

# Amazon Web Services

Working with the cloud



# Cloud

# What is Cloud computing?

**On demand** delivery of IT resources with **pay-as-you-go** pricing

# A Brief History of IT Infrastructure

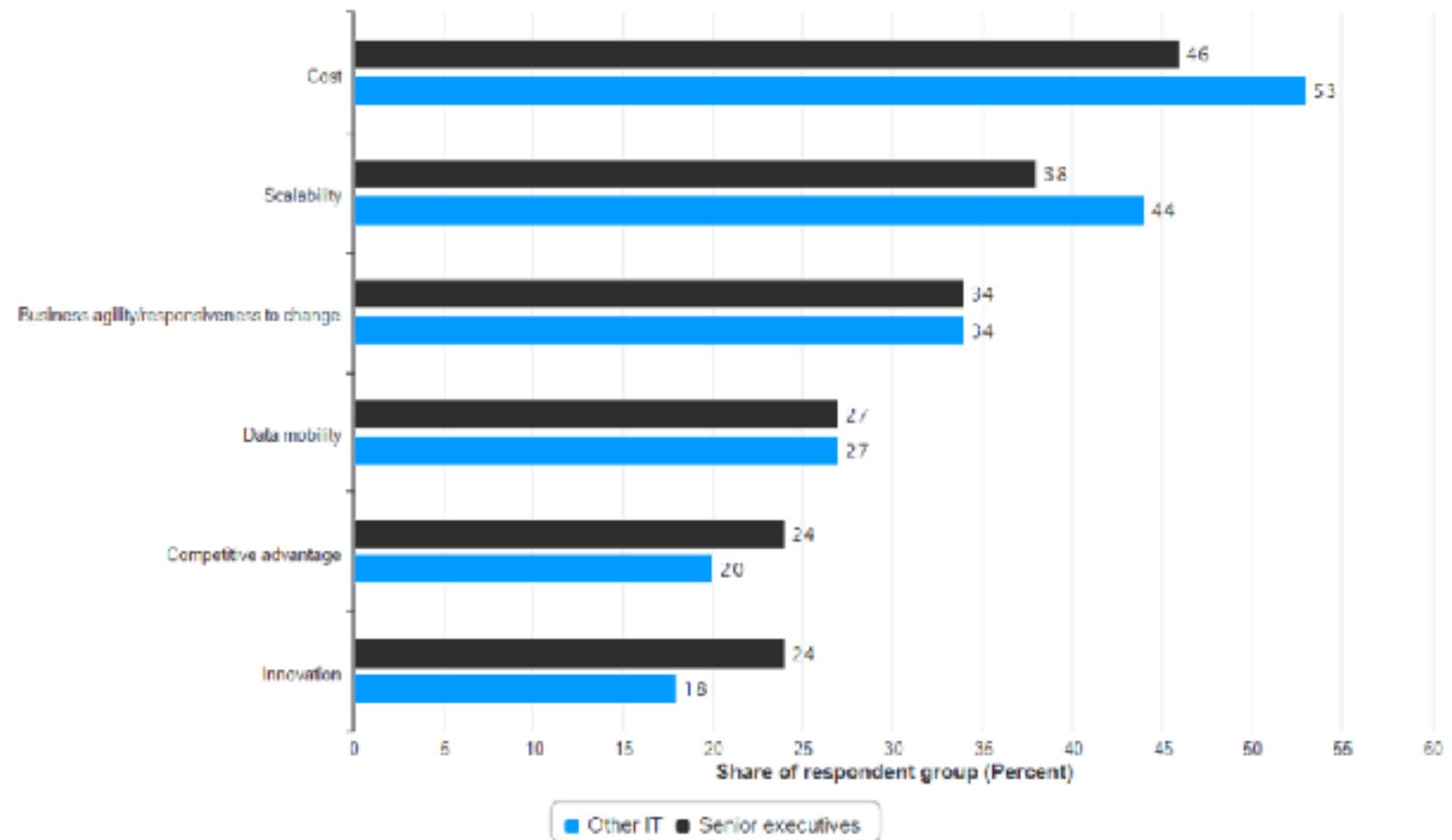
- The “Physical” Era
  - Advantages: Dedicated Resources for your applications
  - Disadvantages: Very Complex, Expensive.
- The “Virtual” Era
  - Advantages: Ease of (VM) management, Shared Resources
  - Disadvantages: Still quite Complex to setup
- The “Cloud” Era
  - Advantages: Shared Resources, Economies of Scale, Complexity hidden from you (As A Service model)
  - Disadvantages: Loss of Control

# Business Drivers for Public Cloud Adoption

- Speed to Market
- Financial Efficiency
- Business Expansion
- Global Expansion
- Core Competency

*Public cloud adoption is first a business decision and then a technical one. When embarking on a project to embrace the cloud, having a strong business driver is the first step toward a successful outcome.*

# Business Drivers for Public Cloud Adoption

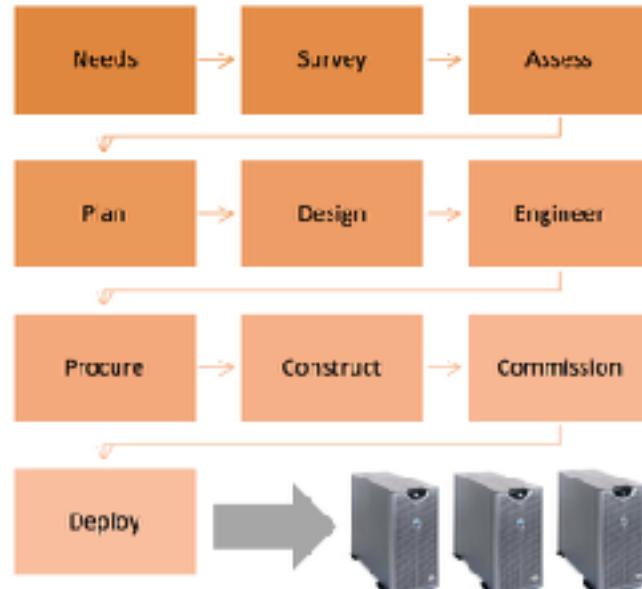


# Business Drivers: Speed to Market

- *Speed to market is undoubtedly one of the most attractive aspects of the public cloud. In a physical environment, to build an entire data center consisting of firewalls, load balancers, networking and virtual machines would take many months. Using the public cloud, all of these capabilities can now be fully deployed and accessible within an hours.*

# Business Drivers: Speed to Market

## On-Premise/Private Cloud



## Cloud Computing

New Infrastructure is always a few clicks away

- New Development Environment
- New Test Environment
- New Environment in Japan
- Add 100 Servers
- Add 10,000 Servers

# Business Drivers: Financial Efficiency

*Will public cloud save me money? Is OPEX better than CAPEX? The answer to both of these questions: It depends. What public cloud definitely does provide is the ability for your organisation to be more financially efficient. With Public Cloud, you have the ability for expenses to match revenue, or put another way, for capacity to match demand. This ensures the amount of money you have sitting in under-utilised assets is minimised.*

*Economies of Scale play at the Public Cloud provider level.*

# Business Drivers: Financial Efficiency

Some Marketing...

## On-Premise

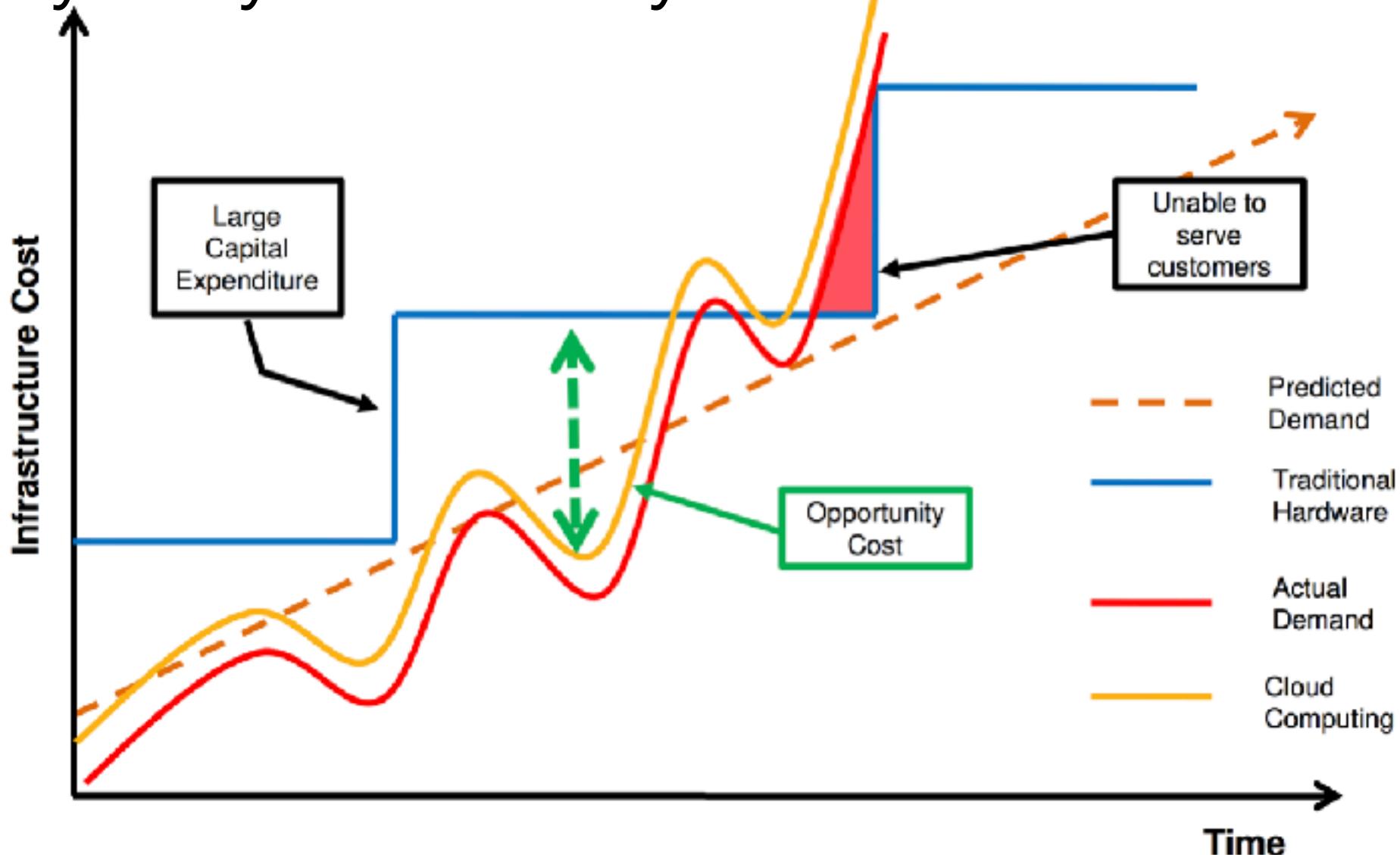
- Physical Space
- Cabling
- Power
- Cooling
- Networking
- Racks
- Servers
- Storage
- Certification
- Labor

## Cloud Computing

\$0

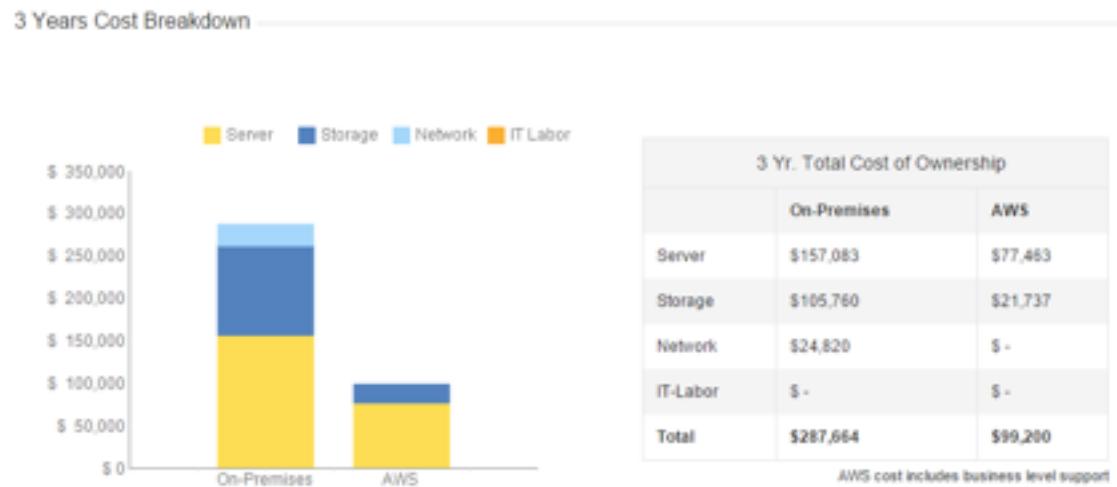
to Get Started

# Pay only for what you use

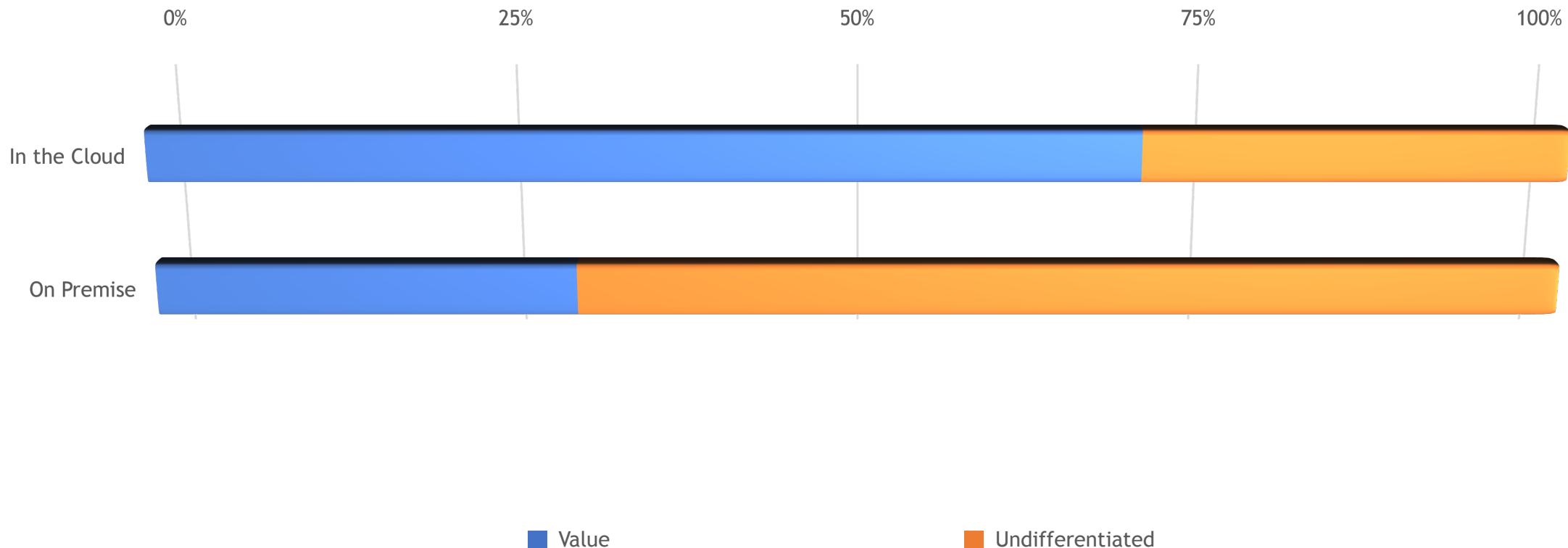


# Business Drivers: Financial Efficiency

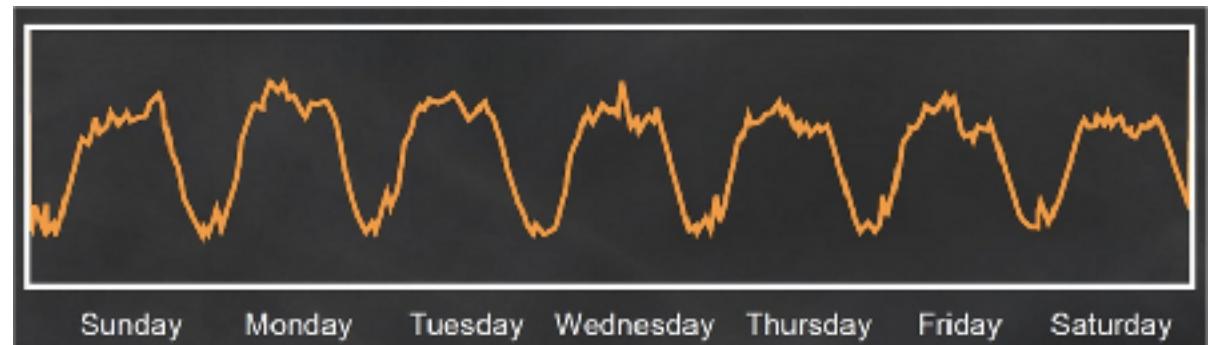
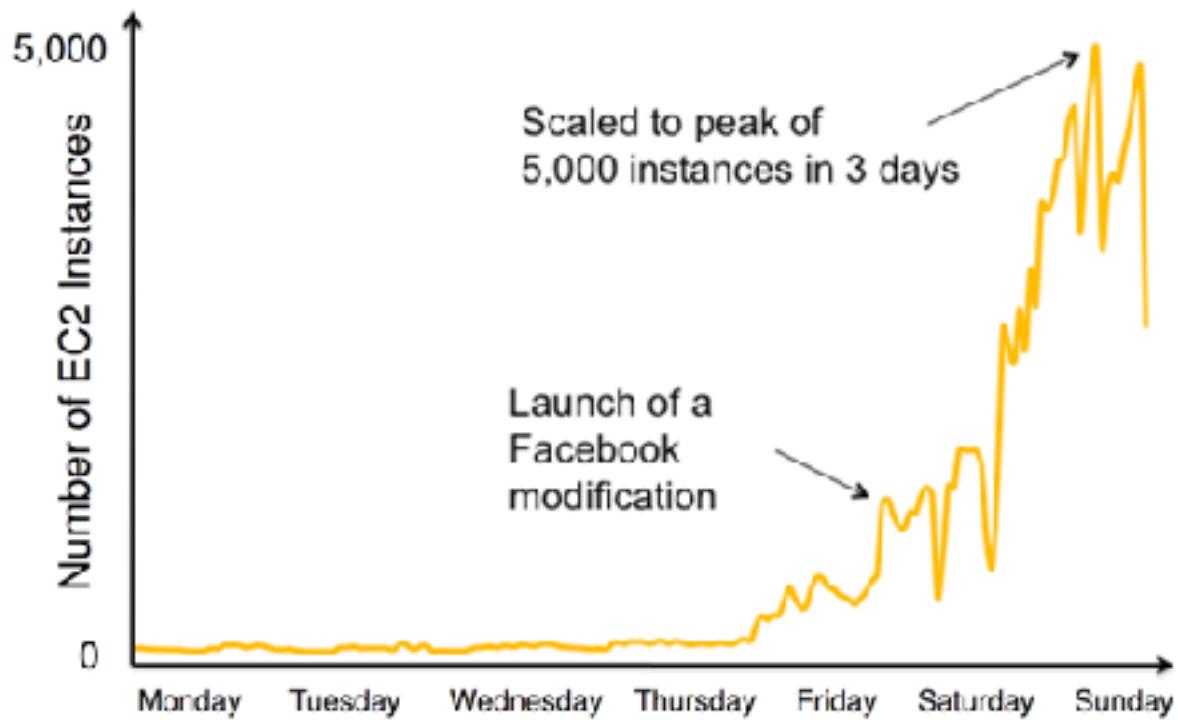
- TCO Calculation: On-Premise vs Public Cloud: <https://awstcocalculator.com>
  - **Use with care**
    - double-check On-premise Cost with vendor
    - double-check Cloud costs with <http://calculators.s3.amazonaws.com/>
    - Don't forget training cost to familiarise your IT staff with Public Cloud
    - Be Careful with 3y lock in (see also Price Reductions)



# Remove heavy lifting



# Easily scale up and down



# Business Drivers: Global Expansion

*Global expansion and business expansion are very similar, and public cloud brings comparable benefits to the table for both of them. With the desire to expand globally comes the initial thought to duplicate infrastructure globally as well. It doesn't always make sense to take on the financial commitment associated with building out dedicated infrastructure when the global expansion is unproven. Public cloud allows for the deployment of data centers in a pay-per-use fashion within American, European, Asia, Pacific or other markets.*

# Business Drivers: Core Competency

*IaaS, Paas or Saas is the core competency of your cloud vendor. That allows cloud users to focus on theirs.*

# Amazon Web Services



*“In terms of market share, AWS is Coke and there isn't yet a Pepsi.”*

*“AWS is the overwhelming market share leader, with more than **ten** times the compute capacity in use than the aggregate total of the other fourteen providers.”*

*“Every day AWS adds enough physical server capacity equivalent to that which was needed to support Amazon.com back when it was a \$7 billion annual revenue company.”*



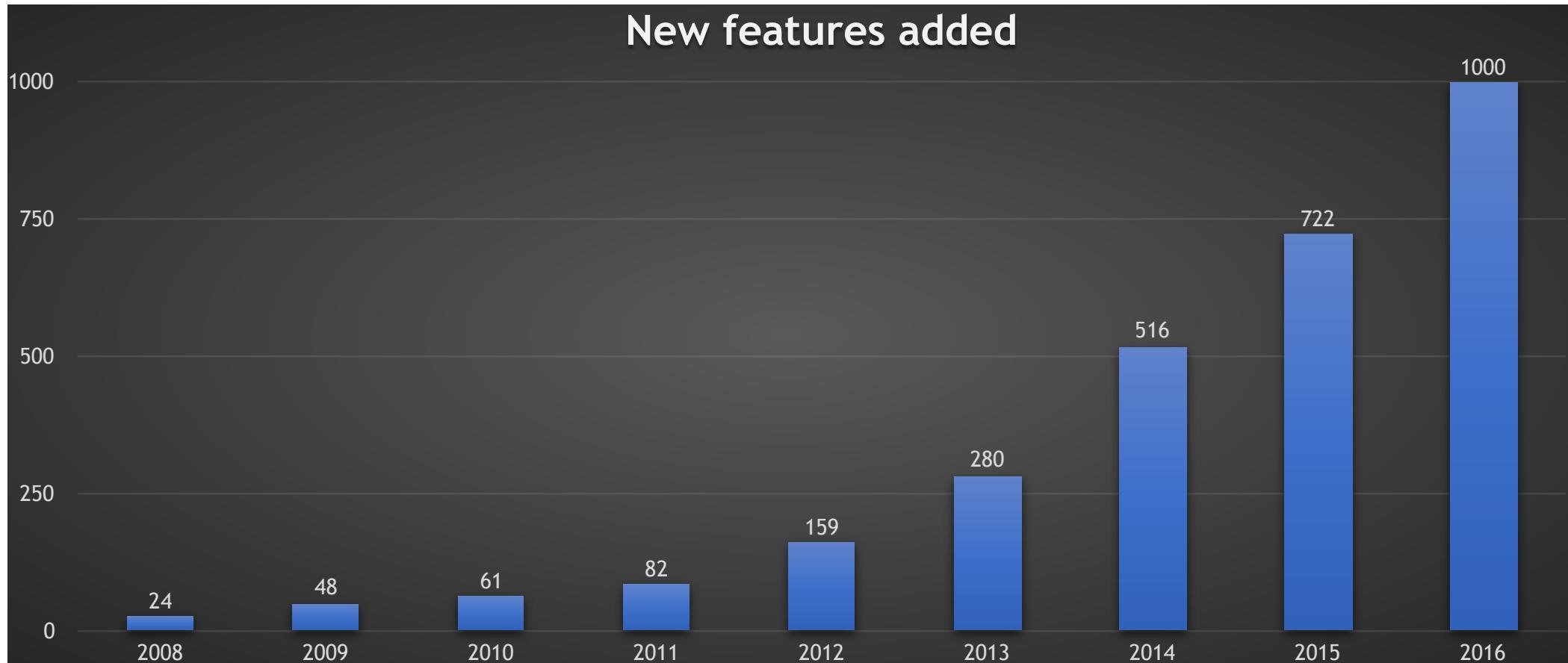


In 2015 AWS Deployed Almost  
ENOUGH SERVER CAPACITY EVERY DAY  
TO SUPPORT AMAZON IN 2005  
When it was an **\$8.49B** Enterprise

AWS adds the capacity equivalent of a **FORTUNE 500** Enterprise daily



# Rapid Pace of Innovation



## Trusted by Enterprises



The New York Times



*ticketmaster*



STANDARD  
& POOR'S



NASDAQ

LIONSGATE



bankinter.



IBM

the guardian

*Kenneth Cole*

razorfish

HITACHI

SEGA

amazon.com

Capgemini  
CONSULTING, TELECOM & BPO SERVING

UniCredit

# Powering the Most Popular Internet Businesses

Instagram



Zoopla! SmugMug



foursquare



Pinterest



NETFLIX



animoto



yelp



o.o.y.a.l.a®



ftopia



tumblr



onoko

sonico

Etsy



gumi

encoding.com



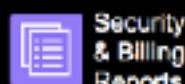
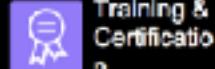


100s of applications supporting 33M+ global members

10,000s of EC2 instances in multiple regions & zones (more than 98% of all resources on AWS).

**At peak consumes 1/3 of US Internet bandwidth**

TECHNICAL &  
BUSINESS  
SUPPORT



HYBRID  
ARCHITECTURE



MARKETPLACE

ANALYTICS

- Data Warehousing
- Business Intelligence
- Hadoop/Spark
- Streaming Data Analysis
- Streaming Data Collection
- Machine Learning
- Elastic Search

APP SERVICES

- Queuing & Notifications
- Workflow
- Search
- Email
- Transcoding

MOBILE SERVICES

- API Gateway
- Single Integrated Console
- Identity
- Sync
- Mobile Analytics
- Mobile App Testing
- Push Notifications

DEVELOPMENT & OPERATIONS

- One-click App Deployment
- DevOps Resource Management
- Application Lifecycle Management
- Containers
- Triggers
- Resource Templates

IoT

- Rules Engine
- Device Shadows
- Device SDKs
- Device Gateway
- Registry

ENTERPRISE APPS

- Virtual Desktops
- Sharing & Collaboration
- Corporate Email
- Backup

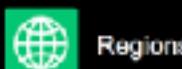
SECURITY & COMPLIANCE

- Identity Management
- Access Control
- Key Management & Storage
- Monitoring & Logs
- Configuration Compliance
- Web application firewall
- Assessment and reporting
- Resource & Usage Auditing

CORE SERVICES



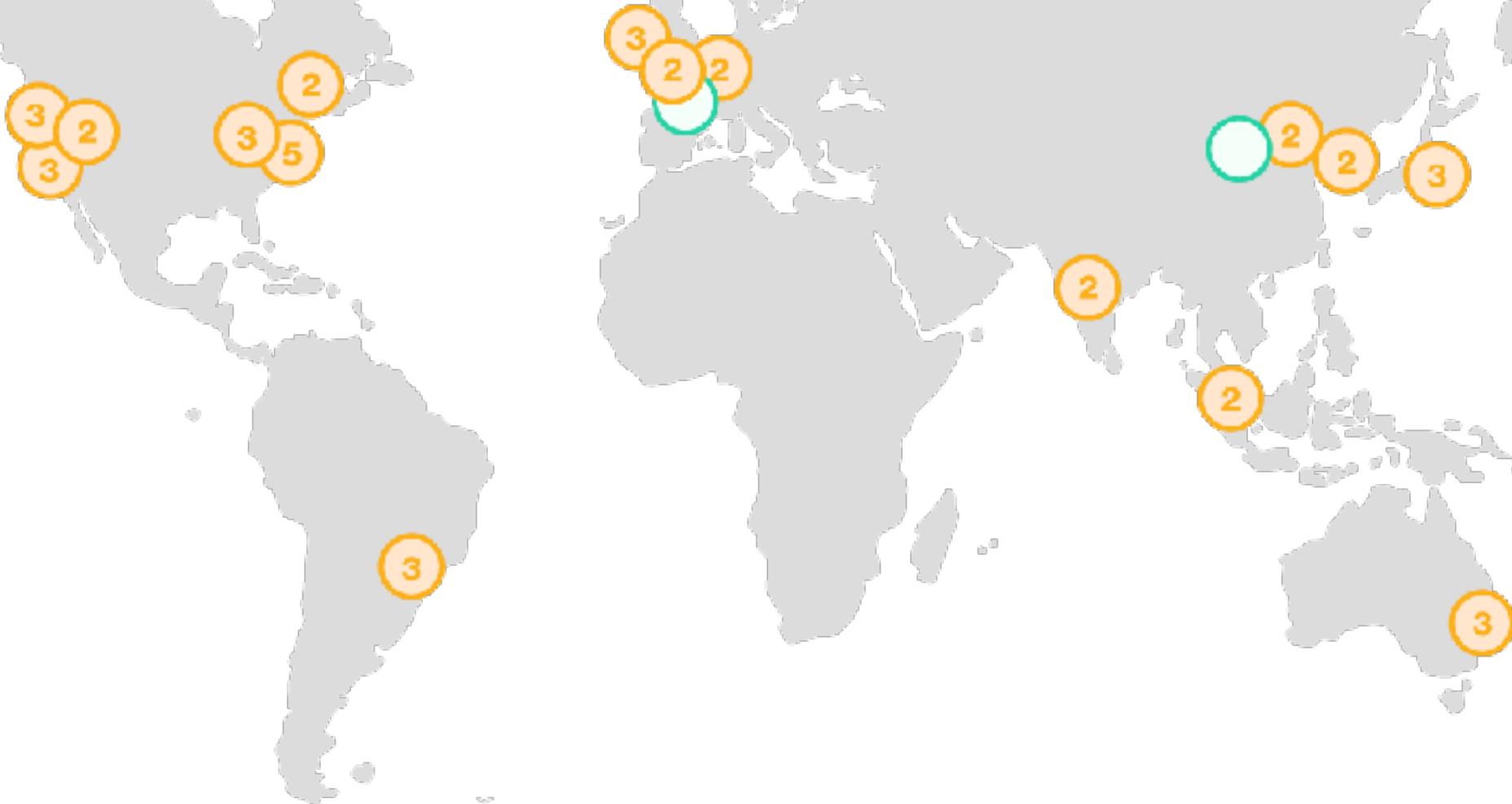
INFRASTRUCTURE



# >65 Services

 <b>Compute</b> EC2 EC2 Container Service Lightsail  Elastic Beanstalk Lambda	 <b>Developer Tools</b> CodeCommit CodeBuild CodeDeploy CodePipeline	 <b>Analytics</b> Athens EMR CloudSearch Elasticsearch Service Kinesis Data Pipeline QuickSight 	 <b>Application Services</b> Step Functions SWF API Gateway AppStream Elastic Transcoder
 <b>Storage</b> S3 Elastic File System Glacier Storage Gateway	 <b>Management Tools</b> CloudWatch CloudFormation CloudTrail Config OpsWorks Service Catalog Trusted Advisor Managed Services Application Discovery Service	 <b>Artificial Intelligence</b> Lex Polly Rekognition Machine Learning	 <b>Messaging</b> SQS SNS SES
 <b>Database</b> RDS DynamoDB ElastiCache Redshift	 <b>Security, Identity &amp; Compliance</b> IAM Inspector Certificate Manager Directory Service WAF & Shield Compliance Reports	 <b>Internet Of Things</b> AWS IoT	 <b>Business Productivity</b> WorkDocs WorkMail
 <b>Networking &amp; Content Delivery</b> VPC CloudFront Direct Connect Route 53	 <b>Game Development</b> GameLift	 <b>Desktop &amp; App Streaming</b> WorkSpaces AppStream 2.0	
 <b>Migration</b> DMS Server Migration Snowball	 <b>Mobile Services</b> Mobile Hub Cognito Device Farm Mobile Analytics Pinpoint		

# Global Infrastructure - Regions





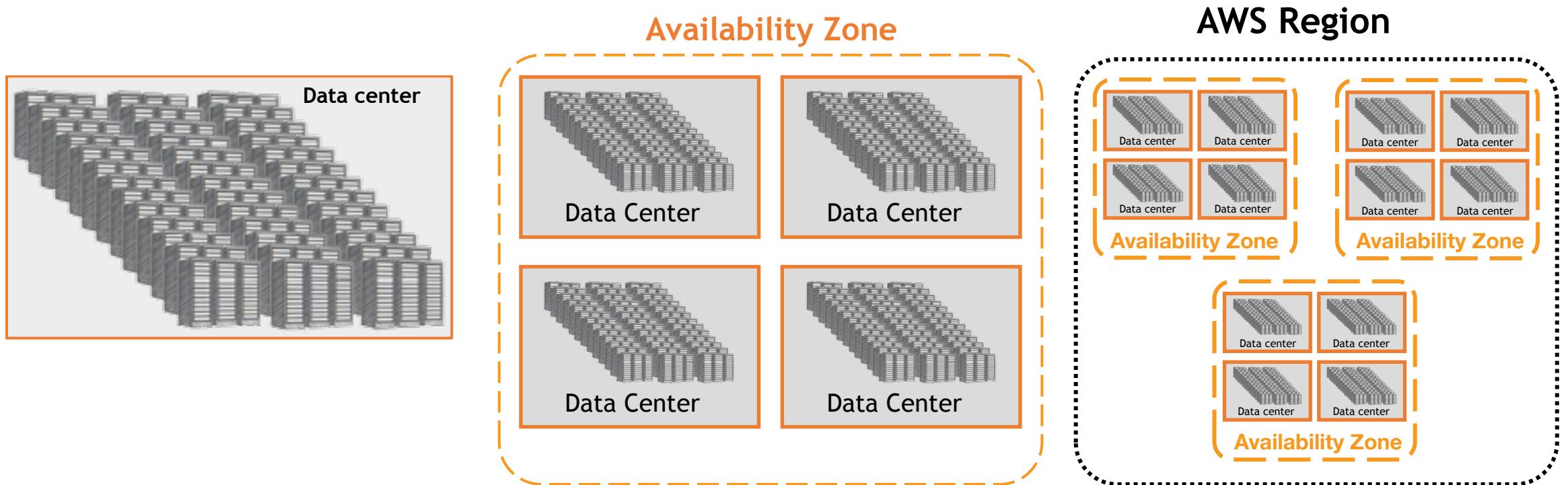
# Technology Drivers: Amazon Architecture Mantra

***“Everything fails all the time”***

We lose whole datacenters! Those things happen.

*Werner Vogels  
CTO Amazon*

# Global Infrastructure - AZs



# Technology Drivers: Design For Failure

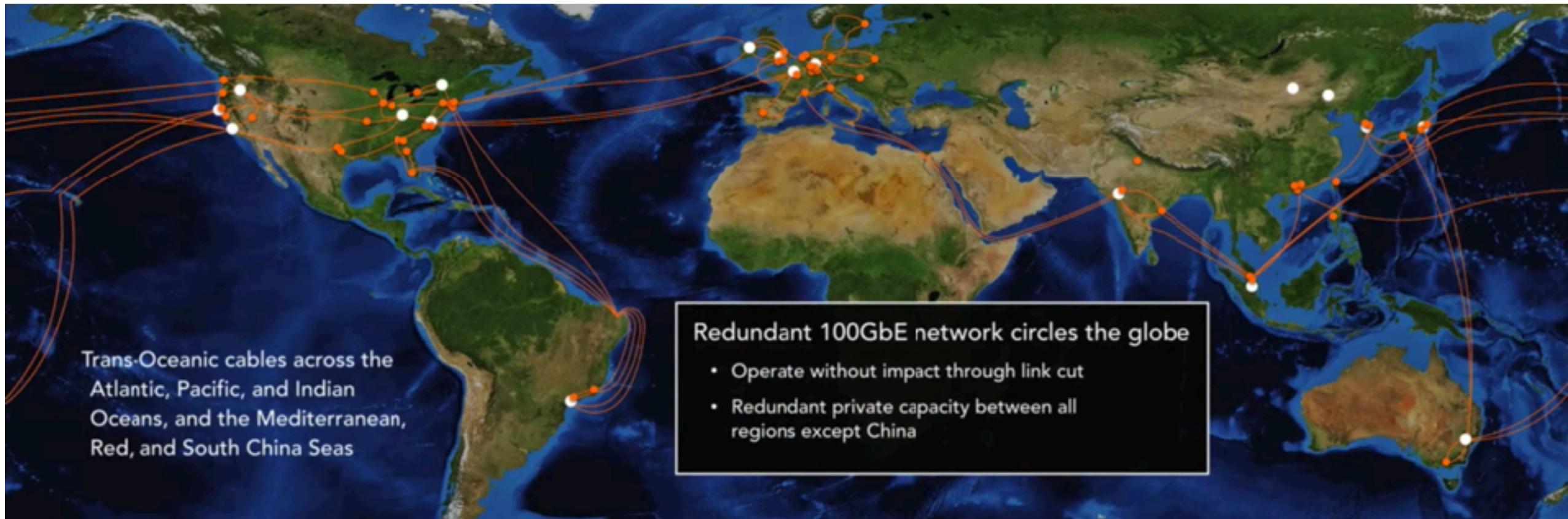
## Netflix Chaos Monkey

- Randomly kill EC2 instances in AWS autoscaling Groups

## Netflix Chaos Gorilla

- Kill an AZ (planned)

# Global Infrastructure – AWS Network



# Low level services



Deployment & Administration

App Services

Compute

Storage

Database

Networking

AWS Global Infrastructure

## Direct Connect

*Dedicated connection to AWS*

## VPN Connection

*Secure internet connection to AWS*

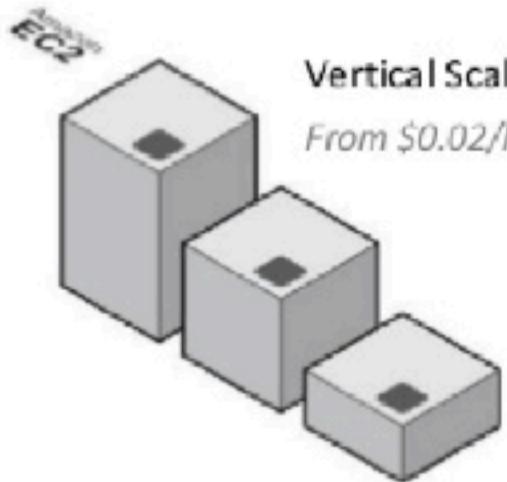
## Virtual Private Cloud

*Private, isolated section of the AWS Cloud*

## Route 53

*Highly available and scalable Domain Name System*

## Compute



### Vertical Scaling

From \$0.02/hr

Deployment & Administration

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## Elastic Compute Cloud (EC2)

*Basic unit of compute capacity*

*Range of CPU, memory & local disk options*

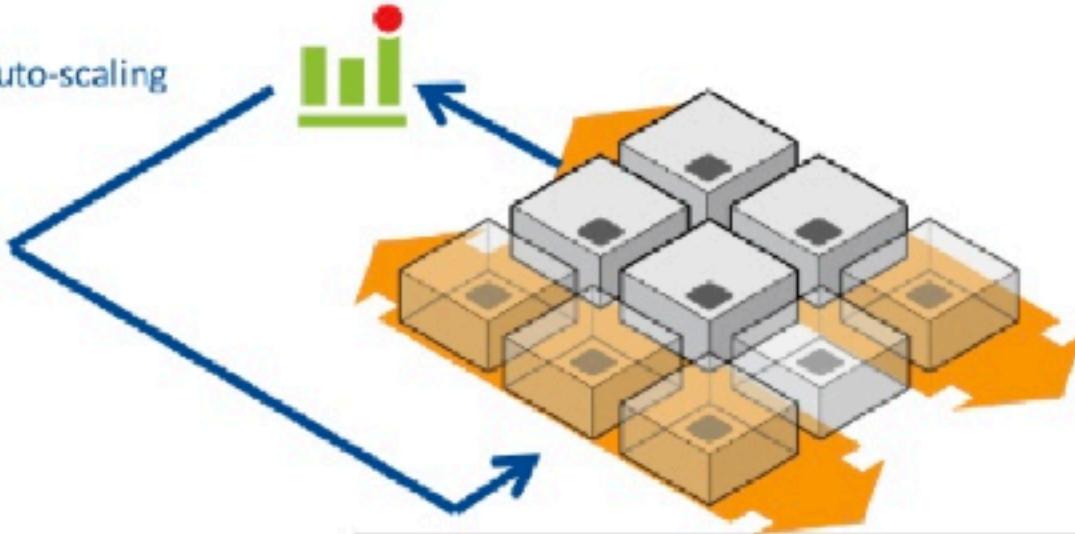
*Wide range of instance types available, from micro to cluster compute*

Feature	Details
<b>Flexible</b>	Run windows or Linux distributions
<b>Scalable</b>	Wide range of instance types from micro to cluster compute
<b>Machine Images</b>	Configurations can be saved as machine images (AMIs) from which new instances can be created
<b>Full control</b>	Full root or administrator rights
<b>Secure</b>	Full firewall control via Security Groups
<b>Monitoring</b>	Publishes metrics to Cloud Watch
<b>Inexpensive</b>	On-demand, Reserved and Spot instance types
<b>VM Import/Export</b>	Import and export VM images to transfer configurations in and out of EC2

```
aws create-auto-scaling-group MyGroup  
  --launch-configuration MyConfig  
  --availability-zones eu-west-1a  
  --min-size 4  
  --max-size 200
```



Trigger auto-scaling policy



Deployment & Administration

App Services

Compute

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Networking

AWS Global Infrastructure

## Auto-scaling

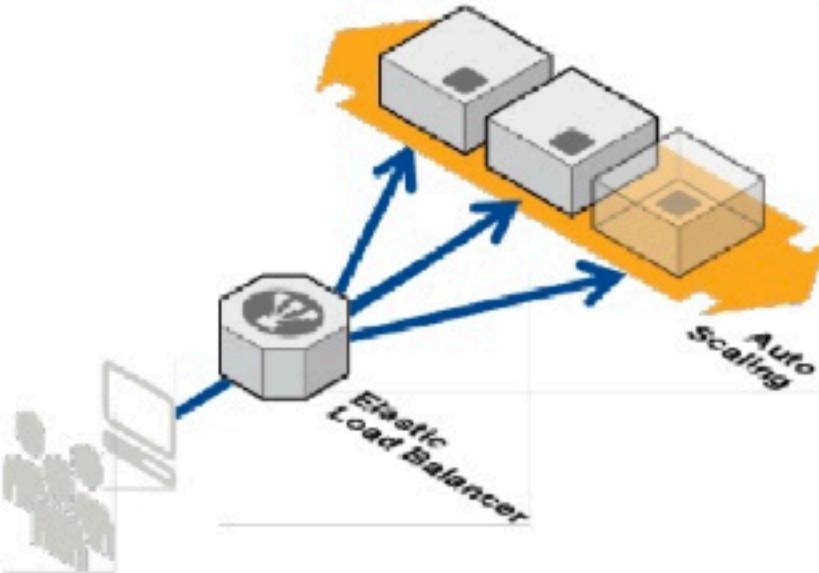
*Automatic re-sizing of compute clusters based upon demand*

Feature	Details
Control	Define minimum and maximum instance pool sizes and when scaling and cool down occurs
Integrated to CloudWatch	Use metrics gathered by CloudWatch to drive scaling
Instance types	Run auto scaling for on-demand instances and spot. Compatible with VPC

## Elastic Load Balancing

Create highly scalable applications

Distribute load across EC2 instances in multiple availability zones



Deployment & Administration

App Services

Compute

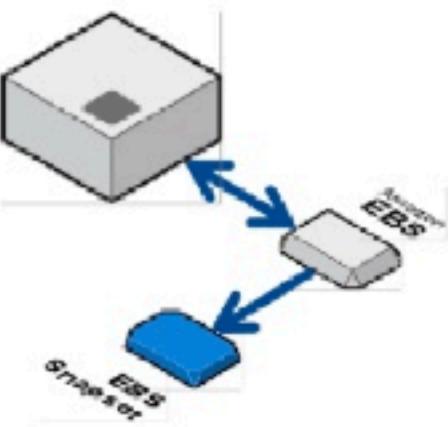
Storage

Database

Networking

AWS Global Infrastructure

Feature	Details
Auto-scaling	Automatically scales to handle request volume
Available	Load balance across instances in multiple availability zones
Health checks	Automatically checks health of instances and takes them in or out of service
Session stickiness	Route requests to the same instance
Secure sockets layer	Supports SSL offload from web and application servers with flexible cipher support
Monitoring	Publishes metrics to Cloud Watch



## Elastic Block Store

*High performance block storage device*

*1GB to 1TB in size*

*Mount as drives to instances*

Deployment & Administration

App Services

Compute

Storage

Database

Networking

AWS Global Infrastructure

### Feature Details

**High performance file system** Mount EBS as drives and format as required

**Flexible size** Volumes from 1GB to 1TB in size

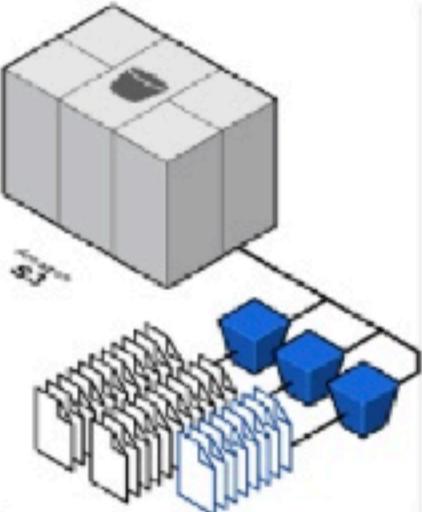
**Secure** Private to your instances

**Performance** Use provisioned IOPS to get desired level of IO performance

**Available** Replicated within an Availability Zone

**Backups** Volumes can be snapshotted for point in time restore

**Monitoring** Detailed metrics captured via Cloud Watch



Deployment & Administration

App Services

Compute

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Networking

AWS Global Infrastructure

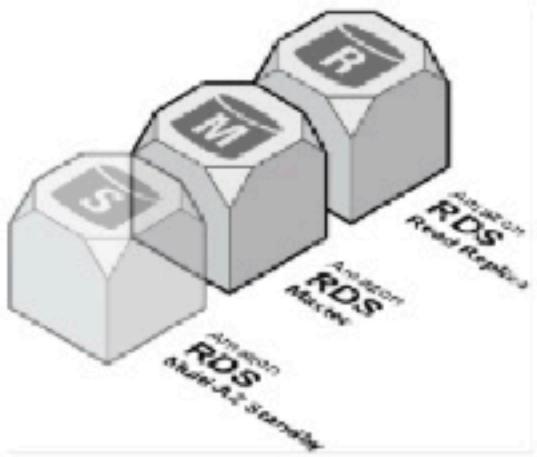
## S3 - Durable storage, any object

*99.99999999% durability of objects*

*Unlimited storage of objects of any type*

*Up to 5TB size per object*

Feature	Details
<b>Flexible object store</b>	Buckets act like drives, folder structures within
<b>Access control</b>	Granular control over object permissions
<b>Server-side encryption</b>	256bit AES encryption of objects
<b>Multi-part uploads</b>	Improved throughput & control
<b>Object versioning</b>	Archive old objects and version new ones
<b>Object expiry</b>	Automatically remove old objects
<b>Access logging</b>	Full audit log of bucket/object actions
<b>Web content hosting</b>	Serve content as web site with built in page handling
<b>Notifications</b>	Receive notifications on key events
<b>Import/Export</b>	Physical device import/export service



Deployment &amp; Administration

App Services

Compute

Storage

Database

Networking

AWS Global Infrastructure

## Relational Database Service

*Database-as-a-Service*

*No need to install or manage database instances*

*Scalable and fault tolerant configurations*

Feature	Details
<b>Platform support</b>	Create MySQL, SQL Server and Oracle RDBMS
<b>Preconfigured</b>	Get started instantly with sensible default settings
<b>Automated patching</b>	Keep your database platform up to date automatically
<b>Backups</b>	Automatic backups and point in time recovery and full DB backups
<b>Provisioned IOPS</b>	Specify IO throughput depending on requirements
<b>Failover</b>	Automated failover to slave hosts in event of a failure
<b>Replication</b>	Easily create read-replicas of your data and seamlessly replicate data across availability zones

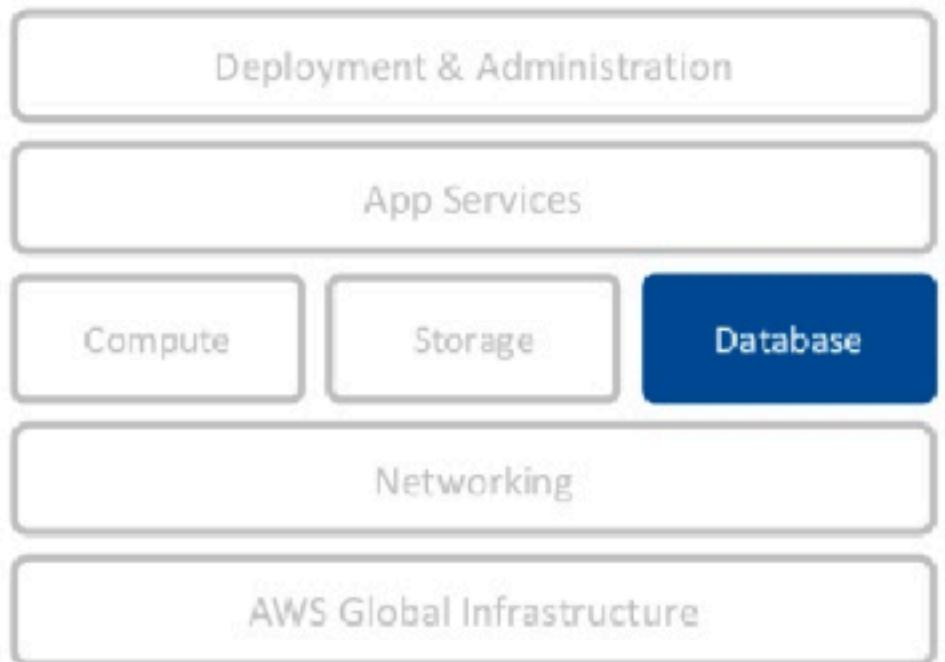


## DynamoDB

*Provisioned throughput NoSQL database*

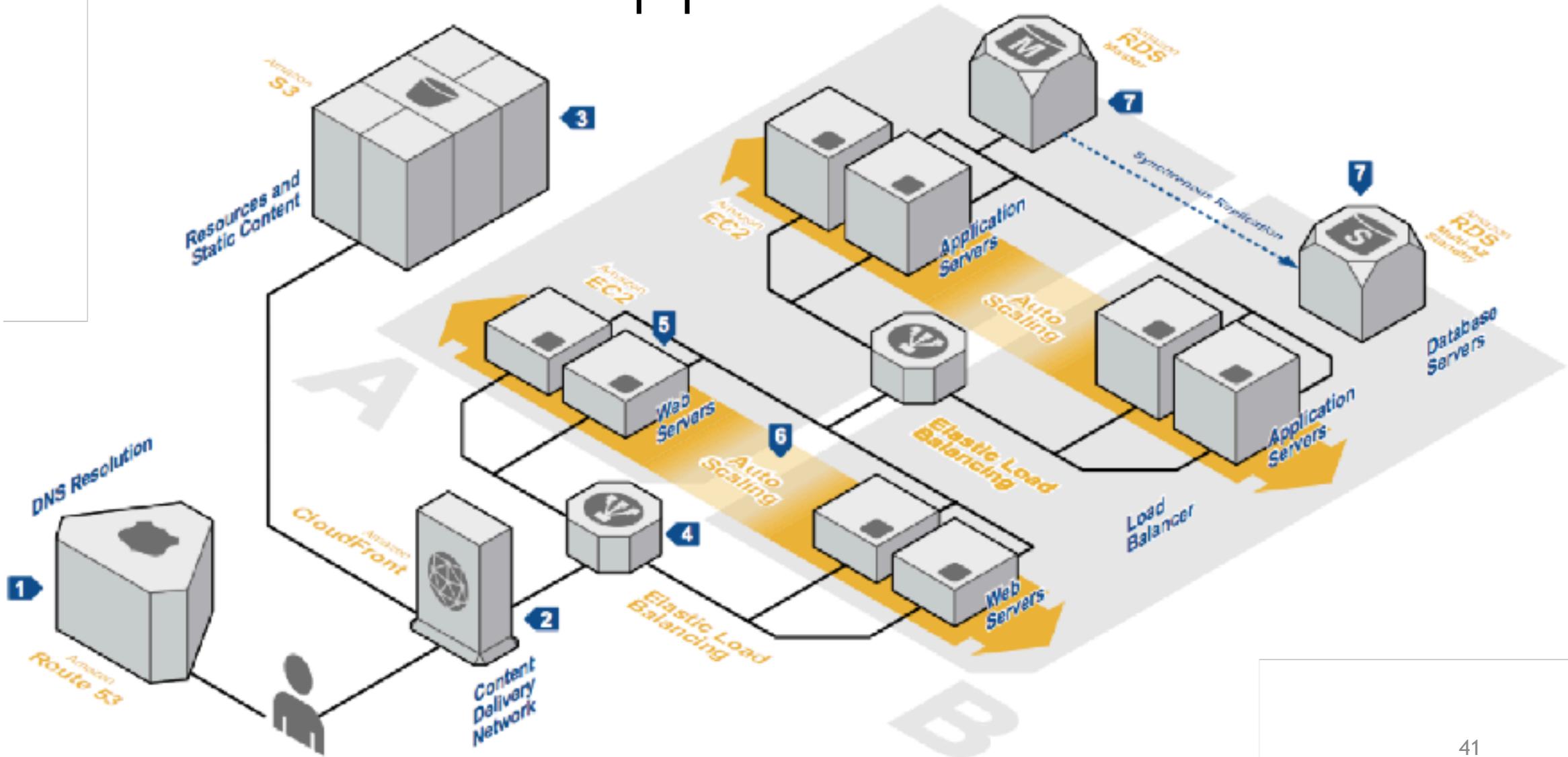
*Fast, predictable performance*

*Fully distributed, fault tolerant architecture*



Feature	Details
<b>Provisioned throughput</b>	Dial up or down provisioned read/write capacity
<b>Predictable performance</b>	Average single digit millisecond latencies from SSD backed infrastructure
<b>Strong consistency</b>	Be sure you are reading the most up to date values
<b>Fault tolerant</b>	Data replicated across availability zones
<b>Monitoring</b>	Integrated to Cloud Watch
<b>Secure</b>	Integrates with AWS Identity and Access Management (IAM)
<b>Elastic MapReduce</b>	Integrates with Elastic MapReduce for complex analytics on large datasets

# Reference Web Application

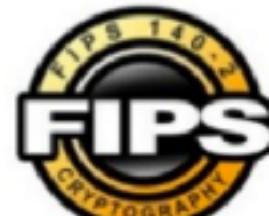


# Security in the AWS Cloud

"Based on our experience, I believe that we can even be more secure in the AWS cloud than in our own data centers"

*Tom Soderstrom, CTO, NASA JPL*

# Key AWS Certifications and Assurance Programs



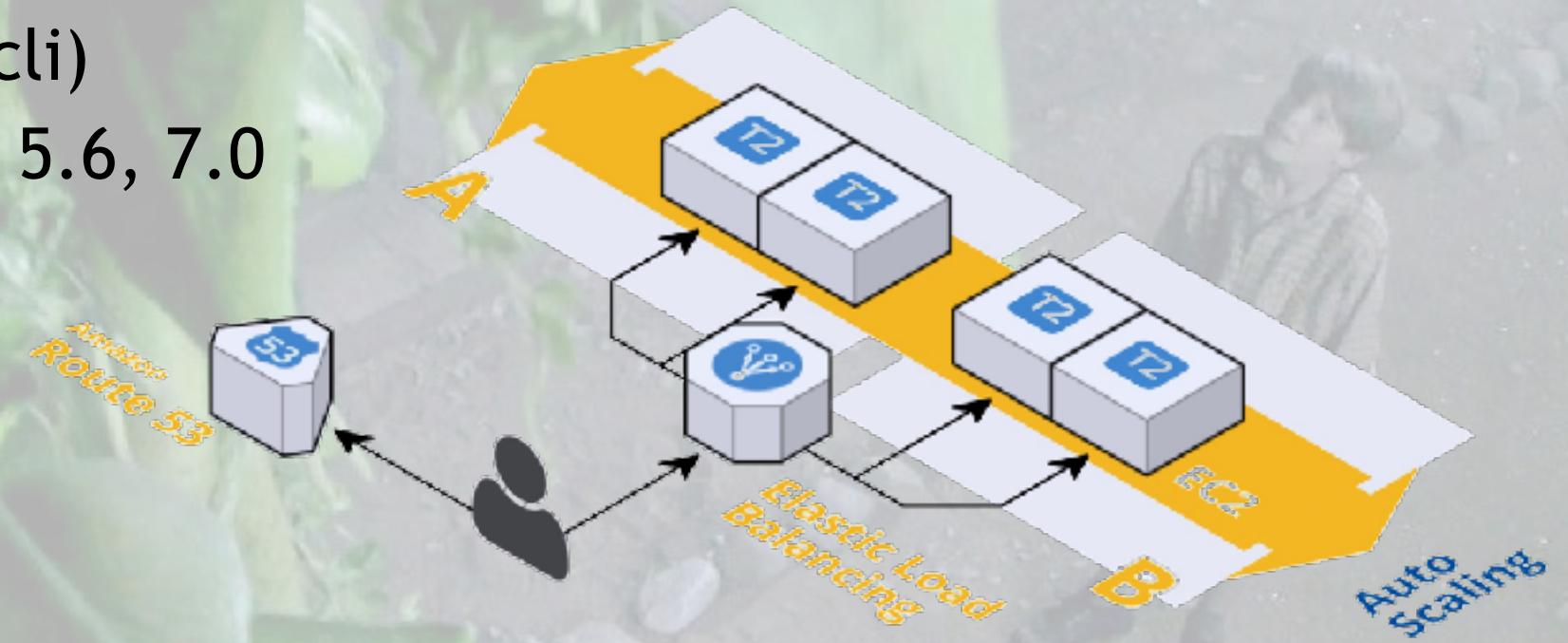
# Using AWS Services

EC2 Demo

EB Demo

# Elastic Beanstalk (EB)

- Just deploy (zip or cli)
- PHP (5.3,) 5.4, 5.5, 5.6, 7.0
- Apache + Composer
- Scalable
- Customizable
- Automatable





# Identity and Access Management (IAM)

## Policy Name

AmazonSQSFullAccess

AmazonS3FullAccess

AmazonDynamoDBFullAccess

AWSelasticBeanstalkFullAccess

AmazonSESFullAccess

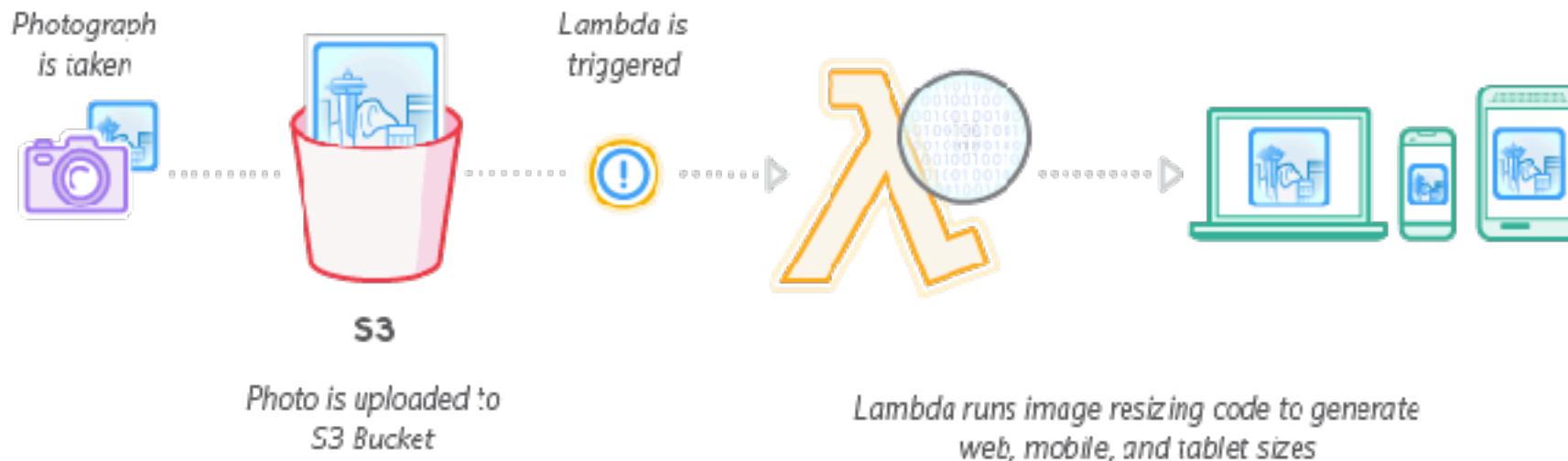
```
$sdk = new Aws\Sdk([
    'region'    => 'eu-west-1',
    'credentials' => [
        'key'      => 'my-access-key-id',
        'secret'   => 'my-secret-access-key',
    ],
]);
```

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "iam:GetPolicyVersion",
                "iam:GetRole",
                "iam:PassRole"
            ],
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": [
                "iam:AddRoleToInstanceProfile",
                "iam>CreateInstanceProfile",
                "iam>CreateRole"
            ],
            "Resource": [
                "arn:aws:iam::*:role/aws-elasticbeanstalk*",
                "arn:aws:iam::*:instance-profile/aws-elasticbeanstalk*"
            ]
        }
    ]
}
```

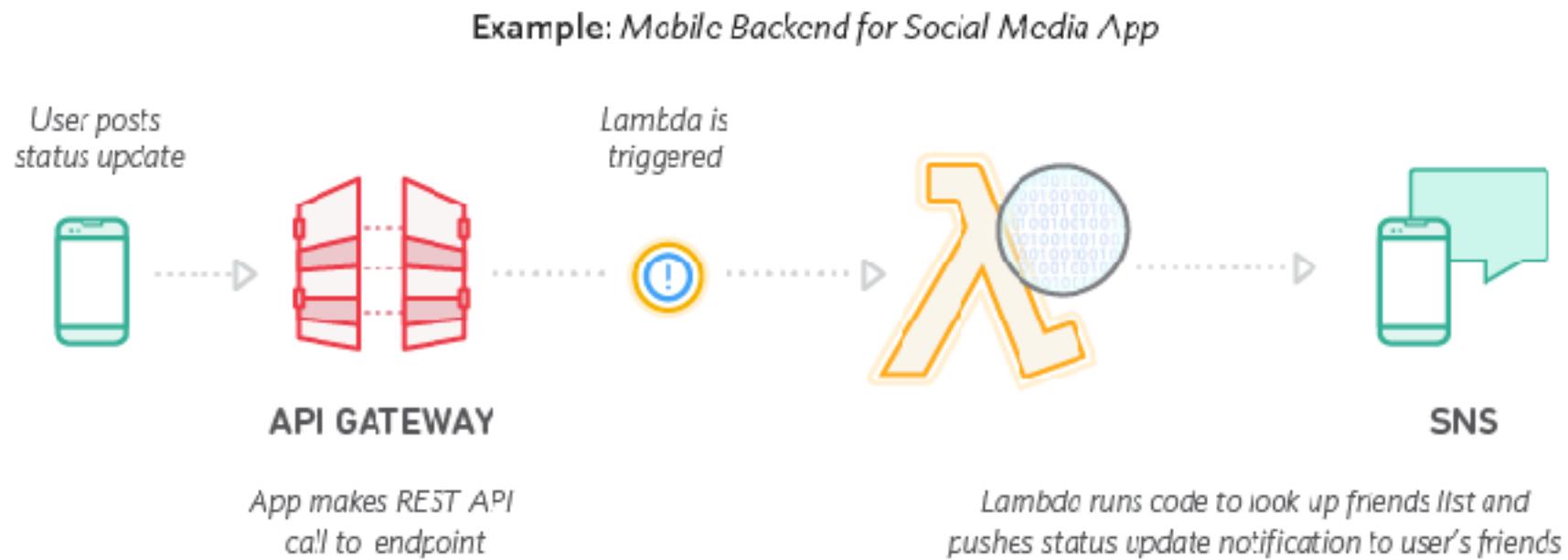
# The Future of Cloud

# Serverless

Example: *Image Thumbnail Creation*



# Serverless



# IoT



**AWS IoT DEVICE SDK**  
Set of client libraries to connect, authenticate and exchange messages



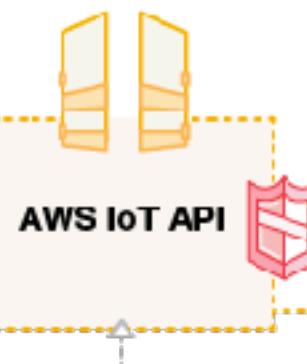
**AUTHENTICATION & AUTHORIZATION**  
Secure with mutual authentication and encryption



**DEVICE GATEWAY**  
Communicate with devices via MQTT, WebSockets, and HTTP 1.1



**REGISTRY**  
Assign a unique identity to each device



**AWS IoT**



**RULES ENGINE**  
Transform device messages based on rules and route to AWS Services



**DEVICE SHADOWS**  
Persistent device state during intermittent connections



**AWS SERVICES**

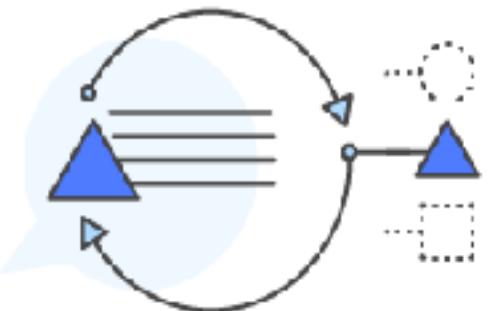
With these endpoints you can deliver messages to every AWS service.



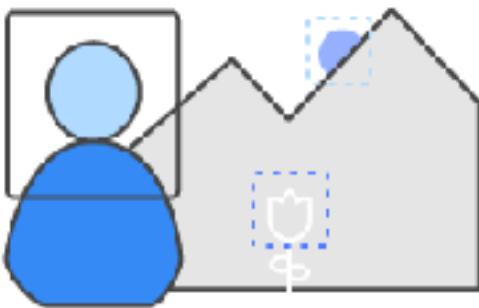
**APPLICATIONS**

Applications can connect to shadows at any time using an API

# AI



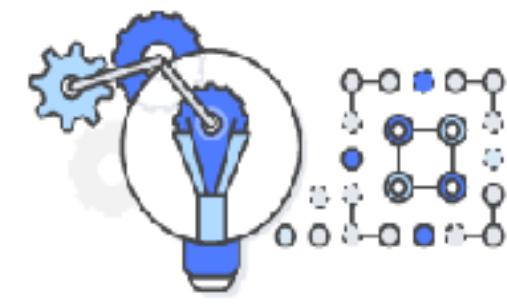
Lex



Rekognition



Polly



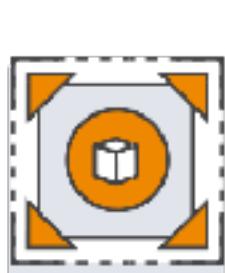
Machine Learning

# Cloudar

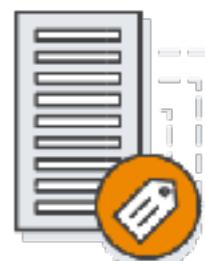
# Costs and Cost Optimization

## Purchasing options

- Instance type
- Reserved Instances
- Spot Market

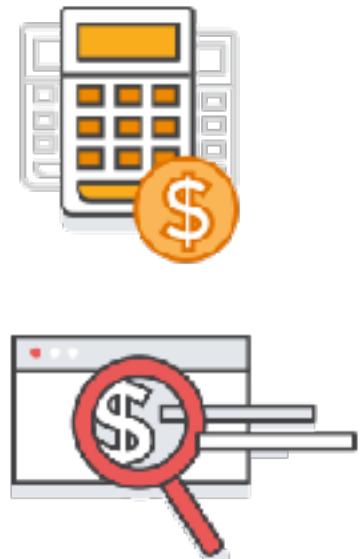


NO UPFRONT | PARTIAL UPFRONT | ALL UPFRONT



## Visibility

- Total Cost
- Utilization
- Optimization



Security (25 issues)	Cost (16 issues)	Availability (10 issues)	Usage (25 issues)
● 12 Idle DynamoDB Tables			
● 16 Idle EC2 Instances			
● 8 Idle Elastic Load Balancers			
● 2 Idle ElastiCache Nodes			
● 2 Previous Generation EC2 Instances Should Be Migrated			
● 2 Previous Generation RDS DB Instances Should Be Migrated			
▲ 19 EC2 Reserved Instance Purchase Recommendations			
▲ 2 ElastiCache Reserved Node Purchase Recommendations			
▲ 2 RDS Reserved DB Instance Purchase Recommendations			

# CLOUDAR SERVICES - Cost Optimisation

Test & Dev, do they really need to run 24/7 ?

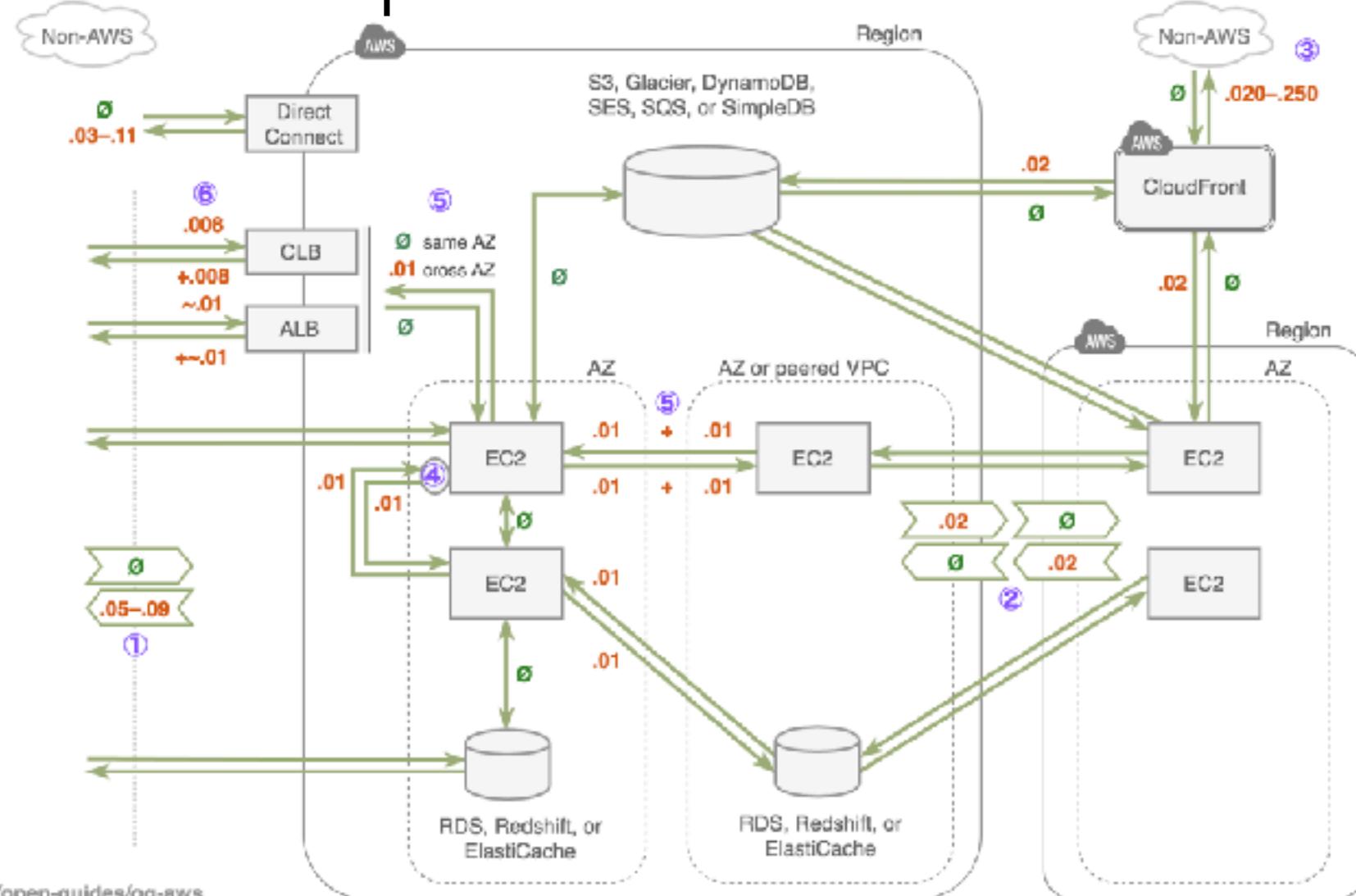
Security (35 issues)	Cost (16 issues)	Availability (18 issues)	Usage (25 issues)
12 Idle DynamoDB Tables			  
16 Idle EC2 Instances			  
8 Idle Elastic Load Balancers			  
2 Idle ElastiCache Nodes			  
7 Previous Generation EC2 Instances Should Be Migrated			 
2 Previous Generation RDS DB Instances Should Be Migrated			 
19 EC2 Reserved Instance Purchase Recommendations			 
2 ElastiCache Reserved Node Purchase Recommendations			 
2 RDS Reserved DB Instance Purchase Recommendations			 

# Costs and Cost Optimization

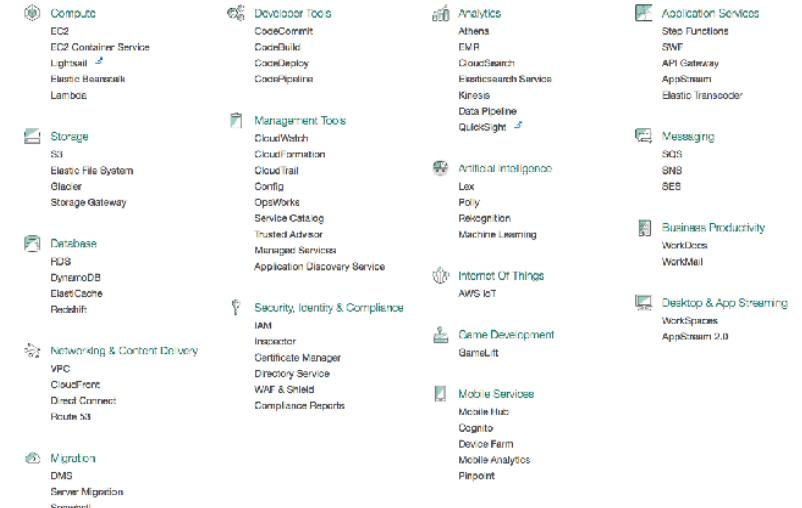
## AWS DATA TRANSFER COSTS

**Numbers are data transfer in \$/GB.**  
Transaction and hourly prices are not shown. See notes.

- ➀ Free. Inbound traffic is mostly free —you pay on the way out. Some but not all internal traffic is free.
- ➁ Direct outbound data starts at **\$0.09/GB** for <10TB, and discounts with volume. First 1GB free.
- ➂ Region-to-region traffic is **\$.02/GB** when it exits a region for indicated services.
- ➃ Outbound CloudFront prices are highly variable by geography and start at **\$.085/GB** in US/Canada.
- ➄ Internal traffic via public or elastic IPs incurs additional fees in both directions.
- ➅ Cross-AZ EC2 traffic within a region costs as much as region-to-region! ELB-EC2 traffic is free except outbound crossing AZs.
- ➆ Elastic Load Balancing: Classic LB is priced per GB. Application LB costs are in LCUs, not \$/GB.



# Architecting



# Implementation



# Operations

