

The use of Videoconferencing as a function of distributed organization:

The differences of implementation depending on scale.

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Abstract

This paper discusses the benefits and disadvantages of using the communication medium, videoconferencing and its relationship with organisational size & complexity. The implementations for different types and sizes of organisation are based on money bandwidth and technical ability. Do these tend to result in different types of implementation and uses of different technical solutions?

Introduction to video conferencing

What is videoconferencing?

The use of videoconferencing has been put in the spotlight, as planes were grounded across America, following the disaster on September 11th (Feiler, J 2001). The use of videoconferencing doubled in the week following the disaster (Mueller, A 2001) - in a sign of things to come. The need to communicate is increased; technologies such as the telephone and fax machine that make quick, affordable long-distance communication possible have contributed to the decentralization of all sizes of organisation. People who are dispersed can work together on projects are able to build a global networks of colleagues. One communication system that has this potential to enhance this communication is videoconferencing.

Videoconferencing is a system that allows two or more people to communicate from different places in the world through an audio and video connection. The colleagues can see real-time video images of their partners on the computer screen and hear them speak as well. In the majority of cases the system includes the ability to share software applications.

A brief history of Videoconferencing

Video conferencing was first developed by AT&T in 1956 and known as the "picturephone"[AT&T]. This was not considered a success, the frame rate was abysmal and the quality poor. AT&T continued to push the "picturephone" into the 1970s where Ericsson produced the first trans-Atlantic video telephone call. In 1981 the Packet Video Protocol (PVP), by Randy Cole was developed [Randy Cole]. In 1982 CCITT developed the forerunner of the H.120 video coding as part of the COST project. Followed in 1991 by First audio/video conference (H.261 hardware codec) by DARTnet. This was swiftly followed the next year by World's first Mbone audio cast at the 23rd meeting of the IETF in San Diego. In 1996 Microsoft released its NetMeeting v2.0b2 (with video). Most recently NTT DoCoMo sells a 3G (WCDMA) mobile videophone for \$570 signalling the future of video conferencing.

Why use videoconferencing?

There are 3 main reasons for using video conferencing; the first is for distributed locations where it is too costly to travel for each meeting (or the meeting is not sufficiently important to warrant the travel) but communication is required. The best reason for having videoconferencing rather than teleconferencing is the idea of "Social Presence" (Short, Williams, and Christie 1976, 65). According to this theory, when people interact they are concerned with both task-oriented communication and interpersonal communication. The degree to which interpersonal information is communicated will determine the level of social presence. Typically, social presence is measured in terms of how warm, sensitive, sociable, and personable an individual is perceived to be by another.

Electronic learning is seen as a key to future education patterns. It makes it possible for learning evangelists and educators to access students across the world. The learning may of course be technical. As telephone support lines can help sort your computer; it appears possible that if your potential problems in any number of fields

could be resolved at home by communicating with a specialist thousands of miles away.

Finally, every group activity requires the physical transfer of information from reports to diagrams, drawings, proposals, and memos. If the group is widely dispersed, this sharing of information can take time. Electronic mail and fax machines cut down on the transfer time needed via traditional postal mail, but videoconferencing can provide a more complete solution. In shared workspaces, information does not have to wait for a courier or fax machine. The reduction in physical transfer of information can lead to a reduction in costs and time involved in group work. (Opper and Fersko-Weiss 1992)

What Are the Associated Standards

H.320 is the standard for video conferencing over ISDN lines. This can be over only a few lines or over a large number of ISDN lines (up to 1.5 Mbps). Since about 1992, H.320 has emerged as the *de facto* standard for wide area video conferencing over ISDN lines. It uses the H.261 video compression standard. H261 is for use with communication channels that are multiples of 64kps for example 128kps, 256kps, 384kps. There are two image sizes, specified in H.261: Common Interchange Format (CIF) is 352 by 288 pixels and Quarter CIF or QCIF is 176 by 144 pixels. The H.261 has been designed to optimise the trade-off between frame rate and picture quality at one of these frame sizes.

H.323 is the standard for video conferencing over the LAN (Local Area Network) or the Internet, with no guaranteed Quality of Service (QoS). It uses the H.263 or H.263+ video compression standard. The associated standard used for multiplexing and control is the H.225. Also defined is a Gateway between the LAN and the ISDN link with other sites. It addresses the issues of security/firewalls and use Gatekeeper (a so-called traffic cop) to restrict connection when a specified maximum amount of bandwidth used by video on the network segment is reached.

H.324 is the standard for video conferencing over normal telephone lines (know as POTS, Plain Old Telephone Service). It uses the H.263 video compression standard. It requires the new modem standard V80. This is a computer-to-modem controller protocol, which allows an asynchronous PC interface to talk to a synchronous V.34 modem. Video conferencing over the standard analog telephone line does have its limitations due to the available bandwidth. The advantages of H324 is being switched circuit based has all the advantages of H.320 except that, because of its very low bit rate, it cannot deliver high-quality video. It's delays, audio quality, and dial-ability are very good. Furthermore, H.324 has the advantage of being an analog phone line system, which means you can get a line anywhere.

Which factors influence the differences in large videoconferencing implementation

In the globalised world the larger a company tends to be the more disparate it tends to be. The key difference between a small organisations and a large organisations use of videoconferencing is that of the geographical spread of large organisations. It is normal for large multinational companies to have large offices in over 100 countries.

This means that the organizations are likely to have a Wide Area Network (WAN), or (over connected via Virtual Private Networks (VPN)) a Metropolitan Area Network (MAN). These large companies have high bandwidth links to the Internet.

Large organisations have defined structures of seniority and importance. Therefore in some large organisations, the ability to use the more expensive communications media is dependent on the rank of the person. It is more likely that in a small organisation that technical people of lower rank will implement limited desktop videoconferencing.

Which factors influence the differences in small videoconferencing implementation

Smaller organisations tend to be more geographically condensed, if they need video conferencing between sites, the sites tend to be, in the same region or country. These sites are likely to have smaller internet access capabilities these are principally the telephone network. Localised organisations have the fringe benefits of local calls between sites that result in the possibility of direct-switched connections.

Smaller organisations can be more pragmatic in the use of these information systems. Implementations are usually designed to overcome specific problems and not to develop an overall strategy.

What are the general factors influencing videoconferencing implementations

The use of ISDN or LAN¹ based connections are the only ones that can ensure consistent QoS [UKERNA]. Over LAN based implementations of a reasonable quality of network is not particularly difficult to ensure Quality of Service. If, however, you are connecting by local network it is often easier to communicate personally.

Internet connections by their very nature are currently non-persistent and do not (without buying power) guarantee QoS in the same way they can guarantee bandwidth. Recent proposals have built into it a way of guaranteeing Quality of Service, these include PPCV [BCD Forum] and the RSVP protocol [IETF] but none are currently available. Therefore for important video conferencing it is important to opt for a connection that is of a suitable specification.

Video Conferencing Equipment

The first is the large-scale systems designed for use with ISDN where quality is obviously (by their expense) the key tenet. These systems are several thousand pounds and are remarkable in their size and complexity.

The second is desktop videoconferencing where a “standard” personal computer connected to the Internet uses a webcam, microphone and speaker and something from the vast array of videoconferencing software to interact with other groups. This is a very cheap solution.

¹ High specification LAN connections 100Mbs or Gigabit Ethernet

The third solution is buying a camcorder connecting it to the computer, putting the computer on the highest bandwidth possible and streaming the content down through the video in. This is more costly than it first appears, as the video card and sound cards must be of massively high specification. This solution is also more prone to failure than the other solutions.

In opposition to smaller business that are localised, multinationals will get vast costs by using ISDN solutions due to the international nature of the calls. Additional data connections (after the primary and secondary internet links) because of the undefended nature of the ISDN line are in danger of being used as a method of covertly accessing an organisation. Corporate security will therefore, in the majority of case dislike the widespread use of ISDN connections onto a site, or sites. H.323 includes support for firewalls and proxies, adding security to the Internet connection that is not available through H.320.

The Future

With NTT DoCoMo's widespread roll out of 3G videophones we must look to mobile & satellite devices as the future. Both offer the great advantages of portability and flexibility to big business. These offer little to the smaller businesses who tend to require less portability.

Findings

Desktop videoconferencing has the potential to replace face-to-face meetings, and some companies are experiencing a reduction in travel costs due to implementing such a system. Still unclear, however, is whether certain types of meetings, such as negotiation and conflict resolution, are appropriate for desktop videoconferencing. Furthermore, evidence of a widespread reduction in net travel costs for those using these systems has yet to appear. Introducing a new communication technology into a company may actually increase the need and desire for travel.

Due to the video connection, desktop videoconferencing, allows the transmission of nonverbal communication. Social presence, or level of personableness, is generally higher using videoconferencing than using just verbal or written forms of communication such as the telephone or electronic mail. It is therefore for creative purposes better than using the technologies.

Large organisations, due to their capital base, can arm themselves with a vast array of potential videoconferencing solutions. At larger sites, where videoconferencing is seen as important, they will tend to have a large, protected or isolated, ISDN based system. It is also likely that a number of employees will experiment with desktop video conferencing. Where impression is more important than clarity, video conferencing can be done largely as an at your desk process. Where looks are important ISDN based-systems are used; however ISDN does not fit the cost method for most large businesses. Absorbing the high costs of video conferencing into the internet connection is far more appealing.

Counter intuitively it seems to make more sense for localised small to medium sized organisations to consider the more costly method of ISDN. Small organisations will tend

The actual systems implemented by smaller organisations will be of lower quality than those used by large businesses for ISDN. The largely will remain attached to the “webcam” products due to their low prices.

Conclusions

Videoconferencing has been the “next big thing” for far too long to signal a long awaited widespread use of the technology. The use of 3G technology and satellite links will push the boundaries of range and the power of video conferencing. This is signalled by the widespread use of videophones by reporters in Afghanistan today, as well as by the proliferation of videoconferencing equipment in boardrooms. The use of widespread videoconferencing in business will increase as quality of service can be guaranteed for a reasonable price. The Internet, through ADSL, will proliferate the technically literate to use videoconferencing. However, we are sometime away from small businesses and home-users taking up the advantages of videoconferencing.

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