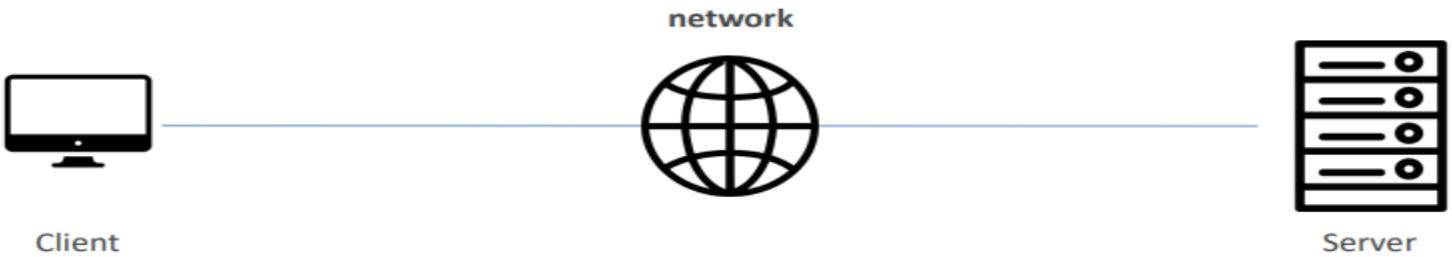
What is Cloud Computing Section

How websites work

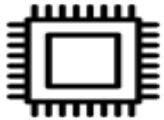


Clients have IP addresses

Servers have IP addresses

What is a server composed of?

- Compute: CPU
- Memory: RAM



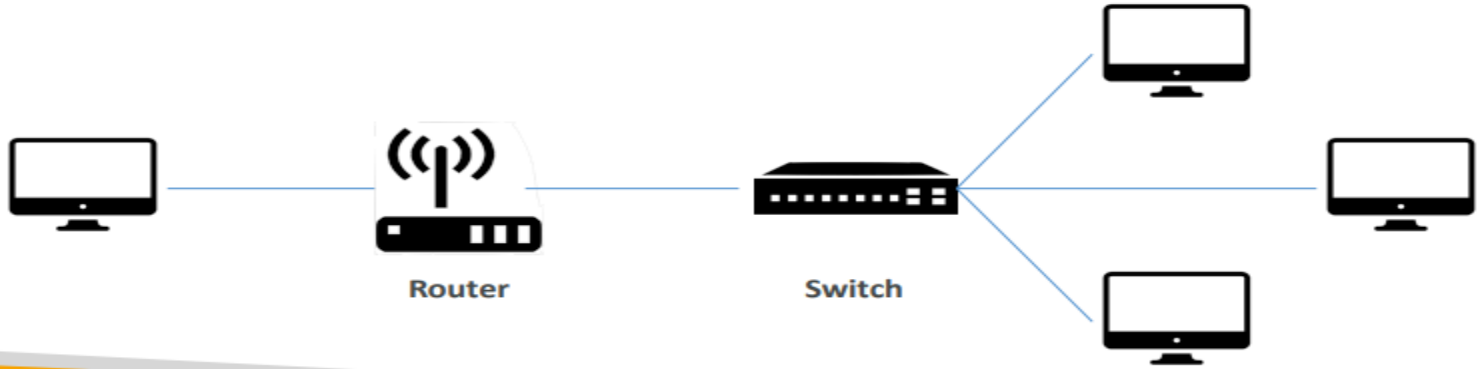
- Storage: Data

- Database: Store data in a structured way

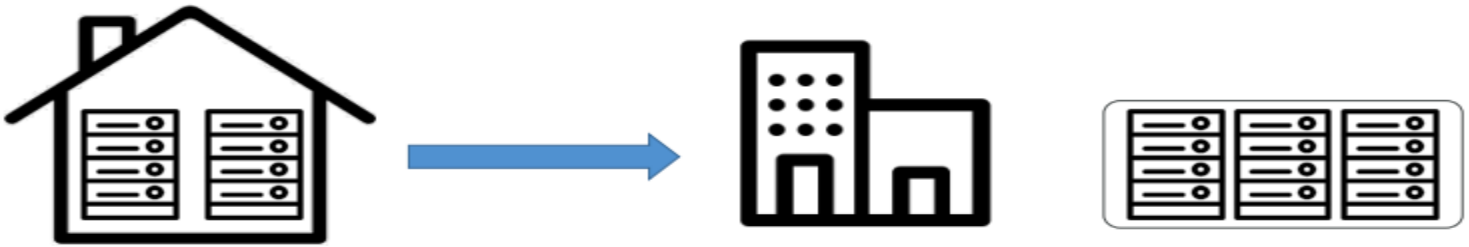
- Network: Routers, switch, DNS server

IT Terminology

- **Network:** cables, routers and servers connected with each other
- **Router:** A networking device that forwards data packets between computer networks. They know where to send your packets on the internet!
- **Switch:** Takes a packet and send it to the correct server / client on your network



Traditionally, how to build infrastructure



Problems with traditional IT approach

- Pay for the rent for the data center
- Pay for power supply, cooling, maintenance
- Adding and replacing hardware takes time
- Scaling is limited
- Hire 24/7 team to monitor the infrastructure
- How to deal with disasters? (earthquake, power shutdown, fire…)

- Can we externalize all this?

What is Cloud Computing?

- Cloud computing is the **on-demand delivery** of compute power, database storage, applications, and other IT resources
- Through a cloud services platform with **pay-as-you-go pricing**
- You can **provision exactly the right type and size of computing** resources you need
- You can access as many resources as you need, **almost instantly**
- Simple way to access **servers, storage, databases** and a set of **application services**

- Amazon Web Services owns and maintains the network-connected hardware required for these application services, while you provision and use what you need via a web application.

Office

The Cloud

You've been using some Cloud services

Gmail

- E-mail cloud service
- Pay for ONLY your emails stored (no infrastructure, etc.)

Dropbox

- Cloud Storage Service
- Originally built on AWS

Netflix

- Built on AWS
- Video on Demand

The Deployment Models of the Cloud

Private Cloud:

- Cloud services used by a single organization, not exposed to the public.
- Complete control
- Security for sensitive applications
- Meet specific business needs

Public Cloud:

- Cloud resources owned and operated by a third-party cloud service provider delivered over the Internet.
- Six Advantages of Cloud Computing

Hybrid Cloud:

- Keep some servers on premises and extend some capabilities to the Cloud
- Control over sensitive assets in your private infrastructure
- Flexibility and cost-effectiveness of the public cloud

The Five Characteristics of Cloud Computing

- **On-demand self service:**
  - Users can provision resources and use them without human interaction from the service provider
- **Broad network access:**
  - Resources available over the network, and can be accessed by diverse client platforms
- **Multi-tenancy and resource pooling:**
  - Multiple customers can share the same infrastructure and applications with security and privacy
  - Multiple customers are serviced from the same physical resources
- **Rapid elasticity and scalability:**
  - Automatically and quickly acquire and dispose resources when needed
  - Quickly and easily scale based on demand
- **Measured service:**
  - Usage is measured, users pay correctly for what they have used

Six Advantages of Cloud Computing

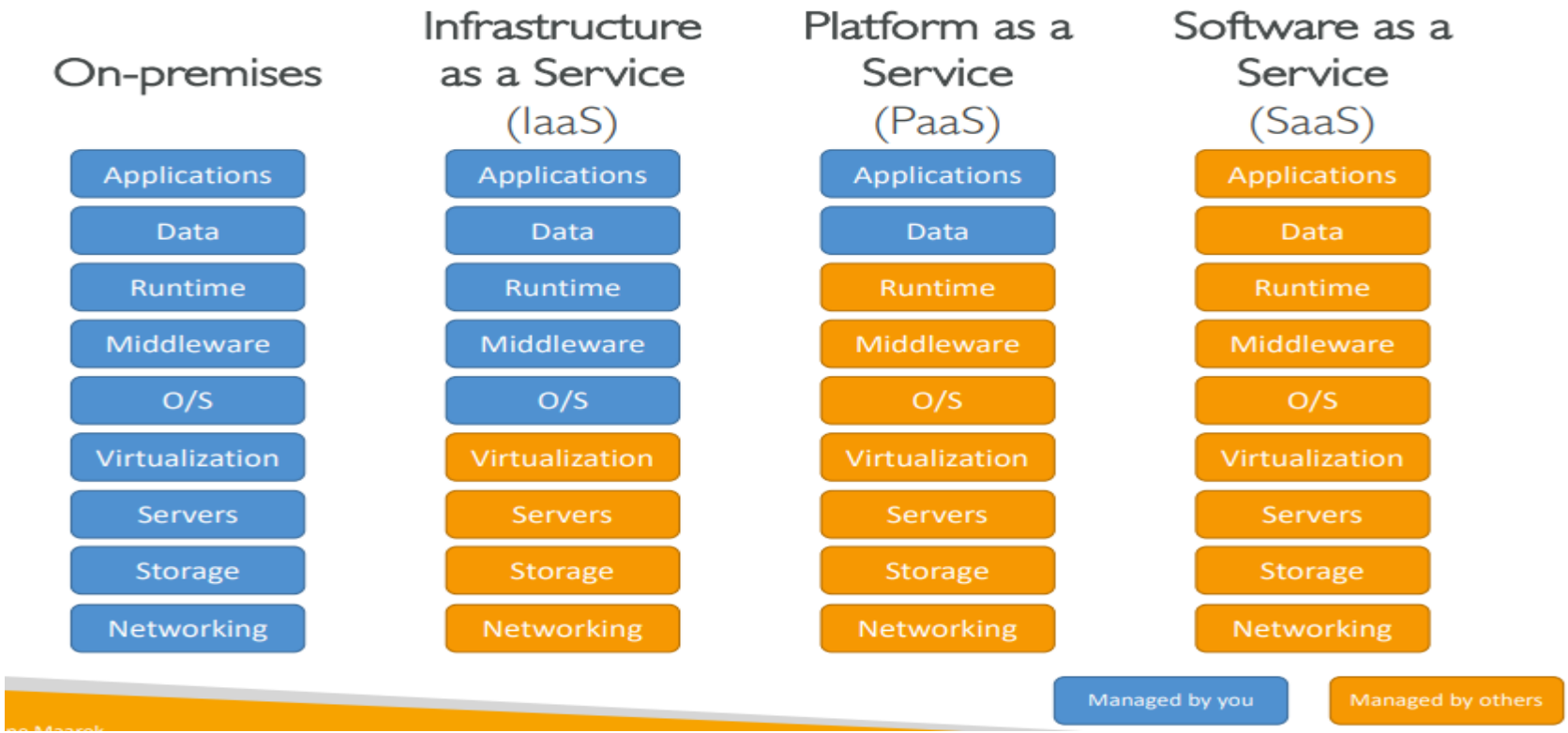
- Trade capital expense (CAPEX) for operational expense (OPEX)
  - Pay On-Demand: don't own hardware
  - Reduced Total Cost of Ownership (TCO) & Operational Expense (OPEX)
- Benefit from massive economies of scale
  - Prices are reduced as AWS is more efficient due to large scale
- Stop guessing capacity
  - Scale based on actual measured usage
- Increase speed and agility
- Stop spending money running and maintaining data centers
- Go global in minutes: leverage the AWS global infrastructure

Problems solved by the Cloud

- **Flexibility:** change resource types when needed
- **Cost-Effectiveness:** pay as you go, for what you use
- **Scalability:** accommodate larger loads by making hardware stronger or adding additional nodes
- **Elasticity:** ability to scale out and scale-in when needed
- **High-availability and fault-tolerance:** build across data centers
- **Agility:** rapidly develop, test and launch software applications

Types of Cloud Computing

- Infrastructure as a Service (IaaS)
  - Provide building blocks for cloud IT
  - Provides networking, computers, data storage space
  - Highest level of flexibility
  - Easy parallel with traditional on-premises IT
- Platform as a Service (PaaS)
  - Removes the need for your organization to manage the underlying infrastructure
  - Focus on the deployment and management of your applications
- Software as a Service (SaaS)
  - Completed product that is run and managed by the service provider


On-premises
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
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Applications
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Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Managed by you
Managed by others

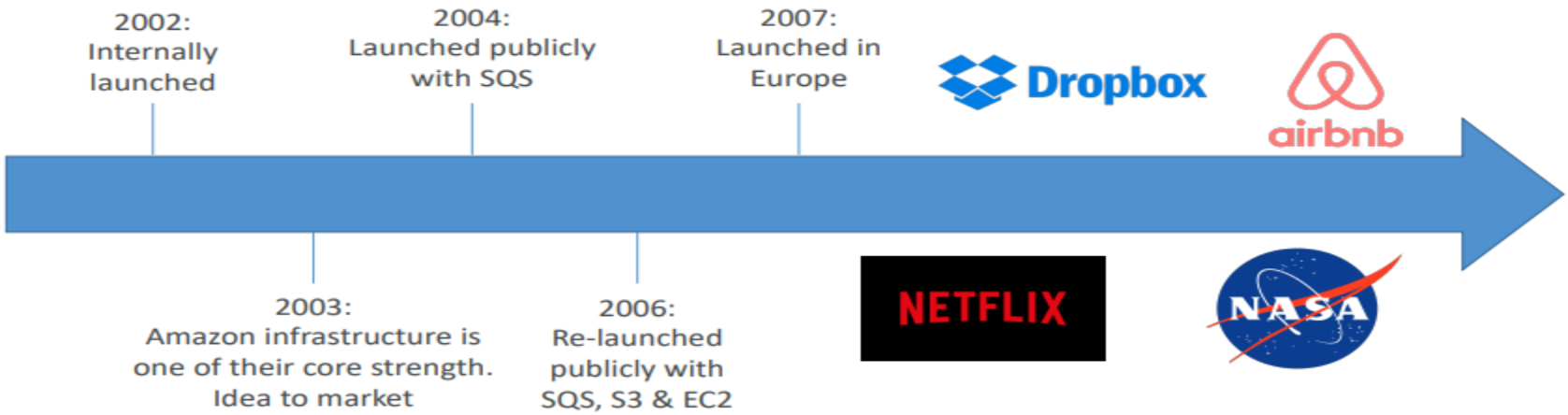
Example of Cloud Computing Types

- **Infrastructure as a Service:**
  - Amazon EC2 (on AWS)
  - GCP, Azure, Rackspace, Digital Ocean, Linode
- **Platform as a Service:**
  - Elastic Beanstalk (on AWS)
  - Heroku, Google App Engine (GCP), Windows Azure (Microsoft)
- **Software as a Service:**
  - Many AWS services (ex: Rekognition for Machine Learning)
  - Google Apps (Gmail), Dropbox, Zoom

Pricing of the Cloud – Quick Overview

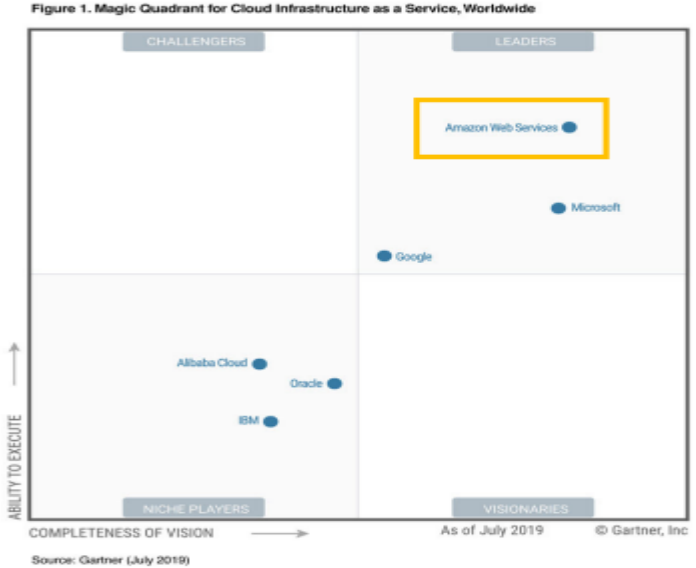
- AWS has 3 pricing fundamentals, following the pay-as-you-go pricing model
- **Compute:**
  - Pay for compute time
- **Storage:**
  - Pay for data stored in the Cloud
- **Data transfer OUT of the Cloud:**
  - Data transfer IN is free
- Solves the expensive issue of traditional IT

AWS Cloud History



AWS Cloud Number Facts

- In 2019, AWS had $35.02 billion in annual revenue
- AWS accounts for 47% of the market in 2019 (Microsoft is 2nd with 22%)
- Pioneer and Leader of the AWS Cloud Market for the 9th consecutive year
- Over 1,000,000 active users



Gartner Magic Quadrant

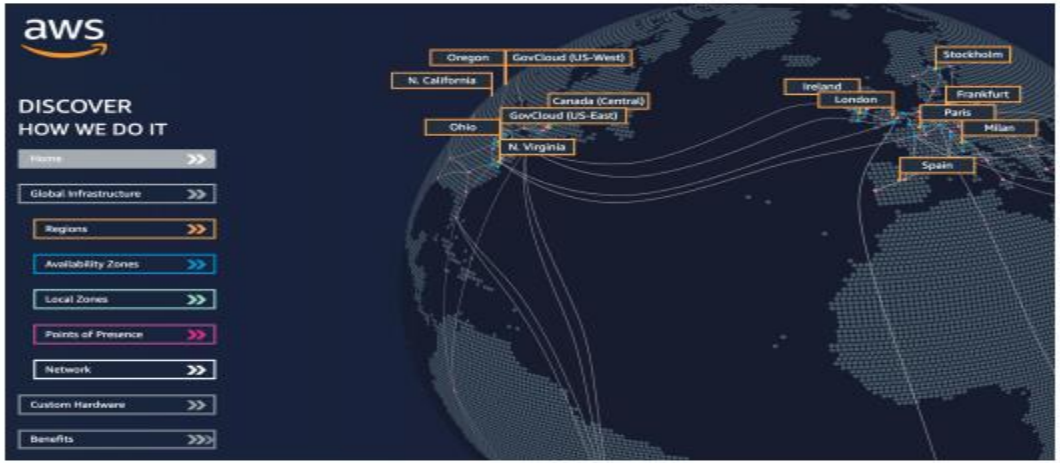
AWS Cloud Use Cases

- AWS enables you to build sophisticated, scalable applications
- Applicable to a diverse set of industries
- Use cases include
  - Enterprise IT, Backup & Storage, Big Data analytics
  - Website hosting, Mobile & Social Apps
  - Gaming

AWS Global Infrastructure

- AWS Regions
- AWS Availability Zones
- AWS Data Centers
- AWS Edge Locations / Points of Presence

- https://infrastructure.aws/



AWS Regions

- AWS has **Regions** all around the world
- Names can be us-east-1, eu-west-3…
- A region is a **cluster of data centers**
- **Most AWS services are region-scoped**

https://aws.amazon.com/about-aws/global-infrastructure/

US East (N. Virginia)	us-east-1
US East (Ohio)	us-east-2
US West (N. California)	us-west-1
US West (Oregon)	us-west-2
Africa (Cape Town)	af-south-1
Asia Pacific (Hong Kong)	ap-east-1
Asia Pacific (Mumbai)	ap-south-1
Asia Pacific (Seoul)	ap-northeast-2
Asia Pacific (Singapore)	ap-southeast-1
Asia Pacific (Sydney)	ap-southeast-2
Asia Pacific (Tokyo)	ap-northeast-1
Canada (Central)	ca-central-1
Europe (Frankfurt)	eu-central-1
Europe (Ireland)	eu-west-1
Europe (London)	eu-west-2
Europe (Paris)	eu-west-3
Europe (Stockholm)	eu-north-1
Middle East (Bahrain)	me-south-1
South America (São Paulo)	sa-east-1

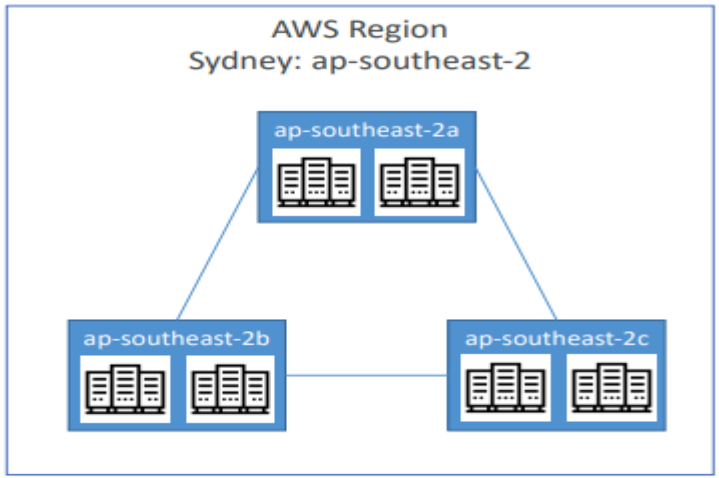
How to choose an AWS Region?

If you need to launch a new application, where should you do it?

- Compliance **with data governance and legal requirements:** data never leaves a region without your explicit permission
- Proximity **to customers:** reduced latency
- Available services **within a Region:** new services and new features aren't available in every Region
- Pricing**:** pricing varies region to region and is transparent in the service pricing page

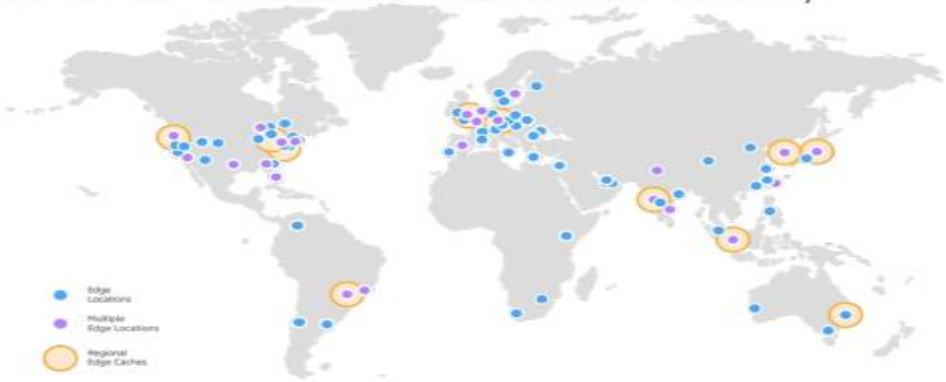
AWS Availability Zones

- Each region has many availability zones (usually 3, min is 3, max is 6). Example:
  - ap-southeast-2a
  - ap-southeast-2b
  - ap-southeast-2c
- Each availability zone (AZ) is one or more discrete data centers with redundant power, networking, and connectivity
- They're separate from each other, so that they're isolated from disasters
- They're connected with high bandwidth, ultra-low latency networking



AWS Points of Presence (Edge Locations)

- Amazon has 216 Points of Presence (205 Edge Locations & 11 Regional Caches) in 84 cities across 42 countries
- Content is delivered to end users with lower latency



https://aws.amazon.com/cloudfront/features/

Tour of the AWS Console

- **AWS has Global Services:**
  - Identity and Access Management (IAM)
  - Route 53 (DNS service)
  - CloudFront (Content Delivery Network)
  - WAF (Web Application Firewall)

- **Most AWS services are Region-scoped:**
  - Amazon EC2 (Infrastructure as a Service)
  - Elastic Beanstalk (Platform as a Service)
  - Lambda (Function as a Service)
  - Rekognition (Software as a Service)

- **Region Table:** https://aws.amazon.com/about-aws/global-infrastructure/regional-product-services

Shared Responsibility Model diagram

CUSTOMER = RESPONSIBILITY FOR THE SECURITY **IN** THE CLOUD

AWS = RESPONSIBILITY FOR THE SECURITY **OF** THE CLOUD

https://aws.amazon.com/compliance/shared-responsibility-model/

AWS Acceptable Use Policy

- https://aws.amazon.com/aup/

- No Illegal, Harmful, or Offensive Use or Content
- No Security Violations
- No Network Abuse
- No E-Mail or Other Message Abuse