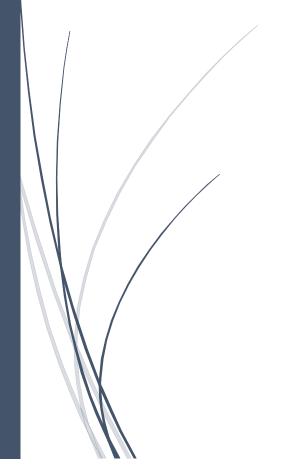# CS524

Homework 01

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Question01:

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 become 5% of the overall expenditure?

Solution:

$$Cummulative\ Support\ Expense\ (CSE) = c * p * m$$
$$since\ CSE = initial\ licensing\ fee = p$$
$$p = c * p * m$$
$$1 = c * m$$
$$m = \frac{1}{c}$$
$$m = \frac{1}{0.40} \approx 2.5 years$$

Initial Cost of Software becomes 5% of overall expenditure.

$$Initial\ Cost\ (IC) = n * p => 12000n$$
$$Overall\ Expenditure\ (OE) = n * p * (1 + m * c) => 12000n * (1 + 0.4m)$$
$$IC = 0.05 * OE$$
$$12000n = 0.05 * \left(12000n * (1 + 0.4m)\right)$$
$$1 = 0.05 * (1 + 0.4m)$$
$$\frac{1}{0.05} = 1 + 0.4m => \frac{\frac{1}{0.05} - 1}{0.04} = m$$
$$m = 47.5 years$$

Question02:

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

Solution:

- Software as a Service (SaaS):
    - Microsoft 365 Apps
    - Google Workspace Apps
    - Dropbox
- Platform as a Service (PaaS):
    - Heroku (Application deployment platform)
    - AWS Elastic Beanstalk
    - AWS Elastic Container Service
- Infrastructure as a Service (IaaS):
    - AWS
    - Google Compute Engine
    - Microsoft Azure

Question03:

In the definition of Hybrid Cloud, a term "Cloud bursting" is mentioned. Search the Web for its definitions. Do these definitions agree with one another? 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.

Solution:

"Cloud Bursting" is the concept where the system is configured in such a way that computation power is fetched from cloud resource when on-premises infrastructure hits peak workload capacity.

"Hybrid Cloud" also refers to the concept of using a combination of on-premises and cloud resources for operational purposes.

Since both the terminologies/concept uses a concept of using both the on-premises and cloud resources in combination, it can be said that Hybrid Cloud is a subset of Cloud Bursting.

Question04:

What are the essential differences between the public cloud and private cloud that have made CIOs worry about the 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.

Solution:

In a public cloud, the only restriction which can be enforced is the account creation of a user/employee on the cloud service provider, once the account is created, you have no control over what the user/employee is granted access to, resulting in zero to bare minimum control of IT/CIO departments to regulate the use/creation/utilization of cloud resources.

In a private cloud, a more established access control can be used where every access/activity can be monitored and regulated in a well-organized and documented fashion. Hence IT/CIO departments can have more control.

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a federal law that required the creation of national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge. The US Department of Health and Human Services (HHS) issued the HIPAA Privacy Rule to implement the requirements of HIPAA. The HIPAA Security Rule protects a subset of information covered by the Privacy Rule. A major goal of the Privacy Rule is to make sure that individuals' health information is properly protected while allowing the flow of health information needed to provide and promote high-quality healthcare, and to protect the public's health and well-being.

The Sarbanes-Oxley Act (SOX) is a federal act passed in 2002 with bipartisan congressional support to improve auditing and public disclosure in response to several accounting scandals in the early-2000s.

- https://www.hhs.gov/hipaa/for-professionals/privacy/laws-regulations/index.html
- https://www.cdc.gov/phlp/publications/topic/hipaa.html#:~:text=HIPAA%20Privacy%20Rule,-The%20Privacy%20Rule&text=A%20major%20goal%20of%20the,public's%20health%20and%20well%2Dbeing.
- https://sarbanes-oxley-act.com/
- https://en.wikipedia.org/wiki/Sarbanes%E2%80%93Oxley_Act

Question05:

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.

Solution:

Amazon EC2 provides high performance, on-demand, and scalable computing resources with complete control over the functionality of that specific instance.

It tends to be more of a IaaS due to the following reasons:

- Provides a bare metal compute instance with more control to the user in terms of various aspects i.e. networking, communications, access controls, operating systems, storage, etc.
- Users are billed according to their usage, the more you use the more you pay and vice versa.
- The user does not have to worry about the underlying infrastructure and can configure the system as per their needs and demand, along with the applications/processes to be executed on that infrastructure.

Question06:

Consider the example of 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.

Solution:

Launching a company using EC2 instance can help in avoiding:

- Avoiding the maintenance cost and overhead of on-premises compute resource.
- Avoid the Cost of purchasing and setting up an on-premises infrastructure.
- Decreased Capital Expenditure.
- No need to anticipate peak and off-peak hours, system can be scaled elastically based on current demands.
- Less human resources are required to maintain the on-premises infrastructure.

Question07:

Consider the case of 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?

Solution:

At the time of acquisition, Facebook paid ~$1B in cash and stocks for 11 employees managing a customer base of 30 million. In 2 years, Facebook was able to generate $1B in value.

The potential reasons to generate such value was:

- No procurement of physical servers.
- No Capital Expenditure
- The upfront cost was the cost of those people and infrastructure that came with the purchase.

Question08:

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

Solution:

CPU pinning is the concept of running a virtual device on a specific physical CPU on a specific host using the same underlying hardware resources.

Intel API supports it by allowing the hardware to reserve a specific percentage of CPU computing power for the virtual machine. This functionality is provided by mean of Hypervisor and Virtualization concept.

Question09:

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

Solution:

The service commitment is to guarantee an uptime of at least 99.95% for each monthly billing cycle.

The salient features of Amazon EC2 are:

- Monthly uptime % was calculated by subtracting the % when the EC2 was in "Unavailability" State from a total of 100%.
- Service Credit for Monthly Uptime % between 99 to 99.95 is 10%.
- Service Credit for Monthly Uptime % less than 99 is 30%.

The bound of downtime in a year is 0.5% ~ 263 minutes.

Question10:

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.)

Solution:

"Telecom Grade" service commitment means specifically engineering hardware to run in telecommunications networks for a life span of 15 years with a maximum allowed downtime of 5minutes per year.

Since designing and maintaining infrastructure with such strict requirements was high cost bearing task. Therefore, the need for an operational model was required that could minimize the cost and speed up the process of new innovations and experimentation.

To address this, the world's seven leading telecom providers partnered together to design the standards for the virtualization of network services. On 12th October 2012, representatives of 13 network operators from all over the world published a White paper to enlighten the benefits and challenges to be faced for this design of standards. Later, 52 other network operators, IT vendors, Technology Consultant came forward and formed ETSI NFV Industry Specification Group.

The ETSI NFV Industry Specification Group is expected to act in:

- Cost Reductions
- Reduction of Development Time
- Reduction of Replacement Cost
- Reduction of Equipment Cost
- Streamlining High Touch Process
- Operational Improvements