



OPEN CLUSTER OF N XPUS (XOC-N) SYSTEM ARCHITECTURE

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Executive Summary

This document describes the System Architecture of an Open Cluster for N xPUs (XOC-N) for AI infrastructure designs. It is a companion document to *Open Pod Group for M xPUs (OPG-M) System Architecture* [1], published by the Open Compute Project. An overview of the market needs that drove the development of these two documents and the high-level cluster architecture can be found in the Open Compute Project White Paper *Open Cluster Designs for AI* [2].

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1. Introduction

This document describes the System Architecture of an Open Cluster for N xPUs (XOC-N) for AI infrastructure designs. It is a companion document to *Open Pod Group for M xPUs (OPG-M) System Architecture* [1], published by the Open Compute Project. An overview of the market needs that drove the development of these two documents and the high-level cluster architecture can be found in the Open Compute Project White Paper *Open Cluster Designs for* AI [2].

2. Compliance with Open Compute Project Tenets

This System Architecture, which is built on top of existing and extensive OCP work, is aligned naturally with the OCP Tenets. In summary:

Efficiency: At the hardware level, OCP designs will be used wherever possible, thus addressing physical issues such as power consumption, cooling requirements, floor-space requirements, etc. At the architectural level, the modular structure of the System Architecture and the complete descriptions of equipment requirements and cabling connectivity will reduce design effort and accelerate deployment. Regarding management, the use of software solutions developed by the OCP and other open initiatives will provide a clear path for the rapid design, deployment, and operation of competitive management platforms optimized for the needs of the particular AI infrastructure under design.

Impact: While hyperscale players typically have extensive engineering resources and can undertake the full design and deployment of large AI networks, enterprises often have lean IT staffs structured for primarily for operational tasks. By providing complete and practical System Architectures, this document should lower the design barrier for the enterprise sector and accelerate AI infrastructure deployment in this important market.

Scalability: The modular nature of the designs developed by this work should naturally facilitate network creation, both during initial design and deployment, as well as subsequent capacity expansion.

Openness: The reliance of this work on the extensive corpus of existing OCP work (e.g., the rack-scale xPU pod designs under development by the OCP Open Systems for AI Strategic Initiative [3]), as well as the availability of proven solutions from other not-for-profit forums (e.g., SONiC [4]), should enable ready extension or modification by users of the System Architecture.

Sustainability: The existing OCP hardware solutions used for much of the System Architecture provide an excellent foundation for durable AI deployments. The designs described here include quantitative estimates of the power, cooling, and other physical requirements at the module and cluster levels, thus providing AI cluster architects and owners with practical insight useful in optimizing the AI infrastructure to meet operational goals.

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3. Scope

This System Architecture was developed as a companion to the OCP *Open Pod Group for M xPUs (OPG-M) System Architecture* [1], which describes the elements and structure of multi-rack systems (OPG-Ms) containing xPU pods/nodes, switches, and storage resources. These OPG-Ms are modular building blocks that are networked together to construct AI clusters. An AI cluster contains the xPUs that share a common scale-out network, plus the other resources necessary for the function of the xPUs. The present work describes the physical network elements located at the spine/aggregation layer, plus the other resources required to knit one or more OPG-Ms into a full AI cluster, which we designate as an xPU Open Cluster for N xPUs (XOC-N). This System Architecture is intended to provide designs which are detailed enough to serve as a technical basis for procurement and implementation. Scale-up, scale-out, scale out-CPU, storage, and management networking spanning the entire design all are in-scope. Physical and logical network topology spanning the entire design are in-scope. Solutions for cabling and cable-management are in-scope. Infrastructure, including power distribution, load bearing, and cooling, are in-scope. This document describes air-cooled solutions, and a future System Architecture document will focus on liquid-cooled solutions.

Relationship with other OCP Contributions: In addition to [5], this System Architecture will leverage Contributions from other OCP Projects wherever possible, and solutions developed by the OCP Open Systems for AI Strategic Initiative and OCP solutions for pod, rack, and cluster infrastructure management will be emphasized.

4. Nomenclature

Following are key terms used in this document. A more extensive list is contained in the Glossary.

OPG-M	Open Pod Group for M xPUs
System Architecture	The elements and structure of an XOC-N
XOC-N	xPU Open Cluster for N xPUs
xPU	Generic term for a special-purpose AI accelerator device

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5. XOC-N architecture

An overview of the structure of an AI cluster and its principal components can be found in [1]. Figure 1 shows the high-level structure of an XOC-N, which is composed of one or more OPG-Ms, plus the spine and aggregation networks (reproduced from [2], Figure 2). In the present work we describe the features and requirements for an XOC-1k (1,024 xPUs), which is built using eight OPG-128s plus the necessary resources at the spine/aggregation layer. Guidance also is given on adapting the XOC-1k design to build either smaller or larger clusters.

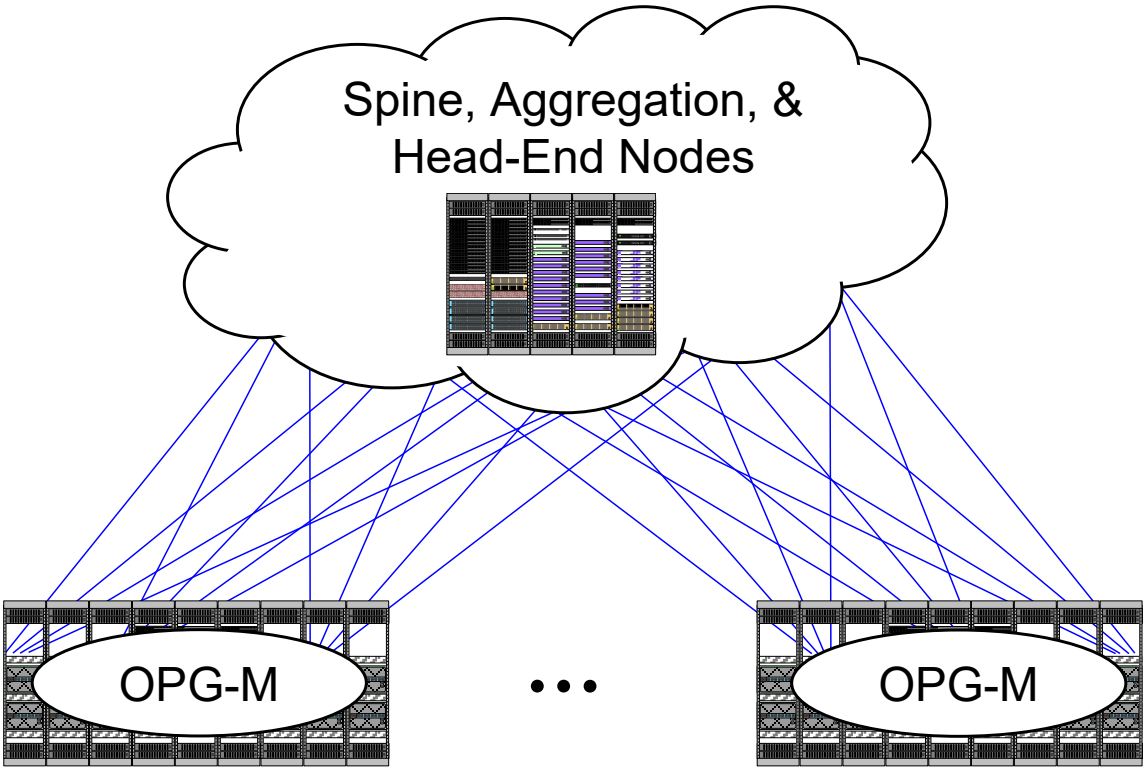


Figure 1: xPU Open Cluster for N xPUs (XOC-N).

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6. 400G XOC-N spine networks, aggregation networks, and head-end nodes

This System Architecture focuses on the air-cooled generation of AI infrastructure, which most commonly uses 400 GbE scale-out links. The emerging liquid-cooled generation, which most commonly uses 800 GbE scale-out links, will be the subject of separate System Architecture documents. Figure 2 shows the spine- / aggregation-layer physical components of the 400G XOC-1k described in the present work.

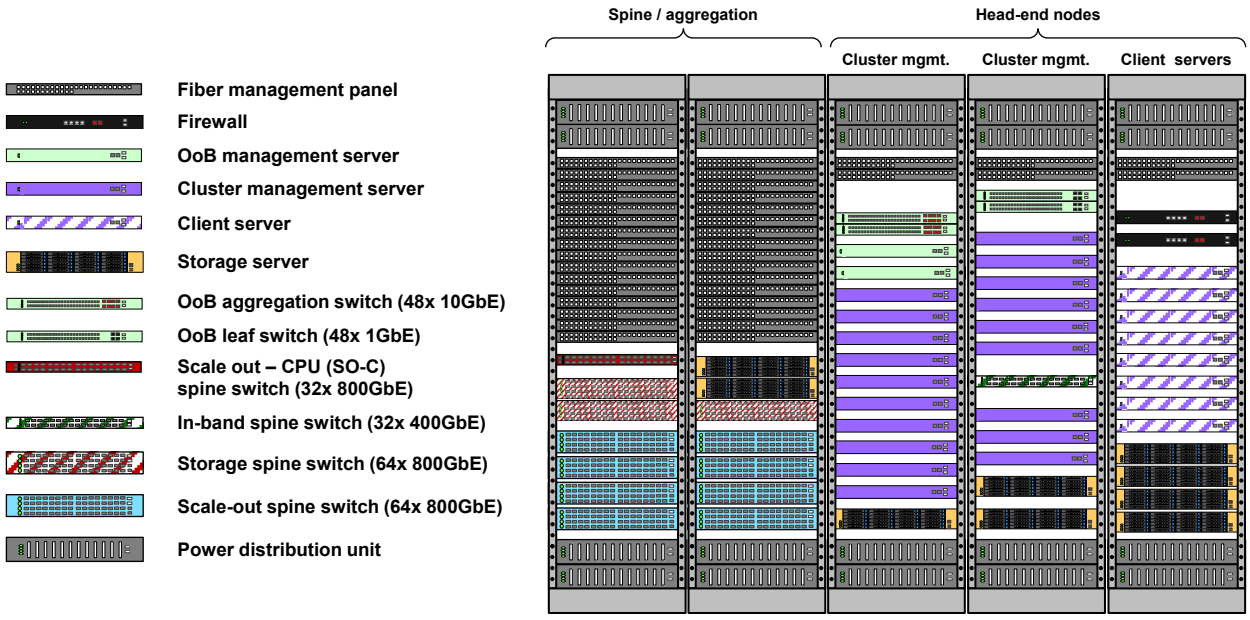


Figure 2. Spine, aggregation, and head-end nodes for an XOC-1k.

Because it is not possible to provide a universal, cost-optimized design suitable for all use cases, this System Architecture instead furnishes a concrete example by describing a solution suitable for training. The dimensioning of the resources and attendant networking shown here are meant to provide plausible, numerical estimates and should be verified as part of any design process. This is especially true of the servers found in the head-end nodes, whose precise hardware and software requirements depend on the function in question, selected software application(s), and target workload. For example, if Kubernetes is chosen for software container deployment and orchestration, the Kubernetes website [6] should be consulted for detailed guidance on server requirements. Other than the recommended use of SONiC for switch management and OpenBMC for hardware management, a bare-metal design is shown. In

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summary, this System Architecture is meant to provide a level of detail sufficient to accommodate a variety of management solutions and to enable ready extension, modification, or adaptation for other use cases.

6.1. Guidelines and assumptions

1. High-power ORv3 racks, equipped with PDUs capable of providing 20+ kW of power.
2. Forced-air cooling is used for all equipment. It is assumed that the data-center cooling capacity is 20 kW per rack.
3. Separate networks for scale-out, storage, SO-C, in-band management, and out-of-band management networks.
4. In this design the front-end network is divided into two physically separate fabrics, namely the SO-C fabric and the in-band management network.
5. In this design the SO-C and storage fabrics are treated as physically separate fabrics.
6. For the five OPG-M networks, namely the scale-out, storage, SO-C, in-band management, and out-of-band management, no redundancy is assumed or required.
10. All scale-out fabric, SO-C fabric, and storage fabric links between the OPG-M and the spine/aggregation layers are 400GbE optical links. This simplifies design and inventory, and enables the construction of large, 2-tier scale-out networks (> 1k xPUs), that otherwise would not be possible if 800GbE links were chosen for these connections. Physically, these connections are OSFP (switch port) ←→ 2x 400GbE (optical) ←→ OSFP (switch port).
11. Single-mode OS2 cabling is used for all optical cabling.
12. MPO-8 connectors are recommended for all 400G optical couplers.
13. 800G OSFP-compliant, single-mode transceivers with dual MPO-8 APC connectors (2x 400GbE) and 500m reach are recommended for all 400G optical links.
14. These designs are compatible with 500m optical trunk cables terminated with MPO-8/12 connectors.
15. 25G and 100G passive DAC cables are recommended for connections inside the spine/aggregation/head-end node racks.
16. Single-mode100G QSFP28 optical transceivers with 500m reach are recommended for the in-band management leaf-spine connections.
17. Single-mode10G SFP+ optical transceivers with 500m reach are recommended for the out-band management leaf-spine connections.
18. All networks in these designs (scale-out, SO-C, storage, in-band management, and OoB management), are designed as non-blocking networks.
19. All active equipment (servers, switches, and power-distribution units) is assumed to have a 1 GbE/RJ45 port for connection to the out-of-band management network.
20. All xPU servers, storage servers, and metadata servers are assumed to have a 25 GbE/SFP28 port for connection to the in-band management network.

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21. Most xPU-nodes, storage servers, and meta-data servers offer some level of redundancy in their designs, often in the power supply. No additional redundancy is assumed or required in the present work. The required storage resources are modelled using a ratio of approximately one PCIe-Gen5 NVMe drive per xPU.
22. Due to the wide variety in fiber-management shelf configuration and plenum-cable size, the port-numbering plans and connection maps for the fiber-management shelves are out-of-scope for this design.
23. Where possible, the OPG-M design will provide resiliency to support a graceful degradation in function in the event of hardware of software impairment.
24. Client systems are not connected to either of the high-speed scale-out networks.
25. This design assumes that high-speed, high-volume data transfers between concurrent producer and consumer applications use the high-speed scale-out networks and storage network, rather than the in-band network. In this context, the term “application” refers to a job running on the xPUs. This applies to scenarios with a single producer application and single consumer application, as well as Single-Program Multiple-Data (SPMD) and Multiple-Program Multiple-Data (MPMD) scenarios.

6.2. Physical elements

This section discusses the physical elements that make up an XOC-1k.

6.2.1. Head-end nodes: client servers (user access)

These servers are responsible for providing a landing zone for users (clients), loading external data into temporary storage, submission of training jobs, etc. Using the total number of xPUs in an XOC-1k (1,024) as a starting point, below we estimate some of the key resource requirements for the client servers. In these estimates, it is assumed that high-performance, muti-core x86 CPUs are used.

Maximum number of clients

- 1,024 – worst-case, one xPU per client

Note: clients can either be external users/applications or internal applications running concurrently within the XOC-1k

Client-server resources

- Processor cores: 2,048 – two cores per client
- DRAM: 8 TB – 8 GB per client
- Local non-volatile storage: 102 TB – 100 GB per client

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These requirements can be met by eight servers with the following configuration:

- 256 cores each
- 2 TB DRAM each
- 102 TB of NVMe / 7 drives, 15.4 TB each
- 1x 100G in-band link each
- 1x 400G storage spine link each

6.2.2. Head-end nodes: cluster-management servers

These servers manage the resources and tasks of the entire XOC-1k. While these units are in the same general class as the client servers described above, the specific configuration details, especially regarding memory and number of cores, will depend on the selected management applications and target use case for the cluster. In all cases in this design, at least two instances of each type of cluster-management server are recommended in order to provide high availability for these critical functions. For reference, following are the roles, numbers, and typical interface requirements for these units.

Out-of-band management

- 2x for high availability
- 1x 25G in-band connection each
- 2x 100G OoB aggregation-switch connections each
- Controls hardware through baseboard management controllers (BMCs) or service processors over a separate low-speed Ethernet network. It handles power control, firmware updates, and hardware health monitoring even when servers are offline or the main network is down.

Scheduler

- 2x for high availability
- 2x 25G in-band connections each
- E.g., SLURM/Kubernetes
- Manages the allocation of compute, GPU, and network resources to AI workloads. It queues, prioritizes, and launches jobs across the cluster to optimize utilization and fairness.

Monitoring / observability

- 2x for high availability
- 2x 25G in-band connections each
- Collects metrics, logs, and traces from compute, network, and storage elements in real time. It supports dashboards and alerts for performance, reliability, and capacity planning.

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OS image build & deploy (operating system)

- 2x for high availability
- 2x 100G in-band connections each
- Assembles custom OS images with drivers, libraries, and security patches tailored for the cluster. It automates bare-metal provisioning and node re-imaging at scale.

OS image repository

- 2x for high availability
- 2x 100G in-band connections each
- Stores validated operating system images and boot artifacts for fast, repeatable deployment. It serves these images to the provisioning tools or PXE boot processes in the cluster.

Container build (2x)

- 2x for high availability
- 2x 100G in-band connections each
- Builds container images containing AI frameworks, dependencies, and job configurations. It ensures consistent runtime environments and optimizes builds for GPU acceleration.

Container repository

- 3x for distributed configuration and capacity
- 2x 100G in-band connections each
- Hosts and versions container images for distribution to compute nodes. It provides access control, caching, and auditing for all containerized workloads.

Code repository

- 2x for high availability
- 2x 100G in-band connections each
- Stores source code for AI applications, models, and cluster tooling with version control. It enables collaboration, branching, and rollback of experiments and pipelines.

Continuous Iteration / Continuous Development (CI/CD)

- 2x for high availability
- 2x 100G in-band connections each
- Automates building, testing, and deploying updated code and container images. It links commits in the code repository to automated validation and rollout across the AI environment.

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Temporary / staging storage

- 2x for high availability
- 1x 25G in-band connections each (Internet traffic)
- 2x 400G storage spine each
- Assembles custom OS images with drivers, libraries, and security patches tailored for the cluster. It automates bare-metal provisioning and node re-imaging at scale.

6.2.3. Head-end nodes: Storage servers

These high-capacity storage servers are complements to the client and cluster-management described above. The specific configuration details will depend on the selected management applications and target use case for the cluster. In all cases in this design, at least two instances of each type of storage server are recommended in order to provide high availability for these critical functions. For reference, following are the roles, numbers, typical and typical interface requirements for these units. In all cases, it is assumed the server is fully populated with 24 NVMe units with 8TB of capacity each.

OS image repository

- 2x for high availability
- 2x 100G in-band links each
- Holds validated operating system images and boot artifacts. These files are needed for fast, repeatable deployment.

Container repository

- 3x for capacity and high availability
- 2x 100G in-band links each
- Stores container images for distribution to compute nodes.

Code repository

- 2x for high availability
- 1x 100G in-band link each
- Stores source code for AI applications, models, and cluster tooling. These files are needed for collaboration, branching, and rollback of experiments and pipelines.

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Temporary / staging storage

- 2x for high availability
- 1x 25G in-band link each (Internet traffic via the firewalls)
- 2x 400G storage spine link each
- Storage for drivers, libraries, and security patches tailored for the cluster. These files are used for bare-metal provisioning and node re-imaging at scale.

6.2.4. Head-end nodes: Firewalls

Following are requirements for the firewalls that provide access to the Internet for the XOC-1k:

- 2x for high availability
- Firewall throughput: 35 Gb/s
- I/O: (2x 100G QSFP28) + (4x 25G SFP28)
- Height: 1 OU
- Weight: 7 kg
- Maximum power: 190W (redundant power supply)
- Traffic model (sustained, line-rate): 35 Gb/s

6.2.5. SO-C spine switch

This 26 Tb/s switch has the same features as the 26 Tb/s switches described in [1].

6.2.6. Scale-out and storage spine switches

These 51 Tb/s switches have the same features as the 51 Tb/s switches described in [1].

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6.2.7. In-band and out-of-band aggregation switches

Following are the requirements for these switches:

- Capacity: 13 Tb/s
- Ports 32x 400GbE QSFP-DD
- Standard Ethernet traffic management features, including VxLAN
- SONiC support
- Forced-air cooling
- OoB management port, RJ45, capable of 1GbE
- Supported speeds: 25/100/400 GbE
- Height: 1 OU
- Maximum power consumption: 1.4 kW
- Traffic model (sustained, line-rate)

6.2.8. Power, space, and weight requirements

At a fundamental level, the core objectives of most AI infrastructure designs are to simultaneously maximize compute density while minimizing costs. To do so, a key requirement is that the equipment power and cooling capacity must match, and this requirement usually is stated on a per-rack basis. In this design, we have assumed a data-center maximum cooling capacity of 20 kW / rack, which is typical for high-end facilities which rely solely on forced-air cooling.

Tables 1 – 6, below, summarize the infrastructure requirements, namely power and weight, for the racks present in spine/aggregation/head-end node layer of an XOC-1k (Figure 3). For the power design, the tables show both the total, worst-case power consumption (maximum), as well as a de-rated value that accounts for the dynamic nature of power loads and represents the average power draw. In these designs, the de-rated power is estimated as 80% of the maximum power. The PDU capacity was sized to support transient power draws of at least 120% of the de-rated power value.

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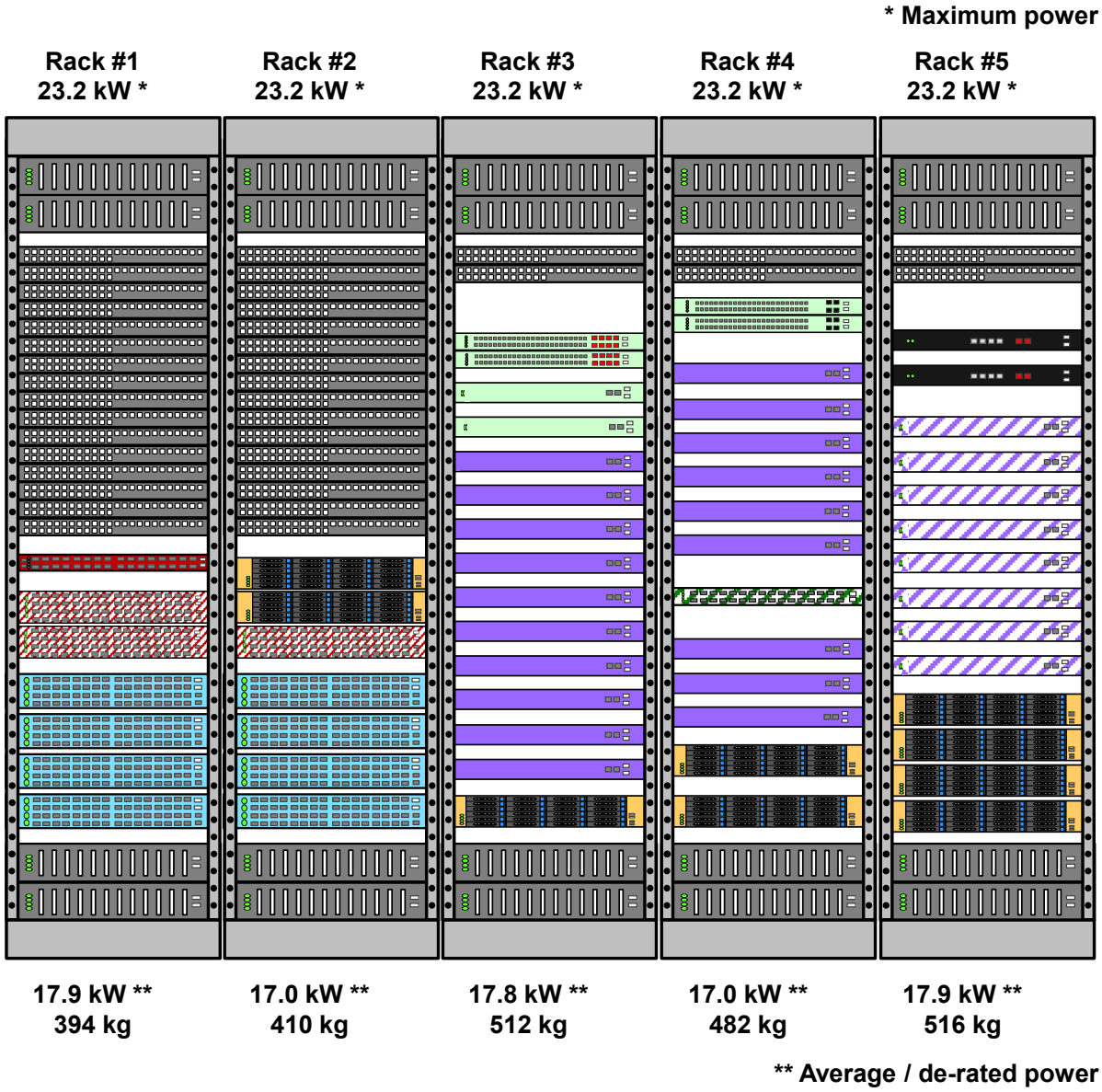


Figure 3. Power and weight estimates for the spine, aggregation, and head-end racks of an XOC-N.

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		Maximum power (kW)	Height (OU)	Weight (kg)
51T Ethernet switch		3.2	2	24
26T Ethernet switch		2.0	1	15
13T storage Ethernet switch		2.0	1	15
13T in-band Ethernet switch		1.4	1	10
48x 1GbE switch		0.1	1	7
48x 25GbE switch		0.3	1	13
XON management server		1.2	1	20
Cluster mgmt. server		1.6	1	20
Client server		1.6	1	20
Storage server		2.0	2	32
Firewall		0.2	1	7
5.8 kW PSU		0.3	2	10
Fiber management tray		0	1	1
ORv3 rack		0	0	170
Power de-rating factor				80%

Table 1: Weight, power, and equipment height values used to estimate the XOC-1k spine-layer infrastructure requirements.

Rack # 1	# per rack	Unit power (kW)	Unit Height (OU)	Unit Weight (kg)	Height subtotal (OU)	Weight subtotal (kg)	Power subtotal (kW)
Scale-out 51 switches	4	3.2	2	24	8	96	12.8
Storage 51T switch	2	3.2	2	24	4	48	6.4
SO-C 26T switch	1	2.0	2	24	2	24	2
5.8 kW PSU	4	0.3	2	10	8	40	1.2
Fiber management tray	16	0.0	1	1	16	16	0
ORv3 rack	1	0	0	170		170	0
Space total (OU)					**38**		
Weigth total kg						**394**	
Total maximum power (W)							22.4
Total de-rated power (W)							**17.9**

Table 2: Weight, power, and total equipment height for Rack #1 (see Figure 3).

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Rack #2	# per rack	Unit power (kW)	Unit Height (OU)	Unit Weight (kg)	Height subtotal (OU)	Weight subtotal (kg)	Power subtotal (kW)
Scale-out 51 switches	4	3.2	2	24	8	96	12.8
Storage 51T switches	1	3.2	2	24	2	24	3.2
Storage server	2	2.0	2	32	4	64	4
5 kW PSU	4	0.3	2	10	8	40	1.2
Fiber management tray	16	0	1	1	16	16	0
ORv3 rack	1	0		170		170	
Space total (OU)					**38**		
Weigth total kg						**410**	
Total maximum power (W)							21.2
Total de-rated power (W)							**17.0**

Table 3: Weight, power, and total equipment height for Rack #2 (see Figure 3).

Rack #3	# per rack	Unit power (kW)	Unit Height (OU)	Unit Weight (kg)	Height subtotal (OU)	Weight subtotal (kg)	Power subtotal (kW)
OoB management server	2	1.2	1	20	2	40	2.4
Cluster mgmt server	10	1.6	1	20	10	200	16
Storage server	1	2.0	2	32	2	32	2
OoB aggregation switches	2	0.3	1	13	2	26	0.6
5 kW PSU	4	0.3	2	10	8	40	1.2
Fiber management tray	4	0	1	1	4	4	0
ORv3 rack	1	0		170		170	
Space total (OU)					**28**		
Weigth total kg						**512**	
Total maximum power (W)							22.2
Total de-rated power (W)							**17.8**

Table 4: Weight, power, and total equipment height for Rack #3 (see Figure 3).

Rack #4	# per rack	Unit power (kW)	Unit Height (OU)	Unit Weight (kg)	Height subtotal (OU)	Weight subtotal (kg)	Power subtotal (kW)
Cluster mgmt servers	9	1.6	1	20	9	180	14.4
Storage servers	2	2.0	2	32	4	64	4
OoB GbE management switch	2	0.1	1	7	2	14	0.2
Firewall	0	0.2	1.0	7	0	0	0
In-band 13T spine switch	1	1.4	1.0	10	1	10	1.4
5 kW PSU	4	0.3	2	10	8	40	1.2
Fiber management tray	4	0	1	1	4	4	0
ORv3 rack	1	0	0	170		170	
Space total (OU)					**28**		
Weigth total kg						**482**	
Total maximum power (W)							21.2
Total de-rated power (W)							**17.0**

Table 5: Weight, power, and total equipment height for Rack #4 (see Figure 3).

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Rack #5	# per rack	Unit power (kW)	Unit Height (OU)	Unit Weight (kg)	Height subtotal (OU)	Weight subtotal (kg)	Power subtotal (kW)
Client servers	8	1.6	1	20	8	160	12.8
Storage servers	4	2.0	2	32	8	128	8
Firewall	2	0.2	1.0	7	2	14	0.4
5 kW PSU	4	0.3	2	10	8	40	1.2
Fiber management tray	4	0	1	1	4	4	0
ORv3 rack	1	0	0	170		170	
Space total (OU)					**30**		
Weigth total kg						**516**	
Total maximum power (W)							22.4
Total de-rated power (W)							**17.9**

Table 6: Weight, power, and total equipment height for Rack #5 (see Figure 3).

6.2.9. Management and software elements

This section describes the software and management elements of an XOC-N. To the greatest extent possible, the OCP management frameworks are leveraged in this design, with particular emphasis on SONiC and Redfish [8] solutions. A discussion of the reasoning behind the software and management recommendations can be found in [1], along with specific recommendations for most of the managed elements that are part of this design. Table 7 contains the software / management recommendations for network elements that are found only in this document.

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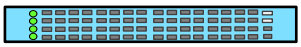
Category	Type	Expected leverage
Servers		
 Cluster mgmt. server	Host CPUs If BMC present	Vendor supplied
 Client server	Host CPUs If BMC present	Vendor supplied
 OoB mgmt. server	Host CPUs If BMC present	Vendor supplied
 Firewall server	Host CPUs If BMC present	Vendor supplied
Switches		
 OoB aggregation switch		Vendor supplied
 In-band spine switch	If BMC present	SONiC / Base Profile recommended OpenBMC recommended
 SO-C spine switch	If BMC present	SONiC / Base Profile recommended OpenBMC recommended
 Storage spine switch	If BMC present	SONiC / Base Profile recommended OpenBMC recommended
 Scale-out spine switch	If BMC present	SONiC / Base Profile recommended OpenBMC recommended

Table 7: Software elements for managed devices in XOC-N designs.

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7. XOC-1k networks

Table 8 summarizes the total number of spine/aggregation links for an OPG-128 and an XOC-1k, which contains eight OPG-128s, and Figure 4 shows the network-element designations for the spine, aggregation, and head-end node equipment used in the XOC-1k connection maps.

Network	OPG-128 [1]	XOC-1k
Scale-out	128x 400G (OSFP)	1,024x 400G (OSFP)
Storage	40x 400G (OSFP)	320x 400G (OSFP)
SO-C	8x 400G (OSFP)	64x 400G (OSFP)
In-band management	2x 100G (QSFP28)	16x 100G (QSFP28)
Out-of-band management	7x 10GbE (SFP+)	56x 10GbE (SFP+)

Table 8: Spine/aggregation links for an OPG-128 and an XOC-1k. All links use single-mode fiber cables.

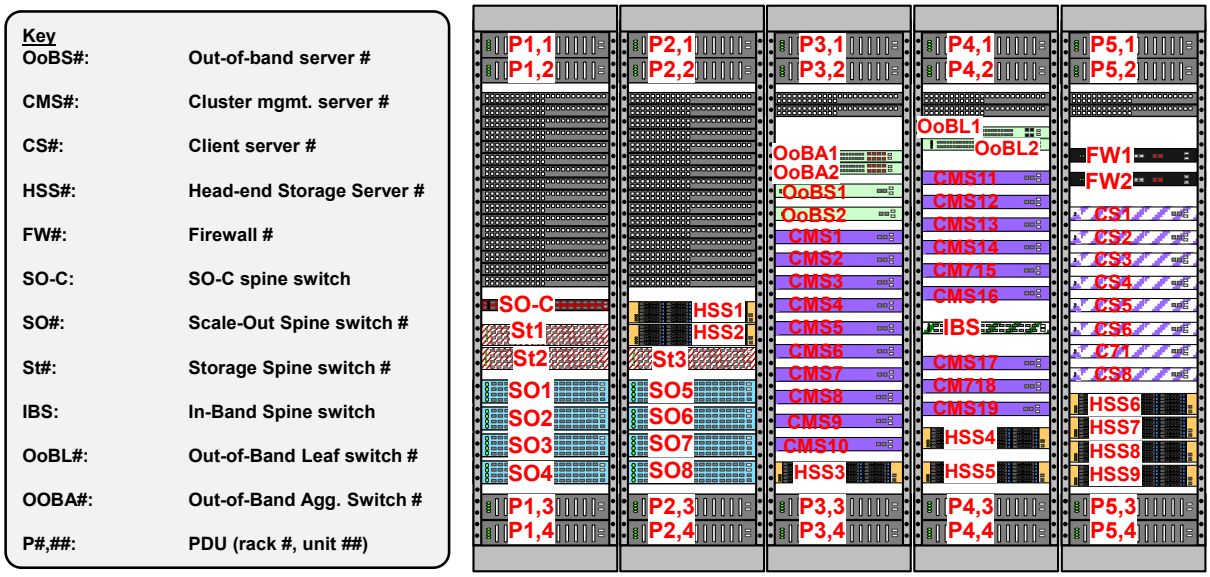


Figure 4. XOC-1k network-element designations for spine, aggregation, and head-end node equipment.

Date: January 2026

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7.1. Scale-out spine

The scale-out network supports high-bandwidth communication between xPUs located in different pods / xPU-nodes. Figure 5 shows two commonly used topologies used for this network, namely the Clos-based and rail-optimized topologies. In both cases two tiers of switches are used, with the leaf switches located in the OPG-128s and the spine switches located elsewhere in the data center. The distance between the leaf and spine switches typically is great enough to require the use of optical links for leaf-spine connections. In this System Architecture the use of single-mode fiber and dual-port (2x 400G) OSFP optical modules with 500m reach is recommended for leaf-spine connections. In these designs, the xPUs in an OPG-128 connect to one of two 51 T/bs leaf switches (Clos topology), or one of four 26 Tb/s leaf switches (rail-optimized topology). These links are called the downlinks and occupy half of the switch ports on the leaf switches [1]. The remaining ports on the leaf switches are called uplinks and are used for connections to the spine switches. The following sections contain the port-numbering plans and connection maps for the two topologies.

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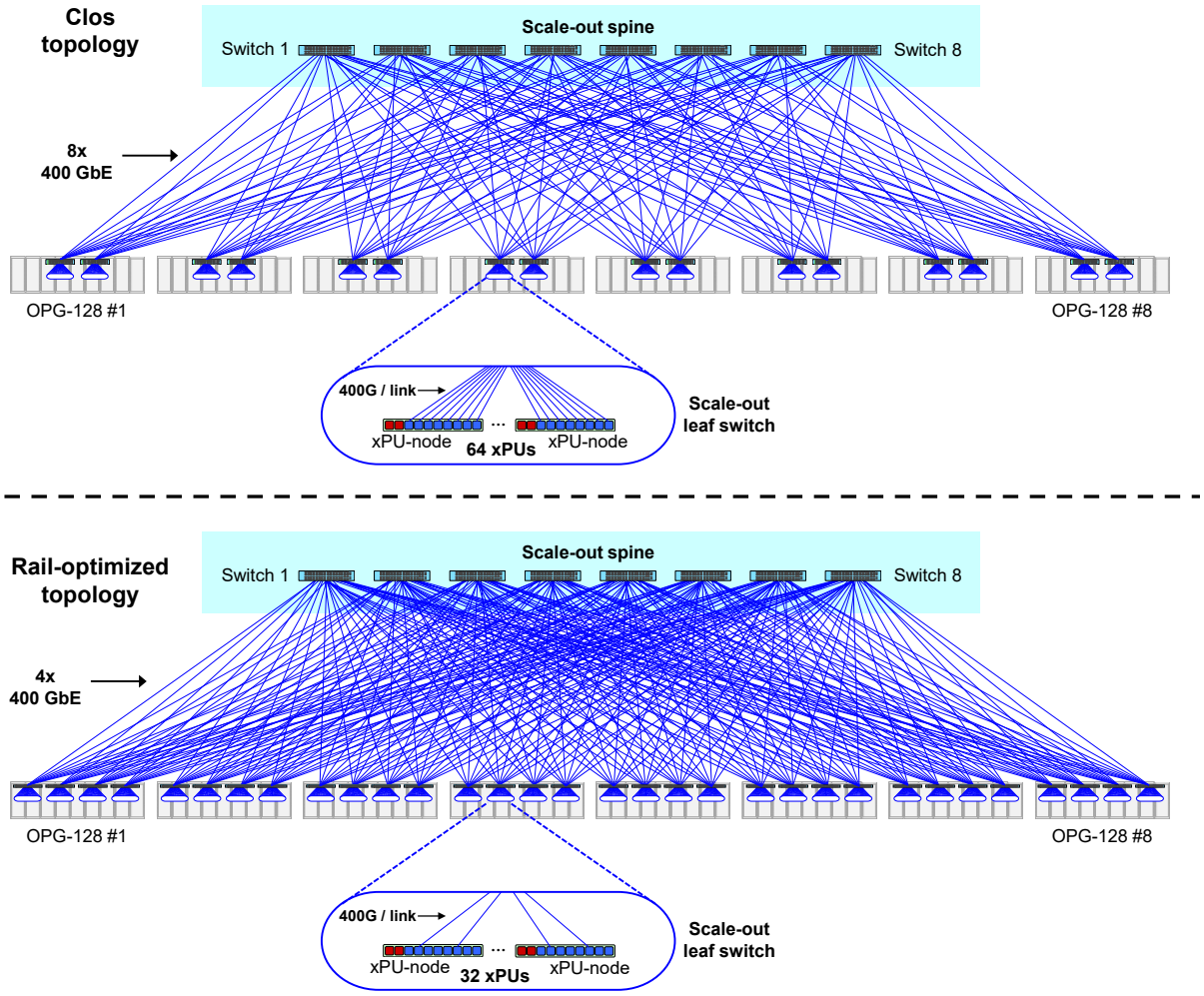


Figure 5. XOC-1k scale-out leaf-spine links. Top panel: Clos topology. Bottom panel: rail-optimized topology.

7.1.1. Clos-based scale-out network

In this topology, the xPU scale-out NICs in an OPG-128 connect to two 51 T/bs leaf switches [1]. An XOC-1k contains eight OPG-128s and requires eight 51 Tb/s spine switches. Figure 6 shows the port-numbering plan for a Clos-based [7] scale-out fabric, and Tables 9-16 contain the connection maps for the scale-out leaf and spine switches.

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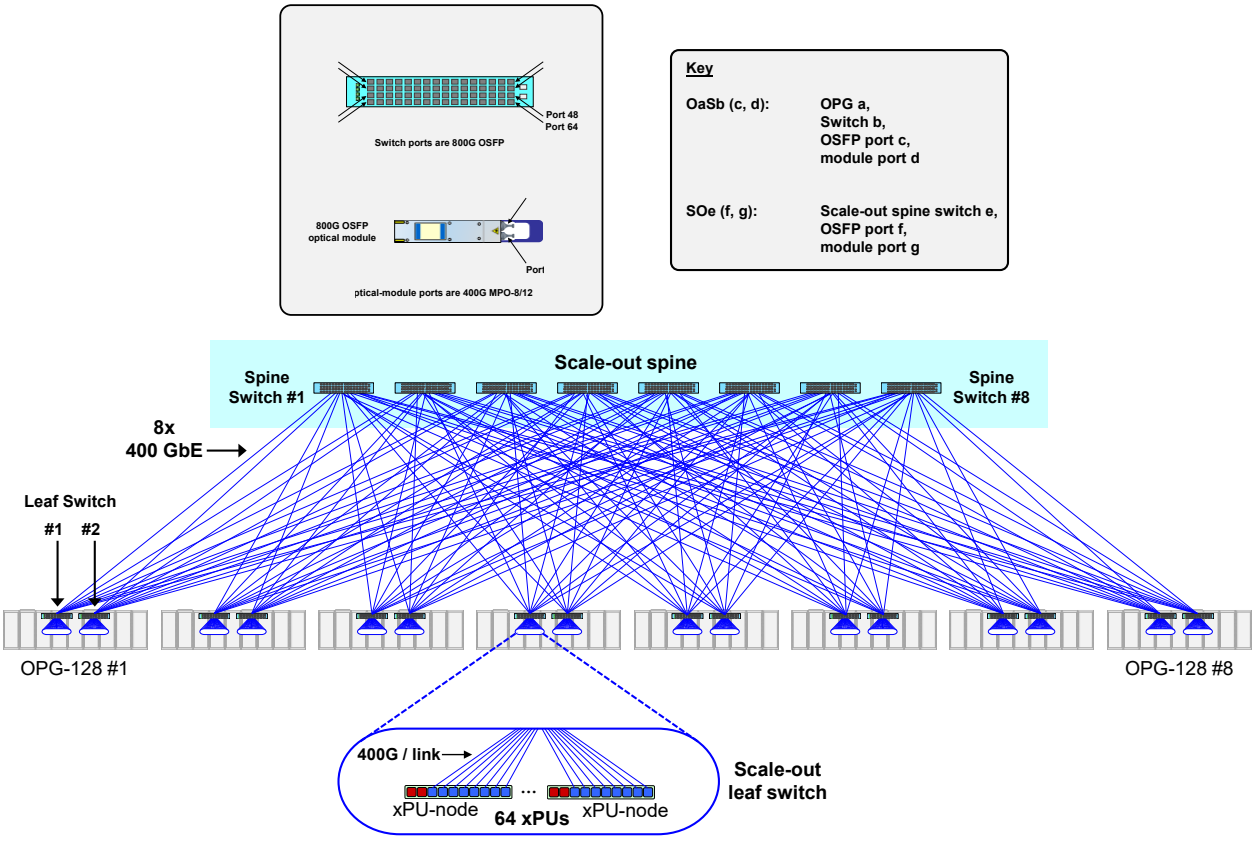


Figure 6. XOC-N scale-out port-numbering plan, Clos topology. The eight spine switches connect to the sixteen leaf switches in the eight OPG-128s. The links are 400G optical.

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SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (2,1)		17,1	O3S1 (2,1)		33,1	O5S1 (2,1)		49,1	O7S1 (2,1)
1,2	O1S1 (2,2)		17,2	O3S1 (2,2)		33,2	O5S1 (2,2)		49,2	O7S1 (2,2)
2,1	O1S1 (4,1)		18,1	O3S1 (4,1)		34,1	O5S1 (4,1)		50,1	O7S1 (4,1)
2,2	O1S1 (4,2)		18,2	O3S1 (4,2)		34,2	O5S1 (4,2)		50,2	O7S1 (4,2)
3,1	O1S1 (6,1)		19,1	O3S1 (6,1)		35,1	O5S1 (6,1)		51,1	O7S1 (6,1)
3,2	O1S1 (6,2)		19,2	O3S1 (6,2)		35,2	O5S1 (6,2)		51,2	O7S1 (6,1)
4,1	O1S1 (8,1)		20,1	O3S1 (8,1)		36,1	O5S1 (8,1)		52,1	O7S1 (8,2)
4,2	O1S1 (8,2)		20,2	O3S1 (8,2)		36,2	O5S1 (8,2)		52,2	O7S1 (8,2)
5,1	O1S2 (2,1)		21,1	O3S2 (2,1)		37,1	O5S2 (2,1)		53,1	O7S2 (2,1)
5,2	O1S2 (2,2)		21,2	O3S2 (2,2)		37,2	O5S2 (2,2)		53,2	O7S2 (2,2)
6,1	O1S2 (4,1)		22,1	O3S2 (4,1)		38,1	O5S2 (4,1)		54,1	O7S2 (4,1)
6,2	O1S2 (4,2)		22,2	O3S2 (4,2)		38,2	O5S2 (4,2)		54,2	O7S2 (4,2)
7,1	O1S2 (6,1)		23,1	O3S2 (6,1)		39,1	O5S2 (6,1)		55,1	O7S2 (6,1)
7,2	O1S2 (6,2)		23,2	O3S2 (6,2)		39,2	O5S2 (6,2)		55,2	O7S2 (6,2)
8,1	O1S2 (8,1)		24,1	O3S2 (8,1)		40,1	O5S2 (8,1)		56,1	O7S2 (8,1)
8,2	O1S2 (8,2)		24,2	O3S2 (8,2)		40,2	O5S2 (8,2)		56,2	O7S2 (8,2)
9,1	O2S1 (2,1)		25,1	O4S1 (2,1)		41,1	O6S1 (2,1)		57,1	O8S1 (2,1)
9,2	O2S1 (2,2)		25,2	O4S1 (2,2)		41,2	O6S1 (2,2)		57,2	O8S1 (2,2)
10,1	O2S1 (4,1)		26,1	O4S1 (4,1)		42,1	O6S1 (4,1)		58,1	O8S1 (4,1)
10,2	O2S1 (4,2)		26,2	O4S1 (4,2)		42,2	O6S1 (4,2)		58,2	O8S1 (4,2)
11,1	O2S1 (6,1)		27,1	O4S1 (6,1)		43,1	O6S1 (6,1)		59,1	O8S1 (6,1)
11,2	O2S1 (6,2)		27,2	O4S1 (6,2)		43,2	O6S1 (6,2)		59,2	O8S1 (6,2)
12,1	O2S1 (8,1)		28,1	O4S1 (8,1)		44,1	O6S1 (8,1)		60,1	O8S1 (8,1)
12,2	O2S1 (8,2)		28,2	O4S1 (8,2)		44,2	O6S1 (8,2)		60,2	O8S1 (8,2)
13,1	O2S2 (2,1)		29,1	O4S2 (2,1)		45,1	O6S2 (2,1)		61,1	O8S2 (2,1)
13,2	O2S2 (2,2)		29,2	O4S2 (2,2)		45,2	O6S2 (2,2)		61,2	O8S2 (2,2)
14,1	O2S2 (4,1)		30,1	O4S2 (4,1)		46,1	O6S2 (4,1)		62,1	O8S2 (4,1)
14,2	O2S2 (4,2)		30,2	O4S2 (4,2)		46,2	O6S2 (4,2)		62,2	O8S2 (4,2)
15,1	O2S2 (6,1)		31,1	O4S2 (6,1)		47,1	O6S2 (6,1)		63,1	O8S2 (6,1)
15,2	O2S2 (6,2)		31,2	O4S2 (6,2)		47,2	O6S2 (6,2)		63,2	O8S2 (6,2)
16,1	O2S2 (8,1)		32,1	O4S2 (8,1)		48,1	O6S2 (8,1)		64,1	O8S2 (8,1)
16,2	O2S2 (8,2)		32,2	O4S2 (8,2)		48,2	O6S2 (8,2)		64,2	O8S2 (8,2)

Table 9. XOC-1k scale-out leaf-spine connection map for spine switch #1 (SO1) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (10,1)		17,1	O3S1 (10,1)		33,1	O5S1 (10,1)		49,1	O7S1 (10,1)
1,2	O1S1 (10,2)		17,2	O3S1 (10,2)		33,2	O5S1 (10,2)		49,2	O7S1 (10,2)
2,1	O1S1 (12,1)		18,1	O3S1 (12,1)		34,1	O5S1 (12,1)		50,1	O7S1 (12,1)
2,2	O1S1 (12,2)		18,2	O3S1 (12,2)		34,2	O5S1 (12,2)		50,2	O7S1 (12,2)
3,1	O1S1 (14,1)		19,1	O3S1 (14,1)		35,1	O5S1 (14,1)		51,1	O7S1 (14,1)
3,2	O1S1 (14,2)		19,2	O3S1 (14,2)		35,2	O5S1 (14,2)		51,2	O7S1 (14,1)
4,1	O1S1 (16,1)		20,1	O3S1 (16,1)		36,1	O5S1 (16,1)		52,1	O7S1 (16,2)
4,2	O1S1 (16,2)		20,2	O3S1 (16,2)		36,2	O5S1 (16,2)		52,2	O7S1 (16,2)
5,1	O1S2 (10,1)		21,1	O3S2 (10,1)		37,1	O5S2 (10,1)		53,1	O7S2 (10,1)
5,2	O1S2 (10,2)		21,2	O3S2 (10,2)		37,2	O5S2 (10,2)		53,2	O7S2 (10,2)
6,1	O1S2 (12,1)		22,1	O3S2 (12,1)		38,1	O5S2 (12,1)		54,1	O7S2 (12,1)
6,2	O1S2 (12,2)		22,2	O3S2 (12,2)		38,2	O5S2 (12,2)		54,2	O7S2 (12,2)
7,1	O1S2 (14,1)		23,1	O3S2 (14,1)		39,1	O5S2 (14,1)		55,1	O7S2 (14,1)
7,2	O1S2 (14,2)		23,2	O3S2 (14,2)		39,2	O5S2 (14,2)		55,2	O7S2 (14,2)
8,1	O1S2 (16,1)		24,1	O3S2 (16,1)		40,1	O5S2 (16,1)		56,1	O7S2 (16,1)
8,2	O1S2 (16,2)		24,2	O3S2 (16,2)		40,2	O5S2 (16,2)		56,2	O7S2 (16,2)
9,1	O2S1 (10,1)		25,1	O4S1 (10,1)		41,1	O6S1 (10,1)		57,1	O8S1 (10,1)
9,2	O2S1 (10,2)		25,2	O4S1 (10,2)		41,2	O6S1 (10,2)		57,2	O8S1 (10,2)
10,1	O2S1 (12,1)		26,1	O4S1 (12,1)		42,1	O6S1 (12,1)		58,1	O8S1 (12,1)
10,2	O2S1 (12,2)		26,2	O4S1 (12,2)		42,2	O6S1 (12,2)		58,2	O8S1 (12,2)
11,1	O2S1 (14,1)		27,1	O4S1 (14,1)		43,1	O6S1 (14,1)		59,1	O8S1 (14,1)
11,2	O2S1 (14,2)		27,2	O4S1 (14,2)		43,2	O6S1 (14,2)		59,2	O8S1 (14,2)
12,1	O2S1 (16,1)		28,1	O4S1 (16,1)		44,1	O6S1 (16,1)		60,1	O8S1 (16,1)
12,2	O2S1 (16,2)		28,2	O4S1 (16,2)		44,2	O6S1 (16,2)		60,2	O8S1 (16,2)
13,1	O2S2 (10,1)		29,1	O4S2 (10,1)		45,1	O6S2 (10,1)		61,1	O8S2 (10,1)
13,2	O2S2 (10,2)		29,2	O4S2 (10,2)		45,2	O6S2 (10,2)		61,2	O8S2 (10,2)
14,1	O2S2 (12,1)		30,1	O4S2 (12,1)		46,1	O6S2 (12,1)		62,1	O8S2 (12,1)
14,2	O2S2 (12,2)		30,2	O4S2 (12,2)		46,2	O6S2 (12,2)		62,2	O8S2 (12,2)
15,1	O2S2 (14,1)		31,1	O4S2 (14,1)		47,1	O6S2 (14,1)		63,1	O8S2 (14,1)
15,2	O2S2 (14,2)		31,2	O4S2 (14,2)		47,2	O6S2 (14,2)		63,2	O8S2 (14,2)
16,1	O2S2 (16,1)		32,1	O4S2 (16,1)		48,1	O6S2 (16,1)		64,1	O8S2 (16,1)
16,2	O2S2 (16,2)		32,2	O4S2 (16,2)		48,2	O6S2 (16,2)		64,2	O8S2 (16,2)

Table 10. XOC-1k scale-out leaf-spine connection map for spine switch #2 (SO2) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (18,1)		17,1	O3S1 (18,1)		33,1	O5S1 (18,1)		49,1	O7S1 (18,1)
1,2	O1S1 (18,2)		17,2	O3S1 (18,2)		33,2	O5S1 (18,2)		49,2	O7S1 (18,2)
2,1	O1S1 (20,1)		18,1	O3S1 (20,1)		34,1	O5S1 (20,1)		50,1	O7S1 (20,1)
2,2	O1S1 (20,2)		18,2	O3S1 (20,2)		34,2	O5S1 (20,2)		50,2	O7S1 (20,2)
3,1	O1S1 (22,1)		19,1	O3S1 (22,1)		35,1	O5S1 (22,1)		51,1	O7S1 (22,1)
3,2	O1S1 (22,2)		19,2	O3S1 (22,2)		35,2	O5S1 (22,2)		51,2	O7S1 (22,2)
4,1	O1S1 (24,1)		20,1	O3S1 (24,1)		36,1	O5S1 (24,1)		52,1	O7S1 (24,1)
4,2	O1S1 (24,2)		20,2	O3S1 (24,2)		36,2	O5S1 (24,2)		52,2	O7S1 (24,2)
5,1	O1S2 (18,1)		21,1	O3S2 (18,1)		37,1	O5S2 (18,1)		53,1	O7S2 (18,1)
5,2	O1S2 (18,2)		21,2	O3S2 (18,2)		37,2	O5S2 (18,2)		53,2	O7S2 (18,2)
6,1	O1S2 (20,1)		22,1	O3S2 (20,1)		38,1	O5S2 (20,1)		54,1	O7S2 (20,1)
6,2	O1S2 (20,2)		22,2	O3S2 (20,2)		38,2	O5S2 (20,2)		54,2	O7S2 (20,2)
7,1	O1S2 (22,1)		23,1	O3S2 (22,1)		39,1	O5S2 (22,1)		55,1	O7S2 (22,1)
7,2	O1S2 (22,2)		23,2	O3S2 (22,2)		39,2	O5S2 (22,2)		55,2	O7S2 (22,2)
8,1	O1S2 (24,1)		24,1	O3S2 (24,1)		40,1	O5S2 (24,1)		56,1	O7S2 (24,1)
8,2	O1S2 (24,2)		24,2	O3S2 (24,2)		40,2	O5S2 (24,2)		56,2	O7S2 (24,2)
9,1	O2S1 (18,1)		25,1	O4S1 (18,1)		41,1	O6S1 (18,1)		57,1	O8S1 (18,1)
9,2	O2S1 (18,2)		25,2	O4S1 (18,2)		41,2	O6S1 (18,2)		57,2	O8S1 (18,2)
10,1	O2S1 (20,1)		26,1	O4S1 (20,1)		42,1	O6S1 (20,1)		58,1	O8S1 (20,1)
10,2	O2S1 (20,2)		26,2	O4S1 (20,2)		42,2	O6S1 (20,2)		58,2	O8S1 (20,2)
11,1	O2S1 (22,1)		27,1	O4S1 (22,1)		43,1	O6S1 (22,1)		59,1	O8S1 (22,1)
11,2	O2S1 (22,2)		27,2	O4S1 (22,2)		43,2	O6S1 (22,2)		59,2	O8S1 (22,2)
12,1	O2S1 (24,1)		28,1	O4S1 (24,1)		44,1	O6S1 (24,1)		60,1	O8S1 (24,1)
12,2	O2S1 (24,2)		28,2	O4S1 (24,2)		44,2	O6S1 (24,2)		60,2	O8S1 (24,2)
13,1	O2S2 (18,1)		29,1	O4S2 (18,1)		45,1	O6S2 (18,1)		61,1	O8S2 (18,1)
13,2	O2S2 (18,2)		29,2	O4S2 (18,2)		45,2	O6S2 (18,2)		61,2	O8S2 (18,2)
14,1	O2S2 (20,1)		30,1	O4S2 (20,1)		46,1	O6S2 (20,1)		62,1	O8S2 (20,1)
14,2	O2S2 (20,2)		30,2	O4S2 (20,2)		46,2	O6S2 (20,2)		62,2	O8S2 (20,2)
15,1	O2S2 (22,1)		31,1	O4S2 (22,1)		47,1	O6S2 (22,1)		63,1	O8S2 (22,1)
15,2	O2S2 (22,2)		31,2	O4S2 (22,2)		47,2	O6S2 (22,2)		63,2	O8S2 (22,2)
16,1	O2S2 (24,1)		32,1	O4S2 (24,1)		48,1	O6S2 (24,1)		64,1	O8S2 (24,1)
16,2	O2S2 (24,2)		32,2	O4S2 (24,2)		48,2	O6S2 (24,2)		64,2	O8S2 (24,2)

Table 11. XOC-1k scale-out leaf-spine connection map for spine switch #3 (SO3) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (26,1)		17,1	O4S1 (26,1)		33,1	O5S1 (26,1)		49,1	O7S1 (26,1)
1,2	O1S1 (26,2)		17,2	O3S1 (26,2)		33,2	O5S1 (26,2)		49,2	O7S1 (26,2)
2,1	O1S1 (28,1)		18,1	O3S1 (28,1)		34,1	O5S1 (28,1)		50,1	O7S1 (28,1)
2,2	O1S1 (28,2)		18,2	O3S1 (28,2)		34,2	O5S1 (28,2)		50,2	O7S1 (28,2)
3,1	O1S1 (30,1)		19,1	O3S1 (30,1)		35,1	O5S1 (30,1)		51,1	O7S1 (30,1)
3,2	O1S1 (30,2)		19,2	O3S1 (30,2)		35,2	O5S1 (30,2)		51,2	O7S1 (30,2)
4,1	O1S1 (32,1)		20,1	O3S1 (32,1)		36,1	O5S1 (32,1)		52,1	O7S1 (32,1)
4,2	O1S1 (32,2)		20,2	O3S1 (32,2)		36,2	O5S1 (32,2)		52,2	O7S1 (32,2)
5,1	O1S2 (26,1)		21,1	O3S2 (26,1)		37,1	O5S2 (26,1)		53,1	O7S2 (26,1)
5,2	O1S2 (26,2)		21,2	O3S2 (26,2)		37,2	O5S2 (26,2)		53,2	O7S2 (26,2)
6,1	O1S2 (28,1)		22,1	O3S2 (28,1)		38,1	O5S2 (28,1)		54,1	O7S2 (28,1)
6,2	O1S2 (28,2)		22,2	O3S2 (28,2)		38,2	O5S2 (28,2)		54,2	O7S2 (28,2)
7,1	O1S2 (30,1)		23,1	O3S2 (30,1)		39,1	O5S2 (30,1)		55,1	O7S2 (30,1)
7,2	O1S2 (30,2)		23,2	O3S2 (30,2)		39,2	O5S2 (30,2)		55,2	O7S2 (30,2)
8,1	O1S2 (32,1)		24,1	O3S2 (32,1)		40,1	O5S2 (32,1)		56,1	O7S2 (32,1)
8,2	O1S2 (32,2)		24,2	O3S2 (32,2)		40,2	O5S2 (32,2)		56,2	O7S2 (32,2)
9,1	O2S1 (26,1)		25,1	O4S1 (26,1)		41,1	O6S1 (26,1)		57,1	O8S1 (26,1)
9,2	O2S1 (26,2)		25,2	O4S1 (26,2)		41,2	O6S1 (26,2)		57,2	O8S1 (26,2)
10,1	O2S1 (28,1)		26,1	O4S1 (28,1)		42,1	O6S1 (28,1)		58,1	O8S1 (28,1)
10,2	O2S1 (28,2)		26,2	O4S1 (28,2)		42,2	O6S1 (28,2)		58,2	O8S1 (28,2)
11,1	O2S1 (30,1)		27,1	O4S1 (30,1)		43,1	O6S1 (30,1)		59,1	O8S1 (30,1)
11,2	O2S1 (30,2)		27,2	O4S1 (30,2)		43,2	O6S1 (30,2)		59,2	O8S1 (30,2)
12,1	O2S1 (32,1)		28,1	O4S1 (32,1)		44,1	O6S1 (32,1)		60,1	O8S1 (32,1)
12,2	O2S1 (32,2)		28,2	O4S1 (32,2)		44,2	O6S1 (32,2)		60,2	O8S1 (32,2)
13,1	O2S2 (26,1)		29,1	O4S2 (26,1)		45,1	O6S2 (26,1)		61,1	O8S2 (26,1)
13,2	O2S2 (26,2)		29,2	O4S2 (26,2)		45,2	O6S2 (26,2)		61,2	O8S2 (26,2)
14,1	O2S2 (28,1)		30,1	O4S2 (28,1)		46,1	O6S2 (28,1)		62,1	O8S2 (28,1)
14,2	O2S2 (28,2)		30,2	O4S2 (28,2)		46,2	O6S2 (28,2)		62,2	O8S2 (28,2)
15,1	O2S2 (30,1)		31,1	O4S2 (30,1)		47,1	O6S2 (30,1)		63,1	O8S2 (30,1)
15,2	O2S2 (30,2)		31,2	O4S2 (30,2)		47,2	O6S2 (30,2)		63,2	O8S2 (30,2)
16,1	O2S2 (32,1)		32,1	O4S2 (32,1)		48,1	O6S2 (32,1)		64,1	O8S2 (32,1)
16,2	O2S2 (32,2)		32,2	O4S2 (32,2)		48,2	O6S2 (32,2)		64,2	O8S2 (32,2)

Table 12. XOC-1k scale-out leaf-spine connection map for spine switch #4 (SO4) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (34,1)		17,1	O4S1 (34,1)		33,1	O5S1 (34,1)		49,1	O7S1 (34,1)
1,2	O1S1 (34,2)		17,2	O3S1 (34,2)		33,2	O5S1 (34,2)		49,2	O7S1 (34,2)
2,1	O1S1 (36,1)		18,1	O3S1 (36,1)		34,1	O5S1 (36,1)		50,1	O7S1 (36,1)
2,2	O1S1 (36,2)		18,2	O3S1 (36,2)		34,2	O5S1 (36,2)		50,2	O7S1 (36,2)
3,1	O1S1 (38,1)		19,1	O3S1 (38,1)		35,1	O5S1 (38,1)		51,1	O7S1 (38,1)
3,2	O1S1 (38,2)		19,2	O3S1 (38,2)		35,2	O5S1 (38,2)		51,2	O7S1 (38,2)
4,1	O1S1 (40,1)		20,1	O3S1 (40,1)		36,1	O5S1 (40,1)		52,1	O7S1 (40,1)
4,2	O1S1 (40,2)		20,2	O3S1 (40,2)		36,2	O5S1 (40,2)		52,2	O7S1 (40,2)
5,1	O1S2 (34,1)		21,1	O3S2 (34,1)		37,1	O5S2 (34,1)		53,1	O7S2 (34,1)
5,2	O1S2 (34,2)		21,2	O3S2 (34,2)		37,2	O5S2 (34,2)		53,2	O7S2 (34,2)
6,1	O1S2 (36,1)		22,1	O3S2 (36,1)		38,1	O5S2 (36,1)		54,1	O7S2 (36,1)
6,2	O1S2 (36,2)		22,2	O3S2 (36,2)		38,2	O5S2 (36,2)		54,2	O7S2 (36,2)
7,1	O1S2 (38,1)		23,1	O3S2 (38,1)		39,1	O5S2 (38,1)		55,1	O7S2 (38,1)
7,2	O1S2 (38,2)		23,2	O3S2 (38,2)		39,2	O5S2 (38,2)		55,2	O7S2 (38,2)
8,1	O1S2 (40,1)		24,1	O3S2 (40,1)		40,1	O5S2 (40,1)		56,1	O7S2 (40,1)
8,2	O1S2 (40,2)		24,2	O3S2 (40,2)		40,2	O5S2 (40,2)		56,2	O7S2 (40,2)
9,1	O2S1 (34,1)		25,1	O4S1 (34,1)		41,1	O6S1 (34,1)		57,1	O8S1 (34,1)
9,2	O2S1 (34,2)		25,2	O4S1 (34,2)		41,2	O6S1 (34,2)		57,2	O8S1 (34,2)
10,1	O2S1 (36,1)		26,1	O4S1 (36,1)		42,1	O6S1 (36,1)		58,1	O8S1 (36,1)
10,2	O2S1 (36,2)		26,2	O4S1 (36,2)		42,2	O6S1 (36,2)		58,2	O8S1 (36,2)
11,1	O2S1 (38,1)		27,1	O4S1 (38,1)		43,1	O6S1 (38,1)		59,1	O8S1 (38,1)
11,2	O2S1 (38,2)		27,2	O4S1 (38,2)		43,2	O6S1 (38,2)		59,2	O8S1 (38,2)
12,1	O2S1 (40,1)		28,1	O4S1 (40,1)		44,1	O6S1 (40,1)		60,1	O8S1 (40,1)
12,2	O2S1 (40,2)		28,2	O4S1 (40,2)		44,2	O6S1 (40,2)		60,2	O8S1 (40,2)
13,1	O2S2 (34,1)		29,1	O4S2 (34,1)		45,1	O6S2 (34,1)		61,1	O8S2 (34,1)
13,2	O2S2 (34,2)		29,2	O4S2 (34,2)		45,2	O6S2 (34,2)		61,2	O8S2 (34,2)
14,1	O2S2 (36,1)		30,1	O4S2 (36,1)		46,1	O6S2 (36,1)		62,1	O8S2 (36,1)
14,2	O2S2 (36,2)		30,2	O4S2 (36,2)		46,2	O6S2 (36,2)		62,2	O8S2 (36,2)
15,1	O2S2 (38,1)		31,1	O4S2 (38,1)		47,1	O6S2 (38,1)		63,1	O8S2 (38,1)
15,2	O2S2 (38,2)		31,2	O4S2 (38,2)		47,2	O6S2 (38,2)		63,2	O8S2 (38,2)
16,1	O2S2 (40,1)		32,1	O4S2 (40,1)		48,1	O6S2 (40,1)		64,1	O8S2 (40,1)
16,2	O2S2 (40,2)		32,2	O4S2 (40,2)		48,2	O6S2 (40,2)		64,2	O8S2 (40,2)

Table 13. XOC-1k scale-out leaf-spine connection map for spine switch #5 (SO5) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (42,1)		17,1	O4S1 (42,1)		33,1	O5S1 (42,1)		49,1	O7S1 (42,1)
1,2	O1S1 (42,2)		17,2	O3S1 (42,2)		33,2	O5S1 (42,2)		49,2	O7S1 (42,2)
2,1	O1S1 (44,1)		18,1	O3S1 (44,1)		34,1	O5S1 (44,1)		50,1	O7S1 (44,1)
2,2	O1S1 (44,2)		18,2	O3S1 (44,2)		34,2	O5S1 (44,2)		50,2	O7S1 (44,2)
3,1	O1S1 (46,1)		19,1	O3S1 (46,1)		35,1	O5S1 (46,1)		51,1	O7S1 (46,1)
3,2	O1S1 (46,2)		19,2	O3S1 (46,2)		35,2	O5S1 (46,2)		51,2	O7S1 (46,2)
4,1	O1S1 (48,1)		20,1	O3S1 (48,1)		36,1	O5S1 (48,1)		52,1	O7S1 (48,1)
4,2	O1S1 (48,2)		20,2	O3S1 (48,2)		36,2	O5S1 (48,2)		52,2	O7S1 (48,2)
5,1	O1S2 (42,1)		21,1	O3S2 (42,1)		37,1	O5S2 (42,1)		53,1	O7S2 (42,1)
5,2	O1S2 (42,2)		21,2	O3S2 (42,2)		37,2	O5S2 (42,2)		53,2	O7S2 (42,2)
6,1	O1S2 (44,1)		22,1	O3S2 (44,1)		38,1	O5S2 (44,1)		54,1	O7S2 (44,1)
6,2	O1S2 (44,2)		22,2	O3S2 (44,2)		38,2	O5S2 (44,2)		54,2	O7S2 (44,2)
7,1	O1S2 (46,1)		23,1	O3S2 (46,1)		39,1	O5S2 (46,1)		55,1	O7S2 (46,1)
7,2	O1S2 (46,2)		23,2	O3S2 (46,2)		39,2	O5S2 (46,2)		55,2	O7S2 (46,2)
8,1	O1S2 (48,1)		24,1	O3S2 (48,1)		40,1	O5S2 (48,1)		56,1	O7S2 (48,1)
8,2	O1S2 (48,2)		24,2	O3S2 (48,2)		40,2	O5S2 (48,2)		56,2	O7S2 (48,2)
9,1	O2S1 (42,1)		25,1	O4S1 (42,1)		41,1	O6S1 (42,1)		57,1	O8S1 (42,1)
9,2	O2S1 (42,2)		25,2	O4S1 (42,2)		41,2	O6S1 (42,2)		57,2	O8S1 (42,2)
10,1	O2S1 (44,1)		26,1	O4S1 (44,1)		42,1	O6S1 (44,1)		58,1	O8S1 (44,1)
10,2	O2S1 (44,2)		26,2	O4S1 (44,2)		42,2	O6S1 (44,2)		58,2	O8S1 (44,2)
11,1	O2S1 (46,1)		27,1	O4S1 (46,1)		43,1	O6S1 (46,1)		59,1	O8S1 (46,1)
11,2	O2S1 (46,2)		27,2	O4S1 (46,2)		43,2	O6S1 (46,2)		59,2	O8S1 (46,2)
12,1	O2S1 (48,1)		28,1	O4S1 (48,1)		44,1	O6S1 (48,1)		60,1	O8S1 (48,1)
12,2	O2S1 (48,2)		28,2	O4S1 (48,2)		44,2	O6S1 (48,2)		60,2	O8S1 (48,2)
13,1	O2S2 (42,1)		29,1	O4S2 (42,1)		45,1	O6S2 (42,1)		61,1	O8S2 (42,1)
13,2	O2S2 (42,2)		29,2	O4S2 (42,2)		45,2	O6S2 (42,2)		61,2	O8S2 (42,2)
14,1	O2S2 (44,1)		30,1	O4S2 (44,1)		46,1	O6S2 (44,1)		62,1	O8S2 (44,1)
14,2	O2S2 (44,2)		30,2	O4S2 (44,2)		46,2	O6S2 (44,2)		62,2	O8S2 (44,2)
15,1	O2S2 (46,1)		31,1	O4S2 (46,1)		47,1	O6S2 (46,1)		63,1	O8S2 (46,1)
15,2	O2S2 (46,2)		31,2	O4S2 (46,2)		47,2	O6S2 (46,2)		63,2	O8S2 (46,2)
16,1	O2S2 (48,1)		32,1	O4S2 (48,1)		48,1	O6S2 (48,1)		64,1	O8S2 (48,1)
16,2	O2S2 (48,2)		32,2	O4S2 (48,2)		48,2	O6S2 (48,2)		64,2	O8S2 (48,2)

Table 14. XOC-1k scale-out leaf-spine connection map for spine switch #6 (SO6) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (50,1)		17,1	O4S1 (50,1)		33,1	O5S1 (50,1)		49,1	O7S1 (50,1)
1,2	O1S1 (50,2)		17,2	O3S1 (50,2)		33,2	O5S1 (50,2)		49,2	O7S1 (50,2)
2,1	O1S1 (52,1)		18,1	O3S1 (52,1)		34,1	O5S1 (52,1)		50,1	O7S1 (52,1)
2,2	O1S1 (52,2)		18,2	O3S1 (52,2)		34,2	O5S1 (52,2)		50,2	O7S1 (52,2)
3,1	O1S1 (54,1)		19,1	O3S1 (54,1)		35,1	O5S1 (54,1)		51,1	O7S1 (54,1)
3,2	O1S1 (54,2)		19,2	O3S1 (54,2)		35,2	O5S1 (54,2)		51,2	O7S1 (54,2)
4,1	O1S1 (56,1)		20,1	O3S1 (56,1)		36,1	O5S1 (56,1)		52,1	O7S1 (56,1)
4,2	O1S1 (56,2)		20,2	O3S1 (56,2)		36,2	O5S1 (56,2)		52,2	O7S1 (56,2)
5,1	O1S2 (50,1)		21,1	O3S2 (50,1)		37,1	O5S2 (50,1)		53,1	O7S2 (50,1)
5,2	O1S2 (50,2)		21,2	O3S2 (50,2)		37,2	O5S2 (50,2)		53,2	O7S2 (50,2)
6,1	O1S2 (52,1)		22,1	O3S2 (52,1)		38,1	O5S2 (52,1)		54,1	O7S2 (52,1)
6,2	O1S2 (52,2)		22,2	O3S2 (52,2)		38,2	O5S2 (52,2)		54,2	O7S2 (52,2)
7,1	O1S2 (54,1)		23,1	O3S2 (54,1)		39,1	O5S2 (54,1)		55,1	O7S2 (54,1)
7,2	O1S2 (54,2)		23,2	O3S2 (54,2)		39,2	O5S2 (54,2)		55,2	O7S2 (54,2)
8,1	O1S2 (56,1)		24,1	O3S2 (56,1)		40,1	O5S2 (56,1)		56,1	O7S2 (56,1)
8,2	O1S2 (56,2)		24,2	O3S2 (56,2)		40,2	O5S2 (56,2)		56,2	O7S2 (56,2)
9,1	O2S1 (50,1)		25,1	O4S1 (50,1)		41,1	O6S1 (50,1)		57,1	O8S1 (50,1)
9,2	O2S1 (50,2)		25,2	O4S1 (50,2)		41,2	O6S1 (50,2)		57,2	O8S1 (50,2)
10,1	O2S1 (52,1)		26,1	O4S1 (52,1)		42,1	O6S1 (52,1)		58,1	O8S1 (52,1)
10,2	O2S1 (52,2)		26,2	O4S1 (52,2)		42,2	O6S1 (52,2)		58,2	O8S1 (52,2)
11,1	O2S1 (54,1)		27,1	O4S1 (54,1)		43,1	O6S1 (54,1)		59,1	O8S1 (54,1)
11,2	O2S1 (54,2)		27,2	O4S1 (54,2)		43,2	O6S1 (54,2)		59,2	O8S1 (54,2)
12,1	O2S1 (56,1)		28,1	O4S1 (56,1)		44,1	O6S1 (56,1)		60,1	O8S1 (56,1)
12,2	O2S1 (56,2)		28,2	O4S1 (56,2)		44,2	O6S1 (56,2)		60,2	O8S1 (56,2)
13,1	O2S2 (50,1)		29,1	O4S2 (50,1)		45,1	O6S2 (50,1)		61,1	O8S2 (50,1)
13,2	O2S2 (50,2)		29,2	O4S2 (50,2)		45,2	O6S2 (50,2)		61,2	O8S2 (50,2)
14,1	O2S2 (52,1)		30,1	O4S2 (52,1)		46,1	O6S2 (52,1)		62,1	O8S2 (52,1)
14,2	O2S2 (52,2)		30,2	O4S2 (52,2)		46,2	O6S2 (52,2)		62,2	O8S2 (52,2)
15,1	O2S2 (54,1)		31,1	O4S2 (54,1)		47,1	O6S2 (54,1)		63,1	O8S2 (54,1)
15,2	O2S2 (54,2)		31,2	O4S2 (54,2)		47,2	O6S2 (54,2)		63,2	O8S2 (54,2)
16,1	O2S2 (56,1)		32,1	O4S2 (56,1)		48,1	O6S2 (56,1)		64,1	O8S2 (56,1)
16,2	O2S2 (56,2)		32,2	O4S2 (56,2)		48,2	O6S2 (56,2)		64,2	O8S2 (56,2)

Table 15. XOC-1k scale-out leaf-spine connection map for spine switch #7 (SO7) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (58,1)		17,1	O4S1 (58,1)		33,1	O5S1 (58,1)		49,1	O7S1 (58,1)
1,2	O1S1 (58,2)		17,2	O3S1 (58,2)		33,2	O5S1 (58,2)		49,2	O7S1 (58,2)
2,1	O1S1 (60,1)		18,1	O3S1 (60,1)		34,1	O5S1 (60,1)		50,1	O7S1 (60,1)
2,2	O1S1 (60,2)		18,2	O3S1 (60,2)		34,2	O5S1 (60,2)		50,2	O7S1 (60,2)
3,1	O1S1 (62,1)		19,1	O3S1 (62,1)		35,1	O5S1 (62,1)		51,1	O7S1 (62,1)
3,2	O1S1 (62,2)		19,2	O3S1 (62,2)		35,2	O5S1 (62,2)		51,2	O7S1 (62,2)
4,1	O1S1 (64,1)		20,1	O3S1 (64,1)		36,1	O5S1 (64,1)		52,1	O7S1 (64,1)
4,2	O1S1 (64,2)		20,2	O3S1 (64,2)		36,2	O5S1 (64,2)		52,2	O7S1 (64,2)
5,1	O1S2 (58,1)		21,1	O3S2 (58,1)		37,1	O5S2 (58,1)		53,1	O7S2 (58,1)
5,2	O1S2 (58,2)		21,2	O3S2 (58,2)		37,2	O5S2 (58,2)		53,2	O7S2 (58,2)
6,1	O1S2 (60,1)		22,1	O3S2 (60,1)		38,1	O5S2 (60,1)		54,1	O7S2 (60,1)
6,2	O1S2 (60,2)		22,2	O3S2 (60,2)		38,2	O5S2 (60,2)		54,2	O7S2 (60,2)
7,1	O1S2 (62,1)		23,1	O3S2 (62,1)		39,1	O5S2 (62,1)		55,1	O7S2 (62,1)
7,2	O1S2 (62,2)		23,2	O3S2 (62,2)		39,2	O5S2 (62,2)		55,2	O7S2 (62,2)
8,1	O1S2 (64,1)		24,1	O3S2 (64,1)		40,1	O5S2 (64,1)		56,1	O7S2 (64,1)
8,2	O1S2 (64,2)		24,2	O3S2 (64,2)		40,2	O5S2 (64,2)		56,2	O7S2 (64,2)
9,1	O2S1 (58,1)		25,1	O4S1 (58,1)		41,1	O6S1 (58,1)		57,1	O8S1 (58,1)
9,2	O2S1 (58,2)		25,2	O4S1 (58,2)		41,2	O6S1 (58,2)		57,2	O8S1 (58,2)
10,1	O2S1 (60,1)		26,1	O4S1 (60,1)		42,1	O6S1 (60,1)		58,1	O8S1 (60,1)
10,2	O2S1 (60,2)		26,2	O4S1 (60,2)		42,2	O6S1 (60,2)		58,2	O8S1 (60,2)
11,1	O2S1 (62,1)		27,1	O4S1 (62,1)		43,1	O6S1 (62,1)		59,1	O8S1 (62,1)
11,2	O2S1 (62,2)		27,2	O4S1 (62,2)		43,2	O6S1 (62,2)		59,2	O8S1 (62,2)
12,1	O2S1 (64,1)		28,1	O4S1 (64,1)		44,1	O6S1 (64,1)		60,1	O8S1 (64,1)
12,2	O2S1 (64,2)		28,2	O4S1 (64,2)		44,2	O6S1 (64,2)		60,2	O8S1 (64,2)
13,1	O2S2 (58,1)		29,1	O4S2 (58,1)		45,1	O6S2 (58,1)		61,1	O8S2 (58,1)
13,2	O2S2 (58,2)		29,2	O4S2 (58,2)		45,2	O6S2 (58,2)		61,2	O8S2 (58,2)
14,1	O2S2 (60,1)		30,1	O4S2 (60,1)		46,1	O6S2 (60,1)		62,1	O8S2 (60,1)
14,2	O2S2 (60,2)		30,2	O4S2 (60,2)		46,2	O6S2 (60,2)		62,2	O8S2 (60,2)
15,1	O2S2 (62,1)		31,1	O4S2 (62,1)		47,1	O6S2 (62,1)		63,1	O8S2 (62,1)
15,2	O2S2 (62,2)		31,2	O4S2 (62,2)		47,2	O6S2 (62,2)		63,2	O8S2 (62,2)
16,1	O2S2 (64,1)		32,1	O4S2 (64,1)		48,1	O6S2 (64,1)		64,1	O8S2 (64,1)
16,2	O2S2 (64,2)		32,2	O4S2 (64,2)		48,2	O6S2 (64,2)		64,2	O8S2 (64,2)

Table 16. XOC-1k scale-out leaf-spine connection map for spine switch #8 (SO8) for a Clos topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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7.1.2. Rail-optimized scale-out network

In this topology, the xPU scale-out NICs in an OPG-128 connect to four 26 T/bs leaf switches [1]. An XOC-1k contains eight OPG-128s and requires eight 51 Tb/s spine switches. Figure 7 shows the port-numbering plan for a rail-optimized scale-out fabric, and Tables 17-24 contain the connection maps for the scale-out leaf and spine switches.

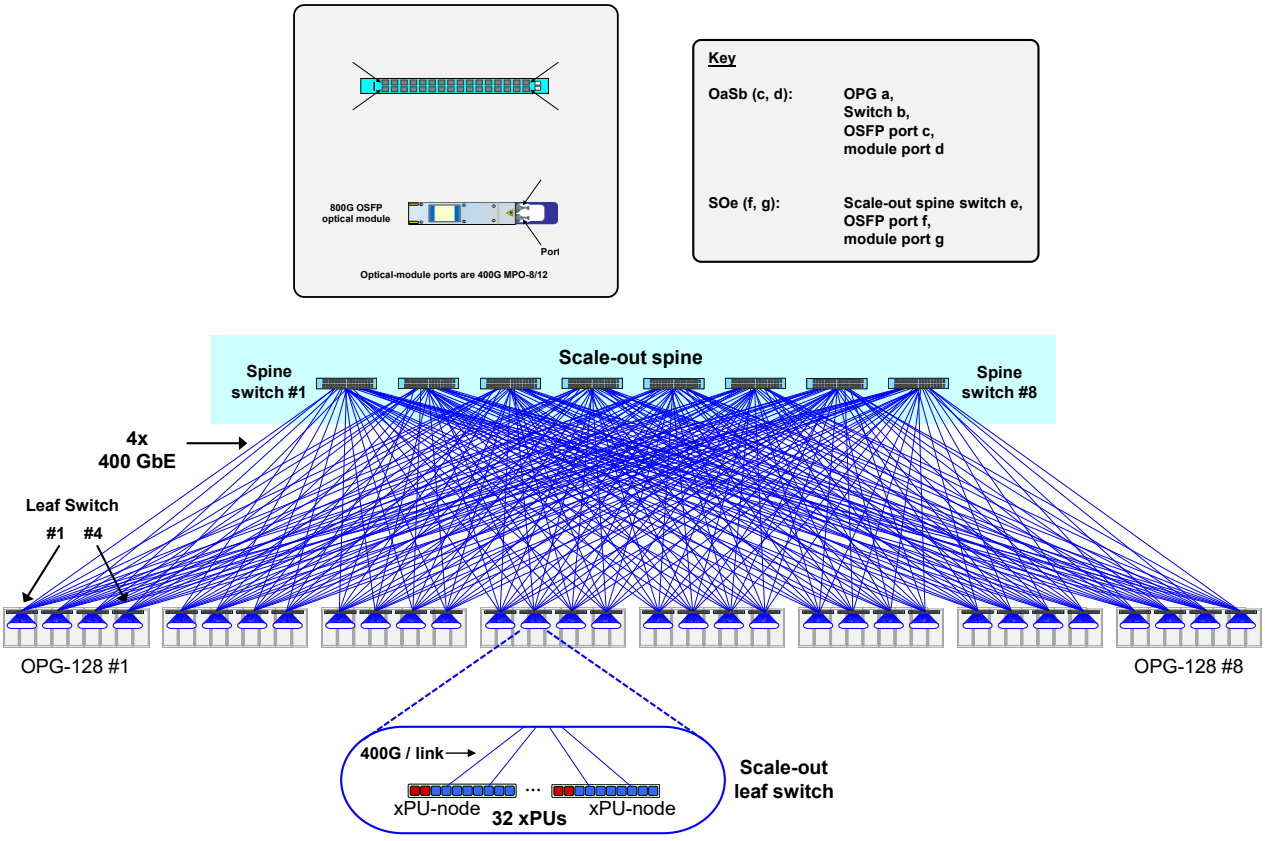


Figure 7. XOC-N scale-out port-numbering plan, rail-optimized topology. The eight spine switches connect to the 32 leaf switches in the eight OPG-128s. The links are 400G optical.

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SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO1 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (2,1)		17,1	O3S1 (2,1)		33,1	O5S1 (2,1)		49,1	O7S1 (2,1)
1,2	O1S1 (2,2)		17,2	O3S1 (2,2)		33,2	O5S1 (2,2)		49,2	O7S1 (2,2)
2,1	O1S1 (4,1)		18,1	O3S1 (4,1)		34,1	O5S1 (4,1)		50,1	O7S1 (4,1)
2,2	O1S1 (4,2)		18,2	O3S1 (4,2)		34,2	O5S1 (4,2)		50,2	O7S1 (4,2)
3,1	O1S2 (2,1)		19,1	O3S2 (2,1)		35,1	O5S2 (2,1)		51,1	O7S2 (2,1)
3,2	O1S2 (2,2)		19,2	O3S2 (2,2)		35,2	O5S2 (2,2)		51,2	O7S2 (2,2)
4,1	O1S2 (4,1)		20,1	O3S2 (4,1)		36,1	O5S2 (4,1)		52,1	O7S2 (4,1)
4,2	O1S2 (4,2)		20,2	O3S2 (4,2)		36,2	O5S2 (4,2)		52,2	O7S2 (4,2)
5,1	O1S3 (2,1)		21,1	O3S3 (2,1)		37,1	O5S3 (2,1)		53,1	O7S3 (2,1)
5,2	O1S3 (2,2)		21,2	O3S3 (2,2)		37,2	O5S3 (2,2)		53,2	O7S3 (2,2)
6,1	O1S3 (4,1)		22,1	O3S3 (4,1)		38,1	O5S3 (4,1)		54,1	O7S3 (4,1)
6,2	O1S3 (4,2)		22,2	O3S3 (4,2)		38,2	O5S3 (4,2)		54,2	O7S3 (4,2)
7,1	O1S4 (2,1)		23,1	O3S4 (2,1)		39,1	O5S4 (2,1)		55,1	O7S4 (2,1)
7,2	O1S4 (2,2)		23,2	O3S4 (2,2)		39,2	O5S4 (2,2)		55,2	O7S4 (2,2)
8,1	O1S4 (4,1)		24,1	O3S4 (4,1)		40,1	O5S4 (4,1)		56,1	O7S4 (4,1)
8,2	O1S4 (4,2)		24,2	O3S4 (4,2)		40,2	O5S4 (4,2)		56,2	O7S4 (4,2)
9,1	O2S1 (2,1)		25,1	O4S1 (2,1)		41,1	O6S1 (2,1)		57,1	O8S1 (2,1)
9,2	O2S1 (2,2)		25,2	O4S1 (2,2)		41,2	O6S1 (2,2)		57,2	O8S1 (2,2)
10,1	O2S1 (4,1)		26,1	O4S1 (4,1)		42,1	O6S1 (4,1)		58,1	O8S1 (4,1)
10,2	O2S1 (4,2)		26,2	O4S1 (4,2)		42,2	O6S1 (4,2)		58,2	O8S1 (4,2)
11,1	O2S2 (2,1)		27,1	O4S2 (2,1)		43,1	O6S2 (2,1)		59,1	O8S2 (2,1)
11,2	O2S2 (2,2)		27,2	O4S2 (2,2)		43,2	O6S2 (2,2)		59,2	O8S2 (2,2)
12,1	O2S2 (4,1)		28,1	O4S2 (4,1)		44,1	O6S2 (4,1)		60,1	O8S2 (4,1)
12,2	O2S2 (4,2)		28,2	O4S2 (4,2)		44,2	O6S2 (4,2)		60,2	O8S2 (4,2)
13,1	O2S3 (2,1)		29,1	O4S3 (2,1)		45,1	O6S3 (2,1)		61,1	O8S3 (2,1)
13,2	O2S3 (2,2)		29,2	O4S3 (2,2)		45,2	O6S3 (2,2)		61,2	O8S3 (2,2)
14,1	O2S3 (4,1)		30,1	O4S3 (4,1)		46,1	O6S3 (4,1)		62,1	O8S3 (4,1)
14,2	O2S3 (4,2)		30,2	O4S3 (4,2)		46,2	O6S3 (4,2)		62,2	O8S3 (4,2)
15,1	O2S4 (2,1)		31,1	O4S4 (2,1)		47,1	O6S4 (2,1)		63,1	O8S4 (2,1)
15,2	O2S4 (2,2)		31,2	O4S4 (2,2)		47,2	O6S4 (2,2)		63,2	O8S4 (2,2)
16,1	O2S4 (4,1)		32,1	O4S4 (4,1)		48,1	O6S4 (4,1)		64,1	O8S4 (4,1)
16,2	O2S4 (4,2)		32,2	O4S4 (4,2)		48,2	O6S4 (4,2)		64,2	O8S4 (4,2)

Table 17. XOC-1k scale-out leaf-spine connection map for spine switch #1 (SO1) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO2 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (6,1)		17,1	O3S1 (6,1)		33,1	O5S1 (6,1)		49,1	O7S1 (6,1)
1,2	O1S1 (6,2)		17,2	O3S1 (6,2)		33,2	O5S1 (6,2)		49,2	O7S1 (6,2)
2,1	O1S1 (8,1)		18,1	O3S1 (8,1)		34,1	O5S1 (8,1)		50,1	O7S1 (8,1)
2,2	O1S1 (8,2)		18,2	O3S1 (8,2)		34,2	O5S1 (8,2)		50,2	O7S1 (8,2)
3,1	O1S2 (6,1)		19,1	O3S2 (6,1)		35,1	O5S2 (6,1)		51,1	O7S2 (6,1)
3,2	O1S2 (6,2)		19,2	O3S2 (6,2)		35,2	O5S2 (6,2)		51,2	O7S2 (6,2)
4,1	O1S2 (8,1)		20,1	O3S2 (8,1)		36,1	O5S2 (8,1)		52,1	O7S2 (8,1)
4,2	O1S2 (8,2)		20,2	O3S2 (8,2)		36,2	O5S2 (8,2)		52,2	O7S2 (8,2)
5,1	O1S3 (6,1)		21,1	O3S3 (6,1)		37,1	O5S3 (6,1)		53,1	O7S3 (6,1)
5,2	O1S3 (6,2)		21,2	O3S3 (6,2)		37,2	O5S3 (6,2)		53,2	O7S3 (6,2)
6,1	O1S3 (8,1)		22,1	O3S3 (8,1)		38,1	O5S3 (8,1)		54,1	O7S3 (8,1)
6,2	O1S3 (8,2)		22,2	O3S3 (8,2)		38,2	O5S3 (8,2)		54,2	O7S3 (8,2)
7,1	O1S4 (6,1)		23,1	O3S4 (6,1)		39,1	O5S4 (6,1)		55,1	O7S4 (6,1)
7,2	O1S4 (6,2)		23,2	O3S4 (6,2)		39,2	O5S4 (6,2)		55,2	O7S4 (6,2)
8,1	O1S4 (8,1)		24,1	O3S4 (8,1)		40,1	O5S4 (8,1)		56,1	O7S4 (8,1)
8,2	O1S4 (8,2)		24,2	O3S4 (8,2)		40,2	O5S4 (8,2)		56,2	O7S4 (8,2)
9,1	O2S1 (6,1)		25,1	O4S1 (6,1)		41,1	O6S1 (6,1)		57,1	O8S1 (6,1)
9,2	O2S1 (6,2)		25,2	O4S1 (6,2)		41,2	O6S1 (6,2)		57,2	O8S1 (6,2)
10,1	O2S1 (8,1)		26,1	O4S1 (8,1)		42,1	O6S1 (8,1)		58,1	O8S1 (8,1)
10,2	O2S1 (8,2)		26,2	O4S1 (8,2)		42,2	O6S1 (8,2)		58,2	O8S1 (8,2)
11,1	O2S2 (6,1)		27,1	O4S2 (6,1)		43,1	O6S2 (6,1)		59,1	O8S2 (6,1)
11,2	O2S2 (6,2)		27,2	O4S2 (6,2)		43,2	O6S2 (6,2)		59,2	O8S2 (6,2)
12,1	O2S2 (8,1)		28,1	O4S2 (8,1)		44,1	O6S2 (8,1)		60,1	O8S2 (8,1)
12,2	O2S2 (8,2)		28,2	O4S2 (8,2)		44,2	O6S2 (8,2)		60,2	O8S2 (8,2)
13,1	O2S3 (6,1)		29,1	O4S3 (6,1)		45,1	O6S3 (6,1)		61,1	O8S3 (6,1)
13,2	O2S3 (6,2)		29,2	O4S3 (6,2)		45,2	O6S3 (6,2)		61,2	O8S3 (6,2)
14,1	O2S3 (8,1)		30,1	O4S3 (8,1)		46,1	O6S3 (8,1)		62,1	O8S3 (8,1)
14,2	O2S3 (8,2)		30,2	O4S3 (8,2)		46,2	O6S3 (8,2)		62,2	O8S3 (8,2)
15,1	O2S4 (6,1)		31,1	O4S4 (6,1)		47,1	O6S4 (6,1)		63,1	O8S4 (6,1)
15,2	O2S4 (6,2)		31,2	O4S4 (6,2)		47,2	O6S4 (6,2)		63,2	O8S4 (6,2)
16,1	O2S4 (8,1)		32,1	O4S4 (8,1)		48,1	O6S4 (8,1)		64,1	O8S4 (8,1)
16,2	O2S4 (8,2)		32,2	O4S4 (8,2)		48,2	O6S4 (8,2)		64,2	O8S4 (8,2)

Table 18. XOC-1k scale-out leaf-spine connection map for spine switch #2 (SO2) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO3 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (10,1)		17,1	O3S1 (10,1)		33,1	O5S1 (10,1)		49,1	O7S1 (10,1)
1,2	O1S1 (10,2)		17,2	O3S1 (10,2)		33,2	O5S1 (10,2)		49,2	O7S1 (10,2)
2,1	O1S1 (12,1)		18,1	O3S1 (12,1)		34,1	O5S1 (12,1)		50,1	O7S1 (12,1)
2,2	O1S1 (12,2)		18,2	O3S1 (12,2)		34,2	O5S1 (12,2)		50,2	O7S1 (12,2)
3,1	O1S2 (10,1)		19,1	O3S2 (10,1)		35,1	O5S2 (10,1)		51,1	O7S2 (10,1)
3,2	O1S2 (10,2)		19,2	O3S2 (10,2)		35,2	O5S2 (10,2)		51,2	O7S2 (10,2)
4,1	O1S2 (12,1)		20,1	O3S2 (12,1)		36,1	O5S2 (12,1)		52,1	O7S2 (12,1)
4,2	O1S2 (12,2)		20,2	O3S2 (12,2)		36,2	O5S2 (12,2)		52,2	O7S2 (12,2)
5,1	O1S3 (10,1)		21,1	O3S3 (10,1)		37,1	O5S3 (10,1)		53,1	O7S3 (10,1)
5,2	O1S3 (10,2)		21,2	O3S3 (10,2)		37,2	O5S3 (10,2)		53,2	O7S3 (10,2)
6,1	O1S3 (12,1)		22,1	O3S3 (12,1)		38,1	O5S3 (12,1)		54,1	O7S3 (12,1)
6,2	O1S3 (12,2)		22,2	O3S3 (12,2)		38,2	O5S3 (12,2)		54,2	O7S3 (12,2)
7,1	O1S4 (10,1)		23,1	O3S4 (10,1)		39,1	O5S4 (10,1)		55,1	O7S4 (10,1)
7,2	O1S4 (10,2)		23,2	O3S4 (10,2)		39,2	O5S4 (10,2)		55,2	O7S4 (10,2)
8,1	O1S4 (12,1)		24,1	O3S4 (12,1)		40,1	O5S4 (12,1)		56,1	O7S4 (12,1)
8,2	O1S4 (12,2)		24,2	O3S4 (12,2)		40,2	O5S4 (12,2)		56,2	O7S4 (12,2)
9,1	O2S1 (10,1)		25,1	O4S1 (10,1)		41,1	O6S1 (10,1)		57,1	O8S1 (10,1)
9,2	O2S1 (10,2)		25,2	O4S1 (10,2)		41,2	O6S1 (10,2)		57,2	O8S1 (10,2)
10,1	O2S1 (12,1)		26,1	O4S1 (12,1)		42,1	O6S1 (12,1)		58,1	O8S1 (12,1)
10,2	O2S1 (12,2)		26,2	O4S1 (12,2)		42,2	O6S1 (12,2)		58,2	O8S1 (12,2)
11,1	O2S2 (10,1)		27,1	O4S2 (10,1)		43,1	O6S2 (10,1)		59,1	O8S2 (10,1)
11,2	O2S2 (10,2)		27,2	O4S2 (10,2)		43,2	O6S2 (10,2)		59,2	O8S2 (10,2)
12,1	O2S2 (12,1)		28,1	O4S2 (12,1)		44,1	O6S2 (12,1)		60,1	O8S2 (12,1)
12,2	O2S2 (12,2)		28,2	O4S2 (12,2)		44,2	O6S2 (12,2)		60,2	O8S2 (12,2)
13,1	O2S3 (10,1)		29,1	O4S3 (10,1)		45,1	O6S3 (10,1)		61,1	O8S3 (10,1)
13,2	O2S3 (10,2)		29,2	O4S3 (10,2)		45,2	O6S3 (10,2)		61,2	O8S3 (10,2)
14,1	O2S3 (12,1)		30,1	O4S3 (12,1)		46,1	O6S3 (12,1)		62,1	O8S3 (12,1)
14,2	O2S3 (12,2)		30,2	O4S3 (12,2)		46,2	O6S3 (12,2)		62,2	O8S3 (12,2)
15,1	O2S4 (10,1)		31,1	O4S4 (10,1)		47,1	O6S4 (10,1)		63,1	O8S4 (10,1)
15,2	O2S4 (10,2)		31,2	O4S4 (10,2)		47,2	O6S4 (10,2)		63,2	O8S4 (10,2)
16,1	O2S4 (12,1)		32,1	O4S4 (12,1)		48,1	O6S4 (12,1)		64,1	O8S4 (12,1)
16,2	O2S4 (12,2)		32,2	O4S4 (12,2)		48,2	O6S4 (12,2)		64,2	O8S4 (12,2)

Table 19. XOC-1k scale-out leaf-spine connection map for spine switch #3 (SO3) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO4 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (14,1)		17,1	O3S1 (14,1)		33,1	O5S1 (14,1)		49,1	O7S1 (14,1)
1,2	O1S1 (14,2)		17,2	O3S1 (14,2)		33,2	O5S1 (14,2)		49,2	O7S1 (14,2)
2,1	O1S1 (16,1)		18,1	O3S1 (16,1)		34,1	O5S1 (16,1)		50,1	O7S1 (16,1)
2,2	O1S1 (16,2)		18,2	O3S1 (16,2)		34,2	O5S1 (16,2)		50,2	O7S1 (16,2)
3,1	O1S2 (14,1)		19,1	O3S2 (14,1)		35,1	O5S2 (14,1)		51,1	O7S2 (14,1)
3,2	O1S2 (14,2)		19,2	O3S2 (14,2)		35,2	O5S2 (14,2)		51,2	O7S2 (14,2)
4,1	O1S2 (16,1)		20,1	O3S2 (16,1)		36,1	O5S2 (16,1)		52,1	O7S2 (16,1)
4,2	O1S2 (16,2)		20,2	O3S2 (16,2)		36,2	O5S2 (16,2)		52,2	O7S2 (16,2)
5,1	O1S3 (14,1)		21,1	O3S3 (14,1)		37,1	O5S3 (14,1)		53,1	O7S3 (14,1)
5,2	O1S3 (14,2)		21,2	O3S3 (14,2)		37,2	O5S3 (14,2)		53,2	O7S3 (14,2)
6,1	O1S3 (16,1)		22,1	O3S3 (16,1)		38,1	O5S3 (16,1)		54,1	O7S3 (16,1)
6,2	O1S3 (16,2)		22,2	O3S3 (16,2)		38,2	O5S3 (16,2)		54,2	O7S3 (16,2)
7,1	O1S4 (14,1)		23,1	O3S4 (14,1)		39,1	O5S4 (14,1)		55,1	O7S4 (14,1)
7,2	O1S4 (14,2)		23,2	O3S4 (14,2)		39,2	O5S4 (14,2)		55,2	O7S4 (14,2)
8,1	O1S4 (16,1)		24,1	O3S4 (16,1)		40,1	O5S4 (16,1)		56,1	O7S4 (16,1)
8,2	O1S4 (16,2)		24,2	O3S4 (16,2)		40,2	O5S4 (16,2)		56,2	O7S4 (16,2)
9,1	O2S1 (14,1)		25,1	O4S1 (14,1)		41,1	O6S1 (14,1)		57,1	O8S1 (14,1)
9,2	O2S1 (14,2)		25,2	O4S1 (14,2)		41,2	O6S1 (14,2)		57,2	O8S1 (14,2)
10,1	O2S1 (16,1)		26,1	O4S1 (16,1)		42,1	O6S1 (16,1)		58,1	O8S1 (16,1)
10,2	O2S1 (16,2)		26,2	O4S1 (16,2)		42,2	O6S1 (16,2)		58,2	O8S1 (16,2)
11,1	O2S2 (14,1)		27,1	O4S2 (14,1)		43,1	O6S2 (14,1)		59,1	O8S2 (14,1)
11,2	O2S2 (14,2)		27,2	O4S2 (14,2)		43,2	O6S2 (14,2)		59,2	O8S2 (14,2)
12,1	O2S2 (16,1)		28,1	O4S2 (16,1)		44,1	O6S2 (16,1)		60,1	O8S2 (16,1)
12,2	O2S2 (16,2)		28,2	O4S2 (16,2)		44,2	O6S2 (16,2)		60,2	O8S2 (16,2)
13,1	O2S3 (14,1)		29,1	O4S3 (14,1)		45,1	O6S3 (14,1)		61,1	O8S3 (14,1)
13,2	O2S3 (14,2)		29,2	O4S3 (14,2)		45,2	O6S3 (14,2)		61,2	O8S3 (14,2)
14,1	O2S3 (16,1)		30,1	O4S3 (16,1)		46,1	O6S3 (16,1)		62,1	O8S3 (16,1)
14,2	O2S3 (16,2)		30,2	O4S3 (16,2)		46,2	O6S3 (16,2)		62,2	O8S3 (16,2)
15,1	O2S4 (14,1)		31,1	O4S4 (14,1)		47,1	O6S4 (14,1)		63,1	O8S4 (14,1)
15,2	O2S4 (14,2)		31,2	O4S4 (14,2)		47,2	O6S4 (14,2)		63,2	O8S4 (14,2)
16,1	O2S4 (16,1)		32,1	O4S4 (16,1)		48,1	O6S4 (16,1)		64,1	O8S4 (16,1)
16,2	O2S4 (16,2)		32,2	O4S4 (16,2)		48,2	O6S4 (16,2)		64,2	O8S4 (16,2)

Table 20. XOC-1k scale-out leaf-spine connection map for spine switch #4 (SO4) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO5 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (18,1)		17,1	O3S1 (18,1)		33,1	O5S1 (18,1)		49,1	O7S1 (18,1)
1,2	O1S1 (18,2)		17,2	O3S1 (18,2)		33,2	O5S1 (18,2)		49,2	O7S1 (18,2)
2,1	O1S1 (20,1)		18,1	O3S1 (20,1)		34,1	O5S1 (20,1)		50,1	O7S1 (20,1)
2,2	O1S1 (20,2)		18,2	O3S1 (20,2)		34,2	O5S1 (20,2)		50,2	O7S1 (20,2)
3,1	O1S2 (18,1)		19,1	O3S2 (18,1)		35,1	O5S2 (18,1)		51,1	O7S2 (18,1)
3,2	O1S2 (18,2)		19,2	O3S2 (18,2)		35,2	O5S2 (18,2)		51,2	O7S2 (18,2)
4,1	O1S2 (20,1)		20,1	O3S2 (20,1)		36,1	O5S2 (20,1)		52,1	O7S2 (20,1)
4,2	O1S2 (20,2)		20,2	O3S2 (20,2)		36,2	O5S2 (20,2)		52,2	O7S2 (20,2)
5,1	O1S3 (18,1)		21,1	O3S3 (18,1)		37,1	O5S3 (18,1)		53,1	O7S3 (18,1)
5,2	O1S3 (18,2)		21,2	O3S3 (18,2)		37,2	O5S3 (18,2)		53,2	O7S3 (18,2)
6,1	O1S3 (20,1)		22,1	O3S3 (20,1)		38,1	O5S3 (20,1)		54,1	O7S3 (20,1)
6,2	O1S3 (20,2)		22,2	O3S3 (20,2)		38,2	O5S3 (20,2)		54,2	O7S3 (20,2)
7,1	O1S4 (18,1)		23,1	O3S4 (18,1)		39,1	O5S4 (18,1)		55,1	O7S4 (18,1)
7,2	O1S4 (18,2)		23,2	O3S4 (18,2)		39,2	O5S4 (18,2)		55,2	O7S4 (18,2)
8,1	O1S4 (20,1)		24,1	O3S4 (20,1)		40,1	O5S4 (20,1)		56,1	O7S4 (20,1)
8,2	O1S4 (20,2)		24,2	O3S4 (20,2)		40,2	O5S4 (20,2)		56,2	O7S4 (20,2)
9,1	O2S1 (18,1)		25,1	O4S1 (18,1)		41,1	O6S1 (18,1)		57,1	O8S1 (18,1)
9,2	O2S1 (18,2)		25,2	O4S1 (18,2)		41,2	O6S1 (18,2)		57,2	O8S1 (18,2)
10,1	O2S1 (20,1)		26,1	O4S1 (20,1)		42,1	O6S1 (20,1)		58,1	O8S1 (20,1)
10,2	O2S1 (20,2)		26,2	O4S1 (20,2)		42,2	O6S1 (20,2)		58,2	O8S1 (20,2)
11,1	O2S2 (18,1)		27,1	O4S2 (18,1)		43,1	O6S2 (18,1)		59,1	O8S2 (18,1)
11,2	O2S2 (18,2)		27,2	O4S2 (18,2)		43,2	O6S2 (18,2)		59,2	O8S2 (18,2)
12,1	O2S2 (20,1)		28,1	O4S2 (20,1)		44,1	O6S2 (20,1)		60,1	O8S2 (20,1)
12,2	O2S2 (20,2)		28,2	O4S2 (20,2)		44,2	O6S2 (20,2)		60,2	O8S2 (20,2)
13,1	O2S3 (18,1)		29,1	O4S3 (18,1)		45,1	O6S3 (18,1)		61,1	O8S3 (18,1)
13,2	O2S3 (18,2)		29,2	O4S3 (18,2)		45,2	O6S3 (18,2)		61,2	O8S3 (18,2)
14,1	O2S3 (20,1)		30,1	O4S3 (20,1)		46,1	O6S3 (20,1)		62,1	O8S3 (20,1)
14,2	O2S3 (20,2)		30,2	O4S3 (20,2)		46,2	O6S3 (20,2)		62,2	O8S3 (20,2)
15,1	O2S4 (18,1)		31,1	O4S4 (18,1)		47,1	O6S4 (18,1)		63,1	O8S4 (18,1)
15,2	O2S4 (18,2)		31,2	O4S4 (18,2)		47,2	O6S4 (18,2)		63,2	O8S4 (18,2)
16,1	O2S4 (20,1)		32,1	O4S4 (20,1)		48,1	O6S4 (20,1)		64,1	O8S4 (20,1)
16,2	O2S4 (20,2)		32,2	O4S4 (20,2)		48,2	O6S4 (20,2)		64,2	O8S4 (20,2)

Table 21. XOC-1k scale-out leaf-spine connection map for spine switch #5 (SO5) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO6 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (22,1)		17,1	O3S1 (22,1)		33,1	O5S1 (22,1)		49,1	O7S1 (22,1)
1,2	O1S1 (22,2)		17,2	O3S1 (22,2)		33,2	O5S1 (22,2)		49,2	O7S1 (22,2)
2,1	O1S1 (24,1)		18,1	O3S1 (24,1)		34,1	O5S1 (24,1)		50,1	O7S1 (24,1)
2,2	O1S1 (24,2)		18,2	O3S1 (24,2)		34,2	O5S1 (24,2)		50,2	O7S1 (24,2)
3,1	O1S2 (22,1)		19,1	O3S2 (22,1)		35,1	O5S2 (22,1)		51,1	O7S2 (22,1)
3,2	O1S2 (22,2)		19,2	O3S2 (22,2)		35,2	O5S2 (22,2)		51,2	O7S2 (22,2)
4,1	O1S2 (24,1)		20,1	O3S2 (24,1)		36,1	O5S2 (24,1)		52,1	O7S2 (24,1)
4,2	O1S2 (24,2)		20,2	O3S2 (24,2)		36,2	O5S2 (24,2)		52,2	O7S2 (24,2)
5,1	O1S3 (22,1)		21,1	O3S3 (22,1)		37,1	O5S3 (22,1)		53,1	O7S3 (22,1)
5,2	O1S3 (22,2)		21,2	O3S3 (22,2)		37,2	O5S3 (22,2)		53,2	O7S3 (22,2)
6,1	O1S3 (24,1)		22,1	O3S3 (24,1)		38,1	O5S3 (24,1)		54,1	O7S3 (24,1)
6,2	O1S3 (24,2)		22,2	O3S3 (24,2)		38,2	O5S3 (24,2)		54,2	O7S3 (24,2)
7,1	O1S4 (22,1)		23,1	O3S4 (22,1)		39,1	O5S4 (22,1)		55,1	O7S4 (22,1)
7,2	O1S4 (22,2)		23,2	O3S4 (22,2)		39,2	O5S4 (22,2)		55,2	O7S4 (22,2)
8,1	O1S4 (24,1)		24,1	O3S4 (24,1)		40,1	O5S4 (24,1)		56,1	O7S4 (24,1)
8,2	O1S4 (24,2)		24,2	O3S4 (24,2)		40,2	O5S4 (24,2)		56,2	O7S4 (24,2)
9,1	O2S1 (22,1)		25,1	O4S1 (22,1)		41,1	O6S1 (22,1)		57,1	O8S1 (22,1)
9,2	O2S1 (22,2)		25,2	O4S1 (22,2)		41,2	O6S1 (22,2)		57,2	O8S1 (22,2)
10,1	O2S1 (24,1)		26,1	O4S1 (24,1)		42,1	O6S1 (24,1)		58,1	O8S1 (24,1)
10,2	O2S1 (24,2)		26,2	O4S1 (24,2)		42,2	O6S1 (24,2)		58,2	O8S1 (24,2)
11,1	O2S2 (22,1)		27,1	O4S2 (22,1)		43,1	O6S2 (22,1)		59,1	O8S2 (22,1)
11,2	O2S2 (22,2)		27,2	O4S2 (22,2)		43,2	O6S2 (22,2)		59,2	O8S2 (22,2)
12,1	O2S2 (24,1)		28,1	O4S2 (24,1)		44,1	O6S2 (24,1)		60,1	O8S2 (24,1)
12,2	O2S2 (24,2)		28,2	O4S2 (24,2)		44,2	O6S2 (24,2)		60,2	O8S2 (24,2)
13,1	O2S3 (22,1)		29,1	O4S3 (22,1)		45,1	O6S3 (22,1)		61,1	O8S3 (22,1)
13,2	O2S3 (22,2)		29,2	O4S3 (22,2)		45,2	O6S3 (22,2)		61,2	O8S3 (22,2)
14,1	O2S3 (24,1)		30,1	O4S3 (24,1)		46,1	O6S3 (24,1)		62,1	O8S3 (24,1)
14,2	O2S3 (24,2)		30,2	O4S3 (24,2)		46,2	O6S3 (24,2)		62,2	O8S3 (24,2)
15,1	O2S4 (22,1)		31,1	O4S4 (22,1)		47,1	O6S4 (22,1)		63,1	O8S4 (22,1)
15,2	O2S4 (22,2)		31,2	O4S4 (22,2)		47,2	O6S4 (22,2)		63,2	O8S4 (22,2)
16,1	O2S4 (24,1)		32,1	O4S4 (24,1)		48,1	O6S4 (24,1)		64,1	O8S4 (24,1)
16,2	O2S4 (24,2)		32,2	O4S4 (24,2)		48,2	O6S4 (24,2)		64,2	O8S4 (24,2)

Table 22. XOC-1k scale-out leaf-spine connection map for spine switch #6 (SO6) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO7 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (26,1)		17,1	O3S1 (26,1)		33,1	O5S1 (26,1)		49,1	O7S1 (26,1)
1,2	O1S1 (26,2)		17,2	O3S1 (26,2)		33,2	O5S1 (26,2)		49,2	O7S1 (26,2)
2,1	O1S1 (28,1)		18,1	O3S1 (28,1)		34,1	O5S1 (28,1)		50,1	O7S1 (28,1)
2,2	O1S1 (28,2)		18,2	O3S1 (28,2)		34,2	O5S1 (28,2)		50,2	O7S1 (28,2)
3,1	O1S2 (26,1)		19,1	O3S2 (26,1)		35,1	O5S2 (26,1)		51,1	O7S2 (26,1)
3,2	O1S2 (26,2)		19,2	O3S2 (26,2)		35,2	O5S2 (26,2)		51,2	O7S2 (26,2)
4,1	O1S2 (28,1)		20,1	O3S2 (28,1)		36,1	O5S2 (28,1)		52,1	O7S2 (28,1)
4,2	O1S2 (28,2)		20,2	O3S2 (28,2)		36,2	O5S2 (28,2)		52,2	O7S2 (28,2)
5,1	O1S3 (26,1)		21,1	O3S3 (26,1)		37,1	O5S3 (26,1)		53,1	O7S3 (26,1)
5,2	O1S3 (26,2)		21,2	O3S3 (26,2)		37,2	O5S3 (26,2)		53,2	O7S3 (26,2)
6,1	O1S3 (28,1)		22,1	O3S3 (28,1)		38,1	O5S3 (28,1)		54,1	O7S3 (28,1)
6,2	O1S3 (28,2)		22,2	O3S3 (28,2)		38,2	O5S3 (28,2)		54,2	O7S3 (28,2)
7,1	O1S4 (26,1)		23,1	O3S4 (26,1)		39,1	O5S4 (26,1)		55,1	O7S4 (26,1)
7,2	O1S4 (26,2)		23,2	O3S4 (26,2)		39,2	O5S4 (26,2)		55,2	O7S4 (26,2)
8,1	O1S4 (28,1)		24,1	O3S4 (28,1)		40,1	O5S4 (28,1)		56,1	O7S4 (28,1)
8,2	O1S4 (28,2)		24,2	O3S4 (28,2)		40,2	O5S4 (28,2)		56,2	O7S4 (28,2)
9,1	O2S1 (26,1)		25,1	O4S1 (26,1)		41,1	O6S1 (26,1)		57,1	O8S1 (26,1)
9,2	O2S1 (26,2)		25,2	O4S1 (26,2)		41,2	O6S1 (26,2)		57,2	O8S1 (26,2)
10,1	O2S1 (28,1)		26,1	O4S1 (28,1)		42,1	O6S1 (28,1)		58,1	O8S1 (28,1)
10,2	O2S1 (28,2)		26,2	O4S1 (28,2)		42,2	O6S1 (28,2)		58,2	O8S1 (28,2)
11,1	O2S2 (26,1)		27,1	O4S2 (26,1)		43,1	O6S2 (26,1)		59,1	O8S2 (26,1)
11,2	O2S2 (26,2)		27,2	O4S2 (26,2)		43,2	O6S2 (26,2)		59,2	O8S2 (26,2)
12,1	O2S2 (28,1)		28,1	O4S2 (28,1)		44,1	O6S2 (28,1)		60,1	O8S2 (28,1)
12,2	O2S2 (28,2)		28,2	O4S2 (28,2)		44,2	O6S2 (28,2)		60,2	O8S2 (28,2)
13,1	O2S3 (26,1)		29,1	O4S3 (26,1)		45,1	O6S3 (26,1)		61,1	O8S3 (26,1)
13,2	O2S3 (26,2)		29,2	O4S3 (26,2)		45,2	O6S3 (26,2)		61,2	O8S3 (26,2)
14,1	O2S3 (28,1)		30,1	O4S3 (28,1)		46,1	O6S3 (28,1)		62,1	O8S3 (28,1)
14,2	O2S3 (28,2)		30,2	O4S3 (28,2)		46,2	O6S3 (28,2)		62,2	O8S3 (28,2)
15,1	O2S4 (26,1)		31,1	O4S4 (26,1)		47,1	O6S4 (26,1)		63,1	O8S4 (26,1)
15,2	O2S4 (26,2)		31,2	O4S4 (26,2)		47,2	O6S4 (26,2)		63,2	O8S4 (26,2)
16,1	O2S4 (28,1)		32,1	O4S4 (28,1)		48,1	O6S4 (28,1)		64,1	O8S4 (28,1)
16,2	O2S4 (28,2)		32,2	O4S4 (28,2)		48,2	O6S4 (28,2)		64,2	O8S4 (28,2)

Table 23. XOC-1k scale-out leaf-spine connection map for spine switch #7 (SO7) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

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SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO8 Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1S1 (30,1)		17,1	O3S1 (30,1)		33,1	O5S1 (30,1)		49,1	O7S1 (30,1)
1,2	O1S1 (30,2)		17,2	O3S1 (30,2)		33,2	O5S1 (30,2)		49,2	O7S1 (30,2)
2,1	O1S1 (32,1)		18,1	O3S1 (32,1)		34,1	O5S1 (32,1)		50,1	O7S1 (32,1)
2,2	O1S1 (32,2)		18,2	O3S1 (32,2)		34,2	O5S1 (32,2)		50,2	O7S1 (32,2)
3,1	O1S2 (30,1)		19,1	O3S2 (30,1)		35,1	O5S2 (30,1)		51,1	O7S2 (30,1)
3,2	O1S2 (30,2)		19,2	O3S2 (30,2)		35,2	O5S2 (30,2)		51,2	O7S2 (30,2)
4,1	O1S2 (32,1)		20,1	O3S2 (32,1)		36,1	O5S2 (32,1)		52,1	O7S2 (32,1)
4,2	O1S2 (32,2)		20,2	O3S2 (32,2)		36,2	O5S2 (32,2)		52,2	O7S2 (32,2)
5,1	O1S3 (30,1)		21,1	O3S3 (30,1)		37,1	O5S3 (30,1)		53,1	O7S3 (30,1)
5,2	O1S3 (30,2)		21,2	O3S3 (30,2)		37,2	O5S3 (30,2)		53,2	O7S3 (30,2)
6,1	O1S3 (32,1)		22,1	O3S3 (32,1)		38,1	O5S3 (32,1)		54,1	O7S3 (32,1)
6,2	O1S3 (32,2)		22,2	O3S3 (32,2)		38,2	O5S3 (32,2)		54,2	O7S3 (32,2)
7,1	O1S4 (30,1)		23,1	O3S4 (30,1)		39,1	O5S4 (30,1)		55,1	O7S4 (30,1)
7,2	O1S4 (30,2)		23,2	O3S4 (30,2)		39,2	O5S4 (30,2)		55,2	O7S4 (30,2)
8,1	O1S4 (32,1)		24,1	O3S4 (32,1)		40,1	O5S4 (32,1)		56,1	O7S4 (32,1)
8,2	O1S4 (32,2)		24,2	O3S4 (32,2)		40,2	O5S4 (32,2)		56,2	O7S4 (32,2)
9,1	O2S1 (30,1)		25,1	O4S1 (30,1)		41,1	O6S1 (30,1)		57,1	O8S1 (30,1)
9,2	O2S1 (30,2)		25,2	O4S1 (30,2)		41,2	O6S1 (30,2)		57,2	O8S1 (30,2)
10,1	O2S1 (32,1)		26,1	O4S1 (32,1)		42,1	O6S1 (32,1)		58,1	O8S1 (32,1)
10,2	O2S1 (32,2)		26,2	O4S1 (32,2)		42,2	O6S1 (32,2)		58,2	O8S1 (32,2)
11,1	O2S2 (30,1)		27,1	O4S2 (30,1)		43,1	O6S2 (30,1)		59,1	O8S2 (30,1)
11,2	O2S2 (30,2)		27,2	O4S2 (30,2)		43,2	O6S2 (30,2)		59,2	O8S2 (30,2)
12,1	O2S2 (32,1)		28,1	O4S2 (32,1)		44,1	O6S2 (32,1)		60,1	O8S2 (32,1)
12,2	O2S2 (32,2)		28,2	O4S2 (32,2)		44,2	O6S2 (32,2)		60,2	O8S2 (32,2)
13,1	O2S3 (30,1)		29,1	O4S3 (30,1)		45,1	O6S3 (30,1)		61,1	O8S3 (30,1)
13,2	O2S3 (30,2)		29,2	O4S3 (30,2)		45,2	O6S3 (30,2)		61,2	O8S3 (30,2)
14,1	O2S3 (32,1)		30,1	O4S3 (32,1)		46,1	O6S3 (32,1)		62,1	O8S3 (32,1)
14,2	O2S3 (32,2)		30,2	O4S3 (32,2)		46,2	O6S3 (32,2)		62,2	O8S3 (32,2)
15,1	O2S4 (30,1)		31,1	O4S4 (30,1)		47,1	O6S4 (30,1)		63,1	O8S4 (30,1)
15,2	O2S4 (30,2)		31,2	O4S4 (30,2)		47,2	O6S4 (30,2)		63,2	O8S4 (30,2)
16,1	O2S4 (32,1)		32,1	O4S4 (32,1)		48,1	O6S4 (32,1)		64,1	O8S4 (32,1)
16,2	O2S4 (32,2)		32,2	O4S4 (32,2)		48,2	O6S4 (32,2)		64,2	O8S4 (32,2)

Table 24. XOC-1k scale-out leaf-spine connection map for spine switch #8 (SO8) for a rail-optimized topology. All switch ports are 800G OSFP, and all optical modules are dual port (dual 400G). The scale-out leaf-switch connection maps can be found in [1].

7.2. Storage spine

This spine, illustrated in Figures 8 and 9, provides dedicated, cluster-wide connectivity for the xPU-node CPUs, storage servers, and metadata servers. The details of the OPG-128 storage fabric are described in [1]. Tables 25-27 contain the connection maps for the storage fabric.

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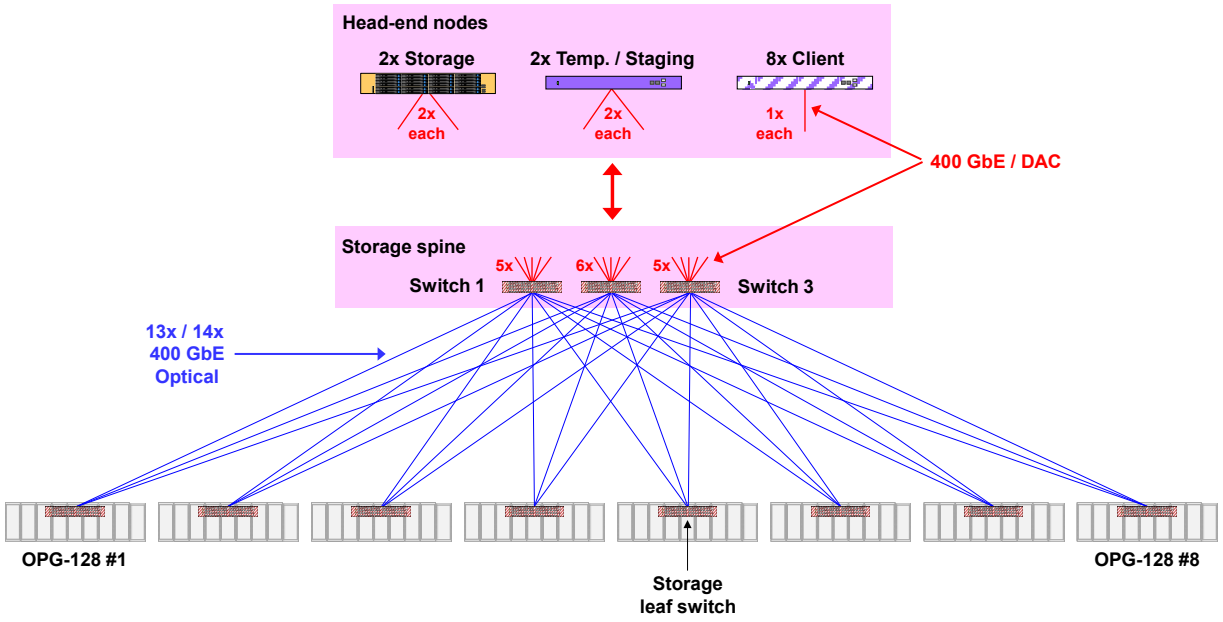


Figure 8. XOC-1k storage network topology.

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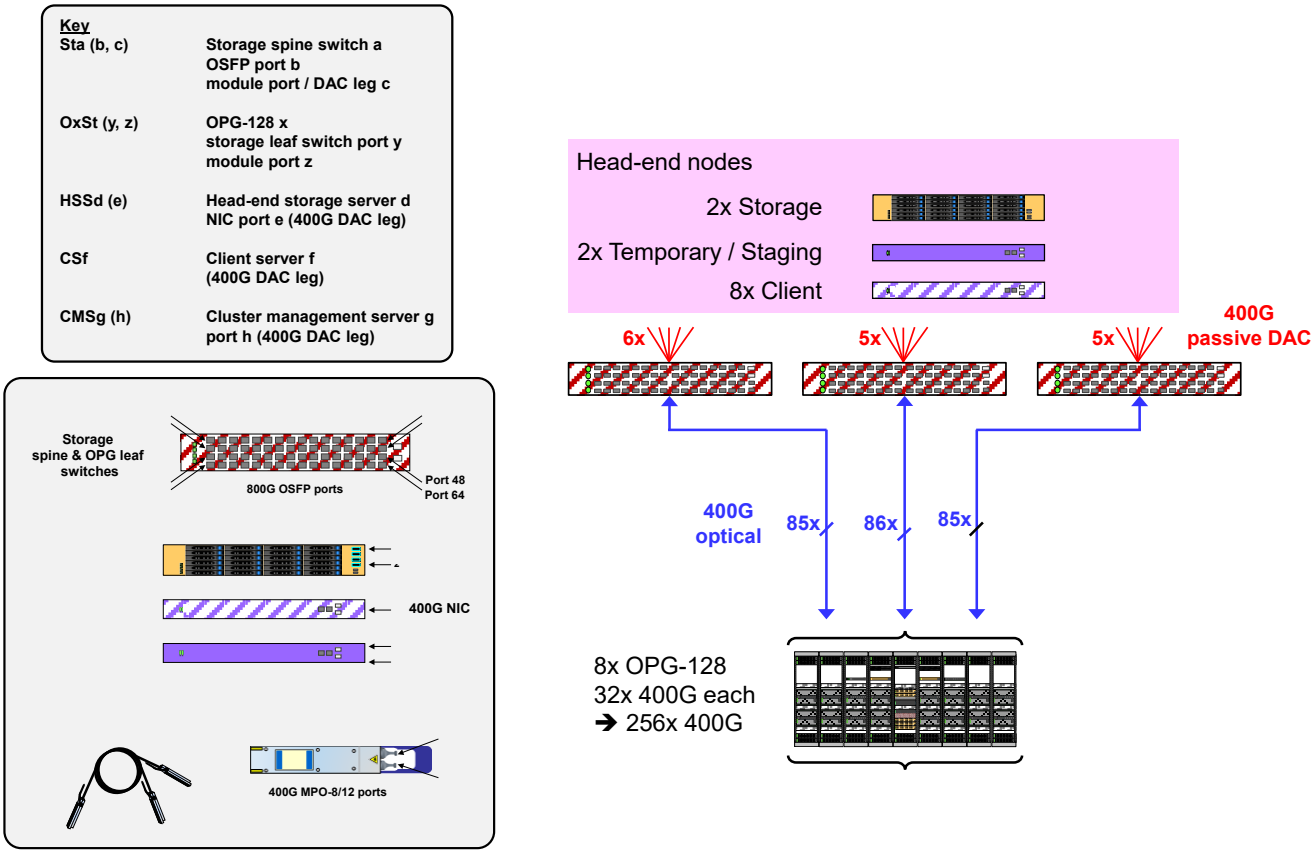


Figure 9. XOC-1k storage network port number plan.

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St1 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St1 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St1 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St1 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)
1,1	O1St (2,1)		17,1	O2St (22,1)		33,1	O5St (2,1)		49,1	O7St (2,1)
1,2	O1St (2,2)		17,2	O3St (2,1)		33,2	O5St (2,2)		49,2	O7St (2,2)
2,1	O1St (4,1)		18,1	O3St (2,2)		34,1	O5St (4,1)		50,1	O7St (4,1)
2,2	O1St (4,2)		18,2	O3St (4,1)		34,2	O5St (4,2)		50,2	O7St (4,2)
3,1	O1St (6,1)		19,1	O3St (4,2)		35,1	O5St (6,1)		51,1	O7St (6,1)
3,2	O1St (6,2)		19,2	O3St (6,1)		35,2	O5St (6,2)		51,2	O7St (6,2)
4,1	O1St (18,1)		20,1	O3St (6,2)		36,1	O5St (18,1)		52,1	O7St (18,1)
4,2	O1St (18,2)		20,2	O3St (18,1)		36,2	O5St (18,2)		52,2	O7St (18,2)
5,1	O1St (20,1)		21,1	O3St (18,2)		37,1	O5St (20,1)		53,1	O7St (20,1)
5,2	O1St (20,2)		21,2	O3St (20,1)		37,2	O5St (20,2)		53,2	O7St (20,2)
6,1	O2St (2,1)		22,1	O3St (20,1)		38,1	O5St (22,1)		54,1	O8St (2,1)
6,2	O2St (2,2)		22,2	O3St (22,1)		38,2	O6St (2,1)		54,2	O8St (2,2)
7,1	O2St (4,1)		23,1	O4St (2,1)		39,1	O6St (2,2)		55,1	O8St (4,1)
7,2	O2St (4,2)		23,2	O4St (2,2)		39,2	O6St (4,1)		55,2	O8St (4,2)
8,1	O2St (6,1)		24,1	O4St (4,1)		40,1	O6St (4,2)		56,1	O8St (6,1)
8,2	O2St (6,2)		24,2	O4St (4,2)		40,2	O6St (6,1)		56,2	O8St (6,2)
9,1	O2St (18,1)		25,1	O4St (6,1)		41,1	O6St (6,2)		57,1	O8St (18,1)
9,2	O2St (18,2)		25,2	O4St (6,2)		41,2	O6St (18,1)		57,2	O8St (18,2)
10,1	O2St (20,1)		26,1	O4St (18,1)		42,1	O6St (18,2)		58,1	O8St (20,1)
10,2	O2St (20,2)		26,2	O4St (18,2)		42,2	O6St (20,1)		58,2	O8St (20,2)
11,1	HSS1(1)		27,1	O4St (20,1)		43,1	O6St (20,2)		59,1	O8St (22,1)
11,2	CMS1(1)		27,2	O4St (20,2)		43,2	O6St (22,1)		59,2	CMS2(1)
12,1	CS1		28,1			44,1			60,1	
12,2	CS2		28,2			44,2			60,2	
13,1	CS3		29,1			45,1			61,1	
13,2			29,2			45,2			61,2	
14,1			30,1			46,1			62,1	
14,2			30,2			46,2			62,2	
15,1			31,1			47,1			63,1	
15,2			31,2			47,2			63,2	
16,1			32,1			48,1			64,1	
16,2			32,2			48,2			64,2	

Table 25. XOC-1k storage-spine connection map for storage spine switch #1 (St1). All switch ports are 800G OSFP. All spine-leaf connections are optical, and all connections between the storage spine switches and the head-end storage nodes are via passive DAC break-out cables. All optical modules are dual port (dual 400G). The storage leaf-switch connection maps can be found in [1].

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St2 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St2 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St2 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St2 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)
1,1	O1St (22,1)		17,1	O3St (22,2)		33,1	O5St (34,1)		49,1	O7St (34,1)
1,2	O1St (22,2)		17,2	O3St (34,1)		33,2	O5St (34,2)		49,2	O7St (34,2)
2,1	O1St (34,1)		18,1	O3St (34,2)		34,1	O5St (36,1)		50,1	O7St (36,1)
2,2	O1St (34,2)		18,2	O3St (36,1)		34,2	O5St (36,2)		50,2	O7St (36,2)
3,1	O1St (36,1)		19,1	O3St (36,2)		35,1	O5St (38,1)		51,1	O7St (38,1)
3,2	O1St (36,2)		19,2	O3St (38,1)		35,2	O5St (38,2)		51,2	O7St (38,2)
4,1	O1St (38,1)		20,1	O3St (38,2)		36,1	O5St (40,1)		52,1	O7St (40,1)
4,2	O1St (38,2)		20,2	O3St (40,1)		36,2	O5St (40,2)		52,2	O7St (40,2)
5,1	O1St (40,1)		21,1	O3St (40,2)		37,1	O5St (42,1)		53,1	O7St (42,1)
5,2	O1St (40,2)		21,2	O3St (42,1)		37,2	O5St (42,2)		53,2	O8St (22,2)
6,1	O1St (42,1)		22,1	O4St (22,1)		38,1	O6St (22,1)		54,1	O8St (34,1)
6,2	O2St (22,2)		22,2	O4St (22,2)		38,2	O6St (34,1)		54,2	O8St (34,2)
7,1	O2St (34,1)		23,1	O4St (34,1)		39,1	O6St (34,2)		55,1	O8St (36,1)
7,2	O2St (34,2)		23,2	O4St (34,2)		39,2	O6St 36,1)		55,2	O8St (36,2)
8,1	O2St (36,1)		24,1	O4St (36,1)		40,1	O6St (36,2)		56,1	O8St (38,1)
8,2	O2St (36,2)		24,2	O4St (36,2)		40,2	O6St (38,1)		56,2	O8St (38,2)
9,1	O2St (38,1)		25,1	O4St (38,1)		41,1	O6St (38,2)		57,1	O8St (40,1)
9,2	O2St (38,2)		25,2	O4St (38,2)		41,2	O6St (40,1)		57,2	O8St (40,2)
10,1	O2St (40,1)		26,1	O4St (40,1)		42,1	O6St (40,1)		58,1	O8St (42,1)
10,2	O2St (40,2)		26,2	O4St (42,2)		42,2	O6St (42,1)		58,2	O8St (42,2)
11,1	O2St (42,1)		27,1	O4St (42,1)		43,1	O7St (22,1)		59,1	HSS1(2)
11,2	O2St (42,2)		27,2	O5St (22,2)		43,2	O7St (22,2)		59,2	HSS2(1)
12,1	CS4		28,1			44,1	CS6		60,1	
12,2	CS5		28,2			44,2			60,2	
13,1			29,1			45,1			61,1	
13,2			29,2			45,2			61,2	
14,1			30,1			46,1			62,1	
14,2			30,2			46,2			62,2	
15,1			31,1			47,1			63,1	
15,2			31,2			47,2			63,2	
16,1			32,1			48,1			64,1	
16,2			32,2			48,2			64,2	

Table 26. XOC-1k storage-spine connection map for storage spine switch #2 (St2). All switch ports are 800G OSFP. All spine-leaf connections are optical, and all connections between the storage spine switches and the head-end storage nodes are via passive DAC break-out cables. All optical modules are dual port (dual 400G). The storage leaf-switch connection maps can be found in [1].

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St3 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St3 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St3 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)		St3 Switch, Module (400G, 400G)	Leaf Switch / HSS (1x 400G)
1,1	O1St (42,2)		17,1	O3St (50,1)		33,1	O5St (50,2)		49,1	O7St (42,2)
1,2	O1St (50,1)		17,2	O3St (50,2)		33,2	O5St (52,1)		49,2	O7St (50,1)
2,1	O1St (50,2)		18,1	O3St (52,1)		34,1	O5St (52,2)		50,1	O7St (50,2)
2,2	O1St (52,1)		18,2	O3St (52,2)		34,2	O5St (54,1)		50,2	O7St (52,1)
3,1	O1St (52,2)		19,1	O3St (54,1)		35,1	O5St (54,2)		51,1	O7St (52,2)
3,2	O1St (54,1)		19,2	O3St (54,2)		35,2	O5St (56,1)		51,2	O7St (54,1)
4,1	O1St (54,2)		20,1	O3St (56,1)		36,1	O5St (56,2)		52,1	O7St (54,2)
4,2	O1St (56,1)		20,2	O3St (56,2)		36,2	O5St (58,1)		52,2	O7St (56,1)
5,1	O1St (56,2)		21,1	O3St (58,1)		37,1	O5St (58,2)		53,1	O7St (56,2)
5,2	O1St (58,1)		21,2	O3St (58,2)		37,2	O6St (42,2)		53,2	O7St (58,1)
6,1	O1St (58,2)		22,1	O4St (42,2)		38,1	O6St (50,1)		54,1	O7St (58,2)
6,2	O2St (50,1)		22,2	O4St (50,1)		38,2	O6St (50,2)		54,2	O8St (50,1)
7,1	O2St (50,2)		23,1	O4St (50,2)		39,1	O6St 52,1)		55,1	O8St (50,2)
7,2	O2St (52,1)		23,2	O4St (52,1)		39,2	O6St (52,2)		55,2	O8St (52,1)
8,1	O2St (52,2)		24,1	O4St (52,2)		40,1	O6St (54,1)		56,1	O8St (52,2)
8,2	O2St (54,1)		24,2	O4St (54,1)		40,2	O6St (54,2)		56,2	O8St (54,1)
9,1	O2St (54,2)		25,1	O4St (54,2)		41,1	O6St (56,1)		57,1	O8St (54,2)
9,2	O2St (56,1)		25,2	O4St (56,1)		41,2	O6St (56,2)		57,2	O8St (56,1)
10,1	O2St (56,2)		26,1	O4St (56,2)		42,1	O6St (58,1)		58,1	O8St (56,2)
10,2	O2St (58,1)		26,2	O4St (58,1)		42,2	O6St (58,2)		58,2	O8St (58,1)
11,1	O2St (58,2)		27,1	O4St (58,1)		43,1	HSS2(2)		59,1	O8St (58,1)
11,2	O3St (42,2)		27,2	O5St (50,1)		43,2	CMS1(2)		59,2	CMS2(2)
12,1	CS7		28,1			44,1			60,1	
12,2	CS8		28,2			44,2			60,2	
13,1			29,1			45,1			61,1	
13,2			29,2			45,2			61,2	
14,1			30,1			46,1			62,1	
14,2			30,2			46,2			62,2	
15,1			31,1			47,1			63,1	
15,2			31,2			47,2			63,2	
16,1			32,1			48,1			64,1	
16,2			32,2			48,2			64,2	

Table 27. XOC-1k storage-spine connection map for storage spine switch #3 (St3). All switch ports are 800G OSFP. All spine-leaf connections are optical, and all connections between the storage spine switches and the head-end storage nodes are via passive DAC break-out cables. All optical modules are dual port (dual 400G). The storage leaf-switch connection maps can be found in [1].

7.3. SO-C spine

This spine, illustrated in Figure 10, provides dedicated, cluster-wide connectivity for the CPUs residing in the xPU-nodes. The details of the OPG-128 SO-C fabric are described in [1]. Table 28 contains the connection map for the SO-C fabric.

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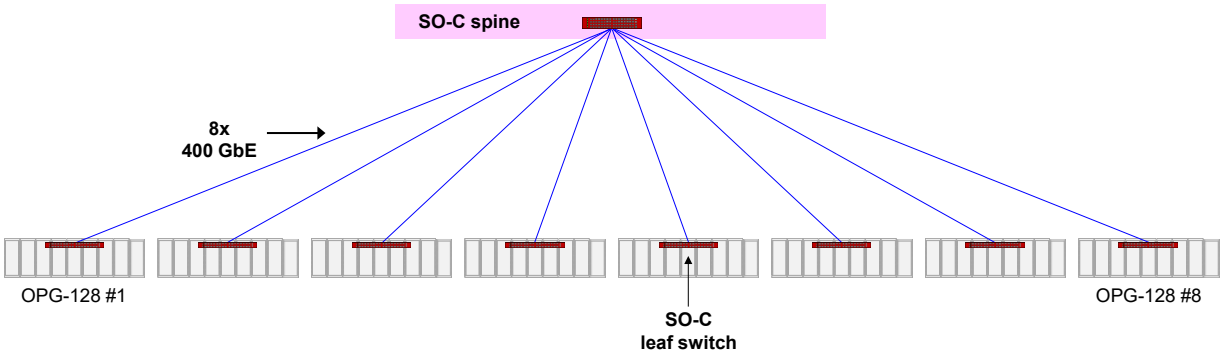


Figure 10. XOC-1k SO-C spine topology.

SO-C spine Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO-C spine Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO-C spine Switch, Module (400G, 400G)	Leaf Switch (1x 400G)		SO-C spine Switch, Module (400G, 400G)	Leaf Switch (1x 400G)
1,1	O1M (18,1)		9,1	O3M (18,1)		17,1	O5M (18,1)		25,1	O7M (18,1)
1,2	O1M (18,2)		9,2	O3M (18,2)		17,2	O5M (18,2)		25,2	O7M (18,2)
2,1	O1M (21,1)		10,1	O3M (21,1)		18,1	O5M (21,1)		26,1	O7M (21,1)
2,2	O1M (21,2)		10,2	O3M (21,2)		18,2	O5M (21,2)		26,2	O7M (21,2)
3,1	O1M (24,1)		11,1	O3M (24,1)		19,1	O5M (24,1)		27,1	O7M (24,1)
3,2	O1M (24,2)		11,2	O3M (24,2)		19,2	O5M (24,2)		27,2	O7M (24,2)
4,1	O1M (27,1)		12,1	O3M (27,1)		20,1	O5M (27,1)		28,1	O7M (27,1)
4,2	O1M (27,2)		12,2	O3M (27,2)		20,2	O5M (27,2)		28,2	O7M (27,2)
5,1	O2M (18,1)		13,1	O4M (18,1)		21,1	O6M (18,1)		29,1	O8M (18,1)
5,2	O2M (18,2)		13,2	O4M (18,2)		21,2	O6M (18,2)		29,2	O8M (18,2)
6,1	O2M (21,1)		14,1	O4M (21,1)		22,1	O6M (21,1)		30,1	O8M (21,1)
6,2	O2M (21,2)		14,2	O4M (21,2)		22,2	O6M (21,2)		30,2	O8M (21,2)
7,1	O2M (24,1)		15,1	O4M (24,1)		23,1	O6M (24,1)		31,1	O8M (24,1)
7,2	O2M (24,2)		15,2	O4M (24,2)		23,2	O6M (24,2)		31,2	O8M (24,2)
8,1	O2M (27,1)		16,1	O4M (27,1)		24,1	O6M (27,1)		32,1	O8M (27,1)
8,2	O2M (27,2)		16,2	O4M (27,2)		24,2	O6M (27,2)		32,2	O8M (27,2)

Table 28. XOC-1k SO-C -spine connection map. All switch ports are 800G OSFP. All spine-leaf connections are optical, and all connections between the storage spine switches and the head-end storage nodes are via passive DAC break-out cables. All optical modules are dual port (dual 400G). The storage leaf-switch connection maps can be found in [1].

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7.4. In-band management network

This network, illustrated in Figure 11, connects directly to the CPUs in the pods/xPU nodes, storage servers, firewalls, and metadata servers. The in-band network provides a physically separate path for node provisioning, job scheduling, data movement, telemetry collection, and software updates. Figure 12 contains the network element port-numbering plans and Table 29 contains the connection map for the in-band network.

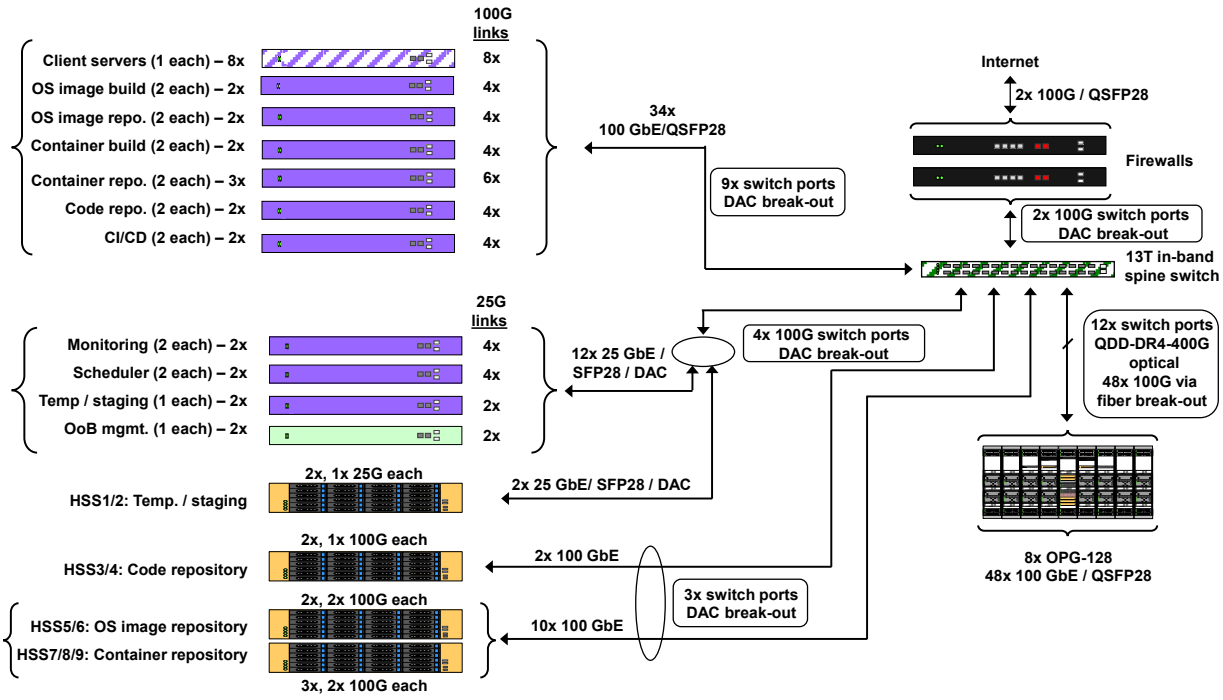
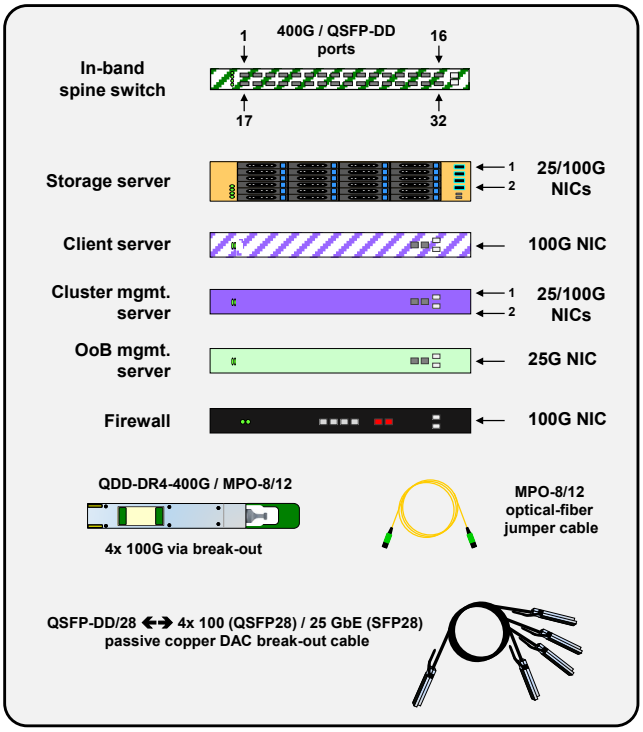


Figure 11. XOC-1k in-band management network.

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Key	
IBS (a, b)	In-band spine switch port a module port / DAC leg b
OcIBL (d)	OPG-128 c In-band leaf-switch port d
HSSd (e)	Head-end storage server d NIC port e
CSf	Client server f
CMSg (h)	Cluster management server g port h
OoBi	OoB management server I
FWj	Firewall j

Figure 12. XOC-1k in-band management network port number plan.

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IBS port	Network element		IBS port	Network element		IBS port	Network Element		IBS port	Network element
IBS (1,1)	O1IBL (1)		IBS (9,1)	O6IBL (3)		IBS (17,1)	CMS4(1)		IBS (25,1)	HSS1 (1)
IBS (1,2)	O1IBL (2)		IBS (9,2)	O6IBL (4)		IBS (17,2)	CMS4(2)		IBS (25,2)	HSS2 (1)
IBS (1,3)	O1IBL (3)		IBS (9,3)	O6IBL (5)		IBS (17,3)	CMS5(1)		IBS (25,3)	
IBS (1,4)	O1IBL (4)		IBS (9,4)	O6IBL (6)		IBS (17,4)	CMS5(2)		IBS (25,4)	
IBS (2,1)	O1IBL (5)		IBS (10,1)	O7IBL (1)		IBS (18,1)	CMS6(1)		IBS (26,1)	HSS3 (1)
IBS (2,2)	O1IBL (6)		IBS (10,2)	O7IBL (2)		IBS (18,2)	CMS6(2)		IBS (26,2)	HSS4 (1)
IBS (2,3)	O2IBL (1)		IBS (10,3)	O7IBL (3)		IBS (18,3)	CMS7(1)		IBS (26,3)	HSS5 (1)
IBS (2,4)	O2IBL (2)		IBS (10,4)	O7IBL (4)		IBS (18,4)	CMS7(2)		IBS (26,4)	HSS5 (2)
IBS (3,1)	O2IBL (3)		IBS (11,1)	O7IBL (5)		IBS (19,1)	CMS8(1)		IBS (27,1)	HSS6 (1)
IBS (3,2)	O2IBL (4)		IBS (11,2)	O7IBL (6)		IBS (19,2)	CMS8(2)		IBS (27,2)	HSS6 (2)
IBS (3,3)	O2IBL (5)		IBS (11,3)	O8IBL (1)		IBS (19,3)	CMS9(1)		IBS (27,3)	HSS7 (1)
IBS (3,4)	O2IBL (6)		IBS (11,4)	O8IBL (2)		IBS (19,4)	CMS9(2)		IBS (27,4)	HSS7 (2)
IBS (4,1)	O3IBL (1)		IBS (12,1)	O8IBL (3)		IBS (20,1)	CMS10(1)		IBS (28,1)	HSS8 (1)
IBS (4,2)	O3IBL (2)		IBS (12,2)	O8IBL (4)		IBS (20,2)	CMS10(2)		IBS (28,2)	HSS8 (2)
IBS (4,3)	O3IBL (3)		IBS (12,3)	O8IBL (5)		IBS (20,3)	CMS11(2)		IBS (28,3)	HSS9 (1)
IBS (4,4)	O3IBL (4)		IBS (12,4)	O8IBL (6)		IBS (20,4)	CMS11(2)		IBS (28,4)	HSS9 (2)
IBS (5,1)	O3IBL (5)		IBS (13,1)	CS1		IBS (21,1)	CMS12(1)		IBS (29,1)	FW1
IBS (5,2)	O3IBL (6)		IBS (13,2)	CS2		IBS (21,2)	CMS12(2)		IBS (29,2)	FW2
IBS (5,3)	O4IBL (1)		IBS (13,3)	CS3		IBS (21,3)	CMS13(1)		IBS (29,3)	
IBS (5,4)	O4IBL (2)		IBS (13,4)	CS4		IBS (21,4)	CMS13(2)		IBS (29,4)	
IBS (6,1)	O4IBL (3)		IBS (14,1)	CS5		IBS (22,1)	CMS14(1)		IBS (30,1)	
IBS (6,2)	O4IBL (4)		IBS (14,2)	CS6		IBS (22,2)	CMS14(2)		IBS (30,2)	
IBS (6,3)	O4IBL (5)		IBS (14,3)	CS7		IBS (22,3)	CMS15(1)		IBS (30,3)	
IBS (6,4)	O4IBL (6)		IBS (14,4)	CS8		IBS (22,4)	CMS15(2)		IBS (30,4)	
IBS (7,1)	O5IBL (1)		IBS (15,1)	CMS1(1)		IBS (23,1)	CMS16(1)		IBS (31,1)	
IBS (7,2)	O5IBL (2)		IBS (15,2)	CMS1(2)		IBS (23,2)	CMS16(2)		IBS (31,2)	
IBS (7,3)	O5IBL (3)		IBS (15,3)	CMS2(1)		IBS (23,3)	CMS17(1)		IBS (31,3)	
IBS (7,4)	O5IBL (4)		IBS (15,4)	CMS2(2)		IBS (23,4)	CMS17(2)		IBS (31,4)	
IBS (8,1)	O5IBL (5)		IBS (16,1)	CMS3(1)		IBS (24,1)	CMS18(1)		IBS (32,1)	
IBS (8,2)	O5IBL (6)		IBS (16,2)	CMS3(2)		IBS (24,2)	CMS19(1)		IBS (32,2)	
IBS (8,3)	O6IBL (1)		IBS (16,3)	CMS3(1)		IBS (24,3)	OOb1 (1)		IBS (32,3)	
IBS (8,4)	O6IBL (2)		IBS (16,4)	CMS3(2)		IBS (24,4)	OOb2 (1)		IBS (32,4)	

Tables 29. XOC-1 in-band management connection map. All spine-leaf connections between the OPG-128 leaf -switches and the in-band management spine-switch are optical. All other connections are via passive DAC cables. The in-band management leaf-switch connection maps for the OPG-128s can be found in [1]. All other connections use passive DAC cables.

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7.5. Out-of-band (OoB) management network

The OoB management network, illustrated in Figure 13, connects the baseboard management controllers (BMCs) of the network elements in the XOC-1k to the management server located in a head node of the XOC-1k. The port-numbering plan is shown in Figure 4, and Tables 30-37 contain the connection maps for this network.

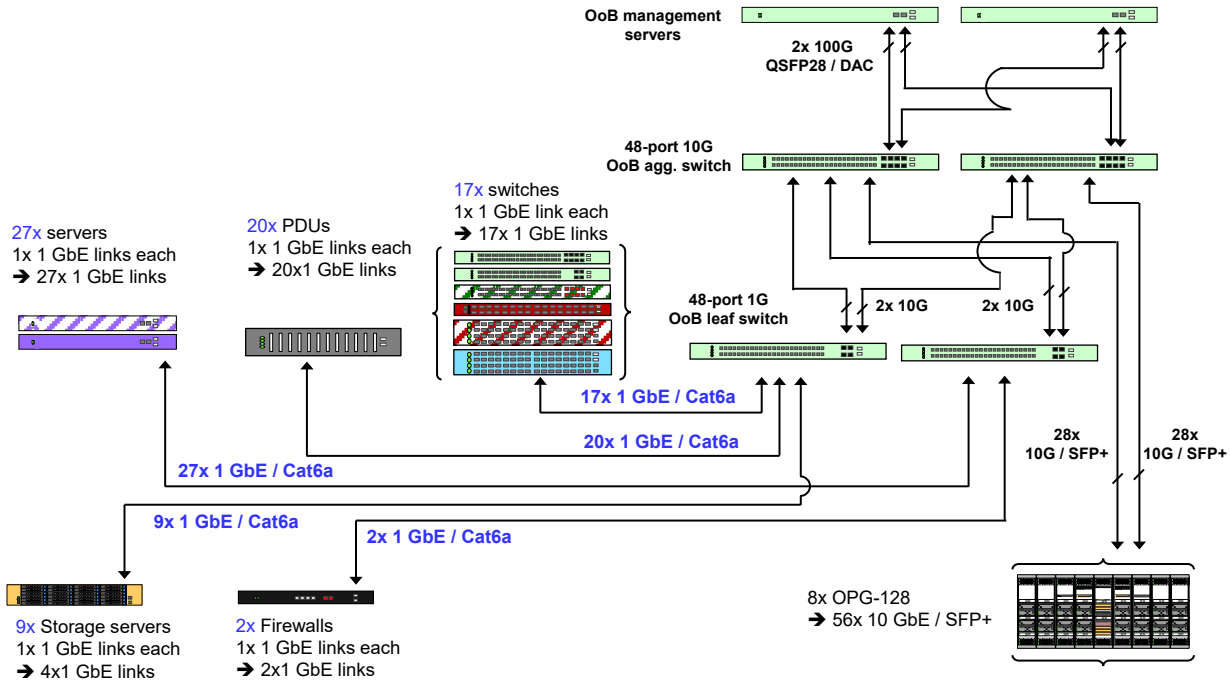


Figure 13. OPG-128 out-of-band management network for the head-end nodes. The switch count, jumper-cable count, and uplink cable count are indicated.

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OoBL1 downlink port	Network element		OoBL1 downlink port	Network element		OoBL1 downlink port	Network element		OoBL1 downlink port	Network element
1	P1,1		13	P4,1		25	SO5		37	OoBS2
2	P1,2		14	P4,2		26	SO6		38	HSS1
3	P1,3		15	P4,3		27	SO7		39	HSS2
4	P1,4		16	P4,4		28	SO8		40	HSS3
5	P2,1		17	P5,1		29	St1		41	HSS4
6	P2,2		18	P5,2		30	St2		42	HSS5
7	P2,3		19	P5,3		31	St3		43	HSS6
8	P2,4		20	P5,4		32	SO-C		44	HSS7
9	P3,1		21	SO1		33	IBS		45	HSS8
10	P3,2		22	SO2		34	OoBL1		46	HSS9
11	P3,3		23	SO3		35	OoBL2		47	
12	P3,4		24	SO4		36	OoBS1		48	

Table 30. Out-of-band leaf-switch #1 (OoBL1) down-link connection map. All downlink connections are 1 GbE/Cat6.

OoBL2 1G downlink port	Network element		OoBL2 1G downlink port	Network element		OoBL2 1G downlink port	Network element		OoBL2 1G downlink port	Network element
1	CMS1		13	CMS13		25	CS6		37	
2	CMS2		14	CMS14		26	CS7		38	
3	CMS3		15	CMS15		27	CS8		39	
4	CMS4		16	CMS16		28	FW1		40	
5	CMS5		17	CMS17		29	FW2		41	
6	CMS6		18	CMS18		30			42	
7	CMS7		19	CMS19		31			43	
8	CMS8		20	CS1		32			44	
9	CMS9		21	CS2		33			45	
10	CMS10		22	CS3		34			46	
11	CMS11		23	CS4		35			47	
12	CMS12		24	CS5		36			48	

Table 31. Out-of-band leaf-switch #2 (OoBL2) down-link connection map. All downlink connections are 1 GbE/Cat6.

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OoBL1 10G uplink port	Network Element (port)
1	OoBA1 (5)
2	OoBA1 (6)
3	OoBA2 (5)
4	OoBA2 (6)

Table 32. Out-of-band leaf-switch #1 (OoBL1) uplink connection map. All uplink connections are 10 GbE/Cat6.

OoBL2 10G uplink port	Network Element (port)
1	OoBA1 (7)
2	OoBA1 (8)
3	OoBA2 (7)
4	OoBA2 (8)

Table 33. Out-of-band leaf-switch #2 (OoBL2) uplink connection map. All uplink connections are 10 GbE/Cat6.

OoBA1 downlink port	Network element	OoBA1 downlink port	Network element	OoBA1 downlink port	Network element	OoBA1 downlink port	Network element
1		13	O1OoB2 (U1)	25		37	O3OoB2 (U3)
2		14	O1OoB2 (U2)	26		38	O4OoB1 (U1)
3		15	O1OoB2 (U3)	27		39	O4OoB1 (U2)
4		16	O2OoB1 (U1)	28		40	O4OoB1 (U3)
5	OoBL1 (U1)	17	O2OoB1 (U2)	29	O2OoB2 (U2)	41	O4OoB1 (U4)
6	OoBL1 (U2)	18	O2OoB1 (U3)	30	O2OoB2 (U3)	42	O4OoB2 (U1)
7	OoBL2 (U1)	19	O2OoB1 (U4)	31	O3OoB1 (U1)	43	O4OoB2 (U2)
8	OoBL2 (U2)	20	O2OoB2 (U1)	32	O3OoB1 (U2)	44	O4OoB2 (U3)
9	O1OoB1 (U1)	21		33	O3OoB1 (U3)	45	
10	O1OoB1 (U2)	22		34	O3OoB1 (U4)	46	
11	O1OoB1 (U3)	23		35	O3OoB2 (U1)	47	
12	O1OoB1 (U4)	24		36	O3OoB2 (U2)	48	

Table 34. Out-of-band aggregation-switch #1 (OoBA1) downlink connection map. All downlink connections are 10 GbE/Cat6.

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OoBA2 downlink port	Network element	OoBA2 downlink port	Network element	OoBA2 downlink port	Network element	OoBA2 downlink port	Network element
1		13	O5OoB2 (U1)	25		37	O7OoB2 (U3)
2		14	O5OoB2 (U2)	26		38	O8OoB1 (U1)
3		15	O5OoB2 (U3)	27		39	O8OoB1 (U2)
4		16	O6OoB1 (U1)	28		40	O8OoB1 (U3)
5	OoBL1 (U3)	17	O6OoB1 (U2)	29	O6OoB2 (U2)	41	O8OoB1 (U4)
6	OoBL1 (U4)	18	O6OoB1 (U3)	30	O6OoB2 (U3)	42	O8OoB2 (U1)
7	OoBL2 (U3)	19	O6OoB1 (U4)	31	O7OoB1 (U1)	43	O8OoB2 (U2)
8	OoBL2 (U4)	20	O6OoB2 (U1)	32	O7OoB1 (U2)	44	O8OoB2 (U3)
9	O5OoB1 (U1)	21		33	O7OoB1 (U3)	45	
10	O5OoB1 (U2)	22		34	O7OoB1 (U4)	46	
11	O5OoB1 (U3)	23		35	O7OoB2 (U1)	47	
12	O5OoB1 (U4)	24		36	O7OoB2 (U2)	48	

Table 35. Out-of-band aggregation-switch #2 (OoBA2) downlink connection map. All downlink connections are 10 GbE/Cat6.

Table 36

OoBA1` 100G uplink port	Network Element (port)
1	OOB Mgmt Server
2	OoB Mgmt Server
3	OOB Mgmt Server
4	OoB Mgmt Server

Table 37

OoBA2 100G uplink port	Network Element (port)
1	OOB Mgmt Server
2	OoB Mgmt Server
3	OOB Mgmt Server
4	OoB Mgmt Server

Tables 36 and 37. Out-of-band aggregation-switch uplink connection map. All uplink connections are 100 GbE / passive DAC. Top: Out-of-band aggregation switch #1 (OoBA1). Bottom: Out-of-band aggregation switch #2 (OoBA2).

Date: January 2026

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8. XOC-1k kit

Table 38 contains a list and count of the major hardware elements of an XOC-1k.

Item	Number
Intrastructure	
OR v3 racks	5
5.8 kW power supplies	20
Fiber management	Design choice *Note 2*
Servers / firewalls	
Client servers	8
Out-of-band management servers	2
Scheduler servers	2
Monitoring/observability servers	2
OS image build & deploy servers	2
OS image repository servers	2
Container build servers	2
Container repository servers	3
Code repository servers	2
Continuous development/ iteration servers	2
Temporary / staging servers	2
Data-storage servers	9
Firewalls	2
Ethernet switches	
51T Scale-out spine (64x OSFP)	8
26T Scale out-CPU spine (32x OSFP)	1
51T Storage spine (64x OSFP)	3
13T In-band spine (32x 400G/QSFP-DD)	1
Out-of-band leaf (48x 1G/RJ45)	2
Out-of-band aggregation (48x 10G/SFP)	2

Item	Number
Optical Modules	
800G single-mode OSFP (2x 400G)	672
400G single-mode QSFP--DD (4x 100G)	12
10G single-mode SFP+	56
Optical fiber patch cables	
MPO-8/12 single-mode	1,356
LC single-mode	104
Optical-fiber cable break-out	
Cable assembly or modular	Design choice *Note 3*
Passive DAC cables	
800G OSFP <==> 4x 400G / QSFP112	8
400G QSFP-DD <==> 4x 100G / SFP56	12
100G QSFP-DD <==> 4x G / SFP28	4
QSFP28 <==> QSFP 28	2
Copper patch cables	
Cat6a jumper	75

Table 38. XOC-1k hardware kit.

Notes

1. Detailed descriptions of the equipment, including NIC requirements, are found in Section 6.
2. Fiber management hardware selection and rack design depends on data-center trunk/plenum cabling selection and policies.
3. Optical-fiber break-out hardware, needed for interconnecting 100G and 10G optical links with trunk/plenum cables, design depends on data-center trunk/plenum cabling selection and policies.

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9. Network utilization

Table 39 summarizes the utilization and surplus capacity of the five networks contained by an XOC-1k.

Network	Switch count	Switch capacity (Tb/s)	Ports per switch	Port speed (Gb/s)	Network capacity (Tb/s)	Network port count	Occupied ports	Network utilization	Available capacity (Tb/s)	Available capacity ports
Scale-out	8	51	64	800	408	512	512	100%	0	0
Scale out - CPU	1	26	32	800	26	32	32	100%	0	0
Storage	3	51	64	800	153	192	93	48%	79	99
In-band	1	13	32	400	13	32	29	91%	1	3
OoB leaf	2	0.05	48	1	0.1	96	75	78%	0.02	21
OoB spine	2	0.5	48	10	1	96	66	69%	0.3	30

Table 39. XOC-1k network utilization and surplus capacity.

10. Adapting the XOC-1k design for smaller and larger clusters

For cluster designs with fewer than eight OPG-128s, it may be possible to reduce some of the resources at the spine / aggregation / head-end layer without impacting the availability of critical functions or the level of performance represented by the full XOC-1k design. Areas of potential savings include:

- Scale-out and storage spine: Depending on the number of leaf-spine links needed by the smaller cluster, it may be possible to reduce the number of spine switches.
- OoB leaf and spine: Depending on the total number of network elements contained by the entire cluster, it may be possible to remove either a leaf OoB switch, a spine OoB switch, or both, from the design.
- Client servers: Depending on the number of xPUs in the smaller cluster, it may be possible to reduce the number of client servers.
- Container repository servers: Depending on the number of xPUs in the smaller cluster, it may be possible to reduce the number of container repository servers from three to two.
- Container repository storage servers: Depending on the number of xPUs in the smaller cluster, it may be possible to reduce the number of container repository storage servers from three to two.

For cluster designs with more than eight OPG-128s, necessary modifications will depend on the available / surplus capacity of each of the resources in the current XOC-1k design. Following are comments on key elements:

- Scale-out and scale-out CPU spines: These spines are at 100% utilization in the current design. New switches are required, with the number depending on how many additional OPG-128s are added. to match. Also, leaf-spine cabling must be remapped.

- Storage spine: Utilization of this resource is approximately 50% in the XOC-1k design (see Table 39), indicating that the requirements of any design up to an XOC-2k can be met by the current

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storage spine. For designs larger than an XOC-2k, additional switches are needed and the storage-spine cabling must be remapped.

- In-band and out-of-band spine-layer networks: Table 39 shows that these networks are close to full utilization for an XOC-1k. Accordingly, larger designs likely will need additional switches for these networks and the cabling must be remapped.
- Client, cluster-management, and storage servers: The required number of these units will depend on the specific function and number of xPUs in the larger cluster (see Sections 6.2.1, 6.2.2, and 6.2.3).

11. References

[1] Lowell D. Lamb, et al, Open Pod Group for M xPUs (OPG-M) System Architecture, 202x, Open Compute Project (2025).

[2] Lowell D. Lamb and Loren Staley, Open Cluster Designs for AI, Open Compute Project (2025).

[3] Madhusudan Iyengar, John Leung, Greg Sellman, and John Stuewe, Eds., Open Systems for AI: Blueprint for a scalable infrastructure, Version 1.0.0. Open Compute Project (2025). https://www.opencompute.org/documents/ocp-open-systems-for-ai-whitepaper-v1-0-0-final-pdf.
[4] Software for Open Networking in the Cloud (SONiC), 2023, The Linux Foundation, https://sonicfoundation.dev/.

[5] Open Rack V3 specifications, 2023, Open Compute Project, https://www.opencompute.org/contributions?contributions%5BrefinementList%5D%5Bfamily%5D%5B0%5D=OpenRack%20v3.

[6] Kubernetes website, Cloud Native Computing Foundation, https://kubernetes.io/ .

[7] Charles, Clos, *A study of non-blocking switching networks*, **Bell System Technical Journal 32**, (2), 406–424 (March 1953).

[8] Redfish specifications, Distributed Management Task Force, https://www.dmtf.org/standards/redfish.

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12. Glossary

Aggregation Network:	A network that aggregates traffic from multiple OPG-Ms and provides connectivity to upstream networks and/or resources. In this context, the SO-C, storage, in-band management, and OoB management networks all have separate aggregation networks.
BMC	A *BaseBoard Management Controller* is a small, specialized processor that is integrated into the motherboard of a managed device and is used for remote monitoring and management.
Cluster:	The term cluster is used to denote all of the network elements that, taken together, comprise a scale-out domain.
CPU:	Central Processing Unit. A CPU is a general-purpose processor that runs the high-layer applications in the OPG-M.
DAC Cable:	Direct Attach Copper (cable). Short-reach (5m or less) copper cables used for high data rate, intra OPG connections. In this design all DACs are passive (no DSPs).
In-Band Management Network:	This dedicated network connects directly to the CPUs in the pods/xPU nodes, storage servers, and meta-data servers. It provides a physically separate path to the cluster-wide head-end nodes located at the spine / aggregation level.
Leaf Switch:	In a multi-tiered switching network, leaf switches occupy the lowest switching tier and connect to the end points.
Metadata Server:	The metadata servers belong to the storage subsystem. They are specialized servers responsible for data storage, data transfer, and file-sharing requests. These units do not participate directly in the bulk transfer or storage of cluster data.
NIC:	Network Interface Controller / Card. A hardware element that allows a CPU or xPU to connect to a network. PCIe cards are a common form factor for NICs.
OPG-M:	The Open Pod Group of M xPUs is the principle building block of an XOC-N. An OPG-M is defined using OCP-based solutions wherever practical.

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Out-of-Band Management Network:	A dedicated, out-of-band management network for the pods/xPU-nodes, network switches, storage servers, etc., that make up the cluster.
PDU:	Power distribution unit.
Pod:	A pod refers to a liquid-cooled, rack-scale system containing a large number (typically 64 or more) of xPUs that are all members of a common scale-up domain, together with all of the other resources required for the function of the member xPUs.
Redfish Profile:	A JSON document enumerating resources and properties that must, should, or could be implemented by a software service accessed via an API.
Scale-out Fabric:	This network supports xPU-to-xPU communication between xPUs in different pods/xPU-nodes. Compared to the scale-up domain, scale-out networks can be much larger, connecting anywhere from a few dozen to over a hundred thousand xPUs. It is designated as a fabric because of its role in supporting high-speed data transfer internal to the cluster. Direct, external connections to this fabric typically are not permitted.
Scale-out – CPU (SO-C) Fabric:	This fabric provides CPU-to-CPU connectivity within the cluster. It is designated as a fabric because of its role in supporting high-speed data transfer internal to the cluster. Direct, external connections to this fabric are not permitted.
Scale-up Fabric:	This network connects a relatively small number of hardware accelerators to form a high-bandwidth, low-latency domain that acts as a single, logical unit and is optimized for distributed processing and highly parallel data movement. It is designated as a fabric because of its role in supporting high-speed data transfer internal to the cluster. Direct, external connections to this fabric typically are not permitted.
SONiC:	An open-source network operating system (NOS) based on Linux.
Spine Switch:	In a multi-tiered switching network, spine switches occupy the highest switching tier and cross-connect the leaf switches.

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Storage Fabric:	The network responsible for data flow between the storage system and the pods/xPU-nodes. It is designated as a fabric because of its role in supporting high-speed data transfer internal to the cluster. Direct, external connections to this fabric typically are not permitted.
Storage Server:	High-density units that contain multiple NVMe drive bays. These units are attached to the storage fabric using high-speed Ethernet links, and are controlled by the metadata servers.
UBB:	Refers to the *Open Accelerator Infrastructure Universal Baseboard (OAI-UBB)*, which is a key component within the OCP *Open Accelerator Infrastructure (OAI)* initiative. The OAI-UBB is a modular baseboard designed to support multiple Open Accelerator Modules (OAMs).
xPU:	A generic term for the special-purpose AI accelerator responsible for the computationally intensive operations of AI models. Examples in this category include GPUs and TPUs.
xPU-Node:	A small network element which contains a small number (typically eight) of xPUs that are all members of a common scale-up domain, together with all of the other resources required for the function of the member xPUs.
XOC-N:	An xPU Open Cluster for N XPUs contains n XPUs, and is constructed using OCP-based solutions wherever practical.

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