

Amazon AppStream 2.0: ESRI ArcGIS Pro Deployment Guide

Build an Amazon AppStream 2.0 environment to stream ESRI ArcGIS Pro to your users

May 2023

<https://aws.amazon.com/appstream2/>

Welcome

This guide describes how to deploy and stream ESRI ArcGIS Pro desktop application for your company (in this example, DemoCo) by using [Amazon AppStream 2.0](#), a fully managed, secure application streaming service that runs in the AWS Cloud.

What you'll accomplish:

- Provision an Amazon virtual private cloud ([Amazon VPC](#)) to provide an isolated virtual network infrastructure within the AWS Cloud. Your AppStream 2.0 resources will use this environment.
- Use the [AWS Management Console](#) to perform the basic administrative tasks required to build an AppStream 2.0 environment. Specifically, you'll:
 1. Install and configure ArcGIS Pro for streaming using an image builder.
 2. Provision a fleet of instances to stream your applications. The fleet will use the Graphics Design instance type and adhere to scaling policies to match the number of users that you want to be able to stream concurrently.
 3. Provision a stack to create a web portal from which users can stream your applications.
 4. Configure persistent storage that users can access across application streaming sessions.
 5. Create a user pool to manage users who access your streaming applications.

What you need before starting:

- **An AWS account:** You need an AWS account to use AppStream 2.0 and other AWS services. For information about how to sign up for and activate an AWS account, see *Appendix A*.
- **A current email address:** During the user configuration process for your AppStream 2.0 environment, AWS sends you two emails. You must use these emails to complete the process.

- **Skill level:** You do not need prior experience with AWS to complete these exercises. A basic understanding of desktop computing is helpful but not required.
- **An active ArcGIS Pro license.** ArcGIS Pro is available as GIS Professional User Type, as part of ArcGIS Desktop, or you can sign up for the ArcGIS Pro trial.
- **An active ArcGIS Online license.** This license is required for the ArcGIS Pro products that you want to import into AppStream 2.0. ArcGIS Pro includes an entitlement for ArcGIS Online.
- **ArcGIS Pro System Requirements:** The hardware and software requirements needed for smoothly running ArcGIS Pro is available on ESRI [website](#). We recommend using the following instance types for deploying ArcGIS Pro.

ArcGIS 2D Workloads – stream.compute.large, stream.memory.large.
Compute and Memory optimized instances are perfectly suited for ArcGIS workloads that does not require a GPU. To learn more about the number of vCPU cores, RAM memory specifications of these instance families, see [Amazon AppStream 2.0 pricing](#).

ArcGIS 3D Workloads (Normal) – stream.memory.z1.xlarge
stream.graphics.g4dn.4xlarge,
Graphics Design instances are ideal for delivering applications such as Adobe Premiere Pro, Autodesk Revit, ESRI ArcGIS Pro and Siemens NX that rely on hardware acceleration of DirectX, OpenGL, or OpenCL. G4dn instances provide the latest generation NVIDIA T4 GPUs, AWS custom Intel Cascade Lake CUs, up to 100 Gbps of networking throughput, and up to 1.8 TB of local NVMe storage. These instances are ideal for streaming graphics intensive applications that rely on NVIDIA GPU libraries such as CUDA using AppStream 2.0. AppStream 2.0 offers six different g4dn instance sizes, ranging from 4 vCPUs and 16 GiB of memory to 64 vCPUs and 256 GiB of memory. To learn more about the Graphics Design instances, refer [Amazon AppStream 2.0 pricing](#).

ArcGIS 3D Workloads (High res) – stream.memory.z1d.2xlarge or stream.graphics-pro.8xlarge. The Graphics Pro instance family offers three different instance types to support the most demanding graphics applications. Powered by NVIDIA Tesla M60 GPUs with 2048 parallel processing cores, there are three Graphics Pro instances types starting from 16 vCPUs, 122 GiB system memory, and 8 GiB graphics memory, to 64 vCPUs, 488 GiB system memory, and 32 GiB graphics memory. These instance types are ideal for graphic workloads that need a massive amount of parallel processing power for 3D rendering, visualization, and video encoding, including applications such as Petrel from Schlumberger Software, Landmark's DecisionSpace, or MotionDSP's Ikena. To learn more about Graphics Pro instances, refer [Amazon AppStream 2.0 pricing](#).

- **End user client recommendations:** To use ArcGIS Pro delivered through AppStream, your user would need a modern HTML browser such as Google Chrome, Mozilla Firefox, Microsoft Edge or Internet Explorer 11+. Your local computer should support a minimum display resolution of 1024x768. You can also use this [tool](#) to run diagnostics.
- **End user network recommendations:** AppStream 2.0 uses an adaptive streaming protocol (NICE DCV) to deliver an interactive streaming session to users. The protocol encodes pixels on a remote host, securely transmits them over the network, and renders them on a client device. It also accepts user keyboard and mouse input, enables file transfer between client and remote host, and provides clipboard support to provide an interactive experience for a user when using streamed applications. While the streaming protocol adapts to changes on the screen and only transmits pixels when required, it will use the available bandwidth on the network. Also, since the streaming session is interactive, and the application on the remote host needs to respond to user inputs on a client device, the round-trip latency will influence the responsiveness that a user will experience.

The amount of bandwidth used when transmitting pixels is proportional to the changes on the screen and the resolution of the display monitor(s) used by the client device. The changes on the screen and the resolution are determined by

the type of application (3D versus business application) and usage pattern (switching between windows and menus quickly). A 3D application may require a high-resolution monitor and trigger large changes to the screen when a user is interacting with complex hi-fidelity models. To transmit these changes on the screen quickly and provide a responsive experience to the user, the protocol will use a large amount of bandwidth momentarily. On the other hand, a business application may only involve text input. While changes to text on screen can be transmitted with very small amount of bandwidth, switching quickly between windows or menus within even a text-based application will result in large changes to the screen and hence drive momentary increases in bandwidth used. The round-trip network latency influences the responsiveness that a user perceives when entering input and viewing changes on the screen. While other factors such as quality of network, client device performance, and remote host instance selection can also influence the responsiveness, latency should be considered as one of the primary factors. In general, lower latency connections will deliver more responsive and performant streaming experience. Below are the recommendations for sample ArcGIS use-cases.

Use case	Recommended bandwidth available per user	Recommended maximum roundtrip latency
ArcGIS Pro (2D)	1-2 mbps	< 150 ms
ArcGIS Pro (3D) – Streaming with low fidelity datasets or maps with 2K monitors	5-6 mbps	< 100 ms
ArcGIS Pro (3D – Streaming high fidelity datasets or maps with 4K monitors	10-12 mbps	< 50 ms

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Step 1. Sign in to the AWS Management Console and select an AWS Region

If you do not have an AWS account, you must first complete the steps in *Appendix A*.

1. Sign in to the AppStream 2.0 console at <http://console.aws.amazon.com/appstream2>.
2. Type your email address or your AWS account ID, and choose **Next**.
3. Type your AWS account password, and choose **Sign In**.

4. In the menu in the upper right corner of the console, select the AWS Region for your environment. AWS currently hosts services in 18 different geographical areas.



5. Select one of the following seven Regions in which AppStream 2.0 is available: Choose the AWS region that is closest to your end users who will be streaming ArcGIS Pro for best performance and user experience.



Figure 1: Available AWS Regions for AppStream 2.0.

Step 2: Create network resources

In this section, you will create an Amazon virtual private cloud (VPC) and other network resources required for your AppStream 2.0 environment. The following steps use a template in AWS CloudFormation to automatically create and configure the necessary network resources. To manually create and configure network resources, see *Appendix B*.

1. Make sure that you are signed in to the [AWS Management Console](#).
2. In the following list of regional choices, open the link associated with the AWS Region in which you want to build your AppStream 2.0 environment.
 - [US East \(N. Virginia\)](#)

- [US West \(Oregon\)](#)
- [EU \(Frankfurt\)](#)
- [EU \(Ireland\)](#)
- [Asia Pacific \(Singapore\)](#)
- [Asia Pacific \(Sydney\)](#)
- [Asia Pacific \(Tokyo\)](#)

The AWS CloudFormation console displays the URL of a template that is used to create your network resources and the name of the resulting AWS CloudFormation stack.

3. In the bottom right corner of the window, choose **Create**. AWS CloudFormation starts creating the resources and displays a status message to indicate progress.

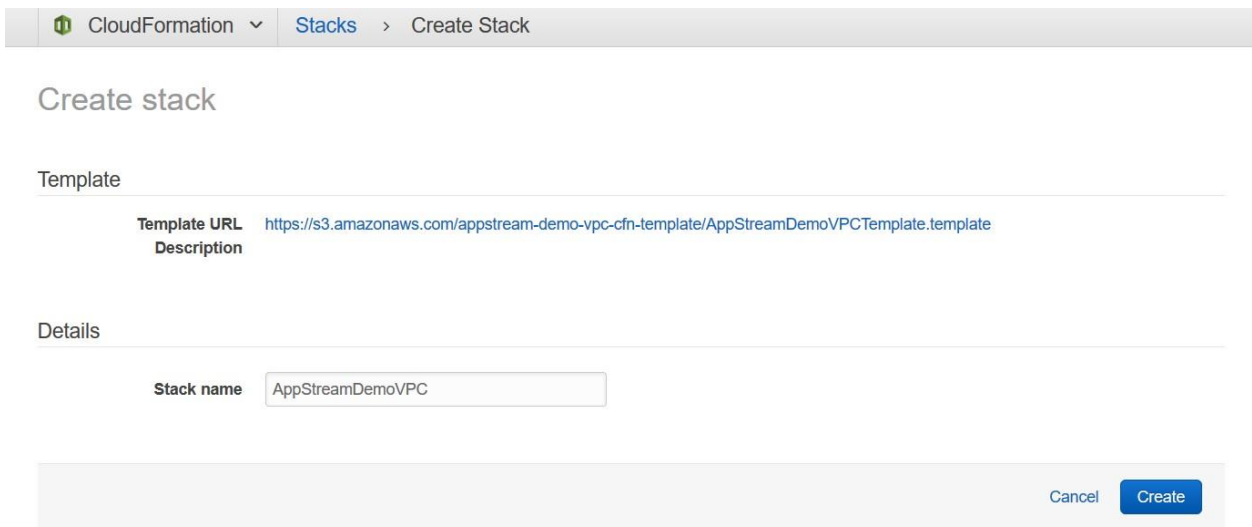


Figure 2: Using a template in AWS CloudFormation to create network resources.

4. When the creation process completes, usually within five minutes, the AWS CloudFormation console displays the status **CREATE_COMPLETE**.
5. Navigate to the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
6. In the navigation pane, under **Virtual Private Cloud**, choose **Your VPCs**. In the list of VPCs, you should see the following VPC that was automatically created:

<input type="checkbox"/>	Name	VPC ID	State	IPv4 CIDR
<input type="checkbox"/>	AppStream2 VPC	vpc-d6ff74ad	available	10.0.0.0/20

Figure 3: VPC created by AWS CloudFormation.

Note: The VPC ID value will differ for your VPC.

- In the navigation pane, under **Virtual Private Cloud**, choose **Subnets**. In the list of subnets, you should see the following subnets that were automatically created:

<input type="checkbox"/>	Name	Subnet ID	State	VPC	IPv4 CIDR
<input type="checkbox"/>	AppStream2 Public Subnet	subnet-1a7dbb50	available	vpc-d6ff74ad AppStream2 VPC	10.0.0.0/24
<input type="checkbox"/>	AppStream2 Private Subnet2	subnet-fd405299	available	vpc-d6ff74ad AppStream2 VPC	10.0.2.0/24
<input type="checkbox"/>	AppStream2 Private Subnet1	subnet-c175b38b	available	vpc-d6ff74ad AppStream2 VPC	10.0.1.0/24

Figure 4: Subnets created by AWS CloudFormation.

Note: The Subnet ID and VPC values will differ for your subnets.

- You have now successfully created your network resources by using AWS CloudFormation. You can proceed to Step 3.

Step 3: Create an AppStream 2.0 image builder

AppStream 2.0 uses EC2 instances to stream applications. You launch instances, called *image builders*, from base images that AppStream 2.0 provides. To create your own custom image, you connect to an image builder instance, install and configure your applications for streaming, and then create your image by creating a snapshot of the image builder instance.

To install and configure applications to stream to your users, you must create an image builder instance as described in the following procedure.

Deploy an image builder instance to install applications

- Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.

2. If you have not previously configured any AppStream 2.0 settings, the following page appears:

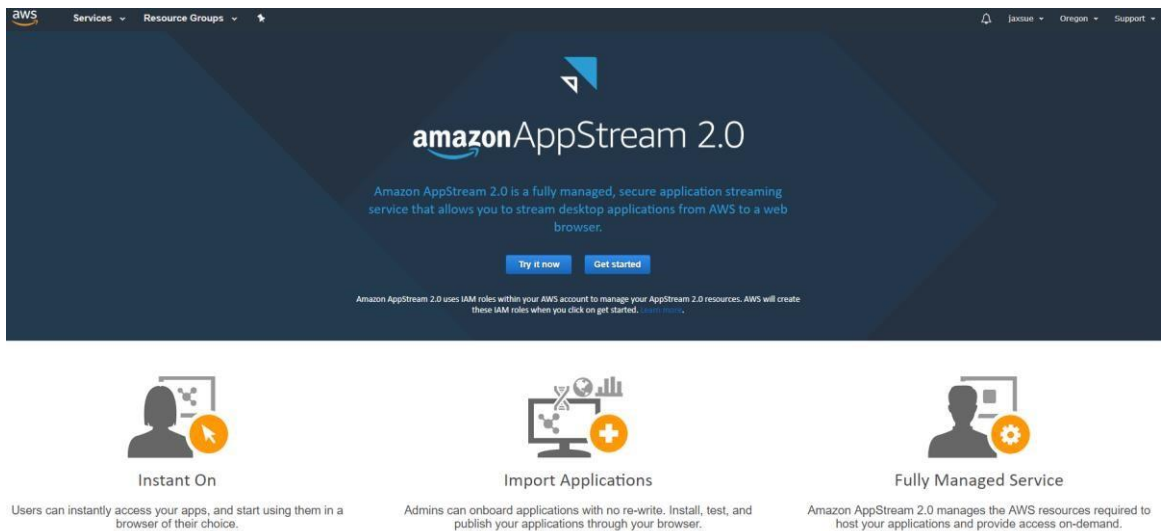


Figure 5: The AppStream 2.0 first experience page.

Note: If the AppStream 2.0 navigation page appears instead, skip to step 5.

3. Choose **Get started**.
4. In the lower right corner of the page, choose **Skip** (this guide walks you through a different process for getting started with AppStream 2.0).

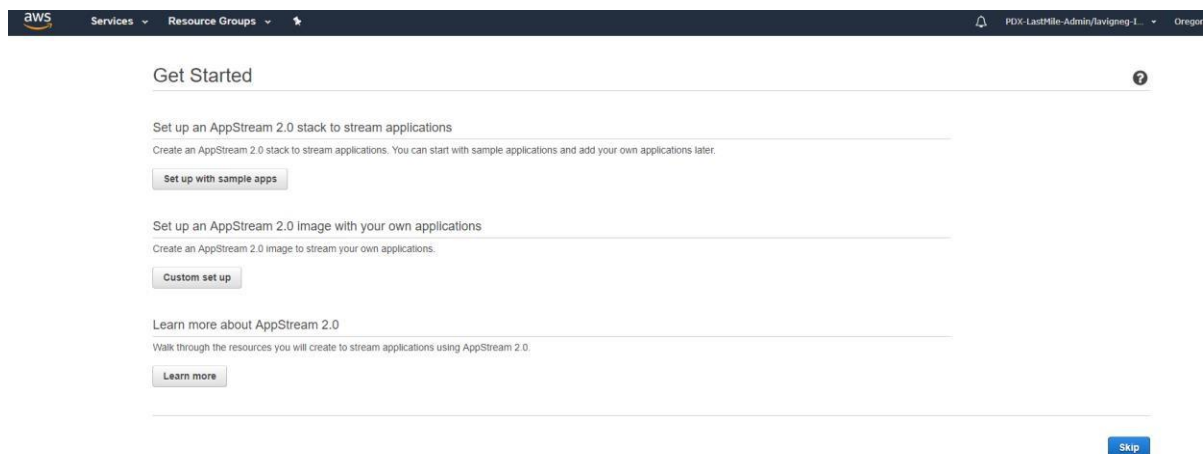


Figure 6: AppStream 2.0 getting started options.

5. In the navigation pane, choose **Images, Image Builder, Launch Image Builder**.

6. In the **Step 1: Choose Image** window, in the list of images, select the image builder with the name *Graphics-Design-Image-Builder-mm-dd-yyyy*, where *mm-ddyyyy* represents the most recent date. Base images include the latest updates to Microsoft Windows and the AppStream 2.0 agent software. You use this base image to create a custom image that includes your own applications.
7. At the bottom of the page, choose **Next**.
8. In **Step 2: Configure Image Builder**, the following image builder configuration options are displayed:
9. Type the following information and then choose **Review**.

Configure image builder fields

Option	Value
Name	Provide a unique name identifier for the image builder, such as <i>DemoCo_Image_v1_mmddyyyy</i> , using any of the following characters: a-Z,0-9,-,_,.
Display Name	Provide an optional name, such as <i>DemoCo Image v1 April 2018</i> , to be displayed in the console for easier reference and readability.
Instance Family	Choose Graphics Design
Instance Type	Select stream.graphics-design.xlarge from the list of available instance types.
Choose Next to continue to Step 3: Configure Network and then type the following information	
Default Internet Access	Make sure that this option is not selected.
VPC	Select the option corresponding to AppStream 2 VPC .
Subnet	Select the subnet with the IP address range 10.0.1.0/24 (AppStream2 Private Subnet1).
Security group(s)	Accept the default security group listed.
Active Directory Domain (Optional)	Do not configure any options.

10. Choose **Review**, and confirm the details for the image builder. To change the configuration for any section, choose **Edit** and make your changes.
11. After you finish reviewing the configuration details, choose **Launch**. If an error message notifies you that you don't have sufficient limits to create the image builder, submit a limit increase request through the AWS Support Center. For more information, see [AWS Service Limits](#).
12. The image builder creation process takes about 15 minutes to complete. During this process, the status of the image builder displays as **Pending** while AppStream 2.0 provisions the necessary resources.

13. Click the **Refresh** icon periodically to update the image builder status. After the status changes to **Running**, the image builder is ready to use and you can create a custom image.

Note: Charges accrue for an image builder instance while it is running, even if no user is actively connected. You can stop or delete the image builder at any time. No user fees are incurred when users connect to an image builder. For more information, see [AppStream 2.0 Pricing](#).

Step 4: Connect to the image builder and install applications

Now that you have provisioned an image builder, you can use it to install and configure the applications to stream to users. First, you must establish a remote connection to the instance to install and configure your applications.

Connect to the image builder instance

1. Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.
2. In the navigation pane, choose **Images, Image Builder**.
3. Select the image builder instance that you created earlier (*DemoCo_Image1_mmdyyy*). Verify that its status is **Running** and choose **Connect**.

Note: If the status is **Stopped**, select the instance, and choose **Actions, Start**. Click the **Refresh** icon periodically to update the instance list until the status is **Running**.

4. The new browser tab opens, displaying options for logging into the image builder instance. Choose **Local User, Administrator**.

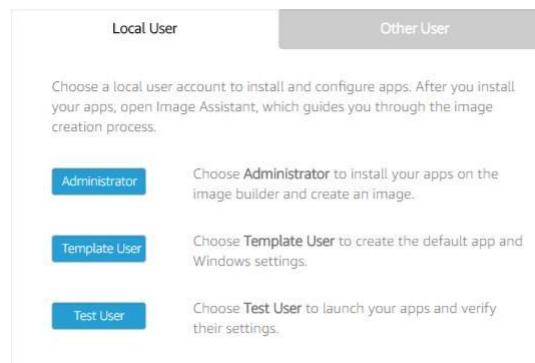


Figure 7: The image builder instance login options window.

Note: If a new browser tab does not open, configure your browser to allow popups from <https://console.aws.amazon.com/>.

5. After a few moments, you are connected to the image builder instance with administrator rights.

Install and configure ArcGIS Pro application

1. Download the ArcGIS Pro installer from your ArcGIS organizational website to a known file location in your image builder.
2. After the download is complete, launch the downloaded executable. This process will extract the installation files to a known file location in image builder.
3. Once the extraction is complete, the installation process will start automatically.
4. Choose to accept the licensing terms and conditions and click **Next**.
5. In the next screen, choose the option **Anyone who uses this computer (all users)** and click **Next**.
6. In the next screen, leave the option to participate in the ESRI user improvement program selected and click **Install**.
7. In the final screen, uncheck the option to run ArcGIS Pro now and click **Finish**.
8. Redirect the ArcGIS Pro Temp folder, (by default AppStream allocates 1GB for temp user profile data this is sometimes not enough for ArcGIS Pro), Use the following procedure to set an ARCTMPDIR User Environment Variable:
 - a. Navigate to **Start > Windows System > Control Panel > System**. Click the **Advanced system settings**. This opens the **System Properties** window.
 - b. Click the **Advanced** tab, and click the **Environment Variables** button in the bottom-right.
 - c. Under **User variables for**, click the **New** button and enter in the following:

```
variable name: ARCTMPDIR  
variable value: C:\temp
```

Note:

Replace C:\temp in the above with a disk location appropriate for the current user. The current user must have full read/write access to this location.

- d. Click **OK** in the **New System Variable** dialog window, click **OK** in the Environment Variables dialog, and click **OK** on the **System Properties** dialog window.
- e. Close ArcGIS Pro (assuming it was open), and log out of your AppStream 2.0 instance. After logging back in, this redirection should now be in effect.

Step 5: Use Image Assistant to create an AppStream 2.0 image

At this point, you have launched an image builder instance and installed ArcGIS Pro on the image builder. Now you'll prepare the applications for streaming, optimize them for streaming performance, and create your image.

In this section, you'll do the following:

- Create an application catalog by using Image Assistant.
- Disable the Internet Explorer Enhanced Security Protection feature.
- Test the application by using a local user account that has the same permissions that end users will have in their streaming sessions.
- Optimize the application's launch performance.
- Configure the image.
- Finish creating the image.

Create your AppStream 2.0 application catalog

The process of creating an AppStream 2.0 application catalog includes specifying the name, display name, executable file to launch, and icon to display for each application that you plan to stream.

1. From the image builder desktop, open Image Assistant.
2. In the **Add Applications to Image** dialog box, on the **Add Apps** tab, choose **Add App**.

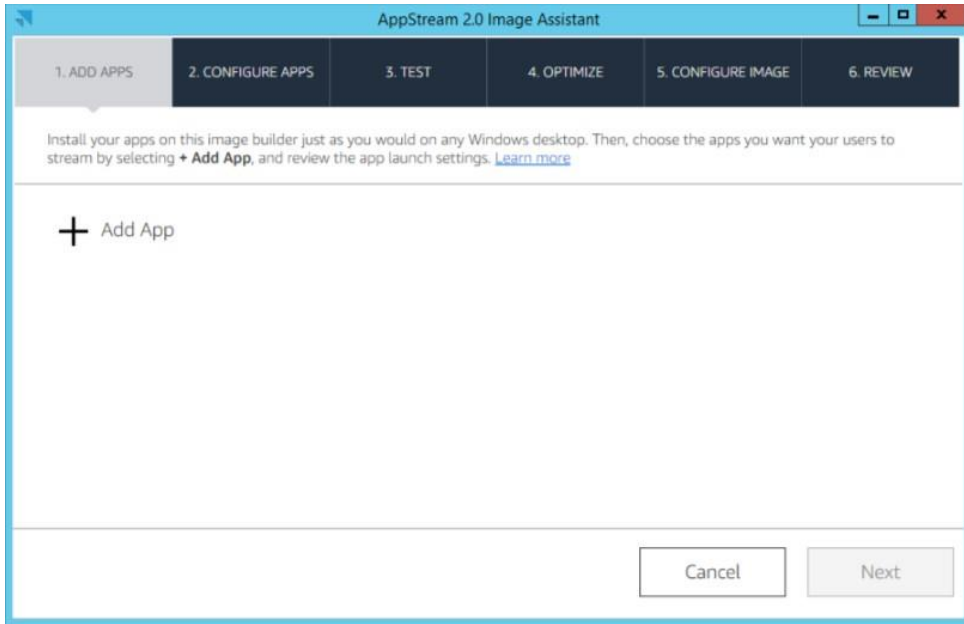


Figure 5: The **Add Applications to Image** dialog box in Image Assistant.

3. Navigate to the location of the ArcGIS Pro application executable (usually C:\Program Files\ArcGIS Pro), select the application executable, and then choose **Open**.
4. In **Edit Application Setting**, type the following information and choose **Save**.

Option	Value
Name	Name of the application executable. This field is automatically populated and not editable.
Display Name	The name of the application that is displayed to end users. Type <i>ArcGIS Pro</i>
Launch Path	The location of your application executable file. Accept the default value.
Icon Path	Accept the default value of C:\ProgramData\Amazon\Photon\AppCatalogHelper...
Launch Parameters	Leave this blank.

Working Directory	Leave this blank.
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5. Now that you have added ArcGIS Pro to your catalog, choose **Next**.

Disable Internet Explorer Enhanced Security Configuration

Applications use Internet Explorer to open http links embedded in the applications. When you launch one of these links, Internet Explorer displays a warning message for every webpage that it opens. This behavior is due to the Internet Explorer Enhanced Security Configuration, a security setting of IE that blocks access to web content and application scripts for security reasons. If this feature is turned on, the ArcGIS Pro login prompt is not rendered correctly. We can safely disable this feature to proceed further. To disable this feature for AppStream 2.0 users, do the following.

6. Connect to your image builder as **Administrator**.
7. Open **Server Manager** from the Windows Task bar.
8. Choose **Local Server -> IE Enhanced Security Configuration**.
9. Choose Off option for both Administrators and Users.

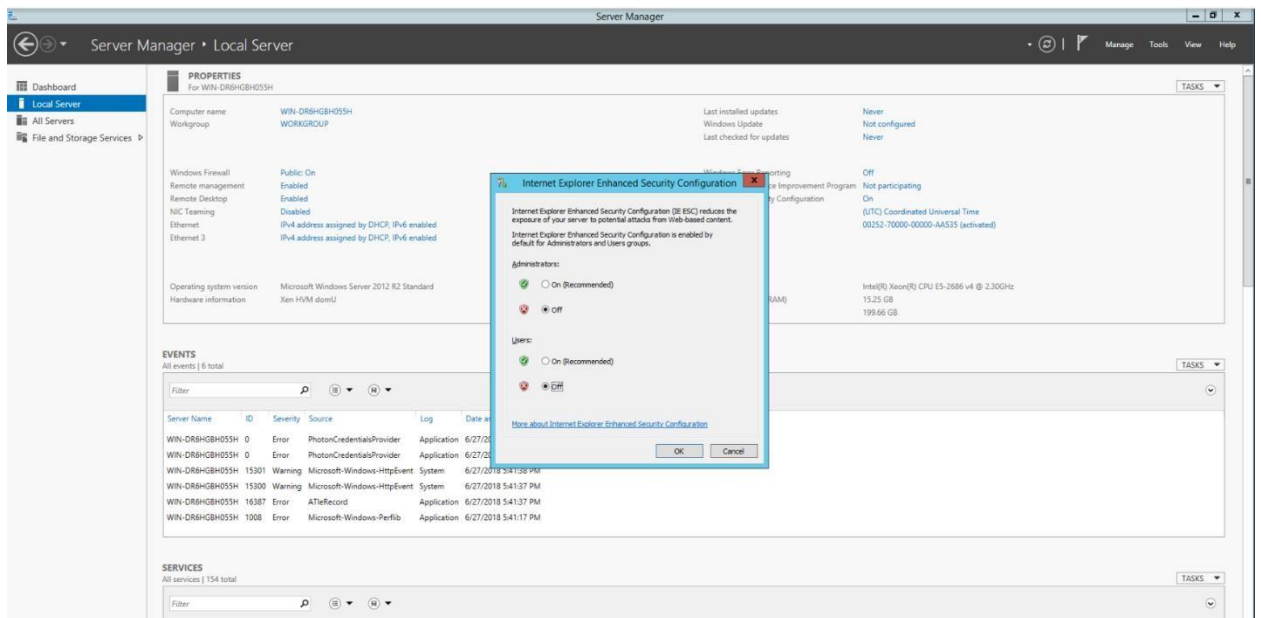


Figure 6: IE ESC - Server Manager in Image Builder

10. Choose **Admin Commands -> Switch User -> Template User** to switch to Template User account.

11. Once you are logged into the Template User account, launch **Internet Explorer**.
12. Choose **Settings** -> **Internet Options** from the top right menu of Internet Explorer. In the prompted dialog, choose **Advanced**.
13. Click the **Reset** button. Click **Reset** again in the prompted dialog. Close **Internet Explorer**.
14. Switch to **Administrator** account. Launch **Image Assistant**. Choose **Next** to proceed to the Configure step. From this tab, click **Save settings**. This will save the template user settings as default user settings.
15. Switch to test user. Launch Internet explorer. Confirm that the message "Internet Explorer Enhanced Security configuration is not enabled" is displayed in the home page. Browse to any website to confirm that IE is not displaying any blocking prompts.

Test your applications by using a local user account

An image builder includes a test user account that enables you to test your applications by using the same policies and permissions as your users. Follow these steps to confirm that your applications open correctly.

1. In the **Test** tab, choose **Switch User, Test User**.

You are now logged into the same Windows Server 2012 R2 instance as a local user who has regular (non-administrative) user rights.

2. Open Image Assistant. In **Test Applications**, ArcGIS Pro application that you added are displayed.
3. Choose the application to open it. Sign-in with your ArcGIS user credentials to launch the application.
4. If you get an error that you don't have licenses associated with your account, contact your administrator. If you are the administrator, you can assign licenses to the test account from your ArcGIS admin console.

5. After successful authentication, wait for the application to launch fully. After validating the launch, sign out from the application and close the application window.
6. Choose **Switch User**.
7. On the **Local User** tab, choose **Administrator**.
8. On the Image Assistant **Test** tab, choose **Next**.

Optimize the launch performance of your applications

During this step, Image Assistant opens your applications one after another, identifies their launch dependencies, and performs optimizations to ensure that applications launch quickly.

1. On the **Optimize** tab, choose **ArcGIS Pro, Launch**.
2. Wait for ArcGIS Pro to completely start, as prompted by a message in the application.
3. After you complete the first run experience for the application and verify that it functions as expected, choose **Continue**.

Configure the image

1. On the **Configure Image** tab, type the following information.

Option	Value
Name	The unique name identifier for the image, such as <i>DemoCo_Image_ArcGISPro_v1_mmddyyyy</i> , using any of the following characters: a-Z,0-9,-,_,. Note: The name cannot begin with "Amazon," "AWS," or "AppStream."
Display Name	A user-friendly name to display in the console

Description	An optional description for the image: for example, <i>Image v1 created by (your initials or name) on mm/dd/20yy.</i>
Option	Value
Always use latest agent version	Leave this check box selected so that streaming instances that are launched from your image always include the latest AppStream 2.0 features, performance improvements, and security updates. For more information, see Amazon AppStream 2.0 Agent Version History .

Finish creating the image

Complete the following steps to disconnect from the remote session and start the image creation process.

1. Review the image details, and choose **Disconnect and Create Image**.
2. The remote session disconnects within a few moments. When the **Lost Connectivity** message appears, close the browser tab.

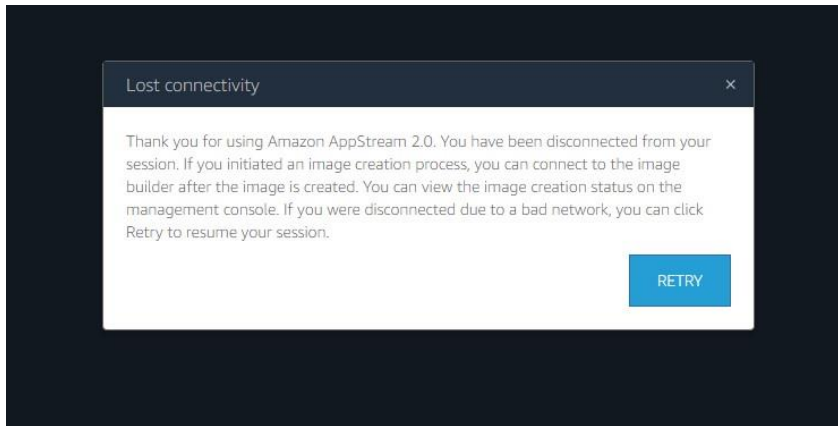


Figure 7: The **Lost connectivity** message indicating that the image creation process has started.

3. Return to the [Amazon AppStream 2.0 console](#) and choose **Images, Image Registry**. While your image is being created, the image status in the image registry of the console appears as **Pending**. While your image is being created, you cannot connect to it.

4. Click the **Refresh** icon periodically to update the status. Image creation takes about 20 minutes. After your image is created, the image status changes to **Available** and the image builder is automatically stopped.

Note: To make changes to your image, such as adding other applications or updating existing applications, you must create a new image. To do so, restart and reconnect to the image builder, make your changes, and then repeat the Image Assistant process to create a new image that includes the changes.

Step 6: Provision a fleet

An AppStream 2.0 fleet defines the hardware, network, Active Directory (if applicable), and scaling configuration for your application streaming infrastructure. For more information, see [Amazon AppStream 2.0 Stacks and Fleets](#).

In this section, you'll do the following:

- Provide details for your fleet.
- Choose an image.
- Configure the fleet.
- Configure the network.

Provide fleet details

1. Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.
2. In the navigation pane, choose **Fleets, Create Fleet**.
3. For **Step 1: Provide Fleet Details**, type the following text and choose **Next**.

Option	Value
Name	The unique name identifier for the fleet, such as <i>DemoCo_Fleet_v1_mmdyyyy</i> , using any of the following characters: a-Z,0-9,-,_,. Note: The name cannot begin with "Amazon," "AWS," or "AppStream."
Display Name	The name displayed in the console, such as <i>DemoCo Fleet v1 April 2018</i> .

Description	An optional description for the fleet. For example, <i>Fleet v1 created by (your initials or name) on mm/dd/20yy.</i>
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Choose an image

For Step 2: Choose an image, choose the image that you created, scroll to the bottom of the page, and then choose **Next**.

Configure the fleet

1. **For Step 3: Configure fleet**, in **Choose instance type**, you define the hardware configuration for each of the instances that make up your fleet. Because you created the image by using the Graphics Design family, the instance type is already populated. However, you can select any of the four instance type options that are presented.
2. For this exercise, select the **Graphics Design** instance family, and then choose **stream.graphics-design.xlarge**. For more information, see [Amazon AppStream 2.0 Instance Families](#).
3. Under **Fleet Type details**, choose a fleet type that suits your needs. The fleet type determines the availability of streaming instances and affects your costs. You can choose either of the following:
 - **Always-on**: Instances run all the time, even when no users are streaming applications. When this option is selected, instances are immediately available for the next user to connect to immediately.
 - **On-Demand**: Instances run only when users are streaming applications. Idle instances that are available for streaming are in a stopped state. When this option is selected, a user must wait for one to two minutes for an instance to start up.

For this exercise, select the **On-Demand** option.

4. Under **User session details**, define the maximum amount of time that users can be connected to streaming sessions and how long streaming sessions should remain active after users disconnect.

- **Maximum session duration** defines how long user streaming sessions can remain active. If users are still connected to a streaming session five minutes before this limit is reached, they are prompted to save any open documents before being disconnected. Choose **8 hours**.
 - **Disconnect timeout** defines how long user streaming sessions can remain active after users are disconnected. If users try to reconnect to the streaming session after a disconnection or network interruption within this time interval, they are connected to the previous session. After the disconnect timeout expires, the session is terminated, and the user must start a new session to reconnect. Leave the default setting of **15 minutes**.
5. Under **Fleet capacity**, set **Minimum capacity** to 2 and **Maximum Capacity** to 4.

Notes:

- Capacity is defined in terms of the number of instances within a fleet and, consequently, every unique user streaming session that is served by a separate instance.
 - The minimum capacity for your fleet is the minimum number of users who are expected to be streaming at the same time.
 - The maximum capacity for your fleet is the maximum number of users who are expected to be streaming at the same time.
6. Choose **Next**.

Configure the network

1. For **Step 4: Configure Network**, make sure that the **Default Internet Access** check box is not selected. This option does not need to be selected because you already configured a VPC with a NAT gateway to provide internet access.
2. For **VPC**, select **vpc-xxxxxxx (AppStream2 VPC)**.
3. For **Subnet 1**, choose **subnet-xxxxxxx | (10.0.1.0/24)**. This is the AppStream2 Private Subnet1.

4. For **Subnet 2**, choose **subnet-xxxxxxx | (10.0.2.0/24)**. This is the AppStream2 Private Subnet2.
5. Choose **Next**.
6. Confirm the fleet configuration details. To change settings for any section, choose **Edit**, and make the needed changes. After you finish reviewing the configuration details, choose **Create**.
7. In the pricing acknowledgement dialog box, select the acknowledgement check box, and choose **Create** to begin provisioning your fleet with the initial set of running instances.

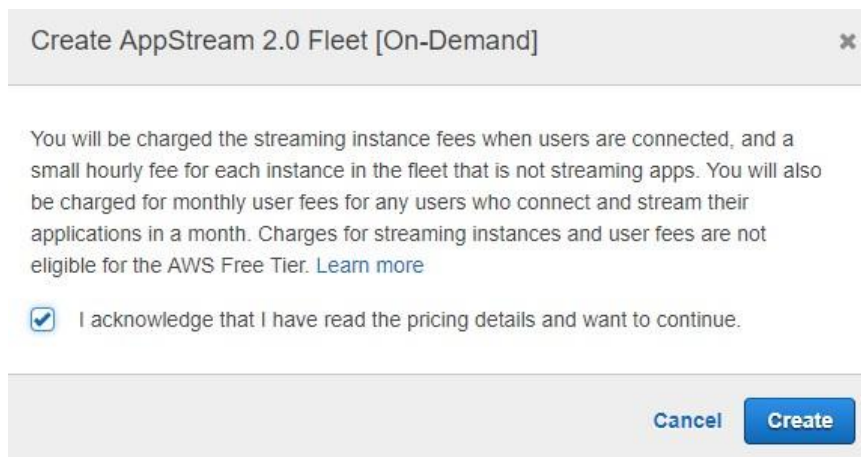


Figure 8: The AppStream 2.0 streaming instance pricing acknowledgement dialog box.

Note: If an error message notifies you that you don't have sufficient limits to create the fleet, submit a limit increase request to the AWS Support Center. For more information, see [Amazon AppStream 2.0 Service Limits](#).

Fleet provisioning usually takes 10 minutes to finish. While your fleet is being created and fleet instances are provisioned, the status of your fleet displays as **Starting** in the **Fleets** list. Choose the **Refresh** icon periodically to update the fleet status until the status is **Running**.

8. After the status changes to **Running**, the fleet is available and you can use it to create a stack.

Step 7: Create an AppStream 2.0 stack and a streaming URL

An AppStream 2.0 stack consists of a fleet, user access policies, and storage configurations. You create a stack to start streaming applications to users.

In this section, you'll do the following:

- Provide details for your stack and associate your stack with a fleet.
- Enable persistent storage for the stack.
- Create a streaming URL.

Provide stack details and associate the stack with a fleet

1. Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.
2. In the navigation pane, choose **Stacks**, **Create Stack**.
3. For **Step1: Stack Details**, type the following information and choose **Next**.

Option	Value
Name	The unique name identifier for the stack, such as <i>DemoCo_Stack_mmdyyyyy</i> , using any of the following characters: a-Z,0-9,-,_. Note: The name cannot begin with "Amazon," "AWS," or "AppStream."
Display Name	The name displayed in the console, such as <i>DemoCo Stack April 2018</i> .
Description	An optional text box where you can enter details of the stack:
Redirect URL	An optional URL to which users are redirected at the end of their streaming session. Type: <i>https://aws.amazon.com</i>

Option	Value
Fleet	Select the <i>DemoCo_Fleet_v1_mmddyyy</i> fleet that you created.

Enable persistent storage for the stack

1. For **Step 2: Enable Storage**, make sure that the **Enable Home Folders** option is selected. When this option is selected for an AppStream 2.0 stack, users of the stack are presented with a persistent storage folder in their AppStream 2.0 sessions. Data stored by users in their Home Folders is backed up to an Amazon S3 bucket that is automatically created in your AWS account. You can also enable *Google Drive for G Suite* or *OneDrive for Business* as user storage options if you use of these storage providers. For more information, see [Persistent Storage with AppStream 2.0](#).

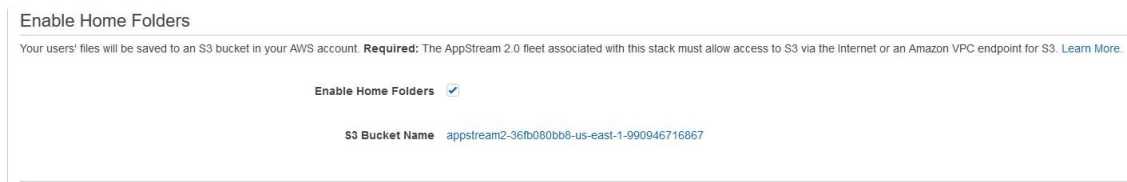


Figure 9: The **Enable Home Folders** page, displaying the Amazon S3 bucket that is automatically created.

2. Choose **Review**.
3. Confirm the stack configuration details. To change the settings for any section, choose **Edit** and make the needed changes. After you finish reviewing the configuration details, choose **Create**.

After a few moments, the **Stacks** list reappears. Your stack is listed with a status of **Active**.

Step 8: Manage user access with an AppStream 2.0 user pool

An AppStream 2.0 user pool is a built-in identity management feature that you can use to enable users to access their streamed applications. Alternatively, you can use SAML

2.0 to federate through Microsoft Active Directory or any other custom identity solution provider that supports SAML 2.0.

Note: This guide describes how to manage user access to AppStream 2.0 with the user pool. For information about configuring third-party SAML 2.0 identity provider solutions to work with AppStream 2.0, see [AppStream 2.0 Integration with SAML 2.0](#).

To enable users in the user pool to open applications after they sign in to the AppStream 2.0 user portal, you must assign each user to at least one stack that contains applications. After you assign the user to a stack, AppStream 2.0 sends an optional notification email to the user with instructions about how to access the stack and a URL. The user can access the stack by using the URL until you delete the stack or unassign the user from the stack.

In this section, you'll configure an AppStream 2.0 user pool and grant a user access to AppStream 2.0 by doing the following:

- Create a user in the user pool. AppStream 2.0 then sends a welcome email with instructions and a temporary password.
- Assign the stack that you created to the user.

Create a user

1. Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.
2. In the navigation pane, choose **User Pool, Create User**.
3. In the **Create User** dialog box, type the following information and choose **Create User**.

Option	Value
Email	An active email address that you can access.
First Name	The first name of the user.
Last Name	The last name of the user.

4. After a few moments, the **User Pool** list refreshes, and the user is listed and enabled.

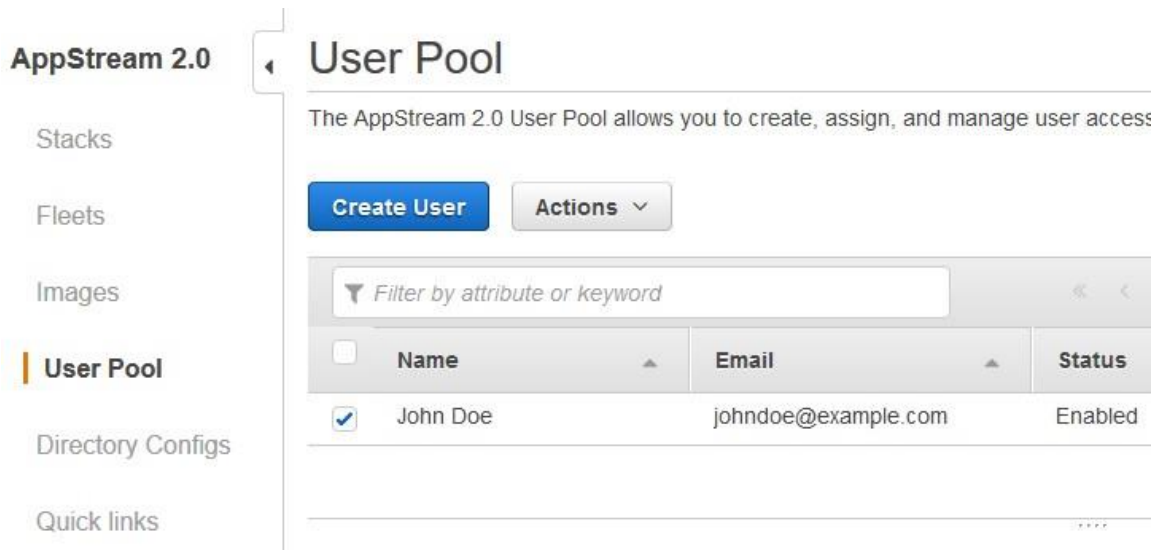


Figure 10: The User Pool dashboard showing the newly created user.

Assign a stack to the user

1. In the navigation pane, choose **User Pool**, and select the user that you created.
2. Choose **Actions, Assign Stack**.
3. In the **Assign Stack** dialog box, for **Stack**, select the *DemoCo_Stack_mmddyyyy* stack that you created earlier.
4. Leave the **Send email notification to user** option selected.
5. Choose **Assign Stack**.
6. After a few moments, the **User Pool** list refreshes. The user that you created appears under **User Details** with *DemoCo_Stack_mmddyyyy* as an assigned stack.

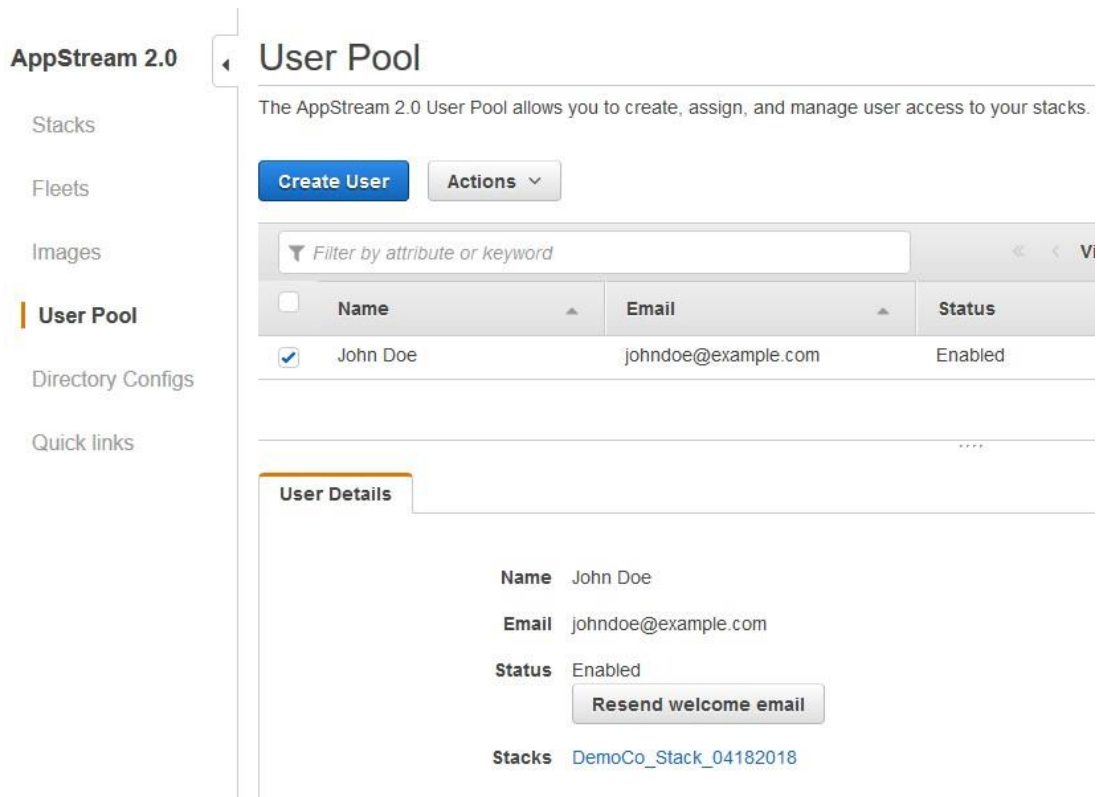


Figure 11: The User Pool dashboard showing the newly created user with a stack now assigned.

Step 9: Test the end user authentication and application streaming experience

In the previous section, you added a user to the user pool by providing a name and an email address and then assigned a stack to the user. AppStream 2.0 sent an email to the email address after each action. To test the end user experience, sign in to AppStream 2.0 as the user that you created and start a streaming session.

1. Open the first notification email that you received, and open the **Login page** link. The AppStream 2.0 portal sign-in page opens in your browser.

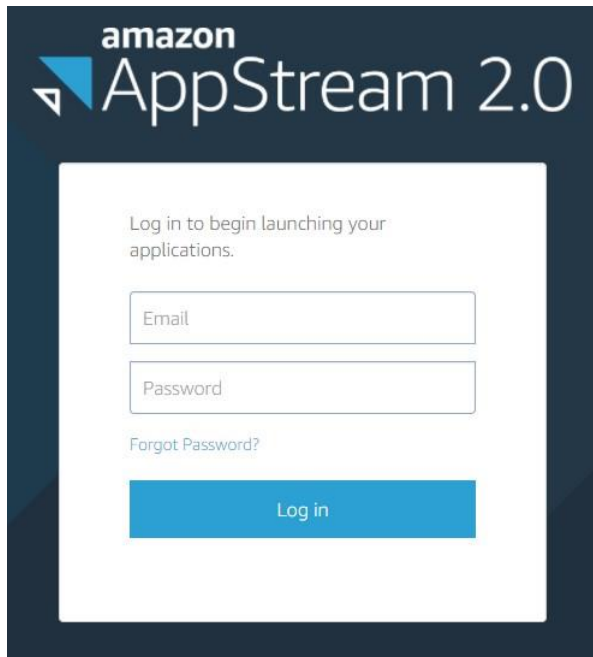


Figure 12: The AppStream 2.0 user login prompt.

2. Type the email address used for the user that you created and the temporary password that was provided in the email, and then choose **Log in**.
3. When prompted, type a new password, confirm it, and then choose **Set Password**. The AppStream 2.0 application catalog page opens, displaying the applications that are available for streaming.
4. Choose an application to begin streaming.

Step 10: Advanced Topics for ArcGIS Deployment

This deployment guide talked about creating an ArcGIS Pro streaming environment using AppStream with ArcGIS Pro online licensing scheme. To learn more about the various advanced configurations, please follow the links

5. **Enabling ports for license communication:** After installing the licensing server, you have to configure the Windows firewall on the EC2 instance to allow the TCP/IP ports used for license communication. To configure the Windows firewall, see [Configure ArcGIS License Manager to work through a firewall](#). In addition to the configuration of Windows firewall on the EC2 instance, you should also edit the inbound rules of the security group associated with the EC2 instance to allow

TCP/IP communication to ports 27000 through 27009. To learn more about how to configure VPC security group rules, see [Adding rules to a Security Group](#)

6. **ArcGIS Server on AWS:** To learn more about migrating your existing ArcGIS Server or deploy a new server to AWS, see [ArcGIS Enterprise on AWS](#). To learn more about how to connect your ArcGIS Pro client on AppStream to a GIS server, see [Connect to a GIS Server](#).
7. **ArcGIS data store:** To learn more about migrating your GIS data to AWS, refer [Move data to AWS](#)
 - If you use an EC2 instance as a data store, you can mount the EC2 instance as a network file share to the AppStream instances provided the file share is accessible through the VPC you use with AppStream.
 - If you use an S3 bucket to store your GIS data, you can expose the files in the S3 bucket as a NFS or an SMB file share using Amazon Storage Gateway Service. To learn more, see [Creating a File Gateway](#).

Step 11: Take the next step with AppStream 2.0

Congratulations, you have now successfully created an AppStream 2.0 environment to stream applications. Below is an architectural diagram illustrating the AppStream 2.0 environment you created:

4. Configure your fleet scaling policies to increase or decrease the number of instances available to users in response to changes in user demand or according to time of day. For more information, see [Fleet Auto Scaling for Amazon AppStream 2.0](#).

Important: Remember to delete the resources that you created in these exercises to avoid further charges to your account. For information about how to delete AppStream 2.0 resources, see *Appendix E*. For more information about AppStream 2.0 pricing, see [Amazon AppStream 2.0 Pricing](#).

Appendix A: Create and activate an AWS account

If you do not already have an AWS account, complete the following steps to create and activate one. During this process, you do the following:

- Create your AWS account.
- Add a payment method.
- Verify your phone number.
- Select an AWS Support plan.
- Watch for three account confirmation emails.

Create your AWS account

1. In a browser window, open the [Amazon Web Services](#) webpage.
2. Choose **Create an AWS Account**. If you've signed in to AWS recently, you might see **Sign In to the Console** instead. If **Create a new AWS account** isn't visible, choose **Sign in to a different account, Create a new AWS account**.
3. On the **Create an AWS Account** page, type a valid email address, a password and password confirmation, and an AWS account name.
4. You must note the account name, email address, and password that you choose for your AWS account because you need these credentials to sign in to AWS.
5. Choose **Continue**.
6. On the **Contact Information** page, the option to choose a company account or personal account is available. These two account types function identically. For the exercises in this guide, choose **Personal Account**, and then enter the requested contact information.
7. Review the **AWS Customer Agreement**, and select the corresponding check box.
8. Choose **Create Account and Continue**.

Note: After you receive an email to confirm that your account is created, you can sign in to your new account by using the email address and password that you

provided. However, you must continue with the activation process before you can use AWS services.

Add a payment method

On the **Payment Information** page, type the requested information associated with your payment method. If the address for your payment method is the same as the address you provided for your account, choose **Secure Submit**.

Otherwise, choose **Use a new address**, type the billing address for your payment method, and then choose **Secure Submit**.

Verify your phone number

1. On the **Phone Verification** page, type a phone number that you can use to accept incoming calls.
2. Type the code displayed in the captcha.
3. When you're ready to receive the call, choose **Call me Now**. In a few moments, you'll receive an automated call from AWS that prompts you to enter your PIN to validate the AWS account.
4. When you receive the call, enter the provided PIN on your phone's keypad.
5. After the process is complete, choose **Continue**.

Choose an AWS Support plan

On the **Select a Support Plan** page, choose **Basic**. For information about AWS Support, see [AWS Support Features](#).

After you choose a Support plan, a confirmation page indicates that your AWS account is being activated. Accounts are usually activated within a few minutes, but the process may take up to 24 hours. If you attempt to sign in to the AWS Management Console before your account is active, the following message appears:

Your service sign-up is almost complete!

Thanks for signing up with Amazon Web Services. Your services may take up to 24 hours to fully activate. If you're unable to access AWS services after that time, here are a few things you can do to expedite the process:

1. Make sure you provided all necessary information during signup. [Complete your AWS registration](#).
2. Check your email to see if you have received any requests for additional information. If you have, please respond to those emails with the information requested.
3. Verify your credit card information is correct. Also, check your credit card activity to see if there's a \$1 authorization (this is not a charge). You may need to contact your card issuer to approve the authorization.

If the problem persists, please contact Support:

Contact Support

Figure 14: Message that appears if you sign in before your account activation is complete.

Watch for three AWS account confirmation emails

When you sign up for your account, you receive three account confirmation emails:

- The first email, with a subject line of "Welcome to Amazon Web Services," confirms the creation of your AWS account and is sent almost immediately after you verify your phone number.
- The second email, with a subject line of "AWS Support (Basic) Sign-Up Confirmation," confirms the AWS Support option that you selected during the account creation process.
- The third email, with a subject line of "Your AWS Account is Ready - Get Started Now," is sent after your AWS account ID is ready to use. After you receive this email, you can access AWS services by using the [AWS Management Console](#).

Appendix B. Manually create and configure network resources

Step 2 of this guide described how to use a CloudFormation template to automatically create and configure the necessary network resources for your AppStream 2.0 environment. To manually create and configure network resources, follow the steps in this appendix. At the end of this appendix, the topology of your "DemoCo" VPC should look similar to the following diagram:

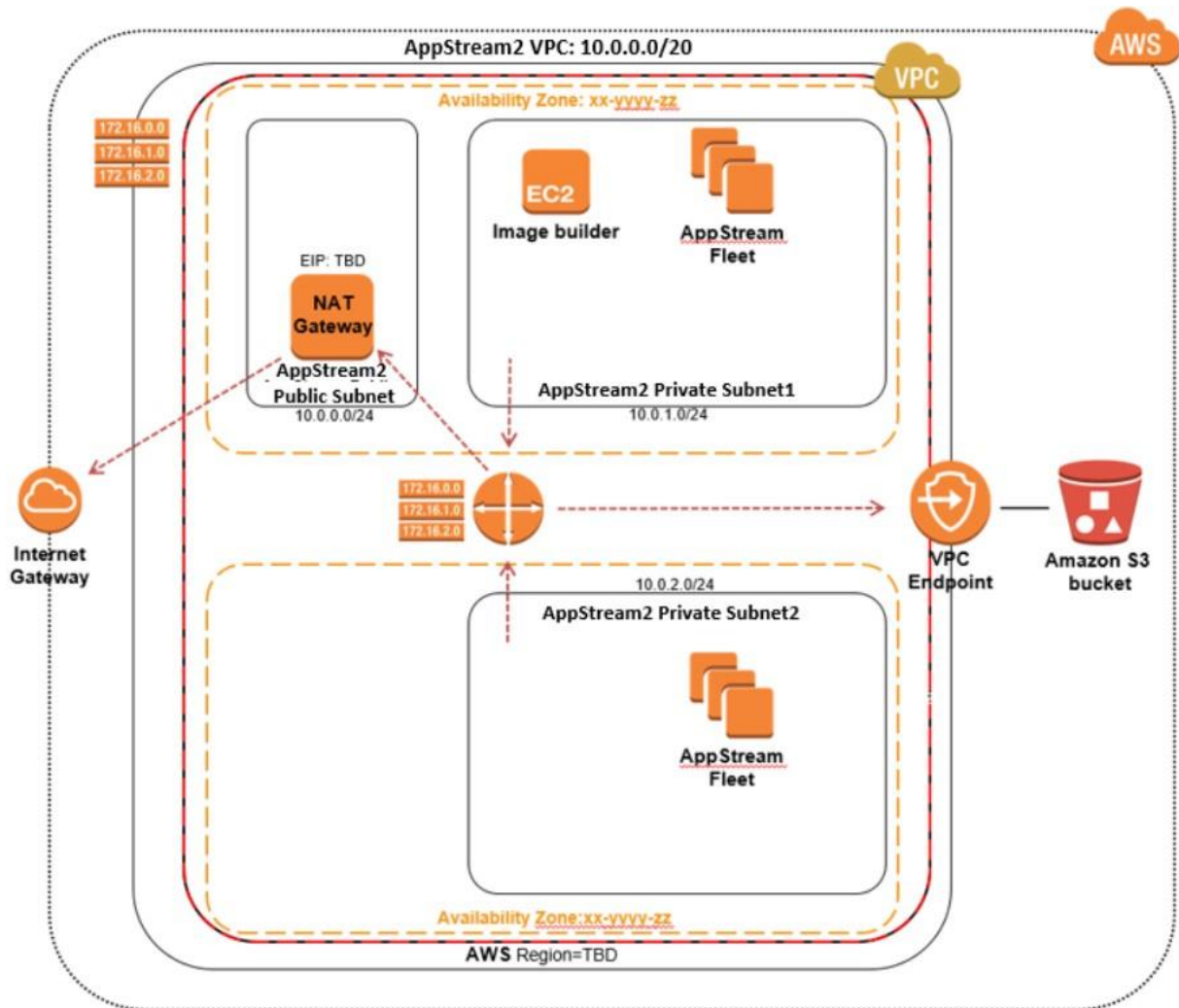


Figure 15: DemoCo VPC architecture.

Note: The CIDR block assignments for the private subnets might be reversed depending on the availability zones used by the VPC wizard.

AppStream VPC requirements

At a minimum, AppStream 2.0 requires a VPC that includes one public subnet and two private subnets. A public subnet has direct access to the internet through an internet gateway. A private subnet requires a Network Address Translation (NAT) gateway or NAT instance to access the internet.

Allocate an Elastic IP address

Before you create your VPC, you must allocate an Elastic IP address in your AppStream 2.0 region. An Elastic IP address enables your streaming instances to be accessible through an internet gateway.

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2>.
2. In the navigation pane, under **Network & Security**, choose **Elastic IPs**.
3. Choose **Allocate New Address** and then choose **Allocate**.
4. Note the Elastic IP address and then choose **Close**.

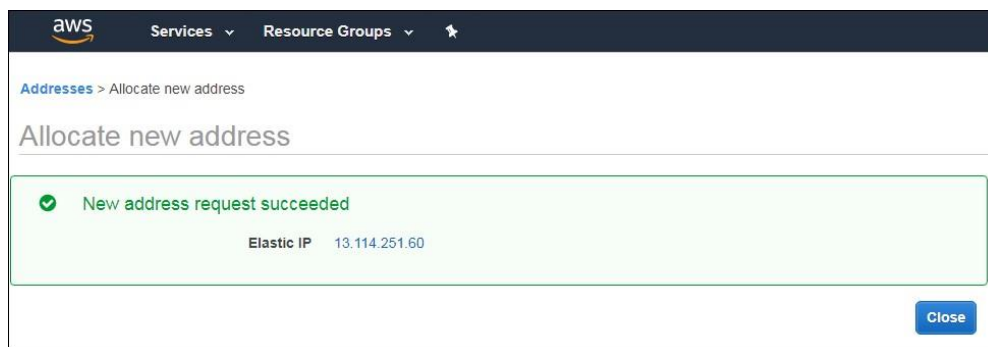


Figure 16: An allocated Elastic IP address.

Create a VPC by using the VPC Wizard

The easiest way to start building your VPC environment is to use the VPC Wizard. The wizard guides you through the process of creating a public subnet, private subnet, NAT gateway, and internet gateway, with the correct route table configurations.

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **VPC Dashboard**, **Start VPC Wizard**.
3. In **Step 1: Select a VP Configuration**, choose **VPC with Public and Private Subnets**, **Select**.

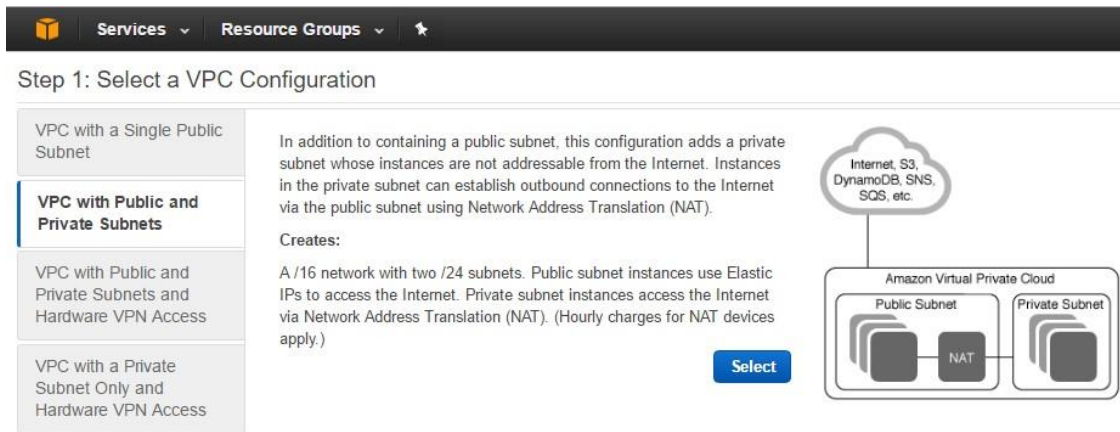


Figure 17: Creating a VPC with the VPC Wizard.

- In **Step 2: VPC with Public and Private Subnets**, type the following information and then choose **Create VPC**.

Option	Value
IPv4 CIDR block	10.0.0.0/20
IPv6 CIDR block	Accept the default value: No IPv6 CIDR Block
VPC Name	AppStream2 VPC
Public subnet's IPv4 CIDR	Accept the default value: 10.0.0.0/24
Availability Zone	Accept the default value: No Preference
Public subnet name	AppStream2 Public Subnet
Private subnet's IPv4 CIDR	Accept the default value: 10.0.1.0/24
Availability Zone	Accept the default value: No Preference
Private subnet name	AppStream2 Private Subnet1

Option	Value
Elastic IP Allocation ID	Click in the text box and select the value that corresponds to the Elastic IP address you created. This address is assigned to the NAT gateway.
Service endpoints	Choose Add Endpoint .
Service	Select the entry in the list that ends with "s3" (the <code>com.amazonaws.xx-rrrr-x.s3</code> service that corresponds to the region in which the VPC is being created). Note: This is not the default value.
Subnet	Select <i>Private subnet</i> .
Policy	Accept the default value: <i>Full Access</i>
Enable DNS hostnames	Accept the default value: <i>Yes</i>
Hardware tenancy	Accept the default value: <i>Default</i>

Note: The VPC names and subnet names are for identification purposes only. You can use different names.

5. After a few minutes, when a message in the VPC dashboard notifies you that the VPC is created, choose **OK**.

Add a second private subnet

1. In the navigation pane, choose **Subnets**.
2. Select the subnet with the name **AppStream2 Private Subnet1**. On the **Summary** tab, below the list of subnets, make a note of the Availability Zone for this subnet.

Search Subnets and their projects

Name	Subnet ID	State	VPC	IPv4 CIDR	Available IPv4	IPv6 CIDR	Availability Zone
AppStream2 Private Subnet2	subnet-fd405299	available	vpc-d6ff74ad AppStream2 VPC	10.0.2.0/24	251		us-east-1b
	subnet-3d64f812	available	vpc-c98ab7b1	172.31.80.0/20	4091		us-east-1c
	subnet-2feeb464	available	vpc-c98ab7b1	172.31.16.0/20	4091		us-east-1d
	subnet-ff4827c0	available	vpc-c98ab7b1	172.31.64.0/20	4091		us-east-1e
	subnet-d3b7278e	available	vpc-c98ab7b1	172.31.32.0/20	4091		us-east-1a
	subnet-b23161d6	available	vpc-c98ab7b1	172.31.0.0/20	4091		us-east-1b
AppStream2 Private Subnet1	subnet-c175b38b	available	vpc-d6ff74ad AppStream2 VPC	10.0.1.0/24	250		us-east-1d

subnet-c175b38b | AppStream2 Private Subnet1

Summary | Route Table | Network ACL | Flow Logs | Tags

Subnet ID: subnet-c175b38b | AppStream2 Private Subnet1
 Availability Zone: us-east-1d
 IPv4 CIDR: 10.0.1.0/24
 Route table: rtb-831e9aff | AppStream2 Private Route Table
 IPv6 CIDR:
 Network ACL: acl-c0a140ba
 State: available
 Default subnet: no
 VPC: vpc-d6ff74ad | AppStream2 VPC
 Auto-assign Public IP: no
 Available IPs: 250
 Auto-assign IPv6 address: no

Figure 18: Identifying the Availability Zone for AppStream2 Private Subnet1.

- At the top of the same page, choose **Create Subnet**. Enter the following information in the **Create Subnet** dialog box and then choose **Yes, Create**.

Option	Value
Name tag	AppStream2 Private Subnet2
VPC	Select the VPC with the name <i>AppStream2 VPC</i> .
Availability Zone	Select an Availability Zone other than the one you are using for AppStream2 Private Subnet1. Selecting a different Availability Zone increases fault tolerance.
IPv4 CIDR block	10.0.2.0/24 (This is a subset of the CIDR block for your VPC.)

Modify the subnet route tables

- In the navigation pane, choose **Subnets**, and then select the subnet with the name **AppStream2 Public Subnet**.
- On the **Route Table** tab, note the ID of the route table (similar to *rtb-XXXXXXXXXX*).
- In the navigation pane, choose **Route Tables** and select the route table with the ID that you noted in the previous step.

- For **Name**, open the empty field, type *AppStream2 Public Route Table*, and then select the check mark to save your changes.

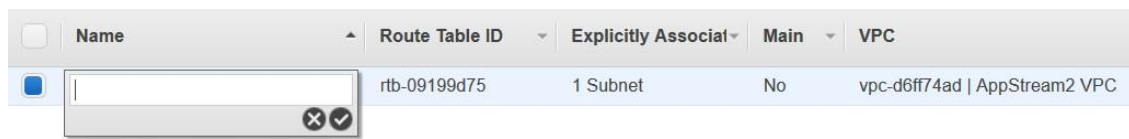


Figure 19: Opening the name field for the route table that serves the AppStream2 Public Subnet.

- Make sure that **AppStream2 Public Route Table** is still selected. On the **Routes** tab, verify that the route table includes the following two routes:

Destination	Target
10.0.0.0/20	local
0.0.0.0/0	igw-XXXXXXXXXX

These two routes function as follows for all resources within a subnet that is associated with the route table:

- Local: All traffic from the resources destined for IPv4 addresses within the 10.0.0.0/20 CIDR block is routed locally within the VPC.
- Outbound: Traffic destined for all other IPv4 addresses is routed to the internet gateway (identified by *igw-XXXXXXXXXX*) that was created by the VPC Wizard.

To modify the route table, choose **Edit** and make the needed changes. For more information, see [Route Tables](#).

- In the navigation pane, choose **Subnets** and select the subnet named **AppStream2 Private Subnet1**.
- On the **Route Table** tab, note the ID of the route table (similar to *rtb-XXXXXXXXXX*).
- In the navigation pane, choose **Route Tables** and select the route table with the ID you noted in the previous step.
- For **Name**, open the empty field, type *AppStream2 Private Route Table*, and then select the check mark to save your changes.

<input type="checkbox"/>	AppStream2 Public Route Table	rtb-09199d75	1 Subnet	No	vpc-d6ff74ad AppStream2 VPC
<input checked="" type="checkbox"/>	AppStream2 Private Route Table	rtb-831e9aff	0 Subnets	Yes	vpc-d6ff74ad AppStream2 VPC
<input type="checkbox"/>		rtb-c7d654ba	0 Subnets	Yes	vpc-c98ab7b1

Figure 20: Opening the name field for the route table that serves the AppStream2 private subnets.

10. Make sure that **AppStream2 Private Route Table** is still selected, and on the **Routes** tab, verify that the route table includes the following routes:

Destination	Target
10.0.0.0/20	<i>local</i>
0.0.0.0/0	<i>nat-XXXXXXXXXXXXXXXXXXXX</i>
pl-YYYYYYYYY (com.amazonaws.<region>-<#>.s3)	<i>vpce-ZZZZZZZZ</i>

These three routes function as follows for all resources within a subnet that is associated with the route table:

- Local: All traffic from the resources destined for IPv4 addresses within the 10.0.0.0/20 CIDR block is routed locally within the VPC.
- Storage: Traffic destined for S3 buckets is routed to the S3 endpoint (identified by *vpce-ZZZZZZZZ*).
- Outbound: Traffic destined for all other IPv4 addresses is routed to the NAT gateway (identified by *nat-XXXXXXXX*).

To modify the route table, choose **Edit** and make the needed changes. For more information, see [Route Tables](#).

11. In the navigation pane, choose **Subnets** and select the subnet with the name **AppStream2 Private Subnet2**.

12. On the **Routes** tab, verify that the route table is the one named AppStream2 Private Route Table. If the route table is different, choose **Edit** and select this route table.

Appendix C. Clean up your AppStream 2.0 resources

Although you can continue to use this AppStream 2.0 environment, keep in mind that you pay for your running resources. For more information, see [Amazon AppStream 2.0 Pricing](#).

Cleaning up the resources that you created frees up resources and helps you avoid unintended charges to your account.

Stop and delete your image builder

1. Open the AppStream 2.0 console at <https://console.aws.amazon.com/appstream2>.
2. In the navigation pane, choose **Images, Image Builder**.
3. Confirm whether the image builder that you created in Step 3 in this guide is in a stopped state. If not, select the image builder and choose **Actions, Stop**. If you created multiple image builders, repeat this step for each image builder that you created.
4. After the image builder has stopped, choose **Actions, Delete**. Repeat this step for each image builder that you created.

Revoke stack permissions for users in the user pool

1. In the navigation pane, choose **User Pool**.
2. Select the user you created in Step 9 in this guide and choose **Actions, Unassign stack**. This action revokes the stack permissions for the user.

Disassociate your fleets from your stack and delete your stack

1. In the navigation pane, choose **Stacks**.
2. Select the stack you created and choose **Actions, Dissociate Fleet**. This action dissociates the fleet from the stack.
3. To delete the stack, choose **Actions, Delete**.

Stop and delete your fleet

1. In the navigation pane, choose **Fleets**.
2. Confirm whether the fleet that you created in Step 6 in this guide is in a stopped state. If not, select the fleet and choose **Actions, Stop**.

3. After the fleet has stopped, choose **Actions, Delete**.

Appendix D. Additional resources

For more information about AppStream 2.0, visit the following resources:

- [Amazon AppStream 2.0 Product Details](#)
- [Amazon AppStream 2.0 Pricing Details](#)
- [Amazon AppStream 2.0 FAQs](#)
- [Amazon AppStream 2.0 Developer Guide](#)
- [Amazon AppStream 2.0 API Reference](#)
- [Amazon AppStream 2.0 CLI Reference](#)
- [Amazon AppStream 2.0 Try It Now Demo](#)
- [Amazon AppStream 2.0 Resources](#)
- [Performance Issues in ArcGIS Pro](#)