HOMEWORK - 1

1)

Given :

P= $12000

C =0.4

As per the formula for total cost for n employees over m yrs:

- ⇨ *Total cost = np(1 + mc)*

Firstly, year in which where the cumulative support expense equals that of the initial licensing fee :

Acc. to the formula,

Total cost = np + npmc,

Where,

np -> initial one-time cost,

npmc -> cumulative support cost

Since no. of employees in not given, we assume n=1, hence our formula becomes:

- ⇨ Total cost = p(1+mc)
  = p + pmc

Thus, cumulative support cost = pmc

From our question,

- ⇨ p = pmc
- ⇨ mc =1
- ⇨ m = 1/0.4 = 2.5 yrs

Thus, in **2.5 yrs** does the cumulative support cost equal initial licensing fee

When will initial cost become 5% of overall cost?

As per our above discussion,

- ⇨ initial cost = 5% of total overall cost
- ⇨ p = 0.05p(1 + mc)
- ⇨ 1 + mc = 20
- ⇨ m = 19/0.4 = **47.5yrs**

Ans : 2.5 yrs, 47.5yrs

2)

The example of SaaS are as follows:

i) A **cloud-hosted computer game** : the game in hosted on the cloud but user can interact with the terminal where the game is played.

ii) **Gmail application** which is hosted on google systems but we can interact with app.

iii) **Twitter**, Instagram and other social media sites are hosted on cloud services distributed around the world providing the application access to user over the internet.

The examples of PaaS are as follows:

i) **Heroku**: Heroku is a platform as a service (PaaS) that enables developers to build, run, and operate applications entirely in the cloud.

ii) **Google App Engine**: Allows you to build highly scalable applications on a fully managed serverless platform.

iii) **AWS Elastic Beanstalk** : allows you to quickly deploy and manage applications in the AWS Cloud without worrying about the infrastructure that runs those applications

The examples of IaaS are as follows:

i) **Amazon EC2** : this service allows the users to manage the operating System, middleware, runtime, data and application, but not the underlying cloud infrastructure like networking, storage, server, and virtualization

ii) **Google Compute engine**: likewise google compute engine provides access to the infrastructure to the users

iii) **DigitalOcean**: DigitalOcean is a cloud infrastructure provider that provides storage, networking, compute and database products.

Sources: Textbook, SaaS vs PaaS vs IaaS: What's The Difference & How To Choose(https://www.bmc.com/blogs/saas-vs-paas-vs-iaas-whats-the-difference-and-how-to-choose/)

3)

After going through several definition for Cloud bursting on the web(which are listed in sources), it can be inferred that they speak of more or less the same idea.

I believe the most definition is as follows:

"Cloud bursting is a technique used by hybrid clouds to provide additional resources to applications hosted on private clouds on an as-needed basis. If the private cloud has the processing power to handle its workloads, the public cloud is not used; however if it need arises it can leverage the elasticity of the public cloud. "

Sources:

Cloud Bursting (https://www.atlassian.com/continuous-delivery/principles/cloud-bursting),

cloud bursting (https://www.techtarget.com/searchcloudcomputing/definition/cloud-bursting),

CLOUD BURSTING (https://www.intricately.com/glossary/cloud-bursting),

CLOUD BURSTING (https://www.alluxio.io/learn/hybrid-cloud/cloud-bursting/),

WHAT IS CLOUD BURSTING, AND WHY IS IT IMPORTANT? (https://www.brightcomputing.com/blog/what-is-cloud-bursting-and-why-is-it-important)

4)

A public cloud is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the Cloud provider. The most important examples of it are Amazon Web Services(AWS), Google Cloud Platform(GCP) and Microsoft Azure.

A private cloud infrastructure is provisioned for exclusive use by a single organization.

This can take the form of a Virtual private cloud which are build on dedicated secure areas on the public cloud that are reserved for exclusive use by a single organization granting its IT full control over security as well as costs. Here service-level agreements and potential liabilities are clearly defined.

Or it can be a true private cloud that is built in the organization's own data centers.

The evolution from public clouds to private clouds in certain organizations is the result of fear over Shadow IT. Many Chief Information Officers(CIOs), have worried about this as it has many security implications. The involvement of a third party(public cloud) with the organization's data(often user data entrusted with the organization), and the loss of control over the personnel(which is outsourced to the public cloud provider); causes legal consequences related to data security and privacy. Usage of a public cloud can often easily leads to data ending up with the cloud provider and out of the custody of the organization entrusted with it. This data is then handles by IT personnel of the clod provider. The HIPAA and SOX are two examples of US government regulation regarding protection of user data to which the CIOs fear running afoul. This has led to gradual movement in certain company's from cloud to either virtual or true private cloud.

US Health Insurance Portability and Accountability Act (HIPAA), prohibits disclosures of records contained in a system of records maintained by a federal agency (or its contractors) without the written request or consent of the individual to whom the record pertains. HIPAA will prohibit any company that is part of the health insurance sector or working as a contractor on public data from disclosing that data to any third party without written consent from the patient to whom the data pertains.

Sarbanes–Oxley Act(SOX) is a United States federal law that mandates certain practices in financial record keeping and reporting for corporations. In a nutshell, it puts requirements on all US public companies boards of directors and management and public accounting firms, with regards to handling financial data of users and also on some private companies regarding wilful destruction of evidence.

Source: Textbook, Health Information Privacy(https://www.hhs.gov/hipaa/index.html), HIPAA Regulations: The Privacy Act - Relationship to Other Federal Laws(https://www.bricker.com/industries-practices/health-care/insights-resources/resource/hipaa-privacy-regulations-the-privacy-act--relationship-to-other-federal-laws-220), Sarbanes–Oxley Act (https://en.wikipedia.org/wiki/Sarbanes%E2%80%93Oxley_Act)

5)

At the time of its purchase by Facebook, Instagram had **11 employees** and **30 million** customers. Facebook bought it for **1 Billion dollars**.

Within 2 years of the purchase, Instagram generated **1 billion dollars value.** The factors enabling this impressive growth was that Instagram had outsourced its entire infrastructure to Amazon Cloud, which enabled it to operate with just 11 employees in the first place. With no cost overhead from capital expenditure, physical servers purchase and maintenance, no technicians needing to maintain them (just 3 employees managed Instagram on Amazon cloud), etc., enabled the company to focus almost entirely toward customer acquisition and retention.

Source: Textbook

6)

Amazon EC2 is a secure and resizable compute capacity for virtually any workload. According to the features of it working, the Amazon EC2, should be classified as *IaaS (Infrastructure as a service)*, for the following reason listed below:-

i)

Amazon EC2 allow you to host your own Operating system, runtimes and middleware on it infrastructure. This is characteristic of IaaS.

ii)

We have the option of enabling enhanced networking in EC2.

iii)

Amazon EC2 provides pay-as-you-go storage facilities as part of its infrastructure.

iv)

While EC2 Auto Scaling allows you to automatically scale your Amazon EC2 capacity up or down according to conditions you define. This is a feature that is characteristic of IaaS, as we are modifying the parameters of the infrastructure, but the infrastructure itself is provided by the Amazon

Source: AWS EC2 documentation and Textbook

7)

To launch the *Zing interactive media*, a service dedicated to providing radio listeners with ability to interact with the content they listen to, via simple voice command – we can deploy it on Amazon EC2 and provide it to the users as SaaS service.

We will follow the steps below to set up the service on EC2:

i) we will create an account on the Amazon web services (AWS) and configure the services we will need such as EC2 by paying for the plans best fitting the requirements of our task. We here avoid the cost of securing a plot to host a physical server infrastructure and renting T1 data transmission service to connect to it, in a non-cloud solution.

ii) before configuring for the various services that AWS provides, we will make a plan estimating the usage of Zing application.

Firstly, we will configure only those many EC2 instances as required for median estimated usage for Zing instead of configuring of peak usage which we would have to do in an on- premise solution. Here, the on-demand extensibility of EC2 will work in peak scenarios.

Secondly, if we need to store any historical data for Zing application, we can configure S3 buckets instead of physical storage.

iii) We here make use of the EC2 maintenance provided by Amazon instead of relying on support contracts. We also avoid the cost of coolers needed for the physical servers and compute engines.

iv) We install the operating systems on EC2 and use Redshift, dynamoDB, etc as needed for any database usage. In on-premise solution, we would need to purchase and install the OS and databases on the server.

v) Finally, we deploy our main Zing Interactive media application on the cloud. We hire a smaller team dedicated mostly to the main application instead of a much larger team for infrastructure management and maintenance as in a non-cloud solution.

Source: AWS EC2 documentation and Textbook

8)

CPU Pinning enables the binding and unbinding of a process or a thread to a central processing unit (CPU) or multiple of CPUs, so that the process or thread will execute only on the designated CPU or CPUs rather than on any CPU.

In recent years, as some businesses feel a drawback in the inability of public clouds to provide granularity in the infrastructure they provide, and feel a need to move to private clouds; intel steps in to contribute to a solution. CPU pinning is part of the solution to reserve-specific configuration parameters.

Intel is providing an API that allows the host to guarantee a certain percentage of the CPU to a given virtual machine running certain process. This is exposed via the hypervisor and the cloud provider's systems.

Source: Textbook, Wikipedia(Processor affinity - Wikipedia) and Intel Technology Guide(CPU Management - CPU Pinning and Isolation in Kubernetes Technology Guide (intel.com))*

9)

In Amazon Compute Service Level Agreement, AWS makes 2 SLA commitments for EC2(and other included services) : (a) a region-level SLA that governs Included Services deployed across multiple AZs or regions, and (b) an instance-level SLA, that governs Amazon EC2 instances individually.

In the region-level SLA, AWS guarantees a Monthly Uptime Percentage of at least 99.99% in any monthly billing cycle. Failing which, the users will receive a service credit from amazon as compensation. This translates to a 0.01% bound on the downtime in a year.

In the instance-level SLA, AWS guarantees a Monthly Uptime Percentage of at least 99.5% in any monthly billing cycle. Failing which, the users will receive a service credit from amazon as compensation. This translates to a 0.5% bound on the downtime in a year.

Source: Amazon Compute Service Level Agreement (https://aws.amazon.com/ec2/sla/)

10)

"Telecom grade" service commitment is true to following cases:

i) It is specifically engineered for running in telecommunications networks

ii) It is designed to survive in a network for more than 15 years.

iii) It must be functional for 99.999% of the time(5 min downtime per year only)

The ETSI NFV industrial specification group were founded by 52 network operators joined by telecom equipment, IT vendors, and technology consultants in 2012. The original white paper was published by representatives of 13 major network operators.

The areas where NFV acts are as follows:

i) Operational improvements:

Since running a network comprises equipment from a number of different vendors, this causes cost overheads and it clearly an area for improvements.

ii) Cost reductions:

Cost of maintaining the infrastructure could be brought down using various ways including automation.

iii) Streamlining high-touch processes:

Provisioning and scaling services presently require manual intervention. This contrasts with cloud which provide instant scaling.

iv) Reduction of development time: Introducing new services required 16-25mnths which is more than most other aspect in IT.

v) Reduction of replacement costs: the lifespan of new services is shortening

vi) Reduction of equipment costs: Related to the 5th point, this calls for reducing the high equipment cost in network infrastructure.

Source: Textbook, ETSI NFV White Papers (https://portal.etsi.org/NFV/NFV_White_Paper.pdf)