

Multimedia Collaboration and Application Sharing

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June 5, 2008

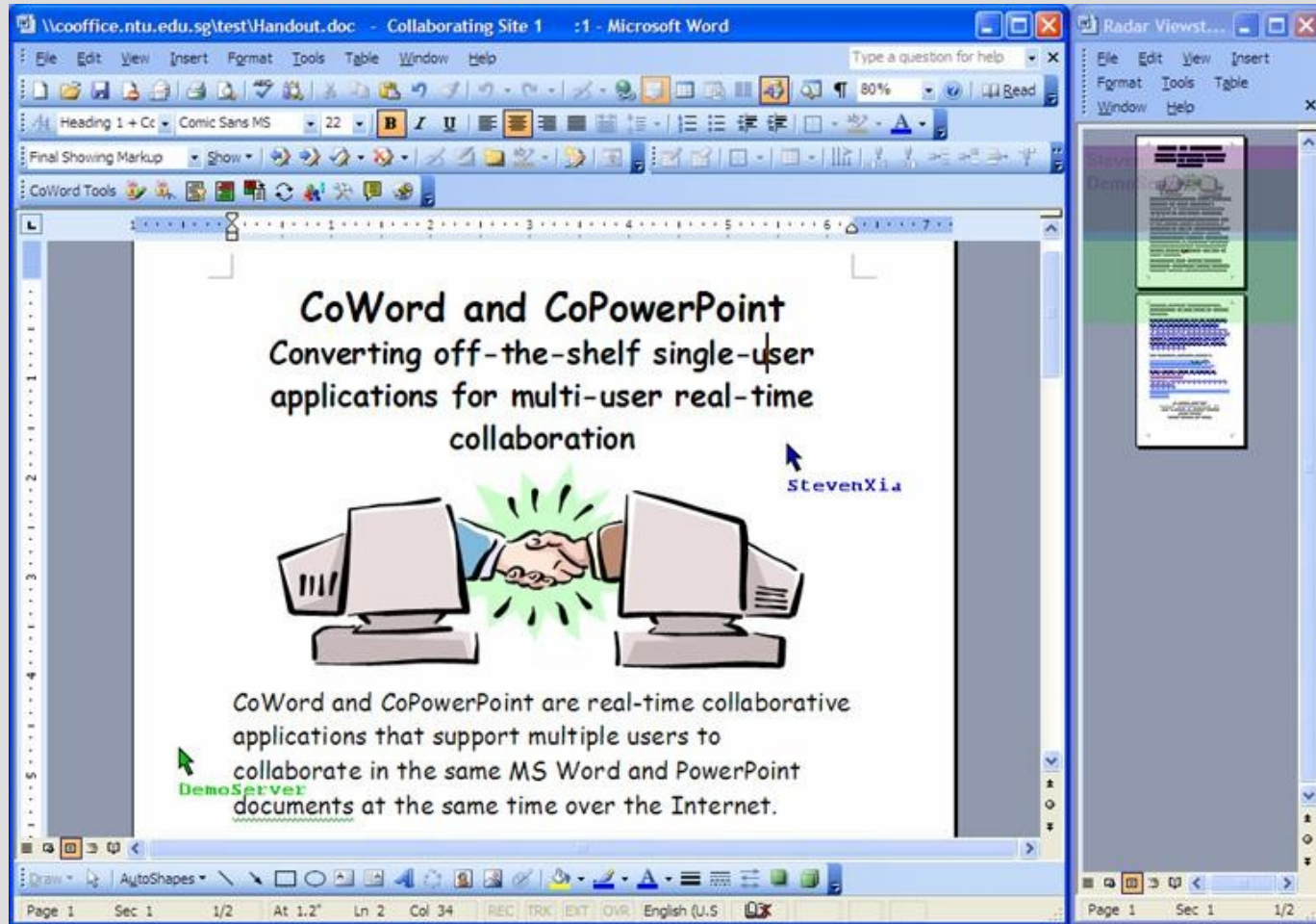
Outline

- Introduction
- Taxonomy of sharing systems
- Collaboration-aware systems
- Collaboration-transparent systems
- Collaboratories

Introduction


- Application sharing
 - Real-time concurrent event
 - Two or more participants
 - Working on the same document/drawing/..

Introduction



The screenshot displays a Microsoft Word application window titled "Collaborating Site 1 :1 - Microsoft Word". The main document area shows a presentation slide with the following content:

CoWord and CoPowerPoint
Converting off-the-shelf single-user applications for multi-user real-time collaboration



CoWord and CoPowerPoint are real-time collaborative applications that support multiple users to collaborate in the same MS Word and PowerPoint documents at the same time over the Internet.

The slide also features a green "DemoServer" logo and a signature "StevenXia" with a mouse cursor pointing to it. The Word interface includes a standard menu bar, a toolbar, and a status bar at the bottom showing "Page 1", "Sec 1", "1/2", "At 1.2\"", "Ln 2", "Col 34", "REC", "TRK", "EXT", "OVR", "English (U.S.)", and a small icon.

To the right of the main window, a "Radar Viewst..." window is partially visible, showing a list of documents or slides.

Introduction

Microsoft Excel - Classeur1

Income for Q4 2006

	Sept.	Oct.	Nov.	Dec.
Income	50	59	45	78

Income for Q4 2006

Since : 0 hours 33 minutes Connected to : Shiny Network usage: [green bar]

Introduction



Introduction

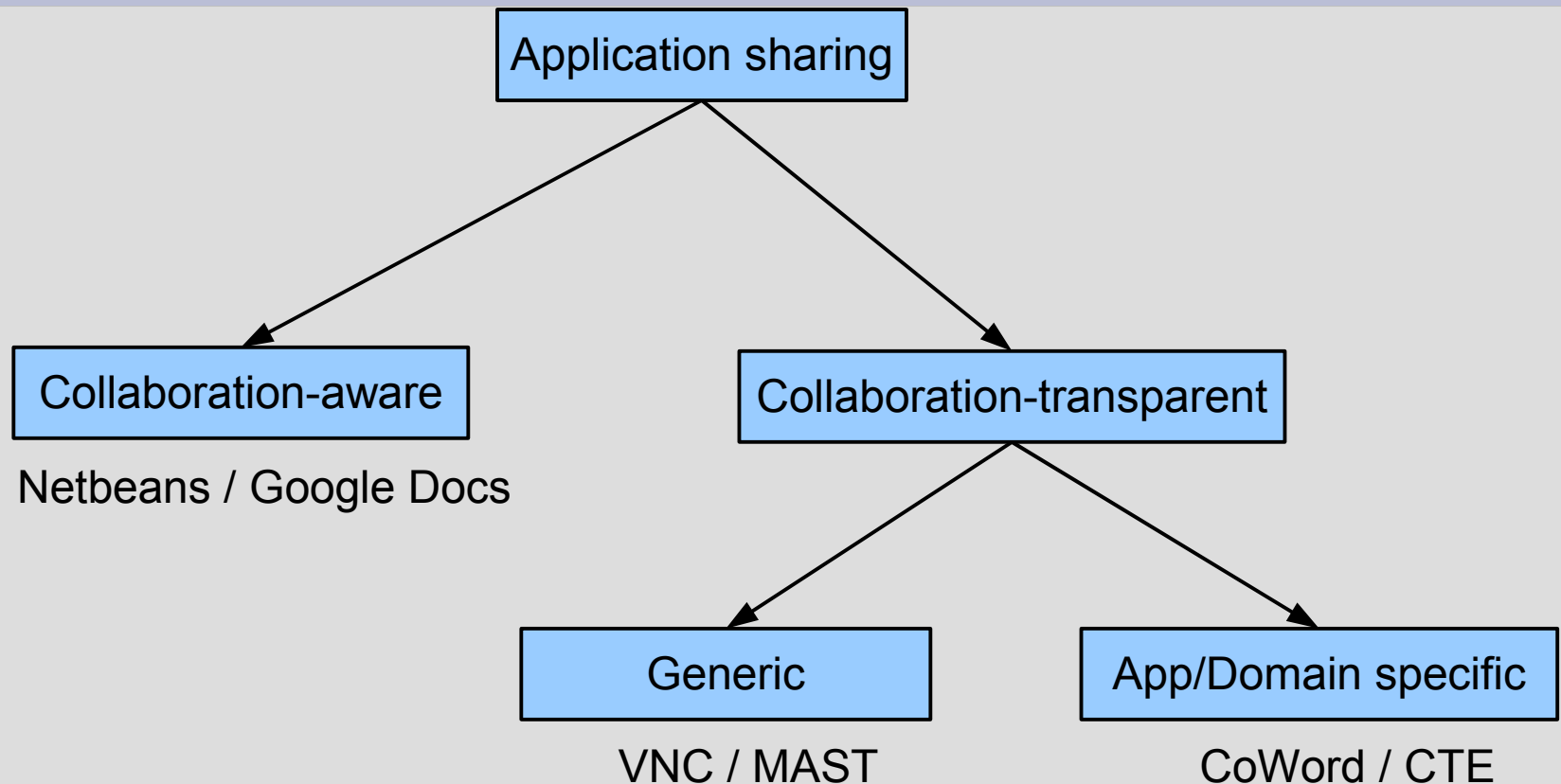


Introduction

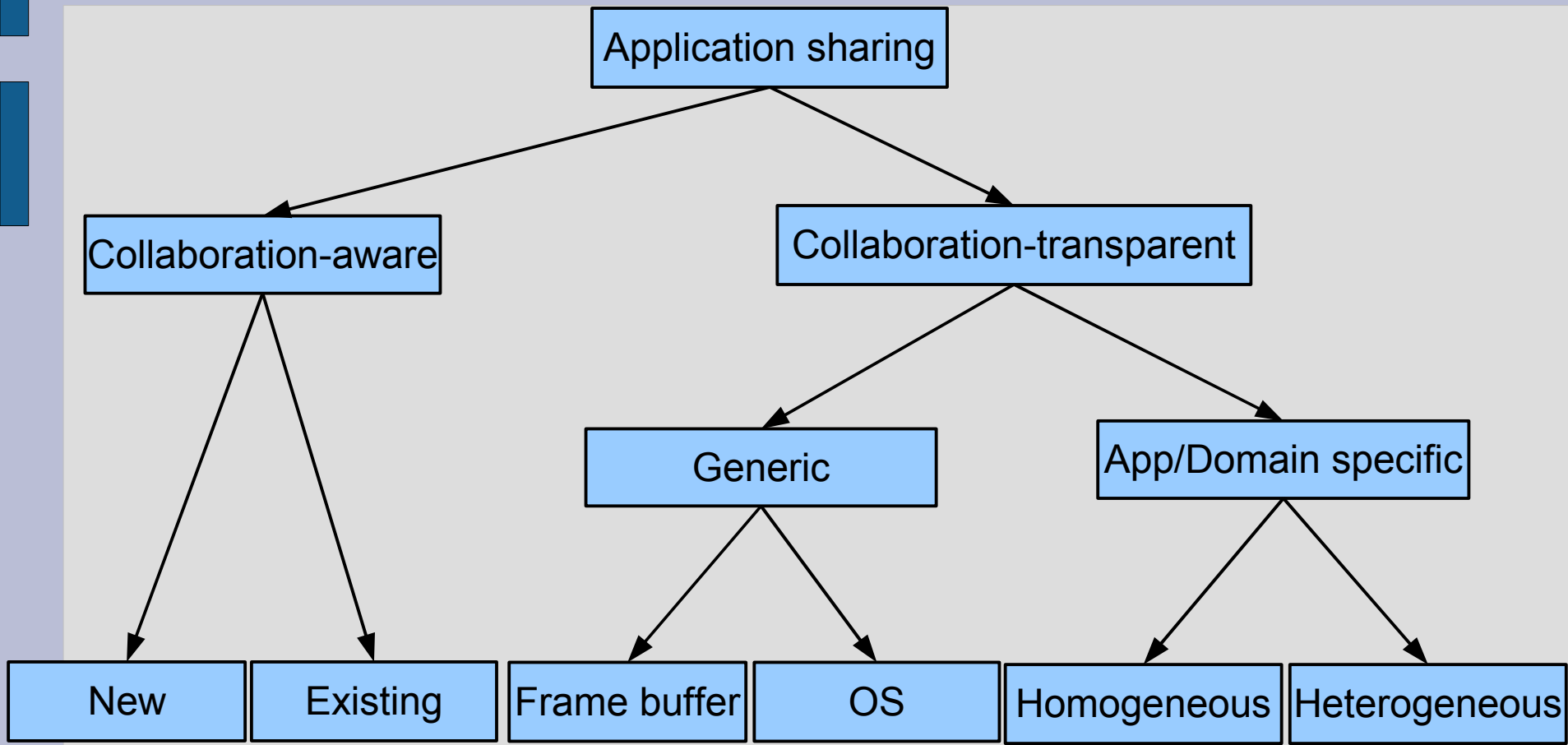
Challenges and features

- Applicability
 - Generic (support all applications)
 - Specific (per application or per domain)
- Scalability
 - Unicast
 - Multicast
- Clients
 - Thin-client
 - Fat-client
- Concurrency and consistency
 - Sequential work
 - Concurrent work

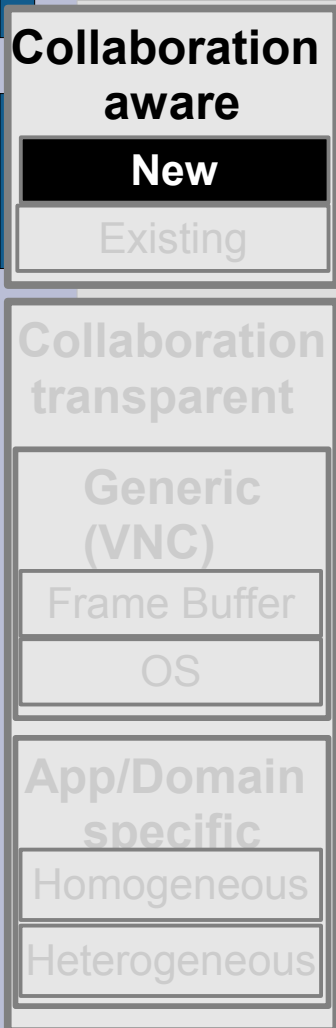
Application sharing models



Application sharing models



Collaboration-aware models



- New
 - Google Docs
 - **Draw-Together**
 - **Collaborative distance learning**
- Existing
 - Microsoft Office
 - Netbeans IDE
 - **N-ABLE**
 - **Collaborative CAD**

Collaboration-aware models (New)

- Draw-together

Collaboration aware

New

Existing

Collaboration transparent

Generic (VNC)

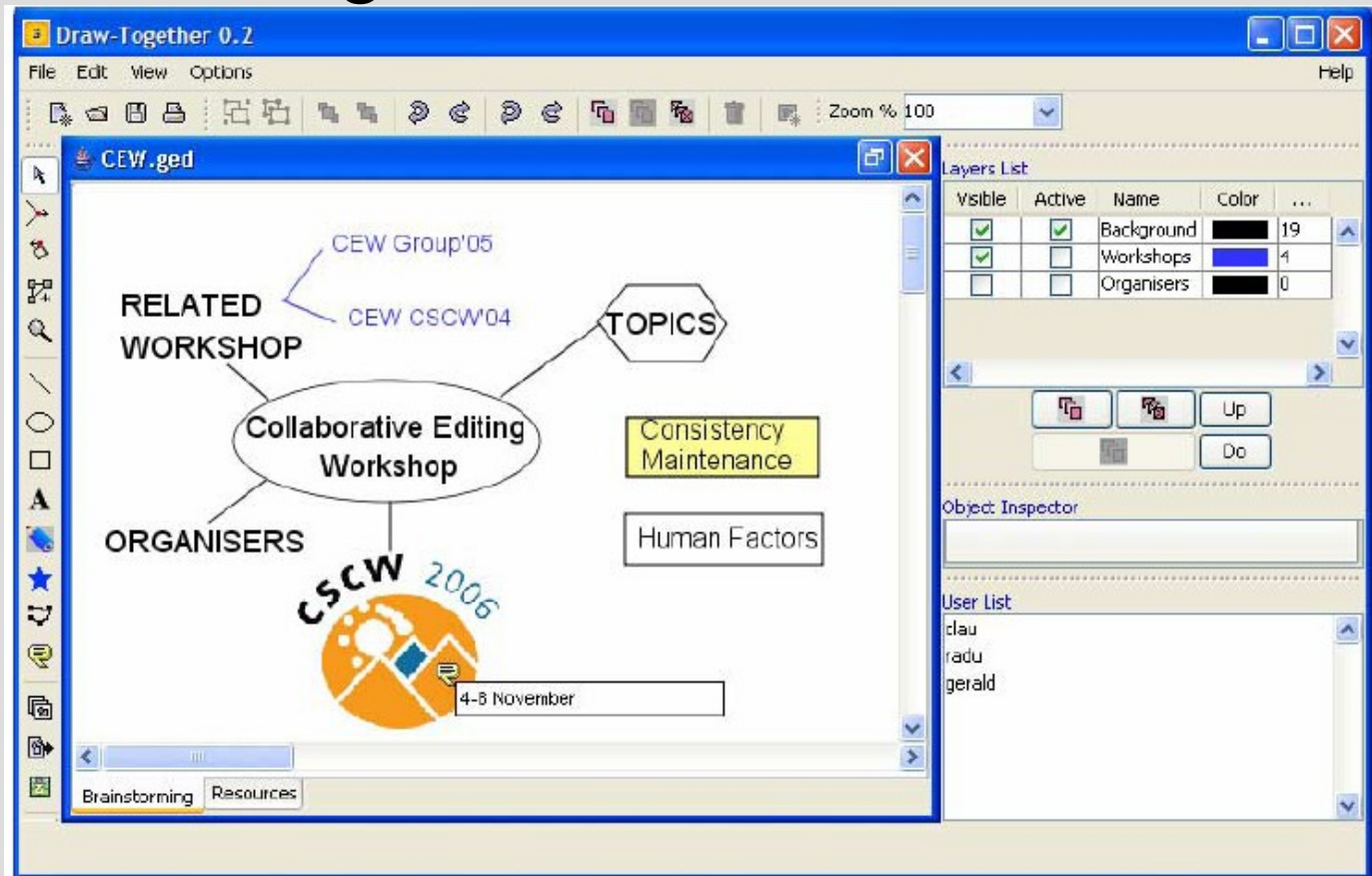
Frame Buffer

OS

App/Domain specific

Homogeneous

Heterogeneous



Draw-Together application

Collaboration-aware models (New)

Collaboration aware

New

Existing

Collaboration transparent

Generic (VNC)

Frame Buffer

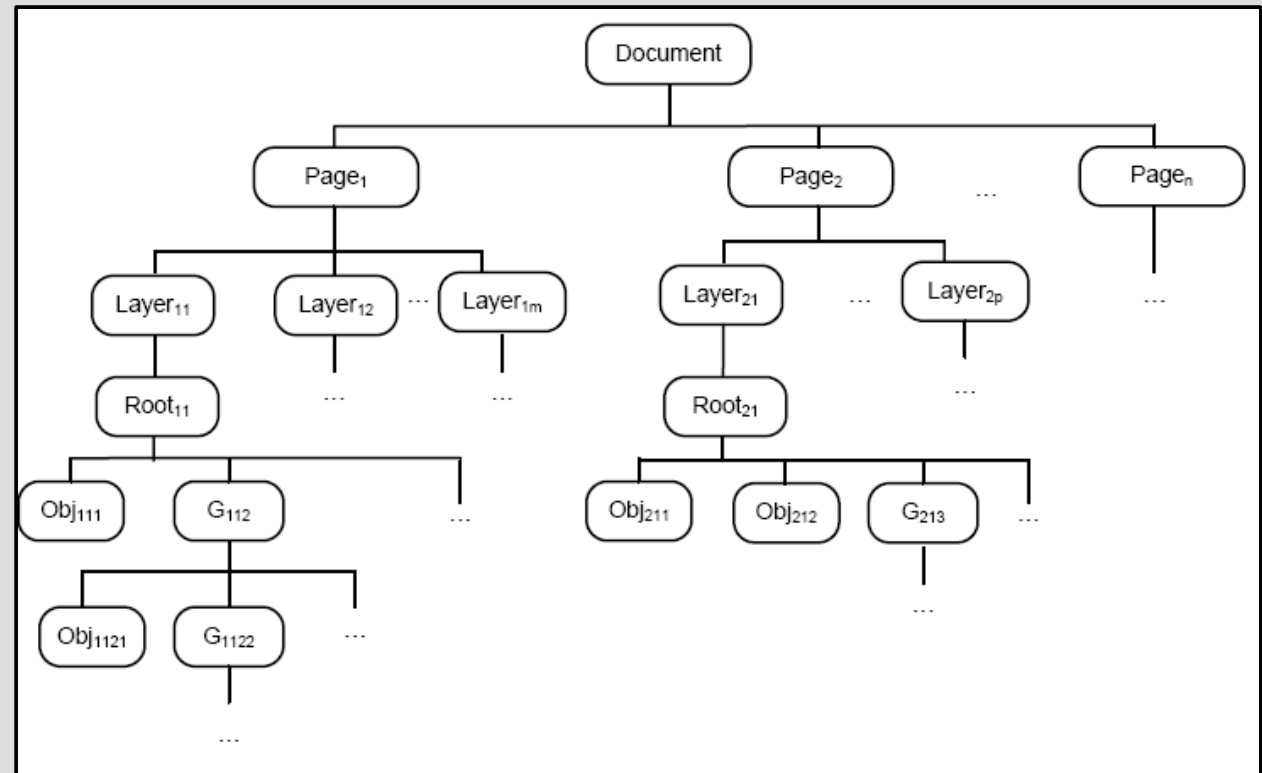
OS

App/Domain specific

Homogeneous

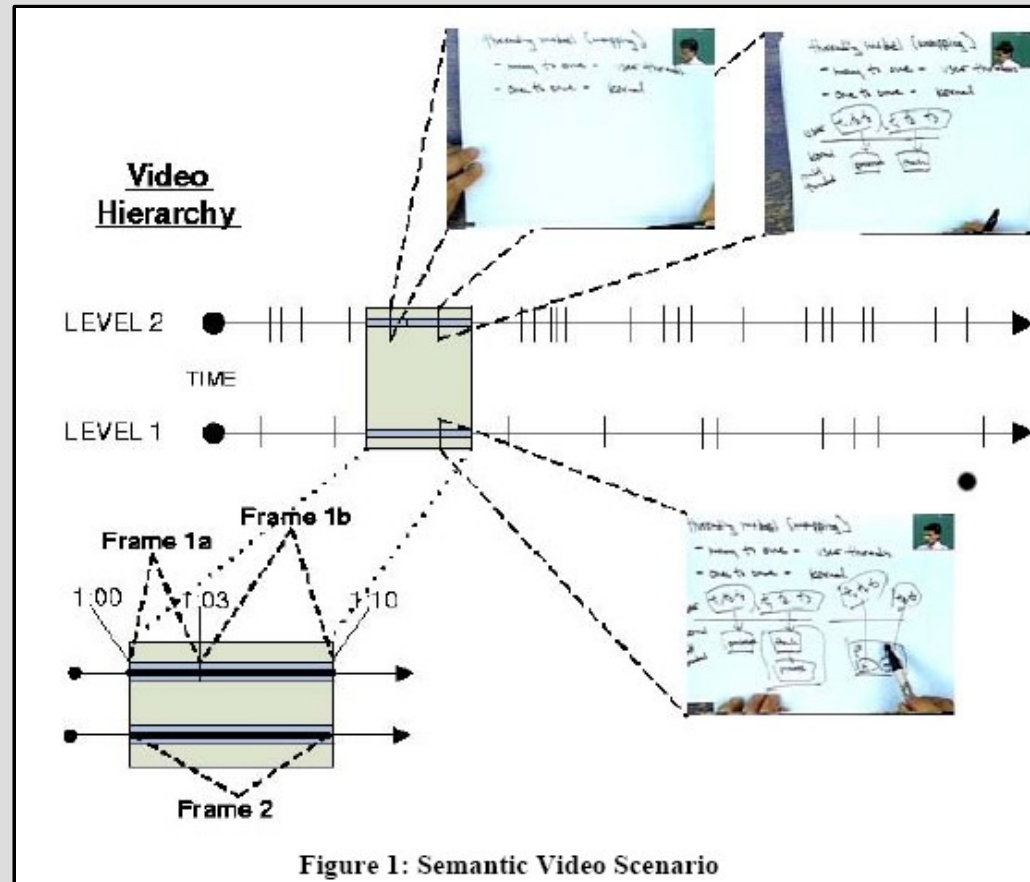
Heterogeneous

- Draw-together
 - Fine granularity locking
 - Concurrent work



Collaboration-aware models (New)

- Collaborative distance learning
 - Different bandwidth clients



Collaboration-aware models (Exist)

Collaboration aware

New

Existing

Collaboration transparent

Generic (VNC)

Frame Buffer

OS

App/Domain specific

Homogeneous

Heterogeneous

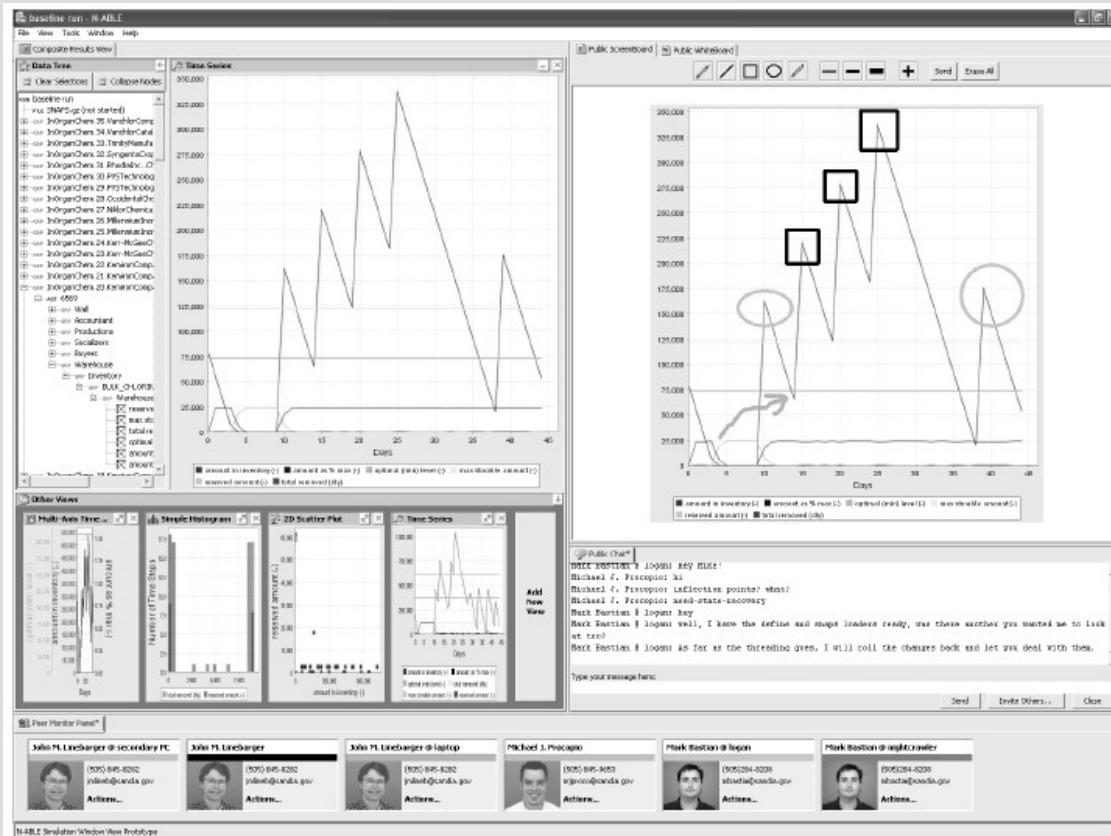
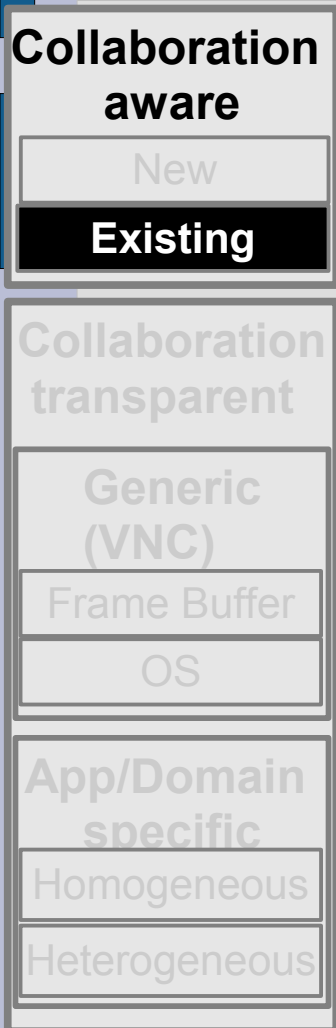


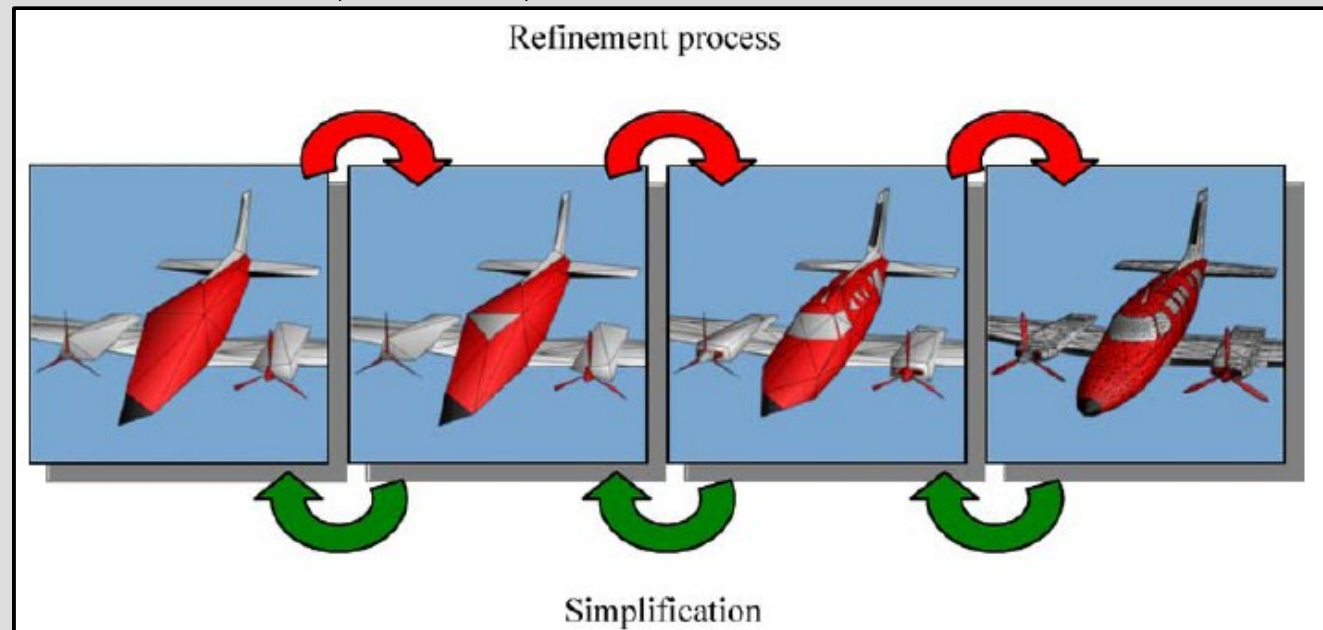
Figure 2: N-ABLE™ snapshot with collaboration enabled, showing peer awareness, group chat, and screenboard

common mental model for problem and solution

Collaboration-aware models (Exist)

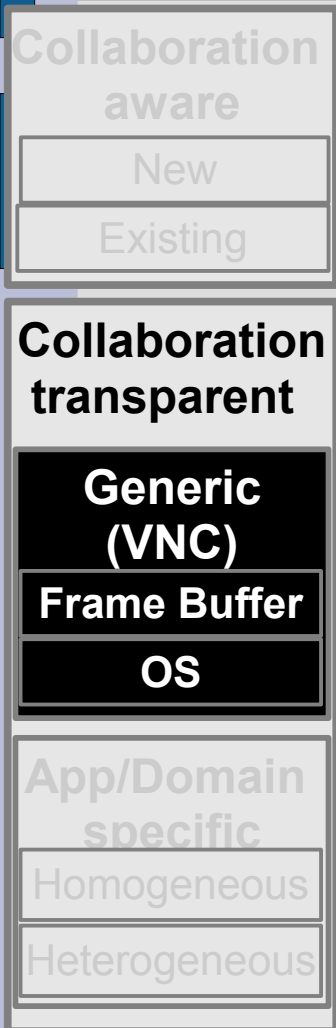


- “3D streaming”
 - VRML, X3D, STEP

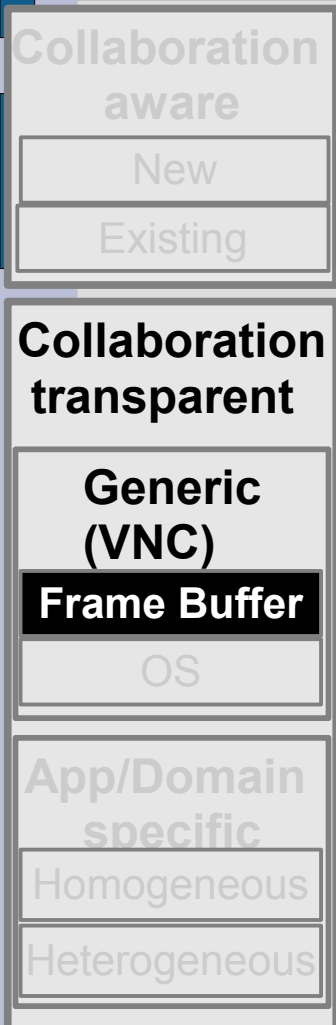


Thin server + strong client
Strong server + thin client
Peer-to-peer

Collaboration-transparent models

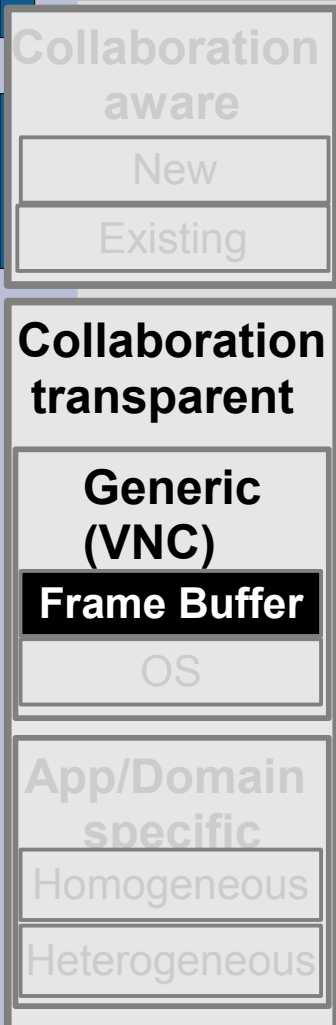


Frame Buffer based models



- VNC
- RDP
- THINC
- Distributed Workspace
- TTT: Tele-teaching Tool
- SharedAppVNC
- MAST: Multicast App Sharing Tool

Frame Buffer based models



- Low level commands (pixel updates)
- Very-thin client
- Can be inefficient
- Compression is a must
- Generic (Collaboration-transparent)
- Mostly sequential access to K&M

Frame Buffer based models

- SharedAppVNC
 - Modified VNC protocol, multiple cursors



Figure 3: Shared Display Wall deployed in the NSTX control room of Princeton Plasma Physics Lab. Tens of data plots from multiple scientists are shown on the shared display. A camera shot of the plasma and also a log are also shown on the left.

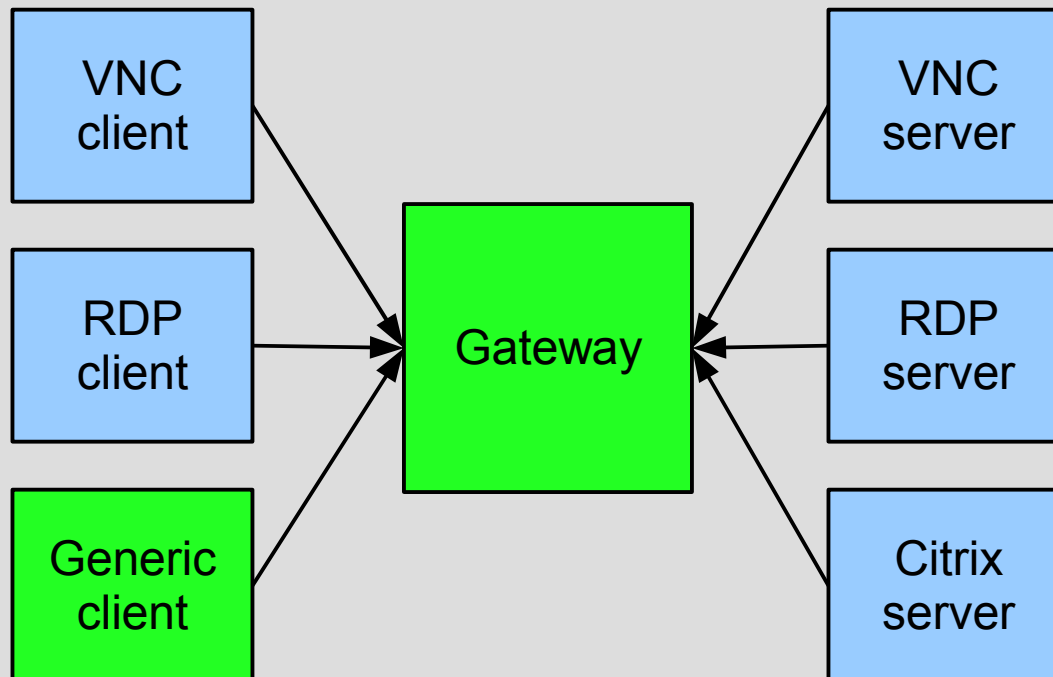
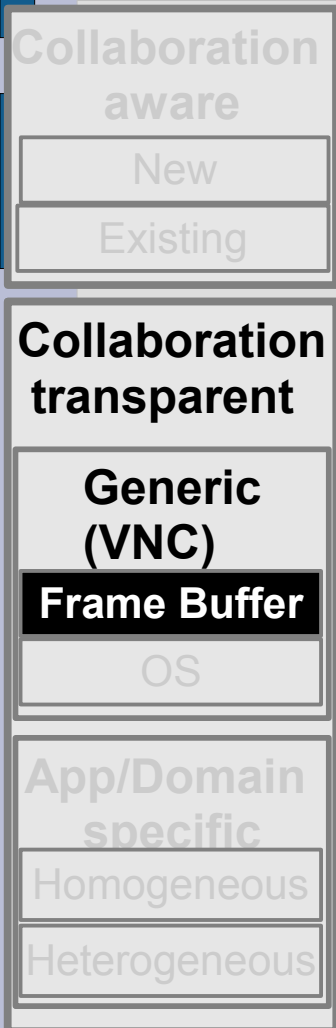
Collaboration aware
New
Existing
Collaboration transparent
Generic (VNC)
Frame Buffer
OS
App/Domain specific
Homogeneous
Heterogeneous

Frame Buffer based models

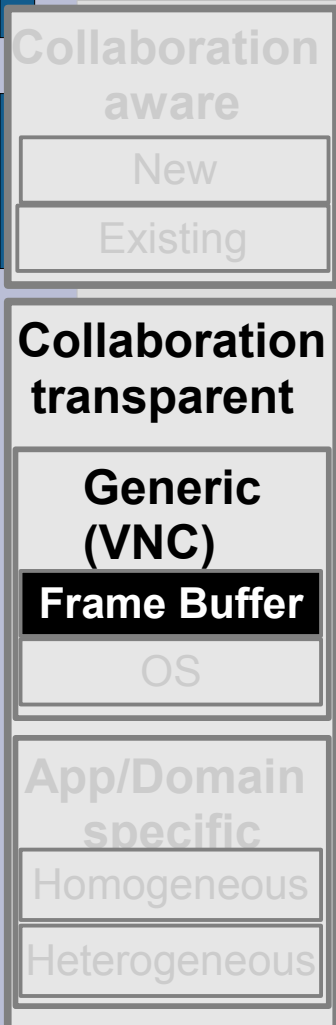
System	Pull / Push	Technique	Multicast	App Sharing	Movies
VNC	Pull	Mirror Driver		Region	
TTT: TeleTeachingTool(VNC)	Pull + Push	Mirror Driver		Region	
SharedAppVNC	Pull	Polling		Region	
MAST	Push	Polling		Region	
RDP	Push	Mirror Driver			High B/W
THINC	Push	Mirror Driver			High B/W
Distributed Workspace	Push	Mirror Driver			High B/W

Interesting Work

- A generic application sharing architecture based on message-oriented middleware platform

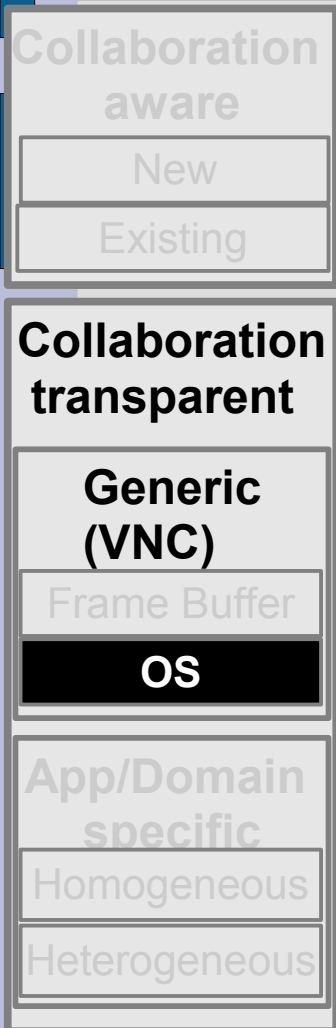


Survey paper

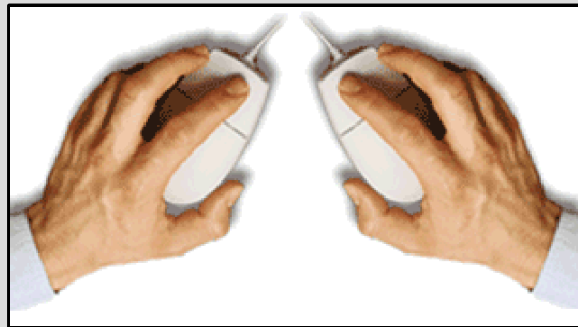


- On the performance of wide-area thin-client computing
 - Optimize latency versus bandwidth
 - Minimize synchronization b/w client/server
 - Use simpler display encoding primitives
 - Compress display updates
 - Push display updates eagerly
 - Optimize transport protocol

OS level models

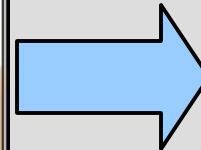


- MPX (Multi-pointer X)

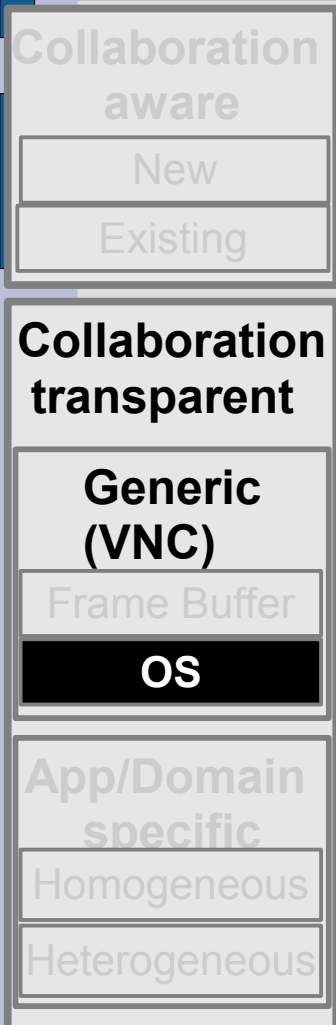


Single PC
Multiple I/O

- MultiPoint for education (MS Research)

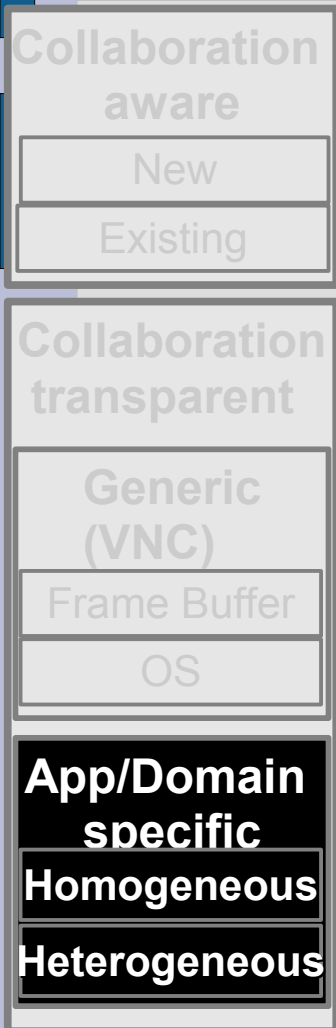


OS level models

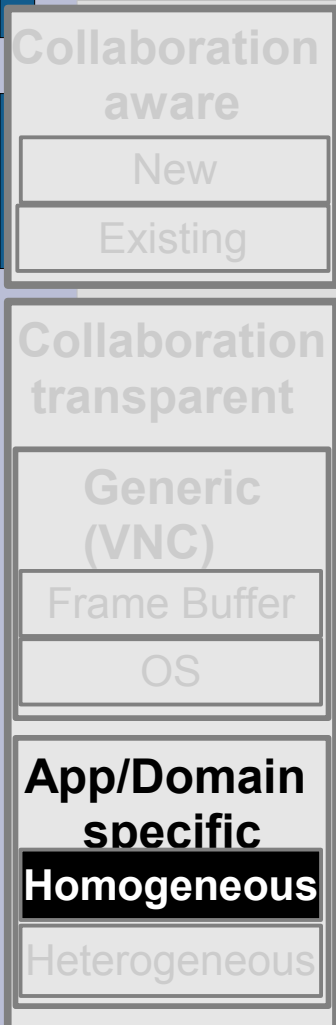


- X-Multiplexors
 - CCFX(98), XMX(93)
 - Heterogeneous X-Servers
 - Byte-orders
 - Pixel format and depth
 - Late connection problem

Collaboration-transparent models



Collaboration-transparent (Homogeneous)



- **CoWord**

- Concurrent work
- High engineering cost
- Independent view
- All participants require MS Word
- Efficient
- Based on Word's API

Collaboration-transparent (Homo)

- CoWord

Collaboration aware

New

Existing

Collaboration transparent

Generic (VNC)

Frame Buffer

OS

App/Domain specific

Homogeneous

Heterogeneous

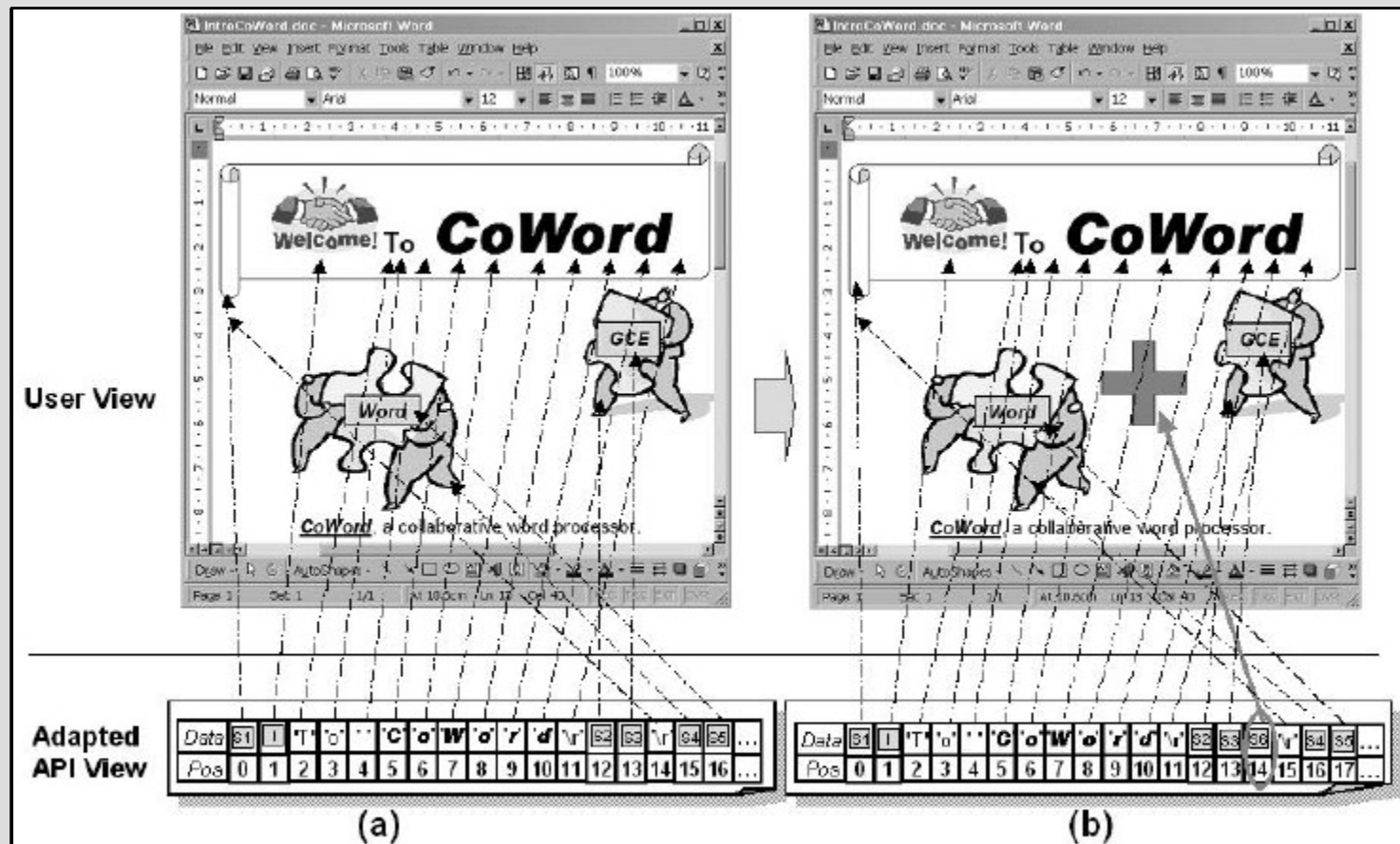
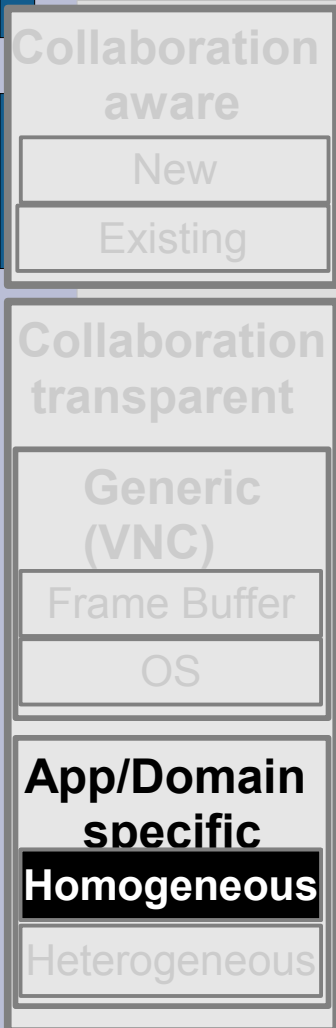


Figure 1: The user's view and the adapted API's view of a Word document.

Collaboration-transparent (Homogeneous)



• CoWord

Problems

- Does not support all MS Word features
- Depends on MS Word API
- Does not support MS Word 2007

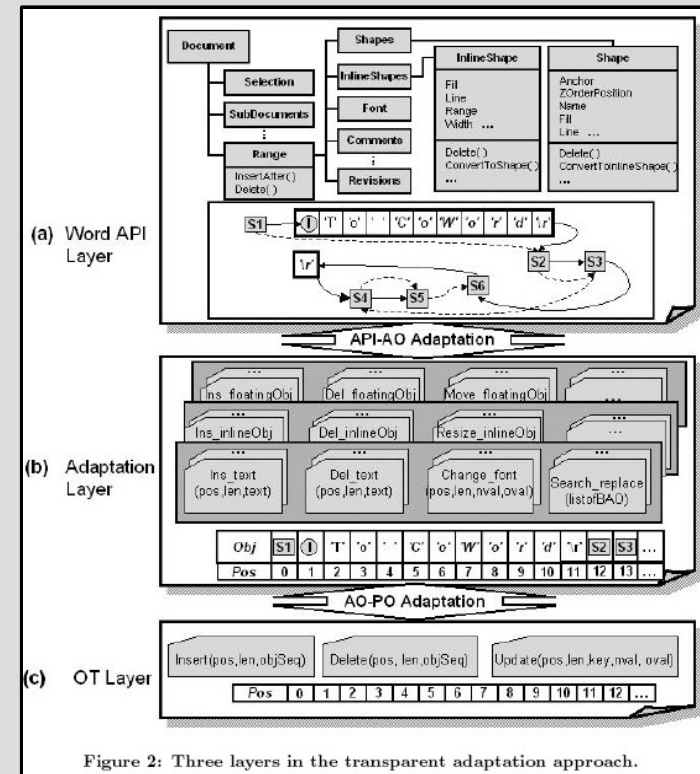


Figure 2: Three layers in the transparent adaptation approach.

Collaboration-transparent (Heterogeneous)

- Li, D. and Lu, J. 2006. **A lightweight approach to transparent sharing of familiar single-user editors.**

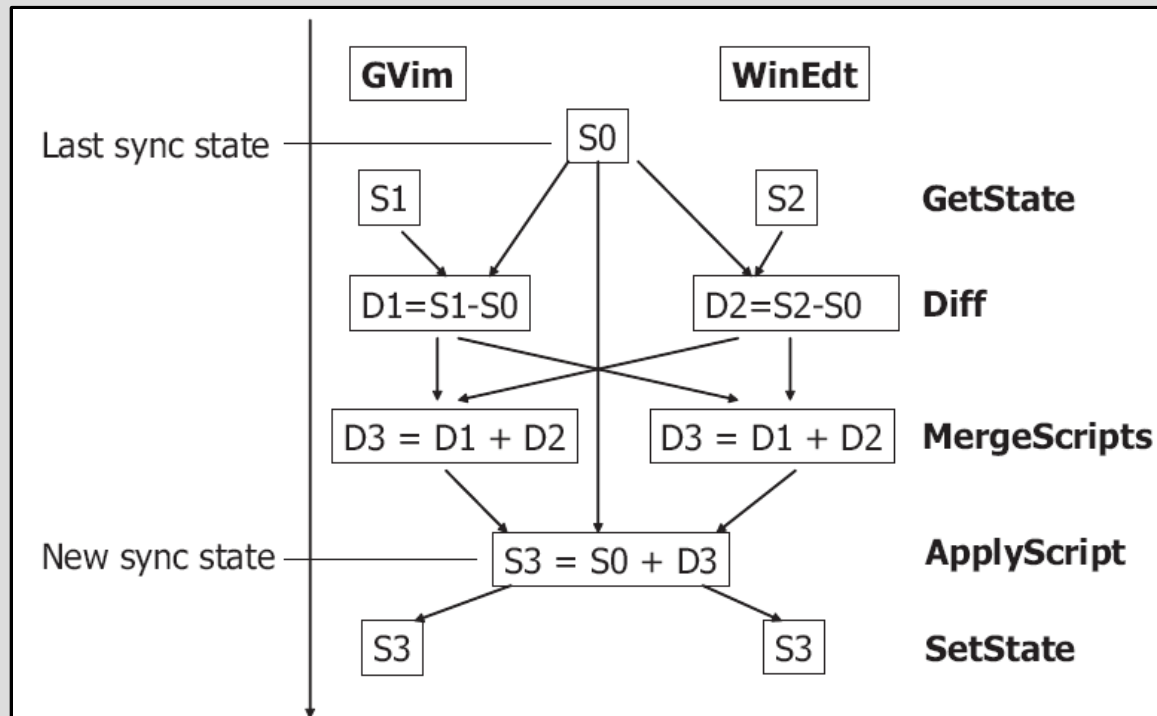


Figure 1: The essential ideas of our approach

Collaboration aware

New

Existing

Collaboration transparent

Generic (VNC)

Frame Buffer

OS

App/Domain specific

Homogeneous

Heterogeneous

Collaboration-transparent (Heterogeneous)

- Fazhi He, Soonhung Han, **A method and tool for human-human interaction and instant collaboration in CSCW-based CAD**

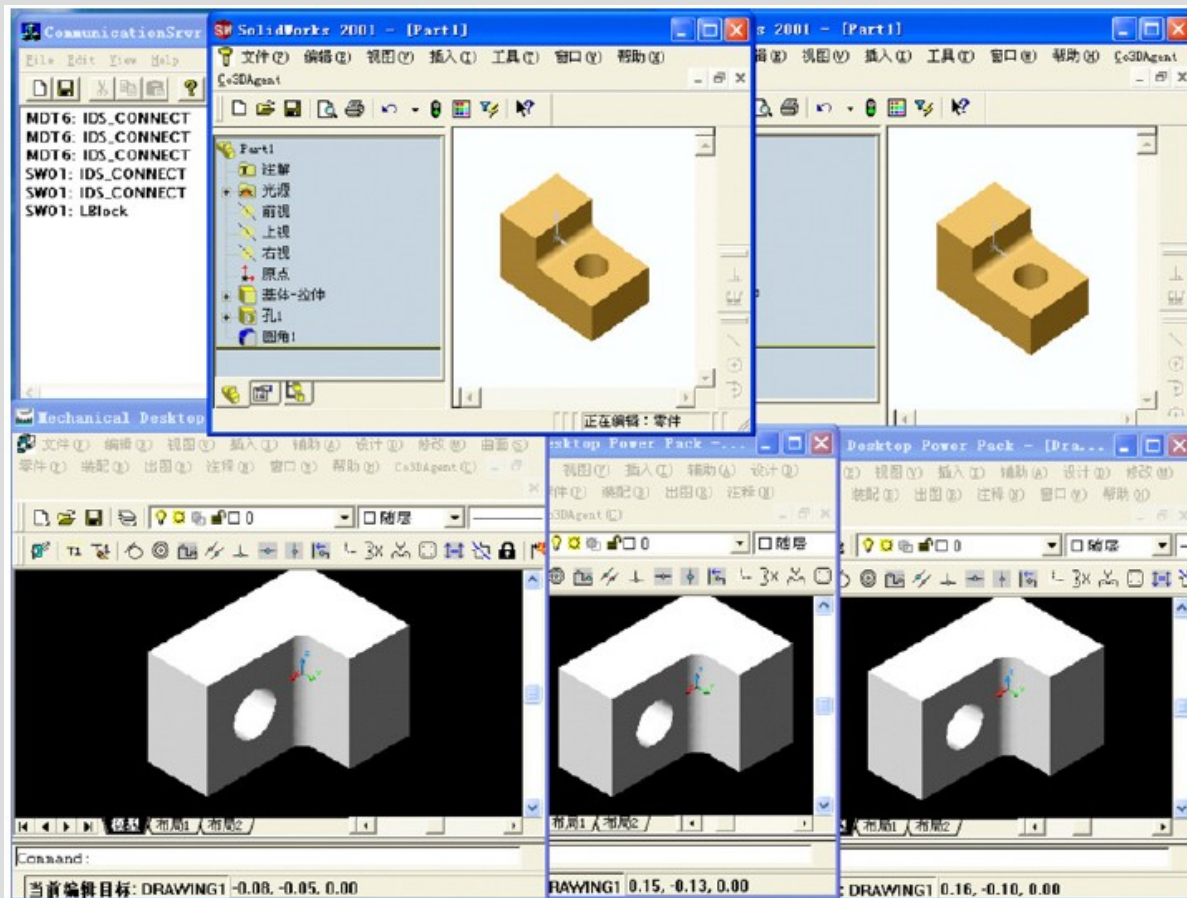


Fig. 15. Group communication for transparent 3D CAD.

Collaboration-transparent (Heterogeneous)

- Fazhi He, Soonhung Han, **A method and tool for human-human interaction and instant collaboration in CSCW-based CAD**
- Fine granularity locking for concurrent work

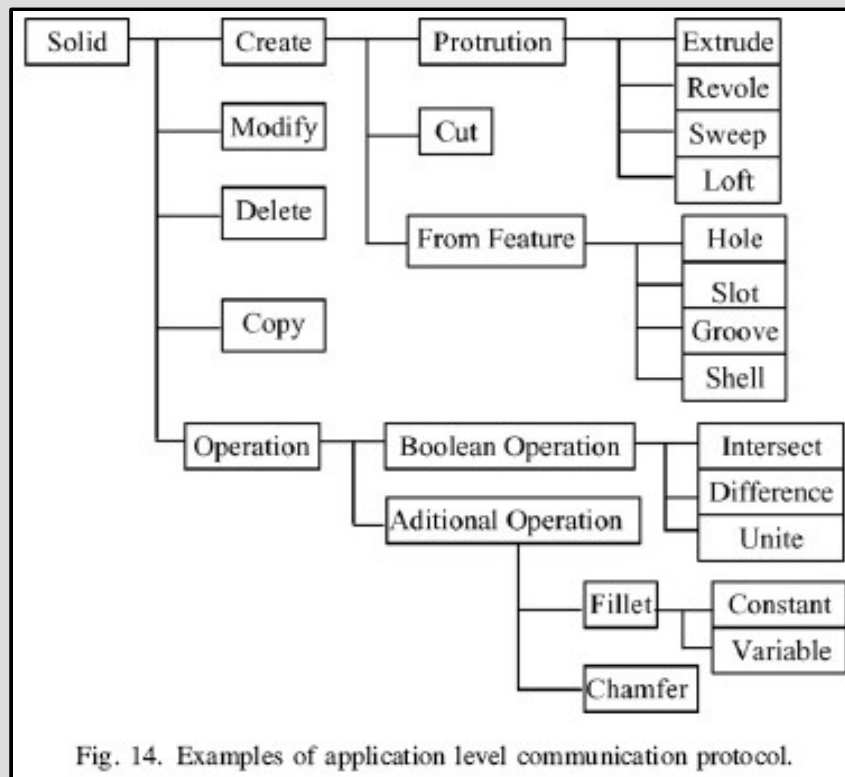
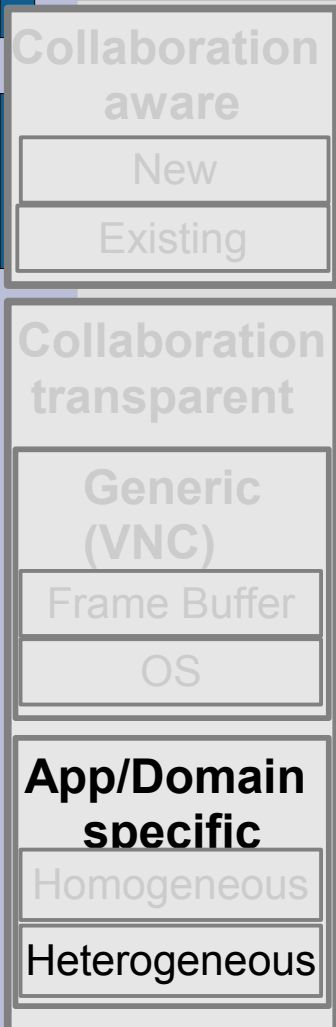


Fig. 14. Examples of application level communication protocol.



Comparison of application sharing models

Metric \ Model	Collaboration-aware	Collaboration-transparent (Generic)	Collaboration-transparent (Specific)
Concurrent work	Yes	No	Yes
Efficiency	Good	Moderate	Good
Application support	Single/some	All	Single/some
Application modification	Source code	No	External plug-in
Engineering cost per app	Moderate	Low	High
Thin-client	No	Yes	No

Collaboratories

- BSC (Biological sciences collaboratory)
- The Access Grid

Collaboratories (BSC)

The image displays a collage of screenshots from the Biosciences Collaboratory (BSC) web application, illustrating its various features and data visualization capabilities.

Project Activity Table:

Date	Time	Person	Activity	Products
01/02/03	08:30 AM	H. Seife	Entered Project	
01/02/03	08:32 AM	H. Seife	Accessed Gene Bank DB	R232.xls
01/02/03	09:37 AM	H. Seife	Executed P31-BLAST Application	Smr222.txt
01/02/03	09:48 AM	H. Seife	Constructed "Domain Analysis" Task	Domain Analysis
01/02/03	10:32 AM	H. Seife	Executed "Domain Analysis" Task	R232Res.txt
01/03/03	10:32 AM	H. Seife	Entered Project	
01/03/03	02:21 PM	D. Kennedy	Accessed PubMed DB	Smith.pdf
01/03/03	02:21 PM	D. Kennedy	Constructed "PMR Superfamily" Concept	PMR Superfamily
01/03/03	02:21 PM	D. Kennedy	Executed "Domain Analysis" Task	R232Res2.txt

Biosciences Collaboratory Interface:

- My Workspace:** Shewanella Project, Shewanella Exp. 1, Shewanella Exp. 2
- BSI Explorer Portlet:** Address: <http://bbsrc.earl.pri.gov/7000/bbsrc/bsiexplorer>
- File Information:**
 - Filename: AL_Exp1.jpg
 - Description: Normalized fluorescence data from GFP reporters - Experiment 1
 - Owner: Jane Smith
 - File Type: Image (JPEG)
 - File Size: 876 KB
 - Creation Date and Time: May 10, 2002, 09:42 AM
 - Last Modification Date and Time: Aug 28, 2003, 12:48 PM
- Conditions:**
 - Reporter's were grown in 180 ul LB in a 96 well plate with a 75 ul mineral oil overlay at 37°C in the fluorometer.
 - Readings were taken every 20 minutes. Samples were shaken automatically at each sampling point.
 - Each plate contained five reporters in triplicate.
 - The average value of the pGFP-Luciferase at each time point was subtracted from the fluorescence values of the samples.
 - Triplate samples were not averaged.
 - Each plate had a blank as experimental run 1-3.
 - Fluorescence for each sample was normalized to the maximum observed fluorescence for that sample (i.e., the data is reported as fraction maximum fluorescence at each time point).

Data Sets:

- Protocols
- Vesicle Data
- Electron
- Transport G
- Fluorescence
 - AL_Exp1.jpg
 - AL_Exp2.jpg
 - AL_Exp3.jpg
 - fdnG-prom.f
 - ORF02094.d
 - ORF01929.p
 - Promoters.xls

Visualizations:

- 3D Molecular Model:** A complex 3D molecular model showing various chemical groups and interactions, including Methylation, DNA methylation, RNA, and Polymers.
- Microscopy Image:** A grayscale microscopy image showing a cell or tissue structure with a scale bar.
- Heatmap:** A heatmap visualization showing data points across different categories, with a color scale from blue to red.

Collaboratories (Active Grid)

Projects

To add your Access Grid Project to the list, click [here](#).

Media Tools

[Video Presence \(VP\)](#)

[SUMOVER Project \(vic and rat\)](#)

Shared Applications

[Shared Desktop](#)

[TigerboardAG](#)

[VPCScreen](#)

Network / Bridging Tools

[VB Multicast Bridge](#)

[Portal Access Grid](#)

[AG Connector](#)

Recording Tools

[AGVCR](#)

Other

[VX](#)

[AccessGrid 3 All in one Installer for Windows](#)

[AG Toolkit Management](#)

Requests

[Improve Bridge Listing](#)

Papers

- VNC
- RDP
- THINC
- Distributed Workspace
- TTT
- SharedAppVNC
- MAST
- MPX
- Wide-area Thin client
- MOM
- Distance Learning
- CoWord
- Familiar editors
- ACPBrush
- CAD tool
- CAD R&D
- Draw-together
- BSC
- N-ABLE
- Access Grid

Backup Slides

Application sharing models

- Distributed
 - Example: CoWord
 - Each participant must install an application
- Centralized
 - Example: Frame Buffer based models

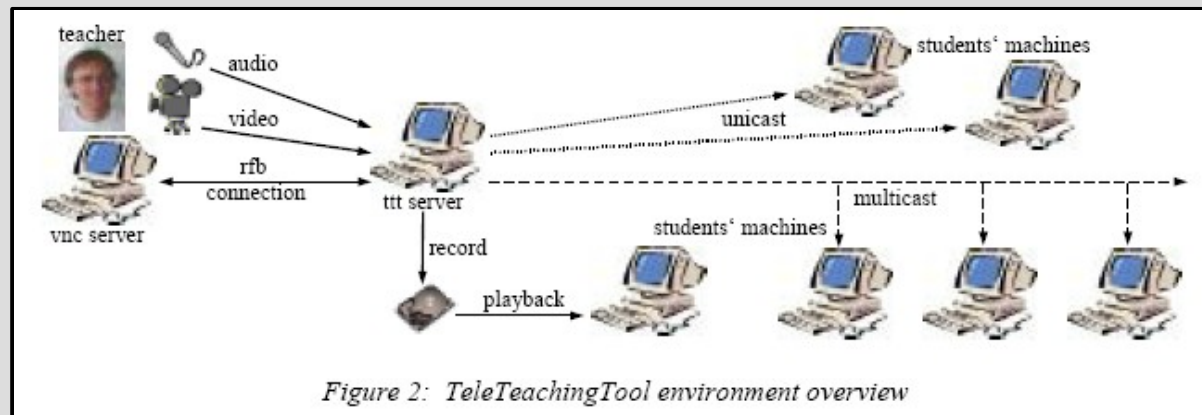
Application sharing models

- Same View
 - Example: All Frame Buffer models
 - May require floor control mechanism
- Independent View
 - Example: CoWord
 - May allow concurrent work

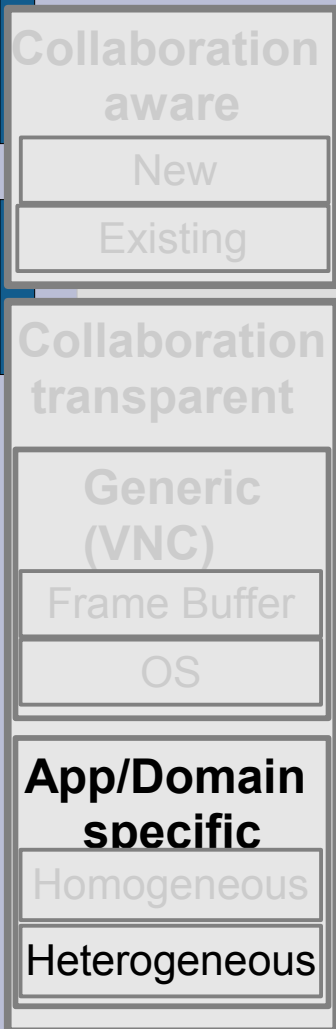
Frame Buffer based models

- **TTT: Tele-teaching Tool**

- VNC based system
- Supports multicasting (Refresh in every 2sec)
- Participants are viewer only
- Basic encoding (Hextile)



Collaboration-transparent (Hetero)



- Li, D. and Lu, J. 2006. **A lightweight approach to transparent sharing of familiar single-user editors.** In Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work (Banff, Alberta, Canada, November 04 - 08, 2006). CSCW '06. ACM, New York, NY, 139-148.
- Fazhi He, Soonhung Han, **A method and tool for human-human interaction and instant collaboration in CSCW-based CAD**, Computers in Industry Volume 57, Issues 8-9, , Collaborative Environments for Concurrent Engineering Special Issue, December 2006, Pages 740-751.

[illegible]

Figure 4. Data organization views showing file system, project structure, and organism phylogeny.

Collaboratories (Active Grid)



Collaboratories (Active Grid)

