

Spirent AION

Spirent TestCenter Routing and Switching Bundles

Overview

Spirent AION is a flexible licensing platform that enables users to achieve improved deployment and provisioning for all their cloud and network testing needs. It is designed to deliver ultimate flexibility in how Spirent TestCenter platforms are purchased and utilized.

The extended platform combines a wealth of industry-leading test solutions with a flexible licensing architecture to support a wide range of next-generation solution-based domain applications.

AION offers a centralized management hub to help leverage software and hardware functionalities across all lab users and locations for a simplified management and decision-making process:

- **Flexible purchasing options** available via subscription, consumption-based, and perpetual plans, with the ability to license different bandwidth, scale, and protocol bundles.
- **Flexible deployment options** offered include cloud-delivery, on-prem, and laptop-hosted licensing services.

Enhanced user serviceability delivers always-on platform services from auto-discovery and inventory management to user and workspace administration, notifications, and log aggregation.

Application Overview

Spirent TestCenter Routing and Switching test solutions support high performance and realistic topologies for unicast routing, multicast routing, switching and MPLS VPN technologies and enable Network Equipment Manufacturers, Service Providers and Enterprises to quickly evaluate and troubleshoot routing functionality, performance and scalability of any routing device or network. Users can expose the true performance of a router/switch by stress testing the routing software, data forwarding hardware, and the overall system architecture under both static and dynamic routing conditions.

- **Realistic Network Topologies**—emulate real world networks and evaluate key performance parameters of routers or networks under typical or extreme traffic load conditions for minutes, hours and days
 - **Network/Service Reliability**—verify scale, reliability, performance of Layer 2 & 3 services including data, multicast, and video delivered via unicast routing, multicast routing, switching, and MPLS VPN technologies
 - **Wide Range of Use cases**—qualify routers during development, quality assurance, and regression testing; requalify routers after software or firmware upgrades and perform comparative analysis of routers during vendor selection
 - **Increase Productivity**—test and configuration wizards allow quick setup; capture functionality, protocol events and live status views make troubleshooting easy with TestCenter IQ and help save time
 - **Cost-Effective Solution**—complete routing protocol emulation suite in simple affordable packages
 - **Trusted Partner**—benefit from decades of testing experience with Spirent as your guide through a world of complex testing
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Routing and Switching Bundle

The **Routing and Switching Bundle** features offer comprehensive testing of use cases including unicast routing, high availability, fast convergence, and multicast group management scenarios.

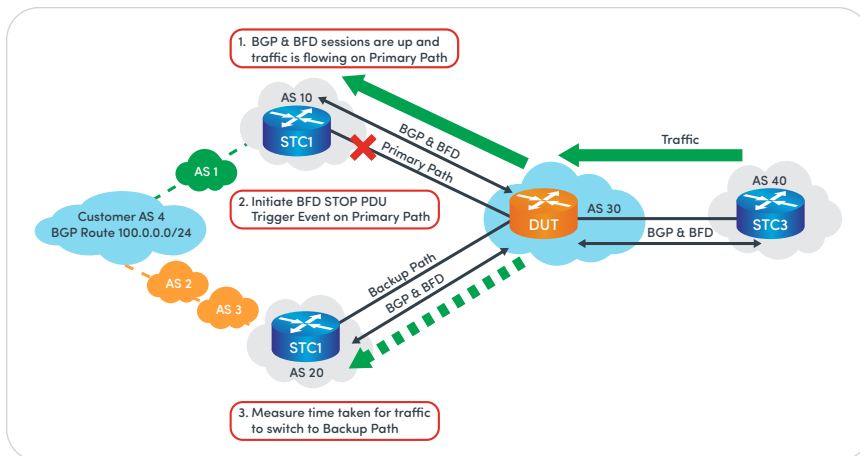
Unicast Routing protocols in this package helps users address the challenge of quickly verifying complex features and applications for enterprise, metro and core routers. This package includes emulation for IPv4 and IPv6 interior and exterior gateway routing protocols: OSPFv2/v3, ISISv4/v6, BGP-4, BGP+, and MP-BGP; it can emulate a variety of realistic and worst-case conditions and provide performance measurements.

IGMP and MLD emulations in this package emulate the host side multicast group memberships and help evaluate Multicast routing protocols functionality and performance in DUT along with IPv4 and IPv6 Multicast traffic forwarding behavior.

BFD protocol emulation works with other routing/MPLS protocols to communicate link and protocol state transitions. This allows users to view protocol performance during network events such as session, route, link flap events or network over-subscription.

Convergence Test solutions for Unicast Routing and BFD, help quickly simulate various failover scenarios and validate DUT convergence behavior with measurements using data plane and control plane events as reference point.

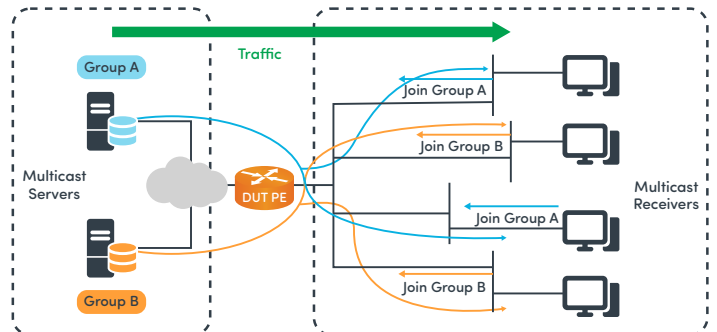
Spanning Tree Protocol and Multiple Spanning Tree Protocol emulation provide functional and performance tests for Layer 2 loop prevention, load balancing and convergence.



Multicast Routing Bundle

Multicast Routing Bundle features helps quickly evaluate and troubleshoot Multicast routing protocols, forwarding behavior, and performance in devices and networks.

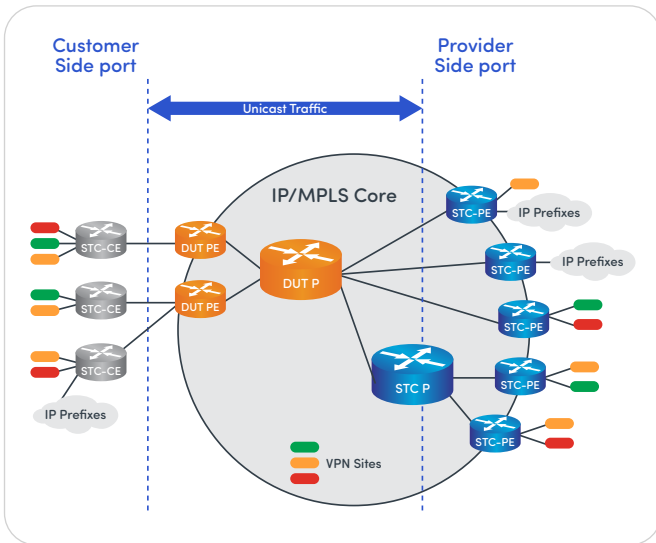
Protocol Independent Multicast Sparse Mode (PIM-SM) and **Protocol Independent Multicast Source Specific Multicast (PIM-SSM)** emulations are the most common multicast routing protocols for IPv4 and IPv6 Multicast traffic. **Bit Index Explicit Replication (BIER)** is a new technology for forwarding multicast traffic. Instead of building multicast forwarding trees, this protocol encapsulates the multicast packets into a BIER header and are forwarded within a BIER domain based on the header information. Using BIER header, multicast traffic is only forwarded to the nodes that need to receive the multicast traffic. As a result, multicast traffic follows an optimal path within the BIER domain. The **Multicast Source Discovery Protocol (MSDP)** is used between PIM-SM domains to convey information about active sources available in other domains.



Multiprotocol Label Switching (MPLS) Bundle

The **Multiprotocol Label Switching (MPLS) Bundle** features cover complete testing of MPLS transport and Layer 2 and Layer 3 VPN networks. The MPLS protocols work with the Unicast Routing and Multicast Routing protocols, to create complex IP/MPLS transport network.

User can emulate **LDP** and **RSVP-TE** sessions to test performance and scalability of any MPLS-enabled LSR device or network with traffic engineering or VPN technologies by stress testing the routing, label lookup, binding, and forwarding operations under dynamically changing conditions. User can choose from more than 25 emulated MPLS/VPN 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. This package includes **MPLS-TP** as well to test MPLS-TP protocol functionality, performance, and interoperability with IP/MPLS scenarios.

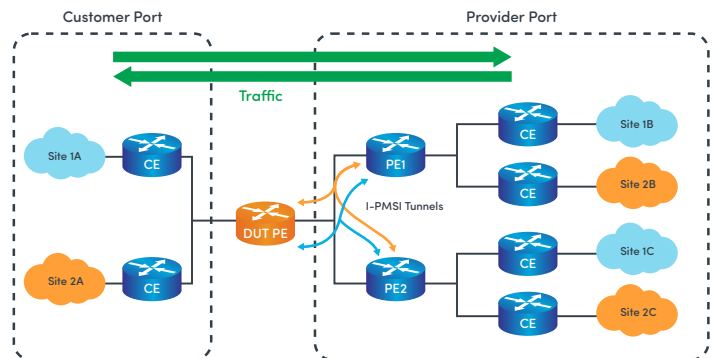


Multicast Virtual Private Network (MVPN) Bundle

Multicast Virtual Private Network (MVPN) Bundle features cover comprehensive testing of Multicast VPN and next-generation Multicast VPN architectures.

Multicast VPN (MVPN) (Draft-Rosen) defines the ability to transport multicast traffic across a Layer 3 VPN network with the use of multicast distribution trees (MDT) between PEs within a given VRF.

Next Generation Multicast VPN (NGMVPN) is predominantly used in service provider networks and provides improvements on scalability and manageability issues over traditional MVPN (Draft-Rosen) technology. BGP based next-generation MVPN control plane, distributes all the necessary information to enable end-to-end C-multicast routing exchange via BGP. The responsibilities of the control plane include MVPN auto-discovery, distribution of provider tunnel information, and PE-PE C-multicast route exchange. A new BGP address family called MCAST-VPN is introduced for supporting next-generation MVPN control plane operations.



The Multicast VPN technologies in this package work with the Unicast Routing, Multicast Routing and MPLS VPN protocols, to create complex Multicast VPN topology over IP/MPLS transport network. User can emulate MPBGP sessions, MLDP and RSVP-TE P2MP tunnels to test performance and scalability of any GRE based Multicast VPN network with traffic engineering or Next Generation MVPN technologies by stress testing the routing, label lookup, binding, and P2MP forwarding operations under dynamically changing conditions.

All of the above packages are integrated component of Spirent TestCenter and work with other Spirent TestCenter components to deliver easy, consistent TCL and Python scripting API and Command Sequencer NoCode automation. The routing and switching protocols can also be combined with Access or Segment Routing control-plane over routing/ MPLS topology with stateful or stateless data-plane traffic.

Features and Benefits

Routing and Switching Bundle

- Support for dual-stack IPv4 and IPv6 in all routing emulation and traffic generation allows users to test the migration of routed networks from IPv4 to IPv6 under realistic deployment scenarios
- Quickly set up large IGP Protocols: OSPF, IS-IS or BGP network emulations on all ports with data-plane traffic going to each network advertised from all transmitting ports
- Quickly emulate large and complex routing topologies running a combination of unicast routing, multicast group memberships, fast convergence
- BGP Route Import functionality allows users to import real internet routing table for IPv4 and IPv6
- Emulate thousands of IGMP/MLD hosts per port and perform Join/Leave latency testing
- Verify the ability of switches and routers to manage users joining and leaving multicast groups over extended periods and perform comparative analysis of switches and routers with multicast traffic.
- Automatic configuration with single-click activation for BFD in Protocol Dependent mode
- Create static BFD sessions in Control Plane Independent mode for static or policy routing functional protocol testing, and protocol scale testing
- Stress test BFD-enabled device forwarding performance and scalability while running routing protocols with BFD, and data-plane traffic
- Test high availability routing features including Graceful Restart for OSPF, IS-IS and BGP under various realistic routing failover scenarios including integrated BFD testing
- Evaluate scalability and reliability of Spanning Tree and Multiple Spanning Tree designs and implementations on large-scale switching systems

Multicast Routing Bundle

- Support for PIM-SM, PIM-SSM for testing efficient forwarding of IPv4 and IPv6 Multicast traffic
- Support for BIER over OSPF, ISIS and BGP control plane to establish BIER domains
- Combine with Unicast Routing and MPLS protocols to

test multicast traffic distribution, Multicast VPN or Next Generation Point-to-Multipoint Traffic Engineering (P2MP-TE)

- Combine with Application Layer Protocols, Video Quality Analysis (VQA) or RFC 3918 Multicast Benchmarking to test or bench-mark Multicast networks under realistic environments
- Multicast Routing Wizard quickly builds hundreds or thousands of emulated routers

Multiprotocol Label Switching (MPLS) Bundle

- 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
- Dynamic MPLS label binding automatically learns millions of 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 changes in MPLS topology
- BGP Route Import functionality for VPN routes allows users to import millions of IPv4 and IPv6 VPN routes
- Combined with Unicast routing, users can test control plane and data-plane router convergence in a MPLS network and high availability routing features including Graceful Restart and BFD integrated with LSPs
- PWE wizard takes the complexity out of single and multi-segment PWE emulation testing with FEC128/129, PW status signaling, control word and helps tests any mobile backhaul configuration including pseudo-wire redundancy
- 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
- Use out of band signaling mechanisms defined by GMPLS to test negotiation of DWDM wavelengths. This is accomplished using 32-bit generalized MPLS Labels

Features and Benefits (cont'd)

Multicast Virtual Private Network (MVPN) Bundle

- Quickly emulate large and complex MVPN or NG-MVPN topologies running multiple protocol operations from a single application interface
- Support Multicast LDP emulation for the setup of point-to-multipoint (P2MP) and multipoint-to-multipoint (MP2MP) Label Switched Paths (LSPs) in MPLS networks
- 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
- Next-Generation Multicast VPN wizard builds MPBGP based next-generation MVPN topology with customer side and provider side of the VPN network, emulated and simulated CE, P, and PE routers, routing and labeling protocols, and creates the traffic that is sent between VPNs

Common Features

- Integrated data-plane traffic enables users to send, receive, inspect, and accumulate statistics at wire-rate; users can also monitor the real time effects that router configurations have on traffic and QoS classes
- Validate performance, scalability and protocol functionality in the same test by running multiple protocols concurrently on each port
- Using advanced multi-threading architecture, user can scale number of sessions or route scale with multi-dimension
- Use the 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; advanced command sequencer capabilities allow users to extend Spirent TestCenter to meet their test needs

Technical Specifications

Parameter	Description
Routing and Switching Bundle	
Unicast Routing	
OSPF	<ul style="list-style-type: none"> OSPFv2, OSPFv3
BGP	<ul style="list-style-type: none"> BGP-4, BGP+, and MP-BGP BGP Route Import for IPv4 and IPv6
IS-IS	<ul style="list-style-type: none"> ISIS v4/v6
RIP	<ul style="list-style-type: none"> RIPv1, RIPv2, RIPng
Multicast Group Membership	
IGMP	<ul style="list-style-type: none"> IGMPv1, IGMPv2, IGMPv3 Host IGMPv1, IGMPv2, IGMPv3 Querier
MLD	<ul style="list-style-type: none"> MLDv1, MLDv2 Host MLDv1, MLDv2 Querier
Connectivity	
BFD	<ul style="list-style-type: none"> Control Plane Independent and Protocol Dependent Integrated with Unicast Routing protocols GenTX mode for high performance (3.33ms interval)
Spanning Tree	<ul style="list-style-type: none"> STP/RSTP/PVST+ MSTP (Up to 64 MSTI)
Convergence	
Unicast Routing Convergence	<ul style="list-style-type: none"> Data Plane based Convergence Test Advanced Control Plane based Convergence Test for BGP, OSPF, ISIS
BFD Convergence	<ul style="list-style-type: none"> BFD Control Plane Convergence Test for BGP, OSPF, ISIS
Multicast Routing Bundle	
Multicast Routing	
PIM	<ul style="list-style-type: none"> PIM SM, PIM SSM Full Bootstrap Router (BSR) emulation Emulate First Hop Routers (FHRs), Rendezvous Points (RPs), and simulate Last Hop Join (*, G), (S, G) or (*, *, RP) Multicast groups
BIER	<ul style="list-style-type: none"> Bit Index Explicit Replication OSPF BIER ISIS BIER BGP BIER
MSDP	<ul style="list-style-type: none"> Multicast Source Discovery Protocol
Multiprotocol Label Switching (MPLS) Bundle	
MPLS and VPN	
LDP	<ul style="list-style-type: none"> LDPv4/v6 Pseudowire Emulation Edge-to-Edge (PWE3) FEC 128, FEC 129 MLDP P2MP
RSVP-TE	<ul style="list-style-type: none"> RSVP-TE integration with OSPF and ISIS RSVP P2MP Make Before Break ERO and Fast Reroute Bidirectional LSP GMPLS
VPN	<ul style="list-style-type: none"> MPLS IP VPN (RFC 2547bis) for IPv4 6VPE or 6PE for IPv6 BGP Route Import for IPv4 and IPv6 VPN Routes BGP-VPLS LDP VPLS
MPLS-TP	<ul style="list-style-type: none"> MPLS-TP Static MPLS-TP BFD MPLS-TP Y.1731 MPTS-TP Protection Switching MPTS-TP Performance Monitoring
BFD	<ul style="list-style-type: none"> BFD for MPLS LSP

Technical Specifications (cont'd)

Parameter	Description
Multicast Virtual Private Network (MVPN) Bundle	
Multicast VPN	
MLDP	<ul style="list-style-type: none"> MLDP P2MP MLDP MP2MP
Multicast VPN	<ul style="list-style-type: none"> Multicast VPN (Draft-Rosen)
NGMVPN	<ul style="list-style-type: none"> Next Generation Multicast VPN Ingress Replication RSVP-TE P2MP MLDP

Ordering Information

Product Number	Description
AON-PB-RTSW	AION Routing & Switching Bundle
AON-PB-MCAST-RT*	AION Multicast Routing Bundle
AON-PB-MPLS*	AION Multi Protocol Label Switching (Mpls) Bundle
AON-PB-MCAST-VPN**	AION Multicast Virtual Private Network (Vpn) Bundle

* Requires AION Routing & Switching Bundle (AON-PB-RTSW)

** Requires AION Routing & Switching Bundle (AON-PB-RTSW), AION Multicast Routing Bundle (AON-PB-MCAST-RT), and AION Multiprotocol Label Switching Bundle (AON-PB-MPLS)

About Spirent Communications

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks. We help bring clarity to increasingly complex technological and business challenges. Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled. For more information visit: www.spirent.com

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