

Transparent Computer Shared Cooperative Workspace (T-CSCW) Prototype Specification

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Abstract:

The purpose of this paper is to define the architectural specifications for creating the Transparent CSCW model as a consumer based product.

Rev #	Date	Description
0.10	01-10-95	Initial Draft
0.20	01-25-95	Research References
0.30	02-01-95	Multi-Point Architectures
0.40	03-03-95	Details about Connectivity
0.50	04-10-95	Prototype Overview, Logic Flow, Acceptance Requirements, and I/O Control Commands
1.01	05-30-95	Proposed Possible Camera Video as Grayscale
2.01	04-20-96	Replaced dependency upon ISDN with suggestions for other technologies (HDSL).
3.00	08-13-96	Split document into Overview, Architecture, Functional, and Prototype specifications.

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1 Introduction

What is the future of CSCW? Are the developers of CSCW applications following a "waterfall" method of development, or is it a truly iterate process? Are the collaborative needs of users driving the technology, or *is the technology driving -- and limiting -- collaborative behavior?*

CSCW, although still in its infancy, may become the standard of communication for tomorrow. How much of this growth will be dependent on *changes in human behavior* versus *changes in system interfaces*? An engineer would tend to think that human behavior must adapt, whereas an ergonomist would demand that system interfaces must adapt.

A system interface that emulates a model of face-to-face cooperation is a double-edged sword. Groupware has been designed to project as much as possible from one environment into another in the hope that the two worlds will seem as one. However, it is the mechanism of projection itself that becomes the hinderance to effective telepresence.

Even at the current point of groupware implementations, the merits of talking heads in a collaborative situation has been argued; yet it is easily demonstrated that details about a person's gestures and gazes are not fully communicated through these current implementations of talking heads [Heath and Luff, 91]. And the real estate issue not only diverts a user's attention improperly, but these small video queues may not be effective enough to grab the user's attention.

Consider also that all packages for desktop collaboration have the same basic interface. Other methods of context projection must be explored from in more realistic environment.

Current CSCW implementations require users to evolve their behavior to new methods of communication. However, CSCW application developers must realize that additional new methods of communication must evolve as users define what becomes necessary to communicate effectively. On a discussion of computer mediated communication (CMC), researchers observed that ". . . subtle changes in community norms and expectations are underway because the CMC technologies have given voice to interests not previously heard in the traditional channels of communication" [Pickering and King, 92]. NYNEX must build

a unique CSCW product that creates new needs, not just satisfies existing needs, because the existing needs will change as people become familiar with the concept of CSCW.

An effective solution must not only provide telecommuters with a seamless sense of place but also a seamless integration of a shared desktop. The proposition that is being constructed here is two-fold: use the bulk of the bandwidth and the speed of independent hardware-based video transmission to enhance the sense of a shared workspace, and replace the talking heads model with a full-screen overlaid image of the remote person to promote the effective use of gestures [Heath and Luff 91] and possibly gaze awareness [Ishii, Kobayashi and Grudin 92].

Note: The transport mechanism throughout this proposal focuses on HDSL; however, the CSCW box should have an internal architecture that eases the redesign for other broadband transmission protocols.

The two main puposes for a prototype are to demonstrate the advantages of a hardware-intensive solution as well as to explore the usefulness of gesture (and possibly gaze awareness) with a novel method of content projection.

2 Development Phases:

A proposed prototype would be created in multiple phases. Each phase description consists of a technical overview, a list of technical/marketing objectives, a list of possible HCI objectives, and resource requirements for obtaining each objective. At the end of each phase, all estimates for remaining phases will be re-evaluated.

2.1 Phase 1:

This initial phase tests the usability of the telepresence principles originally present in ClearBoard [Ishii]. Due to the novelty of this solution, prototyped hardware would be needed, however it is too costly to build. Until the effectiveness of this communication paradigm can be proven, “wizard of oz” studies will be conducted.

An initial link between two homogenous (PC-based) computers would be accomplished using a direct video and audio connections. Transfer of user input from one computer to another would take place using a direct PC-multiplexer.

Studies would take place within the NYNEX Science & Technology labs.

2.1.1 Technical Goals:

- 1) Can a desktop image be seamlessly converted to video and displayed?
- 2) Can all aspects of a remote desktop be successfully manipulated?

2.1.2 Marketing Goals:

- 1) Is this method of groupware more preferable to use than traditional methods?

2.1.3 Research Goals:

- 1) What are the perceived differences between manipulating a remote desktop versus a local desktop?
- 2) How does application manipulation vary from local to remote desktops?
- 3) How does application manipulation vary from single to shared workspaces?
- 4) Using a matrix of collaborative tasks -- highly versus sparsely social, highly versus sparsely application intensive -- several psychological and social concepts can be evaluated, such as:
 - a) Are gestures communicated, and how do they affect communication [Heath and Luff 91]?
 - b) Increased problem solving with computer-mediated meetings [Fish, Kraut, Root, Rice 92].
 - c) Change in communication habits [Hulbert, Jones 92].
 - d) Equalization with computer-mediated decision making [Dubrovsky, Kiesler, Sethna 91].
 - e) How can gaze-awareness be enhanced [Ishii, Kobayashi, and Grudin 92]?

2.1.4 Estimated Resources:

2 full-time people would be needed to support this phase technically, followed by a single person to design, execute and evaluate the trial results. The timeframe for phase 1 technical completion given the aforementioned head count would be approximately 3 months from the completion of the “wizard of oz” setup.

The range for study design, execution, and evaluation -- depending on the primary focus - - could be anywhere from 3 months to a full year.

2.2 Phase 2:

At this phase, we would only be testing the feasibility of transporting a desktop SVGA signal, mixing in a full-sized image, and displaying it on an SVGA monitor. This is the most important phase of this project.

An initial hardware prototype would need to be fabricated. The two homogenous (PC-based) computers used in Phase 1 above would be connected using prototype hardware to transport video and audio connections through HDSL. However, transfer of user input from one computer to another would take place using a direct PC-multiplexer.

Trials would take place within the NYNEX Science & Technology labs.

2.2.1 Technical Goals:

- 1) Can a desktop image be seamlessly converted to video, *digitized, encoded, transported, decoded* and displayed?

2.2.2 Marketing Goals:

- 1) Can NYNEX successfully provide this method of CSCW to its customers?

2.2.3 Research Goals:

- 1) With which task models does the seamless desktop metaphor start to fail? This comparison uses tasks with the following parameters: highly computer processing intensive applications (i.e. graphics applications where lower frame rates are more noticeable) versus document editing, highly application interactive tasks versus occasional application interactivity, and highly social tasks versus sparsely social tasks.

2.2.4 Estimated Resources:

2 full-time people would be needed to support this phase technically, followed by a single person to design, execute and evaluate the trial results. At least one of the technical people involved should have extensive experience in the design and implementation of HDSL communications. At least one of the technical people should have experience in writing device drivers to control a variety of prototyped hardware. The timeframe for phase 1 technical completion given the aforementioned head count would be approximately 3 months from the delivery of the prototyped hardware.

The range for trial design, execution, and evaluation -- depending on the purpose of the trial -- could be anywhere from 3 months to a full year.

2.3 Phase 3:

At this phase, we would only be testing the feasibility of desktop sharing (i.e replicating user input data from one computer to another) through the communications link.

An enhanced version hardware prototype would need to be fabricated which allows Out-Of-Band data to be transferred over the communication line. The two homogenous (PC-based) computers used in Phase 2 above would be connected using prototype hardware to transport video and audio connections through HDSL. Transfer of user input from one computer to another would take place using the communication line.

Trials would take place within the NYNEX Science & Technology labs.

2.3.1 Technical Goals:

- 1) Can standard user input be seamlessly transported?
 - a) via Software Drivers?
 - b) via Hardware Redirection?
- 2) Is data transfer necessary, and how can it be accomplished?

2.3.2 Estimated Resources:

2 full-time people would be needed to support this phase technically, followed by a single person to design, execute and evaluate the trial results. At least one of the technical people involved should have extensive experience in the design and implementation of HDSL communications. At least one of the technical people should have experience in writing device drivers to control a variety of prototyped hardware. The timeframe for phase 1 technical completion given the aforementioned head count would be approximately 3 months from the delivery of the prototyped hardware.

The range for trial design, execution, and evaluation -- depending on the purpose of the trial -- could be anywhere from 3 months to a full year.

2.4 Phase 4:

Heterogenous systems will be explored via additional platform software device drivers. Also, several hardware options with the CSCW device will be explored, possibly support for other transport mediums (e.g. ISDN-PRI).

2.4.1 Technical Goals:

- 1) What design and implementation issues are there for heterogenous support?

2.4.2 Marketing Goals:

- 1) Is there a desire to have heterogenous support?

2.4.3 Research Goals:

- 1) How does the ability to provide heterogenous access affect collaboration?

2.4.4 Estimated Resources:

2 full-time people would be needed to support this phase technically, followed by a single person to design, execute and evaluate the trial results. At least one of the technical people involved must have a detailed understanding of implementing the user input architecture on a non-PC platform. The timeframe for phase 3 completion given the aforementioned head count could range from 2 months for each platform to be supported. An additional 6 months would be needed to add support for ISDN-PRI capability.

The range for trial design, execution, and evaluation should fall within the 3-6 month range.

2.5 Phase 4:

Multi-point architectures will be explored. Multi-point server hardware and software would need to be designed and prototyped. Since this opens an entirely new set of variables to be discussed, it will be defined in more detail as the other phases are completed.

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