

WAN Optimization — A New Approach

Employing intelligent WAN optimization technology over virtually any broadband access technology, HughesNet® offers the distributed enterprise unmatched bandwidth scalability, high availability, and application performance—all at a price point less than other managed MPLS solutions.

HughesNet® 

WAN Optimization — A New Approach

The Distributed Enterprise IP Network

For a variety of strategic and operational reasons, many enterprises are moving toward a distributed networking model—consolidating data centers, concentrating servers in selected hub locations, and recentralizing deployment of formerly localized applications. The former client-server paradigm is shifting to Web-based application delivery, which in turn, demands that all users—whether at headquarters or at remote branch offices—obtain “anytime, anywhere, always” functionality from their enterprise applications. Not coincidentally, corporate America is also seeing a steady migration from legacy networks to IP networks. For example, Vertical Systems Group has forecast that enterprise private IP networks in the US will grow from an estimated 476 K sites in 2007 to over 900 K in 2010.¹

In support of this architectural shift to a distributed, all-IP-network, numerous innovative solutions are emerging in the market that optimize network utilization and performance, as well as accelerate a broad range of applications accessed by distributed enterprise users. Collectively referred to as WAN Optimization, the choice of which direction to take has, until now, presented IT managers with this dilemma: Either to deploy expensive, private leased line MPLS; or to potentially compromise performance and security by choosing traditional, lower cost broadband access technologies, such as DSL or cable.

As illustrated in Figure 1, HughesNet® Managed VPN Services offers a compelling alternative to solve this dilemma: *“The synergistic combination of WAN optimization intelligence at the edge and widely available broadband networking brings the distributed enterprise a highly cost-effective, enterprise-grade private networking solution—offering bandwidth scalability, high availability, and excellent application performance.”*

Broadband VPN Delivers

- Attractive price points
- Fully IP-based networking
- Unsurpassed geographic and access reach
- Flexible connectivity to extranets and remote users

HughesNet Managed Service Delivers

- Covers entire life cycle—design, implementation, operations, and management
- High network reliability
- Security

HughesNet WAN Optimization Delivers

- Application prioritization
- Improved application performance at branch sites
- Increased usable WAN throughput
- Network variability mitigation

Figure 1. Combination of Broadband VPN and WAN Optimization Delivers Highly Effective Enterprise Networking

1 2007 Vertical Systems Group

To summarize, HughesNet Managed VPN Services provide the following capabilities:

- **Network Availability:** HughesNet offers the option of physically diverse dual broadband access throughout the network, utilizing any combination of terrestrial and/or satellite technologies at each site, delivering overall network availabilities up to 99.99+% on an end-end basis.
- **Bandwidth Scalability:** Bandwidth scalability can be readily addressed by HughesNet’s dual access architecture, which provisions two broadband links to branch locations, offering upgradeable bandwidth capability on a site-by-site basis.
- **Application-Aware Networking:** The combination of a broadband VPN and WAN optimization intelligence at the network edge delivers a highly cost-effective, application-aware enterprise networking solution. This is possible because the HughesNet solution has integrated WAN optimization technology within the access router at every location, thereby delivering application performance, security, and throughputs similar to more costly, leased line MPLS.
- **End-End Network and Service Management:** HughesNet Managed VPN Services are comprehensive and full life-cycle, beginning with network assessment and design, and encompassing operations, fault management, performance management, and customer support. Optional professional services include application profiling and testing, and overall network optimization.

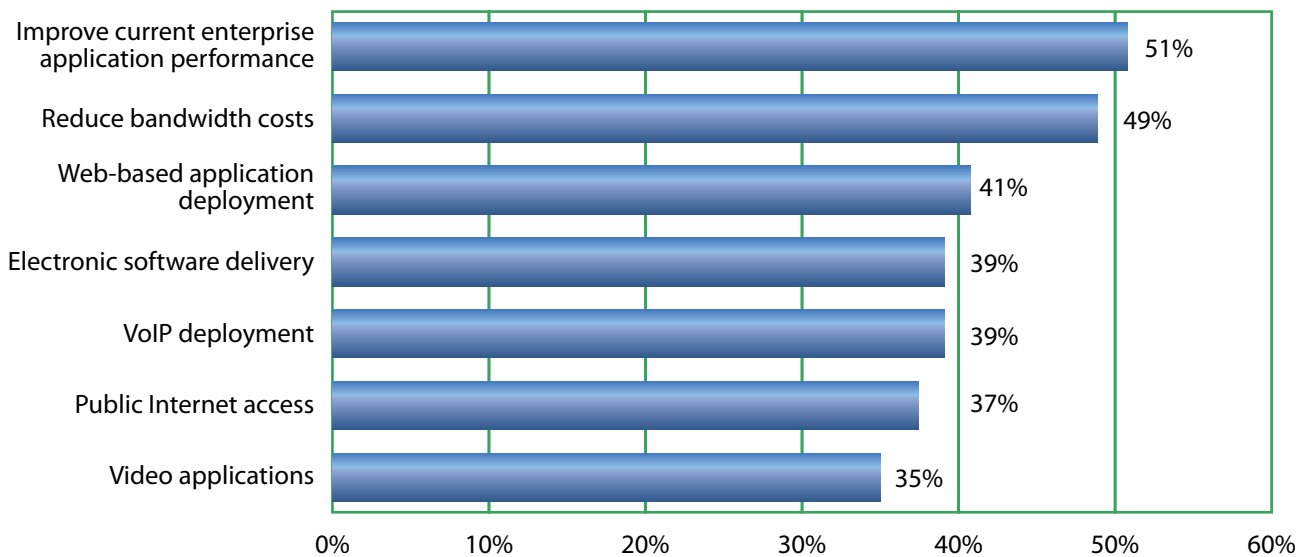
WAN Optimization: From Expensive Fat Pipes to Smarter Pipes

WAN Optimization refers to a suite of capabilities that seeks to optimize network utilization and accelerate a broad range of applications accessed by distributed enterprise users via a variety of methods, such as:

- Traffic management methods that give priority to mission-critical applications and related traffic during “rush hour” congestion
- TCP and other protocol-specific acceleration algorithms to minimize the effects of network latency
- File and object caching with “pre-fetch” mechanisms to speed up response times
- Data reduction techniques, including compression and protocol redundancy removal, to improve network throughput

IDC’s 2007 U.S. WAN Manager Survey of over 500 IT managers found that 34% of them already deploy WAN optimization or application acceleration solutions, and another 43% planned to do so within 12 months.

The same survey also found that the top reasons to use WAN optimization or application acceleration solutions was to improve application performance and reduce bandwidth costs. Some of the other reasons WAN managers seek network optimization or application acceleration solutions are shown in Figure 2.



N=388. Base: currently use/plan to use WAN optimization/application acceleration solutions. Source: IDC’s U.S. WAN Manager Survey, 2007

Figure 2. Increasing Adoption of WAN Optimization

WAN Optimization 1.0 – Between a WOC and a Hard Place

Prevailing WAN optimization solutions have been widely accepted for networking of large sites served by T1/T3 or OCx technologies, but have not proven effective for deployment in a multisite, distributed network for a variety of reasons. Two of the primary reasons are:

- **Long Payback Period:** Typical deployments are WAN overlays—with a specialized appliance, generically referred to as a WAN Optimization Controller (WOC), requiring up-front capital expenses ranging from \$2,000 to \$3,000 per site. For sites with low speed or broadband access, the hard cost payback period is long or uncertain due to the cost of the additional appliance.
- **Management Complexity:** Managing hundreds or thousands of devices across the distributed network introduces complexity that can tax an already overburdened IT staff. Additional costs include the added burden of deployment, configuration, ongoing monitoring and maintenance of yet another network device at each site.

However, the market is evolving toward integration of routing and WAN optimization technologies. Gartner noted in its report, “At present, WOC capabilities are delivered by dedicated equipment, usually purchased by the user organization. As the market develops, we expect to see increasing deployment of managed WAN optimization services, and some integration of WOC features into other network equipment such as routers.”²

WAN Optimization 2.0 – Managed, Cost-Effective

As outlined earlier, the benefits of WAN optimization have in the past been mostly limited to larger network locations with higher performance broadband options. However, solutions such as HughesNet provide a wide range of high performance and cost-effective broadband access options at even the most remote and smallest of branches in a typical, multisite distributed enterprise. Hence, any enterprise WAN, including small/medium businesses with offices in remote locations having only standard broadband access, can now enjoy big-pipe, MPLS performance without the attendant price premium.

HughesNet Managed VPN Services

The HughesNet Managed VPN Services offering is graphically depicted in Figure 3. The solution uses a symmetrical architecture approach for effective bandwidth control and acceleration, with a Hughes HN7700SR enterprise-class router deployed at each remote location. The HN7700SR integrates a high performance, multi-access router with WAN optimization technology. This yields a low CPE investment as well as affordable service delivery, making it scalable and cost-justified for deployment over a wide range of small to large broadband VPNs.

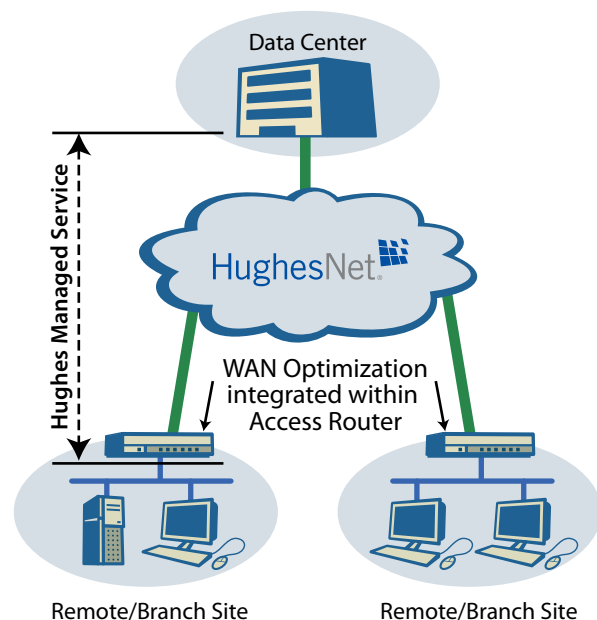


Figure 3. HughesNet WAN Optimization Service Overview

² “Magic Quadrant for WAN Optimization Controllers, 2007” Gartner RAS Core Research Note G00153256, Andy Rolfe, Joe Skorupa, 14 December 2007 R2577 12192008.

The following summarizes the key features and benefits of WAN optimization techniques employed by HughesNet Managed VPN Services:

Application Prioritization and Traffic Shaping

With the growth in remote applications and well as recreational traffic, demand for WAN bandwidth often will exceed available bandwidth at branch sites. Instead of traditional traffic engineering approaches that attempt to manage traffic levels, a more efficient method is to oversubscribe the WAN link and allow prioritization to ensure business-critical applications are provided preferential access to WAN bandwidth.

The HughesNet Managed VPN solution provides four priority levels. Traffic flows are classified via a variety of rules, such as application type, TCP ports or IP addresses, and mapped into one of the four priority queues (see Figure 4).

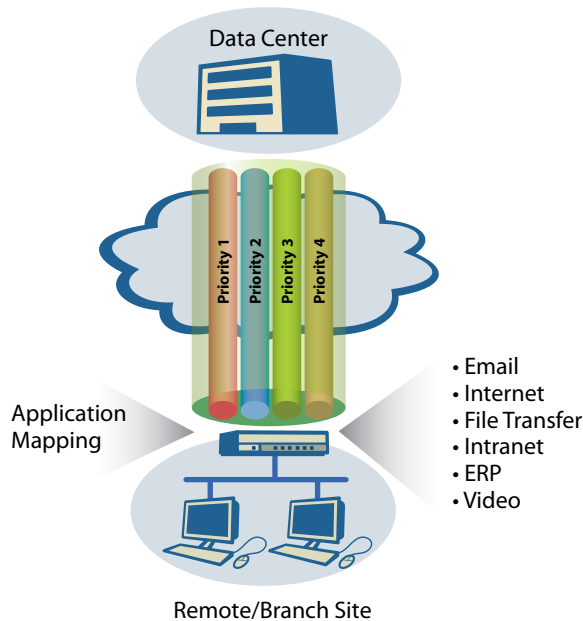


Figure 4. HughesNet Prioritization

The prioritization method is Weighted Fair Queuing (WFQ), which assigns each queue a relative percentage of the WAN rate. Traffic is allowed into the WAN based on these priorities. If a priority queue is empty, another queue can take its allocation.

Data Reduction

Data Reduction refers to the reduction or elimination of redundant data over the WAN, delivering significant benefit in terms of WAN bandwidth efficiency. Hughes has incorporated two forms of data reduction to maximize these gains—compression and protocol overhead removal. Both are transparent to the end systems. Stateful, content-aware compression provides lossless compression gains of up to 10X, depending on the actual traffic content. Documents are generally highly compressible, while content, such as images or zip files, cannot be compressed further.

Protocol overhead removal significantly reduces TCP and application level overhead through the use of local TCP termination. The state-of-the-art Hughes designed router at each remote location terminates TCP sessions locally, and uses a high efficiency WAN protocol to transfer the data to the destination, where the reverse process occurs. An advanced form of protocol overhead reduction is also incorporated at the HTTP level to significantly reduce bandwidth required for web requests.

The benefits of data reduction are significant—enabling WANs to carry more data, which in turn gives them higher effective transport capacity, and thus maximizes utilization of the network on an end-to-end basis. For a broadband VPN, this also mitigates the often narrow upstream pipe. See Figure 5 for an example of a branch site connected with a 128 kbps upstream ADSL.

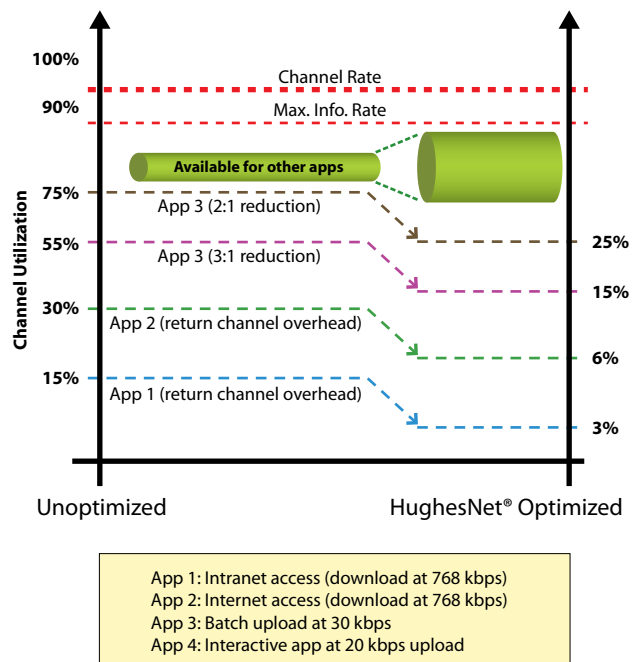


Figure 5. Improved Network Throughput

TCP and Web Acceleration

Hughes incorporates both TCP and Web acceleration functionality—a feature called TurboPage®—which improves Web acceleration by reducing the chattiness involved in fetching objects that are part of a Web page. The TurboPage client intercepts Web requests on the remote and talks to a TurboPage server at the data center. Instead of waiting for a remote PC to parse the initial HTML page, send a DNS request for each server that has an object (images, flash files, etc.), and then open another TCP connection to each of those other servers to request the objects—the TurboPage server simply pre-fetches the items and caches them for a brief time. The TurboPage client responds to the remote PC's DNS requests immediately with the cached information and then intercepts the TCP three-way handshake when the remote PC tries to contact each of the other Web servers. Instead, it issues a single message requesting the pre-fetched objects from the TurboPage server, and then hands these to the remote PC. See Figure 6.

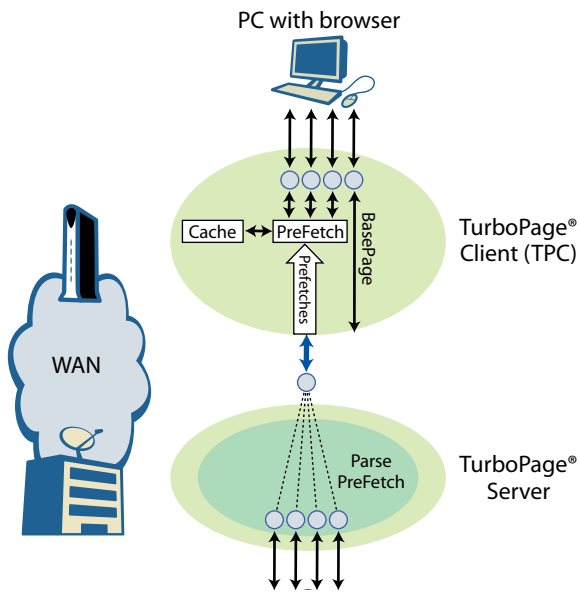


Figure 6. TurboPage HTTP Acceleration

TurboPage essentially reduces the number of interactive transactions across the WAN. Because the pre-fetching process locally prepositions objects for LAN-speed delivery to the remote PC, TurboPage preempts the normal WAN latency of requesting each object serially.

TurboPage accelerates both secure and nonsecure Web pages.

Scalable Bandwidth

In some cases, increasing raw bandwidth to a site may be the right solution to provide high application performance. Hughes' managed service includes an option for provisioning additional broadband access to a site to provide scalable bandwidth. This option can also provide high availability at each remote location via the use of physically diverse transport mediums (wired and wireless) to ensure that there is no single point of failure. See Figure 7.

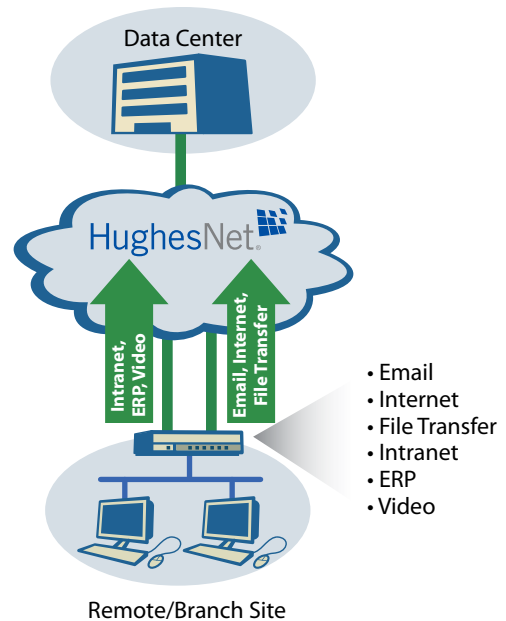


Figure 7. HughesNet Bandwidth Scalability

Hughes Managed Services

HughesNet Managed VPN Services offer a full lifecycle approach to WAN optimization, beginning with an optional consulting study related to network capacity and performance, as well as application performance and profiling. Two broad areas are typically covered: service management and network management.

Some of the standard service management features include:

- Program Management
- Network Design and Optimization
- Network Deployment
- Enterprise-Grade Operations
- Standard Help Desk Support
- Site Level Ticket Generation
- Network Level Ticket Generation
- Service Management Tools
 - Customer Gateway
 - Network Management Portal
- Virtual Automated Dial Backup (VADB) Utilization Reports
- Geographical Network Map
- Industry leading SLAs

Some of the standard network management features include:

- Fault Management
 - Network Views (Site Level)
 - Automatic Ticket Generation
 - Infrastructure View
 - Device Status Details
 - VADB Status View
- Performance Management
 - Scheduled Reports
 - Aggregate Traffic Utilization Report – MRTG (Multirouter Traffic Grapher)

All of these features are explained in greater detail in the *HughesNet Managed Services – Scope & Functionality*.

Summary

More and more enterprises are evaluating next generation IP-based networks, seeking to improve network performance, reliability and flexibility, while simultaneously controlling costs. Distributed enterprises with multiple branch locations will find that the HughesNet Managed VPN Services, now enhanced with WAN Optimization, are a compelling solution that:

- Delivers a comprehensive, fully-managed networking service
- Supports all types of broadband access—wireline, wireless, and satellite
- Provides integral WAN optimization enabling improved application performance and network efficiency
- Offers successful field-proven technology already in operation across thousands of enterprise sites

Proprietary Statement

All rights reserved. This publication and its contents are proprietary to Hughes Network Systems, LLC. No part of this publication may be reproduced in any form or by any means without the written permission of Hughes Network Systems, LLC, 11717 Exploration Lane, Germantown, Maryland 20876.

HUGHES, HughesNet, IPoS, TurboPage, SPACEWAY, AIReach, Broadband Unbound, and Connect to the future are trademarks of Hughes Network Systems, LLC. All other trademarks are the property of their respective owners.