CS6620 Cloud Computing *Qichen An*

1. If this e-commerce web app from #1 is built as a Java Web App, and you can use only VMs your IT department is hosting but not the Amazon AWS or any other public cloud, how would you design the infrastructure for this app? How would you deploy the app? What are the disadvantages of this approach if you want to rapidly grow your e-com startup? **[15 points]**

For the design of the infrastructure for this app, I would first set network, operating system and storage by using VMS that my IT department is hosting. Then manage the infrastructure of some characteristics such as Multi-tenancy, Virtualized hardware, Management & monitoring tools, Disaster recover.

For the deployment of the app, the first step is to create the enterprise application wrapper (EAR file) using VMS that my IT department is hosting. And then create the web application in the root of my EAR file. Package the Web application and place the Web application Java source files. The third step is creating the build.xml File and execute the split development directory structure.

If I want to rapidly grow the e-com startup, the disadvantage is apparent. Using public cloud such as AWS, IT team can very easily configure and manage the set up remotely with just an internet connection. Businesses can set up their public cloud within a matter of few hours. It can be easily bought on the Internet and deployed and configured remotely through the cloud provider website. However, without public, staffing budgets and other things putting on growing the e-com startup could be much more.

2. Explain how IaaS can be used to host the same e-commerce web app. Which components of AWS will you use for this design? What are the advantages of this cloud model? **[7 points]**

IaaS means Infrastructure-as-a-Service. It's a kind of Cloud Computing services. It can be used for the same web application. For example, I can use Amazon AWS's service. Virtual computing, storage and network resource that can be provisioned on demand.

In detail, I will use some components of AWS. For example, EC2, VPC, container and lambda.

For the advantages of this cloud model, I could shift focus from IT management to core activities and there would be no IT infrastructure management costs. The evident benefit from the use of cloud computing systems and technologies is the increased economical return due to the reduced maintenance costs and operational costs related to IT software and infrastructure. What's more, in detail, increased agility Increased agility in defining and structuring software systems is another significant benefit of cloud computing.

3. Why do you need a Load Balancer in an IaaS cloud? Why do you need it in a SaaS platform? What are the different functions it serves in each case? How is it different from a Message Queue? **[8 points]**

Load balancer is a type of load balancing that is performed in cloud computing. Load balancer is the process of distributing workloads across multiple computing resources. Cloud load balancing reduces costs associated with document management systems and maximizes availability of resources.

In an IaaS cloud, I can increase or decrease my storage server capacity on-demand. IaaS is completely scalable and adjustable to my needs and requirements.

In a SaaS platform, the benefits of high availability, scalability, and elasticity that load balancer can offer.

For the difference of functions, it could be different types of load balancer - Application Load Balancer and Network Load Balancer

For the difference of load balancer form a message queue, message queuing services focus on asynchronous communication between disparate application parts, while load balancing services focus on synchronous communication between clients and one or more of a pool of back-end servers.

4. In a public cloud, what is multi-tenancy? Explain using an example. How do you design for isolation in multitennacy using VPN, VPC and VLAN? Please explain the differences among these three. **[15 points]**

Multi-tenancy is an architecture in which a single instance of a software application serves multiple customers.
Example: for Amazon AWS, IAM set different roles, groups.

How to design isolation in multitenancy using VPN, VPC and VLAN: For different users in different groups, set different permission of VPN, VPC and VLAN. As a result, even in the same instance, it can serve multiple customers.

The difference among VPN, VPC and VLAN: VPN technology is a service, while VLANs are a type of subnetwork. A VPC is an elastic cloud service that can be used to host websites and applications. VPC can be turned off or on at will and can quickly scale to meet resource needs. VPNs provide authorized users and employees with secure connections to their organizations' networks, while VLANs group geographically separate devices together to improve communication among the devices and simplify how network administrators make changes to network infrastructure.

5. In the context of the above e-commerce web app, what is meant by State of the app? What are REST web services and provide an example of how they are used for this app. What are Microservices and how are they different in this context? Which one would you prefer in your design? **[15 points]**

RESTful web services are built to work best on the Web. Representational State Transfer (REST) is an architectural style that specifies constraints, such as the uniform interface, that if applied to a web service induce desirable properties, such as performance, scalability, and modifiability, that enable services to work best on the Web. In the REST architectural style, data and functionality are considered resources and are accessed using Uniform Resource Identifiers (URIs), typically links on the Web. The resources are acted upon by using a set of simple, well-defined operations.

For the example of application using RESTful web service, it could be helpful for guiding the design and development of the architecture of the app such as API using.

Microservice is a small, autonomous application that performs a specific service for a larger application architecture. Web service is a strategy to make the services of one application available to other applications via a web interface.

Both microservices and web services can be used to build application architectures. Here's a brief description of both architectural styles:

Microservices application architecture: A modular, services-oriented application architecture comprised of loosely connected, independently running microservices. These microservices usually offer APIs so other microservices and apps can integrate with them.

Web services application architecture: A modular, services-oriented application architecture where the applications that comprise the architecture connect via web services. Developers can use web services to connect microservices, monolithic applications, and more to form a larger application.

I prefer microservices in my design.

6. How is Serverless cloud computing useful for hosting this e-commerce web app? How is it diferent from the IaaS and SaaS models from the above questions? What are its advantages and disadvantages?
[15 points]

Serverless cloud computing is useful as it offers advantages over traditional cloud-based or server-based infrastructure. The serverless architectures offers better scalability, flexibility, and allow less time for release. As a result, cost would be lower. Using serverless, I don't need to worry about buying and managing complex backend servers instead of I can deploy my e-commerce web application to the serverless service.

So it truly make some difference from the IaaS and SaaS models for e-commerce web app.

Advantages and Disadvantages:

Advantage:

No server management is necessary

Developers are only charged for the server space they use, reducing cost

Serverless architectures are inherently scalable

Quick deployments and updates are possible

Code can run closer to the end user, decreasing latency

Disadvantage:

Testing and debugging become more challenging

Serverless computing introduces new security concerns

Serverless architectures are not built for long-running processes

Performance may be affected

7. What is the diference between an API and an API Gateway? Why do you need the latter? **[10 points]**

API is short for Application Programming Interface, so that it is a group of definitions and protocols that allow communications among multiple software services with each other via the internet.

API Gateway is a tool which sits in front of an API as the entry point for incoming requests to the API.

I need API Gateway because it can help me to facilitate client requests, combine the results from the server, and handle extra logics such as authentication, throttling gateway.

8. What are the different models of hosting a structured (SQL) Database as a part of a web app for multiple tenants on a SaaS (App) platform? Discuss the relative davantages and drawbacks of each. Which AWS storage service would you use for this hosting? **[15 points]**

Different models:

Multi-tenant app with database-per-tenant, database-per-tenant

Multi-tenant app with multiple tenant databases, shared multiple tenant

Application-level isolation, Standalone app

Advantages and Drawbacks

Standalone app has lowest scalability. Standalone app makes it more convenient to perform monitoring and management. Also, the complexity is low simple.

Shared multiple tenant app has unlimited scalability and high tenant isolation. The cost of its database is lowest

database-per-tenant app has high scalability and high tenant isolation. The cost of its database is low.

Standalone app has high tenant isolation and highest cost of database.

I prefer use AWS EC2 of AWS RDS in my design.