UNIT-1 INTRODUCTION

1 Define cloud computing NOV/DEC 2021.

According to NIST, Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

2. What is on-demand provisioning?

The on-demand provisioning in cloud computing refers to process for the deployment, integration and consumption of cloud resources or services by an individuals or enterprise IT organizations.

3. List the main characteristics of cloud computing NOV/DEC 2020.

The characteristics of cloud computing are

- On-demand self-service
- Broad network access
- Rapid elasticity
- Measured service

4. Illustrate the virtual appliances in cloud computing NOV/DEC 2020

A VM is a virtualized instance of a computer that can perform almost all of the same functions as a computer, including running applications and operating systems. Virtual machines run on a physical machine and access computing resources from software called a hypervisor.

5. Enlist the pros and cons of cloud computing. Dec-19

Pros of Cloud computing

- Improved accessibility
- Optimum Resource Utilization
- Scalability and Speed
- Minimizes licensing Cost of the Softwares
- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity

Cons of Cloud computing

- Security
- Privacy and Trust Vendor lock-in
- Service Quality
- Cloud migration issues
- Data Protection
- Data Recovery and Availability
- Regulatory and Compliance Restrictions
- Management Capabilities
- Interoperability and Compatibility Issue

6. Explain the term "Elasticity in cloud computing".

The Elasticity in cloud is a popular feature associated with scale-out solutions (horizontal scaling), which allows for resources to be dynamically added or removed when needed. It is generally associated with public cloud resources which is commonly featured in pay-per-use or pay-as-you-go services.

7. What is on-demand provisioning ?

Ans. : The on-demand provisioning in cloud computing refers to process for the deployment, integration and consumption of cloud resources or services by an individuals or enterprise IT organizations.

8. Differentiate between Grid and Cloud Computing. AU Dec.-17

Feature	Grid Computing	Cloud Computing
Computing architecture	Distributed computing	Client-server computing
Scalability	Low to moderate	High.
Flexibility	Less	More
Management	Decentralized	Centralized
Owned and Managed by	Organizations	Cloud service providers
Provisioning	Application-oriented.	Service-oriented.
Accessibility	Through grid middleware	Through standard web protocols
Resource allocation	pre-reserved	on-demand
Speed	Slow	Fast
Resource management	Distributed	Centralized
Cost	High	Low

9. Highlight the importance of Cloud Computing. AU Dec.-16

Cloud computing is important in every business and applications due to the following advantages

- Scalability and Speed
- Minimizes licensing Cost of the Softwares
- Less personnel training
- Flexibility of work practices
- Sharing of resources and costs
- Minimize spending on technology infrastructure
- Less Capital Expenditure

10. Enlist any two advantages of distributed systems. Dec.-18

Advantages of Distributed System are

- Supports heterogeneous hardware and software.
- The resources shared in the distributed system are easily accessible to the users across the network.
- The distributed system is scalable such a way that if the number of users or computers increases, the performance of the system does not get affected.
- It is capable to detect and recover from failure, that is, it should be fault tolerant and robust.

11. Define SOA. Dec.-18

The Service Oriented Architecture (SOA) is an architectural style for building an enterprise Solution based on Services. It maintains a software system into a collection of interacting services. Applications built using an SOA style deliver functionality as services that can be used or reused when building applications or integrating within the enterprise or trading partners. An SOA application is a composition of services that encapsulate a business process.

12. What is web service ? Dec.- 18

The Web services are loosely coupled (platform independent), contractual components that communicate in XML-based (open standard) interfaces. The Web service composed of set of operations that can be invoked by leveraging Internet-based protocols. It provides method operations supporting parameters and return values with complex and simple types.

13. Define Parallel computing

- In parallel computing, all processors are either tightly coupled with centralized shared memory or loosely coupled with distributed memory.
- Interprocessor communication is accomplished through shared memory or via message

passing.

- A computer system capable of parallel computing is commonly known as a parallel computer.
- Programs running in a parallel computer are called parallel programs. The process of writing parallel programs is often referred to as parallel programming..

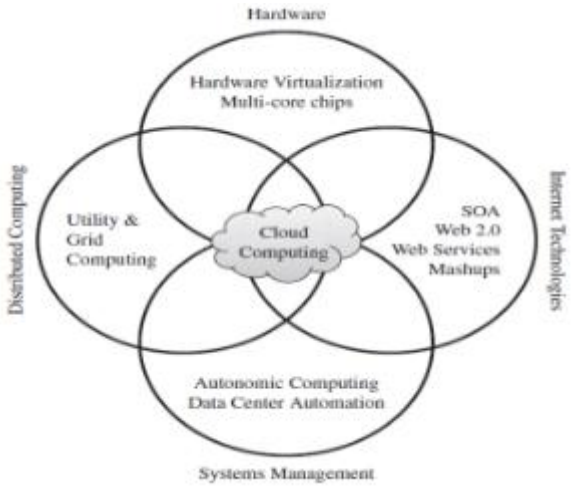
14. What are the computing Paradigm Distinctions?

- Centralized computing
- Parallel Computing
- Distributed Computing
- Cloud Computing

15. What is meant by Centralized Computing?

- This is a computing paradigm by which all computer resources are centralized in one physical system.
- All resources (processors, memory, and storage) are fully shared and tightly coupled within one integrated OS.

16. What are the Convergence of various advances leading to the advent of cloud computing.



17. What is a grid system?

Interconnected computer systems where the machines utilize the same resources collectively. Grid computing usually consists of one main computer that distributes information and tasks to a group of networked computers to accomplish a common goal. Grid computing is often used to complete complicated or tedious mathematical or scientific calculations.

18. What are the desirable features of Cloud ?

- self-service
- per-usage metering and biling
- elasticity
- customizable

19. What is OGSA in grid computing? /Define OGSA

- Open Grid Services Architecture (OGSA) is a set of standards that extends Web services and service-oriented architecture to the grid computing environment.
- OGSA definitions and criteria describe how information is shared and distributed among the components of large, heterogeneous grid systems; they apply to hardware, platforms and software.
- It was developed within the Open Grid Forum, which was called the Global Grid Forum (GGF)

20. What is virtualization in cloud computing?

Virtualization is a software that creates virtual (rather than actual) version of something, such as an operating system, a server, a storage device or network resource. It is the fundamental technology that powers cloud computing.

PART –B & C

1. Explain the evolution of cloud in detail

- Hardware evolution
- Internet Hardware evolution
- Server virtualization

2. Explain in detail about the underlying principles of parallel and distributed computing

- Elements of parallel computing
- Elements of Distributed computing

3. Explain in detail about the characteristics of cloud and various deployment models in cloud

Charcteristics:

- Broad network access
- Resource pooloing
- Rapid elasticity
- Measured services

Deployment models

- Private cloud
- Public cloud
- Hybrid cloud

4. Explain the cloud computing architecture in detail with a suitable diagram

- Cloud deployment model
- Cloud service model
- Essential characteristics

5. Write in detail about the four hardware architectures for parallel processing with suitable diagrams.

- SISD
- SIMD
- MISD
- MIMD

6. Explain in detail about Elasticity in Cloud with a suitable example.

Elasticity= scalability+ Automation+optimization

Classification

7. Illustrate in detail about On-demand provisioning in cloud computing.

- Static provisioning
- Dynamic provisioning

UNIT 2 CLOUD ENABLING TECHNOLOGIES

1.What are the characteristics of virtualization in cloud. NOV/DEC 2021.

- Maximum resource utilization
- Reduces Hardware Cost
- Minimize the maintenance cost
- Supports Dynamic Load balancing
- Server Consolidation
- Disaster recovery

2. What is disaster recovery? NOV/DEC 2021.

Disaster recovery is a technique which provides continuous and uninterrupted delivery of IT resources and services even in case of hardware or other failures due to natural disasters or any

other reasons. Disaster recovery involves a collection of policies, tools and procedures to enable the recovery or continuation of critical infrastructure resources and systems following a natural or human-induced disaster.

3. Differentiate full virtualization and para-virtualization NOV/DEC 2020

BASIS FOR COMPARISON	FULL VIRTUALIZATION	PARAVIRTUALIZATI
Technique	Binary translation and direct execution	Hypercalls
Guest modification/Compatibility	Unmodified guest OS and excellent compatibility.	Guest OS codified to is hypercalls so it.
Performance	Moderate	Good
Security	Less secure	More secure
Speed	Intermediate	Fast
Used by	VMware, Microsoft, Parallels	VMware, Xen

4. Outline the requirements of VMM. NOV/DEC 2020 , DEC 2017

The requirements of VMM or hypervisor are

- VMM must support efficient task scheduling and resource allocation techniques.
- VMM should provide an environment for programs which is essentially identical to the original physical machine.
- A VMM should be in complete control of the system resources.
- Any program run under a VMM should exhibit a function identical to that which it runs on the original physical machine directly.
- VMM must be tightly related to the architectures of processors

5. Justify Web and Web architectures are SOA based. AU : May-18

SOA is an architectural style for building software applications that use services available in a network such as the web. The applications built using SOA are mostly web based that uses web architecture defined by the World Wide Web Consortium (W3C). These web applications are

often distributed over the networks which aim to make services interoperable, extensible and effective. The web and web services are the most common example provided by the SOA model which delivers well-defined set of implementation choices for web architectures like XML based SOAP and Web Service Definition Language (WSDL).

6.“Although virtualization is widely accepted today; it does have its limits”. Comment on the statement. AU : May-18

Although virtualization is widely accepted today; it does have its limitations that are listed below.

- High upfront Investments : Organisations need to acquire resources beforehand to implement Virtualization. Also, there might occur a need to incur additional resources with time.
- Performance Issues : Although virtualization is an efficient technique and efficiency can be increased by applying some techniques, there may be chances when the efficiency is not as good as that of the actual physical systems
- Difficulty in Root Cause Analysis : With the addition of an additional layer in virtualization, complexity gets increased. This increased complexity makes root cause analysis difficult in case of unidentified problems.

7. List the requirements of VMM. AU : Dec.-17

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5 Give the role of a VM. AU : Dec.-16 or Give the basic operations of a VM. AU : May - 17

Virtualization allows running multiple operating systems on a single physical machine. Each instance of operating system running inside called Virtual machine (VM).

- The main role of VM is to allocate the host machine resources to run Operating system.

The other roles of VM are

- Provide virtual hardware, including CPUs, memory, storage, hard drives, network interfaces and other devices to run virtual operating system.
- Provide fault and security isolation at the hardware level.
- Preserve performance with advanced resource controls.
- Save the entire state of a virtual machine to files.

6 What is the impact of SOA in cloud ? AU : Dec.-19

- The SOA and cloud computing share many common principles as both works on principals of service.
- The key challenges of a cloud computing are security, integration, adaptation, agility and QoS aspects like performance, latency and availability.
- These challenges can be addressed with an SOA-based architecture using concept of service intermediation, service arbitrage and service aggregation.

Because of SOA, cloud computing leverage has many advantages like,

- Simple construction and maintenance of services
- Service reusability
- Ease of data exchange
- Platform integration
- Loosely coupled architecture

Q.7 Give the significance of virtualization. AU : Dec.-19

As we know that the large amounts of compute, storage, and networking resources are needed to build a cluster, grid or cloud solution. These resources need to be aggregated at one place to offer a single system image.

Therefore, the concept of virtualization comes into the picture where resources can be aggregated together to fulfill the request for resource provisioning with rapid speed as a single system image

The virtualization is a novel solution that can offer application inflexibility, software manageability, optimum resource utilization and security concerns in existing physical machines. In particular, every cloud solution has to rely on virtualization solution for provisioning the resources dynamically.

Therefore, virtualization technology is one of the fundamental components of cloud computing. It provides secure, customizable, and isolated execution environment for running applications on abstracted hardware. It is mainly used for providing different computing environments. Although these computing environments are virtual but appear like to be physical.

The different characteristics of virtualization are,

- Maximum resource utilization
- Reduces Hardware Cost
- Minimize the maintenance cost
- Supports Dynamic Load balancing
- Supports Server Consolidation
- Supports Disaster recovery
- Can run Legacy applications and can test Beta Softwares

Q.8 Define Virtualization. AU : May -19

The term Virtualization is nothing but creation of a virtual version of hardware platform, operating system, storage or network resources rather than actual. It allows to run multiple operating systems on a single physical machine called host machine.

Each instance of operating system called Virtual Machine (VM) and operating system runs inside virtual machine is called guest operating system.

Q.**9 Define the term web service. AU : Dec.-18**

Web services are loosely coupled (platform independent), contracted components (behavior, input and output parameters, binding specifications are public) that communicate in XML-based (open standard) interfaces.

When a web service is deployed, different applications and other web services can find and invoke the deployed service. The term "web service" is frequently alluded to an independent, selfdescribing, modular application intended to be utilized and accessible by other software applications over the web.

Q.10 What are different characteristics of SOA ?

The different characteristics of SOA are as follows :

- Provides interoperability between the services.
- Provides methods for service encapsulation, service discovery, service composition, service reusability and service integration.
- Facilitates QoS (Quality of Services) through service contract based on Service Level Agreement (SLA).
- Provides loosely couples services.
- Provides location transparency with better scalability and availability.
- Ease of maintenance with reduced cost of application development and deployment.

Q.11 Define REST.

Representational State Transfer (REST) is a software architectural style for distributed system that defines a set of constraints to be used for creating web based services. It is mean to provide interoperability between the systems based on services running on the Internet. The web services that follow the REST architectural style are called RESTful Web services.

Q.12 What is the role of WSDL in web services ?

The WSDL is an XML based document which describes the interfaces and set of operations supported by a web service in a standardize format. It is used for standardizing the representation of input and output parameters along with its operations. It is an XML document used for describing web services. The WSDL document contains information on data types to be used, messages to be exchanged, operations performed by the web service and communication protocol to be followed

13.What is server virtualization ?

A server virtualization is the process of dividing a physical server into multiple unique and isolated virtual servers by means of software. It partitions a single physical server into the multiple virtual servers; each virtual server can run its own operating system and applications independently. The virtual server is also termed as virtual machine.

14. Compare between different implementation levels of virtualization.

Implementation Level	Performance	Application Flexibility	Implementation Complexity	Application Isolation
Instruction Set Architecture Level (ISA)	Very Poor	Very Good	Medium	Medium
Hardware Abstraction Level (HAL)	Very Good	Medium	Very Good	Good
Operating System Level	Very Good	Poor	Medium	Poor
Library Level	Medium	Poor	Poor	Poor
Application Level	Poor	Poor	Very Good	Very Good

15. Enlist advantages and disadvantages of Bare-Metal structure.

The advantages of Bare-Metal structure are

- It is faster in performance and more efficient to use.
- It provides enterprise features like high scalability, disaster recovery and high availability. It has high processing power due to the resource pooling.
- It provides ease of backup and recovery.
- It provides built-in fault-tolerance mechanisms.

- It has improved mobility and security.

The disadvantages of Bare-Metal structure are

- It has limited hardware support and poor stack of device drivers.
- It has high implementation cost
- It requires specialized servers to install and run hypervisor and do not run on user workstations**.**
- In some cases, it becomes complex for management

16. What is Xen ?

Xen is an open source Bare-Metal (Type I) hypervisor developed by Cambridge University. It runs on the top of hardware without needing a host operating system. The absence of host OS eliminate the need for pass through permission by the hypervisor. Xen is a microkernel hypervisor, which separates the policy from the mechanism. It provides a virtual environment located between the hardware and the OS.

17.**Difference between virtualization and cloud computng**

Virtualization differs from cloud computing because virtualization is software that manipulates hardware, while cloud computing refers to a service that results from that manipulation.

18.**Define virtual machine manager**
Virtual machine monitors (VMM) or virtual manager, which separates compute environments from the actual physical infrastructure.

19.Illustrate the three structures of virtualization
Hypervisor architecture/ VMM(Virtual Machine Monitor).
Para-virtualization
Host-based virtualization
20.**List the disadvantages of virtualization**
Performance degradation
Inefficiency and degraded user experience
Security holes and new threats

PART-B & C

1. Write short note on Sevice Oriented Architecture. (Dec 16)

- Properties of SOA
- SOA model

2. Discuss how virtualization is implemented in different layers (May 17)

- Application level
- Library level

- OS level
- Hardware abstraction level
- Instruction level

3. Write about the REST interaction between user and server in HTTP specification with a suitable diagram

- REST interaction between user and server in HTTP
- REST Principles

4. Write in detail about the Virtualization of CPU, Memory and I/O devices with suitable diagrams.

- Virtualization of CPU
- Memory and
- I/O devices

5. Explain in detail about web services protocol stack and Publish/subscribe models with respect to web services.

- Web services protocol stack
- Publish/ subscribe model

6. Illustrate the architecture of virtualization and brief about operation

Structure of Virtualization (hosted and bare metal)

7. Describe in details the tools and mechanisms for virtualization

Tools

Mechanism

UNIT-3 LOUD ARCHITECTURE, SERVICES AND STORAGE

1.What is a Hybrid cloud? NOV/DEC 2021.

The hybrid cloud services are composed of two or more clouds that offers the benefits of multiple deployment models. It mostly comprises on premise private cloud and off - premise public cloud to leverage benefits of both and allow users inside and outside to have access to it

2.Outline the key challenges associated in the process of storing images in cloud NOV/DEC 2021.

3.Differentiate Public cloud and Private cloud. NOV/DEC 2020, DEC 016

Sr. No	Feature	Public Cloud	Private Cloud
1	Scalability	Very High	Limited
2	Security	Less Secure	Most Secure
3	Performance	Low to Medium	Good
4	Reliability	Medium	High
5	Upfront Cost	Low	Very High
6	Quality of Service	Low	High
7	Network	Internet	Intranet
8	Availability	For General Public	Organizations Internal Staff
9	Example	Windows Azure, AWS etc.	Openstack, VMware Cloud, CloudStack, Eucalyptus etc.

1. **4.SWhat are the Benefits of deployment model?**

Customer Scenario	Service Model	Deployment Model	Benefits
Payroll Processing	IaaS(VMs), Cloud storage	Public Cloud	Processing time reduced Hardware requirements reduced. Elasticity enabled for future expansion
Astronomic Data Processing	IaaS (VMs), Cloud Storage	Public Cloud	Hardware expense greatly reduced Processing power and storage. Energy costs greatly reduced. Administration Simplified
Central Government	IaaS,PaaS	Private Cloud	IT expertise consolidated. Hardware requirements reduced.
Local Government	IaaS,PaaS	Hybrid Cloud	IT expertise consolidated. Hardware requirements reduced.

5. Why do we need hybrid cloud ? AU : Dec.-16

- Maintain security and high performance
- Run workloads where they perform best
- Reduce IT cost and improve network efficiency

6. Write a short note on community cloud. AU : Dec.-18

More than one group with common and specific needs shares the cloud infrastructure. This can include environments such as a U.S. federal agency cloud with stringent security requirements, or a health and medical cloud with regulatory and policy requirements for privacy matters.

7. Summarize the differences between PaaS and SaaS. AU : May-17

Platform as a Service (PaaS)	Software as a Service (SaaS)
It is used for providing a platform to develop, deploy, test or run web applications quickly and easily without worrying about buying and maintaining the software and infrastructure.	It is used for on demand software or application delivery over the internet or intranet.
It is used for web hosting.	It is used for software or application hosting.
It provides tools for development, deployment and testing the softwares along with middleware solutions, databases, and APIs for developers.	It provides hosted software stack to the users from which they can get access to particular software at any time over the network.
It is used by developers.	It is used by end users.
The abstraction in PaaS is moderate.	The abstraction in SaaS is very high.
It has significantly lower degree of control than SaaS.	It has higher degree of control than PaaS.
Risk of vendor-interlocking is medium.	Risk of vendor-interlocking is very high.

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8. Who are the major players in the cloud ? AU : May-19

Sr. No.	Name of Cloud service provider	Supported services	Deployment model
1)	Amazon Web Service (AWS)	Infrastructure as a Services using EC2, Platform as a service using elastic beanstalk, Database as a service using RDB, Storage as a service using S3, Network as a service using pureport, Containers as a service using amazon elastic container service, Serverless computing using lambda etc.	Public cloud
2)	Openstack	Infrastructure as a services using Nova, Platform as a service using Solum, Database as a service using Trove, Network as a service using Neutron, Big data as a service using Sahara etc.	Private cloud
3)	Google cloud platform	Infrastructure as a services using google compute engine, Platform as a service using google app engine, Software as a service using google docs, Gmail and google suit, Database as a service using Cloud SQL, Containers as a service using Kubernetes, Serverless computing using functions as a service, Big data as a service using Big Query, Storage as a service google cloud storage, etc.	Public cloud

9. What are the basic requirements for cloud architecture design ?

The basic requirements for cloud architecture design are given as follows :

- The cloud architecture design must provide automated delivery of cloud services along with automated management.
- It must support latest web standards like Web 2.0 or higher and REST or RESTful APIs.
- It must support very large - scale HPC infrastructure with both physical and virtual machines.
- The architecture of cloud must be loosely coupled.

10. What are different layers in layered cloud architecture design ?

The layered architecture of a cloud is composed of three basic layers called infrastructure, platform, and application.

- The infrastructure layer consists of virtualized services for computing, storage, and networking.
- The platform layer is responsible for providing readily available development and deployment platform for web applications to the cloud users without needing them to install in a local device. A collection of all software modules required for SaaS applications forms the application layer.
- Application layer is mainly responsible for making on demand application delivery. In this layer, software applications include day-to-day office management softwares used for information collection, document processing, calendar and authentication.

11. What are different roles of cloud providers ?

Cloud provider is an entity that offers cloud services to interested parties. A cloud provider manages the infrastructure needed for providing cloud services. The CSP also runs the software to provide services, and organizes the service delivery to cloud consumers through networks. The major activities of a cloud provider include :

- Service deployment : Service deployment refers to provisioning private, public, hybrid and community cloud models.
- Service orchestration : Service orchestration implies the coordination, management of cloud infrastructure, and arrangement to offer optimized capabilities of cloud services
- Cloud services management : This activity involves all service-related functions needed to manage and operate the services requested or proposed by cloud consumers.
- Security : Security, which is a critical function in cloud computing, spans all layers in the reference architecture. Security must be enforced end-to-end.
- Privacy : Privacy in cloud must be ensured at different levels, such as user privacy, data privacy, authorization and authentication, and it must also have adequate assurance levels

12. What are different complications in PaaS ?

The following are some of the complications or issues of using PaaS :

- Interoperability
- Compatibility
- Vulnerability and Security
- Vendor lock-in

13. Enlist the pros and cons of storage as a service.

PROS

- Cost
- Automation
- Accessibility
- Syncing
- Collaboration
- Data Protection
- Disaster Recovery

CONS

- Potential downtimes
- Limited customization
- Vendor lock-in

14. Enlist the different cloud storage providers

- Amazon S3
- Google Bigtable Datastore
- Microsoft Live Mesh
- Nirvanix

15. What is Amazon S3 ?

Amazon S3 is a cloud-based storage system that allows storage of data objects in the range of 1 byte up to 5 GB in a flat namespace. Amazon S3 offers a simple web services interface that can be used to store and retrieve any amount of data from anywhere, at any time on the web. It gives any developer access to the same scalable, secure, fast, low-cost data storage infrastructure that Amazon uses to operate its own global website network.

16.**List some of the disadvantages of cloud computing?**

- Technical Issues
- Less Secured
- Prone to Attack
- Limited Control
- Requires Constant Internet Connection

17.**Give examples for IAAS, SAAS, PAAS Clouds**

IAAS: Amazon EC2, Windows Azure, Rackspace, Google Compute Engine.
SAAS: AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos.
PAAS: Google Doc

18.**List the various Actors in Cloud Computing**

- Cloud Provider
- Cloud Consumer
- Cloud Auditor
- Cloud Broker

19. **State any two service provider of SaaS.**

Some of the service providers are

- Amazon Web services
- Google Apps
- icloud
- Oracle
- Salesforce.com
- Windows Azure

20. Define anything-as-a-service? (April/May 2019)

Providing services to the client on the basis on meeting their demands at some pay per use cost such as data storage as a service, network as a service, communication as a service etc. It is generally denoted as anything as a service XaaS.

PART-B & C

1. What are the services provided by cloud with deployment model? Explain in detail (Nov/Dec 2017)

SAAS
PAAS
IAAS

2. List the cloud deployment models and give a detailed about them (Nov/Dec 2016)

Private cloud
Public cloud
Hybrid cloud

3. Write about the Amazon Simple Storage Service (S3) cloud service provider in detail

AWS S3

4.Explain in detail about the Cloud Computing Reference Architecture with a suitable diagram

NIST cloud computing architecture
Actors

5.Explain in detail about the Architectural Design Challenges in Cloud with suitable examples

Service availability and Data lock-in parallelism
Data privacy and security concerns
Unpredictable performance and bottlenecks
Distributed storage and widespread software bugs
Cloud scalability, Interoperability and standardization
Software licensing and reputation sharing

6. Describe in detail about the cloud storage.

Storage as a service
Cloud storage providers

7. What are the pros and cons for public, private and hybrid cloud (Nov/Dec 2016).

Pros of public cloud

offers unlimited scalability

Lower costs

No maintenance not interrupt service.

Location independent

Cons

No control over privacy or security

Cannot be used for use of sensitive applications

Lacks complete flexibility(since dependent on provider)

No stringent (strict) protocols regarding data management

Pros of private cloud

Offers greater Security and Privacy

Organization has control over resources

Highly reliable

Saves money by virtualizing the resources

cons

Expensive when compared to public cloud

Requires IT Expertise to maintain resources.

Pros of hybrid cloud

It is scalable

Offers better security

Flexible

Cost-effectiveness

Control

Cons

Infrastructure Dependency

Possibility of security breach(violate) through public cloud

UNIT-4 RESOURCE MANAGEMENT AND SECURITY IN CLOUD

1.What is Inter-cloud? **NOV/DEC 2021.**

Intercloud is a network of cloud s that are linked with each other. This includes private, public,and hybrid clouds that come together to provide a seamless exchange of data.

2. Name any two security challenges associated with cloud in today's digital scenario**.** **NOV/DEC 2021.**

Data Breaches In an on-premise setup, your in-house IT team exercises absolute control over your network infrastructure and physical hardware. ...
Insufficient Identity, Credential, Access and Key Management ...
Account Hijacking

3. List any four host security threats in public IaaS. AU : Dec.-17

The most common host security threats in public IaaS public cloud are

- Hijacking of accounts those are not properly secured.

- Stealing the keys like SSH private keys those are used to access and manage hosts.
- Attacking unpatched and vulnerable services by listening on standard ports like FTP, NetBIOS, SSH.
- Attacking systems that are not secured by host firewalls.
- Deploying Trojans embedded viruses in the software's running inside the VM

4. Mention the importance of transport level security. AU : Dec.-16

- The TLS protocol allows client / server applications to communicate across a network in a way that avoids eavesdropping, exploitation, tampering and message forgery.
- TLS uses cryptography to ensure endpoint authentication and data confidentiality. TLS authentication is a single way, since the client knows the identity of the server already.
- The end user must verify the identifying information contained in the certificate of the server in order to be truly identifiable.

5.. Discuss on the application and use of identity and access management. AU : Dec.-16 OR What is identity and access management in a cloud environment ? AU : Dec.18

The Identity and access management in cloud computing is the security framework composed of policy and governance components used for creation, maintenance and termination of digital identities with controlled access of shared resources. It composed of multiple processes, components, services and standard practices. It focuses on two parts namely Identity management and access management. The directory services are used in IAM for creating a repository for identity management, authentication and access management. The IAM provides many features like user management, authentication management, authorization management, credential and attribute management, compliance management, monitoring and auditing etc.

6.What are the various challenges in building the trust environment ? AU : May-17

a) Lack of trust between service providers and cloud users can prevent cloud computing from being generally accepted as a solution for on demand service.

b) It can generate Lack of transparency, difficulty in communication and confidentiality between cloud service provider and cloud users.

c) Lack of Standardization.

d) Challenges due to multi-tenancy and audit trails.

7. Differentiate between authentication and authorization. AU : Dec.-19

Authentication is the process of validating individuals' credentials like User Name/User ID and password to verify your identity.

Authentication technology provides access control for systems by checking to see if a user's credentials match the credentials in a database of authorized users or in a data authentication server

Authorization checks whether the user is permitted to access the particular resources or not. In authentication process, the identity of users is checked for providing the access to the system while in authorization process; person's or user's authorities are checked for accessing the resources.

The authentication is always done before the authorization process

8. List key privacy issues in cloud. AU : Dec.-19

- Compliance issue
- Storage issue
- Retention issue
- Access issue
- Auditing and monitoring
- Destruction of data
- Privacy and security breaches

9..**List out the security challenges in cloud. AU : May -19**

The security challenges in cloud are

a) A Lack of Visibility and Control

b) Compliance complexity issues

c) Trust and Data Privacy Issues

d) Data Breaches and Downtime

e) Issues related to User Access Control

f) Vendor Lock-In

g) Lack of Transparency

h) Insecure Interfaces and APIs

i) Insufficient Due Diligence

10. How can the data security be enforced in cloud ? AU : May-19

In Cloud computing data security can be enforced by

a) Providing data encryption for in transit data

b) Providing data privacy and privacy protection

c) Providing data availability with minimal downtime

d) Preserving data integrity

e) Maintaining confidentiality, integrity, and availability for data

f) Incorporating different access control schemes like Role Based Access Control (RBAC), Mandatory Access Control or Discretionary Access Control.

g) Secure data from different threats

11. **What is the purpose of Open Authentication in the cloud computing ?**

- OAuth is a standard protocol in cloud computing which allows secure API authorization for various types of web applications in a simple, standard method.
- OAuth enables users to access their information which is shared by service providers and consumers without sharing all their identities.
- This mechanism is used by companies such as Amazon, Google, Facebook, Microsoft and Twitter to permit the users to share information about their accounts with third party applications or websites.

12.What are the challenges of inter cloud.

- **Identification:** A system should be created where each cloud can be identified and accessed by another cloud, similar to how devices connected to the internet are identified by IP addresses.
- **Communication:** A universal language of the cloud should be created so that they are able to verify each other's available resources.
- **Payment:** When one provider uses the assets of another provider, a question arises on how the second provider will be compensated, so a proper payment process should be developed.

13.What is Resource Provisioning in cloud?

Cloud provisioning is the allocation of a **cloud** provider's **resources** and services to a customer. The growing catalogue of **cloud** services that customers can **provision** includes infrastructure as a service, software as a service and platform as a service, in public or private **cloud** environments.

14.What are the types of resource provisioning methods.

a. Demand-Driven Resource Provisioning
b. Event-Driven Resource Provisioning
c. Popularity-Driven Resource Provisioning

15.What is Demand Driven resource provisioning?

This method adds or removes computing instances based on the current utilization level of the allocated resources. The demand-driven method automatically allocates two processors for the user application, when the user was using one processor more than 60 percent of the time for an extended period. When a resource has surpassed a threshold for a certain amount of time,

the scheme increases that resource based on demand. When a resource is below a threshold for a certain amount of time, that resource could be decreased accordingly.

16.What is Event-Driven Resource Provisioning?

This scheme adds or removes machine instances based on a specific time event. The scheme works better for seasonal or predicted events. During these events, the number of users grows before the event period and then decreases during the event period. This scheme anticipates peak traffic before it happens. The method results in a minimal loss of QoS, if the event is predicted correctly.

17.What is Popularity-Driven Resource Provisioning?

In this method, the Internet searches for popularity of certain applications and creates the instances by popularity demand. The scheme anticipates increased traffic with popularity. Again, the scheme has a minimal loss of QoS, if the predicted popularity is correct. Resources may be wasted if traffic does not occur as expected.

4.1

18.What are the Extended Cloud Computing Services.[U]

1. Hardware as a Service (HaaS).
2. Network as a Service (NaaS).
3. Location as a Service (LaaS),
4. Security as a Service ("SaaS").
5. Data as a Service (DaaS).
6. Communication as a Service (CaaS)

19.What is Data integrity?

Data integrity means ensuring that data is identically maintained during any operation (such as transfer, storage, or retrieval).

20.Define Secure Software Development Life Cycle (SecSDLC).

The SecSDLC involves identifying specific threats and the risks they represent, followed by design and implementation of specific controls to counter those threats and assist in managing the risks they pose to the organization and/or its customers. The SecSDLC must provide consistency, repeatability, and conformance.

21.List phases of SecSDLC. [R]

a) Investigation
b) Analysis
c) Logical design
d) Physical design
e) Implementation
f) Maintenance

4.2

PART B & C

1. "In today's world, infrastructure security and data security are highly challenging at network, host and application levels", Justify and explain the several ways of protecting the data at transit and at rest. (Apr/May 2018)

- Cloud Infrastructure security

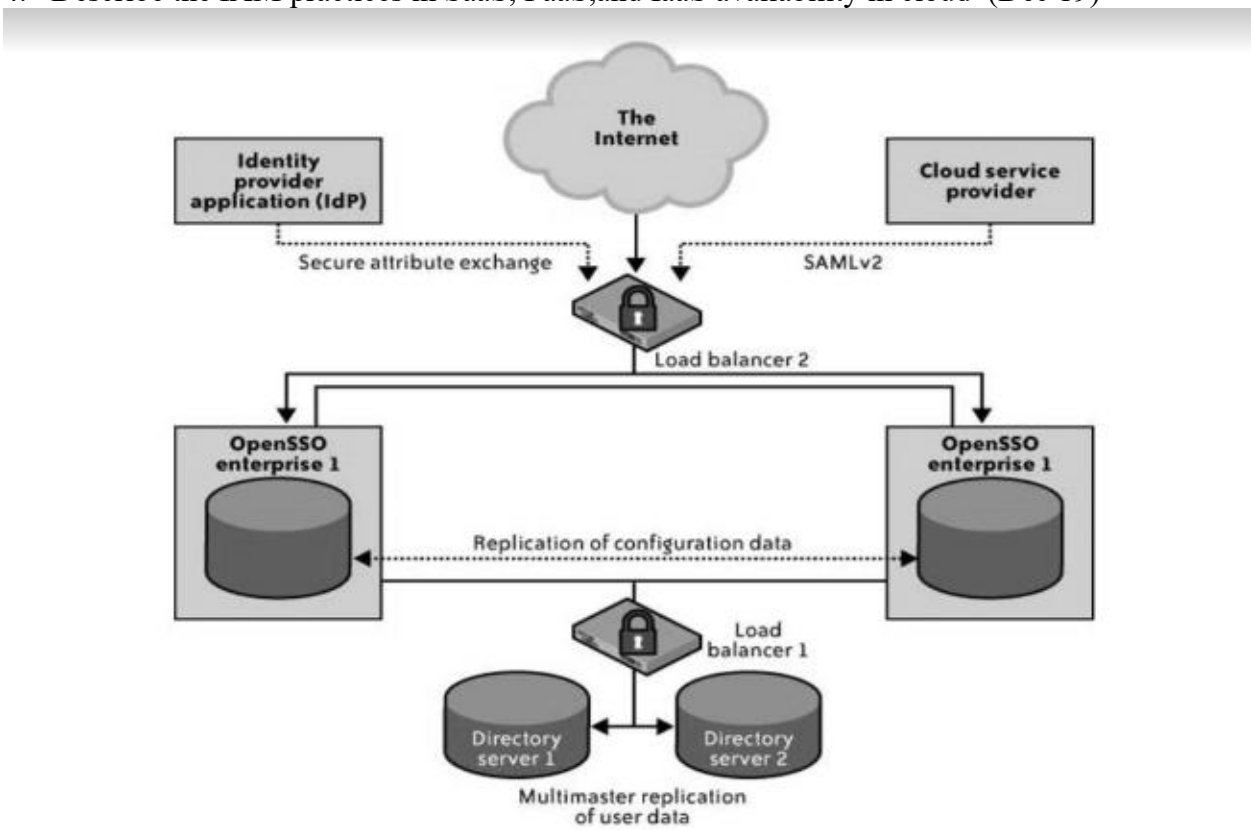
- Network level security
- Host level security
- Application level security

2. Explain the baseline identity and access management (IAM) factors to be practice by the stakeholders of cloud services and common key privacy issues likely to happen in the cloud environment. (Apr/May 2018)
    - IAM
    - Key privacy issues in the cloud

3. What is the purpose of IAM?Describe its functional architecture with an illustration.(Nov/Dec 17) **OR** Write detailed note on identity and access management architecture (May 17)

IAM Architecture and Practice

4. Describe the IAM practices in SaaS, PaaS,and IaaS availability in cloud (Dec 19)



5. Explain in detail about cloud resource provisioning methods**.**

Provisioning of Compute Resources (VMs)
Provisioning Methods
Demand Driven Methods
Event-Driven Resource Provisioning
Popularity-Driven Resource Provisioning
Dynamic Resource Deployment

6. How security governance can be achieved in cloud computing environment.

A security committee should be developed whose objective is to focus on providing

guidance about security initiatives with business and IT strategies.

7. Explain different security standards used in cloud computing.

Security (SAML ,OAuth, OpenID, SSL/TLS)
Security Assertion Markup Language (SAML)
Open Authentication (OAuth)
OpenID
SSL/TLS

UNIT-5 Cloud Technologies and Advancements

1.What is Hadoop? NOV/DEC 2021

The Apache Hadoop is an open source software project that enables distributed processing of large data sets across clusters of commodity servers using programming models. It is designed to scale up from a single server to thousands of machines, with a very high degree of fault tolerance

2. Write a note on Federated services. NOV/DEC 2021

Cloud federation refers to the unionization of software infrastructure and platformservices from disparate networks that can be accessed by a client.The federation of cloud resources is facilitated through network gate ways that connectpublic or external clouds like private or internal clouds.

3. What are the advantages of using Hadoop ?

- Hadoop is a highly scalable in nature for data storage and processing platforms.
- It satisfies all four characteristics of big data like volume, velocity, variety and veracity.
- It is a cost-effective solution for Big data applications as it uses a cluster of commodity hardware to store data.
- It provides high throughput and low latency for high computational jobs.

4. What is the purpose of heart beat in Hadoop. AU : Dec.-17 OR

State the significance of heart beat message in Hadoop. AU : Dec.-19 OR

Give the significance of heart beat message in Hadoop. AU : May-19

In Hadoop Name node and data node does communicate using Heartbeat. The Heartbeat is the signal that is sent by the data node to the name node in regular time interval to indicate its presence, i.e. to indicate that it is alive. Data Nodes send a heartbeat signal to the Name Node every three seconds by default.

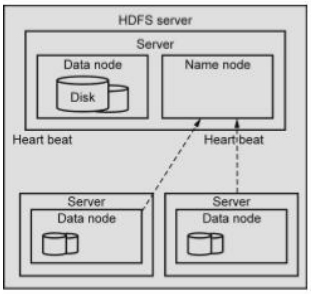


Fig. 5.1 : Heartbeat in HDFS

If after a certain time of heartbeat (which is ten minutes by default), Name Node does not receive any response from Data Node, then that particular Data Node used to be declared as dead. If the death of a node causes the replication factor of data blocks to drop below their minimum value, the Name Node initiates additional replication to normalized state.

5. Name the different modules in Hadoop framework. AU : May-17

The Hadoop core is divided into two fundamental modules called HDFS and MapReduce engine.

- The HDFS is a distributed file system inspired by GFS that organizes files and stores their data on a distributed computing system.
- MapReduce is the computation engine running on top of HDFS as its data storage manager

6. "HDFS" is fault tolerant. Is it true ? Justify your answer. AU : Dec.-17

Fault tolerance refers to the ability of the system to work or operate uninterrupted even in case of unfavorable conditions (like components failure due to disaster or by any other reason). The main purpose of this fault tolerance is to remove frequently taking place failures, which occurs commonly and disturbs the ordinary functioning of the system. The three main solutions which are used to produce fault tolerance in HDFS are data replication, heartbeat messages and checkpoint and recovery. In data replication, The HDFS stores multiple replicas of same data across different clusters based on replication factor. HDFS uses an intelligent replica placement model for reliability and performance. The same copy of data is positioned on several different computing nodes so when that data copy is needed it is provided by any of the data node. major advantage of using this technique is to provide instant recovery from node and data failures. But one main disadvantage is it consume high memory in storing the same data on multiple nodes

7.What is Amazon Web Service (AWS)?

Amazon web services is a collection of remote computing services(web services) that together make up a cloud computing platform offered over the internet by Amazon.com

8.What does Amazon Web Service offering?

- Low ongoing cost

- Instant Elasticity and Flexible capacity (Scaling up and down)
- Speed and Agility
- Apps not Ops
- Global Reach
- Open and flexible
- Secure

9. What is Amazon Elastic Compute Cloud (EC2)?

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) Cloud. Using Amazon EC2 eliminates your need to invest in hardware up front, so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. Amazon EC2 enables you to scale up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

10. What is Amazon Elastic Block Store (EBS)?

EBS provides block level storage volumes (1 GB to 1 TB) for use with Amazon EC2 instances

- multiple volumes can be mounted to the same instance
- EBS volumes are network-attached and persist independently from the life of an instance
- Storage volumes behave like raw, unformatted block devices, allowing users to create a file system on top of Amazon EBS volumes or use them in any other way you would use a block device

11. What is Amazon Simple Storage Service (S3)?

Amazon S3 provides a simple web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web.

12. What is Amazon Elastic Map Reduce (EMR)?

Amazon EMR is a web service that makes it easy to quickly and cost-effectively process vast amounts of data using Hadoop. Amazon EMR distributes the data and processing across a resizable cluster of Amazon EC2 instances.

13. What is Amazon Relational Database Service (RDS)?

Amazon RDS is a web service that makes it easy to set up, operate, and scale a relationa database in the cloud. It gives access to the capabilities of a familiar MySQL, Oracle o Microsoft SQL Server database engine.

14. What is Amazon DynamoDB?

DynamoDB is a fast, fully managed NoSQL database service that makes it simple and cost-effective to store and retrieve any amount of data and serve any level of request traffic.

15. What is Eucalyptus?

Eucalyptus is an open source software platform for implementing Infrastructure as a Service (IaaS) in a private or hybrid cloud computing environment.

The Eucalyptus cloud platform pools together existing virtualized infrastructure to create cloud resources for infrastructure as a service, network as a service and storage as a service.

The name Eucalyptus is an acronym for Elastic Utility Computing Architecture for Linking Your Programs to Useful Systems.

16. List the features of Eucalyptus.

Supports both Linux and Windows virtual machines (VMs).
Application program interface- (API) compatible with Amazon EC2 platform.
Compatible with Amazon Web Services (AWS) and Simple Storage Service (S3).
Works with multiple hypervisors including VMware, Xen and KVM.
Can be installed and deployed from source code or DEB and RPM packages.
Internal processes communications are secured through SOAP and WS-Security.
Multiple clusters can be virtualized as a single cloud.
Administrative features such as user and group management and reports.

17. What are the components of Eucalyptus?

- Cluster Controller (CC)
- Cloud Controller (CLC)
- Node Controller (NC)
- Walrus Storage Controller (WS3)
- Storage Controller (Sc)

18.What is Open Nebula?

Open Nebula is an open source platform for constructing virtualized private, public and hybrid clouds. It is a simple yet feature-rich, flexible solution to build and manage data centre virtualization and enterprise clouds.

19. What are the benefits of OpenNebula?

- It is 100 per cent open source and offers all the features in one edition.
- It provides control via the command line or Web interface, which is ideal for a variety of user groups and needs.
- OpenNebula is available for all major Linux distributions, thus simplifying installation.

20.**Describe the services available in User services?**

It provides a simple API for authentication and authorization
It detect if a user is signed in App
It detect if a user is an admin

21.What are the three authentication options in User service?

Google Account

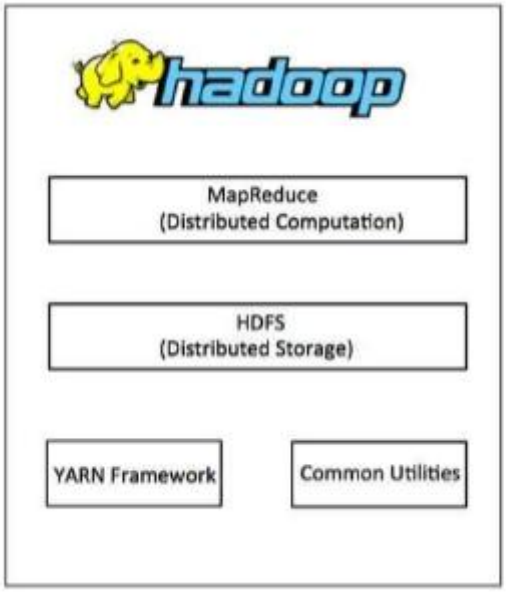
Google Apps domains users
OpenID - experimental

PART-B 7& c

1. Explain Hadoop Ecosystem framework **Or** Give a Detailed note on Hadoop framework (Dec16)

Hadoop = MapReduce + HDFS
(MapReduce Processing ; HDFS Storage)
Hadoop architecture

2. Explain Hadoop Distributed File system architecture with diagram (Dec 18)(May 17)



3. Illustrate dataflow in HDFS during file read/write operation with diagram (Dec 17)

HDFS- Read Operation
HDFS-Write Operation

4. Discuss Mapreduce with suitable diagram **OR** Analyse how Mapreduce framework supports parallel and distributed computing on large data sets with suitable example **or** Illustrate the Hadoop implementation of Mapreduce framwork (May 17)(May 19)

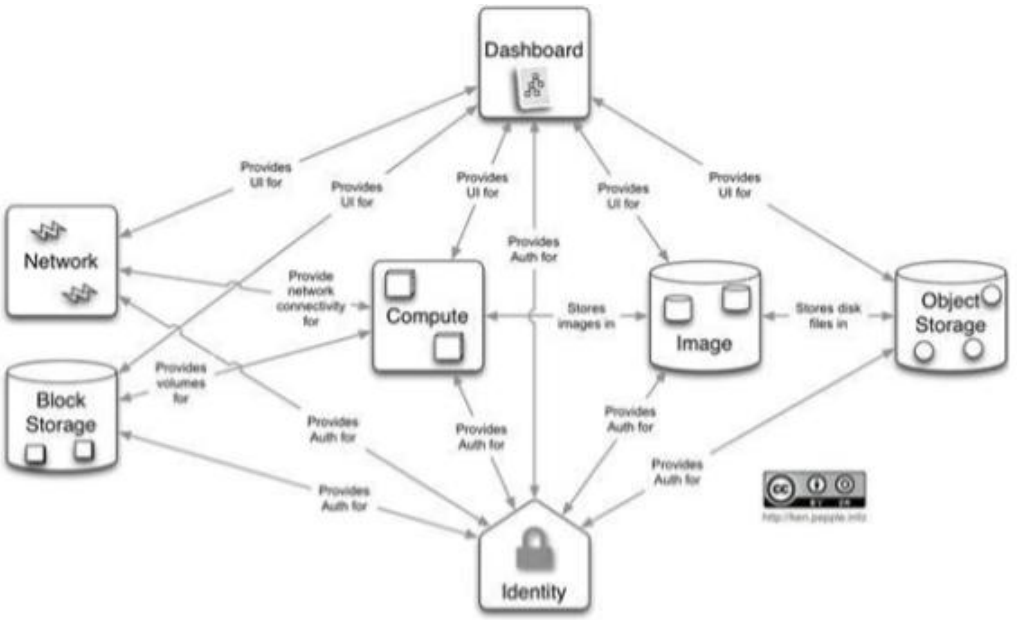
Distributed file system (HDFS)
Execution engine (MapReduce)

5. Explain Federation in the cloud

Four Levels of Federation:
Permissive
Verified
Encrypted
Trusted

6. Explain Open stack in detail.

OpenStack is a free and open-source software platform for cloud computing.



7. Explain the functional architecture of the Google cloud platform for app engine in detail.

GOOGLE CLOUD INFRASTRUCTURE