Unit 4 Various aspects related to Cloud services

4.1 Service oriented architecture

4.2 Diversified services

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4.4 Role of data center in cloud services

4.5 Legal issues in cloud computing service provision

4.1 Service oriented architecture

Service Oriented Architecture (SOA)

Advantages:

- Reuse of the component.
- Scalable
- Resilient

Disadvantages:

- Complex design and implementation.
- More network traffic..

4.1 Service oriented architecture

- Service-Oriented Architecture (SOA) is a stage in the evolution of application development.
- It defines a way to make software components reusable using the interfaces.
- SOA is an architectural approach in which applications make use of services available in the network.
- In this architecture, services are provided to form applications, through a network call over the internet.
- Each service in SOA is a complete business function in itself.
- The services are published in such a way that it makes it easy for the developers to assemble their apps using those services.

4.1 Service oriented architecture

- SOA allows users to combine a large number of facilities from existing services to form applications.
- SOA-based computing packages functionalities into a set of interoperable services, which can be integrated into different software systems belonging to separate business domains.

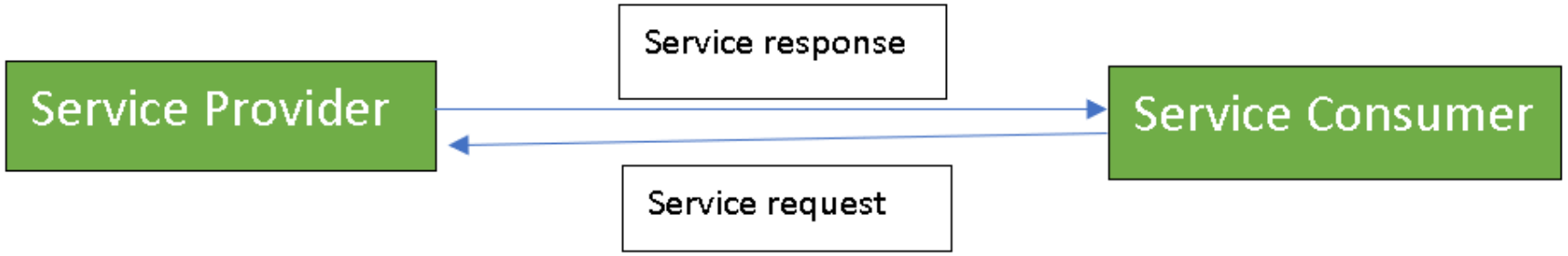
The different characteristics of SOA are as follows :

- 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.

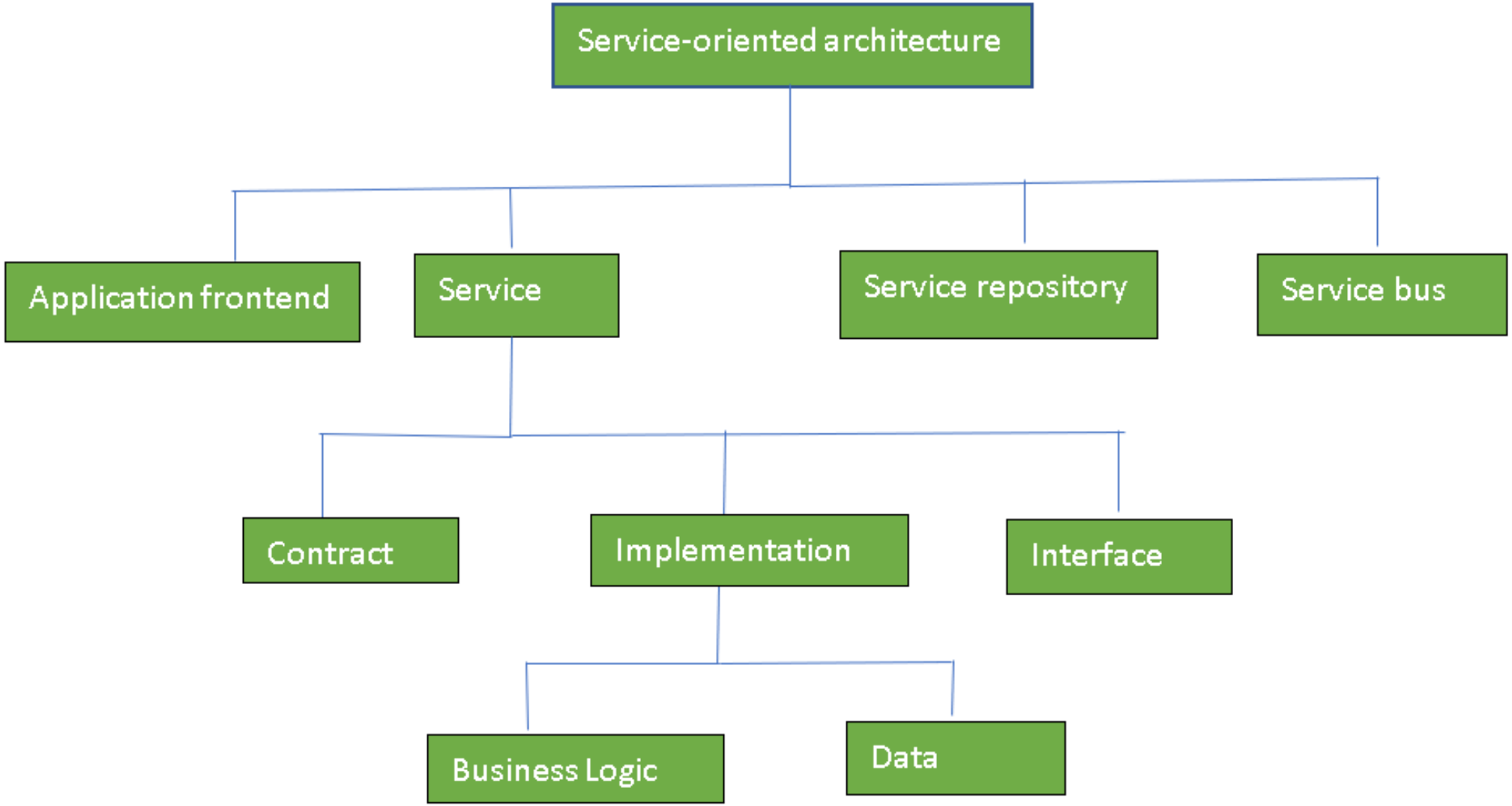
There are two major roles within Service-oriented Architecture:

1.Service provider: The service provider is the maintainer of the service and the organization that makes available one or more services for others to use. To advertise services, the provider can publish them in a registry, together with a service contract that specifies the nature of the service, how to use it, the requirements for the service, and the fees charged.

2.Service consumer: The service consumer can locate the service metadata in the registry and develop the required client components to bind and use the service.



Components of SOA:



Guiding Principles of SOA:

1. **Standardized service contract:** Specified through one or more service description documents.
2. **Loose coupling:** Services are designed as self-contained components, maintain relationships that minimize dependencies on other services.
3. **Abstraction:** A service is completely defined by service contracts and description documents. They hide their logic, which is encapsulated within their implementation.
4. **Reusability:** Designed as components, services can be reused more effectively, thus reducing development time and the associated costs.

Guiding Principles of SOA:

5. **Autonomy:** Services have control over the logic they encapsulate and, from a service consumer point of view, there is no need to know about their implementation.

6. **Discoverability:** Services are defined by description documents that constitute supplemental metadata through which they can be effectively discovered. Service discovery provides an effective means for utilizing third-party resources.

7. **Composability:** Using services as building blocks, sophisticated and complex operations can be implemented. Service orchestration and choreography provide a solid support for composing services and achieving business goals.

Advantages of SOA:

- **Service reusability:** In SOA, applications are made from existing services. Thus, services can be reused to make many applications.
- **Easy maintenance:** As services are independent of each other they can be updated and modified easily without affecting other services.
- **Platform independent:** SOA allows making a complex application by combining services picked from different sources, independent of the platform.
- **Availability:** SOA facilities are easily available to anyone on request.

Advantages of SOA:

- **Reliability:** SOA applications are more reliable because it is easy to debug small services rather than huge codes
- **Scalability:** Services can run on different servers within an environment, this increases scalability

Disadvantages of SOA:

- **High overhead:** A validation of input parameters of services is done whenever services interact this decreases performance as it increases load and response time.
- **High investment:** A huge initial investment is required for SOA.
- **Complex service management:** When services interact they exchange messages to tasks. the number of messages may go in millions. It becomes a cumbersome task to handle a large number of messages.

Practical applications of SOA: SOA is used in many ways around us whether it is mentioned or not.

1.SOA infrastructure is used by many armies and air forces to deploy situational awareness systems.

2.SOA is used to improve healthcare delivery.

3.Nowadays many apps are games and they use inbuilt functions to run. For example, an app might need GPS so it uses the inbuilt GPS functions of the device. This is SOA in mobile solutions.

4.SOA helps maintain museums a virtualized storage pool for their information and content.

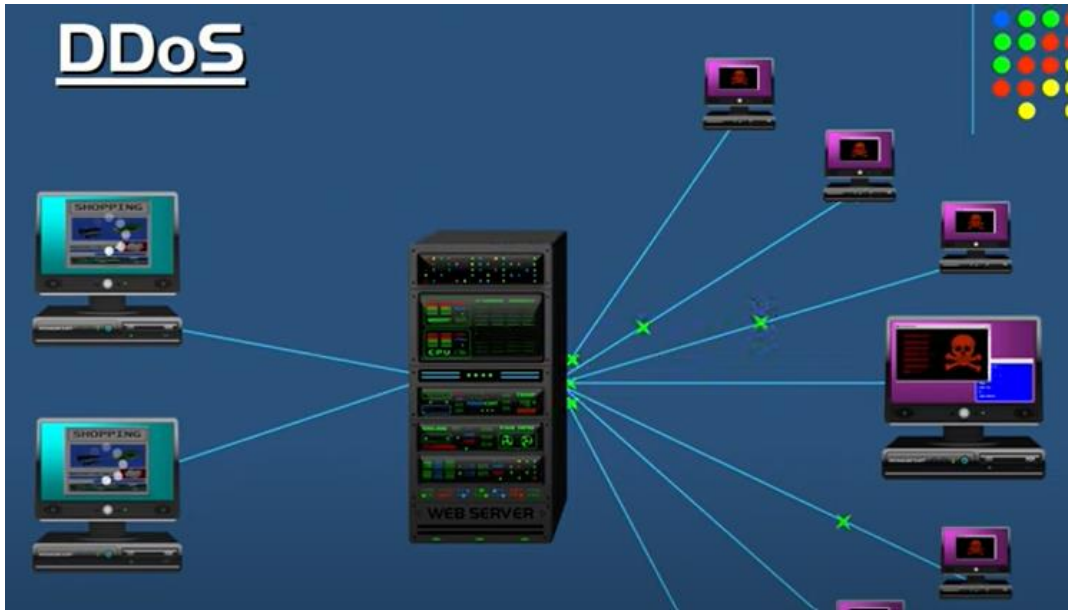
4.2 Diversified services

Cloud computing offers a range of diversified services tailored to meet various user needs. These services are generally categorized into:

1. **Infrastructure as a Service (IaaS)**: Provides virtualized computing resources. Ex. Amazon Web Services (AWS) EC2 for virtual servers.
2. **Platform as a Service (PaaS)**: Offers a platform for developing, testing, and deploying applications. Ex. Google App Engine for app development.
3. **Software as a Service (SaaS)**: Delivers software applications over the internet. Ex. Microsoft 365 for productivity tools.

4.3 Performance issues in cloud computing services

- **Security** – The impact of security on cloud performance may seem lightly strange, but the impact of security on network infrastructure has been proven.
- For ex- DDoS attacks have wide impact on network performance and if happen, it will greatly reduce network performance and also be effective on response time too.



Distributed Denial of Service

4.3 Performance issues in cloud computing services

- **Service Level Agreements** – The better, more optimal and more timely the agreed requests, the higher performance will be.
- **Recovery** - Cloud performance may be affected due to the time required for the data retrieval and amount of data which are recoverable.
- **Storage Capacity** – Physical memory can also be effective on the performance.
- **Buffer Capacity** - If the buffer capacity is low many requests will be rejected and therefore performance will be low.
- **Disk capacity** – can also have positive or negative impact on performance in cloud.

4.3 Performance issues in cloud computing services

- **Network Bandwidth** – If the bandwidth is too low to provide the service to clients, performance will be low and vice-versa.
- **Fault Tolerance** – If the data center is in deficient and is able to provide minimum services, this can increase the performance.
- **Availability** – With easy access to cloud services and the services are always available, performance will increase.
- **Number of Users** –Increase in the number of users will reduce the performance of services.
- **Location** – If the data center is too distant from the user's location this may reduce the performance.

4.3 Performance issues in cloud computing services

- **Workload** – In a cloud environment, the larger and less predictable workload also leads to greater variability in service delivery.
- **Latency** – Latency greatly influence how usable and enjoyable devices and communications are.

4.4 Role of data centre in cloud services

What is a Data center?

- Data centers are often referred to as a singular thing, but in actuality they are composed of a number of technical elements.
- These can be broken down into three categories:
- **Compute:** The memory and processing power to run the applications, generally provided by high-end servers.
- **Storage:** Important enterprise data is generally housed in a data center, on media ranging from tape to solid-state drives, with multiple backups.
- **Networking:** Interconnections between data center components and to the outside world, including routers, switches, application- delivery controllers, and more.

Role of Data center in cloud:

- Data Centre is a secured space which consists of infrastructures like Network Computers and Data Storage.
- In a Data Centre components like Servers, Storage Systems, Switches, etc. make it a large IT network.
- It is just like a larger version of servers and infrastructure you will find in your office.
- The working of a Data Centre is to store and process data, It can be in many forms. In a company, it can store its files or entire IT network into it.
- We normally don’t need to own a Data Centre, there are Cloud-based facilities in Data Centres by which we can access them anywhere remotely.

Role of Data center in cloud:

- Cloud-based facilities include Cloud Storage, Software as a Service (SAAS), Web Hosting, Infrastructure as a Service (IAAS).
- By using Data Centres, many big businesses have shifted their IT networks to the Cloud.
- Rather than storing data or information in one workplace, now they can store it on Cloud which is accessible from anywhere in the world with full security.
- One more advantage of remote Data Centres is that it reduces the burden of IT hardware and equipment on the company.
- Cloud computing adoption is one of the best ways to maximize the
- benefits of a data center.
- This, along with its financial benefits, is why many organizations are incorporating cloud computing in the management of their data centers.

Cloud Computing and Data Center Efficiency:

- Cloud computing makes it easier to simplify and streamline operations.
- Mergers can fragment IT systems, causing inefficiency.
- This makes it difficult for a data center to function optimally.
- Virtual computing integrates operations at the data center, thus improving efficiency and cost-effectiveness.
- Cloud computing does not require a large number of servers and other hardware.
- Incorporating it in a data center setup takes a load off the data center.

Cloud Computing and Data Center Efficiency:

- Further, IT agility will be improved since employees can have access to company data and applications from any location, making a company more responsive to the needs of its clients.
- When integrating virtual computing systems into a data center’s operations, it is advisable to ensure that cloud-based solutions are managed by a reputable service provider.
- Active monitoring of both systems is equally important.

4.5 Legal issues in cloud computing service provision

- Legal issues in cloud computing arise due to the complex nature of data storage, sharing, and management over distributed networks.
- As businesses increasingly adopt cloud computing, ensuring compliance with legal and regulatory frameworks is crucial.

1. Data Privacy and Protection

Data privacy laws regulate how organizations collect, store, and process personal data. Cloud providers must comply with these regulations to ensure the protection of sensitive information.

- **Challenges**:
  - Determining who is responsible for compliance (cloud provider or client).
  - Ensuring that personal data isn't improperly accessed or exposed.

2. Data Ownership

Data ownership refers to the rights of individuals or businesses over their data stored in the cloud. Disputes can arise over who controls, uses, or profits from the data.

- **Concerns**:
  - Clarifying ownership in contracts.
  - Ensuring data is not misused by cloud providers.
- **Example**: A business storing customer data in the cloud should include explicit terms in the service agreement to retain ownership and restrict the provider's usage.

3. Jurisdiction and Data Residency

Jurisdictional issues occur when data crosses international borders, as different countries have varying laws regarding data storage and privacy.

- **Challenges**:
  - Determining which country's laws apply.
  - Data sovereignty laws requiring data to be stored within specific regions.

4. Intellectual Property (IP) Rights

Cloud platforms often host proprietary content, including software, designs, or research data. Protecting intellectual property stored in the cloud is essential.

- **Concerns**:
  - Unauthorized access or replication of proprietary data.
  - Ensuring providers respect IP rights.
- **Example**: A startup using a cloud platform to host its patented algorithms must ensure that the cloud provider cannot access or replicate the algorithms without permission.

5. Service-Level Agreements (SLAs)

SLAs are legal documents that define the terms of service between the cloud provider and the customer, including performance guarantees, data security measures, and dispute resolution mechanisms.

- **Key Clauses**:
  - **Uptime Guarantees**: Ensures the cloud service is available for a specified percentage of time.
  - **Data Security**: Defines measures for encryption, backups, and breach notifications.
  - **Termination Policies**: Specifies how data is handled if the contract ends.
- **Example**: A business relying on a SaaS provider should ensure the SLA includes penalties for extended downtime or data loss.

6. Contractual Disputes

Contracts between cloud providers and clients can lead to legal disputes over:

- Performance failures.
- Misrepresentation of service capabilities.
- Violations of data protection clauses.
- **Example**: A cloud provider failing to deliver promised uptime or not encrypting data as specified in the SLA can face legal action.

Mitigation Strategies

1. **Careful SLA Review**: Ensure contracts include clear terms about responsibilities, performance guarantees, and penalties.
2. **Regulatory Compliance**: Work with providers compliant with global and industry-specific regulations.
3. **Data Encryption**: Use encryption for data both at rest and in transit.
4. **Regular Audits**: Periodically review cloud provider practices and compliance.
5. **Legal Counsel**: Engage legal experts to navigate complex cross-border and regulatory issues.

Assignment

1. Explain how SOA improves modularity in software design
2. Give an example of SOA in a real-world application.
3. Differentiate between IaaS and SaaS with examples.
4. Why is PaaS preferred for application development?
5. What is latency in cloud computing, and how does it affect users?
6. Suggest a solution to address scalability challenges in cloud services.
7. Explain the significance of data centers in cloud computing.
8. How do energy-efficient data centers benefit cloud providers?
9. What is the role of SLAs in cloud computing?
10. Why is jurisdiction a challenge in cloud computing?