

# Workshop on Genomics 2018

Connecting to the cloud and starting an instance.

## Instructors

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- Workshop Team

## Objectives

By the end of this session, you will be expected to be able to:

- Understand the basic terms we will use throughout this tutorial e.g. “cloud”, “virtual machine (VM)”
- Access the instance via a variety of methods, e.g. SSH & X2Go
- Continue with tutorials at your own pace

## **Important Notes**

For the purposes of this workshop, we will have already set up your individual instances each day to save some time.

Your instance IP addresses can be found on this list [here](#).

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# Introduction

For this workshop we will potentially use two high performance cloud platforms and several instances/virtual machines. Amazon Web Services and XSEDE/Jetstream. Both are very flexible resources to get computational work done quickly and relatively inexpensively.

You will already have had a short lecture on what the cloud *is*, and an understanding of the basics of a virtual machine/instance from Julian.

For the first tutorial, Unix, we will be leveraging a standard copy of Ubuntu Linux running on Amazon's Elastic Compute Cloud (EC2) and a "Free Tier" instance. This means the cost is free for the time you use on their services - however, the resources are limited (fine for learning unix, but not necessarily enough to run genomics software).

For the rest of week one we will be using another instance (virtual machine) with all the software and data you will need along with more CPU and RAM. In week two we will likely move to the XSEDE/Jetstream systems. There will be little noticeable difference in how you interact with these different systems within this workshop - although the login details may vary between each instance.

Please note that the XSEDE services are US-centric (you will need to be a US-citizen or a US-resident enrolled at a US university to submit proposals), nonetheless the process of using the resources is not too different to that of using Amazon Web Services or another competing cloud platform.

## Terminology

- **Amazon Machine Image (AMI):** This is the starting point or template for the course - it contains all the programs and data that you require to follow the course. An AMI is analogous to powering down your computer, and pulling out the hard drive -- the hard drive is an "image" of your computer.
- **An Instance:** Almost the first thing you will do is create your own copy of the AMI - we call this an instance. It contains everything that was in the AMI plus any files you create during the course. One way you can think about an instance, and how it differs to an AMI, is that an instance is analogous to putting a hard drive into a physical computer and powering it on.
- **XSEDE** - a single virtual system that scientists can use to interactively share computing resources, data and expertise.
- **Jetstream** - a user-friendly cloud computing environment for researchers based on Atmosphere and OpenStack (your university may have similar resources in the HPC centre). It is designed to provide, "a configurable cyber-infrastructure that gives

researchers access to interactive computing and data analysis resources on demand, whenever and wherever they want to analyze their data”.

- **Atmosphere** - This is the name of the portal software that you will access the Jetstream services through - i.e. the website.
- **Project** - a space within Atmosphere where you can keep your instances and attached storage separate from other projects.
- **Instance**: Almost the first thing you will do is create your own copy of the workshop environment. It will contain everything that you need to run the workshop: including all data and software, along with any files you create during the course. One way you can think about an instance is as analogous to putting a hard drive into a physical computer and powering it on.

## Useful Links

- [Workshop Homepage](#)
- [Jetstream User Manual](#)
- [Amazon Web Services](#)
- [X2Go Software](#)
- [MobaXTerm Software](#)
- [PuTTY Software](#)

## Task 1 - Logging-in to your Instance

There are many ways to interact with a running virtual machine / instance. We shall be accessing the instance via programs that support SSH, X2Go and a web browser for some applications (e.g. R Studio).

Many of you will be familiar with a desktop environment, and we can access our instance's version of the desktop via a piece of software called X2Go (discussed below, with install instructions).

For most of the workshop tutorials we recommend that you access the instance by using X2Go or directly via a terminal program and the shell unless otherwise asked. You will learn more about how to use the shell in the Unix tutorials.

For all tutorials you will need to know and have ready:

## Username & Password

This is the username that you used to login to the Jetstream service along with the associated password (there will not be a password if you need a keyfile, see below).

Username: 'ubuntu' or 'genomics' or 'tb170112'  
Password: please see the whiteboard in the lab room.

The username will change depending on which virtual machine we are accessing on the day. Don't worry, you will be told which one it is and it will be up on the whiteboards at the front of the Prelate.

## Private Key

Cryptographic keys are a convenient and secure way to authenticate without having to use passwords. They consist of a pair of files called the *public* and *private* keys: the public part can be shared with whomever you'd like to authenticate with (in our case, Jetstream), and the private part is kept "secret" on your machine.

Things that are encrypted with the public key can be decrypted with the private key, and it is computationally intractable (i.e., it would take on the order of thousands of years) to determine a private key from a public key. You can read more about it [here](#) if you are super-keen / bored or talk to Dan ;).

The good news is that we have already created a public key for our Jetstream and Amazon accounts. However, to make use of it, you'll need the private key. They are available from [\[temporary link\]](#).

**Mac and Linux users must 'secure' their private key file permissions. Windows users do not need to do this. To secure your private key, type this in your terminal:**

```
chmod 600 <your private key.pem>
```

## IP Address

For some web services access, e.g. R Studio Server you will only need your IP Address and a port number. For example [http://your\\_instance\\_IP:8787](http://your_instance_IP:8787) will take you to the R Studio interface.

## Terminal / Shell (SSH)

### Windows

Windows uses a different type of 'shell' compared to both Mac and Linux. Until recently it only came installed with a copy of "PowerShell" which was not useful to connect to our linux-based instance.

However, there are several free options that we can use to gain access, MobaXTerm is our preferred way of interacting with our instances

## PuTTY

PuTTY is a SSH terminal for Windows. It is very basic, but it can be used to access our instance as a terminal. To download putty go to:

<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html> and select the version you want. In this case it should be “putty.exe”

**For Windows on Intel x86**

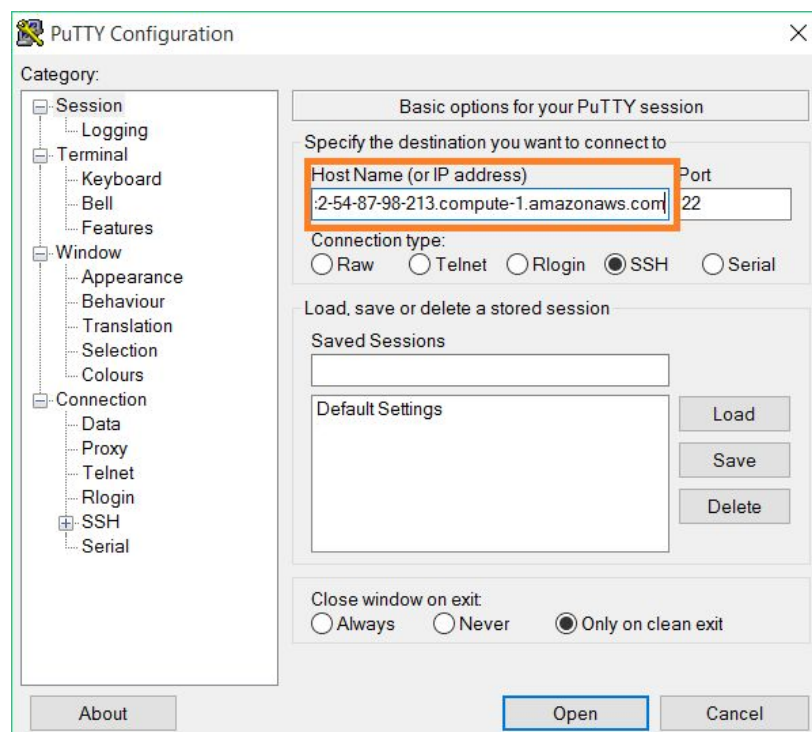
PuTTY: [putty.exe](#)

[\(or by FTP\)](#)

[\(signature\)](#)

After downloading the file, run it.

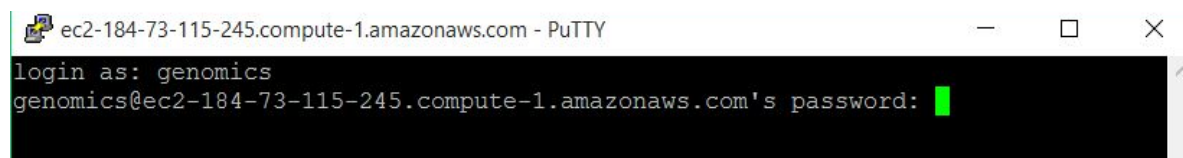
In the Host Name bar insert the IP Address number for the Instance.



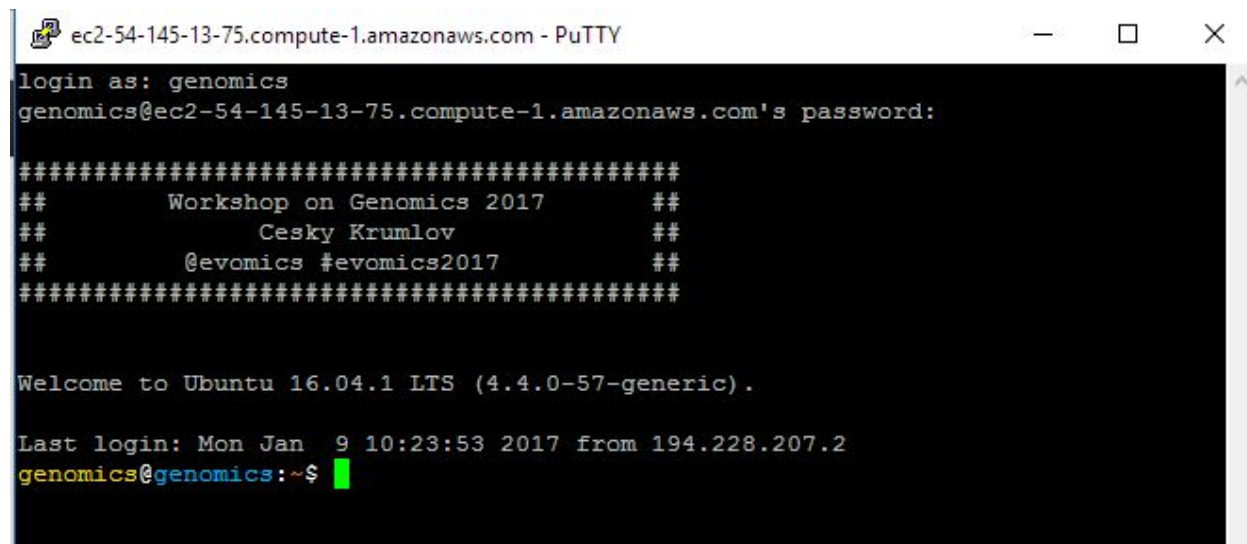
If this warning message appears, click “Yes”. This is a check that you trust the computer you are connecting to.



Enter the username and the password.



You are now accessing the terminal of your instance.



## MobaXTerm

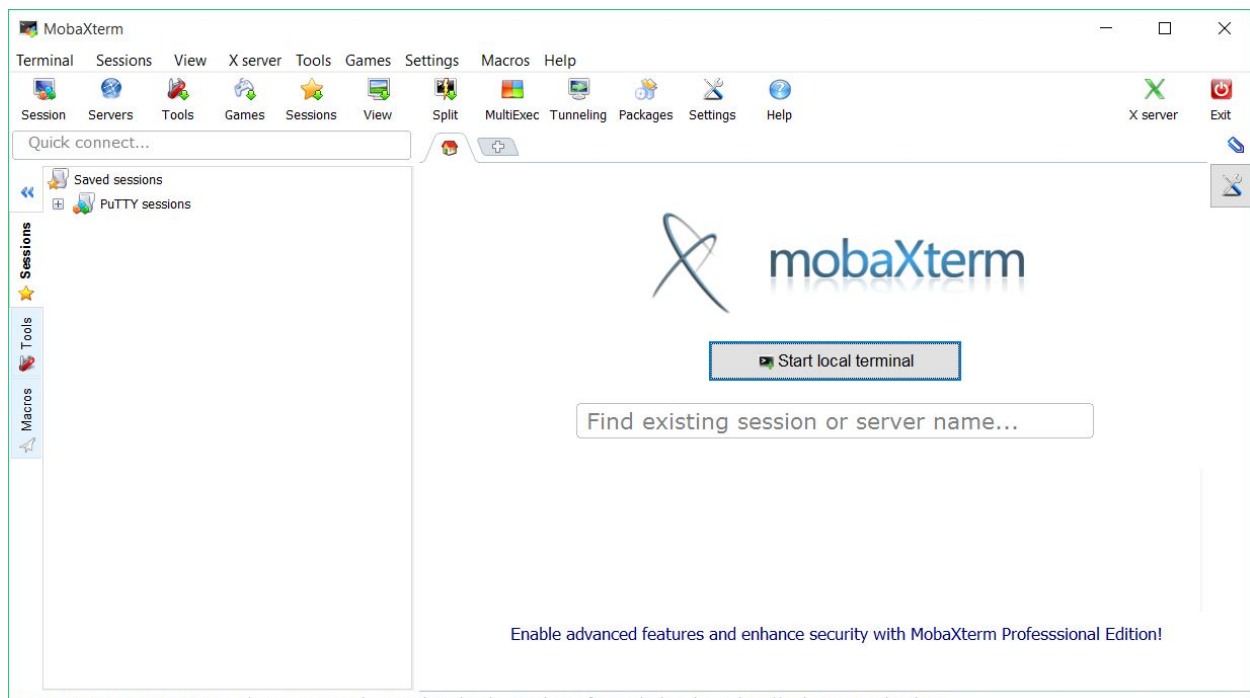
MobaXTerm is another terminal for use in Windows environments. It has more features and options than PuTTY, some of which you will need to pay to use. However, the majority of the options/features you will use in these sessions are available in the free portable version! This means you do not need to be an administrator to use/install the program.

Download here - [http://mobaxterm.mobatek.net/MobaXterm\\_v9.4.zip](http://mobaxterm.mobatek.net/MobaXterm_v9.4.zip)

Use your favourite unzip manager (e.g. 7-Zip) to unzip the archive and place the executable file somewhere you can find it (perhaps in your "Program Files" folder under MobaXTerm, not your Desktop if you can help it!). Double click the file to run the program...



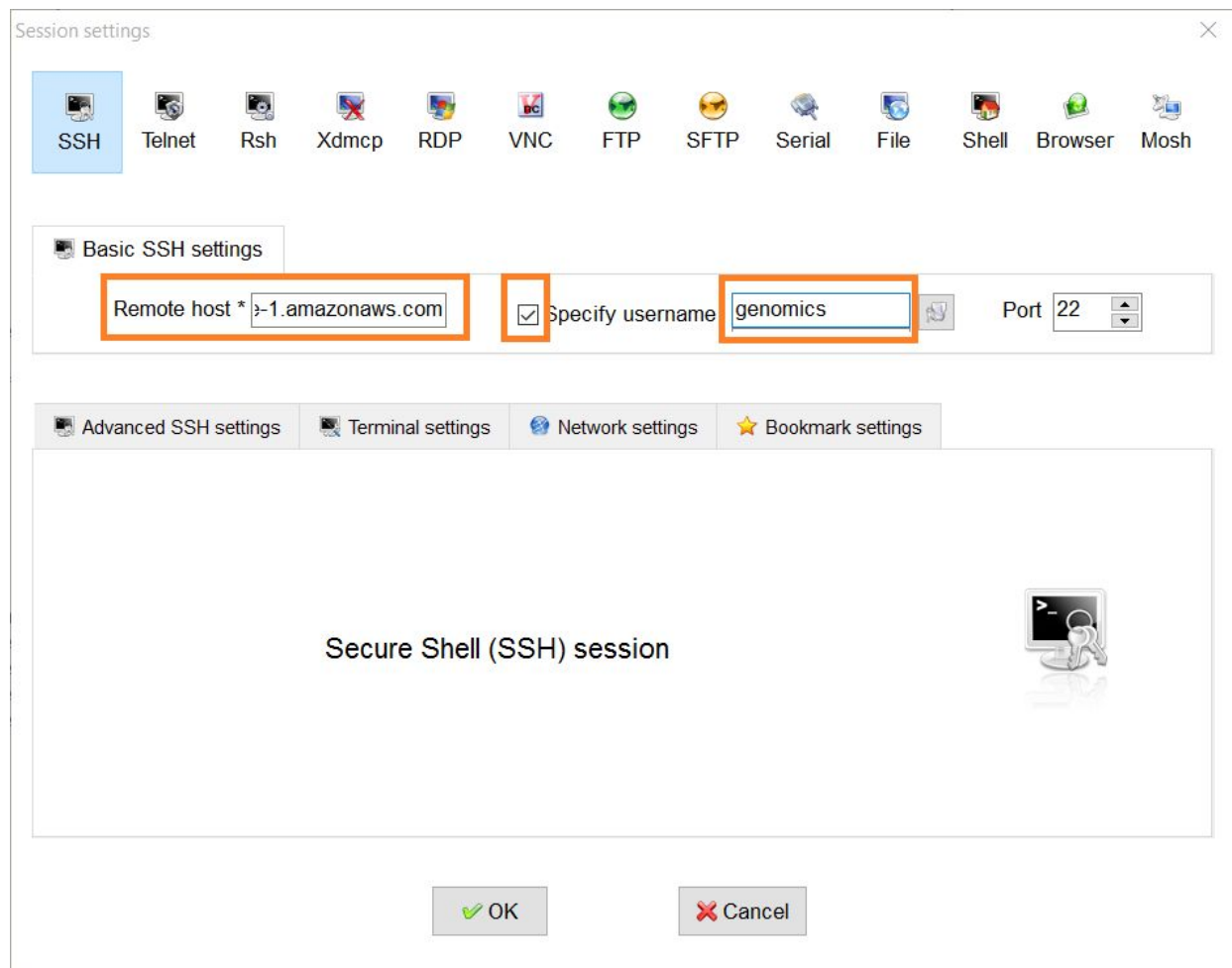
When the program has started you will be shown a screen like below:



The black screen - terminal - gives you access to your local computer file system with many of the UNIX commands built in (e.g. ls, cat, head).. You may also see saved PuTTY sessions already loaded on the left side of the screen, if you have used that program before and saved them.



However, if you do not you should click the “Session” button on the top left. You will then be shown a screen with many options of session type (e.g. SSH, Telnet, RDP, FTP). You will want to select “SSH”.



Enter your IP Address in the “Remote host” box and specify your username as “genomics”.



Please leave all settings as their defaults. You may also notice a checkbox that says “Use private key”, this is where you specify your private key.

Once you are logged in, one of the nice features of MobaXTerm is that you can easily transfer files with an inbuilt browser (via SFTP) on the left hand side of the program window in the Sftp toolbar. You can also detach your tabbed window terminal session (much like you can in Firefox or Chrome with a website tab) and should try and auto-reconnect if you lose your connection.

MobaXTerm should also save all your session details, including passwords and private keys between sessions of using it. Your saved sessions will appear on the left hand side of your program screen.

A full installation is also possible if you do not want to use the portable version. The link for download is here: [http://mobaxterm.mobatek.net/MobaXterm\\_Setup\\_9.4.msi](http://mobaxterm.mobatek.net/MobaXterm_Setup_9.4.msi)

## Using Windows Bash (Ubuntu on Windows)

Install Ubuntu on Windows, instructions here:

<http://www.howtogeek.com/249966/how-to-install-and-use-the-linux-bash-shell-on-windows-10/>

This option is still in beta and will require you to have administrator access to your machine in order to install it.

Enable 'paste using right-click' by going into properties and Check the box called "QuickEdit Mode".

## Apple Mac

OS X comes preinstalled with an application called "Terminal", you can search for it with the Finder app.

However, many Mac users prefer using iTerm2 - you can download and install from here - <https://www.iterm2.com/>

## Linux

All linux distributions will come with a terminal application. These may be in different places depending on what type of linux system you have installed. It is likely that if you are using linux you already know how to find this, if not please ask one of the instructors for help.

## X2Go

X2Go will allow you to see a windowing environment (similar to your current desktop). It is a great option if you want to use a GUI application (Graphical User Interface like IGV).

Here are the steps to get remote X2Go login working. Note that these instructions will only work

for this workshops' particular instance. Many VMs will not have the X2Go server installed as default and therefore you will not be able to connect using the X2Go client.

## X2Go on Windows

### Installation

The link to install for Windows is here:

<http://code.x2go.org/releases/binary-win32/x2goclient/releases/>

(If you do not have admin rights, alternative instructions can be found here

<http://wiki.x2go.org/doku.php/doc:installation:x2goclient>)

Click on the latest link (it may be different to the version shown here):

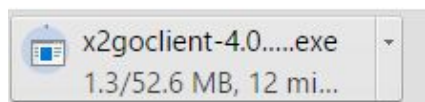
 [4.0.5.2-2016.09.20/](#) 20-Nov-2016 08:24 -

Then select the setup program:

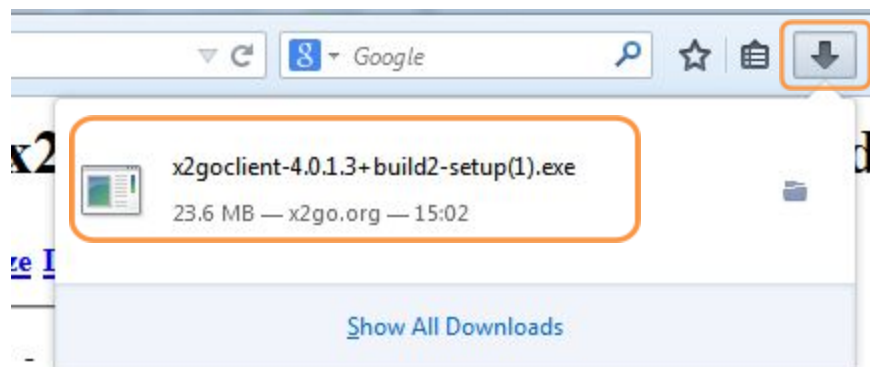
 [x2goclient-4.0.5.2-2016.09.20-setup.exe](#) 21-Sep-2016 05:37 53M

This will download the setup program to your computer. Find the file and click on it: Depending on what browser you are using

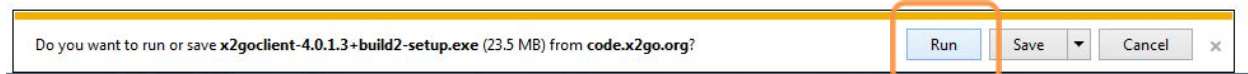
In Chrome:



Or FireFox (version number will vary from this screenshot, do not panic):

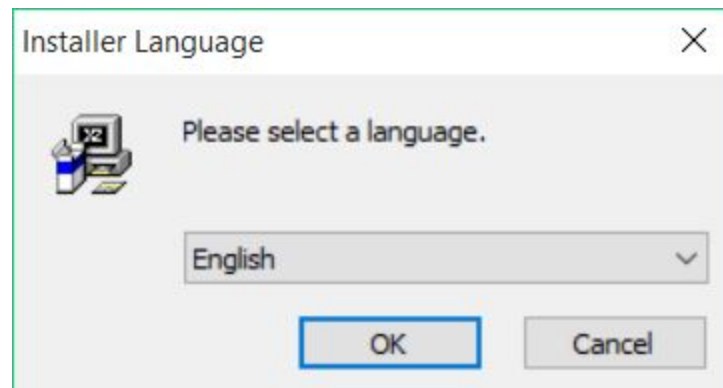


Internet Explorer (Yet again, the version number will differ, this is no cause for concern):

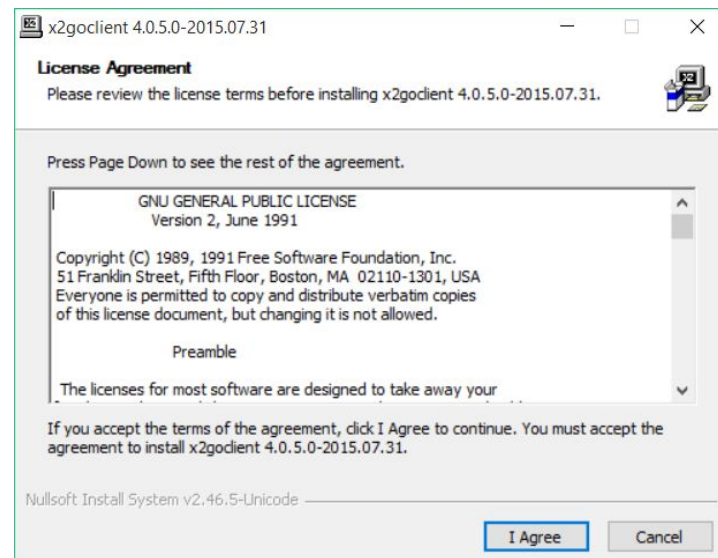


You will get a screen asking for permission to continue - select 'yes'.

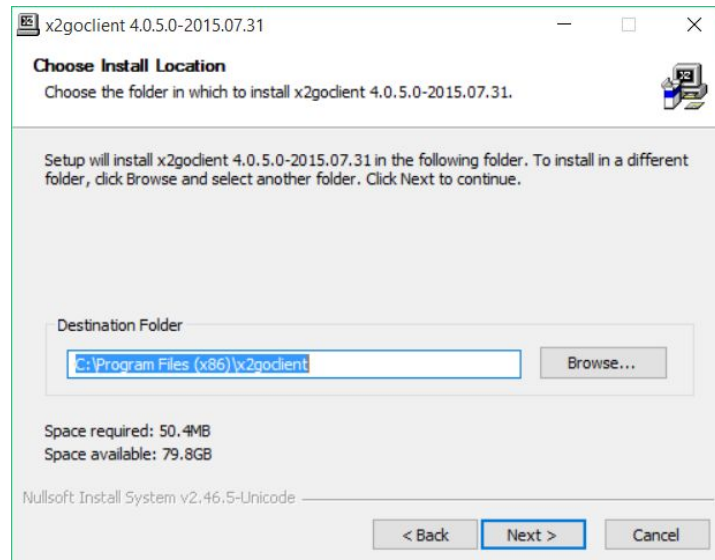
The installer will prompt you to select the language of installation. English might be fine.



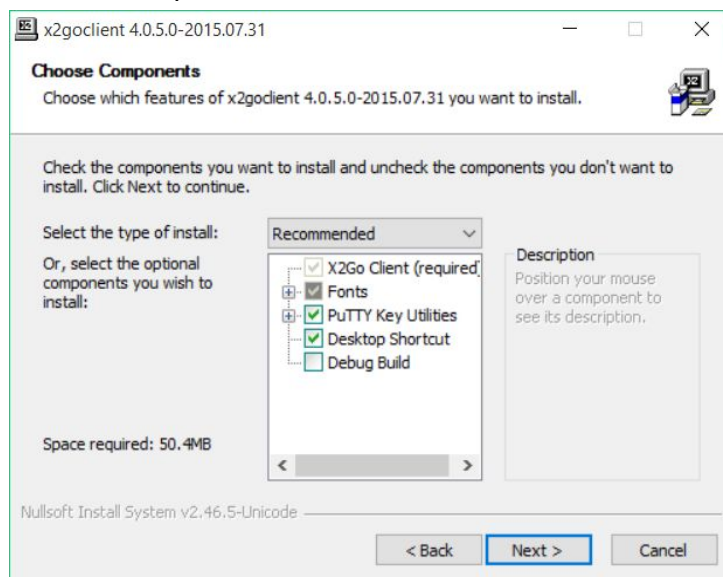
The license agreement. Click "I agree".



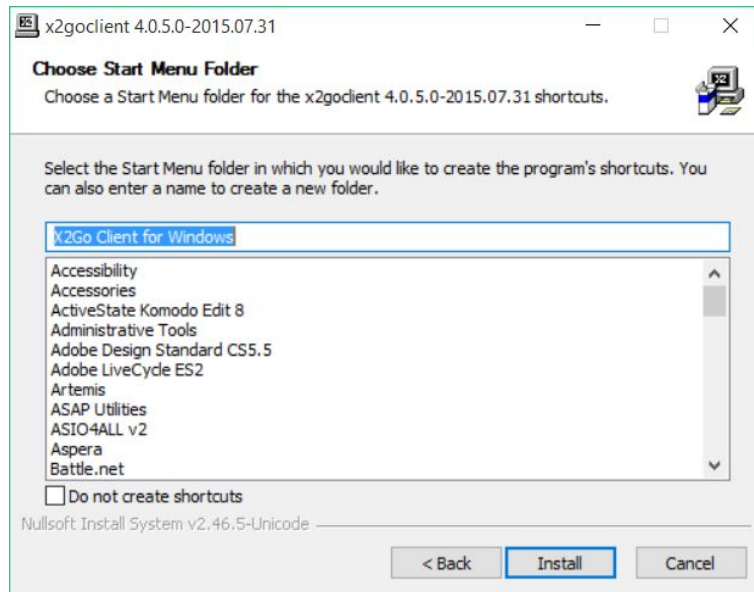
The install location. The default location is acceptable, please just click "Next".



In this step you can choose components to install. Default is OK. Click “Next”.



The start menu location. The defaults are acceptable, please just click “Install”.

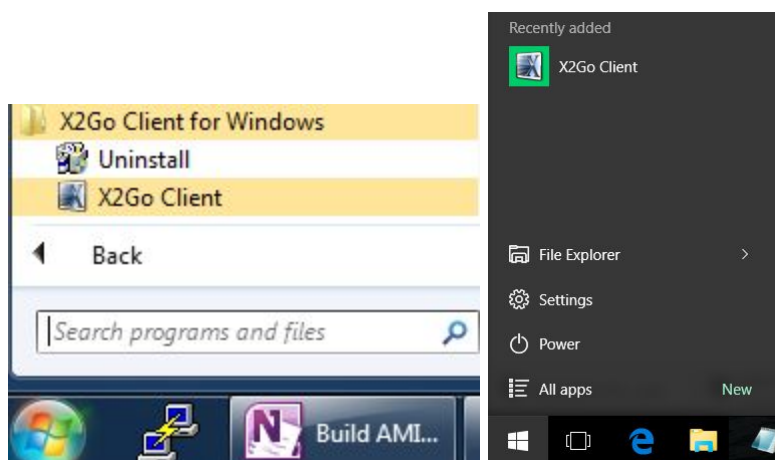


Start X2Go client in Windows.

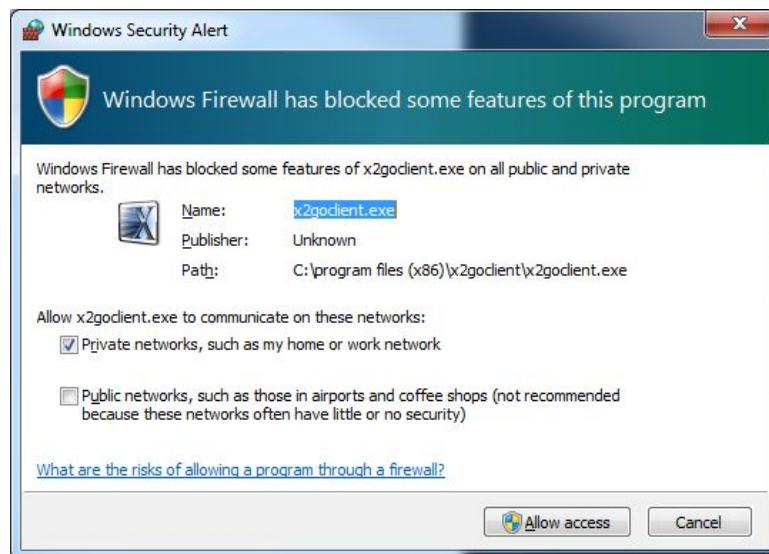
Once installed, you should have an X2go Client icon on your desktop which you can double click. The icon looks like:



Alternatively, you can look for it in your Start Menu :



When you first run the X2go Client, you may get a message about changes to your firewall. These changes are not necessary, so please just click “Cancel”.



## X2Go on Mac OSX

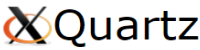
### Installing X2Go client on Mac OSX

#### XQuartz

Prior to the installation of X2Go, you will have to install XQuartz (if you have not done it at home already).

Download the dmg file at <http://xquartz.macosforge.org/landing/>

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The XQuartz project is an open-source effort to develop a version of the [X.Org X Window System](#) that runs on OS X. Together with supporting libraries and applications, it forms the X11.app that Apple shipped with OS X versions 10.5 through 10.7.

### Quick Download

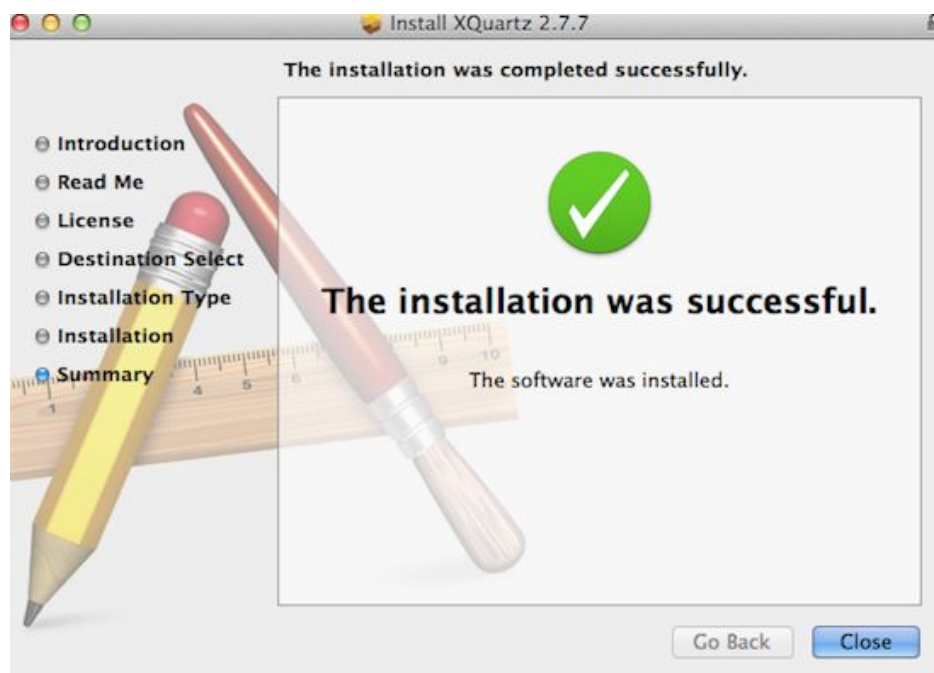
Download	Version	Released	Info
<a href="#">XQuartz-2.7.11.dmg</a>	2.7.11	2016-10-29	For OS X 10.6.3 or later

### License Info

An XQuartz installation consists of many individual pieces of software which have various licenses. The X.Org software components' licenses are discussed on the [X.Org Foundation Licenses page](#). The [quartz-wm](#) window manager included with the XQuartz distribution uses the [Apple Public Source License Version 2](#).

- Home
- Releases
- Support
- Contributing
- Bug Reporting
- GitHub

Once it is downloaded, just click on the XQuartz-2.7.11.dmg and then open the XQuartz.pkg. Follow the standard installation procedures until you reach the following screen :

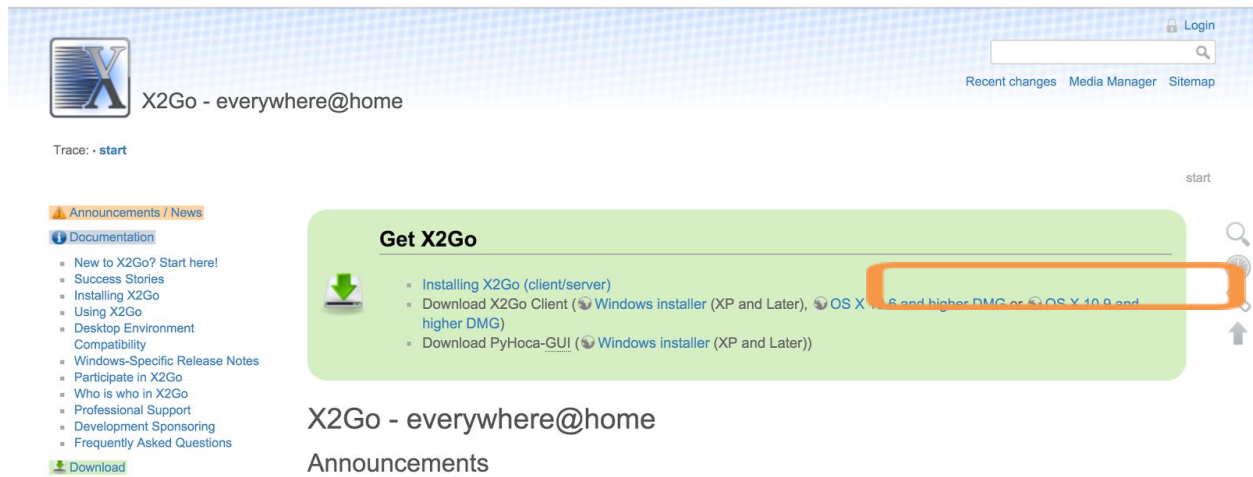




Once XQuartz is installed, you'll then be able to install X2Go. You may have to log out and log back in before the new XQuartz is launched but this will be promoted by your computer.

X2Go.

Go to <http://wiki.x2go.org/doku.php> and click on the appropriate MacOS dmg for your computer to download.

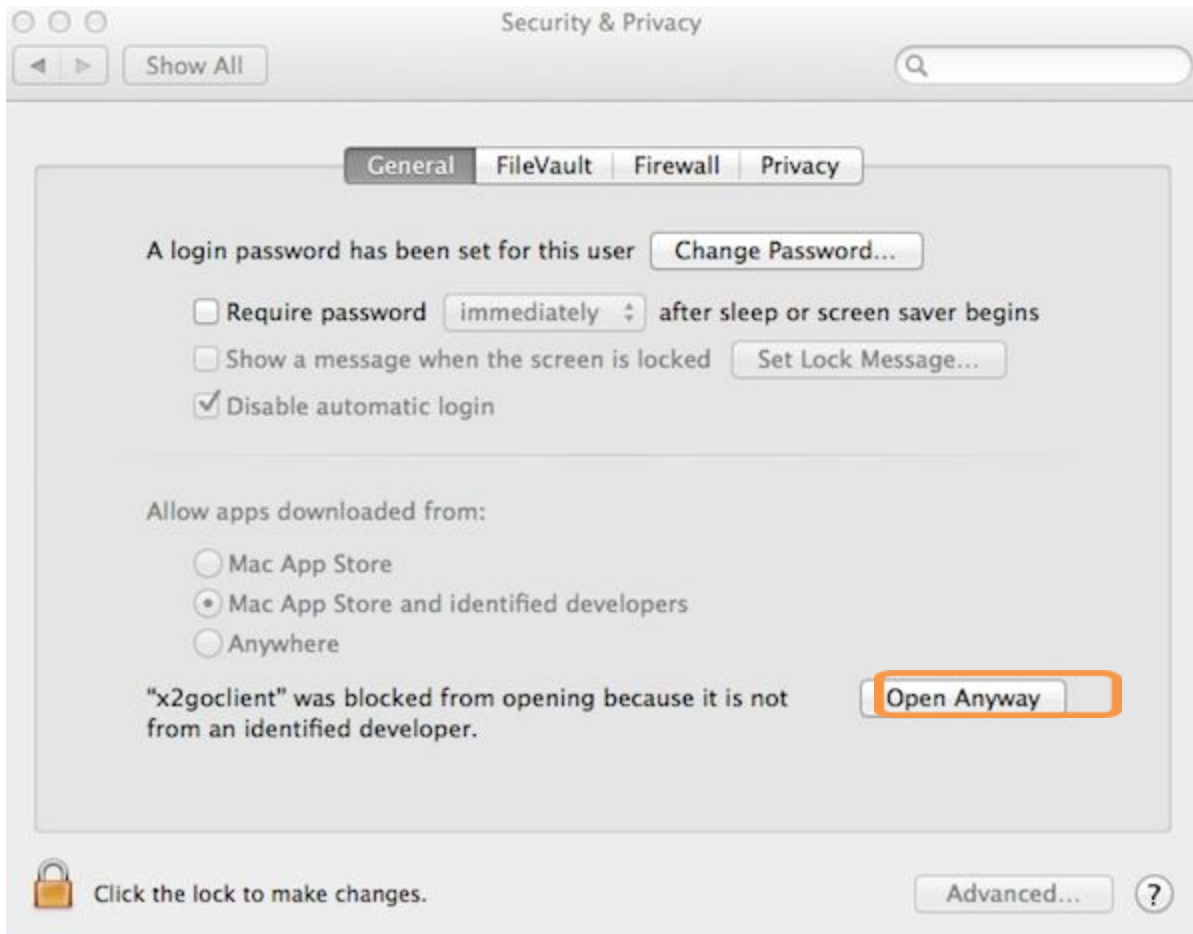


The X2Go download page. Please click on the “OS X 10.6 and higher DMG” or “OS X 10.9 and higher DMG” link based on the version of OS X on your computer.

Once downloaded, try to open the X2GoClient\_latest\_macosx\_10\_?.dmg file. You may get the following warning:

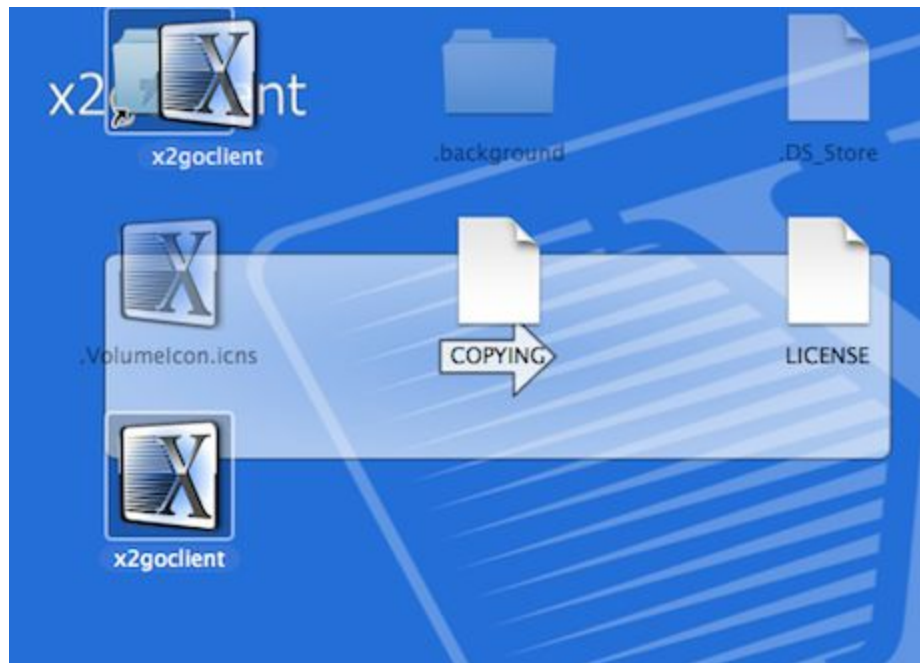


If you see this message, to open the file, please navigate to your Security and Privacy settings. You can do this by going to your System Preferences (under the Apple menu in the upper left of your screen) and then clicking on “Security and Privacy.”



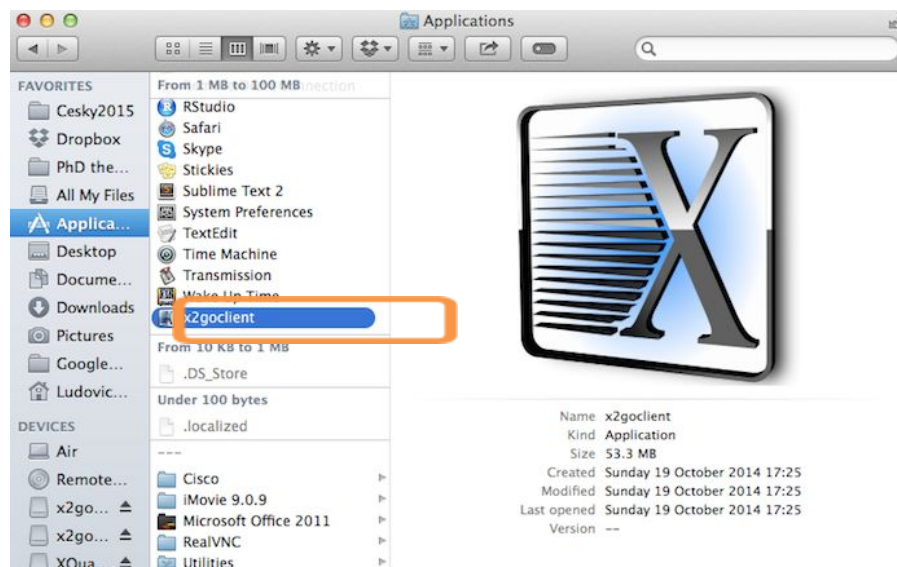
Please "Open Anyway" for the x2goclient.

You can now go back and open the X2GoClient\_latest\_macosx.dmg file. Once open, please move x2go into your Applications folder.



Starting the X2Go client on Mac OSX

From Applications, open x2goclient.



## X2Go on Linux

Installing X2Go client on Ubuntu (Linux).

X2Go Client is part of Ubuntu 12.04 & later, as well as Debian Wheezy & Jessie. In Ubuntu, to install it you will probably need admin rights (sudo, root, etc.):

- Open a terminal (Ctrl + Alt + T)
- In the terminal, type “sudo apt-get install x2goclient”

```
sudo apt-get install x2goclient
```

Detailed instructions for other Linux flavours can be found in this link:

<http://wiki.x2go.org/doku.php/doc:installation:x2goclient>

Start X2Go client in Ubuntu (Linux).

In a terminal, type “x2goclient”.

### Create a session with X2Go client (all OS).

After launching X2Go in your OS (see above), you should see the main screen. Note: on some versions of Windows you might get a security message. If so, please select “keep blocking.”

Now you need to tell your computer where to connect to. If this is the first time you’ve opened X2Go, a new dialog will automatically pop up. If this is not the first time, then you’ll need to click on the “New session” icon.

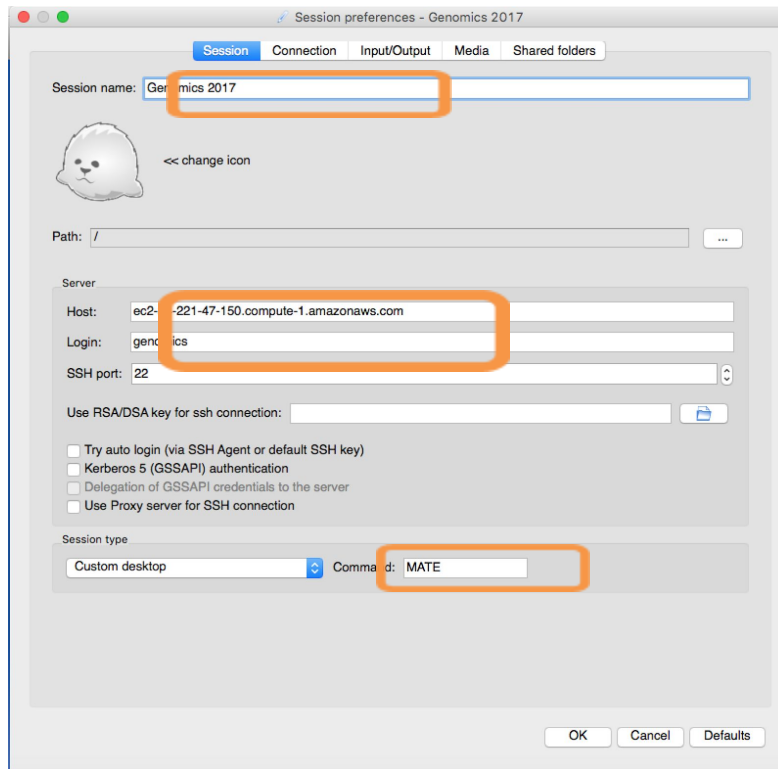


Within the new session dialog box, you’ll need to specify:

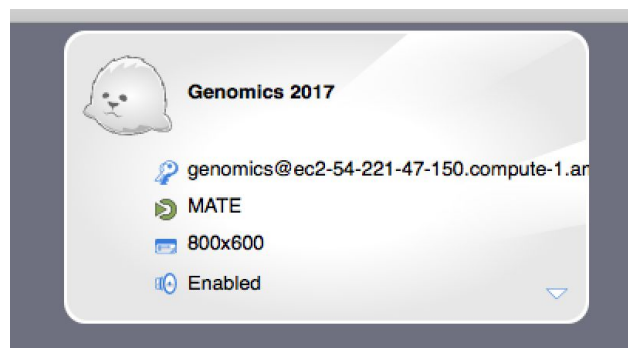
- A session name. We recommend “Genomics 2018”.
- A host. This is your instance. Please enter the Public IP Address of your instance.

	Josie	i-a5700724	m3.large	us-east-1d	 running	 2/2 checks ...	None 	 ec2-54-87-98-213.compute-1.amazonaws.com
---	-------	------------	----------	------------	---	--	--	--

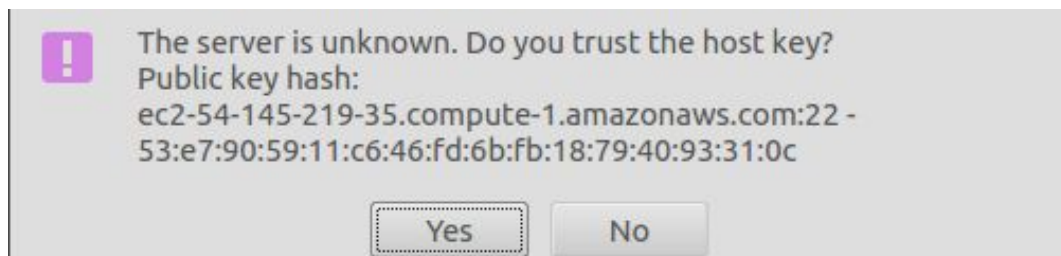
- A login. This is the username. Please enter “tb170112”.
- The session type. Please select “MATE”.



When you click on OK, you should be taken to a new page that looks like the following.



The first time you connect to your instance (or if the public DNS changes) you will see a message that looks something like this (look of this error is dependent on your system, so it does not have to be exactly same as here) :





Simply click next/yes to continue.

Note : If you are using Mac, you may see two error messages one after the other, just ignore them. Similarly in Windows, an error message about Print and File sharing may appear, you are safe to dismiss it.

After approximately 30 seconds, you should see the connection open as below.

Congratulations! You're now connected to your instance! It will look similar to below...

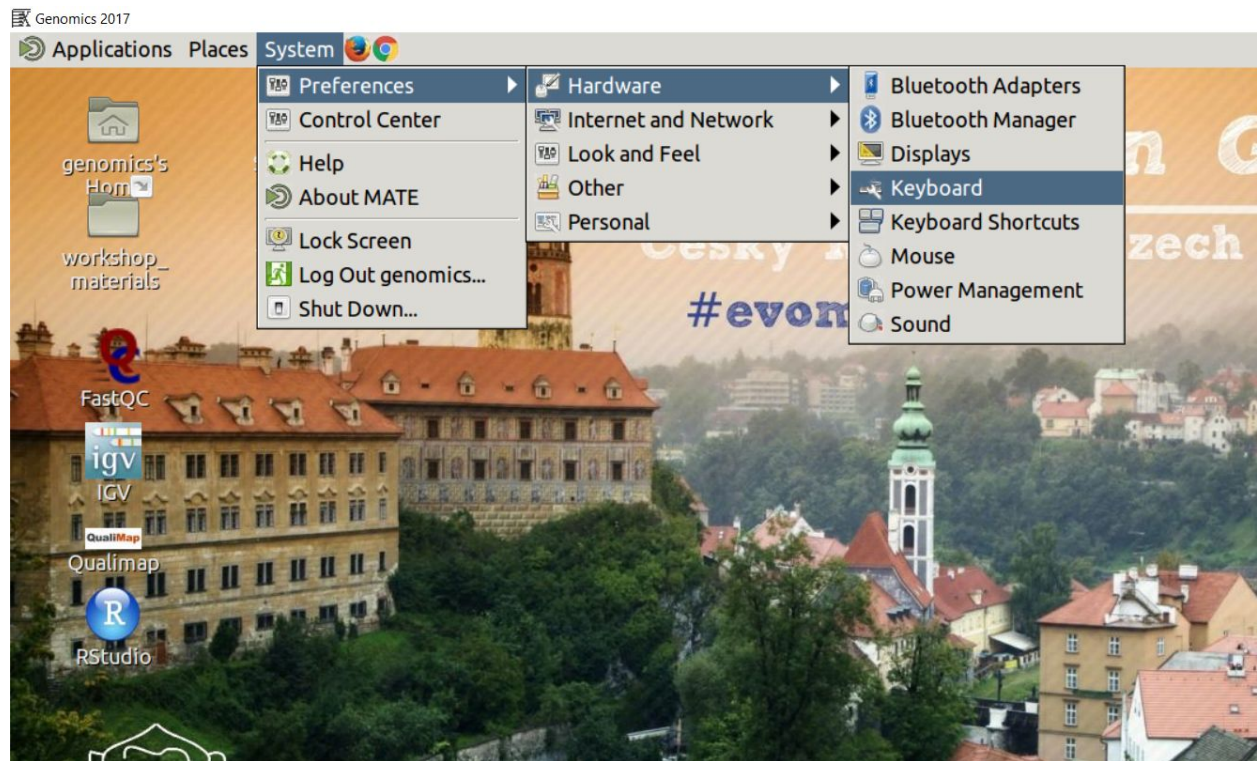


# Other Information

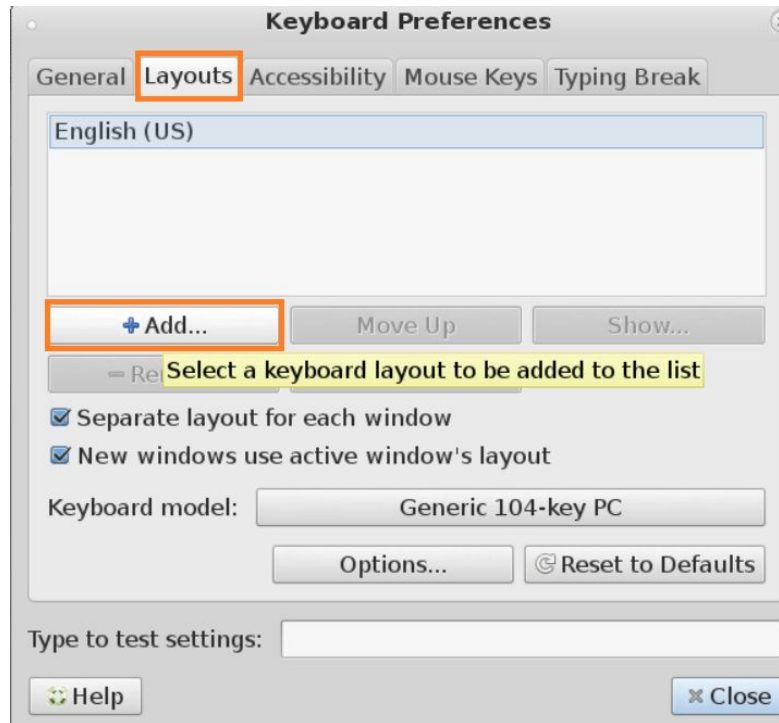
## Troubleshooting the Keyboard Layout.

In most cases X2Go should transfer the layout from your computer to the virtual instance. If for some reason this does not work for you, there is an option to change the layout in the instance itself.

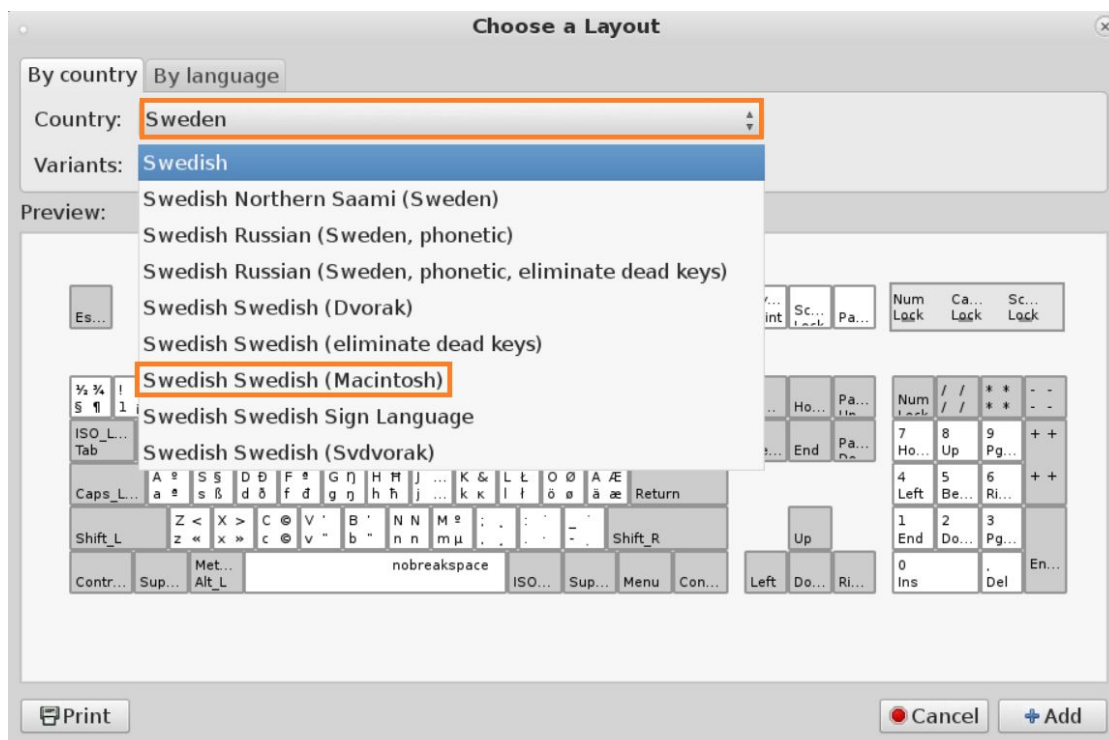
Click on “**System**” on the top bar on the instance desktop. Then go “**Preferences**” and “**Hardware**” and “**Keyboard**”.



A keyboard preferences menu will appear. Click the “**Layout**” tab and then the “**Add**” button.



Then you can choose the desired layout by country and variant. Choose the one you like and you can preview the layout on a scheme just below the selection. When you are happy click the **“Add”** button in the bottom.





After this a new options for layout should appear in the main keyboard menu like so:



You can then switch keyboards by moving the selected one up or down.

Here is and short list of most used keys that you should get familiar with:

sign	name	czech keyboard	swedish keyboard
/	forward slash	shift + ú	shift + 7
\	backslash	rAlt + Q	alt + shift + 7
	pipe	rAlt + W	alt + 7
*	asterisk	rAlt + -	shift + ‘
\$	dollar sign	rAlt + ů	alt + 4
#	hash	rAlt + x	shift + 3
>	greater than sign	rAlt + .	separate key
<	lesser than sign	rAlt + ,	separate key
~	tilde	rAlt + 1	alt + ``/^ (the key with two dots)