

Cloud Deployment Model Assignment 1

Question-1: Define Cloud Computing. Briefly discuss various cloud services and their features. Illustrate the distinct advantages and disadvantages of cloud computing. Identify the recent trends of cloud computing.

Ans: Cloud computing is a technology that allows users to access computing resources, such as storage, processing power, and applications, over the internet, rather than locally on their own devices. The resources are hosted on servers located in data centres, which are managed by cloud service providers. This allows users to access and use the resources they need, when they need them, without having to worry about the underlying infrastructure or maintenance. Cloud computing has become increasingly popular in recent years because it offers a number of benefits, including flexibility, scalability, and cost efficiency.

There are mainly three types of cloud services:

1. Infrastructure as a Service (IaaS): IaaS is also known as Hardware as a Service (HaaS). It is a computing infrastructure managed over the internet. The main advantage of using IaaS is that it helps users to avoid the cost and complexity of purchasing and managing the physical servers.

Features:

- Resources are available as a service
- Services are highly scalable
- Dynamic and flexible
- GUI and API-based access
- Automated administrative tasks

2. Platform as a Service (PaaS): PaaS cloud computing platform is created for the programmer to develop, test, run, and manage the applications. Features:

- Accessible to various users via the same development application.
- Integrates with web services and databases.
- Builds on virtualization technology, so resources can easily be scaled up or down as per the organization's need.
- Support multiple languages and frameworks.
- Provides an ability to "Auto-scale".

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3. **Software as a Service (SaaS):** SaaS is also known as "on-demand software". It is a software in which the applications are hosted by a cloud service provider. Users can access these applications with the help of internet connection and web browser.
 - Managed from a central location
 - Hosted on a remote server
 - Accessible over the internet
 - Users are not responsible for hardware and software updates. Updates are applied automatically.
 - The services are purchased on the pay-as-per-use basis

Advantages of Cloud Computing:

1. Once the data is stored in the cloud, it is easier to get back-up and restore that data using the cloud.
2. Cloud applications improve collaboration by allowing groups of people to quickly and easily share information in the cloud via shared storage.
3. Cloud allows us to quickly and easily access store information anywhere, anytime in the whole world, using an internet connection. An internet cloud infrastructure increases organization productivity and efficiency by ensuring that our data is always accessible.
4. Cloud computing reduces both hardware and software maintenance costs for organizations.
5. Cloud computing allows us to easily access all cloud data via mobile.
6. Cloud computing offers Application Programming Interfaces (APIs) to the users for access services on the cloud and pays the charges as per the usage of service.
7. Cloud offers us a huge amount of storing capacity for storing our important data such as documents, images, audio, video, etc. in one place.
8. Data security is one of the biggest advantages of cloud computing. Cloud offers many advanced features related to security and ensures that data is securely stored and handled.

Disadvantages of Cloud Computing:

1. Every data (image, audio, video, etc.) is stored on the cloud, and we access these data through the cloud by using the internet connection. If you do not have good internet connectivity, you cannot access these data. However, we have no any other way to access data from the cloud.
2. Vendor lock-in is the biggest disadvantage of cloud computing. Organizations may face problems when transferring their services from

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one vendor to another. As different vendors provide different platforms, that can cause difficulty moving from one cloud to another.

3. As we know, cloud infrastructure is completely owned, managed, and monitored by the service provider, so the cloud users have less control over the function and execution of services within a cloud infrastructure.
4. Although cloud service providers implement the best security standards to store important information. But, before adopting cloud technology, you should be aware that you will be sending all your organization's sensitive information to a third party, i.e., a cloud computing service provider. While sending the data on the cloud, there may be a chance that your organization's information is hacked by Hackers.

Cloud computing is an ever-evolving technology with new trends emerging regularly. Here are some of the recent trends in cloud computing:

1. Multi-cloud and hybrid cloud adoption: Organizations are increasingly adopting multi-cloud and hybrid cloud environments to leverage the strengths of multiple cloud platforms and achieve better flexibility, cost savings, and scalability.
2. Edge computing: With the growth of Internet of Things (IoT) and other connected devices, edge computing is gaining popularity. It involves processing data closer to the source, rather than sending it to centralized cloud servers, thereby reducing latency and improving performance.
3. Serverless computing: Serverless computing is a new way of building and running applications without managing the underlying infrastructure. It offers automatic scaling, reduced costs, and increased agility.
4. AI and machine learning in the cloud: Cloud providers are offering more AI and machine learning services, making it easier for developers to build intelligent applications without requiring specialized expertise.
5. Containerization: Containerization is becoming more popular as it provides a lightweight and flexible way to package and deploy applications. Kubernetes is the most widely used container orchestration platform.
6. Quantum computing in the cloud: With the rise of quantum computing, cloud providers are starting to offer quantum computing services, allowing organizations to experiment with quantum algorithms and simulations.
7. Cloud-native development: Cloud-native development is an approach to

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building and deploying applications that take full advantage of the cloud's capabilities. It involves using microservices, containerization, and other cloud-native technologies.

These are just a few of the recent trends in cloud computing. As the technology continues to evolve, we can expect to see many more innovations in the coming years.

Question-2: Define convergence in Cloud Computing with examples. Write short notes on Hyper-convergence. Discuss the various hyper-convergence policies for the private cloud. Define cloud sourcing.

Ans: Convergence in Cloud Computing: It refers to the integration of multiple components and functions of the cloud into a single, unified system. Convergence helps to simplify the management and operation of the cloud, improve efficiency, and reduce costs. For example, convergence can be achieved by combining different components such as storage, compute, and networking into a single system. This can be done using tools such as software-defined networking (SDN), software-defined storage (SDS), and hyper-converged infrastructure.

Hyper-convergence: It is an approach to infrastructure management that combines storage, compute, and networking into a single, integrated system. This is achieved using software-defined storage and virtualization technologies, which allow the resources to be managed and allocated dynamically. It offers several advantages, such as improved performance, increased scalability, and reduced management complexity. It is particularly useful for organizations that are looking to deploy private clouds, as it provides a flexible and cost-effective solution.

There are several hyper-convergence policies that can be implemented for private clouds, including:

1. **Policy-driven resource allocation:** This involves automatically allocating resources based on pre-defined policies, such as workload priorities or resource utilization.
2. **Dynamic resource allocation:** This involves dynamically allocating resources based on real-time demand, which can help to improve efficiency and reduce waste.
3. **Automated workload migration:** This involves automatically migrating workloads between different servers and storage systems to optimize resource utilization and reduce downtime.
4. **Self-service provisioning:** This involves allowing users to provision their own resources based on pre-defined policies, which can help to improve

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efficiency and reduce administrative overhead.

Cloud sourcing: It refers to the process of selecting and acquiring cloud services from external providers. This can include public cloud services such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform, as well as private cloud services from third-party providers. It can offer several advantages, such as cost savings, scalability, and increased flexibility. However, it also involves certain risks, such as data security and vendor lock-in. To mitigate these risks, organizations should carefully evaluate potential providers and develop a comprehensive sourcing strategy.

Question-3: Define Hybrid cloud and Cloud Federation. Discuss the benefits of the Hybrid Cloud. Illustrate the architecture of the Federated Cloud. Explain the advantages and disadvantages of Federated Cloud.

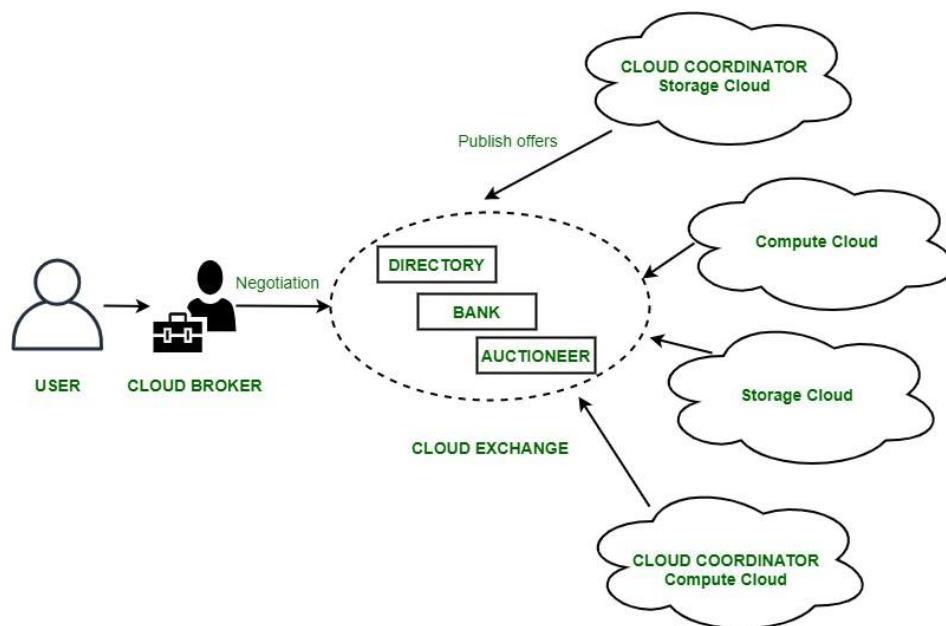
Ans: Hybrid Cloud: It is a cloud computing environment that combines public and private clouds, allowing organizations to utilize the benefits of both. In a hybrid cloud, an organization can host critical applications and sensitive data on its private cloud, while leveraging the scalability and cost-effectiveness of public cloud resources for less sensitive workloads.

Cloud Federation: It is the practice of interconnecting multiple cloud computing environments from different cloud providers to create a single, unified and cohesive computing environment. This enables seamless access to resources across multiple clouds, allowing organizations to manage their workloads across different cloud providers.

Benefits of Hybrid Cloud:

1. **Improved Scalability and Flexibility**: Hybrid clouds allow organizations to scale up their computing resources quickly and efficiently, as they can leverage the benefits of both public and private clouds.
2. **Enhanced Security and Control**: Organizations can keep their sensitive data and critical applications on their private cloud while still enjoying the benefits of public cloud resources.
3. **Reduced Cost**: Hybrid cloud can reduce costs as organizations can use public cloud resources for less sensitive workloads, which do not require the same level of security and control.

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Architecture of Cloud Federation

The architecture of Federated Cloud consists of three basic components:

1. Cloud Exchange: It acts as a mediator between cloud coordinator and cloud broker. The demands of the cloud broker are mapped by the cloud exchange to the available services provided by the cloud coordinator. The cloud exchange has a track record of what is the present cost, demand patterns, and available cloud providers, and this information is periodically reformed by the cloud coordinator.
2. Cloud Coordinator: It assigns the resources of the cloud to the remote users based on the quality of service they demand and the credits they have in the cloud bank. The cloud enterprises and their membership are managed by the cloud controller.
3. Cloud Broker: It interacts with the cloud coordinator, analyzes the Service-level agreement and the resources offered by several cloud providers in cloud exchange. Cloud broker finalizes the most suitable deal for their client.

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Advantages of Federated Cloud:

1. Improved Scalability and Availability: Federated cloud allows organizations to access resources from multiple cloud providers, which increases the availability of resources and improves scalability.
2. Reduced Cost: Federated cloud can reduce costs as organizations can choose the most cost-effective cloud provider for each workload.
3. Increased Innovation: Federated cloud enables organizations to access a wide range of resources and services from multiple cloud providers, which can drive innovation and enable faster time-to-market.

Disadvantages of Federated Cloud:

1. Complexity: Federated cloud environments can be complex to manage, as they require a deep understanding of the different cloud providers, middleware technologies, and security and compliance requirements.
2. Security and Compliance: Federated cloud environments can pose security and compliance challenges, as data and applications may be distributed across multiple cloud providers, which can increase the risk of data breaches and compliance violations.
3. Interoperability: Federated cloud environments require a high degree of interoperability between different cloud providers, which can be challenging, especially if cloud providers use different technologies and standards.

Question-4: List the different prioritized cloud computing applications and their adequate details. Describe the application transformation and application modernization techniques in detail. Describe the application of multithreading in a cloud computing environment. Define multi-cloud.

Ans: List of Prioritized Cloud Computing Applications:

1. Software as a Service (SaaS): This application provides access to software applications over the internet, without the need for local installation. Examples of SaaS applications include email services, customer relationship management (CRM) systems, and enterprise resource planning (ERP) systems.
2. Platform as a Service (PaaS): This application provides a platform for building, testing, and deploying web applications, without the need for infrastructure management. Examples of PaaS include Google App Engine and Heroku.
3. Infrastructure as a Service (IaaS): This application provides virtualized computing resources, such as servers, storage, and

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networking, on a pay-per-use basis. Examples of IaaS include Amazon Web Services (AWS) and Microsoft Azure.

Application Transformation: Application transformation involves migrating an application from one environment to another, such as from an on-premises data center to the cloud. This can involve re-architecting the application to take advantage of cloud-native services and technologies, such as serverless computing, containers, and microservices.

Application Modernization: Application modernization involves updating an existing application to improve its functionality, performance, and user experience. This can involve re-architecting the application to use cloud-native services and technologies, such as artificial intelligence, machine learning, and data analytics.

Multithreading in a Cloud Computing Environment: Multithreading is the ability of an application to perform multiple tasks simultaneously. In a cloud computing environment, multithreading can help to improve application performance by enabling parallel processing of tasks across multiple virtual machines or containers.

Multi-Cloud: Multi-cloud is the practice of using multiple cloud providers to host different workloads, applications, or data. This can provide organizations with greater flexibility, resilience, and cost efficiency, as they can choose the most appropriate cloud provider for each workload. Multi-cloud environments can be managed through a unified management platform, such as Kubernetes or OpenShift.

Question-5: List down the advantages and disadvantages of multi-cloud. Describe scaling, its different types, and applications in detail. Define self-service cloud computing and cloud management. Explain the security issues in various cloud applications.

Ans: Advantages of Multi-Cloud:

1. **Improved Flexibility:** Multi-cloud environments offer greater flexibility in terms of workload placement, as organizations can choose the most appropriate cloud provider for each workload.
2. **Increased Resilience:** Multi-cloud environments can improve resilience and reduce the risk of downtime, as workloads can be distributed across multiple cloud providers.
3. **Cost Optimization:** Multi-cloud environments can help to optimize costs, as organizations can choose the most cost-effective cloud provider for

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each workload.

Disadvantages of Multi-Cloud:

1. Complexity: Multi-cloud environments can be complex to manage, as they require a deep understanding of the different cloud providers, technologies, and interoperability between cloud services.
2. Security: Multi-cloud environments can pose security risks, as data may be distributed across multiple cloud providers, which can increase the risk of data breaches and compliance violations.
3. Management Overhead: Managing a multi-cloud environment can be challenging, as it requires different tools, processes, and skills to manage each cloud provider.

Scaling: It is the ability of an application or infrastructure to handle increased workload or traffic. There are two types of scaling: horizontal scaling and vertical scaling.

1. Horizontal Scaling: It involves adding more instances or nodes to a system to handle increased workload or traffic. This is often done by deploying more virtual machines or containers.
2. Vertical Scaling: Vertical scaling involves increasing the capacity of existing nodes or instances to handle increased workload or traffic. This is often done by adding more resources, such as CPU, RAM, or storage.

Applications of Scaling: Scaling is essential in cloud computing environments to ensure that applications and services can handle increased workload and traffic, especially during peak periods. Scaling can be automated through tools like Kubernetes, which automatically scale applications based on demand.

Self-Service Cloud Computing: It is a model in which users can provision and manage cloud resources on-demand, without requiring assistance from IT administrators. Self-service cloud computing can improve agility and speed of deployment, as users can quickly provision the resources they need.

Cloud Management: It involves the management of cloud resources, such as infrastructure, applications, and services, to ensure that they are running efficiently and effectively. Cloud management can include tasks such as monitoring, provisioning, patching, and troubleshooting.

Security Issues in Cloud Computing: Security is a major concern in cloud computing environments, as data and applications may be distributed across multiple cloud providers. Some of the security issues in cloud computing include data breaches, compliance violations, identity and access management, and application-level security. Organizations can mitigate these risks by

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implementing strong security policies, encrypting data in transit and at rest, and using multi-factor authentication.

Question-6: Illustrate the Software Define Network (SDN) and its architecture. Briefly explain software-defined data centres and their challenges. Write a short note on big data analytics. Explain the Cloud-based IoT and its advantages.

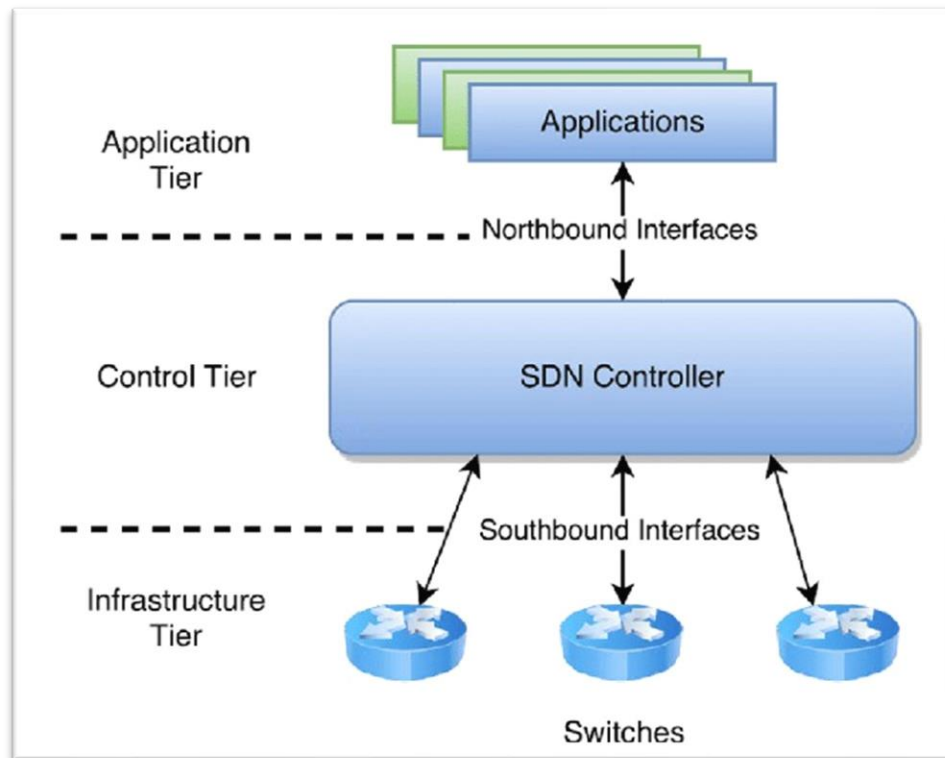
Ans: Software-Defined Networking (SDN): It is an approach to network management that allows administrators to manage network traffic dynamically and centrally. SDN separates the control plane from the data plane, which enables network administrators to manage traffic flows in a more flexible and efficient manner.

SDN Architecture:

The SDN architecture consists of three main tiers:

1. Application Tier: It consists of network applications that interact with the control layer to manage network traffic flows. Examples of network applications include firewalls, load balancers, and intrusion detection systems.
2. Control Tier: It consists of the SDN controller, which is responsible for managing network traffic flows. The SDN controller communicates with the infrastructure layer to configure network devices and manage network traffic flows.
3. Infrastructure Tier: It consists of network devices, such as switches and routers, which are responsible for forwarding network traffic. The infrastructure layer communicates with the control layer to receive configuration information and instructions on how to forward network traffic.

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Software-Defined Data Centers (SDDC): It is a data center architecture in which all infrastructure elements, including compute, storage, and networking, are virtualized and delivered as a service. SDDCs enable organizations to quickly provision and scale infrastructure resources based on demand, while reducing management overhead and increasing resource utilization.

Some of the challenges of SDDCs include complexity, security, and management overhead. SDDCs require a deep understanding of the underlying infrastructure and software-defined technologies, which can be complex to manage. Security is also a major concern, as SDDCs rely on virtualized infrastructure and software-defined networking, which can increase the risk of data breaches and compliance violations.

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Big Data Analytics: It is the process of analysing large and complex data sets to extract insights and make informed business decisions. Big data analytics typically involves the use of machine learning, data mining, and data visualization tools to analyse and visualize data.

Cloud-Based IoT: It is an approach to managing IoT devices and data that relies on cloud computing services. In cloud-based IoT, IoT devices send data to the cloud, where it is processed, analysed, and stored. Cloud-based IoT can provide organizations with greater scalability, flexibility, and cost efficiency, as they can quickly provision and scale infrastructure resources based on demand.

Some of the advantages of cloud-based IoT include scalability, flexibility, and cost efficiency. Cloud-based IoT enables organizations to quickly provision and scale infrastructure resources based on demand, while reducing management overhead and increasing resource utilization. Cloud-based IoT can also provide organizations with greater flexibility in terms of workload placement, as they can choose the most appropriate cloud provider for each workload.

UNIT-2

Question-1: Describe the workings of Cloud Computing. Describe the necessity of cloud computing. Briefly explain the scalability and elasticity of cloud computing. Define Dynamic Provisioning. Precisely explain the multitenancy.

Ans: Cloud computing is a technology that allows users to access computing resources, such as servers, storage, and applications, over the internet. In cloud computing, users can use these resources as a service, rather than managing their own infrastructure.

The necessity of cloud computing stems from the growing demand for digital services and the need for organizations to be agile and flexible in responding to changing business needs. Cloud computing provides a cost-effective and scalable solution to managing computing resources, allowing organizations to quickly provision and scale infrastructure resources based on demand.

Scalability and elasticity are two key features of cloud computing. Scalability refers to the ability to increase or decrease computing resources based on demand. Elasticity refers to the ability to automatically provision and de-provision computing resources based on changes in demand.

Dynamic provisioning is a key technology used to achieve scalability and elasticity in cloud computing. Dynamic provisioning allows resources to be

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provisioned automatically, based on predefined rules and policies. For example, a web server may be automatically provisioned when website traffic exceeds a certain threshold, and de-provisioned when traffic decreases.

Multitenancy is another key concept in cloud computing, referring to the ability of multiple users to share the same computing resources. In a multitenant environment, users are provided with isolated and secure environments to run their applications, while sharing the underlying computing infrastructure. Multitenancy allows for greater resource utilization and cost efficiency, as computing resources can be shared across multiple users. However, it also introduces potential security risks, as a breach in one tenant's environment may affect others. Therefore, it's important to have strong security measures and access controls in place in a multitenant environment.

Question-2: Briefly explain the composable business approaches and related benefits. Illustrate the various cloud migration, complementary strategies, and advantages. Write a short note on virtualization.

Ans: Composable business approaches refer to the ability of an organization to quickly and easily assemble and reconfigure their IT systems to respond to changing business needs.

Composable business approaches allow organizations to leverage the latest technologies and quickly adapt to new business requirements.

Some of the benefits of composable business approaches include:

1. **Agility:** Composable business approaches allow organizations to respond quickly to changing market conditions, customer needs, and business requirements.
2. **Flexibility:** Organizations can quickly and easily reconfigure their IT systems to meet changing business needs, without incurring significant costs or downtime.
3. **Cost efficiency:** Composable business approaches can help organizations to minimize IT costs by avoiding costly hardware upgrades and reducing the need for specialized IT expertise.

Cloud migration refers to the process of moving an organization's IT systems and applications to the cloud. There are several complementary strategies that can be used to optimize cloud migration, including:

1. **Lift and shift:** This strategy involves moving existing applications and systems to the cloud with minimal modifications.
2. **Refactoring:** This strategy involves modifying applications to take

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advantage of cloud-native features and services.

3. **Replatforming**: This strategy involves moving applications to a different platform that is more compatible with the cloud.

Some of the advantages of cloud migration include:

1. **Scalability**: Cloud computing allows organizations to quickly provision and scale computing resources based on demand.
2. **Cost efficiency**: Cloud computing can help organizations to reduce IT costs by avoiding hardware investments and reducing maintenance costs.
3. **Flexibility**: Cloud computing allows organizations to quickly and easily reconfigure their IT systems to meet changing business needs.

Virtualization refers to the creation of a virtual version of a computing resource, such as a server, storage device, or network. Virtualization allows multiple virtual resources to run on a single physical resource, enabling greater resource utilization and flexibility.

Some of the benefits of virtualization include:

1. **Resource utilization**: Virtualization allows organizations to use physical resources more efficiently, by running multiple virtual resources on a single physical resource.
2. **Flexibility**: Virtualization allows organizations to quickly and easily reconfigure their IT systems to meet changing business needs.
3. **Cost efficiency**: Virtualization can help organizations to reduce IT costs by avoiding hardware investments and reducing maintenance costs.

Question-3: Explain the storage, server, and network virtualizations in brief. Write the various advantages of cloud virtualization. Describe automation and its necessity in cloud computing. Briefly explain the different cloud monitoring strategies in brief.

Ans: **Storage virtualization**: It is the process of abstracting the physical storage resources, such as hard drives or SSDs, into a logical pool that can be managed and allocated as needed.

Server virtualization: It is the process of abstracting the physical server hardware into one or more virtual servers, each running its own operating system and applications.

Network virtualization: It is the process of abstracting the physical network resources, such as routers and switches, into a logical network that can be

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managed and configured independently from the physical network.

Advantages of cloud virtualization:

1. Scalability: Cloud virtualization allows for easy and quick scaling up or down of resources as needed, without the need for physical hardware changes.
2. Flexibility: Virtualization allows for easy and efficient allocation and reallocation of resources across multiple applications or users.
3. Cost-effectiveness: By sharing physical resources across multiple virtual machines, cloud virtualization reduces the need for costly hardware purchases and maintenance.
4. Reliability: Virtualization can increase system uptime by allowing for rapid failover and disaster recovery in case of hardware failure.
5. Security: Virtualization can enhance security by isolating applications and users within their own virtual environments.

Automation refers to the use of software tools and scripts to automatically provision, configure, and manage cloud infrastructure resources. Automation is essential in cloud computing because of the sheer scale and complexity of modern cloud environments. Manual management of cloud resources is time-consuming and error-prone, and can result in configuration drift and security vulnerabilities. By automating routine tasks, cloud administrators can ensure that their infrastructure is consistent, reliable, and secure.

Cloud monitoring strategies:

1. Reactive monitoring: This involves monitoring cloud resources after a problem or outage has occurred, and then taking action to resolve the issue. This approach is not ideal because it can result in significant downtime and lost productivity.
2. Proactive monitoring: This involves setting up alerts and thresholds to detect and prevent problems before they occur. This approach can help to minimize downtime and improve system performance.
3. Predictive monitoring: This involves using machine learning algorithms and other advanced analytics tools to predict potential issues before they occur. This approach can help to prevent downtime and optimize system performance.

Question-4: Describe the advantages of the cloud monitoring system. Define the different characteristics related to various cloud services. Briefly explain cloud service management. Define service management automation.

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Ans: Advantages of cloud monitoring system:

1. Improved system performance: By monitoring cloud resources in real-time, administrators can identify and resolve performance bottlenecks and optimize resource utilization.
2. Increased availability: By detecting and responding to issues quickly, cloud monitoring can help to reduce downtime and improve system availability.
3. Enhanced security: Cloud monitoring can help to identify security threats and vulnerabilities, and provide insights into potential security breaches.
4. Cost optimization: By identifying idle or underutilized resources, cloud monitoring can help to reduce cloud costs and optimize resource usage.
5. Better user experience: Cloud monitoring can help to ensure that applications are performing as expected and delivering a high-quality user experience.

Characteristics of various cloud services:

1. Infrastructure as a Service (IaaS): Provides access to virtualized computing resources such as servers, storage, and networking. Customers can deploy and manage their own software and applications on these resources.
2. Platform as a Service (PaaS): Provides a platform for developing, deploying, and managing software applications without the need to manage the underlying infrastructure. Customers have access to pre-configured application platforms and services.
3. Software as a Service (SaaS): Provides access to pre-built software applications that are hosted and managed by the cloud provider. Customers can access the software through a web browser or API.

Cloud service management involves the planning, delivery, and support of cloud services to customers. It includes tasks such as service level management, capacity planning, incident management, and problem management. Cloud service management is important to ensure that cloud services are delivered efficiently, effectively, and in a cost-effective manner.

Service management automation refers to the use of software tools and workflows to automate routine service management tasks such as incident resolution, change management, and provisioning. Automation can help to reduce manual errors, increase efficiency, and improve service quality. It is an important component of cloud service management, especially in large and complex cloud environments.

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Question-5: Explain data sovereignty along with its primary considerations and challenges. Explain the various steps for ensuring data sovereignty. Discuss the advantages and disadvantages of onshore support operations.

Ans: Data sovereignty refers to the concept that data is subject to the laws and regulations of the country in which it is located. It means that the data must be managed and controlled in a way that complies with local laws and regulations, and that data owners have the right to determine how their data is collected, processed, stored, and transferred.

Primary considerations for data sovereignty include privacy laws, data protection laws, and intellectual property laws, as well as national security and government surveillance laws.

Companies must ensure that they comply with these laws and regulations in each country where their data is located. Failure to comply with data sovereignty laws can result in significant legal and financial penalties.

Challenges associated with data sovereignty include the complexity of managing data across multiple jurisdictions, the cost of compliance with local laws and regulations, and the risk of data breaches or unauthorized access by third parties.

Steps for ensuring data sovereignty include:

1. Understanding local laws and regulations: Companies must research and understand the local laws and regulations that apply to their data.
2. Creating data management policies: Companies must create policies and procedures for managing data in compliance with local laws and regulations.
3. Implementing data security measures: Companies must implement appropriate security measures to protect their data from unauthorized access, theft, or breaches.
4. Conducting regular audits: Companies must conduct regular audits of their data management policies and procedures to ensure compliance with local laws and regulations.

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Advantages of onshore support operations include:

1. Access to local expertise: Onshore support operations provide access to local expertise, which can be particularly important when dealing with complex or sensitive data.
2. Improved data security: Onshore support operations can provide increased data security by ensuring that data is stored and managed in compliance with local laws and regulations.
3. Improved data quality: Onshore support operations can improve data quality by providing local resources to validate and maintain data accuracy.

Disadvantages of onshore support operations include:

1. Higher costs: Onshore support operations can be more expensive than offshore operations due to higher labour costs.
2. Limited scalability: Onshore support operations may have limited scalability due to the availability of local resources.
3. Increased regulatory complexity: Onshore support operations may be subject to additional regulatory requirements, which can increase complexity and costs.

Question-6: Define a backup system and various strategies for creating a backup plan in cloud computing. Explain distinct data recovery procedures. Explain briefly about ITIL and its benefits.

Ans: A backup system is a process of copying and archiving data to protect against data loss due to system failure, data corruption, or accidental deletion. In cloud computing, backup systems are critical for data protection, disaster recovery, and business continuity.

Here are some strategies for creating a backup plan in cloud computing:

1. Determine the criticality of the data: Identify which data is critical and needs to be backed up frequently.
2. Choose a backup method: Select an appropriate backup method, such as full backup, incremental backup, or differential backup.
3. Select a backup location: Choose a secure and reliable location to store the backups, such as a cloud storage provider.
4. Set backup frequency: Determine how often backups should be taken based on the criticality of the data and the frequency of changes.
5. Test backups regularly: Regularly test backups to ensure that they can be restored successfully in case of data loss.

Data recovery procedures are the methods used to recover data in case of

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data loss due to system failure, hardware failure, software corruption, or human error. Here are some distinct data recovery procedures:

1. File restoration: If only a few files or folders are lost, they can be restored from the latest backup.
2. System recovery: In case of a system failure, the entire system can be restored from a full backup.
3. Disk imaging: Disk imaging is the process of creating a copy of the entire hard drive, including the operating system, applications, and data. The image can be used to restore the system in case of a catastrophic failure.
4. Cloud disaster recovery: In cloud computing, disaster recovery can be achieved by replicating data to multiple data centers and automatically switching to the secondary data center in case of a failure.

ITIL (Information Technology Infrastructure Library) is a framework for IT service management that provides a set of best practices for managing IT services. ITIL is widely used in organizations to improve the quality of IT service delivery, reduce costs, and increase customer satisfaction.

Benefits of using ITIL:

1. Improved service quality: ITIL provides a set of best practices for managing IT services that help to improve service quality and reduce downtime.
2. Cost reduction: ITIL helps to reduce costs by improving efficiency, eliminating waste, and optimizing resources.
3. Increased customer satisfaction: ITIL helps to align IT services with business needs, improving customer satisfaction.
4. Better communication: ITIL provides a common language and framework for IT service management, improving communication and collaboration between IT and other business units.
5. Continuous improvement: ITIL emphasizes continuous improvement, ensuring that IT services are continually optimized to meet changing business needs.

Question-7: Write a short note on Operational Transformation (OT). Explain App- Migration in brief. Describe the various challenges of App-migrations. Discuss the multiple scopes of cloud computing.

Ans: Operational Transformation (OT) is a technique used to maintain the consistency of collaborative editing systems. OT enables multiple users to collaborate on the same document in real-time while maintaining the

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consistency of the document. OT achieves this by transforming the operations performed by each user in a way that ensures consistency.

OT is widely used in collaborative editing systems, such as Google Docs and Microsoft Office

365. It enables multiple users to work on the same document simultaneously, without the risk of data loss or inconsistency.

App-Migration is the process of moving an application from one computing environment to another, such as from an on-premises data center to a cloud-based environment. App-Migration can be complex and challenging, requiring careful planning and execution to ensure that the application runs smoothly in the new environment.

Challenges of App-Migrations:

1. Compatibility issues between the source and target environments.
2. Data loss or corruption during the migration process.
3. Performance issues due to differences in hardware, network, or storage infrastructure.
4. Security risks due to differences in security policies or controls.
5. Lack of expertise or experience in managing the migration process.

The scope of growth for cloud computing is immense. More and more organizations need to prioritize the use of this technology. In fact, they need to restructure and invest in coding standards that can support seamless migration into the cloud. Also, cloud computing is strongly associated with concepts like the internet of things. When data gets stored in the cloud, it becomes easier for IoT to ensure performance, security, and functionality. The only limitation would be the speed of the network, which controls the pace at which data is gathered and processed. If the network is fast, everything else about the use of cloud computing will fall in place.

Question-8: Discuss the various future aspects of cloud computing in brief. Elaborate on customer expectations and their different types. Please write a short note on system redundancy and its importance. Define Business Continuity and discuss its various processes.

Ans: Future Aspects of Cloud Computing:

1. Hybrid Cloud: Hybrid cloud combines public and private clouds, allowing organizations to move workloads between them seamlessly. Hybrid clouds are expected to grow in popularity as they offer greater flexibility and control.

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2. Edge Computing: Edge computing refers to processing data at or near the source instead of sending it to a centralized data centre. Edge computing is expected to become more prevalent as it reduces latency and provides real-time data analysis.
3. Artificial Intelligence: Cloud providers are increasingly incorporating AI and machine learning capabilities into their services. This will allow customers to build and deploy AI-powered applications without having to invest in expensive hardware and software.
4. Serverless Computing: Serverless computing allows developers to write and run code without worrying about the underlying infrastructure. This eliminates the need for servers, making it easier to scale applications and reduce costs.

Customer Expectations:

1. Security: Customers expect their data to be secure and protected from unauthorized access or theft.
2. Reliability: Customers expect their applications and data to be available and accessible at all times.
3. Performance: Customers expect their applications to perform well and respond quickly to user requests.
4. Cost-effectiveness: Customers expect cloud services to be cost-effective and provide value for their money.

System redundancy refers to having duplicate systems or components in place to ensure that if one system fails, the backup system can take over immediately. Redundancy is important because it minimizes downtime and ensures that critical systems remain operational in the event of a failure.

Business continuity is the process of ensuring that critical business functions can continue in the event of a disruption, such as a natural disaster or cyber-attack. The main processes involved in business continuity include:

1. Business Impact Analysis: This involves identifying critical business functions and assessing the potential impact of a disruption on those functions.
2. Risk Assessment: This involves identifying potential threats and vulnerabilities that could disrupt critical business functions.
3. Business Continuity Plan: This is a detailed plan that outlines the steps to be taken in the event of a disruption to ensure that critical business functions can continue.
4. Testing and Training: This involves regularly testing the business continuity plan and training employees to ensure that they are prepared.

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to respond to a disruption.

Question-9: Explain disaster recovery and its working principles. Write the different advantages of disaster recovery in cloud computing. Write a short note on cloud deployment. Discuss the benefits of cloud deployment in brief.

Ans: Disaster recovery is the process of recovering data and systems after a disruption, such as a natural disaster, cyber-attack, or hardware failure. The goal of disaster recovery is to minimize downtime and ensure that critical business functions can continue.

Working Principles:

1. Backup: Data is backed up regularly to ensure that it can be recovered in the event of a disruption.
2. Recovery Point Objective (RPO): This is the point in time to which data can be recovered. For example, if the RPO is one hour, data can be recovered up to one hour before the disruption.
3. Recovery Time Objective (RTO): This is the amount of time it takes to recover data and systems after a disruption.
4. Failover: If a primary system fails, a backup system takes over immediately to ensure that critical business functions can continue.

Advantages of Disaster Recovery in Cloud Computing:

1. Cost-effective: Cloud disaster recovery is often more cost-effective than traditional disaster recovery solutions as it eliminates the need for expensive hardware and infrastructure.
2. Scalability: Cloud disaster recovery solutions can be scaled up or down as needed, making it easy to adjust to changing business needs.
3. Flexibility: Cloud disaster recovery solutions can be customized to meet the specific needs of each organization, making it easier to address unique challenges and requirements.

Cloud deployment refers to the process of deploying applications and services to the cloud. There are three main types of cloud deployment:

1. Public Cloud: Public cloud services are provided by third-party vendors and are accessible over the internet.
2. Private Cloud: Private cloud services are owned and operated by individual organizations and are accessible only to authorized users.
3. Hybrid Cloud: Hybrid cloud combines public and private cloud

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services, allowing organizations to leverage the benefits of both.

Benefits of Cloud Deployment:

1. Scalability: Cloud deployment allows organizations to quickly scale up or down as needed, making it easier to adjust to changing business needs.
2. Cost-effective: Cloud deployment eliminates the need for expensive hardware and infrastructure, making it more cost-effective than traditional deployment methods.
3. Flexibility: Cloud deployment can be customized to meet the specific needs of each organization, making it easier to address unique challenges and requirements.
4. Accessibility: Cloud deployment allows users to access applications and services from anywhere, making it easier to collaborate and work remotely.

Question-10: Discuss the distinct challenges and strategies of deploying different cloud applications. List down the releases of top cloud computing trends and the adequate justification. Write down the various success factors of cloud computing.

Ans: Challenges and Strategies of Deploying Different Cloud Applications:

1. Infrastructure-as-a-Service (IaaS): One of the biggest challenges of deploying IaaS is ensuring that the infrastructure is scalable and can handle the demands of the application. Strategies for deploying IaaS include automating infrastructure management and using containerization to increase scalability.
2. Platform-as-a-Service (PaaS): One of the biggest challenges of deploying PaaS is ensuring that the platform is secure and can support the development and deployment of custom applications. Strategies for deploying PaaS include using a vendor with a strong security track record and offering developer tools and support.
3. Software-as-a-Service (SaaS): One of the biggest challenges of deploying SaaS is ensuring that the software is scalable and can handle the demands of multiple users. Strategies for deploying SaaS include using a vendor with a strong track record for uptime and availability and ensuring that the software is customizable to meet the needs of individual users.

Top Cloud Computing Trends and Releases:

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1. Multi-cloud: The use of multiple cloud providers to meet different business needs. This trend has emerged as organizations look to take advantage of the unique features and benefits of different cloud providers.
2. Serverless computing: Serverless computing is the use of cloud-based services to manage the infrastructure required to run applications. This trend has emerged as organizations look to reduce the cost and complexity of managing infrastructure.
3. AI and machine learning: Cloud providers are increasingly incorporating AI and machine learning capabilities into their services. This trend has emerged as organizations look to build and deploy AI-powered applications without having to invest in expensive hardware and software.

Success Factors of Cloud Computing:

1. Security: Cloud providers must offer strong security features and adhere to industry best practices to ensure that customer data is protected.
2. Reliability: Cloud providers must offer reliable services with high availability to ensure that customers can access their applications and data at all times.
3. Cost-effectiveness: Cloud providers must offer cost-effective services that provide value for money to customers.
4. Performance: Cloud providers must offer high-performance services that can handle the demands of modern applications.
5. Scalability: Cloud providers must offer scalable services that can grow or shrink as needed to meet changing business needs.
6. Flexibility: Cloud providers must offer flexible services that can be customized to meet the specific needs of individual customers.

UNIT-3

Question-1: Write a short note on a private cloud. Discuss the advantages and disadvantages of the private cloud. Briefly discuss the services the Google, Microsoft, Amazon, and Salesforce cloud platforms provide. Define Run-as-Service in brief.

Ans: Private cloud is a cloud computing environment that is dedicated to a single organization. The private cloud infrastructure is usually hosted within the organization's data center or within a third-party provider's data center. Private clouds are designed to provide the benefits of cloud

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computing, such as scalability, flexibility, and cost savings, while maintaining the security and control of an organization's data.

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Advantages of Private Cloud:

1. Greater control over data and security
2. Customization of infrastructure to meet specific needs
3. Ability to maintain compliance with industry regulations and standards
4. Enhanced reliability and availability of resources
5. Increased efficiency and resource

utilizationDisadvantages of Private Cloud:

1. Higher upfront costs for hardware and software
2. Requires skilled IT staff to manage and maintain the infrastructure
3. Limited scalability compared to public cloud options
4. May be more difficult to integrate with other cloud services

Google Cloud Platform (GCP) offers services such as computing, storage, and application development tools. GCP includes services such as Compute Engine, Cloud Storage, and Kubernetes Engine.

Microsoft Azure offers services for computing, storage, and networking. Azure includes services such as Virtual Machines, Azure SQL Database, and Azure Active Directory.

Amazon Web Services (AWS) offers services for computing, storage, and database management. AWS includes services such as Elastic Compute Cloud, Simple Storage Service, and Amazon Relational Database Service.

Salesforce offers services for customer relationship management (CRM) and marketing automation. Salesforce includes services such as Sales Cloud, Marketing Cloud, and Service Cloud.

Run-as-a-service refers to the practice of running software applications or processes as a service, rather than as an individual user. This approach allows applications to run continuously and independently of any specific user session, providing enhanced stability and reliability. Run-as-a-service is commonly used for critical applications that require 24/7 availability, such as server software and database management systems.

Question-2: Briefly explain the dedicated private cloud hosting. Illustrate the different steps to planning the cloud Strategies. Define cloud standardization in brief. Discuss virtualization and its various types in personal cloud computing.

Ans: Dedicated private cloud hosting refers to a cloud computing environment that is entirely dedicated to a single organization. This type of hosting provides the organization with complete control over the infrastructure, allowing for

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customization and the ability to maintain compliance with industry regulations and standards. Dedicated private cloud hosting also provides enhanced security and reliability.

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Steps to Planning Cloud Strategies:

1. Identify business requirements and goals.
2. Assess existing IT infrastructure and identify gaps.
3. Evaluate cloud service providers and select the most suitable option.
4. Develop a migration plan for moving applications and data to the cloud.
5. Implement and test the new cloud environment.
6. Establish cloud governance policies and procedures.
7. Monitor and optimize cloud performance and costs.

Cloud standardization refers to the process of establishing common technical standards and specifications for cloud computing. This approach ensures interoperability between cloud services and enables organizations to switch between providers more easily. Cloud standardization also helps to improve security and reliability by establishing consistent practices and protocols.

Virtualization in Personal Cloud Computing:

Virtualization refers to the practice of creating a virtual version of an operating system, server, storage device, or network resource. In personal cloud computing, virtualization can be used to create multiple virtual machines on a single physical machine, allowing users to run different operating systems or applications simultaneously. There are several types of virtualizations, including:

1. Operating System Virtualization - This type of virtualization allows multiple operating systems to run on a single physical machine, with each operating system running in its own virtual environment.
2. Application Virtualization - This type of virtualization allows applications to run in a virtual environment, independent of the underlying operating system.
3. Network Virtualization - This type of virtualization enables multiple virtual networks to run on a single physical network infrastructure, allowing for more efficient use of network resources.

Question-3: Discuss automation and its different types in private cloud infrastructure. Write down the benefits of cloud automation. Explain the differences between cloud automation and cloud orchestration. Write the short notes on VMware vCloud.

Ans: Automation in private cloud infrastructure refers to the use of software tools to automatically perform tasks such as provisioning, scaling, monitoring, and management of cloud resources. There are several types of automation that can be used in private cloud infrastructure, including:

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1. Infrastructure Automation - This type of automation involves the use of tools to automatically provision and manage infrastructure resources such as servers, storage, and networking.

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2. Configuration Automation - This type of automation involves the use of tools to automate the configuration and management of software applications and services.
3. Workflow Automation - This type of automation involves the use of tools to automate the workflow of tasks and processes within the cloud environment.

Benefits of Cloud Automation:

1. Improved efficiency and productivity
2. Reduced operational costs
3. Enhanced reliability and consistency
4. Increased scalability and flexibility
5. Improved security and compliance

Differences between Cloud Automation and Cloud Orchestration:

Cloud automation refers to the use of software tools to automatically perform tasks, while cloud orchestration refers to the process of coordinating and managing multiple automated tasks to achieve a specific goal. Cloud orchestration involves the use of a centralized management platform that provides visibility and control over the cloud environment, enabling IT teams to automate complex workflows and manage cloud resources more efficiently.

VMware vCloud is a cloud computing platform that enables organizations to build, deploy, and manage private clouds. The platform provides a range of features and tools for infrastructure automation, configuration management, and workflow orchestration.

VMware vCloud is designed to be highly scalable and flexible, allowing organizations to quickly adapt to changing business needs and requirements. Additionally, vCloud includes a range of security and compliance features, such as role-based access controls and automated compliance checks. Overall, VMware vCloud provides organizations with a powerful and flexible platform for building and managing private clouds.

Question-4: Discuss IBM SmartCloud entry and deployment. Illustrate the Features, benefits, and roles of IBM SmartCloud Entry. Illustrate the various business challenges of the private cloud.

Ans: IBM SmartCloud Entry is a cloud computing platform that enables organizations to deploy private clouds quickly and easily. The platform provides a range of features and tools for infrastructure automation, virtualization, and management, making it an ideal solution for organizations looking to reduce costs, improve efficiency, and enhance flexibility.

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Features and Benefits of IBM SmartCloud Entry:

1. Infrastructure Automation - SmartCloud Entry provides tools for automated provisioning and management of infrastructure resources, such as servers, storage, and networking.

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2. Virtualization - SmartCloud Entry includes a range of virtualization features, including support for multiple hypervisors and the ability to create virtual machines on demand.
3. Self-Service Portal - SmartCloud Entry includes a self-service portal that enables end-users to request and manage cloud resources on their own, reducing the workload on IT teams.
4. Scalability - SmartCloud Entry is designed to be highly scalable, enabling organizations to quickly scale up or down as needed to meet changing business needs.
5. Security - SmartCloud Entry includes a range of security features, such as role-based access controls and automated compliance checks, to ensure the security and integrity of cloud resources.

Roles of IBM SmartCloud Entry:

1. Infrastructure Provisioning - SmartCloud Entry enables IT teams to provision and manage infrastructure resources quickly and easily, reducing the time and effort required for manual provisioning.
2. Self-Service Provisioning - SmartCloud Entry enables end-users to request and manage cloud resources on their own, reducing the workload on IT teams.
3. Virtualization - SmartCloud Entry includes a range of virtualization features, enabling IT teams to create and manage virtual machines and virtual networks more efficiently.
4. Cloud Management - SmartCloud Entry includes a range of management tools, such as performance monitoring and capacity planning, enabling IT teams to manage cloud resources more effectively.

Business Challenges of the Private Cloud:

1. Security and Compliance - Private clouds are subject to the same security and compliance requirements as traditional IT environments, requiring organizations to implement robust security measures and compliance controls.
2. Cost - Private clouds can be expensive to deploy and maintain, requiring significant upfront investment and ongoing maintenance and support costs.
3. Complexity - Private clouds can be complex to deploy and manage, requiring specialized skills and expertise that may be difficult to find.
4. Integration - Private clouds need to integrate with existing IT systems and applications, requiring careful planning and coordination to ensure seamless integration.
5. Scalability - Private clouds need to be scalable to meet changing

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business needs and requirements, requiring careful planning and capacity management to ensure adequate resources are available when needed.

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UNIT-4

Question-1: Write a short note on Public Cloud. Discuss the workings of a public cloud. Explain the various advantages and disadvantages of the public cloud. State the differences between the public and private clouds.

Ans: Public cloud is a cloud computing model in which resources such as servers, storage, and applications are provided by a third-party provider over the internet. Public cloud providers offer on-demand access to resources, which can be easily scaled up or down to meet changing business needs. Popular public cloud providers include Amazon Web Services(AWS), Microsoft Azure, and Google Cloud Platform.

Working of a Public Cloud:

In a public cloud model, the cloud provider is responsible for managing and maintaining the infrastructure, including hardware, software, and networking resources. Users access the cloud resources through a web-based interface or API, which enables them to provision and manage their own resources as needed. Public cloud resources are shared among multiple users and customers, with each user accessing their own separate resources.

Advantages of Public Cloud:

1. Scalability - Public clouds offer scalable resources that can be easily provisioned and scaled up or down as needed to meet changing business needs.
2. Cost-effective - Public clouds offer a cost-effective way to access enterprise-grade infrastructure resources without the need for upfront investment in hardware and software.
3. Accessibility - Public clouds are accessible from anywhere with an internet connection, enabling users to access resources from remote locations or while on the go.
4. Reduced IT overhead - Public cloud providers handle infrastructure maintenance, reducing the IT overhead required to manage on-premises infrastructure.

Disadvantages of Public Cloud:

1. Security and privacy concerns - Public clouds are shared among multiple users, which can raise security and privacy concerns.
2. Limited control - Public clouds offer limited control over infrastructure and applications, as users rely on the cloud provider to manage and maintain these resources.

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3. Performance variability - Public cloud resources are shared among multiple users, which can lead to variability in performance.

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Differences between Public and Private Clouds:

Public clouds are shared among multiple users and customers, while private clouds are dedicated to a single organization. Private clouds offer greater control over infrastructure and applications, while public clouds offer scalability and cost-effectiveness. Private clouds are typically used by organizations with strict security and compliance requirements, while public clouds are used by organizations of all sizes and types.

Question-2: Explain the critical trends for moving into the public cloud. Discuss the adoption strategies of the public cloud. List down the different risks of adopting the public cloud in brief. Discuss choosing the cloud service provider.

Ans: Moving into the public cloud has become a critical trend for businesses due to several reasons, including cost savings, scalability, agility, and security. Some of the critical trends for moving into the public cloud are:

1. **Hybrid cloud:** Many businesses are opting for a hybrid cloud model that combines public cloud services with their private cloud or on-premises infrastructure. This approach allows businesses to take advantage of the benefits of both public and private clouds while addressing concerns around data security and compliance.
2. **Multi-cloud:** Multi-cloud refers to the use of multiple cloud providers for different services or applications. This approach allows businesses to avoid vendor lock-in and take advantage of best-of-breed services from multiple providers.
3. **Serverless computing:** Serverless computing allows businesses to run code without managing infrastructure. This approach eliminates the need for servers and reduces operational costs.
4. **Containerization:** Containerization is the process of packaging an application and its dependencies into a container that can run consistently across different environments. This approach allows businesses to deploy applications faster and more reliably.

The adoption strategies of the public cloud vary depending on the business's goals and requirements. Some common adoption strategies include:

1. **Lift and shift:** This strategy involves moving existing applications and workloads to the cloud without making any significant changes. This approach is suitable for businesses that want to migrate quickly and minimize disruption.

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2. Cloud-native: This strategy involves building new applications specifically for the cloud using modern development practices like microservices and DevOps. This approach allows businesses to take full advantage of cloud services and achieve greater agility.
3. Hybrid cloud: This strategy involves using a combination of public and private clouds to meet specific business requirements. This approach is suitable for businesses that have regulatory or compliance requirements or need to manage sensitive data.

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Adopting the public cloud comes with several risks that businesses need to be aware of. Some of the common risks include:

1. Security and compliance: Public cloud providers have robust security measures, but businesses are responsible for ensuring their data is secure and compliant with regulations.
2. Data loss: Public cloud providers have redundant systems to prevent data loss, but businesses need to ensure they have adequate backup and recovery procedures in place.
3. Vendor lock-in: Businesses need to be aware of the risk of becoming too reliant on a single cloud provider and ensure they have a contingency plan in case they need to switch providers.
4. Cost: Public cloud services can be expensive if not managed effectively. Businesses need to monitor their usage and optimize their infrastructure to avoid unnecessary costs.

Choosing the right cloud service provider is critical to the success of any public cloud adoption strategy. When choosing a provider, businesses should consider factors like security, reliability, performance, cost, and vendor lock-in. Some of the leading public cloud providers include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform. Businesses should evaluate each provider's strengths and weaknesses and choose the one that best meets their needs.

Question-3: Illustrate the migration process in a public cloud computing environment. Write a short note on the service level agreement (SLA). Discuss the importance and requirements of SLA in brief. Define SLA credits in brief.

Ans: The migration process in public cloud computing involves the following steps:

1. Assessment: Determine the applications and workloads to be migrated and analyze their dependencies.
2. Planning: Develop a migration plan that includes timelines, resources, and dependencies.
3. Configuration: Configure the cloud environment, including the network, storage, and security settings.
4. Data Migration: Migrate data from the on-premises environment to the cloud.
5. Application Migration: Migrate applications and workloads to the cloud environment.
6. Testing: Test the migrated applications and workloads to ensure they are working correctly.

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7. Go-live: Make the migrated applications and workloads available to users.

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Service Level Agreement (SLA) is a contract between a cloud service provider and a customer that defines the level of service the customer can expect from the provider. The SLA specifies the performance metrics, uptime guarantees, support options, and penalties for non-compliance.

Importance and Requirements of SLA:

SLAs are essential for establishing a clear understanding of the responsibilities and expectations of both the provider and the customer. They ensure that customers receive the agreed-upon level of service, and providers are held accountable for meeting their commitments.

SLA Credits are compensation offered to customers when the cloud service provider fails to meet the performance metrics specified in the SLA. These credits can take the form of service discounts, service credits, or refunds. SLA credits are intended to compensate customers for the downtime or reduced service level they experienced due to the provider's failure to meet the SLA.

Question-4: Describe Compensation within the SLA precisely. Write down the various Credit Requests and Payment Procedures in a public cloud environment. Discuss the different backup and disaster recovery policies of the public cloud. Define exclusion filter for cloud-based protection.

Ans: Compensation within the SLA refers to the terms that dictate how a cloud service provider will provide compensation to their customers if they fail to meet the agreed-upon service level targets. The compensation can take various forms, such as service credits, refunds, or discounts.

Credit Requests and Payment Procedures in Public Cloud Environment:

In a public cloud environment, credit requests and payment procedures for SLA violations may vary depending on the provider. However, some common steps include:

1. The customer should document the SLA violation and submit a credit request to the provider within a specific timeframe.
2. The provider will investigate the request and determine if it is valid.
3. If the provider finds the request valid, they will issue a credit to the customer's account based on the provider's SLA.

Backup and disaster recovery policies of public cloud providers are critical to ensuring the availability and resilience of customers' data and applications. Some common backup and disaster recovery policies in public cloud environments include:

1. Data Replication: Providers replicate customer data across multiple

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geographic regions to ensure high availability and disaster recovery capabilities.

2. Automated Backups: Providers offer automated backup and recovery options, which enable customers to back up their data on a scheduled basis.

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3. Disaster Recovery as a Service (DRaaS): Providers offer DRaaS solutions that enable customers to quickly recover their applications and data in the event of a disaster.

Exclusion Filter for Cloud-based Protection:

An exclusion filter for cloud-based protection is a tool that allows customers to specify which files or directories should be excluded from being backed up or protected by cloud-based security solutions. This filter enables customers to exclude unnecessary files or directories and reduce backup and storage costs. However, it is essential to carefully review the exclusion filter to ensure critical data is not inadvertently excluded from backup or protection.

Question-5: Precisely list the various security challenges of the public cloud. Briefly explain about threat migration. Write a short note on identity and access management. Illustrate the cloud maintenance and required various operations.

Ans: The following are some of the significant security challenges of public cloud environments:

1. **Data Protection:** Ensuring the protection of sensitive data in the cloud is a significant challenge, as it requires implementing robust security controls and encryption methods.
2. **Network Security:** Public clouds are prone to network attacks such as DDoS, man-in-the-middle, and spoofing attacks. Providers must implement robust network security controls to prevent such attacks.
3. **Compliance and Regulatory Requirements:** Public cloud providers must comply with various industry-specific regulations and standards such as PCI DSS, HIPAA, and GDPR. Ensuring compliance and meeting regulatory requirements can be challenging for providers and customers.
4. **Insider Threats:** Insider threats such as data theft, sabotage, and unauthorized access can cause significant damage to cloud environments.

Threat migration refers to the phenomenon of cybercriminals shifting their focus from traditional IT infrastructures to cloud environments. As more businesses migrate to the cloud, cybercriminals are increasingly targeting cloud services to exploit vulnerabilities and gain access to sensitive data.

Identity and Access Management (IAM):

IAM refers to the process of managing user identities and controlling access to resources in a cloud environment. IAM solutions enable organizations to establish access controls, manage user privileges, and authenticate user identities to ensure only authorized users can access sensitive data and

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resources.

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Cloud Maintenance and Required Operations:

Cloud maintenance involves various operational activities required to ensure the performance, availability, and security of cloud environments.

Some common cloud maintenance and operations activities include:

1. Patch Management: Ensuring all software and applications in the cloud environment are updated with the latest security patches and updates.
2. Backup and Recovery: Ensuring regular backups are taken and establishing disaster recovery plans to ensure the availability of data in the event of an outage.
3. Monitoring and Alerting: Monitoring the cloud environment for performance issues, security threats, and potential service disruptions and alerting the appropriate teams in real-time.
4. Resource Optimization: Monitoring resource utilization and optimizing resource allocation to ensure efficient use of resources and cost optimization.

Question-6: Discuss the various advantages of cloud maintenance. Define data locality and data center in brief. Illustrate the importance and workings of the data center. Write a short note on the collocation data centers.

Ans: Advantages of Cloud Maintenance:

1. Improved Performance: Cloud maintenance helps to ensure optimal performance by regularly monitoring and fine-tuning the cloud environment.
2. Increased Availability: Regular maintenance activities such as backups, disaster recovery planning, and security updates help to ensure high availability of cloud services and resources.
3. Enhanced Security: Regular maintenance activities help to identify and remediate security vulnerabilities, reducing the risk of data breaches and other security incidents.
4. Cost Optimization: Cloud maintenance helps to optimize resource utilization, reducing unnecessary spending on resources and improving cost efficiency.

Data locality refers to the practice of storing data in a location that is physically close to the users or applications that require it.

Data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems. Data centers are designed to provide secure, scalable, and high-performance computing

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infrastructure.

Importance and Workings of Data Center:

Data centers are essential to modern IT infrastructure and are critical to the operation of cloud computing services. They are designed to provide a secure and stable environment for computing equipment, including servers, storage devices, and networking equipment. Data centers are typically staffed with IT professionals who manage and maintain the equipment, monitor the performance of the systems, and respond to incidents and issues as they arise.

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Colocation data center is a facility that provides space, power, and cooling infrastructure for customers to house their computing equipment. In a colocation data center, customers rent space and infrastructure from the provider, but they are responsible for managing and maintaining their equipment. Colocation data centers offer several benefits, including access to robust infrastructure and shared resources, lower capital expenditures, and increased flexibility and scalability.

Question-7: Write a short note on Jurisdiction and cloud computing. Define Cloudonomics and cloud pricing in brief. Discuss the various cloud pricing models briefly. Explain briefly about Total Cost Ownership (TCO).

Ans: Jurisdiction refers to the legal authority and control over a particular geographic area. In cloud computing, jurisdiction is an important consideration because the location of data and services can have significant legal and regulatory implications. Cloud providers must comply with the laws and regulations of the jurisdictions in which they operate, and customers must be aware of the legal and regulatory requirements that apply to their data and services.

Cloudonomics is the study of the economics of cloud computing, including the costs and benefits of using cloud services.

Cloud pricing refers to the process of determining the cost of using cloud services. Cloud pricing models are typically based on resource usage, and providers offer several pricing models to meet different customer needs.

Cloud Pricing Models:

1. Pay-As-You-Go: In this model, customers pay only for the resources they use, with no upfront costs or long-term commitments.
2. Reserved Instances: In this model, customers commit to using a particular amount of resources over a specified period, typically 1-3 years, in exchange for a lower hourly rate.
3. Spot Instances: In this model, customers bid on unused cloud resources, and the provider allocates resources based on the highest bid.

Total Cost of Ownership (TCO):

TCO refers to the total cost of owning and operating a technology solution over its lifetime, including both direct and indirect costs. In cloud computing, TCO includes the costs of cloud services, as well as other costs such as migration,

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training, and ongoing maintenance and support. Evaluating TCO is an essential step in determining the economic viability of using cloud services compared to on-premises solutions.

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Question-8: Define Measured Services in the public cloud. Discuss the various measurable benefits of any public cloud. Illustrate cloud interoperability and its importance in brief. Write a short note on the unified cloud interface.

Ans: Measured services in the public cloud refer to the ability to monitor and measure the usage of cloud resources and services. Cloud providers typically offer tools and services that allow customers to track their usage and costs of cloud resources, enabling them to optimize their usage and control their costs.

Measurable Benefits of Public Cloud:

1. Scalability: Public cloud services offer the ability to scale resources up or down as needed, enabling customers to respond quickly to changing business demands.
2. Cost Efficiency: Public cloud services can be more cost-effective than on-premises solutions, as they offer pay-as-you-go pricing and eliminate the need for upfront capital expenditures.
3. Agility: Public cloud services enable rapid deployment of new applications and services, reducing time-to-market and increasing business agility.

Cloud Interoperability and its Importance:

Cloud interoperability refers to the ability of different cloud systems to work together seamlessly, enabling data and services to be shared across multiple clouds. Interoperability is essential to the adoption of cloud computing, as it allows customers to choose the best cloud services for their needs and to avoid vendor lock-in.

Unified cloud interface is a common interface that allows customers to access and manage multiple cloud services from a single portal. A unified cloud interface simplifies cloud management by providing a consistent and intuitive user experience, regardless of the underlying cloud infrastructure. A unified cloud interface also enables customers to easily compare and manage costs across multiple clouds, improving cost efficiency and optimization.

Question-9: Write a short note on Open Cloud Computing Interface (OCCI). Discuss the various dimensions of interoperability in brief. Define lock-in public cloud and classify different lock-in conditions. Define vendor lock-in.

Ans: Open Cloud Computing Interface (OCCI) is an open standard for cloud computing interfaces. OCCI provides a standard interface for accessing and managing cloud resources, enabling interoperability between different cloud systems. OCCI is designed to be extensible, enabling new features and services to be added to the interface as needed.

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Dimensions of Interoperability:

1. Technical Interoperability: This refers to the ability of different cloud systems to communicate with each other using common protocols and standards.
2. Semantic Interoperability: This refers to the ability of different cloud systems to understand and interpret the data and metadata exchanged between them.
3. Organizational Interoperability: This refers to the ability of different organizations to work together and share resources effectively, including issues such as governance, trust, and legal compliance.

Lock-in in Public Cloud:

Lock-in in public cloud refers to the situation where a customer becomes dependent on a particular cloud provider and is unable to switch to another provider without significant cost and effort. There are different types of lock-in conditions, such as contractual lock-in, technological lock-in, and data lock-in.

Vendor Lock-in:

Vendor lock-in refers to the situation where a customer becomes dependent on a particular vendor and is unable to switch to another vendor without significant cost and effort. In cloud computing, vendor lock-in is a significant concern, as customers must rely on the cloud provider for critical services and data. To avoid vendor lock-in, customers should choose open standards and open source technologies and avoid proprietary solutions.

Question-10: Illustrate the process to avoid vendor lock-in. Briefly discuss the Cloud Exit Termination Strategies. Write a short note on the proven track records of public cloud. Briefly discuss about the various public cloud service providers.

Ans: Process to Avoid Vendor Lock-in:

- Choose Open Standards: Select cloud providers that adhere to open standards and protocols. This ensures that your data and applications can be easily migrated to another cloud provider in case of vendor lock-in.
- Use Interoperable Technologies: Use cloud services and tools that are interoperable with other cloud systems. This ensures that you can migrate to other cloud systems without significant cost and effort.
- Plan for Migration: Plan for cloud migration from the beginning of the project. This ensures that your applications and data can be easily migrated to another cloud provider, reducing the risk of vendor lock-in.

Cloud Deployment Model Assignment 1

Cloud exit termination strategies are strategies that help organizations to safely and efficiently exit from a cloud provider. Some of the cloud exit termination strategies are:

1. Backup and Recovery: Maintain regular backups of critical data and applications to ensure that they can be quickly restored in case of vendor lock-in.

Cloud Deployment Model Assignment 1

2. Multi-cloud Strategy: Use multiple cloud providers to reduce the risk of vendor lock-in.
3. Negotiate Exit Clauses: Negotiate exit clauses in the service level agreement (SLA) to ensure that you can easily exit from the cloud provider.

Proven Track Records of Public Cloud:

Public cloud services have a proven track record of reliability, scalability, and cost efficiency. Public cloud providers invest heavily in data centers, network infrastructure, and security, ensuring that their services are highly available and secure. Public cloud providers also offer a wide range of services and tools that enable organizations to deploy, manage, and scale their applications and services quickly and efficiently.

Some of the leading public cloud service providers are:

- Amazon Web Services (AWS)
- Microsoft Azure
- Google Cloud Platform (GCP)
- IBM Cloud
- Oracle Cloud
- Alibaba Cloud

Each of these providers offers a range of services and tools, enabling organizations to choose the best cloud provider for their needs.