

Presentation Online

- ▶ <https://github.com/medale/presentations>
- ▶ Slides, notes and code sample with Maven

Intro

- ▶ Markus - first used AWS for Data Science MOOC in 2013 (EMR)
- ▶ Several AWS classes later...

Amazon Web Services: AWS

- ▶ Started in 2006
 - ▶ Elastic Compute Cloud (EC2)
 - ▶ Simple Storage Service (S3)
 - ▶ (Amazon EC2 history Clark 2012)
- ▶ By 2010: Amazon.com retail web services mostly moved to AWS
- ▶ 2015: Over a Million Active Customers in 190 Countries
 - ▶ e.g. Netflix, Dropbox, Airbnb, Supercell (Clash of Clans, Hay Day, Boom Beach)

Amazon Web Services (AWS) In the News

Wired Magazine July 2015

Amazon has figured out how to make cloud pay

*\$391 million profit based on \$1.82 billion in revenue.
That's a 407 percent increase in profit from the year
before, and an 81 percent bump in revenue.*

Gartner: Infrastructure As A Service Magic Quadrant

- ▶ X-axis: Completeness of vision
- ▶ Y-axis: Ability to execute
- ▶ Four quadrants: Niche players, visionaries, challengers, leaders
- ▶ Other providers: Rackspace, Google, Microsoft - trying to catch up

AWS Regions and Edge Points of Presence

- ▶ 10 public, 2 US government regions
 - ▶ AWS GovCloud
- ▶ Each region: 3 or more Availability Zones (~ each AZ is 1 or more independent data centers)
 - ▶ AZs connected with private fiber in a 50m radius < 1ms latency
- ▶ Points of Presence - edge nodes for content delivery network (CloudFront - cache)
- ▶ How much overall? "Every day, AWS installs enough server infrastructure to host the entire Amazon e-tailing business from back in 2004" (700 million dollar revenue - Rare Peek into Massive Scale of AWS Morgan 2014)

Multiplayer Mobile Game Application

- ▶ Start-up: Mobile device, backend server and database
- ▶ Show to investors, Minimum Viable Product

Scaling Up - Getting Beefy

- ▶ Scaling up/Scale vertically - bigger equipment (sell old or use for testing)
- ▶ Must provision for peak demand? - must scale horizontally

Scaling Out/Horizontal, Content Delivery Network & Analytics

- ▶ Scale horizontal, load balancer
- ▶ Backend to NoSQL - better scaling and no fixed schema (evolutionary architecture)
- ▶ User experience - forward deploy with CDN
- ▶ Batch and realtime analytics, datawarehouse for business analysts

Redundant Environments

- ▶ Development
- ▶ Testing
- ▶ Production
 - ▶ DevOps - Blue/Green Deployments?
 - ▶ Disaster recovery (somebody didn't call Miss Utility)

Amazon Elastic Compute Cloud (EC2)

- ▶ Must provision for peak demand/Good Morning America
- ▶ Instead of capital expense - operating expense
- ▶ Multiple regions/Availability Zones (AZs)
- ▶ EC2 - Elastic Compute Cloud
 - ▶ Elastic Load Balancer service (no single point of failure)
 - ▶ Auto-scaling group - up/down (pay only for what is used)
- ▶ Route 53 - Blue/Green deployments (DNS server - also DR)

Amazon RDS, DynamoDB, ElastiCache

- ▶ Administering database is hard - RDS (redundancy, backups, read replicas)
- ▶ DynamoDB - NoSQL Key/Value store with attributes (provisioned service)
- ▶ ElastiCache Service - Redis or Memcached (faster response times)

Amazon CloudFront CDN, S3

- ▶ CloudFront CDN - serve static content from Points of Presence - read S3, cache
- ▶ Simple Storage Service - Scalable Key, object store 1 byte to 5TB per object
 - ▶ Can use S3 as input to Elastic MapReduce Hadoop job!
 - ▶ Buckets, store key/objects
 - ▶ 11 9s of durability (99.999999999) - lose two facilities
 - ▶ 4 9s of availability (99.99) - 52.56 minutes per year
 - ▶ SSL and automatic encryption
 - ▶ Storage classes: General Purpose, Infrequent Access (IA), Glacier (hours to access)

Amazon Scalable Analytics - Batch, Streaming, Datawarehouse

- ▶ Elastic MapReduce (EMR) - Hadoop, Spark, Hive, Pig, Hue, Zeppelin against S3, RedShift...
 - ▶ Priced by the hour! Linear scaling - double instances?
- ▶ Kinesis Streaming - think managed Kafka? real-time analytics, scalable ETL
- ▶ RedShift - Datawarehouse, columnar, fast, petabyte-scale (1000/TB/year)

Security At Every Layer

- ▶ Identity & Access Management (IAM) - Amazon infrastructure/services
- ▶ Users, groups, roles, rich policies/conditions
- ▶ Virtual Private Cloud (VPC) - subnets w/ Network Access Control Lists, route tables, network gateways
- ▶ EC2 - Security groups (like iptables firewall)
- ▶ Web Application Firewall
- ▶ CloudTrail - all AWS service access logged
- ▶ CloudWatch - Monitor, alarm - e.g. auto-scaling up/down

Compute As A Service

- ▶ Sys admin - hard, deploy web apps via Elastic Beanstalk
- ▶ Short running code? React to environment/change/time - Lambda
- ▶ Lambda: 1 to 5 minutes (Python, Java, Node.js/JavaScript)
- ▶ Pricing: per 100 ms
- ▶ API Gateway - invoke Lambda from web URL

52 AWS Services

- ▶ Simple Queuing Service, SNS
- ▶ Simple Workflow Service (SWF)
- ▶ CloudFormation

EC2 Instances

- ▶ On Demand
- ▶ Reserved 1-3 years, up to 75% off on demand
- ▶ Reserved Instance Marketplace
- ▶ Spot Instances - up to 90% on excess, may lose if demand goes up or outbid

Infrastructure As Code - RESTful via Management Console

- ▶ All service endpoints are REST endpoints
- ▶ GUI frontend to configure services

Infrastructure As Code - RESTful via AWS CLI

- ▶ Command line interface with Python boto backend to REST endpoints
- ▶ Script start up/shutdown, make repeatable, can version

Infrastructure As Code - RESTful via AWS SDKs

- ▶ Software Dev Kits for many languages
- ▶ Use in program to communicate with services securely
- ▶ Tonight: AWS Java SDK

Infrastructure As Code - CloudFormation JSON

- ▶ Export existing setup to different region
- ▶ Version-controlled, auditable infrastructure (no router, hardware)

AWS Marketplace

- ▶ Get instances with configured software
- ▶ Try out, pay by the hour with option to rent for year
- ▶ Preconfigured, installed, license (or bring your own)

Re:Invent 2015

- ▶ 2013: 8,000
- ▶ 2014: 13,000 attendees
- ▶ 2015: Over 20,000 attendees (TechRepublic)
- ▶ Capital One and GE as part of key note

Re:Invent 2015: Internet of Things

- ▶ From AWS IoT Tutorial right on AWS Management Console
-> IoT
- ▶ Control Unit, light bulb (and mobile app)
- ▶ IoT Gateway/Message broker: X509 certs or Amazon Cognito IDs, MQTT/HTTPS
- ▶ Rules engine - transform to AWS endpoints (Kinesis Stream, S3, Lambda)
- ▶ Device shadow - keep state if device offline
- ▶ Device registry - unique ID to each thing, metadata (capabilities, attributes)

Re:Invent 2015: QuickSight

- ▶ Business Intelligence Service
- ▶ Visualizations, ad-hoc analysis
- ▶ Super-fast, Parallel, In-Memory Calculation Engine (SPICE)
- ▶ Data sources: Redshift, RDS, EMR, DynamoDB, Kinesis Streams, S3, MySQL, Oracle

Re:Invent 2015: Amazon Kinesis Firehose

- ▶ Managed service - automatically scale
- ▶ Compression, encryption to designated S3 bucket
- ▶ Run Lambda as objects arrive or EMR over bucket
- ▶ Redshift: CVS, JSON, AVRO etc. only selected columns, data type conversion

Re:Invent 2015: AWS Import/Export Snowball

- ▶ 50lbs, self-contained, tamper resistant, up to 50TB
- ▶ 100TB on 100MB/s dedicated > 100 days
- ▶ AES 256-bit encryption at host, stored encrypted
- ▶ Decrypt when loaded into S3 bucket
- ▶ Sanitize after use using NIST standard
- ▶ Send email to SNS when in bucket
- ▶ \$200 per job, plus shipping, \$15 per extra day

Re:Invent 2015: Security

- ▶ Inspector: 100s of rules mapped to common security compliance standards (e.g Payment Card Industry Data Security Standard PCI DSS), regular updates by AWS Security researchers
- ▶ WAF: Web Application Firewall - protect against SQL injection, cross-site scripting
- ▶ AWS Config Rules: cloud governance, define standards, monitor for compliance. Pre-built best practices or custom (e.g. proper tagging, use of elastic IPs etc.)
- ▶ AWS Config: All AWS resources with configurations over time

Re:Invent 2015: Other Services

- ▶ Amazon Elasticsearch Service: Document indexing (Lucene), log analytics, time series queries, works with visualization like Kibana
- ▶ Amazon Kinesis Streams Extended Retention - from 24hrs to 7 days
- ▶ AWS Database Migration Service (Preview): Oracle to Oracle, RDS etc. Data, SQL, functions, stored procedures, warn about things that cannot be auto-converted
- ▶ Amazon RDS for MariaDB - MySQL clone by creator of MySQL
- ▶ Amazon Cloudwatch Dashboards: reusable graphs of AWS CloudWatch and custom metrics
- ▶ AWS Lambda
 - ▶ Python, Versioning, Scheduled Jobs, and 5 Minute Functions

AWS SDKs - Credentials for Java

- ▶ Environment Variables: `AWS_ACCESS_KEY_ID`, `AWS_SECRET_ACCESS_KEY`
- ▶ Java System Properties: `aws.accessKeyId`, `aws.secretKey`
- ▶ Default credentials: `~/.aws/credentials`
- ▶ Instance credentials (e.g. IAM role assigned to EC2 instance)

AWS Java SDK - Maven

- ▶ All inclusive or service-by-service jar

AWS Java S3 SDK

- ▶ ProfileCredProvider looks for ~/.aws/credentials
- ▶ S3: Bucket, key, object
- ▶ SLPRCELL bucket, key: damage, object: file (type=bullet target=heart - calculate damage, kevlar vest etc.)
- ▶ s3 client, PutObjectRequest
- ▶ Server exception: Problem on the server, client: no network?

AWS S3 Management Console

- ▶ view from management console: bucket, key (damage)

References I

Links



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