This tutorial is adopted from a tutorial created by Jim Detwiler at Penn State University – thanks Jim! Original version at [https://www.e-education.psu.edu/spatialdb/node/2022](https://www.e-education.psu.edu/spatialdb/node/2022). This version is by Dr. Bethany Bradley (UMass Amherst), with a few minor tweaks. This is a communal resource – please contribute!
A. Prepare to work in the Amazon cloud environment

In these steps, you will create an account with AWS Educate, which will give you a $100 credit to use for virtual machining. This should give you plenty of time, as long as you remember to close the virtual machine (‘instance’) to stop charges. Charges are based on time spent on the virtual machine, and typically cost much less than $1 per hour.

1. Go to AWS Educate (awseducate.com) and click Join AWS Educate.
2. Choose your role of Student.
3. You’ll need to fill in some personal information, including your UMass email address. Click Next, scroll through and agree to the terms, and submit your application.
4. Check your email. AWS Educate will send you an email verification to complete the application. Now, you wait for approval (it took 4 hours for me, but they say it could be up to a day).
5. Once Amazon approves your AWS Educate application, sign in to the AWS Educate Student Portal and go to the “AWS Account” tab.

6. Click the button AWS Educate Starter Account. This will redirect you to the Vocareum website. Accept whatever terms and conditions appear.
7. On the Vocareum website, you should see a message that your account is “Active” and that you have $100 remaining credits. Click the button AWS Console to launch the AWS Console in a new tab.
8. Now you are good to go!

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2 There’s a way to get your instance to stop automatically by setting up an Alarm – see section E.
B. Create a key pair

One of the settings involved in launching a new instance in EC2 is the key pair. A key pair is a security measure that will come into play when you log in to your instance for the first time. You will be logging in to your instance as a user named Administrator. The password for the Administrator user will be encrypted by AWS. The procedure for getting that password so that you can log in to your instance involves (1) creating a key pair (one key held by Amazon and another key given to you) in the AWS Management Console, (2) providing the name of that key pair when launching the instance, and (3) using the key pair after the instance has been created to decrypt the password.

1. If you already have the AWS Console open, you can skip this step. Otherwise, access the AWS Console by:
   a. Signing in to the AWS Educate Student Portal (awseducate.com/signin/SiteLogin).
   b. Clicking on the ‘AWS Account’ tab in the upper right corner, then clicking the AWS Educate Starter Account button.
   c. In the Vocareum website that opens, click the AWS Console button.

2. Click the “Services” tab in the upper left corner, then in the search bar type EC2, and click on EC2.

3. In the navigation pane on the left side of the page, click NETWORK & SECURITY > Key Pairs.

4. Click the Create key pair button, give it a Name (something like “NRC585_keypair”), choose .pem for the file format, then click Create key pair.

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3 Time for acronyms! Drop AWS, VPC, and EC2 into a sentence and watch your family stare at you blankly.
5. **Save** the `.pem` file produced by AWS to a folder on your machine where you'll be able to find it later.
C. Create your own cloud-based instance of Windows

There are different ways to deploy ArcGIS in AWS. With an AWS Educate Starter Account, you need to create a virtual Windows machine set up so that it will be well-equipped to run ArcGIS. Then, once the machine is up and running, you can install the ArcMap software the same way you would on a physical computer.

1. In the navigation pane on the left side of the page, click INSTANCES > Instances.

2. Click the Launch Instance button. This will take us through the “Launch Instance Wizard”, one step at a time.

3. The first step is to choose our Amazon Machine Image (AMI). In the search bar at the top, type in Microsoft Windows Server 2019 Base. To the right of this instance, click Select.

4. You're taken to a page where you can choose which instance type you want to launch. The higher the number and size, the better the computer, and the more expensive it is to operate. The recommended instance for our setup is m4.xlarge ($0.20 per hour). Scroll down and click this option. If you want to save money, you can always go smaller. You can look up current pricing per hour by clicking ‘Windows’ at https://aws.amazon.com/ec2/pricing/on-demand/.

   We will leave most of the remaining options in the wizard at their default values.

5. In the upper menu bar, click 6. Configure Security Group. We will now create a new security group. This will set up the instance so that it will accept connections from a Remote Desktop application (more on that below).

   a. There is already an RDP protocol set up. Under the “Source” column, change from “Custom” to My IP.

   b. Click Add Rule and set the “Type” to HTTP. Leave the rest default.

   c. Click Add Rule and set the “Type” to HTTPS. Leave the rest default.
Important: You've just specified that your instance should accept remote desktop connections from your current IP address and you'll shortly make your first remote desktop connection. It's possible that your IP address will change in the future. For example, your Internet service provider might use dynamic IP address assignment. Or you might be working on a laptop in a different location. If that's the case, then you'll need to come back and edit your RDP rule to accept connections from whatever your new IP address happens to be at that time.

6. In the bottom right corner, click **Review and Launch**. You'll see a warning message that “Your instance configuration is not eligible for the free usage tier” - you can ignore this, it's what your $100 credits are for!

7. In the bottom right corner, click **Launch**. This will bring up a window asking for a key pair. Select the key pair you created in the previous step. Check the box asking for your acknowledgement that you can access that keypair (it should be saved somewhere you remember!), then click **Launch Instances**.

3…2…1, liftoff, we have liftoff.
8. On the resulting “Launch Status” page, click on the **View Instances** button in the bottom right corner. On the Console page, you'll be taken to a listing of your Instances. You should see an entry for the instance you just launched. The instance is running (shown under ‘Instance State’), but still initializing (shown under ‘Status Checks’).

![Console page showing instance details](image)

It could take anywhere from 5-30 minutes for your instance to be ready for use. You'll know it's ready when you see the ‘Status Checks’ change from **Initializing** to **2/2 checks**. You may have noticed that the instance doesn't have a name. While you wait, you can give it one.

9. Hover your mouse over the instance's ‘Name’ field. You should see a pencil icon appear. Click on this icon to obtain a text box, then enter a suitable name.

Every instance you create has a public-facing address, or Public DNS that can be used to reference the instance from anywhere on the Internet. The challenge is that this address changes every time you stop and then start your instance. To give your machine a more permanent address, you'll set up an Amazon Elastic IP. This is an unchanging address that Amazon allocates to you for your use. You can then associate it with any instance you choose. Every time you stop and start the instance, you'll associate it with this IP address.

10. In the left-side navigation pane of the Console, under **NETWORK & SECURITY**, click **Elastic IPs**.

11. Click **Allocate Elastic IP Address** and in the resulting panel click **Allocate**. You should see a message indicating that your request was successful along with the address that was allocated to you, such as 107.20.220.152. You could save your IP address, but you should be able to easily locate it in the AWS Console when you need to.

12. In the upper right corner, click **Associate this Elastic IP address** (you can also find Associate under Actions), choose your instance from the drop-down, and click **Associate**.

13. In the left-side navigation pane, click **Instances** again to return to your list of instances. Hopefully by now you’ve got your 2/2 status checks.

14. At the top of the lower panel, you should now see “Elastic IP:” followed by a bunch of numbers.
You made it!! You have created a virtual computer running Windows. There were a lot of steps involved in launching this instance, but the good news is that you should not need to go through these steps again. Stopping and restarting your instance now that it's been created is a much simpler process.
D. Start and stop your instance via the AWS Management Console

Whether starting or stopping your instance, you'll want to be viewing the Instances page in the AWS Management Console. Remember, any time you have an instance running, it is charging you $0.20 per hour. Make sure to stop your instance when you've finished your coursework for the day.

To stop your instance:

- Right-click on the instance, and select **Instance State > Stop**.

To start your instance:

- Right-click on the instance, and select **Instance State > Start**.

- Double check that your Elastic IP is still associated with this instance. If it isn’t, go to the Elastic IPs page in the Console and associate your Elastic IP with your running instance as outlined above.

- Reboot your instance. (In Instances, right click, **Instance State > Reboot**).

**Note:** The benefit to the Elastic IP will be avoiding the need to locate the instance's new Public DNS address each time you want to restart it and connect to it through remote desktop. If you'd rather not bother with associating your Elastic IP with your instance and rebooting each time you want to work, then you're welcome to skip that step and instead look up the instance's new Public DNS and connect through that address.
E. Create an alarm to stop an idle instance

1. On the left-hand panel, navigate to **INSTANCES > Instances**.

2. Right click on the instance (or click the drop-down Actions box) and select **Instance State > Start**... wait a minute until you see ‘running’.

3. Select the instance. In the bottom panel, on the ‘Monitoring’ tab, click **Create Alarm**.

4. In the Create Alarm dialog box:
   a. Uncheck **Send a notification to**.
   b. Check **Take the action**, and toggle **Stop this instance**.
   c. **Whenever**: set the statistic and metric you want to use. In this example, choose **Average** and **Disk Reads**.
   d. **Is**: set the preferred metric threshold. In this example, enter <= 10 Bytes.
   e. **For at least**: try 4 consecutive period(s) of 15 Minutes. (This will STOP your instance if it is running idle for one hour – adjust the time periods to your preference).
   f. **Name of alarm**: enter a new name.

5. Click **Create Alarm**.

For the next section, we’re going to use the running instance. If you stopped it above, go ahead and start it again^5. **Be sure to stop it when you’re ready to quit working!**

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^5 If you’re ready to take a nap, stop the instance and regroup later in Section F.
F. Log in to your Windows instance

Now that your instance has been created, you can get ready to log in and start the ArcGIS software install process. Your instance needs to be running, so if you stopped it at the end of the previous section, open the AWS Management Console > Instances and Start it again.

The instance is already set up to accept connections through the Remote Desktop app (instructions on where to download below). There are two bits of information we'll need to make a connection: the instance's IP address and the password of the Administrator account.

1. Copy and Paste your Elastic IP address into a text editor like Word or Notepad.
2. Go back to the Instances panel in the AWS Management Console, right-click your instance name, select Get Windows Password, and use the Browse or Choose file link to locate and open the key pair file (.pem file) that was created when launching the instance. The text box will fill with the key pair information.
3. Click on Decrypt Password. The password can be seen at the bottom of the window. Copy and paste the decrypted password into the text document where you pasted the IP address. Click the Close button.

Connect through Remote Desktop

**Mac users**

1. Download and install the Microsoft Remote Desktop App from the Mac App Store. Once installed, open the app.
2. Click PCs > Add PC.
3. Under PC Name, copy the Elastic IP of your instance. Leave everything else at the default settings and click Add.
4. Double-click the PC icon that appears in your remote desktop window. This opens a pop-up window to ‘Enter Your User Account’.
   b. Password: the decrypted password you saved previously.
5. Click Continue. Then skip the next section to continue.
PC users

1. Open the Windows Remote Desktop Connection app on your machine.

2. In the Remote Desktop Connection dialog, expand the Show Options list > Local Resources tab > More button and ensure that the box for Drives is checked, then click OK. This will allow you to copy data from your machine on to the remote machine (in this case, your Amazon EC2 instance).

3. Under the General tab, type or paste the Elastic IP of your instance into the Computer input box. In the User name input box, type Administrator, then click the Connect button. In the ‘Do you trust this Remote connection?’ window, click Connect.

4. In the Windows Security dialog, log in with the following credentials:
   a. User name: Administrator.
   b. Password: the decrypted password you saved previously.

5. Click OK. Continue with the next section.

Everyone

1. With either form of remote desktop, you'll probably receive a warning that "the identity of the remote computer cannot be verified." Go ahead and answer Yes, that you want to connect anyway. You should see the desktop of your remote instance open up.

   Amazon gave you a pretty strong password for this instance, but it's not one you're liable to remember easily. You should change the administrator password once you've logged in.

2. On the remote instance, click Start > Windows Administrative Tools > Computer Management.

3. Expand System Tools > Local Users and Groups and click Users.

4. In the list of users, right-click “Administrator” and click Set Password > Proceed. The password rules are fairly stringent; (at least six characters in length with 3 of the following 4 criteria: Upper case, lower case, number, special character).

   Select and confirm a new password that you can remember. In the future you can use this password when logging in to your instance.

   Close the Computer Management and Administrative Tools windows. Do NOT close your Remote Connection desktop.
Disable IE ESC

As a security precaution, it's usually not a good idea to go around browsing the web from your server machine. To do so is to invite malware intrusions onto one of your most sensitive computers. The operating system on your instance, Windows Server 2016, enforces this by blocking Internet Explorer from accessing most sites. This is called IE Enhanced Security Configuration (ESC). IE ESC gets burdensome when you're using the server to run software like we are. To smooth out the workflow in the next step, you'll disable IE ESC right now and leave it off in your instance.

1. In your remote instance, go to Start > Server Manager.

2. Click Local Server.

3. Scroll over to the right and find IE Enhanced Security Configuration. Click the On link to access the options for turning it off.

4. Select Off for both Users and Administrators and click OK. (Heads-up – the IE Enhanced Security Configuration will still show “On” until you close the Server Manager.)

5. Close the Server Manager.
G. Install and license your GIS software

Now that your Windows instance is up and running, you can download and install GIS software the same way you would on a physical computer. These steps need only be performed once after launching your instance.

Keep in mind that you will need access to the software install and license files via Internet Explorer on the Windows instance. Ask your instructor to upload the install and license to a shared platform like DropBox or Box. For UMass folks who don’t have a license provided through a specific class, you can request access to the install files and license here: https://www.geo.umass.edu/arcgis.

Install ArcMap

1. Start the install process by double-clicking the install .exe file. *** You should also refer to the install instructions provided by your instructor or campus Esri Administrator.***

   Take a break. Have a coffee, go for a walk. The install process might take a few minutes.

2. When you get the message that ArcGIS Desktop has been successfully installed, click Finish.

3. The ArcGIS Administrator Wizard launches. Select Advanced (ArcInfo) Single Use, click Apply, then click Authorize Now.

4. Choose “I have received an authorization file and am now ready to finish the authorization process.” Browse to wherever you downloaded the .prvc file and click Open to load it. Click Next.

5. Choose ‘Authorize with Esri now using the Internet’. Enter your information on the next two screens.

6. Click Next a bunch of times until you get to a Finish button.

Install ArcGIS Pro

1. Before we can start the GIS install fun, you need to install the Microsoft .NET Framework 4.8 on your Windows instance. Open Internet Explorer and go to the Microsoft Download .NET (dotnet.microsoft.com/download) website. Click the button Download .NET Framework Runtime. Save the file in your Downloads folder.

2. Once the file is downloaded, double-click it and follow the installation prompts.
3. Once that finishes, you can start the install process for ArcGIS Pro by double-clicking the install .exe file. *** You should also refer to the install instructions provided by your instructor or campus Esri Administrator.***

4. After ArcGIS Pro installs successfully, you will log in using your UMass NetID. Launch the application and click Sign in in the top right corner of the window.

5. At the login page, click: Sign in with Enterprise Login.

6. Type umass-amherst into the text box.

7. Click Sign in to University of Massachusetts-Amherst using UMASS-AMHERST.

8. Enter your UMass NetID credentials.

You should now be able to launch ArcGIS on your virtual Windows instance. You made it!! Huzzah!! 😊

A parting note… Whatever data you download to your cloud computer or create on your cloud computer should still be there when you log in later, but it’s never a bad idea to test that and move a back-up onto Google Drive or Box!

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6 Time to eat the rest of that chocolate.
H. Quick Start: Open ArcGIS on your instance at a later time

You’ve made an instance, set up and licensed ArcGIS Desktop on it. Your machine is now available for you over the internet any time you want it. Here’s how to get it again.

1. Log in to the AWS Console via the AWS Educate Student Portal (awseducate.com/signin/SiteLogin).

2. On the left-hand panel, navigate to INSTANCES > Instances.

3. Right click on the instance (or click the drop-down Actions box) and select Instance State > Start … wait a minute until you see ’running’.

4. Open Microsoft Remote Desktop App (Mac) or Remote Desktop Connection (Windows) and double-click the PC you created the first time you launched the app. If you don’t see a PC, copy/paste the Elastic IP from your instance screen to PC Name/Computer Name.

5. Log in as the Administrator and enter the password that you copied onto your notepad previously (or if you changed the password, enter that one).

6. Voila! Your remote desktop is back wherever you left off.

Don’t forget to STOP your instance when you are finished to avoid hourly charges! If you’re worried you might forget, there’s a way to set up an alarm that will automatically STOP your instance for you if it’s idle for more than a user-specified period of time.