Agilent RouterTester

# BGP-4 Protocol Software

E7851B

Technical Datasheet

**Agilent's BGP-4 Protocol Software provides realistic Internet-scale routing simulation for comprehensive verification and stressing of routers and networks, including IPv6 and VPNs.**

- Multi-protocol environments
  - IPv6 and VPN-IPv4
- Functional and stress testing
- Packet capture and measurement
- Testing both data and control plane technologies
- Wire speed traffic generation

Agilent Technologies

## Key Features

- Verify BGP/MPLS VPN signaling function
- Advertise IPv6 routes and verify BGP-4+ signaling functions
- Stress and Verify BGP-4 and BGP/MPLS VPN implementations
- Use with OSPF, ISIS and MPLS to emulate a multi-protocol environment
- Dynamically flap routes to simulate network instability
- Emulate BGP-4 environments through an easy to use GUI
- Script powerful customized tests

Additional features available on RouterTester

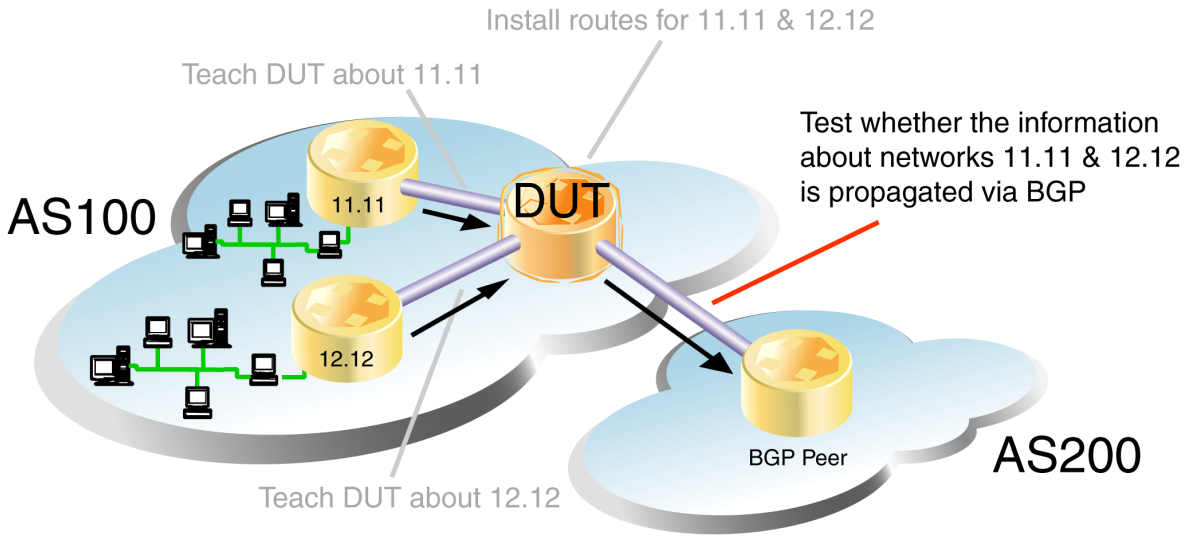
- Determine route convergence times
- Generate wire speed traffic

## Product Overview

The BGP-4 Protocol software provides unprecedented realism to router testing by emulating and measuring the impact of dynamic route changes on the forwarding performance of gigabit and terabit routers. By emulating both internal and external BGP-4 sessions, the BGP-4 Protocol Software builds a realistic network cloud around the router under test. Any number of routes with a flexible range of attributes can be advertised into the router (or network) under test, building immense and complex forwarding tables within these devices.

A typical test scenario is depicted in the figure below.

- The protocol software builds a realistic network cloud around the router under test.
- DUT installs routes into tables and then uses BGP to advertise the new routes to a neighbor.
- IPv6, VPN-IPv4, as well as IPv4 routes are then injected into DUT's IPv6, IPv4 routing and VPN VRF tables.
- The corresponding traffic can then be sent to verify that the DUT is forwarding appropriately.




This autonomous system can consist of one or more internal gateway protocol for example OSPF, ISIS or RIP

A typical BGP-4 Protocol Test Scenario

## Product Features

### Verify BGP/MPLS VPN Signaling Function

The enhanced BGP Protocol Software provides the multi-protocol extensions to BGP, which includes the capability to advertise VPN IPv4 routes, Route Targets and the BGP VPN labels and verify the receipt of this information from the device being tested.

### Advertise IPv6 routes and verify BGP4+ signaling function

The multi-protocol extensions to BGP include the capability to advertise, withdraw and flap IPv6 routes. I-BGP4+ and E-BGP4+ are running over an IPv4 protocol stack, injecting IPv6 routes to the DUT.

### Stress and Verify BGP-4 and BGP/MPLS VPN Implementations

Complete coverage of the applicable IETF RFCs provides confidence that your implementation works properly. Stress the implementation by simulating intense periods of route updates, withdrawals and route flaps. Clear pass and fail verdicts verify correct implementation and DUT performance.

### Emulate real-world multi-protocol environments

By offering a comprehensive range of control protocols, the QA Robot and Router Tester enables you to simulate many protocols simultaneously on single or multiple ports. MPLS Traffic Extensions are included to allow full multi-protocol routing and switching across hundreds of nodes, fully simulating a multi-protocol environment.

### Dynamically flap routes to simulate network instabilities

A single IPv4, IPv6, or VPN IPv4 route or a pool of routes can be advertised or withdrawn continuously to simulate network instabilities, rigorously stressing the ability of a router to forward packets during route changes.

### Easy to use Graphical User Interface

The graphical user interface provides simple point and click features to dynamically define your sessions and generate routes and peers, quickly emulating a BGP-4 environment.

### Flexible, powerful scripting

Automated scripts are quickly created using the Tcl/Tk and QBOL scripting environments. With only a few lines of code, thousands of networks are easily advertised from simulated peers on any or all ports.

### Online Help

An extensive online help system provides complete descriptions and detailed usage instructions. 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.

## Additional Capabilities of the RouterTester

The RouterTester expands the test capabilities of the QA Robot by providing the wire-speed traffic generation required when measuring the forwarding performance and functionality of IP routers.

### Determine router convergence times

Precisely measure the ability of a router to withstand route flap "storms" as well as the time it takes for a router to converge new routes. How much user data is lost when a route changes? RouterTester enables you to benchmark a network or router with realistic 'real-life' tests to gauge its performance when deployed in the real world.

### Generate wire speed traffic

With RouterTester's wire speed traffic capability you can generate a complex,

real-world mix of traffic types (voice, video, and data) lengths and profiles (burst vs. constant), easily determining the impact of mixtures on router performance.

## Related Product Information

The BGP-4 Protocol Software is also included with the E7862A, the IP Routing Protocol Test Software. This bundled software package includes BGP-4, IS-IS, OSPF and RIP software packages.

## Applicable Standards

- BGP/MPLS VPNs draft-ietf-ppvpn-rfc2547bis-xx
- A Border Gateway Protocol (BGP-4) draft-ietf-idr-bgp4-xx
- Multiprotocol Extensions for BGP-4 - RFC 2858
- Carrying Label Information in BGP-4 RFC 3107
- BGP Extended Communities Attribute draft-ietf-idr-bgp-ext-communities-x
- BGP Route Reflections Message encoding and decoding according to RFC 2796, BGP Route Reflection: An alternative to full mesh IBGP (supersedes IETF RFC 1966)
- BGP Confederations Message encoding and decoding according to IETF RFC 3065, Autonomous System Confederations for BGP BPG Communities Message encoding and decoding according to IETF RFC 1997, BGP Communities Attribute

## Acronyms

| | |
|---|---|
| AFI | Address Family Identifier |
| BGP-4 | Border Gateway Protocol, Version 4 |
| CIDR | Classless Internet Domain Routing |
| CPU | Central Processing Unit |
| DUT | Device Under Test |
| HTTP | HyperText Transfer Protocol |
| IETF | Internet Engineering Task Force |
| IP | Internet Protocol |
| IPv4 | Internet Protocol, Version 4 |
| IS-IS | Intermediate System-Intermediate System |
| MPLS | Multiprotocol Label Switching |
| NLRI | Network Layer Reachability Information |
| OSPF | Open Shortest Path First |
| RFC | Request for Comment |
| SAFI | Subsequent Address Family Identifier |
| TCP | Transmission Control Protocol |
| UDP | User Datagram Protocol |

# Technical Specifications

This section contains the features of the BGP-4 Protocol Software that are accessible using the GUI and Tcl/TK scripting environment. Simple point and click actions enable you to dynamically change the environment being tested. Also, for our power users we have made these and other features accessible through the QBOL scripting language

## Emulation

| | QA Robot | RouterTester |
|---|---|---|
| Peering Capacity* | 2500 per CPU* | 100 per port |
| Peering Sessions | IBGP, EBGP & Multihop | |
| Messages Supported | Open | |
| | Update | |
| | Notification | |
| | KeepAlive | |

## Connection Initiation

Customize connection initiation with the following control parameters. The BGP-4 connection (using an OPEN message) supports both Active and Passive connections.

| | QA Robot | RouterTester |
|---|---|---|
| BGP Identifier | <Any IP address> | |
| AS Number Range | 0 to 65,535 | |
| Hold Timer | 0 to 65,535 seconds | 0 and 3 to 65,535 seconds |
| Connection Retry | 10 to 200 seconds | 10 to 300 Seconds |
| Route Update | 0 to the maximum number of NLRI routes up to the maximum UPDATE message size of 4,096 bytes | |
| Authentication Code | 0 to 255 | |
| Authentication Data | <Variable length data> | |
| Inter Update Delay | 1 - 10,000 ms | |
| KEEPALIVE Timer Value | User defined in ms units between 0 and 65,535 seconds | |

## Route Generation

An arbitrary number of routes can be updated for each BGP-4 peer. The entire IPV4 address space may be used. Each UPDATE message may contain and arbitrary number of NLRIs or withdrawn routes, up to a maximum UPDATE message size of 4,096 bytes.

| | QA Robot | RouterTester |
|---|---|---|
| Maximum Update Message Size | 4,096 bytes | |
| Prefix Range | 2_32 | |
| Attributes | AS_SEQUENCE | |
| | ORIGIN | |
| | NEXT_HOP | |
| | MULTI_EXIT_DISC | |
| | LOCAL_PREF | |
| | COMMUNITIES | |
| | CONFED_SET | |
| | CONFED_SEQUENCE | |
| | AS_SET | |

## Notification

Configure the following Notification Message Fields.

| | QA Robot | RouterTester |
|---|---|---|
| Error Code | User-defined, 0-255 | |
| Error Subcode | User-defined, 0-255 | |

## Route Flapping

Configure your route flapping tests. Advertise and withdraw information dynamically to measure the performance and verify ability to forward packets during network changes.

| | QA Robot | RouterTester |
|---|---|---|
| Advertise to withdraw delay | 1 - 120 seconds | |
| Withdraw to advertise delay | 1 ms to 120 seconds | |
| Inter-Update delay | 1 ms to 120 seconds | 0 to 10,000ms |

## Available through Scripting

| | QA Robot | RouterTester |
|---|---|---|
| Attributes | Atomic_Aggregate<br>Aggregator<br>Cluster_List<br>Originator_ID<br>MPLS | |
| Withdrawn Route Length | Set Automatically | |
| Withdrawn Routes | User defined from unfeasible pool or CIDR specification | |
| Total Path Attributes Length | Set Automatically | |
| User-defined Attributes | User-defined <User Attribute Flags>, <User Attribute Code>,<User Value>, <Data> | |

## Expect Commands

Expect commands are programmable using the QBOL scripting language. Expect commands can be issued to monitor for specific BGP-4 events

| | QA Robot | RouterTester |
|---|---|---|
| NLRI and NLRI POOL | Configure to expect updates of specific NLRIs or a pool of NLRIs | |
| NOTIFY | Configure to expect updates of specific NOTIFICATION messages | |
| PATH_ATTRIBUTES | Configure to expect updates of specific path attributes defined in supported standards | |
| UNFEASIBLE_ROUTES and UNFEASIBLE_POOL | Configure to expect updates of specific route withdrawals or a pool of withdrawn routes | |

## Capture and Decode

Expect commands are programmable using the QBOL scripting language. These commands allow you to verify that your protocol is reacting as predicted.

| | QA Robot | RouterTester |
|---|---|---|
| Capture Capacity | BGP-4 transactions can be captured. Any number of BGP-4 connections can be configured for capture. The number of messages that can be captured is limited to hard disc capacity. | |
| Decodes | All fields on all supported BGP-4 standards are decoded. Decoding is provided at the BGP-4 layer | |

## Statistics

Statistics are collected over the duration of the BGP-4 peer session. These statistics are updated as packets are transmitted and received. The statistics are not submect to the sampling interval and measurement interval processing associated with the real-time forwarding statistics. Numerical, graphical and snapshot save-to-file representations are available.

| | QA Robot | RouterTester |
|---|---|---|
| State of Connections | Up/Down | - |
| Notification Received | - | Number of Notification messages received |
| NLRI Received | Number of NLRI messages received | |
| NLRI Transmitted | Number of NLRI messages transmitted | |
| OPEN Received | Number of open messages received | |
| KEEPALIVE Received | Number of KEEPALIVE messages received | |
| UPDATE Received | Number of Update messages received | |
| OPEN Transmitted | Number of OPEN messages transmitted | |
| KEEPALIVE Transmitted | Number of KEEPALIVE messages transmitted | |
| UPDATE Transmitted | Number of UPDATE messages transmitted | |
| NOTIFICATION Transmitted | Number of NOTIFICATION messages transmitted | |
| Flow Control Event | Number of times TCP flow control occurred while attempting to send update messages | - |
| Total Flow Time | Duration in ms the TCP window was closed while attempting to send update messages | - |
| Unfeasible (withdrawn routes) received | Number of Unfeasible routes received | |
| Unfeasible (withdrawn routes) transmitted | Number of Unfeasible routes transmitted | |
| Duration | - | Length of time the connection has been up |
| IP header Checksum | - | The number of IP packets that contained an IP header checksum error |
| UDP/TCP Checksum errors | - | The number of received IP packets that encapsulated a TCP or UDP packet that contained a TCP or UDP header checksum |
| Fragmentation | - | The number of received packets that were fragmented |

This page intentionally left blank.

## 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:

Agilent Technologies
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
1-800-452-4844

Canada:

Agilent Technologies Canada Inc.
2660 Matheson Blvd. E
Mississauga, Ontario
L4W 5M2
1-877-894-4414

Europe:

Agilent Technologies
European Marketing Organisation
P.O. Box 999
1180 AZ Amstelveen
The Netherlands
(31 20) 547-2323
United Kingdom
07004 666666

Japan:

Agilent Technologies Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi,
Tokyo 192-8510, Japan
Tel: (81) 426-56-7832
Fax: (81) 426-56-7840

Latin America:

Agilent Technologies
Latin American Region Headquarters
5200 Blue Lagoon Drive, Suite #950
Miami, Florida 33126
U.S.A.
Tel: (305) 269-7500
Fax: (305) 267-4286

Asia Pacific:

Agilent Technologies
19/F, Cityplaza One, 1111 King's Road,
Taikoo Shing, Hong Kong, SAR
Tel: (852) 3197-7777
Fax: (852) 2506-9233

Australia/New Zealand:

Agilent Technologies Australia Pty Ltd
347 Burwood Highway
Forest Hill, Victoria 3131
Tel: 1-800-629-485 (Australia)
Fax: (61-3) 9272-0749
Tel: 0-800-738-378 (New Zealand)
Fax: (64-4) 802-6881


www.agilent.com/comms/RouterTester



Specifications subject to change
December 13, 2002.
5980-1422E, Rev K


Agilent Technologies