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Magic Lounge: A Thematic Inhabited Information Space with "Intelligent" Communication Services

http://www.dfki.de/imedia/mlounge/

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Abstract

Networked computers, multimedia, and mobile communication have already begun to fundamentally change working places and private telecommunication. This technological progress will enable new communication scenarios, which are much more complex since groups of users may communicate with each other using multiple media. In order to hide complexity, a number of new intelligent communication services are required. Such services are currently under development in the project Magic Lounge[1]. This paper provides an overview on the project's goals and the research challenges which must be addressed for achieving these goals. Besides some illustrating scenarios, a sketch of the underlying technological approach is provided.

Keywords

Computer Mediated Communication, CSCW, multimedia, multimodal, Internet

RÈsumÈ

Les rÈseaux d'ordinateurs ainsi que les moyens de communications multimÈdia et mobiles interviennent de plus en plus dans les mÈthodes de travail mais aussi comme moyens de communication privÈe. Ces progrËs technologiques font apparaitre de nouveaux scÈnarii de communication plus complexe qu'auparavant puisque des groupes d'utilisateurs pourront communiquer par l'intermÈdiaire de multiples mÈdias. Cela entraÓne le besoin de nouveaux services de communication intelligents qui font l'objet du projet Magic Lounge. Nous

[1] Magic Lounge is funded under the Esprit Long-Term Research pro-active initiative i3. The project is one of 13 projects within the i3 initiative. Project partners are DFKI, Saarbrucken Germany; MIP, The Maersk Mc-Kinney Moller Institute for Production Technology, Odense University, Denmark; LIMSI-CNRS Paris France; CompiËgne University, France, Siemens AG, M¸nchen, Germany; and The Danish Isles - User Community, Denmark.

donnons ici une description gÈnÈrale du projet et des thËmes de recherches concernÈs. Nous prÈsentons Ègalement des scÈnarios illustratifs et la technologie sous-jacente.

Mots-clÈs

Communication mÈdiatisÈe par l'ordinateur, multimÈdia, multimodal, Internet

1. Introduction

Research in computer-supported cooperative work has led to an infrastructure that allows people to work together while being at different locations. When looking at today's applications, however, it turns out that the technology is either used (a) as a platform for the exchange of text, audio, video and graphics (technically challenging as this may be, it is little else than a straightforward augmentation to the classical telephone); or (b) to enable joint collaboration among geographically separated colleagues who are usually experts trained in operating in such highly specialized workplaces. Many videoconferencing systems are already available (http://www3.ncsu.edu/dox/video/products.html). Collaborative features of some of these systems include chat window, whiteboard, media sharing and editing, and privacy protection. Several collaborative (TalkShow, FarSite, NetMeeting) and shared applications are available. Some systems use 3D graphical representations and voice disguising of the connected users ("OnLive !"). Yet these systems do not provide sophisticated functions, such as media conversion depending on each participant's channel configuration, automatic multimodal input interpretation combining speech and pointing gestures, summarizing of previous communications for a new participant, or automatic multimodal output generation.

A next step is to bring the above technologies together by implementing research demonstrators that will meet the needs of the broad population. There clearly are an unlimited number of real life occasions in which ordinary people need to communicate with each other on everyday matters while at the same time communicating with computing tools and services. The Magic Lounge project is committed to developing "intelligent" communication services, which will help to enable new communication scenarios, which are much more complex since groups of non-professional, and possibly mobile users may communicate with each other using multiple media. Communication scenarios as illustrated in figure 1 rise a number of interesting research challenges.

In section 2, we describe the work we have done on involving a user population inhabiting smaller Danish Islands. Section 3 elaborates on some of the research challenges. The last section provides ideas on how to tackle with them from a technical point.

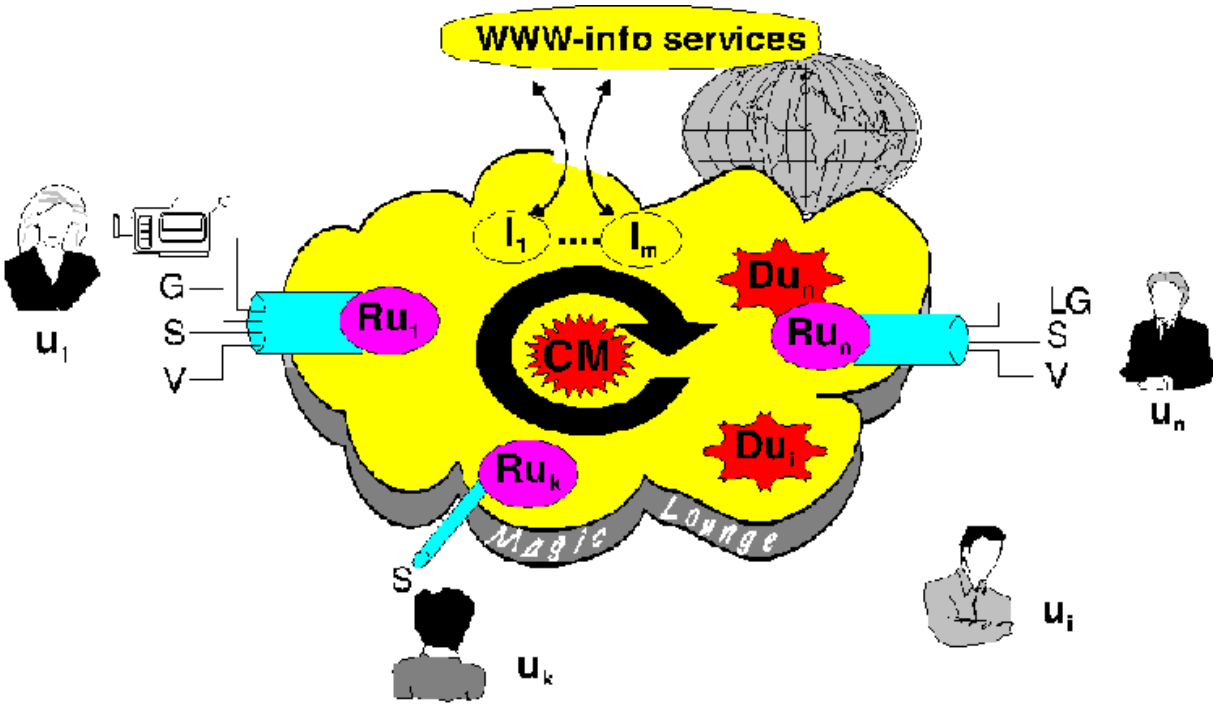

Figure 1: Imaging complex communication scenarios: Several users (ui) may virtually meet in the Magic Lounge while having different configurations including high-resolution graphics (G) or low resolution graphics (LG), speech (S), video (V). Each connected user has a representation of itself (Rui). A ´delegate' (Dui) can represent users who are not connected while interested in the meeting. The Magic Lounge acts as a communication facilitator and provides access to multimedia information sources (Ii) from the Internet and other functions providing an "added value" compared to existing multi-user system (history of communication, multimodal human-machine interaction...).

2. Involving the users

2.1. Participatory design and evaluation

The Magic Lounge demonstrators will be partially based on the results of the participatory design and evaluation process which will be carried out by MIP and will involve a user population coming from various Danish isles. This user population is deemed representative of the intended Magic Lounge user population because: (a) they are widely distributed geographically; (b) they are "ordinary users" with very different professional backgrounds; and (c) they are expected to use Magic Lounge for their ordinary activities which are assumed to represent the shared activities of users with different skills and professional backgrounds. Although it has not been investigated to what extent this user group of eight people is representative of the population of the Danish isles in general, it is *not* at least representative because they are all males aged between 34 and 57 years old, and they are all computer and networking enthusiasts with state-of-the-art home computers.

The idea behind participatory design is not that the users *drive* systems design, telling the designers more or less what the system should be able to do and how the user-system interaction should work. Rather, what users can help with initially is to (a) express their needs with respect to the system, (b) provide detailed information on the tasks they might want to achieve using the system, and (c) tell how they might envision doing those tasks based on general background information about the system's capabilities and limitations. The process of eliciting information from the users may involve several iterations.

In the first iteration the users were asked to explore the design space for themselves, thereby generating design ideas, solutions to design problems and novel design issues to be faced and resolved in the design process. A questionnaire was developed for this purpose. The specification was viewed as a particular set of answers to a partially ordered series of questions about the functionality and usability of Magic Lounge. It was hoped that

the users would explore the Magic Lounge design space without overly influencing the findings they might make.

Of the 24 questions in the first questionnaire, questions 1 to 3 were concerned with the purposes and advantages of using the Magic Lounge. Questions 4 through 23 addressed aspects of the actual use of Magic Lounge. Question 24 asked for suggestions for additional questions. Following the initial questions (Q1-Q3), questions 4 through 23 had been intended to allow each user to "play through" one or more self-selected scenarios of actual use of Magic Lounge, such as conducting a virtual meeting in a series of such meetings on the history of marine forces. The data received shows that this idea did not work out. Only one or two users actually tried to consistently follow one or several scenarios in their answers to Q4-Q23. Instead, the answers received to Q4-Q23 mostly address each question more or less in general, abstracting from any particular scenario of use. This means that the data, rather than exploring particular scenarios, explore the large design space around Magic Lounge in a piecemeal fashion, guided by the questionnaire.

The qualitative data received in response to the First Magic Lounge Participatory Design Questionnaire have provided a wealth of information on how the users view the design space. The next steps in our research are:

- To do a proper data analysis (Bernsen and DybkjÊr 1998).
- To confront the users' input with our own developing design ideas for the three planned Magic Lounge demonstrators.
- To deepen the participatory design process through visiting and interviewing the members of the user group.
- To make Magic Lounge available to the users for hands-on experience with the developing system.

2.2. Complementary sociological studies

The Magic Lounge project should also benefit of inputs from CSCW community. But, in the case of Magic Lounge, one must shift from a goal-oriented model to a community one, where the only fact of being in touch may be an activity and provides information. In fact, as a result of a first survey we have done, it appears that many results on CSCW processes might be used in Magic Lounge approach. CSCW has been very sensitive to the ability to provide useful information without intention to do it. Some devices were developed in CSCW in order to duplicate the feeling of active co-presence, that gives to anyone the ´ awareness ª of what is going on in the group. Yet, the previous unique criterion of efficiency previously examined in CSCW items has been often recently replaced by the satisfaction criterion, which may include efficiency but allows room for a global feeling of comfort, of usability, of compliance with the everyday rules of interaction among a group of people, either professional or ordinary ones. Finally, a great part of the CSCW innovative work has been done to improve the translation of the face-to-face environment features to the mediated space (expressive intentions, overlap of sentences, co-presence feeling, sensorial interaction, easy going in decision-making).

Theoretical principles of analysis could help organize both the field observations and the interface design, from recent and on-going research in social sciences on cooperative work:

- Memory could be a storage process but it is a selective and analytical process: it becomes an historical process when everyone reorganize all the data to give sense to a new situation.
- The process of cooperation relies on the production of a common representation of a situation. The cooperation process will require an on-going task of controlling the truth, the relevance of the data exchanged between the members.
- Cooperation as well as communication is not a task as such: they have goals, they create chains of tasks to reach them.
- Cooperation, and the use of the tools for cooperation, depends upon the competencies of members.

•A sociologist team from the University of CompiËgne and from Limsi will be in charge of activity analysis of the existing groups related to travel, or to the ordinary preparation of a trip by people at a distance. During the whole project, we will use methods for constantly checking what kind of cultural assumptions about the user profile we are making while designing some specific parts of the technology. This is a way of creating history, that is to say not only storing but also organizing data so that the previous choices could be revised, but fully knowing it.

•3. Research Challenges

•*3.1. Enabling access via heterogeneous devices*

•Today's telecommunication and teleconferencing systems require that all communication partners have more or less the same communication channels at their disposal. For Magic Lounge we do not make such an assumption. Rather, the goal is conversion to enable the access to virtual meeting places through devices varying in complexity and available communication bandwidths. Consider the situation in which a group of three persons P1, P2, and P3 meet in the Magic Lounge in order to discuss the details of an impending trip to downtown Saarbr¸cken. Assume further that P1 accesses the virtual meeting place via his PC, P2 via a phone, and P3 via a PDA (figure 2). In order to clarify how to get from a certain location to another, the participants want to consult a map, which may be retrieved from the web. P1 is now in an advantageous position as his PC can easily display even highly colored and detailed maps. As far as usability is concerned, it does not make much sense to output a complex graphics on a small PDA screen. The phone user is certainly in the weakest position as there is no way to output graphics on his phone. In order to keep all communication partners in the loop, we imagine a service that provides each partner with an individual view on the underlying information. While P1 will receive the detailed map, P2 is provided with a more abstract graphical presentation. P1 on the phone will only be informed that the others are currently looking at a map of the town. There is an even more challenging problem of allowing the communication partners to interact with their representations. P1 may perform a pointing gesture on his map in order to show the others how they might go from one location to another. Such a pointing gesture can be transferred to the more abstract map display on the PDA. However, the system has to take into account that the exact course of the pointing gesture can not be transferred using a 1:1 mapping of screen coordinates. Rather, the system has to translate the recorded trajectory of the gesture into a more abstract gesture, which can be shown in the graphics displayed on the PDA. For the phone user P3 the system may provide a short verbal description of the gesture such as "Peter moves along Bahnhofstrasse".

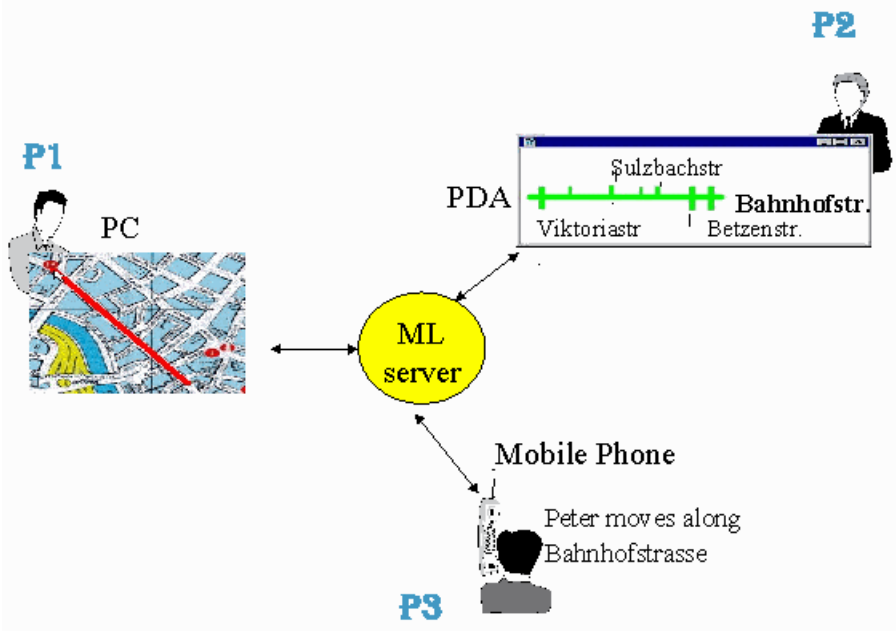

Figure 2: One goal of the Magic Lounge: to provide different views on a single geographical information source retrieved from the web depending on each user's configuration.

The general solution to enable a flexible exchange of information from one medium to another medium would require sophisticated mapping mechanisms. Thus an important simplification of the general media-mapping problem is to avoid the media analysis and understanding task. This can be achieved by starting from a common representation of the information content. Following such an approach requires a suitable representation of the underlying information – a representation that allows generating all desired views. A data description scheme, which is based on hierarchically, ordered layers, is currently under development by DFKI and Limsi.

3.2. Access to external information

One of the goals of Magic Lounge is allowing the access and the integration of information coming either from another user, from local databases, the Internet or other inhabited spaces. Thus, pieces of information coming from several sources need to be integrated. Furthermore, several types of services could be useful to allow users to take benefit of all these pieces of information. In the case of the Internet, they are called "Internet agents" and can be of several types: search agents, information filtering, off-line delivery and notification agents (Caglayan and Harrison 97). Although such technology is already available for the Internet, its integration with pieces of information exchanged in textual chat and other stored in local databases does not exist yet.

3.3. Intuitive human-computer communication

Magic Lounge will investigate solutions to:

- Spoken interrogation of Web facilities, such as travel information; some research prototypes already enable speech-based interrogation of web-servers, for instance the SRI demonstration of an Air Travel Information System with speech recognition over the telephone: http://www.speech.sri.com/demos/atis.html.

- Discussing an itinerary on a map using combined speech and gestures. This will include situations in which not all inhabitants have visual access to the Lounge and thus cannot see the map or the pointing gestures to the map made by some other inhabitant.

- Combine speech and gesture to interact with graphical representations of web sites such as MerzScope: (http://www.merzcom.com/try/maps.html).

Speech-based Web-surfing is at an early research stage. However, web surfing in a multimodal and multi-party context is a research challenge that has not been addressed so far. The multimodal module to be used is based on TYCOON, a typology of "types of cooperation" between modalities (Martin and BÈroule 93, Martin 98), developed at Limsi. One of the challenge here is to achieve a transparent integration of several modalities using the same media, some modalities being devoted to human-human communication (audio conference) and others devoted to human-computer interaction (speech command).

3.4. Agents: facilitators and delegates

The development of virtual communities and meeting places has become a major topic in research on virtual reality, too. For example, standardization initiatives such as VRML 2 and MPEG-4 foresee parts for building and animating virtual humans, which are envisioned as the inhabitants of virtual spaces. While this line of research is mainly concerned with the graphical dimension of animated agents, the Magic Lounge project addresses the notion of synthetic agent too but from another perspective. At a later stage of the project, we plan to have virtual inhabitants in the Magic Lounge. Virtual inhabitants will appear as life-like characters with their own behaviors. There are two types of them: delegates and moderators. A delegate represents a human user who cannot be in the Lounge on-line. Although a delegate has its own behavior, it will act on behalf of the user whom it represents. By contrast, a facilitator agent (cf. icon CM in Fig.1) is a manifestation of the system's co-ordination functionality. The primary task of the virtual communication facilitator is to provide inhabitants with information about relevant meta-level information collected by observing all communication activities in the space from a bird's-eyes view. As a starting-point, the facilitator will exploit available information sources such as system/network status information, the dialogue history, and also the nature of information sources, which have been incorporated into the Lounge. Furthermore, the facilitator will maintain models of the co-

present inhabitants, including individual preferences for modalities and participation styles. These models are needed because advise and suggestions must be tailored to the individual participants.

3.5. History functions

One of the functions that we do not find in existing communication tools is a history function enabling a user who missed the meeting to retrieve information that is of interest to him and to have an idea of what happened during the meeting. In a more general framework, building a history of a dialogue is a very complex task. As a first step, Limsi has specified the structure of a table recording meeting events (Table 1). The implementation of the building, storage and query of such a table is under development by DFKI.

The history function aims at providing the users with a means of knowing/remembering what did happened during a meeting. People who attended the full meeting, who missed part of the meeting, or who finally did not attend the meeting, may use it. The history can also be used during the meeting by the system in order to successfully execute a user's command (ex: "show me again the web page about hotels in London, please").

3.6. Magic Lounge as a virtual meeting complex

The Magic Lounge environment can be visualized as a virtual meeting complex, consisting of a main entrance hall and a variable number of rooms in which the Magic Lounge users can conduct their meetings. Each room will provide the users with a wide range of cooperative tools that could be used to facilitate various types of social or professional meetings. The users will be able to create public or private rooms with different degrees of content visibility to those who do not have access to such rooms.

One of the Magic Lounge tools will be its Magic Board. The Magic Board is envisaged to be a multi-media/hyper-media tool, which can be used for human-to-human communication as well as for cooperative activities. The Magic Board of a particular room will also serve as its meeting history record. Figure 1 shows a possible view of the Magic Board. In this particular scenario, three meetings have been carried out in a room, with Meeting No. 3 being in progress. While the Magic Board will show the textual and diagrammatic parts of the history in its window, the audio or video data will be represented as icons. Clicking on the icon of an audio, video, or hyper-link data will allow viewing of its contents in full.

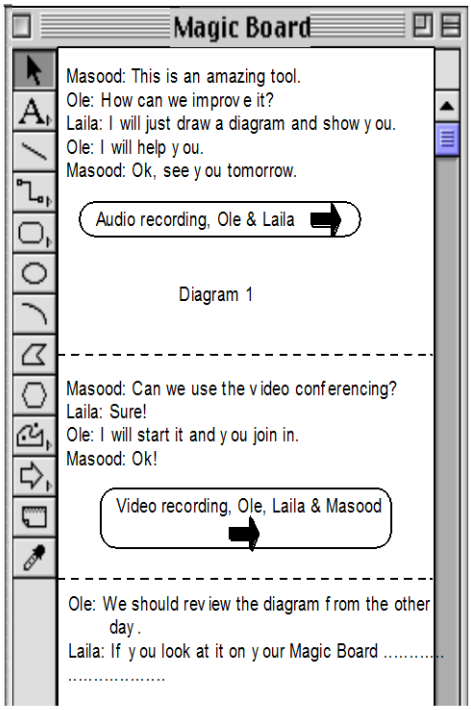

Figure 3. The Magic Board will enable recording and interaction with textual, audio and video interaction.

4. The first Magic Lounge demonstrator

Magic Lounge has to be based on a technical framework for creating and managing a distributed information space running on several platforms. Software and hardware tools are needed for video and audio conferencing, hypertext/hypermedia whiteboard. Libraries are required since we intend to develop our own "added value" functions. As a first step, we have developed an API for sharing objects and used it for implementing a shared textual chat with web browsing. We are currently studying how to use the NSCA Habanero framework for building collaborative applications and the Mbone for video transmission.

A preliminary demonstrator was presented in November 1997 (EITC 97) including a simulated phone interface with limited textual display (figure 4). Since then other functions were added among which spoken command for driving the web browser (figure 5).

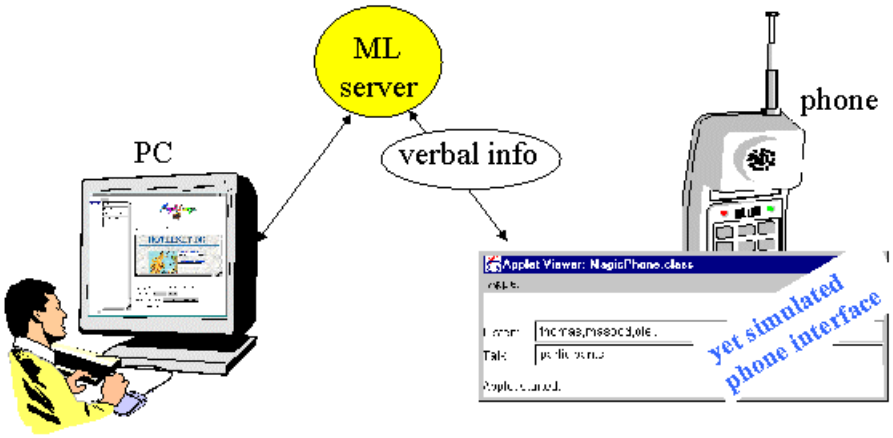

Figure 4: Configuration of the Magic Lounge demonstrator as presented at EITC'97 in Brussels

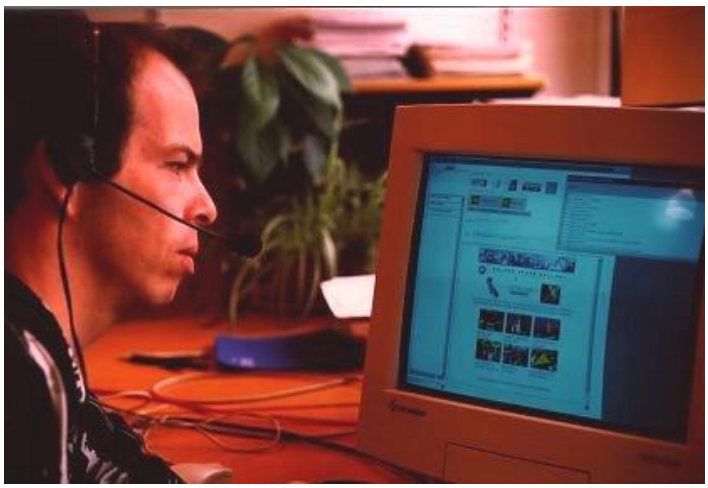

Figure 5: Integration of speech recognition for driving the web browser. The user has a local speech recognizer (ViaVoice) which allows driving the web browser with speech ("I want some information about hotels please", "Show me the previous page"). The embedded Web browser is the SUN Hot Java HTML Component.

5. Conclusion

In this paper we have presented a number of new research challenges which must be addressed when building the next generation of telecommunication and telecooperation systems which are able to cope with heterogeneous communication bandwidths of non-professional and possibly mobile users. We have described the Magic Lounge project that is committed to the development of a virtual meeting place for members of a geographically distributed community such as the inhabitants of the Smaller Danish Isles community who will serve as test users during the project. While being still in an early stage of development, some functions have already been implemented within a demonstrator. Although some of the functions that we have described in this paper already exist in some available products, we have not found any product providing all of them integrated.

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