Cloud Computing
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Agenda

• Automation testing

• Cloud Computing
  • Motivation factors from Distributed systems
  • Advantages
  • Service models
  • Deployment models
  • Challenges

• Main building blocks
  • Computing
  • Storage, Database, Networking and other applications
Ristcall wearable communication platform

Administrative Dashboard

Patient device

Staff device: RN, CNA, LPN
Automation Testing Near

- Patient bed
- Bathroom
- Outside patient room
WiFi scanning in hospital
Motivation factors

• Distributed Systems
  “Group of Independent computers that are networked together and appear to user as one computer and work together to achieve a common goal”

• Advantages
  Economics, Speed, Inherent Distribution, Reliability, Incremental Growth

• Disadvantages
  Software development, Networking, Security

Ref: http://www.qatar.cmu.edu/~msakr/15319-s10/lectures/lecture11.pdf
What is Cloud Computing

“On demand delivery of IT resources and applications via Internet with Pay as you go pricing”

Resources : Servers, Storage, data bases and applications

Advantages

• Capital expense Vs variables expense
• Economies of Scale
• Capacity Planning
• Speed and Agility
• Go Global

Ref:https://d0.awsstatic.com/whitepapers/aws-overview.pdf
Service delivery models

Ref: http://www.mazikglobal.com/blog/cloud-computing-stack-saas-paas-iaas/
Cloud Deployment models

• **Private Cloud**
  • Managed and Organized for its sole purpose

• **Community Cloud**
  • Managed by several organizations and supports specific community interests

• **Public Cloud**
  • Managed and organized by large cloud service provider (CSP)

• **Hybrid Cloud**
  • Composed of two are more of above models
Challenges - Security

- Guest Hopping Attack
- SQL Injection
- Side Channel Attack
- Malicious Insider
- Data Storage Security
- Address Resolution Protocol Cache Poisoning
- End users attack
- Network Level Security Attacks
- Domain Name System Attack
- Domain Hijacking
- IP Spoofing
  - (Denial of Service Attacks DOS)
- TCP SYN flooding
- Man In The Middle Attack (MITM)

What is Amazon EC2?

- Infrastructure-as-a-Service (IaaS)
- You can rent various types of virtual machines by the hour
- In your VMs, you can run your own (Linux/Windows) programs
  - Examples: Web server, search engine, movie renderer, ...

Source: http://www.cis.upenn.edu/~nets212/
Oh no - where has my data gone?

• Not all EC2 instances have persistent storage
  • Data survives stops & reboots, but not termination

If you store data on the virtual hard disk of your instance and the instance fails or you terminate it, your data WILL be lost!

• So where should I put persistent data?
  • Elastic Block Store (EBS) - in a few slides
  • Ideally, use an AMI with an EBS root (Amzon's default AMI has this property)
  • Caution: Default behavior is to delete the EBS upon termination of the instance

Source: http://www.cis.upenn.edu/~nets212/
Amazon Machine Images

• When I launch an instance, what software will be installed on it?
  • Software is taken from an Amazon Machine Image (AMI)
  • Selected when you launch an instance
  • Essentially a file system that contains the operating system, applications, and potentially other data
  • Lives in S3

• How do I get an AMI?
  • Amazon provides several generic ones, e.g., Amazon Linux, Fedora Core, Windows Server, ...
  • You can make your own
    • You can even run your own custom kernel (with some restrictions)

Source: http://www.cis.upenn.edu/~nets212/
Security Groups

- Basically, a set of firewall rules
  - Can be applied to groups of EC2 instances
  - Each rule specifies a protocol, port numbers, etc...
  - Only traffic matching one of the rules is allowed through

Sometimes need to explicitly open ports

Source: http://www.cis.upenn.edu/~nets212/
Regions and Availability Zones

• Where exactly does my instance run?
  • No easy way to find out - Amazon does not say

• Instances can be assigned to **regions**
  • Currently 12 available: US East (Northern Virginia), US West (Northern California), US West (Oregon), EU (Ireland), EU (Frankfurt), Asia/Pacific (Seoul), Asia/Pacific (Singapore), Asia/Pacific (Sydney), Asia/Pacific (Tokyo), Asia/Pacific (Mumbai), South America (Sao Paulo), AWS GovCloud
  • Important, e.g., for reducing latency to customers

• Instances can be assigned to **availability zones**
  • Purpose: Avoid correlated fault
  • Several availability zones within each region

Source: http://www.cis.upenn.edu/~nets212/
Network pricing

- AWS does charge for network traffic
  - Price depends on source and destination of traffic
  - Free within EC2 and other AWS services in the same region (e.g., S3)
  - Remember: ISPs are typically charged for upstream traffic

Source: http://www.cis.upenn.edu/~nets212/
Instance types

- So far: **On-demand instances**
- Also available: **Reserved instances**
  - One-time reservation fee to purchase for 1 or 3 years
  - Usage still billed by the hour, but at a considerable discount
- Also available: **Spot instances**
  - Spot market: Can bid for available capacity
  - Instance continues until terminated or price rises above bid


Source: [http://www.cis.upenn.edu/~nets212/](http://www.cis.upenn.edu/~nets212/)
Service Commitment
AWS will use commercially reasonable efforts to make Amazon EC2 and Amazon EBS each available with a Monthly Uptime Percentage (defined below) of at least 99.95% in each case during any monthly billing cycle (the "Service Commitment"). In the event Amazon EC2 or Amazon EBS does not meet the Service Commitment, you will be eligible to receive a Service Credit as described below.

Definitions

- "Monthly Uptime Percentage" is calculated by subtracting from 100% the percentage of minutes during the month in which Amazon EC2 or Amazon EBS, as applicable, was in the state of "Region Unavailable." Monthly Uptime Percentage measurements exclude downtime resulting directly or indirectly from any Amazon EC2 SLA Exclusion (defined below).
- "Region Unavailable" and "Region Unavailability" mean that more than one Availability Zone in which you are running an instance, within the same Region, is "Unavailable" to you.
- "Unavailable" and "Unavailability" mean:
  - For Amazon EC2, when all of your running instances have no external connectivity.
  - For Amazon EBS, when all of your attached volumes perform zero read write IO, with pending IO in the queue.
- A "Service Credit" is a dollar credit, calculated as set forth below, that we may credit back to an eligible account.

Service Commitments and Service Credits
Service Credits are calculated as a percentage of the total charges paid by you (excluding one-time payments such as upfront payments made for Reserved Instances) for either Amazon EC2 or Amazon EBS (whichever was Unavailable, or both if both were Unavailable) in the Region affected for the monthly billing cycle in which the Region Unavailability occurred in accordance with the schedule below.

<table>
<thead>
<tr>
<th>Monthly Uptime Percentage</th>
<th>Service Credit Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 99.95% but equal to or greater than 99.0%</td>
<td>10%</td>
</tr>
<tr>
<td>Less than 99.0%</td>
<td><a href="http://aws.amazon.com/ec2-sla/">link</a> (9/11/2013; excerpt)</td>
</tr>
</tbody>
</table>

Source: [http://www.cis.upenn.edu/~nets212/](http://www.cis.upenn.edu/~nets212/)
Recap: EC2

• What EC2 is:
  • IaaS service - you can rent virtual machines
  • Various types: Very small to very powerful

• How to use EC2:
  • Ephemeral state - local data is lost when instance terminates
  • AMIs - used to initialize an instance (OS, applications, ...)
  • Security groups - "firewalls" for your instances
  • Regions and availability zones
  • On-demand/reserved/spot instances
  • Service level agreement (SLA)

Source: http://www.cis.upenn.edu/~nets212/
Demo

• Logging into AWS Management Console
• Launching an instance
• Contacting the instance via ssh
• Terminating an instance

• Have a look at the AWS Getting Started guide:
  • http://www.cis.upenn.edu/~nets212/handouts/aws-getting-started.pdf
Questions ?