“Virtual Controlroom”

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Preface

A couple of quotes relevant to wearable computing.

“A person’s computer should be worn, much as eyeglasses or clothing are worn, and interact with the user based on the context of the situation.”

(NN@MIT)

“But what we need to know is, do people want nasally-insertable computers?”

(FORTUNE@UNIX)
Abstract

This report is a study of which possibilities a wearable computer holds when used as a substitute for a controlroom. Main concern being evaluation of current technological solutions.
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Chapter 1

Introduction

This report is built up as follows: Chapter 2 is an elaboration and discussion of possible interpretations of the term “virtual controlroom”. Chapter 3 looks at the hardware needs in a virtual controlroom design. The next chapter 4 concerns applications needed to fullfill the objective of the virtual controlroom. Concluding with a chapter 5 as a discussion and conclusion.

This report is mainly concentrated around the physical and technical aspects of designing a wearable controlroom. Aspects such as security, psychology, pedagogics, finance or other socially related topics are not treated.

We experienced some problems while trying to get additional information from companies and research institutions active in the field of wearable computing.
Chapter 2

Concept

2.1 Approaches to ‘Virtual Controlroom’

The term “Virtual Controlroom” has in no way a clearly defined interpretation, so let us discuss the question: What is a Virtual controlroom.

Let us start to analyze which possible needs we can imagine useful in an industrial plant of any kind. Our object is to remove or minimize the need of physical presence of a human being in a plant’s controlroom, or eventually completely remove the controlroom itself. From this point of view, the following approaches arises:

- Distributed controlroom
- Wearable controlroom
- 3D-modelled controlroom
- Remote controlroom
- Simulator

All these approaches are roughly discussed in the following sections.

2.1.1 “Distributed Controlroom”

“Distributed controlroom” is one possible interpretation of “Virtual Controlroom”. This term is more or less self explaining. The idea is simply to remove the physical controlroom from the plan, and distribute it somewhere else. Maybe preferably to several distinct locations. Alternatively you could make some sort of a copy of an existing controlroom to ensure redundancy or other safety demands, and remotely distribute this copy. The following question naturally arises: Why distribute a controlroom?
• An expert or a group of experts will be able to run several plants or one particular part of the plants.

• If the plant is dangerous or in other ways unsuitable for human beings, you can situate the operators in safe locations with the same possibilities to operate the plant as if he/she was situated in a local controlroom on the plant.

• It is possible to minimize transportation needs.

Figure (2.1) illustrates the idea.

![Figure 2.1: Distributed Controlroom](image)

### 2.1.2 “Wearable Controlroom“

“Wearable Controlroom” is the idea of making a computer wearable, supply it with communication equipment, to make it possible to take control of, or in other ways communicate with an already existing computer or set of computers. This approach to the problem of defining “Virtual Controlroom” can be implemented in any number of ways, in fact, it is possible to embed or utilize all the other approaches mentioned with a wearable computer.

This approach will be discussed in detail in later chapters.
2.1.3 “3D-modelled controlroom“

“3D-modelled controlroom” is an approach built on the idea of virtual reality. You simply make up a three dimensional model of a controlroom with possibilities to interact with the controlling devices in the physical controlroom situated in a plant. Areas where this technique would be useful is:

- Educational purposes
- Test user interface of controlling devices before the device is physically created.
- An alternative way to control a device.
- It is easier to redesign and reimplement than a physical device.

The controlroom might or might not exist in the real world.

2.1.4 “Remote controlroom“

By “Remote controlroom” we think of a plant with an ordinary controlroom except that the controlroom is physically located somewhere else. This technique allows several plants
to be controlled from one central controlroom (which, in turn, could be distributed) to obtain effectivity and cost reduction.

The difference between our interpretation of “Distributed controlroom” and “Remote controlroom” are illustrated by the figures (2.1) and (2.3).

![Diagram of control and plant connections](image)

Figure 2.3: Remote Controlroom

### 2.1.5 “Simulator“

This approach is simply a reversed idea of “virtual controlroom”. Here the controlroom exists, but you do not necessarily need a physical plant to control. In other words, you have a virtual plant.

Reasons to build a controlroom with no plant is e.g. for educational purposes, training of crew, simulating disasters and so on.

### 2.1.6 Discussion

We have evaluated all the approaches listed above, and our conclusion is that a “wearable controlroom” is by far the most interesting method to extend or remove a plant’s control-
room. This is because the concept “wearable controlroom” not necessarily is bounded by our interpretation of the term (presented in detail in chapter 2.3) and can replace all of the other approaches mentioned.

2.2 Possible application areas for a virtual control room

The term Virtual control room is in no way limited to only including a wearable computer as a substitute for the traditional control room located in for instance a chemical plant or on an oil platform. A control room can be broadened to include such wide interpretations as a health care worker getting information from the clinics or hospitals main database, a taxi driver receiving information about where to pick up the next passenger or even a disabled person operating a wheelchair. We will here try to give some examples of possible applications of a virtual control room to help illustrate our interpretation of the term.

- **Inspection** Inspectors of transportation vehicles, utilities, factories, and complex equipment can voice-input data, check regulations, transfer information, and make timely decisions in the field, eliminating the often tedious and time consuming communication between field operators and administrators.

- **Health Care** Home health care workers can interface with diagnostic equipment, voice-annotate examinations, and access and transfer medical information while leaving their hands free to physically assist the patient. Doctors and surgeons in any medical setting will soon be able to create digitized records through dictation. Diagnoses, documentation of care, prescriptions and access to other physician guidelines can be fully automated. Access to information and treatment of peculiar area-specific diseases can be resident on the Wearable enabling medical personnel to take appropriate action with their patients. The health care industry, striving to provide more and better services at lower cost, benefits from the portability and hands-free use of a wearable computer system. Applications can be augmented include instant access to general medical information, patient charts, treatment options, diagnostics, drug delivery options, recording of updated patient and treatment information, and entry of technical and administrative data.

- **Inventory** Using your voice and hands is a natural way to conduct inventory. With a wearable computer, your hands are free to count items or climb ladders, while the wearable computers sends data directly to the database, reducing errors.

- **Emergency services** Personnel who respond to disasters or emergency situations can access updated, relevant data concerning weather, maps, or building plans to aid communications and help coordinate relief efforts. Head-mounted video cameras can also document and communicate conditions for insurance adjustment. Consider
a burning chemical plant. A fireman can be guided through the plant and receive vital information on which process to shut down without any special training or understanding of the plant or process. Experts can be incorporated in an emergency situation to help the emergency workers make the crucial decisions the often face without being exposed to any danger.

- **Computer-aided instruction and training** Learning how to repair, inspect, or perform a certain task no longer needs to be limited to the classroom. A wearable computer can assist in training and certification by allowing you to bring an interactive, electronic instructor to the work site. Here, a trainee equipped with a head-mounted display and a wearable can visually be taken through for instance an aircraft maintenance and repair procedure. See picture 2.2

- **Distributor Route Management** Virtually any company involved in the physical distribution of products to large numbers of outlets (beer & mineral water dealers, snack-food distributors, vending machine operators, etc.) will benefit from giving its employees instant, continuous, and hands-free access to a wearable computer. A wearable system can be used for general route management, keeping track of inventories, and allowing efficient utilization of drivers' time. In addition, it can handle other tasks such as billing, order entry, and routines specific to the company and client or customer.

- **Maintenance and utility operations** The wearable computer allows maintenance personnel to bring databases, diagnostic software and documentation, as well as full communications capability to the work site, while virtually eliminating supporting “paper.” Interactive Electronic Technical Manuals (IETMs) provide all of the information needed on maintenance and troubleshooting procedures, parts and components inventories, maintenance logs, system diagrams, subsystems locations, and animated sequences to show the technician how to maintain and repair equipment. While repairing a wiring system in a remote location, the user realizes the need for a wiring diagram. Instead of returning to the office terminal to find the microfilm reader, he simply consults the wearable computer on his belt. With a wearable, maintenance manuals, illustrated parts catalogs and other reference manuals are with the individual at all times, eliminating time consuming departures from the work site or mistakes made while rushing to find parts information. A wearable allows personnel to stay hands-on with the equipment on which they are working, while connection to logistics databases and/or support centers helps confirm parts availability and the swift shipment of spares.

- **Military** Military personnel depend on having - and using - complete, accurate information. A wearable will be able to provide information on demand. Incredibly small and ultra lightweight, this personal computer gives users hands-free access to volumes of resident information, plus communications links to data bases and command personnel.
The use of sophisticated voice recognition technology, using headset-mounted communication and display capabilities, eliminates the need for a keyboard and monitor. Users call up information by simply speaking into a small microphone, integrated with a lightweight data display. Users go about their tasks while recording, retrieving or viewing information. Troops can use global positioning satellite interfaces to provide themselves and their commanders with their precise locations, report critical data on threats, and keep in close contact with the chain of command to receive orders, make reports and request supplies.

Figure 2.4: A wearable used in aircraft maintenance

2.3 The concept: "Wearable computer"

Wearable computer is a modern invention. It is defined by the MIT (see [8]):

“A wearable computer is a small computer with heads-up displays, unobtrusive input devices, personal wireless local area networks, and a host of other context sensing and communication tools, the wearable computer can act as an intelligent assistant, whether it be through a Remembrance Agent, augmented reality, or intellectual collectives.”

Now, let us take a closer look at this definition and inspect the elements mentioned in the above definition grouped as follows:

- Unobtrusive input devices
- Personal wireless local area networks, and in other context sensing and communication tools
- Augmented reality using heads-up display
2.3.1 Unobtrusive input devices

Unobtrusive input devices ensures **hands-free or one-handed operation** which is extremely important in most situations where a wearable computer is needed, actually some researchers in the field of wearable computers claims *The whole point about using a wearable computer is not having to use both hands to operate it and being able to use it while doing other things like holding a tool. Hands-free operation represents an important user-interface design challenge which has not been adequately addressed.* (See [17]).

2.3.2 Personal wireless local area networks, and in other context sensing and communication tools

This aspect ensures **mobility**, which is important due to the fact that wearable computers are intended to be used in the “real world”, doing real-world tasks, where the users need ability to move around freely while having uninterrupted access to services of the wearable devices. This is a critical aspect of wearable computing, and is unfortunately not possible in “real-world environment” with the technology of today.

2.3.3 Augmented-Reality

An augmented-reality system uses a heads-up display to project information onto physical objects in the user’s surrounding. Augmented-reality is an user-interface technique which allows to focus the user’s attention and present information in an unobtrusive and effective manner. The complexity of augmented reality is in tracking body movements and aligning physical space with information space.

2.3.4 Perception

Perception refers to the computer’s ability to perceive and act upon certain aspects of its physical environment. Perception is the basis for context-dependent computing where the result of computations depend on an explicit set of context variables. The context might include physical and logical parameters such as absolute location, relative location (proximity), identity of objects and persons in the immediate surrounding, a user’s medical condition (heart-rate, blood pressure), and the state of devices of machines (temperature and noise level).

2.3.5 Devices used to assemble a wearable computer

As shown in figure (2.5) the following devices can/must be included in a wearable computer:
Virtual Controlroom - The concept

- Heads up display.
- Microphone
- Camera
- Headphone(s)
- Communication devices (e.g. modem, Ethernet-card)
- Controlling devices (mouse, keyboard etc.)
- Portable power supply
- And of course an appropriate **Computer and software.**

The wearable computer adds a totally new dimension to computing. These opportunities are explored by Massachusetts Institute of Technology [8] and the University of Oregon [14]. NASA, Boeing, Ford, Valmet and Mercedes have tried to integrate a wearable computer in their production.

Xybernaut [6] has a commercially available concept which they try to expose for the world, but it seems that people have not discovered its potential (See figure (3.15)).

On the other hand, it seems to have won a few supporters. Known Cyborgs:

- Steve Mann (http://wearcomp.org/steve.html)
- Thad Starner (http://www-white.media.mit.edu/testarne/)
- Alex (Sandy) Pentland (http://sandy-www.media.mit.edu/people/sandy/profile.html)
- Bradley Rhodes (http://rhodes-www.media.mit.edu/people/rhodes/)
- E. Rhemi (http://physics-www.media.mit.edu/rehmi/)
- Lenny Foner (http://foner-www.media.mit.edu/people/foner/)

### 2.3.6 Why use a wearable computer?

A wearable computer makes it possible to access information everywhere, as an example surf the World Wide Web (WWW) or use the computer as a picture phone. In some jobs it would be nice to have this opportunity.

### 2.3.7 Why don’t all use wearable computers?

It is a variety of reasons why people do not use wearable computers. It is a new concept for most of us. Some people have never heard of it, and if they have it sounds more like a
Sci-Fi project than the reality.

The technical solutions

Another reason can be that the technical solutions given today are to bad or to expensive. **Batteries** do not have good enough capacity, they are heavy and cost a lot of money. **Heads up displays** with a price acceptable for most mortals do not have the quality required (see [3] appendix A.2). **Wireless communication** must be built in the computer and the infrastructure. In Norway there is GSM (Global System For Mobile Communications) see chapter 3.4.1, but it only has a bandwidth of 9600 bps, which is not good enough if you want to surf the WWW or use the computer as a picture phone.

There are other options like radiomodems and wireless LANs, but it requires that the infrastructure are built.

Social aspects

The term “nerd” is already defined as a person with low EQ, thick glasses, who spends all his time and money on computers. We do not think that the nerds reputation will improve by ”wearing” their computers 24 hours a day. Social intercourse between humans is healthy for most people, so we think that it is quite good that the nerds have not discovered this invention. An example of this taken from a Newsgroup is: ”How can I waterproof my wearable computer?” The reason for this question was that he wanted to use his computer while walking his dog in the rain. How do we maintain some kind of privacy when everyone expects us to be available via our wearable computer. We are already seeing problems regarding this due to the increasing amount of cellular phones among people.

Medical opinions

A common opinion among doctors, are that long lasting radiation can cause cancer. This is as far as we know not proved, but it sounds like a logic conclusion. 2 W UHF radiation through the body 7.5 hours a day, does not sound healthy. The long term effects of viewing a display at such short distances from the eyes have not been investigated enough, and the longterm psychological and physical effects of constantly having to interact with a large amount of information and equipment needs further research.
Figure 2.5: Hardware in a wearable computer
Chapter 3

Hardware

3.1 Commercially available Wearable systems

There are several companies making complete wearable systems. In the proceeding the main suppliers and their product will be presented in brief. Comment to all of them is that their product is compatible with software and hardware already on the market, and can me made operable in a reasonable amount of time.

3.1.1 Xybernaut Corporation

The Xybernaut Mobile Assistant ® [6] includes a central processing unit, head-mounted display, and battery pack. The Mobile Assistant uses speech recognition to supply hands free operation and all capabilities of a standard desktop computer. For further specification of this and the further systems see appnedix C.

3.1.2 Via Wearable

The ViA Wearable [12] provides functional connections between a processor, a series of PC Cards, a power source and peripheral interface connections The processor is a 586/133 MHz with 24 MB of memory and full duplex audio for speech recognition. The ViA Wearable uses Phoenix Technologies’ BIOS software to provide processor control, power management, graphic control, keyboard and mouse control, serial port control and PC Card and socket services. Operating systems available on the ViA Wearable include DOS, Windows 3.1, Windows 95, Windows NT and UNIX. The ViA Wearable uses a single miniature connector to provide input/output signals for keyboard, mouse, microphone, speaker, two serial ports, VGA and flat-panel display, and power for displays and other peripheral devices.
3.1.3 **Mentis™ system**

With the Mentis [11] solution, users gain the portability of a laptop, the ruggedness of a wearable computer, and the full multimedia capabilities of a desktop system. Visual displays for the Mentis system are available in two formats: flat-panel or head mounted. The high-bright, flat-panel display includes a unique snake-like mounting assembly for attachment to a variety of surfaces or objects, providing viewing from any angle. All displays provide VGA-or-better full-color resolution. These screens may be optionally equipped with touch/pen sensitivity. With both the flat-panel and head-mounted display, a mini-boom microphone is included for simultaneous two-way voice communication. A variety of connectivity options, including an optional satellite up-link, provide instant communication anywhere in the world. Because of its long battery life, portability, and durability, the Mentis system works well in remote and primitive locations. Its designers succeeded in creating a rugged, dependable product that you can use almost anywhere in the world, under almost any condition. With its Pentium power and advanced multimedia features, Mentis can run a variety of demanding software packages for both civilian and military use. Some of the many applications that could benefit from the sophistication of
the Mentis solution are voice-activated on-line manuals, critical procedure-assist situations, interactive on-the-job training, and Real Time Mentoring[tm].

![Mentis System Image](image)

Figure 3.3: Mentis system

### 3.1.4 The Wearable Computer

Computing Devices International has a wearable system on the market which is very similar to the Via wearable.

### 3.2 Single Board Computers

The single board computer is the heart of a wearable system, and with technology available today you can get almost the same performance as a standard PC-CPU in a motherboard that is the size of a credit card (54mm x 85mm x 5-12.7mm). Most of the motherboards are based on the PC/104-Plus standard, which supports Intel™ 486 processors as well as Intel Pentium® processors. The fact that the Pentium® processors uses more power and generally emits more heat than other processors should be taken into consideration when choosing a processor for the wearable. For many applications of wearables, a 486 processor technology will be sufficient and will not drain the limited battery supply of valuable power. One drawback of the small motherboards is that they generally have support for a limited amount of RAM (e.g. the parvus® Scream has a maximum of 32MB of RAM), but they do not require a special RAM, Industry-standard memory: 32-bit 60-66MHz DRAM is supported by most manufacturers.

**Some suppliers and their Internet Pages**
- 80486 - 33/66/100/133 MHz CPUs WITH UP TO 32MB OF PARITY RAM (http://www.comarkcorp.com/cgi-bin/cmarks2.pl/ID=16)

- ScreamN/104 - The parvus Corporation (http://www.parvus.com/screamm.html)

- Card PC (http://www.cellcomputing.com/)


- Advantech (http://www.advantech-usa.com/)

- LB586 - All-In-One PC with 5x86DX-133MHz, LCD-Graphic Controller (mono LCD, TFT, STN), Ethernet and PC/104-Bus (http://www.jumptec.de/product/data/seite20.html)

- Little Board/P5 (http://www.ampro.com/products/littlebd/lb-p5i.htm)


- Advanced Digital Logic, Inc - Embedded PC/104 Modules (http://www.adlogic-pc104.com/)

- PC/104 ethernet card with 2 serial ports... (http://www.parvus.com/versinet.html)

- PC/104 card with NE2000 ethernet, 2 serial, one parallel and a scsi-II interface!! (http://www.ampro.com/products/minimod/mmses.htm)

- Aaeon PCM-5890 - PCI SBC with SVGA, Ethernet, 4 COM ports (http://www.tri-m.com/products/aaeon/pcm5890.html)

- Ant Computer (http://www.antcomputer.com/)
3.3 Display technology

3.3.1 Personal display technology

When choosing a display technology for the wearable computer there are several important aspects to consider. What is the designated use of the display, where is it convenient to wear the display and how much power do I have available are some of the questions that have to be answered before a display technology can be decided upon.

Flat Panel Displays

In many situations it is most convenient to have the display mounted in front of one or both eyes. If this is the case, then the most commonly used is the Active Matrix Liquid Crystal Display (AMLCD) technology. Other types of Flat Panel Displays (FPDs) include Field Emissive Displays (FEDs), Active Matrix Electro-Luminescent displays (AMELs) and Ferroelectric Liquid Crystal displays (FLCs). The suitability and cost of these miniature display screens, however, have been compromised by limitations and performance trade-offs. Miniature flat panel image sources project pixels to the eye in parallel streams that emanate from an integrated matrix of electronically controlled light valves, or light-emitting elements. Many of the cost/performance trade-offs associated with miniature flat panels are a direct result of the difficulty and complexity of using large scale integration techniques to develop and fabricate such highly integrated, dense arrays in a miniature product. The performance of miniature flat panel arrays is also hampered by the limited optical properties of the matrix elements: pixel size, cancellation/interference effects, pixel dynamics (including smearing), purity and range of color, and brightness of emitted or transmitted light (especially relative to power consumption). This makes the FPDs available today most suitable for wrist mounted displays. Here the screen can be much larger, and the difficulties mentioned above will not be a problem. When the technology is to be used as a head mounted display the pixelsize and lightsensitivity becomes a major hassle. The displays available today are mainly monochromatic or dichromatic. This is sufficient if the purpose of the display is to read small amounts of text alone. For use in a virtual control room the requirement are much more demanding. The display must be able to present a normal windows platform with the same readability as a standard desktop monitor. This is not possible with the FPDs available today.

Virtual Retinal Display

The Virtual Retinal Display (VRD) technology in contrast to the FPDs eliminate the screen outside the eye and addresses the retina with a single stream of pixels. As the beam is scanned rapidly across the eye in a raster pattern, the human visual system completes the function performed by the flat panel’s matrix array, visually integrating the pixel
elements into a stable coherent image. Another advantage with the VRD technology is that it eliminates the costly and extremely complex development and manufacturing challenges associated with the flat panel technology. This should make the VRD more suitable for a head-mounted display for use in a virtual control room. The downside to this technology is that Microvision is not currently offering products for sale directly to end-users. The company is working with a select group of strategic partners who are incorporating VRD technology into their products in very specific applications for sale through their distribution channels. Early product prototypes have begun to appear in the military market and will continue throughout the next several months. Timing of availability and pricing of non-military products is difficult to predict, as they will be determined by Microvisions partners, not directly by the company.

Figure 3.4: Microvisions VRD

3.3.2 What is available at the moment

Reflection Technology's P7 and P5

Reflection Technology use a technology which they call Virtual Display. This technology will according to the manufacturer solve conflicting requirements from users who want the actual device to be as small and light as possible, but at the same time want a large, high resolution display. The basic display mechanism of Reflection's Scanned Linear Array technology consists of a linear array of light emitting diodes (LEDs), a magnifying lens, and a vibrating scan mirror. The user looking into the mirror sees a magnified vertical line
of LEDs. This vertical line corresponds to one column of the full image. As the mirror swings, the apparent location of the vertical line of LEDs sweeps horizontally from one edge of the vertical screen to the other. Although only one column of the screen is visible at any instant, the user’s eye perceives a full screen of information. The inherent sharpness of the light emitting elements creates a magnified image of good clarity and definition. This technology has been used by numerous researchers developing different types of wearable computers.

Reflection Technology currently have a displays in full color, VGA standard resolution, the P7. The P7, see figure 3.3.2 is said to combines recent advances in LED technology with an innovative high-density LED module design to create a full-color, VGA resolution (640 x 480) display that has the inherent advantages of Reflection’s virtual display technology: small size, low weight, low cost, low power, and bright, high contrast, sharp images. Its vital image specifications are presented in table 3.1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nom.</th>
<th>Units</th>
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<tbody>
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<td>640</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>480</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Pixel aspect ratio</td>
<td>1 : 1</td>
<td>horiz:vert</td>
</tr>
<tr>
<td>Number of colors</td>
<td>4096</td>
<td></td>
</tr>
<tr>
<td>Image refresh rate</td>
<td>60</td>
<td>Hz</td>
</tr>
<tr>
<td>Brightness</td>
<td>12</td>
<td>foot lamberts</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>5000:1</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Reflection’s P7 display image specifications

Figure 3.5: Reflection Tech. P7

Its predecessor the P5 display (see figure 3.3.2) is a monochrome display providing red and black images at resolutions up to 864 by 256 pixels. The display consists of two pieces: a Optics/LED module and a Scanner module. The Optics/LED module consists of a linear
LED array with driver ICs; a movable lens assembly for adjustable focus; a stationary fold-mirror, and a supporting chassis. The Scanner module consists of a scanning mirror and companion counterbalancing weight, both pivoted on flexure springs; a tiny voice-coil motor; an opto-interrupter with signal-conditioning circuit to sense the scanning mirror’s motion, and a supporting chassis. According to the manufacturer, the P5 display provides an image that is equivalent to a 12-inch diagonal display screen at a distance of 24 inches from the user’s eye. This provides the user with a large, high resolution display screen in a small compact package. The image specifications are presented in table 3.2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nom.</th>
<th>Units</th>
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</thead>
<tbody>
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<td>Horizontal resolution</td>
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<td>number of pixels</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>256</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Pixel aspect ratio</td>
<td>1 : 2</td>
<td>horiz:vert</td>
</tr>
<tr>
<td>Wavelength (color)</td>
<td>655</td>
<td>nanometers</td>
</tr>
<tr>
<td>Image refresh rate</td>
<td>60</td>
<td>Hz</td>
</tr>
<tr>
<td>Brightness</td>
<td>4</td>
<td>foot lamberts</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>5000:1</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>32</td>
<td>grams</td>
</tr>
<tr>
<td>Typical power consumption</td>
<td>191</td>
<td>mW</td>
</tr>
</tbody>
</table>

Table 3.2: Reflection’s P5 display image specifications

Seattle Sight Systems FX series

The FX series of head-mounted displays are designed to be an unobtrusive display. The optical head is mounted on a prehensile arm. The optical head can be adjusted precisely for the user’s eye and the flexible arm allows the user to deflect the optical head to the side for viewing and return it to the preferred eye position. The optics can be see-through or light blocking by selection of the back lens. The arm can be mounted on either side to match the users preferred viewing eye. The display comes with a small control unit that contains a membrane switch with on-off and brightness control functions. Image specifications are listed in table 3.3

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nom.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal resolution</td>
<td>640</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>480</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>100:1</td>
<td></td>
</tr>
<tr>
<td>Field of view</td>
<td>30</td>
<td>degrees horizontal</td>
</tr>
<tr>
<td>Focus</td>
<td>Adjustable virtual image distance to infinity</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.3: Seattle Sight Systems FX-series display image specifications
Liquid Images M1

Liquid Image have designed a display which is meant for use as a field of view display. The M1 consists of a head mounted display and a belt pack drive electronics assembly, which allows it to be connected to any standard VGA or NTSC video signal. The model is automatically selected based on the input signal. It can as the FX series be mounted in front of either eye, and adjusted to fit any user. Image specifications are listed in table 3.4

Displaytech

Displaytech is a company that delivers a wide range of displays. Especially interesting is their developers kit which include a miniature, full-color VGA display, separate drive electronics and software for custom color configuration. Display specifications are listed in table 3.5
3.3.3 Up and coming display technology

The MicroOptical Corporation

The MicroOptical Corporation has developed a set of eyeglasses that include a concealed electronic display. When the user wears the glasses and turns the display on, an image of a video or computer screen appears at a distance of several feet. A focus adjustment allows the user to place the image at a comfortable distance. The eyeglasses perform the same functions as ordinary corrective lenses, sunglasses, or safety glasses. Additionally, the glasses provide the user with a convenient, portable means for carrying a display that may be connected to a notebook computer or other electronic device. Such eyeglasses are expected by MicroOptical to become increasingly important as wearable electronic products enter the market. The glasses work by way of a computer, VCR, television, or other electronic device that generates a signal that carries the image electronically up to the eyeglass frame. A small liquid crystal display is used to generate the image that the user sees. The light rays from the liquid crystal display are relayed to the eye through reflectors within the eyeglass lens. The reflectors fold the optical path and magnify the image so that it can be viewed comfortably. The user perceives an image floating in space.
Table 3.4: Liquid Image M1 display image specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nom.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal resolution</td>
<td>320</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>240</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Display format</td>
<td>monocular</td>
<td></td>
</tr>
<tr>
<td>Image refresh rate</td>
<td>60</td>
<td>Hz</td>
</tr>
<tr>
<td>Brightness</td>
<td>20</td>
<td>foot lamberts</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>80:1</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>4</td>
<td>oz</td>
</tr>
<tr>
<td>Typical power consumption</td>
<td>20 @ 20 foot-Lamberts</td>
<td>mW</td>
</tr>
<tr>
<td>Input voltage</td>
<td>300/9</td>
<td>mAmp/VDC</td>
</tr>
<tr>
<td>Field of view</td>
<td>16</td>
<td>° horizontal</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 - 70°C</td>
<td>°C</td>
</tr>
</tbody>
</table>

at an adjustable focal distance of three feet or more. If the display is turned off, the computer image disappears and the glasses revert to ordinary glasses. The user can see through the eyeglass lens. The image provides 320 by 240 pixels with 8 bit greyscale. The field of view is approximately 8 degrees (horizontal). A color display has also been demonstrated. Are MicroOptical’s glasses used for virtual reality? The glasses are not intended to provide an immersive environment. Rather, the glasses provide a computer screen similar to a computer monitor. The glasses are, however, well-suited to augmented reality. The technology can be applied to both lenses in the eyeglasses to form a 3D image. MicroOptical is not currently developing stereo glasses, but may do so in the future. MicroOptical’s eyeglass lens is unique in the manner that the computer image is brought to the eye. In MicroOptical’s approach (patent pending) there are no external lenses or other optical components so that the eyeglass lens can be inserted into an eyeglass frame having ordinary appearance. The electronic circuits are built into the temple of the
## Table 3.5: Displaytech ChronoColor Developer’s Kit 1.0 image specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nom.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal resolution</td>
<td>640</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>420</td>
<td>number of pixels</td>
</tr>
<tr>
<td>Display format</td>
<td>monocular</td>
<td></td>
</tr>
<tr>
<td>Image refresh rate</td>
<td>60</td>
<td>Hz</td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>13</td>
<td>μm</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>100:1</td>
<td></td>
</tr>
<tr>
<td>Magnifier Optics Aperture</td>
<td>20.3</td>
<td>mm</td>
</tr>
<tr>
<td>Typical power consumption</td>
<td>60</td>
<td>mW</td>
</tr>
<tr>
<td>Input voltage</td>
<td>300/9</td>
<td>mAh/VDC</td>
</tr>
<tr>
<td>Field of view</td>
<td>20</td>
<td>° horizontal</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 - +50</td>
<td>°C</td>
</tr>
</tbody>
</table>

glasses. MicroOptical intends to conceal all of the electronics and optics in the eyeglass frame. The MicroOptical Corporation is formulating a manufacturing plan. A limited number of eyeglasses may be made available to developers and other partners in 1998.

### Microvisions Virtual Retinal Display

As mentioned before Microvision is working on a new technology that will greatly improve the usage of miniature personal displays. Their technology consists of four primary components: The drive electronics, light sources, scanners and optics. The drive electronics receive and process signals from an image source (e.g., a computer, a video camera, or any video output). The processed signals contain information that controls the intensity and mix of color and the coordinates to position the individual picture elements (pixels) that comprise the image. The VRD uses a very low power light source to create and a single pixel at a time through the pupil to the retina. With color images, three light sources - red, green, and blue - are modulated and then merged to produce a pixel of the appropriate color. Operating at extremely low intensity levels, the VRD poses no danger to the eye. Horizontal and vertical scanners "paint" an image on the eye by rapidly moving the light source across and down the retina, in a raster pattern. Refractive and reflective optical elements project the rapidly scanning beam of light into the viewers eye through the viewers pupil and onto the retina to create a large virtual

### 3.4 Wireless communication

In this chapter we will present a number of different types of wireless communications ranging from infrareds and modems to wireless Local Area Networks (LAN). Different ap-
Applications and surroundings will require different solutions for communication. Parameters such as range, bandwidth requirements, noise sensitivity of both the communication equipment and the surrounding equipment, and price all have to be considered carefully before choosing a method of communication. In the proceeding sections we will give examples of some of the technology available today. The theoretical part of this chapter is taken from the textbook [16].

3.4.1 Three categories of wireless transmission

Infrared

Infrared communications is achieved using transmitters/receivers (transceivers) that modulate incoherent infrared light. The transceivers must be in line of sight of each other, either directly or via a reflection from a light-colored surface such as the ceiling of a room. Infrared transmission does not penetrate through walls, thus the security and interference problems encountered in other types of transmission are not present. There is also no frequency allocation issue with infrared, because no licensing is required. The characteristics of infrared communication makes it suitable to local point to point and multipoint communication within confined areas, such as a single room.
Broadcast Radio

Broadcast radio is a term used to describe the frequency range from 30 MHz to 1 GHz. Transmission is limited to line of sight, and distant transmitters will not interfere with each other due to reflection form the atmosphere. The optical line of sight between transmitter and receiver is given by $d = 7.14\sqrt{K h}$, where $h$ is the antenna height in meters, $K$ is an adjustment factor to account for the fact that the waves are bent or refracted with the curvature of the earth and will, and $d$ is the distance between antennas in kilometers. For radio the maximum distance is slightly more than the distance given by 3.1. The characteristics can be viewed in table 3.4.1.

\[ d = 7.14\sqrt{K h} \]  \hspace{1cm} (3.1)

Cellular phones for datatransmition

GSM

GSM (Global System For Mobile Communications) is world wide standard for mobile services. In Norway there are two companies that deliver GSM services: Telenor Mobil (see [2]) and Netcom GSM (see [1]). NetCom GSM is a private company that covers about
<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Name</th>
<th>Analog Data</th>
<th>Digital data</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-300 kHz</td>
<td>LF (low frequency)</td>
<td>Generally not practical</td>
<td>ASK, FSK, MSK 0.1-100 bps</td>
</tr>
<tr>
<td>300-3000 kHz</td>
<td>MF (medium frequency)</td>
<td>AM, To 4 kHz</td>
<td>ASK, FSK, MSK 10-1000 bps</td>
</tr>
<tr>
<td>2-30 MHz</td>
<td>HF (high frequency)</td>
<td>AM, SSB, To 4 kHz</td>
<td>ASK, FSK, MSK 10-3000 bps</td>
</tr>
<tr>
<td>30-300 MHz</td>
<td>VHF (very high frequency)</td>
<td>AM, SSB, FM 5 kHz to 5 MHz</td>
<td>FSK, PSK To 100 kbps</td>
</tr>
<tr>
<td>300-3000 MHz</td>
<td>UHF (ultra high frequency)</td>
<td>FM, SSB, To 20 MHz</td>
<td>PSK To 10 Mbps</td>
</tr>
<tr>
<td>3-30 GHz</td>
<td>SHF (super high frequency)</td>
<td>FM, To 500 MHz</td>
<td>PSK To 100 Mbps</td>
</tr>
<tr>
<td>30-300 GHz</td>
<td>EHF (extremely high frequency)</td>
<td>FM, To 1 GHz</td>
<td>PSK To 750 Mbps</td>
</tr>
</tbody>
</table>

Table 3.6: Frequency band description
93% of Norway. Telenor mobil is a national company that covers about 90% of Norway. GSM can be used for transmitting data, but it requires good coverage and can deliver a maximum of 9600 of bits per second (bps). It’s possible to combine several GSM lines to get a better transmission rate.

NMT900

The old mobile system in Norway, NMT 900, has a much better bandwidth, but it is analog and the company (Telenor mobil) is soon closing the net.

A new standard for mobile services

A new standard for mobile services is planned. The new standard would have a much greater bandwidth than GSM. Two different standards are suggested, but it seems that it would take some time to reach an agreement.
Microwave

Terrestrial Microwave

This method of communication uses a parabolic antenna. The antenna is fixed rigidly and focuses a narrow beam to achieve line-of-sight transmission to the receiving antenna. The maximum distance between antennas is given by equation 3.1. To achieve long distance transmission, a series of microwave relay towers is used; point to point microwave links are strung together over the desired distance. This can be used as a data link in a LAN or even between different LANs. Microwave transmission covers a substantial portion of the electromagnetic spectrum, and the most commonly used frequencies are in the range 2 to 40 GHz. The higher the frequency used, the higher the potential bandwidth and therefore the higher the potential data rate. The typical frequency used in wireless LAN products today is 2.4 GHz. This should theoretically give a data rate of about 10–20 Mbps, but products on the market typically have a data rate of 1-2 Mbps.

As with any transmission system, a main source of loss is attenuation. For microwave as well as radio frequencies, the loss can be described by

\[ L = 10 \log \left( \frac{4\pi}{\lambda} \right)^2 dB \]  

(3.2)

where \( d \) is the distance and \( \lambda \) is the wavelength, in the same units. Loss varies as the square of the distance. Attenuation increases with rainfall, the effect of which becomes especially noticeable above 10 GHz. Another source of impairment is interference. With the growing popularity of microwave, transmission areas overlap and interference is always a danger. As a result, the assignment of frequency bands is strictly regulated. This is of course a major drawback to microwave communication.

Satellite Microwave

The optimal frequency range for satellite transmission is 1 to 10 GHz. Below 1 GHz, there is a significant noise from natural sources, including galactic, solar, and atmospheric noise, and human-made interference from various electronic devices. Above 10 GHz, the signal is severely attenuated by atmospheric absorption and precipitation. Most satellites providing point-to-point service today use a frequency bandwidth in the range 5.925 to 6.425 GHz for transmission from earth to satellite (uplink) and a bandwidth in the range 3.7 to 4.2 GHz for transmission from satellite to earth (downlink). This combination is referred to as the 4/6 GHz band. For continuous operation without interference, a satellite cannot transmit and receive on the same frequency.

Several properties of satellite communication should be noted. First, because of the long distance involved, there is a propagation delay of about a quarter of a second between transmission from one earth station to another earth station. This can cause problems in
areas of error control and flow control. Second, satellite microwave is inherently a broadcast facility, and therefore many stations can transmit to the satellite, and a transmission from a satellite can be received by many stations. The satellite provider can divide the total capacity into a number of channels and lease these channels to individual business users. A user equipped with the antennas at a number of sites can use a satellite channel for a private network.

Commercial products

Infra reds

Because of their limited range and bandwidth, infrareds will not be suitable for the purposes of this text, and will therefore not be discussed any further.

Wireless modems

Wireless modems or radio modems as they are also referred to use a frequency in the range of 900 MHz. They can supply the same data rate as a conventional modem, and will be quite useful for solutions where the connection does not set high demands to data transfer rate, and where funds are limited. Radio modems are typically priced at about $300 to $600. These modems can easily be implemented in a corporate LAN to enable a user to gain access to all the facilities of the LAN. The following are some suppliers of wireless modems.

- Ricochet Wireless Modem (http://www.ricochet.net/)
- AIRplex Cordless Modems (http://www.kme.com)

Wireless LAN

Wireless LAN use a frequency range around 2.4 GHz, and are able to supply a throughput of 1 to 3 Mbps. Theoretically they can provide a much greater bit rate (see table 3.4.1) but experience has shown that they only provide about 2 Mbps. But by combining several links a throughput in the range of 17 Mbps can be achieved. Some commercial providers of wireless LAN are:

- Breezeecom (http://www.breezeecom.com)
- WaveLAN (http://www.wavelan.com)
- Proxim (http://www.proxim.com)


3.5 Keyboards

The voice command programs can be a little awkward to use, so it is possible that a keyboard is needed as an additional source of interaction. There are many alternatives on the marked, some of them are listed below. Which is the best alternative is a subjective opinion.

3.5.1 Twiddler™

A portable keyboard is Twiddler™, figure (3.12) (see [5]). It is a combination of keyboard and mouse that weighs 4 ounces and fits in the palm of your hand. The Twiddler™ is an enabling technology of wearable computing.
Figure 3.12: Example of a keyboard for a wearable computer: "Twiddler”

3.5.2 IBM’s alternative

IBM has a miniature keyboard with a touchscreen (as shown in figure (3.13)).
3.5.3 Phoenix Group Inc. (PGI)

PGI has a armmounted keyboard as shown in figure (3.5.3).
3.6 Pointing devices

Ever since Apple tied the tail of a mouse to its original Macintosh in 1983, engineers and manufacturers have worked hard to come up with improved pointing devices for a new generation of graphics-based machines.

Over the years, there are developed trackballs, touch screens, touch pads, joystick pointers, tracking pens and dozens of other gadgets. Some have found a market, but most desktop computers still come with a conventional mouse. This is a testament to the durability of the original point-and-click concept, but for a wearable computer the mouse is useless.

3.6.1 How does a mouse work?

The mouse and other pointing devices have four functions:

1. they allow movement of the cursor around the screen.

2. they make it possible to select objects and drag them from place to place using one or more buttons.
3. by double-clicking on a file or program icon with the mouse, an application will be launched.

4. in a window based operating system, the second mouse button allows the user to perform an action on a highlighted object.

The mouse and other pointing devices differ in the way they read your hand movements and pass the information back to your computer.

### 3.6.2 Mouse

- **Mechanical mouse** Most mice are mechanical. On the underside of the mouse is a rubber ball that protrudes slightly from a cage containing two rollers set at right angles. As you roll the ball across the desktop, it turns the rollers, which in turn send horizontal and vertical positioning information back to your computer. Those signals tell the computer to make the mouse pointer on the screen move left, right, up and down.

- **Optical mouse** An optical mouse does not use a rolling ball. Instead, it reflects a beam of light from inside the mouse casing to a reflective pad and then back to a sensor on the mouse casing. Optical mice have no moving parts, and they’re less subject to mechanical failure. However, they’re limited in their movement to the boundaries of the reflective pad.

- **Opto-mechanical mouse** This hybrid uses a rubber ball to generate movement but interpret that movement with photo-interrupter discs that are turned by the internal rollers.

### 3.6.3 How the mouse communicates with your computer

A mouse communicates with a computer through a cord attached to a port on the back of the computer. Newer IBM-compatible machines have dedicated mouse ports, while older machines use a serial port. On most Macintosh computers, the mouse can be plugged into the keyboard or the computer’s Apple Desktop Bus port.

To avoid problems made by the wire, there are some options:

- **A infrared mouse** use an infrared transmitter to send signals back to a receiver attached to your computer’s mouse port. They do not require a cord, but the mouse always has to be within the receiver’s line of sight (nothing can come between the mouse and the receiver).

- **A radio mouse** use low-power radio signals to transmit positioning information to the computer. They are not subject to direct line-of-sight limitations.
All remote mice require batteries. Some use replaceable alkaline batteries, while others have rechargeables. If the batteries run out of power or fail, the mouse can not be used until you replace or recharge them.

**Buttons**

Pressing a mouse button signals your computer that you want to do something. The software that comes with the mouse or the operating system interprets the message and acts accordingly.

Apple’s designers thought people would be confused by more than one button, and they’ve stuck with that principle for the Macintosh mouse. The 100 million or so Microsoft Windows users with two- or three-button mice would contest that point of view. In any case, it is possible to buy a third-party, two- or three-button pointing device for the Mac, but the extra buttons may not be supported by the software.

**Other input devices**

Although most computer users are happy with the mouse. There are a variety of alternatives:

- **Trackballs.** Next to the mouse, trackballs are the most popular pointing devices. Users like them because they do not take up as much room on the desktop and require less arm movement. Trackballs are like a mouse turned upside down. Instead of rolling across the desktop, the ball faces upward and you turn it with your fingers, thumb or entire palm, depending on the size of the unit. Trackball fans say they get more control of the mouse pointer with less arm fatigue than they do with a mouse. Because they are small and stationary, trackballs are frequently built into laptop computers. On the downside, trackballs can be thrown out of kilter by the oil from the skin and have to be cleaned frequently.

- **Touch pads.** These relatively new devices, developed originally for laptops, show some potential for competing with the mouse. Touch pads are pads that are sensitive to the touch of a finger. Unlike other gadgets, they are true pointing devices. As the finger moves across the pad, the cursor moves. To select an object or click, just tap a finger. Since pointing is the most natural movement of all, touch pads may well crop up as popular alternatives for desktop systems over the next few years.

- **Pen input devices.** Pen or stylus input devices look like their namesakes, and they are designed to mimic natural writing and drawing. They are shaped like pens and have one or more tiny buttons that correspond to mouse buttons. The tip of the pen can be moved across a plastic pad and to select an object on the screen tap the point of the pen on the pad or click the button. Many casual users find that pens soon
cause hand cramps, but some graphic artists and people working with handwriting recognition programs find them useful.

- **Digitizing pads.** These expensive add-ons use a mouse-like device with protruding cross hairs and a special sensitized tablet; they are used for precision work by architects, draftsmen, designers and graphic artists. Digitizing pads can be calibrated precisely for tracing existing plans and producing mechanical drawings and blueprints.

- **Remote "air" mice.** These specialty devices use infrared or radio signals that allow mouse operations at some distance from the computer. They are not bound to the desktop; in fact, by waving the device in the air, the cursor can be moved. Remote mice are particularly useful if you are delivering a computerized presentation with an overhead projector and prefer to stand elsewhere in the room while delivering your pitch.

- **Finger mice.** Imagine waving your finger at the screen and seeing the cursor move. That is what finger mice do, using a tiny infrared transmitter and a receiver. The finger mouse straps onto your index finger. Theoretically, a finger mouse lets you move the mouse pointer on the screen without removing your hands from the keyboard, but it’s more likely to be popular with gamers because it can record movement in three dimensions.

See also chapter 3.5.

### 3.7 The hardware we used

The university supplied us with some of the hardware we needed. The equipment we used during the project is listed below. This equipment was used to test out different possible solutions and to get an insight into the problems which may arise when trying to design a virtual controlroom.

#### Laptop

The laptop we used was a Toshiba Satellite Pro400 CDT with a pentium 75 Mhz processor and 16 Mbyte ram. The laptop had a built in soundcard.

#### Display

We got a heads up display by "Virtual I-glasses" that supported VGA graphics. It also had an integrated headset.
Headset and microphone

We used a combined microphone/headset solution during the experiment. The microphone was not especially good, but it was enough for our purpose.

3.7.1 Wanted hardware

The equipment that we really want is very expensive, but we think that it will fulfill most of our needs in a wearable computer:

- waterresistant
- shockproof
- throat microphone (to avoid unnecessary noise for the voice recognition program)
- long lasting battery pack

The rules for offshore equipment even stricter than mentioned above, so it is important to buy hardware that complies with these rules.

Figure (3.15) shows Xybernaut’s latest commercial wearable computer.
Figure 3.15: Xybernaut’s latest wearable computer
Chapter 4

Software

4.1 Software Engineering

4.1.1 Challenges

Designing software for a wearable computer system today is very difficult. This is mainly due to the ever changing technologies involved. The fact that wearable computers must be portable forces the size and weight of both the computer and batteries to be limited. This again results in wearable computers having slower CPUs, a smaller hard disk and less RAM than the desktop computers available today. There are also limitations connected to wireless communication as opposed to wired communications. These are all factors that have to considered carefully when designing or choosing software to run on the wearable. Technologies such as speech recognition, virtual reality and augmented reality have in the past been designed for use on state of the art computers with very rich resources, and will therefore drain the wearable system of vital power resources if not redesigned for use on a wearable.

4.1.2 Integration

Another key issue is the numerous different technologies involved. This requires a great deal of system integration in the design of the wearable system. One would like to be able to integrate advanced solutions for individual needs and problems whenever they become available. This requires techniques which allow the designers to integrate diverse system components without having to reengineer the entire system. The software designed today must therefore be compliant with the possible technologies of the future. A wearable system has to be able to process input form a number of different external sensors whilst also displaying augmented reality information to the user’s display in real-time and per-
haps also process information stored on a remote computer. Here we are dealing with synchronization problems due to different characteristics of the wearable components, and the highly dynamic performance of the wearable system. In addition it must be easy to remove or add input or output devices without the entire system having to be rebooted.

### 4.1.3 An assessment framework

In order to be able to assess the alternative architectures, a framework for comparison has to be specified. This results in the following set of requirements:

- The support of multiple system configurations with respect to input and output devices: A wearable system should be able to operate with a wide set of different devices, and drivers (i.e. switching form textmodus to graphical modus)
- The support for on the spot configuration in order to adapt to the given environment and the available resources, the user’s task or the hardware devices to communicate with.
- The support of an intelligent way of filtering unnecessary updating of the display.
- The support of access to remote resources as a method of limiting the need for on-board resources.

### 4.1.4 Resource Management

Resource management is another important aspect to consider when designing a wearable system. Resources can be everything that an application needs in the course of processing data (i.e. files, data, servers, hardware devices, CPU, battery power, etc). Since all the resources cant be available at the same time, the need to manage the resources becomes vital.

### 4.1.5 Infrastructure concerns

When designing a mobile system, special attention to communication and data management is important. The fact that the system is mobile and the limited characteristics of a wireless link (bandwidth, latency, reliability) increase the complexity of the underlying communication software as well as the application software. At the same time the characteristics mentioned (need for remote resources) might help to overcome resource limitations on the wearable system. For instance the need for a large local storage space is not important when the system can access remote files or databases. Similarly processor intensive jobs can be distributed to run on network server to save the local CPU processor time. This produces a need for engineering of software for distributed applications via wireless links.
4.1.6 Real-time operation requirements

The nature of the applications for which the wearable is intended makes the need for real-time operation evident. There will almost always be strict time demands for data-retrieval, processing, displaying and updating. Many of the systems designed today use standard PC platforms (i.e. Windows 95, Windows NT, Dos). These platforms do not satisfy the strict requirements of a real-time operating system. This is a major concern that has to be dealt with in future design. Operating system design for wearables needs to be directed towards the design of real-time operating systems.

4.1.7 User-interface development

User interface management systems (UIMS) are available to help the development of window based direct manipulation user-interface. But there is no such support systems for the development of non-traditional user-interfaces that make use of voice-recognition technology or body-tracking technology. In addition, the limited experience in designing user-interfaces for body-worn, hands-free or one-handed operations poses a serious problem.

4.2 Available software

We will try to introduce some applications that may be helpful to fulfill the interaction between the cybernaut and the wearable computer. It is important that the cybernaut has the same possibilities for interaction with the wearable computer as he/she would have with a conventional desktop.

In a wearable controlroom, it is important that the cybernaut can communicate with the eventually maincomputer, other cybernauts or the people that are present in the controlroom (if that exists). This communication can be a bit difficult. How shall this be done?

CSCW applications or other groupware can be the solution. Another way of fulfilling the demands of cooperation can be to use the intranet/Internet.

4.2.1 Groupware

“Groupware” represents an entire field of research, centered around CSCW (Computer Supported Cooperative Work) which covers groupware and other related problems. We will not discuss these problems further here.

An example on a groupware program is: Lotus Notes. This is a well known product used by many Norwegian firms. Lotus Notes gives possibilities to access e-mail, browse the web,
write documents and so on. However it is a bit expensive to purchase, so it may not be the best investment for a firm that has not already purchased it.

### 4.2.2 Web browsers

There are many web browsers on the market. The most common are probably “Netscape Navigator” and “Microsoft Internet Explorer”. A great number of “plug-ins” makes it possible to perform tasks as play sound, view videos, chat, or launch Java applications within the web browser. (Corel has released WordPerfect written for Java.) It is also possible to access and edit databases through browsers.

Among other popular web browsers are “Lynx” and “Opera”. These are small, fast browsers, so the download time is minimized due to the browsers simplicity.

### 4.2.3 Virtual desktop applications

There are numerous applications supporting virtual/shared/distributed desktops. We have chosen one of these for a closer inspection.

**VNC**

The VNC (Virtual Network Computer) developed by Oracle and Olivetti Research labs (see [13]) is a freeware product that can be downloaded from http://www.orl.co.uk/vnc/. Precompiled versions are available for operating systems as Win32, Unix etc., and source code is freely distributed, so it is possible to compile it for all platforms using X11, and possibly others as well (though a lot of library-calls and system-hooks has to be re-written). It is, in essence, a remote display system which allows the user to view and interact with a computing “desktop” environment not only on the machine where it is running, but from anywhere on the Internet and from a wide variety of machine architectures.

For this simple mode of operation, it could be achieved a similar effect by installing an X server the PC. The important factors which distinguish VNC from other remote display systems such as X are as follows:

- No state is stored at the viewer. This means you can leave your desk, go to another machine, whether next door or several hundred miles away, reconnect to your desktop from there and finish the sentence you were typing. Even the cursor will be in the same place. With a PC X server, if your PC crashes or is restarted, all the remote applications will die. With VNC they go on running.

- It is small and simple. The Win32 viewer, for example, is about 150K in size and can be run directly from a floppy. There is no installation needed.
• It is truly platform-independent. A desktop running on a Linux machine may be displayed on a PC. Or a Solaris machine. Or any number of other architectures. The simplicity of the protocol makes it easy to port to new platforms. We have a Java viewer, which will run in any Java-capable browser. We have a Windows 32 (95/NT) server, allowing you to view the desktop of a remote NT machine on any of these platforms using exactly the same viewer. (The NT server is not multi-user - see the documentation). Developers at ORL states: We developed VNC to give us platform-independence after the success of our Teleporting system, which was purely X-based.

• It supports shared sessions. One desktop can be displayed and used by several viewers at once, allowing CSCW-style applications, although problems as concurrency control are not considered.

• It is free! It can be downloaded, used, and redistributed under the terms of the GNU Public License. Both binaries and source code are available from the download page.

4.2.4 Video conference tools

Video conference tools make it possible to communicate over distances with live video and sound. There are many alternative to choose from. A list over available video conference tools, see appendix D.

4.2.5 Voice recognition tool

Many manufacturers of wearable computers have preferred to use voice recognition as the primary mode of interaction (see [6]). IBM has explored this possibility for years, and they have a product named ViaVoice. It can be used to dictate documents or give commands to the computer. In noisy environments the voice recognition program can “misunderstand” the given commands. This problem can be avoided by using a throat microphone.

Each and every voice are unique, like our fingerprint, so some programs will have problems to understand a voice which has not ever before used the program. Here lies the main differences in quality. Short words and letters are the hardest words to recognize for the computer, so a good program can understand these words more often.

IBM’s ViaVoice

According to IBM, their product ViaVoice Gold (see [4]) handles continuous dictation and commands. It is adaptive, which means that the program can “learn” new words and sentences during use. ViaVoice shall also manage to understand a variety of different voices, without calibration each time a new user shall use it.
JustVoice

JustVoice by IpiSpeech (see [10]) is an other alternative. It has the same functionality as IBM’s ViaVoice.

Dragon®

Dragon™ [7] is a company that produces program for voice recognition. A program by Dragon will be included in the next version of WordPerfect. This is, like ViaVoice and JustVoice, a program that shall handle continous speech.

DragonPro™ Language Module for Business and Finance

DragonBusiness has transformed DragonDictate for Windows into a comprehensive PC dictation system available for most business and financial applications.

The speech recognition system can be tailored to meet peoples different needs. It is possible to improve the recognition performance, 60,000 terms, phrases, names, and abbreviations to the standard 120,000-word dictionary. This are the words from Dragon.

4.3 Software we used

4.3.1 Operating system

We used Windows95 on our wearable computer. The server used WinNT4.0 or SunOS5.5 machine. The reason we chose Windows95, was the possibility of getting the software we needed. But MIT and other wearable research groups, use Linux as operating system. So it is possible to get software for other platforms than Windows.

4.3.2 Voice recognition tool

The voice recognition tool we used, was “QuickVoice”. The program is a freeware, and came with a soundcard. The program was not adaptive so we had to teach and calibrate the program each time we started a new session or an other person wore the wearable computer.

With a newer and better adaptive program, this problem probably would not be an issue. For a list of available voicerecognition programs see 4.2.5.
4.3.3 VNC - Virtual Network Computing

The VNC (Virtual Network Computer) see chapter 4.2.3 is a freeware, upon we based our wearable computer. The program worked very satisfying.

To use VNC we got two options: either to run it as a Java applet within a web browser, or to run it as a separate application. The preferable web-browser is Netscape Navigator 4.04. This is because of Microsoft do not follow the standard for instructions that SUN has decided. Java has been split into two unlike dialects. An other reason for choosing Netscape over Microsoft Internet Explorer is that ”plug-ins” are primary developed for Netscape.
Chapter 5

Discussion and conclusion

It looks as though the problems concerning building wearable computers for use as the method of realizing a virtual controlroom are mainly related to wireless communication and intelligent software in sense of recognition of the given context. The communication part of the problem can partly be solved if money is not an issue, and the context is partly predefined. Software engineers all over the world are currently trying to design a new, implementable model of perception. Unfortunately, this seems to be a problem which will be of great concern for still some time to come. However is it possible to design a single task wearable computer with existing technology in surroundings with limitations regarding

- Electrical or magnetical fields (Power plants e.g.).
- Fragile instruments (Hospitals e.g.).
- Magnetically shielded environments (A coal mine e.g.).
- Information security/sensitivity (Concerning e.g. industrial espionage or military secrets).
- Other surroundings that in any way interfere or conflicts with the equipment used in the wearable computer.

Other problems regarding wearable computing such as displays, power supply, unobtrusive input devices are minor, and will probably be solved in the near future. Actually there exists devices for the above mentioned problems which work satisfactory for some applications at present time.

Wearable computers for use as a substitute for, or supplement to the controlroom of industrial plants are simply not good enough with technology of today. The most interesting applications in which today's computers are suitable are areas such as testing, (on the job) training, simulation of possibly dangerous situations/emergency handling, or in simple exchange of information (database-lookup-style).
Bibliography


    Available from http://www.orl.co.uk/vnc.

    [Accessed 14th February 1998]
    Available from: http://www.cs.uoregon.edu/research/wearables.


Appendix A

Wireless Providers, Services, Products

Abacus .
RF front end to Percon’s IntelliTrack modules. RF Functions include receiving,
putaway, picking and physicals. Runs on 2.4GHZ wireless networks with terminals
from Percon, intermec, symbol and norand.

Aerospace Consulting .
( http://www.aeroconsult.com/ ) Aerospace Consulting provides rf, microwave, and
wireless design, development, simulation, and prototyping services. Other services
include circuit board design and layout using P-CAD.

Air Communications .
( http://www.aircomm.com/ ) Features the AirCommunicator cellular/data/fax/phone.

AIRplex Cordless Modems .
( http://www.kme.com/ ) A new category of PCMCIA 28.8 modems have been
developed which are similar to conventional modems but require no cord to connect
to the telephone line. The idea is to permit you to use your notebook freely without
being tied to your desk. They also permit multiple users in an office to easily share
an analog telephone line. New wireless technology (AIRplex) is used which permits
use of these modems in every room in a large building without mutual interference.

AirTouch Cellular’s Data Hut .
( http://datahut.airtouch.net/ ) AirTouch is a cellular service provider. This web
site contains information regarding cellular data technologies - namely CDPD and
cellular circuit-switched. Our web has an on-line wireless data forum, a wireless data
developer support section, which contains white papers on wireless technologies, a
developer tools discount page, and a form used to sign up for the AirTouch Developer
Support Program. We are also setting up some pages that will be used for customer
support (i.e. modem configuration info, etc.).

Data TeleMark.
(http://www.mnsinc.com/datatelemark/dtm.html) Data TeleMark has developed
a unique technology to carry ISDN Basic Rate Interfaces wireless via satellites, ra-
dio waves or laser. Any existing wireless link is upgradable to any type of ISDN
worldwide.

Digital’s Mobilizer for Windows.
(http://www.digital.com/info/mobile/)

Ex Machina, Inc.
(http://exmachina.com/) Ex Machina, Inc. is the largest developer of wireless
messaging software for the paging industry, providing cross-platform mobile com-
munications software for partners including Motorola, Apple Computer and Hewlett
Packard. Through co-development efforts with over 250 leading computer software
developers, Ex Machina’s products add in-bound and out-bound wireless messaging
capabilities to hundreds of software programs from publishers including Microsoft,
Apple, AST, Aldus/Adobe, Borland, Dayna, Okna, Hewlett-Packard and Claris.

Freespace Interbuilding Links.
(http://www.silcomtech.com) SilCom designs and manufactures high-performance
network-connectivity solutions. Products include the Freespace family of high-speed
wireless links, hubs, MAUs, repeaters, adapter cards and network-management soft-
ware. In addition, SilCom provides advanced transceivers and ASIC solutions to
leading manufacturers of network equipment.

Glenayre Electronics.
(http://www.synernet.com/glenayre/) Our current project is two-way messaging,
for many of the NPCS Auction winners. We also beep about 85% of the pagers in
North America.

Granite Communications.
(http://www.gcicom.com) A designer and manufacturer of wireless touchscreen
handheld data communicators for mobile applications.

GTE Mobilenet.
(http://www.wireless-gte.com) The Cellular Home Page by GTE Mobilnet Florida
is an online encyclopedia of information regarding cellular, wireless data, telecommu-
ications and related services, as well as technical information, media releases and
customer service options. The site is also a hub for Florida related web links and a
twisted little game called HackerX, in which you must thwart the plans of demented
cyber-terrorist.

GTE Wireless Data Services.
(http://wwwdatalife.gtem.com) GTE Wireless Data Services provided by GTE
Mobilnet offers wireless data products and services across the United States. This website contains wireless data applications and benefits, case study, partners programs and technical information.

**HarrisSemiconductor / PRISM**


**HHCA, Inc.**

( [http://bertha.chattanooga.net/HHCA/](http://bertha.chattanooga.net/HHCA/) ) Handheld Computer Applications is a small reseller / system integrator specializing in MS-DOS handhelds manufactured by DAP Technologies in Quebec. The latest offering has an external PCMCIA slot which will accept an ethernet adapter (AIRLAN from SOLECTEK) for free roaming ethernet access.

**Hiperlan/Netplan**

( [http://www.netplan.dk/netplan/](http://www.netplan.dk/netplan/) ) Hiperlan is a coming ETSI standard for 20 Mbit/sec wireless LANS at 15.7 GHz. Torben Rune at Netplan was Project Team Leader of PT41, the ETSI project team responsible for defining Hiperlan. Netplan is a danish consultancy company in the field of tele and datacommunications. On our Web server you find articles among others about wireless computing. We contribute to the ITU Telecom 95 with a paper on Wireless LANs. The paper is also on our Web server.

**IBM Mobile andWireless Solutions**

( [http://www.raleigh.ibm.com/wir/wirehdqt.html](http://www.raleigh.ibm.com/wir/wirehdqt.html) ) IBM now specializes in reliable solutions for wireless communications. These exciting wireless solutions offer the flexibiltiy of roaming inside and outside your workplace without the inconveniences of wires and cables. IBM supports both your small networks and your wide-ranging business activities. IBM products include: Wireless Modems for ARDIS, Mobitex, and Cellular/CDPD, plus Wireless LAN and LAN Entry adapters.

**Inet, Inc.**

( [http://www.inetinc.com/](http://www.inetinc.com/) ) Inet is dedicated to providing easy-to-use, innovative solutions for the telecommunications industry and wireless data users. Our products include protocol converters, testing and monitoring systems, SS7 network optimization platforms, and CDPD wireless modems.

**InfoManager Service**

( [http://www.infoexpress.com/](http://www.infoexpress.com/) ) InfoManager provides information and connectivity services for mobile professionals. The easy-to-use Windows client offers e-mail, personalized news, stock quotes, file transfers, and Internet access over wired and wireless protocols.

**InfoWave**

( [http://www.gdt.com/Product.Info/infowave.html](http://www.gdt.com/Product.Info/infowave.html) ) GDT Softworks provides an af-
fordable wireless service in Canada called InfoWave which allows subscribers to send e-mail, faxes, and messages to alpha-numeric pagers from most portable computing devices.

INMARSAT (The InternationalMobile Satellite Organization) .
( http://www.inmarsat.org/inmarsat/ ) Inmarsat is an international co-operative set up in 1979 to provide mobile satellite communications world-wide for the maritime community. Today it has 79 member countries and is now used in business and commerce, as well as in times of greatest human need, by a growing number of users on land, at sea and in the air.

iPost Services .
( http://www.ipost.net/ ) iPost is a universal communications service integrating voice, fax, email, and paging into a single messaging environment. A mobile subscriber can receive all messages of all types through their secure iBox, accessible via phone, fax machine, email, or their iBox page on the Web. iPost is being developed and marketed by IRdg, Inc., a research and development group specializing in communications and storage solutions.

KarlNet .
( http://www.karlnet.net/ ) KarlNet is a provider of wireless bridges, routers, firewalls and access points. KarlNet was one of the first companies to provide building-to-building wireless bridging and routing products. Many others, including Lucent Technologies, have simply licensed KarlNet’s KarlBridge/Router software to power their wireless LAN, WAN and CAN products. KarlNet’s software supports 10/100 Mbps Ethernet, WaveLAN wireless, Microwave, T1/E1, ASYNC, PPP and many other media. The software also supports IP Routing, Roaming, and the KarlNet custom CellWave Reliable Link Protocols. The CellWave Protocol required for proper operation of multiple building wireless links with hidden nodes.

Laser Communications,Inc. .
( http://www.lasercomm.com/lasercomm/ ) Laser Communications, Inc. is the leading supplier of high speed wireless LAN and Telecommunications solutions based on infrared laser transmissions. Since 1983, LCI has over 1000 systems sold worldwide in over 50 countries. Ease of installation, a range of 1200 meters and data rates of 1 to 155 Mbps make LCI products a practical solution to the toughest communication problems.

LongRanger .
( http://www.utilicom.com ) Utilicom, Inc. provides spread spectrum radio modems with data rates up to 256 KBps full duplex and ranges up to 60 miles, with operation in the 900 MHz and 2.4 GHz bands.

Los AngelesCellular Telephone Company Direct .
for the Los Angeles Cellular Telephone Company.

**Lynn-Arthur Associates, Inc.**

**Magic Number**

**McCaw Cellular**

**The MCS Group, Inc.**

**Mentor Engineering Inc.**

**Metricom**

**Mobile Data Studio**
( [http://www.technisyst.com.au](http://www.technisyst.com.au) ) MDS is a toolkit of products which enable application developers to quickly and easily incorporate wireless functionality into their applications. MDS remove all communication specific issues for the developer. MDS currently provides support for Motorola DataTAC networks.

**The Mobile Office Outfitter**
( [http://www.themooo.com/](http://www.themooo.com/) ) The Mobile Office Outfitter provides products and services that address the needs of people who work from and rely on their vehicle as a mobile office.

**Mobile Planet Online Catalog**
Motorola .
   ( http://www.mot.com/ )

MultipointNetworks .

NOCOM'sReflection .
   ( http://www.nocom.se/noweb/produkt/wrq/ ) NOCOMs Reflection web page has some interesting information about well performing network software with support for mobile communication.

ORA Electronics .

Pacific CommunicationSciences, Inc. (PCSI) .
   ( http://www.pcsi.com/ ) Pacific Communication Sciences, Inc. (PCSI), is a leading supplier of products and technology for the emerging new world of digital communications. PCSI's products include CDPD Cellular Communications systems, CDPD base stations, advanced semiconductor products for PCS, cellular and other wireless communications, access multiplexers for private network communications, and advanced digital messaging devices.

PacketCluster Patrol .
   ( http://www.cerulean.com ) Cerulean Technology, Inc. is an innovative developer of wireless client/server mobile information software. The primary product, Packet-Cluster Patrol, is a wireless mobile information software solution for law enforcement.

Pinpoint Communications Inc. .
   ( http://www.avl.com/ ) Pinpoint owns and operates a digital wireless network that combines automatic vehicle location and two-way data communications in one revolutionary technology. Pinpoint provides fleet and service managers a cost-effective way to manage vehicles and improve the efficiency of their business.

Portable Products,Inc. .
   ( http://www.portableproducts.com/ ) The ultimate source for data collection and wireless communications solutions, specializing in wireless data communications, 2-way paging, vertical applications, pen based computers, PDA's, and bar code data collection for commercial, government, and educational applications.

Proxim .
   ( http://www.proxim.com/ ) Proxim is the leader in wireless LANs. The Proxim RangeLAN2 functions at 1.6Mbps as a wireless Ethernet LAN. It offers connectivity through the use of PCMCIA and ISABUS wireless network interface cards. The RangeLAN2 access point connect the wireless Ethernet devices to wired Ethernet. RangeLAN2 uses 2.4GHz frequency hopping spread spectrum radio technology.
RangeLAN2 is incorporated into over 50 mobile hand held computer products and wireless LAN solutions.

Qualcomm .
( http://lorien.qualcomm.com/QualHome.html )

RadioMail Corporation .
( http://www.radiomail.net/ ) The RadioMail service combines wireless electronic mail, faxing, paging, stock quotes, news and more. It’s a simple to use nationwide wireless service that provides members with a personal Internet address for their portable computer or personal communicator, so they can exchange wireless messages - and automatically receive information - wherever they are, whenever they want.

RAM Mobile Data - UK .
( http://www.ram.co.uk/ ) RAM Mobile Data Limited is the operator of a public mobile data network in the UK.

(RAM Mobile Data - USA .
( http://www.ram-wireless.com/ ) RAM Mobile Data USA L.P., a business venture between RAM Broadcasting and BellSouth, provides nationwide, two-way, packet-switched, wireless data communications services. RAM’s core technology is Mobitex(R), the de-facto international standard for wireless data communications being used in over 17 countries worldwide. RAM provides proven communications solutions for numerous applications including Field Sales, Field Service, Transportation, Utilities, Finance, Fixed Data, and Point-of-Sale, as well as wireless electronic mail and database access.

Sierra Wireless .
( http://www.sierrawireless.com/ ) Sierra Wireless WWW features a new compact CDPD wireless modem and provides other information related to wireless computing, with a particular emphasis on cellular communications.

Silverlake Communications, Inc. .
( http://www.silverlake2000.com ) Silverlake Communications, Inc. is a world wide leading provider of wireless messaging PCS paging software. Over 130,000 copies have been sold world wide in 5 languages and is currently used by more than 50% of the Fortune 50.

Socket Communications, Inc. .
( http://www.socketcom.com/ ) Socket Communications, Inc., makes intelligent and easy-to-use wireless and wired data communications solutions for mobile computer users. The PageCard is a unique wireless communications product using paging technology to deliver information directly to MS Mail, Exchange Client or cc:Mail.

Software Corporation of America (SCA) .
( http://sca.talkthru.com/ ) SCA is a leading provider of wireless middleware and vertical market applications for public safety, real estate, transportation and field
service. SCA developed the first commercial CDPD application with Bell Atlantic Mobile for the Town of Groton, Connecticut police force. SCA wireless enables legacy systems, from mainframe 3270 sessions to Client/Server architected systems. SCA has partnerships with leading network carriers (both CDPD and RAM Mobile Data), system integrators, and hardware manufacturers to deliver a total, wireless solution.

**Speedycom International**


**Steinbrecher Corporation**


**TDK Systems**

( [http://www.tdksystems.com/](http://www.tdksystems.com/) ) TDK Systems provides the most technologically advanced PC Card (PCMCIA) solutions for notebook and Macintosh PowerBook connectivity. TDK Systems has a complete line of Modem and Lan PC Cards.

**TekNow, Inc.**

( [http://www.teknow.com/](http://www.teknow.com/) ) TekNow, Inc., in Phoenix, Arizona, supplies wireless communications software (paging software) and wireless hardware (paging hardware) to the wireless industry. TekNow’s wireless data messaging software (Mobile Express) and wireless communications hardware (PhenX, Alphabox) enable wireless data transmission through paging networks to notebook computers with PCMCIA cards or alphanumeric pagers.

**Telular Corporation**

( [http://www.telular.com/](http://www.telular.com/) ) Telular is a leading supplier of wireless CPE. Our equipment is used in existing mobile infrastructure as well as to deliver primary telephone service in wireless local loop applications. As regards mobile computing, check out our Axxcell cellular interface product!

**TerraLink Laser Communications Systems**

( [http://www.astroterra.com/](http://www.astroterra.com/) ) The TerraLink products create a secure, protocol-independent data link between sites, providing an alternative to fiber optic cable or microwave system installation. Laser communication is quickly deployable, easily maintained, and does not require FCC licensing. With data rates up to 622 Mbps, ranges up to 15 miles, automatic alignment tracking, and upgradeable data rates, TerraLink systems are designed to provide reliable wireless connectivity now and into the future.

**Tetherless Access Ltd.**

( [http://www.tetherless.net/](http://www.tetherless.net/) ) Wireless high-speed (64Kbps) TCP/IP networking over distances of up to 30 Km.
Tucson Amateur Packet Radio

(http://www.tapr.org/tapr/) Licensor of hardware and firmware for wireless packet radio. TAPR also maintains
Appendix B

Riccochet Wireless Modem

All the information presented here is from Metricoms homepage [15]

General specifications for the Riccochet modems

- 902-928 MHz operating frequency range +30 dBm (1 Watt) maximum
- Pseudo-random, spread-spectrum, frequency hopping RF output power
- Conforms to FCC part 15 regulation

Transmitter (All Riccochet Modems)

- +30 dBm (1 Watt) maximum
- RF output power

The Riccochet SX Wireless Modem, for handheld PCs, PDAs and laptops, is a flat, lightweight external modem. With up to six hours of battery life during typical use. It comes with an AC adapter that charges the modem battery while in use. The unit is easy to install out of the box, and may be used with the HP 300/320 LX, Philips’ Velo 1, the Apple Newton 2000, and other popular H/PC devices. Visual and audible indicators on the SX make Riccochet simple and easy to use. Specifications:

Mechanical

- 10 ounces
- 6.75”L x 3.5”W x .4”H
- RGB LED

Data Port Format

- RS-232C serial interface
- Female modem serial connector
- Standard AT commands

Modem Power Supply & Battery
- 115 VAC nominal modem AC adapter input voltage
- 6 VDC, NiMH rechargeable battery
- 700 mAh, typical battery capability
- Up to 6 hours battery life, typical operation

Environmental Mechanical
- 0 to -50 degrees Centigrade operating temperature range 10 ounces
- -20 to +80 degrees Centigrade storage temperature range 6.75”L x 3.5”W x 4”H
- -20 to +40 degrees Centigrade battery storage temperature range
- Humidity 90% RH non-condensing over temperature range

The Ricochet SE Wireless Modem is small and compact enough to carry inside a pocket. Its extended battery life of eight to 12 hours helps to make a more efficient use of the computing time. The SE features icons and audible tones that make it simple and intuitive to use. Suitable for smaller computers and mobile devices. Specifications:

Weight & Size
- 8 oz. (with battery)
- 4.65”L x 2.28”W x 1.0”H

Data Port Format
- RS-232D serial interface
- 14 pin custom modem serial connector
- Standard AT command set

Modem Power Supply & Battery
- 3.6 VDC, NiCAD, rechargeable battery
- 650 mAh, typical battery capacity
- 8-12 hours battery life, typical operation
- 115 VAC nominal modem AC adapter input voltage

Environmental Mechanical
- 0 to +50C operating temperature range
- -40 to +60C storage temperature range
-20 to +60°C battery storage temperature range Humidity 95% RH non condensing over temp. range

The Ricochet Original Wireless for Modem Mobile Computers with four to six hours of battery life outlasts most portable computing devices. It comes with an AC adapter that charges the modem battery while in use. Visual and audible indicators on the original modem model make using it simple and easy. Specifications:

Weight & Size
- 13.15 oz. (with battery)
- 7.70”L x 2.45”W x .92”H

Data Port Format
- RS-232C serial interface
- RJ-45, female modem serial connector
- Standard AT command set

Modem Power Supply & Battery
- 6 VDC, NiMH, rechargeable battery
- 1100 mAh, typical battery capacity
- 4-6 hours battery life, typical operation
- 115 VAC nominal modem AC adapter input voltage

Environmental Mechanical
- 0 to +50°C operating temperature range
- -40 to +80°C storage temperature range
- -20 to +40°C battery storage temperature range Humidity 90% RH non condensing over temp. range

Ricochet Original Wireless Modem for Desktop Computers has an AC adapter and comes with a 25’ cable which allows the modem to be placed where reception is best (such as near an outside window) and where interference is least (away from cordless phones, stereo speakers and computer monitors). This unit may be upgraded for use with mobile computers to operate from a battery for an additional charge. Specifications:

Weight & Size
- 9.75 oz.
- 7.70”L x 2.45”W x .92”H

Data Port Format
- RS-232C serial interface
- RJ-45, female modem serial connector
- Standard AT command set

**Modem Power Supply & Battery**
- 115 VAC nominal modem AC adapter input voltage

**Environmental Mechanical**
- 0 to +50°C operating temperature range
- -40 to +80°C storage temperature range
- -20 to +40°C battery storage temperature range Humidity 90% RH non condensing over temp. range
Appendix C

Specifications of some commercially available wearable systems

Xybernaunt Corporation

CENTRAL PROCESSING UNIT

- Intel Pentium™ 133 MHz
- 32 MB internal EDO RAM
- 1.4 GB serviceable, internal hard drive
- 256 KB of L2 Cache
- 256 KB of Flash Memory
- Two CardBus slots: Two Type I,II or One Type III
- Connections for:
  - PS/2 Keyboard
  - Serial Port
  - Parallel Port
  - External VGA
  - External Floppy disk drive
  - Head Mounted Display
- SVGA Video
- Support for simultaneous use of HMD and external VGA monitor
- 1 MB EDO DRAM
- 16 Million colors at 640x480
- 64K colors at 800x600
- 256 colors at 1024x768 and 1152x864
- 16 colors at 1280x1024
- SoundBlaster™ compatible audio chip
  - HMD connector contains: One microphone input, left and right speaker output
- Three LED’s:
  - Power on
  - Hard Disk activity
  - Reserved for Future Use
- IrDA Transceiver (115 Kbps)
- Built-in pointing device
- Battery back-up for the real-time clock and CMOS
- Length: 8.5”
- Width: 2.2”
- Depth: 4.75”
- Weight: Approximately 2.75 pounds

HEAD-MOUNTED DISPLAY

- VGA 640x480
- Monochrome backlight
- AMLCD 1.0” diagonal
- 256 levels of gray scale
- 32 degree field of view
- Min. 25 LUX; adjustable daylight viewable
- Brightness and focus control dials
- Eyepiece rotates in front of either eye
- Noise-canceling microphone and earphone
- Communications arm can be mounted on either side
- Weight: Approximately 15 ounces

**BATTERY PACK**

- Lithium-ion battery pack, standard
- LED battery life indicator
- Battery charger with A/C Adapter
- Hot swap capability
- Weight: Approximately 1.5 pounds

**ACCESSORIES**

- Miniature Keyboard
- A/C Power Supply
- Hard Sided Carrying Case (optional)

**SOFTWARE**

- MS-DOS/Windows95 OSR2 preloaded
- Verbex Listen for Windows 95TM, preloaded

**ENVIRONMENT**

- Operating temperature: 32 to 104 F (0 to 40 C)
- Storage temperature: -22 to 158 F (-30 to 70 C)
- Humidity: 5% to 95% non-condensing

**Via Wearable**

The Via Wearable currently comes in two versions, a two card version and a four card version.
Two card Wearable specification

General
- One expansion socket for Type I, II or III PC Cards (in addition to standard hard disk card)
- PC Cards must meet PCMCIA Rel. 2.1 or JEIDA Rel. 4.1
- Flexible belt packaging

Computer
- AMD 586 (133 MHz) processor
- BIOS with power management
- Full duplex audio for speech recognition
- VGA compatible video for CRTs and LCDs
- Digital display interface, LVDS characteristic
- Two serial communication ports
- Mouse and keyboard ports

Memory
- 24 MB DRAM

Mass Storage
- Standard: 340 MB hard disk card
- Optional: PC Card flash disk

Peripheral Devices (Optional)
- Keyboard: IBM AT, PS/2 compatible; 85 keys; provides full function of 101-key enhanced layout
- Pointing device: Glidepoint or Trackball
- Audio headset
- LCD digital flat panel display
- Head-mounted VGA display
- Hand-held VGA display

PC Interface Cards (Optional)
- Serial port
• Parallel port
• GPS or differential GPS
• Video camera interface
• Wireless LAN
• Wired LAN
• Cellphone
• Many others

**Standard Software**

• Microsoft Windows 95
• Phoenix Card Manager Plus (PCM+), version 3.20 (Phoenix Technologies, Ltd.)
• Microsoft CD-ROM Extensions, version 2.2
• Windows Video Driver, version 1.10 (Cirrus Logic, Inc.)
• AudioDrive for Windows, version 4.16.12 (ESS Technology, Inc.)

**Optional Software**

• MS-DOS version 6.22 / Microsoft Windows for Workgroups, version 3.11
• IBM Voice-Type Application Factory Development System
• SCO UNIX
• Microsoft Windows NT

**Physical Characteristics**

• Computer assembly: 9.1 in. L by 5.0 in. H by 1.25 in. D
• Battery holder assembly: 5.2 in. H by 3.7 in. W by 1.1 in. D
• Computer assembly: 1 lb. 2.3 oz.
• Hard disk card: 3.1 oz.
• Belt assembly: 4.9 oz.

**Battery**

• Battery holder assembly w/o battery: 3.7 oz.
• Battery Options: 11.8 oz. (20 watt NiMH), 22 oz. (36 watt NiMH), 16 oz. (42 watt Lithium Ion), 10.8-volt Lithium Ion (LiIon) Rechargeable
• Battery charger: Alexander Batteries battery charger with 15-volt adapter
- Auxiliary power: Optional 12-volt regulated AC adapter
- Power consumption: 12 W maximum when using auxiliary 12-volt regulated power adapter
- As delivered: 7 watts
- Available to user: 5 watts

Environmental
- Operating temperature: -10°C to 40°C or 14°F to 104°F
- Storage temperature: -30°C to 70°C or -22°F to 158°F
- Humidity: 5% to 95% non-condensing

Four card Wearable specifications
General
- Three expansion sockets for Type I and II PC Cards (in addition to standard hard disk card)
- One socket can also accommodate a Type III PC Card.
- PC Cards must meet PCMCIA Rel. 2.1 or JEIDA Rel. 4.1
- Flexible belt packaging

Computer
- AMD 586 (133 MHz) processor
- BIOS with power management
- Full duplex audio for speech recognition
- VGA compatible video for CRTs and LCDs
- Digital display interface, LVDS characteristic
- Two serial communication ports
- Mouse and keyboard ports

Memory
- 24 MB DRAM

Mass Storage
- Standard: 340 MB hard disk card
- Optional: PC Card flash disk
Peripheral Devices (Optional)

- Keyboard: IBM AT, PS/2 compatible; 85 keys; provides full function of 101-key enhanced layout
- Pointing device: Glidepoint or Trackball
- Audio headset
- LCD digital flat panel display
- Head-mounted VGA display
- Hand-held VGA display

PC Interface Cards (Optional)

- Serial port
- Parallel port
- MIL-STD 1553 interface
- GPS or differential GPS
- Video camera interface
- Wireless LAN
- Wired LAN
- Cellphone
- Many others

Standard Software

- Microsoft Windows 95
- Phoenix Card Manager Plus (PCM+), version 3.20 (Phoenix Technologies, Ltd.)
- Microsoft CD-ROM Extensions, version 2.2
- Windows Video Driver, version 1.10 (Cirrus Logic, Inc.)
- AudioDrive for Windows, version 4.16.12 (ESS Technology, Inc.)

Optional Software

- MS-DOS version 6.22 / Microsoft Windows for Workgroups, version 3.11
- IBM Voice-Type Application Factory Development System
- SCO UNIX
- Microsoft Windows NT
Physical Characteristics

- Computer assembly: 12.5 in. L by 5.0 in. H by 1.25 in. D
- Battery holder assembly: 5.2 in. H by 3.7 in. W by 1.1 in. D
- Computer assembly: 1 lb. 8 oz.
- Hard disk card: 3.1 oz.
- Belt assembly: 4.9 oz.

Battery

- Battery holder assembly w/o battery: 3.7 oz.
- Battery Options: 11.8 oz. (20 watt NiMH), 22 oz. (36 watt NiMH), 16 oz. (42 watt Lithium Ion), 10.8-volt Lithium Ion (LiIon) Rechargeable
- Battery charger: Alexander Batteries battery charger with 15-volt adapter
- Auxiliary power: Optional 12-volt regulated AC adapter
- Power consumption: 12 W maximum when using auxiliary 12-volt regulated power adapter
  - As delivered: 7 watts
  - Available to user: 5 watts

Environmental

- Operating temperature: -10°C to 40°C or 14°F to 104°F
- Storage temperature: -30°C to 70°C or -22°F to 158°F
- Humidity: 5% to 95% non-condensing

Mentis™ system

SYSTEM BOARD SPECIFICATIONS

CPU: Intel Pentium 75 to 200 MHz
Input/Output:
  - 2 serial ports
  - 1 parallel port (enhanced)
  - 2 infrared ports
  - Keyboard (PS/2 style)
• Mouse (PS/2 style)
• Enhanced IDE Floppy
• Audio headset (microphone/speakers)
• External LCD display

**DRAM:** 8 to 128 MB  
**Cache:** Up to 512 K on board (256 K standard)  
**BIOS:** Phoenix (Flash)  
**Flash memory (BIOS):** 256 K  
**Video:** VGA, SVGA, XGA for CRT or LCD engineered to support live motion video at varying color depths up to 16 bit (hi-color)  
**Sound:** Full duplex, Sound Blaster compatible, 16 bit 44.1 KHz sampling and playback  
**MPEG playback:** Full screen, full motion (up to 30 frames per second) at all resolutions  
**Network:** 32-bit PCI Ethernet (build option)  
**PC Card (PCMCIA):** 2 type II/1 type III slot  
**Rotating Storage Media:** 810 MB to 2.5 GB enhanced IDE hard drive, 8 to 16x CD-ROM drive (optional)  
**Power Management/Battery:** Full power management capabilities and battery recharging circuitry provided

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**The Wearable Computer**

**THE WEARABLE** offers a combination of state-of-the-art technologies, including:

• Voice Recognition  
• Head-mounted display (mono or binocular)  
• Flexible “belt” design  
• PCMCIA card options - 4PC slots  
  • Additional hard drive, expandable to 520MB  
  • SRAM Flash memory  
  • SCSI  
  • Cellular-modems/pagers/fax/phone  
  • Fax modem  
  • Serial,Parallel I/O
- LAN (wired/wireless)
- GPS (Global Positioning System)
- Video Capture
- Encryption

THE WEARABLE includes the following on-board connectors to support any PC peripheral device:

- VGA Video
- Mouse
- Keyboard
- Audio in/out
- Two serial ports

**Wearable Specifications**

Processor: PC compatible, 75 or 133Mhz

Memory: RAM: 8 - 24 Mb, Hard Disk: up to 520 Mb

Dimensions: 9-12.5L x 54H x 1.2D inches

Weight: 2.0 pounds

Environmental: 0 to +40 degrees Celsius

Operating Systems: DOS, Windows, Windows95, Windows NT, UNIX
Appendix D

Video Conferencing Tools

Desktop Videoconferencing Features

This is an index of features common in desktop videoconferencing systems. The information presented here can also be viewed on [9] Runs on UNIX Workstations

- Avistar Conference
- Communique!
- DECspin
- Eris Visual Communication System
- ICU Video Services
- InPerson
- InterVideo
- IVS (Inria Videoconference System)
- jointX
- LANscape
- MediaGate
- MINX
- MMC (MultiMedia Collaboration)
- NV (Network Video)
- PictureView
- Pronto
- ShowMe
- Simplicity

**Runs on Apple Macintoshes**

- Avistar Conference
- BeingThere
- Cameo Personal Video System
- Connect 918
- Connectix VideoPhone
- CorelVIDEO
- CU-SeeMe
- CU-SeeMe (Enhanced)
- DynoVision
- ES+F2F (Electronic Studio’s Face To Face)
- Eris Visual Communications System
- Meet-Me
- Meet-Me Light
- MINX
- MMC (MultiMedia Collaboration)
- Phonoscope
- QuickTime Conferencing
- ShareVision Mac 3000
- VISIT Video

**Runs on PCs (Windows, DOS, or OS/2)**

- Acer Axess 100
- AEON AVShare 6000
- AETHRA SDV8000
- Audiovision
- Avistar Conference
• Boca VideoPhone
• Bitfield Video Communication System
• CLI’s Desktop 1000/2000
• CamWiz Works
• CineVideo/Direct
• ClearPhone
• CoCoWin
• CollabOrator System 4000
• CommunicatorIII
• Communique!
• Connectix VideoPhone
• ConXion
• CorelVIDEO
• CU-SeeMe
• CU-SeeMe (Enhanced)
• digitel 2000
• Dwyco Video Conferencing System
• ELSAvision
• Eris Visual Communications System
• Focus PC
• FreeVue
• ICU Video Services
• Incite Conversational Multimedia Network
• InPerson
• InSight 100
• InSight 300
• Intel Video Phone
• Intel Internet Video Phone
• InterVideo
- INTERVu
- InVision
- LANscape
- Mediaphone
- MediaGate
- Meet-Me
- MegaConference
- Datapoint MINX Networked Video Systems
- MMC (MultiMedia Collaboration)
- Ntv
- NetMeeting
- Omega MVP
- Panorama PC
- Personal Communication Computer (PCC)
- PICFON
- PictureTel Live PCS 200 series
- PictureTel Live PCS 100
- PictureTel Live PCS 50
- PictureTel LiveLAN
- Plug & See
- Pronto
- ProShare Video System 200
- ProVision Business
- SeeQuest
- ShareVIDEO
- ShareVision PC 3000
- TeamVision
- TeleView 1000C
- TeleView Plus
- Teleworker Video Conference Kit 2
- V-Fone
- VCS8000
- VCON ARMADA Cruiser 50 System
- VCON ARMADA Cruiser 100 System
- VCON ARMADA Cruiser 150 System
- VCON ARMADA Escort
- VDOPhone
- VidCall
- VideoPacker Pro II
- VideoVu
- VideoWare 1000
- ViewPoint-FamilyFone
- ViewPoint-PRO
- VISIT Video
- VISTACOM VCI-10
- VISTACOM VCI-100
- Vivo320
- VS1000
- VTEL Personal Collaborator
- VuFone
- Winnov VideumConf Pro
- XtX Internet Communications Suite

**Capable of Multipoint Conferences**
- AEON AVShare
- AETHRA SDV8000
- Avistar Conference
- Bitfield Video Communication System
- CLT's Desktop 1000/2000 System
- CineVideo/Direct
- ClearPhone
- CollabOrator System 4000
- CommunicatorIII
- Communique!
- Connectix VideoPhone
- CorelVIDEO
- CU-SeeMe
- CU-SeeMe (Enhanced)
- DECspin
- Dwyco Video Conferencing System
- DynoVision
- ELSAvision
- Eris Visual Communication System
- Focus PC
- FreeVue
- ICU Video Services
- Incite Conversational Multimedia Network
- InPerson
- InSight 300
- InterVideo
- InVision
- IVS (Inria Videoconference System)
- jointX
- LANscape
- MediaGate
- Meet-Me
- Meet-Me Light
- Datapoint MINX Networked Video Systems
- MMC (MultiMedia Collaboration)
- Ntv
- NV (Network Video)
- Omega MVP
- Panorama PC
- Personal Communication Computer (PCC)
- Phonoscope
- PICFON
- PictureTel Live PCS 100
- PictureTel Live PCS 50
- PictureView
- Plug & See
- Pronto
- ProShare Video System 200
- ProVision Business
- QuickTime Conferencing
- ShowMe
- Simplicity
- TeleView Plus
- VCON ARMADA Cruiser 50 System
- VCON ARMADA Cruiser 100 System
- VCON ARMADA Cruiser 150 System
- VideoVu
- ViewPoint-FamilyFone
- ViewPoint-PRO
- VISTACOM VCI-10
- VISTACOM VCI-100
- Vivo320
- VTEL Personal Collaborator
- VuFone
- Winnov VideumConf Pro
- XtX Internet Communications Suite

**H.320/H.323/H.324 Compliant**

- Acer Axess 100
- AETHRA SDV8000
- Boca VideoPhone
- BVCS (Bitfield Video Communication System)
- CLI’s Desktop 1000/2000 System
- C-Phone
- CollabOrator System 4000
- CommunicatorIII
- Communique!
- Connect 918
- Connectix VideoPhone
- CorelVIDEO
- ELSAvision
- Eris Visual Communications System
- Focus PC
- ICU Video Services
- Incite Conversational Multimedia Network
- InSight 300
- Intel Video Phone
- Intel Internet Video Phone
- Interact
- InterVideo
- INTERVu
- jointX
- LANscape
• MediaGate
• Meet-Me
• Meet-Me Light
• Datapoint MINX Networked Video Systems
• NetMeeting
• Omega MVP
• Panorama PC
• Personal Communication Computer (PCC)
• PictureTel Live PCS 200 series
• PictureTel Live PCS 100
• PictureTel Live PCS 50
• Plug & See
• ProShare Video System 200
• ProVision Business
• QuickTime Conferencing
• TeamVISION
• TeleView Plus
• Teleworker Video Conference Kit 2
• VCS000
• VCON ARMADA Cruiser 50 System
• VCON ARMADA Cruiser 100 System
• VCON ARMADA Cruiser 150 System
• VCON ARMADA Escort
• VideoPacker Pro II
• ViewPoint - FamilyFone
• VISTACOM VCI-10
• VISTACOM VCI-100
• Vivo320
• VTEL Personal Collaborator
Acer Axess 100

- **Version:**
- **Description:** Desktop videoconferencing system over ISDN
- **Platforms:** PC
- **Requirements:** Pentium-based PC with 8MB DRAM, 20MB available hard disk space, one PCI slot available, PCI-based VGA with 1MB memory, Windows 95
- **Price:** List Price: US $1200. Includes: Single PCI card solution, ISDN phone set, video camera, system software, and bundled with Microsoft’s NetMeeting S/W.
- **Contact Info:** Oliver Cheng, Acer Inc., 6th, Fl., 156 Min-Sheng E. Road, Sec. 3, Taipei, Taiwan, R.O.C., phone: +886-2-545-5288, fax: +886-2-545-5308
- **LAN Protocols:**
- **Audio Encoding:** G.711, G.728
- **Video Encoding:** H.261
- **Interoperability Standard Support:** H.320, T.120
- **Multipoint:** Data only
- **Collaboration Features:** Included with Microsoft’s NetMeeting
- **Notes:**
- **Survey Info Updated:** 18-Mar-97

AEON AVShare

- **Version:** 2.0D
- **Provider:** Aeon Tech International Co., Ltd.
- **Description:** Low-cost software based audio/video conferencing kit over Internet, LAN/WAN and analog
- **Platforms:** PC
• Requirements: 486DX-33MHz or higher, 4MB RAM, 4MB disk space, Windows 3.1+, Windows NT, or Windows compatible LAN, WAN, TCP/IP network

• Price: US $495.00/kit includes AVShare software, 28.8K DSVD modem, and Digital Color CCD Camera.

• Contact Info: Ms. Arlene Lin /Aeontech International Co., Ltd./ 6F-1, No. 94, Pao Chung Road/ Hsin Tien City Taipei Hsien Taiwan R. O C. phone: 886 2 914 6677 fax: 886 2 914 6688 e-mail: aeontech@tpts1.seed.net.tw

• LAN Protocols:
• Audio Encoding: transmitted over analog phone line
• Video Encoding: proprietary
• Interoperability Standard Support:
• Multipoint: on LAN/WAN
• Collaboration Features: whiteboard and image sharing
• Notes: AEON AVCAM digital camera plugs into a PC’s parallel port, thus a video capture board is no longer required.

• Survey Info Updated: 23-Sept-96

AETHRA SDV8000

• Version: 3.20

• Provider: (http://www.aethra.com) AETHRA

• Description: Desktop Videoconference System Model SDV8000 (ISDN Desktop)

• Platforms: PC

• Requirements: 486-DX-2/66MHz, 30MB of harddrive space, and 8MB RAM - Win 95 for application sharing, and Win3.1 for multimedia application only.

• Price:

• Contact Info: Corrado Mazzocato/Paolo Compagnucci +39.71.2189893

• LAN Protocols: N/A

• Audio Encoding: G.711, G.722, G.728

• Video Encoding: CIF, QCIF at 30fps

• Interoperability Standard Support: H.320
• **Multipoint**: Yes.
• **Collaboration Features**: Application sharing and electronic whiteboard.
• **Notes**:
• **Survey Info Updated**: 11-Mar-97

## Audiovision

• **Version**: 1.0
• **Provider**: (http://www.smithmicro.com)Smith Micro Software
• **Description**: Audiovision allows high quality videoconferencing over ordinary phone lines without the need for a special modem. You can also create and send video e-mail over the Internet.
• **Platforms**: PC
• **Requirements**: 486/66 with 8MB RAM, 28.8K modem, video capture board recommended for Pentium-100 and below.
• **Price**: $99
• **Contact Info**: Mark Maupin, Smith Micro, phone: 714-360-8515 e-mail: mmaupin@smithmicro.com
• **LAN Protocols**:
  - **Audio Encoding**: CELP
  - **Video Encoding**: H.261
  - **Interoperability Standard Support**: No.
• **Multipoint**: No.
• **Collaboration Features**: No.
• **Notes**: Will do 8-10 fps on a Pentium 120 under optimum conditions. V-80 modem not required
• **Survey Info Updated**: 24-Sept-96

## Avistar Conference

• **Provider**: (http://www.avistar.com/avistar/)Avistar
• **Description:** client/server solution for desktop videoconferencing over LANS.

• **Platforms:** PC, Mac, Sun

• **Requirements:**

• **Price:**

• **Contact Info:** Avistar Systems, 555 Hamilton Avenue, Palo Alto CA 94301, USA, +1.415.617.1350, fax: +1.415.617.1351, info@avistar.com.

• **LAN Protocols:**

• **Audio Encoding:**

• **Video Encoding:**

• **Interoperability Standard Support:**

• **Multipoint:** Up to 4 simultaneous participants.

• **Collaboration Features:** Shared window with annotation capability.

• **Notes:**

• **Survey Info Updated:** 29-June-95

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**BeingThere**

• **Version:** 2.0

• **Provider:** Intelligence at Large

• **Description:** Video/Audio/Tools over LAN (Ethernet, Token Ring, LocalTalk) and WAN (analog dial-up, ISDN and other switched/dedicated digital telephone lines).

• **Platforms:** Mac

• **Requirements:** Mac 68040 or Power Mac, Mac OS 7.1 or later, 8 MB RAM, 3.5 MB disk space, QuickTime video capture, video input (S-VHS, NTSC, PAL, SECAM), audio input. ISDN use requires an ISDN card and BRI ISDN service (2 B channels), Modem use requires 28.8 kbps for audio, video and collaboration (9.6 kbps sufficient for collaboration only).

• **Price:** $299 for Standard, $599 for PRO, $149 for Starter kit, includes 2 versions of Standard. Limit 1 Starter Kit per site.

• **Contact Info:** Intelligence at Large, Inc., 3508 Market Street, Suite 230, Philadelphia, PA 19104, USA, phone: +1.215.387.6002, 1-800-425-7638, fax: +1.215.387.9215, info@beingthere.com.
- **LAN Protocols:** Appletalk and ARA, TCP/IP.
- **Audio Encoding:** QuickTime
- **Video Encoding:** Quicktime, National Semiconductor Video Codec
- **Interoperability Standard Support:**
  - **Multipoint:** Yes (Pro version), 4 with sound/video; 10 collaboration only. ISDN and modem are point to point only.
  - **Collaboration Features:** Full document window sharing, real-time updates of shared documents, whiteboard, drag and drop interface for file transfer, file and clipboard transfer, object-based whiteboard mark-up tools.
  - **Notes:** Free upgrade to (http://quicktime.apple.com/qtconf.html) QuickTime Conferencing compatibility from Apple Computer will be available soon after QuickTime Conferencing ships. Free demonstration version available via FTP. Send an email request to info@beingthere.com.

**Survey Info Updated:** 06-June-95

**Boca VideoPhone**

- **Version:** Elite
- **Provider:** (http://www.bocaresearch.com/videophone) Boca Research
- **Description:** Provides H.324 compliant videoconferencing
- **Platforms:** PC
- **Requirements:** Pentium system with PCI bus master slot, Windows 95, 12MB RAM (minimum), "Video Ready" V.34 modem VGA graphics adapter with DirectDraw support, microphone, camcorder or camera (NTSC/PAL), 10MB free hard disk space.
- **Price:** $399.00
- **Contact Info:** Boca Research, Inc. U.S.A., 1377 Clint Moore Road, Boca Raton, Fl 33487-2732, phone: 561-997-6227, fax: 561-994-5848, e-mail: sales@bocaresearch.com
- **LAN Protocols:**
- **Audio Encoding:** G.723
- **Video Encoding:** H.263
- **Interoperability Standard Support:** H.324(POTS)
BVCS (Bitfield Video Communication System)

- **Version**: 2.2
- **Provider**: (http://www.bitfield.fi/)Bitfield Oy
- **Description**: Video/Audio over ISDN (single/multi BRI, PRI), LAN (TCP/IP, NetBIOS), T1/E1 and other networks.
- **Platforms**: PC
- **Requirements**: Microsoft Windows 3.1+, video overlay board or external monitor.
- **Price**: 
- **Contact Info**: info@bitfield.fi, phone: +358-9-5024 220, fax: +358-9-455 2240, Bitfield Oy, Ukonvaaja 2, 02130 Espoo, Finland.
- **LAN Protocols**: TCP/IP, NetBIOS
- **Audio Encoding**: G.711, G.722, G.728
- **Video Encoding**: H.261
- **Interoperability Standard Support**: H.320
- **Multipoint**: Yes - using H.320 compliant MCU’s
- **Collaboration Features**: Databeam’s FarSite collaboration software included.
- **Notes**: 
- **Survey Info Updated**: 11-Mar-97 (http://www3.ncsu.edu/dox/video/”>
- **Author**: Kathy Hewitt / klhewitt@eos.ncsu.edu
- **Contact**: klhewitt@eos.ncsu.edu
- **Last Modified**: March 18, 1997 by Kathy Hewitt
CLI’s Desktop 1000/2000

- **Version:** 2.4
- **Provider:** (http://www.clix.com/) Compression Labs, Inc.
- **Description:** Video/Audio/Collaboration Tools over ISDN
- **Platforms:** PC
- **Requirements:** Windows3.1 and Windows95
- **Price:** DVS 1000 - $1795, DVS 2000 - $2295
- **Contact Info:** Compression Labs, Inc. 2860 Junction Ave., San Jose, CA, 95134, USA, phone: +1.408.435.3000, toll free: 1-800-CALL-CLI. e-mail: jim.ross@clix.com
- **LAN Protocols:** UDP/TCP/IP, SNMP
- **Audio Encoding:** G.711, G.728, G.722
- **Video Encoding:** H.261
- **Interoperability Standard Support:** H.320, T.120, H.323
- **Multipoint:** Yes through multipoint bridge
- **Collaboration Features:** Databeam Collaborative software. Shared whiteboard, file transfer, (optional features)
- **Notes:** support for Intel ProShare Premier, support for dual video input. Difference in 1000/2000 systems is 1000 offers 15fps in FCIF and 2000 offers 22fps. Data transfer rate for 1000 is 56-128 and 56-384 for 2000
- **Survey Info Updated:** 11-Mar-97

C-Phone

- **Provider:** (http://www.cphone.com/) C-Phone Corporation
- **Description:** Windows Desktop Video Conferencing System over LAN, ISDN, fractional T1, or Switched-56 digital lines.
- **Platforms:** PC
- **Requirements:** Windows 3.1+, 386SX or higher, 4MB RAM, VGA or better display, graphics board with feature connector.
- **Price:** $1,995 (for LAN user)
**Contact Info:** Target Technologies, Inc., 6714 Netherlands Dr., Wilmington NC, USA, 28405. Phone: +1.910.395.6100. Fax: +1.910.395.6108

**LAN Protocols:** IPX/SPX, TCP/IP, NETBIOS

**Audio Encoding:** LAN - 20Hz - 15kHz; WAN - G.711, G.722, G.728

**Video Encoding:** LAN - 30 FPS TV Quality; WAN - H.261

**Interoperability Standard Support:** H.320

**Multipoint:** Yes

**Collaboration Features:** High speed file transfer, document camera (optional), and video playback.

**Notes:** Full screen TV quality video, Operates on existing PCs

**Survey Info Updated:** 24-Sept-96

### Cameo Personal Video System

- **Provider:** Compression Labs Inc.
- **Description:** Video over Switched 56, ISDN, and Ethernet. Audio requires separate ISDN or Analog phone line.
- **Platforms:** Macintosh
- **Requirements:** System 7 or higher, QuickTime, ISDN card for ISDN use, video card (RasterOps 24STV, 24LTV), Analog telephone or speakerphone.
- **Price:** $1595 without camera, $2095 with camera.
- **Contact Info:** Compression Labs Inc., 2860 Junction Ave., San Jose CA, 95134, USA, phone: +1.408.435.3000, toll free: 1-800-CALL-CLI.
- **LAN Protocols:**
- **Audio Encoding:** Proprietary CLI PV2 compression algorithm
- **Video Encoding:** Proprietary CLI PV2 compression algorithm
- **Interoperability Standard Support:**
- **Multipoint:** No
- **Collaboration Features:** File Transfer.
- **Notes:**
Survey Info Updated:

CamWiz Works

- **Version:** 3.0
- **Provider:** (http://www.cst.com.au/) Creative Software Technologies
- **Description:** A complete Internet video conferencing and photography combination pack including: CamWiz colour digital camera, and Camwiz for NetMeeting multipoint video conferencing.
- **Platforms:** PC
- **Requirements:** Windows 3.1x and Windows95
- **Price:** $AUS 399
- **Contact Info:** simonc@cst.com.au
- **LAN Protocols:** TCP/IP
- **Audio Encoding:**
- **Video Encoding:** Software compression via parallel port
- **Interoperability Standard Support:** T.120
- **Multipoint:** Yes.
- **Collaboration Features:**
- **Notes:**
- **Survey Info Updated:** 21-Feb-97

CineVideo/Direct

- **Version:** 1.09
- **Provider:** (http://www.cinecom.com/) CINECOM Corporation
- **Description:** Desktop Videoconferencing over 28.8 modems. Cinevideo offers audio and video in B&W or color! Works with the QuickCam and any MSVIDEO compliant device. TCP/IP based support with text window to boot.
- **Platforms:** PC
• **Requirements:** 8 MB RAM, MS Windows 3.1, 3.11, 95, and NT, VGA and 1 MB disk storage

• **Price:** $39.95 - CineVideo/Direct, $149.00 Bundle Package includes: CineVideo/Direct, Microphone and a QuickCam

• **Contact Info:** Annie Potter, CINECOM Corporation 15621 Neath Drive, Woodbridge VA 22193, phone: 703-680-4733, fax: 703-680-1697

• **LAN Protocols:** TCP

• **Audio Encoding:** CINECOM AUDIO Compression

• **Video Encoding:** CINECOM VIDEO Compression

• **Interoperability Standard Support:** H.324 (future)

• **Multitpoint:** Yes

• **Collaboration Features:** Works with Intel ProShare

• **Notes:**

• **Survey Info Updated:** 8-Mar-96

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**ClearPhone**

• **Version:** 2.0

• **Provider:** (http://www.clearphone.com/) ClearPhone

• **Description:** An Internet video Conferencing Phone including Voice EMAIL and white board.

• **Platforms:** MAC (Windows soon)

• **Requirements:** Macintosh with system 7.5.3 and Open transport 1.1

• **Price:** $59.95

• **Contact Info:** Robert Blumenkranz, phone: 714-671-2009

• **LAN Protocols:**

• **Audio Encoding:** proprietary

• **Video Encoding:** proprietary

• **Interoperability Standard Support:** No.

• **Multipoint:** Yes.
• **Collaboration Features:** White board, file transfer, Picture and sound transfer, group conferencing.

• **Notes:** The ClearPhone works well at 14.4, 28.8 or higher network speeds and has quality hi res video transfer up to 640x480 size.

• **Survey Info Updated:** 30-Jan-97

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**CoCoWin (Desktop Video Conferencing Collaboration System on Windows)**

• **Version:** 1.0

• **Provider:** ( http://www.Panda.ccl.itri.org.tw/ ) ITRI/CCL, Taiwan

• **Description:** Video/Audio/Tools over LAN/WAN (Including Ethernet, 100VG-AnyLAN, FDDI,...etc.)

• **Platforms:** PC (IBM Compatible)

• **Requirements:** 486 or faster, Microsoft Windows 3.1 or Windows 95 or higher, 8 MB RAM

• **Price:** Engine Library-Individual Contact, Full Product - Individual Contact

• **Contact Info:** Fengmin@panda.ccl.itri.org.tw or Jesfa@ccl.itri.org.tw Fax: 886-35-820240, 886-35-820462

• **LAN Protocols:** TCP/IP, UDP/IP, IPX

• **Audio Encoding:** PCM

• **Video Encoding:** Indo or Motion JPEG

• **Interoperability Standard Support:** No.

• **Multipoint:** No.

• **Collaboration Features:** Includes Shared White Board, Share Text Editor, and File Transfer

• **Notes:** Video/Audio/Tools over Modem, ISDN, and ATM under development

• **Survey Info Updated:** 14-Mar-96
CollabOrator System 4000

- **Provider:** (http://www.cst.com.au/) Creative Software Technologies
- **Description:** Fully integrated simultaneous video, audio, and data conferencing PC upgrade kit supporting interconnection via ISDN and LAN/WAN
- **Platforms:** PC
- **Requirements:** i486 33MHz or higher ISA bus PC, Microsoft Windows 3.1 or Windows for Workgroups 3.11, SVGA or VGA Monitor, 8 Mb RAM, 5 Mb disk space, One expansion slot for H.320 codec card, ISDN or LAN/WAN support
- **Price:** To be confirmed. Includes:
  - H.320 codec card
  - External peripheral connector box
  - Video camera, cabling and connectors
  - Headset, cabling and connectors
- **Contact Info:** Alan Steel at CST Inc. on (802) 326-4215, fax: (802) 326-4488 or email: mediaway@interserv.com
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:**
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes with the System 9000 which is a software-only MCU server for multipoint CollabOrator over TCP/IP networks. Right now, it provides multipoint data, switched audio and slow motion JPEG video. Later releases it will support simultaneous T.120 data and H.320 video/audio in conjunction with hardware.
- **Collaboration Features:** Application sharing (Microsoft Windows applications), file transfer, shared whiteboard, textual dialogue
- **Notes:**
- **Survey Info Updated:** 2-Nov-95

CommunicatorIII

- **Version:** 3.0
• **Provider:** ( http://www.eyetel.com/ ) EyeTel Communications Inc.

• **Description:** Video/Audio/Tools over Switched 56, ISDN, T1, Ethernet, or Token Ring.

• **Platforms:** PC

• **Requirements:** Novell Netware 3.11+, 386SX or higher, 4 MB RAM, Super VGA w/256 colors and feature connector, Microsoft Windows 3.1+, audio input/output, 5 MB hard disk space.

• **Price:** $6995, includes camera, microphone, speakers, CODEC and video capture board. Optional motion estimation board $995.

• **Contact Info:** EyeTel Communications Inc., #206 - 267 W. Esplanade, N. Vancouver, B.C., Canada, V7M1A5, phone: +1.604.984.2522, toll free: 1-800-736-3236, fax: +1.604.984.3566.

• **LAN Protocols:** NetBIOS, TCP/IP, IPX.

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

• **Video Encoding:** H.261

• **Interoperability Standard Support:** H.320

• **Multipoint:** Yes

• **Collaboration Features:** Whiteboard, File transfer.

• **Notes:**

• **Survey Info Updated:**

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Communique!

• **Provider:** ( http://www.insoft.com/ ) 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:**

<table>
<thead>
<tr>
<th>Platform</th>
<th>Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>SunOS 4.1.3, 4.1.4</td>
</tr>
<tr>
<td>Sun</td>
<td>Solaris 2.3, 2.4</td>
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<td>HP</td>
<td>HP-UX 9.0.3, 9.0.5, 10.0</td>
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<tr>
<td>IBM</td>
<td>AIX 3.2.5, 4.1.1</td>
</tr>
<tr>
<td>DEC</td>
<td>Digital Unix</td>
</tr>
</tbody>
</table>
Virtual Control Room - Appendix

- **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:** 1-Dec-95

**Connect 918**

- **Provider:** Nuts Technologies
- **Description:** Video/Audio/Tools over Analog, Switched 56, ISDN, or Ethernet.
- **Platforms:** Mac
- **Requirements:**
- **Price:** $3000-$5000 depending on ISDN or LAN options.
- **Contact Info:** Nuts Technologies, 2374 Walsh Ave., Santa Clara CA, 95051 USA, phone: +1.408.980.7800, Applelink: NUTS.USA.
- **LAN Protocols:**
- **Audio Encoding:** G.711, G.722, G.728
- **Video Encoding:** H.261
- **Interoperability Standard Support:** H.320
- **Multipoint:** No
- **Collaboration Features:** Whiteboard, Screen sharing.
• **Notes:** Reported not to be fully H.320 compliant yet (though product literature claims they are). PC version in the works.

• **Survey Info Updated:** 26-Apr-95

## Connectix VideoPhone

• **Version:** 2.0

• **Provider:** (http://www.connectix.com/) Connectix Corporation

• **Description:** Low-cost software based audio/vido 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 - 55.00-60.00USD 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; EtherTalk

• **Audio Encoding:** PCM, ADPCM, GSM, TrueSpeech

• **Video Encoding:** VIDE, Indeo, NSVideo, H.261

• **Interoperability Standard Support:** H.324 announced

• **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 Updated:** 11-Mar-97
ConXion

- **Version:**
- **Provider:** Imaging Business Systems
- **Description:** Audio/Video tools over the Internet and POTS
- **Platforms:** PC
- **Requirements:** minimum: 386/33 Processor, 4MB RAM, 12MB free space, Windows 3.1 or later, 14.4kbps modem; recommended: 486/50 Processor, 8MB RAM, 40MB free space, 28.8kbps modem
- **Price:** $499
- **Contact Info:** conxion@webex.com
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:** proprietary
- **Interoperability Standard Support:** No.
- **Multipoint:** No.
- **Collaboration Features:** whiteboard, file transfer, and application sharing
- **Notes:**
- **Survey Info Updated:** 21-May-96

CorelVIDEO

- **Version:** 1.0
- **Provider:** (http://www.corel.com/) 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:** 18-Mar-96

**CU-SeeMe / Cornell**

**CU-SeeMe / White Pine**

- **Version:** 83b3 (Macintosh), 64a4 (PC).
- **Provider:** Cornell University and ( http://www.wpine.com/index.html ) 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/ ) 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: 9-Nov-95

CU-SeeMe (Enhanced)

• Version: 2.0 (PC), 2.0 (Mac in beta)
• Provider: (http://www.cu-see.me/) 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-see.me.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 Win-
dow - 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: (http://www.cu-see.me.com/) www.cu-see.me.com

- **Survey Info Updated:** 8-Apr-96

## DECspin

- **Version:**
- **Provider:** (http://www.digital.com/info/home.html) DEC
- **Description:** Audio/Video Tools over TCP/IP, DECnet, ISDN
- **Platforms:** DEC 3000 Alpha AXP workstation
- **Requirements:** OSF/1 AXP v1.3, video camera, headset, microphone
- **Price:**
- **Contact Info:**
- **LAN Protocols:** TCP/IP, DECnet
- **Audio Encoding:** G.725
- **Video Encoding:** JPEG
- **Interoperability Standard Support:** No.
- **Multipoint:** Yes - up to 6 users
- **Collaboration Features:** No.
- **Notes:**
- **Survey Info Updated:** 21-May-96
digitel 2000

- **Version:** 2.01
- **Provider:** Digivision Milano Italy
- **Description:** Video/audio/data & application sharing over standard telephone lines at 28.8kbaud. The digitel 2000 kit includes everything needed to turn your PC into a videoconferencing workstation
- **Platforms:** PC
- **Requirements:** Windows 3.11 or Windows95, PCI BUS
- **Price:** Italian liras = 2,600,000 US dollars = $1600. Kit includes a 28.8kbaud modem, camera (ccd toshiba), video capture board, software
- **Contact Info:** digivision srl Via carlo Poerio 29 - 20129 Milano Italy. phone: ++39, 2, 2951, 3323 fax: ++39, 2, 2951, 3466 e-mail: dgvision@micronet.it
- **LAN Protocols:**
- **Audio Encoding:** proprietary
- **Video Encoding:** proprietary
- **Interoperability Standard Support:** future
- **Multipoint:** future
- **Collaboration Features:** document conferencing, shared application, remote control functions, telephone and fax functions
- **Notes:** Audio is sent at 4.4kbaud leaving the rest for video, data, images. The modem and related software is able to distinguish between an incoming fax, data transfer, or voice messaging. It can handle fax on demand and voice messages
- **Survey Info Updated:** 16-Apr-96

Dwyco Video Conferencing System

- **Version:** 0.70
- **Provider:** Dwyco, Inc.
- **Description:** Provides video/audio/chat conferencing over low-speed internet links. Features are independent, so the software can be used as an internet phone, or video-chat system. Can also be sued as an unattended video/audio server.
• Platforms: PC

• Requirements: Windows 95, video capture device that supports Video For Windows.

• Price: Shareware, but registration is $0 for this version of the software.

• Contact Info: Dwight Melcher, e-mail: dwight@dwyco.com

• LAN Protocols: IP/TCP/UDP

• Audio Encoding: GSM6.10

• Video Encoding: Proprietary (H.263 hybrid)

• Interoperability Standard Support:

• Multipoint: video & chat: yes, audio: point-to-point and broadcast only.

• Collaboration Features:

• Notes: Product also comes with a simple directory service to allow you to find other people using the software. Has call screening, and call management. Supports full-duplex audio for hardware capable of full-duplex operation.

• Survey Info Updated: 11-Mar-97

DynoVision


• Description: DynoVision is an Audio / Video system that has been designed to operate over standard analog telephone lines or various network situations. The system focuses on utilizing a wide range of Macintosh platforms in order to provide a user with a suitable system to meet his/her needs.

• Platforms: Macintosh

• Requirements: 68020 or higher, 2Mb RAM for DynoVision, Mac OS 7.1 or higher with MacTCP 2.0.4 & Sound Manager, 1.7 Mb HD, 9.6 K modem for 1-way video, 14.4 K modem required for 2-way video and 19.2 K modem or higher required for audio and video.

• Price: $199.95 for 1 unit or $329.95 for a set. DynoVision includes: 1 or 2 cameras, software, User’s manual, and cables.

• Contact Info: DynoVision, Inc., Toll free: 1-800-800-9292, e-mail: dyno@dynacs.com

• LAN Protocols: UDP/IP, IP multicast
• Audio Encoding: N/A
• Video Encoding: N/A
• **Interoperability Standard Support:** Point-to-point modem connections allow any Internet application to run while using video services (Fetch, FTPd, MacHTTP, etc.). PC compatible for dial up modem connects, for those wanting to share Mac/PC resources.
• **Multipoint:** Yes - with the aid of a CU-SeeMe video reflector.
• **Collaboration Features:** N/A
• **Notes:** System is cost effective and is Mac or PC CU-SeeMe application and video reflector compatible.
• **Survey Info Updated:** 15-January-96

**ELSAvision**

• **Version:** v1.30
• **Provider:** (http://www.elsa.com/) ELSA Inc
• **Description:** Single slot PCI board solution for ISDN. Can be used either with one or two B-channels. Two inputs for analog cameras. Speakerphone Features: videoconferencing, standard telephone, ISDN-board, MPEG-Decoder. Comes with: PCI board, color camera, Headset, Software.
• **Platforms:** PC
• **Requirements:** PCI slot, PCI graphics board that supports DCI (Win3.x), or Direct X (Win95), ISDN-BRI. Runs on Win3.x, Win95, Win NT (i.p.)
• **Price:**
• **Contact Info:** ELSA Inc., 2150 Trade Zone Blvd., Suite 101, San Jose, CA 95131. phone: 408-935-0350, fax: 408-935-0370.
• **LAN Protocols:** IPX/PX, TCP/IP (i.p.)
• **Audio Encoding:** G.711, G.728, G.722
• **Video Encoding:** H.261
• **Interoperability Standard Support:** H.320
• **Collaboration Features:** Application sharing software: Intel’s Proshare Premier.
• **Notes:**
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

ES+F2F (Electronic Studio’s Face 2 Face)

- **Version:** 1.0
- **Provider:** Electronic Studio
- **Description:** Video/Tools over ISDN, Analog, Ethernet. Audio requires ISDN or Analog phone line.
Virtual Controlroom - Appendix

- **Platforms:** Macintosh
- **Requirements:** Apple Communications Toolbox, video capture board.
- **Price:** $995 video, $995 text and image exchange, $1495 both.
- **Contact Info:** The Electronic Studio, 7 Fitzroy Square, London, W1P 6HJ, Great Britain, phone: +1.408.974.0784, toll free: 1-800-377-8681.
- **LAN Protocols:** Appletalk
- **Audio Encoding:**
- **Video Encoding:**
- **Interoperability Standard Support:**
  - Multipoint: No
- **Collaboration Features:** Text and image exchange.
- **Notes:**
- **Survey Info Updated:**

**Focus PC**

- **Version:**
- **Provider:** (http://www.hiway.co.uk/gpt/) GPT Video Systems
- **Description:** Audio/Video tools over ISDN
- **Platforms:** PC
- **Requirements:** Windows3.x, Windows 95, Windows NT
- **Price:** $5850
- **Contact Info:** Mr. Chris Arnold phone: +01635 550660 fax: +01635 521268
- **LAN Protocols:** n/a
- **Audio Encoding:** G.711, G.728
- **Video Encoding:** H.261 (CIF and QCIF)
- **Interoperability Standard Support:** H.320
- **Multipoint:** yes.
- **Collaboration Features:** whiteboard, file transfer
FreeVue

- **Version**: 1.03
- **Provider**: AMS
- **Description**: Audio and video conferencing software for the PC. Internet based, allows both point to point, multi-point, and broadcasting
- **Platforms**: PC
- **Requirements**: 486 or better, 4MB RAM, 14.4K or better internet connection.
- **Price**: Currently free at web site
- **Contact Info**: feedback@freevue.com
- **LAN Protocols**: TCP/IP
- **Audio Encoding**: Proprietary
- **Video Encoding**: Proprietary
- **Interoperability Standard Support**: None yet.
- **Multipoint**: yes
- **Collaboration Features**: Audio, video, text chat
- **Notes**: No compression hardware required - works with any video for windows device
- **Survey Info Updated**: 23-Feb-96

ICU Video Services

- **Version**: 2.0.6
- **Provider**: Uni-Data and Communications, Inc.
- **Description**: Audio/Video/Tools over LAN/WAN.
- **Platforms**: PC, SUN, DEC
• **Requirements:** TCP/IP LAN and/or WAN for call setup. Cat 3 UTP for video within a premise; ISDN, SW56, ATM or private circuits for video transmission between premises. Motif (Solaris/Ultrix) or Windows 3.1 with Winsock-compliant TCP/IP.

• **Price:**


• **LAN Protocols:** TCP/IP

• **Audio Encoding:**

• **Video Encoding:** H.261

• **Interoperability Standard Support:** H.320

• **Multipoint:** 4-, 9-, 16-way viewing with all participants simultaneously displayed and audible.

• **Collaboration Features:** White Pages, On-Line directory services, text messaging, frame grabbing.

• **Notes:** TV-quality desktop and room video conferencing and broadcast distribution over unshielded twisted pair up to 300 meters within a premise and via WAN between premises. No impact on LAN throughput. Works with any analog video camera or monitor/video board. Non-clocking video switch guarantees that every call will complete successfully. Complete call control from every desktop. Feature set includes: caller ID, call roaming, speed dialling, detailed billing and usage reports. Operable within a single premise or throughout a global enterprise. Distributed architecture allows for multiple video switches to be interlinked to provide end-to-end calling capability from any desktop. Can distribute VCR, CATV, broadcast TV, stored video.

• **Survey Info Updated:** 14-May-95

### Incite Conversational Multimedia Network

• **Provider:** (http://www.incite.com/) Incite

• **Version:**

• **Description:** "Incite Conversational Media is actually several products, including multimedia hubs, WAN hubs, cameras, software and servers that constitute a multimedia, voice, data and video over isoEthernet technology"
- **Platforms:** PC
- **Requirements:**
  Desktop PC’s:
  - 486DX2-66mHz or better
  - 8M of RAM (16 recommended)
  - 30M of available hard disk space
  - Windows 3.1/3.11 (Windows 95 recommended)
  - Amplified Speakers or Telephone Headset
  - Two full-size 16-bit bus slots available
  - SVGA Windows-supported Graphics Monitor (256+ colors)

Incite Server Requirements:
  - 486DX2-66MHz or better
  - 32M of RAM
  - 70M of available hard disk space
  - Windows NT v3.5.1
  - 10BaseT Network Interface Card
- **Price:** $450 per port (estimated). Base Package - $25,400 which includes: One Incite WAN Hub, One Incite Multimedia Hub, Four Desktop Multimedia Packages, Four User Software License
- **Contact Info:** Incite, a division of Intecom, Liberty Plaza II 5057 Keller Springs Rd., Dallas, TX 75248. phone: +214-448-8200 fax: +214-447-8205 or toll free: +1-800-9INCITE. e-mail: info@incite.com
- **LAN Protocols:**
- **Audio Encoding:** G.711, G.728
- **Video Encoding:**
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes.
- **Collaboration Features:** whiteboard, on-line image editing
- **Notes:** Runs over existing LAN, WAN, and PBX links. It uses Isochronous Ethernet (isoEthernet), which adds a 6-Mbps circuit-switched channel on top of the existing
10-Mbps 10BaseT Ethernet channel. It can run with any network operating system and supports any video codec algorithm.

- **Survey Info Updated:** 14-Nov-95

**InPerson**

- **Provider:** (http://www.sgi.com/) Silicon Graphics
- **Version:** 2.0 (April 1995)
- **Description:** Video/Audio/Tools over ISDN, T1, Ethernet, FDDI. A conference includes a shared whiteboard and a "shared shelf" for visual file transfer.
- **Platforms:** InPerson runs on any SGI platform with graphics. The SGI Indy comes bundled with all the audio/video hardware/software you need. For machines without video hardware, a static image is used instead of live video. For machines without audio hardware, the InPerson whiteboard can be used with an analog phone line for voice. The InPerson whiteboard is available on Windows from NetManage (+1-408-973-7171, sales@netmanage.com). InPerson is now running on Windows PC (486+ with Windows 3.x, Windows 95, Windows NT) as a videoconferencing tool as well as a whiteboard. Internezzo Technologies (+1.415.561.5171) plans to provide InPerson on Suns and HPs by Dec. 1995.
- **Requirements:** IRIX 5.3 system software. No additional hardware needed on Indy.
- **Price:** $495 U.S. list
- **Contact Info:** US toll free: 1-800-800-7441, inperson@sgi.com More info and evaluation copy available from (http://www.sgi.com/Products/inperson_main.html) www.sgi.com.
- **LAN Protocols:** Audio and video data is sent using UDP/IP. IP multicast is used for all conferences with more than two participants. The whiteboard uses TCP/IP.
- **Audio Encoding:** InPerson supports several standard audio compression formats:

<table>
<thead>
<tr>
<th>Encoder/Decoder</th>
<th>Sample Rate (kHz)</th>
<th>Bit Rate (kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel/IMA DVI ADPCM</td>
<td>16</td>
<td>64 (default)</td>
</tr>
<tr>
<td>Intel/IMA DVI ADPCM</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>CCITT/ITU-T G.711u-law PCM</td>
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<td>64</td>
</tr>
<tr>
<td>GSM 06.10 RTE/LTP</td>
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<tr>
<td>uncompressed mono</td>
<td>44.1</td>
<td>706</td>
</tr>
<tr>
<td>CCITT/ITU-T G.728</td>
<td>8</td>
<td>16 with optional hardware</td>
</tr>
</tbody>
</table>
- **Video Encoding:** H.261, RGB8, HDCC (video compression algorithm developed at SGI)
• **Interoperability Standard Support:**

• **Multipoint:** Yes

• **Collaboration Features:** Text, image, 3D model sharing. Whiteboard can include graphics, as well as text and images. Whiteboard in version 2.0 supports sharing 3D models among participants. InPerson also includes a "shared shelf" for visual file transfer between participants in a call.

InPerson is part of Silicon Graphics' MindShare(TM) collaborative environment. This environment includes: - interactive discussion of text, images, 3D models. - software tools for digital media capture, creation, edit and playback. - interactive presentation and authoring tool. - store and forward of digital media and 3D documents. - 3D support among all collaboration tools.

• **Notes:** Optional hardware board for Indy provides G.728 audio compression and acoustic echo cancellation. InPerson and MindShare are trademarks of SGI.

• **Survey Info Updated:** 18-July-95

**InSight 100**

• **Version:** 3.5

• **Provider:** (http://www.eyetel.com/) EyeTel Technologies, Inc.

• **Description:** Simple to use, highly optimized software based videophone program that is ideal for use by means of modem connections over regular phone lines or cellular phone connections. Chat.

• **Platforms:** PC

• **Requirements:** 486-80 or faster (Pentium recommended), 8 MB RAM, 6 MB hard disk space, 1 free PCI or ISA slot, VGA card with 256 color support or better, 9600 to 28.8 modem (28.8 recommended), MS Windows 3.x

• **Price:** $129 software only, $369 - software and video card

• **Contact Info:** Sales and Marketing: EyeTel Technologies, Inc./ 501 Goodlette Rd., N., Suite D306/Naples, FL, 33940 phone: (941) 435-1079 fax: (941) 434-7613

Contact: Bill Follin or Will Gibbs
Research & Development/Technical Sales: EyeTel Technologies, Inc./ #734 - 4720 Kingsway/ Burnaby, BC, V5H 4N2 Canada phone: (604) 451-3352 fax: (604) 451-3346

Contact: Robert Calis
Executive Office: EyeTel Technologies, Inc./ 11933 North Ogden Point Rd./Syracuse, IN 33940 phone: (219) 457-8200 fax: (219) 457-8635

Contact: Chuck Madlock email: jose@panamnet.net

• **LAN Protocols:**
Virtual Controlroom - Appendix

- **Audio Encoding**: CELP (4.8 Kbps)
- **Video Encoding**: H.261
- **Interoperability Standard Support**: Proprietary
- **Multipoint**: No
- **Collaboration Features**: Chat box, phone book
- **Notes:
- **Survey Info Updated**: 17-Apr-96

**InSight 300**

- **Version**: 3.5
- **Provider**: (http://www.eyetel.com/) EyeTel Technologies, Inc.
- **Description**: H.320, full motion videoconferencing that operate over a variety of LANs and WANs including ISDN & SW56
- **Platforms**: PC
- **Requirements**: 486-50 or better, *MB RAM, 10 MB hard disk space, 3 available ISA slots, VGA graphics card, 256 colors or better, MS Windows 3.1 or 3.11, NetBios or Windows Socket compliant TCP/IP stack for LAN connectivity
- **Price**: starts at $5,495.00
- **Contact Info**: See information under InSight 100
- **LAN Protocols**: NetBui, TCP/IP, Net Bios
- **Audio Encoding**: G.711, G.728, G.722
- **Video Encoding**: H.261
- **Interoperability Standard Support**: H.320
- **Multipoint**: Yes.
- **Collaboration Features**: Application sharing, create OLE documents, whiteboard with unlimited document capacity, chat window, full clipboard support, real time interactive & simultaneous annotation.
- **Notes:
- **Survey Info Updated**: 17-Apr-96
Intel Video Phone

- **Version:**
- **Provider:** (http://www.intel.com/) Intel Corporation
- **Description:** Audio/Video conferencing over Plaid Old Telephone Service (POTS)
- **Platforms:** PC
- **Requirements:** Pentium-133MHz, 16MB RAM, Windows 95
- **Price:**
- **Contact Info:** (http://www.intel.com/) Intel Corporation
- **LAN Protocols:**
- **Audio Encoding:** G.723
- **Video Encoding:** H.263
- **Interoperability Standard Support:** H.324
- **Multipoint:**
- **Collaboration Features:**
- **Notes:** With Video Phone, you can call or answer your normal phone line and then move to your PC to add video.
- **Survey Info Updated:** 17-Mar-97

Intel Internet Video Phone

- **Version:** Beta 1
- **Provider:** (http://www.intel.com/) Intel Corporation
- **Description:** Audio/Video over the Internet
- **Platforms:** PC
- **Requirements:** Pentium-133MHz, 16MB RAM, 5MB free disk space, Microsoft Internet Explorer or Netscape Navigator, Windows 95
- **Price:** Download beta version (expires April 19, 1997)
- **Contact Info:**
- **LAN Protocols:** TCP/IP
- **Audio Encoding**: G.723
- **Video Encoding**: H.263
- **Interoperability Standard Support**: H.323
- **Multipoint**:
- **Collaboration Features**:
- **Notes**: Uses Intel Proshare Technology.
- **Survey Info Updated**: 17-Mar-97

**Interact**

- **Provider**: Applied Communication Concepts Inc.
- **Description**: Windows Desktop Video Conferencing System over ISDN line or RS-449 interface.
- **Platforms**: PC
- **Requirements**: Windows 3.1+, Intel 386SX or higher based computer system, 4MB RAM, VGA or better display and graphics board.
- **Price**: $5,995 includes variable-focus proprietary person and document camera with built in speakerphone/handset.
- **Contact Info**: Applied Communication Concepts Inc., Research Traingle Park NC, USA, +1.919.549.0874.
- **LAN Protocols**:
- **Audio Encoding**: G.711, G.722, G.728
- **Video Encoding**: H.261
- **Interoperability Standard Support**: H.320
- **Multipoint**: Yes (maximum of 8 participants, can only display up to two remote participants at a time).
- **Collaboration Features**: Shared drawing areas, shared clipboards, file transfer, OLE links, document camera, video playback, and other collaborative tools.
- **Notes**: This system allows remote control of others’ cameras and can record full-motion audio/video broadcasts. Bandwidth: 56k to 128k bits per second. Frame speed: up to 15 frames per second.
InterVideo

- **Version:** 2.2
- **Provider:** (http://www.visualone.com/) Visual One
- **Description:** Videoconferencing system over LAN, WAN, ISDN BRI, ISDN PRI, Fractional T-1, or T-3. Provides full motion, full screen, 30fps desktop videoconferencing system.
- **Platforms:** PC, Unix
- **Requirements:**
- **Price:** Starts at $5999.00
- **Contact Info:** Visual One, 1950 Stemmons Freeway, Suite 5037 I, Dallas, TX 75207, phone: 214-746-4629
- **LAN Protocols:** IPX, SPX, NetBui, TCP/IP, NETBIOS
- **Audio Encoding:** G.711, G.721, G.728
- **Video Encoding:** CIF, QCIF
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes - via MCU
- **Collaboration Features:** Infi.Share Plus Data Collaboration Software includes whiteboard, file transfer, application sharing, video playback, and video mail.
- **Notes:** Use with Visual One’s Infi.Net Video Network to connect your videoconferencing systems together.
- **Survey Info Updated:** 11-Mar-97

INTERVu

- **Provider:** (http://www.zydacron.com/) Zydacron, Inc.
- **Description:** Video/Audio/Data over IsoEthernet (802.9), ISDN, Switched 56, or V.35/RS366.
- **Platforms:** PC
• **Requirements:** 386 or higher, Microsoft Windows 3.1 or higher.

• **Price:**

• **Contact Info:** Zydacron, Inc., 670 Commercial St., Manchester NH, 03101, USA, phone: +1.603.647.1000.

• **LAN Protocols:**

• **Audio Encoding:** G.711u/a, G.722, G.725, G.728

• **Video Encoding:** H.261 (QCIF,CIF)

• **Interoperability Standard Support:** H.320

• **Multipoint:** Yes

• **Collaboration Features:** File Transfer, runs most collaborative software already on the market (i.e. talkshow, vis-a-vis, person to person, farsite, terminal, carbon copy, proshare, etc.)

• **Notes:** Operates at fixed frame rates of 15fps @FCIF and 30fps @QCIF without sacrificing clarity. INTERVu is completely CPU independent. Future plans to come out with a multiplatform product capable of 20(fixed) fps @ Full CIF.

• **Survey Info Updated:**

### InVision

• **Version:** 3.0

• **Provider:** InVision Systems Corp.

• **Description:** Video/Audio/Tools over LAN/WAN (including Ethernet, Token Ring, FDDI, Frame Relay, ATM, ISDN, etc.) Also V.32 or faster modem.

• **Platforms:** PC

• **Requirements:** 486/33 or faster, Microsoft Windows 3.1+, 8MB RAM, 3MB hard disk space, high density 3.5” disk drive, 256 color VGA or SVGA - local bus recommended, Windows-compatible mouse or pointing device, Wave compatible sound card, Video for Windows compatible compression board, camera and microphone.

• **Price:** $595, includes software only.

• **Contact Info:** InVision Systems Corp., 317 S. Main Mall, Suite 310, Tulsa OK , 74103, USA, toll free: 1-800-847-1662, phone: +1.918.584.7772, fax: +1.918.584.7775, Internet: info@invision.com, Compuserve: 72002,1677.
• LAN Protocols: TCP/IP, IPX
• Audio Encoding:
• Video Encoding: DVI (ActionMedia II or MediaShare Mambo)
• Interoperability Standard Support:
• Multipoint: Video is point to point, document conferencing up to 12 users.
• Collaboration Features: Includes VisionGraphics document sharing software which includes a whiteboard and supports (http://www.microsoft.com/pages/peropsys/winnews/chicago/) OLE.
• Notes: H.261, H.320, MPEG under development.
• Survey Info Updated:

**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/FreeBSD 2.0 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.
• Contact Info: (http://zenon.inria.fr:8003/rodeo/personnel/Thierry.Turletti/me.html) Thierry Turletti, Thierry.Turletti@sophia.inria.fr.
Virtual Controlroom - Appendix

- **LAN Protocols**: UDP/IP, IP Multicast.
- **Audio Encoding**: PCM, ADPCM, VADPCM
- **Video Encoding**: H.261
- **Interoperability Standard Support**: 
- **Survey Info Updated**: 
- **Multipoint**: Yes 
- **Collaboration Features**: None 
- **Notes**: 
- **Survey Info Updated**: 28-May-95

**jointX**

- **Version**: 2.2
- **Provider**: (http://www.sni.de/) Siemens Nixdorf Informationssysteme AF (subsidiary of Siemens-Nixdorf)
- **Description**: Multipoint desktop conferencing system that supports X11 application sharing with simultaneous videoconferencing using our SC320 systems.
- **Platforms**:
  - SUN SunOS 4.3
  - SUN Solaris 2.x
  - SGI IRIX 4.x and 5.x (6.x in preparation)
  - HP HP-UX 9.x
  - SNI RM Sinix-5.4
  - IBM AIX 3.x / 4.1.x
- **Requirements**: SNI’s SC320 video module for H.320 based videoconferencing, Parallax PowerVideo board (for JPEG), SunVideo board (for CellB)
- **Price**: Call for prices.
- **Contact Info**: Siemens Nixdorf Informationssysteme AF / Advanced Services & Media, Mr. Carsten Kruschel, Technical Manager Telecooperation - phone: +49 30 386-28148, fax: +49 30 386-23780, email: carsten.kruschel@asmtc.bln.sni.de
• **LAN Protocols:** TCP/IP (UDP)
• **Audio Encoding:** G.711, PCM (SC320 videoconferencing solutions)
• **Video Encoding:** JPEG, CellB, H.261
• **Interoperability Standard Support:** H.320 (SC320 videoconferencing solution)
• **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 like CATIA, Pro/Engineer 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:** 18-Mar-97

**LANscape**

• **Version:** 1.3
• **Provider:** (http://www.videoconferencing.com/) Intelect Visual Communications
• **Description:** LAN-based videoconferencing systems for both PC and UNIX environments.
• **Platforms:** PC, UNIX
• **Requirements:** 486-66 PC, 12MB RAM, Standard PC/AT ISA Bus
• **Price:** N/A
• **Contact Info:** Mary McNally, phone: 212-317-9600, e-mail: mmcnally@videoconferencing.com
• **LAN Protocols:** TCP/IP
• **Audio Encoding:**
• **Video Encoding:** M-JPEG
• **Interoperability Standard Support:** H.320
• **Multipoint:** yes.
• **Collaboration Features:** T.120 collaborative software available.

• **Notes:**

• **Survey Info Updated:** 11-Mar-97

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**Mediafone**

• **Version:** 7.1q

• **Provider:** ( http://www.fiberware.com/ ) Fiber & Wireless

• **Description:** Mediafone is videoconferencing software. Allows full video/audio conferencing, document and application sharing, video/audio mail etc. over a single analog phone line, the internet, any windows-based LAN or WAN, or ISDN.

• **Platforms:** PC

• **Requirements:** For desktop PC upgrade kit: 486DX-33MHz or higher, 4Mb RAM, 256k external cache, 12Mb hard disk space, high density floppy drive, 14,400bps or higher modem, camera.

• **Price:** $124 per software copy. PC upgrade kit includes Mediafone/Fonewatch software, video capture and VGA board, feature connector and AV/VGA cable. Other configurations are available including a software only package, a complete portable system and a software only laptop kit.

• **Contact Info:** Fiber & Wireless Inc., 400 Crenshaw Blvd, Torrance, CA 90503, phone: 310-787-7097, fax: 310-787-7099, e-mail: fiberwire@worldnet.att.net

• **LAN Protocols:** ethernet, novell, TCP/IP, Token Ring

• **Audio Encoding:** proprietary, G.723

• **Video Encoding:** proprietary, H.261

• **Interoperability Standard Support:**

• **Multipoint:** Yes.

• **Collaboration Features:** Whiteboard, application sharing.

• **Notes:**

• **Survey Info Updated:** 11-Mar-97
MediaGate

- **Version:** 2.01
- **Provider:** (http://www.mycom-media.com/) Mycom Eyretel
- **Description:** MediaGate is a range of range of products that span from: Stand Alone (PC based) H.320 128K - 1.92MB Video Codec, Networked Multi Media platform comprising of an Windows NT based Server that distributes audio and video over UTP cabling. Controlled via a TCP/IP based network operating system called MVOS.
- **Platforms:** PC, Unix
- **Requirements:** Win3.11, Win95, WinNT 3.51/4.0, SunOS, Solaris. Client position PC with 16MB RAM
- **Price:** View only positions from $650, Two Positions from $1650
- **Contact Info:** Nick Harper, Mycom Eyretel, phone: +44 (0)1403 214400, fax: +44 (0)1403 214420 e-mail: nick.harper@mycom-media.com
- **LAN Protocols:** TCP/IP
- **Audio Encoding:** G.711 A Law and M Law, G.722, G.728
- **Video Encoding:** H.261, H.263
- **Interoperability Standard Support:** H.320
- **Multipoint:** Built in 4 way constant presence bridge + support for external bridges including Video Server and Madge Telios
- **Collaboration Features:** T.120 compliant (Microsoft NetMeeting shipped)
- **Notes:**
- **Survey Info Updated:** 20-Mar-97

Meet-Me

- **Version:** 2.02
- **Provider:** (http://www.satusa.com/) SAGEM
- **Description:** Video/Audio/Collaboration Tools over LAN (using ISO ethernet) or ISDN.
- **Platforms:** Mac, PC
- **Requirements:** Mac (PCI & NuBus) - Mac AV or PowerMac AV (except 660AV and 6100AV). Provides ISDN "S/T" interface, NT-1 Bundled with product. 1 Nubus slot. PC: 386 SX 25, ISA slot 8MB of RAM

- **Price:**
  Mac - $1850 includes:
  - H.320 Nubus Codec 1 slot
  - Telephone handset
  - Camera
  - no speakers though
  PC - $4495 includes:
  - H.320 ISA - format codec with built-in ISDN interface (1 slot)
  - Telephone handset
  - Color camera with integrated microphone
  - Camera connector and power supply
  - External speakers

- **Contact Info:** SATSAGEM, Dominique Schraen, 20370 Town Center Lane Ste. 255, Cupertino, CA, 95014, USA, phone: +1.408.446.8690, fax: +1.408.446.9766. e-mail: Christian.McMillan@satusa.dcm.sat.fr

- **LAN Protocols:**

- **Audio Encoding:** G.711, G.722, and G.728

- **Video Encoding:** H.261, CIF, QCIF

- **Interoperability Standard Support:** H.320

- **Multipoint:** Yes - through MCU's only

- **Collaboration Features:** Whiteboard, High Speed File Transfer

- **Notes:** Communications interfaces: ISDN (Both B ch.s and ISO ethernet.) H.320 codec with (http://catalog.com/satusa/Planet1.html) Planet ISDN daughterboard for 1 Nubus connection. ISDN (2B+D): 2x64kb/s or 2x56 kb/s. H.320 components for quicktime conferencing. Integrated ISDN card not dedicated to video conferencing allowing use for all ISDN purposes including access to the Internet. Windows API is available to developers of applications for this product. Due to the MVIP connector, Meet-Me PC is an open platform allowing for transfer rate of up to 384kbps. Meet-Me PC and Meet-Me are cross platform compatible.

- **Survey Info Updated:** 11-Mar-97
Meet-Me Light

- **Version:** 1.0
- **Provider:** (http://www.satusa.com/) SAGEM
- **Description:** H.320 software only videoconferencing solution for the Macintosh
- **Platforms:** MAC
- **Requirements:** 100Mhz Mac with AV capability
- **Price:** $295 US
- **Contact Info:** SAGEM, 20370 Town Center Ln St. 255, Cupertino, CA 95014
- **LAN Protocols:**
- **Audio Encoding:** G.711
- **Video Encoding:** QCIF
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes - through MCUs only
- **Collaboration Features:** None
- **Notes:** This is a software only H.320 videoconferencing solution.
- **Survey Info Updated:** 11-Mar-97

MegaConference

- **Version:**
- **Provider:** Alpha Systems Lab
- **Description:** Video/Audio Tools over POTS
- **Platforms:** PC
- **Requirements:** Windows 3.x, Windows 95, Windows NT
- **Price:** $1195
- **Contact Info:** Alpha Systems Lab / 2361 McGaw Ave. / Irvine, CA 92714 USA
  phone: +1.714.622.0688 toll-free: 1-800-576-4275
- **LAN Protocols:**
- **Audio Encoding:**
Virtual Controlroom - Appendix

- **Video Encoding**: M-JPEG
- **Interoperability Standard Support**: No.
- **Multipoint**: No.
- **Collaboration Features**: whiteboard, file transfer
- **Notes**: 
- **Survey Info Updated**: 21-May-96

**Datapoint MINX Networked Video Systems**

- **Provider**: (http://www.datapoint.com/) 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 MAC OS 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 rollouts 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:** 9-Nov-95
MMC (MultiMedia Collaboration)

- **Provider:** Technical University of Berlin and Hewlett Packard
- **Description:** Video/Audio/Application Sharing over LAN
- **Platforms:** HP9000/7xx (Sun, SGI, DEC, PCs and Apple Macintosh)
- **Requirements:** HP9000/7xx, Parallax PowerVideo700 or Conference Cam, Camera, Headset, HP-UX 9.01 or above, MPower
- **Price:**
- **Contact Info:** Nicolai Leymann, Technical University of Berlin, nicolai@prz.tu-berlin.de
- **LAN Protocols:** IP
- **Audio Encoding:** G.711
- **Video Encoding:** M-JPEG, H.261
- **Interoperability Standard Support:**
- **Multitpoint:** Yes
- **Collaboration Features:** Application Sharing
- **Notes:**
- **Survey Info Updated:** 29-Jan-96

Ntv

- **Provider:** (http://www.peregrine.com/) Peregrine Systems
- **Description:** Video/Audio/Tools over Ethernet and Token Ring.
- **Platforms:** PC
- **Requirements:** 386 DX/25 or higher, 4MB RAM, Microsoft Windows 3.1+ or Windows for Workgroups, Network connection, Video capture board, Audio capture board, Camera, Microphone, Speakers.
- **Price:**
LAN Protocols:
Audio Encoding:
Video Encoding:
Interoperability Standard Support:
Multipoint: Yes
Collaboration Features: Application sharing of Windows-based applications.
Notes:
Survey Info Updated: nv provides unicast and multicast video over the Internet. It is commonly supplemented with vat (Visual Audio Tool) and wb (Whiteboard) for full-featured video/audio conferencing and collaboration.
Platforms: Sun SPARCstation, DECstation 5000 and Alpha, SGI, HP9000, IBM RS6000.
Requirements: Receivers need no special hardware - just an X display. Senders require a camera that is compatible with the video capture hardware:
Sun/SunOS 4: Parallax, PARCVideo, VideoPix, X11.
Sun/SunOS 5: SunVideo, VideoPix, X11.
DEC 5000/Ultrix: PIP, X11;
DEC Alpha/OSF 1: J300, X11;
SGI/Irix 5: SGI VL (Indy, Galileo), X11.
HP9000/HPUX: VideoLive, X11.
RS6000/AIX: IBM VCA, X11.
Contact Info: Ron Frederick, frederick@parc.xerox.com
Audio Encoding: N/A
Video Encoding: Native NV, CU-SeeMe, Sun CellB
Interoperability Standard Support:
Multipoint: Yes
Collaboration Features: None

- **Survey Info Updated:** 26-May-95

**NetMeeting**

- **Version:** 2.0b4
- **Provider:** ([http://www.microsoft.com/](http://www.microsoft.com/)) Microsoft Corporation
- **Description:** Audio/Video/Data collaboration Tools over the Internet, modem, or IP over ISDN
- **Platforms:** PC, Apple Macintosh in 1997
- **Requirements:** Windows 95: Pentium based processor at 90MHz with 16MB RAM (minimum) Windows NT4.0: Pentium based processor at 90MHz with 24MB RAM (minimum). For modem connection: 28.8Kbps modem.
- **Price:** ([http://www.microsoft.com/msdownload/netmeeting2.htm](http://www.microsoft.com/msdownload/netmeeting2.htm)) Download
- **Contact Info:** Microsoft Corporation, One Microsoft Way, Redmond WA 98052
- **LAN Protocols:** TCP/IP, IPX
- **Audio Encoding:** G.711, G.723.1
- **Video Encoding:** H.263
- **Interoperability Standard Support:** H.323
- **Multipoint:** For data conferencing only at this point.
- **Collaboration Features:** Application Sharing, Whiteboard, Chat, File Transfer.
- **Notes:** Ability to receive video without hardware support.
- **Survey Info Updated:** 17-Mar-97

**Omega MVP**

- **Version:**
- **Provider:** ([http://www.vsin.com/](http://www.vsin.com/)) VSI
• **Description:** Premier desktop video conferencing system

• **Platforms:** PC

• **Requirements:** 486-66 processor (Pentium 90 recommended), running Windows3.x or Win95, 8MB RAM (16 recommended), 1 full-card ISA slot, 4MB available on hard drive.

• **Price:** $2895 for system with single BRI interface. Other options are available.

• **Contact Info:** VSI phone: 1-800-423-0769

• **LAN Protocols:**

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

• **Video Encoding:** H.261

• **Interoperability Standard Support:** H.320

• **Multipoint:** multipoint capable

• **Collaboration Features:**

• **Notes:** compatible with FarSite, ProShare, TALKShow, mediaRing, LiveShare Plus. High quality desktop video conferencing with a high level of flexibility.

• **Survey Info Updated:** 23-Sept-96

### Panorama PC

• **Version:** v1.2

• **Provider:** (http://www.videoconferencing.com/) Intelect Visual Communications

• **Description:** PC-WAN based video conferencing. Single board codec with additional ISDN or Switched-56 communications board. This does not use ISA bus to transfer audio and video which enables the PC to run more efficiently for other applications running simultaneously to videoconferencing.

• **Platforms:** PC

• **Requirements:** i486DX33 with 8MB RAM (16MB if Windows for Workgroups)

• **Price:** $5995, including hardware, software, camera, speakers and microphone

• **Contact Info:** Intelect Visual Communications, Mary McNally, phone: 212-317-9600, e-mail: mmcnally@videoconferencing.com

• **WAN Protocols:** ISDN or Switched-56
• **Audio Encoding:** H.320 (Audio-G’s)

• **Video Encoding:** H.320 (H.261), CIF = 352x288, QCIF = 176x144

• **Interoperability Standard Support:** H.320

• **Multipoint:** Yes. Certified with AT&T GBVS in Atlanta

• **Collaborative Features:** bundled with SMART 2000 groupware package, which includes whiteboard and application sharing functionality.

• **Notes:** Uses a bandwidth of 128 Kbps up to 1.544Mbps and runs at 15fps in CIF and 30fps in QCIF.

• **Survey Info Updated:** 18-Mar-97

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**Personal Communication Computer**

• **Version:** 2.5

• **Provider:** ( http://www.olivetti.it/ ) Ing. C. Olivetti & C.

• **Description:** Video/Audio/Data communications over ISDN

• **Platforms:** PC (ISA)

• **Requirements:** 20 MHz 386 PC (486 recommended), 8 MB RAM, 1 ISA slot, VGA or SVGA monitor, Microsoft Windows 3.1+

• **Price:** 2200 UK pounds includes:
  
  - PCC Software Services Rel 2.2
  
  - ISA card featuring on board ISDN controller, H.320 audio-video codecs and video overlay.
  
  - NTSC or PAL camera.
  
  - Telephone set with keypad and hands free operation.
  
  - Telephone set works (voice calls) also when is PC is switched off.
  
  - Connection unit for auxiliary audio-video input-output.
  
  - AC/DC adaptor.

• **Contact Info:** Ing. C. Olivetti & C. Via Jervis 77 Ivrea, Italy. Gabriele Cottura, PCC Marketing Manager, fax: +39 125 523124, gcottura@dss.ico.olivetti.it

• **LAN Protocols:**
- **Audio Encoding**: G.711, G.722, G.728
- **Video Encoding**: H.261 (QCIF moving images, CIF image capture)
- **Interoperability Standard Support**: H.320
- **Multipoint**: Yes (only audio/video H.242)
- **Collaboration Features**: Application Sharing, Whiteboard, File Transfer, Cooperative Form Filling
- **Notes:**
- **Survey Info Updated**: 10-Jun-96

**Phonoscope**

- **Version**: 5.0
- **Provider**: [http://WWW.neosoft.com/](http://WWW.neosoft.com/) Neosoft
- **Description**: Phonoscope desktop uses a switched network television quality video and audio operated over fiber optic cabling. This system is non compressed, non digitized baseband video and audio. Phonoscope users simply dial up other subscribers or use the codec pool or Internet based video for long distance connections. The desktop version supports point-to-point, or four way multidrop with all microphones and pictures active and present during the conference.
- **Platforms**: Macintosh
- **Requirements**: Operates on AV Macintosh
- **Price**: Less than $2,700 per station
- **Contact Info**: Phonoscope Communications/910 Travis #2017/Houston, TX 77002
- **LAN Protocols**: None
- **Audio Encoding**: None
- **Video Encoding**: None
- **Interoperability Standard Support**: As required H.320 up to 768Kbps switched
- **Multipoint**: Yes. Full duplex - up to four way.
- **Collaboration Features**: Compatible with any desktop collaborative software
- **Notes:**
- **Survey Info Updated**: 17-Apr-96
PICFON

- **Version:** 1.0
- **Provider:** Specom Technologies
- **Description:** Video/Audio over Analog and ISDN phone lines.
- **Platforms:** PC
- **Requirements:** 386 or higher, 4MB RAM, 40MB hard disk, DOS 5.0 or higher, camera.
- **Price:**
- **Contact Info:** Specom Technologies Corp., 2322 Walsh Ave., Santa Clara CA, 95051, USA, phone: +1.408.982.1880, fax: +1.408.982.1883.
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:**
- **Interoperability Standard Support:**
- **Multipoint:** Yes (maximum of 3 parties).
- **Collaboration Features:** Still-image sharing.
- **Notes:** Not sure if this is still available. See Specom’s new product, TelePro.
- **Survey Info Updated:**

PictureTel Live 200 Series

- **Version:** 1.6
- **Provider:** (http://www.picturetel.com/) PictureTel
- **Description:** Single board solution for Video/Audio/Collaborative Tools over ISDN
- **Platforms:** PC
- **Requirements:** Windows95, 16MB RAM, 20MB disk space
- **Price:** $1495 includes: single videoconferencing board, camera, headset, LiveWare collaborative software
Contact Info: PictureTel Corp., The Tower at Northwoods, 222 Rosewood Dr., Danvers MA, 01923, USA, phone: +1.508.762.5000, toll free: 1-800-716-6000, fax: +1.508.762.5245

LAN Protocols:

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

Video Encoding: H.261 (CIF, QCIF)

Interoperability Standard Support: H.320

Multipoint:

Collaboration Features: shared whiteboard, shared clipboard, windows application sharing, drag-and-drop file transfer

Notes: Live200p is add-on solution for PCI bus PC’s; Live200i is add-on solution for ISA (or EISA) bus PC’s, comes complete with VMC graphics controller.

Survey Info Updated: 20-May-96

PictureTel Live PCS 100

Version: 1.6

Provider: ( http://www.picturetel.com/ ) PictureTel

Description: Video/Audio/Tools over Switched 56, ISDN, and V.35/RS449 dialed and non-dialed networks. It also supports network data rates from 56Kbps to 384Kbps.

Platforms: PC

Requirements: 386/25 or faster CPU, 8MB RAM, 20MB hard disk space, 2 ISA slots, Microsoft Windows 3.1, Windows 95, SVGA or VGA monitor.

Price: $4995


LAN Protocols:

Audio Encoding: G.711, G.721, G.722, G.728, PT 724 proprietary algorithm

Video Encoding: H.261

Interoperability Standard Support: H.320
• **Multipoint**: Yes, voice-activation through the use of a MCU (maximum of 16 parties).

• **Collaboration Features**: LiveShare Plus Data Collaboration software includes: whiteboard, file transfer, application sharing, clipboard linking, messaging, remote control.

• **Notes**: Supports multiple video and audio inputs & outputs.

• **Survey Info Updated**: 24-Sept-96

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**PictureTel Live PCS 50**

• **Version**: 1.6

• **Provider**: (http://www.picturetel.com/) PictureTel Corporation

• **Description**: Video/Audio/Tools over ISDN, Switched 56 and V.35/RS449 dialed and non-dialed networks. It also supports network data rates from 56Kbps to 384Kbps

• **Platforms**: PC

• **Requirements**: 386/25 or faster CPU, 1 ISA (or EISA) slot, Microsoft Windows 3.1 or Windows 95, SVGA or VGA monitor.

• **Price**: $2495

• **Contact Info**: PictureTel Corp., Worldwide Headquarters, 100 Minuteman Road, Andover MA, 01810, USA, phone: +1.508.292.5000, toll free: 1-800-716-6000, fax: +1.508.292.3300.

• **LAN Protocols**:

• **Audio Encoding**: G.711, G.721, G.722, G.728, PT 724 proprietary algorithm

• **Video Encoding**: H.261

• **Interoperability Standard Support**: H.320

• **Multipoint**: Yes voice-activation through MCU(maximum of 16 parties).

• **Collaboration Features**: LiveShare Data Collaboration software includes: whiteboard, file transfer, clipboard linking, messaging, remote control.

• **Notes**: A version of PCS-50 complete with camera, speakerphone, and software will be included in the Zenith Data Systems (http://www.zds.com/htdocs/zds/htm/zstatvc.htm) Z-STATION GT 575 VC, a 75Mhz Pentium based system.
PictureTel LiveLAN

- **Provider:** (http://www.picturetel.com/) PictureTel
- **Description:** Video/Audio/Tools over Local Area Network.
- **Platforms:** PC
- **Requirements:** 486-66+, video capture card, Microsoft Windows 3.1+, camera, audio card, speakers, microphone.
- **Price:** $395
- **Contact Info:** PictureTel Corp., The Tower at Northwoods, 222 Rosewood Dr., Danvers MA, 01923, USA, phone: +1.508.762.5000, toll free: 1-800-716-6000, fax: +1.508.762.5245.
- **LAN Protocols:** IPX
- **Audio Encoding:** Proprietary
- **Video Encoding:** Proprietary
- **Interoperability Standard Support:**
  - **Multipoint:** No.
- **Collaboration Features:** Application Sharing.
- **Notes:**
- **Survey Info Updated:** 20-Feb-95

PictureView

- **Version:** 2.0
- **Provider:** (http://www.total.net/coretech) CoreTech Software Inc.
- **Description:** Audio/Video conferencing over Ethernet, Token Ring, ATM, T1, T3, FDDI, ISDN, Frame Relay, Switch 56
- **Platforms:** SUN
• **Requirements:** SunSparc 1, 1+, IPX, IPX, 2, LX, Classic, 4, 5, 10, 20, Ultra with the Solaris 2+ operating system, X11R5/Motif 1.2 or OpenWindow 3.+, minimum 16M Memory, SunVideo capture card.

• **Price:**

• **Contact Info:** CoreTech Software Inc., 24 Eva Road Suite 605, Etobicoke, Ontario, M9C 2B2 phone: 416-622-9124, e-mail: coretech@total.net

• **LAN Protocols:** TCP, UDP

• **Audio Encoding:** G.711, G.728

• **Video Encoding:** H.261, JPEG, CellB

• **Interoperability Standard Support:** No

• **Multipoint:** Yes - up to 8 participants

• **Collaboration Features:** Whiteboard

• **Notes:**

• **Survey Info Updated:** 11-Mar-97

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**Plug & See**

• **Version:**

• **Provider:** Matra Communication (Lagardere Group)

• **Description:** Audio/Video/Collaboration tools over ISDN

• **Platforms:** PC

• **Requirements:** 386 or higher, 1 ISA slot, Microsoft Windows 3.1+

• **Price:** $4000

• **Contact Info:** Matra Communication, Rue JP Timbaud, 78392 Bois d’Arcy Cedex, France. Phone : +33 (1) 34 60 78 58

• **LAN Protocols:**

• **Audio Encoding:** G.721, G.722, G.728

• **Video Encoding:** H.261

• **Interoperability Standard Support:**H.320

• **Multipoint:** Yes
• **Collaboration Features:** Whiteboard, File Transfer, Screen Sharing, Application Sharing.

• **Notes:** a LAN version is being developed (will be available June 96)

• **Survey Info Updated:** 26-Oct-95

**Pronto**

• **Version:** 1.0

• **Provider:** (http://cybermarche.dmssoft.com/) 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:** 17-Apr-96 (http://www.intel.com/comm-net/proshare/)

**ProShare Video System 200**

• **Version:** (http://www.intel.com/comm-net/proshare/prod/VS200DS.htm#features) 2.0

• **Provider:** (http://www.intel.com/) Intel Corporation

• **Description:** Video/Audio/Tools over LAN/WAN/ISDN.

• **Platforms:** PC

• **Requirements:** PC with Intel486(tm) 66 MHz CPU minimum. Pentium(tm) processor recommended. Windows 3.1, 3.11, or Windows 95, 16 MB RAM minimum (20 MB recommended), plus 45 MB hard disk space (minimum). VGA or SVGA display with 256 colors or higher (no feature connector required). Graphics card required for full screen Video Display. 2 full-length ISA slots.

  For ISDN use
  - NT-1 adapter
  - SDN telephone service from local phone company

  For LAN/WAN use
  - Network interface card
  - Intel LANDesk Conferencing Manager
  - Supported protocol stacks, at least one of:
    - IPX: Novell NetWare 3.12, v4.1 IPX
    - TCP/IP: FTP PC/TCP, version 4.0, FTP OnNet, version 2.0, Microsoft Windows
      * for Workgroups, Windows 95 native 32 bit
      * Novell LAN WorkPlace for DOS, version 4.2, 5.0
      * NetBIOS: Microsoft Windows for Workgroups, version 3.11

• **Price:** $1499. Includes software, 2 full length ISA cards (video capture card and ISDN/audio board), color CCD camera, headset/microphone unit.

• **Contact Info:** Intel Corp., 2200 Mission College Blvd., P.O. Box 58199, Santa Clara CA, 95052-8119, USA, phone: +1.503.629.7354, toll free: 1-800-538-3373, fax: 1-800-525-3019.
- **LAN Protocols:** NetBIOS, TCP/IP, and IPX
- **Audio Encoding:** G.711, G.728
- **Video Encoding:** Indeo., QCIF H.261
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes, using H.320-compatible bridges.
- **Collaboration Features:** Whiteboard, application sharing, file transfer

**Notes:** You can now purchase ProShare packaged with a complete workstation. TeamStation is shipped with a 120 MHz Pentium based PC with ProShare VS 200 preinstalled and a Diamond Viper Pro graphics card to provide full screen video with ProShare. It also comes with a 37 inch monitor, a software controlled pan-tilt-zoom camera, and a high end room echo canceller. New Plus Package Offers: Video voice mail answering machine, Conference recording machine, Full-screen video window, multipoint application sharing, multipoint notebook, Photo exchange, ISDN voice call support.

- **Survey Info Updated:** 17-Mar-97

**ProVision Business**

- **Version:** 2.3
- **Provider:** [http://www.sican.de/](http://www.sican.de/) SICAN GmbH
- **Description:** Desktop Videoconferencing over ATM networks.
- **Platforms:** PC
- **Requirements:** PC Pentium PCI, 32MB RAM, ATM network infrastructure, ISDN for H.320 interworking
- **Price:** depends on system
- **Contact Info:** SICAN GmbH / Garbsenter Landstr. 10 / D-30419 Hannover, Germany. e-mail: info@sican.de
- **LAN Protocols:** TCP/IP
- **Audio Encoding:** CD, G.711, G.722, G.728
- **Video Encoding:** MJPEG, H.261
- **Interoperability Standard Support:** H.320 (with PVM-card)
- **Multipoint:** Yes.
**Collaboration Features:** SICAN DocViewer

**Notes:** High quality VC, PAL or NTSC resolution (768x576 or 640x480), 50/60 halfframes/sec, up to 16 Overlay Windows, multipoint conference, audio stereo cd quality, for narrowband interworking: G.711 compatibility, H.320 compatibility possible (with PVM-card), includes ATM-155 MBit/s PCI Adapter

**Survey Info Updated:** 23-Sept-96

## QuickTime Conferencing

- **Version:** 1.0.3
- **Provider:** (http://qtc.quicktime.apple.com/) Apple Computer, Inc.
- **Description:** Apple’s affordable videoconferencing and collaboration software lets up to nine Macintosh users at once get connected worldwide over Ethernet or the Internet with network connection speeds of 112K or greater. Conferences can be recorded and played back as QuickTime movies. Shared window lets users share graphics, text, sounds, and QuickTime movies
- **Platforms:** Macintosh
- **Requirements:** Macintosh AV
- **Price:** QuickTime Conferencing $49.95; QuickTime Conferencing Kit under $300 includes: software and a high resolution color camera; QuickTime Conferencing ISDN Kit under $1800.
- **Contact Info:** QuickTime Conferencing is downloadable online at the (http://qtc.quicktime.apple.com/) QuickTime Conferencing WWW site e-mail: qtc@apple.com
- **LAN Protocols:** MovieTalk
- **Audio Encoding:** MACE 3:1, Mace6:1, ISDN Kit: G.711, G.722, G.728
- **Video Encoding:** H.261, JPEG, Apple Video, ISDN Kit: H.261 video codec
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes - up to 9 users; ISDN Kit: No.
- **Collaboration Features:** Users can share graphics, text, sounds, QuickTime movies. "Capture Screen" lets users share a picture of anything on their screen. Shared whiteboards can be saved for later viewing.
- **Notes:** Network protection features include flow control for real-time media, multicast media distribution, low bit-rate video coding algorithms, and bandwidth monitoring and control via a Simple Network Management Protocol (SNMP) station.

- **Survey Info Updated:** 24-Sept-96

### SeeQuest

- **Version:** 1.0
- **Provider:** (http://www.sharkmm.com/) Shark Multimedia
- **Description:** Low-Cost PC desktop videoconferencing - POTS videoconferencing kit using Connectix color QuickCam, DSVD modem and Connectix VideoPhone software
- **Platforms:** PC
- **Requirements:** 486DX66 w/16MB RAM, win3.1+, win95
- **Price:** $399 MSRP color version, $299 MSRP Black&White version
- **Contact Info:** Shark Multimedia Inc., 3040 Oakmead Village Dr., Santa Clara, CA 95051, phone: 1-800-800-3321, e-mail: Jeff@Sharkmm.com
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:**
- **Interoperability Standard Support:**
- **Multipoint:**
- **Collaboration Features:**
- **Notes:** Includes Shark Multimedia DSVD modem, Connectix camera, Connectix VideoPhone software, and many other bundled applications.

- **Survey Info Updated:** 30-Jan-97

### ShareVIDEO

- **Version:** 2.1
- **Provider:** (http://www.gs.com.sg/zen) Zen Multimedia Pte Ltd
• **Description:** Video Conferencing using POTS. Low cost, affordable video conferencing solution. Support DSVD modem

• **Platforms:** PC

• **Requirements:** MS Windows 3.11 & Windows 95, 486DX2-66 System & above, 8MB RAM, 120MB HDD, VL/PCI based Windows Accelerator

• **Price:** Please call. Video conferencing kit includes: ShareVideo software, camera, video capture card, fax/modem

• **Contact Info:** Zen Multimedia Pte Ltd / 527 Serangoon Road / Singapore 218161 phone: 65-292-1413 fax: 65-292-1751 email: zenmm@singnet.com.sg

• **LAN Protocols:**

• **Audio Encoding:**

• **Video Encoding:**

• **Interoperability Standard Support:**

• **Multipoint:**

• **Collaboration Features:** Electronic whiteboard. Application sharing via their ShareWORK product.

• **Notes:**

• **Survey Info Updated:** 25-Apr-96

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**ShareVision Mac 3000**

• **Provider:** (http://www.creat.com/) Creative Labs

• **Description:** Audio/Video/Tools over Analog phone line.

• **Platforms:** Macintosh

• **Requirements:**

• **Contact Info:** Creative Labs, Inc., 1901 McCarthy Boulevard, Milpitas CA, 95035, USA, phone: +1.408.428.6600, toll-free: 1-800-998-1000, fax: +1.408.428.6611, AppleLink: SHAREVIS.MKT.

• **Price:** $1299

• **LAN Protocols:**

• **Audio Encoding:**
• Video Encoding:

• **Interoperability Standard Support:** Future versions will support the ITU-T H.324 standards which are expected to be ratified in November 1995.

• Multipoint:

• Collaboration Features:

• **Notes:** Interoperable with ShareVision PC product.

• Survey Info Updated: 06-June-95

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**ShareVision PC 3000**

• **Provider:** (http://www.creaf.com/) Creative Labs

• **Description:** Audio/Video/Tools over Analog phone line.

• **Platforms:** PC

• **Requirements:** 486SX/33MHz (486DX/66MHz recommended), 2 available 16-bit ISA bus slots, 8MB RAM, 6MB hard disk space, Windows 3.1, VGA or SVGA display (16-bit or 24-bit VGA display card recommended).

• **Price:** $1599, includes software, 2 boards (Video Blaster RT300 video capture/compression card and ShareVision PC Audio card), color CCD camera, fax/modem, headset/microphone.

• **Contact Info:** Creative Labs, Inc., 1901 McCarthy Boulevard, Milpitas CA, 95035, USA, phone: +1.408.428.6600, toll-free: 1-800-998-1000, fax: +1.408.428.6611.

• **LAN Protocols:**

• **Audio Encoding:** VATP

• **Video Encoding:** VATP

• **Interoperability Standard Support:** Future versions will support the ITU-T H.324 standards which are expected to be ratified in November 1995.

• **Multipoint:** No.

• **Collaboration Features:** Application sharing, Whiteboard, Document sharing, File transfer.

• **Notes:** Interoperable with ShareVision Mac product.

• **Survey Info Updated:** 06-June-95
ShowMe

- **Version:** 2.0.1
- **Provider:** (http://www.sun.com/) Sun Microsystems
- **Description:** Video/Audio/Tools over the Internet.
- **Platforms:** Sun SPARCstation
- **Requirements:** Solaris 2.3 or later, X11 R5, OpenWindows 3, 1 SBUS slot, Sun-Video board, SunMicrophone.
- **Price:** $3270, including SunVideo board and camera. Educational discount available.
- **Contact Info:** sunsol-www@sunso lutions.eng.sun.com, toll free: 1-800-873-7869.
- **LAN Protocols:** UDP/IP, TCP/IP, IP Multicast, RTP.
- **Audio Encoding:** G.711 (uncompressed 8-bit, 8 KHz audio bit stream at 64 Kilobits per second)
- **Video Encoding:** CellB
- **Interoperability Standard Support:** No
- **Multipoint:** Yes, with and without IP Multicast.
- **Collaboration Features:** Whiteboard, Application Sharing for X11 R4/R5-based applications and Wabi 1.0 supported MS Windows applications.
- **Notes:**
- **Survey Info Updated:** 26-Apr-95

Simplicity

- **Version:**
- **Provider:** (http://www.paradise.com/) Paradise Software, Inc.
- **Description:** Audio/Video/Tools over ISDN, Ethernet, ATM
- **Platforms:** Sun SPARCstation, HP 9000/700, IBM PowerPC
- **Requirements:** Sun: SunOS 4.1.3,U1 +, Solaris 2.4+, and OpenWindows 3.x or X11R5/Motif1.2; HP: HPUX 9.0.3+, X11R5/Motif1.2; IBM PowerPC: PowerPC 40P hardware, AIX 4.1, X11R5/Motif 1.2
• **Price:**

• **Contact Info:** Paradise Software, Inc., 7 Centre Drive, Suite 9, Jamesburg NJ, 08831, USA; phone: +1.609.655.0016, fax: +1.609.655.0045, support@paradise.com

• **LAN Protocols:** TCP/IP

• **Audio Encoding:**

• **Video Encoding:** M-JPEG

• **Interoperability Standard Support:**

• **Multipoint:** Yes.

• **Collaboration Features:** Whiteboard, VideoMail, Screen Capture

• **Notes:** Videoconferencing capabilities come from Paradise Software’s previous product PSVC.

• **Survey Info Updated:** 21-May-96

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**TeamVISION**

• **Provider:** (http://www.iclnpbg.co.uk/) ICL Networking Business

• **Description:** Uses VC8000 video telephony and Fujitsu’s DeskTop Conferencing data conferencing integrated under TeamVISION’s simple to use graphical interface.

• **Platforms:** PC

• **Requirements:** Recommended PC configuration: 486SX 33MHz 100% ISA compatible PC, 15” SVGA screen, 16MB memory, 170MB Fixed disk, Microsoft MS-DOS 5.0+, plus Windows 3.1, Basic rate ISDN2 connection

• **Price:**

• **Contact Info:** Tony Sherwood on +44- (0)1344-472195 or Sue Dorgan on +44- (0)1344-472501 at ICL in Bracknell.

• **LAN Protocols:**

• **Audio Encoding:**

• **Video Encoding:** H.261 (QCIF moving images, CIF image capture)

• **Interoperability Standard Support:** H.320

• **Multipoint:**

• **Collaboration Features:** Share applications, file transfer, shared whiteboard
TelePro with VisionTime

- **Provider:** Specom Technologies Corp.
- **Description:** Video/Audio/Tools over WAN (Analog phone lines and ISDN).
- **Platforms:** PC
- **Requirements:** 386 PC, 8MB RAM, 8MB disk space, Windows 3.1+, high-color VGA card with 64K true colors, video capture card with Video for Windows drivers, camera.
- **Price:** $995, includes software, frame grabber card, voice/data modem, handset.
- **Contact Info:** Specom Technologies Corp., 2322 Walsh Ave., Santa Clara CA, 95051, USA, phone: +1.408.982.1880, fax: +1.408.982.1883.
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:**
- **Interoperability Standard Support:**
- **Multipoint:** Optional, up to 64 simultaneous users.
- **Collaboration Features:** Document sharing of Windows applications, supports Windows application sharing through (http://www.microsoft.com/pages/peropsys/win_news/chicago.html) OLE.
- **Notes:**
- **Survey Info Updated:**

TeleView 1000C

- **Provider:** (http://www.videoconf.com/) VCC (Video Conferencing Communications, Inc.)
- **Description:** Video over Analog phone lines.
- **Platforms:** PC
Teleview Plus

- **Version:** 3.0.01
- **Provider:** (http://www.videoconf.com/) Video Conferencing Communications
- **Description:** Low priced video conferencing software solution. Works over POTS and ISDN. Speeds of up to 18fps over POTS (when connected at 28.8) and 25fps over ISDN.
- **Platforms:** PC
- **Requirements:** 486-66 or better with 4M of RAM running Windows 3.1 or Win95, need 28.8 or faster connection to receive video and a video capture board/camera if you want to send video. Uses standard equipment available on any multimedia capable computer.
- **Price:** $89.95 for one copy. For additional copies and/or any hardware, please call.
- **Contact Info:** To order - phone: 1-800-284-3364. For a live demo or more information, please contact Veroncia Nunex at phone: 714-452-0800, e-mail: vcc@videoconf.com
- **LAN Protocols:** TCP/IP protocols
- **Audio Encoding:** G723.1
- **Video Encoding:** H.263
- **Interoperability Standard Support:** H.324
Virtual Controlroom - Appendix

- Multipoint: Yes
- Collaboration Features: Whiteboarding and document sharing coming soon.
- Notes: Offers an integrated phonebook that allows you to put a contacts picture next to their entry. Two way chat for users without sound capabilities. Image sizes up to CIF size (352x288) at 16 bit color.
- Survey Info Updated: 23-Sept-96

Teleworker Video Conference Kit 2

- Version: VCK Version 2
- Provider: MediaCom Technologies
- Description: This is a videoconferencing kit that works with PSTN Modems, TCP/IP LANs, Novell LANs, ISDN adaptors, and can also be used over the Internet.
- Platforms: PC
- Requirements: 486-66 and above with 8 MB RAM
- Price: SRP US$699.00 Kit Includes: Video Capture Board, Color Desktop Video Camera, microphone and earphone set, videoconferencing software
- Contact Info: MediaCom Technologies / George Hu, VP Marketing & Sales, fax: (65) 299-4828, e-mail: ghuzysin@singnet.com.sg
- LAN Protocols: TCP/IP, IPX/SPX
- Audio Encoding: G.723
- Video Encoding: Proprietary, upgradeable to H.261, H.263
- Interoperability Standard Support: H.324 (future - Q1’97)
- Multipoint:
- Collaboration Features: Whiteboard, application sharing of any windows application. Remote access and file transfer.
- Notes: New release August of 1996
- Survey Info Updated: 24-Sept-96
V-Fone

- **Version:** 1.00
- **Provider:** (http://www.summersoft.com/) SummerSoft
- **Description:** Audio/Video/Text for under $30. Provides up to 15fps in color or B&W on a 28.8 connection.
- **Platforms:** PC
- **Requirements:** 486/50 (Pentium recommended) running Windows 95 or Windows NT, 8MB RAM (16 recommended), SVGA monitor, video capture card (to send video), sound card (to send audio)
- **Price:** $29.95 FREE trial copy available on SummerSoft website
- **Contact Info:** For sales - phone: 1-800-879-4141 e-mail: sales@summersoft.com
- **LAN Protocols:** TCP/IP
- **Audio Encoding:** GSM, mu-law
- **Video Encoding:** ADV (Adaptive Differential Video)
- **Interoperability Standard Support:** Future H.323
- **Multipoint:** Future - 4th quarter 1996
- **Collaboration Features:** Works with other collaboration tools.
- **Notes:** Supports full duplex sound cards and full 24-bit color.
- **Survey Info Updated:** 24-Sept-96

VC8000

- **Provider:** BT (British Telecommunications plc)
- **Description:** ISA PC multimedia communications card. Software applications packages from IBM, ICL or Olivetti provide the user-interface. Allow Audio/Video/Tools over ISDN.
- **Platforms:** PC
- **Requirements:** 20 MHz IBM PC 386 (486 recommended), 8MB RAM, 10-15MB hard disk space, full length ISA expansion slot, VGA, SVGA or XGA monitor (non-interlaced), ISDN2, Microsoft Windows 3.1 or higher, DOS 5.0 or higher, BT partner application software.
Virtual Controlroom - Appendix

- **Price:** Approximately 2700 UK pounds (excluding PC software), includes ISA card, NTSC or PAL camera, audio unit, connection unit, AC/DC adaptor, associated leads and accessory pack.

- **Contact Info:**

  **USA/Canada Inquiries:** BT Visual Images, 360 Herndon Parkway, Suite 2200, Herndon, Virginia 22070-4820, Tel. (800) 778-4820
  Fax. (703) 709-4231 for attention of John Taylor
  EMAIL: taylor@vaherndon1.bttna.com

  **Rest of the world:** BT Visual Systems, PP1.1, Ambassador House, 75-77 St. Michaels Street, London, England, W2 1QS.
  Tel. +44 171 298 4194
  Fax. +44 171 298 4325 for attention of Kim Britten
  EMAIL: 100627.3617@compuserve.com
  ATTN: Simon Grumbt or Kim Britten

  **Technical Information:** iain@empire.bt.co.uk (technical questions only please).

- **LAN Protocols:**

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

- **Video Encoding:** H.261 (QCIF moving images, CIF image capture)

- **Interoperability Standard Support:** H.320

- **Multipoint:** Yes (H.242)

- **Collaboration Features:** Application sharing, file transfer, chalkboard.

- **Notes:** Basic rate ISDN (I420) S-Interface. ISDN code supports AT&T, Northern Telecom, and Siemens implementations of US National ISDN 1, Euro-ISDN, Australia, Japan. 56 and 64 Kbits/s long distance connections are supported. Full interworking between country variants. CIF resolution for image capture, QCIF resolution for moving images. T.120 data support soon. Has own ‘telephone’ which remains operational for audio calls (loudspeaking or handset) when the PC is powered down. Card software for audio and video coding and ISDN is down-loadable from the host PC. All processing is done on the card. Hardware and software are available and approved for connection to public telecommunications networks in the USA, Canada, UK, Australia, Japan, Austria, Denmark, Eire, France, Germany, Holland, Belgium, Sweden, Finland, Norway, Switzerland, Spain, and Luxembourg.
PC applications are available from IBM (ScreenCall and P2P), Olivetti (PCC), and ICL/Fujitsu (TeamVision), offering various group working features on top of the videophone. A connection box with ports for external cameras, monitors microphones and speakers (or a VCR) is provided.

- **Survey Info Updated:** 31-July-95

### VCON ARMADA Cruiser 50 System

- **Version:** 2.21
- **Provider:** (http://www.vcon.co.il/) VCON, Inc.
- **Description:** Video/Audio/Data Collaboration Tools over ISDN/ISOEthernet/ATM
- **Platforms:** PC
- **Requirements:** 586, 1 PCI slot, PCI VGA Card w/DCI support, Microsoft Windows 3.1+, Win95, NT1
- **Price:** $1395
- **Contact Info:** VCON, Inc., 5000 Quorum Drive Suite 700, Dallas, TX 75240, USA, phone: +1.214.774.3890, fax: +1.214.774.3893, email: mkecl@vcon.com
- **LAN Protocols:** ISOEthernet, SDK Independent
- **Audio Encoding:** G.728, G.722, G.711
- **Video Encoding:** H.261
- **Interoperability Standard Supported:** H.320, T.120, MPEG
- **Multipoint:** Yes.
- **Collaboration Features:** Whiteboard, File Transfer, OLE
- **Notes:** ISDN on board to support 2B up to 128kbpsSoftware upgrades available for Application sharing and T.120 application. SDK allows users to develop their own application based on Visual C++. Supports data rates up to 384kbps, delivering high video quality. VCON’s post processing algorithms increase the frame rate up to 30fps and remove block artifacts to achieve TV-quality video.

- **Survey Info Updated:** 30-Jan-96
VCON ARMADA Cruiser 100 System

- **Version:** 2.21
- **Provider:** (http://www.vcon.co.il/) VCON, Inc.
- **Description:** Video/Audio/Data Collaboration Tools over ISDN/IsoEthernet/ATM
- **Platforms:** PC
- **Requirements:** 586, 1 PCI slot, PCI VGA Card w/DCI support, Microsoft Windows 3.1+, Win95, NT1
- **Price:** $1595
- **Contact Info:** VCON, Inc., 5000 Quorum Drive Suite 700, Dallas, TX 75240, USA, phone: +1.214.774.3890, fax: +1.214.774.3893, email: mikecl@vcon.com
- **LAN Protocols:** IsoEthernet, SDK Independent
- **Audio Encoding:** G.728, G.722, G.711
- **Video Encoding:** H.261
- **Interoperability Standard Supported:** H.320, T.120, MPEG
- **Multipoint:** Yes.
- **Collaboration Features:** Whiteboard, File Transfer, OLE
- **Notes:** ISDN on board for 2B call has MVIP to support up to 284kbps, Software upgrades available for Application sharing and T.120 application. SDK allows users to develop their own application based on Visual C++. Supports data rates up to 384kbps, delivering high video quality. VCON’s post processing algorithms increase the frame rate up to 30fps and remove block artifacts to achieve TV-quality video. VCON ARMADA Cruiser 100 system includes all the Escort functionality as option.
- **Survey Info Updated:** 30-Jan-96

VCON Cruiser Armada 150

- **Version:**
- **Provider:** (http://www.vcon.co.il/) VCON, Inc.
- **Description:** Video/Audio/Data Collaboration tools over ISDN/Iso Ethernet/ATM
- **Platforms:** PC
- **Requirements:** Win 3.11, Win95, Pentium PC, 16MB RAM, 2MB VRAM
- **Price:** $1895  
- **Contact Info:** Mike Clifford, VCONmikecl@vcon.com  
- **LAN Protocols:** TCP/IP  
- **Audio Encoding:** G.728, G.722, G.711  
- **Video Encoding:** H.261  
- **Interoperability Standard Support:** H.320, T.120 & MPEG  
- **Multipoint:** supported through vendor devices  
- **Collaboration Features:** support MS Net Meeting & Far Site, File Transfer, whiteboard  
- **Notes:**  
- **Survey Info Updated:** 11-Mar-97

**VCON ARMADA Escort**

- **Version:** 2.22  
- **Provider:** (http://www.vcon.co.il/) VCON, Inc.  
- **Description:** Video/Audio/Data Collaboration Tools over LAN/WAN  
- **Platforms:** PC  
- **Requirements:** 586, 1 PCI slot, PCI VGA Card w/DCI support, Microsoft Windows 3.1+, Win95, NT1, plus any LAN card  
- **Price:** $1395. Package contents: Armada Escort codec, digital video camera, telephone handset VCON’s Win2Win video and data conferencing software.  
- **Contact Info:** VCON, Inc., 5000 Quorum Drive Suite 700, Dallas, TX 75240, USA, phone: +1.214.774.3890, fax: +1.214.774.3893, email: haimb@vcon.co.il  
- **LAN Protocols:** TCP-IP  
- **Audio Encoding:** G.728, G.722, G.711  
- **Video Encoding:** H.261  
- **Interoperability Standard Supported:** H.320, T.120, MPEG  
- **Multipoint:** No.  
- **Collaboration Features:** File transfer, whiteboard
Virtual Controlroom - Appendix

- **Notes:** H.323 support - Q3-4/96 - depending on standard availability. Supports data rates up to 384kbps, delivering high video quality. VCON’s post processing algorithms increase the frame rate up to 30fps and remove block artifacts to achieve TV-quality video.

- **Survey Info Updated:** 30-Jan-96

**VDOPhone**

- **Version:** 0.1.0B
- **Provider:** ( http://www.vdolive.com/ ) VDOnet
- **Description:** Video/Audio tools over the Internet - direct and modem connections (14.4kps +)
- **Platforms:** PC
- **Requirements:** Pentium 90 or higher recommended, Windows 95, 8MB RAM, sound card, microphone, video capture capability (for sending video only)
- **Price:** free beta ( http://www.vdo.net/cgi-bin/Xdownload.cgi?2&5&VDOPhone&1&Windows+’95 ) download
- **Contact Info:** geisips@vdolive.com
- **LAN Protocols:** TCP/IP
- **Audio Encoding:** Proprietary
- **Video Encoding:** Proprietary - VDO wavelets
- **Interoperability Standard Support:** No.
- **Multipoint:** No.
- **Collaboration Features:** Chat, quick note
- **Notes:**

- **Survey Info Updated:** 21-May-96

**VidCall**

- **Provider:** MRA Associates Inc.
- **Description:** Video/Tools over Analog, ISDN, Ethernet, Token Ring. Audio requires separate phone line or voice/data modem to send voice and video over one telephone line.

- **Platforms:** PC

- **Requirements:** 386/33 (486 recommended), 2 MB disk space, 4 MB RAM, VGA graphics, Microsoft Windows 3.1+ or Windows NT, Microsoft mouse, video capture board (compatible with many boards including Video For Windows compatible boards), MNP/V.42 modem (14.4+) or Windows compatible LAN, WAN, TCP/IP network, still or motion camera.

- **Price:** $99, includes software for two stations and documentation.

- **Contact Info:** MRA Associates Inc., 2102B Gallows Rd., Vienna VA, 22182, USA, phone: +1.703.448.5373, fax: +1.703.734.9825, BBS: +1.703.448.5931.

- **LAN Protocols:**

- **Audio Encoding:** Audio transmitted on analog phone line.

- **Video Encoding:** Proprietary video encoding routines.

- **Interoperability Standard Support:** No

- **Multipoint:** Point-to-point modem operations, Multi-point LAN/WAN operations.

- **Collaboration Features:** Whiteboard, Image sharing and annotation, application sharing via OLE.

- **Notes:** (http://www.access.digex.net/vidcall/demo.html) Demo available from WWW page.

- **Survey Info Updated:** 13-Mar-95

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### Video Packer Pro II

- **Version:** 2.0

- **Provider:** (http://vic-corp.com/) VIC Hi-Tech Corporation

- **Description:** H.320 and H.324 compatibility on same video board (codec and video capture functions combined). Sold as software and card set or as system.

- **Platforms:** PC

- **Requirements:** Windows 95, Pentium 75MHz or faster, 28.8Kbps modem (either V.34, V.80, or ISDN modem)
• **Price**: For equipped workstation and accessories, suggested retail is $3495.00

• **Contact Info**: Kathleen Nemetz Marketing Manager, phone: 310-643-5193, e-mail: Marketing@vic-corp.com

• **LAN Protocols**:
  
• **Audio Encoding**:

• **Video Encoding**:

• **Interoperability Standard Support**: H.320, H.324, T.120 later this spring

• **Multipoint**:

• **Collaboration Features**:

• **Notes**:

• **Survey Info Updated**: 11-Mar-97

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**VideoVu**

• **Provider**: Future Communications Systems, Inc.

• **Description**: Audio/Video/Tools over modem, LAN, or Internet

• **Platforms**: PC

• **Requirements**:

• **Price**: $74.95, VideoVu Two Pak $129.95, VideoVu Complete Kit $325 (2 copies of VideoVu with the Video Logic Captivator PRO capture board)

• **Contact Info**: Future Communications Systems, Inc., P.O. Box 244, Syosset N.Y. 11791 USA, phone: +1.516.496.7121, fax: +1.516.496.7121, future@i-2000.com.

• **LAN Protocols**:

• **Audio Encoding**:

• **Video Encoding**:

• **Interoperability Standard Support**:

• **Multipoint**: Yes (LAN/WAN only, up to 8 participants)

• **Collaboration Features**:

• **Notes**: Demo disk available (info on WWW page)

• **Survey Info Updated**: 26-May-95
**VideoWare 1000**

- **Version:** 1.0
- **Provider:** (http://www.videoware.com/) VideoWare
- **Description:** Videophone software/hardware to send and receive live or recorded audio and color video using regular phone lines.
- **Platforms:** PC.
- **Requirements:** 486 DX, 80MHz or Pentium, 8MB RAM, Super VGA - 256 colors, 4M disk space, 28.8 modem, Sound card/speakers/microphone (optional to send/receive audio), PCI bus slot (optional to send video)
- **Price:** $139.99 for software, $389.99 for software and PCI video capture board
- **Contact Info:** jose@videoware.com or jose@panamnet.net
- **LAN Protocols:**
- **Audio Encoding:**
- **Video Encoding:** Proprietary algorithm
- **Interoperability Standard Support:**
  - **Multipoint:** No.
- **Collaboration Features:**
- **Notes:**
- **Survey Info Updated:** 8-Apr-96

**ViewPoint FamilyFone**

- **Version:** 1.0
- **Provider:** (http://www.mmac.com/) Multimedia Access Corp.
- **Description:** Designed to keep families close! Standards-based, real-time videoconferencing, Viewpoint FamilyFone (co-branded with Boca Research) is priced low for families.
- **Platforms:** PC
- **Requirements:** 486 DX66, Win 95, 8 MB RAM, 1.3MB Hard disk, 1 PCI slot, 28.8 modem
- **Price**: $550 w/NTSC compatible camera
- **Contact Info**: Dan Dodson - VP Marketing, 2665 Villa Creek Dr., Suite 100, Dallas, TX 75234, phone: 214-488-7200, fax: 214-243-0635, email: info@mmac.com (general information/sales) or dand@dfw.mmac.com (webmaster)
- **LAN Protocols**: NA
- **Audio Encoding**: G.723 (G.728 software upgrade)
- **Video Encoding**: H.263 (H.261 software upgrade)
- **Interoperability Standard Support**: H.324 (H.320, H.323 upgrades)
- **Multipoint**: 3rd party MCU
- **Collaboration Features**: File transfer.
- **Notes**: Simple consumer oriented interface. Co-developed/Co-branded with Boca Research. Based on Lucent AVP chip.
- **Survey Info Updated**: 18-Jun-96

**ViewPoint-PRO**

- **Version**:
- **Provider**: (http://www.mmac.com/) Multimedia Access Corp.
- **Description**: Full-featured desktop videoconferencing for your existing LAN/WAN. Communicate visually with your associates or customers across the city or across the country while simultaneously sharing files/images from windows on your screen.
- **Platforms**: PC
- **Requirements**: 486/66, Win 3.1+, 8MB RAM, 1MB Harddisk, 1 ISA slot. Requires Ethernet.
- **Price**: $995 (Includes viewer only site license)
- **Contact Info**: Todd Trenasty / Sales Manager, 2665 Villa Creek Dr., Suite 100, Dallas, TX 75234, phone: 214-243-0635, email: info@mmac.com (general information and sales) or dand@dfw.mmac.com (webmaster)
- **LAN Protocols**: TCP/IP
- **Audio Encoding**:
- **Video Encoding**:
• Interoperability Standard Support:
• Multipoint: 5-way multipoint supported (No MCU required)
• Collaboration Features: Yes. Databeam.
• Notes: LAN based videoconferencing product. Variable bandwidth from 56Kbps to 640Kbps. Software site license allows single Viewpoint Pro to multicast to unlimited software enabled workstations
• Survey Info Updated: 18-JUN-96

VISIT

• Version: 2.0
• Provider: (http://www.nortel.com/) Northern Telecom Inc.
• Description: Video/Tools over ISDN or Switched 56. Audio requires separate ISDN or Analog phone line.
• Platforms: PC, Macintosh.
• Requirements:
  • PC: 386 minimum and hard drive, Microsoft Windows 3.1+, AT-bus expansion slot, DOS 5.0 or greater, 8MB RAM (12 MB RAM max on ISA PC, 16MB or more possible on EISA w/ memory re-mapping ), 256-color VGA board and color monitor (Super VGA w/ thousands of colors support recommended).
  • Mac: Macintosh II family or other NuBus-equipped Apple computer, NuBus expansion slot, System 7 or greater, 8MB RAM, Color monitor. Camera included with product.
• Price: $5319
• LAN Protocols:
• Audio Encoding:
• Video Encoding: H.261
• Multipoint: No
• Collaboration Features: Whiteboard, File transfer.
VISTACOM VCI-10

- **Provider:** (http://www.vistacom.fi/) VistaCom, Inc.
- **Description:** OEM video codec up to 384 kbps with composite and Y/C input/output, option: video overlay piggyback of 1024 X 768 pixels, 3 freely sizeable windows, MVIP interface
- **Platforms:** PC
- **Requirements:** 486/33Mhz or higher, Windows 3.1 or higher, 1 ISA slot
- **Price:** $2,950, video overlay option: $495
- **Contact Info:** VistaCom, Inc 20431 Stevens Creek Blvd., Suite 240, Cupertino, CA 95014 phone: (408)253-5165, Fax: (408)253-5170
- **LAN Protocols:** API functions allow HOST and LAN access to video, audio, data channel and muxed H.221 data
- **Audio Encoding:** G.711, G.722, G.728
- **Video Encoding:** H.261
- **Interoperability Standard Support:** H.320, T.120
- **Multipoint:** Yes
- **Collaboration Features:** T.123 (for interfacing with third party T.120 software packages)
- **Notes:** For OEM customers the following options are available: SDK with API and sample source code; a program for customized codecs; manufacturing and software licensing policy
- **Survey Info Updated:** 15-Jan-96

VISTACOM VCI-100

- **Provider:** (http://www.vistacom.fi/) VistaCom, Inc.
- **Description:** High end OEM video codec up to T1 and 2 Mbps / 30fps with composite and Y/C input/output, MVIP interface, V.35, RS-449/V.11, E1, T1(limited)
• Platforms: PC
• Requirements: 386/33Mhz or higher, Windows 3.1 or higher, 1 ISA slot
• Price: $5,500
• Contact Info: VistaCom, Inc., 20431 Stevens Creek Blvd., Suite 240, Cupertino, CA 95014, phone: (408) 253-5165, fax: (408)253-5170
• LAN Protocols: (customized only)
• Audio Encoding: G.711, G.722, G.728
• Video Encoding: H.261
• Interoperability Standard Support: H.320, T.120
• Multipoint: Yes.
• Collaboration Features: T.123 (for interfacing with third party T.120 software packages)
• Notes: For OEM customers the following options are available: SDK with API and sample source code; a program for customized codecs; manufacturing and licensing policy.
• Survey Info Updated: 15-Jan-96

Vivo320

• Description: Video/Audio/Tools over ISDN.
• Platforms: PC
• Requirements: 486 66-MHz PC, 8 MB memory, A PC display adapter using the PC’s local bus (either VESA or PCI), Two free ISA or EISA slots, not necessarily adjacent, in your PC, Microsoft Windows 3.1.
• Price :$1495 for new product Telework 5 includes Vivo320 plus additional features to take full advantage of the ISDN interfact. This includes remote lan access, internet access, faxing, etc. Vivo320 includes:

  Vivo320 software application
  Logitech VideoMan digital video camera and microphone
  Monitor-top and desktop stands for the VideoMan camera
  speaker for hands-free operation and an earpiece for privacy
  Logitech MovieMan ISA-bus video capture card
The IBM WaveRunner ISA-bus ISDN terminal adapter card and associated driver software
software installation kit including device drivers
Documentation and technical support


- **LAN Protocols**: 

  - **Audio Encoding**: send and receive audio using either the G.711 toll-quality audio standard, or the G.722 7KHz high-band audio standard.
  
  - **Video Encoding**: transmits QCIF (176x144), receives CIF (352x288) and QCIF
  
  - **Interoperability Standard Support**: H.320

  - **Multipoint**: Yes, using H.320 compliant MCU (Multi-point Conferencing Unit).

  - **Collaboration Features**: Document Sharing (Databeam’s FarSite 2.0 collaboration software included), Image Presentation and markup.

  - **Notes**: all audio/video coding done in software Vivo TeleWork-5 is a comprehensive visual and data communications suite. It includes Vivo320 and capabilities for high-speed wide-area-network data applications and file sharing. Includes: Vivo320v1.5, IBM’s WaveRunner board, Logitech’s VideoMan digital camera, MovieMan video capture card, DataBeam’s FarSite data collaboration application, speakers, and an earpiece.

- **Survey Info Updated**: 21-May-96

**VS1000**

- **Provider**: Mentec International Ltd.

- **Description**: Video/Audio

- **Platforms**: PC

- **Requirements**: Microsoft Windows.

- **Price**: 

  - **Contact Info**: Mentec International Ltd., Mentec House, 520 Birchwood Boulevard, Birchwood, Warrington, WA3 7QX, Great Britain, phone: +44 925 830000.

- **LAN Protocols**: 

- Audio Encoding: G.711
- Video Encoding: H.261
- Interoperability Standard Support:
- Multipoint:
- Collaboration Features:
- Notes:
- Survey Info Updated:

**VTEL Personal Collaborator**

- **Version:** 1.0
- **Provider:** (http://www.vtel.com/) VTEL Corporation
- **Description:** This cost-effective, single-board solution turns any ordinary Windows 95-based PC into a full-featured desktop conferencing and communications tool. The new VTEL Personal Collaborator combines all the hardware and software you need into one, easy-to-install package. It includes VTEL’s exclusive AppsView(tm) graphical conference-control interface, which exploits the power of Windows 95 to make operating your entire system incredibly easy and intuitive. Personal Collaborator shares a consistent look and feel with the entire VTEL Enterprise Series product line.
- **Platforms:** PC
- **Requirements:** Windows 95 PC with free ISA slot.
- **Price:** $2,495 MSRP
- **Contact Info:** VTEL Corporation/108 Wild Basin Rd./Austin, TX 78746 phone: 1-800-856-VTEL
- **LAN Protocols:**
- **Audio Encoding:** G.728, G.711, G.722
- **Video Encoding:** H.320, standards only, FCIF full-screen capable, with PIP
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes, via a multipoint controller
- **Collaboration Features:** Application sharing via Intel’s ProShare, VTEL’s ObjectShare, drag-and-drop file send and local and remote screen capture
- Notes:
  - Survey Info Updated: 17-Apr-96

**VuFone**

- **Version:** 1.1
- **Provider:** (http://www.cybertroninc.com/) CyberTron, Inc.
- **Description:** Video/Audio/Data over ISDN (single or multi BRI), IsoEthernet (802.9), Switched 56, or V.35/RS366
- **Platforms:** PC
- **Requirements:** 486/33 or higher, Windows 3.11, Windows NT, or Windows 95
- **Price:** VuFone-250 US$3995.00, includes: Single ISA bus codec board with integrated ISDN BRI interface, CCD camera, VuFone application software.
- **Contact Info:** CyberTron, Inc., 100 Treble Cove Rd. Suite 3, N. Billerica MA 01862 phone: 508-663-3978, fax: 508-663-2417
- **LAN Protocols:**
- **Audio Encoding:** G.711, G.728, G.722
- **Video Encoding:** H.261
- **Interoperability Standard Support:** H.320
- **Multipoint:** Yes
- **Collaboration Features:** Drag and drop file transfer, works with most collaborative software on the market (TalkShow, FarSite, ProShare, etc.) Soon to be working with NETMeeting

- Notes:
- **Survey Info Updated:** 24-Sept-96

**Winnov VideumConf Pro**

- **Version:** 1.0
- **Provider:** (http://www.winnov.com/) Winnov
Description: VideumConf Pro is a bundle that includes the Winnov AV board, the VideumCam video camera, and White Pine’s Enhanced CU-SeeMe software

Platforms: PC

Requirements: Recommended - Pentium 90 or above with 16MB RAM running Windows NT 4.0, Win 95, or Windows 3.1x

Price: $499

Contact Info: info@winnov.com

LAN Protocols: see Enhanced CU-SeeMe

Audio Encoding: see Enhanced CU-SeeMe

Video Encoding: see Enhanced CU-SeeMe

Interoperability Standard Support:

Multipoint: Yes, using Enhanced CU-SeeMe reflector

Collaboration Features: See Enhanced CU-SeeMe

Notes:

Survey Info Updated: 23-Sept-96

XtX Internet Communications Suite

Version: 1.1

Provider: ( http://www.lamail.com/ ) Wintronix, Inc.

Description: Windows Desktop Video Conferencing software over the Internet/Intranet for person to person or group conferencing.

Platforms: PC

Requirements: Pentium 75MHz or higher, 16MB RAM, 10MB free hard disk space, Windows 95, PC digital video camera(optional)


Contact Info: Wintronix, Inc., 2350 Mission College Blvd. #710, Santa Clara, CA 95054, phone: 408-988-4300, fax: 408-988-4555, e-mail: info@lamail.com

LAN Protocols: TCP/IP

Audio Encoding:
• **Video Encoding:**

• **Interoperability Standard Support:**

• **Multipoint:** Yes - up to 10 w/o a server

• **Collaboration Features:** Whiteboard, Chat with full conferencing minutes capability, video recording.

• **Notes:** User-selectable video & audio compression.

• **Survey Info Updated:** 11-Mar-97