RAJALAKSHMI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

25 years OF ACADEMIC EXCELLENCE

Rajalakshmi Engineering College

CLOUD COMPUTING

UNIT IV

CLOUD COMPUTING CS19741

Department of CSE

AFFILIATED TO

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UNIT IV

CLOUD COMPONENTS MECHANISM

Cloud Infrastructure Mechanism:

Cloud Storage and Usage Monitor

Resource Replication

Specialized Cloud Mechanism:

Load Balancer

SLA Monitor

Pay-per-use Monitor

Audit Monitor

Failover System

Hypervisor

Resource cluster

Multi Device Broker

State Management Database

Cloud Infrastructure Mechanism

Cloud infrastructure mechanisms are foundational building blocks of cloud environments that establish primary artifacts to form the basis of fundamental cloud technology architecture.

Cloud Storage

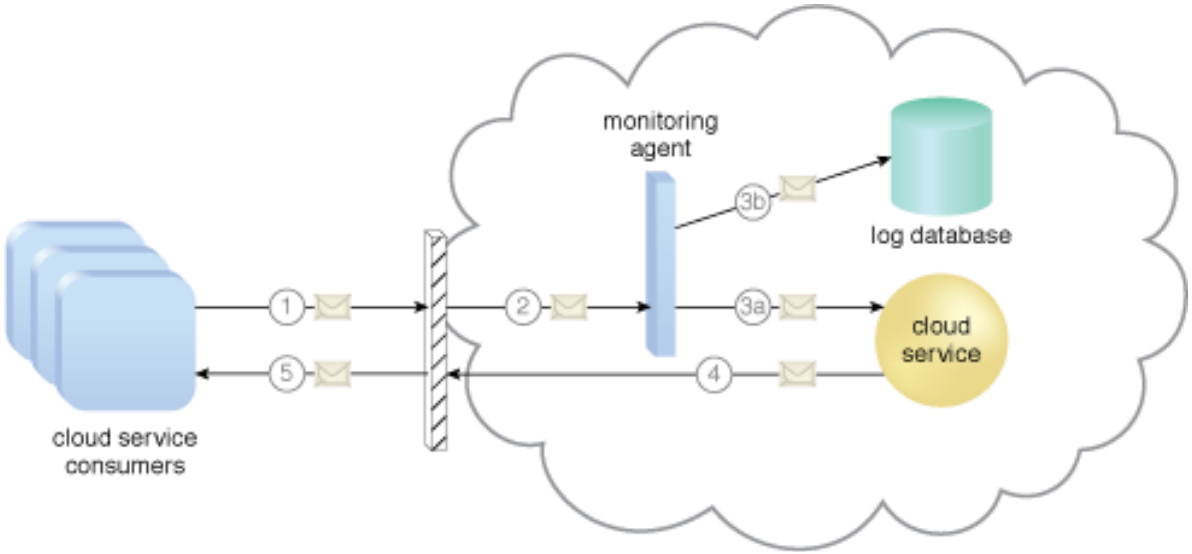
Cloud storage is a cloud computing model that enables storing data and files on the internet through a cloud computing provider that you access either through the public internet or a dedicated private network connection.

The provider securely stores, manages, and maintains the storage servers, infrastructure, and network to ensure you have access to the data when you need it at virtually unlimited scale, and with elastic capacity.

Cloud storage removes the need to buy and manage your own data storage infrastructure, giving you agility, scalability, and durability, with any time, anywhere data access.

Cloud Usage Monitor

A cloud usage monitor is a tool that tracks and analyzes the usage of cloud resources to optimize their utilization and minimize costs. It provides visibility into resource usage patterns such as CPU usage, memory usage, network traffic, and storage usage. It enables businesses to identify underutilized resources and make the necessary adjustments to optimize performance and reduce expenses.



Resource Replication

Resource replication in cloud computing refers to the process of duplicating data, applications, or services across multiple servers or data centers within a cloud infrastructure. This redundancy ensures high availability, fault tolerance, and reliability of services offered by cloud providers.

The process of resource replication typically involves several steps:

1. **Data Distribution:** When data is stored in the cloud, it's often replicated across multiple servers or data centers. This distribution ensures that if one server fails, the data can still be accessed from another location without interruption.

2. **Automatic Replication:** Cloud platforms often have built-in mechanisms for automatic replication. When a file or piece of data is uploaded to the cloud, it's automatically replicated to multiple locations according to predefined replication policies set by the cloud provider or user.
3. **Load Balancing:** Resource replication also involves load balancing mechanisms to evenly distribute workloads across replicated resources. This ensures optimal performance and prevents any single server from becoming overwhelmed with requests.

4. **Synchronization:** To ensure consistency across replicated resources, synchronization mechanisms are employed. Changes made to data or applications in one location are synchronized with all other replicated instances in real-time or at defined intervals.

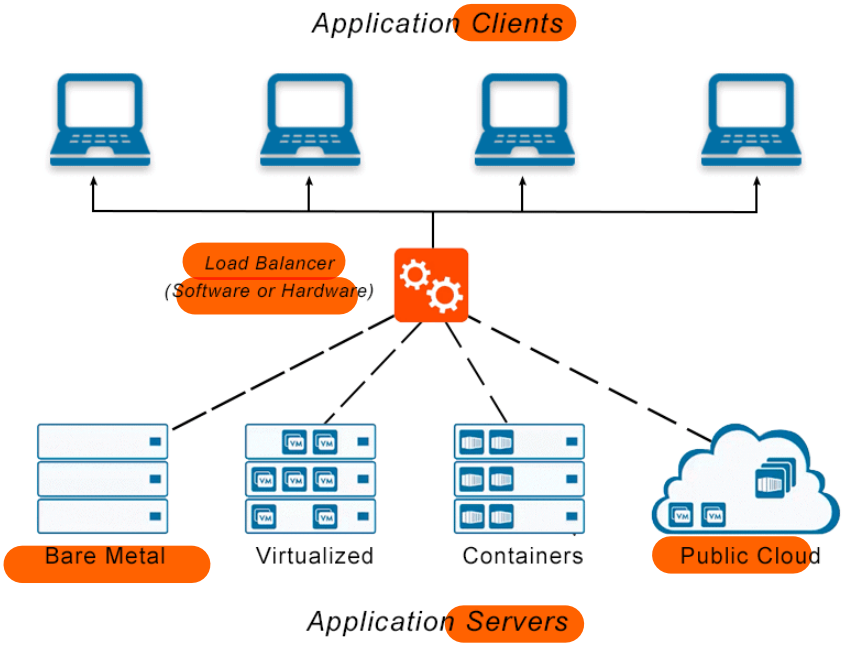
5. **Failover and Disaster Recovery:** Replication plays a crucial role in failover and disaster recovery scenarios. If one server or data center experiences a failure, traffic can be rerouted to replicated resources, minimizing downtime and ensuring continuity of service.

6. **Geographical Distribution:** Cloud providers often replicate resources across multiple geographic regions to improve performance and provide resilience against natural disasters or regional outages.

Specialized Cloud Mechanism

Load Balancer

A load balancer manages the flow of information between the server and an endpoint device (PC, laptop, tablet or smartphone). A load balancer is a hardware or software solution that helps to move packets efficiently across multiple servers, optimizes the use of network resources and prevents network overloads.



SLA Monitor

Service-Level Agreements are publicly stated or implied contracts with users. An SLA in networking is a formal and negotiated contract or agreement between a network service provider (such as an Internet Service Provider or ISP) and a customer (which can be an individual, business, or organization).

The purpose of an SLA in networking is to define the specific terms, conditions, and performance expectations related to the delivery of network services.

Service Based SLA

Customer Based SLA

Multi Level SLA

1.Service Level SLA: The service level SLA is also called service-based SLA, an agreement that is the same for all the customers who are using the services provided by the service provider. For e.g. if a telecom network provides services and it charges for annual maintenance costs. The charges are the same for all customers who are using the same telecom network

2.Customer-Based SLA: The second type of SLA is customer-based SLA, an agreement that covers all the services used by this customer. E.g., an IT service provider provides different services like networking, maintenance, installations, monitoring, and more to the customers and businesses, and all are documented in one service level agreement, then it is called customer-based SLA.

3.Multi-Level SLA: The Multi-level SLA is again divided into three levels, each defining a different set of customers for the same services and different services for the specific set of customers. Maintaining SLA's part of service level management (SLM)

Customer Level: It covers all the service level management (SLM) problems relevant to the particular customer groups, irrespective of their services.

Service Level: It covers all the service level management (SLM) problems relevant to a specific set of services in relation to a specific customer group.

Corporate Level: It covers all the service level management (SLM) problems apt to every customer in an organization.

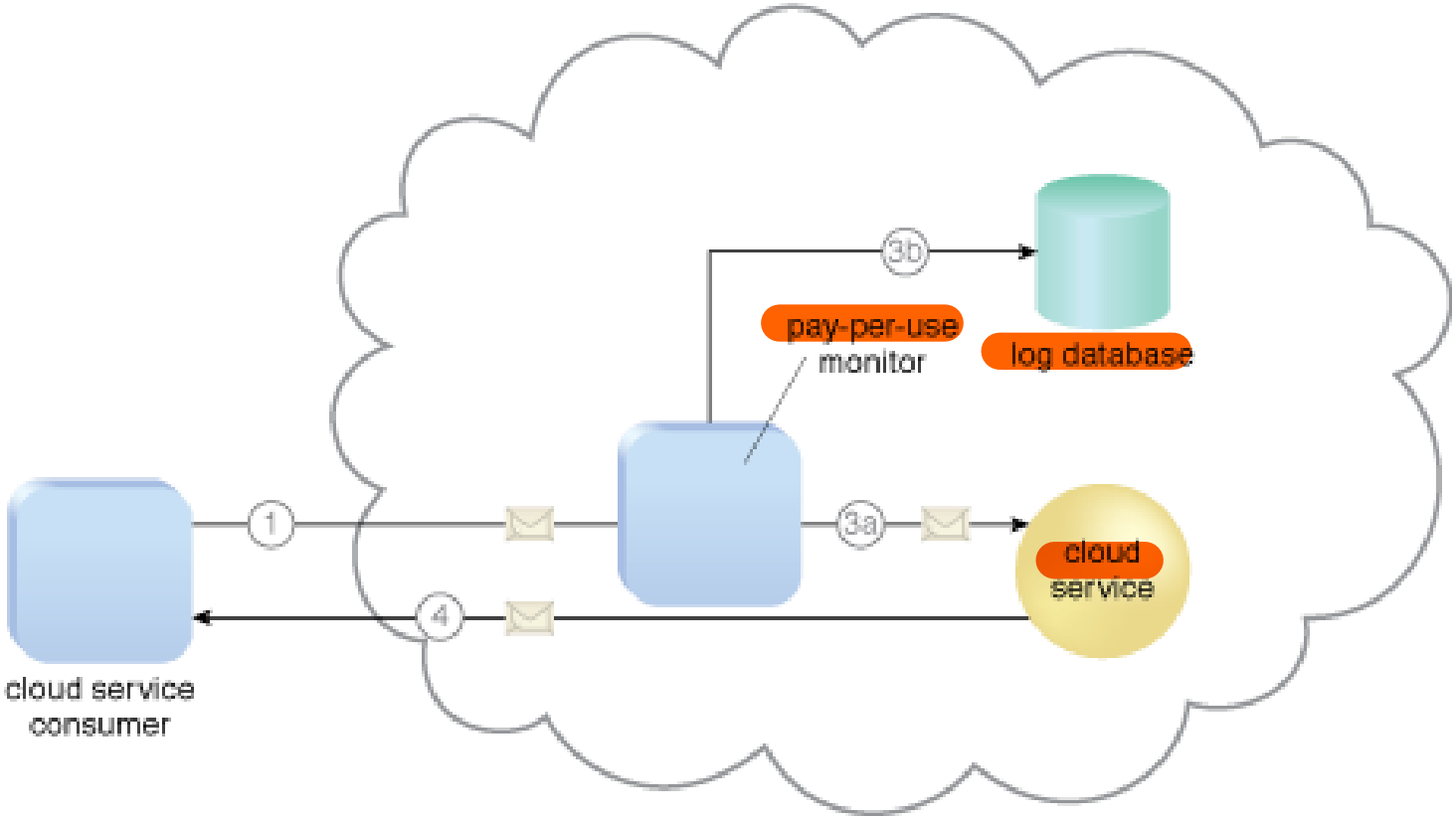
Pay-Per-use Monitor

The pay-per-use monitor mechanism measures cloud-based IT resource usage in accordance with predefined pricing parameters and generates usage logs for fee calculations and billing purposes.

Some typical monitoring variables are:

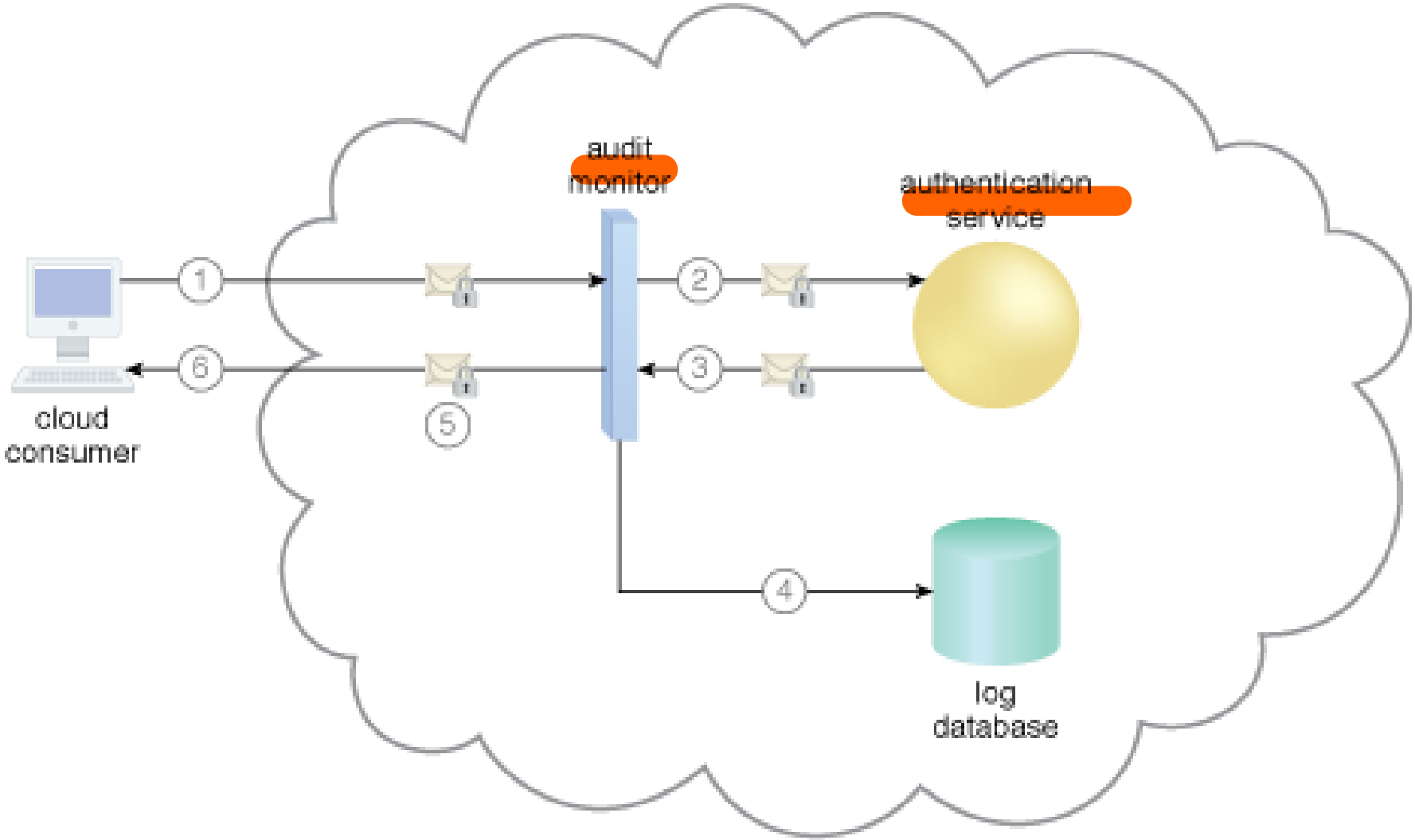
- request/response message quantity
- transmitted data volume
- bandwidth consumption

The data collected by the pay-per-use monitor is processed by a billing management system that calculates the payment fees.


3b
pay-per-use
monitor
log database
1
3a
cloud
service
4
cloud service
consumer

Audit Monitor

The audit monitor mechanism is used to collect audit tracking data for networks and IT resources in support of, or dictated by, regulatory and contractual obligations. The figure depicts an audit monitor implemented as a monitoring agent that intercepts "login" requests and stores the requestor's security credentials, as well as both failed and successful login attempts, in a log database for future audit reporting purposes.


audit
monitor
authentication
service
1
2
3
4
5
6
cloud
consumer
log
database

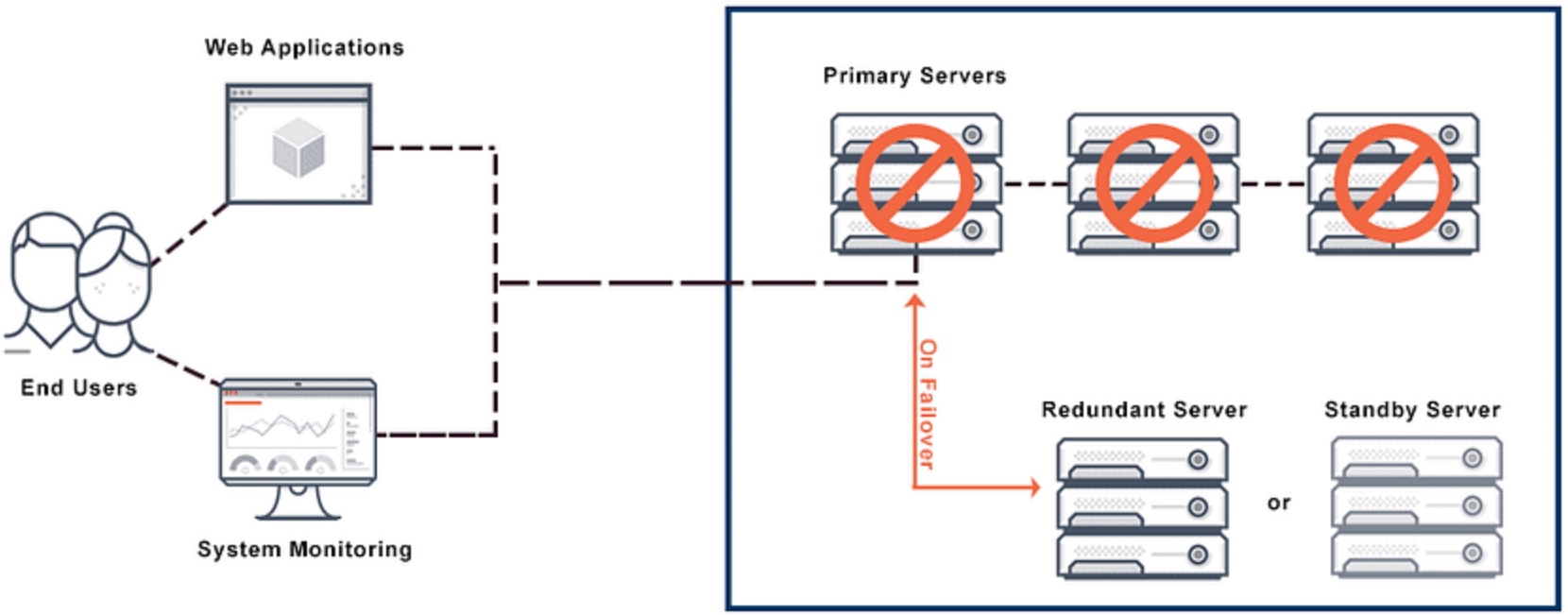
Failover System

Failover is a mechanism in cloud computing that enables an automatic and seamless transition from a failed component to a healthy one. Failover ensures the high availability and reliability of services and applications in case of unexpected system failures or outages.

failover mechanisms typically involve the use of redundant resources, such as servers, storage, or network connections, which are constantly monitored for failures or performance degradation.

When a failure is detected, the system automatically switches to a redundant resource, either locally or in a remote data centre, to ensure that the service remains available to users.

Failover


Web Applications
End Users
System Monitoring
Primary Servers
On Failover
Redundant Server
or
Standby Server

Resource Cluster

Resource cluster refers to a collection of interconnected computing resources that work together to perform tasks more efficiently than a single resource could alone. These resources often include servers, storage systems, and networking components, all grouped to provide a unified and scalable infrastructure.

Compute Nodes

Storage Nodes

Networking

Scalability and Fault Tolerance

Multi Device Broker

Multi-device broker is a system or service that manages and coordinates interactions between multiple devices and cloud-based resources. Its role is to facilitate seamless communication, data synchronization, and task management across various devices, which might include smartphones, tablets, laptops, and IoT (Internet of Things) devices.

Device Coordination: It ensures that multiple devices can work together harmoniously, sharing data and resources as needed

Data Synchronization: The broker handles the synchronization of data across devices. This is crucial for applications where data needs to be consistent and up-to-date across all user devices, such as in collaborative work tools or personal data management apps.

Resource Allocation: The broker can help in managing the distribution of resources (like cloud storage or processing power) among multiple devices, optimizing performance and ensuring that resources are used efficiently.

Authentication and Security: It ensures that access controls and security measures are consistently applied across all devices. This includes managing user authentication, authorization, and encryption to protect data and user privacy.

State Management Database

state management databases are systems designed to manage and persist the state of applications or services. They are essential for tracking and storing the dynamic data that applications use and generate during their operation. This includes user sessions, application states, transaction histories, and other data that need to be preserved across different interactions and instances.

State Persistence: State management databases store the current state of an application or service, ensuring that data is preserved even if the application or server is restarted or fails. This is crucial for maintaining continuity and reliability in cloud applications

Session Management: For web and mobile applications, state management databases can handle user session data, such as login status, preferences, and ongoing activities. This allows users to maintain their session across different devices or after reconnecting.

Transactional Data: These databases often manage transactional data, including business transactions, financial records, and order histories. They ensure data integrity and consistency through mechanisms like ACID (Atomicity, Consistency, Isolation, Durability) properties.

Hypervisors

A Hypervisor or virtual machine monitor (VMM) is a pieceof computer software, firmware or hardware that creates and runs virtual machines. A computer on which a hypervisor is running one or more virtual machines is defined as a host machine. Each virtual machine is called a guest machine.

In virtualization technology, hypervisor is a software program that manages multiple operating systems (or multiple instances of the same operating system) on a single computer system. The hypervisor manages the system's processor, memory, and other resources to allocate what each operating system requires. Hypervisors are designed for a particular processor architecture and may also be called virtualization managers