

CS 524 Homework #1

Due: January 29, 2019

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?

Answer: (ref: Module 1)

Part-1

- The support expense for one year is " cp ". Thus, the cumulative support expense will for " m " years will be " mcp ". (Here, c is support ratio coefficient and p is one-time per user license fee)
- Now it is give that that cumulative support expense = initial licensing fee " p ". Thus,
 $\Rightarrow mcp = p$
 $\Rightarrow mc = 1$
 $\Rightarrow m = 1/c$ (given $c=0.40$)
 $\Rightarrow m = 1/0.40$
 $\Rightarrow m = 2.5$ years
- Thus, it will take 2.5 years where the cumulative support expense will equal to initial licensing fee.

Part-2

- The initial cost of the software will be and the overall expenditure will be $np(1+mc)$ (where " m " is number of years, " c " is support ratio coefficient, " n " is number of employees and " p " is one-time per user license fee)
- Now if initial cost of software becomes 5% of the overall expenditure then,
 $\Rightarrow np = 0.05 np(1+mc)$
 $\Rightarrow 1/0.05 = 1+mc$
 $\Rightarrow 20 = 1+mc$
 $\Rightarrow mc = 19$
 $\Rightarrow m = 19/0.40$
 $\Rightarrow m = 47.5$ years

- Thus, it will take 47.5 years where the cost of software becomes 5% of the overall expenditure.
2. 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.

Answer:

- **Definition 1** (ref: <https://searchcloudcomputing.techtarget.com/definition/cloud-bursting>): Cloud bursting is an application deployment model in which an application runs in a private cloud or data center and bursts into a public cloud when the demand for computing capacity spikes.
 - **Definition 2** (ref: <https://azure.microsoft.com/en-us/overview/what-is-cloud-bursting>): In cloud computing, cloud bursting is a configuration that’s set up between a private cloud and a public cloud to deal with peaks in IT demand. If an organization using a private cloud reaches 100 percent of its resource capacity, the overflow traffic is directed to a public cloud so there’s no interruption of services.
 - **Definition 3** (ref: <https://www.techopedia.com/definition/26438/cloud-burst>): Cloud burst is a quality of service (QoS) metric used to gauge cloud solution scalability and measure software application capability and performance on hosted cloud platforms. Cloud application and service vendors provide benchmark performance ratios for total leased infrastructure and ensure maximized application hosting. However, a well-designed, scalable, flexible and reliable architecture easily handles network traffic and computing requirements, while a poorly-designed architecture will falter when subjected to resource-hungry applications. Also known as cloud bursting.
 - *The above given definitions are expressing the same idea in different ways. Moreover, cloud bursting is a configuration (used by well-designed architecture)which handles the overload of the data when the demand of computing capacity is on peak for a private cloud of an organization, thereby, directing the overload to public cloud. Thus the key advantage is economical savings. The organization only pay for the additional resources when there is a demand for those resources.*
3. 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.

Answer:

- **Private Cloud:** A private cloud hosting solution, also known as an internal or enterprise cloud, resides on company's intranet or hosted data center where all of your data is protected behind a firewall. This can be a great option for companies who already have expensive data centers because they can use their current infrastructure. However, the main drawback people see with a private cloud is that all management, maintenance and updating of data centers is the responsibility of the company. Over time, it's expected that your servers will need to be replaced, which can get very expensive. On the other hand, private clouds offer an increased level of security and they share very few, if any, resources with other organizations. Thus, private cloud follows the SOX and HIPAA acts completely but as mentioned above it can be very expensive.
 - **Public Cloud:** The main differentiator between public and private clouds is that you aren't responsible for any of the management of a public cloud hosting solution. Your data is stored in the provider's data center and the provider is responsible for the management and maintenance of the data center. This type of cloud environment is appealing to many companies because it reduces lead times in testing and deploying new products. However, the drawback is that many companies feel security could be lacking with a public cloud. Even though you don't control the security of a public cloud, all of your data remains separate from others and security breaches of public clouds are rare. There is a possibility of violation of SOX and HIPAA acts and can compromise the privacy of the user.
4. 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?

Answer: (ref: textbook)

- At the time of the purchase by Facebook, Instagram had 11 employees and 30 million customers.
- Facebook bought Instagram for one billion dollars.
- The value that the purchased business has generated in the first two years was one billion dollars. The factors which enabled generating this value were no capital expense required, no physical servers needed to be produced and maintained, and no technicians paid to administer them.

5. 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.

Answer: (ref: <http://aws.amazon.com/ec2/>)

- AWS Elastic Compute Service or EC2 is IaaS (Infrastructure as a Service). This is because Amazon takes the responsibility of networking, storage, server and virtualization and the user is responsible for managing the Operating System, middleware, runtime, data and application
6. Read the article on Fog Computing provided in the lecture. Familiarize yourself with the OpenFog Consortium (www.openfogconsortium.org) and answer the following questions:
- a. How many members does the consortium have?
 - The consortium has a remarkable global presence with members in more than 30 countries.
 - b. What is the definition (one sentence) of Fog computing according to the consortium?
 - Fog computing is a system-level horizontal architecture that distributes resources and services of computing, storage, control and networking anywhere along the continuum from Cloud to Things
 - c. What is the goal of the consortium?
 - The goal of the OpenFog Consortium is to create open reference architecture for fog computing, build operational models and testbeds, define and advance technology, educate the market and promote business development through a thriving OpenFog ecosystem.

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.

Answer: (ref: Textbook, <http://aws.amazon.com/ec2/>)

- The steps which can be followed for the concept of Zing Interactive Media using Amazon EC2 can be:
 1. Creating and configuring the virtual machine and launching the instance.
 2. specify the software and specifications of the instance you want to use
 3. Choosing appropriate instance type.(Instance types comprise of varying combinations of CPU, memory, storage, and networking capacity)
 4. Creating key pair to launch the instance.
 5. Finally connecting the instance created.
- Here, specifically we can reduced the cost and some of the steps used in the example. They are as follows:
 1. Anticipating the peak use amount and developing redundancy schema of the service can be excluded.
 2. Negotiation with the vendors can be excluded as you pay only for the compute power, storage, and other resources you use, with no long-term contracts or up-front commitments. This reduces the cost too.
 3. You take advantage of a scalable, reliable, and secure global computing infrastructure thereby, avoiding the IT team for maintenance.
 4. Finally, we would hire fewer developers as building a robust scalable application would be as simple as defining the life cycle management rules in the relevant service of the Cloud provider

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

Answer:

(ref:<https://www.intel.com/content/www/us/en/programmable/documentation/fvw1509735491174/skl1509737392386/vvh1509739935019/wsf1509990556196.html>)

- CPU pinning, enables the binding and unbinding of a process or a thread to a central processing unit (CPU) or a range of CPUs, so that the process or thread will execute only on the designated CPU or CPUs rather than any CPU.
- Intel supports CPU pinning through APIS. The *NX platform has a scheduler library that provides APIs for CPU affinity. Intel is providing API that allows the host to guarantee a certain percentage of the CPU to a given virtual machine.

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

Answer: (ref: <https://aws.amazon.com/compute/sla/>)

- Amazon EC2 SLA commits of at least 99.95% service commitment.
- The bound on the downtime in a year is therefore calculated as under:
 $365 * 0.0005 = 0.1825$ days or 4.38 hours
- Thus, if during a year of service there is an outage and system is down for more than 4.38 hours, then one is liable for compensation.

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.)

Answer: (ref: <https://www.etsi.org/technologies/nfv>)

- “Telecom grade” means that the hardware is specifically engineered for running in telecommunications networks, designed to live in the network for over 15 years, and functional 99.999% of the time.
- The founders of ETSI NFV ISG includes: AT&T, BT, Deutsche Telekom, Orange, Telecom Italia, Telefonica, and Verizon.
- The areas the NFV is expected to act includes: operational improvements cost reductions streamlining high-touch processes reduction of development time reduction of replacement costs reduction of equipment costs