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CS 524-A Introduction to Cloud computing – Homework #1

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?**

- Cumulative support expense = CSE(p) = p*c*m
  C*m = 1
  m = 1/c = 1/0.40
  m = 2.5 years
  Initial cost = IC = n*p
  Overall expenditure = OE = n*p (1+m*c)
- So, IC = 5% of OE
  IC = 0.05*OE
  N*p = 0.05 * n*p (1+m*c)
  1 = 0.05 * (1+m*0.40)
  20 = 1+m*0.40
  19 = m * 0.40
  m = 19/0.40
  m = 47.5 years
  In 47.5 years, the initial cost of software becomes 5% of overall expenditure.
  [formula: Oxford University Press (OUP) - Academic Publishing - Homepage]

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

- **SaaS**: SaaS (Software as a service) is on-demand access to ready-to-use and cloud-hosted application software.
  E.g., Google Apps, Microsoft Office 365, PayPal, Dropbox, Gmail.
- **PaaS**: PaaS (Platform as a service) is on-demand access to a complete, ready-to-use, cloud-hosted platform for developing, running, maintaining and managing applications.
  E.g., Google App Engine, Red Hat OpenShift, Oracle Cloud Platform.
- **IaaS**: IaaS (Infrastructure as a service) is on-demand access to cloud-hosted physical and virtual servers, storage and networking infrastructure for running applications in the cloud.
  E.g., Amazon Web Services (AWS), Google Compute Engine (GCE), host firewalls, Microsoft Azure.
  [Source: Textbook, www.ibm.com]

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.**

- Definitions:

  1)Hybrid cloud integrates public cloud services, private cloud services and on-premises infrastructure and provides orchestration, management and application portability across all three. (e.g., cloud bursting for load balancing between clouds)
  [Source: IBM - United States]

  2)The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).
  [Source: National Institute of Standards and Technology (nist.gov)]

  3)In hybrid cloud, 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.
  [Source: Cloud Computing Services | Microsoft Azure]

- Yes, this definitions agree as it says the same meaning, but in different ways. End of the definition, all have one explanation that is hybrid cloud consists of more than one cloud, so cloud bursting creates balance between them.
  However, I think the best definition is the middle one as it generated in easy way.
  [Source: Textbook, www.ibm.com]

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.**

- With the Shadow IT trend, among CIOs faced the loss of control over personnel. In private cloud, CIO has observed shadow IT trend and understood that it is not enough just to implement virtualization in their data centers. Facing the alternative of either not change much with virtualization or consuming a Cloud service, often opted to bypass the IT department, take out a credit card, and start developing on a public Cloud.
- Public clouds can lose access to shadow cloud-based data, particularly when the user who owns the information leaves the company. Organizational attack surfaces increase with shadow IT that affects the CIOs.
  [Source: Cloudflare - The Web Performance & Security Company | Cloudflare]

- **HIPAA**: Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy Rule and federal civil rights laws protect Americans' fundamental health rights. It consistes Administrative protections, Physical protections, and Technical protections. It protect the rights

of individuals and entities from unlawful discrimination on the basis of race, color, national origin, disability, age, or sex in health and human services.

- **SOX**: The Sarbanes-Oxley Act was signed into law by President George W. Bush on July 30, 2002. It is a U.S. federal law that aims to protect investors by making corporate disclosures more reliable and accurate. The Act was spurred by major accounting scandals, such as Enron and WorldCom, that tricked investors and inflated stock prices. fter the implementation of this act, financial crime and accounting fraud became much less widespread than before.
  [Source: HHS.gov]

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.**

- Amazon Elastic Compute Cloud (Amazon EC2) is the most used AWS service. It provides businesses with the ability to run applications on the public cloud. Amazon EC2 is a web service that offers secure, resizable compute capability in the cloud. It is designed to create web-scale cloud computing easier for developers. Amazon EC2's easy web service interface permits you to get and configure capability with essential friction. It offers you with complete management of your computing resources and permits you to run on Amazon's proven computing environment.
- Amazon EC2 enables users to create applications to change scaling according to changing requirements and peak periods and makes it easy to deploy virtual servers and manage storage, lessening the require to invest in hardware and helping streamline development processes.
- Amazon EC2 is IaaS (Information As A Service) service model because it takes the responsibility of networking, storage, server and virtualization and the user is responsible for managing the Operating System, middleware, runtime, data and application. It delivers IT infrastructure like compute, storage, and network resources on a pay-as-you-go basis over the internet. We can use IaaS to request and configure the resources we require to run your applications and IT systems. We are responsible for deploying, maintaining, and supporting our applications, and the IaaS provider is responsible for maintaining the physical infrastructure. Infrastructure as a Service gives us flexibility and control over our IT resources in a cost-effective manner.
  [Source: Cloud Computing Services - Amazon Web Services (AWS)]

6. **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.**

- An instance is a virtual server in the AWS Cloud. You launch an instance from an Amazon Machine Image (AMI). The AMI provides the operating system, application server, and applications for the instance.
- When we sign up for AWS, we can get started with Amazon EC2 for free using the AWS Free Tier. We can use the free tier to launch. If we launch an instance that is not within the free tier,

we incur the standard Amazon EC2 usage fees for the instance. We can launch instance by using different methods like with wizard, template, PowerShall and as a base.

- When we launch our instance, we can launch our instance in a subnet that is associated with one of the following resources:
  1) An Availability Zone - This option is the default.
  2) A Local Zone - To launch an instance in a Local Zone, you must opt in to the Local Zone, and then create a subnet in the zone.
  3) A Wavelength Zone - To launch an instance in a Wavelength Zone, you must opt in to the Wavelength Zone, and then create a subnet in the zone.
  4) An Outpost - To launch an instance in an Outpost, you must create an Outpost. After launching, we can connect to it and use it.
- By launching Zing Interactive Media on Amazon EC2, we would avoid this costs:
  1) Capital expenditures on hardware and datacenter infrastructure.
  2) Ongoing costs associated with maintaining and upgrading hardware.
  3) Upfront software licensing fees for operating system and database software.
  [Source: Cloud Computing Services - Amazon Web Services (AWS)]

7. 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?

- An incisive example reflecting the change in this industry is Instagram. Facebook bought Instagram for one billion dollars. At the time of the purchase, Instagram had 11 employees managing 30 million customers.
  In the first two years, Instagram has generated one billion dollars in value for Facebook.
  [Source: Textbook]
- **There were significant factors that enabled generating this value:**
  1. More Room for Growth
  Just like a rising economic power can only post dramatic growth for so long, Facebook's running out of new users to sign up. Since 2012, Instagram organic reach has gone up by a full 200%.
  2. Higher Engagement
  According to the data in this infographic, you get 58 times more engagement on Instagram than Facebook, for every follower you have.
  3. Advertisement income
  Instagram introduced advertising to its platform in 2013, which became a significant source of revenue for the company and for Facebook.
  4. More Valuable Users
  The average order value of an engaged Instagram follower is a full $10 higher than a Facebook one.
  5. Branding

Instagram's brand and reputation as a leading sharing platform added value to Facebook's services and strengthened its position.

6. Joint connection

The connection of Instagram with Facebook allowed sharing of content between the two platforms.

[Source: Social Media Management Software | Agorapulse]

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

- CPU pinning enables applications to bind or unbind a process or a thread to a specific core or to a range of cores or CPUs. The operating system ensures that a given thread executes only on the assigned core(s) or CPU(s) each time it is scheduled, if it was pinned to a core.
- CPU pinning takes advantage of the fact that the remnants of a process execution remains valid when the same process or thread is scheduled a second time on the same processor. So, the cache may still be valid when a thread execution is re-scheduled after being preempted. This helps scale the performance on multiple core processor architectures that share the same global memory and have local caches. Operating systems support CPU affinity through APIs. The *NX platform has a scheduler library that provides APIs for CPU affinity.
- As one uses higher abstraction layers, one gains simplicity, but as one consumes generic services, one's ability to do unique things is very limited. Or otherwise put, if a capability is not exposed through an API, it cannot be used. For example, if one would like to use a specific advanced function of a load balancer of a specific vendor, one is in trouble in a generic Cloud. One can only use the load balancing functions exposed by the Cloud provider's API, and in most cases one would not even know which vendor is powering this service.

[Source: Intel | Data Center Solutions, IoT, and PC Innovation]

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

- This Amazon ECS Anywhere Service Level Agreement ("SLA") is a policy governing the use of Amazon Elastic Container Service Anywhere ("Amazon ECS Anywhere") and applies separately to each account using Amazon ECS Anywhere.
- The Amazon EC2 Service Level Agreement (SLA) guarantees at least 99.95%.

The bound of downtime in a year:

Downtime per Year (Hours) = (1 – Uptime Ratio) x 365 x 24

= (1 – 99.95%) x 365 x 24

= 43.2 minutes

[Source: Textbook]

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.

- 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. This comes with a high cost of installation and maintenance of customized equipment.

- The ETSI NFV Industry Specifications Group (NFV ISG) was founded by a group of telecommunications companies, including AT&T, Verizon, NTT and others. Switching elements: BNG, CG-NAT, routers.
- **The NFV is expected to act in several areas, including**:
  - 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 virtualized home environments.
  - Tunneling gateway elements: IPSec/SSL VPN gateways.
  - Traffic analysis: DPI, QoE measurement.
  - Service Assurance, SLA monitoring, Test and Diagnostics.
  - NGN signaling: SBCs, IMS.
  - Converged and network-wide functions: AAA servers, policy control and charging platforms.
  - Application-level optimization: CDNs, Cache Servers, Load Balancers, Application accelerators.
  - Security functions: Firewalls, virus scanners, intrusion detection systems, spam protection.

  [Source: Microsoft Word - NFV_White_Paper_ETSI_CM]