Multimedia Collaboration and Application Sharing

Omer Boyaci

June 5, 2008

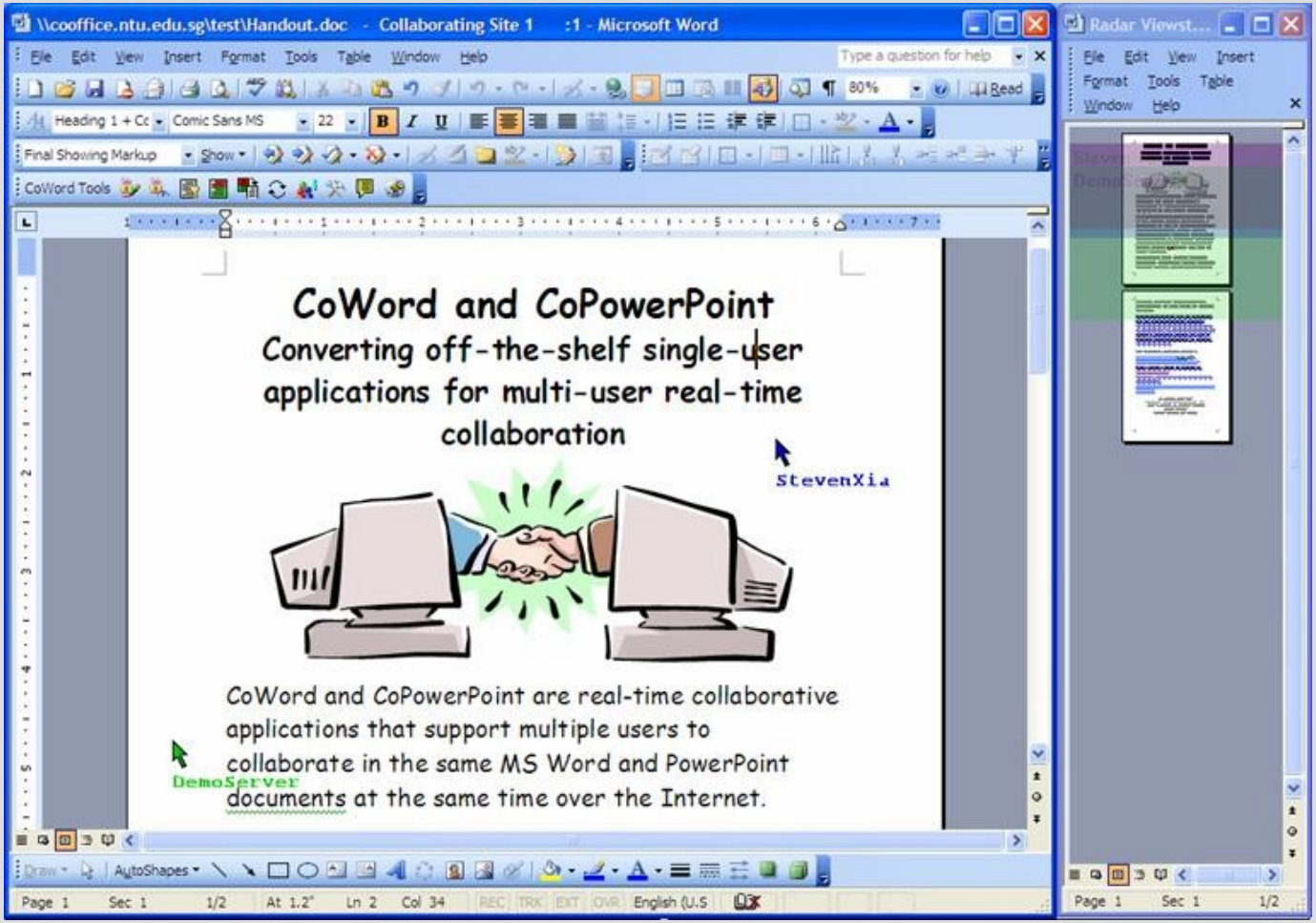
Outline

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

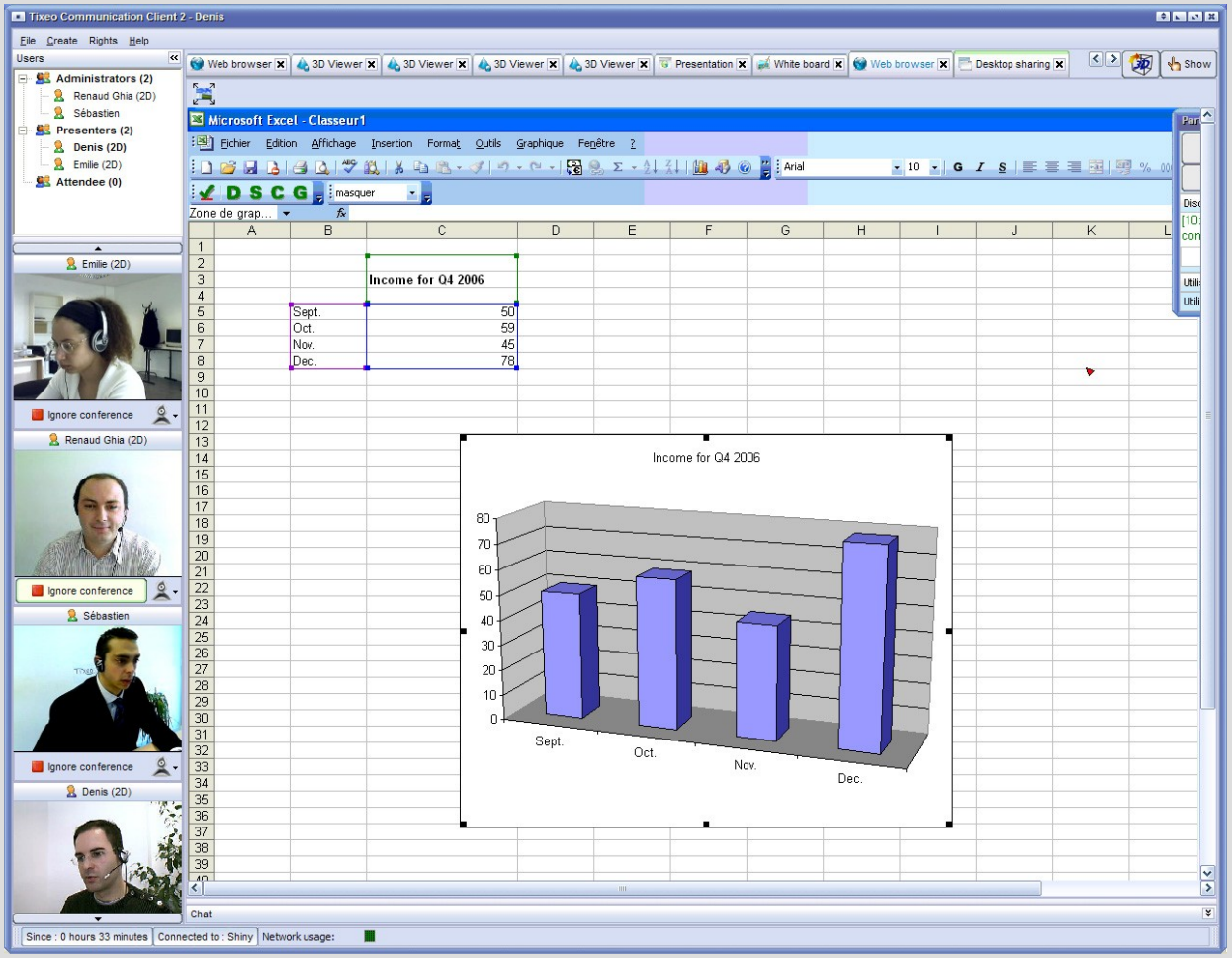
Introduction

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

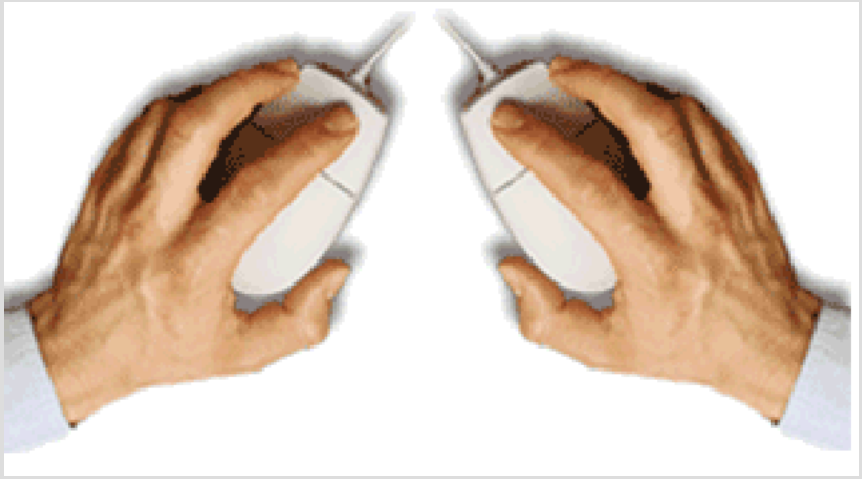
Introduction



Introduction



Introduction



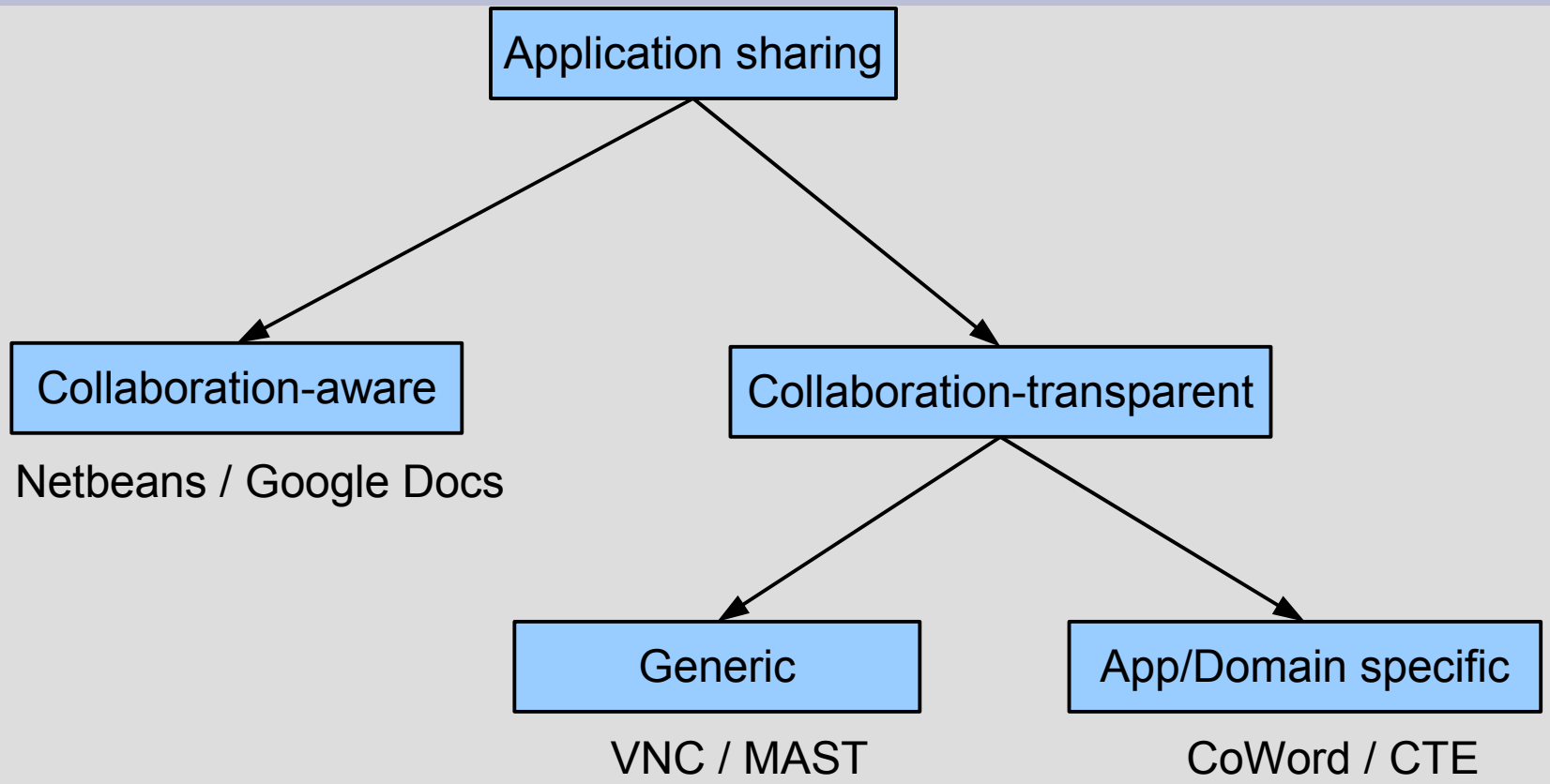
Introduction

Introduction

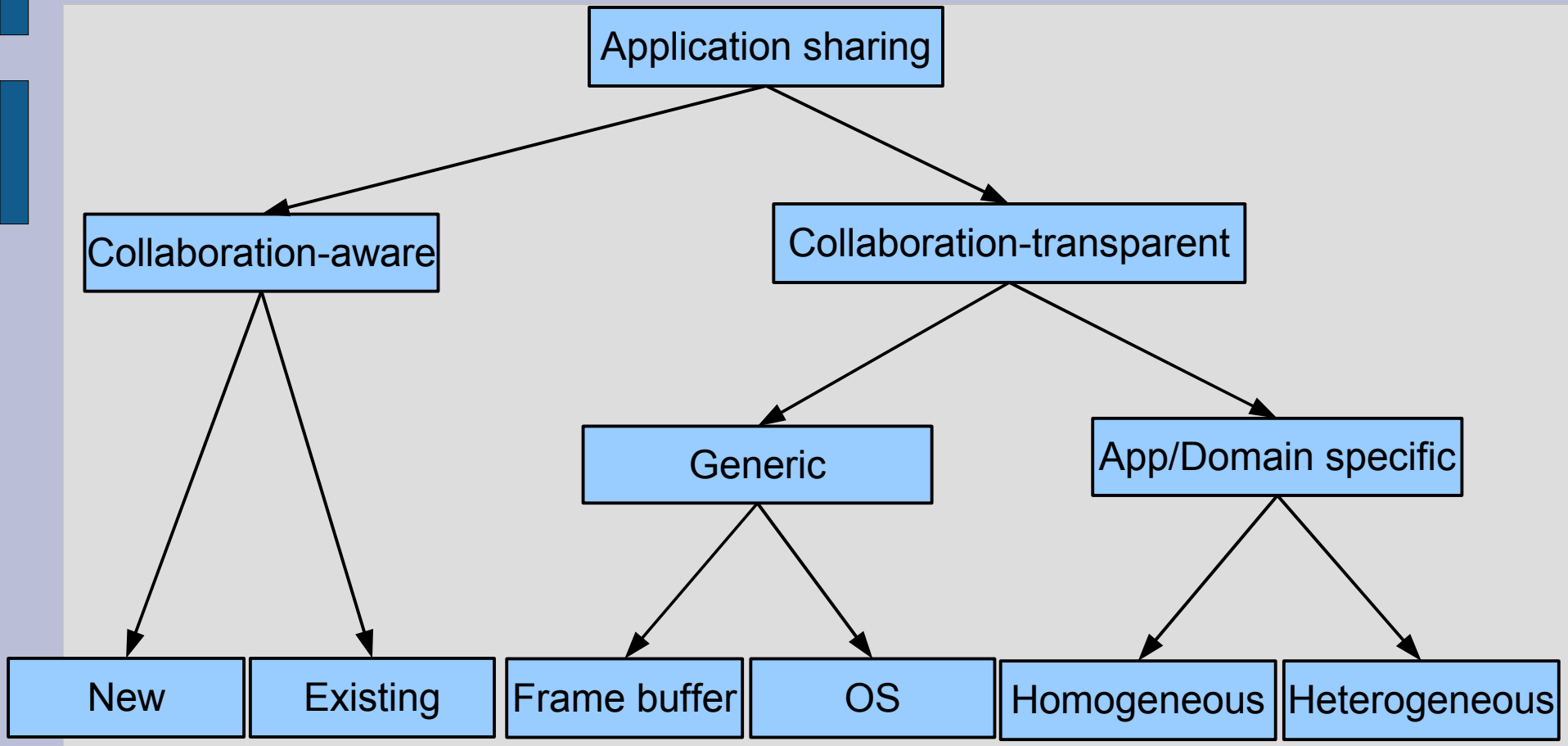
Challenges and features

- 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)

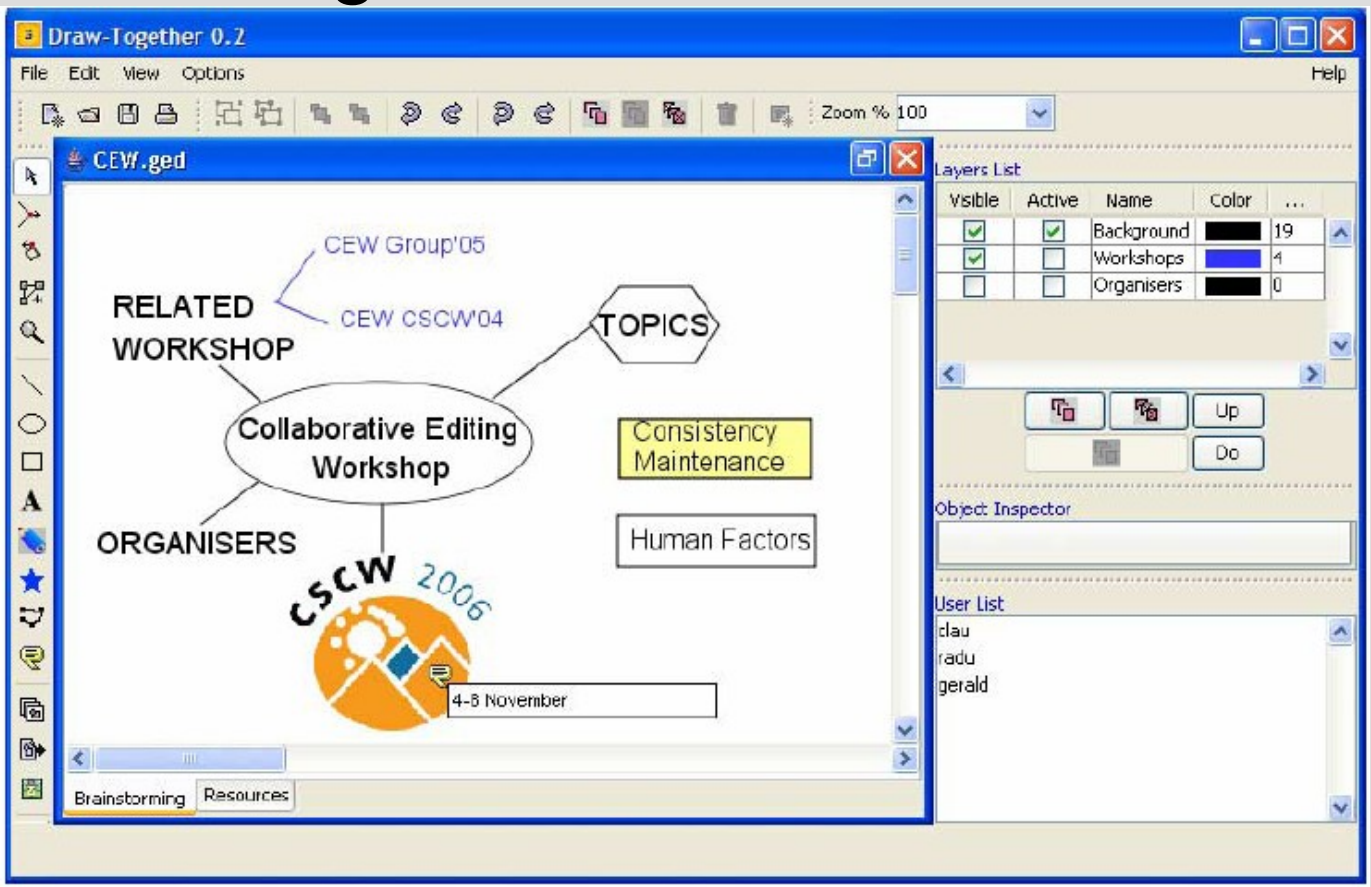
Collaboration aware
- New
- Existing

Collaboration transparent

Generic (VNC)
- Frame Buffer
- OS

App/Domain specific
- Homogeneous
- Heterogeneous

- Draw-together



Draw-Together application

Collaboration-aware models (New)

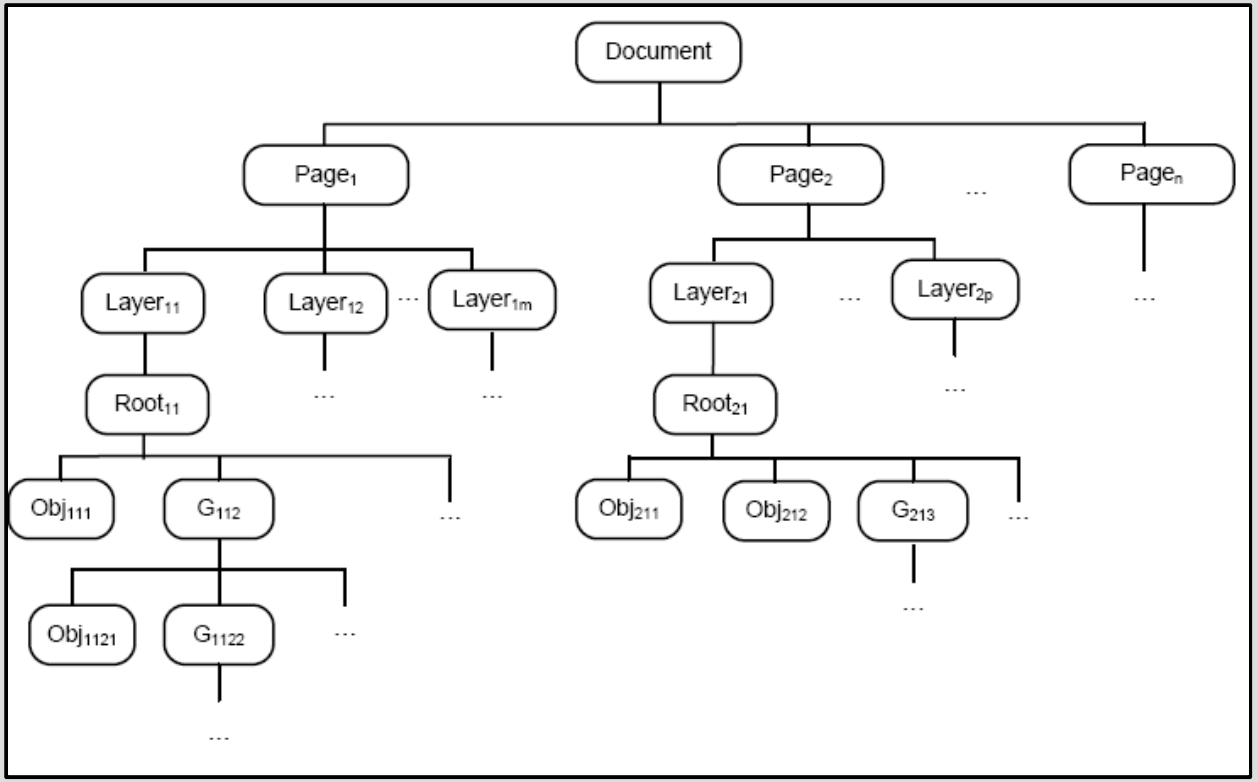
Collaboration aware
- New
- Existing

Collaboration transparent

Generic (VNC)
- Frame Buffer
- OS

App/Domain specific
- Homogeneous
- Heterogeneous

- Draw-together
  - Fine granularity locking
  - Concurrent work



Collaboration-aware models (New)

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

- Collaborative distance learning
  - Different bandwidth clients

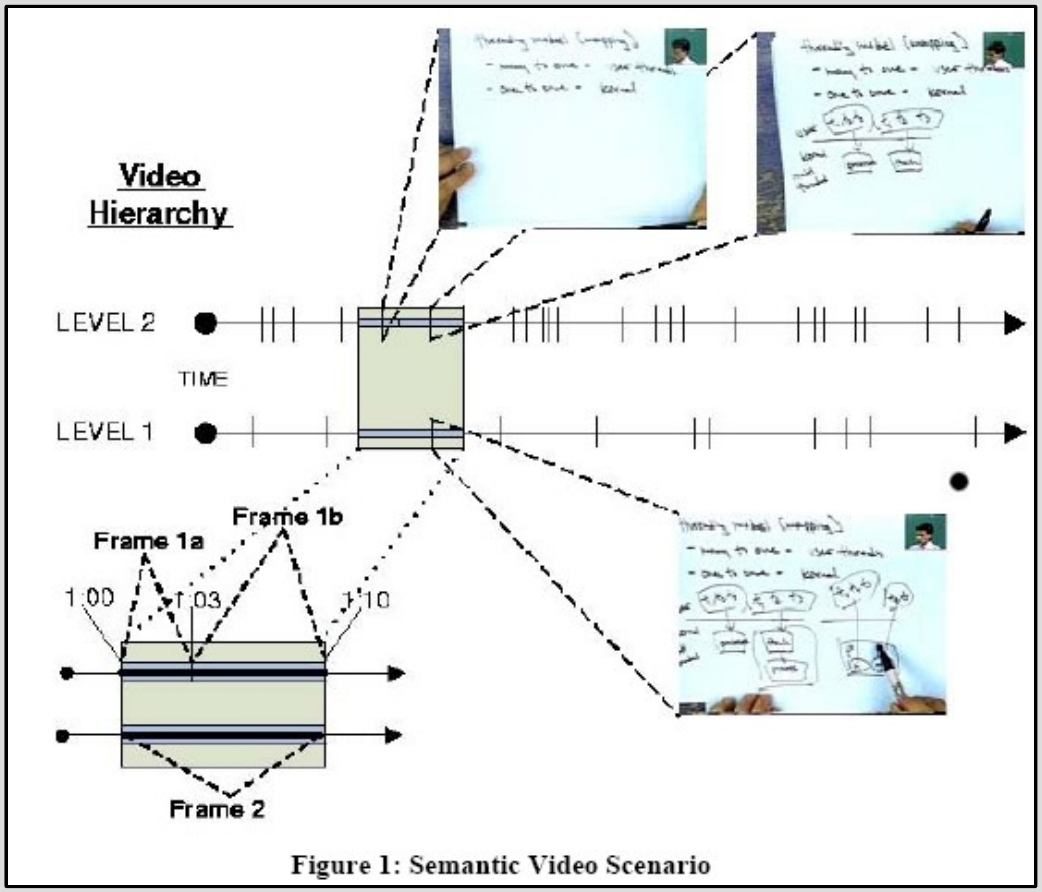


Figure 1: Semantic Video Scenario

Collaboration-aware models (Exist)

Collaboration aware

- New
- **Existing**

Collaboration transparent

Generic (VNC)

- Frame Buffer
- OS

App/Domain specific

- Homogeneous
- Heterogeneous

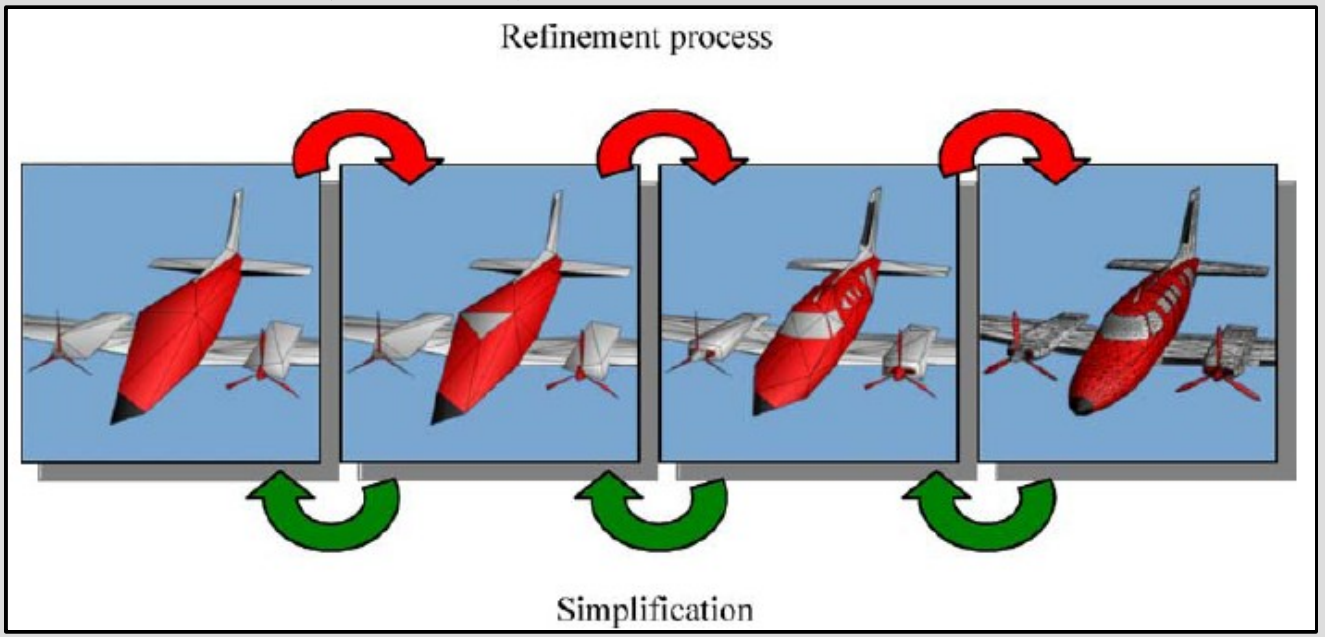
Figure 2: N-ABLE™ snapshot with collaboration enabled, showing peer awareness, group chat, and screenboard

common mental model for problem and solution

Collaboration-aware models (Exist)

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

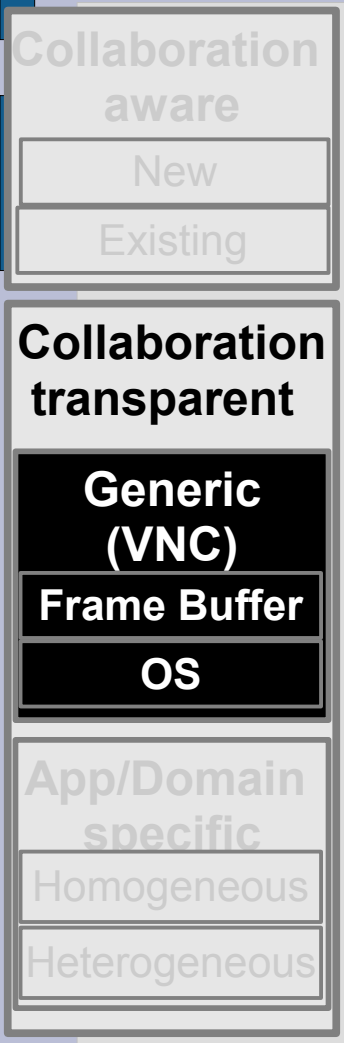
- "3D streaming"
  - VRML, X3D, STEP



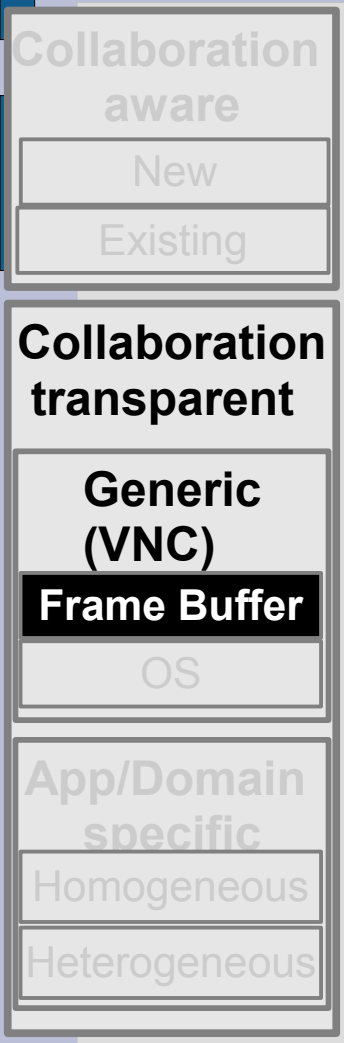
Thin server + strong client
Strong server + thin client
Peer-to-peer

Collaborative computer-aided design, W.D. Li

Collaboration-transparent models

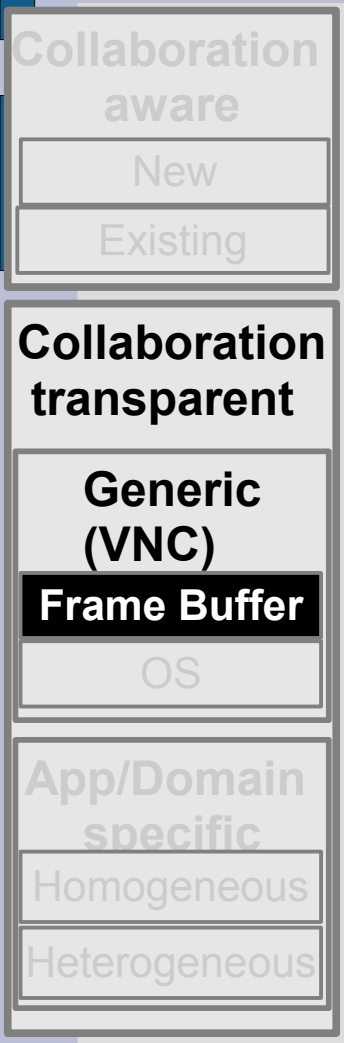


Frame Buffer based models



- 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

Collaboration aware
- New
- Existing

Collaboration transparent
- Generic (VNC)
- **Frame Buffer**
- OS

App/Domain specific
- Homogeneous
- Heterogeneous

- **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.

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

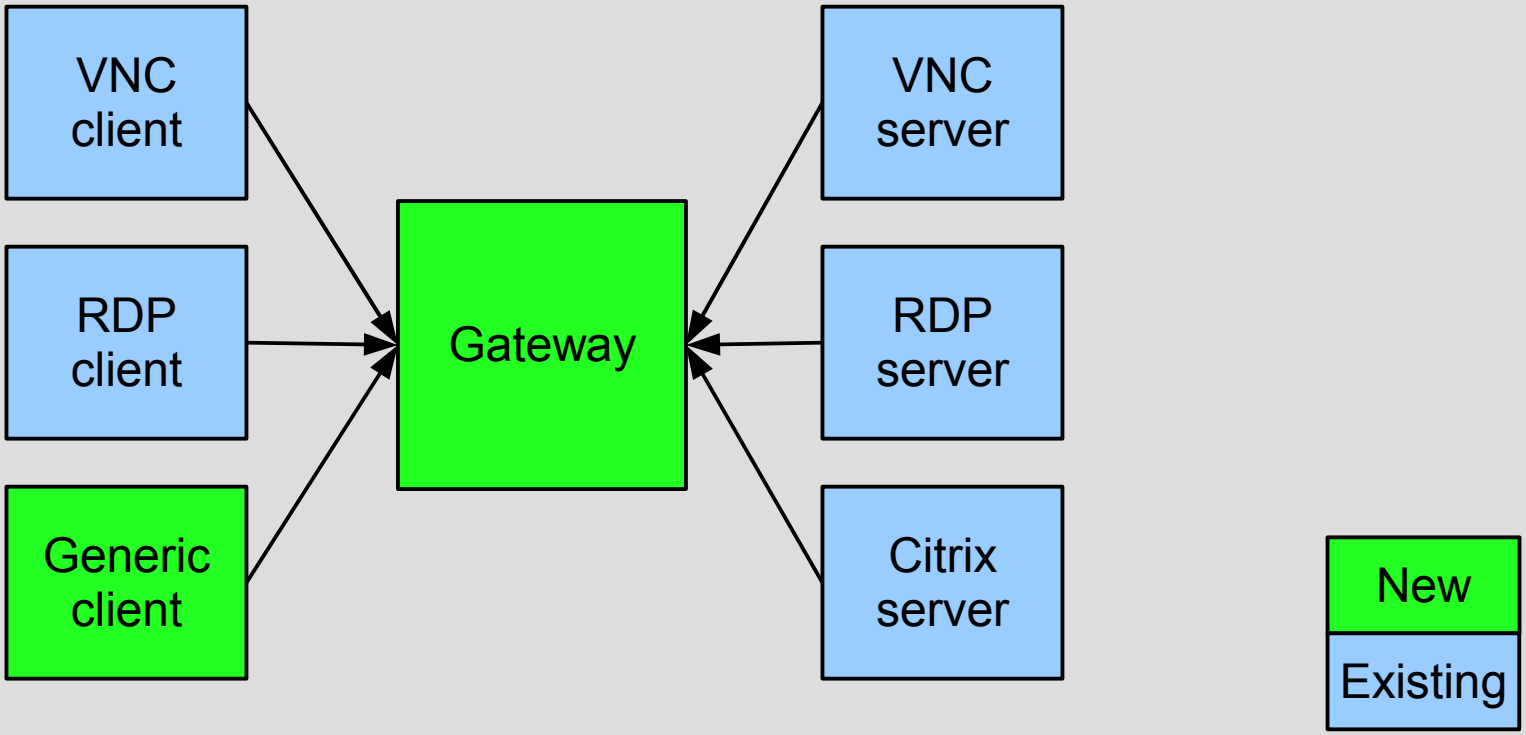
Collaboration aware
- New
- Existing

Collaboration transparent

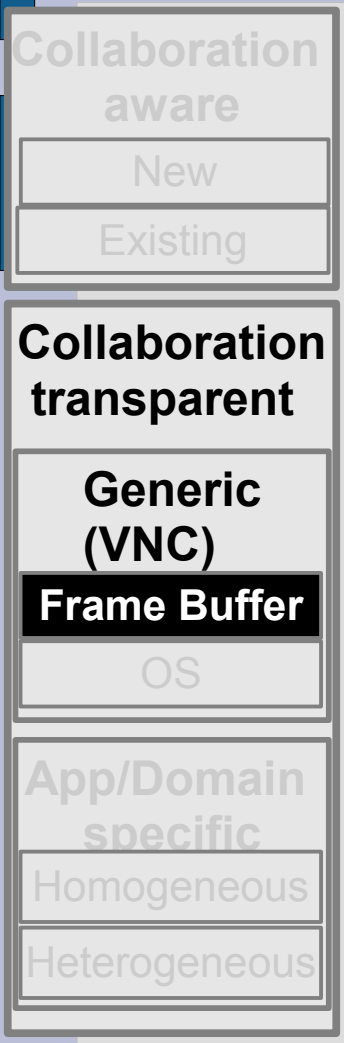
Generic (VNC)
- **Frame Buffer**
- OS

App/Domain specific
- Homogeneous
- Heterogeneous

- 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

Collaboration aware
- New
- Existing

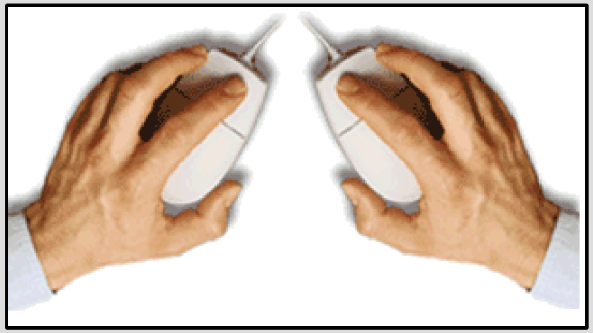
Collaboration transparent

Generic (VNC)
- Frame Buffer
- **OS**

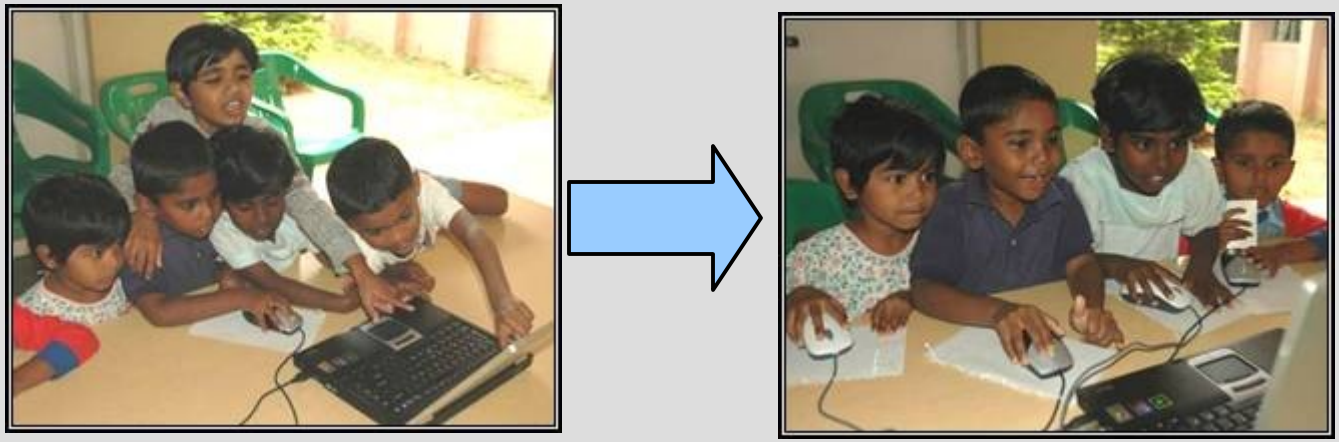
App/Domain specific
- Homogeneous
- Heterogeneous

- MPX (Multi-pointer X)

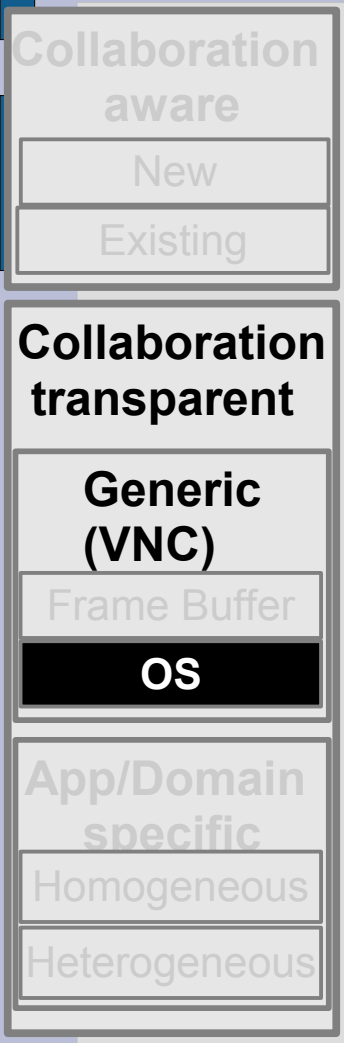
Single PC
Multiple I/O



- 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**

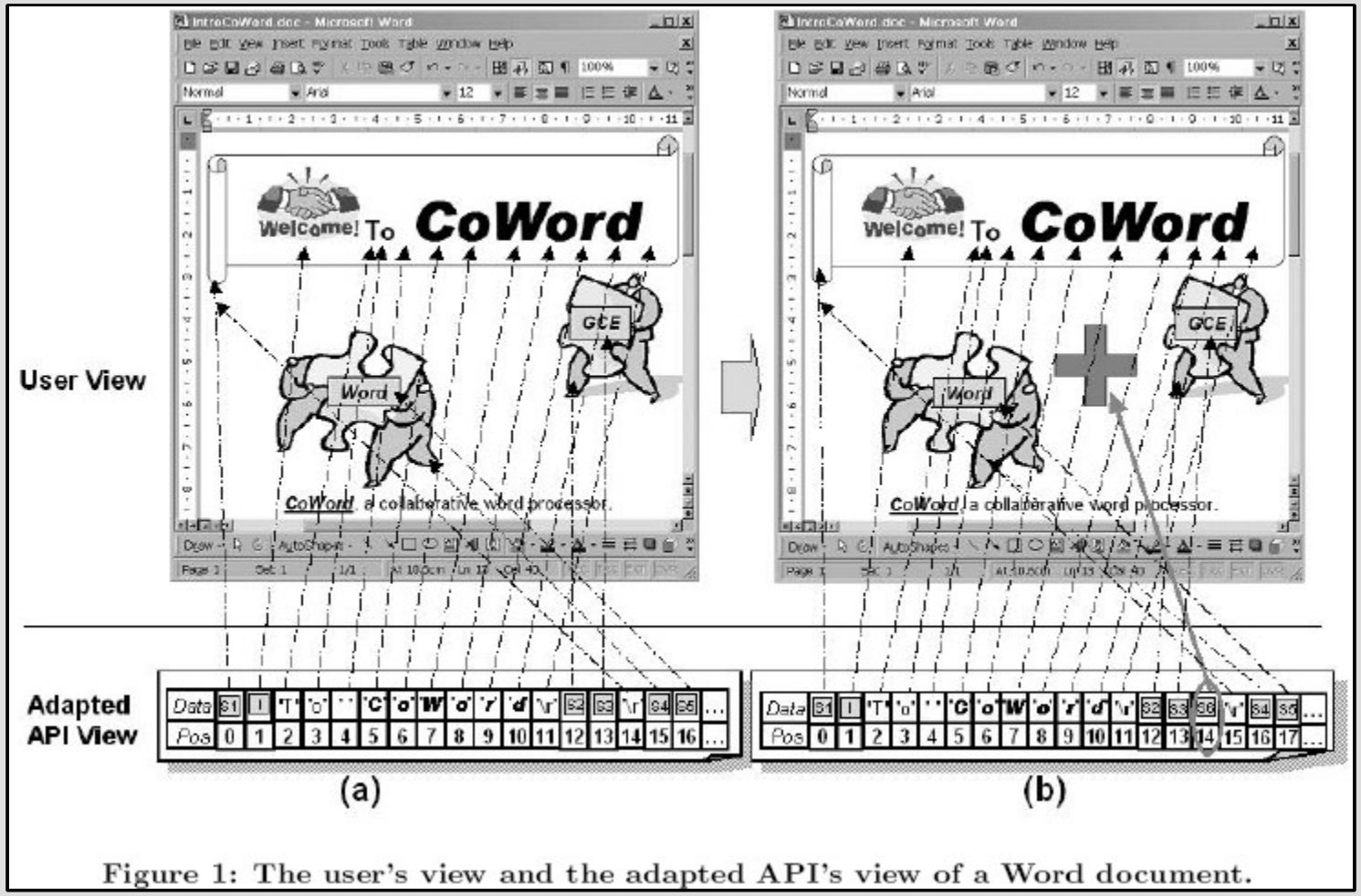


Figure 1: The user's view and the adapted API's view of a Word document.

Collaboration-transparent (Homogeneous)

Collaboration aware
- New
- Existing

Collaboration transparent

Generic (VNC)
- Frame Buffer
- OS

App/Domain specific

Homogeneous

Heterogeneous

- **CoWord**

Problems

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

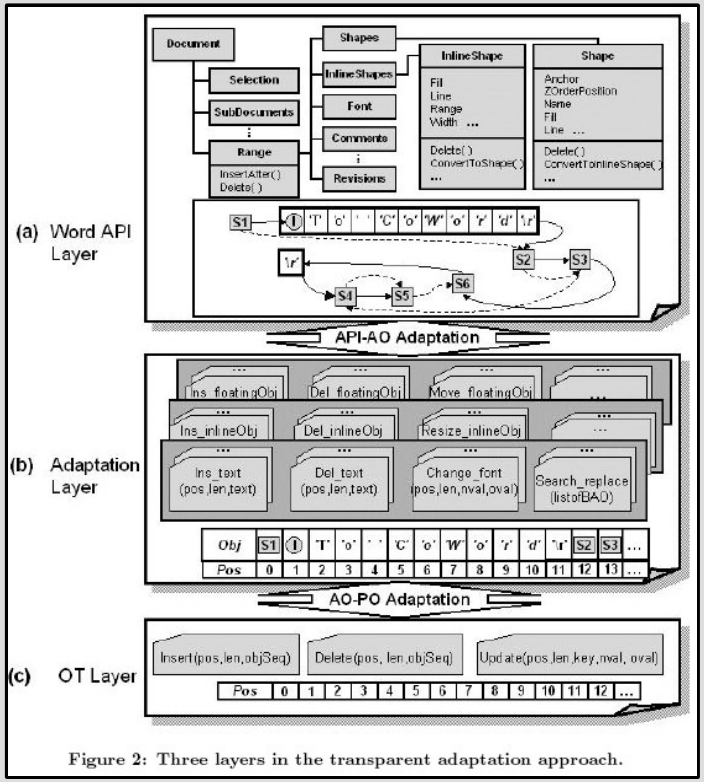


Figure 2: Three layers in the transparent adaptation approach.

Collaboration-transparent (Heterogeneous)

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

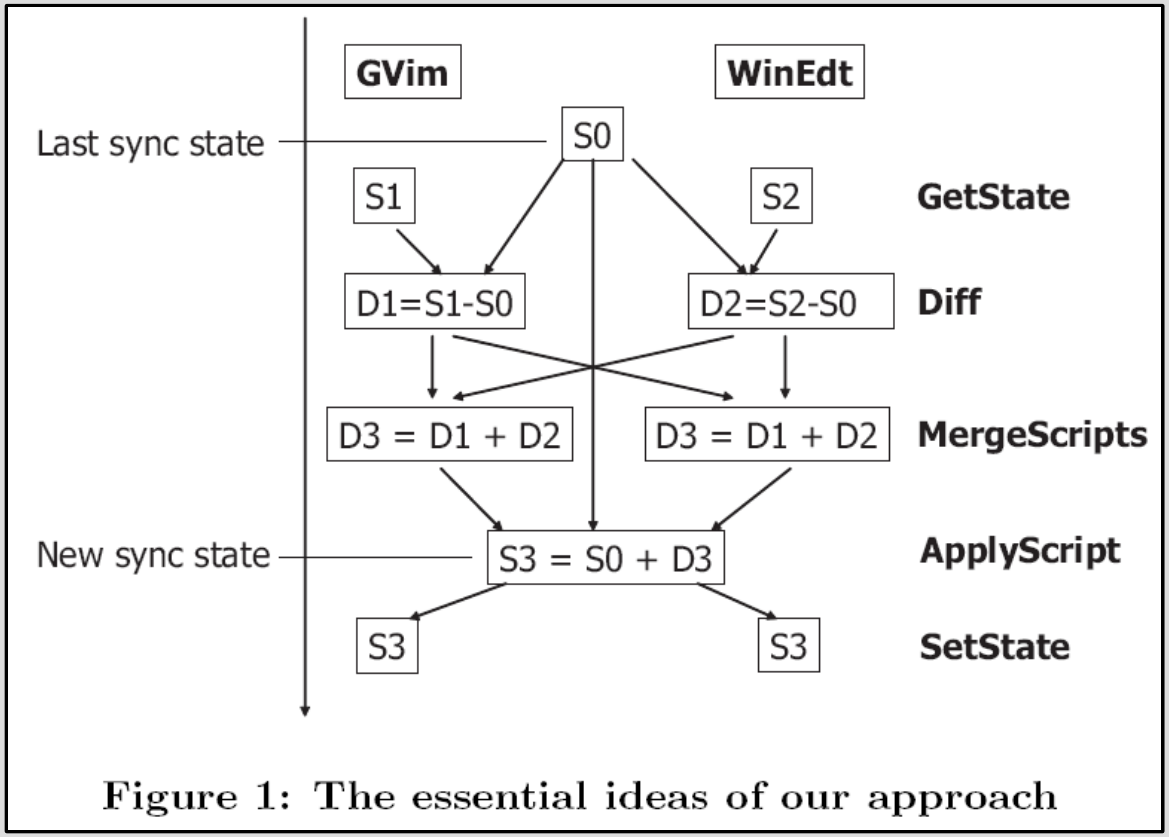


Figure 1: The essential ideas of our approach

Collaboration-transparent (Heterogeneous)

Collaboration aware
- New
- Existing

Collaboration transparent
- Generic (VNC)
- Frame Buffer
- OS

App/Domain specific
- Homogeneous
- **Heterogeneous**

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

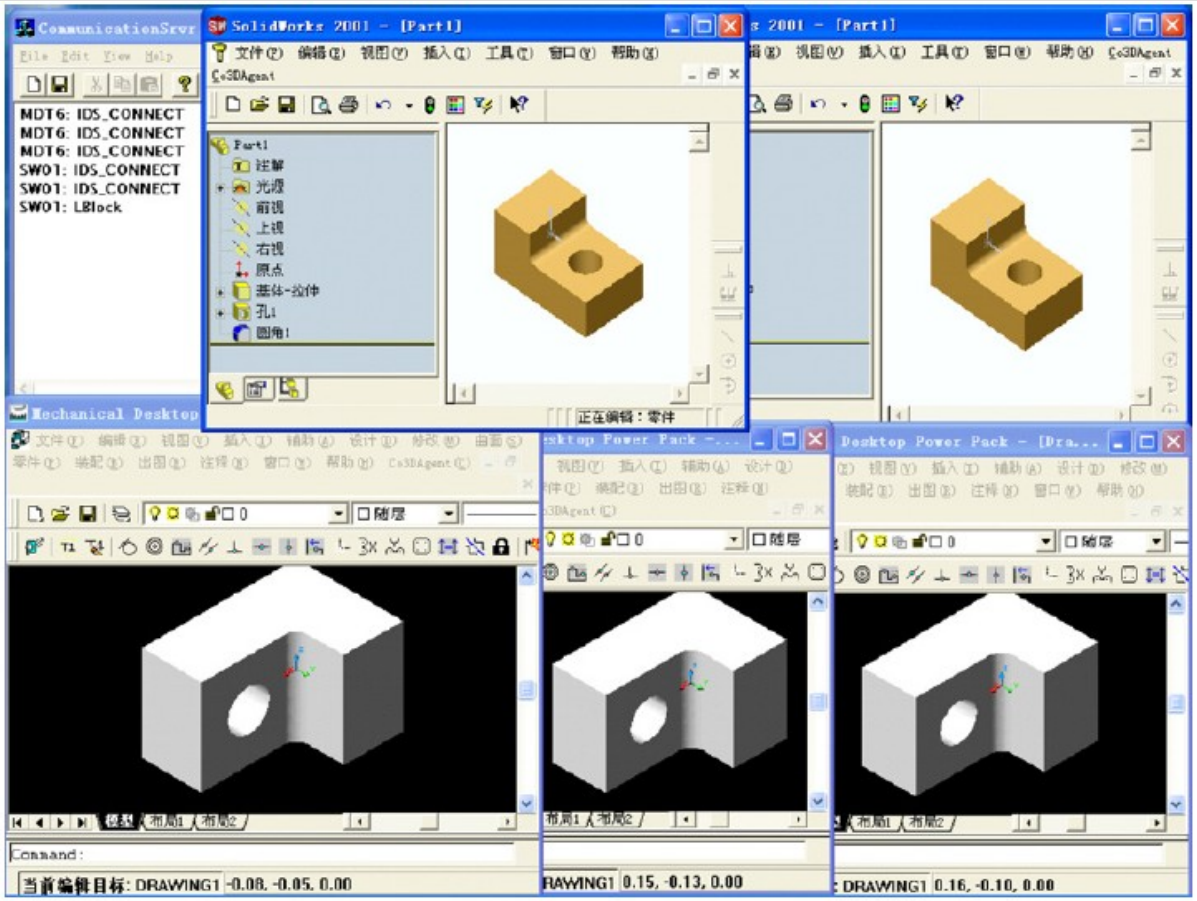


Fig. 15. Group communication for transparent 3D CAD.

Collaboration-transparent (Heterogeneous)

Collaboration aware
- New
- Existing

Collaboration transparent

Generic (VNC)
- Frame Buffer
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App/Domain specific
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- Heterogeneous

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-Fine granularity locking for concurrent work

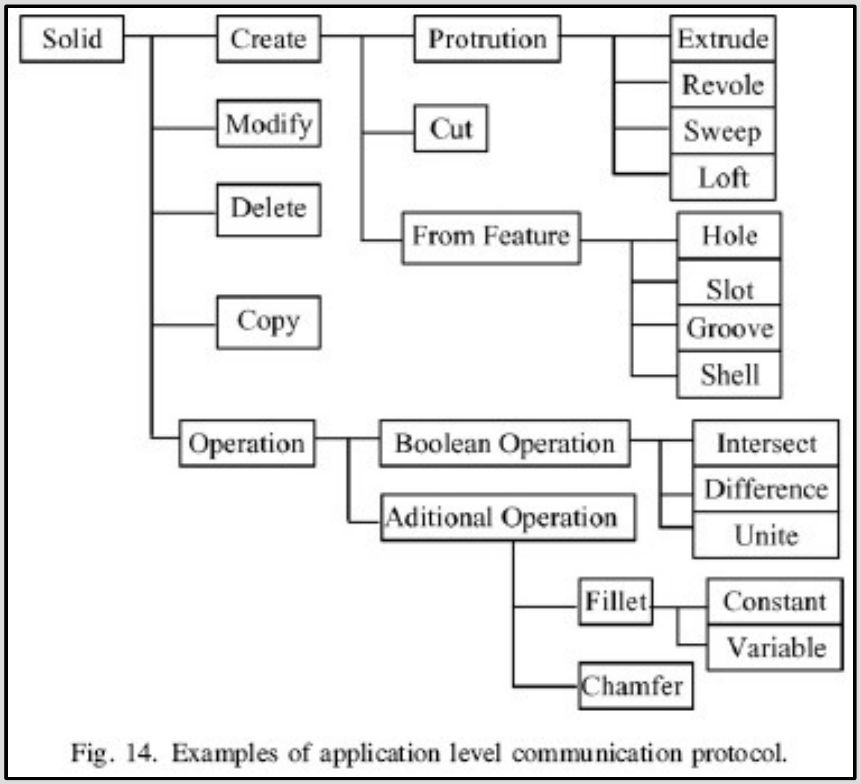


Fig. 14. Examples of application level communication protocol.

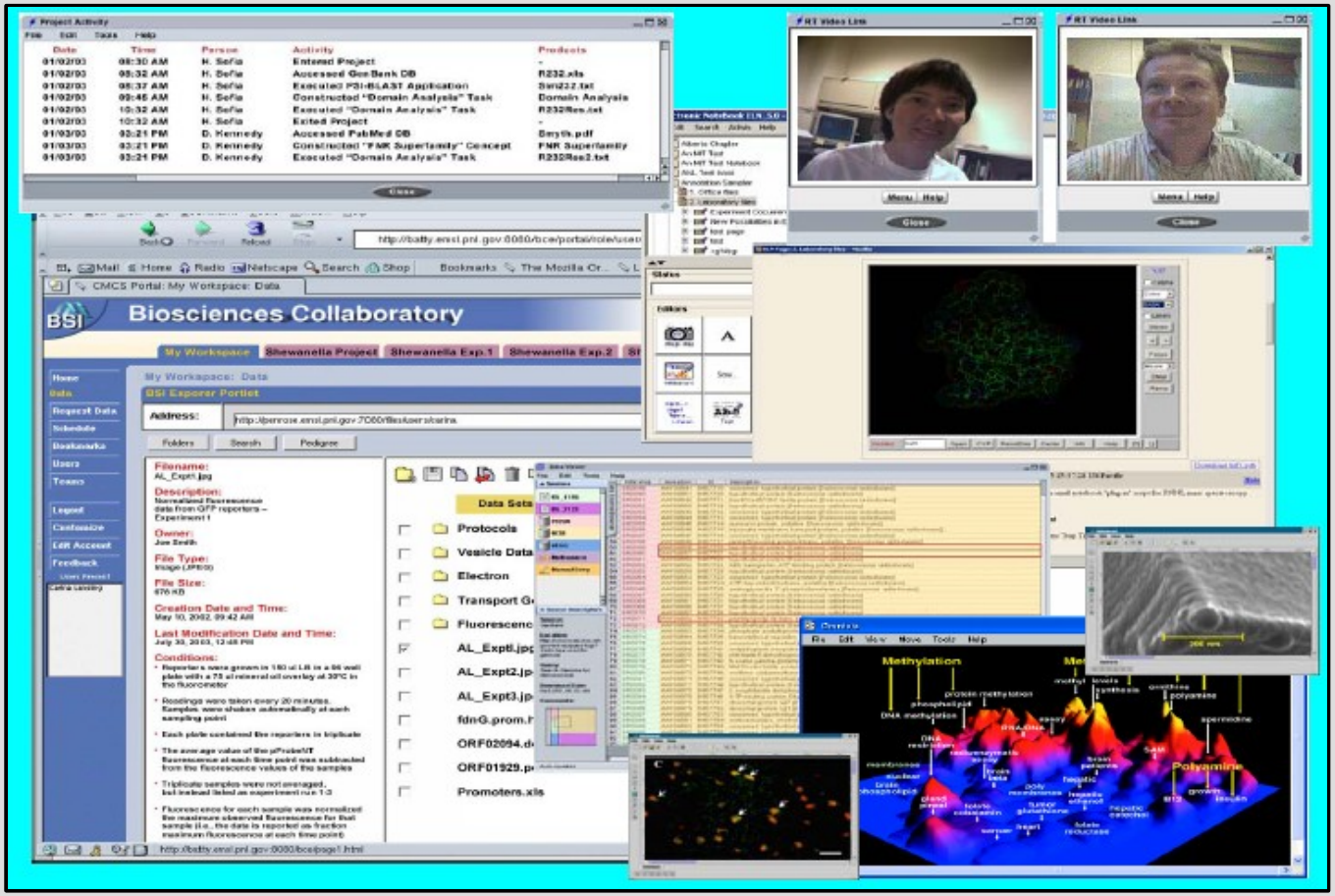
Comparison of application sharing models

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

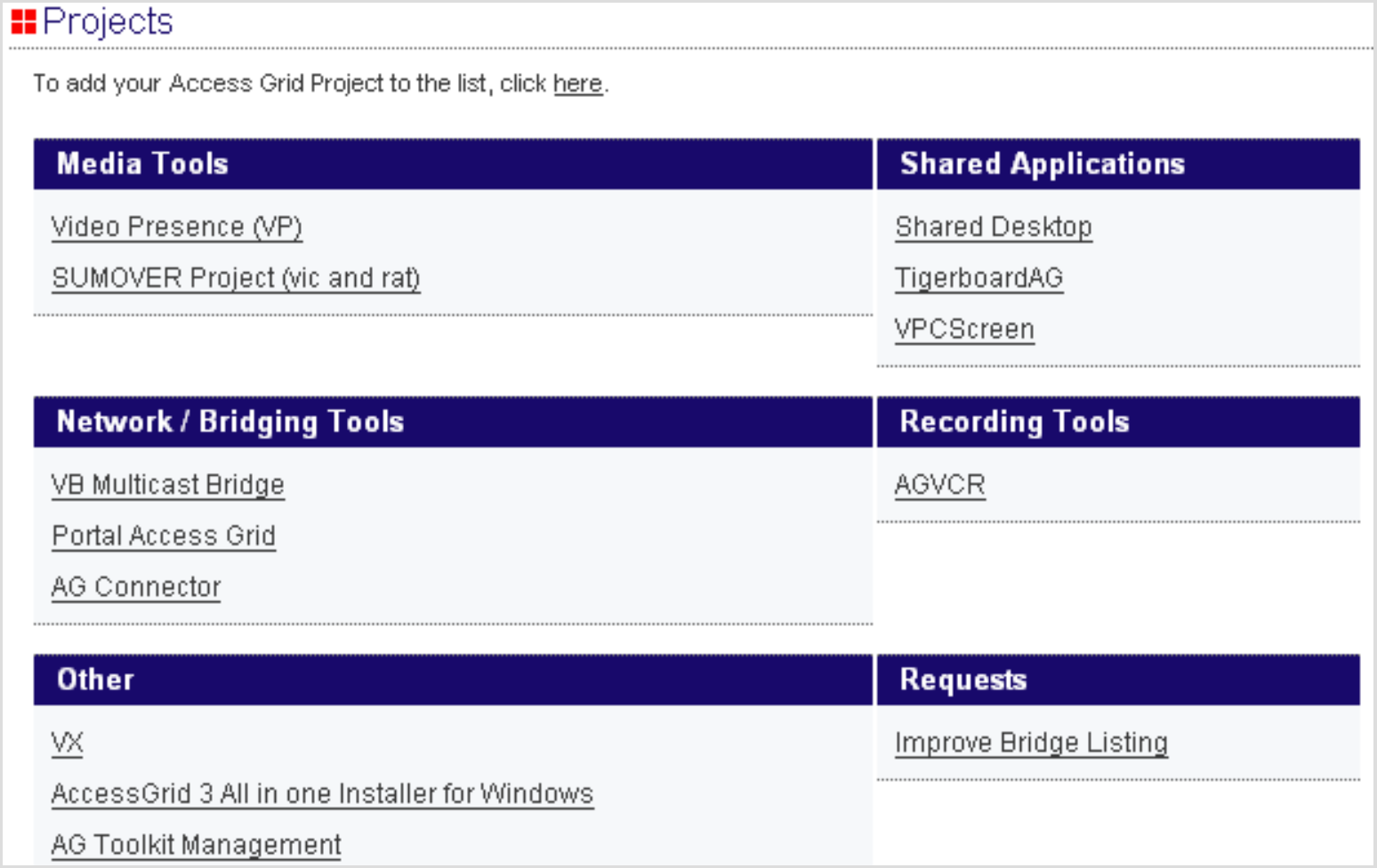
Collaboratories

- BSC (Biological sciences collaboratory)
- The Access Grid

Collaboratories (BSC)



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

Collaboration aware
- New
- Existing

Collaboration transparent

Generic (VNC)
- Frame Buffer
- OS

App/Domain specific
- Homogeneous
- Heterogeneous

- **TTT: Tele-teaching Tool**
  - VNC based system
  - Supports multicasting(Refresh in every 2sec)
  - Participants are viewer only
  - Basic encoding (Hextile)

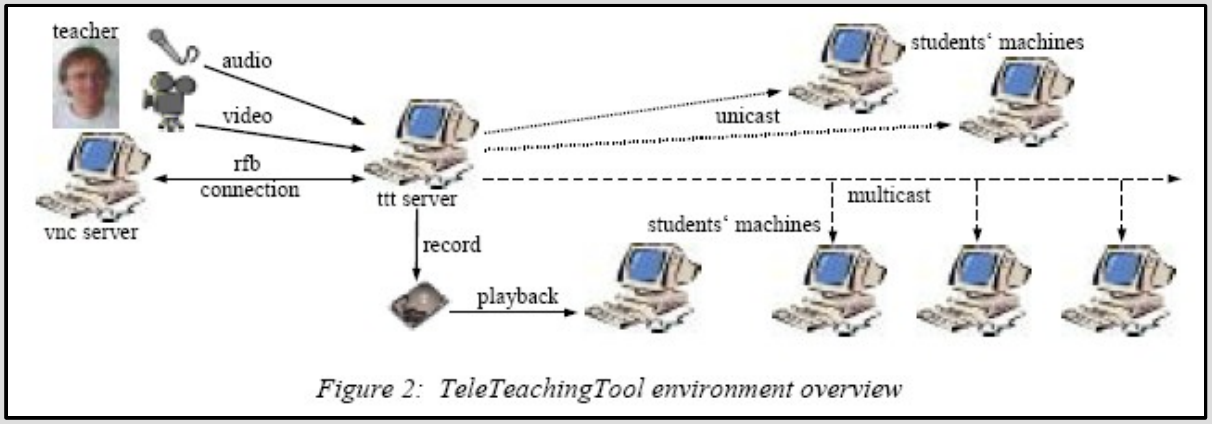
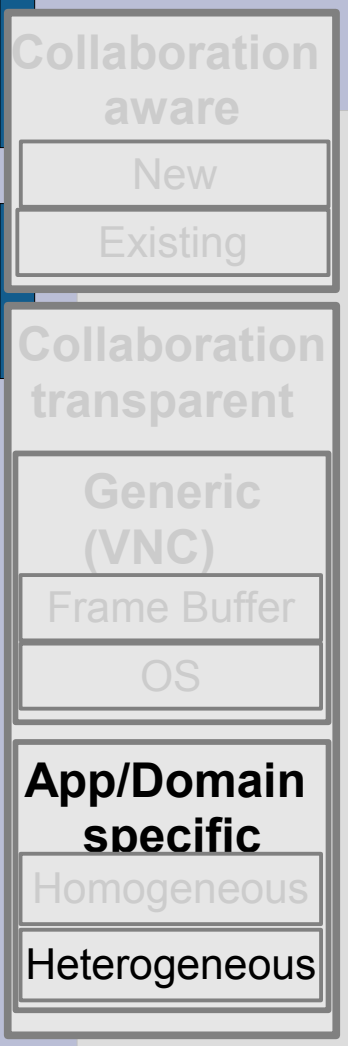


Figure 2: TeleTeachingTool environment overview

Collaboration-transparent (Hetero)



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- Fazhi He, Soonhung Han, **A method and tool for human-human interaction and instant collaboration in CSCW-based CAD**, Computers in IndustryVolume 57, Issues 8-9, , Collaborative Environments for Concurrent Engineering Special Issue, December 2006, Pages 740-751.

Collaboratories (BSC)

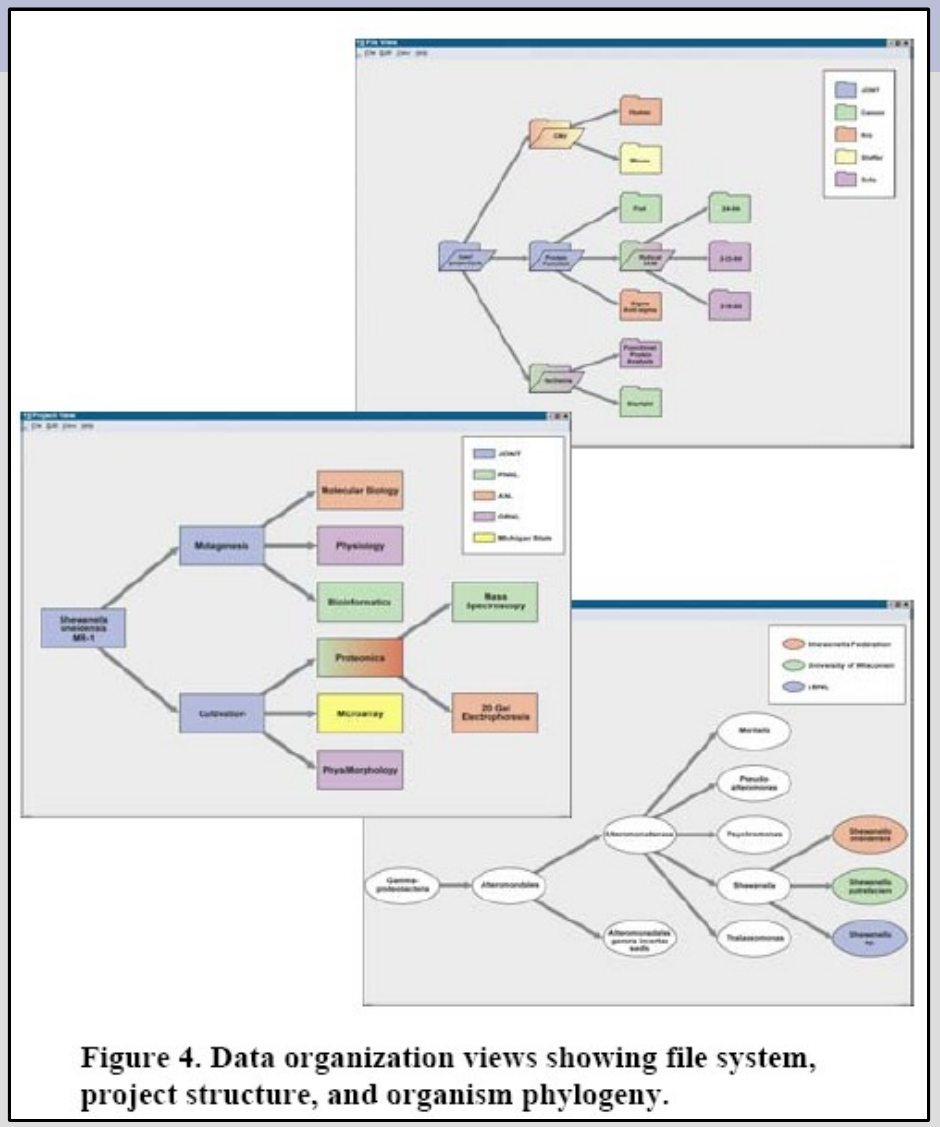

Figure 4. Data organization views showing file system, project structure, and organism phylogeny.

Collaboratories (Active Grid)

Collaboratories (Active Grid)