

OcNOS Cell Site Router (CSR)

August 2024

1.0 OcNOS for Cell Site Router

The OcNOS network operating system-based solution supports cost optimized white-box cell site gateway devices based on and fully compliant with Telecom Infra Project's (TIP) DCSG specifications, including support for segment routing, Multiprotocol Label Switching (MPLS), and timing. This DCSG solution provides cell site backhaul networking for carriers with existing 4G LTE and future 5G mobile infrastructure. The OcNOS cell site router solution is available on a wide variety of DCSG platforms supporting varied switching capacities.

The OcNOS CSR product is a smart converged integrated access platform which enables Service Providers to deliver next-level business and entertainment experiences.

KEY COMPONENTS:

Multi-vendor CSR hardware platform

Open Compute Project (OCP) and TIP DCSG Compliant ODM smart integrated access platforms supporting up to 360 Gbps capacity.

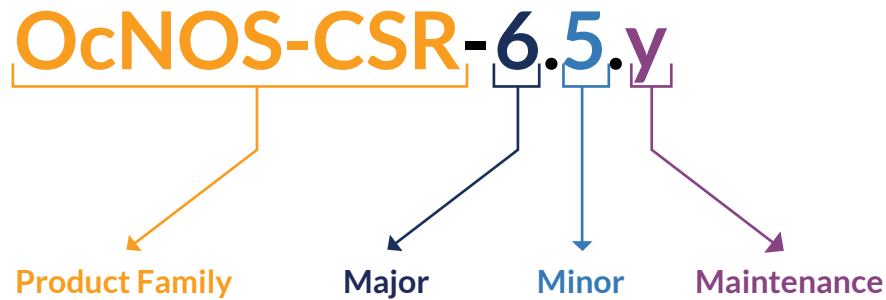
OcNOS as a full-featured network OS for open networking

Its features include advanced capabilities, such as extensive switching and routing protocol support, MPLS (Multiprotocol Label Switching) support, and SDN (software defined networking) integration capabilities. OcNOS features hybrid, centralized or distributed network support; scalable, modular high-performance network; and a robust data plane built on merchant silicon.

IP Infusion Advanced Network Services

Includes comprehensive network design, monitoring and technical support services.

2.0 IP Infusion Product Release Version



Product Name: Refers to IP Infusion Product Family.

Major Version: A major release consists of major new features and/or large architectural changes.

Minor Version: A minor release includes some feature enhancement, functions and bug fixes.

Maintenance: Improvements and fixes to existing features enhancing stability of the product.

3.0 OcNOS-CSR Features

The table below lists the software features for OcNOS-CSR. Note, the following mentioned features are only indicative and the detailed feature list may vary. Please refer to the Feature Matrix for the complete feature list on supported ODM platforms.

3.1 CSR Software Features

SOFTWARE FEATURE	SPECIFICATION
Layer 2 Switching	<ul style="list-style-type: none">• VLAN• Spanning Tree Protocol (STP)• Multiple Spanning Tree Protocol (MSTP)• Rapid Spanning Tree (RSTP)• Link Layer Discovery Protocol (LLDPv2)• Link Aggregation• Multi-Chassis Link Aggregation (MLAG)• MLAG with RSTP• MLAG + Provider Bridging (PB) with RSTP• MLAG + VRRPv4 with RSTP• MLAG + VRRPv6 with RSTP• Provider Bridging• Static MAC Address Assignment• Bridge Protocol Data Unit (BPDU) Protect• Root Guard• MAC Learning Disable• Port-based Authentication with RADIUS Server• Port Security• Unidirectional Link Detection (UDLD)

SOFTWARE FEATURE	SPECIFICATION
<p>Layer 3 Routing</p>	<ul style="list-style-type: none"> • Ethernet ARP • Transmission of IP Datagrams over Ethernet • Congestion Control in IP/TCP Networks • IP Broadcast • IP Broadcast in the Presence of Subnets • IP Subnetting • Classless Inter-Domain Routing (CIDR) • Requirements for IP Version 4 Routers • Route Redistribution across RIP, OSPF and BGP • VLAN Routing • Policy Based Routing • Inter Virtual Routing and Forwarding (VRF) Route Leaking • Static Inter VRF Route Leaking for IPv6 (between Default and Non-Default instances) • Multiple Loopback interfaces in same VRF • Static route tracking using object tracking (IP SLA) • Route Advertisement for IPv6 • Route Monitor • URPF • BGP • RIP • OSPF • ISIS • BFD • VRRPv3
<p>Multi-Protocol Label Switch (MPLS)</p>	<ul style="list-style-type: none"> • Label Distribution Protocol (LDP) • LDP ECMP • LDP Authentication support for Auto Targeted Peer • Resource Reservation Protocol [Traffic Engineering] (RSVP-TE) • Layer 2 VPN (VPWS and VPLS) • Layer 3 VPN • 6PE/VPE • LSP Stitching • MPLS OAM • MPLS Diffserv • MPLS Label Switching Router (LSR) MIB • MPLS Forwarding Equivalence Class to Next Hop Label Forwarding Entry (FEC-To-NHLFE) MIB • MPLS PW and LSP Traffic Statistics • MPLS Label Stack Encoding • Time To Live (TTL) Processing MPLS Networks • RSVP Shared Risk Link-Group (SRLG) support • Multiple match criteria for VPWS Ethernet Encapsulation using Service Template • Multiple match criteria for VPLS Ethernet Encapsulation using Service Template • RSVP-TE • FRR • LDP over RSVP-TE • Auto-Bandwidth with RSVP-TE

SOFTWARE FEATURE	SPECIFICATION
Carrier Ethernet	<ul style="list-style-type: none"> • Connectivity Fault Management (CFM) <ul style="list-style-type: none"> - CFM over L2 Bridge with xSTP - CFM over VPWS - CFM over EVPN ELINE Single Homing - CFM over EVPN MPLS ELINE Multi Homing • ITU-T Y.1731 over MPLS/VPWS/EVPN-ELINE using Subinterface • Ethernet Ring Protection Switching (ERPS) <ul style="list-style-type: none"> - ERPS over CFM on Provider/Customer domain - Sub-ring support (Multiple ring and ladder topologies) - Support of multiple ERP Instances on single ring - ERPS Over Bridge-domain • Ethernet Linear Protection (ELPS) • EFM-OAM
Multicast Features	<ul style="list-style-type: none"> • PIM • PIM ECMP-IPv4 • IGMP
Quality of Service (QoS)	<ul style="list-style-type: none"> • DiffServ Field in IPv4/IPv6 Headers • Assign matching traffic flow to a specific queue • 1/2/3 Level queuing hierarchy • L2 and L3 QoS • Shaping per queue, per port • Multiple hardware queues per port • WFQ/SP Scheduling Per Queue • WRED • 802.1p remarking • Classification based on interface, ACL, DSCP, IP precedence, 802.1p, and VLAN • Trust IEEE 802.1p/DSCP • Police Rate (SRTCM/TRTCM) • Minimum and Maximum Bandwidth Per Queue • Service Queuing (Mapping services to specific vlans and shaping each vlan based traffic) • IP SLA (ICMP Echo) • ToS Based queue distribution over Layer 2 Interface
Management	<ul style="list-style-type: none"> • Two-way Active Measurement Protocol (TWAMP) <ul style="list-style-type: none"> - TWAMP - One Way Measurement - TWAMP - Link level Delay and Loss Measurement - TWAMP over MPLS transport - TWAMP - Reflector/Server - TWAMP Client • TWAMP - Link level Delay and Loss Measurement • TWAMP over MPLS transport • TWAMP - Reflector/Server • Role based CLI management and access • CLI access via console, telnet and SSH • CLI commit rollback • Authentication using TACAS+/RADIUS Client • Extended ping and traceroute • SNMP v1, v2, and v3 • DHCP client • DHCP relay • DHCP group (IPv4 and IPv6) • DHCP Option 82 (IPv4) • NTP Client • NTP Server

SOFTWARE FEATURE	SPECIFICATION
Management (cont'd)	<ul style="list-style-type: none"> • Syslog • File Upload/Download using FTP/TFTP/SFTP/SCP • Management VRF • Ansible • Upgrade Mechanism from ONIE prompt using onie nos install and from OcNOS shell using sys-update • Zero Touch Provisioning (ZTP) (with IPv4) • Zero Touch Provisioning (ZTP) (with IPv6) • ACL Support over Management, VTY and Loopback • sFlow • Debounce Timer • DHCPv6 Prefix Delegation • DNS Relay (v4 and v6) • Storing Multiple images on Platform • DHCP Relay over L3VPN • Fault Management System • DHCP Relay across VRFs • DHCP Server (IPv4 and IPv6) • Network Configuration Protocol (NETCONF) <ul style="list-style-type: none"> - YANG 1.0 Data Modeling Language - YANG 1.1 Data Modeling Language - NETCONF Protocol over Secure Shell (SSH) - NETCONF Event Notifications - YANG Module for NETCONF Monitoring - NETCONF Base Notifications - NETCONF Access Control Model - Multiple simultaneous config session for CLI - Transaction based CLI - NetConf OpenConfig - Netconf Call Home • Streaming Telemetry dial-in and dial-out • Configurable Password Policy • Event Manager
Security	<ul style="list-style-type: none"> • Secure interface login and password • Control Plane Policing (CoPP) • Storm control • Flow control • DHCP Snooping • IP Source Guard • Dynamic ARP Inspection • Access Control Lists (ACLs) based on <ul style="list-style-type: none"> - IP/Port/IP-ProtocolType/MAC/Ethertype - TCP Flags, Protocol type, IP fragment flags, DSCP, CoS, IP Precedence, VLAN - Rule Prioritization and re-sequence - On-Fly modification - Timed ACL

SOFTWARE FEATURE	SPECIFICATION
Hardware Monitoring Features	<ul style="list-style-type: none"> • Switched port analyzer (SPAN) • Remote switched port analyzer (RSPAN) • Load Balancing • PHY/MAC level interface loopback • TCAM space monitoring • Chassis Monitoring <ul style="list-style-type: none"> - Temperature monitor - Fan control - CPU load monitoring - Board information (EEPROM) - Fan and PSU FRU information - 100G Port Breakout • Digital Diagnostics Monitoring <ul style="list-style-type: none"> - Temperature monitor • Power Monitoring (Power, Current, Voltage)
Timing and Synchronization	<ul style="list-style-type: none"> • Timing characteristics of a synchronous equipment slave clock (SyncE) - G.8262 • Distribution of timing information through packet networks (ESMC) - G.8264 • PTP Telecom profile for phase/time synchronization with full timing support from the network (T-BC) - G.8275.1 (T-BC) • Timing characteristics of telecom boundary clocks for use with full timing support from the network (T-BC) - G.8273.2 (T-BC) • PTP Telecom profile for phase/time synchronization with full timing support from the network (T-GM with Antenna Compensation) - G.8275.1 (T-GM) • PTP TP for time/phase synchronization with partial timing support from the network (T-BC-P, T-BC-A) - G.8275.2 (T-BC-P, T-BC-A) ; ITU-T G.8273.4 • PTP TP for time/phase synchronization with partial timing support from the network (T-GM with Antenna Compensation) - G.8275.2 (T-GM) • Default profile (T-BC) - IEEE-1588 (Annex J) • Default profile (T-GM) - IEEE-1588 (Annex J) • PTP Telecom Profile for frequency synchronization (T-GM) - G.8265.1 (T-GM) • PTP Telecom Profile for frequency synchronization (T-TSC) - G.8265.1 (T-TSC) • E2E Transparent clock (TC) - IEEE-1588 ; ITU-T G.8273.3 [Works with both G8275.1, G8275.2, default profile] • IWF (Interworking function)
Sub-interface	<ul style="list-style-type: none"> • Support for L2 Sub-Interface • Support for L3 Sub-Interface
MPLS with EVPN	<ul style="list-style-type: none"> • EVPN MPLS - ELINE and ELAN • EVPN MPLS Multihoming (ELINE & ELAN) • EVPN MPLS - QoS (ELINE & ELAN) • EVPN MPLS - ETREE • EVPN MPLS - CFM over ELINE • EVPN over Segment-Routing (LSP/Policy) • EVPN MPLS Service Mapping via local Tunnel Policy • Support EVPN MPLS with RSVP-ECMP • EVPN MPLS - L2CP on EVPN Access • EVPN MPLS - SR + TI-LFA • EVPN MPLS - BGP-LU • EVPN MPLS - LU/SR service-update Support • EVPN MPLS - MAC hold timer • Support EVPN MPLS with LDP-ECMP • Inter AS option A and C • RSVP/LDP GR support with EVPN service • Integrated Routing and Bridging in Ethernet VPN (EVPN MPLS with IRB)

SOFTWARE FEATURE	SPECIFICATION
Segment Routing	<ul style="list-style-type: none"> • OSPF extensions for Segment-Routing • User Defined Adjacency SID (OPSFv2) • ISIS extensions for Segment-Routing • LDP and SR interworking • Segment Routing MPLS Conflict Resolution • SR Mapping server • Segment-Routing Policy (Traffic Engineering) • Segment-routing OAM (LSP Ping/Traceroute) for MPLS dataplane • Segment-routing BFD • Topology Independent Fast Reroute using Segment Routing • Service mapping using tunnel policy over SR policy • Support of Segment routing IPv6 generic base infrastructure. • OSPF Extension to Support Segment Routing over IPv6 Dataplane • IS-IS Extension to Support Segment Routing over IPv6 Dataplane • BGP based L3VPN (VPNv4) over SRv6 core • BGP-LS support for Segment routing IPv6 (OSPF)
PCEP (Path Computation Element Protocol)	<ul style="list-style-type: none"> • Support for Path Computation Element Protocol • Support for Stateful PCE • PCEP Extensions for Segment Routing



TIP Validated Solution (Gold) is awarded to solutions that got validated in an end-to-end environment, within a TIP Community Lab or approved third-party lab, upon meeting the minimum pass/fail criteria defined by the relevant TIP project group. Telecom Infra Project (TIP) recognized its OcNOS®-based Disaggregated Cell Site Gateway (DCSG) solution with the TIP Validated Solution Gold Badge.

3.2 OcNOS CSR Software SKUs

SKU NAME	DESCRIPTION
OCNOS-CSR-32/64/120/300/800	Open Compute Network Operating System MPLS image for 120-300 Gbps Cell Site Routing and Fixed Wireless, Microwave Integrated Backhaul with Layer 2/L3 switching and Routing Support for (OSPF, IS-IS, BGP), IP/MPLS support, Ring/Linear Protection Switching, ITU/IETF/IEEE OAM & Timing, Openconfig/NETCONF with perpetual use license (1 license).
OCNOS-SP-IPBASE-120/300/800/2400/4800/14400	Open Compute Network Operating System IPBASE image for Service Providers with support for L2 switching, L3 Routing v4/v6 (OSPF, IS-IS, BGP), VxLAN-EVPN, IETF OAM and NETCONF with perpetual use license (1 license). Applicable for Service Provider customers with carrier aggregation switching platforms with ports speeds between 120 Gbps to 14400 Gbps.
OCNOS-SP-MPLS-120/300/800/2400/4800/14400	Open Compute Network Operating System MPLS image with support for L2 switching, L3 Routing v4/v6 (OSPF, IS-IS, BGP), MPLS, SR-MPLS, VxLAN/MPLS-EVPN, Ring/Linear Protection Switching, CE 3.0, ITU/IETF/IEEE OAM and Openconfig/NETCONF with perpetual use license (1 license). Applicable for Service Provider customers with White Box switching platforms with ports speeds between 120 Gbps to 14400 Gbps.
OcNOS-SP-PLUS-300/800/2400/4800/14400	Open Compute Network Operating System image with support for L2 switching, L3 Routing v4/v6 (OSPF, IS-IS, BGP), MPLS, SR-MPLS, SRv6, VxLAN-MPLS-EVPN, Openconfig/NETCONF, CE 3.0, 1588v2/SynchE, Ring/Linear Protection Switching, ITU/IETF/IEEE OAM with perpetual use license (1 license). Applicable for Service Provider Customers with High Density carrier aggregation switching platforms with ports speeds between 300-14400 Gbps.

4.0 Solution Ordering Guide

4.1 OcNOS Cell Site Router Hardware Platforms

PLATFORM	CHIPSET	SWITCHING SPEED	SPEED/INTERFACE	CPU	OCNOS-SP SKU
Edgecore AS5915-18X	Qumran-UX	64 Gbps	8 x 1GE ports, 6 x 10GE ports, 4 x 100/1000 Base-T RJ-45 ports	Intel® Denverton C3308 2 core	OCNOS-SP-CSR-64, OCNOS-SP-CSR-120, OCNOS-SP-IPBASE-64, OCNOS-SP-MPLS-64
Edgecore AS7315-27X	Qumran-AX	300 Gbps	20 x 10GE ports, 4 x 25GE ports, 3 x 100GE ports	Intel ATOM C3508	OCNOS-CSR-300, OCNOS-SP-IPBASE-300, OCNOS-SP-MPLS-300
Edgecore AS7315-30X	Qumran-AX	300 Gbps	4 x 1GE ports, 16 x 10GE ports, 8 x 25GE ports, 2 x 100GE ports	Intel ATOM C3508	OCNOS-CSR-300, OCNOS-SP-IPBASE-300, OCNOS-SP-MPLS-300
Edgecore AS7316-26XB	Qumran-AX	300 Gbps	16 x 10GE ports, 8 x 25GE ports, 2 x 100GE ports	Intel Broadwell-DE D-1519 1.5G 4C	OCNOS-CSR-300, OCNOS-SP-IPBASE-300, OCNOS-SP-MPLS-300
UfiSpace S9500-22XST	Qumran-AX	300 Gbps	2 x 100GE ports, 8 x 25GE ports, 8 x 10GE ports, 4 x 1GE RJ45 ports	Intel Broadwell-DE D-1519 1.5GHz 4-Core	OCNOS-CSR-300, OCNOS-SP-IPBASE-300, OCNOS-SP-MPLS-300
UfiSpace S9500-30XS	Qumran-AX	300 Gbps	2 x 100GE ports, 8 x 25GE ports, 20 x 10GE ports	Intel Broadwell-DE D-1519 1.5GHz 4-Core	OCNOS-CSR-300, OCNOS-SP-IPBASE-300, OCNOS-SP-MPLS-300
UfiSpace S9501-18SMT	Qumran-UX	64 Gbps	6 x 10GE ports, 8 x 1GE ports, 4 x 1GE Base-T RJ45 ports	Intel Denverton-NS C3508 4 Cores @1.6GHz	OCNOS-SP-CSR-64 OCNOS-SP-IPBASE-64 OCNOS-SP-MPLS-64
UfiSpace S9501-28SMT	Qumran-UX	120 Gbps	8 x 10GE ports, 16 x 1GE ports, 4 x 1GE Base-T RJ45 ports	Intel Denverton-NS C3508 4 Cores @1.6GHz	OCNOS-CSR-120, OCNOS-SP-IPBASE-120, OCNOS-SP-MPLS-120
UfiSpace S9502-12SM	Qumran-UX	32 Gbps	4 x 1/10GE ports, 8 x 1GE ports, 1 x 1000 Base-T RJ45 ports	Intel Denverton-NS C3308 Dual Core @1.6GHz	OCNOS-SP-CSR-32, OCNOS-SP-IPBASE-32, OCNOS-SP-MPLS-32
UfiSpace S9502-16SMT	Qumran-UX	32 Gbps	4 x 10GE ports, 8 x 1GE ports, 4 x 100/1000 Base-T RJ45 ports	Intel Denverton-NS C3308 Dual Core @1.6GHz	OCNOS-SP-CSR-32, OCNOS-SP-IPBASE-32, OCNOS-SP-MPLS-32
AS5916-54XKS	Qumran-MX	800 Gbps	48 x 10G ports, 6 x 100G ports	Intel® Xeon® D-1548 processor 8-core 2.0 GHz	OcNOS-SP-CSR-800, OcNOS-SP-IPBASE-800, OcNOS-SP-MPLS-800
AS5916-54XKS-OT	Qumran-MX	800 Gbps	48 x 10G ports, 6 x 100G ports	Intel® Xeon® D-1548 processor 8-core 2.0 GHz	OcNOS-SP-CSR-800, OcNOS-SP-IPBASE-800, OcNOS-SP-MPLS-800

4.3 Maintenance & Support

SKU	MAINTENANCE & SUPPORT
OCNOS-MS-1Y	1 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for Severity 1 issues, normal business hours for all other issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.
OCNOS-MS-3Y	3 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for Severity 1 issues, normal business hours for all other issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.
OCNOS-MS-5Y	5 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for Severity 1 issues, normal business hours for all other issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.
OCNOS-MS-1Y-Premium	1 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for all issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.
OCNOS-MS-3Y-Premium	3 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for all issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.
OCNOS-MS-5Y-Premium	3 Year Maintenance & Support with Upgrades – Includes Technical support resources, software updates & upgrades, email and phone support, access to Support web site including case management system. Access to technical support team 24 x 7 for all issues. “Upgrade” means a version change for the licensed software with substantial improvements, enhancements and bug fixes.

5.0 Relevant Links

Additional information about the following documents is available on the IP Infusion website (<https://www.ipinfusion.com/products/ocnos/>)

- Feature Matrix
- Hardware Compatibility List
- Supported Optical Transceivers & Cables
- NETCONF Support

For More Information

Contact us today to learn more about the OcNOS Cell Site Router product.

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ABOUT IP INFUSION

IP Infusion is a leading provider of open network software and solutions for carriers, service providers and data center operators. Our solutions enable network operators to disaggregate their networks to accelerate innovation, streamline operations, and reduce Total Cost of Ownership (TCO). Network OEMs may also disaggregate network devices to expedite time to market, offer comprehensive services, and achieve carrier grade robustness. IP Infusion network software platforms have a proven track record in carrier-grade open networking with over 500 customers and over 10,000 deployments. IP Infusion is headquartered in Santa Clara, Calif., and is a wholly owned and independently operated subsidiary of ACCESS CO., LTD. Additional information can be found at <http://www.ipinfusion.com>

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