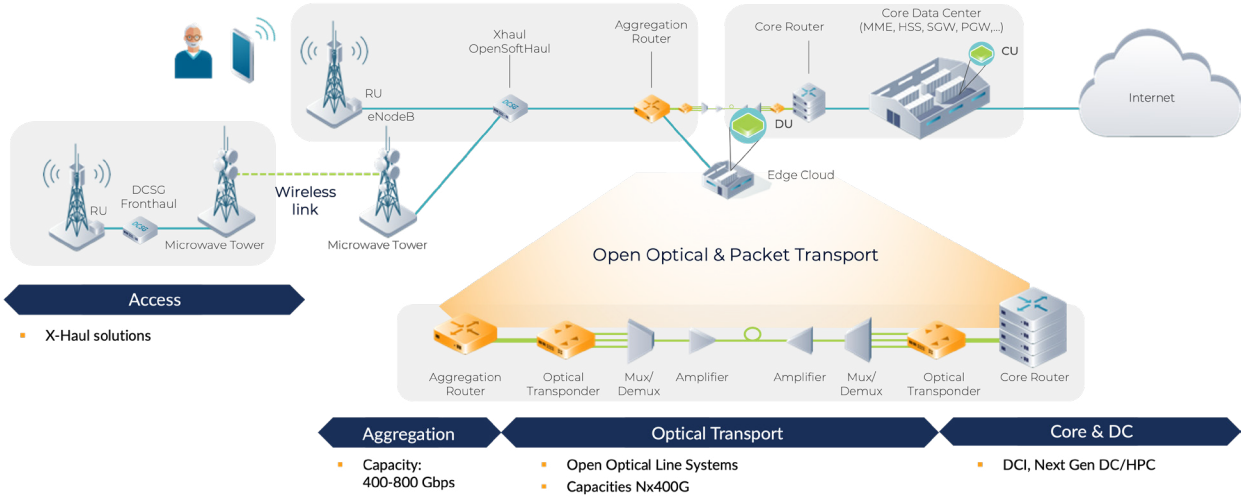
DATASHEET

OcNOS Routed Optical Networking (RON)

July 2023

1.0 OcNOS for Routed Optical Networking

IP Infusion's Routed Optical Networking (RON) product portfolio provides IPoDWDM optical transport for Data Center Interconnect (DCI), metro and long-haul applications. The following picture shows RON deployed in a typical regional communications network using optical and packet transport over distances greater than 80km. While the aggregation network aggregates the traffic from various access networks, the Routed Optical Network routes and transports this traffic over IPoDWDM optical open line systems to remote ends of the network.



OcNOS-RON (Routed Optical Networking) solution is a disaggregated packet transponder solution using open networking switches.

OcNOS-RON provides optical transport for the following use cases:

- Data Center Interconnect
- Backhaul of access edge services
- Metro Ethernet services
- Long haul optical networking

Summary of OcNOS-RON Features

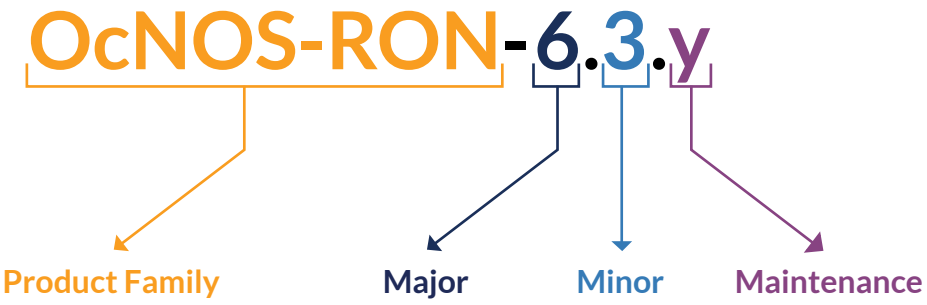
DESCRIPTION	FEATURES
Form factor	CFP2, QSFP-DD
Distances	Metro to Long haul
NOS Features	OcNOS with comprehensive L2/L3/Multicast/VXLAN features or a L1 transponder design
Configuration	Modulation: DP-16QAM, DP-8QAM, DP-QPSK Output power (dBm) Frequency (Hz)
Monitoring	Current pre-FEC BER (bps), current post-FEC (bps) Current input power (dBm), current output power (dBm) Current frequency (Hz) Chromatic Dispersion and DGD counter on the RON side
Debug and Alarms	PRBS – generator and checker Loopback – hostif and networkif PM Counters
Management and Automation	ZTP, Netconf/Openconfig, Telemetry
Supported CFP2 vendors	Lumentum, Fujitsu, Acacia, Skylane

1.1 OcNOS Routed Optical Networking Benefits

Following are key benefits of the OcNOS Routed Optical Networking:

- Flexible disaggregated network for scaling more subscribers by increased capacity per fiber
- Efficiency
  - Reconfigurable optical add-drop multiplexer (ROADM), switching traffic at □ level, reducing latency, footprint, power, complexity
  - Migration to FlexGrid ROADM: Support traffic volumes of hundreds Tb/s or even some Pb/s
- Coherent pluggable
  - Service agility: Extensive use of coherent pluggable optics
  - Seamless migration from legacy to next gen networks
- Open Routed Optical Networking
  - Moving from Layered Architecture to Flat Hop-by-Hop Architecture
  - Collapsing management plane and control plane, DWDM, RON & packet
  - Enables hardware independence delivering faster roll-out of new services and shorter time-to-market
  - Simplify operations to reduce Total Cost of Ownership (TCO)

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 Routed Optical Networking Features

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

3.1 Routed Optical Networking Features

SOFTWARE FEATURE	SPECIFICATION
Layer 2 Switching	• VLAN • Spanning Tree Protocol (STP) • Multiple Spanning Tree Protocol (MSTP) • Rapid Spanning Tree (RSTP) • Rapid Per VLAN Spanning Tree (RPVST+) • 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	• 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) • Layer 2 VPN (VPWS and VPLS) • Layer 3 VPN • MPLS OAM • MPLS PW and LSP Traffic Statistics
Carrier Ethernet	• Connectivity Fault Management (CFM) – CFM over L2 Bridge with xSTP – CFM over VPWS – CFM over EVPN ELINE Single Homing • 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 • 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 QoS • Static VXLAN • VXLAN Trunk as access port
Multicast Features	• Protocol Independent Multicast – Sparse Mode (PIM-SM) • Protocol Independent Multicast – Dense Mode (PIM-DM) • PIM - Source Specific Multicast • PIM ECMP IPv4 • Internet Group Management Protocol (IGMP), Version 2 • Internet Group Management Protocol (IGMP), Version 3 • ICMP-based Multicast Forwarding (“IGMP Proxying”)

SOFTWARE FEATURE	SPECIFICATION
Quality of Service (QoS)	• DiffServ Field in IPv4/IPv6 Headers • Assign matching traffic flow to a specific queue • 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 • 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 • Storing Multiple images on Platform • Fault Management System • DHCP Relay across VRFs • 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 session for CLI – Transaction based CLI – Netconf Call Home

SOFTWARE FEATURE	SPECIFICATION
Security	• Secure interface login and password • Storm control • Flow control • DHCP Snooping • IP Source Guard • 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) • Unified Forwarding Table (UFT) • 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 – 100G Port Breakout • Digital Diagnostics Monitoring – Temperature monitor • Power Monitoring (Power, Current, Voltage) • Hardware MIB and Traps
Coherent Optics	• Analog Coherent Optical (ACO-CFP2-200G) module support • Digital Coherent Optical (DCO-CFP2-200G) module support • Support for QSFP-DD 400G ZR/ZR+ • Module specific attributes • Network interface specific configuration and monitoring attributes such as Tx-Power, Tx-Laser-Frequency, Modulation format, FEC modes • Host interface specific attributes such as RS FEC type • Digital Diagnostic Monitoring (DDM) support
Timing and Synchronization	• E2E Transparent clock (TC) - IEEE-1588; ITU-T G.8273.3 [Works with both G8275.1, G8275.2, default profile]

3.2 OcNOS RON Software SKUs

SKU NAME	DESCRIPTION
OCNOS-RON-IPBASE	Open Compute Network Operating System RON IPBASE image with support for Coherent packet optical networking using DWDM optics, L2 switching, L3 Routing v4/v6 (via OSPF, IS-IS, BGP) and NETCONF with perpetual use license (1 license). Applicable for Datacenter and Service Provider customers with modular whitebox packet transponders with integrated 100 Gigabit Ethernet (GbE) packet switching ports and 100/200 Gbps coherent optical interfaces. Please refer Data Sheet for detailed feature set descriptions. NOTE: The software SKU to manage one standard pluggable slot (ACO/DCO) is OCNOS-RON-CFP2-WDM

SKU NAME	DESCRIPTION
OCNOS-RON-XCONNECT	Open Compute Network Operating System image for Datacenter and Service Provider networks with support for Coherent packet optical networking using DWDM optics. Connect client ports to network line ports through L1 cross-connect feature including NETCONF management capabilities with perpetual use license (1 license). Applicable for mobile backhaul, Service Provider and DC customers on modular Whitebox packet transponders with integrated 100 Gigabit Ethernet (GbE) client ports and pluggable 100/200 Gbps coherent optical line interfaces. Please refer to Data Sheet and Hardware Compatibility Matrix for supported platforms and detailed feature set descriptions NOTE: The software SKU to manage one standard pluggable slot (ACO/DCO) is OCNOS-RON-XC-CFP2-WDM.
OCNOS-RON-MPLS	Open Compute Network Operating System RON MPLS image for Datacenter and Service Provider networks with support for Coherent packet optical networking using DWDM optics, L2 Switching, L3 Routing v4/v6 (via OSPF, IS-IS, BGP), IP/MPLS (via LDP/RSVP-TE) and NETCONF/Openconfig with perpetual use license (1 license). Applicable for Datacenter and Service Provider customers with modular whitebox packet transponders with integrated 100 Gigabit Ethernet (GbE) packet switching ports and 100/200 Gbps coherent optical interfaces. Please refer Data Sheet for detailed feature set descriptions. NOTE: The software SKU to manage one standard pluggable slot (ACO/DCO) is OCNOS-RON-CFP2-WDM
OCNOS-RON-CFP2-WDM	OCNOS-RON Software based License to activate one CFP2-DCO PIU module for OCNOS-RON-IPBASE/ OCNOS-RON-MPLS SKU's. Per port license applicable for Cassini and Galileo Platforms.
OCNOS-RON-XC-CFP2-WDM	OCNOS RON Software based License to activate one CFP2-DCO PIU module for RON-RON-XCONNECT SKUs. Per port license applicable for Cassini and Galileo Platforms.

4.0 Solution Ordering Guide

4.1 OcNOS Routed Optical Networking Hardware Platforms

PLATFORMS	OPTICS
Edgecore AS7716-24SC (Cassini) **SKU**: IPBASE, MPLS, XCONNECT **Ports**: 16 x 100GE QSFP28; 8 x 100/200GE CFP2-DCO **Switching capacity**: 3.2 Tbps **Switching chipset**: Tomahawk Plus 	**CFP2-200G-DCO**  **Lumentum**: TRB200DAA-01 **Skylane Optics**: C2DTULDS0200, C2DTULDJ0200, C2DTULDH0300

4.2 Platforms Supported per SKU

PLATFORM	CHIPSET	SWITCHING SPEED	SPEED/INTERFACE	CPU	OCNOS-SP SKU
Edgecore AS7716-24SC (Cassini)	Tomahawk Plus	3.2 Tbps	16 x 100G ports each splitable into 4 x 10G ports or 2 x 50G ports or 4 x 25G ports. 8 Coherent slots 200/100G each	Intel® Xeon® D-1518 quad-core x86 Processor	OCNOS-RON-IP-BASE, OCNOS-RON-MPLS, OCNOS-RON-XCONNECT

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 Compatability List
- Supported Optical Transceivers & Cables
- NETCONF Support

For More Information

Contact us today to learn more about the OcNOS Routed Optical Networking.

Phone: +1-877-699-3267 | Email: sales@ipinfusion.com

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**

Phone | +1-877-699-3267 **Email |** sales@ipinfusion.com **Web |** www.ipinfusion.com