Final Term Paper (Spring - 2020)
Cloud Computing

Name:	Yahya Riaz	ID #:	12280

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Instructor: M Omer Rauf

Note: Attempt all Questions. Answers should be in your own words. Plagiarism will not be tolerated, if detected, it will lead to failure.

Question No. 1:   (20)

    a. Explain in detail network and cloud-based storage.

Question No. 2:   (20)

    a. Explain in detail web application and multitenant technology.
    b. Explain in detail cloud security threats.

Question No. 3:   (10)

    a. Briefly describe following.
        a. Advantages and disadvantages of cloud computing.
        b. Collaborative meeting in cloud.

Question #1:

Network Storage:

Network storage is a file-level computer data storage server which is connected to a computer network providing access to the data to the miscellaneous number of clients. Network storage is dedicated for serving file either by its hardware, software or configuration.

Data storage in clouds (Network Storage):

- Devices which are linked with Local Area Network (LAN) may require storage space for easy file sharing, copying files and storage for large files.
- This additional space is provided through file server that have larger storage capacity.
- As the computer networks evolved, the file server was extended with the evolution through Storage Area Network (SAN).
- The storage devices which are enabled with SAN are linked to the network.
- SAN enabled devices and their software allows direct access to these devices throughout network.
- After that a class of storage is emerged as Network Attached Storage (NAS).

Advantages of Network storage (SAN) are:
- Reliability of data and making more data through replication.
- Provides a lot better performance than file server.
- Compatible with different operating systems and with common file system.
- Provides better backup solutions.

Uses:

NAS is useful for more than just general centralized storage provided to client computers in environments with a large amount of data. NAS can provide simpler and cheaper system such as load-balancing and fault-tolerant email and web server systems by providing storage services. The potential emerging market for NAS is the consumer market where there is a large amount of multi-media data. Such consumer market appliances are available through out the market. The price of NAS appliances has suffered down fall in recent years, offering flexible network-based storage to the home consumer market for little more than the cost of regular USB or firewire external hard disk. Many of these

home consumer devices are built around ARM, PowerPC or MIPS processors running an embedded linux operating system.

Advantages:

- Easy to access.
- Safety of personal data.
- Hard drive space.

Disadvantages:

- Accessibility.
- Security.
- Privacy.
- Cost.

Cloud Based Data Storage:

- Cloud storage comes after the evolution of network storage devices.
- Instead of storing the data in device, data can be stored on clouds and can be accessed from anywhere through web.
- The cloud storage can have unlimited virtual storage space which are available at affordable rates.
- There are different modes of accessing data on cloud:
  - ➢ Access through web browser interfaces to move and copy files from devices to cloud.
  - ➢ Through a disk drive which is mounted on local user's computer.
  - ➢ Through API calls to access the cloud storage.

- There are different cloud storage providers, which offer file storage, file sharing and synchronization. Such as:
  - ➢ Carbonite.
  - ➢ pCloud.
  - ➢ Dropbox.
  - ➢ Elephant Drive.
- These providers offer specific amount of free storage and paid storage at low price.

Types of Cloud based Storage:

Private Cloud

Private cloud is a cloud in which deployment model is only for single organization, whether the company's on-site data center is physically located, or the third-party provider hosts or manages it. private cloud shares no resources with other organizations, and the company is entirely responsible for the management, maintenance and the regular updates. Which can be more expensive than public cloud.

❖ **Merits:**
1. Customization of the cloud with more possibilities.
2. High security and privacy.
3. Greater control over the server.

❖ **Demerits:**
1. Accessing data from remote areas can be difficult.
2. High costs on private cloud infrastructure.
3. Maintenance responsibility.

Public cloud

A cloud is said to be public when the services are made by the third-party providers over a network that is used publicly, which means the hardware, software and the network devices shares the same as the other client of the same provider.

Public and private clouds differentiate as one has the responsibility over cloud's hosting and management. And as the public cloud rents a space on the cloud from a third-party provider, cost and the maintenance will be assumed as a whole of the infrastructure. The client who is paying for such service has no responsibility of management of the cloud, it is only used to store the data as the client pays for it.

❖ **Merits:**
1. Time reduction in developing, testing and launching of new products.
2. Cost effectiveness
3. Payment on scalability

❖ **Demerits:**
1. Higher security risks due to shared resources.
2. Networks performance can be affected.
3. Lack of customization

Hybrid Cloud

As the name clarifies it that it is the combination of private and public cloud deployment models. It provides the benefits of both infrastructure to the company.

Companies are capable of shifting data and applications between private and public clouds, depending on the purposes.

Hybrid model offers cloud bursting option in which resources can be shifted if any problem occurs.

❖ **Merits:**
1. Flexibility and control.
2. Cost effectiveness.
3. Enhanced organizational agility.

❖ **Demerits:**
1. More maintenance is required.
2. Initial costs for activating both infrastructures can be really high for many organizations.
3. Data and application integration.

Community Cloud

Community cloud is that cloud in which the infrastructure is shared in between many organizations with a specific community and common interests. Such as security, compliance, regulations etc. whether managed and hosted internally or by the third-party. This cloud is used by the organizations that have common interests.

Advantages of cloud-based storage:

- **Scalability**: The user can rank/scale the storage capacity (high or low) as per user's requirement.
- different convenient payment options are available. One-time payment, monthly payment or payment as per use of cloud storage.
- **Reliability**: the storage providers offers assurance of reliability of data (through replication).
- Data on cloud can be accessed from anywhere in the world through internet.
- Data accessibility is available in various methods.
- Usability and accessibility.
- Cost saving.
- Easy sharing.
- Automation.
- Collaboration.
- Convenience.

Disadvantages:

- **Performance:** as the accessibility depends on internet, the cloud storage is slower than SAN or NAS based local storage.
- **Security:** not all users may be able to trust the cloud provider for the user's data.
- **Data Orphans**: the users have to accept the policies of data deletion by provider. The data on cloud storage deleted by the user may not be deleted immediately from the cloud storage.

Question #2 (A):

Web Application:

Definition:

A web application is a computer program that executes specific tasks for users using internet. A web application is an application that runs on a web server, distinct to computer applications that are kept on the software of the device.

Examples:

Examples are Gmail, Yahoo and AOL, online retail sales, online forms, shopping carts, word processors, spreadsheets, video, and photo editing, file conversion, file scanning, Google Apps such as Google Docs, Google Sheets, Google Slides, online storage and more.

Types of Web Application:

- Static
- Dynamic
- Online Store or E-Commerce
- Portal Web Apps
- Animated
- Content Management System

Web Application working:

- A user sends a request to the web server through the internet, which uses either an internet browser or an application's user interface.
- Web server forwards this request to the suitable internet application server.
- The server performs a specified function like querying the database or processing the requested information.
- Web application server sends results to the web server with the requested info or processed information.
- In the end, the net server displays the requested info of a user on the screen.

Web Application Process:

- Initially, the consumer will request to HTTP server through HTTP.
- Next, the online server will send a message to the static information store with the assistance of static information request.
- The internet server responds to a static information store and moves to an application server by using the servlet request that features web container and different services.
- Then servlet request extracts data from the application information store and responds to an internet server.
- In the end, the online server provides a response to the user by using HTTP Response.

Benefits of Web Application:

- Web applications run on multiple platforms despite of OS or device as long as the browser is compatible.
- All users access identical version, eliminating any compatibility problems.
- They are not installed on the disk drive, therefore eliminating space limitations.
- Software piracy is reduced in subscription-based web applications (i.e. SaaS).
- They reduce prices for each the business and end user as there's less support and maintenance needed by the business and lower needs for the end user's pc.

Multitenant Technology:

Definition:

Multi-tenancy implies that a single instance of the software package and its supporting infrastructure serves multiple customers. Every client shares the software package application and additionally shares a single database. Every tenant's information is isolated and remains invisible to other tenants.
The multitenant applications enable isolation to concurrent users. The information and settings of one user cannot be accessed by other users. The tenants can edit their business methods, data models and can control multi-tenant applications.

Features of Multitenant technology:

- User Interface – Tenants will outline a specialized "look and feel" for their application interface.
- Business process – Tenants will customize the principles, logic, and workflows of the business processes that are enforced within the application.

- Data Model – Tenants will extend the information schema of the application to incorporate, exclude, or rename fields within the application information structures.
- Access control – Tenants will severally control the access rights for users and groups.

Characteristics of Multitenant Technology:

- Usage isolation**.**
- Data security.
- Backup and restore is isolated for each tenant.
- Application upgrades do not negatively affect the existing users.
- Scalability in terms of number of tenants.
- Metered usage.
- Databases, tables and/or schema isolation for each user.

Benefits of Multitenant Technology:

- Helps a good deal in cutting the value of investment.
- Adding a client is simple.
- It becomes a lot convenient to take care of a similar application.
- Maximizing the resource usage.
- Holds Multiple Tenants all at a similar Time.
- Better use of resources.
- Can control multiple tenants at one time.

Question #2 (B):

Data Security Threats:

- **Data Breach:**

 A data breach is the most common cloud security threat. When an unknown users or programs get access to our personal data while view, copy or transfer it, because of cloud computing security attacks.

- **Data Loss:**

Data loss usually happens because of man-made disasters. It happens because of user fault. It can also be happening our data is targeted. However, nothing changes, you will lose all of your collected data.

- **Denial of Service (DoS):**

A Denial of Service (DoS) attack can damage your cloud services and resources. DoS can temporarily ban your services. The threat can be caused by flooding the system with uncontrolled traffic of users and as a result the system cannot buffer the task and can be caused by bugs.

- **Crypto jacking:**

In Crypto jacking, hackers will use your computing resources to process cryptocurrency transactions by putting in a crypto mining script on your servers without you approve. This can cause load on your processor and usually slower your system.

- **Account Hijacking:**

In this threat hackers will guess the characters no matter your employees are using default passwords and as a result hackers steal and control your data.

- **Insecure interfaces**

Cloud service suppliers expose a group of software system user interfaces or application programming interfaces (APIs) that organizations use to manage and act with the cloud services. Moreover, customers and third-party users usually provide services to their customers through these interfaces.

- **Advanced persistent threats:**

Several advanced persistent threat teams not only target cloud environments however use public cloud services to conduct their attacks.

- **Spectre & Meltdown:**

Attackers will exploit Meltdown to look at information on virtual servers hosted on a similar hardware, probably unfortunate for cloud computing hosts. Spectre is even worse—harder to use, however tougher to repair too.

- **Misconfigured Cloud Storage:**

It could be a continuation of an insecure API cloud security threat. For the most part, security problems with cloud computing happen because of an oversight and consequent superficial audits.

Question #3: (A)

Advantages of Cloud Computing:

- **Scalability**

  Increases or reducing performance on the basis of user needs.

- **Data Security**

  Cloud has advance features of security which ensure data is secure and handled.

- **Accessibility**

  By connecting to the internet, you can easily access your data from anywhere and anytime, which means that data is always accessible

- **Collaboration**

  It Allows bunch of people to share information in the cloud storage.

- **Backup & Restore Data**

  When the data is stored in the cloud, it is easy to back-up or restore Data

- **Unlimited Storage**

  Cloud gives a lot of space to upload and shared data.

- **Fast Response**

Cloud computing allows you to deploy services fast and quick with high speed.

Disadvantages of Cloud Computing

- **Connectivity issue**

  All the data which is upload on cloud storage, and we access the data through internet. If you don't have good internet you cannot access data.

- **Vendor Lock-In**

  It's the problem for the companies when transferring data from one to another because different companies provide different platforms.

- **Security**

  Cloud computing has implemented the best security features for the user, but user is sending all the information to the cloud computing service provider. While sending your data there may be a chance that your information is attacked by hackers.

- **Technical Issues**

  Cloud computing uses best technology but even it also may face maintenance for some time which will be problem for users.

Question #3 (B):

Collaborative meeting in cloud:

When multiple individuals work together to achieve an objective then it is said to be collaboration. The collaboration is done through face to face meeting in the conference rooms. Some high rank member must need to attend the meetings no matter they are far from the office. If any member could not attend the meeting, he has two ways, either he calls to the speaker phone which is there on the conference table or either to study how many minutes of meeting. A solution that might reduce the requirements of private conferences saves a lot of time and energy and to extend the productivity from the collaborations. When the webmail is ready, the web-based collaboration starts. Users can send, receive the emails to one another by using the web browser and to access of Internet connection. Multiple receivers can be addressed by one user. Voice over Internet Protocol gives the permission to the users to do calls within the Internet. Through the computer or mobile, the conference calls can be easily attended with the use of Voice over Internet Protocols (VoIP) tool like Skype, zoom, Google DUO, anydesk etc.