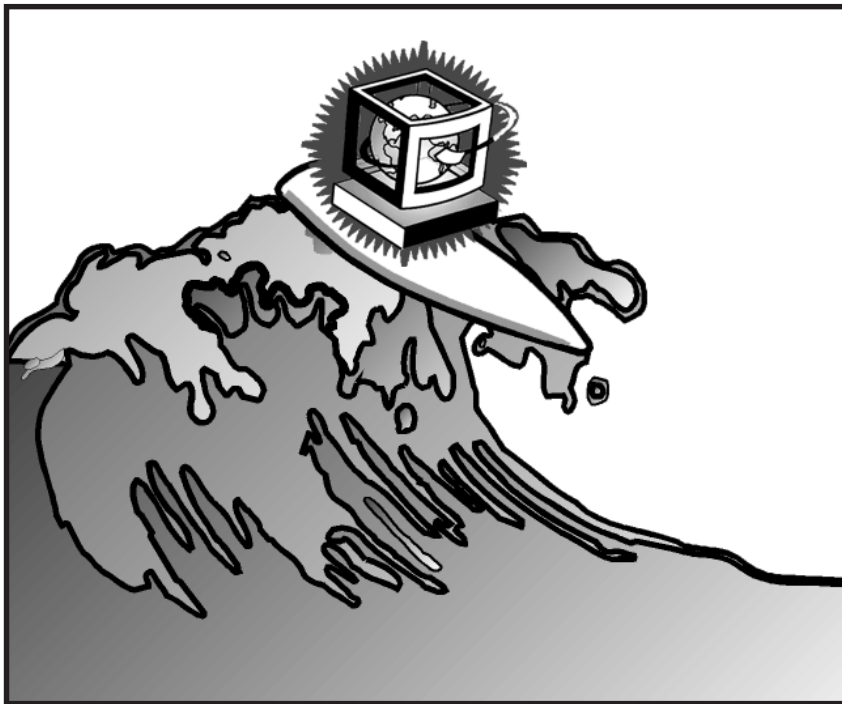

Riding the Internet Wave

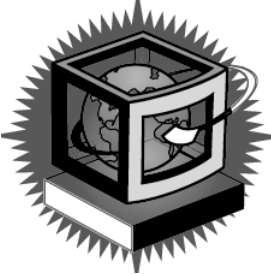
Ensuring Safe, Solid Internet Services for the Enterprise

**HP NetMetrix empowers IT
to measure and report in the
networked environment for
accountability to the business
and end users.**

Application Note 1295



**Written by James Herman
and Theo Forbath of
Northeast Consulting Resources, Inc.
for Hewlett-Packard Company**



"The Internet has hit enterprise networks hard, bringing a tidal wave of new applications and a flood of multimedia traffic. In the past few years, the rapid adoption of this collection of technologies, standards and public services has brought many advantages, but it is also leaving network support organizations drowning in a new set of serious problems such as network congestion and engineering web server performance. Network planners, engineers and managers are challenged to keep ahead of the rapidly advancing wave of new uses of internetworking, especially given its decentralized, grass roots adoption and the scarcity of trained engineering and support staff.

Hewlett-Packard is delivering the infrastructure for measurement, monitoring and analysis that is needed to meet the needs of today's enterprises that are working seriously to tame the Internet tempest for business advantage. With its global solution delivery capability, its family of OpenView management products, an overarching service management framework, and the industry's leading network performance analysis system, NetMetrix, Hewlett-Packard is best positioned to meet your needs in intranet and extranet measurement and reporting.

This white paper explores the challenges of riding the Internet wave for network design, engineering, operations and support and defines the requirements for Internet-capable, enterprise-wide measurement and monitoring infrastructure."

James Herman
Vice President
Northeast Consulting Resources, Inc.

The Internet Wave Hits Enterprise Networks

The Internet (see Figure 1 on page 5) is dramatically changing network traffic and creating important new support needs. Widespread adoption of the World Wide Web standards has brought multimedia, and the step function increases in data volumes that comes with it, onto enterprise networks much faster than most people ever expected. The web has also brought a model of software design based on a simpler browser desktop, changing the traffic characteristics of client-to-server interaction. Browsers download graphics, and now sound and even video, from servers to desktops, sometimes clear across the enterprise. This flood of traffic requires immediate attention by network designers and operators. To do so, they need measurement and analysis tools that are designed to understand Internet traffic and the unique problems of intranets and extranets.

Patterns of information exchange are changing radically as the islands of data and automation are now being united by the web. End users, once isolated by their particular choice of network operating system, can now reach a larger portion of the enterprise information. Measuring and analyzing these new traffic patterns, and engineering network and Internet access capacity to support them well, are critical new requirements. It is time now to extend the measurement and monitoring infrastructure of your current LANs and WANs to fully embrace the Internet protocols, platforms and applications.

Reliable and safe access to the public Internet is also becoming a business critical service for a growing portion of the enterprise workforce. Knowledge workers throughout the organization now depend now on customized access to up-to-date, computer-searchable financial, technical and market information via the web. Electronic commerce on the web is becoming a mandatory addition to marketing, sales and support strategies of most businesses. Customers reach you via the Internet. Internet-based supply chain integration is streamlining core business processes. Network managers must adapt to an enlarged concept of the enterprise network, which now includes Internet-based services anywhere in the world. Access to these Internet-based business services will be via the enterprise's intranet and will be particularly difficult, but essential, traffic flows to analyze.

Batten Down the Hatches

For many infrastructure managers, the initial response to this tempest of activity is defensive, to insure that existing mission critical applications riding on the enterprise router network are not adversely affected by the rising tide of intranet and extranet traffic. Most router networks suffer from uneven performance and congestion as it is, and are easily swamped by multimedia data. Monitoring of traffic levels, tuning of routing, and judicious increases in capacity are required to protect existing applications as employees explore the possibilities of the Internet. You cannot make proper decisions on capacity increases or changes in routing, however, without accurate, global information on your Internet traffic.

Protecting the security of the enterprise obviously ranks high on initial concerns and rightly so. Connecting to the public Internet subjects the business to the full fury of the global hacker community, as well as potentially to the more subtle probes of competitors. Constant vigilance is required. Continuous monitoring of key network entry points and backbone links, akin to the role of security cameras for building security, is becoming a requirement for most enterprises. This auditing can also be a prudent and reasonable measure for monitoring appropriate use of the enterprise's Internet access.

Tracking growth and change in internal web sites, as well as the spread of external connections, should start now before things get totally out of control and the enterprise infrastructure group falls hopelessly behind. The Internet has swept through most enterprises with little initial centralized direction or control. Much like the early years of PCs and client/server technology, grass roots intranet efforts are often the most aggressive. Already, however, companies are recognizing the need to at least know what's going on, who's doing what, and what is it that is being put in place.

Fundamentally, it is a technology for global multimedia data exchange among dissimilar computer systems, which has been standardized and adopted by practically every major computer system supplier. It comprises standards for transport (including TCP/IP, routers, name servers, HTTP), data exchange (HTML and other web standards), software platforms (browsers, web servers, Java, etc.), as well as technologies for searching and navigating a large collection of web-based information.

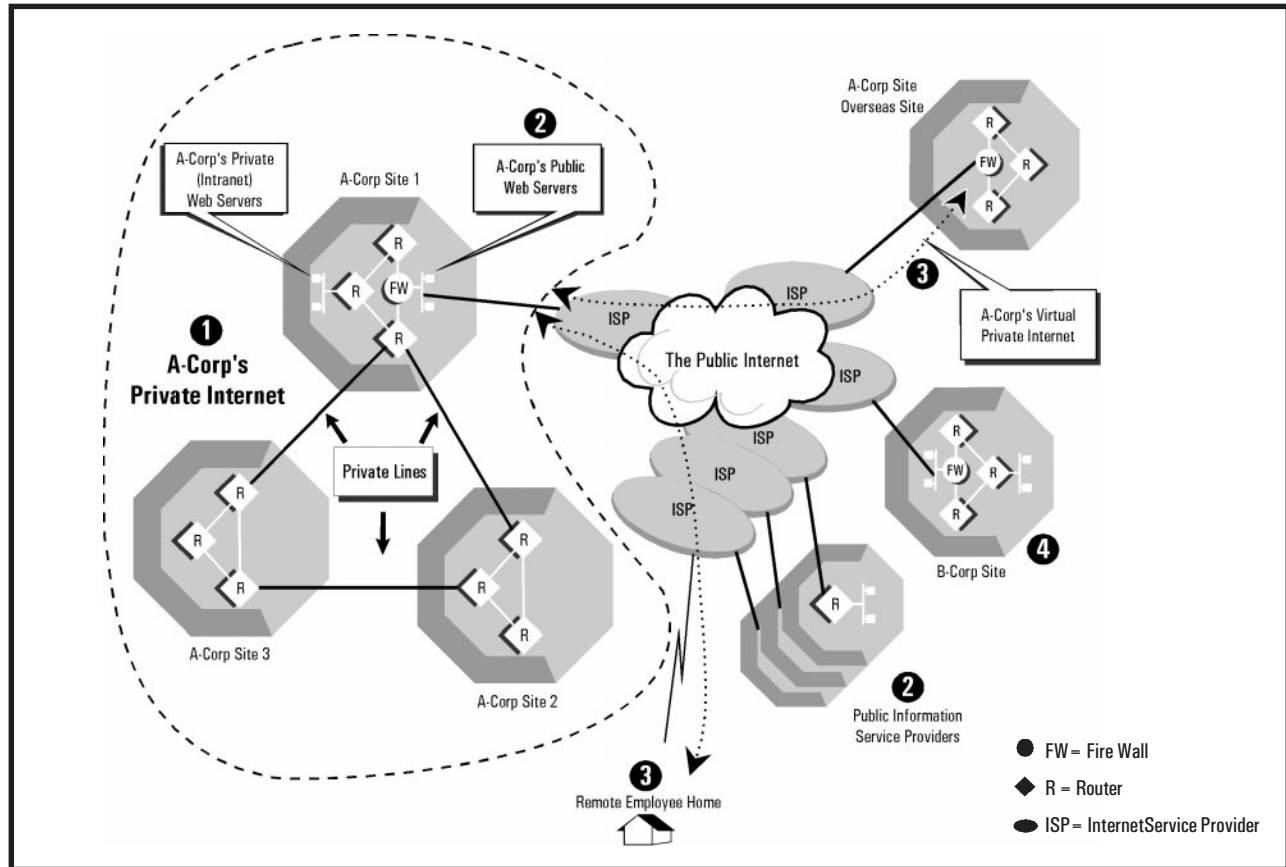


Figure 1: The Internet is a multi-faceted phenomenon.

Organizations are using this technology in at least four ways today:

- ▶ (1) **Intranet:** a private, internal Internet for a company as illustrated above with A-Corp. where three sites are linked using private lines and routers. All systems at those sites that contain the Internet software can exchange information, subject to security constraints.
- ▶ (2) **Access to the public Internet:** The rapidly growing collection of interconnected service providers all over the world who adhere to the Internet standards and cooperate to create a truly global information service. Many businesses offer public information and other services over the public Internet for a variety of business and consumer needs. Most organizations are also putting up public web servers, which have become an important form of advertising, and an important channel for customer service and sales, as well.
- ▶ (3) **Virtual private Internet:** An extension of a company's private Internet to overseas sites and telecommuting employee's homes using the public Internet without the high cost of private lines. Special security arrangements are used to ensure that company business is protected even while traversing the public Internet.
- ▶ (4) **Extranet:** Using the public Internet or private connections to link to business partners, suppliers and customers and exchange information electronically as part of efforts to speed up processes and lower costs.

Ride the Wave, Don't Just Tread Water

The Internet is not just a threat, it is also an opportunity. Thus, a mixture of reactive AND proactive efforts will keep you ahead of the Internet demand curve (see Figure 2). The Internet is the most important change in computing, networking and content creation since the introduction of the PC 15 years ago. It is fostering innovation and competition, as upstarts like Netscape challenge Microsoft and Internet Service Providers (ISPs) take on the major telcos. Network managers should also embrace these technologies and treat the new generation of intranet and extranet applications as mission critical and deserving of the professional engineering and service management.

Getting on top of this wave requires making it work for you. Fight fire with fire. Use the Internet technologies to manage the Internet technologies. Exploit the increased access to vendor and service provider assistance that is available via the web. Vendor web sites are some of the most useful on the net, providing product information and opportunities to share questions and problems with a wide community of other users and vendor technical support people. Train your engineers and support people in these technologies, invest in intranet management and measurement tools, and apply the Internet technology to improving your own service delivery work processes. Even more radically, consider how the incorporation of Internet capabilities into key management products will allow you to open up access to status information on current operations and outstanding service requests to end users, making network operations, itself, a part of the enterprise intranet. Or, you might say, creating a management intranet.

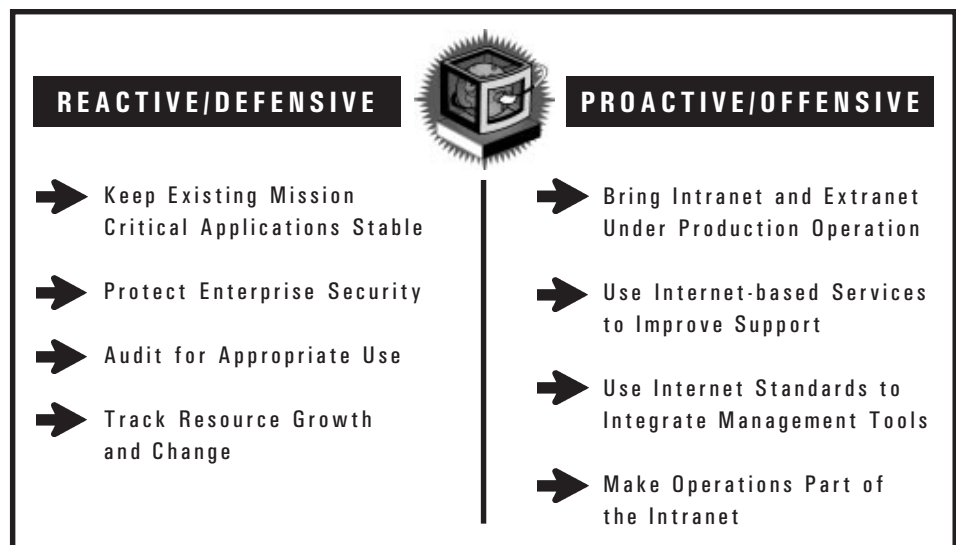


Figure 2: Success in meeting the Internet challenge requires a combination of defensive and offensive moves.

Know What You're Up Against

Internet technologies present unique and formidable challenges to network operators and analysts. Designing effective strategies for managing intranet/extranet growth requires understanding the true nature of these new systems and developing comprehensive measurement and management solutions that are up to the task. The key challenges are:

- **Distributed complexity:** Internet technologies are modular and layered, involving many different elements (routers, LANs, name servers, security servers, time servers, firewalls, proxy servers, web servers, browsers, etc.) which must all work well for end users to experience good service. Troubleshooting often becomes an onion skin problem, where solving one layer of problem only reveals another. This requires the ability to track delay and throughput between any of these components and understand their many interactions. Slow response time could be due not to insufficient network capacity, but to a slow name server. Just throwing bandwidth at a web performance problem may have little or no effect.
- **Lack of control:** Network managers get little warning of new intranet uses and few decentralized web site creators keep support staff informed of what they are doing. Instead, intranet management tools must discover traffic patterns, the arrival of new applications, the demographics of use and formation of communities of interest on the enterprise intranet. The public Internet and extranet links involve other enterprises, giving the infrastructure group limited control.
- **Global reach:** Management of intranet and extranet systems must be global and able to quickly identify hot spots wherever they might flare up. The 80/20 rule may no longer apply to local versus remote traffic as users expand their horizons beyond LAN file servers. The world wide web puts everyone in touch with everywhere. Performance problems can crop up unexpectedly as someone puts up a web server halfway around the world with a big graphic or an audio file that becomes popular overnight and congests a portion of the internal Internet.
- **Hostile conditions:** New security devices are being deployed all the time to protect sensitive information and prevent malicious attacks. These security measures present barriers to operations and support visibility as well, however, that new management and measurement systems must understand and cope with effectively.

KEY CHALLENGES



▶ Distributed complexity

▶ Lack of control

▶ Global reach

▶ Hostile conditions

▶ Internet time

▶ Few experts

- **Internet time:** Measurement and monitoring solutions must be capable of handling not only today's load but the rapid adoption of tomorrow's broadband traffic without being swamped. Today's 2-D graphics will soon be augmented with 3-D and virtual reality. Approaches that automatically push information and alerts to users will augment today's browsers, creating major new, continuous traffic flows. The Internet is a moving target and managers must commit to track it.
- **Few experts:** The overnight success of the Internet has meant that there is an extreme shortage of people who are knowledgeable in it. Centralized measurement, monitoring and analysis tools will help to leverage the effectiveness of those experts that are available.

The good news is that Internet technologies are characterized by flexibility, adaptability, resilience, and graceful degradation under load. The Internet's resilience can sometimes be a problem, however. If a primary name server goes down at night and no one notices, the secondary may function fine for a while but become intolerably slow during peak hours. Comprehensive, Internet-aware management tools are critical to meeting these challenges and putting the Internet to work reliably and safely for your enterprise.

Early Steps in Integrating Internet into your Management

This is no time to run blind. You must quickly augment your current network management infrastructure with Internet-aware and Internet-based management subsystems that give you visibility into what is happening on the enterprise intranet. As your enterprise network incorporates Internet technology, so must your management infrastructure. Creating what you might call the management intranet means incorporating Internet user interfaces and protocols into management tools and using the web technology to tie together your different sources of management information.

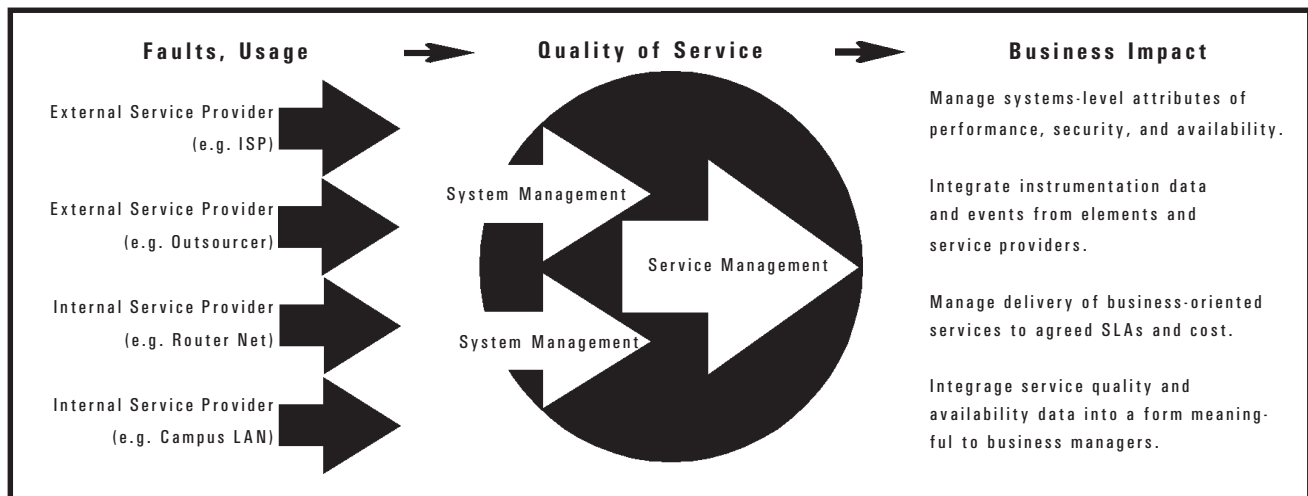


Early milestones that build core functionality should include:

- ▶ The ability to generate accurate, regular reports on enterprise-wide intranet and extranet traffic levels and distribution.
- ▶ The availability of an accurate, regularly updated enterprise-wide baseline of intranet and extranet traffic patterns.
- ▶ Management systems that can deliver trending and exception alerting services via web-based management infrastructure to a distributed support team.
- ▶ Automated traffic monitoring and analysis that can be used to provide early warning of suspicious behavior and post-facto audit trails.
- ▶ Network engineering and support staff who are trained in Internet protocol analysis.
- ▶ Management work processes that exploit Internet ubiquity and web-based groupware, workflow and document management for management information.

Service Management of Internet Services

It is time to make the Internet an integral part of your infrastructure, something that people can count on. Users will become frustrated and unable to exploit the advantages of the Internet unless you can make it reliable, safe and well-behaved. The business relies on extranet links and expects them to be dependable. Your intranet infrastructure needs to be managed professionally, using production operation disciplines of problem, change and service management, adapted to unique characteristics of the Internet. The place to start is with the fundamentals: the ability to measure, monitor, alert, diagnose, fix and report.



IT service delivery organizations of all types are adopting a comprehensive discipline for heterogeneous system and service management, which is a new layer of management above network and systems management (see Figure 3). This service management approach puts the relationship with the service consumer on an open, factual basis supported by objective measurements. Customer-focused services, including web-based applications and network services such as electronic mail and Internet access, are defined in terms of their importance to the business and regularly measured with regard to performance and service quality metrics. Reporting at the level of business-critical services requires that measurements be aggregated, consolidated and forwarded between management domains. Detailed measurements on Internet traffic are a necessary base.

Service management models and reporting tools will need access to discovered inventory and topology of sources and destinations of Internet traffic. Comprehensive measurement and baselining of performance and load data will help enable the adoption of service level agreements and chargeback systems among all types of service providers and their customers. For Internet services, integration of management data from external service providers, as well as internal ones, will become critical. Achieving this level of integration, the management extranet, is surely a growing but challenging future requirement.

Figure 3: Under a service management discipline, the enterprise integrates diverse services and service providers through processes and measurement systems.

Measurement and Monitoring Infrastructure for Your Enterprise Internet

Overall, these requirements mean that the enterprise must invest in comprehensive reporting on its end-to-end, global enterprise Internet. A wide variety of engineers, designers, technicians, purchasers and managers need detailed reports on intranet traffic to stay ahead of user demands and complaints. Each support person needs to leverage his or her expertise across the entire enterprise Internet using data and analysis that spans multiple sites and departments. Relatively few people can do capacity planning and performance management for large-scale, distributed applications, and to be as productive as possible they need the big picture view of these applications and the intranet that supports them.

Data on network usage and performance can help in making decisions about where to locate proxy servers, firewalls, name servers and web servers for frequently accessed home pages. Meeting performance requirements may require replication of web content at multiple sites. Traffic data and access to what if modeling capability can help determine the number of replicas and where to locate them.

An enterprise-wide solution for measurement and reporting is also essential to any serious cost improvement effort for Internet services. To start, it is critical to baseline and analyze cost components to identify opportunities for savings. Inventory data can help avoid unnecessary purchases. People abandon web servers all the time and this can be detected by monitoring traffic patterns. A single, flexible, enterprise-wide approach to measurement will also be less costly than the use of many, uncoordinated local analyzers that can only see a small part of the network and whose data cannot be shared with other tools. A distributed approach to measurement gives anyone who is authorized access to both local and remote traffic data allowing for better analysis with less cost and effort.

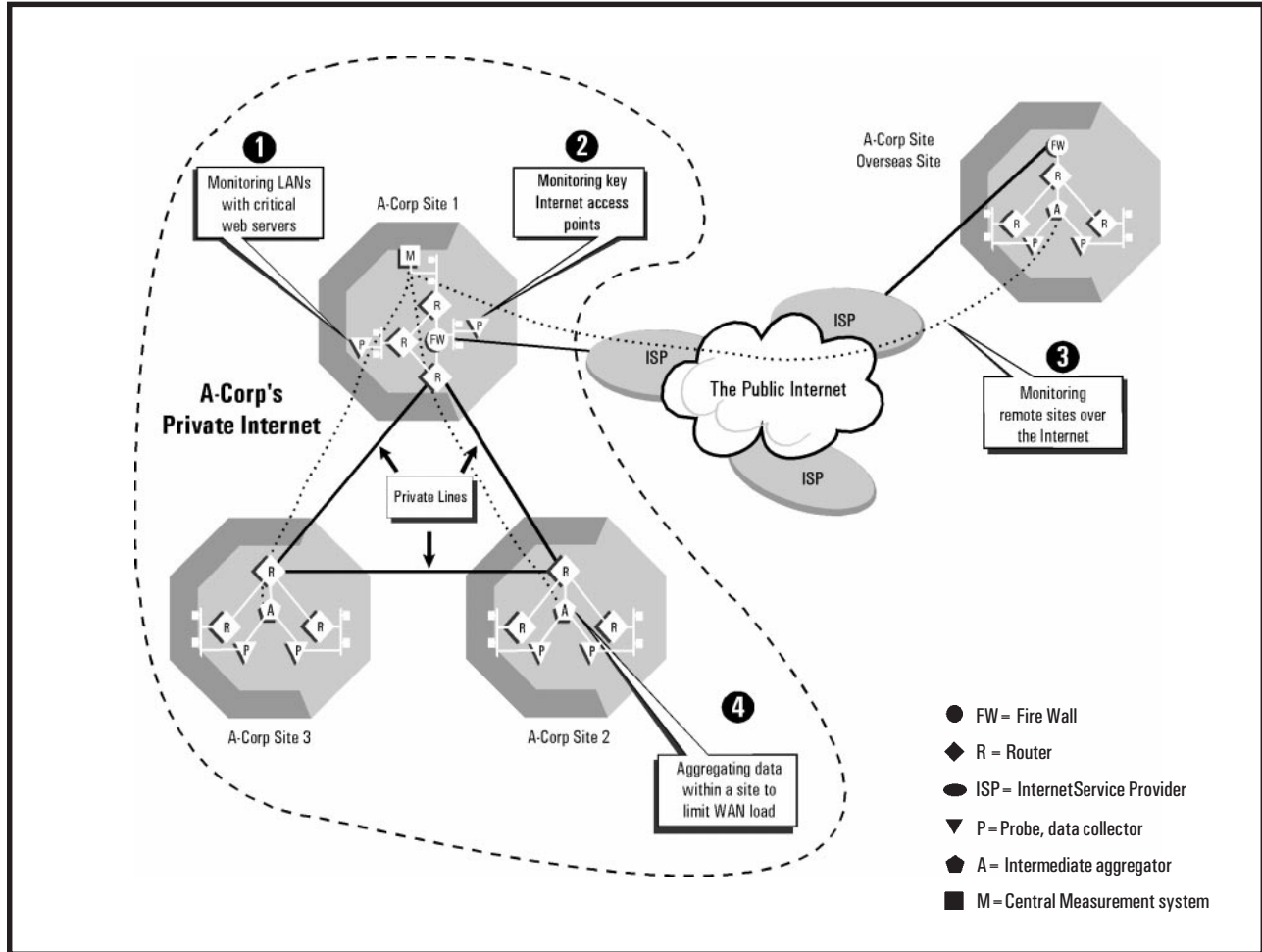


Figure 4: Measurement infrastructure for the enterprise Internet

Four capabilities are critical to comprehensive intranet and extranet measurement:

- ▶ (1) Monitoring traffic on LAN segments where critical web servers are located and sending data to a centralized measurement system for end-to-end analysis and reporting.
- ▶ (2) Monitoring key Internet access points to observe flows in and out of the public Internet and sending data to a centralized measurement system.
- ▶ (3) Monitoring remote sites over the Internet and collecting the data at a central measurement system.
- ▶ (4) Aggregating measurements from a major site and sending condensed data to a central measurement system in order to limit measurement data flowing over the WAN.

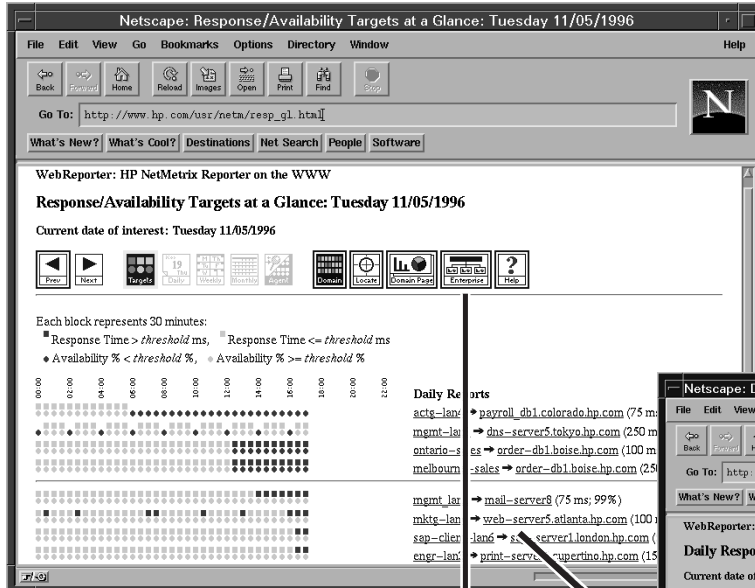
You must prepare for the growth and development of your intranet and extranet by developing a measurement and monitoring infrastructure that is Internet-capable. Such a system is illustrated on page 11. The following attributes define Internet-capable:

- **Internet in scale:** capable of expanding with increased traffic volumes and geographic dispersion. This implies a highly distributed architecture for data collection, aggregation, correlation and analysis in order to avoid clogging up already overloaded chokepoints.
- **Internet in scope:** able to integrate information from across the intranet and compose an end-to-end picture that correlates data from different parts of the world. This requires sophisticated timestamping and global correlation capabilities.
- **Internet savvy:** knowledgeable about Internet technology and designed to operate in real-world Internet conditions. This requires measurement tools that understand Internet protocols and configurations.
- **Internet responsive:** able to provide real-time interactive analysis and automated exception notification, combined with historical trend analysis and automated delivery of regular reports.
- **Internet flexible:** able to change and adapt as router networks and service provider interfaces evolve. Your measurement and surveillance points must be easily reconfigured and targeted to key intranet-extranet intersections. Each engineer should be able to customize the content, the formats and the delivery channels for reports they need.
- **Internet federated:** able to fit into broader solutions and frameworks and be used by multiple internal support organizations. Internet measurement and monitoring must integrate, in particular, with higher-level service management systems.
- **Internet-based:** using web-based publishing of reports and access via web browsers to most commonly used functions (see page 13), including use of hypertext features of the web to support easy drill down on hot spots and chokepoints.

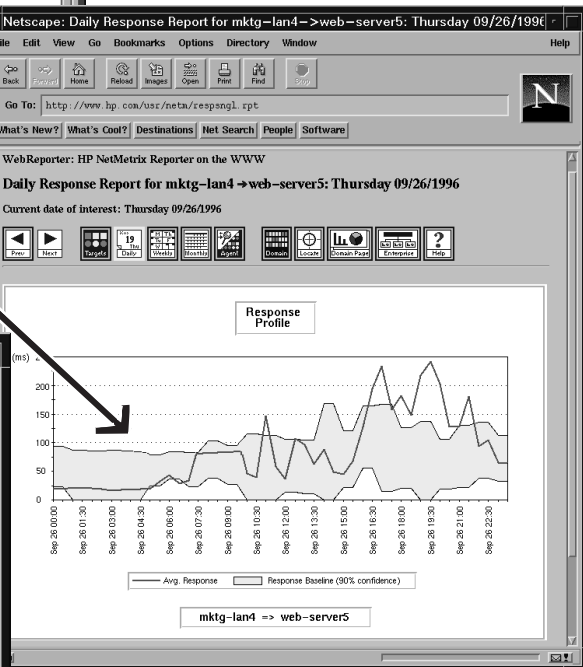
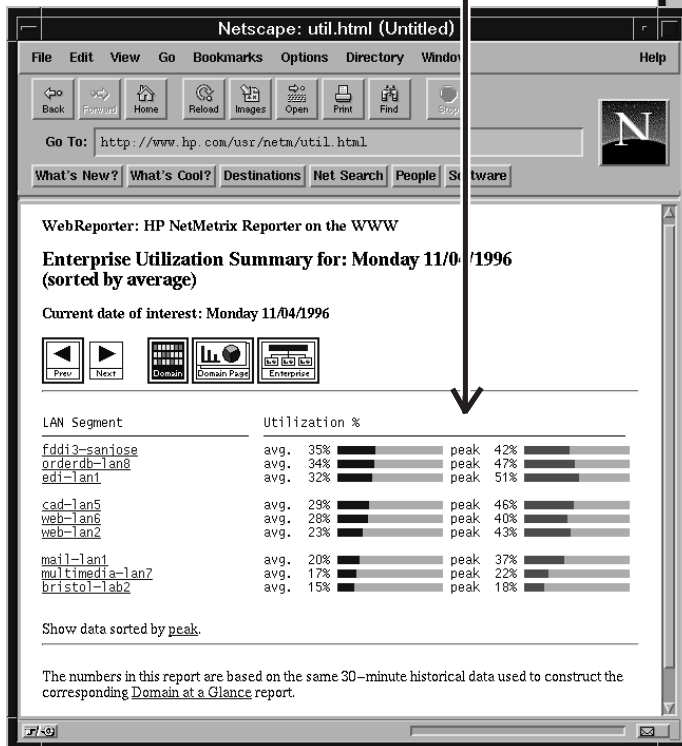
INTERNET-CAPABLE ATTRIBUTES

- ▶ Internet in scale
- ▶ Internet in scope
- ▶ Internet savvy
- ▶ Internet responsive
- ▶ Internet flexible
- ▶ Internet federated
- ▶ Internet-based

Using Internet Technology to Manage Internet Technology



▶ **Spotting Availability and Response violations across the enterprise!**
At-a-glance visualization of both availability and response of mission critical intranet resources. Individual service level objectives may be applied to each measurement.

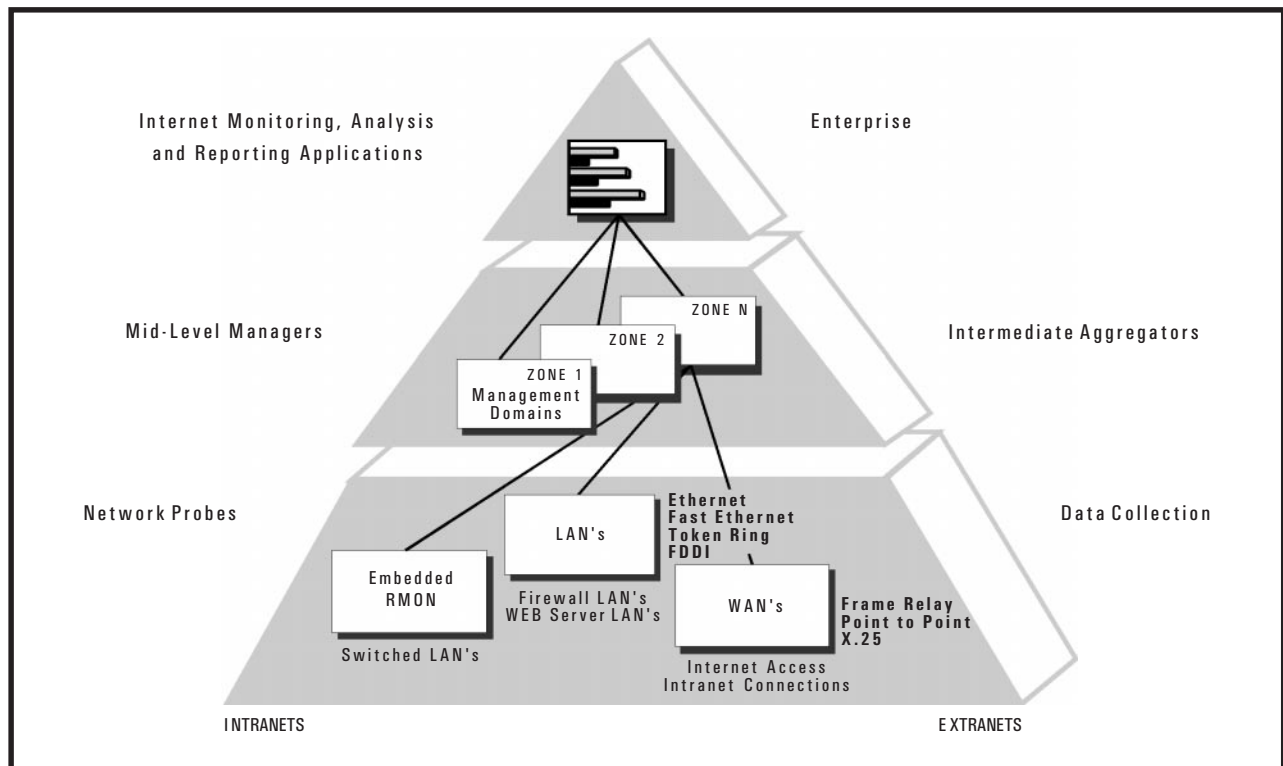


▶ **How does response time compare to the historical norm?**
Time-based display of actual response measurement with a historical operating boundary overlay showing the abnormal condition.

▶ **What's the utilization across the Intranet?**
At-a-glance display across the enterprise displaying the most utilized network segments sorted by average or peak utilization.

HP: The Internet Measurement Company

Beyond the technical requirements, an Internet measurement system must be supported globally by a solution provider well matched to your enterprise's scale and scope, one who is seriously committed to riding the Internet wave and making it work for process improvement and teamwork. HP is such a supplier of enterprise-scale, Internet-capable measurement and management systems, which are delivered by HP's own worldwide support and professional services organizations, as well as a strong armada of third party systems integrators and service providers.

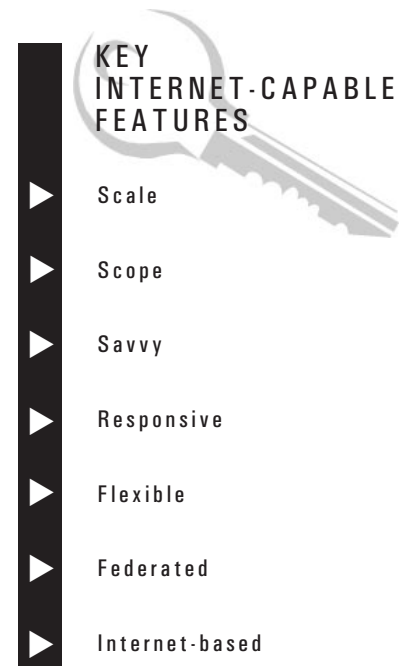


HP is one of the few companies seriously delivering the infrastructure for measurement, monitoring and analysis that is needed to meet the needs of today's virtual corporations. HP's entire OpenView family of products, including NetMetrix, MeasureWare and PerfView, is the most comprehensive and experienced in the market. Moreover, HP is aggressively implementing service management models and analysis tools into which its measurement products feed to put your operation on a sound production operation footing. HP is very active and deeply experienced in Internet technology; being one of the earliest adopters of TCP/IP for its own corporate infrastructure. OpenView has always been focused on managing the router backbone and had TCP/IP at its design center. Now HP is delivering comprehensive management of intranets.

Figure 6: NetMetrix Distributed Architecture

The NetMetrix family of measurement and monitoring systems from HP provide excellent support for intranets and extranets. Key Internet-capable features include:

- **Scale:** The NetMetrix architecture provides scalability with mid-level managers and a distributed architecture (see Figure 5) that allows flexible allocation of aggregation, correlation and archiving tasks in order to minimize traffic and eliminate centralized bottlenecks. Its cost effective probes are capable of handling the rigors of collecting detailed RMON2 data, and monitoring of critical WAN connections.
- **Scope:** NetMetrix is the network performance component of the OpenView solution. Its data can be combined with data from other management agents and subsystems, server logs, and other sources to get an end-to-end view. Time-correlated traffic analysis throughout the infrastructure allows comparison of activity at opposite ends of the network and develop a global picture of traffic flow.
- **Savvy:** NetMetrix is TCP/IP-based, works over the Internet and supports key standards such as SNMP, RMON and RMON2. It can track and decode all the major Internet applications such as Telnet, FTP, SMTP, NNTP and HTTP. Its ability to profile intranet traffic by protocol is the most sophisticated available today. NetMetrix can recognize the use of proxy servers to discriminate intranet from extranet traffic flows. Its own protocols are fully adapted to secure transport through firewalls to collect measurements from remote sites.
- **Responsive:** NetMetrix features a user interface combining real-time and historical data on availability and performance. Stored baselines allow automatic detection of exceptions while filtering out unimportant management noise.
- **Flexible:** The NetMetrix distributed architecture and open interface enables integration of a diverse and changing set of measurement points. The wide variety of reports and tools are easily customized to individual needs.
- **Federated:** NetMetrix unquestionably delivers the most comprehensive integration with HP's OpenView Network Node Manager, the best selling TCP/IP management system in the world. NetMetrix uses data supplied by embedded management agents in network devices and HP is committed to interoperability with leading network equipment manufacturers. NetMetrix can supply raw or refined data to higher-level service management and network design packages.
- **Internet-based:** NetMetrix already offers extensive reporting of availability and other reports via HTML for instant access by anyone with a web browser and the right access permissions.



Today, NetMetrix is the leading system for enterprise-scale performance measurement. HP is committed to integrating Internet technology even more fully into NetMetrix and extending it with additional built-in analysis and correlation capabilities for specific Internet protocols and services. New features will provide the ability to more easily isolate the causes of faults and the components of performance slow downs. More flexibility will be built into reporting and alerting, based on policy models and workflow automation.

Summary: Get Yourself a Life Preserver

As we have seen, the Internet in all its guises represents a fundamental step function change in enterprise networking. Although defensive moves are needed to prevent disruption to existing systems, network managers must also move offensively to master these technologies and bring them under the production operation and service management umbrellas of the enterprise. Although these Internet technologies are often being adopted in a highly distributed, grass roots manner, their management cannot be a piecemeal, decentralized effort. Enterprise-wide visibility, baselining, reporting and alerting will ensure that these technologies are incorporated smoothly into the enterprise network. Network managers need the best tools with enterprise-wide coverage to help them stay ahead of the rising tide of new responsibilities and requests.

HP can be your Internet measurement company, able to provide the enterprise-wide, Internet-capable measurement infrastructure you need and to support it globally. The OpenView family of products, featuring NetMetrix, provides the industry's leading solution for measurement, monitoring and management. With this family of products, your intranet and extranet traffic patterns, growth and performance will become understandable, controllable and subject to improvement. Those enterprises that accept the challenge of riding the Internet wave need a solution like NetMetrix and a partner like HP.

James Herman is a Vice President, and Theo Forbath a consultant, at Northeast Consulting Resources, Inc., a Boston-based consulting firm focused on IT and business strategy.



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