

# Azure Architects Connect: Azure Virtual Desktop – Architektur Design Session

Herzlich Willkommen zur heutigen Veranstaltung!  
In wenigen Minuten geht es los....

## AGENDA



Einführung

Wie sieht eine Azure Virtual Desktop Architektur nach Enterprise-scale aus?

Welche Sicherheitsfunktionen sollten aktiviert werden?

Wie kann eine Hochverfügbarkeit gewährleistet werden?

Ist es möglich die Azure Virtual Desktop Umgebung zu automatisieren?

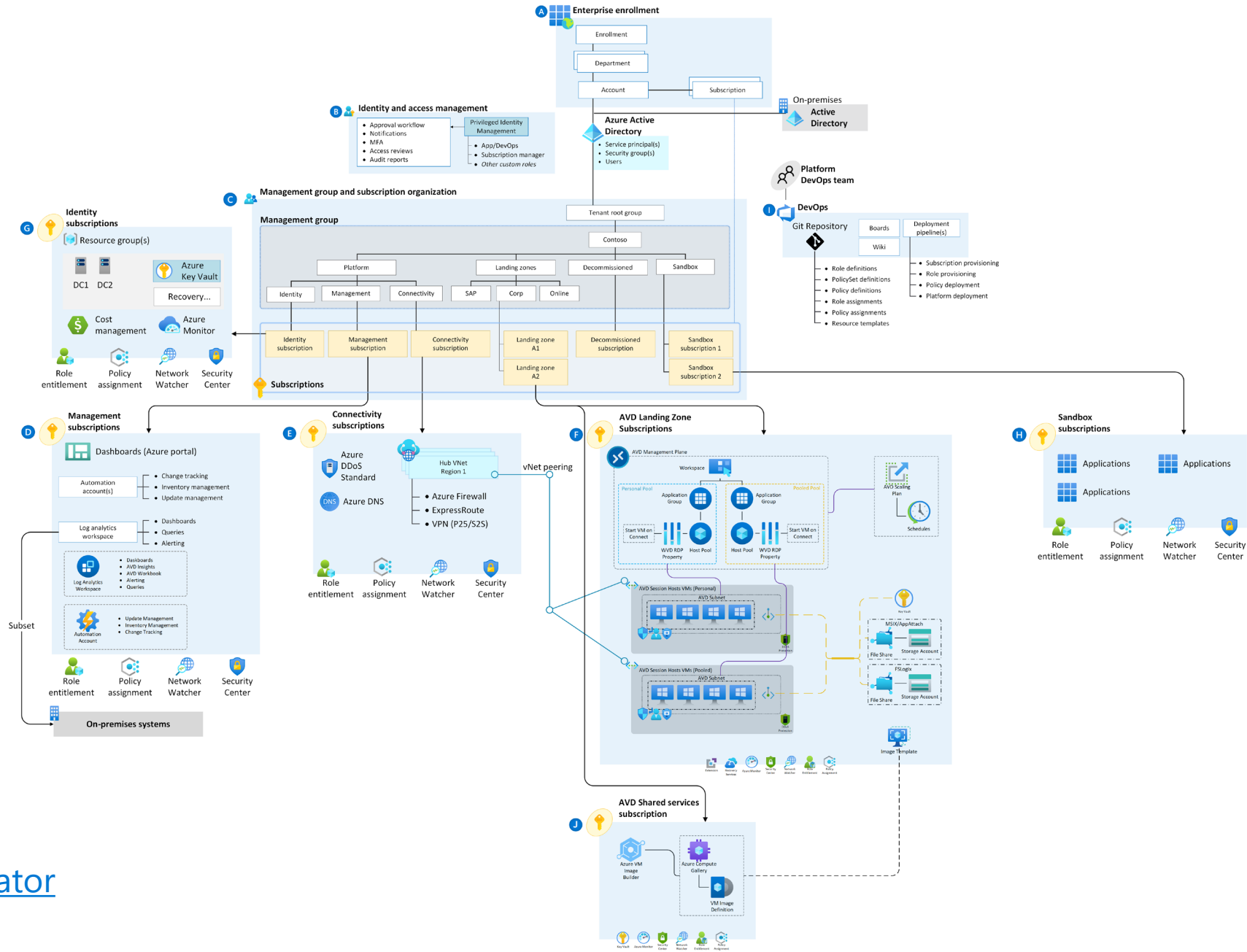
Wie können die Kosten optimiert werden?

Q & A

# Azure Virtual Desktop at Enterprise Scale

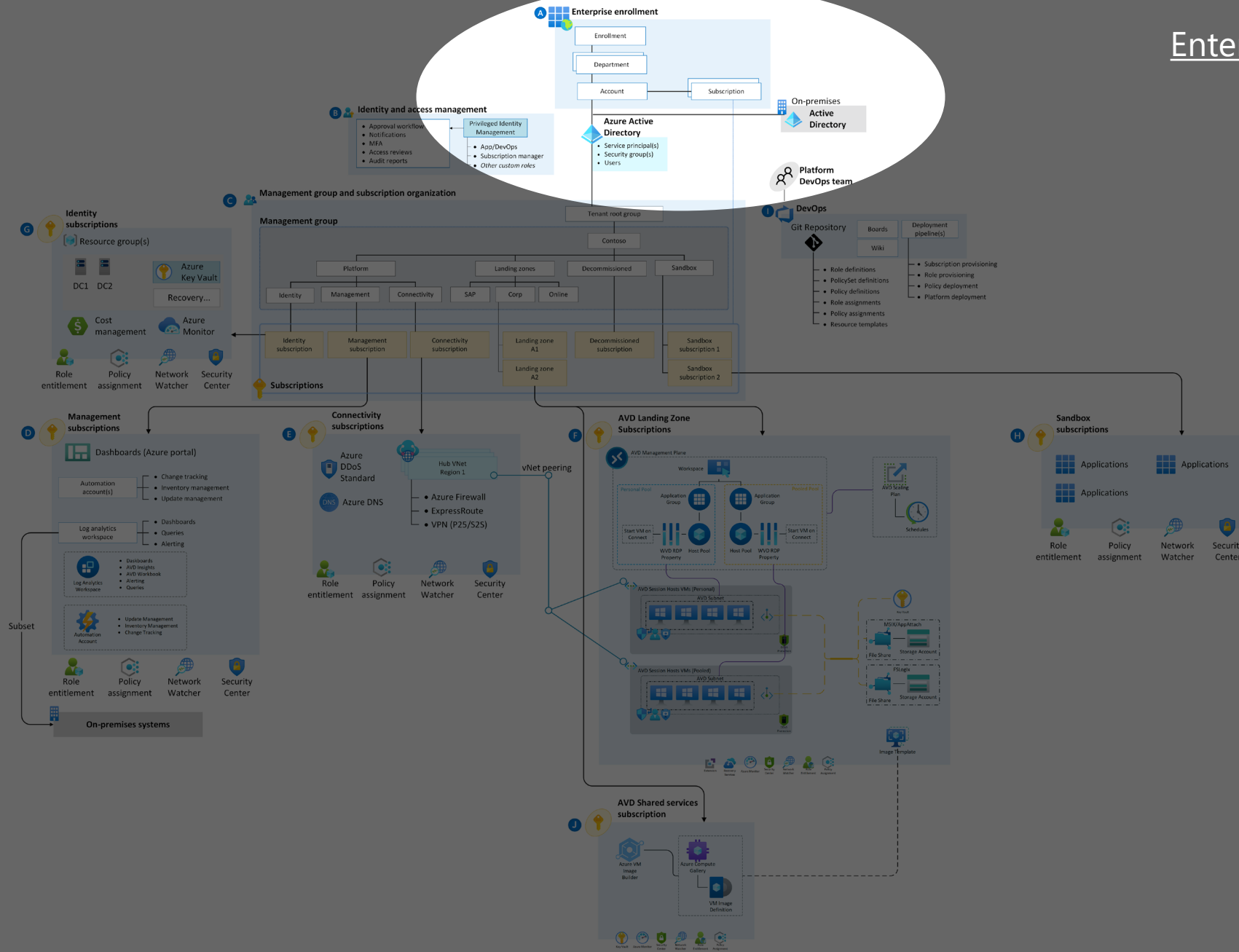


# Azure Virtual Desktop at Scale



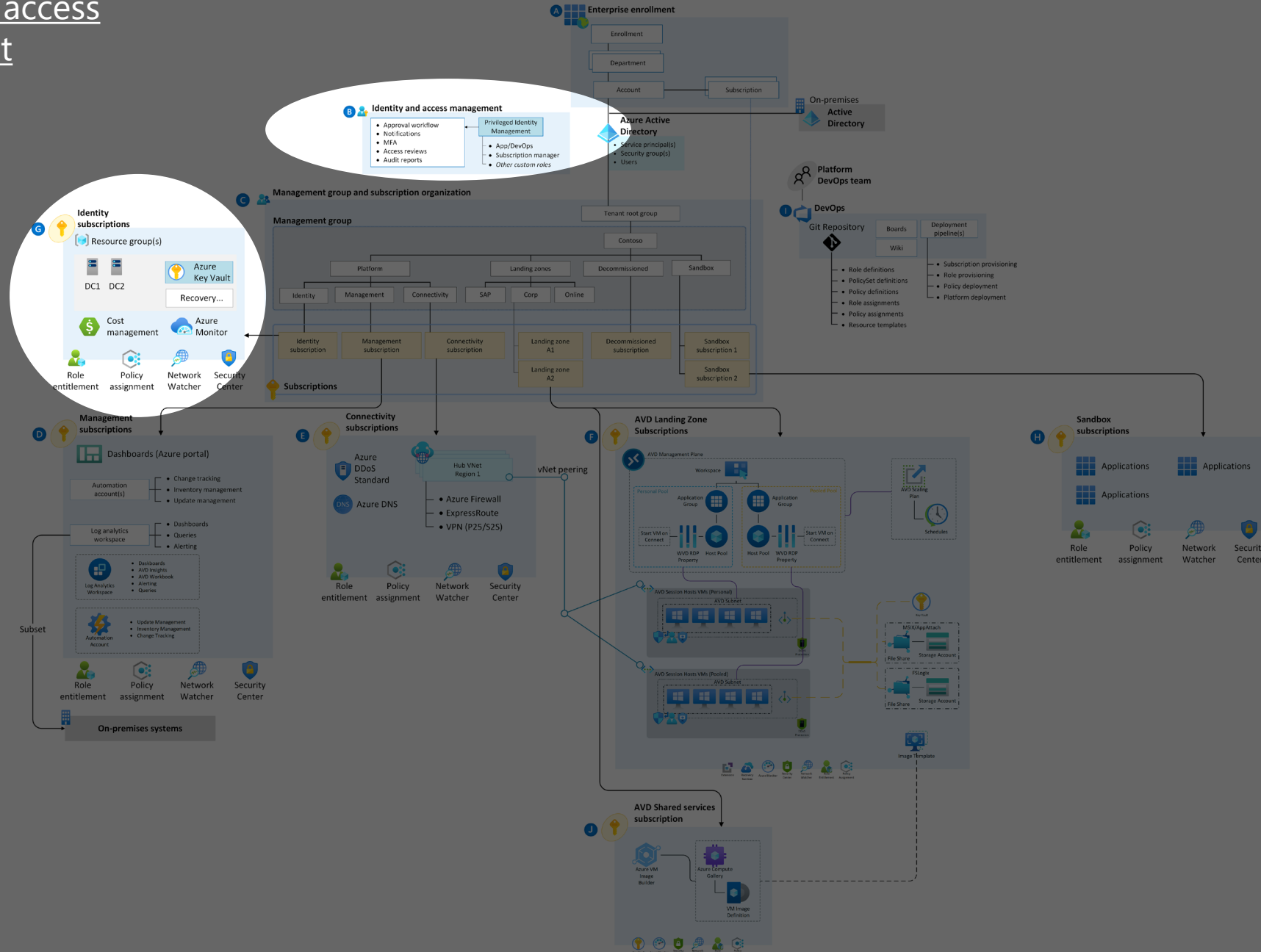
# Azure Virtual Desktop at Scale

Enterprise enrollment

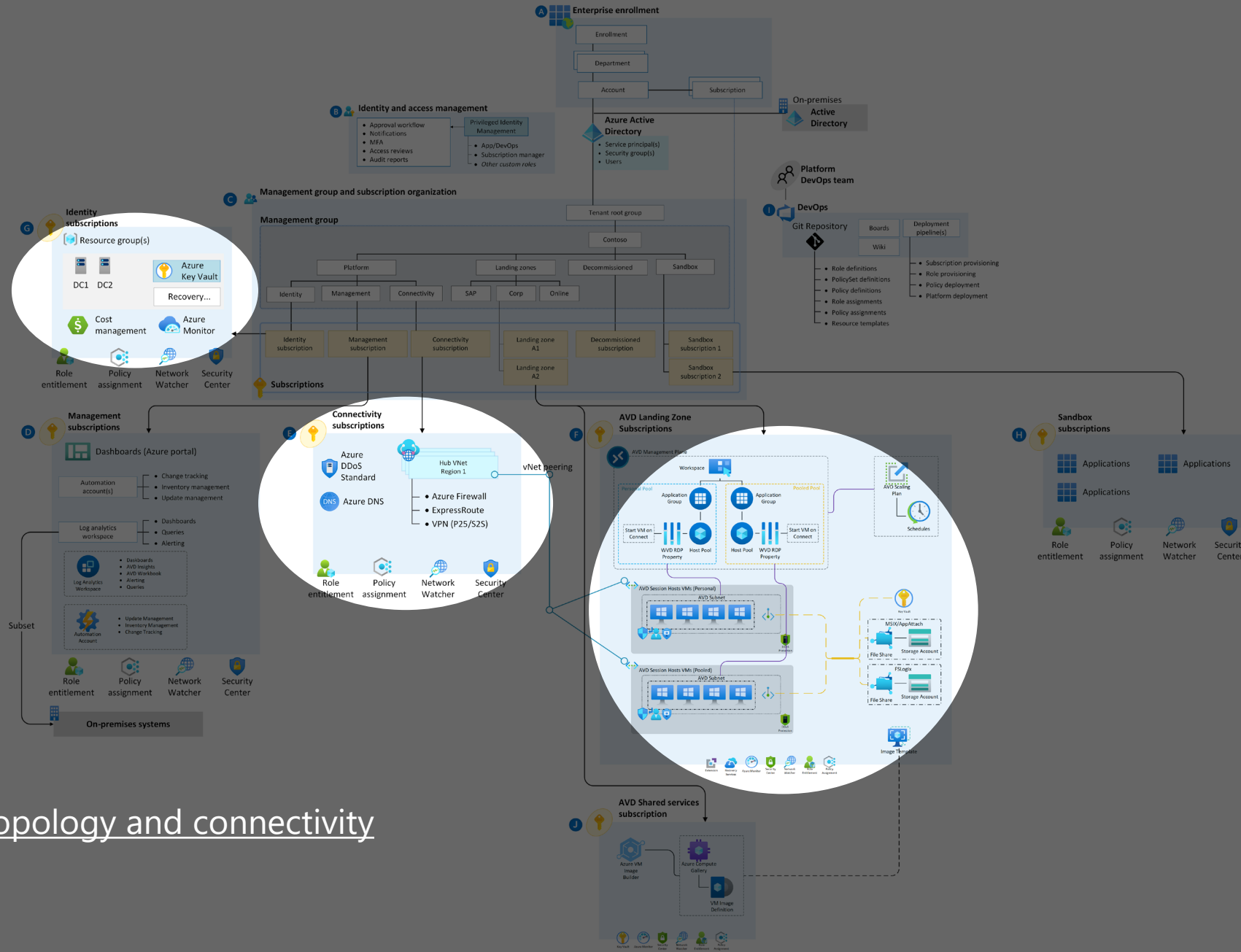


# Azure Virtual Desktop at Scale

## Identity and access management

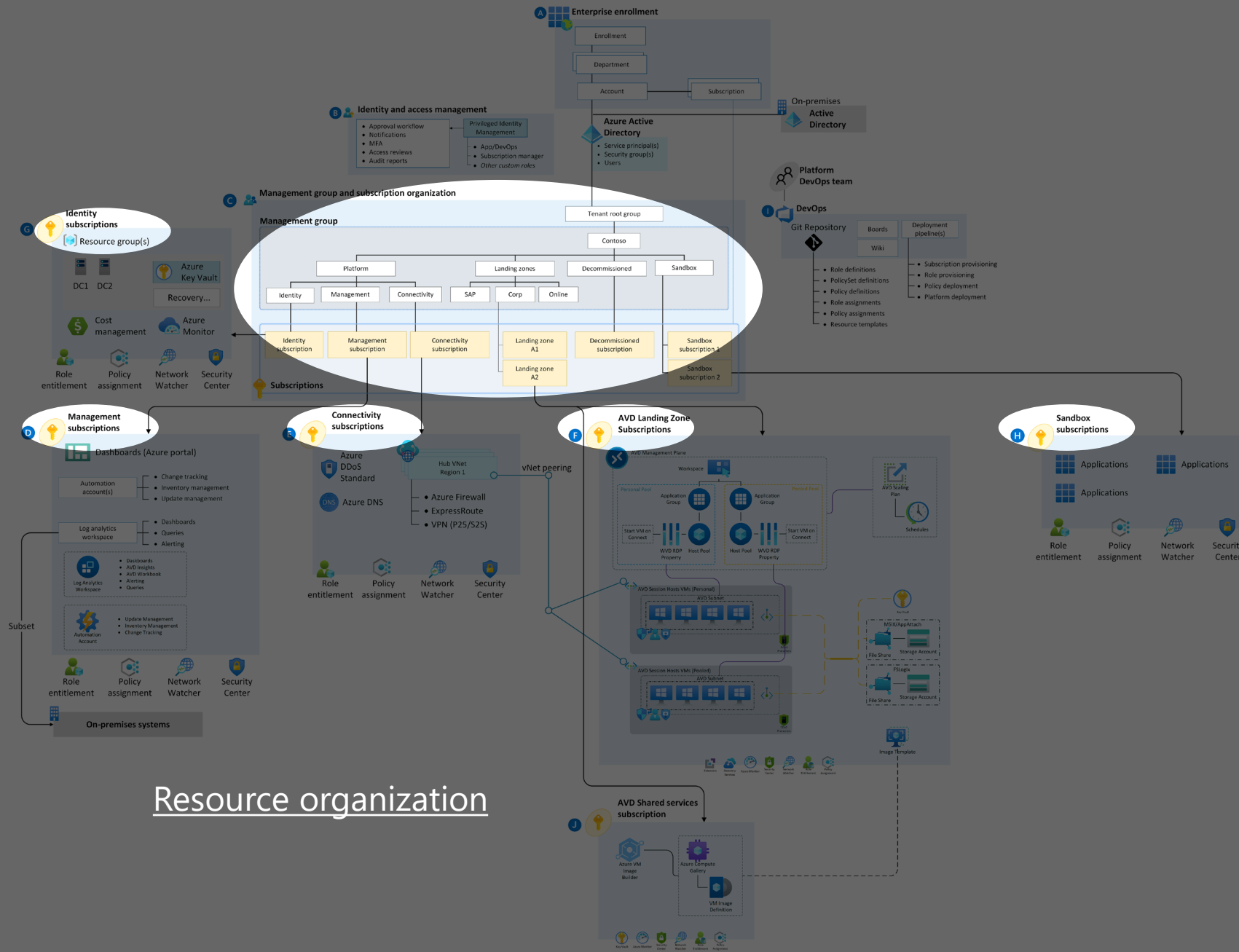


# Azure Virtual Desktop at Scale



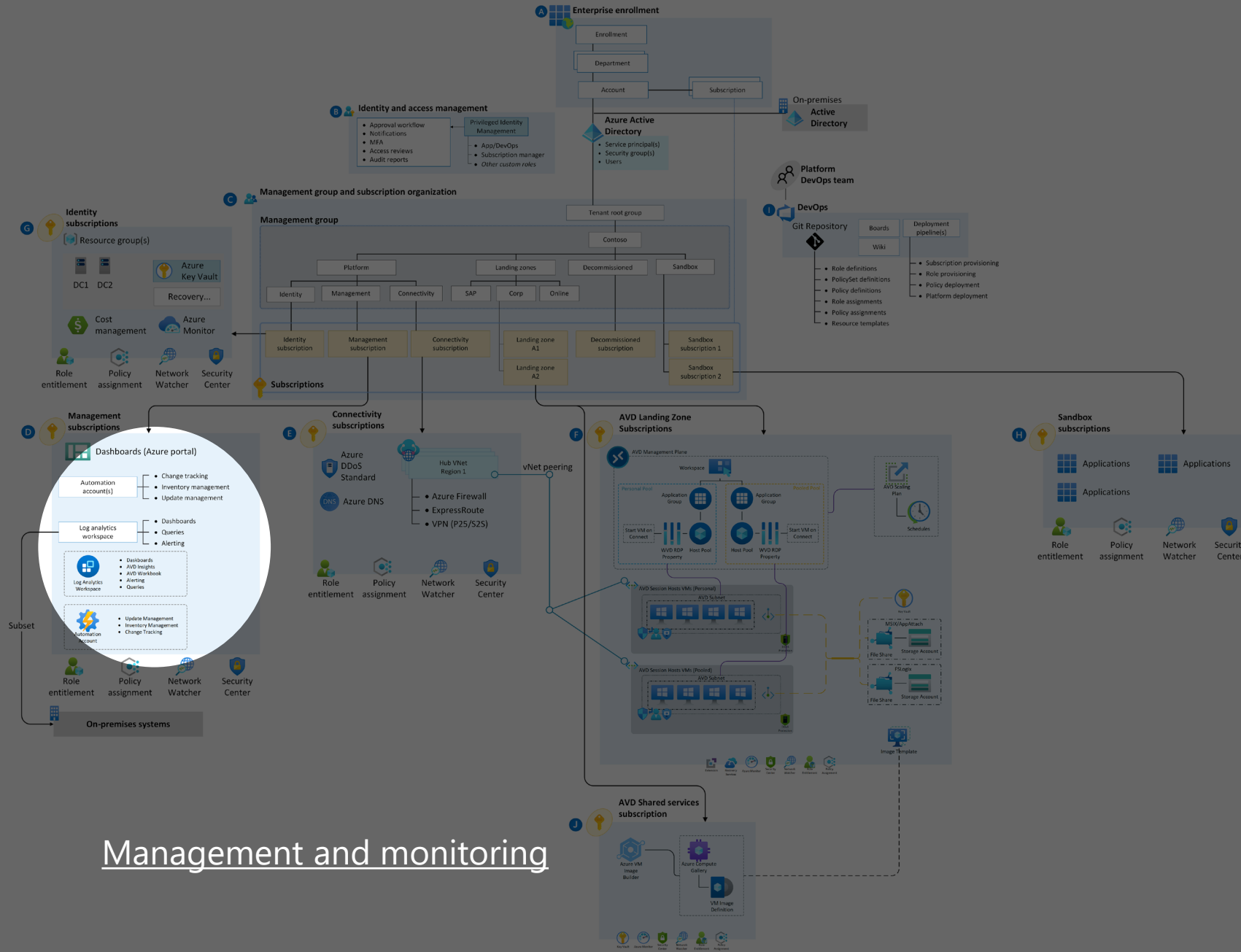
Network topology and connectivity

# Azure Virtual Desktop at Scale



Resource organization

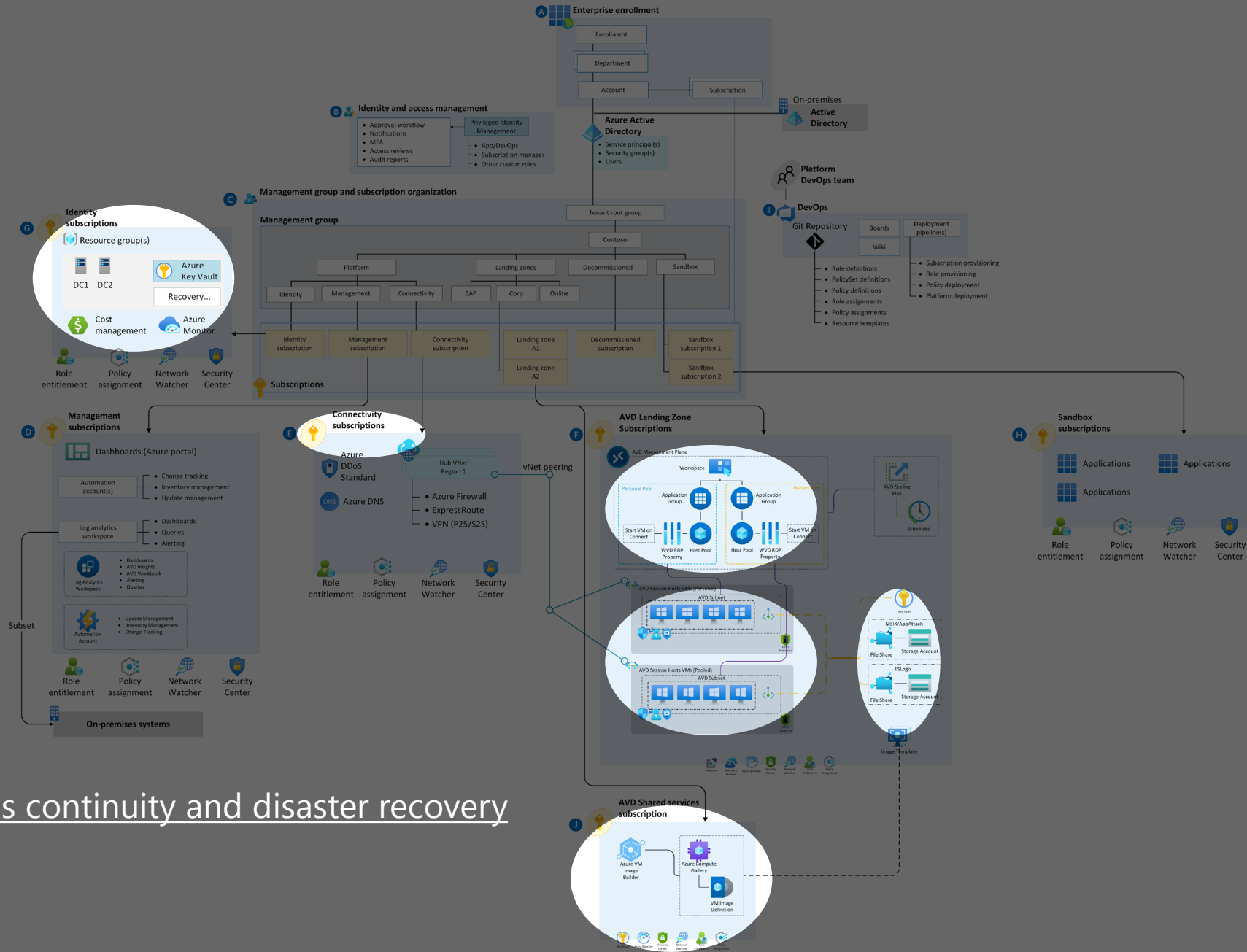
# Azure Virtual Desktop at Scale



Management and monitoring

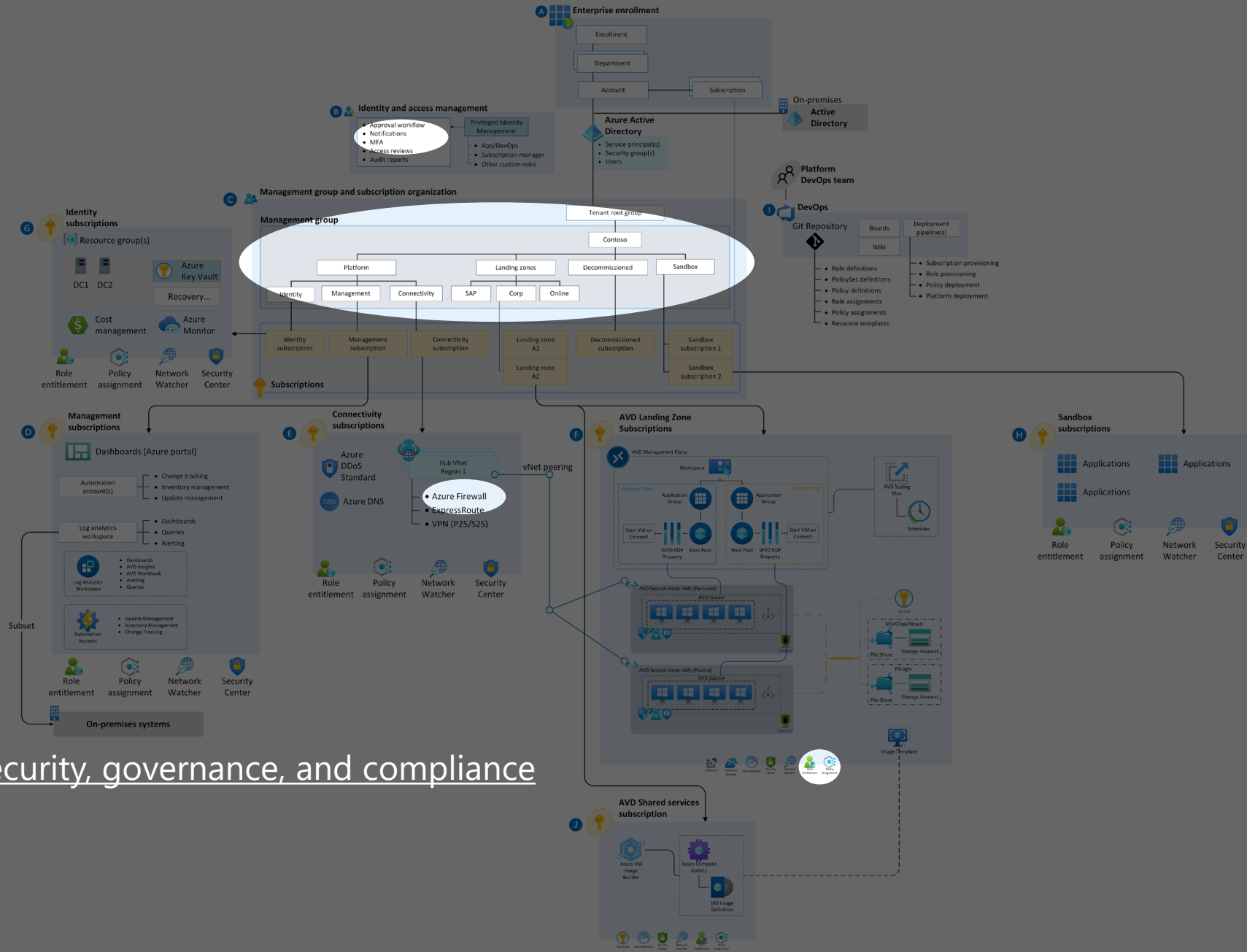


# Azure Virtual Desktop at Scale



Business continuity and disaster recovery

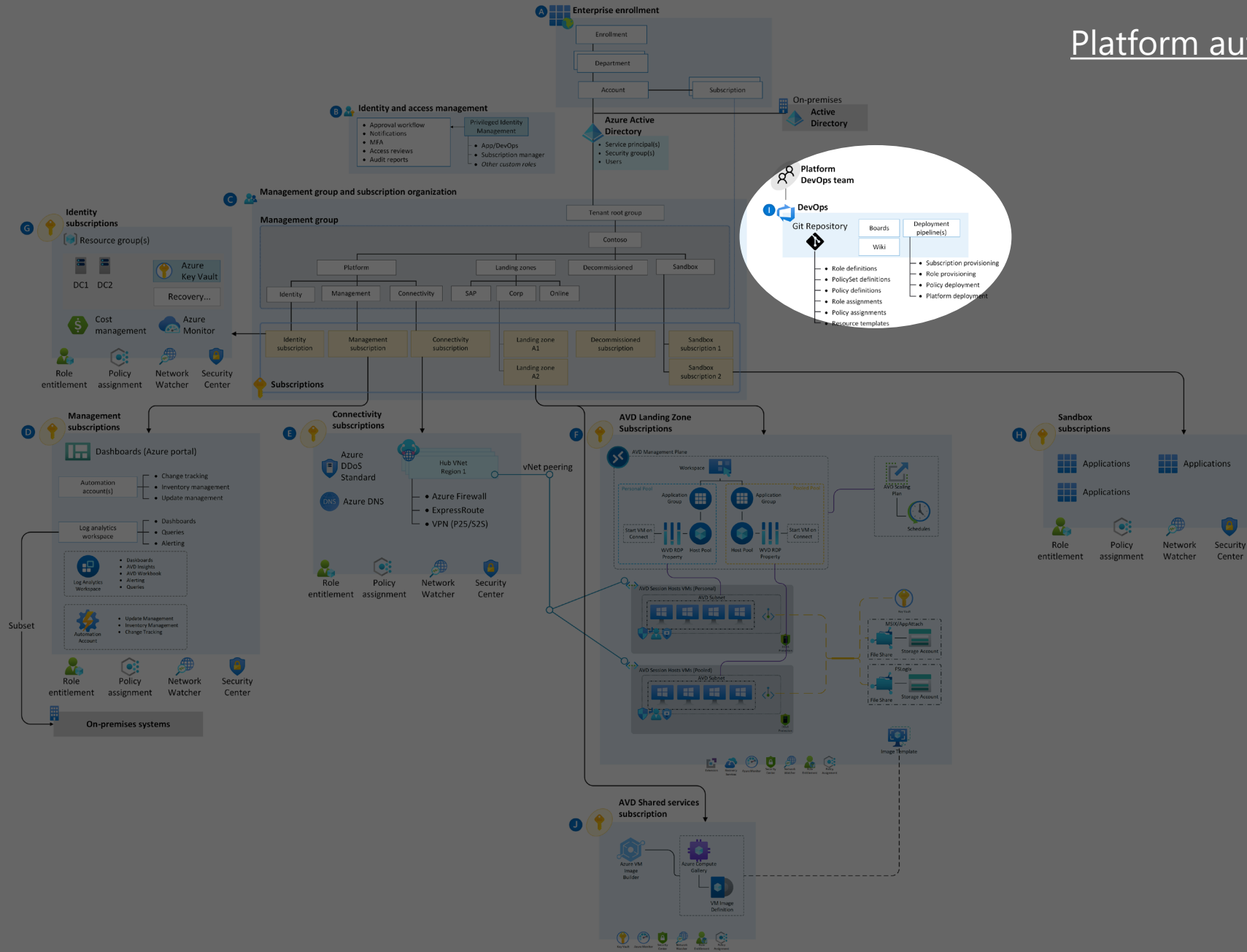
# Azure Virtual Desktop at Scale



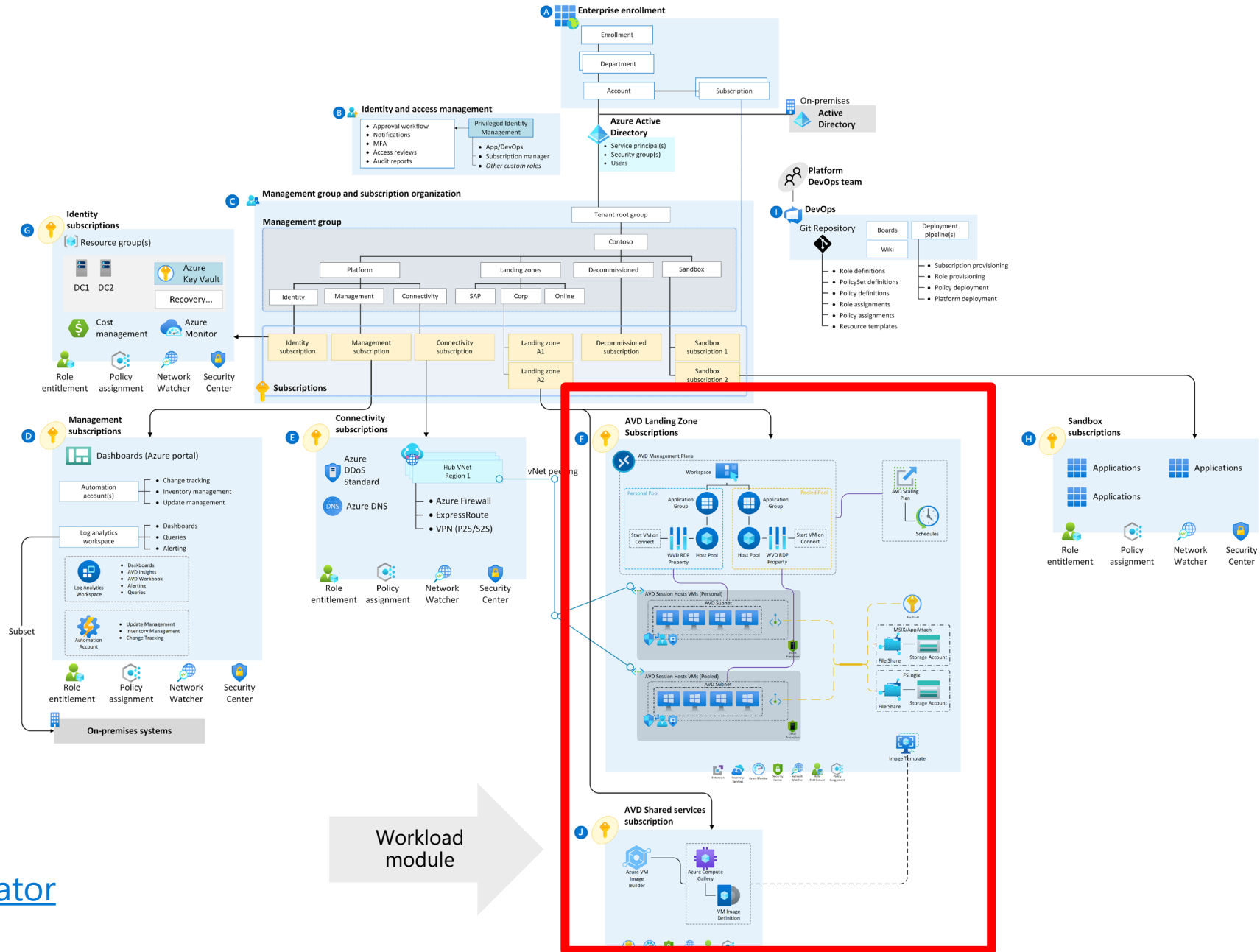
Security, governance, and compliance

# Azure Virtual Desktop at Scale

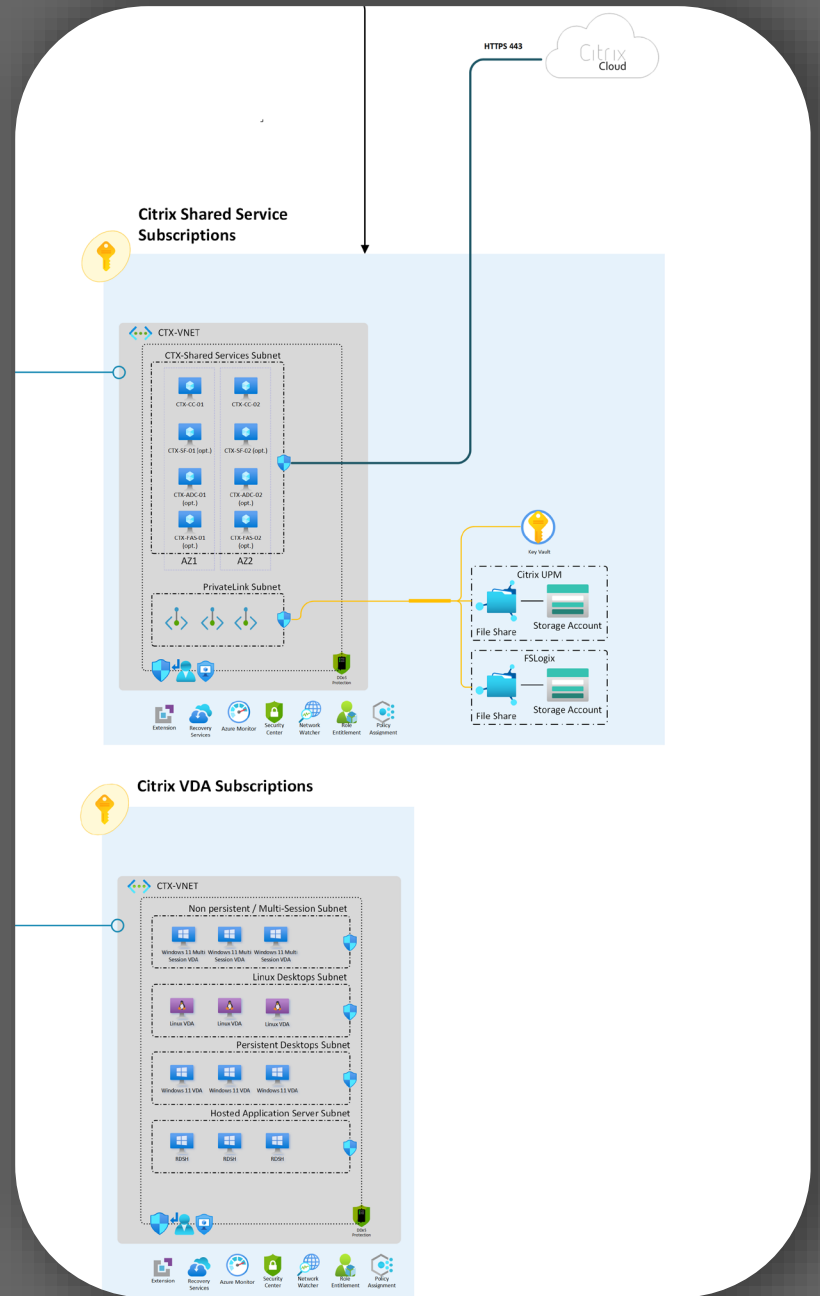
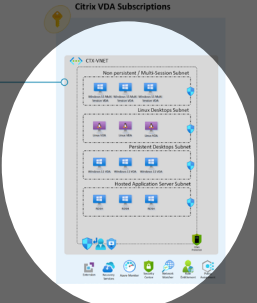
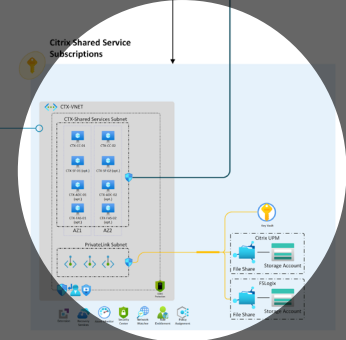
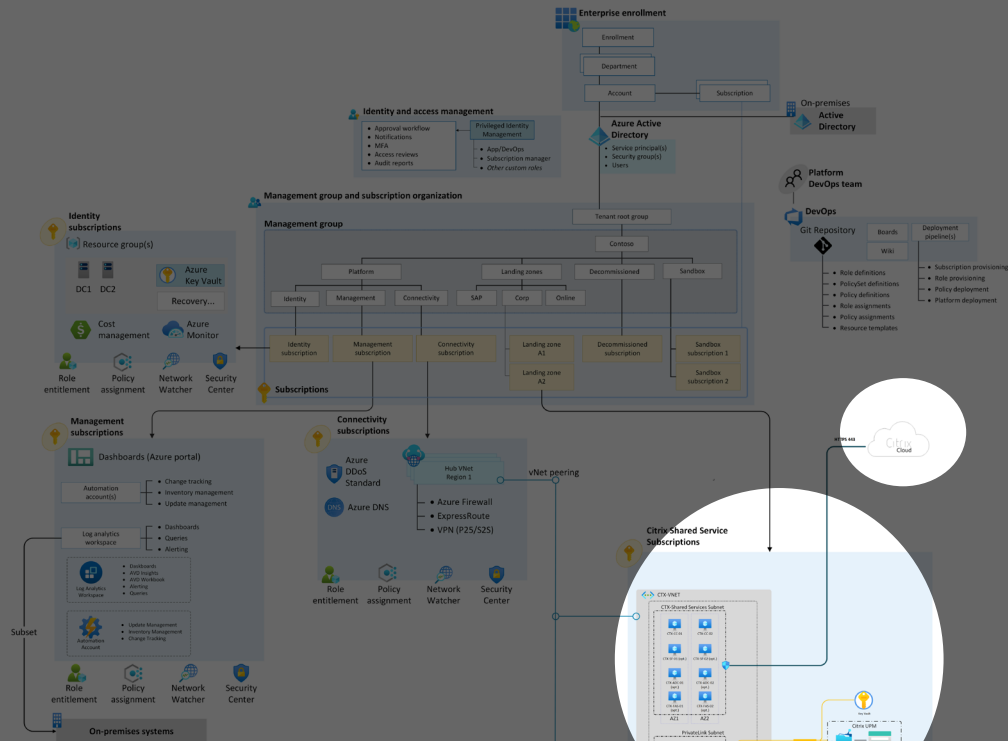
Platform automation and DevOps



# Azure Virtual Desktop at Scale



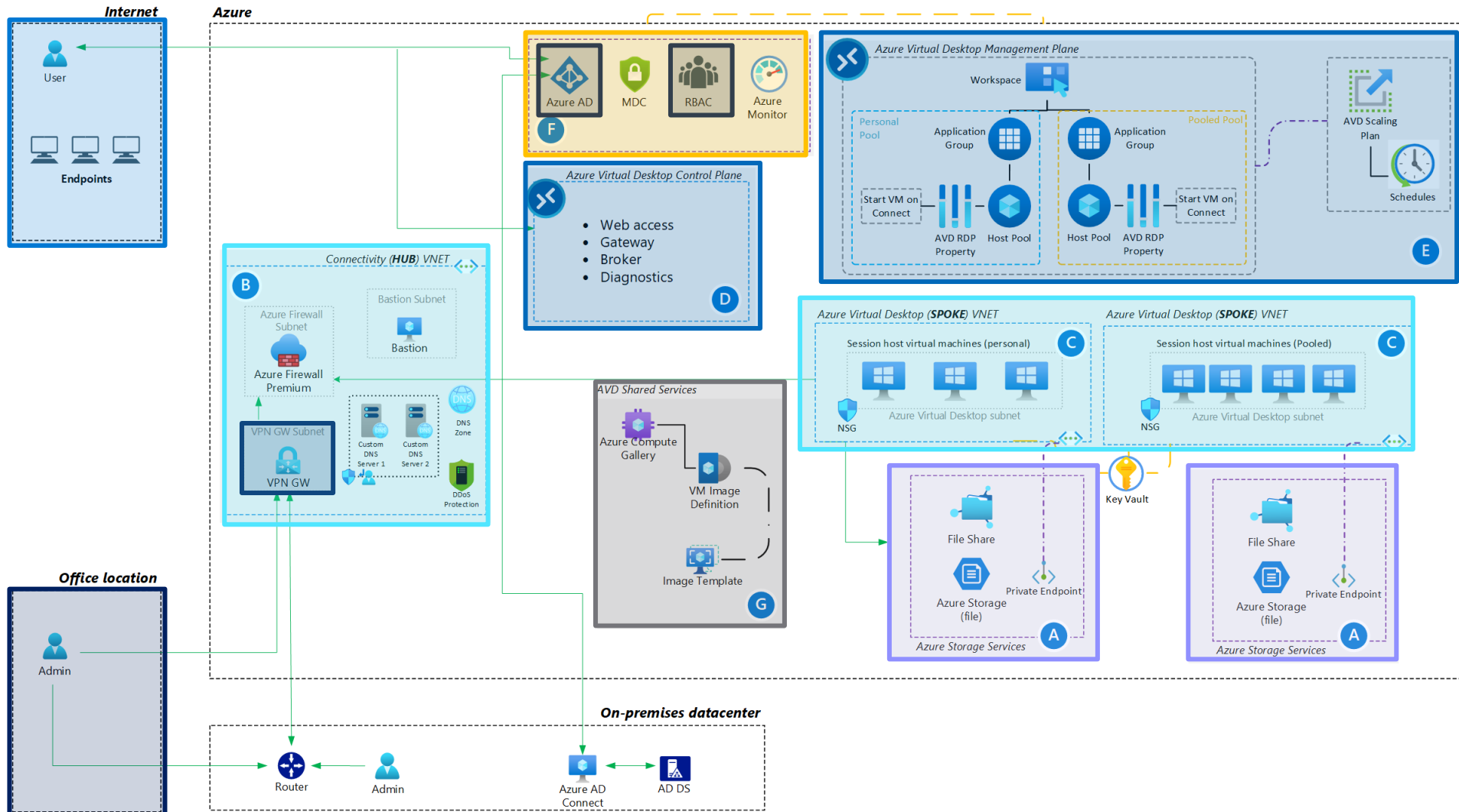
# Citrix on Azure



# Azure Virtual Desktop Zero Trust

The background of the image is a low-angle, upward-looking shot of a modern building's exterior. The structure is composed of a complex network of white or light-colored metal beams and a grid of glass windows. The perspective creates a sense of height and architectural scale, with lines converging towards the top of the frame. The lighting is somewhat dim, giving the scene a moody, industrial feel. The overall color palette is dominated by greys, whites, and muted blues/greens from the glass reflections.

# Azure Virtual Desktop Zero Trust



How can high availability  
be guaranteed?





99.997%

Azure single-instance VM uptime  
(rolling 12-month average, to April 2021)

# Outages can strike across any one of the layers of your infrastructure

## Your workload





















Your workload architecture, built on the below entities.

## Resilient services

Built-in Azure services for high availability, disaster recovery and backup.

## Resilient foundation

Resilient cloud platform on how the foundation is designed, operated, and monitored to ensure availability.

Responsibility	Traditional On Prem VDI	Azure Virtual Desktop
Identity		
End User Devices (Mobile and PCs)		
Application Security		
Operating systems		
Deployment Configuration		
Network Controls		
Virtualization Control Plane		
Physical hosts		
Physical network		
Physical datacenter		

CUSTOMER

MICROSOFT



# Azure datacenter design

Microsoft has invested billions of dollars in building a highly secure, scalable, available, and sustainable cloud infrastructure on which customers can rely



**Obvious redundancies** — power utility feeds, onsite generators, battery arrays, as well as heating, ventilation and air conditioning (HVAC)

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**Expanding Availability Zones (AZs)** — isolated power, networking, and cooling to provide redundancy against DC-level failures, launched in the 10 largest regions

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**Open Compute Project** — sharing hardware designs with the community to learn from feedback, including our datacenter buildings and server specifications

# Why do bad things happen?



## Hardware will fail

We incorporate physical redundancies wherever possible



## Software will have bugs

We deploy code changes cautiously to reduce the impact

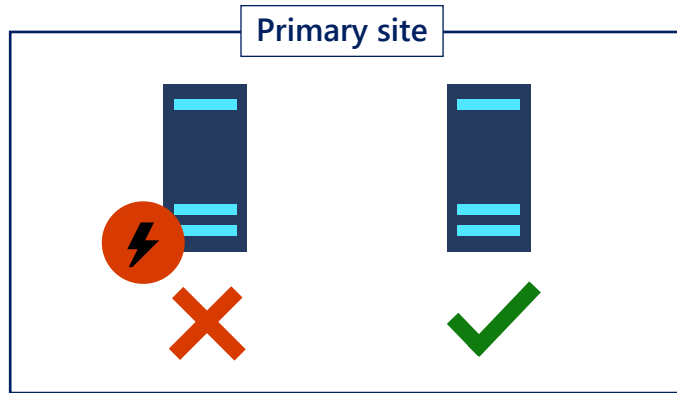


## People will make mistakes

We automate people out of the equation where it makes sense

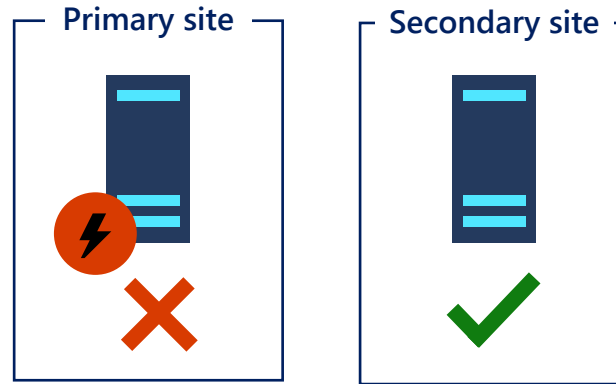
# High Availability vs. Disaster Recovery vs. Backup

These are not about avoiding failure—they're about responding to failure appropriately



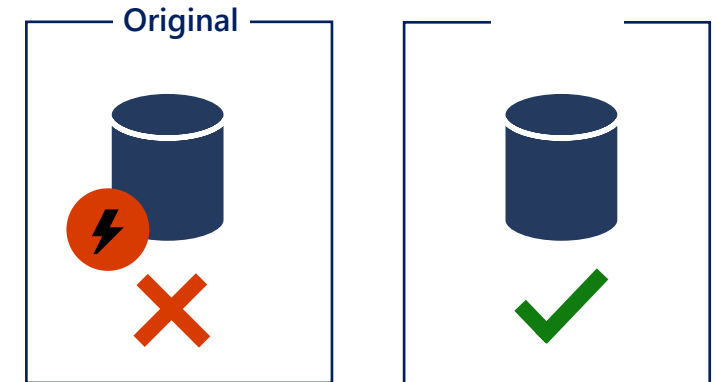
## High availability

When your applications have a catastrophic failure, run a second instance.



## Disaster recovery

When your applications have a catastrophic failure, run them in Azure or a secondary datacenter.



## Backup

When your data is corrupted, deleted, or lost, you can restore it.

- Available region
- Announced region
- Edge Site
- WAN Links



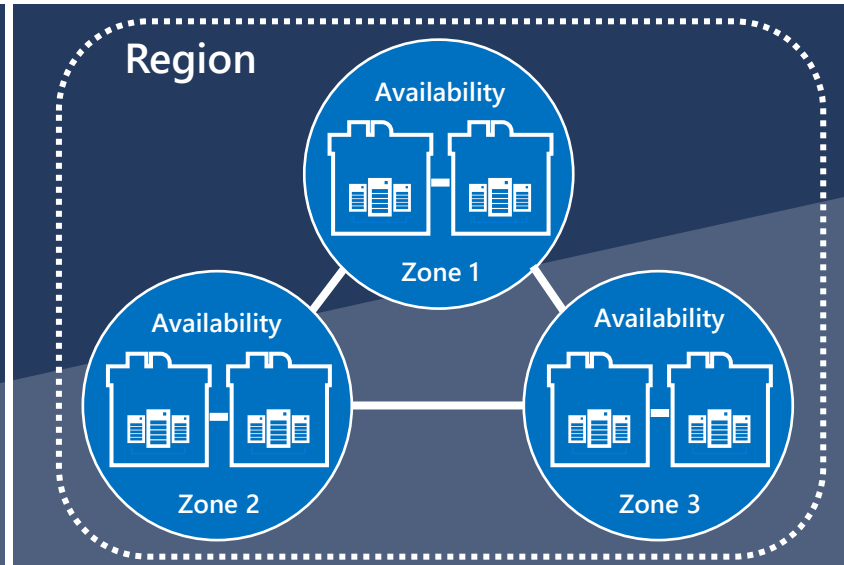
# Azure protection options for all scenarios

Resilient from hardware, datacenter, and regional outages



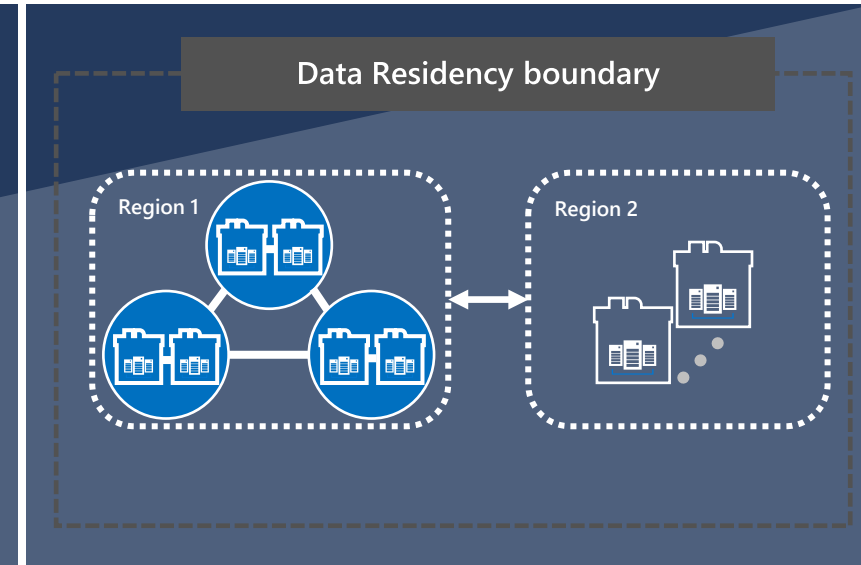
## Availability Sets

High Availability protection from hardware failures in a datacenter.



## Availability Zones

High Availability protection against loss of datacenters. Multiple datacenters per physically separated zone. Each zone features independent network, cooling, and power.

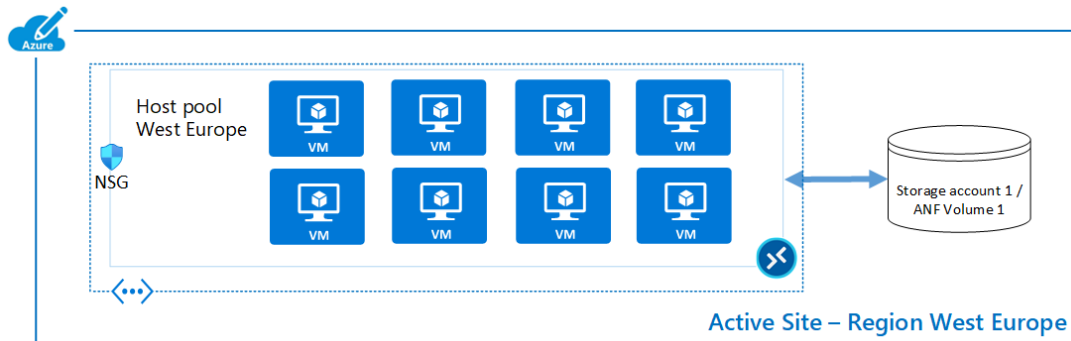


## Region Pairs

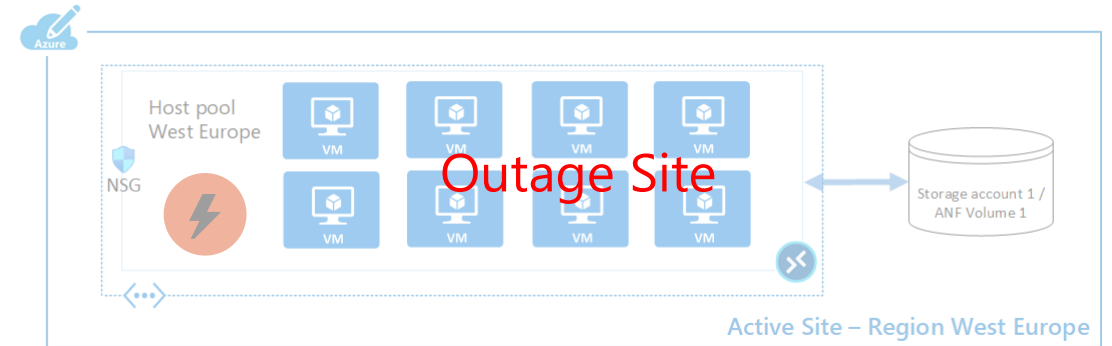
Protection for your data and applications from the loss of an entire region with Geo-redundant storage (GRS) and Azure Site Recovery.

# High-Availability for AVD - Design considerations

Host pool active-active vs. active-passive



Host pool active-active



Host pool active-passive



Demo

A futuristic robotic hand, primarily white and black, is shown holding a glowing blue sphere. The hand is positioned in the upper right quadrant of the frame. The background is dark and filled with bokeh lights in shades of blue, purple, and red, suggesting a high-tech or virtual environment. In the lower right, there are faint, glowing lines and a grid-like pattern on a surface, possibly representing a virtual desktop or data interface. The overall aesthetic is clean, modern, and technological.

Is it possible to automate the Azure Virtual Desktop environment?

# What can you automate?



**AVD Objects**  
Host Pools  
Application Groups  
Workspaces



**Session Host  
Deployments**



**Custom Image**



**Azure File Share for  
FSLogix Containers**

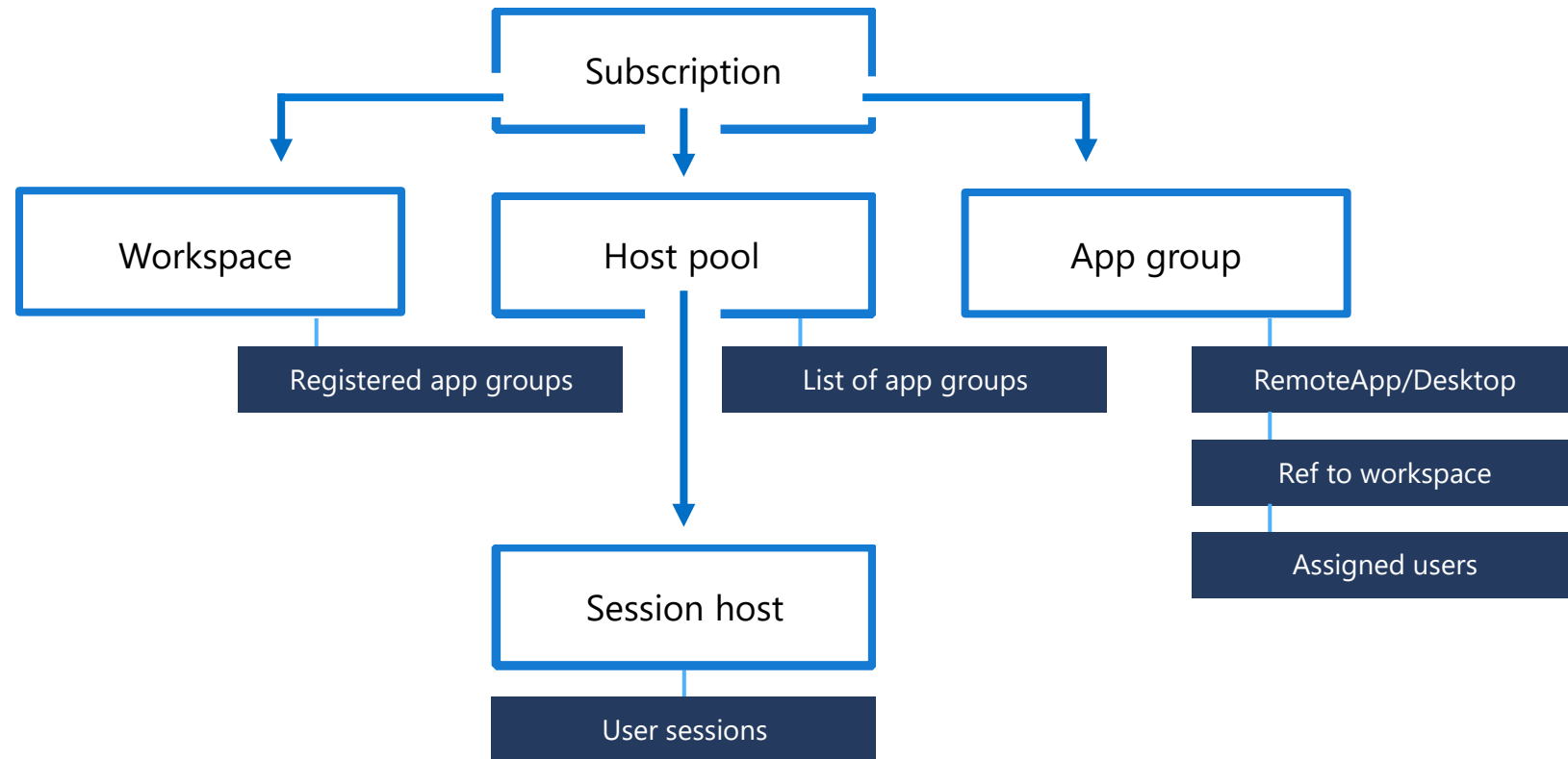
# Azure Resource Manager object model

**Workspaces** organize all AVD ARM objects (**host pool**, **workspace** and **app group**) have locations associated with them

To be associated, they all need to be in the **same location**

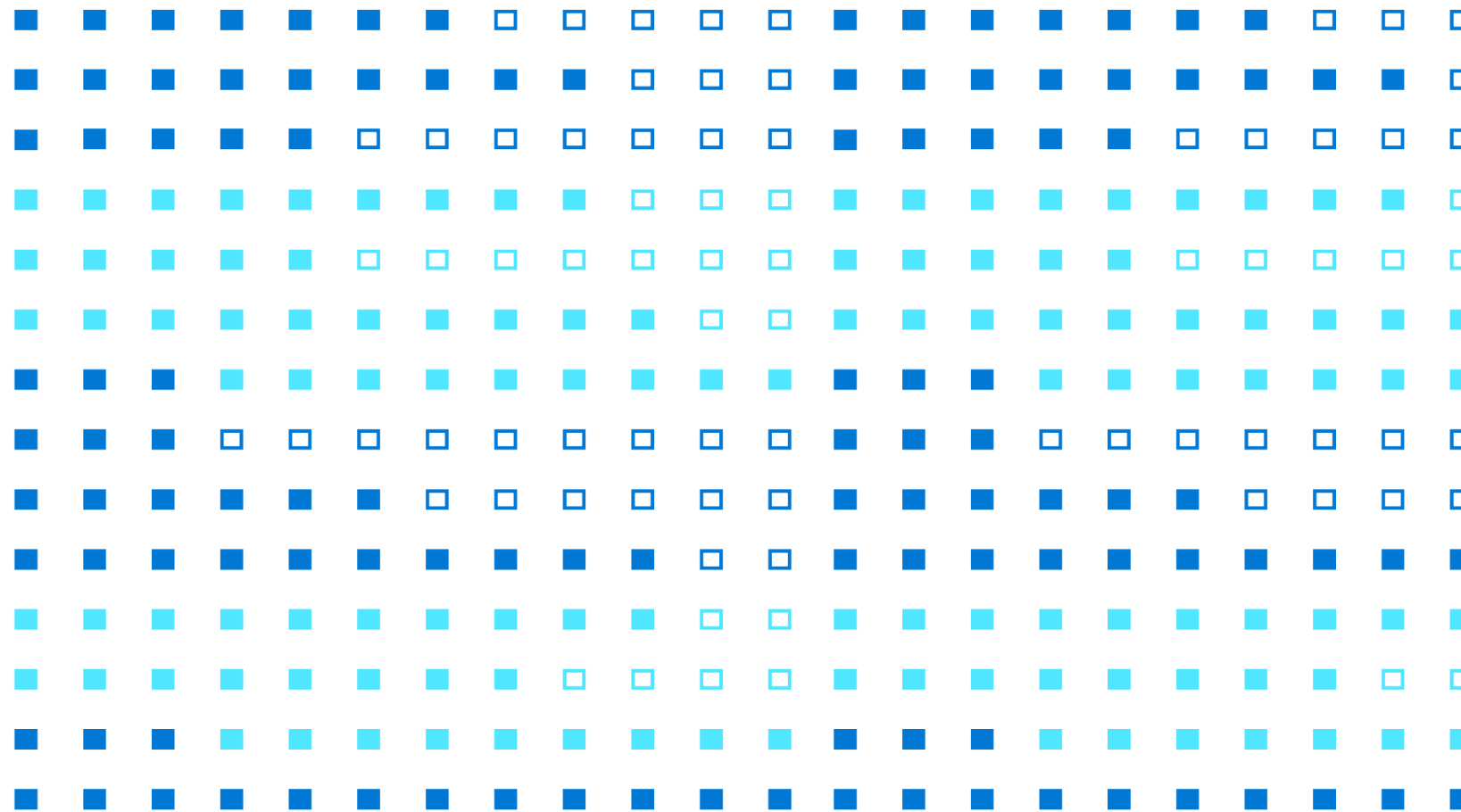
For users to access remote resources they should be **assigned to an app group**

The app group must be **registered to a workspace**



Demo

# Pricing & licensing



# Most customers are already eligible for Azure Virtual Desktop

## Client

Customers are eligible to access Windows 10 and 11 single and multi session with Azure Virtual Desktop if they have one of the following licenses\*:

Microsoft 365 E3/E5

Windows 10/11 Enterprise E3/E5

Microsoft 365 A3/A5/Student Use Benefits

Microsoft 365 F3

Windows 10/11 Education A3/A5

Microsoft 365 Business Premium

Windows 10/11 VDA per user

\*Customers can access Azure Virtual Desktop from their non-Windows Pro endpoints if they have a Microsoft 365 E3/E5/F3, Microsoft 365 A3/A5 or Windows 10/11 VDA per user license.

## Server

Customers are eligible to access Server workloads with Azure Virtual Desktop if they have one of the following licenses:

RDS CAL license with active Software Assurance (SA)



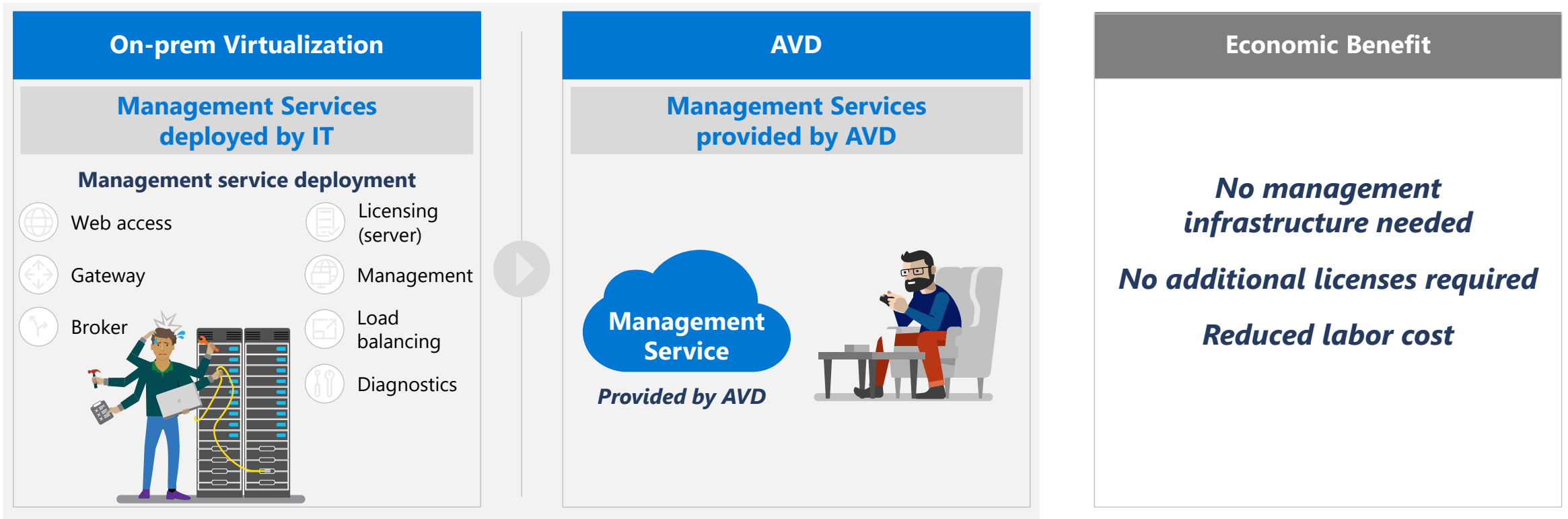
Pay only for the virtual machines (VMs), storage, and networking consumed when the users are using the service

Take advantage of options such as [one-year or three-year Azure Reserved Virtual Machine Instances](#), which can save up to 72 percent versus pay-as-you-go pricing. [Now with monthly payment options!](#)

## Cost-advantaged licensing

# Management service included with the licenses you already own

- AVD management service included with the licenses\* most Microsoft customers own
- Eliminate the infrastructure cost associated with on-prem management services



\*See Appendix for AVD Client licensing requirements, including specific SKUs

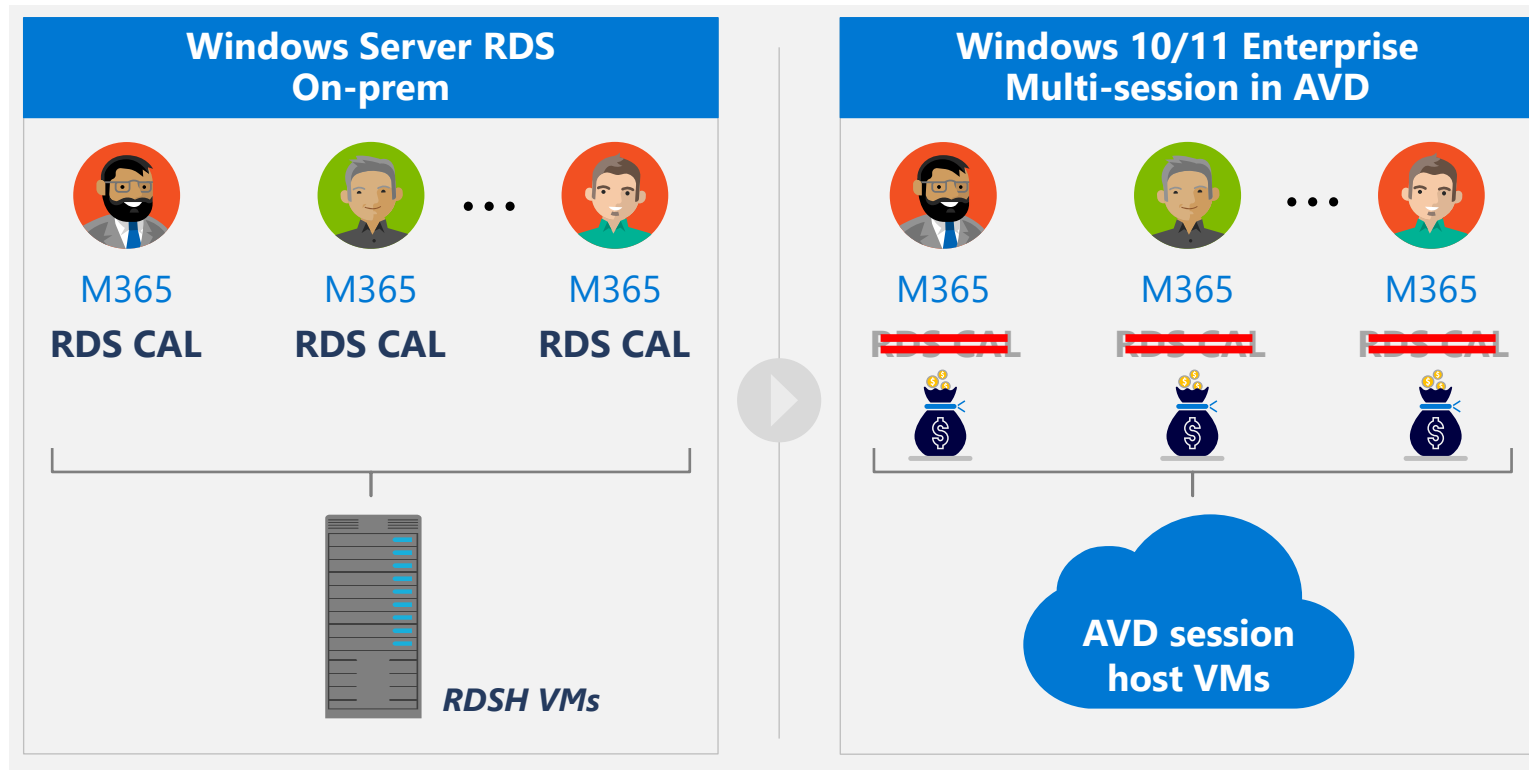
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and current licensing position

Note: Customers who require Citrix or VMware management services to meet their needs will incur additional cost



# Savings on RDS CAL with Multi-session Deployment

Save on RDS CAL when migrating from Windows Server RDS on-prem to Windows 10/11 Enterprise multi-Session\* in AVD



\*Customers can leverage the license (e.g. M365 E3/E5, Win 10 E3/E5) they already own. See Appendix for a complete list of AVD licensing requirements

Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and current licensing position

Note: Customers need to fully refactor desktops and apps when migrating from Windows Server deployment to Windows 10 multi-session in AVD

A large pyramid of stone blocks, likely the Great Pyramid of Giza, is shown against a clear blue sky. The pyramid is constructed from numerous layers of large, rectangular stone blocks. The text 'Networking', 'Storage', and 'Virtual Machines' is overlaid on the pyramid in white, sans-serif font. 'Networking' is at the top, 'Storage' is in the middle, and 'Virtual Machines' is at the bottom.

Networking

Storage

Virtual Machines

# Virtual Machines

## Virtual Machine type

Azure resources can be optimized with scale to offer cost savings. In the case of Azure Virtual Desktop the most important resource is the VM (compute)

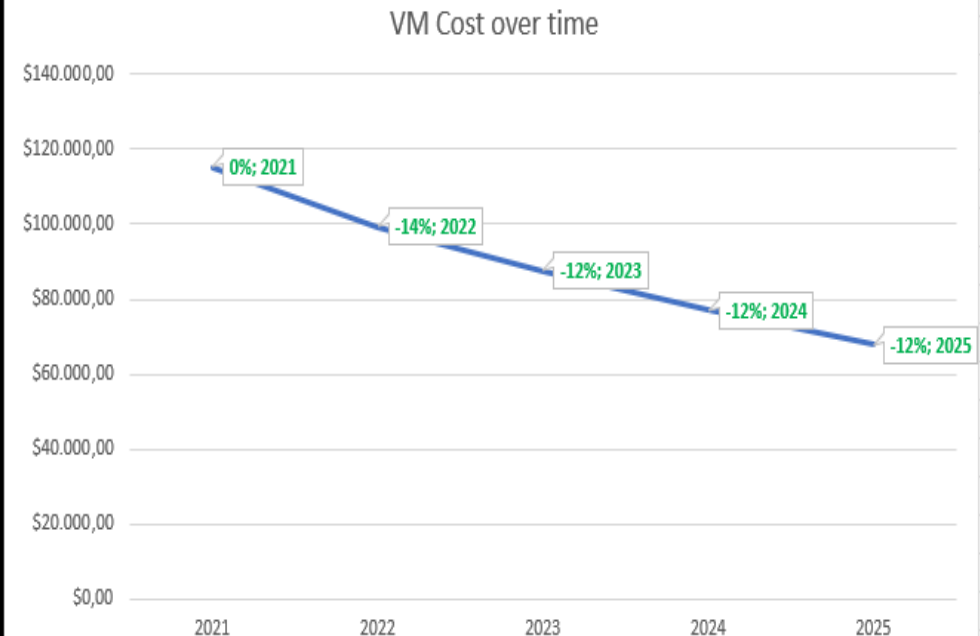
If we start by looking at a popular VM series for Azure Virtual Desktop, the D-series, VMs get more powerful and could be optimized to become cheaper.

Over time it can offer [great cost savings](https://aka.ms/AzureMakesAVDCheaperOverTime) (aka.ms/AzureMakesAVDCheaperOverTime)



Select the newest VM families to help get the optimal price/performance ratio

		Ds8 v3	Ds8 v4	Ds8 v5	Ds8 v6?	Ds8 v7?
Number of users	1000					
Number of users per VM	11					
ACU increase (worst case)		0%	10%	10%	10%	10%
Number of hosts (VMs) required		91	82	74	66	60
Running hours	220					
Cost of VM per hour		\$0,48	\$0,46	\$0,45	\$0,44	\$0,43
Cost per month		\$9.600,00	\$8.280,00	\$7.290,00	\$6.415,20	\$5.642,46
Cost per year		\$115.200,00	\$99.360,00	\$87.480,00	\$76.982,40	\$67.709,52
Savings\$ per year		\$0,00	\$15.840,00	\$11.880,00	\$10.497,60	\$9.272,88
Savings% per year		0%	-14%	-12%	-12%	-12%
		2021	2022	2023	2024	2025
Cummulative savings		\$0,00	\$15.840,00	\$27.720,00	\$38.217,60	\$47.490,48



# Virtual Machines

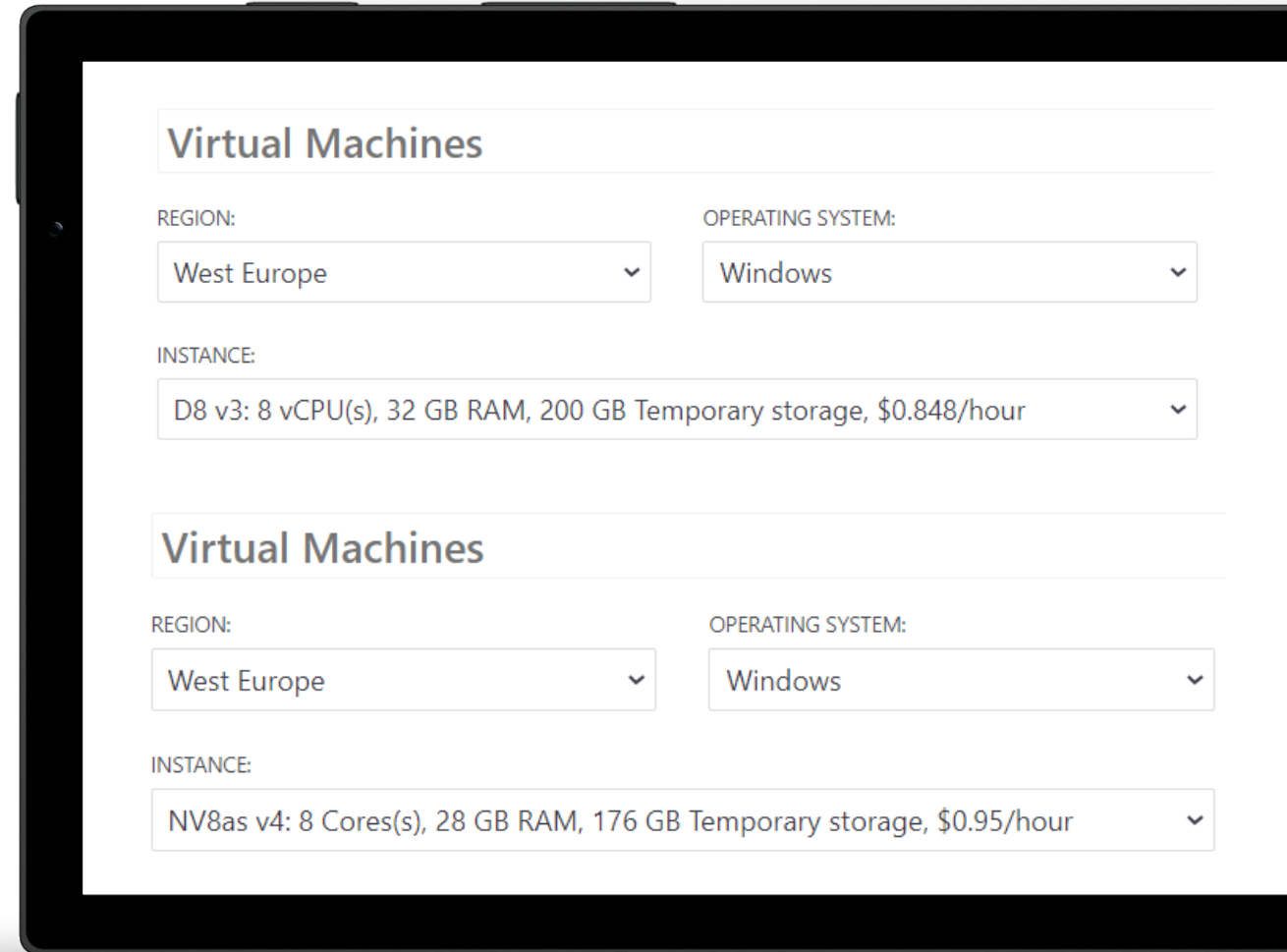
## Virtual Machine type

Azure offers many different Virtual Machine types, where the D, F and N (with GPU) series are the most used with Azure Virtual Desktop

Because the N series VMs (aka.ms/GPUOptimizedVMSizes) have a GPU, they not only offer better graphical performance, but also offload the CPU significantly. Even if you have a moderately graphically intense workload, it'll help increase your density with a minimal increment in cost

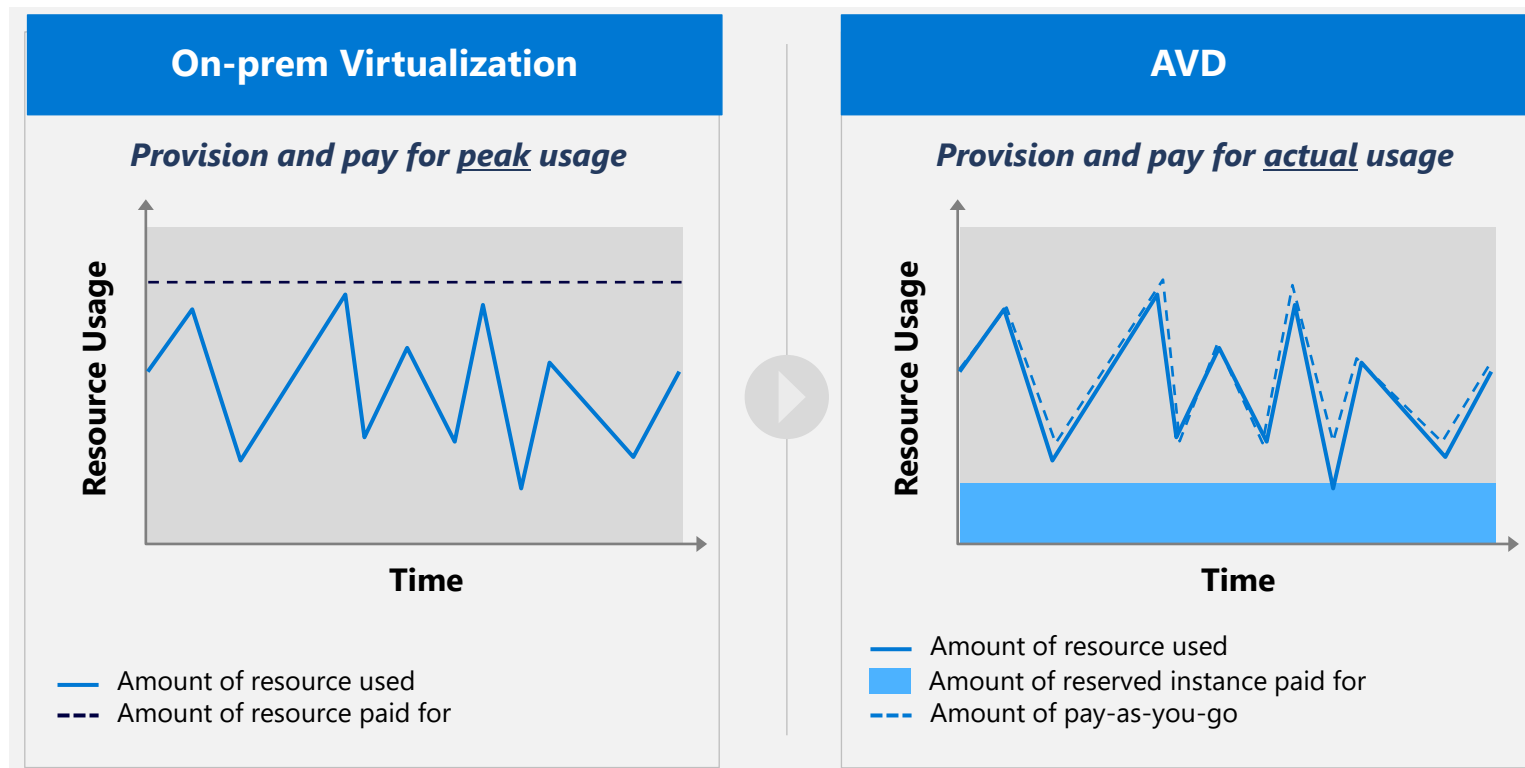


**Investigate if the N series lowers the average cost per user for your workload**



# Virtual Machines Usage

Pay for actual usage instead of peak usage; optimize compute by using both Pay-as-you-go and Reserved Instance



\*When using Azure NetApp Files or Azure Files for storage, customers pay for actual consumed storage (vs. pay for fixed-sized disks)

Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and infrastructure configuration

# Virtual Machines

## Reserved VM Instances

A [Reserved VM Instance](https://aka.ms/AzureReservedVMInstances) (aka.ms/AzureReservedVMInstances) is a 1 or 3 year—24/7, 365 days per year—reservation discount for a VM type of your choosing

Reserved instances or pay as you go?

From ~300 work hours per month a 3-year reserved instance is more financially attractive or from ~450 work hours per month for a 1-year reserved instance

Instance size flexibility group	ArmSkuName	Ratio
DSv3 Series	Standard_D2s_v3	1
DSv3 Series	Standard_D4s_v3	2
DSv3 Series	Standard_D8s_v3	4
DSv3 Series	Standard_D16s_v3	8
DSv3 Series	Standard_D32s_v3	16
DSv3 Series	Standard_D48s_v3	24
DSv3 Series	Standard_D64s_v3	32

But did you know that for reserved instances you can:

- Scope across subscription(s) with tagging, enrollment/account
- Pay per month with 0% interest
- Exchange reservations
- Cancel



**Seriously consider Reserved VM Instances for (part of your) Azure Virtual Desktop workload**

# Virtual Machines

## Azure region

Usually, the single most important thing for the user experience is to have the virtual machines as close to the user as possible, but it's important to be aware of the [different prices](https://aka.ms/AzureVMPriceComparison) (aka.ms/AzureVMPriceComparison) of VMs in the different Azure regions



Investigate if you can run a VM cheaper in another Azure region without impacting the end user experience

### Azure VM Comparison

Find and compare Azure Virtual Machines specs and pricing on one page across different tiers, payment types, and regions. Check the column Best region price: it will help you to find the region where that particular VM is cheapest. Also, you should know that the prices are different across currencies. Sometimes the difference is significant, so check the [exchange rates](#). To help you find the best VM for your money, please check the [price/performance](#) page.

The data is updated daily from Azure API and may be not accurate. This site is not affiliated to Microsoft or Azure. The latest update was at **11/18/2021, 5:21:14 AM GMT**

Euro (€) East US per hour Standard Pay as-you-go

vCPUs: Memory:

VM Name	vCPUs	Memory (GiB)	Linux Cost	Windows Cost	Best Alternative VMs	Price by Regions	Best price region / Diff
Standard_B20ms	20	80	0.7175	0.7865	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / 0%
Standard_D14	16	112	1.3298	1.8205	<a href="#">find better</a>	<a href="#">compare</a>	South Central US / -10.1%
Standard_D14_v2	16	112	1.2780	1.8205	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / -19.3%
Standard_D15_v2	20	140	1.5980	2.2758	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / -19.3%
Standard_D32_v3	32	128	1.3246	2.5940	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / 0%
Standard_D32_v4	32	128	1.3246	2.5940	<a href="#">find better</a>	<a href="#">compare</a>	North Central US / 0%
Standard_D32_v5	32	128	1.3246	2.5940	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / -50%
Standard_D32a_v4	32	128	1.3246	2.5940	<a href="#">find better</a>	<a href="#">compare</a>	Central India / -35.7%
Standard_D32as_v4	32	128	1.3246	2.5940	<a href="#">find better</a>	<a href="#">compare</a>	Central India / -35.7%
Standard_D32d_v4	32	128	1.5592	2.8286	<a href="#">find better</a>	<a href="#">compare</a>	North Central US / 0%
Standard_D32d_v5	32	128	1.5592	2.8286	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / -50%
Standard_D32ds_v4	32	128	1.5592	2.8286	<a href="#">find better</a>	<a href="#">compare</a>	West US 2 / 0%
Standard_D32ds_v5	32	128	1.5592	2.8286	<a href="#">find better</a>	<a href="#">compare</a>	East US 2 / -50%

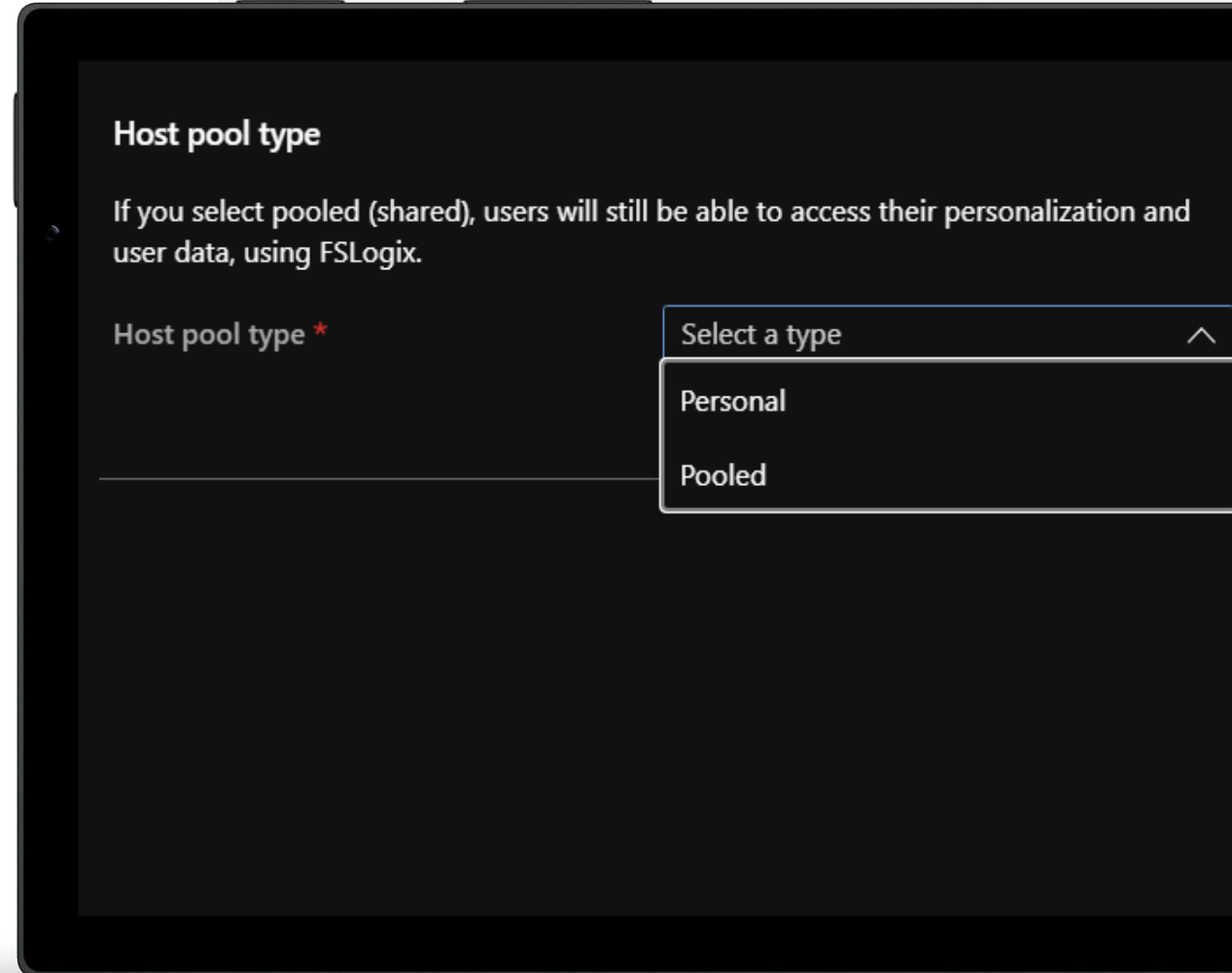
# Virtual Machines

## Pooled vs. personal

	Pooled Windows 10/11 multi-session	Pooled Win10/11 single session	Personal Win10/11
Application compatibility	● ●	● ● ●	● ● ● ●
Windows 10/11 experience	● ● ●	● ● ●	● ● ●
User can install applications	●	●	● ● ●
Low cost	● ● ● ● ● ●	● ● ●	●



Use pooled wherever possible





Introducing

# Azure Virtual Desktop for Azure Stack HCI (preview)

Extending the benefits of cloud-managed VDI to on-premises

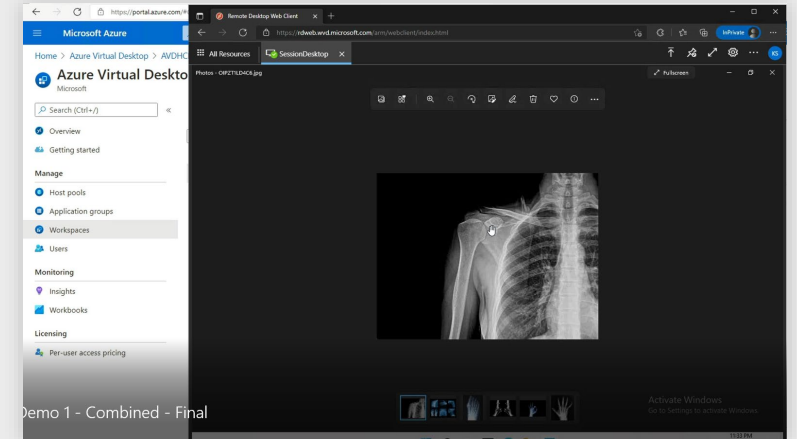
Meet unique performance and data locality requirements with on-premises desktop and app virtualization

Centralized, cloud-based management for virtual desktops and applications

The only VDI solution with full Windows 10 or 11 multi-session support for cost optimization

Seamless integration with Microsoft 365 and Teams

End-user access from virtually anywhere



# Virtual Machines

## Pooled OS: Windows 10/11 multi-session vs. Windows Server

	Win10/11 multi-session	Windows Server
RDCAL with SA required?	No	Yes
Microsoft 365 Apps Support end date	No	Yes (Oct 2026)
Best application compatibility	Yes	No
Regular feature updates	Yes	No



Use Windows 10/11 multi-session whenever possible

If you have applications that do not work on Windows 10/11 multi-session, you can use the [AppAssure](https://aka.ms/AppAssure) (aka.ms/AppAssure) program to get free help to make it work



Use Microsoft AppAssure to increase your usage of Windows 10/11 multi-session

# Virtual Machines

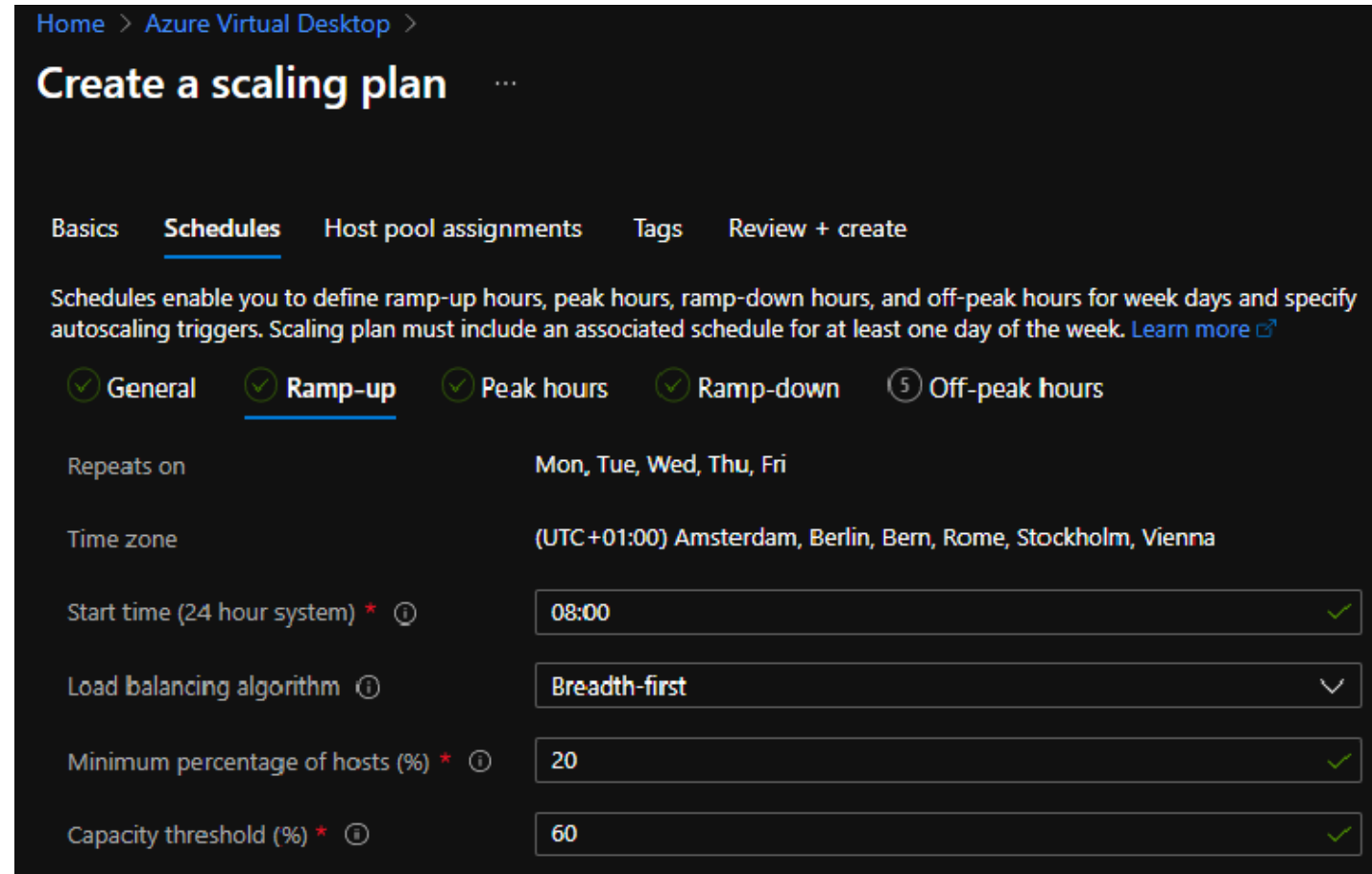
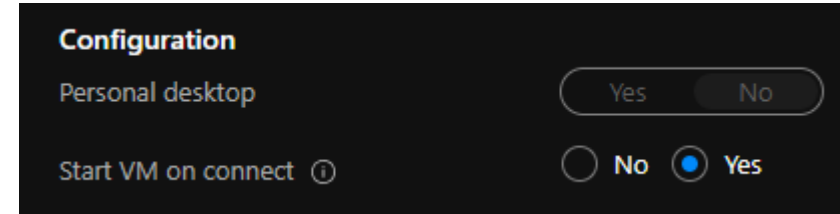
## Scaling & load balancing

For pooled scenarios:

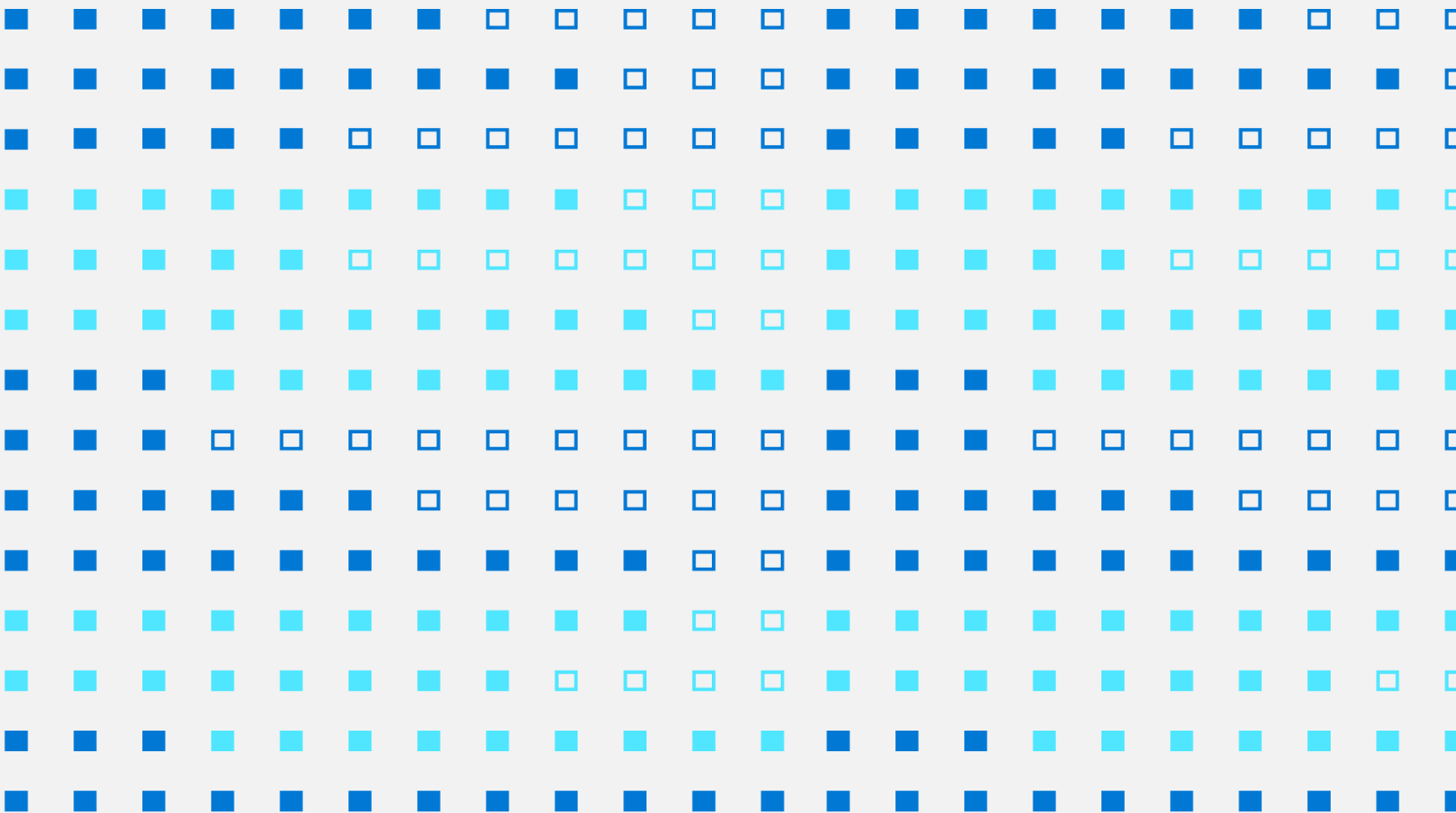
- ✓ Use Azure Virtual Desktop scaling plans to help achieve optimal mix of available hosts and lowest costs

For personal scenarios:

- ✓ Use power on connect to only start personal desktops when users need them
- ✓ Shut down & deallocate personal desktops when they are not being used



# Storage



# Storage

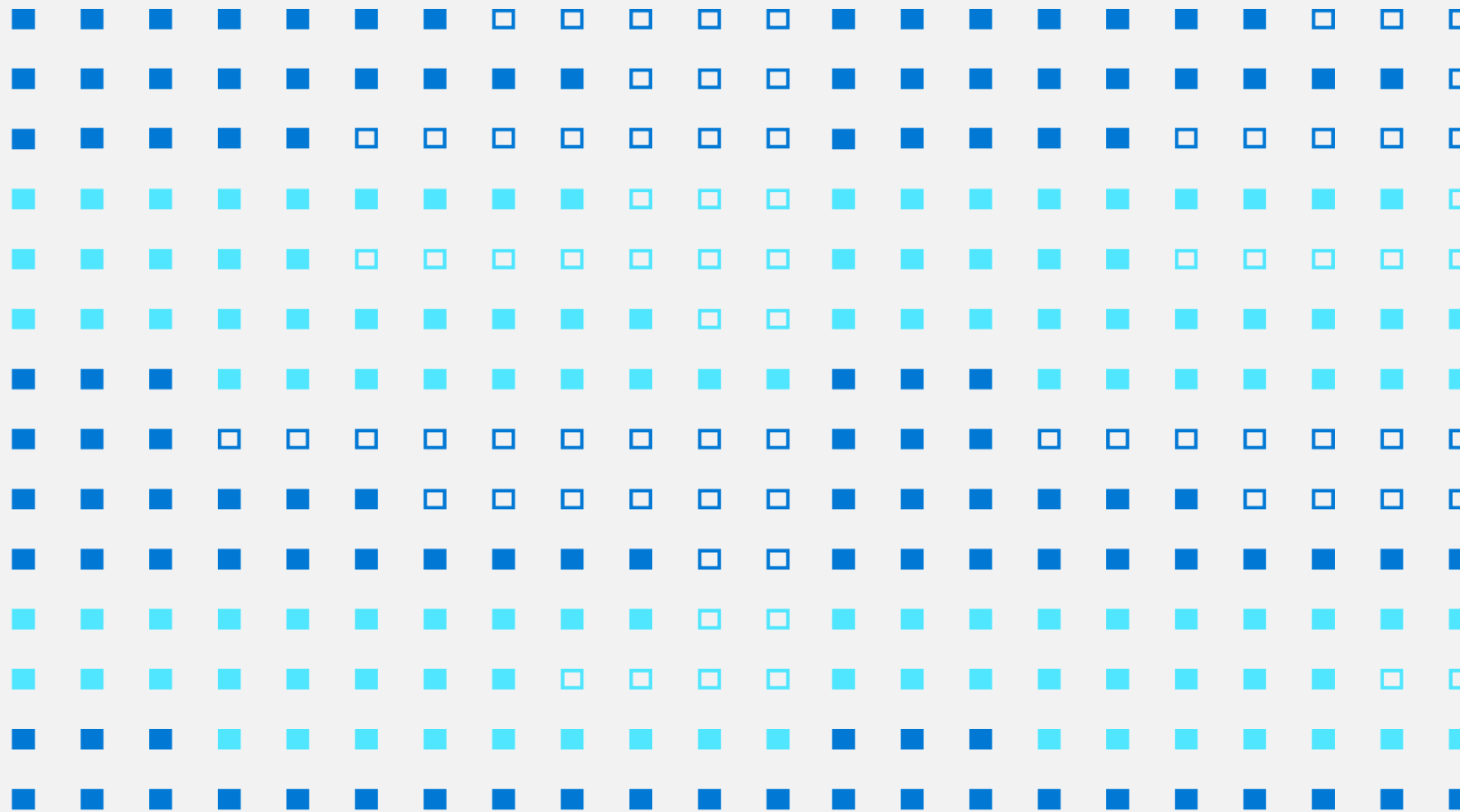
## OS disk type

Each Azure Virtual Desktop VM needs an OS disk. The table below compares the different options at a high level (more details [here](https://aka.ms/AzureManagedDiskTypes) (aka.ms/AzureManagedDiskTypes))

	Premium SSD	SSD	HDD	<u>*Ephemeral Disk</u>
<a href="#">SLA</a> + <a href="#">HA</a>	● ● ●	● ●	● ●	●
IOPS & throughput	● ●	● ●	●	● ● ●
Flexibility	● ● ●	● ●	● ●	●
Low cost	●	● ●	● ● ●	● ● ● ● ●

\*Use Ephemeral disks (free) to save costs if your scenario allows it

# Networking



# Networking

## Inter-Azure traffic



Try to place VMs in an Azure region where there is an Azure Virtual Desktop Control Plane, if possible



Investigate if you can meet your security requirements without forced tunneling to an on-premises environment

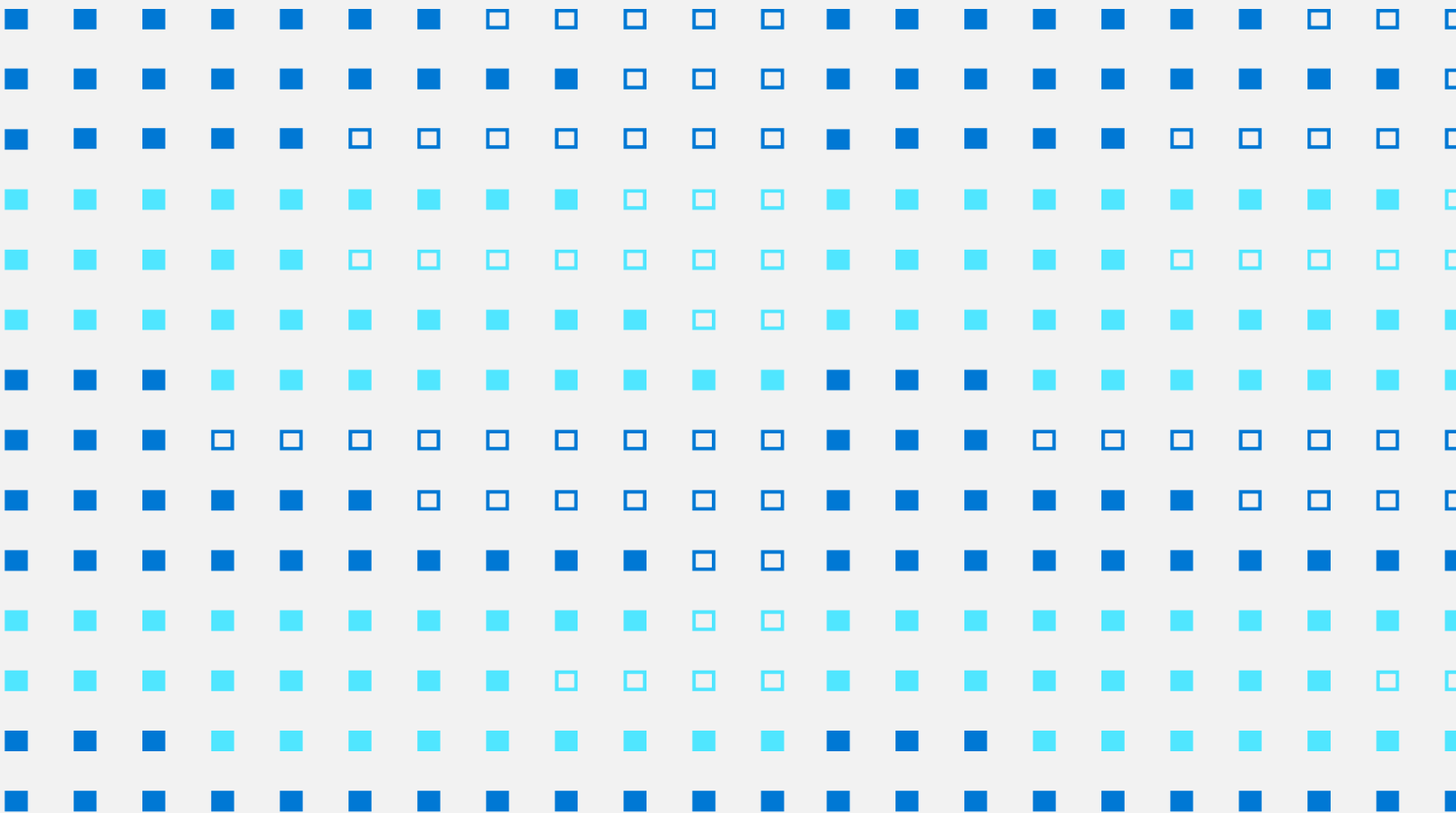


For large deployments, calculate (aka.ms/AzureExpressRoutePricing) if an unlimited Express Route is cheaper

The screenshot shows the 'Bandwidth' calculator interface. It features three dropdown menus for configuration: 'DATA TRANSFER TYPE' set to 'Inter Region', 'SOURCE REGION' set to 'UK South', and 'DESTINATION REGION' set to 'North Europe'. Below these is the 'Outbound Data Transfer' section with an information icon, a numeric input field containing '50', and a unit dropdown set to 'TB'. On the right side, the calculated cost is displayed as '\$921.60'.

Parameter	Value
Data Transfer Type	Inter Region
Source Region	UK South
Destination Region	North Europe
Outbound Data Transfer	50 TB
Calculated Cost	\$921.60

# Cost estimation and tracking





# Cost estimation and tracking (1/2)

Before your deployment you can estimate your costs using the Azure Pricing Calculator. It has a dedicated calculator for AVD that includes VM, Disks, FSLogix storage and networking



Use the Azure Pricing Calculator to make your personal estimations for your AVD deployment(s)

After (during) your deployment you should use [tagging](#) (aka.MS/TagAVDResources), so you can accurately track the costs of your Azure Virtual Desktop deployment



Use the tagging to accurately track the cost of (the different components) of your AVD deployment

## Pricing calculator

Configure and estimate the costs for Azure products

Products

Example Scenarios

Saved Estimates

FAQs

Select a product to include it in your estimate.

Azure Virtual Desktop



**Azure Virtual Desktop**

Enable a secure, remote desktop experience from anywhere

# Use Azure Monitor for Azure Virtual Desktop

Azure Monitor for Azure Virtual Desktop (Insights) is a dashboard built on Azure Monitor Workbooks that helps you understand your Azure Virtual Desktop environment

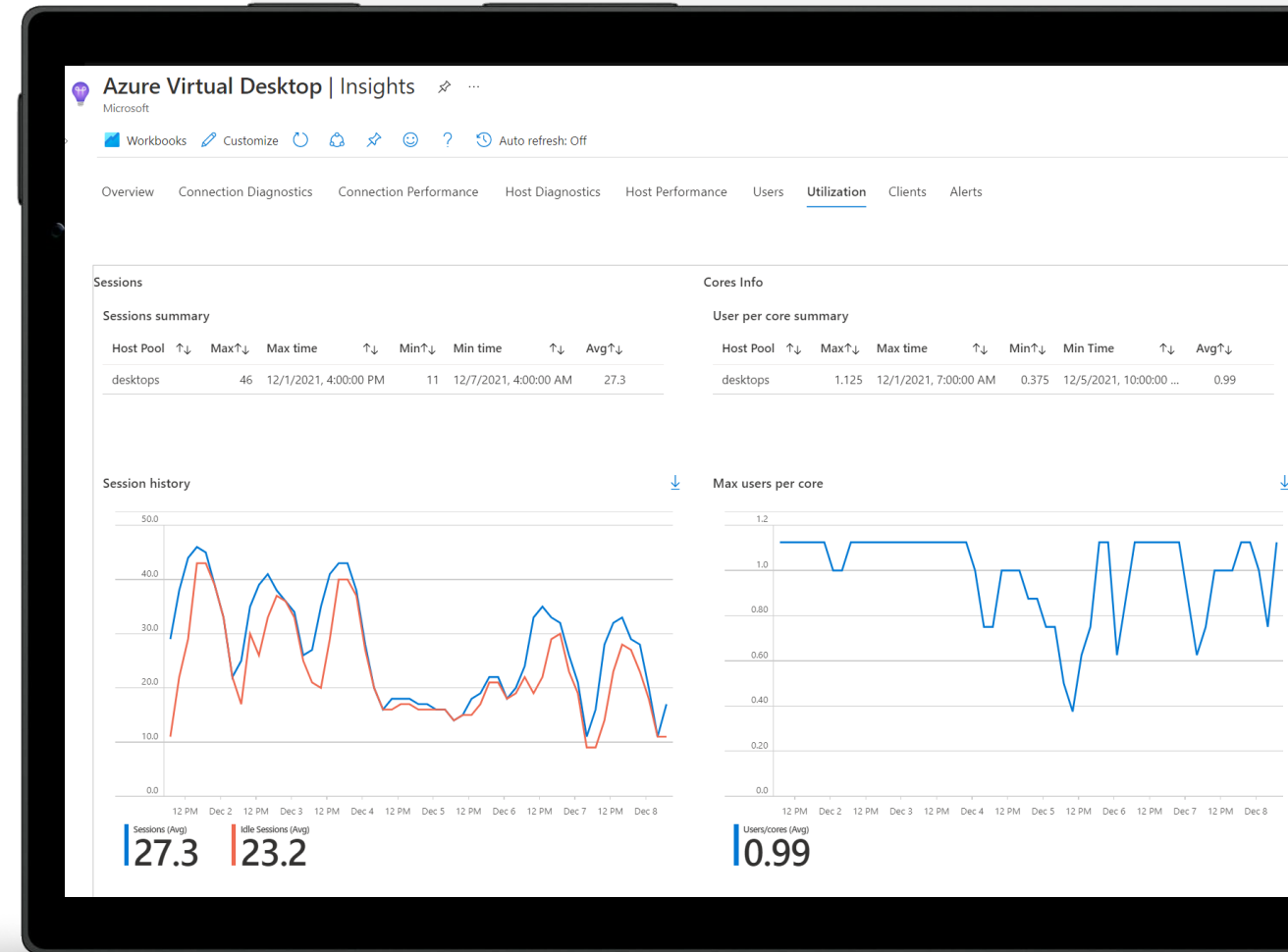
It can help save cost directly and indirectly

Here are just some of the examples:

- Showing how (under)utilized your VMs are
- Allowing you to spot usage patterns so you can optimize scaling and load balancing
- Determining if there are session hosts that are unhealthy but are powered on (incurring cost)
- Informing you about a bad user experience (which is an indirect support cost)



Start using Azure Monitor for Azure Virtual Desktop (Insights)



# Cost estimation and tracking (2/2)

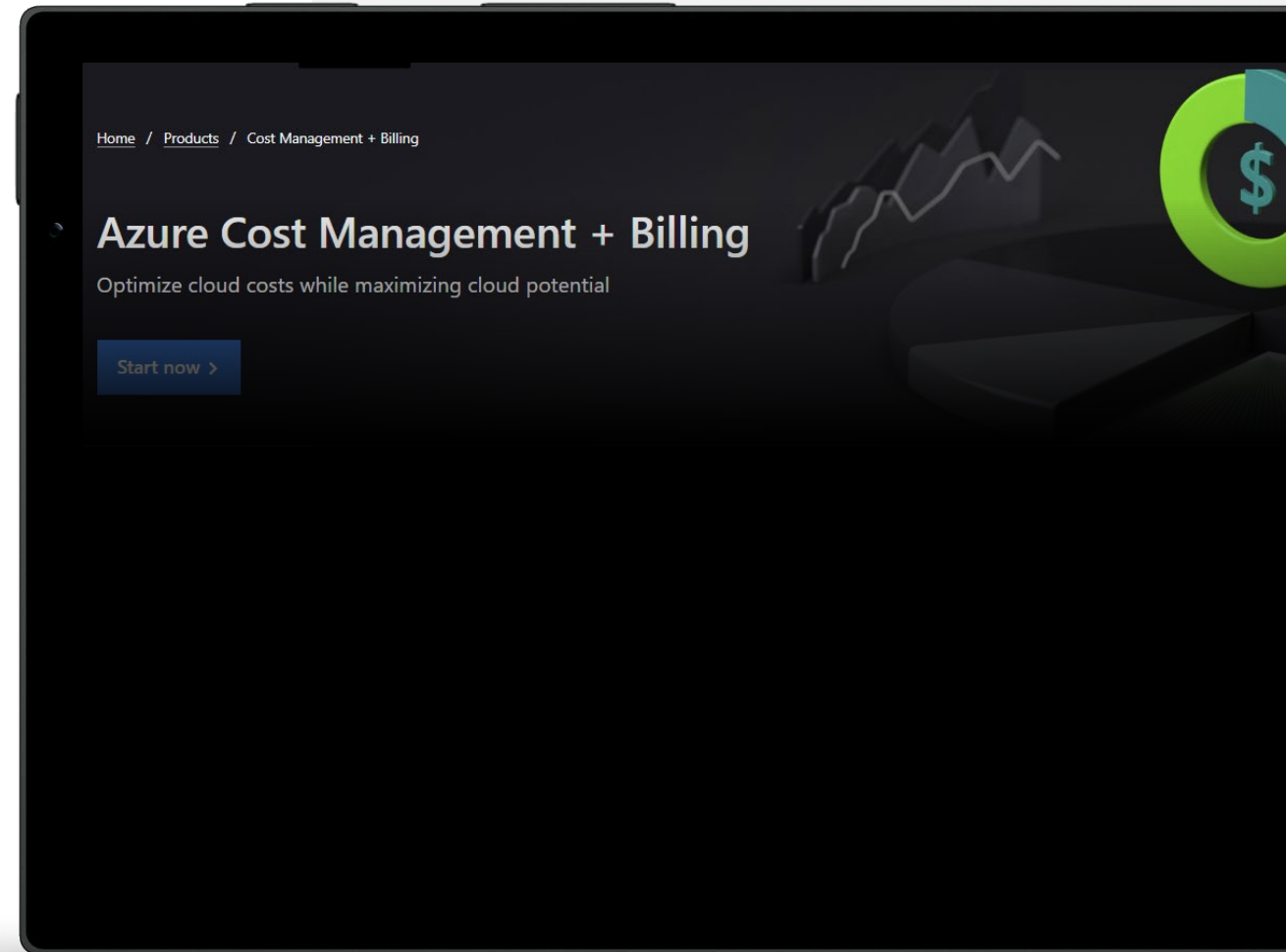
Take advantage of the tools included in your Azure subscription to get more value out of the cloud and help implement financial governance in your organization

Both services are at no additional cost, so there is no reason not to use them!



[Regularly review Azure Cost Management + Billing](#)  
(aka.ms/AzureCostManagementAndBilling)

[Use Azure Advisor](#)  
(aka.ms/ReduceCostsWithAzureAdvisor)



# Resources

Azure Virtual Desktop pricing (aka.ms/AVDpricing)

[Azure pricing calculator—Azure Virtual Desktop](#)

(aka.ms/AzurePricingCalculator)

[Michel Roth blog—Cost optimization](#)

(aka.ms/AzureMakesAVDCheaperOverTime)

[Total Economic Impact study by Forrester—Azure Virtual Desktop](#)

(aka.ms/AVDForresterConsultingTEI)

# Resources

## Explore:

Learn more, trial new features, and provide feedback

[Aka.ms/avdwhatsnew](https://aka.ms/avdwhatsnew)

[Azure Academy - YouTube](https://aka.ms/azureacademy)

## Find a partner:

Find an Azure Virtual Desktop Certified Partner

[Aka.ms/AVDFindPartner](https://aka.ms/AVDFindPartner)

## Dive Deeper:

Get started with Enterprise Scale Landing Zones in Azure:

[Azure Virtual Desktop Landing Zone Accelerator](https://aka.ms/AVDLandingZones)

[Enterprise-Scale Support for AVD](https://aka.ms/AVDEnterpriseScaleSupport)

Get Azure Virtual Desktop Certified

[aka.ms/AVDCert](https://aka.ms/AVDCert);

get 50% off with [aka.ms/30daysToLearnIT](https://aka.ms/30daysToLearnIT)

Check out Azure Virtual Desktop Documentation:

[aka.ms/AVDDocumentation](https://aka.ms/AVDDocumentation)

Learn about Azure Virtual Desktop

[aka.ms/AVDEventsandWebinars](https://aka.ms/AVDEventsandWebinars)

## Watch the on-demand Ignite Sessions:

[New ways to optimize flexibility, improve security, and reduce costs with Azure Virtual Desktop](https://aka.ms/AVDNewWays)

[Experience Windows in the cloud with Azure Virtual Desktop and Windows 365](https://aka.ms/AVDExperienceWindows)

[Aka.ms/AVDIgnite2022](https://aka.ms/AVDIgnite2022)

# AVD MicroHack

[Microhack Landingpage](#)

[AVD Microhack 22.05.](#)

Digital

## Azure Virtual Desktop Microhack

Wann: Montag, 22. Mai 2023, 9:30 AM – 4:15 PM (GMT+02:00)

Wo: Online

### Jetzt anmelden

Präsentationssprache(n): Deutsch






Untertitelsprache(n): Deutsch

Im Rahmen der "MicroHacks" bieten wir regelmäßig einen technischen Hands-On Workshop an.

Die Serie zeichnet sich dadurch aus, dass wir den Teilnehmern nicht nur Folien zeigen oder Produkte vorstellen wollen, sondern viel Wert auf praktische Demos und Übungen legen. Wollen Sie selbst etwas davon ausprobieren dann sind Sie hier genau richtig! Begleitet wird der MicroHack von Cloud Solution Architekten, die bei Aufgaben als Coaches unterstützen. Die MicroHacks können in Deutsch sowie in Englisch durchgeführt werden.

In diesem MicroHack lernen Sie, wie Sie einen Azure Virtual Desktop in einem typischen Szenario einrichten und aufbauen. Sobald Ihre AVD-Umgebung aufgebaut ist, werden Sie lernen, wie Sie die Umgebung mit anderen Azure-Ressourcen skalieren, überwachen und verwalten können.

### Agenda

09:30 AM - 10:30 AM	 KickOff-MicroHack Umgebung
10:30 AM - 12:00 PM	 Happy Hacking
12:00 PM - 01:00 PM	 Mittagspause
01:00 PM - 03:45 PM	 Happy Hacking
03:45 PM - 04:15 PM	 Get Together

Vorname \*

Nachname \*

E-Mail-Adresse \*

Aufgabengebiet \*

Name des Unternehmens \*

Telefonnummer \*

Land \*

Anmelden

Abbrechen

# Q&A