CS 683 Emerging Technologies
Fall Semester, 2008
Doc 10 Cloud Computing
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References

Amazon Simple Storage Service Getting Started Guide, http://docs.amazonwebservices.com/AmazonS3/2006-03-01/gsg/

Amazon Simple Storage Service, http://aws.amazon.com/s3/

Twenty-One Experts Define Cloud Computing, http://cloudcomputing.sys-con.com/node/612375/print

Cloud Computing Community Wiki, http://wiki.cloudcommunity.org/wiki/Main_Page
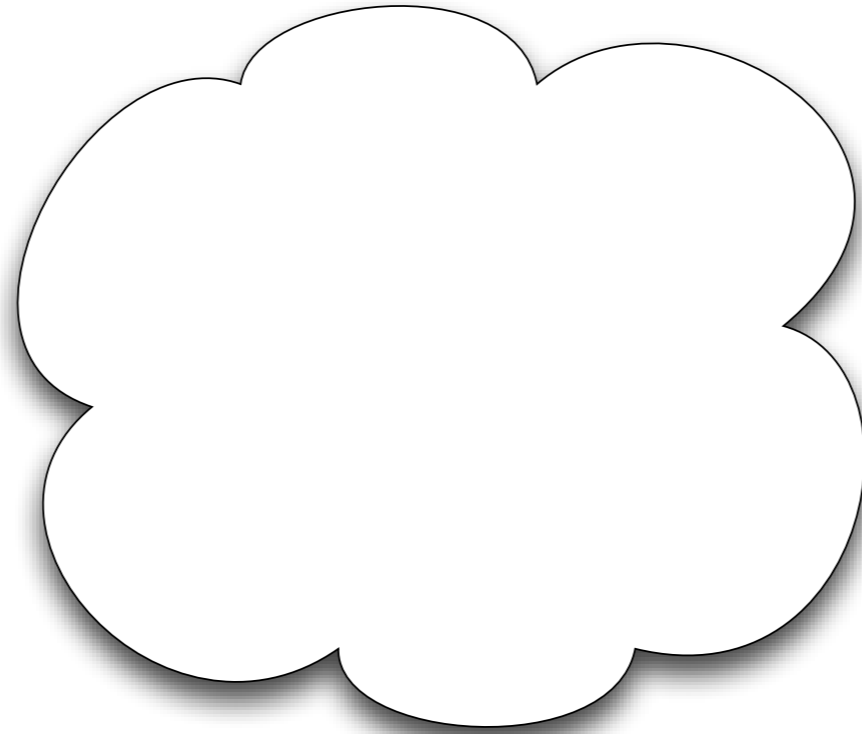
Cloud computing, http://en.wikipedia.org/wiki/Cloud_computing

Reading

Cloud computing, http://en.wikipedia.org/wiki/Cloud_computing

Amazon Simple Storage Service Getting Started Guide, http://docs.amazonwebservices.com/AmazonS3/2006-03-01/gsg/

Cloud Computing

Examples

Google Apps
iTunes Store
Bittorent
Skype
Web mail
Facebook
Google Maps

In the Beginning

"computation may someday be organized as a public utility"

John McCarthy
1960

Wikipedia Definition

IT-related capabilities are provided "as a service"

Services accesses anywhere via network access

IEEE

It is a paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, entertainment centers, table computers, notebooks, wall computers, handhelds, etc.

Key Characteristics

Capital expenditure minimized for users

Device and location independence

Performance

Reliability by way of multiple redundant sites

Scalability

Security

Sustainability through improved resource utilization

Multitenancy

Multitenancy

Single instance of software runs on a software-as-a-service (SaaS) vendor's servers
Google Apps

Serving multiple client organizations (tenants)

Beware of Hype

http://wiki.cloudcommunity.org/wiki/CloudComputing:Incidents_Database

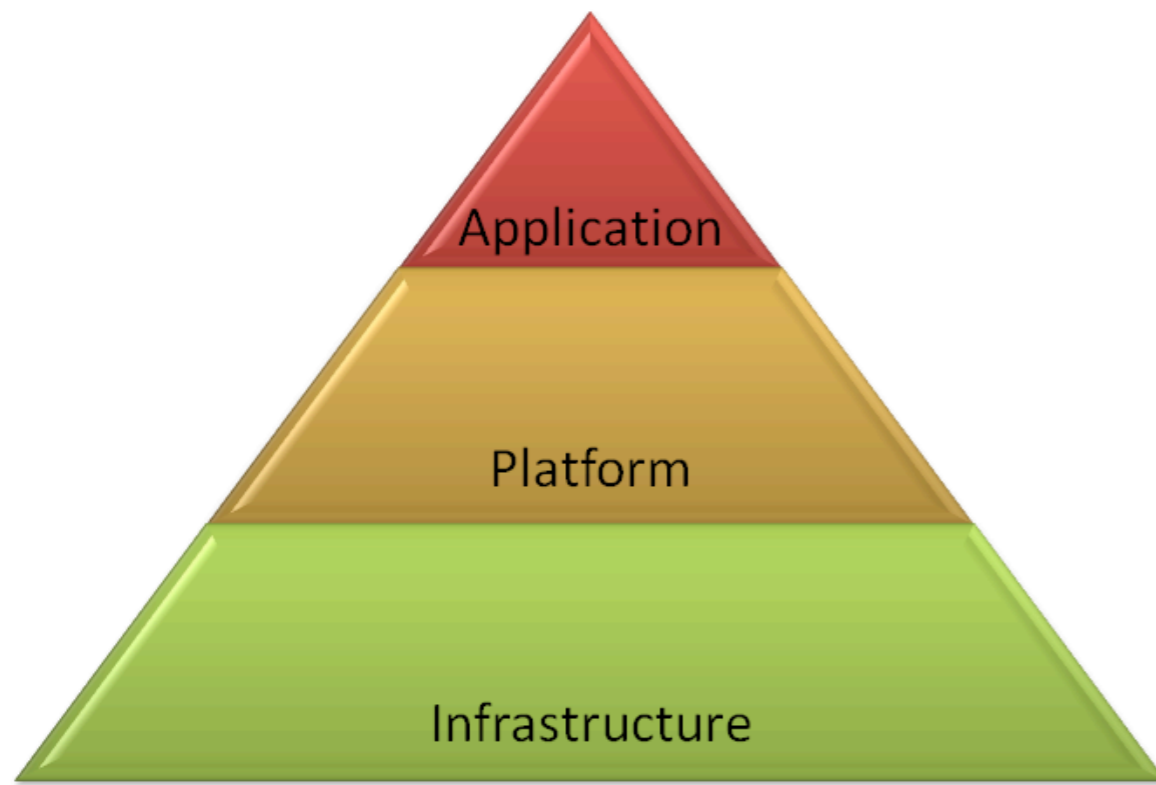|		

Other Definitions

http://cloudcomputing.sys-con.com/node/612375/print

21 IT professionals give their definition of cloud computing

Cloud Computing Journal
    http://cloudcomputing.sys-con.com/

Michael Sheehan

http://cloudcomputing.sys-con.com/node/609938

Application
Web email
Software as a Service (SaaS)
SalesForce

Platform
Enables cloud applications

Google App Engine, Heroku, Mosso, Engine Yard, Joyent, force.com

Infrastructure
Enables cloud applications & platforms

Amazon's EC2, GoGrid, RightScale, Linode

Components (wikipedia)

Clients
Services
Application
Platform
Storage
Infrastructure

These term are poorly defined in the Wikipedia article

Infrastructure

Delivery of computer infrastructure as a service

Full virtualization (GoGrid, Skytap)

Grid computing (Sun Grid)

Management (RightScale)

Paravirtualization (Amazon Elastic Compute Cloud)

Storage

Delivery of data storage as a service

Often billed on a utility computing basis

Database

Amazon SimpleDB

Google App Engine's BigTable datastore

Network attached storage

MobileMe iDisk component,

Nirvanix CloudNAS

Synchronization

Live Mesh Live Desktop component

MobileMe push functions

Web service

Amazon Simple Storage Service

Nirvanix SDN

Platform

Facilitates deployment of applications

Web application frameworks
    Python Django (Google App Engine)
    Ruby on Rails (Heroku)

Web hosting
    Mosso

Proprietary
    Force.com

Application

Peer-to-peer/volunteer computing
  Bittorrent
  SETI@home
  Skype

Web application
  Facebook

Software as a service
  Google Apps
  Salesforce

Software plus services
  Microsoft Online Services

Service

Software system[s] designed to support interoperable machine-to-machine interaction over a network

Identity

    OAuth, OpenID

Integration

    Amazon Simple Queue Service

Mapping

    Google Maps, Yahoo! Maps

Payments

    Amazon Flexible Payments Service, Google Checkout, PayPal

Search

    Alexa, Google Custom Search, Yahoo! BOSS

Others

    Amazon Mechanical Turk

Client

Computer hardware and/or computer software which
    Relies on The Cloud for application delivery,
    Or which is specifically designed for delivery of cloud services

        Mobile
          Android, iPhone

        Thick client/Web browser

Amazon Cloud Computing

Amazon Cloud Parts

Simple Storage Service (S3)
   Data storage
   Accessible from the Web

Elastic Compute Cloud (C2)
   Scalable, pay as you go compute capacity

SimpleDB
   Allows queries on structured data

Simple Queue Service
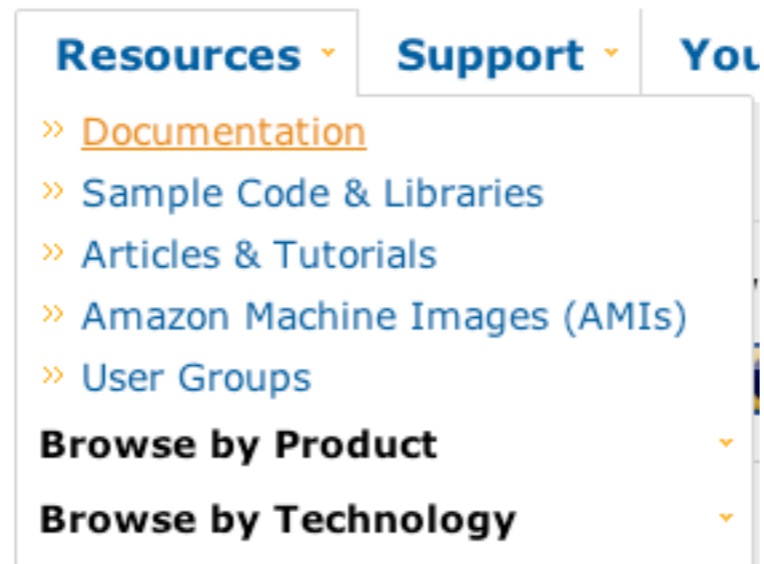   Support messages between Web services

Getting Started

http://aws.amazon.com/

Create an account at http://aws.amazon.com/

Documentation

    Select "Documentation" under Resources at http://aws.amazon.com/

Resources ˅   **Support** ˅   **You**

» Documentation
» Sample Code & Libraries
» Articles & Tutorials
» Amazon Machine Images (AMIs)
» User Groups

Browse by Product ˅

Browse by Technology ˅

Simple Storage System - S3

Store data on Amazon's servers

Objects
- Stored in buckets
- Accessed by key

Low level access
- SOAP
- REST

High level access
- Java
- C#
- Perl
- PHP
- Ruby

S3 Costs

Storage

$0.15 per GB-Month of storage used

Data Transfer

$0.100 per GB – all data transfer in

$0.170 per GB – first 10 TB / month data transfer out

$0.130 per GB – next 40 TB / month data transfer out

$0.110 per GB – next 100 TB / month data transfer out

$0.100 per GB – data transfer out / month over 150 TB

Requests

$0.01 per 1,000 PUT, POST, or LIST requests

$0.01 per 10,000 GET and all other requests

Objects

Objects contain
  Object data
  Metadata

Size
  1 byte to 5 gigabytes per object

Object data
  Just bytes
  No meaning associated with bytes

Metadata
  Name-value pairs to describe the object
  Some http headers used
    Content-Type

Buckets

Namespace for objects

No limitation on number of object per bucket

Only 100 buckets per account

Each bucket has a name
    Up to 255 bytes long
    Cannot be same as existing bucket name by any S3 user

Key

Unique identifier for an object within a bucket

Object Url

http://buckerName.s3.amazonaws.com/Key

http://doc.s3.amazonaws.com/2006-03-01/AmazonS3.wsdl

Bucket = doc
Key = 2006-03-01/AmazonS3.wsdl

Access Control Lists

Each Bucket has an access control list
    Determines who has read/write access

Each Object can have an access control list
    Determines who has read/write access

Authentication

AWS Access Key ID
  Key given to developer

AWS Secret Access Key
  Used to generate signature for request

Signature
  HMAC-SHA1 hash of request information
  Uses Secret Access key to generate hash

Creating a Bucket Using Java

```
AWSAuthConnection conn =
    new AWSAuthConnection("[aws-access-key-id]", "[aws-secret-access-key-id]");

Response response = conn.createBucket("[bucket-name]", null);
if (response.connection.getResponseCode() == 200) {
    // bucket was created
} else {
    // something bad happened
```

Writing an Object

```
AWSAuthConnection conn =
    new AWSAuthConnection("[aws-access-key-id]", "[aws-secret-access-key-id]");

3Object simpleObject = new S3Object("this is a test".getBytes(), null);
Response response = conn.put("[bucket-name]", "[key-name]", simpleObject, null);
```

Reading an Object

```
AWSAuthConnection conn =
    new AWSAuthConnection("[aws-access-key-id]", "[aws-secret-access-key-id]");

GetResponse response = conn.get("[bucket-name]", "[key-name]", null);
String value = response.object.data;
Map metadata = response.object.metadata;
List values = (List)metadata.get("title");
String title = (String)values.get(0);
```