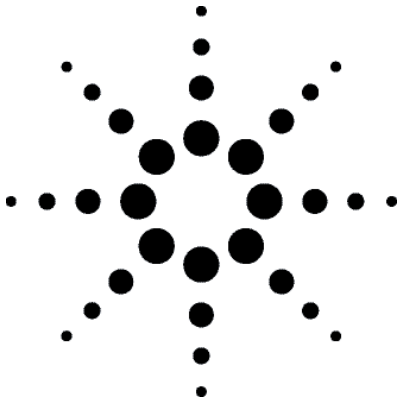

Agilent Technologies
Network Performance Metrics:
How Measurements Can Enhance the Performance of Your Network

Application Note

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Introduction

It's been the same for years. When users complain about response time to their IT staff, the reply is always the same: systems administrators requisition newer, faster systems; network administrators demand to buy more bandwidth; and application developers point fingers at the other two groups. Now, there is a way to find out whether the network is actually the problem. With Agilent's new FrameScope 350 you can measure the response of key resources and determine how they compare to similar devices across the industry.

The FrameScope 350 is Unique

The FrameScope 350 has several features that set it apart. It allows you to connect information gathered about the lower layer circuits and devices to the performance of the services on your network. If your network suffers from congestion, error prone links or bottlenecks, you will receive a low rating of your servers. Once this is established, you can run additional tests to determine whether the slow response is a connectivity issue or a server performance problem. This will eliminate the accusations that are common within IT staffs. Until now, such response problems were addressed with two kinds of tools. First, you could use hand held devices that addressed only the first three layers. These provided information about utilization, addresses, layer one to three protocols, and routing related information. However, they failed to view even a single TCP session. The second option was to invest in application specific software products that simulated sending a particular type of traffic across your network. However these treated the network like a cloud and cost tens of thousand of dollars. The FrameScope 350 targets the bottom line – *how well your servers respond to client requests*. Furthermore, it's available in a hand held form and it costs less than those expensive software products.

The first important information the FrameScope 350 provides you with is a list of your key devices. It will discover your Internet related devices such as web servers and email servers. It will also find your important NT devices including file servers, domain controllers, WINS servers, and DHCP servers. Additionally, it will list your Novell servers, Unix servers, SNMP agents and routers. Once this list is compiled, you can test each of these servers or devices and obtain a rating in the range of one to five. This simple technique allows you to answer important questions about your network environment such as:

- What are my key devices?
- How quickly can I log onto my servers?
- Can I efficiently read and write information to my file servers?
- How quickly can I retrieve a file or page from my web server or email server?
- Do I get my essential configuration information from the DHCP server in an acceptable time?
- How do my results compare with those of my peers across the industry?

The metric used by the FrameScope 350 is a simple scale that ranges from one to five. If a server receives a rating of five, it means that its response to the client request was excellent. A rating of one tells you that the response was very poor. Agilent uses this scale because it's easy to understand and it immediately conveys the necessary information. We'll discuss how the actual rating is assigned later in the paper.

In the initial release of the product, the following tests are included:

- Web Server
- NT File Server
- Email Server
- DNS Server
- WINS Server
- DHCP Server
- NFS Server
- FTP Server
- Novell Server
- Print Server
- Primary DC
- Backup DC
- Router
- SNMP Agent
- Workstation (Ping)

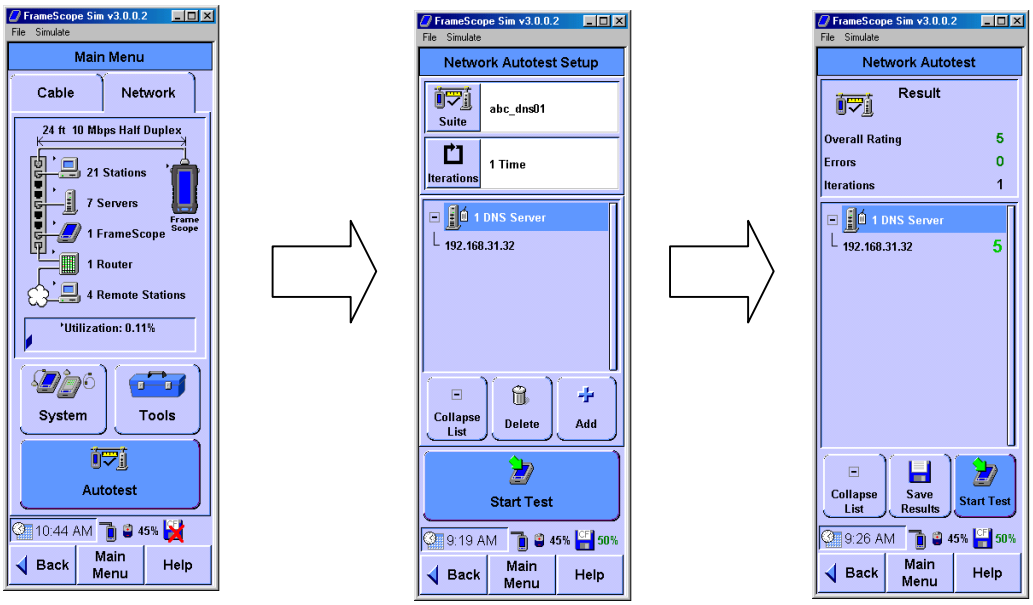
Using these tests, you can build an Autotest suite, which is custom fit to your organization. Consequently, it is easy to repeat the tests over time to discover any fluctuation in performance. This also allows your network engineer to simply delegate the task of conducting the test to a technician. Eventually, you may want to have a unit at each important company location so that you can run the tests and compare results. Or, you may want to install the units at a location and control them remotely. This enables you to conduct the tests at any time, day or night, from a central control point such as your corporate headquarters. No other handheld device in the market is so easy to use. No other device provides these unique features.

How is the Metric Determined?

Every server in your network has one or more purposes for its existence. These purposes are called services. For example, a device might provide mail services, web services or address assignment services. Naturally, your users would like these services to be fast and efficient. The FrameScope 350 provides a measure of this speed and efficiency by emulating a client device in the network. By making a request for service to a key device, and comparing the results to reasonable expectations, it can provide a rating of the service.

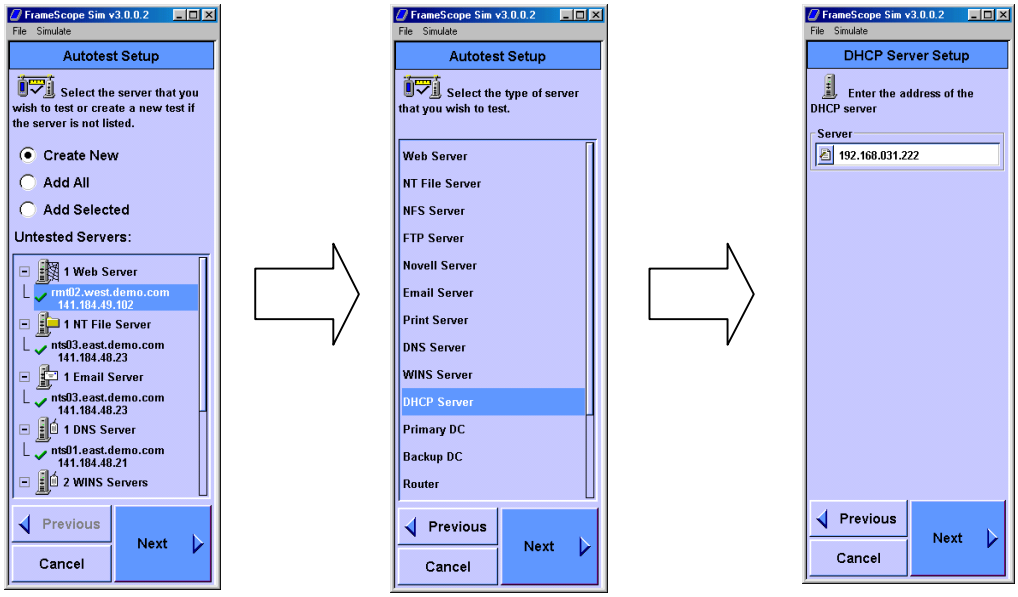
Let's show how to run two sample tests. We will use the DNS Server test and the DHCP Server test. A DNS server provides name services. When a client device needs to contact a device or other resource in the network that has a name, DNS provides the IP address at which that named resource can be found. DHCP provides devices with configuration information such as IP addresses, default gateways and subnet masks. Generally, this is done when the device enters the network. These two tests are representative of all the tests.

To conduct each test, you begin at the **Main Menu**, shown at the top of the next page. By pressing the **Autotest** Button, you would view the Autotest Setup Screen that lists the test you want to conduct, shown in the next screen to the right. This example assumes that the test was previously created or that you are running the default test which was shipped in the tester. Creating tests will be discussed later. When you press **Start Test,** the FrameScope 350 conducts the test of your DNS Server. The result will be a screen similar to the one shown on the top right of the next page. This screen provides your DNS server's rating, how many tests resulted in an error, and how many times the test was run. It's really that simple.



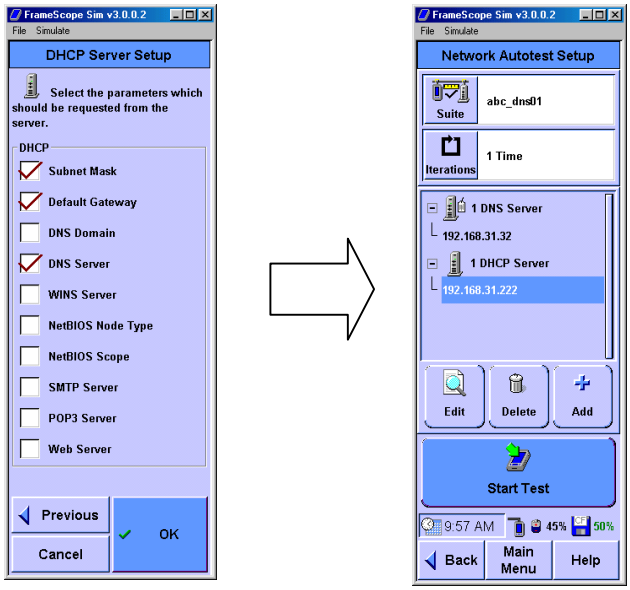
Two steps to conduct a test.

As a second example, we'll examine how to create and run a DHCP server test. Starting at the **Main Menu**, you would select **Autotest** to get the above middle screen. Next, you would select the **Add** button to add a new test. The result would be a screen similar to that shown below on the left. By selecting **Create New**, as shown, and pressing **Next**, a new screen will appear that allows you to indicate that you want to create a DHCP Server test. This screen is shown in the middle below. If you highlight **DHCP Server** and press **Next**, a screen appears which allows you to provide the IP address of the DHCP server. To do this, double-click on the icon next to the address field.



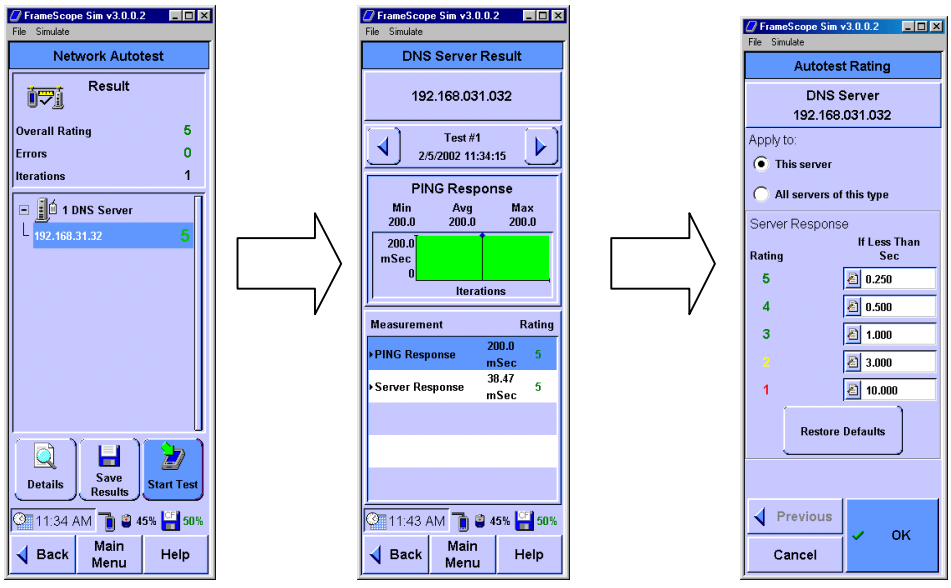
Setting up at DHCP Server Test

When you press **Next** on the DHCP Server Setup Screen, you can select the data you want to retrieve from the DHCP Server. The screen you use is shown below on the left. When you press **Next,** you will return to the screen that allows you to start the test of both the DNS server and the DHCP server as shown on the right.



Customizing a Metric

Suppose you suspect that the results of a particular test have rated a server higher or lower than it should have been. For example, you may know that the connection to the available domain name server is over a slow link and this link cannot be upgraded. Consequently, it may be more important for you to have a test that is less sensitive but provides meaningful results that can be compared over time. The FrameScope 350 can do this for you. After you've run the test and received a result, such as that shown below on the left, you can highlight the server address and press **Details**. The screen shown in the middle provides the measured results of the test. If you double click on **Server Response**, you can change the rating scale to whatever values you choose. The screen on which you do that is shown below on the right.



How the FrameScope 350 will help you

You will want to create a suite of tests that correspond to your key devices. At your main corporate building, suppose you have a web server, email server, two file servers and three devices providing DHCP services. Further, suppose that at a remote location you have only a file server and a DHCP server. You can build two test suites, one named HQ and one named Remote. Once the tests are created, simply connecting to the appropriate network, selecting the correct suite and pressing **Start Test** will test all of the key devices at that location. If the locations are too far apart to travel conveniently, you can ship the tester so that a technician can run the test. Or, you can control the remote tester from your location with your web browser.

The FrameScope 350 enables you to conduct quick, simple tests of all of your key servers. Agilent selected the ratings based on a combination of experience and research in the field. Such independent testing allowed network administrators and users to indicate whether or not the response of the key devices matched the FrameScope 350's evaluation. As a result, you can compare your results with those that are representative of the rest of the industry. If your results are good, they can be cited in reports to management. Or, they can be used to justify financial expenditures you've made to improve the network. If a key service is found to have a low metric, you can break down the result into network response and server performance. This will indicate whether to further diagnose the network or focus on upgrading the server. If the network or server is upgraded, you can once again use the metric to illustrate the improvement in performance.

The FrameScope 350 can also be used to compare connection paths. Suppose a group of users in one building complain that their Internet connection is extremely slow. With the Web Server and DNS Server tests, you can compare that location with other locations where the connection is acceptable. This might reveal a low link speed to the location or client software or system problems. You can even use the FrameScope 350 to monitor a service provider. If your ISP at one location provides low metrics while others do not, you have data with which to approach the ISP that is providing the poor service.

Another useful function of the FrameScope 350 is its ability to conduct network audits. Once your suite of tests is created, you can run periodic tests and store the results sorted by key device. Then, if you upgrade a server, reconfigure your network topology, or simply add bandwidth, you have before and after results to measure the effectiveness of your change. This will be particularly useful if you change service providers.

The FrameScope 350 will be different than any tool you have ever experienced. It is simple enough that almost any technician can use it. It's flexible enough to be customized to your own unique environment, yet it provides essential bottom-line data about the services provided by your network's key devices. It's everything you've come to expect from Agilent.

default router	The router to which a packet will be sent if no specific entry in its route table directs it elsewhere.
DHCP	Dynamic Host Configuration Protocol is a procedure which allows devices that are entering or re-entering the network to request that certain parameters are automatically assigned to them. Besides the IP address, a device may request a subnet mask, default router address, name server address, and many other important parameters and addresses.
DHCP server	Any of several kinds of devices that provide DHCP services. These commonly include file servers and routers.
DNS	Domain Name Server or Domain Name Services. A capability used widely within both the Internet and corporate networks that resolves (or matches) names with IP addresses. For example, if a workstation needs to retrieve a web page from abc.com, a request containing the name abc.com is sent to a domain name server. That server, or another acting on its behalf, will respond with the IP address of the host at which the web page is stored.
domain controller	In an NT environment, the domain controller has the responsibility for storing certain information about users, resources and devices on the network. There will be a primary domain controller and a backup domain controller. These are referred to as the PDC and BDC, respectively.
email server	A device that stores incoming and outgoing email messages. The protocol most often used for retrieving messages from the email server to a user's workstation is POP3. Conversely, the protocol most often used to send email messages from the workstation to the email server is SMTP (Simple Mail Transfer Protocol.) SMTP is also used in order that the source and destination email servers may exchange emails.
file server	A generic term for a device that provides files upon request. It overlaps other commonly used terms such as Novell server, NT server, and Unix server, which are more specific because they indicate the operating system running in the file server. File servers often provide other functions such as remote access, DHCP, or security related services.
IP address	A four-byte address always written in decimal with each byte separated by dots. This is an address normally assigned through software and associated with a hardware address of a network interface card. It can also be associated with a resource on the network such as an SNMP agent.
IP	Internet Protocol. The protocol developed and used in the Internet. It is now used in nearly all public and private networks. It provides an addressing structure that allows relaying of packets in a manner that is logically separated from the underlying physical network.
layer	The term layer is usually associated with the seven-layer model. This is a design reference model widely used to explain functions of network and communications software and hardware. The lower layer functions are usually associated with hardware and the higher layer functions related to protocols and software.
Novell server	A device that provides services such as file services and print services in a network where a Novell operating system is being used.

ping	A commonly used test which determines whether a device can be reached. Generally, from a command line a user types *ping a.b.c.d* <enter> to determine whether the device at IP address a.b.c.d can be reached. The response is often an indication of the success of the test and a time stamp designating the length of the query-response, usually in milliseconds.
router	A device that relays packets based on the layer-three destination address in the packet. The most widely used layer three protocol is IP.
server	Any device in the network that provides services upon request.
session	A logical end-to-end connection established by two hosts using the TCP protocol.
SNMP agent	Devices that are being managed in a network can contain an SNMP agent. A network management program or device sends a query to the agent. The agent retrieves the requested value from a database stored in the managed device and sends the reply. SNMP agents often retrieve and reply with statistics about the managed device. Examples include utilization values on ports, address tables that are stored, and vendor profiles. The protocol used to communicate the information is the Simple Network Management Protocol (SNMP).
TCP	Transmission Control Protocol. TCP is a connection-oriented protocol that is used between end stations. It provides key reliability functions for the transmission of data including sequencing of packets, controlling the rate of flow, and retransmission of lost packets.
Unix server	A device providing services in a network and running a version of the Unix operating system.
utilization	A measure of how much of the network's bandwidth is being used. It is usually expressed as a percent of the maximum line speed in the network. For example, if the network's current usage is at 2 Mb/sec and the bandwidth available (line speed) is 100 Mb/sec., we say the utilization is 2%.
web browser	The program running in a client host when someone is interacting with a web server. It is the software used to browse the Internet.
web server	A network server that contains files that describe Internet pages. The pages are usually developed in a language named Hypertext Markup Language (HTML). A company's home page is an example of an HTML file that can be retrieved from a web server.
WINS server	A type of name server used in the Microsoft NT environment. WINS stand for Windows Internet Name Services. It is a variation of DNS.

About the Author

Dr. Phil Hippensteel is a consultant and instructor from Harrisburg, Pennsylvania. He is nationally recognized for his knowledge of network infrastructure. His clients include schools, government agencies, hospitals, manufacturing firms, and universities. He has worked with IBM, Sprint, Bethlehem Steel, Tyco Electronics, Lockheed Martin, Mitel, and many other firms throughout the United States and Canada. He has helped to develop networking products and the training associated with those products.

After spending a substantial portion of his career in higher education as professor and college administrator, Dr. Hippensteel began teaching data communications and consulting. He has been an instructor for several major universities and dozens of colleges. He also regularly provides presentations at major conferences and seminars including Supercomm, Networld Interop, and the meetings of the International Communications Associations. Recently, he was the keynote speaker for a seminar series conducted nation-wide by *Network World* magazine. He currently teaches an on-site class for them.

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