

Dell EMC Virtual Workstation Solutions for Automotive and Manufacturing

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White Paper

Abstract

This white paper describes a Dell EMC virtual workstation solution for producing 3D graphics models for the automotive and manufacturing industry.

Dell EMC Solutions

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Executive summary

Business challenge

Technical and creative professionals in the automotive and manufacturing industry use graphics applications that require an immersive visual platform. These professionals design, simulate, and visualize products while working on complex 3D modeling workflows. They therefore require a high-quality interactive graphics platform that is also collaborative, secure, and flexible. With the changing dynamics of the modern-day workforce, it has become challenging for IT teams to manage a professional graphics platform that is running on physical workstations.

Traditionally, designers and engineers in the automotive and manufacturing industry are tethered to high-end physical workstations. IT teams in these organizations find the deployment, upgrading, and maintenance of physical workstations difficult and time-consuming. For example, in the automotive industry, each production model has a single version of the software for its entire life cycle. IT administrators need to ensure that the application versions for multiple production models are supported on workstations and are compatible with the underlying operating system and hardware. It is often challenging for IT to ensure interoperability among different components in a physical workstation with multiple application versions.

Also, the original equipment manufacturers (OEMs) in the automotive industry must collaborate with multiple suppliers. The designers and engineers in these organizations work on multiple design environments that are intended for different customers and partners. These environments host 3D graphics applications from vendors such as Dassault Systèmes, Siemens, and Autodesk. To avoid the cost of investing in additional workstations, IT teams must either deploy physical workstations for each environment or deploy multiboot workstations. Managing large numbers of physical or multiboot workstations during upgrade and patching activities is cumbersome.

Real-time collaboration among a globally dispersed team of employees, partners or customers presents a significant challenge for organizations in the automotive industry. These organizations use complex 3D modeling workflows that require large datasets. These datasets are typically stored in shared storage. For collaboration purposes, the datasets are often downloaded over a WAN network to physical workstations in a partner or customer organization. Copying the datasets back and forth over the WAN network delays the execution of projects and the time-to-market (TTM) of vehicle models.

The loss or breach of intellectual property (IP) is a major concern for automotive manufacturers. The 3D modeling files and other critical data are often transferred outside the corporate firewall to supplier organizations for collaboration purposes, creating a risk that the IP might be compromised and seen by competitors.

Lastly, for users, switching between multiple design environments is time-consuming and hampers productivity. Designers and engineers must either go to physical workstations hosting different modeling environments, or, in the case of multiboot workstations, reboot their systems to switch environments. Physical workstations limit a user's mobility. Also, a data security risk arises in the case of mobile workstations because the data might be transferred outside the corporate firewall.

In the automotive and manufacturing industry, a virtual desktop infrastructure (VDI) with virtual workstations presents an opportunity to overcome many of the challenges involved in IT management and maintenance, collaboration, security, and flexibility. Virtualization enables IT teams to deploy and present multiple virtual workstations to a user's endpoint device. The virtual workstations reside in a data center and IT can manage and maintain them centrally. Upgrading operating systems and applications and applying security patches is easier. Also, if an outage occurs, virtual workstations can be recovered more quickly than physical workstations.

Virtual workstations enable greater collaboration because large datasets can be copied quickly back and forth between virtual workstations and the shared repository in a LAN network. For collaboration outside the corporate firewall, only a stream of encrypted pixels is transferred over the WAN network, which reduces latency and increases an application's responsiveness. Employees who are on the premises can make changes to models and collaborate with other employees while on the move by using a mobile device.

Most importantly, with virtual workstations, automotive manufacturers can secure the organization's IP inside their corporate firewall. For example, they can share their concept models with suppliers through virtual workstations while the workstations remain centralized and secure in the data center. Only a stream of encrypted pixels showing the virtual workstations' display image is transferred to endpoint devices. It is no longer necessary to transfer the 3D modeling datasets to the shared drive of a physical workstation located in a supplier organization. Automotive manufacturers can therefore collaborate with multiple suppliers without fearing that their IP might be compromised by competitors.

Virtualization gives flexibility to designers and professionals working with multiple modeling environments. Using VDI, you can present multiple virtual workstations with different operating systems to a single endpoint device. Also, virtualization gives users the flexibility to switch back and forth easily among various modeling environments.

Dell EMC Ready Solutions for VDI offer virtual workstation solutions that provide you with performance and experience levels that match those of physical workstations. The solution combines best-in-class technologies from Dell EMC, VMware, and NVIDIA. The virtual workstations run on industry-leading Dell EMC VxRail hyperconverged infrastructure (HCI) appliances and Power Edge servers. NVIDIA Tesla T4 GPU hardware powers the graphic acceleration. VMware Horizon 7 is the desktop virtualization software and NVIDIA Quadro Virtual Data Center Workstation Software (Quadro vDWS) enables graphics virtualization. These virtual workstation solutions address the business challenges described in the preceding section and simplify IT management. Professionals working in the automotive industry can now collaborate on the most demanding 3D graphics applications, from any device, in any location, while tackling larger datasets and meeting the necessary security requirements.

The Dell EMC Ready Solutions for VDI team works with software vendors to ensure that our solutions are compatible with their applications. Our virtual workstations are Independent Software Vendor (ISV) certified by Dassault Systemes and Autodesk for running professional 3D graphics applications.

Solution overview

Key benefits

Virtual workstation solutions from Dell EMC Ready Solutions for VDI provide multiple benefits that can overcome the challenges associated with physical workstations. The key benefits of using Dell EMC virtual workstation solutions in the automotive and manufacturing industry include:

- **Centralized management**—Centralized management and faster provisioning of virtual workstations reduces the timeline of projects. IT can focus instead on things that are more important to the business while preventing and managing threats and vulnerabilities efficiently.
- **Easy maintenance**— Virtual workstations can be recovered more quickly if there is an outage when compared to a physical workstation. Management is simplified as your IT teams have less hardware to manage. Maintenance costs also go down. IT can on-board third party contractors or vendors with ease. Your IT team only needs to add vendor user accounts to the user group assigned for virtual workstations, there is no requirement to buy new workstation hardware or for distributed management.
- **Secure your IP**—You can secure your IP within the perimeter of your organization. Virtual workstations reside in the data center and only the encrypted pixel stream from their displays travel outside the data center perimeter. Automotive manufacturers can collaborate with stakeholders outside their organization while ensuring that their IP is protected in their data center.
- **Collaborate anywhere on any device**—Greater collaboration is achievable among globally dispersed teams because VDI allows access to virtual workstations from anywhere, on any device.
- **Ease of access**—You can efficiently work with large datasets, whether you are a global, mobile, or third-party user. For example, with physical workstations, teams need to send or copy large datasets over WAN networks, which can cause congestion in the network and delays in accessing applications. In contrast, virtual workstations reside in the data center along with the application servers and database. Copying large files over a high-speed LAN network does not take long. Only pixel streams from workstation displays are transmitted to end-point devices over the network.
- **Improved version control**—Centralized data eliminates the need to synchronize the distributed datasets . Syncing issues are reduced and everyone is working on the same up-to-date model.
- **Flexible workplace**—With the ability to work from any device, employees are no longer tethered to physical workstations. They can take their design with them wherever they go on a laptop, tablet, or mobile device.
- **Accelerate TTM**—With greater collaboration and ease of access to 3D applications, you can improve employee productivity, resulting in compressed design cycles and faster project delivery.
- **Disaster Recovery and High Availability (HA)**—The virtual workstation solution comes with vMotion capability so that you can migrate the workstation between hypervisors or hardware. This capability provides HA and organizations can perform maintenance on a workstation without affecting production hours.

- **Better monitoring and management**—NVIDIA Quadro vDWS comes with best-in-class management and monitoring features. You can define the desired user experience, predict the capacity requirements, and provision the workstations quickly without compromising productivity.

Document purpose

This white paper introduces the design and configuration for virtual workstation solutions from Dell EMC Ready Solutions for VDI. The solution configurations that this document describes are intended for the 3D Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) applications that are used in the automotive and manufacturing industry. The document describes the benefits of using a Dell EMC virtual workstation for professional graphics workloads in these sectors and provides guidance for configuring VMware Horizon virtual workstations running on Dell EMC hardware.

Audience

This document is for decision-makers, managers, architects, developers, and technical administrators of IT environments in the automotive and manufacturing industry who want an understanding of Dell EMC virtual workstation solutions. Readers should have some knowledge of Dell EMC VxRail appliances, PowerEdge servers, VMware virtualization, and NVIDIA GPU technologies.

We value your feedback

Dell EMC and the authors of this document welcome your feedback on the solution and the solution documentation. Email the [Dell EMC Ready Solutions for VDI team](#) with your comments.

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Note: For links to additional documentation for this solution, see the [Dell EMC Solutions Info Hub for VDI](#).

Technology overview

Overview

This section describes the key hardware and software components in the solution.

Dell EMC VxRail appliances

Dell EMC VxRail appliances utilize VMware vSAN technology, run on Dell EMC PowerEdge servers, and are further enabled by Dell EMC management software. The VxRail appliances simplify IT operations and provides a highly scalable and agile VDI environment for running your virtual workstations. The VxRail hyperconverged infrastructure (HCI) appliance is an integrated, preconfigured, turn-key appliance that makes the deployment and configuration of virtual workstations easier and faster. The appliance is sustained as a single product and comes with automated life cycle management capabilities. Upgrades and patches are nondisruptive.

The VxRail V Series appliances are optimized for VDI workloads. They support GPU hardware configurations that are capable of running the graphics-intensive applications commonly used in the automotive and manufacturing industries. The models available in the V series are the VxRail V570 (hybrid) and the VxRail V570F (all-flash). The VxRail V570 is a 2U appliance with a broad range of configuration options. These appliances are based on PowerEdge R740xd rack servers.

Dell EMC PowerEdge servers

Dell EMC PowerEdge servers provide uncompromising performance with scalable architecture, intelligent automation, and integrated security for your VDI workloads. They are also the foundation for VxRail appliances.

The PowerEdge R740xd server is the platform of choice for VDI workloads. PowerEdge R740xd rack servers provide a 2U, two-socket platform that is ideal for virtual desktop workloads with GPU configurations. The R740xd server can accommodate two of the Intel Xeon family of scalable processors, each with up to 28 cores. These servers now ship with the latest Intel Xeon Scalable Processors, code-named Cascade Lake, providing exceptional performance and scalability. R740xd servers have up to 24 DIMMs and eight PCI Express (PCIe) 3.0 enabled expansion slots.

NVIDIA Tesla T4 GPU

The NVIDIA Tesla T4 is a universal GPU that serves a variety of workloads. The Tesla T4 is based on Turing architecture and comes with 2,560 CUDA cores and a 16 GB DDR6 memory. The Tesla T4 operates at 70 W, providing higher energy efficiency and lower operating costs than its predecessors. It has a single-slot PCIe form factor. You can configure up to six Tesla T4s in a single PowerEdge R740xd server. The Tesla T4 comes with an enhanced NVIDIA NVENC encoder that can provide higher compression and better image quality with H.264 and H.265 (HEVC) video codecs. The NVIDIA Tesla T4 NVENC encoder provides up to 25 percent bit rate savings for H.265 and up to 15 percent bit rate savings for H.264.

NVIDIA Quadro vDWS

NVIDIA Quadro vDWS delivers powerful virtual workstations from data centers to an end-point device. The Quadro vDWS software provides easy access to 3D CAD and CAE applications in a VDI environment. The ease of accessing datasets enables greater collaboration among professionals in the automotive and manufacturing industry. From an

IT standpoint, Quadro vDWS provides centralized management of virtual workstations and exceptional monitoring features.

NVIDIA vGPU software creates virtual GPUs that are mapped to underlying physical GPUs. These virtual GPUs are assigned to each virtual workstation. NVIDIA Quadro vDWS licenses enable the powerful Quadro graphics driver for professional 3D applications. The driver, which is installed on each virtual machine (VM), enables graphics commands from the VMs to pass to the GPU hardware. Quadro vDWS comes with multiple profile size options that cater for different use cases and varying graphics requirements. Select the correct GPU and vGPU profile (frame buffer) size for your professional graphics use cases.

Quadro vDWS supports applications with the highest resolution graphics and enables professionals to work with multiple 4K, 5K and 8K displays. Quadro vDWS software supports up to four 4K displays or two 8K displays, enabling professionals in the automotive and manufacturing industry to work on the details of graphics with ease.

VMware Horizon 7

VMware Horizon 7 provides the centralized management, agility, and simplicity that is required for your virtual desktop infrastructure. With Horizon 7, your workstations reside inside the data center premises, which makes the provisioning, maintenance, and recovery of virtual workstations easier. Horizon 7 with VMware Just-in-Time Management Platform (JMP) can provision and deliver virtual desktops and applications in a fast, flexible, and personalized manner. JMP uses Instant Clones for ultrafast provisioning of desktops, App Volumes for real-time application delivery, and Dynamic Environment Manager for contextual policy management to deliver an experience with the simplicity of non-persistent management.

When implementing VDI using Horizon 7, the IP of your organization is secure inside your data center premises. A lightweight Horizon 7 client is installed on the end-point devices that communicates with virtual workstations in the data center. The Horizon 7 client is compatible with most devices on the market. It provides flexibility for employees working from home, as well as contractors and partners working from any device anywhere, thus increasing collaboration and productivity.

For graphics accelerated VDI workloads, Dell EMC recommends using the Blast Extreme Display protocol, which provides an enhanced remote session experience for professional graphics applications, even in a low latency network. The Blast Extreme protocol supports the H.264 and H.265 codecs, which can encode the graphics content from a virtual workstation display. NVIDIA Tesla T4 GPUs come with an advanced NVENC encoder. This encoder can offload H.264 or H.265 encoding from server processors, providing lower latency and better performance for the professional graphics applications that are used in the automotive and manufacturing industry.

Dell Wyse thin clients

The Dell Wyse 5070 extended thin client is a high-performance thin client with quad-core processors designed for secure and easy-to-manage virtual desktop environments. The device supports the ThinOS, ThinLinux, and Windows 10 IoT Enterprise operating systems and can run a professional 3D graphics application with up to four 4K monitors.

Solution configuration for virtual workstations on VxRail

Dell EMC Ready Solutions for VDI offers Virtual Workstation solutions for running the professional graphics applications that are used in the automotive and manufacturing industry. The solution configuration based on the VxRail HCI platform is recommended for running professional graphics applications such as Autodesk (Revit, Inventor, 3DS Max and AutoCAD) and Dassault Systèmes (Catia and Solidworks).

The compute layer consists of VxRail V570F appliances. These are VDI-optimized and offer the highest processor speeds and graphics capability. The storage layer is powered by VMware vSAN software-defined storage technology. The network layer consists of Dell EMC PowerSwitch S5248 (25GbE ToR switches). Virtual workstations run on a VMware ESXi hypervisor. VMware Horizon 7 is the virtual desktop brokering software. NVIDIA Quadro vDWS virtualizes the GPU hardware to provide virtual GPUs for each virtual workstation.

For more information, see the [VMware Horizon VDI solution on Dell EMC VxRail Design Guide](#).

The following figure shows an overview of the solution architecture of the virtual workstation environment on a VxRail platform:

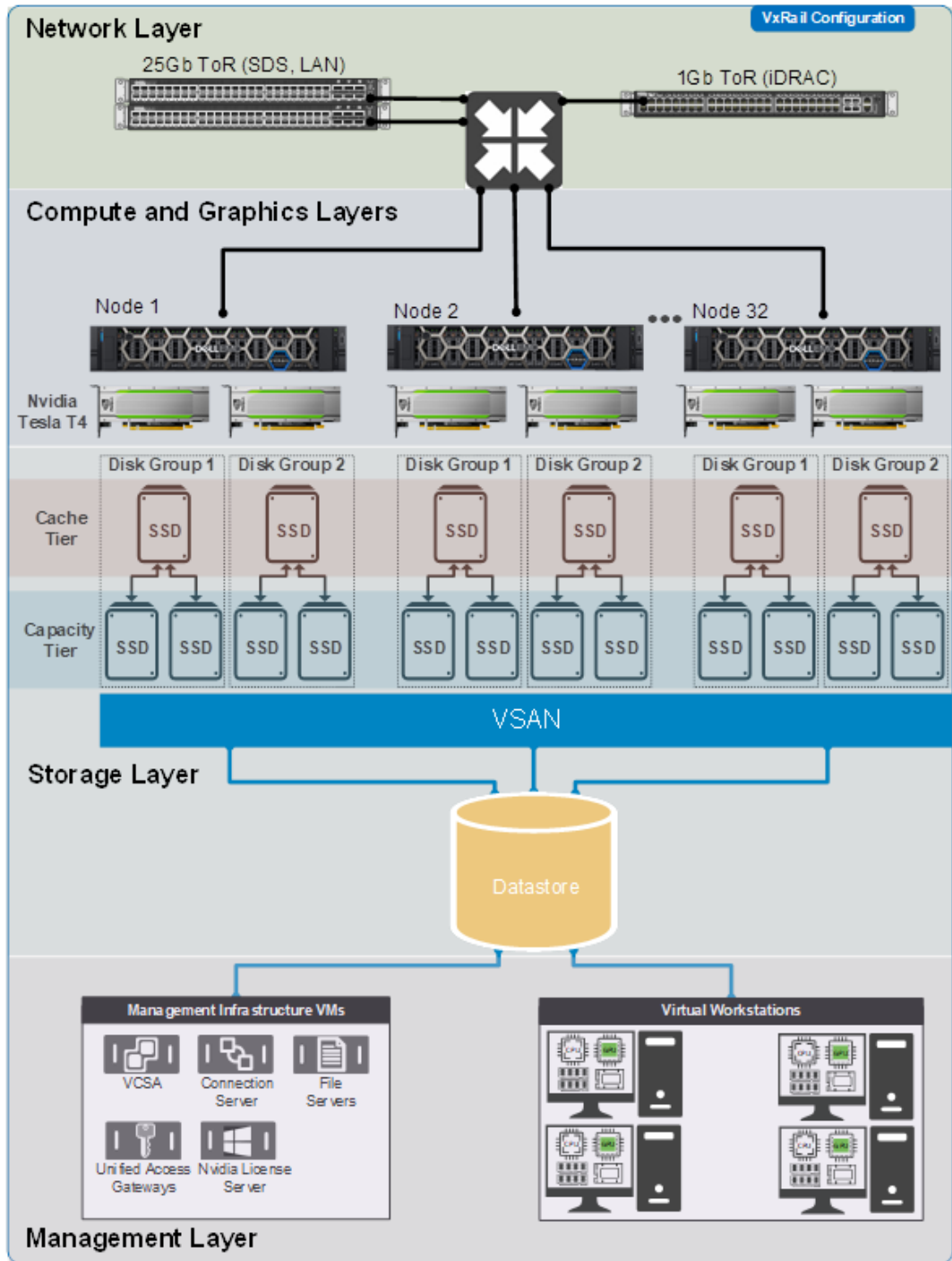


Figure 1. Virtual Workstation on VxRail solution architecture

The following table shows the hardware configuration that Dell EMC recommends for the virtual workstation solution on the VxRail platform:

Table 1. Hardware configuration

Component	Configuration
CPU	2 x Intel Xeon Gold 6254

Component	Configuration
Memory	384 GB (12x 32 GB) @ 2933MT
Storage Adapter	HBA 330
Network	25 GbE
Boot Device	BOSS + M.2 SATA SSDs
Cache Tier	800 GB WI SAS SSD
Capacity Tier	1.92 or 3.84 3.84 TB RI SAS or SATA SSD
GPU	6 x Tesla T4 GPU

Table 2 shows the virtual workstation VM configuration that Dell EMC recommends for the solution. This configuration is only applicable to the hardware configuration shown in Table 1. The Table 2 configurations assume a fixed memory per node of 384 GB, but you can change the memory to a higher or lower value based on the datasets that the application uses. The operating system used by the VMs is Windows 10, version 1803. The screen resolution is 1080p.

Frame buffer or vGPU profile size is one of the major factors to consider when you do the sizing of virtual workstations. Choosing a vGPU profile for the user depends on the type of workflow and the size of the model that they work with. Users with more advanced graphics requirements and larger datasets require a larger frame buffer. For these users, assign a larger vGPU profile that can cater to the frame buffer requirement of the application. To understand the frame buffer requirement, perform appropriate tests in the pilot phase with tools such as GPU Profiler. We recommend that you size the vGPU profiles based on the application that uses the largest frame buffer. If an application’s utilization of the frame buffer nears 100 percent, assign the next profile size to that user.

You can configure an VxRail V570F appliance with up to six NVIDIA Tesla T4 GPUs, providing 96 GB of frame buffer per node. With a vGPU profile size of 4 GB, you can have 24 concurrent users running per VxRail node. If you opt for the highest available profile size of 16 GB, you can accommodate a maximum of six concurrent users per VxRail node, as shown in the following table:

Table 2. Virtual workstation VM configuration

Users per node	vCPU	Memory	vGPU Profile	Virtual Disk
24	4	12	T4-4Q	> 250 GB
12	6	24	T4-8Q	> 250 GB
6	12	48	T4-16Q	> 250 GB

Solution configuration for virtual workstations on PowerEdge Server and XtremIO X2 storage

Dell EMC Ready Solutions for VDI offers virtual workstation solutions on the PowerEdge server and XtremIO X2 storage hardware. The solution configuration that this section describes is recommended for running professional graphics applications including Autodesk and Dassault Systèmes.

The following figure shows an overview of the solution architecture of the virtual workstation environment. The compute layers consist of PowerEdge R740xd servers that can host up to six NVIDIA Tesla T4 GPUs. The storage layer is XtremIO X2 storage, which you can configure with up to four bricks per cluster. The network layer consists of Dell EMC PowerSwitch S5248—25 GbE ToR switches. Virtual workstations run on a VMware ESXi hypervisor. VMware Horizon 7 is the virtual desktop brokering software. NVIDIA Quadro vDWS software virtualizes the GPU hardware to provide virtual GPUs for each workstation.

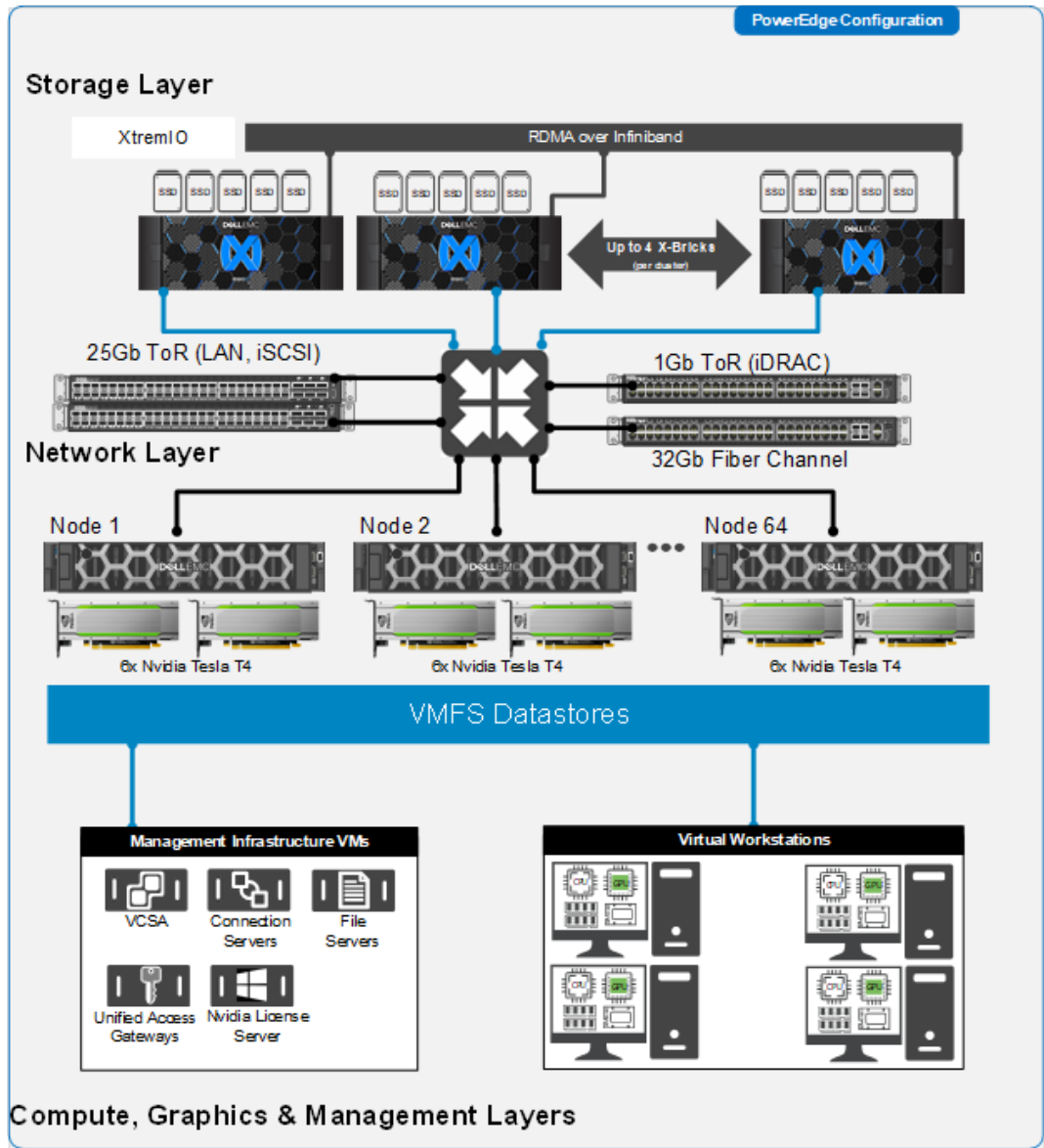


Figure 2. Solution architecture: Virtual workstations on PowerEdge servers and XtremIO X2 storage

The following table shows the recommended hardware configuration for a Dell EMC virtual workstation with PowerEdge servers and XtremIO X2 storage:

Table 3. Hardware configuration

Component	Configuraton
Platform	PowerEdge R740xd
CPU	2 x Intel Xeon Gold 6254
Memory	384 GB (12x 32 GB) @ 2933MT
Storage Adapter	Fiber Channel HBA
Network	25 GbE

Component	Configuraton
Boot	BOSS + M.2 SATA SSDs
GPU	6 x Tesla T4 GPU
Storage	XtremIO X2

The following table shows the virtual workstation VM configuration that Dell EMC recommends for the solution. This configuration is only applicable to the hardware configuration shown in Table 3. The configurations shown assume a fixed 384 GB of memory per node, but you can change the memory to a higher or lower value based on the dataset that the application uses. The operating system of the VMs is Windows 10, version 1803, with a screen resolution of 1080p.

Table 4. Virtual workstation VM configuration

Users per node	vCPU	Memory	vGPU Profile	Virtual Disk
24	4	12	T4-4Q	> 250 GB
12	6	24	T4-8Q	> 250 GB
6	12	48	T4-16Q	> 250 GB

Configuration for VMware Horizon virtual workstations on Dell EMC hardware

The Dell EMC Ready Solutions for VDI team recommends that you consider the following factors when configuring a VMware Horizon virtual workstation on Dell EMC hardware.

Physical host configuration

On the R740xd host:

1. Set the BIOS System Profile to Performance.
2. If the ambient temperature is not cool enough, consider changing the **iDRAC Thermal Profile to Maximum Performance**. This configuration reduces the probability of thermal throttling of the CPU and GPUs. For more information, see [the Integrated Dell Remote Access Controller 9 Version 3.15.15.15 User's Guide](#).
3. Size the virtual CPUs of the workstation VMs within the NUMA node boundaries of the physical processors. For more information, see [Virtual Machine vCPU and vNUMA Rightsizing – Rules of Thumb](#).
4. Choose and set the appropriate GPU scheduler for your workload and use case. The following section shows the available GPU scheduler options are given below.
 - Best Effort (Default)
 - Equal Share
 - Fixed Share

For more information, see [Nvidia's virtual GPU software documentation](#).

Workstation VM configuration

On the workstation VM:

1. Set the VMware Horizon Blast **Max Frame Rate** to **60** using the registry key or GPO. For more information, see [VMware Blast Policy Settings](#).
2. Using the **VMware Horizon Performance Tracker** in the Virtual Workstation VM, ensure that the Protocol is **Blast** and the Encoder Name is **NVIDIA NvEnc H264**, as shown in the following figure. The recommended protocol for running graphics workloads in a VMware Horizon environment is **Blast Extreme**. The following figure shows the VMware Horizon Performance Tracker settings:

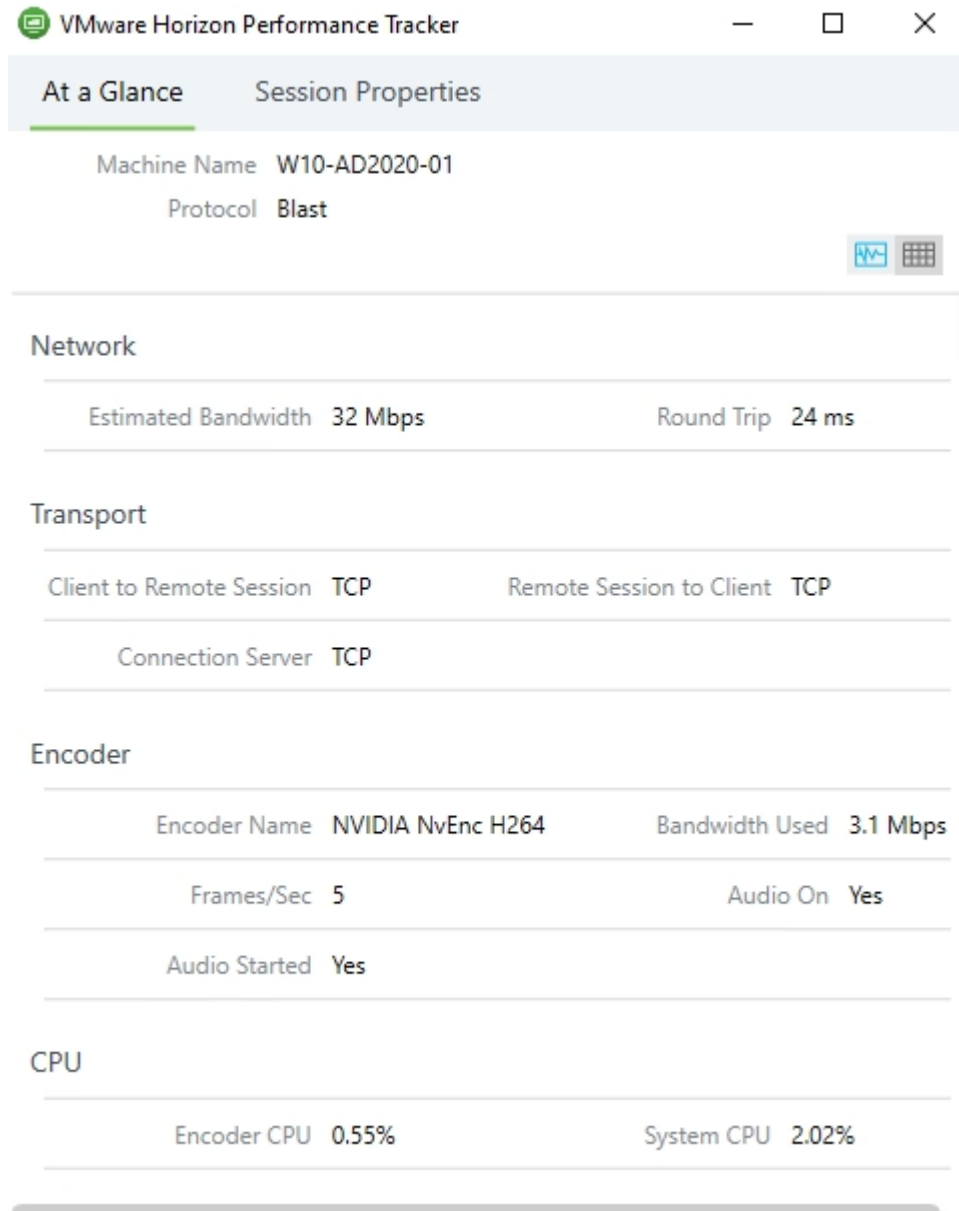


Figure 3. VMware Horizon Performance Tracker settings for your workstation VM

3. Ensure that the monitor refresh rate is set to 60 Hz in the NVIDIA Control Panel within the Virtual Workstation VM.
4. In the NVIDIA Control Panel, consider using the **Dassault Systemes – V5 3D Experience** Global Preset when running the Catia application, as shown in the following figure:

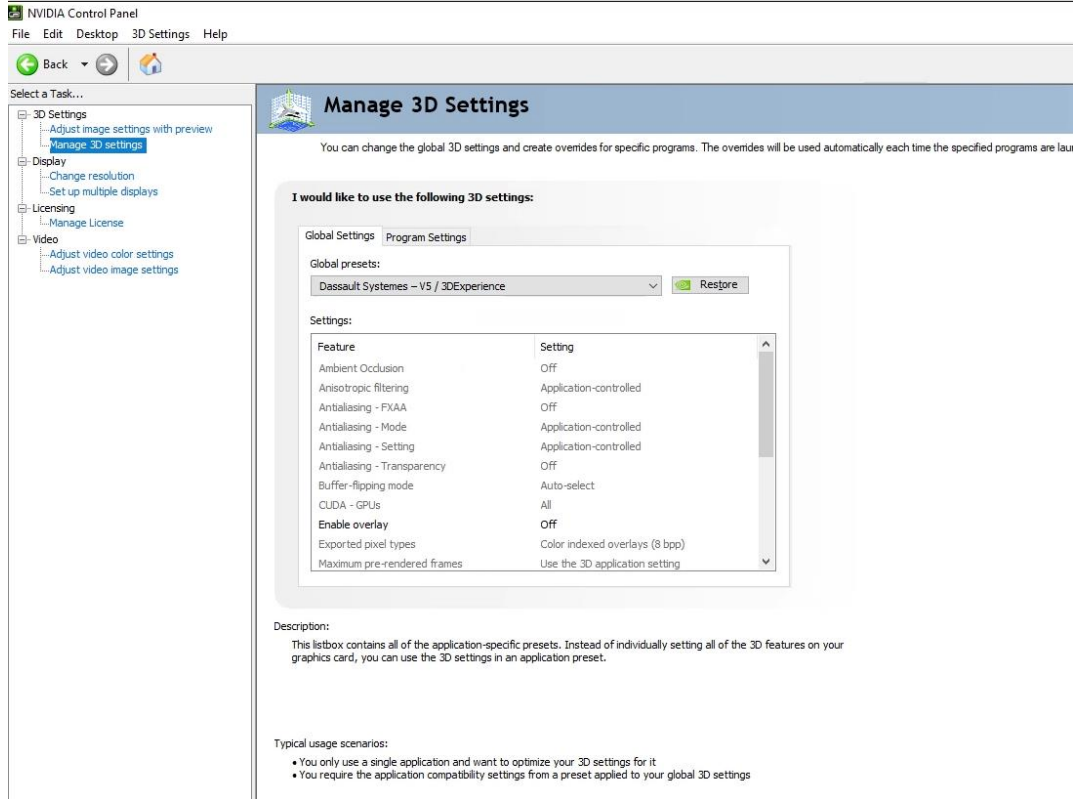


Figure 4. NVIDIA Control Panel settings for your workstation VM

Client device configuration

Use the latest version of the VMware Horizon Client. At the time of publication of this white paper, the latest version was 5.2.

Conclusion

The virtual workstation solutions from Dell EMC Ready Solutions for VDI accelerated by NVIDIA Tesla T4 GPUs and NVIDIA Quadro vDWS software offer an excellent platform to run the professional graphics applications that are used in the automotive and manufacturing industry. These virtual workstations provide an experience that is on a par with physical workstations. The solution simplifies the provisioning and management of virtual workstations and your IT teams can instead focus on innovation. Creative and technical professionals get a high-quality interactive graphics platform that fosters collaboration and provides flexibility. The virtual workstations are secure and your organization's IP is not compromised.

We provide virtual workstation configurations that are ISV certified so that you get a predictable performance level from our solutions. The Dell EMC Ready Solutions for VDI team provide a starting configuration for virtual workstations that are certified by Dassault Systèmes and Autodesk. The solution configurations in this white paper show the best way to integrate a Dell EMC hardware platform with NVIDIA Tesla T4 GPUs and virtual workstations powered by Quadro vDWS.

The Dell EMC Ready Solutions for VDI team recommends the solution configuration in this white paper for running the professional graphics applications that are typically used in the automotive and manufacturing industry. However, we recommend that you perform pilot tests to right-size the virtual workstation environment according to your application requirements.

References

The following provides additional information.

- Dell EMC**
 - [*Designs for VMware Horizon on VxRail and vSAN Ready Nodes*](#)
 - [*Dell EMC Power Edge R740xd spec sheet*](#)
- NVIDIA**
 - [*NVIDIA virtual GPU software documentation*](#)
 - [*NVIDIA Tesla T4 encoding*](#)
- VMWare**
 - [*Blast Extreme display protocol in VMware Horizon 7*](#)
- Autodesk**
 - [*Certified Graphics Hardware*](#)