

The logo for the University of Nebraska, featuring the word "UNIVERSITY OF" in a small, white, sans-serif font above the word "Nebraska" in a large, white, serif font. A registered trademark symbol (®) is located at the end of "Nebraska".

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HOLLAND COMPUTING CENTER

Anvil: HCC's Cloud
HCC Fall Kickstart 2018

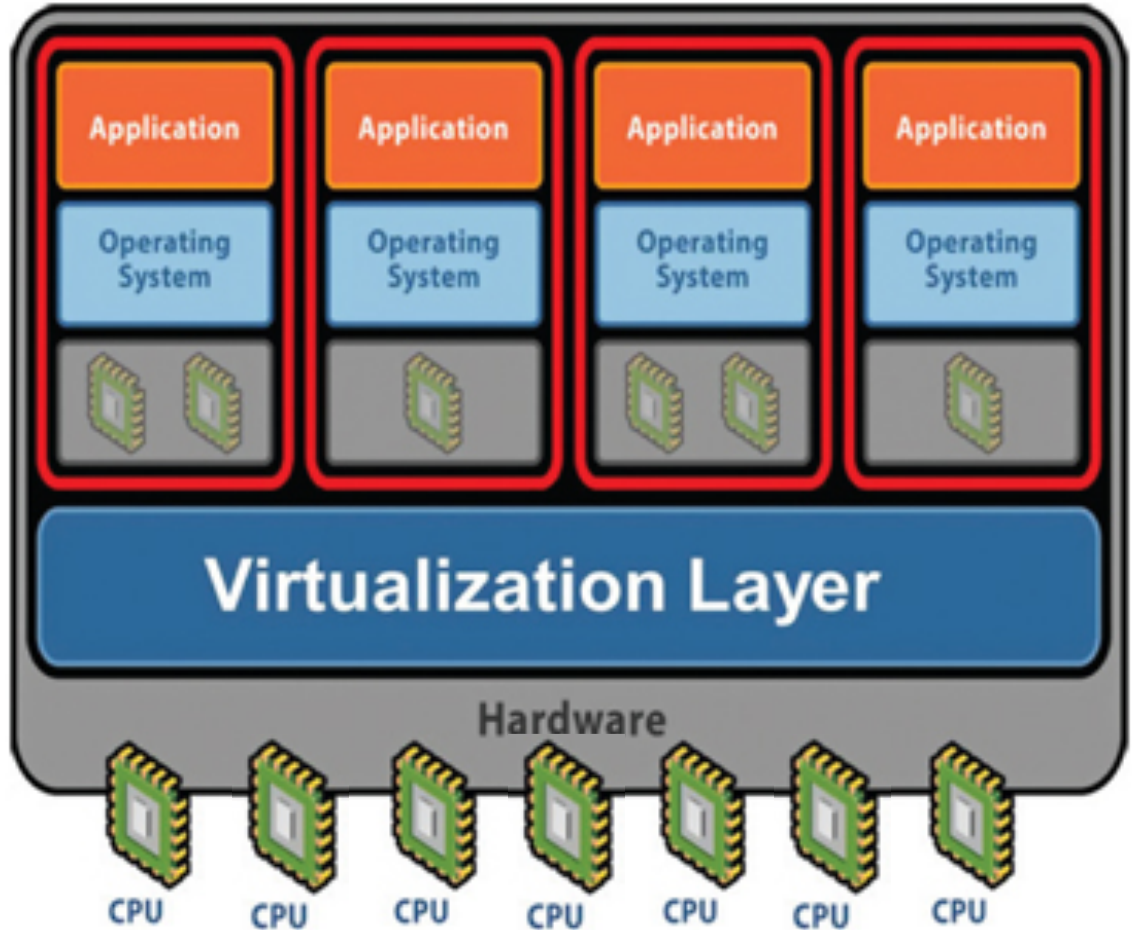
Anvil: HCC's Cloud

- OpenStack Cloud Resource offering customizable virtual machines
- For projects **not well served by a traditional Linux environment:**
 - Software with graphical interfaces
 - Alternate Operating Systems (such as Windows)
 - projects that require root access or dedicated resources
 - test cluster environments
 - webserver
 - databases



What is a Virtual Machine?

- "computer within a computer"
- Shared hardware that is partitioned and isolated to act as a stand alone system
- Can run different types of operating systems and software.



Terminology

- **Project:** HCC group = project
 - basic unit of ownership
- **Image:** "Software"
 - Everything needed to create a virtual machine for a specific OS
- **Flavor:** "Hardware"
 - The resources allotted to the virtual machine
- **Instance:** Image + Flavor = Instance
 - The virtual machine itself
- **Volume:** "External Hard Drive"
 - Persistent storage that can exist even after an instance is destroyed
- **Snapshot:** "Backup"
 - A saved copy of an instance at a specific point of time

Setting up a New Computer

Imagine you just bought a new PC from your local box store...



Before you can start using it, you need to...

- Set up the machine
- Setup a new user/login
- Add files and software

After setting it up, you only need to...

- Check that the computer is on
- Login to the computer
- Begin working

Setting up a New Instance

Using Anvil is similar to buying a new computer:

Before you can start using it, you need to...

- ~~Set up the machine~~ Create an instance
- ~~Setup a new user/login~~ Create SSH Keys
- Add files and software

After setting it up, you only need to...

- ~~Check that the computer is on~~ Ensure the instance is running
- ~~Login to the computer~~ Connect to your instance
- Begin working

Creating a VM: Overview

- Connect to Anvil VPN *
- Create SSH Keys
- Create Instance
- Connect to Instance *

* Only these steps are needed to connect to an instance once it is created

Creating a VM: Connect to the Anvil VPN

- The Anvil web portal is accessible from the Internet in general
- For security reasons, **the Anvil instances are not**
- In order to access the Anvil instance from on and off-campus, you will need to first **connect to the Anvil VPN**

Creating a VM: Connect to the Anvil VPN

- If you've already connected to the campus VPN service before, you'll already have the **Cisco AnyConnect client** installed and can use it to connect to Anvil VPN
- If you do not have the Cisco AnyConnect client installed, connect to your home institution's VPN and follow the onscreen prompts to install.



<http://vpn.unl.edu>



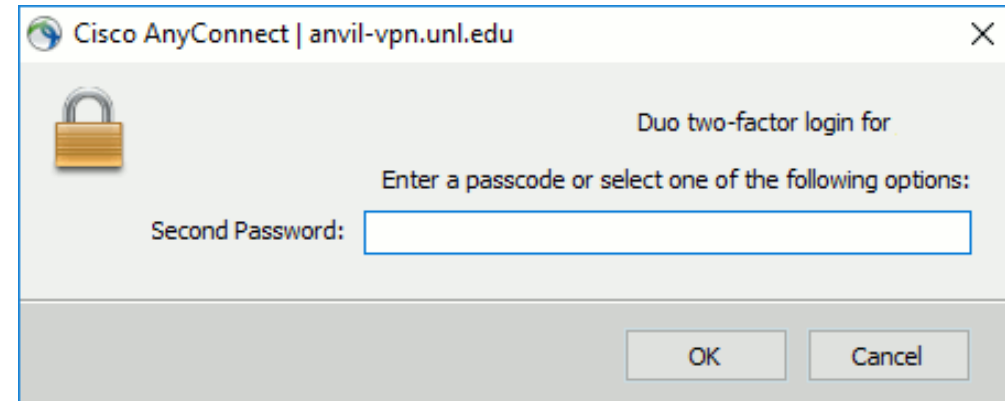
<http://vpn.unomaha.edu>



<http://vpn.unk.edu>

Creating a VM: Connect to the Anvil VPN

- Once installed, connect to **anvil-vpn.unl.edu** with your HCC credentials.
- The third prompt is for two-factor authentication



Type...	To...
<i>push</i>	Push a login request to your phone
<i>phone</i>	Authenticate via phone callback
<i>sms</i>	Get a new batch of SMS passcodes
A passcode	Login using a passcode, such as those generated by Duo Mobile, a Yubikey or sent to you in an SMS

Creating a VM: Create SSH Keys

- OpenStack uses SSH key pairs to identify users and control access to the VMs themselves - instead of username/password
- Key pairs consist of two files, a **public key** and a **private key**



Anvil Instance



Public Key



Private Key


**Treat the private key file the same as you would a password
Keep your private key in a secure location and do not share it with anyone**

Creating a VM: Connect to the Anvil Dashboard

- Anvil instances are administered through the dashboard

<http://anvil.unl.edu>

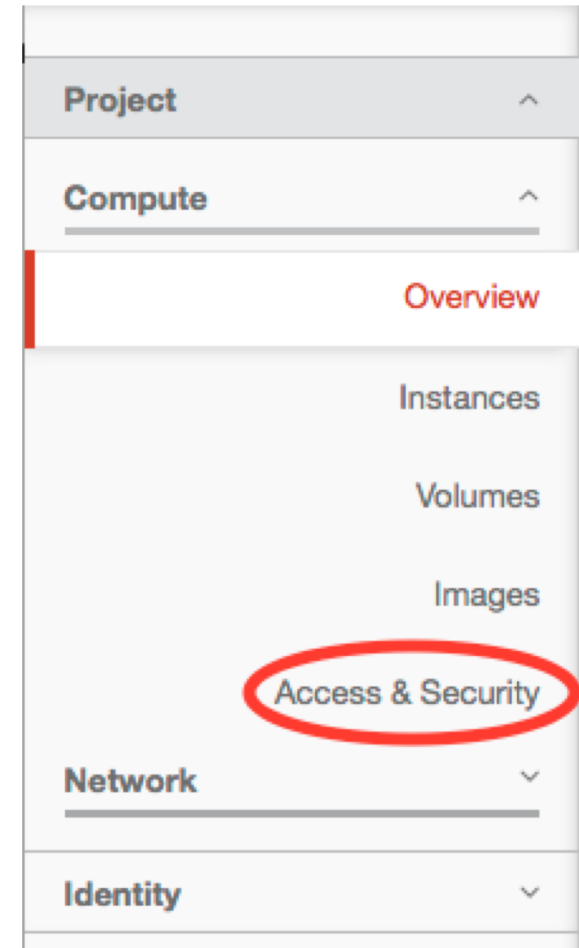
- Login using your HCC credentials
- A Duo Push Notification will automatically be sent to your phone
- To login using a passcode or Yubikey, enter:
password, passcode
in the password field



The screenshot shows the HCC Anvil login interface. At the top, the text "HCC Anvil" is displayed in large, bold letters against a background of a blue sky with white clouds. Below this, the words "Log In" are centered. There are two input fields: "User Name" and "Password". The "Password" field includes a small eye icon for toggling visibility. Below the password field, there is a text prompt: "YubiKey login: password<comma><press YubiKey>". A blue "Sign In" button is located at the bottom right of the form area.

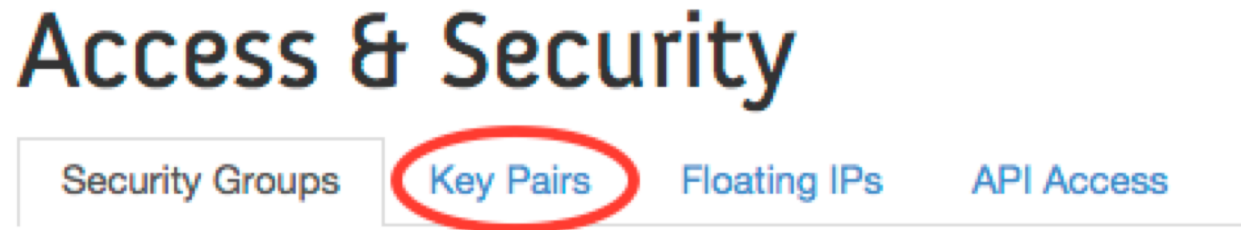
Creating a VM: Create SSH keys

- SSH Keypairs can be created using the Anvil Dashboard.
- On the left-hand side navigation menu, click **Access & Security**

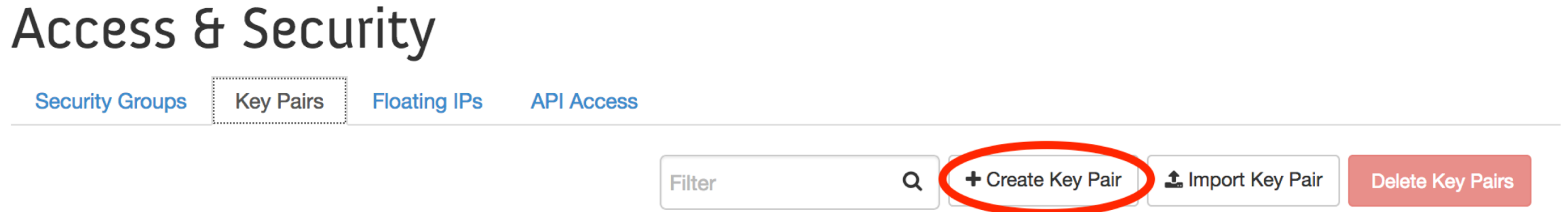


Creating a VM: Create SSH keys

- Choose the **Key Pairs tab** in the main window section:

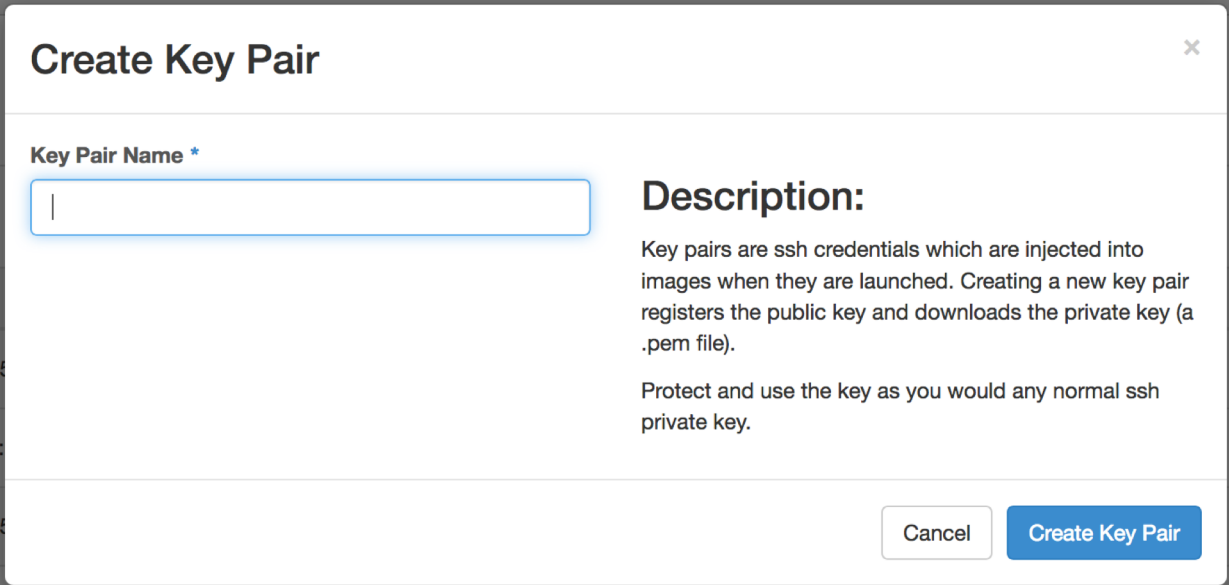


- On the right-hand side, click the **Create Key Pair** button:



Creating a VM: Create SSH keys

- In the pop-up window, fill in the **Key Pair Name** field with a convenient name (e.g. *my_key_pair*)
- Click the **Create Key Pair** button to close the pop-up and save the key



Create Key Pair ×

Key Pair Name *

Description:

Key pairs are ssh credentials which are injected into images when they are launched. Creating a new key pair registers the public key and downloads the private key (a .pem file).

Protect and use the key as you would any normal ssh private key.

- The private key file should begin downloading. Put this file someplace safe.

Do not navigate away from this page until you have successfully downloaded the private key file or you will need to create a new one

Creating a VM: Create SSH keys

- You should then see an entry with the saved key (the fingerprint value will be different than the example below)

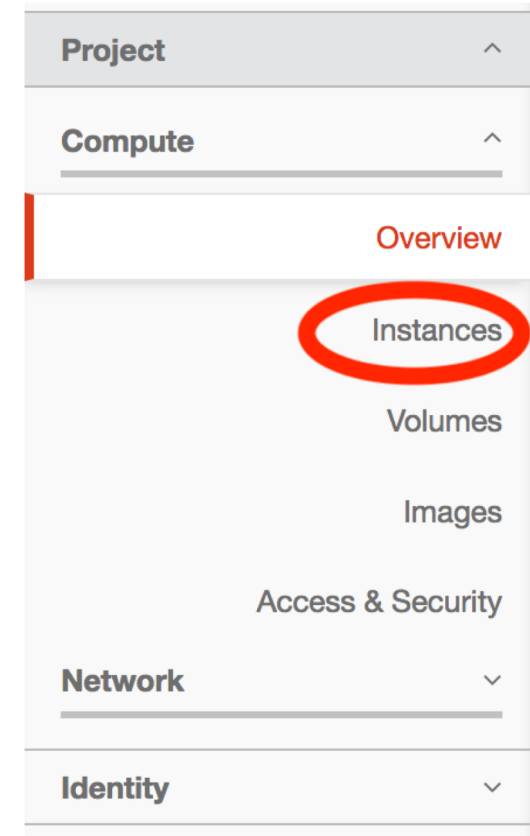
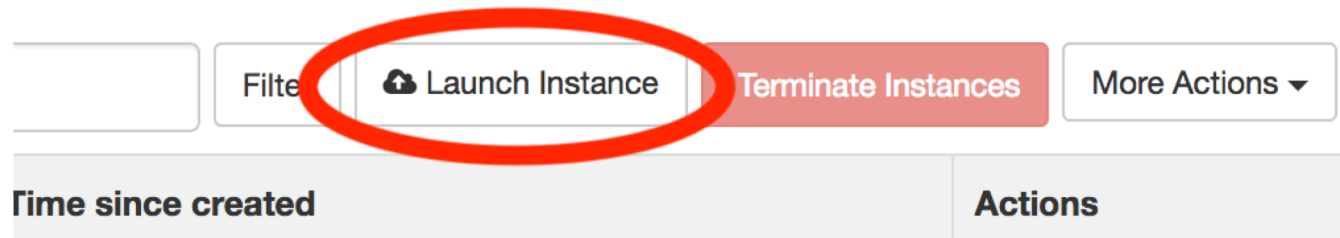
<input type="checkbox"/>	My SSH Key Pair	a7:30:b0:d4:cd:7d:c3:67:09:3e:26:64:be:8f:e3:32	Delete Key Pair
--------------------------	---------------------------------	---	-----------------

- The key pair can now be associated with any newly created instances
 - You can use the same key pair with multiple instances

Creating a VM: Create Instance (Windows)

- On the left-hand side navigation menu, click **Instances**

- Click the **Launch Instances** button on the top right-hand corner



Creating a VM: Create Instance (Windows)

1. Give your instance a recognizable name, such as *yourname_windows_instance*
2. Select **general.medium** for the flavor
3. Select **Boot from image** for Instance Boot Source
4. Choose **Windows 7 (29.0 GB)** for the boot image

Launch Instance

Details * **Access & Security** Networking * Post-Creation Advanced Options

Availability Zone: nova

Instance Name * 1: my_windows_instance

Flavor * 2: general.medium

Instance Count * 3: 1

Instance Boot Source * 3: Boot from image

Image Name * 4: Windows 7 (29.0 GB)

Specify the details for launching an instance. The chart below shows the resources used by this project in relation to the project's quotas.

Flavor Details

Name	general.medium
VCPUs	1
Root Disk	40 GB
Ephemeral Disk	0 GB
Total Disk	40 GB
RAM	3,840 MB

Project Limits

Number of Instances: 2 of 64 Used

Number of VCPUs: 3 of 64 Used

Total RAM: 6,816 of 262,144 MB Used

Cancel Launch

Creating a VM: Create Instance (Windows)

- Click the **Access & Security** tab
- Under **Key Pair**, select your SSH key pair from the drop-down menu
- Under **Security Groups**, check the default box

Launch Instance

Details * Access & Security Networking * Post-Creation Advanced Options

Key Pair ⓘ **Select your key pair**

My SSH Key Pair +

Control access to your instance via key pairs, security groups, and other mechanisms.

Security Groups ⓘ

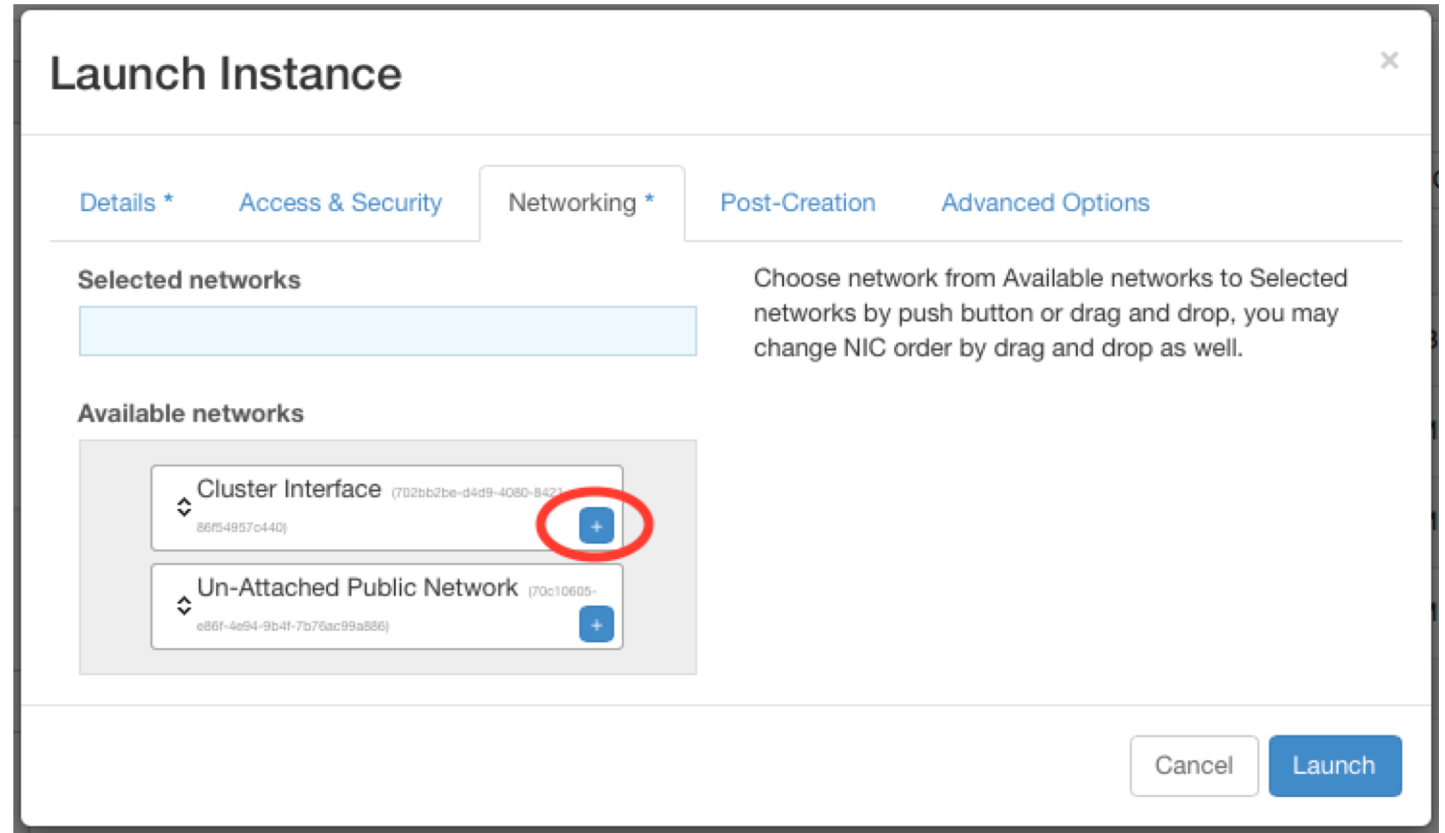
default **Check this box**

http access

Cancel Launch

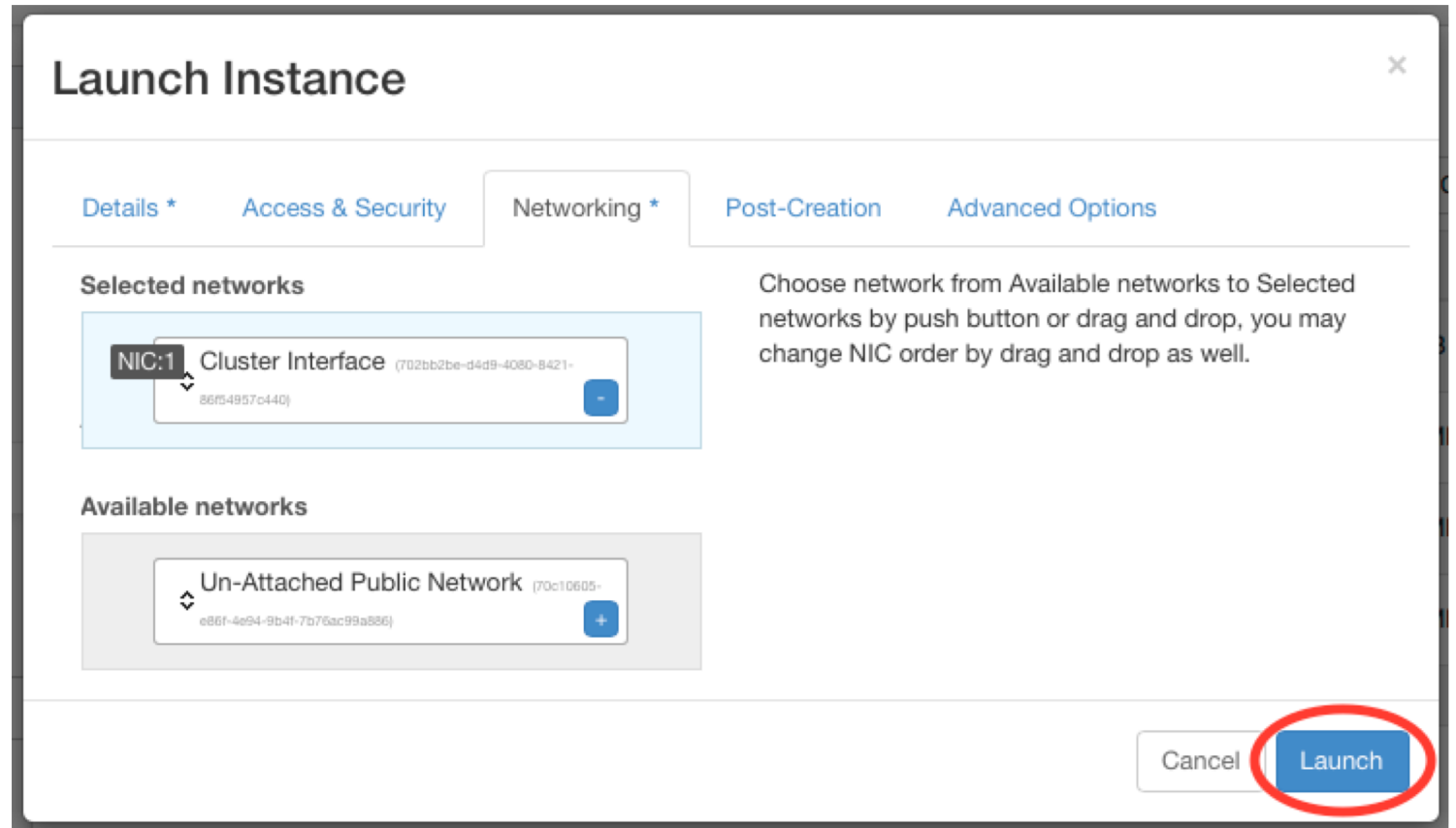
Creating a VM: Create Instance (Windows)

- Click the **Networking** tab
- Under **Available networks**, click the small *blue '+' icon* in the *Cluster Interface* box
- This will add *Cluster Interface* to the **Selected networks**



Creating a VM: Create Instance (Windows)

- Click the **Launch** button to start the instance
- It may take several minutes for the instance to complete



Creating a VM: Exercise

- While you are waiting for your Windows instance to finish setting up, create a second VM.
- Use the same steps as before, but this time use:
 - image: **CentOS 7.4 (8.0GB)**
 - flavor: **general.small**

Once you have finished, put up your **green sticky note**.

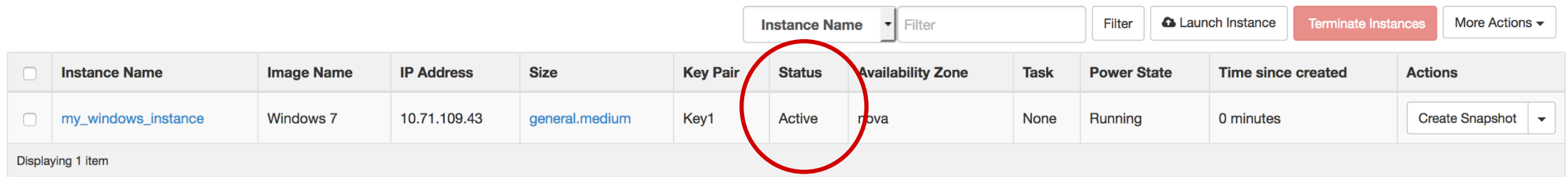
If you have issues, put up your **red sticky note** and one of the helpers will be around to assist.

Creating a VM: Connect to the Instance (Windows)

- After an instance has been created, you can connect (login) and begin using it
- Connecting is done via **SSH or X2Go for Linux instances** and via **Remote Desktop (RDP) for Windows instances**
- When the Windows instance is created, the password is set randomly using your SSH Key Pair
- This password can be retrieved via the Dashboard web interface, and then is used to login via Remote Desktop

Creating a VM: Connect to the Instance (Windows)

- On the left-hand side navigation menu, click **Instances**



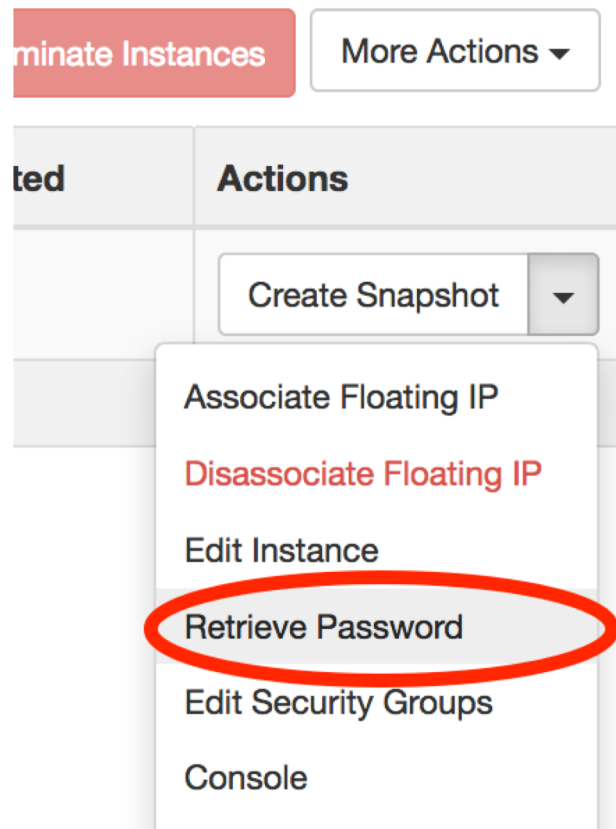
The screenshot shows the AWS Management Console interface for the 'Instances' page. At the top, there are several controls: a dropdown menu for 'Instance Name', a search filter, a 'Filter' button, a 'Launch Instance' button, a 'Terminate Instances' button, and a 'More Actions' dropdown. Below these controls is a table with the following columns: Instance Name, Image Name, IP Address, Size, Key Pair, Status, Availability Zone, Task, Power State, Time since created, and Actions. The table contains one row for an instance named 'my_windows_instance' with the following details: Image Name: Windows 7, IP Address: 10.71.109.43, Size: general.medium, Key Pair: Key1, Status: Active, Availability Zone: nova, Task: None, Power State: Running, Time since created: 0 minutes. The 'Status' cell for this instance is circled in red. At the bottom of the table, there is a 'Create Snapshot' button. Below the table, it says 'Displaying 1 item'.

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	my_windows_instance	Windows 7	10.71.109.43	general.medium	Key1	Active	nova	None	Running	0 minutes	Create Snapshot <input type="button" value="v"/>

Displaying 1 item

- It may take several minutes for a Windows instance to complete setup and be accessible.
- It is recommended to wait 10 minutes after the *Status* field shows *Active* before trying to connect

Creating a VM: Connect to the Instance (Windows)



To retrieve the password for your instance:

- Click the down arrow next to the **Create Snapshot** button to the right of your instance listing.
- Click **Retrieve Password**

If you get the message "Instance Password is not set or is not yet available" wait a bit and try again.

Key Pair Name ⓘ

Key1

Encrypted Password ⓘ

Instance Password is not set or is not yet available

Creating a VM: Connect to the Instance (Windows)

- In the new pop-up window you will need to select your *private SSH key file*
- Click the **Choose File** button to open a File Explorer window
- Navigate to your private key file and choose to open the file

Retrieve Instance Password

Key Pair Name

My SSH Key Pair

Encrypted Password

```
rzugWpcD5GXxhWoL7wFkc7iJvz9jWnJgkyBIH
qSdqNSMpAq2lkxFhj2c9fBaCi2L2fzWhWlI8eS0
+3Ti8oJfmiVTelkWffj6Z9qItxE3IGV8hDpE/9Bd
w0ZVnQAakbUEuucA/3iZzoBrcvHZDUA6OrGC
[...]
```

Private Key File *

Choose File no file selected

OR Copy/Paste your Private Key *

Password

Cancel Decrypt Password

Description:
To decrypt your password you will need the private key of your key pair for this instance. Select the private key file, or copy and paste the content of your private key file into the text area below, then click Decrypt Password.
Note: The private key will be only used in your browser and will not be sent to the server

Creating a VM: Connect to the Instance (Windows)

- The contents of your private key file should now be inside the text box
- Click the **Decrypt Password** button

Retrieve Instance Password

Key Pair Name
My SSH Key Pair

Encrypted Password
rzugWpcD5GXxhWoL7wFkc7iJvz9jWnJgkyBIH
qSdqNSMpAq2lkxHj2c9fBaCi2L2fzWhWII8eS0
+3Ti8oJfmiVTeldkWffj6Z9qItxE3IGV8hDpE/9Bd
w0ZVnQAakbUEuucA/3iZzoBrcvHZDUA6OrGC
w0ZVnQAakbUEuucA/3iZzoBrcvHZDUA6OrGC

Private Key File
Choose File anvil_rsa

OR Copy/Paste your Private Key

```
-----BEGIN RSA PRIVATE KEY-----  
MIIIEogIBAACAQEAzK+um402A3PwFkIreY1fx  
3a8LPGOVgomXeJMi4apkdHZIP0t  
GpCsCqYBBcKizab6Xz6eNueMZ5xj  
KeZRAoGAJ86mQwFNqHsNCQYNtocHmrv0gV  
Vh1c0CthK0ZlxbP2xlQhVGQV0BMSVn  
0hL3lOqg82QX1Tv6PE9yipR3PhjQ7nhzsX5OGt  
bz98QX9YiQLnK7WnC/lyQg0vHa  
8nHyl5z864Ao8zMrW6EuUU1hJ6TB21IMoOsS  
hhDYgey0NLVG79I=  
-----END RSA PRIVATE KEY-----
```

Description:
To decrypt your password you will need the private key of your key pair for this instance. Select the private key file, or copy and paste the content of your private key file into the text area below, then click Decrypt Password.

Note: The private key will be only used in your browser and will not be sent to the server

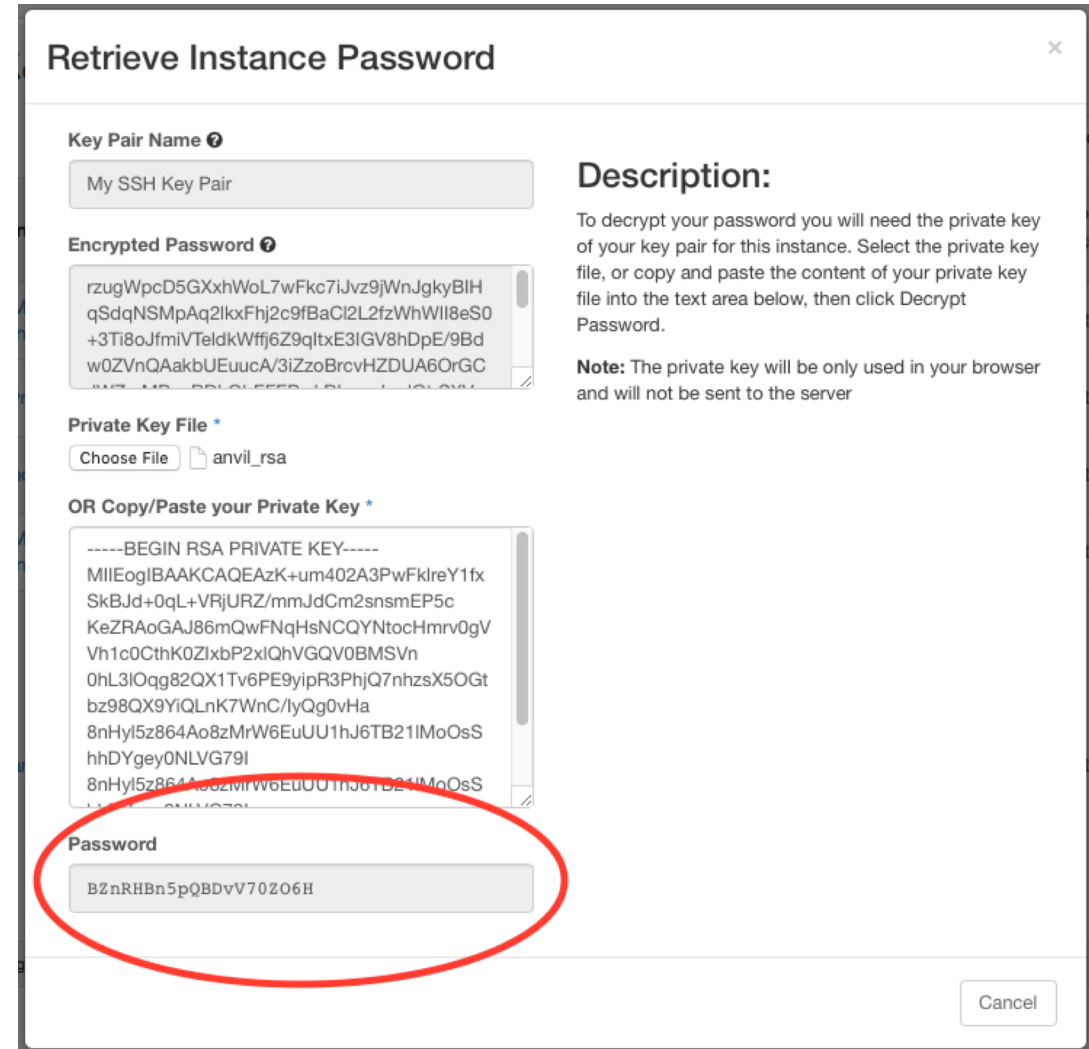
Password

Cancel **Decrypt Password**

Creating a VM: Connect to the Instance (Windows)

- The randomly generated password should appear in the **Password** field
- Copy and paste this password into a convenient text editor so it is readily accessible

Do not save this password in a text file. If you need it in the future, you can retrieve it again using the same process.



Retrieve Instance Password

Key Pair Name
My SSH Key Pair

Description:
To decrypt your password you will need the private key of your key pair for this instance. Select the private key file, or copy and paste the content of your private key file into the text area below, then click Decrypt Password.
Note: The private key will be only used in your browser and will not be sent to the server

Encrypted Password
rzugWpcD5GXxhWoL7wFkc7iJvz9jWnJgkyBIH
qSdqNSMpAq2lkxFhj2c9fBaCi2L2fzWhWII8eS0
+3Ti8oJfmiVTeldkWffj6Z9qItxE3IGV8hDpE/9Bd
w0ZVnQAakbUEuucA/3iZzoBrvcHZDUA6OrGC

Private Key File
Choose File anvil_rsa

OR Copy/Paste your Private Key
-----BEGIN RSA PRIVATE KEY-----
MIIEogIBAAKCAQEAzK+um402A3PwFkreY1fx
SkBJd+0qL+VRjURZ/mmJdCm2snsmEP5c
KeZRAoGAJ86mQwFNqHsNCQYNtocHmrv0gV
Vh1c0CthK0ZlxbP2xlQhVGQV0BMSVn
0hL3lOqg82QX1Tv6PE9yipR3PhjQ7nhzsX5OGt
bz98QX9YiQLnK7WnC/lyQg0vHa
8nHyI5z864Ao8zMrW6EuUU1hJ6TB21IMoOsS
hhDYgey0NLVG79I
8nHyI5z864Ao8zMrW6EuUU1hJ6TB21IMoOsS

Password
B2nRHBn5pQBDvV70Z06H

Cancel

Creating a VM: Connect to the Instance (Windows)

Access to Windows instances is provided via Remote Desktop (RDP)

- **Windows:**

- The Remote Desktop Connection Client is already installed on Windows

- **Mac:**

- Install the free Microsoft Remote Desktop from the app store, <http://go.unl.edu/RemoteDesktopMacOS>

Be sure to use an up-to-date client program when connecting to Windows 10 instances (older RDP clients may have problems connecting to Windows 10 instances due to changes in security protocols)

Creating a VM: Connect to the Instance (Windows)

- Determine the **IP address** of your instance

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	my_windows_instance	Windows 7	10.71.109.43	general.medium	Key1	Active	nova	None	Running	0 minutes	Create Snapshot ▼

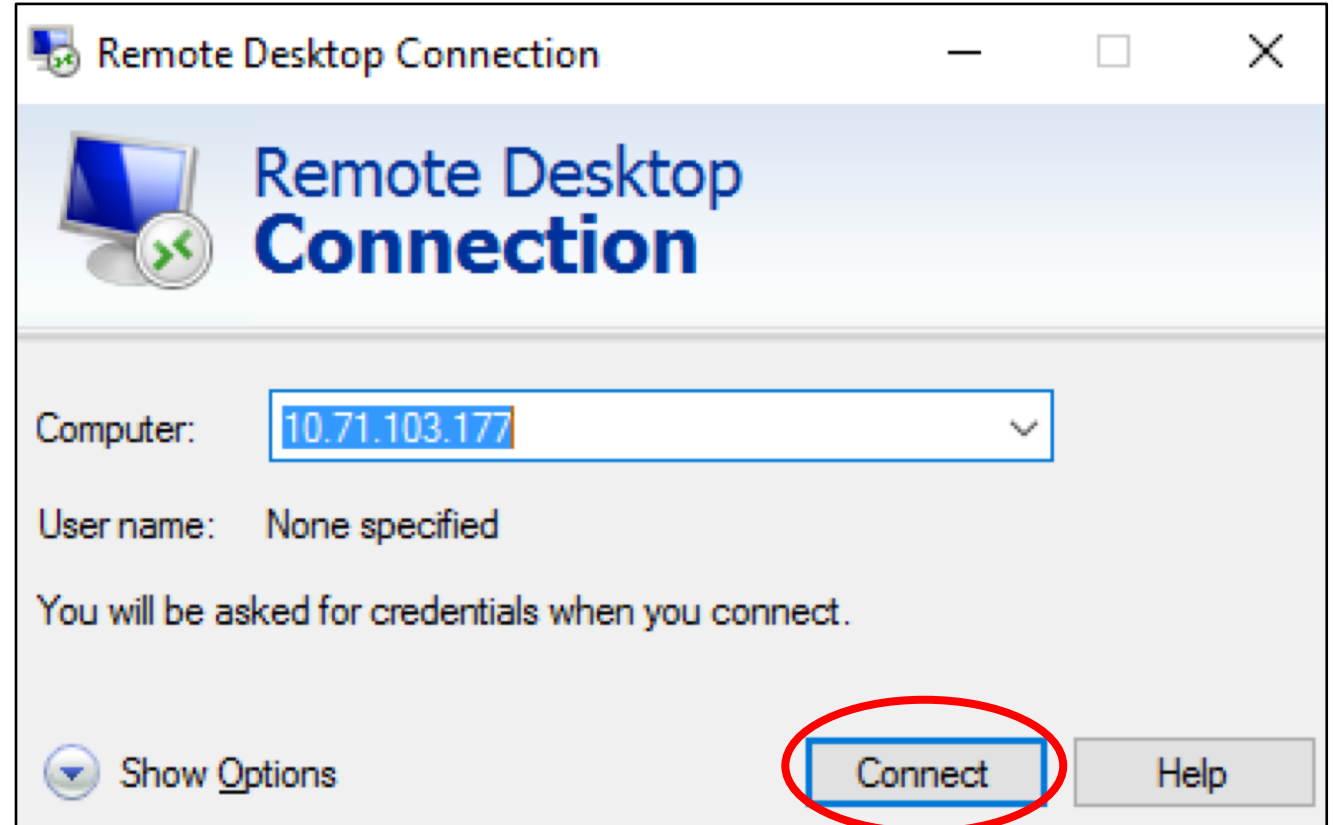
Displaying 1 item

- The **username** used to connect is always:
 - **cloud-user**
- The **password** was retrieved earlier

Creating a VM: Connect to the Instance (Windows)

From Windows:

- Start your Remote Desktop client
- Enter the IP address in the **Computer** field
- Click **Connect**



Creating a VM: Connect to the Instance (Windows)

From Windows (cont.):

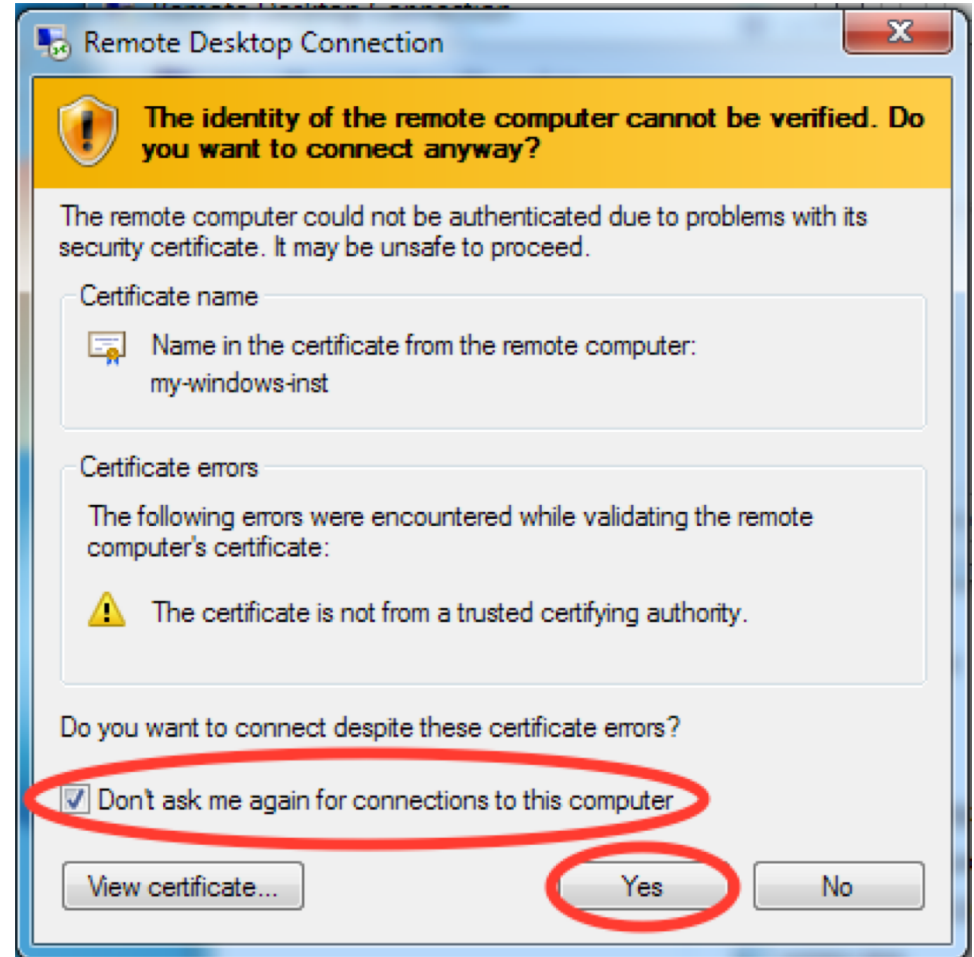
- Enter the **username**:
 - **cloud-user** (for Windows 7)
- Enter the **password** you retrieved



Creating a VM: Connect to the Instance (Windows)

From Windows (cont.):

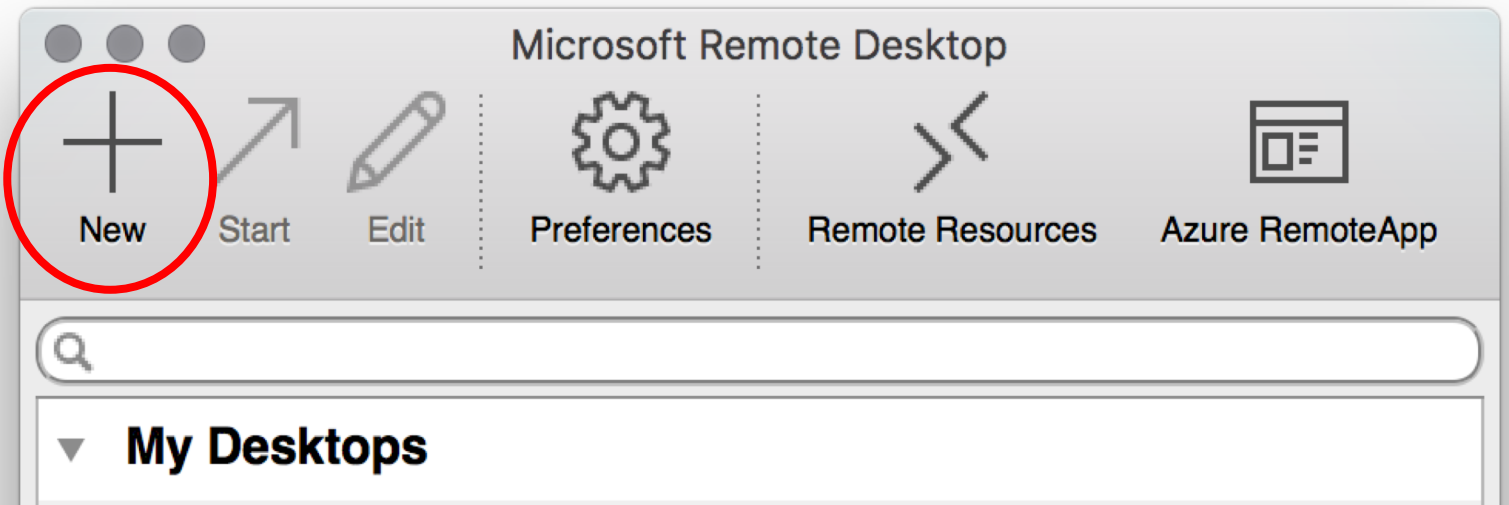
- You may see a warning box about the certificate of the remote computer
- To avoid this warning in the future, check the box that says "*Don't ask me again for connections to this computer*"
- Click **Yes**



Creating a VM: Connect to the Instance (Windows)

From MacOS:

- Start your Remote Desktop client
- Click the **New** button



Creating a VM: Connect to the Instance (Windows)

From MacOS:

Connection name

- Name for your connection. This can be anything you want.

PC Name

- Your Instance IP address as retrieved from the dashboard

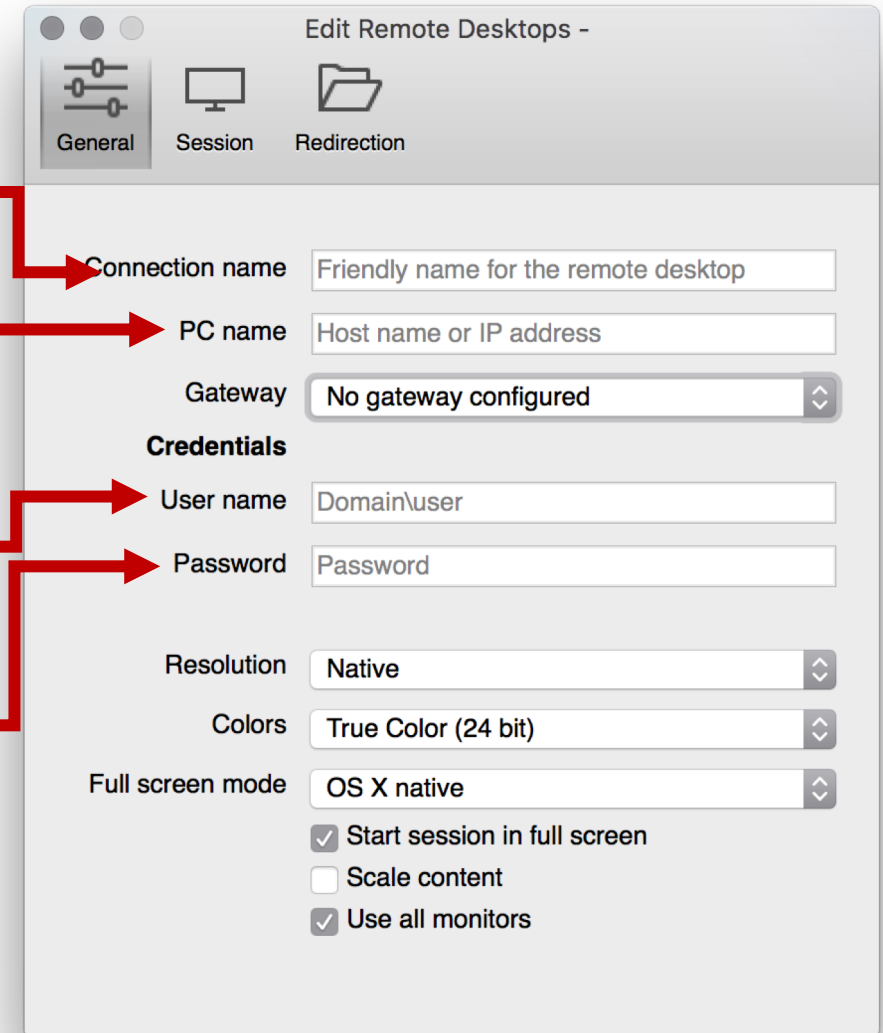
User name

- This is always **cloud-user** for Windows 7 instances

Password

- The password you decrypted using your private key file

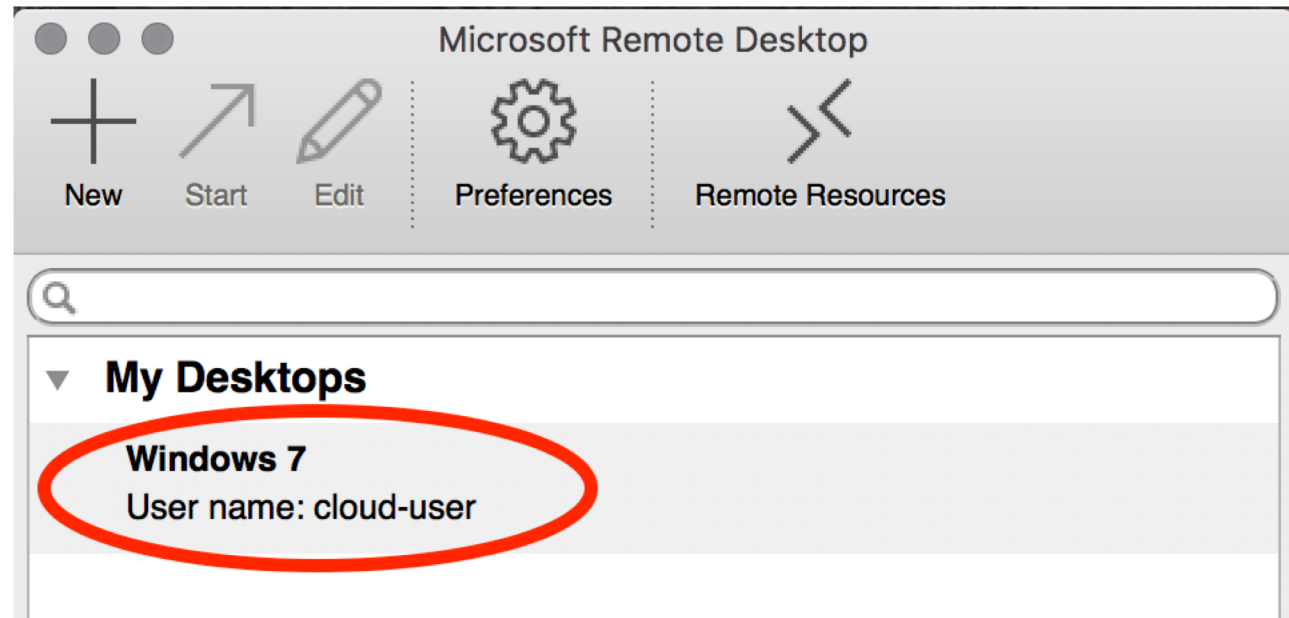
Close the window to save changes



Creating a VM: Connect to the Instance (Windows)

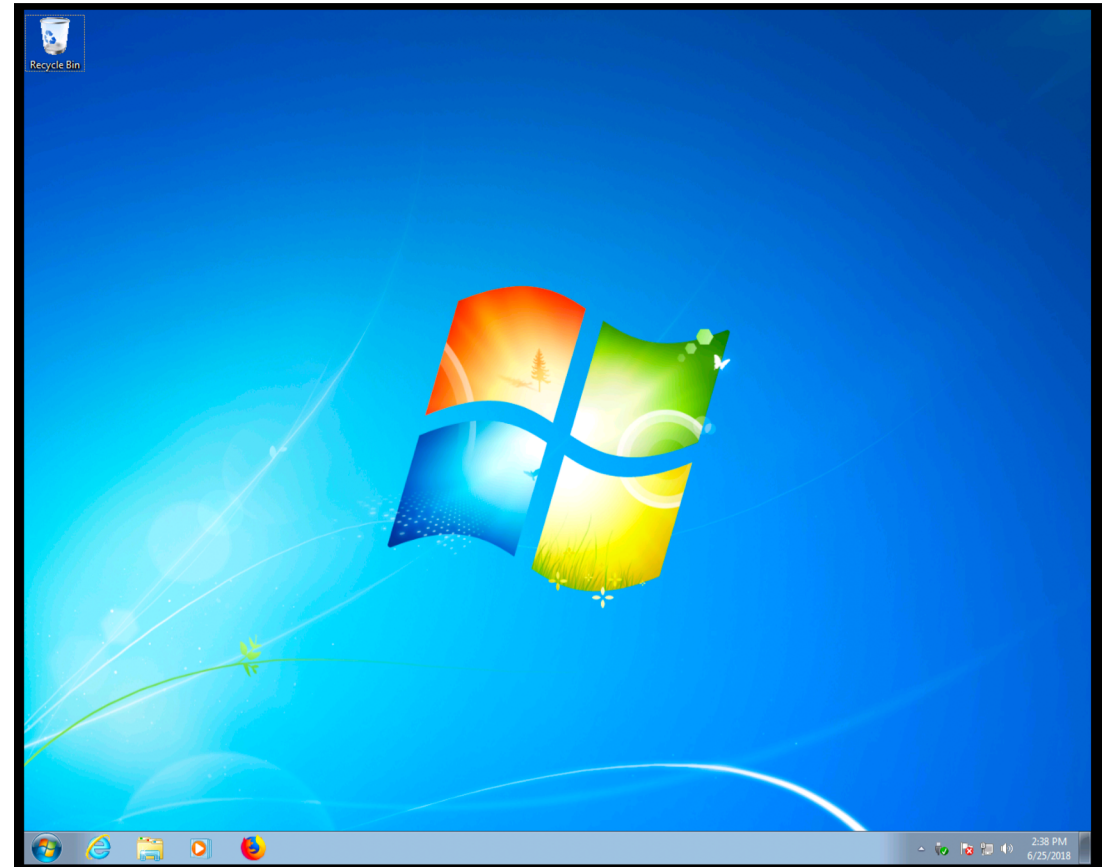
From MacOS:

- Double click on the new connection listed to connect.



Creating a VM: Connect to the Instance (Windows)

- Your virtual machine is ready for installation of additional software or custom configuration!
- **To transfer files in and out of your VM, add a cloud-based storage application such as Google Drive or Box.**
- Or you can setup a personal endpoint for Globus.



Creating a VM: Exercise

- Exit the Remote Desktop and Cisco AnyConnect clients
- Following the steps we just did, reconnect to your instance
- Remember, to connect we need to follow these basic steps:
 - Connect to the Anvil VPN using Cisco AnyConnect
 - Connect to your instance using Remote Desktop
- Note: You shouldn't need to use the Anvil dashboard at all!

Once you have finished, put up your **green sticky note**.

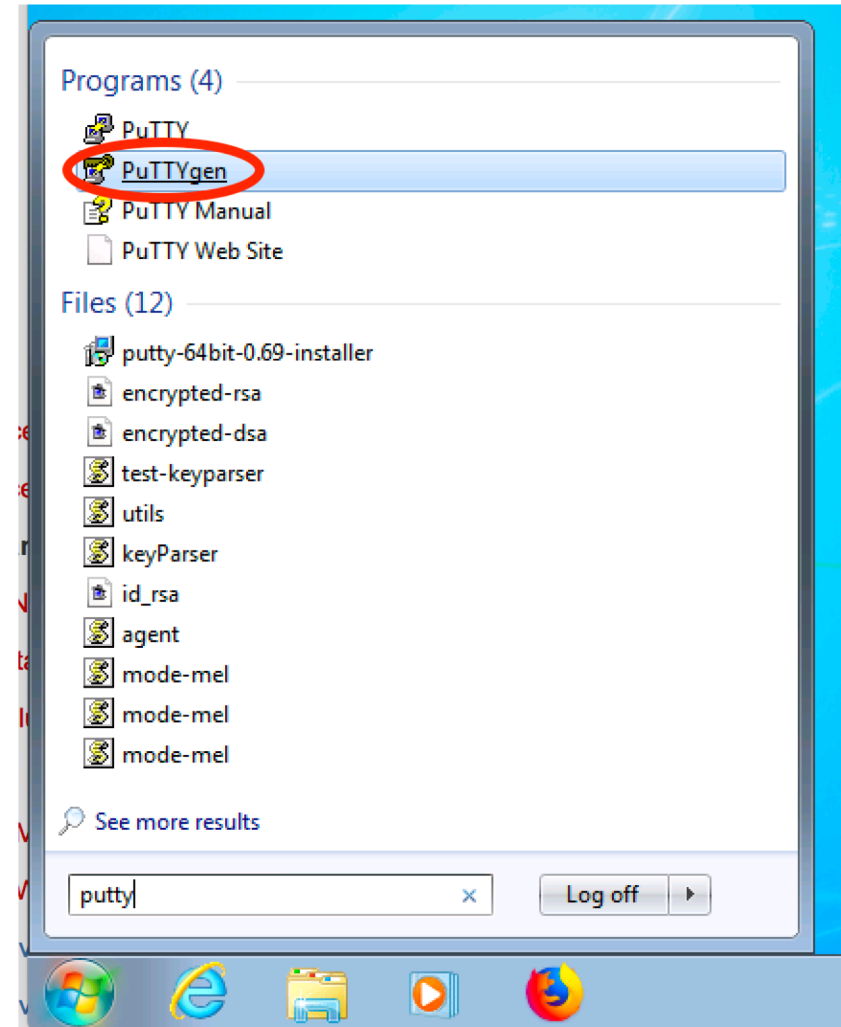
If you have issues, put up your **red sticky note** and one of the helpers will be around to assist.

Creating a VM: Connect to the Instance (Linux)

- To connect to your VM, we will use an SSH connection using the same approach as connecting to HCC clusters
- **Once your instance is created, note the IP address as before**
- **With Linux images, you will not need to retrieve the password**
 - **We will use our keypair file to authorize our connection**

Creating a VM: Connect to the Instance (Linux)

- **From Windows:**
 - We will be connecting using PuTTY, just as before
 - **PuTTY uses a proprietary format for their keys, so we will need to convert the keyfile you downloaded**
 - **Run the PuTTYgen application**

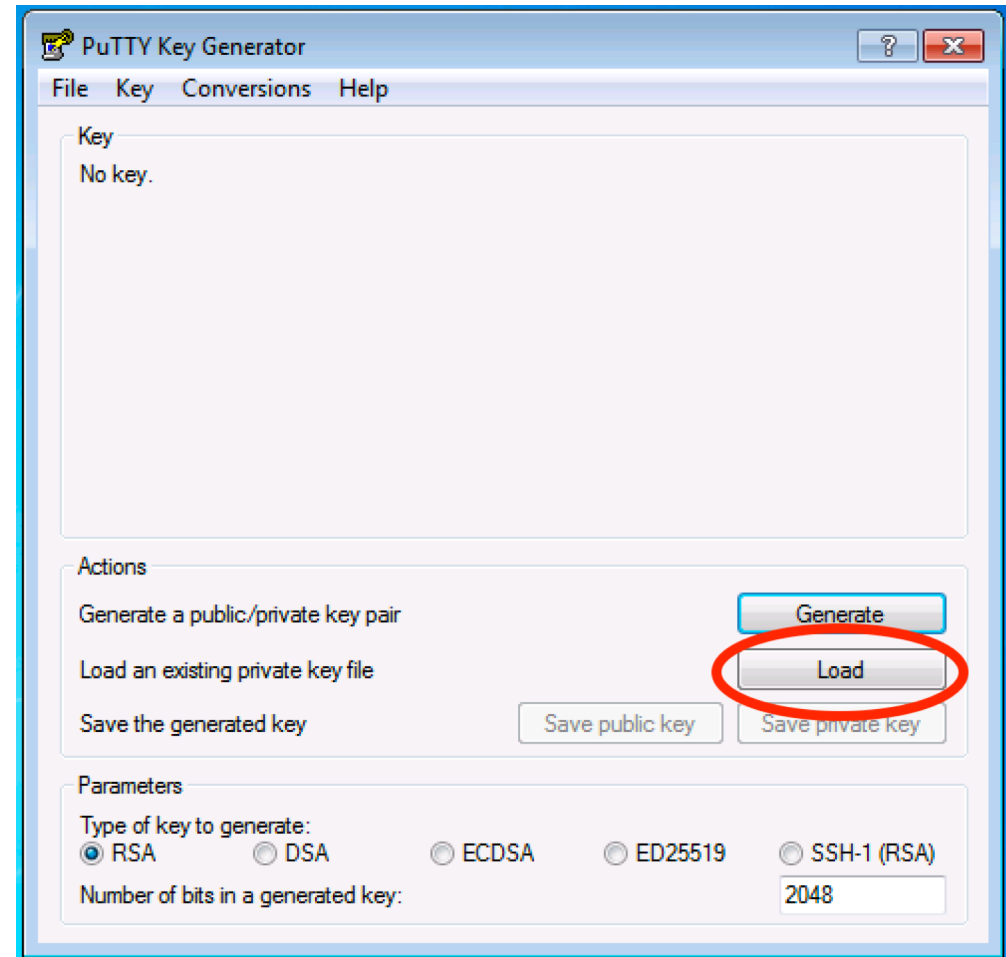
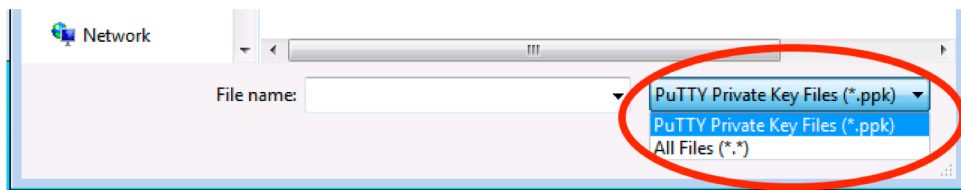


Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

- Click the "Load" button and select the private key file you downloaded previously

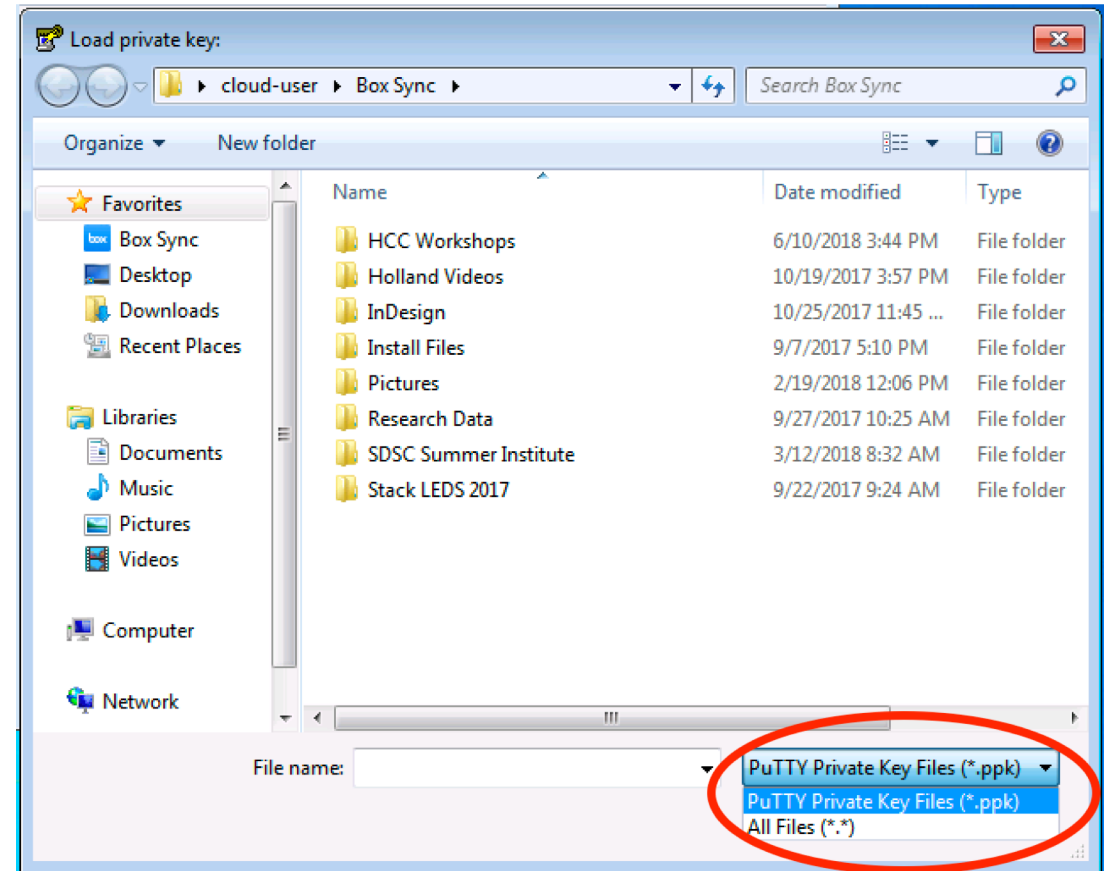
If you cannot see your private key file, change the file type to All files (*.*) in the dropdown box next to File name.



Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

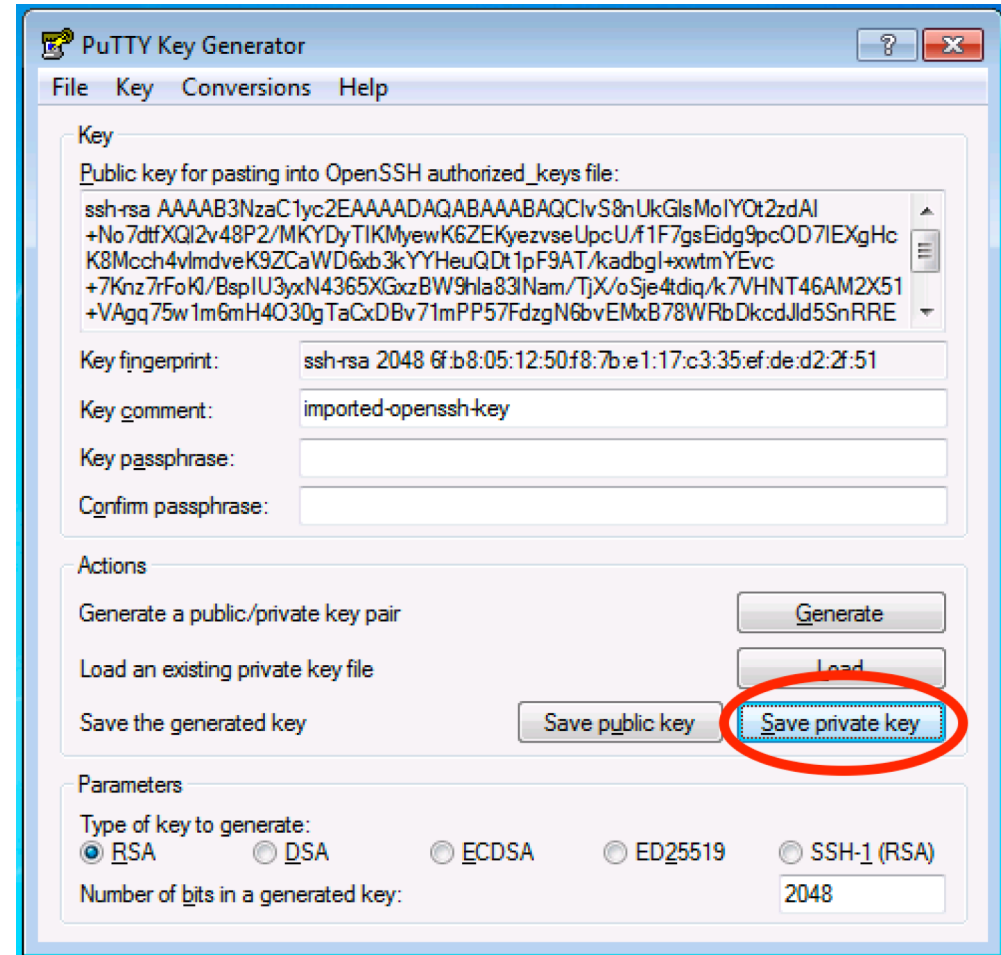
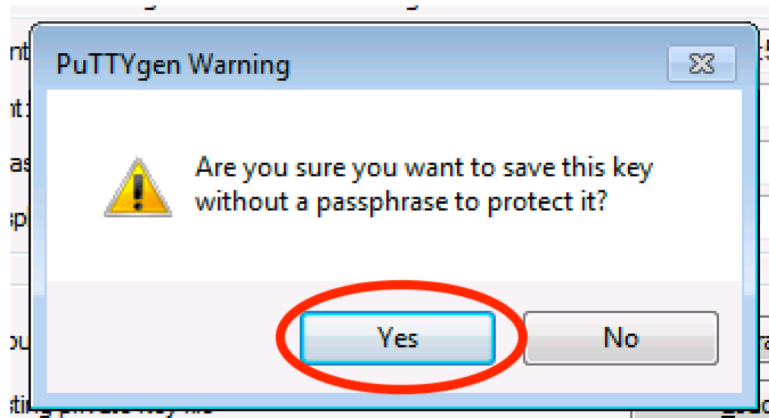
- You will need to change the files shown to include All Files by clicking the drop down box next to "File name:"



Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

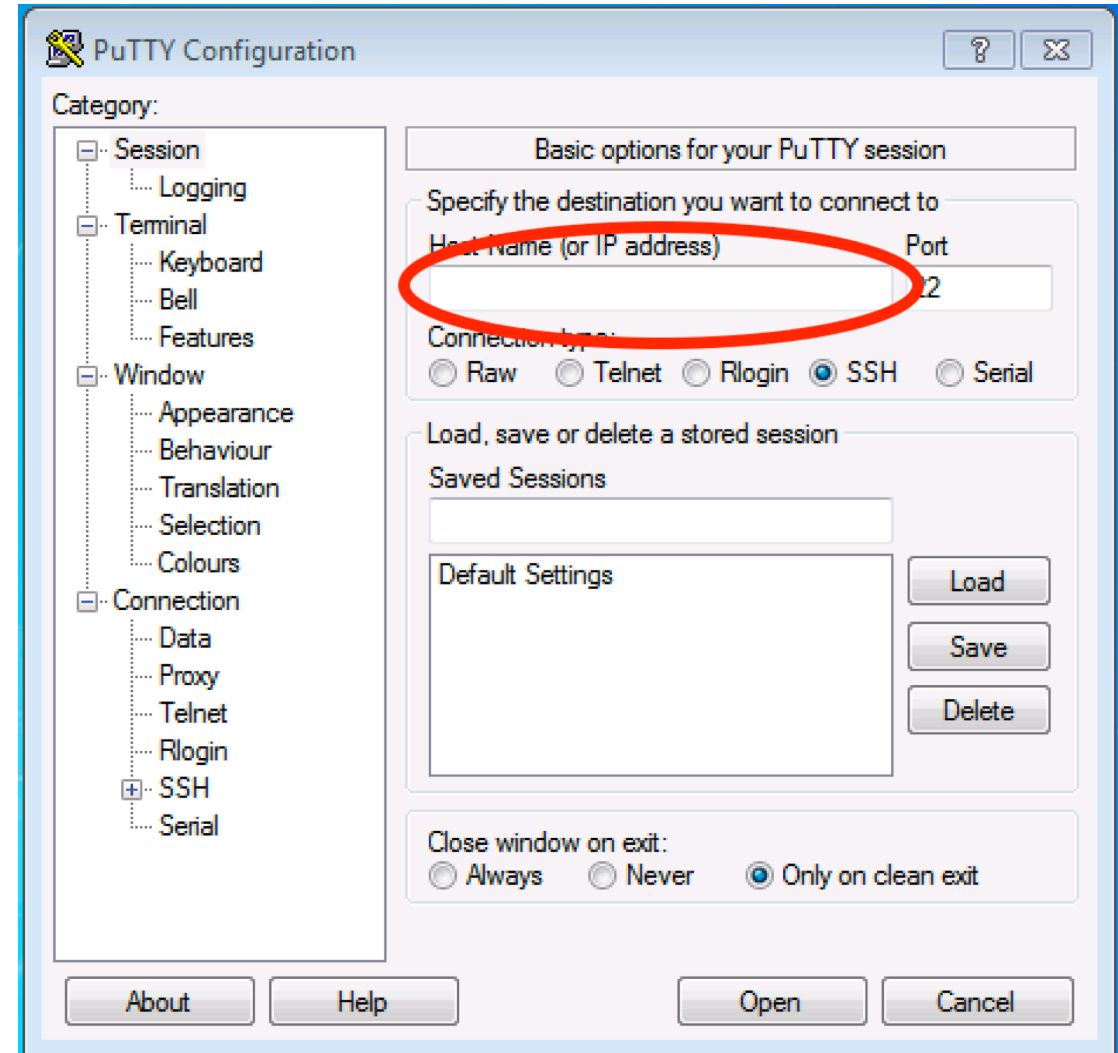
- Click **Save private key** to save the key as a ppk file
- When prompted, click **Yes**



Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

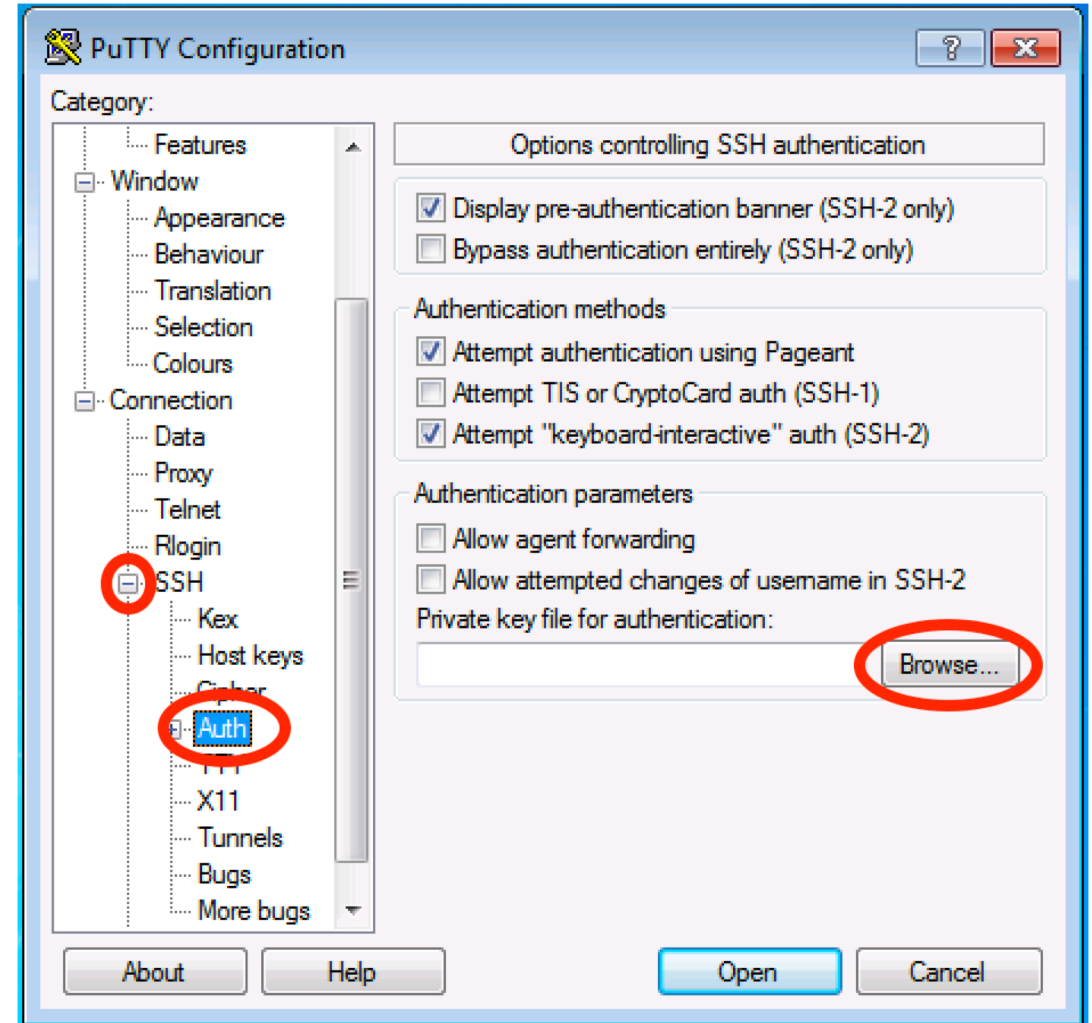
- Run PuTTY and enter the IP address of your instance into the **Host Name** box.



Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

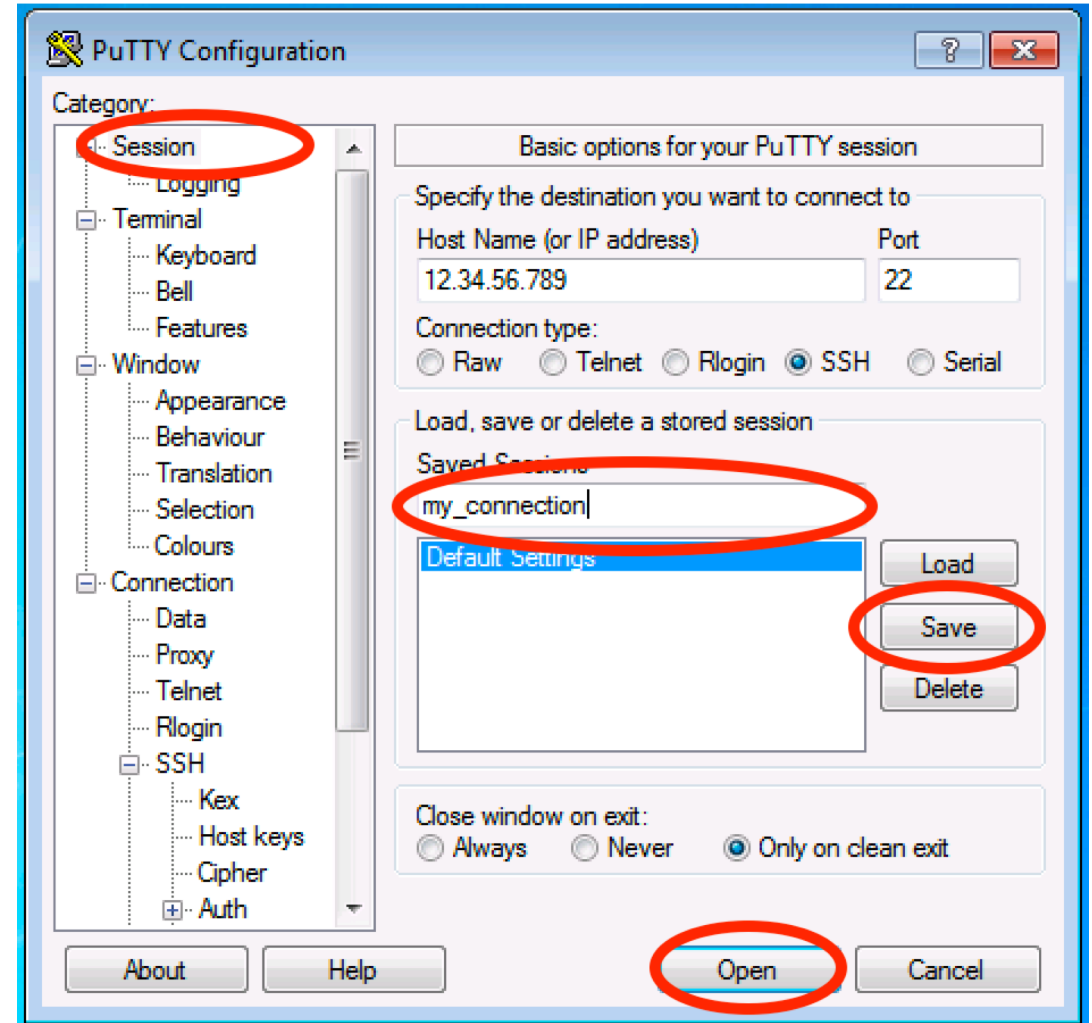
- In the left-hand category list, click + next to SSH and select **Auth**
- Click **Browse** and select the ppk version of your private key file.



Creating a VM: Connect to the Instance (Linux)

From Windows (cont.):

- To save this session for future use, scroll back up the left-hand list and select **Session**.
- Type a name for your session in the text box under **Saved Sessions** and click **Save**.
- To open the connection, click **Open**



Creating a VM: Connect to the Instance (Linux)

For Mac/Linux:

- Open your terminal and enter the command:

```
ssh -i key_file.pem centos@ip.of.your.vm
```

- -i allows us to use a key to connect
- The username depends on what Linux image you created your instance with
 - Since we are using CentOS, we use `centos` as the username
 - For an Ubuntu instance, the username would be `ubuntu`

- **If you get this error:**

```
Permissions 0644 for 'key_file.pem' are too open.
```

- **Enter the command** `chmod 700 key_file.pem` **and try to reconnect**

Connecting to Previously Created Instances

1. Connect to the Anvil VPN

- Use Cisco AnyConnect Client to connect to anvil-vpn.unl.edu

~~2. Create SSH Keys~~

~~3. Create Instance~~

4. Connect to Instance

- Use Remote Desktop to connect to Windows instances
- Use SSH to connect to Linux instances

Using Anvil: Access and Overview

- Access to Anvil is by request only:
 - To request access visit: <https://hcc.unl.edu/request-anvil-access>
- Group Resource Limits:
 - Groups are initially allocated the following limits:

Number of Instances	Virtual Cores	RAM	Number of Volumes	Volume Storage
10	20	60GB	10	100 GB

- Resource limits can be increased if necessary.
 - Email us at hcc-support@unl.edu to request an increase.

Contact Us

- Email: hcc-support@unl.edu
- In Person:



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