



# TCSS 562: SOFTWARE ENGINEERING FOR CLOUD COMPUTING

## AWS Demo


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## OBJECTIVES

- Term project questions
- Tutorials #1: Submit to PDF Canvas
  - Teams up to 2
- AWS Demo
- Cloud Enabling Technology (Ch. 5 Erl book)
- Online lectures to be posted, week of 4/16

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## AWS DEMO



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## GIT HUB EDUCATION PACK



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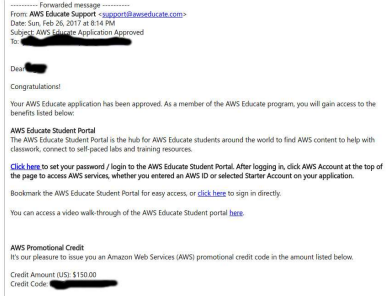
## AWS EDUCATE

- All TCSS 562 students should register using new link
- Each student that sign-up grows our collective pool of shared credits...
- Link in CANVAS announcement:
- <https://www.awseducate.com/Registration?apptype=student&courseview=true#INFO-Student>
- On the second screen, please enter your existing AWS account ID...
- DO NOT Select the option for a starter account.
- For TCSS 562 assignments, can select whether to use your personal AWS account, or the IAM account for various activities throughout the quarter.

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## AWS CREDITS

- Up to \$150, good for ~ 2 years
- Coupon code should arrive in email



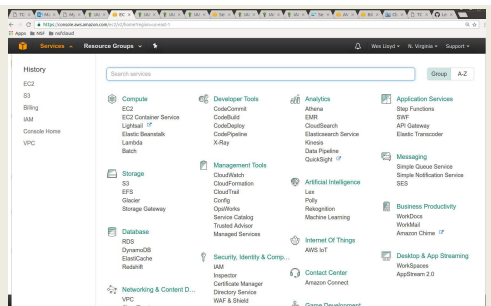
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## CLOUD 101 WORKSHOP

- Course outline:
  - eScience center @ UW Seattle
  - 1-day cloud workshop
  - AWS, Azure, Google Cloud
  - Deploying a Python DJANGO web application
  - Tutorials available
- [https://cloudmaven.github.io/documentation/rc\\_cloud101\\_immersion.html](https://cloudmaven.github.io/documentation/rc_cloud101_immersion.html)

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## AWS MANAGEMENT CONSOLE



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## AWS EC2

- **Elastic Compute Cloud**
- Instance types
  - On demand instance – full price
  - Reserved instance – contract based
  - Spot instance – auction based, terminates with 2 minute warning
  - Dedicated/reserved host – reserved HW
  - Reserved host
  - Instance families: General, compute-optimized, memory-optimized, GPU, etc.
- Storage types
  - Instance storage - ephemeral storage
  - Elastic block store
  - Elastic file system

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## INSTANCE STORAGE

- Also called ephemeral storage
- Persisted using images saved to S3 (simple storage service)
  - ~2.3¢ per GB/month on S3
  - 5GB of free tier storage space on S3
- Requires “burning” an image
- Multi-step process:
  - Create image files
  - Upload chunks to S3
  - Register image
- Launching a VM
  - Requires downloading image components from S3, reassembling them... is potentially slow
- VMs with instance store backed root volumes not pause-able
- Historically root volume limited to 10-GB max – **faster imaging...**

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## ELASTIC BLOCK STORE

- EBS cost model is different than instance storage (uses S3)
  - ~10¢ per GB/month
  - 30GB of free tier storage space
- EBS provides “live” mountable volumes
  - Listed under volumes
  - **Data volumes:** can be mounted/unmounted to any VM, dynamically at any time
  - **Root volumes:** hosts OS files and acts as a boot device for VM
  - In Linux drives are linked to a mount point “directory”
- Snapshots back up EBS volume data to S3
  - Enables replication (required for horizontal scaling)
  - EBS volumes not actively used should be snapshotted, and deleted to save EBS costs...

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## EBS VOLUME TYPES - 2

- Metric: I/O Operations per Second (IOPS)
- General Purpose 2 (GP2)
  - 3 IOPS per GB, Max 10,000 IOPS, 160MB/sec per volume
- Provisioned IOPS (IO1)
  - 32,000 IOPS, and 500 MB/sec throughput per volume
- Throughput Optimized HDD (ST1)
  - Up to 500 MB/sec throughput
  - 4.5 ¢ per GB/month
- Cold HDD (SC1)
  - Up to 250 MB/sec throughput
  - 2.5 ¢ per GB/month
- Magnetic
  - Up to 800 MB/sec throughput
  - 5 ¢ per GB/month

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### ELASTIC FILE SYSTEM

- Network file system (NFSv4 protocol) for EC2 instances
- Hosted by EC2 instances
- ~ 30 ¢ per GB/month
- Enables mounting (sharing) the same disk “volume” for R/W access across multiple instances at the same time
- Different performance behavior and limitations

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### AMAZON MACHINE IMAGES

- AMIs
- Unique for the operating system (root device image)
- Two types
  - Instance store
  - Elastic block store (EBS)
- Deleting requires multiple steps
  - Deregister AMI
  - Delete associated data - (files in S3)
- Forgetting both steps leads to costly “orphaned” data
  - No way to instantiate a VM from deregistered AMIs
  - Data still in S3 resulting in charges

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### EC2 VIRTUALIZATION - PARAVIRTUAL

- **1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> generation → XEN-based**
- **5<sup>th</sup> generation Instances → KVM (full virtualization)**
- XEN - two virtualization modes
- XEN Paravirtualization “paravirtual”
  - 2008-2012: required because of poor performance of HVM mode
  - I/O performed in kernel mode for better performance
  - Requires special OS paravirtual kernel
  - Notice use of common **AKI** files on AWS – **Amazon kernel Image(s)**

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### EC2 VIRTUALIZATION - HVM

- XEN HVM mode
  - Full virtualization – no special OS kernel required
  - Computer entirely simulated
  - MS Windows runs in “hvm” mode
  - Allows work around: 10GB instance store root volume limit
  - Kernel is on the root volume
  - No AKIs (kernel images)
  - Commonly used today (**EBS-backed instances**)

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### INSTANCE ACTIONS

- Stop
  - Costs of “pausing” an instance
- Terminate
- Reboot
- Image management
- Creating an image
  - EBS (snapshot)
- Bundle image
  - Instance-store

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### EC2 INSTANCE: NETWORK ACCESS

- Public IP address
- Elastic IPs
  - Costs: in-use FREE, not in-use ~12 ¢/day
  - Not in-use (e.g. “paused” EBS-backed instances)
- Security groups
  - E.g. firewall
- Identity access management (IAM)
  - AWS accounts, groups
- VPC / Subnet / Internet Gateway / Router
- NAT-Gateway

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## SIMPLE STORAGE SERVICE (S3)

- Key-value blob storage
- What is the difference vs. key-value stores (NoSQL DB)?
- Can mount an S3 bucket as a volume in Linux
  - Supports common file-system operations
- Eventual consistency

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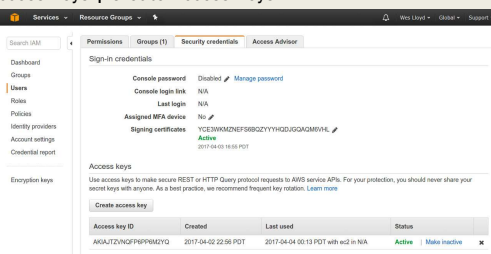
## AWS CLI

- Launch Ubuntu 16.04 VM
  - Instances | Launch Instance
- Install the general AWS CLI
  - `sudo apt install awscli`
- Create config file  
[default]  
`aws_access_key_id = <access key id>`  
`aws_secret_access_key = <secret access key>`  
`region = us-east-1`

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## AWS CLI - 2

- **Creating access keys:** IAM | Users | Security Credentials | Access Keys | Create Access Keys




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## AWS CLI - 3

- Export the config file
  - Add to `/home/ubuntu/.bashrc`
- `export AWS_CONFIG_FILE=$HOME/.aws/config`
- Try some commands:
  - `aws help`
  - `aws command help`
  - `aws ec2 help`
  - `aws ec2 describes-instances --output text`
  - `aws ec2 describe-instances --output json`
  - `aws s3 ls`
  - `aws s3 ls vmscaleruw`

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# QUESTIONS



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