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Review of Computer-Supported Collaborative Work Systems

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ABSTRACT

The advent of computer-supported collaborative work (CSCW) systems significantly impacts group collaboration. This paper reviews three CSCW systems: Lotus Notes, Xerox DocuShare, and SevenMountains Integrate. We focus on their different capabilities and uses in distributed group projects.

Keywords

Computer-supported collaborative work, distributed group work

Introduction

Computer-Supported Collaborative Work (CSCW) is a multi-disciplinary research field that focuses on tools and techniques to support multiple people working on related tasks. CSCW provides individuals and organizations with support for group cooperation and task orientation in distributed or networked settings.

In 1984, Greif and Cashman coined the term 'Computer-Supported Collaborative Work' at a workshop attended by individuals interested in using technology to support people in their work (Grudin, 1994). Since then, CSCW has been interpreted and understood in a number of different ways. Some researchers use the term to express the idea of collaboration among a group of people using computers (Howard, 1988; Kling, 1991). CSCW is also referred to as 'software for groups of people' or 'groupware'. To others, CSCW represents a paradigm shift (Hughes et al., 1991; Suchman, 1989). Still others, especially Scandinavian system developers, emphasize participatory design (Clement & van Besselaar, 1993; Greenbaum & Kyng, 1991).

We accept Bannon & Schmidt's (1989) definition of CSCW: "an endeavor to understand the nature and characteristics of cooperative work with the objective of designing adequate computer-based technologies" (pp. 3-5). This definition of CSCW combines an understanding of how people work in groups and how computer networking technologies can be designed to support activities. CSCW systems are collaborative environments that support dispersed working groups so as to improve quality and productivity.

Our main purpose is to present different capabilities of CSCW systems and to exemplify how they can be utilized for more effective and efficient distance collaboration. Initially, CSCW tools focused on a single aspect of collaboration. Early CSCW tools include:

- Applications focused on communications
 - Electronic mail (Bullen & Bennett, 1990)
 - The MIT Information Lens Project (Malone et al., 1987)
 - The Coordinator System (Winograd, 1988)
- Applications focused on meeting support
 - Xerox PARC CoLab (Stefik et al., 1987)
 - Ventana Group Systems (Nunamaker et al., 1991)
- Applications focused on coordination and procedures
 - Domino Office Procedure System (Kreifelts et al., 1991)
 - XCP (Sluizer & Cashman, 1984)

Although these experiences with single applications were mostly successful, the need for integrated platforms for CSCW applications promoted further progress (Eseryel & Ganesan, 2001). These new integrated technologies have enabled distributed group collaboration and affected the nature of practices in many fields (Ganesan et al., 2001).

We examine three CSCW applications: Lotus Notes, Xerox DocuShare, and SevenMountains Integrate. All these are used to support collaboration among distributed groups. We believe that an integrated CSCW system should address four basic areas of concern: Communication, Collaboration, Coordination, and Control (Ganesan et al., 2001). Our review focuses on how each tool addresses each of these areas. Along with a review of functionalities, some current uses of each are presented.

Lotus Notes

Lotus Notes is a leading groupware system with comprehensive messaging tools. Features include e-mail, calendar, group schedule, to-do list, and newsgroups. Lotus Notes uses a client-server network technology in conjunction with a Lotus Domino Server running on a Windows, Macintosh or Unix platform. Lotus Notes' Domino Offline Services (DOLS) provides offline access to Lotus Domino web-based applications, by allowing its disconnected users interact with applications as if they were online. Work done offline is synchronized when a user reconnects with the server using the Lotus iNotes Sync Manager. This feature helps users work online or offline with the option to synchronize their work at a later time. Lotus Notes has two other companion software products: Learning Space is a powerful Domino application that integrates collaborative technology with the Internet to create a flexible distributed learning environment; and Quick Place, another Domino application, is a web-based tool kit that facilitates the sharing and organization of ideas, creates discussion forums, and posts announcements.

The single inbox through which users can access all their e-mail accounts in any sub-application provides much flexibility. Users can access and send messages from their inbox both online and offline using DOLS, and dynamically prioritize and display important emails. Lotus Notes makes it possible for users to receive voice messages, faxes and paged messages, allowing for various forms of communication and enabling users to constantly and seamlessly stay in communication with others. Lotus Notes has additional features that allow users to easily schedule meetings and events, create common to-do lists with user-friendly calendars and scheduling capabilities. The client application gives users the look and feel of a web browser and can access information on the web from within the application itself.

Lotus Notes provides an innovative and comprehensive environment to build collaborative applications. Calendars are integrated with the to-do lists and this makes group planning and execution of tasks and activities easy. The secure search feature allows users to seek and retrieve important files either from their inbox, desktop or any of the Domino databases. Domino also provides a suite of development tools that enable developers to add capability to their groupware. The replication technology in Lotus Notes enables users to automatically receive updates to documents thus keeping information current.

Delegation and distribution of tasks is accomplished through the calendar and group-scheduling feature. Users can check each other's free time, schedule meetings based on the information and reserve conference rooms and equipment. The calendar feature is integrated with the to-do list feature for increased efficiency. Quick Place can be used to share and organize ideas, promote discussions and delegate tasks. Workflow among individuals and groups in a networked environment can be achieved through the *Teamroom*, another significant feature of Lotus Notes. Lotus Workflow is a Domino based stand-alone application that provides users the ability to develop, manage, and monitor all their business processes thus leading to a paper-less environment.

Lotus Notes (Figure 1) places power and flexibility in the hands of the user. The application is platform independent, allows online and offline (with DOLS) access, supports mobile users and provides dynamic search capability of a user's inbox, desktop and Domino databases. It offers adequate scalability, ensures reliability and protection from data loss. The suite of development tools offered allows developers to build powerful capabilities irrespective of platforms and software protocols. Lotus Notes and Domino also allow system administrators to define seven levels of access based on user needs and roles, thus offering powerful control in the administration of the application.

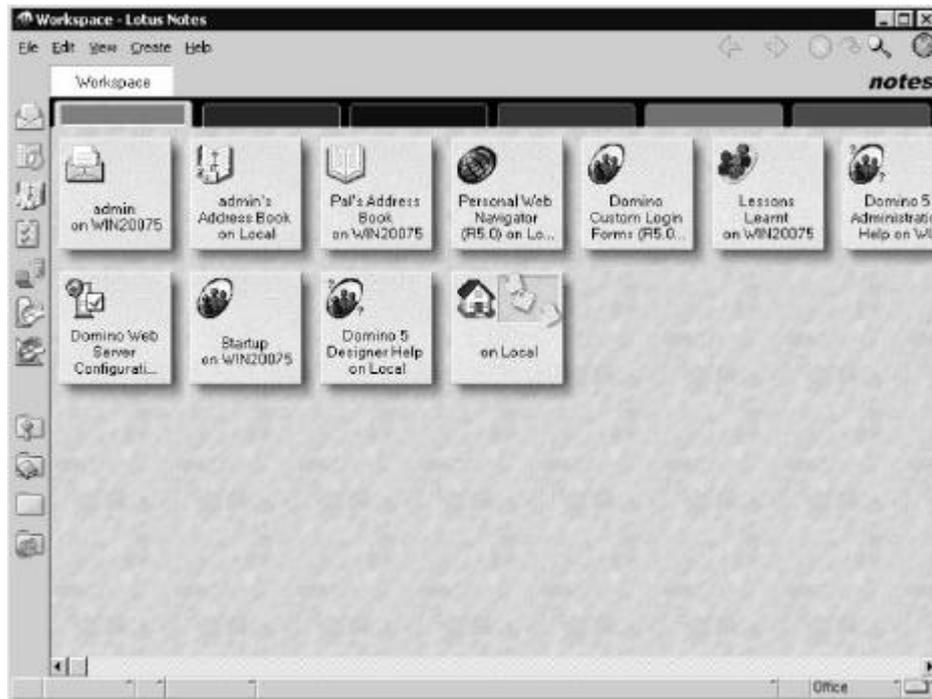


Figure 1. Screen capture of a Lotus Notes interface

Xerox DocuShare and Flowport

DocuShare (Figure 2) is a powerful, yet, extremely simple web-based document management software that enables users to share documents via the web, to collaborate on projects and to communicate in a secure environment.



Figure 2. Screen capture of a Xerox DocuShare site

Each user can add, post, change, search for and retrieve information in a secure, controlled environment. Users can exchange anything in digital format over the web - text, images, video, office documents, sound files - without FTP software, browser plug-ins, or HTML skills. DocuShare can track from 1 to 999 different versions of a document, thereby freeing users from the need to coordinate different versions with multiple users. DocuShare is platform and program independent, which means that users only need a connection to the Internet to share files created in the familiar software application programs. DocuShare makes use of icons with which users are familiar (Figure 3). When a document is added to the web, every piece of text on the page is indexed for searching purposes, thereby creating a powerful repository of accessible information. Security for documents can be assigned at the document level, or by directory, individual or group.

There are four methods for placing documents into a DocuShare collection on the web:

1. Via web browsers: Using a web browser (any version of Netscape or Internet Explorer) users can add files, calendars, bulletin boards, Uniform Resource Locators (URLs) or collections (directory) to the web.
2. Via the Windows client: The DocuShare Windows' client creates a mapped drive on user computers. Users simply double click on the icon and then drag and drop multiple items to the Web or drag items from the web to their local computer.
3. Via Open Document Management (ODMA) software: When the DocuShare client is installed users are given the option of enabling ODMA integration. Once installed, from within applications such as Microsoft Word or PowerPoint, users can save or open their document directly to or from the web.
4. Via FlowPort and Transmission Control Protocol/Internet Protocol (TCP/IP) enabled scanners: FlowPort is an application working in conjunction with a scanner that allows users to scan papers directly to the web, without the use of a computer, to be shared via applications such as DocuShare or Lotus Notes. A cover sheet with encoded data *glyphs* (binary data that is encoded) allows users to check boxes with a regular pen or pencil to indicate where they would like to send documents. Destinations include web repositories, email account or Internet fax numbers.

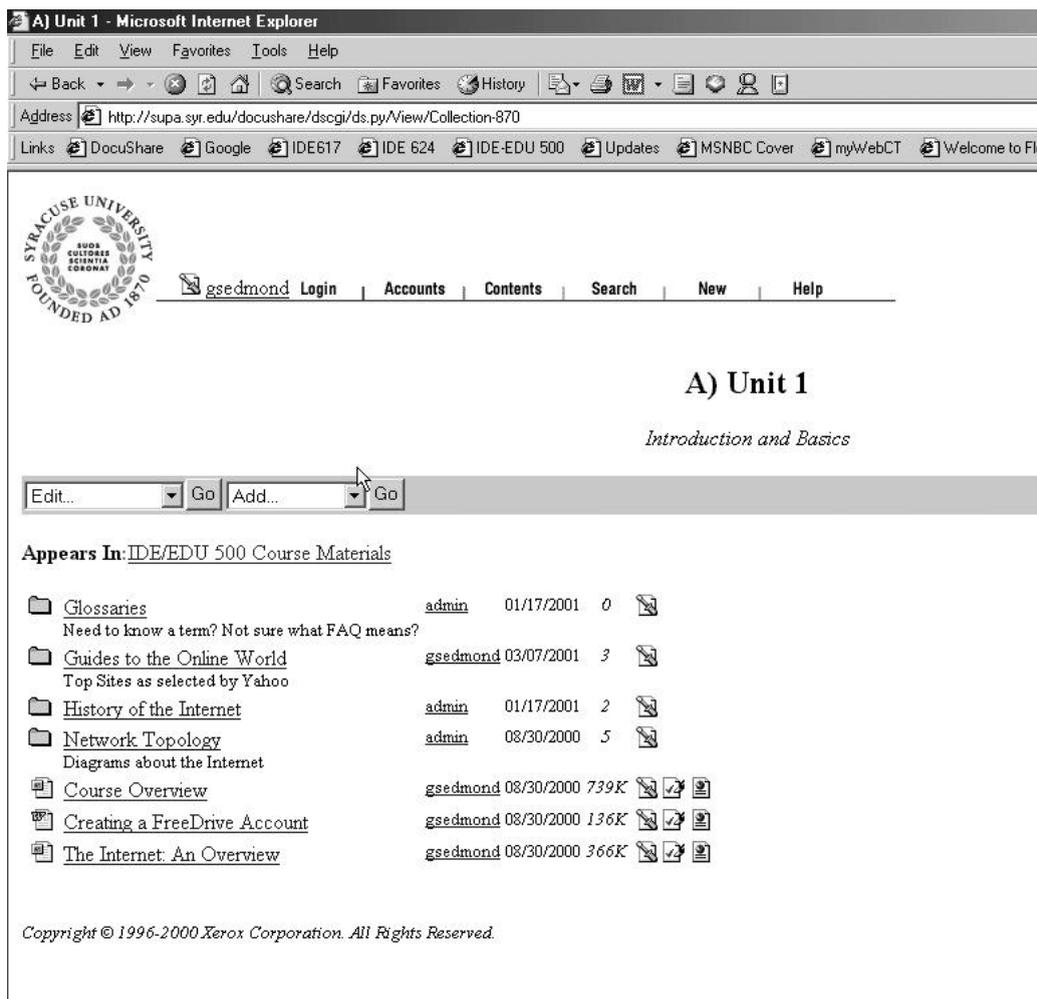


Figure 3. Screen capture from Syracuse University's IDE 500 course site

Syracuse University Project Advance® created Syracuse's first paperless office using both DocuShare and FlowPort to store files on the web, thus reducing the need for physical storage space. Project Advance also uses the software to support over 400 instructors who deliver SU first-year courses to qualified high school students in the northeastern part of the United States. Syracuse's School of Education uses both software applications to support campus-based and online courses. The software allows faculty not familiar with the web to use pre-generated coversheets to scan material to the web. More advanced users can easily customize the environment.

The SevenMountains Integrate

SevenMountains (7M) Integrate is a java-based, enterprise-level knowledge management software system that provides support for creating and managing documents that are to be shared among a variety of persons. It has generic document managing functionalities such as creating, storing, editing, viewing, searching, deleting, publishing, distributing, and routing. The software also supports automatic version control and archiving with an intuitive interface to allow users to upload, download, or check out documents. Checking out a document insures that another user cannot alter it until it is checked back in. The environment allows file and folder hierarchies to be easily created and provides standard access to documents, calendars, browsers, contact persons, and other relevant project activities. 7M Integrate offers functions for collecting, publishing and maintaining documents within an Intranet. These are then uploaded directly onto the Intranet server, stored, and retrieved from the relational database according to a user's privileges. 7M Integrate also contains mechanisms for the dynamic generation of documents directly from the underlying database. This facilitates document management and data exchange based upon user needs and specifications. Sources to be included in a document can also be specified and they can either be static sub-documents or dynamic data from the database. In addition, 7M Integrate has built-in Internet browser and e-mail to support communication and information exchange between group members.

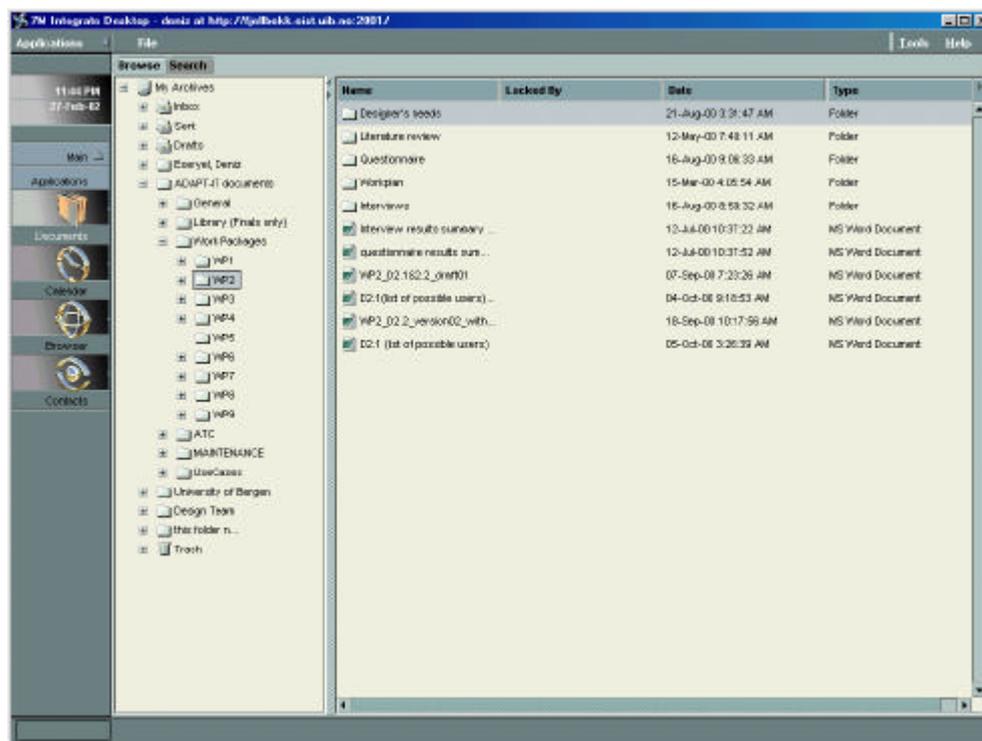


Figure 4. ADAPT^{II} 7M environment hosted at the University of Bergen

Given these capabilities, 7M Integrate presents a simple, easy-to-use CSCW system that can enhance the coordination, and control. In fact, this system is now being used by the members of ADAPT^{II}, a project funded by the European Commission's Information Society Technologies program. The goal of the project is to develop Information and Communication Technology (ICT) based tools for training designers that embodies a validated training design methodology for personalized training based on cognitive science, and optimizes the integrated use of advanced training technologies (Eseryel & Spector, 2000). Since the members of this consortium are from five different countries, 7M Integrate has become the core technology that allows the members of the project to

collaborate even on complex tasks. Figure 4 depicts the 7M environment hosted by the University of Bergen, which is used to support the collaborative design of tools and materials for the ADAPT^{IT} project. This technology has significantly reduced travel costs and promoted frequent collaboration among members in different countries and time zones.

Concluding Remarks

Technologies that are used to facilitate, augment, and support interactions among members of community of practice are called computer-supported collaborative work systems (Koschmann et al., 1996). Making use of groupware and other technologies, CSCW systems support distributed group work for the purpose of achieving higher levels of productivity within a group. It is important to note that CSCW systems are not just useful for the purposes of collaborative work. Their capabilities are equally important for collaborative learning and knowledge construction (see Jonassen et al., 2000). That is why many organizations are utilizing CSCW technologies in their training programs.

This paper reviewed three highly sophisticated CSCW systems. Although each has its own approach and specifications, they all provide enhanced support for communication, collaboration, coordination, and control among group members.

Lotus Notes, DocuShare, and 7M Integrate represent the current state-of-the-art for collaborative web-based software systems. Thanks to the advent of Internet technologies, they do not require highly specialized networks. Therefore, users are free from frustrations due to incompatibilities between different systems, or the inability of applications to support multiple users in different settings. Most importantly, their seamless integration of highly sophisticated applications into one simple and easy-to-use environment shortens the learning time and improves productivity.

Much work has been done on the design of CSCW systems, particularly regarding the integration of methods that incorporate social knowledge into the design process. However, the issues related to the evaluation of CSCW remain a challenge. Unanswered questions include:

- Are the evaluation methods created for single-user systems likely to work with multi-user systems? If not, how can they be modified?
- Are we aiming to evaluate the usability of the systems, as in human-computer interaction studies, or are there other factors that are equally relevant?
- How can CSCW systems be evaluated with regard to influence on work patterns?

We contend that existing methods of evaluation are not adequate. We need to consider new ways of evaluating CSCW systems to take into account the issues of individual, group, and organizational effects as well as questions of usability.

CSCW technologies have enhanced collaboration in the ways previously thought impossible. We believe that the advancement in the information technologies will affect our working, learning, and teaching practices. What is not as well known is how to build a model of collaborative work across distance. There is very little evidence on which to base broad conclusions or to form strong beliefs about causal relationships between forms of collaboration and associated outcomes. There are just good possibilities with little evidence as to what forms of collaboration work best in various situations.

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