Datasharing on Janet VideoConferencing Service

Data Sharing within Videoconferencing

Author: Geoff Constable, University of Wales, Aberystwyth

Version: 1

1. INTRODUCTION

Data sharing, data exchange, ecollaboration,remote collaboration- there are many terms used to describe the simultaneous sharing of a document or application across a network. This is an area of communication that is full of promise and exciting possibilities. Although interactive collaboration of this kind can be useful on its own, productivity is greatly enhanced if the participants are able to talk to each other, and/or see each other. For this reason this guide considers only data sharing within videoconferencing, i.e. as an additional presentation or communication tool that is used as part of a conference with audio and video.

These pages present an overview of options for data sharing within videoconferencing, but most attention is paid to those methods and applications that are applicable to users of the Janet Videoconferencing Service (JVCS).

Here are the definitions of terms used in this document:

- **Data sharing** means the simultaneous display of the desktop (screen) of one computer (or of an application running on one computer), on another display at a different location, with changes updated on both displays in real time. A practical example would be the sharing of a Microsoft (MS)

PowerPoint presentation, where the lecturer shares the presentation by running it simultaneously on a local and a remote monitor. The students at the remote location(s) can see the presentation, but not alter it, or change slides, etc.

- **Interactive data sharing** means the same as above, but with the additional possibility of either/any location being able to take control of the desktop or application, and thus update it in realtime,

so that both ends

see the changes. A practical example would be a meeting in which a MS Word document under development was shared so that all users could enter, delete or review text.

- **PC** Personal

Computer, usually a desktop, but may be a portable

computer or laptop.

2. DATA SHARING STANDARDS

The standards that are relevant to contemporary videoconferencing are:

- H.320 for

  circuitbased networks, such as ISDN

- H.323 for packetbased networks, such as the Internet.

Both of these standards are International Telecommunications Union (ITU) Recommendations (the formal name the ITU uses for its standards). They can be found at:

http://www.itu.int [1]

These standards define, in detail, the processes and procedures used for

standardsbased

videoconferencing, over ISDN and Internet Protocol (IP)

networks (such as the Internet itself).

Equipment needs to support these standards in order to interoperate with other videoconferencing equipment made and used in different countries, and/or developed by different manufacturers. This does not preclude a particular manufacturer's equipment from having a proprietary means of communicating, as long as it can also use the defined standards when interoperating with equipment that does not support those proprietary standards.

For some time Janet has supported videoconferencing using commercial ISDN services offered by telecommunications companies and Janet Videoconferencing:

At the time of writing, a videoconferencing service that will make use of the Janet IP data network is being piloted. Only equipment that supports the relevant standards will be supported by either of these services.

The standards that have been produced to define videoconferencing have included a data sharing element, and this is also defined in an ITU recommendation: T.120 " Data protocols for multimedia conferencing":

http://www.itu.int [1]

This means that the same data sharing protocol applies to both the IP/H.323 and the ISDN/H.320 domains. It should be noted that T.120 data sharing (like video) is an optional feature of an H.323 terminal.

The T.120 standard supports a number of data sharing features including whiteboards, textual chat, application sharing, interactive data sharing and desktop sharing.

3. INBAND

DATA SHARING

This is where a maximum bandwidth has been allocated to a videoconference (by choice, due to network capacity, or the limitations of the equipment) and the addition of data sharing is handled within the same connection and hence the same bandwidth limits.

3.1 Document Camera

The simplest way to share data within a videoconference is to point the camera at a printout.

This method probably yields the poorest quality, but has been known to work when all else fails!

A step up from this is a dedicated document camera that all well equipped videoconferencing studios should now have. These enable participants to show printed slides, over head projector (OHP) slides, etc., with some degree of quality, and to send these into the conference as video, replacing the image of the person talking. This is a useful method for using existing material, for adhoc display of documents and objects, diagrams in books, freehand notes, etc. and will be most useful when there is no other means of sharing the data concerned.

3.2 SCAN Conversion

This is the process of turning a computer signal into a video format. Many videoconferencing systems come with suitable connectors to allow the connection of external PCs (and possibly other inputs). The image of the display is captured, encoded for transmission and sent into the conference as an alternate video source. In this case the other end sees a video picture of the computer screen displayed on their video monitor. This method works reliably, is often adequate for the purpose, is simple, and can overcome interoperability problems. However, it does have several disadvantages:

the image is poor, as it is degraded by the conversion process, which restricts the applications and presentations that can be made successfully;
it is not possible to view the data and the speaker simultaneously, as the converted image is being sent as an alternative to the camera image;
it is not possible to use the data sharing interactively because only a picture of the computer screen is sent, which gives the remote end has no means of control;
colours seen at the remote end are not always exactly the same as those seen on the local display.

3.3 Inband Data Sharing using T.120

T.120 information and signals are exchanged within the total bandwidth of a conference, and are interleaved with the audio and video data. An ISDN6 call,
for example, allows a maximum of 384kbit/s of information in either direction. By default most terminals will treat the exchange of audio as the top priority, the exchange of data as the second priority, and then allocate any further computing resources and network capacity to video. In practice this means that using inband data sharing over a narrowband
network link (IP or ISDN, less than
384kbits/s) can result in a deterioration of the video quality. The audio quality can also suffer.

There are various scenarios for inband
data sharing with T.120. The precise
details will depend on the particular equipment.

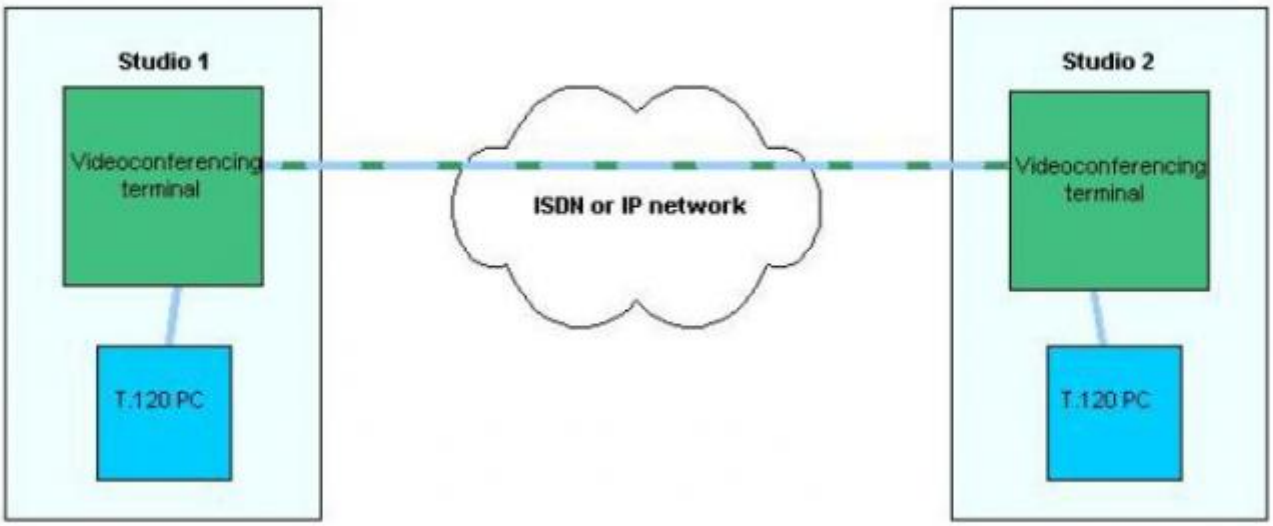
The H.320 or H.323 terminal may itself be a PC, in which case the

shared data can be running on the terminal. Using a suitable data sharing application (often Windows NetMeeting or a proprietary program) the data is presented on the remote screen in various ways: as an alternative to the video image, as a pictureinpicture,
as a separate window, or displayed on
a second connected monitor.

A terminal PC can have another PC connected to it, and again, using suitable communications software, the display of the second PC is shown at the remote end.

A terminal that is a dedicated videoconferencing unit may have an input and an output for a PC to be connected that will run the communications software and application to be shared. A PC is also connected at the remote end to share the presentation or whiteboard, etc.

Figure 1. Inband data sharing



A number of the commercial H.323 videoconferencing products and terminals include the software to achieve this in proprietary form, or with a version of Microsoft NetMeeting (see below). Where a proprietary T.120 data sharing application is offered. It will generally have the same functionality and services as NetMeeting (i.e., interactive application sharing, desktop sharing, whiteboard, chat and integrated file transfer).

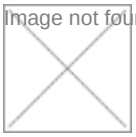
4. OUTOFBAND

DATA SHARING

Videoconferencing applications are realtime

applications that generate large
amounts of data which need to be transported across networks very quickly to be of use. Even slight delays in the transmission of data can result in impairments to picture or audio quality. For these reasons it makes sense to give the audio and video a clear path, without the extra data traffic of the T.120 session. The outofband
method relies on a completely separate call being
made for the data sharing element of a conference.
Where the call is an Internet call (IP/H.323) the transmitted information is competing with all of the other services that are running on the networks that it traverses between the source and destination of the call. All web surfers have experienced the apparently unpredictable ebbs and flows of data transfer over the Internet: web pages can be fast one day and slow the next according to who else is using the net, and what they are doing. In fact these ebbs and flows take place over seconds and fractions of seconds too. These changes cause variations in the speed and regularity of the arrival of data at its destination, which can in turn affect the quality of the playout
of audio and video.
Data sharing is not quite so timesensitive.
A delay of half a second on the
update of a presentation can in most situations be tolerated without affecting the quality of the interaction. For this reason it makes sense to extract the data sharing information from the video and audio, so that it is not competing with them for precious network resources, so a separate call is made for the data sharing element of the conference.

Figure 2. Outofband data sharing



The desktop PC that is attached to a Local Area Network (that is in turn able to access the Internet) has become so ubiquitous that it provides the simplest and most costeffective solution to setting up a separate, parallel call over the Internet for the data sharing session. This dataonly Internet call can complement an audio/video conference irrespective of whether the conference is using the Internet or ISDN as its network connection. The outofband method also results in a better quality of image than any of the inband methods as there is no conversion of format, interleaving or contention for finite resources. The JVCS does not currently support the use of inband data sharing. This policy has been built on experience of the use of both the inband and outofband methods. Inband data sharing compromises the amount of video and audio data that can be passed between the end systems involved in a conference. Outofband data sharing keeps the video and audio exchanged between systems completely separated from any data sharing information that they exchange. Keeping these separated and distinct allows network engineers to treat them differently: for example by prioritising the realtime

services (audio
and video) over the data sharing.
The outofband
method as described here gives a level of flexibility, interactivity
and quality that is often not possible using inband
methods. This method helps
to avoid potential problems caused by incompatibilities between endsystems
or
their software. It also allows Janet network engineers to apply appropriate
support within the network to optimise the quality of each conference. The next
section examines in some detail Microsoft Netmeeting, the software which is
currently in general use to facilitate outofband
datasharing.

Image not found or type unknown

5. MICROSOFT WINDOWS NETMEETING

Figure 3. Microsoft NetMeeting 3.01: 'Data Only' view

NetMeeting is a collaboration tool, that has been developed and freely distributed by Microsoft since Version 1 was released in August 1996. Originally a T.120 data sharing tool, it did not include video with the first release, although version 2, released later in 1996, did include video. Version 3.01 is the current version, and will be the last, and it is recommended that this version be used. Some older proprietary products include version 2.1, but version 3.01 has various improvements and supports the H.323 standard (opinions differ as to whether it supports H.323 to the letter, but it has been found to interoperate
with
many H.323 products). The last version supports multiway

data sharing, and

pointtopoint

audio or video calls.

The use of software CODECs, like NetMeeting, to make video and audio calls across Janet is not currently supported and would not be initially supported by an IPbased

Videoconferencing Service. It is predominantly the data sharing

element of NetMeeting that has led to its use within the Janet community.

NetMeeting has been included in all versions of MS Windows since Windows 98, and can usually be found in the Programs/Accessories/Communications menu (or by locating My Computer/C:/Program Files/NetMeeting/conf.exe). The software has become the de facto standard communications software for T.120 applications for a number of reasons:

- · it is easy to setup;
- · it is easy to use;
- · it adheres closely to the T.120 standard;
- · the ubiquity of the MS Windows operating system;
- · it is reliable and robust;
- · it was (and continues to be) distributed absolutely free.

Although no longer supported or developed by Microsoft (the last build was 3396), it has a large number of enthusiastic users worldwide and there is still a lot of support for the product available. The last version is available for download from:

http://windows.microsoft.com/ [2]

This version will not install onto machines running Windows XP or Windows 2000 the

versions supplied with the operating system should be used (it can be

installed by selecting Run... from the Windows Start Menu and typing in

'conf.exe') .

Many people with lowbandwidth

private connections to the Internet use

NetMeeting for conferencing successfully, using its video and audio capabilities, without having to buy additional hardware other than a cheap and simple digital video camera and a sound card/microphone and headphones set. However, this use is generally recreational; even using high bandwidth connections, the video quality would not usually be acceptable for use in commerce or education.

However, NetMeeting's implementation of the T.120 standard gives very effective data sharing capabilities. By placing a networked Windows PC running NetMeeting in the same room as a videoconferencing terminal it is possible to see the whiteboard, document or presentation being discussed, while still seeing the presenter. If it is also possible to project the computer screen then the experience is enhanced, particularly in a larger room or studio.

Microsoft still maintains support pages for NetMeeting and these are listed in the References section. The NetMeeting interface is very easy to use and the help files it contains are copious and thorough.

The T.120 services that NetMeeting allows include the following:

- · Shared whiteboard all

parties can input simultaneously, pictures and

text can be cut and pasted into the whiteboard from other applications, files can be saved by participants in a proprietary format. Useful for brainstorming, labelling a diagram, etc.

- · Chat tool allows

text to be input and displayed on a shared window,

also allows messages to be sent discreetly to individuals in a multiway

call.

The text can be saved by all participants as plain text or HTML files. Useful for conference control messages in large multiparty conferences, and to exchange brief messages.

- · File Transfer allows the speedy transfer of files between participating computers. Useful for sending presentations, etc. to other participants at the end of a session.
- · Shared desktop allows remote computer(s) to view a host's desktop. Control of the host computer can be transferred to the remote computer. Useful for demonstrations, teaching, etc. but should be used with care because of the security implications.
- · Shared applications allows any program that can be run on the host operating system to be displayed in real time on remote computer(s). The program does not need to be installed on the remote computer(s). Control can be given to a remote computer user. Files can be saved on the host computer. This feature is particularly useful for remotely displaying a presentation or document.

5.1 Finding and Connecting to Other NetMeeting Users

NetMeeting can make calls using IP numeric addresses (e.g. 193.66.8.24), or DNS addresses (e.g. pcname.college.ac.uk). These are entered so that the data PC knows which other Internetconnected computer to contact. The numeric IP

address of the host machine can be found by selecting the 'Help' menu and then 'About Windows NetMeeting'.

Image not found or type unknown

Figure 4. Finding your IP address in NetMeeting

To avoid people having to keep and maintain lists of addresses, and because addresses can change over time, Microsoft have released a free directory program called the Internet Locator Service (ILS). This software allows a directory computer to maintain a list of NetMeeting users who are currently logged on. Individual locations can be selected from the list and contacted. Once the call has been initiated, the directory machine plays no further part in the call, its role is simply as a directory. ILS server software is no longer supported by Microsoft but is still available, and remains a popular method of finding and connecting to other NetMeeting users.

The JVCS operates an ILS server for academic users in the UK. Its address is ils.ja.net. Any NetMeeting users with a UK academic address can log on to the server as a means of locating and connecting to other academic locations.

Image not found or type unknown

Figure 5. The Janet ILS server directory listing page.

To contact another user who is currently logged on to the ILS server, click on the 'Directory' button in NetMeeting. When the ILS list of logged on sites appears, select the individual location that you wish to contact, and click 'Call'.

5.2 Security and Firewalls

Firewalls exist at the boundaries between different physical and logical networks. Specifically, they are often located between a campus network and access to the wider Internet. They can be dedicated machines or software

running on routers at the boundary of a network. Their role is to stop unwanted traffic; be it malicious (e.g. hackers), or antisocial (e.g. people engaged in activities which unfairly consume the available bandwidth to a site, starving other users).

Firewalls are often setup to start by denying access to the campus to everything, and then allowing small, defined and controlled 'holes' in the firewall to accept legitimate traffic. A recognised problem with H.323 communications is that they demand a number of holes to be made in firewalls, and in many cases, the holes they require are not predictable. This means that most people will find it impossible to communicate with NetMeeting (or any other H.323 software) with people who are offcampus, without manual changes being made to their firewall. The Appendix gives the ports of the services needed by NetMeeting for ILS and data sharing services, and further references to discussions of this problem.

5.3 Usage Issues

- · Wherever possible use the latest version of NetMeeting (3.01), and be sure that both ends of the connection are using the same version.
- · Use the same screen settings (number of colours and resolution) at both ends of the call (for example, all studios on the Welsh Video Network use 24 bit True Colour, at 1024x768 resolution). These screen settings can be found by rightclicking the desktop, then selecting 'Properties', and 'Settings'.

- · Version 2.1 only allows sharing in 256 colours. This is also the default

for later versions and

is often sufficient but

checking the box marked

'Share in true colour' (in the 'Sharing' window) usually gets better results,

particularly when faithful representation of the colours is important to the

presentation or application. Image not found or type unknown

Figure 6. Sharing presentations in true colour with NetMeeting

- · Close any programs running on the NetMeeting computer that are not

needed for the current session.

- · Try to keep graphics simple in shared applications.
- · Although you can include video effects in presentations or shared web

pages, the quality is often very poor, and this should be avoided if possible.

- · Make sure you have no windows open on top of the shared application the

other end will not see this part of the screen.

6. ALTERNATIVE APPROACHES

6.1 Other Operating Systems

- · Solaris users have a free T.120 communications application called

SunForum available for download. Tests have shown that this interoperates

very well with NetMeeting, and the simultaneous use of

NetMeeting on a PC and SunForum on a Solaris workstation allows the

control of Unix applications from a PC and vice versa. SunForum 3.2, the

current version, includes support for video, audio, and interactive data

sharing (chat, whiteboard and application sharing) between users of the

software. It can also log on to, and make use of, ILS servers. Further

Information can be found at:

http://www.sun.com/desktop/products/software/sunforum/ [3]

and SunForum can be downloaded from

http://www.sun.com/desktop/products/software/sunforum/download.html [4]/

- · HPUX

workstation users can find details of the T.120 data sharing

product hp visualize conference at:

http://www.software.hp.com/cgibin/ [5]

swdepot_parser.cgi/cgi/displayProductInfo.pl?productNumber=B7580A

A/

Interoperability with NetMeeting, ILS servers, and other H.323/T.120

programs is offered.

- · SGImeeting is a collaborative data sharing product for Silicon Graphics

IRIX workstations. The current version is SGImeeting 2.0 and this is

available at:

http://www.sgi.com/software/sgimeeting/ [6]

Again, full interoperability is offered.

- · There is currently development work in producing H.323 software for

Linux and opensource

users. Pointers and further information can be found

at:

http://www.openh323.org/ [7]

Initiatives include GnomeMeeting which does not yet include data sharing

(apart from a text chat tool for use with other GnomeMeeting users).

Further details are available from:

http://www.gnomemeeting.org/ [8]

· There are no applications that the author is aware of that currently offer Apple Mac users T.120based data sharing. There is at least one commercial H.323 program available: VideoLink Pro, from Smith Micro Software, at:

http://www.smithmicro.com/ [9]

This offers only a chat program, not full T.120 services.

6.2 The Access Grid, Multicast Videoconferencing and Data Sharing

Multicast videoconference users have a different set of applications available for videoconferencing and data sharing.

Data sharing applications that are used in multicast videoconferencing include:

· wb a shared whiteboard, available at:

http://mice.ed.ac.uk/mice/archive/wb.html [10]

· NetText is a shared text editor. More information is available from:

http://mice.ed.ac.uk/mice/archive/nt.html [11]

Largescale pooling of computing resources and sharing of data over the Internet are realised by the use of multicast and the Access Grid. Further details can be found at the Access Grid Home Page:

http://www.accessgrid.org/ [12]

6.3 T.120 Servers

In H.320 and unicast H.323, calls involving only two participants are pointtopoint, from one endpoint to another. In order to take part in calls involving more than two endpoints, each of the endpoints needs to be in conference with an

Multipoint Control Unit (MCU) which acts as the hub of the meeting. The T.120 datacollaboration element of a conference can be routed through the MCU as well. This allows the session to scale to a far larger number of users than would otherwise be possible, but it means that all network traffic (video/audio and data sharing) is routed through the same server. The use of T.120 servers or 'conference servers' would appear to be most appropriate for internal use by organisations on an intranet for example. JANET does not have a T.120 server, and there are currently no plans to implement one. The current situation, of noncentralised, outofband data sharing is the most appropriate for the Janet network.

7. NEW DEVELOPMENTS

7.1 Windows Messenger

As has been mentioned, there are no plans to upgrade Microsoft NetMeeting beyond the current version. In the latest operating system to be released by Microsoft XP the Instant Messenger service 'Windows Messenger' has all the functionality of Windows NetMeeting. As well as audio and video conferencing, it also includes a text chat window, shared whiteboard, file transfer, desktop and application sharing, and has a look and feel similar to that of NetMeeting. Currently it can only be used when all participants are running Windows Messenger on XP. When Windows Messenger is installed onto a Windows 2000

or lower machine, it has a menu item 'Start NetMeeting' to enable data sharing functions. In order to allow interworking with previous versions of Microsoft Windows (presumably), NetMeeting is also included in the XP Operating System.

Currently Windows Messenger and Windows NetMeeting are not compatible. In fact, Messenger does not use the H.323 standard to setup and manage conferences, but another emerging protocol called SIP (Session Initiation Protocol). To what extent Messenger is a standardsbased product is unclear, but if and when XP becomes more commonly deployed, this may emerge as an alternative means of data sharing to NetMeeting. The situation will be monitored and reported in updates to this guide.

7.2 Distributed PowerPoint

Distributed PowerPoint is a small program which runs on the java 'Microsoft Virtual Machine'. It is installed onto all computers participating in a conference. When the program is run, each machine downloads a copy of the presentation from a URL, then the master machine sends control signals to the other machines indicating each time a slide is changed. This results in much less bandwidth being consumed than would be by a similar sharing of a presentation using NetMeeting, which distributes an updated image each time the slide is changed. The program requires technical competence to install and configure, but is worthy of further investigation as an alternative to NetMeeting, particularly for conferences where participants have limited bandwidth. The program can be found at:

http://www.accessgrid.org/agdp/guide/dppt.html [13]

7.3 Data Sharing Using the World Wide Web

An alternative approach to data sharing has emerged which is available to anyone through a standard web browser. Using a proprietary server, all participants logon
by opening a particular URL. This enables them to share data interactively in the ways that are covered by T.120 solutions: they can display documents or presentations; interactively share applications, or the entire desktop; use a shared whiteboard; text chat with individual participants; save and print resultant files. Because these web collaboration solutions use a single, central server, access can be controlled by password and sessions can be encrypted. They do not need a client installed on the user's desktop PC. The need for firewall changes is avoided as the server uses the same settings as all other web browsing sessions. This method of data sharing is promising in its simplicity, but relatively untried in an educational environment. There are links to some example products in the References section.

7.4 Use of Projection and Interactive Whiteboards

It is becoming increasingly common for videoconferencing studios to include projection facilities. Where these facilities are available at both local and remote studios, presentations running on a NetMeeting PC in the local studio can be displayed locally, while simultaneously being displayed in the remote studio (via a NetMeeting PC in that studio). This means that participants in a studio (eg Studio 1 in Figure 7) can see the image of the remote speaker on their terminal as s/he addresses them; and simultaneously view a projection of the presentation, document or web page that is being discussed.

Image not found or type unknown

Figure 7. Outofbanddata sharing with projection

It is also possible for the projection screen to act as a giant touchscreen, or interactive whiteboard. It is connected to the PC by a separate cable and allows windows commands to be run using the finger as a mouse. If this is the case, there is no need for the presenter to change position at the front of the class in order to control the presentation, etc. A second camera helps in this situation, to ensure that participants at the remote end see the presenter faceon, as the presentation is being made.

Image not found or type unknown

Figure 8. Example studio layout with interactive whiteboard

8. CONCLUSION

There are a number of different ways of sharing data and collaborating on applications while taking part in a videoconference. Many of these are proprietary, and often have the drawback that they share the data inband using valuable bandwidth (and computing resources) that would otherwise be available to the video and audio data.

Experience within the Scottish videoconferencing community has shown that the most efficient and practical means of data sharing, without sacrificing the quality of any of the media (audio, video or data) is to use outofband data sharing. The most suitable product that has been found to facilitate this data sharing is Microsoft NetMeeting. It is easy to use and fairly robust. It has become the de facto standard and the data sharing package against which all others are

measured. It is standardsbased.

The use of outofband

NetMeeting over IP within videoconferencing to facilitate

data sharing, is likely to meet the needs of the vast majority of academic users of both the H.320 and H.323 videoconferencing service. There is a wide body of experience and support available for this method. For those that have particular requirements, there are alternatives, and these have been outlined.

This is a fastchanging

area of information and communications technology, in

which new products, product updates and protocol developments are frequent. The managers of the various JANET videoconferencing services will continue to keep a close watch on developments and experiences in data sharing in order to offer the best possible options to videoconferencing users.

The references and links below lead to a number of support sites and articles. Further assistance is available from video and collaboration technology experts who support the work of the Video Technology Advisory Service (VTAS). VTAS can be contacted via Janet Customer Service at service@ja.net [14]

APPENDIX: Firewalls and port numbers for H.323 data sharing

80 Static IP HTTP Interface MS

ILS (Optional)

389 Static TCP ILS Registration MS

ILS / LDAP

1503 Static TCP T.120 (Data)

1718 Static TCP Gatekeeper discovery

1719 Static TCP Gatekeeper RAS

1720 Static TCP H.323 call setup

8080 Static TCP HTTP Server Push MS

ILS (Optional)

1024 65535

Dynamic TCP H245

Discussions of the H.323/Firewall problem can be found at:

http://erris.med.virginia.edu/tech/FIREWALL.HTM [15]

http://www.h323forum.org/papers/firewall_nat_traversal.pdf [16]

http://www.h323forum.org/papers/firewall_nat_vtel.zip [17]

http://www.vtel.com/support/galaxy/H323_Proxies_Firewalls.htm [18]

http://www.vcon.com/pdfdoc/eng/wp/020227.eng.wp.Firewalls.and.Proxy.Server [19]

s.zip

Further information on the ports and their services can be found at:

http://www.teamsolutions.co.uk/tsfirewall.html [20]

http://www.surfnet.nl/innovatie/surfworks/showcase/h4.html [21]

http://www.microsoft.com/windows/NetMeeting/Corp/reskit/Chapter4/default... [22]

REFERENCES AND SOURCES

JANET Services

· The JANET Videoconferencing Service:

http://www.jvcs.video.ja.net/ [23]

· Video Technology Advisory Service VTAS:

http://www.video.ja.net [24]

· JANET Videoconferencing Services Under Development:

http://www.ja.net/development/voicevideo [25].

html

· The Welsh Video Network:

http://www.wvn.ac.uk/ [26]

Standards

The Standards Documents

· H.320 and H.323:

http://www.itu.int/rec/recommendation.asp?type=products&parent=TRECh [27]

· T.120:

http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=TRECT [28].

120

· H.323 and related protocols:

http://www.packetizer.com/ [29]

Primers and Discussion

· Videoconferencing Standards

· Primers on the T.120 and H.323 Standards:

http://www.lotus.com/products/sametime.nsf/standards/ [30]

· A Primer on the T.120 Series Standard:

http://www.dtic.mil/ieb_cctwg/contribdocs/ [31]

T.120/T.120WP.

html

· H.323 and Associated Protocols:

http://www.cis.ohiostate [32].

edu/~jain/cis78899/

h323

· The PictureTel Standards Page:

http://standard.pictel.com/ [33]

· An Introduction to H.323 Videoconferencing

Microsoft Windows NetMeeting

Official Microsoft Sites

· NetMeeting Home:

http://www.microsoft.com/windows/netmeeting/ [34]

· NetMeeting Downloads:

http://www.microsoft.com/windows/netmeeting/download/default.asp [35]

· NetMeeting Resource Kit:

http://www.microsoft.com/windows/NetMeeting/Corp/reskit/default.asp [36]

Other NetMeeting Sites

· Meeting By Wire:

http://www.meetingbywire.com [37]

User Guides

· SMVCN Guide

to Data Sharing with NetMeeting:

http://www.jvcs.video.ja.net/docs/datash/ [38]

· Setting Up and Using NetMeeting with the JVCS Internet Locator Server

(ILS):

http://www.jvcs.video.ja.net/docs/ilsproc.shtml [39]

· Microsoft NetMeeting Features:

http://www.microsoft.com/windows/netmeeting/features/default.asp [40]

· Security and Firewalls: see the Appendix

NetMeeting for Education

· Collaborating With Others Using NetMeeting:

http://www.microsoft.com/education/default.asp?ID=netm3Tutorial [41]

· Integrating Videoconferencing and Educating:

http://www.rscwales [42].

ac.uk/english/ilt/videoconferencing.shtml

Alternative Approaches

Other Operating Systems

· Solaris, SunForum:

http://www.sun.com/desktop/products/software/sunforum/ [3]

· HPUX,

hp visualize:

http://www.software.hp.com/cgibin/ [5]

swdepot_parser.cgi/cgi/displayProductInfo.pl?productNumber=B7580A

A

· Silicon Graphics, SGImeeting 2.0:

http://www.sgi.com/software/sgimeeting/ [6]

· Linux, GnomeMeeting:

http://www.gnomemeeting.org/ [8]

· Apple, VideoLink Pro:

http://www.smithmicro.com/ [9]

Access Grid

· The Multimedia Conferencing Applications Archive:

http://www.video.ja.net/mice/ [43]

T.120 Servers

Among the products available are those from:

· Radvision:

http://www.radvision.com/f_products/f1_DCS.php3?prod=DCS++ [44]

Data+Collaboration+Server

· Cisco:

http://www.cisco.com/univercd/cc/td/doc/pcat/vc3540.htm#xtocid6 [45]

· Microsoft Exchange Server:

http://www.microsoft.com/exchange/evaluation/overview/anytimecommunic [46]

ation.asp

New Developments

Windows Messenger / MSN Messenger

· Net Messenger Service:

http://messenger.msn.co.uk/ [47]

· Windows Messenger press release June 2001:

http://www.microsoft.com/presspass/features/2001/jun01/0604messenger [48].

asp

· Meetingbywire

review:

http://www.meetingbywire.com/windowsmessenger.htm [49]

Distributed PowerPoint:

http://www.accessgrid.org/agdp/guide/dppt.html [13]

Data Sharing using the World Wide Web

Examples of products that enable data sharing using a web browser include:

· Cisco Collaboration Server:

http://www.cisco.com/warp/public/180/prod_plat/cust_cont/nam/collaboratio [50]

n.html

· PolyCom WebOffice

http://www.polycom.com/products_services/products_groups/0,1422,18810327... [51].

html

General

· Videoconferencing Atlas a

useful resource for distance learning,

videoconferencing, etc:

http://www.savie.com/ [52]

· Network World Fusion another

starting point for lots of related

information:

http://www.nwfusion.com/research/videoconf.html [53]

ACKNOWLEDGEMENTS

I would like to record my thanks to the following people for their assistance in the

preparation of this report:

· Dave Price, Dept. Computer Science, University of Wales, Aberystwyth

· Sandy Spence, Dept. Computer Science, University of Wales,

Aberystwyth

· John Martin, University of Edinburgh Computing Service

· Urwin Wood, University of Newcastle upon Tyne

· Jim Sheach, Media and Learning Technology, University of Edinburgh

· Gill Price, Information Services, University of Wales, Aberystwyth

· Tim Davies, Information Services, University of Wales, Aberystwyth

· My Welsh Video Network Support Team colleagues: Ian, Steve, Phil and

Matt and Deirdre

Thanks!

Links
[1] http://www.itu.int
[2] http://windows.microsoft.com/
[3] http://www.sun.com/desktop/products/software/sunforum/
[4] http://www.sun.com/desktop/products/software/sunforum/download.html
[5] http://www.software.hp.com/cgibin/
[6] http://www.sgi.com/software/sgimeeting/
[7] http://www.openh323.org/
[8] http://www.gnomemeeting.org/
[9] http://www.smithmicro.com/
[10] http://mice.ed.ac.uk/mice/archive/wb.html

[11] http://mice.ed.ac.uk/mice/archive/nt.html
[12] http://www.accessgrid.org/
[13] http://www.accessgrid.org/agdp/guide/dppt.html
[14] mailto:service@ja.net
[15] http://erris.med.virginia.edu/tech/FIREWALL.HTM
[16] http://www.h323forum.org/papers/firewall_nat_traversal.pdf
[17] http://www.h323forum.org/papers/firewall_nat_vtel.zip
[18] http://www.vtel.com/support/galaxy/H323_Proxies_Firewalls.htm
[19] http://www.vcon.com/pdfdoc/eng/wp/020227.eng.wp.Firewalls.and.Proxy.Server
[20] http://www.teamsolutions.co.uk/tsfirewall.html
[21] http://www.surfnet.nl/innovatie/surfworks/showcase/h4.html
[22] http://www.microsoft.com/windows/NetMeeting/Corp/reskit/Chapter4/default.asp
[23] http://www.jvcs.video.ja.net/
[24] http://www.video.ja.net
[25] http://www.ja.net/development/voicevideo
[26] http://www.wvn.ac.uk/
[27] http://www.itu.int/rec/recommendation.asp?type=products&parent=TRECh
[28] http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=TRECT
[29] http://www.packetizer.com/
[30] http://www.lotus.com/products/sametime.nsf/standards/
[31] http://www.dtic.mil/ieb_cctwg/contribdocs/
[32] http://www.cis.ohiostate
[33] http://standard.pictel.com/
[34] http://www.microsoft.com/windows/netmeeting/
[35] http://www.microsoft.com/windows/netmeeting/download/default.asp
[36] http://www.microsoft.com/windows/NetMeeting/Corp/reskit/default.asp
[37] http://www.meetingbywire.com
[38] http://www.jvcs.video.ja.net/docs/datash/
[39] http://www.jvcs.video.ja.net/docs/ilsproc.shtml
[40] http://www.microsoft.com/windows/netmeeting/features/default.asp
[41] http://www.microsoft.com/education/default.asp?ID=netm3Tutorial
[42] http://www.rscwales
[43] http://www.video.ja.net/mice/
[44] http://www.radvision.com/f_products/f1_DCS.php3?prod=DCS++
[45] http://www.cisco.com/univercd/cc/td/doc/pcat/vc3540.htm#xtocid6
[46] http://www.microsoft.com/exchange/evaluation/overview/anytimecommunic
[47] http://messenger.msn.co.uk/
[48] http://www.microsoft.com/presspass/features/2001/jun01/0604messenger
[49] http://www.meetingbywire.com/windowsmessenger.htm
[50] http://www.cisco.com/warp/public/180/prod_plat/cust_cont/nam/collaboratio
[51] http://www.polycom.com/products_services/products_groups/0,1422,188103271,00
[52] http://www.savie.com/
[53] http://www.nwfusion.com/research/videoconf.html