

What is Groupware?

- CSCW: Computer Supported Cooperative Work is a generic term, which combines the understanding of the way people work in groups with the enabling technologies of computer networking, and associated hardware, software, services and techniques.
- Software *specifically* designed
 - ☐ to support group working
 - ☐ with cooperative requirements in mind





CSCW - Groupware

"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

... Groupware ... is software that accentuates the multiple user environment, coordinating and orchestrating things so that users can "see" each other, yet do not conflict with each other."

Baecker (1995)

Why is Groupware design hard?


- Multiple users
- “Virtual” (not physical) presence
- The Network!!



- Some distinguishing features of Groupware:
 - ☐ asynchronous communication
 - ☐ anonymous communication
 - ☐ automatically archive of communication

Classification of Groupware


- Groupware can be classified in several ways:
 - by **where and when** the individual participants perform the cooperative work - summarized in a time/space matrix.



Classification of Groupware

□ by the **structural support function** of the software

- *computer-mediated communication* — where direct communication between participants is supported.
- *meeting and decision support systems* — where common understandings are captured.
- *shared applications and artifacts* — where the participants' interaction with shared work object (the artifacts of work) are supported.



Why is Groupware becoming Important?

- Form groups with common interests
- Better customer service
- Fewer meetings - cut down on travel costs, time and related costs
- Integration of geographically disparate teams
- Leveraging professional expertise
- Facilitate group problem-solving

The Need for CSCW -Groupware

- Much work in HCI focuses on the development of better interfaces between users and computer systems.

- Emphasis has been on the individual user's model of the task, the actual behavior of users, their errors, etc.

- A core problem in HCI has been that the majority of studies to date take as their focus the *individual user* working on a computer system



The Need

- The object of interest is no longer simply human-computer interaction (HCI), but rather human-computer-human-interaction (HCHI).



The Need for CSCW - Groupware

- The focus in CSCW is more on the nature of the work performed, and the role of computers in its support or disruption, than simply on the affordances offered by technologies of "communication".
- There is a greater emphasis on field studies in specific work domains
- Much interest has centered on more qualitative, interpretive, ethnographic studies of work practices in an effort to understand more fully the "artful practices" of ensembles of workers as they accomplish their work activities

The Need for CSCW

CSCW vs. HCI:

- Interaction among people, not between computers and people.
- Simple extensions of single-user applications do not work!
- We have to understand group processes.
- Intuition does not work. We have to understand the working environment



Time/Space Matrix

	same place	different place
same time	face-to-face conversation	telephone
different time	post-it note	letter





The Need for CSCW

CSCW vs. HCI:

- Interaction among people, not between computers and people.
- Simple extensions of single-user applications do not work!
- We have to understand group processes.
- Intuition does not work. We have to understand the working environment



The Time/Space Matrix

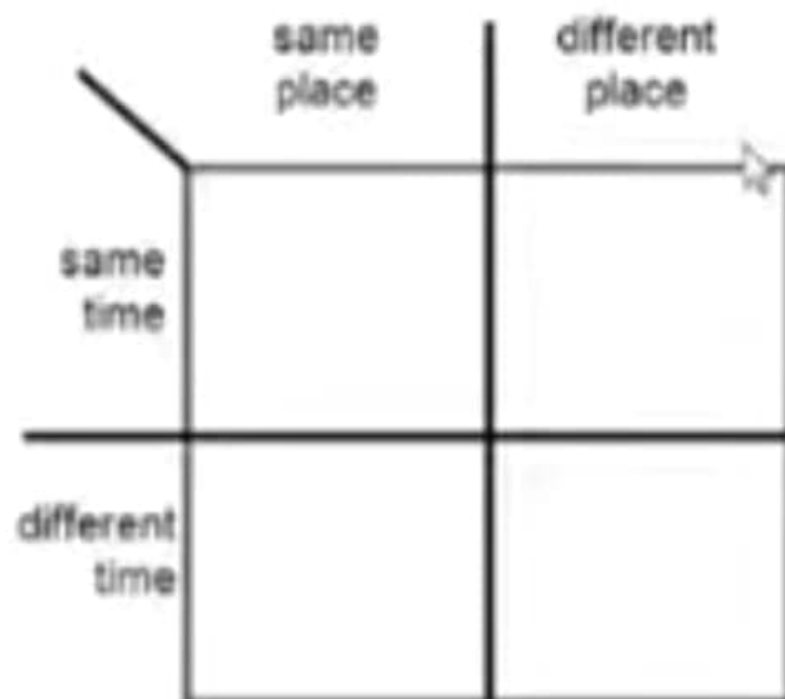
Common names for axes:

time:

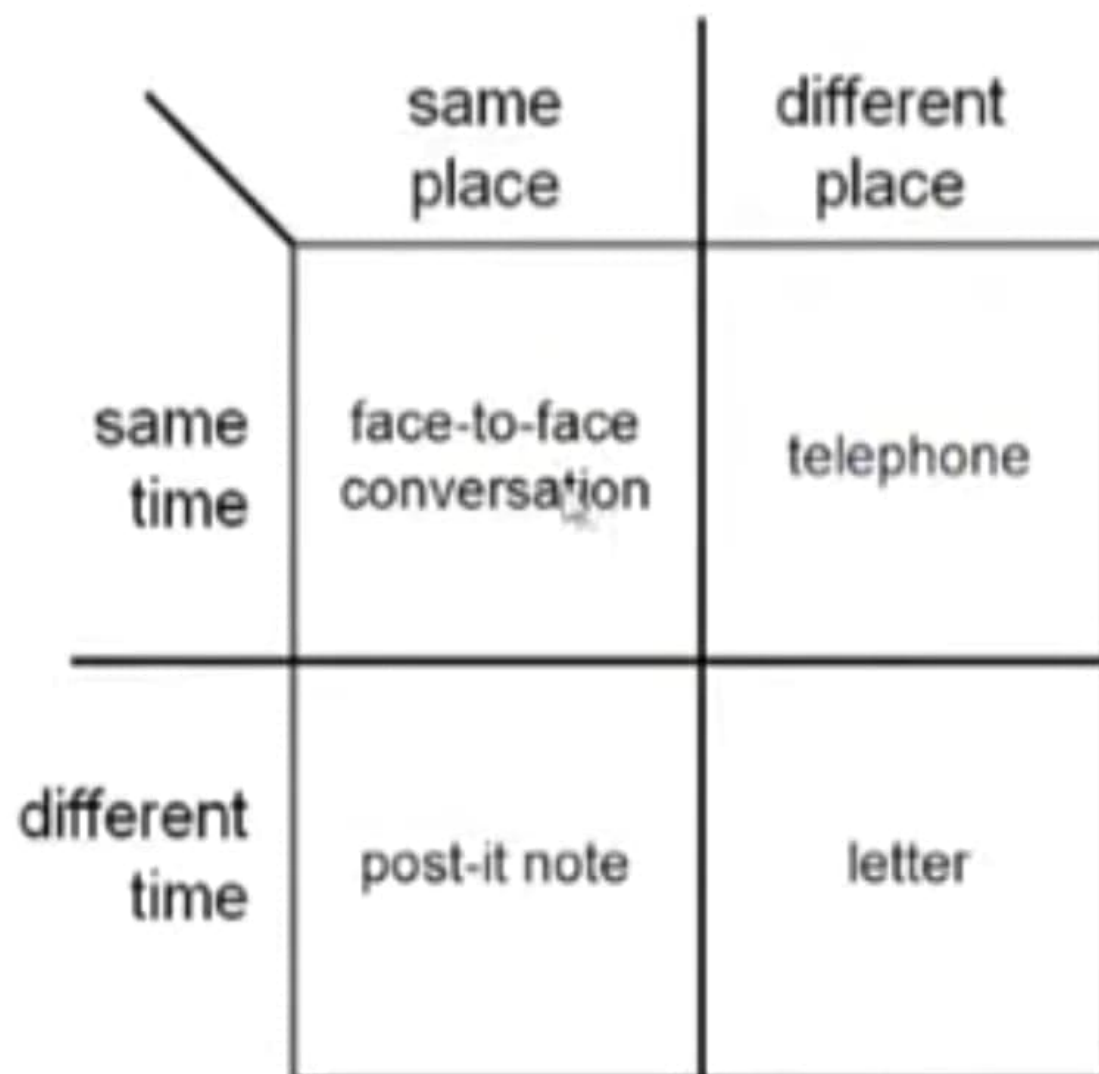
synchronous/asynchronous

place:

co-located/remote



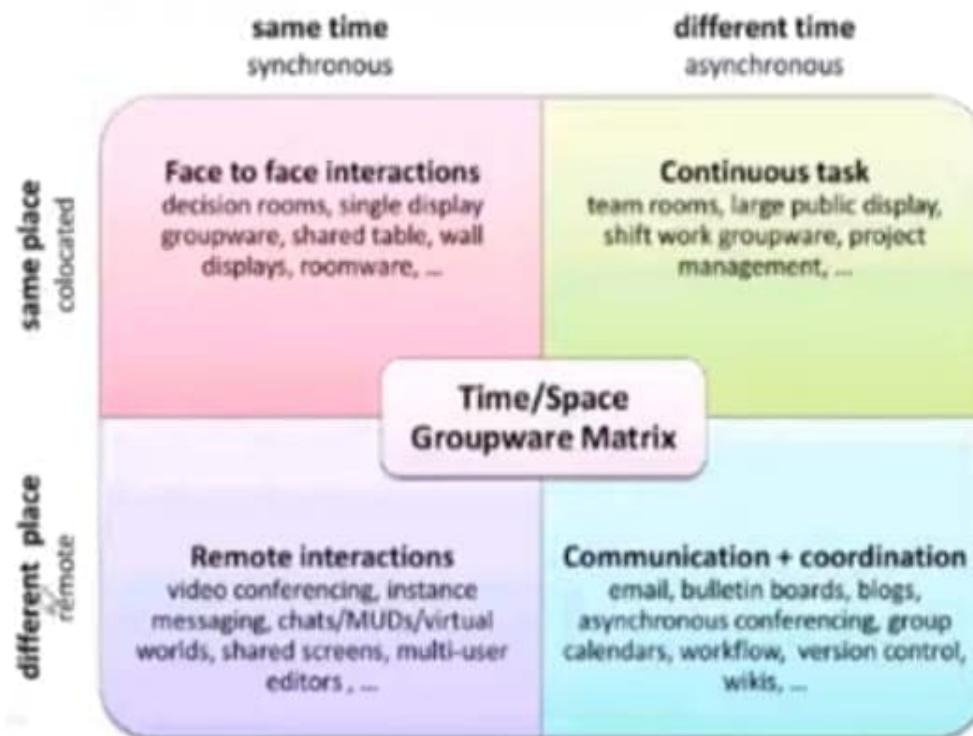
Time/Space Matrix



	same place	different place
same time	face-to-face conversation	telephone
different time	post-it note	letter



Groupware Matrix



18





[1] Different time / different place

Communication + Coordination

- Wiki
- Blogs
- Workflow
- Version Control



- Shared participation over time
- Geographically world wide



Wikis

■ Group-viewable / editable web site

□ community of strangers
to
community of collaborators

□ culture of what is allowed
VS.
hard-coded access control



Email and Bulletin Board



Structured message systems (ctd)

Type: Lecture announcement

To: all students

From: Yasser Fouad --**Moderator**

Subject: Course seminar

Time: 8:10 Thursday

Place: Hall 1

Speaker: students

Title: The HCI

Text: Recent research on HCI constructed meaning has focused on the image of the Computer and its dialectic interpretation within an uncultured hermeneutic. This talk ...

N.B. global structuring by designer
vs. local structuring by participants





Email and bulletin boards

- *asynchronous/remote*
- familiar and most successful groupware
- Recipients of email:
 - direct* in To: field
 - copies* in Cc: field
- delivery identical – difference is social purpose





txt is gr8

- instant messaging
 - 1996 – ICQ small Israeli company

- SMS

- y is it we al lv shrt msgs
- originally a feature of internal management protocol
- short messages (160 chars) and text with numbers
- no-one predicted mass adoption!!
- now phones with cameras for MMS





txt is gr8

- instant messaging
 - 1996 – ICQ small Israeli company

Hi, u there
yeh, had a good night last night?
uhu 😊
want to meet later

- SMS
 - y is it we al lv shrt msgs
 - originally a feature of internal management protocol
 - short messages (160 chars) and text with numbers
 - no-one predicted mass adoption!!
 - now phones with cameras for MMS





Group Calendars

- common calendar
 - meeting scheduling
 - resource use
 - privacy
 - who keeps things up to date?
 - how do you stop people scheduling your meetings?



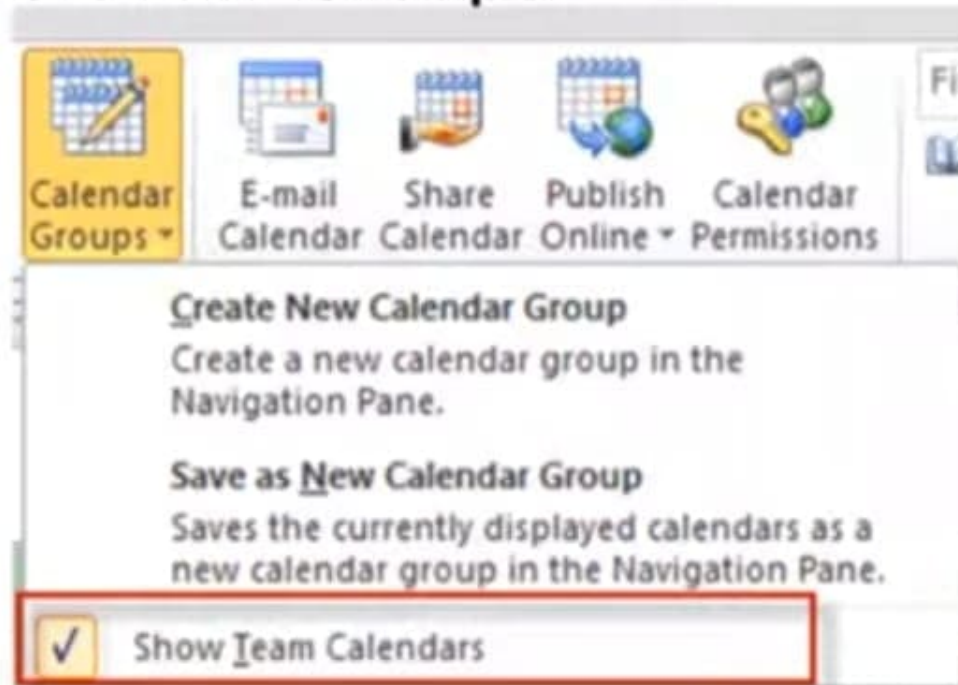
Group Calendars

- common calendar
 - ☐ meeting scheduling
 - ☐ resource use
 - ☐ privacy
 - ☐ who keeps things up to date?
 - ☐ how do you stop people scheduling your meetings?





Calendar Groups





[2] Same time / different place

Remote interaction

- Video-Conferencing,
- Real-time groupware
- Messaging (Instant messaging, Email)
- Virtual worlds
- Multi-User editors
- Shared Screen (vnc)



- Multi-user participation
- Nonverbal cues
- Differing levels of fidelity (text, voice, avatar)



Video / Audio conferencing

■ Desktop conferencing

- ☐ bandwidth/latency issues
- ☐ what is the value of talking heads?





Famous Instant Messengers



Enhancements in same time / different place



Internet Traffic and Number of users Increased!





Rich Instant Messaging

- Can do much more than text
 - How does one handle complexity?
 - How does one handle interruption?





Shared Screens/Windows

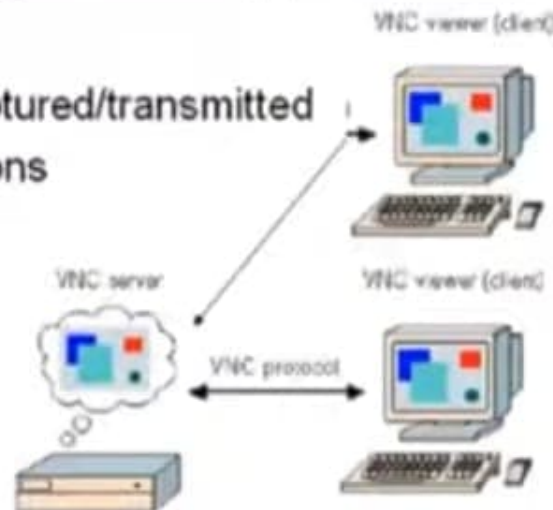
- Share unaltered single user applications

- technical concerns

- how regions are captured/transmitted
 - architectural limitations
 - controlling input
 - access control...

- social limitations

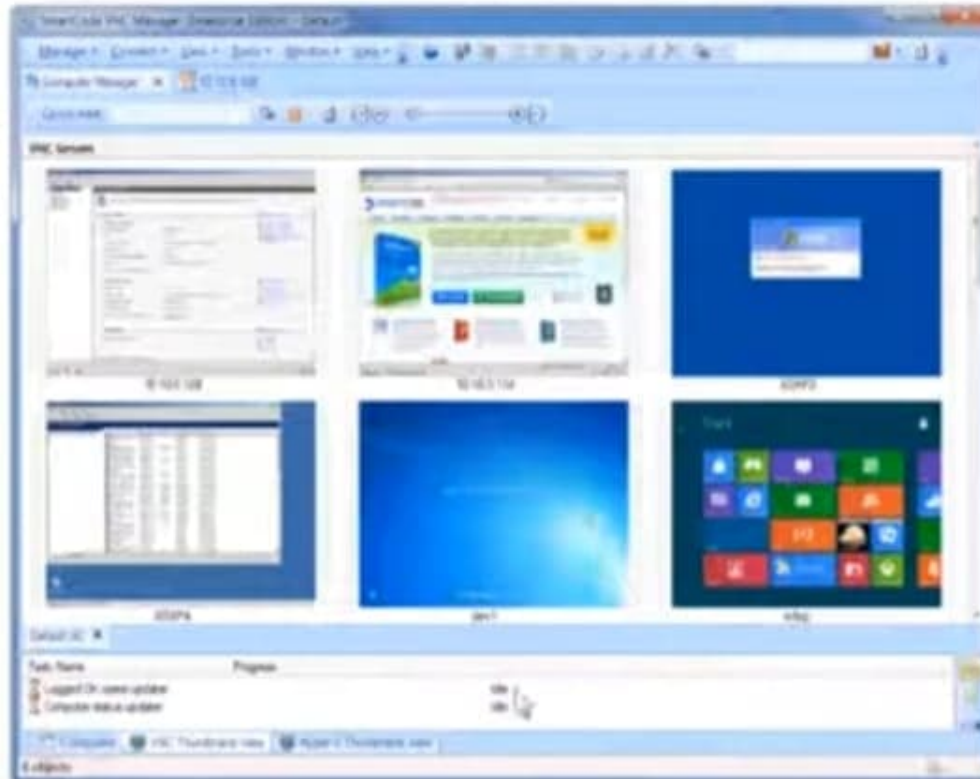
- turntaking
 - control
 - privacy



Richardson, T., Stafford-Fraser, Q., Wood, K. and Hopper, A.
Virtual Network Computing. IEEE Internet Computing, vol. 2, No. 1, p33-39, January/February, 1998. 30



Shared Screens –VNC Manager



31



Multi-user editors

- True groupware for visual artifacts
 - structured documents (e.g., text paper)
 - visual workspace (2d graphics)

- awareness
- conflicting actions
- tight vs loose coupling
- relaxed wysiwi



- synchronous/remote

- Technology:
 - ISDN + video compression
 - internet, web cams
- major uses:
 - video conferences
 - pervasive video for social contact
 - integration with other applications
- often cheaper than face-to-face meetings
 - (telecommunications costs vs. air flights)



- meet others in a virtual world

- ☐ participants represented – embodiment
- ☐ artifacts too ...
 - computer (e.g. spreadsheet) and 'real' (virtually) objects
- ☐ text?
 - consistent orientation or easy to read



- MUDs (Multi-user domains)

- ❑ 2D/3D places to meet on the web
- ❑ users represented as avatars





Example: ideas for different time / same place

Lean Manufacturing:
Visible System Metrics



Machine Number	Next Job Skills	Current Job%	OEE %
1531	75%	72%	
1532	95%	77%	
1572	44%	82%	
1514	15%	93%	
1499	15%	93%	
1527	26%	63%	

Location	Flow Rate	Temperature	PPM Emission
Area 1	245	385	11000
Area 2	385	400	10000
Area 2A	423	360	12500
Area 3	504	275	10000
Area 4	343	320	11500
Area 5	440	330	11000
Area 5A	452	290	10500
Area 5B	352	340	11700
Area 6	476	400	12000
Area 6A	275	275	12000
Area 6B	285	275	13500





[3] same time / same place

With
"PowerPoint
Slides"



Without
"Slides"

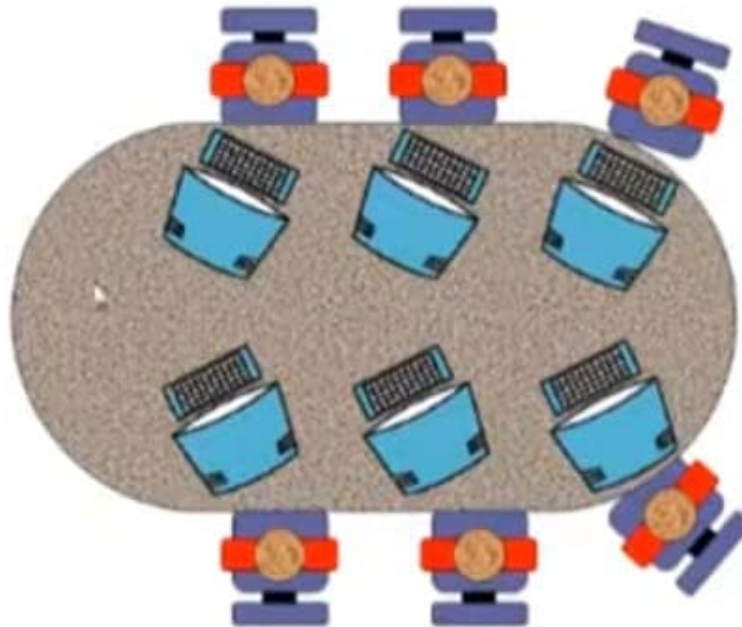


Is PowerPoint
in need of
Groupware
innovation?



Typical meeting room

shared
screen





Group Decision Rooms

- Embeds decision making process
 - dedicated computer-based conference facility
 - real time large group support (5-50)
 - typically facilitated
 - embeds a structured meeting process
 - domain of MIS





Group Decision Rooms

- Typical function
 - ☐ explore unstructured problems
 - ☐ brainstorm ideas
 - ☐ organize/prioritize results
 - ☐ voting...
 - ☐ good for brainstorming.





Single Display Groupware

- Multiple people using a single display

- ☐ multiple input devices
- ☐ simultaneous input
- ☐ new interaction widgets
- ☐ technical issues (O/S)
- ☐ conflict with conventional applications
- ☐ supporting social conventions of simultaneous work
- ☐ mice vs. direct touch...





Shared Table / Wall Displays

- device characteristics
- social affordances of tables/wall



*InteracTable and Dynowall,
From the GMD Darmstadt web site on I-Land*

41





The Time/Space Groupware Matrix

	same time synchronous	different times asynchronous
same place collocated	face to face interactions	continuous task team rooms large public displays shift work groupware project management
different places remote	remote interactions	communication+coordination





Control Rooms

- Information that goes across shifts



Reuters,
http://www.electronics.com/command_and_control.shtml



NASA Mission Control Center
<http://spaceflight.nasa.gov/shuttle/reference/mcc/>





Connected meeting rooms ??

- Meeting / classroom
- Video /
- audio links
- Which type??





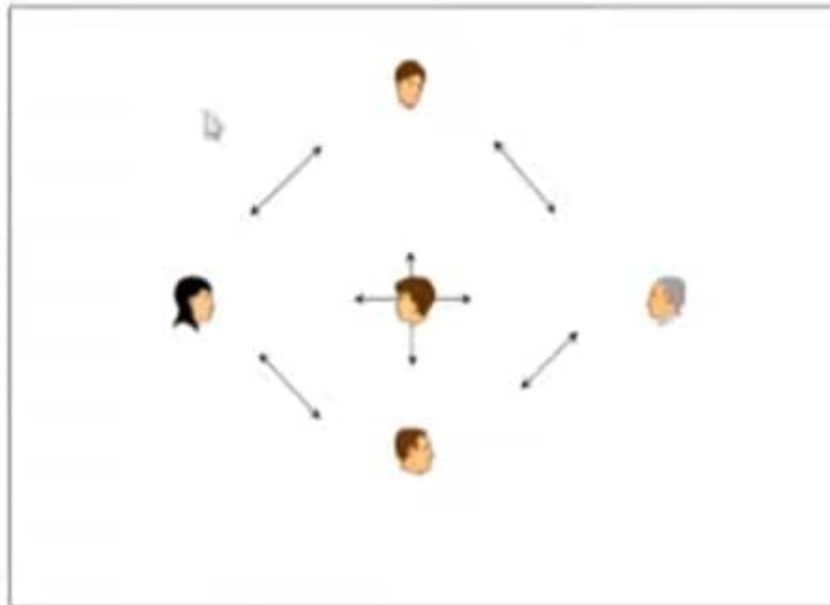
Anytime, any place groupware

same time

different times

same
place

different
places



Teamwave Workplace

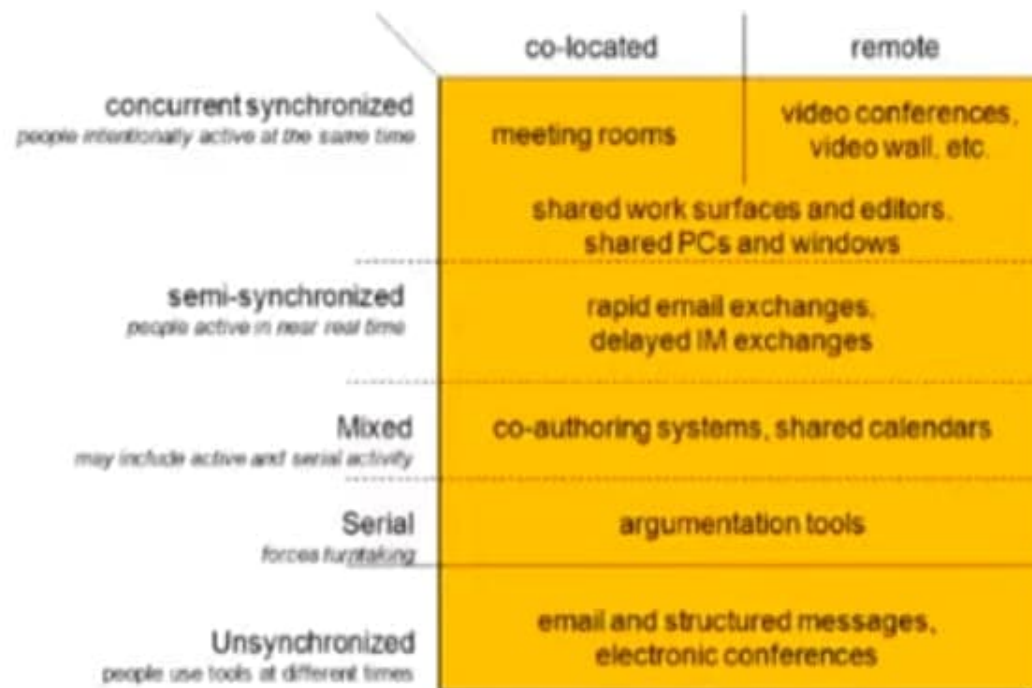


COMSATS VIRTUAL CAMPUS
Institute Of Information Technology





Perspective : Synchronicity



47

Modified from Figure 13.5 in Cox, Foray, Abbott & Davis, Human Computer Interaction, 2nd Ed. Prentice Hall, 1999





Extended matrix for CSCW

From Grudin, 1994

		Time		
		Same	Different but predictable	Different and unpredictable
Place	Same	Meeting facilitation	Work shifts	Team rooms
	Different but predictable	Tele/video/desktop conferencing	Electronic mail	Collaborative writing
	Different and unpredictable	Interactive multicast seminars	Computer bulletin boards	Workflow





Applying CSCW to Education

- Virtual Classroom is an environment to facilitate collaborative learning for distance education students.
- Constant communication with other learners is obvious.
- Virtual Classroom is expected to exceed the traditional classroom in its ability to 'connect' students and course materials.





COMSATS VIRTUAL CAMPUS
Institute Of Information Technology

implementing groupware

feedback and network delays
architectures for groupware
feedthrough and network traffic
toolkits, robustness and scaling





Types of architecture

centralised – single copy of application and data

- ☐ client-server – simplest case
 - N.B. opposite of X windows client/server
- ☐ master-slave special case of client-server
 - N.B. server merged with one client

replicated – copy on each workstation

- ☐ also called peer-peer
- ☐ + local feedback
- ☐ race conditions

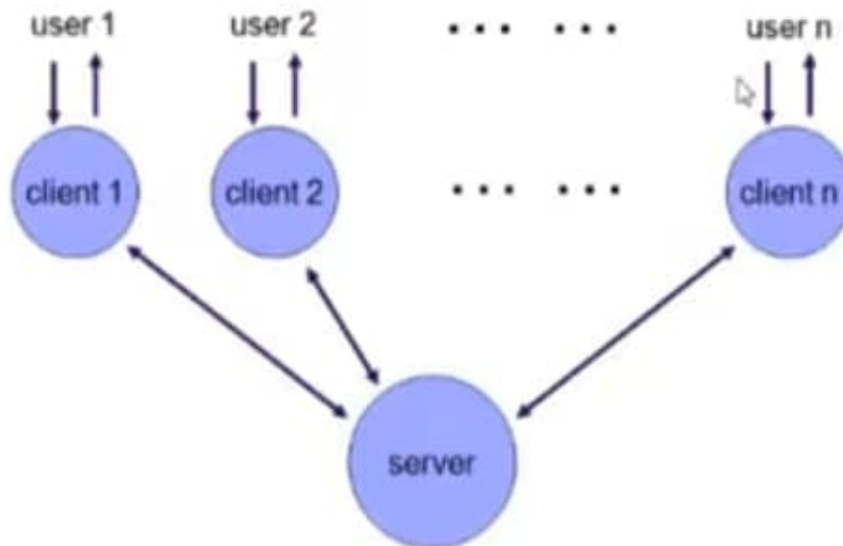
Often 'half way' architectures:

- ☐ local copy of application + central database
- ☐ local cache of data for feedback
- ☐ some hidden locking





Client-server architecture





Shared window architecture

- Non-collaboration aware applications
⇒ *client/server* approach
corresponding feedback problems
- no 'functionality' – in the groupware
but must handle *floor control*

example: shared X

- single copy of real application
- *user stub* for each user acts as an X application (X client)
- one *application stub* acts like X server for real application
- *user stub* passes events to single *application stub*
- stubs merge X events coming in
and replicate X lib calls going out (strictly protocol)





Feedthrough & traffic

- Need to inform all other clients of changes
- Few networks support broadcast messages, so ...
n participants \Rightarrow n-1 network messages!
- Solution: increase granularity
 - reduce frequency of feedback
 - but ...
poor feedthrough \Rightarrow loss of shared context
- Trade-off: timeliness vs. network traffic





Graphical toolkits

Designed for single user interaction

Problems for groupware include

- pre-emptive widgets
(e.g., pop-up menus)
- over-packaged text
(single cursor, poor view control)

notification-based toolkits with callbacks help (chap. 8)





Robustness and scaleability

crash in single-user interface – one sad user

crash in groupware – disaster !

but ...

- ☐ groupware complex: networks, graphics etc.
- ☐ scaling up to large numbers of users?
- ☐ testing and debugging – hard!





... some tips ...

- network or server fails – standard solutions
- client fails – three 'R's for server:
 - **robust** – server should survive client crash
 - **reconfigure** – detect and respond to failure
 - **resynchronise** – catch up when client restarts
- errors in programming
 - defensive programming
 - simple algorithms
 - formal methods
- unforeseen sequences of events
 - *deadlock* – never use blocking I/O
 - never assume particular orders
 - network packet ≠ logical message





scaling and testing

■ scaling up

- robustness \Rightarrow simple algorithms
... but don't scale well – need to evolve
- good software architecture helps
- document fixed-size assumptions
- know operating system limits (e.g. open files)

■ testing for robustness

- take off the kid gloves ... mistreat it
- reboot, pull out network cable, random input
- create a rogue client, simulate high loads
- and when you think it is perfect
... give it to some computing students to test

