

Survey and comparison of CSCW Groupware applications

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Groupware allows many concurrent users to work on the same project. Whereas a single user system focuses on the individual, Groupware focuses on the group. We take a look at what makes a CSCW application, the categories of CSCW applications, and the differences between CSCW and Groupware. We compare a number of academic and commercial systems against a number of criteria. We conclude by comparing each of these systems against all criteria. We notice the similarities and differences between each of these systems and our Groupware system, Nomad.

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Additional Key Words and Phrases: CSCW, Groupware, Human-computer interaction, Survey, Comparison

1. INTRODUCTION

Computer Supported Cooperative Work (CSCW) is the study of how people use technology, with relation to hardware and software, to work together in shared time and space. CSCW began as an effort by technologists to learn from anyone whom could help them better understand group activity and how one could use technology to support people in their work. These specialists spanned many areas of research, including economists, social psychologists, anthropologists, organizational theorists and educators [Grudin 1994].

This paper compares a number of CSCW groupware systems against criteria which we devised. The systems include three commercial systems and four academic systems, one which is our own system, Nomad. Nomad is a “behind the scenes operator” that aims to allow globally dispersed members of small casually connected communities to share artifacts. The intention of Nomad is to operate as a decentralized artifact control system, where artifacts are gathered on a best effort approach. Nomad is in an advanced stage of development. This paper thus serves as an evaluation of the Nomad system and shows the similarities and differences against other systems.

Technology already plays an important aspect in our everyday lives. From the advent of the first telephone, to the current usage of email and cellular phones, humans continue to be social creatures, who aim to keep in touch, whenever and wherever. In fact, emails and cellular phones are tools of CSCW. In addition, it was found that instant messaging [Campbell 2004] can be seen as a CSCW tool. A more recent tool which has made an impact in the social arena of CSCW is blogging [Nardi 2004]. Blogging is a web based communication tool which allows individuals and small groups with a limited audience to share information. Personal views are placed in the commonplace of worldwide criticism. The aim of these systems is to give us the ability to collaborate and communicate at will. Each system is used under different scenarios.

2. CSCW AND GROUPWARE

There are two dimensions to CSCW - *space* and *time*. Figure 1 shows examples relevant to this study in the usual CSCW quadrants. We illustrate these concepts by means of the following example. Assume David and Andrei are working on the same project. They are collaborators in a project. If David and Andrei need to share information immediately, they are sharing their time. This is termed *synchronous* sharing, with example being the cellular phone.

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Although the collaborators are not in the same place, each individual is connected by the time that they share for the duration of the phone call. This example would fall in the 3rd CSCW quadrant. If David sends Andrei an email, they are not sharing time. This is termed *asynchronous* sharing. Andrei will only have the information once he reads the email. This example would fall in the 4th CSCW quadrant.

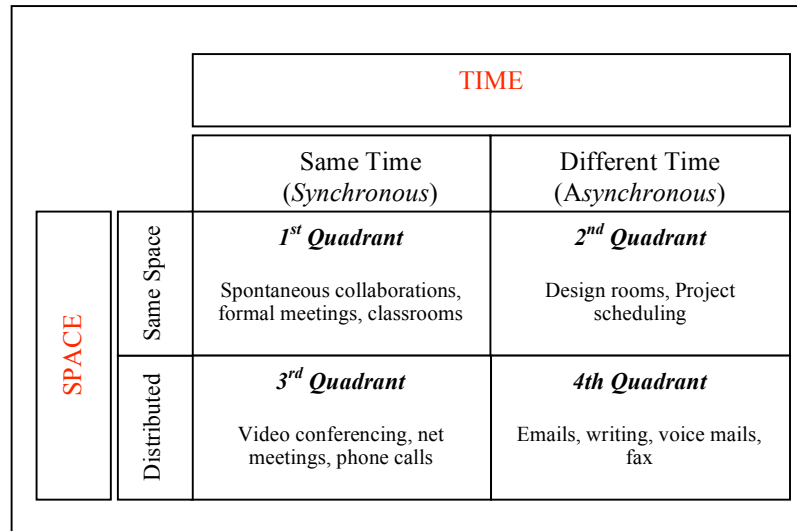


Figure 1 : CSCW Quadrants

In the examples above, David and Andrei are not in the same place when the information is shared. They are therefore distributed. The following examples show synchronous and asynchronous situations where the collaborators are in the same place. Information sharing can take place when David and Andrei meet for a cup of tea at tea time to discuss the project. Although this is a spontaneous collaboration, information is still shared between the two collaborators. They share the same place, and share the same time. This example would fall in the 1st CSCW quadrant. However, David and Andrei occasionally go to the design room, where other team members share their ideas on whiteboards and project status is shown on notice boards. They hence share the same place, but visit the room at different times. The information shared in this instance need not be shared immediately and is generally formed over time, but is still relevant to the totality of the project. This example would fall in the 2nd CSCW quadrant.

Nomad falls in the in the 4th CSCW quadrant. Nomad aims to provide collaborators which do not share time or space to easily collaborate and communicate as a virtual team and co-exist in a community. Other projects which are considered CSCW based are Novell iFolder¹, SubethaEdit, Microsoft Sharepoint, CoCoDoc [Hofte 1997], Basic Support for Collaborative Work (BSCW) [Appelt 2001; Bentley 1995; Bentley 1997] and X-peers. These systems are compared directly with Nomad in section 3.2.

Although CSCW and groupware are difficult to define, and no single definition satisfies everyone, there are individual conferences held for each. The term CSCW is used to define the research and Groupware defines the technology [Grundin 1994]. It is common to differentiate between these terms so that Groupware is technologically focused and narrows the social forms of cooperation that CSCW spans [Banno 1991]. For the purposes on this paper, we make the distinction of CSCW and Groupware. Groupware is considered to be the enabling technology, be it hardware, software, services and/or techniques, which allows people to work in groups. CSCW, on the other hand, focuses on the study of tools and techniques of groupware as well as their psychological, social, and organizational impact. We now discuss Groupware, and aspects relating to Groupware.

Groupware, also known as *collaborative software* [Banno 1991], allows many concurrent users to work on the same project. Whereas a single user system focuses on the individual, Groupware focuses on the group. What advantages does a Groupware system offer when compared to a single user system? When working in a project where communication is essential between collaborators, Groupware facilitates communication faster and clearer, and enables communication where it would not otherwise be possible. It aims to allow multiple perspectives, expertise and assistance with group problem solving. It aims to save time and cost in coordinating group work. With this in mind, Groupware is far more complex to design and maintain than a single user system.

¹ Systems with a primary reference as a website are listed under the project name in the website references section at the end of the paper.

The design of groupware has to be created around the users of the system. Understanding of the context of how the system will be used within the group is essential. Analysis of the type of users and their intentional use of the system is crucial. The system is being created for the user and the user has to accept the system and group has to adopt use of the system. For example; users might refuse to use the system if the system is not easy to use or understand. This would result in a failed system.

As stated earlier, blogging is a tool for CSCW. Blogging itself is not defined as groupware, but the blogging system and infrastructure which allow groups to communicate and collaborate via web pages, maintain different and possibly anonyms identities, comment on other peoples views and allow collaborators to manage and coordinate multiple posts, or projects, qualifies blogging as a group support technology. The general approach of groupware, as will be seen with each of the systems compared in this paper, is to allow distributed members in a group to collaborate through some type of infrastructure. The type of infrastructure is dependant on the service the system aims to offer.

3. SYSTEM COMPARISON

During the requirements phase of Nomad, comparisons to other systems were done to evaluate Nomad. We evaluated Nomad against three commercial and three academic systems.

The commercial systems are:

- Novell iFolder
- SubethaEdit
- Microsoft Sharepoint

The academic systems are:

- CoCoDoc [Hofte 1997]
- Basic Support for Collaborative Work (BSCW) [Appelt 1999; Bentley 1995; Bentley 1997]
- X-peers

We now give a short introduction to each of these systems, by means of extracts from related references given above. The reader is asked to follow references given for each system for more detailed information.

3.1 Systems overview

3.1.1 *Novell iFolder*

“Novell iFolder®, which ships in Novell® Open Enterprise Server, allows your files to automatically follow you everywhere-online and offline-across multiple systems and the Internet. Any changes you make to a Novell iFolder directory are automatically and intelligently updated to your company's Novell iFolder server and your other computers through your Internet connection. You can also share your files with others in the network.”

3.1.2 *SubethaEdit*

“SubEthaEdit is a powerful and lean text editor. And it's the only collaborative one you can actually use. By combining the ease of Bonjour with the world's best text collaboration engine, it makes working together not only possible but even fun [...]Editing documents in groups can be a challenge. Versioning systems like subversion or cvs help your group to keep a consistent copy of your document, but don't provide realtime collaboration. Wouldn't it be great to edit the same document, live, in realtime, together with everyone in your group?”

3.1.3 *Microsoft Sharepoint*

“SharePoint Products and Technologies facilitate collaboration within an organization and with partners and customers. Using the combined collaboration features of Microsoft Windows SharePoint Services and Microsoft Office SharePoint Portal Server 2003, users in your organization can easily create, manage, and build their own collaborative Web sites and make them available throughout the organization.”

3.1.4 *CoCoDoc*

“We propose collaborative compound document editing as a new paradigm for editing environments and describe the design and implementation of CoCoDoc, a framework based on OpenDoc and CORBA. CoCoDoc supports reuse of existing editors as simple collaborative editors and supports development of new collaborative compound part editors with flexible collaboration facilities, thus facilitating a gradual migration towards collaborative editing environments that are both rich in editing support and rich in collaboration support.”

3.1.5 *Basic Support for Collaborative Work (BSCW)*

“The BSCW system supports collaboration by providing shared workspaces over the Internet. A shared workspace allows storage and retrieval of documents and sharing information within a group. This functionality is integrated with an event mechanism to provide each user with an awareness of the activities of others within the workspace. It comprises numerous features, e.g., support for threaded discussions, version management of documents, group management, search features and many more. The system is designed primarily to support self-organising groups.”

3.1.6 *X-peers*

“xpeers is for group communications. It is designed to help people work together in a secure fashion from anywhere and with almost any type of computer system. The unique power enables an unlimited range of new applications for information sharing, collaboration, and coordination. The basic installation of xpeers solves three core-communication problems:

1. Information sharing: xpeers keeps every member in a group in sync. Each member has a copy of the same version of a file for offline access. xpeers keeps track what and when to sync. You can add every filetype to the xpeers universe.
2. Communication: xpeers provide private and public instant messaging. You can create as many topic groups as you like.
3. Versioning: xpeers has a built in version control system. You only have one file on your system, the most recent one. You don't need to keep older version yourself, the xpeers server has all versions. You can recall a version at any time.”

3.1.7 *Nomad*

“Nomad is a framework for a distributed resource management system, with special emphasis placed on the accessibility of information stored on detached devices, such as personal computers, laptops, PDA's and flash-disks. Nomad is intended to address the emerging problem of information spread and neglect, where users have the same copy of the same work, stored on various conventional devices, but no way to keep track of where the most up to date version reside. Nomad does not however restrict itself to personal computing environments, but is also intended to be an information sharing system in much larger contexts, such as project groups or anonymous public domain (read-only) access. Unlike conventional centralized repository-based information sharing applications, Nomad is intended to be an integrated behind-the-scenes operator. Information gathering is only performed on request from a user (pull-based-system), while information sharing on any of the interacting devices is always active, as long as that device remains on and connected to the network.”

3.2 Systems comparison

There are criteria common to all Groupware applications. During the development of Nomad, we selected the following criteria which would enable us compare Nomad with other systems. The criteria selected include functional, architectural, focus, time, user involvement and platform dependency of each system.

3.1.1 *Functional Criteria*

Groupware applications can be described by its functional criteria. The functional criteria specify what a user can expect of the system regardless of its environmental or non-functional constraints.

— **Messaging**

Messaging systems provide users with the functionality to communicate via synchronous and asynchronous messages. Examples of synchronous messaging systems are Instant Messaging systems (IRC, MSM) while asynchronous systems are mostly email-type applications.

- **Conferencing and Electronic Meeting Systems (EMS)**
Conferencing and electronic meeting systems provide users with a shared communication channel, interface or workspace where they can work, talk or share simultaneously.
- **Group Decision Support**
Group decision support systems are portal-like applications that ensure all collaborating users have access to the same, accurate and most up to date data on a given subject.
- **Document Management**
These systems provide document management features such as indexing, searching and distributing documents to authorized users.
- **Document Collaboration**
Document collaboration systems include document management functionalities and extend them by providing history, versioning and change management.
- **Compound Document Management**
These systems provide the functionality to see one document as a collection or combination of smaller documents. Compound document management systems allow users to view the single merged or compound version of the document.

3.1.2 Architectural Criteria

The architectural criteria of Groupware applications define where and how the collaboration is managed.

- **Central Architecture**
Collaboration is managed at a central server. All data are exchanged via a central point of access. This architecture relates directly to client-server architecture.
- **Replicated Architectures**
Collaboration is managed by all the peers in the network. Data and information are exchanged between peers and all peers are equal in such a network. This architecture relates to pure Peer-to-Peer architectures.
- **Hybrid Architecture**
The Hybrid Architecture can be seen as a Peer-To-Peer architecture where some nodes are more significant than other nodes. Data and information are shared among the peers, but there exist a single or multiple master peers that can override information received from peers or they can guide peers to other nodes. This architecture relates to Peer-to-Peer networks with super-nodes.

3.1.3 Focus Criteria

Focus area criteria defines the focal point of collaboration. This means that all collaborative tasks are centered on this particular area and that no collaboration is possible without the focus criteria being present.

- **User Centered**
Collaborative tasks focus on the user. This implies that the user is the most important aspect in user centered collaboration. User centered groupware creates a communication channel between collaborating users; the groupware is not interested in what the users do with the channel.
- **Artifact Centered**
All collaborative tasks focus on the artifact. Artifact centered Groupware provide methods to collaborate on a specific artifact. The Groupware will typically store information with regards to the structure and history of the artifact. The communication channel between users is transparent.
- **Workspace Centered**
Workspace centered Groupware can be seen as an extension to user-centered Groupware with the exception that a workspace can exist without users. The workspace can store the state and in this way allows asynchronous user centered collaboration. Collaborative users share the same workspace.

3.1.4 Time Criteria

Time criteria define the restrictions placed on the time of collaboration.

- **Synchronized**
Collaboration must happen in a structured manner at the same time. Synchronized Groupware will handle locking and collision detection in real-time.
- **Unsynchronized**

Collaboration can happen entirely unsynchronized. Unsynchronized Groupware supports people working together, completely separate from each other. Collaboration only kicks in when requested from a user, otherwise all work performed does not affect other collaborating users.

- **Mixed (Synchronized & Unsynchronized)**

Collaboration can be either synchronized or unsynchronized.

- **Serial**

Serial collaboration are unsynchronized with the exception that one user must perform a specific task before another user can continue with another task. Email is a classical example of serial collaboration.

3.1.5 Platform Criteria

The platform criteria define the execution platform for the groupware application.

- **Mobile Platforms**

Collaboration can be extended onto mobile and handheld devices.

- **Operating System based Platform**

Collaboration can only occur on nodes sharing the same operating system.

- **Browser based platforms**

Collaboration can occur via any Web browser.

- **Platform independent (Multi-platform)**

Collaboration can occur on multiple platforms. These solutions are either built on top of runtimes such as Java or .NET or there exist a binary distributable version for most platforms.

At the time of writing:

- Nomad uses .NET and .NET compact framework.
- Novell iFolder runs on Novell Netware.
- X-Peers have binary versions available for various operating systems.
- SubethaEdit runs on Mac OS X only.

3.1.6 User involvement Criteria

Defines the level of involvement required from the user to gain advantages provided by the groupware.

- **High**

High user involvement means that the user is forced to work with a different interface that he is used to in order to access the collaboration functionalities. This is typical to shared workspace environments.

- **Medium**

Medium user involvement implies that users can work with their normal user interfaces and only need to execute collaborative commands at any given time.

- **Low**

Low user involvement means that the user is only involved in setting up the collaboration environment and can then continue to work as if they are not collaborating. All collaboration functions are automated and intended to be transparent to the user.

4. DISCUSSION

Table 1 shows the combination of the systems against all criteria. We note that there exist commonalities between the systems. All of them:

- Work with closed communities or groups. There is no public file sharing. All users are aware of all other collaborators in the community.
- Focus is on collaboration; not sharing. This means they work with dynamic documents (documents that change over time) rather than sharing which focuses on static documents.
- Execute in a distributed environment using common network protocols such as TCP and HTTP, with the internet as backbone.

On a functional level, the CoCoDoc framework is the closest match to Nomad. Both provide a framework to support collaboration on compound documents. Nomad extends this by adding Group Document Management features. Microsoft Sharepoint is the only “group decision support” and “serial” project. This product is least similar to Nomad.

		System							
		NOMAD	Novell iFolder	SubethaEdit	Microsoft Sharepoint	CoCoDoc	BSCW	X-peers	
Criteria	Functional	Messaging			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Conferencing & EMS			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
		Group Decision Support				<input checked="" type="checkbox"/>			
		Document Management	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Document Collaboration	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Compound Document Management	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>		
	Architectural	Central				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Replicated		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
		Hybrid	<input checked="" type="checkbox"/>						
	Focus	User Centered			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
		Artifact Centered	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			
		Workspace Centered			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Time	Synchronized			<input checked="" type="checkbox"/>				
		Mixed					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Serial				<input checked="" type="checkbox"/>			
		Unsynchronized	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	Platform	Mobile Platforms	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			
		Operating System Based Platforms			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
		Browser Based Platforms		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
		Platform Independent	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>
	User	High			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
		Medium							<input checked="" type="checkbox"/>
		Low	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					

Table 1 : *Combined systems comparison*

5. CONCLUSION

This paper takes a broad look at CSCW and specifically Groupware applications. We established a set of multi-dimensional criteria for comparing such tools, and evaluated our system, Nomad, against other commercial and academic systems. We classify Nomad as a CSCW Groupware tool that lies in the 4th quadrant of CSCW. We find that Nomad shares commonalities with other Groupware systems, yet it is different due to the user requirements and the way users intend to use the system. The design of Groupware is tightly coupled to the intentions that the users have of the CSCW tool. Nomad developers have spent much time and effort on design specific issues taking the user intentions into high regard.

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