3930
Service Delivery Switch

Ciena's 3930 Service Delivery Switch is an advanced packet networking system focused on the transition to high-bandwidth applications requiring sophisticated Quality of Service (QoS) capabilities, including mobile backhaul and Ethernet business services.

The 3930 incorporates a complete Operations, Administration, and Maintenance (OAM) suite to support the network and service performance monitoring requirements of large-scale Ethernet deployments, while reducing network operating costs.

The 3930 software architecture is based on the Service-Aware Operating System (SAOS) used in all Ciena service delivery and service aggregation switches to provide advanced Carrier Ethernet services with consistent system and service attributes to improve operational efficiency. The 3930 leverages the SAOS to deliver Ethernet services cost-effectively with the ability to stay ahead of bandwidth demands, protecting the operator's investment. The feature capabilities address the widely varying demands of end-customers and a multitude of deployment scenarios.

The 3930 exemplifies Ciena's focus on OAM and the Total Cost of Operations (TCO) to deliver Carrier Ethernet services by supporting all the leading OAM standards and expanding OAM capabilities, including Y.1564 and RFC 2544 Performance Benchmarking generation and reflection capabilities. This broad service support enables detailed Service Level Agreement (SLA)-conformance testing from the Network Operations Center (NOC) and dramatically lowers OPEX. In combination with the low-touch deployment methods provided by Ciena, operators can achieve a very profitable business case, even in highly competitive markets.

The 3930 features a high-capacity switching fabric, two NNI SFP+ ports that support 1GbE or 10GbE, 4 100/1000M SFP UNI ports, and 4 dual-mode UNI ports (10/100/1000 RJ-45 and 100/1000 SFP). The 3930 provides a temperature-hardened

Features and Benefits

- Provides advanced Carrier Ethernet and low TCO, powered by Ciena's SAOS

- Supports 2 1GbE/10GbE NNI ports to deliver exceptional capacity for bandwidth-hungry applications

- Supports 8 GbE UNI ports including 4 100/1000Base-X Small Form-factor Pluggable (SFP) ports and 4 dual-mode ports: RJ-45 10/100/1000 Base-TX and 100/1000Base-X SFPs

- Incorporates on-board Y.1564 and RFC 2544 Performance Benchmark testing capabilities, enabling end-to-end SLA verification without a truck roll

- Includes environmentally hardened electronics (-40°C to +65°C) and external alarm inputs, providing flexible deployment options

- Provides advanced synchronization support
  - ITU-T G.8262 SyncE on all Ethernet ports
  - IEEE 1588v2 Precision Time Protocol including Ordinary and Boundary Clock for frequency, phase and time distribution
  - Stratum 3E oscillator provides exceptional stability as synchronization master or slave
  - Dedicated ports for frequency, phase and time

- Metro Ethernet Forum (MEF) Carrier Ethernet (CE) 2.0-compliant for E-Line, E-LAN, E-Tree and E-Access

single rack unit form factor (1RU) with redundant AC or DC power supply modules.

Proven Service-Aware Operating System

Ciena's SAOS delivers consistent benefits across all Ethernet access and aggregation applications, including:

- Interoperability with Ethernet equipment from other vendors

- Improved efficiency and cost savings resulting from a common deployment and service provisioning model

- Service offering ubiquity, permitting rapid rollout of new services across the entire network

- Complete MEF-compliant Ethernet service offerings

  - E-Line (virtual and private)

  - E-LAN (virtual and private)

  - E-Tree (virtual and private) and

  - E-Access (virtual and private)

Figure 1. Metro packet architecture for aggregation of multiple services

Sophisticated Multi-Level QoS Handling

The 3930 implements carrier-class, MEF CE 2.0-certified 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 SLAs. These capabilities are enabled by:

- Eight hardware queues/port, up to 64 ingress meters per port

- Per-port, per-VLAN QoS with CIR/EIR settings

- Two rate Three Color Metering (trTCM), marking, policing, shaping

- Random Early Detection (RED), flexible Deficit Weighted Round Robin (DWRR), and Strict Priority Scheduling

- Hierarchical QoS (H-QoS)

The 3930 enables automated service provisioning, resulting in a more comprehensive deployment of QoS at a significantly lower cost.
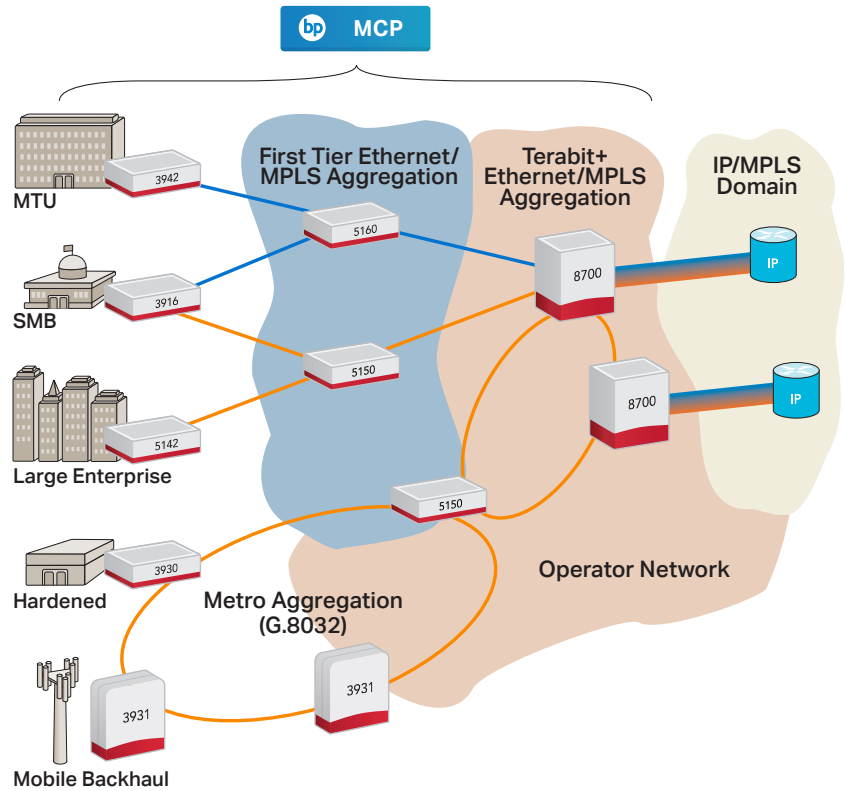
G.8032 Ethernet Ring Protection Switching

The 3930 supports multiple resiliency options, including G.8032 Ethernet Rings. G.8032 provides deterministic 50 ms protection switching, enabling operators to deliver carrier-grade Ethernet services and attain the resiliency capabilities of the legacy SONET infrastructure without the associated costs. Ciena's solution is highly scalable, permitting the number of network elements on the ring to increase as needs grow. Additionally, ring bandwidth can be based on 1GbE or 10GbE, and even include ring spans based on other service layer technologies and speeds permitting exceptional flexibility for operators to create G.8032 rings and provide sub-50 ms resiliency.

Performance Benchmarking and SLA Conformance Testing	IETF RFC 2544 Generator/Reflector ITU-T Y.1564 Generator/Reflector
Layer 3 SLA Monitoring & Metrics: Frame Delay, Frame Delay Variation	IETF RFC 5357 TWAMP Two-Way Active Measurement Protocol
Layer 2 SLA Monitoring & Metrics: Frame Delay, Frame Delay Variation, Frame Loss	ITU-T Y.1731 Ethernet OAM
Service Heartbeats, End-to-End & Hop-by-Hop fault detection	IEEE 802.1ag CFM Connectivity Fault Management
Enhanced troubleshooting, rapid network discovery	IEEE 802.3ah EFM Physical Link

Figure 2. 3930 OAM suite

Industry-Leading OAM Suite

Successful Carrier Ethernet service deployments require an effective strategy to monitor the health and performance of the network and end-customer EVCs. The approach to OAM can make or break the business case, as customers demand expanded SLA verification and inefficient approaches drive OPEX.

Ciena's portfolio has a strong OAM feature suite providing comprehensive link, service, and network monitoring and performance metrics. OAM features available today include:

• IEEE 802.1ag Connectivity Fault Management (CFM)

• IEEE 802.3ah Ethernet in the First Mile (EFM)

• IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

• ITU-T Y.1731 Performance Monitoring: Delay, Jitter, Loss

• IETF RFC 5618 TWAMP Sender and Responder for L3 SLA Monitoring

• IETF RFC 2544 Performance Benchmarking Test Generation and Reflection

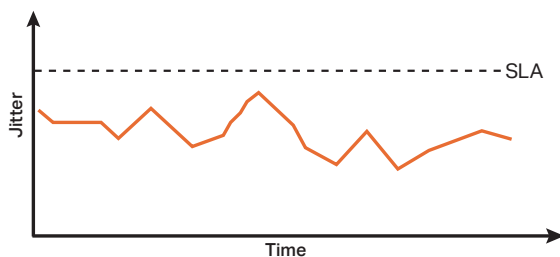• ITU-T Y.1564 Ethernet Service Activation Test Methodology

Figure 3: Proactive performance monitoring

The 3930 integrates performance benchmarking generation and reflection capabilities directly within the service delivery switch, enabling exceptional OPEX savings. Most mobile operators and other demanding end-customers require performance test and characterization before service acceptance. Typically, this testing is performed by technicians with expensive handheld test sets, leading to scheduling delays and associated high OPEX costs.

Ciena's low-touch turn-up simplifies system turn-up and enables 2544 performance testing to be run from the NOC. This efficiency minimizes service personnel costs and ensures consistent, reproducible test reports ready for immediate transmission to the customer for service acceptance.

A built-in test generator/reflector also empowers the operator to be highly responsive to service disruptions. When service impacts are detected by ongoing performance monitoring tests (Y.1731 or TWAMP) or upon report by the end-customer, performance tests can be initiated immediately by the NOC; no technician scheduling is required, no trucks are rolled. Testing to isolate and localize the issue and then focus resources on addressing the specific root cause can occur at virtually no cost. This responsiveness means troubles are fixed faster, minimizing service impact and creating higher customer satisfaction.

The 3930 enhances the RFC 2544 standard by providing additional metrics like Frame Delay Variation, including more expedient test suite results and architecting to the ITU-T Y.1564 standard for even greater capabilities.

Synchronization and Timing

The cost-effectiveness and versatility of Carrier Ethernet is driving the convergence of services, and placing new network synchronization requirements onto the Ethernet access/aggregation network. Provision of accurate frequency, phase, or time references from the Carrier Ethernet network is also beginning to emerge as a service in its own right. The 3930 includes capabilities to enable accurate and scalable delivery and distribution of frequency, phase, and time across the packet network to support applications such as LTE backhaul or synchronization as a service.

3930 supports:

- ITU-T G.8262 Synchronous Ethernet on all Ethernet ports for frequency distribution and reference
- IEEE 1588v2 Precision Time Protocol including ordinary and boundary clock support for frequency, phase and time distribution
- Hybrid timing distribution model using synchronous Ethernet for frequency and PTP for phase and time
- A Stratum 3E oscillator for exceptional accuracy and stability as a timing master or slave
- Dedicated external BITS, GPS*, and 1pps* ports for local frequency, phase and time references

Blue Planet Manage, Control and Plan (MCP)

Blue Planet MCP unifies network and service management with resource control and network planning to drive service agility for Ciena's packet and optical networking portfolio. MCP is an open network lifecycle operations system unifying network/service management, control, and planning in a single platform with advanced visualization. Comprising a strategic shift away from traditional fragmented network management software, MCP enables the transformation to real-time, scalable software control, easily integrating into network operators' business processes through open APIs. It provides unified inventory and service management across multiple technology layers, real-time monitoring, and online planning, with the purpose of delivering an exceptional user experience. This results in fast, streamlined, data-driven operations for informed business decisions.

Flexible Deployment

The architecture of the 3930 provides flexibility to operators, enabling the one platform to address a multitude of service applications and deployment environments without sacrificing service feature capabilities.

- Extended temperature rating (-40°C to +65°C) enables deployment in a wide variety of locations
- Universal power options for DC applications (+24/-24/+36/-36/-48V), AC applications (100-240V) and simplex or duplex powering
- External alarm inputs enable the 3930 to be housed in Outside Plant (OSP) cabinets and provide environmental monitoring including doors and rectifiers

10G, at 1G Price Points

The 3930 provides the ability to deploy with 1G backhaul today and simply swap transceivers to upgrade to 10G when the customer needs it. This level of efficiency means no forklift change-outs are needed to migrate to high bandwidths, and no wasted capital investments.

For operators with a predominantly 1G access network, the 3930 enables a single platform deployment and tactical use of 10G where needed, plus an up-sell ability to market 10G to current 1G end-customers.

Technical Information

Interfaces

2 x 1/10G SFP+ NNI ports
4 x 100/1000M SFP UNI ports
4 x 10/100/1000M RJ-45; 100/1000M SFP UNI
    combo ports
1 x Console Port (RJ-45, EIA-561)
16 x External Alarm Inputs
1 x RJ45 sync input/output port
2 x mini-SMB sync input/output ports

Ethernet

IEEE 802.3 Ethernet
IEEE 802.3u Fast Ethernet
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)
Per-VLAN MAC Learning Control
Per-Port MAC Learning Control
IEEE 802.3ad Link Aggregation Control
    Protocol (LACP)
ITU-T G.8032 Ethernet Ring Protection Switching
Jumbo Frames to 9216 bytes
Layer 2 Control Frame Tunneling
MEF CE 2.0 Certified:
    E-LINE: EPL, EVPL
    E-LAN: EP-LAN, EVP-LAN
    E-Access: Access EPL, Access EVPL
    E-Tree: EP-Tree, EVP-Tree

Multicast Management

RFC 2236 IGMPv2 Snooping
IGMP Domains
IGMP Message Filtering
IGMP Inquisitive Leave
Broadcast/Multicast Storm Control
Unknown Multicast Filtering
Well-known Protocol Forwarding

Quality of Service

8 Hardware Queues per-Port
Committed and Excess Information Rate
    (CIR and EIR)
Classification based on
    IEEE 802.1D priority
    VLAN, source port, destination port,
    IP Precedence and IPDSCP
Layer 2, 3 Quality of Service
Ingress metering per-port
Ingress metering per-port per-CoS

Ingress metering per-port per-VLAN
Up to ~2000 Ingress Meters per-port
Up to 2048 Ingress Meters per-system
C-VLAN Priority to S-VLAN Priority Mapping
S-VLAN Priority based on C-VLAN ID
Per-VLAN Classification, Metering, and Statistics
Per-port, per-VLAN QoS with CIR and EIR
    traffic on Egress Queues

Synchronization

ITU-T G.8262/G.8264 SyncE
IEEE 1588v2 (OC, TC & BC)**
ITU-T G.8261
ITU-T G.8265/G8265.1
ITU-T G.8275
ITU-T G.8275.1*
Stratum3E oscillator
External Timing Interfaces:
    BITS in or out (1.544MHz, 2.048MHz, 2 Mb/s)
    10MHz, 1.544MHz, 2.048MHz in or out
    1pps in or out

Carrier Ethernet OAM

IEEE 802.1ag Connectivity Fault Management
    (CFM)
IEEE 802.3ah Ethernet in the First Mile (EFM)
IEEE 802.1AB Link Layer Discovery Protocol
    (LLDP)
ITU-T Y.1564 Ethernet Service Activation Test
    Methodology
RFC 2544 Performance Benchmarking Test
    Generation and Reflection
ITU-T Y.1564-compliant architecture
RFC 5618 TWAMP Responder and Receiver
TWAMP Sender
TWAMP +/- 1ms timestamp accuracy
Dying Gasp with Syslog and SNMP Traps

MPLS/VPLS

RFC 2205, 3031, 3036, 3985 MPLS Pseudowire
    Emulation Edge-to-Edge (PWE3)
RFC 3916, 3985, 4446, 4447, 4448 Pseudowires
RFC 5654 MPLS-Transport Profile (TP)
    LSP Static provisioning
    1:1 Tunnel protection
    LSP BFD via Gal/Gach
MPLS Virtual Private Wire Service (VPWS)
RFC 4664, 4665 L2VPNs
RFC 4762 VPLS (Virtual Private LAN Service) and
    Hierarchical VPLS (H-VPLS)
Provider Edge (PE-rs) Functionality for VPLS and
    H-VPLS
PE-rs Functionality with Spoke and Mesh Virtual
    Circuits

MTU-s Functionality for H-VPLS deployment
MTU-s Multihoming (redundant VCs to different
    PE-s switches)
MPLS Virtual Circuit as H-VPLS spoke Virtual
    Circuit
Q-in-Q Ethernet Virtual Circuit as H-VPLS spoke
    Virtual Circuit
MPLS Label Switch Path (LSP) Tunnel
    Redundancy
Layer 2 Control Frame Tunneling over MPLS
    Virtual Circuits
RFC 3209 RSVP-TE (for MPLS Tunnel Signaling)
RFC 3630 OSPF-TE (for MPLS Tunnel Routes)
RFC 3784 IS-IS-TE (for MPLS Tunnel Routes)
RFC 3036 Targeted LDP (for VPLS VC signaling)
RFC 4090 MPLS Fast ReRoute (via RSVP-TE)
MPLS Performance Monitoring
RFC 4379 LSP Ping
RFC 4379 LSP Traceroute
RFC 5085 LSP Ping and Traceroute extensions to
    work over Pseudowires (PW VCCV)

Service Security

Egress Port Restriction
IEEE 802.1X Port-Based Network Access
    Control (RADIUS/MD5)
Layer 2, 3 Protocol Filtering
Broadcast Containment
User Access Rights
Per-port or per-VLAN Service Access Control
Hardware-based DOS Attack Prevention
Hardware-based Access Control Lists (ACLs)

Network Management

Enhanced CLI
CLI-based configuration files
SNMP v1/v2c/v3
SNMPv3 Authentication and Message
    Encryption
RFC 1213 SNMP MIB II
RFC 1493 Bridge MIB
RFC 1643 Ethernet-like Interface MIB
RFC 1573 MIB II interfaces
RFC 1757 RMON MIB - including persistent
    configuration
RFC 2021 RMON II and RMON Statistics
Per-VLAN Statistics
RADIUS Client and RADIUS Authentication
TACACS + AAA
RFC 2131 DHCP Client
RFC 1305 NTP Client
RFC 1035 DNS Client
Telnet Server
RFC 1350 Trivial File Transfer Protocol (TFTP)

Technical Information continued

RFC 959 File Transfer Protocol (FTP)
Secure File Transfer Protocol (SFTP)
Secure Shell (SSHv2)
Syslog with Syslog Accounting
Port State Mirroring
Local Console Port
Comprehensive Management via Ethernet
Services Manager
Remote Autoconfiguration via TFTP, SFTP
Software download/upgrade via TFTP, SFTP

MAC Address Table Capacity

32,000 MAC addresses

Power Requirements

DC Input: -48, -36, +36, -24, +24 VDC (nominal)
AC Input: 100V, 240V AC (nominal)
AC Frequency: 50/60 Hz
Maximum Power Input: 75 to 95W, depends on
variant

Agency Approvals

Safety: UL/CSA 60950-1-07; IEC 60950-1:2005
(2nd edition); EN 60950-1:2006
Emissions: FCC Part 15 (2009); EN55022 (2006
+A1 2006); AS/NZS CISPR 22 (2006); CISPR
22 (2005 + A1 2005); ICES-003 Issue 4 (2004);
EN 61000-3-2 (2006); EN 300 386 (v1.4.1,
2008); EN 300 132-2 (2007-10); EN 300 132-
3 (2003-08)
Environmental: WEEE 2002/96/EC
RoHS 2002/95/EC
Immunity: CISPR 24 (1997, +A1 2001 + A2
2002); EN 55024 (1998 + A1 2001 + A2 2003);
EN 300 386 (v1.4.1, 2008); EN 61000-4-11
(2005); EN 61000-3-3 (2008); EN 300 132-2
(2007-10) ; EN 300 132-3 (2003-08)
Laser Safety: CDRH Letter of Approval (US FDA
Approval); FCC 21 CFR subpart (J) (Safety of
Laser Products); IEC 60825-1:2007

Environmental Characteristics

GR-63-CORE, Issue 3 – NEBS Level 3
GR-1089 Issue 5 – NEBS Level 3
GR-950 Issue 2 Optical Network Unit
GR-3108 Issue 2 Network Equipment in the
Outside Plant (OSP) Class 2
ETSI 300 019 Class 1.1, 2.2, 3.1
Operating Temperature:
-40°F to +149°F (-40°C to +65°C)
Storage Temperature:
-40°F to +158°F (-40°C to +70°C)
Relative Humidity:
5% to 90% (non-condensing)

Physical Characteristics

Dimensions: 17.5" (W) x 9.9" (D) x 1.75 " (H);
444mm (W) x 252mm (D) x 44mm (H)
Weight: 11.0 lbs; 5.0 kg

Ordering Information

3930, (4) 100/1000M SFP, (4) 10/100/1000
SFP/RJ-45, (2) 1G/10G SFP+, ext. temp.,
(2) slots AC/DC power sup.;
Part/Kit#: 170-3930-900
3930, (4) 100/1000M SFP, (4) 10/100/1000
SFP/RJ-45, (2) 1G/10G SFP+, synch.,
ext. temp., (2) slots AC/DC power sup.;
Part/Kit#: 170-3930-910
3930, (2) 1G/10G SFP+, (4) 100/1000M
SFP/RJ-45, (4) 100/1000M SFP, synch.,
(2) AC or DC plug power sup.;
Part/Kit#: 170-3930-930
3930/3932/5142, DC pluggable power supply,
wide range 24/48V; Part/Kit#: 170-0013-900
3930/3932/5142, AC pluggable power
supply, wide range 120/240V;
Part/Kit#: 170-0014-900

* Denotes features available in a future release

** It is recommended that a telecom profile be
utilized with IEEE1588v2 in telecom networks.
Contact your Ciena representative for details.

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