

OPEN

Compute Project

Poseidon V1 E1.S SSD Storage System

Version 1.0
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1. License

1.1. OPTION B: Open Web Foundation (OWF) CLA

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Notes:

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1.2 Acknowledgements

The Contributors of this Specification would like to acknowledge the following companies for their feedback:

List all companies or individuals who may have assisted you with the specification by providing feedback and suggestions but did not provide any IP.

2. Compliance with OCP Tenets

Please describe how this contribution addresses compliance with three out of the four OCP Tenets.

Note: The ideals behind open sourcing stipulate that everyone benefits when we share and work together. Any open source project is designed to promote sharing of design elements with peers and to help them understand and adopt those contributions. There is no purpose in hearing if all parties aren't aligned with that philosophy. The IC will look beyond the contribution for evidence that the contributor is aligned with this philosophy. The contributor actions, past and present, are evidence of alignment and conviction to all the tenets.

2.1 Openness

The Poseidon V1 Design Specification provides openness by providing a design for the latest EDSFF E1.S SSD reference system which can be used as a high performance shared network storage system for NVMe-oF. This system design also can be used as a reference of the latest PCIe Gen4 platform to help customize of other data center systems. This base specification is jointly contributed by Samsung and Inspur, with commitment to have associated products made available to cover the enterprise usage model supporting E1.S SSD. The specification requires many of the mature OCP elements as part of the building blocks for the 1U/2U product. Poseidon V1 E1.S SSD storage system specification also required firmware open source for Openness.

2.2 Efficiency

One of the advantages of EDSFF E1.S form factor is its robustness of power efficiency in high speed interface such as PCIe Gen4. By adopting the latest form factor, the system offers improved IOPs per watt compare to traditional all flash storage system. The orthogonal backplane system design not only improve the power efficiency, but lower the temperature of SSDs. 19-inch 1U/2U form factor as an easy adoption choice for the enterprise community members. We understand that there are many more advanced and efficient designs within the OCP community. However, many of those designs required a much significant change/modification of the existing infrastructure. The goal of the Poseidon V1 E1.S SSD storage system specification under GP Enterprise Server specification is to allow a pathway for end users to adopt many of the mature OCP elements in the conventional 19” form factor so that they can enjoy the outcome/results of the community without taking that “full” step forward of changing their existing infrastructure.

2.3 Impact

EDSFF form factor was first introduced at SNIA in 2017, but it has yet to become popular in the industry despite the various advantages to the data center system. By providing the reference system design to the industry, one can expect to copy our idea and build customized system to utilize the EDSFF E1.S devices to expand an eco-system. Moreover, the Poseidon System accommodates the industry first OCP NVMe SSD Specification compliant Samsung PM9A3 OCP SSD which proves the effectiveness of OCP community defined technology. With at least Samsung/Inspur signed up for the initial workstream, and we anticipate more system vendors joined this E1.S SSD and GP enterprise server discussion. As a community, we will have a new “baseline” for any future 1U/2U design supporting E1.S SSD that makes consuming OCP products (with OCP elements) much easier. Both Samsung, Inspur signed up for the project intent to GTM with an actual product based on this spec in 2021.

3. Version Table

Date	Revision #	Author	Description
2021/10/4	0.1	Jungsoo Kim, Alan Chang	initial draft
2022/03/	0.3	Mehee Yun	Contents and format update
2022/5/10	0.5	Inspur team	CAD drawings and hyperlinks updated
2022/5/13	0.7	Jungsoo Kim, Mehee Yun	Minor changes to submit
2022/5/24	0.8	Inspur team	Minor changes to submit
2022/08/16	1.0	Samsung & Inspur	Minor changes for IC review

4. Terminology

Terminology	Definition
Bezel	Aesthetic plastic or metal front-facing cover of a typical computer server.
Cabinet	A freestanding and self-supporting 4-post enclosure for housing electrical and/or electronic equipment. It is usually fitted with access doors and/or side panels, which may or may not be removable.
Chassis	A mechanical structure designed specifically to support associated electrical and electronic components.
EIA-310-D	EIA-310-D is the original document issued by the Electronic Industries Association (renamed the Electronic Alliance in 1997) written to standardize varying features of 19” rack cabinets.
EIA Mounting Flange	The front internal mounting surface within a Cabinet Enclosure or Rack that provides a mounting surface for the server chassis, chassis guides, or slide rails.
Open Units (OU)	An Open Unit, or OU, is 48mm high, and are used instead of Rack Units in Open Rack specifications.
Rack	An open-air structure for mounting electrical or electronic equipment. A Rack is an open Cabinet. There are 2 basic types of Racks, 2-post & 4-post.
Rack Unit (RU)	Equal to 1.75 inches (44.45 millimeters)
Slide Rails	A slide rail is used to mount servers in a 2-post or 4-post rack, and also extend out from the rack for service. There can be sliding, fixed, or tool-less designs.

5. Scope

This specification describes the design of the Poseidon V1 E1.S SSD Storage System based on Intel Xeon Scalable processors (formerly codename Ice Lake) Intel Xeon. This document provides the reference specifications for the General Purpose Enterprise Server of 19” products supporting E1.S SSD, detailing the features and functionality of a general purpose 2-socket server board for adoption by the Open Compute Project community. The purpose of this document is to define a common baseline set of features that are most important to general purpose usage by enterprise and private cloud operators. ODM or OEM products will comply with the features sets that are important to “general purpose” usage.

6. Overview

This document serves as the specification for the Poseidon V1 – EDSFF E1.S reference system design. Poseidon V1 is a rack-mounted, all-flash-based storage server in a 1U EIA-310D (19”) form factor with Samsung PM9A3 E1.S devices. It is comprised of 32 X E1.S SSD drives (up to 8TB of each SSD) connected to a compute motherboard via a PLX PCIe switch fabric, dual Intel® Xeon® processors and up to 2X100Gbe NIC cards. Each processor has a PCIe root complex to connect to the NICs and the Microchip PCIe switches. The processors function in a fully balanced and symmetrical topology to deliver the desired bandwidth from the E1.S SSDs, as well as from NICs out the box. Poseidon V1 can deliver a 256TB and 102GB of read bandwidth in a 1U system.

The Poseidon V1 system uses the latest Intel Whitley baseboard architecture, but extends the PCIE port to connect with a Microchip PCIE switch, in order to support 32 EDSFF E1.S NVMe SSDs. Poseidon V1 also uses the latest generation of Microchip PCIE switch PM40100. Each PM40100 connects X32 PCIe links from the CPU to 16 E1.S NVMe SSDs. The two PM40100 switches are able to support a total of 32 E1.S NVMe SSDs within a single system.

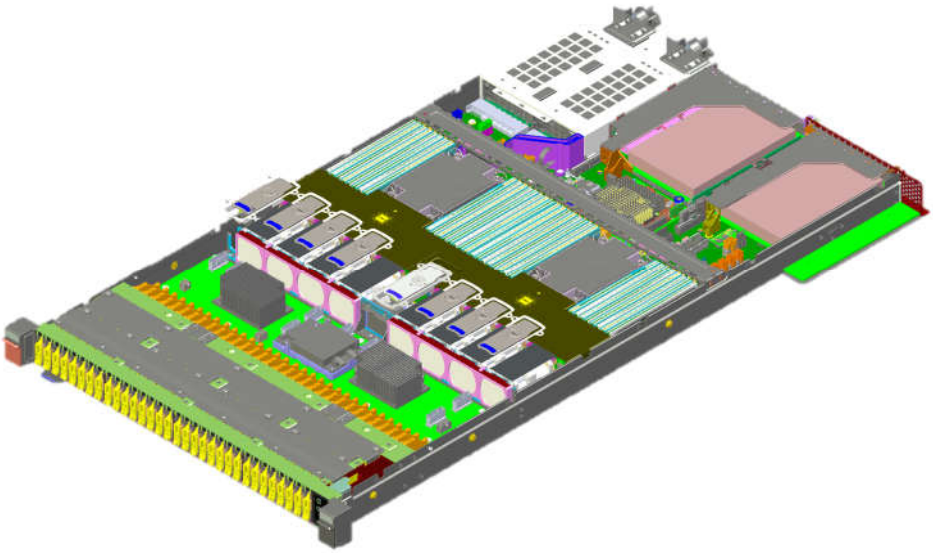


Figure 1 Poseidon V1 E1.S storage system

The Poseidon system is designed to use Intel Xeon Ice Lake Scalable processors utilizing the performance of 3rd Generation Intel Xeon Scalable processors, and it works together with 32 DDR4 dimm memories and Intel’s C621A Chipset series Platform Controller Hub (PCH).

Poseidon V1 has an EIA standard 1U chassis. It should be used at the product level, as a popular form-factor chassis for datacenter storage servers. The chassis holds an Intel Ice Lake Xeon-based baseboard in its rear section, cooling fans in the middle, and a modular backplane, plus up to 32 NVME

SSD drives in the front drive bay area. It should have a front panel on its right on the front side, which includes a power button, reset button, LEDs to indicate power and status. The rear of the chassis has two redundant hot plug power supplies whose power capacity is 1300Watt to support maximum system power.

To optimize performance, the Poseidon V1 system utilizes all PCIe resources in a balanced and symmetric topology. We extracted all the PCIe IOs available through Ice Lake and provides maximum bandwidth to each SSDs by providing PCIe Gen4 x4 lanes to maximize system storage IO performance.

Item	Description	
Time to Market	2021/4	
Processor	Processor Type	2 third generation Intel® Xeon® scalable processors (TDP at 185 W)
Chipset	Chipset Type	C621A
Memory	Memory Type	RDIMM, LRDIMM, and Barlow Pass
	Memory Slot Qty	32
	Total Memory Capacity	Up to 10 TB
Storage	Storage Configuration	Front panel: • 32 hot-swap E1.S SSDs Internal storage: • Up to 2 TF cards (one for BIOS and the other for BMC) • Up to 2 SATA M.2 drives
I/O Connector	USB Port	2 rear USB 3.0 ports
	Video	1 rear VGA ports
	Serial Port	1 rear serial port
	UID LED Interface	2 UID buttons with LEDs (1 front and 1 rear)
	Management Network Port	One 1000 Mbps BMC management network port
Display	Controller Type	Integrated in the Aspeed AST2500 chip, up to 1280 × 1024 resolution
Network	NIC Controller	1 optional OCP 3.0 module (1 Gb/s, 10 Gb/s, 25 Gb/s, 40 Gb/s, 100 Gb/s) Support standard 1 Gb/10 Gb/25 Gb/40 Gb/100 Gb NICs
Expansion Slot	PCIe Expansion Slot	• Up to 2 PCI Express 4.0 slots for standard PCIe cards (2 PCIe 4.0 x16 full height cards) • 1 onboard OCP 3.0 SFF slot for OCP 3.0 card • 2 internal SATA M.2
Fan	Fan Configuration	8 hot-swap N+1 redundant fans (4056)
Power	Specification	1+1 redundant power supplies (1300 W and above)
	Power Input	Please refer to the power input on the nameplate label of the chassis
Physical	Outer Packaging Dimensions	• 840 case: 1080 × 600 × 240 mm (Length × Width × Height)

Item	Description	
	Chassis Dimensions	• With mounting ears: 32 E1.S SSDs: 482 × 43.05 × 871.8 mm (W × H × D) • Without mounting ears: 32 E1.S SSDs: 438 × 43.05 × 840 mm (W × H × D)

This product is intended to support usages requiring high storage, compute performance, configuration flexibility, common Redfish-based management, ease of deployment, and supports latest component technologies.

•Fits in a conventional 19” EIA rack.

•Support the highest TDP offering either using air-cooling or advanced cooling.

•Deliver high performance by supporting a minimum of 1 DPC at the highest memory frequency and support a balanced PCIe subsystem.

•Support conventional enterprise storage I/O requirements

•Support the industry standard OCP NIC interface.

•Provide a path for sustainable firmware by making source code available

7. Required Features

To ensure the delivery of products that can be deployed over a period of time, and assure consistency in the services offered to the client of the cloud data server, certain features must be present in each general purpose server. These features are listed in the following tables.

Features	Description
Rack Compatibility	See section 8 for detailed requirements
Processor	Supports up to 2x CPU from any CPU silicon providers. • 1U system shall support 1 or 2 165W TDP processors
Memory	• A Minimum of 1x DPC per CPU • Support for maximum memory capacity and frequency of silicon of choice. • Memory protection including ECC, memory mirroring, and memory rank sparing
Storage Requirement	Minimum requirement: 32* E1.S
Expansion Slots	Minimum requirement: 1 * OCP 3.0 slots 1 * M.2 for boot device 2 * PCIe x16 G4 (symmetric)

Networking	Minimum requirement: 1* 1Gb management port 1* OCP NIC 3.0 slot (with NCSI)
Management	See Section 14
Security Feature	TPM 2.0 (either module or on baseboard)

8. Rack Compatibility

Requirement	Status
The server chassis SHALL compliant with the EIA-310-D (or later) standard	Required
The server chassis SHALL be designed to fit in racks that are 900mm to 1000mm in depth.	Required
The chassis bezel and pull handles SHALL not extend more than 50mm beyond the EIA Mounting Flange.	Required

8.1 Chassis Dimensions

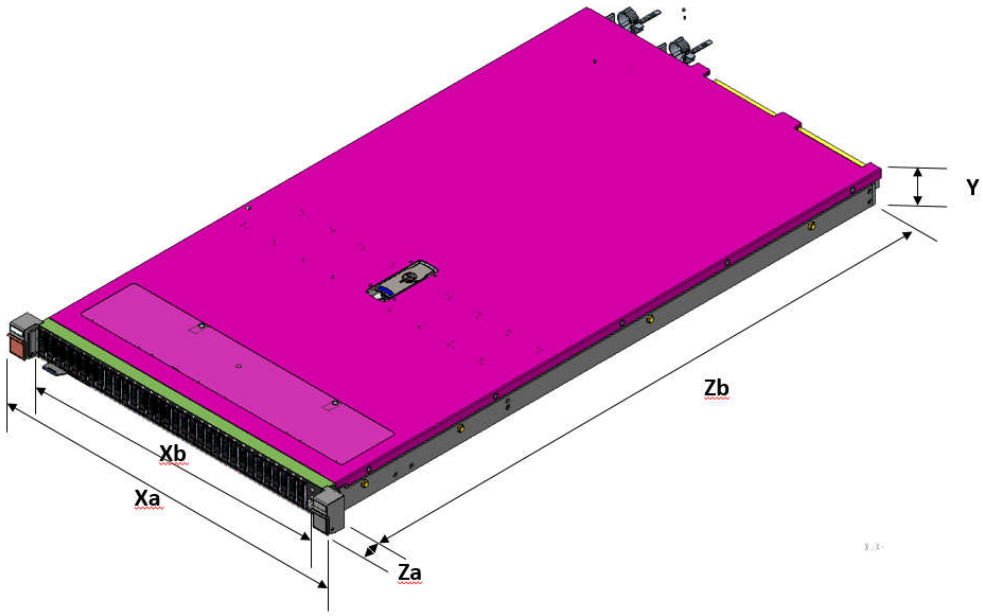


Figure 2 System dimension

System	Xa	Xb	Y	Za (with bezel)	Zb
1U Chassis	482mm	438mm	43.05mm	31.8mm	840mm

Requirement	Status
For Za, the bezel, pull handles, or outer most features should not exceed a maximum of 31.8mm beyond the front mounting flange, which allows for space to the cabinet door and airflow.	Required
The chassis height (Y) should not exceed a maximum of 43.05mm to account for stack-up tolerances, along with chassis sag and bow concerns.	Required
The total chassis length (Za + Zb) should allow space for server cables of about 152mm, and should not exceed a maximum of 748mm for 900mm rack depth, or 848mm for 1000mm rack depth.	Recommended

8.2 Thermal Considerations

Requirement	Status
The system should support front to back air flow in air-cooled environments.	Required
Support for liquid cooling should comply with the ACS Project recommendations.	Recommended

9. Block Diagram

General Purpose Server baseboard supporting E1.S SSD supports two processors and a minimum of 1x DPC. The CPUs are interconnected over either UPI or any high speed interconnect link provided by the silicon vendor.

Connected to three onboard PCIe slots via the PCIe bus, the processor supports a maximum of two PCIe Gen4 x16 full-height half-length cards or two PCIe Gen4 x16 half-height half-length cards and one PCIe Gen4 x16 full-height half-length card.

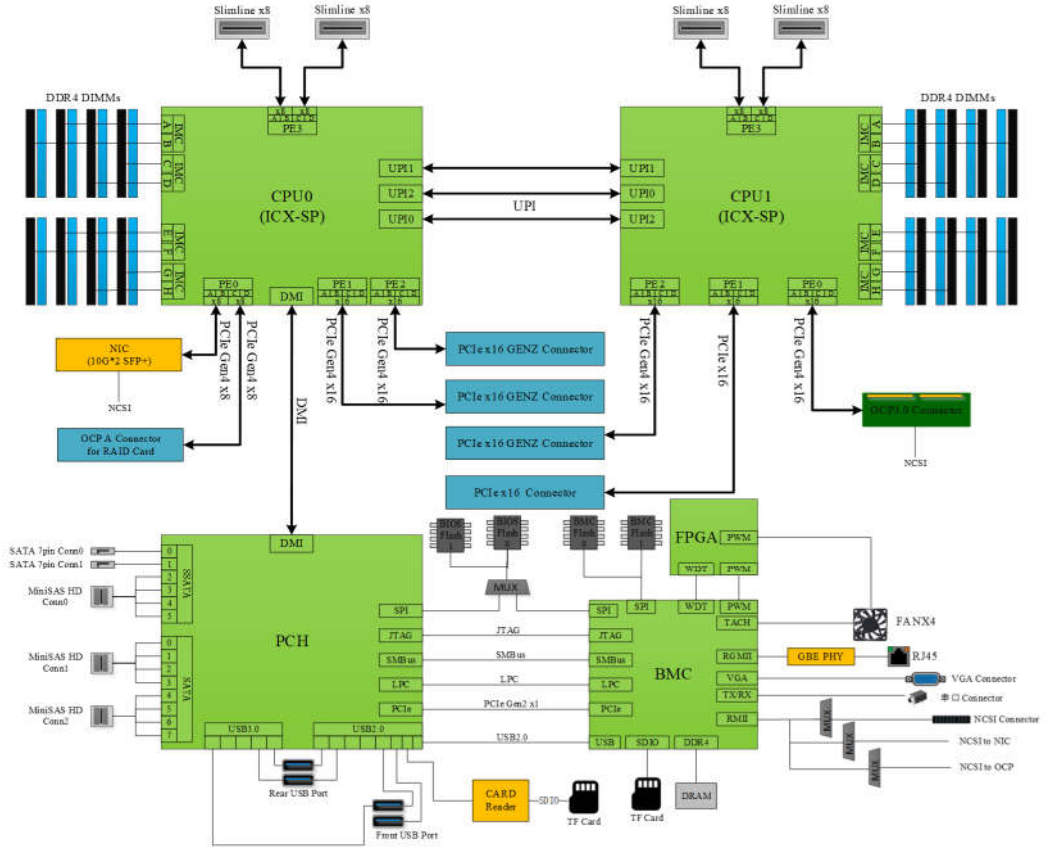


Figure 3 Reference system motherboard block diagram

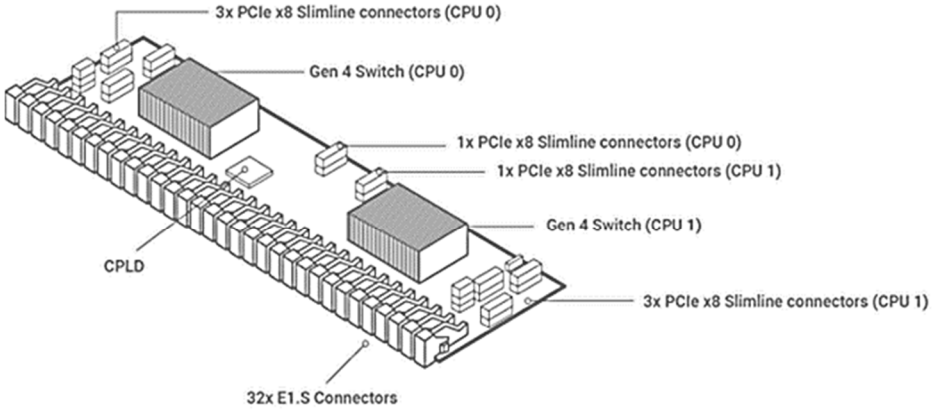


Figure 4 Poseidon system backplane

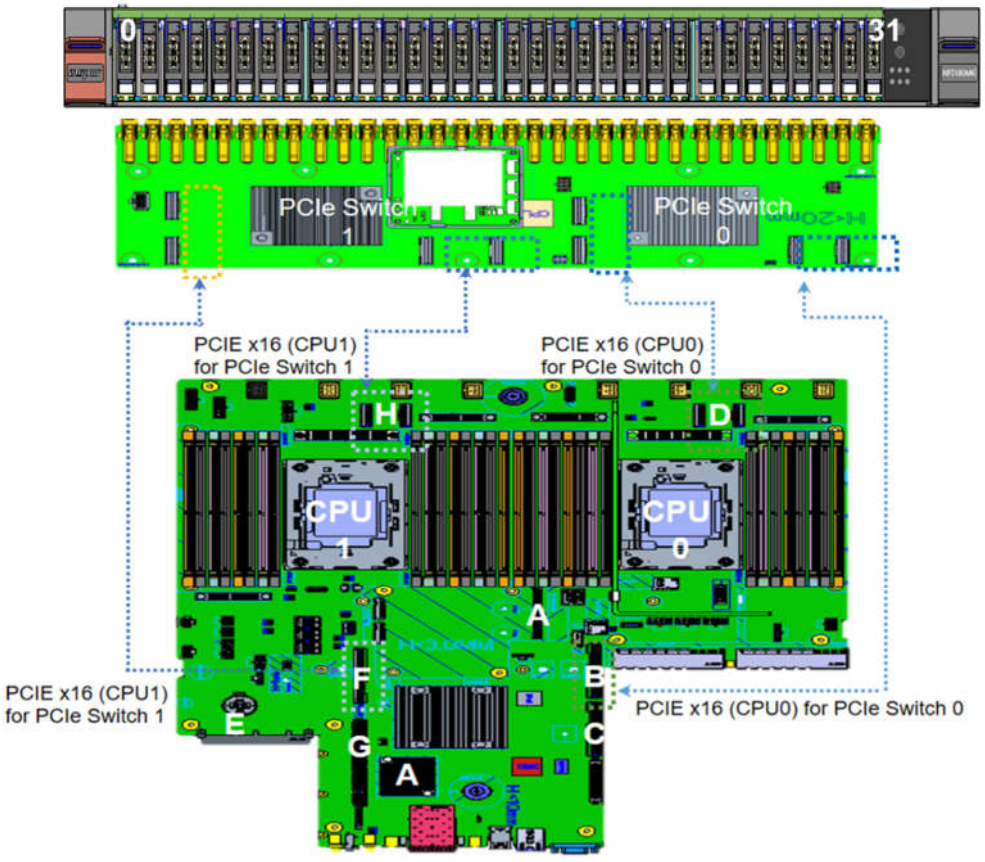


Figure 5 Poseidon V1 Motherboard

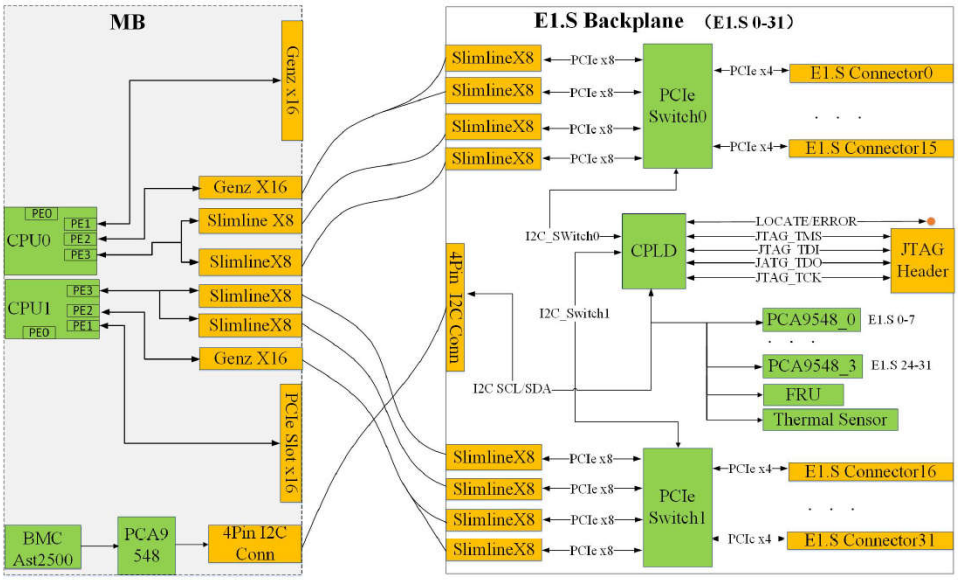


Figure 6 32 E1.S Backplane block diagram

CPU Root Port	Assignment	Connection No.
CPU0 PE0 x16	LOM（10G*2 SFP+） PE0A~B OCP A Slot for RAID MEZZ PE0C~D	A
CPU0 PE1 x16	Gen-Z 4C connector	B
CPU0 PE2 x16	Gen-Z 4C connector	C
CPU0 PE3 x16	two Slimline x8 Connectors	D
CPU1 PE0 x16	OCP 3.0 SFF Bay connector 4C+	E
CPU1 PE1 x16	PCI-e X16 connector	G
CPU1 PE2 x16	Gen-Z 4C connector	F
CPU1 PE3 x16	two Slimline x8 Connectors	H

10. Memory Subsystem Requirements

The Poseidon V1 Server supporting E1.S SSD will call out minimum 1x DPC per CPU. A maximum of two memory slots for each memory channel, DIMM0 & DIMM1 shall have different color code upon OxM choice for user to easy identify

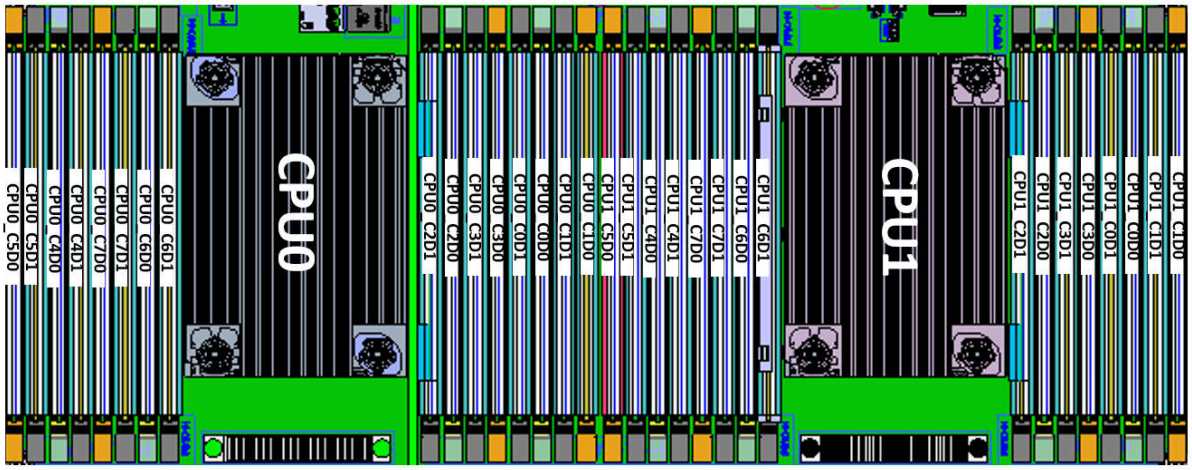


Figure 7 Poseidon V1 Memory Subsystem

11. I/O Subsystem Requirements

11.1 OCP 3.0 NIC Interface

The Poseidon V1 supporting E1.S SSD SHALL support one OCP 3.0 module at a transmission rate of 1 Gbit/s, 10 Gbit/s, 25 Gbit/s, 40 Gbit/s, or 100 Gbit/s, which is configurable. The connector pin definition must follow the OCP NIC 3.0 Design Specification.

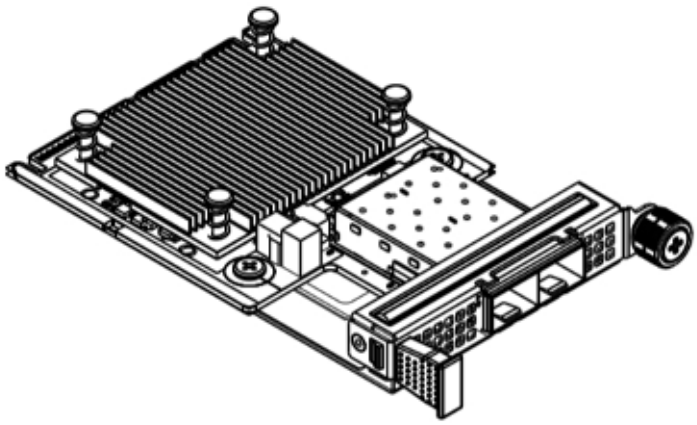


Figure 8 OCP 3.0 NIC Module

11.2 Network Interface

The General Purpose Enterprise Server supporting E1.S SSD system data network shall use a Single or Dual Port OCP 3.0 NIC module.

For the Management network baseboard has two options of management network interface for BMC's connection.

a) One dedicated RJ45 port for Board management and shares data network's physical interface, driven by BMC through RMII/NC-SI.

b) One OCP NIC 3.0 shared-NIC, driven by BMC through NCSI

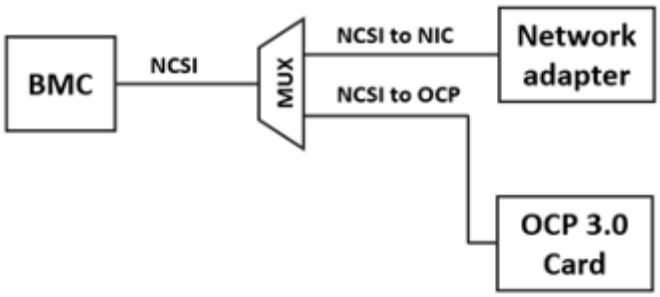


Figure 2 BMC management network topology

11.3 TPM Support

Must support TPM module

Optional Trusted Platform Module (TPM)/Trusted Cryptography Module (TCM) for data encryption and security to support secure boot of servers.

12. System Requirements

12.1 Power Delivery

The system SHALL support 2 power supplies and support 1+1 redundancy.

12.2 Thermal Design

To meet thermal reliability requirements, the thermal and cooling solution should dissipate heat from the components when the system is operating at its maximum thermal power. The thermal solution should be found by setting a high power target for initial design in order to avoid redesign of cooling solution; however, the final thermal solution of the system should be optimized and energy efficient under data center environmental conditions with the lowest capital and operating costs. Thermal solution should not allow any overheating issue for any components in the system. CPU or memory should not throttle due to any thermal issue under the following environment

• Inlet temperature lower than or equal to 35°C, and 0 inch H2O datacenter pressure with all FANs in each thermal zone running properly

• Inlet temperature lower than or equal to 35°C, and 0.001 inch H2O datacenter pressure with one FAN (or one rotor) in each thermal zone failed

12.3 Operational Conditions

Altitude: 0 to 914 meters (3000 feet); Operating temperature 0 to 35 degrees Celsius

Altitude: 914 to 2133 meters (7000 feet); Operating temperature 10 to 32 degrees Celsius

Operating relative humidity: 10%~90% R.H

Storage relative humidity: 10%~93% R.H.

Working temperature: 5~35°C (heat dissipation needs to be clear at (35°C /40°C /45°C)

Storage temperature range: -40~+70°C

12.4 Advanced Cooling Compatibility

A system that supports or utilizes liquid cooling using cold plate technology SHALL comply with the ACS Liquid Cooling Cold Plate Requirements document revision 1.0 or later.

A system that supports or utilizes Immersion Cooling SHALL complies with the Immersion Requirements document revision 1.0 or later.

13. System Firmware (BIOS)

System Firmware must comply with the OCP Open System Firmware Checklist (v1.1) or later.

A pdf of the v1.1 checklist on the OSF Wiki:

https://www.opencompute.org/wiki/Open_System_Firmware/Checklist

13.1 Open System Firmware Binary and Source components

For any monolithic servers that receive the OCP Accepted™ or OCP Inspired™ certification mark SHALL conform to OCP OSF checklist (v1.1) or later. Binary blobs and source artifacts should at least, be made available on a third-party repo, e.g. Github.

To make it easy for customers to recreate firmware, ODMs SHALL document where the various components are and how to build a complete firmware image. These documents, instructions, and (e.g.) make files shall be placed in the repos shown below; however, we do not require that the entirety of (e.g.) the source code be copied into these repos.

For example, if an ODM is using coreboot or Linux, source code SHALL be upstreamed to those projects. The OCP repos can then contain configuration files and, almost certainly, a git hash of the version of the software used. Binary artifacts SHOULD be placed in the OCP repos, as well as a link to the source of the binary(ies), and a license document.

13.2 System Firmware

All products seeking OCP Accepted™ Product Recognition must complete the Open System Firmware (OSF) Tab in the 2021 Supplier Requirements Checklist.

If based on an open bios (like AMI's Aptio-OpenEdition), a completed checklist shall be uploaded and made available on the OCP Github.

Note to authors: replace [vendor_name] and [product_name] with actual company name and product identifier

14. Hardware Management (BMC)

14.1 Redfish Interface

The out-of-band manageability interface of the platform SHALL conform to the Redfish Specification v1.2 and above(DMTF DSP0266, ISO/IEC 30115:2018).

The conformance of the platform should be verified by executing the Redfish Service Validator (https://github.com/DMTF/Redfish-Service-Validator) and the Redfish Service Conformance Check

(https://github.com/DMTF/Redfish-Service-Conformance-Check).

14.2 Compliance

All products seeking OCP Inspired™ or OCP Accepted ™ Product Recognition shall comply with the OCP Hardware Management Baseline Profile V1.0 and provide such evidence by completing the Hardware Management Tab in the 2021 Supplier Requirements Checklist.

14.3 OCP Profile Support

The platform's manageability interface SHALL conform to the OCP Hardware Baseline Profile v1.0.0. The platform's manageability interface MAY conform to the OCP <platform> Profile v1.x.x.

The conformance of the platform should be verified by executing the Redfish Interop Validator (https://github.com/DMTF/Redfish-Interop-Validator). The Redfish Interop Validator reads a Profile file as input and will run the tests necessary to verify conformance to the Profile file.

The Profile files mentioned above can be found at https://github.com/opencomputeproject/OCP-Profiles

14.4 BMC Features

In addition to the requirements described in this section, the BMC must also support the following features:

•IPMI 2.0

•Redfish1.8

•Simple network management protocol (SNMP v1/v2c/v3)

•HTML5/Java remote console (keyboard, mouse, and video)

•Remote virtual media

•Web browser login

•Intelligent fault diagnosis system

14.5 BMC Firmware Source Code Availability (If Applicable)

All Products seeking OCP Accepted™ Product Recognition shall have source code and binary blobs submitted for BMC, if applicable.

The BMC management source code shall be uploaded at:
https://github.com/opencomputeproject/Hardware-Management/[vendor_name]/[product_name]

If the BMC is based on an open source BMC (like AMI's MegaRAC-OpenEdition), the BMC source code shall be uploaded and made available on the OCP Github.

15. Environmental and Regulatory Requirements

15.1 Regulations

Region	Certification Item	Certification Logo	Mandatory/ Voluntary
China	3C		Mandatory
	Environment label		Voluntary
	Energy conservation certification		Voluntary
International recognition	CB		Voluntary
EU	CE		Mandatory
Australia	RCM		Voluntary
India	BIS		Voluntary
USA	FCC		Mandatory
	UL		Voluntary
	Energy star		Voluntary
Russia	CU Certification		Voluntary
	Information security	N/A	Voluntary
	CU RoHS	N/A	Voluntary
Korea	E-Standby Energy Efficiency Certification		Mandatory
	KC Certification		Mandatory

16. Security

Inspur had finished Security review in Poseidon V1. (Common Security Threats Checklist)

Appendix A - Checklist for IC approval

List all the requirements in one summary table with links from the sections.

Requirements	Details	Link to which Section in Spec
Is this contribution entered into the OCP Contribution Portal?	Yes	If no, please state reason.
Was it approved in the OCP Contribution Portal?	Yes	If no, please state reason.
Is there a Supplier(s) that is building a product based on this Spec? (Supplier must be an OCP Solution Provider)	Yes	List Supplier Name(s) Samsung, Inspur
Will Supplier(s) have the product available for GENERAL AVAILABILITY within 120 days?	Yes	Please have each Supplier fill out Appendix B.

Appendix B- Inspur **- OCP Supplier Information**

Company: Inspur
Contact Info: Alan Chang (AlanChang@Inspur.com)

Product Name: Poseidon V1 E1.S SSD Storage System
Product SKU#: NF5180M6 E1.S
Link to Product Landing Page:
https://www.inspursystems.com/product/nf5180m6

The following is needed for OCP hardware product recognition:

For OCP Inspired™

- All Suppliers must be a Silver, Gold or Platinum Member.
- Declare product is 100% compliant with specification
- Complete the OCP Inspired™ Product Recognition Checklist, which includes hardware management conformance checks and security profile.

List all the requirements in one summary table with links from the sections.

Item	Details	Links
Which product recognition?	OCP Inspired™	https://www.inspursystems.com/product/nf5180m6
If OCP Accepted™, who provided the Design Package?		Link to OCP Contribution Database
Where can a potential adopter purchase the product?		Link to OCP Marketplace