



KUNGL. TEKNISKA HÖGSKOLAN
Royal Institute of Technology

Teleworking in a Flex Office Environment

Per Lindgren, Ulf Berggren,
Örjan Ljungqvist, Tobias Öbrink

TRITA-IT R 97:14
ISSN 1103-534X
ISRN KTH/IT/R--97/14--SE

Department of Teleinformatics



KUNGL. TEKNISKA HÖGSKOLAN
Royal Institute of Technology

Teleworking in a Flex Office Environment

Per Lindgren, Ulf Berggren, Örjan
Ljungqvist, Tobias Öbrink

This document describes a teleworking environment based on a “flex office” at the department of Teleinformatics at KTH. The flex office consists of two parts; a flexible workspace at the department and a home office environment. The main focus of this document is on the technical description of how the communication platform between office and home is handled.

Currently, more than 30 persons have ISDN access at their homes, and totally over 40 persons have access via either ISDN or modems to the department network. Finally, a survey and evaluation of the opinions of the people working in this type of environment is presented. This document was developed within the Tecodis project.

TRITA-IT R 97:14
ISSN 1103-534X
ISRN KTH/IT/R--97/14--SE



Department of Teleinformatics
Telecommunication Systems Laboratory

1. Introduction	1
1.1 Outline of Document.....	1
2. Flex Office Environment at KTH/Teleinformatics	3
2.1 Technical Specification	3
2.1.1 Hardware Set-up	3
2.1.2 Software Set-up.....	4
2.1.3 Videoconferencing Applications	5
2.2 Administration Issues.....	5
2.2.1 Back-up.....	5
2.2.2 Security	6
3. Evaluation of the Flex Office Environment.....	7
3.1 Home Working Place	7
3.1.1 Technology	7
3.1.2 Functions.....	7
3.1.3 Environment	9
3.2 Flex Office.....	10
3.2.1 Environment	10
3.3 Evaluation Summary	11
4. Summary	13
5. References.....	15

1. Introduction

The area of teleworking has developed rapidly over the last few years. Increasingly more enterprises and universities use teleworking in their daily work. This has resulted in a strong interest for issues related to this area and several papers concerning these matters have appeared, e.g., the Swedish Distans and Decision.

Since teleworking people do much work at places other than the office, less office space is required. Teleworking is therefore often combined with new more flexible office environments [1, 3]. This new way of working has resulted in new demands on many different aspects of work environment [4]. For example, it has been shown that new managing methods are needed [2]. Additionally, information distribution, to get hold of people and meeting scheduling are aspects to consider in a flex office environment. Furthermore, soft aspects, such as being away from the informal spread of information, career positioning and the lack of socializing are important to the people working in such ways. There are also several legal aspects such as insurances that have to be handled [5].

1.1 Outline of Document

In section 2, an introduction to the ideas of flex office and teleworking at the department of Teleinformatics at KTH is presented. The technical specification of the home offices, including hardware and software issues, and their ISDN connections are described in section 2.1. In section 3, an evaluation based on weekly reports and a questionnaire is presented. Some advice and guidelines derived from our experience with this type of working environment is presented in section 3.3. Finally, in section 4, a short summary of the document is presented.

2. Flex Office Environment at KTH/Teleinformatics

At the flex office of the department of Teleinformatics, people do not have their own rooms or even their own work places. Instead, all work places can be used by all people. This is made possible by the computer platforms and the telephones used. The department has installed a DECT telephone system, with mobile DECT phones that can be used independently of the work place used. Additionally, no personal computers are employed. Instead, a file system distributed over several servers that can be connected from any computer is used. When a user logs in to a computer, he gets direct access to his personal files. The flex office environment also demands that all work places are tidied up at the end of the day and papers and books are put into personal movable book shelves. To minimize the amount of paper needed to be stored, digitizing of documents is needed.

One important part of the installation of the flex office environment at the department of Teleinformatics is to provide home offices for the people involved. Traditionally, doing research is a very flexible work, where the number of hours spent at the office varies significantly. One reason for this is that much work at a research department is individually oriented – you are working on your own degree. It is therefore important to also provide places where individual work, such as reading reference literature and writing, may be performed.

Providing a good home office environment has therefore been important. Most home computers are attached to ISDN lines, providing 128 kb/s between the home computer and the department's local area network. This means that all personal data files at the department are accessible from home and that the home computers have Internet access. Currently, more than 30 persons have ISDN access at their homes, and totally over 40 persons have access via either ISDN or modems to the department network.

2.1 Technical Specification

The idea with flex offices is to make people more productive by letting them work where and when they want. Most of the work done at the department requires a computer, and therefore a good computer environment at home is important. The home computers are therefore as similar to the ones at the office as possible, even though some differences are necessary.

A solution based on ISDN connections to the homes makes the home computers part of the office computer network. This gives fairly good performance (128 kb/s), but ISDN is usually not fast enough to run applications directly from the file servers. Therefore, most programs are stored on the local disk, while for example license servers are still run at the central office.

This text is not to be considered as a guide on how to set up a home office environment, but should be regarded as a collection of thoughts and experiences on the subject of home offices.

2.1.1 Hardware Set-up

Most people use the same computer platform at home as at the department, i.e., SUN SPARCstations, making it easy to switch between the work sites. The home computers are set up as stand-alone machines, i.e., the whole operating system is maintained locally. This means that the hard disks need to be at least 1 GB. However, Silicon Graphics workstations, PC:s and Macintosh computers are also supported.

Instead of using the ISDN interface of the SUN SPARCstations, an Ascend router (P50 or P75) is used. The reasons for this are that it was easier to configure towards the main Ascend ISDN router used at the department and that the built-in ISDN cards only supported 64 kb/s. A third advantage is that the routers may connect to several computers, i.e., it is possible to have a small local area network at home. Most home offices are therefore provided with IP numbers (subnetted) for up to six hosts. The computer is attached to the router via the Ethernet interface. In this way the computer is configured in the normal way using the local Ascend router as the default router for outgoing traffic.

The Ascend P75 has another benefit, it has two analog telephone interfaces which means that it is possible to connect two telephones. In this way everyone with an Ascend P75 gets an extra telephone line at home.

At the office, an Ascend MAX router is used that receives all ISDN-connections via its primary rate (PRI) interface (32 B-channels). Even though there are only 32 B-channels, which only allows for 16 simultaneous users, more than 30 persons have ISDN connections to their homes. The Ascend MAX is connected to the local area network of the department, which is further connected to the Internet (see Figure 1).

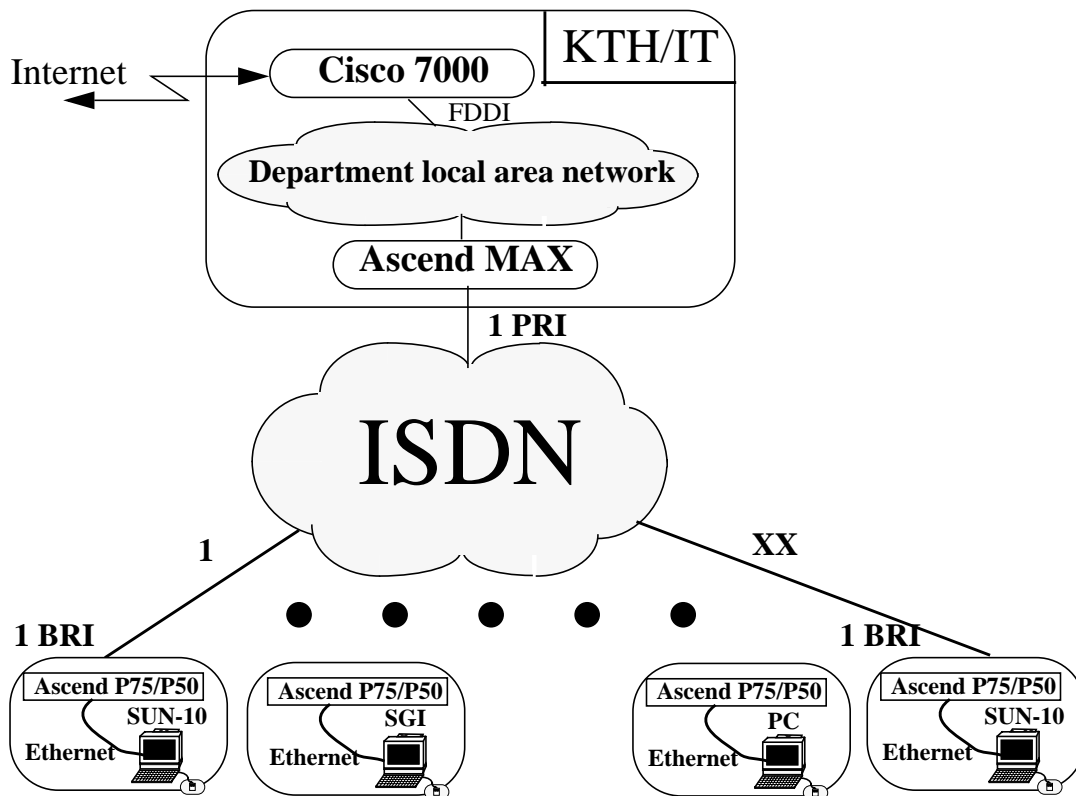


FIGURE 1. ISDN to Home Setup

2.1.2 Software Set-up

What software to use at home depends of course on what type of work to do and the computer platform used. Most programs, such as word processors, text editors, web-browsers, security applications and backup routines, are used independently of the type of work that is performed. The most common platform is currently the SUN/Solaris platform at both the department and at the home offices, why those programs are listed here.

Programs installed include:

Solaris 2.5.1	OS
Emacs	text editor
gcc/g++/libg++	c and c++ compilers
perl	perl script language interpreter
bash, tcsh	shells
Netscape	Web Browser
FrameMaker	Word processor
Kerberos (Athena)	security system, provides security
exmh	mail program, runs at a server at IT
xv	image (jpeg, gif, tiff, etc.) viewer
ghostview	Postscript viewer
Adobe Acrobat	Acrobat viewer
Mbone Tools (vic, vat, sd)	Conferencing tools

Not all programs are suited for running at home, for example E-mail clients. The reason is that if E-mail clients are run on several computers with different filesystems, the E-mails tend to get messed up. Some E-mails are on the home computer while others are at the office file servers. A solution to this is to always run the e-mail client at the office and display the window at home. This is possible as a standard feature of the Xwindow system used by most Unix machines.

2.1.3 Videoconferencing Applications

The plan is that every home computer will have SUNvideo boards and video cameras (or the corresponding for other computer platforms), but this has only been set up at a couple of home stations. Due to lack of time, there has not been any evaluations of different platforms, even though several different platforms have been identified. The video conferencing tools used at the home sites have been the Mbone tools for video conferencing. There are currently many different applications that provide video conference services and several of those are listed in Appendix A. An evaluation at the department has shown that most people believe videoconferencing tools provide an additional functionality compared to E-mail and telephones.

2.2 Administration Issues

One important issue to consider when setting up home offices is how system administration is handled. In the case of KTH/Teleinformatics, the users are considered to have the ability to handle most of the system support themselves. The central system support group has two main responsibilities; to set up the ISDN connections, including IP address handling, and to handle emergency situations the user cannot handle. However, a need for educating and guiding novice users has been identified. There are two issues that are further investigated in the following sections; back-up strategies and security aspects.

2.2.1 Back-up

A good back-up strategy is essential for all type of computer work. The problem with home offices is that much of the responsibility for performing back-ups is put on the individual.

There are several ways to arrange backups, and different users currently use different methods. The following solutions are used:

- The user can manually copy important files to the file servers at the office where backup is performed at a regular basis.
- Back-ups can be automatically performed through the use of scripts. However, there are problems with this solution. If the operation is time-scheduled it means that the home office computer has to be turned on at those times. If it is event driven, (let's say that the computer transfers data to the office when the ISDN-link is available) there is always a risk that the user turns off the computer in the middle of a transfer since he may not know about it. In addition, transferring files may take a lot of both the computer power and the capacity of the ISDN link. It may therefore be preferable to let the back-up process have a lower priority.
- Another solution would be to arrange the home computer to have two hard disks and ensure that data is stored on both. This solves the problem of a disk crash, but not the one if the computer is stolen or if there is a fire.
- A similar but more modular solution is to use removable hard disks, such as jaz disks.
- Since DAT-stations are becoming cheap, it is possible to equip all users with a DAT-station and write a script that backs up the hard disk. This is a nice solution but requires more out of the user. There is also a problem of storing the DAT tapes so that effective backup is actually achieved.

The best back-up solution is probably to make a combination of these variants, i.e., make a total back-up with regular intervals, using a DAT-station or a removable hard disk, and use differential back-ups (perhaps only for the personal account where usually most work is performed).

2.2.2 Security

This is an area for further study. Most home computers and office computers at the department of Teleinformatics use Kerberos to achieve secure communications. Kerberized Telnet, etc. is used to ensure that passwords are never sent in clear text over the network.

3. Evaluation of the Flex Office Environment

An evaluation of how people at the department work in the Flex Office environment has been conducted. The evaluation stems from a questionnaire about the working environment, both technical and social aspects. Additionally, approximately 15 persons were asked to submit weekly reports during one month on how they felt about teleworking, what type of work they performed at home and at the office, etc.

3.1 Home Working Place

3.1.1 Technology

Most people use the same computer platform at home as at the department. The evaluation showed however that several persons would prefer using a PC platform at home, preferably with an NT environment.

How is back-up handled?

The survey showed that there are no automatic back-up routines. Most people do no back-ups at all or perform manual back-ups, i.e., copy all files manually to a special directory at the office computer system. This issue was identified to need a plan on how to handle more efficiently.

What security measures are used at home?

Approximately 50% use Kerberos to achieve secure communication when using UNIX computers. For PC:s and Macintosh computers, different disinfectant programs are used. Additionally, 15% use PGP regularly for E-mails.

Is anything missing technically at your home site?

A printer is what most people would like to have at home, thereafter a scanner. See also next question.

Are there any suggestions on how to improve the home site, technically?

- More memory to the computer
- Larger hard disk
- Videoconferencing utilities
- Thermostat controlled fans to the computers or boxes that keep the noise of the computers low
- Most people would like to have the same mobile telephone at home as at the office

3.1.2 Functions

What type of work do you do mostly at home?

Administration, E-mail and WWW-related work are the dominant types of work performed at home.

Additionally, word processing, development work, programming, and reference reading are frequent work tasks at the home office.

How much of your time do you spend at your home site?

~0-25% : 45%

~ 25-50% : 45%

~ 50-75% : 10%

~>75% : 0%

Is there a problem working both at the office and at home?

70% answered no.

30% answered yes. The reasons are:

- Not enough space at home
- Hard to get system support at home
- Reference material are sometimes at the 'other' site
- Hard to get in contact with people when needed

What programs do you need at home?

100% answered Word processor, E-mail client, and Web browser.

~75% answered c compiler and acrobat viewer.

~50% answered PS viewer and image viewer.

For those with PC's, most have answered they need the MS Office tools. Some persons need more specific programs, such as Cad tools.

How would access to a video conferencing system at home affect your work?

50% gave positive answers. The reasons are:

- It increases the feeling of presence
- It decreases the need to travel to the office
- It makes it easier to get system support help
- It increases the social effect

50% do not think it will significantly affect their work.

0% are negative.

3.1.3 Environment

Do you have enough space at home to accommodate a work site?

80% : Yes

20% : No

Do you disturb other people at home?

85% : No

15% : Yes. It seems to depend on the location of the office. If possible, the bedroom should be avoided.

Do you get disturbed by others at home?

85% : No

15% : Yes

What are the main advantages with working at home?

- More efficient work
- Easier to concentrate
- No travel time
- The flexibility and feeling of freedom
- Easier to determine the time spent on different tasks

What are the main disadvantages with working at home?

- Hard to get system support
- The computer platform needs to be upgraded with new software versions, etc., which takes time
- Isolated from social contacts with colleagues
- Hard to get a distinction between leisure time and work
- Missing important information
- Feeling of not being payed attention to (from a career perspective)
- Hard to work when other people are at home
- Harder to get in contact with people
- Takes a lot of space at home

What do you think about having a home site?

95% of those with a working home site felt it was very valuable to be able to work at home. Some people did not have a working computer platform at home. These few people were somewhat negative, mainly due to the lack of system support. Another negative reaction was the added costs of home computers for the department.

3.2 Flex Office

3.2.1 Environment

Is the support enough from the department to work in the Flex office?

25%: Yes

75%: No, Reasons are:

- Not enough computer system support, neither at home nor at the office
- Too little introduction on how to handle the computer and the router

Is the flex office environment made in order to make the work easier?

25%: Yes

75%: No, Reasons are:

- Need further improvements
- Too noisy, both regarding noise from computers and from other people. There needs discipline to not disturb others
- a quiet study room for reading, etc. is needed
- There needs to be better rules on how to behave in the Flex office in order to not disturb others

What is the office site mainly used for by you? (More than one answer accepted)

- Group work: 60%
- Individual work: 30%
- Meetings: 30%
- To establish and keep contacts: 20%
- To do work that requires specific equipment: 20%

Does your productivity increase?

60%: Yes,

- It is easy to ask people in the flex office environment
- There is a larger choice to work when appropriate, which makes it easier to combine with a family.

30%: No, It is a too noisy environment with too many distractions.

10%: Ambivalent.

Is it valuable to work like this?

70%: Yes,

- There is a high degree of freedom and flexibility.
- It gets fast to accommodate to new colleagues and new projects.

20%: No, it takes too much space at home and is too noisy at work.

10% Ambivalent.

3.3 Evaluation Summary

The overall impression from the answers of the survey and from our experience is that most people think it is a benefit to be able to work in the flex office with a computer at home. It is especially the possibility to individually determine how and when to work that appeals to people. However, there are several issues that need to be addressed with this type of environment.

It has been shown during the process that it is important to shape an increased awareness of the long terms goals (or visions) of a program or project. This is something that is emphasized more and more in this type of network based organization. Additionally, it is of great importance to inform, both at an early state and repetitively, about and discuss the idea of flexible work and give feedback after reviews and surveys have been completed. It is recommended to arrange personal network meetings to share information, on program or laboratory basis, to discuss good examples of "home office environments" including down-to-earth details.

There are also several practical issues to handle for the company, such as, type of office furniture, whether the company should support the extra cost of having a home office, insurance matters, etc. The home computer platform also needs to be addressed in form of system support as well as backup and security strategies. It was also discovered that an introduction to new people is needed. It would be very useful to have a CD containing all necessary programs including a guideline.

It has also been shown during the process that it is important to shape an increased awareness of the long terms goals (or visions) of a program or project. This is something that is emphasized more and more in this type of network based organization. Overall strategies for reporting and information sharing need to be formed.

One problem with having people sitting at different sites is to get hold of people, for example to schedule meetings. A distributed calendar where it is possible to see when people are available would be useful. Additionally, to use mobile phones that can be used both at home and at the flex office has shown to be valuable. Currently, cordless DECT telephones are used at the office while at home, regular phones are used. New phones with combined DECT (to be used at the office) and GSM are currently emerging. However, these phones are still rather expensive, both to buy and use.

Another aspect that has been identified is that it is important to have easy access to small conferencing rooms as well as quiet study rooms at the office. It is not possible to keep discussions within the flex office or talk in the phone. At the department, there are two study rooms with a computer. These computers are equipped with video conferencing utilities. It is thus possible to have a conference over ISDN with people sitting at home.

4. Summary

The Flex office environment at the department of Teleinformatics contains two main parts; a flexible office workspace and a home office environment. This document has described the technical set-up for handling home offices. Currently, more than 30 users are connected via ISDN lines between the department and their homes. Additionally, several users use lower capacity modems.

Several different computer platforms are used at home, but the most common platform, both at the department and at home, is SUN SPARCstations. The computers are set up as stand-alone machines with most programs run locally. License servers and some special programs, such as E-mail clients, are however accessed via the ISDN link. The ISDN link also makes it easy to access all personal and public files at the central office and/or the home office, and to get access to the Internet.

Moreover, several programs used at the home computers have been described and a set of conferencing tools have been identified. Additionally, security issues and back-up strategies have been discussed.

The evaluation of Teleworking at the department has shown that over 70% are positive to teleworking and the flex office environment and all people who are using a home computer have positive experiences. The most valuable aspect is the high degree of freedom of choice and flexibility experienced. Additionally, introducing new colleagues goes fast and informally and the "team feeling" is improved. The lack of social contacts and lack of informal information are sometimes point out as negative aspects of teleworking. A video conferencing platform, however, could potentially improve this. Some guidelines are presented, related to our personal experiences, based on the evaluation so far. It is emphasized that flex office design should be looked at as an iterative process rather than a ready made design. Organizational design and technological development are interacting and together representing one main challenge for the future.

5. References

- [1] Ericsson, Customer Competence Culture Change, “The Changing Office – Taking the Lead by Working Smarter”, Technical Report, Ericsson.
- [2] A. Lundin and T. Stolpe, “Distansarbete ur ett chefsperspektiv” Technical Report, Stockholm University.
- [3] TCO, “Hemmet som arbetsplats”, Report 2-1995, art. nr. 08 62546–109.
- [4] TCO, “På lagom Distans – För och emot distansarbete”, Report, ISBN 91-7168-345-3.
- [5] TCO, “Med Jobbet på Distans–Att avtala om distansarbete i hemmet”, Report, ISBN 91-7168-345-3.

APPENDIX A

There are currently very many different more or less proprietary applications providing a videoconferencing-like set of services to the users. There are ongoing efforts in several places to collect information about all these applications, and we have used this information to compile the list of applications presented in Appendix A. Note that this doesn't imply that we have had any experience in using these applications.

Entries in the list are commercial and non-commercial products that conforms to the following criteria:

- Platform independent; The product should be available on more than one of the most common platforms available, namely Unix platforms, Intel/Microsoft platforms, and Apple Macintosh platforms. Too many combinations are available to make it feasible to say that some application is completely "Platform independent".
- Hardware independent; The product should run over more than one combination of cards/chipsets for video/audio/graphics/network.
- Network independent; The product should run over a heterogeneous network environment without severe service degradation.
- Standards compliant; The product should comply to a suite of widespread, preferably formalized (approved by one or more international standardizations organization) standards for compression/decompression, transfer, signalling, session handling, conference setup and management, et.c.

Communique!

Provider: InSoft, Inc.

Description: Integrates real-time digital video technology with fully interactive, real time collaborative tools, such as application sharing, shared whiteboard, chat, audio, text and graphics tools.

Platforms:

- Sun SunOS 4.1.3, 4.1.4
- Sun Solaris 2.3, 2.4, 2.5
- HP HP-UX 9.0.3, 9.0.5, 10.0
- IBM AIX 3.2.5, 4.1.1
- DEC Digital Unix
- SGI IRIX 5.3
- Intel PC Windows 3.1, 3.11, 95, NT

Requirements: Video card and camera.

Price: Based on supportive platforms.

Contact Info: InSoft, Executive Park West 1, 4718 Old Gettysburg Rd., Mechanicsburg PA, 17055, USA, phone: +1.717.730.9501, fax: +1.717.730.9504, info@insoft.com.

LAN Protocols: Packet/Cell/Telephony Networks

Audio Encoding: G.7xx

Video Encoding: CellB, JPEG, H.261, DVE, Indeo.

Interoperability Standard Support: H.320

Multipoint: Yes

Collaboration Features: Video/Audio/Real Time Collaborative Tools.

Notes:

Survey Info Updated: May-96

Connectix VideoPhone

Version: v1.1

Provider: Connectix Corporation

Description: Low-cost software based audio/video and whiteboard conferencing application for both Windows and MacOS. Available as a software-only product or bundled with their digital camera, the Connectix QuickCam.

Platforms: PC and Mac

Requirements: Pentium or faster processor, Windows v3.x or Windows95, WindowsNT. MacOS, Centris, Quadras, and PowerMacs.

Price: Connectix Videophone Software: SRP - 99.00 USD, Street Price - ~59.00USD
Connectix Videophone with QuickCam: SRP - 199.00 USD, Street Price - ~169.00USD

Contact Info: Connectix Corporation, 2655 Campus Drive, San Mateo, CA 94403, USA.
phone: +1.415.571.5100 toll free: 1-800-950-5880 fax: +1.415.571.5195

LAN Protocols: TCP/IP; Novell IPX

Audio Encoding: PCM, ADPCM, GSM, TrueSpeech

Video Encoding: VIDEDEC, Indeo, NSVideo, H.261

Interoperability Standard Support: No.

Multipoint: Yes.

Collaboration Features: Whiteboard

Notes: Connectix QuickCam digital camera plugs into a PC's parallel port or into a Mac's printer port. Since the QuickCam plugs directly into already available ports, there is no need for additional hardware.

Survey Info from: May-96

CorelVIDEO

Version: 1.0

Provider: Corel

Description: CorelVIDEO is a video PBX, providing high resolution, full-motion video to the desktop. Includes data sharing and many other workgroup features.

Platforms: PC, Mac

Requirements: Windows 95/NT (now), Win3.11, or OS/2. Macintosh. External camera, external/internal NTSC/PAL video monitor, one spare pair of UTP per desk.

Price: \$499.00 per seat excluding camera

Contact Info: Faxback 1-613-728-0826 ext 3080 doc#1081 or catherinej@corel.com LAN Protocols: IPX, TCP/IP, NETBEUI Audio Encoding: internal: n/a, external H.320/G.711/G.728 Video Encoding: internal: n/a, external H.320, G.261

Interoperability Standard Support: H.320

Multipoint: internal: available as an option, external: compatible with H.320

Collaboration Features: video: broadcasts, multipoint. data: text messaging, shared screen, shared document, file transfer

Notes: Survey Info Updated: Apr-96

CU-SeeMe / Cornell **CU-SeeMe / White Pine**

Version: 83b3 (Macintosh), 64a4 (PC).

Provider: Cornell University and White Pine

Description: Video/Audio over the Internet. (PC version is receive-only for the audio).

Platforms: Macintosh, PC.

Requirements: Video camera. Mac: 68020 or higher, System 7 or higher, 16-level-grayscale display, MacTCP, video hardware (Video Spigot hardware or AV Mac), audio hardware, Quicktime.

PC: 386DX or higher, Microsoft Windows 3.1+, Windows Sockets compliant TCP/IP, 8 bit video driver, video hardware supporting Microsoft Video For Windows.

Price: Free, by anonymous ftp from <ftp://gated.cornell.edu/pub/CU-SeeMe/>.

Contact Info: Dick Cogger, R.Cogger@cornell.edu, phone: +1.607.255.7566.

LAN Protocols: UDP/IP, IP Multicast.

Audio Encoding: ?

Video Encoding: Non-standard

Interoperability Standard Support: –

Multipoint: Yes, using Unix reflector software.

Collaboration Features: None

Notes: PC runs on both Windows and Windows 95

Survey Info Updated: Jan-96

CU-SeeMe (Enhanced)

Version: 2.0 (PC), 2.0 (Mac in beta)

Provider: White Pine Software

Description: Desktop Video Conferencing software for person to person or group conferencing. Enhanced CU-SeeMe can be used over the Internet or any TCP/IP network. Enhanced CU-SeeMe is a software only solution and is crossplatform supporting all Windows and Macintosh platforms.

Platforms: PC and Mac

Requirements: Video camera.

PC:

486 or Pentium processor, 8MB RAM, Windows 3.1+, Windows95, Windows/NT, TCP/IP - Winsock compliant.

MAC:

68020, 030, 040, Power Macintosh, 4MB RAM, System 7.0 or greater, TCP/IP - MacTCP included, Open Transport in System 7.5.2. Macintosh PowerPC and Macintosh 68K

Price: \$99 Retail, \$69 electronic version only purchased over the Internet

Contact Info: White Pine Software, Inc. 40 Simon Street, Nashua, NH 03060-3043 phone: 603-886-9050, fax: 503-886-9051, email: info@cu-seeme.com

LAN Protocols: TCP/IP

Audio Encoding: 2.4k Voxware, 8.5k Digitalk, 16K Delta-mod

Video Encoding: White Pine 24-bit True Color, CU-SeeMe Grey

Interoperability Standard Support:

Multipoint: Yes - White Pine Reflector - Unlimited

Collaboration Features: WhitePineBoard - Object oriented, color, multiuser with text draw objects. Copy, paste, and full editing for information sharing. Chat Window - for non-audio conversations using text entry from keyboard. Filtering for selection of individual conversations.

Notes: CU-SeeMe offers a total Internet video conferencing software only solution. It can be used as an Internet phone over a low bandwidth 14.4 modem or as a video and audio conferencing solution over a 28.8 modem or higher bandwidth connection. When used with the White Pine Reflector, Enhanced CU-SeeMe supports group conferencing and video for “cybercasting” to large audiences.

Enhanced CU-SeeMe can be downloaded for 30 day evaluation from our web site at: www.cu-seeme.com

Survey Info Updated: Apr-96

DVTCS-3000 ULTRA

Version:

Provider: SYSTEMS of Excellence

Description: The DVTCS-3000 ULTRA is a cross-platform (PC, MAC, UNIX), 30fps desktop video teleconferencing system. SOEI provides for multipoint, continuous presence audio and video as well as file and application sharing. Additional features include analog transmission over UTP in a LAN/Campus environment and standards based wide area transmission at 30fps. Multiple “seats” are simultaneously transmitted (4, 8, 16, 32, etc.) in all conferences. Video on demand ad-hoc connectivity are standard features.

Platforms: PC, MAC, UNIX

Requirements: 286 or above

Price: List price \$5999. plus requisite infrastructure.

Contact Info: Fred M. Raumer/Vice President of Sales and Marketing/Systems of Excellence/1420 Springhill Road, Suite 155/McLean, VA 22102 phone: (703) 734-9200 fax: (703) 883-1434

LAN Protocols: NetBios, TCP/IP, Novell

Audio Encoding:

Video Encoding:

Interoperability Standard Support: H.320, T.120, G.721

Multipoint: Yes.

Collaboration Features: Yes.

Notes:

Survey Info Updated: 17-Apr-96

Eris Visual Communications System

Provider: RSI Systems Incorporated

Description: Video/Audio/Tools over ISDN.

Platforms: PC, Mac, Unix

Requirements: PC running Windows 3.1 or later / Macintosh running System 7.0 or later / SUN workstations

Price: \$3995 includes desktop unit (with integrated speakerphone), cables, software and documentation.

Contact Info: RSI Systems Incorporated, One Corporate Plaza, 7400 Metro Blvd., Suite 475, Edina, MN, 55439 USA, +1.612.896.3020, toll free: 1-800-496-4304, fax: +1.612.896.3030.

LAN Protocols: N/A

Audio Encoding: G.728, G.711

Video Encoding: H.261 (QCIF,CIF)

Interoperability Standard Support: H.320

Multipoint: Yes.

Collaboration Features: Real-time sharing of any document window (cross-platform) and file transfer capability (cross-platform).

Notes: Eris is a self-contained SCSI or PCMCIA peripheral (requires no board installation). It can be easily moved between systems.

Survey Info Updated: 21-May-96

IVS (INRIA Videoconferencing System)

Version: 3.5

Provider: RODEO Project, INRIA Sophia Antipolis, France.

Description: Video/Audio over the Internet.

Platforms: Various Unix platforms (see Requirements section).

Requirements: A workstation with a 1, 4, 8 or 24 bit screen depth. Multi-host conferences require kernel support for multicast IP extensions (RFC 1112). Video frame grabbers supported are:

- SPARC stations with Parallax, SunVideo, VideoPix and the new Vigrapix
- Silicon Graphic stations with IndigoVideo, GalileoVideo and VinoVideo
- PC/Linux with SCREENMACHINE II
- DEC 5000 stations with VIDEOTX
- DEC ALPHA stations without video capture
- PC/FreeBSD2.0 stations without video capture.
- HP stations with VideoLive

No special hardware apart from the workstation's build-in audio hardware is required for audio. Requires a camera compatible with the video board.

Price: Free, by anonymous ftp from <ftp://zenon.inria.fr/rodeo/ivs>.

Contact Info: Thierry Turletti, Thierry.Turletti@sophia.inria.fr.

LAN Protocols: UDP/IP, IP Multicast.

Audio Encoding: PCM, ADPCM, VADPCM, GSM, LPC

Video Encoding: H.261

Interoperability Standard Support:

Multipoint: Yes

Collaboration Features: None

Notes: IVS new system Rendez-vous is being released Q4-96, with RTP support.

Survey Info Updated: Aug -95

jointX

Version: 2.1

Provider: Sietec Systemtechnik (subsidiary of Siemens-Nixdorf)

Description: Multipoint desktop conferencing system that supports X11 application sharing with simultaneous videoconferencing.

Platforms:

- SUN SunOS 4.3
- SUN Solaris 2.x
- SGI IRIX 4.x and 5.x
- HP HP-UX 9.x
- SNI RM Sinix-5.4
- IBM AIX 3.x

Requirements: Sietec's SC320 video module for H.320 based videoconferencing, Parallax PowerVideo board (for JPEG), SunVideo board (for CellB)

Price: Call for prices.

Contact Info: Sietec Systemtechnik GmbH & Co. OHG, Nonnendammallee 101, D-13629 Berlin Mr. Carsten Kruschel, Product Manager - phone: +49 30 386-28148, fax: +49 30 386-23780, mail: carsten.kruschel@sietec.de

LAN Protocols: TCP/IP (UDP)

Audio Encoding: G.711, PCM

Video Encoding: JPEG, CellB, H.261

Interoperability Standard Support: H.320

Multipoint: yes, H.320 with MCU

Collaboration Features: X11 application sharing, shared group filestore, chatbox, and shared whiteboard

Notes: The videoconferencing modules support H.320/ISDN, JPEG/UDP and SUN-CellB/UDP based video. jointX enables several physically remote people to work simultaneously on networked, heterogeneous UNIX hosts within the framework of a group. The group work is based on an X-application (e.g. a CAD-application, a DTP-application). jointX normally supports all X-applications if they don't use X-extensions. jointX allows the members of a work group to use X-applications jointly and to save data centrally in order to avoid version conflicts.

Survey-Info Updated: Mar-96

The MBone tools

Provider: Many

Description: Local and Wide Area Video Conferencing consisting of a wide range of more or less free tools for audio, video, shared whiteboard, shared editing, conference session tools

(announcement, scheduling, setup, management), awareness tools, debugging tools, multicast routing software and WWW frontends.

Platforms: Sources are freely available for most of the tools. Binaries are available for most of the common platforms.

Requirements:

Price: Free.

LAN Protocols: UDP/IP, IP Multicast. RTP

Audio Encoding: PCM, ADPCM, VADPCM, DVI, GSM

Video Encoding: H.261, MJPEG, nv, CellB, nvdct, bvc

Interoperability Standard Support: RTP

Multipoint: Yes

Collaboration Features: audio, video, shared whiteboard, shared editing, conference session tools, awareness, WWW frontends

Survey Info Updated: Dec-96

Datapoint MINX Networked Video Systems

Provider: Datapoint Corp.

Description: Local and Wide Area Video Conferencing System - Utilizes existing available wiring in building including: unused twisted pair in your 10baseT LAN wiring or any available unshielded twisted pair (UTP) in your building - Cat. 2 UTP, Cat. 3 UTP, Cat. 4 UTP or Cat. 5 UTP, or shielded twisted pair (STP), or COAX, or Fiber Optics for local connections. For long distance digital video communications the system supports ISDN line rates from BRI to PRI, Switched Digital line rates from 56Kbps to 2Mbps(E1) with additional support for ATM, Satellite, Microwave, and Digital Fiber Optics connectivity.

Platforms:

- PC - Any PC(386, 486, Pentium) supporting Windows 3.1, Windows 95, Windows NT, or OS/2 for Windows 2.11 with ISA bus and VGA or RGB display monitor supporting video overlay card (WinTV).
- MAC - Any MAC AV system or any MAC which supports a MAC running any version of the MACOS that supports a video overlay card for the RGB display.
- SUN - Any SUN Workstation running SUN OS or Solaris that is Video Enabled with SUN Video card or other video overlay card (SlicVideo, RasterVideo, Parallax).
- Other UNIX workstations - Any UNIX workstation or X-Terminal that is video enabled or supports a video overlay interface that accepts standard NTSC or PAL (Composite Video) input.
- Standard NTSC and PAL Display Devices - Any video display devices/monitors that support standard NTSC or PAL video input(such as Televisions).

Requirements: See above.

Price: PC version - \$1750 at desktop includes camera, microphone, speakers, video overlay card and MINX interface card. 8 Port Server - \$7450 (32 port, 64 port and 128 port servers available). Standards :(ITU H.320) based CODEC supporting up to 384Kbps - \$12,990. DTC Desktop Collaborative Computing Application for PC - \$99

Contact Info: Datapoint Corp., 8400 Datapoint Drive, San Antonio, Texas, USA, 78299, Tel. 1-210-593-7900, Toll free: 1-800-378-6469

LAN Protocols: IP, IPX (also modem support) for Collaborative Computing Software on PC

Audio Encoding: G.711, G.722, G.728

Video Encoding: H.261

Interoperability Standard Support: H.320

Multipoint: Yes this is a standard feature. Datapoint's patented video follows voice technology automatically switches view to current speaker. Over 1100 parties may be engaged in video conferencing within a Local Area of Interest (LAI) or campus environment. This system supports over 550 two way calls simultaneously or any combination of multiple parties(3, 10, 20, 100, etc. up to 1100 simultaneous users) on a single call. For wide area or long distant calls, the Datapoint Servers and SuperHubs can support any number of codecs which can be running at the same or different line rates. The Datapoint system handles the rate adaptation between different line speeds.

This allows a remote desktop running at 128Kbps (ISDN BRI) to participate in a multipoint call with parties on the local video network and remote room systems and/or rollabouts that may be running at higher line rates such as 384Kbps and/or 768Kbps. No other MCU is capable of this rate adaptation function. A Continuous Presence Option (Hollywood Squares) is also available and can work in conjunction with the system's standard multipoint functions.

Collaboration Features: Shared Whiteboard, Real-time interactive document manipulation (up to 128 users working on same document at same time), file transfer, document camera support, shared video resources (VCRs, cameras, TV tuners, etc.) and support of other third party collaboration tools.

Notes: Software on the Server and/or SuperHubs automatically changes remote view to the current speaker. Software on the Personal Computer can capture video. Datapoint standards based codec supports line rate from 56Kbps to 2Mbps and can handle Switched Digital Service and/or ISDN Services. Frame rates for wide area calls vary based on line rates from 15FPS CIF to 30FPS CIF. Local video is full motion standard TV quality NTSC or PAL video. In addition to supporting our standards based codecs on the network the MINX networked Video System also supports proprietary codecs such as PictureTel and CLI codecs, as well as, high speed DS3 codecs such as Grass Valley that support line rates of 45Mbps.

Survey Info Updated: Nov-95

Pronto

Version: 1.0

Provider: Cybermarche Inc.

Description: Pronto is a personal desktop video conferencing system that supports real-time audio, video, text and Graphics. It supports application-sharing (X-window applications) and whiteboards. It supports multiple audio and video formats and hardware. It works on IP-based networks as well as ISDN lines. It provides an integrated address book and has a user-friendly interface for controlling various audio and video parameters.

Platforms: Unix, PC

Requirements: 486 or better running Windows 95 or Windows NT, SparcStations, DEC 5000, SGI Indy, 16MB RAM. Video Hardware: Parallax, SunVideo, VideoPix, Connectix QuickCam, and any video for Windows compatible device. Audio Hardware: Any SoundBlaster compatible device, and any mu-law or GSM device. Supports CellB, JPEG, MPEG, and others.

Price: Contact Representative

Contact Info: Ms. Michal Cleetus/Marketing Manager/Cybermarche Inc./Suite 412, 235 High Street/Morgantown, WV 26505. phone/fax: (304) 296-1113 e-mail: michal@cybermarche.dmssoft.com

LAN Protocols: IP, Novell

Audio Encoding: mu-law, GSM

Video Encoding: Vfw, Quicktime, JPEG, CellB

Interoperability Standard Support: future

Multipoint: Yes

Collaboration Features: Application sharing (X-windows only)

Notes: Provides Unix and Windows interoperability. Supports digital cameras which eliminate the need for hardware framegrabbers and hence a very low-cost videoconferencing system.

Survey Info Updated: Apr-96

TRITA-IT R 97:14
ISSN 1103-534X
ISRN KTH/IT/R--97/14--SE



Telecommunication Systems Laboratory
Department of Teleinformatics
Royal Institute of Technology
Electrum 204
S-164 40 Kista
Sweden