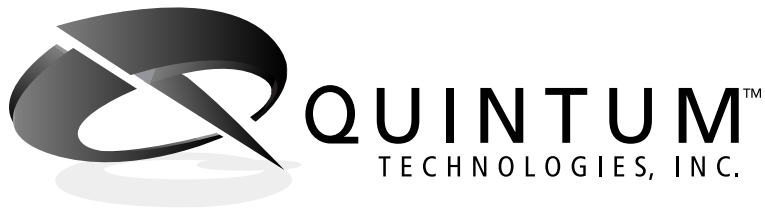


Risks and Rewards:



Strategies for Migrating Corporate
Voice Traffic to the Data Network



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Executive Summary

With the rapid pace of change taking place in communications technology today, business decision-makers face both compelling opportunities and potentially costly pitfalls. "Convergence" – whereby voice, fax, data and multimedia traffic are transmitted over a single multipurpose network – is a particularly delicate issue. The business and technological advantages of combining a company's various types of communications over a common infrastructure are appealing.

These advantages include: 1) lower recurring transmission charges, 2) reduced long-term network ownership costs, and 3) the ability to deploy a wide range of powerful voice-enabled applications.

On the downside, technology professionals are concerned with the quality of voice calls on the data network, the stability of voice-over-IP (VoIP) solutions, and the consequences of being prematurely "locked-in" to a given vendor's architecture. A lack of expertise and experience with VoIP technology is also preventing many organizations from taking even the most tentative first steps into the world of converged networking.

Fortunately, with the right strategy and the right technical architecture, business and IT decision-makers don't have to postpone their exploration of VoIP indefinitely. **By using an intelligent multi-path gateway switch that links the PBX, the data network and the public switched telephone network (PSTN), companies can effectively "hedge their bets" even as they move ahead with their initial VoIP deployments.** This type of intelligent switching solution allows organizations to enjoy the promised benefits of converged communications without financial risk or organizational disruption.

The Rewards of Voice-over IP

While there is plenty of debate in the telecommunications industry about how's and when's of network convergence, there is complete consensus on the why's. In fact, there is really nothing speculative about these core benefits; they are already being experienced by aggressive early adopters of voice-over-IP, voice-over-frame and other convergence technologies.

In general, these benefits can be classified into three main categories:

1) Lower recurring transmission charges

By directing voice calls over the corporate data network, rather than through a carrier, companies can significantly reduce their monthly phone bills. These savings are obviously dependent on several factors, including the volume of intracompany calls and the distances between company offices. Companies with overseas offices, obviously, can experience the greatest savings, since they can eliminate a great deal of international long-distance charges. These charges are often particularly high when the call originates in a foreign country that still has a highly monopolistic telecom market.

In some configurations, these savings can be extended to calls outside of the company as well. This is done by first routing calls bound for destinations outside of the company over the corporate network to the closest remote office, and then interfacing with the public switched telephone network (PSTN) at that point. Thus, for example, a company with offices in Chicago and Tokyo could route a Chicago-to-Osaka call to its Tokyo office, and then hand it off to a local carrier for the last leg of its trip. This can further reduce long-distance charges.

The economic appeal of transmitting voice calls over the data network arises from two technical factors. First, data networks almost always have spare capacity. Network managers typically over-provision IP networks to allow room for growth and to avoid congestion during periods of peak utilization. At the same time, voice calls consume relatively little bandwidth. The characteristics of human speech – especially the comparatively large amount of silence that takes place during conversations – allows for a great deal of compression in the digitized transport of the call. This makes it possible for voice to "piggyback" on existing data network connections without requiring investments in adding to the capacity of those connections. Even when such additions have to be made because of call volumes, those costs are typically a fraction of the recurring costs charged by carriers to carry that same calling volume.

2) Reduced long-term network ownership costs

In addition to reducing a company's monthly phone bills, a converged network architecture also reduces the ongoing costs of owning two separate networks – one for voice and one for data. These costs include the need to buy two separate sets of equipment, the staff time dedicated to the "care and feeding" of that equipment, the licensing of any software relating to the management of that equipment, and the monitoring of traffic on the two networks.

Personnel costs are of particular concern to communications and IT departments at this time. With the Internet revolution in full swing, the demand for skilled, experienced technicians far outstrips supply. This has driven salaries for voice and data network staff through the roof, and has also made it difficult to recruit and retain such engineering talent. Companies that are able to reduce their need for technical staff by streamlining their network operations can therefore eliminate many of the human resource management headaches that plague their competitors.

3) The ability to deploy powerful new integrated voice-and-data applications

Of course, businesses don't exist just to save money. They exist to make money, gain market-share, and serve customers. That's why the most compelling aspect of converged voice/data networking may well be the new generation of applications it enables. These applications include Web-enabled call centers, unified messaging and real-time collaboration.

Take the example of a Web-enabled call center. One of the biggest obstacles that companies face in converting Web site visitors into Web site buyers is poor online interaction. In a bricks-and-mortar store, customers can ask a nearby salesperson a question that may end up determining whether or not they head for the check-out line. On a Web site, that kind of interaction is more problematic. But using VoIP, site visitors can click a button and open up a voice conversation with a real, live call center staffer – who can quickly address any question or problem the customer might have.

Other examples include real-time multimedia video/audio-conferencing, distance learning, and the embedding of voice links into electronic documents. In fact, the full business potential of such applications is only beginning to be discovered. But one thing is clear: these integrated voice-and-data applications will require a converged IP network.

This last point is indicative of what is perhaps the most critical reason that business executives must move forward and at least pilot VoIP in one way or another within their organizations: future readiness. Three or four years ago, the Internet was not ready for primetime as a medium for commerce. But now it is – big-time. And, when it was finally ready as a place to make lots of money, which companies were best positioned to take advantage of its explosive growth? Those that had already dipped their toes in the water and had developed a reasonable amount of in-house expertise and experience with the technology.

The same is true of converged networking. Regardless of any individual observer's opinion about when and how voice-over-data is going to explode, the fact is that it inevitably will. Companies that enter into VoIP at that point in the history of business technology without any convergence experience or momentum will be at a significant competitive disadvantage. They won't be able to gain the internal operational benefits that convergence offers. They won't be able to effectively partner with other companies that have made convergence a core component of their technology portfolios. And they won't be able to effectively service customers who will expect VoIP capabilities. Chances are that they will wind up spending more money in an effort to "play catch up" than would have been necessary if they had started moving in the right direction earlier in the game.

It is therefore essential that any company with intentions to survive and thrive in a communications-based economy take steps now to ensure its ability to compete in a future that will clearly include universal adoption of VoIP technology.

Risk Factors in Voice-over-IP Implementation

Naturally, as every decision-maker knows, any potential business gain comes with a variety of potential business risks. Voice-over-IP is no exception. Market research indicates that the following risks are of greatest concern to business and technology executives as they consider a migration to voice-over-data convergence:

1) Loss of voice quality

Technologists understand that data networks are very different from voice networks. On the data network – especially the Ethernet transports that dominate corporate computing environments – packets bounce around somewhat indeterminately. They can collide and get distorted or even lost. Error-correction mechanisms in Ethernet hardware and the IP protocol itself can readily compensate for these phenomena on the data side, since the millisecond delays that occur as the network readjusts don't affect most computer applications. But such problems can adversely affect voice calls – which require a good quality, real-time flow of packets from one end of the network to the other. And, while the human brain can comprehend human speech even when there is a lot of distortion, users have become accustomed to a certain level of call quality. Any deterioration in that quality is perceived as very disruptive to the normal way of doing business – and users won't tolerate it.

2) Loss of reliability

Technologists and business people both know from experience that data networks are not yet as reliable as voice networks. We all know what it is like to have our computer freeze or to be told that the network is "down." But this rarely happens with our phones

or our telephone carriers. Immediate and uninterrupted access to others over the phone is such an essential aspect of conducting business that few executives want to put voice communications at risk, regardless of how attractive the potential savings may be.

3) Being prematurely "locked-in" to a given vendor's architecture

The pace of change in computing and communications technology today makes vendor "lock-in" a major concern for any potential buyer. There are really two aspects of lock-in that trouble most decision-makers. One is the possibility that another, superior solution for VoIP will come along shortly after a commitment has been made to a particular vendor's product. If the investment in that product is substantial, it's usually impractical to scrap it and switch to the better approach.

Of even greater concern for technology managers, however, is the fact that selection of one vendor's approach to voice/data convergence may cause a lock-in that extends far beyond the VoIP solution itself – forcing a long-term commitment to that vendor's overall networking architecture. This is something that many companies have already experienced with their desktop applications and data network hardware, where use of a particular operating system or routing technology has narrowed their choices in many other areas – such as applications and management tools. No one wants their VoIP implementation to result in the same type of limitation of long-term choices.

This concern is exacerbated by the lack of clear standards in the VoIP market. In the absence of such standards, technology managers have legitimate concerns about committing their companies to any proprietary architecture.

4) Lack of expertise and experience in convergence technologies

Technologists, by their nature, like to really know what they're doing. And, in recent years, they have already had to put a great deal of effort into rapidly assimilating a wide range of new technologies – Web site development, Internet security, object-oriented programming, etc. The addition of VoIP technology to this knowledge base is not an especially attractive prospect to already overburdened staff, especially if convergence has not yet gained strong support from the executive suite.

There is one other factor that should be discussed in relation to corporate convergence initiatives. The **very idea of convergence can potentially disrupt the roles and structures of corporate technology staff**. As things stand now, data applications are typically the responsibility of an IT team – while voice communications fall under the aegis of a separate and distinct telecommunications group. Convergence can therefore pose a threat to the positions and even the very jobs of individuals or groups of individuals in the company. While in an ideal world such personal and political agendas shouldn't have an impact on corporate decision-making, the fact is, they will. So any executive considering an initial foray into VoIP should carefully consider how implementation would impact the company's technology professionals.

Voice-over-IP Implementation Options

While the VoIP market continues to evolve, the current universe of VoIP implementation options can be segmented into four broad categories. Each of these has its own advantages and disadvantages:

PBX-based gateways

The leading manufacturers of PBX equipment are all introducing their own solutions to the VoIP challenge. With their significant marketshare and mindshare among corporate telecom managers, these companies are well-positioned to capture a sizable piece of the early VoIP market. From a technical point of view, these companies can effectively integrate the management of VoIP functionality with the existing corporate voice communications platform. They also have many years of experience building hardware and software that meets the reliability standards of the voice market.

The downside is that these vendors have minimal experience in IP-centric data networking. Without strong expertise in the vagaries of connectionless, non-determinate protocols, it is unclear how well they will be able to address the issues of voice signal quality in the IP world. And, as strong as their market position may be among telecom buyers and distribution channels, it is extremely weak on the data communications side of the equation. This may hamper PBX vendors' long-term ability to achieve dominance in a world dominated by IP innovators.

Perhaps the biggest drawback to the PBX-based approach is that this class of solution is tied so directly to highly proprietary PBX platforms. The leading PBX vendors have no demonstrable track record in either defining or adopting the types of open technical standards that have accelerated adoption of the Internet over the past decade. Without this commitment to standards-based technology, PBX vendors' VoIP solutions won't be a very good bet for companies seeking broad interoperability and flexible migration paths.

Router-based gateways

Manufacturers of routers and other data networking hardware are also attacking the VoIP market, albeit from the other direction. Like their PBX counterparts, these suppliers have healthy marketshare and mindshare among an entrenched constituency – in this case, data communications managers and networking equipment resellers. Their expertise in IP technology should also stand them in good stead, especially when it comes to solving voice quality problems using the IP quality-of-service (QoS) techniques they have been developing for some time.

Unfortunately, router vendors' vulnerabilities mirror those of PBX vendors. Their unfamiliarity with voice technology and call management continues to hamper their ability to deliver corporate-class telephony solutions. And continuing failure to rise to the reliability standards that have been perfected among telephony vendors over the past several decades essentially disqualifies them from serious consideration when it comes to corporate voice infrastructure.

Finally, it must be noted that the standards-based approach that has characterized recent advances in data networking is beginning to show signs of unraveling. In their pursuit of competitive advantages, many networking vendors are introducing an increasing – though subtle – element of proprietary flow control mechanisms. More and more, they are steering their customers to so-called "end-to-end" solutions – which is really a code-phrase for requiring a single manufacturer's equipment across the edge, access and core strata of the

network. This, again, represents the type of lock-in that most technology managers would prefer to avoid at this early stage of their VoIP plans.

PC-based gateways

Several vendors are bringing stand-alone gateways to market. These products offer a router- and PBX-independent solution, since they are not tied to a particular manufacturer's platform. These smaller, more nimble vendors exhibit a greater ability to rapidly adopt – and even help define – emerging standards.

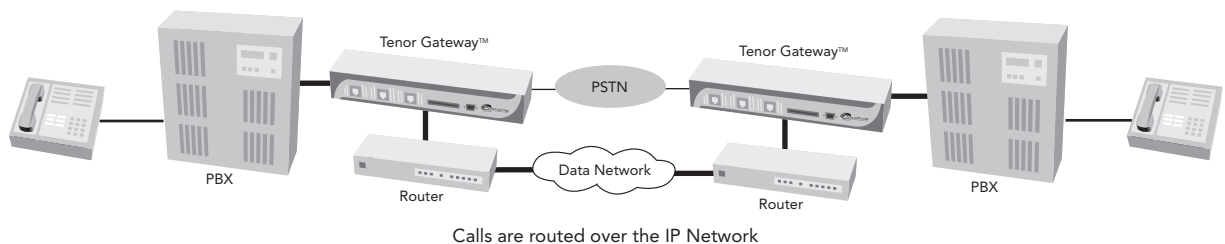
However, stand-alone gateways are also typically based on a PC platform, which calls into question their inherent reliability. Also, these vendors do not have access to the type of manufacturing scale that lends itself to cost-efficiency. ***It is doubtful that expensive, unstable products will find broad acceptance among buyers and distributors of corporate voice equipment.***

Intelligent, multi-path switching gateways

A fourth alternative to the above categories has recently appeared on the VoIP scene: the multi-path switch. These devices are specifically designed to address the issues unanswered by the product categories described above – including voice quality, network reliability, and vendor independence. It is this type of solution that the following section focuses on in further depth.

Eliminating Risk with Intelligent, Multi-path Voice/Data Switching

The underlying architecture for intelligent, multi-path voice/data switching was developed by Cheng T. Chen and Dr. Rajiv Bhatia of Quintum Technologies, Inc., in 1997. A multi-path voice/data switch sits between the corporate PBX and both the PSTN and the corporate IP data network. Its most prominent distinguishing characteristic is its ability to continuously monitor the condition of the data network, and to route voice traffic accordingly. This intelligent switching capability is the key to its value for safe, controlled migration to VoIP. If conditions on the corporate network are sufficient to support the required level of voice quality, the gateway switches voice traffic to the appropriate router. If conditions on the corporate network deteriorate for any reason, the switch automatically and transparently re-directs voice traffic over the public switched network.



Intelligent multi-path switching addresses the foremost concerns of both business and technology managers who are considering a first-stage implementation of VoIP. It is particularly appealing at this stage of VoIP's evolution, because:

It eliminates the risk of substandard voice quality

If conditions on the network threaten the quality of voice-over-data transmission – such as overall network congestion or a high packet error rate – an intelligent switch immediately and automatically responds with a "failover" to the PSTN. While this means that the company will be charged by its carrier for those calls temporarily, that is a small price to pay for avoiding any potential interruption to normal business operations.

It eliminates the risk of inadequate voice reliability

An intelligent multi-path switch protects against loss of voice service in two ways. First, it reroutes calls over the PSTN in the event that the failure of a data networking device threatens the continuity of voice service. Second, it protects against its own failure by becoming a transparent "wire" to the PSTN in the event of shutdown. Thus it provides 100% uptime for voice services. It should also be noted that, because it is essentially a telecom switch rather than a piece of data networking hardware, such a gateway is far less prone to failure than conventional routers and access devices.

It eliminates the possibility of vendor "lock-in"

Such a switch can be used with virtually any PBX and any router architecture. Because it is not directly tied to either device, it can serve as a highly flexible "shim" during any type of PBX and/or router migration.

It eliminates pain and risk from the VoIP learning curve

Because a multi-path gateway allows the networking staff to turn VoIP off or on at a moment's notice, it significantly raises the comfort level that both technical and business managers have with any initial foray into VoIP implementation. Note, too, that because a multi-path gateway can easily be programmed to selectively route only specified types of calls over the corporate data network, it provides an ideal method for testing, piloting and benchmarking VoIP traffic in advance of any incremental "production" deployments. In other words, it allows technicians to safely conduct a wide range of point-to-point experiments on the corporate network without impacting business-as-usual.

A multi-path gateway can also allay any of the personal and political concerns alluded to earlier, since it neither displaces nor interferes with telecom or data network infrastructure. In this way, it provides an excellent means for initiating a migration to convergent networking while executives are still undecided about how to tackle the thornier issues associated with restructuring their technical organizations.

Finally, the simplicity and technical elegance of the multi-path gateway switch make it an extremely attractive solution from an economic point of view. Requiring far less capital investment and service/configuration costs than other VoIP products, the multi-path solution further reduces the risk associated with VoIP migration.

Convergence is on its way. Companies that delay for too long the adoption of first-wave convergence technologies – most notably VoIP – will suffer a substantial competitive disadvantage as these technologies enter the mainstream. There are, however, clear risks that need to be avoided at this early stage of converging technologies. To avoid these risks while still practicing due diligence in advancing the corporate technology portfolio, decision-makers should carefully consider the use of intelligent multi-path gateway switching. In a time of uncertainty and doubt, these switches offer an ideal first step towards the exciting and lucrative future of convergence.

About Quintum

Quintum Technologies is an innovator in the voice-over-IP (VoIP) market. The company offers highly reliable VoIP products that deliver superior voice quality and provide an easy, risk-free migration path to the convergent future of networking. Quintum was founded by Cheng T. Chen and Dr. Rajiv Bhatia, both of whom have over 20 years of experience as lead engineers at companies including Bell Laboratories, Teleos, Madge and 3Com. The company's mission is to deliver enterprise-class VoIP solutions that provide:

- Outstanding value to customers
- Ease of installation, ease of use, and ease of management
- Superior quality and reliability
- Open architectures and standards compliance
- Flexible migration to succeeding generations of convergence technology

Quintum's unique Tenor MultiPath VoIP Gateway is the first VoIP gateway that intelligently switches calls over both IP networks and the PSTN in order to ensure high voice quality and provide failover capability. Unlike conventional VoIP gateways that only route calls over IP networks, the Tenor Gateway can transparently switch calls over to the PSTN if IP network congestion or a device failure impacts voice quality. The Tenor Gateway thus addresses the reliability concerns that have heretofore prevented many corporate decision-makers from moving ahead with VoIP and receiving all of its benefits.

Quintum Technologies Inc. is a privately held corporation headquartered in Eatontown, N.J. More information on the company, its management team, and its products can be found at www.quintum.com.



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