

1. Explain under-provisioning and over-provisioning in traditional datacenters. How does a cloud provide elastic computing?

- Under-provisioning occurs when there are insufficient resources allocated to a datacenter to meet the demand which leads to slow performance and possible downtime.
- Over-provisioning occurs when a datacenter is allocated more resources than necessary which results in wasted capacity and higher operational costs.
- Elastic computing in the cloud allows resources to be automatically allocated based on real-time demand to ensure that applications can scale up when demand increases and scale down when it decreases. This can help optimize both performance and cost-efficiency.

2. Compare Amazon AWS, Google cloud, and Microsoft Azure cloud in terms of services they provide.

- Amazon AWS provides numerous services across Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) which includes EC2 for compute, S3 for storage, RDS for databases, etc.
- Google Cloud offers similar services with Compute Engine (IaaS) and App Engine (PaaS) as well as unique services of BigQuery for analytics and GCP Storage for data storage.
- Microsoft Azure provides services such as Virtual Machines (IaaS), Azure App Services (PaaS), and enterprise tools such as Azure SQL Database and Azure Blob Storage.

3. How do Amazon AWS and Google Cloud achieve auto-scaling?

Auto-scaling in both AWS and Google Cloud is achieved by automatically adjusting EC2 instances based on real-time demand: AWS uses Auto Scaling Groups, and Google Cloud uses Managed Instance Groups. Users can define policies that scale the infrastructure based on metrics like CPU usage or network traffic.

4. Explain REST protocol and the operations it provides.

- REST (Representational State Transfer) is an architectural style that relies on web standards and operates on stateless communication between client and server with basic operations below:

GET = Retrieve a resource

POST = Create a resource

PUT = Update a resource

DELETE = Remove a resource

5. How are buckets and containers used in Amazon and Azure clouds?

- Amazon S3 uses buckets to store objects (files), where each bucket can contain a virtually unlimited number of objects.
- Azure uses containers within blob storage to organize blobs (files). Similar to S3 buckets, containers allow for scalable storage and organization of data.

6. What's the difference between web and worker roles in Azure cloud?

- Web roles are used to host web applications and handle HTTP/HTTPS requests via IIS (Internet Information Services).

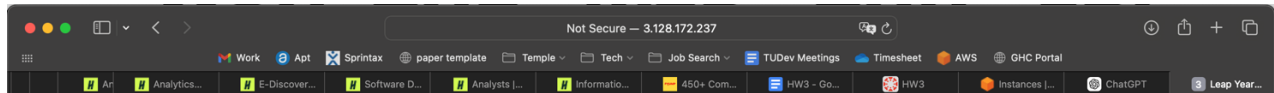
- Worker roles run background tasks and handle processing that doesn't require direct web user interactions. They can interact with web roles but focus on data processing or messaging.

7. What's the difference between full virtualization and para-virtualization?

- Full virtualization is when the guest OS is unaware that it is running in a virtual environment and does not need any modification. It simulates hardware, allowing unmodified guest operating systems to run as if on a real machine.
- Para-virtualization requires modifications to the guest OS to communicate with the hypervisor, improving efficiency by replacing non-virtualizable instructions with hyper-calls compared to full virtualization.

8. Using the EC2 you created in HW2, write a program to test whether a given year is a leap year or not and run this program on your EC2.

i. Screenshot of the results on web server:



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Year 1996 is a leap year

Year 2000 is a leap year

Year 2006 is not a leap year

Year 2023 is not a leap year

Year 2024 is a leap year

ii. The code source:

```
#/bin/bash

yum update -y
yum install -y httpd
systemctl start httpd
systemctl enable httpd

cat << 'EOF' > /var/www/html/index.html
<DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<title>Leap Year Checker</title>
</head>
<body>
<h1>CIS 4517 - Elle Nguyen - HW2</h1>
<div id="results"></div>
<script src="leapyear.js"></script>
</body>
</html>
EOF

cat << 'EOF' > /var/www/html/leapyear.js
function isLeapYear(year) {
  return year % 4 === 0 && (year % 100 !== 0 || year % 400 === 0);
}
const yearsToCheck = [1996, 2000, 2006, 2023, 2024];
const resultsList = document.getElementById('results');
yearsToCheck.forEach(year => {
  const p = document.createElement('p');
  if (isLeapYear(year)) {
    p.textContent = `Year ${year} is a leap year`;
  } else {
    p.textContent = `Year ${year} is not a leap year`;
  }
  resultsList.appendChild(p);
});
EOF

chmod 644 /var/www/html/index.html /var/www/html/leapyear.js
systemctl is-active --quiet httpd || systemctl start httpd
echo "HW2 Results:"
cat /var/www/html/index.html
```

iii. Screenshot of code running in EC2:

```
us-east-2.console.aws.amazon.com

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Last login: Fri Sep 27 02:34:56 2024 from 3.16.146.4
[ec2-user@ip-172-31-15-124 ~]$ cat /var/www/html/leapyear.js
function isLeapYear(year) {
  return year % 4 === 0 && (year % 100 !== 0 || year % 400 === 0);
}
const yearsToCheck = [1996, 2000, 2006, 2013, 2024];
const resultsList = document.getElementById('results');
yearsToCheck.forEach(year => {
  const p = document.createElement('p');
  if (isLeapYear(year)) {
    p.textContent = `Year ${year} is a leap year`;
  } else {
    p.textContent = `Year ${year} is not a leap year`;
  }
  resultsList.appendChild(p);
});
[ec2-user@ip-172-31-15-124 ~]$ cat /var/www/html/index.html
<!doctype html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Leap Year Checker</title>
</head>
<body>
  <h1>CIS 4517 - Elle Nguyen - HW2</h1>
  <div id="results"></div>
  <script src="leapyear.js"></script>
</body>
</html>
[ec2-user@ip-172-31-15-124 ~]$
```