

## CS 524 Homework-1

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**1. Using the formulae for the first software business model, find the year where the cumulative support expense equals that of the initial licensing fee  $p$ , where  $p = \$12,000$  per user, and  $c = 0.40$ . In how many years will the initial cost of software becomes 5% of the overall expenditure?**

**Ans:**

$$CSE = P * C * M$$

Cumulative support expense (CSE),  $P$  is licensing fee per user,  $C$  is ratio coefficient,  $M$  is number of years

Let,  $CSE = P$  (When CSE equals to that of the initial licensing fee)

$$P = P * C * M$$

$$1 = C * M$$

$$1 = 0.40 * M \quad (C = 0.40)$$

$$M = 1/0.40$$

$$M = 2.5$$

$$IC = N * P$$

Initial Cost (IC),  $N$  is number of employees,  $P$  is licensing fee per user

$$OE = N * P (1 + M * C)$$

Overall Expenditure (OE),  $N$  is number of employees,  $P$  is licensing fee per user,  $C$  is ratio coefficient,  $M$  is number of years

Let,  $IC = 5\%$  of  $OE$  (When the initial cost of software becomes 5% of the overall expenditure)

$$IC = 0.05 * OE$$

$$N * P = 0.05 * N * P (1 + M * C)$$

$$1 = 0.05(1 + M * 0.40) \quad (C = 0.40)$$

$$1/0.05 = 1 + M * 0.40$$

$$20 = 1 + M * 0.40$$

$$M * 0.40 = 19$$

$$M = 19/0.40$$

$$M = 47.5$$

Cumulative support expense equals that of the initial licensing fee in 2.5 years and the initial cost of software becomes 5% of the overall expenditure in **47.5 years**.

**2. Give three examples of each, SaaS, PaaS, and IaaS.**

**Ans:**

Some examples of Software as a Service(SaaS) companies are:

- i. Dropbox
- ii. Amazon Web Services

- iii. Cloud-based Microsoft Office 365

Some examples of Platform as a Service(PaaS) companies are:

- i. AWS Elastic Beanstalk
- ii. Windows Azure
- iii. Google App Engine

Some examples of Infrastructure as a Service(IaaS) are:

- i. Cisco Metacloud
- ii. Microsoft Azure
- iii. Google Compute Engine(GCE)
- iv. Amazon Web Services(AWS)

**3. In the definition of Hybrid Cloud, a term “Cloud bursting” is mentioned. Search the Web for its definitions. Do these definitions agree? If so, provide what you think is the best definition (you can rephrase it as you see fit). If not, explain the differences between the definitions.**

**Ans:**

Cloud bursting is an application configuration that allows the private cloud to “burst” into the public cloud and access additional computing resources without service interruption. These cloud bursts are triggered automatically in reaction to high demand usage or by a manual request.

A hybrid cloud, sometimes called a cloud hybrid. Is a computing environment that combines an on-premises data-center (also called a private cloud) with a public cloud, allowing data and applications to be shared between them.

From my studies and perspective I would say that cloud bursting and hybrid cloud are related to each other in a way that whenever necessary hybrid cloud uses cloud bursting to increase computing capacity.

(References: <https://www.atlassian.com/continuous-delivery/principles/cloud-bursting#:~:text=Cloud%20bursting%20is%20an%20application,or%20by%20a%20manual%20request.> , <https://azure.microsoft.com/en-us/overview/what-is-hybrid-cloud-computing/#:~:text=A%20hybrid%20cloud%E2%80%94sometimes%20called,to%20be%20shared%20between%20them.> )

**4. What are the essential differences between the public and private cloud that have made CIOs worry about legal consequences of Shadow IT? Read the original text of the US Government acts mentioned in the text (HIPAA and SOX) and summarize each in one paragraph.**

**Ans:**

In a Public Cloud scenario, individuals of each department in an organization access the cloud to satisfy their own needs. There is no involvement from the IT department. It is up to the department to decide what technology to utilize once the money has been authorized. They no longer require permission from the IT department or the CIO. Everything is available and accessible through the use of a Public Cloud. As a result, in the event of a Public Cloud, it is difficult to put a halt to Shadow IT. In contrast, everything in a Private Cloud system is monitored and requires formal approval from the IT department. The Private Cloud resources are monitored and cannot be accessed without permission. When accessing resources via the cloud, departments and employees must follow the

rules and regulations established by respective IT departments. As a result, Shadow In the case of a Private Cloud, it is readily combated. HIPAA is an acronym that stands for Health Insurance Portability and Accountability Act.

HIPAA was designed to establish data privacy and security safeguards for the protection of medical information. HIPAA protects and maintains an individual's medical records and health plans, whether electronic, written, or spoken. The rule establishes national security standards for digitally protected health information. The security regulation outlines a series of administrative, technical, and physical safeguards designed to ensure the integrity, availability, and confidentiality of electronic protected health information.

SOX is an abbreviation for the Sarbanes Oxley Act, also known as the "Public Company Accounting Reform and Investor Protection Act" and the "Corporate and Auditing Accountability and Responsibility Act." SOX was created to safeguard investors from the potential of firms engaging in false accounting practices. The SOX Act required severe regulations to improve corporate financial disclosures and prevent accounting fraud.

(References: <https://searchhealthit.techtarget.com/definition/HIPAA> ,  
<https://www.dhcs.ca.gov/formsandpubs/laws/hipaa/Pages/1.00WhatIsHIPAA.aspx> ,  
[https://en.wikipedia.org/wiki/Sarbanes%E2%80%93Oxley\\_Act](https://en.wikipedia.org/wiki/Sarbanes%E2%80%93Oxley_Act) )

**5. Consider the case of the Instagram as described in the textbook. How many employees and customers did it have at the time of the purchase by Facebook? How much did Facebook pay for it? What was the value that the purchased business has generated in the first two years, and what were the factors that enabled generating this value?**

**Ans:**

At the time of the Facebook acquisition, Instagram had 11 workers and 30 million customers. Facebook paid a one-billion-dollar sum. In the first two years after the purchase, Instagram produced a \$1 billion dollar valuation. The following are the factors that enabled this value to be generated:

- i. Having no physical infrastructure
- ii. A total of 11 employees
- iii. Just 3 employees employed to manage the infrastructure within Amazon Cloud
- iv. No capital expense required
- v. No physical servers needed to be procured and maintained and no technician paid to administer them.

The majority of the company's expenses were devoted to client acquisition and retention. The cloud enabled Instagram to scale automatically as more users joined without the site crashing.

**6. Familiarize yourself with the description of the Amazon Elastic Cloud Computing (<http://aws.amazon.com/ec2/>). What kind of a service model does it provide (i.e., SaaS, PaaS, IaaS, or a combination of these)? Please list the features that support your answer.**

**Ans:**

Amazon Elastic Computation Cloud (Amazon EC2) is a cloud computing online service that provides safe, resizable compute capacity. It is intended to make web-scale cloud computing more accessible to developers. The easy web service interface of Amazon EC2 allows you to access and configure capacity with minimal effort. It gives you complete control over your computing resources and allows you to run on Amazon's tried-and-true computing environment.

Amazon Elastic Cloud Computing offers IaaS as a service model for the following reasons:

- **Dispersed Services** — Similar to IaaS, resources such as servers, storage, networks, operating systems, and so on are distributed. By combining all of these resources, it gives the user with a highly strong working environment. The client is not required to acquire any of these, but has complete flexibility over how these sources are used and deployed.
- **Elastic Scaling** - For high performance, the web service handles resources more efficiently. This means that the resource capacity can be adjusted up or down based on the need. If there is a strong demand for the resources, the web service swiftly scales up the resources to meet the demand, and vice versa.
- **Complete Control** — Amazon EC2 gives customers complete computational control. As with IaaS, the user has control over processing, storage, networks, and other essential computing resources, and the user is free to deploy and run arbitrary applications, including operating systems. The user is not required to operate the underlying cloud infrastructure, but he or she does have control over the resources.
- **Numerous Users** — Similar to IaaS, Amazon EC2 permits multiple users, which means that all computational resources (such as computing power, memory size, and so on), servers or storages, privacy and security, and other instances are available to many users at the same time. This feature provides for the most efficient use of resources.
- **Variable Pricing** - The cost of using an IaaS's resources is not fixed. The customer must pay based on the amount of time used. There are no minimum costs; fees vary depending on how the resources are used. This results in controlled spending when the services are not in demand. As a result, it is ideal for workloads that are transitory, experimental, or vary suddenly.

For businesses who want to host cloud-based applications, EC2 delivers scalable infrastructure. Users of EC2 do not own the real servers; instead, AWS provides virtual servers.

(References: <https://aws.amazon.com/ec2/> , <https://aws.amazon.com/types-of-cloud-computing/> , <https://www.bigcommerce.com/blog/saas-vs-paas-vs-iaas/#the-three-types-of-cloudcomputing-service-models-explained> , <https://aws.amazon.com/application-hosting/benefits/> )

**7. Consider the example of the Zing Interactive Media and explain how you would launch the same service today using Amazon EC2. Specifically list the steps (and costs) you would avoid by doing so.**

**Ans:**

These are the steps I would have totally avoided if I were to launch Zing media today.

1. Rent space on hosting site.
2. Purchase and install server
3. Lease dedicated T1 lines.
4. Purchase networking gear
5. Purchase and install software (OS, DB, etc)
6. Purchase networking gear for installation in the **CAGE**
7. Purchase and install load balancer
8. Hire an IT team of networking experts, system administrators, database administrator in order to maintain the same.

**I would have deployed the product on AWS.**

(References: Cloud Computing Business Trends and Technologies)

**8. Explain what CPU pinning is and how Intel supports it with API.**

**Ans:**

Processor affinity, also known as CPU pinning or "cache affinity," allows a process or thread to be bound and unbound to a central processing unit (CPU) or a range of CPUs, such that the process or thread will execute only on the chosen CPU or CPUs rather than any CPU. In a symmetric multiprocessing operating system, this is a modification of the native central queue scheduling algorithm. Each item in the queue is labeled with the name of its kin processor. When it comes to resource allocation, each task is prioritized for its kin processor over others.

Intel provides an API that enables the host to guarantee a specific percentage of the CPU to a given virtual machine. This feature, which is effected by assigning a virtual machine to a specific processor or a set of processes, is available through the hypervisor and the Cloud provider's services and can be consumed by the application.

(References: Cloud Computing Business Trends and Technologies,  
[https://en.wikipedia.org/wiki/Processor\\_affinity](https://en.wikipedia.org/wiki/Processor_affinity))

**9. Study the Amazon EC2 SLA. What service commitment (in percentage) does it guarantee? What is the bound on the downtime in a year?**

**Ans:**

Amazon Compute Service Level Agreement (this "SLA") is a policy governing the use Amazon Elastic Compute Cloud (Amazon EC2) and applies separately to each account using the Included Services. AWS will use commercially reasonable efforts to make the Included Services each available for each AWS region with a Monthly Uptime Percentage of at least 99.99%, in each case during any monthly billing cycle (the "Service Commitment"). In the event any of the Included Services do not meet the Service Commitment, you will be eligible to receive a Service Credit as described below.

Service Credits are calculated as a percentage of the total charges paid by you (excluding onetime payments such as upfront payments made for Reserved Instances) for the individual Included Service in the affected AWS region for the monthly billing cycle in which the Unavailability occurred in accordance with the schedule below.

Monthly Uptime Percentage	Service Credit Percentage
Less than 99.99% but equal to or greater than 99.0%	10%
Less than 99.0% but equal to or greater than 95.0%	30%
Less than 95.0%	100%

The bound on the downtime in a year is atmost 876 hours

(References: Cloud Computing Business Trends and Technologies,  
<https://aws.amazon.com/compute/sla/>)

**10. What is the “telecom-grade” service commitment? Who were the ETSI NFV Industry Specifications Group founders? List the areas where the NFV is expected to act. (Optional recommended reading: the ETSI NFV White Papers.)**

**Ans:**

Telecom grade hardware is specifically intended for use in telecommunications networks, is designed to last over 15 years, and is functional 99.999 percent of the time. Solving the problems needed a new operational model that cuts costs and accelerates the deployment of new growth services.

To address the issue, seven of the world's largest telecom network operators collaborated to develop a set of standards that would serve as the foundation for the progress of virtualizing network services. On October 12th, 2012, representatives from 13 network operators throughout the world released a white paper describing the benefits and obstacles of doing so, as well as a call to action.

The areas in which the NFV is anticipated to act:

- Switching elements: BNG, CG-NAT, routers.
- Mobile network nodes: HLR/HSS, MME, SGSN, GGSN/PDN-GW, RNC, Node B, eNode B.
- Functions contained in home routers and set top boxes to create virtualised home environments.
- Tunnelling gateway elements: IPSec/SSL VPN gateways.
- Traffic analysis: DPI, QoE measurement.
- Service Assurance, SLA monitoring, Test and Diagnostics.
- NGN signalling: SBCs, IMS.
- Converged and network-wide functions: AAA servers, policy control and charging platforms.
- Application-level optimisation: CDNs, Cache Servers, Load Balancers, Application Accelerators.
- Security functions: Firewalls, virus scanners, intrusion detection systems, spam protection.