

# Lecture 11: Clouds

## Applied Cloud Computing

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How was research?

# Clouds

- We run on top of Openstack
- Openstack means we manage everything
- But there are others...

# The Giants



Google Cloud Platform



Microsoft  
Azure

# The Giants



Google Cloud Platform

**amazon**  
**web services**



# The Giants



Google Cloud Platform



Microsoft  
Azure

# Amazon Web Services (AWS)



- The largest by far of the public clouds
  - You use it every day and don't even know it
  - Netflix, Reddit, Spotify, and millions others
- When it goes down, the half of the internet goes down

# AWS Offerings



## Compute

EC2  
EC2 Container Service  
Lightsail [↗](#)  
Elastic Beanstalk  
Lambda  
Batch



## Storage

S3  
EFS  
Glacier  
Storage Gateway



## Database

RDS  
DynamoDB  
ElastiCache  
Redshift



## Networking & Content Delivery

VPC  
CloudFront  
Direct Connect  
Route 53



## Migration

Application Discovery Service  
DMS  
Server Migration  
Snowball



## Developer Tools

CodeCommit  
CodeBuild  
CodeDeploy  
CodePipeline  
X-Ray



## Management Tools

CloudWatch  
CloudFormation  
CloudTrail  
Config  
OpsWorks  
Service Catalog  
Trusted Advisor  
Managed Services



## Security, Identity & Compliance

IAM  
Inspector  
Certificate Manager  
Directory Service  
WAF & Shield  
Compliance Reports



## Analytics

Athena  
EMR  
CloudSearch  
Elasticsearch Service  
Kinesis  
Data Pipeline  
QuickSight [↗](#)



## Artificial Intelligence

Lex  
Polly  
Rekognition  
Machine Learning



## Internet Of Things

AWS IoT



## Contact Center

Amazon Connect



## Game Development

Amazon GameLift



## Mobile Services

Mobile Hub  
Cognito  
Device Farm  
Mobile Analytics  
Pinpoint



## Application Services

Step Functions  
SWF  
API Gateway  
Elastic Transcoder



## Messaging

Simple Queue Service  
Simple Notification Service  
SES



## Business Productivity

WorkDocs  
WorkMail  
Amazon Chime [↗](#)



## Desktop & App Streaming

WorkSpaces  
AppStream 2.0



# Azure Services

## Platform Services

### Security & Management

- Portal
- Active Directory
- Multi-Factor Authentication
- Automation
- Key Vault
- Store / Marketplace
- VM Image Gallery & VM Depot

### Compute

- Cloud Services
- Service Fabric
- Batch
- Remote App

### Web and Mobile

- Web Apps
- API Apps
- API Management
- Mobile Apps
- Logic Apps
- Notification Hubs

### Developer Services

- Visual Studio
- Azure SDK
- Team Project
- Application Insights

### Hybrid Operations

- Azure AD Connect Health
- AD Privileged Identity Management
- Backup
- Operational Insights
- Import/Export
- Site Recovery
- StorageSimple

### Integration

- Storage Queues
- Biztalk Services
- Hybrid Connections
- Service Bus

### Analytics & IoT

- HDInsight
- Machine Learning
- Data Factory
- Event Hubs
- Stream Analytics
- Mobile Engagement

### Data

- SQL Database
- SQL Data Warehouse
- Redis Cache
- Search
- DocumentDB
- Tables

### Media & CDN

- Media Services
- Content Delivery Network (CDN)

## Infrastructure Services

### Compute

- Virtual Machines
- Containers

### Storage







- BLOB Storage
- Azure Files
- Premium Storage

### Networking






- Virtual Network
- Load Balancer
- DNS
- Express Route
- Traffic Manager
- VPN Gateway
- Application Gateway

# Google Cloud Platform









## Ingest

-  App Engine
-  Compute Engine
-  Container Engine
-  Cloud Pub/Sub
-  Stackdriver Logging
-  Cloud Transfer Service




## Store

-  Cloud Storage
-  Cloud SQL
-  Cloud Datastore
-  Cloud Bigtable
-  BigQuery

## Process & Analyze

-  Cloud Dataflow
-  Cloud Dataproc
-  BigQuery
-  Cloud ML
-  Cloud Vision API
-  Cloud Speech API
-  Translate API
-  Cloud Natural Lang API

## Explore & Visualize

-  Cloud Datalab
-  Google Data Studio
-  Google Sheets

# Feature Parity

- All clouds try to compete on features so they all end up having extremely similar feature sets

# Virtual Machines

# AWS Elastic Compute Cloud (EC2)

- The basic one which all of these clouds provide are Virtual Machines
- AWS has everything from the tiny to gigantic monsters
  - T2.Nano: 1 VCPU 512 MB Ram
  - X1.32xlarge: 128 VCPU 2000 GB Ram (One of these is more powerful than our cluster)
- Everything is billed by the hour
- They have GPUS!
  - Can do deep learning
- Most are fixed price per hour but there is a price auction for unused machines
  - Lets you do stuff super cheap as long as your program can handle getting a shutdown notice within 30 seconds

# Azure Virtual Machines

- Similar to AWS
- GPUs
- Not as many CPUs (Max is 32 currently)
- Not as much ram (Max 800 GB currently)
- But you probably will not hit these limits

# Google Compute Engine

- Provides VMs
- Largest server is 64 VCPU, 416 GB Ram
- Provides custom sized machines
- Cost is per minute!!

# Storage

- AWS Simple Storage Service (AWS S3)
  - Massive storage, a ton of the internet stores all their content here.
    - Imgur
- Google Cloud Storage
- Azure Storage



# Hosted Data Processing

- Hosted Hadoop, Spark, HBase, Presto, Hive clusters
  - Does all the management for you
  - Is extremely reliable (more than our current cluster sadly)
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- Amazon Elastic Map Reduce
  - Microsoft HDInsight
  - Google Dataproc

# Databases

- Let the clouds manage your database hosting
  - Does create tables and stuff for you, just the stuff below it
- AWS
  - DyanamoDB
  - Relational Database Server (RDS)
- GCP
  - BigTable
  - BigQuery
  - CloudSQL
  - Spanner
- Azure
  - MSSQL
  - DocumentDB

# Unique Features

- GCP
  - CloudSpanner
    - A planet distributed database
    - CP System
    - But not really...
    - They changed the rules
  - Tensor Processing Unit
    - Do deeplearning in hardware
- AWS
  - Absurdly large feature set
  - FPGAs

# Technical Reports

- Next week your rough draft is due
- Should be 4-6 pages
- You should use our template
- Your rough draft is not an outline, it's a paper. We will grade it.