



Azure Virtual Desktop

Virtual Desktop Service

NetApp
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Azure Virtual Desktop

AVD Deployment Guide

Overview

This guide will provide the step by step instructions to create a Azure Virtual Desktop (AVD) deployment utilizing NetApp Virtual Desktop Service (VDS) in Azure.

The guide starts at: <https://cwasetup.cloudworkspace.com/>

This Proof of Concept (POC) guide is designed to help you quickly deploy and configure AVD in your own test Azure Subscription. This guide assumes a green-field deployment into a clean, non-production Azure Active Directory tenant.

Production deployments, especially into existing AD or Azure AD environments are very common however that process is not considered in this POC Guide. Complex POCs and production deployments should be initiated with the NetApp VDS Sales/Services teams and not performed in a self-service fashion.

This POC document will take you thru the entire AVD deployment and provide a brief tour of the major areas of post-deployment configuration available in the VDS platform. Once completed you'll have a fully deployed and functional AVD environment, complete with host pools, app groups and users. Optionally you'll have the option to configure automated application delivery, security groups, file share permissions, Azure Cloud Backup, intelligent cost optimization. VDS deploys a set of best practice settings via GPO. Instructions on how to optionally disable those controls are also included, in the event your POC needs to have no security controls, similar to an unmanaged local device environment.

AVD basics

Azure Virtual Desktop is a comprehensive desktop and app virtualization service that runs in the cloud. Here is a quick list of some of the key features and functionality:

- Platform services including gateways, brokering, licensing, and login and included as a service from Microsoft. This minimized infrastructure requiring hosting and management.
- Azure Active Directory can be leveraged as the identity provider, allowing for the layering of additional Azure security services such as conditional access.
- Users experience single sign-on experience for Microsoft services.
- User sessions connect to the session host via a proprietary reverse-connect technology. This means that no inbound ports need to be open, instead an agent creates and outbound connection to the AVD management plane which in turn connects to the end user device.
- Reverse connect even allows virtual machines to run without being exposed to the public internet enabling isolated workloads even while maintaining remote connectivity.
- AVD includes access to Windows 10 Multi Session, allowing a Windows 10 Enterprise experience with the efficiency of high density user sessions.
- FSLogix profile containerization technology is including, enhancing user session performance, storage efficiency and enhancing the Office experience in non-persistent environments.
- AVD supports full desktop and RemoteApp access. Both persistent or non-persistent, and both dedicated and multi-session experiences.
- Organizations can save on Windows licensing because AVD can leverage "Windows 10 Enterprise E3 Per

User" which replaces the need for RDS CALs and significantly reduces the per-hour cost of session host VMs in Azure.

Guide scope

This guide walks you through the deployment of AVD using NetApp VDS technology from the perspective of an Azure and VDS administrator. You bring the Azure tenant and subscription with zero pre-configuration and this guide helps you setup AVD end-to-end.

This guide covers the following steps:

1. Confirm prerequisites of the Azure tenant, Azure subscription and Azure admin account permissions
2. Collect required discovery details
3. Build the Azure environment using the purpose-built VDS for Azure Setup wizard
4. Create the first host pool with a standard Windows 10 EVD image
5. Assigning virtual desktops to Azure AD user(s)
6. Add users to the default app group for delivering the desktop environment to users. Optionally, create additional host pool(s) for delivering RemoteApp services
7. Connect as an end user via client software and/or web client
8. Connect to the platform and client services as local and domain admin
9. Optionally enable VDS' multi-factor authentication for VDS admins & AVD end users
10. Optionally walk through the entire application entitlement workflow including populating the app library, app install automation, app masking by users and security groups
11. Optionally create and manage Active Directory security groups, folder permissions and application entitlement by group.
12. Optionally configure cost optimization technologies including Workload Scheduling and Live Scaling
13. Optionally create, update and Sysprep a virtual machine image for future deployments
14. Optionally configure Azure Cloud Backup
15. Optionally disable default security control group policies

Azure prerequisites

VDS uses native Azure security context to deploy the AVD instance. Before starting the VDS Setup wizard, there are a few Azure prerequisites that need to be established.

During the deployment, service accounts and permissions are granted to VDS via authentication of an existing admin account from within the Azure tenant.

Quick prerequisites checklist

- Azure Tenant with Azure AD instance (can be Microsoft 365 instance)
- Azure Subscription
- Available Azure Quota for Azure virtual machines
- Azure Admin Account with Global Admin and Subscription Ownership Roles

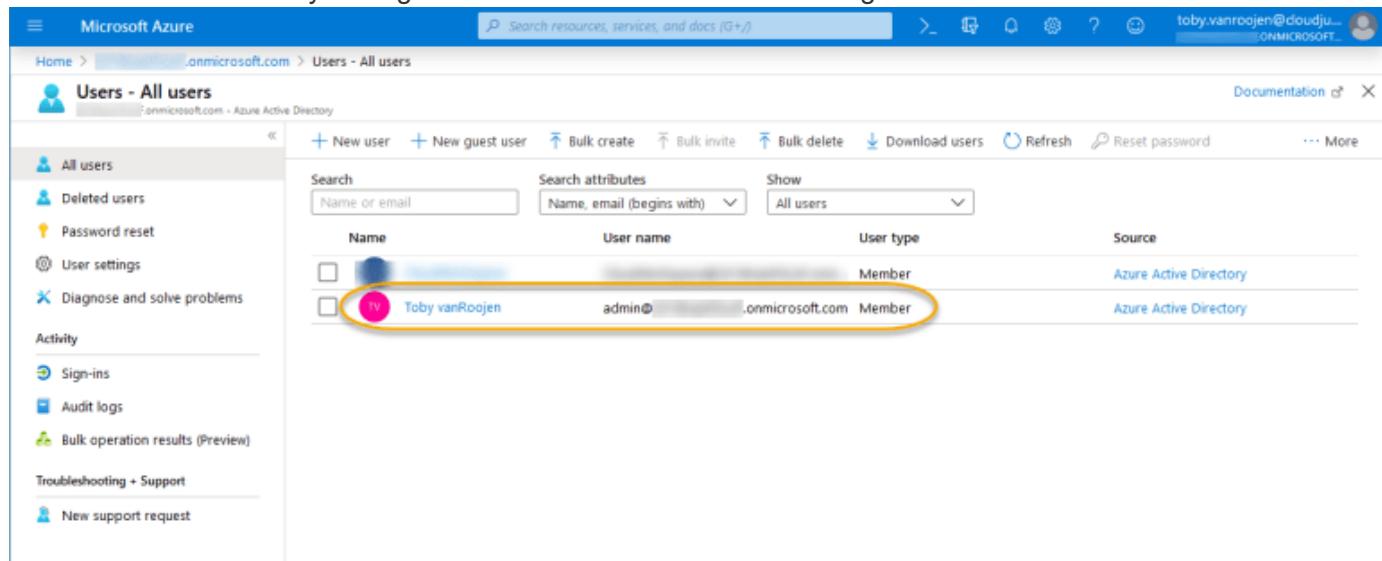


Detailed prerequisites are documented on [this PDF](#)

Azure administrator in Azure AD

This existing Azure admin must be an Azure AD account in the target tenant. Windows Server AD accounts can be deployed with the VDS Setup but additional steps are required to setup a sync with Azure AD (out of scope for this guide)

This can be confirmed by finding the user account in the Azure Management Portal under Users > All Users.



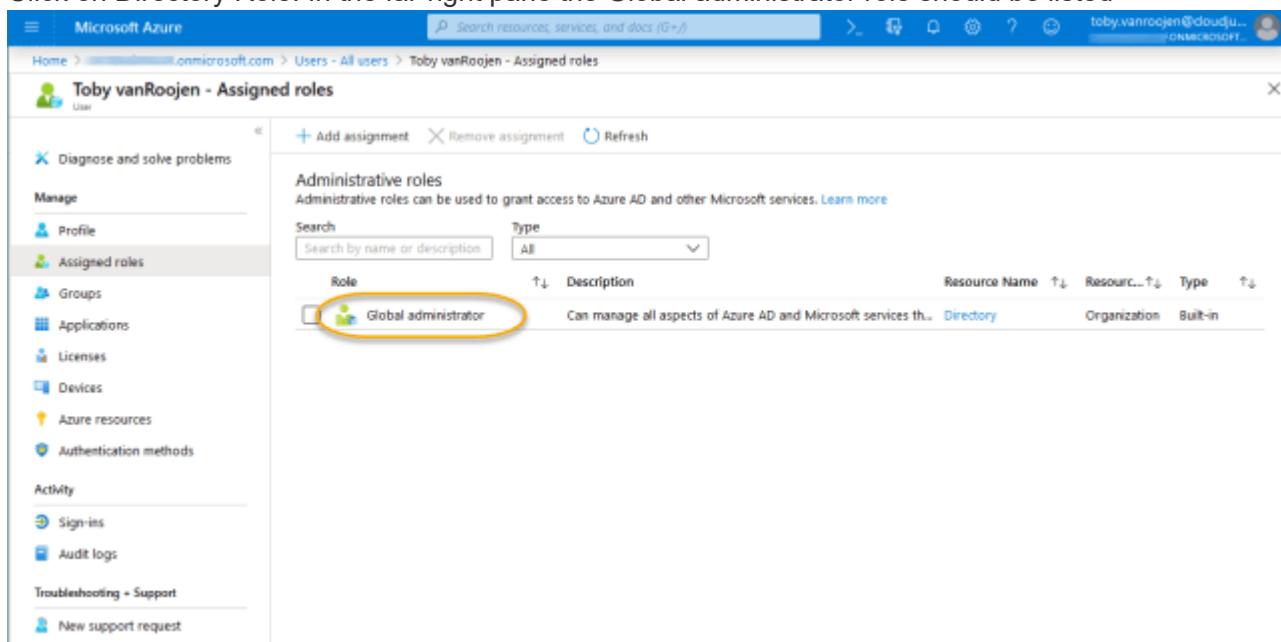
The screenshot shows the 'Users - All users' page in the Azure Management Portal. On the left, there's a sidebar with options like 'All users', 'Deleted users', 'Password reset', etc. The main area shows a table with columns: Name, User name, User type, and Source. One row is highlighted with a yellow circle around the 'Name' column, which contains 'Toby vanRoojen'. The 'User type' is listed as 'Member' and the 'Source' is 'Azure Active Directory'.

Global administrator role

The Azure Administrator must be assigned the Global administrator role in the Azure tenant.

To check your role in Azure AD, follow these steps:

1. Log in to the Azure Portal at <https://portal.azure.com/>
2. Search for and select Azure Active Directory
3. In the next pane to the right, click on the Users option in the Manage section
4. Click on the name of the Administrator user that you are checking
5. Click on Directory Role. In the far-right pane the Global administrator role should be listed



The screenshot shows the 'Toby vanRoojen - Assigned roles' page in the Azure Management Portal. On the left, there's a sidebar with options like 'Diagnose and solve problems', 'Profile', 'Assigned roles', etc. The main area shows a table with columns: Role, Description, Resource Name, Resource Type, and Type. One row is highlighted with a yellow circle around the 'Role' column, which contains 'Global administrator'. The 'Description' column indicates that this role can manage all aspects of Azure AD and Microsoft services.

If this user does not have the Global administrator role, you can perform the following steps to add it (Note that the logged in account must be a Global administrator to perform these steps):

1. From the user Directory Role detail page in step 5 above, click the Add Assignment button at the top of the detail page.
2. Click on Global administrator in the list of roles. Click the Add button.

The screenshot shows the Microsoft Azure portal interface. On the left, there's a sidebar with various management options like 'Diagnose and solve problems', 'Profile', 'Assigned roles', 'Groups', 'Applications', 'Licenses', 'Devices', 'Azure resources', 'Authentication methods', 'Activity', 'Sign-ins', 'Audit logs', 'Troubleshooting + Support', and 'New support request'. The main area is titled 'Toby vanRoojen - Assigned roles'. It has a sub-header 'Administrative roles' with a note: 'Administrative roles can be used to grant access to Azure AD and other Microsoft services.' Below this is a search bar with 'Search by name or description' and a 'Type' dropdown set to 'All'. A table titled 'No directory roles assigned.' is shown with columns 'Role' and 'Description'. On the right, a list of 'Directory roles' is displayed, each with a checkbox and a brief description. The 'Global administrator' role is checked and highlighted with a yellow circle. At the bottom of this list is a blue 'Add' button, which is also highlighted with a yellow circle.

Azure subscription ownership

The Azure Administrator must also be a Subscription Owner on the subscription that will contain the deployment.

To check that the Administrator is a Subscription Owner, follow these steps:

1. Log in to the Azure Portal at <https://portal.azure.com/>
2. Search for, and select Subscriptions
3. In the next pane to the right, click on the name of the subscription to see the subscription details
4. Click on the Access Control (IAM) menu item in the pane second from the left
5. Click on the Role Assignments tab. The Azure Administrator should be listed in the Owner section.

Microsoft Azure - Azure subscription 1 - Access control (IAM)

Check access Role assignments Deny assignments Classic administrators Roles

Manage access to Azure resources for users, groups, service principals and managed identities at this scope by creating role assignments. Learn more ↗

Name	Type	Role	Scope
Toby vanRoojen admin@onmicrosoft.com	User	Owner	This resource
[redacted]		Owner	This resource
[redacted]		Owner	This resource
[redacted]		Owner	This resource

If the Azure Administrator is not listed, you can add the account as a subscription owner by following these steps:

1. Click the Add button at the top of the page and choose the Add Role Assignment option
2. A dialog will appear to the right. Choose “Owner” in the role drop down, then start typing the username of the Administrator in the Select box. When the full name of the Administrator appears, select it
3. Click the Save button at the bottom of the dialog

Add role assignment

Role: Owner

Assign access to: Azure AD user, group, or service principal

Select: Search by name or email address

AAD DC Administrators

CloudWorkspace

Selected members: Toby vanRoojen admin@onmicrosoft.com

Save Discard

Azure compute core quota

The CWA Setup wizard and VDS portal will create new virtual machines and the Azure subscription must have available quota to successfully run

To check quota follow these steps:

1. Navigate to the Subscriptions module and click “Usage + Quotas”
2. Select all providers in the “providers” drop-down, select “Microsoft.Compute” in the “Providers” drop-down
3. Select the target Region in the “Locations” drop-down
4. A list of available quotas by virtual machine family should be shown

Quota	provider	location	Usage
Availability Sets	Microsoft.Compute	East US 2	0 % 0 of 2000
Basic & Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 250
Premium Storage Managed Disks	Microsoft.Compute	East US 2	0 % 0 of 50000
PremiumStorageSnapshots	Microsoft.Compute	East US 2	0 % 0 of 50000
Standard A0-A7 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 250
Standard A8-A11 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 350
Standard A1c Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 350
Standard B5 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 250
Standard D Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 350
Standard DASv4 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 0
Standard DAv1 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 0
Standard DCv2 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 8
Standard DS Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 350
Standard DSV2 Family vCPUs	Microsoft.Compute	East US 2	0 % 0 of 250

If you need to increase quota, click Request Increase and follow the prompts to add additional capacity. For the initial deployment specifically request increased quote for the “Standard DSv3 Family vCPUs”

Collect discovery details

Once working through the CWA Setup wizard there are several questions that need to be answered. NetApp VDS has provided a linked PDF that can be used to record these selections prior to deployment. Item include:

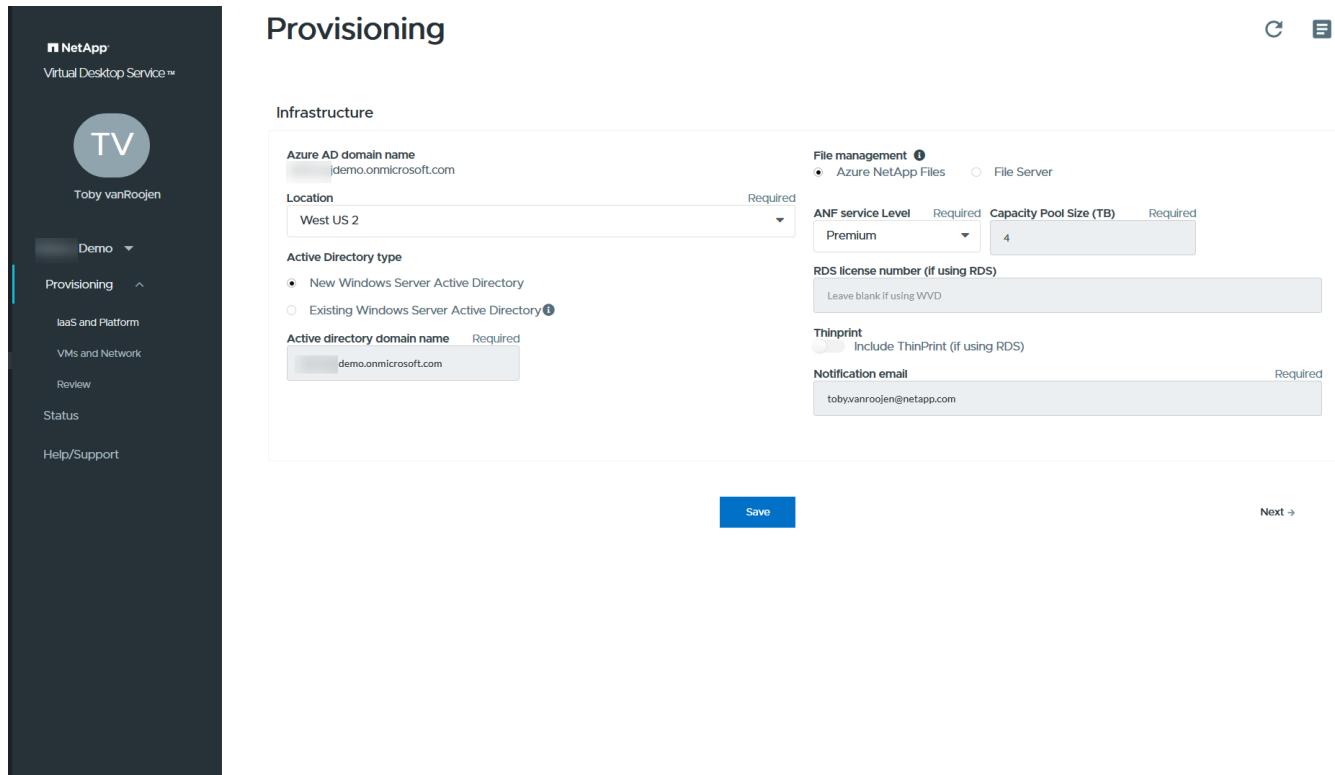
Item	Description
VDS admin credentials	Collect the existing VDS admin credentials if you already have them. Otherwise a new admin account will be created during deployment.
Azure Region	Determine the target Azure Region based on performance and availability of services. This Microsoft Tool can estimate end user experienced based on region.
Active Directory type	The VMs will need to join a domain but can't directly join Azure AD. The VDS deployment can build a new virtual machine or use an existing domain controller.
File Management	Performance is highly dependent on disk speed, particularly as related to user profile storage. The VDS setup wizard can deploy a simple file server or configure Azure NetApp Files (ANF). For nearly any production environment ANF is recommended however for a POC the file server option provides sufficient performance. Storage options can be revised post-deployment, including using existing storage resources in Azure. Consult ANF pricing for details: https://azure.microsoft.com/en-us/pricing/details/netapp/

Item	Description
Virtual Network Scope	A routable /20 network range is required for the deployment. the VDS setup wizard will allow you to define this range. It is important that this range does not overlap with any existing vNets in Azure or on-premises (if the two networks will be connected via a VPN or ExpressRoute).

VDS setup sections

Login to <https://cwasetup.cloudworkspace.com/> with your Azure admin credentials found in the prerequisites section.

IaaS and platform



The screenshot shows the 'Provisioning' step of the NetApp Virtual Desktop Service setup. On the left, a sidebar menu includes 'Demo', 'Provisioning' (which is expanded), 'IaaS and Platform', 'VMs and Network', 'Review', 'Status', and 'Help/Support'. The main area is titled 'Provisioning' and has a sub-section 'Infrastructure'. It contains the following fields:

- Azure AD domain name:** demo.onmicrosoft.com
- Location:** West US 2 (Required)
- Active Directory type:** New Windows Server Active Directory (selected)
- Active directory domain name:** demo.onmicrosoft.com (Required)
- File management:** Azure NetApp Files (selected)
- ANF service Level:** Premium (Required)
- Capacity Pool Size (TB):** 4 (Required)
- RDS license number (if using RDS):** Leave blank if using WVD
- Thinprint:** Include ThinPrint (if using RDS) (unchecked)
- Notification email:** tobyvanrooijen@netapp.com (Required)

At the bottom are 'Save' and 'Next →' buttons.

Azure AD domain name

The Azure AD domain name is inherited by the selected tenant.

Location

Select an appropriate **Azure Region**. This [Microsoft Tool](#) can estimate end user experienced based on region.

Active Directory type

VDS can be provisioned with a **new virtual machine** for the Domain Controller function or setup to leverage an existing Domain Controller.

In this guide we will select New Windows Server Active Directory, which will create one or two VMs (based on choices made during this process) under the subscription.

A detailed article covering an existing AD deployment is found [here](#).

Active Directory domain name

Enter a **domain name**. Mirroring the Azure AD Domain Name from above is recommended.

File management

VDS can provision a simple file server virtual machine or setup and configure Azure NetApp Files. In production Microsoft recommends allocating 30gb per user and we've observed that allocating 5-15 IOPS per user is required for optimal performance.

In a POC (non-production) environment the file server is a low-cost and simple deployment option however the available performance of Azure Managed Disks can be overwhelmed by the IOPS consumption of even a small production deployment.

For example, a 4TB Standard SSD disk in azure supports up to 500 IOPS, which could only support a maximum of 100 total users at 5 IOPS/user. With ANF Premium the same sized storage setup would support 16,000 IOPS posting 32x more IOPS.

For production AVD deployments, **Azure NetApp Files is Microsoft's recommendation**.



Azure NetApp Files needs to be made available to the subscription you wish to deploy into - please contact your NetApp account rep or use this xref:./ <https://aka.ms/azurenappfiles>

It is also required that you register NetApp as a provider to your subscription. This can be done by doing the following:

- Navigate to Subscriptions in the Azure portal
 - Click Resource Providers
 - Filter for NetApp
 - Select the provider and click Register

RDS license number

NetApp VDS can be used to deploy RDS and/or AVD environments. When deploying AVD, this field can remain **empty**.

Thinprint

NetApp VDS can be used to deploy RDS and/or AVD environments. When deploying AVD, this toggle can remain **off** (toggle left).

Notification email

VDS will send deployment notifications and ongoing health reports to the **email provided**. This can be changed later.

VMs and network

There are a variety of services that need to run in order to support a VDS environment – these are collectively referred to as the “VDS platform”.

Depending on the configuration these can include CWMGR, one or two RDS Gateways, one or two HTML5 Gateways, an FTPS server, and one or two Active Directory VMs.

Most AVD deployments leverage the Single virtual machine option, as Microsoft manages the AVD Gateways

as a PaaS service.

For smaller and simpler environments that will include RDS use cases, all of these services can be condensed into the Single virtual machine option to reducing VM costs (with limited scalability). For RDS uses cases with more than 100 users the Multiple virtual machines option is advised in order to facilitate RDS and/or HTML5 Gateway scalability

The screenshot shows the 'Provisioning' step of the NetApp VDS setup. On the left, a sidebar shows a user profile (Toby vanRoojen) and navigation links: Demo, Provisioning (selected), IaaS and Platform, VMs and Network, Review, Status, and Help/Support. The main area is titled 'VMs and Network Configuration'. It includes a 'Platform VM configuration' section with a radio button for 'Single virtual machine' (selected) and 'Multiple virtual machines'. Below this are fields for 'Time zone' (set to America/Los Angeles, Vancouver (UTC-07:00)) and 'Virtual network scope' (set to 10.0.0.0/20). To the right is a 'Network subnet groups' table:

Name	Subnet Group
Tenant	10.0.0.0/22
Services	10.0.13.0/24
Platform	10.0.14.0/24
Directory	10.0.15.0/24

At the bottom of the configuration area are 'Validate' (button) and 'Validation of network scope succeeded' (status message). Below the configuration area are 'Back' and 'Save' buttons, and above them are 'Next →' and 'Cancel' buttons.

Platform VM configuration

NetApp VDS can be used to deploy RDS and/or AVD environments. When deploying AVD the Single virtual machine selection is recommended. For RDS deployments you need to deploy and manage additional components such as Brokers and Gateways, in production these services should be run on dedicated and redundant virtual machines. For AVD, all of these services are provided by Azure as an included service and thus, the **single virtual machine** configuration is recommended.

Single virtual machine

This is the recommended selection for deployments that will exclusively use AVD (and not RDS or a combination of the two). In a Single virtual machine deployment the following roles are all hosted on a single VM in Azure:

- CW Manager
- HTML5 Gateway
- RDS Gateway
- Remote App
- FTPS Server (Optional)
- Domain Controller role

The maximum advised user count for RDS use cases in this configuration is 100 users. Load balanced RDS/HTML5 gateways are not an option in this configuration, limiting the redundancy and options for

increasing scale in the future. Again, this limit does not apply to AVD deployments, since Microsoft manages the Gateways as a PaaS service.



If this environment is being designed for multi-tenancy, a Single virtual machine configuration is not supported - neither is AVD or AD Connect.

Multiple virtual machines

When splitting the VDS Platform into Multiple virtual machines the following roles are hosted on dedicated VMs in Azure:

- Remote Desktop Gateway

VDS Setup can be used to deploy and configure one or two RDS Gateways. These gateways relay the RDS user session from the open internet to the session host VMs within the deployment. RDS Gateways handle an important function, protecting RDS from direct attacks from the open internet and to encrypt all RDS traffic in/out of the environment. When two Remote Desktop Gateways are selected, VDS Setup deploys 2 VMs and configures them to load balance incoming RDS user sessions.

- HTML5 Gateway

VDS Setup can be used to deploy and configure one or two HTML5 Gateways. These gateways host the HTML5 services used by the *Connect to Server* feature in VDS and the web-based VDS Client (H5 Portal). When two HTML5 Portals are selected, VDS Setup deploys 2 VMs and configures them to load balance incoming HTML5 user sessions.



When using Multiple server option (even if users will only connect via the installed VDS Client) at least one HTML5 gateway is highly recommended to enable *Connect to Server* functionality from VDS.

- Gateway Scalability Notes

For RDS use cases, the maximum size of the environment can be scaled out with additional Gateway VMs, with each RDS or HTML5 Gateway supporting roughly 500 users. Additional Gateways can be added later with minimal NetApp professional services assistance

If this environment is being designed for multi-tenancy then the Multiple virtual machines selection is required.

Time zone

While the end users' experience will reflect their local time zone, a default time zone needs to be selected. Select the time zone from where the **primary administration** of the environment will be performed.

Virtual network scope

It is a best practice to isolate VMs to different subnets according to their purpose. First, define the network scope and add a /20 range.

VDS Setup detects and suggests a range that should prove successful. Per best practices, the subnet IP addresses must fall into a private IP address range.

These ranges are:

- 192.168.0.0 through 192.168.255.255

- 172.16.0.0 through 172.31.255.255
- 10.0.0.0 through 10.255.255.255

Review and adjust if needed, then click Validate to identify subnets for each of the following:

- Tenant: this is the range that session host servers and database servers will reside in
- Services: this is the range that PaaS services like Azure NetApp Files will reside in
- Platform: this is the range that Platform servers will reside in
- Directory: this is the range that AD servers will reside in

Review

The final page provides an opportunity to review your choices. When you have completed that review, click the Validate button. VDS Setup will review all the entries and verify that the deployment can proceed with the information provided. This validation can take 2-10 minutes. To follow the progress, you can click the log logo (upper right) to see the validation activity.

Once validation is complete the green Provision button will appear in place of the Validate button. Click on Provision to start the provisioning process for your deployment.

Status

The provisioning process takes between 2-4 hours depending on Azure workload and the choices you made. You can follow the progress in the log by clicking the Status page or wait for the email that will tell you the deployment process has completed. Deployment builds the virtual machines and Azure components required to support both VDS and a Remote Desktop or a AVD implementation. This includes a single virtual machine that can act as both a Remote Desktop session host and a file server. In a AVD implementation this virtual machine will act only as a file server.

Install and configure AD Connect

Immediately after the install is successful, AD Connect needs to be installed and configured on the Domain Controller. In a singe platform VM setup the CWMGR1 machine is the DC. The users in AD need to sync between Azure AD and the local domain.

To install and configure AD Connect, follow these steps:

1. Connect to the domain controller as a domain admin.
 - a. Get credentials from the Azure Key Vault (See [Key Vault instructions here](#))
2. Install AD Connect, login with the domain admin (with Enterprise Admin role permissions) and the Azure AD Global Admin.

Activating AVD services

Once the deployment is complete, the next step is to enable the AVD functionality. The AVD enablement process requires the Azure Administrator to perform several steps to register their Azure AD domain and subscription for access using the Azure AVD services. Similarly, Microsoft requires VDS to request the same permissions for our automation application in Azure. The steps below walk you through that process.

Create AVD host pool

End User access to AVD virtual machines is managed by host pools , which contain the virtual machines, and app groups, which in-turn contain the users and type of user access.

To build your first host pool

1. Click the Add button in the right hand side of the AVD host pools section header.

The screenshot shows the Microsoft Cloud Workspaces interface. On the left, there's a sidebar with options like Dashboard, Organizations, Deployments, Workspaces (which is selected), App Services, Service Board, Scripted Events, Admins, and Reports. The main area is titled 'TrainWVD2's Workspace (rs6a)' and has tabs for Overview, Users & Groups, VM Resource, Workload Schedule, and WVD (which is selected). Below this, there's a 'WVD Details' section with Tenant ID (c551bdff-0eb5-4f9d-be70-54c9e5fb92b7) and HTML5 URL (<https://rweb.avd.microsoft.com/webclient/index.html>). To the right, there's a 'Diagnostic Activities' section with a 'View Diagnostic Activities' link. The bottom part of the screen shows a table titled 'WVD Host Pools' with one entry: 'hostpool1' (First Host Pool, Shared, 2 Session Hosts). A large red arrow points from the text above to the 'Add' button in the top right corner of this table.

2. Enter a name and description for your host pool.
3. Choose a host pool type
 - a. **Pooled** means multiple users will access the same pool of virtual machines with the same applications installed.
 - b. **Personal** creates a host pool where users are assigned their own session host VM.
4. Select the Load Balancer type
 - a. **Depth First** will fill the first shared virtual machine to the max number of users before starting on the second virtual machine in the pool
 - b. **Breadth First** will distribute users to all the virtual machines in the pool in a round robin fashion
5. Select an Azure virtual machines template for creating the virtual machines in this pool. While VDS will show all templates available in the subscription, we recommend selecting the most recent Windows 10 multi-user build for the best experience. The current build is Windows-10-20h1-evd. (Optionally create a Gold Image using the Provisioning Collection functionality to build hosts from a custom virtual machine image)
6. Select the Azure machine size. For evaluation purposes, NetApp recommends the D series (standard machine type for multi-user) or E series (enhanced memory configuration for heavier duty multi-user scenarios). The machine sizes can be changed later in VDS if you want to experiment with different series and sizes
7. Select a compatible storage type for the virtual machines' Managed Disk instances from the drop down list
8. Select the number of virtual machines you want created as part of the host pool creation process. You can

- add virtual machines to the pool later, but VDS will build the number of virtual machines you request and add them to the host pool once its created
9. Click the Add host pool button to start the creation process. You can track progress on the AVD page, or you can see the details of the process log on the Deployments/Deployment name page in the Tasks section
 10. Once the host pool is created it will appear in the host pool list on the AVD page. Click on the name of the host pool to see its detail page, which includes a list of its virtual machines , app groups, and active users

AVD Hosts in VDS are created with a setting that disallows user sessions to connect. This is by design to allow for customization prior to accepting user connections. This setting can be changed by editing the session host's settings.

Online	Status
Yes	Available
Yes	Available

Add	Refresh

Enable VDS desktops for users

As noted above, VDS creates all the elements required to support end user workspaces during deployment. Once the deployment has completed, the next step is to enable workspace access for each user you want introduced to the AVD environment. This step creates the profile configuration and end user data layer access that is the default for a virtual desktop. VDS reuses this configuration to link Azure AD end users to the AVD App Pools.

To enable workspaces for end users follow these steps:

1. Log in to VDS at <https://manage.cloudworkspace.com> using the VDS primary administrator account you created during provisioning. If you don't remember your account information, please contact NetApp VDS for assistance in retrieving it
2. Click on the Workspaces menu item, then click on the name of the Workspace that was created automatically during provisioning
3. Click on the Users and Groups tab

Cloud Workspace

All Workspaces TrainWVD2's Workspace (rs6a)

Overview Users & Groups VM Resource Workload Schedule WVD Delete Client

Groups

Groups Add

Filter by Keyword

Group Users

risk-all-users 1

Users

Add/Import Refresh

You have 1 user(s) pending Cloud Workspace approval.

Filter by Keyword

Name	Username	Status	Connection Status
Toby vanRoojen	Toby vanRoojen	Pending (Pending Cloud Workspace)	Offline
WVD User1	WVDUser1@r...	Available	Offline

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-
4. For each user that you want to enable, scroll over the username and then click on the Gear icon
 5. Choose the “Enable Cloud Workspace” option

Cloud Workspace

All Workspaces TrainWVD2's Workspace (rs6a)

Overview Users & Groups VM Resource Workload Schedule WVD Delete Client

Groups

Groups Add

Filter by Keyword

Group Users

risk-all-users 1

Users

Add/Import Refresh

You have 1 user(s) pending Cloud Workspace approval.

Filter by Keyword

Name	Username	Status	Connection Status
Toby vanRoojen	Toby vanRoojen	Pending (Pending Cloud Workspace)	Offline
WVD User1	WVDUser1@r...	Available	Offline

Enable Cloud Workspace

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-
6. It takes about 30-90 seconds for the enablement process to complete. Note that the user status will change from Pending to Available



Activating Azure AD Domain Services creates a managed domain in Azure, and each AVD virtual machine that is created will be joined to that domain. In order for traditional login to the virtual machines to work, the password hash for Azure AD users must be synced to support NTLM and Kerberos authentication. The easiest way to accomplish this task is to change the user password in Office.com or the Azure portal, which will force the password hash sync to occur. The sync cycle for Domain Service servers can take up to 20 minutes.

Enable user sessions

By default, session hosts are unable to accept user connections. This setting is commonly called “drain mode” as it can be used in production to prevent new user sessions, allowing the host to eventually remove all user sessions. When new user sessions are allowed on a host this action is commonly referred to as placing the session host “into rotation.”

In production it makes sense to start new hosts in drain mode because there are typically configuration tasks that need to be completed before the host is ready for production workloads.

In testing and evaluation you can immediately take the hosts out of drain mode to enable user connects and to confirm functionality.

To Enable user sessions on the session host(s) follow these steps:

1. Navigate to the AVD Section of the workspace page.
2. Click on the host pool name under “AVD host pools” .

The screenshot shows the Microsoft Cloud Workspaces interface for a workspace named "2019 Training Step 3 - WVD Activated's Workspace (z58b)". The left sidebar has a "Workspaces" tab selected, showing other options like Dashboard, Organizations, Deployments, App Services, Service Board, Scripted Events, Admins, and Reports. The main area displays "WVD Details" with fields for Tenant ID (redacted), HTML5 URL (<https://rdweb.wvd.microsoft.com/webclient/index.html>), and Diagnostic Activities. Below this is the "WVD Host Pools" section, which includes a search bar and an "Add" button. A table lists host pools:

Name	Description	Tenant	Type	Session Hosts
apps	apps	z58b	Shared	1
Desktop Users	Hostpool for Desktop Users	z58b	Shared	4

3. Click on the name of the Session host(s) and check the box “Allow New Sessions”, Click “Update Session Host”. Repeat for all hosts that need to be placed into rotation.

The screenshot shows the 'WVD Host Pool Desktop Users' page. On the left, there's a sidebar with options like Dashboard, Organizations, Deployments, Workspaces (selected), App Services, Service Board, Scripted Events, Admins, and Reports. The main area shows 'Host Pool Details' for 'Desktop Users' with a description 'Hostpool for Desktop Users' and tenant 'z58b'. Below this is a 'Session Hosts' table with four entries: Z58BTS1, Z58BTS2, Z58BTS3, and Z58BTS4, all from 'onmicrosoft.com'. A yellow arrow points from the 'Allow New Sessions' checkbox in the 'Edit Session Host' dialog to the 'Allow New Session' column in the table. Another yellow arrow points from the 'Edit Session Host' dialog to the table.

Name	Allow New Session	Sessions	Online	Status
Z58BTS1.onmicrosoft.com	Yes	0	Yes	Available
Z58BTS2.onmicrosoft.com	Yes	0	No	NoHeartbeat
Z58BTS3.onmicrosoft.com	Yes	0	No	NoHeartbeat
Z58BTS4.onmicrosoft.com	Yes	0	No	NoHeartbeat

4. The current stats of “Allow New Session” is also displayed on the main AVD page for each host line item.

Default app group

Note that the Desktop Application Group is created by default as part of the host pool creation process. This group provides interactive desktop access to all group members.

To add members to the group:

1. Click on the name of the App Group

The screenshot shows the 'WVD Host Pool hostpool1' page. It has sections for 'Host Pool Details', 'Session Hosts', and 'App Groups'. In the 'App Groups' section, there is one entry: 'Desktop Application Group'. A black arrow points to this link. Below it is a 'Active Users' section with the message 'No active users found.'

Name	Description	Resource	Users	Remote Apps
Desktop Application Group	Desktop Application Group	Desktop	1	-

2. Click on the link that shows the number of Users Added

3. Select the users you wish to add to the app group by checking the box next to their name
4. Click the Select Users button
5. Click the Update app group button

Create additional AVD app group(s)

Additional app groups can be added to the host pool. These app groups will publish specific applications from the host pool virtual machines to the App Group users using RemoteApp.

i AVD only allows end users to be assigned to the Desktop App Group type or RemoteApp App Group type but not both in the same host pool, so make sure you segregate your users accordingly. If users need access to a desktop and streaming apps, a 2nd host pool is required to host the app(s).

To create a new App Group:

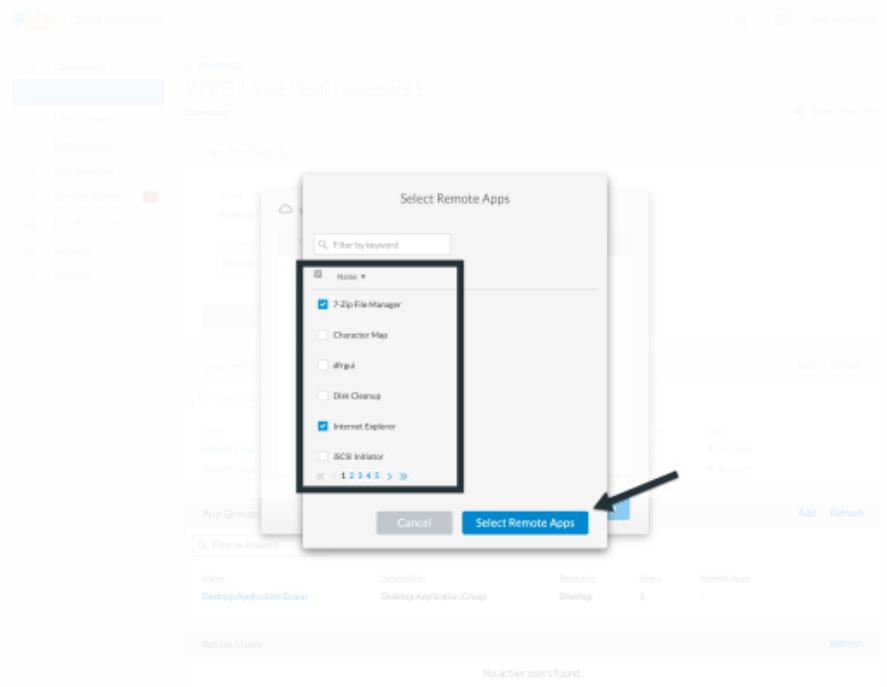
1. Click the Add button in the app groups section header

The screenshot shows the Cloud Workspace interface for managing a WVD Host Pool named 'hostpool1'. In the 'Host Pool Details' section, the host pool is described as a 'First Host Pool' of type 'Shared'. The 'Session Hosts' section lists two hosts: 'RS6AT51.trainwvd.com' and 'RS6AT52.trainwvd.com', both marked as 'Available'. The 'App Groups' section shows a single group named 'Desktop Application Group' associated with a 'Desktop' resource and one user. An arrow points to the 'Add' button in the 'App Groups' section.

2. Enter a name and description for the App Group
3. Select users to add to the group by clicking on the Add Users link. Select each user by clicking the check box next to their name, then click the Select Users button

The screenshot shows the 'Select Remote Apps' dialog box overlaid on the Cloud Workspace interface. The dialog lists several applications: 7-Zip File Manager, Character Map, dlp4, Disk Cleanup, Internet Explorer, and SCSI Initiator. Two applications are selected: '7-Zip File Manager' and 'Internet Explorer'. An arrow points to the 'Select Remote Apps' button at the bottom right of the dialog.

4. Click the Add RemoteApps link to add applications to this App Group. AVD automatically generates the list of possible applications by scanning the list of applications installed on the virtual machine . Select the application by clicking on the check box next to the application name, then click the Select RemoteApps button.



-
5. Click the Add App Group button to create the App Group

End user AVD access

End users can access AVD environments using the Web Client or an installed client on a variety of platforms

- Web Client: <https://docs.microsoft.com/en-us/azure/virtual-desktop/connect-web>
- Web Client Login URL: <http://aka.ms/AVDweb>
- Windows Client: <https://docs.microsoft.com/en-us/azure/virtual-desktop/connect-windows-7-and-10>
- Android Client: <https://docs.microsoft.com/en-us/azure/virtual-desktop/connect-android>
- macOS Client: <https://docs.microsoft.com/en-us/azure/virtual-desktop/connect-macos>
- iOS Client: <https://docs.microsoft.com/en-us/azure/virtual-desktop/connect-ios>
- IGEL Thin Client: <https://www.igel.com/igel-solution-family/windows-virtual-desktop/>

Log in using the end user username and password. Note that Remote App and Desktop Connections (RADC), Remote Desktop Connection (mstsc), and the CloudWorksapce Client for Windows application do not currently support the ability to log in to AVD instances.

Monitor user logins

The host pool detail page will also display a list of active users when they log in to a AVD session.

Admin connection options

VDS Admins are able to connect to virtual machines in the environment in a variety of ways.

Connect to server

Throughout the portal, VDS Admins will find the “Connect to Server” option. By default, this function connects the admin to the virtual machine by dynamically generating local admin credentials and injecting them into a web client connection. The Admin does not need to know (and is never provided with) credentials in order to connect.

This default behavior can be disabled on a per-Admin basis as described in the next section.

.tech/Level 3 admin accounts

In the CWA Setup process there is a “Level III” admin account created. The user name is formatted as username.tech@domain.xyz

These accounts, commonly called a “.tech” account, are named domain-level administrator accounts. VDS Admins can use their .tech account when connecting to a CWMGR1 (platform) server and optionally when connecting to all other virtual machines in the environment.

To disable the automatic local admin login function and force the Level III account to be used, change this setting. Navigate to VDS > Admins > Admin Name > Check “Tech Account Enabled.” With this box checked, the VDS admin will not be automatically logged into virtual machines as a local admin and rather be prompted to enter their .tech credentials.

These credentials, and other relevant credentials, are automatically stored in the *Azure Key Vault* and can be accessed from within the Azure Management Portal at <https://portal.azure.com/>.

Optional post-deployment actions

Multi-factor authentication (MFA)

NetApp VDS includes SMS/Email MFA at no charge. This feature can be used to secure VDS Admin accounts and/or End User accounts.

[MFA Article](#)

Application entitlement workflow

VDS provides a mechanism to assign end users access to applications from a pre-defined list of applications called the Application Catalog. The Application catalog spans all managed deployments.



The automatically deployed TSD1 server must remain as-is to support application entitlement. Specifically, do not run the “convert to data” function against this virtual machine.

Application Management is detailed in this Article: https://docs.netapp.com/us-en/virtual-desktop-service/Management.Applications.application_entitlement_workflow.html

Azure AD security groups

VDS includes functionality to create, populate and delete user groups which are backed by Azure AD Security Groups. These groups can be used outside of VDS just like any other Security Group. In VDS these groups can be used to assign folder permissions and application entitlement.

Create user groups

Creating user groups is performed on the Users & Groups tab within a workspace.

Assign folder permissions by group

Permissions to view and edit folders in the company share can be assigned to users or groups.

https://docs.netapp.com/us-en/virtual-desktop-service/Management.User_Administration.manage_folders_and_permissions.html

Assign applications by group

In addition to assigning applications to users individually, applications can be provisioned to groups.

1. Navigate to the Users and Groups Detail.

The screenshot shows the 'Cloud Workspace' interface. In the top left, there's a navigation bar with 'Dashboard', 'Organizations', 'Deployments', 'Workspaces' (which is highlighted with a blue box and has a red notification badge), 'App Services', 'Service Board', 'Scripted Events', 'Admins', and 'Reports'. On the right, there's a search bar, a user profile for 'Toby vanRoojen', and a 'Delete Client' button. The main area is titled 'TrainWVD2's Workspace (rs6a)' and has tabs for 'Overview', 'Users & Groups' (which is selected and highlighted with a blue box), 'VM Resource', 'Workload Schedule', and 'WVD'. Under 'Users & Groups', there are sections for 'Groups' and 'Users'. The 'Groups' section has a search bar and an 'Add' button. The 'Users' section has a search bar and a table with columns for 'Name', 'Username', 'Status', and 'Connection Status'. It lists two users: 'Toby vanRoojen' (admin@trainwv...), 'Available', 'Offline' and 'WVD User1' (WVDUser1@r...), 'Available', 'Offline'. At the bottom, there are links for 'Privacy / Terms of Use / Cookies' and copyright information.

2. Add a new group or edit an existing group.

3. Assign user(s) and application(s) to the group.

Configure cost optimization options

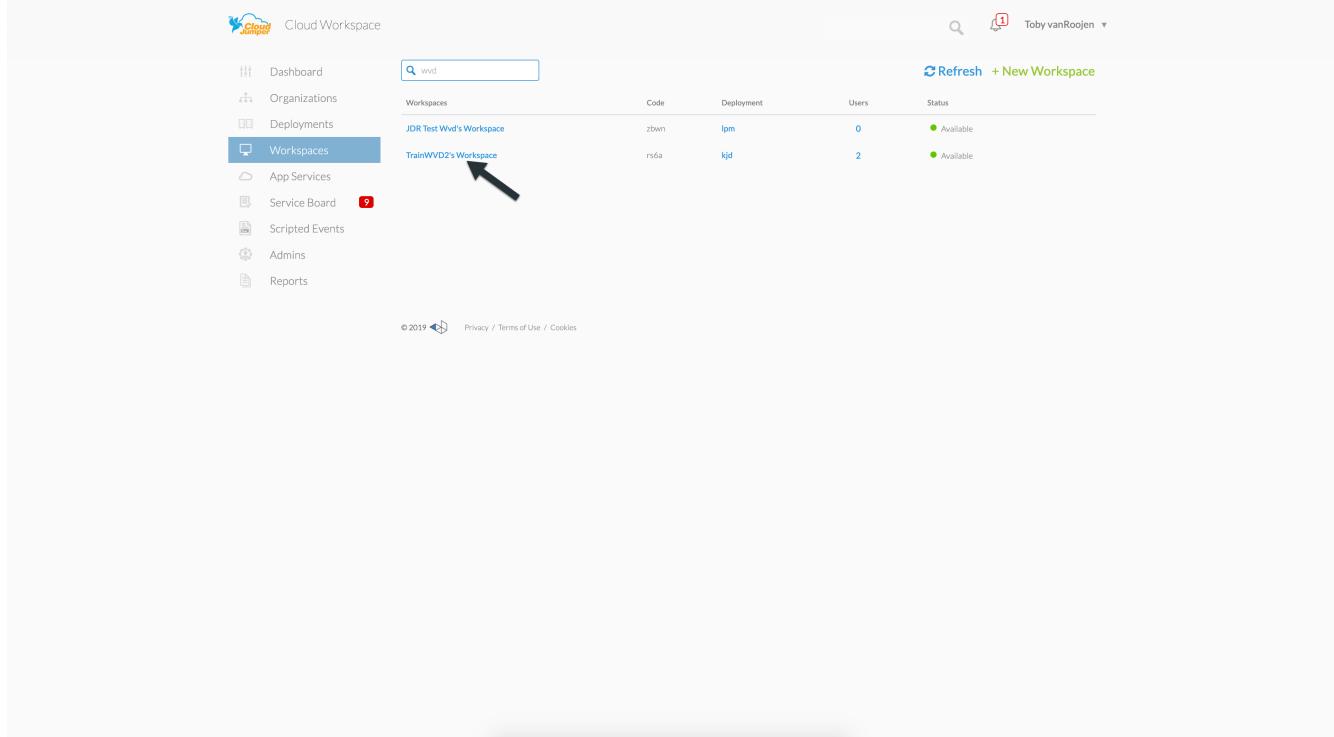
Workspace management also extends to managing the Azure resources that support the AVD implementation. VDS allows you to configure both Workload Schedules and Live Scaling to turn Azure virtual machines on and off based on end user activities. These features result in matching Azure resource utilization and spending to the actual usage pattern of end users. In addition, if you have configured a proof of concept AVD implementation you can turn the whole Deployment from the VDS interface.

Workload scheduling

Workload Scheduling is a feature that allows the Administrator to create a set schedule for the Workspace virtual machines to be on to support end user sessions. When the end of the scheduled time period is reached for a specific day of the week, VDS Stops/Deallocates the virtual machines in Azure so that hourly charges stop.

To enable Workload Scheduling:

1. Log in to VDS at <https://manage.cloudworkspace.com> using your VDS credentials.
2. Click on the Workspaces menu item and then click on the name of the Workspace in the list.



The screenshot shows the Cloud Workspace management interface. On the left, a sidebar lists navigation options: Dashboard, Organizations, Deployments, Workspaces (which is selected and highlighted in blue), App Services, Service Board (with a red notification badge), Scripted Events, Admins, and Reports. In the center, there is a search bar with the placeholder 'wvd'. Below it, a table displays 'Workspaces' with two entries:

	Code	Deployment	Users	Status
JDR Test Wvd's Workspace	zbnw	lpm	0	Available
TrainWVD2's Workspace	rs6a	kjd	2	Available

A large black arrow points from the bottom right towards the 'TrainWVD2's Workspace' row. At the bottom of the page, there is a footer with links for '© 2019', 'Privacy / Terms of Use / Cookies', and a 'Logout' button.

3. Click on the Workload Schedule tab.

Cloud Workspace

TrainWVD2's Workspace (rs6a)

Overview Users & Groups VM Resource Workload Schedule WVD

Active Users

Resource Consumption

Deployment

trainwvd2.onmicrosoft.com (kjd) Azure Available

No App Services.

Company Details		Contact Details	
Company Name TrainWVD2	Company Code rs6a	Primary Notification Email	Phone
Status Available	Partner CloudJumper CSP Master	Address 1	Address 2
Organization Type Client	Login Identifier @trainwvd2.onmicrosoft.com	City Garner	Zip Code
Created By	Deployment	State	Country

4. Click the Manage link in the Workload Schedule header.

Cloud Workspace

TrainWVD2's Workspace (rs6a)

Overview Users & Groups VM Resource **Workload Schedule** WVD

Live Scaling

Enabled Disabled

Extra Powered On Servers Enabled

Shared Users Per Server Enabled

Number of Shared Users Per Server
2

Max Shared Users Per Server Enabled

Update

Workload Schedule

Description
Workload is running 24/7

Custom Scheduling
Off

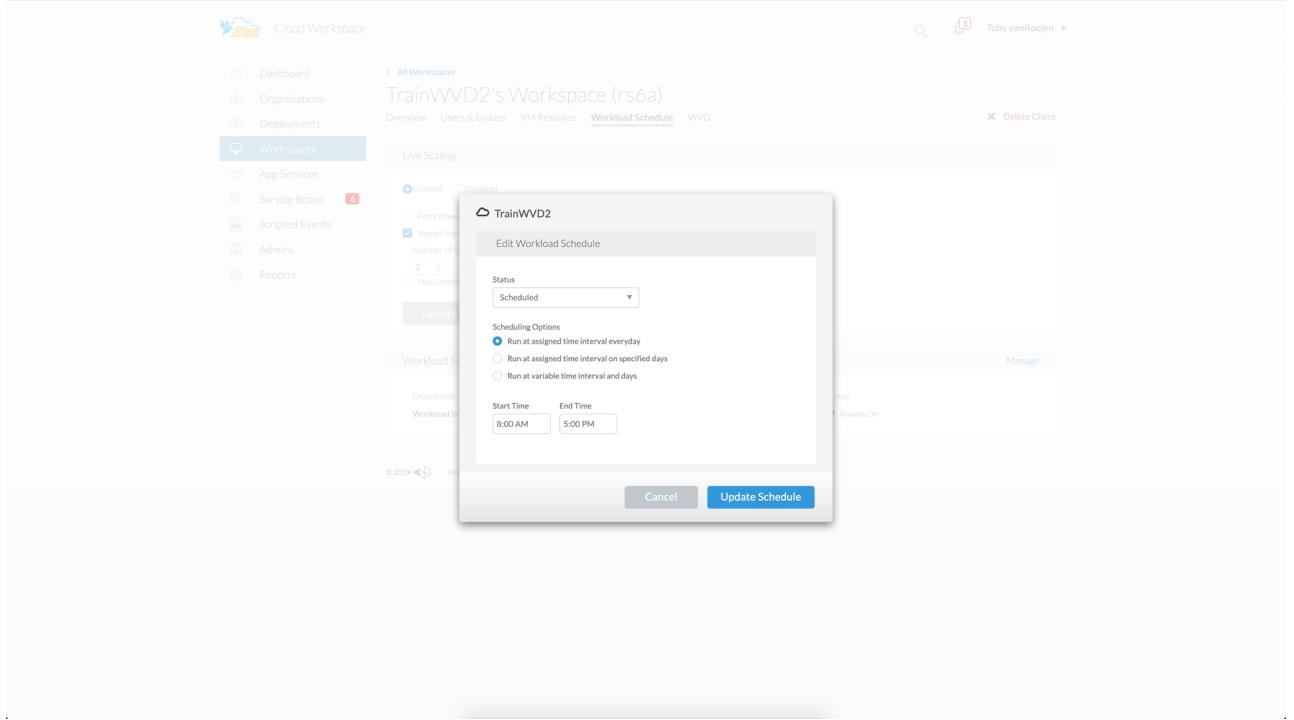
Status
Always On

Manage

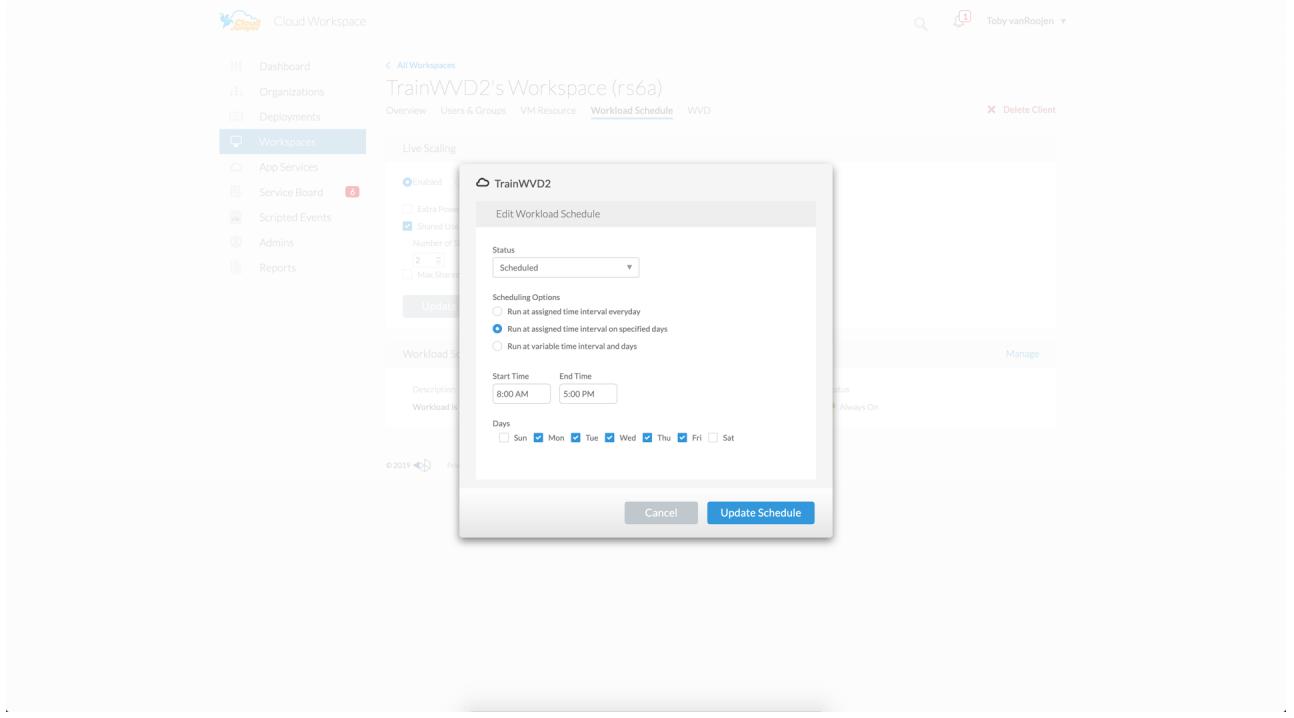
5. Choose a default state from the Status drop down: Always On (default), Always Off, or Scheduled.

6. If you choose Scheduled, the Scheduling options include:

- Run at Assigned Interval every day. This option sets the schedule to be the same Start Time and End Time for all seven days of the week.



- b. Run at Assigned Interval for Specified Days. This option sets the schedule to the same Start Tie and End Time only for selected days of the week. Non-selected days of the week will cause VDS to not turn the virtual machines on for those days.



- c. Run at variable time intervals and days. This option sets the schedule to different Start Times and End Times for each selected day.

The screenshot shows the 'Edit Workload Schedule' dialog box open over the main workspace management interface. The dialog includes fields for 'Status' (set to 'Scheduled'), 'Scheduling Options' (set to 'Run at variable time interval and days'), and 'Days' (set to Wednesday and Friday). A tooltip 'Always On' is visible on the right side of the screen.

- d. Click the Update schedule button when finished setting the schedule.

The screenshot shows the 'Edit Workload Schedule' dialog box open over the main workspace management interface. A large black arrow points to the 'Update Schedule' button at the bottom right of the dialog.

Live Scaling

Live Scaling automatically turns virtual machines in a shared host pool on and off depending on concurrent user load. As each server fills up, an additional server is turned on so that it's ready when the host pool load balancer sends user session requests. For effective use of Live Scaling, choose "Depth First" as the load balancer type.

To enable Live Scaling:

1. Log in to VDS at <https://manage.cloudworkspace.com> using your VDS credentials.

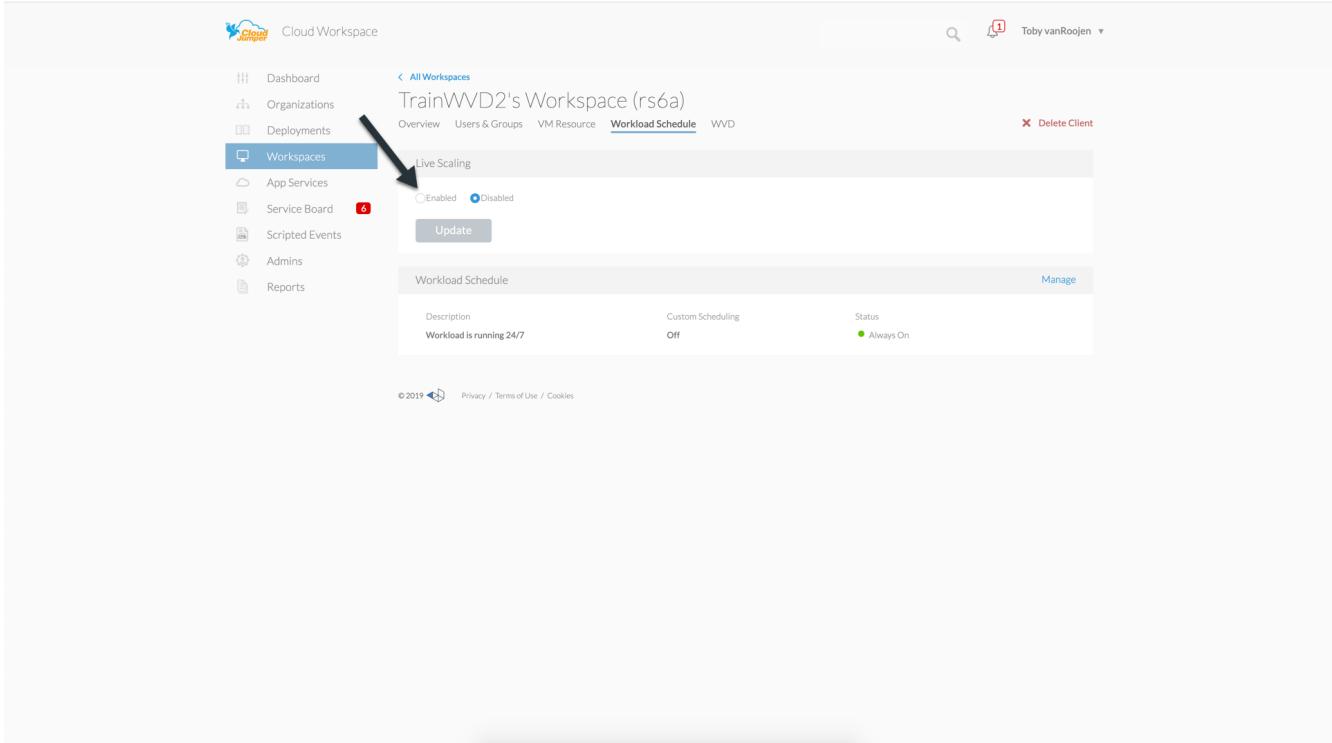
2. Click on the Workspace menu item and then click on the name of the Workspace in the list.

The screenshot shows the Cloud Workspace interface. On the left, a sidebar lists various menu items: Dashboard, Organizations, Deployments, Workspaces (which is selected and highlighted in blue), App Services, Service Board (with a red notification badge), Scripted Events, Admins, and Reports. In the center, there is a search bar with the text 'wvd'. Below it is a table titled 'Workspaces' with two rows. The first row is for 'JDR Test Wvd's Workspace' and the second row is for 'TrainWVD2's Workspace'. The 'TrainWVD2's Workspace' row is highlighted with a blue background. At the top right, there are buttons for 'Refresh' and '+ New Workspace', along with a user profile for 'Toby vanRoojen'. The bottom of the screen includes copyright information and links for Privacy, Terms of Use, and Cookies.

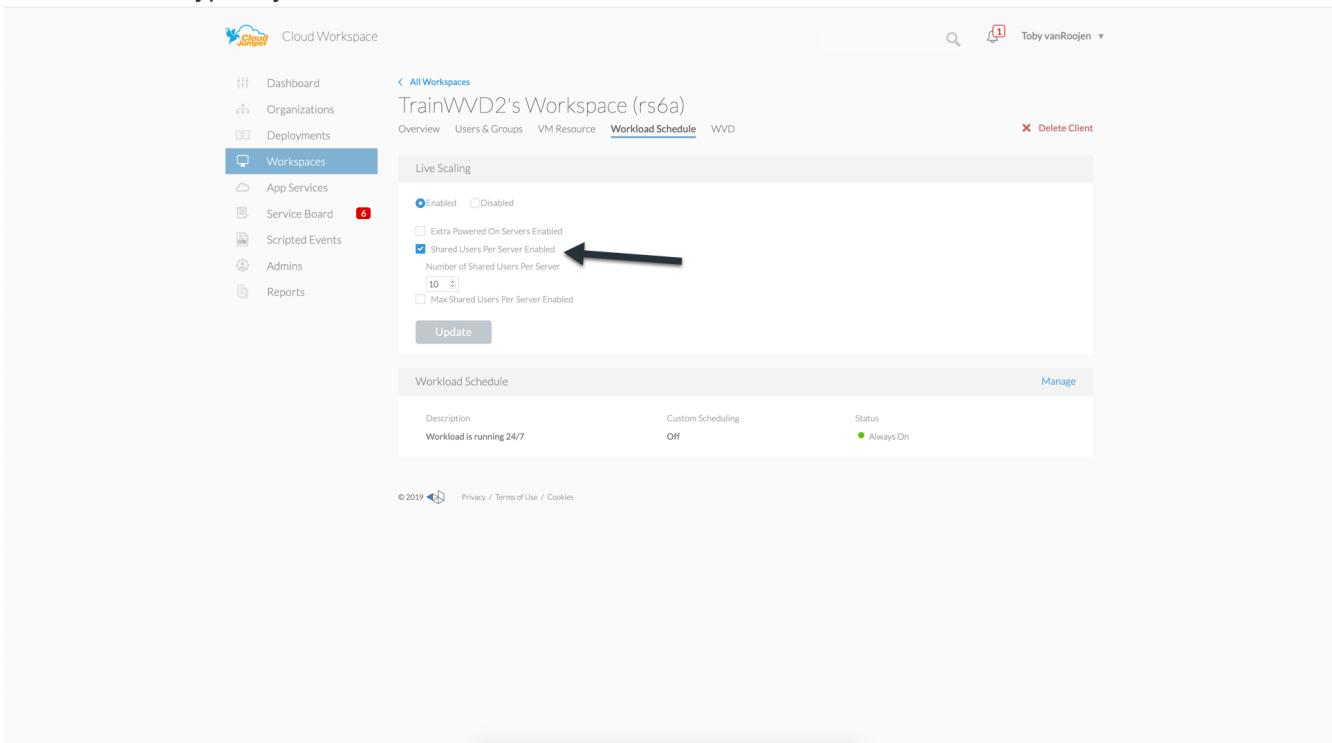
3. Click on the Workload Schedule tab.

The screenshot shows the 'TrainWVD2's Workspace (rs6a)' page. The navigation bar at the top includes tabs for Overview, Users & Groups, VM Resource, Workload Schedule (which is selected and highlighted in blue), and VWD. Below the navigation bar are two line charts: 'Active Users' and 'Resource Consumption'. The 'Active Users' chart shows a steady increase from approximately 1.0 to 2.0 over the last few days. The 'Resource Consumption' chart shows 'Total CPU' (blue line) remaining low until August 19, after which it rises sharply to about 4.0, and 'Total RAM (GB)' (green line) also rises to about 8.0. At the bottom of the page, there are sections for Deployment (listing 'trainwvd2.onmicrosoft.com (kjd)' and 'Azure' status as 'Available'), App Services (listing 'No App Services.'), Company Details, and Contact Details.

4. Click the Enabled radio button in the Live Scaling section.



5. Click the Max Number of Users Per Server and enter the max number. Depending on virtual machine size, this number is typically between 4 and 20.



6. OPTIONAL – Click the Extra Powered On Servers Enabled and enter a number of additional servers that you want on for the host pool. This setting activates the specified number of servers in addition to the actively filling server to act as a buffer for large groups of users logging on in the same time window.

The screenshot shows the Cloud Workspace interface with the 'Workspaces' menu selected. A modal dialog is open under the 'Workload Schedule' tab, titled 'TrainWVD2's Workspace (rs6a)'. Inside the dialog, there are several configuration options:

- A radio button for 'Enabled' (selected) and 'Disabled'.
- A checkbox for 'Extra Powered On Servers Enabled' (unchecked).
- A checkbox for 'Shared Users Per Server Enabled' (checked).
- A dropdown for 'Number of Shared Users Per Server' set to 10.
- A checkbox for 'Max Shared Users Per Server Enabled' (unchecked).

At the bottom left of the dialog is a 'Update' button. Below the dialog, the main workspace summary shows:

- Description: 'Workload is running 24/7'
- Custom Scheduling: 'Off'
- Status: 'Always On' (green dot)

At the bottom of the page, there are copyright and link information: © 2019 Cloud Workspace, Privacy / Terms of Use / Cookies.



Live Scaling currently applies to all Shared resource pools. In the near future each pool will have independent Live Scaling options.

Power down the entire deployment

If you plan to only use your evaluation deployment on a sporadic, non-production basis you can turn off all the virtual machines in the deployment when you are not using them.

To turn the Deployment on or off (i.e. turn off the virtual machines in the deployment), follow these steps:

1. Log in to VDS at <https://manage.cloudworkspace.com> using your VDS credentials.
2. Click on the Deployments menu item.

<https://preview.manage.cloudworkspace.com/#/deployments>

Scroll your cursor over the line for the target Deployment to display the Configuration gear icon.

Deployment	Code	Version	Infrastructure Platform	Clients	Connection	Status
trainwvd2.onmicrosoft.com	kjd	5.3	Azure	1	● Online	● Available
wvdgpu.onmicrosoft.com	ceb	5.2	Azure	0	● Offline	● Available

3. Click on the gear, then choose Stop.

The screenshot shows the Cloud Workspace interface with the 'Deployments' tab selected. A search bar at the top contains 'wvd'. Below it, a message says 'You have 16 deployment(s) which require manual intervention for completion'. A table lists two deployments:

Deployment	Code	Version	Infrastructure Platform	Clients	Connection	Status
trainwvd2.onmicrosoft.com	kjd	5.3	Azure	1	● Online	● Available
wvdgpu.onmicrosoft.com	ceb	5.2	Azure	-	● Offline	● Available

On the right side of the table, there are 'Delete' and 'Stop' buttons for each row. The 'Stop' button for the first row is highlighted with a blue box and a black arrow pointing to it.

4. To restart or Start, follow steps 1-3 and then choose Start.

This screenshot shows the same Cloud Workspace interface as the previous one, but with a different focus. The 'Start' button for the 'wvdgpu.onmicrosoft.com' deployment is highlighted with a blue box and a black arrow pointing to it.



It may take several minutes for all the virtual machines in the deployment to stop or start.

Create and manage VM images

VDS contains functionality for creating and managing virtual machine images for future deployments. To reach this functionality, navigate to: VDS > Deployments > Deployment Name > Provisioning Collections. The "VDI Image Collection" features are documented here: https://docs.netapp.com/us-en/virtual-desktop-service/Management.Deployments.provisioning_collections.html

Configure Azure cloud backup service

VDS can natively configure and manage Azure Cloud Backup, an Azure PaaS service for backing up virtual machines. Backup Policies can be assigned to individual machines or groups of machine by type or host pool. Details are found here: https://docs.netapp.com/us-en/virtual-desktop-service/Management.System_Administration.configure_backup.html

Select app management/policy mode

By default, VDS implements a number of Group Policy Objects (GPO) that lock down the end user workspace. These policies prevent access to both core data layer locations (ex: c:\) and the ability to perform application installations as an end user.

This evaluation is intended to demonstrate the capabilities of Window Virtual Desktop, so you have the option to remove the GPOs so that you can implement a “basic workspace” that provides the same functionality and access as a physical workspace. To do this, follow the steps in the “Basic Workspace” option.

You can also choose to utilize the full Virtual Desktop management feature set to implement a “Controlled Workspace”. These steps include creating and managing an application catalog for end user application entitlement and using Administrator level permissions to manage access to both applications and data folders. Follow the steps in the “Controlled Workspace” section to implement this type of workspace on your AVD host pools.

Controlled AVD workspace (default policies)

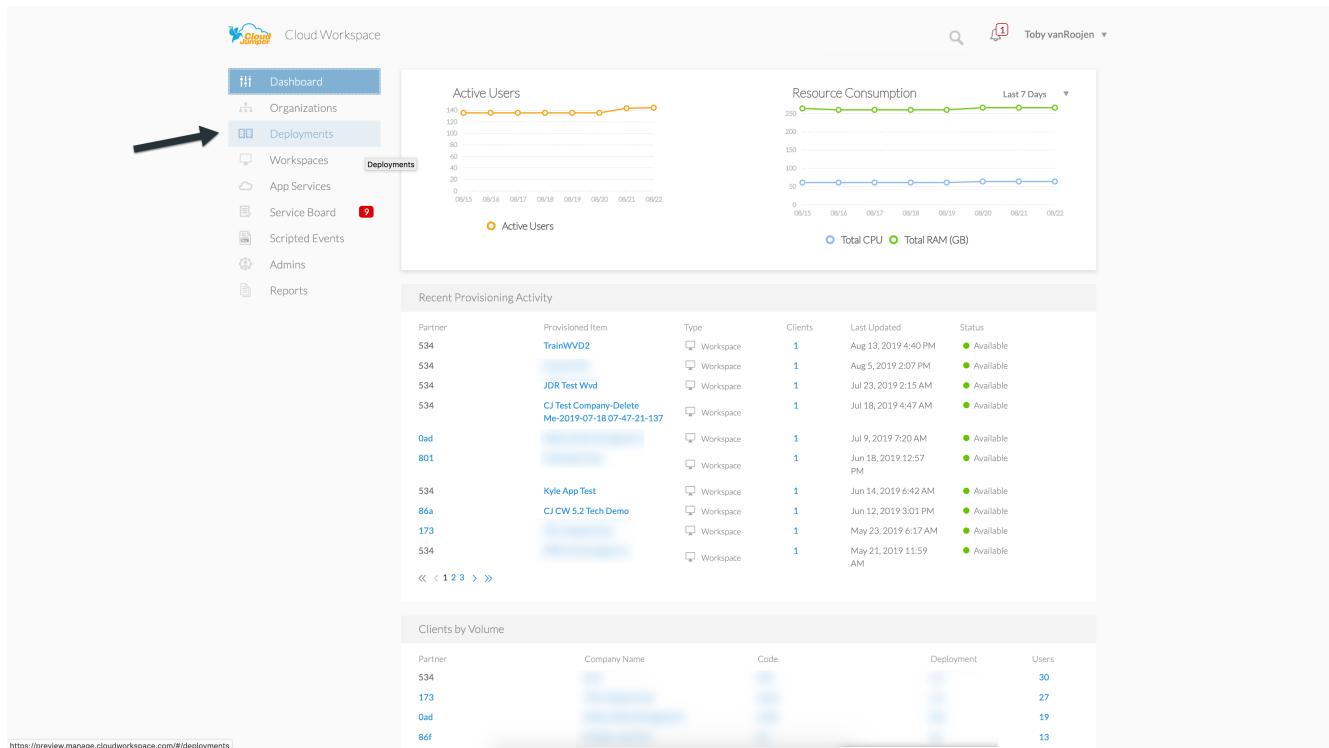
Using a controlled workspace is the default mode for VDS deployments. The polices are applied automatically. This mode requires VDS Administrators to install applications and then end users are granted access to the application via a shortcut on the session desktop. In a similar fashion, access to the data folders are assigned to end users by creating mapped shared folders and setting up permissions to see only those mapped drive letters instead of the standard boot and/or data drives. To manage this environment, follow the steps below to install applications and provide end user access.

Reverting to basic AVD workspace

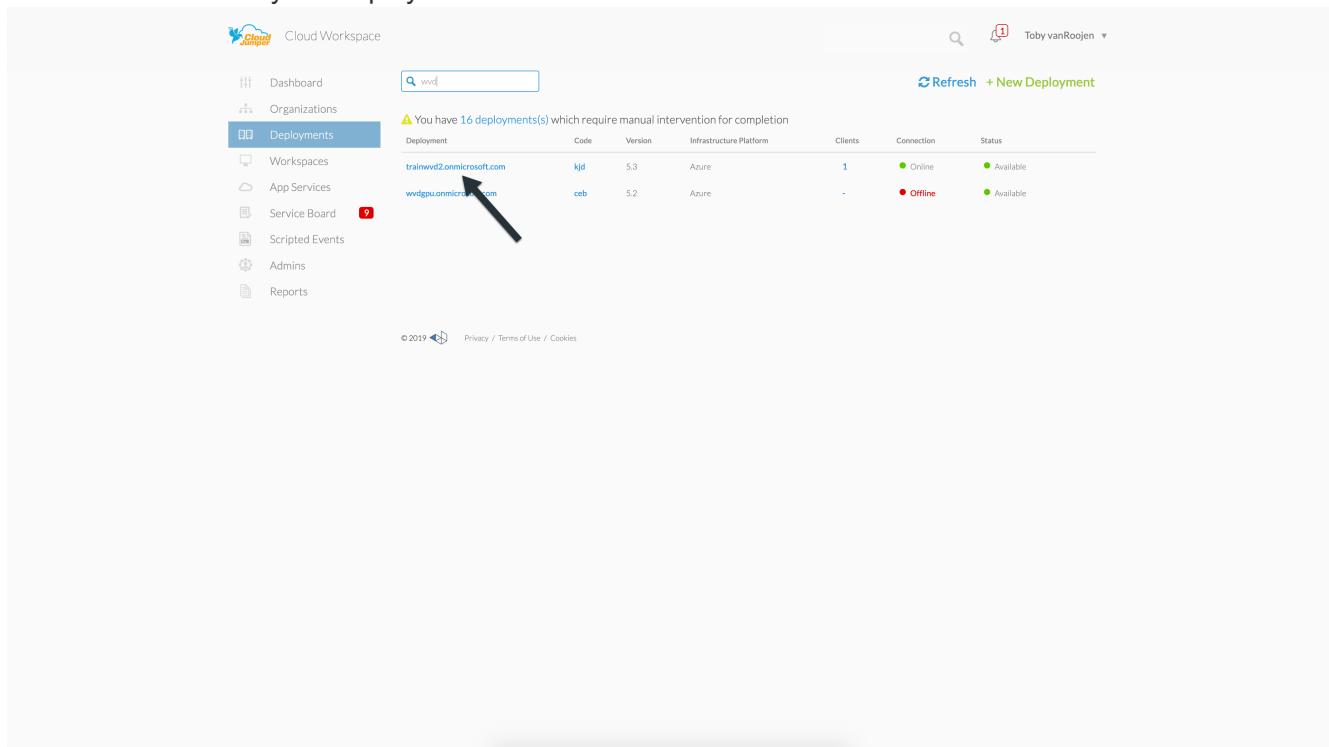
Creating a basic workspace requires disabling the default GPO policies that are created by default.

To do this, follow this one-time process:

1. Log in to VDS at <https://manage.cloudworkspace.com> using your primary admin credentials.
2. Click on the Deployments menu item on the left.



3. Click on the name of your Deployment.



4. Under the Platform Servers section (mid page on right), scroll to the right of the line for CWMGR1 until the gear appears.

Cloud Workspace

All Deployments

trainwvd2.onmicrosoft.com (kjd)

Deployment Details

Workloads

Profile Server

Platform Servers

Platform Processes

Refresh

CWMGR1 2 4 Status: Online

Connect

5. Click on the gear and choose Connect.

Cloud Workspace

All Deployments

trainwvd2.onmicrosoft.com (kjd)

Deployment Details

Workloads

Profile Server

Platform Servers

Platform Processes

Refresh

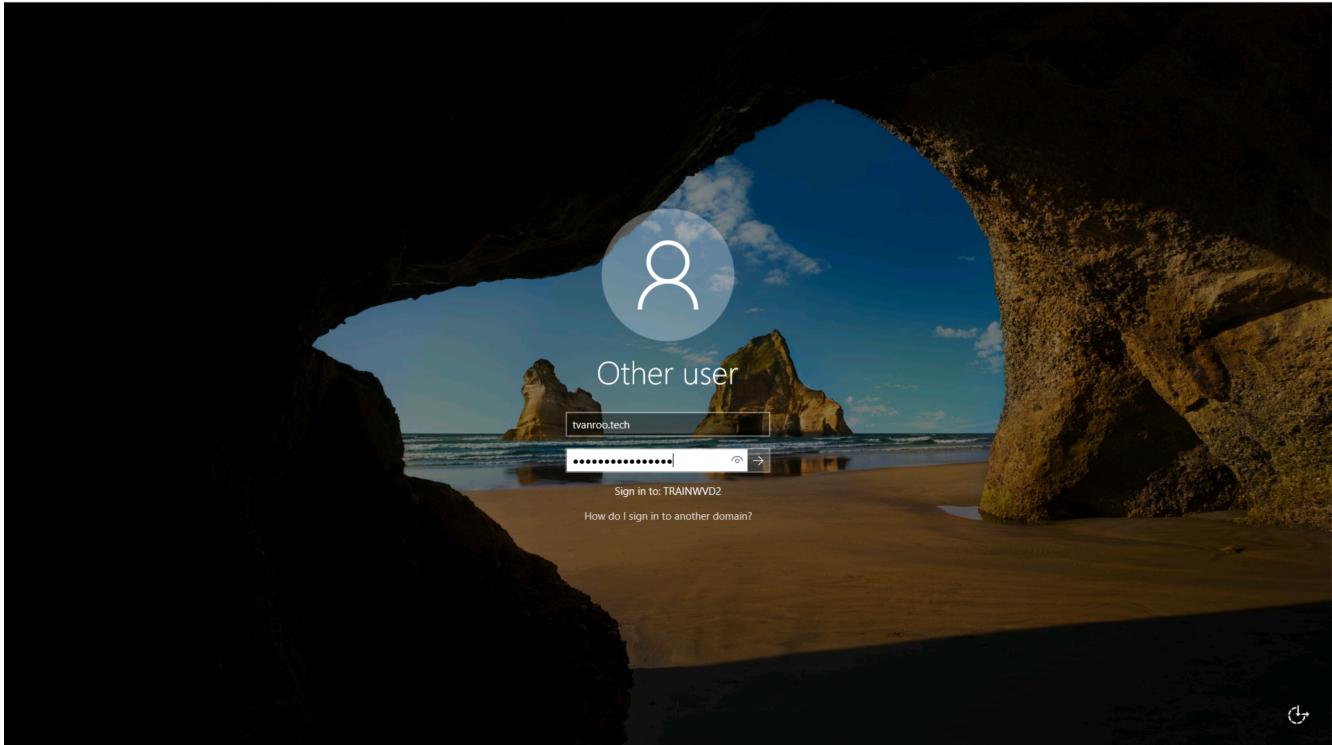
CWMGR1 2 4 Status: Online

Backup

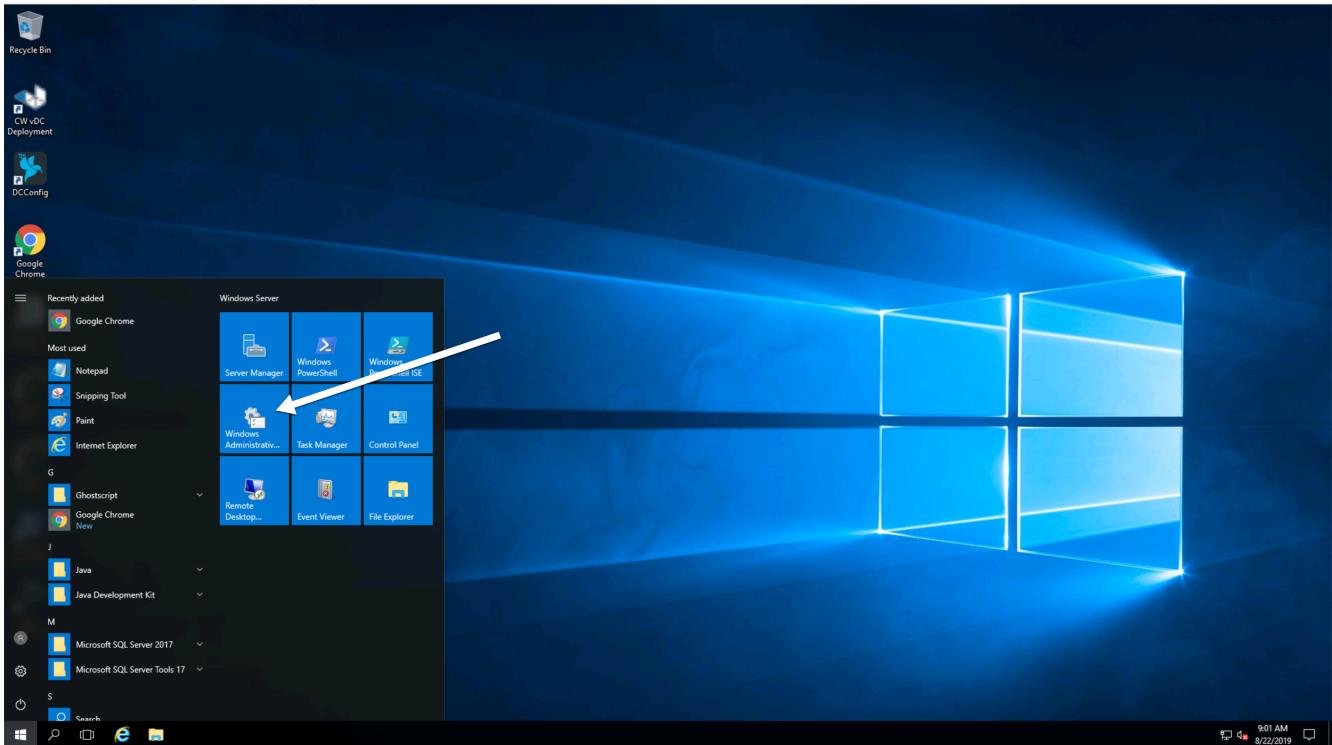
Connect

Connect

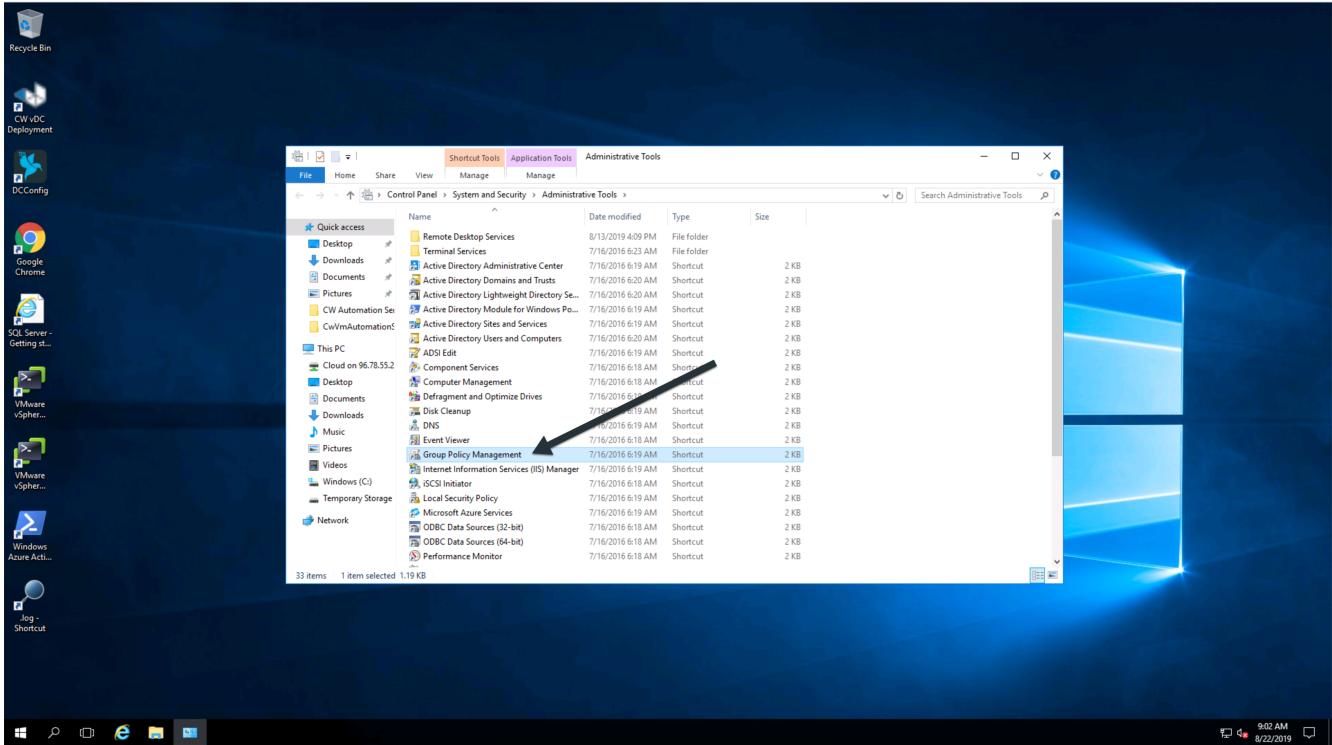
6. Enter the “Tech” credentials you created during provisioning to log on to the CWMGR1 server using HTML5 access.



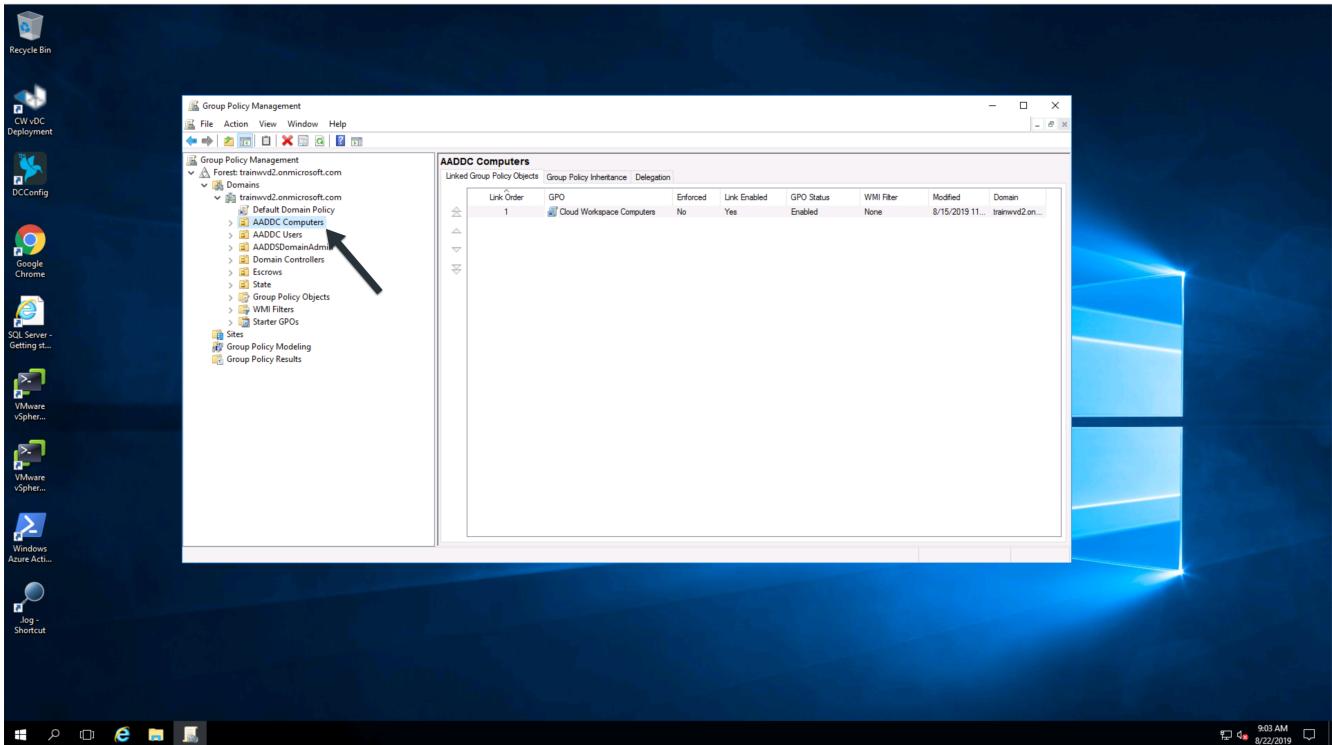
7. Click the Start (Windows) menu, choose Windows Administrative Tools.



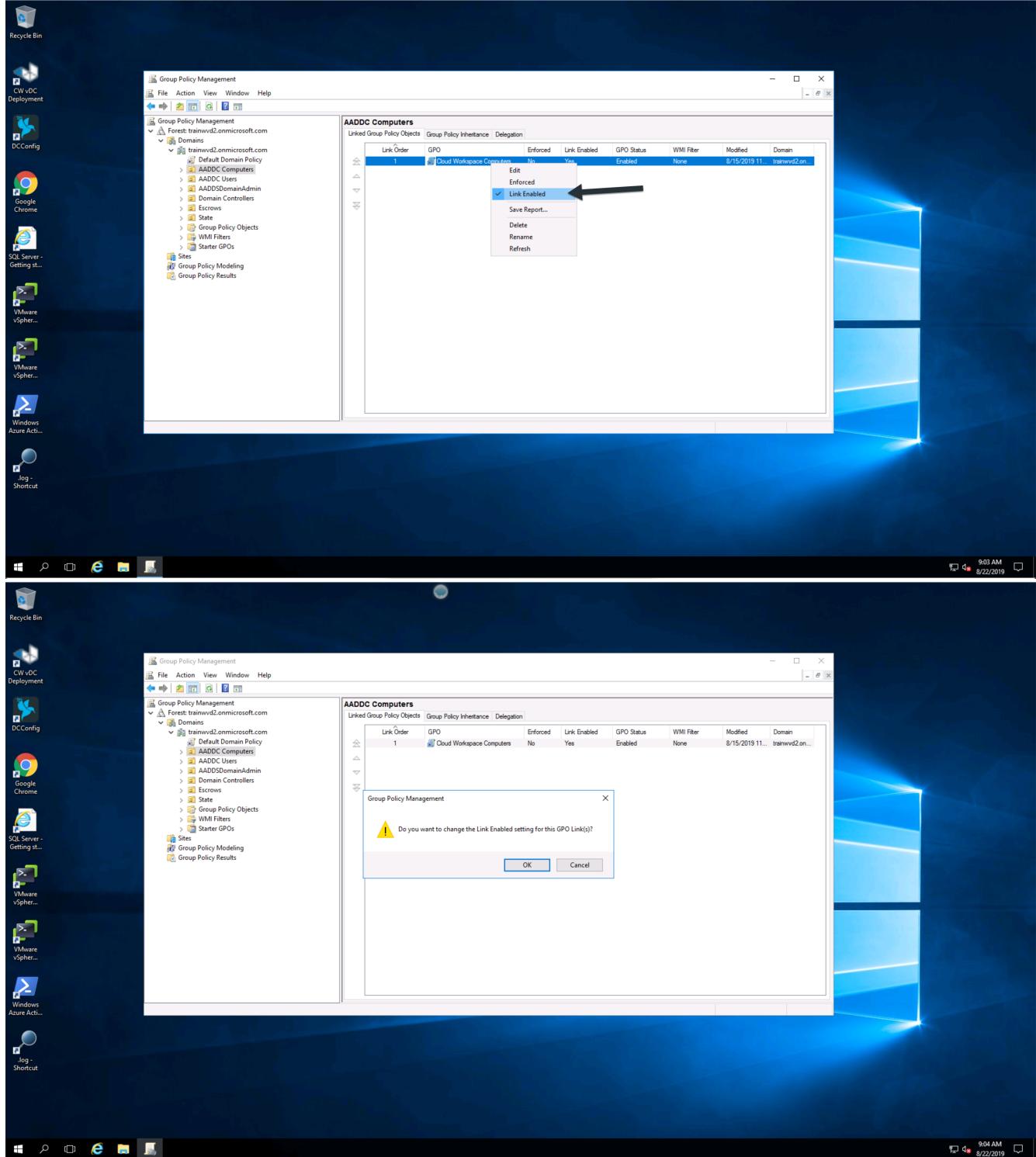
8. Click the Group Policy Management icon.



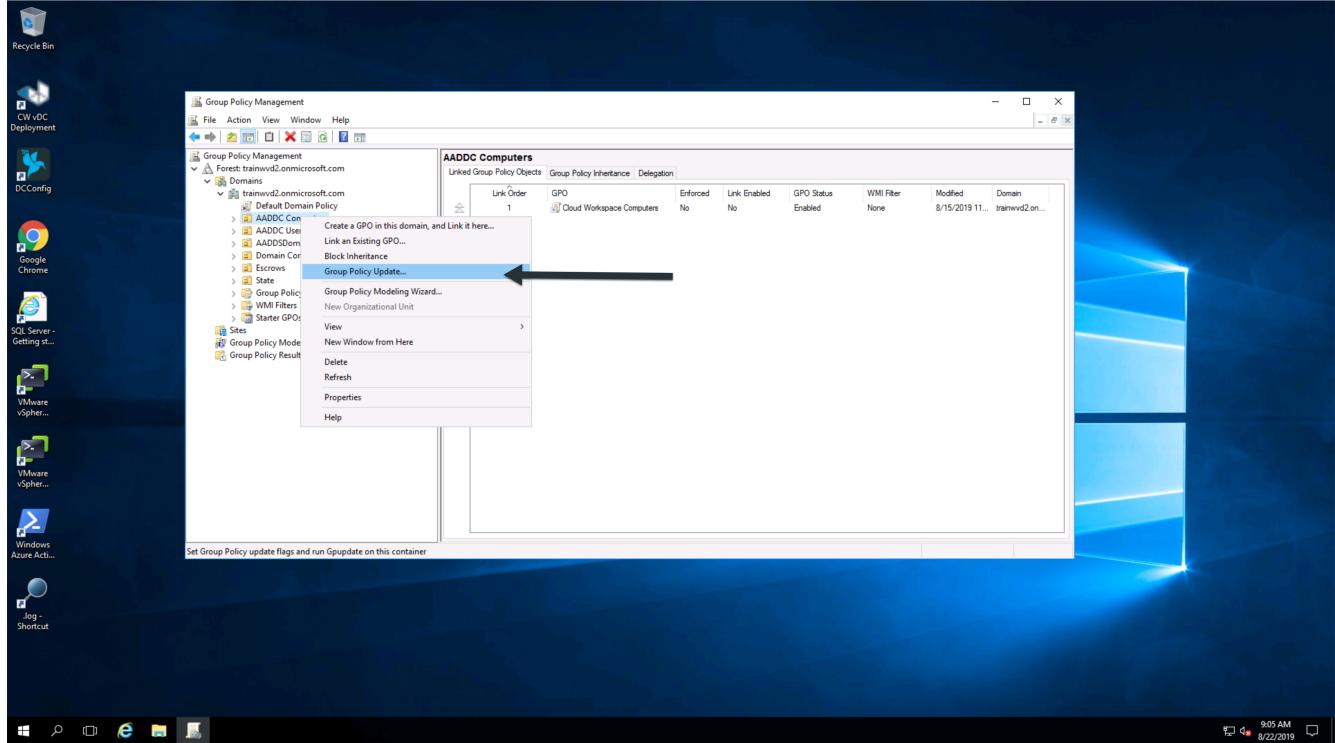
9. Click on the AADDC Users item in the list in the left pane.



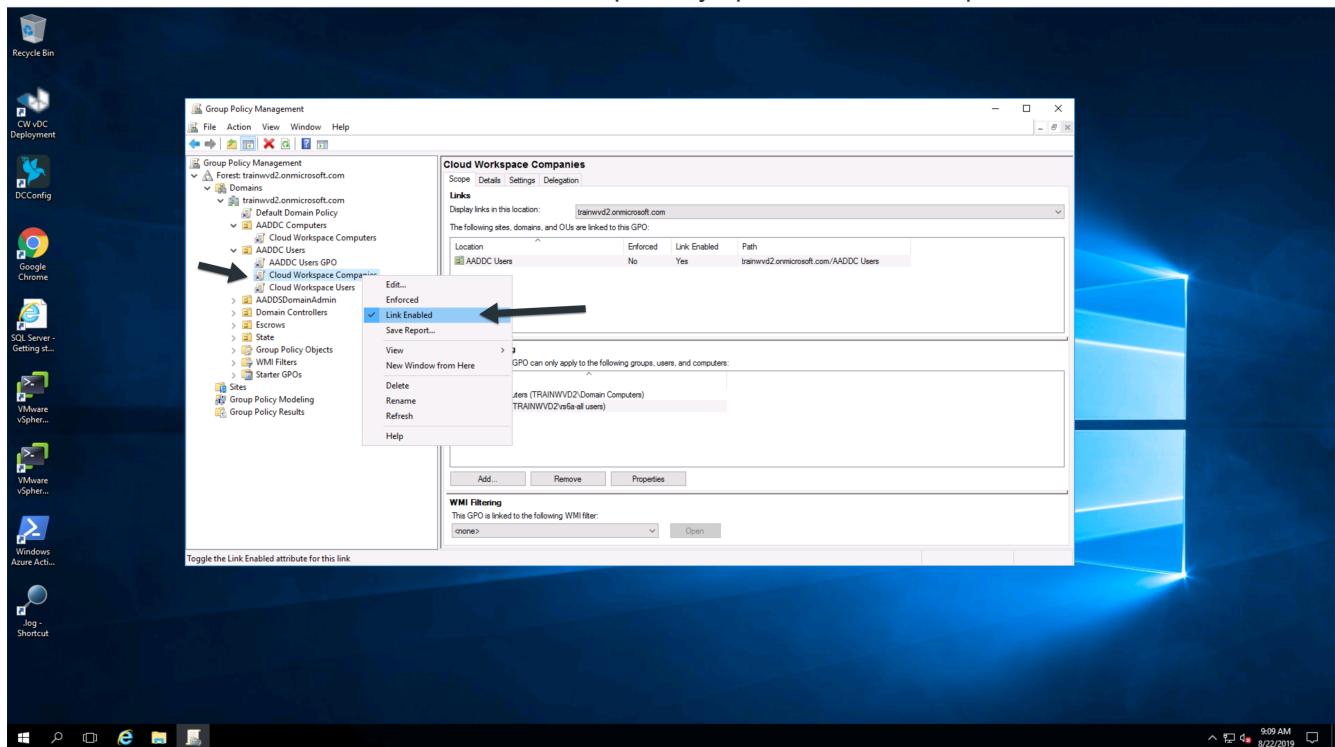
10. Right click on the "Cloud Workspace Users" policy in the list on the right pane, then deselect the "Link Enabled" option. Click OK to confirm this action.

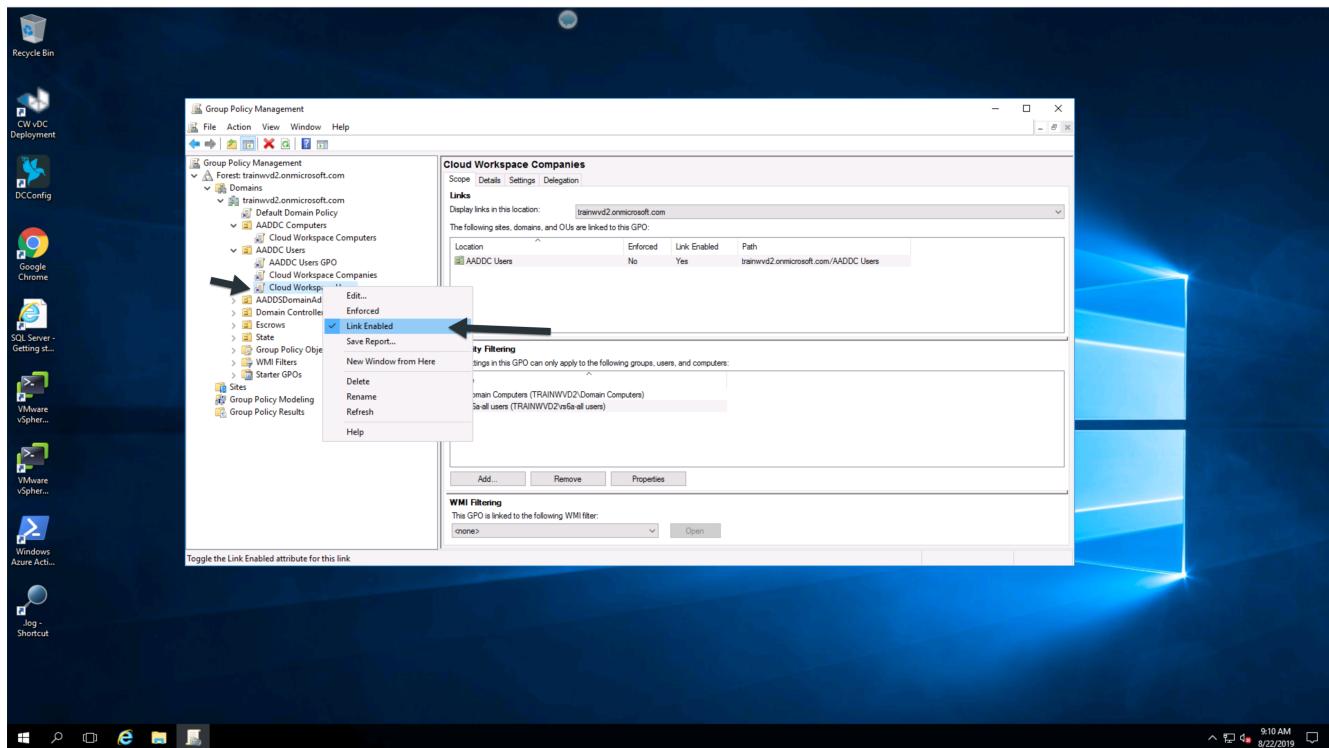


11. Select Action, Group Policy Update from the menu, then confirm that you want to force a policy update on those computers.

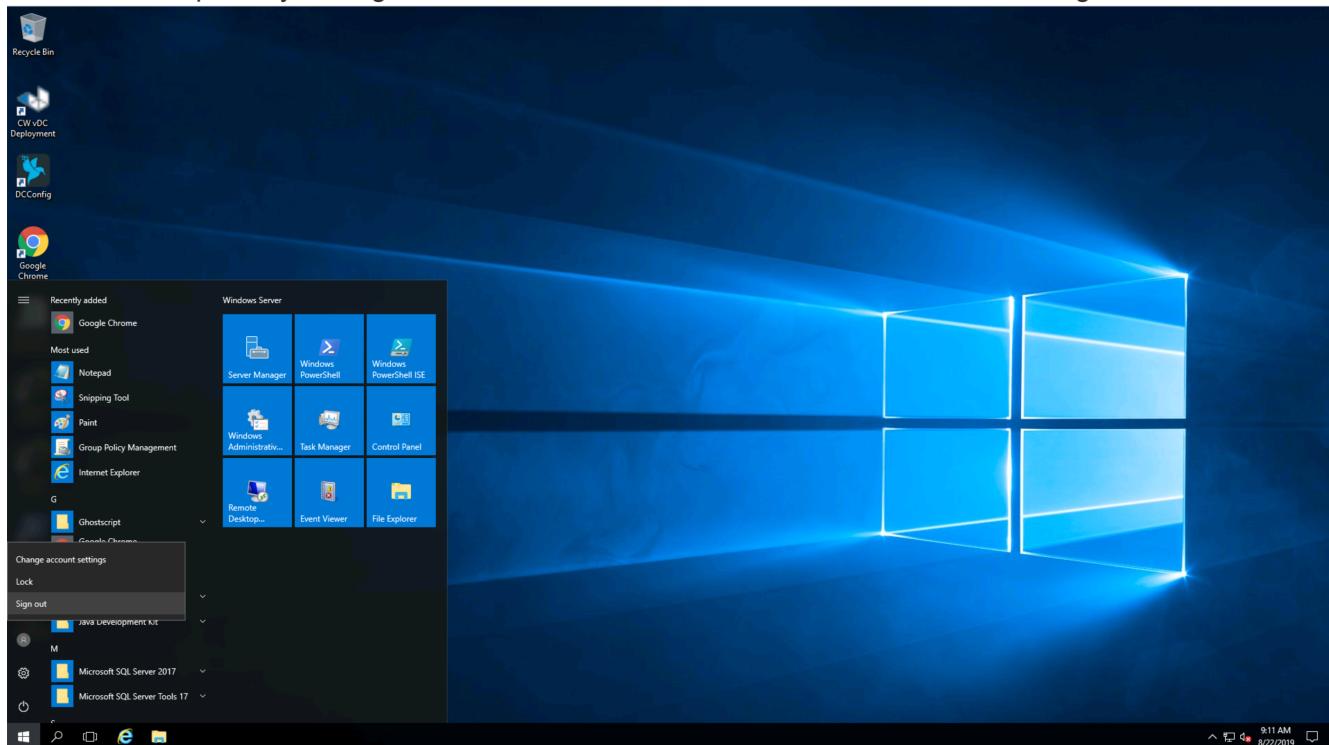


12. Repeat steps 9 and 10 but select “AADDC Users” and “Cloud Workspace Companies” as the policy to disable the Link. You do not need to force a Group Policy update after this step.





13. Close the Group Policy Management editor and Administrative Tools windows, then Log Off.



These steps will provide a basic workspace environment for end users. To confirm, log in as one of your end user accounts – the session environment should not have any of the Controlled Workspace restrictions like hidden Start menu, locked down access to the C:\ drive, and hidden Control Panel.

 The .tech account that was created during deployment has full access to install applications and change security on folders independent of VDS. However, if you want end users from the Azure AD domain to have similar full access, you should add them to the Local Administrators group on each virtual machine.

AVD Deployment Guide - Existing AD Supplemental

Overview

VDS Setup has the ability to connect a new deployment to an existing AD structure. These instruction cover that option in detail.

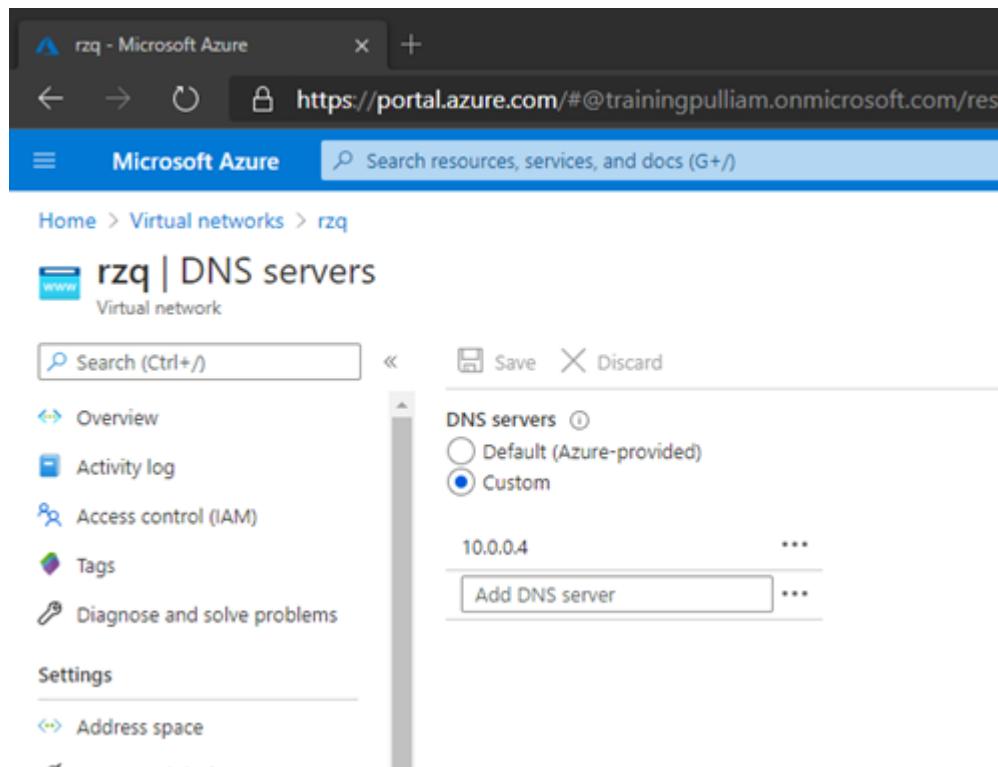
This article does not stand-alone, rather it is a detailed explanation of an alternative to the New AD option covered in the [AVD Deployment Guide](#)

Active Directory type

The next section defines the Active Directory deployment type for the VDS deployment. In this guide we will select Existing Windows Server Active Directory, which will leverage an AD structure that already exists.

Existing AD network

VDS Setup will display a list of vNets that could represent the connection between the existing AD structure and Azure AD. The vNet that you select should have the an Azure-hosted DC that you have configured in Azure. In addition, the vNet will have Custom DNS settings pointed at the Azure-hosted DC.



Existing Active Directory domain name

Enter the existing domain name that will be used. Note: you do not want to use the domain that is found in the Azure Portal under the Active Directory module, as it can cause DNS issues. The primary example of this is that users will not be able to access the that website (<yourdomain>.com, for example) from inside their desktop.

Existing AD username and password

There are three ways to provide the credentials necessary to facilitate a deployment using an existing AD structure.

1. Provide Active Directory Domain Admin Username and Password

This is the easiest method – providing domain admin credential that are used to facilitate the deployment.



This account can be created for a one-time purpose and be deleted once the deployment process is complete.

2. Create Account Matching Required Permissions

This method involves customer administrators manually creating the permission structure here, then entering the credentials for the CloudWorkspaceSVC account here and proceeding.

3. Manual Deployment Process

Contact NetApp VDS Support for assistance configuring AD access with least privileged account principals.

Next Steps

This article covers the unique steps to deploy into an existing AD environment. With these steps complete, you can return to the standard deployment guide [here](#).

VDS Components and Permissions

AVD and VDS security entities and services

Azure Virtual Desktop (AVD) requires security accounts and components in both Azure AD and the local Active Directory to perform automated actions. NetApp's Virtual Desktop Service (VDS) creates components and security settings during the deployment process that allow administrators to control the AVD environment. This document describes the relevant VDS accounts, components, and security settings in both environments.

The components and permissions of the deployment automation process are mostly distinct from the components of the final deployed environment. Therefore this article is constructed in two major sections, the deployment automation section and the deployed environment section.



AVD deployment automation components & permissions

VDS deployment leverages multiple Azure and NetApp components and security permissions to implement both deployments and workspaces.

VDS Deployment Services

Enterprise applications

VDS leverages Enterprise Applications and App Registrations in a tenant's Azure AD domain. The Enterprise Applications are the conduit for the calls against the Azure Resource Manager, Azure Graph and (if using the AVD Fall Release) AVD API endpoints from the Azure AD instance security context using the delegated roles and permissions granted to the associated Service Principal. App registrations may be created depending on initialization state of AVD services for the tenant through VDS.

To enable the creation and management of these VMs, VDS creates several supporting components in the Azure Subscription:

Cloud Workspace

This is the initial Enterprise Application admins grant consent to and is used during VDS Setup Wizard's deployment process.

The Cloud Workspace Enterprise Application requests a specific set of permissions during the VDS Setup Process. These permissions are:

- Access Directory as the Signed In User (Delegated)
- Read and Write Directory Data (Delegated)
- Sign In and Read User Profile (Delegated)
- Sign Users in (Delegated)
- View Users' Basic Profile (Delegated)
- Access Azure Service Management as Organization Users (Delegated)

Cloud Workspace API

Handles general management calls for Azure PaaS functions. Examples of Azure PaaS functions are Azure Compute, Azure Backup, Azure Files, etc. This Service Principal requires Owner rights to the target Azure subscription during initial deployment, and Contributor rights for ongoing management (note: Use of Azure Files requires subscription Owner rights in order to set per user permissions on Azure File objects).

The Cloud Workspace API Enterprise Application requests a specific set of permissions during the VDS Setup Process. These permissions are:

- Subscription Contributor (or Subscription Owner if Azure Files is used)
- Azure AD Graph
 - Read and Write All Applications (Application)
 - Manage Apps That This App Creates or Owns (Application)
 - Read and Write Devices (Application)
 - Access the Directory as the Signed In User (Delegated)
 - Read Directory Data (Application)
 - Read Directory Data (Delegated)
 - Read and Write Directory Data (Application)
 - Read and Write Directory Data (Delegated)
 - Read and Write Domains (Application)

- Read All Groups (Delegated)
- Read and Write All Groups (Delegated)
- Read All Hidden Memberships (Application)
- Read Hidden Memberships (Delegated)
- Sign In and Read User Profile (Delegated)
- Read All Users' Full Profiles (Delegated)
- Read All Users' Basic Profiles (Delegated)
- Azure Service Management
 - Access Azure Service Management as Organization Users (Delegated)

NetApp VDS

NetApp VDS components are used via the VDS control plane to automate the deployment and configuration of AVD roles, services and resources.

Custom role

The Automation Contributor role is created to facilitate deployments via least privileged methodologies. This role allows the CWMGR1 VM to access the Azure automation account.

Automation account

An Automation account is created during deployment and is a required component during the provisioning process. The Automation account contains variables, credentials, modules and Desired State Configurations and references the Key Vault.

Desired state configuration

This is the method used to build the configuration of CWMGR1. The configuration file is downloaded to the VM and applied via Local Configuration Manager on the VM. Examples of configuration elements include:

- Installing Windows features
- Installing software
- Applying software configurations
- Ensuring the proper permission sets are applied
- Applying the Let's Encrypt certificate
- Ensuring DNS records are correct
- Ensuring that CWMGR1 is joined to the domain

Modules:

- ActiveDirectoryDsc: Desired state configuration resource for deployment and configuration of Active Directory. These resources allow you to configure new domains, child domains and high availability domain controllers, establish cross-domain trusts and manage users, groups and OUs.
- Az.Accounts: A Microsoft provided module used for managing credentials and common configuration elements for Azure modules
- Az.Automation: A Microsoft provided module for Azure Automation commandlets

- Az.Compute: A Microsoft provided module for Azure Compute commandlets
- Az.KeyVault: A Microsoft provided module for Azure Key Vault commandlets
- Az.Resources: A Microsoft provided module for Azure Resource Manager commandlets
- cChoco: Desired state configuration resource for downloading and installing packages using Chocolatey
- cjAz: this NetApp-created module provides automation tools to the Azure automation module
- cjAzACS: this NetApp-created module contains environment automation functions and PowerShell processes that run from within the user context.
- cjAzBuild: this NetApp-created module contains build and maintenance automation and PowerShell processes that run from the system context.
- cNtfsAccessControl: Desired state configuration resource for NTFS access control management
- ComputerManagementDsc: Desired state configuration resource that allow computer management tasks such as joining a domain and scheduling tasks as well as configuring items such as virtual memory, event logs, time zones and power settings.
- cUserRightsAssignment: Desired state configuration resource that allow management of user rights such as logon rights and privileges
- NetworkingDsc: Desired state configuration resource for networking
- xCertificate: Desired state configuration resource to simplify management of certificates on Windows Server.
- xDnsServer: Desired state configuration resource for configuration and management of Windows Server DNS Server
- xNetworking: Desired state configuration resource related to networking.
- xRemoteDesktopAdmin: this module utilizes a repository that contains desired state configuration resources for configuring remote desktop settings and Windows firewall on a local or remote machine.
- xRemoteDesktopSessionHost: Desired state configuration resource (xRDSessionDeployment, xRDSessionCollection, xRDSessionCollectionConfiguration and xRDRemoteApp) enabling the creation and configuration of a Remote Desktop Session Host (RDSH) instance
- xSmbShare: Desired state configuration resource for configuration and managing an SMB share
- xSystemSecurity: Desired state configuration resource for managing UAC and IE Esc

 Azure Virtual Desktop also installs Azure components, including Enterprise Applications and App Registrations for Azure Virtual Desktop and Azure Virtual Desktop Client, the AVD Tenant, AVD Host Pools, AVD App Groups, and AVD registered Virtual Machines. While VDS Automation components manage these components, AVD controls their default configuration and attribute set so refer to the AVD documentation for details.

Hybrid AD components

To facilitate integration with existing AD either on-premises or running in the public cloud, additional components and permissions are required in the existing AD environment.

Domain Controller

The existing domain controller can be integrated into a AVD deployment via AD Connect and/or a site-to-site VPN (or Azure ExpressRoute).

AD Connect

To facilitate successful user authentication through the AVD PaaS-services, AD connect can be used to sync the domain controller with Azure AD.

Security Group

VDS uses a Active Directory Security Group called CW-Infrastructure to contain the permissions required for automating the Active Directory dependent tasks such as domain join and GPO policy attachment.

Service Account

VDS uses an Active Directory service account called CloudworkspaceSVC that is used as the identity for the VDS Windows services and the IIS application service. This account is non-interactive (does not allow RDP login) and is the primary member of the CW-Infrastructure account

VPN or ExpressRoute

A site-to-site VPN or Azure ExpressRoute can be used to directly join Azure VMs with the existing domain. This is an optional configuration available when project requirements dictate it.

Local AD permission delegation

NetApp provides an optional tool that can streamline the hybrid AD process. If using NetApp's optional tool, it must:

- Run on a server OS as opposed to a Workstation OS
- Run on a server that is joined to the domain or is a domain controller
- Have PowerShell 5.0 or greater in place on both the server running the tool (if not run on the Domain Controller) and the Domain Controller
- Be run by a user with Domain Admin privileges OR be run by a user with local administrator permissions and ability to supply a Domain Administrator credential (for use with RunAs)

Whether created manually or applied by NetApp's tool, the permissions required are:

- CW-Infrastructure group
 - The Cloud Workspace Infrastructure (**CW-Infrastructure**) security group is granted Full Control to the Cloud Workspace OU level and all descendent objects
 - <deployment code>.cloudworkspace.app DNS Zone – CW-Infrastructure group granted CreateChild, DeleteChild, ListChildren, ReadProperty, DeleteTree, ExtendedRight, Delete, GenericWrite
 - DNS Server – CW-Infrastructure Group granted ReadProperty, GenericExecute
 - Local admin access for VMs created (CWMGR1, AVD session VMs) (done by group policy on the managed AVD systems)
- CW-CWMGRAccess group This group provides local administrative rights to CWMGR1 on all templates, the single server, new native Active Directory template utilizes the built-in groups Server Operators Remote Desktop Users, and Network Configuration Operators.

AVD environmental components & permissions

Once the deployment automation process is complete the ongoing use and administration of deployments and workspaces a distinct set of components and permissions are required as defined below. Many of the

components and permissions from above remain relevant but this section is focused on defining the structure of a deployed.

The components of VDS deployments and workspaces can be organized into several logical categories:

- End user clients
- VDS control plane components
- Microsoft Azure AVD-PaaS components
- VDS platform components
- VDS workspace components in Azure Tenant
- Hybrid AD Components

End user clients

Users can connect to their AVD desktop and/or from a variety of endpoint types. Microsoft has published client applications for Windows, macOS, Android and iOS. Additionally, a web client is available for client-less access.

There are some Linux thin-client vendors who have published endpoint client for AVD. These are listed at <https://docs.microsoft.com/en-us/azure/virtual-desktop/linux-overview>

VDS control plane components

VDS REST API

VDS is built on fully documented REST APIs so that all actions available in the web app are also available via the API. Documentation for the API is here: <https://api.cloudworkspace.com/5.4/swagger/ui/index#>

VDS web app

VDS admins can interact with the AVD application via the VDS web app. This web portal is at: <https://manage.cloudworkspace.com>

Control plane database

VDS data and settings are stored in the control plane SQL database, hosted and managed by NetApp.

VDS Comms

Azure tenant components

VDS deployment automation creates a single Azure Resource Group to contain the other AVD components, including VMs, network subnets, network security groups, and either Azure Files containers or Azure NetApp Files capacity pools. Note – the default is a single resource group, but VDS has tools to create resources in additional Resource Groups if desired.

Microsoft Azure AVD-PaaS components

AVD REST API

Microsoft AVD can be managed via API. VDS leveraged these APIs extensively to automate and manage AVD environments. Documentation is at: <https://docs.microsoft.com/en-us/rest/api/desktopvirtualization/>

Session broker

The broker determines the resources authorized for the user and orchestrates the connection of the user to the gateway.

Azure diagnostics

Azure Diagnostics has been specially built to support AVD deployments.

AVD web client

Microsoft has provided a web client for users to connect to their AVD resources without a locally installed client.

Session gateway

The locally installed RD client connects to the gateway to securely communicate into the AVD environment.

VDS platform components

CWMGR1

CWMGR1 is the VDS control VM for each Deployment. By default, it is created as a Windows 2019 Server VM in the target Azure subscription. See the Local Deployment section for the list of VDS and 3rd party components installed on CWMGR1.

AVD requires the AVD VMs be joined to an Active Directory domain. To facilitate this process and to provide the automation tools for managing the VDS environment several components are installed on the CWMGR1 VM described above and several components are added to the AD instance. The components include:

- **Windows Services** - VDS uses Windows services to perform automation and management actions from within a deployment:
 - **CW Automation Service** is a Windows Service deployed on CWMGR1 in each AVD deployment that performs many of the user-facing automation tasks in the environment. This service runs under the **CloudWorkspaceSVC** AD account.
 - **CW VM Automation Service** is a Windows Service deployed on CWMGR1 in each AVD deployment that performs the virtual machine management functions. This service runs under the **CloudWorkspaceSVC** AD account.
 - **CW Agent Service** is a Windows Service deployed to each virtual machine under VDS management, including CWMGR1. This service runs under the **LocalSystem** context on the virtual machine.
 - **CWManagerX API** is an IIS app pool-based listener installed on CWMGR1 in each AVD deployment. This handles inbound requests from the global control plane and is run under the **CloudWorkspaceSVC** AD account.
- **SQL Server 2017 Express** – VDS creates a SQL Server Express instance on the CWMGR1 VM to manage the metadata generated by the automation components.
- **Internet Information Services (IIS)** – IIS is enabled on CWMGR1 to host the CWManagerX and CWApps IIS application (only if RDS RemoteApp functionality is enabled). VDS requires IIS version 7.5 or greater.
- **HTML5 Portal (Optional)** – VDS installs the Spark Gateway service to provide HTML5 access to the VMs in the Deployment and from the VDS web application. This is a Java based application and can be disabled and removed if this method of access is not desired.
- **RD Gateway (Optional)** – VDS enables the RD Gateway role on CWMGR1 to provide RDP access to RDS Collection based Resource Pools. This role can be disabled/uninstalled if only AVD Reverse Connect

access is desired.

- **RD Web (Optional)** – VDS enables the RD Web role and creates the CWApps IIS web application. This role can be disabled if only AVD access is desired.
- **DC Config** – a Windows application used to perform Deployment and VDS Site specific configuration and advanced configuration tasks.
- **Test VDC Tools** – a Windows application that supports direct task execution for Virtual Machine and client level configuration changes used in the rare case where API or Web Application tasks need to be modified for troubleshooting purposes.
- **Let's Encrypt Wildcard Certificate (Optional)** – created and managed by VDS – all VMs that require HTTPS traffic over TLS are updated with the certificate nightly. Renewal is also handled by automated task (certificates are 90 day so renewal starts shortly before). Customer can provide their own wildcard certificate if desired.
VDS also requires several Active Directory components to support the Automation tasks. The design intent is to utilize a minimum number of AD component and permission additions while still supporting the environment for automated management. These components include:
 - **Cloud Workspace Organizational Unit (OU)** – this Organization Unit will act as the primary AD container for the required child components. Permissions for the CW-Infrastructure and Client DHP Access groups will be set at this level and its child components. See Appendix A for sub-OUs that are created in this OU.
 - **Cloud Workspace Infrastructure Group (CW-Infrastructure)** is a security group created in the local AD to allow required delegated permissions to be assigned to the VDS service account (**CloudWorkspaceSVC**)
 - **Client DHP Access Group (ClientDHPAccess)** is a security group created in the local AD to allow VDS to govern the location in which the company shared, user home and profile data reside.
 - **CloudWorkspaceSVC** service account (member of Cloud Workspace Infrastructure Group)
 - **DNS zone for <deployment code>.cloudworkspace.app domain** (this domain manages the auto-created DNS names for session host VMs) – created by Deploy configuration.
 - **NetApp-specific GPOs** linked to various child OUs of the Cloud Workspace Organizational Unit. These GPOs are:
 - **Cloud Workspace GPO (linked to Cloud Workspace OU)** – Defines access protocols and methods for members of the CW-Infrastructure Group. Also adds the group to the local Administrators Group on AVD session hosts.
 - **Cloud Workspace Firewall GPO** (linked to Dedicated Customers Servers, Remote Desktop and Staging OUs) - creates a policy that ensures and isolates connections to sessions hosts from Platform server(s).
 - **Cloud Workspace RDS** (Dedicated Customers Servers, Remote Desktop and Staging OUs) - policy set limits for session quality, reliability, disconnect timeout limits. For RDS sessions the TS licensing Server Value is defined.
 - **Cloud Workspace Companies** (NOT LINKED by default) – optional GPO to “lock down” a user session/ workspace by preventing access to administrative tools and areas. Can be linked/enabled to provide a restricted activity workspace.



Default Group Policy setting configurations can be provided on request.

VDS workspace components

Data layer

Azure NetApp Files

An Azure NetApp Files Capacity Pool and associated Volume(s) will be created if you choose Azure NetApp Files as the Data Layer option in VDS Setup. The Volume hosts the shared file storage for user profiles (via FSLogix containers), user personal folders, and the corporate data share folder.

Azure Files

An Azure File Share and its associated Azure Storage Account will be created if you chose Azure Files as the Data Layer option in CWS Setup. The Azure File Share hosts the shared file storage for user profiles (via FSLogix containers), user personal folders, and the corporate data share folder.

File server with Managed Disk

A Windows Server VM is created with a Managed Disk if you choose File Server as the Data Layer option in VDS Setup. The File Server hosts the shared file storage for user profiles (via FSLogix containers), user personal folders, and the corporate data share folder.

Azure networking

Azure virtual network

VDS creates an Azure Virtual Network and supporting subnets. VDS requires a separate subnet for CWMGR1, AVD host machines, and Azure domain controllers and peering between the subnets. Note that the AD controller subnet typically already exists so the VDS deployed subnets will need to be peered with the existing subnet.

Network security groups

A network security group is created to control access to the CWMGR1 VM.

- Tenant: contains IP addresses for use by session host and data VMs
- Services: contains IP addresses for use by PaaS services (Azure NetApp Files, for example)
- Platform: contains IP addresses for use as NetApp platform VMs (CWMGR1 and any gateway servers)
- Directory: contains IP addresses for use as Active Directory VMs

Azure AD

The VDS automation and orchestration deploys virtual machines into a targeted Active Directory instance and then joins the machines to the designated host pool. AVD virtual machines are governed at a computer level by both the AD structure (organizational units, group policy, local computer administrator permissions etc.) and membership in the AVD structure (host pools, workspace app group membership), which are governed by Azure AD entities and permissions. VDS handles this “dual control” environment by using the VDS Enterprise application/Azure Service Principal for AVD actions and the local AD service account (CloudWorkspaceSVC) for local AD and local computer actions.

The specific steps for creating a AVD virtual machine and adding it to the AVD host pool include:

- Create Virtual Machine from Azure template visible to the Azure Subscription associated with AVD (uses Azure Service Principal permissions)

- Check/Configure DNS address for new Virtual Machine using the Azure VNet designated during VDS Deployment (requires local AD permissions (everything delegated to CW-Infrastructure above) Sets the Virtual Machine name using the standard VDS naming scheme **{companycode}TS{sequencenumber}**. Example: XYZTS3. (Requires local AD permissions (placed into OU structure we have created on-prem (remote desktop/companycode/shared) (same permission/group description as above)
- Places virtual machine in designated Active Directory Organizational Unit (AD) (requires the delegated permissions to the OU structure (designated during manual process above))
- Update internal AD DNS directory with the new machine name/ IP address (requires local AD permissions)
- Join new virtual machine to local AD domain (requires local AD permissions)
- Update VDS local database with new server information (does not require additional permissions)
- Join VM to designated AVD Host Pool (requires AVD Service Principal permissions)
- Install Chocolatey components to the new Virtual Machine (requires local computer administrative privilege for the **CloudWorkspaceSVC** account)
- Install FSLogix components for the AVD instance (Requires local computer administrative permissions on the AVD OU in the local AD)
- Update AD Windows Firewall GPO to allow traffic to the new VM (Requires AD GPO create/modify for policies associated with the AVD OU and its associated virtual machines. Requires AD GPO policy create/modify on the AVD OU in the local AD. Can be turned off post-install if not managing VMs via VDS.)
- Set “Allow New Connections” flag on the new virtual machine (requires Azure Service Principal permissions)

Joining VMs to Azure AD

Virtual machines in the Azure tenant need to be joined to the domain however VMs cannot joining directly to Azure AD. Therefore, VDS deploys the domain controller role in the VDS platform and then we sync that DC with Azure AD using AD Connect. Alternative configuration options include using Azure AD Domain Services (AADDS), syncing to a hybrid DC (a VM on-premises or elsewhere) using AD Connect, or directly joining the VMs to a hybrid DC through a site-to-site VPN or Azure ExpressRoute.

AVD Host pools

Host pools are a collection of one or more identical virtual machines (VMs) within Azure Virtual Desktop environments. Each host pool can contain an app group that users can interact with as they would on a physical desktop.

Session hosts

Within any host pool is one or more identical virtual machines. These user sessions connecting to this host pool are load balanced by the AVD load balancer service.

App groups

By default, the *Desktop users* app group is created at deployment. All users within this app group are presented with a full Windows desktop experience. Additionally app groups can be created to serve streaming-app services.

Log analytics workspace

A Log Analytics workspace is created to store logs from the deployment and DSC processes and from other services. This can be deleted after deployment, but this isn't recommended as it enables other functionality.

Logs are retained for 30 days by default, incurring no charges for retention.

Availability sets

An Availability Set is set up as a part of the deployment process to enable separation of shared VMs (shared AVD host pools, RDS resource pools) across fault domains. This can be deleted after deployment if desired but would disable the option to provide additional fault tolerance for shared VMs.

Azure recovery vault

A Recovery Service Vault is created by VDS Automation during deployment. This is currently activated by default, as Azure Backup is applied to CWMGR1 during the deployment process. This can be deactivated and removed if desired but will be recreated if Azure Backup is enabled in the environment.

Azure key vault

An Azure Key Vault is created during the deployment process and is used to store certificates, API keys and credentials that are used by Azure Automation Accounts during deployment.

Appendix A – Default Cloud Workspace organizational unit structure

- Cloud Workspace
 - Cloud Workspace Companies
 - Cloud Workspace Servers
 - Dedicated Customer Servers
 - Infrastructure
- CWMGR Servers
- Gateway Servers
- FTP Servers
- Template VMs
 - Remote Desktop
 - Staging
 - Cloud Workspace Service Accounts
 - Client Service Accounts
 - Infrastructure Service Accounts
 - Cloud Workspace Tech Users
 - Groups
 - Tech 3 Technicians

AVD and VDS v5.4 Prerequisites

AVD and VDS requirements and notes

This document describes the required elements for deploying Azure Virtual Desktop (AVD) using NetApp Virtual Desktop Service (VDS). The “Quick Checklist” provides a brief list of required components and pre-deployment steps to take to ensure an efficient deployment. The rest of the guide provides greater detail for

each element, depending on the configuration choices that are made.

Quick checklist

Azure requirements

- Azure AD Tenant
- Microsoft 365 Licensing to support AVD
- Azure Subscription
- Available Azure Quota for Azure virtual machines
- Azure Admin Account with Global Admin and Subscription Ownership Roles
- Domain admin account with 'Enterprise Admin' role for AD Connect setup

Pre-deployment information

- Determine total number of users
- Determine Azure Region
- Determine Active Directory Type
- Determine Storage Type
- Identify session host VM image or requirements
- Assess existing Azure and on-premises networking configuration

VDS deployment detailed requirements

End user connection requirements

The following Remote Desktop clients support Azure Virtual Desktop:

- Windows Desktop
- Web
- macOS
- iOS
- IGEL Think Client (Linux)
- Android (Preview)



Azure Virtual Desktop does not support the RemoteApp and Desktop Connections (RADC) client or the Remote Desktop Connection (MSTSC) client.



Azure Virtual Desktop does not currently support the Remote Desktop client from the Windows Store. Support for this client will be added in a future release.

The Remote Desktop clients must have access to the following URLs:

Address	Outbound TCP Port	Purpose	Client(s)
*.AVD.microsoft.com	443	Service traffic	All

Address	Outbound TCP Port	Purpose	Client(s)
*.servicebus.windows.net 443 Troubleshooting data	All	go.microsoft.com	443
Microsoft FWLinks	All	aka.ms	443
Microsoft URL shortener	All	docs.microsoft.com	443
Documentation	All	privacy.microsoft.com	443
Privacy statement	All	query.prod.cms.rt.microso ft.com	443



Opening these URLs is essential for a reliable client experience. Blocking access to these URLs is unsupported and will affect service functionality. These URLs only correspond to the client sites and resources, and do not include URLs for other services like Azure Active Directory.

VDS setup wizard starting point

The VDS setup wizard can handle much of the prerequisite setup required for a successful AVD deployment. The setup wizard (<https://cwasetup.cloudworkspace.com>) either creates or uses the following components.

Azure tenant

Required: An Azure tenant and Azure Active Directory

AVD activation in Azure is a tenant-wide setting. VDS supports running one AVD instance per tenant.

Azure subscription

Required: An Azure subscription (note the subscription ID that you want to use)

All the deployed Azure resources should be setup in one dedicated subscription. This makes cost tracking for AVD much easier and simplifies the deployment process.

NOTE: Azure free trials are not supported as they do not have enough credits to deploy a functional AVD deployment.

Azure core quota

Enough quota for the VM families you will use - specifically at least 10 cores of the Ds v3 family for the initial platform deployment (as few as 2 cores can be used, but 10 covers every initial deployment possibility).

Azure admin account

Required: An Azure global administrator account.

The VDS setup wizard requests that the Azure admin grant delegated permissions to the VDS service principal and install the VDS Azure Enterprise application. The admin must have the following Azure roles assigned:

- Global Administrator on the tenant
- Owner role on the subscription

VM image

Required: An Azure image that supports multi-session Windows 10.

The Azure Marketplace provides the most recent versions of their base Windows 10 image and all Azure subscriptions have access to those automatically. If you want to use a different image or a custom image, want the VDS team to provide advice about creating or modifying other images or have general questions about Azure images let us know and we can schedule a conversation.

Active Directory

AVD requires that the user identity be a part of Azure AD and that the VMs are joined to an Active Directory domain that is synced with that same Azure AD instance. VMs cannot be attached directly to the Azure AD instance so a domain controller needs to be configured and in-sync with Azure AD.

These supported options include:

- The automated build of an Active Directory instance within the subscription. The AD instance is typically created by VDS on the VDS control VM (CWMGR1) for Azure Virtual Desktop deployments that use this option. AD Connect must be setup and configured to sync with Azure AD as part of the setup process.

- Integration into an existing Active Directory domain that is accessible from the Azure subscription (typically via Azure VPN or Express Route) and has its user list synced with Azure AD using AD Connect or a 3rd party product.

Storage layer

In AVD the storage strategy is designed so that no persistent user/company data resides on the AVD session VMs. Persistent data for user profiles, user files and folders, and corporate/application data are hosted on one or more data volume(s) hosted on an independent data layer.

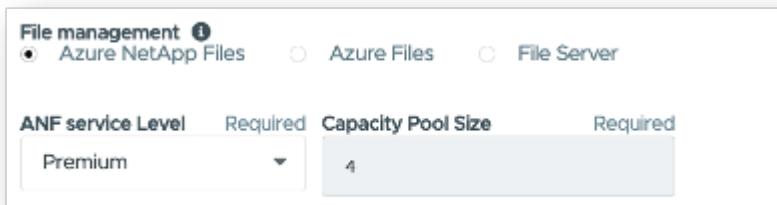
FSLogix is a profile containerization technology that solves many user profile issues (like data sprawl and slow logins) by mounting a user profile container (VHD or VHDX format) to the session host at session initialization.

Due to this architecture a data storage function is required. This function must be able to handle the data

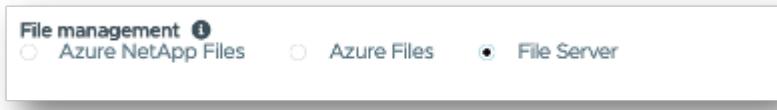
transfer required each morning/afternoon when a significant portion of the users login/logout at the same time. Even moderately sized environments can have significant data transfer requirements. The disk performance of the data storage layer is one of the primary end user performance variables and special care must be taken to appropriately size the performance of this storage, not just the amount of storage. Generally, the storage layer should be sized to support 5-15 IOPS per user.

The VDS Setup wizard supports the following configurations:

- Setup and configuration of Azure NetApp Files (ANF) (Recommended). *ANF standard service level supports up to 150 users, while environments of 150-500 users ANF Premium is recommended. For 500+ users ANF Ultra is recommended.*



- Setup and configuration of a File Server VM



Networking

Required: An inventory of all existing network subnets including any subnets visible to the Azure subscription via an Azure Express Route or VPN. The deployment needs to avoid overlapping subnets.

The VDS setup wizard allows you to define the network scope in case there is a range that is required, or must be avoided, as part of the planned integration with existing networks.

Determine an IP range to use during your deployment. Per Azure best practices, only IP addresses in a private range are supported.

Supported choices include the following but default to a /20 range:

- 192.168.0.0 through 192.168.255.255
- 172.16.0.0 through 172.31.255.255
- 10.0.0.0 through 10.255.255.255

CWMGR1

Some of the unique capabilities of VDS such as the cost saving Workload Scheduling and Live Scaling functionality require an administrative presence within the tenant and subscription. Therefore, an administrative VM called CWMGR1 is deployed as part of the VDS setup wizard automation. In addition to VDS automation tasks this VM also holds VDS configuration in a SQL express database, local log files and an advanced configuration utility called DCCConfig.

Depending on the selections made in the VDS setup wizard, this VM can be used to host additional functionality including:

- An RDS gateway (only used in RDS deployments)
- An HTML 5 gateway (only used in RDS deployments)
- An RDS license server (only used in RDS deployments)
- A Domain Controller (if chosen)

Decision tree in the Deployment Wizard

As part of the initial deployment a series of questions are answered to customize the settings for the new environment. Below is an outline of the major decisions to be made.

Azure region

Decide which Azure region or regions will host your AVD Virtual Machines. Note that Azure NetApp Files and certain VM families (GPU enabled VMs, for example) have a defined Azure region support list while AVD is available in most regions.

- This link can be used to identify [Azure product availability by region](#)

Active Directory type

Decide which Active Directory type you want to use:

- Existing on-prem Active Directory
- Refer to the [AVD VDS Components and Permissions](#) document for an explanation of the required permissions and components in both Azure and the local Active Directory environment
- New Azure subscription based Active Directory instance
- Azure Active Directory Domain Services

Data Storage

Decide where the data for user profiles, individual files, and corporate shares will be placed. Choices include:

- Azure NetApp Files
- Azure Files
- Traditional File Server (Azure VM with Managed Disk)

NetApp VDS Deployment Requirements for Existing Components

NetApp VDS Deployment with Existing Active Directory Domain Controllers

This configuration type extends an existing Active Directory domain to support the AVD instance. In this case VDS deploys a limited set of components into the domain to support automated provisioning and management tasks for the AVD components.

This configuration requires:

- An existing Active Directory domain controller that can be accessed by VMs on the Azure VNet, typically via either Azure VPN or Express Route OR a domain controller that has been created in Azure.
- Addition of VDS components and permissions required for VDS management of AVD host pools and data

volumes as they are joined to the domain. The AVD VDS Components and Permissions guide defines the required components and permissions and the deployment process requires a Domain user with domain privileges to run the script that will create the needed elements.

- Note that the VDS deployment creates a VNet by default for VDS created VMs. The VNet can be either peered with existing Azure network VNets or the CWMGR1 VM can be moved to an existing VNet with the required subnets pre-defined.

Credentials and domain preparation tool

Administrators must provide a Domain Administrator credential at some point in the deployment process. A temporary Domain Administrator credential can be created, used and deleted later (once the deployment process completes).

Alternatively, customers who require assistance in building out the pre-requisites can leverage the Domain Preparation Tool.

NetApp VDS deployment with existing file system

VDS creates Windows shares that allow user profile, personal folders, and corporate data to be accessed from AVD session VMs. VDS will deploy either the File Server or Azure NetApp File options by default, but if you have an existing file storage component VDS can point the shares to that component once the VDS deployment is complete.

The requirements for using and existing storage component:

- The component must support SMB v3
- The component must be joined to the same Active Directory domain as the AVD session hosts
- The component must be able to expose a UNC path for use in the VDS configuration – one path can be used for all three shares or separate paths may be specified for each. Note that VDS will set user level permissions on these shares so refer to the VDS AVD Components and Permissions document to ensure the appropriate permissions have been granted to the VDS Automation Services.

NetApp VDS deployment with existing Azure AD Domain Services

This configuration requires a process to identify the attributes of the existing Azure Active Directory Domain services instance. Contact your account manager to request a deployment of this type.

NetApp VDS Deployment with Existing AVD deployment

This configuration type assumes that the necessary Azure VNet, Active Directory, and AVD components already exist. The VDS deployment is performed in the same manner as the “NetApp VDS Deployment with Existing AD” configuration, but adds the following requirements:

- RD Owner role to the AVD Tenant needs to be granted to the VDS Enterprise Applications in the Azure
- AVD Host Pool and AVD Host Pool VMs need to be imported into VDS using the VDS Import function in the VDS Web App. This process collects the AVD host pool and session VM metadata and stores in it VDS so that these elements can be managed by VDS
- AVD User data needs to be imported into the VDS User section using the CRA tool. This process inserts metadata about each user into the VDS control plane so their AVD App Group membership and session information can be managed by VDS

APPENDIX A: VDS control plane URLs and IP addresses

VDS components in the Azure subscription communicate with the VDS global control plane components such as the the VDS Web Application and the VDS API endpoints. For access, the following base URI addresses need to be safelisted for bi-directional access on port 443:

<https://docs.netapp.com/us-en/virtual-desktop-service/api.cloudworkspace.com>
<https://docs.netapp.com/us-en/virtual-desktop-service/autoprodb.database.windows.net>
<https://docs.netapp.com/us-en/virtual-desktop-service/vdctoolsapi.trafficmanager.net>
<https://docs.netapp.com/us-en/virtual-desktop-service/cjbootstrap3.cjautomate.net>
<https://cdownload3.file.core.windows.net/media>

If your access control device can only safe list by IP address, the following list of IP addresses should be safelisted. Note that VDS uses the Azure Traffic Manager service, so this list may change over time:

13.67.190.243
13.67.215.62
13.89.50.122
13.67.227.115
13.67.227.230
13.67.227.227
23.99.136.91
40.122.119.157
40.78.132.166
40.78.129.17
40.122.52.167
40.70.147.2
40.86.99.202
13.68.19.178
13.68.114.184
137.116.69.208
13.68.18.80
13.68.114.115
13.68.114.136
40.70.63.81
52.171.218.239
52.171.223.92
52.171.217.31
52.171.216.93
52.171.220.134
92.242.140.21

APPENDIX B: Microsoft AVD requirements

This Microsoft AVD Requirements section is a summary of AVD requirements from Microsoft. Complete and current AVD requirements can be found here:

<https://docs.microsoft.com/en-us/azure/virtual-desktop/overview#requirements>

Azure Virtual Desktop session host licensing

Azure Virtual Desktop supports the following operating systems, so make sure you have the appropriate licenses for your users based on the desktop and apps you plan to deploy:

OS	Required license
Windows 10 Enterprise multi-session or Windows 10 Enterprise	Microsoft 365 E3, E5, A3, A5, F3, Business Premium Windows E3, E5, A3, A5

OS	Required license
Windows 7 Enterprise	Microsoft 365 E3, E5, A3, A5, F3, Business Premium Windows E3, E5, A3, A5
Windows Server 2012 R2, 2016, 2019	RDS Client Access License (CAL) with Software Assurance

URL Access for AVD machines

The Azure virtual machines you create for Azure Virtual Desktop must have access to the following URLs:

Address	Outbound TCP Port	Purpose	Service Tag
*.AVD.microsoft.com	443	Service traffic	WindowsVirtualDesktop
mrsglobalsteus2prod.blob.core.windows.net	443	Agent and SXS stack updates	AzureCloud
*.core.windows.net	443	Agent traffic	AzureCloud
*.servicebus.windows.net	443	Agent traffic	AzureCloud
prod.warmpath.msftcloudes.com	443	Agent traffic	AzureCloud
catalogartifact.azureedge.net	443	Azure Marketplace	AzureCloud
kms.core.windows.net	1688	Windows activation	Internet
AVDportalstorageblob.blob.core.windows.net	443	Azure portal support	AzureCloud

The following table lists optional URLs that your Azure virtual machines can have access to:

Address	Outbound TCP Port	Purpose	Service Tag
*.microsoftonline.com	443	Authentication to MS Online Services	None
*.events.data.microsoft.com	443	Telemetry Service	None
www.msftconnecttest.com	443	Detects if the OS is connected to the internet	None
*.prod.do.dsp.mp.microsoft.com	443	Windows Update	None
login.windows.net	443	Login to MS Online Services, Office 365	None
*.sfx.ms	443	Updates for OneDrive client software	None
*.digicert.com	443	Certificate revocation check	None

Optimal performance factors

For optimal performance, make sure your network meets the following requirements:

- Round-trip (RTT) latency from the client's network to the Azure region where host pools have been deployed should be less than 150ms.
- Network traffic may flow outside country/region borders when VMs that host desktops and apps connect to the management service.
- To optimize for network performance, we recommend that the session host's VMs are collocated in the same Azure region as the management service.

Supported virtual machine OS images

Azure Virtual Desktop supports the following x64 operating system images:

- Windows 10 Enterprise multi-session, version 1809 or later
- Windows 10 Enterprise, version 1809 or later
- Windows 7 Enterprise
- Windows Server 2019
- Windows Server 2016
- Windows Server 2012 R2

Azure Virtual Desktop does not support x86 (32-bit), Windows 10 Enterprise N, or Windows 10 Enterprise KN operating system images. Windows 7 also does not support any VHD or VHDX-based profile solutions hosted on managed Azure Storage due to a sector size limitation.

Available automation and deployment options depend on which OS and version you choose, as shown in the following table:

Operating System	Azure Image Gallery	Manual VM Deployment	ARM Template Integration	Provision Host Pools on Azure Marketplace
Windows 10 multi-session, version 1903	Yes	Yes	Yes	Yes
Windows 10 multi-session, version 1809	Yes	Yes	No	No
Windows 10 Enterprise, version 1903	Yes	Yes	Yes	Yes
Windows 10 Enterprise, version 1809	Yes	Yes	No	No
Windows 7 Enterprise	Yes	Yes	No	No
Windows Server 2019	Yes	Yes	No	No
Windows Server 2016	Yes	Yes	Yes	Yes
Windows Server 2012 R2	Yes	Yes	No	No

AVD and VDS v6.0 Prerequisites

AVD and VDS requirements and notes

This document describes the required elements for deploying Azure Virtual Desktop (AVD) using NetApp Virtual Desktop Service (VDS). The “Quick Checklist” provides a brief list of required components and pre-deployment steps to take to ensure an efficient deployment. The rest of the guide provides greater detail for each element, depending on the configuration choices that are made.

Quick checklist

Azure requirements

- Azure AD Tenant
- Microsoft 365 Licensing to support AVD
- Azure Subscription
- Available Azure Quota for Azure virtual machines
- Azure Admin Account with Global Admin and Subscription Ownership Roles
- Domain admin account with 'Enterprise Admin' role for AD Connect setup

Pre-deployment information

- Determine total number of users
- Determine Azure Region
- Determine Active Directory Type
- Determine Storage Type
- Identify session host VM image or requirements
- Assess existing Azure and on-premises networking configuration

VDS deployment detailed requirements

End user connection requirements

The following Remote Desktop clients support Azure Virtual Desktop:

- Windows Desktop
- Web
- macOS
- iOS
- IGEL Think Client (Linux)
- Android (Preview)



Azure Virtual Desktop does not support the RemoteApp and Desktop Connections (RADC) client or the Remote Desktop Connection (MSTSC) client.



Azure Virtual Desktop does not currently support the Remote Desktop client from the Windows Store. Support for this client will be added in a future release.

The Remote Desktop clients must have access to the following URLs:

Address	Outbound TCP Port	Purpose	Client(s)
*.AVD.microsoft.com	443	Service traffic	All
*.servicebus.windows.net 443 Troubleshooting data	All	go.microsoft.com	443
Microsoft FWLinks	All	aka.ms	443
Microsoft URL shortener	All	docs.microsoft.com	443
Documentation	All	privacy.microsoft.com	443
Privacy statement	All	query.prod.cms.rt.microso ft.com	443



Opening these URLs is essential for a reliable client experience. Blocking access to these URLs is unsupported and will affect service functionality. These URLs only correspond to the client sites and resources, and do not include URLs for other services like Azure Active Directory.

VDS setup wizard starting point

The VDS setup wizard can handle much of the prerequisite setup required for a successful AVD deployment. The setup wizard (<https://cwasetup.cloudworkspace.com>) either creates or uses the following components.

Azure tenant

Required: An Azure tenant and Azure Active Directory

AVD activation in Azure is a tenant-wide setting. VDS supports running one AVD instance per tenant.

Azure subscription

Required: An Azure subscription (note the subscription ID that you want to use)

All the deployed Azure resources should be setup in one dedicated subscription. This makes cost tracking for AVD much easier and simplifies the deployment process.

NOTE: Azure free trials are not supported as they do not have enough credits to deploy a functional AVD deployment.

Azure core quota

Enough quota for the VM families you will use - specifically at least 10 cores of the Ds v3 family for the initial platform deployment (as few as 2 cores can be used, but 10 covers every initial deployment possibility).

Azure admin account

Required: An Azure global administrator account.

The VDS setup wizard requests that the Azure admin grant delegated permissions to the VDS service principal and install the VDS Azure Enterprise application. The admin must have the following Azure roles assigned:

- Global Administrator on the tenant
- Owner role on the subscription

VM image

Required: An Azure image that supports multi-session Windows 10.

The Azure Marketplace provides the most recent versions of their base Windows 10 image and all Azure subscriptions have access to those automatically. If you want to use a different image or a custom image, want the VDS team to provide advice about creating or modifying other images or have general questions about Azure images let us know and we can schedule a conversation.

Active Directory

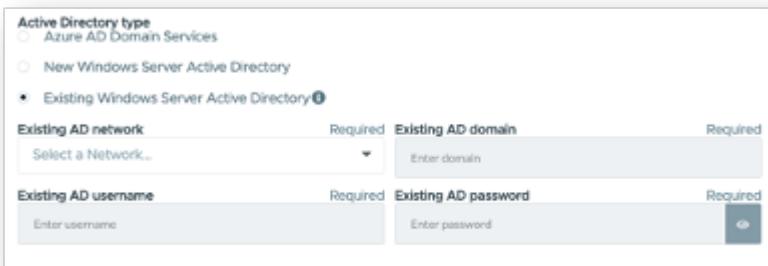
AVD requires that the user identity be a part of Azure AD and that the VMs are joined to an Active Directory domain that is synced with that same Azure AD instance. VMs cannot be attached directly to the Azure AD instance so a domain controller needs to be configured and in-sync with Azure AD.

These supported options include:

- The automated build of an Active Directory instance within the subscription. The AD instance is typically created by VDS on the VDS control VM (CWMGR1) for Azure Virtual Desktop deployments that use this option. AD Connect must be setup and configured to sync with Azure AD as part of the setup process.



- Integration into an existing Active Directory domain that is accessible from the Azure subscription (typically via Azure VPN or Express Route) and has its user list synced with Azure AD using AD Connect or a 3rd party product.



Storage layer

In AVD the storage strategy is designed so that no persistent user/company data resides on the AVD session VMs. Persistent data for user profiles, user files and folders, and corporate/application data are hosted on one or more data volume(s) hosted on an independent data layer.

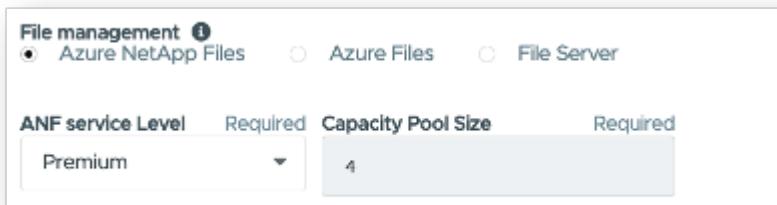
FSLogix is a profile containerization technology that solves many user profile issues (like data sprawl and slow logins) by mounting a user profile container (VHD or VHDX format) to the session host at session initialization.

Due to this architecture a data storage function is required. This function must be able to handle the data

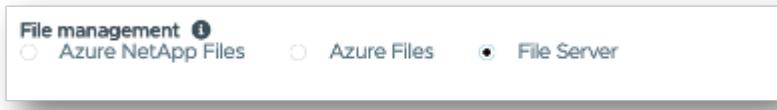
transfer required each morning/afternoon when a significant portion of the users login/logout at the same time. Even moderately sized environments can have significant data transfer requirements. The disk performance of the data storage layer is one of the primary end user performance variables and special care must be taken to appropriately size the performance of this storage, not just the amount of storage. Generally, the storage layer should be sized to support 5-15 IOPS per user.

The VDS Setup wizard supports the following configurations:

- Setup and configuration of Azure NetApp Files (ANF) (Recommended). *ANF standard service level supports up to 150 users, while environments of 150-500 users ANF Premium is recommended. For 500+ users ANF Ultra is recommended.*



- Setup and configuration of a File Server VM



Networking

Required: An inventory of all existing network subnets including any subnets visible to the Azure subscription via an Azure Express Route or VPN. The deployment needs to avoid overlapping subnets.

The VDS setup wizard allows you to define the network scope in case there is a range that is required, or must be avoided, as part of the planned integration with existing networks.

Determine an IP range to use during your deployment. Per Azure best practices, only IP addresses in a private range are supported.

Supported choices include the following but default to a /20 range:

- 192.168.0.0 through 192.168.255.255
- 172.16.0.0 through 172.31.255.255
- 10.0.0.0 through 10.255.255.255

CWMGR1

Some of the unique capabilities of VDS such as the cost saving Workload Scheduling and Live Scaling functionality require an administrative presence within the tenant and subscription. Therefore, an administrative VM called CWMGR1 is deployed as part of the VDS setup wizard automation. In addition to VDS automation tasks this VM also holds VDS configuration in a SQL express database, local log files and an advanced configuration utility called DCCConfig.

Depending on the selections made in the VDS setup wizard, this VM can be used to host additional functionality including:

- An RDS gateway (only used in RDS deployments)
- An HTML 5 gateway (only used in RDS deployments)
- An RDS license server (only used in RDS deployments)
- A Domain Controller (if chosen)

Decision tree in the Deployment Wizard

As part of the initial deployment a series of questions are answered to customize the settings for the new environment. Below is an outline of the major decisions to be made.

Azure region

Decide which Azure region or regions will host your AVD Virtual Machines. Note that Azure NetApp Files and certain VM families (GPU enabled VMs, for example) have a defined Azure region support list while AVD is available in most regions.

- This link can be used to identify [Azure product availability by region](#)

Active Directory type

Decide which Active Directory type you want to use:

- Existing on-prem Active Directory
- Refer to the [AVD VDS Components and Permissions](#) document for an explanation of the required permissions and components in both Azure and the local Active Directory environment
- New Azure subscription based Active Directory instance
- Azure Active Directory Domain Services

Data Storage

Decide where the data for user profiles, individual files, and corporate shares will be placed. Choices include:

- Azure NetApp Files
- Azure Files
- Traditional File Server (Azure VM with Managed Disk)

NetApp VDS Deployment Requirements for Existing Components

NetApp VDS Deployment with Existing Active Directory Domain Controllers

This configuration type extends an existing Active Directory domain to support the AVD instance. In this case VDS deploys a limited set of components into the domain to support automated provisioning and management tasks for the AVD components.

This configuration requires:

- An existing Active Directory domain controller that can be accessed by VMs on the Azure VNet, typically via either Azure VPN or Express Route OR a domain controller that has been created in Azure.
- Addition of VDS components and permissions required for VDS management of AVD host pools and data

volumes as they are joined to the domain. The AVD VDS Components and Permissions guide defines the required components and permissions and the deployment process requires a Domain user with domain privileges to run the script that will create the needed elements.

- Note that the VDS deployment creates a VNet by default for VDS created VMs. The VNet can be either peered with existing Azure network VNets or the CWMGR1 VM can be moved to an existing VNet with the required subnets pre-defined.

Credentials and domain preparation tool

Administrators must provide a Domain Administrator credential at some point in the deployment process. A temporary Domain Administrator credential can be created, used and deleted later (once the deployment process completes).

Alternatively, customers who require assistance in building out the pre-requisites can leverage the Domain Preparation Tool.

NetApp VDS deployment with existing file system

VDS creates Windows shares that allow user profile, personal folders, and corporate data to be accessed from AVD session VMs. VDS will deploy either the File Server or Azure NetApp File options by default, but if you have an existing file storage component VDS can point the shares to that component once the VDS deployment is complete.

The requirements for using and existing storage component:

- The component must support SMB v3
- The component must be joined to the same Active Directory domain as the AVD session hosts
- The component must be able to expose a UNC path for use in the VDS configuration – one path can be used for all three shares or separate paths may be specified for each. Note that VDS will set user level permissions on these shares so refer to the VDS AVD Components and Permissions document to ensure the appropriate permissions have been granted to the VDS Automation Services.

NetApp VDS deployment with existing Azure AD Domain Services

This configuration requires a process to identify the attributes of the existing Azure Active Directory Domain services instance. Contact your account manager to request a deployment of this type.

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This configuration type assumes that the necessary Azure VNet, Active Directory, and AVD components already exist. The VDS deployment is performed in the same manner as the “NetApp VDS Deployment with Existing AD” configuration, but adds the following requirements:

- RD Owner role to the AVD Tenant needs to be granted to the VDS Enterprise Applications in the Azure
- AVD Host Pool and AVD Host Pool VMs need to be imported into VDS using the VDS Import function in the VDS Web App. This process collects the AVD host pool and session VM metadata and stores in it VDS so that these elements can be managed by VDS
- AVD User data needs to be imported into the VDS User section using the CRA tool. This process inserts metadata about each user into the VDS control plane so their AVD App Group membership and session information can be managed by VDS

APPENDIX A: VDS control plane URLs and IP addresses

VDS components in the Azure subscription communicate with the VDS global control plane components such as the the VDS Web Application and the VDS API endpoints. For access, the following base URI addresses need to be safelisted for bi-directional access on port 443:

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<https://docs.netapp.com/us-en/virtual-desktop-service/autoprodb.database.windows.net>
<https://docs.netapp.com/us-en/virtual-desktop-service/vdctoolsapiprimary.azurewebsites.net>
<https://docs.netapp.com/us-en/virtual-desktop-service/cjbootstrap3.cjautomate.net>
<https://cjdownload3.file.core.windows.net/media>

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13.67.227.115
13.67.227.230
13.67.227.227
23.99.136.91
40.122.119.157
40.78.132.166
40.78.129.17
40.122.52.167
40.70.147.2
40.86.99.202
13.68.19.178
13.68.114.184
137.116.69.208
13.68.18.80
13.68.114.115
13.68.114.136
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52.171.217.31
52.171.216.93
52.171.220.134
92.242.140.21

APPENDIX B: Microsoft AVD requirements

This Microsoft AVD Requirements section is a summary of AVD requirements from Microsoft. Complete and current AVD requirements can be found here:

<https://docs.microsoft.com/en-us/azure/virtual-desktop/overview#requirements>

Azure Virtual Desktop session host licensing

Azure Virtual Desktop supports the following operating systems, so make sure you have the appropriate licenses for your users based on the desktop and apps you plan to deploy:

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OS	Required license
Windows 7 Enterprise	Microsoft 365 E3, E5, A3, A5, F3, Business Premium Windows E3, E5, A3, A5
Windows Server 2012 R2, 2016, 2019	RDS Client Access License (CAL) with Software Assurance

URL Access for AVD machines

The Azure virtual machines you create for Azure Virtual Desktop must have access to the following URLs:

Address	Outbound TCP Port	Purpose	Service Tag
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*.core.windows.net	443	Agent traffic	AzureCloud
*.servicebus.windows.net	443	Agent traffic	AzureCloud
prod.warmpath.msftcloudes.com	443	Agent traffic	AzureCloud
catalogartifact.azureedge.net	443	Azure Marketplace	AzureCloud
kms.core.windows.net	1688	Windows activation	Internet
AVDportalstorageblob.blob.core.windows.net	443	Azure portal support	AzureCloud

The following table lists optional URLs that your Azure virtual machines can have access to:

Address	Outbound TCP Port	Purpose	Service Tag
*.microsoftonline.com	443	Authentication to MS Online Services	None
*.events.data.microsoft.com	443	Telemetry Service	None
www.msftconnecttest.com	443	Detects if the OS is connected to the internet	None
*.prod.do.dsp.mp.microsoft.com	443	Windows Update	None
login.windows.net	443	Login to MS Online Services, Office 365	None
*.sfx.ms	443	Updates for OneDrive client software	None
*.digicert.com	443	Certificate revocation check	None

Optimal performance factors

For optimal performance, make sure your network meets the following requirements:

- Round-trip (RTT) latency from the client's network to the Azure region where host pools have been deployed should be less than 150ms.
- Network traffic may flow outside country/region borders when VMs that host desktops and apps connect to the management service.
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Supported virtual machine OS images

Azure Virtual Desktop supports the following x64 operating system images:

- Windows 10 Enterprise multi-session, version 1809 or later
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- Windows Server 2016
- Windows Server 2012 R2

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Windows 10 Enterprise, version 1903	Yes	Yes	Yes	Yes
Windows 10 Enterprise, version 1809	Yes	Yes	No	No
Windows 7 Enterprise	Yes	Yes	No	No
Windows Server 2019	Yes	Yes	No	No
Windows Server 2016	Yes	Yes	Yes	Yes
Windows Server 2012 R2	Yes	Yes	No	No

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