The ISDN to IP Migration for Videoconferencing

Real World Options that Make Both Dollars and Sense

The ISDN to IP Migration for Videoconferencing

Real World Options That Make Both Dollars and Sense

Ira M. Weinstein
Wainhouse Research

January 2006

TANDBERG

Table of Contents

List of Figures

Introduction

Since the release of IP-capable videoconferencing solutions in the mid-1990s, the percentage of video calls hosted over IP networks has continued to grow. As shown in the left chart below, WR estimates that in 2004 IP became the most common network used for hosting videoconference calls.

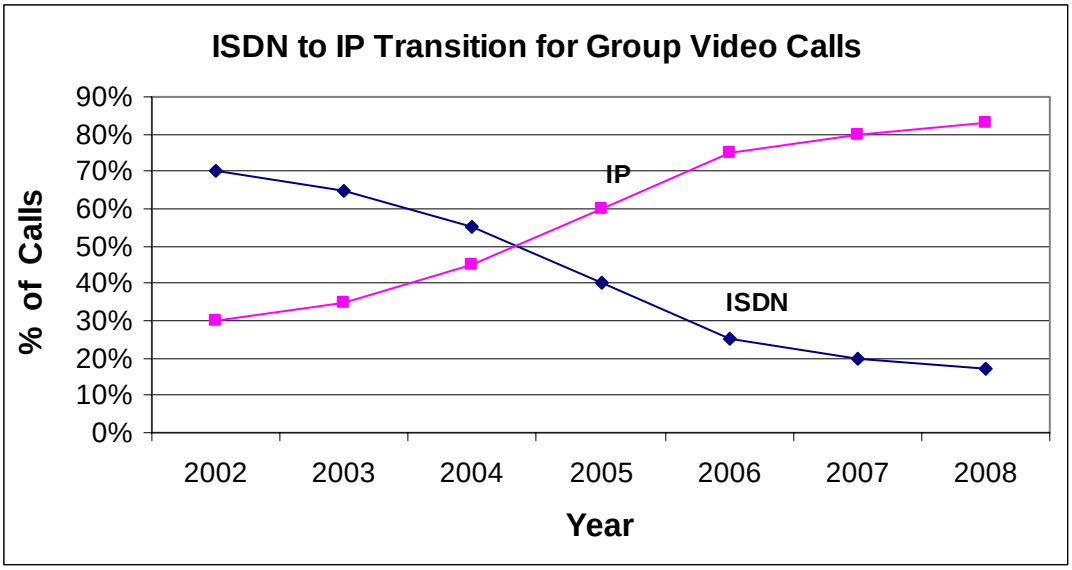

Figure 1: Percent of Video Calls Using IP vs. ISDN

In addition, virtually all video systems today include IP network capability, while only a limited percentage support ISDN.

For some, the justification for migrating from ISDN to IP for videoconferencing was purely financial as it allowed companies to enjoy a pay-one-price cost structure for unlimited videoconferencing usage. For many others, however, it was the soft benefits of running videoconferencing over IP, such as enhanced reliability and manageability, tighter security, and an improved user experience that prompted the shift.

This white paper provides insight into the pros and cons of the four most common network architectures in use today for videoconferencing:

- ISDN networks – using digital phone lines from telephone companies
- Converged IP - using the enterprise's data network to host video traffic
- IP Overlay - involves the deployment of a dedicated network to host video traffic
- Hybrid – utilizing a combination of the above options to meet specific business challenges

For both new and existing VC users, there are many benefits and reasons for running videoconferencing traffic over IP. Even if customers won't save significant costs by migrating from ISDN to IP, the IP strategy allows enterprise managers to turn videoconferencing into a manageable enterprise business tool, instead of a technology gadget or curiosity.

Architecting the Videoconferencing Environment

Modern day videoconferencing environments follow one of four basic network architectures: ISDN-only, Converged IP, IP Overlay, or some combination of the three which we call a hybrid environment.

ISDN-Only Environments

The diagram below highlights a traditional videoconferencing environment using only ISDN service from a local telephone provider. Note that this organization *may not* be able to connect to IP-only external endpoints (listed as Client Location below).

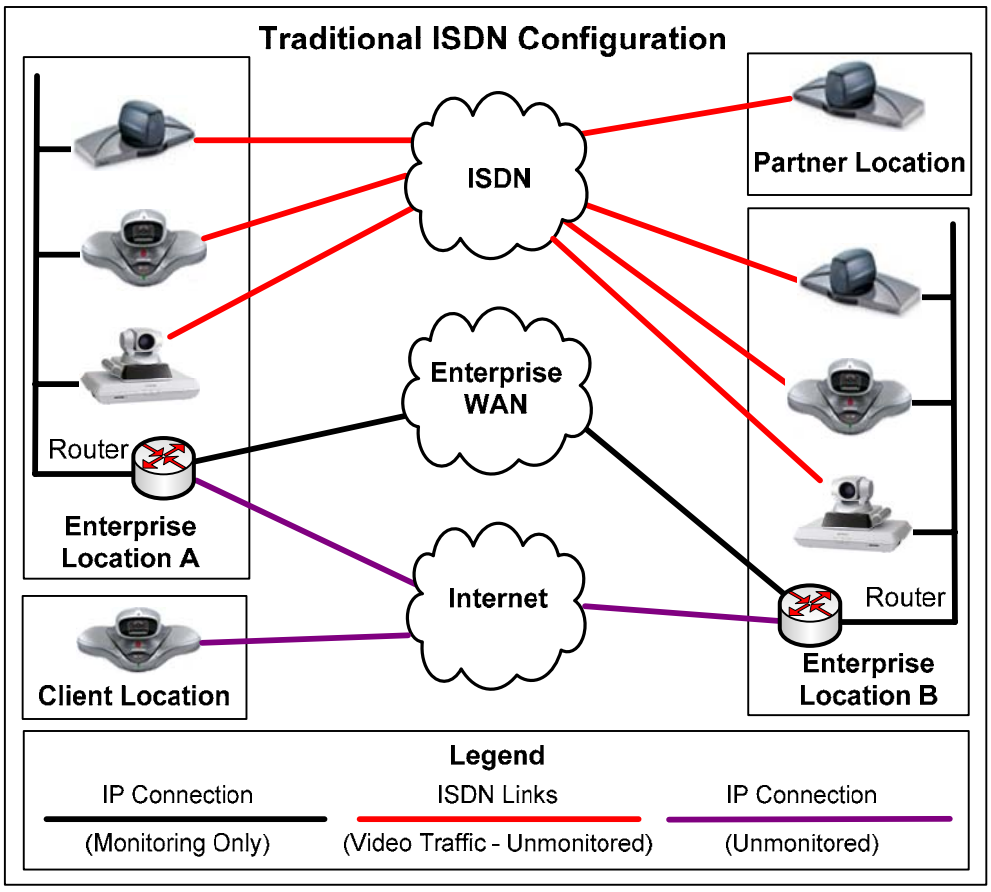

Figure 2: Traditional ISDN-Only Videoconferencing Environment

ISDN-Only Advantages

Data Isolation - In an ISDN videoconferencing environment the video traffic does not touch the organization's data network, which is a source of comfort for IT and network managers.

Universal Availability - ISDN service is available almost anywhere in the world (or at least in most places where phones services are available).

Low Fixed Costs - The fixed monthly cost for ISDN services is relatively low (typically $150 per month for 384 kbps ISDN connectivity), which makes ISDN cost-effective for organizations with limited monthly video usage.

ISDN-Only Disadvantages

Endpoint Cost – With today's videoconferencing systems, ISDN network support is typically an option costing several thousands of dollars per endpoint.

Endpoint Monitoring – ISDN-only environments typically include a number of legacy, ISDN-only video systems which do not support the advanced endpoint monitoring features available on current video endpoints. It is not possible to monitor the health and "readiness" of these video endpoints.

Network Monitoring – Like the plain old telephone network (POTS), ISDN is a switched technology in which the network is only connected when calls are in progress. This means that an ISDN problem, such as a down ISDN line, will not be apparent until a call is attempted – at which point the likelihood is that the users will be impacted. Even commercially available video network management systems are not able to detect ISDN issues while calls unless a call is connected.

Network Efficiency and Scalability – The typical ISDN environment requires that each endpoint have its own dedicated bandwidth[1], which means that even though the ISDN lines connected to a specific system may only be in use for a few hours each month, that system's ISDN bandwidth cannot be shared with other endpoints. Deploying additional endpoints will require additional ISDN lines.

Usage Costs – In most ISDN environments, every single video call – whether across town, across the world, or simply between two rooms in the same building – will involve per-minute ISDN transport and usage fees. Depending upon the frequency of usage, these fees can be quite high on a monthly basis and can negatively impact the adoption of videoconferencing within the enterprise.

Global Reach – In order to communicate with IP-only endpoints, such as those deployed at the partner location shown above, either an ISDN to IP gateway device or an external gateway service must be used.

Lack of Redundancy – In the event that one or more of an endpoint's ISDN lines experiences problems, the endpoints' ability to communicate will either be blocked or impacted. There is no alternate network to host the video traffic.

Limited TELCO Support – The decreased demand for ISDN lines for videoconferencing has prompted telephone companies to reduce their ISDN support staff; a phenomenon that can significantly impact ISDN troubleshooting and problem resolution efforts.

---

[1] It is possible to share ISDN lines between multiple video systems using ISDN switches available from a number of providers including Adtran and Initia. These devices, however, are often too expensive to justify and can be difficult to configure and maintain.

Converged IP Environments

In a converged IP environment, videoconferencing traffic rides over the organization's primary IP data network as shown in the diagram below. Note that unless an ISDN gateway (or gateway service is used), this enterprise may not be able to connect to ISDN-only endpoints (labeled Partner Location below).

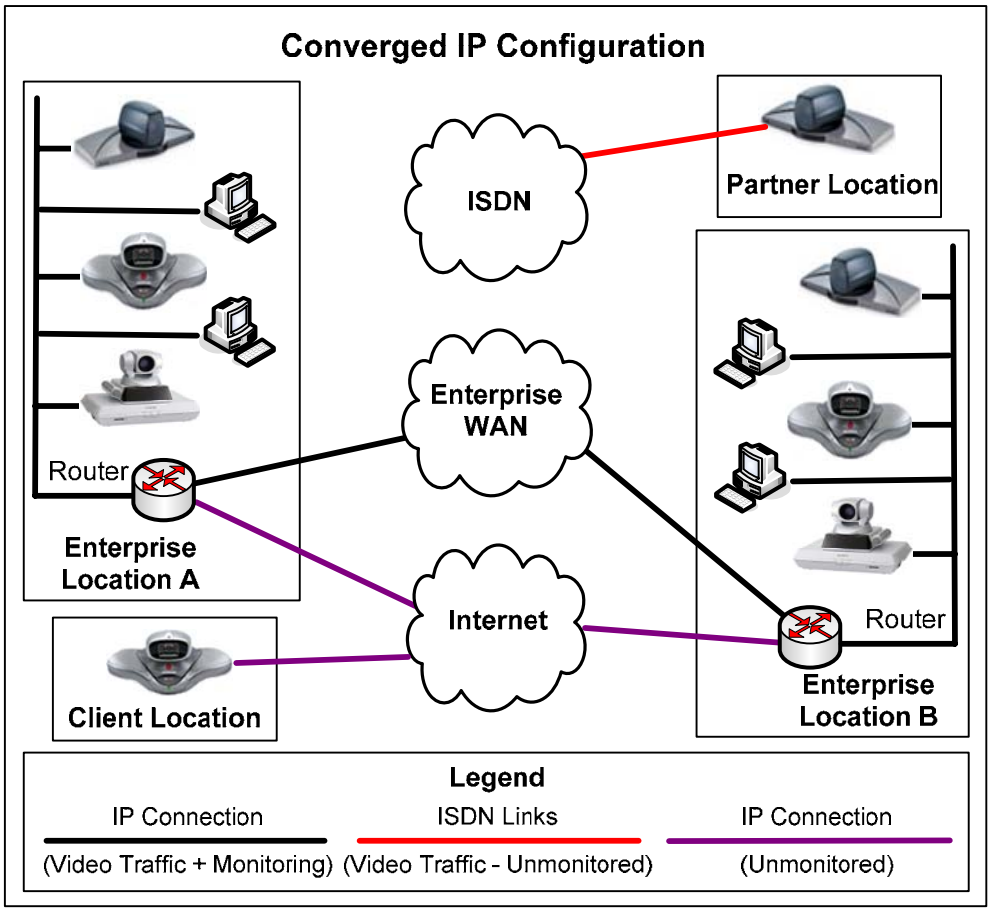

Figure 3: Converged IP Videoconferencing Environment

Converged IP Advantages

Ability to Leverage Infrastructure – Since the endpoints are connected to the corporate IP network, the enterprise can to leverage its existing network lines, support staff, and monitoring / management systems.

Improved Reliability – IP endpoints and network can be monitored continuously meaning that should a problem arise, the support team will be pro-actively notified, unlike an ISDN environment in which problems are only discovered once a call is attempted. In addition, ISDN video calls use multiple lines bonded together to form a single data pipe; a process that often causes problems during ISDN video calls.

Enhanced Manageability – IP-capable video systems can be remotely managed either individually or using a centralized management system like TMS, a software solution available from TANDBERG, the

sponsor of this white paper. Management features include remote call launching and termination, endpoint configuration, software upgrades, and more. Note that some legacy ISDN-only video systems include IP connections for remote management, but the management capabilities do not include monitoring of the ISDN network lines.

Installation Simplicity – By using IP instead of ISDN, organizations can avoid the headaches often associated with the deployment of ISDN lines including assignment of SPIDs and the activation of long distance service.

Expanded Scalability – In an IP environment, the deployment of an additional video system does not require the activation of dedicated lines. Instead, the enterprise simply needs to connect the video system to the enterprise network. This is especially important for organizations planning to make desktop videoconferencing capabilities available to their user base as these deployments typically involve thousands of endpoints.

Decreased Cost of Ownership – IP-only endpoints are less expensive to purchase (ISDN is now an optional add-on for most endpoints), cheaper to keep under a service plan (fees are based on purchase price), and do not require dedicated ISDN lines, resulting in a lower total cost of ownership.

Predictable Usage Fees – While ISDN is a "metered" service with transport fees charged on a per-minute basis, IP networks typically include unlimited usage for a fixed monthly fee. This allows enterprise organizations to predict and budget for the monthly costs associated with videoconferencing.

Call Speed Flexibility – In ISDN environments, the maximum possible connection speed stems from the number of installed ISDN lines (ex. 3 ISDN lines permit a single call up to 384 kbps). In an IP environment, endpoints are usually connected to high bandwidth connections either on the LAN or WAN, and therefore higher bandwidth calls are often possible. This is especially important for multisite meetings during which the host endpoint may require additional bandwidth to host the meeting.

Tighter Security – Although most IP video endpoints include support for AES data encryption, including secure password authentication, most legacy ISDN systems do not support encryption. Because securing ISDN calls on legacy endpoints requires the use of expensive and complex external encryption systems, these are used primarily in military and government environments.

Converged IP Disadvantages

Network Capability - Many enterprise networks are not equipped to host video traffic, and cannot be cost-effectively upgraded to do so in some locations. For example, in one organization the connections to the Los Angeles and London offices may be "video-ready," but those to the Milan and Singapore offices are not up to the task. In an IP-only environment, the Milan and Singapore offices would be unreachable from the enterprise's IP video systems (unless an ISDN gateway product / service or an IP-overlay solution was used).

Endpoint Capability – Many legacy video systems are not IP-capable and would need to be replaced or upgraded to function in an IP-only environment.

Global Reach – In order to communicate with ISDN-only endpoints, such as those deployed at the client location shown above, either an IP to ISDN gateway device or an external gateway service must be used. In addition, corporate security systems, including the enterprise firewalls and NAT systems, often block IP traffic between enterprises, making it impossible to host IP video calls between organizations.

Lack of Redundancy – In the event that the enterprise LAN or WAN experiences problems, one or more endpoints may be unable to place or receive video calls. Once again, there is no alternate network to host the video traffic.

Potential Impact on Network – If not properly planned and managed, it is possible that the videoconferencing traffic could negatively impact the other traffic on the data network. This risk, however, is easily avoided through the use of a videoconferencing gatekeeper.

IP Overlay Environments

Many organizations are unable to host videoconferencing traffic on all or specific segments of their primary data network due to limited bandwidth or lack of QoS (quality of service). To bypass these issues, some organizations choose to replace their ISDN network with a totally separate IP network dedicated to hosting IP video traffic.

The graphic below highlights an IP overlay environment. Note the use of the IP overlay network provider's ISDN and Internet gateways to allow the host organization to connect to external ISDN and IP endpoints.

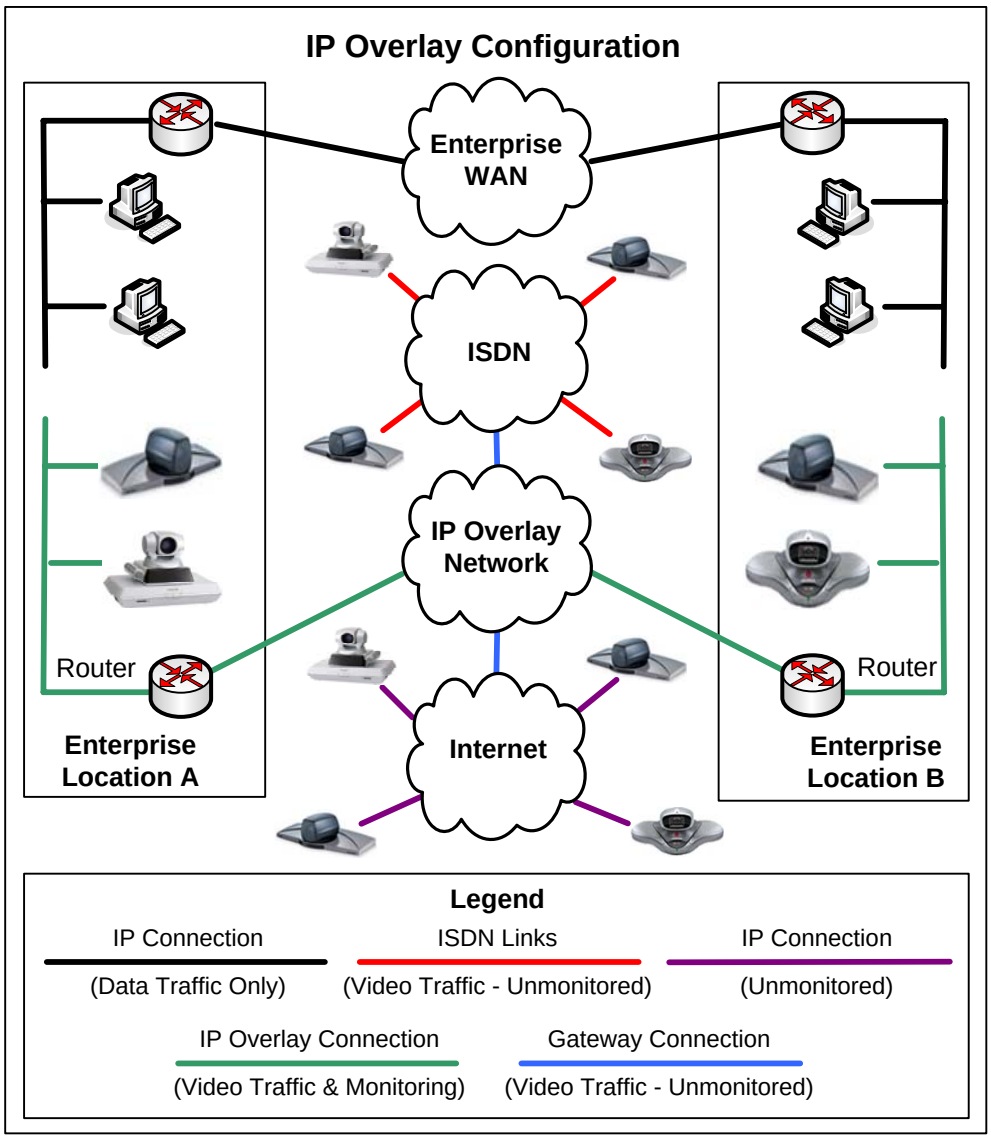

Figure 4: Pure IP-Overlay Videoconferencing Environment

IP Overlay Advantages

IP video overlay solutions share many of the advantages of the converged IP solution, plus several key advantages:

Network Isolation - the IP overlay architecture allows organizations to enjoy the benefits of IP videoconferencing without impacting the existing data network.

Upgrade Avoidance – the IP overlay method allows an organization to avoid the need for network capacity and/or performance upgrades in some or all locations.

IP-Overlay Disadvantages

IP video overlay solution disadvantages include the need to purchase additional network services dedicated to hosting IP video traffic, and the fact that gateways (which never improve but often detract from the user experience) must be used to conduct calls with any locations not on the IP overlay network.

Hybrid Video Environments

The fourth videoconferencing architecture involves a combination of two or more of the ISDN, converged IP, and IP overlay methodologies as shown below.

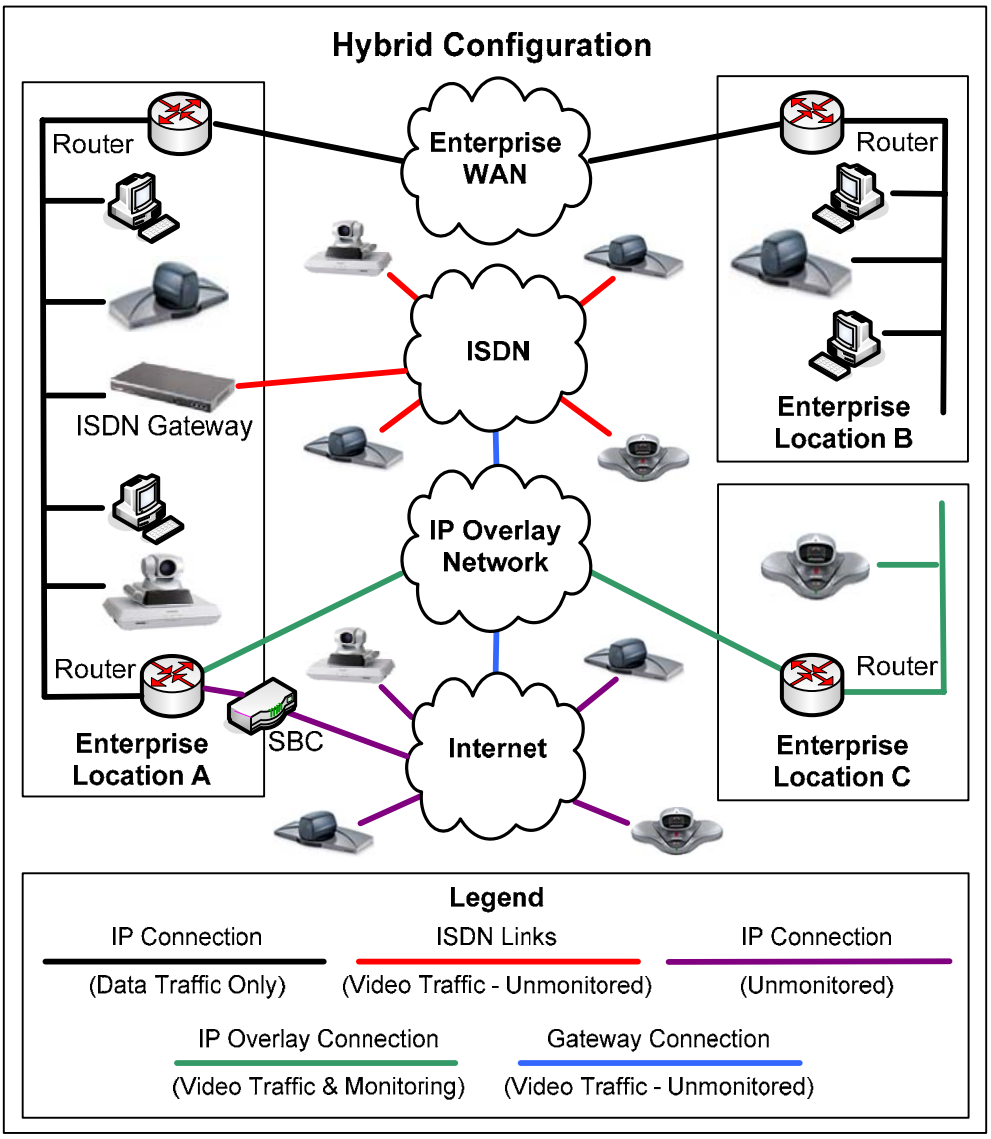

Figure 5: Hybrid IP / ISDN Videoconferencing Environment

As shown above, in a well-designed hybrid environment, the majority of the enterprise endpoints have access to both IP and ISDN connections, either directly or using the enterprise gateway. In addition, the use of a session border controller (labeled SBC in the diagram above) allows internal IP endpoints to connect to external IP (Internet) endpoints without compromising enterprise network security.

Hybrid Environment Advantages

This architecture affords many advantages from the three prior methods, plus additional benefits:

Endpoint Flexibility –The enterprise can utilize a mixture of new (and relatively inexpensive) IP-capable video endpoints and legacy, ISDN-only endpoints.

Network Redundancy – Since most endpoints have access to IP and ISDN connections, video connections can be made even if one of the networks (IP or ISDN) is experiencing problems.

Global Reach – The support for IP and ISDN video traffic throughout the enterprise makes it easier to host video calls between different organizations.

Hybrid Environment Disadvantages

The most significant disadvantage of this method is the frequent use of gateways (products or services) to connect to internal and external video endpoints.

Real World Examples

The following examples highlight differences between ISDN and IP videoconferencing environments.

Example 1 – Total Cost of Ownership

The organization in this example plans to deploy ten (10) video endpoints in five different locations around the world. In three of the five locations the company's wide area network is video-capable. In the fourth and fifth locations, the company will need to deploy dedicated T1s, at a monthly cost of $800 each, to host the IP video traffic. The following assumptions have been made for these calculations:

Cost Item	IP	ISDN
Endpoint - Purchase Cost per System	$8,000	$10,000
Management System – Purchase Cost	$25,000	$25,000
Annual Maintenance (% of Purchase)	15 %	15 %
Equipment Life Span (Months)	48	48
Typical Call Speed	384 kbps	384 kbps
Monthly Fixed Cost for Data Lines	$800 per T1 x 2	$50 / BRI x 30 lines
Hourly Usage Fees	$0	$0.15 / Min / B channel
Annual Cost per Support Person	$62,500	$62,500
# of Support Staff Required to Manage Environment	0.5	1

Figure 6: Example 1 - Basic Assumptions

The following assumptions also apply:

1) The use of IP transport and the ability to pro-actively monitor the IP network decreases the support requirements for this environment from one full person (for an ISDN deployment) to only half a person.

The table below compares the total cost of ownership (TCO) in IP and ISDN environments based on the assumptions above with monthly usage volumes of 0, 10, 20, and 30 hours per video system.

Hours of Usage per Month per System *	IP – Monthly TCO	ISDN – Monthly TCO	Difference ($ and %)	Savings per Year
0	$7,704	$10,875	$3,171 or 29 %	$38,050
10	$7,704	$13,575	$5,871 or 43 %	$70,450
20	$7,704	$16,275	$8,571 or 53 %	$102,850
30	$7,704	$18,975	$11,271 or 59 %	$135,250

* Assumes that each ISDN system dials out (and incurs associated ISDN usage and transport charges) only 50% of the time.

Figure 7: Example 1 - Total Cost of Ownership Calculations

Based on these cost assumptions, and even before the first video call is made, the monthly TCO for an ISDN environment is greater than that for an IP environment. As shown below, usage increases result in a linear increase in the total cost of ownership in the ISDN environment, while the TCO in the IP environment remains unchanged.

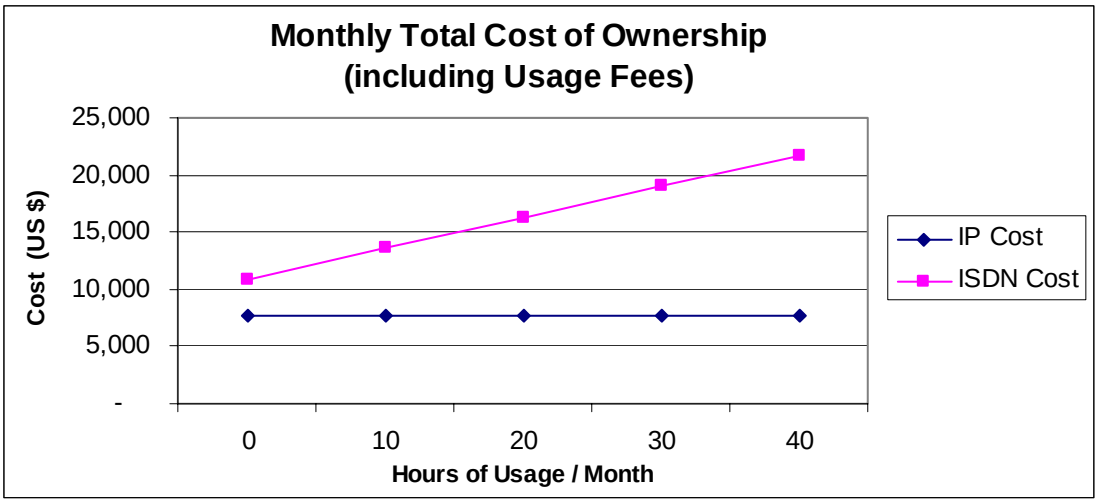

Figure 8: Example 1 - TCO Comparison of an ISDN vs. an IP Environment (US)

The key takeaways and noteworthy items in this example are as follows:

1) ISDN video systems are more expensive to purchase, maintain, and manage than IP video systems.

2) The combination of IP video systems and a video management system decreases support needs significantly. In this example, the video management system has a monthly TCO of roughly $800, but allows the organization to save $2.6k per month in support staff costs.

3) 3) As usage increases, the monthly costs increase in the ISDN, but not in the IP environment.

4) The monthly cost to add an additional video system in the ISDN world is significantly more expensive than in the IP environment as shown below. In fact, the annual TCO for an IP system is almost $6k less than that for an ISDN system.

	IP – Monthly TCO	ISDN – Monthly TCO	Difference ($ and %)	Savings per Year
Asset Cost	$267	$333	$67 or 20%	$800
Data Line Cost *	$0	$150	$150	$1,800
Support Staff Cost	$260	$521	$260 or 50%	$3,125
TOTAL	$527	$1,004	$477 or 48%	$5,725

* Assuming the organization's IP network (LAN / WAN, T1s) can support the traffic associated with the additional endpoint.

Figure 9: Example 1 - Cost of Ownership Calculation per Additional Endpoint

5) This organization could increase its video calling speed without incurring additional costs in the IP world (assuming the organization's IP network can support the additional bandwidth). But, in an ISDN-based deployment, the firm would face both additional ISDN fixed fees $6k per year to increase the bandwidth per system from 384 to 512 kbps) and additional ISDN usage fees of roughly $18 per hour.

6) The above example does not reflect the additional ISDN usage fees that this organization is likely to incur as a part of the system testing and early call connection. Depending upon the usage volume and testing frequency, this can amount to thousands of dollars per month.

7) To connect to external ISDN endpoints, this organization would need to purchase and deploy an ISDN gateway which would enable all endpoints within the environment to place and receive ISDN video calls at an estimated monthly fixed cost of $750. Alternatively, the organization could utilize a 3rd party gateway services provider.

The assumptions above are based on cost estimates for IP and ISDN connectivity within the United States. For non-US locations, the cost per hour for ISDN traffic is likely to decrease from $0.15 to perhaps $0.05 / minute / B channel, and the monthly cost for a dedicated T1 is likely to increase from $800 to perhaps $2,500 / month. Assuming no other cost changes, the TCO for this environment is shown below.

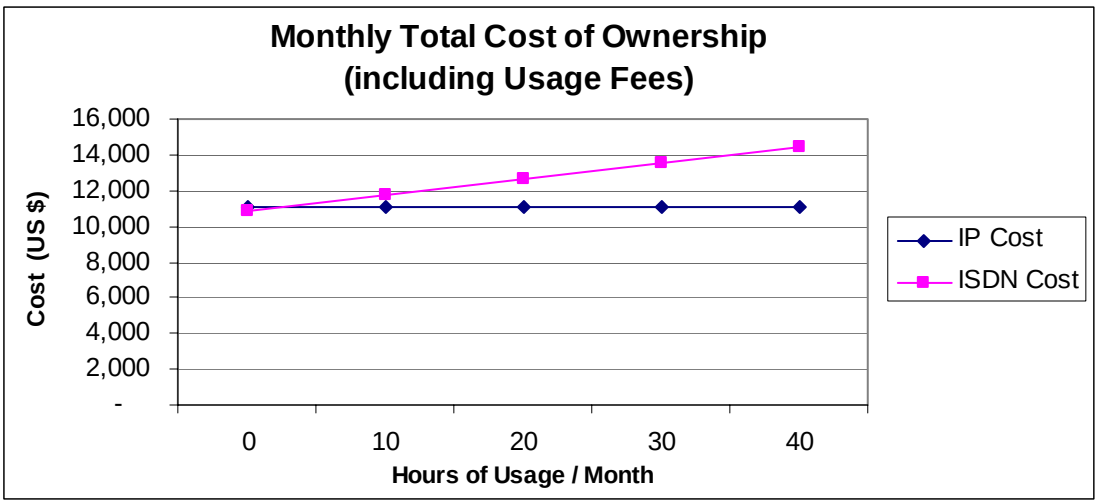

Figure 10: Example 1 - TCO Comparison of an ISDN vs. an IP Environment (Non U.S.)

As shown above, based on these cost assumptions the TCOs for the two environments are roughly equal before the first call is placed, but as usage increases the IP environment becomes more cost-effective.

Example 2 – Enhanced Reliability

The organization in this example has a mixture of legacy ISDN videoconferencing systems (some with remote monitoring capabilities) and IP systems deployed throughout their global environment. In addition, they have deployed a centralized management and monitoring system at their London facility.

Scenario 1 – IP Video Endpoints

A manager in New York has scheduled a videoconference call with a colleague in the Washington DC office for Tuesday at 8:30 AM EST. The video systems that will be used for this video call are both IP-capable and connected to the centralized management system.

Very early Tuesday morning (around 4 AM EST) a number of phone lines were added at the Washington DC office. While connecting the phone lines, the technician inadvertently disconnected the IP connection to the video system slated for use Tuesday morning. Three minutes later the management system noted that communication to the video system has been lost, and a text message was released to the IT support manager on duty at that time.

Based on the firm's "follow the sun" management style, the IT manager in London received the alert message and immediately contacted the facilities manager in the Washington DC office. The facilities manager contacted the technician adding the phone lines and asked him to check whether he could have disconnected the IP connection to the meeting room. Five minutes later, and four hours before the scheduled meeting start time, the technician fixed the problem.

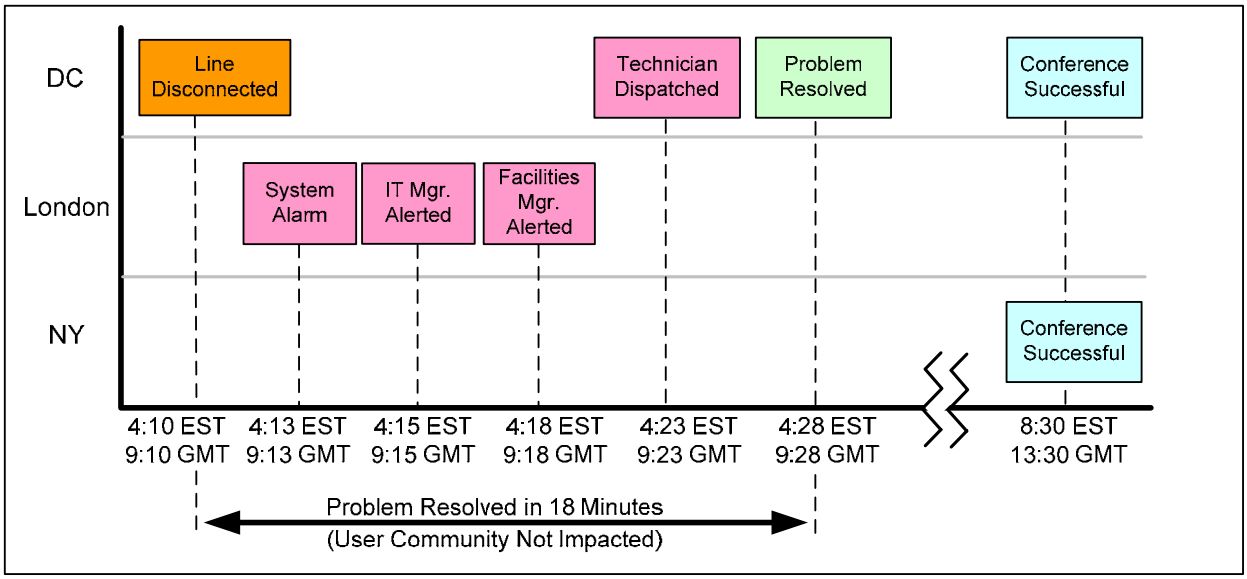

Figure 11: Example 2 – Timeline with Pro-Active Monitoring

The takeaway here is that thanks to the monitoring and management capabilities in an IP video environment, this problem was pro-actively discovered and resolved long before it could impact the end user community or the scheduled 8:30 AM EST meeting.

Scenario 2 – ISDN Video Endpoints

Two other managers have scheduled a meeting between the company's San Francisco and Frankfurt offices on Thursday at 7 AM PST / 4 PM CET. Although both of these systems have IP connections for remote management, they use ISDN as the transport network for their video calls.

Due to an accounts payable mistake, the ISDN lines in the San Francisco office were disconnected late Monday afternoon (3 days before the scheduled meeting). At the scheduled meeting start time the managers reported to their conference rooms and tried to connect the video call.

After a few failed connection attempts, the San Francisco manager called the IT support desk, and five minutes later an IP support person tried to remotely launch the video call (using the video system's IP interface). After 15 minutes of troubleshooting, including numerous failed call attempts between the two systems and a successful test call from the Frankfurt video room to a video system in London, the technician determined that there was a problem with the ISDN lines in the San Francisco office. Five minutes later he opened a trouble ticket with the local telephone provider.

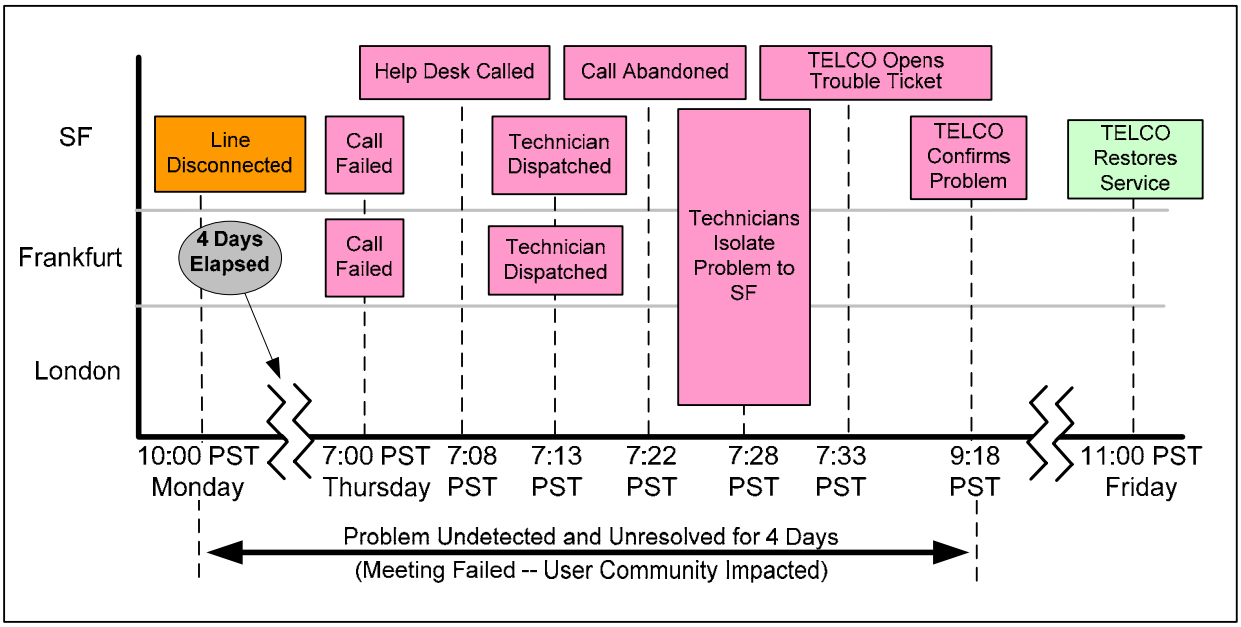

Figure 12: Example 2 – Timeline without Pro-Active Monitoring

Almost two hours later the telephone company contacted the support person and confirmed that the ISDN lines had been shut down a few days earlier.

Because ISDN lines cannot be proactively monitored, this organization had no way of knowing that the ISDN lines in the San Francisco office had been disconnected three days before the scheduled meeting. As a result, these managers wasted more than 20 minutes waiting for the video call to connect and finally diverted to an audio call for this meeting. The ability to proactively monitor the "readiness" status of an endpoint and the associated IP network is a compelling reason to consider a migration from ISDN to IP.

Conclusion

The migration from ISDN to IP for videoconferencing is well underway. Several years ago the primary motivator for this shift was to decrease (or limit) the costs associated with the videoconferencing environment.[2] Today, however, the need for enhanced reliability and performance has, for most organizations, trumped cost savings as the main justification for IP videoconferencing.

Organizations should recognize that it is not always necessary or prudent to shift all videoconferencing over to IP. Instead, organizations should consider a mixed IP / ISDN strategy (called a hybrid environment) that combines control, flexibility, and redundancy with cost reduction and control. A mixed IP / ISDN environment is common among a variety of enterprises including:

- Enterprises that have been using videoconferencing for many years and maintain an inventory of legacy, ISDN-only video systems.
- Enterprises able to host video traffic on some, but not all, segments of their wide area network.
- Enterprises that frequently conduct video calls with external entities (clients, vendors, etc.).

Connecting videoconferencing equipment over IP networks allows enterprises to manage their videoconferencing environment with the same level of precision and accountability already in place for other key communication tools like email and the telephone.

[2] Although in most cases migrating to IP will result in cost savings for the host organization, enterprises with very limited monthly usage whose existing data networks are not technically capable of hosting video traffic may find ISDN to be less expensive than IP for videoconferencing.

About Wainhouse Research

Wainhouse Research (http://www.wainhouse.com) is an independent market research firm that focuses on critical issues in rich media communications, videoconferencing, teleconferencing, and streaming media. The company conducts multi-client and custom research studies, consults with end users on key implementation issues, publishes white papers and market statistics, and delivers public and private seminars as well as speaker presentations at industry group meetings. Wainhouse Research publishes Conferencing Markets & Strategies, a three-volume study that details the current market trends and major vendor strategies in the multimedia networking infrastructure, endpoints, and services markets, as well as a variety of segment reports, the free newsletter, The Wainhouse Research Bulletin, and the PLATINUM (www.wrplatinum.com) content website.

About the Author

Ira M. Weinstein is a Senior Analyst and Consultant at Wainhouse Research, and a 14-year veteran of the conferencing, collaboration and audio-visual industries. Prior to joining Wainhouse Research, Ira was the VP of Marketing and Business Development at IVCi, managed a technology consulting company, and ran the global conferencing department for a Fortune 50 investment bank. Ira's current focus includes IP video conferencing, network service providers, global management systems, scheduling and automation platforms, ROI and technology justification programs, and audio-visual integration. Mr. Weinstein holds a B.S. in Engineering from Lehigh University and is currently pursuing an MBA in Management and Marketing. He can be reached at iweinstein@wainhouse.com.

About TANDBERG

TANDBERG is a leading global provider of visual communication products and services. The Company has dual headquarters in New York and Norway. TANDBERG designs, develops and markets systems and software for video, voice and data. The Company provides sales, support and value-added services in more than 90 countries worldwide. TANDBERG is publicly traded on the Oslo Stock Exchange under the ticker TAA.OL. Please visit www.tandberg.net for more information.