



# CLOUD COMPUTING

# CLOUD COMPUTING

When it's smarter to rent  
than to buy..

Presented by  
Anand Tirumani

# Agenda

## ➤ Cloud Computing: Concepts and Terminologies

- ❖ What is Cloud Computing?
- ❖ Essential Characteristics
- ❖ Service Models
- ❖ Deployment Models
- ❖ IT Efficiency and Challenges

## ➤ Amazon Web Services (AWS)

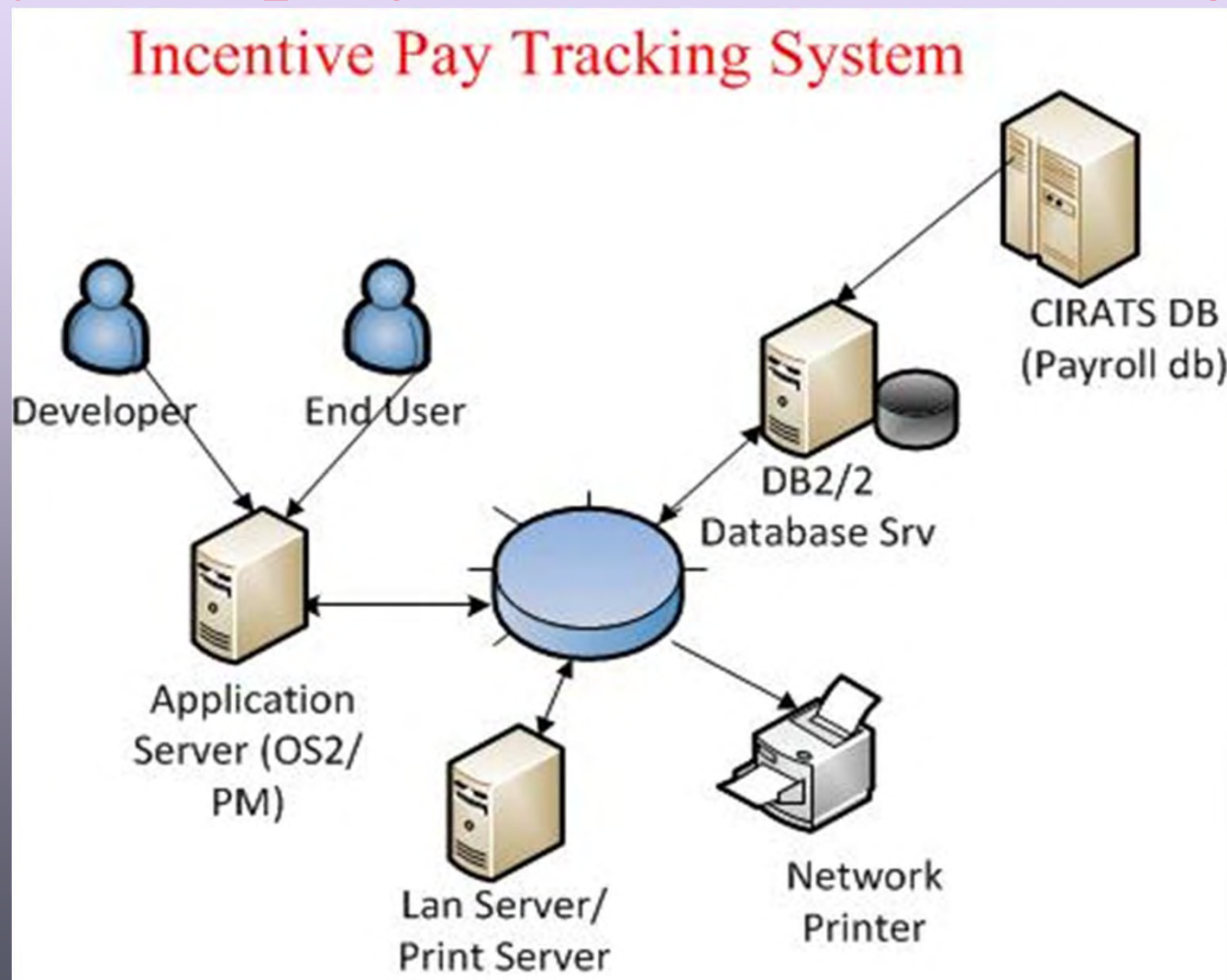
- ❖ What is AWS?
- ❖ Reference Model
- ❖ Brief overview of S3 services: Functions, Concepts & Advantages of S3

## ➤ Demo of S3 Services

- ❖ Creating a static website on Amazon S3

## ➤ Conclusion

# My first project Architecture diagram

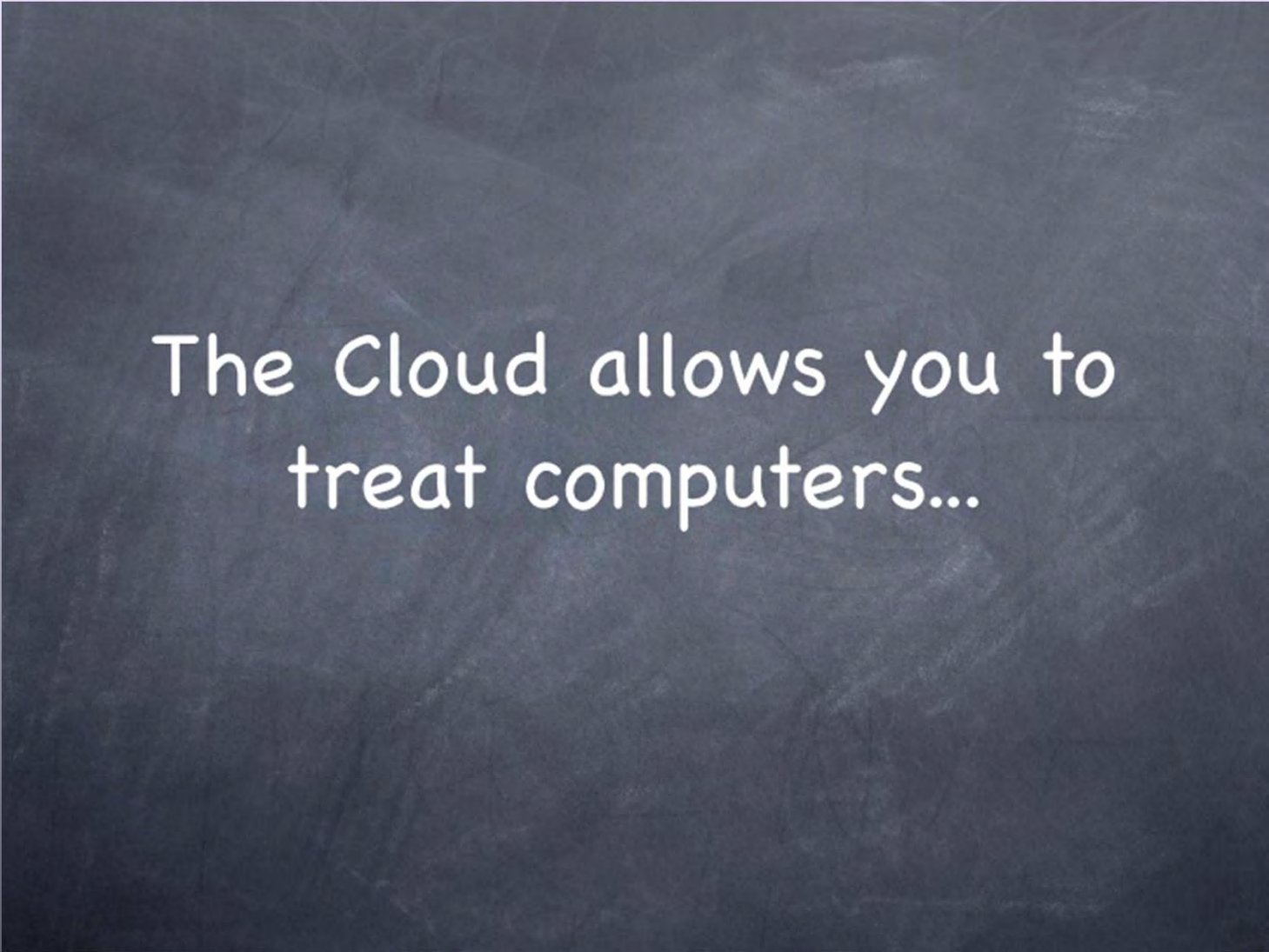


# What is Cloud Computing ?

- ▶ Cloud computing can prove to be complicated-different people have different explanations, but at the root, they're all saying the same.
- ▶ **Cloud Computing refers to the delivery of IT Infrastructure, applications and services to organizations and end users on an on-demand basis –remotely, via internet.**



Think of it this way...

A dark, textured rectangular area resembling a chalkboard, centered within a light purple gradient background. The text is written in a white, casual, hand-drawn font.

The Cloud allows you to  
treat computers...



...like electricity





# Essentials of Cloud Computing by NIST

## ➤ On-demand self-service

- ❖ No human intervention

## ➤ Broad Network Access

- ❖ Integration of multiple services (multimedia, audio etc..,) with advances in broadband technologies and high speed information processing

## ➤ Resource Pooling

- ❖ Location independence

## ➤ Rapid Elasticity

- ❖ Scale in and scale out of computing resources

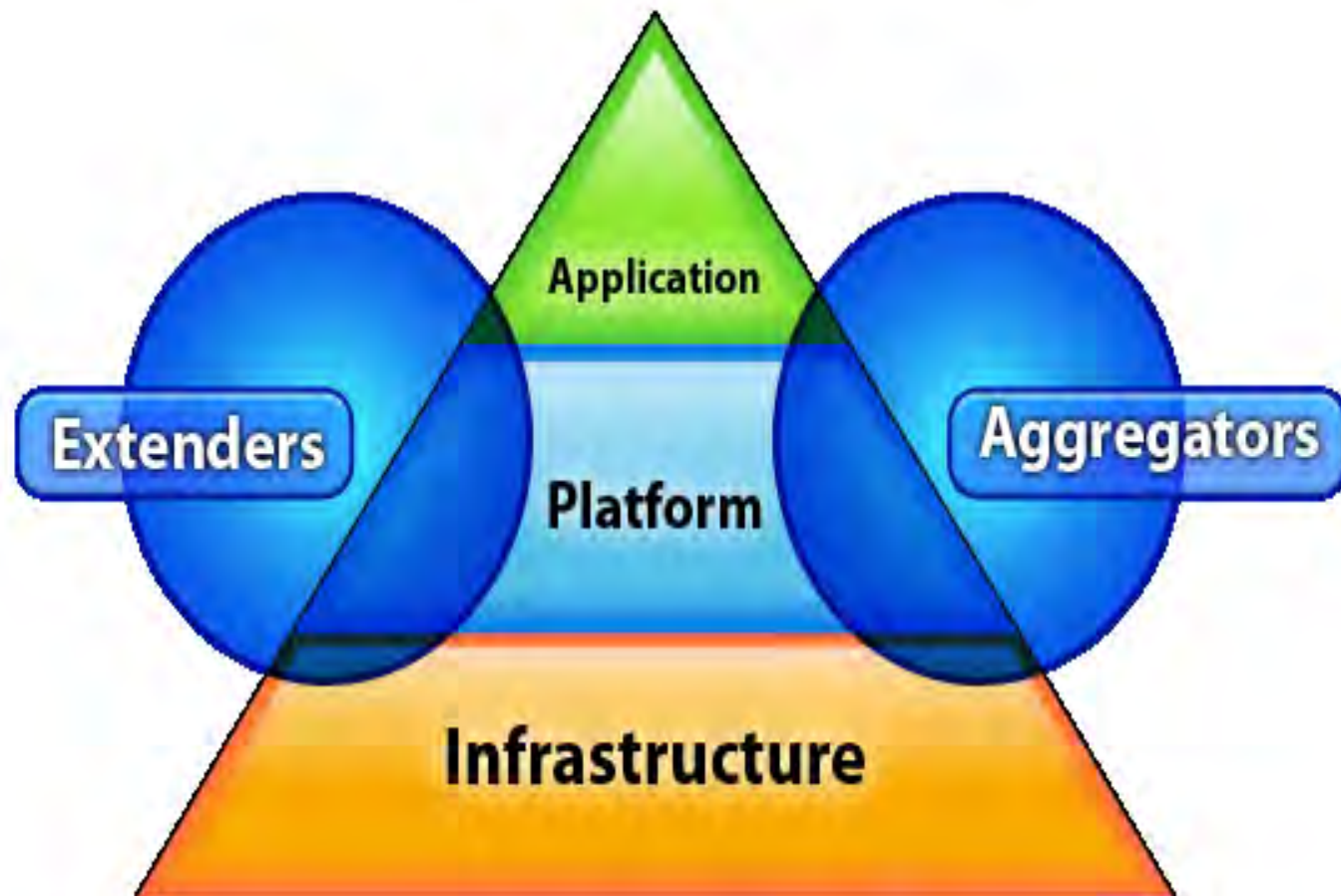
## ➤ Measured Service

- ❖ Pay as you go

# Cloud Computing Service Models

- ▶ Software as a Service (SaaS)-End Users
- ▶ Platform as a Service (PaaS)-Application Developers
- ▶ Infrastructure as a Service (IaaS)-Network Architects

# The NEW “Cloud Pyramid”



# Software as a Service-End Users

- ▶ Just run it for me!
- ▶ Also known as On-demand Service.
- ▶ Is an application that can be accessed from anywhere in the world as long as you can have an computer with an Internet Connection.
- ▶ We can access this cloud hosted application without any additional hardware or software.
- ▶ E.g. : G-mail, Yahoo mail, Hotmail etc..,
- ▶ Also they can provide security features such as SSL encryption, a cryptographic protocol.





# SaaS Examples

salesforce.com   
Success On Demand.™

 **NETSUITE**  
ONE SYSTEM. NO LIMITS.

Microsoft Online Services: Business Productivity Online Suite

Microsoft  
SharePoint Online

Microsoft  
Office Communications Online

Microsoft  
Exchange Online

Microsoft  
Office Live Meeting



**facebook.**

**postini** 



**Cloud Computing:**

**Rethink** IT.  
**Reinvent** Business.

Smart. Secure and Ready for Business.

# Platform as a Service (PaaS)- Application Developers

- ▶ Give us nice API (Application Programming Interface) and take care of the implementation.
- ▶ In the PaaS model, cloud providers deliver a computing platform and/or solution stack typically including operating system, programming language execution environment, database, and web server.
- ▶ Is a platform for developers to write and create their own SaaS i.e. applications.
- ▶ Which means rapid development at low cost.
- ▶ E.g.: Salesforce.com, Windows Azure etc.

# PaaS Examples



# Infrastructure as a Service (IaaS)- Network Architect

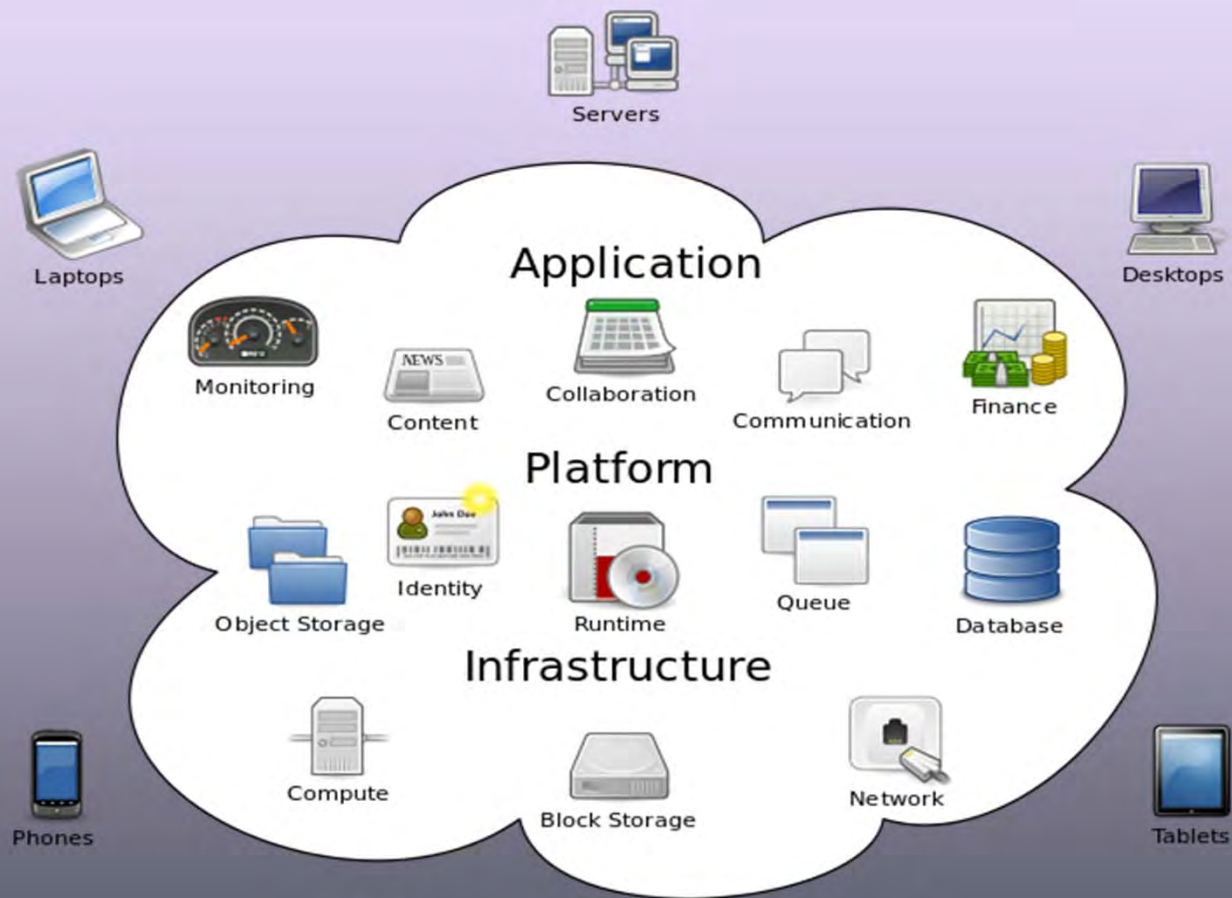
- ▶ Also known as hardware as a service.
- ▶ Is a computing power that you can rent for a limited period of time.
- ▶ Allows existing applications to be run on a cloud suppliers hardware.
- ▶ Cloud providers offer computers – as physical or more often as virtual machines – raw (block) storage, firewalls, load balancers, and networks



# IaaS Examples



# Cloud Architecture



Cloud Computing

# Cloud Deployment Models

## Public Cloud

- ▶ Computing infrastructure is hosted by cloud vendor at the vendors premises.
- ▶ and can be shared by various organizations.
- ▶ E.g. : Amazon, Google, Microsoft, Sales force

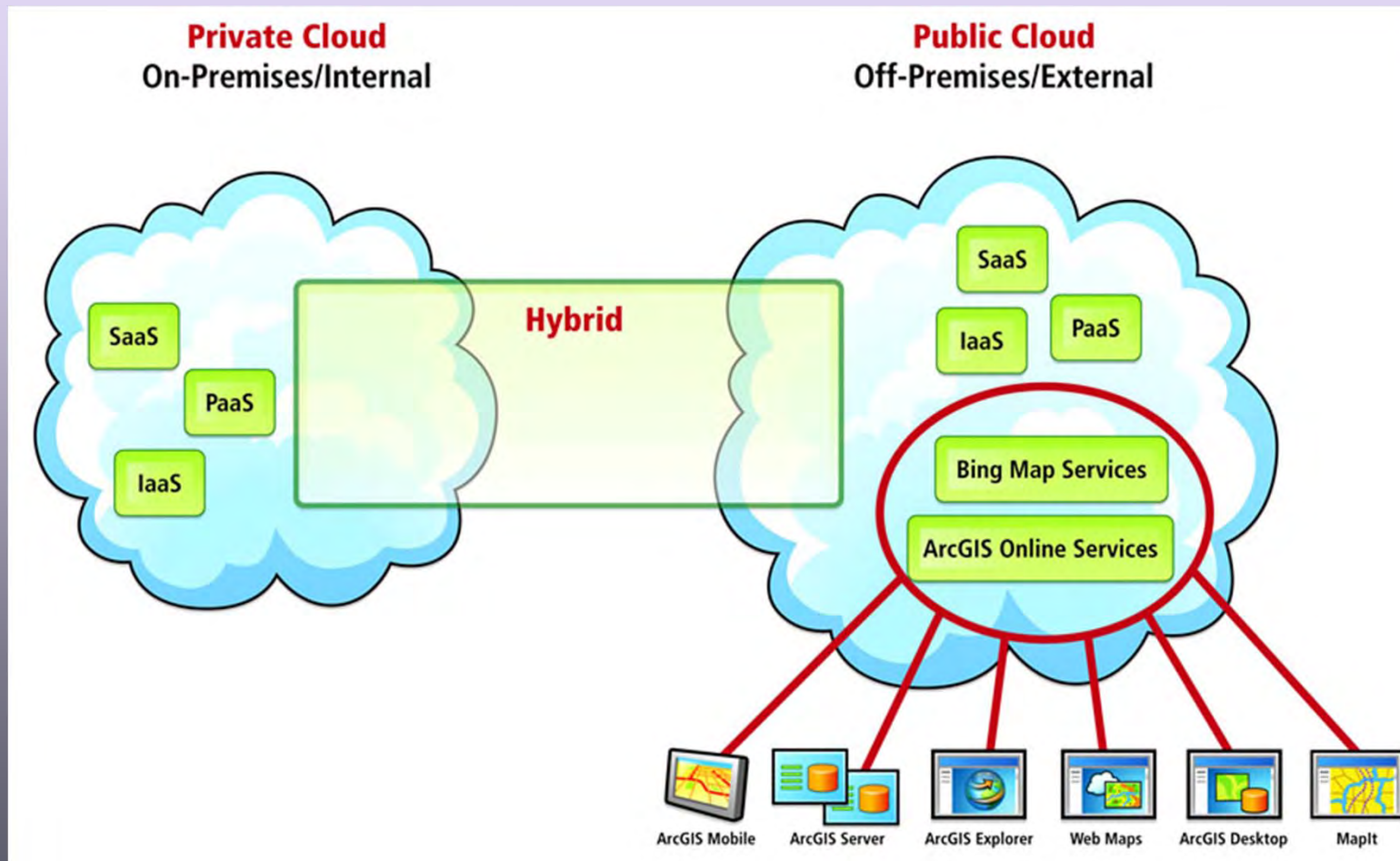
## Private Cloud

- ▶ The computing infrastructure is dedicated to a particular organization and not shared with other organizations.
- ▶ more expensive and more secure when compare to public cloud.
- ▶ E.g. : HP data center, IBM, Sun, Oracle, 3tera

## Hybrid Cloud

- ▶ Organizations may host critical applications on private clouds.
- ▶ where as relatively less security concerns on public cloud.
- ▶ usage of both public and private together is called hybrid cloud

# Cloud Deployment Models





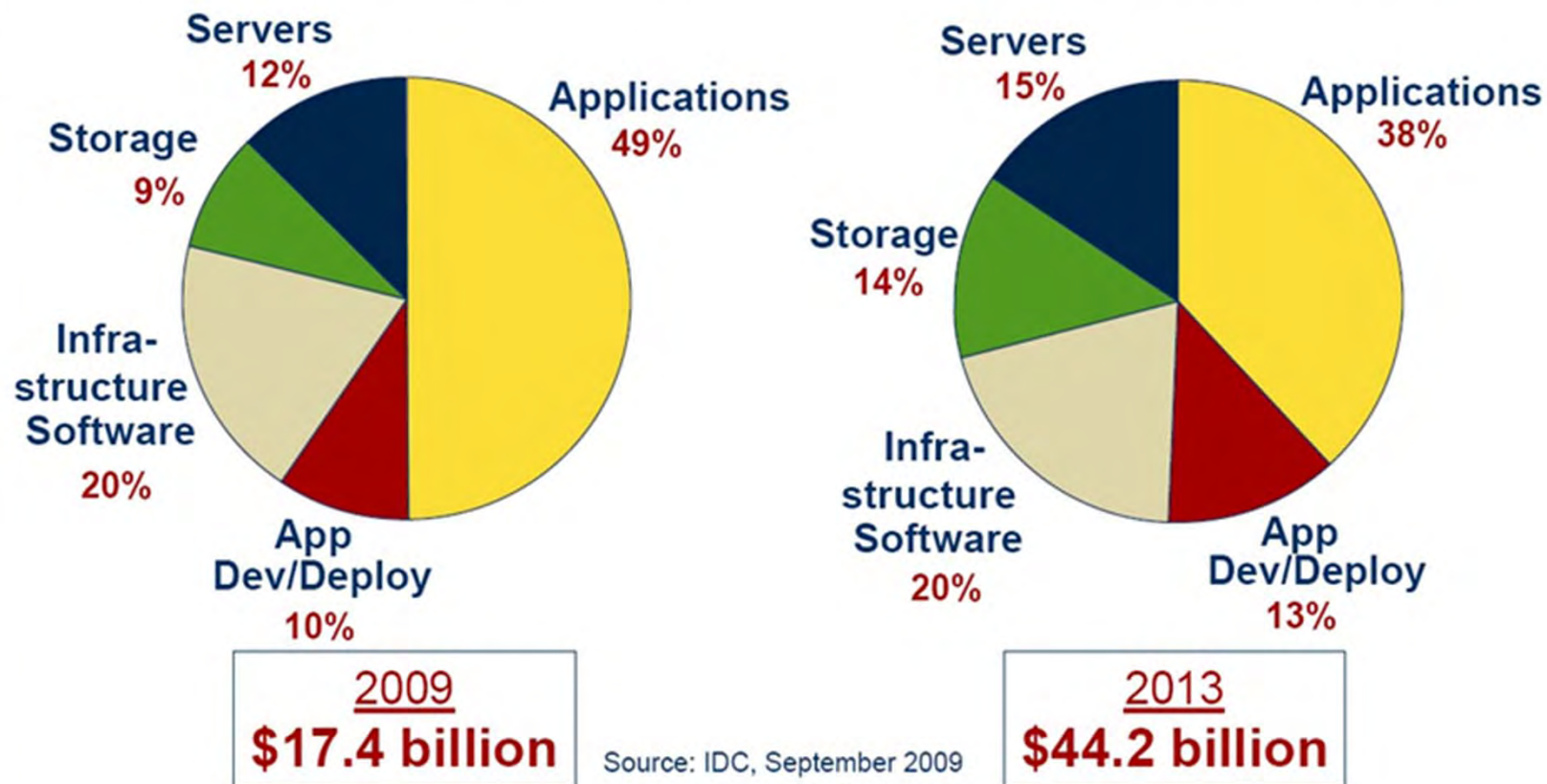
# Where is the Cloud Going?

- ▶ IDC's updated IT Cloud Services Forecast predicts that public cloud computing will grow from \$17.4 billion worth of IT spend in 2009 to \$44 billion by 2013.
- ▶ Additionally, Federal CIO Vivek Kundra has vowed to spend \$19 billion of U.S. government's \$70 billion IT budget on cloud computing.
- ▶ The five year growth outlook remains strong, with a five-year annual growth rate of 26% – over six times the rate of traditional IT offerings.

<sup>1</sup> Public Cloud Only

# Cloud Distribution Examined

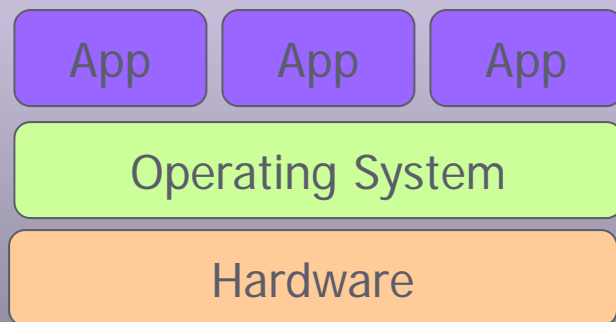
## Worldwide IT Cloud Services Revenue\* by Product/Service Type



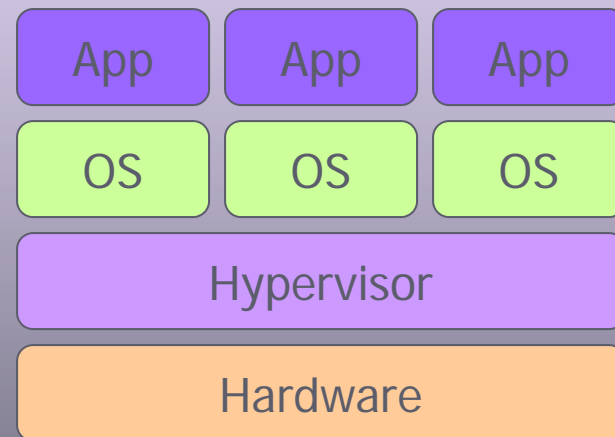
\* Includes revenue from delivery of Applications, App Development/Deployment SW, Systems Infrastructure SW, and Server and Disk Storage capacity via Cloud Services model; AD&D excludes online B2B messaging providers/exchanges

# Why Now?

- The acceptance and proliferation of hardware virtualization and multi-tenant applications



Traditional Stack



Virtualized Stack

# Why Now?

- ▶ Internet has become ubiquitous and an accepted method of connecting providers with consumers
- ▶ ISPs/Telcos are offering robust, redundant and managed corporate internet service enabling service consolidation efficiencies.
- ▶ The cost verses risk equation has tipped toward shared solutions
- ▶ Computing capabilities are being seen as a ongoing service rather than an internal capital expense



# The Reality

- ▶ Enterprises will be dragged kicking and screaming through the gates of cloud computing by the economy, consumers, SMBs and emerging markets.

# IT Efficiency Challenges



## CLOUD SERVICES

On-Demand IT Infrastructure

Reliable/Secure

Scalable/Flexible

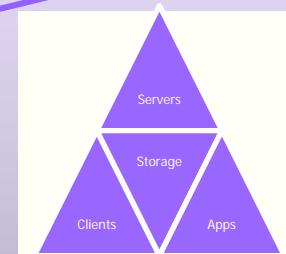
Pay for what you use

Free Staff Time

Application Commoditization

Cost Savings

SMB to Enterprise Solutions



## VIRTUALIZATION

Server Consolidation

Storage Consolidation

Desktop Consolidation

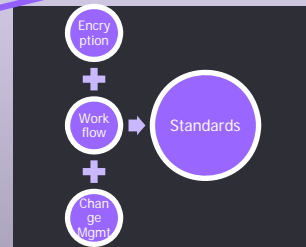


## STORAGE OPTIMIZATION

Tiered Storage

Data Deduplication

Storage Archiving



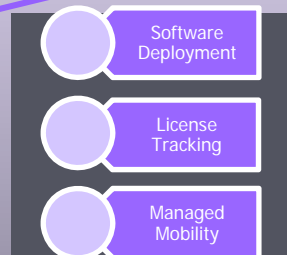
## SECURITY/STANDARDIZATION

Change Management

Drive Encryption/End-Point Protection

Windows/Linux

Automation/Scripting



## DATA MANAGEMENT

Software Deployment

Licenses tracking

Managed Mobility

# Distributed vs. Grid vs. Cloud

	Distributed	Grid	Cloud
<b>Time</b>	Weeks to Months	Days to Weeks	Minutes
<b>Scalability</b>	Slowest, Rigid & Costly	Slower, somewhat flexible, Costly	Instant, Flexible, Pay-per-usage
<b>Cost</b>	High CapEx	Costly, sometimes month/year contracts, no CapEx	No contracts, usage based, no upfront costs
<b>“Green”</b>	Low	Low	High - virtualized
<b>Pricing model</b>	<u>Buy</u> Servers & Colo costs whether used or not	<u>Rent</u> Servers & Hosting costs whether used or not	<u>Rent</u> based on usage only

# Does Cloud Computing reduce E-Waste?

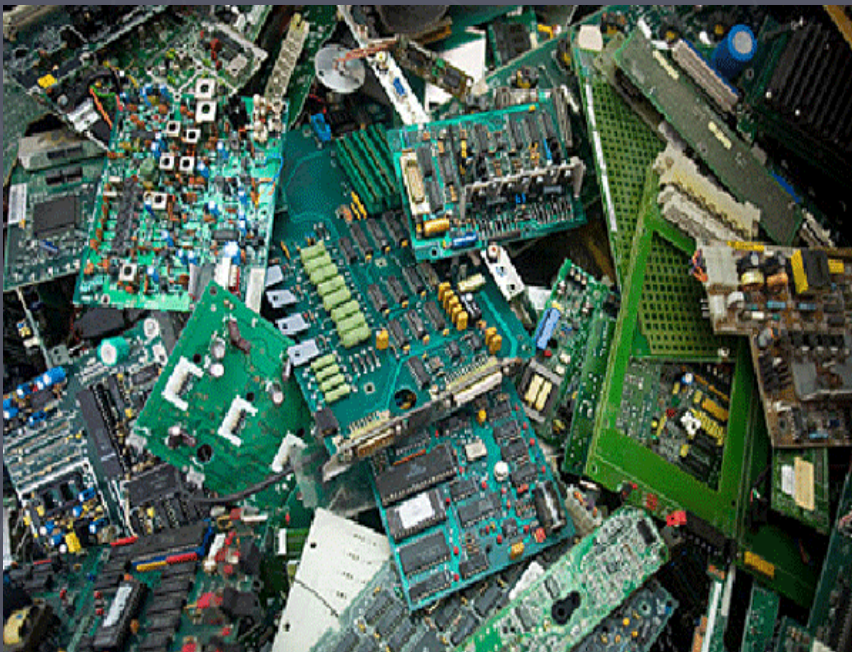
- ▶ Green IT Cloud Computing
- ▶ Cloud Computing is Eco-Friendly.
- ▶ We can reduce E-waste by using Cloud Computing i.e. by Infrastructure as a Service (IaaS).
- ▶ Cloud Computing Helps to Accelerate Green IT
- ▶ Can reduce Global Warming too..







Facebook DateCenter



Google Server



# Disadvantages of Cloud Computing

- ▶ Cloud computing is impossible if you cannot connect to the Internet.
- ▶ Since you use the Internet to connect to both your applications and documents, if you do not have an Internet connection you cannot access anything, even your own documents.
- ▶ A dead Internet connection means no work and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker.
- ▶ When you are offline, cloud computing simply does not work.

# Commercial Clouds



Amazon Elastic Compute Cloud (Amazon EC2) - Beta



Cloud Computing:

Rethink IT.  
Reinvent Business.  
Smart. Secure and Ready for Business.



TAP INTO THE  
POWER OF NETWORK.COM



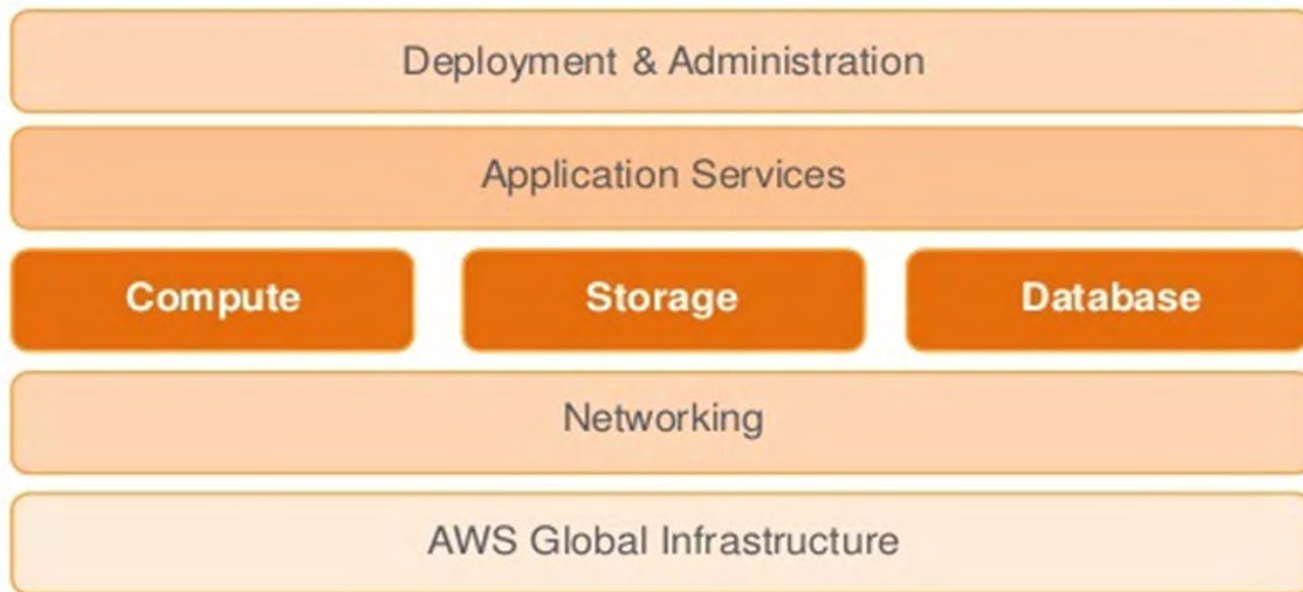
# AMAZON WEB SERVICES

## SIMPLE STORAGE SERVICE - S3

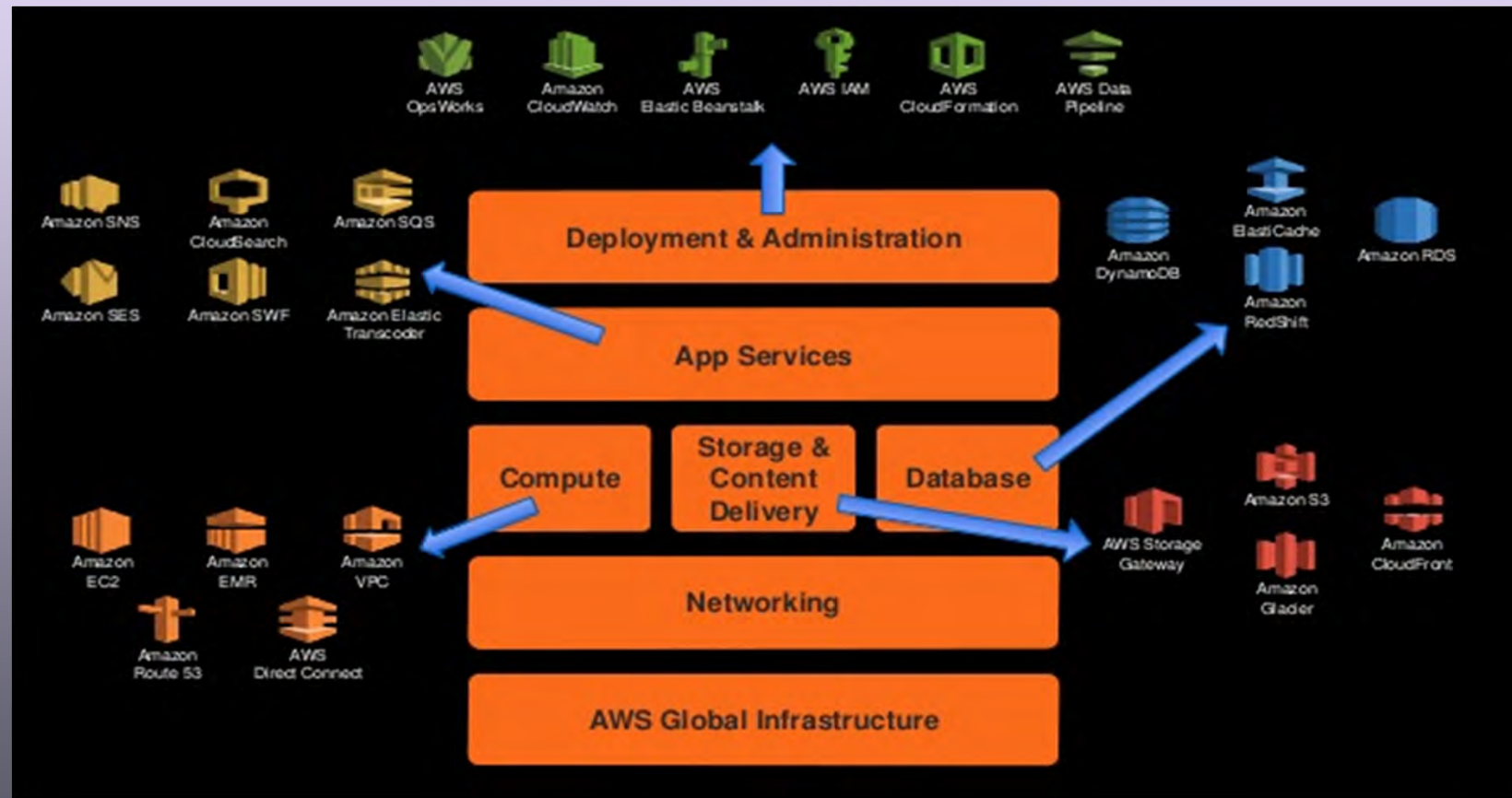
# What is AWS?

- ▶ AWS stands for Amazon Web Services
- ▶ AWS is an On-demand, self service provisioning of computing resources no human intervention.
- ▶ Full control on the entire stack – no abstraction.
- ▶ Pay by the hour.

# AWS Web Service Reference Model



# AWS Products with Reference Model





# AWS Global Infrastructure

10 Regions  
25 Availability Zones  
51 Edge Locations



# AWS Console

The screenshot shows the AWS Management Console interface. At the top, there's a navigation bar with 'Services' and 'Edit' dropdowns, and user information 'Anand Tirumani' in 'N. Virginia' region. Below this is a grid of service categories: Compute & Networking (Direct Connect, EC2, Route 53, VPC, WorkSpaces), Storage & Content Delivery (CloudFront, Glacier, S3, Storage Gateway), Database (DynamoDB, ElastiCache, RDS, Redshift), Deployment & Management (CloudFormation, CloudTrail, CloudWatch, Elastic Beanstalk, IAM, OpsWorks), Analytics (Data Pipeline, Elastic MapReduce, Kinesis), and App Services (AppStream, CloudSearch, Elastic Transcoder, SES, SNS, SQS, SWF). To the right, there are sections for 'Additional Resources' (Getting Started, Trusted Advisor), 'Service Health' (All services operating normally), and 'Set Start Page' (Console Home). At the bottom right is a box for 'AWS Marketplace'.

File Edit View History Bookmarks Tools Help

AWS Management Console x AWS Simple Icons x Architecture cible VMware ... x +

https://console.aws.amazon.com/console/home?region=us-east-1

Most Visited Getting Started

Services Edit

Anand Tirumani N. Virginia Help

## Amazon Web Services

### Compute & Networking

- Direct Connect**  
Dedicated Network Connection to AWS
- EC2**  
Virtual Servers in the Cloud
- Route 53**  
Scalable Domain Name System
- VPC**  
Isolated Cloud Resources
- WorkSpaces**  
Desktops in the Cloud

### Storage & Content Delivery

- CloudFront**  
Global Content Delivery Network
- Glacier**  
Archive Storage in the Cloud
- S3**  
Scalable Storage in the Cloud
- Storage Gateway**  
Integrates On-Premises IT Environments with Cloud Storage

### Database

- DynamoDB**  
Predictable and Scalable NoSQL Data Store
- ElastiCache**  
In-Memory Cache
- RDS**  
Managed Relational Database Service
- Redshift**  
Managed Petabyte-Scale Data Warehouse Service

### Deployment & Management

- CloudFormation**  
Templated AWS Resource Creation
- CloudTrail**  
User Activity and Change Tracking
- CloudWatch**  
Resource and Application Monitoring
- Elastic Beanstalk**  
AWS Application Container
- IAM**  
Secure AWS Access Control
- OpsWorks**  
DevOps Application Management Service

### Analytics

- Data Pipeline**  
Orchestration for Data-Driven Workflows
- Elastic MapReduce**  
Managed Hadoop Framework
- Kinesis**  
Real-time Processing of Streaming Big Data

### App Services

- AppStream**  
Low Latency Application Streaming
- CloudSearch**  
Managed Search Service
- Elastic Transcoder**  
Easy-to-use Scalable Media Transcoding
- SES**  
Email Sending Service
- SNS**  
Push Notification Service
- SQS**  
Message Queue Service
- SWF**  
Workflow Service for Coordinating Application Components

### Additional Resources

#### Getting Started

See our documentation to get started and learn more about how to use our services.

#### Trusted Advisor

Best practice recommendations to save money, improve fault tolerance, increase performance, and close security gaps.

### Service Health

All services operating normally.

Updated: May 28 2014 11:24:00 GMT-0400

[Service Health Dashboard](#)

### Set Start Page

Console Home

### AWS Marketplace

Find & buy software, launch with 1-Click and pay by the hour.

# Amazon Storage Services

**Amazon EBS**  
Block storage for use  
with Amazon EC2



**Amazon S3**  
Internet scale  
storage via API



**Amazon Glacier**  
Storage for archiving  
and backup



**AWS Storage Gateway**  
Integrates on-premises  
IT and AWS storage



# What is Amazon S3?

- ▶ S3 stands for Simple Storage Service.
- ▶ Remote data storage, it is storage for Internet.
- ▶ No up-front costs
- ▶ High-availability
- ▶ High bandwidth
  - ❖ Uses Amazon's own networking infrastructure
- ▶ Provided via a web service interface. (REST and SOAP)

# S3 Database Structure

► You must have S3 account id

► Buckets

- ❖ Equivalent of directories
- ❖ Single, common namespace across S3
- ❖ But bucketNames can include “/”, eg.,  
mgateway/backups/presentations



► Objects

- ❖ Equivalent to files
- ❖ Up to 5 Gb in size
- ❖ Identified by key (== filename)



► Objects can be made available to public by the http or bittorrent protocol.

# Functions & concepts of S3

- ▶ Buckets are similar to Internet domain names.  
They are accessed via  
bucket name.s3.amazonaws.com
- ▶ A key is the unique identifier for an object within a bucket.
- ▶ A bucket and a key together uniquely identify each object in S3. Every object can be addressed through bucket and key combination.
- ▶ For example, if your bucket name is mybucket and key is my homepage.html, the URL for the object will be <http://mybucket.s3.amazonaws.com/myhomepage.html>



# Advantages of using S3

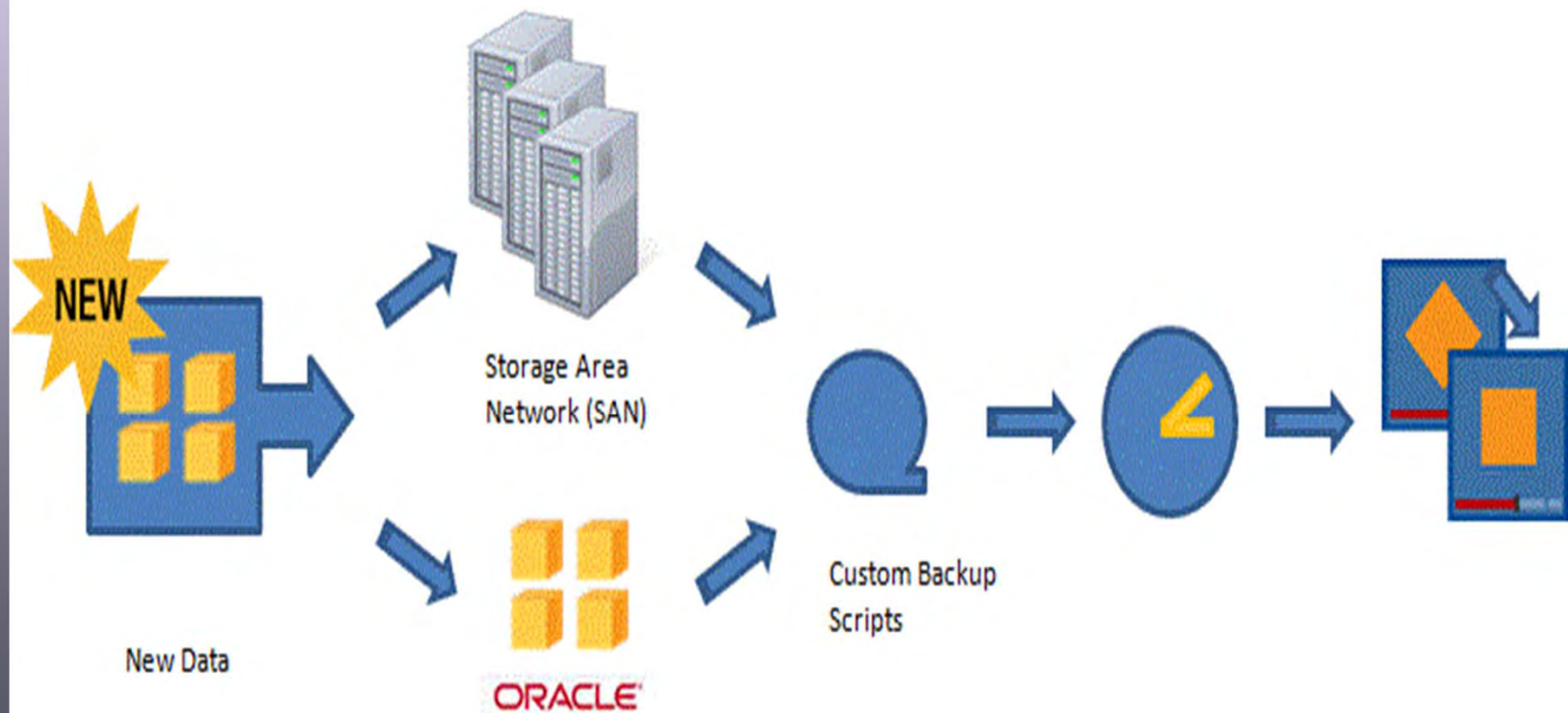
- ▶ Scalability. The amount of storage & bandwidth you need can scale as you like without any configuration changes needed.
- ▶ Availability, speed, throughput, capacity, and robustness is not affected even if you gain 10,000 users overnight.
- ▶ Unlimited storage. You pay as you go.
- ▶ Inexpensive and no capital outlay. Great for startups!
- ▶ Data is accessible from any location.
- ▶ Since it is based on the Amazon infrastructure, it is probably more reliable than other cheap data storage providers.

# S3: Uses

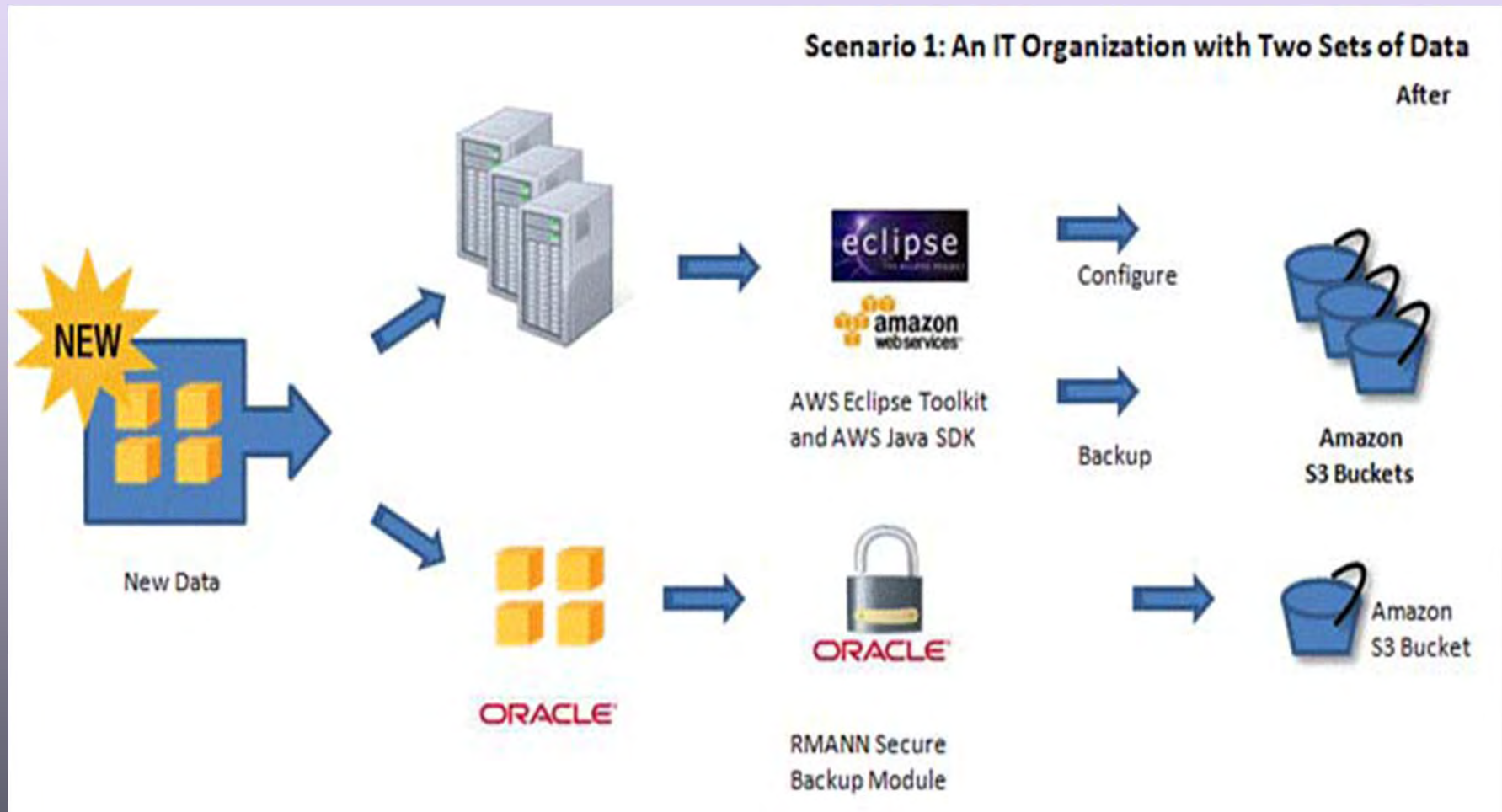
- ▶ Remote Backup
- ▶ Archiving
- ▶ Primary online storage
- ▶ Examples
  - ❖ SmugMug (Similar to Flickr)
    - ❖ Photos saved in S3 storage
    - ❖ Estimated to have saved \$1m in storage costs
  - ❖ Pluggable Storage Engine for MySQL:
    - ❖ Made available as tables and rows in MySQL

# S3 Use Case 1 without S3

Scenario 1: An IT Organization with Two Sets of Data  
Before



# S3 Use Case 1 with S3



## S3 Use Case 2

### Scenario 3: An IT Organization with a Large Data Warehouse

Before



High CPU  
Extra Large



10 x 800 GB  
EBS Volumes

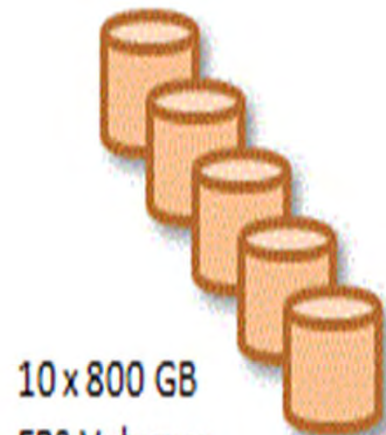
# S3 Use Case 2 with S3 with hourly snapshot

## Scenario 3: An IT Organization with a Large Data Warehouse

After



High CPU  
Extra Large  
Amazon EC2  
Instance



10 x 800 GB  
EBS Volumes



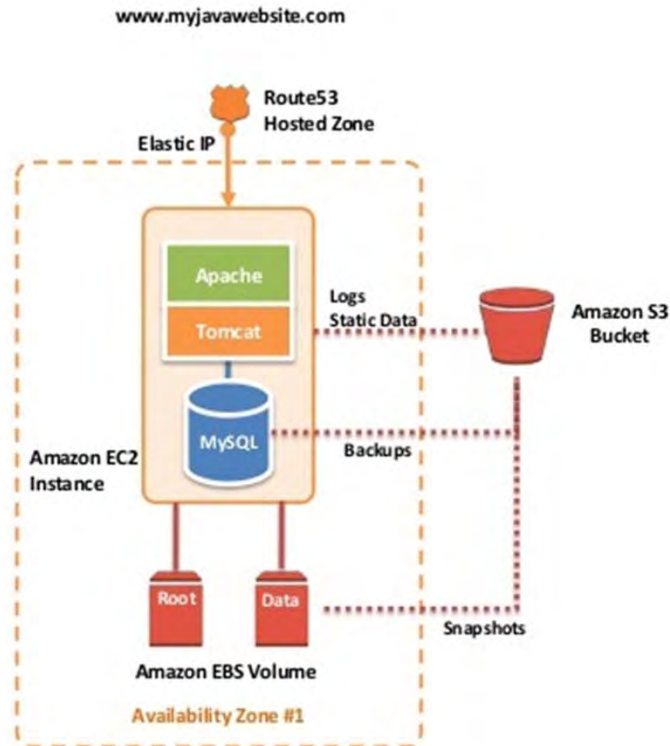
Snapshot  
Application



Amazon S3  
Buckets



# S3 Use Case 3



# Requirements

- ▶ To get started using S3, an AWS account is needed. An AWS account is simply an Amazon.com account that has AWS services enabled.
- ▶ Sign up at <https://aws.amazon.com>
- ▶ After creating the AWS account, you need to sign up for S3 by clicking the sign up for S3 web service button.
- ▶ A credit card needs to be associated with the account.
- ▶ You will be given a Access Key ID and secret Access Key on successful creation. (note: they are not emailed to you.)

# Accessing S3 using S3 Browser from windows machine

- ▶ Download S3 Browser from the link below:  
<http://s3browser.com/download.php>
- ▶ Add the Amazon account you want to access in the S3 Browser.
- ▶ S3 Browser is free for personal use.
- ▶ For Commercial use, must purchase pro license which is \$29.95 for single license for life.

# Add/Edit an account to access S3

**Edit Account** [online help](#)

Edit account details and click Save changes

Account Name:  
[Redacted]  
You can assign any name to your account. S3 Browser uses it to distinguish one account from another.

Access Key ID:  
[Redacted]  
Access Key ID can be found here: [https://console.aws.amazon.com/iam/home?#security\\_credential](https://console.aws.amazon.com/iam/home?#security_credential)

Secret Access Key:  
[Redacted]  
Secret Access Key can be found here: [https://console.aws.amazon.com/iam/home?#security\\_credential](https://console.aws.amazon.com/iam/home?#security_credential)

☐ Encrypt Access Keys with a password:  
[Redacted]  
Turn this option on if you want to protect your Access Keys with a master password.

[Advanced...](#) [Click here to sign up for Amazon S3.](#)

10:26 AM 6/1/2014

# Pricing

- ▶ Charges for using S3 is based on the location of your buckets.
- ▶ You are billed according to storage(average), data transfer in and out and the number of requests per month.
- ▶ There is no minimum fee to use S3, you pay for only what you use.
- ▶ You can view your current charges incurred almost immediately on the S3 portal.
- ▶ Detailed usage reports can also be downloaded in xml or csv format.



# Pricing – US usage

## ► **Storage**

- \$0.150 per GB – first 50 TB / month of storage used
- \$0.140 per GB – next 50 TB / month of storage used
- \$0.130 per GB – next 400 TB / month of storage used
- \$0.120 per GB – Storage used / month over 500 TB

## ► **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

- For more pricing details please visit  
<http://aws.amazon.com/s3/pricing>

# Cost Breakdown for a basic static web site architecture

- ▶ **Storage**

0.001 GB / month (20 JPEG files(objects))

- ▶ **Requests**

PUT Requests: 20 / month

GET Requests: 2000 / month

- ▶ **Data Transfer**

Data out: 0.1 GB / month (Assuming average object size 50 KB and we make 2000 requests per month.

- ▶ **Estimated Monthly Bill using calculator**

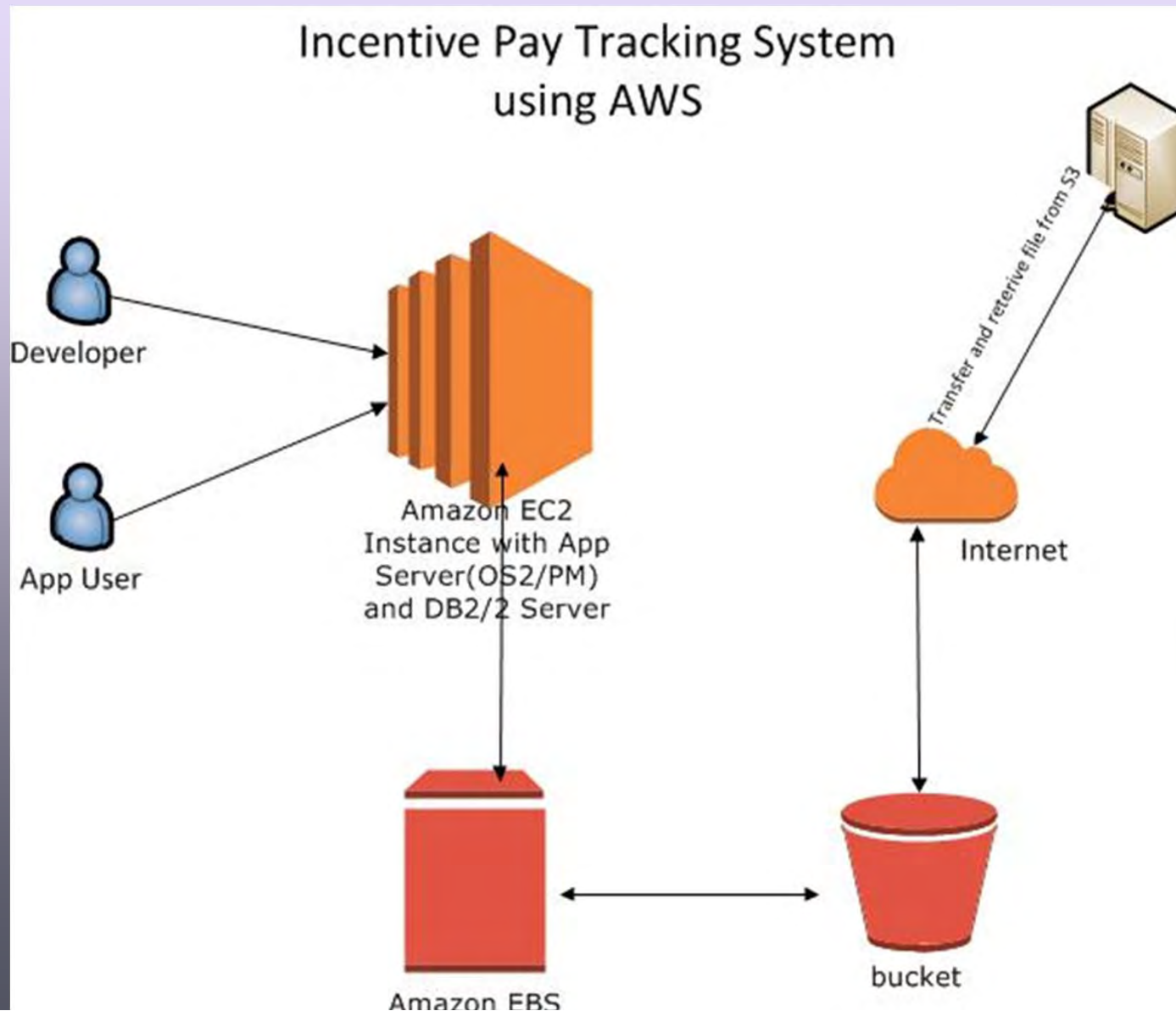
\$5.22

- ▶ For more pricing details for static web site hosting please visit <http://docs.aws.amazon.com/gettingstarted/latest/static-website-hosting-pricing-s3.html>

# Analysis of Different Storage Service

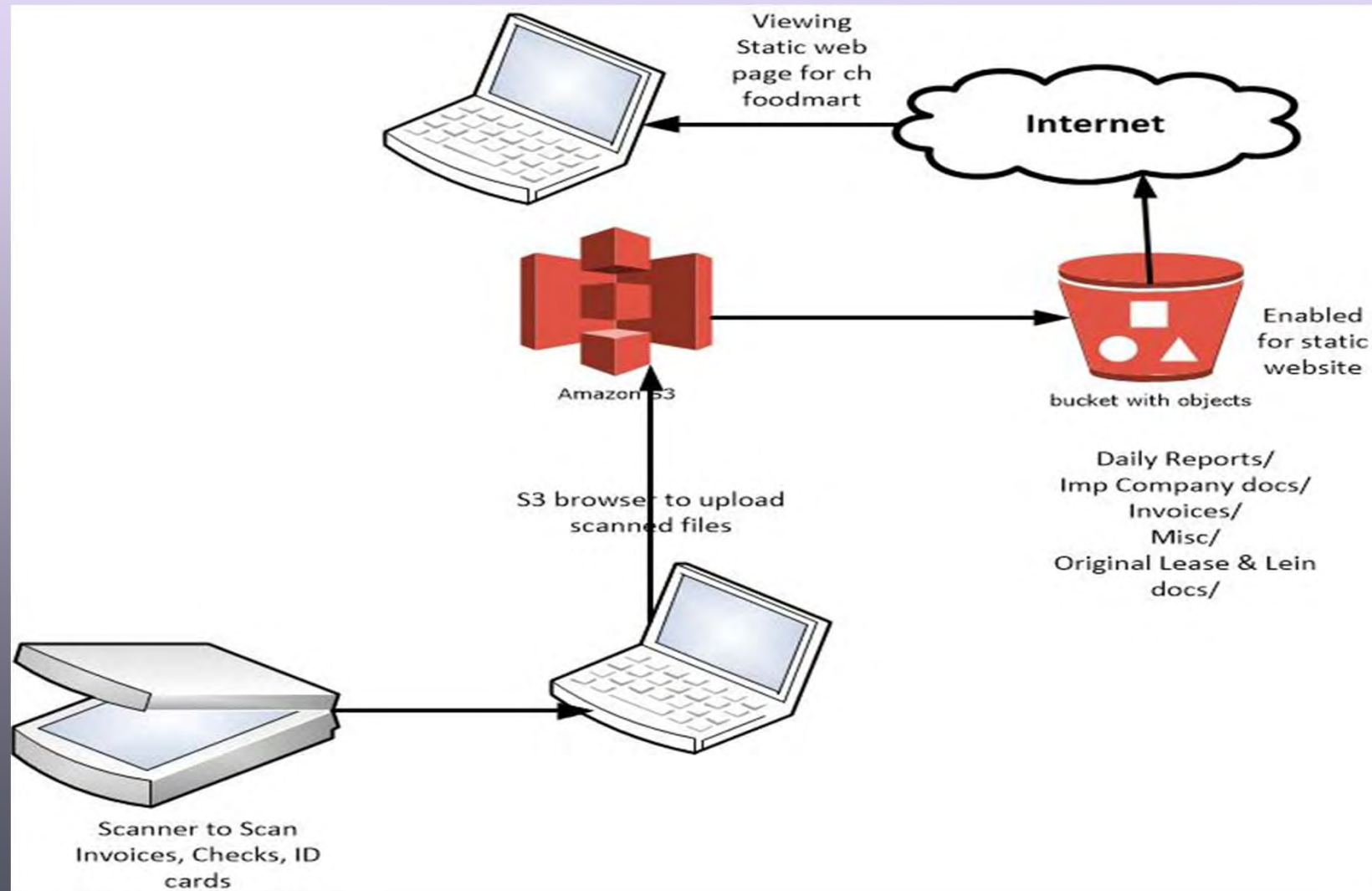
Characteristics	Amazon s3	Google Drive	Microsoft Sky Drive	Drop Box	iCloud
Free Storage	5 GB	5 GB	7 GB	2 GB	5 GB
Cost for 25 GB/moth	\$0.75	\$2.49	0.83 (27 GB)	\$9.99	\$3.33
Cost for 50 GB/month	\$1.50	\$4.99	\$2.08 (52 GB)	\$9.99	\$8.33
Advantages	Cheap, Easy to upload, scalability	Use of collaborators, Remote accessibility, Various types of files	Free online storage, Remote accessibility, use of microsoft office tools	Public sharing, Mobile drop box, Backup files	Back up and restore data in apple devices, quick, back up a lot of applications
Disadvantages	Need special Amazon Explorer app to browse back up files like Backup4all	Supports only 15 file formats	Lacks sophisticated admin tools	No third party can have access to the data or developer	Only compatible with IOS devices and has widespread accessibility issues

# My first project Architecture diagram



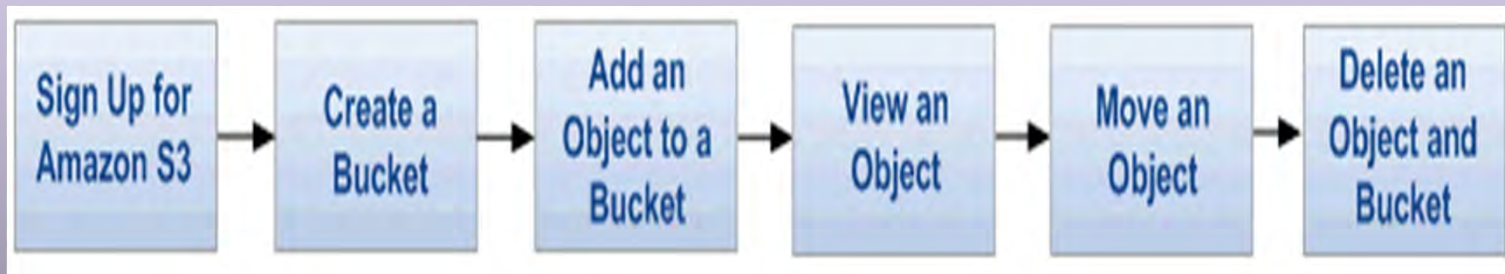
DEMO

# Simple Architecture diagram for a retail store use case of AWS S3





# Get Started with Amazon Simple Storage Service



# References

- ▶ Wikipedia [http://en.wikipedia.org/wiki/Cloud\\_computing](http://en.wikipedia.org/wiki/Cloud_computing)
- ▶ Analysts reports on AWS Services  
<https://aws.amazon.com/resources/analyst-reports/>
- ▶ Above the Clouds: A Berkeley View of Cloud Computing  
<http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf>
- ▶ How Cloud Computing Is Changing the World  
<http://www.theguardian.com/media-network/media-network-blog/2013/sep/24/cloud-computing-changing-world-healthcare>  
[http://www.businessweek.com/technology/content/aug2008/tc2008082\\_445669.htm](http://www.businessweek.com/technology/content/aug2008/tc2008082_445669.htm)

# Conclusion

- ▶ Cloud Computing is outpacing the IT industry
- ▶ Real business value can be realized by customers of all sizes
- ▶ Cloud solutions are simple to acquire, don't require long term contracts and are easy to scale up and down as needed.
- ▶ Proper planning and migration services are needed to ensure a successful implementation.
- ▶ Public and Private Clouds can be deployed to leverage the best of both.

Thanking You  
Queries?..

