

TestCenter™

MPLS Technologies Base Package

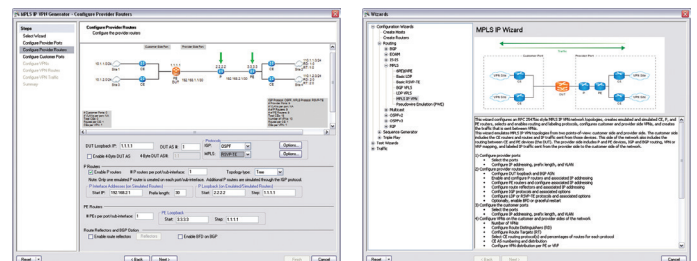
The MPLS Base Package enables Network Equipment Manufacturers, Service Providers and large Enterprises to quickly evaluate and troubleshoot MPLS and VPLS functionality. This includes performance and scalability of any MPLS-enabled LSR device or network with traffic engineering or VPN technologies.

Applications

- Choose from more than 25 emulated MPLS topologies, including: MPLS LDP LSP, Martini or Kompella-style PWE3, LDP or BGP Signaled VPLS, BGP based auto discovered VPLS, RSVP-TE (transit, ingress, or egress) RSVP-TE with FRR (facility or node failure) MPLS IP VPN, GMPLS, 6PE, 6VPE, GRE-based Rosen MVPN, P2MP-TE (Ingress, transit, bud, branch or leaf topologies), InterAS VPN (Options A-C) and Carrier Supporting Carrier with 11 associated test configuration wizards
- Quickly set up any size MPLS, VPLS or GMPLS network emulation with integrated Access, Routing, or Carrier Ethernet protocols and stateful or state-less Unicast or Multicast Layer- 2, IPv4, or IPv6 traffic with Topology Emulation
- Dynamic MPLS label binding automatically learns label bindings from the device under test (DUT) and binds those labels to stateful or stateless control or data-plane protocols— labels automatically update upon DUT changes MPLS topologies can learn and bind up to 4 million labels
- The MPLS Base package supports testing high availability routing features including Graceful Restart for OSPF, IS-IS and BGP, and can be used with the BFD Base Package for integrated BFD testing

The MPLS Technologies Base Package works with the Unicast Routing Base Package and Multicast Routing Base Package to emulate LDP and RSVP-TE sessions that create realistic MPLS topologies. This works with MPLS-TP Base Package to test IP/ MPLS and MPLS-TP interoperability scenarios. Show the true performance of MPLS LSR devices and upper-layer control-plane protocol by stress testing the routing, label lookup, binding, and forwarding operations under dynamically changing conditions.

Because it is an integrated component of VIAVI TestCenter™, this package works with other TestCenter components to deliver easy, consistent TCL and Perl scripting API and Command Sequencer NoCode automation. The MPLS Technology Base Package can also be combined with Access or Carrier Ethernet Base Packages to provide control-plane over MPLS emulation with stateful or stateless data-plane traffic. Some of these protocols include spanning tree protocol, Ethernet OAM, DiffServ QoS, stateless IPv4/IPv6, DHCP, IGMP/MLD, HTTP, FTP, SIP data-plane traffic.



Features & Benefits

- Emulate any imaginable topology using TestCenter's unique Topology Emulation—quickly build MPLS topologies running broadband access protocols, Carrier Ethernet protocols, or stateful application-layer protocols from a single application interface
- PWE wizard takes the complexity out of single and multisegment PWE emulation testing with FEC128/129, PW status signaling, control word and helps tests any mobile backhaul configuration including pseudo-wire redundancy
- Multicast VPN wizard builds GRE-based Rosen-style VPNs. Including Unicast routing, PIM routing, routes, Multicast groups, GRE encapsulated traffic and optional Unicast labeled traffic
- Point-to-Multipoint TE (P2MP-TE) wizard quickly builds any of the five most common P2MP-TE topologies (ingress, transit, branch, bud or leaf), complete with Unicast routing, routes, RSVP sessions, LSPs, sub-LSPs and RSVP options, including the new SERO object and support for OSPF and IS-IS-TE
- RSVP-TE FRR wizard and emulation helps to test high availability and topology convergence. Options include P2P and P2MP make-before-break feature to test reroute and ERO route optimization
- Quickly configure complex tests that include configuring routers, routing and labeling protocols, routes and label allocation, LSPs and dynamically labeled traffic
- Use out of band signaling mechanisms defined by GMPLS to test negotiation of DWDM wavelengths. This is accomplished using 32 bit generalized MPLS Labels
- Advanced command sequencer with TCL scripts to send SNMP commands, get SNMP data, configure the device under test, run entire test and generate pass/fail results
- Use Command Sequencer Conditional test logic to automate complex test cases without writing any TCL code
- Create large scale tests generating thousands of LSPs, VPNs, pseudowires or tunnels
- Integrated traffic generator and analyzer send and analyze control and data plane traffic from a single application interface in real-time
- Dynamically map and view MPLS label to FEC bindings for up to 3 labels
- Traffic Analyzer supports filtering MPLS traffic based on any field in the header including MPLS labels, Experimental (Exp) bit, or Bottom-of-Stack (S) bit with detailed real-time results
- Dynamic support for generating and processing implicit and explicit-null labels
- Support for discontinuous label assignments and dynamic label rebinding upon configuration changes
- Generate and send labeled traffic and gather statistics

Features & Benefits cont.

- Quickly build traffic patterns through integration with the traffic wizard and analyzer
- Simulate real network conditions and view results on demand at any time during a test without starting and stopping the protocols or traffic with interactive controls
- Use interactive commands to flap (withdraw or age-out, and readvertise) individual routes or route blocks or by route type
- Log the real-time exchange of control-plane messages to test over any media type or encapsulation supported by TestCenter
- Test data-plane outer convergence and network high availability features like BFD and Graceful Restart and monitor the affects of router configurations on traffic and QoS classes in real time
- Test scalability and protocol functionality in the same test by running multiple protocols concurrently on each port

Technical Specifications for MPLS Routing

LDP features

- Hundreds of LDP sessions per port
- Generate thousands of LSPs per port
- LDP wizard to quickly configure MPLS label switched topologies with routers, routing and labeling protocols, routes, LSPs, labels and traffic
- VPLS wizards for LDP and BGP signaled VPLS to quickly configure VPLS topologies with routers, routing and labeling protocols, routes, VCs, hosts, labels and traffic
- Pseudowire Emulation Edge-to-Edge (PWE3) wizard quickly configures PWE3 tests with routing protocols, routes and labeled traffic for single and multi-segment topologies
- MPLS IP VPN wizards to quickly configure MPLS IP VPN, 6VPE or 6PE topologies with routers, routing and labeling protocols, routes, VRFs and labeled traffic
- Interactive configuration and testing configuration wizards for each MPLS test type including:
 - MPLS IP VPN (RFC 2547bis) for IPv4
 - 6VPE or 6PE for IPv6 IP VPN
 - BGP signaled VPLS
 - LDP signaled VPLS
 - PWE3
 - MPLS LDP LSPs and RSVP-TE tunnels that configure the entire test and generate labeled traffic
- Test InterAS VPN options A-C with dynamically labeled traffic and detailed test results
- Graceful Restart signaling for LDP with support for Helper and Restarter modes and configurable Recovery and Reconnect timers

Technical Specifications for MPLS Routing cont.

LDP features cont.

- Integrated with BFD for convergence and scalability testing including:
 - Interactive BFD commands: Admin up or down
 - Stop and resume PDUs
 - Enable or disable demand mode
 - Initiate poll
 - Set diagnostic state and per router BFD results
- Direct and targeted hellos with user specified transport mode
- Downstream unsolicited and downstream on demand LSPs
- Support for generating and receiving implicit and explicit-null labels for IPv4 and IPv6 traffic and user defined label space
- VC encapsulation for Pseudowire Emulation and VPLS LSPs
- Configure Pseudowire LSP values including: IPv4 prefixes, prefix length and IPv4 prefix increment
- Configure VPLS VC LSP values including: starting VC ID, VC ID increment, encapsulation, group ID and MTU
- Support for FEC type 128 and generalized FEC 129
- BGP auto discovery mechanism for LDP based VPLS
- PWE Redundancy and PW status code based on 'draft-ietf-pwe3-redundancy-02' draft. Support for 1:1 or 1:N option with Main, Subordinate and Independent mode
- Flow aware transport of PWE including entropy label generation and Equal Cost Multi Path (ECMP) verification
- Monitor, detect and isolate LSP faults with automatic or on-demand LSP ping and trace route protocol emulation. MPLS OAM tools are fully integrated with MPLS wizards with accurate round trip latency measurements
- Interactive and Command Sequencer events: Start or stop LDP, Establish LDP, Advertise LDP, Stop or Resume Hellos, Stop or Resume Keepalives and Restart Router
- Detailed per-router LDP protocol and state counters including:
 - Router state (not started, up, down, connecting)
 - TX/RX direct hellos
 - TX/RX target hellos
 - LSPs up, LSPs down
 - TX/RX keepalives
 - RX Label requests
 - TX/RX label mapping
 - TX/RX label abort
 - TX/RX label withdraw
 - TX/RX label release
 - TX/RX notification
 - TX/RX notify code (26 codes supported and decoded), prefix/host count and VC route count
- Detailed LDP LSP counters including:
 - Router name
 - Label
 - State (up/down)
 - Type (ingress/egress)
 - Mode (downstream unsolicited or downstream on demand)
 - FEC Info (IPv4 address or VC ID)
 - FEC Type (prefix, host address or Virtual Circuit (VC))

Technical Specifications for MPLS Routing cont.

LDP features cont.

- Per test, port, and router LDP protocol and LSP summaries include:
 - Number of LDP ports per test
 - Number of LDP routers per test
 - Number of active LDP routers per port and test
 - Number of prefix/hosts, number of VC LSPs
 - Summary statistics for the number of LDP routers in the following states: Up, down, open, failed, connected, and graceful restart restarted and helper
- View filter and export FEC to LDP label mappings per router or per stream filter based on FEC type, label source and traffic binding types
- Integrated with BFD for convergence and scalability testing including:
 - Interactive BFD commands: Admin up or down
 - Stop and resume PDUs
 - Enable or disable demand mode
 - Initiate poll
 - Set diagnostic state and per router BFD results
- RSVP graceful restart, helper and restarter modes with configurable restart and recovery timers
- RSVP fast reroute emulation for high availability and topology convergence testing support. Improved RSVP-TE FRR support for one-to-one backup. Detour object and make before break LSP establishment.

RSVP-TE features

- Thousands of RSVP-TE sessions per port
- Integrated support for OSPF-TE and IS-IS-TE
- RSVP-TE tunnel signaling extensions for IS-IS and OSPFv2
- RSVP-TE wizards to quickly configure traffic engineering topologies with routers, routing and labeling protocols, routes, tunnels, labels and traffic
- MPLS IP VPN wizards to quickly configure RFC 2547 or 6VPE/6PE topologies with routers, routing and labeling protocols, routes, VRFs and labeled traffic
- Test InterAS VPN options A-C with RSVP-TE signaling using dynamic label binding
- Test RSVP P2MP make-before-break and verify reroute and ERO optimization operation
- Support for generating and receiving implicit and explicit-null labels for IPv4 and IPv6 traffic and user defined label space
- Route configuration options: Label configuration (including egress label type, transit label behavior, min and max label allocation), BFD and graceful restart configuration options
- GMPLS enhancements: Support for:
 - User configurable Interface ID for each Tunnel (IF_ID_RSVP_HOP object),
 - User configurable Router ID (HOP_TLV_ID object),
 - Support for sending acceptable label set object when requested Ingress label is not available and
 - Support for complete list of encoding and switching types defined by RFC 3471 that are required for DWDM

Technical Specifications for MPLS Routing cont.

RSVP-TE features cont.

RSVP message bundling enhancements:

Support for:

- New bundle mode option—Manual and Observation modes
- New Ack mode for reliable delivery—Immediate and piggyback Ack modes
- LSP configuration path and reservation options:
 - Source/destination IP address
 - Tunnel ID
 - Extended tunnel ID
 - Enable P2MP RSVP tunnel
 - P2MP Identifier, enable ERO compression
 - SubGroup originator ID
 - ERO/SERO objects
 - Make before break
 - Retry algorithm for signaling backup LSP
 - Make before break retry time
 - Multicast group name, session attributes
 - Session name, session attribute options
 - T-Spec
 - Record route
 - Fast reroute options
 - Detour objects
 - Enable generalized label request
 - Enable upstream label object
 - LSP encoding type
 - Switching type
 - Generalized-PID
 - GMPLS parameters
 - Interface ID
 - TE router ID
 - Label value
- ERO and RRO support including:
 - Loose and strict options Next-Hop IP Address
 - Prefix length
 - FRR merge point
 - Label, RRO sub-object flags (local protection available)
 - Local protection in use
 - Bandwidth protection
 - Node protection, and (Node ID), with wizard support for automatic ERO/SERO/RRO configuration
- Configurable session attributes including:
 - Session names
 - Setup priority
 - Hold priority and flags (Local protection, label record, SE style, bandwidth protection, and node protection) and optional include or exclude affinities
- Configurable RSVP parameters including request RESV CONF message, hello message interval, bundle interval and refresh reduction
- Configurable reliable delivery options including retransmission interval, retransmission limit, and retransmission delta
- Configurable T-Spec values including: token bucket size, token bucket rate, peak data rate, min policed unit and max packet size
- Interactive and Command Sequencer events:
 - Graft egress P2MP Sub-LSPs
 - Graft ingress P2MP Sub-LSPs
 - Initiate make before break
 - Prune egress P2MP sub-LSPs
 - Prune ingress P2MP-sub-LSPs
 - Restart router, resume hellos
 - Stop Hellos and wait for LSP reroute

Technical Specifications for MPLS Routing cont.

RSVP-TE features cont.

- Detailed per-router RSVP-TE protocol and state counters including:
 - Router state (not started, up, down)
 - LSP up, down, or connecting
 - Egress LSP up
 - TX/RX hello
 - TX/RX PATH
 - TX/RX RESV
 - TX/RX PATH error
 - TX/RX RESV error
 - TX/RX RESV confirm
 - TX/RX PATH tear
 - TX/RX RESV tear
 - Min/Max/Average LSP setup time
 - Last TX/RX RESV error code
 - Last TX/RX PATH error code and TX/RX PATH recovery
- Detailed RSVP-TE tunnel LSP counters including:
 - Tunnel head-end (PATH) count
 - Tunnel tail-end (RESV) count
 - Tunnel state (not started, up, down or connecting)
 - Direction (ingress or egress)
 - Source IP address
 - Destination IP address
 - Tunnel ID
 - LSP ID
 - Extended tunnel ID
 - Label
 - TX/RX PATH message
 - TX/RX RESV message
- Per test, port, and router RSVP-TE protocol and LSP summaries include:
 - Number of RSVP-TE ports per test
 - Number of RSVP-TE routers per test
 - Number of active RSVP-TE routers per port and test
 - Number of headend and tail-end tunnels
 - Summary statistics for the number of RSVP-TE routers in the following states: Total up, down, up, down and init
- View filter and export FEC to LDP label mappings per router or per stream filter based on FEC type, Label source and traffic binding types
- Integrated support for MPLS PWE3 Ethernet protocol conformance testing with the BPK-1024A Conformance Application Base Package and the TPK-00254 for PWE3 protocol testing

Supported Modules/Platforms

Supports all TestCenter test modules and personality cards

Ordering Information

Description	Part Number
MPLS/LDP/RSVP-TE Base Package A Supports up to 10 LDP/RSVP sessions per port	BPK-1006A
MPLS/LDP/RSVP-TE Base Package B Supports up to the maximum LDP/RSVP sessions per port	BPK-1006B
GMPLS Base Package A	BPK-1190A

System Requirements

Testcenter requirements

- BPK-1066A required for BFD protocol testing
- BPK-1005A/B required for MVPN or P2MP-TE testing
- BPK-1004A/B required for Unicast routing protocol support
- BPK-1001A/B required for packet generator/analyzer features
- BPK-1029A required for real-time capture/decode feature
- BPK-1024A required for conformance testing
- TPK-0025 required for MPLS PWE3 protocol conformance testing
- BPK-1160 required for IP/MPLS & MPLS-TP interoperability testing

Related Standards

- Draft-lasserre-vkompella-ppvnp-vpls-00—Virtual private LAN services over MPLS
- Draft-martini-atm-encap-mpls-01—Encapsulation methods for transport of ATM cells/frame Over IP and MPLS networks
- Draft-ietf-ccamp-rsvp-restart-ext—Extensions to GMPLS RSVP graceful restart
- Draft-ietf-idr-bgp-identifier-08.txt—Describes BGP 4-byte AS
- Draft-ietf-l2vpn-bgp-00 and 02—Virtual private LAN service
- Draft-martini-ethernet-encap-mpls-01—Encapsulation methods for transport of Ethernet frames Over IP and MPLS networks
- Draft-martini-frame-encap-mpls-01—Frame relay encapsulation over pseudo-wires
- Draft-martini-l2circuit-trans-mpls—Transport of Layer 2 frames over MPLS
- Draft-martini-ppp-hdlc-encap-mpls-00—Encapsulation methods for transport of PPP/HDLC frames over IP and MPLS networks
- Draft-ietf-ppvnp-vpls-ldp-01 draft-ietf-ppvnp-vpls-ldp-00.txt— Virtual private LAN services over MPLS
- Draft-rosen-vpn-mcast-06, 07, and 08.txt— Multicast in MPLS/ BGP IP VPNs
- RFC 2205—Resource ReSerVation Protocol (RSVP)
- RFC 2547bis—MPLS BGP VPNs
- RFC 3031—MPLS architecture
- RFC 3032—MPLS label stack encoding
- RFC 3036—LDP specification
- RFC 3037—LDP Applicability
- RFC 3107—Carrying label information in BGP4
- RFC 3209—RSVP-TE: Extensions to RSVP for LSP tunnels
- RFC 3215—LDP State Machine
- RFC 3478—Graceful restart mechanism for label distribution protocol
- RFC 4090—Fast reroute extensions to RSVP-TE for LSP tunnels
- RFC 4360—Describes BGP extended communities
- RFC 4364—Describes MPLS IP VPNs with InterAS VPN options A-C
- RFC 4420—Encoding of attributes for MPLS LSP establishment using RSVP-TE
- RFC 4461—Signaling requirements for P2MP-TE LSPs
- RFC4659—BGP MPLS IP VPN extension for IPv6 VPN (6VPE)
- Describes BGP 4-byte AS
- RFC 4798—IPv6 MPLS BGP VPNs (6PE)
- RFC 4873—GMPLS recovery
- RFC 4875—Extensions to RSVP-TE for P2MP LSPs
- RFC 5073—IGP routing protocol extensions for discovery of traffic engineering node capabilities
- RFC 4447—Pseudowire setup and maintenance using LDP
- RFC 4762—VPLS using LDP signaling
- RFC 4385—PWE3 control word for use over an MPLS PSN
- RFC 5254—Requirements for multi-segment PW emulation
- Draft-ietf-pwe3-fat-pw-05: Flow aware transport of pseudowires over an MPLS PSN
- Draft-ietf-pwe3-redundancy-02: Pseudowire redundancy
- RFC 3471—GMPLS signaling functional description
- RFC 3473—GMPLS RSVP-TE extensions



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