INTERACTIVE TELEPRESENCE
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A Review

TRI — Marketing, Training, Communications

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Abstract

There is a niche known as Interactive Telepresence within the sphere of conferencing or remote meeting technology.

It is based upon a fundamentally different class of technology and associated underlying standards.

While still small/specialized, it is a legitimate departure from traditional (legacy) videoconferencing, delivering a more realistic, "being there" experience.

Within the niche there are several players, some of which do a better job of meeting (adhering) to key Interactive Telepresence requirements than others.

Customers who have bought these systems are realizing tremendous value.

The market is stable and mature enough to mean purchases of Interactive Telepresence systems are no longer a high risk.

Introduction

Now more than ever, organizations are faced with difficult choices regarding how to leverage their global talent in a timely manner without undue risk. While worldwide travel will continue to persist, organizations are becoming much more selective in its role and frequency. In today's marketplace, dynamics such as competition, global enterprises, and new technologies mean that organizations are increasingly using virtual workforces to get things done. This means putting the right people together, regardless of their geographic locations, to get a job done. So how does one make up for lost time and put scattered workforces together to work efficiently?

While some would tell you that videoconferencing is the answer, the fact that in almost four decades, (since the advent of the first Picture Phone by the Bell System at the 1964 World's Fair), videoconferencing remains a niche market used primarily by Fortune 1000 companies and some vertical markets (government, education, telemedicine) indicates that many feel traditional videoconferencing has too many limitations. The technology has been over promised and under delivered -- works like your telephone and looks like a television – a statement frequently made, but not achieved. For several years vendors have focused on product differentiation, which can be futile if users do not see meaningful applications in a user friendly environment.

And yet, there still remains a need to communicate at a distance, in a timely manner, without the need to travel. Productivity is an issue, sharing scarce talent in different locations is a concern, and the need to be increasingly competitive remains. An alternative may exist in a new space labeled Interactive Telepresence.

Interactive Telepresence – What Is It?

Several firms have stepped into the arena to attempt to achieve what traditional videoconferencing has failed to do before – emulate true face-to-face meetings without the need to compensate for audio delay, the inability to see others clearly, and be able to share any document at a distance.

Many people are confused as to what is important in a video conference and when evaluating an IT based technology like videoconferencing, certain criteria are more important than others to ensure a successful meeting. In addition to audio and video quality these include document sharing, control systems, diagnostics, room environment, and transport.

Interactive Telepresence can be defined as the ability to share audio, data, and video with a distant site or sites as though the person were truly in the same room, across the conference table from you. In other words, the ability to have a meeting that is as good as being there.

This document explores the technology behind Interactive Telepresence, presents several players in the space, shares comments from users who have tried the technology, provides a comparison to what is available today, and discusses future trends.

Technology Factors

What makes Interactive Telepresence different from traditional videoconferencing relates to how the audio, video, document sharing, control systems, room environment, and transport are handled. A brief review of each of these factors is warranted to better understand their differentiation from traditional videoconferencing. Three factors: audio quality, video quality, and latency are all governed by standards associated with the class of codec used (i.e. H.323, H.320, Mpeg, etc.). The offerings of the vendors profiled in this document will be rated on a quality scale of low, medium and high.

Audio Quality

To ensure the highest quality audio, attention must be given to microphone placement, echo cancellation, audio balancing, tone adjustment, and audio pre and post processing. Proper audio quality ensures that audio delivery is below the maximum tolerances detectable by the human ear in order to allow meeting participants to "talk over" each other, as they might during an in-person meeting. Careful attention to microphone placement and audio processing also allows simultaneous "side conversations".

To go beyond audio associated with traditional videoconferencing the audio quality needs to allow for users all talking at the same time with no clipping, lack of echo, the ability to reproduce low and high volume levels and not reproduce others (i.e. a whisper), and the ability to reproduce left and right conversations in order to identify which user is speaking. In this document the audio quality achieved by each vendor will be rated on a 1 – 4 scale, with 1 being the best audio quality possible.

Video Quality

With conventional videoconferencing participants typically convene in rooms configured to include elongated or u-shaped tables. The on-screen result is that some people appear close while others are barely visible, so the camera must be continuously adjusted to capture images as people speak. When this happens, the technology becomes intrusive and distracts attention away from the communications at hand. Even those traditional videoconferences, where participants are seated around a boat or banana shaped table so they are equidistant from the screen, still lack the clarity of an Interactive Telepresence system because the images and audio are not as crisp and clear and the technology has not been designed to be completely user friendly. Other factors that play a role in having excellent video quality include latency and vectoring. In this document the video quality for each vendor will be rated on a 1 – 4 scale, with 1 being the best quality video possible.

Latency

Latency is a fancy word for waiting time. Real-time interactive applications, like videoconferencing, are sensitive to accumulated delay, which is referred to as latency. Latency results from everything that sits between the origination of the sound and the ear of the person listening to it. The human brain wants to feel that interaction is real. Telephone networks are engineered to provide less than 400 milliseconds (ms) round-trip latency. The lower the number, the less the delay. There is a point where latency becomes imperceptible, usually under 250 ms. Achieving imperceptible latency is a critical requirement of a true Interactive Telepresence solution. Latency should be measured looking at both the codec and the network. In this document the latency achievement by each vendor will be rated on a 1 – 4 scale, with 1 being the lowest latency possible, whereby the picture has the best image possible.

Vectoring

Vectoring allows a meeting to be enhanced by creating a more realistic orientation and interface among users. This includes the ability to consistently maintain eye contact, allowing the maximum number of individuals to appear on each screen, never sending the same image to more than one site, and proper camera placement to ensure that sight lines for all users are maintained. The fundamental issue is how to scale from a point-to-point call to a multi-site call. For effective meetings there should be no difference. To accomplish the feeling of "being there" requires multiple cameras and encoders to capture different perspectives of the table. Another major concept in the vectoring category is the concept of the system adapting to maximize itself for the particular call. During the call set up the camera zooms in to capture the correct number of people in each room and when more than one camera is involved adjustments are made for different positions at the table.

Document Sharing
During the course of any meeting users often wish to exchange information using various forms of collateral including: pre-printed documents, handwritten notes, drawings, computer generated images, PowerPoint presentations, web-based collaborative tools, pre-recorded audio and video, document cameras, etc. Attendees should be able to present information to the local room and remote locations using whatever tools are most comfortable. The goal should be to provide total and equal access to information for everyone, ensure ease of use ("plug and play"), deliver a high level of quality for viewing/reviewing materials, and create a sense of "sameness" regarding the user experience (e.g. putting a screen on the side of a room so that when participants in a multi-point meeting are looking at materials it appears as if everyone is turning their heads in the same direction to view it). While document sharing has improved, in traditional videoconferences there are still users who find it difficult to easily share documents with others. Part of the problem is lack of training, but another issue for many is ease of use. Some document sharing systems are software based while others are hardware based systems. One of the issues with collaboration based software is the need to load software on ones laptop and then know how to use that software.

Control Systems
Control systems for videoconferencing products have traditionally been action-specific (user-directed instructions "pushed" to individual parts of the system) and not function-oriented (an integrated solution querying users regarding their needs in a "pull" scenario). All users want to do is have a flawless meeting and not have to deal with the technology by pushing buttons or accessing menu screens. With Interactive Telepresence technologies users are better able to meet without having to control anything. While minimal control is also possible with traditional videoconferencing systems, it is not the norm. More often someone needs to take control of the meeting technology or the meeting tools available to the participants are not frequently used. With some Interactive Telepresence systems the vendor controls all aspects of the meeting. If the vendor ceases to exist, the customer may have no control over the system. In other Interactive Telepresence systems, the customer has the option of vendor versus customer control.

Diagnostics
To ensure successful meetings it is important to be able to fully test the systems. This includes not only testing the components of the system, but also the actual functioning of the system (i.e. Is audio passing from site A to B to C and are all screens displaying the video?). With traditional videoconferencing systems the components are tested, but not the actual functioning of the system.

Room Environment
Unfortunately, many organizations do not put enough emphasis on the room environment in which videoconferencing technology is placed. This often results in distant sites being unable to clearly see or hear the other end. The lighting is not optimized for video, resulting in shadows on faces, and the room is not properly treated for sound absorption, resulting in poor audio. Firms who pay close attention to the room environment, whether in a traditional videoconference or an Interactive Telepresence meeting, have a better meeting. Environmental issues needing to be addressed include: room dimensions, furniture and equipment placement, table shape, room acoustic treatments, fabric selection, colors, lighting design/placement, number of participants per room, and intent of usage (multi-purpose or dedicated).

Transport
Transport relates to the network used to get the information from point A to point B to point C, etc. Issues involved in transporting information include speed, consistency of speed, amount of bandwidth, resiliency/redundancy, and network options. Video is a specialized type of data stream with very tight quality of service requirements.

Transmission speed relates to how quickly the data packets are transmitted from point A to point B to point C, etc. Consistency of speed means the transmission rate must be constant without a significant amount of deviation. A sophisticated use of bandwidth is required to deliver high-resolution images and video that emulates a face-to-face meeting. When transporting video and audio, the transport must provide sequenced packets at a constant bandwidth rate with no errors. Systems for video transmission should be designed with a varying degree of resiliency and the level of redundancy and fault tolerance should be designed to match the levels of criticality of the application (e.g. more bandwidth is needed for surgery than for a talking head).

The transport facility chosen is entirely independent of the video solution. The transport selection should be based on reliability, availability, service quality, vendor guarantees, and cost. A variety of transport options may be chosen including: T1/E1 lines, ISDN, DS3 circuits, ATM, broadband fiber optics, satellite, and IP based transports. Today, doing quality video over the Internet is often still difficult as the quality of bandwidth is not always guaranteed. Any data network design must take into account other transport needs of the customer, including voice and data. Video will only be a part of the overall communications strategy employed by the customers.

Firms in the Interactive Telepresence space have chosen a variety of transport options. In addition to the amount of bandwidth deployed, what makes these firms unique is the way they have treated the video and the environment.

The Players & Customer Reactions

A number of firms can be put into the Interactive Telepresence space. In this document a review is provided of the following companies: High Speed Video, Telanetix, Teleportec, TeleSuite, and Teliris. In addition to providing information about each of these companies, individuals who use each technology were interviewed to learn why they selected the technology they use, how it is utilized, what improvements they would like to see, and any reactions they have to other firms in this space. Most importantly, a chart has been provided showing how each firm addresses the technology issues most important to Interactive Telepresence: audio quality, video quality (latency and vectoring), document sharing, control systems, diagnostics, room environment, and transport.

High Speed Video (HSV)

Company Overview
Based in Westport, Connecticut, High Speed Video was founded in 1998 by Michael Maresca and M. Walter Levine. Mr. Maresca, inventor of the HSV technology, has over twenty years of experience related to the engineering, research, and development of audio and video technology.
Mr. Levine is an entrepreneur with a repeat track record of building successful user/subscriber-based enterprises in emerging technology, consumer, and entertainment markets.

Product/Solutions Overview
High Speed Video (www.highspeedvideo.us) has developed a patented proprietary process called Callervision that uses a proprietary set top box called CV-1000 that runs at transmission speeds of 800 Kbps to 8 Mbps.

Callervision consists of a camera and microphone, a Sony 27" monitor and cabinet, and a Callervision Processor that serves as the compression and encoding device. The Callervision Processor allows for multiple parties to interact with one another on the same call. A user friendly infra-red remote control is supplied with each system. All diagnostics are handled by the HSV control center. Each unit is monitored for operational readiness 24/7, allowing HSV to anticipate any problems that may occur.

The system is set up to allow multiple parties to interact on-screen with no loss of quality.

Technology Assessment
The key advantage claimed by HSV is an innovative video communications process, conceived to facilitate the delivery of real-time, two-way, broadcast-quality video using a unique high-speed transmission process. This patented process (established with 16 claims in 30 countries) provides users with full duplex video and audio at a sustained rate of 29.97 frames per second.

Latency
Although HSV was unable to provide exact latency figures for both its proprietary codec and transport, in viewing the image the latency would be rated as a 2 in North America, low latency with a very good quality image. Because HSV is not yet overseas it is difficult to evaluate their latency internationally.

Audio Quality
As HSV does not emphasize room environment issues, audio quality would be rated a 2, very good but not outstanding. It is important to note here that at least one HSV client, the National Football League, is pushing the audio envelope very far by trying to hold video calls from the 50 yard line of an active football game! While they would like to see improvement in the audio quality from HSV, they still like the system and use it extensively.

Video Quality
The video image would be rated a 2, because HSV does not place any emphasis on room environment which can greatly impact video quality. The image from the HSV proprietary codec is extremely clear and life-like, but can be impacted by the environment in which the equipment is placed. It is important to note that the image seen was displayed on a 27" television monitor. On larger display devices the image may not appear as high a quality.

Vectoring/Non-Verbal Cues Replication
HSV does no vectoring and is essentially a firm that offers a set top box, much like traditional videoconferencing firms, but with better video quality.

Document Sharing
For document sharing HSV uses whatever the user provides.

Network Transport
Connections are made anywhere in the world via HSV's virtual private network, which also allows for connection to all legacy systems. Because Callervision is always on there is no need to schedule a videoconference. In addition to DSL transport, the service can also be offered over any other reliable digital transport (i.e. fiber optics, Ethernet, T1/E1, etc.) unattached to the Internet or a company's private network.

HSV's service is delivered around a hub and spoke architecture. The service operates using any digital transport over twisted pair, including DSL, Fractional T1, and Ethernet. The call center is located in the High Speed Video research and development facility in Edgewater, New Jersey.

Room Design/Environment Assessment
HSV does not address room design issues.

Management and Control Systems
HSV provides an easy to use infra-red (IR) remote control device with each system. The system can also be controlled via any room system (i.e. AMX, Crestron, etc.). HSV also offers full remote control via their network operations center. All diagnostics are handled by the HSV control center. Each unit is monitored for operational readiness 24/7.

Pricing Model
The hardware and installation cost for High Speed Video are $8,000 per unit. The usage cost is $150 per hour of usage with a minimum of 10 hours usage per month. Additional usage is billed at $2.00 per minute. An open pipe, 24/7 is $5,000 per month. (Note: these prices are U.S. prices only.) Full interoperability with ISDN and IP-based systems is ensured by HSV's proprietary network architecture.

Track Record & User Comments
HSV currently has less than 50 systems installed and until this year had less than a dozen systems in use. They are ramping up quickly and are beginning to obtain an impressive list of customers, primarily in the sports, entertainment, and advertising space. However, as more firms experience the quality and ease-of-use of the HSV system, the number of users will increase.

The National Football League has purchased 37 HSV systems for connection at their 32 franchises and broadcast studios. Bob Scanlon, cable and broadcast TV consultant to the NFL stated, "HSV was selected by the NFL because it has a lower cost than traditional broadcast video and audio transport systems, offers instant access and there is no additional cost to be always available. Additionally, it is easy to use and bi-directional."

November 4, 2003 was the inaugural call for NFL Total Access, a nightly show on Direct TV. At the conclusion of the show the NFL stated, "This is the birth of a new network in the NFL using the birth of a new system – High Speed Video."

Scanlon also stated that the weakest link in the HSV system is the audio, but that HSV is working hard to improve the audio quality. He views HSV as the first offering of broadcast quality videoconferencing for business applications.

In addition to the NFL, High Speed Video also has a contract to install 9 systems for ESPN at their headquarters in Bristol, CT and at 8 ESPN Zone restaurants. Several other organizations are looking at the technology.

Key Strengths
HSV shines in the areas of video quality, and ease-of-use. While they do not address all the factors listed as being a company in the Interactive Telepresence space, the improvement they offer over traditional videoconferencing warrants their inclusion in this space. The involvement of M. Walter Levine, an individual with a proven track record at starting and growing profitable companies, is also a plus to the HSV offering.

Limitations/Risk Factors
Because the HSV offering is proprietary it is only as good as those using its codec and transport. Currently the firm only has a Network Operations Center on the east coast, although they do have plans to build a second NOC on the west coast when additional funding is obtained. While other parts of the world can be involved with HSV, they are not yet a global company.

HSV does not address vectoring or room environment issues with their offering and thus, is not really a company offering complete Interactive Telepresence capabilities. However, they are an improvement over traditional videoconferencing and should be viewed as a useful technology that makes meetings better than they are today.

Telanetix

Company Overview
Telanetix, Inc. (www.telanetix.com) is a privately held California corporation located in San Diego. The company, founded in 2001, provides a fully integrated hardware, software, and services implementation to electronically merge multiple remote rooms into a single state-of-the-art environment. A key to providing this fully integrated solution is the Telanetix MPEG-4 codec offering high-resolution real-time encoders and decoders used to process the video signals for transmission across the Telanetix Network, a private, broadband IP network that offers guaranteed high availability and low latency.

Telanetix is focused on applications and not the sale of technology. They are utilizing their expertise to offer a robust network and associated equipment to offer a complete package – hardware, software, and services to organizations desiring higher quality communications than what is currently available with traditional videoconferencing.

Product/Solutions Overview
Telanetix systems (based on a standards compliant MPEG-4 codec containing Telanetix software) all communicate using Internet Protocol (IP) and operate over public or private broadband IP networks.

Telanetix has designed technology for applications in the entertainment, education and corporate markets. Utilizing the entire product line developed within Telanetix, Hollywood Bridge introduces new solutions to the entertainment industry that will not only save time and money on existing production practices, but offer new opportunities, that do not exist today, to enhance the production process. Production processes supported by the Hollywood Bridge include, but are not limited to: "live" casting sessions, production meetings, "table readings" of scripts, wardrobe sessions, creative development meetings, reviewing of film footage (dailies and rough cuts), as well as corporate meetings.

Collabridge, a division of Telanetix, is focused on the corporate and educational marketplaces. Collabridge offers systems to universities that operate on their existing Internet2 infrastructure. For commercial customers, Collabridge offers a broad range of immersive conferencing systems and collaboration tools that connect via the Telanetix Network.

Technology Assessment

Latency
The network latency averages 65 – 125 ms in North America and 65 – 570 ms worldwide. This means the latency would be given a rating of 2 (very good) in North America and probably a 2-3 (very good or good) elsewhere in the world depending on the international strategy they select. The rating for international latency will not be accurate until tested.

Audio Quality
The audio uses high end echo cancellation with sufficient bandwidth and, although not experienced, it is envisioned that the audio quality offered by Telanetix would be rated a 1 (excellent) because they also place emphasis on room environment and acoustical treatment.

Video Quality
The video is very good MPEG-4 based video, and Telanetix has low latency with their system. Video quality would be given a rating of 2 (very good), in that Telanetix pays attention to latency and room environment.

Vectoring/Non-Verbal Cues Replication
Telanetix uses IP multicasting and the SIP protocol to send the same image to up to eight sites without the use of a central bridge. This conserves network bandwidth, but does not afford true vectoring.

Document Sharing
For document sharing Telanetix provides software that allows any user, with his or her own computer, to share their screen across the network. Using the Telanetix media cube (an optional subsystem) users can play VCR tapes, digital video tapes, or DVD's across the network. Telanetix also offers an electronic whiteboard capability as an option, which allows users to turn one of the data screens into an electronic whiteboard that can be seen in all rooms on the conference.

Network Transport
Conferences usually run on the Telanetix network, which is a broadband IP networking running over ATM with guaranteed high quality of service in terms of low latency, minimal jitter, and guaranteed availability. Users pay a monthly fee for this network, which includes all local loop and long haul charges and all customer premises equipment. In addition, systems are Internet 2 compatible.

Telanetix offers software and services that allow authorized users to view sessions, either previously recorded or in real-time, via their desktop computers.

The communications systems are state-of-the-art telecommunications systems that control the network. The technical characteristics of the Telanetix network provide a minimum bandwidth per site of 3.7 Mbps with a guaranteed availability of 99% worldwide.

Room Design/Environment Assessment
Telanetix can provide a complete room environment or be integrated into existing environments.

Management and Control Systems
Control systems are used by the Network Operations Engineers to set up, control and monitor all broadcasts. While most of the scheduling and routing is automated, all sessions are monitored by human operators to ensure successful operation and to provide assistance to the user at any time needed.

The system is controlled by the user via a small touch screen display that is provided as part of the system. This presents a very simple and easy to use graphical interface to the user to place calls and use the system. For diagnostics Telanetix offers a complete service package, which includes system monitoring and diagnostics by the Network Operations Center. All systems run diagnostics all the time and silently report any problems to the NOC. NOC personnel can schedule more comprehensive diagnostics to run in house.

Pricing Model
Pricing on the hardware and software for Telanetix offerings ranges from $50K - $250K per site. Typical charges for the Telanetix Network are $3,500 per month, including all local loop and long haul charges as well as all required customer premises equipment, plus 1% per month of the system MSRP for system maintenance, and $500 per month for NOC services. There are no additional connect or per call fees.

Track Record & User Comments
Telanetix is in the product introduction phase of the product/service offering and, thus, it is too early to tell how successful the firm will be as there are currently no customers using the technology.

Alan Brawn, National Product Marketing Manager for the Samsung Pro AV Group is very familiar with Telanetix. He stated, "In the Telanetix system, the interaction of the participants is the number one consideration. When you walk into the room at each end there are screens, tables, and chairs and little else to distract the participants. There is no pan and tilt camera and no complex remote control and audio systems to master and frankly to intimidate the users. The images on the screens are full size on both ends creating and guaranteeing the full value of the communication exchange "face-to-face"." He continued, "Being the normal skeptic that most educators are, I was extremely surprised when I attended my first demo a couple of weeks ago…The seamless nature of the technology coupled with a built in economic model that makes sense to even occasional users, insures the success of the Telanetix offering."

Key Strengths
Telanetix offers users another option in the Interactive Telepresence space: the ability to select a complete turn-key package that is application focused with a choice of prices to meet specific user needs.

They offer very good audio quality, video quality, and low latency. They also understand the impact room environment has on a successful meeting and address the environmental issues.

Limitations/Risk Factors
At this time the firm is too new to know whether they will be successful or not. Much will depend on ongoing funding and reactions from actual end users.

Teleportec

Company Overview
Teleportec (www.teleportec.com) was founded in Manchester, England in 1999 by Duffie White, the inventor of the technology and current CTO for the company. Teleportec has grown into a thriving international business with headquarters in Dallas, Texas run by previous EDS executives, Jim Young, Chairman and CEO. European operations are run from an office in Belgium and Teleportec, Inc. has distributor offices in Hong Kong, Dubai, Taipei, Tokyo, Brussels, Paris, Munich and New York.

Teleportec technology allows people to appear live, life-sized within an apparent 3-D environment in a remote location and achieve eye-to-eye contact with all participants.

Product/Solutions Overview
Teleportec technology is compatible with standard videoconferencing equipment and can use a range of connectivity options including ISDN (minimum 384 Kbps – 3 pairs of lines), T1 and broadband (LANS, VANS, VPN, and IP).   With no visible cameras or monitors, Teleportec systems are user friendly, require minimum training, and can be installed in a variety of situations.

What makes Teleportec unique from other videoconferencing devices is the way the background of the image disappears so that meeting participants only see the life-size image of the speaker. Using a proprietary technology based on beam-splitting, the Teleportec product line presents the illusion of people actually being present. The beam splitter superimposes the person's image into free space where it is viewed in front of a three dimensional background, which achieves a true depth relationship. Since the person appears as an optical effect, the camera can see through it at eye level to capture the view of the people in the room from the same perspective as actually being there. Eye contact appears natural and one feels like they are able to touch the people displayed.

Since the Teleportec system displays the image of a life-size person with the background dropped out, all of the transmitted data is concentrated on rendering an excellent quality image of the person. As a result, the Teleportec system achieves better quality with less bandwidth compared to flat screen systems displaying a video image of people within the background of a remote location.

Currently, Teleportec products are available for purchase, lease or rental in two formats: a conference system and a lectern system. Teleportec is working on a desktop model and can design fully integrated custom solutions to meet particular requirements.

Conference System
The conference table is the ideal meeting room solution. It enables a person or group of people to be teleported to appear within an apparent 3-D environment at a board room table and have eye-to-eye contact with all participants. Participants will feel a sense of presence at a meeting as if they are actually sitting in a chair at the table.

Lectern System
The Teleportec lectern is ideal for training, events, and conferences. A person can be teleported from anywhere in the world and appear in apparent 3-D standing behind a lectern on a stage or within a training room. The teleported person can see and interact with the audience as if they are at the front of the room or on stage.

Technology Assessment

Latency
The latency is as good as the codec used. This means the latency rating can have a wide range in quality.

Audio Quality
The audio quality is also dependent on the codec used. Again, quality range can be fair to excellent.

Video Quality
Video quality is also dependent on the codec selected.

Vectoring/Non-Verbal Cues Replication
Teleportec does no vectoring and is essentially a firm that offers a unique display device that gives a 3D effect to an image.

Document Sharing
None offered with the Teleportec system.

Network Transport
Teleportec does not offer transport technology, but the system can operate on a variety of networks. The units require a minimum of 384 Kbps for minimum operation over ISDN and 768 Kbps over IP.

Room Design/Environment Assessment
Teleportec does not address room design or environmental issues. Teleportec units are put into a variety of room environments, out of control of Teleportec. Rooms that have been properly treated for videoconferencing will have better images than those not treated.

Management and Control Systems
Document sharing and diagnostics are not part of the Teleportec offering, as these devices are peripheral to the system. The system has a remote control device for operation of the technology.

Pricing Model
The Teleportec device retails for $29,950 per unit and can be leased for less than $1,000 a month. The price does not include the cost of a codec, but any H.320 or H.323 codec on the market can be used.

Track Record & User Comments
Teleportec systems have been used in a number of applications including retail, training & education, healthcare, government, financial services, events & conferences, and corporate communications.

Steve Baker, CEO of the Baker Design Group (Architects, Interior Designers, and Industrial Designers) has created projects and design concepts that demonstrate to clients how the Teleportec system can be integrated into a variety of environments. The applications for the technology are endless and raise typical video conferencing to a new and more satisfying level of direct personal collaboration, delivering on the concept of "telepresence". Mr. Baker stated, "Wherever personal communication is necessary, but not easily achieved, the Teleportec system provides the next best thing to being there." Baker is always on the hunt for the latest and greatest technologies to allow clients to more easily connect and communicate. He stated, "Every person who has seen the unit agrees that it has unlimited potential in every area of business and personal relations."

Ray Kurzweil of Kurzweil Technologies uses a Teleportec unit to give presentations all over the world. During his first conference a person in the audience walked up to the podium after the talk, thinking Ray was actually in attendance at the conference.

Jeff Storm at EDS supports the Army. He brought in Teleportec two years ago for distance learning and to address the troops. He stated, "Teleportec is easy to use."
Although Teleportec is very different from other firms in the Interactive Telepresence space, it certainly is unique, very interactive, and you truly feel as though someone has been beamed to the meeting.

Key Strengths
The Teleportec device is a unique display device for meetings. Teleportec has signed an agreement with Verizon to help sell devices. This relationship with a large carrier will be viewed positively by others.

Limitations/Risk Factors
The only limitations seen to date with Teleportec are the size of the equipment and the fact that it isn't well suited for large groups of people talking to other large groups. Teleportec is working on the size issue, both from a packaging perspective and from a group to desktop perspective.

Success for the company will be dependent on continued funding and increased sales of the units.

Although the Teleportec offering is not a true Interactive Telepresence solution it is unique enough to warrant its inclusion in this space.

TeleSuite

Company Overview
Founded in 1993 in Dayton, Ohio, TeleSuite (www.Telesuite.com) Corporation designs, manufactures, and delivers turnkey virtual conferencing rooms for businesses and educational institutions.

TeleSuite provides a precisely designed room environment, remote equipment management, enterprise reservations, complete systems maintenance, utilization reporting, and backward compatibility with existing legacy systems.

Product/Solutions Overview
The TeleSuite is built modularly as a "room-within-a-room" and requires minimal make-ready/tenant improvements for installation. TeleSuite's modular environments are complete with integrated electronics, lighting, audio, and collaborative tools. Participants appear life-sized, and environments are visually coordinated on each end to create the ambience of a single meeting space. TeleSuite systems range in size from 4 to up to 20 seats in custom configuration, with interaction taking place across multiple 4' x 4' curved "video mirror" screens. There are no cameras or microphones to manipulate.

Unlike traditional videoconferencing rooms, which tend to vary dramatically from room-to-room with respect to camera alignment, acoustics, microphone capture, network, etc., the TeleSuite environment allows disparate organizations to connect with a consistency of quality. The offering entails:
- Mirrored Room Environments
- Static Camera Capture
- Approximation of Eye Contact
- Good Acoustics
- Enhanced Lighting
- Life-size Representation of Participants
- Culturally Correct Format for Business & Education.

TeleSuite has developed their own proprietary technology platform, which they call Managed Video Array (MVA). It is composed of three systems:
- The MVA codec, which is based on the draft H.264 video standard. TeleSuite states that the MVA codec allows them to increase picture resolution in the suite from ~400K pixels to 1.3MM pixels to provide better quality images over traditional T1 lines. The codec also allows connection of up to 5 TeleSuite systems in a single conference without a bridge. This equates to up to a 100 person meeting with 20 images of participants (5 from each of the remote sites) on the screen at one time.
- The MVA imaging system includes a special camera and proprietary lens that is designed for extreme panoramic capture in an all-digital format. The camera is married to a wide-angle optics system that delivers a 16:3 aspect ratio to closely match the aspect ratio of the human eye.
- The Vision Array display subsystem features a nearly seamless, high-resolution 16 foot by 4 foot curved display that fills the field of view of the human eye.

MVA is a newer platform for TeleSuite which removes some of the earlier restrictions that existed because the older systems were hardwired to Dayton, Ohio. They had lower quality video and higher latency, and were dependent on the TeleSuite NOC for operation. The new MVA does not require connection to Dayton and has slightly better video quality and lower latency. However, it is a proprietary product.

Technology Assessment

Latency
It was very difficult to get accurate latency figures from TeleSuite. TeleSuite is still in the process of measurement testing for this attribute, which need to be independently verified.

Audio Quality
The audio quality is very good and uses high end echo cancellation with sufficient bandwidth.

Video Quality
The video quality is good (a rating of 3), but could be better. Part of this is affected by the way the calls are routed through Dayton, Ohio.

Vectoring/Non-Verbal Cues Replication
TeleSuite does not address vectoring as well as some of the other vendors reviewed. With the MVA the primary site gets vectored and the other sites show up in smaller quadrants on the screen. The MVA allows for moving around the tertiary sites, but the vectoring is still only fair. TeleSuite is actually offering multicasting, which involves sending the same image to multiple locations, which is not what essence of vectoring is, that is mirroring the true feeling of "being there" regardless of the number of sites in a call.

Document Sharing
For document sharing TeleSuite uses what is in their table or the software provided on the users laptop.

Network Transport
TeleSuite has contracted with Level (3) Communications, AT&T, Verizon, British Telecom, Colt, Qwest, Ameritech, Sonic Telecom, and other telecommunications providers to architect an international backbone topology that traverses the United States and extends into European communities. Dedicated high-speed connections on TeleSuite's private broadband network minimize video latency to create more realism in human interaction. TeleSuite systems are compatible with legacy video conferencing systems. It is important to note that TeleSuite has developed a hub & spoke network where calls are routed through the TeleSuite NOC in Dayton, Ohio. As such, latency is higher with TeleSuite calls than with some of its competitors. The newer MVA platform does not require connection to Dayton.

TeleSuite's Network Operations Center (NOC), with multi-point bridging management services, provides customer support, 24/7 monitoring of the network, and remote diagnostics on every aspect of the TeleSuite system environment. Conferencing sessions can be arranged between any number of TeleSuite systems, and can also include legacy video and audio conferencing equipment. The user simply contacts the NOC via an 800 number or e-mail to provide scheduling information.

Room Design/Environment Assessment
TeleSuite emphasizes room environment as they believe this is a very critical element to successful meetings. However, some users complained that the "room in a box" approach causes some people to feel claustrophobic.

Management and Control Systems
Control of the system is handled by the Network Operations Center. This limits the user's involvement, but means if a customer divorces themselves from the TeleSuite service they have no control over the system. System monitoring and diagnostics are also handled by the NOC.

TeleSuite stated they will license a "mini-NOC" to customers and will integrate it into the TeleSuite Network, so that customers can handle their own internal conferences. TeleSuite did not identify any customers currently using the "mini-NOC" arrangement.

Pricing Model
TeleSuite offers two systems, the 200 Series to seat from four to ten people and the 400 Series with seating capacity from eight to twenty people. Costs for these systems range from $80K to $326K. TeleSuite also offers specially designed Distance Learning TeleSuite Systems that hold 21 to 36 students for $326K and $374K respectively. Monthly managed service charges, which include QoS IP Network, Concierge Class Reservation and Help Desk, and Field Maintenance range from $6,500 to $9,200 per month for unlimited usage to less expensive usage based plans. Many of TeleSuite's corporate customers lease the TeleSuite System/Environment on a 36 – 60 month lease, which gives them a fixed monthly cost more than off-set by their savings in hard dollar travel avoidance and increased productivity. The above rates are US based costs.

In addition to building systems for specific customers, TeleSuite also offers a public meeting room service, with TeleSuite facilities available for rent at The Waldorf=Astoria in New York, The Savoy in London, and the Ritz-Carlton in Phoenix. These rooms make it possible for the general public to utilize the capabilities of the TeleSuite sites at a cost of $595 per hour with discounts for volume and term. In addition to the three hotels cited above, a public room is also available for use at TeleSuite corporate headquarters in Dayton, Ohio. Additional public rooms are under negotiations around the world.

Track Record & User Comments
TeleSuite has a track record in this space, having been around since 1993. They have a wide range of customers and continue to improve their offering.

Organizations in a variety of industries have deployed TeleSuite systems. PriceWaterhouseCoopers (PwC) has systems deployed in the UK, New York City, Los Angeles and Chicago. They are also looking to deploy TeleSuite systems in Edinburgh, Scotland and Manchester, England. The biggest use of the systems is for point-to-point calls, primarily between London and New York City. Paul Adams, Senior Manager of Infrastructure and Procurement at PwC in the UK stated, "PwC installed TeleSuite systems because traditional videoconferencing wasn't being well used. The systems allow us to save on travel costs and offer a better lifestyle to our employees."

3COM has TeleSuite systems deployed in the UK, Chicago, Boston, and Santa Clara, California. The TeleSuite systems are used for executive meetings, sales meetings, and engineering meetings. David Laver, Audio Visual Manager for 3COM in the UK stated, "We deployed TeleSuite systems because we found business disruptions and productivity to be the key issues."

Key Strengths

Longevity in the Interactive Telepresence space and a variety of customers are key strengths for TeleSuite.

Although technology is a concern to TeleSuite, their clear focus, and differentiator from others, is the fact that their systems are modularized rooms that they take responsibility for installing and operating for customers. They are definitely environmentally focused and the end result is a unique virtual conferencing package. Users are able to walk into a well designed meeting room and be productive without having to worry about the technology, thus having a superior experience than offered by traditional videoconferencing.

Limitations/Risk Factors

Video quality is limited when TeleSuite uses traditional T1 lines and routes calls through their Dayton, Ohio NOC. The migration to an IP network may improve video quality, this will be easier to judge once customers have deployed the newer MVA units.

They also do not handle latency and vectoring as well as others in the Interactive Telepresence space.

Questions still remain about the robustness of the network and true international support.

Concerns related to TeleSuite that were expressed by those interviewed related to cost and the fact that some people feel claustrophobic in a TeleSuite room.

Teliris

Company Overview
Teliris (www.Teliris.com) is a UK company, (founded in 1999) that was formed as a joint venture between US-based IT and network services company, Mycroft Inc., and UK-based corporate communications design and integration company, Global Intercasting Ltd. Teliris maintains offices in New York and London.

Teliris is not a "product" company. It defines solutions by working backwards from clients' business objectives. Teliris has assembled a new set of custom technologies, appliances and protocols to ensure a new class of service for meetings. They offer a modular platform that is an integration solution molded to meet each customer's needs.   The firm is the only one in this space using Mpeg 2 network technology to link multiple sites together.

Product/Solutions Overview
Teliris has developed GlobalTable, a highly advanced communications platform that delivers audio without delay, seamless DVD-quality pictures, and real-time collaboration tools that effectively replace in-person meetings.

GlobalTable's instant-on hand held controls transform the most technology challenged person into a pro, making the meeting set-up a breeze without the need for technical support. It is easy to add other media like hard-copy documents, electronic presentations, and phone calls with the touch of a button.

To achieve Interactive Telepresence, Teliris has focused on the following: virtual vectoring, video presentation, audio presentation, encoding/decoding, environment design, control systems, management, integration with legacy systems, presentation and collaboration, network transport, global coverage, and casting and other technologies.

Technology Assessment

Latency
Teliris offers the lowest latency of any product on the market, thus providing an image that is almost like being there.

Audio Quality
Teliris audio quality uses high end echo cancellation with sufficient bandwidth and would be rated a 1, excellent.

Video Quality
Video quality is excellent (rating of 1) using Mpeg-2 based video. The plasma screens used are limited with lots of people on them. Teliris has the lowest latency of any product on the market and their handling of vectoring is exceptional, which is a big differentiator between them and others. This is especially useful in a multipoint call to allow the highest quality meeting possible among all the sites involved.

Vectoring/Non-Verbal Cues Replication
Teliris is the only company in this space that effectively deals with the vectoring issue, mirroring the true feeling of "being there" regardless of the number of sites in a call.

Virtual vectoring is a unique concept pioneered by Teliris that enhances the meeting environment by creating a more realistic orientation and interface among users by replicating non-verbal cues normally seen in an in-person meeting. The requirements to achieve Virtual Vectoring are as follows:
- Consistently maintaining eye contact and sight lines among participants
- Never sending the same image to more than one site
- Proper placement of "camera right" and "camera left" equipment that flanks the screen, to ensure that sight lines for all users are maintained
- Dimensioning – the complexity of creating camera placement and sight lines to enable true eye-to-eye contact at all times.

Document Sharing
For document sharing, Teliris can use whatever the user provides. This can be software or hardware based. With the hardware solution one very simply connected a laptop or PC; no software is required. The image quality is excellent.

Network Transport
The transport can be done in a variety of ways. Customers can run over their own network or thru the Teliris network, which meets the stringent requirements for latency and quality.

Teliris primarily uses Mpeg 2 and high definition capable codecs (encoder/decoder) to achieve the quality they are seeking.

Room Design/Environment Assessment
Teliris also places great emphasis on the room environment by paying careful attention to room dimensions, table shape, equipment placement (i.e. layout and distance from screens to participants), room acoustics, lighting design, fabrics, colors, number of participants per room and intent of usage.

Teliris systems are integrated into the customer environment and are customized to meet each need. GlobalTable is integrated into the customer environment and Teliris evaluates each space's needs and constraints prior to integrating the room.

Management & Control Systems
Teliris control systems are all "wizard-based" and guide the participants through the set up process. All the user needs to know is:
- How many people are in the room?
- What cities do you want to talk to?

The control system controls the functions not the equipment. Because customers are supplied with the control system they have a complete system available to them should they decide to take ownership of the network contract. This is not the case with all competitors. Teliris also offers outsourced control and management services through their global video Network Operations Center.

A full diagnostics system is provided and available either on an outsourced or insourced basis. The entire system can be tested remotely without having to be in the room.

Pricing Model
GlobalTable ranges in price from $65,000 to $250,000 per room. The cost is dependent on the type and number of codecs and camera used, as well as the amount of work needed to achieve an optimal room environment. It is also important to realize that to achieve true vectoring with multiple sites costs additional dollars dependent on the number of people involved in a typical meeting. The more participants per site, the greater the need for additional cameras to obtain all the images desired.

Track Record & User Comments
Teliris has an impressive client list of very satisfied customers and continues to grow their position in the marketplace. They were not willing to disclose the number of customers using their technology, but stated they have been successful in the financial, publishing, entertainment, technology, and pharmaceutical industries.

Martin Gagen, President and CEO of US operations for 3i, a world leader in venture capital and private equipment investments, uses Teliris between his offices in Menlo Park, California and London. The systems are used to share technology, hold due diligence meetings, participate in board meetings, for international portfolio meetings, and when meetings need to be held on short notice. The company was looking for something better than videoconferencing. The key benefit of the Teliris system is its ability to allow people to talk in a natural style. At 3i conversations are very fast and with traditional videoconferencing there was a need to stop and start conversations to be sure each site was heard.

"The system was originally installed for my own use, stated Martin Gagen, but now my team uses it all the time. I could easily see the system installed in 4 – 5 other 3i locations. The way the voice and image are packaged is what makes Teliris work for us."

Justine Drew, Development Manager of Pearson, a UK based global media group who owns Financial Times, Penguin, and Pearson Education, also uses the Teliris system. The GlobalTable is currently installed in Pearson offices in London and New York City, with an additional room being planned for New Jersey. The systems were originally used for monthly and quarterly meetings, but are now used to the point that it is often difficult to get access to the rooms. Justine Drew explained, "The quality of the meetings is far superior to traditional videoconferencing and people feel more comfortable using GlobalTable. People are having conversations they weren't having before. People started traveling less almost immediately, since they could connect with colleagues across the globe at a moment's notice." Monthly management meetings, strategy meetings and communication department meetings were conducted via GlobalTable, realizing dramatic cost savings within months.

Getting the technology right is the focus of Teliris and they clearly have made meetings at a distance more like being there.

Key Strengths
Teliris offers high flexibility to customers. Their solutions are designed to meet customer needs. Their understanding of networking concepts and trends is a benefit to customers. They offer the highest quality video, true multipoint, and the lowest latency in the Interactive Telepresence space.

Limitations/Risk Factors
With their standard 42" display, vectoring limits the number of users able to be on the screen at one time. Newer display technologies and larger screens significantly address this issue.

Interactive Telepresence Compared To:

This segment of the document looks at how the vendor offerings compare to other forms of information/meeting exchange.

Videoconferencing

Clearly Interactive Telepresence goes beyond traditional videoconferencing. In fact the space was born because so many users have been dissatisfied with traditional videoconferencing. Complaints have centered around poor audio and video, difficulty in making and sustaining network connections, problems with collaboration, and the fact that video conferences are not "just like being there". Complaints also extend to reliability and poor multipoint calls. Several of the firms profiled in this document strive to address the underlying technology factors behind the disappointment with videoconferencing. (i.e. Telanetix, TeleSuite, and Teliris). Others are looking at different ways of displaying video (i.e. Teleportec), but don't truly focus on the technology behind the transmission or environment.

Collaboration

While Interactive Telepresence was not introduced for the sole purpose of addressing the collaboration segment, the way the sharing of documents is handled is a critical factor to the overall success of a meeting using Interactive Telepresence technology. However, there are a number of offerings in the collaboration space (i.e. WebEx, Raindance, Microsoft's acquisition of Placeware) that are really focused on data sharing not video.

Therefore, while Interactive Telepresence vendors address the collaboration needs of meeting participants, Interactive Telepresence cannot be directly compared to all offerings in the collaboration space.

Distance Learning

Like business meetings, distance learning has also had similar problems with many aspects of traditional videoconferencing. However, the traditional videoconferencing vendors have done a better job developing product and service offerings designed specifically for distance learning. Users in the distance learning space will indeed benefit from the improvements seen by the advent of Interactive Telepresence, but the Interactive Telepresence vendors will need to be sure the design and application of their systems meet specific distance learning needs.

Is It Like Being There?

Based on user testimonials and personal experience with most of these vendors, Interactive Telepresence is definitely more like being there. One can see the whites of peoples' eyes, watch them sweat, and interrupt conversations as if being there. The firms who do it best (i.e. Telanetix, TeleSuite, and Teliris) are those that concentrate on all aspects of the meeting: the hardware, the network and the environment. The more emphasis placed on the technology behind the scenes, thus making the meeting process real and not technology focused, the more the offering simulates an in-person experience. This is not to say that firms like High Speed Video and Teleportec do not have a place. They do, but their emphasis is less on the total meeting environment and more on either high speed access or a different visual display. The important point to keep in mind is that each of these firms has a place in the industry and the offerings from each need to be selected based on actual user needs, not based on technology.

Is It Time To Consider Buying This Technology?

As users assess the pros and cons of adopting Interactive Telepresence systems they need to be asking themselves if now is the right time to deploy these technologies or will waiting be advantageous? The answer to these questions is the same as the answer given twenty years ago about traditional videoconferencing: if one has the application and need to deploy Interactive Telepresence, one should do so now. While costs may continue to drop, it is doubtful the costs will significantly drop in a short timeframe. While Interactive Telepresence is a new space that is more expensive than traditional videoconferencing, the firms using it find it has greater value than traditional videoconferencing and found it easy to justify the cost for both domestic and international meetings.

Is It A Real and Separate Space?

Because there is not a group of vendors that meets all the attributes of Interactive Telepresence it may be hard to turn Interactive Telepresence into its own space, but it is worth the attempt if for no other reason than the fact that many view videoconferencing as a negative word.

The firms reviewed in this document do not all fit the Interactive Telepresence space because they do not all treat every aspect of a meeting (hardware, network and environment). What could be offered are three new spaces beyond traditional videoconferencing: high speed access, 3D (three dimensional) offerings, and Interactive Telepresence. The point being made is that there are alternatives to traditional videoconferencing.

Another reason this may not be a real and separate space, at least not for long, is that traditional videoconferencing vendors (i.e. Polycom, Sony, and Tandberg) and their distributors continue to come up with better technology and packaging geared to meet identified needs. Sooner or later, they too may jump on the Interactive Telepresence bandwagon as they see firms having success in this space. Additionally, firms like Cisco and Microsoft have also entered this environment and could have a major impact on how the technology is viewed in the future.

Another issue relates to a product versus a service offering. Telephone carriers are apt to view these technologies as opportunities to attach an offering or service to their network to obtain more network usage. Carriers may contend that they can now offer "high speed video access with pictures as clear as your television. We have finally made it just like being there." Carriers may eventually have to acquire others in order to be focused on all aspects of conferencing technology that allow them to get the most usage from their networks.

Finally, as with any technology it remains to be seen if all the firms mentioned will have the necessary funding to continue their activities. Perhaps some or all of the companies profiled will fold or be acquired by others.

Future Trends & The Impact of Interactive Telepresence

Given that very large organizations have opted to install Interactive Telepresence systems, and their senior management is using them, indicates the need for better technology and integration of technologies than is currently available with videoconferencing. As such, as more organizations realize there is an alternative to traditional videoconferencing, Interactive Telepresence will be better utilized and demanded by more.

The vendors in the spaces beyond traditional videoconferencing need to continue to "toot their horns" and make others aware of the alternatives. Not one of the users interviewed felt negatively about the products reviewed. Instead they are relieved that an alternative exists. This is especially true given the need to communicate globally, the streamlining of staffs, and the increased difficulty of travel. Customers using these systems like them a lot and feel they provide tremendous value.

The advent of Interactive Telepresence should be a wake up call to technology firms in the videoconferencing space. It should also be a welcome signal to users that an alternative exists.

The future will see more firms offering high speed video access, companies realizing there is more to virtual meeting success than quality audio and video, and a drop in the price to install and conduct virtual meetings.

Additionally, convergence of telecommunications and information technology are making it easier and less costly to deploy networks that are more robust and meet a variety of needs.

In the future, audio conferencing will become more reliable over the web, there will be more movement of videoconferencing to the desktop, and there will also be a desire for Interactive Telepresence systems that truly emulate being there.

Telecommunications carriers will also realize that these offerings could be a service presented to clients as an alternative or enhancement to current meetings.

It is assuring and refreshing to realize that there are firms reacting to the need to communicate at a distance and that these firms are seeking a better way to meet that is easy for the users and works without effort. In other words, the ability to have a meeting without having to be there.

Interactive Telepresence Vendor Comparison

	Audio Quality	Video Quality	Latency	Vectoring	Document Sharing	Control Systems	Diagnostics	Room Environment	Transport
High Speed Video	Proprietary, step down compatibility with G. standards.	Proprietary set top box running at speeds from 800 Kbps to 8Mbps over a private network.	Very good	none	They use whatever the user provides.	The system can be controlled via any room system (AMX, Crestron, etc.), as well as full remote control via the network.	All diagnostics are handled by the HSV control center. Each unit is monitored for operational readiness 24/7.	None	Private networks using any digital transport over twisted pair, including DSL, Fractional T1, and Ethernet.
Telanetix	Very good using high end echo cancellation with sufficient bandwidth	Very good using high end echo cancellation with sufficient bandwidth	Very good	Multicasting, not true vectoring.	They use whatever the user provides.	Small touch screen with each system, as well as full remote control via the network.	Systems continuously run diagnostics and they are also done from the NOC.	Can provide complete room environment	Broadband IP network running over ATM.
Teleportec	As good as allowed by the codec used	Directly dependent on the codec used	As good as the codec used	None	none	none	none	Totally self contained environment.	none
TeleSuite	Very good using high end echo cancellation with sufficient bandwidth	Good and will be better with MVA. Previously affected by routing of calls through Dayton.	Difficult to get accurate figures from TeleSuite. Currently being measured.	Multicasting, not true vectoring	They use what is in their table or software on your laptop.	None, outsourced services only	Handled by the NOC.	Emphasizes room environment.	Private broadband contracted through multiple carriers and hub & spoke network with calls routed through Dayton.
Teliris	Very good using high end echo cancellation with sufficient bandwidth	Very good Mpeg-2 based video. 42" plasma screens are limited with lots of people on them. Larger screens address this issue.	Lowest latency of any product on the market.	Exception, big differentiator between them and others.	Hardware plug and play solution. Software can also be used.	Controls functions, not equipment. Outsourced or insourced.	Full, and allows you to test the system without having to leave the room.	Integrated into the customer environment.	Can be done in a variety of ways. Customer can run over their own network or thru the Teliris network.

About TRI

Telemanagement Resources International Inc. (TRI) is a 22 year old management consulting firm specializing in marketing, communications, and training with an emphasis on design, assessment, project management, promotions, and training for collaborative conferencing systems. More information about TRI can be obtained at www.TRIInc.com.

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