What you really need to know about Video Conferencing Systems

How do I choose a Video Conferencing system?

Well, you could just buy the same as the person you want to have a conference with. However, this might not be the best solution. There are essentially two types of systems, proprietary and standards based. If the person you want to have a conference with uses a proprietary system, then you must buy the same as them, or persuade them to buy something different.

There are many questions that must be answered as you steer your way towards identifying which is the best Video Conferencing system that meets your needs. This document is about standards based systems and is intended as a guide to their selection.

The following technical papers are also available to provide more information:

- ***Video Conferencing Standards and Terminology.***
- ***H.323 Terminals, Gatekeepers, Gateways & MCUs.***
- ***Global Dialling Scheme (GDS) for Schools VideoConferencing.***
- ***H.323 Dial Plan and Service Codes used by Gatekeepers etc.***
- ***IP Ports and Protocols used by H.323 Devices.***
- ***Cost Efficient ISDN Conferencing, including Multipoint Access.***
- ***H.221 Framing used in ISDN Conferences.***

International Telecommunications Union & The Internet Engineering Task Force.

Telecommunications standards are set by the United Nations agency, International Telecommunications Union (ITU) and the Internet Engineering Task Force (IETF). Products that adhere to these standards allow users to participate in a conference, regardless of their platform. These standards for desktop video conferencing ensure compatibility on a worldwide basis. The ITU has developed the H, G and T Series of standards whilst the IETF has developed Real-Time Protocol (RTP) & Resource Reservation Protocol (RSVP). These standards apply to different transport media.

Before you start, it is useful to understand what types of media are available. ISDN, LAN, WAN, Internet, ADSL (Asynchronous Digital Subscriber Lines) and VPN, (Virtual Private Networks) are the popular transport media used in desktop video conferencing. They all have strengths and weaknesses that should be considered carefully before deciding upon which one to use. The worldwide availability of the Internet has virtually stopped the use of POTS (Plain Old Telephone Service) as a direct means of connecting video conferencing systems. However, the forthcoming media-enabled 3G mobile phone has caused the creation of a derivative of the H.324 POTS standard in the form of 3G-324M as well as next generation Gateways to transcode the new protocols.

You also need to be aware of new and emerging standards that might have an impact on what you purchase. The latest video compression used by Video Conferencing systems is H.264. As a guideline, H.264 offers twice the quality of H.263 at the same bandwidth, or the same quality at half the bandwidth. So if you are restricted in the available bandwidth, take a look at systems that support the latest video compression, H.264.

There are also changes in the way data collaboration is achieved, with the development of the H.239 standard and 'data-showing' being favoured as an alternative to T.120 'data sharing'. H.239 defines how additional media channels are used and managed by Video Conferencing systems. It introduces the concept of 'data-showing', whereby the PC desktop graphics is converted into a separate media stream and transmitted in parallel with the video stream. Endpoints that support H.239 will receive the dual streams and display the desktop graphics and far-end video in separate windows. Endpoints that don't support H.239 will display the desktop graphics instead of the far-end

video in one window.

Integrated Digital Services Network (ISDN).

There are two available ISDN connections, Basic Rate Interface (BRI) and Primary Rate Interface (PRI). Essentially, a BRI provides two 64kbps B-channels and one 16kbps D-channel. In Europe, a PRI provides 30 x 64kbp B-channels and one 64kbp D-channel, whilst in North America a PRI provides 23 x 64kbp B-channels and one 64kbp D-channel.

ISDN connections usually aggregate the BRI and share the same number for both B-channels. Known as ISDN-2, this provides a line speed of 128kbps is typically used by Desktop Video Conferencing Systems over ISDN. For increased bandwidth, ISDN-6 provides a line speed of 384kbps and is typically used by Group or room-based Video Conferencing Systems over ISDN. With ISDN-6, the sequence in which the lines are aggregated must be known and adhered too! Furthermore, if the connection is going to use some form of 'switch', this must be configured to pass both voice and data!

In the past, H.320 conferences would have been between just two participants as ISDN is essentially a point-to-point connection. However, multipoint technology now makes it possible for groups of people to participate in a conference and share information. To hold a multipoint conference over ISDN, participants must use either a dedicated Multipoint Control Unit (MCU) that connects and manages all the ISDN lines, or an endpoint with an embedded H.320 multipoint capability such as the Polycom ***HDX 8006*** or Emblaze-VCON ***xPoint***.

Basic H.320 Configuration

H.320 is the ITU standard for ISDN conferencing and includes H.264, H.263, H.261 video; G.711, G.722, G.722.1, G.728 audio; H.239, T.120 data and H.221, H.231, H.242, H.243 control.

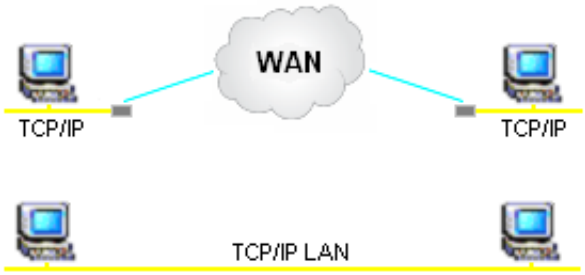
Local Area Network (LAN) & Intranet.

100 Mbps LANs with switches and routers are used in most companies today and these have enough bandwidth to support desktop conferences. With a LAN offering significantly more bandwidth than ISDN, the video quality within a conference is much higher and can approach that of television. Technology as also helped, we now have communications advancements such as Gigabit Ethernet (1000 Mbps), Faster Switches as well as Asynchronous Digital Subscriber Lines (ADSL) and Synchronous Digital Subscriber Lines (SDSL) that have increased the availble bandwidth, whilst IP Multicasting has reduced network loading in conferences involving more than two participants.

Unlike ISDN networks, LANs and WANs use TCP/IP protocol and the H.323 standard defines how to assemble the audio, video, data and control (AVDC) information into an IP packet. Most companies use DHCP and allocate dynamic IP addresses to PC's. Therefore, in order to correctly identify a user, the H.323 endpoints are usually registered with a Gatekeeper and 'called' into a conference by their H.323 alias. The Gatekeeper translates the alias into the corresponding IP address. Another method of identifying H.323 users is for them to register their presence using Light Directory Access Protocol (LDAP) with a Directory Service such as Microsoft's Windows 2003 Active Directory or the freely available OpenLDAP.

To hold a multipoint conference over a LAN/WAN, H.323 systems require a Multipoint Conference Server (MCS). This is also referred to as an H.323 Multipoint Control Unit (H.323 MCU). This is not the same as an H.320 MCU; hence it is important to be clear about what you mean when using the term MCU.

To hold a multipoint conference over IP, participants must use either a dedicated Multipoint Control Unit (***MCU***) connected to the IP network, or an endpoint with an embedded H.323 multipoint capability such as the Polycom ***HDX 7002XLP*** or Emblaze-VCON ***xPoint***.



Basic H.323 Configurations

H.323 is the ITU standard for LAN conferencing and includes H.264, H.263, H.261 video; G.711, G.722, G.722.1, G.723.1, G.728, G.729 audio; H.239, T.120 data and H.225, H.245 control.

Plain Old Telephone Service (POTS).

The standard telephone system is the most readily available form of transport media for home users. With V.92 modems giving transmission speeds of up to 56kbps, there is just about sufficient bandwidth available to support audio, video and data sharing with this media, especially when used in conjunction with the latest CPU's, compression techniques and technologies like DirectDraw.

H.324 is the ITU standard for POTS conferencing and includes H.263 video; G.723.1 audio; T.120 data and H.223, H.245 control. However, the use of standard telephone lines for POTS based H.324 conferencing has given way to the ever increasing popularity of the Internet.

Cellular Networks.

The cellular phone network is a readily available form of wireless multimedia delivery and with the forthcoming media-enabled 3G mobile phone or Personal Digital Assistants, PDAs, that support the CDMA2000 or WCDMA Air Interface, there is sufficient bandwidth to enable IP-based multipoint audio and video conferencing to existing desktop video conferencing systems when used in-conjunction with next generation Gateways and MCU's that also support these new protocols.

3G-324M is an extension by the 3rd Generation Partner Project (3GPP) and 3rd Generation Partner Project2 (3GPP2) to the ITU H.324M standard for 3G mobile phone conferencing and includes MPEG-4 (not H.264) video; G.722.2 (AMR-WB), G.723.1 audio and H.223 A/B, H.245 control.

Internet, VPN, ASDL & SDSL.

With its ever increasing popularity, people have sought to use the Internet in more ways than just a means of sending email or browsing interesting sites.

Like LANs, the Internet, VPNs, ASDL and SDSL are other forms of TCP/IP networks and hence can be used as a transport media in desktop conferencing systems. Not to be confused with POTS, the Internet uses a modem as a TCP/IP dial-up adapter in order to gain access to the network. What the users must do is to get their Internet Service Provider (ISP) to provide them with a fixed IP address. Alternatively, users can register their presence using Light Directory Access Protocol (LDAP) with a Directory Service such as OpenLDAP. This is how you determine the address of the machine that you want to conference with. Obviously, speed is limited to that of the slowest link, but most ISPs now support ISDN Dial-up at 128kbps or V.92 modems at 56kbps.

For a more secure and faster connection, ISP and telecoms companies are now offering VPN and ADSL or SDSL links. A VPN provides a secure tunnel over the providers network with a guaranteed bandwidth. ADSL, whilst being faster than ISDN, is only as fast as the slowest uplink when used for Video Conferencing. Although an ADSL may be quoted as having a 256kbps uplink, in reality, you can only acheive something in the 128-168kbps range due to contention. Hence SDSL is much better as the uplink speed matches the downlink and is faster. Again, users should get their DSL Service Provider to provide them with a fixed IP address for the Video Conferencing system, which should either be located behind an ***H.323 Intelligent Firewall or Proxy*** or outside a non H.323 Intelligent Firewall. Otherwise, too many Firewall ports will have to be opened in order to provide access, which defeats the objectives of having a Firewall.

Basic H.323 Internet Configuration

H.323 is the ITU standard used for Internet conferencing and includes H.264, H.263 video; G.723.1, G.722.1, G.728 audio; H.239, T.120 data and H.225, H.245 control.

Issues to Consider.

Each of the above technologies has there own strengths and weaknesses that should be considered carefully before deciding upon which one to use.

The trade-off factors involved in determining the best system for your situation will be:

- Expectation Levels
- Acceptable Quality
- System Management
- Usage Concept
- Available Bandwidth
- Number of Participants
- Location of Participants
- Installation & Usage Costs

Expectation Levels.

A crucial area in selecting a system is to discuss and then set the expectations levels of the users to be attainable. What is a realistic frame rate and window size for the available bandwidth will most probably be much lower than that expected by the users. However, for the users to get the most out of a Video Conferencing system, they must be content when using it. Their expectation levels must be aligned to what is realistic from the available systems.

Don't expect full screen motion video via the Internet, the numbers just don't add-up!

Required versus Available Bandwidth.

Video Conferencing is a form of communications involving the transfer information between two or more locations. The connection between these locations is the communications channel and is called the network. It is the network loading in terms of required bandwidth that needs to be considered. Bandwidth is the resource of a network. It is the term given to the rate of transfer of information, usually in bits/second; it is like the speed limit of the network and cannot be exceeded.

Analogues can be made between speed and bandwidth. If you wanted to know how long it would take to travel 1000 km when you are limited to 50 km/h; then a simply calculation of 1000 divided by 50 shows that it would take 20 hours. Likewise, if you wanted to transfer one megabyte of data across a network with an available bandwidth of 9600 kbps, it would take just over 14 minutes.

Available bandwidth is the limiting factor with desktop conferencing and sending video creates lots of data. Consider a typical CIF video image size of 352x288 pixels; then this represents 101376 pixels or 304128 bytes of information (if the image depth is 24 bits) per single frame. Now consider how many frames per second that you want to see; this is called frame rate. The human eye perceives 25 frames per second as continuous motion, therefore using this rate in our calculation means that if we wanted to see continuous motion video at this image size, we would need to transfer 304128 x 25 or approximately 7.2 Mbytes per second.

It is clear from the above example that video can place enormous demands on the network and hence why available bandwidth is the bottleneck with desktop conferencing systems.

There are essentially two ways of reducing the impact of this bottleneck. One is to use a faster method of communications that increases the

available bandwidth to the conference; the other is to utilise methods that reduce the amount of data to be transmitted and use systems that support H.264 compression.

Acceptable Quality.

There are several steps that can be taken to reduce the amount of data that has to be transmitted when conferencing. The obvious combination is to use the smallest acceptable window size with the minimum acceptable frame rate. Applying compression can then further reduce the resulting amount of data; but which type has a crucial effect on quality.

There are two types of compression techniques, lossless and lossy. GIF files are an example of lossless compression. With this technique, the exact data that went into the algorithm comes out when the data is uncompressed. But GIF compression is applied to still images and is not applicable to conferencing.

Take the previous example of a CIF sized video at 25 frames per second; to transfer this over an ISDN-2 line at 128 kbps, we need to apply a compression ratio of approximately 500:1. To achieve this, Video Conferencing Systems use lossy compression. The amount of lossy compression applied, or lack of compression, is sometimes expressed as a 'quality' percentage, with 100% quality meaning least compression. The use of lossy algorithms creates a compromises between acceptable image quality and data volume. An important consideration in the selection of a compression technique is the interoperability between the systems being used in the conference.

Video Conferencing applies Compression.

H.261 was the original ITU-T developed standard used in Video Conferencing. This was quickly followed by H.263 in 1995. After this, the ITU-T Video Coding Experts Group (VCEG) started work on a short-term effort to add extra features, (H.263 v2) and a long-term effort to develop a new standard that offers higher video compression efficiency and better resilience from packet and data loss. A standard that will significantly outperform H.263, with more features and support higher quality at low-bitrates.

In 2001, the ISO Motion Picture Experts Group (MPEG) recognised the potential of this ITU-T development and formed the Joint Video Team (JVT) that included people from MPEG and VCEG. The result is two identical standards: ISO MPEG4 Part 10 and ITU-T H.264, with the official name Advanced Video Coding (AVC).

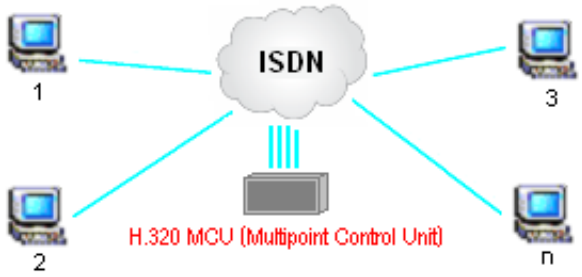
The H.261, H.263 and H.264 algorithms are all designed for use with low bandwidth communications and incorporate motion prediction as well as lossy compression to further reduce the amount of information to be transmitted. Whilst H.261 and H.263 images are also limited to CIF and QCIF sizes, H.264 can support graphics at XGA resolution when used in H.239 data streaming.

The basic technique of motion prediction works by sending a full frame followed by a sequence of frames that only contain the parts of the image that have changed. Full frames are also known as 'key frames' or 'I-frames' and the predicted frames are known as 'P-frames'. Since a lost or dropped frame can cause a sequence of frames sent after it to be illegible, new 'I-frames' are sent after a predetermined number of 'P-frames'. It is the combination of both lossy compression and motion prediction that allows H.261, H.263 and H.264 systems to achieve the required reduction in data whilst still providing an acceptable image quality.

There is little difference between the functional elements of H.264 and those of the earlier H.261 and H.263 standards. The changes that do make the difference lie mainly in the detail within each element, how well the algorithm is implemented and whether it is performed in hardware or software. Be cautious of systems that claim to achieve high frame rates over low bandwidths using software implemented compression. These codecs still need computational power and it is unlikely that H.264 can be satisfactorily achieved in software with anything less than a 1.4GHz Centrino or 2.8 GHz Pentium IV based system.

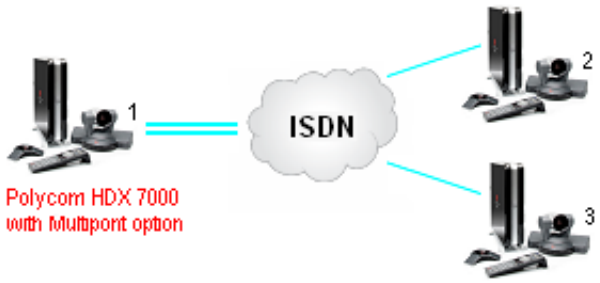
Number of Participants.

H.320 conferences are essentially a point-to-point connection and need to use a some form of Multipoint Control Unit (MCU) to link and manage all the ISDN lines in order to hold a conference with three or more participants.



H.320 Multipoint Conference

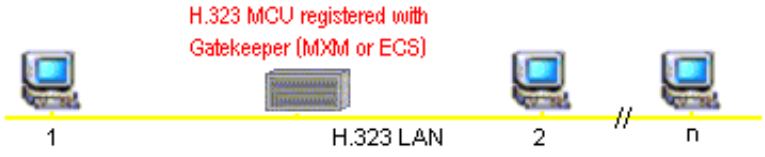
The MCU's basic function is to maintain the communications between all the participants in the conference. H.320 MCU's are usually a separate piece of hardware dedicated to their function as they need to connect to all of the ISDN lines from each participant. For example, to manage a conference between four H.320 systems, each at 384kbps (3xBRI), the H.320 MCU needs to connect the twelve BRI's. This is typically done as 24 x 64kbps channels within a Primary Rate Interface, (PRI). A dedicated H.320 MCU can represent a large capital investment that maybe difficult to justify, in this case, you could use a Bureau Service whilst you determine usage and costs.



ISDN Connections using Built-in Multipoint

Alternatively, small groups who need a multipoint capability could use an endpoint with an embedded H.320 MCU option. Typically, these endpoints, such as the Polycom ***HDX 8004XLP*** or Emblaze-VCON ***xPoint***, must participate in the conference to use the multipoint option.

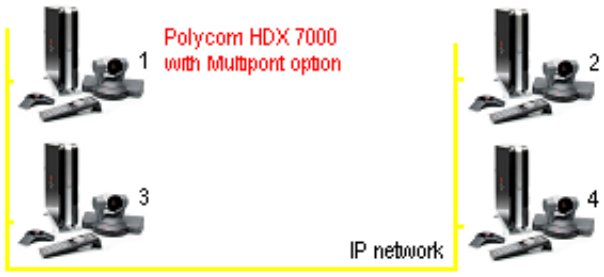
Most H.323 systems support IP multicast and use this to send just one audio and one video stream to the other participants when in a broadcast. However, to allow three or more participants into a conference, most H.323 systems usually require a Multipoint Control Unit (H.323 MCU). This is not the same as an H.320 MCU; hence it is important to be clear about what you mean when using the term MCU.



H.323 Multipoint Conference

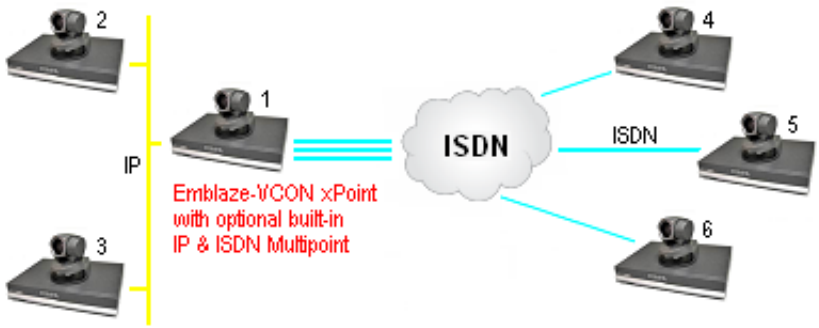
The H.323 MCU's basic function is to maintain all the audio, video, data and control streams between all the participants in the conference. Whilst most H.323 MCU's, such as the the ***SCOPIA$_{100}$ 12/24 Series*** are hardware based, Emblaze-VCON have introduced the VCON Conference Bridge™, ***VCBPro*** that in its basic form as an option to MXM provides a software MCU capable of allowing Ad-Hoc Conferencing in both Continuous Presence or Voice-Activated Switching modes.

Alternatively, small groups who need a multipoint capability could use an endpoint with an embedded MCU capability. Both the Polycom ***HDX 7002XLP*** or Emblaze-VCON ***xPoint*** have embedded multipoint options that support themselves and the other sites in either a Voice-Activated or Continuous Presence session.



IP Connections using Built-in Multipoint

Furthermore, both of these systems have BRI or PRI ISDN connectivity options that when used in conjunction with their IP connectivity and multipoint capability, they allow mixed-mode operation between both ISDN and IP networks.



IP <> ISDN mixed connections using built-in Multipoint

In a simplistic manner, they act like a Gateway bridging between the other ISDN and IP endpoints.

In general, dedicated MCU's support simultaneous sessions, more participants, higher bitrates, more screen layout options and more features than embedded MCU's found in some endpoints.

System Management.

Although the H.323 standard describes the Gatekeeper, as an optional component, it is in practice an essential tool for defining and controlling how voice and video communications are managed over the IP network. Gatekeepers are responsible for providing address translation between LAN aliases and IP addresses, call control and routing services to H.323 endpoints, system management and security policies. These services provided by the Gatekeeper in communicating between H.323 endpoints are defined in RAS; Registration/ Admission/Status.

Gatekeepers provide the *intelligence* for delivering new IP services and applications. They allow network administrators to configure, monitor and manage the activities of registered endpoints, set policies and control network resources such as bandwidth usage within their H.323 zone. Registered endpoints can be H.323 Terminals, Gateways or MCU's.

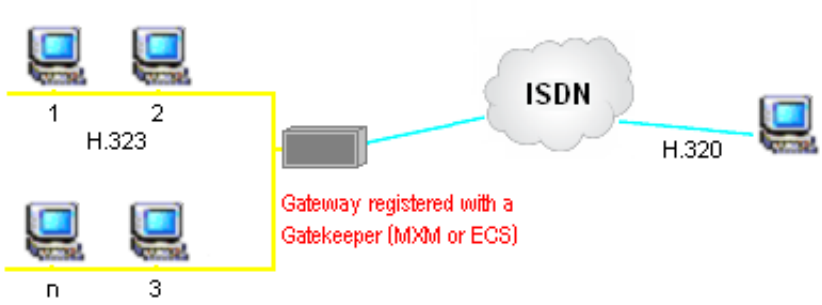
Only one Gatekeeper can manage a H.323 zone, but this zone could include several Gateways and MCU's. Since a zone is defined and managed by only one Gatekeeper, endpoints within a zone that also contain a built-in Gatekeeper must provide a means for disabling this functionality. This ensures that multiple H.323 endpoints can all be configured into the same zone and be controlled by a more powerful Gatekeeper such as the Enhanced Communications Server within the ***ECS*** or utilise the ***PBX*** like features of the comprehensive Media Xchange Manager.

With media networks becoming more and more complex, the ability for the administrator to effectively manage and control their usage becomes crucial. To address these issues, Emblaze-VCON have introduced Media Xchange Manager, ***MXM***. From a remote console, the administrator can now perform centralised management functions such as configure endpoints, monitor the status and availability of endpoints, control and limit bandwidth usage and more. MXM automatically generates Call Detail Reports, CDR; which can be used for

network planning or billing purposes. With video telephony services such as Call Forward, Call Transfer and Call Pickup, MXM provides the functions that make Video Conferencing as simple as making a telephone call. Furthermore, ***MXM*** includes a H.323 Gatekeeper.

Location of Participants.

H.323, H.320 and H.324M (3G-324M) systems can interoperate with the use of a Gateway. Essentially, the Gateway provides translation and transcoding between different circuit-switched networks (ISDN & Cellular) and packet-based networks (LAN), enabling the endpoints to communicate. Most Gateways have multiple BRI connections and can support several conferences simultaneously. For example, a Quad BRI Gateway such as the ***SCOPIA$_{100}$ B40*** from RADVISION can support four conferences at 128kbps, two at 256kbps or one at 384kbps.



H.320 (ISDN) Gateway <> H.323 (IP)

Most Gateways work in conjunction with and include a basic Gatekeeper functionality. A real world H.323 implementation of a Gateway working in conjunction with a Gatekeeper is in a Multimedia Call Centre were needs-based call routing and a variety of other automatic call distribution features are used.

The first question that starts the process of identifying your Video Conferencing system is concerned with who and where are the people that you want to conference with. It is a networking issue that determines how the participating platforms are going to be connected together and hence which is the applicable standard that you should consider following. As indicated above, there are two main standards used in Video Conferencing, H.320 or H.323. After you have decided which standard you want to adhere too, you can start looking at the platform, price and performance equation.

Do you want to conference just within your organisation, with suppliers or with the world?

If it's just within your organisation, *do you have an existing LAN?* If so, then you already have a network in place that can be used for VC. Look at the section titled H.323 based Video Conferencing systems. Otherwise you need to create a corporate LAN or look at alternative network types. Look at the section titled ADSL, ISDN or the Internet?

If it's to suppliers, *are they on your corporate LAN?* If so, then you already have a network that can be used. Look at the section titled H.323 based Video Conferencing systems. If not, then you need to extend the corporate LAN to include your suppliers or look at alternative network types. Look at the section titled ADSL, ISDN or the Internet?

If it's a mixture of different networks, including anybody with a 3G mobile or PDA that supports the 3G-324M standard, then you will need a Gateway and maybe an MCU that supports these devices. The Gateway should feature Rate Matching in order to traverse the wide range of bandwidths required by different endpoints.

ADSL, ISDN or the Internet.

The decision on which of the above networks to use is essentially a trade between quality, cost and topology. At the high performance, high cost end there is ISDN, at the high performance, medium cost end there is ADSL, whilst at the low performance, low cost end there is the Internet option. They are all effectively standalone systems, but adhere to different standards.

There are both Desktop and Group systems that support 384kbps ISDN connections and offer the highest performance within the H.320 standard. Obviously, there is the initial investment of installing ISDN lines to all the sites involved and this is probably the most common reason for not going H.320. The big question here is ***'What is an acceptable frame rate and window size'?*** If it is 2-6 fps at

QCIF, then the Internet option and low cost H.323 systems will provide a solution. However, most professional people will demand much higher frame rates at CIF size and as such, ISDN linked H.320 compliant Desktop or Group systems are the solution. These systems can achieve 25 fps at CIF size with low-bitrates, especially if they use H.264 video compression. Look at the section titled H.320 based Video Conferencing systems.

Alternatively, you might be able to use ADSL if you are within range of an ADSL enabled exchange. With ADSL, you share the service with other users on the exchange and the contention ratio is typically 20:1 or 50:1 depending upon the options you choose. Remember that you will need a fixed IP address and will need to overcome any ***security or firewall issues***. Look at the section titled H.323 based Video Conferencing systems.

Usage Concepts.

There is a major difference in the usage concept between Desktop and Group Video Conferencing systems. Group systems are usually in a specific room that has to be reserved in order to schedule when they can be used. This can be restrictive and takes away the spontaneity of using Video Conferencing. Furthermore, Group systems usually have remote keyboards, a PTZ (Pan, Tile & Zoom) camera with remote controller and there own specific Graphical User Interface that needs to be learnt and navigated, hence they tend to be used by only a small number of people.

On the other hand, Desktop Video Conferencing systems are PC based and use the familiar Windows® GUI. However, they are ***not*** usually left running in the background in an ***always-on*** mode. If there is going to be a large uptake of DVC, then it must be always available and easy to use. You need to exploit the spontaneity of the occasion in order to get the most from Video Conferencing. The concept is like that of using the telephone. It's always there and easy to use. Likewise, Video Conferencing systems should be configured to be always on and available.

Installations and Usage Costs.

For H.323 based systems, the installation costs need to cover any upgrades to the network infrastructure such as faster switches and better routers. They also need to cover managing the network, endpoints and any MCU's and Gateways. That's were ***Media Xchange Manager*** has the advantage, it manages the network resources, offers telephony like services and makes the endpoints easy to access.

For H.320 based systems, the costs need to cover installation of the ISDN lines and the on-going line rental as well as the initial purchase of the H.320 equipment. With regards to multi-party H.320 conferences, the costs would have to cover the purchase of an MCU. However, as these can be very expensive and there usage unknown, it is probably more cost-effective to either use a Bureau Service until the exact requirements are known. Alternatively, use an endpoint with embedded multipoint capability such as the Polycom ***HDX 8004XLP*** or Emblaze-VCON ***xPoint***. Both of these systems have BRI or PRI ISDN connectivity options that when used in conjunction with their IP connectivity and multipoint capability, they allow mixed-mode operation between both ISDN and IP networks.

H.323 based Video Conferencing systems.

H.323 is the most flexible member of this group of standards and uses TCP/IP as its transport protocol. TCP/IP based networks range from Dial-up modems at 28.8 kbps, 10 Mbps Ethernet, 16 Mbps Token-Ring, 100 Mbps Fast Ethernet to 1000 Gigabit Ethernets. They use Fast Switches, Virtual Private Networks (VPN), Asynchronous Digital Subscriber Lines (ADSL), Synchronous Digital Subscriber Lines (SDSL) and even ISDN, V.35, T1 or E1 lines between routers that maintain the TCP/IP packet integrity. In all these cases, the available bandwidth is limited to that of the slowest link.

Emblaze-VCON's vPoint HD is the world's first H.323 endpoint that's implemented an H.264 codec in software and is aimed at the professional user who wants quality at a low cost. ***vPoint HD*** uses either a USB camera or a video capture card. By using an ***Osprey-100***, users have the ability to connect a Pan, Tilt and Zoom, ***PTZ*** camera and a wired tabletop microphone. However, by using an ***Osprey-210*** instead, users can directly attach a wireless microphone system such as the audio-technica ***ATW-701***.

For an overview of available H.323 products, please see ***IP based H.323 compliant systems***.

H.320 based Video Conferencing systems.

Most H.320 systems are dual standards compliant and also support H.323 connectivity. They vary from entry-level set-top systems such as

the Polycom ***V500*** for small office or home office users to group systems such as the Emblaze-VCON ***xPoint***, a set-top based system with an optional built-in 6-way multipoint capability and a display monitor for each conference participant.

For an overview of available H.320 products, please see ***ISDN based H.320 compliant systems***.

21st Century Video can advise, supply and support whichever system is appropriate to your needs. For more information and help in selecting the right system, please email: ***info@c21video.com***
