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

### Step 1: Choose an Amazon Machine Image (AMI)

An AMI is a template that contains the software configuration (operating system, application server, and other software) necessary to run an Amazon EC2 instance. 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**

#### Amazon Linux AMI 2014.03.2 (HVM) - ami-9e8b1303

- **Amazon Linux**
- **Free tier eligible**

The Amazon Linux AMI is an EBS-backed image. It includes the minimum stack for running your own software and is optimized for use with Python, Ruby, and Tomcat.

- Root device type: ebs
- Virtualization type: hvm

#### Red Hat Enterprise Linux 7.0 (HVM) - ami-7a64237d

- **Red Hat**

Red Hat Enterprise Linux version 7.0 (HVM), EBS-backed.

- Root device type: ebs
- Virtualization type: hvm
1.7 Choose an instance type. The following directions apply to an Ubuntu Linux server.

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 you need for your applications. Learn more about instance types and how they can meet your computing needs.

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

Your instance may be accessible from any IP address. We recommend that you update your security group to allow only your instances' private IP addresses only.

You can also open additional ports in your security group to facilitate access to the application's 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 at https://aws.amazon.com/cloud/services/.

Root Device Type: ebs  Virtualization type: hvm

Instance Type

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>ECUs</th>
<th>vCPUs</th>
<th>Memory (GiB)</th>
<th>Instance Storage (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t2.micro</td>
<td>Variable</td>
<td>1</td>
<td>1</td>
<td>EBS only</td>
</tr>
</tbody>
</table>

Security Groups

Security group name: launch-wizard-2

Description

launch-wizard-2 created 2014-09-01T16:23:14.813-04:00
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.
1.10 Launch your instance

Launch Status

![Your instance is now launching](image)
The following instance launch has been initiated: i-f3e5bdfe [View launch log]

![Get notified of estimated charges](image)
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, you can connect to your instance.

- Here are some helpful resources to get you started
1.11 After launching your instance you can View Instances.
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
- [x] 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**: ubuntu
- **Key name**: EC2.pem
- **Private key path**: eg. C:\KeyPairs\EC2.pem
- **Save key location**: [ ] 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.

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
3 Time to upload a .scad file

3.1 Download and install FileZilla if you have not done so already
3.2 Open FileZille 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 $\text{fn}=100$, the time required to com-
/* 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);
}

pute increases dramatically.
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.

```bash
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=3,2= (16056 bytes)
CGAL Cache insert: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache hit: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache hit: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache hit: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache hit: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache hit: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 bytes]
CGAL Cache insert: multmatrix([[1,0,0,0],[0,1,0,0],[0,0,1,16056 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,$fs=2,h= (259704 bytes)
CGAL Cache insert: group(){cylinder($fn=100,$fa=12,$fs=2,h= (79896 bytes)
CGAL Cache insert: difference(){group(){cylinder($fn=100,$fa=12,$fs=2,h= (337944 bytes)
CGAL Cache insert: cube(size=[45,45,45],center=false); (10872 bytes)
CGAL Cache insert: difference(){group(){cylinder($fn=100,$fa=12,$fs=2,h= (337944 bytes)
CGAL Cache insert: multmatrix([[2.22045e-16,1.0,0],[0,1.0,0], (10872 bytes)
CGAL Cache insert: difference(){group(){difference(){group( (267768 bytes
CGAL Cache insert: difference(){group(){difference(){group( (267768 bytes
```

```bash
```
```bash
wheel.scad wheel.stl
```
```bash
```
```bash
```
```bash
```bash
ubuntu@ip-172-31-30-108:~/home$ ls
wheel.scad wheel.stl
```
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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