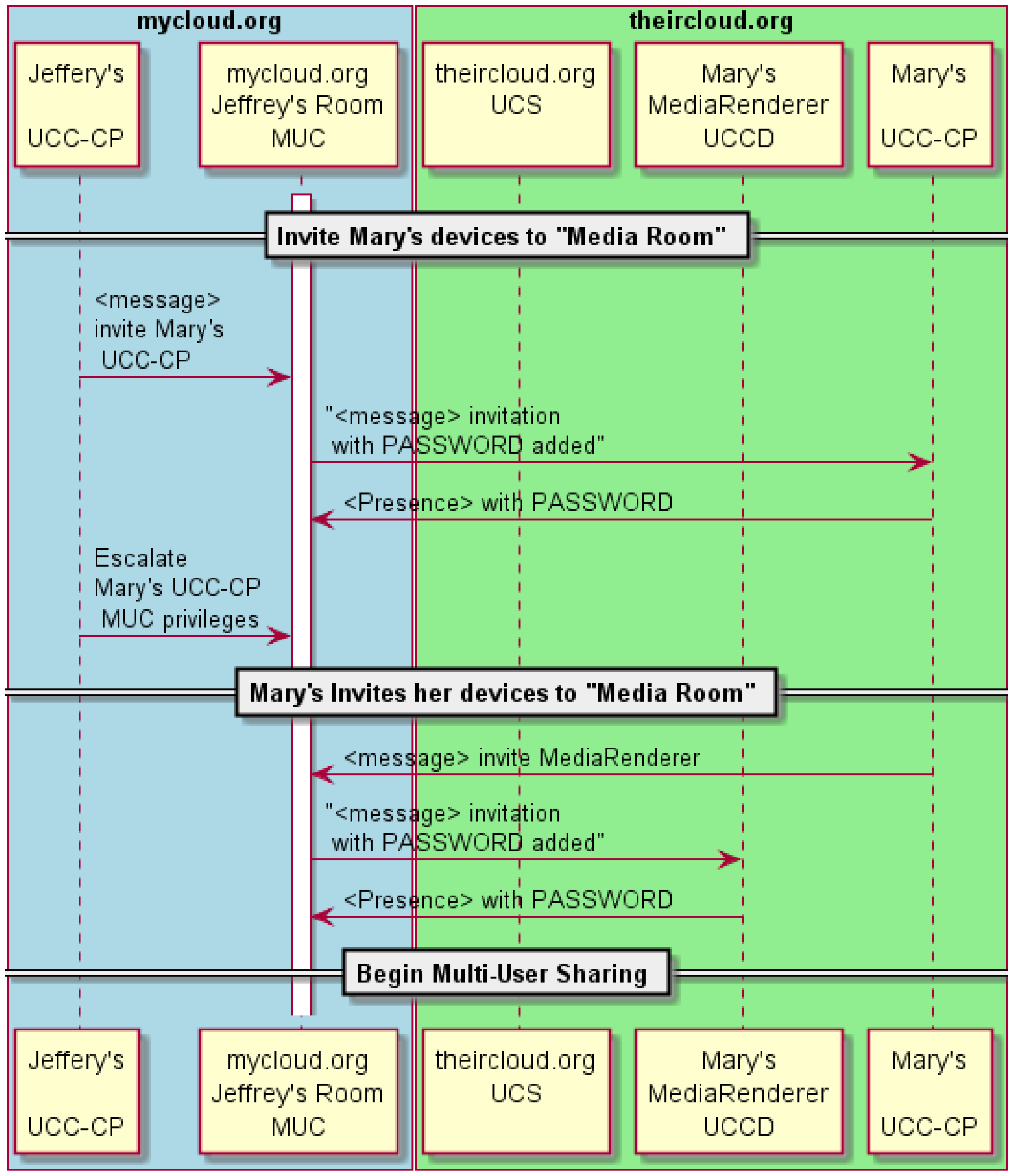

mycloud.org
Jeffery's UCC-CP
Jeffrey's MediaServer UCCD
Jeffrey's MediaRenderer UCCD
mycloud.org UCS +MUC
mycloud.org Jeffrey's Room MUC
Create "Media Room"
<Presence> to MUC Media Room
Room Created with default configuration
<iq> "get" configuration info
Configuration Forms
<iq> "set" configure Room
Room configured
Invite devices to "Media Room"
<message> invite MediaServer
"<message> invitation with PASSWORD added"
<Presence> with PASSWORD
<message> invite MediaRenderer
"<message> invitation with PASSWORD added"
<Presence> with PASSWORD
Start Sharing

Figure 1-2: Multi User MUC Scenario (`jeffrey@mycloud.org, mary@theircloud.org`)


mycloud.org
theircloud.org
Jeffery's UCC-CP
mycloud.org Jeffrey's Room MUC
theircloud.org UCS
Mary's MediaRenderer UCCD
Mary's UCC-CP
Invite Mary's devices to "Media Room"
<message> invite Mary's UCC-CP
"<message> invitation with PASSWORD added"
<Presence> with PASSWORD
Escalate Mary's UCC-CP MUC privileges
Mary's Invites her devices to "Media Room"
<message> invite MediaRenderer
"<message> invitation with PASSWORD added"
<Presence> with PASSWORD
Begin Multi-User Sharing
Jeffery's UCC-CP
mycloud.org Jeffrey's Room MUC
theircloud.org UCS
Mary's MediaRenderer UCCD
Mary's UCC-CP

2 The MUC Protocol

MUC is an add-on Service usually supported on the UCS. It can be discovered via XMPP Service Discovery [XEP-0030] as an <identity> response with a category of "conference", type of "chat", and with an associated feature var of "http://jabber.org/protocol/muc". A typical response element has the form shown below.

```
   <identity category="conference" type="chat" name="ChatRoom"/>
   <feature var="http://jabber.org/protocol/muc"/>
```

It can be used to create MUC Rooms which are somewhat analogous, from a UPnP perspective to a localized network where access can be controlled and both unicast and multicast type messaging are supported and, from an XMPP perspective, as an limited Roster of UCCDs and UCC-CPs authorized for the specific usage of the Room.

2.1 MUC Rooms

MUC Rooms can be configured to have many layers of privacy and security. They can be:

- "hidden" or "public",
- "members-only" or "open",
- "password-protected" or "unsecured",
- "temporary" or "persistent"
- "moderated" or "unmoderated"
- "semi-anonymous" or "non-anonymous"

Rooms have a Bare JID identity or Room ID which will reside on the domainpart supporting the MUC Service. For example, the jeffrey *Cloud Account*, could be located at ChatRoom@conference.mycloud.org[2], as Bare JID:

virtual-family-Room@conference.mycloud.org,

while occupants of the Room are identified as Full JIDs attached to the Room, for example:

virtual-family-Room@conference.mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:randomstring

2.1.1 MUC Room Creation

A Room can be created by simply sending a <presence> stanza to the MUC Service with Room Name (localpart) and Occupant Name (resourcepart) of the form shown below.

```
<presence
   to="RoomName localpart@MUCdomainpart/OccupantNameresourcepart">
  <x xmlns="http://jabber.org/protocol/muc"/>
</presence>
```

The MUC protocol requires that the Room Name and Occupant Name (aka NickName) also be unique to the MUC Service instant. Therefore, it is suggested that they both contain some randomization or uniqueness component plus a human readable component (in the case of UCC-CPs and UCCDs the UPnP schema urn plus the device or control point type string). The design principle behind the naming suggestion is to keep some degree of autonomy between the Full JID of the UCC-CP or UCCD and its Room persona.

[2] The conference.upnpcloud.org JID is discovered initially with #item requests to the UCS.

In the example below, Jeffrey's UCC-CP (jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8) requests creation of a MUC **Room** with **Name** (**localpart**):

virtual-family-Room-4hQj1eTZyx

and semi-autonomous **Occupant Name** with **resourcepart** of:

urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd.

UCC-CP jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8
Sends:

```
<presence
  to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-upnp
     -org:cloud-1-0:ControlPoint:1:ZugTTaInPd">
  <x xmlns="http://jabber.org/protocol/muc"/>
</presence>
```

Upon successful creation of the **Room**, a <**presence**> stanza is received from the newly created **Room** with an <**item**> and one or more <**status**> elements. The response is of the form shown below.

```
<presence
   from="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart"
   to="FullJIDlocalpart@UCSdomainpart/FullJIDresourcepart">
   <x xmlns="http://jabber.org/protocol/muc#user"/>
      <item
        affiliation="owner"
        role="moderator"
        jid="FullJIDlocalpart@UCSdomainpart/FullJIDresourcepart"/>
      <status code="110"/>
                . . .
      <status code="XXX"/>
   </x>
</presence>
```

The <**item**> element indicates the **JID** of the **Room** Occupant (UCC-CP), its **Affiliation** (**#owner**) and **Role** (**#moderator**); the <**status**> element indicates **code** **110** - "Room Created". See [XEP0045] section 5 for more details on **Affiliation**s and **Role**s and section 15.6.2 for the registered <**status**> codes.

The specific response for the example is:

```
<presence
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas
         -upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   xml:lang="en"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:
       ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8">
   <x xmlns="http://jabber.org/protocol/muc#user">
      <item
        affiliation="owner"
        role="moderator"
        jid="jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:
             ControlPoint:1:ZugTTaInPd"/>
      <status code="110"/>
   </x>
</presence>
```

2.1.2 Configuring a MUC Room

When a **Room** is created it is created with a default configuration. The default configuration can be determined by the **Room owner** by sending an <**iq**> stanza of type "**get**" to the **Room Bare JID** with the <**query**> element. The stanza form is shown below.

```
<iq
   type="get"
   id="vendor defined value"
   to="RoomName localpart@MUCdomainpart">
  <query xmlns="http://jabber.org/protocol/muc#owner"/>
</iq>
```

In response, the MUC Service will return a FORM indicating the configuration features supported and the current and or allowed values. The response stanza will be in the form shown below.

```
<iq
   from="RoomName localpart@MUCdomainpart "
   type="result"
   to="RoomName localpart@MUCdomainpart/OccupantNameresourcepart"
   id="vendor defined value">
   <query xmlns="http://jabber.org/protocol/muc#owner">
      <instructions>You need an x:data capable client to configure Room
      </instructions>
      <x
         xmlns="jabber:x:data"
         type="form">
         <title>Configuration of Room RoomName localpart@MUCdomainpart
         </title>
         <field
            type="hidden"
            var="FORM_TYPE">
            <value>http://jabber.org/protocol/muc#Roomconfig</value>
         </field>
         <field
            type="text-single"
            label="Room title"
            var="muc#Roomconfig_Roomname">
            <value/>
         <field/>

            response shortened; see Example 157 in [XEP0045] for full listing

         <field
            type="list-single"
            label="Maximum Number of Occupants"
            var="muc#Roomconfig_maxusers">
            <value>20</value>
            <option label="10">
               <value>10</value>
            </option>
            <option label="20">
               <value>20</value>
            </option>
            <option label="50">
               <value>50</value>
            </option>
         </field>
      </x>
   </query>
</iq>
```

The configuration of the **Room** can be modified by sending an <**iq**> stanza of type "**set**" to the **Room Bare JID**. It is suggested that the MUC support the configuration of the following parameters with the suggested default values.

Table 2-1: Room Configuration and Suggested Defaults

<Field>::<var>	Suggested Default Value	Comment
muc#Roomconfig_Roomname	-	Vendor/User defined according to use case
muc#Roomconfig_Roomdesc	-	Vendor/User defined according to use case
muc#Roomconfig_changesubject	0	Owner sets <Subject> according to use case or leaves blank
muc#Roomconfig_allowinvites	0	Moderators only
muc#Roomconfig_allowpm	anyone	allows direct <iq> and <message> exchanges between Room participants, this is needed for UPnP UCA description and control
muc#Roomconfig_presencebroadcast	participant	Enables discovery as described in UCA
muc#Roomconfig_getmemberlist	participant	allows UCC-CP or UCCD to query Room occupants if state is lost
muc#Roomconfig_publicRoom	0	Use case dependent, allows Room to be discovered but not necessarily entered by any user connected to the MUC service
muc#Roomconfig_persistentRoom	1	Use case dependent. Avoids having to reconfigure Room but requires clean up if Room no longer needed
muc#Roomconfig_moderatedRoom	0	Reflects typical UPnP use cases, ensures all UCC-CPs and UCCDs in the Room can communicate by not requiring Voice to send information
muc#Roomconfig_membersonly	1	Use case dependent, needed for Password protected Room
muc#Roomconfig_passwordprotectedRoom	1	Makes Room secure by default
muc#Roomconfig_Roomsecret	PASSWORD	Vendor/User defined
muc#Roomconfig_whois	moderator	Defines who can discover real JIDs
muc#maxhistoryfetch	0	Retrieval of history generally not needed, would generate extra traffic
muc#Roomconfig_Roomadmins	-	use case dependent but typically no additional admins are needed
muc#Roomconfig_Roomowners	-	use case dependent but typically no additional owners are needed

Continuing the example, the Room owner sends a configuration request to the Room Bare JID to make the Room more secure, as well as, persistent; this includes a request to make the Room Password protected with a PASSWORD of "imapassword". The example request follows.

UCC-CP `jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8`
Sends:

```
<iq id="setconfig1"
    to= virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
    type="set">
   <query xmlns="http://jabber.org/protocol/muc#owner">
      <x xmlns="jabber:x:data' type='submit">
         <field var="FORM_TYPE">
            <value>http://jabber.org/protocol/muc#Roomconfig</value>
         </field>
         <field var="muc#Roomconfig_publicRoom">
            <value>0</value>
         </field>
         <field var="muc#Roomconfig_persistentRoom">
            <value>1</value>
         </field>
         <field var="muc#Roomconfig_membersonly">
            <value>1</value>
         </field>
         <field var="muc#Roomconfig_passwordprotectedRoom">
            <value>1</value>
         </field>
         <field var="muc#maxhistoryfetch">
            <value>0</value>
         </field>
         <field var="muc#Roomconfig_Roomsecret">
            <value>imapassword</value>
         </field>
      </x>
   </query>
</iq>
```

Upon success, the response is as follows:

```
<iq
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   type="result"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:
   ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8"
   id="setconfig1">
   <query xmlns="http://jabber.org/protocol/muc#owner"/>
</iq>
```

Note that the response is from the **Room** **JID** to the **Full** **JID** of the UCC-CP. Note also that when multiple configuration fields are sent in a single stanza that an "**error**" will not distinguish which field failed, therefore it is probably a sound strategy to send the request in a more granular fashion.

To avoid frequent resetting of the Room occupants and loss of Roles, implementers are encouraged to make Room presence as long lived as possible but also minimize "ghost" occupants.

2.1.3 MUC Room Invitations and Acceptance

Once the **Room** has been configured, the next step is to populate the **Room** with **participant**s, that is, other UCCDs (and perhaps UCC-CPs). The preferred method is for the UCC-CP (**owner**) to send a **Room** invitation to the **participant**. The invitation will occur in two parts: 1) a <**message**> stanza invitation request from the **owner** to the **Room**, and 2) a modified <**message**> stanza invitation from the **Room** to the requested **participant**. The form of the first part is shown below.

```
<message
```

```
   id="vendor defined value"
   type="normal"
   to="RoomNamelocalpart@MUCdomainpart">
   <x xmlns="http://jabber.org/protocol/muc#user">
      <invite
         to="FullJIDlocalpart@UCSdomainpart/FullJIDresourcepart">
         <reason>Vendor defined message</reason>
      </invite>
   </x>
</message>
```

Note that the message **type** needs to be "**normal**" or undefined. The second part of the invitation is an augmentation, by the **Room**, of the original invite with the PASSWORD of the **Room** added in a <**password**> element and, optionally, some additional information provided in a <**body**> element. The form of the second part is shown below.

```
<message
   id="vendor defined value"
   type="normal"
   from="RoomNamelocalpart@MUCdomainpart"
   to="FullJIDlocalpart@UCSdomainpart/FullJIDresourcepart">
   <x xmlns="http://jabber.org/protocol/muc#user">
      <invite
         to="FullJIDlocalpart@UCSdomainpart/FullJIDresourcepart ">
         <reason>Vendor defined message</reason>
         <password>imapassword</password>
      </invite>
   </x>
   <x
   xmlns="jabber:x:conference"
   jid="RoomNamelocalpart@MUCdomainpart"/>
   <body>Something like UCC-CP invites you to Room virtual-family-Room,
         the password is 'imapassword'
   </body>
</message>
```

The invitation is accepted by the **participant** (UCC-CP or UCCD) by sending a <**presence**> stanza to the **Room JID** with the <**password**> element. The stanza form is show below.

```
<presence
   to="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart">
   <x xmlns="http://jabber.org/protocol/muc">
      <password>imapassword</password>
   </x>
   <uc xmlns="urn:schemas-upnp-org:cloud-1-0">
      <configIdCloud hash="sha-256">
         Vendor calculated value, the <uc> element only appears for UCCDs
      </configIdCloud>
   </uc>
</presence>
```

An example invitation sequence follows.

Jeffrey's UCC-CP with MUC **admin Role** sends an invite to a **Room JID** requesting a known MediaRenderer belonging to `jeffrey@mycloud.org`.

UCC-CP `jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8`
Sends:

```
<message
   id="invite1"
   type="normal"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org">
   <x xmlns="http://jabber.org/protocol/muc#user">
      <invite
         to="jeffrey@mycloud.org/urn:schemas-upnp-org:device:
                  MediaServer:4e70e9d0e-d9eb-4748-b163-636a323e7950">
         <reason>Need Media Renderer in Virtual Room</reason>
      </invite>
   </x>
</message>
```

The **Room** modifies the request to include the **Room** PASSWORD and forwards it to the MediaRenderer UCCD; a human readable <**body**> element is also added composed autonomously by the **Room**.

```
<message
   id="invite1"
   type="normal"
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:device:
               MediaServer:4:e70e9d0e-d9eb-4748-b163-636a323e7950">
   <x xmlns="http://jabber.org/protocol/muc#user">
      <invite
         to="jeffrey@mycloud.org/urn:schemas-upnp-org:device:
                  MediaServer:4:e70e9d0e-d9eb-4748-b163-636a323e7950">
         <reason>Need MediaRenderer for Virtual Room</reason>
         <password>imapassword</password>
      </invite>
   </x>
   <x
   xmlns="jabber:x:conference"
   jid="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"/>
   <body>Jeffrey's Control Point (UCC-CP) invites you to Room
         virtual-family-Room-4hQj1eTZyx, the password is 'imapassword'
   </body>
</message>
```

The MediaRenderer UCCD accepts the invitation by sending a <**presence**> stanza to the **Room** **JID** with the provided PASSWORD. Depending on the use case, the request can be vetted by a human user (via a User Interface) prior to accepting the invite. The UCCD uses a shortened **JID** to indicate its UCCD **DeviceType**, the User component of the UCCD is hidden from **Room** **participant**s and known only by the "**owner**/**moderator**".

UCC-CP jeffrey@mycloud.org/urn:schemas-upnp-org:device:
MediaServer:4:e70e9d0e-d9eb-4748-b163-636a323e7950
Sends:

```
<presence
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       /urn:schemas-upnp-org:device:MediaServer:4: RFH163jJt4">
   <x xmlns="http://jabber.org/protocol/muc">
      <password>imapassword</password>
   </x>
   <uc xmlns="urn:schemas-upnp-org:cloud-1-0">
      <configIdCloud hash="sha-256">
         jNwTQLAos+iQRmkykrNHk6YDvqxcCSP6dF8FZ1VhXBA=
      </configIdCloud>
   </uc>
</presence>
```

The UCCD (MediaServer) receives <**presence**> from the UCC-CP and itself (with status) from the **Room**.

```
<presence
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-
         upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   xml:lang="en"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:device:MediaServer:4
       :e70e9d0e-d9eb-4748-b163-636a323e7950"
   id="join2">
   <x
      xmlns="http://jabber.org/protocol/muc#user">
      <item
         affiliation="owner"
         role="moderator"/>
   </x>
</presence>
```

```
<presence
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas
         -upnp-org:device:MediaServer:4:RFH163jJt4"
   xml:lang="en"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:device:MediaServer:4
       :e70e9d0e-d9eb-4748-b163-636a323e7950"
   id="join2">
   <x
      xmlns="http://jabber.org/protocol/muc#user">
      <item
         affiliation="member"
         role="participant"/>
      <status code="110"/>
   </x>
   <uc xmlns="urn:schemas-upnp-org:cloud-1-0">
      <configIdCloud hash="sha-256">
         jNwTQLAos+iQRmkykrNHk6YDvqxcCSP6dF8FZ1VhXBA=
      </configIdCloud>
   </uc>
</presence>
```

The UCC-CP receives <**presence**> from the UCCD (MediaServer) with status for the **Room** as well.

```
<presence
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas
         -upnp-org:device:MediaServer:4:RFH163jJt4"
   xml:lang="en"
   to="jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1
       :ad93e8f5-634b-4123-80ca-225886a5c0e8"
   id="join2">
   <x
      xmlns="http://jabber.org/protocol/muc#user">
      <item
         affiliation="member"
         role="participant"
         jid="ibcdemo@upnpcloud.comarch.com/urn:schemas-upnp-org:
              cloud-1-0:ControlPoint:1:7e7e4d4d7e-ibcdemo"/>
   </x>
   <uc xmlns="urn:schemas-upnp-org:cloud-1-0">
      <configIdCloud hash="sha-256">
         jNwTQLAos+iQRmkykrNHk6YDvqxcCSP6dF8FZ1VhXBA=
      </configIdCloud>
   </uc>
</presence>
```

Note that the received presence is from the **Room** **Occupant** **JID**s. To complete the initial scenario Jeffrey's UCC-CP also successfully invites a MediaRenderer to `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org`.

The **Room** `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org` now contains the semi-anonymous UPnP **participant**s:

- UCC-CP: `urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd`
- UCCD: `urn:schemas-upnp-org:device:MediaRenderer:3:mPEPPIqIH4`
- UCCD: `urn:schemas-upnp-org:device:MediaServer:4:RFH163jJt4`

which correspond, respectively, to their **Full JID** versions:

- `jeffrey@mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ad93e8f5-634b-4123-80ca-225886a5c0e8`
- `jeffrey@mycloud.org/urn:schemas-upnp-org:device:MediaRenderer:3:88509d0e-e8f5-80ca-4123-225886a50ee7`
- `jeffrey@mycloud.org/urn:schemas-upnp-org:device:MediaServer:4:e70e9d0e-d9eb-4748-b163-636a323e7950`

2.2 The MUC Session

Once the desired devices are members of the **Room** normal UPnP Cloud sharing can occur, that is, device interaction involving UPnP UCA description, eventing, and control. Since the **Room** has been configured to support **muc#Roomconfig_allowpm** with "anyone", <**iq**> and <**message**> stanzas can be exchanged between the **participant**s in a unicast fashion (although they will be relayed through the **Room**), as well as, a multicast fashion using <**message**> stanzas of **type** "**groupchat**"

2.2.1 Description

DDD and SCPD descriptions are exchanged via **Room JID** to **Room JID** <**iq**> stanzas. The format is the same as described in [UDA] 2.0 section C.6.6 with the exception of the addressing. The <**iq**> stanza is of the form shown below.

```
<iq
   id="vendor defined value"
   to="RoomName localpart@MUCdomainpart/OccupantNameresourcepart of UCCD"
   from="RoomName localpart@MUCdomainpart/OccupantNameresourcepart of UCC-CP"
   type="get">
   <query xmlns="urn:schemas-upnp-org:cloud-1-0"
      type="description"
      name="value of UDN"/>
</iq>
```

The control point from the continuing example requests the MediaServer:4 DDD.

UCC-CP `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd`
Sends:

```
 <iq
   id="get-MediaServer-ddd"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas
       -upnp-org:device:MediaServer:4:RFH163jJt4"
   type="get">
   <query
      xmlns="urn:schemas-upnp-org:cloud-1-0"
      type="description"
      name="uuid:e70e9d0e-d9eb-4748-b163-636a323e7950"/>
</iq>
```

Note that the <**iq**> stanza is relayed through the **Room**.

The UCCD sends the response as described in the form below.

```
<iq
   id="vendor defined value"
   from="RoomName localpart@MUCdomainpart/OccupantNameresourcepart of UCCD"
   to="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart of UCC-CP"
   type="result"
   <query xmlns="urn:schemas-upnp-org:cloud-1-0"
      type="described|error"
      name="received value of UDN"/>
        Concatenated DDD XML, SCPDs
           or
         UPnP Cloud error Description
   </query>
</iq>
```

Continuing the previous example, Jeffrey's MediaServer UCCD sends the following response.

UCCD virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
urn:schemas-upnp-org:device:MediaServer:4:RFH163jJt4
Sends:

```
<iq
   id="get-MediaServer-ddd"
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
         urn:schemas-upnp-org:device:MediaServer:4:RFH163jJt4"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   type="result">
   <query
      xmlns="urn:schemas-upnp-org:cloud-1-0"
      type="described"
      name="uuid:e70e9d0e-d9eb-4748-b163-636a323e7950"/>
      <root xmlns="urn:schemas-upnp-org:device" configId="2">
         <specVersion>
            <major>1</major>
               . . .
         </specVersion>
         <device>
             <deviceType>urn:schemas-upnp-org:device:
                  MediaServer:4<deviceType>
                  . . .
            <iconList>
               . . .
            </iconList>
            <serviceList>
               . . .
            </serviceList>
         </device>
      </root>
      <scpd
         xlmns="urn:schemas-upnp-org:service-1-0"
         . . .
         configId="2">
         <specVersion>
            <major>4</major>
               . . .
         </specVersion>
         <actionList>
            <action>
                  . . .
            </action>
          </actionList>
      </scpd>
       . . .
      <scpd
         xmlns="urn:schemas-upnp-org:service-1-0"
         . . .
         configId="2">
         <specVersion>
            <major>3</major>
               . . .
         </specVersion>
         <actionList>
            <action>
                  . . .
            </action>
          </actionList>
      </scpd>
   </query>
</iq>
```

Note that the **from** attribute is optional on the outgoing <**iq**> and is added by the MUC Service.

2.2.2 Control

Control in the MUC session requires an addressing modification as described for MUC Description and is otherwise the same as described in [UDA] 2.0 section C.8. That is the UCC-CP sends an <**iq**> request to the UCCD **Room JID** with the form shown below.

```
<iq id='vendor defined value'
   to="RoomName localpart@MUCdomainpart/OccupantNameresourcepart of UCCD"
   from="RoomName localpart@MUCdomainpart/OccupantNameresourcepart of UCC-CP"
   type="set">
   <s:Envelope
      xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
      s:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <s:Header mustUnderstand="1">
         <uc xmlns="urn:schemas-upnp-org:cloud-1-0" serviceId="serviceId"/>
      </s:Header>
      <s:Body>
         <u:actionName xmlns:u="urn:schemas-upnp-org:service:serviceType:v">
            <argumentName>in arg value</argumentName>
            <!-- other in args and their value go here, if any -->
         </u:actionName>
      </s:Body>
   </s:Envelope>
</iq>
```

The reply is identical to the "**result**" and "**error**" response described in [UDA] 2.0 section C.8 with the exception of modified addressing; that is, the response is sent to the UCC-CP **Room JID** of the UCC-CP. An example MUC based Control <**iq**> Request and Response is shown below.

UCC-CP virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/ urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd
Sends:

```
<iq
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:device:MediaRenderer:3:mPEPPIqIH4"
   id="cp-1-soap-action-1"
   type="set">
   <s:Envelope
      xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
      s:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <s:Header mustUnderstand="1">
         <uc xmlns="urn:schemas-upnp-org:cloud-1-0"
             serviceId="RenderingControl"/>
      </s:Header>
      <s:Body>
         <u:SetVolume
            xmlns:u="urn:schemas-upnp-org:service:RenderingControl:3">
            <DesiredVolume>20</DesiredVolume>
         </u:SetVolume>
      </s:Body>
   </s:Envelope>
```

```
</iq>
```

The UCCD responds with a SOAP action or SOAP error response as defined in [UDA] 2.0 section C.8.

In the response below the Action is successful.

UCCD `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/ urn:schemas-upnp-org:device:MediaRenderer:3:mPEPPIqIH4` **Sends:**

```
<iq
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:device:MediaRenderer:3:mPEPPIqIH4"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   id="cp-1-soap-action-1"
   type="result">
   <s:Envelope
      xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
      s:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <s:Header mustUnderstand="1">
         <uc xmlns="urn:schemas-upnp-org:cloud-1-0"
             serviceId="RenderingControl"/>
      </s:Header>
      <s:Body>
         <u:SetVolume xmlns:u="urn:schemas-upnp-org:
               service:RenderingControl:3">
            <DesiredVolume>20</DesiredVolume>
         </u:SetVolume>
      </s:Body>
   </s:Envelope>
</iq>
```

2.2.3 Eventing

UPnP UCA eventing is based on XMPP **PubSub**, however, since the **Room** can serve as a convenient **PubSub** alternative, UCCD events are sent directly to the **Room** within a <**message**> stanza of **type** "**groupchat**". The advantage of eventing this way being three fold: 1) **PubSub** authorization to "other" user's **PubSub**s is not needed, 2) events within the **Room** are likely to have less jitter in their delivery and 3) the implementation is slightly less complex. On the other hand, a slight disadvantage is that there could be more unwanted event traffic for some UCC-CPs.
The UCCD waits until it has received an acknowledgement from its **PubSub** with <**item**> **id** so that it can supply the value in the event message to the **Room**. This is to allow UCC-CPs that have already subscribed to the even via regular **PubSub** to easily filter duplicates. The MUC event is of the form shown below.

```
<message
   id="vendor defined value"
   type="groupchat"
   to="RoomNamelocalpart@MUCdomainpart"
   from="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart of UCCD">
   <event xmlns="http://jabber.org/protocol/pubsub#event"/>
      <items node="name of event node the UCCD published its UCA event to">
         <item id="unique id assigned by PubSubName and copied here before
                  sending to the Room">
            <e:propertyset xmlns:e="urn:schemas-upnp-org:event-1-0">
               <e:property>
                  <variableName>new value</variableName>
               </e:property>
            </e:propertyset>
         </item>
      </items>
   </event>
</message>
```

Note that the <**event**> element is opaque when included in a message body and will need to be caught by interested UCC-CPs.

In the example below the UCCD MediaServer:4 events a *SystemUpdateID* [CDS4] state variable and it is sent to the MUC **Room**.

UCCD `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-upnp-org:device:MediaServer:4:RFH163jJt4`
Sends:

```
<message
   id="WEnCONy2g1rJQ9SN0TWN"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   type="groupchat">
   <e:propertyset xmlns:e="urn:schemas-upnp-org:event-1-0">
       <e:property>
           <SystemUpdateID>2716658</SystemUpdateID>
       </e:property>
    </e:propertyset>
</message>
```

The event is the sent to each occupant of the **Room**. Note that there is no need to subscribe to events for MUC sessions. The <**message**> sent to the UCC-CP is shown below.

Room `virtual-family-Room-4hQj1eTZyx@conference.mycloud.org`
Sends:

```
<message
   id="WEnCONy2g1rJQ9SN0TWN"
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   type="groupchat">
   <e:propertyset xmlns:e="urn:schemas-upnp-org:event-1-0">
       <e:property>
           <SystemUpdateID>2716658</SystemUpdateID>
       </e:property>
    </e:propertyset>
</message>
```

2.3 MUC with Other Users

The strategy suggested when devices from a different account are to be added to a MUC session is to first invite a UCC-CP from the other user's *Cloud Account*, say `mary@theircloud.org`, make that user a **moderator** and then allow their UCC-CP to invite other devices to the **Room**. Note that the trust among UCCDs and UCC-CPs is established outside of the MUC Session. If `Jeffrey` does not trust `Mary` to invite only desired devices then an out-of-band mechanism for Jeffrey to invite Mary's devices to the **Room** directly could be implemented.

Note that the **moderator Role** is granted to the *OccupantNameResource* in the **Room** and does not necessarily have to be a UCC-CP and in fact could well be a separate application with knowledge of Mary's UCC-CPs and UCCDs. This allows the scenario where Jeffrey sends the invite to Mary's **Bare JID** which is well-known and easier to remember by a human user (does not require knowing the randomized part or UUID), she accepts the invite and then sends Jeffrey knowledge of her *OccupantNameResource* via normal chat, whereby Jeffrey escalates the corresponding participants **Role** to **moderator**.

For the example, Jeffrey's UCC-CP sends an invite similar to the one in 2.1.3 to Mary's Control point at:

mary@theircloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:e8f5ad93-634b-4123-c0e8-86a5225880ca.

Mary's UCC-CP accepts as:
virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:dMYTvwfSGG

Jeffrey's UCC-CP (the **Room**'s **owner**) then escalates Mary's UCC-CP to the **moderator Role** via an <**iq**> stanza to the **Room JID**. The stanza is of the form shown below.

```
<iq
   from="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart of UCC-CP
         Room owner"
   id="vendor defined value"
   to="RoomNamelocalpart@MUCdomainpart"
   type="set">
   <query xmlns="http://jabber.org/protocol/muc#admin">
      <item nick="OccupantNameresourcepart (NickName) of invited UCC-CP"
         role="moderator">
         <reason>Optional Reason Element for user consumption</reason>
      </item>
   </query>
</iq>
```

Upon success the **owner** UCC-CP is informed with an <**iq**> response of **type** "**result**" and the new **Role** of Mary's UCC-CP is sent to all **Room** occupants with an updated <**presence**> response. An example sequence is shown below.

UCC-CP virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd
Sends:

```
<iq
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   id="make-mary-moderator"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   type="set">
   <query xmlns="http://jabber.org/protocol/muc#admin">
      <item nick="urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:dMYTvwfSGG "
         role="moderator">
         <reason>Mary can you share your devices?</reason>
      </item>
   </query>
</iq>
```

And receives from the MUC Service the response <**iq**> stanza

```
<iq
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   id="make-mary-moderator"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   type="result">
</iq>
```

All **Room** members receive updated <**presence**>, the response to Jeffrey's UCC-CP is shown below.

```
<presense
   from="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org"
   to="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
       urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:ZugTTaInPd"
   <x xmlns="http://jabber.org/protocol/muc#user">
```

```
      <item affiliation="member"
         jid="virtual-family-Room-4hQj1eTZyx@conference.mycloud.org/
              urn:schemas-upnp-org:cloud-1-0:ControlPoint:1:dMYTvwfSGG"
         role="moderator"/>
   </x>
</presence>
```

The **Room** now contains two **moderator** UCC-CPs both with privileges to invite other UCCDs and UCC-CPs to the **Room**. Note that Jeffrey's UCC-CP is still the only UCC-CP with **owner** and **admin** privileges. Mary can now invite her UCCDs as describing in section 2.1.3. It needs to be noted that Mary might need to add the **Room JID** to her **Roster** before the invitation is sent from the **Room** if non-**Roster** stanzas are blocked.

3 Other Considerations

3.1.1 Room Maintenance

Currently a subscription Service to a MUC **Room** does not exist, therefore if **participant**s are disconnected from the **Room** they will need to re-join by re-sending <**presence**> as described in 2.1.3. Also, only **Affiliations** are maintained across re-joins so privileges associated with **Role**s, such as **moderator**, would have to be re-established by the **owner** if still needed.

3.1.2 Room Moderation

The MUC Service defines several capabilities for moderating and managing MUC **Room**s. In general descriptive capabilities, such as defining a **Room subject** are left to the implementer. Also, the level of management capability for the **owner** UCC-CP is implementation dependent, however, the **owner** UCC-CP at a minimum will probably need to be able to **kick** a **participant** UCC-CP or UCCD out of the **Room** and perhaps **Ban** them.

3.1.3 Room Teardown

Only the **owner** of a **Room** can **destroy** it. If the **Room** is no longer needed then it can be removed from the MUC Service by sending an <**iq**> stanza of the form below.

```
<iq
   from="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart of UCC-CP
         Room owner"
   id="vendor defined value"
   to="RoomNamelocalpart@MUCdomainpart"
   type="set">
   <query xmlns="http://jabber.org/protocol/muc#owner">
      <destroy jid="AlternateRoomNamelocalpart@MUCdomainpart">
         <reason>Optional Reason Element for user consumption</reason>
      </destroy>
   </query>
</iq>
```

Upon success all **participant**s are informed with a <**presence**> stanza of **type** "**unavailable**" from their **Room JID** to their **Full JID** that includes the <**x**> element including the <**destroy**> element. The **owner** can include an alternate **Room** for continuing the use case, as well as a <**reason**> element to describe why the **Room** is being destroyed. This is helpful when the same participants are desired in an expanded or combined new use case. The stanza is of the form shown below.

```
<presence
   from="RoomNamelocalpart@MUCdomainpart/OccupantNameresourcepart"
    id="vendor defined value"
    to="FullJIDocalpart@domainpart/FullJIDResourcepart"
    type="unavailable">
   <x xmlns="http://jabber.org/protocol/muc#user">
    <destroy jid="AlternateRoomNamelocalpart@MUCdomainpart">
      <reason>Optional Reason Element for user consumption</reason>
    </destroy>
  </x>
</presence>
```

3.1.4 Roles and Affiliations

This section provides information from [XEP0045] for the convenience of the implementer. See the XEP for specific details.

As previously described UCCDs will be **Participants** and UCC-CPs (or applications) can be either **Participants** or **Moderators**. Entries in Table 3-1 and Table 3-2 that correspond to Privileges or **Roles** not suggested in the **Room** configuration are grayed out.

Table 3-1: Roles and Associated Privileges

	Roles			
Privilege	**None**	**Visitor**	**Participant**	**Moderator**
Is this Role Required?	N/A	NO	Yes	Yes
Present in Room	No	Yes	Yes	Yes
Receive Messages	No	Yes	Yes	Yes
Receive Occupant Presence	No	Yes	Yes	Yes
Broadcast Presence to All Occupants	No	Yes*	Yes	Yes
Change Availability Status	No	Yes*	Yes	Yes
Change Room Nickname	No	Yes*	Yes	Yes
Send Private Messages	No	Yes*	Yes	Yes
Invite Other Users	No	Yes*	Yes*	Yes
Send Messages to All	No	No**	Yes	Yes
Modify Subject	No	No*	Yes*	Yes
Kick Participants and Visitors	No	No	No	Yes
Grant Voice	No	No	No	Yes
Revoke Voice	No	No	No	Yes***

* Default; configuration settings MAY modify this privilege.
** An implementation MAY grant voice by default to visitors in unmoderated **Rooms**.
*** A **moderator** MUST NOT be able to revoke voice privileges from an **admin** or **owner**.

Table 3-2: Affiliations and Associated Privileges

	Affiliations				
Privilege	**Outcast**	**None**	**Member**	**Admin**	**Owner**
Enter Open Room	No	Yes*	Yes	Yes	Yes
Register with Open Room	No	Yes	N/A	N/A	N/A
Retrieve Member List	No	No	Yes	Yes	Yes
Enter Members-Only Room	No	No	Yes*	Yes	Yes
Ban Members and Unaffiliated Users	No	No	No	Yes	Yes
Edit Member List	No	No	No	Yes	Yes

Assign and Remove Moderator Role	No	No	No	Yes**	Yes**
Edit Admin List	No	No	No	No	Yes
Edit Owner List	No	No	No	No	Yes
Change Room Configuration	No	No	No	No	Yes
Destroy Room	No	No	No	No	Yes

* As a default, an unaffiliated user enters a moderated **Room** as a visitor, and enters an open **Room** as a **participant**. A member enters a **Room** as a **participant**. An **admin** or **owner** enters a **Room** as a **moderator**.
** As noted, a **moderator** SHOULD NOT be allowed to revoke moderation privileges from someone with a higher affiliation than themselves (i.e., an unaffiliated moderator SHOULD NOT be allowed to revoke moderation privileges from an **admin** or an **owner**, and an **admin** SHOULD NOT be allowed to revoke moderation privileges from an **owner**).

4 Summary of Suggested Capabilities

Table 4-1 provides a short summary of MUC stanza support needed for UCC-CPs and UCCDs to realize the above described MUC experience. The assumption is that the UCS implements MUC according to [XEP0045] and that the configuration parameters described in section 2.1.2 are implemented.

Table 4-1: MUC Stanza Summary for UCC-CP and UCCD

XMPP Stanza	UCC-CP MUC Capabilities	UCCD MUC Capabilities
<**iq**> discovery MUC service	X	
<**presence**> Generate and Examine **Room** Create stanzas	X	
<**iq**> Fetch **Room** Configuration stanzas	X	
<**iq**> Generate **Room** Configuration stanzas	X	
<**message**> Generate **Room** invitation	X	
<**presence**> Accept **Room** invitation	X	X
<**iq**> send to **Room Occupant** for description and control	X	X
<**iq**> receive and respond from **Room Occupant** for description and control	X	X
<**message**> send event to **Room** with **PubSub** ID		X
<**message**> receive and recognize event from **Room** and **PubSub** ID	X	
<**iq**> send **Room destroy**	X	

X - indicates support that could be implemented by a separate application from a UCC-CP and UCCD.

5 References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[RFC-6120] - Extensible Messaging and Presence Protocol XMPP: Core. Available at http://tools.ietf.org/html/rfc6120

[RFC-6121] - Extensible Messaging and Presence Protocol XMPP: Instance Messaging and Presence. Available at http://tools.ietf.org/html/rfc6121

[RFC-6122] - Extensible Messaging and Presence Protocol XMPP: Address Format. Available at http://tools.ietf.org/html/rfc6122

[XEP-0030] - Service Discovery, XMPP Standards Foundation, 1999-2015. Available at http://xmpp.org/extensions/xep-0030.html

[XEP0045] - Multi-User Chat. XMPP Standards Foundation, 1999-2015. Available at http://xmpp.org/extensions/xep-0045.html

[XEP-0060] - Publish-Subscribe, XMPP Standards Foundation, 1999-2015. Available at http://xmpp.org/extensions/xep-0060.html

[UDA] - UPnP Device Architecture, version 2.0, UPnP Forum, February 20, 2015. Available at: http://upnp.org/specs/arch/UPnPDA10_20000613.pdf. Latest version available at: http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v2.0.pdf.

[DP] - UPnP DeviceProtect:1 Service, UPnP Forum, February 4, 2011. Available at http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service-20110224.pdf. Latest version available at: http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service.pdf.

[CDS4] - UPnP Content Directory:4 Service, UPnP Forum, June 30, 2015. Available at http://www.upnp.org/specs/av/ContentDirectory-av-v4-Service-201150630.pdf. Latest version available at: http://www.upnp.org/specs/av/ContentDirectory-av-v4-Service.pdf.

[MS4] - UPnP MediaServer:4 Device, UPnP Forum, March 31, 2013. Available at http://www.upnp.org/specs/av/MediaServer-av-v4-Device-20130331.pdf. Latest version available at: http://www.upnp.org/specs/av/MediaServer-av-v4-Device.pdf.

[MR3] - UPnP MediaRenderer:3 Device, UPnP Forum, March 31, 2013. Available at http://www.upnp.org/specs/av/MediaRenderer-av-v3-Device-20130331.pdf. Latest version available at: http://www.upnp.org/specs/av/MediaRenderer-av-v3-Device.pdf.