NUDGEIT
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Mapping VDI user load to Machine type and sizes: An example

Contents

Executive Summary

Azure Virtual Desktop (AVD) deployment marks a significant shift towards more flexible, scalable, and secure organizational operations in the dynamic world of digital workspaces. IT. and Infrastructure managers play a crucial role in this change, focusing on crafting a virtual desktop setup that meets current user needs while preparing for future requirements. This paper highlights the essential task of finding the best configuration of virtual host machines to support specific environments efficiently.

Based on a company we will call NUDGEIT Customer, a real company with 180 users, 104 on Virtual Desktops. The WhitePaper walks through the thinking and offers guidance for IT Managers on aligning user needs with hardware capabilities. We employ Microsoft's user type definitions—from Light to Power users—to devise a method for calculating the vCPU and memory required for a varied user group. We then use the NUDGEIT load table to calculate the required capacity (CPU, Memory). Finally, we walk through the process of selecting the suitable machines. This strategy ensures users have the resources they need for efficient work without wasting capacity, balancing performance against cost. The process is simple:

Sample company
NudgeContoso

180
Total Users

104
on Virtual Desktops

1. Allocate users into 4 categories for load calculation (Light, Medium, Heavy, and Power).
2. Use the NUDGEIT user category to Resouce mapping to calculate the required resources of vCPU and RAM.
3. Evaluate the Heavy and Power users and assign relevant resources
4. Spread Lilgt and Medium users over several machines using NUDGEIT guidelines

Concrete example

Using Microsoft Categorization of Users, see Figure 1. We categorize each user group supposed to be on AVD into 4 classes: Light, Moderate, Heavy, and Power users. The details of the Microsoft user categorization are here: Microsoft guidance page for Azure Virtual Desktop sizing.

- **Light Users –** Typically utilize basic applications like word processors, email clients, and simple spreadsheets. Their resource demands are minimal and predictable.
- **Medium Users –** Engage with more complex functionalities of standard applications and may occasionally use more resource-intensive software.
- **Heavy Users –** Engage regularly with Graphics, or Video editing, doing engineering design and simulation, or heavy programming with automated testing.
- **Power Users –** Regularly use high-demand applications for data analysis, design, or development tasks. Their activities result in significant, variable load patterns.

Figure 1: The Microsoft standard Virtual user load grouping.

The result from the sample company – is shown in Figure 2. How do we arrive at the outcome of categorizing the users!, this is a more extended discussion and is not the scope of this paper; we kindly refer to the whitepaper Sizing Virtual Desktop environments, where we cover the process in detail.

Company Users VDI Load Class	Number of users
Light Users	**62**
Medium Users	**33**
Heavy Users	**6**
Power Users	**3**
TOTAL	**104**

Figure 2: The company evaluation shows the following number of Virtual Desktop user categories.

At NUDGEIT, we boast extensive experience in deploying Azure Virtual Desktop (AVD) across various industries. Our insights stem from years of analyzing user types and the corresponding loads they generate on the system. We've crafted a refined classification system through comprehensive evaluations across a broad spectrum of clients. This system categorizes users into four distinct classes: Light, Medium, Heavy, and Power users. Based on this classification, we've developed a guideline that outlines the virtual CPUs and memory requirements for each user class.

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Key Highlights of Our Sizing Guide

At NUDGEIT, we boast extensive experience in deploying Azure Virtual Desktop (AVD) across various industries. Our insights stem from years of analyzing user types and the corresponding loads they generate on the system. We've crafted a refined classification system through comprehensive evaluations across a broad spectrum of clients. This system categorizes users into four distinct classes: Light, Medium, Heavy, and Power users. Based on this classification, we've developed a guideline that outlines the virtual CPUs and memory requirements for each user class.

User-Friendly Classification
Users are categorized as Light, Medium, Heavy, and Power, simplifying the process of identifying requirements.

Benchmarked Standards
The guide provides averaged benchmarks for virtual CPUs and memory, offering a reliable starting point for resource allocation.

Adaptability
While our table serves as a general guide, it achieves remarkable accuracy in environments with over 100 mixed users.

Special Considerations
We acknowledge the presence of specialized users or groups that may exhibit higher load patterns, particularly among Heavy and Power users, warranting closer examination.

Company Users VDI Load Class	Number of users	vCPU	RAM GB	DISK GB
Light Users	**62**	**50**	**198**	**198**
Medium Users	**33**	**38**	**151**	**151**
Heavy Users	**6**	**16**	**64**	**64**
Power Users	**3**	**12**	**112**	**680**
TOTAL	**104**	**115**	**525**	**1093**

Figure 3. Using the NUDGEIT User Class to Resource index, we translate the number of users in each category into requirements for CPU and Memory.

As we can see from the table, we need a total of 115 vCPU equivalents and 525 GB of memory.
Now, the challenge is how we distribute this on the available machine types in an effective manner.

There are additional considerations before we move on to the machine size and map the vCPU, RAM, and disk requirements.

- Pooled versus Personal.
- Deploying session host monitoring and scaling capabilities (Like NUDGEIT ECO).
- Specific storage requirements for certain users (Capacity or Size requirements).
- Network speed and capacity special requirements.
- Security or compliance considerations, such as whether users need to be separated.

Covering this is beyond this paper's scope; if you are interested, contact the NUDGEIT AVD team for a detailed discussion.

Possible Azure Machine types

Microsoft has many types of hosts available in Azure; the table below is an overview of the machine types, with a column on their usability for AVD from a NUDGEIT perspective.

VM type & their usage	Series from Microsoft	General Main Usage	NUDGEIT recommended for AVD Usage
General Purpose VMs ★★★	Av2, Dv3, Dv4, Dsv3, DsvX, etc.	A balanced CPU-to-memory ratio	Our recommended general-purpose VDI host is the DsvX series. It has an optimal relationship with CPU/Memory and a lower cost than others. It is essential that you can attach fast storage. AvX is not recommended because you cannot reserve it. DvX is not recommended due to Storage limitations.
Compute Optimized VMs ★	Fsv2	These VMs offer a high CPU-to-memory ratio	Sometimes, with user groups with extreme computing requirements.
Memory Optimized VMs ★	Esv3, Esv4, Mv2, M, Dsv2, etc.	A high memory-to-CPU ratio.	In special situations where many users have shallow CPU requirements, these machines can be effective – but rarely seen. It is better to mix users on a general purpose like DsvX.
Storage Optimized VMs	Lsv2	Optimized for high disk throughput and IO.	We have never recommended or seen this used in a VDI environment.
GPU VMs ★	NC, NCv2, NCv3, ND, NDv2, NV, NVv3, NVv4	Designed for graphics, AI-intensive applications.	We have used this for some special Power users who work on AI, heavy graphics, or video editing.
High Performance Compute VMs ★	H, HB, HBv2, HC	For advanced computing tasks like molecular modelling fluid dynamics.	In sporadic cases used for specialty users in VDI environments.
Specialty VMs	Burstable B-series File server F-series	Specialty VMs are used for burstable workloads or file servers.	Generally, these are never used as Virtual Desktop Hosts.

Which types of VMs are recommended by NUDGEIT

Our experience implementing AVD for a variety of customers concludes that for general-purpose Multi Session Windows AVD environments with pooled users, the most commonly recommended VM host types are from the DsvX series:

Balanced CPU-to-Memory Ratio

The DsvX series offers a balanced CPU-to-memory ratio, crucial for supporting various general-purpose applications and workloads in a multi-user environment. This balance ensures that resources are efficiently utilized and perform well across multiple tasks without over-provisioning.

Scalability

These series allow for easy scaling, which is essential in pooled AVD scenarios where active users can fluctuate. Azure's ability to scale these VMs up or down based on demand helps maintain performance while optimizing costs.

Cost-Effectivenes

DsvX VMs offer a good balance of performance and cost, making them an economical choice for organizations looking to provide users with a versatile and responsive desktop experience without incurring unnecessary expenses.

Availability

These VM types are widely available in many Azure regions, ensuring that organizations can deploy AVD environments globally without significant constraints on resource availability.

Storage Options

The 's' in DsvX denotes support for premium SSD storage, which provides faster disk access times and better performance for IO-intensive operations. This is particularly beneficial in multi-session environments where multiple users access and operate applications concurrently, as it helps reduce latency and improve the overall user experience. The lack of Premium storage capability is also why NUDGEIT does not recommend the DsX series.

Conclusion

The DsvX series VMs strike an optimal balance between performance, cost, and scalability, making them a preferred choice for general-purpose multi-session Windows AVD environments with pooled users. Their design caters well to the dynamic nature of such environments, ensuring that users receive a responsive and efficient desktop experience while organizations maintain control over their Azure expenditures.

Selecting the sizes to deploy

Having selected the machine type Dsv4, it is now time to decide which sizes of machine you will deploy. In doing so, you need to consider a few elements:

User Experience and Performance – Ensure users get adequate resources (CPU, memory) to perform their tasks efficiently without experiencing slowdowns or resource contention.

Cost Optimization – Analyze the cost implications of different VM sizes and types, including potential savings from Azure Reserved Instances or spot VMs for non-critical workloads.

Scalability and Elasticity – Consider how your choice affects the ability to scale up or down based on actual demand, potentially impacting cost and user experience.

Management Overhead – Larger numbers of VMs can increase the complexity of management, monitoring, and maintenance tasks.

Fault Tolerance and Availability – Assess how the distribution of users across VMs affects your ability to provide uninterrupted service in the event of VM failures.

Session Host Load Balancing – Understand how Azure's load balancing will distribute sessions across your VMs and how this impacts performance and user density.

The table below compares the two extreme approaches to covering the loads, with very few large hosts or many smaller hosts.

	Few Large VMs	Many small VMs
PROS	• **Simplified Management**: Fewer VMs to maintain reduced administrative burden. • **Cost Efficiency**: Larger VMs offer better cost-to-performance ratios, considering per-VM resources like storage and networking. • **Consolidated Networking and Security**: Easier to manage with fewer endpoints.	• **Granular Scalability**: It is easier to scale in or out with precision, closely aligning resources with demand. • **Reduced Blast Radius**: Failures or performance issues in a single VM affect fewer users, enhancing overall system resilience. • **Improved Isolation**: Limits the impact of resource-intensive applications or processes to fewer users.
CONS	• **Higher Risk of Disruption**: A failure impacts more users, potentially leading to significant service interruptions. • **Resource Contention**: The "noisy neighbor" effect increases the risk of performance issues. • **Reduced Flexibility**: Scaling requires adding substantial resources simultaneously, possibly leading to temporary overprovisioning or underutilization.	• **Increased Management Complexity**: More VMs to monitor, update, and secure lead to operational overhead. • **Potentially Higher Costs**: The cumulative cost of many small VMs may exceed that of larger VMs due to less efficient resource utilization. • **Network Complexity**: More VMs can complicate network configuration and security management.

Figure 4. The pros and cons of two extreme host choices

As always, the truth is somewhere between the two extremes, and there is no simple formula for this selection. The Dsv4 series has several options, and Figure 5 lists all options available as of February 2024.

	vCPU	RAM GB	Max data Disks	Max NiCs	Burst uncacned Disk Throughput IOP S	Burst uncacned Disk Throughput MB/S
Standard_D2s_v4	**2**	**8**	**4**	**2**	**4000**	**200**
Standard_D4s_v4	**4**	**16**	**8**	**2**	**8000**	**200**
Standard_D8s_v4	**8**	**32**	**16**	**4**	**16000**	**400**
Standard_D16s_v4	**16**	**64**	**32**	**8**	**32000**	**800**
Standard_D32s_v4	**32**	**128**	**32**	**8**	**64000**	**1600**
Standard_D48s_v4	**48**	**192**	**32**	**8**	**80000**	**2000**
Standard_D64s_v4	**64**	**256**	**32**	**8**	**80000**	**2000**

Figure 5. The Microsoft DsvX series of machines (Feb 2024)

For the details of which machine to use, this is tricky as there are many options, if you need 16 medium load users (2vCPU/4 GB per user) is it better to use 8 * 4CPU/16 GB machines (only two users for each VD host) or to use a single 32vCPU/64 GB Machine for all users – the short answer is it depends, but generally for optimal performance and cost-efficiency and availability in multi-session virtual desktop environments, it's recommended to use several medium size (8 or 16 vCPU) VMs, carefully considering the core-to-user ratio.

Taking the concrete company example from NUDGEIT Customer where we have 104 users, In total requiring 115 vCPU and 431 GB Memory, choosing the Dsv4 Type, you would get a table like below just calculating the number of VMs needed.

			TOTAL		LIGHT AND MEDIUM ONLY	
	vCPU	RAM GB	No. of Machines VCPU	No. of Machines RATAM	No. of Machines VCPU	No. of Machines RATAM
Standard_D2s_v4	**2**	**8**	**58**	**66**	**44**	**44**
Standard_D4s_v4	**4**	**16**	**29**	**33**	**22**	**22**
Standard_D8s_v4	**8**	**32**	**14**	**35**	**11**	**11**
Standard_D16s_v4	**16**	**64**	**7**	**8**	**5**	**5**
Standard_D32s_v4	**32**	**128**	**4**	**4**	**3**	**3**
Standard_D48s_v4	**48**	**192**	**2**	**3**	**2**	**2**
Standard_D64s_v4	**64**	**256**	**2**	**2**	**1**	**1**

Figure 6. The available Dsv4 machine types and the number of machines needed for the customer SwissContoso

The comparison in Figure 4 shows the advantages and disadvantages of two very different hosting options for the entire workload. You could use 58 smaller machines (D2s_v4) or just two large ones (D64s_v4). However, grouping Heavy and Power users with Light and Medium users for sizing is not practical. Considering only Light and Medium users, the requirement comes down to 44 small machines (D2s_v4) or 2 large machines to manage the workload. Unfortunately, neither option is ideal.

For the NUDGEIT Customer, we ended up doing the following. Starting with the specialty load, which is most commonly in the Heavy and power user groups, then move on to the general users in the Light and Medium category:

Power Users

The power users consisted of 3 Engineering staff, with a heavy requirement for GPU as they were doing AI; hence, we deployed on an NC12v2 type VM. As they are not working fully all the time, Using one machine as reserve instance, and one PayAsYouGo (PAYG) and off normally.

Heavy Users

Under Heavy users, we had two in Marketing focused on intensive video graphics and four Data Analysts. To optimize performance and resources:

Marketing Team: The two marketing professionals who required advanced graphics capabilities for video editing were allocated to smaller NC6v2 machines equipped with GPU support. This choice ensured they had the necessary power for their graphics-intensive tasks.

Data Analysts: The four data analysts were assigned to two DS32s_v4 machines. This setup was chosen to provide failover capabilities, ensuring reliability and uninterrupted service. We aimed to balance load and enhance performance by placing only two users per machine.

To prevent any potential 'Noisy Neighbor' effect, which could hinder performance by overloading shared resources, we isolated the data analysts from the rest of the staff. This strategic separation ensures that all team members can work efficiently without interference.

Light and Medium Users

For the Light and Medium user groups to ensure seamless daily operations and optimal performance, our deployment strategy encompasses a dedicated pool of D16s_v4 machines specifically chosen for their balance of performance and efficiency. The deployment strategy

Core Pool: We established a core deployment of 6 D16s_v4 machines. We decided to add 1 machine, not on a reserved basis to cover exceptions. This setup accommodates an average user density of 15 individuals per machine, balancing resource availability and user demand.

Operational Flexibility: Recognizing the need for operational agility, particularly during maintenance activities such as software updates and system reboots, we've added D16s_v4 machine to our deployment. This extra machine plays a critical role in our infrastructure, serving as a buffer to ensure that maintenance activities can be conducted without impacting user productivity. It allows for a seamless transition of users to alternative resources during these periods, thereby minimizing downtime and enhancing user experience.

A summary for NUDGEIT Customer ended up being as in Figure 7 below.

Type VM	No. VMs	For which type of users
NC12s_v2	**2**	**Forpower users in engineering, with GPU**
NC6s_v2	**2**	**Marketing Video Editing personel**
NC32s_v4	**2**	**For Data Analyst people**
NC16s_v4	**8**	**For Light and Mediumusers, pooled**

Figure 7. Packaging users into hosts is tricky and needs some consideration. Here is the final result from the company.

The approach chosen for this customer enhances user experience and offers greater resource management flexibility. Generally, you learn a lot in production, so we highly recommend that you consider:

Performance Baseline – Conduct performance testing to establish a baseline informing the VM size and type selection, considering peak and average loads.

Dynamic Scaling – Utilize Azure's autoscaling capabilities to adjust resources dynamically, aligning with demand patterns and optimizing costs.

Hybrid Approach – Consider a mix of VM sizes to balance the trade-offs, using larger VMs for consistent, predictable workloads and smaller VMs for fluctuating or isolated speciality workloads.

Continuous Monitoring – Implement a robust monitoring solution to track performance, user experience, and system health, enabling informed decisions about scaling and resource allocation, which can lead to significant cost savings and better user experience.

Note of caution

Deploying virtual desktops is not straightforward – there are exceptions, traps, and best practices you need to be aware of. NUDGEIT has encountered and learned over the years, in no specific order:

- Establish effective monitoring, but don't fall into the trap of monitoring too deep and wide, as it can be costly; we have seen situations where monitoring (log and performance) was nearly as costly as the hosting itself.
- Not all loads are modern new applications; you can choose to have a legacy application delivered through RemoteApp. And often, you can get like +40 users on a standard single eight vCPU Host.
- There are special applications of AVD, where you actually 'publish' a Local, mighty workstation for, e.g. Simulation over the AVD framework and, as such, gain the policy and security framework and allow users to work from home – securely.
- Paying attention to pools and how you allocate workloads and users to pools can be a puzzle and requires attention.
- Network latency and bandwidth usually are not critical, but certain workloads or special distribution of users across geographies may require special attention.
- This paper has not covered Disaster recovery and business continuity; Azure comes with a series of options, but choosing the proper setup can be tricky. A complete understanding of the business requirements is required for the right solution.
- Not leveraging Azure cost management tools or failing to optimize resource usage can lead to unexpectedly high expenses.
- Leverage AVD to apply a Modern Workplace together with Zero Trust Security concepts in your organization; it makes much sense.

So mapping hosts and user load and balancing cost and user experience is tricky. Talk to the team that has done this repeatedly in Azure Virtual Desktop. If you already have AVD deployed, you may benefit from our experience and cost optimization of the AVD ECO. Arrange for a call by filling in Get to speak to a NUDGEIT AVD expert form.

Get to speak to a specialist