

# Using AWS

Benjamin S. Skrainka  
**Cary**

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# Objectives

- Describe core AWS services & concepts
- Configure your laptop to use AWS
- Use SSH key to access EC2 instances
- Launch & access EC2
- Access S3

# Agenda

- ➊ Introduction to AWS
- ➋ Install and configure AWS CLI
- ➌ Configure & use SSH
- ➍ Access EC2
- ➎ Access S3
- ➏ Advanced topics

AWS documentation is weak and poorly organized, so:

⇒ Google it...

# Introduction to AWS

# Amazon Web Services (AWS)

AWS provides on-demand use of computing resources in the cloud:

- No need to build data centers
- Easy to create a new business
- Only pay for what you use
- Handle spikes in computational demand
- Secure, reliable, flexible, scalable, cost-effective

AWS skills are much in demand

AWS's core services:

- Elastic compute cloud (EC2): computers for diverse problems
- Elastic block store (EBS): virtual hard disks for use with EC2
- Simple storage solution (S3): long-term bulk storage
- Dynamo DB: a variety of databases
- And much, much more

# Elastic compute cloud (EC2)

Spin up EC2 instances for on-demand computing power:

- Instance: a type of hardware you can rent, e.g., 'm3.xlarge' or 't2.micro'
- AMI: *Amazon Machine Image*, an OS you can run on an instance
- Region: a geographic region such as Oregon aka 'us-west-2'
- Availability Zone (AZ): a specify subset of a region, often a data center, such as 'us-west-2a'



# Elastic block store (EBS)

EBS provides disk-drive style storage:

- Create a virtual hard disk
- Then mount virtual hard disk on EC2 instances
- SSD or magnetic
- Can store data even when you aren't running any EC2 instances
- Built-in redundancy
- Lower latency than S3 but more expensive

# Simple storage solution (S3)

S3 provides cheap, bulk storage:

- Create a *bucket* which serves as a container for files and directories
- Specify permissions using an *access control list* (ACL)
- Access via URL or AWS CLI or suitable API
- Higher latency than EBS but less expensive

DynamoDB provides databases in the cloud:

- Support for most common flavors of SQL (Oracle, MySQL, etc.)
- Once setup, works like normal SQL database
- AWS supports other database types as well

## Install & configure CLI

Use the AWS command line interface (CLI):

- To debug your configuration
- To manage AWS instances in EC2
- To access S3

# Install AWS CLI (OS/X or Linux)

On Linux, run:

```
$ curl
    "https://s3.amazonaws.com/aws-cli/awscli-bundle.zip" \
    -o "awscli-bundle.zip"
$ unzip awscli-bundle.zip
$ sudo ./awscli-bundle/install -i /usr/local/aws \
    -b /usr/local/bin/aws
```

See Amazon's [doc](#)

# Install AWS CLI (OS/X)

Can also install via brew (or pip):

```
$ brew install awscli
```

But, may not be the latest version...

# Obtain your AWS credentials

Find your **AWS credentials**:

- 1 Login to AWS
- 2 Click *Your Account* in the upper right menu bar
- 3 Select *Security Credentials*
- 4 Select *Users*
- 5 Then select your username and click *User Actions > Manage Access Keys*
- 6 Create your credentials

Make sure you choose Oregon (us-west-2) as your *region*



# AWS credentials

The screenshot shows the AWS IAM Management Console. The left sidebar contains navigation links: Dashboard, Details, Groups, Users, Roles, Policies, Identity Providers, Account Settings, Credential Report, and Encryption Keys. The main content area displays a table of users with columns: User Name, Groups, Password, Password Last Used, Access Keys, and Creation Time. A modal dialog titled 'Manage Access Keys' is open, showing details for the user 'alessandro'. The dialog includes a table of access keys and a note about key rotation.

**Manage Access Keys**

Use access keys to make secure REST or Query protocol requests to any AWS service API.

Access Key ID	Created	Last Used	Last Used Service	Last Used Region	Status
[Redacted]	2015-08-24 17:55 PDT	N/A	N/A	N/A	Active ( <a href="#">Make Inactive</a>   <a href="#">Delete</a> )
[Redacted]	2015-08-25 09:58 PDT	2015-08-25 11:32 PDT	s3	N/A	Active ( <a href="#">Make Inactive</a>   <a href="#">Delete</a> )

Note: For your protection, you should never share your secret keys with anyone. In addition, industry best practice recommends frequent key rotation.

[Learn more about Access Keys](#)

[Cancel](#) [Create Access Key](#)

Figure 1: AWS credentials

# Configure AWS CLI (1/3)

Easiest to run `aws configure`:

- Creates default profile in `~/.aws/config`
- Stores credentials in `~/.aws/credentials`
- Can create multiple profiles:  

```
$ aws configure --profile fancy_profile
```
- Can also set credential on CLI or via environment variables

## Configure AWS CLI (2/3)

Create AWS configuration info in ~/.aws:

```
$ aws configure
```

```
AWS Access Key ID [None]: AKIAIOSFODNN7EXAMPLE
```

```
AWS Secret Access Key [None]: wJalrXUtnFEMI/K7MDENG/bPxRfiCYEX
```

```
Default region name [None]: us-west-2
```

```
Default output format [None]: json
```

See Amazon's [doc](#) for details

## Configure AWS CLI (3/3)

Some tools get AWS credentials via environment variables. Set the following in `~/.bash_profile` or equivalent:

```
export AWS_ACCESS_KEY_ID='your access key'
export AWS_SECRET_ACCESS_KEY='your secret key'
```

- Must set `AWS_*` environment variables to use some big data tools!
- Problematic if using AWS in multiple data centers. . .

# Verify configuration

Check S3:

```
$ aws s3 ls
2015-08-25 10:42:43 dsci
2015-08-25 11:30:33 seattle-dsi
$ aws s3 ls s3://seattle-dsi
                PRE cohort1/
                PRE skrainka/
```

Check EC2:

```
$ aws ec2 describe-instances --output table
$ aws ec2 describe-instances --output json
```

# Help with AWS CLI

See the built-in help for more details:

```
$ aws help
```

```
$ aws ec2 help
```

... or Google

## Configure and use SSH

# Introduction

To use AWS:

- Setup *Key Pairs* to access EC2
- Configure SSH on your laptop
- Can use SSH to access any remote machine running an SSH server



The *secure shell* protocol allows you to:

- Login to remote machines, such as EC2 using `ssh`
- Transfer files between remote machines using `scp` and `sftp`
- Execute commands on remote machines using `ssh`

Do not use telnet, rlogin, or FTP, which are older, insecure protocols!

# Public key encryption

SSH uses *public-key encryption* to protect access:

- Generate a *public & private* key
- Known as a *key pair*
- Need both public and private key to decrypt
- Keep private key safe
- Create a key pair for each resource you want to access (AWS, GitHub, etc.)  $\Rightarrow$  can revoke individual keys in case of a security breach

See AWS [doc](#) for details

# Setup Key Pairs

Create and configure key pair to access EC2:

- Create and import key pair as described in [AWS documentation](#)
- Set permission on private key to 400:

```
$ chmod 600 ~/.ssh/bss-aws-master.pem
```

```
$ chmod 644 ~/.ssh/bss-aws-master.pub
```

- Can also generate key pair with `ssh-keygen`

# Configuring SSH

Modify SSH config to:

- Create alias for long-running instance
- Forward X11 or security information
- Specify which key to use
- And, much much more...
- `man ssh_config` for details

## Example ~/.ssh/config

```
Host github.com
  HostName github.com
  User git
  ForwardAgent yes
  IdentityFile /Users/bss/.ssh/git-hub-id_rsa
```

## Example ~/.ssh/config

If you master will run for a long time, setup an alias:

Host master

```
HostName ec2-54-186-136-57.us-west-2.compute.amazonaws.com
```

```
User ubuntu
```

```
ForwardAgent yes
```

```
ForwardX11Trusted yes
```

```
TCPKeepAlive yes
```

```
IdentityFile /Users/bss/.ssh/aws-master.pem
```

Now, `ssh master` will connect to your EC2 instance

# Accessing an EC2 instance with ssh

Connect to your machine via ssh:

- 1 Launch an EC2 instance from console
- 2 Use ssh from command line to connect to the instances *public DNS* (Shown in EC2 Dashboard):

```
$ ssh -X -i ~/.ssh/aws-master.pem \  
ubuntu@ec2-54-186-136-57.us-west-2.compute.amazonaws.com
```

or

```
$ ssh -X -i ~/.ssh/aws-master.pem \  
ec2user@ec2-54-186-136-57.us-west-2.compute.amazonaws.com
```

## Example: ssh to EC2

```
$ ssh -i ~/.ssh/bss-aws-master.pem ubuntu@ec2-54-186-136-57.us
```

The authenticity of host 'ec2-54-186-136-57.us-west-2.compute

RSA key fingerprint is b9:05:ff:da:34:7d:82:20:15:d1:c3:80:10:

```
Are you sure you want to continue connecting (yes/no)? yes
```

Warning: Permanently added 'ec2-54-186-136-57.us-west-2.comput

```
Welcome to Ubuntu 14.04.2 LTS (GNU/Linux 3.13.0-48-generic x86_64)
```

\* Documentation: <https://help.ubuntu.com/>

System information as of Tue Aug 25 21:58:16 UTC 2015

System load: 0.0                      Memory usage: 5%    Processes:

Usage of /: 9.8% of 7.74GB Swap usage: 0% Users logged in: 0

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# Transferring files with scp

To copy files between machines, use `scp`:

- Works just like regular copy
- Good for simple operations
- ...if you specify remote user and machine (IP, DNS) correctly
- Reference remote location as *user@host:path*

```
$ scp -i ~/.ssh/bss-aws-master.pem ./toy_data.txt \  
    ubuntu@54.186.136.57:/home/ubuntu/data  
toy_data.txt                100%  136      0.1KB/s   00:00
```

# Transferring files with sftp

To copy files interactively, use sftp:

- Interactive shell for transferring files
- Use to transfer many files
- Use when you don't know the location of a file

```
$ sftp -i ~/.ssh/bss-aws-master.pem ubuntu@54.186.136.57  
Connected to 54.186.136.57.  
sftp> help
```

# Managing a session with `tmux`

Use `tmux` to persist jobs across multiple sessions:

- On logout, all child processes terminate
- Use `tmux` to safely disconnect from a session
- Reconnect on next login
- Install `tmux` via `brew` or Linux package manager
- See `tmux` exercise

# EC2

# Launching an EC2 instance

To launch an EC2 instance, follow this [tutorial](#)  
... or the official [tutorial](#)

A few tips to make EC2 easier to deal with:

- Always create instances with tags so that you can find them easily
- Choose the appropriate hardware type for your problem
- If in doubt, use Ubuntu because it is a friendly flavor of Linux
- Use `tmux` when you login in case you need to disconnect or your connection dies
- Be paranoid: sometimes Amazon will reboot or reclaim your instances
- Put data you need to persist in EBS or a database
- Never put AWS keys in GitHub because someone will steal them

S3

To master the basics, see this [tutorial](#) or `lecture_notes.ipynb` in the repo

- Can find URL to access a file from S3 console
- Set properties (access) via S3 console
- Make sure names conform to S3 conventions:
  - ▶ lowercase bucket names of at least four characters
  - ▶ no leading or terminal ‘



# Where to put your files

For Seattle DSI students:

- Use the bucket `seattle-dsi`
- Create a directory with your surname under the `cohort1` sub-directory
- Put your lab files under `seattle-dsi/cohort1/your_surname`

# Boto config

To access S3 via Python, use the boto package

- Should be installed if you followed setup instructions
- Make sure boto is up to date:

```
$ conda update boto
```

- Uses credentials in `~/.aws/credentials` which you setup earlier
- Can also read directly from Pandas if you specify S3 URL

## Advanced issues

# Advanced: accessing ipython notebook

- Use an ssh tunnel to run ipython notebook on a remote instance

- ▶ On remote host:

```
$ ipython notebook --no-browser --port=8889
```

- ▶ On local machine:

```
$ ssh -N -f -L localhost:8888:localhost:8889 \  
    remote_user@remote_host -i ~/.ssh/aws_key.pem
```

- ▶ Access notebook via browser at URL localhost:8888

- Run a notebook server:

- ▶ [Official documentation](#)
- ▶ Blog on [ipython notebook server](#)