

# Socially enhanced reachability support within an IMS-community-based infrastructure solution

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**Abstract:** At Deutsche Telekom Laboratories we are investigating how group communication can be enhanced with contextual information such as reachability. We demonstrate these methods using a group communication scenario which is of interest to us from a user and telco perspective. The scenario includes features such as messaging, presence and “click-to” style communication, including conferencing between friends and persons with common interests. We summarize our analysis of two types of approaches to the next generation IMS platform capabilities, modular and layered approaches. We include lessons learned from our prototypes efforts, which made use of IMS capabilities. We point out some of the technical challenges that were confronted while realizing a showcase of use cases involving groups communication involving users using mobile devices and as well as users connected by web on their home PCs.

## 1 Introduction

Social network activities<sup>1</sup> involve a combination of ad-hoc as well as planned communication among community members. To support this set of communication requirements – the underlying architecture must be fairly robust. The community services architecture being developed by Deutsche Telekom Laboratories is based on IMS (IP Multimedia Subsystem [3GPP]) since it offers a fully-functional community infrastructure. The full-fledged community infrastructure and all community end-user facing components that was developed is called CoSIMS (**C**ommunity-based **S**ervices on **I**P **M**ultimedia **S**ubsystem) and consists of middleware including a CoSIMS application enabler. This system was developed internally, and has been evaluated within a number of user trials, and has been further refined in terms of the results of these evaluations. The basic capabilities of this service include the ability for community end-users to create and manage friendship circles within the community, and to communicate with one another, one-to-one or by group, both over the web or over mobile [DO07, DO08]. The core middleware components which are used in current prototype efforts is called GEMS (G**E**neric **I**MS **C**ommunity **S**ervice). Figure 1 shows the integrated view of CoSIMS across web, mobile and PC.

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<sup>1</sup> The market of mobile social communities will grow until 2012 [VI08].



Figure 1: Integrated community service environment

Ingredients of the next-generation communication scenarios which are held in our current community service design are described below. Each of these is supported to various degrees by the core APIs available from the GEMS infrastructure.

- *Managed identity* – Access to multiple social networks or communities. The user is able to use these services without logging in and out multiple times.
- *Personal communication context* – Users should be able to maintain their own personal blog, and socially-oriented message inbox. Additionally they can create their own personal profile and configure their privacy settings and preferences.
- *Community-based communication context* – Supporting 1-to-many or many-to-many communication among group members which encourages group interaction..
- *Social and spatial awareness* – With the location information, the users are able to view the position of their friends. Additionally, they can monitor the activities of the group and get their status information in the group blog.
- *Shared community-based content spaces* – A group is associated with a blog. The blog is accessible to group members. Members can follow group activities through the group blog which is especially relevant when they are not able to participate in direct communication.

## 2 Establishing a communication context within online communities

The focus of our current research is on presence and reachability and more specifically we have focused on identifying means within the service to help users establish a sense of context within community communication scenarios. Since communities are assumed to be mobile, establishing context is especially complex. Our assumption is that when the context for communication is clear it helps to maintain reachability and keep users in touch with each other. When users communicate with others within their social network, the context is even more complex, and social reachability is a challenging but our service attempts to expose a number of resources to community groups members to increase reachability. The context of communication includes not just the type of device or the device environment of users, but also the current user's presence status, their location, and as well as an indication of the activities within social communities that users are

engaged in. Knowing these aspects related to the communication helps to encourage further communication with community members. The following figure (cf. Figure 2) shows the various influences on presence that our service design will include.

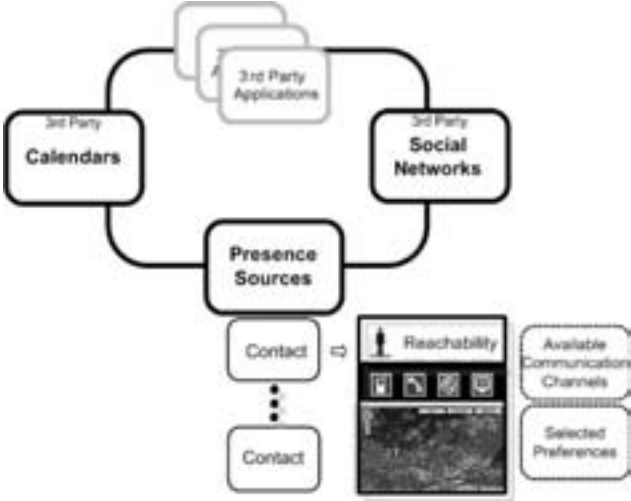


Figure 2: Presence sources and reachability

### 3 Social entities and related presence sources

We identify several kinds of social entities for handling our group communication scenarios. Service users are able to create contacts, which are required for participatory communication. Contacts may be imported from various social networks. If a user wants to have a fully synchronized access to a contact that they introduce into the service through an import or data entry process, the contact needs to be made into a registered service user, which can be done on both the mobile and web through messaging containing active links. All users have access to a contact list of user entries which can include private, managed and open groups. Groups are collections of service users, and each user can belong to multiple groups. Groups are maintained and used by other service enablers related to presence management, group messaging, calendaring. Group management functionality is made available to the other services via an XDM enabler (cf. section 5).

Each social entity type is associated with a number of presence aspects (status, location, reachability, blogging, and search) as well as various levels of exposure to recipient social entities. Table below (cf. Table 1) shows the kinds of functionality available to an end-user with respect to other community social entities.

	Status	Location	Reachability	Blog	Search
<b>+Self</b>	R/W	R/W	R/W	On status, location, reachability	By status, time
<b>+Trusted Other</b>	R	R	R	On status	By status, time, membership
<b>+Member of Private Group</b>	W	R/W	R	On status	By status, time, location or reachability
<b>+Member of Managed Group</b>	W	R/W	R/W	On status, Location, Reachability	By status, time, location or reachability
<b>+Contact List</b>	Call log	-	Call log	Call Log History	By membership, location or reachability

Table 1: Presence related functionality related to social entities

In the table above R (Read) indicated the ability to view a presence aspect, and W (Write) means the ability to actually modify a presence aspect. Contacts that are not members of a social group are associated with the base case presence aspects which include their communication history, which includes their IM (Instant Messaging), SMS and voice call activity. For instance, a user can publish a new status and make it available to other groups or individuals. They can also make their current location available to others, given that privacy agreements are exchanged between them to allow the release of location. If the users browse their community, they can view the aggregated form of this information from within a customized community application interface available on their mobiles and over their web. An extra interface is required to set up, configure and enter their status and reachability information. Another interface is associated with viewing this information from a personal or group perspective. We have designed the service to make it complementary to social networking applications, but to differentiate from them by emphasizing reachability and personal productivity.

Managed groups are created by specific community members, who send out invitations to specific contacts to become members of the group. Open groups are created by a community members, and the group is then listed as a part of an open group directory, and other community members can then elect to join any of the open groups. Private groups function like buddy lists, in that members have no awareness of being in the same group.

#### 4 Walkthrough of a social reachability scenario

In this section a social reachability scenario which was introduced in the beginning of this paper will be described in more detail. We include all the features which are the target of our community service, based on GEM, plus extensions, which runs on both the

web and mobile. We support in this example managed groups, the ability to establish communication with group members, basic presence and reachability and group blogs. Let us follow through with an example of the scenario in action:

- Two friends, Harry and Hermione, still are deciding what to do on Friday night, and start getting in contact with their friends. Harry has confirmed himself as Hermione's friend and granted her permission to be on his friends list, and visa versa. Harry enters his current presence status, which also includes additional information about a meeting he is currently attending, and the best way to reach him, which is by IM on his notebook.
- Hermione checks Harry's presence status on her mobile phone and goes home and her status is automatically updated to include the fact that she is at home and available over IM.
- Another friend, Arnold has posted an item on the managed group presence blog, using his online community interface related to an event taking place on the weekend. There are pictures included in the group blog related directly to this event suggestion and a link to an event in the group calendar corresponding to the actual event.
- Hermione responds with an IM alert directly to Arnold's presence posting. Hermione enters her support for Arnold's suggestion by voting for it so that other users can see that this is something that others are interested.
- Later, Harry checks the group blog and finds out about the event that is being considered for that evening, and sees that others have communicated their support for the event. Harry makes a group conference call over his mobile with Arnold and Hermione, to see who will be able to take Hermione to the event, and based on this picks up Hermione and together they visit the selected event location. He updates the group blog to indicate they are now there.
- The event sponsor, a dance hall, publishes a coupon that Harry retrieves on his mobile as soon as he gets close to the event location. He is offered a discounted ticket for all of his friends. Harry publishes this coupon on the friend feed.
- As the party is so much fun, Harry and Hermione both leave a couple of comments later on, on their personal blogs to encourage others to join them next time.

These phases within this scenario may take place among many overlapping groups of friends at the same time. In the initial phase friends propose interest in the idea of participating in events. Next events are proposed for the evening agenda to friends. Friends can respond with alternative proposals. Comments to proposals can be made in the form of any group based communication modality including email, conferencing, or chat. The influence of an event increases when new circles of friends are involved. Next comes a phase where communication regarding alternative ideas or proposals take place. User content, such as a picture is shared with members of the group. In this phase contact with members of alternative friendship circles or groups may also take place. Shared experiences and memories of the event can be entered within the community service, and shared among friends, with easy access to all related information and content, to anyone who has rights to view the content.

In order to support the scenario mentioned above, a detailed description about the underlying technical infrastructure, the layered architecture and the enabler is given in the following section. The service is based on GEMS, which includes core elements of the CoSIMS middleware architecture which supports primarily group communication and group management.

## **5 Technical solutions**

### **5.1 Technical overview**

A variety of implementation prototypes of the underlying community service infrastructure have been implemented. For instance, in one prototype and existing online service was implemented with our CoSIMS prototype. This meant integration of identities from both services. The advantage to the users of the existing online service is that its users were able to engage in group based communication. The extended capabilities of the new service included conferencing and some limited participation of site activities over a mobile. The community service was also implemented as a stand-alone web-based prototype, with a Web 2.0 look and feel with easy click-through functionality. Furthermore, several custom flash interfaces were built which communicate the core of CoSIMS.

The level of integration with legacy web sites depends on the commercial partners' requirements. The integration can be rather deep, or it can function like a completely independent but cooperative 3<sup>rd</sup> party relationship. The GUI can be customized and branded as required by the service provider.

CoSIMS features are included in the initial prototypes [DO07, DO08] and were internally evaluated within a user trial. This trial consisted of university students, which performed a number of predefined community-related activities on their mobile devices. We also examined usage logs, questionnaires, and direct observations about how the trial users integrated group communication into their day to day social lives. We gained insight into the design of our service, which was followed up with some redesign efforts of our software solution. Certain aspects of group communication worked well, while others like group mobile conferencing needed further investigation.

Our user surveys also revealed the fact that requirements of older, established users were rather different from younger IP generation users. The former demanded simpler interfaces and requirements and the latter demanded the latest features related to presence and location-based services, and standard community features are expected. So as expected the service provider has to have a good idea of which user population they are targeting.

## 5.2 Layered architecture

Figure 3 shows the essential components that are a part of the architecture of the existing prototype.

*Control & transport layer.* There are additional key functionalities that mark the IP Multimedia Subsystem as the future technology in a comprehensive service and application oriented network. The IMS provides easy and efficient ways to integrate different services, even from third parties. Interactions between different value-added services are anticipated.

The particular techniques and methodologies that are required to gain these key functionalities are not new, but the IMS provides the first major integration and the interaction of all key functionalities. By defining logical entities that are connected to each other through standardized protocols, a plug-and-play architecture has been created that offers the possibility to physically place each function at different locations and to assemble an IMS with functions from different vendors.

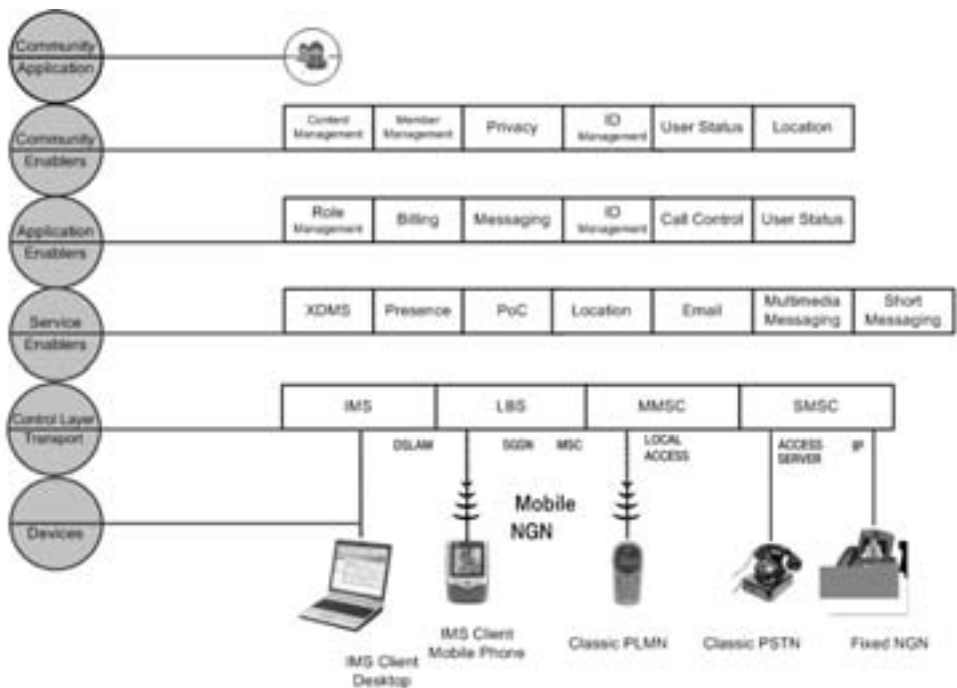


Figure 3: CoSIMS layered architecture

### 5.3 Enabler layer

The IP Multimedia Subsystem [VW06, FO08] is defined from 3GPP Release 5 specifications as overlay architecture on top of the 3GPP Packet Switched (PS) Core Network for the provision of real time multi-media services. IMS can be used for any mobile access network technology, and it can also be used for handling fixed line access technology. This capability is specified in the Next Generation Network reference architecture definition being promoted by the European Telecommunications Standards Institute (ETSI) Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN). The central session control protocols are the Session Initiation Protocol (SIP) [SC02] and Diameter [CA05].

*Service Enabler Layer.* The Service Enabler layer allows services to make use of telecommunications resources. For instance a **P**ush-to-talk over **C**ellular (PoC)-server [OP07] can be seen as an enabler that allows services to set up PoC-Sessions without having knowledge about how PoC really works. They are bound to the specific network technologies that they use to provide their functionality and thus do not offer independence from the control layer but offer a higher abstraction so that services do not need to directly address the networks but rather may use specific enabler interfaces. For these reasons, the Web-services can be considered as a middleware technology between this layer and the application-enabler layer. Enablers include presence, location, multimedia conference, multimedia messaging, community service enabler and PoC. Most of these enablers sit on the top of the IMS interfaces and thus utilize all IMS offered control and management functions. On the other hand, service enablers such as multimedia messaging may make use of the SMS-C [EM06, SM03] and MMS-C [EN06, PP06] to send multimedia message to users on the legacy networks (GSM).

*Application Enabler Layer.* The Application Enabler handles the support for user access, for user contacts, for shared content, location information, and communication options for users. This layer encapsulates service enabler functionalities and mediates the access to services. The Application Enabler is capable of exploiting IMS capabilities that can help to carry out the demands of the community service [CA05, E146, E136]. The enabler deploys a web service which provides direct access to the IMS enabling technology layer [PM08].

## 6 Providing functionality to service providers

We consider the business scenario whereby commercial applications need to enhance their existing functionality with more group-based communication functionality. In this case the functionality of our extended IMS-based presence enabler can be provided within a toolkit, accessible via a web-services API. The value-add to the application provider is achieved through their ability to tap into the IMS enabled multimedia communication capabilities available through a web browser running on a desktop or mobile client.



Our current approach is based on a distributed service infrastructure where user information is stored in many systems. There must be a means to federate these user identities to allow the service to take advantage of the CoSIMS Toolkit. In the first step CoSIMS introduces a simple federation mechanism by exchanging a unique service specific user ID. In this way a user may be identified to by a service and in CoSIMS. This service ID is an anonymous ID, which carries no user specific data. The user himself has full control over data that might be transmitted from the service to CoSIMS such as contact data. Services have no knowledge about a user's federation status.

The *Community Enabler Layer* contains the controls which communicate with the platform – provided mainly as a library of JavaScript objects. The controls will be downloaded to clients and provide the communication with the CoSIMS platform in a way that the CoSIMS features can be provided. Controls include those related to user access, personal settings, contact presence, user presence, group management, group communication, group invitations, as well as email, messaging and inbox controls.

The *Community Application* consists of all provider-specific application level pieces of a service – but in our showcase remains CoSIMS branded. A community application includes a registration view, the service portal view and an exemplary community page view which is the core community-based part of the service. Each application within this layer implements a community service, with a specific goal and scope. These community applications use the enablers from application enabler layer to trigger actions in the telecommunication networks. They should not communicate directly with layer 2 or 1 in order to be independent of any specific network technology.

## 7 Community convergence – integrating mobile devices

Communities have traditionally been split into 2 different segments – the mobile and the online communities. Since the backend of our initial community service offerings is based on an IMS infrastructure we decided in our first client approach to provide access to the community infrastructure via a pure IMS client. This community client was the basis for a extensive usability evaluation, as well as for analysis of technical problems of IMS-based clients. Key findings here were limited processing power and battery lifetime of the chosen Windows CE / Windows Mobile platform.

A second client approach was also pursued – to solve both the battery lifetime challenge and the requirement to support multiple mobile platforms. The mobile client became proprietary, exchanging presence and notification information only when necessary and bound to the IMS infrastructure via a server side IMS proxy to exchange buddy list, presence information, messages and IMS notifications.

Next we investigated the newest IMS frameworks together with upcoming user interface packages. For the Symbian Series S60 mobile we used Sun's LWUIT<sup>2</sup> – for user

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<sup>2</sup> See URL <https://lwuit.dev.java.net/tutorial/index.html>

interface support. The result leads to a rapidly developed and lightweight IMS-client which provided a broad base of deployable mobile platforms, nearly like the proprietary client approach above. The prototypes also showed the increasing power and professionalism of newly available toolkits and libraries.

The world of mobiles is changing rapidly and their capabilities are improving continuously [BI08, CA07]. This is particularly the case for web browsers. Therefore we also considered accessing the web user interface directly. Although there are various toolkits available for web code development, the javascript compatibility tests showed increasingly good results. After user interface modifications the web solution could also be shown on mobile browsers. The usability from a user perspective could of course not compete with the above mentioned mobile applications, because of limited browser speed and the need to adapt the web UI especially for mobiles. One technique for improving the usability for the users is to reduce the number of buttons and information available on any single screen.

## 8 Outlook

Providing end-users with direct communication over the web to members of their social networks can give providers of traditional services an advantage. Their offerings can be made more compelling by being able to “plug-in” more functionality to their customers. Their customers are increasingly members of various social networks, can be attracted to services which provide live communication functionality. These enhancements can also extend the lifetime of the traditional online offerings, as well as the scope of their existing content [VI08], and offer a natural community-driven feedback pipe to their service offering. Various projects at Deutsche Telekom have looked at group communication, using IMS and follow up projects now look more closely at improving communication by looking at aspects of reachability and presence.

Community based services can be expanded to include a unique combination of features, if the right set of enablers support the middleware [ER05, OS07, OP07, IM06, OX07]. We have created a number of clients which are able to respond to various service requirements, coming from the mobile and online web-based service areas [DO08, RE07]. We have implemented and evaluated a number of mobile solutions which access a network-based community platform in various ways. In the market place, however, community providers are often forced to react very quickly towards new emerging standards and technologies such as the BONDI<sup>3</sup> initiative – and hypes around newly launched devices such as the Google Android G1 phone or the Apple iPhone - as well as the responses of the developer community. Community providers are certainly not able to follow all the solution trends at every point, but rather should show flexibility in responding to market trends and should not loose contact to successful competitive solutions.

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<sup>3</sup> See URL <http://bondi.omtp.org/default.aspx>

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