ciena®

3928

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

The 3928 features a high-capacity 48 Gb/s switching fabric supporting four 10GbE/1GbE ports and 8 1GbE 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 Routing and Switching 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.

Efficient 10GbE service delivery

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.

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 MCP multilayer provisioning support for end-to-end network management control and planning

- Allows for orchestration via Blue Planet MDSO or a third-party solution; a truly open platform for integration of best-in-breed software functions

- Can be configured as an IP Router (SAOS 10.x) or Universal Access Platform (SAOS 6.x)

- Supports secure ZTP to minimize OPEX and accelerate service turn-up while providing 10G line-rate, built-in traffic generation and reflection testing

- Fixed dual AC or DC power supplies with extended temperature support (DC version)

- Complies with MEF 3.0 specifications for E-Line, E-LAN, E-Tree, and E-Access services
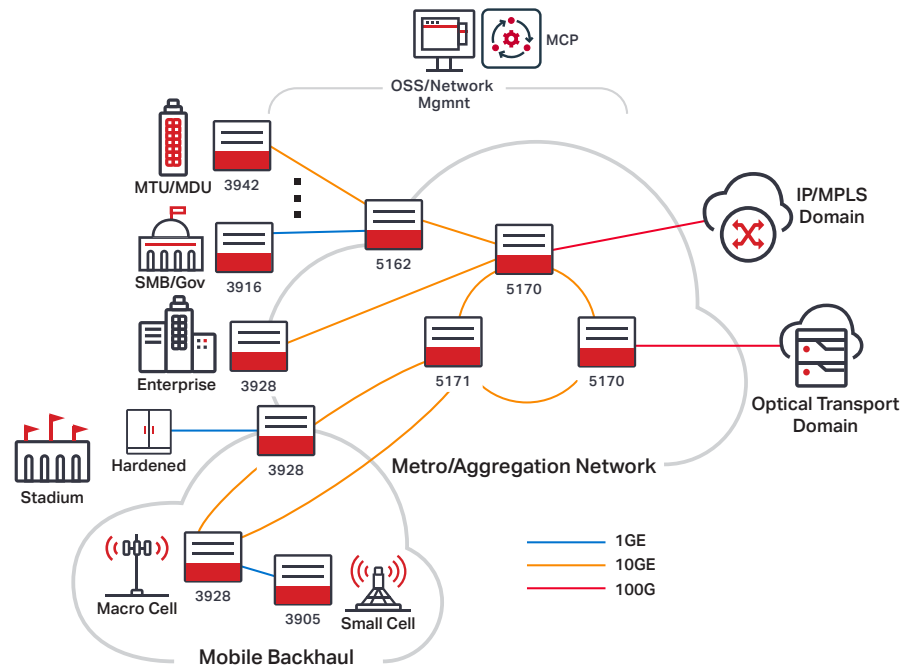
Figure 1. Sample metro aggregation network

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.

Fine-grained SLA monitoring and enforcement

The 3928 includes performance benchmark testing based on ITU-T Y.1564 and RFC2544, enabling end to end 10G line-rate traffic measurements across virtual circuits. 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.

Comprehensive OAM functions

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

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
• Redundant AC or DC power options provide increased
  service availability

Synchronization and timing

The cost-effectiveness and versatility of networking is driving the convergence of services and placing new network synchronization requirements onto the 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 provides the ability to address these requirement with support for synchronous Ethernet, IEEE 1588v2 and Stratum 3E holdover. Additionally, the DC variant of the 3928 provide external interfaces for synchronization including BITS, frequency reference and 1pps phase reference.

Zero-Touch Provisioning

Ciena's Zero-Touch Provisioning (ZTP) 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 rollouts faster, securely, and at lower cost, often avoiding truck rolls altogether.

Simplified multilayer management and control

Ciena's 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, while providing unprecedented multi-layer visibility from the photonic to the packet layers. With this innovative management approach, MCP returns control of the metro network and services directly to the network operator.
By providing a unified view to the network from the photonic to the data layer, network operations are simple, secure, and highly cost-effective.

IP Router Configuration (SAOS 10.x)

When configured with SAOS software stream 10.x, the 3928 operates as an IP router supporting NETCONF/YANG to enable an open SDN environment with full visibility via telemetry and automated provisioning using open APIs. The 3928 is purpose-built to provide Layer 2 and Layer 3 services over carrier-grade infrastructure, by supporting a rich suite of Ethernet, IP/MPLS, BGP, IS-IS, and OSPF. The 3928 is open and standardized, making it the perfect platform for deployments in both greenfield and brownfield scenarios.

Universal Access Configuration (SAOS 6.x)

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.

Technical information (Common)

Interfaces
4 x 10GbE/1GbE SFP+ ports
4 x 1GbE/100M SFP ports
4 x 1GbE SFP ports
1 x RJ-45 BITS input/output port (DC version)
1 x SMB frequency input/output port (DC version)
1 x SMB 1pps phase input/output port (DC version)
1 x 10/100/1000M RJ-45 management port
1 x serial console (RJ-45, EIA-561)
1 USB2.0 port

Power Requirements
DC Input: -24, +24, -48 VDC (nom)
DC max power consumption 62W
AC Input: 100V, 240V AC (nom)
AC frequency: 50Hz, 60Hz
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, Immunity (EMC):
CISPR 22
CISPR24
CISPR 32
EN 300 386
EN 55032
EN55024
FCC Part 15 Class A
GR-1089 Issue 6
Industry Canada ICES-003 Class A
VCCI CISPR 32
AS/NZS CISPR 32

Environmental:
RoHS Directive
WEEE
GR-1089 Issue 6
GR-63-Core Issue 5
ETSI EN 300 132-2
ETSI EN 300 132-3
Safety:
UL 60950-1 2nd edition 2007
CAN/CSA C22.2 No. 60950-1-07
EN 60950-1
IEC 60825-1
IEC 60825-2
Service Security
Broadcast Containment
Egress Port Restriction
Hardware-based DOS Attack Prevention
Layer 2, 3, 4 Protocol Filtering
User Access Rights

Technical information (SAOS 10.x) – Router Configuration

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)
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
Layer 2 Control Frame Tunneling
Link Aggregation (LAG): Active/Active; Active/ Standby
Jumbo frames to 9216 bytes
Per-VLAN MAC Learning Control

MEF 3.0 Compliance

E-Line
E-LAN
E-Tree
Access E-Line
Transit E-Line

Carrier Ethernet OAM

• Dying Gasp with Syslog and SNMP Traps
• IEEE 802.1ab Link Layer Discovery Protocol (LLDP)
• IEEE 802.1ag Connectivity Fault Management (CFM)
• ITU-T Y.1731 Performance Monitoring (SLM; DMM)

Synchronization

ITU-T G.8262 Synchronous Ethernet
ITU-T G.8262/G.8264 EEC option1 and option2
ITU-T G.8264 for SyncE ESMC/SSM
ITU-T G.781
GR-1244
ITU-T G.813
ITU-T G.823/G.824
IEEE 1588v2 Precision Time Protocol
ITU-T G.8275/G.8275.1
Stratum 3E oscillator

External Timing Interfaces (DC version):

• BITS in or out (1.544Mb/s, 2.048MHz and 2 Mb/s)
• Frequency 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

Networking Protocols

ISO10598 IS-IS intra-domain routing protocol

RFC1195 Use of OSI Is-Is for Routing in TCP/IP and Dual Environments

RFC3359 Reserved Type, Length and Value (TLV) Codepoints in Intermediate System to Intermediate System

RFC3719 Recommendations for Interoperable Networks using IS-IS

RFC3787 Recommendations for Interoperable IP Networks using IS-IS

RFC.5309 Point-to-Point Operation over LAN in Link State Routing Protocols

RFC.5303 Three-Way Handshake for IS-IS Point-to-Point Adjacencies

RFC.5302 Domain-Wide Prefix Distribution with Two-Level IS-IS

RFC.5301 Dynamic Hostname Exchange Mechanism for IS-IS

RFC 3787 Recommendations for interoperable IP networks using IS-IS

RFC 3359 Reserved TLV Codepoints in IS-IS

RFC1772 BGP basic functions support

RFC1930 Guidelines for creation, selection, and registration of an Autonomous System (AS)

RFC1997 BGP Community Attribute

RFC1998 An Application of the BGP Community Attribute in Multi-home Routing

RFC2270 Using a Dedicated AS for Sites Homed to a Single Provider

RFC2439 BGP Route Flap Damping

RFC2519 A Framework for Inter-Domain Route Aggregation

RFC4364 BGP/MPLS IP Virtual Private Networks (VPNs)

RFC2918 Route Refresh Capability for BGP-4

RFC3107 Support BGP carry Label for MPLS

RFC4271 A Border Gateway Protocol 4 (BGP-4)

RFC4360 BGP Extended Communities Attribute

RFC4364 BGP/MPLS IP Virtual Private Networks

RFC4760 Multiprotocol Extensions for BGP-4

RFC6793 BGP Support for Four-Octet Autonomous System (AS) Number Space

RFC5004 Avoid BGP Best Path Transitions from One External to Another

RFC5398 Autonomous System (AS) Number Reservation for Documentation Use

RFC5492 Capabilities Advertisement with BGP-4

RFC 7911 Advertisement of Multiple Paths in BGP

RFC4684 Constrained Route Distribution for Border Gateway Protocol/Multiprotocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs)

RFC5668 4-Octet AS Specific BGP Extended Community

RFC2764 A Framework for IP Based Virtual Private Networks

RFC5681 TCP Congestion Control

RFC2873 TCP Processing of the IPv4 Precedence Field

RFC 3443 MPLS TTL processing

RFC 3032 MPLS label stack encoding

RFC5036 LDP Specification

RFC3215 LDP State Machine

RFC5037 Experience with the LDP protocol

RFC5561 LDP Capabilities

RFC3031 Multiprotocol Label Switching Architecture

RFC5462 Multiprotocol Label Switching (MPLS) Label Stack Entry: "EXP" Field Renamed to "Traffic Class" Field

RFC1321 The MD5 Message-Digest Algorithm

RFC4250 Protocol Assigned Numbers

SSH File Transfer Protocol, Draft 13

RFC1812 Requirements for IP Version 4 Routers

RFC2865 Remote Authentication Dial in User Service (RADIUS)

RFC2475 An Architecture for Differentiated Services

RFC2597 Assured Forwarding PHB Group

RFC2697 A Single Rate Three Color Marker.

RFC2698 A Two Rate Three Color Marker

RFC3260 New Terminology and Clarifications for Diffserv

Networking Protocols continued

RFC4632 Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan

RFC6310 Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping

RFC2328 OSPF Version 2

BGP Prefix Independent Convergence draft-ietf-rtgwg-bgp-pic-08.txt

RFC7737 Label Switched Route (LSP) Ping and Traceroute Reply Mode Simplification

RFC 6241 Network Configuration Protocol (NETCONF)

Technical information (SAOS 10.x) – Router Configuration (continued)

Network Management

Alarm Management & Monitoring Configuration

Event and Alarm Notification/Generation

Comprehensive Management
• Via CLI Management
• Via Netconf/YANG Models

IPv4 & IPv6 Management Support

Remote Auto configuration via TFTP, SFTP

RFC2131 DHCP Client

RFC5905 NTP Client

RFC1350 Trivial File Transfer Protocol (TFTP)

Secure File Transfer Protocol (SFTP)

Secure Shell (SSHv2)

Software upgrade via FTP, SFTP

Syslog Accounting

TACACS + AAA

gRPC based Telemetry

RADIUS, AAA

Zero-Touch Provisioning (ZTP)

Technical information (SAOS 6.x) – Universal Access Configuration

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 3.0 Certified

E-Line

E-LAN

E-Tree

Access E-Line

Transit E-Line

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 10GbE

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

ITU-T G.8262/G.8264 EEC option1 and option2

ITU-T G.8264 for SyncE ESMC/SSM

ITU-T G.781

GR-1244

ITU-T G.813

ITU-T G.823/G.824

IEEE 1588v2 Precision Time Protocol

ITU-T G.8275/G.8275.1

Stratum 3E oscillator

External Timing Interfaces (DC version):
• BITS in or out (1.544Mb/s, 2.048MHz and 2 Mb/s)
• Frequency 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

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

Networking Protocols continued

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

DHCPv4 Relay Agent with Option 82

G.8032/IGMP interworking

IGMP over MPLS-TP

IGMPv3 with SSM

8 Hardware Queues per-Port

Committed and Excess Information Rates (CIR and EIR)

Technical information (SAOS 6.x) – Universal Access Configuration (continued)

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)
NRTL (NA)
VCCI (Japan)
Mexico
BSMI (Taiwan)
CCC (China)
KC (Korea)
ANATEL (Brazil)

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

Ordering Information (SAOS 10.x) - Router Configuration

Part Number	Description
170-3928-910	3928,(4)100M/1G SFP,(4)1G SFP,(4)10/1G SFP+,SAOS 10.X,SYNCH,DUAL AC POWER,REQ. POWER CABLE
170-3928-911	3928,(4)100M/1G SFP,(4)1G SFP,(4)10/1G SFP+,SAOS 10.X,SYNCH,EXT. TEMP,DUAL DC POWER
Required OS Base System Perpetual Software Licenses	
S75-LIC-3928EO-P	SAOS BASE OS, ETHERNET & OAM SOFTWARE LICENSE FOR 3928, PERPETUAL
Optional OS Applications	
S75-LIC-3928MPLS-P	SAOS ROUTING AND MPLS SOFTWARE LICENSE FOR 3928, PERPETUAL
S75-LIC-3928SYNC-P	SAOS SYNCHRONIZATION SOFTWARE LICENSE FOR 3928, PERPETUAL
S75-LIC-392810G-P	SAOS 10G SOFTWARE LICENSE FOR 3928, PERPETUAL
S75-LIC-3928SEC-P	SAOS SECURITY SOFTWARE LICENSE FOR 3928, PERPETUAL

Ordering Information – (SAOS 6.x) - Universal Access Configuration

Part Number	Description
170-3928-908	3928,(4)100M/1G SFP,(4)1G SFP,(4)10/1G SFP+,SAOS 6.X,SYNCH,DUAL AC POWER,REQ. POWER CABLE
170-3928-909	3928,(4)100M/1G SFP,(4)1G SFP,(4)10/1G SFP+,SAOS 6.X,SYNCH,EXT. TEMP,DUAL DC POWER
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

CIENA 3928 PLATFORM EQUIPMENT

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Ciena's 3928 Platform is a cost-effective platform for 10 Gb/s Ethernet service delivery in a variety of business or mobile backhaul environments. Based on the Service-Aware Operating System (SAOS) used in all of Ciena's Routing and Switching products it delivers a consistent set of benefits, including interoperability between platforms, improved efficiency of operations, and service consistency among applications.

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BILL MCAULIFFE
Director of Sales – National Accounts
TEAMMCAULIFFE@PICSTELECOM.COM | 585.746.6383 | TELECOMCAULIFFE.COM