

Using OpenSCAD on Amazon Web Services Elastic Compute Cloud (AWS EC2)

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This document describes how to use OpenSCAD on an Amazon EC2 server. This is not a paid or free endorsement of AWS, EC2 nor any of the other applications I mention. This tutorial was produced using Gimp to screen capture and LYX to assemble the document. No warranties are made. Use these directions at your own risk.

Amazon Web Services (AWS) offers a variety of services for cloud computing. I will show you how to use EC2 Elastic Compute Cloud to run openSCAD. Why is this useful? If you have a fairly complex model in openSCAD you may tax your computer or exceed it's memory resulting in swapping of memory to disk with resultant very slow model rendering. AWS allows you to purchase computing time quite cheaply. There is a free version of AWS that allows you to use one CPU (they term it an ECU Elastic Computing Unit or a vCPU virtual CPU). Once comfortable with the process you can move to a paid, faster CPU with more memory. Typically I design my parts at fairly low resolution (few facets) then increase the resolution and run the model on EC2 to produce an STL file for 3-D printing.

Even if you have a fairly powerful CPU, your desktop or notebook has to keep the GUI running along with any other programs you typically use in addition to OpenSCAD. The Amazon EC2 server is only running the base operating system plus a command line call to OpenSCAD without a GUI front end. After producing your STL file you FTP the file to your local machine and view it using a program to view STL files.

This is sort of the 2014 version of connecting to a 1970 era mainframe, sans the phone, acoustic coupler and 300 baud modem.

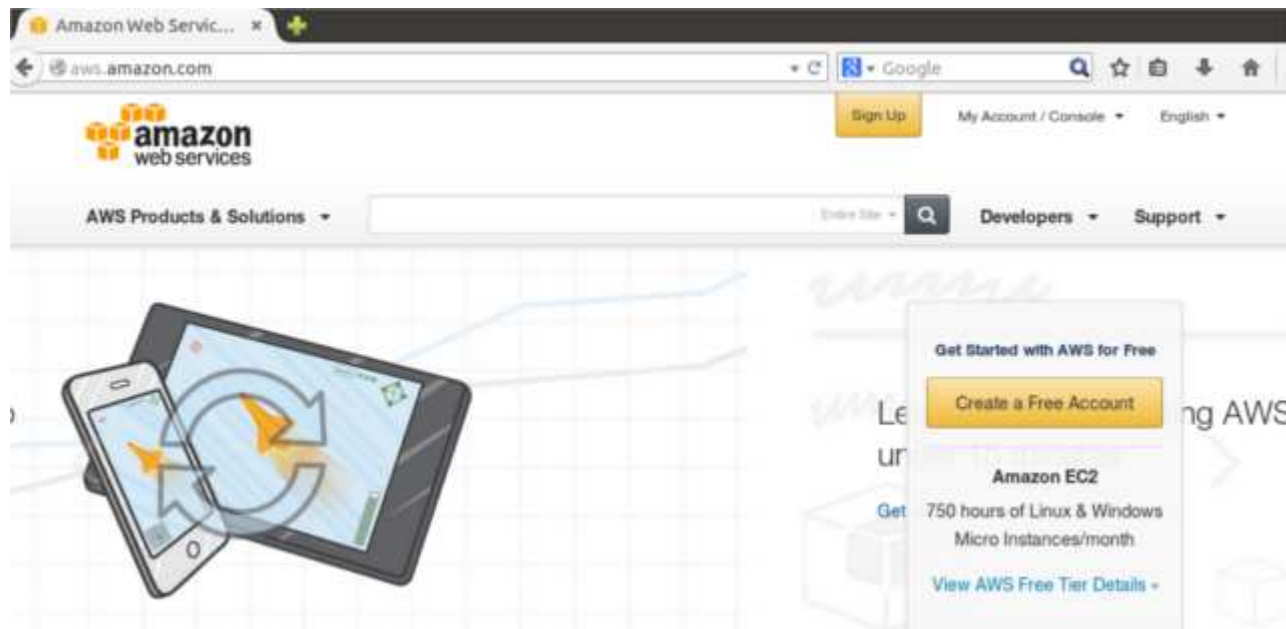
I use Linux on my desktop and notebook and these directions are based on the programs I typically use. For FTP I use FileZilla, the

connection to Amazon is via the Netscape or Chrome web browser. To view STL files on my Linux machine I use Netgen Mesh Generator. To produce the OpenSCAD script I use OpenSCAD with it's integrated text editor , Geany or Gedit. To SSH to the Amazon server set-up, I use either the Amazon Java Terminal application or a local terminal program Byobu Terminal.

Here goes-

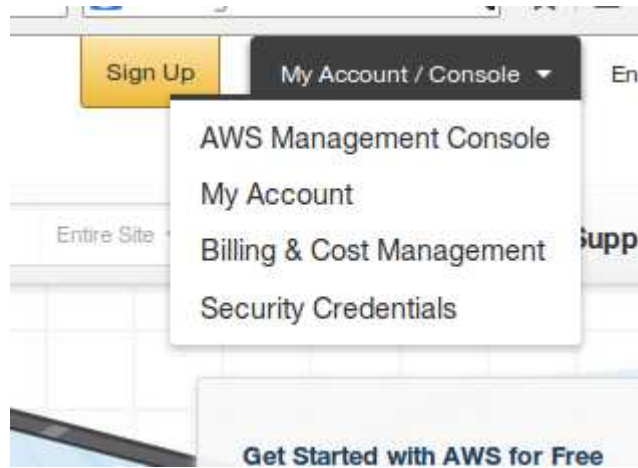
1 Setting up an Amazon EC2 instance

1.1 Open your browser and navigate to Amazon AWS.
<http://aws.amazon.com>

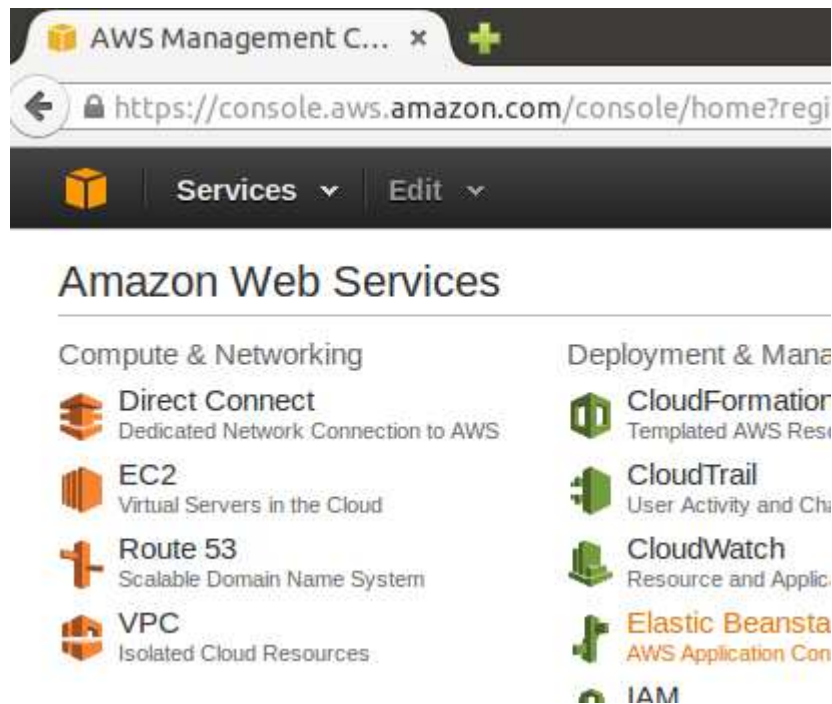


1.2 Sign-up (you will need a credit card and email address).

1.3 Sign-in by clicking on MyAccount/Console > AWS Management Console.



1.4 Navigate to EC2



- 1.5 Launch Instance if this is your first time. If you already have an instance you can go to the Instances EC2 Dashboard window.

The screenshot shows the AWS Management Console interface for the EC2 service in the us-west-2 region. The browser address bar displays the URL: `https://console.aws.amazon.com/ec2/v2/home?region=us-west-2#`. The navigation bar includes the AWS logo, 'Services', and 'Edit' menus. The left-hand navigation pane is expanded to 'EC2 Dashboard', showing sub-sections for Events, Tags, Reports, Limits, INSTANCES (Instances, Spot Requests, Reserved Instances), IMAGES (AMIs, Bundle Tasks), and ELASTIC BLOCK STORE (Volumes, Snapshots). The main content area is titled 'Resources' and states 'You are using the following Amazon EC2 resources'. A table lists the following resources:

0	Running Instances	0	E
1	Volume	0	S
1	Key Pair	0	L
0	Placement Groups	2	S

Below the table is a blue button with a speech bubble icon and the text: 'View [AWS Trusted Advisor](#) to optimize EC2.'. Underneath is a section titled 'Create Instance' with the text: 'To start using Amazon EC2 you will want to launch an instance.' A large blue button labeled 'Launch Instance' is prominently displayed. At the bottom, a note reads: 'Note: Your instances will launch in the US West (Oregon) region.'

1.6 Choose a machine image to run on your server (instance). The following directions apply to an Ubuntu Linux server.


1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance

Step 1: Choose an Amazon Machine Image (AMI)

An AMI is a template that contains the software configuration (operating system, application server, and so on). You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own.

Quick Start

- My AMIs
- AWS Marketplace
- Community AMIs
- Free tier only ⓘ




Amazon Linux
Free tier eligible

Amazon Linux AMI 2014.03.2 (HVM) - ami-

The Amazon Linux AMI is an EBS-backed image. It includes the latest version of Ruby 2, and repository access to multiple versions of Python, Ruby and Tomcat.

Root device type: ebs Virtualization type: hvm



Red Hat

Red Hat Enterprise Linux 7.0 (HVM) - ami-

Red Hat Enterprise Linux version 7.0 (HVM). FRS-

1.7 Choose an instance type. The following directions apply to an Ubuntu Linux server.

- 1. Choose AMI
- 2. Choose Instance Type
- 3. Configure Instance
- 4. Add Storage
- 5. Tag Instance

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types offer varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to run a wide range of applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance types Current generation [Show/Hide Columns](#)

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory)

	Family	Type	vCPUs	Memory (GiB)	Instance
<input checked="" type="checkbox"/>	General purpose	t2.micro Free tier eligible	1	1	EB

1.8 Review and Launch

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to start the launch process.



Improve your instance's security. Your security group, launch-wizard-2, is open to all IP addresses.

Your instance may be accessible from any IP address. We recommend that you update your security group to allow access from only the IP addresses you need.

You can also open additional ports in your security group to facilitate access to the application you are running on your servers. [Edit security groups](#)

▼ AMI Details



Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-e7b8c0d7

Free tier eligible

Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available for [Amazon Linux](#) and [Ubuntu](#) (see [AMI documentation](#) for details).

Root Device Type: ebs Virtualization type: hvm

▼ Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)
t2.micro	Variable	1	1	EBS only

▼ Security Groups

Security group name

launch-wizard-2

Description

launch-wizard-2 created 2014-09-01T16:23:14.813-04:00

Type ⓘ

Protocol ⓘ

Port Range ⓘ

- 1.9 Generate a key-pair to provide secure access to your instance. If you have multiple instances you can use the same key pair. Store the pem file on your secure local machine in a directory you have access to.

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

Create a new key pair

Key pair name

Download Key Pair



You have to download the **private key file** (*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

Cancel

Launch Instances

1.10 Launch your instance

Launch Status



Your instance is now launching

The following instance launch has been initiated: [i-f3e5bdfc](#) [View launch log](#)



Get notified of estimated charges

[Create billing alerts](#) to get an email notification when estimated charges on your AWS bill exceed your free usage tier).

How to connect to your instance

Your instance is launching, and it may take a few minutes until it is in the **running** state, when it will start immediately and continue to accrue until you stop or terminate your instance.

Click **View Instances** to monitor your instance's status. Once your instance is in the **running** state, connect to your instance.

▶ Here are some helpful resources to get you started

1.11 After launching your instance you can View Instances.

Console Home
EC2 Dashboard
Events
Tags
Reports
Limits

INSTANCES
Instances
Spot Requests
Reserved Instances

Launch Instance Connect Actions ▾

Filter: All instances ▾ All instance types ▾ Search

<input type="checkbox"/>	Name	Instance ID	Instance Type	Availability Zone
<input type="checkbox"/>		i-78d18d75	t2.micro	us-west-2
<input type="checkbox"/>		i-f3e5bdfc	t2.micro	us-west-2

- 1.12 Connect to your instance with the Amazon Java Terminal. Set the path to your Private key. Take note of the Public IP and User Name as you will need those to FTP into your instance to upload and download files.

Connect To Your Instance

I would like to connect with A standalone SSH client
 A Java SSH Client directly from my browser (Java required)

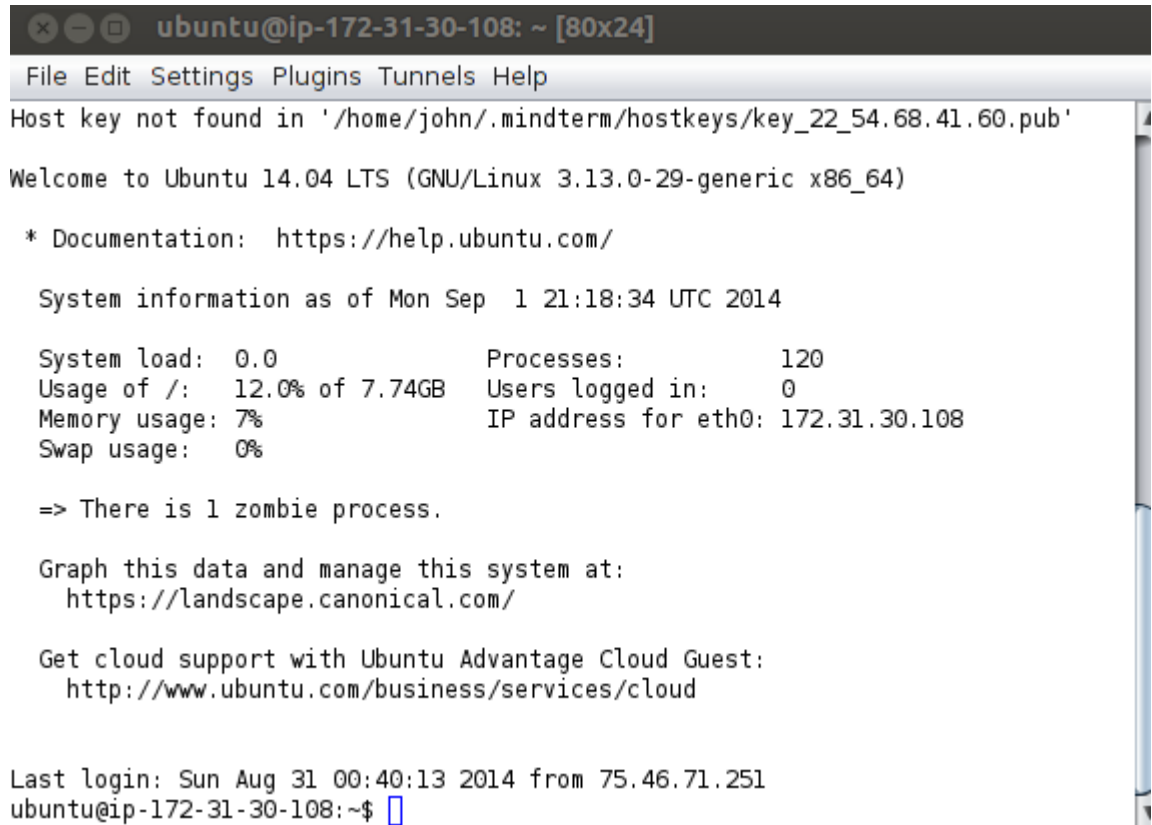
Enter the required information in the fields below to connect to your instance. AWS automatically detects the key pair name, and Public IP for your instance. You need to enter the location and name of the .pem file containing your private key.

Public IP	54.68.41.60
User name	<input type="text" value="ubuntu"/>
Key name	EC2.pem
Private key path	<input type="text" value="eg. C:\KeyPairs\EC2.pem"/>
Save key location	<input checked="" type="checkbox"/> Store in browser cache

[Launch SSH Client](#)

[Close](#)

1.13 Launch the Amazon SSH Client. If this is the first time, you will have to accept a license for the Amazon MindTerm Java Terminal client.



```
ubuntu@ip-172-31-30-108: ~ [80x24]
File Edit Settings Plugins Tunnels Help
Host key not found in '/home/john/.mindterm/hostkeys/key_22_54.68.41.60.pub'
Welcome to Ubuntu 14.04 LTS (GNU/Linux 3.13.0-29-generic x86_64)

* Documentation:  https://help.ubuntu.com/

System information as of Mon Sep  1 21:18:34 UTC 2014

System load:  0.0                Processes:            120
Usage of /:   12.0% of 7.74GB     Users logged in:     0
Memory usage: 7%                IP address for eth0: 172.31.30.108
Swap usage:   0%

=> There is 1 zombie process.

Graph this data and manage this system at:
  https://landscape.canonical.com/

Get cloud support with Ubuntu Advantage Cloud Guest:
  http://www.ubuntu.com/business/services/cloud

Last login: Sun Aug 31 00:40:13 2014 from 75.46.71.251
ubuntu@ip-172-31-30-108:~$
```

2 Load OpenSCAD onto your server instance

- From OpenSCAD.org There is a PPA (private package archive) for more recent versions of OpenSCAD that is maintained by chrysn. To install, run the following commands in the terminal connected to your instance: (Ctrl-V does not work in the terminal. Type the commands)
- `sudo add-apt-repository ppa:chrysn/openscad`
- `sudo apt-get update`
- `sudo apt-get install openscad`
- Hopefully all goes well and you have OpenSCAD installed
- Test by typing `openscad` and hit Enter

```
ubuntu@ip-172-31-30-108:~/home$ openscad
Requested GUI mode but can't open display!
ubuntu@ip-172-31-30-108:~/home$
```

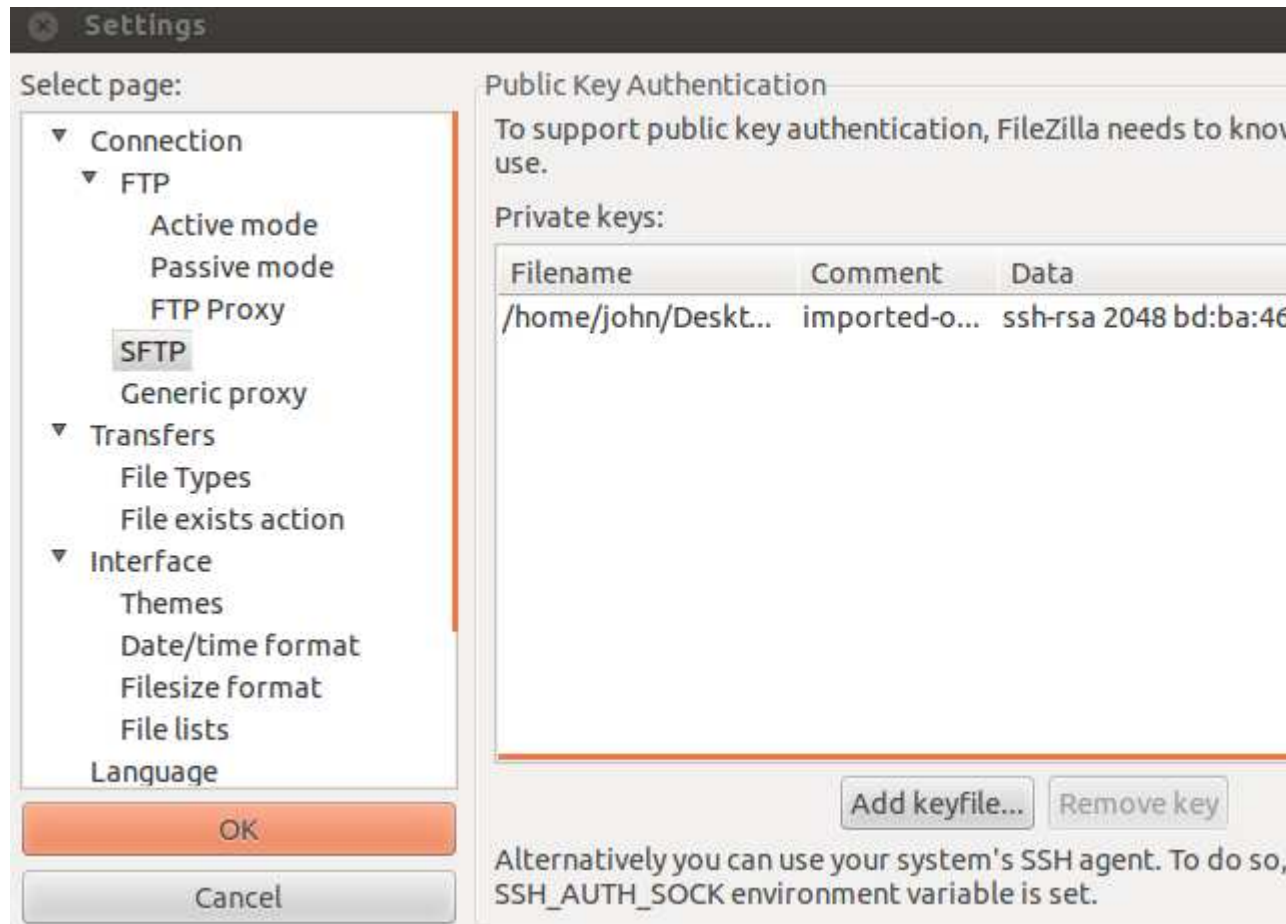
- This response indicates OpenSCAD is present but it won't run because it cannot open a GUI window. Success!

3 Time to upload a .scad file

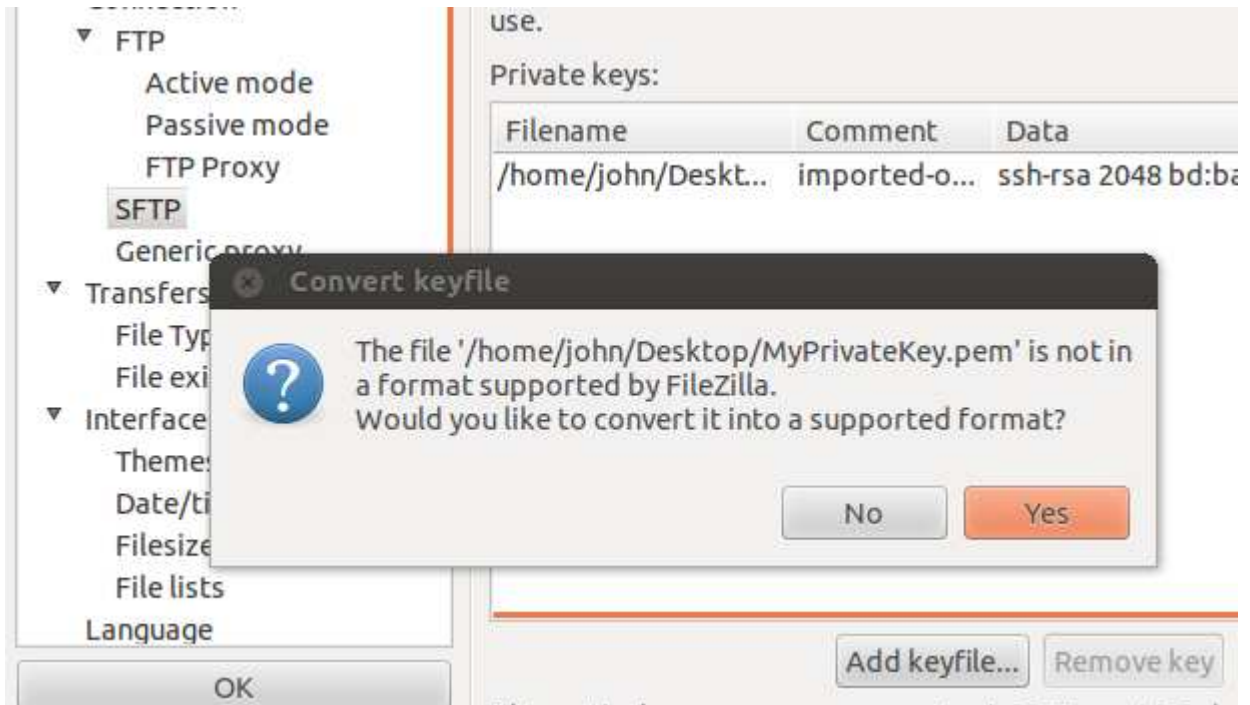
3.1 Download and install FileZilla if you have not done so already



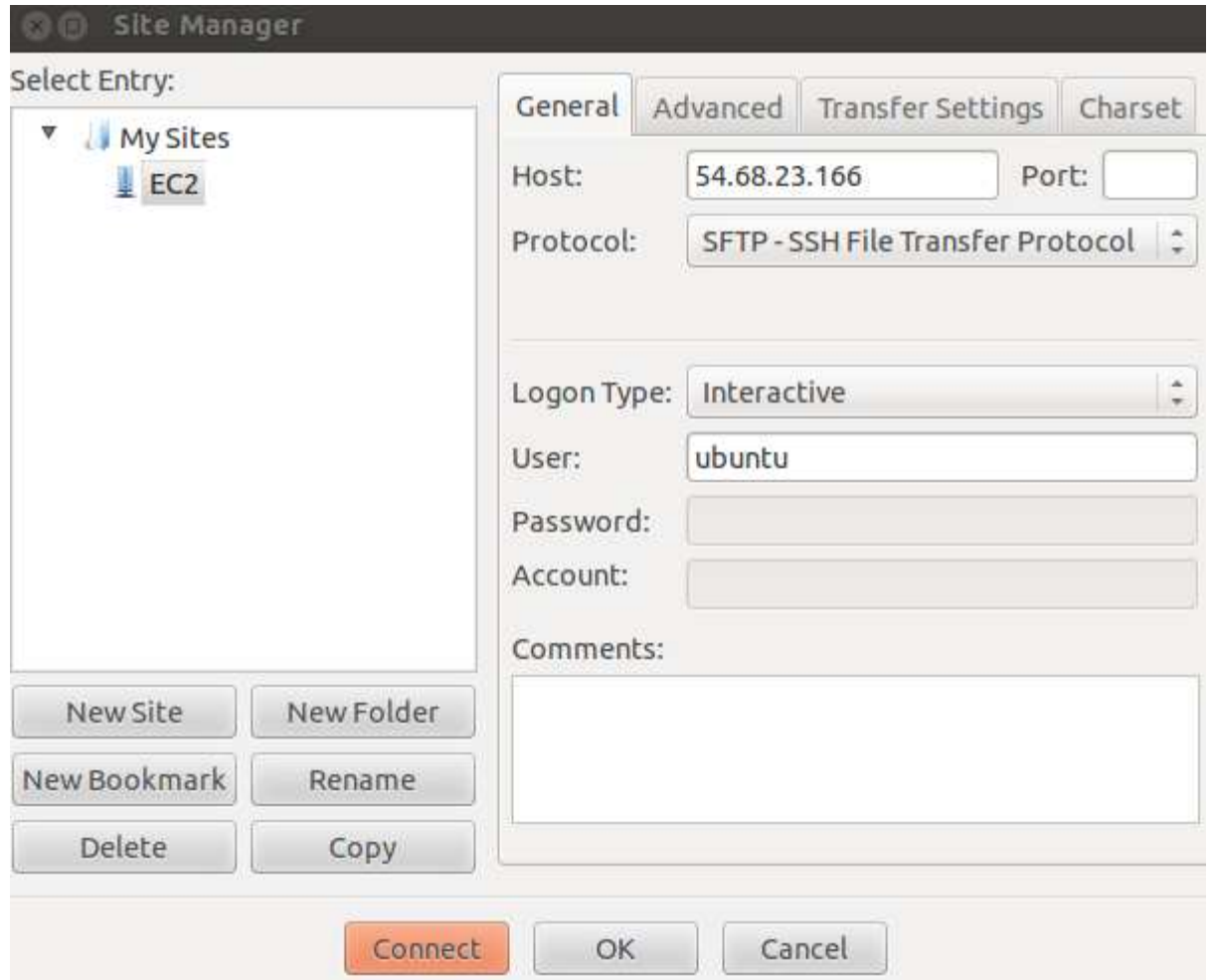
3.2 Open FileZilla Edit > Settings. Select SFTP.



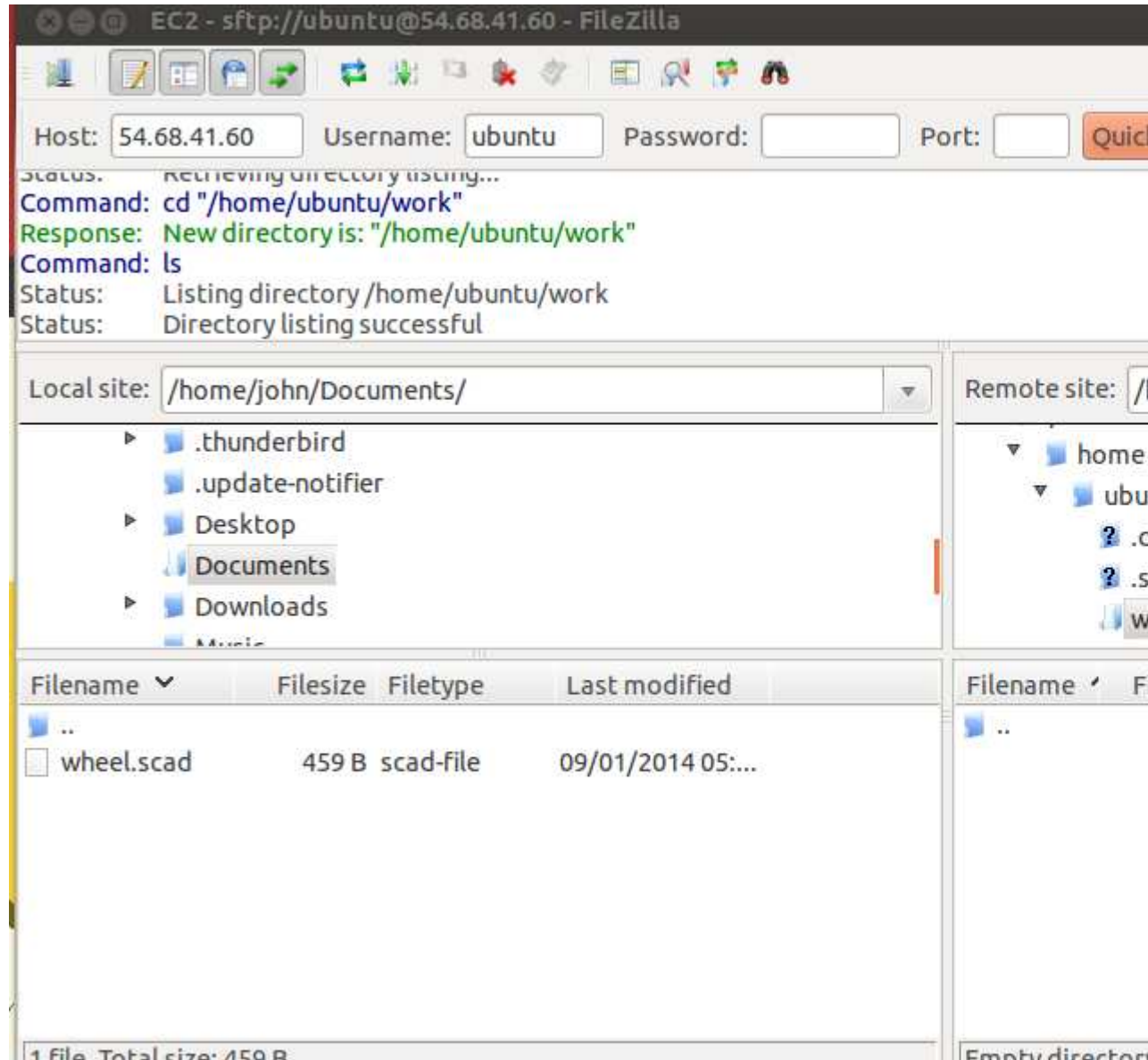
- 3.3 Add your Private Key from the Key Pair you generated during your server instance set-up. Note: Your Private Key is in .pem format but FZ will ask you to convert it to PuTTY .ppk format. Convert the file format to use it in FZ.



- 3.4 Open FileZilla Menu>Site Manager and create a new site to connect to your server (instance). Enter the IP and User Name that you used earlier. Choose Interactive login and FZ will use your Private Key to login. Click Connect in the Site Manager window.



- 3.5 Using the FZ main window navigate to your local directory containing your .scad files and your working directory on your Amazon EC2 instance. Drag (copy) the files you want to process from your local machine to your EC2 instance.



4 Prepare your .scad file.

This is a trivial example as it runs quickly on most CPUs. However, if the holes are made smooth with `$fn=100`, the time required to com-

pute increases dramatically.

```
OpenSCAD - wheel.scad
/* definitions
   wh  height
   wr  well radius
*/

wh = 5;
wr = 30;

// start with slug

module slug(){
  cylinder(r= wr, h=wh, $fn=100);
}

// holes
module holes(){
  difference() {
    slug();
    for (i = [0 : 4] ) {
      rotate([0,0,i*360/5])
      translate([wr/4, 0, 0])
      cylinder(r=wr/10, h=wh, $fn=6);
    }
  }
}

// cutaway

difference(){
  holes();
  rotate([0,0,-90])
  cube(size = [wr*1.5,wr*1.5, wh+6],
  center = false);
}
```

CGAL C
CGAL C
CGAL C
CGAL C
CGAL C
bytes)
CGAL C
bytes)

- 5 Upload your .scad files with FileZilla. You can use FZ to make directories and delete files on your Amazon EC2 instance.
- 6 Run your .scad files on your EC2 instance. Using the Terminal.

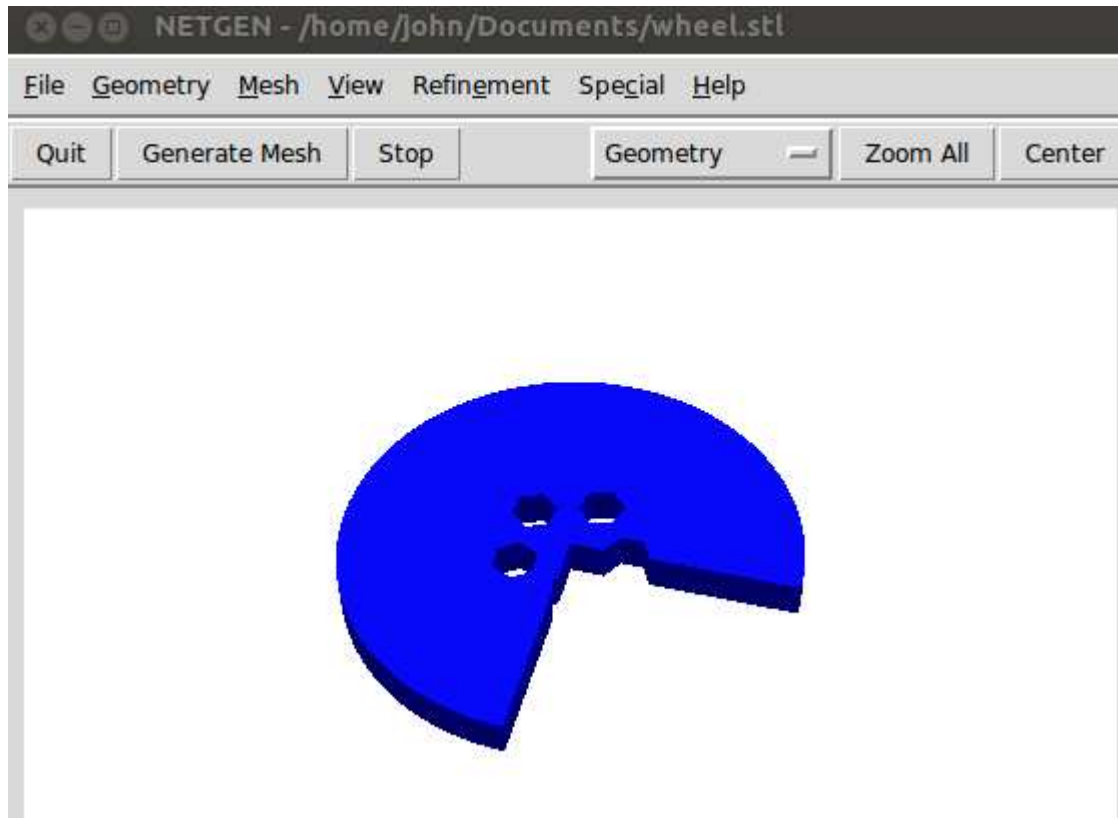
- `openscad -o file.stl file.scad` to run OpenSCAD in Command Line mode on “file.scad” outputting “file.stl” . You have to use the `-o` parameter to run OpenSCAD in Command Line mode. If your file is too processor/memory intensive it may be killed. This indicates that you need to use an instance with more memory and virtual processor power than the one CPU that is given free.

```

ubuntu@ip-172-31-30-108:~/home$ ls
wheel.scad
ubuntu@ip-172-31-30-108:~/home$ openscad -o wheel.stl wheel.scad
CGAL Cache insert: cylinder($fn=100,$fa=12,$fs=2,h=5,r1=30, (259704 bytes)
CGAL Cache insert: cylinder($fn=6,$fa=12,$fs=2,h=5,r1=3,r2= (16056 bytes)
CGAL Cache insert: multmatrix([[1,0,0,7.5],[0,1,0,0],[0,0,1 (16056 bytes)
CGAL Cache hit: multmatrix([[1,0,0,7.5],[0,1,0,0],[0,0,1 (16056 bytes)
CGAL Cache hit: multmatrix([[1,0,0,7.5],[0,1,0,0],[0,0,1 (16056 bytes)
CGAL Cache hit: multmatrix([[1,0,0,7.5],[0,1,0,0],[0,0,1 (16056 bytes)
CGAL Cache hit: multmatrix([[1,0,0,7.5],[0,1,0,0],[0,0,1 (16056 bytes)
CGAL Cache insert: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,0 (16056 bytes)
CGAL Cache insert: multmatrix([[0.309017,-0.951057,0,0],[0. (16056 bytes)
CGAL Cache insert: multmatrix([[ -0.809017,-0.587785,0,0],[0 (16056 bytes)
CGAL Cache insert: multmatrix([[ -0.809017,0.587785,0,0],[ -0 (16056 bytes)
CGAL Cache insert: multmatrix([[0.309017,0.951057,0,0],[ -0. (16056 bytes)
CGAL Cache insert: group(){cylinder($fn=100,$fa=12,$fs=2,h= (259704 bytes)
CGAL Cache insert: group(){multmatrix([[1,0,0,0],[0,1,0,0], (79896 bytes)
CGAL Cache insert: difference(){group(){cylinder($fn=100,$f (337944 bytes)
CGAL Cache insert: cube(size=[45,45,11],center=false); (10872 bytes)
CGAL Cache insert: group(){difference(){group(){cylinder($f (337944 bytes)
CGAL Cache insert: multmatrix([[2.22045e-16,1,0,0],[-1,2.22 (10872 bytes)
CGAL Cache insert: difference(){group(){difference(){group( (267768 bytes)
CGAL Cache insert: group(){difference(){group(){difference( (267768 bytes)
ubuntu@ip-172-31-30-108:~/home$ ls
wheel.scad wheel.stl
ubuntu@ip-172-31-30-108:~/home$ █

```

- 7 Return to FileZilla to download your .stl file to your local machine for viewing.
- 8 Use an STL file viewer to inspect the .stl file. I use NetGenMesh generator.



- 9 Don't forget to Stop your EC2 instance when finished. No sense using up your free hours with non-activity.

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