

OcNOS Data Center (DC)

July 2023

1.0 OcNOS for Data Center

1.1 OcNOS for Data Center Key Features

Following are key features of the OcNOS Data Center:

- Comprehensive L2 switching and L3 routing
- EVPN-VxLAN
- Advanced QoS and Data Center Bridging
- SNMP
- ZTP
- Netconf, OpenConfig Yang data model

KEY BENEFITS:

- Deployment proven disaggregated networking solutions at Tier-1 Internet Exchange
- Open standards-based product, interoperable with existing deployments
- Small footprint resulting from an optimized design
- Scalable NOS with Terabits switching bandwidth support
- Available in multiple packages for out-of-band management network, data center CLOS and overlay networking, and data center interconnect use cases

1.2 Data Center Use Cases

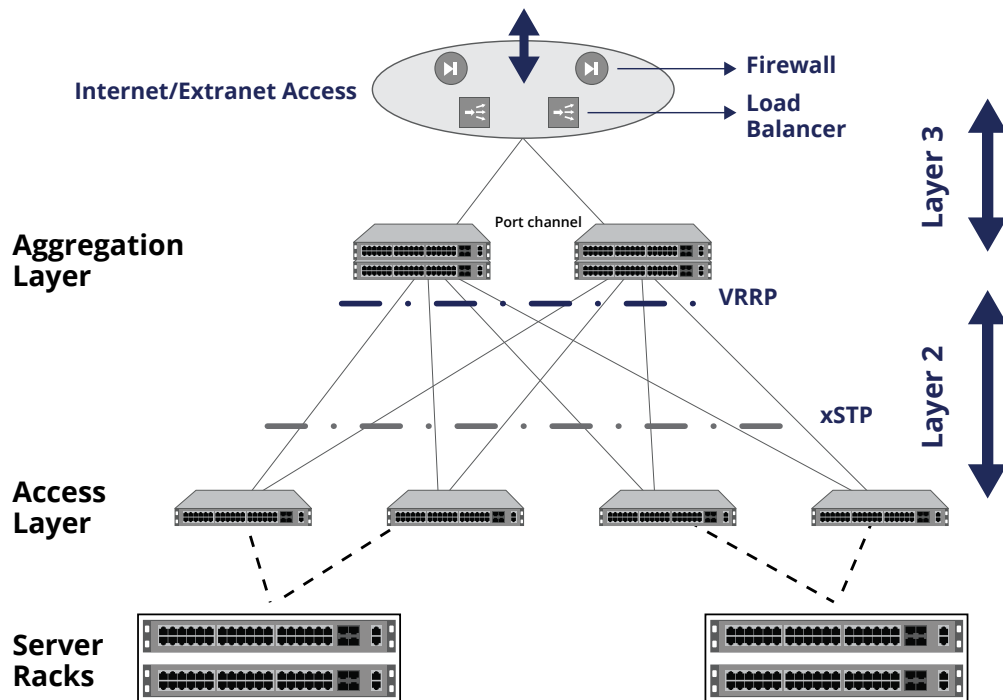
Following lists use cases for OcNOS Data Center:

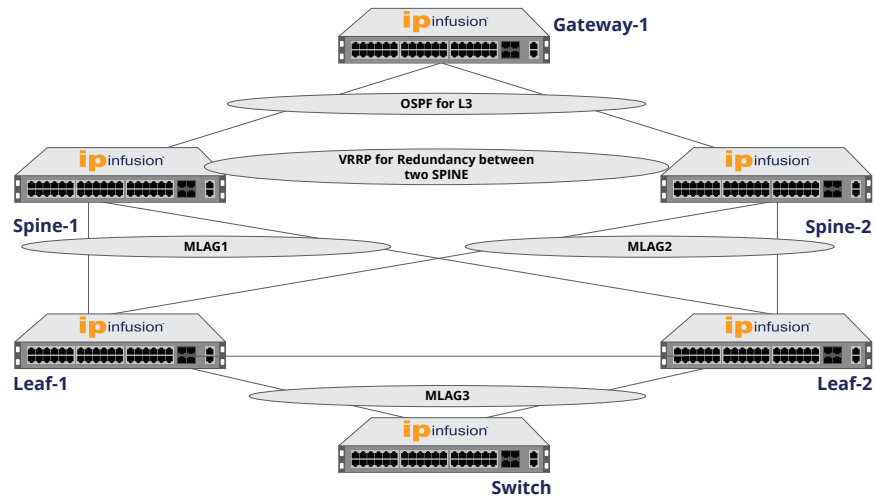
- DC-CLOS
- Multi-tenant DC (Underlay + Overlay)
- BGP Peering Router
- Data Center Interconnect
- Data center devices Out-Of-Band Management

Following lists few deployment options.

1.2.1 DATA CENTER LAYER 2 AND LAYER 3

Hybrid of Layer 2 / Layer 3 can be used to limit the size of failure domain and scale up the datacenter. Layer 3 routing can be used in Tier 1 (core) and Layer 2 in Tier 3 (access). Tier 2 can be based on either Layer 2 or Layer 3. A hybrid model has the advantage of seamless Virtual Machine mobility and requires less IP subnets for the data center.





Typical Network Topology

The major features of this solution are:

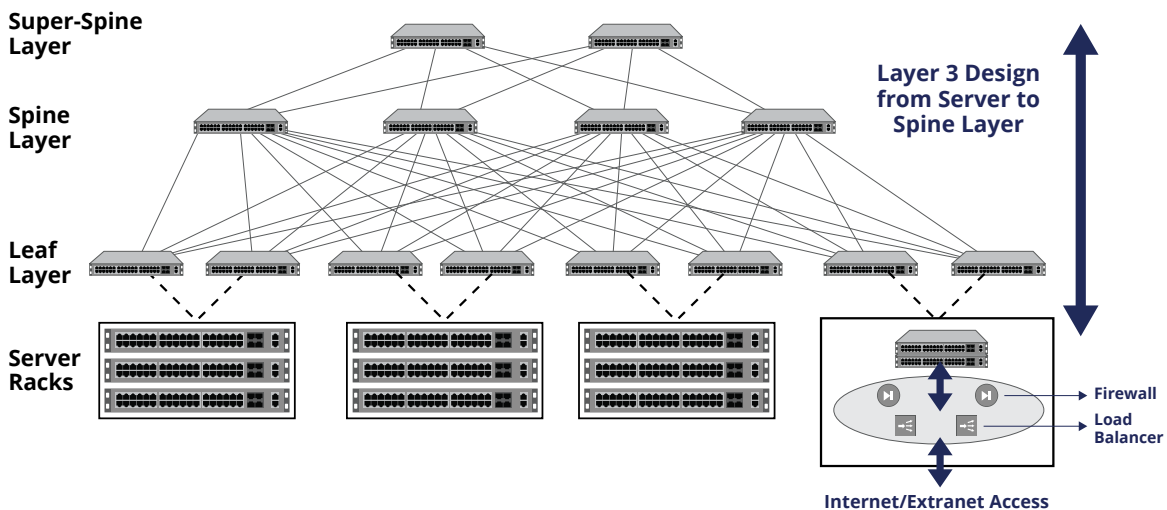
- Leaf switches are configured with MLAG for redundancy and increased bandwidth.
- Spine routers distribute traffic within the sites and uses VRRP for redundancy.

1.2.2 CLOS TOPOLOGY - L3 EBGp

This design is based on a full L3 BGP (eBGP) CLOS fabric to provide a resilient and horizontally scalable network design. BGP is used for its simplicity to configure and troubleshoot a large uniform topology such as CLOS, and high vendor interoperability.

Typical network topology:

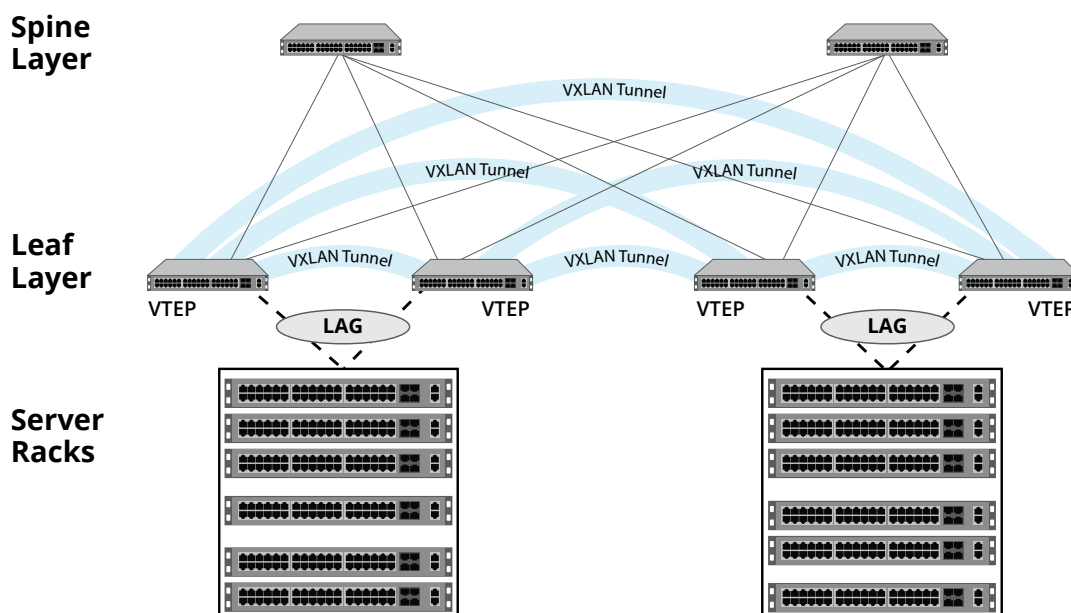
- Fully routed design from TOR. A L3 only design simplifies the network design and the network operations.
- Redundant server connection to the TOR switch.
- Build a large scale data center using uniform nodes.



Leaf Spine Architecture with Core service layer in a Leaf Service Block

1.2.3 EVPN-VXLAN OVERLAY WITH A L3 CLOS DESIGN

EVPN VXLAN runs on a Layer 3 routed network. Thus, when deploying EVPN VXLAN on a data center, first the core data center has to be Layer 3 in design. eBGP is used in the CLOS. The main advantage of eBGP lies in its ability to scale for large scale designs, easy compatibility and cross vendor availability. Besides when used with EVPN, it reuses BGP with only a separate address family thus keeping the protocol complexity to minimal.

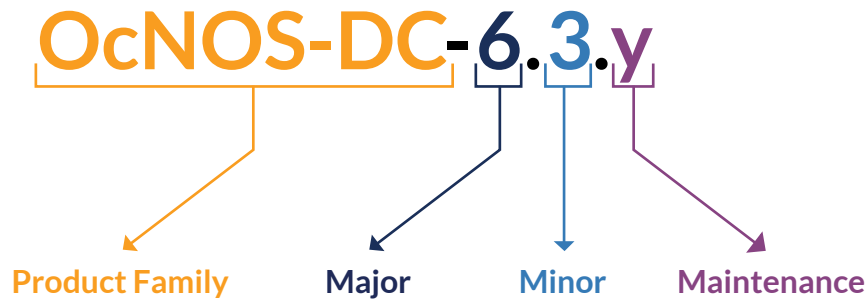


- Fully routed design from TOR – A L3 only design simplifies the network design and simplifies the operation.
- Build a large scale data center using uniform nodes – horizontal scaling vs scale up.
- Enable EVPN VXLAN on all the Leaf and Spine nodes.
- EVPN Multihoming ensures redundancy and optimal utilization.

Following EVPN Features are supported:

- Route-types 1 to 5.
- VLAN-based, VLAN-bundle and VLAN-aware-bundle services.
- Auto-RT for L2 VPN's.
- Standard based all-active multihoming.
- Layer 2 ARP/ND learning enables flood control in overlay.
- Layer 3, both interface-full (IRB) and interface-less models.
- Symmetrics and Asymmetric routing.
- Port+VLAN based access-port mapping.

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 Features on OcNOS-DC Release

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

3.1 Data Center 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• Protected Port on MLAG with RSTP• MLAG + Provider Bridging (PB) with RSTP• MLAG + VRRPv4 with RSTP• MLAG + VRRPv6 with RSTP• Provider Bridging• Data Center Bridging (DCB)• 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
Layer 3 Routing	<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 • URPF • BGP • RIP • OSPF • ISIS • BFD • VRRPv3
Multi-Protocol Label Switch (MPLS)	<ul style="list-style-type: none"> • Label Distribution Protocol (LDP) • Resource Reservation Protocol (RSVP) • Fast Reroute Extensions to RSVP - RFC 4090 • Layer 2 VPN (VPWS and VPLS) • Layer 3 VPN • MPLS OAM • MPLS PW and LSP Traffic Statistics
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 • 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 • Ethernet Linear Protection (ELPS) • Ethernet in the First Mile (EFM)
Virtual Extensible LAN (VxLAN)	<ul style="list-style-type: none"> • Layer 2 EVPN for VXLAN • Layer 2 EVPN Auto RT for VxLAN • Layer 2 EVPN Multihoming for VXLAN • VxLAN EVPN with BGP unnumbered • VXLAN-EVPN L2CP on EVPN Access • VxLAN QoS • VxLAN support over SVI interface • VxLAN IRB • VxLAN-IRB QoS • VXLAN IRB - Inter-VRF route leaking • Selectively enabling multiple IP addresses on IRB interface for anycast-gateway • DHCP Relay for VXLAN IRB • Static VXLAN

SOFTWARE FEATURE	SPECIFICATION
Virtual Extensible LAN (VxLAN) (cont'd)	<ul style="list-style-type: none"> • VXLAN Trunk as access port • VXLAN - Overlay Equal-Cost Multipath (ECMP) • VxLAN E-LINE/X-Connect • VxLAN Sub-interface as access
Multicast Features	<ul style="list-style-type: none"> • Protocol Independent Multicast – Sparse Mode (PIM-SM) • Protocol Independent Multicast – Dense Mode (PIM-DM) • PIM - Source Specific Multicast • Multicast Source Discovery Protocol (MSDP) • Bidirectional Protocol Independent Multicast (BIDIR-PIM) • PIM ECMP IPv4 • Internet Group Management Protocol (IGMP), Version 2 • Internet Group Management Protocol (IGMP), Version 3 • Multicast Listener Discovery (MLD)
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"> • Role based CLI management and access • CLI access via console, telnet and SSH • Authentication using TACAS+/RADIUS Client • Extended ping and traceroute • SNMP v1, v2, and v3 • DHCP client • DHCP relay • DHCP Option 82 (IPv4) • NTP Client • NTP Server • 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 • License Server • sFlow • Debounce Timer • DHCPv6 Prefix Delegation • DNS Relay (v4 and v6)

SOFTWARE FEATURE	SPECIFICATION
Management (cont'd)	<ul style="list-style-type: none"> • Storing Multiple images on Platform • DHCP Relay over L3VPN • Fault Management System • DHCP Relay across VRFs • Infrastructure for pluggable OLT modules • DHCP Server (IPv4 and IPv6) • Network Configuration Protocol (NETCONF) <ul style="list-style-type: none"> - YANG 1.0 Data Modelling Language - YANG 1.1 Data Modeling Language - NETCONF Protocol - 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 Call Home
Security	<ul style="list-style-type: none"> • Secure interface login and password • 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
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 • Digital Diagnostics Monitoring <ul style="list-style-type: none"> - Temperature monitor • Power Monitoring (Power, Current, Voltage)

3.2 OcNOS Data Center Software SKUs

OcNOS-DC-MPLS supports MPLS Protocol and OcNOS-DC-IPBASE does not support MPLS. This is the main difference between these two SKUs.

SKU NAME	DESCRIPTION
OCNOS-DC-MGMT	Open Compute Network Operating System MGMT image with Layer 2/L3 switching and Routing Support for (OSPF, IS-IS, BGP) with perpetual use license (1 license). Applicable for Data Center customers with ports speeds between 1Gbps -100 Gbps. Please refer Data Sheet for detailed feature set descriptions.
OCNOS-DC-IPBASE	Open Compute Network Operating System IPBASE image with Layer 2/L3 switching and Routing Support for (OSPF, IS-IS, BGP) with perpetual use license (1 license). Applicable for Data Center customers with ports speeds between 1G-100G.
OCNOS-DC-MPLS	Open Compute Network Operating System MPLS image with Layer 2/L3 switching and Routing Support for (OSPF, IS-IS, BGP), and with IP-MPLS support with perpetual use license (1 license). Applicable for Data Center customers with ports speeds between 1G-100G.

4.0 Solution Ordering Guide

4.1 OcNOS Data Center Supported Hardware Platforms

The following hardware platforms are supported.

Celestica DS1000 SKU: MGMT Ports: 48 x 10/100/1000Base-T RJ45; 8 x 10 GE SFP+ Switching capacity: 1.28Gbps	Edgecore AS5835-54T SKU: IPBASE, MPLS Ports: 48 x 10GE RJ-45; 6 x 100GE QSFP28 Switching capacity: 1.28 Tbps Switching chipset: Trident III	Edgecore AS7712-32X SKU: IPBASE, MPLS Ports: 32 x 1/40/100 GE QSFP28 Switching capacity: 3.2 Tbps Switching chipset: Tomahawk	Edgecore AS7726-32X SKU: IPBASE, MPLS Ports: 32 x 40/100GE QSFP28 Switching capacity: 3.2 Tbps Switching chipset: Trident III	Celestica Seastone2 DX030 SKU: IPBASE, MPLS Ports: 32 x 100 GE QSFP28; 2 x 10 GE SFP+ Switching capacity: 3.2 Tbps Switching chipset: Trident III	Dell S5296F-ON SKU: IPBASE, MPLS Ports: 96 x 10/25 GE SFP28; 8 x 100 GE QSFP28 Switching capacity: 3.2 Tbps Switching chipset: Trident III
Edgecore AS5835-54X SKU: IPBASE, MPLS Ports: 48 x 1/10GE SFP+; 6 x 100GE QSFP28 Switching capacity: 1.28 Tbps Switching chipset: Trident III	Edgecore AS7326-56X SKU: IPBASE, MPLS Ports: 48 x 25 GE SFP28; 8 x 100 GE QSFP28 Switching capacity: 2 Tbps Switching chipset: Trident III	Delta AG-9032v1 SKU: IPBASE, MPLS Ports: 32 x 100 GE QSFP28 Switching capacity: 3.2 Tbps Switching chipset: Tomahawk	Delta AG-9032v2 SKU: IPBASE, MPLS Ports: 32 x 40/100 GE QSP28 Switching capacity: 3.2 Tbps Switching chipset: Trident III	Edgecore AS7816-64X SKU: IPBASE, MPLS Ports: 64 x 100 GE QSFP28 Switching capacity: 6.4 Tbps Switching chipset: Tomahawk II	

128 Gbps 2 Tbps 3.2 Tbps 6.4 Tbps

4.2 Platforms Supported per SKU

Solution Ordering Guide

S. NO.	VENDOR PLATFORM	CHIPSET	SPEED/INTERFACE	CPU	OCNOS-DC SKU
1	Celestica DS1000	Trident III BCM56277_A1	48 x 1G RJ45 8 x 10G SFP+	Intel Atom	OcNOS-DC-MGMT
2	Celestica-Seastone2 DX030	Trident III BCM56870	2 x 10 GbE, 32 x 100 GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
3	Dell S5296F-ON	Trident III BCM56870	96 x 25 GbE, 8 x 100GbE. Each 100 GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
4	Delta AG-9032V1	Tomahawk BCM56960	32 x 100 GbE ports. Each 100GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
5	Delta AG-9032V2	Trident III BCM56870	2 x 10GbE, 32 x 100GbE ports. Each 100GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Denverton C3538	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
6	Edgecore AS5835-54T	Trident III BCM56771_A0	48 x 10G RJ45 6 x 100G QSFP28	Intel Atom	OCNOS-DC-IPBASE OCNOS-DC-MPLS
7	Edgecore AS5835-54X	Maverick 2 BCM56771	48 x 10GbE, 6 x 100GbE ports. Each 100GbE port is splittable into 4 x 25GbE	Intel Denverton C3558	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
8	Edgecore AS7326-56x	Trident III BCM56873	2 x 10GbE, 48 x 25GbE, 8 x 100GbE ports. Each 100GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
9	Edgecore AS7712-32X	Tomahawk BCM56960	32 x 100GbE ports. Each 100 GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
10	Edgecore AS7726-32X	Trident III BCM56870	2 x 10GbE, 32 x 100GbE ports. Each 100GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
11	Edgecore AS7816-64x	Tomahawk II BCM56970	64 x 100 GbE ports. Each 100GbE port is splittable into 4 x 10GbE or 2 x 50GbE or 4 x 25GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS

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.

SKU	MAINTENANCE & SUPPORT
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 Data Center.

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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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