

Shared Screens and Windows

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CPSC 781

Outline

- Introduction
- Implementation Strategies
- Technical Issues
- Non-Technical Issues
- Examples
- Future Work

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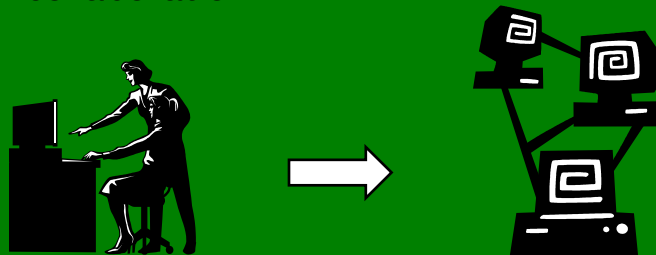
Readings

- Lauwers, J. C., & Lantz, K. A. (1990). Collaboration Awareness in Support of Collaboration Transparency: Requirements for the Next Generation of Shared Window Systems. *Proc. CHI 1990*, ACM Press, 303-311.
- Richardson, T., Stafford-Fraser, Q., Wood, K. R., & Hopper, A. (1989). Virtual Network Computing. *IEEE Internet Computing*, 2(1), 33-39.
- (optional) Stotts, D., Smith, J., & Gyllstrom, K. (2004). FaceSpace: Endo- and Exo-Spatial Hypermedia in the Transparent Video Facetop. *Proc. Hypertext 2004*, ACM Press, 48-57.

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Shared-View Systems

- share another's screen/window
 - initially used to augment face-to-face
 - soon used for distributed, real-time collaboration



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Two Approaches

- collaboration transparent
 - uses existing single-user applications



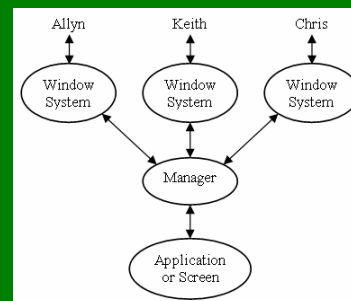
- collaboration aware
 - specifically designed for groups



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Abstract Architecture

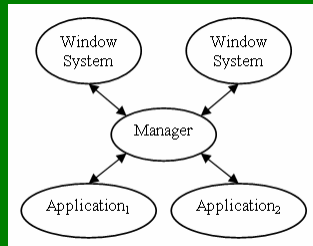
- system consists of:
 - participants' window systems
 - application or screen being shared
 - manager



- shared workspace
- each participant sees the same view
 - each participant can interact with the application

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Centralized Architecture

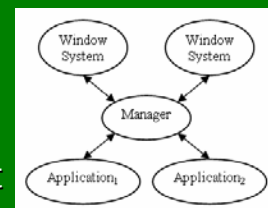


- system consists of:
 - participants' window systems
 - one instance of each application or screen
 - one instance of manager

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Centralized Environment

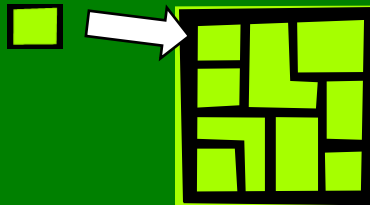
- example
 - window system sends input to application₁
 - application₁ produces output → view changes
 - manager distributes output request or changed view to all window systems
 - can be an image file



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VNC Protocol

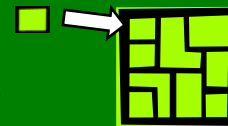
- basic message sent:
*put a rectangle of pixel data at a
given x, y position*



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VNC Optimizations

- raw encoding (basic)
 - pixel data sent left-to-right
- copy-rectangle encoding
 - when framebuffer has same pixel data elsewhere
 - sent (x, y) where pixel data is copied
- majority-color encoding
 - describes rectangles of different colors
 - background and sub-rectangles



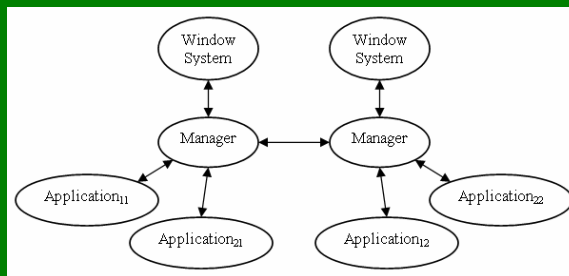
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VNC Updates

- can encode each update using a different scheme
- choose most appropriate for:
 - screen content being transmitted
 - available network bandwidth
- demand-driven
 - only sent when explicitly requested
 - adaptive quality

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Replicated Architecture

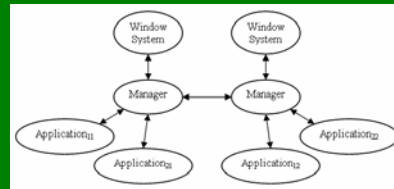


- system consists of:
 - participants' window systems
 - for each participant, an instance of the manager and each application/screen being shared

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Replicated Environment

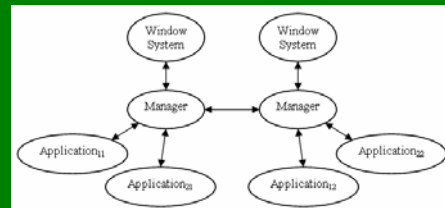
- example
 - window system sends input to application₁
 - input is distributed to other managers
 - replicas of application₁ receive input
 - replicas produce output
 - view changes
 - output request to window system



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Tradeoffs

- replicated has better performance
 - but replicas must be synchronized



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Technical Issues

- also want to support:
 - spontaneous interactions
 - group work
 - workspace management
 - floor control
 - data sharing

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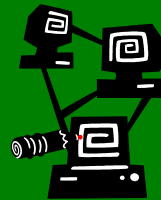
Spontaneous Interactions

- many interactions are spontaneous
 - should accommodate these interactions
- minimize startup overhead
- allow latecomers to join shared sessions
 - replay history of events
 - transfer shared state directly
 - apply process migration techniques
- enable private windows to be later shared
 - dynamically put manager into communication link

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Group Work

- support the mechanics of collaboration
 - provide telepointers
 - support annotation
 - channel for direct communication
- without affecting shared application



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Workspace Management

- traditional window managers not good
 - distinguish shared and private windows
 - identify windows in a particular session
 - determine which session a window is associated with
 - coordinate windows
 - WYSIWIS
 - handle window movements/destructions gracefully



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Floor Control

- determines who has control of what
 - technological approaches
 - queue: keep list of people who request
 - pre-emptive: pass to requester on demand
 - ring-passing: give current floor holder control
 - open floor: allow anyone to hold floor at any time
 - social protocol
 - if high-quality audio available
 - let participants negotiate access

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Data Sharing

- determine how data should be shared
 - possible for data to be overwritten
 - individuals may have different permissions
 - create copies of data



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Non-Technical Issues

- customizing views
- social conventions
- group dynamics



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RealVNC

<http://www.realvnc.com/>

- (free, open source) variant of VNC
 - no telepointing, annotation
 - scroll around to view
 - open floor control

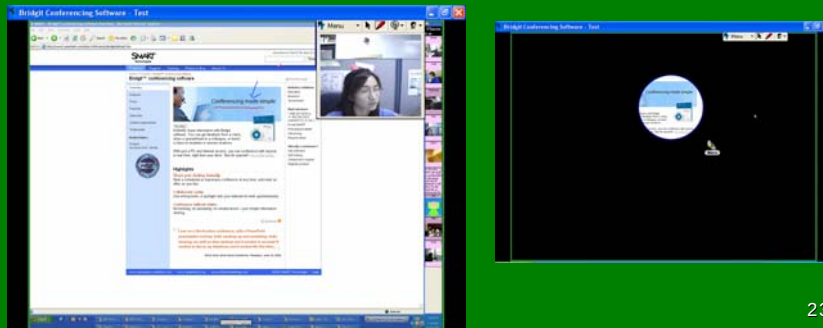


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Bridgit

<http://www2.smarttech.com/st/en-US/Products/Bridgit/>

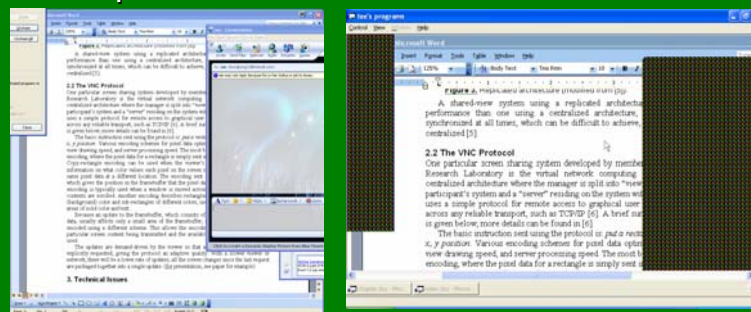
- developed by SMART Technologies
 - annotation, webcam, spotlight tool
 - screen owner gets priority for control



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MSN Messenger's Application Sharing

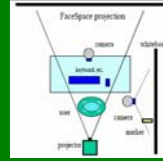
- uses Windows NetMeeting
 - no telepointing, annotation
 - application owner can accept or deny requests for control



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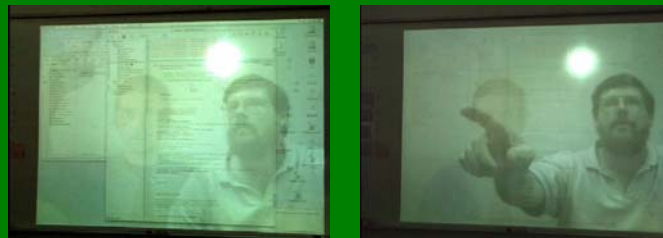
FaceTop

David Stotts, Jason Smith, Karl Gyllstrom



Examples

- two video streams over shared desktop
 - light-weight transition between communication and interaction
 - supports synchronous paired collaboration
 - can see facial expressions, gestures



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Remote Access to Physical Devices

Future Work

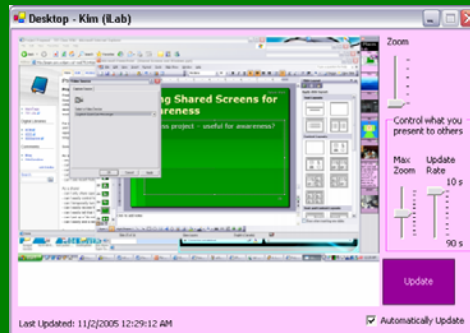
- extend VNC
 - remote access to devices
 - use standardized GUI protocol for devices that have no physical display of their own
 - when display becomes available, can then provide graphical information



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Using Shared Screens for Awareness

- class project – useful for awareness?
 - build shared screen application
 - support awareness → interaction



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Discussion

- as a viewer:
 - what do you want to see?
 - how much information is too much?
 - do you want to be notified if someone is working in a particular application?
 - do you want a recent history of what someone has been working on?
- as a sharer:
 - how much control over what you share?
 - what would you share?
 - visual indication to indicate what you are sharing?
 - times you don't want to share?

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