LE-311v SERVICE DELIVERY SWITCH

Features & Benefits

- Uses a common service-aware operating system for efficiency
- Enables high-velocity Ethernet service rollout, reducing time-to-service revenue
- Provides multiple Carrier Ethernet transport options for superior investment protection
- Delivers reliability and ultrafast resiliency, protecting against network failure
- Supports carrier-class QoS for robust service stratification
- Provides rich OAM features to ensure service quality conforms to SLAs

The LE-311v Service Delivery Switch is a next-generation Carrier Ethernet switching platform that costeffectively delivers business, transport, and residential Ethernet services such as Layer 2 Virtual Private Networks (VPNs), mission-critical data, high-speed Internet, and high-quality IPTV and Voice-over-IP applications. Employing the latest innovations in Carrier Ethernet switching technology, the LE-311v delivers sophisticated Quality of Service (QoS) capabilities, superior Virtual LAN (VLAN) and Virtual Switching functions, and carrier-grade Operations, Administration, and Maintenance (OAM) features.

The LE-311v is based on Ciena's field-proven True Carrier Ethernet® technology, deployed by dozens of network operators in tens of thousands of homes and businesses. It combines the low cost and high capacity of Ethernet with the reliability, management, and service quality usually associated with SONET/SDH networking systems. The LE-311v software architecture is based on a common service-aware operating system used in all Ciena Service Delivery Switches (SDS) and Service Aggregation Switches (SAS) to provide operational efficiency and consistent system and service attributes.

Ciena is an industry leader in the development and implementation of Provider Backbone Bridging – Transport Engineering (PBB-TE) and is one of the first vendors in the market to deliver a solution that supports both traditional Multi-Protocol Label Switching (MPLS) and PBB-TE-based solutions. By supporting both of these important technologies on the LE-311v switch, Ciena delivers maximum flexibility, enabling subscribers and providers to select, and mix and match the wide area transport that meets their needs today and in the future.

The LE-311v includes 24 10/100 Mb/s (RJ- 45) ports and 4 1 Gb/s optical ports. Architected for high availability, the LE-311v has redundant fans and pluggable redundant 1+1 power supplies, available in AC or DC. The entire platform occupies just 1 rack unit (1.75”/44.2mm), making the most efficient use of available rack space.

Proven Service-Aware Operating System

The LE-311v software architecture is based on a common service-aware operating system—used in all Ciena SDS and SAS—that delivers consistent benefits across all Ethernet access and aggregation applications. These benefits include:

- Rapid implementation of the latest standards-based Ethernet technical advances across all SDS/SAS products
- Interoperability with multi-vendor Ethernet equipment already installed in a network
- Industry-leading network services based on the latest advances in Ethernet technologies from standards bodies like the IEEE, IETF, and the Metro Ethernet Forum (MEF)
- Improved efficiency and cost savings resulting from a common deployment and service provisioning model and reduced need for training

PBB-TE

The LE-311v gives service providers a variety of Carrier Ethernet transport options, including PBB-TE, 802.1q tunnel tags (Q-in-Q) ,and MPLS. Ciena is an industry leader in the implementation of PBB-TE, an innovative technology that extends and adapts Ethernet to provide carrier-grade transport over Metro and Wide Area Networks (MANs/WANs).

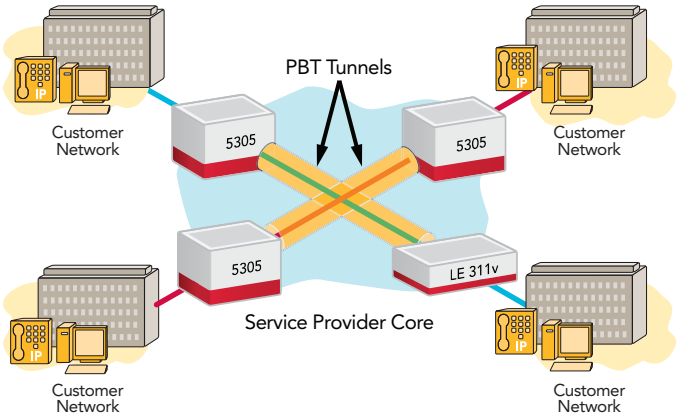

Figure 1. PBB-TE tunnel example

As one of the industry’s first PBB-TE-enabled Carrier Ethernet switch platforms, the LE-311v delivers a reliable, cost-effective transport solution ideal for delivering a variety of new services to a fast-growing customer base. The PBB-TE feature set of the LE-311v includes a tunneling protocol, illustrated in Figure 1, and advanced management mechanisms that enable service provider networks to deliver point-to-point services with high levels of scalability, reliability, manageability, and security.

Based on extensions to current Ethernet standards, PBB-TEenabled products maintain compatibility with existing Ethernet deployments. This broad compatibility enables the LE-311v to deliver a wide range of connectivity services with guaranteed QoS, while interoperating seamlessly with an installed base of multi-vendor switching and routing systems that do not support PBB-TE. Because the advantages of PBBTE are available without major changes to existing network equipment or architectures, the LE-311v offers superior investment protection.

MPLS Services

MPLS support on the LE-311v enables delivery of multiple services over a single converged Carrier Ethernet infrastructure, as shown in Figure 2, with high performance, high availability, and flexible bandwidth guarantees.

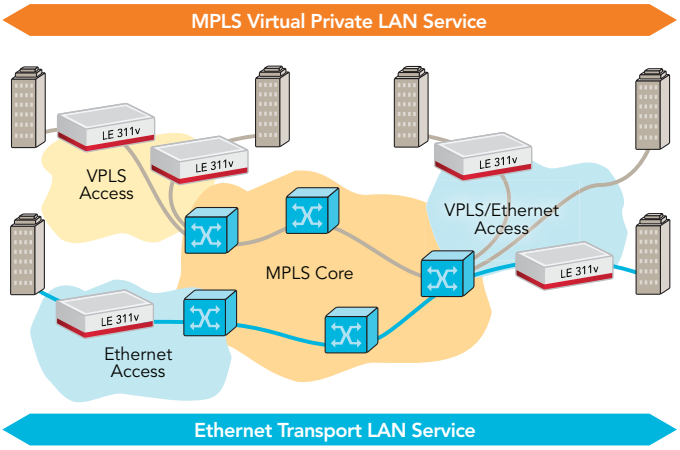

Figure 2. Ethernet to MPLS flexible service transition

The LE-311v MPLS feature set supports the provisioning of MPLS pseudowires, Virtual Private Wire Services (VPWS), and Hierarchical-VPLS (H-VPLS), extending the functionality and scalability of MPLS core networks directly to subscribers.

The LE-311v MPLS/H-VPLS feature set supports the interworking of customer and provider VLANs with VPLS VPNs on Carrier Ethernet access and aggregation networks. It enables network operators to deploy H-VPLS VPN services to

*For more information on PBB-TE, see Ciena White paper entitled “Provider Backbone Bridging – Traffic Engineering of Carrier Ethernet Services.”

targeted customers while maintaining Ethernet VLAN and VPN services on the same network. Network flexibility is further enhanced by LE-311v support for MPLS pseudowires, which enables the network to deliver Ethernet Private Line and Ethernet Virtual Private Line (E-LINE) services. All of these service types can be provisioned on a single LE-311v for maximum flexibility and investment protection.

The LE-311v supports advanced MPLS resiliency to deliver both system and network high availability, including:

- Label Switch Path (LSP) Ping/Traceroute
- MPLS Tunnel Protection, Primary and Backup
- MPLS Tunnel Protection with RSVP-TE Fast Reroute

Carrier-Class QoS

The LE-311v implements true carrier-class, MEF-14 compliant QoS that permits delivery of a wide range of traffic types and rates over a single access infrastructure without interference or degradation. These capabilities enable greater revenue generation by utilizing available network resources efficiently, while improving customer relations with enforceable and reliable Service Level Agreements (SLAs). QoS guarantees in the LE-311v are based on the ability to track creation, implementation, enforcement, and monitoring of all QoS parameters. These capabilities are enabled by:

- A flexible QoS implementation, based on service mapping and service level definition, including Committed Information Rate (CIR), Excess Information Rate (EIR), and Priority
- Sophisticated congestion handling based on two-rate Three-Color Marking (trTCM)
- Automated service provisioning, resulting in a more comprehensive deployment of QoS at a significantly lower cost

The LE-311v guarantees SLAs by providing an MEFcompliant, flexible QoS architecture. This includes:

- 8 hardware queues per port
- 64 Kb/s granularity
- Protection of management, routing, and revenueoriented traffic
- Protection of both Unicast and Multicast Traffic
- Flexible service mapping, based on:
  - VLAN
  - Source port or source link aggregation group
  - Destination port or destination link aggregation group
  - IEEE 802.1D priority
  - Port (TCP, UDP)
  - Differentiated Services Code Point (DSCP)
  - EIR, CIR, Excess Burst Size (EBS), Committed Burst Size (CBS)

Reliability and Resiliency

The LE-311v delivers carrier-class reliability and availability based on three major features:

- A modular service-aware software architecture with a realtime kernel that delivers reliability and high availability by protecting against complete operating system failures.
- An advanced optimization of the IEEE 802.1w Rapid Spanning Tree Protocol (RSTP), as depicted in Figure 3. Ciena's service-aware operating system can be configured to deliver sub-50 ms failover times* to support timesensitive applications such as video and voice with the same service level guarantees as SONET/SDH optical rings.
- Support for IEEE 802.3ad Link Aggregation, including support for Protection Link Aggregation and "hot standby" failover, which facilitates bundling of several physical ports together to form one logical port, and delivers both interoperability and resiliency of the connection even if connectivity with one physical port is interrupted.

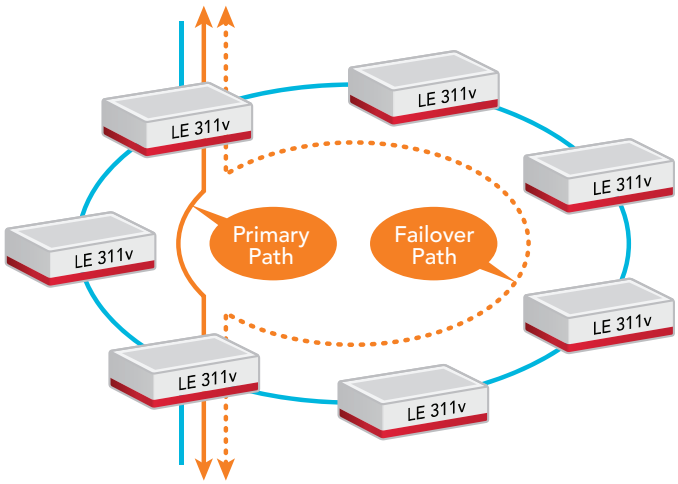

Figure 3. RSTP ring with sub-50 ms resiliency

*RSTP performance will vary by size and configuration of the network. Sub-50 ms failover time based on a test configuration with a 7-node ring and 8,000 Media Access Control (MAC) addresses.

Advanced Security

The LE-311v delivers an advanced set of security features to protect the access and aggregation network and fully interoperate with security protocols in the network core. The LE-311v implements:

- Advanced authentication protocols, such as IEEE 802.1x port-based Network Access Control, are based on password encryption and can be authenticated through a Remote Authentication Dial-In User Service (RADIUS) server for comprehensive network-wide security coordination.
- Policy-based network access, including advanced Service Access Control that can be configured with dynamic or static access control lists. The LE-311v also supports ingress and egress port filtering and Layer 2 + Layer 4 protocol filtering, as well as Secure Shell version 2 (SSH2) for an encrypted management channel when connecting systems over an insecure network such as the Internet.

Carrier-Class Ethernet OAM

The LE-311v supports a rich set of OAM features defined in the latest versions of IEEE, ITU, and IETF standards, including:

- IEEE 802.3ah EFM (Ethernet in the First Mile) physical layer OAM, including Link Events and Remote Loopback
- IEEE 802.1ag CFM (Connectivity Fault Management), including MAC Ping/Traceroute and Continuity Check
- ITU Y.1731 Performance Management
- IETF TWAMP (Two Way Active Management Protocol)

These capabilities enable the LE-311v to monitor the status of system and network links; measure the performance of customer Ethernet Services; confirm link and service throughput and quality conform to SLAs; and distribute this management information across point-to-point, point-to-multipoint, and multipoint-to-multipoint connections.

Technical Information

Interfaces
SFP: 4 x 1000X ports
RJ-45: 24 x 10/100TX ports ; 1 x 10/100TX Management Port
DB-9: 1 x Console Port (RS-232)

Ethernet
IEEE 802.3u Fast Ethernet
IEEE 802.3x Ethernet Flow Control
IEEE 802.3z Gigabit Ethernet
IEEE 802.1D MAC Bridges
IEEE 802.1Q VLANs - Including .1p Priority
IEEE 802.1ad Provider Bridging (Q-in-Q) VLAN - full S-VLAN range
VLAN tunneling (Q-in-Q) for Transparent LAN Services (TLS)
Single and double VLAN tag translations on ingress and egress
IEEE 802.1w Rapid Spanning Tree (RSTP) - now in .1D
Spanning Tree Domains
RSTP Self Loop Detection
IEEE 802.1s Multiple Spanning Tree (MSTP)
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
LACP Dynamic RSTP Path Cost
Manual Link Aggregation
81-00, 91-00, 88-a8 Ethertype Support
Jumbo Frames to 9216 bytes
Layer 2 Control Frame Tunneling
MEF 9 Ethernet Private Line
MEF 9 Ethernet Private LAN
MEF 9 Ethernet Virtual Private Line
MEF 9 Ethernet Virtual Private LAN
MEF 14 Traffic Management

Carrier Ethernet OAM
IEEE 802.1ag Connectivity Fault Management (CFM)
Connectivity Fault Management Enhanced Statistics
IEEE 802.3ah Ethernet in the First Mile (EFM)
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
Y.1731 Performance Monitoring
TWAMP Responder and Reciever
TWAMP +/- 1ms timestamp accuracy

Provider Backbone Bridging-Traffic Engineering
IEEE 802.1Qay PBB-TE
PBB-TE Multi-Homed Protection Failover

MPLS/VPLS
MPLS RSVP-TE
MPLS LDP
MPLS OSPF-TE
MPLS Pseudo-Wire Emulation (PWE3)
MPLS/H-VPLS MTUs
Statically configurable EXP
Label Switched Path (LSP) Ping
LSP Traceroute
MPLS Fast Reroute

Quality of Service
128 Service Levels
8 Hardware Queues per Port
Committed and Excess Information Rate (CIR and EIR)
Classification based on IEEE 802.1D priority
Classification based on VLAN, source port, destination port, TCP/UDP port
Classification based on IP Precedence, DSCP, DSCP group
Layer 2, 3, 4 Quality of Service
Diffserv
DiffServ Remarking
Traffic Profiling
Ingress Rate Limiting
Trust/No-Trust COS marking
Egress Port Shaping Control

Multicast Management
ChannelStream™
IGMPv2 Snooping (RFC 2236)
IGMP Domains IGMP Message Filtering
IGMP Inquisitive Leave
Broadcast/Multicast Storm Control
StreamCast™
ResilientStream™
Unknown Multicast Filtering
Well-known Protocol Forwarding

Network Management
Enhanced CLI
CLI-based configuration files
SNMP v1/v2c/v3
SNMPv3 Authentication and Message Encryption
SNMP MIB II (RFC 1213)
Bridge MIB (RFC 1493)
Ethernet-like Interface MIB (RFC 1643)
MIB II interfaces (RFC 1573) RMON MIB (RFC 1757) - inc. persistent configuration
RMON II (RFC 2021)
RMON Statistics Per-VLAN Statistics
RADIUS Client and RADIUS Authentication
TACACS + AAA
DHCP Client (RFC 2131)

Technical Information

DHCP Relay
DHCP Option 82
NTP Client (RFC 1305)
DNS Client (RFC 1035)
Telnet Server
Secure File Transfer Protocol (SFTP)
Trivial File Transfer Protocol (TFTP)
Secure Shell (SSHv2)
Syslog with Syslog Accounting
Port State Mirroring
Protocol Filtering
Fault Detection (Traceroute, packet trace, IFG shaving)
CPU Load Query
Device Archive
Local Console Port
Comprehensive Management via Ethernet Services Manager
VLAN Loopback
Remote Autoconfiguration via TFTP, SFTP
Software download/upgrade via TFTP, SFTP

Service Security

Egress Port Restriction
Layer 2,3,4 Protocol Filtering
Broadcast Containment
802.1x Port-based Network Access Control
User Access Rights
Per-port or per-VLAN Service Access Control

MAC Address Table Capacity

20,480 MAC addresses

Power Requirements

AC: 100 to 240V AC, 50/60 Hz, 0.27/0.71 Amps;
DC: -70 to -40 DC, 0.9/1.4 Amps; Redundant hot swappable AC/DC power supplies

Agency Approvals

Safety: European Union, CE mark (Declaration of Conformity); UL 60950; IEC 60950 (CB); EN 60950; CAN/CSAC22.2 No. 60950-00 (Canadian Safety)
Emissions: FCC 47CFR Part 15 Class B; EN55022 (1994) Class B (With amendments A1 and A2)
Environmental: RoHS 2002/95/EC; WEEE 2002/96/EC
Immunity: EN 55024; ETSI/EN 300 386:V1.3.2 (2003-05) (EU Telecommunication Emissions and Immunity)
NEBS: Level 3 Certified

Environmental Characteristics

Operating Temperature: +32°F to +122°F (0°C to +50°C)
Storage Temperature: 14°F to +158°F (-10°C to +70°C)
Maximum Humidity: 90% (non-condensing)

Physical Characteristics

Dimensions: 1.74" (H) x 17.5" (W) x 15.5" (D) 44.2 mm (H) x 444.5 mm (W) x 394.5 mm (D)
Weight: 14 lbs; 6.35 kg

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