



IP Telephony

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# **Migrating To A Converged Network**

**Re-Looking at the Enterprise IP Telephony Business Case**

**April 2005**



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## Introduction

Many enterprises with distributed operations, and branch locations find themselves with a network architecture and topology that were designed based upon the constraints of the dominant Voice/TDM paradigm of the last several decades.

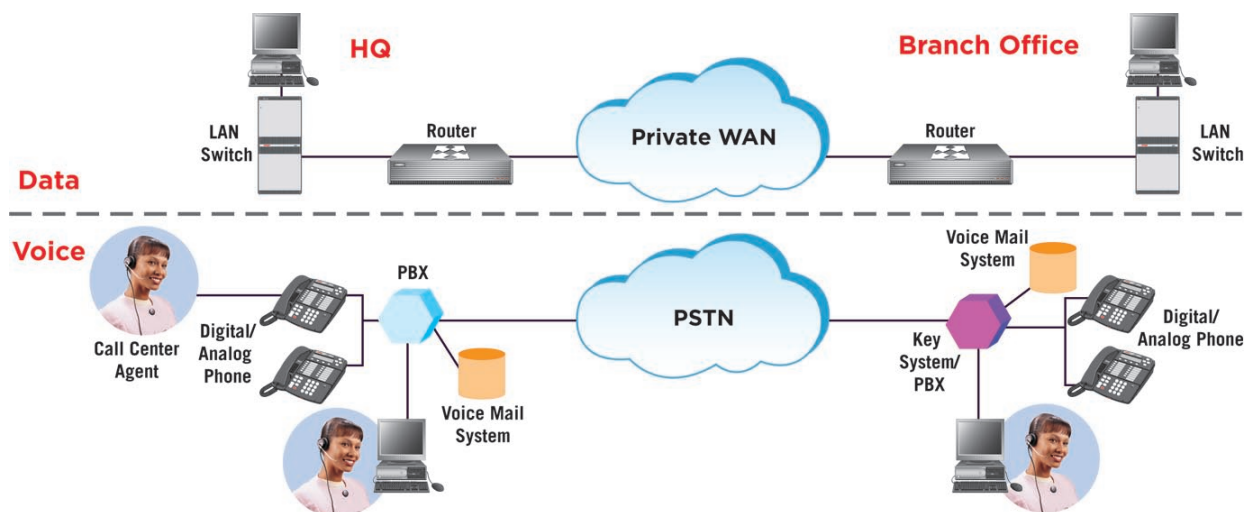
A leading industry analyst has aptly characterized the situation in the following way, “We are finding many enterprises are stuck in the dominant network paradigm of the late 20th century and have not fully realized the advances that have been made in converging and integrating networks and the exciting new applications that can run on these 21st century environments. There are tremendous cost savings and productivity enhancements for those willing to challenge the old models.”<sup>1</sup>

This has led to separate classes/segments of communications capability with:

- Large locations with the fullest set of voice application functionality based upon enterprise class PBX services
- Smaller/less intensive communications locations with Key systems/Hybrid systems with lower levels of voice application functionality in stand alone configurations

This separate and unequal topology has been implemented through two parallel networks for voice and data traffic.

- Data connectivity options have included private line, ATM, Frame Relay, dial up and more recently T1/T3 and DSL/Internet connectivity
- Voice connectivity options have included voice tie-lines (private lines), SDN and PSTN dial LD connectivity and local voice lines for remote locations



### ENTERPRISE PARALLEL DATA AND VOICE NETWORK MODEL

Figure 1: Enterprise Parallel Data and Voice Network Model

The last generation architecture was based upon a number of major constraints including:

- Mileage based network cost combined with LD/Local PSTN voice rates
- Expensive long haul bandwidth rates

- Emphasis on per-user scale as the cost basis for functionality levels in location-based voice systems
- Limited networked advanced voice applications (i.e. network messaging/ call centers)

These constraints have created a number of problems as business communications have intensified:

- Inefficient use of branch resources
- Dampening of demand for communications applications
- Limited communications productivity enablement at remote/branch locations
- Higher costs in communications systems management based upon the need to manage each site separately
- Difficulty of management of entire enterprise network built with diverse components

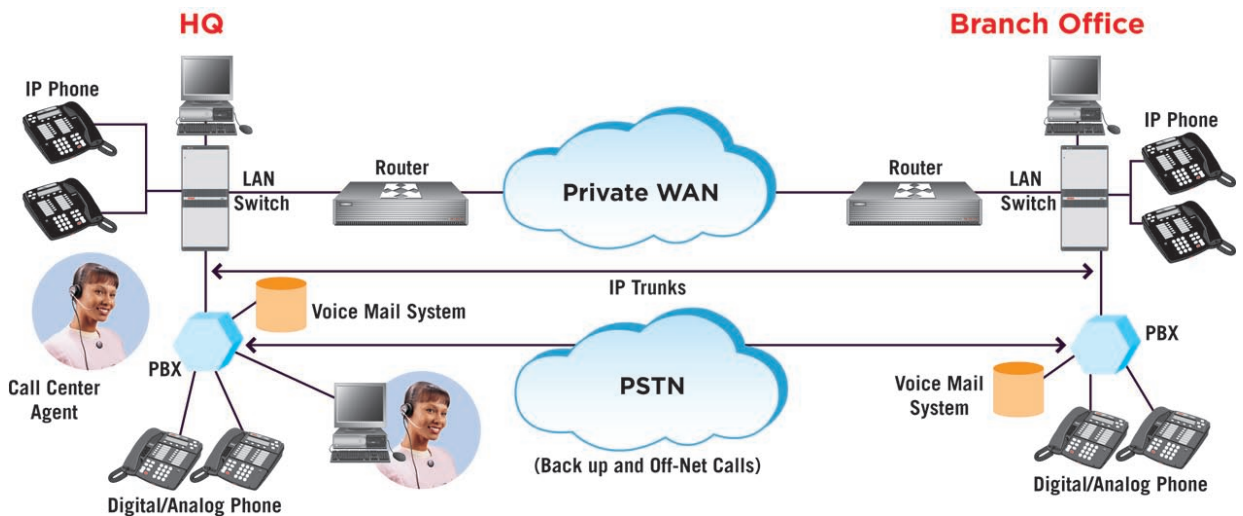
The last five years have brought forth a number of significant solutions that can remove many of these constraints and yield a new architecture, network topology, and applications environment that are deployed cost effectively to enable a major leap in communications productivity.

This paper will explore this transformation and the supporting technologies and solutions being created by Avaya as well as their impact on the underlying business case rationale for IP Telephony migration.

### Initial IP Telephony Business Case Cost Savings

The emergence of IP networks and the move to converge disparate applications (data, voice, & video) on a single corporate IP network has eliminated many of the constraints of the old enterprise networking model

Initial IP network transformation business cases focused upon the major network cost savings associated with converging voice traffic upon a single data backbone.



### INTEGRATED DATA AND VOICE TRAFFIC ON IP BACKBONE

Figure 2: 1st Phase Deployment of Converged IP Networks

Cost savings from toll avoidance undermines the LD minute based pricing model of the dominant network service providers. Scarcity of long haul resources could be somewhat nullified by achieving economies of scale in combining voice and data traffic over dedicated network connections.

Enabling this disruption was the emergence of the internet and the elimination of the cost/distance assumptions of previous industry network pricing. Pricing is increasingly shifting to cost for bandwidth and local access rather than minute based costs.

For new locations there was a clear cost savings from the deployment of a single network wiring plan. In Greenfield locations, this savings can be substantial and clearly provides enterprises with cost incentives for selecting IP Telephony systems at these locations.

Another major cost saving identified for IP telephony was that achieved through the elimination of the costs of most moves, adds, and changes within the single site location. Since connections to the IP Telephony voice application were based upon IP addressing rather than physical connections, users could simply unplug their phone sets and plug them into the network at their new physical office locations.

### **IP Telephony Business Case Expansion**

Beyond the basic cost and administrative savings identified for IP Telephony, the convergence of telephony as an application over the IP network shifts the business case focus from just cost savings to the upside potential for productivity associated with advanced telephony applications including messaging, mobility, and distributed call center operations/remote agents.

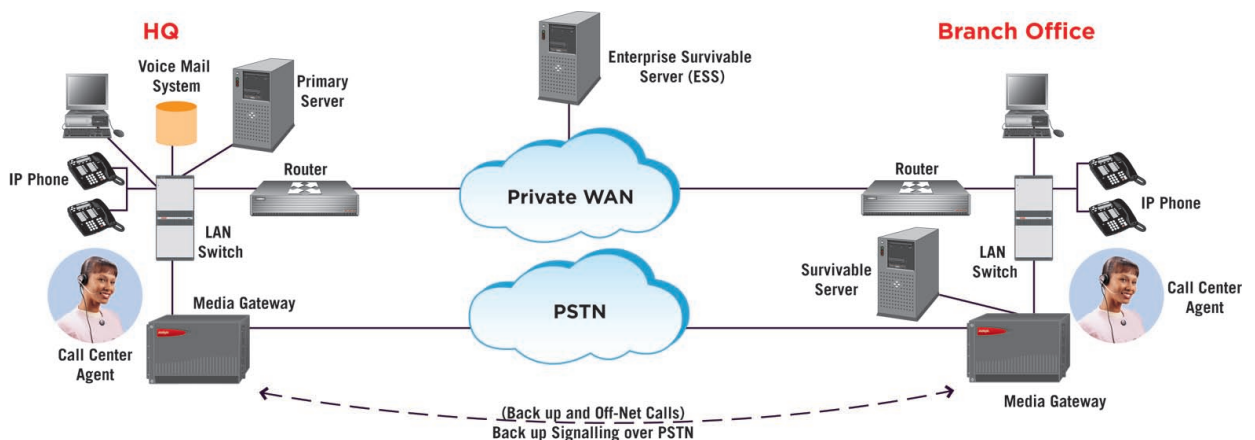
Avaya communication solutions are based on a modular architecture of centralized media servers that provide Avaya Communication Manager Call control to a distributed network of media gateways. Designed to extend Communication Manager's telephony services to all users throughout the enterprise, Avaya Media Gateways work with Media Servers to replace disparate and complex collections of key systems and/or legacy PBX systems with a networked, integrated, and centrally administered solution that delivers significant benefits to the enterprise:

- Single, unified dial plan that provides enterprise-wide extension-to-extension calling, single directory access to all users in the enterprise, and simplified site-to-site call transfers
- Centralized access and simplified sharing of voice mail messages
- Reduced user training costs and enhanced communications through the deployment of a unified call feature set
- Enhanced adaptability to changing capacity requirements through the consolidation and central management of user licenses for all locations
- Dramatically simplified enterprise-wide system and feature upgrades
- Support for centrally resourced call center operations extended out to branch offices

Despite the advantages of this networked, centralized model of communication, initial deployment of IP Telephony systems did not challenge the fundamental separation of locations into isolated systems (one system for each location). In part, this reluctance to challenge the architecture came from concerns about the losing the connection between the gateway at the branch office and the call controller at the headquarters location.

What is needed is an approach that combines cost-effective survivability at the branch office with a migration path from isolated systems towards a centralized networked model. The Avaya new branch office media gateways support a multi-stage approach to survivability that helps assure continued operation if connectivity to the main site fails, or if the central call controller fails.

First, if the central call controller fails or connectivity to it is lost, the branch office gateway can register to one or more Enterprise Survivable Servers (ESS) located elsewhere over the IP WAN network. If the entire WAN connection is lost but the central call controller is still available, the media gateway can initiate a connection using a back-up modem to dial either a modem bank at the main site or to establish an internet connection over the PSTN line for a VPN link. This will provide limited call signaling back to the call controller, with calls also re-directed over the PSTN. Finally, if all connectivity options to the central call controller and back-up ESS server fail, an Enhance Local Survivability (ELS) option for most branch office media gateways takes over to retain Communication Manager functionality and operate the location as a standalone system until network operations are restored. For smaller branch offices, a more cost-effective Survivable Local Server (SLS) option provides similar survivability with a more basic set of telephony operations.



### DISTRIBUTING APPLICATIONS ACROSS THE IP BACKBONE

Figure 3: Centralized IP Telephony System connected to survivable gateways at branch locations

This approach also supports a phased migration option allowing branch office media gateways to be deployed initially as separate standalone systems, allowing enterprises to extend IP Telephony to branch office locations while retaining their existing mode of operation. These systems can then be later migrated by converting their local call controller to ELS operation, and connecting back to a central call controller over an IP WAN link. By providing a flexible approach to implementation, Avaya enables customers to leverage their initial investment, while still achieving long term cost savings from eliminating the ongoing maintenance and administration of multiple systems and the advantages of a robust centrally managed network that offers multiple stages of survivability.

### Growing Impact of Implementation and Management Tools on the IP Telephony Business Case

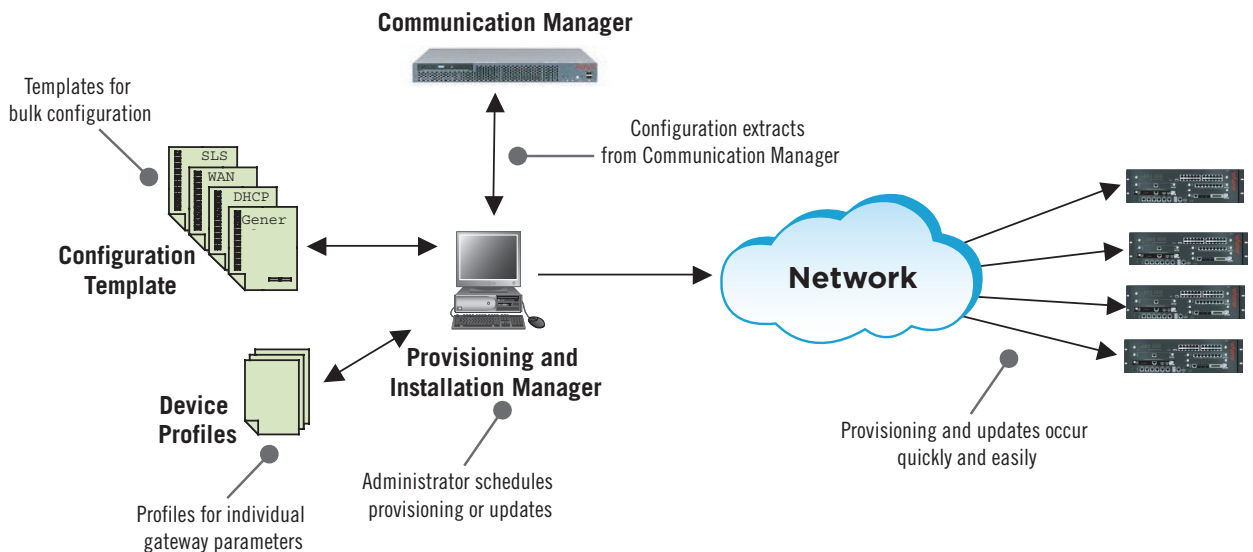
The new communication architecture centralizes telephony call control over a distributed network of gateways. Enterprises can now benefit from the administration of a single telephony communication system that extends a common set of features to all employees in all locations. But with this new architecture also comes the need for new tools that help simplify the physical challenge of managing potentially hundreds of branch office media gateways over an IP WAN network, particularly in the following areas:

- Initial deployment
- Security management

- Ongoing software updates
- Trouble-shooting

Avaya Integrated Management offers a comprehensive set of network and system management solutions for converged voice and data networks that simplify the management of complex communication environments.

Included within the Avaya Integrated Management suite is the Avaya Provisioning and Installation Manager (PIM) which addresses the need to simplify and reduce the costs of distributed branch office deployments. Provisioning and Installation Manager allows enterprise networking experts to create configuration templates and profiles at a central staging center then apply these templates to groups of gateways in a bulk provisioning process either at the staging site, or as part of a scheduled installation at the field. The result is branch office deployments performed faster, with less error, and with reduced need for on-site technical expertise at the remote office.



### PROVISIONING AND INSTALLATION MANAGER

Figure 4: The Avaya Provisioning and Installation Manager

Once distributed IP Telephony systems are deployed, tools such as the Avaya Network Management Console help administrators at the main site trouble-shoot system issues for any user, regardless of where they are in the network. The Network Management Console with VoIP SystemView discovers and displays a hierarchical and logical view of the Avaya VoIP network from the Avaya voice server level, to its components, including branch office gateways, and the IP Phones. With this end-to-end view of the network, administrators can quickly and easily locate users anywhere in the enterprise, and identify both their actual physical location as well as their logical connections to the converged network.

For many enterprises, the challenge of managing and changing security access rights and privileges to conform to security best practices is a daunting prospect when extended out to hundreds of devices. This task can be greatly simplified with Secure Access Administration (SAA), which provides a centralized console for managing user access rights and privileges to Avaya branch office gateways, access points, and converged infrastructure switches. Through this tool, user lists can be defined and deployed to multiple devices across the network, eliminating error prone device-by-device configuration.

Software maintenance and updates have also traditionally been a challenge when applied to large, complex networks. The Avaya Software Update Manager simplifies the process by automatically retrieve the latest software updates from the Avaya support site, comparing this against the current versions of all gateways in the network, and highlighting devices running outdated versions. The administrator can then check the list and schedule updates as needed to devices or groups of devices. Software Update Manager also manages the distribution of IP phone firmware updates to remote branch offices, reducing bandwidth usage over the WAN by allowing remote IP phones to get their updates from the local TFTP server embedded in Avaya branch office media gateways.

For those seeking a managed services option, Avaya Software Release Management provides proactive management for full software and firmware updates delivered remotely by Avaya Global Services. Avaya will manage the identification, risk assessment, scheduling and implementation for product updates by using our new Enterprise Service Platform. Avaya can quickly map each released update to identify customer sites and systems that are affected. Avaya coordinates the authorized updates using best practices to minimize risk during the update process. The Avaya automated, proactive process easily scales to support multiple sites and products to ensure the IP Telephony application is updated with the optimum software and firmware release.

The robust tools within the Avaya Integrated Management suite and Avaya Managed Services provide important cost saving capabilities to manage the ongoing operations of a distributed IP Telephony implementation and add another layer of savings that needs to be factored into the IP Telephony business case.

### **Latest Expansion of the IP Telephony Business Case**

While the initial round of network based cost savings for IP Telephony was generated from the reduction of voice networking costs for internal company communication by moving that traffic to the existing data network, new network management capabilities have recently emerged which promise to provide an additional round of network savings to the IP Telephony business case.

IP telephony has reached mainstream growth levels that are projected to exceed all other forms of telephony by 2007, and is spreading rapidly beyond main enterprise locations. The branch office market totals approximately 4 million locations around the world, and is becoming a major driver of IP Telephony growth as enterprises seek to drive productivity growth from their ranks of remote office employees.

IP Telephony deployments were often initially driven by the cost savings of moving voice traffic over the IP network. Increasingly, enterprise business process re-engineering initiatives are driving not only IP Telephony, but also business-critical applications such as Customer Relationship Management, Enterprise Resource Planning, Sales Force Automation, and Supply Chain applications to the branch office. In fact, since 2003 the percentage of enterprises planning deployment of these applications to their branch offices has more than doubled.

Ironically, as enterprises have come to depend more on IP WANs for business-critical operations, they are the one element in the network in which the enterprise has little control. Enterprise system survivability features and IP WAN routing protocols help to mitigate the impact of IP WAN “blackout” conditions in which a network link is lost or a critical system component fails, but do not address the more common problem of application brownouts. Brownouts, also called soft outages, occur when connectivity still exists but excessive latency, loss, and jitter make the connection unusable for the desired application. Because a connection still exists, standard routing protocols do not detect brownouts and do not have the intelligence to understand how link degradation impacts application performance. The result is inconsistent application performance across the WAN.

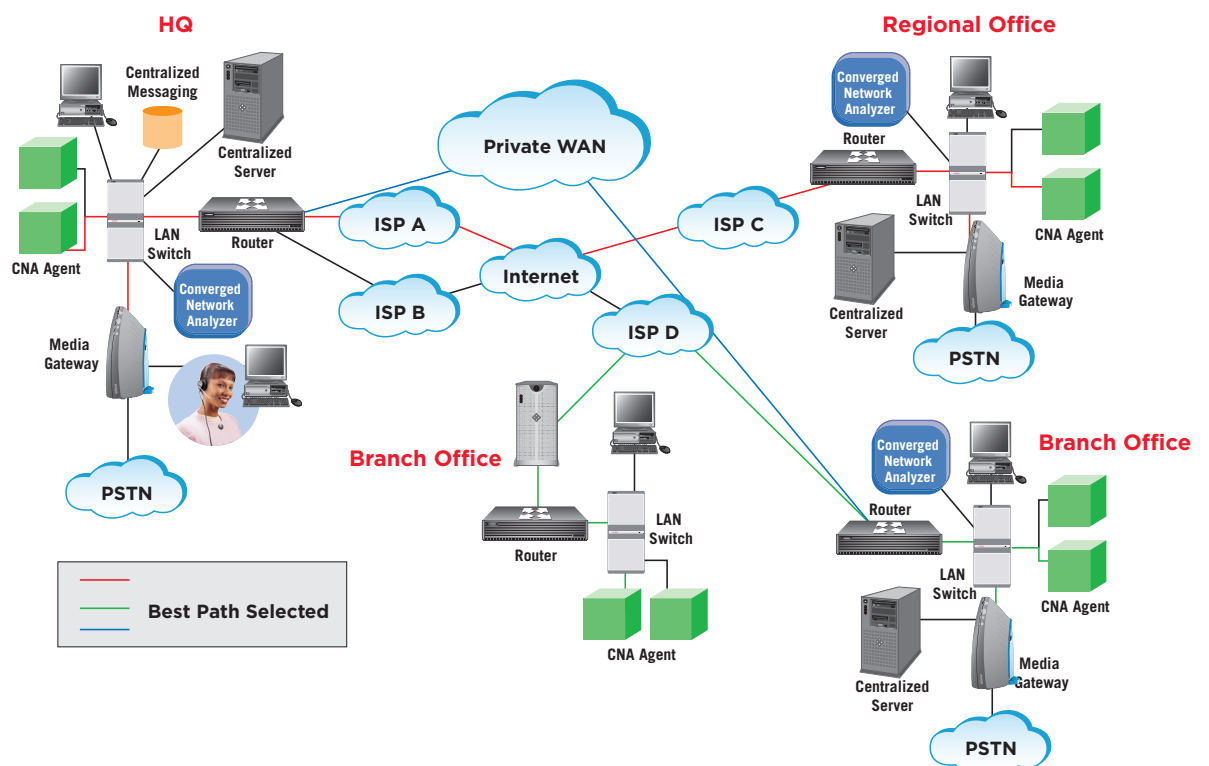


Fearing the frailty of Internet based connections, many enterprises have chosen to deploy applications such as IP Telephony using expensive private WANs, hoping to depend on the terms of the service providers' service level agreements (SLAs) for assurance. Unfortunately, SLAs really provide an avenue for compensation, not an assurance of service adequate to their real-time application needs. Even with SLA-backed private WANs, performance degradation and network downtime occur.

Avaya has two approaches for dealing with the underlying unreliability of the WAN infrastructure. For those seeking external expertise to monitor and/or manage the performance of their IP Telephony application, Avaya offers Remote Managed Services for IP Telephony. With this solution Avaya monitors the real time health of the IP Telephony application in a holistic manner across the entire communication domain including the Avaya Media Servers, Gateways, data devices and LAN/WAN links. The Avaya automation tools will then quickly correlate events and alarms to quickly find the true root cause of the problem. This correlation shortens remediation time, which helps deliver maximum uptime.

For those seeking a solution that allows them to monitor their IP Telephony applications and network from the end to end path of the IP Telephony traffic, Avaya offers its new Converged Network Analyzer (CNA). CNA addresses the core problem of unreliable business service over distributed networks through a comprehensive approach to network monitoring, application-based assessment, and adaptive path control that delivers consistent network availability and performance for IP networks.

CNA employs fully distributed mesh-based monitoring through a network of CNA test agents embedded in Avaya Media and Security Gateways, IP phones, the CNA server itself, and Extreme Network Switches. The agents provide continuous end-to-end active monitoring, mirroring the unique communication paths that peer-to-peer applications such as IP Telephony and video conferencing take through the network.



**ACTUAL IP CALL PATHS CAN BE MONITORED AND OPTIMIZED WITH CNA**

Figure 5: Avaya Converged Network Analyzer

CNA graphically depicts how changing IP WAN conditions impact different types of applications by applying sophisticated application models, that transform raw network measurements into easy to understand star-based rating scale (1-5 stars) for VoIP, web, enterprise, streaming media, and real-time multimedia applications. With this tool, enterprises can easily identify how changing network conditions impact each of their business-critical applications.

For larger site locations deploying multi-homed IP WAN connections, the CNA Adaptive Path Controller can even provide the enterprise with control over the WAN by assessing and determining the best path based on specific application needs and current network conditions, then adjusting the path in real-time through the network automatically to assure the appropriate levels of service. By adaptively routing over alternate paths through the WAN, up to 99% of network application “bad minutes” can be eliminated compared to an uncontrolled WAN deployment.

This technology can dramatically improve the availability and reliability of public Internet VPNs, making them viable for VoIP and other latency-sensitive traffic. CNA has been documented to add a “9” of availability over non-optimized IP WAN networks. This enables a multi-path IP VPN environment to approach the reliability and predictability of a private WAN, but at a reduced cost, greater worldwide reach, and much faster deployment times. When deployed in a hybrid private/public WAN environment, CNA can provide even better availability than private WANs, with significantly reduced operating costs.

Configuration	Bad Minutes	Reliability (%)
Frame Relay	14.7	99.966
Internet	344.6	99.203
CNA optimized Internet	40.2	99.907
CNA Optimized Internet + Frame Relay	1.3	99.997

Figure 6: 30-Day Study Comparing Private, Public, and Hybrid WAN Options

With its WAN Cost Optimizer module, CNA helps enterprises with usage-based billing contracts minimize their monthly bandwidth cost by steering traffic away from premium-priced private WANs to lower-cost ISPs, and by allocating traffic to avoid bursting above contractual minimum commitments. With support for multiple cost thresholds per link and configuration choices that mirror all the ways service providers calculate 95th percentile usage levels, CNA can save enterprises 20%-50% on their monthly bandwidth costs.

CNA is the first example of Application Assurance Networking, a new technology that focuses on the availability of IP communication and business applications such that the user experience approaches communications over circuit-switched telephony, while at the same time maximizing the potential long-term savings that can be achieved through IP migration. It also provides an important additional business case incentive for enterprises to migrate to converged IP networks.

## Conclusions

The business case for the migration to IP Telephony and converged /re-architected corporate networks has been getting stronger as new cost-saving components, implementation, and management tools have been introduced.

The Avaya newest capabilities in survivable gateways, efficient deployment processes, powerful management tools and application assurance networking capability have added major new considerations to the IP Telephony business case. The advantages that can be gained from these capabilities are convincing many enterprise technology planners that they should accelerate their migration to converged enterprise networks and IP Telephony applications that extend to the full breadth of their enterprise's reach.

### **Customer Case Study for Avaya Adaptive Networking Solution**

E\*TRADE, a Global 1000 financial services company, had begun its initial deployment to VoIP, based upon the expectation of reducing its telecommunications costs and the opportunity for integrated IP communications applications running on a converged network infrastructure. E\*TRADE initially started with VoIP trunking over its existing IP private WAN with redundant DS-3 connections at major locations.

The next phase of the project was intended to implement full IP Telephony for a limited number of locations, all connected via the private WAN. Before this step was taken, a consensus breakdown occurred between the IT data team and the telecom team over the networking design. The data team, hoping to realize significant additional reductions in networking costs, favored the substitution of Internet VPN connections in place of private WAN connections to carry the VoIP traffic, as this approach had produced a highly available VPN architecture with multiple ISP connections and redundant routing connections. The telecom team was skeptical about the reliability of Internet connections for VoIP traffic but agreed to a limited trial.

During the trial, the telecom team's fears about the performance of Internet VPN connections were initially realized. While overall performance was acceptable most of the time, it was unacceptable some of the time. Call quality fell below cell phone levels, calls were dropped, and the telecom team quickly concluded that the more expensive private IP WAN was the only suitable environment for deploying VoIP. The data team, based upon their earlier experience with optimized IP routing for Web applications, proposed using Avaya CNA to measure the quality of service of parallel Internet VPN and private WAN paths.

The measurements made by Avaya CNA uncovered performance problems on both the Internet VPN and private WAN paths. Intermittent packet losses and delay spikes were detected on both of the parallel ISP connections. What surprised both the data and telecom teams were the discovery of loss events on the private WAN. The solution to these impairments was to allow Avaya CNA Adaptive Path Controller to select the best path for VoIP in real time. By eliminating the bad minutes from each of the ISP paths, The Avaya solution was able to achieve 99.9% (three nines) of availability, comparable to the private WAN performance, which was judged acceptable for carrying VoIP traffic. By adding the private WAN choice into the list of available paths, The Avaya solution was able to increase availability for VoIP to 99.99% (four nines.) E\*TRADE was thus able to realize the advantages associated with VoIP by leveraging lower cost Internet connections with Avaya CNA Adaptive Path Controller.<sup>2</sup>

For more information on how Avaya can take your enterprise from where it is to where it needs to be, contact your Avaya Client Executive or Authorized Avaya BusinessPartner, or visit us at [www.avaya.com](http://www.avaya.com)

#### **Footnote**

<sup>1</sup> Richard Kent, Principal of GreenSpring Partners, Briefing on Customer Perceptions Gathered During VoiceCon2005.

<sup>2</sup> For more technical detail on the E\*TRADE experience see — Avaya, "Adaptive Networking Software Testimonial", March 2005. Note that CNA was previously named Adaptive Networking Software (ANS) and was acquired by Avaya from RouteScience.

## About Avaya

Avaya enables businesses to achieve superior results by designing, building and managing their communications infrastructure and solutions. For over one million businesses worldwide, including more than 90 percent of the FORTUNE 500®, Avaya's embedded solutions help businesses enhance value, improve productivity and create competitive advantage by allowing people to be more productive and create more intelligent processes that satisfy customers.

For businesses large and small, Avaya is a world leader in secure, reliable IP telephony systems, communications applications and full life-cycle services. Driving the convergence of embedded voice and data communications with business applications, Avaya is distinguished by its combination of comprehensive, world-class products and services. Avaya helps customers across the globe leverage existing and new networks to achieve superior business results.

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