



Internet Advisor

Gigabit Ethernet Getting Started

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Introduction

Introduction

The HP Internet Advisor LAN - Gigabit Ethernet is a powerful protocol analyzer designed to help you troubleshoot and analyze your network.

It consists of a ruggedized personal computer equipped with modular data acquisition and transmission hardware, as well as powerful Microsoft® Windows® based network analysis software. Standard peripherals such as serial/parallel ports, floppy drive, pc card slot, etc. are also included.

You can use the Internet Advisor LAN - Gigabit Ethernet to:

- prevent network problems before they affect users
- resolve network problems quickly and effectively
- optimize network performance

Today, Gigabit Ethernet is used mostly for switch-to-switch communication. These links are both the most heavily used and the most critical for network up-time. You need to have equipment that can be used for more than troubleshooting your network.

The Gigabit Ethernet Advisor measurements help you with all phases of network operation - from designing and implementing new networks to maintaining and troubleshooting existing networks.

The following pages provide a more detailed overview of the features of this network test equipment.

- Use Statistics to perform baseline testing when your network is operating correctly. Then, if problems arise, new measurements can be compared to the baseline measurements to see where the differences lie. These measurements also let you develop long-term analysis of trends.
- Use Statistics and RFC1944 Benchmarks to find frame, byte and error counts; utilization and connection statistics; and latency, throughput and frame loss measurements.
- Use the Full Traffic Generation and Simple Traffic Generation measurements to inject specialized traffic patterns of variable length, utilization, frame rate, and interframe spacing and delays onto your network.

Looking at the Health of Your Network

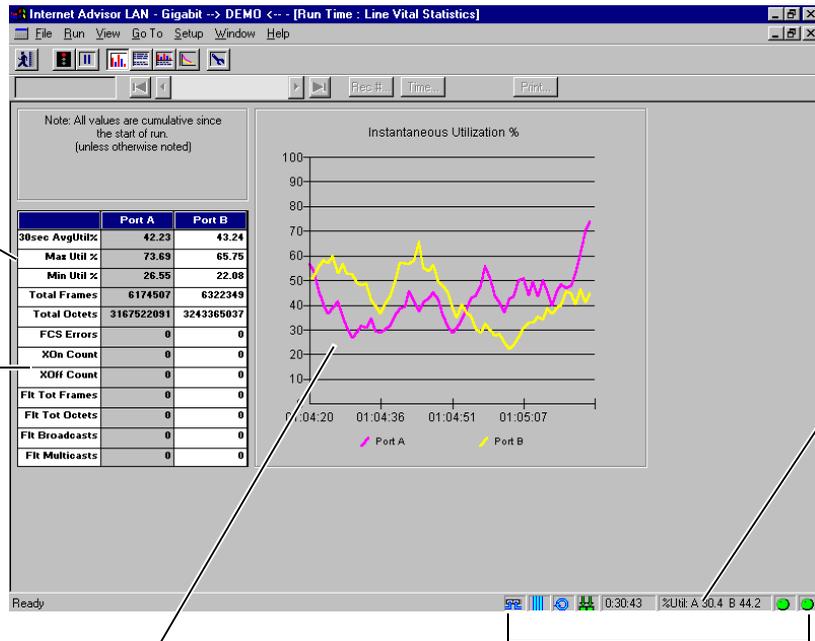
See network utilizations, errors, and statistics at the physical layer

Line Vital Statistics give you a quick view of the health of your network. Statistics collected include utilization and physical errors. The information is provided in both a tabular and a graphical view.

Use Line Vital Statistics to keep track of bandwidth utilization, counts and errors. The Instantaneous Utilization chart shows at a quick glance the current utilization rate.

Look at minimum, maximum, and average utilizations for both ports.

See counts and errors and which port they are occurring on.



The graph shows instantaneous utilization over a period of time.

The Status Bar shows the connection mode, capture filter status, buffer options, run status, duration of capture, and dropped frame indications at a glance.

The exact utilization for each port is shown.

Decoding the Frames on your Network

Use Decodes to view the details of every frame.

Decoding network traffic helps you manage and troubleshoot a network. The basic function of a decode measurement is to examine data on a communications link to verify devices are handling data correctly. If unsuitable traffic is present, you can easily identify the source and take corrective action.

Sometimes all you need to see are the network addresses to ensure the data on the link is being properly routed. If unintended traffic is present, you may need to reconfigure some of the network devices. Protocol decodes help indicate which devices require attention.

Decodes help verify that expected protocols are present and, perhaps more importantly, discover whether unexpected protocols are present on the link. This is particularly important when wide area links connect LAN segments.

Displayed data can be filtered and/or searched for specific frame or data events.

Edit and Playback buttons are for editing frames and sending them on the network.

The Summary view shows a short one line explanation of each frame. Right click for other formatting options.

The Detailed view shows the complete decoded contents of each frame.

The Hex view shows the actual bytes in the decoded frame. The right column shows the contents in ASCII or EBCDIC.

The screenshot shows the 'Internet Advisor LAN - Gigabit -> DEMO -> [Stopped - Decode]' window. The main area displays a table of network frames with columns for Frame, Len, Absolute Time, Source, Destination, and Prot. The table contains several rows of data, with the 17th frame selected. Below the table, the 'Record #17' details are shown, including the capture time and length. The 'Detailed' view shows the 'ETHER Header' with fields for Destination (2E-00-AC-00-BF-00), Source (A1-00-00-00-00-00), and Protocol (Novell_8136). The 'Hex' view shows the raw bytes of the frame in hexadecimal and ASCII/EBCDIC format.

Frame	Len	Absolute Time	Source	Destination	Prot
13	994	11:59:05.000000000	B8-00-00-00-00-C2	A7-00-A4-00-00-00	ETHER
E	14	1071	11:59:06.000000000	00-00-00-D5-00-00	*** CR
15	1274	11:59:07.000000000	00-00-00-00-00-00	00-00-00-FA-00-00	ETHER
E	16	445	11:59:08.000000000	00B20000-00000000A902	*** S
17	743	11:59:09.000000000	A1-00-00-00-00-00	2E-00-AC-00-BF-00	ETHER
E	18	881	11:59:10.000000000	C5-00-1B-00-00-00	*** Sy

Record #17 (Port B) Captured on 09.23.98 at 11:59:09.000000000 Length = 743
Runtime Frame# 16

```

----- ETHER Header -----
ETHER: Destination: 2E-00-AC-00-BF-00
ETHER: Source: A1-00-00-00-00-00
ETHER: Protocol: Novell_8136
  
```

```

2e 00 ac 00 bf 00 a1 00  00 00 00 00 81 36 00 00  .....81.
00 00 00 52 00 00 00 00  00 00 1a 36 00 00 00 00  .....R.....6...
00 00 00 00 00 00 00 1a 00  49 00 32 00 00 00 00 00  .....I.2.....
00 00 00 00 00 00 00 00  00 00 b6 f6 00 00 00 00  .....
00 00 00 10 00 00 00 00  00 00 00 00 00 00 00 00  .....
  
```

One port is shown in grey and the other is shown as white

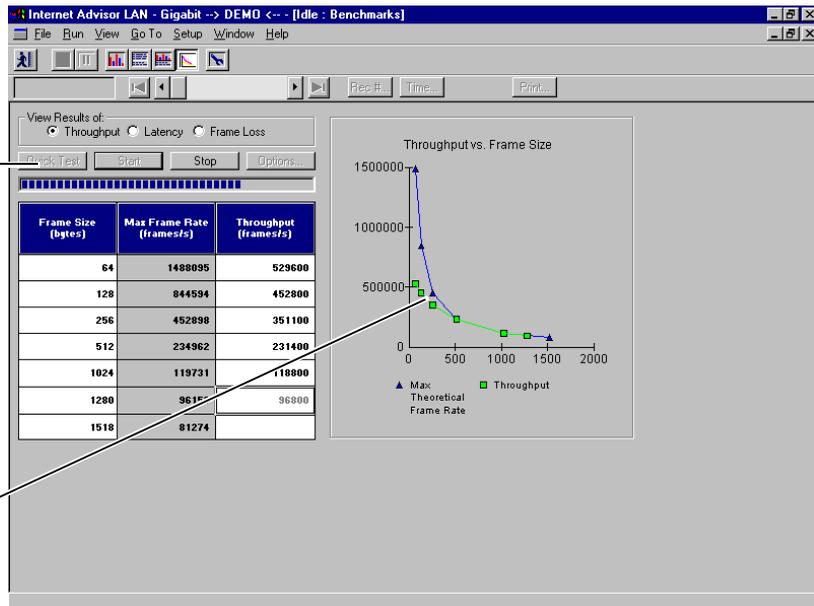
Click a field in the Detailed or Hex view to see the corresponding data.

Measuring Throughput, Latency, and Frame Loss

The Benchmarks measurement is a specialized test that automatically runs the RFC1944 tests on a single piece of equipment such as a switch or router. This measurement has been specifically designed to help network manufacturers run repeatable, defined tests while developing or modifying their equipment.

The Quick Test button performs a quick connectivity test.

Look at the measured throughput versus the various frame sizes.



Sending Generated Traffic on the Network

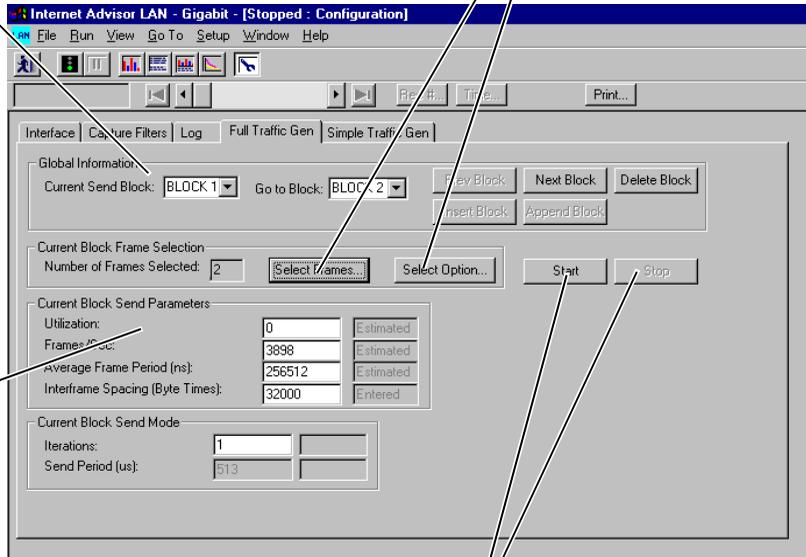
Choose from two Traffic generation measurements.

The Full Traffic Generation and Simple Traffic Generation measurements in the Gigabit Ethernet Advisor give you the ability to inject specialized traffic patterns of variable length, utilization, frame rate, and interframe spacing and delays onto your network.

Set up Global information by defining different blocks of traffic to be transmitted.

Use the Current Block Send Parameters section to set up utilization, framing and spacing values.

Create and edit frames to be transmitted on the network. Then, select options to apply to these frames.



Start and stop traffic generation directly from the Configuration menu.

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- Starting the Application, page 2-6
- Connecting to the Network, page 2-7
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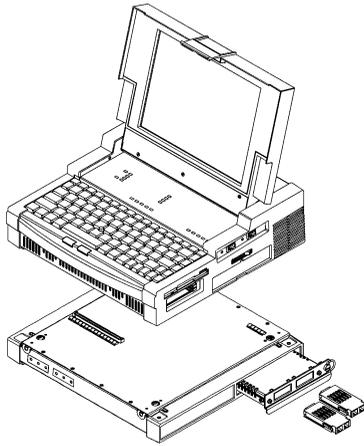
Getting Started

Getting Started

This chapter describes the steps you use to get started testing with the HP Internet Advisor LAN - Gigabit Ethernet.

There are some steps you perform each time you start testing your network. Other steps you do only one time or periodically.

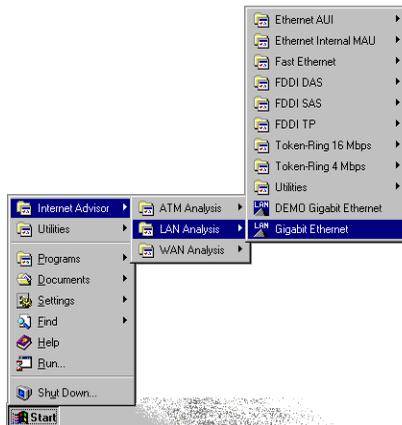
- 1 Install the Gigabit Ethernet undercradle and the GBIC Transceivers. Install software if necessary.



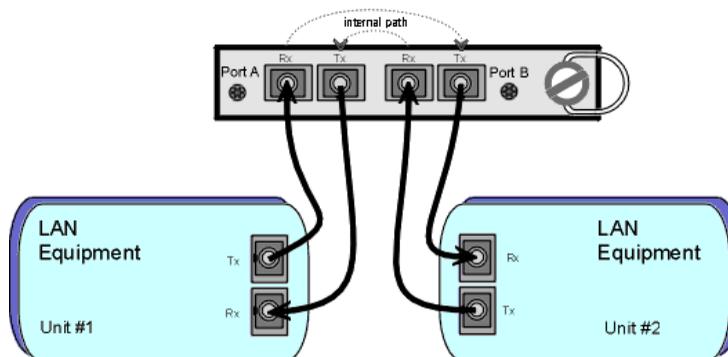
Use the Mainframe Features Guide to connect the mainframe, undercradle, and slide-in modules.

Use the Installation Guide to install or add software.

- 2 Start the Gigabit Ethernet application.

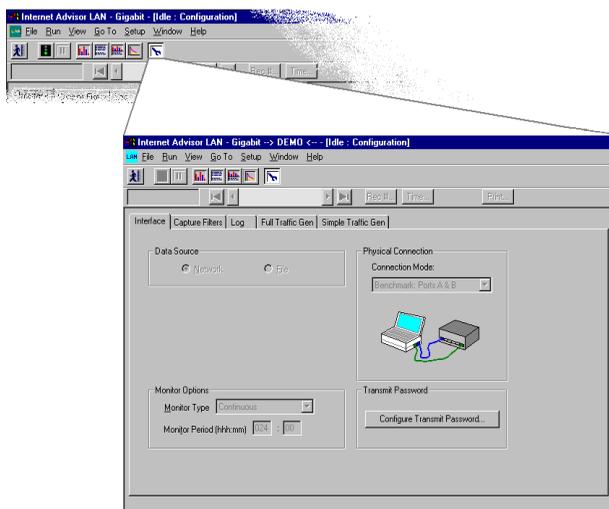


- ③ Connect to the network.

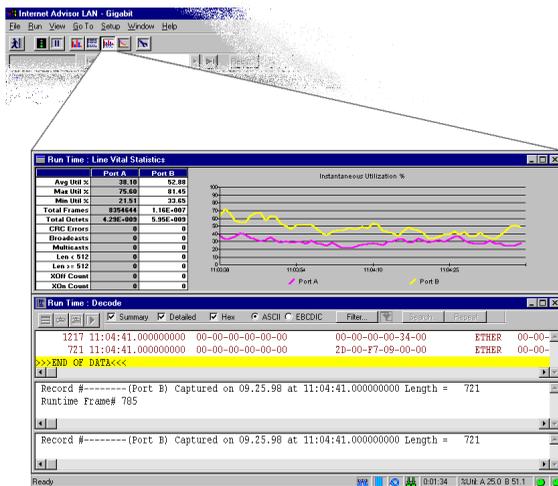


This illustration shows the Gigabit Ethernet Advisor connected in the Rx Pass Through: Ports A & B mode.

- ④ Configure the Gigabit Ethernet application.



- 5 Select a measurement, start a test, and view the results.



Installing Undercradles, Interface Modules, and Software

Undercradle and Interface Module installation

Depending on the options you have ordered, you may have to install an interface module or undercradle for the specific physical interface you intend to connect to.

To attach a Gigabit Ethernet undercradle to an Internet Advisor mainframe, the connector board must be inserted in the slot closest to the front of the Internet Advisor.

For more information about installing hardware, refer to the *Mainframe Features* guide for instructions.

CAUTION

Be sure the Internet Advisor power is **Off** before removing or installing undercradles or interface modules.

The Gigabit Ethernet software should be installed on your Internet Advisor when you received it.

Software Installation

If, for some reason the software is not installed or you want to reinstall the software, remove any attached undercradle and then use the instructions in the *HP Internet Advisor Software Installation Guide* supplied with the Internet Advisor software CD.

Be sure to save any measurement and configuration files you have created to a floppy disk before installing any new Internet Advisor software.

Installing the GBIC Transceivers.

The GBIC (Gigabit Interface Converter) transceivers are packaged separately for shipment. To install the transceivers, gently slide each GBIC transceiver into the opening of the Gigabit Ethernet interface module until it clicks into place (it is not possible to insert the GBIC transceivers upside-down).

The GBIC ports are available in either 1000Base SX 850nm laser multimode (standard on the J2901A) or in 1000Base LX 1300nm laser multimode or single mode (option 201). It is possible to mix the GBIC transceivers, using an SX in one port and an LX in the other.

Starting the Application

Start the Internet Advisor for the first time.

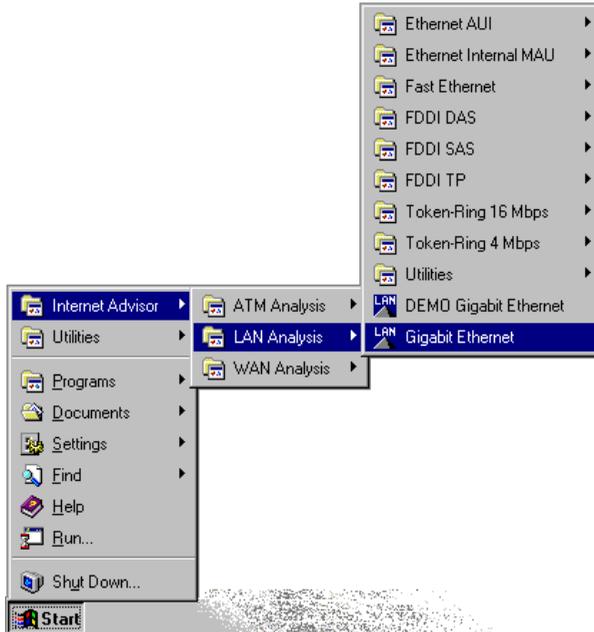
The first time you start the HP Internet Advisor with software shipped from Hewlett-Packard, Microsoft requires you to provide some information to complete the configuration.

Several dialog boxes prompt you for information such as user name, company name, etc. You can accept the default selections by pressing ENTER.

A Certificate of Authenticity box prompts you for an authenticity number. The number you should enter is located on the front cover of the *Microsoft Windows 98 Getting Started* book shipped with your Internet Advisor. Look for the Product ID number above the bar code label.

Start the Gigabit Ethernet application.

To start the Gigabit Ethernet application, select Internet Advisor | LAN Analysis | Gigabit Ethernet from the Start menu in the Windows desktop.



Connecting to the Network

The type of measurements you want to make determines how you physically connect the Gigabit Ethernet Advisor to a network.

For monitoring tests, the Internet Advisor passively monitors the circuit under test. To monitor passively means to gather information from the circuit without interfering with the circuit. Each device's received signal is instantly retransmitted, with no significant delay, to the other device.

For traffic generation tests, the Internet Advisor is used to generate traffic to the network or to stress test a device. This is the only connection mode in which the Internet Advisor can generate traffic to the network.

For Benchmark tests, the Internet Advisor is used to run the RFC1944 suite of tests on a gigabit device. RFC1944 discusses and defines a number of standard tests that are used to characterize performance results such as latency, throughput, and frame loss.

All of the connection modes are set using the Interface/Protocols tab in the Configuration options.

Cables

Use standard SC fiber connectors such as AMP's SC Duplex Multimode Cable assemblies for the J2901A multimode GBICs. For single mode GBICs, it is important to use single mode cable. Call AMP at 1 800 522 6752 for information.

The following part numbers are current as of January 1998:

- 504941-1: 1 meter SC Duplex 62.5 micron Multimode Cable Assembly
- 503141-1: SC Loopback 62.5 micron Cable Assembly
- 503625-1: 1 meter SC to ST Multimode 62.5 micron Cable Assembly
- 107842-3: multimode 1 x 2 coupler (hdx splitter) (order 2)

Check the Network Diameter and Latency.

The operating distances of gigabit fiber networks vary depending on the testing mode and diameter of the fiber. The operating distance of 62.5 micron multimode fiber is specified as 260 meters; for 50 micron multimode fiber the distance increases to 550 meters.

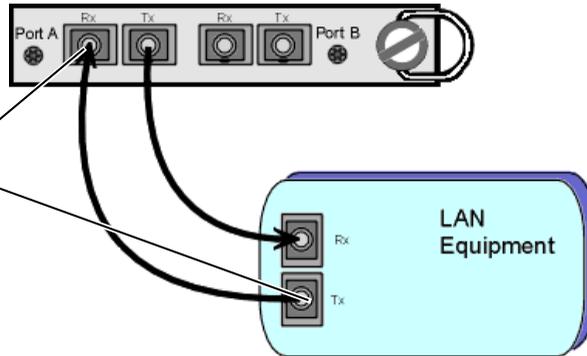
As a signal passes through a network device, some latency can be expected. The worst case latency through the Gigabit Advisor is 125 bit periods (100 ns). The nominal latency is 110 bit periods (88 ns). In full-duplex, Pass Through mode, the signal is regenerated and thus extends the possible network diameter. For half-duplex networks, the effective diameter reduction through the Advisor is 25 meters.

Rx/Tx Port A

Use the Rx/Tx mode to generate traffic on the network.

In the Rx/Tx Port A mode, Port A is used to connect the Internet Advisor to another gigabit device in a point-to-point configuration.

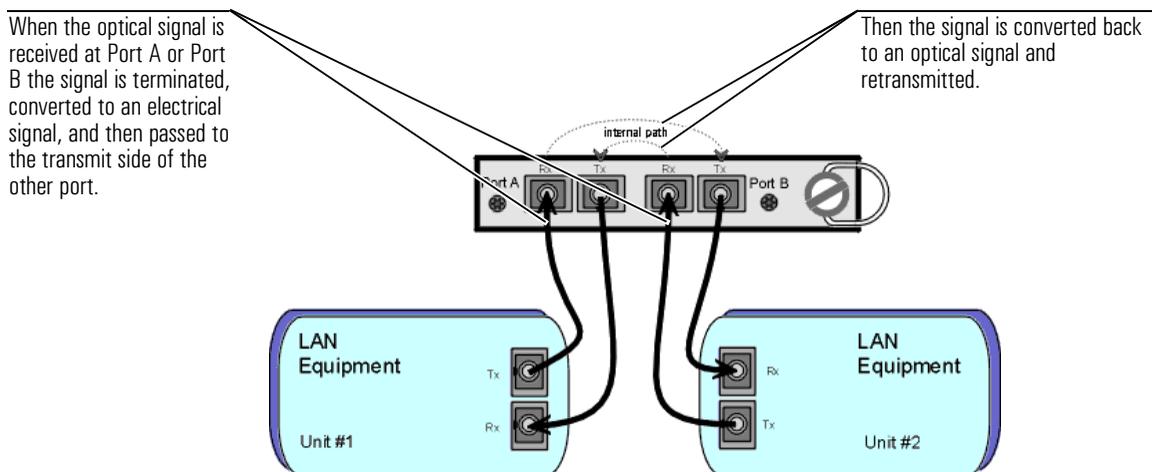
This is the only connection mode in which the Internet Advisor Gigabit Ethernet can generate traffic to the network. When connecting the Advisor in this way, make sure you use Port A, as shown below.



Rx Pass Through: Ports A & B Connection

Pass Through mode monitors two full-duplex devices in-line.

In Rx Pass Through mode, the Gigabit Advisor is inserted between two communicating devices in order to monitor and analyze frames being sent in both directions on a connection. The Advisor is completely passive in this mode. Measurements that require transmitting on the network do not run in this mode.



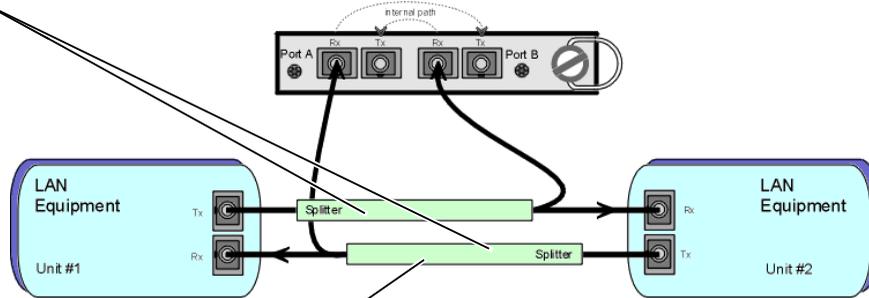
Rx Pass Through: Ports A & B Connection with a Splitter

Pass Through mode used with a splitter monitors the network unobtrusively.

Use Rx Pass Through mode to insert the Gigabit Advisor between two communicating devices using splitters. This lets you attach and remove the Internet Advisor without interrupting network traffic and eliminates the small amount of latency added to the line by passing traffic through the Advisor. The Gigabit Ethernet Advisor is completely passive in this mode.

This is a good way to run baseline tests to get a feel for how the network is operating under normal conditions.

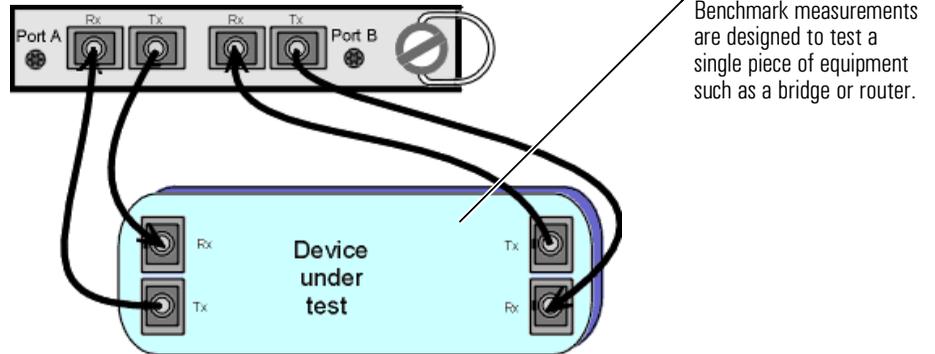
Use optical splitters with a 50/50 power split.



Some splitters that have been qualified by HP are:
AMP multimode 1x2 coupler; 2-107842-3 (order two)
Netoptics FDX Splitter; 96042-2
Alcoa Fugikura Ltd. HDX Splitter; 1-1x2 (order two)

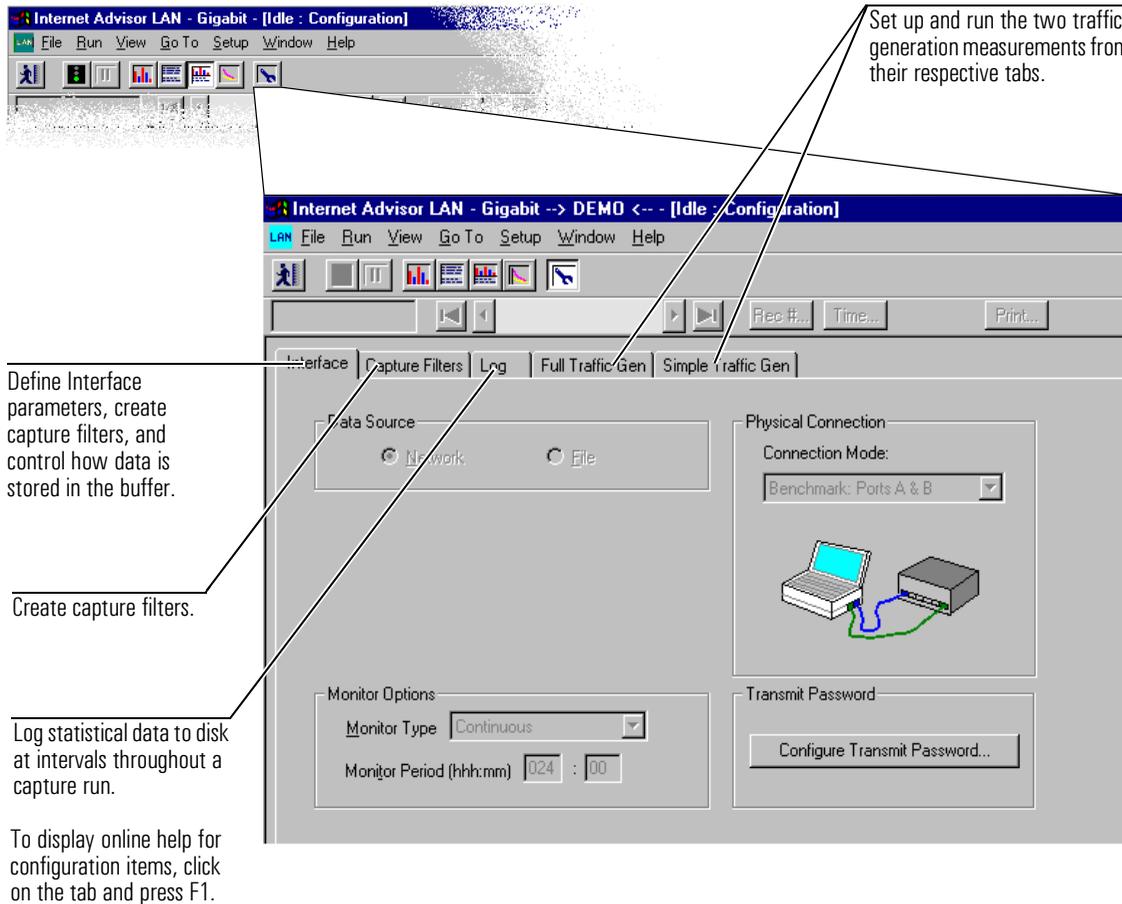
Benchmark: Ports A & B

The Benchmark mode is used to run the RFC1944 suite of tests on a gigabit device. RFC1944 discusses and defines a number of standard tests that are used to characterize performance results such as latency, throughput, and frame loss.



Configuring the Instrument

Before you start a measurement, you need to configure the Gigabit Ethernet Advisor. The configuration menu has a list of tabs designed to make setting up the various functions of the Gigabit Ethernet Advisor quick and simple.



Starting a Capture and Looking at the Results

Start a capture run and analyze Data in real time. You can look at data in several different formats as the Gigabit Ethernet Advisor is capturing data as well as study the data after the run has been stopped.

Start and stop measurements here.

The screenshot shows the 'Internet Advisor LAN - Gigabit' software interface. The main window is titled 'Run Time : Line Vital Statistics' and contains a table of performance metrics for Port A and Port B, along with a line graph of 'Instantaneous Utilization %' over time. Below this is the 'Run Time : Decode' window, which displays network traffic in hexadecimal and ASCII, with a yellow highlight on the text '>>>END OF DATA<<<'. A status bar at the bottom shows system information like '0:01:34' and '%Util: A 25.0 B 51.1'.

See statistics (in graphs and spreadsheets) and decoded traffic.

To display online help for a measurement window, open the measurement and press F1.

	Port A	Port B
30sec AvgUtil%	48.19	55.17
Max Util %	81.27	80.82
Min Util %	20.77	25.83
Total Frames	17612269	20163515
Total Octets	9035092971	10343883195
FCS Errors	0	0
In Count	0	0
XOff Count	0	0
Flt Tot Frames	0	0
Flt Tot Octets	0	0
Flt Broadcasts	0	0
Flt Multicasts	0	0

```

1217 11:04:41.000000000 00-00-00-00-00-00 00-00-00-00-34-00 ETHER 00-00-
721 11:04:41.000000000 00-00-00-00-00-00 2D-00-F7-09-00-00 ETHER 00-00-
>>>END OF DATA<<<
Record #----- (Port B) Captured on 09.25.98 at 11:04:41.000000000 Length = 721
Runtime Frame# 785
Record #----- (Port B) Captured on 09.25.98 at 11:04:41.000000000 Length = 721
    
```

Finding More Information

Gigabit Ethernet Online Help

The Gigabit Ethernet Advisor has an extensive online help system. You can quickly find information for the currently displayed measurement view or dialog by pressing **F1**.

Use the Help Topics button to display help organized by Contents and Index tabs.



Help for the active window is organized by Overview, How To, and Details buttons.

Sample Tests

The next chapter in this book describes examples for using the Advisor to make measurements on your network.

Other Internet Advisor Books

Each of the technologies that can be tested with the Internet Advisor has a separate Getting Started manual. Use the appropriate Getting Started manual when you go to test another network technology. All Getting Started manuals for the Internet Advisor are on the documentation CD.

Windows Online Help

You can find information on general Windows operation from the online Help tutorial - About Windows. It is a good idea to spend a few minutes learning the basic functions and terminology associated with the Windows environment.



Microsoft Windows 98 Getting Started manual

The manual, Introducing Microsoft Windows, is shipped with each Internet Advisor to help you get up and running quickly.

- Stress Testing Network Devices using Traffic Generation, page 3-3
- Editing and Replaying Captured Frames to Verify Network Operations, page 3-9
- Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements, page 3-14

Sample Tests

Sample Tests

This chapter illustrates some sample tests to help you quickly learn and use the Gigabit Ethernet Advisor:

- Editing and Replaying captured frames to verify network operations
- Stress Testing network devices using Traffic Generation
- Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements

Example data file

Data used in some of the example tests is available in a file. You can just read the following pages, or, you can use the sample data file and perform the example steps with your Internet Advisor.

The data file for this example is included with the Internet Advisor in location:

```
C:\ADVISOR\GELAN\CONFIG\TRANSMIT.DAT
```

This file is just a sampling of all the parameters and may be handy as a template to learn with.

To learn more...

For more information about how to use the features of the Internet Advisor, refer to the online help. You can press F1 while using the Gigabit Ethernet Advisor application to get specific information about the currently active window, measurement view, or dialog box.

Stress Testing Network Devices using Traffic Generation

You want to create some traffic conditions that cause hard to find intermittent problems on the network. At the same time, you want to stress test network components and traffic handling applications to see how they react to repeating data patterns, high bit rates, etc.

This example illustrates how you can use the Gigabit Ethernet Advisor to automatically generate and transmit traffic onto the network. Some conclusions you want from a test like this might include:

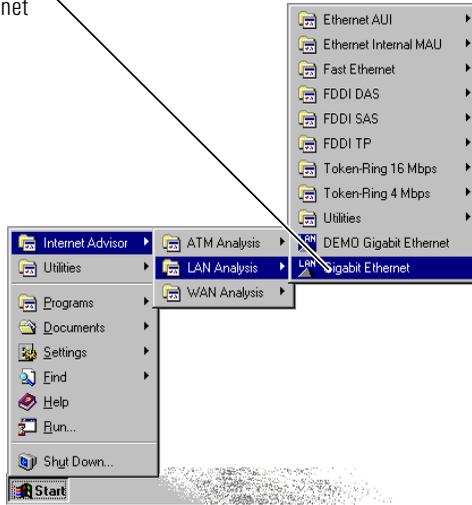
- verify utilization rates
- test the limits of a device
- check specialized traffic patterns

To begin, you need to have a Gigabit Ethernet Advisor, have the necessary cables, and have turned the Advisor on.

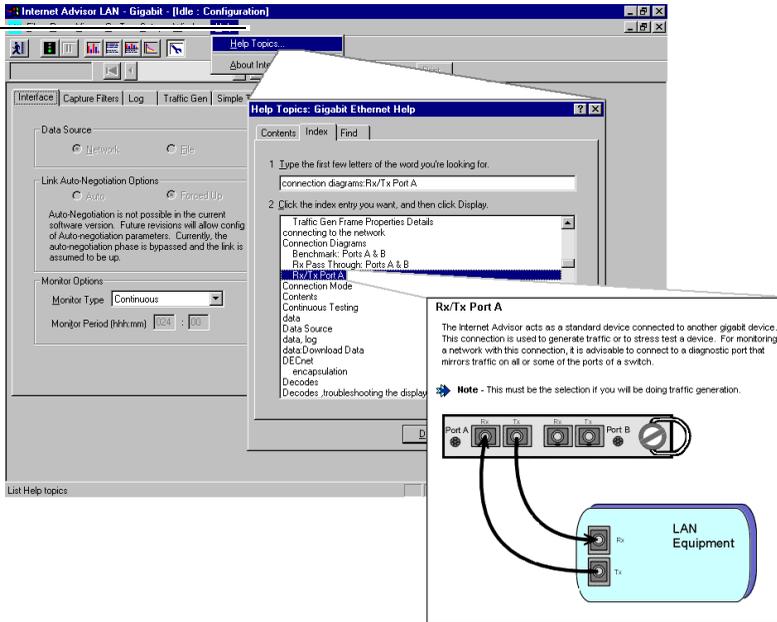
Sample Tests

Stress Testing Network Devices using Traffic Generation

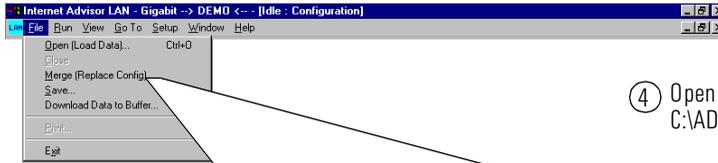
① Start the Gigabit Ethernet application.



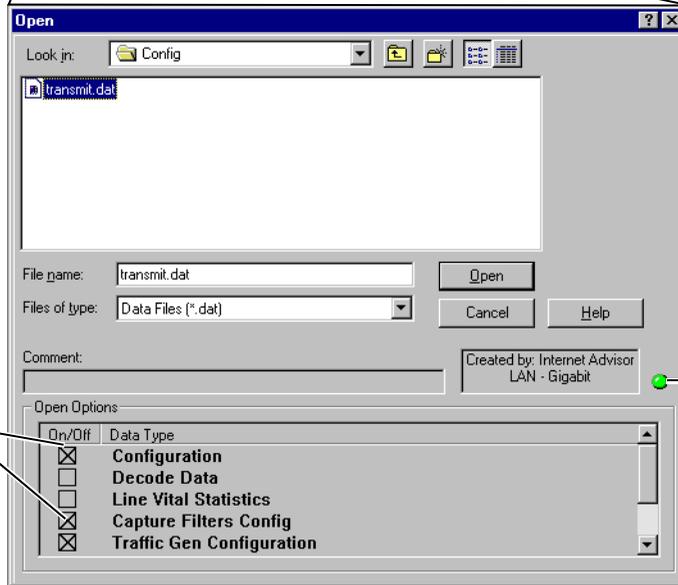
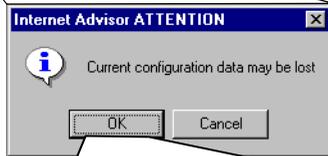
② Look in the online help for the Rx/Tx: Port A connection diagram. This is the type of connection to use for Traffic Generation.



③ Connect the Gigabit Ethernet Advisor to the network.



④ Open the Transmit.dat in the directory C:\ADVISOR\GELan\Config\.



Marked boxes indicate the merged file contains these parameters.

A 'green' indicator here shows the highlighted file is compatible with the Gigabit Ethernet application.

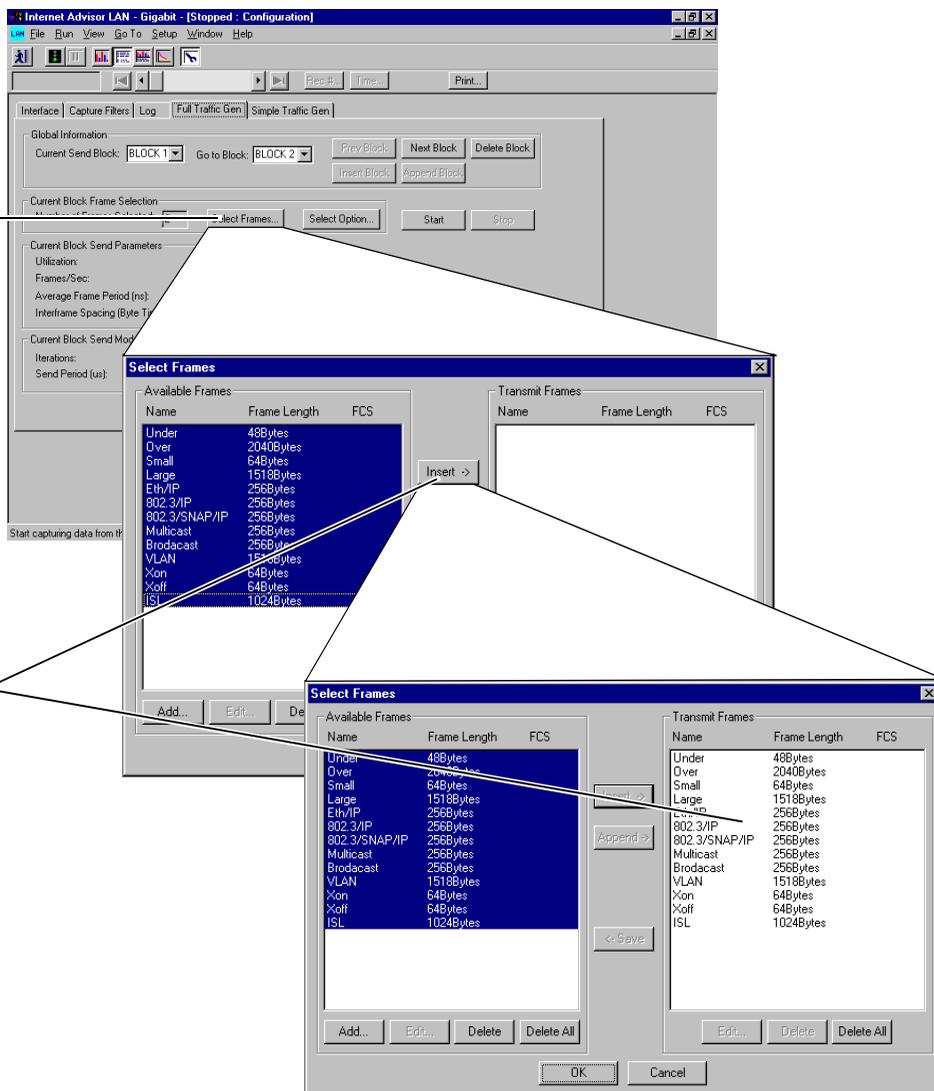
Sample Tests

Stress Testing Network Devices using Traffic Generation

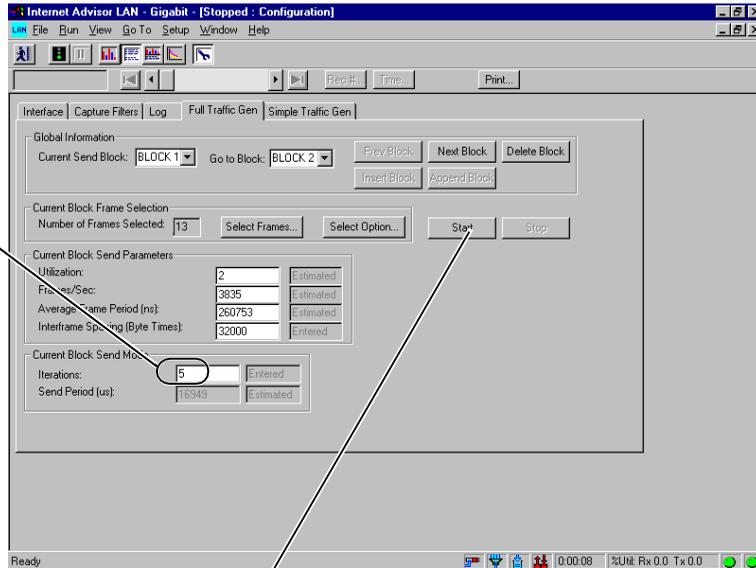
⑤ Select the Full Traffic Gen tab in the Configuration menu.

⑥ Click Select Frames to see the Available Frames.

⑦ Highlight all of the available frames and click on Insert to copy them to the Transmit Frames pane. Click OK.



⑧ Change the Current Block Send Mode to have 5 Iterations.

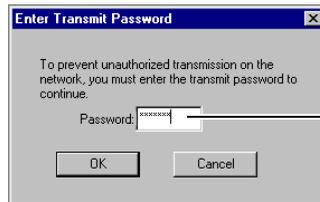


⑨ Select Start to start transmitting frames on the network.

Notice the figures in the Status Bar. Since merging the Transmit.dat file, different icons appear here.

See the online help for more information about the Status bar.

⑩ Type in the password - advisor - and select OK to continue. (See the online help for more information about passwords.)

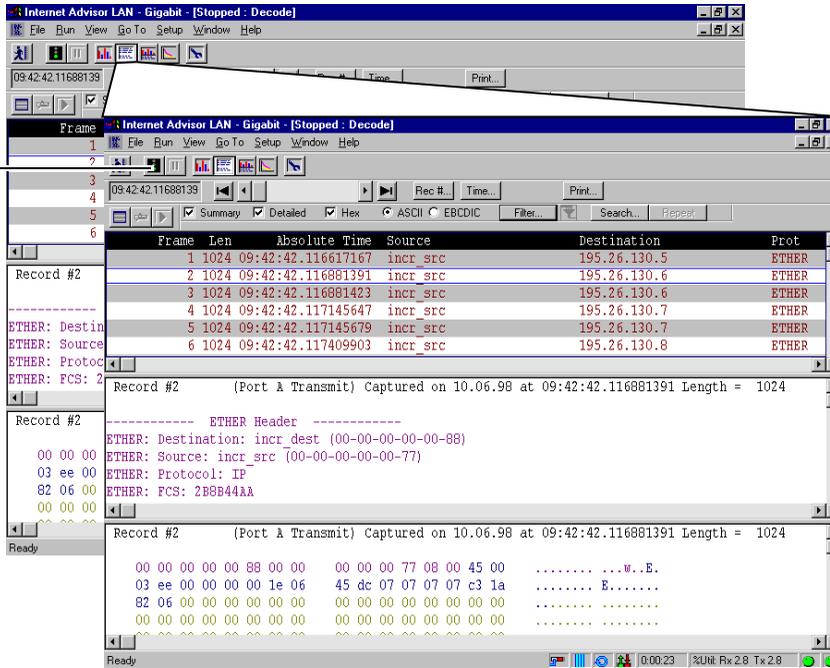


The Advisor prompts you to enter a password before transmitting data on the network.

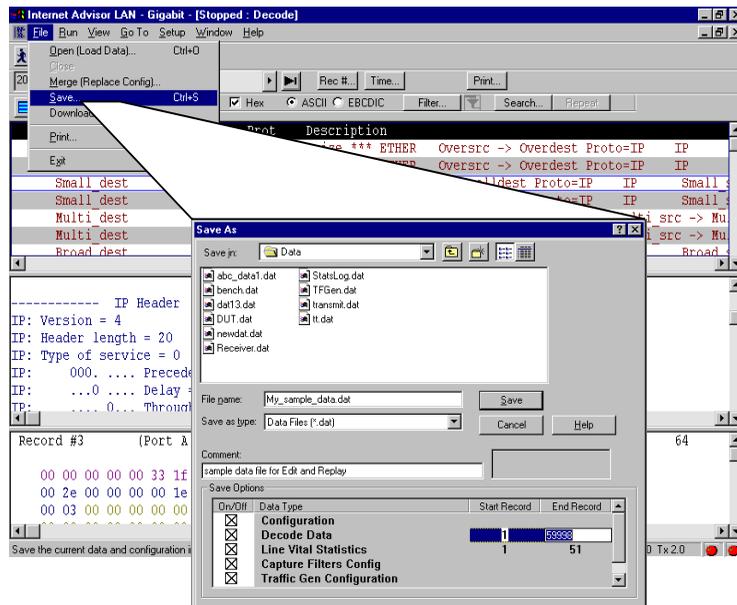
Sample Tests

Stress Testing Network Devices using Traffic Generation

- 11 Select Decodes and Start to see the decoded data from the transmitted traffic on the network.



- 12 Stop the capture and save the decoded data to a file. Save the file name - My_sample_data.dat in the C:\Advisor\GELan\Data directory. Type in a descriptive comment for the file. Click on the Decode Data box and double click on the End Record value. Enter 100 to save only the first 100 records in the file.



Editing and Replaying Captured Frames to Verify Network Operations

Using the Edit and Playback functions in the Gigabit Ethernet Advisor is a feature that lets you

- capture data
- edit that data
- retransmit that data on the network

This example illustrates how you can use the Gigabit Ethernet Advisor to download a previously saved data file, edit existing frames, and play them back onto the network.

Example File

The data file used in this example was created in the previous sample test - *Stress Testing network devices using Traffic Generation*.

To begin, you need to have a Gigabit Ethernet Advisor (and have it plugged in), have the necessary cables, and turned the Advisor on.

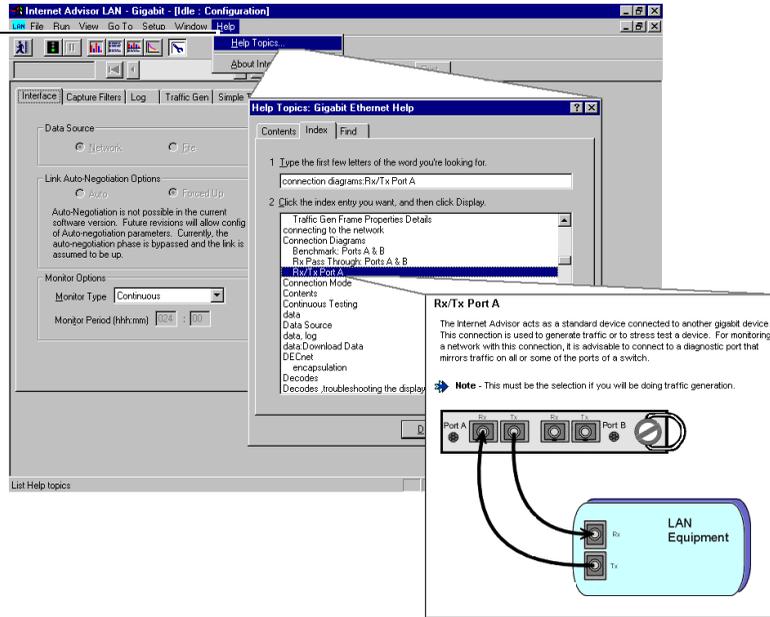
Sample Tests

Editing and Replaying Captured Frames to Verify Network Operations



① Start the Gigabit Ethernet application.

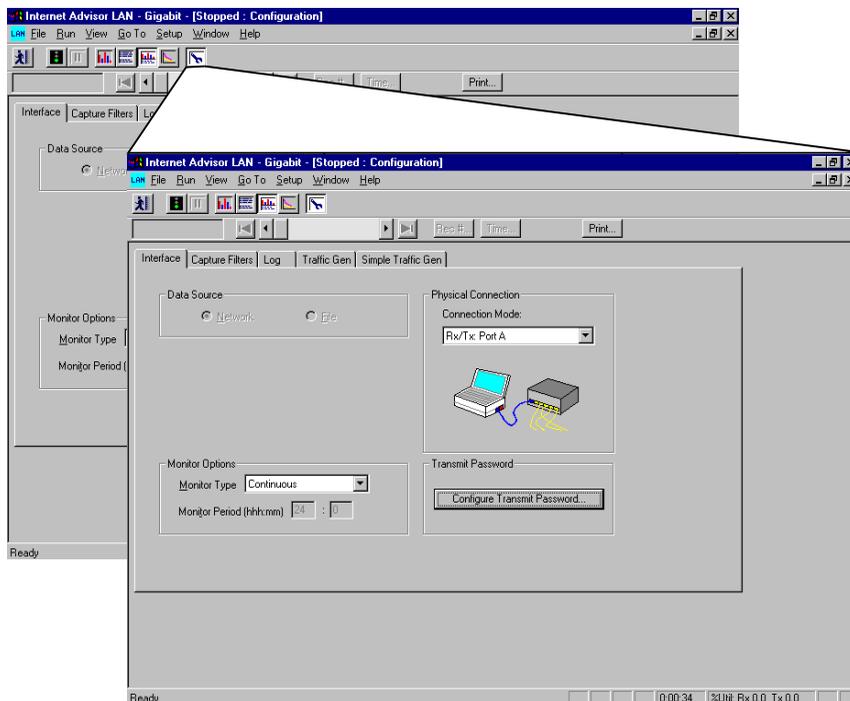
② Look in the online help for the Rx/Tx: Port A connection diagram. This is the type of connection to use for this test.



③ Connect the Gigabit Ethernet Advisor to the network.

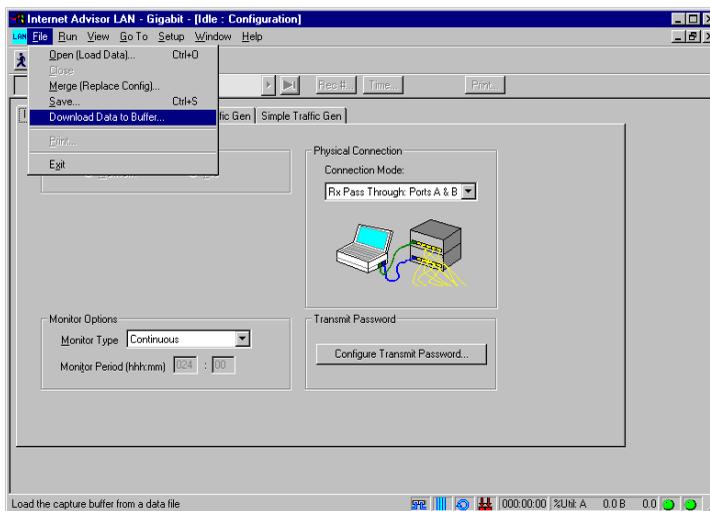
Editing and Replaying Captured Frames to Verify Network Operations

- ④ Configure the Gigabit Ethernet Advisor.



- ⑤ Download the file - My_Sample_data.dat to the to the buffer.

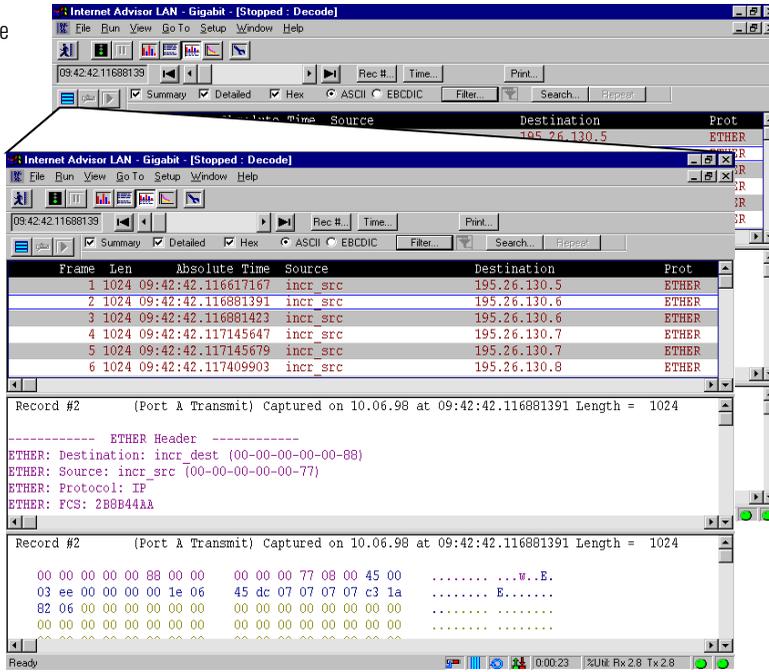
You can find this file in the C:\Advisor\GELan\Data directory if you performed all of the steps in the previous sample test.



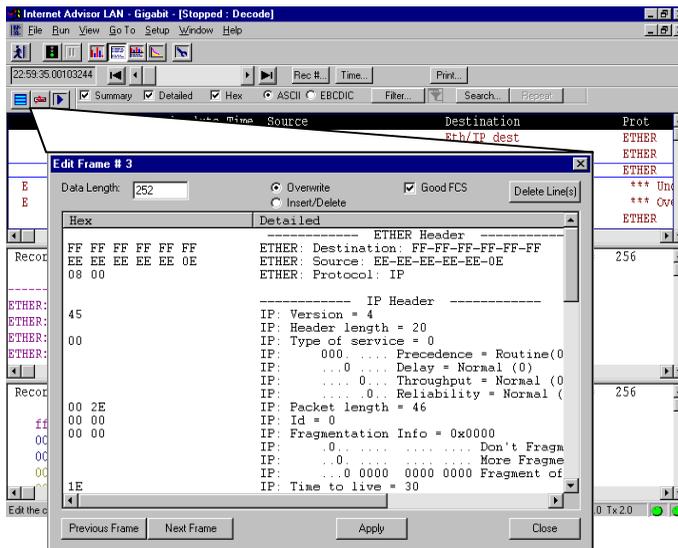
Sample Tests

Editing and Replaying Captured Frames to Verify Network Operations

⑥ Select the Decode Port.

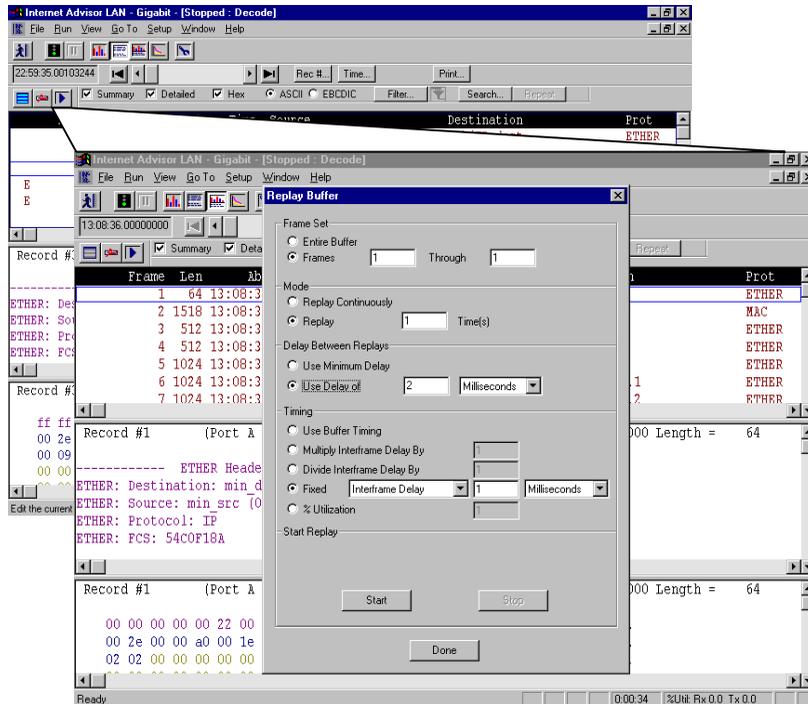


⑦ Edit frames on the Port A transmit side.



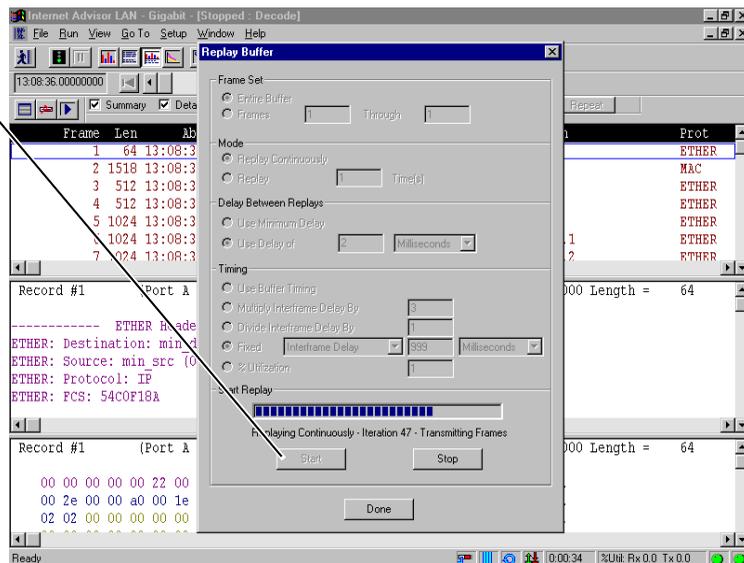
See the online help for more information about editing frames.

8 Set up the replay parameters you want to use.



See the online help for more information about replay parameters.

9 Replay (send) these frames out on the network.



Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements

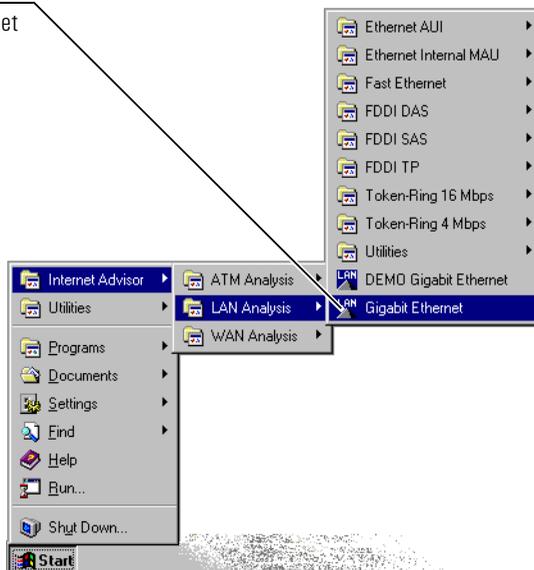
The Benchmarks measurement has been designed to help network equipment manufacturers run repeatable, defined, standardized tests while developing or modifying their equipment.

This example illustrates how you can use the Gigabit Ethernet Advisor to automatically run the RFC1944 tests on a single piece of equipment such as a bridge or router. Some conclusions you want from a measurement like this might include:

- check for connectivity
- determine the maximum throughput (in frames/sec) for a given device
- measure the time for particular sized frames to go through a device
- look at the percentage of frames lost during a certain amount of time

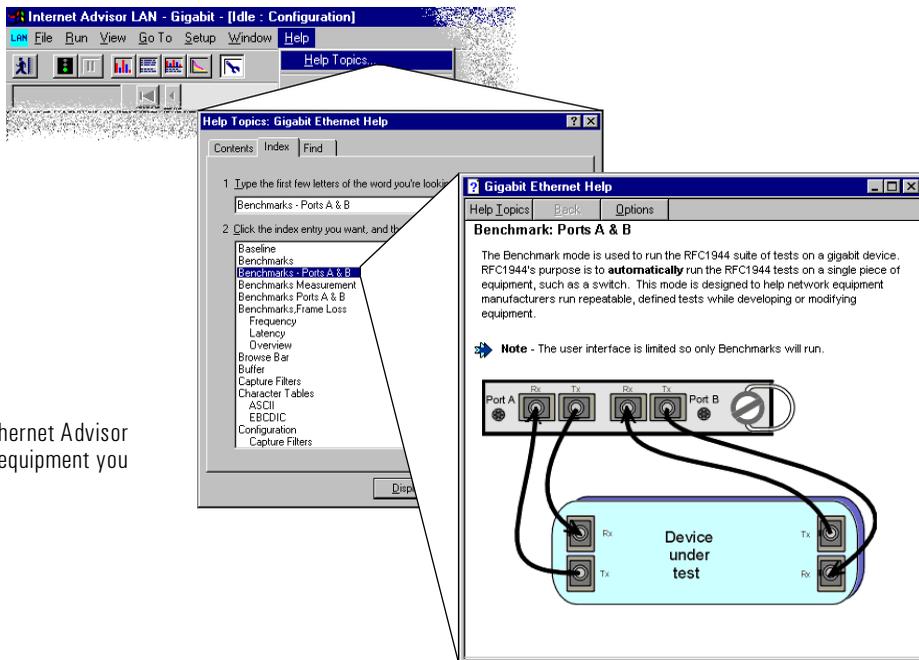
To begin, you need to have a Gigabit Ethernet Advisor (and have it plugged in), gone to the device you want to test, have the necessary cables, and turned the Advisor on.

① Start the Gigabit Ethernet application.

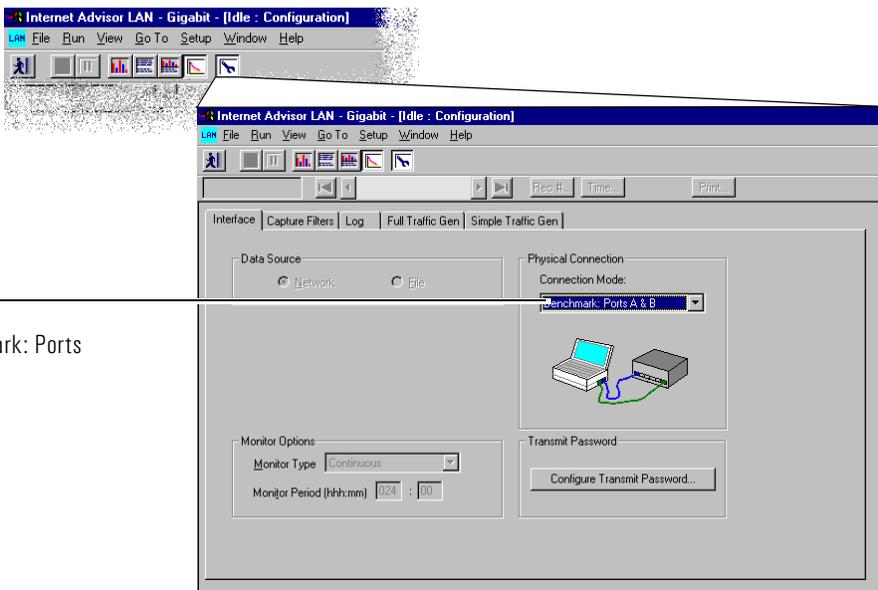


Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements

- Look in the online help for the Benchmarks: Ports A & B connection.



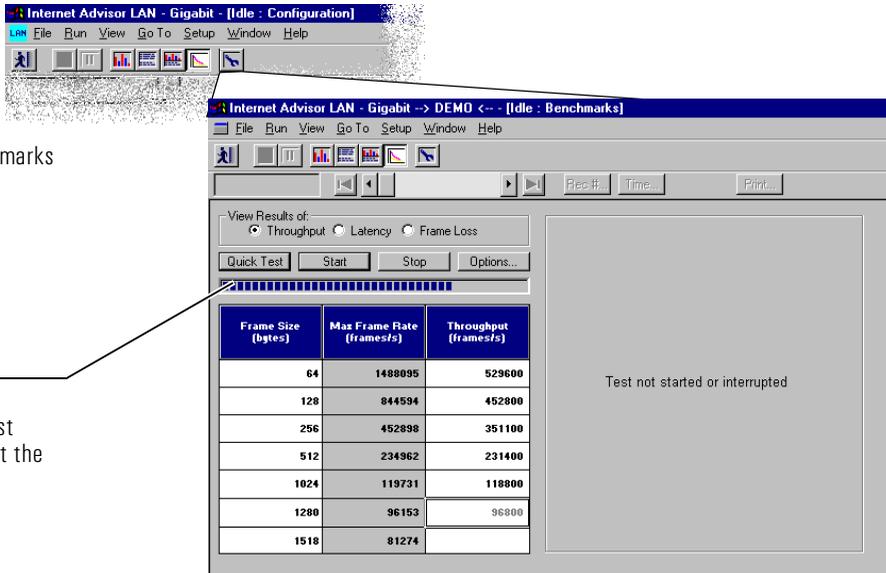
- Connect the Gigabit Ethernet Advisor to the network and/or equipment you want to verify.



- Configure the physical connection to Benchmark: Ports A & B.

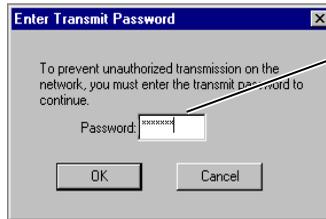
Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements

⑤ Open the Benchmarks measurement.



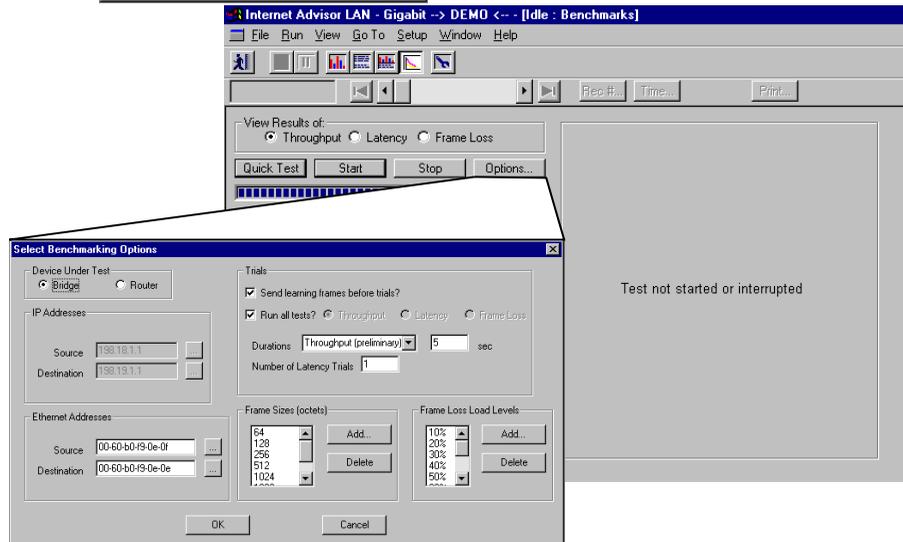
⑥ Perform a fast connectivity test before you start the full Benchmark measurement.

⑦ Type in the password - advisor - and select OK to continue. (See the online help for more information about passwords.)



The Advisor prompts you to enter a password before transmitting data on the network.

⑧ The Options menu is where you change any of the test parameters.

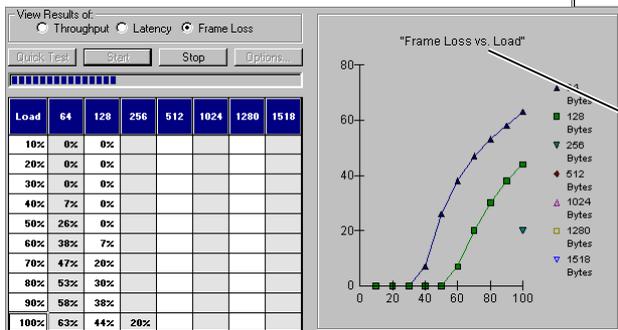
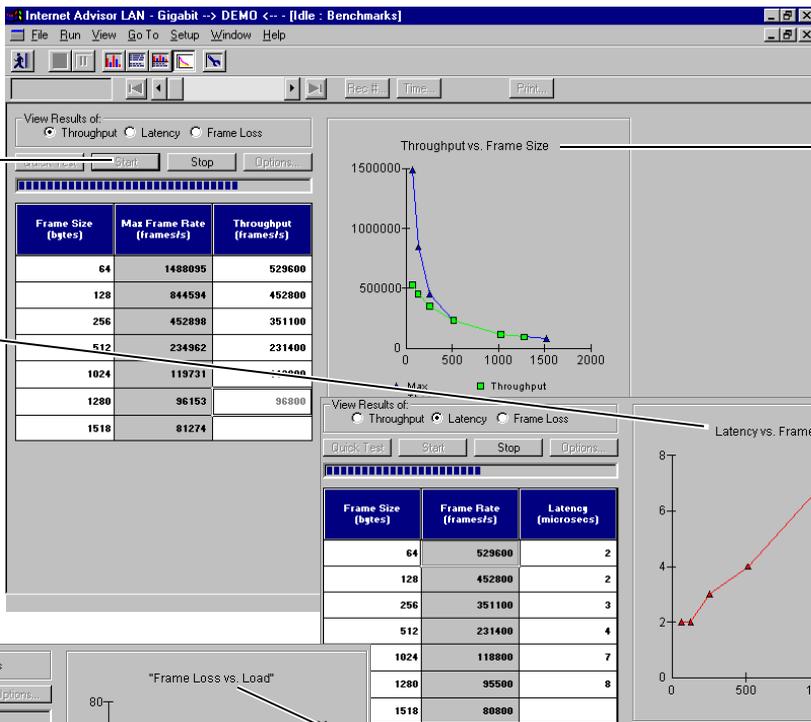


Verifying a new Bridge is operating up to RFC1944 Standards using the Benchmark Measurements

9 Start the Benchmarks measurement.

The Latency tests show a chart of the frame transmit time determined at pre-set frame sizes and are calculated using the throughput values measured by the Throughput tests.

Look at the measured throughput versus the various frame sizes.



The Frame Loss tests show a chart of the frame loss determined at pre-set frame sizes and traffic loads as specified by RFC1944.

Sample Tests

**Verifying a new Bridge is operating up to RFC1944 Standards using the
Benchmark Measurements**

A

Declaration of Conformity

Declaration of Conformity

DECLARATION OF CONFORMITY	
according to ISO/IEC Guide 22 and EN 45014	
Manufacturer's Name:	Hewlett-Packard Co.
Manufacturer's Address:	Network Systems Test Division 5070 Centennial Boulevard Colorado Springs, Colorado 80919
declares that the product	
Product Name:	Gigabit Ethernet interface undercradle for Internet Advisor LAN
Model Number(s):	HP J2901A
Product Option(s):	001, 1A3, 250, 8ZE
conforms to the following Product Specifications:	
Safety:	EN 61010-1:1993 / IEC 1010-1:1990 + A1+ A2
EMC:	EN 55011:1991 / CISPR 11:1990 (Group 1, Class A) ¹ EN 50082-1:1992 IEC 801-2:1991 4 kV CD, 8 kV AD IEC 801-3:1984 3 V/m IEC 801-4:1988 0.5 kV Signal Lines, 1 kV Power Lines
Supplementary Information:	
The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE marking accordingly.	
¹ The product was tested in a typical configuration.	
Colorado Springs, CO 12 March 1998	 _____ Bob Eaton / Quality Manager (acting)
European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ / Standards Europe, Herrenberger Strasse 130, D-71034 Boeblingen, Germany (FAX +49-7031-14-3143)	

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