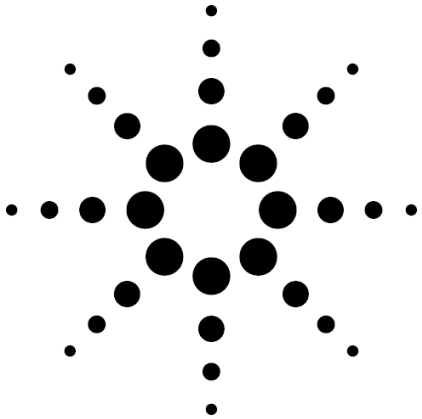

Agilent Technologies

Enterprise LAN Monitoring and Analysis

White Paper

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Introduction

Today's enterprise Ethernet networks are rapidly evolving from shared media topologies to switched media topologies, and from mostly single speed interfaces to a wide range of speeds distributed throughout the network. As this evolution continues, and as diverse applications and traffic load requirements exist on the same network, administrators find themselves in a situation where network testing methods and equipment must be as scaleable and flexible as the networks themselves. Comprehensive test solutions must range from NIC-based software-only solutions to portable, ruggedized, hardware-enhanced devices.

This white paper discusses some of the testing issues facing enterprise network managers today, and presents measurement techniques that can address those issues.

Evolving Issues for Enterprise Network Managers

What are the conditions under which administrators must work in order to maintain performance and relatively error free operation for their enterprise LANs? This section discusses some of the answers to this question.

VLANs, Demanding Applications, and the Web

In the enterprise, network managers face a whole host of new challenges not seen several years ago. One example is the increasing use of VLANs (Virtual LANs). VLANs blur the line between physical and logical topology. The migration from a distributed client/server environment to the centralized server farm model has turned the 80/20 rule on its head (80% of the traffic must now traverse the backbone). In addition, new applications such as video conferencing, distributed databases, Voice over IP, telecommuting, virtual private networks, and the explosion of Web technology have also added high quality of service expectations and unpredictability to a network's traffic patterns and bandwidth demands. This evolution has made the task of managing enterprise networks even more complex, which in turn has created a whole new market for creative network management and troubleshooting solutions.

The Changing Landscape

The physical topology of the network also creates challenges. The typical network topology has grown from a small number of network segments (10 to 100), to thousands of network segments. The actual physical layout of a network can change rapidly as organizations adapt to increasing bandwidth demands, varying numbers of users, and new applications. As Figure 1 shows, a single network could easily utilize a range of transport speeds from 10 Mbps to 100Mbps and 1000Mbps, using switched or shared, half or full duplex technologies.

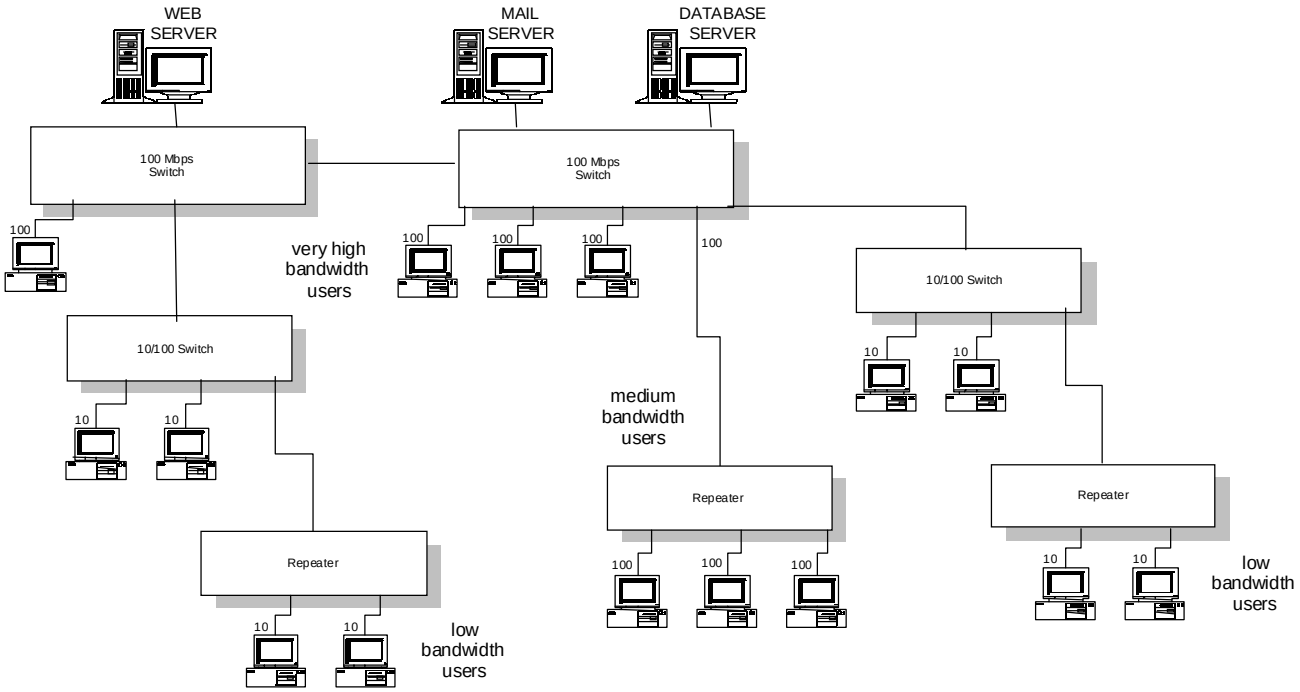

Figure 1

For less demanding applications such as email and word processing, shared 10 Mbps connections are employed, and as usage increases, work stations can be moved to switched connections. For database or Web traffic, shared 100 Mbps connections generally provide the necessary performance, but for CAE or CAD (Computer Aided Engineering/Drafting) applications, switched 100 may make more sense. For switch-to-switch or switch-to-server links, full-duplex 100 Mbps (or even gigabit) connections are necessary. If enterprise networks employ a wide spectrum of transport speeds and connection requirements, it stands to reason that network test tools must also scale to the situation at hand.

Proactive Network Management

In general, network managers need to be more proactive, and less reactive than in the past, allowing them to look at longer-term trends and thus predict and solve problems before they affect network performance in a critical way. In addition, the kind of information that needs to be monitored has evolved as well. No longer is it sufficient to simply look at bytes, packets, collisions, etc., but higher level information is needed to understand the performance and behavior of the network. Information such as protocol distribution, The users and applications that are consuming the most bandwidth, conversation matrices, and application response times are needed by network managers to understand the overall performance of their network. More and more, IS organizations are responsible for providing a certain level of service to their users (SLAs or service level agreements), and this in turn is driving the need for tools that can accurately determine if IS is meeting their internal commitments.

Monitoring and Analysis Techniques for Enterprise Networks

Network managers, like most other administrators, must find ways to provide increasing amounts of service with decreasing resources. Managers of smaller networks do not (and should not) have to spend exorbitant amounts of money to monitor and troubleshoot their networks. On the other hand, managers of larger enterprise networks need analysis features appropriate for the types of traffic and problems they are likely to encounter. Regardless of the size of the network, scaleable test solutions that provide a consistent user interface, an overlap in features from test application to application, and a range of cost options is very desirable.

Types of Analysis

Whether testing in a small isolated LAN or across large-scale enterprise LANs, certain types of tests almost always need to be performed. Traffic statistics such as utilization levels and error counts are valuable whether you are monitoring a shared 10 Mbps connection between a workstation and a hub or a switched 100 Mbps connection between switches. More detailed information such as protocol distribution, response time measurements, and 'top-talkers' (the highest bandwidth users) is often necessary when tracking down network performance problems. And detailed decodes of traffic must sometimes be used to verify or troubleshoot server, switch, or workstation configuration problems. One increasingly important need of enterprise network managers is 'expert' analysis where the test equipment itself provides varying levels of diagnostic information. Expert analysis can speed network troubleshooting processes by providing help on what the causes and solutions are without requiring an examination of decoded frames. Expert analysis is also highly valuable for those new to network troubleshooting, particularly today as it becomes increasingly difficult to find personnel with network troubleshooting skills.

NIC-Based, Software-Only Network Analysis

For relatively small enterprise LANs, or for remotely located, low-bandwidth segments of a larger LAN (see Figure 1), network testing should be scaled for convenience and cost-effectiveness. One method network managers might consider is to use NIC-based analysis software installed on an appropriately located PC or a laptop. In this way network managers can monitor the network from their desktop, or easily move from segment to segment to perform detailed testing. To make the best use of this type of testing, the NIC and analysis software must be capable of most (if not all) of the measurement capabilities found in dedicated test devices. Said another way, it is useful if the same set of measurements (that is, network monitoring, data capture, expert analysis, and statistical analysis) exist in all parts of a scaleable testing solution. In addition, any low-cost test solution of this type should be deployable throughout the network and be controllable from another PC or laptop to increase efficiency and keep costs low.

Half Duplex Analysis

NIC-based, software-only analysis is often not adequate in situations where higher speeds are being used. Instead, dedicated hardware is required. Examples include the half-duplex 100 Mbps links between servers and switches or between switches. Generally, these mission critical transmission paths cannot tolerate downtime. In addition, when testing is required, network managers need to be able to capture all the traffic at full performance.

LAN analyzers available today can monitor half-duplex links in switched 10/100 networks in two ways:

- Connecting to a "mirror port" on a switch that supports this capability (analyzer A1 in Figure 2)
- Connecting to a hub port which is connected to the switch (analyzer A2 in Figure 2)

"Port mirroring" is the ability for a switch to copy data from a switch port to a specially designated port called the "mirror port" (sometimes called the "monitor port"). The analyzer is connected to the "mirror port", and the network manager specifies which switch port(s) to mirror. This solution gives the network manager great flexibility since one analyzer can be used to monitor all segments on a switch, although not simultaneously.

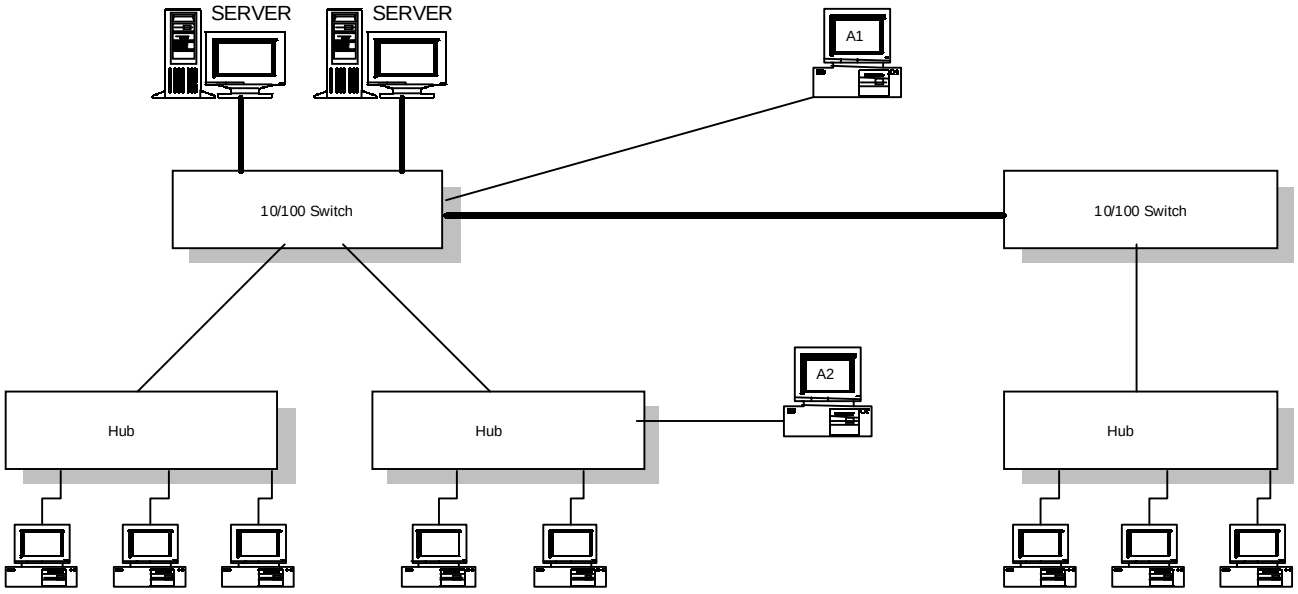

Figure 2

Although it can be useful, port mirroring has its disadvantages. Reconfiguring the mirror port so that different segments can be monitored can be inconvenient. In addition, the mirror port itself consumes some percentage of the switch's backplane bandwidth. In some cases, mirror ports are simply not available.

For switches that do not support "port mirroring", an analyzer can be used to monitor a single switch segment by physically connecting the analyzer to a hub port on the segment to be monitored (shown in Figure 2). In order to monitor another segment, the network manager would have to reconnect the analyzer to the second segment.

Full Duplex Analysis

Port mirroring or monitoring at a hub port is not sufficient when full duplex analysis is necessary. In this case, a 'tap' into the full duplex signal path is required (see Figure 3). Since a full-duplex connection consists of two devices, there typically has been no way to introduce a LAN analyzer into a full-duplex link without changing the connection to half-duplex.

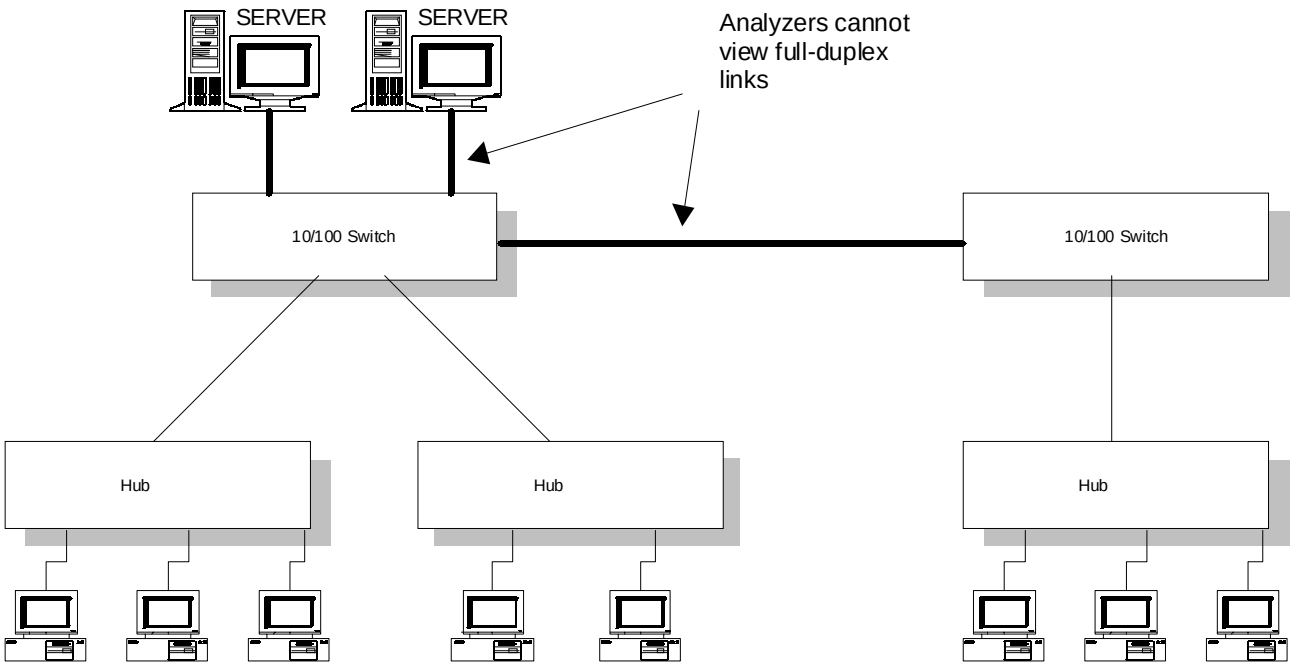

Figure 3

One way to enable network managers to monitor a full-duplex 10/100 link using a LAN analyzer is to utilize a 'tap' device. Figures 4 and 5 show a full-duplex deployment scenario in which switch-to-server links and switch-to-switch links are monitored. As shown, the tap is used to insert a LAN analyzer into full-duplex links so that the analyzer can passively listen to both sides of a full-duplex conversation.

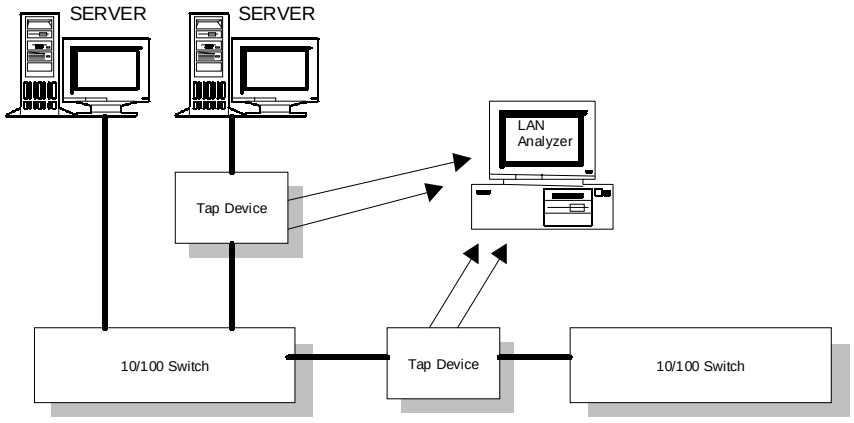

Figure 4

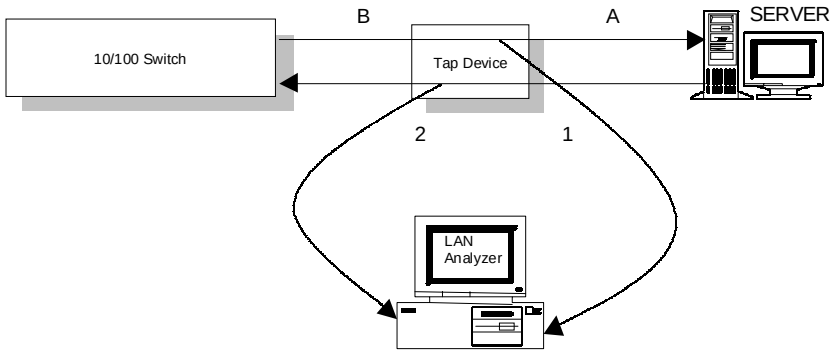

Figure 5

The advantage of using a full-duplex tap device is that it does not affect either the performance or the configuration of the full-duplex connection. Ideally, what is needed is a device that is compliant with both the 10Base-T and 100Base-Tx Ethernet specifications, and does not add a hop count to the full-duplex segment (i.e. it cannot act as a repeater) - essentially a "Y-cable" for Fast Ethernet.

Agilent's Enterprise Solutions

Agilent Technologies offers a full spectrum of scaleable LAN testing solutions well suited for all levels of the enterprise LAN environment. These products, all utilizing a consistent Windows user interface, provide solutions that are flexible and portable, and can be distributed for remote control from a central console. In addition, statistics can collated, analyzed, and formatted for archiving and distribution. For more detailed information, please contact your Agilent representative.

Agilent LAN Analyzer

The Agilent LAN Analyzer, a software-based network analysis package, can be used on most PCs enabled with network interface cards (NIC). This low-cost solution, used for 10/100/1000 Ethernet and 4/16 Token Ring networks, offers real-time network statistics, 7-layer packet decodes and analysis, advanced alarm setting and actions, powerful multilayer filtering, packet slicing, and automatic name table updating. The LAN Analyzer also consists of optional Expert, Active, and Distributed software modules to further enhance its capabilities.

Agilent LAN Analyzer - Portable

The Agilent LAN Analyzer - Portable offers all the analysis features its software-only counterpart, but includes a custom 10/100 Ethernet CardBus NIC and driver to be used with any CardBus-enabled laptop PC. This additional hardware enables busy field service engineers and network managers to analyze network behavior not only with 7-layer statistics and decodes, but also to detect and examine MAC-level error conditions as well.

Agilent LAN Analyzer - Pod

For full-duplex wire-speed 10/100 Ethernet analysis, the Agilent LAN Analyzer - Pod is an excellent solution. Again, offering all the features of the LAN Analyzer software, this stand-alone package provides high performance distributed LAN analysis along with 100% wire-speed capture and transmit capabilities.

Agilent LAN Analyzer - Tap

For full or half duplex, fault-tolerant, non-intrusive 10/100 Ethernet monitoring, Agilent offers the LAN Analyzer - Tap family of wiring devices. These devices allow the LAN Analyzer - Pod (and third party analyzers) a cost-effective and unique way to see all the traffic on one or more full duplex or switched network links.

Contact us with FaxBack

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Fax to: 1-303-662-2038

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Do you have a budget set for this application?

- ☐ Yes
- ☐ No
- ☐ In process

What is your time frame to implement this product?

- ☐ 30 days
- ☐ 90 days
- ☐ 180 days
- ☐ Other – (please define) _____
_____
_____

Product(s) of Interest

- ☐ ***The Agilent Advisor*** – Integrated, High-Performance Troubleshooting for:
  - ____ Advisor LAN
  - ____ Advisor WAN
  - ____ Advisor ATM
- ☐ ***The LAN Analyzer*** – Scaleable Ethernet and Token Ring Test Solutions
- ☐ ***Telegra Fax Test*** – Fax Protocol and Low Generation Analysis
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- ☐ ***Telegra Voice and Fax over IP*** – Protocol Analysis
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What is the main problem you need to solve on your network?

_____
_____
_____

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Notes

Notes

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This product is Y2K compliant.

About the Author

Aileen Johnson is the Enterprise Business Team Product Manager for Hewlett-Packard's Network System Test Division located in Colorado Springs, Colorado, now Agilent Technologies. She has worked for Hewlett-Packard for over 20 years starting first in Scotland before moving to Colorado Springs. Aileen has worked as an R&D Project Manager for many of the HP LAN protocol analyzer solutions, and now heads NSTD's marketing efforts in the area of Enterprise LAN testing.

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