NF5468M6
White Paper

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Preface

Abstract

This white paper describes the NF5468M6 server's appearance, features, performance parameters, and software and hardware compatibility, providing in-depth information of NF5468M6.

Intended Audience

This white paper is intended for pre-sales engineers.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	A potential for serious injury, or even death if not properly handled
WARNING	A potential for minor or moderate injury if not properly handled
CAUTION	A potential loss of data or damage to equipment if not properly handled
IMPORTANT	Operations or information that requires special attention to ensure successful installation or configuration
NOTE	Supplementary description of document information

Revision History

Version	Date	Description of Changes
V1.0	2021/03/30	Initial release
V1.1	2021/09/30	Changed the overall format
V2.0	2021/11/22	Modified product features, exploded views, system architecture, software and hardware compatibility, power consumption calculation, and new technology description
V2.1	2022/04/11	Updated the format
V2.2	2023/02/07	Updated some descriptions

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1 Product Overview

The NF5468M6 is an industry-leading AI cloud infrastructure server designed for mainstream AI computing scenarios such as AI public cloud, enterprise-level AI cloud platform, smart security, and video encoding/decoding. It supports PCIe 4.0, twice as fast as PCIe 3.0. In addition, the NF5468M6 is compatible with accelerator cards in different PCIe form factors and supports topology switch between Balance, Common, and Cascade, meeting customers' performance requirements for different AI application scenarios. With up to twenty-four 2.5-inch drives or twelve 3.5-inch drives at the front, the server provides a high storage capacity.

Figure 1-1 NF5468M6

2 Features

2.1 Super Computing Power

- Up to two 3rd Gen Intel Xeon Scalable processors (code-named “Ice Lake”) with a TDP of up to 270 W in a standard 4U space.
- 3 UPI links per CPU.
- 32 DDR4 DIMMs.
- 4 or 8 dual-slot FHFL PCIe GPU cards or 16 Tesla T4 graphics cards.
- With wide compatibility to support various GPU cards.

2.2 Increased Communication Performance

- Supports PCIe 4.0 x16 accelerator cards with a bandwidth of up to 64 GB/s.
- Backward compatible with PCIe 3.0 accelerator cards.
- Supports NVLink Bridges, further enhancing the P2P performance.

2.3 Multiple Topologies Supported

The NF5468M6 supports Balance, Common, and Cascade topologies. Topology switching can be achieved by BMC commands to meet performance requirements for different AI application scenarios in the most convenient way.

2.4 Large Local Storage Capacity

The NF5468M6 supports twenty-four 2.5-inch drives or twelve 3.5-inch drives at the front, with up to 8 U.2 NVMe drives supported, delivering efficient data access. Besides, it supports 2 internal M.2 SSDs, further expanding the system storage capacity.

2.5 Multi-Host Technology

Multi-Host technology enables direct connectivity from multiple compute or storage hosts to a single network controller, reducing capital and operating expenses by reducing the quantity of switches, network cards, and cables. Besides, Multi-Host technology can balance the performance of network communication among the cores of multiple processors, providing an efficient network communication environment.

2.6 Security

- Supports Trusted Platform Module (TPM 2.0) and Trusted Cryptography Module (TCM) that provide advanced encryption functions.
- Supports Intel Trusted Execution Technology that provides hardware-based mechanisms to help protect against software-based attacks.
- Supports Intel Software Guard Extensions (SGX) technology that allows applications to run in enclaves to help prevent malicious theft and modification of critical codes and data.
- Supports the firmware update mechanism based on digital signatures to prevent unauthorized firmware updates.
- Supports UEFI Secure Boot to protect the system from malicious boot loaders.
- Supports hierarchical password protection in BIOS to ensure system boot and management security.
- Supports BIOS Secure Flash and BIOS Lock Enable (BLE) to reduce attacks from malicious software on the BIOS flash regions.
- Supports dual-image mechanism for BMC and BIOS to recover firmware upon the detection of corrupted firmware.
- Supports BMC Secure Boot to protect BMC from malicious tampering.
- Supports flexible BMC access control policies to improve BMC management security.
- Supports chassis intrusion detection to enhance physical security.

3 System Parts Breakdown

Figure 3-1 NF5468M6 Exploded View (12 × 3.5-inch Drive Configuration)

Item	Feature	Item	Feature
1	Front Bezel	9	PSUs
2	Drives	10	M.2 SSDs
3	Drive Backplane	11	Air Duct
4	Top Cover	12	Motherboard
5	GPUs	13	Fans
6	PCIe Expansion Cards	14	Chassis
7	GPU Board and Tray	15	RAID Controller Card Module
8	OCP 3.0 Card		

4 Logical Structure

4.1 System Topology Overview

The NF5468M6 supports two 3rd Gen Intel Xeon Scalable processors (code-named “Ice Lake”) and 32 DDR4 DIMMs. The 2 processors are interconnected by 3 UPI links at up to 11.2 GT/s. Each processor is connected to 16 Slimline x8 connectors on the motherboard via the PCIe bus to provide PCIe signal.

The server supports 1 RAID riser card which supports up to 2 RAID controller cards and is connected to Slimline x8 connectors of CPU0 via the PCIe cable. The RAID controller cards can be connected to different drive backplanes via SAS/SATA signal cables to provide multiple local storage solutions. NVMe SSDs can be connected to a tri-mode RAID controller card, supporting hardware RAID.

There are 3 Slimline x4 connectors directly routed from the PCH that can be connected to 12 SATA drives on the drive backplane via SATA cables, providing a low-cost local storage solution. Mixing drives directly attached to a PCH with drives directly attached to a RAID controller card is not supported, because wrong drive sequence issue will occur if storage controllers from different manufacturers are used in the same system. The motherboard supports up to 8 NVMe SSDs directly connected to CPUs, via connecting the drive backplane to Slimline x8 connectors directly routed from the CPU on the motherboard.

The OCP 3.0 riser card supports an OCP 3.0 card in Single-Host or Multi-Host mode. In Single-Host mode, the OCP 3.0 riser card is connected to CPU0 via their Slimline x8 connectors. In Multi-Host mode, the OCP 3.0 riser card is connected to CPU0 and CPU1 via connecting its 2 Slimline x8 connectors with the Slimline x8 connectors of CPU0 and CPU1 respectively.

The NF5468M6 supports 8 GPUs in P configuration, 4 GPUs in T configuration, and 16 GPUs in V configuration. The GPU board is connected to the motherboard via a Slimline x8 cable.

Figure 4-1 Motherboard Logic Block Diagram

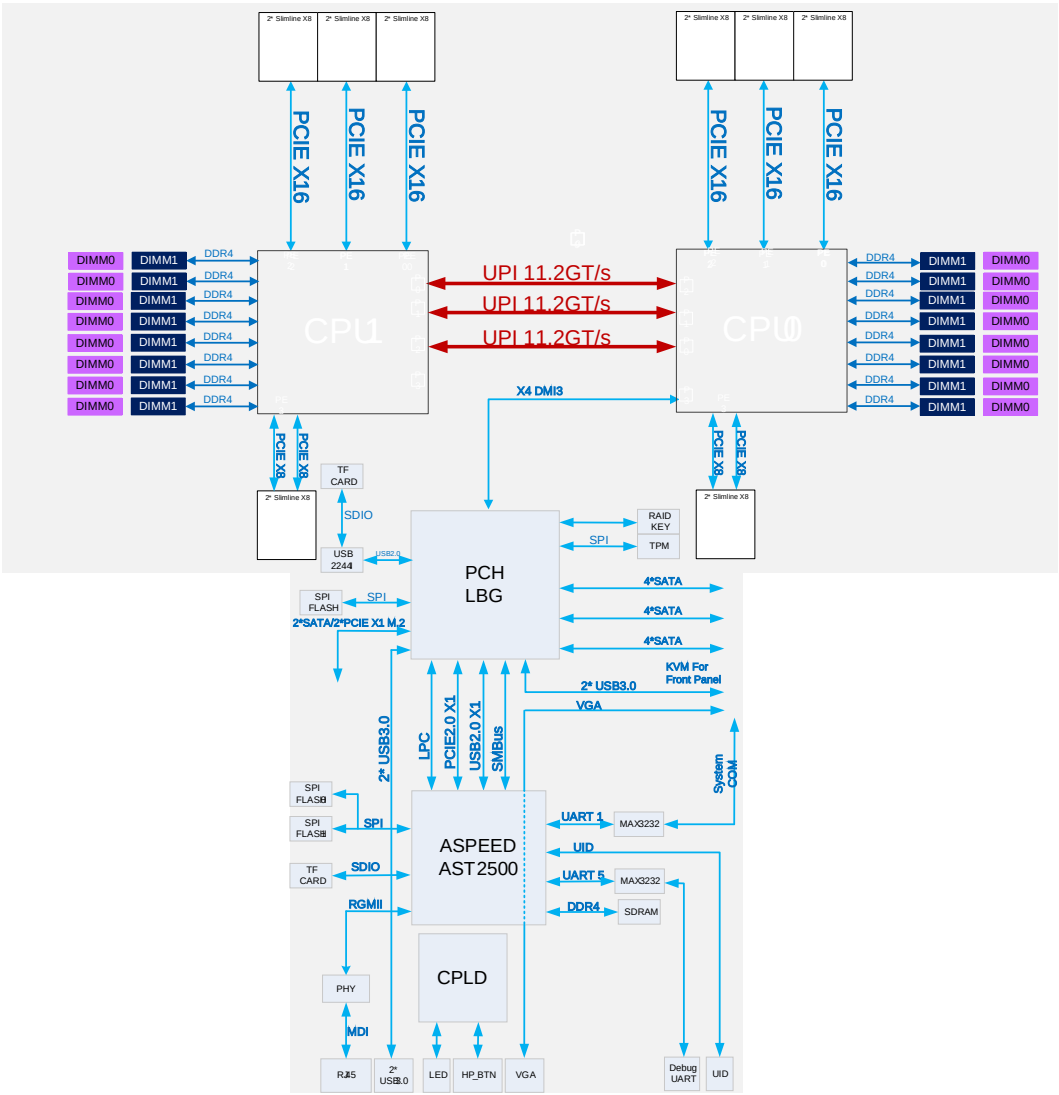
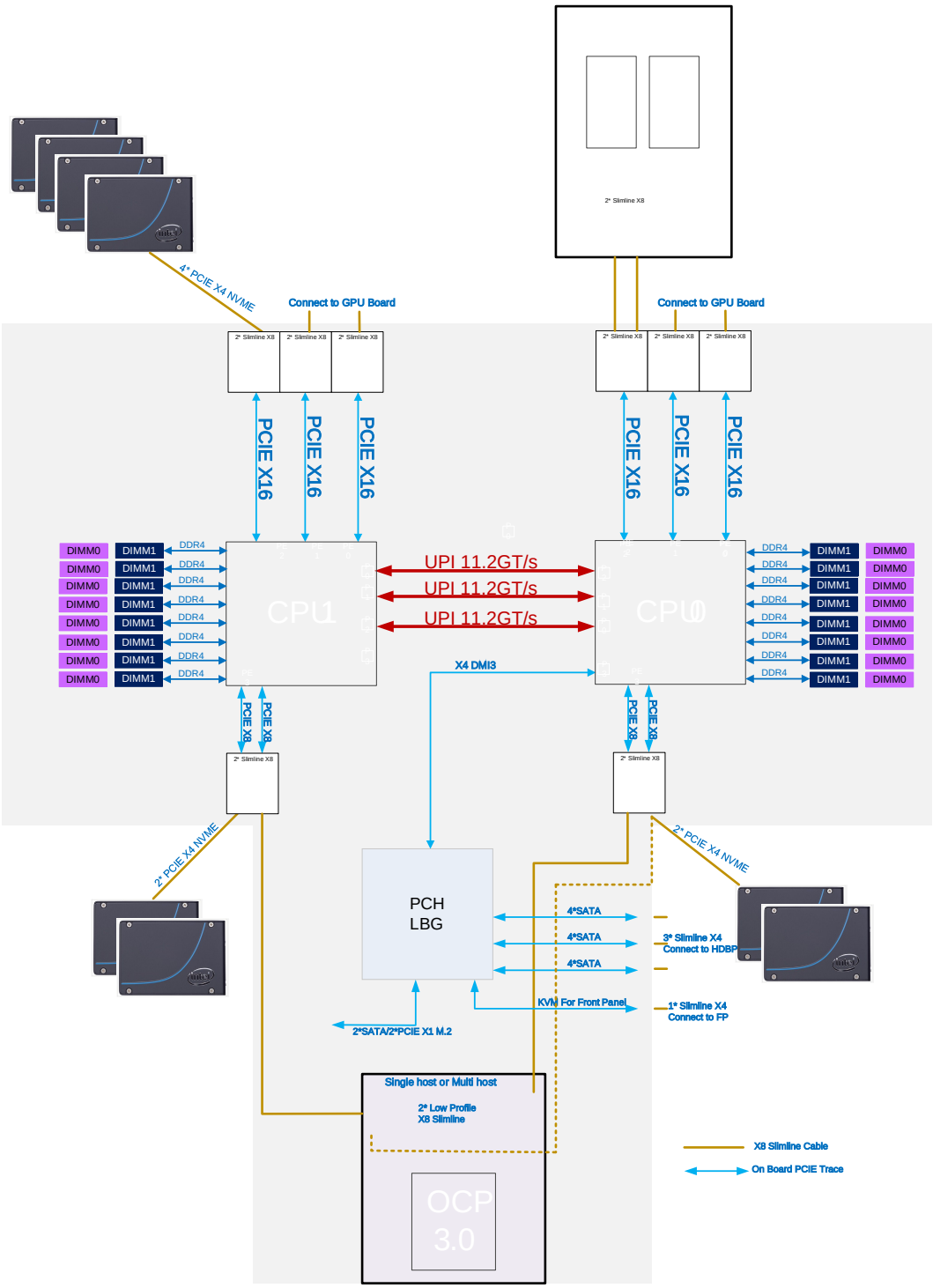


Figure 4-2 PCIe Topology Logic Block Diagram

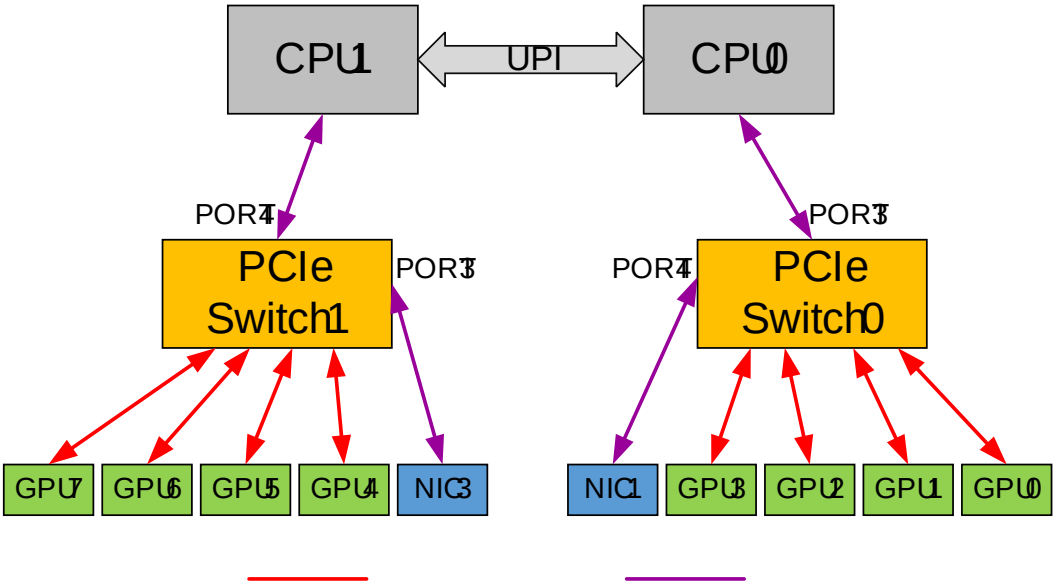


4.2 PCIe Topologies of NF5468M6 - P Configuration

NF5468M6 - P configuration supports remote topology switching between Balance,

Common, and Cascade modes by BMC commands, thereby meeting the needs of AI computing in different business scenarios.

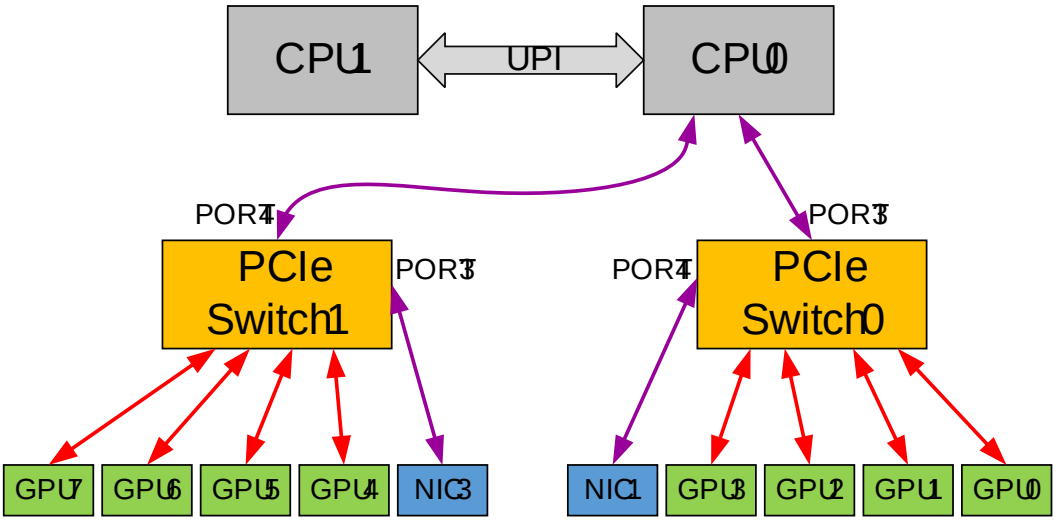
Figure 4-3 Balance Topology



Features: Each CPU has a PCIe switch, which is then connected to 4 GPUs. This topology maximizes CPU utilization and provides a greater upstream bandwidth. But in this topology, the P2P communication between 2 GPUs connected to different CPUs is limited by the UPI link speed.

Applicable business scenarios: As the mainstream topology of NF5468M6 servers, it is applicable to high performance computing (HPC), virtual desktop infrastructure (VDI), public cloud, AI training and other scenarios.

Figure 4-4 Common Topology

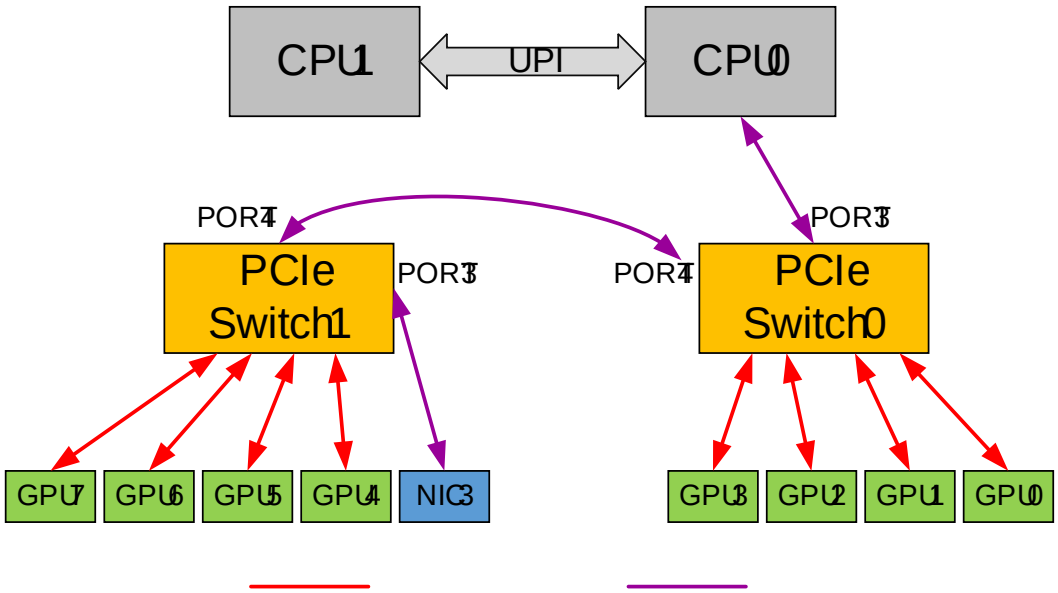


Features: CPU0 is connected to 2 PCIe switches. Each PCIe switch is connected to 4

GPUs. The communication between 2 GPUs connected to different PCIe switches can be accomplished without cross-CPU communication, delivering better P2P communication and higher data throughput.

Applicable business scenarios: It is applicable to the P2P communication-intensive training algorithm models where CPUs are involved in many tasks, for example, ResNet101/50.

Figure 4-5 Cascade Topology



Features: Only CPU0 is connected to a PCIe switch and this PCIe switch interconnects with another one. Each PCIe switch is connected to 4 GPUs. The PCIe switch interconnection provides more powerful GPU P2P communication but low data throughput from CPU to GPU.

Applicable business scenarios: It is applicable to the P2P parameter-intensive training algorithm models where CPUs are involved in few tasks, for example, VGG-16.

Based on the Balance, Common and Cascade topologies, there are a total of 14 PCIe topology options for the NF5468M6 - P configuration, which are as follows:

Figure 4-6 PCIe Topology Logic Block Diagram (Balance or Cascade GPU Topology/Single-Host OCP NIC 3.0)

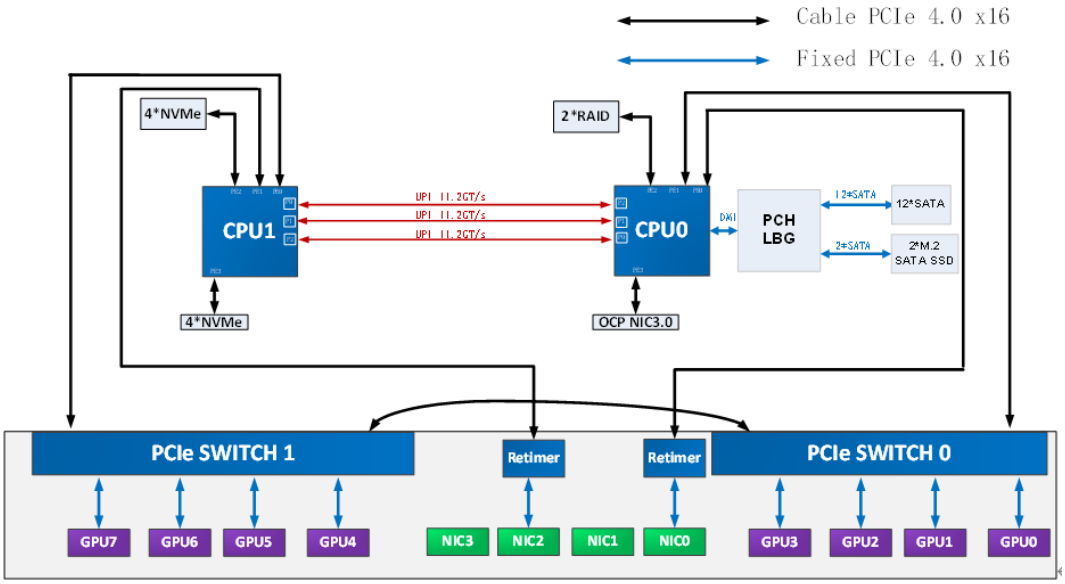


Figure 4-7 PCIe Topology Logic Block Diagram (Balance or Cascade GPU Topology/Multi-Host OCP NIC 3.0)

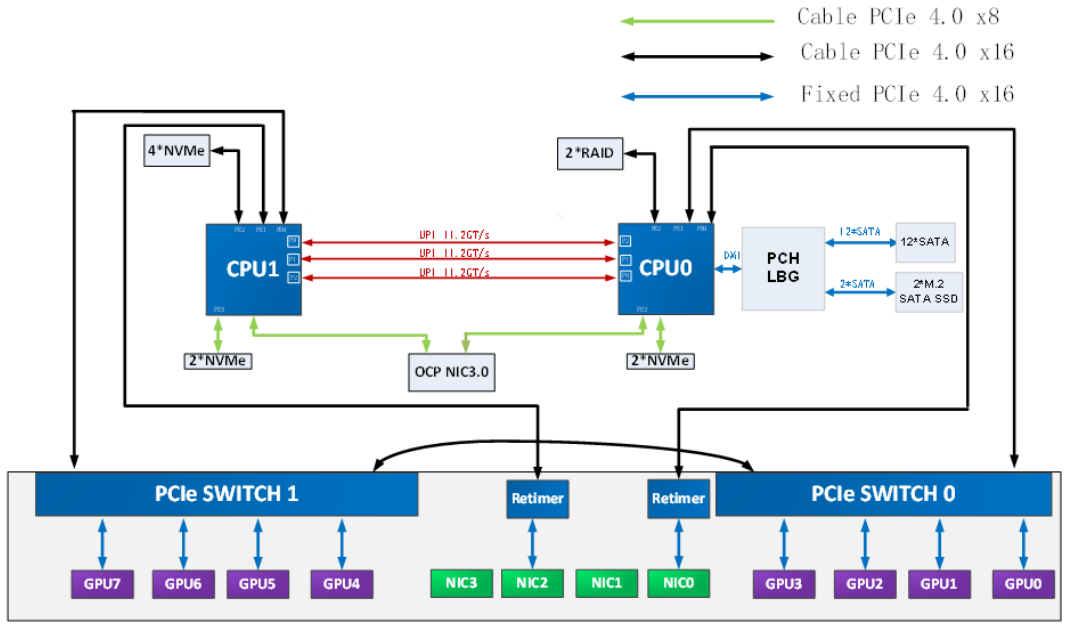


Figure 4-8 PCIe Topology Logic Block Diagram (Balance or Common GPU Topology/Single-Host OCP NIC 3.0)

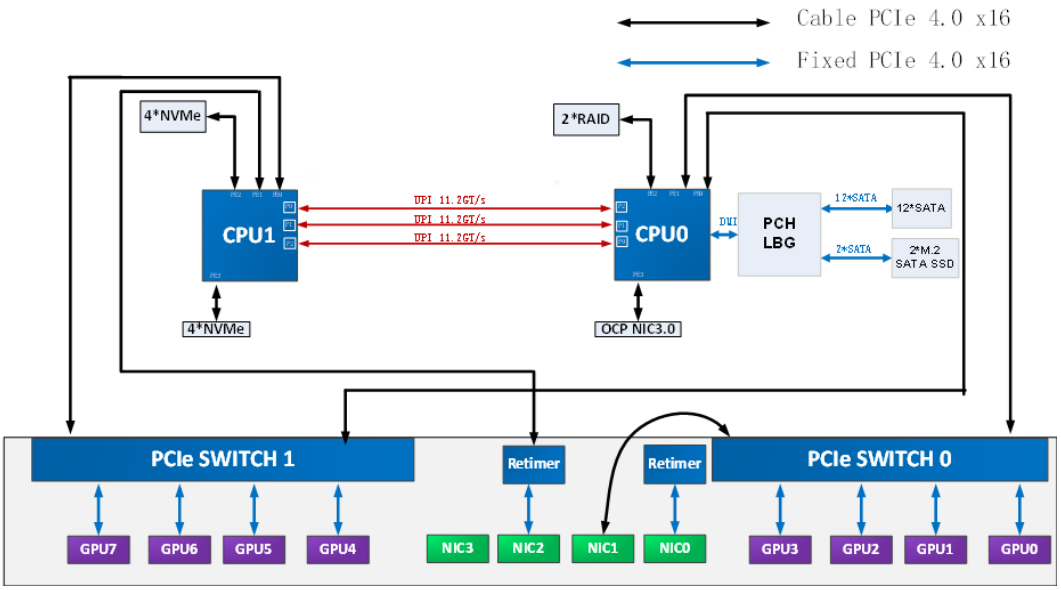
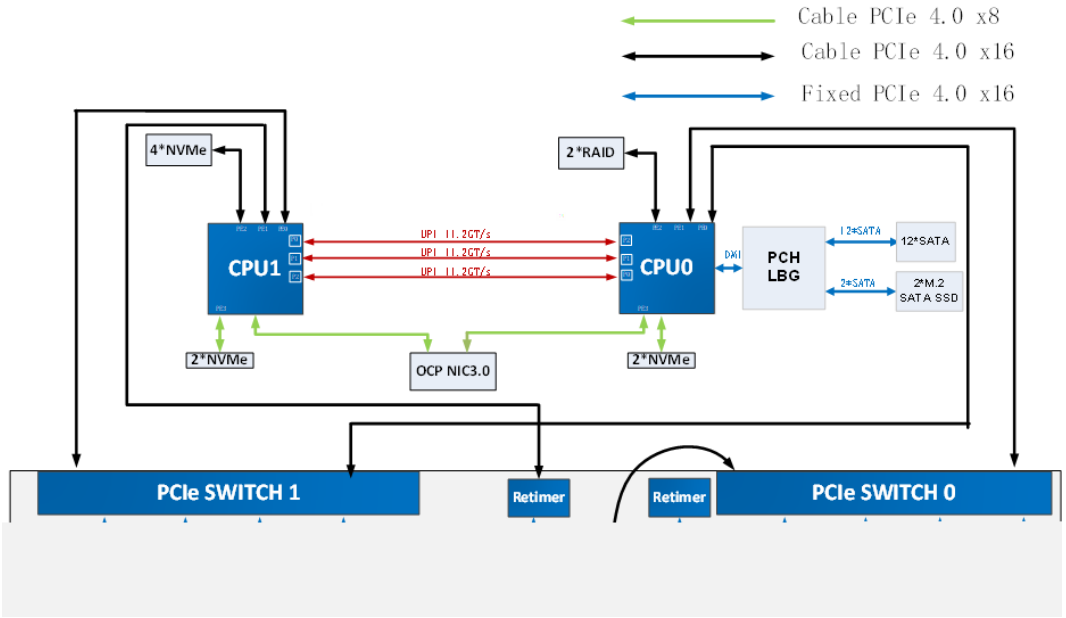



Figure 4-9 PCIe Topology Logic Block Diagram (Balance or Common GPU Topology/Multi-Host OCP NIC 3.0)