

Telepresence, Telecommuting and Telecommunications

Ora Li

Bailey Wylie



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Table of Contents

Chapter 1 - Telepresence

Chapter 2 - List of Video Telecommunication Services and Product Brands

Chapter 3 - Videotelephony

Chapter 4 - Videoconferencing

Chapter 5 - Videophone

Chapter 6 - Telecommuting

Chapter 7 - Virtual Volunteering and Virtual Teams

Chapter 8 - Telecentre

Chapter 9 - Hotelling (office) and Virtual Office

Chapter 10 - Telecommunication

Chapter 1

Telepresence



A Teliris VL Executive telepresence system in 2007

Telepresence refers to a set of technologies which allow a person to feel as if they were present, to give the appearance that they were present, or to have an effect, via telerobotics, at a place other than their true location.

Telepresence requires that the users' senses be provided with such stimuli as to give the feeling of being in that other location. Additionally, users may be given the ability to affect the remote location. In this case, the user's position, movements, actions, voice, etc. may be sensed, transmitted and duplicated in the remote location to bring about this effect. Therefore information may be traveling in both directions between the user and the remote location.

A popular application is found in telepresence videoconferencing, a higher level of videotelephony which deploys greater technical sophistication and improved fidelity of both video and audio than in traditional videoconferencing.

History

The term *telepresence* was coined in a 1980 article by Marvin Minsky, who outlined his vision for an adapted version of the older concept of teleoperation that focused on giving the remote participation a feeling of actually being present.

The first commercially successful telepresence company, *Teleport* (which was later renamed *TeleSuite*), was founded in 1993 by David Allen and Harold Williams. Before *TeleSuite*, they ran a resort business from which the original concept emerged, because they often found businessmen would have to cut their stays short to participate in important meetings. Their idea was to develop a technology that would allow businessmen to attend their meetings without leaving the resorts so that they could lengthen their hotel stays.

Hilton Hotels had originally licensed to install them in their hotels throughout the United States and other countries, but usage was low. The idea lost momentum, with Hilton eventually backing out. *Teleport* later began to focus less on the hospitality industry and more on business-oriented telepresence systems. Shareholders eventually held enough stock to replace the company's original leadership, which ultimately led to its collapse. David Allen purchased all of the assets of *TeleSuite* and then renamed the new company *Destiny Conferencing*.

Although *Destiny* survived, the idea did not become more popular until other large corporations, such as HP and Cisco, moved into the field; they began releasing similar systems around the mid-2000s. David Allen sold *Destiny Conferencing* on January 5, 2007 to Polycom for \$60 million.

An important research project in telepresence began in 1990. Headquartered at the University of Toronto, the Ontario Telepresence Project "was a three year, \$4.8 million pre-competitive research project whose mandate was to design and field trial advanced media space systems in a variety of workplaces in order to gain insights into key sociological and engineering issues. The OTP, which ended December, 1994, was part of the *International Telepresence Project* which linked Ontario researchers to counterparts in four European nations. The Project's major sponsor was the Province of Ontario through two of its Centres of Excellence—the Information Technology Research Centre (ITRC) and the Telecommunications Research Institute of Ontario (TRIO)." (quoting from the project's final report) The Project was an interdisciplinary effort involving social sciences and engineering.

Benefits



A Teliris Unified VirtuaLive telepresence room in use (2007)

An industry expert described some benefits of telepresence: "There were four drivers for our decision to do more business over video and telepresence. We wanted to reduce our travel spend, reduce our carbon footprint and environmental impact, improve our employees' work/life balance, and improve employee productivity."

Rather than traveling great distances in order to have a face-face meeting, it is now commonplace to instead use a telepresence system, which uses a multiple codec video system (which is what the word "telepresence" most currently represents). Each member/party of the meeting uses a telepresence room to "dial in" and can see/talk to every other member on a screen/screens as if they were in the same room. This brings enormous time and cost benefits. It is also superior to phone conferencing (except in cost), as the visual aspect greatly enhances communications, allowing for perceptions of facial expressions and other body language.

Implementation



Telepresence today: this particular room, a **210 Series** owned by Pangeair, was built by **Destiny Conferencing** (later bought out by Polycom)

Telepresence has been described as the human experience of being fully present at a live real-world location remote from one's own physical location. Someone experiencing video telepresence would therefore be able to behave, and receive stimuli, as though part of a meeting at the remote site. The aforementioned would result in interactive participation of group activities that would bring benefits to a wide range of users.

Implementation of human sensory elements

To provide a telepresence experience, technologies are required that implement the human sensory elements of vision, sound, and manipulation.

Vision

A minimum system usually includes visual feedback. Ideally, the entire field of view of the user is filled with a view of the remote location, and the viewpoint corresponds to the movement and orientation of the user's head. In this way, it differs from television or cinema, where the viewpoint is out of the control of the viewer.

In order to achieve this, the user may be provided with either a very large (or wraparound) screen, or small displays mounted directly in front of the eyes. The latter provides a particularly convincing 3D sensation. The movements of the user's head must

be sensed, and the camera must mimic those movements accurately and in real time. This is important to prevent unintended motion sickness.

Another source of future improvement to telepresence displays, compared by some to holograms, is a projected display technology featuring life-sized imagery.

Sound

Sound is generally the easiest sensation to implement with high fidelity, based on the foundational telephone technology dating back more than 130 years. Very high-fidelity sound equipment has also been available for a considerable period of time, with stereophonic sound being more convincing than monaural sound.

Manipulation

The ability to manipulate a remote object or environment is an important aspect of real telepresence systems, and can be implemented in large number of ways depending on the needs of the user. Typically, the movements of the user's hands (position in space, and posture of the fingers) are sensed by wired gloves, inertial sensors, or absolute spatial position sensors. A robot in the remote location then copies those movements as closely as possible. This ability is also known as teleoperation.

The more closely the robot re-creates the form factor of the human hand, the greater the sense of telepresence. Complexity of robotic effectors varies greatly, from simple one axis grippers, to fully anthropomorphic robot hands.

Haptic teleoperation refers to a system that provides some sort of tactile force feedback to the user, so the user feels some approximation of the weight, firmness, size, and/or texture of the remote objects manipulated by the robot.

Degree of implementation: immersive vs. adaptive or lite

Telepresence is a matter of degree. Gartner notes that telepresence solutions differ in degree of implementation from "immersive" through "adaptive" to "lite" solutions. At the top are immersive solutions where the environments at both ends are highly controlled (and often the same) with respect to lighting, acoustics, decor and furniture, thereby giving all the participants the impression they are together at the same table in the same room, hence the "immersive" label.

Adaptive telepresence solutions may use the same technology, but the environments at both ends are not highly controlled and hence often differ.

Adaptive solutions differ from telepresence lite solutions not in terms of control of environments, but in terms of integration of technology. Adaptive solutions use a managed service, whereas telepresence lite solutions use components that someone must integrate.

Transparency of implementation

A good telepresence strategy puts the human factors first, focusing on visual collaboration solutions that closely replicate the brain's innate preferences for interpersonal communications, separating from the unnatural "talking heads" experience of traditional videoconferencing. These cues include life-size participants, fluid motion, accurate flesh tones and the appearance of true eye contact. This is already a well-established technology, used by many businesses today. The chief executive officer of Cisco Systems, John Chambers in June 2006 at the Networkers Conference compared telepresence to teleporting from Star Trek, and said that he saw the technology as a potential billion dollar market for Cisco.

Rarely will a telepresence system provide such a transparent implementation with such comprehensive and convincing stimuli that the user perceives no differences from actual presence. But the user may set aside such differences, depending on the application.

The fairly simple telephone achieves a limited form of telepresence using just the human sensory element of hearing, in that users consider themselves to be *talking to each other* rather than talking to the telephone itself.

Watching television, for example, although it stimulates our primary senses of vision and hearing, rarely gives the impression that the watcher is no longer at home. However, television sometimes engages the senses sufficiently to trigger emotional responses from viewers somewhat like those experienced by people who directly witness or experience events. Televised depictions of sports events, or disasters such as the September 11 terrorist attacks, can elicit strong emotions from viewers.

As the screen size increases, so does the sense of immersion, as well as the range of subjective mental experiences available to viewers. Some viewers have reported a sensation of genuine vertigo or motion sickness while watching IMAX movies of flying or outdoor sequences.

Because most currently feasible telepresence gear leaves something to be desired; the user must suspend disbelief to some degree, and choose to act in a natural way, appropriate to the remote location, perhaps using some skill to operate the equipment. In contrast, a telephone user does not see herself as "operating" the telephone, but merely talking to another person with it.

Related technologies

Videocalls and videoconferencing

Videophone calls (also: '*videocalls*' and '*video chat*'), differ from **videoconferencing** in that they expect to serve individuals, not groups. However that distinction has becoming increasingly blurred with technology improvements such as increased bandwidth and sophisticated software clients that can allow for multiple parties on a call. In general

everyday usage the term *videoconferencing* is now frequently used instead of *videocall* for point-to-point calls between two units. Both videophone calls and videoconferencing are also now commonly referred to as a '*video link*'.

Webcams are popular, relatively low cost devices which can provide live video and audio streams via personal computers, and can be used with many software clients for both video calls and videoconferencing.

A **videoconference system** is generally higher cost than a videophone and deploys greater capabilities. A *videoconference* (also known as a videoteleconference) allows two or more locations to communicate via live, simultaneous two-way video and audio transmissions. This is often accomplished by the use of a multipoint control unit (a centralized distribution and call management system) or by a similar non-centralized multipoint capability embedded in each videoconferencing unit. Again, technology improvements have circumvented traditional definitions by allowing multiple party videoconferencing via web-based applications. A separate webpage article is devoted to videoconferencing.

A **telepresence system** is a high-end videoconferencing system and service usually employed by enterprise-level corporate offices. Telepresence conference rooms use state-of-the-art room designs, video cameras, displays, sound-systems and processors, coupled with high-to-very-high capacity bandwidth transmissions.

Typical uses of the various technologies described above include videocalling or videoconferencing on a one-to-one, one-to-many or many-to-many basis for personal, business, educational, deaf Video Relay Service and tele-medical, diagnostic and rehabilitative use or services. New services utilizing videocalling and videoconferencing, such as personal videocalls to inmates incarcerated in penitentiaries, and videoconferencing to resolve airline engineering issues at maintenance facilities, are being created or evolving on an on-going basis.

Virtual presence (virtual reality)

Telepresence refers to a user interacting with another live, real place, and is distinct from *virtual presence*, where the user is given the impression of being in a simulated environment. Telepresence and virtual presence rely on similar user-interface equipment, and they share the common feature that the relevant portions of the user's experience at some point in the process will be transmitted in an abstract (usually digital) representation. The main functional difference is the entity on the other end: a real environment in the case of telepresence, vs. a computer in the case of immersive virtual reality.

The cooperative web

The **Cooperative Web** or Co-Web refers to a browser-based platform that promises to replicate the power of face-to-face communications via web-touch without sacrificing the quality of human interactions. A Co-Web enabled situational application exploits direct high-definition video mixed with web based telepresence to further increase conversational productivity. The objective of the Cooperative Web is to enrich collaborative web meetings with a browser metaphor that supports simultaneous interactions between meeting participants.

Overview

A convergence is occurring between various technologies associated with the notion of live web meetings. The phrase Web conferencing has been used to describe group discussions over the internet. These discussions are often implemented using Synchronous conferencing protocols and are commonly used for webinars, where one meeting participant lectures to other participants while presenting some information that is rendered to all participants by a common client application (web or fat client). The term Telepresence refers to a set of technologies which allow a person to feel as if they were present, to give the appearance that they were present, or to have an effect, at a location other than their true location. Telepresence requires that the senses of the user, or users, are provided with such stimuli as to give the feeling of being in that other location. Additionally, the user(s) may be given the ability to affect the remote location. As the analysts at IDC describe, the goal is to create a sensory experience that communicates the full range of human interactions in a live meeting.

While many Telepresence solutions have focused on the ambiance aspects of remote meeting environments and while most web conferencing solutions have focused on the integration of webinar and telephony features into collaboration software offerings/services, little has been done to simulate or reflect the asynchronous or simultaneous aspects of live meetings over the internet. Ideally what is required is a set of technologies that enrich communications with sensory elements that provide a *just-like-being-there* experience for live meetings. The sensory experience should include a range of sight, sound, and touch interactions. However, the current state of web conferencing and telepresence solutions focus mainly on the sight and sound aspects of a meeting and fall short on the interaction capabilities of participants. Moreover, web conferencing and telepresence solutions are typically not vendor neutral and tend to be pricey.

Interestingly, users have the ability to incorporate webinar capabilities into an Immersive or Adaptive Telepresence solution to extend meeting attendance. Yet this injection of Telepresence Lite capabilities all along the Telepresence solution spectrum still does not address support for simultaneous interactions with the material being presented in a meeting.

Orthogonal to this convergence in the technologies that support live web meetings, the web browser platform has evolved to a point whereby the mediation of user interactions

amongst meeting attendees is possible. The common browser has raised the bar of expectation by users. Regardless of your browser of choice, your ability to access web applications simply and efficiently has become the norm. The overall browser experience has improved due in part by the broad adoption of web standards by browser providers and by the sheer economics and reach of the web browser platform. Essentially, the browser has evolved into the ubiquitous application container for the web.

Solution Concepts

People meet, gather, huddle for business and personal endeavors. The majority of the discussions associated with these conferencing activities tend to be associated with decisions. Typically, the decision making process incorporates the analysis of one or more visualizations of data. The Cooperative Web pertains to a set of technologies and associated architectures that promise to empower decision agility with respect to information available for evaluation via web-based applications.

While Cooperative Web solutions can incorporate digital components (audio, video) to replicate the face-face meeting experience with the human sensory elements of sight and sound, the interactive sensory element is a differentiating factor. A core value proposition of this technology is that it provides all meeting participants with the ability to manipulate data and drive web centric applications that are used in the decision making process.

In consideration to IDC's call for the ability to develop a low-cost plug-and-play Telepresence solution that can be easily adopted by medium-sized companies to extend the reach and promise of Telepresence, the Cooperative Web offers solution vendors and composite web application developers the ability to develop standards based web applications that can be used in collaborative communication-oriented meetings.

Sample Solution Scenarios Characteristics

- Webinar whereby Audio, Video and Co-Web enabled applications are combined
- Traditional teleconference or phone conversations aided by a Co-Web enabled application (this would be useful when broadband limitations exists or when video cameras are not present)
- Ad-hoc just-in-time web conference
- Video conferencing meeting whereby a remote mobile attendee is required

Solution Scenarios

- TeleMedicine: Remote health care or diagnosis
- E-Learning or Distance Learning
- Call Center Support
- Financial Analyst Briefing

Conceptual Architecture

The maturity of service-oriented-architectures has fueled an ecosystem of ajax-based gadgets (widgets) that encapsulate content services (REST, WSDL). These gadgets, standalone fragments of a web page, make up the information rich web palette that can be assembled, wired and shared in composite web applications.

Lets assume that the gadgets used in a given web page all publish the events associated with user-interactions to a predefined mediation server whereby all participants in a managed web meeting were notified of the interactions. Now, each instance of the gadgets in the web page (running in each meeting participants browser) would receive these remote interaction events as if they were locally triggered. The result would be that each meeting participant would broadcast his/her web page interactions and also subscribe to the results associated with interactions of other meeting participants.

Comparison with Telepresence

While many vendors associate the following attributes with Telepresence solutions:

- Quality of Image
- True Eye Contact
- Life Size Image
- Proximity of image
- Sound quality
- Full complement of content presentation capabilities

the reality is that many of top selling solutions focus more on the features associated with sight and sound and complementary ambiance aspects like high-end furniture. However, few focus on extending the Telepresence experience with interactive presentation capabilities. *Cooperative Web* enabled applications are complementary to the spectrum of Telepresence solutions as they extend the scope of the browser-based platform to allow all meeting participants to share browser applications in a live online meeting.

As described by Gartner, the spectrum of Telepresence solutions can range from Lite to Adaptive to Immersive. *Cooperative Web* enabled applications can be leveraged along all points on the solution spectrum to help enrich the *just-like-being-there* aspects of the Telepresence experience.

Typically, sophisticated technologies are required for a user to be given a convincing telepresence experience. However, one of the benefits of *Cooperative Web* solutions is the ubiquity of the technology dependencies. The cost of entry for adoption has been reduced to a common browser, a few JavaScript libraries and some browser plug-ins. The net result is that the *Cooperative Web* not only extends the reach of Telepresence solutions, this technology also improves the overall experience of remote communications.

However, in its raw state, a Co-Web enabled application does not require a Telepresence environment nor a hosted Web Conferencing solution. The minimum requirement is a mediation server and a co-web enabled application.

Applications

Application examples could be cited within emergency management and security services, B&I, and the entertainment and education industries.

Connecting communities

Telepresence can be used to establish a sense of shared presence or shared space among geographically separated members of a group.

Hazardous environments

Many other applications in situations where humans are exposed to hazardous situations are readily recognised as suitable candidates for telepresence. Mining, bomb disposal, military operations, rescue of victims from fire, toxic atmospheres, or even hostage situations, are some examples.

Pipeline inspection

Small diameter pipes otherwise inaccessible for examination can now be viewed using pipeline video inspection.

Remote surgery

The possibility of being able to project the knowledge and the physical skill of a surgeon over long distances has many attractions. Thus, again there is considerable research underway in the subject. (Locally controlled robots are currently being used for joint replacement surgery as they are more precise in milling bone to receive the joints.) The armed forces have an obvious interest since the combination of telepresence, teleoperation, and telerobotics can potentially save the lives of battle casualties by allowing them prompt attention in mobile operating theatres by remote surgeons.

Recently, teleconferencing has been used in medicine (telemedicine or telematics), mainly employing audio-visual exchange, for the performance of real time remote surgical operations - as demonstrated in Regensburg, Germany in 2002 . In addition to audio-visual data, the transfer of haptic (tactile) information has also been demonstrated in telemedicine.

Sign language communications via videotelephony



Video Interpreter sign used at VRS/VRI service locations

One of the first demonstrations of the ability for telecommunications to help sign language users communicate with each other occurred when AT&T's videophone (trademarked as the 'Picturephone') was introduced to the public at the 1964 New York World's Fair –two deaf users were able to freely communicate with each other between the fair and another city. Various other organizations, including British Telecom's Martlesham facility and several universities have also conducted extensive research on signing via videotelephony. The use of sign language via videotelephony was hampered for many years due to the difficulty of using it over regular analogue phone lines coupled with the high cost of better quality data phone lines, factors which largely disappeared with the advent of high-speed ISDN and IP Internet services in the last decade of the 20th Century.



A deaf or hard-of-hearing person at his workplace using a **VRS to communicate with a hearing person** in London.

Using such video equipment, the deaf, hard-of-hearing and speech-impaired can communicate between themselves and with hearing individuals using sign language. The United States and several other countries compensate companies to provide 'Video Relay Services' (VRS). Telecommunication equipment can be used to talk to others via a sign language interpreter, who uses a conventional telephone at the same time to communicate with the deaf person's party. Video equipment is also used to do on-site sign language translation via Video Remote Interpreting (VRI). The relative low cost and widespread availability of 3G mobile phone technology with video calling capabilities have given deaf and speech-impaired users a greater ability to communicate with the same ease as others. Some wireless operators have even started free sign language gateways.

Sign language interpretation services via VRS or by VRI are useful in the present-day where one of the parties is deaf, hard-of-hearing or speech-impaired (mute). In such cases the interpretation flow is normally within the same principal language, such as French Sign Language (FSL) to spoken French, Spanish Sign Language (SSL) to spoken Spanish, British Sign Language (BSL) to spoken English, and American Sign Language (ASL) also to spoken English (since BSL and ASL are completely distinct), and so on.



A Video Interpreter (V.I.) assisting an on-screen client

Multilingual sign language interpreters, who can also translate as well across principal languages (such as to and from SSL, to and from spoken English), are also available, albeit less frequently. Such activities involve considerable effort on the part of the translator, since sign languages are distinct natural languages with their own construction, semantics and syntax, different from the aural version of the same principal language.

With video interpreting, sign language interpreters work remotely with live video and audio feeds, so that the interpreter can see the deaf or mute party, and converse with the hearing party, and vice versa. Much like telephone interpreting, video interpreting can be used for situations in which no on-site interpreters are available. However, video interpreting cannot be used for situations in which all parties are speaking via telephone alone. VRI and VRS interpretation requires all parties to have the necessary equipment. Some advanced equipment enables interpreters to remotely control the video camera, in order to zoom in and out or to point the camera toward the party that is signing.

Education



A professional development expert in Denver uses telepresence to coach a teacher in Utah during the initial research of **Project ThereNow**, by Digital Video Enterprises (DVE)

Research has been conducted on the use of telepresence to provide professional development to teachers. Research has shown that one of the most effective forms of teacher professional development is coaching, or cognitive apprenticeship. The application of telepresence shows promise for making this approach to teacher professional development practical.

The benefits of enabling schoolchildren to take an active part in exploration have also been shown by the JASON and the NASA Ames Research Center programs. The ability of a pupil, student, or researcher to explore an otherwise inaccessible location is a very attractive proposition; For example, locations where the passage of too many people is harming the immediate environment or the artifacts themselves, e.g. undersea exploration of coral reefs, ancient Egyptian tombs, and more recent works of art.

Telepresence art



A soap opera for iMacs

True telepresence is a multidisciplinary art and science that foundationally integrates engineering, psychology, and the art of television broadcast.

In 1998, Diller and Scofidio created the "Refresh", an Internet-based art installation that juxtaposed a live web camera with recorded videos staged by professional actors. Each image was accompanied with a fictional narrative which made it difficult to distinguish which was the live web camera.

In 1993, Eduardo Kac and Ed Bennett created a telepresence installation "Ornitorrinco on the Moon", for the international telecommunication arts festival "Blurred Boundaries" (Entgrenzte Grenzen II). It was coordinated by Kulturdata, in Graz, Austria, and was connected around the world.

Telepresence and artificial intelligence

Marvin Minsky was one of the pioneers of intelligence-based mechanical robotics and telepresence. He designed and built some of the first mechanical hands with tactile sensors, visual scanners, and their software and computer interfaces. He also influenced many robotic projects outside of MIT, and designed and built the first LOGO "turtle."

Chapter 2

List of Video Telecommunication Services and Product Brands

This **list of video telecommunication services and product brands** is for groupings of video telecommunication services and for manufacturers' brands of videophones, webcams and video conferencing hardware and systems, all related to videotelephony for two-way communications with live video and audio.

- The first section includes **video telecommunication devices** such as: videophones, videoconferencing and telepresence systems, webcams and related products such as codecs and videoconferencing software clients;
- the second section is a listing of **video telecommunication services** such as Video Relay Services (for deaf, hard-of-hearing and speech-impaired individuals), Telemedicine, Public Access Videoconferencing facilities, etc...;
- the last section at the bottom of this page lists **defunct brands and services** for historical research purposes.

Descriptive names and terminology



A typical **low-cost webcam** for use with personal computers and many popular videotelecommunication programs

Videophone calls (also: '*videocalls*' and '*video chat*'), differ from **videoconferencing** in that they expect to serve individuals, not groups. However that distinction has become increasingly blurred with technology improvements such as increased bandwidth and sophisticated software clients that can allow for multiple parties on a call. In general everyday usage the term *videoconferencing* is now frequently used instead of *videocall* for point-to-point calls between two units. Both videophone calls and videoconferencing are also now commonly referred to as a '*video link*'.

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The products below are listed by their *normal and intended* purpose, even though their names or descriptions may differ from the categories shown here (refer to terminology within general article pages).

Section 1: Hardware and related product brands



Worldgate Ojo PVP-900 broadband videophone from 2005, notable for its vertical styling and the cordless handset resting on the support arm for its 'portrait' type display.

Videophone hardware brands for person-to-person (point-to-point) use

Stand-alone videophones are point-to-point units *not* employing *Multipoint Control Units* (centralized distribution and call management systems). Earlier models make video calls utilizing older analogue POTS telephone lines, while later models use newer, higher quality, ADSL, ISDN or cable broadband technologies. Some videophones also employ Internet calling (IP) capabilities which can dispense with the need for telephone service.

- ACN: **IRIS** (United States)
- BrightCom: **Clearview & Lumina Telepresence** (United States)
- D-Link: **DVC series** (Taiwan)
- HP: Halo Telepresence Solutions (United States)
- Leadtek: IP broadband videophone (Taiwan)
- LifeSize: **Passport & Express** (United States)
- LG/LifeSize: **LG Executive powered by LifeSize** (United States)
- LG-Nortel: LVP series PSTN, ISDN and IP videophones (South Korea)
- Tandberg: **E20** (Norway)
- Telio: **Telio videotelefon IP3870** (Norway)
- Worldgate: **Ojo PVP series** (United States)

Videoconferencing and telepresence hardware systems meant for multiple participants



A Teliris VirtualLife **high resolution telepresence system** in use



Applying telepresence to education: a professional development expert in Colorado, U.S. uses telepresence to coach a teacher in Utah during research for *Project thereNow*

Video conferencing systems allow multiple participants by use of a *Multipoint Control Unit* (a centralized distribution and call management system) or via a similar non-centralized multipoint capability technology embedded in each unit. Some multiple party systems utilize Web-based *bridging service* providers, which can occur slight time delays.

- Aethra: **X-Line** series (Italy)
- AVerMedia: **AVerComm H-Series** (United States)
- BrightCom: **Lumina Telepresence** (United States)
- Cisco Systems: Cisco TelePresence (United States)
- HP: **Halo** (United States)
- LG-Nortel: LVP series PSTN, ISDN and IP videophones (South Korea)
- LifeSize: **Team, Room & Conference** (United States)
- Panasonic: **VC500** (Japan)
- Polycom: **RPX, TPX, HDX, VSX series** (United States)
- Polycom: **VVX** (United States)
- Radvision: **Scopia** systems (Israel)
- Sony: **PCS** systems (Japan)
- Tandberg: **T3 Telepresence** (Norway)
- Vidyo: **VidyoRoom & VidyoDesktop** (United States)

Videoconferencing hardware systems meant for the deaf, hard-of-hearing, telemedical and other institutional services

- IVèS: Total conversation solution (video, voice and real time text) for Video Relay Services (VRS), Video Remote Interpreting (VRI), Text Relay and telemedecine.
- Mirial s.u.r.l.: PSE Video Contact Center, comprehensive solution for remote audio and video contact services
- Polycom: Practitioner Cart, HDX Immersive Telemedicine Education systems

Videoconference bridging service providers

- CoroWare Inc.: CoroCall HD Video Conferencing Service (United States)
- Glowpoint Conferencing Services, Glowpoint Inc. (United States)

Webcam hardware brands for use on personal computers



A pre-2006 **Apple iSight webcam**, with software drivers written specifically for Apple's operating systems



A 2009 **LifeCam** Cinema USB video device for use with standard drivers

- Apple: **iSight** series/components (United States)
- BrightCom: **ClearView PC** series (United States)
- Creative: **Live! Cam** series (Singapore)
- FaceVtion: **TouchCam** (Taiwan)
- Genius (Taiwan)
- Hama **CM Series**, plus other various models (Germany)
- Hercules: **Dualpix** (France)
- Labtec: **Labtec WebCam** Series (United States)
- Lenovo: **Webcam** (People's Republic of China)
- Logitech: **QuickCam** series (Switzerland)
- Linksys by Cisco (United States)
- Microsoft: **LifeCam** Series (United States)

- Philips: **SPC Webcam** Series (Netherlands)
- Samsung (South Korea)
- Sony: **Playstation EYE** webcam (Japan)
- Trust: **WB Series**, plus various other models (Netherlands)

Software clients –general brands

- Adobe Systems: **Acrobat Connect**
- BrightCom: **Visual Collaboration System - VCS**
- Cisco: **WebEx**
- Glance Networks
- GlobalMedia: "**EasyShareVC**"
- InterCall
- IVèS: **Live Video Plugin**
- LifeSize: **Desktop**
- Microsoft: **NetMeeting**
- Microsoft: **Office Live Meeting**
- Mirial s.u.r.l.: **Mirial Softphone**
- Nefsis: **Nefsis Professional**
- ooVoo: **ooVoo (Only for Windows & Mac)**
- Radvision: **MTF, VTA & IMS Applications**
- SightSpeed: **Video Chat**
- Skype
- Stickam
- Tandberg: **Movi**
- Tokbox
- Vidy: **Vidyo Conferencing**
- vzRoom

Software clients –free instant messaging video programs

- AOL Instant Messenger (AIM)
- Camfrog
- CU-SeeMe
- Ekiga
- FilmOn
- Gmail
- Google Talk
- iChat
- **Meetcam**
- Microsoft: Windows Live Messenger
- Microsoft: Windows Live Video Messages
- ooVoo
- Paltalk (now PaltalkScene)
- SightSpeed
- Skype

- Stickam
- Tokbox
- Yahoo Messenger
- MeBeam

Software clients for deaf and hard-of-hearing VRS/VRI facilities

- IVèS: Live Video Plugin
- Mirial s.u.r.l.: Mirial Softphone

Server Software

- BrightCom: Visual Collaboration System
- GNU Gatekeeper
- IVèS : Total conversation cloud
- Mirial s.u.r.l.: ClearSea

Section 2: Video telecommunication services listing

Video telecommunication services for the deaf and hard-of-hearing

- National Association for the Deaf: **Video Relay Service (VRS)**

Medical organizations employing video telecommunications

- American Telemedicine Association
- Association of Telehealth Service Providers (ATSP) (International)
- Ontario Telemedicine Network

Public video conferencing facilities

- FedEx Office: formerly *FedEx-Kinko's*. Conference rooms with video conferencing.
- Marriott Hotels: conference rooms with video conferencing.
- **Regus Offices**: conference rooms with video conferencing.

Section 3: Defunct brands & services

Brands, manufacturers and other services listed here are no longer in production or no longer exist, and are listed for historical or research purposes.

Defunct videophone brands

- **Picturephone**, world's first commercialized videophone for individual and business use, developed by AT&T and Bell Labs

Defunct videoconferencing system brands

- IBM **Person to Person**, a software-only collaborative conferencing system interoperable between OS/2, Windows and AIX developed and marketed between 1991 and 1995.

WWT

Chapter 3

Videotelephony

Videotelephony comprises the technologies for the reception and transmission of audio-video signals by users at different locations, for communication between people in real-time.

At the dawn of the technology, videotelephony also included *image phones* which would exchange still images between units every few seconds over conventional POTS-type telephone lines, essentially the same as slow scan TV systems.

Currently videotelephony is particularly useful to the deaf and speech-impaired who can use them with sign language and also with a video relay service, and well as to those with mobility issues or those who are located in distant places and are in need of telemedical or tele-educational services.



An upscale Teliris VirtuaLive **telepresence** system in use

Early history

The concept of videotelephony was first popularized in the late 1880s in both the United States and Europe, although the sciences to permit its very earliest trials would take nearly a half century to be discovered. These evolved from studies and experimentation in the fields of electrical telegraphy, telephony, radio and television.

The development of video and television transmission technologies in the United States and the United Kingdom started in the latter half of the 1920s, spurred notably by AT&T, occurred in part to serve as an adjunct to the use of the telephone. A number of organizations believed that videotelephony would be superior to plain voice telecommunication. However video technology was to be deployed as television broadcasting long before it could become practical in videotelephony.

Major categories



A modern Avaya Nortel 1535 IP model broadband **videophone**

Videotelephony can be categorized by its functionality, that is to its intended purpose, and also by its method of transmissions.

Videophones were the earliest form of videotelephony, dating back to initial tests in 1927 by AT&T. During the late 1930s the post offices of several European governments established public videophone services for person-to-person communications utilizing dual cable circuit telephone transmission technology. In the present day standalone videophones and UMTS video-enabled mobile phones are usually used on a person-to-person basis.

Videoconferencing saw its earliest use with AT&T's Picturephone service in the early 1970s. Transmissions were analog over short distances, but converted to digital forms for longer calls, again using telephone transmission technology. Popular corporate videoconferencing systems in the present day have migrated almost exclusively to digital ISDN and IP transmission modes due to the need to convey the very large amounts of data generated by their cameras and microphones. These systems are often intended for use in conference mode, that is by many people in several different locations, all of whom can be viewed by every participant at each location.



An older dual-display Polycom **videoconferencing** system

Telepresence systems are a newer, more advanced subset of videoconferencing systems, meant to allow higher degrees of video and audio fidelity. Such high end systems are typically deployed in corporate settings.

Personal computer based web cameras are an often modest form of videotelephony, usually used for point-to-point videophone calls.

Each of the systems has its own advantages and disadvantages, including video quality, capital cost, degrees of sophistication, transmission capacity requirements, and cost of use.

Categories by cost and quality of service

From the least to the most expensive systems:

- Web camera videophone and videoconferencing systems that serve as compliments to personal computers, connected to other participants by computer and VoIP networks –lowest direct cost assuming the users already possess computers at their respective locations. Quality of service can range from low to very high, including high definition video available on the latest model webcams;



A typical **low-cost webcam** for use with personal computers

Sign language communications via videotelephony

One of the first demonstrations of the ability for telecommunications to help sign language users communicate with each other occurred when AT&T's videophone (trademarked as the 'Picturephone') was introduced to the public at the 1964 New York World's Fair –two deaf users were able to freely communicate with each other between the fair and another city. Various other organizations, including British Telecom's Martlesham facility and several universities have also conducted extensive research on signing via videotelephony. The use of sign language via **videotelephony** was hampered for many years due to the difficulty of using it over regular analogue phone lines coupled with the high cost of better quality data phone lines, factors which largely disappeared with the advent of high-speed ISDN and IP Internet services in the last decade of the 20th Century.

Using such video equipment, the deaf, hard-of-hearing and speech-impaired can communicate between themselves and with hearing individuals using sign language. The United States and several other countries compensate companies to provide 'Video Relay Services' (VRS). Telecommunication equipment can be used to talk to others via a sign language interpreter, who uses a conventional telephone at the same time to communicate with the deaf person's party. Video equipment is also used to do on-site sign language translation via Video Remote Interpreting (VRI). The relative low cost and widespread availability of 3G mobile phone technology with video calling capabilities have given deaf and speech-impaired users a greater ability to communicate with the same ease as others. Some wireless operators have even started free sign language gateways.

Sign language interpretation services via VRS or by VRI are useful in the present-day where one of the parties is deaf, hard-of-hearing or speech-impaired (mute). In such cases the interpretation flow is normally within the same principal language, such as French Sign Language (FSL) to spoken French, Spanish Sign Language (SSL) to spoken Spanish, British Sign Language (BSL) to spoken English, and American Sign Language (ASL) also to spoken English (since BSL and ASL are completely distinct), and so on.

Multilingual sign language interpreters, who can also translate as well across principal languages (such as to and from SSL, to and from spoken English), are also available, albeit less frequently. Such activities involve considerable effort on the part of the translator, since sign languages are distinct natural languages with their own construction, semantics and syntax, different from the aural version of the same principal language.

With video interpreting, sign language interpreters work remotely with live video and audio feeds, so that the interpreter can see the deaf or mute party, and converse with the hearing party, and vice versa. Much like telephone interpreting, video interpreting can be used for situations in which no on-site interpreters are available. However, video interpreting cannot be used for situations in which all parties are speaking via telephone alone. VRI and VRS interpretation requires all parties to have the necessary equipment. Some advanced equipment enables interpreters to remotely control the video camera, in order to zoom in and out or to point the camera toward the party that is signing.

Descriptive names and terminology

Videophone calls (also: '*videocalls*' and '*video chat*'), differ from **videoconferencing** in that they expect to serve individuals, not groups. However that distinction has becoming increasingly blurred with technology improvements such as increased bandwidth and sophisticated software clients that can allow for multiple parties on a call. In general everyday usage the term *videoconferencing* is now frequently used instead of *videocall* for point-to-point calls between two units. Both videophone calls and videoconferencing are also now commonly referred to as a '*video link*'.

Webcams are popular, relatively low cost devices which can provide live video and audio streams via personal computers, and can be used with many software clients for both video calls and videoconferencing.

A **videoconference system** is generally higher cost than a videophone and deploys greater capabilities. A *videoconference* (also known as a videoteleconference) allows two or more locations to communicate via live, simultaneous two-way video and audio transmissions. This is often accomplished by the use of a multipoint control unit (a centralized distribution and call management system) or by a similar non-centralized multipoint capability embedded in each videoconferencing unit. Again, technology improvements have circumvented traditional definitions by allowing multiple party videoconferencing via web-based applications. A separate webpage article is devoted to videoconferencing.

A **telepresence system** is a high-end videoconferencing system and service usually employed by enterprise-level corporate offices. Telepresence conference rooms use state-of-the-art room designs, video cameras, displays, sound-systems and processors, coupled with high-to-very-high capacity bandwidth transmissions.

Typical uses of the various technologies described above include videocalling or videoconferencing on a one-to-one, one-to-many or many-to-many basis for personal, business, educational, deaf Video Relay Service and tele-medical, diagnostic and rehabilitative use or services. New services utilizing videocalling and videoconferencing, such as personal videocalls to inmates incarcerated in penitentiaries, and videoconferencing to resolve airline engineering issues at maintenance facilities, are being created or evolving on an on-going basis.

Chapter 4

Videoconferencing



A Tandberg T3 high resolution telepresence room in use

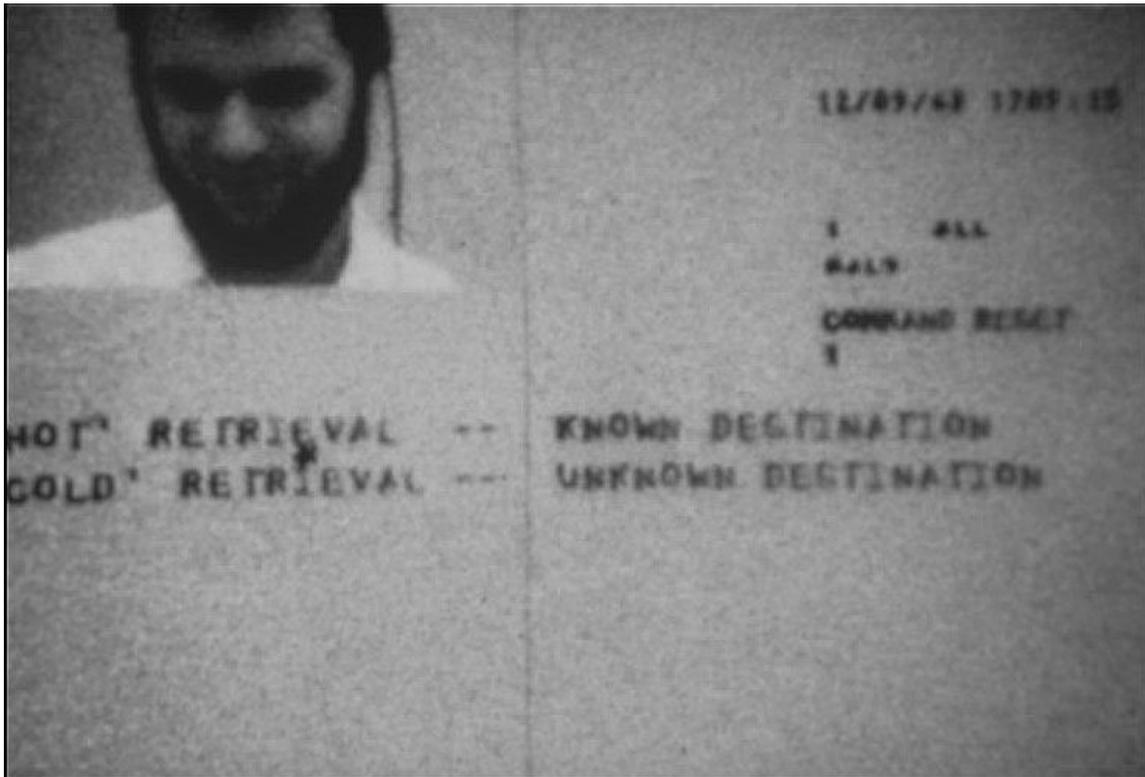


Indonesian and U.S. students participating in a **educational videoconference**

A **videoconference** or **video conference** (also known as a *videoteleconference*) is a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously. It has also been called 'visual collaboration' and is a type of groupware.

Videoconferencing differs from videophone calls in that it's designed to serve a conference rather than individuals. It is an intermediate form of videotelephony, first deployed commercially by AT&T during the early 1970s using their Picturephone technology.

History



Videoconferencing first demonstrated in 1968

Videoconferencing uses telecommunications of audio and video to bring people at different sites together for a meeting. This can be as simple as a conversation between two people in private offices (point-to-point) or involve several sites (multi-point) with more than one person in large rooms at different sites. Besides the audio and visual transmission of meeting activities, videoconferencing can be used to share documents, computer-displayed information, and whiteboards.

Simple analog videoconferences could be established as early as the invention of the television. Such videoconferencing systems usually consisted of two closed-circuit television systems connected via coax cable or radio. An example of that was the German Reich Postzentramt (Post Office) network set up in Berlin and several other cities from 1936 to 1940.

During the first manned space flights, NASA used two radiofrequency (UHF or VHF) links, one in each direction. TV channels routinely use this kind of videoconferencing when reporting from distant locations, for instance. Then mobile links to satellites using specially equipped trucks became rather common.

This technique was very expensive, though, and could not be used for applications such as telemedicine, distance education, and business meetings. Attempts at using normal

telephony networks to transmit slow-scan video, such as the first systems developed by AT&T, failed mostly due to the poor picture quality and the lack of efficient video compression techniques. The greater 1 MHz bandwidth and 6 Mbit/s bit rate of Picturephone in the 1970s also did not cause the service to prosper.

It was only in the 1980s that digital telephony transmission networks became possible, such as ISDN, assuring a minimum bit rate (usually 128 kilobits/s) for compressed video and audio transmission. During his time, there was also research into other forms of digital video and audio communication. Many of these technologies, such as the Media space, are not as widely used today as videoconferencing but were still an important area of research. The first dedicated systems started to appear in the market as ISDN networks were expanding throughout the world. One of the first commercial Videoconferencing systems sold to companies came from PictureTel Corp. who had an Initial Public Offering in November, 1984. Videoconferencing systems throughout the 1990s rapidly evolved from very expensive proprietary equipment, software and network requirements to standards based technology that is readily available to the general public at a reasonable cost.

Finally, in the 1990s, IP (Internet Protocol) based videoconferencing became possible, and more efficient video compression technologies were developed, permitting desktop, or personal computer (PC)-based videoconferencing. In 1992 CU-SeeMe was developed at Cornell by Tim Dorcey et al. In 1995 the First public videoconference and peacecast between the continents of North America and Africa took place, linking a technofair in San Francisco with a techno-rave and cyberdeli in Cape Town. At the Winter Olympics opening ceremony in Nagano, Japan, Seiji Ozawa conducted the Ode to Joy from Beethoven's Ninth Symphony simultaneously across five continents in near-real time.

In the 2000s, videotelephony was popularized via free Internet services such as Skype and iChat, web plugins and on-line telecommunication programs which promoted low cost, albeit low-quality, videoconferencing to virtually every location with an Internet connection.

In May 2005, the first high definition video conferencing systems, produced by LifeSize Communications, were displayed at the Interop trade show in Las Vegas, Nevada, able to provide 30 frames per second at a 1280 by 720 display resolution. Polycom introduced its first high definition video conferencing system to the market in 2006. Currently, high definition resolution has now become a standard feature, with most major suppliers in the videoconferencing market offering it.

Technology



Dual display: An older Polycom VSX 7000 system and camera used for videoconferencing, with two displays for simultaneous broadcast from separate locations.



Various components and the camera of a LifeSize Communications Room 220 high definition multipoint system.

The core technology used in a videoconferencing system is digital compression of audio and video streams in real time. The hardware or software that performs compression is called a codec (coder/decoder). Compression rates of up to 1:500 can be achieved. The resulting digital stream of 1s and 0s is subdivided into labeled packets, which are then transmitted through a digital network of some kind (usually ISDN or IP). The use of audio modems in the transmission line allow for the use of POTS, or the Plain Old Telephone System, in some low-speed applications, such as videotelephony, because they convert the digital pulses to/from analog waves in the audio spectrum range.

The other components required for a videoconferencing system include:

- **Video input** : video camera or webcam
- **Video output**: computer monitor , television or projector
- **Audio input**: microphones, CD/DVD player, cassette player, or any other source of PreAmp audio outlet.
- **Audio output**: usually loudspeakers associated with the display device or telephone
- **Data transfer**: analog or digital telephone network, LAN or Internet

There are basically two kinds of videoconferencing systems:

1. **Dedicated systems** have all required components packaged into a single piece of equipment, usually a console with a high quality remote controlled video camera. These cameras can be controlled at a distance to pan left and right, tilt up and down, and zoom. They became known as PTZ cameras. The console contains all electrical interfaces, the control computer, and the software or hardware-based codec. Omnidirectional microphones are connected to the console, as well as a TV monitor with loudspeakers and/or a video projector. There are several types of dedicated videoconferencing devices:
 1. Large group videoconferencing are non-portable, large, more expensive devices used for large rooms and auditoriums.
 2. Small group videoconferencing are non-portable or portable, smaller, less expensive devices used for small meeting rooms.
 3. Individual videoconferencing are usually portable devices, meant for single users, have fixed cameras, microphones and loudspeakers integrated into the console.
2. **Desktop systems** are add-ons (hardware boards, usually) to normal PCs, transforming them into videoconferencing devices. A range of different cameras and microphones can be used with the board, which contains the necessary codec and transmission interfaces. Most of the desktops systems work with the H.323 standard. Videoconferences carried out via dispersed PCs are also known as e-meetings.

.Conferencing Layers.

The components within a Conferencing System can be divided up into several different layers: User Interface, Conference Control, Control or Signal Plane and Media Plane.

Video Conferencing User Interfaces could either be graphical or voice responsive. Many of us have encountered both types of interfaces, normally we encounter graphical interfaces on the computer or television, and Voice Responsive we normally get on the phone, where we are told to select a number of choices by either saying it or pressing a number. User interfaces for conferencing have a number of different uses; it could be used for scheduling, setup, and making the call. Through the User Interface the administrator is able to control the other three layers of the system.

Conference Control performs resource allocation, management and routing. This layer along with the User Interface creates meetings (scheduled or unscheduled) or adds and removes participants from a conference.

Control (Signaling) Plane contains the stacks that signal different endpoints to create a call and/or a conference. Signals can be, but aren't limited to, H.323 and Session Initiation Protocol (SIP) Protocols. These signals control incoming and outgoing connections as well as session parameters.

The Media Plane controls the audio and video mixing and streaming. This layer manages Real-Time Transport Protocols, User Datagram Packets (UDP) and Real-Time Transport Control Protocols (RTCP). The RTP and UDP normally carry information such the payload type which is the type of codec, frame rate, video size and many others. RTCP on the other hand acts as a quality control Protocol for detecting errors during streaming.

Multipoint videoconferencing

Simultaneous videoconferencing among three or more remote points is possible by means of a Multipoint Control Unit (MCU). This is a bridge that interconnects calls from several sources (in a similar way to the audio conference call). All parties call the MCU unit, or the MCU unit can also call the parties which are going to participate, in sequence. There are MCU bridges for IP and ISDN-based videoconferencing. There are MCUs which are pure software, and others which are a combination of hardware and software. An MCU is characterised according to the number of simultaneous calls it can handle, its ability to conduct transposing of data rates and protocols, and features such as Continuous Presence, in which multiple parties can be seen on-screen at once. MCUs can be stand-alone hardware devices, or they can be embedded into dedicated videoconferencing units.

The MCU consists of two logical components:

1. A single multipoint controller (MC), and
2. Multipoint Processors (MP), sometimes referred to as the mixer.

The MC controls the conferencing while it is active on the signaling plane, which is simply where the system manages conferencing creation, endpoint signaling and in-conferencing controls. This component negotiates parameters with every endpoint in the network and controls conferencing resources. While the MC controls resources and signaling negotiations, the MP operates on the media plane and receives media from each endpoint. The MP generates output streams from each endpoint and redirects the information to other endpoints in the conference.

Some systems are capable of multipoint conferencing with no MCU, stand-alone, embedded or otherwise. These use a standards-based H.323 technique known as "decentralized multipoint", where each station in a multipoint call exchanges video and audio directly with the other stations with no central "manager" or other bottleneck. The advantages of this technique are that the video and audio will generally be of higher quality because they don't have to be relayed through a central point. Also, users can make ad-hoc multipoint calls without any concern for the availability or control of an MCU. This added convenience and quality comes at the expense of some increased network bandwidth, because every station must transmit to every other station directly.

Vide Conferencing modes

Vide Conferencing systems have several common operating modes that are used:

1. Voice-Activated Switch (VAS);
2. Continuous Presence.

In VAS mode, the MCU switches which endpoint can be seen by the other endpoints by the levels of one's voice. If there are four people in a conference, the only one that will be seen in the conference is the site which is talking; the location with the loudest voice will be seen by the other participants.

Continuous Presence mode display multiple participants at the same time. The MP in this mode puts together the streams from the different endpoints and puts them all together into a single video image. In this mode, the MCU normally sends the same type of images to all participants. Typically these types of images are called "layouts" and can vary depending on the number of participants in a conference.

Echo cancellation

A fundamental feature of professional videoconferencing systems is Acoustic Echo Cancellation (AEC). Echo can be defined as the reflected source wave interference with new wave created by source. AEC is an algorithm which is able to detect when sounds or utterances reenter the audio input of the videoconferencing codec, which came from the audio output of the same system, after some time delay. If unchecked, this can lead to several problems including:

1. the remote party hearing their own voice coming back at them (usually significantly delayed)
2. strong reverberation, rendering the voice channel useless as it becomes hard to understand and
3. howling created by feedback. Echo cancellation is a processor-intensive task that usually works over a narrow range of sound delays.

Problems

Some observers argue that two outstanding issues have prevented videoconferencing from becoming a standard form of communication, despite the ubiquity of videoconferencing-capable systems. These issues are:

1. **Eye Contact:** Eye contact plays a large role in conversational turn-taking, perceived attention and intent, and other aspects of group communication. While traditional telephone conversations give no eye contact cues, many videoconferencing systems are arguably worse in that they provide an incorrect impression that the remote interlocutor is avoiding eye contact. Some telepresence systems have cameras located in the screens that reduce the amount of parallax

observed by the users. This issue is also being addressed through research that generates a synthetic image with eye contact using stereo reconstruction. Telcordia Technologies, formerly Bell Communications Research, owns a patent for eye-to-eye videoconferencing using rear projection screens with the video camera behind it, evolved from a 1960s U.S. military system that provided videoconferencing services between the White House and various other government and military facilities. This technique eliminates the need for special cameras or image processing.

2. **Appearance Consciousness:** A second psychological problem with videoconferencing is being on camera, with the video stream possibly even being recorded. The burden of presenting an acceptable on-screen appearance is not present in audio-only communication. Early studies by Alphonse Chapanis found that the addition of video actually impaired communication, possibly because of the consciousness of being on camera.
3. **Signal latency:** The information transport of digital signals in many steps need time. In a telecommunicated conversation, an increased latency larger than about 150-300ms becomes noticeable and is soon observed as unnatural and distracting. Therefore, next to a **stable large bandwidth**, a small total round-trip time is another major technical requirement for the communication channel for interactive videoconferencing.

The issue of eye-contact may be solved with advancing technology, and presumably the issue of appearance consciousness will fade as people become accustomed to videoconferencing.

Standards



The Tandberg E20 is an example of a SIP-only device. Such devices need to route calls through a Video Communication Server to be able to reach H.323 systems, a process known as "interworking".

The International Telecommunications Union (ITU) (formerly: Consultative Committee on International Telegraphy and Telephony (CCITT)) has three umbrellas of standards for videoconferencing

ITU H.320 is known as the standard for public switched telephone networks (PSTN) or videoconferencing over integrated services digital networks (it is accessible to anyone with a high speed Internet connection, such as DSL).

H.264 SVC (Scalable Video Coding) is a compression standard that enables video conferencing systems to achieve highly error resilient IP video transmission over the public Internet without quality of service enhanced lines. This standard has enabled wide scale deployment of high definition desktop video conferencing and made possible new architectures which reduce latency between transmitting source and receiver, resulting in fluid communication without pauses.

In addition, an attractive factor for IP videoconferencing is that it is easier to set-up for use with a live videoconferencing call along with web conferencing for use in data collaboration. These combined technologies enable users to have a much richer multimedia environment for live meetings, collaboration and presentations.

The Unified Communications Interoperability Forum (UCIF), a non-profit alliance between communications vendors, launched on May 19, 2010. The organization's vision is to maximize the interoperability of UC based on existing standards. Founding members of UCIF include HP, Microsoft, Polycom, Logitech/LifeSize Communications and Juniper Networks.

ITU V.80: videoconferencing is generally compatibilized with H.324 standard point-to-point video telephony over regular phone lines.

Social and institutional impact

Impact on the general public

High speed Internet connectivity has become more widely available at a reasonable cost and the cost of video capture and display technology has decreased. Consequently, personal videoconferencing systems based on a webcam, personal computer system, software compression and broadband Internet connectivity have become affordable to the general public. Also, the hardware used for this technology has continued to improve in quality, and prices have dropped dramatically. The availability of freeware (often as part of chat programs) has made software based videoconferencing accessible to many.

For over a century, futurists have envisioned a future where telephone conversations will take place as actual face-to-face encounters with video as well as audio. Sometimes it is simply not possible or practical to have face-to-face meetings with two or more people. Sometimes a telephone conversation or conference call is adequate. Other times, an e-mail exchanges are adequate. However, videoconferencing adds another possible alternative, and can be considered when:

- a live conversation is needed;
- visual information is an important component of the conversation;

- the parties of the conversation can't physically come to the same location; or
- the expense or time of travel is a consideration.

Deaf, hard-of-hearing and mute individuals have a particular interest in the development of affordable high-quality videoconferencing as a means of communicating with each other in sign language. Unlike Video Relay Service, which is intended to support communication between a caller using sign language and another party using spoken language, videoconferencing can be used between two signers.

Mass adoption and use of videoconferencing is still relatively low, with the following often claimed as causes:

- Complexity of systems. Most users are not technical and want a simple interface. In hardware systems an unplugged cord or a flat battery in a remote control is seen as failure, contributing to perceived unreliability which drives users back to traditional meetings. Successful systems are backed by support teams who can pro-actively support and provide fast assistance when required.
- Perceived lack of interoperability: not all systems can readily interconnect, for example ISDN and IP systems require a gateway. Popular software solutions cannot easily connect to hardware systems. Some systems use different standards, features and qualities which can require additional configuration when connecting to dis-similar systems.
- Bandwidth and quality of service: In some countries it is difficult or expensive to get a high quality connection that is fast enough for good-quality video conferencing. Technologies such as ADSL have limited upload speeds and cannot upload and download simultaneously at full speed. As Internet speeds increase higher quality and high definition video conferencing will become more readily available.
- Expense of commercial systems - a well designed system requires a specially designed room and can cost hundreds of thousands of dollars to fit out the room with codecs, integration equipment and furniture.
- Participants being self-conscious about being on camera, especially new users and older generations.
- Lack of eye contact (as mentioned in Problems)

For these reasons many hardware systems are often used for internal corporate use only, as they are less likely to run into problems and lose a sale. An alternative is companies that hire out videoconferencing equipped meeting rooms in cities around the world. Customers simply book the rooms and turn up for the meeting - everything else is arranged and support is readily available if anything should go wrong.

Impact on education

Videoconferencing provides students with the opportunity to learn by participating in two-way communication forums. Furthermore, teachers and lecturers worldwide can be brought to remote or otherwise isolated educational facilities. Students from diverse

communities and backgrounds can come together to learn about one another, although language barriers will continue to persist. Such students are able to explore, communicate, analyze and share information and ideas with one another. Through videoconferencing students can visit other parts of the world to speak with their peers, and visit museums and educational facilities. Such virtual field trips can provide enriched learning opportunities to students, especially those in geographically isolated locations, and to the economically disadvantaged. Small schools can use these technologies to pool resources and provide courses, such as in foreign languages, which could not otherwise be offered.

A few examples of benefits that videoconferencing can provide in campus environments include:

- faculty members keeping in touch with classes while attending conferences;
- guest lecturers brought into classes from other institutions;
- researchers collaborating with colleagues at other institutions on a regular basis without loss of time due to travel;
- schools with multiple campuses collaborating and sharing professors;
- faculty members participating in thesis defenses at other institutions;
- administrators on tight schedules collaborating on budget preparation from different parts of campus;
- faculty committee auditioning scholarship candidates;
- researchers answering questions about grant proposals from agencies or review committees;
- student interviews with an employer in other cities, and
- teleseminars.

Impact on medicine and health

Videoconferencing is a highly useful technology for real-time telemedicine and telenursing applications, such as diagnosis, consulting, transmission of medical images, etc... With videoconferencing, patients may contact nurses and physicians in emergency or routine situations; physicians and other paramedical professionals can discuss cases across large distances. Rural areas can use this technology for diagnostic purposes, thus saving lives and making more efficient use of health care money. For example, a rural medical center in Ohio, United States, used videoconferencing to successfully cut the number of transfers of sick infants to a hospital 70 miles (110 km) away. This had previously cost nearly \$10,000 per transfer.

Special peripherals such as microscopes fitted with digital cameras, videoendoscopes, medical ultrasound imaging devices, otoscopes, etc., can be used in conjunction with videoconferencing equipment to transmit data about a patient.

Impact on business

Videoconferencing can enable individuals in distant locations to participate in meetings on short notice, with time and money savings. Technology such as VoIP can be used in conjunction with desktop videoconferencing to enable low-cost face-to-face business meetings without leaving the desk, especially for businesses with widespread offices. The technology is also used for telecommuting, in which employees work from home. One research report based on a sampling of 1,800 corporate employees showed that, as of June 2010, 54% of the respondents with access to video conferencing used it “all of the time” or “frequently”.

Videoconferencing is also currently being introduced on online networking websites, in order to help businesses form profitable relationships quickly and efficiently without leaving their place of work. This has been leveraged by banks to connect busy banking professionals with customers in various locations using video banking technology.

Although videoconferencing has frequently proven its value, research has shown that some non-managerial employees prefer not to use it due to several factors, including anxiety. Some such anxieties can be avoided if managers use the technology as part of the normal course of business.

Researchers also find that attendees of business and medical videoconferences must work harder to interpret information delivered during a conference than they would if they attended face-to-face. They recommend that those coordinating videoconferences make adjustments to their conferencing procedures and equipment.

Impact on law

Videoconferencing has allowed testimony to be used for individuals who are not able to attend the physical legal settings. In a military investigation in North Carolina, Afghan witnesses have testified using videoconferencing. In Hall County, Georgia, LifeSize video conferencing systems are used for initial court appearances. The systems link jails with court rooms, reducing the expenses and security risks of transporting prisoners to the courtroom.

Impact on media relations

The concept of press videoconferencing was developed in October 2007 by the African Press Organization (APO), a Swiss based non-governmental organization, to allow African journalists to participate in international press conferences on developmental and good governance issues.

Press videoconferencing permits international press conferences via videoconferencing over the Internet. Journalists can participate on an international press conference from any location, without leaving their offices or countries. They need only be seated by a computer connected to the Internet in order to ask their questions to the speaker.

In 2004, the International Monetary Fund introduced the Online Media Briefing Center, a password-protected site available only to professional journalists. The site enables the IMF to present press briefings globally and facilitates direct questions to briefers from the press. The site has been copied by other international organizations since its inception. More than 4,000 journalists worldwide are currently registered with the IMF.

Videotelephony descriptive names & terminology

Videophone calls (also: '*videocalls*' and '*video chat*'), differ from **videoconferencing** in that they expect to serve individuals, not groups. However that distinction has becoming increasingly blurred with technology improvements such as increased bandwidth and sophisticated software clients that can allow for multiple parties on a call. In general everyday usage the term *videoconferencing* is now frequently used instead of *videocall* for point-to-point calls between two units. Both videophone calls and videoconferencing are also now commonly referred to as a '*video link*'.

Webcams are popular, relatively low cost devices which can provide live video and audio streams via personal computers, and can be used with many software clients for both video calls and videoconferencing.

A **videoconference system** is generally higher cost than a videophone and deploys greater capabilities. A *videoconference* (also known as a videoteleconference) allows two or more locations to communicate via live, simultaneous two-way video and audio transmissions. This is often accomplished by the use of a multipoint control unit (a centralized distribution and call management system) or by a similar non-centralized multipoint capability embedded in each videoconferencing unit. Again, technology improvements have circumvented traditional definitions by allowing multiple party videoconferencing via web-based applications. A separate webpage article is devoted to **videoconferencing**.

A **telepresence system** is a high-end videoconferencing system and service usually employed by enterprise-level corporate offices. Telepresence conference rooms use state-of-the-art room designs, video cameras, displays, sound-systems and processors, coupled with high-to-very-high capacity bandwidth transmissions.

Typical uses of the various technologies described above include videocalling or videoconferencing on a one-to-one, one-to-many or many-to-many basis for personal, business, educational, deaf Video Relay Service and tele-medical, diagnostic and rehabilitative use or services. New services utilizing videocalling and videoconferencing, such as personal videocalls to inmates incarcerated in penitentiaries, and videoconferencing to resolve airline engineering issues at maintenance facilities, are being created or evolving on an on-going basis.

Chapter 5

Videophone

A **videophone** is a telephone with a video screen, and is capable of full duplex (bi-directional) video and audio transmissions for communication between people in real-time. It was the first form of videotelephony, later to be followed by videoconferencing, webcams, and finally telepresence.

At the dawn of the technology, videotelephony also included *image phones* which would exchange still images between units every few seconds over conventional POTS-type telephone lines, essentially the same as slow scan TV systems.

Currently videophones are particularly useful to the deaf and speech-impaired who can use them with sign language, and also with video relay services to communicate with hearing persons. Videophones are also very useful to those with mobility issues or those who are located in distant places and are in need of telemedical or tele-educational services.

Descriptive names and terminology



Modern trend: newer units, such as this Avaya Nortel 1535 IP model, have migrated away from slow *POTS* lines to higher speed *ISDN* and *broadband VoIP* services

The name *videophone* never became as standardized as its earlier counterpart, the *telephone*, resulting in a variety of names and terms being used worldwide, and even within the same region or country. Videophones are also known as **video phones**, **videotelephones** (or **video telephones**) and often by an early trademarked name "**Picturephone**", which was the world's first commercial videophone produced in volume. The compound name '*videophone*' slowly entered into general use after 1950, although '*video telephone*' likely entered the lexicon earlier after '*video*' was coined in 1935.

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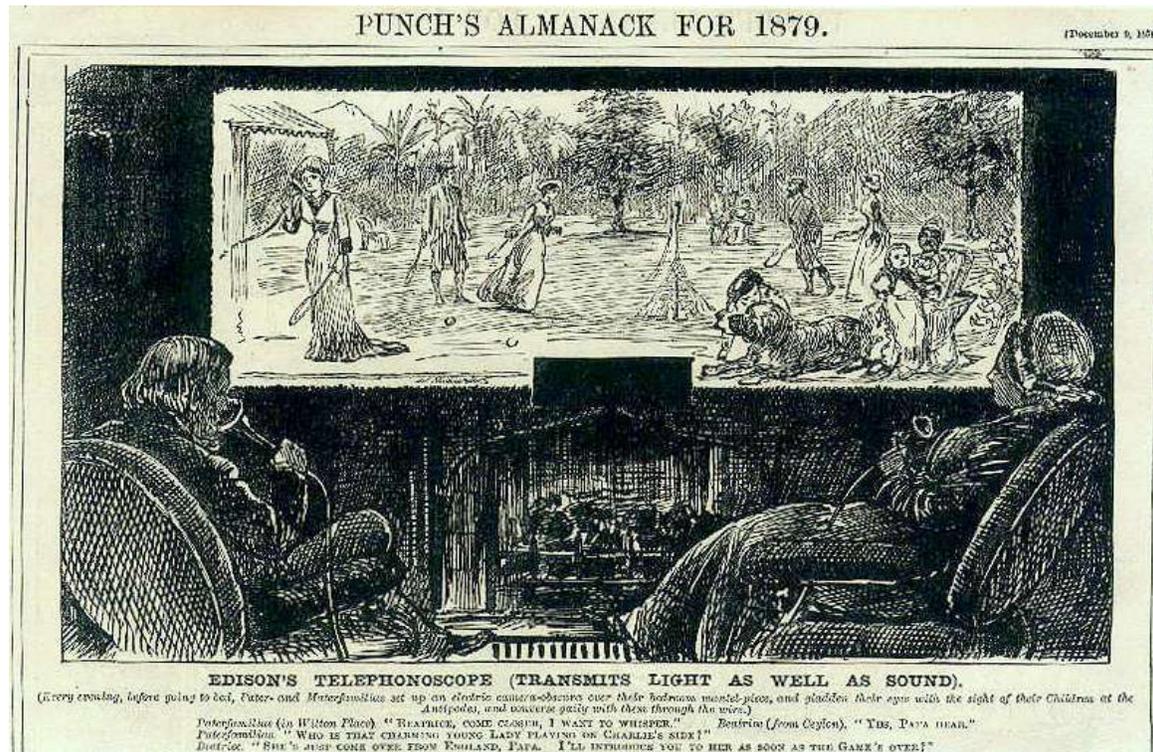
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Other names for 'videophone' that have been used in English are: **Viewphone** (the British Telecom equivalent to AT&T's Picturephone), and **visiophone**, a common French translation that has also crept into limited English usage, as well as over twenty less common names and expressions. Latin-based translations of 'videophone' in other languages include **vidéophone** (French), **bildtelefon** (German), **videotelefono** (Italian), both **videófono** and **videoteléfono** (Spanish), both **beeldtelefoon** and **videfoon** (Dutch), and **videofonía** (Catalan).

Early history



Fiction becomes fact: an imaginary early combination videophone-television, conceptualized by George du Maurier and published in 1878. Note the use of then-contemporary *speaking tubes* by both the father in the foreground and his daughter on the viewing display.

Barely two years after the telephone was first patented in the United States, an early concept of a combined videophone/wide-screen television called a **telephonoscope** was conceptualized in the popular periodicals of the day. It was also mentioned in various early science fiction works such as *Le Vingtième siècle: La vie électrique* (*The 20th Century: The Electrical Life*) and other works written by Albert Robida, and was also sketched in various cartoons by George du Maurier as a fictional invention of Thomas Edison. One such sketch was published on December 9, 1878 in *Punch* magazine.

The term **telectroscope** was also used in 1878 by French writer and publisher Louis Figuier, to popularize an invention wrongly interpreted as real and incorrectly ascribed to Alexander Graham Bell. Written under the pseudonym "Electrician", his article *claimed* that an "an eminent scientist" had invented a device whereby objects or people anywhere in the world "...could be seen anywhere by anybody". The device, among other functions, would allow merchants to transmit pictures of their wares to their customers, and the contents of museum collections to be made available to scholars in distant cities. In the era prior to the advent of broadcasting, electrical "seeing" devices were viewed as adjuncts to the telephone, thus creating the concept of a *videophone*.

In April 1891, Alexander Graham Bell did actually record conceptual notes on an **electrical radiophone**, which discussed "...*the possibility of seeing by electricity*" using devices that employed tellurium or selenium imaging components. Bell wrote, decades prior to the invention of the image dissector:

"Should it be found... [that the image sensor] is illuminated, then an apparatus might be constructed in which each piece of selenium is a mere speck, like the head of a small pin, the smaller the better. The darkened selenium should be placed in a cup-like receiver which can fit over the eye.. Then, when the first selenium speck is presented to an illuminated object, it may be possible that the eye in the darkened receiver, should perceive, not merely light, but an image of the object..."

Bell went on to later predict that: "...*the day would come when the man at the telephone would be able to see the distant person to whom he was speaking.*"

The compound name '*videophone*' slowly entered into general usage after 1950, although '*video telephone*' likely entered the lexicon earlier after '*video*' was coined in 1935. Prior to that time there appeared to be no standard terms for '*video telephone*', with expressions such as '*sight-sound television system*', '*visual radio*' and nearly 20 others (in English) being used to describe the marriage of telegraph, telephone, television and radio technologies employed in early experiments.

One technological precursor to the videophone was the *teleostereograph* machine developed by AT&T's Bell Labs in the 1920s, which was a forerunner of today's fax (facsimile) machines. By 1927 AT&T had created its earliest electromechanical videophone, called an *ikonophone* (Greek: '*image-sound*'), which operated at 18 frames per second and occupied half a room full of equipment cabinets. An early U.S. test in 1927 had their then-Commerce Secretary Herbert Hoover address an audience in New York City from Washington, D.C.; although the audio portion was two-way, the video portion was one-way with only those in New York being able to see Hoover. By 1930, AT&T's 'two-way television-telephone' system was in experimental use; with their New York City Bell Labs facility devoting years of research to it up to the 1930s, led by Dr. Herbert Ives along with a team of more than 200 scientists, engineers and technicians, intending to develop it for both telecommunications and broadcast entertainment purposes.

First public video telephone service

The world's first public video telephone service was developed by Dr. Georg Schubert and opened by the German Reichspost in 1936 using square displays of 8 inches (20 cm), but which quickly closed in 1940 due to the WWII. In that service trial, video telephone lines linked Berlin to Nuremberg, Munich, and Hamburg, with terminals integrated within public telephone booths and transmitting at the same resolution as the first German TV sets, at 440 lines. The service was offered to the general public who had to simultaneously visit special post office videotelephone booths in their respective cities,

but at the same time also had Nazi political and propagandistic overtones similar to the broadcasting of the 1936 Olympic Games in Berlin.

The Deutsche Bundespost postal service would later develop and deploy its BIGFON (Broadband Integrated Glass-Fiber Optical Network) video telephony network from 1981 to 1988, serving several large German cities.

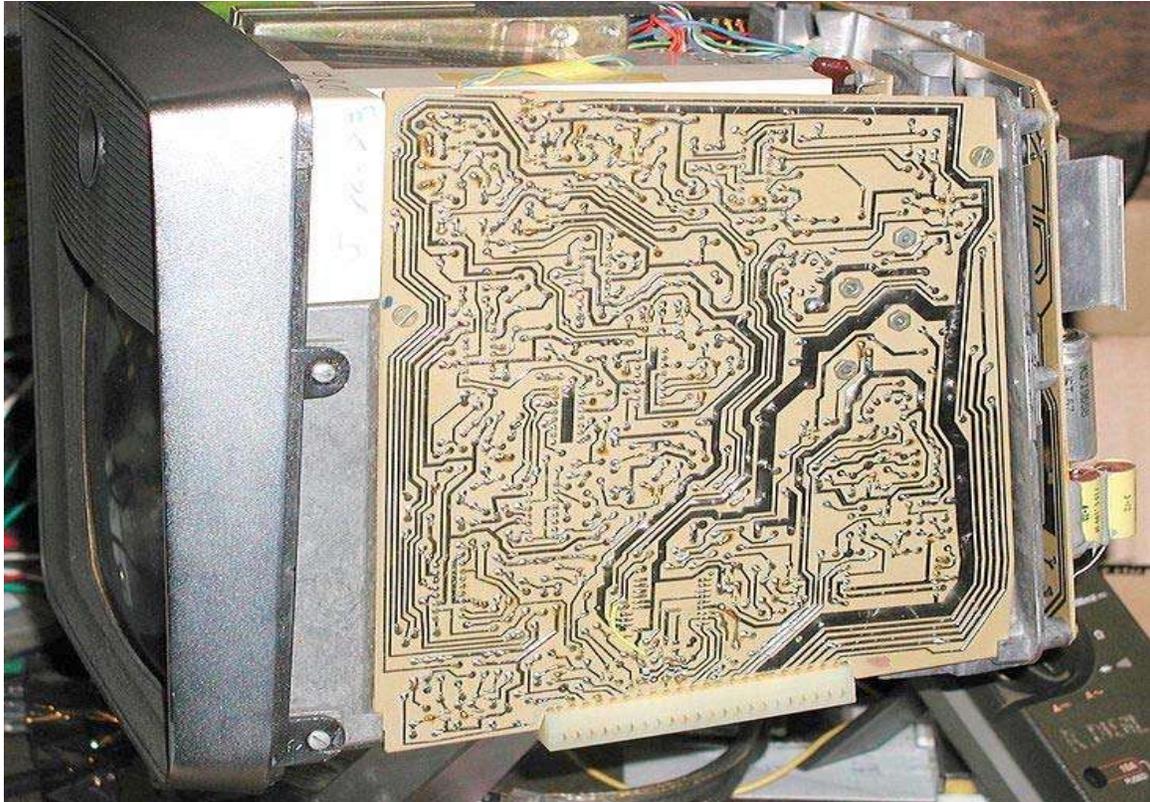
AT&T Picturephone

In the United States AT&T's Bell Labs conducted extensive research and development of videophones, leading to public demonstrations of its trademarked *Picturephone* product and service in the 1960s, including displays at the 1964 New York World's Fair. The demonstration units usually used small oval housings on swivel stands, intended to stand on desks. Similar AT&T Picturephone units were also featured at the Telephone Association of Canada Pavilion (the 'Bell' Pavilion) at Expo 67, an International World's Fair held in Montreal, Canada in 1967. Demonstration units were available at these fairs for the public to test, with fair-goers permitted to make videophone calls to volunteer recipients at other locations.



AT&T Picturephone (Mod II) fully enclosed in its housing, with its control pad at bottom

The United States would not see its first public video telephone booths until 1964, when AT&T installed their earliest *commercial* videophone unit, the **Picturephone Mod I**, in public booths in three cities: New York, Washington, D.C. and Chicago. Picturephone booths were set up in New York's Grand Central Station and elsewhere. With fanfare, Picturephones were also installed in offices of Westinghouse in Pittsburgh, and at other progressive companies. However the use of reservation time slots and their initial cost of US\$16 per three minute call at public booths greatly limited their appeal to the point that they were discontinued by 1968.



Right side view, housing removed, one of its printed circuit boards exposed

Unrelated difficulties at New York Telephone also slowed AT&T's efforts, and few customers signed up for the service in either city. A CNN report on 6 September 2001 stated that Picturephone service only had a total of 500 subscribers at its peak, and the service faded away in the 1970s. AT&T's initial *Mod I* and its upgraded **Picturephone Mod II** programs,, researched principally at its Bell Labs, spanned 15 years and consumed US\$500 million, eventually meeting with commercial failure. AT&T concluded that its early videophone was a "*concept looking for a market*" and discontinued its Picturephone service in the late 1970s. The research and development programs conducted by Bell Labs were highly notable for the beyond-the-state-of-the-art results produced in materials science, advanced telecommunications, microelectronics and information technologies.



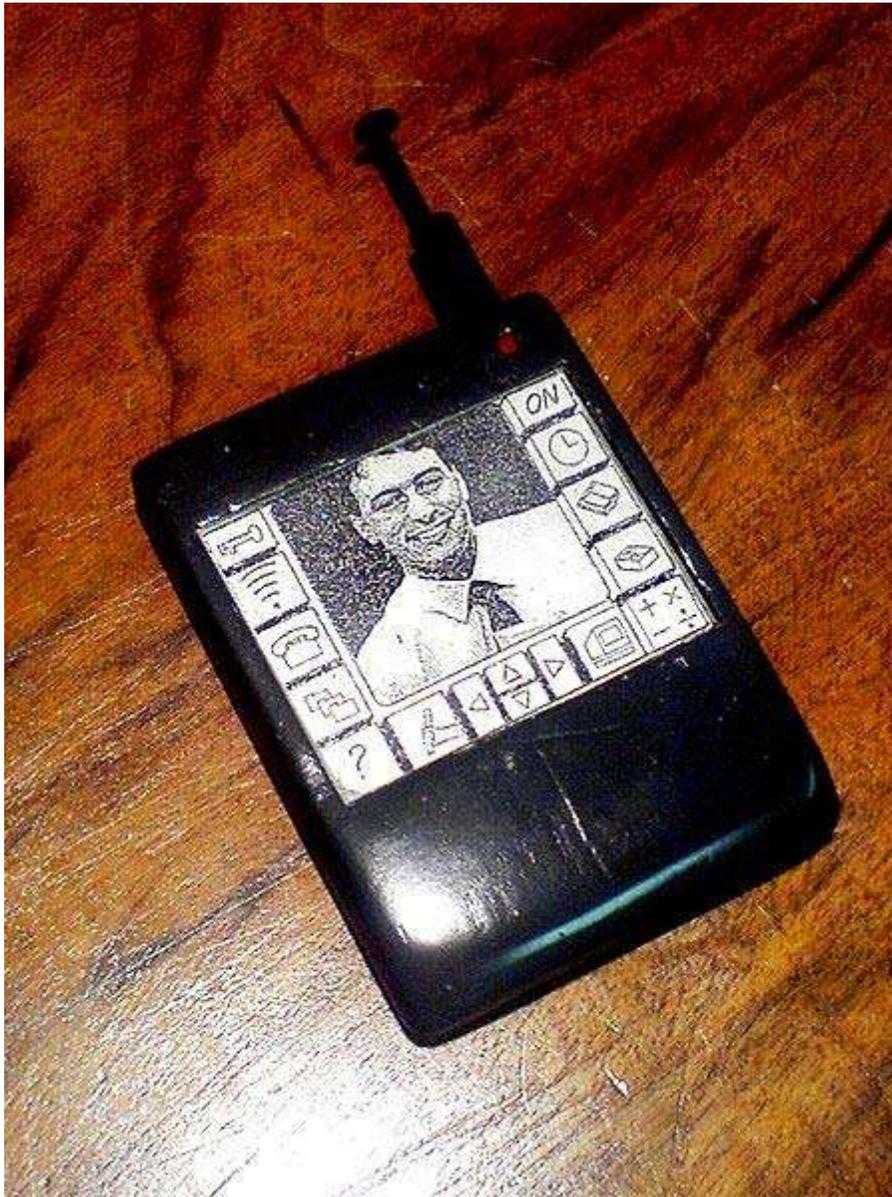
An exposed view of the Picturephone's rear circuit board

Color on AT&T's Picturephone was not employed with their early models. These Picturephone units packaged Plumbicon cameras and small CRT displays within their housings. The cameras were located atop their screens to help users see eye to eye. Later generation display screens were larger than in the original demonstration units, approximately six inches (15 cm) square in a roughly cubical cabinet.

AT&T would then market its **VideoPhone 2500** to the general public from 1992 to 1995 with prices starting at US\$1,500 and later dropping to \$1,000, again with very little commercial success.

Other early devices: 1976–1999

The **Lumaphone** was developed and marketed by Atari and Mitsubishi in 1985. The project was started by the Ataritel division of the Atari Video Game Company in 1983 under the direction of Atari's Steve Bristow. Atari then sold its division to Mitsubishi in 1984. The Lumaphone was marketed by Mitsubishi Electric of America in 1986 as the Luma LU-1000. Similar to Bell Labs' very early image transfer phone of 1956, it could transmit still images every 3–5 seconds over analog POTS lines, and could also be connected to a regular TV or monitor for improved teleconferencing. A larger video image was available by attaching its optional VisiTel LU-500 display.



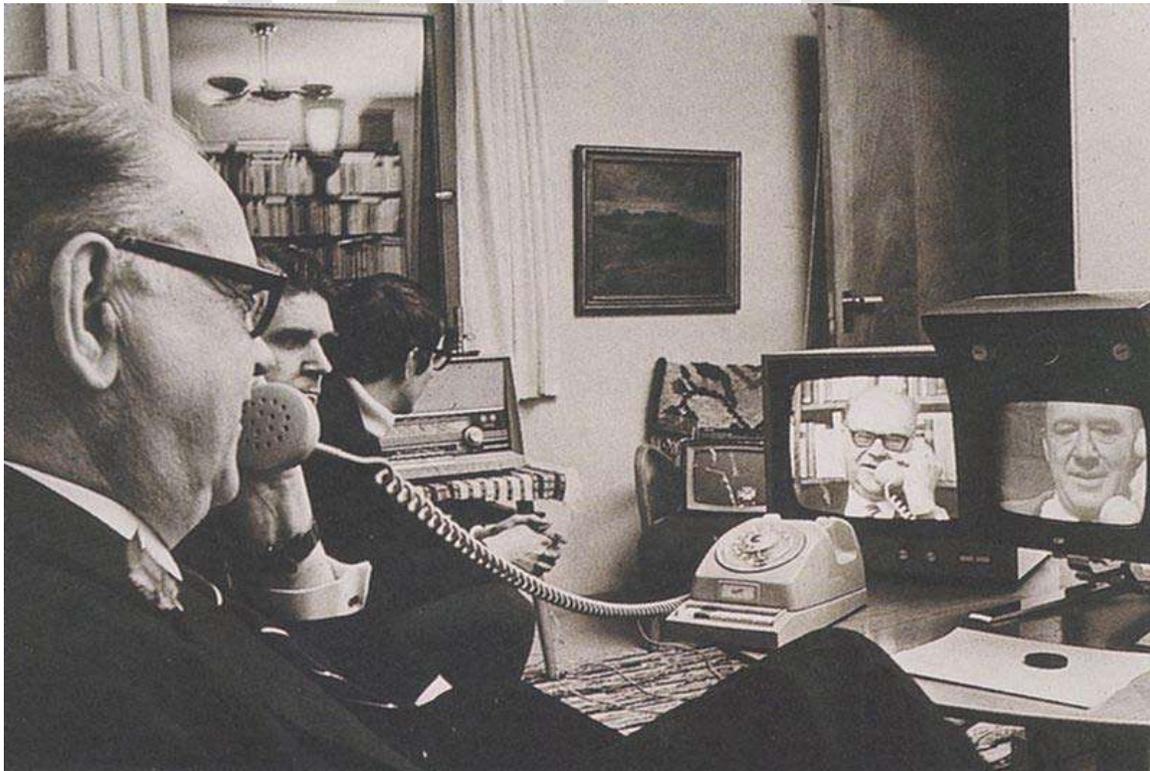
Intellect (1993): was an experimental wireless quasi-videophone

The **Intellect** was a neo- or prototype wireless videophone. It was developed in 1993 by inventor Daniel A. Henderson, and featured still image and non-live video clip transfers. The pioneering system and device were designed to receive pictures and video data sent from an originator to a message center for transmission and display to a wireless device such as a cellular telephone.

The Intellect was essentially a cell phone handset with a large black and white display that could show still images and video clips downloaded remotely from a computer via a wireless transmitter. The data transfer protocols pioneered in the Intellect design were later deployed with the common camera phones released in the early 2000s. However, the complete integration of the cellular phone, digital camera and its wireless transmission infrastructure would take a few more years to complete. The prototype models were donated to the Smithsonian's National Museum of American History in 2007.

General lack of public acceptance

Early AT&T Picturephones had few users, in part because the service was relatively expensive, with a service cost of approximately US\$90 per month in 1974. However as modern technology reduced the costs to nominal (see: webcams), videophone calling continued to be used marginally. This contrasts to many early, overly optimistic views that videotelephony would become ubiquitous.



Swedish Prime Minister Tage Erlander using an **Ericsson videophone** to speak with Lennart Hyland, a popular TV show host, 1969.

One reason may be that even today videophone calling is often a poor analog for direct face-to-face conversation. Videophone users also commonly look at the video screen and not at the video camera, preventing users from having direct eye-to-eye contact, as the video cameras are usually positioned away from the screen.

Another reason may be that some people actually desired less fidelity in their communication, as evidenced by the popularity of written conversation (i.e. texting and instant messaging, which are commonly available on all video-enabled cell phones and webchat programs). Additionally, others did not want to be seen at home—a videophone was viewed as an intrusion.

However it has also be noted that videotelephony is of great benefit to certain groups and demographics, such as members of a family living far apart and who may have a strong desire, but little opportunity for face-to-face conversations. Other groups that have strongly embraced videotelephony include those in the deaf community, where high quality video greatly facilitates sign language communications both within and outside of their personal and social settings.

Current usage



Ultimate in downsizing: a mobile video call between Sweden and Singapore made on a Sony-Ericsson K800

The widest deployment of video telephony now occurs in mobile phones, as nearly all mobile phones supporting UMTS networks can work as videophones using their internal cameras, and are able to make video calls wirelessly to other UMTS users in the same country or internationally. As of the second quarter of 2007, there are over 131 million UMTS users (and hence potential videophone users), on 134 networks in 59 countries.

Videophones are increasingly used in the provision of telemedicine to the elderly and to those in remote locations, where the ease and convenience of quickly obtaining diagnostic and consultative medical services are readily apparent. In one single instance quoted in 2006: *"A nurse-led clinic at Letham has received positive feedback on a trial of a video-link which allowed 60 pensioners to be assessed by medics without travelling to a doctor's office or medical clinic."* A further improvement in telemedical services has been the development of new technology incorporated into special videophones to permit remote diagnostic services, such as blood sugar level, blood pressure and vital signs monitoring. Such units are capable of relaying both regular audiovideo plus medical data over either standard (POTS) telephone or newer broadband lines.

Videotelephony has also been deployed in corporate teleconferencing, also available through the use of public access videoconferencing rooms. A higher level of videoconferencing that employs advanced telecommunication technologies and high-resolution displays is called *telepresence*.

Today the principles, if not the precise mechanisms of a videophone are employed by many users worldwide in the form of webcam videocalls using personal computers, with inexpensive webcams, microphones and free videocalling web client programs. Thus an activity that was disappointing as a separate service has found a niche as a minor feature in software products intended for other purposes.

A videophone can also be created by using an old or inexpensive computer and dedicating it to run as a video softphone. This shows that some users may want to use conventional videophones, but are likely to trade ease of use for lower costs.

Some have argued that unless conventional videophones add considerable value at low cost, and as long as less expensive alternatives (such as webphones) are available, it will be unlikely that dedicated videophones will become popular.

Technology

Bandwidth requirements

Videophones have historically employed a variety of transmission and reception bandwidths, which can be understood as data transmission speeds. The lower the transmission/reception bandwidth, the lower the data transfer rate, resulting in a more limited and poorer image quality. Data transfer rates and live video image quality are related, but are also subject to other factors such as data compression techniques. Some

early videophones employed very low data transmission rates with a resulting sketchy video quality.

Broadband bandwidth is often called "**high-speed**", because it usually has a high rate of data transmission. In general, any connection of 256 kbit/s (0.256 Mbit/s) or greater is more concisely considered **broadband Internet**. The International Telecommunication Union Standardization Sector (ITU-T) recommendation I.113 has defined broadband as a transmission capacity at 1.5 to 2 Mbit/s. The United States Federal Communications Commission definition of broadband is 768 kbit/s (0.8 Mbit/s).

Currently, adequate video for some purposes becomes possible at data rates lower than the ITU-T broadband definition, with rates of 768 kbit/s and 384 kbit/s used for some video conferencing applications, and rates as low as 100 kbit per second used for videophones using H.264/MPEG-4 AVC compression protocols. The newer MPEG-4 video and audio compression format can deliver high-quality video at 2 Mbit/s, which is at the low end of cable modem and ADSL broadband performance.

Picturephone technology



Deutsche Telekom T-View 100 ISDN type videophone meant for home offices and small businesses with a lens cover which can be rotated upward to assure privacy when needed

The Picturephone's video bandwidth was 1 MHz with a vertical scan rate of 30 Hz, horizontal scan rate of 8 kHz, and about 250 visible scan lines. The equipment included a Speakerphone hands free telephone, with an added box to control picture transmission. Each Picturephone line used three twisted pairs of ordinary telephone cable, two pairs for video and one for audio and signaling. Cable amplifiers were spaced about a mile apart (1.6 kilometres) with built-in six-band adjustable equalization filters. For distances of more than a few miles, the signal was digitized at 2 MHz and 3 bits per sample DPCM, and transmitted on a T-2 carrier.

The original Picturephone system used contemporary crossbar and multi-frequency operation. Lines and trunks were six wire, one pair each way for video and one pair two way for audio. MF address signaling on the audio pair was supplemented by a Video Supervisory Signal (VSS) looping around on the video quad to ensure continuity. More complex protocols were later adopted for conferencing.

To deploy Picturephone service new wideband crossbar switches were designed and installed into the Bell System's 5XB switch offices, this being the most widespread of the relatively modern kinds. Hundreds of technicians attended schools to learn to operate the Cable Equalizer Test Set and other equipment, and to install Picturephones.

AT&T later marketed the **VideoPhone 2500** to the general public from 1992 to 1995. It was limited by analog phone line connection speeds of about 19 Kilobits per second, the video portion being 11,200 bits/s, and with a maximum frame rate of 10 frames per second, but typically much lower. The VideoPhone 2500 used proprietary technology protocols.

Call setup

Videoconferencing in the late 20th century was limited to the H.323 protocol (notably Cisco's SCCP implementation was an exception), but newer videophones often use SIP, which is often easier to set up in home networking environments. H.323 is still used, but more commonly for business videoconferencing, while SIP is more commonly used in personal consumer videophones. A number of call-setup methods based on instant messaging protocols such as Skype also now provide video. The principal open systems SIP source is Counterpath Corp., which provides support for British Telecom, Deutsche Telekom, Sprint, Telmex, AT&T's Callvantage, and the unified communicator of Cisco and Verizon.

Another protocol used by videophones is H.324, which mixes call setup and video compression. Videophones that work on regular phone lines typically use H.324, but the bandwidth is limited by the modem to around 33 kbit/s, limiting the video quality and frame rate. A slightly modified version of H.324 called 3G-324M defined by 3GPP is also used by some cellphones that allow video calls, typically for use only in UMTS networks.

There is also H.320 standard, which specified technical requirements for narrow-band visual telephone systems and terminal equipment, typically for videoconferencing and videophone services. It applied mostly to dedicated circuit-based switched network (point-to-point) connections of moderate or high bandwidth, such as through the medium-bandwidth ISDN digital phone protocol or a fractionated high bandwidth T1 lines. Modern products based on H.320 standard usually support also H.323 standard.

WWT

Chapter 6

Telecommuting

Telecommuting or **telework** is a work arrangement in which employees enjoy flexibility in working location and hours. In other words, the daily commute to a central place of work is replaced by telecommunication links. Many work from home, while others, occasionally also referred to as **nomad workers** or **web commuters** utilize mobile telecommunications technology to work from coffee shops or other locations. **Telework** is a broader term, referring to substituting telecommunications for any form of work-related travel, thereby eliminating the distance restrictions of telecommuting. All telecommuters are teleworkers but not all teleworkers are telecommuters. A frequently repeated motto is that "work is something you do, not something you travel to".

A successful telecommuting program requires a management style which is based on results and not on close scrutiny of individual employees. This is referred to as management by objectives as opposed to management by observation. The terms *telecommuting* and *telework* were coined by Jack Nilles in 1973.

Telecommuting statistics

Estimates suggest that over fifty million U.S. workers (about 40% of the working population) could work from home at least part of the time, yet in 2008, only 2.5 million employees (not including the self-employed) considered their home their primary place of business.

Occasional telecommuters— those who work remotely (though not necessarily at home) —totaled 17.2 million in 2008.

Very few companies employ large numbers of home-based full-time staff. The call center industry is one notable exception to this; several U.S.-based call centers employ thousands of home-based workers. For most employees, the option to work from home is granted as an employee benefit; most do so only part of the time.

In 2009 the Office of Personnel Management reported that approximately 102,000 Federal employees telework.

In the next three years, public and private sector IT decision makers expect telework to increase by sixty five percent and thirty three percent, respectively.

Technology

The roots of telecommuting lay in early 1970s technology, linking satellite offices to downtown mainframes by dumb terminals using telephone lines as a network bridge. The massive ongoing decrease in cost and increase in performance and usability of personal computers forged the way to decentralize even further, moving the office to the home. By the early 1980s, these branch offices and home workers were able to connect to the company mainframe using personal computers and terminal emulation.

Long distance telework is facilitated by such tools as groupware, virtual private networks, conference calling, videoconferencing, and Voice over IP (VOIP). It can be efficient and useful for companies as it allows staff and workers to communicate over a large distance, saving significant amounts of travel time and cost. As broadband Internet connections become more commonplace, more and more workers have enough bandwidth at home to use these tools to link their home office to their corporate intranet and internal phone networks.

The adoption of local area networks promoted sharing of resources, and client-server computing allowed for even greater decentralization. Today, telecommuters can carry laptop PCs around which they can use both at the office and at home (and almost anywhere else). The rise of cloud computing technology and Wi-Fi availability has enabled access to remote servers via a combination of portable hardware and software.

Potential Benefits

Telecommuting offers benefits to communities, employers, and employees.

For communities, telecommuting can offer fuller employment (by increasing the employability of proximal or circumstantially marginalized groups, such as Work at home parents and caregivers, the disabled, retirees, and people living in remote areas), reduces traffic congestion and traffic accidents, relieves the strain on transportation infrastructures, reduces greenhouse gases, saves fuel, reduces energy use, improves disaster preparedness, and reduces terrorism targets.

For companies, telecommuting expands the talent pool, reduces the spread of illness, reduces costs, increases productivity, reduces their carbon footprint and energy usage, offers an inexpensive method of complying with the Americans with Disabilities Act of 1990 (ADA), reduces turnover and absenteeism, improves employee morale, offers a continuity of operations strategy, improves their ability to handle business across multiple timezones, and hastens their cultural adaptability. Full-time telework can save companies approximately \$20,000 per employee.

For individuals, telecommuting, or more specifically, work from home arrangements, improves work-life balance, reduces their carbon footprint and fuel usage, frees up the equivalent of 15 to 25 workdays a year—time they would have otherwise spent commuting, and saves between \$4,000 and \$21,000 per year in travel and work-related costs (not including daycare). When gas prices average \$3.00 per gallon, the average full-time employee who commutes 5 days per week spends \$138.80 per month on gasoline. If 53% of white-collar employees could telework 2 days a week, they could collectively save 9.7 billion gallons of gas and \$38.2 billion a year.

Half-time telecommuting by those with compatible jobs (40%) and a desire to do so (79%) would save companies, communities, and employees over \$650 billion a year—the result of increased productivity, reduced office expense, lower absenteeism and turnover, reduced travel, less road repairs, less gas consumption, and other savings.

Environmental Benefits

Telecommuting gained more ground in the United States in 1996 after "the Clean Air Act amendments were adopted with the expectation of reducing carbon dioxide and ground-level ozone levels by 25 percent." The act required companies with over 100 employees to encourage car pools, public transportation, shortened workweeks, and telecommuting. In 2004, an appropriations bill was enacted by Congress to encourage telecommuting for certain Federal agencies. The bill threatened to withhold money from agencies that failed to provide telecommuting options to all eligible employees.

If the 40% of the U.S. population that holds telework-compatible jobs and wants to work from home did so half of the time,

- The nation would save 280 million barrels of oil (37% of Gulf oil imports)
- The environment would be saved the equivalent of taking 9 million cars permanently off the road.
- The energy potential from the gas savings would total more than twice what the U.S. currently produces from all renewable energy sources combined.

Employee Satisfaction

Telework flexibility is a desirable perquisite for employees. A 2008 Robert Half International Financial Hiring Index, a survey of 1,400 CFOs by recruitment firm Robert Half International, indicated that 13% consider telework the best recruiting incentive today for accounting professionals. In earlier surveys, 33% considered telework the best recruiting incentive, and half considered it second best.

Current Trends

U.S. Federal Government

If all Federal employees who are eligible to telework full time were to do so, Feds could realize \$13.9 billion savings in commuting costs annually and eliminate 21.5 billion pounds of pollutants from the environment each year.

Recent events have pushed telework to the forefront as a critical measurement for the U.S. federal government. Telework relates to continuity of operations (COOP) and national pandemic preparedness planning, reducing dependence on foreign oil and the burden of rising gas prices, the Defense Base Closure and Realignment Commission (BRAC), and a focus on recruitment and retention.

During a keynote address at the September 12, 2007 Telework Exchange Town Hall Meeting, Lurita Doan, at that time the Administrator for the General Services Administration, announced an aggressive commitment goal to increase agency telework participation. Her challenge will enable 50 percent of eligible agency employees to telework one or more days per week by 2010. Currently 10 percent of eligible GSA employees telework, compared to 4.2 percent for the overall Federal workforce. Her goal is to increase participation to 20 percent by the end of 2008, 40 percent by the end of 2009, and finally 50 percent by 2010.

A 2007 study of National Science Foundation employees indicated that approximately one-third participated in telework regularly, characterized staff satisfaction with the program, and noted savings in employee time and greenhouse-gas emissions as a result of telework.

Rep. Sarbanes (D-MD) introduced the Telework Improvements Act of 2009 in March 2009. Co-sponsors of the bill included Reps. Connolly (D-VA), Wolf (R-VA), and Capito (R-WV). The bill requires each executive agency to establish a policy under which employees may be authorized to telework to the maximum extent possible without diminishing employee performance or agency operations. At the same time in the U.S. Senate, Sen. Akaka (D-HI) introduced the companion bill, along with Sens. Landrieu (D-LA) and Voinovich (R-OH).

On May 24, 2010 the Senate passed the Telework Enhancement Act (S. 707) sponsored by Sens. Daniel Akaka (D-Hawaii) and George Voinovich (R-Ohio). The bill grants Federal employees eligibility to telework and requires Federal agencies to establish telework policies and identify telework managers.

On July 14, 2010 the House passed the Telework Improvements Act of 2010 (H.R. 1722) with a vote of 290-131.

Telework Centers

Telework centers are offices that are generally set up close to a majority of people who might otherwise drive or take public transit. They usually feature the full complement of office equipment and a high-speed Internet connection for maximum productivity. Some feature support staff such as receptionists. For example, a number of telework centers have been set up around the Washington Metropolitan Area: 7 in Maryland, 8 in Virginia, 3 in Washington, D.C. and 1 in West Virginia.

Telework centers allow people to reduce their commute yet still work in a traditional office setting. Some Telework Centers are set up by individual companies while others are established by independent organizations for use by many organizations. Telework centers are attractive to people who do not have the space or inclination to work from home. They offer employers the ability to maintain a more formal structure for their workforce.

These work arrangements are likely to become more popular with current trends towards greater customization of services and virtual organizing. Distributed work offers great potential for firms to reduce costs, enhance competitive advantage and agility, access a greater variety of scarce talents, and improve employee flexibility, effectiveness and productivity. It has gained in popularity in the West, particularly in Europe. While increasing in importance, distributed work has not yet gained widespread acceptance in Asia.

Remote Office Centers

Remote Office Centers are office space leasing centers which lease individual offices to employees from multiple companies in a single office location or center. The purpose of Remote Office Centers is to provide professional office space in locations that are near where people live, so they can cut down on the commute, but still work out of a real office with professional grade internet, phone service and security.

Office Center Locations

Remote Office Centers are usually located in close proximity to where people live; they are generally distributed throughout suburban and near-suburban locations. The idea behind a Remote Office Center is that you lease an office near where you live, in a building shared with other remote office users and you telecommute from a professional, secure, and reliable office work environment.

Services Provided by Remote Office Centers

- Professional grade internet access for use with company VPN. (Personal firewalls, for each office, are configured in order to ensure security within the center).
- Professional work space environment (desks, chairs, lighting, file cabinets, etc).

- Professional grade phone system
- Mail Stop
- Security system (complete with system logs that can be provided to employers in order to guarantee work attendance).
- Flexible office space leasing that can grow or shrink as a company grows or shrinks, which is no longer constrained by location, or limited floor space in existing facilities.

Leasing

- Remote Office Centers allow for flexible leasing, so that companies are not stuck in long term leases in case an employee quits or leaves employment for any reason.
- Remote Office Centers may offer additional services such as optional equipment or hands-on technical support for additional fees.

Advantages Over Traditional Telecommuting

- Professional work space with professional internet/network access.
- Freedom from distractions inherent in home work environments (TV, family, chores, etc).
- Secure facilities with attendance logging so that employers can be assured of employee work hours.
- Separation of home and work. This is a key to mental health. For many people, it is hard to separate work from home, if you never leave home. Most people need a work place to go to and more importantly come home from. An ROC provides the office, and the social contact that comes from working in an office with other workers (even if they work for a different company).

Limited Acceptance of Traditional Telecommuting

- Dice Holdings recently ran a survey and found that 30 percent of technology workers who were surveyed would accept a 10 percent pay cut if they were allowed to telecommute. However, the same study showed that only 7 percent of technology workers actually did telecommute, and they were mostly consultants. There is obviously a large discrepancy between those who want to telecommute and those who are able to telecommute through traditional telecommuting implementations.
- A government study showed that only 20 percent of government workers telecommuted at all. The same study showed that 96 percent could telecommute part time and 79 percent could telecommute full time. The same study showed that \$19.9 billion dollars of commuting cost and \$21.5 billion in pollution costs could be saved if government workers and management were to fully embrace telecommuting either from home or remote centers.

Government Initiatives

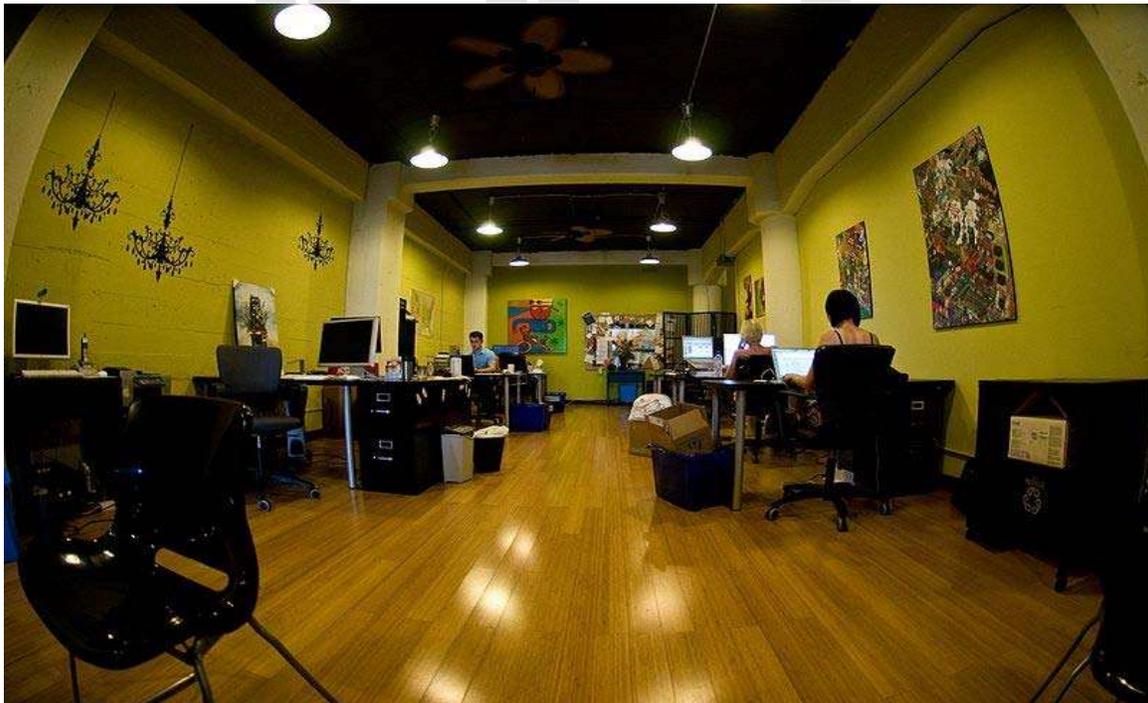
- On June 3, 2008, the House passed H.R. 4106. H.R. 4106 would require agencies to develop a program allowing employees to telework at least 20 percent of every two-week work period.
- GSA currently (June 20, 2008) provides 14 Remote Offices in the D.C. area that can be used by Federal Employees.
- The Oregon Telecommunity Center Project produced a replicable model for planning and developing a telecommunity center to reduce travel demand while increasing access to jobs. The project assessed the needs of specific Oregon rural communities that can be served by technology and network services through a telecommunity center.

Related Terms / Concepts

Office Hoteling

Some companies, particularly those where employees spend a great deal of time on the road and at remote locations, offer a hotdesking or office hoteling arrangement where employees can reserve the use of a traditional office, at the company headquarters, a Remote Office Center, or other shared office facility.

Coworking



Citizen Space in San Francisco, CA

Coworking is a style of work which involves a shared working environment, sometimes an office, yet independent activity. Unlike in a typical office environment, those coworking are usually not employed by the same organization. Typically it is attractive to work-at-home professionals, independent contractors, or people who travel frequently who end up working in relative isolation. Coworking is the social gathering of a group of people, who are still working independently, but who share values, and who are interested in the synergy that can happen from working with talented people in the same space.

Some coworking spaces were developed by nomadic internet entrepreneurs seeking an alternative to working in coffeeshops and cafes, or to isolation in independent or home offices. A 2007 survey showed that many employees worry about feeling isolated and losing human interaction if they were to telecommute. Roughly a third of both private and public-sector workers also reported that they didn't want to stay at home during work. Coworking offers a solution to the problem of isolation that many freelancers experience while working at home, while at the same time letting them escape the distractions of home.

Business accelerators, business incubators and executive suites do not seem to fit into the coworking model, because they often miss the social, collaborative, and informal aspects of the process, with management practices closer to that of a Cooperative, including a focus on community rather than profit. Many of the coworking participants are also participants in BarCamp and other related open source technology activities.

Coworking is not only about the physical space but initially and mostly about establishing the Coworking community first. The benefits of Coworking can already be experienced outside of Coworking spaces and it is recommended to start with building a Coworking community first before considering opening a Coworking space. However, some Coworking Spaces don't build a community, they just get a part of an existing one by combining their opening with an event which attracts their target group.

A lot of Coworking communities are formed by organizing Casual Coworking events (e.g. Jellies) that can take place in people's living room or in public places such as suitable cafes, galleries or multi-functional spaces. During these events Coworkers can experience the benefits of Coworking and get to know each other which lowers the barriers to join a Coworking space later.

History

The term "coworking" was coined by Bernie DeKoven in 1999, and in 2005 used by Brad Neuberg to describe a physical space which he firstly called '9 to 5 group'.

Neuberg organized a coworking site called the "Hat Factory" in San Francisco, which is a live-work loft that is home to three technology workers, and is open to others during the day. Coworking spaces now exist in Argentina, Australia, the United Kingdom, Canada and Germany, although most of the sites are in the U.S. Hub Culture Pavilions are

leading the development of coworking on a global basis, with a network of locations that merge online tools with physical coworking environments.

The San Francisco-based consulting firm *Citizen Agency* has actively promoted coworking, starting a space called *Citizen Space* which rents desks but also allows free drop-ins in the public spaces. Coworking has also spread into many other metropolitan areas, with cities such as Portland, Oregon now offering several thriving coworking venues.

Distributed Work

Distributed work entails the conduct of organizational tasks in places that extend beyond the confines of traditional offices. It can refer to organizational arrangements that permit or require workers to perform work more effectively at any appropriate location, such as their homes and customers' sites - through the application of information and communication technology. An example is financial planners who meet clients during lunchtime with access to various financial planning tools and offerings on their mobile computers, or publishing executives who recommend and place orders for the latest book offerings to libraries and university professors, among others. If this type of distributed work replaces the workers commute, it would be considered telecommuting. If it did not, it would be considered telework.

Jellies

Some telecommuters and teleworkers form local groups that gather at coffee shops and other locations to socialize, collaborate, or just reduce the isolation of working on their own.

Potential Drawbacks / Concerns

- Employers largest concerns about telecommuting are: fear of loss of control; 75% of managers say they trust their employees, but a third say they'd like to be able to see them, just to be sure.
- Barriers to continued growth of telecommuting include distrust from employers and personal disconnectedness for employees.
- Telecommuting has come to be viewed by some as more a "complement rather than a substitute for work in the workplace".
- Security must be addressed for teleworkers and non-teleworkers as well. In 2006, a United States Department of Veterans Affairs employee's stolen laptop represented what was described as "potentially the largest loss of Social Security numbers to date.". While he was not a telecommuter, this incident brought attention to the risks inherent in working off-site. Ninety percent of executives charged with security in large organizations feel that telework is not a security concern. They are more concerned with the occasional work that's taken out of the office by non-teleworkers because they lack the training, tools, and technologies that teleworkers receive.

- Managers may view the teleworker as experiencing a drop in productivity during the first few months. This drop occurs as "the employee, his peers, and the manager adjust to the new work regimen". The drop could also be accountable to inadequate office setup. Managers need to be patient and let the teleworker adapt. It can be claimed that as much as "70 minutes of each day in a regular office are wasted by interruptions, yakking around the photocopier, and other distractions". Eventually, productivity of the teleworker will climb. Over two-thirds of employers report increased productivity among telecommuters. CompTIA survey of 212 diverse employers (October 2008).
- Traditional line managers are accustomed to managing by observation and not necessarily by results. This causes a serious obstacle in organizations attempting to adopt telecommuting. Liability and workers' compensation can become serious issues as well. Companies considering telecommuting should be sure to check on local legal issues, union issues, and zoning laws. Telecommuting should incorporate training and development that includes evaluation, simulation programs, team meetings, written materials, and forums. Information sharing should be considered synchronous in a virtual office and building processes to handle conflicts should be developed. Operational and administrative support should be redesigned to support the virtual office environment. Facilities need to be coordinated properly in order to support the virtual office and technical support should be coordinated properly. The conclusion for managers working within telecommuting organizations is that new approaches to "evaluating, educating, organizing, and informing workers" should be adopted.
- Teleworking can negatively affect a person's career. A recent survey of 1,300 executives from 71 countries indicated that respondents believe that people who telework were less likely to get promoted. Companies rarely promote people into leadership roles who haven't been consistently seen and measured.

Telecommuting and Work At Home Scams



An ad for a work-at-home scheme posted on a pole

A **Work-at-Home scheme** is a get-rich-quick scheme in which a victim is lured by an offer to be employed at home, very often doing some simple task in a minimal amount of time with a large amount of income that far exceeds the market rate for the type of work. The true purpose of such an offer is for the perpetrator to extort money from the victim.

Work-at-home schemes have been around for decades. Originally found as ads in newspapers or magazines, they have expanded to more high-tech media, such as television and radio ads, and on the Internet. In some countries, law enforcement agencies work to fight work-at-home schemes. In 2006, the United States Federal Trade Commission established Project False Hopes, a federal and state law enforcement sweep that targets bogus business opportunity and work at home scams. The crackdown involved more than 100 law enforcement actions by the FTC, the Department of Justice, the United States Postal Inspection Service, and law enforcement agencies in eleven states.

Legitimate work-at-home opportunities do exist, and many people do their jobs in the comfort of their own homes. But anyone seeking such an employment opportunity must be wary of accepting a home employment offer, as only about one in 42 such ads have been determined to be legitimate. Most legitimate jobs at home require some form of post-high-school education, such as a college degree or certificate, or trade school, and some experience in the field in an office or other supervised setting. Additionally, many legitimate at-home jobs are not like those in schemes are portrayed to be, as they are

often performed at least some of the time in the company's office, require more self discipline than a traditional job, and have a higher risk of firing.

Types of work

Common types of work found in work-at-home schemes include:

- Stuffing envelopes
- Assembly of items of some type, such as crafts, jewellery or medical equipment
- Data entry
- Processing medical claims
- Making phone calls
- Phone sex
- Online surveys
- Sales of a product or service that is difficult or impossible to sell. This is often done in the form of a pyramid scheme.
- Legitimate Network Marketing Systems that fall under the Code of Ethics within the Direct Selling Industry (DSA)
- Some ads claim to offer a device that makes passive sales calls, and the "employee" will be paid a commission of the sales.

Some ads offer legitimate forms of work that really do exist, but exaggerate the salary and minimize the effort that will have to be put into the job, or the exaggerate amount of work that will be available. Many such ads do not even specify the type of work that will be performed.

Some similar schemes do not advertise work that would be performed at home, but may instead offer occasional, sporadic work away from home for large payments, paired with a lot of free time. Some common offers fitting this description are:

- **Acting** - seeking extras to perform in movies and television commercials.
- **Mystery shopping** - Getting paid to shop and dine. While mystery shopping actually does exist, it requires hard work, is paid close to minimum wage, and most importantly, does not require an up-front fee to join.

Victims

The typical victim of a work-at-home scheme may be:

- A burned out employee of a legitimate job seeking an exit to his/her stressful lifestyle
- An unemployed person seeking high-paying easy work
- An uneducated person with few or no skills looking for a job with a good salary
- An employed person wanting to make extra money to supplement his/her regular income.

- Senior citizens, disabled persons, stay-at-home parents, and others who cannot easily leave home in order to make a living.
- Those with busy schedules full of unpaid activities who wish to earn money in their spare time.
- Those with long or tiresome commutes looking to remain at home and eliminate their travel to work.
- Someone who doesn't take the time to carefully investigate the industry, job and company.

Signs of a scam

Signs of a work-at-home scam versus a legitimate job may include:

- Payment of fee is required prior to starting employment. In the United States, the Federal Trade Commission states that under no circumstances should anyone be forced to pay a fee in order to obtain a job. In many countries, no legitimate employer will require a fee be paid as a condition of starting work (except perhaps a small amount for a criminal background check).
- Pay is too good to be true. Though there may be legitimate jobs in existence in which employees are paid to perform the particular task in question, even from home, in reality, they would be paid a wage that is fair for that type of work and level of education, not the \$40 per hour or \$3000 per week that is typically offered in a work-at-home scheme.
- Employer will seemingly hire anyone, with no experience necessary and no qualifications. Legitimate work-at-home employers will only be interested in those who have the proper experience, skills, certification, and other qualifying factors, and will give at least some scrutiny to an applicant seeking employment. But the perpetrator of a work-at-home scheme is only interested in the payment required to join.
- Company is little known, and does not seemingly have a customer base bringing them revenue from which they can pay employees.
- Company does not appear to have a permanent location. Its address, phone number, and website appear to be centered around recruitment of employees, not customers.

Consequences

The consequences of falling for a work-at-home scheme may be as follows:

- **Loss of money:** It may be only the initial fee to join, which may be a large or small amount. Some scammers will run after receiving just this fee. Others will continue to ask for more in order for the promise of high pay to be fulfilled. Some will act on a two-way street, actually issuing paychecks, all the while receiving payments of greater value in return, which in some cases have exceeded tens of

thousands of US dollars. In other cases, the employer may obtain the victim's personal information for purposes of identity theft.

- **Loss of legitimate job:** Those with a real job may quit in hopes of a better one, only to find they cannot get their original job back after they discover their dream job was only a hoax.
- **Damaged Reputation:** Those who engage in sales of a faulty or otherwise controversial product may be tarnishing their own name as the salesperson of such a worthless item.
- **Trouble with law:** Some victims may actually receive money. But at the same time, they may be unknowingly breaking the law, on behalf of the perpetrator of the scheme, but will be fully legally responsible. Such violations may be criminal or civil in nature. In other cases, they will not be committing any criminal acts, but they will end up framed in an investigation for the crimes of the perpetrator.
- **Wasted time:** Victims will often invest huge amounts of time with no pay in return. This is time that can be spent earning money at a legitimate job.

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Chapter 7

Virtual Volunteering and Virtual Teams

Virtual Volunteering

Virtual volunteering is a term describing a volunteer who completes tasks, in whole or in part, offsite from the organization being assisted, using the Internet and a home, school, telecenter or work computer or other Internet-connected device. Virtual volunteering is also known as online volunteering, cyber service, telementoring, and teletutoring, and various other names. Virtual volunteering is similar to telecommuting, except that, instead of online employees who are paid, these are online volunteers who are not paid, and they are working to benefit a nonprofit organization, school, government program or other not-for-profit entity, as opposed to a for-profit business.

In practice

People engaged in virtual volunteering undertake a variety of activities from locations remote to the organization or people they are assisting, via a computer or other Internet-connected device, such as:

- translating documents
- researching subjects
- creating web pages
- editing or writing proposals, press releases, newsletter articles, etc.
- developing material for a curriculum
- designing a database
- designing graphics
- providing legal, business, medical, agricultural or any other expertise
- counseling people
- tutoring or mentoring students
- moderating online discussion groups
- writing songs
- creating a podcast
- editing a video
- monitoring the news
- answering questions
- tagging photos and files

- managing other online volunteers

Early history of the practice

The practice of virtual volunteering to benefit nonprofit initiatives dates back to at least the early 1970s, when Project Gutenberg began involving online volunteers to provide electronic versions of works in the public domain.

In 1995, a new nonprofit organization called Impact Online (now called VolunteerMatch), based in Palo Alto, California, began promoting the idea of "virtual volunteers". In 1996, Impact Online received a grant from the James Irvine Foundation to launch an initiative to research the practice of virtual volunteering and to promote the practice to nonprofit organizations in the USA. This new initiative was dubbed the Virtual Volunteering Project, and the web site was launched in early 1997. After one year of operations, the Virtual Volunteering Project moved to the Charles A. Dana Center at The University of Texas at Austin. In 2002, the Virtual Volunteering Project moved within the university to the Lyndon B. Johnson School of Public Affairs.

The first two years of the Virtual Volunteer Project were spent reviewing and adapting telecommuting manuals and existing volunteer management guidelines with regarding to virtual volunteering, as well as identifying organizations that were involving online volunteers. By April 1999, almost 100 organizations had been identified by the Virtual Volunteering Project as involving online volunteers and were listed on the web site.

Due to the growing numbers of nonprofit organizations, schools, government programs and other not-for-profit entities involving online volunteers, the Virtual Volunteering Project stopped listing every such organization involving online volunteers on its web site in 2000, and focused its efforts on promoting the practice, profiling organizations with large or unique online volunteering programs, and creating guidelines for the involvement of online volunteers.

Until January 2001, the Virtual Volunteering Project listed all telementoring and teletutoring programs in the USA (programs where online volunteers mentor or tutor others, through a nonprofit organization or school). At that time, 40 were identified.

Current state of the practice

Virtual volunteering has been adopted by at least a few thousand nonprofit thousand organizations and initiatives. There is no organization currently tracking best practices in online volunteering in the USA or worldwide, how many people are engaged in online volunteering, or how many organizations are involving online volunteers, and studies regarding volunteering, such as reports on volunteering trends in the USA, rarely include information about online volunteering (for instance, a search of the term *virtual volunteering* on the Corporation for National Service's "Volunteering in America" yields no results.)

The United Nations runs an online volunteering service, formerly a part of NetAid, that allows organizations working in or for the developing world to recruit online volunteers, and does have statistics available regarding numbers of online volunteers and organizations involving such through its service. Several other matching services, such as VolunteerMatch and Idealist, also offer virtual volunteering positions with nonprofit organizations in addition to traditional, onsite volunteering opportunities.

VolunteerMatch currently reports that around 5 percent of its active volunteer listings are virtual in nature. As of June 2010, its directory included more than 2,770 such listings including roles in interactive marketing, fundraising, accounting, social media, and business mentoring. The percentage of virtual listings has dropped since 2006, when it peaked at close to 8 percent of overall volunteer opportunities in the VolunteerMatch system.

Micro-volunteering is also an example of virtual volunteering and crowd-sourcing, where volunteers undertake assignments via their PDAs or smartphones. These volunteers aren't required to undergo any screening or training by the nonprofit for such tasks, and do not have to make any other commitment once a micro-task is completed. Micro-volunteering was invented by a San Francisco-based social enterprise called The Extraordinaries in 2008.

Virtual Team

A **virtual team** — also known as a **geographically dispersed team** (GDT) — is a group of individuals who work across time, space, and organizational boundaries with links strengthened by webs of communication technology. Members of virtual teams communicate electronically, so they may never meet face to face. Virtual teams are made possible by a proliferation of fiber optic technology that has significantly increased the scope of off-site communication. Virtual teams allow companies to procure the best talent without geographical restrictions. According to Hambley, O'Neil, & Kline (2007) "virtual teams require new ways of working across boundaries through systems, processes, technology, and people (Duarte & Snyder, 1999), which requires effective leadership...despite the widespread increase in virtual teamwork, there has been relatively little focus on the role of virtual team leaders" (p 41).

Types of virtual teams

Offshore ISD outsourcing teams are teams in which a company subcontracts portions of work to an offshore independent service provider to be worked in conjunction with an onshore team. Offshore ISD is commonly used for software development as well as international R&D projects.

Chapter 8

Telecentre



Telecentre building in Senegal

A **telecentre** is a public place where people can access computers, the Internet, and other digital technologies that enable them to gather information, create, learn, and communicate with others while they develop essential digital skills. While each telecentre is different, their common focus is on the use of digital technologies to support community, economic, educational, and social development—reducing isolation, bridging the digital divide, promoting health issues, creating economic opportunities, and reaching out to youth for example.,

Telecentres exist in almost every country, although they sometimes go by a different name: public internet access center (PIAP), village knowledge center, infocenter, community technology center (CTC), community multimedia center (CMC), multipurpose community telecentre (MCT), Common/Citizen Service Centre (CSC), school-based telecentre, etc.

Evolution of the telecentre movement



African children in a telecentre in Zambia

The telecentre movement's origins can be traced to Europe's telecottage and Electronic Village Halls (originally in Denmark) and Community Technology Centers (CTCs) in the

United States, both of which emerged in the 1980s as a result of advances in computing. At a time when computers were available but not yet a common household good, public access to computers emerged as a solution. Today, in spite of the fact that home ownership of computers is widespread in the United States and other industrialized countries, there remains a need for public (free) access to computing, whether it is in CTCs, telecottages or public libraries to ensure that everyone has access to technologies that have become essential. In the 1990s, the telecentres spread to Africa, Asia and Latin America.

Types

Beyond the differences in names, public ICT access centers are diverse, varying in the clientele they serve, the services they provide, as well as their business or organizational model. Around the world, some telecentres include NGO-sponsored, local government, commercial, school-based, and university-related. In the United States and other countries, public access to the Internet in libraries may also be considered within the “telecentre concept”, especially when the range of services offered is not limited to pure access but also includes training end-users. Each type has advantages and disadvantages when considering attempts to link communities with ICTs and to bridge the digital divide.

- NGO-sponsored telecentres are hosted by an NGO, which manages the center and integrates it, to one degree or another, into the organization's core business;
- Local government telecentres seek to further local development; they often aim to disseminate information, decentralize services, and encourage civic participation, in addition to providing public ICT access.
- Commercial telecentres, launched by entrepreneurs for profit, range from the purely commercial cybercafé to the social enterprise, where profit and social good objectives are combined.
- School-based telecentres can be structured to involve community members during off-school hours, but costs need to be shared by the school system and the community.
- University-related telecentres can offer social outreach to disadvantaged and community groups, provide training, develop locally relevant content, and establish and facilitate virtual networks.
- Internet access in public libraries.

Telecentres and international development institutions

In the 1990s, international development institutions such as Canada’s International Development Research Centre (IDRC) and UNESCO, sponsored the deployment of many telecentres in developing countries. Both IDRC and UNESCO are still very involved in the telecentre movement. IDRC’s telecentre.org is supporting networks of telecentres around the world and UNESCO continues to support the growth of

community multimedia centers (CMCs), which, unlike most other telecentres, have a local community radio, television or other media component.

Sustainability problems

In light of the rapidly evolving technologies that support telecentres and in light of the increased penetration of mobile technologies (i.e., cell phones), the telecentre model needs to continuously evolve in order to remain relevant and to continue to address the changing needs of the communities they serve. As mobile communication technologies become more pervasive around the world, including in rural areas, the telecentres may no longer need to provide phone services, yet they may still be very relevant in terms of access to web-enabled e-government services, e-Learning, and basic Internet communication needs (email and web browsing).

Evolving models — since the local demand for information and communication services is evolving, the telecentre models need to evolve as well. Franchises and other approaches to linking and networking telecentres are proving to be popular.

Evolving technologies — wireless connectivity technologies, beyond VSAT (known to be expensive) are being explored in many communities around the world. These technologies provide new opportunities for connecting communities through telecentres and eventually at the individual household level.

Evolving services — the types of services that telecentres can and should provide is also rapidly evolving. As the fields of eGovernment, eHealth, e-Learning, eCommerce are evolving and maturing in many countries, telecentres need to take advantage of opportunities to extend the benefits to the community at large, through their public access. Some governments are pursuing the deployment of telecentres precisely as a means of ensuring that larger segments of the population are able to access government services and information through electronic channels.

Community stakeholders - identifying leaders among the community who champion the concept of shared services through telecentre mode, play a crucial role as a bridge between the telecentre operator and hesitant villagers. Indeed, There is a maturing period during which community leaders have to invest constant efforts to drive changes of behaviour in the adoption of innovations.

Community involvement is required however, at the initial phase of the telecentre set up, starting with the site selection and creating a sort of empathy and feeling of empowerment. Furthermore, the telecentre should be well rooted in the socio-cultural context of the community.

Networks

The telecentres of today and of the future are networked telecentres, or telecentres of the 2.0 generation. Increasingly, telecentres are not operating as independent, isolated entities but as members of a network. At times, the network takes the form of a franchise. In other circumstances, the network is much more informal.

One such regional network targeted towards Asia-Pacific is, the Asia-Pacific Telecentre Network.

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Chapter 9

Hotelling (office) and Virtual Office

Hotelling

Hoteling (or hotelling) is a method of supporting unassigned seating in an office environment. It is similar to hot desking, and is sometimes confused with it, since both methods support unassigned seating. Hotelling is *reservation-based* unassigned seating, whereas, hot desking is *reservation-less* unassigned seating.

Background

Offices generally support three kinds of seating assignment:

- Shift/Workshop - People take a seat for a given time-shift. The seat is then released to another person on the next time-shift.
- Assigned - One and only one person is assigned to one or more workstations. Likewise, the workstations are assigned to be used exclusively by one person.
- Unassigned - A person is not assigned to any particular workstation. Likewise, the workstation is not assigned to any particular person.

"Recent studies of knowledge workers, particularly salespeople, customer representatives, and consultants, indicate they spend only 30% of their time in the office. Teleworking also contributes to less frequent presence in the office. So why have a workstation?" Companies are also finding that people may need different kinds of workstations at different times for different tasks (e.g. an enclosed office one day and open space the next and a war room the next - all within the same office.) This means that nomadism is not only inter-office (travellers and teleworkers), but intra-office.

Many companies are beginning to rethink whether assigned seating makes the most sense. With the increasing price of commercial real-estate the modern corporation is always looking for ways to maximize office space of an ever growing business. Corporations attempt to divide up their resources in an efficient and effective manner. A new system that companies have begun using is called hotelling. Hotelling is a fairly recent idea which has begun to pop-up in many large corporations with travelling employees. The

idea stems from that of a hotel where employees must reserve their spot for a specified period of time.

How it works

Hotelling systems can vary from basic to high tech. The system generally works better when they are merged with the overall technology of the firm. Basically, the company uses a piece of software which keeps track of all of its resources. When employees arrive at work in the morning (or log in from home via the company intranet), they access the hotelling reservation software and log in using their unique user ID and password. They can then either reserve spaces by their name/number or, in some systems, by looking at a blueprint of the office and visually selecting a workspace. Once the reservation process is complete, a number of functions may be performed by the system including the routing of phone service to the workspace, the notification of an office "concierge" who prepares the workspace, etc. With many systems, workers are required to "check in" through a terminal connected to the reservations database when they arrive at the office.

Who uses it

Hotelling started and continues to predominantly appear in customer representative and consultant-based companies. This is because most of these companies' employees spend the majority of their time away from the office; thus, reducing the amount of office resources they need to occupy on a regular basis. This allows large firms to utilize the concept of hotelling.

Although hotelling started in consulting companies this does not mean that it is limited to these companies. According to experts, any company that has nomad workers is suited for hotelling. Any service-based business can also benefit from hotelling, and more than 50% of the U.S. economy today is service-based.

Virtual Office

Office types:

- Class A office space
- Back office
- Middle office
- Front office
- Mobile office
- Paperless office
- Serviced office

- Small office/home office
- **Virtual office**

A **virtual office** is a combination of off-site live communication and address services that allow users to reduce traditional office costs while maintaining business professionalism. Frequently the term is confused with “office business centers” or “executive suites” which demand a conventional lease whereas a true virtual office does not require that expense.

History

The virtual office idea came from the convergence of technological innovation and the Information Age. The concept has roots in the Industrial Revolution, where parallels to current work styles, specifically working from home, have been drawn. The term was first used in a 1983 airline in-flight magazine article about portable computing. The virtual office concept is an evolution of the executive suites industry. However, the inflexibility of an executive suite lease doesn't work for many business models and helped spur the virtual office concept. The first commercial application of a virtual office occurred in 1994, when Ralph Gregory founded “The Virtual Office, Inc” now known as Intelligent Office, in Boulder, Colorado.

Services

The term “virtual office” implies space utilization, but a full application includes professional live communications.

1. **Communications Services**

1. **Remote Receptionist** A team of workers in an office environment working remotely, using high-tech Computer Telephone Integration software, to replace a traditional receptionist.
2. **Virtual Assistant** A virtual assistant is often a “lone eagle” working from home, who rarely meets their clients face-to-face. A virtual assistant typically has no access to CTI Software. Rates run \$15 an hour and up.
3. **Answering services/call centers** operate from a centralized location for the purpose of receiving and transmitting a large volume of requests by telephone. Users lament problems of security, impersonal staff with high turnover, language barriers, translation errors and a less-than-professional image.
4. **Voicemail** is a low-cost technology that stores voice messages electronically. In customer service applications, voicemail has limitations. Used for customer service, voicemail has become synonymous with frustration. The complaints are legion and have inspired spoofs on the voicemail experience.

2. Space Services

1. **Professional Address** – A prestigious building to be used as the business address. A professional address alleviates the privacy and personal security concerns of running a home-based business. A user can expand into new markets by utilizing a provider with multiple locations to establish a professional presence in the desired growth markets.
2. **Mailing address** – The professional address can be used for accepting, sending & forwarding mail without the connotations of a PO Box. Under US law, a PO Box is to be clearly indicated and so not conducive for most corporate entities in this regard. Some VO providers offer 24/7 access to individually assigned and locked mailboxes. This allows the staff of a VO user to have a centralized location as a convenient vehicle for the secure transfer of paper documents 24/7. A mail-only provider may be subject to USPS CMRA regulations.
3. **Reception Courtesies** – Receptionists at the business address can receive and sign for incoming overnights, deliveries, packages and provide document drop-off/pick-up services. On-site witnesses and notaries may be available, depending on the provider.
4. **Business Meeting Space** – The on-demand use (hourly, daily or weekly) of conference rooms and offices for meetings.
5. **Casual Workspace** – As an alternative to the distractions of co-working or the interruptions of a home office, office space is available on an occasional or “drop-in” basis, either hourly, daily or monthly.
6. **Executive Suite** – A small percentage of VO users lease space full-time time.
7. **On-Site Amenities** – A full-service virtual office will provide broadband internet, fax-copier-printer, advanced phone features, conference calling, video conferencing, kitchenette and a business-worthy lobby/waiting area.

Users

A virtual office blends home and work to gain efficiencies in both. Office expenses are low, while the user’s professionalism retains the image of a traditional, high-cost office. A virtual office user can reduce their environmental impact, as well as the personal negatives of a daily commute. Virtual office clientele have the flexibility to match expenses with revenue fluctuations immediately, as the costs are usually variable. A virtual office can allow for low-cost expansion with no long-term commitments. Users taking advantage of virtual office receptionists eliminate the traditional burden of health care, records, payroll, insurance & rent. Also, traditional time-off (sick days, vacations, personal leaves, etc...) does not apply to a virtual staff.

Common Virtual Office Users:

1. Home-based entrepreneurs
2. Accountants
3. Attorneys

4. Law Firms
5. Mobile salespeople
6. Trades (Home service industry: roofers, electrical, plumb, landscape, construction, repair/remodel, etc)
7. Doctors/Dentists
8. Therapists
9. Business consultants
10. Mediators/conflict resolution
11. Frequent travelers/foreign companies
12. Chambers of Commerce
13. Senior management
14. Real estate
15. mortgage companies
16. Stock brokers/financial planners
17. Collections agencies
18. Networking groups
19. Trainers/instructors
20. Incubators

Economy

Virtual offices are experiencing growth even in a recessionary economy, and not just in the United States. As businesses look to trim expenses, virtual office services help reduce overhead while keeping professionalism high. For example, by paying for space and communication infrastructure on an as-needed basis, businesses can keep office expenses to a minimum. The portability of today's technology also allows for a more flexible work environment. As businesses trend to a more "online" workplace, the notion of paying for space full-time becomes anachronistic. Traditional receptionists making \$12-14/hour can be replaced with remote receptionist services at a fraction of the traditional cost.

Chapter 10

Telecommunication



A Gower telephone, at the *Musée des Arts et Métiers* in Paris

Telecommunication is the transmission of messages, over significant distances, for the purpose of communication. In earlier times, telecommunications involved the use of visual signals, such as beacons, smoke, semaphore telegraphs, signal flags, and optical heliographs, or audio messages via coded drumbeats, lung-blown horns, or sent by loud whistles, for example. In the modern age of electricity and electronics, telecommunications now also includes the use of electrical devices such as telegraphs, telephones, and teletypes, the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the Internet.

The first breakthrough into modern electrical telecommunications came with the push to fully develop the telegraph starting in the 1830s. The use of these electrical means of communications exploded into use on all of the continents of the world during the 19th century, and these also connected the continents via cables on the floors of the ocean. The use of the first three popular systems of electrical telecommunications, the telegraph, telephone and teletype, all required the use of conducting metal wires.

A revolution in wireless telecommunications began in the first decade of the 20th century, with Guglielmo Marconi winning the Nobel Prize in Physics in 1909 for his pioneering developments in wireless radio communications. Other highly notable pioneering inventors and developers in the field of electrical and electronic telecommunications include Charles Wheatstone and Samuel Morse (telegraph), Alexander Graham Bell (telephone), Nikola Tesla, Edwin Armstrong, and Lee de Forest (radio), as well as John Logie Baird and Philo Farnsworth (television).

Telecommunications play an important role in the world economy and the worldwide telecommunication industry's revenue was estimated to be \$3.85 trillion in 2008. The service revenue of the global telecommunications industry was estimated to be \$1.7 trillion in 2008, and is expected to touch \$2.7 trillion by 2013.

History

Early telecommunications



A replica of one of Chappe's semaphore towers in Nalbach

During the Middle Ages, chains of beacons were commonly used on hilltops as a means of relaying a signal. Beacon chains suffered the drawback that they could only pass a single bit of information, so the meaning of the message such as "the enemy has been sighted" had to be agreed upon in advance. One notable instance of their use was during the Spanish Armada, when a beacon chain relayed a signal from Plymouth to London that signaled the arrival of the Spanish warships.

In 1792, Claude Chappe, a French engineer, built the first fixed visual telegraphy system (or semaphore line) between Lille and Paris. However semaphore systems suffered from the need for skilled operators and the expensive towers at intervals of ten to thirty kilometers (six to twenty miles). As a result of competition from the electrical telegraph, the last commercial semaphore line was abandoned in 1880.

The telegraph and the telephone

The first commercial electrical telegraph was constructed by Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use began on April 9, 1839. Both Wheatstone and Cooke viewed their device as "an improvement to the [already-existing, so-called] electromagnetic telegraph" not as a new device.

The businessman Samuel F.B. Morse and the physicist Joseph Henry of the United States developed their own, simpler version of the electrical telegraph, independently. Morse successfully demonstrated this system on September 2, 1837. Morse's most important technical contribution to this telegraph was the rather simple and highly efficient Morse Code, which was an important advance over complicated Wheatstone's telegraph system. The communications efficiency of the Morse Code anticipated that of the Huffman code in digital communications by over 100 years, but Morse had developed his code purely empirically, unlike Huffman, who gave a detailed theoretical explanation of how his method worked.

The first permanent transatlantic telegraph cable was successfully completed on 27 July 1866, allowing transatlantic electrical communication for the first time. An earlier transatlantic cable had operated for a few months in 1859, and among other things, it carried messages of greeting back and forth between President James Buchanan of the United States and Queen Victoria of the United Kingdom.

However, that transatlantic cable failed soon, and the project to lay a replacement line was delayed for five years by the American Civil War. Also, these transatlantic cables would have been completely incapable of carrying telephone calls even had the telephone already been invented. The first transatlantic telephone cable (which incorporated hundreds of electronic amplifiers) was not operational until 1956.

The conventional telephone now in use worldwide was first patented by Alexander Graham Bell in March 1876. That first patent by Bell was the *master patent* of the telephone, from which all other patents for electric telephone devices and features flowed. Credit for the invention of the electric telephone has been frequently disputed, and new controversies over the issue have arisen from time-to-time. As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on *voice transmission over a wire*, and then they improved on each other's ideas. However, the key innovators were Alexander Graham Bell and Gardiner Greene Hubbard, who created the first telephone company, the Bell Telephone Company of the United States, which later evolved into American Telephone & Telegraph (AT&T).

The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic in the cities of New Haven, Connecticut, and London, England.

Radio and television

In 1832, James Lindsay gave a classroom demonstration of wireless telegraphy via conductive water to his students. By 1854, he was able to demonstrate a transmission across the Firth of Tay from Dundee, Scotland, to Woodhaven, a distance of about two miles (3 km), again using water as the transmission medium. In December 1901, Guglielmo Marconi established wireless communication between St. John's, Newfoundland and Poldhu, Cornwall (England), earning him the Nobel Prize in Physics for 1909, one which he shared with Karl Braun. However *small-scale* radio communication had already been demonstrated in 1893 by Nikola Tesla in a presentation before the National Electric Light Association.

On March 25, 1925, John Logie Baird of England was able to demonstrate the transmission of moving pictures at the Selfridge's department store in London, England. Baird's system relied upon the fast-rotating Nipkow disk, and thus it became known as the mechanical television. It formed the basis of experimental broadcasts done by the British Broadcasting Corporation beginning September 30, 1929. However, for most of the 20th century, television systems were designed around the cathode ray tube, invented by Karl Braun. The first version of such an electronic television to show promise was produced by Philo Farnsworth of the United States, and it was demonstrated to his family in Idaho on September 7, 1927.

Computer networks and the Internet

On 11 September 1940, George Stibitz was able to transmit problems using teletype to his Complex Number Calculator in New York and receive the computed results back at Dartmouth College in New Hampshire. This configuration of a centralized computer or mainframe computer with remote "dumb terminals" remained popular throughout the 1950s and into the 60's. However, it was not until the 1960s that researchers started to investigate packet switching — a technology that allows chunks of data to be sent between different computers without first passing through a centralized mainframe. A four-node network emerged on December 5, 1969. This network soon became the ARPANET, which by 1981 would consist of 213 nodes.

ARPANET's development centred around the Request for Comment process and on 7 April 1969, RFC 1 was published. This process is important because ARPANET would eventually merge with other networks to form the Internet, and many of the communication protocols that the Internet relies upon today were specified through the Request for Comment process. In September 1981, RFC 791 introduced the Internet Protocol version 4 (IPv4) and RFC 793 introduced the Transmission Control Protocol (TCP) — thus creating the TCP/IP protocol that much of the Internet relies upon today.

However, not all important developments were made through the Request for Comment process. Two popular link protocols for local area networks (LANs) also appeared in the 1970s. A patent for the token ring protocol was filed by Olof Soderblom on October 29, 1974, and a paper on the Ethernet protocol was published by Robert Metcalfe and David Boggs in the July 1976 issue of *Communications of the ACM*. The Ethernet protocol had been inspired by the ALOHAnet protocol which had been developed by electrical engineering researchers at the University of Hawaii.

Key concepts

A number of key concepts reoccur throughout the literature on modern telecommunication systems. Some of these concepts are discussed below.

Basic elements

A basic telecommunication system consists of three primary units that are always present in some form:

- A transmitter that takes information and converts it to a signal.
- A transmission medium, also called the "physical channel" that carries the signal. An example of this is the "free space channel".
- A receiver that takes the signal from the channel and converts it back into usable information.

For example, in a radio broadcasting station the station's large power amplifier is the transmitter; and the broadcasting antenna is the interface between the power amplifier and the "free space channel". The free space channel is the transmission medium; and the receiver's antenna is the interface between the free space channel and the receiver. Next, the radio receiver is the destination of the radio signal, and this is where it is converted from electricity to sound for people to listen to.

Sometimes, telecommunication systems are "duplex" (two-way systems) with a single box of electronics working as both a transmitter and a receiver, or a *transceiver*. For example, a cellular telephone is a transceiver. The transmission electronics and the receiver electronics in a transceiver are actually quite independent of each other. This can be readily explained by the fact that radio transmitters contain power amplifiers that operate with electrical powers measured in the watts or kilowatts, but radio receivers deal with radio powers that are measured in the microwatts or nanowatts. Hence, transceivers have to be carefully designed and built to isolate their high-power circuitry and their low-power circuitry from each other.

Telecommunication over telephone lines is called point-to-point communication because it is between one transmitter and one receiver. Telecommunication through radio broadcasts is called broadcast communication because it is between one powerful transmitter and numerous low-power but sensitive radio receivers.

Telecommunications in which multiple transmitters and multiple receivers have been designed to cooperate and to share the same physical channel are called multiplex systems.

Analog or digital communications?

Communications signals can be either by analog signals or digital signals. There are analog communication systems and digital communication systems. For an analog signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (for example, a set of ones and zeros). During the propagation and reception, the information contained in analog signals will inevitably be degraded by undesirable physical noise. (The output of a transmitter is noise-free for all practical purposes.) Commonly, the noise in a communication system can be expressed as adding or subtracting from the desirable signal in a completely random way. This form of noise is called "*additive noise*", with the understanding that the noise can be negative or positive at different instants of time. Noise that is not additive noise is a much more difficult situation to describe or analyze, and these other kinds of noise will be omitted here.

On the other hand, unless the *additive noise* disturbance exceeds a certain threshold, the information contained in digital signals will remain intact. Their resistance to noise represents a key advantage of digital signals over analog signals.

Communications networks

A communications network is a collection of transmitters, receivers, and communications channels that send messages to one another. Some digital communications networks contain one or more routers that work together to transmit information to the correct user. An analog communications network consists of one or more switches that establish a connection between two or more users. For both types of network, repeaters may be necessary to amplify or recreate the signal when it is being transmitted over long distances. This is to combat attenuation that can render the signal indistinguishable from the noise.

Communication channels

The term "channel" has two different meanings. In one meaning, a channel is the physical medium that carries a signal between the transmitter and the receiver. Examples of this include the atmosphere for sound communications, glass optical fibers for some kinds of optical communications, coaxial cables for communications by way of the voltages and electric currents in them, and free space for communications using visible light, infrared waves, ultraviolet light, and radio waves. This last channel is called the "free space channel". The sending of radio waves from one place to another has nothing to do with the presence or absence of an atmosphere between the two. Radio waves travel through a perfect vacuum just as easily as they travel through air, fog, clouds, or any other kind of gas besides air.

The other meaning of the term "channel" in telecommunications is seen in the phrase communications channel, which is a subdivision of a transmission medium so that it can be used to send multiple streams of information simultaneously. For example, one radio station can broadcast radio waves into free space at frequencies in the neighborhood of 94.5 MHz (megahertz) while another radio station can simultaneously broadcast radio waves at frequencies in the neighborhood of 96.1 MHz. Each radio station would transmit radio waves over a frequency bandwidth of about 180 kHz (kilohertz), centered at frequencies such as the above, which are called the "carrier frequencies". Each station in this example is separated from its adjacent stations by 200 kHz, and the difference between 200 kHz and 180 kHz (20 kHz) is an engineering allowance for the imperfections in the communication system.

In the example above, the "free space channel" has been divided into communications channels according to frequencies, and each channel is assigned a separate frequency bandwidth in which to broadcast radio waves. This system of dividing the medium into channels according to frequency is called "frequency-division multiplexing" (**FDM**).

Another way of dividing a communications medium into channels is to allocate each sender a recurring segment of time (a "time slot", for example, 20 milliseconds out of each second), and to allow each sender to send messages only within its own time slot. This method of dividing the medium into communication channels is called "time-division multiplexing" (**TDM**), and is used in optical fiber communication. Some radio communication systems use TDM within an allocated FDM channel. Hence, these systems use a hybrid of TDM and FDM.

Modulation

The shaping of a signal to convey information is known as modulation. Modulation can be used to represent a digital message as an analog waveform. This is commonly called "keying" - a term derived from the older use of Morse Code in telecommunications - and several keying techniques exist (these include phase-shift keying, frequency-shift keying, and amplitude-shift keying). The "Bluetooth" system, for example, uses phase-shift keying to exchange information between various devices. In addition, there are combinations of phase-shift keying and amplitude-shift keying which is called (in the jargon of the field) "quadrature amplitude modulation" (QAM) that are used in high-capacity digital radio communication systems.

Modulation can also be used to transmit the information of low-frequency analog signals at higher frequencies. This is helpful because low-frequency analog signals cannot be effectively transmitted over free space. Hence the information from a low-frequency analog signal must be impressed into a higher-frequency signal (known as the "carrier wave") before transmission. There are several different modulation schemes available to achieve this [two of the most basic being amplitude modulation (AM) and frequency modulation (FM)]. An example of this process is a disc jockey's voice being impressed into a 96 MHz carrier wave using frequency modulation (the voice would then be

received on a radio as the channel "96 FM"). In addition, modulation has the advantage of being about to use frequency division multiplexing (FDM).

Society and telecommunication

Telecommunication has a significant social, cultural, and economic impact on modern society. In 2008, estimates placed the telecommunication industry's revenue at \$3.85 trillion (USD) or just under 3.0 percent of the gross world product (official exchange rate). The following sections discuss the impact of telecommunication on society.

Economic impact

Microeconomics

On the microeconomic scale, companies have used telecommunications to help build global business empires. This is self-evident in the case of online retailer Amazon.com but, according to academic Edward Lenert, even the conventional retailer Wal-Mart has benefited from better telecommunication infrastructure compared to its competitors. In cities throughout the world, home owners use their telephones to organize many home services ranging from pizza deliveries to electricians. Even relatively-poor communities have been noted to use telecommunication to their advantage. In Bangladesh's Narshingdi district, isolated villagers use cellular phones to speak directly to wholesalers and arrange a better price for their goods. In Côte d'Ivoire, coffee growers share mobile phones to follow hourly variations in coffee prices and sell at the best price.

Macroeconomics

On the macroeconomic scale, Lars-Hendrik Röller and Leonard Waverman suggested a causal link between good telecommunication infrastructure and economic growth. Few dispute the existence of a correlation although some argue it is wrong to view the relationship as causal.

Because of the economic benefits of good telecommunication infrastructure, there is increasing worry about the inequitable access to telecommunication services amongst various countries of the world—this is known as the digital divide. A 2003 survey by the International Telecommunication Union (ITU) revealed that roughly one-third of countries have fewer than one mobile subscription for every 20 people and one-third of countries have fewer than one land-line telephone subscription for every 20 people. In terms of Internet access, roughly half of all countries have fewer than one out of 20 people with Internet access. From this information, as well as educational data, the ITU was able to compile an index that measures the overall ability of citizens to access and use information and communication technologies. Using this measure, Sweden, Denmark and Iceland received the highest ranking while the African countries Nigeria, Burkina Faso and Mali received the lowest.

Social impact

Telecommunication has played a significant role in social relationships. Nevertheless' devices like the telephone system were originally advertised with an emphasis on the practical dimensions of the device (such as the ability to conduct business or order home services) as opposed to the social dimensions. It was not until the late 1920s and 1930s that the social dimensions of the device became a prominent theme in telephone advertisements. New promotions started appealing to consumers' emotions, stressing the importance of social conversations and staying connected to family and friends.

Since then the role that telecommunications has played in social relations has become increasingly important. In recent years, the popularity of social networking sites has increased dramatically. These sites allow users to communicate with each other as well as post photographs, events and profiles for others to see. The profiles can list a person's age, interests, sexuality and relationship status. In this way, these sites can play important role in everything from organising social engagements to courtship.

Prior to social networking sites, technologies like SMS and the telephone also had a significant impact on social interactions. In 2000, market research group Ipsos MORI reported that 81% of 15 to 24 year-old SMS users in the United Kingdom had used the service to coordinate social arrangements and 42% to flirt.

Other impacts

In cultural terms, telecommunication has increased the public's ability to access to music and film. With television, people can watch films they have not seen before in their own home without having to travel to the video store or cinema. With radio and the Internet, people can listen to music they have not heard before without having to travel to the music store.

Telecommunication has also transformed the way people receive their news. A survey by the non-profit Pew Internet and American Life Project found that when just over 3,000 people living in the United States were asked where they got their news "yesterday", more people said television or radio than newspapers. The results are summarised in the following table (the percentages add up to more than 100% because people were able to specify more than one source).

Local TV	National TV	Radio	Local paper	Internet	National paper
59%	47%	44%	38%	23%	12%

Telecommunication has had an equally significant impact on advertising. TNS Media Intelligence reported that in 2007, 58% of advertising expenditure in the United States was spent on mediums that depend upon telecommunication. The results are summarised in the following table.

	Internet	Radio	Cable TV	Syndicated TV	Spot TV	Network TV	News-paper	Maga-zine	Out-door	Total
Percent	7.6%	7.2%	12.1%	2.8%	11.3%	17.1%	18.9%	20.4%	2.7%	100%
Dollars	\$11.31 billion	\$10.69 billion	\$18.02 billion	\$4.17 billion	\$16.82 billion	\$25.42 billion	\$28.22 billion	\$30.33 billion	\$4.02 billion	\$149 billion

Telecommunication and government

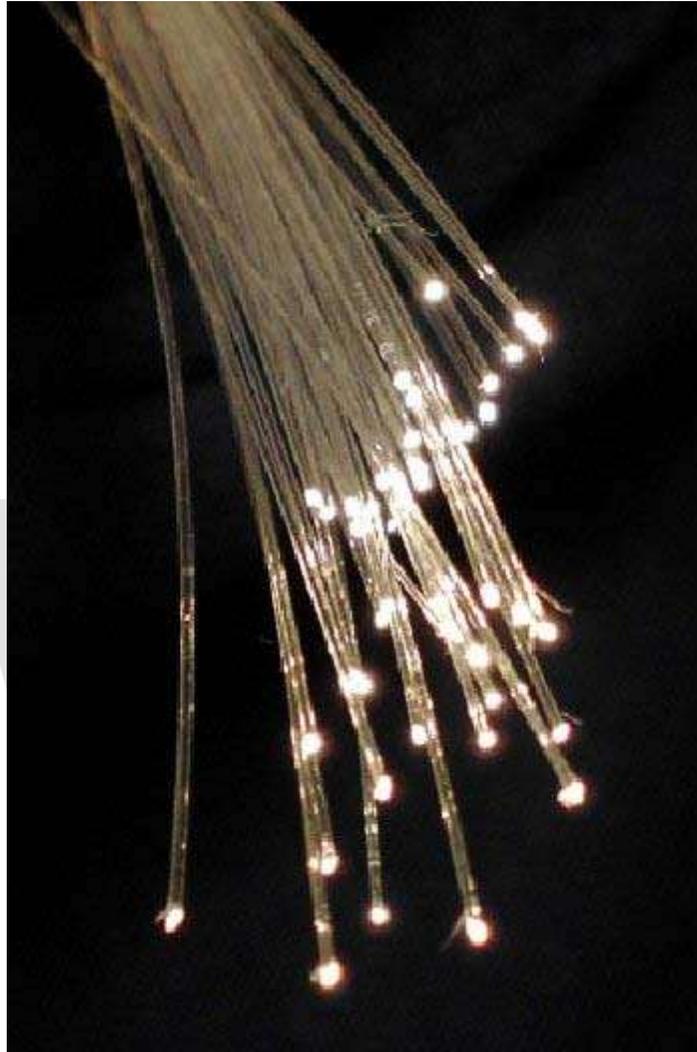
Many countries have enacted legislation which conform to the *International Telecommunication Regulations* establish by the International Telecommunication Union (ITU), which is the "leading United Nations agency for information and communication technology issues." In 1947, at the Atlantic City Conference, the ITU decided to "afford international protection to all frequencies registered in a new international frequency list and used in conformity with the Radio Regulation." According to the ITU's *Radio Regulations* adopted in Atlantic City, all frequencies referenced in the *International Frequency Registration Board*, examined by the board and registered on the *International Frequency List* "shall have the right to international protection from harmful interference."

From a global perspective, there have been political debates and legislation regarding the management of telecommunication and broadcasting. The history of broadcasting discusses some of debates in relation to balancing conventional communication such as printing and telecommunication such as radio broadcasting. The onset of World War II brought on the first explosion of international broadcasting propaganda. Countries, their governments, insurgents, terrorists, and militiamen have all used telecommunication and broadcasting techniques to promote propaganda. Patriotic propaganda for political movements and colonization started the mid 1930s. In 1936, the BBC did broadcast propaganda to the Arab World to partly counter similar broadcasts from Italy, which also had colonial interests in North Africa.

Modern insurgents, such as those in the latest Iraq war, often use intimidating telephone calls, SMSs and the distribution of sophisticated videos of an attack on coalition troops within hours of the operation. "The Sunni insurgents even have their own television station, Al-Zawraa, which while banned by the Iraqi government, still broadcasts from Erbil, Iraqi Kurdistan, even as coalition pressure has forced it to switch satellite hosts several times."

Modern operation

Telephone



Optical fiber provides cheaper bandwidth for long distance communication

In an analog telephone network, the caller is connected to the person he wants to talk to by switches at various telephone exchanges. The switches form an electrical connection between the two users and the setting of these switches is determined electronically when the caller dials the number. Once the connection is made, the caller's voice is transformed to an electrical signal using a small microphone in the caller's handset. This electrical signal is then sent through the network to the user at the other end where it is transformed back into sound by a small speaker in that person's handset. There is a separate electrical connection that works in reverse, allowing the users to converse.

The fixed-line telephones in most residential homes are analog — that is, the speaker's voice directly determines the signal's voltage. Although short-distance calls may be

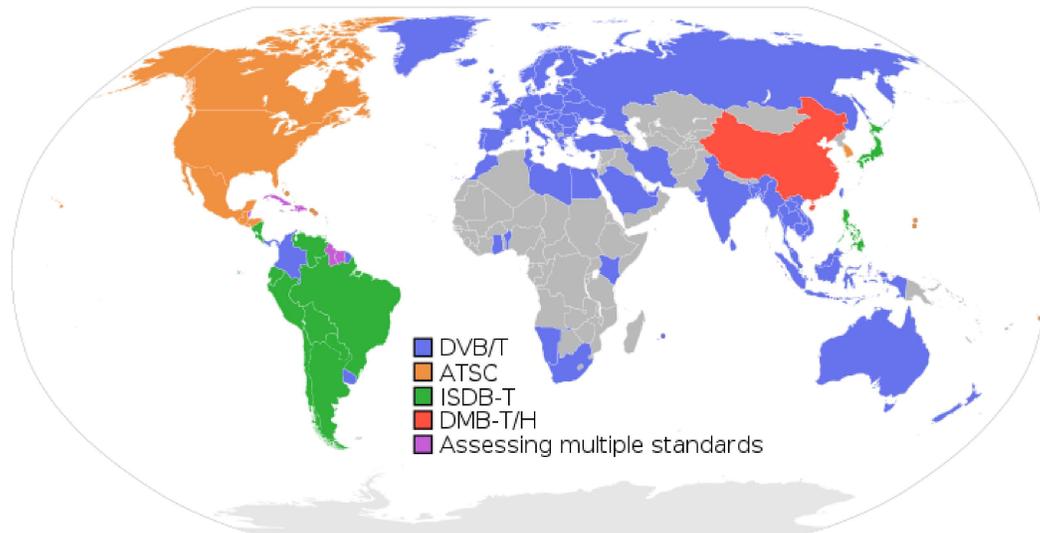
handled from end-to-end as analog signals, increasingly telephone service providers are transparently converting the signals to digital for transmission before converting them back to analog for reception. The advantage of this is that digitized voice data can travel side-by-side with data from the Internet and can be perfectly reproduced in long distance communication (as opposed to analog signals that are inevitably impacted by noise).

Mobile phones have had a significant impact on telephone networks. Mobile phone subscriptions now outnumber fixed-line subscriptions in many markets. Sales of mobile phones in 2005 totalled 816.6 million with that figure being almost equally shared amongst the markets of Asia/Pacific (204 m), Western Europe (164 m), CEMEA (Central Europe, the Middle East and Africa) (153.5 m), North America (148 m) and Latin America (102 m). In terms of new subscriptions over the five years from 1999, Africa has outpaced other markets with 58.2% growth. Increasingly these phones are being serviced by systems where the voice content is transmitted digitally such as GSM or W-CDMA with many markets choosing to depreciate analog systems such as AMPS.

There have also been dramatic changes in telephone communication behind the scenes. Starting with the operation of TAT-8 in 1988, the 1990s saw the widespread adoption of systems based on optic fibres. The benefit of communicating with optic fibers is that they offer a drastic increase in data capacity. TAT-8 itself was able to carry 10 times as many telephone calls as the last copper cable laid at that time and today's optic fibre cables are able to carry 25 times as many telephone calls as TAT-8. This increase in data capacity is due to several factors: First, optic fibres are physically much smaller than competing technologies. Second, they do not suffer from crosstalk which means several hundred of them can be easily bundled together in a single cable. Lastly, improvements in multiplexing have led to an exponential growth in the data capacity of a single fibre.

Assisting communication across many modern optic fibre networks is a protocol known as Asynchronous Transfer Mode (ATM). The ATM protocol allows for the side-by-side data transmission mentioned in the second paragraph. It is suitable for public telephone networks because it establishes a pathway for data through the network and associates a traffic contract with that pathway. The traffic contract is essentially an agreement between the client and the network about how the network is to handle the data; if the network cannot meet the conditions of the traffic contract it does not accept the connection. This is important because telephone calls can negotiate a contract so as to guarantee themselves a constant bit rate, something that will ensure a caller's voice is not delayed in parts or cut-off completely. There are competitors to ATM, such as Multiprotocol Label Switching (MPLS), that perform a similar task and are expected to supplant ATM in the future.

Radio and television



Digital television standards and their adoption worldwide

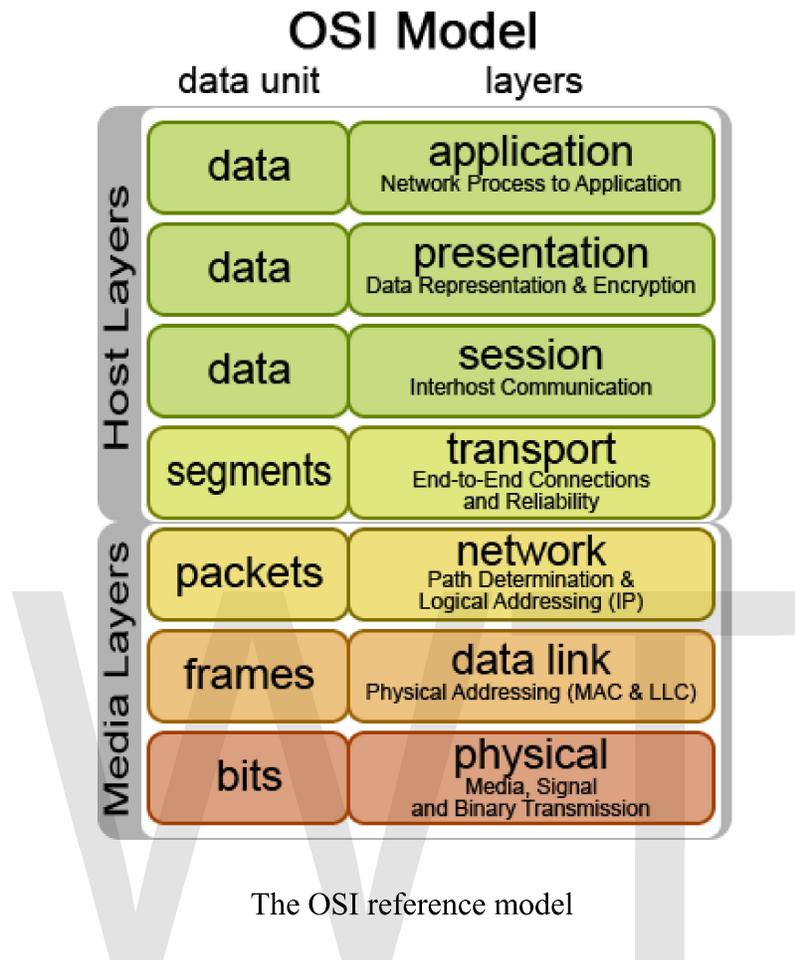
In a broadcast system, the central high-powered broadcast tower transmits a high-frequency electromagnetic wave to numerous low-powered receivers. The high-frequency wave sent by the tower is modulated with a signal containing visual or audio information. The receiver is then tuned so as to pick up the high-frequency wave and a demodulator is used to retrieve the signal containing the visual or audio information. The broadcast signal can be either analog (signal is varied continuously with respect to the information) or digital (information is encoded as a set of discrete values).

The broadcast media industry is at a critical turning point in its development, with many countries moving from analog to digital broadcasts. This move is made possible by the production of cheaper, faster and more capable integrated circuits. The chief advantage of digital broadcasts is that they prevent a number of complaints with traditional analog broadcasts. For television, this includes the elimination of problems such as snowy pictures, ghosting and other distortion. These occur because of the nature of analog transmission, which means that perturbations due to noise will be evident in the final output. Digital transmission overcomes this problem because digital signals are reduced to discrete values upon reception and hence small perturbations do not affect the final output. In a simplified example, if a binary message 1011 was transmitted with signal amplitudes [1.0 0.0 1.0 1.0] and received with signal amplitudes [0.9 0.2 1.1 0.9] it would still decode to the binary message 1011 — a perfect reproduction of what was sent. From this example, a problem with digital transmissions can also be seen in that if the noise is great enough it can significantly alter the decoded message. Using forward error correction a receiver can correct a handful of bit errors in the resulting message but too much noise will lead to incomprehensible output and hence a breakdown of the transmission.

In digital television broadcasting, there are three competing standards that are likely to be adopted worldwide. These are the ATSC, DVB and ISDB standards; the adoption of these standards thus far is presented in the captioned map. All three standards use MPEG-2 for video compression. ATSC uses Dolby Digital AC-3 for audio compression, ISDB uses Advanced Audio Coding (MPEG-2 Part 7) and DVB has no standard for audio compression but typically uses MPEG-1 Part 3 Layer 2. The choice of modulation also varies between the schemes. In digital audio broadcasting, standards are much more unified with practically all countries choosing to adopt the Digital Audio Broadcasting standard (also known as the Eureka 147 standard). The exception being the United States which has chosen to adopt HD Radio. HD Radio, unlike Eureka 147, is based upon a transmission method known as in-band on-channel transmission that allows digital information to "piggyback" on normal AM or FM analog transmissions.

However, despite the pending switch to digital, analog television remains being transmitted in most countries. An exception is the United States that ended analog television transmission (by all but the very low-power TV stations) on 12 June 2009 after twice delaying the switchover deadline. For analog television, there are three standards in use for broadcasting color TV. These are known as PAL (British designed), NTSC (North American designed), and SECAM (French designed). (It is important to understand that these are the ways from sending color TV, and they do not have anything to do with the standards for black & white TV, which also vary from country to country.) For analog radio, the switch to digital radio is made more difficult by the fact that analog receivers are sold at a small fraction of the price of digital receivers. The choice of modulation for analog radio is typically between amplitude modulation (**AM**) or frequency modulation (**FM**). To achieve stereo playback, an amplitude modulated subcarrier is used for stereo FM.

The Internet



The Internet is a worldwide network of computers and computer networks that can communicate with each other using the Internet Protocol. Any computer on the Internet has a unique IP address that can be used by other computers to route information to it. Hence, any computer on the Internet can send a message to any other computer using its IP address. These messages carry with them the originating computer's IP address allowing for two-way communication. The Internet is thus an exchange of messages between computers.

As of 2008, an estimated 21.9% of the world population has access to the Internet with the highest access rates (measured as a percentage of the population) in North America (73.6%), Oceania/Australia (59.5%) and Europe (48.1%). In terms of broadband access, Iceland (26.7%), South Korea (25.4%) and the Netherlands (25.3%) led the world.

The Internet works in part because of protocols that govern how the computers and routers communicate with each other. The nature of computer network communication lends itself to a layered approach where individual protocols in the protocol stack run more-or-less independently of other protocols. This allows lower-level protocols to be customized for the network situation while not changing the way higher-level protocols operate. A practical example of why this is important is because it allows an Internet

browser to run the same code regardless of whether the computer it is running on is connected to the Internet through an Ethernet or Wi-Fi connection. Protocols are often talked about in terms of their place in the OSI reference model (pictured on the right), which emerged in 1983 as the first step in an unsuccessful attempt to build a universally adopted networking protocol suite.

For the Internet, the physical medium and data link protocol can vary several times as packets traverse the globe. This is because the Internet places no constraints on what physical medium or data link protocol is used. This leads to the adoption of media and protocols that best suit the local network situation. In practice, most intercontinental communication will use the Asynchronous Transfer Mode (ATM) protocol (or a modern equivalent) on top of optic fibre. This is because for most intercontinental communication the Internet shares the same infrastructure as the public switched telephone network.

At the network layer, things become standardized with the Internet Protocol (IP) being adopted for logical addressing. For the World Wide Web, these "IP addresses" are derived from the human readable form using the Domain Name System. At the moment, the most widely used version of the Internet Protocol is version four but a move to version six is imminent.

At the transport layer, most communication adopts either the Transmission Control Protocol (TCP) or the User Datagram Protocol (UDP). TCP is used when it is essential every message sent is received by the other computer where as UDP is used when it is merely desirable. With TCP, packets are retransmitted if they are lost and placed in order before they are presented to higher layers. With UDP, packets are not ordered or retransmitted if lost. Both TCP and UDP packets carry port numbers with them to specify what application or process the packet should be handled by. Because certain application-level protocols use certain ports, network administrators can manipulate traffic to suit particular requirements. Examples are to restrict Internet access by blocking the traffic destined for a particular port or to affect the performance of certain applications by assigning priority.

Above the transport layer, there are certain protocols that are sometimes used and loosely fit in the session and presentation layers, most notably the Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols. These protocols ensure that the data transferred between two parties remains completely confidential and one or the other is in use when a padlock appears in the address bar of your web browser. Finally, at the application layer, are many of the protocols Internet users would be familiar with such as HTTP (web browsing), POP3 (e-mail), FTP (file transfer), IRC (Internet chat), BitTorrent (file sharing) and OSCAR (instant messaging).

Local Area Networks and Wide Area Networks

Despite the growth of the Internet, the characteristics of local area networks ("LANs" - computer networks that do not extend beyond a few kilometers in size) remain distinct. This is because networks on this scale do not require all the features associated with

larger networks and are often more cost-effective and efficient without them. When they are not connected with the Internet, they also have the advantages of privacy and security. However, purposefully lacking a direct connection to the Internet will not provide 100% protection of the LAN from hackers, military forces, or economic powers. These threats exist if there are any methods for connecting remotely to the LAN.

There are also independent wide area networks ("WANs" - private computer networks that can and do extend for thousands of kilometers.) Once again, some of their advantages include their privacy, security, and complete ignoring of any potential hackers - who cannot "touch" them. Of course, prime users of private LANs and WANs include armed forces and intelligence agencies that *must* keep their information completely secure and secret.

In the mid-1980s, several sets of communication protocols emerged to fill the gaps between the data-link layer and the application layer of the OSI reference model. These included Appletalk, IPX, and NetBIOS with the dominant protocol set during the early 1990s being IPX due to its popularity with MS-DOS users. TCP/IP existed at this point, but it was typically only used by large government and research facilities.

As the Internet grew in popularity and a larger percentage of traffic became Internet-related, LANs and WANs gradually moved towards the TCP/IP protocols, and today networks mostly dedicated to TCP/IP traffic are common. The move to TCP/IP was helped by technologies such as DHCP that allowed TCP/IP clients to discover their own network address — a function that came standard with the AppleTalk/ IPX/ NetBIOS protocol sets.

It is at the data-link layer, though, that most modern LANs diverge from the Internet. Whereas Asynchronous Transfer Mode (ATM) or Multiprotocol Label Switching (MPLS) are typical data-link protocols for larger networks such as WANs; Ethernet and Token Ring are typical data-link protocols for LANs. These protocols differ from the former protocols in that they are simpler (e.g. they omit features such as Quality of Service guarantees) and offer collision prevention. Both of these differences allow for more economical systems. Despite the modest popularity of IBM token ring in the 1980s and 90's, virtually all LANs now use either wired or wireless Ethernets. At the physical layer, most wired Ethernet implementations use copper twisted-pair cables (including the common 10BASE-T networks). However, some early implementations used heavier coaxial cables and some recent implementations (especially high-speed ones) use optical fibers. When optic fibers are used, the distinction must be made between multimode fibers and single-mode fibers. Multimode fibers can be thought of as thicker optical fibers that are cheaper to manufacture devices for but that suffers from less usable bandwidth and worse attenuation - implying poorer long-distance performance.