

AMD EPYC Processor Characterization for VDI on Cisco C245M8 and X215M8 with Citrix Virtual Apps and Desktops



Contents

| | |
|--|----|
| Introduction | 3 |
| VMware vSphere 8 Update 2 | 4 |
| VMware vSphere vCenter | 4 |
| Citrix Virtual Apps and Desktops 7 2402 LTSR | 5 |
| Citrix Virtual Apps and Desktops test platform for AMD EPYC processors | 5 |
| Testing | 10 |
| GPU testing | 15 |
| Summary | 24 |
| Author | 24 |

Introduction

Organizations are increasingly adopting hybrid-cloud strategies, with Cisco® architecture, particularly the Cisco Unified Computing System™ (Cisco UCS®), at the core of on-premises infrastructure. The addition of the Cisco UCS X-Series, a cloud-managed, modular system, to the Cisco UCS portfolio has helped meet the needs of modern applications and enhance operational efficiency, agility, and scalability through an adaptable, future-ready design. It combines the functionalities of both blade and rack servers, offering compute density, storage capacity, and expandability in a single system. The latest introduction of Cisco UCS M8 servers, developed in collaboration with AMD, has achieved top performance results across several key categories, leading to faster application response times, improved user experiences, and the capability to handle the most demanding workloads for our customers.

This white paper provides data for the characterization of Virtual Desktop Infrastructure (VDI) workloads, including graphics-accelerated VDI solutions, on Cisco UCS M8 servers.

Key features of [Cisco UCS C245 M8](#) Rack Server:

- **Processors:** supports up to two 4th Gen or two 5th Gen AMD EPYC processors, providing high performance and flexibility for various workloads
- **Memory:** enhances performance for data-intensive applications with up to 6TB of main memory with 24x 256 GB DDR5 6000 MT/s or DDR5 4800 MT/s DIMMs, depending on the CPU installed
- **Storage:** supports a versatile range of storage options, including hot-swappable Small-Form-Factor (SFF) SAS/SATA and NVMe drives
- **Management:** is managed through Cisco Intersight®, including cloud-based lifecycle management

Key features of [Cisco UCS X215C M8](#) Compute Node:

- **Processors:** supports up to 2x 4th Gen or 5th Gen AMD EPYC processors with up to 160 cores per processor and up to 384 MB of Level-3 cache per CPU
- **Memory:** enhances performance for data-intensive applications with up to 6TB of main memory with 24x 256 GB DDR5 6000 MT/s or DDR5 4800 MT/s DIMMs, depending on the CPU installed
- **Storage:** supports a versatile range of storage options, including SSD/SATA and NVMe drives.
- **Management:** is managed through Cisco Intersight, including cloud-based lifecycle management

VMware vSphere 8 Update 2

VMware vSphere is a virtualization platform for holistically managing large collections of infrastructure resources (including CPUs, storage, and networking) as a seamless, versatile, and dynamic operating environment. Unlike traditional operating systems that manage an individual machine, VMware vSphere aggregates the infrastructure of an entire data center to create a single powerhouse with resources that can be allocated quickly and dynamically to any application in need.

VMware vSphere 8.0 Update 2 has several new features and enhancements aimed at improving performance, compatibility, and security. Some of the updates are:

- vSphere Distributed Services Engine: now supports NVIDIA BlueField-2 DPUs for server designs from Fujitsu (Intel® Sapphire Rapids)
- vSphere Quick Boot: adds support for multiple servers, including models from Dell, Fujitsu, and Lenovo
- In-Band Error-Correcting Code (IB ECC) Support: allows data integrity checks on hardware platforms without ECC type DDR memory
- Graphics and AI/ML workloads: provides enhanced support for Intel ATS-M
- Enhanced ESXi CPU scheduler: provides performance improvements for systems with high core count CPUs, such as Intel Sapphire Rapids
- Driver updates: includes updates for Broadcom, Mellanox, Marvell, and other drivers to enhance performance and support new hardware
- Virtual Hardware Version 21: supports up to 16 vGPU devices per VM and 256 vNVMe disks per VM
- Hot-Extend Shared vSphere Virtual Volumes Disk: allows increasing disk size without downtime; this is beneficial for VM-clustering solutions.
- USB 3.2 support: the virtual xHCI controller is now 20-Gbps compatible.
- Read-only mode for virtual disks: improves performance by avoiding temporary redo logs

For more detailed information, you can refer to the [VMware vSphere 8.0 Update 2 release notes](#).

VMware vSphere vCenter

VMware vCenter Server provides unified management of all hosts and virtual machines from a single console and aggregates performance monitoring of clusters, hosts, and virtual machines. vCenter Server gives administrators deep insight into the status and configuration of computing clusters, hosts, virtual machines, storage, the guest OS, and other critical components of a virtual infrastructure. VMware vCenter manages the robust set of features available in a VMware vSphere environment.

Citrix Virtual Apps and Desktops 7 2402 LTSR

Citrix Virtual Apps and Desktops 7 2402 Long-Term Service Release (LTSR) provides the following features and enhancements:

- New features and enhancements: improved user experience with updates to the graphical interface and performance optimizations. Enhanced security features to protect data and ensure compliance with industry standards. Updates to the management and monitoring tools for better control and visibility.
- Support and compatibility: extended support for the latest operating systems and compatibility with various client devices. Integration improvements with third-party applications and services.
- Bug fixes and stability improvements: resolution of known issues from previous versions to enhance system stability and performance. Optimizations to reduce system resource consumption and improve overall efficiency.

For additional details, refer to the Citrix documentation [here](#).

Citrix Virtual Apps and Desktops test platform for AMD EPYC processors

This section provides an overview of the infrastructure setup for VDI deployment using Cisco UCS C245 M8 Rack Servers and Cisco UCS X215 M8 Compute Node with 4th Gen AMD EPYC CPUs for enterprise end users with VMware vSphere 8.0 Update 2 and Citrix Virtual Apps and Desktops 7 2402. This section does not cover the design details or configuration of components such as Cisco Nexus® and Cisco MDS switches and storage array systems because their designs and configurations conform to various Cisco Validated Designs for converged infrastructure and are covered widely elsewhere. This document focuses on the design elements and performance of the AMD platform for Virtual Desktop Infrastructure (VDI) deployments.

Physical architecture

The architecture deployed is highly modular and follows the implementation principles of Cisco Validated Designs for converged infrastructure. Although each customer's environment may vary in its exact configuration, the architecture described in this document, once built, can easily be scaled as requirements and demands change. The design can be scaled both up (by adding resources within a Cisco UCS domain) and out (by adding Cisco UCS domains). Figure 1 provides an overview of the physical architecture.

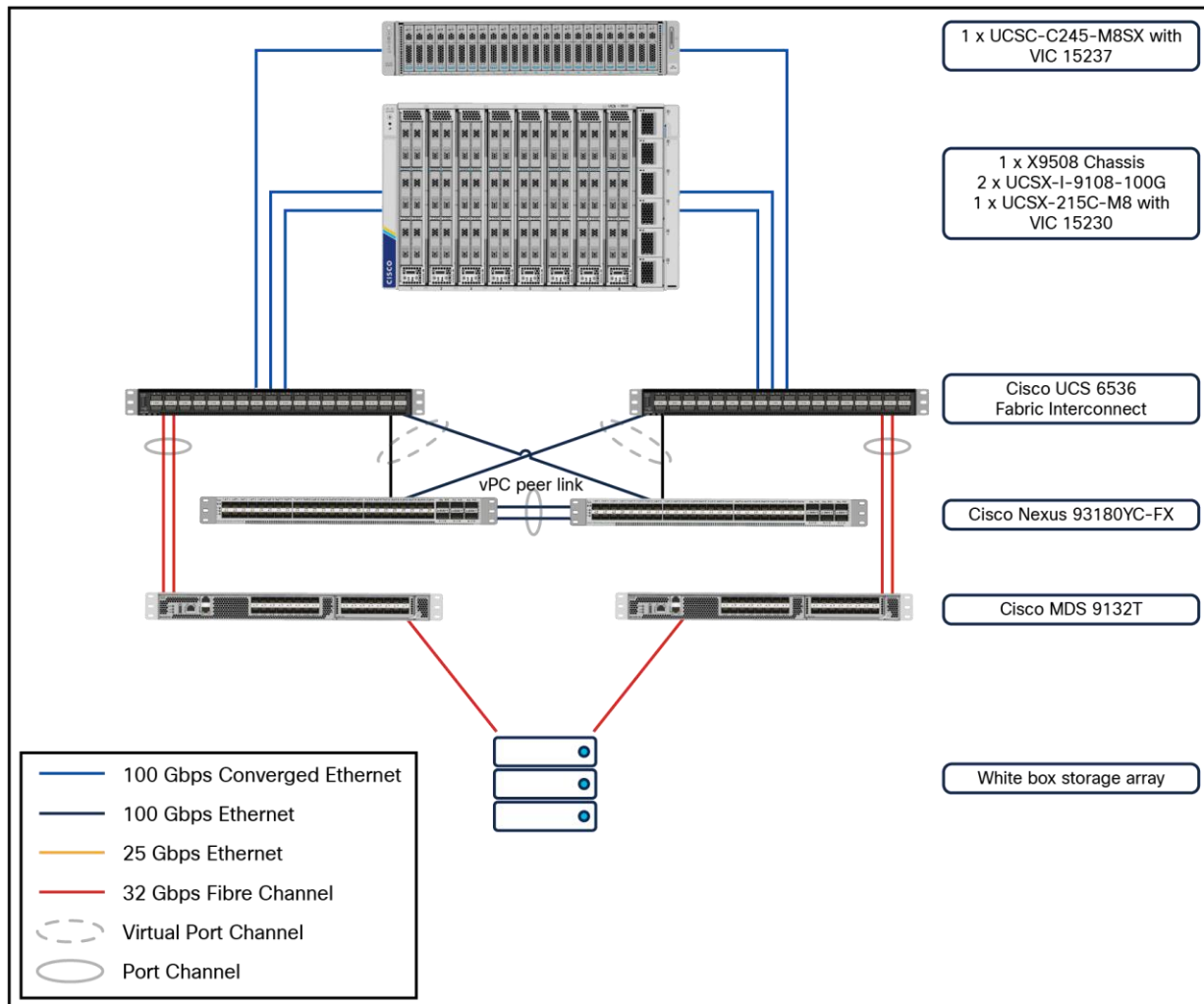


Figure 1.
Physical architecture

Table 1 lists the software and hardware versions used in the solution described in this document.

Table 1. Software and firmware versions

| Component | Version |
|--|-----------------|
| Cisco UCS Fabric Interconnect firmware | 4.3(5.240032) |
| Cisco UCS C245-M8SX server | 4.3(5.250001) |
| Cisco UCS VIC 15237 | 5.3(4.84) |
| Cisco UCS X215C-M8 blade | 5.3(0.250021) |
| Cisco UCS VIC 15230 | 5.3(4.86) |
| VMware vCenter Server Appliance | 8.0.2.00100 |
| VMware vSphere 8.0 U2 | 8.0.2, 22380479 |

Cisco UCS BIOS options for VDI workloads

A BIOS policy automates the configuration of BIOS settings on servers. Multiple BIOS policies that contain a specific grouping of BIOS settings, matching the needs of a server or servers, can be created.

Note: All BIOS tokens are not applicable to all servers. If unsupported tokens are pushed to a server, those tokens are ignored.

This section describes the options you should configure in the Cisco UCS M8 BIOS for VDI workloads.

Creating Cisco UCS BIOS policy

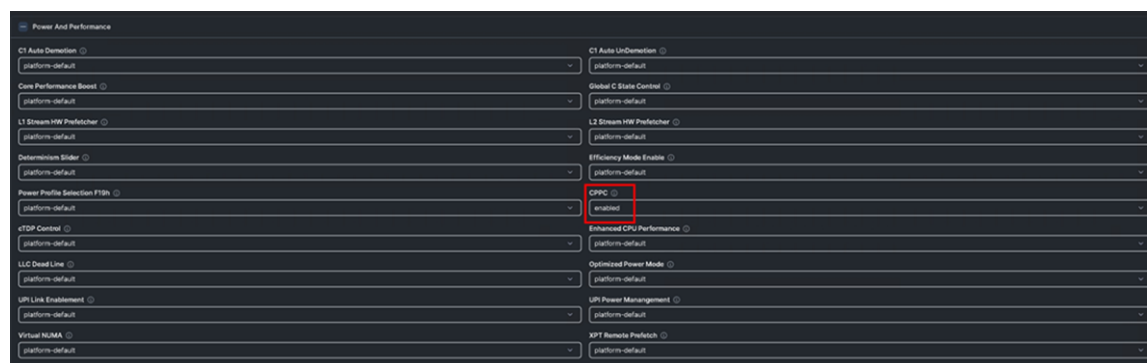
To create a server BIOS policy for VMware ESXi hosts, follow these steps:

1. Log in to Cisco Intersight with your Cisco ID and select admin role.
2. Choose Configure > Policies, and then click Create Policy.
3. Select **BIOS**, and then click Start.
4. On the **General** page, configure the following parameters:
 - Select the Organization.
 - Enter a name for your policy.
5. On the **Policy Details** page, configure the following BIOS policy options:
 - Power and Performance -> CPPC: enabled
 - Memory -> Numa Nodes per Socket: NPS4
6. Click **Create**.

Note: For more information, see

[Performance Tuning for Cisco UCS M8 Platforms with AMD EPYC 4th Gen and 5th Gen Processors](#).

Figure 2 shows the BIOS policy settings.



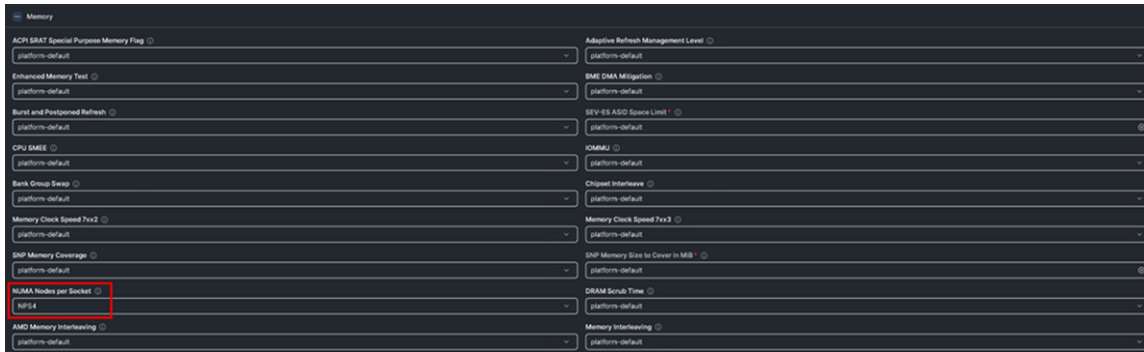


Figure 2.
Cisco UCS M8 BIOS policy settings

Logical architecture

The logical architecture used in the characterization of the Cisco UCS M8 servers is based on Cisco Validated Designs. This design is illustrated in Figure 3. For desktop virtualization, the deployment includes Citrix Virtual Apps and Desktops 7 2402 LTSR running on VMware vSphere ESXi 8.0 U2.

This design is intended to provide a characterization for Citrix Virtual Apps and Desktops (CVAD) desktops on Cisco UCS M8 servers.

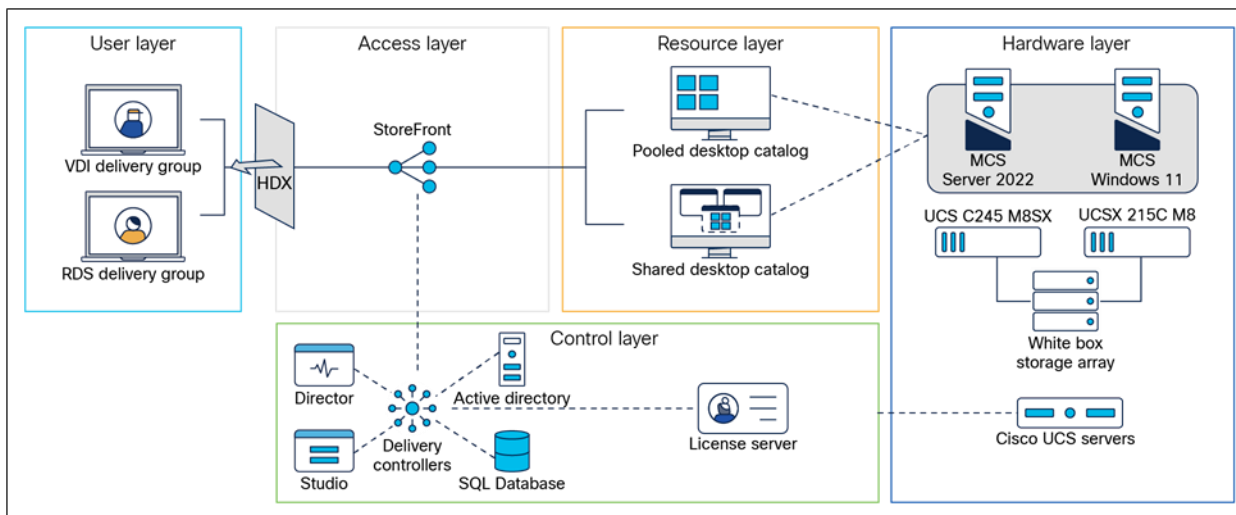


Figure 3.
Logical architecture

Table 2. Software versions

| Component | Version |
|--|--------------------------|
| Citrix Virtual Apps and Desktops 7 2402 LTSR CU1 | Release 2402.0.1100.1256 |
| Citrix Virtual Apps and Desktops 7 2402 LTSR CU1– StoreFront | Release 2402.0.1100.8 |
| Citrix Virtual Apps and Desktops 7 2402 LTSR CU1– Virtual Delivery Agent | Release 2402.0.1100.1256 |
| VMware Tools | Release 12.3.0.22234872 |

Golden images

Virtual machines must first be installed with the software components needed to build the golden images. Additionally, all available security patches for the Microsoft operating system and Microsoft Office should be installed.

The final step is the Virtual Delivery Agent (VDA) installation, and optimization with the Citrix Optimizer.

[Citrix Optimizer](#) is a Windows tool to help Citrix administrators optimize various components in their environment, most notably the operating system with the Virtual Delivery Agent (VDA). The tool is PowerShell-based but also includes a graphical UI.

Note: The images used contain the basic features needed to run the Login Enterprise workload.

The master target virtual machine was configured as outlined in Tables 3 and 4.

Table 3. Configuration of VDI virtual machines

| Configuration | VDI virtual machines |
|--------------------------------------|-------------------------------------|
| Operating system | Microsoft Windows 11 64-bit |
| Virtual CPU amount | 2 |
| Memory amount | 4-GB reserve for all guest memory |
| Network | VMXNET3 |
| Virtual disk (vDisk) size | 96 GB |
| Additional software used for testing | Microsoft Office LTSC Standard 2021 |

Table 4. Configuration of RDS virtual machines

| Configuration | VDI virtual machines |
|--------------------------------------|--------------------------------------|
| Operating system | Microsoft Windows Server 2022 64-bit |
| Virtual CPU amount | 4 |
| Memory amount | 24-GB reserve for all guest memory |
| Network | VMXNET3 |
| Virtual disk (vDisk) size | 90 GB |
| Additional software used for testing | Microsoft Office LTSC Standard 2021 |

Testing

It is essential to test the virtual desktops to ensure they fully meet the expected performance and accessibility standards.

One of the tools available for assessing Virtual Desktop Infrastructure (VDI) environments is Login Enterprise, developed by Login VSI. This industry-standard software simulates human-centric workloads to benchmark the capacity and performance of Virtual Desktop Infrastructure (VDI) solutions. Cisco Technical Marketing utilizes Login Enterprise to evaluate Cisco VDI architectures for Cisco Validated Designs (CVDs).

About Login VSI

Login VSI helps organizations proactively manage the performance, cost, and capacity of their virtual desktops and applications wherever they reside – traditional, hybrid, or in the cloud. The Login Enterprise platform is 100 percent agentless and can be used in all major VDI and Desktop-as-a-Service (DaaS) environments, including Citrix, Omnisia (formerly the End-User Computing division of VMware), and Microsoft. With 360° proactive visibility, IT teams can plan and maintain successful digital workplaces with less cost, fewer disruptions, and lower risk. Founded in 2012, Login VSI is headquartered in Boston, Massachusetts, and Amsterdam, Netherlands. Visit www.loginvsi.com.

Results

We used Login Enterprise to identify the maximum recommended workload for the AMD EPYC 4th Gen processors for VDI and RDSH Knowledge Workers (KWs):

- AMD EPYC 9554
VDI KW maximum recommended workload: 450 users
RDSH KW maximum recommended workload: 510 users
- AMD EPYC 9334
VDI KW maximum recommended workload: 230 users
RDSH KW maximum recommended workload: 255 users

The maximum recommended workload is used to plan for maintenance and failure scenarios.

Each customer's environment and workloads are different. The density numbers shown here are starting points for your unique environment. They are not intended to be performance guarantees.

The following figures show the Login Enterprise Load Testing results for the VDI and RDSH maximum recommended workloads on the Cisco UCS servers.

Recommended workload of 450 VDI users on Cisco UCS C245-M8SX server with AMD EPYC 9554 64-Core Processor and 3 TB of DDR5 memory.

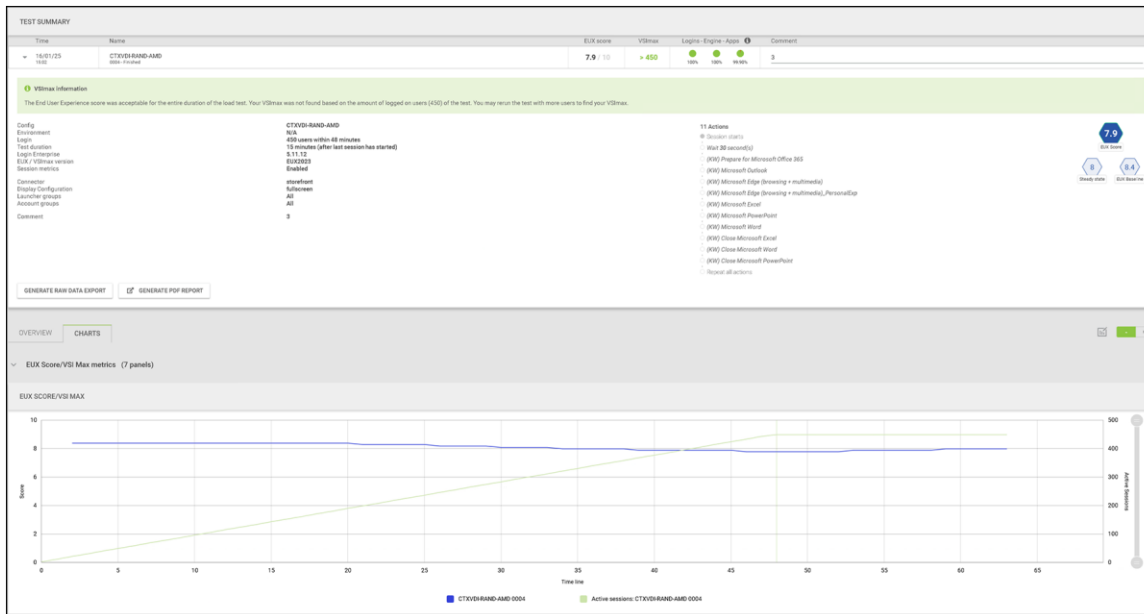


Figure 4.
Load testing 450 VDI users with Login Enterprise – Test Summary

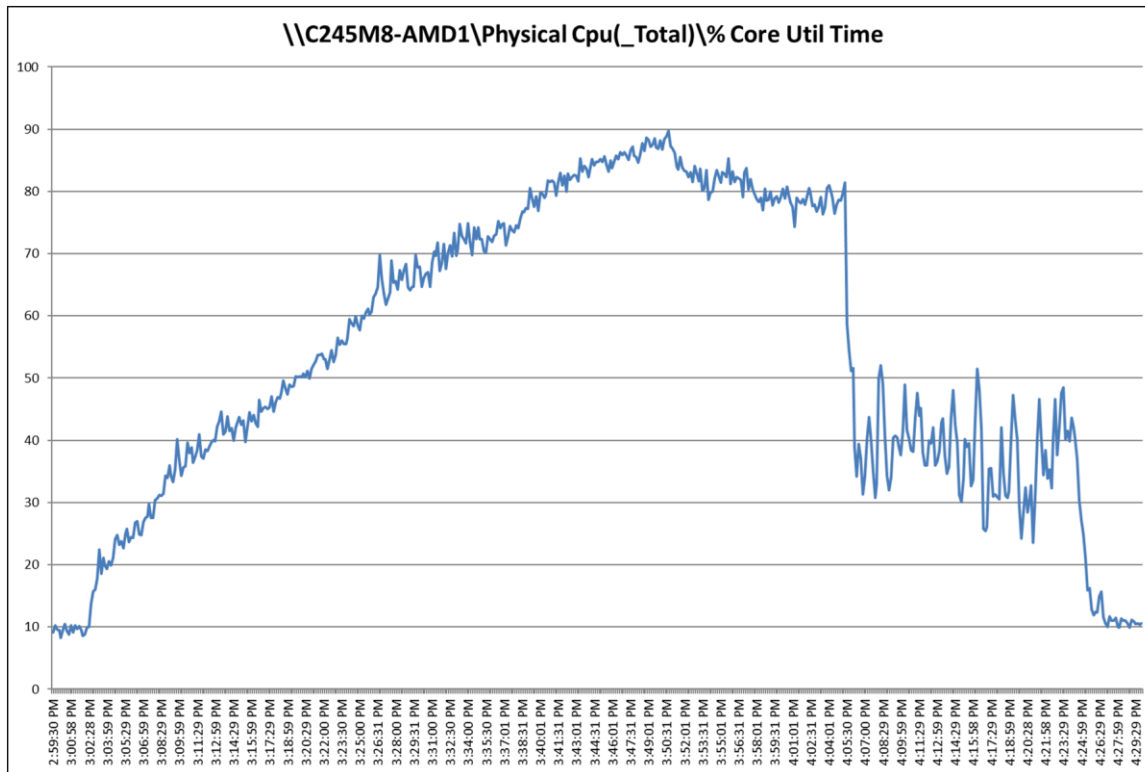


Figure 5.
Cisco UCS C245 M8SX CPU utilization

Recommended workload of 510 RDS users on Cisco UCS C245-M8SX server with AMD EPYC 9554 64-Core Processor and 3 TB of DDR5 memory.

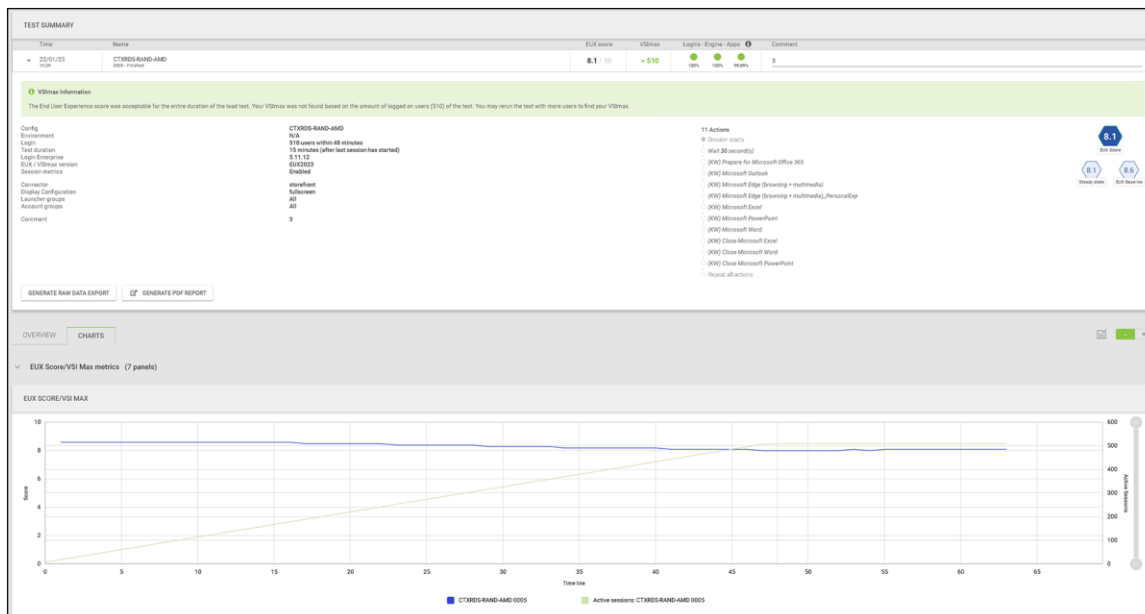


Figure 6.
Load testing 510 RDS users with Login Enterprise - Test Summary

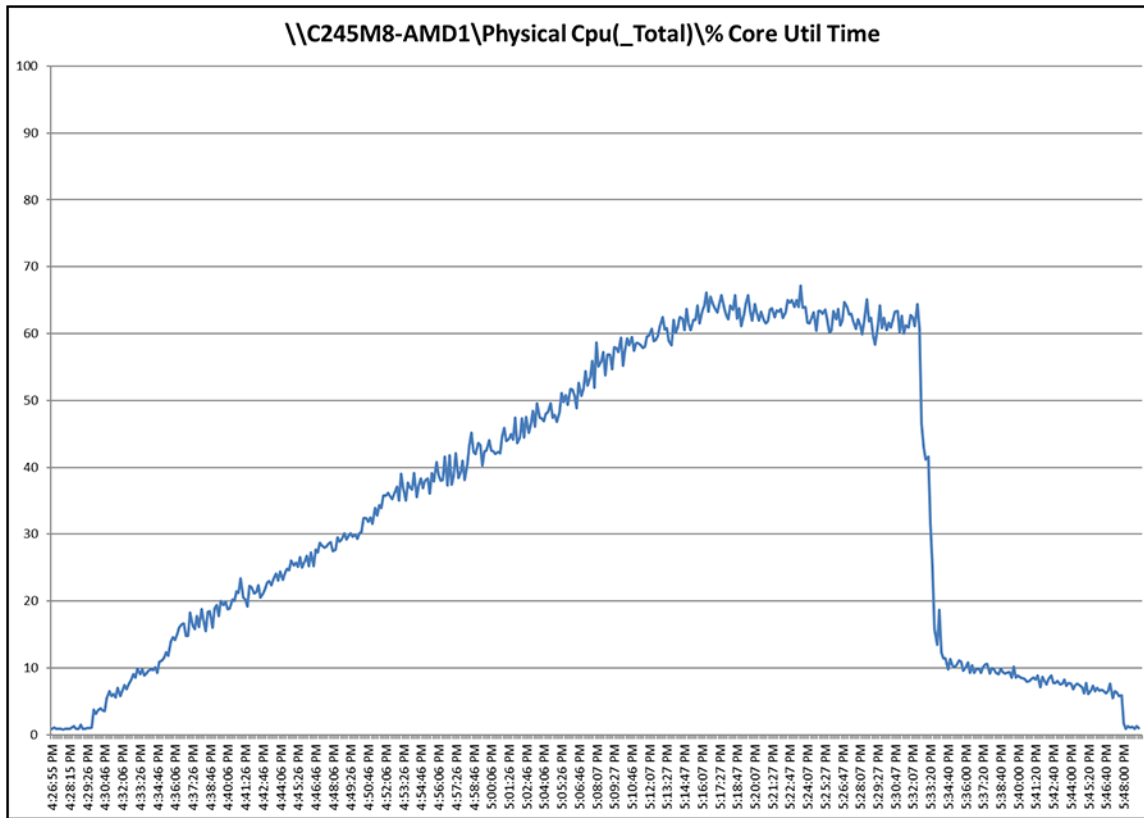


Figure 7.
Cisco UCS C245 M8SX CPU utilization

Recommended workload of 230 VDI users on Cisco UCSX 215C M8 server with AMD EPYC 9334 32-Core Processor and 1.5 TB of DDR5 memory.

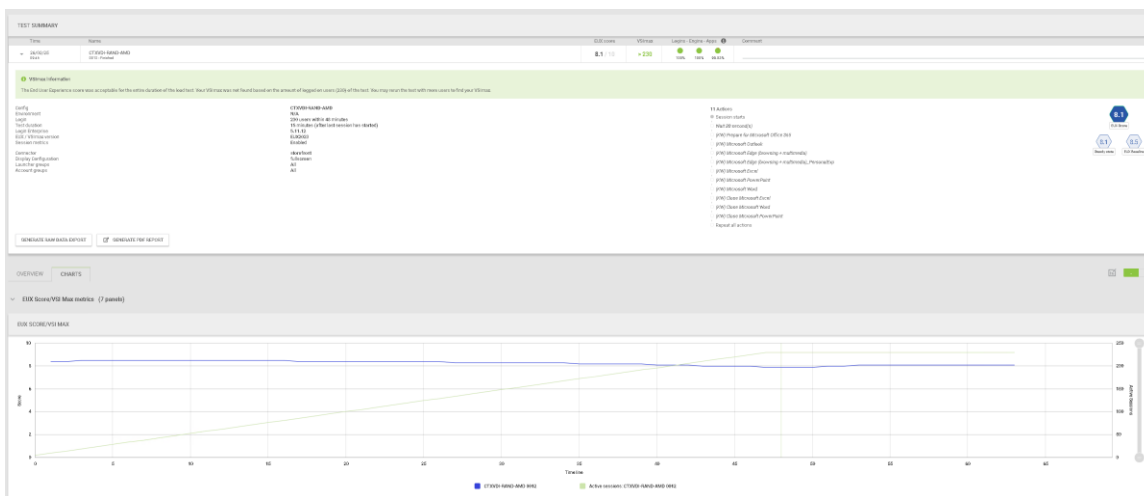


Figure 8.
Load testing 230 VDI users with Login Enterprise - Test Summary

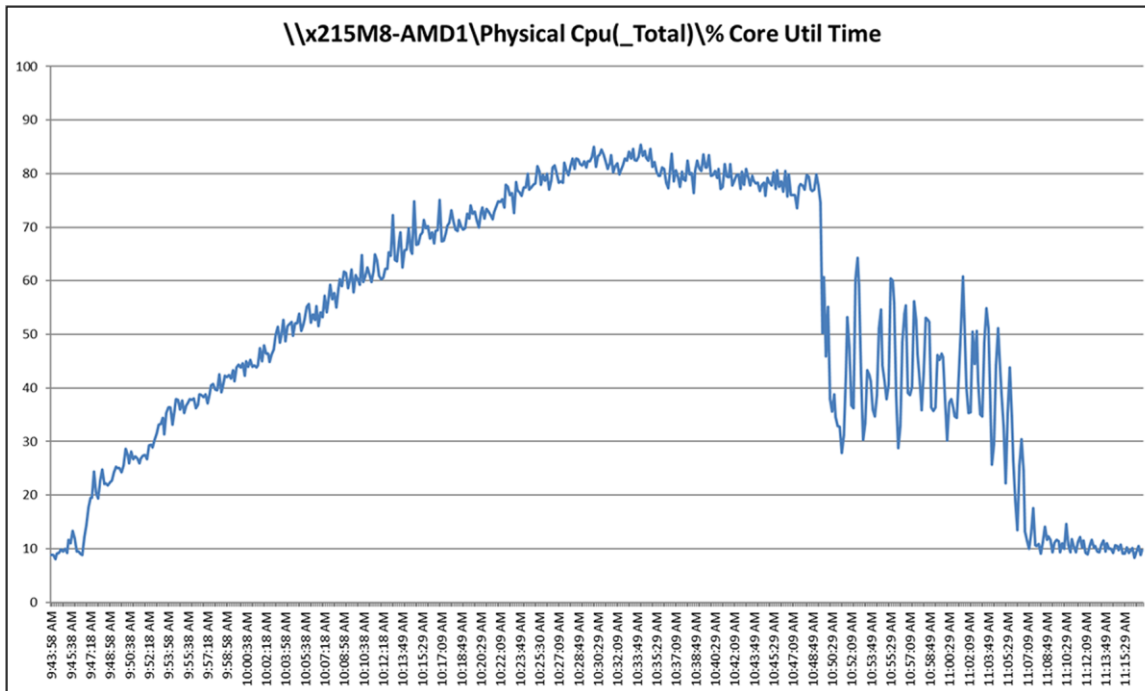


Figure 9.
Cisco UCSX 215C M8 CPU utilization

Recommended workload of 255 RDS users on Cisco UCSX 215C M8 server with AMD EPYC 9334 32-Core Processor and 1.5 TB of DDR5 memory.

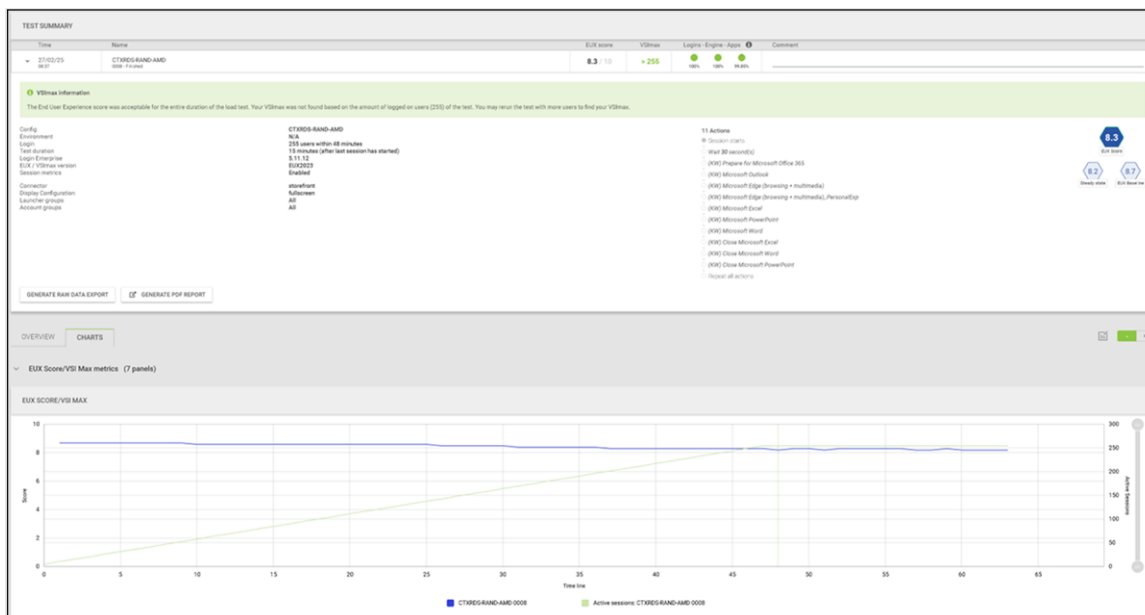


Figure 10.
Load testing 255 RDS users with Login Enterprise - Test Summary

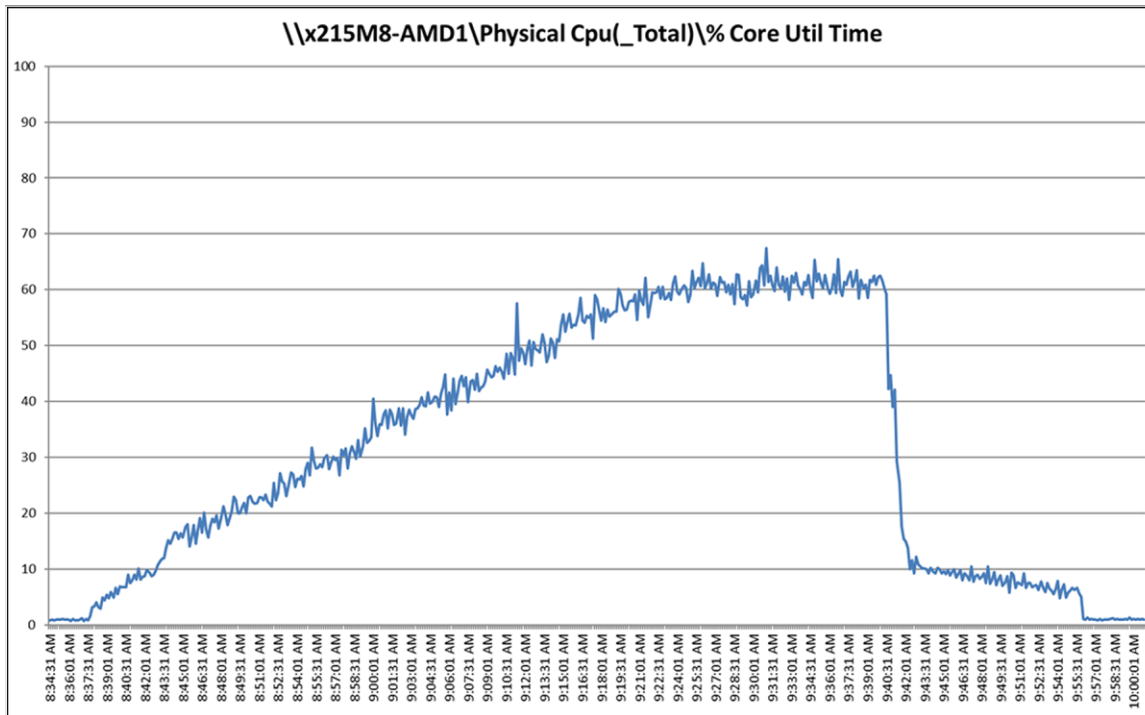


Figure 11.
Cisco UCSX 215C M8 CPU utilization

GPU testing

For graphics-intensive workloads and enhanced-experience Windows 11 environments, you can utilize GPUs specifically designed for these purposes. Cisco UCS M8 servers support popular NVIDIA GPUs such as the NVIDIA A16, NVIDIA L40, and NVIDIA L4, which are commonly used in Virtual Desktop Infrastructure (VDI) settings.

Login Enterprise provides tools that enable you to gauge the performance of graphics-enhanced workloads effectively. The following figures show the results of a graphics-intensive knowledge worker workload using a 2Q vGPU profile on a single Cisco UCS C245 M8 Rack Server equipped with a single GPU.

NVIDIA L4 test

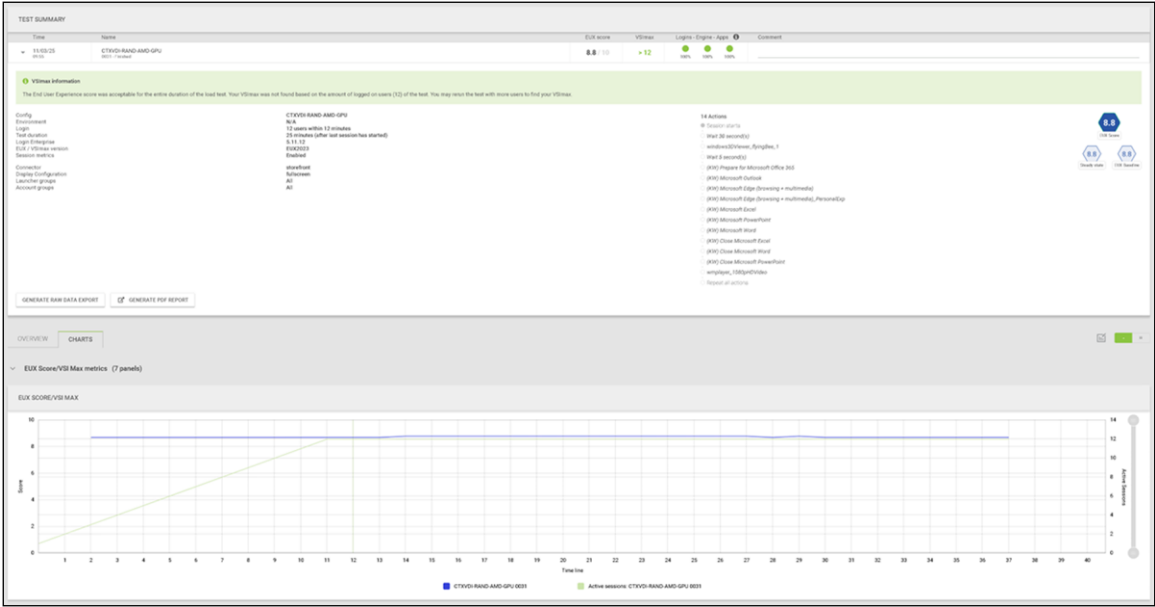


Figure 12. Load testing with Login Enterprise 12 users with NVIDIA L4-Q2 vGPU profile - Test Summary

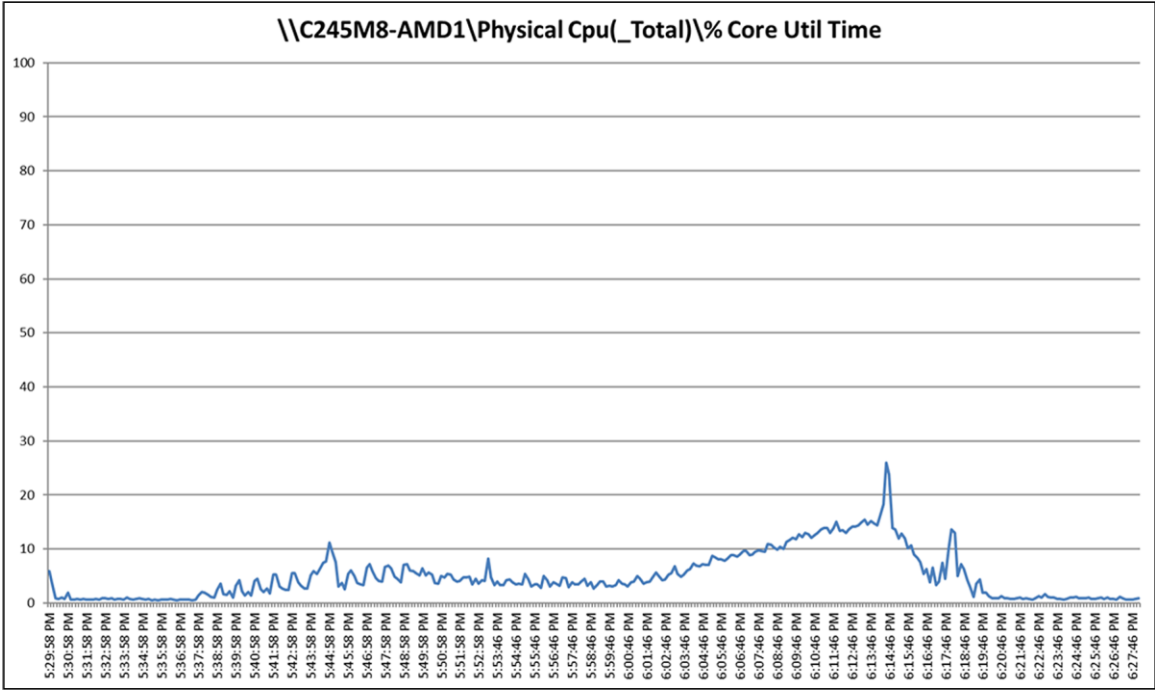


Figure 13. Cisco UCS C245 M8SX CPU utilization

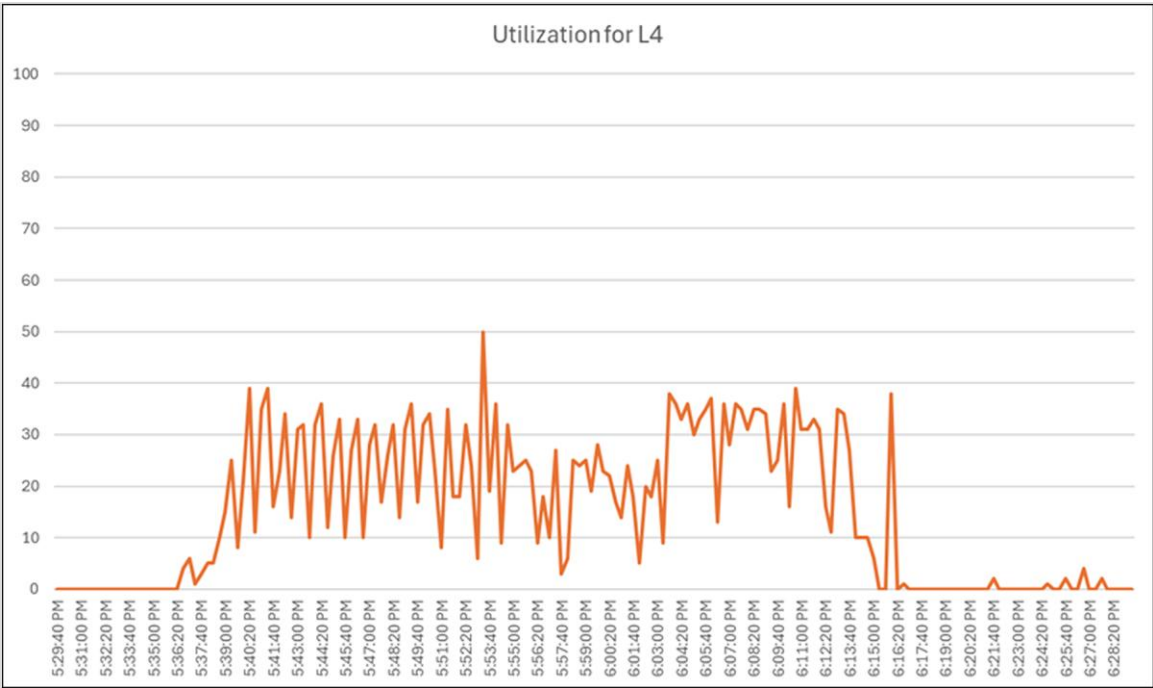


Figure 14.
Cisco UCS C245 M8SX NVIDIA L4 utilization

NVIDIA L40 test

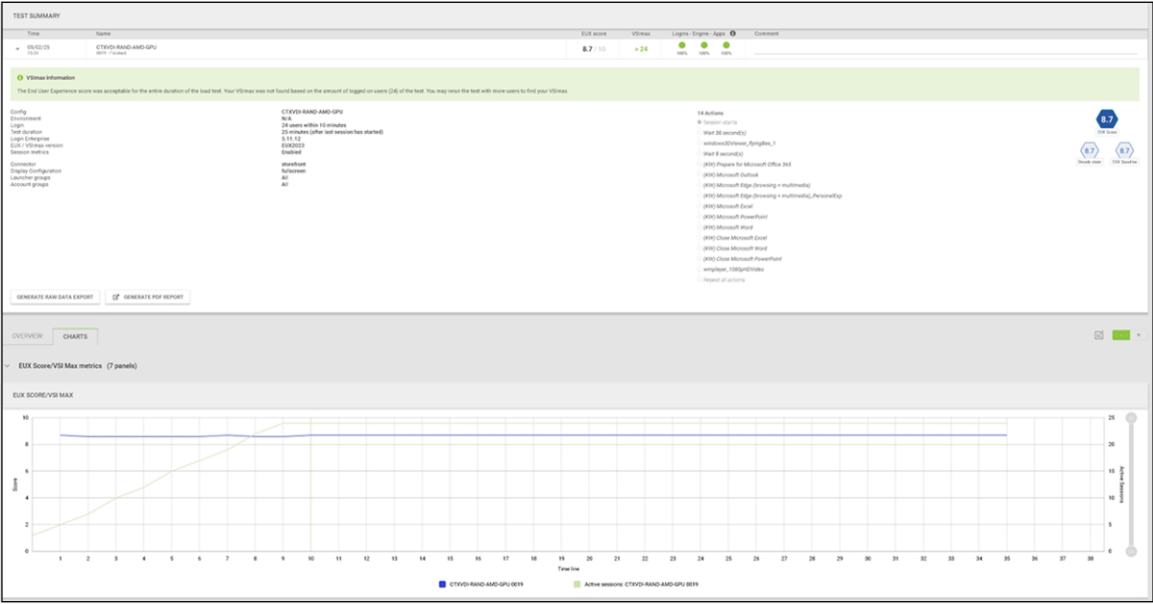


Figure 15.
Load testing with Login Enterprise 24 users with NVIDIA L40-2Q vGPU profile - Test Summary

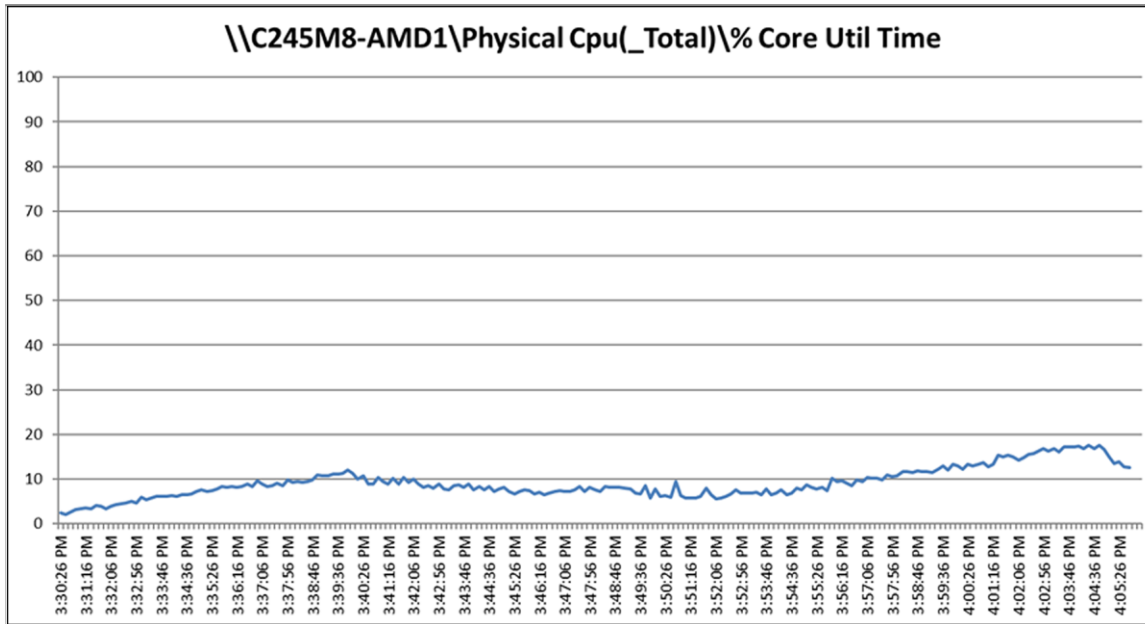


Figure 16.
Cisco UCS C245 M8SX CPU utilization

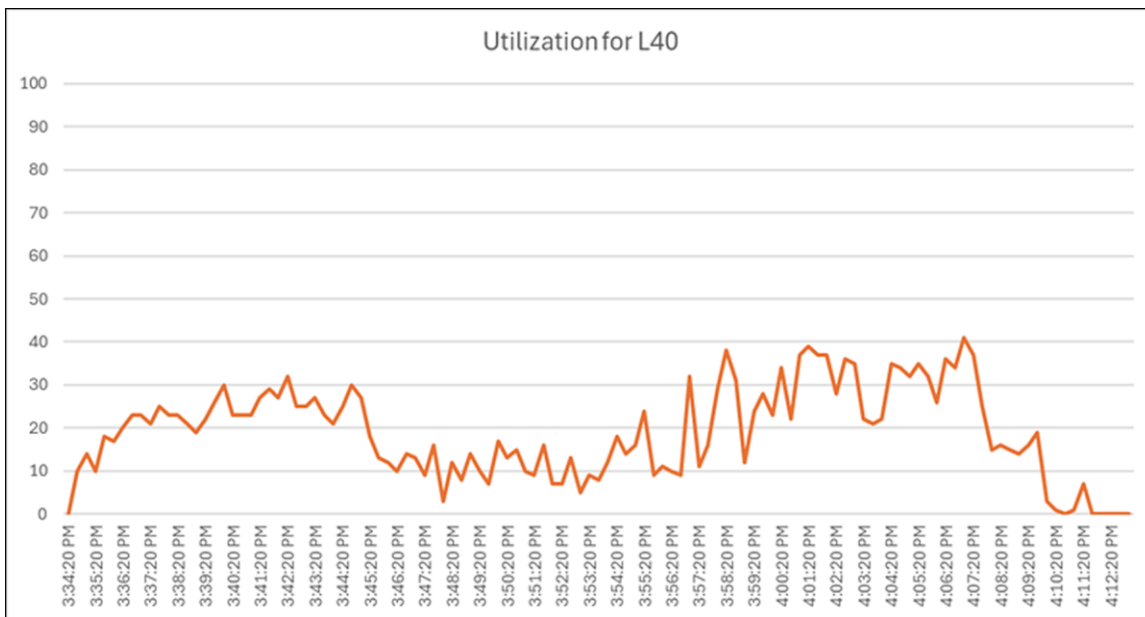


Figure 17.
Cisco UCS C245 M8SX NVIDIA L40 utilization

© 2015 Pearson Education, Inc. or its affiliate(s). All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without prior written permission from Pearson Education, Inc.



Figure 19.

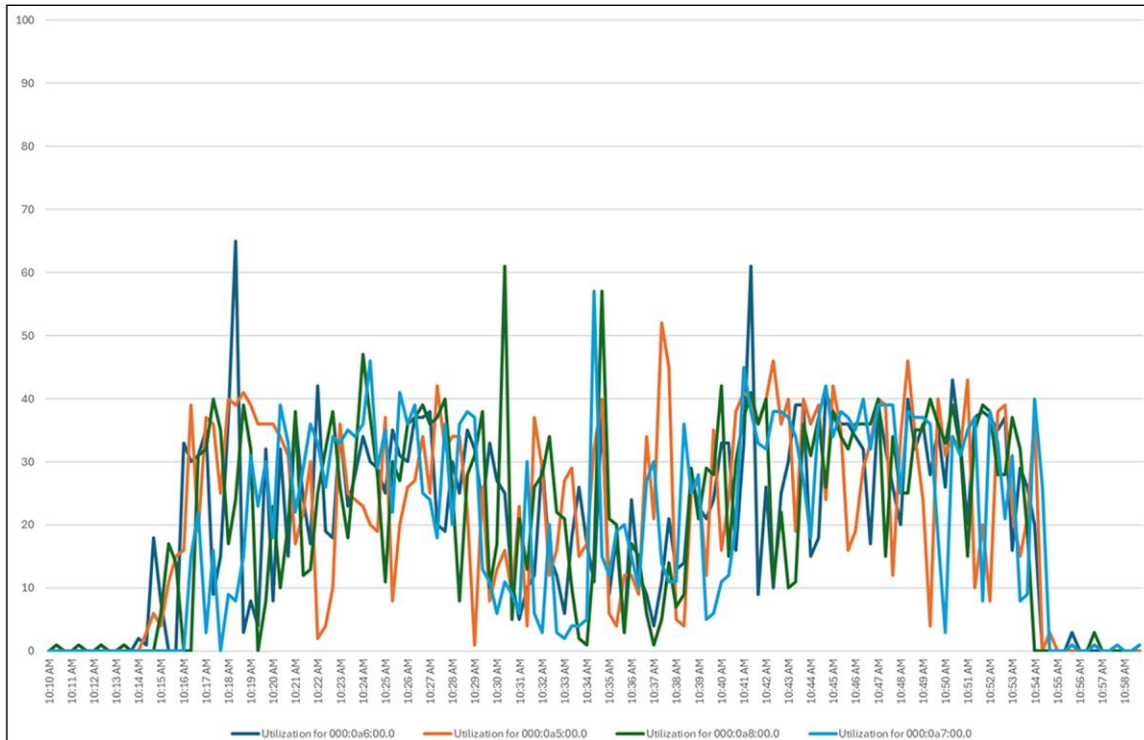


Figure 20.
Cisco UCS C245 M8SX NVIDIA A16 utilization

SPECviewperf

Another tool widely used to evaluate the performance of workstations and graphics hardware by simulating real-world applications in areas such as digital content creation and visualization is SPECviewperf.

SPECviewperf is a benchmark that measures the 3D graphics performance of systems running under the OpenGL and DirectX APIs. It uses workloads, known as viewsets, which represent graphics content and behavior from actual applications. The benchmark includes viewsets for applications such as 3ds Max, CATIA, Creo, Energy (based on rendering techniques used by the open-source OpendTect seismic visualization application), Maya, Medical (demonstrating “slice rendering” and “rayscaling” using the Tuvok visualization library for rendering), Siemens NX, and SolidWorks. Visit [SPECviewperf benchmark](#).

The figures below show examples of the 3dsmax-07 viewset being run on virtual machines running Windows 11 with 4vCPUs and 16 GB of memory on supported graphic cards with a 4Q vGPU profile.

Note: No benchmark specific configurations were applied to virtual machines and/or hypervisor hosts.

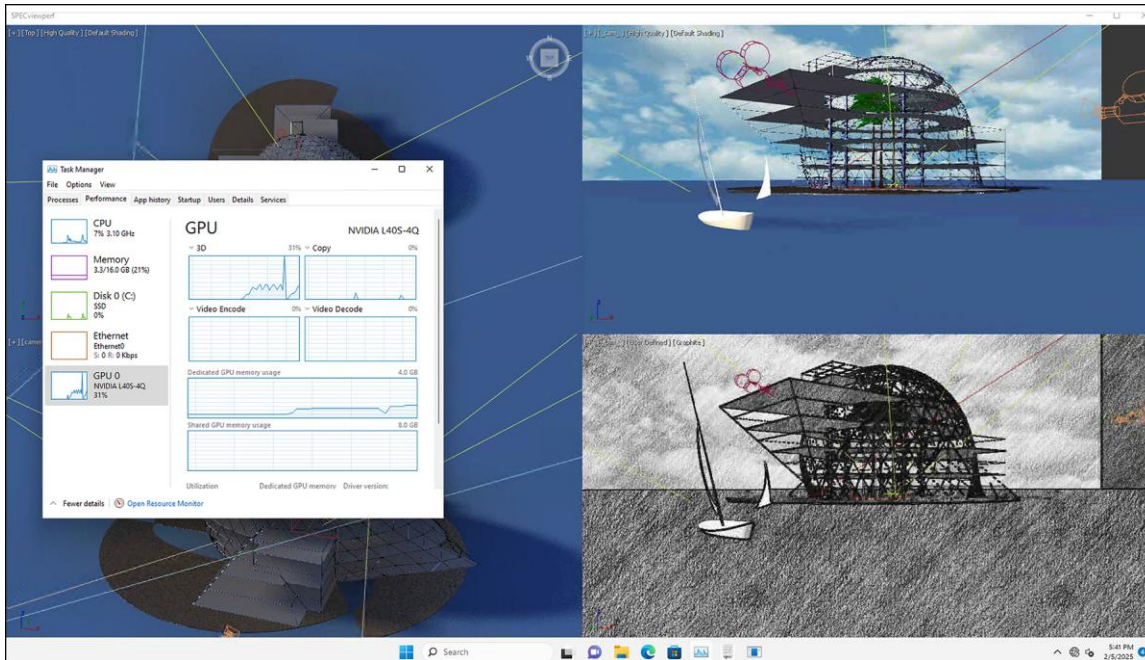


Figure 21.
3dsmax viewset running on Windows 11 virtual machine with 4vCPUs, 16 GB of memory and NVIDIA L40-4Q vGPU profile

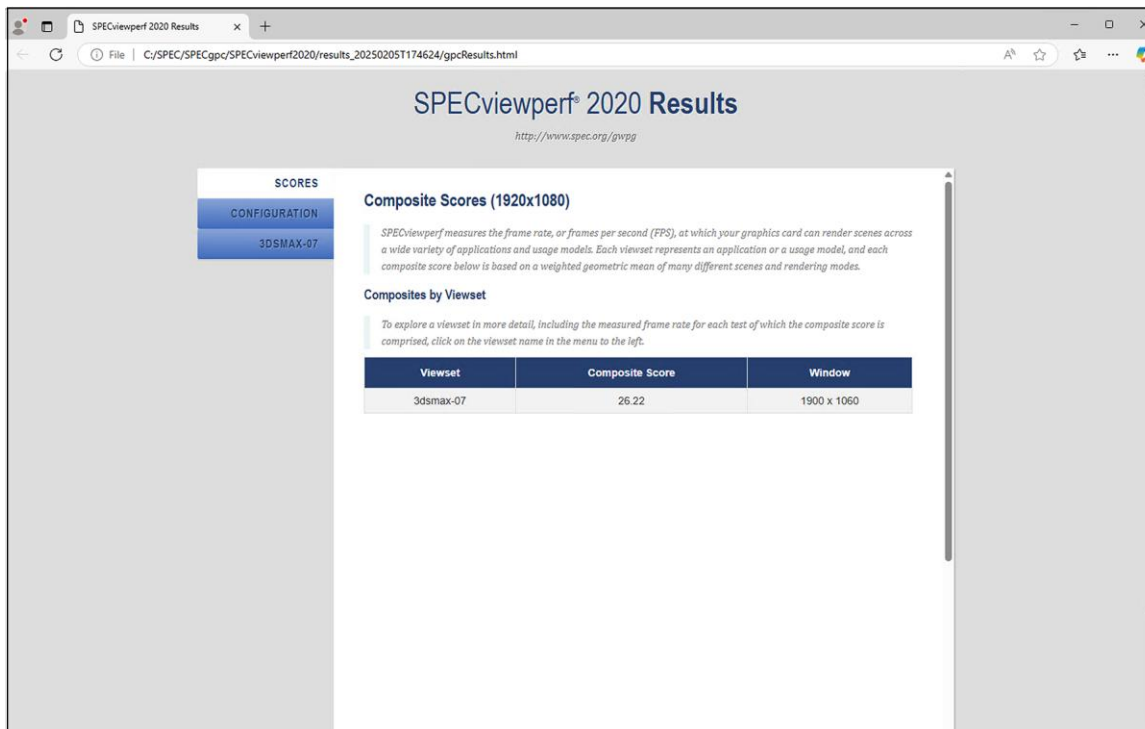


Figure 22.
SPECviewperf 3dsmax result on Windows 11 with NVIDIA L40-4Q vGPU profile

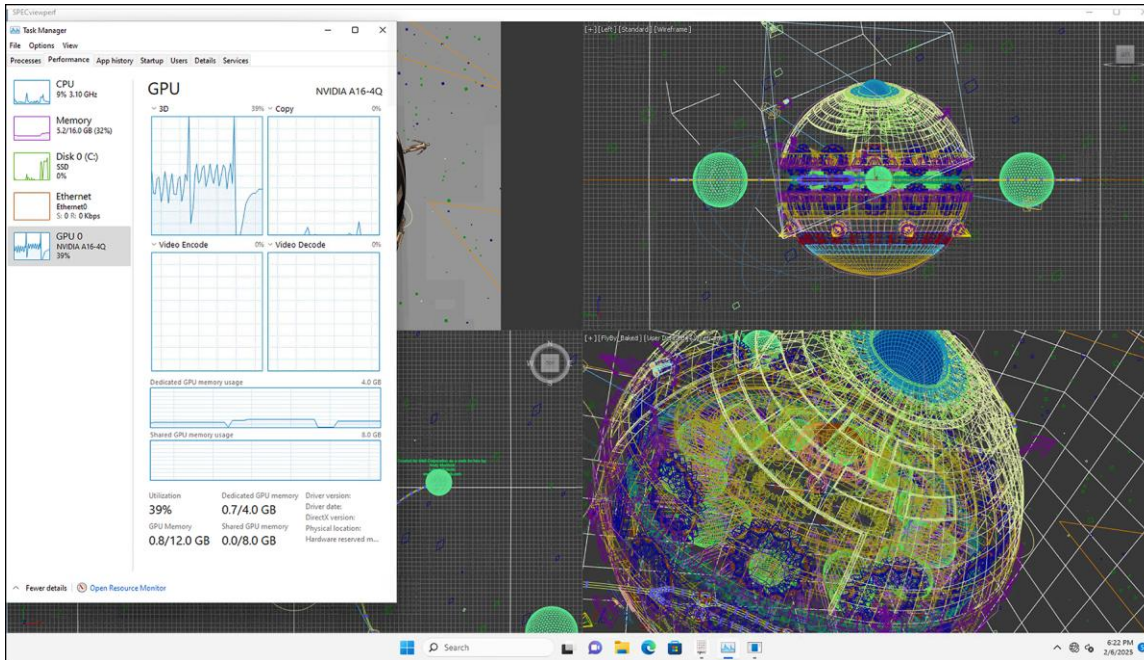


Figure 23.
3dsmax viewset running on Windows 11 virtual machine with 4vCPUs, 16 GB of memory and NVIDIA A16-4Q vGPU profile

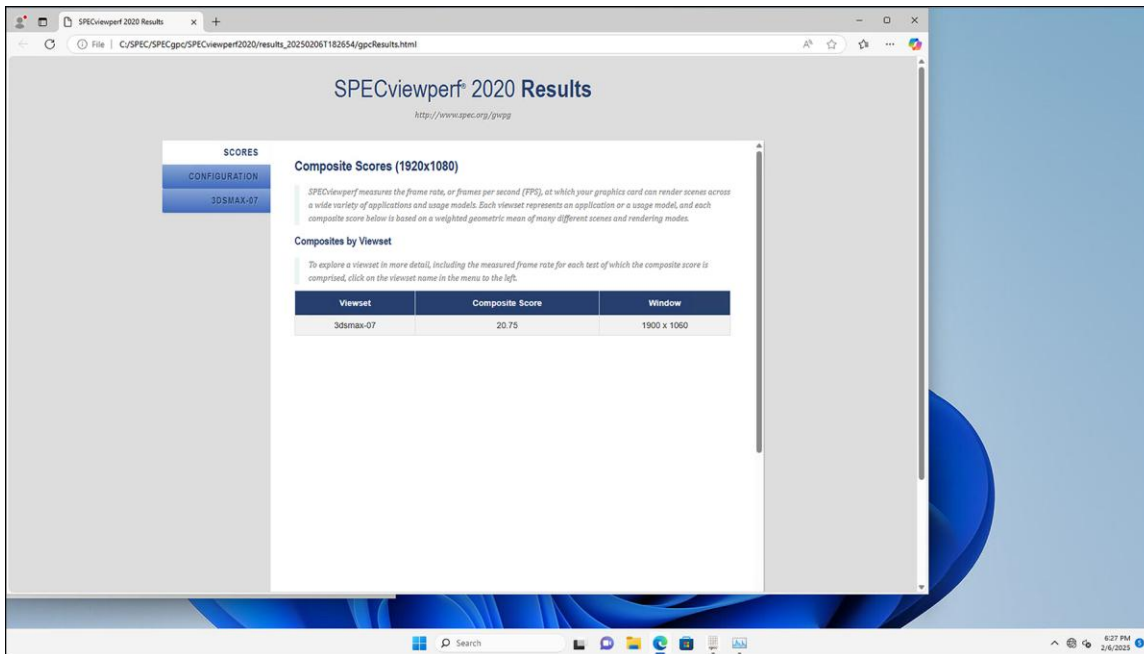


Figure 24.
SPECviewperf 3dsmax result on Windows 11 with NVIDIA A16-4Q vGPU profile

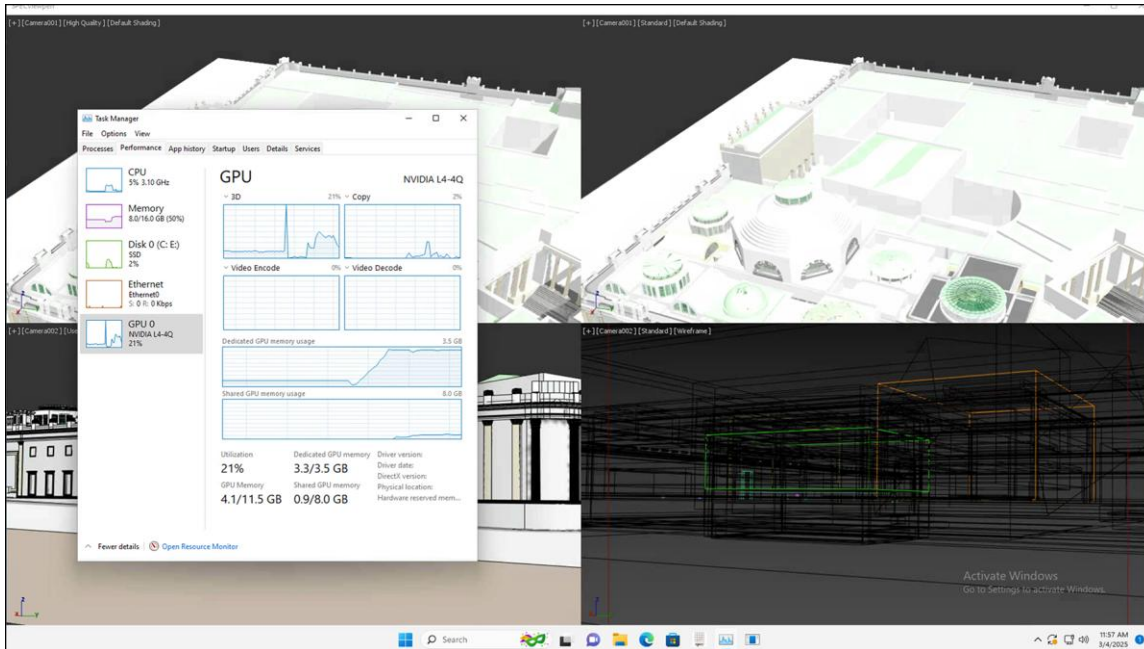


Figure 25.
3dsmax viewset running on Windows 11 virtual machine with 4vCPUs, 16 GB of memory and NVIDIA L4-4Q vGPU profile

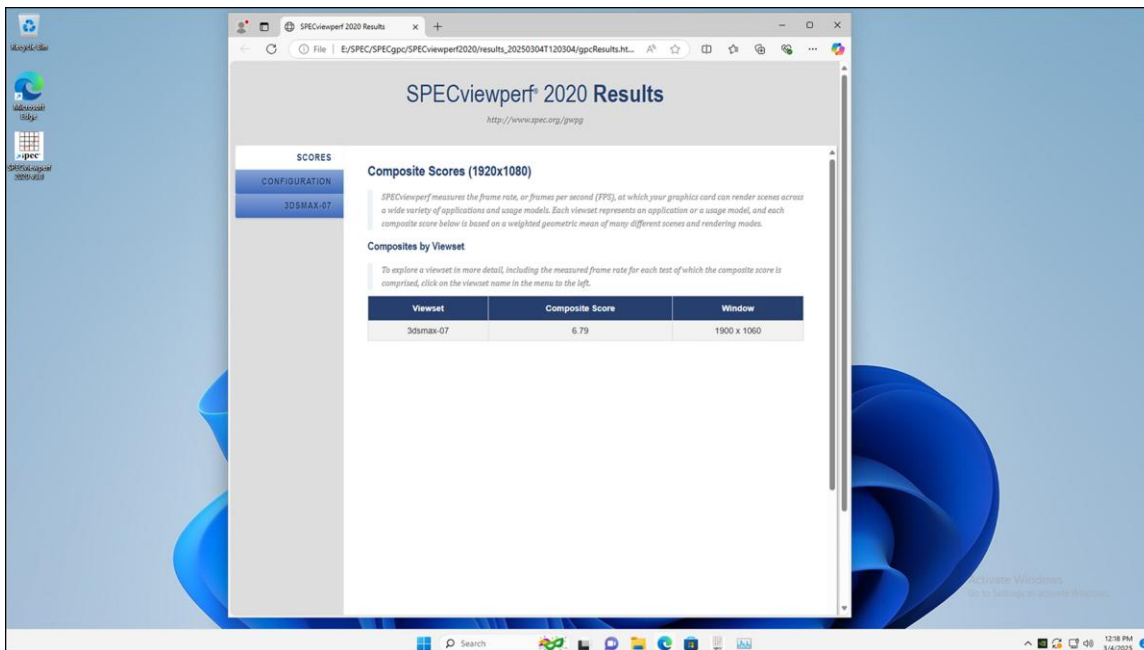


Figure 26.
SPECviewperf 3dsmax result on Windows 11 with NVIDIA L4-4Q vGPU profile

Summary

The Cisco UCS M8 compute platform is designed to excel at running Virtual Desktop Infrastructure (VDI) workloads. Its efficient architecture ensures that CPU performance isn't a limiting factor, while providing plenty of memory to support a large number of users. With support for powerful AMD EPYC Gen 4 and Gen 5 processors and the ability to integrate advanced GPUs, the M8 handles users running graphics-intensive tasks with ease. This combination of strong processing power and effective resource management makes the Cisco UCS M8 an excellent option for businesses seeking reliable and high-performance VDI solutions with Citrix Virtual Apps and Desktops 7.

Author

Vadim Lebedev, Technical Marketing Engineer, Cisco Systems, Inc.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at <https://www.cisco.com/go/offices>.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/go/trademarks>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)