

# Provision Desktops in the Cloud

Learn how to provision, manage, and access Amazon WorkSpaces

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# Welcome

In this project, you'll learn how to deploy cloud desktops using Amazon WorkSpaces and the AWS Directory Service. Amazon WorkSpaces is a fully managed, secure desktop computing service which runs on the AWS cloud. Amazon WorkSpaces allows you to easily provision cloud-based virtual desktops and provide your users access to the documents, applications, and resources they need. The AWS Directory Service makes it easy to setup and run Microsoft Active Directory (AD) in the AWS cloud, or connect your AWS resources with an existing on-premises Microsoft Active Directory.

## What you'll accomplish:

- Provision Cloud Desktops using [Amazon WorkSpaces](#), and access them using the Amazon WorkSpaces client application, available for Windows and Mac computers, Chromebooks, iPads, Fire tablets, and Android tablets.
- Create a new directory using [Microsoft AD](#) and add users. As part of the project, you'll learn how to assign Amazon WorkSpaces to users in your Microsoft AD.
- Perform basic administrative tasks using the [AWS Management Console](#). You'll learn how to reboot and rebuilt Amazon WorkSpaces, create your own custom image which you can use for provisioning new Amazon WorkSpaces, and remove Amazon WorkSpaces.

## What you'll need before starting:

- **An AWS Account:** You will need an AWS account to begin provisioning Amazon WorkSpaces. [Sign-up for AWS](#).
- **Skill level:** A basic understanding of desktop computing and Microsoft AD is helpful but not required.
- **AWS Experience:** No prior experience with AWS is required to complete this project.

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# Step 1. Prepare an AWS Account

1. If you don't already have an AWS account, create one at <http://aws.amazon.com> by following the on-screen instructions. Part of the sign-up process involves receiving a phone call and entering a PIN using the phone keypad.
2. Navigate to the Amazon WorkSpaces console at <https://console.aws.amazon.com/workspaces/>.
3. Select a valid region from the drop-down list in the upper right.

Amazon Web Services currently hosts services in twelve regions in various geographic areas. Amazon WorkSpaces are available in six of the current regions (see figure 1 below).

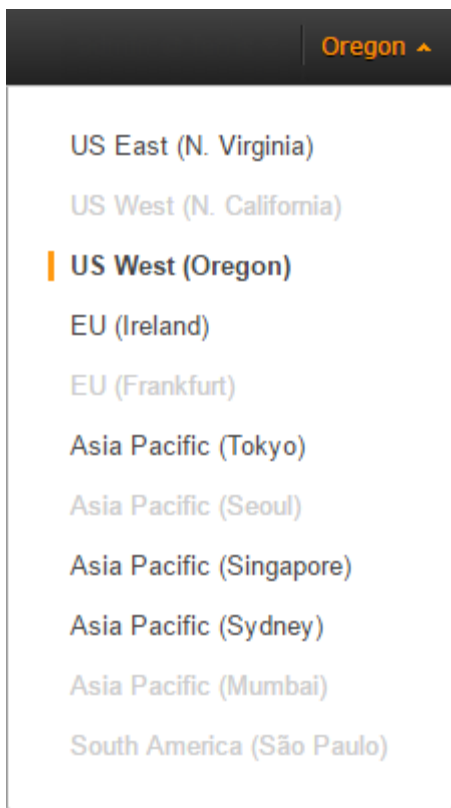


Figure 1: Choosing a region for WorkSpaces

## Note

For help selecting the closest region, we provide a health check page with Round Trip Time to all service regions at <http://health.amazonworkspaces.com>.


	Recommended Region 					
Service Availability	US East (N. Virginia)	US West (Oregon)	Europe (Ireland)	Asia Pacific (Tokyo)	Asia Pacific (Sydney)	Asia Pacific (Singapore)
Registration Services ⓘ	✓	✓	✓	✓	✓	✓
Workspace Services ⓘ	✓	✓	✓	✓	✓	✓
Round Trip Time (ms) ⓘ	40	59	99	125	185	208
Speed Rating ⓘ	FAST	FAST	FAST	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Figure 2: WorkSpaces Health Check

## Step 2: Create VPC and Subnets

For WorkSpaces to function correctly, you will need to have one public subnet and two private subnets. The easiest way to do this is to use the VPC Wizard, which creates one public subnet, one private subnet, a NAT gateway, and an Internet Gateway (IGW) for you. If you use the VPC Wizard, you will not have to manually create the routing tables between the subnets. Before we create the VPC, we'll need to allocate an Elastic IP address.

First, allocate an Elastic IP (EIP) address in your preferred region. To do this, in the navigation pane of the Amazon EC2 console (<https://console.aws.amazon.com/ec2>), choose **Elastic IPs** under the Network & Security section, and choose **Allocate New Address**, then **Yes, Allocate**. Take note of the resulting EIP address. (See figure 3 below)

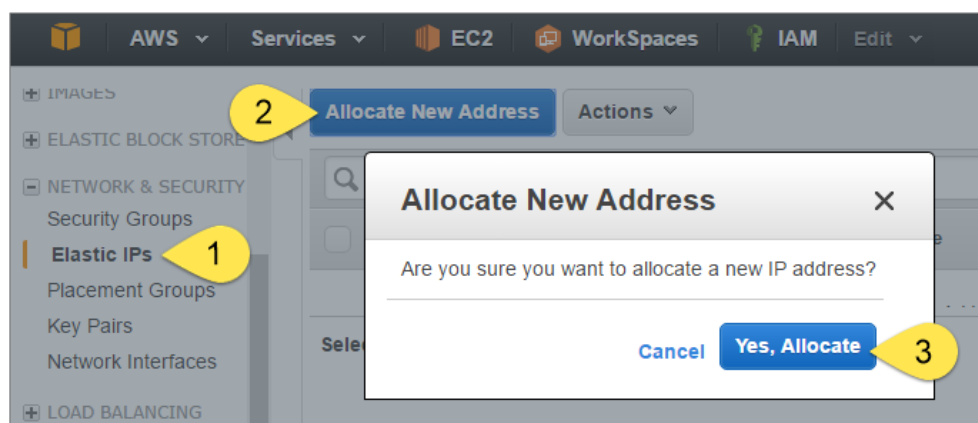


Figure 3: Allocating an Elastic IP address

### To create your VPC using the VPC wizard

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **VPC Dashboard**, **Start VPC Wizard**. If you do not already have any VPC resources, locate the **Your Virtual Private Cloud** area of the dashboard and choose **Get started creating a VPC**.
3. Choose **VPC with Public and Private Subnets**, **Select** (See figure 4 below).

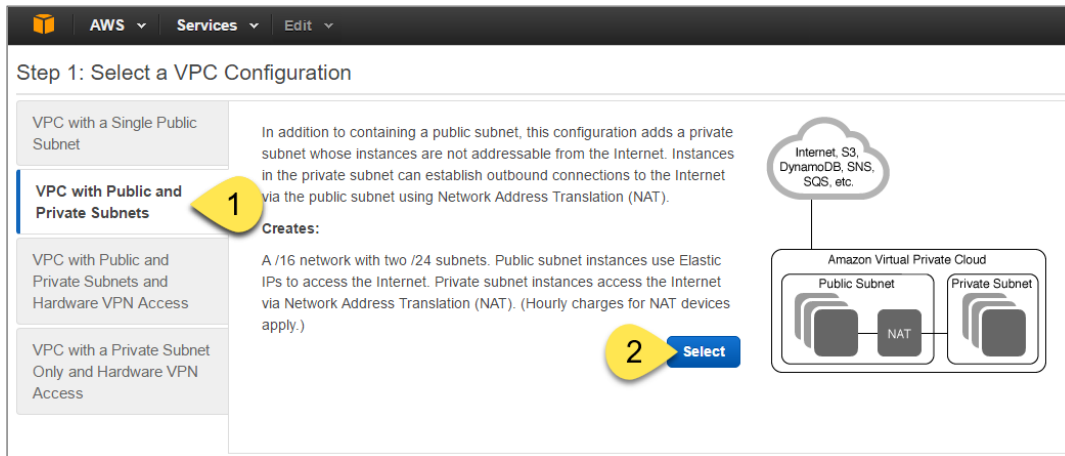


Figure 4: Creating VPCs with the VPC wizard

4. Enter the following information into the wizard and choose **Create VPC**.

### VPC wizard fields

Option	Value
IP CIDR block	10.0.0.0/16
VPC Name	WorkSpaces VPC
Public subnet	10.0.0.0/24
Availability Zone	No Preference
Public subnet name	WorkSpaces Public Subnet
Private subnet	10.0.1.0/24
Availability Zone	No Preference
Private subnet name	WorkSpaces Private Subnet 1
Elastic IP Allocation ID	Select the Elastic IP Allocation ID that corresponds with the address you created in the prior section. This will be

Option	Value
	assigned to the NAT gateway
<b>Add endpoints for S3 to your subnets</b>	Leave as <code>none</code>
<b>Enable DNS hostnames</b>	Leave default selection
<b>Hardware tenancy</b>	<code>Default</code>

5. It takes several minutes for the VPC to be created. After the VPC is created, proceed to the following section.

## Notes

- i. VPC names and subnet names are for identification purposes only; you may use any descriptors that are meaningful to you.
- ii. Take note of the region in which you create the private subnet. You will need to create an additional private subnet in the following step, and it must be in a *different* subnet than the one created via the wizard.



### Add a Second Private Subnet

Create the second private subnet by perform the following steps:

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Subnets**, select the subnet with the name `WorkSpaces Private Subnet 1`, and choose the **Summary** tab at the bottom of the page. Make a note of the Availability Zone of this subnet (see figure 5 below).

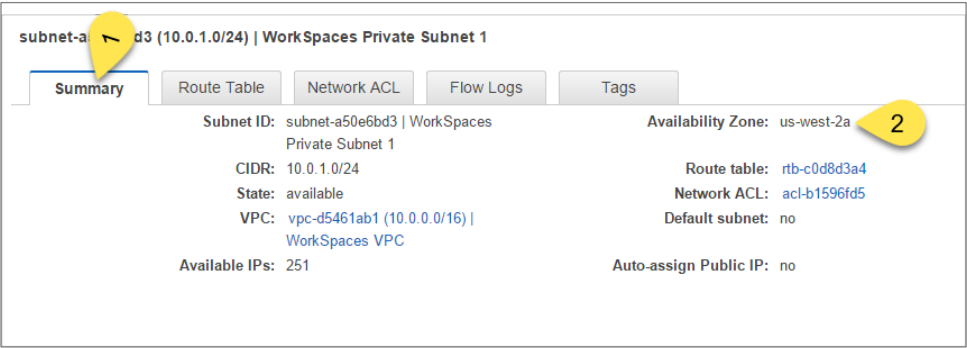


Figure 5: Identifying the Availability Zone for WorkSpaces Private Subnet 1

3. Choose **Create Subnet**, enter the following information in the **Create Subnet** dialog box, and choose **Yes, Create**.

### Subnet 2 Settings

Option	Value
Name tag	WorkSpaces Private Subnet 2
VPC	Select your VPC. This is the VPC with the name <code>WorkSpaces VPC</code> .
Availability Zone	Select any Availability Zone other than the one noted in step 2. The two subnets used by Amazon WorkSpaces must reside in different Availability Zones.
CIDR Block	10.0.2.0/24

## Modify the Route Tables

Modify the route tables for your subnets by performing the following steps:

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Subnets** and select the subnet with the name `WorkSpaces Public subnet`. At the bottom of the page, choose the **Route Table** tab and make a note of the **Route Table** identifier for the subnet. The route table identifier will be similar to `rtb-XXXXXXX`.
3. In the navigation pane, choose **Route Tables**, select the route table identified in the previous step, and change the name to `Workspaces Public Route table`.
4. At the bottom of the page, choose the **Routes** tab and verify that the following entries are in the route table for `WorkSpaces Public route table`. Modify the route table if needed by choosing **Edit**.

### NAT Subnet Route Table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	<i>igw-XXXXXXX</i>

This routes all traffic destined for the VPC locally, and traffic destined to all other IP addresses to the Internet Gateway (IGW) that was created with the Amazon VPC wizard. *igw-XXXXXXX* identifies the Internet.

5. In the navigation pane, choose **Subnets** and select the subnet with the name `WorkSpaces Private Subnet 1`. At the bottom of the page, choose the **Route Table** tab and make a note of the **Route Table** identifier for the subnet. The route table identifier will be similar to `rtb-XXXXXXX`.
6. Select the subnet with the name `WorkSpaces Private Subnet 2` and choose the **Route Table** tab at the bottom of the page. The route table identifier should be the same for

WorkSpaces Private Subnet 1 and WorkSpaces Private Subnet 2. If the route table for WorkSpaces Private Subnet 2 is different, edit the entry to make them the same.

7. In the navigation pane, choose **Route Tables**, select the WorkSpaces route table identified previously, and change the name to WorkSpaces Private Route Table.
8. At the bottom of the page, choose the **Routes** tab and verify a local route for the VPC range, and a NAT route for 0.0.0.0/0 as shown below.

### WorkSpaces Subnets Route Table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	<i>nat-XXXXXXXXXXXXXXXXXX</i>

This routes all traffic destined for the VPC locally, and traffic destined to all other IP addresses to the NAT gateway. *nat-XXXXXXXXXXXXXXXXXX* identifies the NAT gateway.

## Step 3: Create an Amazon WorkSpaces Directory in the Cloud

Amazon WorkSpaces uses a directory to store and manage WorkSpace and user information, and you can have Amazon WorkSpaces create this directory in the cloud for you using Simple AD or Microsoft AD. Additionally, you can connect to an existing Active Directory using the Active Directory Connector.

### Creating a Microsoft AD Directory

For this walkthrough, we'll create a Microsoft AD Directory using the Amazon Directory Services console.

#### To create the Microsoft AD directory

1. Open the Amazon Directory Services console at <https://console.aws.amazon.com/directoryservice/>.
2. Choose **Get Started Now**.
3. Choose **Create Microsoft AD**.
4. Provide the following information:

Option	Value
Directory DNS	The fully qualified name for the directory, such as <code>workspaces.demo.com</code>
NetBIOS name	The short name for the directory, such as <code>workspaces</code>
Administrator password	The password for the directory administrator. The directory creation process creates an administrator account with the user name <code>Admin</code> and this password. Note password requirements below.
Confirm password	Retype the administrator password.

Option	Value
Description	An optional description for the directory.

### Administrator password requirements

The password for the directory administrator. The directory creation process creates an administrator account with the user name `Admin` and this password.

The password cannot include the word "admin."

The directory administrator password is case-sensitive and must be between 8 and 64 characters in length. It must also contain at least one character from three of the following four categories:

- Lowercase letters (a-z)
- Uppercase letters (A-Z)
- Numbers (0-9)
- Non-alphanumeric characters (~!@#\$%^&\* \_+=`|\\(){}[];:"'<>.,?/)

5. Provide the following information in the **VPC Details** section and choose **Next Step**.

Option	Value
VPC	The VPC for the directory ( <code>WorkSpaces VPC</code> , or the VPC with IP range <code>10.0.0.0/16</code> ).
Subnets	Select the two private subnets, <code>WorkSpaces Private subnet 1</code> and <code>WorkSpaces Private Subnet 2</code> for the directory servers (IP ranges <code>10.0.1.0/24</code> and <code>10.0.2.0/24</code> ).

6. Review the directory information and make any necessary changes. When the information is correct, choose **Create Microsoft AD**.

It takes several minutes for the directory to be created. When it has been successfully created, the **Status** value changes to “ACTIVE”.

## Step 4: Launch WorkSpaces

Once the Directory is set up WorkSpaces can now be launched via the console.

1. Navigate to <https://console.aws.amazon.com/workspaces/>. Choose **Launch WorkSpaces** (see figure 6 below).

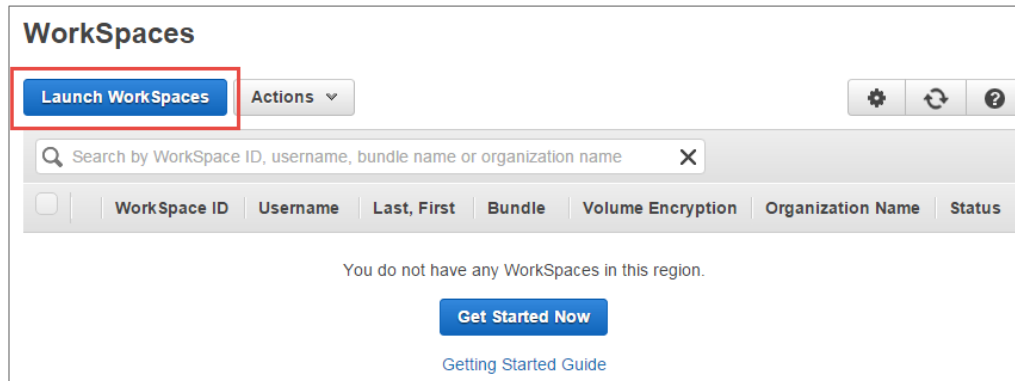


Figure 6: Using the Launch WorkSpaces wizard

2. Select the directory you created in the previous section and choose **Next Step**. WorkSpaces will register your directory with the WorkSpaces service; this could take up to five minutes.
3. You can now either add users to your directory or select from existing users. Since we just created this directory, you'll need to create at least one user. Enter all of the appropriate information for the new user, and choose **Create**. The user accounts you created will automatically be added to the WorkSpaces list. See figure 7 below.

## Launch WorkSpaces

Step 1: Select Directory

**Step 2: Identify Users**

Step 3: Select Bundles

Step 4: WorkSpaces Configuration

Step 5: Review

### Identify Users

To create a WorkSpace for existing users in this directory, search and select from the search results below. Then, click the "Add Selected" button. Once you have finish selecting users, click "Next" to select the WorkSpace Bundle.

Create New Users and Add Them to Directory: workspaces.vandijkenonline.com

Username	First Name	Last Name	Email	
ImageBuilder	ImageBuilder	TestAccount	imagebuilder@exampleco	REMOVE

+ Create Additional Users

Create Users

Select Users from Directory:

Username	Name	Email
Search for users by username, first name, last name or email		
1-1 of 0		

Add Selected

1 WorkSpaces ( 20 users can be selected at a time )

	Username	Name	Email
✖	ImageBuilder	ImageBuilder TestAccount	imagebuilder@exampleco.com

Figure 7: Creating and selecting a user

## Notes

- i. The first WorkSpace you provision in this walkthrough will be used to create a master image for subsequent deployments, so you may wish to indicate that by naming the first account "ImageBuilder"
  - ii. It's important to use a valid email address where you can receive email so that you can receive the one-time activation link. In order for this user account to become active, you need to set a password by following the instructions on the activation page. If you don't use a valid email address, you'll need to retrieve the registration link from the console.
4. Next you will assign a WorkSpaces Bundle to the user you just created. For this walkthrough, select the **Performance** bundle and assign it to the user you created in the prior step (see figure 8 below).



## Select Bundle

Select a bundle of compute, storage and applications for each of your users. You can install your own applications on your Workspace once it has launched.

<input type="checkbox"/>	Standard	2 vCPU	4 GiB	50 GB
<input type="checkbox"/>	Standard Plus with Offi...	2 vCPU	4 GiB	50 GB
<input type="checkbox"/>	Standard Plus with Offi...	2 vCPU	4 GiB	50 GB
<input checked="" type="checkbox"/>	Performance	2 vCPU	7.5 GiB	100 GB
<input type="checkbox"/>	Performance Plus with ...	2 vCPU	7.5 GiB	100 GB
<input type="checkbox"/>	Performance Plus with ...	2 vCPU	7.5 GiB	100 GB

Language

English (US)

### Performance

Windows 7 Experience, 2 vCPU, 7.5 GiB Memory, 100 GB St...

Applications: Microsoft Internet Explorer, Firefox, 7-Zip

\*Each Workspace is billed on a monthly subscription. Charges are prorated for the remainder of the first month. Subsequent months are billed for the entire month. Amazon WorkSpaces is not eligible for the AWS Free Usage Tier.

## Assign Workspace Bundles

Username	Bundle	Language
ImageBuilder	Performance	English (US)

Figure 8: Selecting a WorkSpaces Bundle, and assigning it to a user

- You are now presented with the WorkSpaces Configuration options (see figure 9 below). On this screen, you can select the AlwaysOn or AutoStop running mode, enable encrypted drives, and specify tags. Note that the AlwaysOn running mode is used for monthly billing, and AutoStop for hourly billing. Configure this Workspace for AutoStop, choose an option for Encryption, and click **Next**. Note that encrypting the Root Volume will increase the time required to provision a Workspace, but there is no operational performance impact once provisioned.

## WorkSpaces Configuration

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### Running Mode

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Choose how you will run and pay for your WorkSpaces. Learn more [here](#).

☐ **AlwaysOn**  
Billed monthly. Instant access to an always running WorkSpace.

☒ **AutoStop**  
Billed by the hour. WorkSpaces start automatically when you login, and stop when no longer being used.

**AutoStop Time (hours)**

**Note:** When possible AutoStop will snapshot the state of the desktop to the root volume of the WorkSpace. When a user next logs into their WorkSpace it is resumed and all open documents and running programs return to their previous state. To further enhance the security of your WorkSpaces we recommend you encrypt all storage volumes (see below).

### Encryption

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To further enhance the security of your WorkSpaces we recommend you encrypt all storage volumes. To configure volume encryption you need to use KMS keys in your account. You may use the [IAM console](#) to create additional KMS keys. To learn more about encryption on WorkSpaces, please see our documentation [here](#).

☒ **Root Volume (C: Drive) Encryption**

☒ **User Volume (D: Drive) Encryption**

**Encryption Key**  [Refresh](#)

### Manage Tags

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You can use tags to add metadata to your WorkSpaces. In addition, these tags can be used to track costs in the AWS Cost Explorer. A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key="Name" and value="Webserver". [Learn More](#)

Key	Value	
<input type="text"/>	<input type="text"/>	<input type="button" value="x"/>

Figure 9: WorkSpaces Configuration

- On the next screen you will verify the details then choose **Launch WorkSpaces** which will start the process and will take around 60 minutes to complete (20 minutes if you did not select the option to encrypt the root volume). During this process, your WorkSpace will show a status of "PENDING". Once completed the user will receive an email containing the Registration Code with instructions on downloading the client (<https://clients.amazonworkspaces.com/>).

If you do not receive the email, you can see the content of this message by selecting the user's WorkSpace and selecting **Actions, Invite User** (see figure 10 below).

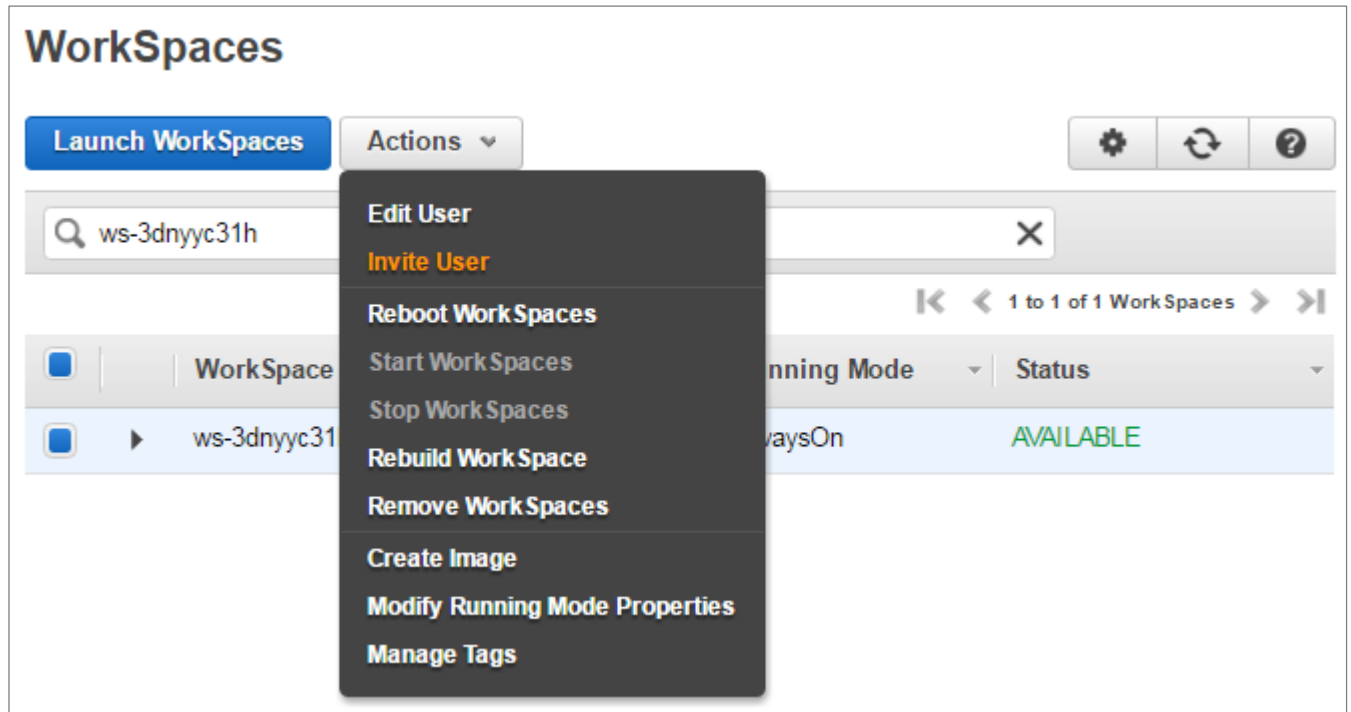


Figure 10: Retrieving the activation link for a user

7. Follow the link in the Invitation email to complete your user profile, download the WorkSpaces Client, and connect to the WorkSpace.

## Step 5: Customize the Initial WorkSpace

By this point, you should be logged in to your first Amazon WorkSpace. Now, let's update the WorkSpace and add some applications.

1. Run Windows Update and apply any updates to bring your client up to date. Reboot when prompted; it takes around 5 minutes to reboot a WorkSpace, and note that some Windows Updates will cause the restart to take longer. Once all Windows Updates have been applied, we'll continue customizing this WorkSpace.
2. Change the Wallpaper.
3. Install the Chrome browser from <http://www.google.com/chrome>.
4. Download and install the latest version of Notepad++ from <https://notepad-plus-plus.org/download>.
5. Choose **Start, Run**, and type "Server Manager" (Amazon WorkSpaces runs Windows Server 2008 R2 with the Windows 7 Experience Pack). Start Server Manager.
6. In Server Manager, choose **Features**. After Server Manager finishes collecting data, choose **Add Features** from the Action menu (see figure 11 below).

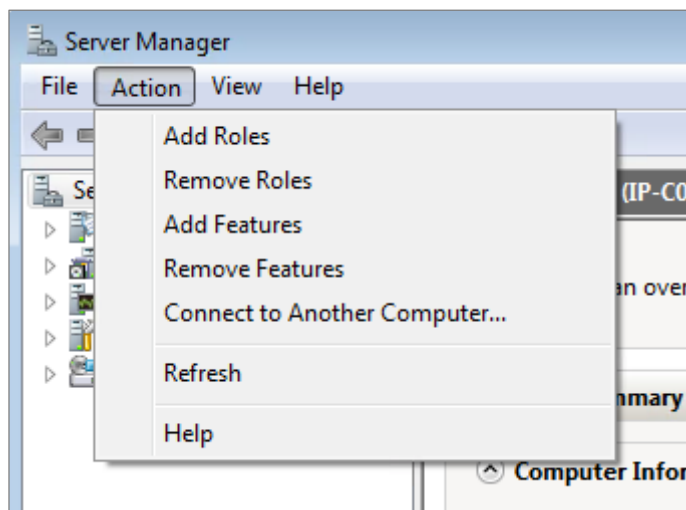


Figure 11: Adding features using Server Manager

7. Under Remote Server Administration Tools, Role Administration Tools, select AD DS and AD LDS Tools and choose **Next** (see figure 12 below).
8. Under Remote Server Administration Tools, Role Administration Tools, select AD DS and AD LDS Tools and choose **Next** (see figure 12 below).

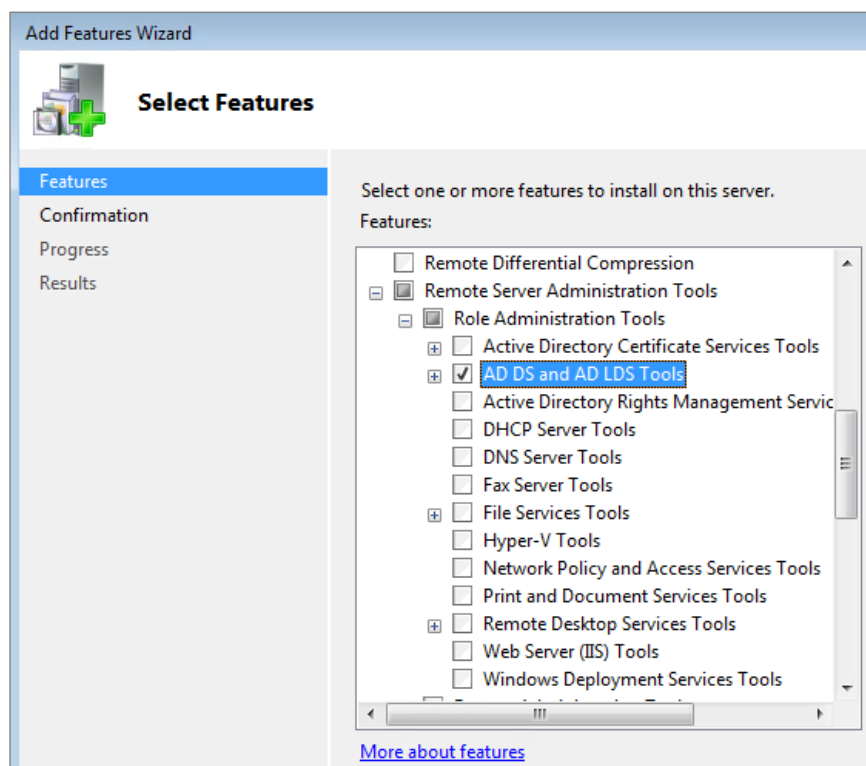


Figure 12: Adding Active Directory administrator capabilities

9. The Add Features Wizard will prompt you to restart the WorkSpace after adding this role. Go ahead and restart. After about 5 minutes, reconnect to your WorkSpace.
10. The Server Manager Wizard will automatically resume. Close it once it completes.
11. Choose **Start, Run**, and type "Users and Computers." You should see the Active Directory Users and Computers administrative tool. Hold Ctrl+Shift, right-click Active Directory Users and Computers, and choose "Run as different user"
12. When prompted, enter Admin as the username, and the password you used when creating the directory in Step 3 (see figure 13 below).

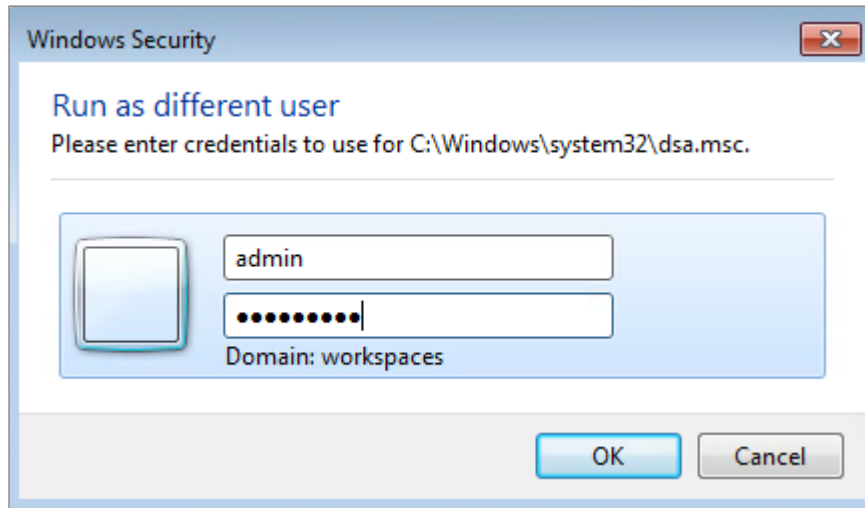


Figure 13: Run as Admin

13. This is your Microsoft AD directory. Go to the workspaces.demo.com domain, expand the workspaces Organization Unit (OU), and select the Users OU (see figure 14 below).

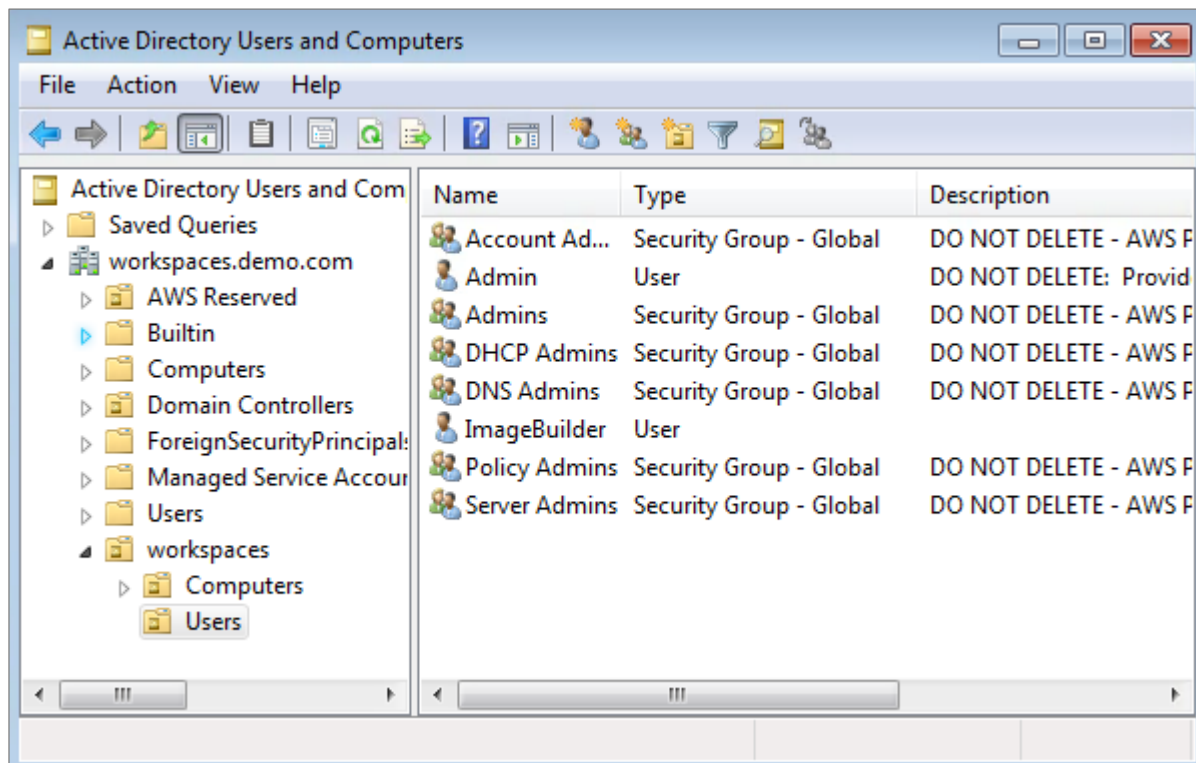
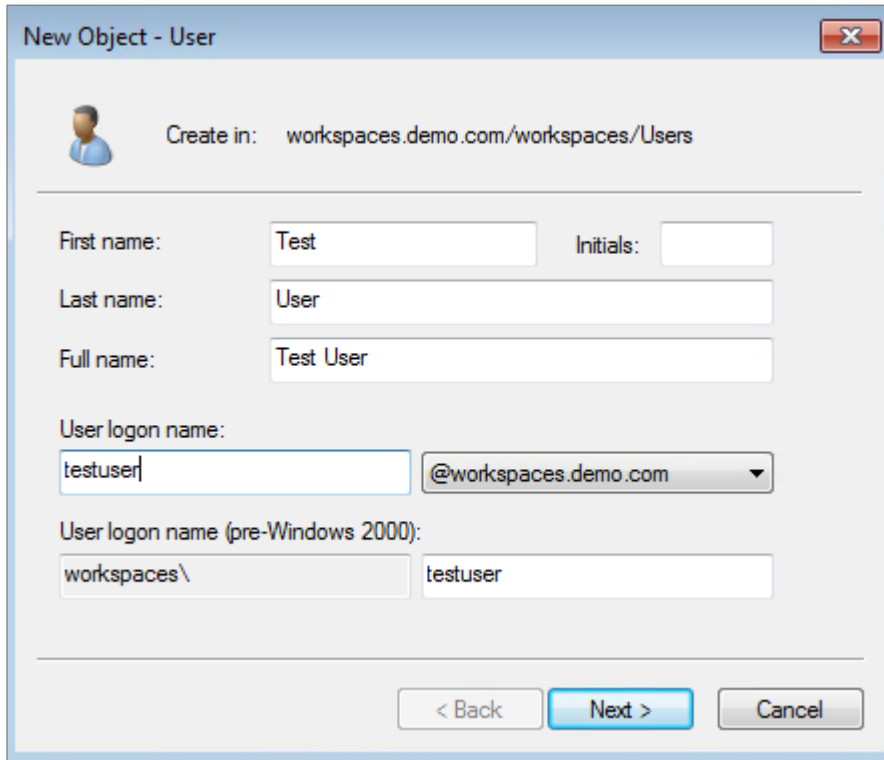


Figure 14: Active Directory view

14. From the Action menu, select **New**, then **User**, and create a new Test User in your directory (see figure 15 below).



The screenshot shows a 'New Object - User' dialog box. At the top, it says 'Create in: workspaces.demo.com/workspaces/Users'. Below this, there are several input fields: 'First name:' with 'Test', 'Initials:' (empty), 'Last name:' with 'User', 'Full name:' with 'Test User', 'User logon name:' with 'testuser' and a dropdown menu showing '@workspaces.demo.com', and 'User logon name (pre-Windows 2000):' with 'workspaces\' and 'testuser'. At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'.

Figure 15: Adding a new user to your Active Directory

We'll use this user later when deploying an additional WorkSpace, so on the next screen, set a password you'll remember, and deselect "User must change password at next logon." After creating the user account, right-click **Test User**, select **Properties**, and specify an email address. Without an email address, you won't be able to provision a WorkSpace in later steps.

15. Close the Active Directory Users and Computers console, and restart the WorkSpace.

## Step 6: Create a Custom Image and Bundle.

Now that you've customized your WorkSpace, it's time to create an image that you can use for subsequent deployments.

1. Go to the WorkSpaces console at <https://console.aws.amazon.com/workspaces>.
2. Ensure the status of the WorkSpace assigned to ImageBuilder is "AVAILABLE".
3. Select the ImageBuilder WorkSpace, choose **Actions**, **Create Image** (see figure 16 below).

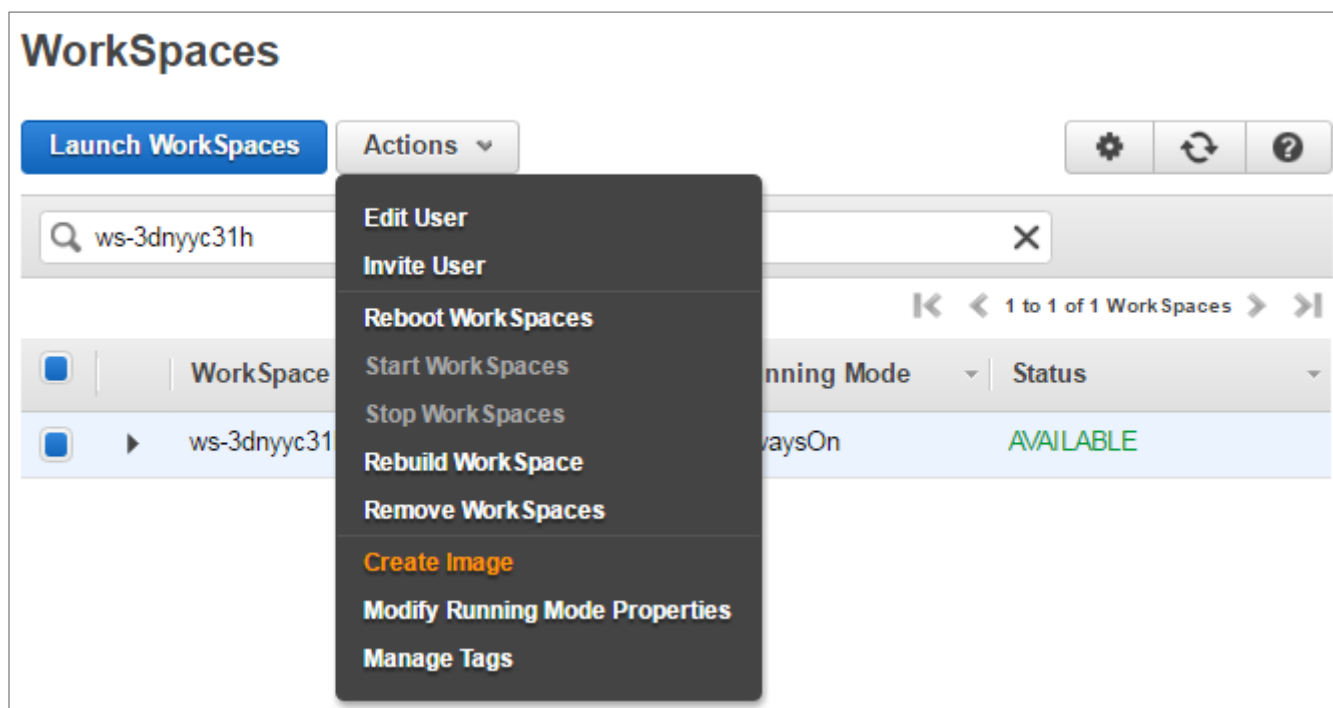
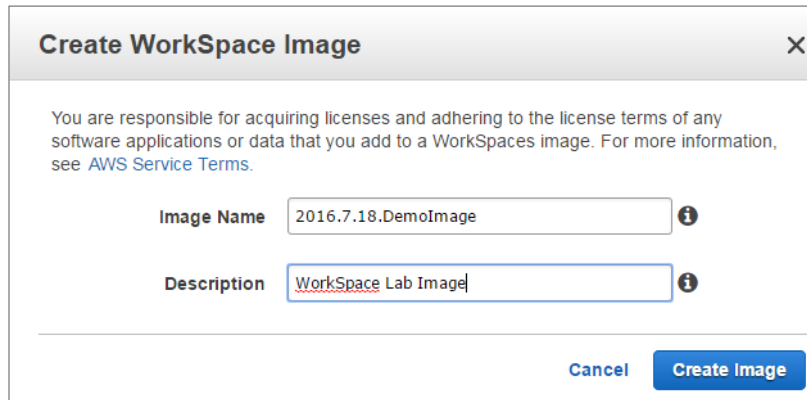


Figure 16: Creating a new image for future WorkSpaces

4. Give the image a Name and Description, then choose **Create Image**. This process takes approximately 45 minutes to complete. The ImageBuilder WorkSpace will be unavailable during this time (see figure 17 below).



A dialog box titled "Create Workspace Image" with a close button (X) in the top right corner. Below the title, there is a disclaimer: "You are responsible for acquiring licenses and adhering to the license terms of any software applications or data that you add to a WorkSpaces image. For more information, see [AWS Service Terms](#)." Below this, there are two input fields: "Image Name" with the value "2016.7.18.DemoImage" and "Description" with the value "WorkSpace Lab Image". Both fields have an information icon (i) to their right. At the bottom right, there are two buttons: "Cancel" and "Create Image".

**Create Workspace Image** X

You are responsible for acquiring licenses and adhering to the license terms of any software applications or data that you add to a WorkSpaces image. For more information, see [AWS Service Terms](#).

**Image Name** 2016.7.18.DemoImage ⓘ

**Description** WorkSpace Lab Image ⓘ

Cancel Create Image

Figure 17: Naming your new image

You can monitor the progress from the Images section of the WorkSpaces console. Once the Image Status changes to “AVAILABLE”, your ImageBuilder WorkSpace will reboot and be available for use.

5. Once the image is complete, we need to create a bundle based on this Image. On the Images page, select the new image, choose **Actions**, and **Create Bundle** (see figure 18 below).

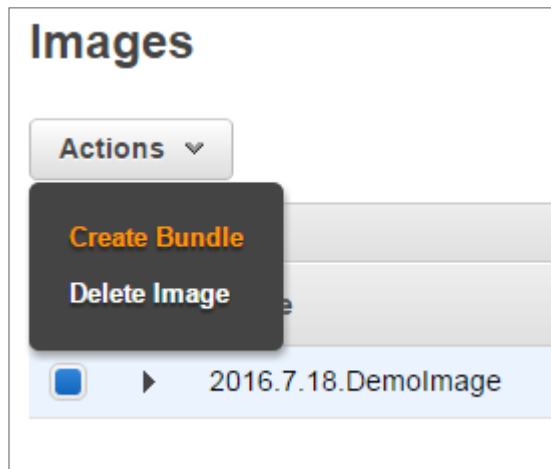
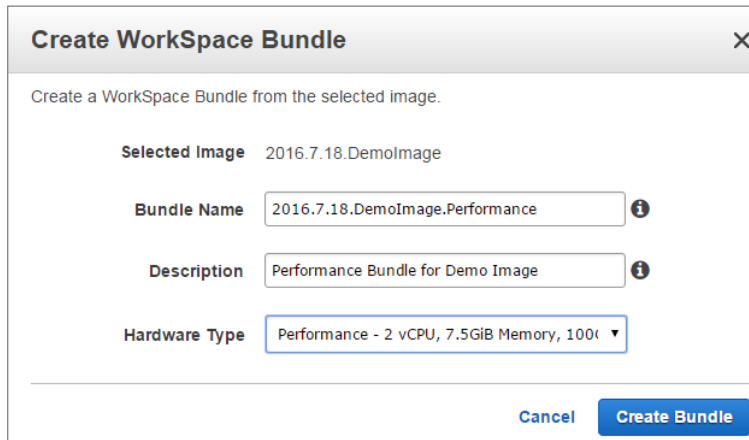


Figure 18: Creating a bundle with your new image

6. Give the bundle a name, description, and select the Performance hardware type, then choose **Create Bundle** (see figure 19 below).



**Create Workspace Bundle** [X]

Create a Workspace Bundle from the selected image.

**Selected Image** 2016.7.18.DemoImage

**Bundle Name**  ⓘ

**Description**  ⓘ

**Hardware Type**  ▼

[Cancel](#) [Create Bundle](#)

Figure 19: Creating your new bundle

## Note

The Hardware Type *does not* have to match the hardware type you used when creating the initial Workspace.

7. Back on the main WorkSpaces console, choose **Launch Workspace**.
8. Select the workspaces.demo.com directory and choose **Next Step**.
9. Choose “Show All Users” and check the Test User account you previously created, then choose **Add Selected**, and **Next Step**.
10. Assign your custom bundle to the testuser account and choose **Next Step** (see figure 20 below).



Assign Workspace Bundles		
Username	Bundle	Language
testuser	<input type="text" value="2016.7.18.DemoImage"/> ▼	<input type="text" value="English (US)"/> ▼

Figure 20: Using your new bundle to create a new Workspace

11. Choose AutoStop for Running Mode on the WorkSpaces Configuration screen, then click **Next Step**.
12. Click **Launch WorkSpaces** on the Review & Launch screen. It will take approximately 60 minutes for your Workspace to complete, if you selected the option to encrypt the root volume.

13. Once the WorkSpace for Test User is complete, connect to the WorkSpace using the WorkSpaces client. Note, registration codes are unique per directory, so the registration code will be the same as it was for your initial WorkSpace.
14. Once you're at the desktop for the Test User WorkSpace, you should see:
15. The Wallpaper is the same as for your ImageBuilder WorkSpace.
16. Chrome and Notepad++ are installed.
17. The Active Directory Remote Server Administration Tools are already available.
18. The WorkSpace has all Windows Updates available up to the point where you created the Image.

## Step 7: Reboot and Rebuild

The two primary actions you'll use when troubleshooting a WorkSpace are Reboot and Rebuild. If you're connected to the WorkSpace, you can always restart the WorkSpace as with any other Windows client, from the start menu. For this example, we're going to connect to the WorkSpace, then force and administrative reboot from the WorkSpaces console.

### Rebooting

1. After confirming the state of the Test User WorkSpace, connect to the WorkSpace, then go back to the main screen of the WorkSpaces console. While still logged in and connected to the Test User WorkSpace, select the Test User WorkSpace in the console, choose **Actions**, and then **Reboot Workspaces** (see figure 21 below).

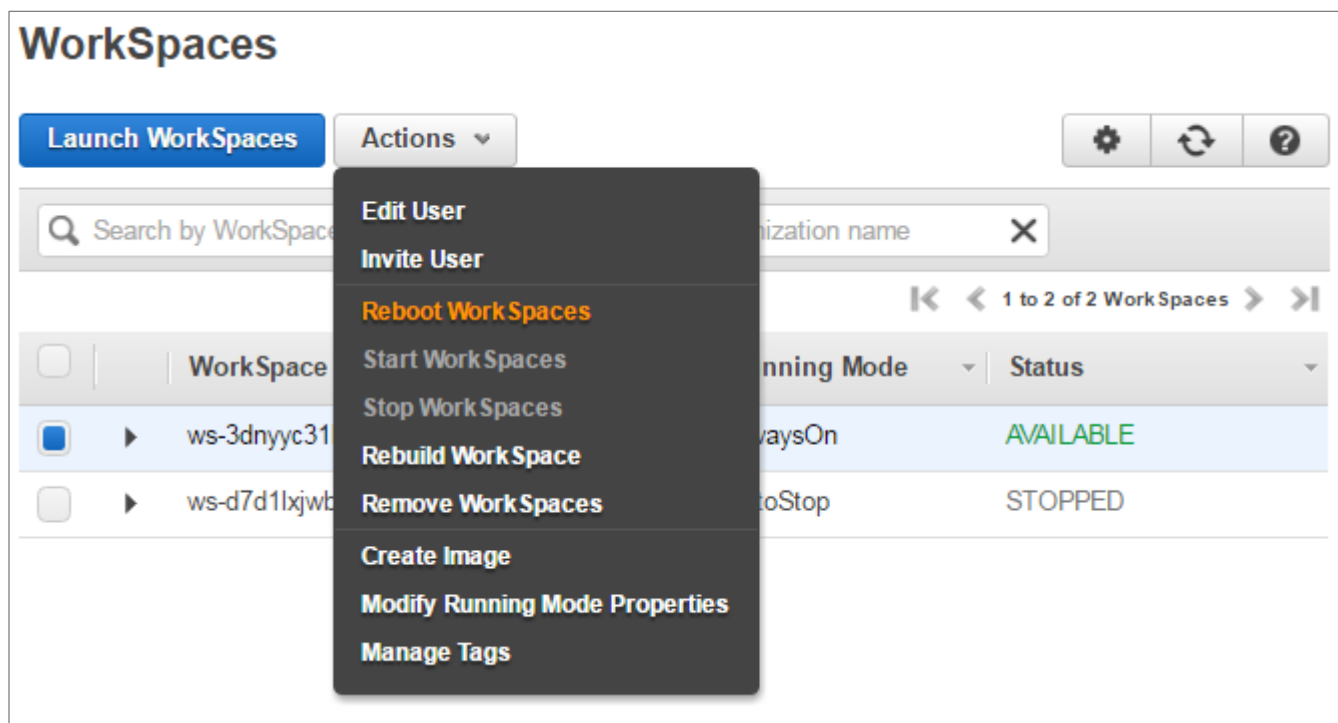


Figure 21: Rebooting your WorkSpace

You'll be disconnected from the WorkSpace while it reboots.

2. Wait around five minutes for the workspace to transition states from AVAILABLE, to REBOOTING, and back to AVAILABLE, then reconnect.

## Rebuilding

Rebuilding a WorkSpace is a more destructive action. The system volume (Drive C) will be rebuilt from the image used to provision the WorkSpace, and the User Data volume (Drive D) will be restored to the last snapshot. Any new applications installed to the System volume will not be restored. Snapshots of the Data volume are taken every 12 hours, but the exact time varies. For this lab, if you wish to see the snapshot recovery in action, you may wish to write some data files to the D: drive, then come back 12 hours later to try the rebuild operation.

Let's see how a Rebuild works.

1. Connect to the Test User WorkSpace.
2. Go to Add or Remove Programs
3. Uninstall Notepad++
4. Go to <https://www.sublimetext.com/3> and download the installer for Windows 64 bit. Save the downloaded file on the D drive.
5. Run the install with the default install directory of c:\Program Files\Sublime Text 3.

Now, your Test User WorkSpace has Sublime Text 3 installed, but you've removed Notepad++.

If you rebuild right now, you'll revert to the prior state, but since this WorkSpace is less than 12 hours old, you will not get an updated snapshot of the D volume. To see the data volume snapshot restore at work, you'll have to pause the lab and come back tomorrow. If you wish, go ahead and copy some additional files to the D: volume.

*....12 hours later*

Welcome back! Let's continue with the Rebuild operation.

6. Log back in to the WorkSpaces console.
7. Select the Test User WorkSpace.
8. Choose **Actions, Rebuild WorkSpace**. You'll be prompted to confirm (see figure 22 below).

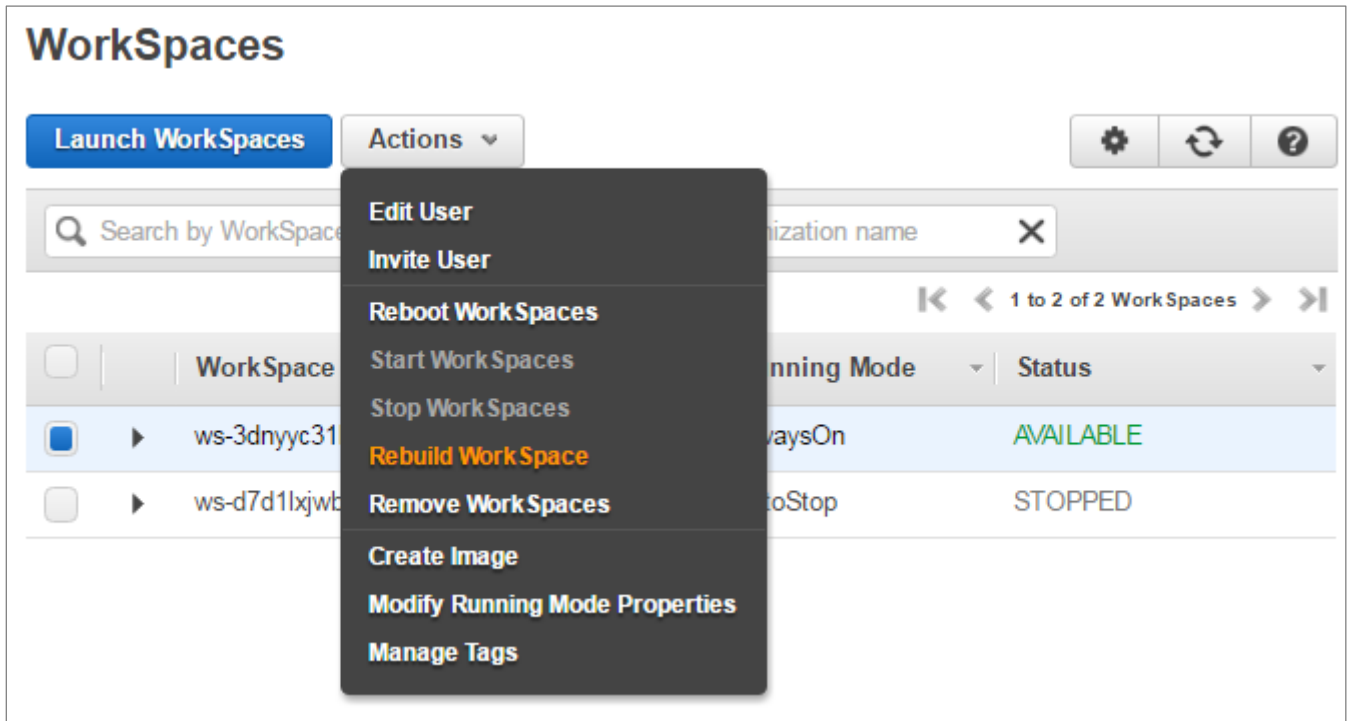


Figure 22: Rebuilding a WorkSpace

The rebuild operation takes about half an hour to complete. Once the process is complete, reconnect to the Test User WorkSpace. You should notice the following:

- SublimeText is gone.
- Notepad++ is back.
- Assuming you waited at least 12 hours, any files you created on the D drive are still present. This would include the SublimeText installer you previously downloaded and saved to the D volume.

## Step 8: Modify Running Mode Properties

Amazon WorkSpaces provides the flexibility to pay monthly or hourly. With monthly billing, you pay a fixed monthly fee for unlimited usage during the month. With hourly billing you pay a small fixed monthly fee per WorkSpace to cover infrastructure costs and storage, and a low hourly rate for each hour the WorkSpace is used during the month. To pay monthly, your Amazon WorkSpaces needs to be configured to run in the AlwaysOn running mode. To pay hourly, your Amazon WorkSpace needs to be configured to run in the AutoStop running mode. You can mix monthly and hourly billing within your AWS account, and you can also switch between billing options at any time during a billing period to optimize your AWS bill. You can learn more about billing options and pricing [here](#).

To change the running mode for one of your WorkSpaces:

1. Log back in to the WorkSpaces console.
2. Select the Test User WorkSpace (previously configured to run in the AutoStop running mode).
3. Click **Actions**, and select **Modify Running Mode Properties** as shown in Figure 23.

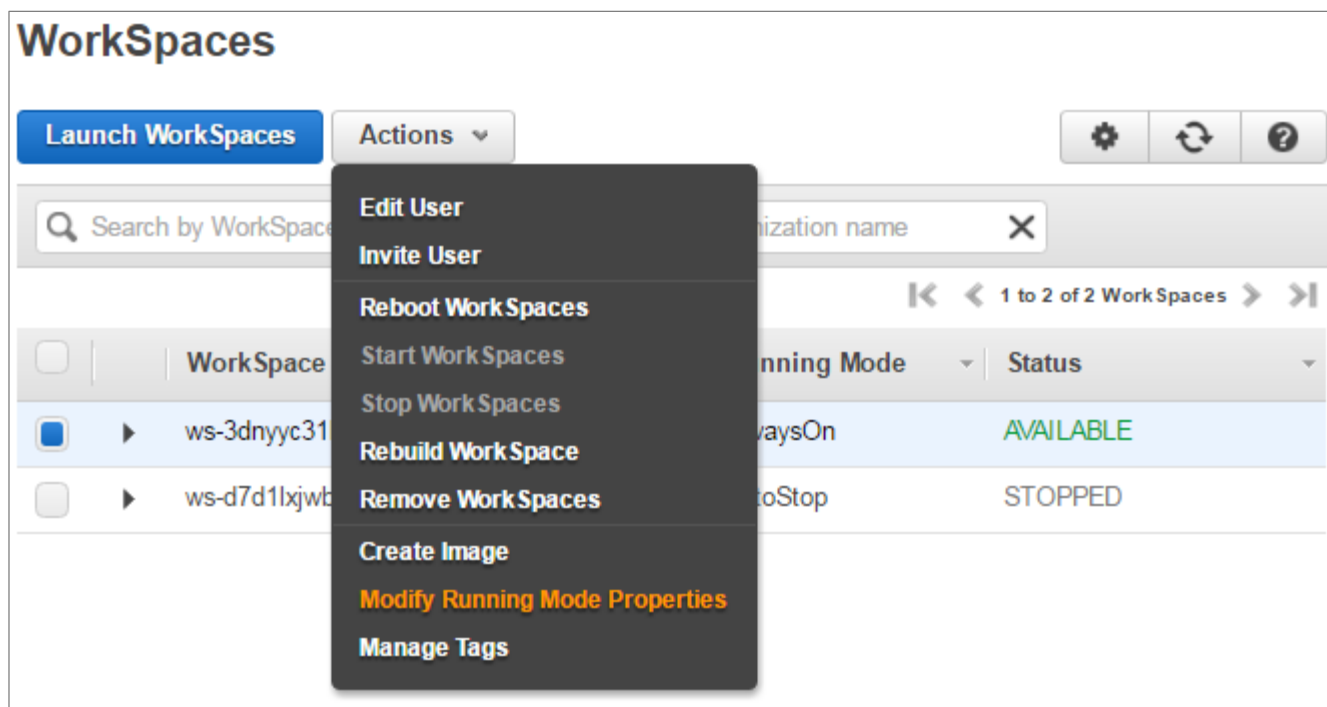
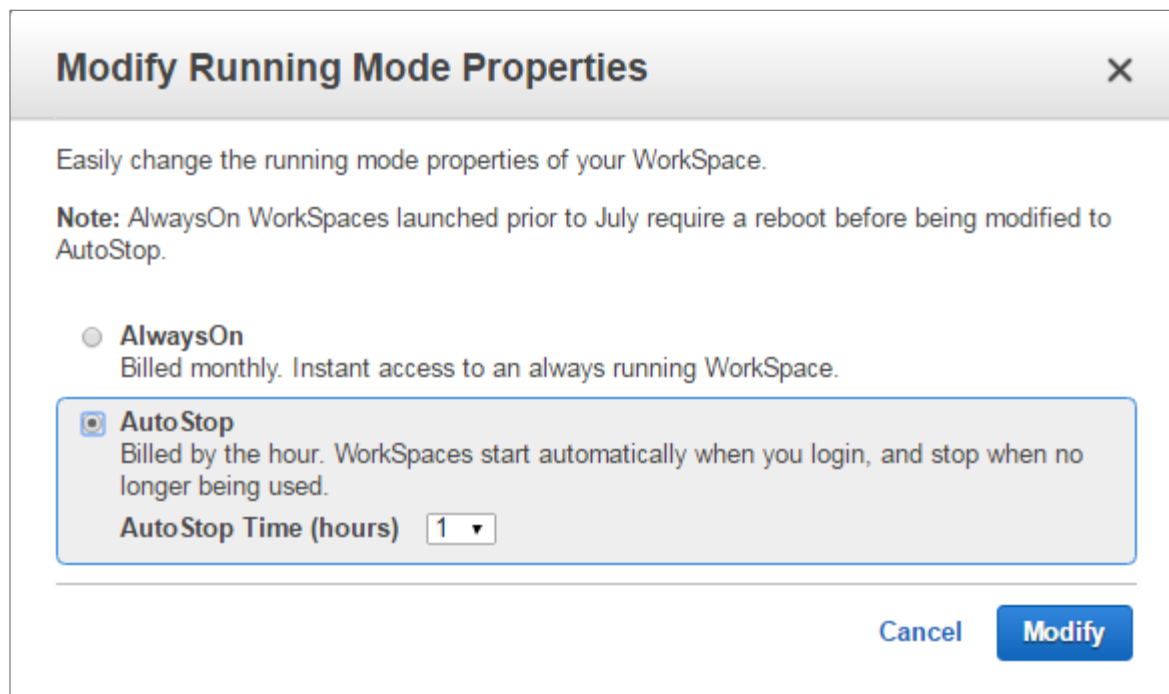


Figure 23: Changing the Running Mode Properties

4. Select the new running mode for your WorkSpace as shown in Figure 24.



**Modify Running Mode Properties** ✕

Easily change the running mode properties of your WorkSpace.

**Note:** AlwaysOn WorkSpaces launched prior to July require a reboot before being modified to AutoStop.

☐ **AlwaysOn**  
Billed monthly. Instant access to an always running WorkSpace.

☒ **Auto Stop**  
Billed by the hour. WorkSpaces start automatically when you login, and stop when no longer being used.  
**AutoStop Time (hours)** 1 ▾

Cancel Modify

*Figure 24: Changing the Running Mode Properties*

5. You'll see the Running Mode reflected in the console. For AutoStop instances, there are additional options under the **Actions** menu to start or stop the WorkSpace.



## Step 9: Cleanup

Congratulations! You've successfully provisioned a WorkSpace, created an Image of the initial WorkSpace, created a Bundle from the Image, deployed a new WorkSpace from a custom Bundle, rebooted and rebuilt a WorkSpace, and switched Running Modes.

If you're ready to clean up the environment, you'll have to delete components in the right order.

Go to the WorkSpaces console. Under Bundles, select your custom bundle, choose **Actions**, and **Delete Bundle**. The action will not succeed, because all WorkSpaces built from that bundle must be deleted first. The same is true if you attempt to delete the Image while a Bundle is still attached to the Image.

To unwind what we've done:

1. Go to the WorkSpace page, select the Test User WorkSpace, choose **Actions**, **Remove WorkSpaces**, and confirm by choosing **Remove WorkSpaces**.
2. After the WorkSpace terminates, go to Bundles, select the custom bundle, choose **Actions**, **Delete Bundle**.
3. Now go to Images. Select the custom image, **Actions**, **Delete Image**.
4. If you want to delete the directory, you'll need to remove the ImageBuilder WorkSpace as well. Go back to the WorkSpaces page, select the ImageBuilder WorkSpace, choose **Actions**, **Remove WorkSpaces**, and confirm.
5. Before deleting the directory, we have to de-register from the WorkSpace service.
6. Go to the Directories tab of the WorkSpaces console. Select the directory, choose **Actions**, **Deregister** (see figure 25 below).

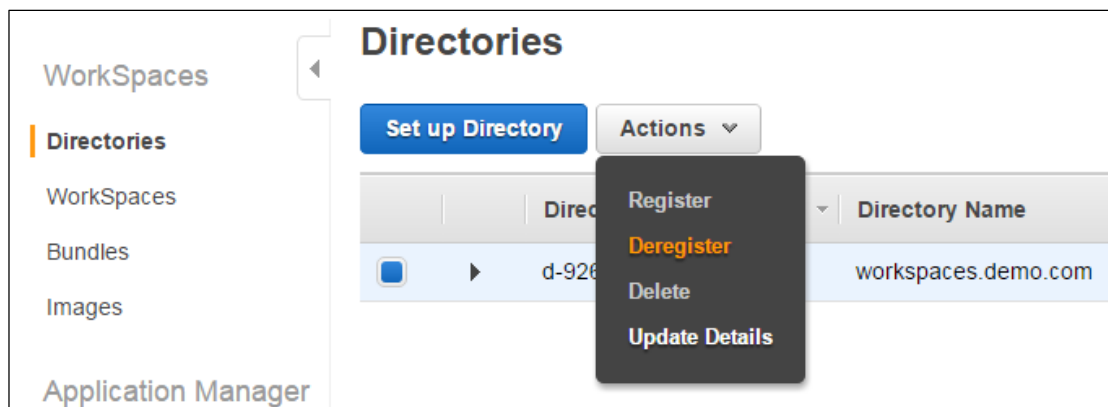


Figure 25: Deregistering Amazon WorkSpaces from your Microsoft AD service

7. Select the Directory again, but this time, choose **Actions**, then **Delete**, and confirm (see figure 26 below).

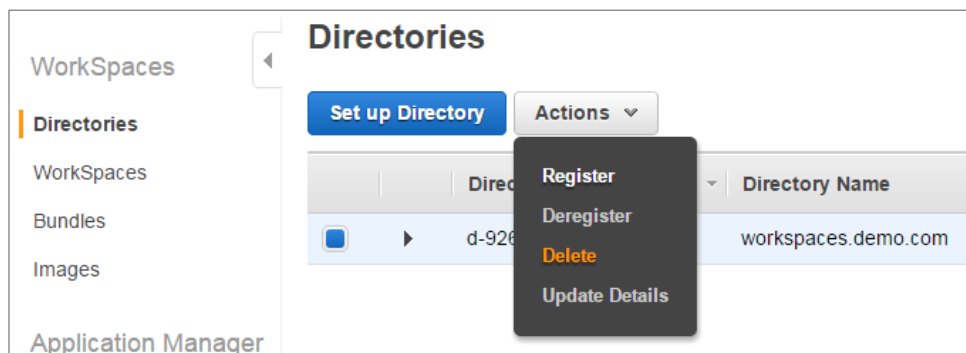


Figure 26: Deleting your Microsoft AD

It will take a few minutes for the directory to delete. Wait for the process to complete.

8. You can now go to the VPC console and delete the WorkSpaces VPC (see figure 27 below).

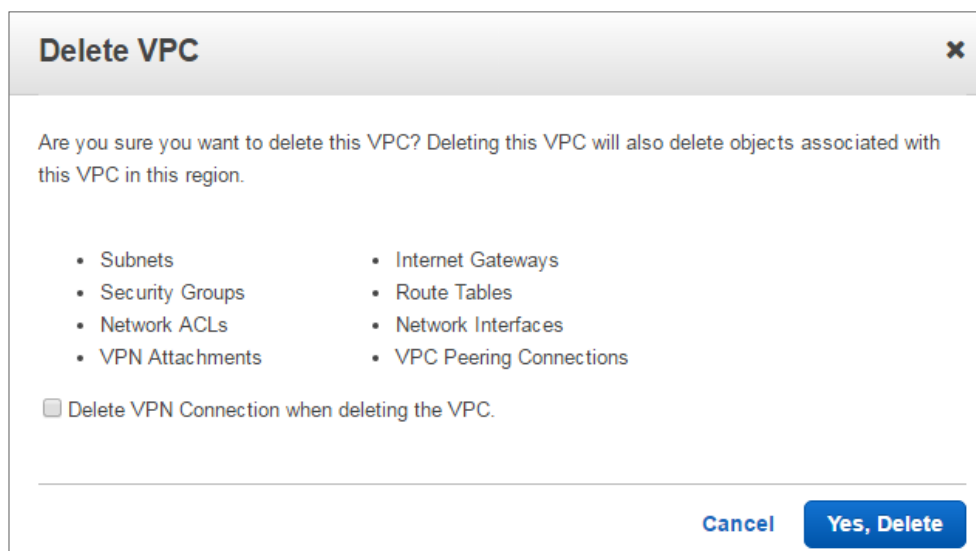


Figure 27: Deleting your WorkSpaces VPC

9. Delete the Elastic IP address from the EC2 Console.

# Informational Links

<https://clients.amazonworkspaces.com/> - List of downloadable clients

<https://clients.amazonworkspaces.com/Health.html> - Global health check for WorkSpaces Service

<https://aws.amazon.com/workspaces/faqs/> - FAQs on WorkSpaces

[http://docs.aws.amazon.com/workspaces/latest/adminguide/what\\_is.html](http://docs.aws.amazon.com/workspaces/latest/adminguide/what_is.html) - WorkSpaces Admin Guide