AMIDA
Augmented Multi-party Interaction with Distance Access
http://www.amidaproject.org/

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D2.2 User Requirements Elicitation and Interface Concepts

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Abstract: This report describes the user requirements elicitation process and presents a number of user interface concepts for the proposed concept of a *meeting assistant*. The report both addresses the active role the meeting assistant can play, and how it can support remote meeting aspects. It starts with describing the method that has been followed during the user requirements work. Next, the central concept of the meeting assistant is defined and described how its functionalities are related to the meeting cycle. After that, user scenarios are described to make the meeting concept more concrete. This is followed by a description of the progress on four meeting assistant concepts: Content Linking, User Engagement, Meeting Hopping and Remote Monitoring. Plans for the remainder of the project are included.

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1 Introduction

The AMIDA project builds on the AMI project (IST FP6-506811, www.amiproject.org), that was aimed at enhancing meetings by developing tools for capturing, processing, searching and browsing multi-modal meeting information. The aim of AMIDA is to incorporate this technology into a the concept of a *meeting assistant* that can understand what is happening well enough to play an active role in improving meetings, e.g., to tell someone who cannot join the whole meeting when topics of interest come up, or to track the agenda and influence the course of a meeting, if necessary. Such new functionalities extent the more passive role a meeting browser plays.

AMIDA also extends its scope with remote meetings. Recently, it has become more and more common for colleagues and project teams to cooperate at a distance. This is partly caused by the fact that more people have started teleworking, i.e. "working in a location away from the main office or production facilities, without personal contact with colleagues, but instead through electronic communication (Cascio, 2000)". Another important reason is internationalization of work, for instance in the context of the European Union or multinational companies. Allowing people to be still able to cooperate when not co-located physically, is made possible through the advance of multiple Information and Communication Technology (ICT) applications, such as teleconferencing, electronic meeting rooms, chat, shared (network) disks and electronic cooperation spaces.

Cooperation at a distance offers many advantages to the society, organization as well as employee, such as less traveling, a higher productivity and a higher work satisfaction. However, part of the other side of the medal is the fact that people who cooperate at a distance feel they lack personal contact with colleagues, diminishing social commitment, cohesion and team spirit, and find it hard to tune work to one another (Bailey & Kurland, 2002). Despite the availability of various ICT applications, people still experience a threshold for participation in remote meetings. Important causes of this threshold are that remote meetings need to be planned and tend to be rather formal and long, allowing limited support for having ad hoc, more informal and shorter meetings. This latter type of meeting is much easier to organize in the traditional workplace. During informal communication not only information transfer takes place (as addition or correction to the formal information provided), but it is also a way of finding a connection with colleagues. A lack of informal contact also strengthens the 'feeling of distance' (Kraut et al., 1998; Mulder, 2004).

This report describes the user requirements elicitation process and presents a number of user interface concepts for the proposed concept of a *meeting assistant*. The report both addresses the active role the meeting assistant can play, and how it can support remote meeting aspects. It starts with describing the method that has been followed during the user requirements work. Next, the concept of the meeting assistant is further defined. After that, user scenarios are described to make the meeting concept more concrete. This is followed by a description of the progress on four meeting assistant concepts: Content Linking, User Engagement, Meeting Hopping and Remote Monitoring. We conclude with providing our plans for the remainder of the project. Note that we report ongoing work: the different concepts are in various stages of development.

2 Method

User Requirements specification should be seen as part of a larger Usability Engineering process (Streefkerk, van Esch-Bussemakers, Neerincx & Looije, in press). Basic steps are:

1. The definition of a concept, which is a broad description of the proposed system.
2. Scenarios that describe users, their tasks and context.
3. From these scenarios, the user requirements are analyzed, resulting in a requirements specification. These requirements describe the user needs with respect to their work practice and the role the system fulfills in addressing these needs.
4. User requirements form the basis for the system features. Features can be considered solutions to user needs. As the method progresses from concept to features, the level of detail increases.

Usability Engineering is a cyclic process of both design and evaluation, in which user needs and design solutions are refined towards a required level of effectiveness, efficiency and satisfaction.

In AMIDA, the usability engineering process takes place as follows.

(1) **Concept definition**. The general concept is *the meeting assistant*. Several potential functionalities of this meeting assistant have been identified. They may be organized in a matrix with the dimensions communication-process-content and during-between meetings, or organized in their relation to the meeting cycle. Both organizations are discussed in Chapter 3. Next, the technical feasibility of these functionalities has been determined. The technology experts from WP4 and WP5 were tasked to do this. Based on their assessment, it has been decided to initially explore functionalities for "content linking" and "engagement and floor control". Later on, functionalities for remote monitoring and meeting hopping have been added. These functionalities are explained in Chapters 5 to 8.
(2) **Scenarios**. The Design Project scenario, developed in AMI provides a general description of users, their tasks and their context. For content linking and meeting hopping, a scenario was developed to extract the user requirements. Chapter 4 describes the user scenarios.
(3) **User requirements and system features**. The user requirements are put into a user-interface mock-ups, that also incorporates the system features. In focus groups, the concepts and the user interfaces were evaluated and refined.
(4) **Evaluation**. In WP2 and WP3, a test bed has been around the Design Project scenario has been developed in which the effectiveness, efficiency, and satisfaction of the meeting assistant functionalities can be tested, including remote meeting support (see Post & Lincoln, 2008).

3 Concept definition

3.1 Central concept

The AMIDA objectives have been refined during the first 12 months of the project. A common vision has been agreed upon, and will be used as a shared focus that forms a point of integration and evaluation. As illustrated in figure 3.1, the AMIDA application

vision takes the form of a Meeting Assistant, whose functionalities are factored in two dimensions concerning when AMIDA technologies are used (between meetings or during meetings) and the different aspects of meeting support that they provide (communication, process or content).

Table 3.1: Schematic AMIDA application vision. Meeting Assistant functionalities during or between meetings, to support communication, meeting process or access to content.

	DURING MEETINGS	BETWEEN MEETINGS
COMMUNICATION	Alert remote participants Improve engagement and presence	Exchange of meeting related data
PROCESS	Track meeting agenda, time, etc. Floor control, process visualization	Relate items across meetings
CONTENT	Automatic linking of content Browsing and search (gist, actions) Summarization, fast playback Track decision making	

Between Meetings:
The Meeting Assistant will allow fast and efficient multimodal browsing and search of multimedia meeting archives, summaries, and related documents as well as accelerated playback of meeting videos.

During Meetings:
The Meeting Assistant, in addition to providing the functionality above, optimized for use during meetings, will automatically generate multimodal indices of meetings in or close to real-time to support multimodal search of meetings in progress, as well as other functionalities. For example, the Assistant could automatically generate multimedia meeting summaries "on the fly", and suggest documents, past meeting segments or names of people related to the topic of discussion, and it could allow instant "replay" at various speeds of segments of the meeting in progress. It could also keep track of important items to aid in minute taking, for example, by maintaining a list of names, dates, and deliverables mentioned. In AMIDA, meeting participants will have the option of using any subset of the Meeting Assistant functionalities without recording the meeting in progress (e.g., saving only the end-of-meeting summary rather then the entire video or audio of the meeting).

Remote meetings:
In meetings where the participant is not physically in the same room as the rest of the meeting participants, the Assistant will provide additional functionality to facilitate engagement and collaboration. This functionality will depend on the particular device and bandwidth the participant is using. For example, if video is not available, the Assistant may show who is speaking at a particular time as well as visually represent any movement of the participants in the meeting room (e.g., someone leaves or stands in front of the audience). If video is available, the system could improve engagement by showing the remote participant where the other persons are looking, and so on.

Meeting Assistants of the participants physically at the meeting would show who is participating remotely, and what documents they have contributed, among others.

Relationship to AMI:
The Meeting Assistant will use AMI technologies to automatically index meeting videos,

it will use the AMI corpus to develop applications for use during meetings and for analyzing meeting requirements, among others. However, in addition to fundamental research in all the technology components mentioned above, AMIDA will relax the constraints on meetings, adapt the user requirements, develop real time version of some of its algorithms when required, and further develop tools to quickly integrate and access different sources of information.

3.2 Relation to the meeting cycle

During AMI as well as AMIDA, meetings have always been regarded within the scope of a meeting cycle, existing also of documenting the meeting outcome, to act upon the result of that meeting (e.g., to carry out the actions that have been agreed on), and to prepare a next meeting, and so on. The meetings assistant functionalities of both AMI and AMIDA are now described in relation to this cycle. Figure 3.1 illustrates these functionalities.

AMIDA's predecessor, AMI, was focused on documenting (Recording, Abstraction / Summarization), off-line Browsing and Preparation (speeding up meeting play-back). These provide passive support: the user has to take the initiative. In AMIDA, we will work on active support. AMIDA will focus firstly on support during the meeting: on-line content linking and "catching up": when you are late or asked to join a meeting only for a specific part, and need to be pre-briefed. All these functionalities support the "content level": they fulfill an information need. AMIDA will also focus on supporting the "process level" of the meeting cycle, such as with goal orientation during a meeting (agenda management and leadership support), and on workload balancing: how to tune one's meetings with all other work that has to be done. This aspect has to do with monitoring availability for interaction and ways to alert or contact people to start an interaction. Finally, AMIDA will provide support at the "communication level", to deal with shortcomings related to remoteness (compensating for bandwidth problems, such as engagement enhancement and floor control.

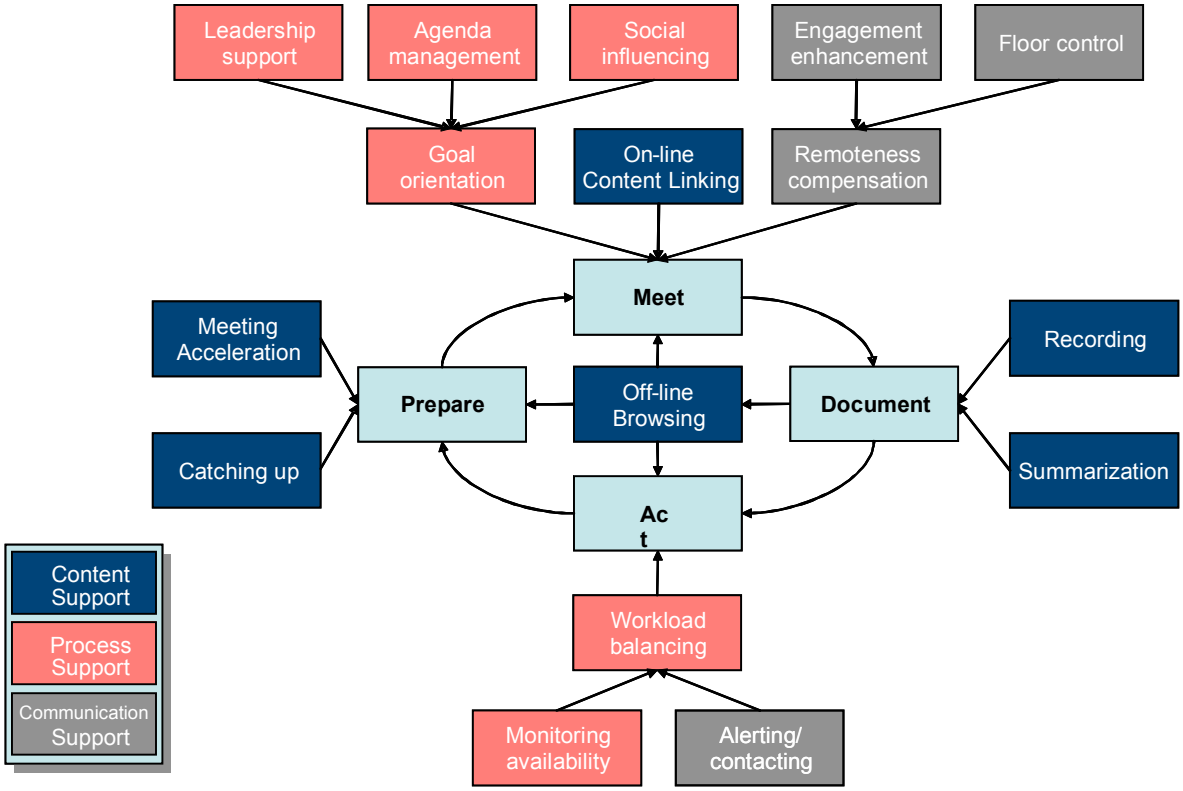


Fig. 3.1. Potential Meeting Assistant functionalities.

4 User scenarios

A basic project scenario was written describing a multidisciplinary design project team that is working on designing a TV remote control, which is described in section 4.1. This scenario was originally written for face-to-face situations and did not take into account remote participation or more dynamic partial participation in meetings. These various possible participant statuses are described in section 4.2. Finally, in section 4.3, a meeting scenario is described in more detail, including some of the statuses of section 4.2, and introducing the concept of a virtual Meeting Assistant who supports meeting participants to carry out various meeting-related tasks.

4.1 Project design scenario

During our work in AMI and AMIDA, we have used a project design scenario both for recording material for the meeting corpus and for evaluation purposes, but also as a means for making concepts concrete. Since it will be referred to regularly in the remainder of the report, we briefly describe the scenario here. Four participants, acting as employees of a consumer electronics company, join a project on designing an innovative TV remote control. The project roles are: project manager (PM), marketing expert (ME), user interface designer (UID) and industrial designer (ID). The overall project method that is being followed has four phases: project start-up, functional design, conceptual design, and detailed design. In each phase a meeting is carried out, for which individual preparatory worked needs to be done.

The first phase of the meeting scenario starts with preparing each role individually, after which the team meets. The participants get acquainted, and the project manager starts the project officially by providing the project plan and the division of work until it is clear to

everyone. After the meeting, individual work is carried out, including the preparation of the next meeting. During the preparation of the second meeting, PM receives e-mails on how to manage the functional design phase, ME receives a marketing report with user requirements and needs, UID devises the remote control functions, based on examples found on the (simulated) web, and the ID devises the functionalities of the remote control, also inspired by the web. They all prepare (pre-structured) PowerPoint presentations. During the second meeting they exchange their findings and ideas, and come to an agreement on the functional design. Then they split up again, to carry out individual work. Now PM receives e-mails about how to manage the conceptual design phase, ME gathers market changes and evaluation criteria on the web, UID finds examples of old and new RC interfaces, and the ID of components, properties and materials. During the (third) meeting that follows, they present their PowerPoint slides, and try to reach agreement on the conceptual design, also dealing with the changing project constraints and market. The last phase starts with individual work again. PM gets financial information, ME develops an evaluation scheme, and UID and ID work together on a prototype. They present their prototype during the fourth (and final) meeting, which is assessed according to the criteria of ME.

More details can be found in Post & Elling (2007). For a version of this scenario for remote meetings, see Post & Lincoln (2008).

4.2 Possible participant statuses

In the envisioned face-to-face and remote meetings of the future, at different points in time, participants may have different statuses. A first division is between people who are not invited and people who are invited to the meeting. People who are not invited are not aware of the meeting, but may receive an ad hoc invitation to join the meeting at a certain point in time, e.g. for giving an expert opinion on a certain matter that is being discussed. People who are invited may either be absent or present at the meeting. If they are currently absent, they may have declined the invitation, they may be late to arrive, or they may have left the meeting temporarily or definitely. Also, people may be standby, i.e., they know they could be asked to join at some point during the meeting, or they may have indicated to be only interested in certain parts of the meeting, at which points they will be alerted. Finally, people who are present may either be just listening in or (supposedly) actively participating (which may vary from having the floor, listening, paying attention to not paying attention at all) in the meeting. It is important for all of these statuses to be clear to the participants of the meeting. Figure 4.1 shows the possible participant statuses.

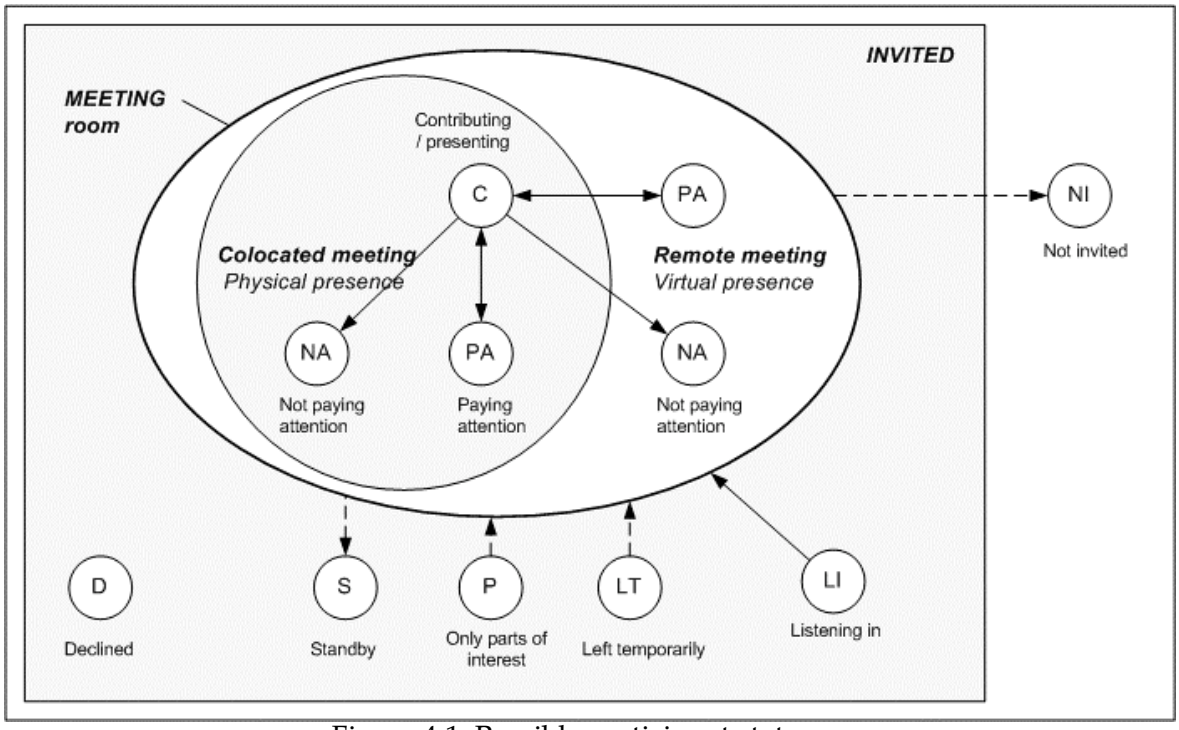


Figure 4.1: Possible participant statuses.

4.3 Meeting scenario

The meeting scenario illustrates how a virtual Meeting Assistant may be involved in a meeting, such as one of the meetings described in section 4.1. The involvement of the meeting assistant shows examples at the communication level (e.g. alert participants, improving engagement and presence), process level (e.g. tracking meeting agenda, time management) and content level (e.g. automatic content linking, browsing and search, summarization, fast playback or track decision making). The interaction with the meeting participants and the changing statuses of the participants are visualized in figure 4.2.

During the meeting, three out of the four invited participants, who join the project on designing an innovative TV remote control, are situated colocated in a meeting. The fourth participant, the marketing expert (ME) is joining remotely. The other three project roles are: project manager (PM), user interface designer (UID) and industrial designer (ID). The participants of the meeting have access to a system where they can see live videos of each other and view more information on the other participants by selecting them in the interface.

The meeting is already in progress. The participants are discussing the latest trends on a certain marketing subject. However, because of a busy schedule the ME has not been able to visit last week's conference on the subject. For the other participants it is very important to be updated to make a well-founded decision on future activities. Because of the urgent matter, they decide to bring the knowledge into the meeting by inviting someone who has attended the conference. Being responsible for this subject, the ME involves the Meeting Assistant. He defines both the required expertise and the condition (attendance at trend-conference), the time span in which the information should be presented (within this meeting) and adds the question for the expert (his reason for contact).

The Meeting Assistant searches for expert(ise)s and checks the availability of possible experts. This results in a notification for the ME with an overview of available expert(s) and a concept invitation for the invitee containing additional information on the project (for example the project's objectives), the current meeting, its participants and location, and an abstract of the meeting discussed this far (if relevant to the expert).

The ME chooses an expert, accepts or improves the invitation proposal and permits the meeting assistant to contact the expert in his place. While doing this, the ME is distracted by his interaction with the Meeting Assistant. Other participants are able to notice this lack of engagement. The Meeting Assistant contacts the chosen expert on behalf of the ME with the invitation and additional information on the project and participants. The expert receives the invitation, is interested in the project and accepts the invitation. However, he wants to finish some work before entering the meeting and decides that he would like to join in half an hour. The Meeting Assistant notifies the ME on the planning and how this will influence the agenda of the meeting. They come to an agreement and the Meeting Assistant adds the new item to the meeting agenda. The attendance of the expert is added to the agenda of the meeting. This is visible for all participants, but is not meant to withdraw the attention from the meeting. The status of the expert is changed by the Meeting Assistant into 'Standby for the meeting'.

The meeting continues, while the expert is minding his urgent activities. Meanwhile the Meeting Assistant keeps track of time (agenda & time management). Some time later the chairman receives a silent notification that the next item on the agenda is due and that the expert is ready and waiting to join the meeting. He decides whether the timing is right for the expert to join the meeting. During a sensitive matter it should be optional to 'snooze' the expert until the matter is closed.

The ME initiates 'opening the door of the meeting room' for the expert. The expert joins the meeting; meanwhile his availability status changes into 'in meeting'. The other participants receive a notification that the expert has become a visible participant. Like in a face-to-face meeting it is sometimes desirable to make personal contact with all participants of a meeting by shaking hands and introducing yourself to each other. This feature can be coordinated by the Meeting Assistant, for instance through one by one highlighting or enlarging a participant and allowing the invitee to greet the participnat and if desired to look at additional background information.
After the expert has joined, the Meeting Assistant continues by tracking subjects discussed. He recognizes persons, subjects or documents mentioned during the discussion of an agenda item, links these to previous meetings, persons and documents and notifies the results to the chairman. The results could be for example: *"You should take a look at the x-paper of the y-conference. I think it was written by Z. And A & B say also interesting things about the matter in last week's meeting."*

During his visit to the meeting, the expert receives an email from his superior. This withdraws his attention from the meeting, the Meeting Assistant notices the lack of engagement and shows this to the other participants. After a few minutes the expert asks to be excused and leaves the meeting.

At the end of the meeting, the Meeting Assistant provides an overview of networked entities (persons, subjects and documents), the meeting summary, decisions made and actions to be taken. He offers the possibility to adjust them manually or to accept and save the results in the meeting minutes.

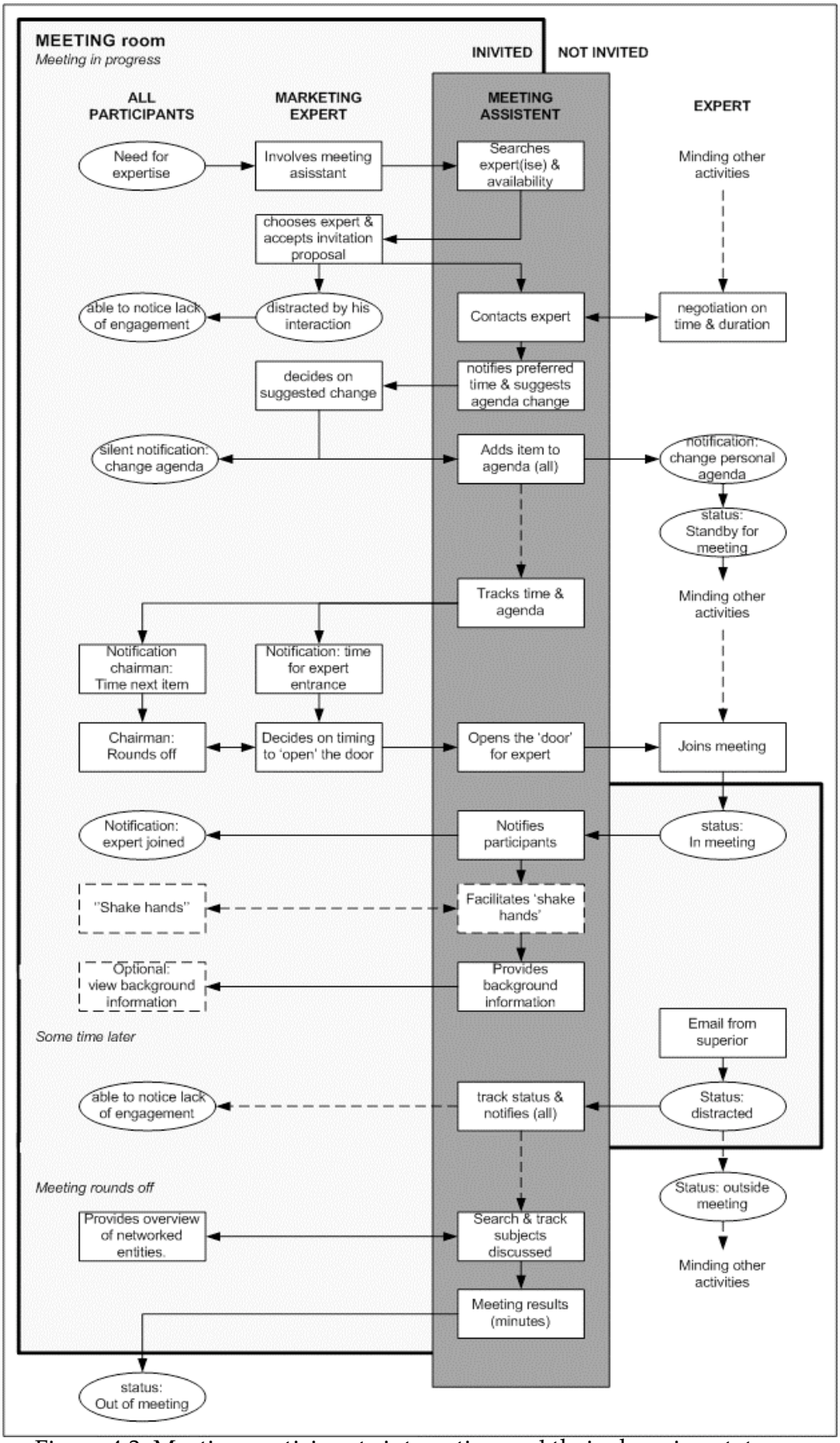


Figure 4.2: Meeting participants interaction and their changing statuses.

5 Content linking

5.1 Concept

During and between meetings the meeting assistant can facilitate meetings by providing meeting-related information. In particular provide efficient access to multimedia meeting and meeting-related archives. Especially during a meeting the meeting assistant can support the meeting process by giving an overview of all meetings within a project, persons, documents, timelines, transcripts, action points, milestones, etc. and the associations between them. When a meeting is in progress, the overview is updated constantly: topics that are covered in the current meeting are added to the overview in real time (see Figure 5.1). The Meeting Assistant supports the process by recognizing previous discussions about the same topic that is being discussed currently.

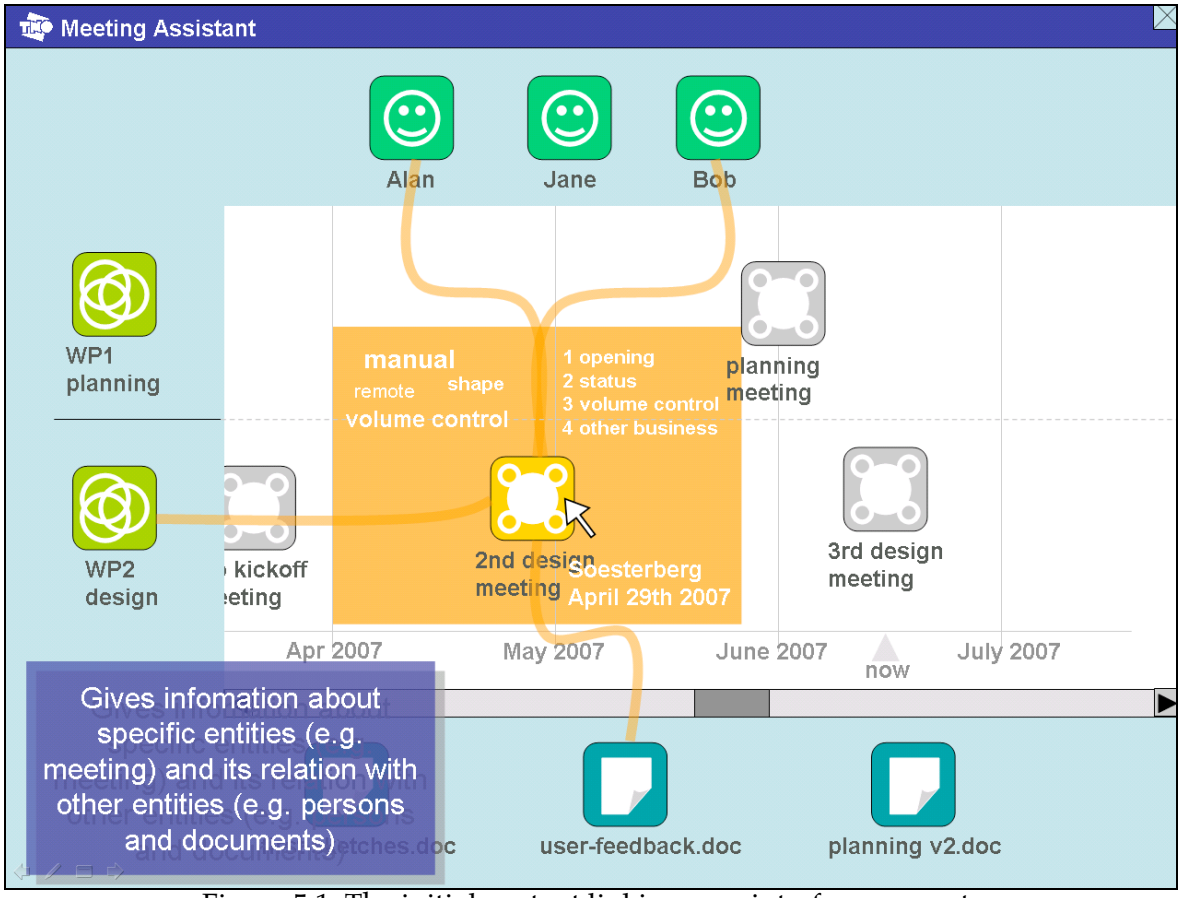


Figure 5.1: The initial content linking user interface concept.

The Meeting Assistant supports the content of the meeting by giving overview (e.g. see 'how the project is doing': give a high-level, overall view of the project that indicates if deadlines are met, finances are still sufficient, people are working together, see connections between meetings, see their context, etc), allowing to search (e.g. find answers on specific questions like: 'who is working on deliverable D2?', 'When is it due?', and 'Who else could help to write it so the deadline will be met?') and allowing to browse (e.g. get an impression of what the project is about, the people that are in it, formal and informal networks, key-persons, who knows what, etc. This functionality is useful for people that are new in the project.)

Scenario example

During a meeting a discussion starts about the volume control of the Remote Control. The chairman sees / gets a warning from the Meeting Assistant (MA) that a discussion about the volume control has been held before, in a different meeting of a different work package.

On the screen the chairman sees immediately that one of the current attendees participated in that meeting (Alan). The chair asks the MA for the minutes from the other meeting. In addition, the chair wants to contact Alan who is participating from a remote location and has the status 'not paying attention'. The MA warns Alan that his input is needed about what he remembers from that previous meeting and that discussion.

The chair notices that a meeting about the same discussion point is planned in a few weeks and decides that it is best that someone from his team should participate as well. The MA shows that Alan will not be available, but Jane will. Since Jane, who was invited for the current meeting, is not present according to the MA, the chair makes a note to ask her later about this.

5.2 Iteration

5.2.1 Focus group

Approach
First participants were asked to fill in a questionnaire about their personal experiences with cooperating and meeting at a distance. Then a brainstorm was held about their experiences. Finally, two concept for future meeting support were presented: content linking and availability (see section 7.2.1).

Participants
Six people participated (5 men, 1 woman). They were all TNO employees, and their ages varied from 30 to 45. They indicated the following information in the questionnaire:

Use of communication means:	daily
Telephone, email:	daily
Chat/MSN/ICQ:	never-weekly-monthly
Audioconferencing:	monthly
Videoconferencing:	never
Participation in meetings:	daily-weekly
Audioconferences	monthly
Videoconferences	never
Organize meetings	weekly-monthly
Size	2-6 persons
Length	face-to-face (5 min–2 hours), audio (maximal 1 hour)
Type	audio: mainly project/peer group

Evaluation of meetings	
Face to face	informal, sensitive subject
Audioconferencing	functional, intense, to-the-point, confusing
Videoconferencing	no comments
Appreciation	time well-spent, goals attained, liked most of times

Results
The most relevant remarks made by participants were:

- the tool seems to be suited for getting an overview of the project, which was a need expressed by the participants;
- participants were somewhat anxious about the artificial intelligence which seems to be part of the tool: automatic alerting when a certain subject is raised which has been discussed before. The tool should provide the possibility to enter information or change it; users should have the ultimate responsibility.

5.2.2 Community of Interest

The ACLD was demonstrated to potential industrial partners, and to a review committee, and received very positive verbal evaluation, as well as useful feedback and suggestions for future work, which can be grouped into three categories. The participants found that both online and offline application scenarios are promising, as well as individual and group uses.

The **graphical layout of the interface** could be improved by allowing a larger part of the screen to be used for displaying the documents, using larger overviews of each document, and discarding past documents more quickly. This would also help to reduce the number of mouse clicks required to access the content of documents. Color-coding the document types and displaying their relations to the meeting ASR would also improve user experience.

Another line of suggestions concerns the **document repository**, which can be extended in various ways. The repository could include documents from larger sets, which are not entirely known to users, so that the interface brings new knowledge into a meeting. These sets could be private, personalized and better structured. A significant extension of the repository would also include a list of websites, but this should be limited to avoid too much potential noise in the results.

A number of **additional functionalities** were suggested. For instance, keeping a record of the documents that were consulted during a meeting might help users who want to go back to them after the meeting. Detecting similarities with previous discussions would help alerting users that they already had this discussion before. Finally, retrieval could be improved by including a relevance feedback mechanism for the returned documents, by representing keywords in a structured manner, and by using word sense disambiguation to improve the precision of the retrieval.

5.3 Current results

Before putting much work into the user interface, first a working version has been built to demonstrate the technical feasibility. Although the current version is not very intuitive, the interface shows already detected keywords, and allows hovering over related documents and previous meetings. An improved interface is underway.

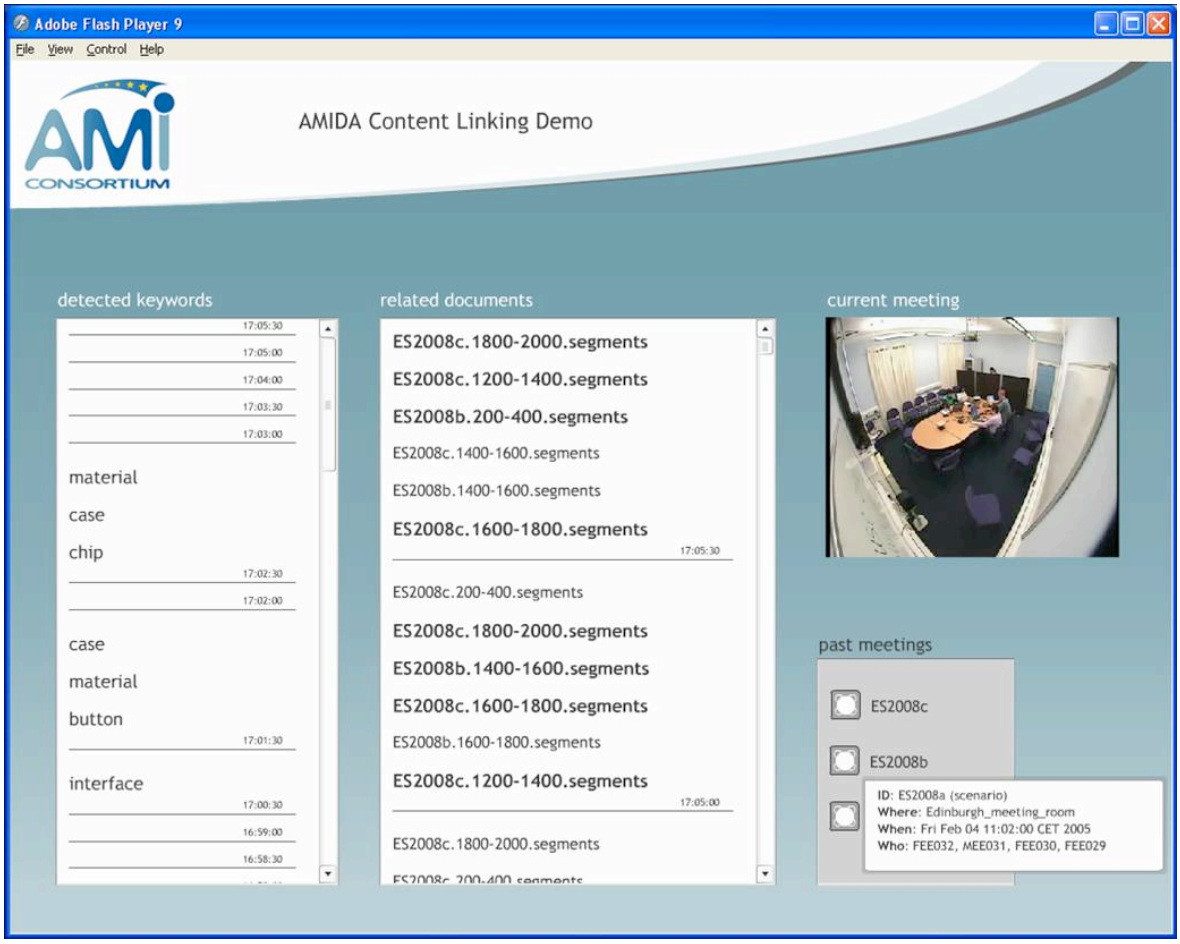


Figure 5.2: The user interface concept from a first working version of the content linking functionality.

6 User engagement and floor control

6.1 Concept

This application supports a remote, mobile participant, who has only a smart phone at his disposal. Lacking the normal cues in face-to-face meetings, which can lead to a low level of user engagement, the remote participants will be supported on his mobile, by

- Showing the focus of attention in the meeting
- Showing who is speaking at any time
- Indicating the best time to interrupt
- Automatically showing the best camera view

6.2 Iteration

The application has been built, to show technical feasibility. The next step is to let the users determine the usefulness of the application or come up with additional features, within a focus group session. This is planned in May 2008. The outcome of this session will result in adaptations of the current version.

6.3 Current results

A user study was performed with 13 subjects, all of whom use information technologies every day and have a university degree in computer science. The subjects were given a demo of the MMA application running on an emulator in real time (see Figure 6.1 below), with a video recording of the meeting playing on second computer, for a duration of 5 minutes (meeting IS1008a from the AMI Corpus). They had then the possibility to interact with the application for a maximum duration of 5 minutes. The subjects answered a questionnaire shortly after the demonstration, where some questions required them to rate implemented or potential functionalities of the MMA, while others enquired about their own needs for a remote meeting assistant. Numeric ratings are coded below from 1 to 5, 1 being best and 5 worst.

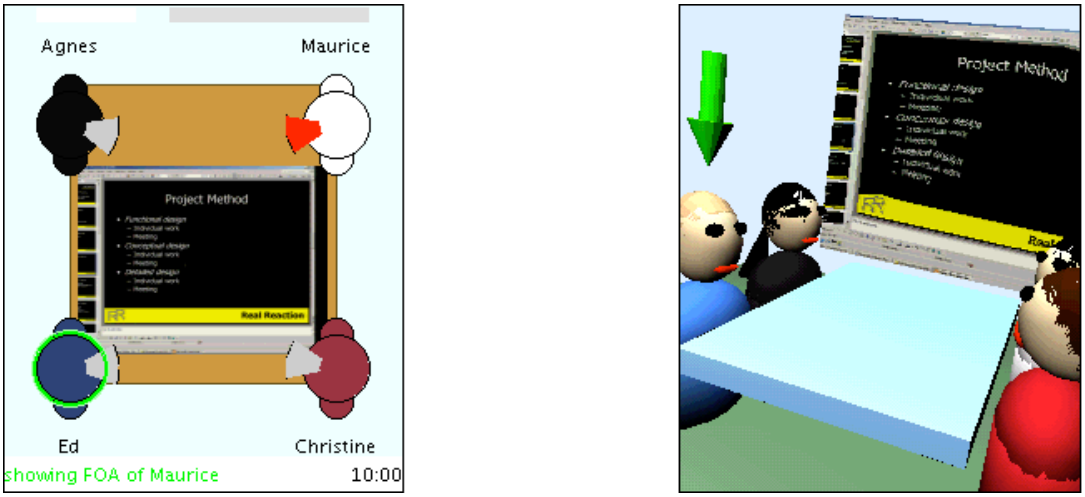


Figure 6.1. Snapshots of 2D and 3D interfaces.

The subjects judged the MMA very positively: they liked the concept (1.5/5) and the present approach (1.9/5). They would use such an application "sometimes" (9 out of 13), mainly for design/technical meetings (11 out of 13) or business meetings (10 out of 13), but less for personal meetings (5 out of 13). They would mainly use the application while waiting at the train station or at the airport (10 out of 13), in the office or on a train/airplane (9 out of 13 both). The main limitations for use in such conditions is the available attention if the user must do something else (e.g. go to a gate or catch a train, 10 out of 13), the small size of the screen, and noise from the environment (7 out of 13 both).

In terms of user experience, users seem equally satisfied with the 2D and the 3D interfaces (2.3/5 and 2.2/5). The interface and color schemes are at the appropriate level of complexity (11 out of 13). The most appreciated information is "who is speaking when/to whom" (1.7/5), followed by the full-screen slide preview (2.0/5), the focus of attention (2.1/5) and head orientation (2.5/5). Possible features to be added in the future have been rated similarly: "you are expected to speak" alert seems the most desired one (2.0/5), followed by the "enter/leave room" alert (2.2/5), use of personalized avatars (2.4/5), and speech transcript (2.5/5). Finally, most of the subjects would also use a desktop version of the MMA (11 out of 13), and many would even prefer it (8 out of 13), a fact that meets some of the explicit suggestions received from industrial partners.

7 'Meeting hopping': availability and catching up

7.1 Concept

Both when initiating a remote meeting and when joining a meeting that has already started, the potential meeting participant should receive cues about the availability of the person(s) he wants to meet with or the meeting he wants to join. Additionally, in the case of joining a meeting, the person should get an overview of the proceedings so far. Once the meeting has started or the person has joined, all participants are assumed to be fully available to the meeting and, consequently, not available to the outside world. However, a person from the outside world may still try to contact a person who is attending a meeting, if the urgency is high. These outside persons may or may not have access to the proceedings of the meeting, depending on their statuses.

7.1.1 Initiating a meeting

Before initiating a meeting with someone, an assessment should be made of whether the person is available for communication. In situations of physical proximity, people make use of various cues, which together form an impression of the availability for communication. These cues are linked to the person one tries to contact, the current situation of the person, the relationship between the two people and additional (digital) information on the current activity:

- Person cues: background information (status, knowledge, experience, skills, interests, private information); activity and behavior (in a conversation, in a formal meeting, working, pausing, absent, medium use); location and body (sitting behind desk, in the vicinity of the desk, somewhere else in the room, posture, gestures); appearance (conspicuous clothing or accessories, symbols or insignia, dress code); emotional constitution (character, mood);
- Situation cues: type of room ((in)formal, own office, meeting room); place and time (in a situation of physical vicinity there is no difference in place and time, but time can be seen in the context of an activity: almost finished, not started yet, etc.); dimensions, acoustics and appearance (size of the room, quality of interior, audibility of what goes on in the room, lighting); atmosphere and accessibility (door ajar, music, laughter, tone of a conversation, type of lighting); other persons present ((un)known colleague, (un)known customer, (un)known person).
- Relationship cues (between the two people): shared knowledge and experience (stories, media (photo's, video); shared culture (company culture, subculture, e.g., what does it mean if the door is closed); forms of address; relationship in the communicative context (type of relationship: work, project-specific, old/new, colleague, private, friend, intimate, family, acquaintance, unknown), hierarchy (superior, subordinate, equal).
- Additional information cues: (public) electronic agenda, use of shared (network) disks and electronic cooperation spaces.

The cues are multidimensional, in the sense that someone on the basis of one cue may not seem to be open to communication (someone is talking to another person), but on the basis of another cue, he is (the door is open). The combination of the cues leads to an initial assessment of the availability. Subsequently, the contact seeker weighs the assessment against the importance or urgency of the communication, and then acts upon it. The act can take several forms: refrain from communication and possibly try later or find somebody else; ask whether the person is available for communication; or start communicating (barge in). The latter two situations may result in the desired communication, or in a kind of 'negotiation', which can again lead to cancellation, postponement or referral to somebody else.

In situations of trying to initiate remote ad hoc communication most of the aforementioned cues unfortunately are not readily accessible to the contact seeker. This makes it harder to assess whether it is the right moment to contact someone, and which communication means are best suited for that. Some existing informal communication means, such as chat or messaging applications offer the possibility to give an indication of the availability for communication. This availability is presented in different ways in different applications (e.g., iChat, GTalk, MSN, ICQ and Skype), but can roughly be subdivided into 'available', 'busy', 'away' and 'offline'. The number of indications for availability in current applications is significantly smaller than the number of cues we display in a physical situation. Also, these indications are always univocal, and one always has to take the initiative to set one's availability. The advantage is that one can control which indication to communicate and has the possibility to be slightly dishonest about it. Unfortunately, this means that the contact seeker can never be sure about the real status, which can form a threshold for trying to get in touch.

In future applications, it should be easier to make a more realistic assessment of the availability of the potential remote communication partner, assuming that working at a distance should become more similar to working in a situation of physical proximity. In this vision, there is no need for people to actively indicate their availability status, but a potential contact seeker can derive the availability from cues that are displayed. These cues may stem from the existing digital information sources mentioned above, but may be supplemented with additional information, e.g., media usage (computer, telephone), specific document and application usage, indication of workload (based on, e.g., number of open documents, keyboard hit frequency), and live audio and video (web cam) of the person (possibly blurred).

First scenario and user interface concept

A project team, consisting of seven persons, is cooperating in the Cues project. Because of the geographical distribution they are dependent of ICT facilities for information exchange and communication. The project team has access to an ICT project environment 'iSeeCues', which helps them to communicate more effectively with each other, formally as well as informally. An important characteristic of the environment is that team members can show each other their availabilities, allowing others to judge whether they can disturb them at a certain moment in time. Frank is the central team member; situations are shown from his perspective. Figure 7.1 depicts a situation where all team members are working independently of each other, but need informal consultations at certain points in time. In this situation only Rose is available for informal deliberation. Tom and Andrea are talking to each other. Since Frank knows both of them and chances are that they are talking about the project anyway he could join the conversation. Yasmin is talking to two people unknown to Frank. However, he can see in her time bar that according to plan the meeting will not continue for a very long time anymore. Both Steffan and Anil are offline and thus not directly available at the moment. Since Steffan is also a personal friend of Frank, he could try to reach him via his mobile phone.

Figure 7.1: Typical situations where all team members are working independently of each other, but need informal consultations at certain points in time.

7.1.2 Joining a meeting

For a person wishing to join (or leave) a meeting, a list of similar availability cues as the ones described above can be composed, in this case not related to an individual person but to the meeting as a whole. Whether or not a person who wants to join the meeting has access to these cues and in which form they are presented to him, depends on his status. In the envisioned dynamic remote meetings of the future, at different points in time, participants may have different statuses (see section 3). It is important for all of these statuses to be clear to the participants of the meeting. The question is how the meeting assistant should indicate these different statuses to the meeting participants. Also, the meeting assistant should automatically provide information on the proceedings of the meeting so far, for catching up purposes when a person is late, is only interested in parts of the meeting, or asked to join a meeting only for a specific part. How to present this type of information to people with various meeting statuses is an open question.

7.2 Iteration

7.2.1 Focus group

A focus group was organized (see section 5.2.1 for characteristics of participants) to assess the first ideas on availability support, using the scenario and sketches presented in section 7.1.1 (see Figure 7.2).

Results

A summary of the most relevant remarks made by the participants is:

- Availability cues already exist in systems, so make use of those!
- Do not show too much information that needs to be processed.
- Good to know if somebody wants to contact you: an idea is to see this person passing by on your screen, possibly with a short message.

– Knowledge of 'informal agenda' (context) would help a lot: a good secretary knows when a person can be disturbed or if he is really needed.
– The system should support quick interaction/negotiation whether someone is available (similar to an exchange of glances, nodding etc).

7.3 Current Result: scenario and user interface design concept

7.3.1 A project team spread geographically

A project team, consisting of eight persons, is cooperating in a project. Because of the geographical distribution they are dependent of ICT facilities for information ex-change and communication. The project team has access to a virtual project environment, which helps them to communicate more effectively with each other, formally as well as informally. An important characteristic of the environment is that team members can show each other their current statuses, allowing others to judge whether they can disturb them at a certain moment in time. Also, the environment provides meeting updates for people who have missed parts of meetings.

The scenario shows two situations. The first is a situation where one of the participants, Frank, arrives late for a formal meeting which has been planned ahead of time. The second situation is a more ad hoc decision during a meeting to ask someone to join the meeting, where it is of relevance whether this person is available to the meeting or not.

Frank arrives late (joining a meeting)
A meeting is being held for which Frank is invited, but he is late. At arrival, Frank 'listens' at the door to make a quick assessment of the situation, to decide whether it is a right time to enter the meeting room. The information presented to him (see Figure 1) can be personalized, where only information relevant to his personal interest, role and status is shown.

Frank can see that a part of the project team, Tom (the chairman, with a hammer), Steffan (who has indicated he will leave early) and Andrea, is present in the virtual project room. Frank overhears blurred audio and sees blurred video of the people in the room as well as a blurred graphic. Apparently an intense discussion is going on.

Also, in the left bar he sees all invited but not present project members in blurred pictures. Their current statuses can be either 'listening in' (not being able to contribute), 'not present' (yet or anymore) and 'declined' the meeting invitation. His own virtual representation is still 'not present', with a 'late' message attached to it by Tom, whom he had already contacted about his late arrival. Other people have appropriate messages attached to their representations. Phillis has indicated that she is only interested in software issues and will receive a warning from the meeting assistant when this has become the current topic of the meeting. Rose is currently having a short meeting break and Anil is ill.

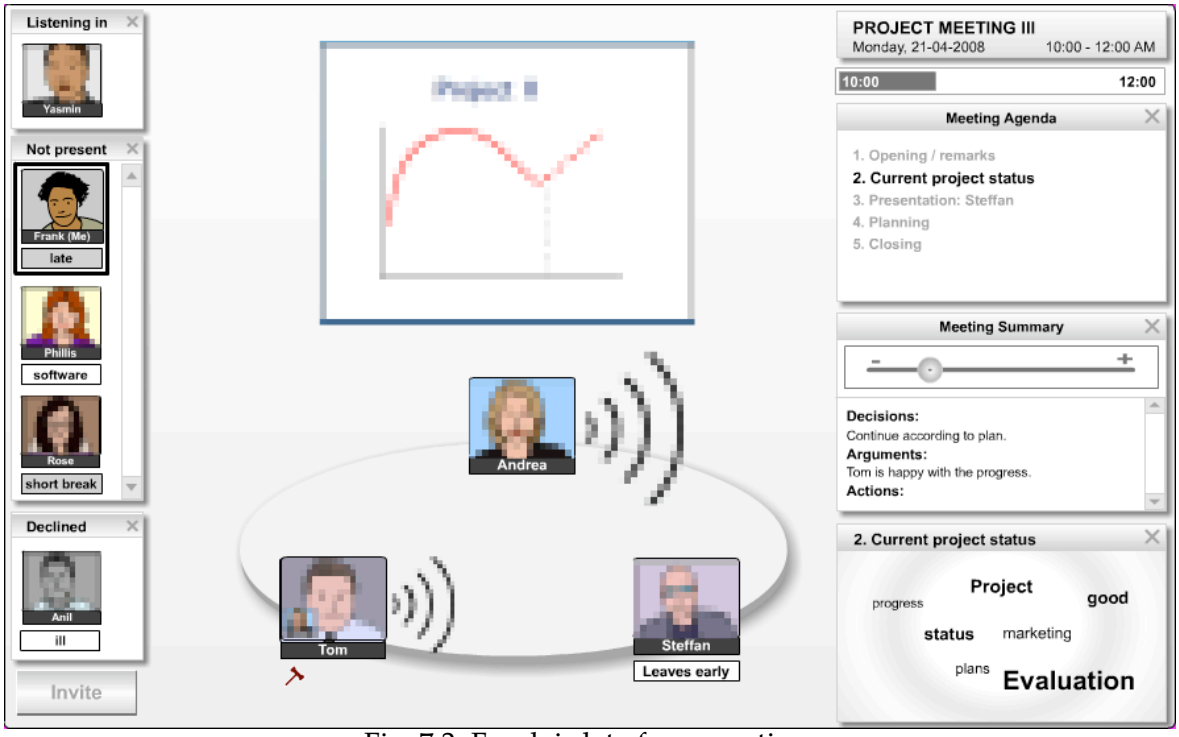


Fig. 7.2. Frank is late for a meeting.

Subsequently, Frank looks at the right part of the room which provides information on the current meeting. On top, the meeting agenda with its past, current and planned agenda items is shown. By clicking on a past agenda item, the summary of that item is shown. By default, in the middle, an overall summary of the meeting up till now is presented. The summary also includes the global meeting atmosphere, indicated by a circle positioned on a negative-positive scale, where the size of the circle indicates the intensity of the interaction. Below, the current agenda item is presented with an overview of automatically recognized current topics, prioritized through size.

Frank is not very interested in the current topic and does not feel like entering in the middle of the discussion, so he decides to wait another minute, gets some coffee and then enters the room. To enter the room he drags his image to the table at which point the comment 'late' is removed. Chairman Tom receives a message of his arrival and greets Frank. After entering the room (see Figure 7.3) all four participants, including himself are visible in a live streaming image. The fact that they all participate in the same meeting is represented by the oval 'table' connecting all of them.

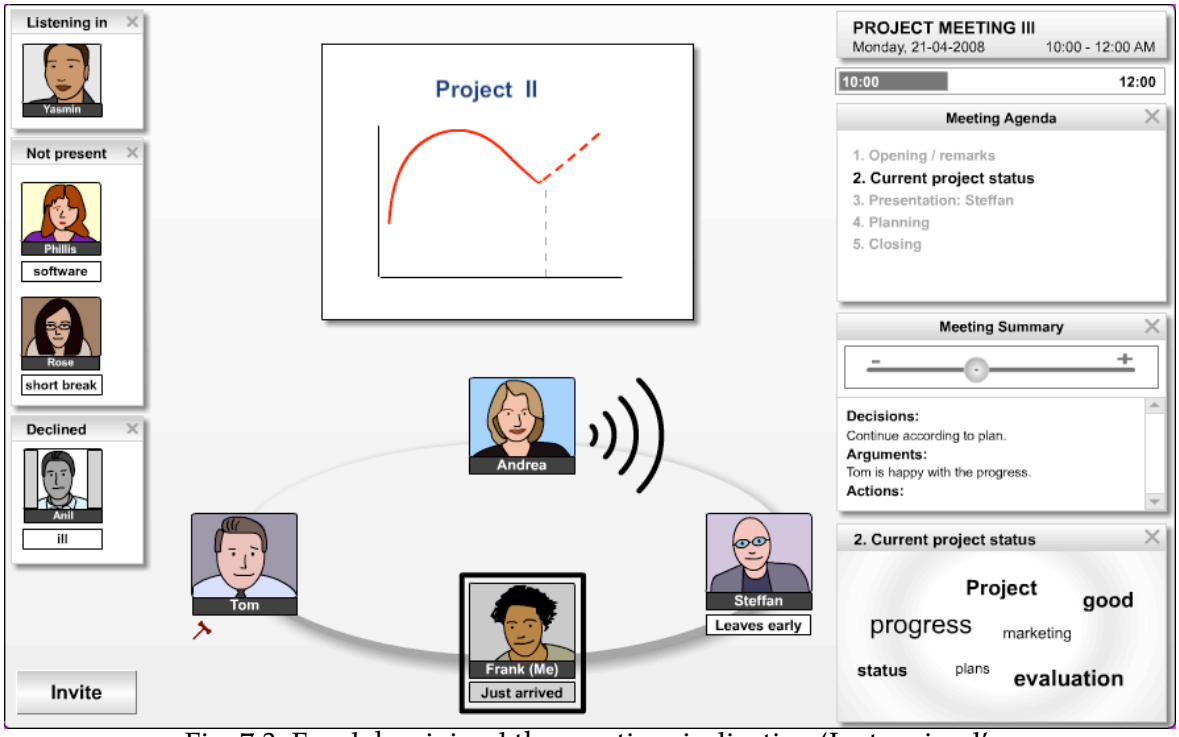


Fig. 7.3. Frank has joined the meeting, indicating 'Just arrived'.

Chairman Tom invites expert Peter to the meeting (initiating a meeting)
During the meeting an expert opinion is needed on a certain matter that is being discussed. Tom knows a person named Peter, who is an expert on the subject. They decide to invite Peter to the meeting. First Tom opens Peters profile from his list of con-tacts, using the invite button, to check his availability and to be able to initiate contact (see Figure 7.4).

Peter's profile shows indications of his availability: his calendar showing he is in the office and not in a meeting, his current level of activity and mood (e.g. based on his media usage, specific document and application usage, workload (e.g. based on number of open documents, keyboard hit frequency) and a blurred video created by a web cam. Tom can derive form the information that Tom is on the phone and his mood is not very positive. However, he can see that Tom still has quite some time available before he has to join another meeting. Since Tom is a personal acquaintance, he decides to wait for Peter's phone conversation to end, and to take the chance to invite him to join the meeting. In the mean time, he still monitors the current meeting, to stay up to date with the proceedings.

The ideas presented here should first be evaluated with persons who are experienced in remote cooperation and meeting. In particular, it should become clear whether these functionalities are expected to relieve current problems. Also, user interface versions of the meeting assistant should be developed to evaluate how interactions that minimalize interruption of the ongoing meeting should be designed. In order to actually build these functionalities, real-time performance of relevant technologies should be assesed. Further, other possible functionalities of a meeting assistant should be explored (Post & Lincoln, 2008), such as goal orientation (e.g., agenda management and leadership support) and engagement enhancement (e.g., compensating for bandwidth problems, and social phenomena such as commitment loss).

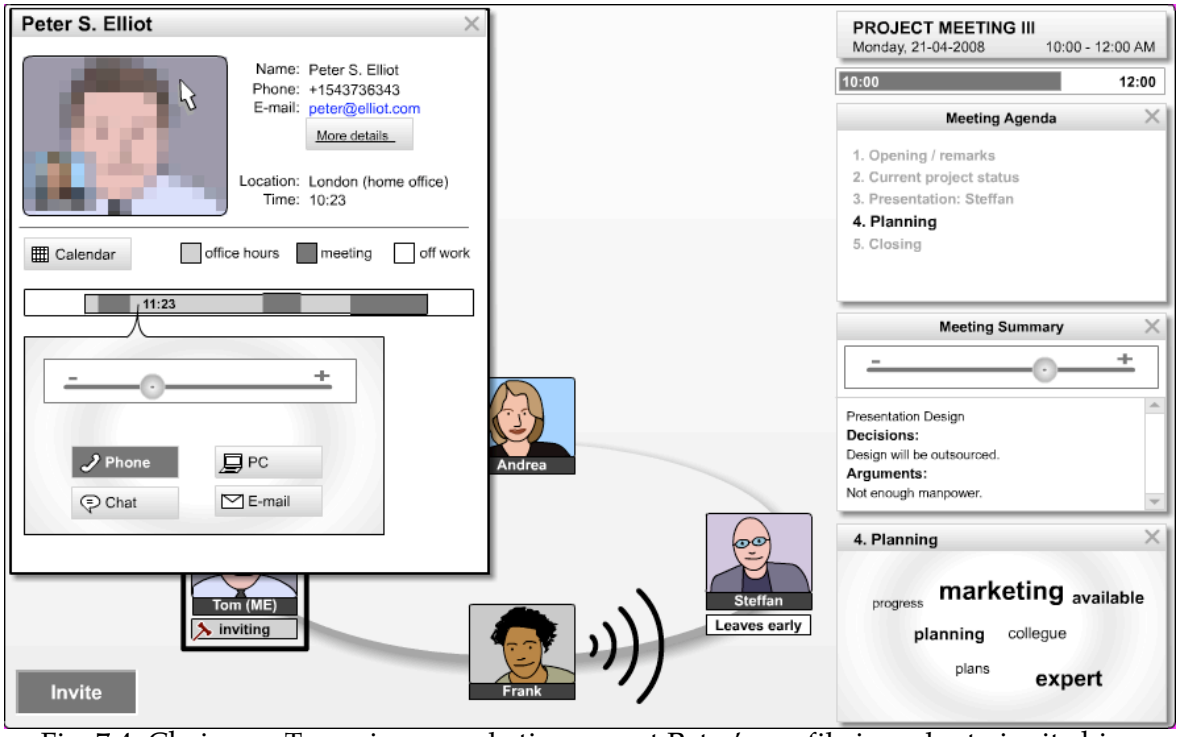


Fig. 7.4. Chairman Tom views marketing expert Peter's profile in order to invite him.

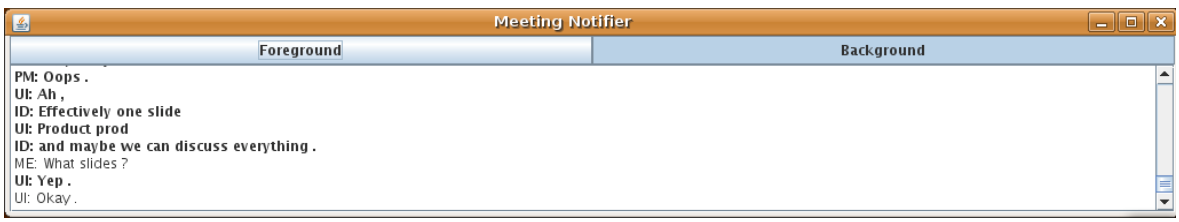
8 Remote meeting monitoring

8.1 Concept

When participating in meetings the relevance of the current topic to each participant varies over the course of the meeting. In cases when participants are remotely engaging in the meeting, times when the current topic is of low relevance can be used to carry out secondary tasks such as dealing with email, writing documents etc.

8.2 Iteration

Current work is investigating user interface tools and techniques to support this behaviour – specifically looking at visual and auditory aids to alerting remote participants to when topics of relevance arise during meetings. In the visual case we are investigating the effect that context has on the effectiveness of visual alerts. We have built two simple alerting interfaces, one which displays a very transparent view of the meeting where the user can always see the transcript of the meeting in progress and an opposing opaque view of the meeting where the user only receives alerts when topics of relevance arise – at all other times the interface is static (see figure 8.1). We are currently running an experiment to investigate the effectiveness of each style of interface and to look at the trade off between potentially missing relevant information and having a high informational throughput.



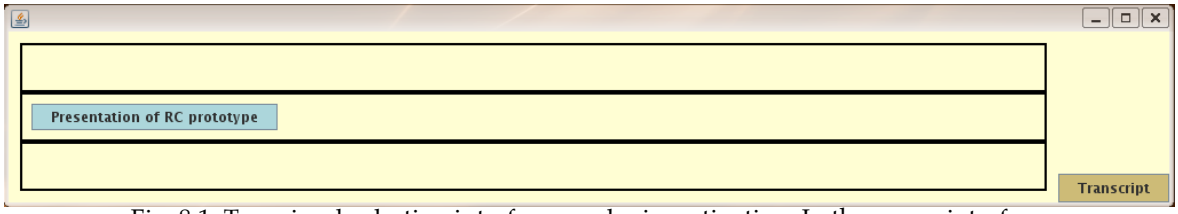


Fig. 8.1: Two simple alerting interfaces under investigation. In the upper interface, the user can always see the transcript of the meeting in progress. The lower interface provides an opaqueview of the meeting, alerting only when topics of relevance arise.

In the audio case we are investigating how using spatialised (three dimensional) audio can effect the ability of remote participants to focus on key topics and also the effect that this has on the engagement of the remote participant within the meeting. To date, we have carried out three short studies that examined the effect of speaker gender and auditory location on the ability of listeners to identify keywords within meeting excerpts whilst engaged in secondary tasks. Future work will examine interfaces that allow users to place meeting participants in different locations of auditory space and investigate the effectiveness of such an interface in terms of productivity and engagement.

8.3 Current result

The results up to now are published in (Wrigley, Tucker, Brown & Whittaker, 2008). We intend to collect user requirements data as part of the evaluation of the proposed UI technologies, in the next phase of the project.

9 Plans

This document reports ongoing work: the different concepts are in various stages of development. In the last 15 months of the AMIDA project, we plan to work, in close cooperation with other work packages, on the further development of:

- **Content Linking and User Engagement & Floor Control**. The current working versions have demonstrated the technical feasibility. At the end of May 2008, new interface concepts will be evaluated in a focus group. During the development of the new versions, to be realized in November 2008, the results of the focus group will be transferred into the design of the interfaces.
- **Remote Meeting Monitoring**. Ongoing work involves user tests, in which a study of the user requirements will be an integral part.
- **Meeting hopping**. We will not strive for a technical realization of this functionality, but for an attractive mockup demonstrator.

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