Experience. Outcomes.

DATA SHEET

3928

Service Delivery Platform

Ciena's 3928 Service Delivery Platform is a cost-effective solution for 10 Gb/s Ethernet service delivery in a variety of business or mobile backhaul environments.

The 3928 features a high-capacity 48 Gb/s switching fabric supporting four 1GbE or 10GbE ports and 8 100/100M/1000M ports in a compact 1RU chassis. The unit is powered by fixed, dual AC or DC power supplies, and is supported in environments requiring extended temperatures (DC option) such as outdoor cabinets or other uncontrolled environments.

The unit is a carrier-grade platform based on the Service-Aware Operating System (SAOS) used in all of Ciena's Packet Networking products to deliver a consistent set of benefits, including interoperability between platforms, improved efficiency of operations, and service consistency among applications. The ease with which these products can be automated and managed has been demonstrated over hundreds of thousands of deployments worldwide.

The SAOS not only delivers benefits of a field-proven and time-tested set of features, but also allows owners to offer services that cost-effectively 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, all of which lead to reduced cost of ownership and increased end-user satisfaction.

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 Ciena provides, operators can achieve a very profitable business case, even in highly competitive markets.

Features and Benefits

- Offers 48 Gb/s of non-blocking switching capacity in a compact service demarcation device, running Ciena's SAOS for advanced OAM and QoS functions
- Features low-footprint 1RU packaging with:
  – 4 x 1GbE/10GbE SFP+ ports
  – 8 x 1GbE SFP ports
- Benefits from Ciena's Blue Planet MCP multilayer provisioning support for end-to-end network management control and planning
- Allows for orchestration via Ciena's Blue Planet MDSO or a third-party solution. A truly open platform for integration of best-in-breed software functions
- Supports secure zero-touch provisioning to minimize OPEX and accelerate service turn-up while providing line-rate, built-in service activation testing
- Fixed dual AC or DC power supplies with extended temperature support (DC version)
- Complies with MEF CE 2.0 specifications for E-Line, E-LAN, E-Tree, and E-Access services

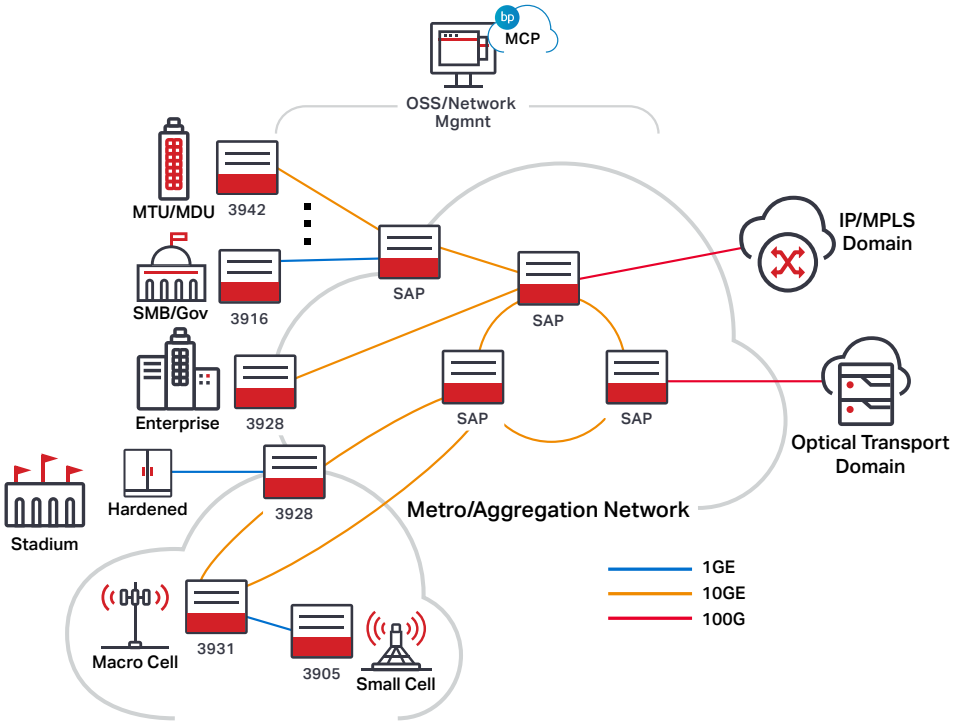

Figure 1. Sample metro aggregation network

10GbE at 1GbE price points

While the 3928 provides the ability to deploy with 10GbE services, not all customers will require the full line rate. The flexibility to adjust bandwidth with a simple swap of transceivers offers investment protection to both the operator and end-user. This level of efficiency means no forklift change-outs are needed to migrate to higher bandwidths, and no wasted capital investments.

For operators with a predominantly 1GbE access network, the 3928 enables a single platform deployment and tactical use of 10GbE where needed, plus an up-sell ability to market multi-gigabit service to current 1GbE end-customers.

Carrier Ethernet transport options

The 3928 provides unmatched flexibility to address multiple applications, business models, and deployment environments without sacrificing service capabilities or Quality of Service (QoS). To accomplish this, it employs a variety of packet transport options for Ethernet services, including G.8032 rings, MPLS-TP, 802.1q VLANs, and 802.1ad provider VLANs (Q-in-Q).

Operators can use combinations of these capabilities to address the specific needs of their packet network deployment. Multi-Chassis Link Aggregation (MC-LAG), G.8032 Ethernet ring protection, or MPLS-TP alternate path capabilities provide redundancy and resilience by addressing single-point-of failure concerns and maintaining high levels of customer satisfaction. The platform supports interworking between these transport options via a flexible and scalable switching architecture, leading to complete service ingenuity and optimal utilization of network resources.

Secure zero-touch provisioning

Ciena's zero-touch provisioning simplifies system turn-up and enables device deployment, service turn-up, and SLA performance testing to be run from the network operations center. This efficiency can significantly lower OPEX, eliminating the need for on-site personnel or adjunct test equipment and ensuring consistent, reproducible test reports are made available to the end-user. Operators can ramp service roll-outs faster, securely, and at lower cost, often avoiding truck rolls altogether.

Fine-grained SLA monitoring and enforcement

The 3928 includes RFC2544 and Y.1564 performance benchmark testing, enabling line-rate traffic measurements end to end across the Ethernet virtual circuit. This approach can improve end-customer satisfaction, enabling operations personnel to proactively respond to network events and increasing performance visibility for end-customer SLA reporting.

The 3928 implements hierarchical QoS that permits delivery of a wide range of traffic types and rates over a single access

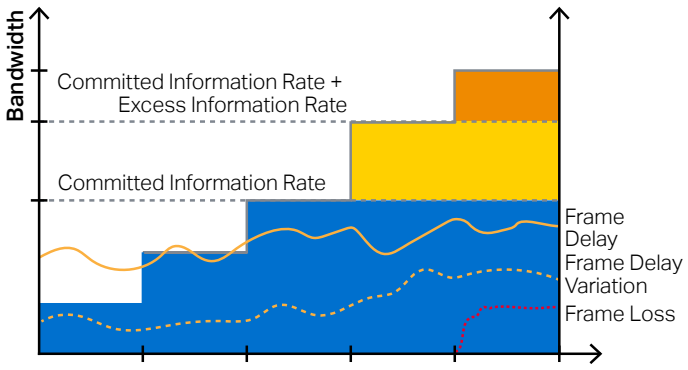

Figure 2. SLA measurement and monitoring

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.

Comprehensive OAM functions

Ciena's Packet Networking products incorporate an extensive Operations, Administration, and Maintenance (OAM) feature suite providing comprehensive link, service, and network monitoring and performance metrics.

The 3928's OAM features include:

- ITU-T Y.1731 performance monitoring for delay, jitter, and loss with hardware-assisted performance
- IEEE 802.1ag Connectivity Fault Management (CFM) with hardware-assisted performance
- IEEE 802. 3ah Ethernet in the First Mile (EFM)
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- IETF RFC 5618 TWAMP sender and responder for L3 SLA monitoring
- Full line-rate, built-in RFC 2544/ITU-T Y.1564 performance benchmark test generation and reflection

Simplified multilayer management and control

Ciena's Blue Planet Manage Control and Plan (MCP) software offers a unique and comprehensive solution for the administration of mission-critical networks that span access, metro, and core domains, and provides unprecedented multi-layer visibility from the photonic to the packet layers. With this innovative management approach, Blue Planet MCP returns control of the metro packet network and services directly to the network operator. By providing a unified view to the network from the photonic to the packet layer, network operations are simple, secure, and highly cost-effective.

With the addition of Blue Planet's Multi-Domain Service Orchestration (MDSO) capabilities, operators can leverage an advanced software architecture and open design concept to deliver a single comprehensive platform that can be tailored to meet customers' Software-Defined Networking (SDN), Network Functions Virtualization (NFV), and service orchestration use cases. These can be deployed across multi-vendor and multi-domain environments and scaled on demand. The result is a dramatic transformation of both how services are delivered and how networks are operated.

Flexible deployment options

The design of the 3928 also provides flexibility to enable deployment in a wide range of physical operating environments supporting:

- Commercial temperature range for AC-powered variant
- Extended temperature range for DC-powered variant
- Fixed AC/DC dual power options for high Mean Time Between Failures (MTBF)

Synchronization and timing

The cost-effectiveness and versatility of packet networking 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 network is also beginning to emerge as a service in its own right. The 3928 includes capabilities to enable accurate and scalable distribution of frequency, phase, and time across the packet network to support applications such as mobile backhaul or legacy TDM service support. The 3928 supports:

- ITU-T G.8262 Synchronous Ethernet on all Ethernet ports for frequency distribution and reference
- IEEE 1588v2 Precision Time Protocol (PTP), 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 (DC version)

Technical Information

Interfaces

8 x 1G SFP ports
4 x 10G SFP+ ports
1 x RJ-45 sync input/output port (DC version)
2 x SMB sync input/output ports (DC version)
1 x 10/100/1000M RJ-45 mgmt port
1 x serial console (RJ-45, EIA-561)
1 USB port

Ethernet

IEEE 802.3 Ethernet
IEEE 802.3u Fast Ethernet
IEEE 802.3z Gigabit Ethernet
IEEE 802.3-2008 10-Gigabit Ethernet
IEEE 802.3ab 1000Base-T via copper SFP
IEEE 802.1D MAC Bridges
IEEE 802.1ad Provider Bridging (Q-in-Q) VLAN full S-VLAN range
IEEE 802.1p Class of Service (CoS) prioritization
IEEE 802.1Q VLANs
VLAN tunneling (Q-in-Q) for Transparent LAN Services (TLS)
ITU-T G.8032 Ethernet Ring Protection Switching
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
Hierarchical Quality of Service (HQoS) w/ Ingress Metering/Egress shaping
Layer 2 Control Frame Tunneling
Link Aggregation (LAG): Active/Active; Active/ Standby
Multi-chassis LAG (MC-LAG) active/standby
Jumbo frames to 9216 bytes
MEF 10.2 Egress Bandwidth Shaping per EVC per CoS
MEF 10.3 Excess/Uncoupled Bandwidth Sharing (Token Cascading)
MEF 10.3/35.1 Performance Monitoring KPIs
Per-VLAN MAC Learning Control
Private Forwarding Groups
MSTP/RSTP

MEF CE 2.0 Compliance

E-Access: Access EPL, Access EVPL
E-LAN: EP-LAN, EVP-LAN
E-LINE: EPL, EVPL
E-Tree: EP-Tree, EVP-Tree

Carrier Ethernet OAM

EVC Ping (IPv4)
IEEE 802.1ab Link Layer Discovery Protocol (LLDP)
IEEE 802.1ag Connectivity Fault Management (CFM)
IEEE 802.3ah EFM Link-fault OAM
ITU-T Y.1564 Ethernet Service Activation Test Methodology
RFC 2544 Benchmarking Methodology for Network Interconnect Devices Generation and Reflection at 100GbE
ITU-T Y.1731 Performance Monitoring (SLM;DM)
RFC 5618 TWAMP Responder and Receiver TWAMP Sender
Dying Gasp with Syslog and SNMP Traps

Synchronization

ITU-T G.8262 Synchronous Ethernet EEC
ITU-T G.8264 for SyncE ESMC/SSM
ITU-T G.781
GR-1244
ITU-T G.813
ITU-T G.823/G.824
Stratum 3E oscillator
External Timing Interfaces (DC version):
• BITS in or out (1.544Mb/s, 2.048MHz and 2 Mb/s)
• GPS in or out (1.544MHz, 2.048MHz, and 10MHz)
• 1pps and ToD in or out (NMEA 0183, MSTS)
Line Timing Interfaces:
• 1GbE/10GbE In and Out

Service Security

Broadcast Containment
Egress Port Restriction
Hardware-based DOS Attack Prevention
Layer 2, 3, 4 Protocol Filtering
User Access Rights

Networking Protocols

Alarm Indication Signaling (AIS) with Link Down Indication (LDI) and Remote Defect Indication (RDI)
Automatic Pseudowire Reversion
ITU-T G.8032 v1, v2, v3 Ethernet Ring Protection Switching
Layer 2 Control Frame Tunneling over MPLS Virtual Circuits
MPLS Label Switch Path (LSP) Tunnel Groups
MPLS Label Switch Path (LSP) Tunnel
MPLS Multi-Segment Pseudowires
MPLS Virtual Private Wire Service (VPWS)
OSPF/IS-IS for Dynamic MPLS-TP Control Plane
RFC 2205 RSVP
RFC 3031 MPLS architecture
RFC 3209 RSVP-TE: Extensions to RSVP for LSP RFC 3630 OSPF-TE
RFC 4447 Pseudowire Setup & Maintenance using Label Distribution Protocol (LDP)
RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks (PW over MPLS)
RFC 4664 Framework of L2VPN (VPLS/VPWS)
RFC 4665 Service Requirement of L2 VPN
RFC 4762 VPLS (Virtual Private LAN Service) and Hierarchical VPLS (H-VPLS)
RFC 5654 MPLS-Transport Profile (TP)
LSP Static provisioning
LSP Dynamic provisioning
1:1 Tunnel protection
RFC 5884 LSP Bidirectional Forwarding Detection (BFD) via GAL/G-Ach channels
RFC 6215 MPLS Transport Profile User-to-Network and Network-to-Network Interfaces
RFC 6426 MPLS On-demand Connectivity Verification and Route Tracing
RFC 6428 LSP and PW Connectivity Verification and Trace Route
Static ARP and MAC Destination Address Resolution
VCCV (Virtual Circuit Continuity Check) Ping and Trace Route
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
Jumbo Frames to 9216 bytes
Layer 2 Control Frame Tunneling

Multicast

DHCPv4 Relay Agent with Option 82
G.8032/IGMP interworking
IGMP over MPLS-TP
IGMPv3 with SSM

Quality of Service

8 Hardware Queues per-Port
Committed and Excess Information Rates (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
Agency Approvals
Australia RCM (Australia/New Zealand)
CE mark (EU)
EMC Directive (2014/30/EU)
LVD Directive (2006/95/EC)
RoHS2 Directive (2011/65/EU)
ETSI 300 019 Class 1.2, 2.2, 3.2

Technical Information

Quality of Service (continued)

GR-1089 Issue 6 – NEBS Level 3
GR-63-CORE, Issue 4 – NEBS Level 3, Zone 4 Earthquake
NRTL (NA)
VCCI (Japan)
NOM (Mexico)

Network Management

Alarm Management & Monitoring Configuration
Comprehensive Management via Enhanced CLI
Integrated Firewall
IPv4 & IPv6 Management Support
Local Console Port
Per-VLAN Statistics Port State Mirroring
RADIUS Client and RADIUS Authentication
Remote Auto configuration via TFTP, SFTP
Remote Link Loss Forwarding (RLLF)
RFC 959 File Transfer Protocol (FTP)
RFC 1035 DNS Client
RFC 1213 SNMP MIB II
RFC 1493 Bridge MIB
RFC 1573 MIB II interfaces
RFC 1643 Ethernet-like Interface MIB
RFC 1757 RMON MIB - including persistent configuration
RFC 2021 RMON II and RMON Statistics
RFC 2131 DHCP Client
RFC 3877 Alarm MIB
RFC 4291 – IPv6 addressing (for Management Plane)
RFC 4443 – ICMPv6
RFC 4862 – Stateless address auto-configuration
RFC 5905 NTP Client
RFC 1350 Trivial File Transfer Protocol (TFTP)
Secure File Transfer Protocol (SFTP)
Secure Shell (SSHv2)
SNMP v1/v2c/v3
SNMP v3 Authentication and Message Encryption
Software upgrade via FTP, SFTP
Syslog with Syslog Accounting
TACACS + AAA
Telnet Server
Virtual Link Loss Indication (VLLI)
Secure Zero Touch Provisioning

Power Requirements

DC Input: -24, +24, -48 VDC (nom)
DC max power consumption 62W
AC Input: 100V, 240V AC (nom)
AC max power consumption 96W

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

Environmental Characteristics

NEBS Level 3 compliant
ETSI Class A compliant
Operating Temperature:
DC: -40°F to +149°F (-40°C to +65°C)
AC: +32°F to +122°F (-0°C to +50°C)
Storage Temperature:
-40°F to +158°F (-40°C to +70°C)
Relative Humidity:
5% to 90% (non-condensing)

Standards Compliance

Emissions:
CISPR 22 Class A
CISPR 32 Class A
EN 300 386
EN 55032
FCC Part 15 Class A
GR-1089 Issue 6
Industry Canada ICES-003 Class A
VCCI Class A
Environmental:
RoHS2 Directive (2011/65/EU)
WEEE 2002/96/EC
Immunity (EMC):
GR-1089 Issue 6
Power:
CISPR 24
EN 300 386
EN 55024
ETSI EN 300 132-2
ETSI EN 300 132-3
Safety:
ANSI/UL 60950-1 2nd edition 2007
CAN/CSA C22.2 No. 60950-1-07
EN 60950-1
IEC 60825-1 2nd edition (2007)
IEC 60825-2 3rd edition (2004)

Ordering Information

Part Number	Description
170-3928-900	3928, (8)100M/1G SFP,(4)10/1G SFP+,SYNCH,DUAL AC POWER,REQ. POWER CABLE
170-3928-901	3928,(8)100M/1G SFP,(4)10/1G SFP+,SYNCH,EXT. TEMP,DUAL DC POWER
Software	
Required OS Base System Perpetual Software Licenses	
S70-0040-900	SAOS ADVANCED ETHERNET & OAM PERPETUAL SOFTWARE LICENSE FOR 3928
Optional OS Applications	
S70-0040-902	SAOS ADVANCED MPLS APPLICATION PERPETUAL SOFTWARE LICENSE FOR 3928
S70-0040-903	SAOS ADVANCED SYNCHRONIZATION PERPETUAL SOFTWARE LICENSE FOR 3928
S70-0040-905	SAOS ADVANCED 10G PERPETUAL SOFTWARE LICENSE FOR 3928
S70-0040-906	SAOS ADVANCED SECURITY PERPETUAL SOFTWARE LICENSE 3928
ESM Related	
S70-0041-900	ESM CARRIER ED RIGHT TO MANAGE PERPETUAL SOFTWARE LICENSE FOR 3928

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