

Cloud

What is cloud

METAPHOR: FOR A USER, THE NETWORK ELEMENTS REPRESENTING THE PROVIDER-RENDERED SERVICES ARE INVISIBLE, AS IF OBSCURED BY A CLOUD.

Motivation

Traditionally:

- Purchasing racks of servers
- Deploying server side OS distribution
- Monitor and maintenance
- Deal with frequent failure

CAPEX model:

- buy the dedicated hardware as **capital expense**
- **depreciate** it over a period of time

Motivation

Company seek:

- sharing of resources to achieve **coherence** and **economies of scale**
- avoid upfront **infrastructure costs**
- improved **manageability** and less maintenance
- **rapidly adjust** resources to meet fluctuating business demand

OPEX model:

- use a shared cloud infrastructure
- pay **operating expense** as one uses it

“New Concept”

1970s

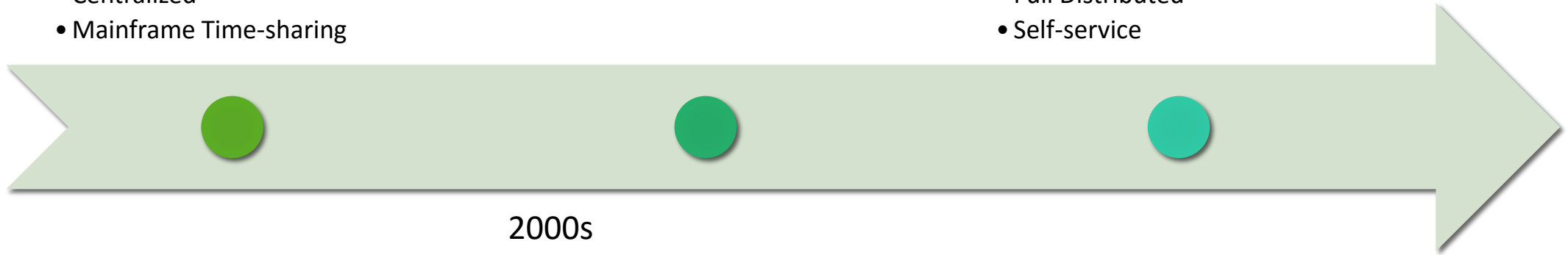
- “Extreme Uptime” (99.9999%)
- Expensive Custom Hardware
- Centralized
- Mainframe Time-sharing

2010+

- “Design for failure” (Always up)
- Cheap “Commodity” Hardware
- Full Distributed
- Self-service

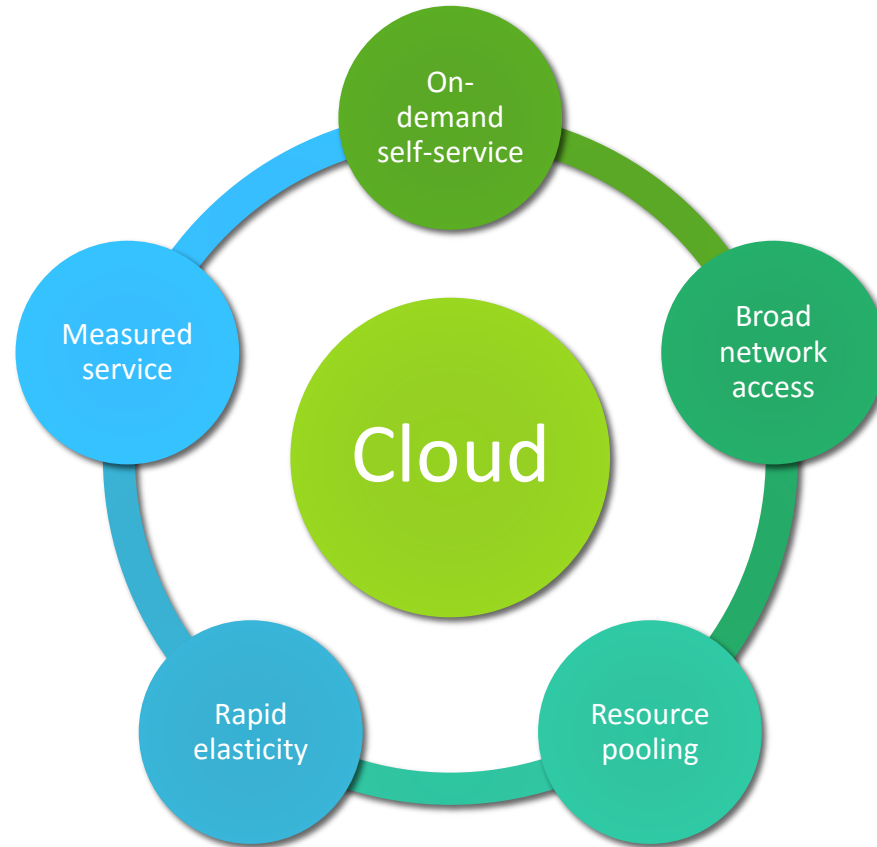
2000s

- “Design for failover”
- High-end “Commodity” Hardware
- Decentralized
- Service sharing



Characteristics

*Source:
National Institute of
Standards and
Technology*



Advantage

Agility

- Rapid adapting
- Easy scaling
- Peak-load ability

Cost Efficient

- Low entry barrier
- utilization efficiency

Reliability

- Fail safe mechanism
- Designed redundancy
- Maintenance

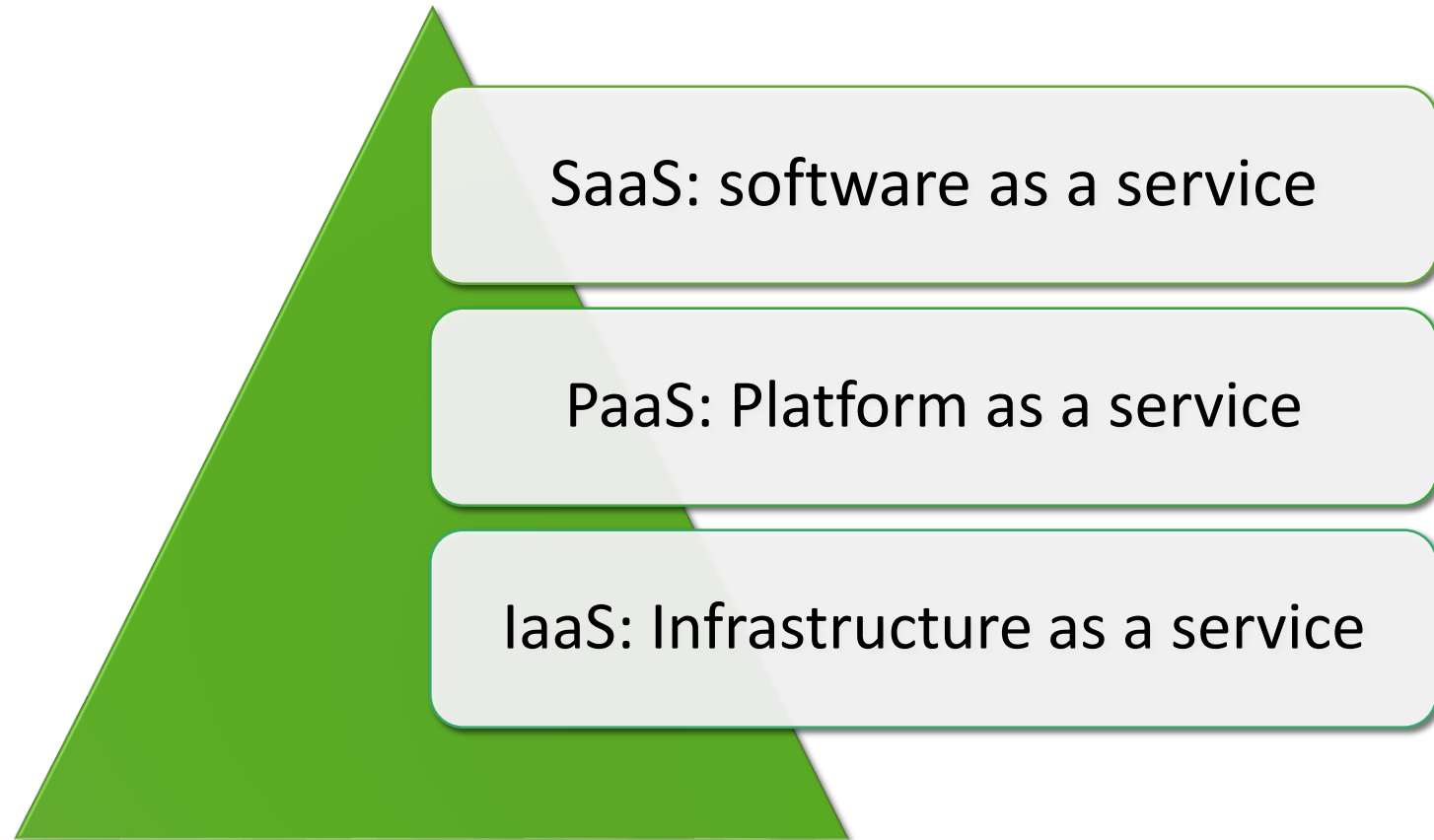
Security

- Devote resource for security
- Configurable control over content

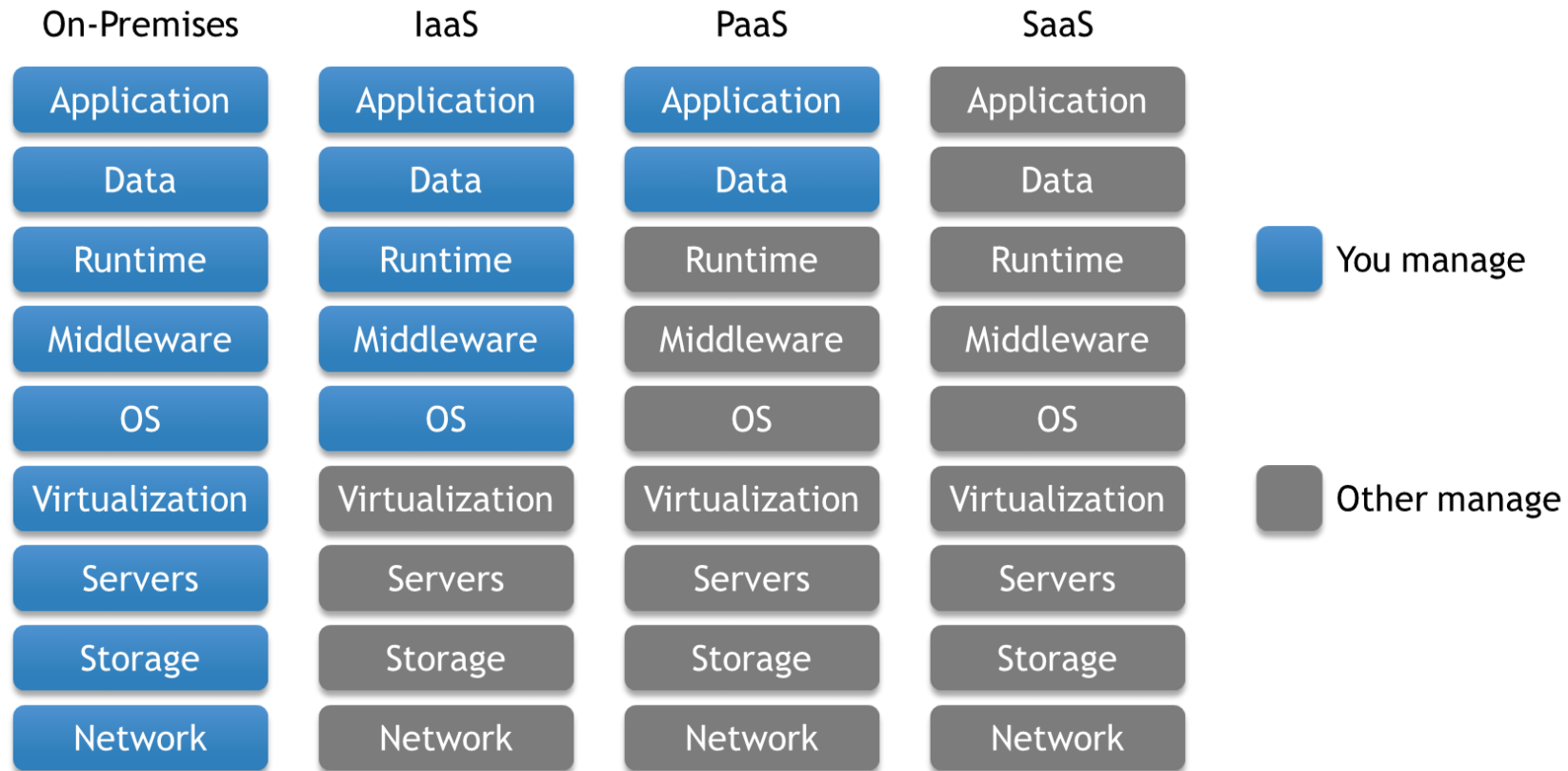
How can we use cloud

KNOW WHO AND HOW TO ORDER YOUR CLOUD

Service Model



Service Model



Market Leaders:

- [illegible]

Source: CloudTimes

Deployment Model

Public Cloud: services are rendered over a network that is **open for public use**

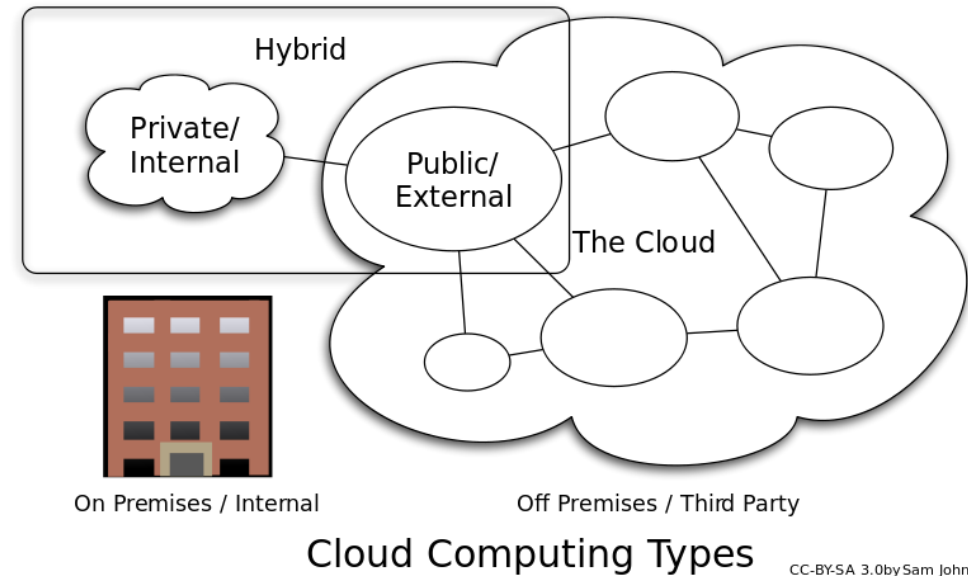
- E.g. AWS, Azure

Private Cloud: cloud infrastructure operated solely **for a single organization**

- E.g. Open Stack, Cisco

Hybrid Cloud: public cloud and private cloud build **remain distinct** entities but are **bound together**

- E.g. Eucalyptus



Source: Sam Johnston

Peek inside the cloud

A.K.A CLOUD PRODUCT/SERVICE HARD COMMERCIAL

AWS

IAAS

AWS (Amazon Web Services: What are they?)



Amazon Web Services is a bundled remote computing service that provides cloud computing infrastructure over the internet with storage, bandwidth and customized support for application programming interfaces (API).

Launched in 2006.



Database

DynamoDB

Predictable and Scalable NoSQL Data Store

ElastiCache

In-Memory Cache

RDS

Managed Relational Database

Redshift

Managed Petabyte-Scale Data Warehouse

Storage & CDN

S3

Scalable Storage in the Cloud

EBS

Networked Attached Block Device

CloudFront

Global Content Delivery Network

Glacier

Archive Storage in the Cloud

Storage Gateway

Integrates On-Premises IT with Cloud Storage

Import Export

Ship Large Datasets

Cross-Service

Support

Phone & email fast-response 24X7 Support

Marketplace

Buy and sell Software and Apps

Management Console

UI to manage AWS services

SDKs, IDE kits and CLIs

Develop, integrate and manage services

Analytics

Elastic MapReduce

Managed Hadoop Framework

Kinesis

Real-Time Data Stream Processing

Data Pipeline

Orchestration for Data-Driven Workflows

Compute & Networking

EC2

Virtual Servers in the Cloud

VPC

Virtual Secure Network

ELB

Load balancing Service

WorkSpaces

Virtual Desktops in the cloud

Auto Scaling

Automatically scale up and down

DirectConnect

Dedicated Network Connection to AWS

Route 53

Scalable Domain Name System

Deployment & Management

CloudFormation

Templated AWS Resource Creation

CloudWatch

Resource and Application Monitoring

Elastic Beanstalk

AWS Application Container

IAM

Secure AWS Access Control

CloudTrail

User Activity Logging

OpsWorks

DevOps Application Management Service

CloudHSM

Hardware-based key storage for compliance

App Services

CloudSearch

Managed Search Service

Elastic Transcoder

Easy-to-use Scalable Media Transcoding

SES

Email Sending Service

SNS

Push Notification Service

SQS

Message Queue Service

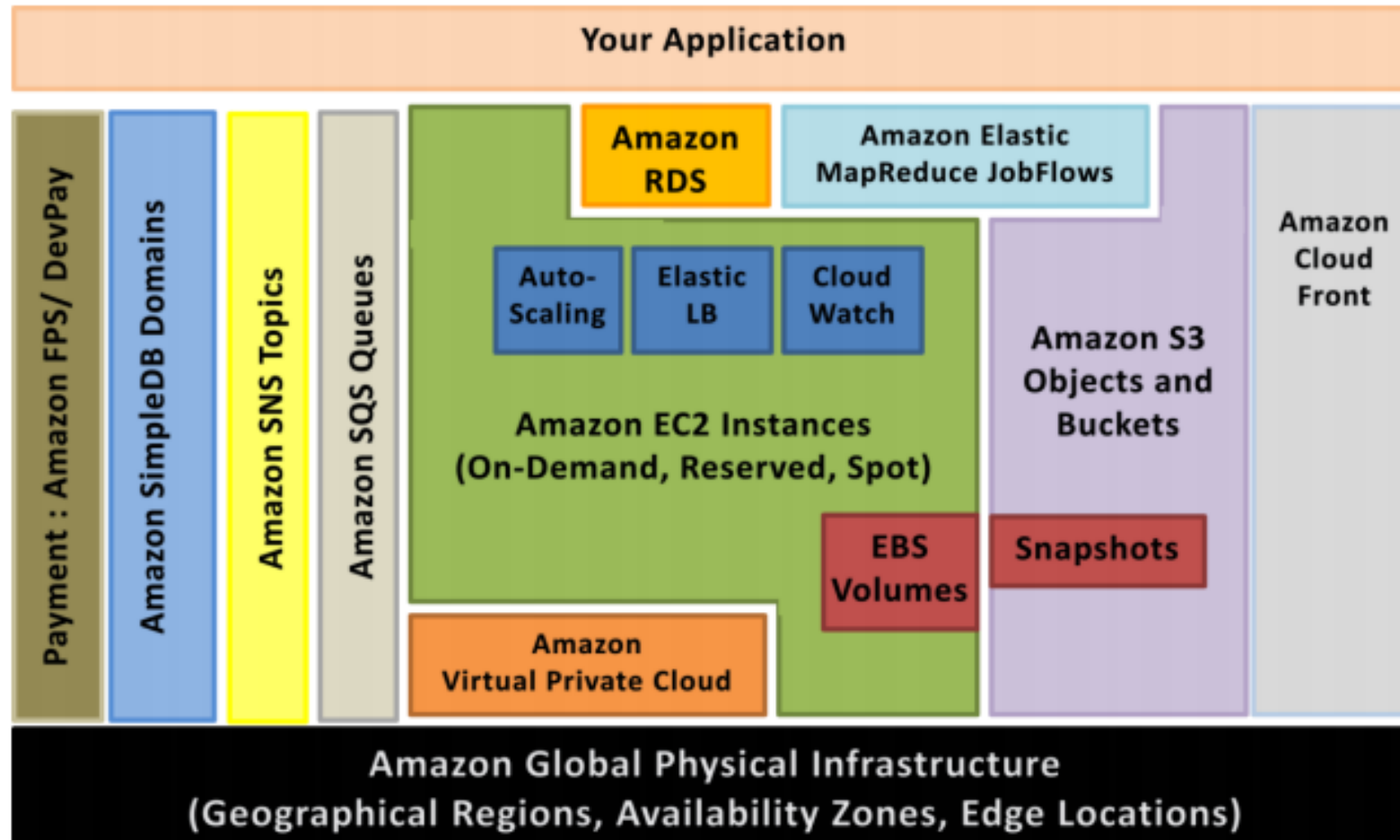
SWF

Workflow Service for Coordinating App Components

AppStream

Low-latency Application Streaming

AWS



Compute & Networking

Amazon Elastic Computing Cloud (AWS EC2)

Central part of AWS cloud computing platform.

Users rent virtual computers on which to run their own computer applications.

Scalable deployment of application by providing “instance” (AMI).

Elastic --- on-demand use and payment.

Storage & Content Delivery Network

Amazon Elastic Block Storage (Amazon EBS)

Block storage attached to EC2 instance

Attach multiple volumes to one instance

Durable, point-in-time snapshots

Easily detach from one instance and attach to another

Provision a specific level of I/O performance if desired

Storage & Content Delivery Network

Amazon Simple Storage Service (Amazon S3)

Object storage for the Internet

An object can be up to 5TB

Each object is stored in a bucket and retrieved via a unique, developer-assigned key

Unlimited storage, unlimited objects

Natively online, HTTP/S access

99.999999% durability via replication across multiple Availability Zones in a region.

AWS S3 Use Case

Backup

Content Storage and Distribution

Big Data Analytics

Static Website Hosting

Cloud-native Application Data

Disaster Recovery

Basic structure of a AWS EC2

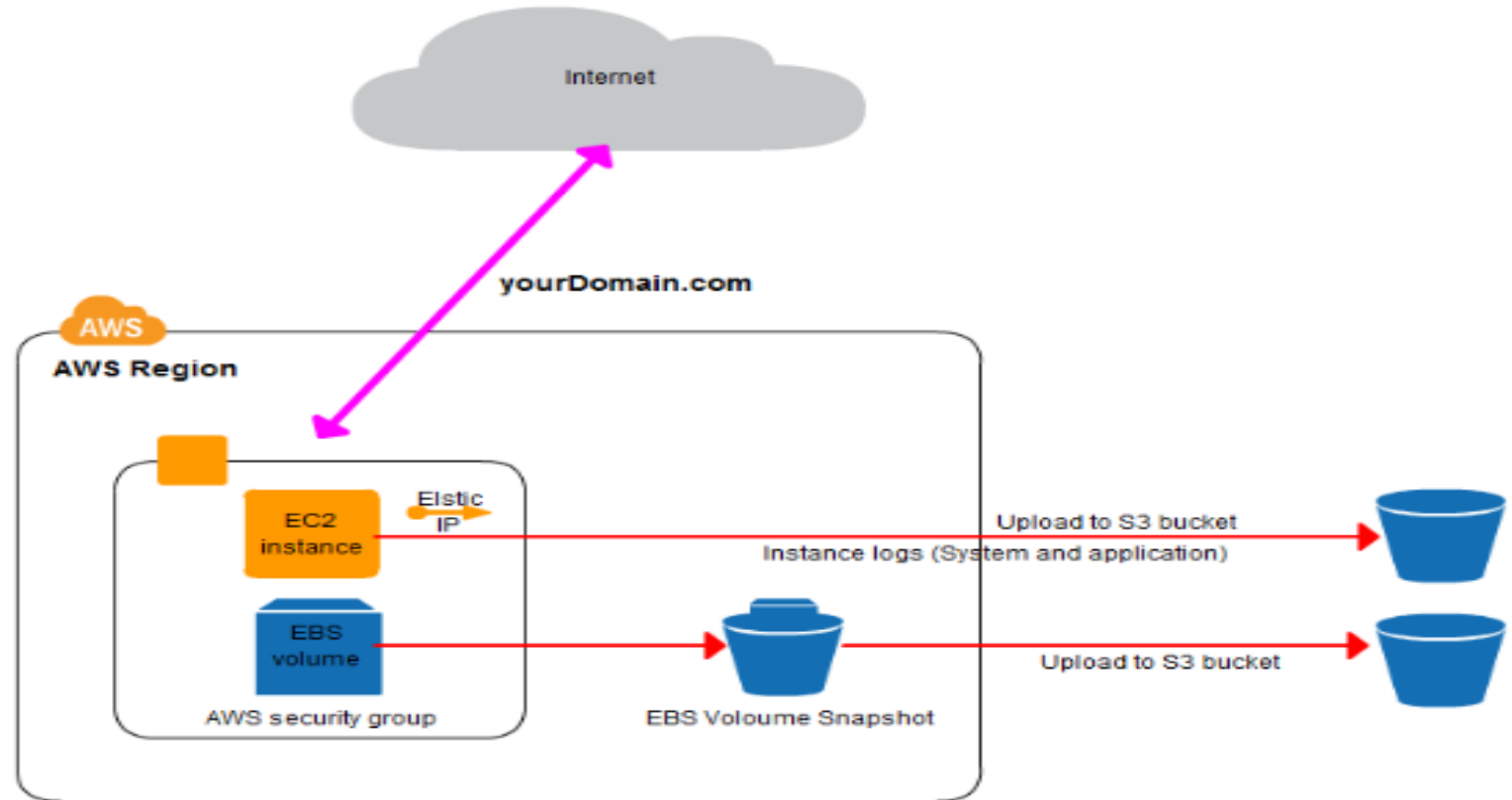
Instances

Xen virtualization

Each virtual machine ->
"Instance"

3 tpyes

- On-demand
- Reserved
- Spot



Running Spark on EC2

<http://spark.apache.org/docs/1.2.0/ec2-scripts.html>

```
ubuntu@ip-172-31-42-94: ~/spark-1.2.0
15/06/12 19:31:44 INFO Utils: Successfully started service 'HTTP class server' on port 50515.
Welcome to

  ____  __
 / ___/ /  _ \
 \___ \|  / __>
  ___/ _ \|  __/
 /___/_\|____|
              version 1.2.0

Using Scala version 2.10.4 (OpenJDK 64-Bit Server VM, Java 1.7.0_79)
Type in expressions to have them evaluated.
Type :help for more information.
15/06/12 19:31:56 INFO SecurityManager: Changing view acls to: ubuntu
15/06/12 19:31:56 INFO SecurityManager: Changing modify acls to: ubuntu
15/06/12 19:31:56 INFO SecurityManager: SecurityManager: authentication disabled; ui acls disabled; use
rs with view permissions: Set(ubuntu); users with modify permissions: Set(ubuntu)
15/06/12 19:31:58 INFO Slf4jLogger: Slf4jLogger started
15/06/12 19:31:58 INFO Remoting: Starting remoting
15/06/12 19:31:58 INFO Remoting: Remoting started; listening on addresses :[akka.tcp://sparkDriver@ip-1
72-31-42-94.ec2.internal:33960]
15/06/12 19:31:58 INFO Utils: Successfully started service 'sparkDriver' on port 33960.
15/06/12 19:31:59 INFO SparkEnv: Registering MapOutputTracker
15/06/12 19:31:59 INFO SparkEnv: Registering BlockManagerMaster
15/06/12 19:31:59 INFO DiskBlockManager: Created local directory at /tmp/spark-local-20150612193159-084
5
15/06/12 19:31:59 INFO MemoryStore: MemoryStore started with capacity 267.3 MB
15/06/12 19:31:59 INFO HttpFileServer: HTTP File server directory is /tmp/spark-8c9594fb-49a7-484c-90a5
-73a181217d3a
15/06/12 19:31:59 INFO HttpServer: Starting HTTP Server
15/06/12 19:31:59 INFO Utils: Successfully started service 'HTTP file server' on port 42640.
15/06/12 19:32:00 INFO Utils: Successfully started service 'SparkUI' on port 4040.
15/06/12 19:32:00 INFO SparkUI: Started SparkUI at http://ip-172-31-42-94.ec2.internal:4040
15/06/12 19:32:00 INFO Executor: Using REPL class URI: http://172.31.42.94:50515
15/06/12 19:32:00 INFO AkkaUtils: Connecting to HeartbeatReceiver: akka.tcp://sparkDriver@ip-172-31-42-
94.ec2.internal:33960/user/HeartbeatReceiver
15/06/12 19:32:00 INFO NettyBlockTransferService: Server created on 45023
15/06/12 19:32:00 INFO BlockManagerMaster: Trying to register BlockManager
15/06/12 19:32:00 INFO BlockManagerMasterActor: Registering block manager localhost:45023 with 267.3 MB
RAM, BlockManagerId(<driver>, localhost, 45023)
15/06/12 19:32:00 INFO BlockManagerMaster: Registered BlockManager
15/06/12 19:32:01 INFO SparkILoop: Created spark context..
Spark context available as sc.

scala>
```

Running Spark on EC2

spark-ec2 script

- Located in Spark's ec2 directory
- Allow to launch, manage and shut down Spark clusters on EC2

Each cluster is identified by placing its machines into EC2 security groups whose names are derived from the name of the cluster.

Running Spark on EC2

AWS Setup

```
cd 600 <keypair_file>  
export AWS_ACCESS_KEY_ID=<>  
export WS_SECRET_ACCESS_KEY=<>
```

Launching a cluster

```
cd spark/ec2  
./spark-ec2 -i <keypair_file> -k<keypair_name> launch <cluster_name>
```

Accessing Data in S3

Spark's file interface allows it to process data in Amazon S3 using the same URI formats that are supported for Hadoop.

URI: `s3n://<bucket>/path`

Launch the Spark cluster with the option-copy-aws-credentials

Advantage

Flexible

Cost-effective

Scalable and elastic

Secure

Experienced

Disadvantage

Complicated

Maintenance

Azure

PAAS



Azure

What is Azure?

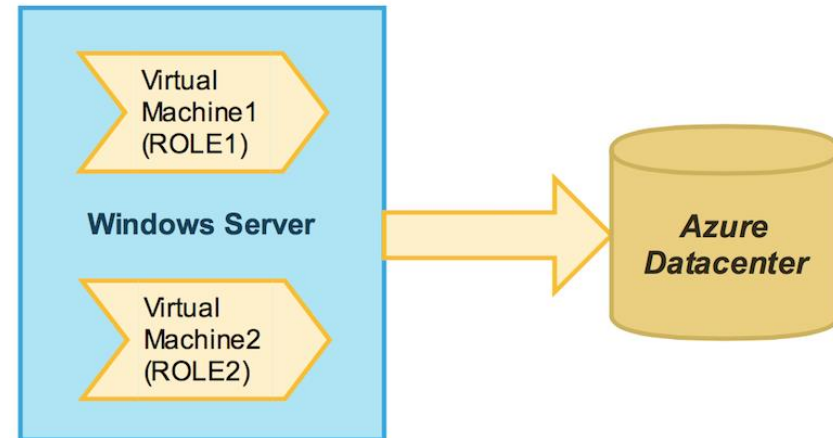
A Microsoft's cloud computing platform, a growing collection of integrated services—analytics, computing, database, mobile, networking, storage, and web.



Azure

Azure Cloud Applications provide two different types of roles as below:

- **Worker Role** is a piece of code that can run in the background and code will communicate with the Windows Azure using either .NET libraries or a REST interface.
- **Web Role** provides a single HTTP and HTTPS endpoint to your code (Similar to an ASP.NET application)



Azure

Use cases:

- Build a web application that runs and stores its data in Microsoft datacenters
- Help on-premises applications connect with each other
- Map between different sets identity information due to wide range of Azure services.

Azure

Launch a web application with WordPress installed

Microsoft Azure

jeremylee623@outlook.com

ALL ITEMS

WEB APPS
1

VIRTUAL MACHINES
0

MOBILE SERVICES
0

CLOUD SERVICES
0

SQL DATABASES
0

STORAGE
1

all items

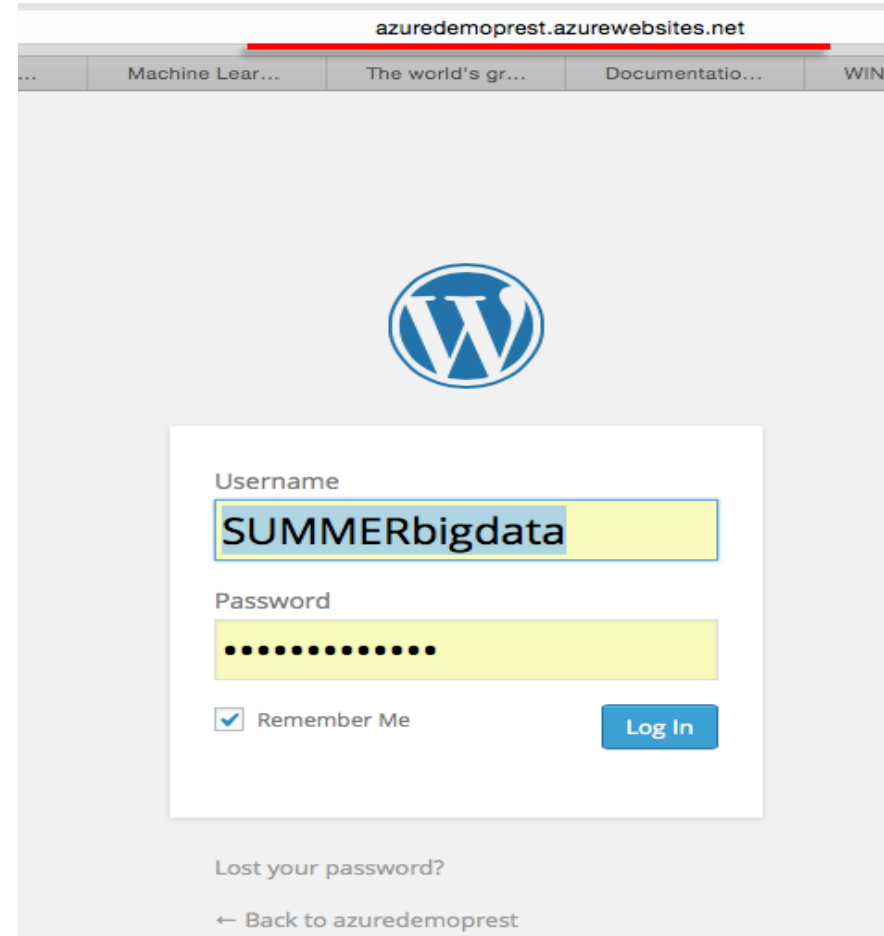
NAME	TYPE	STATUS	SUBSCRIPTION	LOCATION
summerbigdata →	Storage Account	✓ Online	Free Trial	South Central US
azuredemoprest	Web app	✓ Running	Free Trial	South Central US
Default Directory	Directory	✓ Active	Shared by all Default Dir...	United States
SUMMERbigdata	ML Workspace	✓ Online	Free Trial	South Central US

Azure

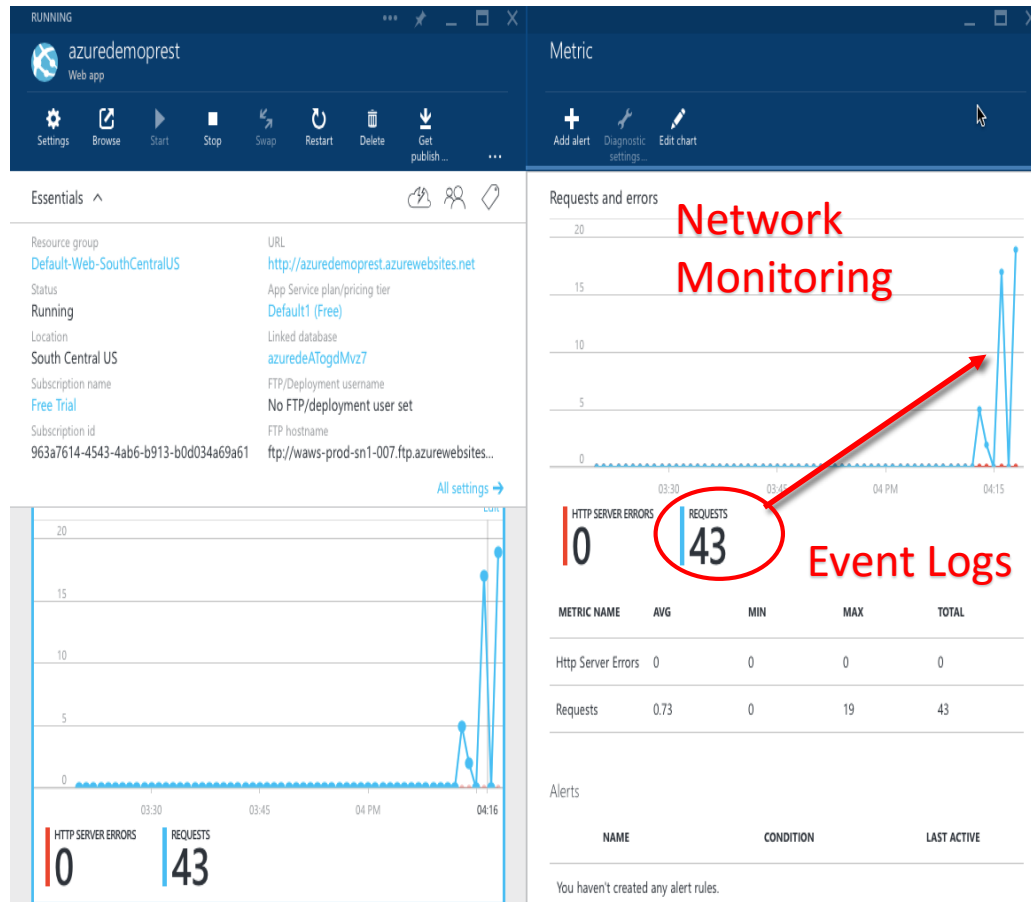
Deployed Web Application on Azure

[http://azuredemoprest.azurewebsites.net/
wp-login.php](http://azuredemoprest.azurewebsites.net/wp-login.php)

- Variety of open source sites and applications
- Deploy rapidly with just a few clicks
- Connect with MySQL database



Azure



azuredemoprest 1 0 + New Howdy, SUMMERbigdata

Dashboard

Welcome to WordPress!
We've assembled some links to get you started:

Get Started
Customize Your Site
or, change your theme completely

Next Steps

- Write your first blog post
- Add an About page
- View your site

More Actions

- Manage widgets or menus
- Turn comments on or off
- Learn more about getting started

At a Glance

- 1 Post
- 1 Page
- 1 Comment

WordPress 4.2.2 running Twenty Fifteen theme.
Search Engines Discouraged

Activity

Recently Published

Today, 8:17 pm Hello world!

Quick Draft

Title

What's on your mind?

Save Draft

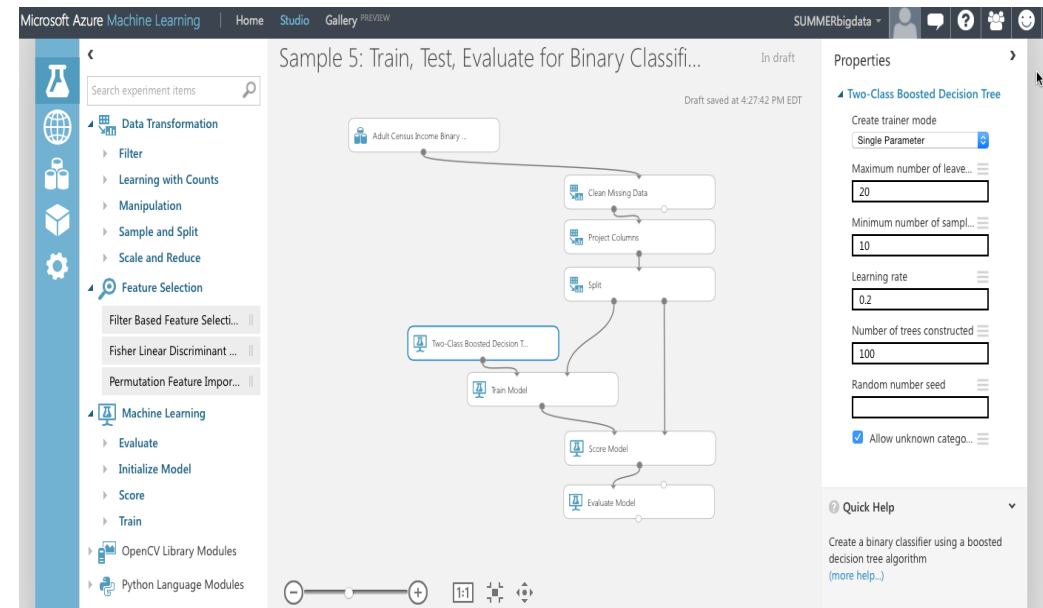
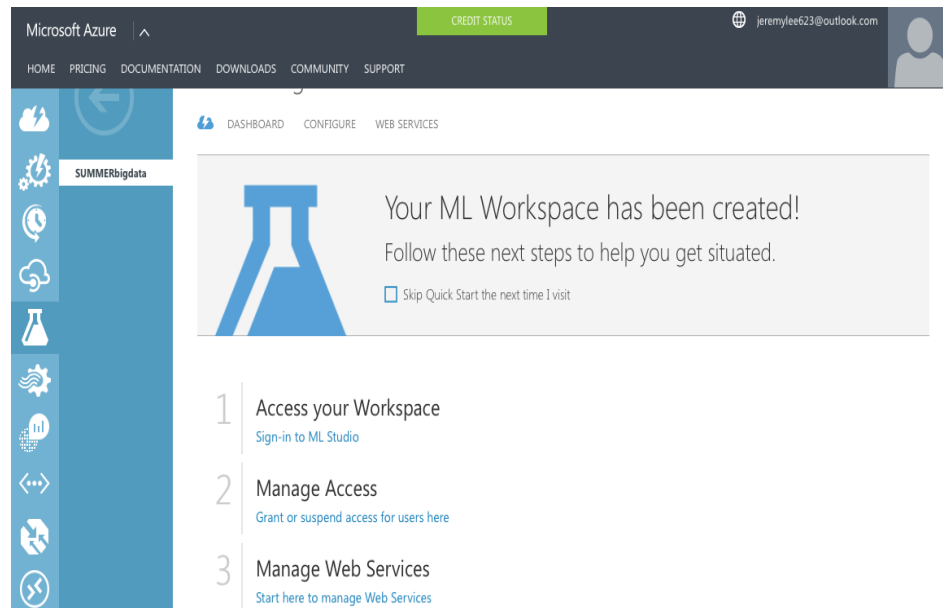
WordPress News

Adding plugins from the WordPress Dashboard
All that work can be finished on such a good PaSS!

Azure ML

Azure Machine Learning

We created the ML workspace studio, then chose the datasets from sample and execute every step in chart flow.



Azure

Azure's Performance

Strengthens	Weakness
Lower application lifecycle costs	Loss of account control to Microsoft
Greater pool of development resources	Increased competition for development resources
Faster deployment times and client adoption	Increased self-hosting and integration costs

Salesforce CRM

SAAS

Component



The screenshot shows the Salesforce interface for an Opportunity record titled "Buy more generators". The page includes a navigation bar with tabs like Home, Chatter, Campaigns, Leads, Accounts, Contacts, Opportunities (selected), Forecasts, Contracts, Orders, Cases, Solutions, Products, Reports, and Dashboards. A left sidebar shows a "Recent Items" list and a "Recycle Bin" button. The main content area displays the "Opportunity Detail" with fields for Opportunity Owner (Chris Waters), Private checkbox, Opportunity Name (Buy more generators), Account Name (Mikes Bikes), Type (Existing Customer - Upgrade), Lead Source, Order Number, Current Generator(s), Tracking Number, Created By (Chris Waters), Description, Custom Links (Delivery Status), Amount (\$2,500.00), Expected Revenue (\$1,250.00), Close Date (3/27/2015), Next Step, Stage (Value Proposition), Probability (50%), Primary Campaign Source, Main Competitor(s), and Delivery/Installation Status. Below the details is a section for "Aha! Ideas" with a table of linked ideas.

Actions	Idea #	Idea Name	Status	Linked By
View Del	FREDBIKES-I-41	Suggest rides based on my history	Needs review	Chris Waters
View Del	FREDBIKES-I-100	Add a uni-cycle model	Planned	Chris Waters

Source: support.aha.io

Strength/Weakness



Strength

- Easier usage for non-engineering personnel
- No configuration or deployment
- Full service support



Weakness

- Lower control over functionality
- Security concern about data
- Limit by network accessibility

Eucalyptus

HYBRID CLOUD

Simple Facts

Open source software for building AWS-compatible private clouds

- github.com/eucalyptus

Acronym: “Elastic Utility Computing Architecture, Linking Your Programs To Useful Systems”

Brought by HP, part of HP Helion

Partner with Amazon, maintain compatibility with AWS:

- Interface: EC2, IAM, S3, Auto Scaling, Elastic Load Balancing
- Tool: s3cmd, AWS Ruby SDK, Eclipse Toolkit

Architecture

Cloud level:

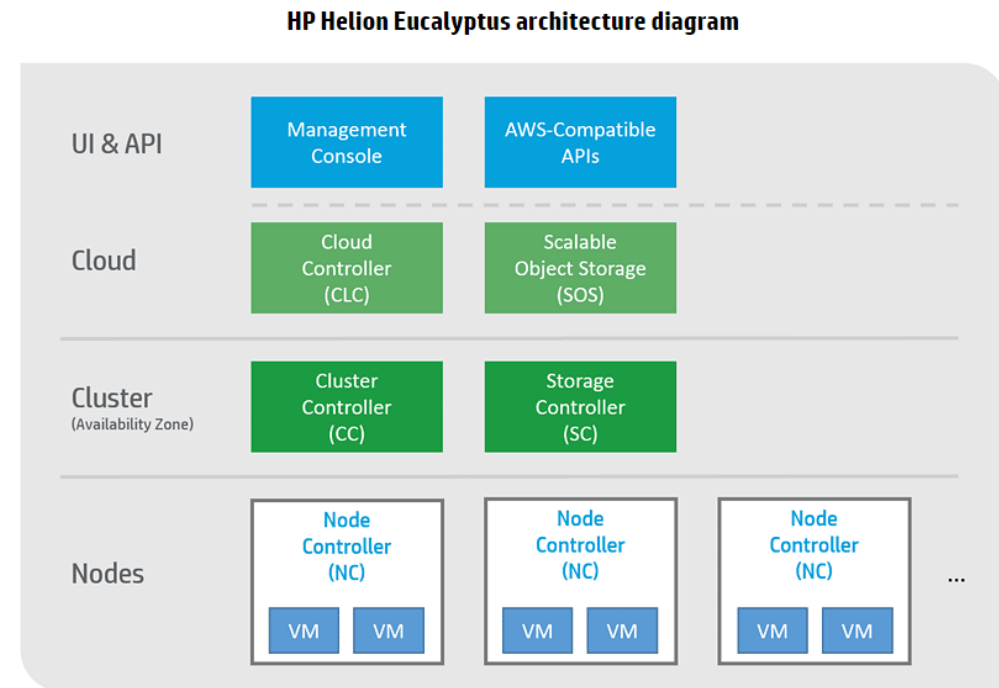
- CLC: EC2 SOAP and Query interface
- SOS (Walrus): S3 REST API

Cluster level:

- CC: AWS Availability Zone
- SC: AWS Elastic Block Store (EBS)

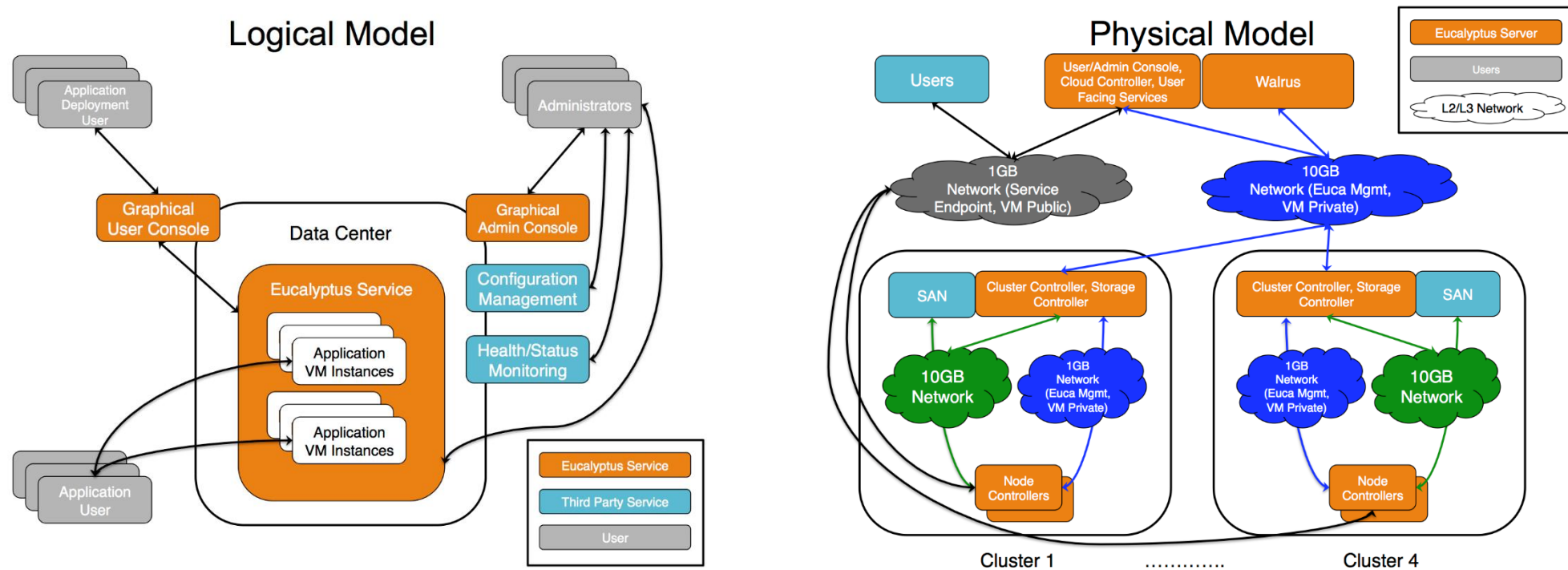
Node level:

- NC: hosts the VM instances and manages the virtual network endpoints



Source: eucalyptus.com

Reference Architecture



Source: eucalyptus.atlassian.net/wiki

Hybrid mode

Eucalyptus:

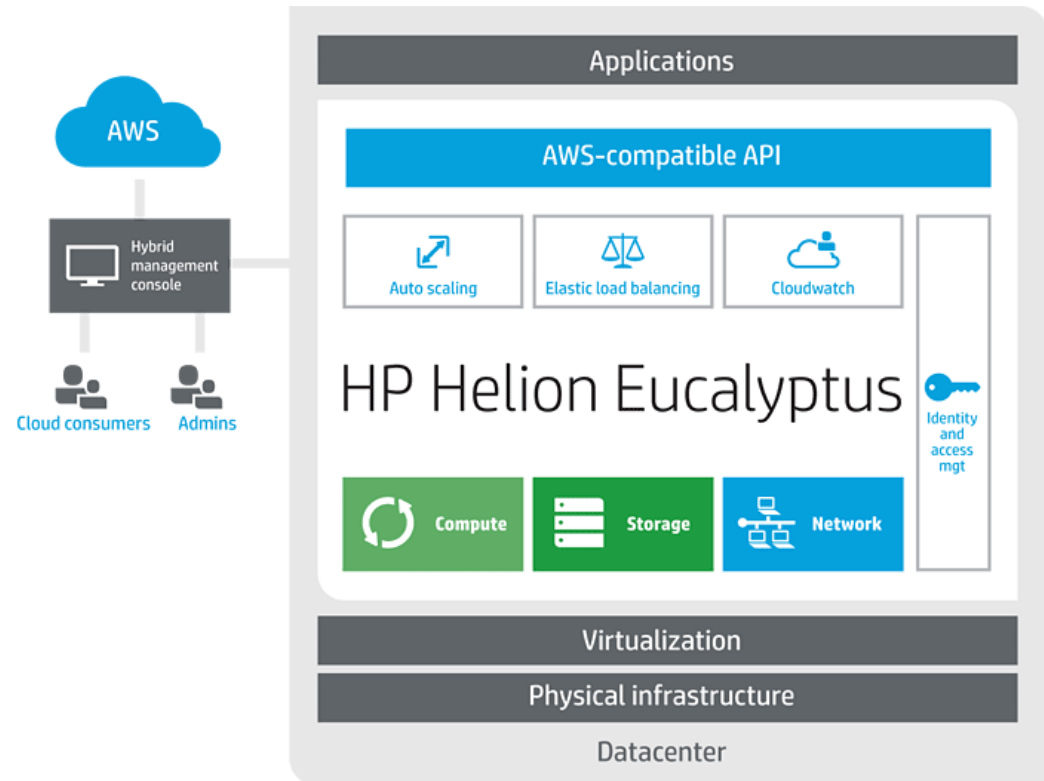
- Cloud on your hardware
- More control and protection

AWS:

- Cloud on other hardware
- More capacity and availability

Hybrid:

- Cloud busting ability
- Data gravity
- Information and resource sharing



Source: eucalyptus.com

Deployment – euca2tool

Config options:

- User
- Region

For easy switch between clouds

- E.g. euca-describe-instances --region aws

```
[user example]
key-id = AKIAIOSF0DNN7EXAMPLE
secret-key = vrwAGfda90v/FDASFE04/498qADFAeefEXAMPLE
;
; After doing so, you can add a "user" option to a "region" section, which
; causes the region to connect as a specific user by default:
;
[region localhost]
user = example
```

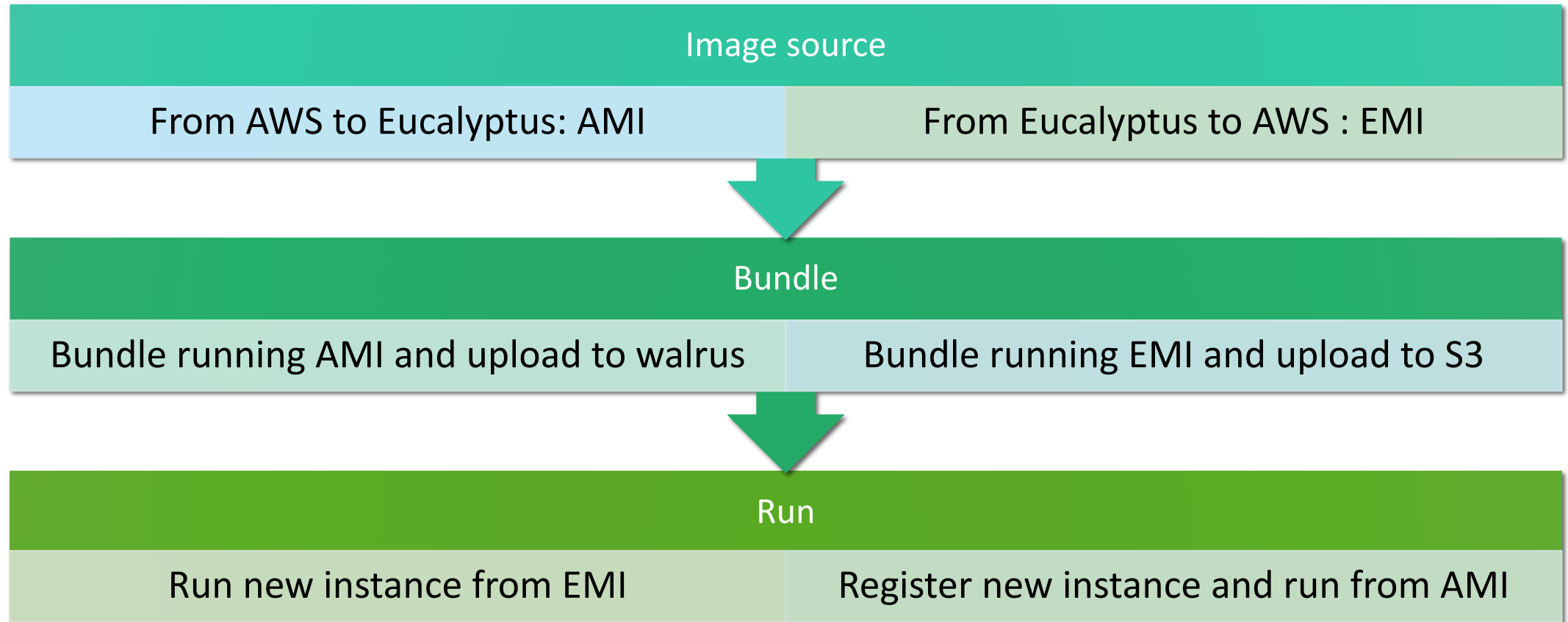
```
[global]
default-region = aws:us-east-1
```

```
[region localhost]
; Eucalyptus (all services on localhost)
autoscaling-url = http://127.0.0.1:8773/services/AutoScaling/
ec2-url = http://127.0.0.1:8773/services/Eucalyptus/
elasticloadbalancing-url = http://127.0.0.1:8773/services/LoadBalancing/
iam-url = http://127.0.0.1:8773/services/Euare/
monitoring-url = http://127.0.0.1:8773/services/CloudWatch/
s3-url = http://127.0.0.1:8773/services/Walrus/
sts-url = http://127.0.0.1:8773/services/Tokens/

; Eucalyptus-specific services, most of which are cloud admin-only
configuration-url = http://127.0.0.1:8773/services/Configuration/
empyrean-url = http://127.0.0.1:8773/services/Empyrean/
properties-url = http://127.0.0.1:8773/services/Properties/
reporting-url = http://127.0.0.1:8773/services/Reporting/

certificate = /var/lib/eucalyptus/keys/cloud-cert.pem
```

Migration – euca2tool



Manage - Eucalyptus Console

EUCALYPTUS

Log in to Eucalyptus **Log in to AWS**

Account Name*
ui-test-acct-03

Username*
admin

Password*

Log in to Eucalyptus

[Forgot your password?](#)

© 2014 Eucalyptus Systems, Inc.

EUCALYPTUS admin@ui-test-acct-00

DASHBOARD IMAGES INSTANCES AUTO SCALING STORAGE NETWORK & SECURITY IDENTITY & ACCESS

Dashboard All availability zones

Running instances 2 Launch Instance	Stopped instances 0	Instances in scaling groups 0 Create scaling group	Elastic IPs 3 Allocate elastic IP
Volumes 4 Create volume	Snapshots 1 Create snapshot	Buckets (S3) 2 Create bucket	Security groups 16 Create security group
Key pairs 5 Create key pair	Users 3 Create users	Groups 1 Create group	Roles 1 Create role

Service status

Compute	✓
Object Storage	✓
Auto Scaling	✓
Elastic Load Balancing	✗
CloudWatch	✓
Identity & Access Mgmt	✓

Source: eucalyptus.com

Hybrid cloud use cases

E.g. small e-commerce website

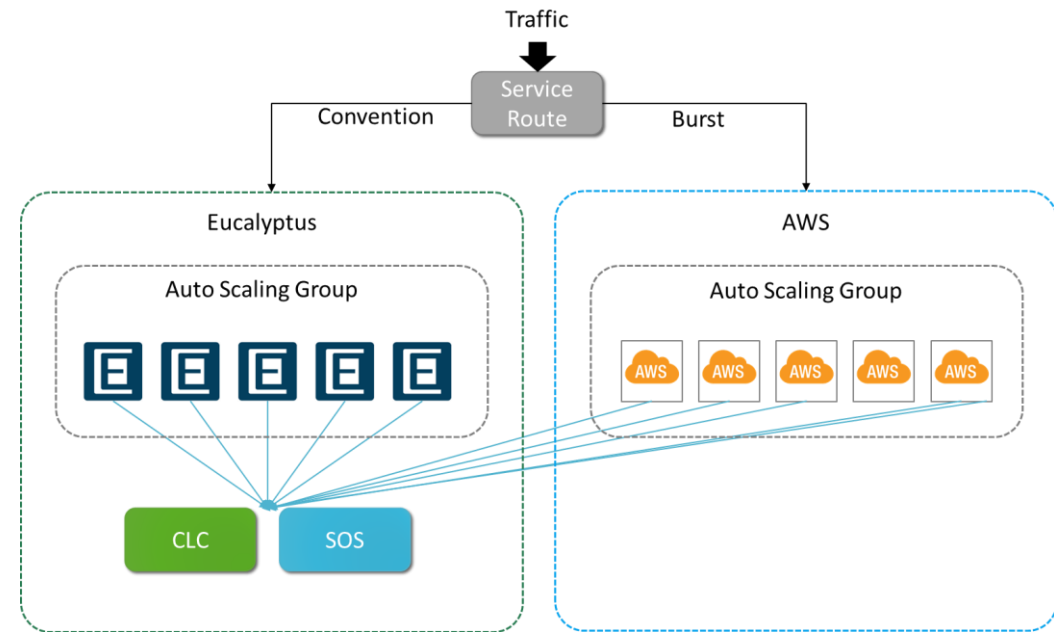
- Limited scale private servers @ US east coast

Cloud Bursting ability:

- Utilize exist cloud for daily low-volume traffic
- Need private storage to protect sensitive information like Credit cards (PCI compliance)
- Need extra resource from public cloud for peak requirement (Black Friday, Christmas)

Geolocation Optimization:

- Lower latency for customer in Australia
- No physical data nodes in Australia



Hybrid cloud use cases

E.g. Non-profit Global Ocean research organization

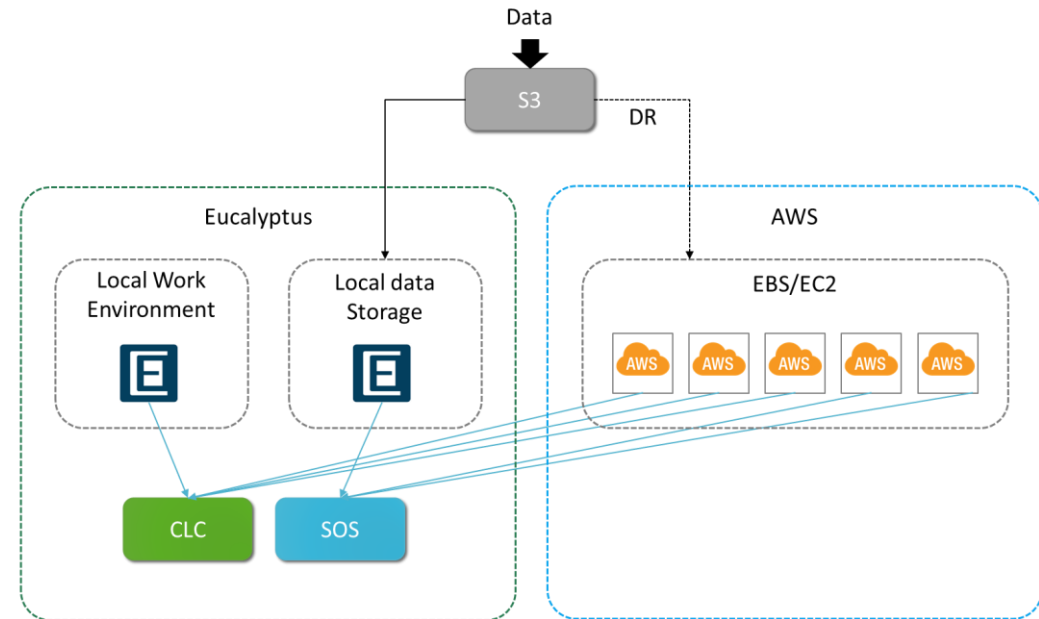
- Mainly long term research
- Intense computation for urgent project

Migration:

- Export research environment from local storage to cloud for high computation need
- Ease migration process to save manpower and cost

Disaster recovery:

- Instable connection with remote expedition team
- Rapid transfer connection endpoint to avoid loss data



Strength/Weakness



Strength

- Full control over sensitive information
- Benefit from public cloud infrastructure
- Flexible cost control



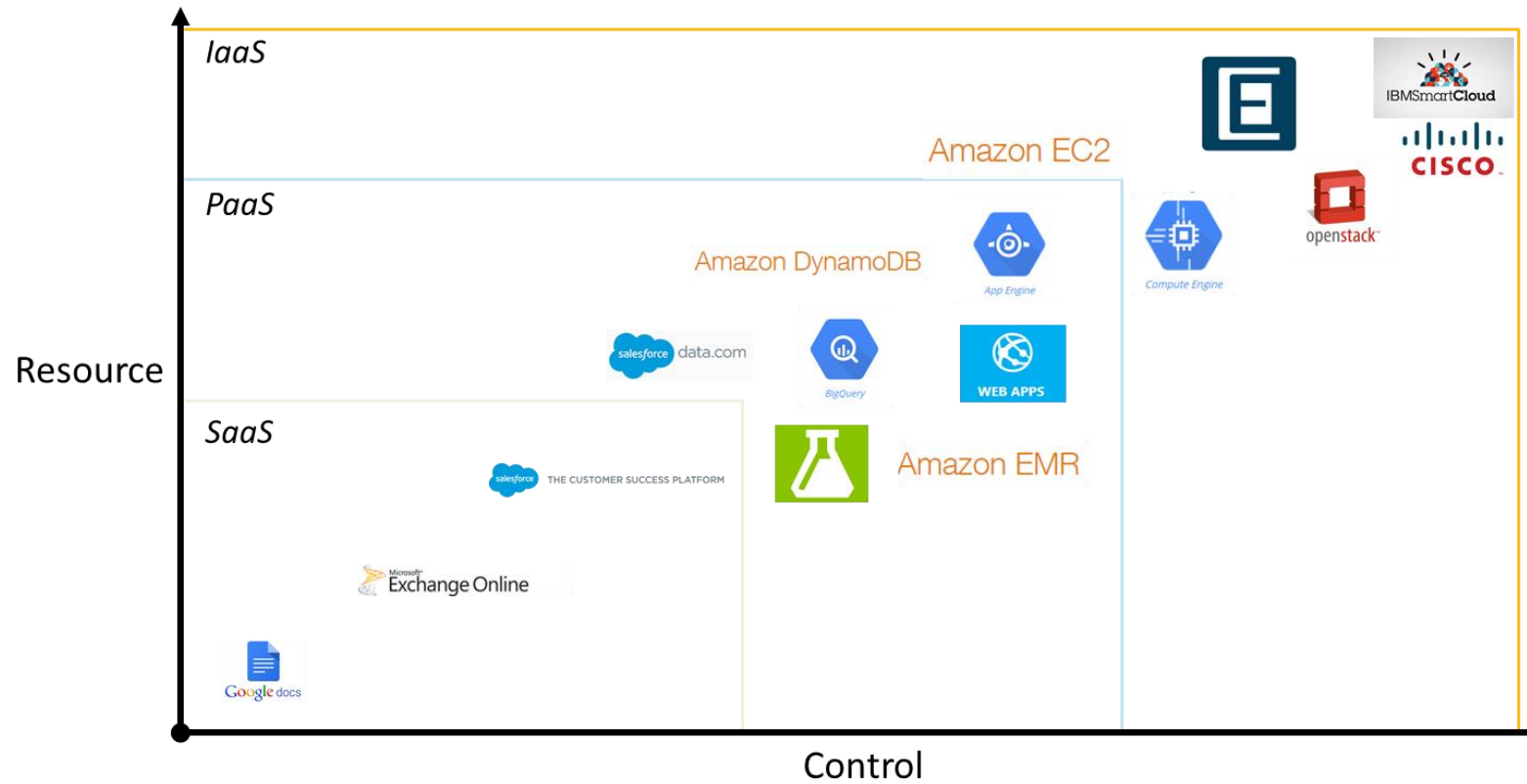
Weakness

- High involvement of manpower
- Capability and efficiency of private cloud

Compare cloud products

ANOTHER COMMERCIAL TIME!

Comparison matrix



Q & A

Thank you!
