Agilent RouterTester

# IP Performance Test Software

E7850A

Technical Datasheet

The RouterTester IP Performance Test Software harnesses the wirespeed packet generation and analysis capabilities of RouterTester test modules and creates realistic Internet-scale traffic patterns.

Agilent Technologies

## Key Features

- **Simultaneous IPv6 and IPv4 generation and analysis capabilities test dual stack routers**
- **Complex, Internet-scale traffic simulations that generate realistic traffic scenarios**
- **Multi-stream traffic stresses router switching, queuing and prioritization mechanisms**
- **Simple, partial and full mesh traffic patterns fully stress router switching fabrics and queues**
- **Over 200,000 IP source/destination address combinations per port stress routing table lookup algorithms**
- **Ability to specify source and destination MAC addresses on Ethernet interfaces**
- **Real-time, per stream throughput, latency and packet loss measurements measure router performance**
- **Easy to use GUI quickly configures physical interfaces and routing protocols**
- **Tcl/Tk Application Programming Interface speeds the creation of custom test scenarios**

## Product Overview

### Internet-Scale IP Traffic Generation and Analysis

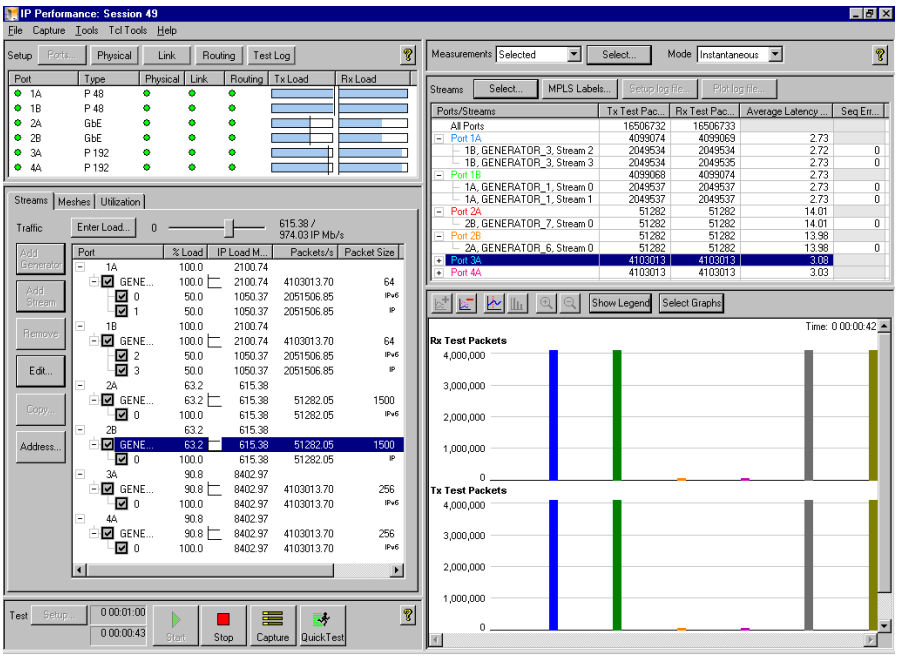
The Agilent Technologies RouterTester provides Internet-scale testing by generating many streams of IPv4 and IPv6 traffic from many simulated networks. Typical metrics such as packet latency, loss and throughput are concurrently analyzed on multiple streams in real-time to determine the true performance of a gigabit or terabit router.

The RouterTester IP Performance Test Software harnesses the wirespeed packet generation and analysis capabilities of RouterTester test modules and creates realistic Internet-scale traffic patterns. These traffic patterns can fully test and stress the routing, switching and Quality of Service (QoS) capabilities of gigabit and terabit routers.

The RouterTester IP Performance Test Software can generate multiple streams of IP packets, each representing a different service class (e.g. IPv4 Differentiated Services using the "Olympic" service model - gold, silver, bronze, best effort) or application type (e.g. voice, video, high/low priority data).

IP Performance Test Software also allows qualification of layer 2 Ethernet swithces by letting the user specify source and destination MAC address pools, as well as 802.1 Q VLAN tag id's. Such Qualification could include access control lists (ACL's) and 802.1 p QoS Testing.

The application is controlled by an extremely easy to use GUI - simplifying test configuration and results analysis.




**IP Performance GUI enables transmission of IPv4 and IPv6 traffic streams simultaneously**

## Product Features

The RouterTester IP Performance Test Software provides an array of powerful features for generating realistic Internet-scale traffic and analyzing the impairments introduced by gigabit and terabit routers.

### Complex Internet-scale traffic simulation

The RouterTester IP Performance Test Software creates traffic patterns closely matching those found within the Internet. Traffic profiles can concurrently simulate bursty voice flows, constant data transfers, and high bandwidth, bursty video transmissions.

### Simulate many traffic sources from many networks

Utilizing the simulated networks created by the RouterTester BGP-4 Emulation Software, the IP Performance Test Software generates traffic streams between individual networks or groups of networks - up to 256 streams are supported per port. Each stream assumes a different profile representing a traffic type defined by a traffic pattern (bursty, constant), protocol type, bandwidth utilization and packet length. Each stream can thus correspond to thousands of source/destination address pairs, simulating aggregates of application flows.

### Simple, partial and full mesh traffic patterns

Complex mesh patterns can be designed to fully stress the switching fabric within a router. A simple mesh transmits single streams of IP packets through pairs of ports on a router. A partial mesh transmits several streams from one port to a number of other ports. A fully meshed traffic pattern transmits streams from every port to every other port - the most rigorous test of a router's switching fabric possible!

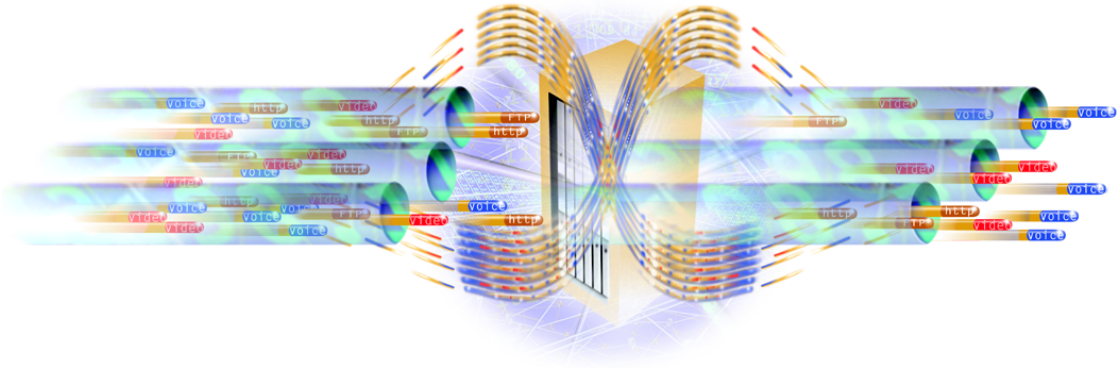
### Multi-stream, real-time traffic analysis

Every stream is analyzed to gather the metrics of router performance - packet latency, packet loss and throughput.

The measurements from multiple streams are displayed simultaneously in order to compare measurements between them. For example, the effects of router congestion on high and low priority traffic can be examined.

### Easy to use graphical user interface

A single dialog displays the complete status of the router test system - physical/link layer status and alarms are highlighted, traffic stream definitions are displayed, and statistics are displayed in real time.



RouterTester IP Performance Test Software generates and analyzes many streams of realistic traffic, in real-time.

The configuration of the RouterTester is easily saved and restored to restore complex network and traffic simulations.

## Tcl/Tk application programming interface

The Tcl (Tool Command Language) based API enables the user to create automated test sequences or pre-defined test configurations, and to integrate RouterTester with other instruments. Tcl scripts can run on the RouterTester System Controller or can run on a remote PC or Unix workstation attached to the RouterTester System Controller via a TCP/IP connection.

## An integrated test system for gigabit/terabit router performance verification

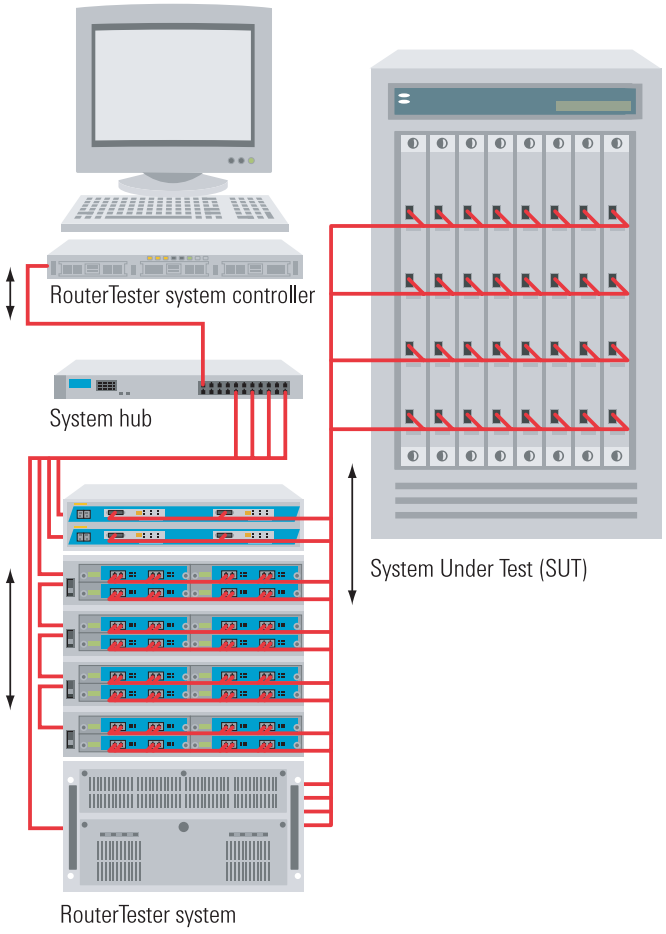
Combining Internet-scale traffic simulations and meshes, along with real-time, multi-stream traffic analysis, RouterTester reveals the performance of gigabit and terabit routers.

## Online Help

An extensive online help system provides complete descriptions and detailed usage instructions for every component of RouterTester. Dialog-level context-sensitive help provides rapid access to the relevant sections of the online help.

A technology reference section provides a complete library of background information pertaining to gigabit and terabit router performance testing.

**The RouterTester system controller manages test modules**



# Technical Specifications

## Traffic Generation

### Traffic Modeling

**Traffic classes**

- A traffic class consists of:
  - A packet definition (IP, TCP/IP or UDP/IP fields) plus packet length
  - A traffic distribution (constant or burst)
  - An indication of the number of IP source/destination address pairs
  - A load (expressed in Mb/s or packets/s)
- Each port on a test module can support up to 15 different traffic classes

**Traffic streams**

- A traffic stream defines a pair of test ports between which packets of the same traffic class flow
- Many streams can use the same traffic class
- Each port on a test module can support up to 256 different streams
- A stream can support up to 65,536 source/destination address pairs

**Traffic meshes**

A traffic mesh provides a convenient method for specifying a large number of traffic streams of the same traffic class

A traffic mesh defines a set of ports between which packets of the same traffic class are delivered

A traffic mesh can be:

- A single source/destination test module port pair
- A partially meshed configuration, wherein a set of source ports transmit to another set of destination ports (unidirectional or bi-directional)
- A fully meshed configuration, wherein all ports in a set transmit to every other port in the set

## Packet Definitions

A packet definition is included within each traffic class. The GUI provides an easy means of editing the relevant fields within IP, TCP or UDP packets.

### Packet Errors

Each packet can be tagged to indicate whether it should be sent with an HDLC error (when sent over a Packet over SONET/SDH interface using PPP/HDLC encapsulation).

**IPv4 Packet Fields**

| Field | Permitted Values |
|---|---|
| Version | 0b0100 (Version 4) |
| Internet Header Length | Automatically calculated |
| Type of Service / Differentiated Services Codepoint | User defined, 0 - 0xFF, Default 0x00 |
| Total Length | Automatically calculated |
| Identification | Automatically calculated |
| Flags (DF, MF Reserved) | Set to 0b000, Fragments not supported |
| Fragment Offset | Set to 0 |
| Time To Live | User defined, 0 to 255, Default 64 |
| Protocol | User defined, 0 to 255, Default 0<br>Automatically set if UDP or TCP packet is selected |
| Header Checksum | Automatically calculated |
| Source Address | Automatically assigned, based on simulated network and stream configuration |
| Destination Address | Automatically assigned, based on simulated network and stream configuration |
| Options | User defined, editable as hex octets with default values of 0x00 |
| Payload | User defined, the user can edit up to 64 octets of the payload directly and specify a fill pattern for the remainder, or indicate that the payload contains a TCP or UDP packet |

**IPv6 Packet Fields**

| Field | Permitted values |
|---|---|
| Version | User defined 0 to 15, Default 6(Ver 6) |
| Traffic Class | User defined, 0 to 255, Default 0 |
| Flow Label | User defined, 0 to 1048575, Default 0 |
| Payload Length | Automatically calculated, Default 0, can also be user defined |
| Next Header | User defined, Default 59 |
| Hop Limit | User defined, 0-255, Default 64 |
| Source Address | Automatically assigned, based on simulated network and stream configuration |
| Destination Address | Automatically assigned, based on simulated network and stream configuration |
| Payload | User defined, the user can edit up to 64 octets of the payload directly and specify a full pattern for the remainder |

**TCP Packet Fields**

| Field | Permitted Values |
|---|---|
| Source Port | User defined, 0 - 65535 |
| Destination Port | User defined, 0 - 65535 |
| Sequence Number | User defined, 32 bit field |
| Acknowledgment Number | User defined, 32 bit field |
| Header Length | Set to 5 |
| Reserved | User defined, 0 - 63 |
| Code Bits | User defined, 0 - 63 |
| Window | User defined, 0 - 65535 |
| TCP Checksum | Automatically calculated or user editable |
| Urgent Pointer | User defined, 0 - 65535 |
| Options | No TCP options supported |
| Pad | No pad required |
| Payload | User defined, the user can edit up to 64 octets of the payload directly, and specify a fill pattern for the remainder |

**UDP Packet Fields**

| Field | Permitted Values |
|---|---|
| Source Port | User defined, 0 - 65535 |
| Destination Port | User defined, 0 - 65535 |
| Message Length | Automatically calculated |
| UDP Checksum | Automatically calculated or user editable |
| Payload | User defined, the user can edit up to 64 octets of the payload directly, and specify a fill pattern for the remainder |

## Traffic Analysis

Traffic measurements are based on the test module measurement system.

**IP Transmit Statistics**

| Statistic | Definition | Resolution |
|---|---|---|
| IP packets Transmitted | • Count of IPv4 datagrams transmitted | • 1 datagram |
| IPv6 packets Transmitted | • Count of IPv6 packets transmitted | • 1 packet |
| IP Octets Transmitted | • Count of IPv4 octets transmitted including the entire IPv4 datagram (Header, Options and Payload) | • 1 octet |
| IPv6 Octets Transmitted | • Count of IPv6 octets transmitted including the entire IPv6 datagram (Header and Payload) | • 1 octet |

**IP Receive Statistics**

| Statistic | Definition | Resolution |
|---|---|---|
| IP packets Received | • Count of IPv4 datagrams received | • 1 datagram |
| IPv6 Datagrams Received | • Count of IPv6 packets received | • 1 packet |
| IP Octets Received | • Count of IPv4 octets received including the entire IPv4 datagram (Header, Options and Payload) | • 1 octet |
| IPv6 Octets Received | • Count of IPv6 octets received including the entire IPv6 datagram (Header and Payload) | • 1 octet |
| IP Header Checksum Errors | • Count of datagrams received with an invalid IPv4 Header checksum | • 1 datagram |
| Fragmented IP Datagrams | • Number of valid IPv4 datagrams received which have the more fragments bit set and a fragment offset of zero. This count is intended to indicate that fragmentation is occurring in the test configuration | • 1 datagram |
| TCP/UDP Checksum Errors | • Count of TCP or UDP packets received with an invalid TCP or UDP checksum. This is valid for IPv4 datagrams only | • 1 packet |

**Per Port Transmit Statistics**

Valid IPv4 and IPv6 packets containing an instrumented payload are included in the transmit stream statistics.

| Statistic | Definition | Resolution |
|---|---|---|
| Total Packets Transmitted | • Count of data packets transmitted | • 1 packet |
| Total Octets Transmitted | • Count of octets transmitted in transmitted data packets | • 1 octet |

**Per Port Receive Statistics**

Valid IPv4 and IPv6 packets containing an instrumented payload are included in the receive stream statistics.

| Statistic | Definition | Resolution |
|---|---|---|
| Total Packets Received | • Count of data packets received containing a valid test payload | • 1 packet |
| Total Octets Received | • Count of octets in data packets received containing a valid test payload including the IP header and payload | • 1 octet |
| Misdirected packets | • Count of unicast IPv4 packets with a single expected destination port, but received at a different port | • 1 packet |
| Minimum Latency | • The minimum latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Maximum Latency | • The maximum latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Average Latency | • The average latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Packets Expected | • Count of IPv4 data packets sent from other test ports addressed to this port | • 1 packet |
| Packets Not Received | • Total Packets Expected - (Total Packets Received - Misdirected Packets) | • 1 packet |

**Per Stream Transmit Statistics**

A stream is classified as an IPv4 or an IPv6 stream depending on whether it contains IPv4 or IPv6 packets.

| Statistic | Definition | Resolution |
|---|---|---|
| Packets Transmitted | • Count of packets transmitted on the particular stream | • 1 packet |
| Octets Transmitted | • Count of octets transmitted on the particular stream including the IP header and payload | • 1 octet |

**Per Stream Receive Statistics**

Statistics can be displayed simultaneously on a number of streams per port. A stream is classified as an IPv4 or an IPv6 stream depending on whether it contains IPv4 or IPv6 packets.

| Statistic | Definition | Resolution |
|---|---|---|
| Packets Received | • Count of packets received on the particular stream | • 1 packet |
| Octets Received | • Count of octets received on the particular stream including the IP header and payload | • 1 octet |
| Minimum Latency | • The minimum latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Maximum Latency | • The maximum latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Average Latency | • The average latency measured during the measurement/sampling interval for all IP data packets received containing a valid test payload | • 10 ns |
| Packets Expected | • Count of IP data packets sent from other test ports addressed to this port | • 1 packet |
| Packets Not received | • Packets Expected - (Packets Received - Misdirected packets) | • 1 packet |
| Sequence Errors | • The count of IP packets whose sequence number is not the successor to the sequence number of the previously received packet on this stream | • 1 packet |
| Severe Sequence Errors | • The count of IP packets whose sequence number varies from the sequence number expected by more than one. These errors will also be included in the Sequence Error count above | • 1 packet |
| Misordered Packets | • The count of IP Packets that hace been misordered (received or transmitted in the wrong order); lost packets are ignored | |

**ICMP Echo Request (ping)**

Integrated within the GUI is a facility for sending ICMP Echo Request packets (pings), and displaying round trip response times.

| | |
|---|---|
| Ping frequency | • The number of pings per burst can be configured (1 to 20), as well as the time interval between requests (1 to 10 s) can be specified |
| Ping results | • The minimum, average and maximum round trip response times are reported for all aggregate valid responses<br>• User configurable timeout period (default 10 s)<br>• Results are accurate to 1 ms |
| Response | • All ports will respond to ICMP Echo Request packets sent to a valid IP address represented on the port |
| Duration | • Pings can be sent as a burst (up to 20) or continuously |

## Application Programming Interface

An Application Programming Interface (API) is provided through the Tool Command Language (Tcl). The API is intended to automate configuration tasks, create repeatable test sequences, or to integrate the test system into a larger test system. The scripting language is Tcl/Tk. Tcl/Tk version 8.2 comes bundled with the RouterTester IP Performance Test Application.

An API client may run directly on the RouterTester System Controller, or may run on any other PC or UNIX workstation connected to the System Controller via a TCP/IP connection. API clients communicate with the System Controller via an included package of Tcl commands.

All functions available through the GUI are available via the API. Any changes made through the API are automatically reflected on the GUI.

## Applicable Standards

| | |
|---|---|
| IP packet format | • IP Packet encoding, addressing and processing according to IETF RFC 791, Internet Protocol |
| IPv6 packet format | • IPv6 Packet encoding, addressing and processing according to IETF RFC 2460, Internet Protocol Version 6 |
| DiffServ field | • Differentiated Services codepoint field according to IETF RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 Header |
| ICMP | • According to IETF RFC 792, Internet Control Message Protocol |
| TCP | • Field encoding according to IETF RFC 793, Transmission Control Protocol |
| UDP | • Field encoding according to IETF RFC 768, User Datagram Protocol |

## Agilent's RouterTester system

Agilent's RouterTester system offers a powerful and versatile test platform to address the evolving test needs of metro/edge platforms, core routers and optical switches. RouterTester provides Network Equipment Manufacturers and Service Providers with the industry's leading tools for wire speed, multiport traffic generation and performance analysis of today's networking devices.

## Warranty and Support

**Hardware Warranty**

Agilent warrants all RouterTester and QA Robot hardware against defects in materials and workmanship for a period of 3 years from the date of delivery. Agilent further warrants that the RouterTester and QA Robot hardware will conform to specifications. During the warranty period, Agilent will, at its option, repair or replace the defective hardware. Services provided under this warranty will normally require return of the hardware to Agilent.

**Software Warranty**

Agilent warrants all RouterTester and QA Robot software for a period of 90 days. Agilent warrants that the software will not fail to execute its programming instructions due to defects in materials and workmanship when properly installed and used on the hardware designated by Agilent. This warranty only covers physical defects in the media, whereby the media is replaced at no charge during the warranty period.

**Software Updates**

With the purchase of any new RouterTester system Agilent will provide 1 year of complimentary software updates. At the end of the first year you can enroll into the Software Enhancement Service (SES) for continuing software product enhancements.

**Support**

Technical support is available throughout the support life of the product. Support is available to verify that the equipment works properly, to help with product operation, and to provide basic measurement assistance for the use of the specified capabilities, at no extra cost, upon request.

**Ordering Information**

To order and configure the test system consult your local Agilent field engineer.


**United States:**

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www.agilent.com/comms/RouterTester



Specifications subject to change
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