

OPEN Compute Project

Qualcomm Centriq[™] 2400 Open Compute Motherboard for Project Olympus -Qualcomm Centriq 2400 OCM Revision 0.5

Author:

Pravind Hurry, Principal Engineer, Qualcomm Datacenter Technologies, Inc.



Revision History

Revision	Date	Name	Description
0.4	February 1, 2017	Pravind Hurry	Initial draft
0.5	February 15, 2017	Pravind Hurry	Added Sections 5 to 9 and included first draft review feedback

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Table of Contents

1	List of	Specifications	6
2	Gloss	ary	6
3	Overv	iew	7
4	Syster	n Block Diagram	8
5	Produ	ct Features	9
	5.1	Feature List and compliance to Project Olympus Specifications	9
		5.1.1 Project Olympus Server Mechanical Specification	9
		5.1.2 Project Olympus PSU Specification Compliance	11
		5.1.3 Project Olympus PSU Server Rack Specification	11
		5.1.4 Project Olympus Power Management Distribution Unit Specification	11
		5.1.5 Project Olympus Server Motherboard Specification	12
6	Qualco	omm Centriq 2400 Open Compute Motherboard	18
	6.1	Motherboard Layout and Interfaces	18
	6.2	Processor and Memory	19
		6.2.1 Processor	19
		6.2.2 Memory Support	19
		6.2.3 DIMM Population Rule	19
	6.3	Risers	19
	6.4	Storage	23
7	Manag	jement Subsystem	24
	7.1	BMC	24
	7.2	NCSI	<u>2</u> 4
8	TPM N	Iodule	24
9	Dual F	unction/Device Support	24

Table of Figures

Figure 1. Qualcomm Centriq 2400 OCM Block Diagram	8
Figure 2. Motherboard Layout and Interfaces	18
Figure 3. x4 PCIe connector interface	21
Figure 4. Riser Type #3 and Riser Type #5	22
Figure 5. Riser Type #3 and Riser Type #4	22
Figure 6. Riser Type #3 and Riser Type #6	22
Figure 7. M.2 Mega Card Form Factor	23

Table of Tables

Table 1. List of Specifications	6
Table 2. Acronyms and Terms	6
Table 3. Mechanical Specifications	9
Table 4. PSU Specification Compliance	11
Table 5. Server Motherboard Specifications	12
Table 6. DIMM Channel Pairing	19
Table 7. Riser Types	20



1 List of Specifications

Table 1 lists the applicable Project Olympus Specifications.

Table 3	1. List	of S	pecifications
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Specification title	Description
Project Olympus Server Rack Specification	Describes the mechanical rack hardware used in the system
Project Olympus Server Mechanical Specification	Describes the mechanical structure for the server used in the system
Project Olympus Server Motherboard Specification	Describes the server motherboard general requirements
Project Olympus PSU Specification	Describes the custom Power Supply Unit (PSU) used in the server
Project Olympus Power Management Distribution Unit Specification	Describes the Power Management Distribution Unit (PMDU)
Project Olympus Server Rack Manager Specification	Describes the Rack Manager PCBA used in the PMDU

The initial Project Olympus Specifications are located at the following link:

https://github.com/opencomputeproject/Project_Olympus/tree/master/Specs

2 Glossary

Table 2 lists the acronyms and terms used in this document.

Acronym or Term	Description
1DPC	1 DIMM per Channel
2DPC	2 DIMMs per Channel
BMC	Baseboard Management Controller
DDR	Dual Data Rate
DIMM	Dual Inline Memory Module
ECC	Error Correcting Code
EMI	Electromagnetic Interference
FHHL	Full Height Half Length
HSC	Hot Swap Controller
l ² C	Inter-Integrated Circuit
IMC	Integrated Management Controller
I/O	Input/Output
JEDEC	Joint Electron Device Engineering Council
JTAG	Joint Test Action Group
LAN	Local Area Network

Table 2. Acronyms and Terms

Open Compute Project • QDT2400 Motherboard Specification for Project Olympus

LGA	Land Grid Array
OCM	Open Computer Motherboard
PMDU	Power Management Distribution Unit
PSU	Power Supply Unit
ROM	Read Only Memory
SEL	System Event Log
SGMII	Serial Gigabit Media Independent Interface
SoC	System-on-Chip
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmit
USB	Universal Serial Bus

3 Overview

This document describes the Qualcomm Centriq 2400 Open Compute Motherboard (OCM), a single node ARM-based motherboard specification based on the 48-core, high-performance Qualcomm Centriq 2400 processor. (The motherboard is referred to as Qualcomm Centriq 2400 OCM throughout this document.) The Open Compute Motherboard is a server blade solution designed in compliance to Project Olympus and leverages the standard 19" Olympus Rack, PMDU, and PSU as-is. For more information on the design specification of Project Olympus and its applicability to scale-out and traditional data centers, refer to http://www.opencompute.org/wiki/Server/ProjectOlympus. The Open Compute Motherboard specification of Project Olympus and its applicability to scale-out and traditional data centers, refer to http://www.opencompute.org/wiki/Server/ProjectOlympus. The Open Compute Motherboard specification is intended to be an "OCP inspired" contribution. Schematics, design, and Firmware/BIOS files are not included.



4 System Block Diagram

Figure 1 illustrates the main features of the Qualcomm Centriq 2400 OCM and all the interfaces supported by the Motherboard.



Figure 1. Qualcomm Centriq 2400 OCM Block Diagram

5 **Product Features**

5.1 Feature List and compliance to Project Olympus Specifications

The Qualcomm Centriq 2400 OCM fits within the physical constraints defined by the Project Olympus Server Mechanical Specification. The Motherboard has the power supply connector interface to be mated with the Project Olympus Power Supply Unit. Qualcomm Centriq 2400 OCM has been design to meet the thermal requirements of Project Olympus and also has the critical Input/Output (I/O) interfaces that are called out in the Project Olympus specification. The following sections detail the compliance to the specific features for Project Olympus as per the specifications called out in Table 1.

5.1.1 Project Olympus Server Mechanical Specification

	Description			
Feature/ Function	Project Olympus Server Mechanical Specification	Qualcomm Centriq 2400 OCM		
Form Factor Height	Supports 1U height server assembly, 43.3 mm	Yes, same form factor		
Chassis Dimensions – Width (W) x Length (L)	441 mm (W) x 945 mm (L)	Yes, fits in chassis		
Rack Width	482.6 mm (19 inch EIA)	Yes, supported		
Motherboard Dimensions – Width (W) x Depth (L)	431 mm (W) x 406 mm (L)	210 mm (W) x 404 mm (L)		
Total Mass	Must not exceed 35 lbs. to meet datacenter handling requirements	The server system integrating Qualcomm Centriq 2400 OCM will be designed to meet this requirement.		
Power blind mating	Supports blind-mate power with Project Olympus Rack with PMDU	Yes, supported		
I/O cards support	Supports up to three Full Height Half Length (FHHL) x16 Gen3 PCIe cards	Supports one FHHL x16 Gen3 PCIe card and one Low Profile x16 Gen3 PCIe card		
Cabling access	Supports cold aisle cabling for I/O and Ethernet Management	Yes, supported		
Servicing	Supports cold aisle servicing (VGA + USB 3.0)	Supports cold aisle servicing (USB 2.0, no VGA)		
Power Supply Unit	Supports integrated Project Olympus PSU	Yes, uses Project Olympus PSU		
SATA devices support	Supports up to two SATA devices	Yes, additionally supports up to eight SATA devices		
Fans	Supports 6 (N+2) non hot-swap 40 mm fans	Yes, Supports 6 (N+2) non hot-swap 40 mm fans		
Optional remote heat sink	Supports optional remote heat sink for high power processors	Not required for Qualcomm Centriq 2400 OCM implementation		

Table 3. Mechanical Specifications



	Description			
Feature/ Function	Project Olympus Server Mechanical Specification	Qualcomm Centriq 2400 OCM		
Front Panel	 Supports the following: Three FHHL x16 PCIe Cards Two USB 3.0 Type A connectors One RJ45 1 GbE connector Status LEDs – UID, Attention, Power Status Optional SFP+ 10 GbE connector (x1) Optional one three-row 15-pin VGA connector 	 Supports the following: One FHHL and One Low Profile x16 PCIe Card Two USB 2.0 Type A connectors Up to three RJ45 1 GbE connector Status LEDs – UID, Attention, Power Status 		
Rear Panel	Support for PSU FCI connection to PMDUSupport for six 40 mm fans	Yes, supported		
Electromagnetic Interference (EMI) Mitigation	For EMI containment, EMI shielding and grounding must be accounted for at the server assembly level. All servers must support a top cover that fits within the U envelope to prevent leakage of electromagnetic fields and airflow	Qualcomm Centriq 2400 OCM will be designed to meet Project Olympus EMI requirements.		
Grounding and Return	The server chassis grounding/return is provided to the motherboard from the tray assembly through the alignment and mounting holes that secure the motherboard to the tray. The motherboard is also tied to the PSU ground through the 12 V connector. Chassis ground and logic are tied together on the motherboard.	Qualcomm Centriq OCM will meet grounding and return requirements per Project Olympus requirements.		
Environmental	 Inlet Temperatures: Operating 50°F to 95°F (10°C to 35°C) Maximum rate of change: 18°F (10°C)/hour Allowable derating guideline of 1.6°F/1000 ft. (0.9°C/304 m) above 3000 ft. 	The server system integrating Qualcomm Centriq OCM will be designed to meet the environmental requirements of Project Olympus.		
	Inlet Temperature: Non-Operating -40°F to 140°F (-40°C to 60°C) Rate of change less than 36°F (20°C)/hour 			
	AcousticsLess than 6.8 bells at maximum fan speed operating condition			
	 Non-Operational Shock and Vibration The server must be capable of rack level transportation via common carrier. Rack level testing to comply with ASTM 4169 Recommendation levels for single server in 			
	 Recommendation levels for single server in a fixture to simulate installation in a rack: Shock – Half sine, 10G, 5 m/s Vibration – 1 146 Grms 1 hour 			
Regulatory and Safety Requirements	Not currently specified	The server system integrating Qualcomm Centriq 2400 OCM will be designed to meet all standard Regulatory and Safety requirements for the regions where the systems are shipped.		

	Description			
Feature/ Function	Project Olympus Server Mechanical Specification	Qualcomm Centriq 2400 OCM		
Thermals	 Maximum airflow per unit power allowed in a server must not exceed 158 CFM/kW at TDP Server must operate at its maximum power configuration without performance degradation while meeting reliability requirements with one failed fan for an N+1 configuration (5 fans running). Server must meet minimum component requirements but not reliability requirements for an N configuration (4 fans running). Failed fan testing should be conducted on all fans with the worst case failed fan locations as the minimum requirement. Variable fan speed capability shall be implemented to enable the rack to minimize energy consumption of the air movers and facilities in conditions that permit it. The speed of airflow is based on component temperature requirements within the server. 	The server system integrating Qualcomm Centriq 2400 OCM will be designed to meet the thermal requirements of Project Olympus.		

5.1.2 **Project Olympus PSU Specification Compliance**

Facture/Function	Description		
Feature/ Function	Project Olympus Server PSU Specification	Centriq 2400 OCM	
Power Supply Unit	Project Olympus Server PSU	Will have Project Olympus PSU	

Table 4. PSU Specification Compliance

5.1.3 Project Olympus PSU Server Rack Specification

The server system integrating Qualcomm Centriq 2400 OCM will comply with the requirements of both Project Olympus chassis and rack specifications.

5.1.4 Project Olympus Power Management Distribution Unit Specification

The server system integrating Qualcomm Centriq 2400 OCM will use and comply with Project Olympus Power Management Distribution Unit Specification.



5.1.5 Project Olympus Server Motherboard Specification

	Description		
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM	
Processors			
SoC	Support for up to 2 CPUs	One 2400 SoC	
Number of Sockets	Support for up to 2 sockets	One Single Socket, Land Grid Array (LGA)	
Memory			
Number of Memory Channels	Not specified	6 channels	
Dual Inline Memory Modules (DIMMs) per channel	Not specified	2 DIMMs per Channel (2DPC)	
Number of Memory Slots	Up to 32 DMIMMs slot	12 memory slots	
DRAM size	Minimum of 256 MB of Dual Data Rate Type 3 (DDR3)/DDR Type 4 (DDR4) memory	Supports DDR4 DRAM minimum requirements	
I/O Devices/Functions ar	nd Slots		
PCI Express Connectors	Supports up to 3 FHHL x16 slots	 Supports 2 PCie x16 connectors on Qualcomm Centriq 2400 OCM Each x16 connector takes a riser. One connector supports an FHHL and the second connector supports a Low Profile PCIe card. Risers plug into connectors for horizontal orientation of PCIe cards to fit within 1U height. 	
SATA	Supports up to 12 SATA devices	Supports up to 8 SATA devices	
SoC Universal Serial Bus (USB) Interfaces	Supports two USB3.0 Type A connectors at the front of the server to enable cold aisle servicing	Supports two USB 2.0 Type A connectors at the front of the server to enable cold aisle servicing	
SoC Serial Peripheral Interface (SPI)	 32 MB SPI device Device shall be Windbond MPN W25Q256 BIOS shall be recoverable from the Baseboard Management Controller (BMC) in the event the chipset is inaccessible 	 One SPI interface (Master) to one "default boot" SPI Read Only Memory (ROM) – DediProg Header for in-circuit programming BMC has ability to update Firmware 	
SoC Inter-Integrated Circuit (I ² C) Interface	Not specified	 Two I²C (one Master and one Slave) to BMC supported Two I²C to DDR channels 	

Table 5. Server Motherboard Specifications

Open Compute Project • QDT2400 Motherboard Specification for Project Olympus

	Description	
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM
SoC Universal Asynchronous Receiver Transmit (UART)	Not specified	 SoC UART 1 –IMC Console. Header on main board with associated cabling to connect to external serial cable. SoC UART 2 – Connected (PCB signals) to BMC UART for Serial Over Local Area Network (LAN) support SoC UART 3 – Main Operating System (OS) Console, brought out to front panel. RS-232 connector required. SoC UART 4 – Debug Console, brought out to front panel. RS-232 connector required.
SoC Ethernet interfaces	Not specified	 Ethernet Interface – Dedicated SoC 1Gb Ethernet (RJ-45) brought out to front panel External 1G Ethernet PHY – Required for SoC Serial Gigabit Media Independent Interface (SGMII) to 1G Base-T translation RJ45 for Debug over Ethernet cable (internal access)
System Management		
BMC device	Design of BMC based on the ASPEED 2500 family	ASPEED AST2520, on motherboard, running AMI MegaRAC ¹ SP-X firmware
BMC Boot Flash	BMC SPI Flash – Minimum 32 MB device (Windbond W25Q256 or equivalent)	BMC SPI Flash – Windbond W25Q256
1 GbE PHY	Server is managed through a 1GbE PHY connected to BMC. The PHY shall be a Broadcom BCM54612E or equivalent.	Ethernet Interface – Dedicated BMC 1Gb Ethernet (RJ-45) brought out to front panel. GbE PHY is planned to be BCM54612E.
CPU Thermal Monitoring	The BMC shall support a mechanism to query CPU, Memory, and server thermal information to provide optimized fan speed control.	Qualcomm Centriq 2400 OCM BMC solution supports a mechanism to query CPU, Memory, and server thermal information to provide optimized fan speed control.
Telemetry through BMC I ² C BMC UART	 To optimize telemetry gathering for power and thermal management as well as general management of the server assembly, the following functions shall support I²C access from the BMC: All PCIe slots All M.2 modules Local Hot Swap Controllers Power Supplies Key Voltage Regulators (processors and memory) Temperature sensors FRUID PROM The motherboard shall support two UART headers connected to the BMC for console 	 Qualcomm Centriq 2400 OCM follows project Olympus for System Management and supports the following telemetry functions: All PCIe slots All M.2 modules Local Hot Swap Controllers Power Supplies Key Voltage Regulators (processors and memory) Temperature sensors FRUID PROM BMC UART 1 – BMC Serial Console. Header on main board with associated
	and debug.	 cabling to connect to external null modem cable. BMC UART 2 – Connected to SoC UART for Serial Over LAN Support.



	Description	
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM
JTAG Master	The motherboard shall support Joint Test Action Group (JTAG) programming of programmable logic devices using the BMC's JTAG master controller. The JTAG programming shall be supported for any required CPLDs and a primary PCIe slot designated for FPGA Cards. The board shall contain mux circuitry controlled by the BMC to switch between the two programmable paths.	 Qualcomm Centriq 2400 OCM will support Project Olympus requirements. BMC JTAG – Onboard header for access to BMC JTAG interface. Can be depopulated on production boards.
SoC Thermal Monitoring	The BMC shall support a mechanism to query CPU, Memory, and server thermal information to provide optimized fan speed control.	Qualcomm Centriq 2400 OCM System Management solution implements a mechanism to query CPU, Memory, and server thermal information to provide optimized fan speed control.
VGA	Optional VGA connector (defined in Mechanical Specifications- Front Panel connectors)	No VGA
Jumpers	See Section 6.6 of Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM supports appropriate debug hooks to comply to Project Olympus
Voltage Regulators	 Voltage Regulators that support I²C or PMBus should be available to the BMC. This includes CPU and Memory subsystem regulators and at a minimum Clock Generators and Buffers Clock Circuitry that supports I²C should be available to the BMC. 	Qualcomm Centriq 2400 OCM meets the requirements of Project Olympus
FRUID PROM	The motherboard shall include a 64Kb serial EEPROM MPN AT24C64 or equivalent for storing manufacturing data.	Qualcomm Centriq 2400 OCM supports FRUID EEPROM for storing manufacturing data.
Temperature sensors	The Motherboard shall include I ² C support for a minimum of two temperature sensors, MPN TMP411 or equivalent, for monitoring the inlet and outlet air temperatures of the motherboard. The motherboard shall include provisions to support temperature monitoring of all DIMMs (SPD) and all PCIe slots, including M.2s. For accurate temperature reading, care shall be taken to not place these temperature sensors close to component or board heat sources.	Qualcomm Centriq 2400 OCM meets the requirements of thermal telemetry for Project Olympus.
Hot Swap Controllers	The motherboard shall include I ² C support for two hot swap controllers for power monitoring and power capping. One controller is located in the 1U space of the motherboard. The other controller is optional and is located in the 2U space accessible to the motherboard by a cable.	Qualcomm Centriq 2400 OCM supports one controller in the 1U space of the motherboard.

	Description	
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM
LEDs	 Section 6.11 of the Motherboard Specification describes the LED requirements for Project Olympus. PSU Status LEDs are optional. The server may support four PSU status LEDs (two per PSU). Each PSU is comprised of two individual status LEDs indicating the PSU status, as shown in Table 3, Section 6.11 of the Project Olympus Server Motherboard Specification. 	Qualcomm Centriq 2400 OCM supports UID, Power Status ID, and Attention ID as per Project Olympus requirements.
Fan Control	The motherboard shall support control of twelve 40 mm fans located at the rear of the server assembly. Fan control is divided between two connectors enabling two separate fan zones. Each connector supports 12 V power, a single PWM, and six TACH signals for controlling up to six fans in a single zone.	Qualcomm Centriq 2400 OCM supports the Fan Control requirements of Project Olympus.
Security		
TPM 2.0	The motherboard shall include a connector to support a TPM 2.0 module connected to the PCH chipset.	 1x TPM 2.0 header, through SPI interface. Header pin-out adheres to Project Olympus specification.
FPGA Card Support		
FPGA Card	The motherboard shall support an FHHL x16 PCIe form factor FPGA card. The card installs in a standard PCIe x16 slot. The motherboard shall include an x8 OCulink connector for cabling an additional x8 PCIe Link from the motherboard to the FPGA card as well as an internal USB connector to support FPGA debug.	Qualcomm Centriq 2400 OCM has support of the FPGA card through a riser (x8 electrical) and also includes an x8 OCulink connector for cabling an additional PCIe link to the FPGA card as well as an internal USB connector to support FPGA debug.
NVDIMM		
NVDIMM support	 The motherboard should include support for DDR4 NVDIMM with 12 V power through the DIMM. 	NVDIMM support is not included.
Power Input and Voltage	Regulators	-
Power Supply Unit interface to Motherboard	The motherboard shall provide a rear connector for interfacing the motherboard to a 12 V PSU. The motherboard shall also provide a rear management connector for enabling external control of server power. Refer to Figure 6 in the Project Olympus Motherboard Specification.	Qualcomm Centriq 2400 OCM complies to the connectors requirements through a Power Distribution Board that sits between the Motherboard and PSU.
Rack Management	The rack manager communicates with the server motherboard through the PMDU. Section 7.1 of Project Olympus Server Motherboard Specification describes the management interfaces.	Qualcomm Centriq 2400 OCM adheres to the interface guideline.



	Description	
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM
PSU Management	The Motherboard shall support management of the PSU as described in Section 7.2 of the Project Olympus Server Motherboard Specification.	Qualcomm Centriq 2400 OCM implements the signals as per the Project Olympus requirements.
Hot Swap Controller	The motherboard shall support a Hot Swap Controller (HSC) for in-rush current protection. The HSC shall include support for PMBus interface. Recommend using ADM1278 or equivalent.	Qualcomm Centriq 2400 OCM supports a hot swap controller for in-rush current protection.
Power Capping	 The motherboard shall enable power capping of the server from different trigger sources. Each of these triggers can be disabled by the BMC. BMC should be able to trigger these events for debugging: SERVER_THROTTLE – Throttle signal driven by the rack manager PSU_ALERT# - Alert signal driven by the PSU. The PSU will be programmed to assert ALERT# in the event the PSU transitions to power source from the AC to battery backup. FM_THROTTLE# - Test signal that allows the BMC to assert power capacitor. 	Qualcomm Centriq 2400 OCM implements the power capping requirements as required by Project Olympus.
Overcurrent Protection	The HSC is responsible for detecting a current level that indicates a catastrophic failure of the server. In this event, the HSC should disable 12 V to the motherboard, typically by disabling the HSC's input FETs.	Qualcomm Centriq 2400 OCM supports Overcurrent Protection.
M.2 Support	 The motherboard shall support M.2 devices with x4 PCIe Gen-3 interface (M.2 connector with M key). These cards can be supported through any of the following methods: Standard M.2 connector mounted directly on the motherboard Dual M.2 transposer Module. PCIe x8 interface described in Section 11.1 of the Project Olympus Motherboard Specification Quad M.2 Carrier Card. FHHL PCIe Card in standard PCIe format For both motherboard and PCIe Card applications, the supported M.2 modules are 60 mm, 80 mm, and 110 mm form factors (Type 2260, 2280, and 22110) 	Qualcomm Centriq 2400 OCM supports M.2 modules through a riser plugged into the standard PCIe x16 slots.
Service Requirements		
USB Service Port	The motherboard shall provide two USB 3.0 Type A connectors at the front of the server to enable cold aisle servicing.	Qualcomm Centriq 2400 OCM provides two USB 2.0 Type A connectors at the front of the server to enable cold aisle servicing.

Open Compute Project • QDT2400 Motherboard Specification for Project Olympus

	Description	
Feature/ Function	Project Olympus Server Motherboard Specification	Qualcomm Centriq 2400 OCM
LED visibility	Motherboard LEDs determined to be important for communicating status to service personnel shall be made visible at the front (cold aisle) of the server. This shall include the following LEDs at a minimum: • UID LED • Power Status LED • Attention LED	Qualcomm Centriq 2400 OCM supports the minimum requirements for LEDs as specified by Project Olympus.



6 Qualcomm Centriq 2400 Open Compute Motherboard

Qualcomm Centriq 2400 OCM fits in a 1U chassis. The motherboard is a half width board and allows for system configuration flexibility. The following sections detail the motherboard features.

6.1 Motherboard Layout and Interfaces



Figure 2. Motherboard Layout and Interfaces

6.2 Processor and Memory

6.2.1 Processor

Qualcomm Centriq 2400 Processor is a high-performance System-on-Chip (SoC) with up to 48 cores.

6.2.2 Memory Support

The Processor provides six Joint Electron Device Engineering Council (JEDEC) based DDR4 memory interfaces. Each memory channel interface is 72-bits wide (64 data + 8 Error Correcting Codes (ECCs)) and supports up to two DIMM slots.

High-level Memory Interface Summary:

- DDR4 JEDEC Memory
- 72-bit Interface (with ECC)
- 1 DIMM Per Channel (1DPC) and 2 DIMMs Per Channel (2DPC) configurations supported
- Max Data Rates: 2667 MT/s (1DPC) and 2400 MT/s (2DPC)
- Max DIMM Capacity per channel: 128 GB
- Maximum DIMM capacity per motherboard: 768 GB

6.2.3 DIMM Population Rule

The SoC architecture requires population of memory channels in pairs. A minimum of two DIMMs (one DIMM per channel) is required for normal system operation. Table 6 lists the channel pairing. If not all channels are going to be populated, the recommendation is to start inserting DIMMs from the outer DIMM pairs first then proceeding to the inner pairs set.

DIMM Pairing	Memory Channels
Pair 0	DDR channels 5 & 4
Pair 1	DDR channels 1 & 2
Pair 2	DDR Channels 0 & 3

Table 6. DIMM Channel Pairing

6.3 Risers

Qualcomm Centriq 2400 OCM supports multiple hardware configurations through the use of risers, which allow for different PCIe link and PCIe add-in card configurations. There are six riser types that have been designed for Qualcomm Centriq 2400 OCM, and they are described in

Table 7.



Table 7. Riser Types

Туре	Description	Rendering
Riser Type #1	 1x16 PCIe slot Supports FHHL or low profile x16 PCIe card 	
Riser Type #2	 1x8 PCIe slot 2x4 M.2 slots Supports one x8 PCIe card and two M.2 modules 	
Riser Type #3	 1x16 PCIe slot (x8 electrical) 1x8 Optical/Copper Link (OCuLink) cable Supports dual function/device PCIe card 	
Riser Type #4	 2x16 PCIe slots mechanical (2x8 electrical) Supports two x8 PCIe cards on each side of the riser 	A Company of the Second Second
Riser Type #5	 1x16 Slot (Secondary Side) Supports PCIe x16 Mega Card (see Section 5.4 for details) 	
Riser Type #6	 1x16 Slot (Secondary Side) Supports double-width, high-power PCIe card 	

The riser edge connector plugs into a standard x16 PCIe and an additional x4 connector. The Qualcomm Centriq 2400 OCM has a riser identification scheme to identify each type of riser so that the PCIe Subsystems in the SoC are properly bifurcated. The scheme is implemented by strapping resistors on the risers and reading them over the I²C bus. The I²C bus is accessible by the BMC.

The x16 PCIe connector is a standard implementation of the PCIe interface between a host and an endpoint.

The x4 PCIe connector is used to route extra clock signals, resets, and power to support the devices plugged into the risers, as illustrated by Figure 3.



Figure 3. x4 PCIe connector interface



The following illustrates some of the different configurations of the server platform:

1. Riser Type #3 and Riser Type #5 to support PCI add-in card (x8 PCIe) and a storage expansion card (x16 PCIe), also referred as M.2 Mega Card in this document.



Figure 4. Riser Type #3 and Riser Type #5

2. Riser Type #3 and Riser Type #4 to support up to three PCI add-in cards (PCIe x8 each).



Figure 5. Riser Type #3 and Riser Type #4

3. Riser Type #3 and Riser Type #6 to support double-width, high-power (up to 300 W) add-in card (PCIe x16).



Figure 6. Riser Type #3 and Riser Type #6

6.4 Storage

Qualcomm Centriq 2400 OCM supports eight SATA ports.

Qualcomm Centriq 2400 OCM can also be configured to support an M.2 Mega Card through a x16 PCIe riser. The expansion card has a PCIe switch, which connects to 20 M.2 NVMe modules (2280 or 22110 form factors). The card form factor is shown in Figure 7.

Physical Properties of M.2 Mega Card:

PCB Thickness	= 1.66 mm (8 layers)
Top Side Max Height	= 10 mm
Bottom Side Max Height	= 2 mm
Total Height of board	= 13.66 mm



322.6 mm or 12.7 in.

Figure 7. M.2 Mega Card Form Factor



7 Management Subsystem

The BMC is based on the ASPEED AST2520 Controller. The System Management implementation is compatible with the Project Olympus Rack Manager.

7.1 BMC

The BMC solution provides the following system management features:

- BMC dedicated GbE LAN for communication with Rack Manager
- Out of band environmental controls for power and thermal management
- FRUID EEPROM for storage of manufacturing data and events (I²C)
- Thermal sensors for inlet and exhaust temperature monitoring (I^2C)
- Power monitoring through the 12 V Hot Swap Controller circuitry (I²C)
- Service LEDs
- Serial Over LAN
- BMC Heartbeat LED
- System Event Log (SEL)

7.2 NCSI

The Qualcomm Centriq 2400 OCM includes a connector for cabling NCSI signals from the module to a NIC. The connector follows the specification as detailed in Section 11.11 of the Project Olympus Server Motherboard Specification.

8 TPM Module

The Qualcomm Centriq 2400 OCM includes a connector to support a TPM 2.0 module connected to the SoC.

9 Dual Function/Device Support

The Qualcomm Centriq 2400 OCM supports a FHHL PCIe add in card. The card installs on a riser and plugs into the x16 PCIe connector (PCIe Slot 1) on the motherboard. The PCIe x16 riser produces two x8 ports, which includes a standard x8 PCIe slot and another x8 OCulink connector. The OCulink connector can be cabled to a second function on the PCIe card. The motherboard has an internal USB connector to support dual function PCIe card debug. As an example, this riser supports the FPGA card mentioned in Section 10 of the Project Olympus Server Motherboard Specification.