Technological and Social Issues of E-Collaboration Support Systems

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INTRODUCTION

Removal of communication impediments and provision for techniques that systematically direct the pattern, timing, and content of cooperative processes are two key prerequisites in the contemporary organization. Their establishment has been proven to facilitate the solution of ill-structured problems by a set of individuals working together as a team, through the interactive sharing of information between them. *E-collaboration* involves a variety of both communication and cooperation issues, in that it leverages the connective powers of a computer network to coordinate the efforts of a group of people. By using e-collaborative capabilities in an organization, people can operate as a single business entity, thus making joint decisions of added value.

At the same time, the representation and visualization of social structures and interaction in a collaborative environment is also of major importance. This is associated to the perception and modeling of actors, groups and organizations in the diversity of collaborative contexts. A problem to be addressed is to provide the means to represent and manage user and group profiles, as well as social relationships in a collaborative context. Neither relationships nor contexts are static; they are emerging and change over time, which necessitates the development of adaptive services. Furthermore, social relationships are diverse and of different intensity. What is required is development and utilization of appropriate mechanisms that perceive given structures in order to extract implicit information.

Issues to be addressed in the establishment of an e-collaboration environment should have a strong *organizational focus*. These include work structuring in order to improve coordination, use of communication technology to make collaboration more efficient and effective, enforcing of rules and procedures for achieving consistency, exploitation of social structures and interaction, and automation of data processing in data intensive situations (Angehrn and Jelassi, 1994).

BACKGROUND

The environment in which a collaborative process takes place sets a series of important requirements. Issues to be taken into account in the design and implementation of an e-collaboration system include:

- The *spatial distance* between team members. This refers to whether full face-to-face communication among them is possible. Depending on the group size and the proximity of members during a decision making procedure, various settings have been identified (DeSanctis and Gallupe, 1987).
- The *temporal distance* among the activities performed by the individual group members. This refers to whether collaboration is taking place through meetings at a particular time, such as in conventional meeting or teleconferencing environments, or whether participants submit their input at different points in time, based on electronic mail, bulletin boards, newsgroups, and computerized conferencing concepts.
- The *type of participants' goals* distinguishes between an environment in which a group wants to solve its common problem cooperatively, and another, in which bargaining takes place. Issues arisen in the first case concern knowledge sharing, preference aggregation, and negotiation support.
- The type of *control* over the collaborative process. There may be cases where the participants follow a democratic process in order to reach a solution, and cases where the system is supported by a human group leader or *mediator*.
- *Separating people from the problem*. The system designer has to evaluate the individual and group characteristics of the participants, as well as their motivations, disagreements, and conflicts, in order to reduce (if not avoid) the negative impact that misunderstandings, emotions and bad communication may have.
- *User modeling*. The term user modeling refers to the process of acquiring knowledge about a user in order to provide adapted services or information to his/her specific needs (McTear, 1993). By having the characteristics of users explicitly represented within a system, it can be used as a resource in various types of computations and services in order to bring user-tailored services. User modeling is in general motivated by the observations that different users have different

needs. The user model is an essential component when considering personalized interaction and adaptive filtering in information systems. It provides the means to control and confront important problems such as cognitive overhead.

- *Social networking.* Social structures, relationships and interaction should be represented and visualized in a way that makes it possible to reflect on them in their context. In order to provide this, appropriate structure representations and visualizations must be provided. Specialized applications for representing social structure and relationships are usually known as *social network applications* (Atzenbeck and Tzagarakis, 2007).
- The *type of communication* between the participants. Collaborative environments can be based either on *point-to-point communications*, or on *broadcasting* of messages.

Furthermore, approaches for the development of a framework for e-collaboration have to address both behavioral and technical aspects (Zigurs, Poole, and DeSanctis, 1988). Behavioral issues reported concern the diffusion of responsibility, pressures toward group consensus and problems of coordination.

COMPUTER SUPPORTED COOPERATIVE WORK

Computer-supported cooperative work (CSCW) has been defined as computer-assisted coordinated activity, such as communication and problem solving, carried out by a group of collaborating individuals (Greenberg, 1991). The multi-user software supporting CSCW is known as *groupware* (Ellis, Gibbs and Rein, 1991). CSCW may also be viewed as the emerging scientific discipline that guides the thoughtful and appropriate design and development of groupware (Greenberg, 1991). Key issues of CSCW are group awareness, multi-user interfaces, concurrency control, communication and coordination within the group, shared information space, and the support of a heterogeneous, open environment which integrates existing single-user applications.

A principal aim for the designer of an e-collaboration framework is to apply state-of-the-art telematics and groupware technology to provide advanced support for the users over wide area networks, in particular the Internet. Generally speaking, CSCW tools can harness the complexity of the social and knowledge processes involved, thus providing benefits in terms of speed and accuracy, and facilitating the development of business policies. Such tools can be used to support the group reasoning processes, that is, to facilitate the evaluation of proposed solutions and their support, to structure the decision-making process through the imple-

mentation of specific methodologies, and to help group members in reaching a shared understanding of the issue by supporting knowledge elicitation, knowledge sharing and knowledge construction. Moreover, by exploiting intranet or Internet technologies, they can connect participants with similar interests, encouraging dialogue and stimulating the exchange of knowledge.

A plethora of systems that support capturing of decision rationale and argumentation for different types of user groups and application areas has been already developed. For instance, *QuestMap* (Conklin and Begeman, 1987) can capture the key issues and ideas during meetings and attempts to create a shared understanding by placing all messages, documents and reference material for a project on a "whiteboard", while *Sibyl* (Lee, 1990) is a system that provides services for the management of dependency, uncertainty, viewpoints and precedents. Generally speaking, this category of systems meets the collaboration requirements concerning the type of control, conflict resolution, and behavioral issues, by providing a cognitive argumentation environment that stimulates reflection and discussion among participants. However, issues related to temporal and spatial distances are not fully addressed. These systems do not exploit any network infrastructure, thus users can work in an asynchronous way only through a human mediator who receives their contributions and appropriately deploys them to the system. Most important, this category of systems does not integrate any reasoning mechanisms to (semi)automate the underlying decision making and negotiation processes.

Increasing interest has been also developed in implementing Web-based conferencing systems, such as *AltaVista Forum Center*, *Open Meeting* and *NetForum*. Such systems exploit the platform-independent communication framework of the Web, as well as its associated facilities for data representation, transmission and access. They usually provide means for discussion structuring and user administration tools, while the more sophisticated ones allow for sharing of documents, on-line calendars, and embedded e-mail and chat tools. Discussion is structured via a variety of links, such as simple responses or different comment types to a previous message. This category of systems meets fully the requirements that are related to the spatial and temporal distances between members of a team. However, these systems merely provide threaded discussion forums, where messages are linked passively. This usually leads to an unsorted collection of vaguely associated comments. As pointed out by the developers of *Open Meeting*, there is a lack of consensus seeking abilities and decision-making methods (Hurwitz and Mallery, 1995). Moreover, as in the previous category of systems, issues related to the appropriate storage of knowledge in order to be exploited in future collaboration settings are not addressed.

This last category of systems belongs to the family of *social media*. Social media have increased in popularity

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