The Bits Are In The Clouds

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Hello!

- I’m Jeff Barr
- Amazon employee since 2002
- Background:
  - Microsoft, consulting, startups
- Career Path at Amazon:
  - Senior developer
  - Web services evangelist
  - Senior web services evangelist
Today’s Talk…

- Cloud Computing: Definition and Attributes
- Amazon Web Services:
  - Introduction
  - Service Roster
  - Service Details
- Cloud Computing in Action
- Cloud Computing Challenges
Cloud Computing: Definition

Wikipedia says:

“Cloud computing is a broad concept of using the internet to allow people to access technology-enabled services. It is a style of computing where IT-related capabilities are provided “as a service” using Internet technologies to multiple external customers. It allows users to consume services without knowledge of, expertise with, nor control over the technology infrastructure that supports them.”
Cloud Computing Attributes

- **Abstract Resources**
  Focus on your needs, not on hardware specs.

- **On-demand Provisioning**
  Ask for what you need, only when you need it.

- **Large Scale**
  Cloud is conceptually of infinite capacity.

- **No Up-front Investment**
  Costs are in direct proportion to actual usage.

- **Cost-Effective & Efficient**
  No investment in depreciating hardware.
Our Offering: Amazon Web Services

- AWS = Amazon Web Services
- Third major line of business
- Access to proven Amazon infrastructure
- Highly scalable & reliable
- Redundant
- Geographically dispersed
- Economical
- Metered, pay-as-you-go access
- Home page: aws.amazon.com
AWS Storage Layers

Third Party Storage Offerings
- Oracle
- MySQL
- Vertica
- Aster*Data
- GigaSpaces

Amazon EC2
Elastic Compute Cloud

Amazon EBS
Elastic Block Storage

Amazon S3
Simple Storage Service

Amazon Content Delivery Service

Amazon SimpleDB
Simple Database
Amazon Simple Storage Storage
Amazon Simple Storage Service

- Amazon S3: Simple Storage Service
- Programmatic access via web services API
- Highly scalable data storage in-the-cloud
- Simple to get going, simple to use
- Fast, highly available and durable
- Economical
- Busy: 22 billion objects stored!
Amazon S3 Features

- Store object up to 5 GB in size
- Read and write entire objects
- Every object has a unique key
- Collect objects into buckets
- Every object has a unique URL
- Intrinsic redundancy
- Full control of access rights
- Addressable S3 installations in US and Europe
- Eventual consistency data model
- BitTorrent seeding
Amazon S3 API

- **Service:**
  - ListAllMyBuckets

- **Buckets:**
  - CreateBucket
  - DeleteBucket
  - ListBucket
  - GetBucketAccessControlPolicy
  - SetBucketAccessControlPolicy
  - GetBucketLoggingStatus
  - SetBucketLoggingStatus

- **Objects:**
  - PutObject
  - PutObjectInline
  - GetObject
  - GetObjectExtended
  - DeleteObject
  - GetObjectAccessControlPolicy
  - SetObjectAccessControlPolicy
Amazon S3 Pricing

- **Storage:**
  - $0.15 / GB / Month

- **Bandwidth:**
  - **Data transfer in:**
    - $0.10 / GB
  - **Data transfer out:**
    - $0.17 / GB – First 10 TB
    - $0.13 / GB – Next 40 TB
    - $0.11 / GB – Next 100 TB
    - $0.10 / GB – Monthly past 150 TB
  - No charge to and from EC2

- **Requests:**
  - $0.01 per 10,000 GET and other requests
  - $0.01 per 1000 PUT, POST, or LIST requests
  - No charge for DELETE requests

- Prices slightly higher in Europe
- Usage data available from AWS Portal
Amazon Content Delivery Service
(Name TBD)
Amazon Content Delivery Service

- Runs on top of S3
- Mark S3 bucket to be used for content delivery
- Global presence on three continents
- Ready before end of year
- No commitment, pay-as-you-go
- Pricing model still TBD
- Stay tuned
Amazon Elastic Compute Cloud
Amazon Elastic Compute Cloud

- **Resizable Compute Capacity**
  *As much as you need, when you need it.*
  *Scale up or down in minutes.*

- **Complete Control via API**
  *Create, scale, & manage instances programmatically.*

- **Variety of Instance Sizes**
  *CPU Power, Cores, RAM, Disk.*

- **Wide Variety of Pre-built AMIs (Amazon Machine Images)**
  *Hit the ground running with minimal system building effort.*

- **Secure & Flexible Network Security Model**
  *Full control of access for each running instance.*
Amazon EC2 Architecture

Multiple Regions

Multiple EC2 Availability Zones

S3 Storage
EC2 API Overview

- **Images:**
  - RegisterImage
  - DescribeImages
  - DeregisterImage
  - ModifyImageAttribute
  - DescribeImageAttribute
  - ResetImageAttribute

- **Instances:**
  - RunInstances
  - DescribeInstances
  - TerminateInstances
  - GetConsoleOutput
  - RebootInstances

- **Keypairs:**
  - CreateKeyPair
  - DescribeKeyPairs
  - DeleteKeyPair

- **Security Groups:**
  - CreateSecurityGroup
  - DescribeSecurityGroups
  - DeleteSecurityGroup
  - AuthorizeSecurityGroupIngress
  - RevokeSecurityGroupIngress

- **Block Storage Volumes:**
  - CreateVolume
  - DeleteVolume
  - DescribeVolumes
  - AttachVolume
  - DetachVolume
  - CreateSnapshot
  - DescribeSnapshots
  - DeleteSnapshot
EBS Features

- **Persistent storage**
  Volume lifetime is independent of any particular EC2 instance.

- **General purpose**
  Raw, unformatted, block device.

- **High performance**
  Equal to or better than local EC2 drive.

- **High reliability**
  Built-in redundancy within availability zone.
  AFR (Annual Failure Rate) between 0.1% and 1%.

- **Scalable**
  Volume sizes ranging from 1 GB to 1 TB.
  (20 TB/account limit while in beta)

- **Easy**
  Easy to create, attach, back up, restore, and delete volumes.
EBS API Overview

- **Volumes**
  - `CreateVolume` – (size/snapshot ID, region, availability zone)
  - `DeleteVolume` - (volume ID)
  - `DescribeVolumes` - (optional list of volume IDs)
  - `AttachVolume` - (volume ID, instance ID, device name)
  - `DetachVolume` – (volume ID)

- **Snapshots**
  - `CreateSnapshot` - (volume ID)
  - `DeleteSnapshot` - (snapshot ID)
  - `DescribeSnapshot` - (optional list of snapshot IDs)
What is Amazon SimpleDB?

- Simple, easy to use, low-cost, web database service
  - Flexible data model, designed for web apps, reduces developer complexity
  - Provides core database functionality – data storage & querying — without the operational complexity
  - Industrial strength availability, reliability, scalability
  - Amazon runs core business applications on SimpleDB

- Extends the capabilities of the AWS computing cloud
  - Designed to make web-scale database processing much easier
  - Scale data storage & query RPS as needed
  - Integrates well with other AWS services - S3, EC2, SQS, …
SimpleDB Scalability

- Designed for highly scalable and highly available web applications.

- Data is geographically dispersed and automatically replicated for high availability and durability.

- Vertically partition data creating domains for each vertical data type (customers, orders, detail).

- Increase scale and throughput by horizontally partitioning data (more domains) & requests (multi-threaded access).
SimpleDB Properties

- Simple semi-structured data storage and query.
- Flexible data model – no rigid schemas.
- Low administrative overhead; no DBA required.
- Easy and simple to use API.
- All data stored as UTF-8 strings.
- All data is automatically indexed for fast retrieval.
SimpleDB API

Domain Management
- CreateDomain
- DeleteDomain
- ListDomains

Attribute Management
- PutAttributes
  - create and update attributes
- DeleteAttributes
  - remove individual values
  - remove attributes

Attribute Retrieval
- GetAttributes
  - retrieve all attributes
  - retrieve a particular attribute

Query [WithAttributes]
- query on attribute ranges
- query on multiple attributes
- results are paginated
Third Party Storage On AWS
Third Party Storage on AWS

- Vertica – Analytic Database for the Cloud
- AsterData – On-Demand Reporting Database
- GigaSpaces – Scale-Out Application Server
- MySQL – Open Source Relational Database
- Oracle – Enterprise Relational Database
Cloud Computing Challenges
Cloud Computing Challenges

- **Outbound bandwidth from your facility**
  Compression always helps. Investigating other options, e.g. peering.

- **Network latency**
  Use multiple parallel connections. Optimize network settings.

- **Security**
  Security white paper is now available.

- **Newness factor**
  This is the time to give it a shot, gain experience and confidence.
Important AWS Sites

- AWS Home Page
  aws.amazon.com

- AWS Blog:
  aws.typepad.com

- AWS Service Health Dashboard:
  status.aws.amazon.com

- AWS Forums:
  aws.amazon.com/forums

- AWS Zone Developer Tools:
  www.awszone.com
Cloud Computing in Action

Challenge:
Create PDFs from the scanned images of 11 million newspaper articles, circa 1851-1922
Solution:
Load 4 TB of data in Amazon S3 and launch **100** Amazon EC2 instances to create PDFs

Result:
Project completed in 24 hours at very reasonable cost.
Q & A
Thanks!
Appendix: Service Pricing
EC2 Pricing

- Running Instances - $0.10 - $0.80 per hour.
- Bandwidth:
  - Data transfer in:
    - $0.100 / GB
  - Data transfer out:
    - $0.170 / GB – First 10 TB
    - $0.130 / GB – Next 40 TB
    - $0.110 / GB – Next 100 TB
    - $0.100 / GB – Monthly past 150 TB
  - Regional data transfer: $0.01 / GB
SimpleDB Pricing

- **Machine Utilization**
  - $0.14 per SimpleDB Machine Hour consumed during request processing.

- **Data Storage**
  - $1.50 / GB / Month
  - 45 bytes of overhead for each [item / attribute name / attribute-value] set

- **Data Transfer:**
  - Data transfer in:
    - $0.10 / GB
  - Data transfer out:
    - $0.17 / GB – First 10 TB
    - $0.13 / GB – Next 40 TB
    - $0.11 / GB – Next 100 TB
    - $0.10 / GB – Monthly past 150 TB
  - No charge for transfer to and from EC2
EBS Pricing

- **EBS Volumes**
  - $0.10 per GB-month of provisioned storage
  - $0.10 per 1 million I/O requests
  - No charge for mounting/unmounting volume

- **EBS Snapshots to Amazon S3**
  - $0.15 per GB-month of data stored
  - $0.01 per 1,000 PUT requests (when saving a snapshot)
  - $0.01 per 10,000 GET requests (when loading a snapshot)