OcNOS Data Center (DC)

November 2023

1.0 OcNOS Data Center

1.1 OcNOS 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 models, streaming telemetry

KEY BENEFITS:

- Deployment proven disaggregated networking solutions
- 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 device 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

The following lists a 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.

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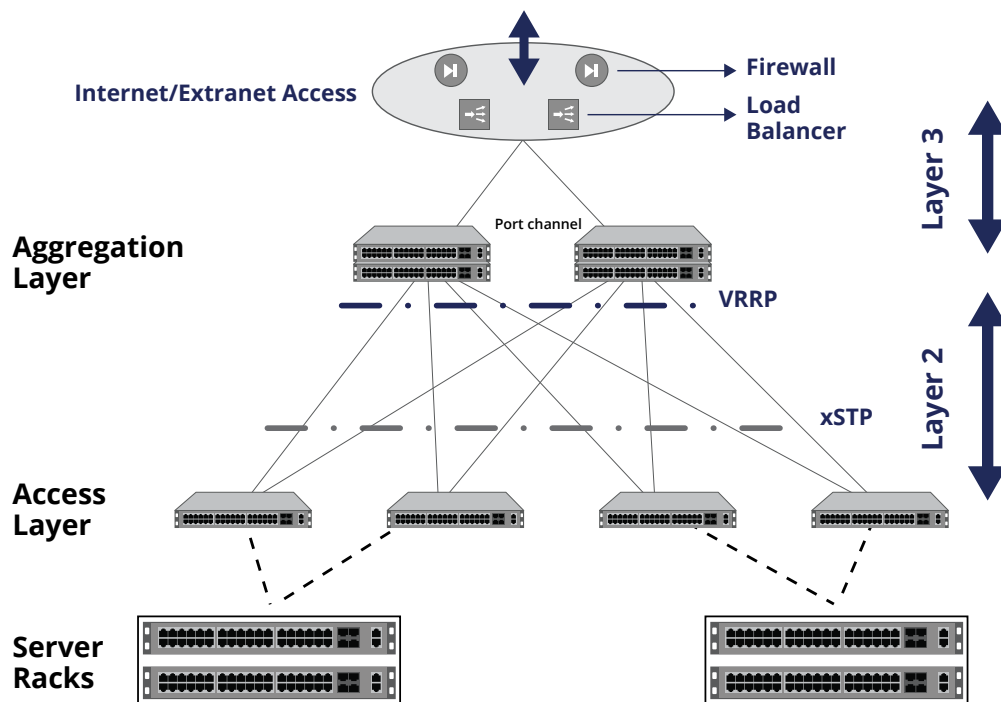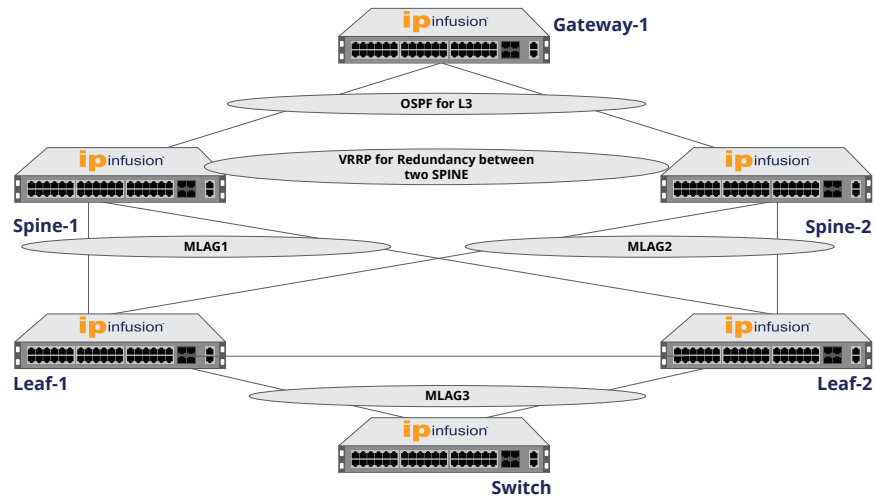
Typical Network Topology

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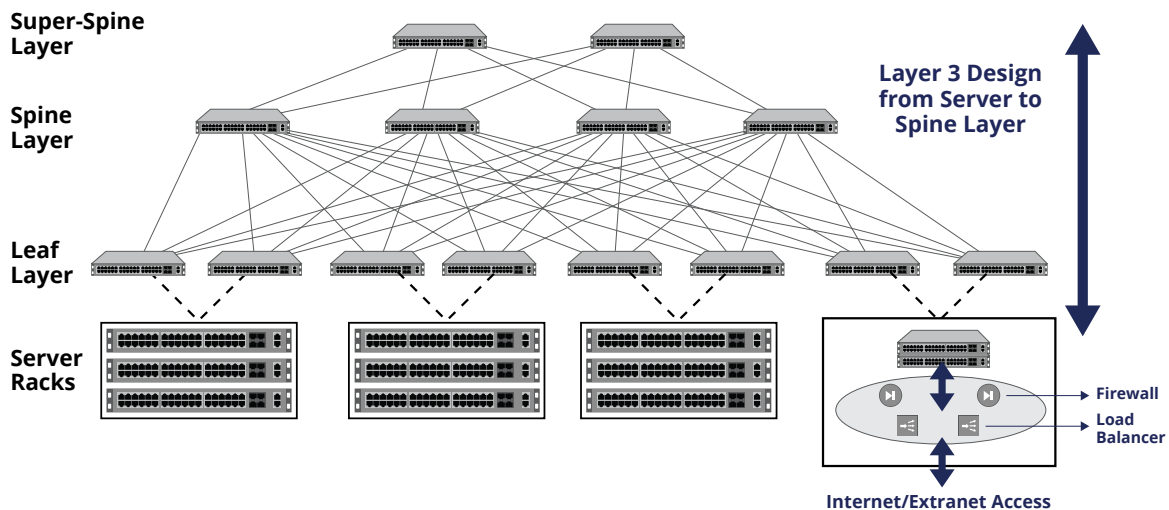
Leaf Spine Architecture with Core service layer in a Leaf Service Block

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.
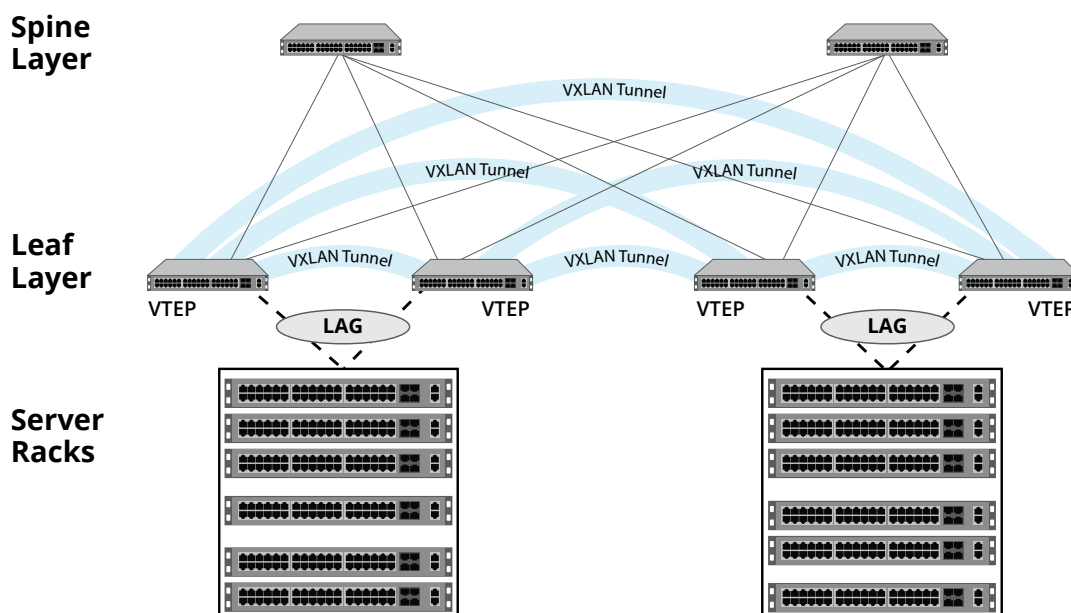

- Fully routed design from TOR – A L3 only design simplifies the network design and simplifies the operation.
- Build a large scale data center using uniform nodes – horizontal scaling vs scale up.
- Enable EVPN VXLAN on all the Leaf and Spine nodes.
- EVPN multihoming ensures redundancy and optimal 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.
- Symmetric and Asymmetric IRB.
- Port+VLAN based access-port mapping.

2.0 IP Infusion Product Release Version

OcNOS-DC-6.4.y

Product Family **Major** **Minor** **Maintenance**
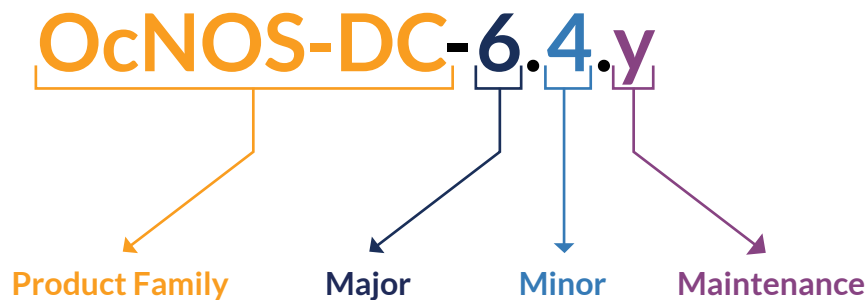
Product Name: Refers to IP Infusion Product Family.

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 Data Center 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	• 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)

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SOFTWARE FEATURE	SPECIFICATION
Layer 3 Routing	• 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 • 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)	• 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	• Connectivity Fault Management (CFM) (control plane only)
	  – CFM over L2 bridge with xSTP
	  – CFM over xConnect
	  – CFM over Provider Bridge
	• Ethernet Ring Protection Switching (ERPS)
	  – ERPS over CFM on provider/customer domain
	  – Sub-ring support (Multiple ring and ladder topologies)
	  – Support of multiple ERP Instances on single ring
	  – Over native L2
	• Ethernet in the First Mile (EFM)

Virtual Extensible LAN (VxLAN)	• 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)	• VXLAN Trunk as access port • VXLAN - Overlay Equal-Cost Multipath (ECMP) • VxLAN E-LINE/X-Connect • VxLAN sub-interface as access
Multicast Features	• Protocol Independent Multicast – Sparse Mode (PIM-SM) • Protocol Independent Multicast – Dense Mode (PIM-DM) • PIM - Source Specific Multicast • Bidirectional Protocol Independent Multicast (BIDIR-PIM) • PIM ECMP IPv4 • Internet Group Management Protocol (IGMP), Version 2 • Internet Group Management Protocol (IGMP), Version 3
Quality of Service (QoS)	• 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	• 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)

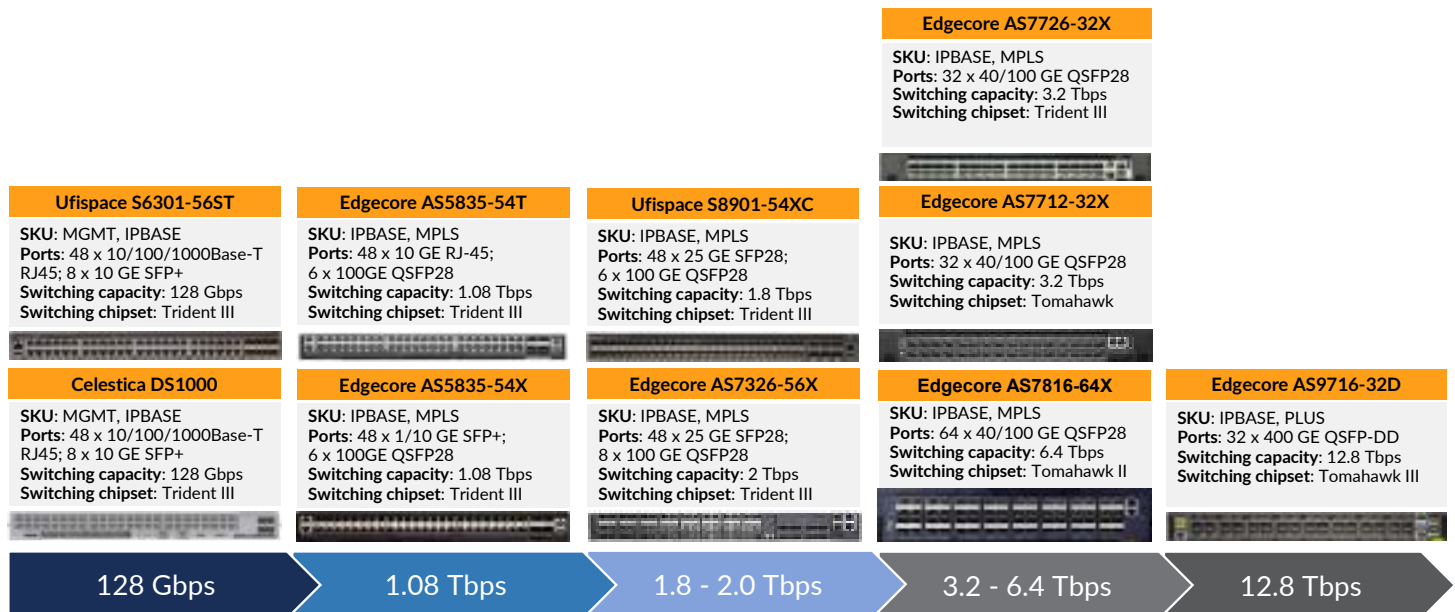| SOFTWARE FEATURE	SPECIFICATION
Management (cont'd)	- Storing multiple images on platform - DHCP Relay over L3VPN - Fault Management System - DHCP Relay across VRFs - Infrastructure for pluggable OLT modules - DHCP Server (IPv4 and IPv6) - Network Configuration Protocol (NETCONF) - YANG 1.0 data modelling 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 sessions for CLI - Transaction based CLI - Netconf Call Home - Streaming telemetry
Security	- Secure interface login and password - Storm control - Flow control - DHCP Snooping - IP Source Guard - Dynamic ARP inspection - Access Control Lists (ACLs) based on - 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	- Switched Port Analyzer (SPAN) - Remote Switched Port Analyzer (RSPAN) - Load balancing - PHY/MAC level interface loopback - TCAM space monitoring - Chassis monitoring - Temperature monitor - Fan control - CPU load monitoring - Board information (EEPROM) - Fan and PSU FRU information - Digital Diagnostics Monitoring (DDM) - Temperature monitoring - 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 Data Center MGMT image with Layer 2 switching and Layer 3 routing (via OSPF, IS-IS, and BGP) support, with perpetual use license (1 license).
OCNOS-DC-IPBASE	Open Compute Network Operating System Data Center IPBASE image with Layer 2 switching, Layer 3 routing (via OSPF, IS-IS, and BGP), and EVPN-VxLAN support, with perpetual use license (1 license).
OCNOS-DC-MPLS	Open Compute Network Operating System Data Center MPLS image with Layer 2 switching, Layer 3 routing (via OSPF, IS-IS, and BGP), EVPN-VxLAN, MPLS, and streaming telemetry support, with perpetual use license (1 license). Applicable for data center switches with port speeds up to 100G.
OCNOS-DC-PLUS	Open Compute Network Operating System Data Center PLUS image with Layer 2 switching, Layer 3 routing (via OSPF, IS-IS, and BGP), EVPN-VxLAN, and streaming telemetry support, with perpetual use license (1 license). Applicable for data center switches with port speeds up to 400G.

4.0 Solution Ordering Guide

4.1 OcNOS Data Center Supported Hardware Platforms

The following hardware platforms are supported.

Edgecore AS7726-32X
SKU: IPBASE, MPLS
Ports: 32 x 40/100 GE QSFP28
Switching capacity: 3.2 Tbps
Switching chipset: Trident III

Ufispace S6301-56ST
SKU: MGMT, IPBASE
Ports: 48 x 10/100/1000Base-T RJ45; 8 x 10 GE SFP+
Switching capacity: 128 Gbps
Switching chipset: Trident III

Edgecore AS5835-54T
SKU: IPBASE, MPLS
Ports: 48 x 10 GE RJ-45; 6 x 100GE QSFP28
Switching capacity: 1.08 Tbps
Switching chipset: Trident III

Ufispace S8901-54XC
SKU: IPBASE, MPLS
Ports: 48 x 25 GE SFP28; 6 x 100 GE QSFP28
Switching capacity: 1.8 Tbps
Switching chipset: Trident III

Edgecore AS7712-32X
SKU: IPBASE, MPLS
Ports: 32 x 40/100 GE QSFP28
Switching capacity: 3.2 Tbps
Switching chipset: Tomahawk

Celestica DS1000
SKU: MGMT, IPBASE
Ports: 48 x 10/100/1000Base-T RJ45; 8 x 10 GE SFP+
Switching capacity: 128 Gbps
Switching chipset: Trident III

Edgecore AS5835-54X
SKU: IPBASE, MPLS
Ports: 48 x 1/10 GE SFP+; 6 x 100GE QSFP28
Switching capacity: 1.08 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

Edgecore AS7816-64X
SKU: IPBASE, MPLS
Ports: 64 x 40/100 GE QSFP28
Switching capacity: 6.4 Tbps
Switching chipset: Tomahawk II

Edgecore AS9716-32D
SKU: IPBASE, PLUS
Ports: 32 x 400 GE QSFP-DD
Switching capacity: 12.8 Tbps
Switching chipset: Tomahawk III

| 128 Gbps | 1.08 Tbps | 1.8 - 2.0 Tbps | 3.2 - 6.4 Tbps | 12.8 Tbps |

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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	48 x 1 GbE RJ45, 8 x 10 GbE SFP+	Intel Atom	OCNOS-DC-MGMT, OCNOS-DC-IPBASE
2	UfiSpace S6301-56ST	Trident III BCM56277	48 x 1 GbE RJ45, 8 x 10 GbE SFP+	Intel Atom	OCNOS-DC-MGMT, OCNOS-DC-IPBASE
3	Edgecore AS5835-54T	Trident III BCM56771_A0	48 x 1/10 GbE RJ45, 6 x 40/100 GbE. 2 x 40/100GbE ports are splittable into 4 x 10/25GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
4	Edgecore AS5835-54X	Maverick 2 BCM56771	48 x 1/10 GbE SFP+, 6 x 40/100 GbE. 2 x 40/100 GbE ports are splittable into 4 x 10/25 GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
5	UfiSpace S8901-54XC	Trident III BCM56770	48 x 1/10/25 GbE, 6 x 40/100GbE. Each 40/100 GbE port is splittable into 4 x 10/25 GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
6	Edgecore AS7326-56x	Trident III BCM56873	48 x 1/10/25GbE, 8 x 40/100GbE. Each 100 GbE port is splittable into 4 x 10/25 GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
7	Edgecore AS7712-32X	Tomahawk BCM56960	32 x 40/100 GbE. Each 40/100 GbE port is splittable into 4 x 10/25 GbE or 2 x 50 GbE	Intel Atom	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
8	Edgecore AS7726-32X	Trident III BCM56870	32 x 40/100 GbE. Each 40/100 GbE port is splittable into 4 x 10/25 GbE or 2 x 50 GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
9	Edgecore AS7816-64x	Tomahawk II BCM56970	64 x 40/100 GbE. Each 40/100 GbE port is splittable into 4 x 10/25 GbE or 2 x 50 GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-MPLS
10	Edgecore AS9716-32D	Tomahawk III BCM56980	32 x 100/400 GbE. Each 100/400 GbE port is splittable into 4 x 100GbE or 4 x 25 GbE	Intel Xeon D-1518	OCNOS-DC-IPBASE, OCNOS-DC-PLUS

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.

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SKU	MAINTENANCE & SUPPORT
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
- NETC ONF Support

For More Information

Contact us today to learn more about the OcNOS Data Center.

PSI

Product Source International Datacomm
330 Franklin Turnpike
Mahwah, NJ 07430
201.488.6000 Tel
www.psitec.com / sales@psitec.com