

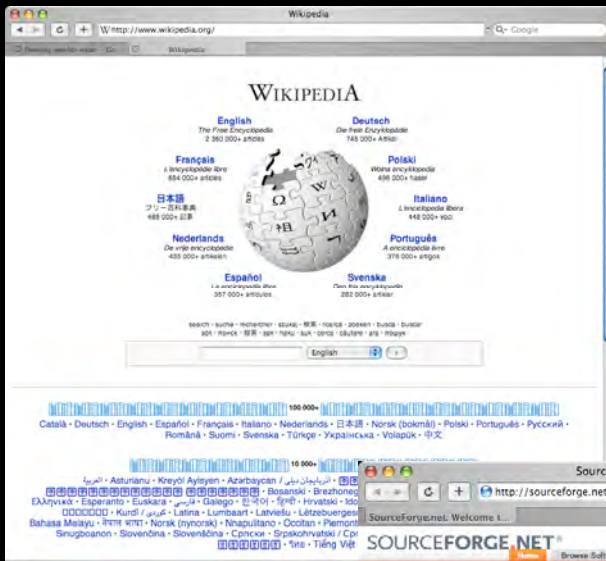
Computer-Supported Cooperative Work: Concepts and Tools

Please note:
these slides were presented
at CTS 2008 on 19 May 2008;
they are selective reflecting
preceding presentations
and discussions there

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The screenshot displays two web pages side-by-side. On the left is the CNN.com homepage, dated October 15, 2007. It features a 'Top Stories' section with headlines such as 'Turks to vote over Ir', 'Three journalists kill', and 'Dark car seen at Dja'. Below this is a news article titled 'Rice: 'Time for Palestinian state'', which discusses Secretary of State Condoleezza Rice's efforts to end the Mideast conflict. On the right is the t-mobile.com website, featuring the slogan 'stick together' and a navigation menu. It includes sections for 'About T-Mobile', 'Company Information', 'Press Room', and 'Working with T-Mobile'. A large diagram of a Boeing 787 Dreamliner is shown at the bottom, with callouts to various parts of the aircraft and their suppliers, such as 'Wing box' from Mitsubishi Heavy Industries (Japan) and 'Engine pylons' from Spirit AeroSystems (Kansas, Oklahoma). The Boeing logo is visible on the aircraft.



[(c) wikipedia.org]



[(c) sourceforge.net]



[(c) telework.gov]

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The Emergence of a New Field—CSCW

- 1980s:
 - Many CSCW **prototypes** built
 - Mostly for **special purposes** and for very specific situations
- 1990—:
 - Increasing flexibility (e.g., situated action)
 - Anthropologists and sociologists joined CSCW community
 - Use of ethnomethodologist methods (e.g., work place studies to analyse, how people act and interact)
- 2000s:
 - Beyond the computer desktop
 - Ubiquitous computing
 - Mobile and wearable computing
 - e-Government
 - ...

CSCW as a Field of Research

- 1st CSCW workshop
 - @ Massachusetts Institute of Technology (MIT) in **1984**
 - Only 20 participants
 - Organised by Irene Greif and Paul Cashman
 - Term Computer-Supported Cooperative Work (**CSCW**) coined
- Tremendously growing interest
 - Since 1986: ACM CSCW Conference
 - Since 1989: ECSCW Conference
 - Since 1997: ACM GROUP
 - Since 2003: CTS
 - Since 1994: Journal on Collaborative Computing
 - ...



Focus on Concepts

- Evolution of technology for social interaction...
- 1940s - Memex [Bush 1945]
- 1960s - ARPA [Licklider 1968]
- 1960s - Augmentation [Engelbart 1968]
- 1980s - Groupware [Johnson-Lentz & Johnson-Lentz 1982]
- 1980s - CSCW [Greif 1988]
- 1990s - Social Software [Tepper 2003]
 - '... allow individuals to communicate with one another, ... bulletin boards, instant messaging, online role-playing games, and even the collaborative editing ... tools for discussion and collaboration ... WebLogs ... content syndication and aggregation tools, collaborative virtual workspaces...'

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CSCW in a Broader Context and Future Perspective

What is CSCW?

- [Ellis et al. 1991]
 - Looks at **how groups work** and seeks to discover how **technology** (especially computers) can help them work. [...] Even systems designed for multi-user applications, such as office information systems, provide minimal support for user-to-user interaction. This type of support is clearly needed, since a significant portion of a person's activities occur in a group, rather than an individual, context.
- CSCW is rather interdisciplinary
 - Distributed systems
 - Virtual reality
 - Artificial intelligence
 - User-centered design
 - Cognitive psychology
 - Small group research
 - Anthropology

Groups

- Oxford Dictionary
 - 'a number of persons or things located close together, or considered or **classed together**'
or 'a number of people working together or **sharing beliefs**, for instance, part of a political party'
- [Rosenstiel 1978]
 - "Eine **Mehrzahl** von Personen..., die in **direkter Interaktion** stehen, durch **Rollendifferenzierung** und gemeinsame **Normen** gekennzeichnet sind und die ein **Wirgefuehl** verbindet"
 - A **limited number** of persons..., with **direct interaction**, different **roles** and shared **norms** with a **self-awareness** as a group

Group Interaction

- **Coexistence**
 - Allow multiple users to share applications synchronously and provide users with **information about presence** of others
- **Communication**
 - Support **explicit** communication (messages), and **implicit** communication (propagation of changes)
- **Coordination**
 - Manage **dependencies** between activities, actors, sub-goals
- **Consensus**
 - Offer support for structuring of **decisions**, voting and evaluating, generating of ideas and analysing of statements
- **Collaboration**
 - Real act of **working together**

Software for Groups: Groupware

- [Johnson-Lentz & Johnson-Lentz 1982]
 - Computer-based system plus social group processes
- [Ellis et al. 1991]
 - Computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment
- [Lynch et al. 1990]
 - Groupware is distinguished from normal software by the basic assumption it makes: groupware makes the **user aware** that he is part of a group, while most other software seeks to hide and protect users from each other. [...] software that accentuates the multiple user environment, co-ordinating and orchestrating things so that users can see each other, yet do not conflict with each other

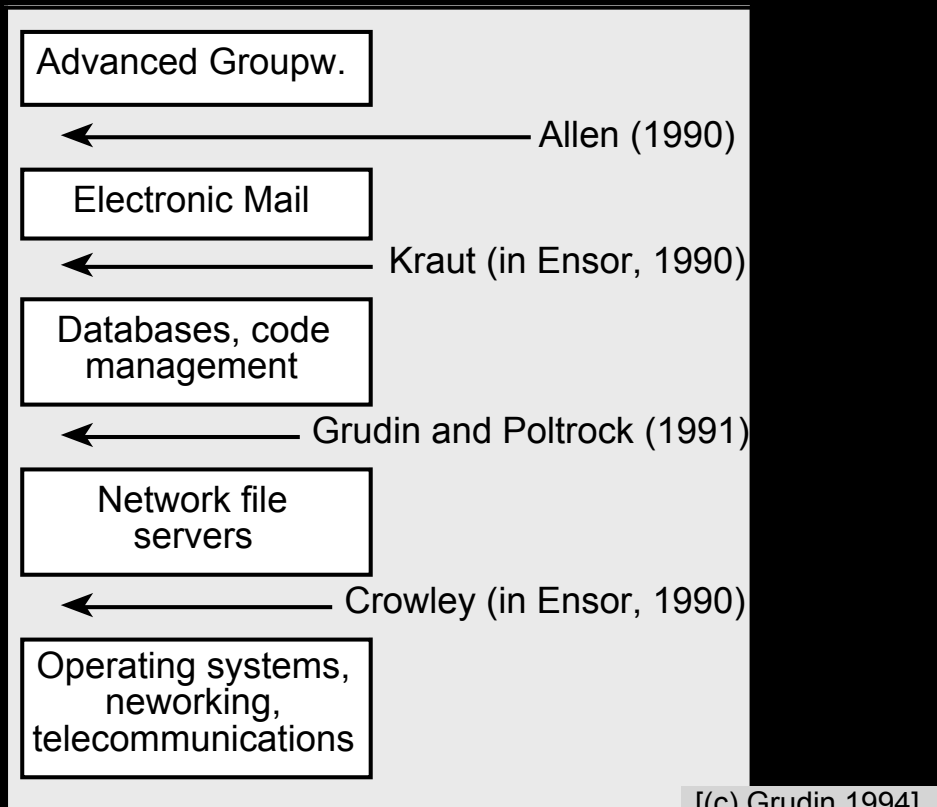


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Classifications: Time-Space Matrix: 4 Fields

- [Johansen 1988]

- Synchronous vs. asynchronous
- Co-located vs. remote

	<i>Same Time</i>	<i>Diff. Time</i>
<i>Same Place</i>		
<i>Diff. Place</i>		

[(c) Jonansen 1988]

- [Rodden & Blair 1991]

- Both dimensions can have various values
- E.g., synchronous, asynchronous, mixed
- E.g., purely co-located, virtually co-located (different locations, but audio or video connection), locally remote (same building), remote (low accessibility of other users)

Classifications: Multi-Dimensional View

- [Ellis et al. 1991]

- Emphasise that there are **no clear borders** between single-user & groupware systems & between different classes of groupware systems

- E.g., common task dimension



Low
timesharing system

High
software review system

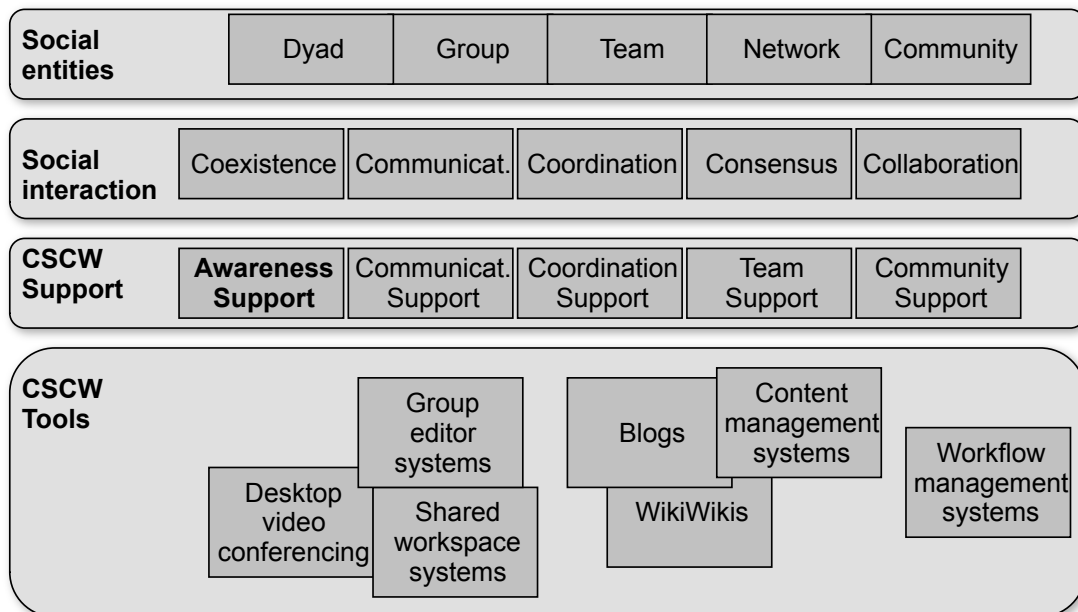
- E.g., shared environment dimension



Low
email system

High
electronic classroom system

Classification We Follow

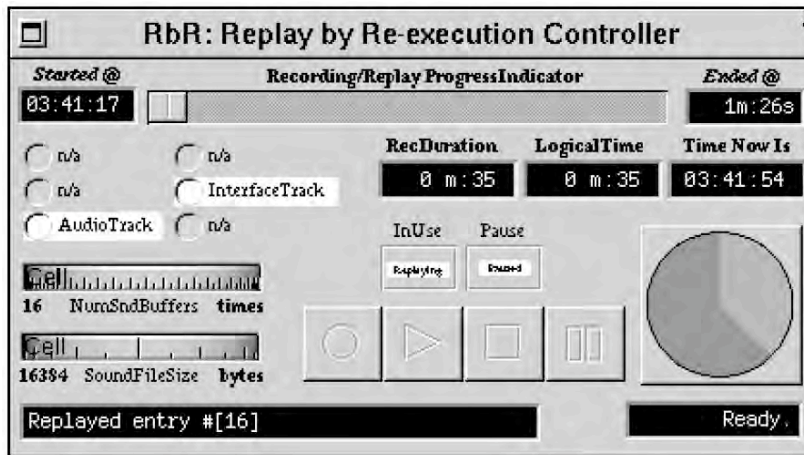


Introduction

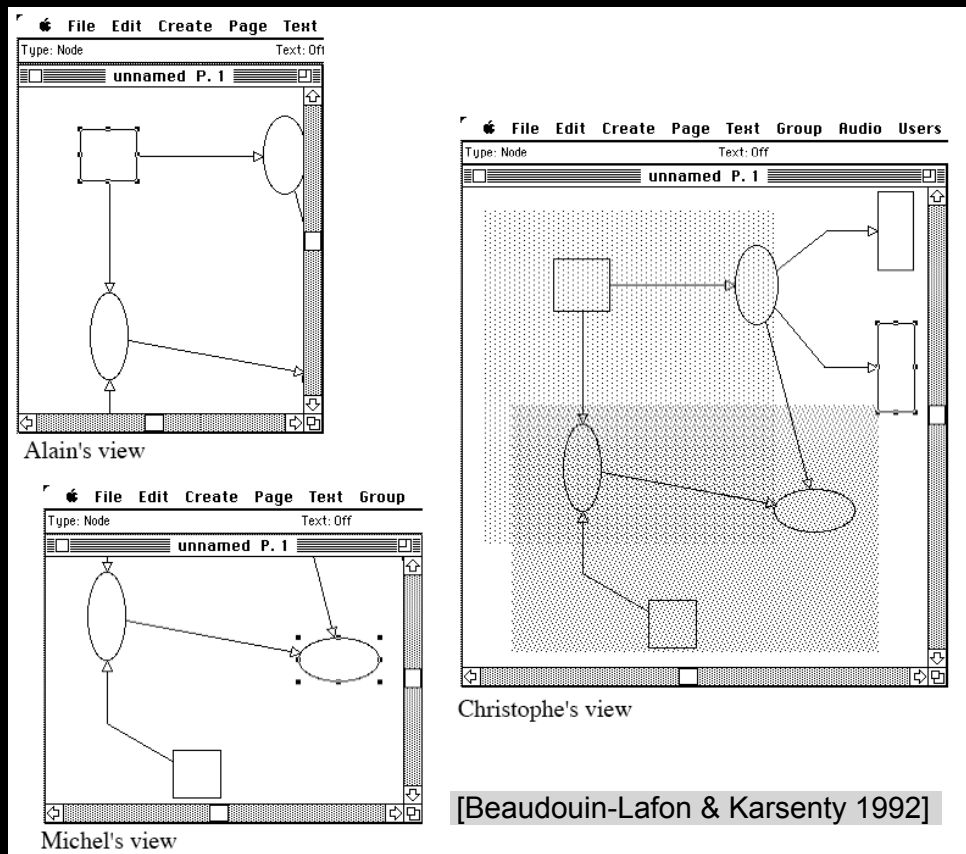
- [Dourish & Belotti 1992]
 - Awareness of individual and group activities is **critical to successful collaboration** and is commonly supported in CSCW systems by active, information generation mechanisms separated from the shared workspace.
 - It [awareness] is fundamental to **coordination of activities** and **sharing of information**, which in turn, are critical to successful collaboration. Awareness plays a number of key roles. First, high-level awareness of the character of others' actions allows participants to structure their activities and avoid duplication of work. Second, lower-level awareness of the content of others' actions allows fine-grained shared working and synergistic group behaviour which needs to be supported by collaborative applications.

Asynchronous Systems

- Session Capture and Replay



[(c) Manohar & Prakash 1995]



[Beaudouin-Lafon & Karsenty 1992]

Control Announcement See Changes Join Others

Control Access Invite Others

Access Control: Locked

Read/Write

- Dominik Wagner 85:14
- Martin Pittenauer 874:0 (15729)
- Martin Ott 1978:0 (5951)

Read Only

- King Kong Awaiting Response

Pending Users

- Stanley Kubrick

Connections

see: //codingmonkeys.de

- Martin Pittenauer Visible
- Cornelius Ape 0 Document(s)
- Doctor Zaius 2 Document(s)
- Study.txt
- Untitled.txt
- King Kong 3 Document(s)
- Chat.txt
- conference.notes
- index.html

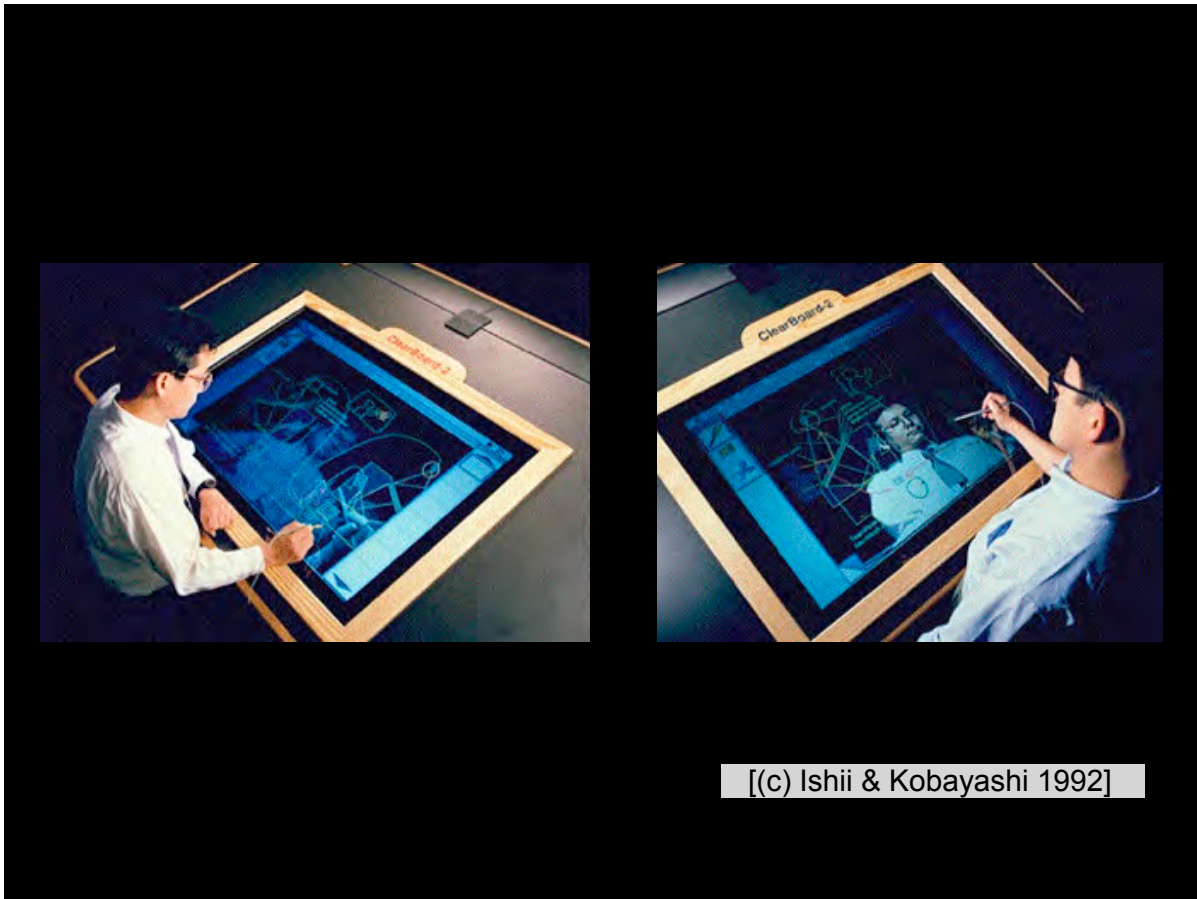
```

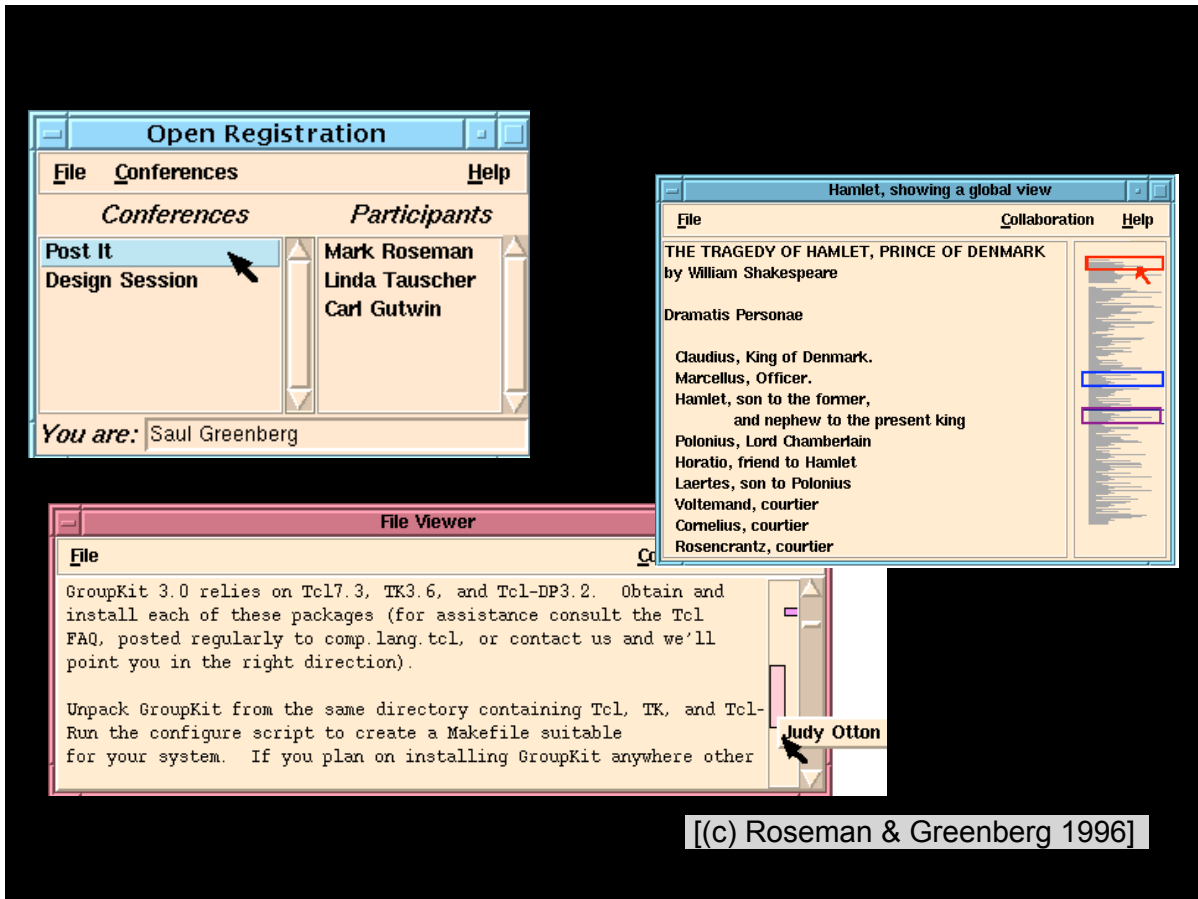
85:14 /Developer/Examples/AppKit/TextEdit/Document.m (1 pending)
Document.m Document.h DocumentReadWrite.m
Written by me
81
82 - (void)setupInitialTextViewSharedState {
83     NSTextView *textView = [self firstTextView];
84
85     [textView setUsesFontPanel:YES];
86     [textView setUsesFindPanel:YES];
87     [textView setDelegate:self];
88     [textView setAllowsUndo:YES];
89     [textView setAllowsDocumentBackgroundColorChange:YES];
90     [textView setContinuousSpellCheckingEnabled:
91      [[Preferences objectForKey:CheckSpellingAsYouType] boolValue]];
92     [self setRichText:[Preferences objectForKey:RichText] boolValue];
93     [textView dealWithAttachments:NO showRuler:NO];
94     [self setHyphenationFactor:0.0];
95 }
96
97 - (id)init {
98     static NSPoint cascadePoint = {0.0, 0.0};
99     NSLayoutManager *layoutManager;
100     NSZone *zone = [self zone];
101
102     self = [super init];
103     textStorage = [[NSTextStorage allocWithZone:zone] init];
104
105     if (![NSBundle loadNibNamed:@"DocumentWindow" owner:self]) {
106         NSLog(@"Failed to load DocumentWindow.nib");
107         [self release];
108         return nil;
109     }
110 }
Objective-C Spaces (4) LF Unicode (UTF-8) 73w
  
```

Accept new Participants Customizable Highlighting Locate Participants

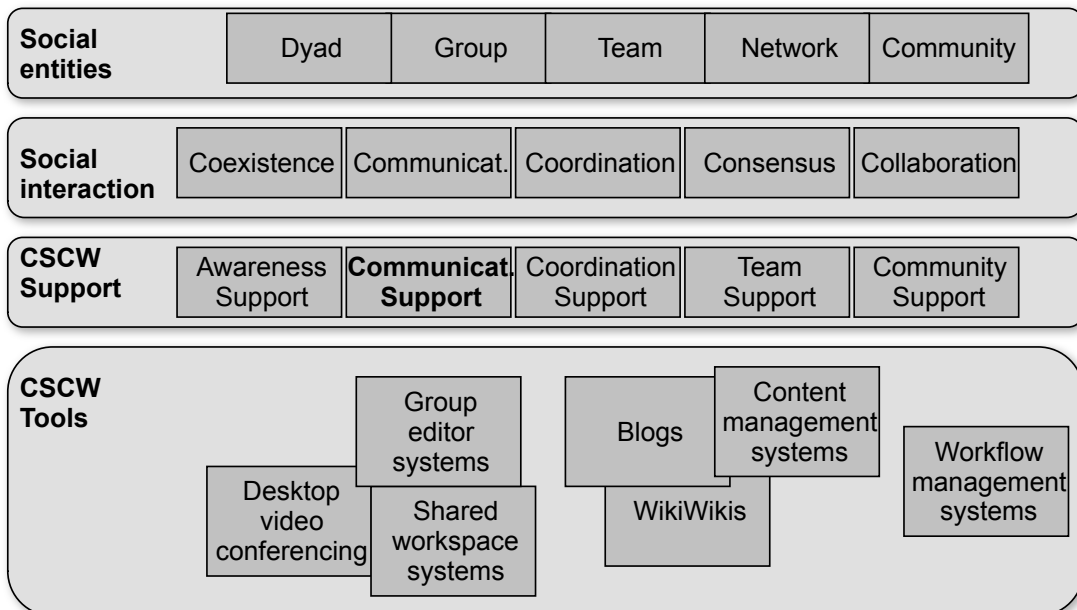
Browse via Internet

[[c) www.codingmonkeys.de]]





Classification We Follow



Introduction

- **Communication**
 - Key requirement for any groupware application
 - Effective communication requires a mutual understanding of subject of conversation
 - Clark & Brennan [1991] call this mutual understanding '**common ground**'. Systems for information exchange primarily focus on providing this common ground
 - Mono-cast; multi-cast; broad-cast

Early Messaging Systems

- **Early Email systems**
 - Communication support for geographically dispersed groups
 - Only textual messages
- **Newer messaging systems**
 - Use Multimedia Integrated Mail Extension (**MIME**) standard for sending & integrating documents (rich text, spread sheets, graphics), computer programs, audio or video sequences
- **Transmission of Email**
 - Over the Internet with Simple Mail Transfer Protocol (**SMTP**)

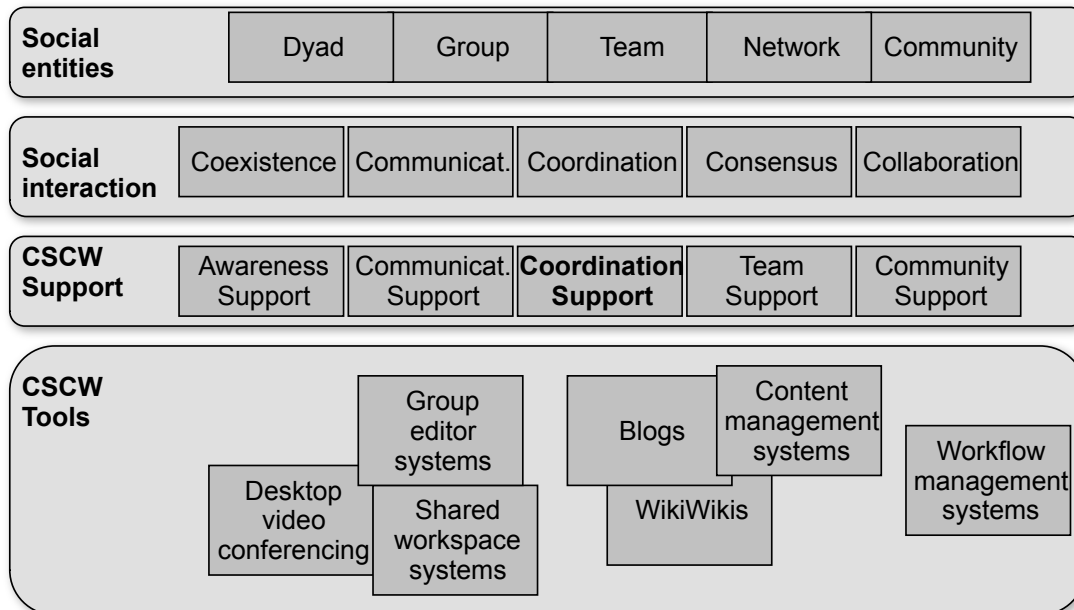
Asynchronous Messaging Systems

- Semi-structured message systems or active message systems
 - Incorporate mechanisms for **automatic** message processing
 - Goal either simplify handling of Email or use Email as a basis for coordination & automation of group activities
 - Semi-structured messages consist of predefined & non-predefined fields
- Information Lens [Malone et al. 1986]
 - Early semi-formal cooperative message systems
 - Techniques from AI should solve problem of information overload
 - Provide message recipients with tools for separation of important messages from less relevant messages; relevance of a message can be specified by values of some structured fields

Synchronous Conferencing Systems (cont'd)

- Audio conferencing systems
 - Simplest form telephones
 - Several more recent systems
 - Skype [Skype 2007]
 - In some OS audio conferencing is integrated (e.g., iChat on Mac OS X supports audio conferencing among up to ten users [Apple Computer 2007])
- Desktop video conferencing systems
 - MERMAID system [Sakata 1994]
 - Supports **multiple video** connections
 - iChat [Apple Computer 2007]
 - NetMeeting [Microsoft 2006]
 - iVisit [iVisit LLC 2007]

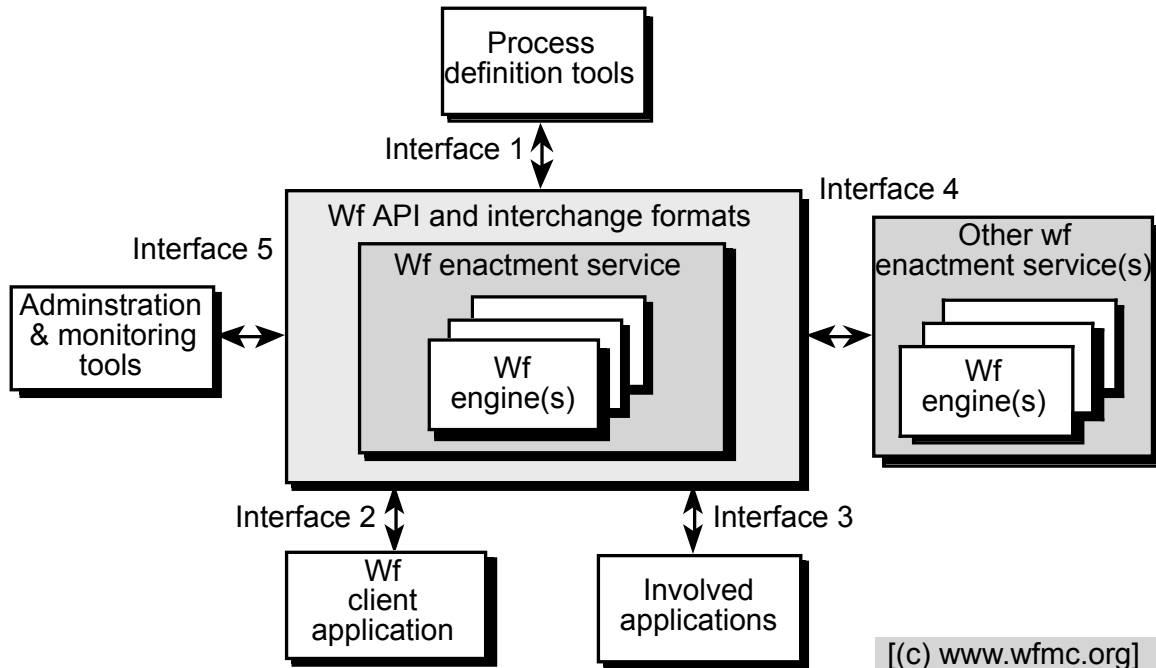
Classification We Follow



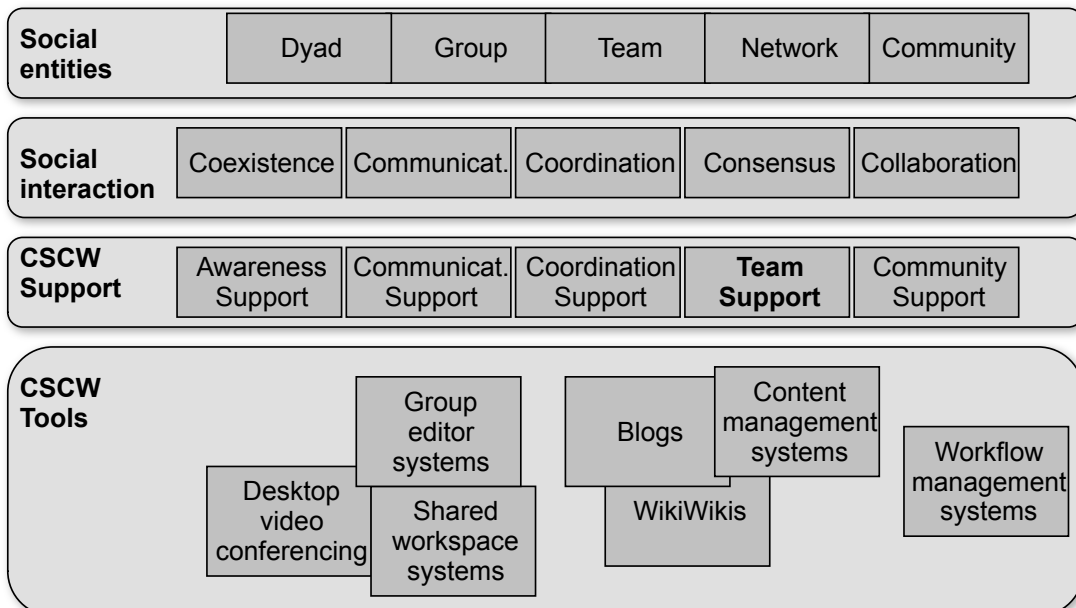
WFMS

- Workflow Management Systems
- 4 generations of WFMS—increasing flexibility
 - **1st** generation: very application-specific with hardcoded process definitions; closed & proprietary
 - **2nd** generation: extracted workflow capabilities from application domain; WFMS were treated as separate applications; process definitions were tailorable through script languages
 - **3rd** generation: offer generic workflow services that are accessible to other applications through APIs; architecture is open & based on standards; interchange formats are already defined
 - **4th** generation: embedded enablers; integrated with other middleware services like Email or desktop management; ubiquitous; invisible

WFMS (cont'd)

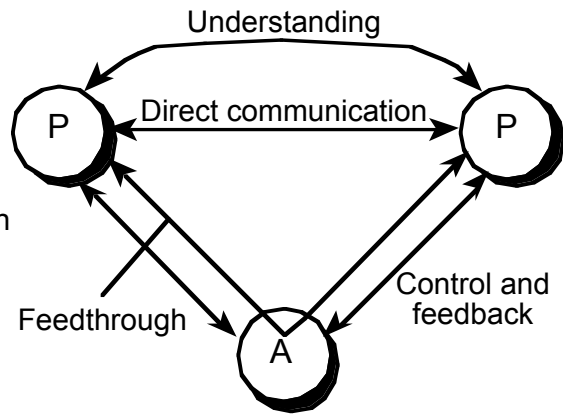


Classification We Follow



Shared Information Space Systems: Introduction

- Shared info spaces [Dix et al. 1994]
 - Support cooperative usage of shared data
 - Users can communicate **through** shared artefacts (i.e., explicit communication through direct communication & implicit communication as feed-through)

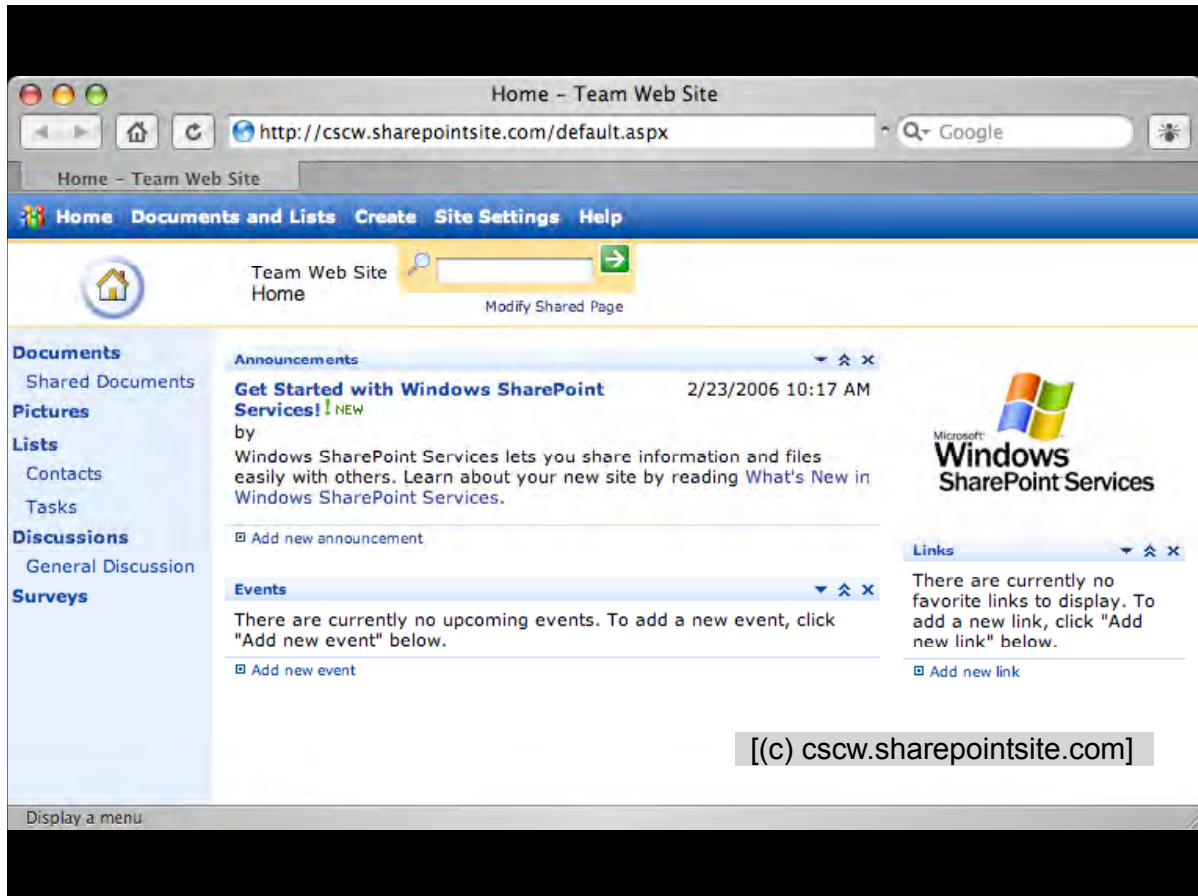


P: person;
A: artefact

The screenshot shows a web browser window with the address bar containing <http://bscw.fit.fraunhofer.de/bscw/bscw.cgi/11233798>. The page displays a file sharing interface for the user 'tom.gross'. The interface includes a menu bar (File, Edit, View, Options, GoTo, Help), a toolbar with icons for Home, Public, Clipbd, Trash, Addr, Calend, Tasks, Bkmks, and Case, and a file list table.

Name	Size	Share Creator	Last Modified	Events	Action
CSCW-Curriculum Workspace zur Entwicklung eines CSCW Curriculums. Kick-off: Mensch und Computer 2005, Linz.	9	prinz	2006-01-18 12:53		
CSCW Curriculum-Übersicht.xls [0.2] Zusammenstellung der Umfrage zu CSCW Vorlesungen.	41.5 K	prinz	2005-09-11		
Interessante Medien Interessante Medien (vor allem Videos), die in Veranstaltungen verwendet werden können	5	kochm	2006-01-18 12:52		
Interessante Software Links oder uploads interessanter Software, die man in der Lehre einsetzen kann.	5	prinz	2006-04-11 15:35		
Klausuren ... wie kann man das ganze möglichst einfach korrigierbar abprüfen?	0	kochm	2006-01-18 12:53		
Literatsammlung	0	prinz	2005-09-11		
Modulbeschreibungen	36	prinz	2006-04-11 15:28		

At the bottom of the page, there is a copyright notice: **[(c) bscw.fit.fraunhofer.de]**



Shared Information Space Systems: Lotus Notes

- [Ehrlich & Cash 1994; IBM 2007]
 - Private, commercial BBS
 - Information & communication system
 - Supports shared usage of documents of group members
 - Documents consist of DB fields (with types like text, number, time, date key word) or of rich text fields (with texts, graphics, tables hyperlinks to other documents)
 - Security features: when notes are transmitted over network, they are encrypted
 - Access control managed by different privileges: reader (read only); author (read, create new documents, manipulate own documents); editor (also change documents of other users); depositor (save new documents but not read); designer (who can develop new applications)

Group Editing Systems

- Quilt [Fish et al. 1988]
 - **Asynchronous** document production using hypertext technology
 - Publicly available base articles can be **annotated**
 - Applies **system-enforced** social roles like co-author, commenter
- ShrEdit [McGuffin & G. Olson 1992]
 - **Synchronous** collaborative editor for f2f design meetings—minimal system constraints and no roles
 - Lacks a communication tool and deliberately does not support asynchronous features like versioning, etc.
- GROVE [Ellis et al. 1991]
 - Multi-user group outline editor for synchronous drafting of texts
 - Imposes hardly any system constraints: roles are not supported and default locking mode is no locking—all users can read and update any part of shared document

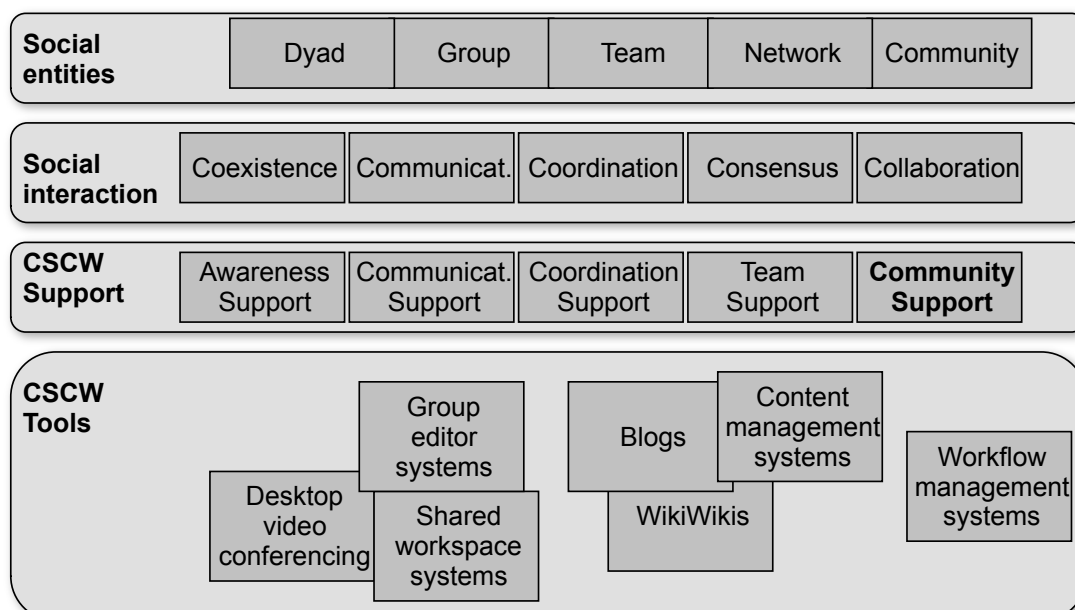
Group Decision Support Systems

- Aim
 - Decision making **process** can be structured, recorded, becomes more transparent
 - Later actors analyse records to see how decisions developed
 - Actors who join group later can view records to see history
- Issue-based information system
 - **Asynchronous** GDSS are often based on issue-based information system method (IBIS)
 - Structures argumentation in issues, positions, arguments
- gIBIS
 - Graphical issue-based information system
- rIBIS
 - Real-time group hypertext system

Electronic Meeting Rooms

- **CoLab [Stefik et al. 1987]**
 - Up to 6 networked workstations; touch-sensitive screen
 - Software packages like Cognoter (a CoLab tool for preparing presentations & organising meetings; structures meetings in a brainstorming, an organising, an evaluation phase) or Argnoter (supports phases like proposing, arguing, evaluating)
- **GroupSystems [Nunamaker et al. 1991]**
 - Early electronic meeting room systems (since 1991)
 - Developed at PlexCenter Planning and Decision Support Laboratory or GroupSystems at University of Arizona
 - Sessions with GroupSystems are lead by a professional facilitator who supports respective meeting leader

Classification We Follow



Introduction—History

- 1990s - Origin of **social software** [Allen 2005]
 - In 1992: Ted Nelson's **Xanadu** was called social software
 - In 2000s used by K. **Eric Drexler** describing his interest in hypertext and group augmentation
 - In 2002 **Clay Shirky** organised a 'Social Software Summit'
 - Clay Shirky:
 - 'I was looking for something that gathered together all uses of software that supported **interacting groups**, even if the interaction was offline... **Groupware** was the obvious choice, but had become horribly **polluted** by enterprise groupware work.'
 - '...**collaborative software** ... seems a **sub-set** of groupware, leaving out other kinds of group processes such as discussion, mutual advice or favours, and play.'

Introduction—Overview

- [Tepper 2003]
 - Social software refers to various, loosely connected types of applications that allow **individuals** to **communicate** with one another, and to track **discussions** across the Web as they happen. Many forms of social software are already old news for experienced technology users; **bulletin boards**, **instant messaging**, online role-playing **games**, and even the collaborative **editing tools** built into most word processing software all qualify. But there are a whole host of new tools for discussion and collaboration, many of them in some way tied to the rise of the **WebLogs** (or "blog"). New content **syndication** and aggregation tools, collaborative virtual **workspaces**, and collaborative **editing** tools, among others, are becoming popular, and social software is maturing so quickly that keeping up with it could be a full-time job in itself.

Introduction—Overview (cont'd)

- [Meatball Wiki 2008]
 - Social Software is a label for software that supports group interaction, including
 - Multi-User Dungeons (MUDs),
 - Multi-User Dungeons Object-Oriented (MOOs),
 - Instant Messaging,
 - Internet Relay Chat,
 - Collaborative Editor,
 - Collaborative Filtering Technology
 - Social Bookmarking, Social Annotation, Social Collaboration

HyperNews Tests

http://www.hypernews.org/HyperNews/get/hypernews/test.1

About HyperNews

HyperNews Tests

Use this page for tests of HyperNews at www.hypernews.org. This version of HyperNews may work differently from what you will find at [other HyperNews sites](#).
Note: You may have wandered in from another site. Membership here does not apply at other sites and vice versa.

Postings here will be deleted. If you have something substantial to say, consider adding it to another forum where the right people will see it.

Next-in-Thread Next Message

Inline: 1 All Outline: 1 2 All

8091 MAS, Dec 31, 18:02

8092 Help!!!!!!!!!!!!!! by LCsweety07@hotmail.com, Jan 08, 12:35 NEW

8093 en cuanto tiempo acabo by drx_mx@yahoo.com.mx, Jan 13, 02:35 NEW

8094 Untitled, Jan 14, 01:08 NEW

Add to: "HyperNews Tests"

Members Subscribe Admin Mode Show Frames Help

[About](#) || [Instructions](#) || [Test](#) || [Guestbook](#) || [Future](#) || [Source](#) || [Installation](#) || [Consortium](#) ||

[(c) www.hypernews.org]

Done

Wikis (cont'd)

- **ComMentor** (Stanford University) [Roescheisen & Winograd 1995]
 - Annotations are **stored separately** from base pages—anyone can create annotations for remote pages
 - Users can keep **bookmarks** of their annotations
 - **Filters** for annotation texts are provided
 - Access rights for annotations: **private, group, public**
 - Special **Web browser** is needed for document synthesis and for rendering Web pages

Wikis (cont'd)

- **WikiWiki** [wiki.org 2002]
 - Wiki is in Ward Cunningham's original description: 'The simplest online database that could possibly work.'
 - Server software that allows users to **freely create** and **edit Web page** content using any Web **browser**
 - Supports **hyperlinks**
 - Has a **simple text syntax** for creating new pages and cross-links between internal pages on the fly
 - WikiWiki or Wiki or WikiWikiWeb
 - Originated in 1994/95, but most important growth has taken place since 2001, with **Wikipedia**

WikiEngineComparison - MoinMoin

http://moinmoin.wikiwikiweb.de/WikiEngineComparison

WikiEngineComparison - MoinMoin

Search

RecentChanges FindPage HelpContents WikiEngineComparison

Edit (Text) Info Attachments More Actions:

Comparison Table

Feature / WikiEngine	MoinMoin	ZWiki	TikiWiki	TWiki	telepark.wiki	PHPWiki	MediaWiki	JSPWiki	UseMod	PmWiki	WikkaWiki	Trac	Confluence
Database	works without	ZODB	any dba (ADODB)	works without	works without	any dba/ADODB/PostDB or files	MySQL (PostgreSQL)	you-name-it or without	works without	works without	MySQL	SQLite/PostgreSQL	MySQL PostgreSQL Oracle
Programming Language	python	python	php	perl	php	php	php	Java	perl	php	php	python	Java
Categorization	using backlinks	in tree form	nested categories and/or structures	by webs, tags, parents, forms	in tree form	using backlinks	real categories, tree plugin	flat	using backlinks	links, groups, categories	categories	flat, backlinks (macro)	spaces, pages, links
Groups	yes (users, pages)	Zope Roles	yes, also nested groups possible	yes, also nested groups possible	yes	yes	limited	roles	no	yes	plugin	yes	yes
Versioning	yes	Zope Versioning	yes	yes, RCS default / Subversion experimental	no	yes	yes	file or RCS	yes	yes	yes	yes	yes
Latex Formulas	add on	plugin	plugin (currently disabled - security issues)	plugin	no	plugin	yes (installation separate)	plugin	no	plugin	plugin	no	plugin
Tables	yes	yes	yes	default plugin	yes	yes	yes	yes	yes	yes	yes (markup/html)	yes	yes
Inlined HTML	add on	yes	yes	yes	optional	subset	yes, limited	optional	yes	optional	yes/no/safe	yes	plugin
Email Notification	yes	yes	yes	yes	yes	yes	yes	plugin	yes	yes	no	no	yes
Comments	add on	yes	yes	plugin	no	plugin	on discussion page	yes	no	plugin	yes	plugin	yes
Feature / WikiEngine	MoinMoin	ZWiki	TikiWiki	TWiki	telepark.wiki	PHPWiki	MediaWiki	JSPWiki	UseMod	PmWiki	WikkaWiki	Trac	Confluence
Permissions	ACLs	extensive Zope permissions assignable to Zope roles	elaborate permissions assignable to groups	yes, assignable to groupe	page level	ACLs	limited	page level or higher	yes, assignable to groups	yes	ACLs per page	yes, assignable to groupe	extensive enterprise-level
Performance ¹	fast	fast	fast	a little slower	fast	fast	a little slower (pretty slow)	fast	fast	fast	(normally fast)	fast	fast
Extensibility	plugins, themes	python scripts, zope Products	plugins	plugins, skins, add-ons	patches	plugins	plugins	plugins filters, almost everything is a module	patches	plugins, themes	actions, handlers	macros, plugins, components	plugins, XML-RPC, SOAP
Unicode Support	complete	unknown	unknown	yes	yes	unknown	yes	yes	unknown	unknown	no	unknown	unknown
Right to left support	yes	unknown	yes	no	no	unknown	yes	unknown	unknown	unknown	no	unknown	unknown
Multiple words	multiple words			multiple words, perl									

Display a menu

[[c) moinmoin.wikiwikiweb.de]]

WebLogs

- Primarily data sharing
- [Kumar et al. 2004]
 - 'Blogs ... **Web pages** with **reverse chronological** sequences of dated entries, usually with sidebars of profile information and usually maintained and published with the help of a popular **blog authoring tool**.
 - They tend to be quirky, highly **personal**, typically read by repeat visitors, and interwoven into a network of tight-knit but active communities.
 - We refer to the collection of blogs and all their links as **blogspace**.'

The screenshot shows the Slashdot website interface. At the top, the browser address bar displays 'http://slashdot.org/'. The site header features the 'Slashdot' logo and the tagline 'NEWS FOR NERDS. STUFF THAT MATTERS.'. A navigation menu on the left lists various sections like 'Main', 'Apple', 'Games', and 'Technology'. The main content area displays two news items. The first, 'Games: London Lawyers Demand £600 For One Game', is posted by 'kdawson' and discusses a legal demand against a PC Pro reader. The second, 'Technology: Windows XP SP3 Creating Havoc', is also by 'kdawson' and reports on user complaints about the Windows XP SP3 update. A sidebar on the right contains 'Recent Tags' such as 'power', 'pogoames', and 'hardware'. A copyright notice '[(c) slashdot.org]' is visible at the bottom right of the page.

Recommender Systems

- Primarily profiling
- **Early** social filtering systems
 - Huge **amounts of information** every day, esp. in Usenet Newsgroups
 - Software **filters** and intelligent agents
 - **Social filters**: colleagues, other researchers with similar interests
 - **Premise**: people who evaluated articles in the past similarly are likely to agree on the evaluation of upcoming articles



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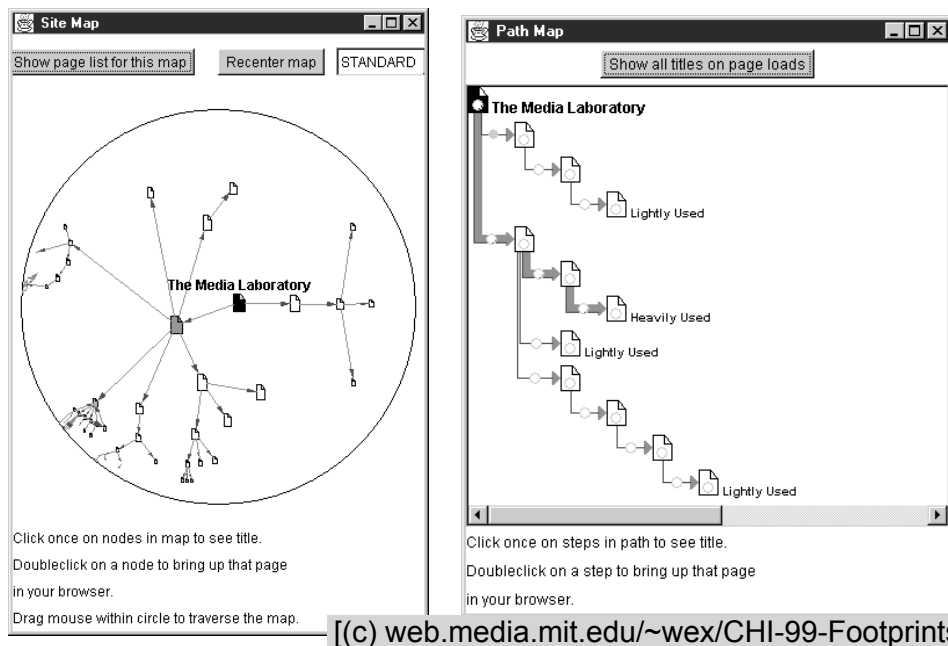
[(c) movielens.umn.edu]

MovieLens is a free service provided by GroupLens Research at the University of Minnesota.

Social Navigation Systems

- Primarily profiling
- Navigation
 - **Following route** through environment
 - Environment can be any domain, in which one has sense of **location** and **locomotion**, not restricted to spatial or physical domains
- Social navigation
 - Ways in which perceived **social factors** influence navigational behaviour
 - Moving towards a **cluster of people** (e.g., in CVEs) or navigating to a **particular place** (e.g., recommender systems), because someone else has been there or seen something

Social Navigation Systems (cont'd)



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Need for Social Investigation

- Software designers often have to develop software for **complex situations**
- Difficult to understand **nature of problem**
- Requirements analysis and capture establishes services that **customer requires** from system and constraints under which it operates and is developed [Sommerville 2000]
- **Requirements specification** as a formal document in software life cycle is written

Information Gathering

- First step in user requirements analysis is to gather background information about the **users and stakeholders** and the processes that currently take place

Comparison Summary

Method	Benefits	Drawbacks
INFORMATION GATHERING		
Stakeholder analysis	Ensures that all relevant stakeholders are considered	-
Secondary market research	Low cost and provides good overview of potential market	Information may be too general or out of date
Context of use analysis	Provides framework for documenting all factors that may affect the usability of the product	May be lengthy process; not all headings applicable to project; could be short-circuited for smaller systems
Task Analysis	Defines and models tasks that can highlight user needs directly	May be over-formal for simple tasks or open-ended tasks

[(c) Maguire & Bevan 2002]

Comparison Summary (cont'd)

Rich pictures	Allows complex user environments to be mapped out and potential requirements to be identified	Pictures may highlight indicative factors but may lack sufficient detail
Field study and observational methods	Allows viewing of what users actually do in context and may discover unnoticed processes	Time consuming to perform; user commentary and analyst observation may disturb tasks
Diary keeping	Allows user to record activities throughout the day	Users may forget to complete diaries or summarise activities at the end; analyst reminders may be annoying
Video recording	Captures real current activities without the intrusiveness of direct observation	Time consuming to perform; requires users to explain activities post-observation

Comparison Summary

USER NEEDS IDENTIFICATION		
User surveys	Relatively quick method of determining preferences of large user groups and allows for statistical analysis	Does not capture in depth comments and may not permit follow-up
Focus groups	Allows analyst to rapidly obtain a wide variety of user views and possibly a consensus	Recruitment effort to assemble groups; dominant participants may influence group disproportionately
Interviewing	Interviews allow for quick elicitation of ideas and concepts; customer visits brings user context to life	Need to negotiate access and to combine range of possibly differing opinions from different users
Scenarios, use cases and personas	Effective way of thinking about future system use in context; personas can bring user needs to life	Scenarios may raise expectations too much; personas may over simplify user population

Comparison Summary (cont'd)

Future workshops	Way of thinking creatively	Results may seem too ambitious for current needs
Existing system or Competitor analysis	Effective means of identifying current problems, possible new features and acceptance criteria	May lead to including too many new functions or make system too similar to a competitor's

Ethnography: Introduction

- [Randall & Bentley 1992]
 - Ethnography is a naturalistic method associated with sociology and anthropology. [It] focuses on the **social organisation of activities** and how this social organisation is accomplished, understood and achieved by **social actors**. [The] ethnographic method relies on an observer **going into the field** for prolonged periods to **immerse** themselves in a real world culture.
- [Anderson 1997]
 - Ethnography is a particular analytic strategy for **assembling and interpreting** the results of fieldwork gathered very often by participant observation. Designers have, by and large, been more likely to be interested in fieldwork in general than in ethnography in particular.

Ethnography: Introduction (cont'd)

- [Myers 1999]
 - Ethnographic research is one of the most **in-depth** research methods possible. Because the researcher is at a research site for a **long time**—and sees what people are **doing** as well as what they **say** they are doing—an ethnographer obtains a deep understanding of the **people**, the **organization**, and the broader context within which they work. Ethnographic research is thus well suited to providing information systems researchers with rich insights into the human, social, and organizational aspects of information systems.

Ethnography and Software Engineering: Challenges

- Ethnographers
 - Concerned with **analysis**
 - **Avoid** making judgements about work
 - Perform studies as **prolonged** activities
- Origins in anthropology
 - Concerned with **analysis** of primitive societies
 - Ethnographers used to composing **questions** rather than coming up with answers
- Software engineers
 - Concerned with **synthesis**
 - Often have to **judge** and **select**
 - Require information **quickly**
- Origins in engineering
 - Concerned with **synthesis**—building complex systems from smaller, simpler components
 - Key part of this process is notion of **abstraction** or hiding of detail

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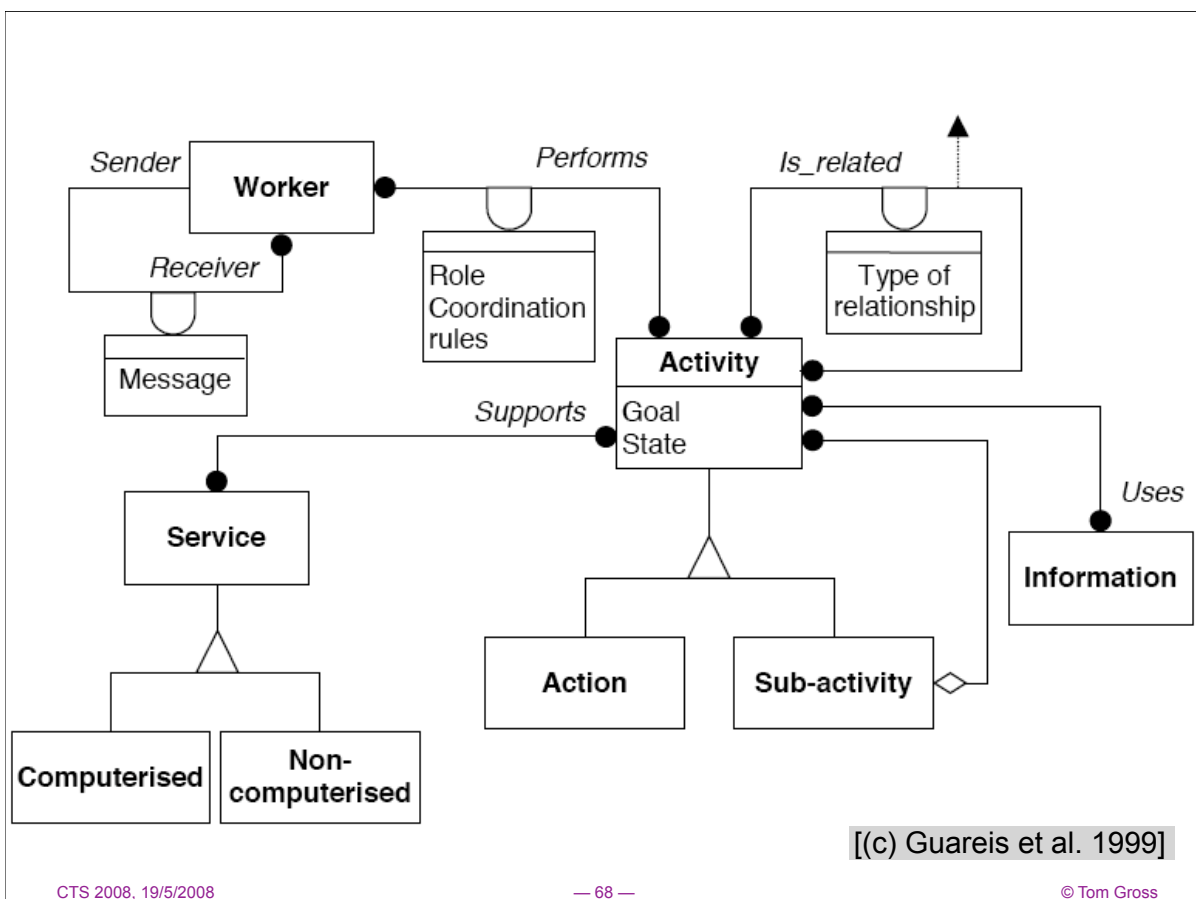
Analysis of Cooperative Environments

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CSCW in a Broader Context and Future Perspective

Frameworks for Design

- Coordination theory
- Activity theory
- Task manager
- Action/interaction theory
- Object-oriented activity support
- Generic framework



Implementation Challenges

- Session management
- Awareness & coupling
- Concurrency control & access control
- Undo/redo
- Collaboration awareness

Session Management (cont'd)

	Explicit		Implicit	
	Initiator	Joiner	Artifact	Locale
Name	Unnamed	Named	Unnamed	Unnamed
Onus on System/User	User	User	System	System
Supports Serendipity	No	No	Yes	Yes
Formality	Formal	Formal	Informal	Informal
Metaphor	Phone call	Yellow pages	Shared document	Co-presence
Requires Shared Artifact	No	No	Yes	No
Requires Shared Locale	No	No	No	Yes

Awareness & Coupling: Timing

Instantly	Audio Video Diff	CAVACAT Active diff
Periodic	Snapshots	Portholes
Explicitly retrieved	Diff Plan	PREP Finger

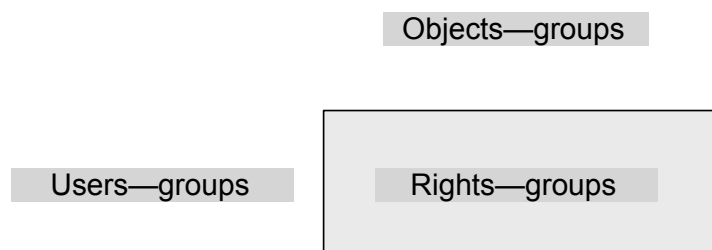
Concurrency Control

- Required to ensure that a **document's state** in a replicated architecture remains **consistent** even when users attempt to modify the document simultaneously in a group editing environment
- **Example** [Prakash 1999]
 - **State S** of document is initially consistent (identical) at various sites
 - 2 users attempt to modify document simultaneously via **operations A and B**
 - If each operation is executed locally first and then broadcast for execution at other sites, operations would be applied in **different orders** at different copies of document, potentially leading to inconsistent states

Concurrency Control—Users' View

- RTCAL
- GROVE
- Collaborative Editing System
- GroupDraw
- Sync
- Floor control
- No control
- Tickle control (each user has the current version of a part of the document)
- Optimistic, selection-based control
- Optimistic transactions

Access Control: Extended Access Matrix



Undo/Redo Challenges

- Individual
 - Recover from self error
 - Single-user commands
 - Explore self alternatives
 - Change own information
- Group
 - Others' errors
 - System errors
 - Collaboration errors (e.g., coupling, access control)
 - Explore group alternatives
 - Modify shared information

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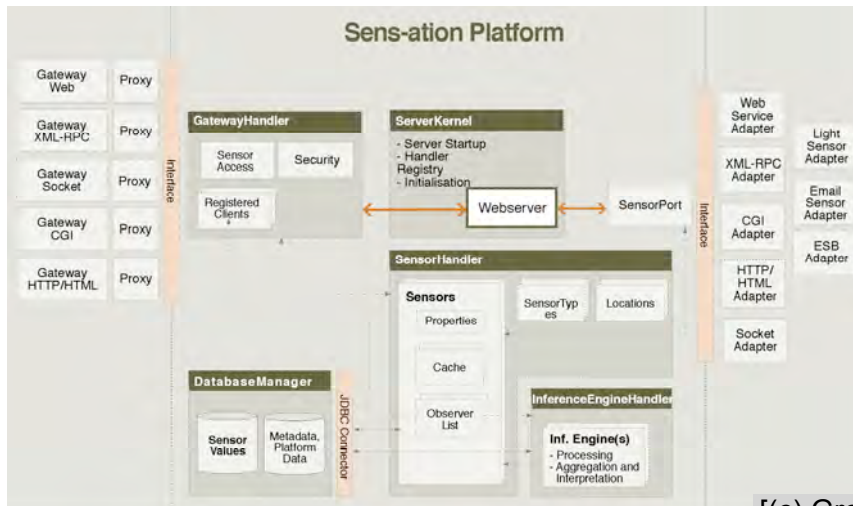
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**CSCW in a Broader Context
and Future Perspective**

Awareness Information Environments

■ Sens-ation

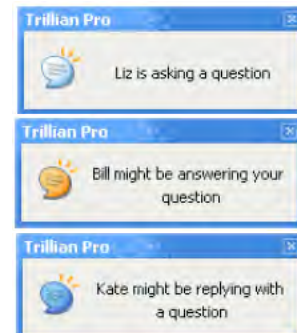


[(c) Gross et al. 2006]

IM—Research Balancing User Responsiveness

■ QnA

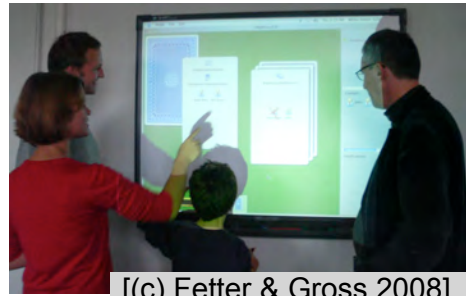
- Help users **identify urgency** of incoming messages
- Based on concept of **adjacency pairs** in conversation (consist of 2 ordered utterances, first and second pair parts, produced by 2 different speakers, with conditional relevance—that is, second pair part is conditionally relevant and expectable)
- Consider incoming IM with **question** as first pair part; incoming IM in **response** to a question as second pair part
- If user does not attend to these IM for a certain period of time, user is **notified** of IM, identity of sender, whether IM is a question/response/both



[(c) Avrahami & Hudson 2004]

PRIMI, PRIMIFaces, and FamilyFaces

- Platform for Research in Instant Messaging (PRIMI)
 - Generic platform for developers of IM systems and infrastructures
 - Text, audio, video communication
 - Sophisticated online states Advanced logging
- PRIMIFaces
 - Faces for the selective information disclosure bridging the gap between mutual awareness and privacy
- FamilyFaces
 - Novel user interaction on large screen wall display allowing families including children and grandparents to manage their shared contacts



[(c) Fetter & Gross 2008]



[(c) research.microsoft.com/sds/whereabouts_clock.aspx]

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