

1

Group Communication Concepts

1.1 Introduction

Group communication consists of two fundamental components – static data and session data. Static data is associated with persistent lists. For example, a service provider is associated with a list of subscribers; a freight company is associated with a list of drivers; a school is associated with a list of students; an end user is associated with a list of contacts on a mobile phone. Session data involves transient interactions between the listed members. For example, in a freight company a dispatcher interacts with other drivers when giving delivery instructions; a student interacts with other student when making a presentation during a conference; the end user interacts with one or more or subscribers when making a call. When one thinks about it, the combinations of listed members and sessions between members are actually quite endless.

This chapter introduces the reader to basic group communication concepts. Section 1.2 explains that role definition and administration are the first requirements for group communication. Section 1.3 defines a group session in terms of group function execution and gives a series of examples. Section 1.4 outlines the basic Internet protocols and signalling concepts required for implementation of OMA enablers – Push-to-talk over Cellular (PoC), XML Document Management (XDMS), and Presence with SIMPLE.

1.2 Group Communication Roles

Group communication involves the setup of a multimedia session between two or more users, in other words a list of users. A list is normally ordered in terms of hierarchy or the importance of its elements and there are different assigned roles for the arranged items or members. A role defines the actions and activities expected by the group and members. This section concentrates on two roles: the service provider and the end user [1].

1.2.1 Service Provider

The service provider assumes the dominant role for multimedia group communication. The service provider owns or leases the infrastructure and has invested in:

- SIP/IP Core and Application Servers that allow subscribers to form groups and conduct peer to peer multimedia communication – that is to enable users to ‘*set up and talk in their own groups*’;
- A Radio Access Network to allow subscribers to quickly form mobile groups and ‘*talk in real time*’, in which the participants may not be physically visible to each other.

To ensure a successful group communication service, the service provider needs to ensure clear administrative strategies:

- A marketing strategy that constantly informs their subscribers of the general concepts of group communication, how to relate mobile group talk to their lives, and how to administrate the experience of talking and listening to other group members;
- An attractive price strategy for group communication. Since group communication is predominately a listening/receiving service – *one person speaks/sends the other five participants’ listen/receive* – the aggregate price for listening or receiving data should always be low;
- An excellent quality of service strategy, in which the call setup and the round trip time of voice from the speaker party to the group listeners appears to be almost instant. The quality of service should mimic a professional walkie talkie experience.

1.2.2 End Users

The end user’s role is to subscribe to the service provider’s group communication service. The subscriber uses client(s) to convey their group communication desires. For mobile group communication, the client is embedded on the mobile phone. For stationary group communication, the client can be embedded on a PC or any other fixed device to perform the enabling operations. The PoC user is the same as a PoC Subscriber and PoC users become participants when engaged in a PoC session.

We will consider two types of PoC users for group communication:

- Basic Users
- Professional Users.

1.2.2.1 Basic PoC Users

Basic PoC users are the service provider’s subscribers who purchased the service to form group talk sessions for entertainment, hobbies, college events, and to coordinate small businesses. Basic PoC users may form a PoC community. Basic PoC users use Access Control Lists (ACL) to define their level of interaction with other PoC users. An Access Control *Reject List* contains rules that restrict other PoC users who may try to establish a PoC session with the PoC user that owns the list. An Access Control *Accept List* allows other PoC users to talk to the PoC user instantly. Access Control Lists are administered using the XDMS service and are stored in the PoC XDM server. These will be described in Chapter 3.

1.2.2.2 Professional PoC Users

Professional PoC users are the service provider's enterprise subscribers, such as government departments, utilities and freight companies, who purchase the service to coordinate their work force. These organizations may allocate PoC Group Administrator rights to define, delete or modify PoC group memberships. Professional PoC users can also be served by a Value Added Service Provider who specializes in providing group communication to niche industries.

Professional PoC users apply role definitions to control communication. As an example, when the 1-to-Many-to-1 PoC communication feature is used, a Distinguished Participant can send and receive media to/from all Ordinary Participants, whilst Ordinary Participants can only send and receive media to/from one Distinguished Participant. *A Distinguished Participant is similar to a dispatcher in a police force who can talk to many different groups. The Ordinary Participant is similar to a policeman, who can only talk to the one nominated dispatcher.* In addition to defining who is who, the dispatcher may be enabled to apply priority talk rights to certain individual participants. A person with pre-emptive priority can interrupt the PoC speech of another user with lower priority. For example, if a worker is talking in a group session – *holding the floor* – a manager can interrupt before the worker has finished his sentence – *taking the floor* – and give commands to the listening participants. Formal OMA definition of roles for PoC group communication is given in Table 1.1.

Figure 1.1 shows example roles involved in mobile group communication. The Service Provider infrastructure simultaneously supports different types of PoC Groups and related

Table 1.1 Push-to-Talk over Cellular main communication roles

Terms	OMA Definitions
PoC Administrator	An entity that creates and maintains relevant aspects of PoC service for a specific PoC subscriber or group of PoC subscribers. The PoC service provider is the default PoC administrator. <i>In this book a service provider can be a cellular network operator such as pocservice@Wirelessfuture.com</i>
PoC Group Administrator	A person(s) or entity that has the authority to define, delete or modify PoC group memberships. The PoC service provider has group administrator rights by default. The service provider can allow Value Added Service Providers and individual organizations to create, modify and delete their own groups
PoC Subscriber	One whose service subscription includes the PoC service. A PoC subscriber can be a PoC user such as <i>John@Wirelessfuture.com</i>
PoC User	PoC user can be the same person as a PoC subscriber. A PoC user uses the PoC features through the User Equipment
Participant	PoC user in a PoC session
Distinguished Participant	A participant in a 1-many-1 PoC group session that sends media to all Ordinary Participants, and that receives media from any Ordinary Participant
Ordinary Participant	A participant in a 1-many-1 PoC group session that is only able to send and receive media to and from the Distinguished Participant

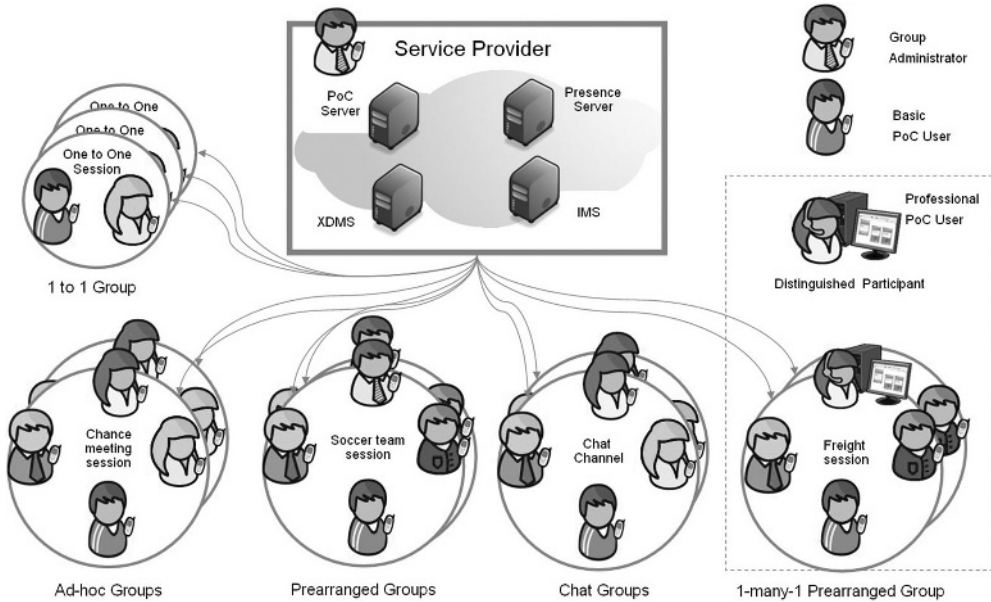


Figure 1.1 Service Provider, PoC Users, Groups and Sessions

sessions. The Service Provider is the root Group Administrator and allows the PoC community to form the different group types. The Service Provider comprises four services – SIP/IP Core (referred to as IMS), PoC Service, Presence Service and Group List Management Service (XDMS). There are four session types – 1 to 1, Ad-hoc, Pre-arranged, and Chat. The Chat session can be further subdivided into Open Chat and Restricted Chat session. PoC users are participants in a PoC session. For Professional PoC, the participants may be subdivided into Distinguished Participant (PoC Dispatcher) and Ordinary Participants.

1.3 Mobile Group Communication Use Cases

It is the service provider's task to market group communication use cases. For ease of explanation, PoC group communication can be simplified into the following:

- A PoC group is a predefined set of users that can be called:
 - Users listed in contacts on User Equipment
 - Users listed in documents stored on the network
- A PoC session is the real time connection between a set of users:
 - The set of users can be invited to the session by another PoC user
 - The set of users can join in to the session by their own free will – this is similar to joining an Internet chat room channel.

The separation between PoC group and PoC session involves the XML Document Management (XDMS) service. XDMS allows end users to create lists (group documents) to predefine

the membership of a group and store these documents on a network server. The documents can be downloaded by the end user for list modification (*I want to remove Paul from my list*), when they upgrade their mobile devices (*I have just bought a new mobile phone and do not want to create the groups again*), or when they move from device to device (*I want to access my group from both my mobile and desktop PC*). The document can also be downloaded by other services such as a Presence server, so the end user may publish his or her availability to PoC to those on the group list. The service provider can capture loyalty from the PoC community by storing group documents on their network.

The PoC session is the execution of the group function. When an individual wants to form a group session there are two modes of execution: the dial-out mode where an individual forms a group by inviting other participants to a session; and dial-in mode, where individuals join an existing Chat channel.

The Dial-Out participant method includes:

1. One to One session
2. Ad-hoc group session
3. Pre-arranged group session
4. 1 to Many to 1 group session.

The Dial-In method includes:

1. Open Chat session
2. Restricted Chat session.

OMA PoC groups and session types are given in Table 1.2.

When a dial-out PoC session type is used, the PoC service sends an invitation request to each intended session participant (each member of the group). In order to complete session establishment, call acceptance by at least one intended callee is required. There are two ways to implement this:

1. The end user being manually alerted before accepting the session invite;
2. The end users' device automatically accepts the session invite.

Alerting is the common method for multiparty conference calls, where the invited party sees who is inviting them to the session. Manual alerting corresponds with an On Demand session setup, as the recipients may or may not accept the session invite. It also corroborates with the notion of the PoC Session Owner, as the session can be dropped when the initiator leaves the group call. The automatic session accept assumes that the recipient does not need to see who is calling and is suitable for professional PoC users who need a walkie-talkie type call setup. In general, all the participants are known, and the calling user is thus placed into the Access Control *Accept List* to enable fast call setup. Automatically accepting the call combined with the Pre-established Session feature, optimizes the call setup time.

The Dial-In PoC session types do not require alerting, as PoC users themselves decide to join or leave Chat channels. The PoC user has the option to be simultaneously attached to many channels and receive PoC speech whenever a speaker from one of the sessions sends a talk burst (*Paivi says 'hi there' from channel 3*). Further, as there is no alerting, a PoC user

Table 1.2 Push-to-Talk over Cellular group and session types

Concept	OMA Definitions
PoC Group	A predefined set of PoC users together with its attributes. A PoC group is identified by a Session Initiation Protocol Uniform Resource Identifier, or SIP URI (PoC Group Identity for PoC Pre-arranged and Chat PoC Groups). PoC users use PoC Groups to establish PoC Group sessions
PoC Group Identity	A SIP URI identifying a Pre-arranged PoC group or a Chat PoC group. A PoC Group Identity is used by the PoC client to establish PoC group sessions with the Pre-arranged PoC groups and Chat PoC groups
Pre-arranged PoC Group	A Pre-arranged PoC group is a persistent PoC group that has an associated set of PoC users/and PoC groups. The establishment of a PoC session with a Pre-arranged PoC group results in all members being invited
Chat PoC Group	A persistent PoC group in which each member individually joins the PoC session. The establishment of a PoC session with that PoC group does not result in other members of the Chat group being invited
Restricted Group	A group that can be joined only by a PoC user that is a member of the group. A Restricted group has a Group List
PoC Group session – is a Pre-arranged PoC group, Ad-hoc PoC group or Chat PoC group session.	
A Session Type is a SIP URI- parameters are used to convey the type of SIP URI, and may take on one of the following values: 1-1, Ad-hoc, Chat Pre-arranged or Chat.	
1-1 PoC Session	A feature enabling a PoC user to establish a PoC session with another PoC user
Ad-hoc PoC Group Session	A PoC group session established by a PoC user to form an Ad-hoc PoC group
Pre-arranged PoC Group Session	A PoC session established by a PoC user with a Pre-arranged PoC group
Chat PoC Group Session	A Chat PoC group session is a PoC session established with a Chat PoC group

may automatically connect to channels that are active when he/she goes online. To differentiate between the channels, there is a Primary PoC Session (*the favourite channel*) and Secondary PoC Session (*a list of channels the user wishes to interact in*).

As PoC sessions are an online service, both the invite (dial-out) and join in (dial-in) group attachments benefit from the Presence service. The Presence service shows who is online and is available for communication. Once seeing Mary and Alice are online, John may initiate an Ad-hoc session with both.

OMA PoC session concepts are presented in Table 1.3.

1.3.1 One to One Session

One to One sessions are PoC calls set up by an originator to a single user instead of a group. John creates a One to One session during a robotics conference by a selecting participant,

Table 1.3 Push-to-Talk over Cellular Session definitions

Concept	OMA Definition
PoC Session Owner	In the case of 1-1 PoC session and Ad-hoc group session, the PoC Session Owner is the initiator of the PoC session. In the case of a Chat PoC group and a Pre-arranged PoC session, the PoC Session Owner is the creator of the PoC group
PoC Session Identity SIP URI	Identifies the PoC session and can be used for routing initial SIP requests. It is received by the PoC client during the PoC Session establishment in the contact header and/or TBCP Connect message in the case of a Pre-established Session
Pre-established Session	A Pre-established Session between the PoC client and the PoC server. The PoC client established the Pre-established Session prior to making requests for PoC sessions to other PoC users. To establish a PoC Session based on a SIP request from a PoC user, the PoC server conferences other PoC servers/PoC users to the Pre-established Session to create an end-to-end connection. <i>This is relevant to an automatically accept answer mode.</i>
On Demand Session	An On Demand Session is a PoC session setup mechanism in which all media parameters are negotiated at PoC session establishment. <i>This is relevant to a manual alert answer mode</i>
Simultaneous Session	This is where a PoC user is a Participant in more than one PoC session, simultaneously using the same PoC client. When a PoC user is participating in Simultaneous PoC Session, the PoC server performing the Participating PoC Function will apply media filtering on continuous media types (voice, video) between PoC sessions providing the same media.
Primary PoC Session	This is the PoC session that the PoC user selects in preference to other PoC sessions. When the user has simultaneous PoC sessions, the Primary PoC Session has priority over Secondary PoC Sessions
Secondary PoC Session	This is a PoC session for which the user receives media when there is no media present on the Primary PoC Session

‘Mary’ from his contact list and presses the PTT key (Figure 1.2). If Mary is not available, John can send her an Instant Personal Alert (*a call-back message*). John’s Instant Personal Alert (IPA) will be stored in Mary’s ‘Call Back Box’. If Mary does not want to be disturbed by John, she can choose to block his call by selecting *Incoming Session Barring (ISB)* or *Incoming Instant Personal Alert Barring*.

The One to One call session starts when the call is initiated and talking is mediated by floor control. When John presses the PTT key to speak, a floor request is sent to the PoC service. The request is acknowledged by the PoC service with a floor grant and John starts to speak – ‘*Hello, Mary, how are you doing?*’ When John ends the transmission, his mobile device sends a floor release indication to release the floor. If Mary tries to interrupt John when he has the floor, the PoC service will deny her request, indicating that she needs to wait until John stops talking. When John releases the floor, (stops pressing the PTT key) the floor is

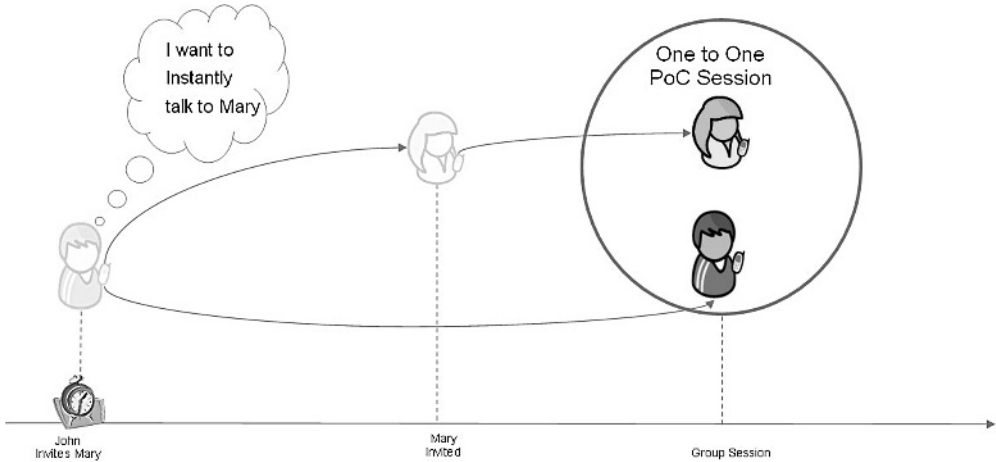


Figure 1.2 One to One Session – John invites Mary for an low cost call

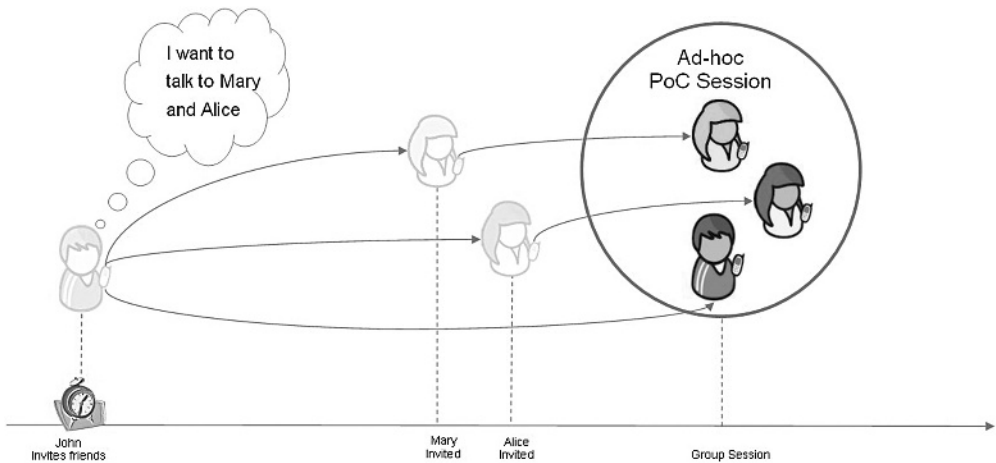


Figure 1.3 Ad-hoc Group Session – John invites Mary & Alice to agree where to meet and when

idle until Mary presses her PTT key and replies *‘I’m fine, John, I have a favour to ask’*. The session ends after a period of inactivity or when explicitly closed by John or Mary.

1.3.2 Ad-hoc Group Session

Ad-hoc sessions are temporary group calls set up by an originator to establish a group session with no requirement of an existing permanent group. John creates an Ad-hoc group during the robotics conference by selecting participants one by one from his contact list and presses the PTT key (Figure 1.3). The mobile device sends the list to the network during the invitation; however the network does not store the list. As John and other online PoC users are at

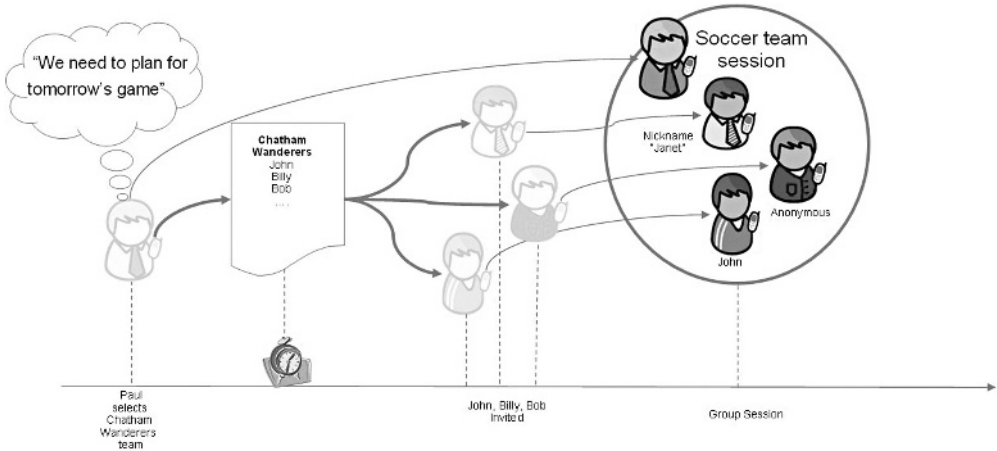


Figure 1.4 Pre-arranged Group Session – Paul invites the ‘Chatham Wanderers’ for team talk

a conference with people they hardly know, they have set their mobile devices to manual alert – so they can see who is calling them before accepting the PoC call. They also use Incoming Session Barring (ISB) during lunch breaks and set the ACL Reject Lists to stop some participants from constantly alerting them.

During the PoC session, John can periodically check the identity of the other members in the group and request indication of group participant changes. For example, during the Ad-hoc PoC session with Mary and Alice, John is sent a notification when Alice leaves the session.

1.3.3 Pre-arranged Group Session

A Pre-arranged group is a group where access is limited to predefined list of participants. This list is created by the group owner, and stored by the service provider by means of a specific XML document. For example, Paul has set up a Pre-arranged sports group called ‘Chatham Wanderers’ (Figure 1.4) and listed all of the team members using his mobile device. This PoC XML group document is stored in the Wirelessfuture.com network. When Paul selects the ‘Chatham Wanderers’ name on his mobile device, the Wirelessfuture.com PoC service will invite the all of the online team members to participate in a group session. As soon as Paul presses the PTT key, the invited team members will receive an indication of the incoming session, including the identifications of the ‘Chatham Wanderers’ group and originator ‘Paul’. The invited team members join the group session either with an automatic or manual reply. Paul will receive a notification of the invited members who have accepted the invitation. If at least one of the invited team participants accepts the invitation, the group session enters the communication phase and any of the participants that are present can start communicating.

As Paul is the group owner, he can invite absent group members to join the session while it is in progress. However, the Chatham Wanderers team members may join, leave, and rejoin

the existing session without affecting the group discussion. Termination of the session occurs when Paul, the Session Owner, leaves the session or if the number of remaining participants in the session drops to one. Session Termination may also occur if there is an inactivity timeout.

1.3.4 Open Chat Group Session

An Open Chat group is a group to which anyone who knows the group identification can join. John has joined an Open Chat group called `sip:pocquiz@games.wirelessfuture.com`, he found the group identification from a gamers' web site named *finders*. The purpose of the gaming group is to answer questions related to the location of an object using PoC. The participant who answers the most questions within a defined time wins a cash prize. The pocquiz Open Chat group is advertised once a week to PoC users who have the free time to join the game. The service provider, *Wirelessfuture.com* charges a special rate for PoC gamers.

1.3.5 Restricted Chat Group Session

A Restricted Chat group is a group where access is limited to predefined participants. John is a part-time employee of an organization called *Enterprise Forwarding*. *Enterprise Forwarding* delivers freight throughout Europe. A local Finnish IT management user has assigned John the rights to talk and listen to members of '*Italian_deliveries*'. He has also given him the rights to create Ad-hoc professional sub groups within the '*northern sector*' delivery region.

John joins the *Italian_deliveries* group channel (Figure 1.5) by selecting the name from the contact list in his mobile device when he starts work and stays connected throughout

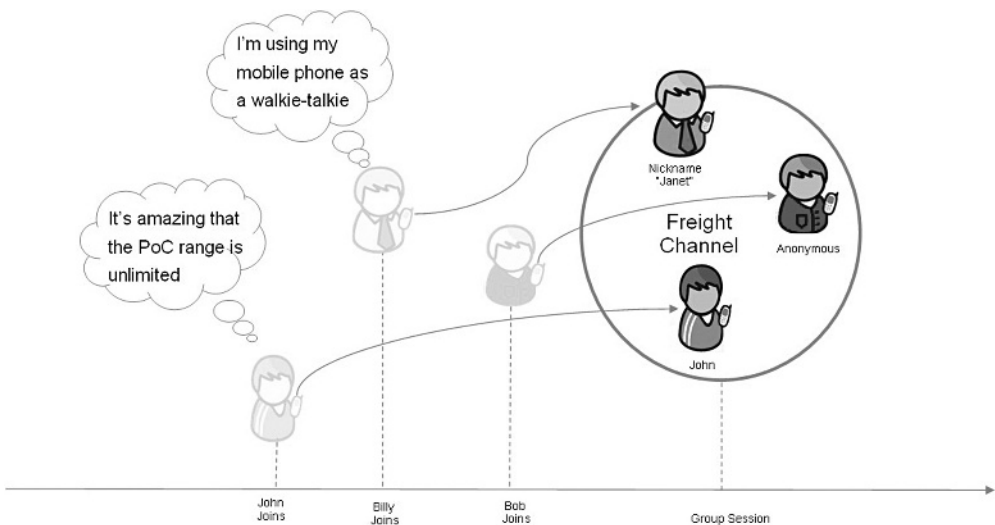


Figure 1.5 Restricted Group Chat – John, Billy and Bob join the Drivers' Session

until the workday finishes. He sets his mobile device to automatic answer so he hears the drivers' talk bursts as soon as they start giving information of their whereabouts. He also sees the drivers' talking party identification. He asks the drivers questions by pressing the PTT key. For special weekend deliveries, John creates his own Restricted Chat groups and advertises the group ID to selected drivers. At the end of the workday, John leaves the 'Italian_deliveries' group talk session without affecting the group session.

1.4 Multimedia Group Communication Implementation

The implementation of multimedia group communication – OMA PoC, XDMS, and Presence with SIMPLE enablers – lies within the domain of computer networking and Internet Protocols (IP). These enablers reuse Internet Protocols – Session Initiation Protocol (SIP), Real-time Protocol (RTP), Real-time Control Protocol (RTCP), and Hypertext (HTTP) – which makes them relatively easy for vendors to develop. Vendors either develop PoC, XDMS and Presence clients, primarily for mobile phones, or PoC, XDMS, Presence application servers.

The interaction between the end user's actions and the application of Internet Protocols are shown in Figure 1.6. SIP is used for call setup set and tear down (signalling), RTCP is used to control the media flow and the right to speak, and RTP is used for PoC Speech transport:

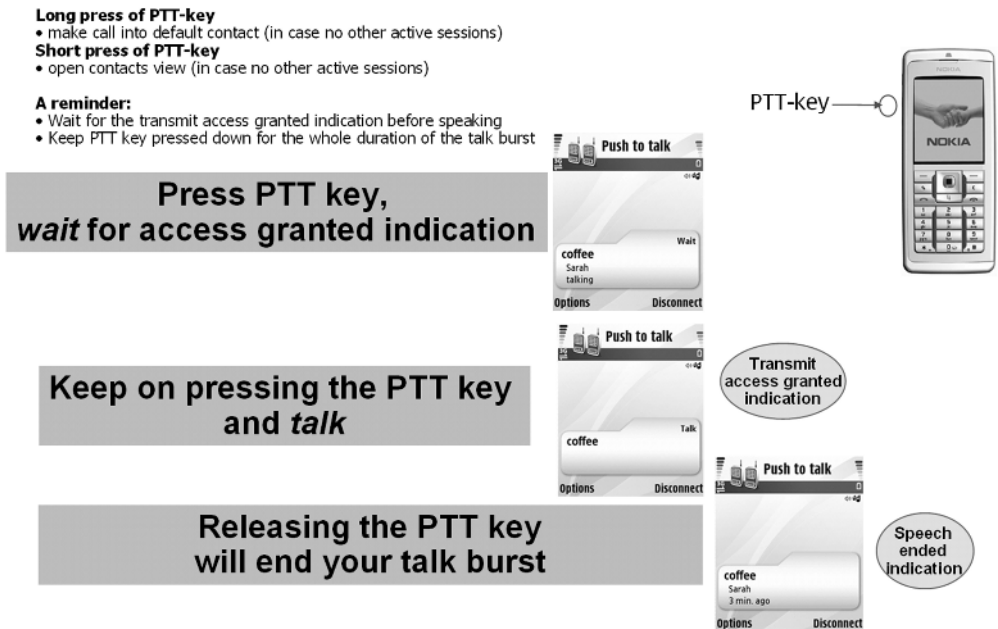


Figure 1.6 Steps on using a prototype PoC Application (2005)

- ‘Long Press of PTT-Key’ to make a call involves PoC Signalling by SIP to the SIP/IP core, PoC server and to other participants;
- ‘Wait for access granted indication’ involves receiving RTCP and Talk Burst Control Protocol (TBCP) messages from the PoC server;
- ‘Keep on pressing the PTT key and talk’ involves RTP transmission to the PoC server and on to the other participants;
- ‘Releasing the PTT key will end your talk burst’ involves sending RTCP and TBCP release message to the PoC server. The floor becomes idle and other participants have the opportunity to talk. After a period of inactivity, session is released by SIP signalling.

In the same way that Internet resources are assigned by Uniform Resource Identifiers (URI), the PoC service, XDMS, and Presence services use URIs to address PoC users, PoC groups, PoC sessions, The PoC service, XML documents, and Presence entities (Table 1.4).

The next sections will elaborate more on PoC SIP signalling, PoC Speech, XDMS and Presence signalling.

1.4.1 PoC Signalling

PoC Signalling is based on the Session Initiation Protocol (SIP). SIP is an application-layer control protocol for creating, modifying and terminating sessions with one or more participants. PoC SIP clients use TCP or UDP (typically on port 5060) to connect to SIP servers (IMS & PoC servers) and other SIP endpoints (PoC clients).

PoC Signalling uses a range of SIP methods and messages to mimic the sequence of a circuit switched telephone call, i.e. call setup, call acknowledgements and call tear down.

In general, all PoC sessions follow the following sequence. The SIP methods are highlighted in capitals [2]:

1. A PoC client (SIP User Agent) is embedded into the User Equipment;
2. A PoC client registers to the service providers PoC service via the SIP/IP Core (IMS) using the SIP REGISTER method;
 - a. SIP/IP Core (IMS) authenticates the PoC user and routes the SIP messages to the PoC server;
3. The PoC client informs the PoC server about the client’s capabilities and the PoC user preferred settings to PoC service by sending a SIP PUBLISH message;
4. Upon user action, the PoC client invites other PoC users (identified by their corresponding PoC identities) to a PoC session or joins a PoC Channel using an SIP INVITE;
 - a. SIP INVITE with Session Description Protocol (SDP) informs the PoC server about the client media parameters to be used in the session, such as audio codec or UDP ports allocated to send/receive media;
5. During a PoC session, PoC users are informed of other PoC users’ changes by means of SIP NOTIFY messages;
 - a. The PoC server informs group Participants who is in attendance;
6. PoC users leave the PoC session sending a SIP BYE.

Table 1.4 Push-to-Talk over Cellular Identities

Concept	OMA Definition
SIP URI	From RF3261: A SIP or SIPS URI identifies a communications resource [1] and follows the guidelines in RF2396. PoC uses SIP URI's to identify PoC clients, PoC servers, and PoC sessions, resource lists that point to URI lists etc . . . 'sip:john@wirelessfuture.com' is a SIP URI
TEL URI	A TEL URI identifies a resource identified by a telephone number. 'tel:+34-600123456' is a TEL URI
PoC User Identity	This is the identity of PoC subscribers. A PoC user identity may take the form of either a SIP URI or a TEL URI. A given subscriber may have assigned one or more PoC identities, of which at least one must be of the form of a SIP URI. The PoC user identity is used to address remote contacts, or to show the identity of the calling user
Session Type	A SIP URI- parameters are used to convey the type of SIP URI, and may take on one of the following values: 1-1, Ad-hoc, Pre-arranged or Chat
PoC Session Identity SIP URI	Identifies the PoC session and can be used for routing initial SIP requests. It is received by the PoC client during the PoC session establishment in the contact header and/or TBCP Connect message in the case of using a Pre-established Session. For example: 'sip:session12345@poc-server.wirelessfuture.com;session=1-1'
Conference-Factory-URI	A provisioned SIP URI that identifies the PoC service in the Home PoC Network, typically used for setting up an Ad-hoc PoC group or 1-1 PoC session. For example: 'sip:ad-hoc@wirelessfuture.com'
PoC Group Identity	A SIP URI identifying a Pre-arranged PoC group or a Chat PoC group. A PoC Group Identity is used by the PoC client to establish PoC Group sessions to the Pre-arranged PoC groups and Chat PoC groups. For example: 'sip:john@wirelessfuture.com;poc-group=mypocgroup'
Exploder URI	An address of a SIP URI-list service. A URI-list service is a specialized application service that receives a SIP request with a list of Uri's and generates a similar SIP request to each of the Uri's on the list. The SIP URI-list service includes a copy of the body of the original SIP request in the generated SIP requests
Anonymous PoC Address	A PoC address that may be used by PoC clients (or servers) to hide the identity of the end user, when privacy has been requested. An anonymous address may be a valid SIP URI, where the username and host part do not contain any valid information about the final user it represents

There are other SIP methods sent to interact with the PoC service, such as CANCEL, PUBLISH, MESSAGE, REFER . . . The dialog also includes a variety of SIP messages, such as Information (100 Trying, 180 Ringing . . .), Success (200 OK), Client Errors (401 Unauthorized, 403 Forbidden, 408 Request Time Out), Server Errors (501 Not Implemented) . . .

Outside the session, PoC users can send SIP messages to inform other users of the existence of a newly created group or to ask a specific user to call back [1][2]:

- Group Advertisement
- Instant Personal Alert.

Figure 1.7 shows the SIP messages used to control PoC Communications. The PoC client is a SIP User Agent and transmits SIP messages to the SIP/IP Core (IMS in this example). The IMS transmits and received SIP messages to the PoC service. The IMS transmits the SIP messages to the invited parties.

There are two important phases in PoC Signalling. The first is when the PoC user's client informs the PoC service about its capabilities and the PoC user's defined settings – such as *'do not disturb' with Instant Personal Alerts* and today my nickname is *'Susan'*. The second important phase concerns media negotiations between PoC clients during session setup. Codec negotiation between originating PoC client, PoC server and terminating PoC client is an area where interoperability issues may arise.

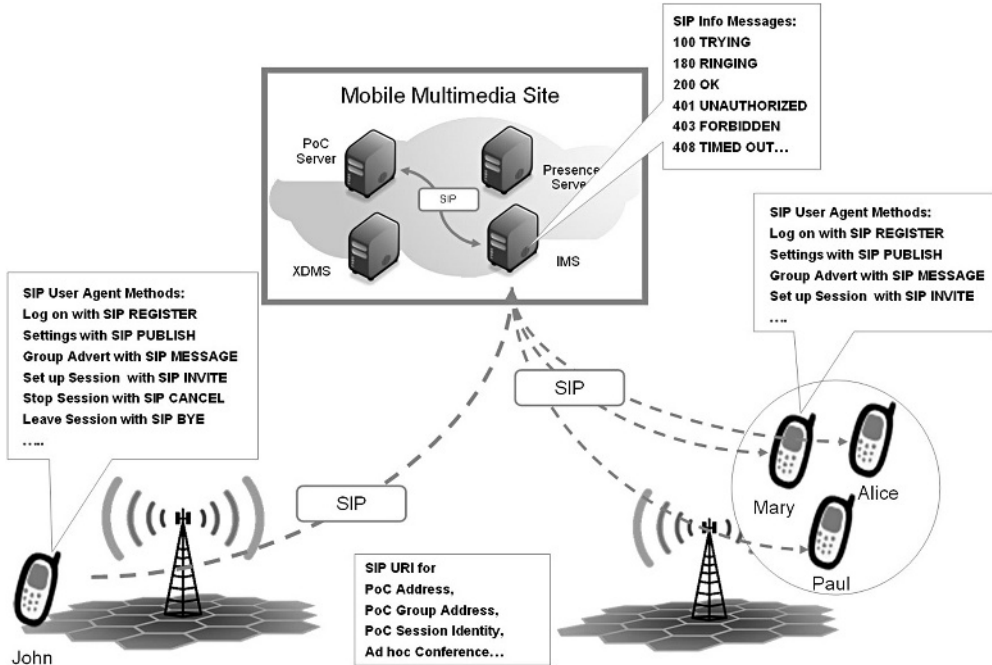


Figure 1.7 SIP Signalling for the PoC Service

1.4.1.1 PoC Client settings

Following SIP REGISTRATION to the PoC service, the PoC client PUBLISHES the capability of the PoC client and the willingness of the PoC user to convey with related PoC client and PoC server functionalities. The PoC client settings are sent as an XML payload and include (Table 1.5).

- Answer Mode – The current Answer Mode setting preference of the PoC user
- Incoming Session Barring – activated/not activated
- Incoming Personal Alert Barring – activated/not activated
- Simultaneous PoC Session Support.

1.4.1.2 CODEC Negotiation

During session setup, SIP/SDP-based information exchanged between the PoC server and the PoC client specifies the Media Parameters for a PoC session being established or that already exists (in the latter, Media Parameters may be re-negotiated in certain cases).

Table 1.5 Push-to-Talk over Cellular Client Service Settings

Concept	OMA Definition
PoC Client	A PoC functional entity that resides on the PoC User Equipment and supports the PoC service
PoC Address	An address that identifies a PoC user and is used by the PoC client to request communication with other PoC users
PoC Service Settings	
Automatic Answer Mode	A PoC client mode of operation in which the PoC client accepts incoming PoC session establishment requests without manual intervention from the PoC user; media is immediately played when received
Manual Answer Mode	A mode of operation in which the PoC client requires the PoC user to manually accept the incoming PoC session before the PoC session is established
Incoming Session Barring	Conveys the PoC user's desire for the PoC service to block all incoming PoC session requests
Incoming Instant Personal Alert Barring	Conveys the PoC user's desire for the PoC service to block all incoming Instant Personal Alerts
Simultaneous PoC Session	Conveys that the PoC client is able and PoC user is willing to use Simultaneous PoC sessions
PoC User Defined Settings	
Nickname	A user-friendly display name that might be associated with a PoC user or a PoC group. This can be the Nickname that is displayed to other users in the channel
Anonymous PoC Address. Instant Personal Alert	A PoC Address identifies a PoC user who has requested privacy A feature in which a PoC user sends a SIP based instant message to a PoC user requesting a 1-1 PoC session. <i>Call back request tone – define the ringing tone for call back requests</i>

The AMR codec modes are negotiated at the start of the session. They are controlled in the server where the session is originated [2].

1. A PoC client sends a list of the codec modes that it supports to the PoC server;
2. The PoC server compares the codec modes sent by the client to the modes listed in the PoC server parameters and makes a common subset. This subset is then returned to the client;
3. The client implementation determines which one of the available codec modes is chosen.

Each PoC client performs codec mode negotiation with the PoC server individually. Even if an identical subset is sent by the PoC server to different terminals, the terminals might choose to use different codec modes. The negotiated AMR codec modes are not changed during the session.

1.4.2 PoC Speech

PoC Speech is transmitted in Real-time Transport Protocol (RTP) packets. RTP is an IP-based protocol providing support for the transport of real-time data such as audio or video streams. RTP is designed to work in conjunction with the auxiliary control protocol RTCP to get feedback on the quality of data transmission and information about participants in the ongoing session. In PoC, RTCP is also used to carry Talk Burst Control Protocol (TBCP) messages that are used to arbitrate requests from PoC clients for the right to send media – *in other words, floor control* [3].

RTP is typically run on top of UDP to make use of its multiplexing and checksum functions. To provide timely delivery of PoC Speech, RTP provides time stamping, sequence numbering, and other mechanisms to take care of the timing issues. The receiving PoC client uses the time stamp to reconstruct the original timing in order to play out the payload data (PoC Speech) in correct rate. Sequence numbers are used to place the incoming payload data packets in the correct order. From the payload type identifier (e.g. what CODEC was used to encode transported data), the receiving application knows how to interpret and play out the payload data. The RTP source identification allows the receiving application to know where (e.g. which PoC user) the data is coming from.

The flow of PoC speech from a PoC client is known as a Talk Burst.

The general flow for exchanging talk bursts between participants is as follows:

1. SIP establishment phase
 - a. SIP INVITE with Session Description Protocol with media parameters;
 - b. UDP port numbers are identified as endpoint of the media packets (unique port numbers for each PoC session) and connection is set up;
2. Inviting PoC user is granted first talk burst
 - a. Inviting PoC user receives TBCP Granted
 - b. Invited PoC users receive TBCP Taken;
3. Inviting PoC user talks – transmits a talk burst
 - a. Real-time data (PoC Speech) sent in RTP payload;
4. Invited PoC users receives talk burst;

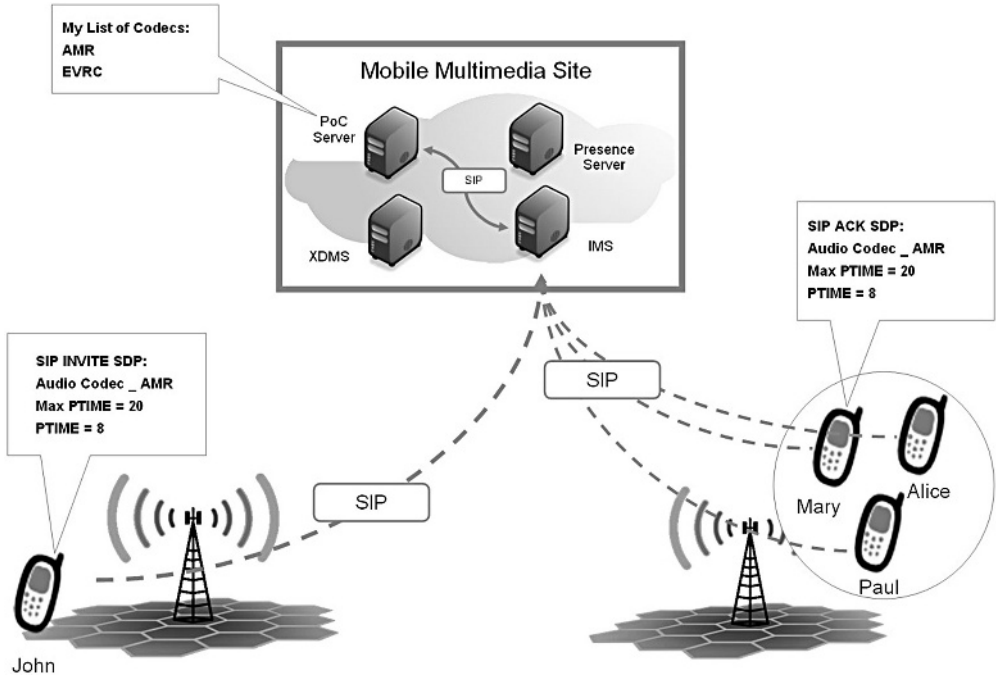


Figure 1.8 PoC Clients and the PoC Server negotiate CODEC to be used in the Session

5. Talking user stops talking and releases the button
 - a. The rest of the users receive a notification that the floor is idle now, and the process reinitiates again at 2, as soon as any user requests the right to send a talk burst;
6. After a period of inactivity the RTP session is closed
 - a. TBCP Idle.

Figure 1.9 shows the flow of RTP Messages used to route PoC Speech from the originator to the terminating parties. The PoC client transmits RTP messages directly to the PoC server. The PoC server transmits the PoC Speech directly to the terminating parties. RTCP is used for statistics. TBCP is used for floor control and gives indications when the floor is free. Table 1.6 lists the various dialogs a user receives during a group session.

1.4.3 XML Document Management Signalling

XML Document Management uses HTTP to make remote connections. HTTP is a request/response protocol between clients and servers. The high level concepts of OMA XDNS are shown in Figure 1.10 and Table 1.7. The general uses for XDNS are described below:

1. XCAP functionality (HTTP client and XML document manager) is embedded into the User Equipment;

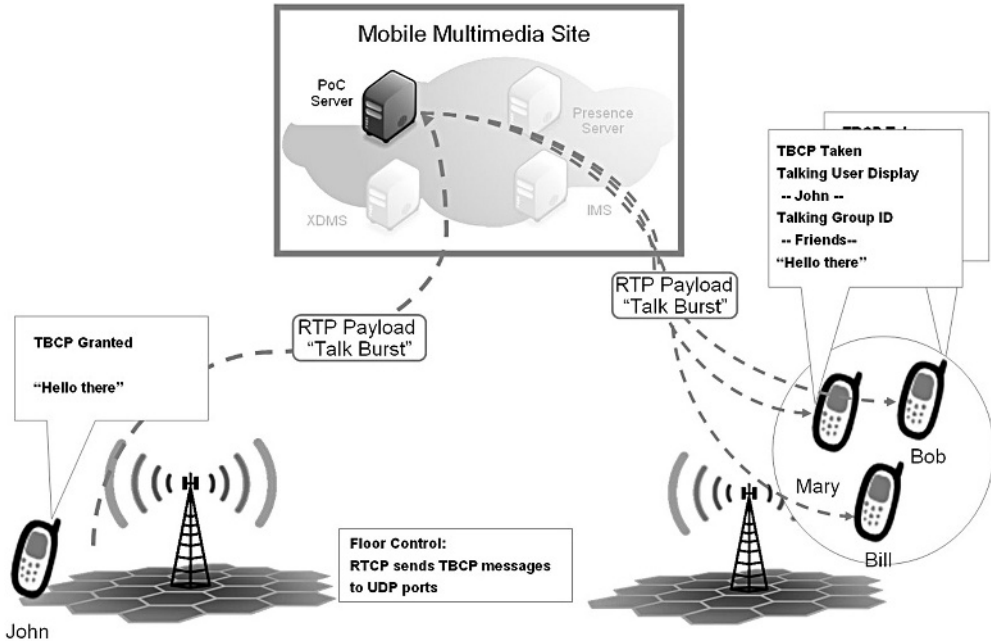


Figure 1.9 Media flow between group Participants is transported by RTP

2. End users create lists and upload XML documents (PoC Group Document or Access Control List, Presence List) using a HTTP client to connect to the XDMs server (a HTTP server);
 - All users are authenticated by the XDMs Aggregation Proxy;
3. XML documents (identified by HTTP URI) are routed to the relevant service, e.g. the PoC server XDM component;
4. End users download XML Documents for modification and deletion;
5. The same XML Document (URI list) can be shared with other services.

1.4.4 Presence Signalling

Presence Signalling between client and server is based on SIP/SIMPLE (Figure 1.11, Table 1.8). The high level concepts of OMA Presence are described below:

1. Presence client (SIP User Agent) watcher functionality is embedded into the User Equipment. This feature lets a client receive notifications about remote contacts, such as their availability for PoC communication.
2. Presence user registers to the Presence service via the SIP/IP Core (IMS) using SIP REGISTER.
3. Presence users (or Presentities) announce their availability using SIP PUBLISH. SIP PUBLISH contains an XML document that expresses Presentity's status. Eventually,

Table 1.6 Push-to-Talk over Cellular Client Displays and Indicators

Indicator	Usage
Talking User ID display	In a one-to-one call, identification (SIP URI, and/or mnemonic) of the individual user, whose voice is currently received, is displayed. In a group call, user identity is displayed together with the group ID
Talking Group ID display	In group calls, the identification of the group (URI), where the voice is currently being received from, is displayed
Instant Personal Alert	Indicator informs the user about the received Instant Personal Alert in a mobile device
Group Advertisement	Indicator informs the user about the received Group Advertisement in a mobile device
Incoming Call Notification	Incoming call notification indicator informs the user about an incoming notification in a mobile device
Notifying	A notifying indicator informs the user, who is trying to make a one-to-one call, that the call attempt has been turned into a notification towards the target user
Call Not Allowed	Call not allowed indicator informs the user, who is trying to make a one-to-one call that the call attempt to the target user is not allowed. The indicator is used in situations where the network does not authorise the call. The recipient is not notified about the call attempt
Ready To Talk	Ready to talk indicator is an indication appearing after pushing the Push-to-Talk key and telling that the user can start talking. It means that there is a high probability for a successful connection
End of Talk Burst	End of talk burst indicator is an indication to the receiving user that the other user has released the Push-to-Talk key, and the others can take turns. The originating user also gets the indication
Time Exceeded	Time exceeded indicator is an indication signifying that the maximum talk burst time has been exceeded and the talk burst is interrupted. To continue with a new talk burst, the user needs to release and press the PTT key again
Transmission Failed	Transmission failed is an indication signifying that the transmission attempt has failed. The reason for the failure can be, for example, that the downlink connection to the recipient could not be established in a one-to-one call or talk burst collision
Incoming Call	A new incoming call is preceded by an indicator. A new call means a voice transmission after a period of inactivity in the communication. It can also mean a changed communication party in a call

information contained in the SIP PUBLISH message is transferred to all watchers interested in receiving Presence information about this user.

- Presence users (Watchers) discover availability of other Presence users (online/offline status) using the SIP SUBSCRIBE message. SUBSCRIBE places a Presence *subscription*. While the subscription is active, the Presence service delivers notifications (SIP NOTIFY) to all subscribed watchers, to inform about changes in the status of each Presentity.

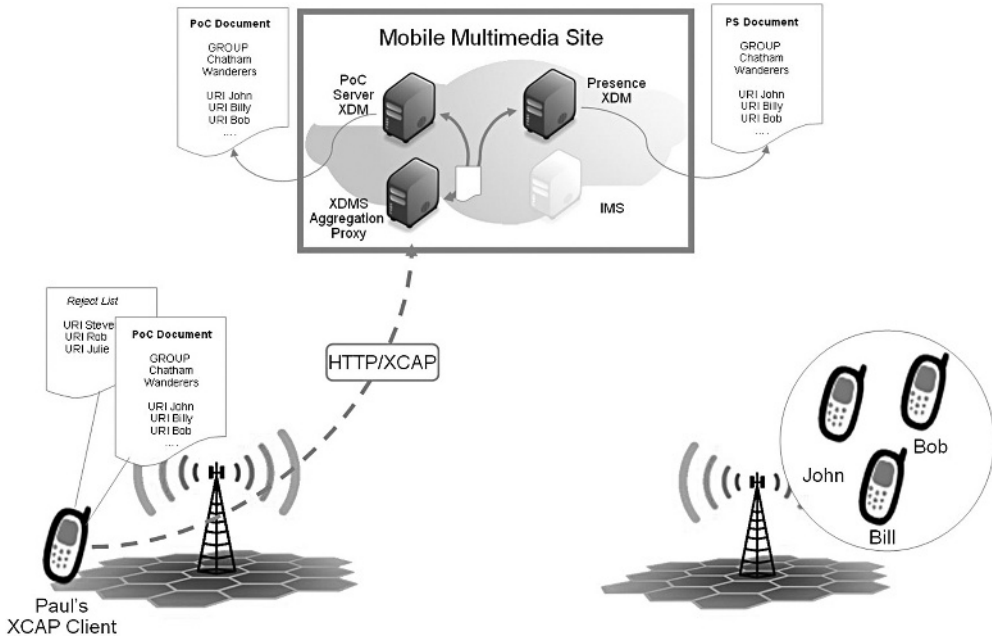


Figure 1.10 Document Management via XDMS

Table 1.7 XML Document Management Concepts

Concept	OMA Definition
URI List	A collection of URI's put together for convenience
Group Management	The action of creation, modification or deletion of XML documents that define groups. Groups can in turn be used by SIP services such as PoC or Presence. XML documents are stored in a XDM server such as the PoC XDMS or the Shared XDMS.
Group Usage List	A list of group names or service URI's that are known by the XDM client. This can be thought as an XML document that stores the list of all PoC groups known to a XDMC. In the future, it may contain group identities related to other services (e.g. Messaging)
XCAP Client	An HTTP client that understands how to follow the naming and validation constraints defined in the XDML specifications
XML Document Management Server	An HTTP server that understands how to follow the naming and validation constraints defined in the XP specification
Shared Group XDMS	The Shared XDMS is an XCAP server that manages XML documents (e.g. URI Lists), which can be shared among several enablers.
Application Unique ID (AUID)	A unique identifier that differentiates XCAP resources accessed by one application from XCAP resources accessed by another.
Document URI	The HTTP URI containing the XCAP root and document selector, resulting in the selection of a specific document
Node URI	The HTTP URI containing the XCAP root, document selector, node selector separator and node selector resulting in the selection of a specific XML node

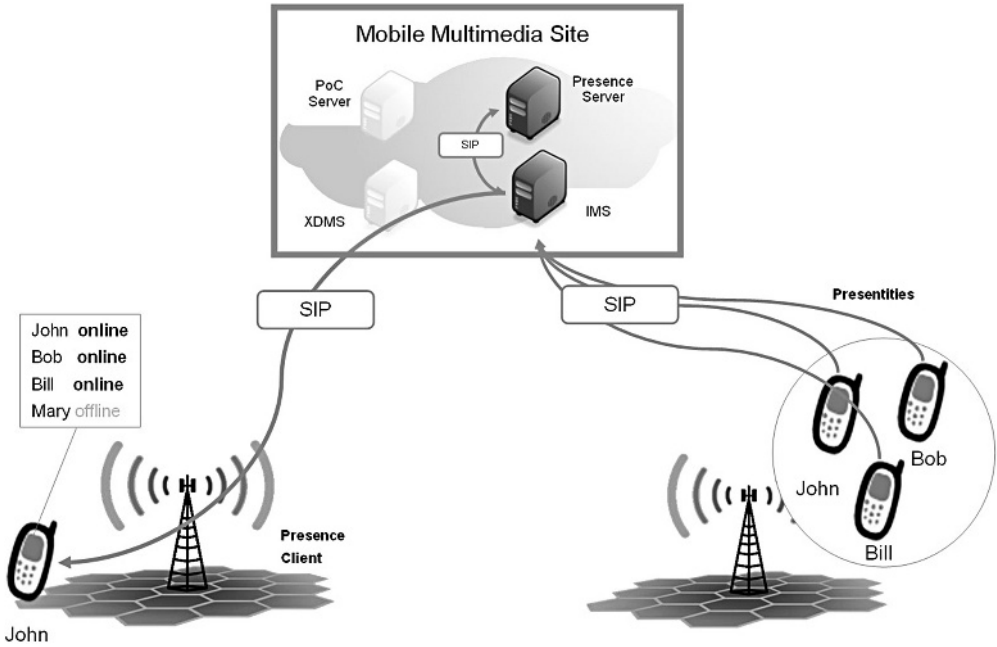


Figure 1.11 Presence Service using SIP signalling

Table 1.8 Presence with SIMPLE concepts

Concept	OMA Explanation
Presentity	A logical entity that has Presence information associated with it. This Presence information may be composed from a multitude of Presence Sources. A Presentity is most commonly a reference for a person, although it may represent a role such as ‘help desk’ or a resource such as ‘conference room #27’ The Presentity is identified by a SIP URI (as defined in R3261), and may additionally be identified by a pres URI (RF3859).
Presence User Agent	A terminal or network located elements that collects and sends user related Presence information to a Presence server on behalf of a Principal Source
Watcher	Any uniquely identifiable entity that requests Presence information about a Presentity from the Presence service.
Subscriber	A form of watcher that has asked the Presence service about a subscriber’s request to be notified of changes in the Presence information of one or more Presentities
Fetcher	A form of watcher that has asked the Presence sservice for the Presence information of one or more Presentities, but is not requesting a notification from the Presence service of (future) changes in a Presentity’s Presence information

Table 1.8 (continued)

Concept	OMA Explanation
Subscribed-watcher	A type of watcher, which requests notification from the Presence service of changes in a Presentity's Presence information, resulting in a watcher-subscription, as they occur in the future
Poller	A fetcher that requests Presence information on a regular basis
Presence Infrastructure	
Presence Server	A logical entity that receives Presence information from a multitude of Presence Sources pertaining to the Presentities it serves and makes this information available to watchers according to the rules associated with those Presentities
Resource List Server (RLS)	A functional entity that accepts and manages subscriptions to presence lists, which enables a Watcher application to subscribe to the Presence information of multiple Presentities using a single subscription transaction
Presence Network Agent (PNA)	Network located element that collects and send network related Presence information on behalf of the Presentity to a Presence server

1.5 Summary and Conclusions

This chapter has given the reader an overview of the main concepts associated with multimedia group communication for the mobile domain. Essentially, Group Communication consists of two components: list management and execution of the group function. List Management concerns administrating the group roles – defining ownership and membership. Execution of a group function concerns the invocation of a PoC session that occurs either in dial-out mode or in dial-in mode. Interaction within a group session is conditioned by floor control in which only one participant can talk at a time.

The implementation of OMA PoC, XDM and Presence with SIMPLE is more akin to mobile computer networking and Internet Protocols than with circuit switched group telephony. OMA PoC is VoIP technology that emulates a walkie-talkie experience and is based on SIP signalling and RTP transport. XDMS uses HTTP to transport XML documents. Presence with SIMPLE uses SIP signalling to express the willingness of online subscribers to communicate.

The rest of this book will expand on the above principles.

1.6 References

- [1] OMA Push-to-Talk over Cellular (PoCv1.0.2): 'Push-to-Talk over Cellular Requirements Document'; June 2006.
- [2] OMA Push-to-Talk over Cellular (PoCv1.0.2): 'Push-to-Talk over Cellular Control Plane'; September 2007.
- [3] OMA Push-to-Talk over Cellular (PoCv1.0.2): 'Push-to-Talk over Cellular User Plane'; September 2007.
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- [5] OMA Presence SIMPLE (Presence v1.0.1): 'Presence SIMPLE Requirements Document'; July 2006.