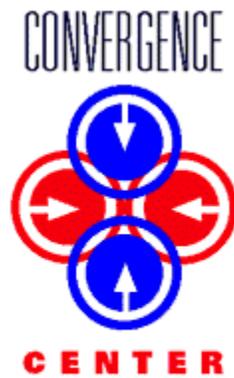


**Planning For Convergence:
Who's Doing It, Who's Not, and Why?**



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CONTENTS

A. Executive Summary

B. Purpose and Overview

C. Research Questions

D. Literature Review and Discussion

E. Research Design and Data Collection

F. Format of Results

G. Analysis, Interpretation, and Discussion of Results

H. Conclusions and Recommendations

I. References and Bibliography

J. Annex

Interview and Questionnaire Form

Tables

A. Executive Summary

In this report, a set of information technology managers and planners were interviewed to obtain answers to questions relating to the implementation of convergence projects; what strategic benefits can result from these projects; and the involvement of their network and equipment providers. The most significant results:

- ◆ Convergence projects are being implemented on the core/backbone areas of their networks, particularly on the international side.
- ◆ Cost benefits are driving these projects, even when network management complexities are expected.
- ◆ There is an absence of information exchange between customers and equipment/network providers regarding unique applications and services, which might provide additional value when implementing convergence.

B. Purpose and Overview

This study investigated whether certain forms of voice and data convergence have been included in the formal strategic plans of information technology organizations within selected corporate businesses. It attempted to find out whether the organizations that plan, support, and implement information technology internally for their business were implementing or planning certain forms of convergence. None of the organizations selected were in the field of selling or providing telecommunications services or equipment. Additionally, this study sought to answer whether these same information technology organizations believed that strategic benefits would result from utilizing voice and data convergence forms. Finally, it gathered information on the role of equipment and network providers in the planning and implementation phases of convergence projects.

We expected to find that not many information technology organizations have firm strategies or projects in place moving toward voice and data convergence. Some of the reasons for this speculation were possibly the lack of funding available to attempt to implement convergence forms, the lack of confidence in successfully implementing or managing convergence, and/or the absence of identified benefits such an undertaking could have.

Studying information technology organizations' strategic plans may reveal the level of interest organizations have in voice and data convergence. Some of the results may suggest that some information technology organizations do not have confidence yet that such an idea is a strategic one. For example, there may be doubt whether cost saving strategies can be realized. There may be questions as to the effectiveness current voice and data convergence forms have in producing reliable networks or simpler network management. Information technology organizations may not be certain that their equipment and network suppliers can deliver voice and data convergence platforms which will result in strategic benefits.

C. Research Questions

The voice and data convergence forms examined in this study are limited to the concept of utilizing internetworks for voice and data, where common LAN (Local Area Network) and WAN (Wide-Area Network) platforms substitute for PSTN (public switched telephone networks) or PBX's (Private Branch Exchanges). The main questions considered:

1. Are there plans for these information technology organizations to implement voice onto their existing LAN and WAN internetworks to substitute for the PSTN or PBX network?
2. What strategic benefits do information technology organizations see, if any, in moving toward such a converged platform?
3. Are equipment or network providers assisting these information technology organizations in moving toward this type of converged platform?

D. Literature Review and Discussion

Defining Convergence

Convergence is a broad term used to describe ubiquitous platforms envisioned for the computing, broadcasting, and telecommunications industries. Voice and data convergence has been defined in several ways. Thyfault (1) states that "at the transport level, convergence means data networks also carry voice, video, and images" (p. 51). This same source also refers to convergence as meaning "PC's becoming telephones... and PBX's and other phone switches [are] replaced or augmented by servers" (1, p. 51). In yet other terms, computer-telephony integration (CTI) appears to be similar to, if not the same as, convergence. Messerschmitt (2, p.66) describes how telecommunications and computing, with their formerly separate media, become integrated in both the network and in the desktop computer under

computer-telephony integration. It seems reasonable that telephony, having voice orientation and computing, having data orientation, would place computer-telephony integration in the same context as what others call voice and data convergence.

Striving Toward Convergence with Horizontal versus Vertical Models

Mueller (9), Messerschmitt (2), Decina and Trecordi (3) and others discuss vertical and horizontal architectures and the evolving move toward the horizontal model. Vertical integration provides an application by using an infrastructure dedicated to a particular range of applications. Examples would be cable television over coaxial cable, telephony over the PSTN network, and computer data over an Ethernet LAN. Historically, as new mass media such as cable television were introduced, vertical models of applications were developed which continued to separate services.

"Horizontalization" is now leading to convergence. Messerschmitt hypothesizes that "powerful economic and technological forces are driving us toward horizontal integration" (2, p. 67). He explains horizontal integration as "bitways" with configurable parameters, which can simultaneously transport voice, video, and data (applications). These horizontally integrated platforms contain an open interface that allow " a diversity of implementations and approaches to coexist and evolve" (2, p. 67). Decina and Trecordi (3, p.1891) also build upon horizontal integration principles when proposing a layered model for information infrastructure.

In this study, the exploration of voice and data convergence is limited to the concept of utilizing internetworks for voice and data, where common LAN (Local Area Network) and WAN (Wide-Area Network) platforms substitute for the public switched telephone network or Private Branch Exchanges. Examples of PSTN and PBX services include Centrex type service, POTS (Plain Old Telephone Service) and PBX equipment used for intra-building or inter-building

communication. Examples of LAN platforms are Ethernet and Token Ring, FDDI (Fiber Distributed Data Interface), and ATM (Asynchronous Transfer Mode) networks. Examples of WAN platforms are frame relay, ATM (Asynchronous Transfer Mode), point to point HDLC (High Level Data Link Control), and SMDS (switched multimegabit data service).

Through the use of additional layers of technology, vertical LAN and WAN platforms now have the capability of evolving into horizontal platforms for both voice and data. Through the use of protocols such as IP (Internet Protocol), frame relay, and ATM, voice can now be carried along with traditional data traffic on LANs and WANs.

Strategy

Strategy has been defined by Wysocki and DeMichiell as "a long term statement of the firm or business unit" (4, p.161). Donnelly and Lightfoot (5) agree with the definition of strategy put forth by Ohmae (6): Strategy is defined as the way in which a corporation endeavors to differentiate itself positively from its competitors through the use of its relative corporate strengths to better satisfy customer needs.

Strategy and strategic planning differentiate a business from its competitors. Some commonly known strategic benefits include cost savings, ease of administration and management, and unique product differentiation. The use of technology is one way to strategically position a business to reap these benefits. Rosenfelder and Gessner believe like many others that "in general, technology is still considered the key to the long term advantage of firms"(7).

Convergence and Strategy

Convergence of voice and data platforms may be a technological strategy capable of benefiting firms. Similar to strategic benefits, these benefits could include reduced network cost, reduced network administration, or the provision of some unique product or service.

Whether or not these benefits can be realized or provide any value to a firm is still being debated. Some believe that voice and data convergence will not occur rapidly, or that networks that carry these two types of traffic now will continue to be distinct in the near future. Forrester Research, for example, predicts that "voice and data integration will enjoy only limited success due to minimal cost savings, network management complexities, and slow carrier development of integrated services " (8). According to Forrester, benefits of voice and data convergence would favor network equipment companies only, and "multiple networks will live on forever"(8).

Others are more positive about the future of voice and data convergence. One strategic benefit proposed is that "integrating networks simplifies the process for both users and administrators" (1, p. 52). Another proposed benefit frequently considered is through cost savings derived from using one platform for both voice and data applications. An example of this would be using voice over IP for long distance calls. Dave House, CEO of Bay Networks commented that "initially, our customers will see tremendous cost-savings and opportunity as they transition to IP for long distance voice calls " (10). In addition, there may be unique services which can be provided through integrating both voice and data onto a single platform. Bill Hawe, also of Bay Networks, says that "others want to develop new services that integrate voice,video,and data to innovate their businesses" (10). The idea is to serve various business needs through one platform and provide rich services that cannot be accomplished on separate platforms.

The ability for business customers to capitalize on convergence opportunities will also depend upon the ability of equipment vendors and network service providers to supply solutions. Others

may seek to internally test and develop their own. One of the questions asked of respondents was whether they felt that their equipment and network providers were assisting them in moving toward convergence, or whether they were internally providing and testing their own solutions.

E. Research Design and Data Collection

E1. Objectives and Definitions

The primary objective of this study was to collect answers to questions regarding the plans by corporate information technology organizations to use LAN and WAN internetworks to substitute for the PSTN or PBX network, as a form of voice and data convergence. In addition, it sought to find whether these same organizations believed that doing so will bring about strategic benefits, and whether external equipment and network providers were assisting them to this end.

Key definitions were used in the interview form which focused on specifically defined internetworks and technologies which may be used for both voice and data, in order to substitute for the PSTN or PBX network. Also defined were the types of strategic benefits that information technology organizations may or may not expect to gain. A distinction between equipment and network providers was made.

Internetwork Types

LAN (Local Area Network): any corporately used Ethernet, Token ring, FDDI (Fiber Distributed Data Interface) or ATM (Asynchronous Transfer Mode) networks

WAN (Wide Area Network): any corporately used frame relay, SMDS (switched-multimegabit data service), ATM,

point to point HDLC (high level data link) networks

PSTN and PBX

Single line POTS (Plain Old Telephone Service)

Centrex service

Private Branch Exchange services (PBX's)

Strategic Benefits

Reduction of network costs for the corporation

Ease of administration or management of the network for the corporation

Unique product or service which can differentiate the corporation from its competitors

Equipment and Network Providers

Equipment Providers: Manufacturers and distributors of hardware and software products enabling telecommunication and transmission.

Network Providers: Non- manufacturers of hardware and software products who provide telecommunication and transmission services.

E2. Survey Design

The questionnaire in Annex 1 and each interview answered the following research questions:

1. Are there plans for these information technology organizations to implement voice onto their existing LAN and WAN internetworks to substitute for the PSTN or PBX network?
2. What strategic benefits do information technology organizations see, if any, in moving toward such a converged platform?
3. Are equipment or network providers assisting these information technology organizations in moving toward this type of converged platform ?

In order to obtain answers to the above, the survey instrument Annex 1 was developed. Each respondent was asked all pertinent questions during a telephone interview, which lasted 15 to

30 minutes in duration. Verbal answers to the questions were translated into written answers on as close to verbatim as possible by the interviewer. All answers were open-ended in order for the respondent to provide for any possible answer. After all interviews were conducted, all of the forms were coded to provide general yes or no answers or summarized into a general response. It was expected that the respondents chosen for interviews were very familiar with the terminology included in the survey and very little explanation was actually needed by the respondents as questions were posed to them.

E. 3 Respondents Used in the Survey

The respondents in this study were fifteen managers or planners in information technology organizations who serve as strategic planners or managers of the data and voice infrastructure at a corporate business organization. The corporations were selected randomly from a set of businesses that outsource the management of at least part of their corporate network infrastructure.

The selected corporations were not in the core business of telecommunications carrier, equipment, or service provider areas. Table 1 provides a list of the core business field of each planner or manager's employing company. Most respondents in this study insisted on anonymity before agreeing to these interviews. This is not unusual in the field of telecommunications; many employees are discouraged or forbidden to discuss company operations or participate in external surveys. Therefore, all respondents were treated equally and identified by interview number only. Consequently, each interview is identified by the chronological interview number and the description of the organization's core business field.

Table 1

Interview Number	CORE BUSINESS
1	Re-Insurance
2	Computer and Database Software Systems
3	Pharmaceuticals and Research
4	Petroleum and Chemicals
5	Insurance and Underwriting
6	Food Products
7	Pharmaceuticals and Research
8	Electrical and Electronic Components
9	Computer and Software
10	Pharmaceuticals and Confectioneries
11	Graphics and Advertising
12	Chemical products
13	Food and Apparel products
14	Advertising and Public Relations
15	Electrical and Fiber Optic Products

F. Format of Results

The results of the interview form in Annex 1 were summarized into table formats shown in Tables 2 - 7. These tables were developed to summarize the main findings from the interviews conducted. The tables were developed to coincide with each of the three research questions originally posed. The relationship between each research question and the corresponding discussion section in Part G and the tables is shown.

G. Analysis, Interpretation, and Discussion of Results

G1. Corporate Information Technology Plans to Use LANs and WANs to Substitute for the PSTN or PBX

Section 1 of the survey instrument identified who had funded projects underway within the next 12 month window that use LAN or WAN technology to substitute for voice networks such as the PSTN or PBX. Respondents who had a positive (**yes**) response with either a LAN or WAN technology were then separated from those who answered negatively (**no**) to both. Those who answered positively (yes) to one of the two were then asked whether their projects were full-scale implementations or beta tests. Those who answered negatively were asked separate follow-up questions: whether there had been meetings to discuss the possibility of ever using LAN or WAN technology used to substitute for voice networks such as the PSTN or PBX network; how soon did they think there would be projects and funds approved; and what opinions were held in their organizations to ever use LAN/WAN technology for voice.

Current Participation Level and Description of Funded Projects

The results in Table 2 show that nearly half (seven of the fifteen) managers and planners surveyed had funded projects currently on-going. The technologies that were identified as being used in current projects included frame relay, ATM, point to point HDLC, and Ethernet. ATM and frame relay were the most often listed technologies being used in these projects. The majority (five of seven) of the current projects had one common purpose: using wide-area technologies for PBX to PBX tie trunks.

Although some of the projects were testing station to station calls over routers with the use of locally attached telephones (bypassing any PBX or PSTN networks), the objectives of most organizations at this stage of convergence was to replace dedicated point to point PBX tie trunks using virtual methods. Rather than using traditional TDM (Time Division Multiplexed)

SECTION 1 DATA

Corporate Information Technology Plans to use LANs and WANs to Substitute for the PSTN or PBX

Question 1.1: Are there currently approved projects and authorized funds to use any of the following within the next 12 months to substitute for PSTN networks used by the corporation:

1.1.1 = For Local Area Networks

Rule: If both 1.1.1 and 1.1.2 was NO, go to Question 1.3

1.1.2 = For Wide Area Networks

Rule: If either 1.1.1 or 1.1.2 was YES, go to Question 1.2

TABLE 2				
Interview	LANS	WANS	Path	Significant Remarks
1	NO	NO	1.3	
2	NO	YES	1.2	Using ATM/CBR to connect PBX's together as a tie trunk.
3	NO	NO	1.3	
4	NO	YES	1.2	Using point to point links between routers on part of an international network for station to station calls.
5	NO	YES	1.2	Using frame relay between routers to act as a PBX tie trunk.
6	YES	YES	1.2	Using Ethernet for PBX tie trunks within same building; using frame relay for some station to station long distance.
7	NO	NO	1.3	
8	YES	YES	1.2	Using ATM/Ethernet for LAN station to station intra-building calls; using frame relay on international side for station to station calls.
9	NO	YES	1.2	Using ATM to connect PBX's together as a tie trunk.
10	NO	NO	1.3	
11	NO	NO	1.3	
12	NO	YES	1.2	Using ATM as a trunk between PBX site in Europe; using frame relay between two domestic locations as a test for PBX tie trunk.
13	NO	NO	1.3	
14	NO	NO	1.3	
15	NO	NO	1.3	

SECTION 1 DATA (continued)

Question 1.2: If there are currently approved projects and authorized funds to substitute LAN and WAN internetworks for the PSTN, are any of these:

1.2.1= Experimental or beta projects

1.2.2= Full implementations for long term use

TABLE 3			
Interview	Beta	Full	Significant Remarks
2	NO	YES	They may not use on a wide-scale basis; cost justification for ATM is still difficult. Justification on international network is easier.
4	NO	YES	Using this on international side only; international telecom service expensive.
5	YES	NO	3 month project to test business case.
6	YES	YES	Beta testing station-station frame relay internationally; definite implemenation for domestic PBX tie trunks within buildings.
8	NO	YES	Very cost-justified on international network.
12	YES	NO	Both the international and domestic applications are being tested- completion expected June 1999.

Question 1.3: If there are no currently approved projects and authorized funds to substitute LAN and WAN internetworks for the PSTN:

1.3.1 Have there been meetings to discuss these possibilities?

1.3.2 How soon do you think there might be any effort to have projects and funds approved?

1.3.3 What would you say is the current prevailing opinion of your organization of ever using LAN and WAN internetworks to substitute for the PSTN types your corporation uses?

TABLE 4				
Interview	1.3.1	1.3.2	1.3.3	Significant Remarks
1	NO	2 years	No serious effort	Most voice communication between customer and branch- not branch to branch. Y2K efforts make up most of current budget.
3	NO	2 years	No serious effort	Cost savings not apparent yet.
7	YES	6 mos	Positive effort	They will be trialing equipment at no cost in next 6 months.
10	NO	2 years	No serious effort	Still need quality proven and cost savings justified.
11	NO	2 years	Positive effort	Still need quality proven and cost savings justified.
13	YES	1 year	Positive effort	They will explore this after year 2000 probably as a test project to begin with.
14	NO	2 years	No serious effort	Current efforts are with Y2K projects.
15	NO	2 years	No serious effort	Watching technology and implementation develop more.

trunking, these managers indicated the desire to share bandwidth with routed data networks. Perhaps this was a logical first step by these organizations toward full convergence but none indicated that there was any objective of eventually replacing their PBX systems.

Experiments Versus Implementations and International Issues

Respondents who were identified as having funded, on-going projects provided further details in Table 3. Of interest was whether these projects were experimental beta-tests or full implementations of voice over LAN and WAN technologies. Approximately two-thirds (four of six) indicated that their projects were full implementations, with one of these showing that there were both experimental and full implementation projects occurring simultaneously. Unexpected feedback occurred at this point, as respondents elaborated on just why they were implementing these projects.

International telecommunication issues emerged as a significant reason for implementing these projects and, in some cases, were a reason for the experimental projects. Summarized remarks which revealed these issues were also provided in Table 3. Additional quotes from these same respondents are provided here. "Mileage-based terrestrial service, particularly in Europe and Asia, makes it easier to cost justify on our international network [using WANs for voice]." "International telecom service is very expensive which is why we are doing this on an international basis." "Using this (frame relay for voice) on the international side is where the cost savings will come in." "We are testing voice over frame relay now between Europe and our headquarters to save on international costs". Price concerns on the international side, and not the domestic side (U.S.) of their networks seemed to prevail. This concern also appears later in the interviews (Section 2) with regard to cost savings and strategy.

Those Without Projects In Place

Table 4 summarizes responses received from those who currently were not involved in projects that use LAN or WAN technologies for voice in the next 12 months. In this area, there was consistency between those who had not had any meetings to discuss the possibility of using LAN or WAN technology for voice and the response received from the related question of what the prevailing opinion was of their organization of ever doing so.

Note the responses of each manager or planner to Questions 1.3.1 and 1.3.3. Where no meetings had been held to discuss this topic, the majority also responded that "no serious effort" was being made to ever use LANs or WANs for voice. In addition, there also was consistency between responses to Questions 1.3.1 and 1.3.2. All respondents (by coincidence) provided a response of two years when asked how soon there might be any projects approved for voice over LANs or WANs. This appeared to be a logical conclusion - where no discussion of convergence existed there was a lack of effort by the organization to proceed in this direction. This turned out to be an unremarkable finding. However, most respondents did provide at least some reason why the topic was not being looked at (see Significant Remarks in Table 4). Some of these included: their organizations' focus on Y2K; the lack of confidence in quality and cost justification; and the topology of their networks.

G2. Strategic Benefits and the Use of LAN and WAN Internetworks as a Voice and Data Converged Platform

Section 2 of the interview form gathered opinions from the same set of managers and planners on key strategic benefits proposed through the use of convergence. Three areas of strategic benefits were given: reduction in network costs; easier administration and management of networks; and unique product or services which could be created to differentiate these companies from their competitors. Specifically, respondents were asked whether carrying voice

over the existing LAN and WAN internetworks, as a form of convergence, would bring any of the above strategic benefits.

Reduction in Costs

Table 5 shows the summary of results for each interview on the three strategic benefits proposed. Column 2.1.1 showed whether each respondent did or did not believe that a reduction in network costs would occur as a result of using LAN and WAN internetworks for voice, rather than using traditional PSTN or PBX networks. All respondents were asked their views regardless of whether or not they were involved funded projects. Of more interest were the respondents' reactions on what they believed this could or could not accomplish.

Nearly two-thirds of this set of managers and planners believed that some reduction in costs would be realized by using this form of convergence. It was clear that the concept of shared bandwidth for both voice and data traffic was the main reason these managers and planners believed they could reduce network costs. Through the use of frame relay and ATM technologies, voice and data could be piped over the same physical line, reducing the need for separate physical connections. Additionally, the use of these technologies on the international side of their networks was often mentioned as a method to reduce network costs. Several managers again stated that high network costs in areas such as Europe, Asia, and Latin America prompted them to begin projects on the international side of their networks using frame relay and ATM for transporting voice, along with data. Another reason given, to a much lesser extent, was the ability reduce network costs by combining voice and data departments within an organization.

The most prevalent reason for doubting that network costs could be reduced was with the expenses associated with equipment changeout or additions. The payback period and cost

SECTION 2 DATA

Strategic Benefits and the Use of LAN and WAN Internetworks as a Voice and Data Converged Platform

Question 2.1: Of the following, do you believe that carrying voice over the same LAN or WAN internetworks described earlier will or will not bring the following benefits?

Easier Unique
Cost Admin. Product/
Reduction & Mgmt Service

TABLE 5

Interview	2.1.1	2.1.2	2.1.3	Significant Remarks
1	NO	NO	YES	More complicated to manage; leading to unique service- PC/PC voice communication.
2	YES	NO	YES	Reduction in costs mainly from international perspective; More complex to manage; unique service- bundled web communication with customers.
3	NO	NO	NO	Carriers pricing voice services low; CPE changeout would add costs; more complex to manage integrated platform.
4	YES	NO	NO	Shared bandwidth reduces costs; more complex to troubleshoot.
5	YES	NO	NO	Shared bandwidth reduces costs; more complex to troubleshoot.
6	YES	NO	NO	Savings achieved through use of frame-relay over point-point links and through routing; more difficult to administer and manage though.
7	NO	NO	NO	Costs offset by equipment changeout, training. Eventual payoff but not rapid; more complexity with management.
8	NO	NO	YES	Integrated platforms may provide some internal operations benefits which could differentiate us from competitors.
9	YES	YES	NO	Able to combine voice and data depts. into one operation and reduce bandwidth needs.
10	YES	YES	NO	One physical line to manage versus separate links; reduce bandwidth.
11	YES	NO	NO	Over time, services will provide value which will exceed equipment costs.
12	YES	NO	NO	Reduction in bandwidth requirements; more complex troubleshooting though.
13	NO	NO	NO	More expensive to replace equipment and train personnel at first; internal communications use only.
14	NO	NO	NO	Equipment changeout may be costly; more difficult to track and manage at first.
15	YES	NO	NO	Using same network for voice and data will save costs; will be more difficult to troubleshoot.

savings derived from shared bandwidth and equipment was not proved in their cost models some said. Other comments began to support earlier findings of why many projects were taking place on the international side of their networks: "carriers (domestic) are pricing voice services low" and "rates are good on the domestic side."

Ease of Administration and Management

Table 5 shows whether each respondent did or did not believe that carrying voice over their LAN or WAN internetworks would bring about easier administration and network management benefits. Every respondent with two exceptions overwhelmingly felt that this was not an area where they would gain any benefit. Rather, it would create an impediment that could make administration and management a lot more difficult.

This significant finding shows that the majority of these managers and planners believe that carrying voice along with data will introduce more complexity to the network. Along with this complexity, they anticipated difficulties in the areas of troubleshooting problems and prioritizing traffic. They were concerned that as voice traffic is encapsulated into higher layers of the datastream, the ability to fix problems might become a more intensified effort. There was an evident sense of worry from the respondents with this aspect. It was also stated by many that more training would be needed by personnel involved with the troubleshooting of such converged networks. Closer scrutiny of network utilization was another area which the respondents felt would require more resources to manage.

Unique Products or Services

Table 5 also displays the results of the question being asked on whether carrying voice over LANs or WANs would create a unique product or service which would differentiate them from

their competitors. The general response from the overwhelming majority was that it would not. This was a disappointing result.

Most managers and planners saw carrying voice over LAN and WAN networks as a way to improve internal operations or simple cost reduction, rather than as an external communication tool with customers or suppliers. Only a few saw it as a movement toward concepts such as PC to PC telephony, or as a way to innovate in applications.

G.3 Using Equipment and Network Providers For Carrying Voice Over LANs and WANs

The final area of inquiry for this study involved obtaining information on the role of equipment and network providers in the movement toward using LAN and WAN internetworks for voice. Here again, respondents were separated into two groups: those with on-going funded projects and those without funded projects. Separate questions were asked of both groups. The answers provided by both might have indicated similar facts as to what sectors of the telecommunications industry were making efforts to provide customers with alternative means of voice communication over LANs and WANs. Specifically, the areas of the telecommunications industry focused on were equipment providers (manufacturers and distributors of hardware and software) versus network providers (non-manufacturing providers of telecommunications and transmission services).

The Role of Equipment and Network Providers in Current Projects

Table 6 provides a summary of the response to the Question 3.1.1 of the interview form. This question asked what roles equipment and network providers played in the voice-data convergence projects of these organizations. If project assistance was being provided to these organizations, was it provided by an equipment vendor or a network services provider?

Table 6 reveals that of the funded, on-going projects, it is usually equipment vendors, not network providers who provide advice and technical assistance. One point of special interest is that when network service suppliers offer technical assistance, the equipment vendor was also involved. None of these cases showed that network service providers acted alone in the effort to provide project assistance and technical advice, whereas equipment providers in many cases are acted without network partners in these projects.

Supporting comments by respondents reinforced the secondary, passive role of the service providers. The comments noted the reluctance of network providers, saying for example that "network providers are more reluctant and not as eager to promote these ideas" and "network providers are not pushing this at all". Equipment providers, on the other hand, made diligent efforts in some cases to provide cost model data supporting the cost savings of combining voice into LAN and WAN infrastructure. Where both equipment provider and network provider were involved, some said that the reason for the network provider's involvement was so that eventually they could take over network management responsibility for this type of service.

Efforts by Equipment and Network Providers to Move Other Organizations Toward Voice Over LANs and WANs

Table 7 summarizes responses from organizations that do not have ongoing projects. Question 3.2.1 of the interview form asked if either network or equipment providers had educated or demonstrated to them that such an idea is feasible now or possible in the future. Again, the purpose was to seek out what level of effort was being made by equipment and network providers in moving organizations towards a converged platform.

SECTION 3 DATA

Using Equipment and Network Providers To Substitute LAN and WAN Internetworks for the PSTN or PBX

Question 3.1.1: If there are currently approved projects and authorized funds to carry out either experimental or full implementations of using LAN or WAN internetworks to substitute for the PSTN, briefly describe any role that the following have:

TABLE 6

Interview	Equipment Providers	Network Providers	Significant Remarks
2	Technical project assistance	Technical project assistance	Both equipment and network providers are supplying cost model data to justify purchases made by this company.
4	Technical project assistance	No project assistance	Network providers reluctant to promote these ideas; eqpt.provider trying to supply cost model data to justify costs.
5	Technical project assistance/eqpt.loan	Technical project assistance	Both equipment provider and carriers are jointly working with this customer.
6	Technical project assistance	No project assistance	Only equipment provider assisting; expect network providers to assist in future management of these services.
8	Technical project assistance	No project assistance	No effort has been made by any of the network providers to promote these ideas.
9	No project assistance	No project assistance	Purchased equipment but no assistance from the eqpt. provider. Formal presentation made by a network provider.
12	Technical project assistance	Technical project assistance	Both equipment provider and carrier are assisting with testing.

Question 3.2.1 : If there are not currently approved projects and authorized funds to carry out either experimental or full implementations of using LAN and WAN internetworks to substitute for the PSTN, briefly describe how any of the following have educated or demonstrated to your corporation that such an idea is either now possible or will be possible:

TABLE 7

Interview	Equipment Providers	Network Providers	Significant remarks
1	NO	NO	Neither equipment or network providers have made presentations or pushed these ideas.
3	NO	NO	Some mention made of technology but no effort to make any presentations.
7	YES	YES	Equipment provider pushed ideas harder than carriers.
10	NO	NO	This company would like to see more effort by both equipment and network providers to discuss solutions.
11	NO	NO	Would not expect network providers to push this idea-seem to have more to lose. Expects eventually, more equipment providers will approach them.
13	YES	NO	Several equipment vendors have contacted them to provide information.
14	NO	NO	Neither equipment or network providers have contacted them to formally provide information or presentations.
15	NO	YES	Two of our carriers have (at their request) included voice over IP as part of overall communications package upgrade to our planners.

Table 7 shows that generally, both equipment and network providers have not made significant efforts to promote voice communication over LANs and WANs with this subset of managers and planners. The lack of focused presentations by equipment and network providers and convincing data to support future projects was found. Referring back to Table 4 in Section 1, many of these same organizations had not pursued formal discussions within their departments to consider these possibilities. The lack of discussion suggested there was a weak effort being made on the part of equipment and network providers and, on the part of these managers and planners as well.

Moreover, it may be possible that equipment and network providers already know of the reasons why these organizations are not ready to proceed with such projects or are aware of their reservations regarding issues such as costs and quality. Some additional comments further agree with those who are involved with convergence projects, where equipment providers are making a harder push for convergent technology and that network providers have more to lose in this effort.

H . Conclusions and Recommendations

Cost Is the Deciding Factor

In this study, one of the objectives was to seek information regarding information technology organizations' plans to use LAN and WAN infrastructure for carrying voice, as a substitution for PSTN or PBX networks. Plans have been set in motion for such undertakings in nearly half of these organizations. Most often, these implementations are occurring at the core or backbone level of their networks; rarely are they occurring at the edges. This is seen by the number of projects involving the use of frame relay or ATM as a virtual method of PBX to PBX tie trunks. In rare instances, locally attached telephony devices on router equipment are actually being tested or used that completely bypass PSTN or PBX networks. From this, it is seen that most organizations are still in the initial stages of using alternatives to traditional voice networks.

More importantly, projects occurring on the international side of these organizations' networks reveals that there is a more compelling reason for implementing alternatives internationally than domestically in the U.S. High costs for telecommunications services in Europe, Asia, and Latin America provide justification in the cost models of these corporations for international implementations. These cost models favor expenditures for new equipment capable of delivering voice over modern data networks such as frame relay and ATM, more often on the international side than on the domestic side. Competitive pricing of traditional voice services by network providers in the U.S. seems to be inhibiting convergence to a degree on the domestic portion of these organizations' networks.

As a second objective of the study, the importance of strategic benefits in moving toward convergent platforms was examined. Even when considering strategic benefits to the organization, cost factors remained a priority to these organizations. Reducing costs was the most important benefit these organizations could see as a result of implementing convergence projects. Although most mentioned that carrying voice over LAN and WAN internetworks would reduce bandwidth needs, equipment costs must also be offset within a certain period of time in their cost models.

Even when network management and complexity issues are considered, projects are based more on cost benefits. Nearly all those interviewed believe that managing a converged network will be more complex and difficult. This result seems to agree with the literature of Forrester Research (8), whose viewpoint is that network management complexities will limit deployment of convergence technology. Network management complications in the areas of troubleshooting and administration are the most common problems these organizations know they will face. More training would be required for the personnel responsible for these areas. As organizations develop convergence beyond the core or backbone areas of their networks, these problems certainly will need increasing attention. Equipment and network providers need to continue to develop software and training methods to ease the burden of these tasks. Yet, even in the face of these complexities, potential cost benefits apparently exceed these concerns.

Development of Unique Applications and Services

In planning for convergence, considerable improvement needs to be made with respect to the development of unique products and services. Very few organizations studied could seem to imagine how unique products and services could be created by integrating voice over LANs and WANs. This might be explained by several factors.

The low participation level of network providers in the discussion, planning, and implementation of voice and data convergence with their customers is uncovered in the last area of this study. With the perception that network providers have 'more to lose' when voice is combined with data traffic, certainly they will need to provide other areas of benefits to replace revenues lost through integration. Perhaps network providers and their customers are still comfortable with the benefits that traditional voice service products offer. Many businesses still rely on advanced intelligent network services not yet found on converged networks. Some of these include 800 number service, automatic call distribution to alleviate congestion, voice mailboxes, and roaming number service. An additional explanation for the lack of information from respondents regarding unique products and services relates to the calling pattern and network topology of some of their networks. Where limited branch to branch calling is necessary and more branch to public customer calling is used, the need to converge is lower. Finally, it should also be considered that organizations may be attempting to eliminate voice communication as much as possible, by implementing richer data communication platforms such as web-based intranet and Internet sites.

The Position of Equipment and Network Providers

The data obtained from this set of managers and planners shows that both equipment and network providers have not achieved a wide level of success in moving their customers onto converged platforms. A slight edge was seen where more equipment providers were working with these customers toward integrating voice and data onto LAN and WAN internetworks. Very few equipment and network providers were working in tandem on partnership projects.

This raises more questions as to the objectives of equipment and network providers. An topic to be investigated deeper is what forms of convergence they see as beneficial for their customers and their own marketing organizations. What level of importance and proportion does the ability to move voice onto data networks have in their proposals for customers? Are there plans for partnership projects between equipment and network providers? What steps can equipment and network providers take to extend convergence beyond just the core or backbone areas of customer networks as this study found?

Study Uses and Limitations

This study provides some useful indications of the current level of interest in convergence and project implementation efforts of information technology organizations. Although the number of organizations studied was small, the ones studied represent some the largest and well-known medium sized private industries. The data show fairly consistent responses to certain questions. Concerns about cost, simplifying network management, the need for more interaction between equipment and network providers amongst themselves and with their customers; and the need to discover and promote more unique products and services are common. Until then, few customers will extend convergence beyond their core and backbone networks.

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Annex 1

Interview and Questionnaire Form

Respondents Name

Company

Interview Number

Date

Section 1

The following questions relate to plans by corporate information technology organizations to use LAN and WAN internetworks to substitute for the PSTN network.

Using the definition of PSTN networks as single POTS (Plain Old Telephone Service), Centrex, and PBX's (Private Branch Exchanges), please answer the following:

Question 1.1:

Are there currently approved projects and authorized funds to use any of the following within the next 12 months to substitute for PSTN networks used by the corporation:

1.1.1 Local area networks :

Any corporately used Ethernet, Token ring, FDDI (Fiber Distributed Data Interface) or ATM (Asynchronous Transfer Mode) networks . List all that apply and what they are substituting for.

1.1.2 Wide area networks:

Any corporately used frame relay, SMDS (switched-multimegabit data service), ATM, or point to point HDLC (high level data link) networks. List all that apply and what they are substituting for.

Question 1.2

If there are currently approved projects and authorized funds to substitute LAN and WAN internetworks for the PSTN, are any of these:

1.2.1 Experimental or beta projects: (list details)

1.2.2 Full implementations for long term use: (list details)

Question 1.3:

If there are no currently approved projects and authorized funds to substitute LAN and WAN internetworks for the PSTN,

1.3.1 Have there been meetings to discuss these possibilities?

1.3.2 How soon do you think there might be any effort to have projects and funds approved to use LAN and WAN internetworks to substitute for PSTNs currently used by your corporation?

1.3.3 What would you say is the current prevailing opinion of your organization of ever using LAN and WAN internetworks to substitute for the PSTN types your corporation uses?

Section 2

The following questions relate to strategic benefits and the use of LAN and WAN internetworks as a voice and data converged platform.

Question 2.1: Of the following, do you believe that carrying voice over the same LAN or WAN internetworks described earlier will or will not bring the following strategic benefits and explain why or why not:

2.1.1 Reduction in network costs

2.1.2 Easier administration and management of your networks

2.1.3 A unique product or service for your corporation which may differentiate you from your competitors

Section 3

The following questions relate to using equipment and network providers to substitute LAN and WAN internetworks for the PSTN.

Question 3.1:

3.1.1 If there are currently approved projects and authorized funds to carry out either experimental or full implementations of using LAN or WAN internetworks to substitute for the PSTN, briefly describe any role that the following have:

Equipment providers

Network providers

3.2.1 If there are not currently approved projects and authorized funds to carry out either experimental or full implementations of using LAN and WAN internetworks to substitute for the PSTN, briefly describe how any of the following have educated or demonstrated to your corporation that such an idea is either now possible or will be possible:

Equipment providers

Network providers