Azure Virtual Desktop on ThinkAgile MX
Solution Brief

Remote hybrid workplace solution

The pace of technology change is accelerating everywhere, especially in the workplace. In recent years companies have come to realize that a flexible secure workplace is here to stay. Azure Virtual Desktop is a hybrid cloud based VDI solution that can be used to deploy and scale Windows desktops and apps on Azure Stack HCI in minutes to enable secure, remote work.

Companies of all sizes are pushing to set up VDI with remote connectivity, security, and management capabilities so that employees can remain productive and access necessary apps from wherever they are. Moving to the cloud offers many benefits to enterprises, including scalability, cost efficiencies, and near-limitless data capacity. However, many industries are required to keep their data on premises due to data-sovereignty needs and regulatory requirements.

Azure Virtual Desktop (AVD) brings all cloud benefits on premises by using familiar tools and applications based on Windows with a fully managed, cloud hosted VDI management plane. Azure Stack HCI with Azure Virtual Desktop on Lenovo Systems helps companies overcome their remote work challenges in a powerful and efficient manner.

Lenovo Solutions for Microsoft Azure Stack HCI and AVD on ThinkAgile MX650 V3 are optimized for both scale and performance and are **Accelerated by Intel** offerings. This technical brief features Microsoft Azure Stack HCI and AVD running on a high-performance Lenovo dual socket 2U rack mount enterprise server. The server is configured with 4th Generation Intel® Xeon® Scalable processors, TruDDR5 4800MHz memory and P5620 NVMe drives among a variety of storage options, including support for the PCIe 5.0 standard devices for I/O. These 4th Gen Intel Xeon processors offer anywhere from 16 to 60 cores and 16x 4800 MHz DDR5 DIMMs per socket.

The MX650 V3 server is a storage dense offering, with up to 40x 2.5" drive bays in the front, middle and rear of the server and 5 different slot configurations at the rear of the server. Onboard NVMe PCIe ports allow direct connections to 16 NVMe SSDs, which frees up PCIe slots and lowers NVMe solution acquisition costs.

Highlights:

- Reduce time to value with pretested and sized hardware configurations
- Simplified evaluation, fast and easy deployment and workload optimized performance
- VDI sized solution with optimal compute, memory, storage and networking components
- Reduce TCO through better performance, rapid deployment and advanced hardware
- Optimize performance with pretested ThinkAgile MX650 V3 hardware configurations

Business VDI solutions with faster time-to-value

Lenovo MX650 V3 systems are methodically tested and tuned to save you months of configuration, setup, testing, and tuning. With these new servers, you get the following advantages:

- Realize better performance for popular workloads running on 4th generation Intel Xeon Scalable processors than on similar servers equipped with previous generation processors
- Improve performance and scale of VDI solutions with higher core counts, memory bandwidth and PCIe Gen 5 devices
- Improve density and support more and larger virtual desktops per host

Microsoft Azure Virtual Desktop

With Azure Virtual Desktop for Azure Stack HCI, IT administrators can create a full Windows 10, Windows 11, or Windows Server desktop virtualization environment that can be used on any device.

With AVD, IT administrators can view all components on the same management plane, and it is simple to create and use Azure Virtual Desktop sessions on an Azure Stack HCI cluster. With the support of Azure Virtual Desktop for Azure Stack HCI, Windows 10 and Windows 11 multisession capabilities are available for on-premise environments. IT staff can support multiple users on a single virtual machine (VM). This greatly reduces the number of VMs and the system-resource overhead costs while still providing the same resources to all users. Azure Virtual Desktop also simplifies management and user support. Because Azure Virtual Desktop is a managed service, organizations don't need to deploy a VDI themselves or have the burden of upgrading infrastructure. This is a huge advantage compared to other VDI solutions.

The following is a high-level summary of what is needed to run Azure Virtual Desktop on Azure Stack HCI:

- An Azure Stack HCI cluster with a minimum of 2 nodes. It's recommended to have at least 16 cores with 256GB memory per node, but this is largely determined by your workload requirements.
- For starters, 1TB of storage capacity in your Azure Stack HCI storage pool used to store virtual machines. However, this will also be determined by your workload requirements.
- External internet connectivity for both the Azure Stack HCI nodes, and the Azure Virtual Desktop components.
- An Azure subscription for Azure Virtual Desktop Session Host Pool with the appropriate permissions.
- Network Validation for AVD Links, reference - https://docs.microsoft.com/en-us/azure/virtual-desktop/safe-url-list
- Configure UEFI (Bios) settings to set Secure Boot as Enabled.

The high-level AVD deployment steps include the following:

Network Preparation

1. ***Choose Network Layout:***

- Select a pre-defined network configuration that matches your physical server cabling. This will serve as a template for configuring your virtual network settings later.

Domain Preparation

2. ***Active Directory:***

- Verify your Active Directory domain is properly configured to integrate with Azure Stack HCI 23H2.

Cluster Deployment

3. ***Download Installation Media:***

- Obtain the Azure Stack HCI version 23H2 ISO file from the Azure portal.

4. ***Install OS on Servers:***

- Install the downloaded Azure Stack HCI operating system on each server that will be part of the cluster.

5. ***Configure Proxy (Optional):***

- If your network utilizes a proxy server for internet access, configure the proxy settings on all cluster servers.

6. ***Register Servers & Assign Permissions:***

- Run the Azure Arc registration script on each server intended for the cluster.
- Assign the necessary permissions required for deployment.

7. ***Create Azure Stack HCI Cluster:***

You have two options for creating the cluster:

- Azure Portal: Use the Azure portal to select the Arc-registered servers and create the Azure Stack HCI cluster.
- ARM Template (Advanced): Utilize an Azure Resource Manager (ARM) template for automated cluster creation (refer to documentation for details).

Azure Virtual Desktop Deployment (Separate Process):

Note: These steps are for deploying Azure Virtual Desktop on your newly created Azure Stack HCI cluster and are not directly part of the Azure Stack HCI deployment itself.

8. ***Choose a VM Image:***

- Azure Marketplace: Browse the Azure Marketplace to find a pre-configured virtual machine image that aligns with your needs. These images often include pre-installed applications and configurations, saving you setup time.
- Custom Image: Alternatively, if you have specific requirements, you can use a custom image that you've prepared beforehand. This image should contain the desired operating system and any necessary applications.

9. ***Create a Virtual Network:***

- Match Your Network: Design a virtual network that mirrors your existing network layout within Azure Stack HCI.

10. ***Create a Host Pool:***

- This is the initial step for setting up your virtual desktops.

11. ***Define Your Workspace:***

- This step involves defining the workspace environment for your virtual desktops.

12. ***Designate Application Groups:***

- Here you will organize your applications into groups for easier management within your virtual desktop environment.

Lenovo ThinkAgile MX650 V3 offerings are ideal for modernizing your data center because of their low cost and high-performance capabilities. They are industry standard x86 servers providing cost effective computing and fast high-density local storage.

Lenovo ThinkAgile MX650 V3 servers offer the necessary performance for bare metal or virtualized workloads. High performance can be achieved using Azure Stack HCI and Storage Spaces Direct technology which are built into Windows Server HCI OS. Several technologies like NVMe storage and Remote Direct Memory Access (RDMA) networking are natively supported in Windows Server to enable the highest levels of performance.

A typical AVD node configuration features the following main components:

- Servers: 2x or 4x Lenovo ThinkAgile MX650 V3
- Processor: 2x 4th Gen Intel Xeon Platinum 8480+ processor with 64 cores
- Memory: 1TB per node of TRUDDR5 4800 MT/s memory
- Storage: 8x Solidigm NVMe mixed use SSDs 1.6TB
- OS Storage: 2x 480GB M.2 SATA SSDs for the operating system (RAID 1)
- Software: Microsoft HCI OS

This high-performance VDI solution with Microsoft Azure Virtual Desktop features the latest Solidigm NVMe mixed use SSDs. These SSDs help build a low latency solution for mission critical VDI environments.

Figure 1. Lenovo ThinkAgile MX650 V3

Performance Testing

Comparative Performance Analysis of Windows 10 Multi-Session vs. Windows 11 Multi Session on Azure Stack HCI

Login VSI testing

Login VSI load testing using Login Enterprise tools helps organizations prepare for production releases of VDI solutions by assessing and enhancing performance, scalability, and user experience before deployment with industry-leading load testing.

For the test we have Windows 10 and Multi session in 3 different configurations and we will focus also on the difference.

Test Description

This benchmark evaluates the performance and scalability of Windows 10 Multi-Session and Windows 11 Multi-Session on an Azure Stack HCI environment. We will assess user experience and resource utilization across various configurations to inform optimal deployment strategies for virtual desktop infrastructure (VDI).

Test Methodology

- **Hypervisor**: Azure Stack HCI 23H2 (Hyper-V)
- **Benchmarking Tool**: LoginVSI 5.11.12
- **Operating Systems**:
  - Windows 10 Multi-Session
  - Windows 11 Multi-Session
- **Configurations**:
  - **vCPU**: 8, 16, 24
  - **Memory**: 32 GB, 64 GB, 96 GB
- **Workload**:
  - Simulated user workloads using LoginVSI Knowledge worker to represent typical office productivity tasks (email, web browsing, document editing, etc.).
  - Workloads will be gradually increased to measure performance under different user densities
- **Metrics:**

The following are some metrics that can be used to characterize system performance.

EUX Baseline Score: The baseline EUX score represents the best possible performance of the system and is the average EUX score of the best minutes of the test. This score indicates how the system performs when it's not under stress. Typically, you capture the baseline EUX score at the beginning of the test before the system is fully loaded.

EUX Score: The average EUX score for the entire test.

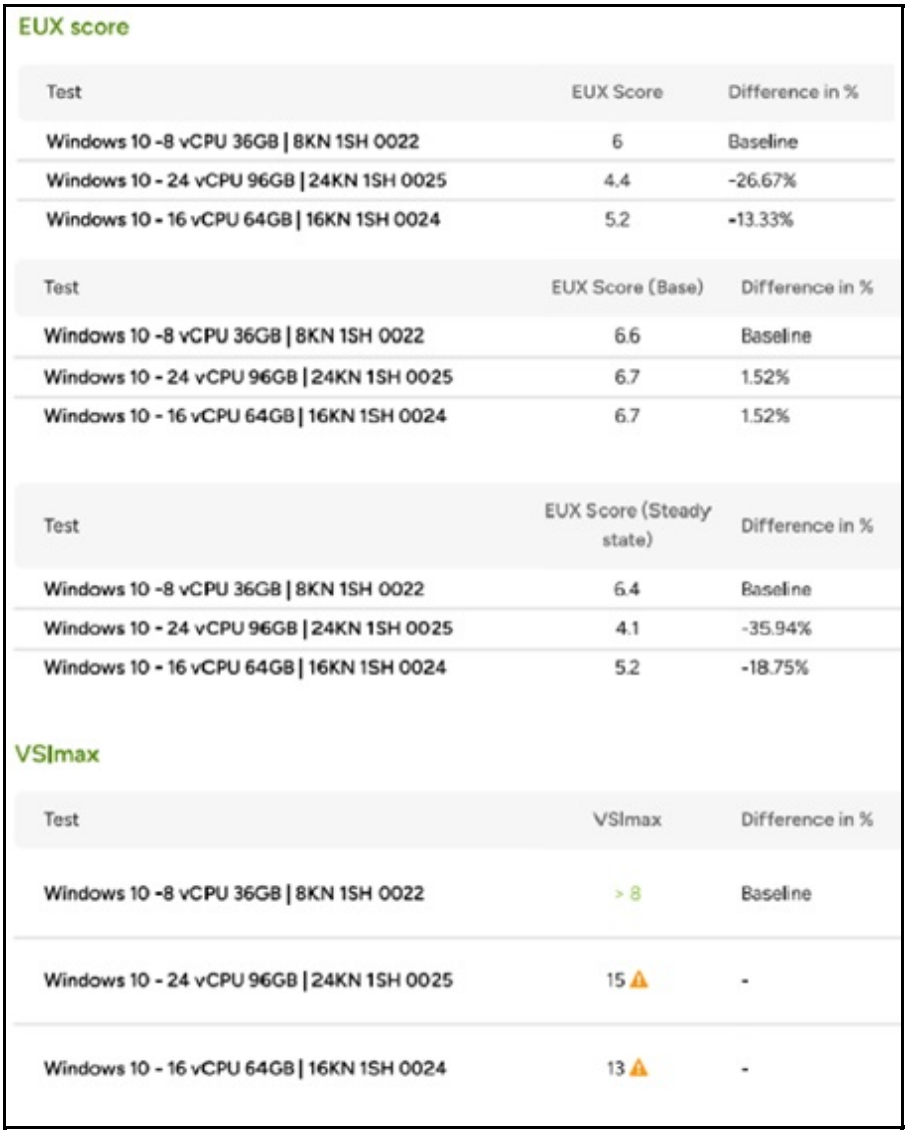
EUX Steady State Score: The steady state represents the period after all users have logged on (login storm) and the system has started to normalize. The steady state EUX score is the average of the EUX scores captured between 5 minutes after all sessions have logged in and at the end of the test.

Total Logon Time: The amount of time it takes the user to go from launching the session to the point where the workspace is ready to be used.

VSIMax: A number of triggers determine the VSImax (or the maximum number of users that can fit on the system before performance degrades).

EUX Comparison Windows 10 Multi-Session vs Windows 11 Multi-Session

This benchmark data compares Windows 10 and Windows 11 Multi-Session performance on Azure Stack HCI. Initial results suggest Windows 11 offers a smoother user experience out-of-the-box, especially with 16 vCPU and 64GB RAM. However, under sustained load, Windows 10 demonstrates more consistent performance across most configurations. Further analysis is needed to pinpoint the factors behind these observations and to determine the optimal choice for specific VDI deployments.



EUX score

Test	EUX Score	Difference in %
Windows 10 -8 vCPU 36GB | 8KN 1SH 0022	6	Baseline
Windows 10 - 24 vCPU 96GB | 24KN 1SH 0025	4.4	-26.67%
Windows 10 - 16 vCPU 64GB | 16KN 1SH 0024	5.2	-13.33%

Test	EUX Score (Base)	Difference in %
Windows 10 -8 vCPU 36GB | 8KN 1SH 0022	6.6	Baseline
Windows 10 - 24 vCPU 96GB | 24KN 1SH 0025	6.7	1.52%
Windows 10 - 16 vCPU 64GB | 16KN 1SH 0024	6.7	1.52%

Test	EUX Score (Steady state)	Difference in %
Windows 10 -8 vCPU 36GB | 8KN 1SH 0022	6.4	Baseline
Windows 10 - 24 vCPU 96GB | 24KN 1SH 0025	4.1	-35.94%
Windows 10 - 16 vCPU 64GB | 16KN 1SH 0024	5.2	-18.75%

VSImax

Test	VSImax	Difference in %
Windows 10 -8 vCPU 36GB | 8KN 1SH 0022	> 8	Baseline
Windows 10 - 24 vCPU 96GB | 24KN 1SH 0025	15 ⚠	-
Windows 10 - 16 vCPU 64GB | 16KN 1SH 0024	13 ⚠	-

Figure 2. LoginVSI EUX Score Windows 10

EUX score

Test	EUX Score	Difference in %
FIX 8vCPU 32GB - 1SH 0008	6.2	Baseline
FIX - 24 vCPU 96GB | 1SH 0015	4.6	-25.81%
FIX 16vCPU 64GB - 1SH 0011	6.7	8.06%

Test	EUX Score (Base)	Difference in %
FIX 8vCPU 32GB - 1SH 0008	7	Baseline
FIX - 24 vCPU 96GB | 1SH 0015	6.5	-7.14%
FIX 16vCPU 64GB - 1SH 0011	7.4	5.71%

Test	EUX Score (Steady state)	Difference in %
FIX 8vCPU 32GB - 1SH 0008	6.5	Baseline
FIX - 24 vCPU 96GB | 1SH 0015	4.6	-29.23%
FIX 16vCPU 64GB - 1SH 0011	6.7	3.08%

VSImax

Test	VSImax	Difference in %
FIX 8vCPU 32GB - 1SH 0008	> 8	Baseline
FIX - 24 vCPU 96GB | 1SH 0015	11 ⚠	-
FIX 16vCPU 64GB - 1SH 0011	> 8	-

Figure 3. LoginVSI EUX Score Windows 11

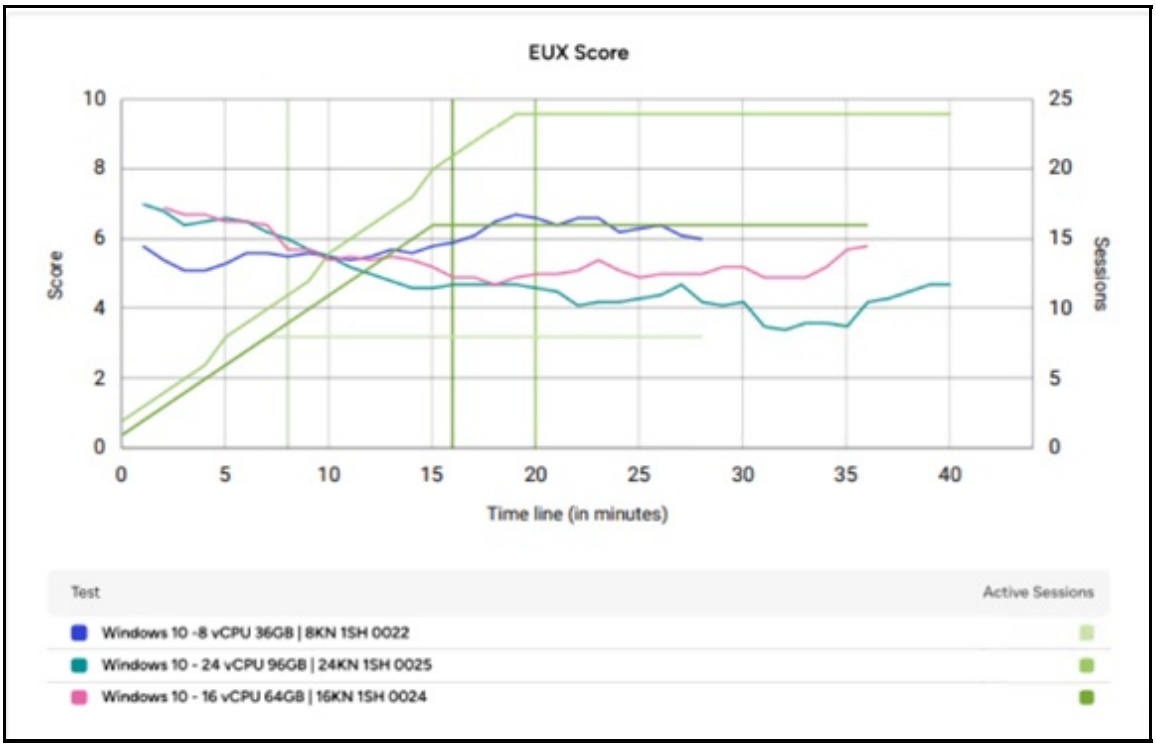


Figure 4. LoginVSI EUX Score Windows 10 on the 3 hardware configurations.

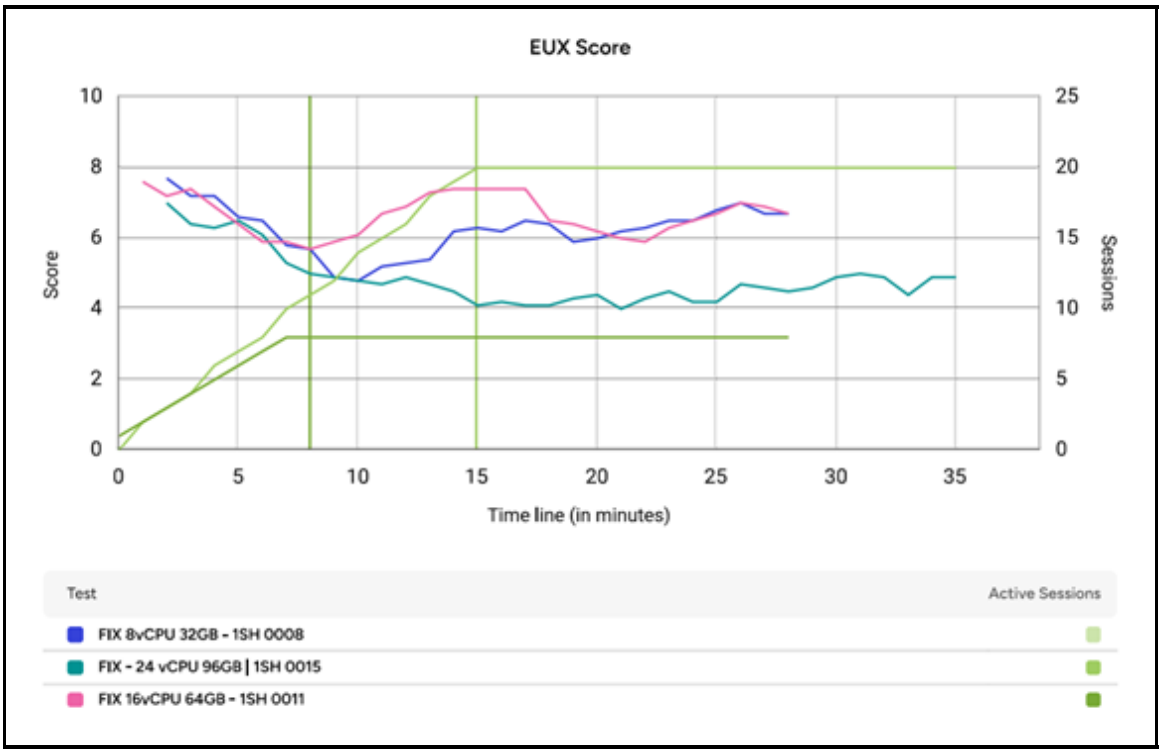


Figure 5. LoginVSI EUX Score Windows 11 on the 3 hardware configurations.

The Generic Application Score

Generic Application Score serves as a key indicator of overall application performance within the multi-session VDI environments tested. A higher score signifies smoother and more responsive application experiences for users, encompassing aspects such as quick application launches, seamless file operations, and a fluid user interface. In this comparison, Windows 10 consistently exhibits higher and more stable scores, suggesting a superior application performance experience compared to Windows 11, especially under heavier loads.

Windows 10 Generic Application Score:

- **Overall:** The Generic Application Score for all three Windows 10 configurations remains relatively stable and high throughout the test, indicating consistent and good application performance.
    - **8 vCPU 36GB:** The score starts high, around 9.5, and stays consistently above 9 for the duration of the test.
    - **16 vCPU 64GB:** The score begins slightly lower, around 9, but quickly rises to match the 8 vCPU configuration and remains stable above 9.
    - **24 vCPU 96GB:** The score shows a similar pattern to the 16 vCPU setup, starting around 9 and stabilizing above 9 for the rest of the test

Figure 6. Generic Application Score Windows 10 on the 3 hardware configurations.

Windows 11 Generic Application Score (“FIX”):

- **Overall:** The Generic Application Score for Windows 11 configurations shows more fluctuation and generally lower scores compared to Windows 10.
    - **8 vCPU 32GB:** The score starts around 8.5 and experiences significant drops throughout the test, reaching as low as 4.5. It recovers somewhat towards the end but remains below the Windows 10 scores.
    - **16 vCPU 64GB:** The score begins around 9 and also exhibits fluctuations, dipping to around 6 at its lowest point. While it shows some recovery, it's still not as stable as the Windows 10 scores.
    - **24 vCPU 96GB:** This configuration demonstrates the most stable score among the Windows 11 setups, starting around 9.5 and staying mostly above 9.However, it still experiences minor fluctuations compared to the consistently high scores of Windows 10.

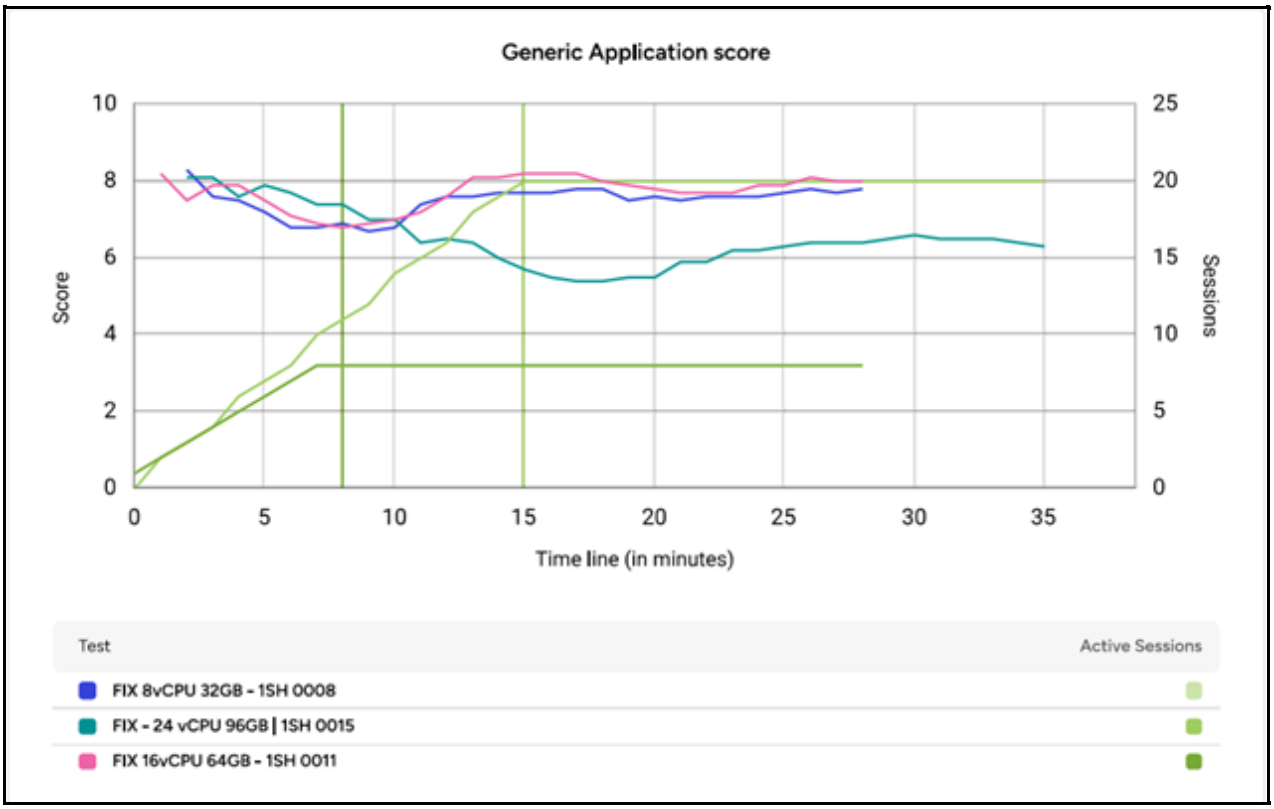


Figure 7. Generic Application Score Windows 11 on the 3 hardware configurations.

User Session metric resource utilization

Windows 10 CPU

- **Overall**: CPU utilization is notably higher across all configurations compared to Windows 10.
  - **8 vCPU 32GB**: CPU usage starts high, reaching nearly 60%, and fluctuates between 30% and 50% for most of the test.
  - **16 vCPU 64GB**: CPU usage is also elevated, starting around 40% and stabilizing between 20% and 30%.
  - **24 vCPU 96GB**: While still higher than Windows 10, this configuration shows the lowest CPU usage among the Windows 11 setups, fluctuating between 10% and 20%.

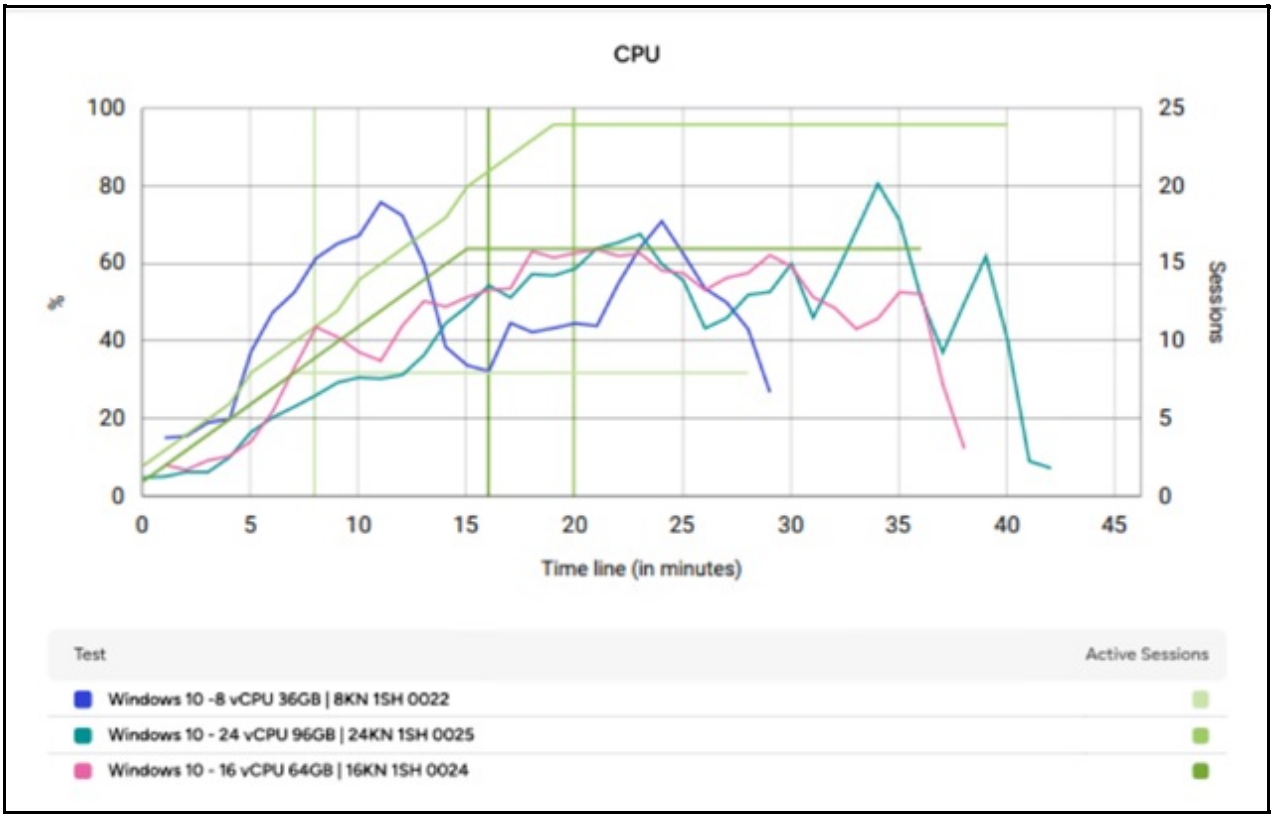


Figure 8. CPU Session usage on Windows 10 on the 3 hardware configurations.

Windows 11 CPU

- **Overall**: CPU utilization is notably higher across all configurations compared to Windows 10.
  - **8 vCPU 32GB:** CPU usage starts high, reaching nearly 60%, and fluctuates between 30% and 50% for most of the test.
  - **16 vCPU 64GB**: CPU usage is also elevated, starting around 40% and stabilizing between 20% and 30%.
  - **24 vCPU 96GB:** While still higher than Windows 10, this configuration shows the lowest CPU usage among the Windows 11 setups, fluctuating between 10% and 20%.

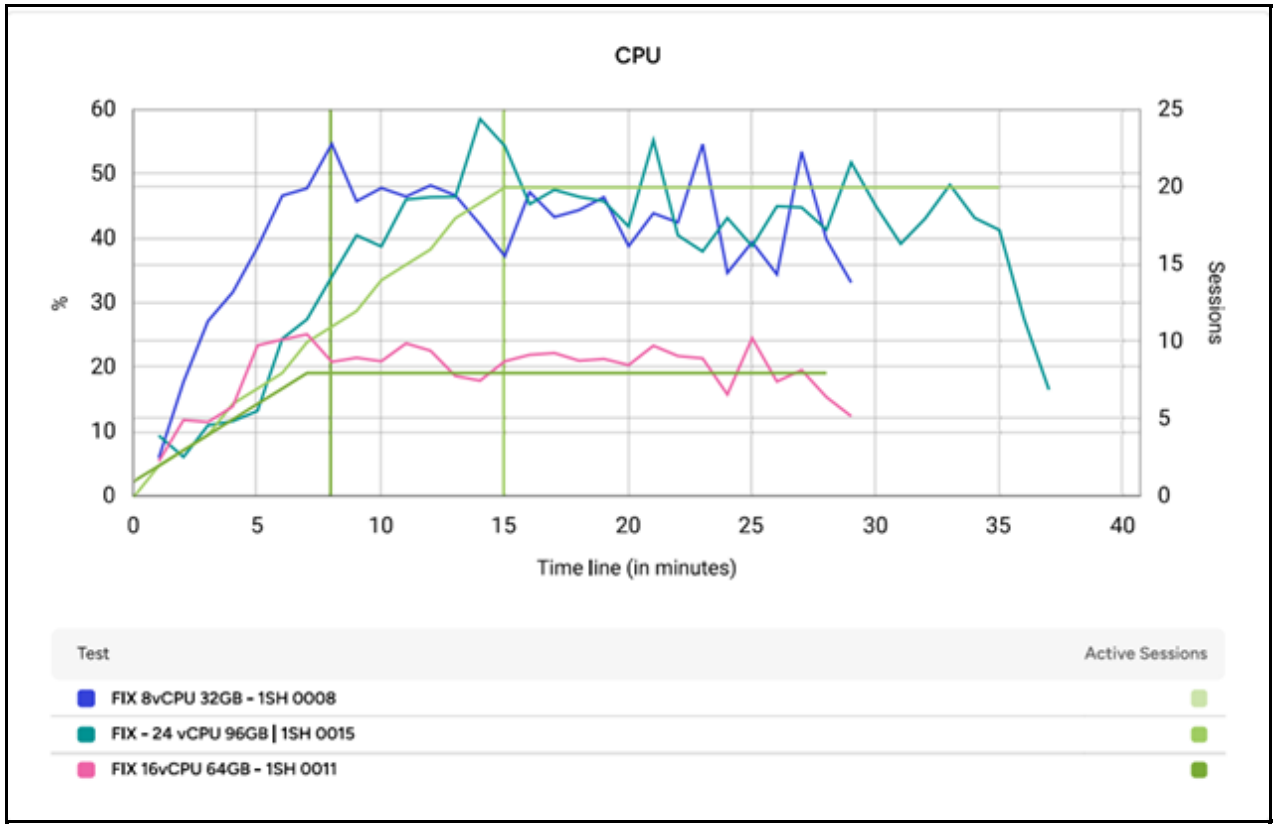


Figure 9. CPU Session usage on Windows 11 on the 3 hardware configurations.

Windows 11 exhibits significantly higher CPU utilization across all comparable configurations, even with more vCPUs available. This suggests that Windows 11 might have higher baseline CPU demands or less efficient resource management in a multi-session environment.

The 24 vCPU 96GB configuration seems to provide the most headroom for both operating systems, as CPU usage remains relatively low even under load.

Memory Session Utilization

- **Overall:** Memory usage across all three configurations remains relatively stable and well within their allocated limits throughout the test.
    - **8 vCPU 36GB:** Memory usage hovers around 10GB, utilizing roughly 28% of the available memory. There are minor fluctuations but no significant spikes.
    - **16 vCPU 64GB:** Memory usage sits comfortably around 15GB, utilizing approximately 23% of the total memory. Again, minor fluctuations are observed but no cause for concern.
    - **24 vCPU 96GB:** Memory consumption is the highest here, reaching around 25GB, which translates to about 26% utilization. It remains steady with minimal fluctuations.

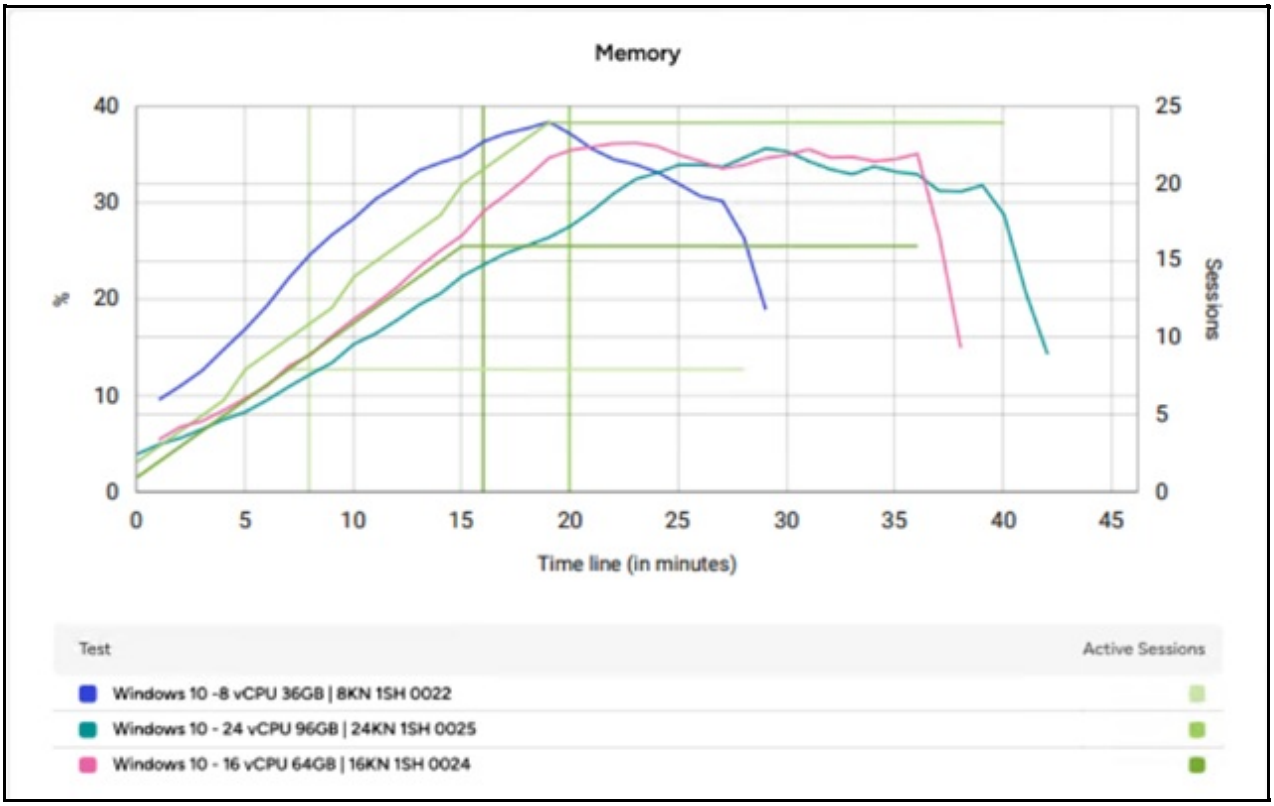


Figure 10. Session Memory usage on Windows 10 on the 3 hardware configurations.

Windows 11 Session Memory (represented by"FIX")

- **Overall:** Memory utilization is noticeably higher across all configurations compared to Windows 10.
  - **8 vCPU 32GB:** Memory usage starts high, approaching 25GB (around 78% utilization), and fluctuates between 20GB and 25GB for the majority of the test.
  - **16 vCPU 64GB:** Memory usage is also elevated, beginning around 30GB (approximately 47% utilization) and stabilizing between 25GB and 30GB.
  - **24 vCPU 96GB:** While still higher than Windows 10, this configuration shows the most efficient memory usage among the Windows 11 setups, fluctuating between 30GB and 40GB (31% to 42% utilization).

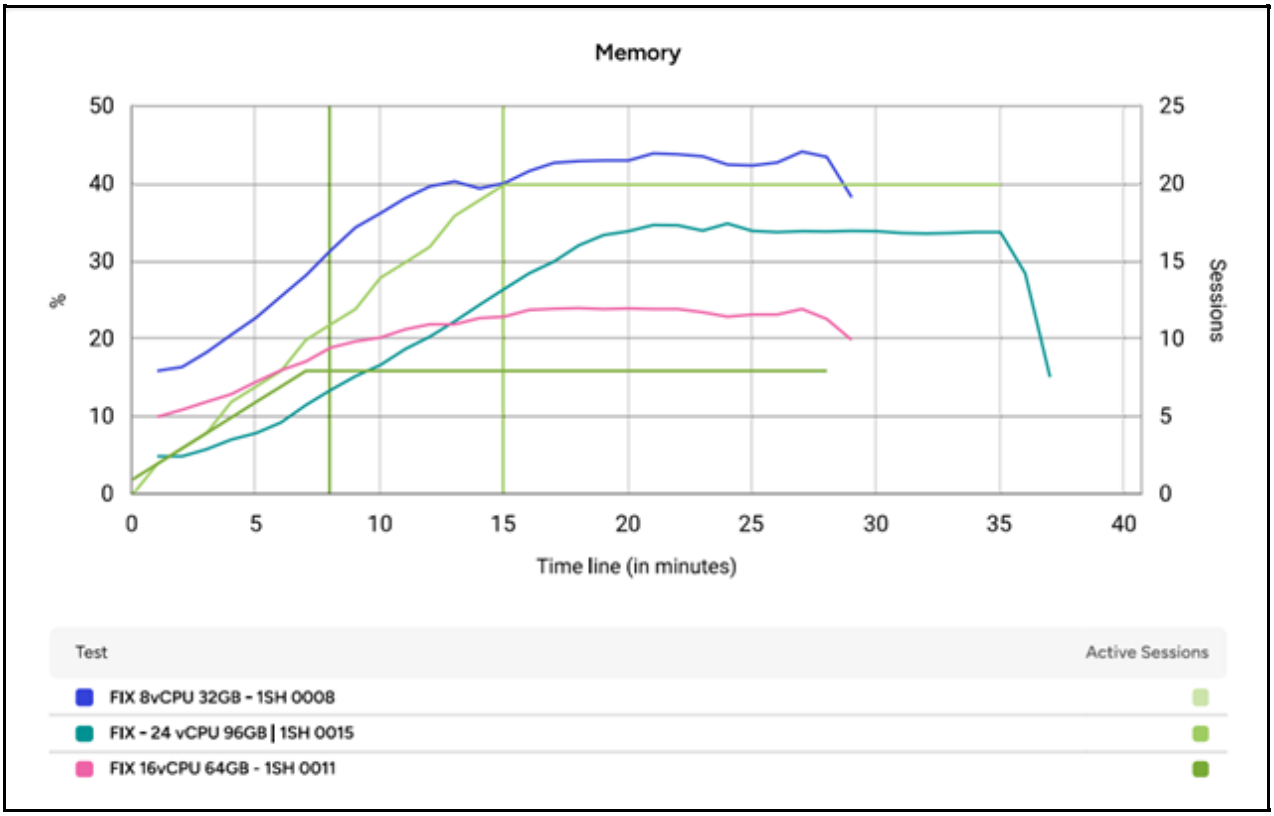


Figure 11. Memory Session usage on Windows 11 on the 3 hardware configurations.

Comparison and Inferences:

- **Windows 11 demonstrates significantly higher memory utilization** in all configurations compared to Windows 10, even when provided with the same amount of memory. This suggests that Windows 11 might have a larger memory footprint or less aggressive memory management in a multi-session environment.
- **The 8 vCPU 32GB configuration** seems to be particularly strained in the Windows 11 environment, with memory usage nearing its limit. This could potentially lead to performance issues or instability under heavier workloads.
- **The 24 vCPU 96GB configuration** provides ample headroom for both operating systems, although Windows 11 still uses a considerably larger portion of the available memory.

Conclusion

Based on the benchmark data comparing Windows 10 and Windows 11 Multi-Session on Azure Stack HCI across the 8, 16, and 24 vCPU configurations with varying memory, we can draw the following conclusions:

Performance

- **User Experience:**
    - While Windows 11 initially offers a smoother user experience, particularly in the 16 vCPU 64GB configuration, the EUX score tends to decrease as more sessions are added. This might be attributed to the shared kernel architecture of multi-session, where increased resource contention can impact individual session performance.
    - Windows 10, on the other hand, demonstrates a more gradual decline in EUX score as sessions scale, indicating better resource management under load.
- **Application Performance:** Windows 10 consistently outperforms Windows 11 in generic application scores. This suggests smoother and more responsive application execution on Windows 10, even as the number of sessions increases.
- **Resource Utilization:** Windows 11 exhibits significantly higher CPU and memory utilization across all configurations. This could contribute to the observed decrease in EUX scores as resources become more constrained with additional sessions.

Cost Benefits of Multi-Session

- **Consolidated Infrastructure:** Multi-session allows multiple users to share the resources of a single virtual machine, reducing the overall number of VMs required and optimizing hardware utilization.
- **Lower Licensing Costs:** Multi-session licensing models often provide cost savings compared to traditional single-session VDI deployments.
- **Simplified Management:** Managing a smaller number of VMs with multiple users per VM can streamline administrative tasks and reduce complexity.

Recommendations:

- When scaling user sessions, consider the potential impact on EUX scores, especially with Windows 11. Adequate resource provisioning and load balancing are essential to maintain a satisfactory user experience.
- If consistent performance under heavy user loads is a priority, Windows 10 currently appears to be the more favorable option, even though Windows 11 might offer a slight edge in initial user experience.
- Leverage the cost benefits of multi-session to optimize your VDI deployment, but carefully assess the trade-offs between user density and individual session performance.

Bill of Materials

Table 1. Bill of Materials

Part number Feature code	Product Description	Qty
7D76CTO1WW	**Server: ThinkSystem SR650 V3 - 3yr Warranty**	1
BLKK	ThinkSystem V3 2U 24 x 2.5" Chassis	1
BNOM	Intel Xeon Platinum 8480+ 64C 350W 2.0GHz Processor	2
BNFC	ThinkSystem 128GB TruDDR5 4800 MT/s (4Rx4) 3DS RDIMM	32
B8NY	ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter	1
BNEG	ThinkSystem 2.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	8
B8LU	ThinkSystem 2U 8 x 2.5" SAS/SATA Backplane	1
BH8D	ThinkSystem 2U/4U 8 x 2.5" NVMe Backplane	1
BM8X	ThinkSystem M.2 SATA/x4 NVMe 2-Bay Enablement Kit	1
AUUV	ThinkSystem M.2 128GB SATA 6Gbps Non-Hot Swap SSD	2
B93E	ThinkSystem Intel I350 1GbE RJ45 4-port OCP Ethernet Adapter	1
BLKM	ThinkSystem V3 2U x16/x16/E PCIe Gen4 Riser1 or 2	2
BMUF	ThinkSystem 1800W 230V Platinum Hot-Swap Gen2 Power Supply	2
BLL6	ThinkSystem 2U V3 Performance Fan Module	6
BRQ1	ThinkSystem SR650 V3,SATA CBL,SLx8-SLx4,M.2-M.2(MB),150mm	1
BSYM	ThinkSystem SR650 V3,PCIe4 Cable,Swift8x-SL8x,2in1,PCIe 6/5(MB) to BP1/BP2	1
BETS	ThinkSystem V3 2U SFF C0 (RAID) to Front 8x2.5" BP1	1
BPE3	ThinkSystem SR650 V3 MCIO8x to SL8x CBL, PCIe4, 8x2.5AnyBay, 200mm	2
BQ12	G4 x16/x16/E PCIe Riser BLKM for Riser 1 Placement	1
BQ19	G4 x16/x16/E PCIe Riser BLKM for Riser 2 Placement	1
7S0XCTO2WW	Lenovo XClarity XCC2 Platinum Upgrade	1
5641PX3	XClarity Pro, Per Endpoint w/3 Yr SW S&S	1
1340	Lenovo XClarity Pro, Per Managed Endpoint w/3 Yr SW S&S	1
QAA8	SR650 V3 3Y Standard	1

Accelerated by Intel

To deliver the best experience possible, Lenovo and Intel have optimized this solution to leverage Intel capabilities like processor accelerators not available in other systems. Accelerated by Intel means enhanced performance to help you achieve new innovations and insight that can give your company an edge.

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For More Information

To learn more about this Lenovo solution contact your Lenovo Business Partner or visit:
https://www.lenovo.com/vdi

References:

Lenovo ThinkAgile SR650 V3: https://lenovopress.lenovo.com/lp1601

References:
Lenovo ThinkSystem SR650 V3: https://lenovopress.lenovo.com/lp1601

Related product families

Product families related to this document are the following:

- Microsoft Alliance
- ThinkAgile MX Series for Microsoft Azure Local
- ThinkSystem SR650 V3 Server

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