Azure Virtual Machines

Azure offers Virtual Machine services running Linux or Windows backed by a variety of different underlying hardware types and capacities.

While it is possible to think of (and manage) a VM as if it were your own physical computer system running under your desk or at a data center, there is an array of supporting services that enable you to manage your compute much more efficiently than is possible with traditional dedicated hardware. These efficiencies promise to reduce your cloud spend and enable you to dedicate more of your time to your primary work.

Managing Resources

If you're new to Azure, you'll probably benefit by starting off in the Azure Web Portal. However, taking advantage of the command line and/or the API may offer much greater efficiency a lot sooner than you think. consider revisiting these more-advanced management methods before you get too deep into infrastructure deployment.

1) Azure Web Portal

The **Azure Web Portal** allows you to manage your Azure resources in a point-and-click fashion from a Web browser.

For many services – including compute VMs – the Portal permits you to bring up a resource by simply filling out a form that prompts you to select values for resource parameters (such as name, size, and location). Clicking a "Create" button submits your choices and launches your new resource.

Other ways of managing resources (command line and API, below) facilitate working reproducibly and at scale, but require more learning and setup to get started.

2) Command Line

When you've become familiar with the basic principles of Azure VMs, the command line tool permits you to carry out many VM infrastructure development and management tasks more quickly and efficiently than is possible via the Web Portal.

You can **install Azure CLI tools** to run in your Windows, Mac, or Linux environment, or you may run them in your own Docker container.

The Azure Web Portal makes these CLI tools available in a **bash shell directly in your browser**.

Microsoft's **PowerShell environment**, also available directly in your browser via the Portal, offers similar access to command-line Azure management tools.

3) API

The Azure Compute REST APIs permit you to manage your Azure VMs from scripts you create, using an Azure SDK. You could even have a Jupyter notebook manage the lifecycle of your VM! **Here is a Quickstart guide** for python.

Minimum Set of VM Parameters

Azure will allow you to use default values for most of the dozens of configuration parameters. However, there are some that you must specify at the time you create your VM:

Subscription + Region + Resource Group

An Azure Resource Group is a named collection of Azure resources. Resource Groups help you organize your Azure deployment. Generally speaking, you will likely benefit from a strategy of "splitting" your resources by frequently making new Resource Groups, rather than "lumping" many resources into one or few Resource Groups.

A Resource Group's scope is restricted to one Region (location), and belongs to one Subscription (owner & payment method).

You may create a new Resource Group at the same time as you create a VM in the Web Portal, by selecting this option on the VM creation forms. You may also create a new VM as a member of an existing Resource Group.

VM "size" (CPU, GPU, RAM)

You may choose from a variety of different **hardware technologies** on which to run your VMs.

Note that not all varieties are available in all regions. This is often the case with newly-available varieties, which may not be initially deployed in all locations.

Note also that your subscription has default **quota settings** by resource type and region.

You may explore your Subscription's quotas by selecting the "Usage + quotas" settings of **your Subscription**. Use the "Request Quota Increase" link to do just that. If an Azure support technician responds with an indication that your quota increase request is not available for your Subscription type, please contact DTI support staff at help@c3dti.ai and we will work directly with Microsoft on your behalf to realize your request.

VM name

The VM name value is required. Do consider crafting a name that is meaningful to you and to your colleagues.

OS Disk Image

You select a disk image when creating an Azure VM. This disk image will contain the VM's operating system.

Popular available choices include various versions of Ubuntu, Red Hat Enterprise Linux, CentOS, Debian, Windows Server, and Windows Pro.

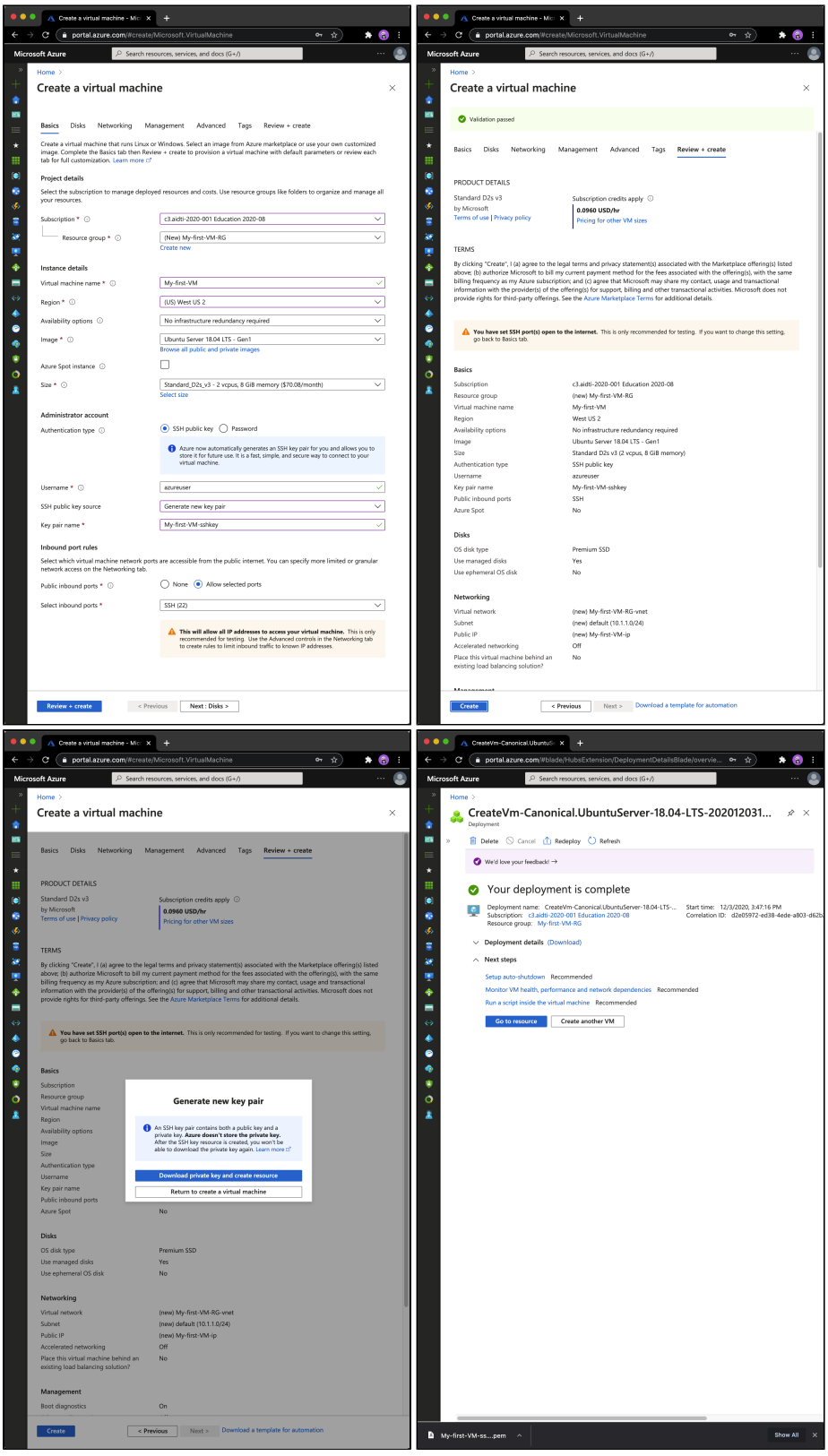
Authentication

When creating your VM, you indicate your access method and credentials. You may define a username and password or use a public/private key pair.

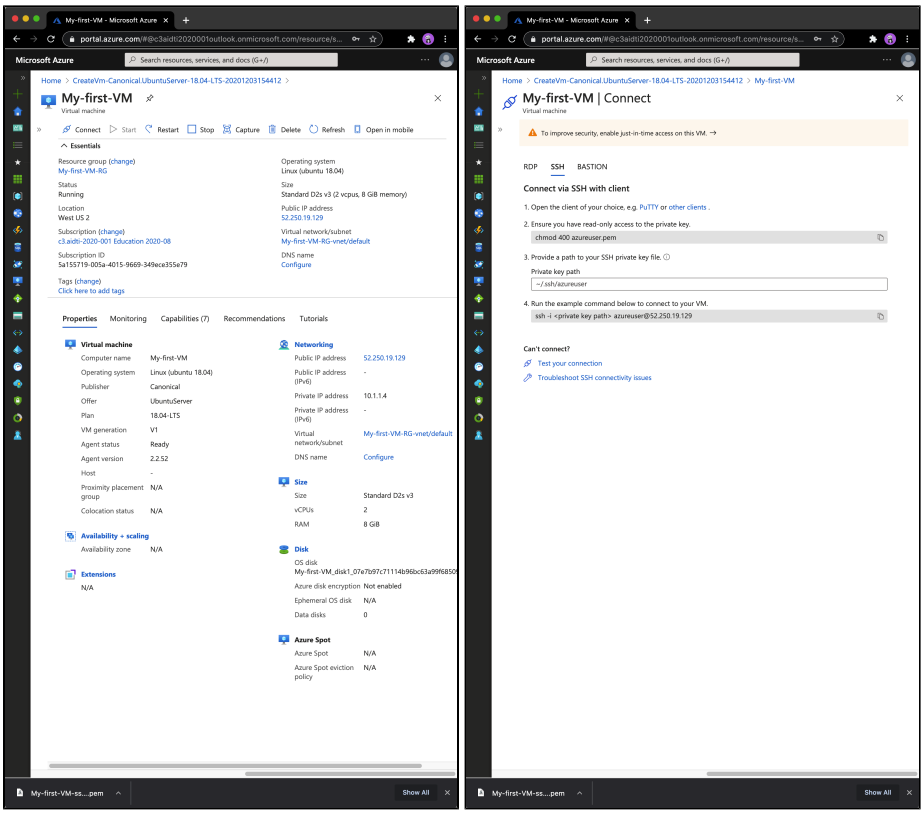
Azure Web Portal VM Lifecycle Example

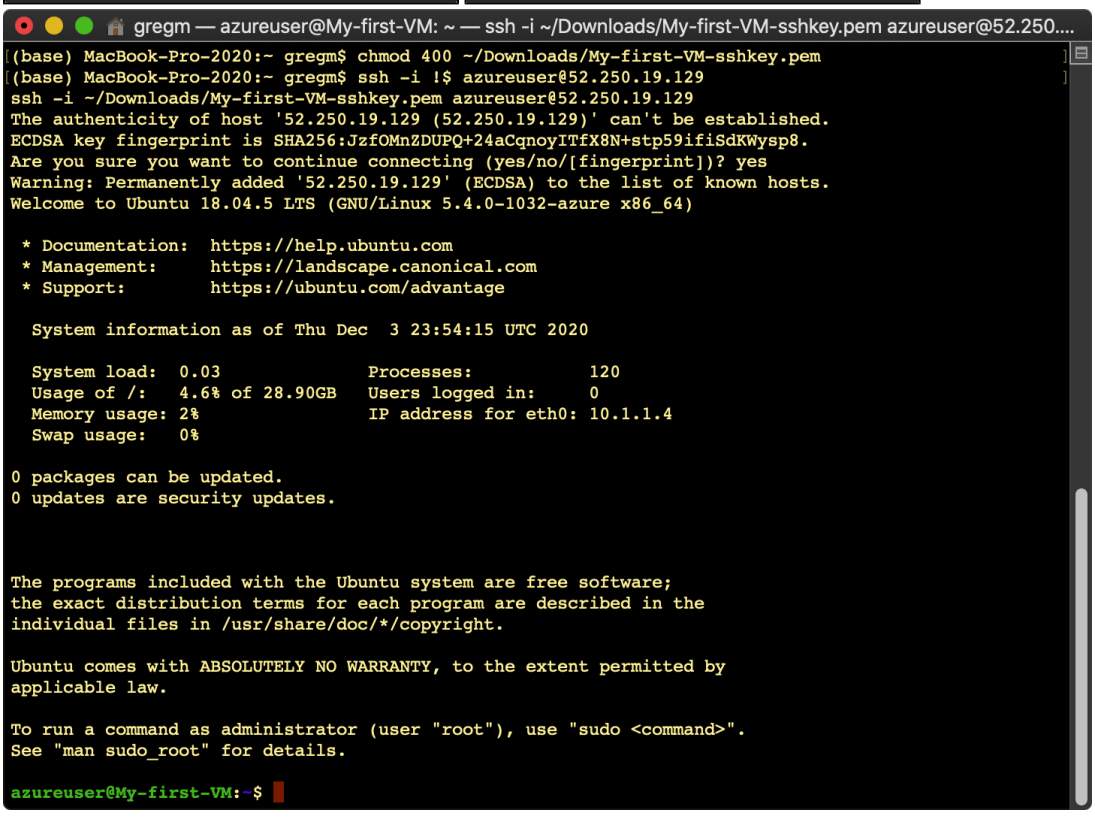
The screenshots below illustrate a simple VM lifecycle, managed in the Azure Web Portal: VM creation, access, and removal:

1) VM creation

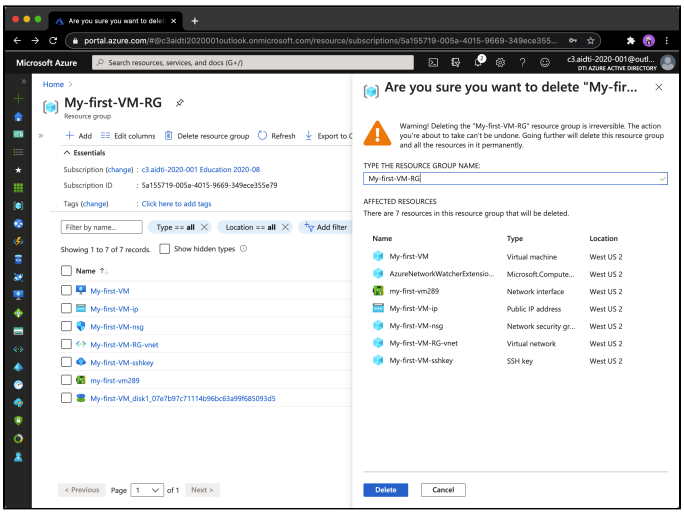

Create a virtual machine
Basics Disks Networking Management Advanced Tags Review + create
Review + create
Next : Disks >
Validation passed
Create
< Previous
Download a template for automation
Generate new key pair
An SSH key pair contains both a public key and a private key. Azure doesn't store the private key. After the SSH key resource is created, you won't be able to download the private key again.
Download private key and create resource
Return to create a virtual machine
CreateVm-Canonical.UbuntuServer-18.04-LTS-202012031...
Your deployment is complete
Go to resource
Create another VM

2) VM access





3) VM removal (via Resource Group deletion)

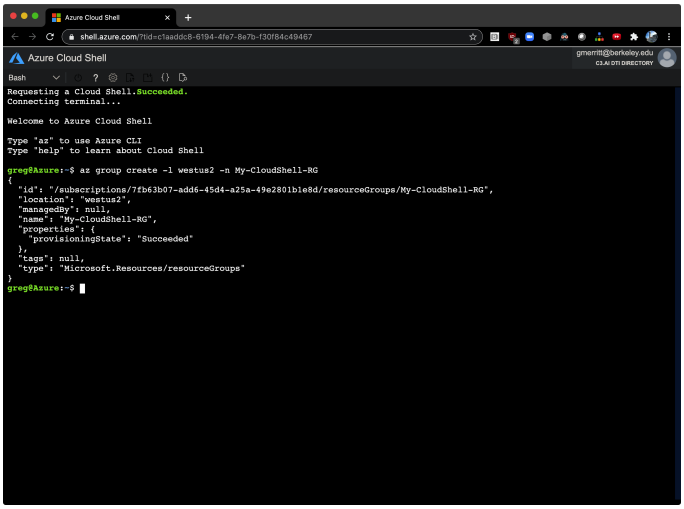


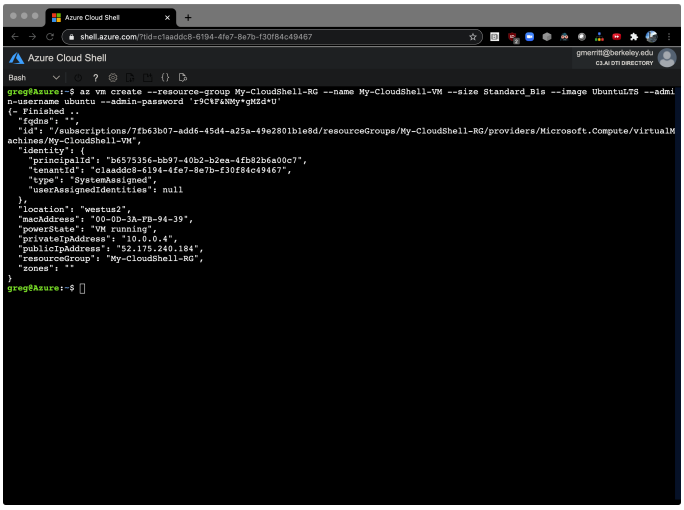
Command Line VM Lifecycle Example

The screenshots below illustrate a simple VM lifecycle, managed from the Cloud Shell command line: VM creation, access, and removal.

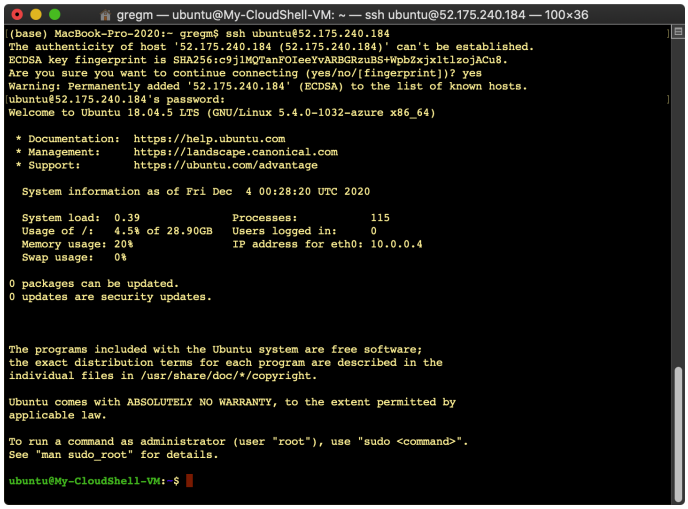
(**Note**: the `az` command, shown below running in Cloud Shell, can be run locally on Windows, Mac or Linux if you install the Azure command line tools.)

1) VM creation

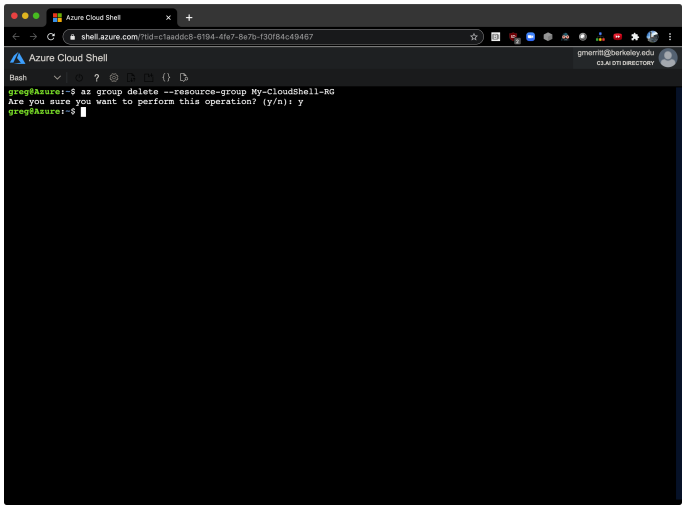




2) VM access



3) VM removal (via Resource Group deletion)



Configuring Your VM

If you wish, you may think about your VM much like a server under your desk or at a data center: log in, carry out many configuration and installation tasks, and perhaps back up the prepared machine once you have it set up. This work style is available to you in the cloud.

Alternatively, you can take an *infrastructure as code* approach and define your VM's configuration in text files. Such files can be archived, version controlled, shared, and re-used:

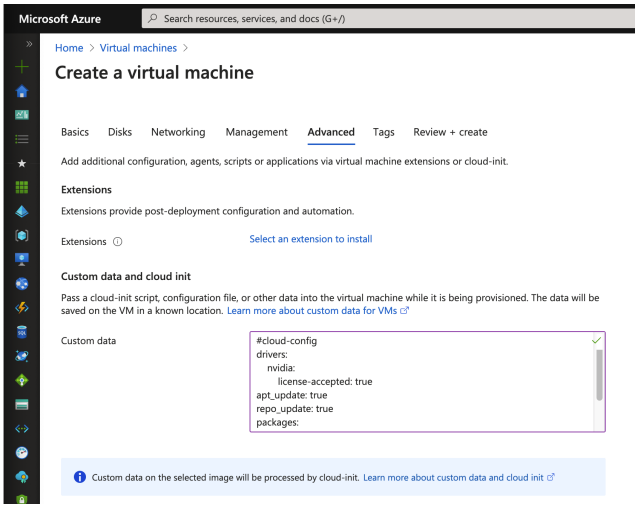
Consider this simple example of cloud-init directives (in YAML format) that can be given to a VM at first launch:

```
#cloud-config
drivers:
    nvidia:
        license-accepted: true
apt_update: true
repo_update: true
packages:
 - nvidia-utils-455
power_state:
    mode: reboot
```

In the example above, the `cloud-config` directives compel your VM to download and install Nvidia GPU drivers and utilities on your VM, and then reboot the machine so that the drivers are loaded and ready to use. You don't have to find any download URLs, unzip anything, or wait for each step to complete before running the next. You also have documentation of what was done to the machine to configure it, and can easily bring up another machine just like the first without having to manually repeat these installations.

Many standard Azure VM images (including examples running Ubuntu, CentOS, and Windows) run the `cloud-init` service, which can read and execute cloud-config directives. A file of such directives encodes your VM configuration, including software package installations. This enables you to define your VM's configuration in a text file, which can be documented, shared, re-used, and even managed under version control. DTI researchers are strongly encouraged to consider using the built-in `cloud-init` service in Azure VMs to help manage deployments.

To use the `cloud-init` service, you may paste `cloud-config` text into the appropriate form field on the Advanced tab of the Web Portal VM creation screens:



When using the `az vm` command line utility to create a VM, you can add a parameter value that indicates the location of a local file that contains your `cloud-config` data:

```
--custom-data "/path/to/my_cloud-config_file.txt"
```

This will deliver (and execute) your cloud-config directives to your VM's built-in `cloud-init` service upon its first boot.

To read more about using cloud-config files with Azure VMs, follow these links to documentation and examples:

- https://docs.microsoft.com/en-us/azure/virtual-machines/linux/using-cloud-init
- https://docs.microsoft.com/en-us/azure/virtual-machines/linux/tutorial-automate-vm-deployment
- https://cloudinit.readthedocs.io/en/latest/topics/examples.html

Note: the `cloud-init` service is not Azure-specific, with support from other cloud providers as well.

Stopping and Starting Your VM

In most cases, you can **Stop** your configured VM at any time and **Start** it again later when you next need to use it. This **Deallocates** most of the VM's resources so that your VM does not incur significant costs while it's stopped.

Note that this must be done from the Web Portal, command line, or API. Simply giving a shutdown command to the VM's OS will not deallocate the underlying resources.

You may also schedule shutdown of your VM at a prescribed time.

Before relying on this, check documentation and do some tests to confirm that disk partitions whose data needs need to preserved behave as you expect after a Stop/Start cycle. This works out fine in most cases, but it's best to confirm in advance.

Resizing Your VM

You can **resize** Azure VMs. For some use cases, it can be convenient and cost-effective to configure and test on a smaller VM (reduced CPUs, GPUs, and RAM), and then resize to higher capacity at run time.

Backing Up Your VM

Azure provides methods for performing **VM backups**.

Disk Roles and Persistence of Data

Read about **Data, OS and Temporary disks**, including notes regarding data persistence.

Upcoming

- ARM templates
- ssh tunneling
- Network Security Groups
- Just-in-time VM access
- Marketplace images
- Workstations: Remote Desktop on both Linux and Windows