

01_CVD: UCS Server Prerequisites

This solution takes an existing FlashStack VSI design and extends it to deliver a FlashStack for AI solution with MLOps provided by Red Hat OpenShift AI. See latest FlashStack VSI Cisco Validated Design (CVD) document for more details on the infrastructure design that this solution is based on.

To build the solution using an existing FlashStack VSI design, we start with changes that must be made to the existing design to support AI/ML workloads. For optimal performance using NVIDIA GPUs, the following policies should be in place as outlined below.

- BIOS Policy: **Intel Virtualization Technology for Directed IO (Intel VT-d /IOMMU)** - Enabled
- BIOS Policy: **Single Root I/O Virtualization (SR-IOV)** - Enabled
- **Hyperthreading** - Enabled
- **Power Setting or System Profile** - High Performance
- **CPU Performance** - Enterprise or High Throughput
- **Memory Mapped I/O above 4-GB** - Enabled (if applicable)

A fully loaded UCS system with M7 servers with GPUs and running AI/ML workloads may require adjustments to the default Thermal Chassis policy, specifically the FAN policy.

- Chassis Policy: Thermal Policy > **FAN Policy**

References:

- Latest FlashStack VSI CVD (at the time of this writing) :
https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/flashstack_m7_vmware_8_ufs_fc.html
- NVIDIA AI Enterprise User Guide:
<https://docs.nvidia.com/ai-enterprise/4.1/user-guide/index.html>
- NVIDIA: Understanding BIOS Configuration for Performance Tuning
<https://enterprise-support.nvidia.com/s/article/understanding-bios-configuration-for-performance-tuning>

- Cisco UCS Server BIOS Tokens in Intersight Managed Mode (IMM):
https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/Intersight/IMM_BIOS_Tokens_Guide/b IMM_Server_BIOS_Tokens_Guide.html
- Performance Tuning Best Practices Guide for Cisco UCS M7 Platforms:
<https://www.cisco.com/c/en/us/products/collateral/servers-unified-computing/ucs-b-series-blade-servers/ucs-m7-platforms-wp.html>

Verify UCS Server policies

Per NVAIE User Guide, the following prerequisite policies are recommended for optimal performance:

1.2. Prerequisites for Using NVIDIA AI Enterprise

Before proceeding, ensure that these prerequisites are met:

- You have a system that meets the requirements in **NVIDIA AI Enterprise Release Notes**.
- One or more supported NVIDIA GPUs are installed in your system.
- If you are using an NVIDIA A100 GPU, the following BIOS settings are enabled on your system:
 - Single Root I/O Virtualization (SR-IOV)
 - VT-d/IOMMU - Enabled

For optimum performance, set options in your server configuration as follows:

- Enable the following options:
 - **Hyperthreading**
 - **Memory Mapped I/O above 4 GB** (if applicable)
- Set the **Power Setting** or **System Profile** option to **High Performance**.
- If applicable, set **CPU Performance** to **Enterprise** or **High Throughput**.

The required policies on a Cisco UCS server can be verified from Cisco Intersight as outlined below.

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1. Enable BIOS Policy: **Intel VT-d /IOMMU**. Per the Cisco UCS Server BIOS Tokens IMM document, this is enabled by default and can be confirmed from Cisco Intersight as shown below.

The screenshot displays the Cisco Intersight interface for a UCS Server Profile. The top navigation bar includes the Cisco logo, 'Intersight', 'Infrastructure Service', a search bar, and various status icons. The main header shows the server ID 'AC09-UCS-FI-6536-1-3' with a 'Healthy' status and an 'Actions' button. Below the header, there are tabs for 'General', 'Inventory', 'UCS Server Profile' (selected), 'HCL', 'Statistics', and 'Topology'. The 'UCS Server Profile' tab is active, showing three panels: 'Details', 'Configuration', and 'BIOS Details'. The 'Details' panel on the left lists server information: Status (OK), Name (FSV-ESXi-Host-13), User Label (-), Target Platform (UCS Server (FI-Attached)), Template Name (FSV-M7a-Intel-5G-iSCSI_Template), and Last Update. The 'Configuration' panel in the middle has tabs for 'General', 'Identifiers', and 'Connectivity'. The 'General' tab is selected, showing a table of BIOS settings: BIOS (M7a-Intel-BIOS_M7_Policy), Boot Order (M7a-iSCSI-Boot-Order-5), UUID Pool (M7a-UUID_Pool), and Virtual Media (M7a-vMedia_Policy). The 'BIOS Details' panel on the right shows the BIOS policy as 'M7a-Intel-BIOS_M7_Policy' and the boot options as 'Intel Directed IO' and 'Intel VT for Directed IO platform-default'. A red box highlights the 'Intel Directed IO' and 'Intel VT for Directed IO platform-default' settings.

Note: The IOMMU setting under BIOS > Memory is for AMD processors and not applicable to Intel processors.

2. Enable BIOS Policy: **Single Root I/O Virtualization (SR-IOV)** . This setting is **not documented** at this time in the Cisco UCS Server BIOS Tokens IMM document but setting can be seen from Cisco Intersight. SR-IOV is enabled and can be verified using one of the following methods:
 - Access Server console and verify BIOS settings
 - `nvidia-smi` from the ESXi host once the NVIDIA GPU is deployed.

Intersight Infrastructure Service Search

Servers

AC09-UCS-FI-6536-1-3 Healthy

Actions

General Inventory UCS Server Profile HCL Statistics Topology

Details

Status OK

Name **FSV-ESXi-Host-13**

User Label -

Target Platform **UCS Server (FI-Attached)**

Template Name **FSV-M7a-Intel-5G-iSCSI_Template**

Last Update **Jan 26, 2024 7:44 PM**

Description **Server Profile Template for Boot from SAN using iSCSI**

Configuration

General Identifiers Connectivity

All Compute Management Network Storage

BIOS	M7a-Intel-BIOS_M7_Policy
Boot Order	M7a-iSCSI-Boot-Order-5G_
UUID Pool	M7a-UUID_Pool
Virtual Media	M7a-vMedia_Policy

BIOS Details

PCI

ASPM Support **platform-default**

IOH Resource Allocation **platform-default**

Memory Mapped IO above 4GiB **platform-default**

MMCFG BASE **platform-default**

Onboard 10Gbit LOM **platform-default**

Onboard Gbit LOM **platform-default**

NVMe SSD Hot-Plug Support **platform-default**

SR-IOV Support
platform-default

3. Enable **Intel Hyperthreading** technology. It is enabled by default and confirmed from the ESXI host as shown below.

Intersight Infrastructure Service Search

Servers

AC09-UCS-FI-6536-1-3 Healthy

Actions

General Inventory UCS Server Profile HCL Statistics Topology

Details

Status OK

Name **FSV-ESXi-Host-13**

User Label -

Target Platform **UCS Server (FI-Attached)**

Configuration

General Identifiers Connectivity

All Compute Management Network Storage

BIOS	M7a-Intel-BIOS_M7_Policy
Boot Order	M7a-iSCSI-Boot-Order-5G_Policy
UUID Pool	M7a-UUID_Pool
Virtual Media	M7a-vMedia_Policy

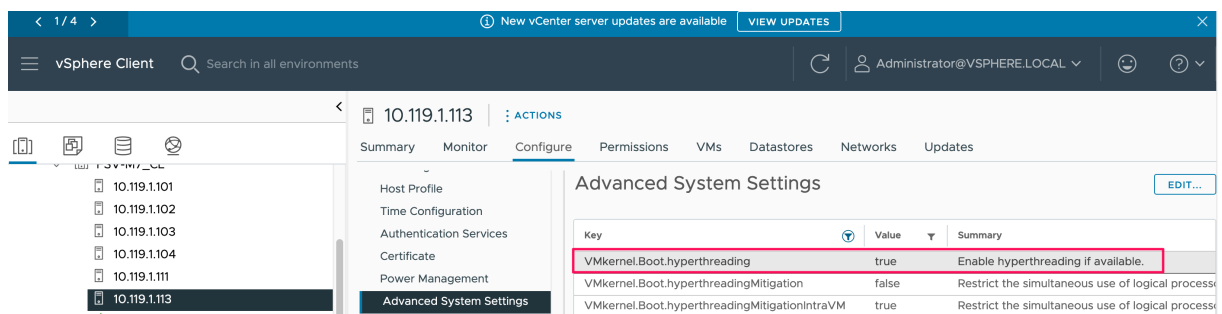
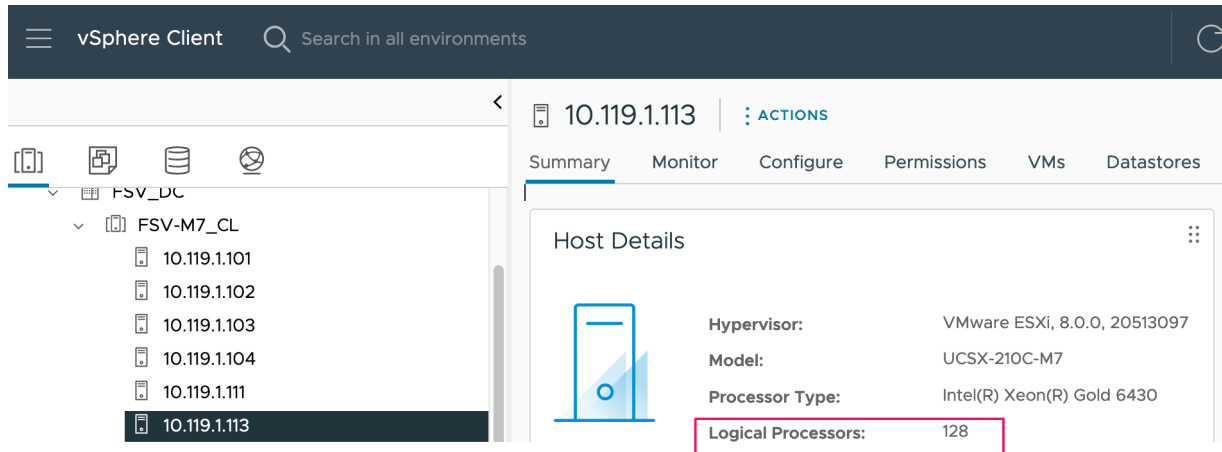
BIOS Details

CPU Hardware Power Management **platform-default**

IMC Interleaving **platform-default**

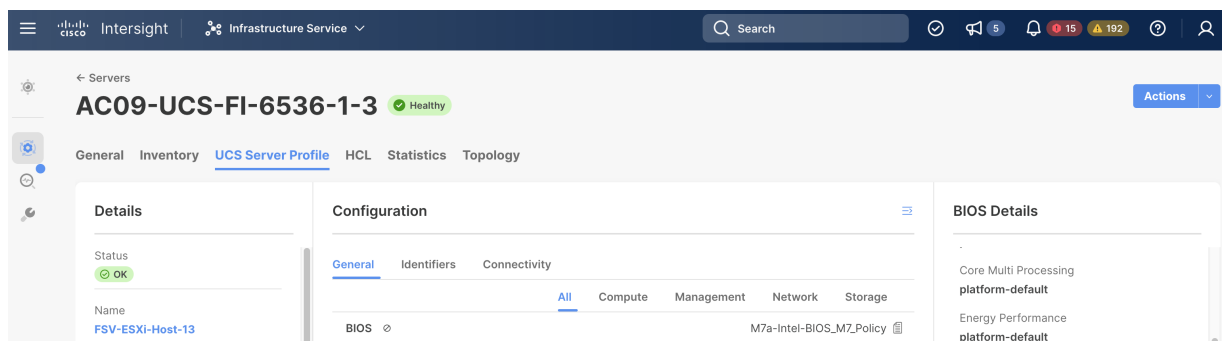
Intel Dynamic Speed Select **platform-default**

Intel HyperThreading Tech
platform-default



4. Energy Performance - Performance.

Per the Cisco UCS Server BIOS Tokens IMM document, this is enabled by default and can be confirmed from Cisco Intersight as shown below.



5. CPU Performance

This is currently disabled by default.

The screenshot shows the Cisco Intersight interface for a UCS Server Profile. The server is named **AC09-UCS-FI-6536-1-3** and is in a **Healthy** state. The **UCS Server Profile** tab is selected, showing details, configuration, and BIOS settings.

Details:

- Status: **OK**
- Name: **FSV-ESXi-Host-13**
- User Label: **-**
- Target Platform: **UCS Server (FI-Attached)**

Configuration:

General	Identifiers	Connectivity
All Compute Management Network Storage		
BIOS	M7a-Intel-BIOS_M7_Policy	
Boot Order	M7a-ISCsi-Boot-Order-5G_Policy	
UUID Pool	M7a-UUID_Pool	
Virtual Media	M7a-vMedia_Policy	

BIOS Details:

- platform-default
- Core Multi Processing
- platform-default
- Energy Performance
- platform-default
- Frequency Floor Override
- platform-default
- CPU Performance
- platform-default

- Memory Mapped I/O above 4-GB** - Enabled (if applicable)
- When adding GPUs to a system, it is important to ensure that the fan control policy reflects the needs of your environment. For a Cisco UCS-X series, it can be specified using the **Fan Control Policy** under **Chassis Policy** as shown.

The screenshot shows the Cisco Intersight interface for editing a policy. The **Policy Details** tab is selected, showing the **Fan Control** settings.

Policy Details:

- General
- Policy Details**

Fan Control:

Fan Control Mode: **Balanced**

- Balanced
- Low Power
- High Power
- Maximum Power
- Acoustic