

Evaluating the need for upgrades in Campus LANs

Long-adopted WAN bandwidth optimization finds its way to the core

Executive Summary

In recent years, IT organizations have embraced the need for application visibility into the traffic flowing over their WANs in order to better manage bandwidth consumption and budgets. Now that concern is beginning to move to campus LANs. All that “excess demand” built into the network a few years ago has seemingly disappeared, and regular trouble tickets are opened daily for “the network is slow today - it's taking forever to get my work done.” In the past, the trend was to “throw bandwidth at the problem” in order to gain better application responsiveness. Curiously, however, as soon as additional capacity became available, a spate of new, bandwidth-hungry applications appeared to consume any excess.

Where many large corporate and government networks operate at Gigabit Ethernet speeds, throwing bandwidth to upgrade to 10 Gigabit Ethernet is quite an expensive proposition. Instead, these enterprises are implementing NetScout's *nGenius*® Solution to gain high-definition application visibility for better network utilization, improved application design, and bandwidth optimization, which lets them save costs and postpone core upgrades.

Business climate drives IT initiatives

Many forces influence changes in the business environment, for example, regulatory compliance, mergers and acquisitions, strategic drive for competitive advantage, operational efficiency initiatives, technological innovation, etc. More times than not, these changes impact the IT department, accelerating the pace of technology implementation within the organization. Examples of recent trends include the following:

- The need for increased operational efficiencies driving the convergence of voice and data on a single IP network
- Corporate mergers and subsequent cost-saving data center consolidation projects
- A drive for competitive advantage compelling the development of new, mission-critical applications
- Compliance with new regulations requiring new back-up data recovery sites

Until now, many of these functions were manually performed with limited input from performance management tools. But in today's global marketplace, the most competitive organizations need more advanced help. Below are challenges IT professionals face when attempting to accomplish IT initiative projects, along with solutions needed to overcome them.

Examples of business processes driving growth:

- **Collaborative work environments that involve the sharing of large files**
- **High-volume SANs with multi-terabyte backups**
- **Grid computing**
- **Heavy-load campus backbones**
- **Redundant data centers**
- **Database backups at regularly scheduled daily intervals**
- **Disaster recovery sites**

The application explosion

Changes in business coupled with technology innovation have led to an explosion of new, networked applications. For example, the current business climate has become global, carrying expectations of immediate communications, no matter the location. Technology has evolved to provide this instant access, in the form of new communication applications, such as voice over IP, video conferencing, instant messaging, and file sharing.

By all accounts, the number of applications running on today's network has increased exponentially, with analyst estimating from 55 to 200+ applications live at any one time. Many are bandwidth intensive, for example, graphics-rich imaging, publishing, and the above-mentioned communications applications.

The resulting difficulty for IT departments has been an increase in the probability of network congestion, which presents a significant risk to the delivery of critical applications, and ultimately, employee productivity. Even a short delay can result in negative consequences, for example, a delay in trades at a brokerage firm can result in millions in monetary losses, or slow delivery in serving up an MRI record at a medical institution can delay treatment for a critical-care patient.

The LAN grows up: higher speeds enable business

One can clearly see the impact of applications on network capacity when looking at the rapid growth in the LAN over recent years. The increased potential for bottlenecks has driven the desire for higher speed networks, from the desktop through the core, in order to improve application performance and meet the requirement of business immediacy. The trend has really been to “throw bandwidth at the problem” when, in reality, better application design and responsiveness is what is being sought.

A startling fact is that yesterday's emerging LAN technology represents only one percent of today's top speed! Just ten years ago the Fast Ethernet standard was approved and corporations were beginning to extend Ethernet to the desktop and by 2000 Gigabit Ethernet was in the early adoption stages. Since that time, as prices have declined, corporations and governments have implemented Gigabit Ethernet more broadly throughout their LANs. Additionally there have been implementations of load-balanced Gigabit links, multi-link GigaChannels, desktops shipped standard with Gigabit Ethernet connections, and now 10-Gigabit Ethernet - all this speed in a quest to facilitate faster processing of larger quantities of information and improve application delivery to the end user.

Bandwidth-intensive applications can be found in all major industries:

- **Hospitals with medical-imaging technology**
- **Universities with distance-learning offerings**
- **Large financial institutions with automated trading and other high-speed transactions**
- **Engineering and design corporations with large CAD/CAM files**
- **Government agencies with Emergency 911 initiatives and Satellite Imagery Downloads**
- **Pharmaceuticals with large quantities of research files for FDA**
- **Publishers with digital photos, manuscripts, and photo books**
- **Retailers with clothing and pattern designs for third-party manufacturers**
- **Entertainment companies with on-demand radio, TV and movies**
- **Journalism with digital news feeds from around the globe**

Right-size the network and balance costs

It's not just new applications that drive network growth - the reverse is also true. As soon as higher speeds are available, additional bandwidth-hungry applications appear that enable new business offerings, competitive advantage, and streamlined processes - but they also consume the "excess" capacity.

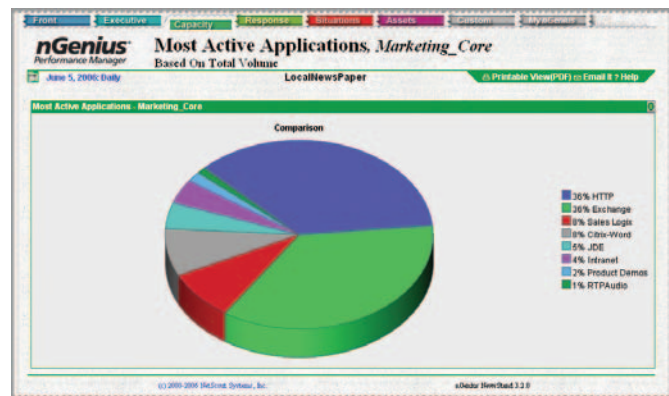
With the current rate of increase in file sizes, continued desires for better response times and augmentations in PC power, analysts expect the drive for higher speed LANs to continue. However, in many cases, blindly adding more bandwidth is not the optimum solution for the business, nor necessarily a solution that will guarantee solid application performance - i.e., upgrades are expensive (the average selling price of 10G in 2004 was \$7,000 per port), time-consuming, and can lead to a less reliable network in the near term.

According to Gartner, "companies planning bandwidth growth rates of more than 120 percent per year will waste bandwidth and incur additional costs of at least 10% compared to more-optimized solutions." Because of a desire to limit costs, organizations are adopting practices that have long been used in the WAN as a way to extend the useful life and avoid the write off of relatively new equipment until absolutely necessary, finding it more appropriate to postpone upgrades to a time when it is required. Businesses are saving the costs through *better network utilization, improved application design, and/or use of bandwidth optimization technologies.*

Curtail misuse for better network utilization

Before upgrading to higher capacity networks, cost-conscious corporations conduct in-depth network audits to distinguish between business and non-business uses of the network and to decide what applications should be retired, re-routed, removed, or rescheduled to alternative times.

In today's complex, converged networks, this in-depth appraisal requires progressive performance management tools that recognize and report on all application types - well-known (e.g., web-browsing, DNS look-ups, Lotus Notes), complex business applications (e.g., MS Exchange, Citrix, SAP), web-enabled (e.g., former client/server apps, e-commerce), custom-developed business applications, new communication types (e.g., peer-to-peer, instant messaging, streaming audio and video), and even legacy-based applications (e.g., IPX, SNA, Banyan).



In order to discriminate between business and recreational use, granular information such as conversation details on these applications must also be available, for example, the ability to:

- Identify "illegal" network use, such as spyware, virus, or Trojan activity
- Differentiate between web-browsing and mission-critical web-enabled applications
- Distinguish between a news video clip of last night's car chase and a video clip of the keynote address at an industry conference
- Tell the difference between streaming Internet radio and a streaming replay of a sales conference call
- Recognize activities, such as a storage area back-up, occurring during network prime time

By conducting such an application audit of the network, a corporation can eliminate security risks, develop recreational usage policies, reschedule activities to more appropriate times, and ensure retired applications are truly retired, or develop alternative processes for distributing high-bandwidth files - and hopefully postpone upgrades for a few months.

Improve design through application profiling

Enterprises continue to deploy an increasing number of applications that have complex network effects, including requirements for higher-speed bandwidth. For example, typical applications that migrate from a client/server to a web-based environment can consume approximately 50% more bandwidth due to a richer graphical content. New application development environments such as Java, Web services and XML, can increase bandwidth requirements up to five times over previous technologies.

nGenius Performance Manager Application Utilization Forecast, New York
 LocalNewsPaper
 Jun 5, 2009, Daily

Application	Stat	Alerts	Trend	Threshold Value	DTT	Projected Date	Projected Value
Web Browsing	Total Utilization	Warning	increase	70.0 %	96	30	85.22 %
Video	Total Utilization	Warning	increase	70.0 %	170	30	25.66 %
Mailbox	Total Utilization	Warning	increase	70.0 %	205	30	24.9 %
Exchange	Total Utilization	Warning	stable	70.0 %	257	30	8.26 %
ERP	Total Utilization	Warning	stable	70.0 %	290	30	7.11 %
CRM	Total Utilization	Warning	stable	70.0 %	> 2 years	30	7.0 %
Internet	Total Utilization	Warning	stable	70.0 %	> 2 years	30	5.92 %
Voice	Total Utilization	Warning	stable	70.0 %	> 2 years	30	5.02 %

Therefore, an important aspect of managing application performance and infrastructure capacity is for network planners and application designers to work together closely to evaluate the application-network interdependencies. To facilitate this inter-departmental interaction, a common source of data is needed to analyze the traffic patterns of all applications that share the enterprise infrastructure. These in-depth pattern profiles provide a(n):

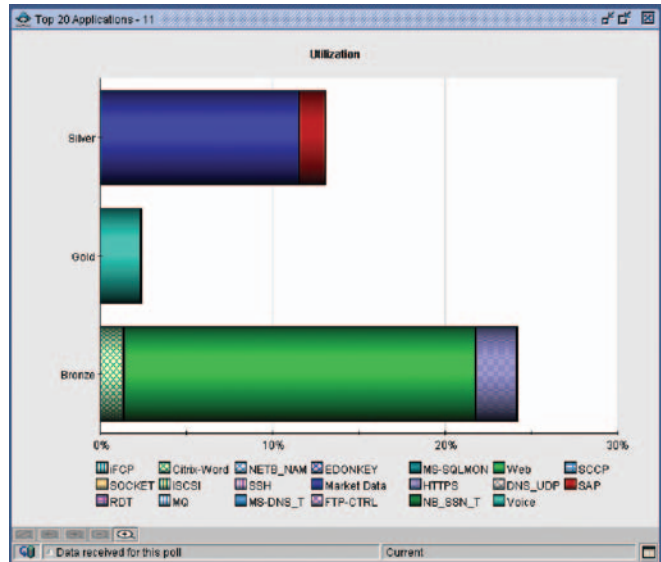
- Understanding of bandwidth needs and forecast growth of each application to understand its impact at each location
- Identification of most- and least- active application servers in order to optimize application distribution across the global enterprise
- Determination of response time of each application as a whole and at each location to isolate network and application issues that may hinder end user experience

Good collaboration and planning among application developers and network managers can make for network savvy applications that will perform well for end users, yet will not contribute unnecessary gigabits of additional traffic, thus easing bandwidth congestion and saving budget.

Conduct audit and monitor the effectiveness of QoS implementations
 Implementing Quality of Service (QoS) policies to prioritize the flow of traffic across the network is another method used to control bandwidth growth and postpone upgrades. This involves classifying each application and provisioning resources based on their assigned importance. In theory, QoS tunes the network to efficiently and reliably deliver business-critical applications like ERP systems or real-time applications like voice over IP, assigning their delivery precedence over lower priority applications like web browsing.

As organizations implement new QoS policies in their networks it is necessary to:

- Identify all applications in the network in order to assign QoS categories
- Assess the response time of each business-critical application
- Evaluate QoS configurations post-implementation to pinpoint errors
- Ascertain the success of the policy, i.e., whether response times of the most critical applications are improved



As the network continues to change over time, it will become necessary to reevaluate it for new applications and adjust QoS policies accordingly in order to facilitate an efficient flow of traffic through the network for optimal application performance and VoIP call quality.

The nGenius Solution Can Help Optimize Bandwidth and Postpone Upgrades

Even after employing all the methods mentioned above for optimizing bandwidth, eventually business and technology evolution will drive the need to upgrade. High-definition application visibility from the nGenius Solution can help with every step in the optimization and upgrade process.

Case Study

A world-renowned cardiac specialty hospital had deployed a sophisticated electronic medical records system (EMR) to manage patient diagnosis, treatment and billing information. However, they began having ten-second response time delays for patient record inquiries, which was unacceptable. Using the nGenius Solution they quickly discovered that whenever a request to print a patient record from the EMR was made, the application would interview every printer on the network - "Are you my printer? Are you my printer? Are you my printer?" - which was creating the ten-second delay. Once identified, the hospital took the evidence to the application developer to correct the problem, reducing response times dramatically, without requiring a bandwidth change.

In a single, fully integrated management application, the *nGenius* Performance Management Solution contains real-time and historical information necessary to ensure service levels, detect and quickly troubleshoot degradations, support intelligent capacity planning and report performance results to the enterprise. This eases the burden on networking teams because it eliminates the need to learn and manually correlate data across multiple products.

To support bandwidth optimization and network upgrades, the *nGenius* Solution can be used to:

- *Optimize with high-definition visibility.* The *nGenius* Solution provides the granular application-level information needed to: distinguish business vs. recreational application use, supply insight into enterprise-wide application response times, distribution and growth, and set and confirm the effectiveness of QoS policies.
- *Upgrade with evidence.* When planning an upgrade, the *nGenius* Solution offers insight into historical trends for identifying when it is the right time to upgrade. It can also baseline network and application performance prior to the migration for an actual point-in-time snapshot against which to compare network and application performance post-implementation.
- *Migrate with confidence.* As the new network is deployed, the *nGenius* Solution has the power and flexibility to monitor and troubleshoot any glitches that may occur. It displays applications side-by-side as they compete for bandwidth and resources, tracks the response time of critical applications, and when necessary, delves all the way into the packet level to troubleshoot the most complex problems.

In addition, the *nGenius* Solution supports a breadth of networking technologies in LANs and WANs and virtually all application types. This means that as the network portfolio changes, it can keep pace with emerging solutions, protecting the corporation's investment in performance management.

The *nGenius* Solution Specifics

The *nGenius* Solution, comprised of *nGenius*® Performance Manager and *nGenius*® Probes, is a unique combination of capabilities that are necessary to cost-effectively optimize the performance of enterprise and government agency networks. Details specific to the solutions discussed above include:

In-depth visibility into all applications

The *nGenius* Solution tracks well-known, custom, complex (e.g., Exchange, SAP), and web-based (e.g., eCommerce, web-based email)

applications, collecting volume, utilization, user, and conversation statistics. The data are made available for multiple purposes, including troubleshooting, capacity planning, forensic analysis, application and network monitoring through the *nGenius* Solution.

Application response time

Response time, as a key performance metric, is delivered as an integral component of the *nGenius* Solution. This valuable information provides insight into the end user's experience with critical business applications, helping to ensure service levels, detect and prevent performance degradations, and troubleshoot application performance problems when they do occur. The IT group can use either active or the passive measurement methods, depending upon needs, deployment or underlying applications and technologies.

Evaluating QoS implementations

The *nGenius* Solution meets the need for monitoring the performance of applications in Quality of Service (QoS) deployments. It displays real-time and historical graphs of traffic by QoS class, delivering details on application utilization for each traffic category, virtual circuit, and/or network segment. With the *nGenius* Solution IT organizations can maximize the performance of their QoS implementations by performing audits of networked application, pinpointing misconfigurations, and dynamically planning network bandwidth changes.

Real-time troubleshooting during upgrade process

The *nGenius* Solution provides real-time information from across the global network for evaluating how applications affect one another. Side-by-side granular information saves investigation time, allows quick diagnosis of application performance impediments, speeds mean-time-to-repair and minimizes business impact.

Enterprise-wide capacity planning

The *nGenius* Solution provides the historical information needed to ensure adequate bandwidth and to optimize the delivery of networked business services. Before and after upgrades, baseline and forecast reports enable network engineers to fine-tune traffic flows across the enterprise, identify the normal behavior patterns of the network and the business applications running over it, and make informed decisions on where to invest resources.

High-definition performance management ("HDPM")

High definition provides industry-best granularity, down to one-minute historical values with corresponding one-second peaks for all applications, hosts and conversations. This gives IT professionals the details necessary for application profiling, identification of microbursts of disruptive traffic, and the elimination of network misuse. Greater granularity provides significant value by helping to detect low-

Case Study

A Midwestern multi-bank holding company with more than 150 banking centers and 3,000 employees throughout six states, needed to protect the performance of customer financial record-keeping applications. In 2004, the bank's IT staff carried out a major network redesign to prepare for a gradual transition to VoIP telephony services. To ensure the continual optimal performance of their critical applications during the network upgrade and gain high call quality after the implementation, they relied on the *nGenius* Performance Management Solution. Prior to deploying any VoIP equipment, the bank used the *nGenius* Solution to perform an essential network audit to characterize the network and performance requirements for the voice services. They determined bandwidth utilization, identified all existing applications and profiled their current performance. By leveraging historical trend information, the IT group forecasted LAN and WAN bandwidth growth, as well as validated that voice and revenue-impacting applications were receiving appropriate QoS treatment.

bandwidth applications that would be undetected by previous toolsets that used formulae to log applications that met a certain utilization criteria (e.g., application must equal at least 1% of total traffic). This capability is very important in today's high-capacity environments: even one percent of 10G is a tremendous amount of data - 5 years ago, that was an entire Fast Ethernet core network! In addition, because the *nGenius* Solution logs all conversations, it provides the capability to distinguish between business and recreational application usage helping to optimize the resources in place and potentially postpone expensive upgrades.

Customization and reporting

The *nGenius* Solution provides information from high-level enterprise-wide summaries to meticulous details in order to suit individual needs. A user can tailor real-time and historical reports to display only the information critical to his/her job. Both on-demand and scheduled reports can be delivered via the web or email.

Investment protection with extensible architecture

In addition to the LAN, the *nGenius*® Solution supports a wealth of network topologies across the enterprise network. Because of NetScout's innovative CDM™ Architecture, it will extend to newly developed technologies, protecting the corporation's investment in NetScout as IT environments evolve.



The *nGenius* Performance Management System

The *nGenius* Solution addresses the complex requirements of network and application performance management in today's converged, virtualized environment and is comprised of:

- ***nGenius* Performance Manager:** Software that analyzes the information collected by *nGenius* Probes, Flow Collectors, Application Fabric Monitors, and other intelligent network devices and delivers integrated network and application monitoring, troubleshooting, capacity planning, and reporting in a single product.
- ***nGenius* Probes:** Dedicated hardware monitoring devices that passively identify, collect, and analyze application-level traffic data across the enterprise.
- ***nGenius* Flow Collectors:** Dedicated hardware devices that collect application conversation data via NetFlow records.
- ***nGenius* Application Fabric Monitors:** Appliances that combine *nGenius* Flow Recorder and *nGenius* Probe functionality for high performance, high reliability, high capacity recording and infrastructure monitoring.
- ***nGenius* Analytics:** Appliance-based software that delivers automated, proactive early detection and diagnosis of network and application performance anomalies.



<p>Corporate Headquarters NetScout Systems, Inc 310 Littleton Road Westford, MA USA Ph: 978.614.4000 Fax: 978.614.4004 www.netscout.com</p>	<p>European Headquarters 100 Pall Mall London SW1Y 5HP United Kingdom SL1 4DX UK Ph: +44 20 7321 5660 Fax: +44 20 7321 5663</p>	<p>Asia/Pacific Headquarters Room 105, 17F/B, No. 167 Tun Hwa N. Road Taipei, Taiwan Ph: +886 2 27179 7010 Fax: +886 2 2547 7010</p>
<p>North American Offices New York City, NY Washington DC Chicago, IL San Jose, CA Toronto, Ontario, Montreal, Quebec</p>	<p>European Offices Frankfurt, Germany Paris, France Oslo, Norway</p>	<p>Asian Offices Beijing, China Guangzhou, China Hong Kong, China Tokyo, Japan Singapore Pune, India</p>

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