Awareness – The Common Link Between Groupware and Communityware

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Abstract. Due to the proliferation of computer networks the electronic support of geographically distributed groups has become increasingly important. With respect to groups we can distinguish between teams and communities. In general, team members know each other and collaborate to achieve a common goal while community members have just common interests or preferences. Often there is no personal contact between community members. The electronic support for both group types has developed independently. While communityware concentrated mostly on the building process, i.e. finding people with similar interests, groupware focused on the collaboration process, i.e. the synchronization and exchange of information in the context of a specific team task. The paper proposes awareness as a common base for both communityware to improve contact building as well as for groupware to maintain group work at a high performance level. We discuss communities and teams in educational settings and propose an architecture which integrates the awareness mechanism.

1 Introduction

Due to the proliferation of personal computers and computer networks the electronic support of geographically distributed groups has become feasible and in recent years increasingly important. The distribution may range from different floors within the same building to locations within different countries or even time zones. Furthermore, a group of people may also be distributed across organizational boundaries. Thus, the electronic support must include intra- and interorganizational interaction and collaboration as well.

With respect to groups we can distinguish between teams and communities. In general, team members know each other and collaborate to achieve a common goal while community members have just common interests or preferences. The team is often formed through a management decision selecting team members according to their skills, competencies and potential contributions to the specified team goal. Usually teams are tightly interacting groups with team interests dominating over personal interests of the individual team members.

Communities do not have a common goal and thus, the interaction between community members is usually loose. In most cases they do not know each other and personal interests dominate over community interests.

The electronic support for both group types has developed independently. While communityware concentrated mostly on the building process, i.e. finding people with similar interests, groupware focused on the collaboration process, i.e. the synchronization and exchange of information in the context of a specific team task. Groupware systems are often targeted to a specific task domain. Teufel et al. [24] categorize groupware systems according to their communication, coordination and cooperation support. The major system categories are conferencing systems, e.g. E-mail and video conferencing, workflow management systems, e.g. FlowMark [13], workgroup computing systems, e.g. Iris [14,16] and shared information spaces, e.g. BSCW [2].

Typical software tools supporting the building and interaction process of communities are Internet Relay Chat [20], MUDS [4] and in more modern environments presence indicators and chat tools integrated into web pages. We define

- *communityware* as a medium for initiating contact with unknown collaborators who have similar interests and preferences, and
- *groupware* as a medium for contacting and interacting with known collaborators in order to achieve a shared goal.

Even though support systems for both group types have developed independently, both areas have something in common: the contact facilitation with unknown or known collaborators. We propose awareness as a common base for both communityware to improve contact building as well as for groupware to maintain group work at a high performance level.

In Section 2 we present definitions of the terms community and team, and highlight the differences. Section 3 discusses possible support mechanisms for both group types, concentrating especially on awareness issues. Section 4 focuses on communities and teams within educational settings. Section 5 proposes an architecture which integrates the awareness mechanism supporting communities and teams as well as the transition between these group types.

2 Communities and Teams

The term "community" has been defined in the literature in different ways; for example Elisabeth Mynatt [17] sees a community as a "*social grouping which exhibit in varying degrees: shared spatial relations, social conventions, a sense of membership and boundaries, and an ongoing rhythm of social interaction*".

For this paper we will further elucidate this definition based on the definition of the term 'community' in Webster's English Dictionary [25]: "*1) social group of any size whose members reside in a specific locality, share government, and often have a cultural and historical heritage; 2) a social, religious, occupational, or other group sharing common characteristics or interests and perceiving itself as distinct in some respect from the larger society within which it exists*".

So our understanding of community is a set of people who share something (e.g. a language, a network access, ...) but who do not necessarily know each

other or interact on a personal basis. Examples for communities are all students at an university, or all Java programmers speaking English. The main usefulness of comunities lays in its being a starting point for identifying a set of people one could interact with, e.g. to find some help for solving problems or to share experiences.

Groups According to our definition, community members do not necessarily know each other. It makes a difference for possible support mechanisms when the members of a grouping know each other. Therefore, we will use a different term for communities whose members know each other. We will refer to such groupings as "groups".

In contrast to teams which we will define in the next paragraph, groups do not necessarily cooperate. Thus, the interaction is loose because there is no shared task or common goal. Examples of groups are a group of friends or the members of a research institute.

Compared with communities contact building within groups for cooperation on a project or a task is easier because there is already a certain level of knowledge and understanding between group members.

Teams The most advanced form of a community is a "team". The members of a team know each other and are cooperating to achieve a common goal sharing some artefacts they are working on, e. g. a jointly edited document. This description corresponds with a definition found in Webster's Dictionary [25]: "*team: a number of persons associated in some joint action*".

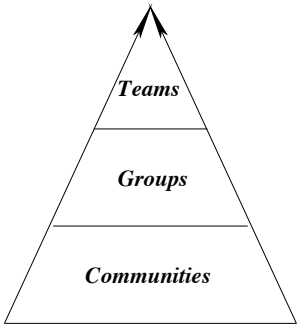

Fig. 1. Communities, groups, and teams

The main differences between these three group types are the level of interaction between the members and the existence of shared goals and artefacts. It should be noted that there is no clear separation between these group types. Seamless transitions occur between them and groups and teams can exist inside communities (see Figure 1).

3 Support Mechanisms for Communities and Teams

In the following we will discuss different support mechanisms available for groupings of people. Thereby we will not consider groups as a separate type of grouping but concentrate on support for communities and teams.

3.1 Goal of Support for Communities and Teams

The basic questions concerning support mechanisms are the following: Does the mechanism only support one individual in the community/team, can it only be used for supporting the majority of individuals or is it restricted to supporting interaction of two or more members of the community/team?

We will focus on communities and teams as an environment for cooperation. Thus, there must be mechanisms to initiate and to carry on the cooperation process. Dividing the cooperation process into smaller stages might help to identify possible support mechanisms. The following stages can be identified:

1. find someone to collaborate with
2. make contact with the selected people
3. build a common understanding; this includes trust building, the identification of a goal, and the negotiation about the way how this goal should be reached.
4. collaborate; collaboration usually consists of two alternating phases
   - the execution of individual work and
   - the communication between co-workers in order to coordinate activities and work plans.

The emphasis of *communityware* is on the first two stages while *groupware* concentrates on the last two stages.

3.2 Support for Communities

According to our definition in Section 2 a community is a set of people who share something (e.g. a native language or an interest) but in general who do not know each other personally. One potential benefit of being part of a community is the easier identification of others who might provide some help for the appropriate execution of an individual (or group) task. For example, to find a person who has the required competencies and skills and who is willing to collaborate and to exchange information.

Hence, the main aspect of community support is to facilitate the identification and selection of potential collaboration partners. Collaboration can be as short as posing and answering a question, but it can also lead to long-term cooperation and even to the founding of business enterprises.

Contact Facilitation There are several ways of supporting contact facilitation. Here are three real life examples:

- In Usenet newsgroups one can identify partners by reading news articles or by analyzing answers after posting a request article.
- In a company which maintains an internal employee database one can find the relevant contact partners by querying the database.
- In a library one can find possible partners by looking at the lending history of a book one might be interested in.

Common to these examples is the goal of identifying and selecting the relevant individuals of a community for interaction. In order to support this process, attributes describing the individuals are required. This information can be obtained along different ways, e.g. by conversations (newsgroups), by querying a database which contains information about people with respect to skills, competencies and interests, or by watching objects where one assumes that access to these objects indicates certain characteristics of the user one is looking for (library). The monitoring of accesses to Web pages is a typical example of the latter category.

These examples already demonstrate a two-step approach to support contact facilitation. In the first step an object is specified whose access and use might identify potential contact partners. Object examples are newsgroups, the employee database or an arbitrary object, such as a document or a book. In the second step, the object is monitored with respect to its usage by other people. Thus, awareness of what is going on with the specified object is of major interest during contact facilitation.

Collaborative Use of Knowledge After the identification process a direct communication channel is established to that person. Thus, after contact a cooperation environment is set up similar to working environments of teams. Contact facilitation results in the establishment of a temporary team.

Indirect cooperation is another mechanism often found in the context of communities. Here people cooperate without knowing each other personally. Information provided by some people is used by other people to support their own work. Classic information systems where different users insert and retrieve data are typical examples of this support mechanism. Increasing the number of submitting people might lead to a larger, less specialized community and the pure database solutions no longer work efficiently. Another class of systems that can help to find interesting data in large databases (e.g. the Web) are recommender systems where people rate the information they read and other people use these ratings for filtering incoming information according to their interest level (e.g. Firefly[1]).

In recent work on recommender systems selection of users and recommendations are often combined, that is: the system does not incorporate the ratings

[1] see http://www.firefly.com/

of all users but only of those which have been selected as advisors (see KnowledgePump [9]).

For the rest of the paper we will concentrate on direct interaction rather the shared databases or recommender systems.

3.3 Support for Distributed Teams

Collaboration within teams requires the coordination of activities which are performed by the team participants in order to reach the shared goal. In general, coordination is achieved via communication between team members.

There are two different types of tasks which should be considered when discussing computer support for distributed teams: structured and unstructured tasks. The former are tasks which are performed according to a standard procedure, such as approving a business trip or processing bank loan applications. These tasks are often formalized by a detailed model that clearly describes the steps necessary for completing the task. Unstructured tasks are never standardized because they are inherently chaotic. Examples are creative work such as writing a paper for a conference or the production of a movie. In contrast to the first task type there is no obvious structure. Single steps inside the task can only be described in a very complex and often fuzzy manner.

For structured tasks explicit support for coordination is suitable. Workflow management systems are increasingly applied to handle the coordination of structured tasks as well as the execution of the individual steps associated with these tasks.

For unstructured tasks, however, there is no abstract work model that describes the steps necessary for performing a task. Instead, the system must offer as much flexibility as possible to team members so that they can do whatever they think is necessary to achieve a particular goal. This requires a high degree of group awareness where co-workers are aware of each other's past, current and possible future activities within the shared environment. The propagation and exchange of group awareness information results in "implicit coordination" of team work.

The exchange of information may be achieved by direct or indirect communication. There are several factors contributing to the success or failure of the collaboration between team members:

- For direct synchronous communication it is necessary to know when the communication partners are available, e.g. for spontaneous collaboration, for initiating direct communication or for explicitly coordinating activities or access to shared resources.
- In addition to planned direct communication there must be a method of supporting spontaneous direct communication. Therefore, awareness of who is around is needed.
- In order to enhance group awareness required for implicit coordination it is necessary to generate, distribute and display various information about the current state of the work and co-workers as well as about the history of past activities and events (indirect communication).

In the following paragraphs we give a brief overview of support technology for these areas. More information can be found in publications of the "Computer-Supported Cooperative Work (CSCW)" area (e.g. biannual ACM CSCW conferences).

Contact facilitation / media spaces Contact facilitation in teams helps the user to determine when to communicate with someone he already knows, rather than finding a new partner. It provides awareness information concerning the absence of team members, availability of team members for conversation and social acceptability of initiating a conversation with any of them.

Several interface techniques have been developed for contact facilitation within teams. Media spaces are one way of providing distributed groups with informal awareness of each other. Video walls, for example, rely on continuous video and audio for information about who is around at other sites [1]. Video snapshots, such as Portholes provide periodically updated video snapshots of other people's offices [6]. Video glimpses, as in Montage give short video views into another person's offices without any additional audio channel. Minimalist awareness systems, such as PeepHoles [10] indicate how long a person has been absent from his computer.

Support for direct communication Direct communication of a distributed team can be realized through standard synchronous and asynchronous methods of computer and network based communication: telephone calls, video and audio conferences, text talk, email/news.

In addition to these standard means we refer the interested reader to recent approaches to make video conferencing more conference like (e.g. MAJIC [11]) and the use of 3D virtual spaces which provide places for direct communication (text based: Blaxxun CommunityClient/Server[2] [21] - audio/video based: FreeWalk [18]).

Processed awareness information In general, Media Spaces only transmit pictures or audio information recorded at one site to all other connected sites. The interpretation is left to the user. It is not possible for the system to preprocess or filter the information.

Informal team awareness is the general sense of which of the team members is around and what others are up to. These are the kinds of things that people track when they work together in the same physical environment. This awareness is the glue that facilitates casual interaction, the spontaneous and one-person initiated meetings that form the backbone of everyday coordination and work [3,8].

The informal awareness and the casual collaboration triggered by informal awareness is an essential and highly productive part of the work experience [5].

[2] see http://www.blaxxun.com/

To summarize, one can say that awareness "is part of the *glue* that allows groups to be more effective than individuals" [10].

Media spaces and awareness systems intend to provide informal awareness for distributed teams which do not share the same physical environment. Besides media spaces awareness information can also be distilled from interaction with workspace objects and displayed in special views to the team members.

3.4 Awareness as a common base for communities and teams

The electronic support for communities and teams developed independently. While communityware concentrated mostly on the building process, i.e. finding people with similar interests, groupware focused on the collaboration process, i.e. the synchronization and exchange of information in the context of a specific team task.

As we showed above there is one task needed in both settings: contact facilitation with unknown or known collaborators. Additionally, there is a need to seamlessly switch from communityware (contact facilitation) to groupware (accomplishing group tasks). Hence, the two areas should grow together. In our opinion the notion of awareness is a common base to connect the two application domains. Making contact requires awareness of who is in the same (virtual) place and who is interested in the same data. For successful synchronization in teams it is essential to have some knowledge of what is going on in the team.

Most of recent CSCW research has emphasized awareness-oriented collaboration systems where users coordinate their work based on the knowledge of what the members of the collaborating group are doing or have done. Group awareness can be defined as "an understanding of the activities of others, which provides a context for your own activity" [6]. Pedersen describes awareness as an "ability to maintain and constantly update a sense of our social and physical context [19]".

An increase of awareness within a collaborating group has several advantages:

- It encourages informal spontaneous communication (e.g. via video conferences, phone calls, etc.), since people are more likely to contact others directly if they know their partner is at leisure and can be interrupted without interfering too much with his/her ongoing work.
- Awareness is important for keeping the group members up-to-date with important events and therefore contributes to their ability to make conscious decisions.

Awareness is needed for both, contact facilitation in communities and teams and for maintaining team work at a high performance level within teams.

The reason why recent awareness systems have focused on one of the two areas is caused by different needs of the different user groups. The main difference is that context is available in team work while not in communities (people do not know each other). Thus, in the latter case there is some need to establish context (e.g. information on which page both users are working upon, where the user

is from, exchange of business cards, etc.). In teams there is more background information available on the team goals as well as on the characteristics of the team members. Therefore contact facilitation can work with less information displayed. Thus, it is enough to display an image of the co-workers; additional information, such as the individual interests and skills is not needed.

As a result, different information is required for providing awareness in teams as opposed to communities. However, it is possible to provide a seamless transitions between these two types.

In the following section we will present mechanisms of using awareness information in different educational settings. Educational environments comprise both group types, communities as well as teams. Our main goal has been to use the same services in all settings and to provide seamless transition between communities and teams.

4 Communities in Education Systems

4.1 Collaboration Entities of Educational Environments

At a university cooperation is a ubiquitous work form of interaction between students, professors and research assistants. Both learning and teaching can be regarded as a kind of cooperative process. Lectures, seminars and practical courses serve as places where cooperation is organized and takes place.

The collaborations occurring at different level of abstractions as well as between different entities lead to the forming of a variety of communities and teams. According to the organizational view (see figure 2) a university is organized into departments, chairs and project teams which respectively correspond to community, group and team as defined above. On the other hand, we will subsequently investigate another kind of view, the event oriented view.

Both views reflect the same relationships between communities, groups and teams. Interpreting the differences between the pyramid bottom and its top, one can observe the following trends from the bottom to the top: less members, but closer cooperative relationships between the members; informal spontaneous interactions dominate within a community (at the bottom of the pyramid) whereas the work in a team (at the pyramid top) is usually planned and goal-oriented.

4.2 Communities and Teams in Lecture 2000

The geographical distribution of a university often restricts and encumbers the cooperation between students, professors and research assistants. For example, the fourteen chairs in the Informatics department of the Technische Universität München (TUM) are located at six different sites requiring up to half an hour travel time by public transportation to go from one site to another. Students must shuttle between dormitories, chair locations and the main campus of the university to attend classes and to interact face-to-face with tutors and fellow

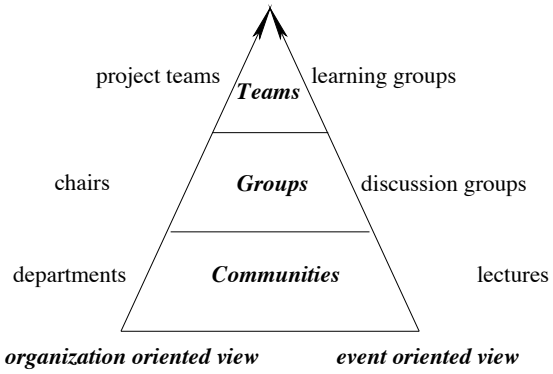

Fig. 2. Different views of communities, groups, and teams in educational systems

students. The project Lecture 2000 [23] aims at supporting and enriching common university lecturing by applying the potential of new technologies and by designing and implementing an integrated multimedia based learning and teaching environment. It enables and facilitates the cooperation between students, professors and research assistants even when they are distributed across several locations.

Derived from the characteristics of the learning and teaching process Lecture 2000 distinguishes between the following collaboration entities (event oriented view): the class of a lecture as a community, learning groups for the lecture as teams, a discussion group and spontaneous groups facilitating the transition from the community to the teams inside the community.

Class as a Community attending a Lecture People who come to attend a lecture may come from different departments of a university, from other cities or other states of a country, and even from other continents. At present, such a group of people can either sit together in a classroom or attend the lecture remotely. As an effort to remove the geographical obstacle some lectures at the TUM are propagated to the wide area network via Mbone. The common interest in the lecture serves as a "glue" to unite people who often do not know each other personally. They constitute a community called "class". Notably, members of the community also include those who never actually make their appearance in class but are nevertheless interested in the content of the course.

The class exists only as a very loose and often only as virtual community. Experience shows that students prefer to participate in discussions in small groups composed of 2 to 5 persons in order to discuss course related issues. Normally, the work of a small group can lead to the answers to the issues arising from the learning process which can be stored as histories for future studies and examinations. Therefore, these small groups will be regarded as teams derived from the community. In section 3.1, we have considered it central for community support to facilitate the identification of potential collaboration partners. The follow-

ing will discuss contact facilition in educational settings distinguishing between asynchronous and synchronous modes.

Discussion Group for asynchronous Contact Facilitation Associated with each lecture there is a discussion group available to all attending students providing asynchronous contact facilitation. The discussion group can be regarded as a public service which enables lecture participants to communicate with others more easily. Normally, the members of such a group share common interests in exchanging learning experiences and discussing problems connected with the learning process.

Under these circumstances people contact each other asynchronously and often anonymously using nick names. In practice, a discussion group of a lecture plays a similar role as the Usenet newsgroups mentioned before. As interactions mature people can establish a team for conducting a more efficient and closer cooperation. A discussion group represents a subgroup in a small community.

Spontaneous Groups for synchronous Contact Facilitation Informal spontaneous interactions have proven to be very important in communities. In a distributed community, where members do not know each other, this kind of "unintented" meeting plays a very important role in facilitating the identification of potential collaboration partners.

In [12] four categories of interactions have been distinguished: planned (prearranged meeting), intended (explicitly sought by one person), opportunistic (anticipated by one party but occurring only when the parties happened to see each other) and spontaneous (unanticipated by either party). These latter two types of interactions are called "unintented". The term "spontaneous (temporary) group" specifies a group formed by people when they meet each other in an "unintended" manner. These kinds of meetings lead to synchronous interactions. Previous research has shown that synchronous interactions provide people with better opportunities for developing a common understanding than asynchronous interactions.

Learning Groups Cooperation in education could be described as the specific cooperative relationships characterized by common goals and responsibilities shared by a group of people. The common goals and responsibilities can be better achieved and assumed in a small group than in a large one. Therefore, the interactions within loosely coupled discussion and spontaneous groups often lead to the creation of small groups for preparing and reviewing the lecture content in more detail. These small groups, called Learning Groups, distinguish themselves from the discussion groups by fewer members, closer relationships and clearer objectives. Mostly the members of learning groups communicate with each other synchronously. Learning groups are examples of teams as defined above.

5 The Lecture 2000 Environment

Lecture 2000 [23] provides a comprehensive information space and supports collaboration facilities. The following will focus on the latter aspect and discuss the support of communities and teams and the seamless transition between them. We will firstly describe our system design and then briefly show how this support is achieved in the system. Finally, some issues with respect to awareness support revealed by the design will be explored in more detail.

5.1 Architecture of Lecture 2000

Lecture 2000 is client/server based. For each lecture there is a separate server (see Figure 3) which after the initiation phase consists of a tutor studio, a discussion group and an entrance hall. As the lecture progresses new learning groups and spontaneous groups might be established. A server which is entered via the entrance hall represents a lecture community. From the entrance hall a student can go into the discussion group, one of the learning groups, the tutor studio, or initiate a spontaneous group with other people whom he encountered in the entrance hall.

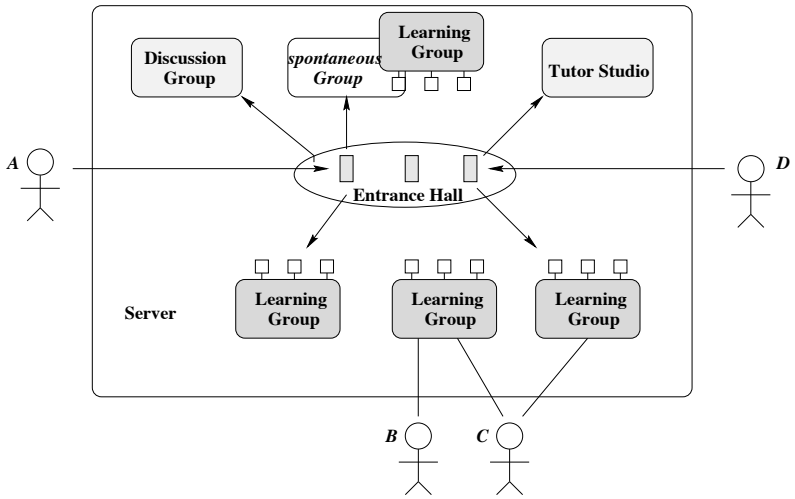

Fig. 3. The structure of a server in Lecture 2000. It consists of Discussion Group, Learning Group, Tutor Studio and Entrance Hall

Discussion Group A discussion group provides an asynchronous interaction mode for lecture participants to discuss and solve lecture related issues.

Learning Groups A learning group is a team that is composed of several students who meet regularly for preparing and reviewing the lecture. Entrance into a learning group is protected by a password selected by the owner of the group. However, the tutor of the lecture is allowed to take part in team discussions without providing a password.

A learning group exports the following information about itself: (1) current group state: there can be four possible states represented by a door sign: between sessions (a closed door), open to all (an opened door), closed to all (a closed door with a red light), and opened after contact (a closed door with a green light); (2) group membership and the contact information of group members; (3) data list of group activities. Based on the exported information members of the lecture community might interact with learning group members and thus participate in team discussions. It can even lead to the change of team membership.

Tutor Studio It is assumed that a tutor occasionally participates in learning group discussions. Additionally there is a tutor studio which aims at increasing the collaboration possibilities between students and the tutor. In practice a tutor studio is similar to an office. Entrance into the studio is restricted to pre-determined consulting hours.

Like a learning group, a tutor studio exports information to provide people with the current state of the studio, data lists and contact information such as the secretary's telephone number.

Entrance Hall The entrance hall is furnished with a variety of information about activities occurring in other places on the server, such as in learning groups and the tutor studio. In particular, one can learn about others who are also in the entrance hall at the same time. Then, the entrance hall provides a medium for awareness and it facilitates all possible interactions in the lecture community:

- With help of the exported information of a learning group people in the entrance hall can attempt to contact team participants. If possible, they can join a team and take part in its discussions.
- People in a learning group can notice those who appear in the entrance hall. When a user has found a potential collaboration partner in the entrance hall, he can invite him to join the group.
- People who happen to meet each other in the entrance hall can initiate a spontaneous (temporary) group. If they agree to form a team for a close and regular collaboration, they can also do so. Thus, the spontaneous group may change into a team (learning group).
- From the entrance hall one can also judge whether or not entrance to the tutor studio is permitted by checking the information on the door of the studio.
- Finally, one can enter into the discussion group to seek possible collaboration with others.

5.2 Support Mechanisms for Community and its Teams

In the design, we have mainly used two contact facilities (discussion group and entrance hall) in supporting the first two cooperation stages depicted in section 3.1. Compared with other methods such as the deployment of an internal employee database, the entrance hall supports synchronous interactions which provide much better opportunities for developing a common understanding among encounters.

Within a team, every place is equipped with groupware tools in supporting the collaboration work among the members of the team, for example multiuser editor [15], chat tool and so on. However, one of our main concerns in supporting the collaboration activities within a team is the link between the discussion process and the information space provided by Lecture 2000. The material stored in the information space serves as a basis for the discussion. Discussion results with respect to the issues can be stored in either private or public workspaces for the future use of the members, and the movement of results between the sites will also be supported.

5.3 Related Issues

In section 3 we have explored the idea that awareness provides a common base for both community and team support. As decribed above, people can use various groupware tools to do collaborative work. Without a doubt, awareness plays a key role in groupware tools. Here, we mainly focus on the investigation of issues related to the awareness support in a community.

Awareness and Privacy Control Awareness involves knowing who is around, what activities are under way, who is talking with whom; it provides a view of one another in the daily work environment [7]. In other words, it means that an individual must enter into public or private areas in order to learn as much as possible about others and their activities. Media space technology typically focuses on the use of direct audio and video connections as a means to obtain such information. However, it is difficult to distinguish between public and private spheres in some situations. Privacy is relative. Even in a public area (e.g. in a cafe), staring at someone is considered impolite. Privacy issues have often been a major concern when designing and installing media spaces.

To enable participation within a widely distributed community Lecture 2000 is designed to support people with audio-video equipment, audio only, or perhaps even text only devices. Furthermore, students have no permanent workplaces compared with workers in a company. Thus, the environment of Lecture 2000 does not depend on the media space technology to obtain awareness information.

Place for Awareness Support Lecture 2000 uses a variety of places to support awareness for the communities. Places, such as "rooms" in TeamWave and

"virtual hallways" in the original design of the Cruiser media space [22] have become increasingly popular in collaborative systems. They facilitate and structure interaction between people.

The awareness provided by a place can be observed in two ways: within a place and outside of a place. Within a place, awareness reflects a kind of interest, preference, cultural background and rules implied by the place. For example, when somebody enters into a lecture room of a university, it means that he is interested in the content of the lecture and will comply with the university rules.

Outside of a place we pay particular attention to the ways people enter the place. Different people may use different ways. A place itself often implies the mechanism in which it should be entered from the outside. For example, a student should knock at the door before he enters into the professor's office whereas he can walk right into a lecture room.

Places in Lecture 2000 Thus, a place as a spatial metaphor can both provide awareness for a community and also serve as a workplace for a team. Furthermore, places which can easily be located will facilitate a variety of spontaneous interactions. However, a place which has no boundaries can also lead to unexpected annoyances and privacy violations. On the other hand, if a place provides very tight boundaries it can encumber the collaboration possiblities with those outside of the place.

Thus, Lecture 2000 provides places which have boundaries but which can export necessary information to the outside. This information may link both sides of a place. Additionally suitable privacy considerations make a place more open and more usable. The places of Lecture 2000 not only have boundaries for privacy protection but they can also export information for supporting a variety of spontaneous interactions.

6 Conclusion

In this paper we have presented a model that connects the application areas of communityware and groupware. Taking this model as a starting point we have highlighted (group) awareness as the connecting point and then presented the Lecture 2000 example where these results are used in a system supporting different community types in an university setting.

The Lecture 2000 project started in 1996. Initially the project focused on the information space publishing and distributing the complete material of several courses electronically as well as teleteaching aspects for online courses. From the very beginning we tried to integrate support mechanisms, such as a study advisor, self assessment tests and chat tools for spontaneous interaction. Currently we are refining the design for the lecture server to support communities and teams as discussed above.

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