

# OcNOS-SP-CSR

## Disaggregated Cell Site Gateway System

### 1.0 Overview

The Service Provider mobile and wireline network of the future will not just need to provide exponentially higher bandwidth at lower operating costs but will also have to be capable of enabling new applications such as pervasive mobile broadband, IoT/sensor networks, autonomous vehicles and smart consumer wireless devices. Mobile network operators are actively seeking cost-effective Cell Site Gateway Solutions to accommodate the mass rollout of 4G/5G services to meet this mobile traffic demands. Disaggregated Open Network Solutions benefit operators as they build out 4G/5G infrastructure by reducing costs, expanding the vendor ecosystem and leveraging automation so they are more agile in introducing new services.

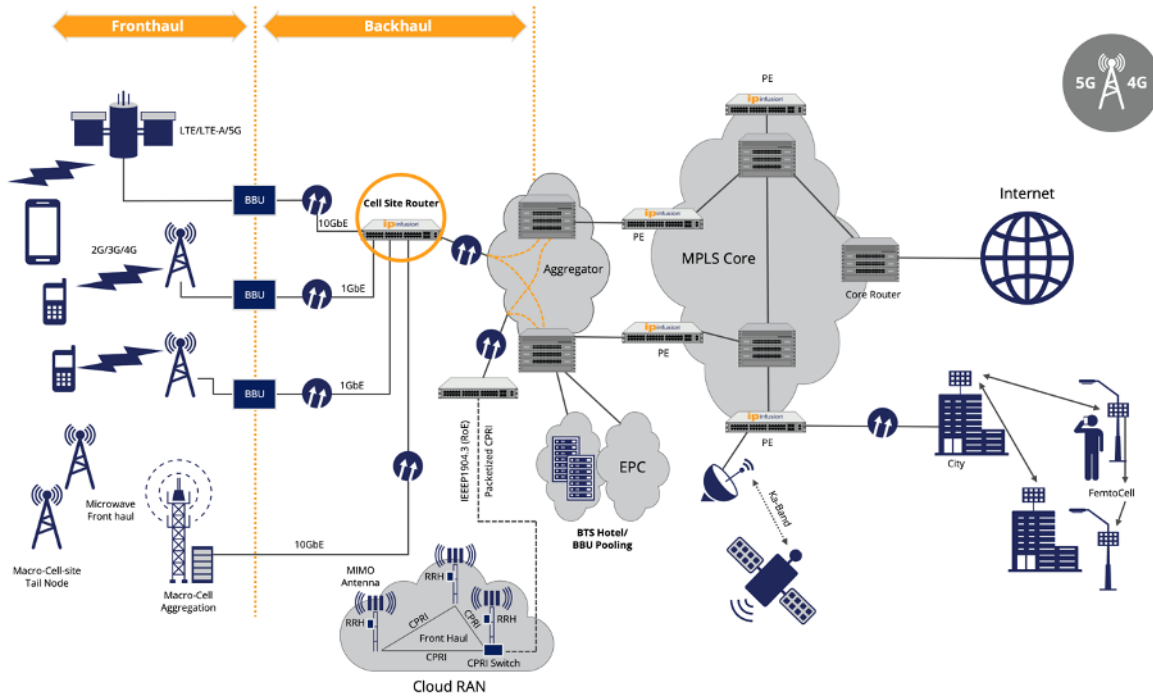
The evolution to next-generation 5G networks introduces architectural changes in the radio access network (RAN) and mobile core that will have significant implications for how operators design and provision transport capacity and services. The mobile transport network will need to meet the higher capacity and lower latency

demands of 5G, as well as flexibly adapt to diverse traffic flows, to support a growing variety of use cases, from augmented reality to factory automation. A key concept that will enable next generation transport networks is disaggregation, whereby networking software is separated from the switching or routing hardware and partitioned into functional components that can be more efficiently operated. Programmability, automation, and agility with better control of their networks are immediate benefits of disaggregation for operators, besides potential cost savings as well.

### 1.1 OcNOS-SP-CSR Disaggregated Cell Site Gateway System

IP Infusion's OcNOS-SP-CSR is a complete carrier class, Cell Site Router (CSR) solution, aligning with the Telecom Infra Project's (TIP) Disaggregated Cell Site Gateway1 (DCSG) technical specification. The technical specification provides detailed requirements for CSR device that operators can deploy in current and future generations of wireless transport networks.

The TIP DCSG specification falls under the TIP Open Optical & Packet Transport project.



The OcNOS-SP-CSR solution is a smart converged integrated access platform which enables Service Providers to deliver next-level business and entertainment experiences and it comprises of the following core components:

- Multi-vendor CSR hardware platform: An Open Compute Project (OCP)2 and TIP DCSG Compliant ODM smart integrated access device platform supporting 300Gbps capacity.
- OcNOS full-featured network OS for White Box. Its features include advanced capabilities, such as extensive switching and routing protocol support, MPLS (Multiprotocol Label Switching), and SDN (software defined networking). OcNOS features hybrid, centralized or distribute network support; scalable, modular high-performance network; and a robust data plane built on merchant silicon.
- IP Infusion Advanced Network Services: Comprehensive network design, installation, commissioning, monitoring and technical support services.

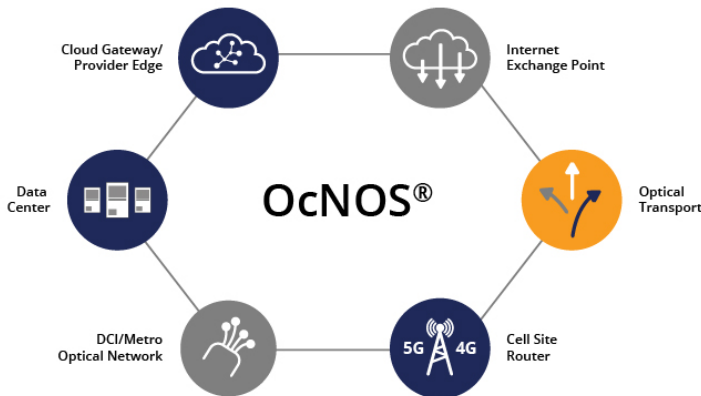
## 1.2 Key CSR ODM Hardware Highlights

- Extremely compact, low-power design
- Flexible form factors for both CO and outdoor deployments
- Highly integrated design: 1-100G interfaces, rich set of QoS capabilities, flexible management options, and integrated timing in a single box
- Versatile licensing scheme to enable a range of commercial objectives
- 1 RU small form factor ODM hardware with depth <300 mm
- Front-to-back airflow
- Low power consumption, minimum <100W, typical <200W, maximum 250W
- Low latency forwarding
- Precise frequency and phase/time synchronization using the latest industry standards
- Excellent manageability

### 1.3 OcNOS Software

OcNOS (Open Compute Network Operating System) is a robust, programmable and innovative operating system, featuring a single software image that runs across the entire portfolio of Open Compute platforms from leading network device vendors. This guarantees consistent operations, workflow automation and high availability, while significantly reducing operational expenses.

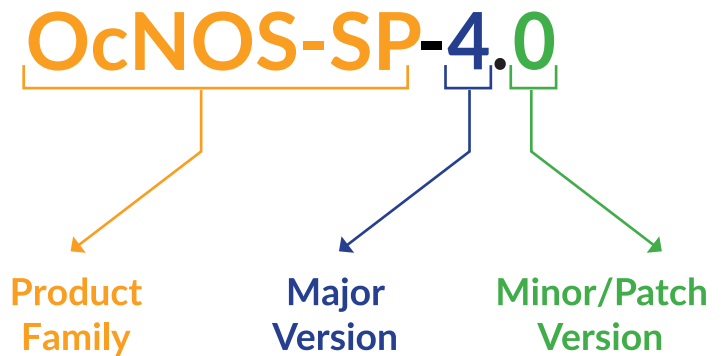
OcNOS borrows heavily from the popular ZebOS line of products, which provides a rich feature density and robustness that has been built up over the years and validated in thousands of diverse customer networks. OcNOS provides industry standard CLIs, supports standard MIBs and other standard operation and management tools. Its integrated centralized management and provisioning layer allows for transaction-based configuration and device feature modelling.



OcNOS is a modular, multi-tasking network operating system, with tight integration capabilities on commodity hardware. This design allows for scaled and performance critical deployments.

### 2.0 IPI Product Release Version

Release versions are denoted using an integer to indicate Major, Minor, and Hotfix / Patch.



**Product Name:** Refers to the IPI Product Family (OcNOS-SP, DVE etc.)

**Major Version:** New customer-facing functionality and represents a significant change to the code base or change of direction in the product.

**Minor Version:** Enhancements/extensions to existing features or requests to meet marketing requirements.

### 3.0 Features on OcNOS-SP-CSR Release

The table below lists the software features in the OcNOS-SP-CSR (SP 4.0) Release. Note, the following mentioned features are only indicative and the detail feature list may vary. Please refer to Feature Matrix for complete feature list on supported ODM platforms.

#### 3.1 OcNOS-SP-CSR (SP 4.0): Technical Specifications – NOS Software Features

| OCNOS-SP FEATURE                   | SPECIFICATION   |
|------------------------------------|---|
| Layer 2 Switching                  | <ul style="list-style-type: none"> <li>• VLAN</li> <li>• VLAN Traslation</li> <li>• Q-in-Q</li> <li>• L2PT</li> <li>• STP</li> <li>• Multiple Spanning Tree Protocol (MSTP)</li> <li>• Rapid Spanning Tree (RSTP)</li> <li>• LLDP v2</li> <li>• Link Aggregation</li> <li>• MC-LAG Active/Standby support as attachment circuit for VPWS Pseudowire Redundancy</li> <li>• Static MAC Address Assignment</li> <li>• BPDU Protect</li> <li>• Root Guard</li> <li>• MAC Learning Disable</li> <li>• Port-based Authentication with RADIUS Server</li> <li>• Port Security</li> </ul>   |
| Layer 3 Routing                    | <ul style="list-style-type: none"> <li>• Ethernet ARP</li> <li>• Transmission of IP Datagrams over Ethernet</li> <li>• Congestion Control in IP/TCP Networks</li> <li>• IP Broadcast</li> <li>• IP Broadcast in the Presence of Subnets</li> <li>• IP Subnetting</li> <li>• Classless Inter-Domain Routing (CIDR)</li> <li>• Requirements for IP Version 4 Routers</li> <li>• Route Redistribution across RIP, OSPF and BGP</li> <li>• VLAN Routing</li> <li>• URPF</li> <li>• BGP</li> <li>• RIP</li> <li>• OSPF</li> <li>• ISIS</li> <li>• BFD</li> <li>• VRRPv3</li> </ul>   |
| Multi-Protocol Label Switch (MPLS) | <ul style="list-style-type: none"> <li>• Label Distribution Protocol (LDP)</li> <li>• Resource Reservation Protocol [Traffic Engineering] (RSVP-TE)</li> <li>• Layer 2 VPN (VPWS and VPLS)</li> <li>• Layer 3 VPN</li> <li>• 6PE/VPE</li> <li>• LSP Stitching</li> <li>• MPLS OAM</li> <li>• MPLS Diffserv</li> <li>• MPLS Label Switching Router (LSR) MIB</li> <li>• MPLS Forwarding Equivalence Class to Next Hop Label Forwarding Entry (FEC-To-NHLFE) MIB</li> <li>• MPLS PW and LSP Traffic Statistics</li> <li>• MPLS Label Stack Encoding</li> <li>• Time To Live (TTL) Processing MPLS Networks</li> <li>• RSVP Shared Risk Link-Group (SRLG) support</li> </ul> |

| OCNOS-SP FEATURE         | SPECIFICATION  |
|--------------------------|--|
| Carrier Ethernet         | <ul style="list-style-type: none"> <li>• Connectivity Fault Management (CFM)               <ul style="list-style-type: none"> <li>- CFM over L2 Bridge with xSTP</li> <li>- CFM over VPWS</li> </ul> </li> <li>• Ethernet Ring Protection Switching (ERPS)               <ul style="list-style-type: none"> <li>- ERPS over CFM on Provider/Customer domain</li> <li>- Sub-ring support (Multiple ring and ladder topologies)</li> <li>- Support of multiple ERP Instances on single ring</li> </ul> </li> </ul>   |
| Multicast Features       | <ul style="list-style-type: none"> <li>• PIM</li> <li>• IGMP</li> </ul>  |
| Quality of Service (QoS) | <ul style="list-style-type: none"> <li>• DiffServ Field in IPv4/IPv6 Headers</li> <li>• Assign matching traffic flow to a specific queue</li> <li>• 1/2/3 Level queuing hierarchy</li> <li>• L2 and L3 QoS</li> <li>• Shaping per queue, per port</li> <li>• Multiple hardware queues per port</li> <li>• WFQ/SP Scheduling Per Queue</li> <li>• WRED</li> <li>• 802.1p remarking</li> <li>• Classification based on interface, ACL, DSCP, IP precedence, 802.1p, and VLAN,</li> <li>• Trust IEEE 802.1p/DSCP</li> <li>• Police Rate (SRTCM/TRTCM)</li> <li>• Minimum and Maximum Bandwidth Per Queue</li> <li>• Service Queuing (Mapping services to specific vlans and shaping each vlan based traffic)</li> </ul>   |
| Management               | <ul style="list-style-type: none"> <li>• Two-way Active Measurement Protocol (TWAMP)</li> <li>• Role based CLI management and access</li> <li>• CLI access via console, telnet and SSH</li> <li>• Authentication using TACAS+/RADIUS Client</li> <li>• Extended ping and traceroute</li> <li>• SNMP v1, v2, and v3</li> <li>• DHCP client</li> <li>• DHCP relay</li> <li>• NTP Client</li> <li>• Syslog</li> <li>• File Upload/Download using FTP/TFTP/SFTP/SCP</li> <li>• Management VRF</li> <li>• Ansible</li> <li>• Yang</li> <li>• NETCONF</li> <li>• Upgrade Mechanism from ONIE prompt using onie nos install and from OcnOS shell using sys-update</li> <li>• Zero Touch Provisioning (ZTP) (with IPv4)</li> <li>• ACL Support over Management, VTY and Loopback</li> <li>• License Server</li> <li>• sFlow</li> <li>• Debounce Timer</li> </ul> |
| Security                 | <ul style="list-style-type: none"> <li>• Secure interface login and password</li> <li>• Control Plane Policing (CoPP)</li> <li>• Storm control</li> <li>• Flow control</li> <li>• Access Control Lists (ACLs) based on               <ul style="list-style-type: none"> <li>- IP/Port/IP-ProtocolType/MAC/Ethertype</li> <li>- TCP Flags, Protocol type, IP fragment flags, DSCP, CoS, IP Precedence, VLAN</li> <li>- Rule Prioritization and re-sequence</li> <li>- On-Fly modification</li> </ul> </li> </ul>  |

| OCNOS-SP FEATURE                         | SPECIFICATION   |
|--|---|
| Hardware Monitoring Features             | <ul style="list-style-type: none"> <li>• Switched port analyzer (SPAN)</li> <li>• Remote switched port analyzer (RSPAN)</li> <li>• Load Balancing</li> <li>• TCAM space monitoring</li> <li>• Chassis Monitoring               <ul style="list-style-type: none"> <li>- Temperature monitor</li> <li>- Fan control</li> <li>- CPU load monitoring</li> <li>- Board information (EEPROM)</li> <li>- Fan and PSU FRU information</li> </ul> </li> <li>• Digital Diagnostics Monitoring               <ul style="list-style-type: none"> <li>- Temperature monitor</li> </ul> </li> <li>• Power Monitoring(Power, Current, Voltage)</li> </ul> |
| Timing and Synchronization               | <ul style="list-style-type: none"> <li>• SyncE (G.8262)</li> <li>• ESMC (G.8264)</li> <li>• G.8275.1 (T-BC)</li> <li>• G.8275.1 (T-GM) with antenna compensation</li> <li>• G.8273.2 (T-BC-P, T-BC-A)</li> <li>• G.8273.2 (T-GM) with antenna compensation</li> </ul>   |
| Subinterface                             | <ul style="list-style-type: none"> <li>• Support for L2 Sub-Interface</li> <li>• Support for L3 Sub-Interface</li> </ul>  |
| MPLS with EVPN                           | <ul style="list-style-type: none"> <li>• EVPN MPLS (ELINE and ELAN)</li> <li>• EVPN MPLS Multihoming (ELINE &amp; ELAN)</li> <li>• EVPN MPLS - QoS (ELINE &amp; ELAN)</li> </ul>  |
| Segment Routing                          | <ul style="list-style-type: none"> <li>• OSPF extensions for Segment-Routing</li> <li>• ISIS extensions for Segment-Routing</li> <li>• LDP and SR interworking</li> <li>• SR Mapping server</li> <li>• Segment-Routing Policy (Traffic Engineering)</li> <li>• Segment-routing OAM (LSP Ping/Traceroute) for MPLS dataplane</li> <li>• Topology Independent Fast Reroute using Segment Routing</li> </ul>   |
| BGP-LS                                   | <ul style="list-style-type: none"> <li>• BGP Link state distribution (OSPF)</li> <li>• BGP Link state distribution (ISIS)</li> <li>• BGP Link state distribution for OSPF-SR</li> <li>• BGP Link state distribution for ISIS-SR</li> </ul>  |
| PCEP (Path Computation Element Protocol) | <ul style="list-style-type: none"> <li>• Support for Path Computation Element Protocol</li> <li>• Support for Stateful PCE</li> <li>• PCEP Extensions for Segment Routing</li> </ul>  |

## 4.0 OcNOS-SP-CSR: ODM CSR Hardware Specification

### 4.1 Edgecore AS7316-26XB

| ODM PRODUCT IDENTIFICATION | EC AS7316-26XB   |   |
|----------------------------|--|---|
| Switch Silicon             | Broadcom Qumran-AX BCM88470  |   |
| CPU Modules                | Processor: Intel Broadwell-DE D-1519 1.5G 4C<br>Memory: DDR4 SO-DIMM 2x 8GB SDRAM with ECC support<br>SSD: 128 GB  |   |
| Ports                      | <p><b>Switch Ports:</b><br/>           16 x SFP+ (each supporting 10 GbE or 1 GbE)<br/>           8 x SFP28 (each supporting 10 GbE or 25 GbE)<br/>           2 x 100G QSFP28 (each supporting 1 x 40/100 GbE or 4 x 10/25 GbE or 2 x 50 GbE)</p> <p><b>Management Ports on Front Panel:</b><br/>           1 x RJ-45 serial console<br/>           1 x RJ-45 1000BASE-T management Ethernet port (MGMT)<br/>           1 x USB Type A storage port</p> <p><b>Clocking and Timing ports:</b><br/>           1 x 1PPS Input port<br/>           1 x 1PPS Output port<br/>           1 x 10MHz Input port<br/>           1 x 10MHz Output port<br/>           1 x Time of day (ToD) RJ-45 port<br/>           1 x Building-Integrated Timing System port (BITS)</p> <p><b>GPS Antenna:</b><br/>           1 x GPS antenna port</p> |   |
| Performance                | High performance packet processor :<br>Switching Capacity: 300 Gbps full-duplex<br>Packet Throughput: 300 Mpps processing rate   |   |
| Regulatory Compliance      | <p><b>Safety</b><br/>           UL (CAN/CSA 22.2 No 60950-1 &amp; UL60950-1)<br/>           CB (IEC/EN60950-1)<br/>           CCC (GB4943.1-2011)<br/>           BSMI (CNS14336-1)</p>   | <p><b>Electromagnetic Compatibility</b><br/>           CE Mark<br/>           EN55032 Class A<br/>           EN55024 (Immunity) for Information Technology Equipment EN 61000-3-3<br/>           EN 61000-3-2<br/>           FCC Title 47, Part 15, Subpart B Class A VCCI Class A<br/>           CNS 13438 (BSMI)<br/>           CCC (GB9254-2008)</p> |
| Power                      | <p><b>48 VDC Power Supply:</b><br/>           400W PSU<br/>           36-75VDC input<br/>           Front-to-back airflow<br/>           Supports load-sharing function</p>  | <p><b>AC Power Supply:</b><br/>           400W PSU<br/>           100-240V AC input Front-to-back airflow<br/>           Supports load-sharing function<br/>           Power Consumption: Approx. 230 W (Max), 170 W (Typical)</p>  |
| OcNOS SKU                  | OCNOS-SP-CSR   |   |

## 4.2 UFISpace S9500-30XS

| ODM PRODUCT IDENTIFICATION | UFISPACE S9500-30XSZ  |   |
|----------------------------|---|---|
| Switch Silicon             | Broadcom Qumran-AX BCM88470   |   |
| CPU Modules                | Processor: Intel® Broadwell-DE D-1519 1.5G 4-Core<br>Memory: DDR4 SODIMM 2x8GB with ECC support<br>SSD: 128 GB  |   |
| Ports                      | Total 10 GE SFP+: 20<br>Total 25 GE SFP28: 8<br>Total 100 GE QSFP28: 2<br>1 RJ45 + Micro USB console/management ports<br>1 1000 Base-T Ethernet port for Out-of-Band management<br>1 USB 2.0 Type-A general purpose port<br>GNSS, 1PPS, 10M, ToD, and BITS timing ports |   |
| Performance                | Packet Throughput 300 Mpps Packet Switching Capacity 300 Gbps   |   |
| Regulatory Compliance      | <b>Safety</b><br>NEBS Level3<br>UL 62368-1<br>IEC/EN 60950-1<br>IEC/EN 62368-1<br>BSMI CNS 14336-1  | <b>Electromagnetic Compatibility</b><br>NEBS Level 3<br>FCC Part 15, Subpart B, Class A<br>EN55032, Class A EN300 386 EN55024<br>EN301 489-1 EN301 489-19 EN303413<br>BSMI (CNS 13438), Class A |
| Power                      | AC input: 100 ~ 240V, 6 ~ 3A, 50 ~ 60Hz<br>DC input: -36 ~ -75V, 16 ~ 8A<br>Max power: 400 Watts  |   |
| OcNOS SKU                  | OCNOS-SP-CSR  |   |

### For more information

For more information about the OcNOS Service Provider CSR Solution, contact your IP Infusion sales representative.

### ABOUT IP INFUSION

IP Infusion, the leader in disaggregated networking solutions, delivers enterprise and carrier-grade software solutions allowing network operators to reduce network costs, increase flexibility, and to deploy new features and services quickly. 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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