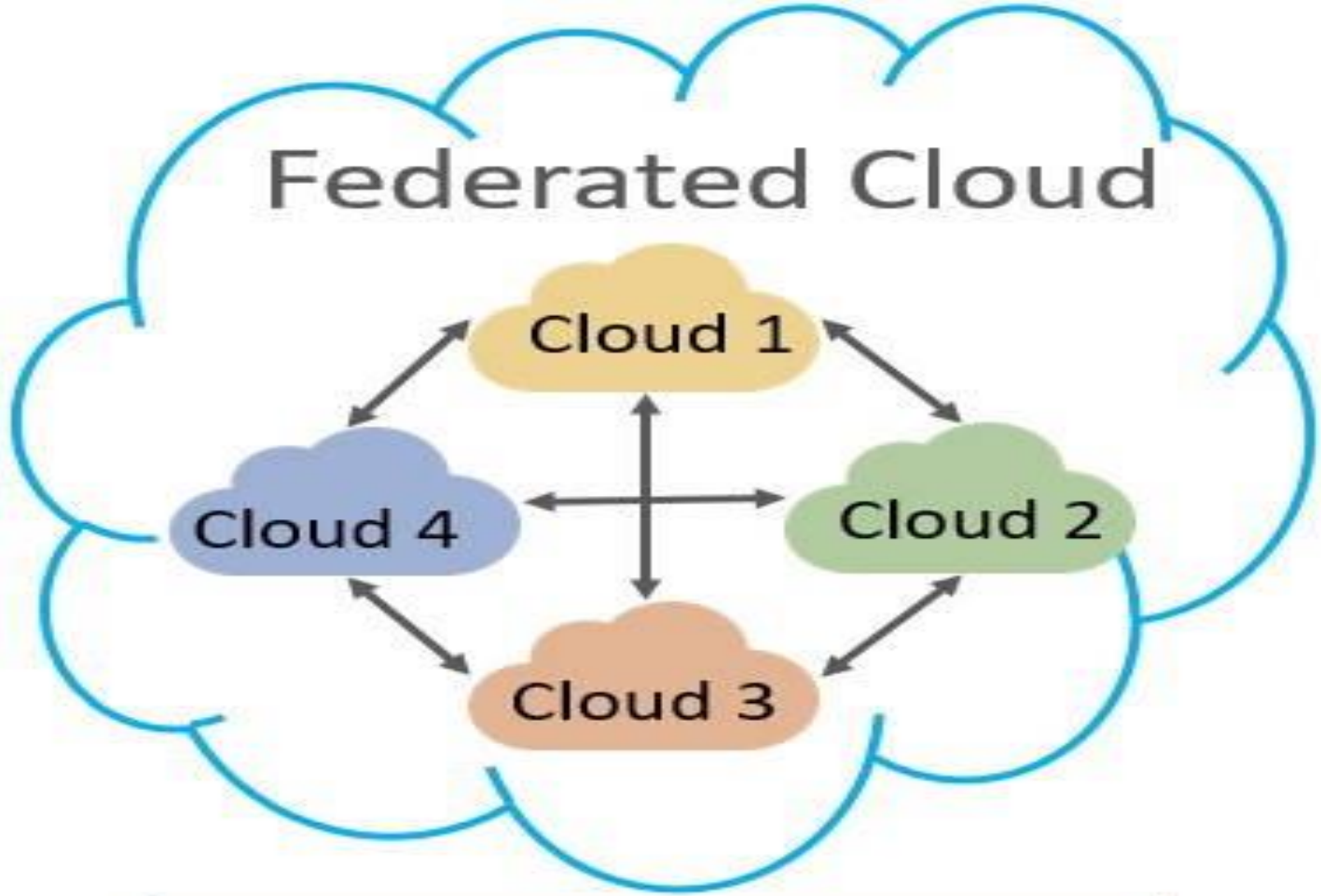
Federated cloud

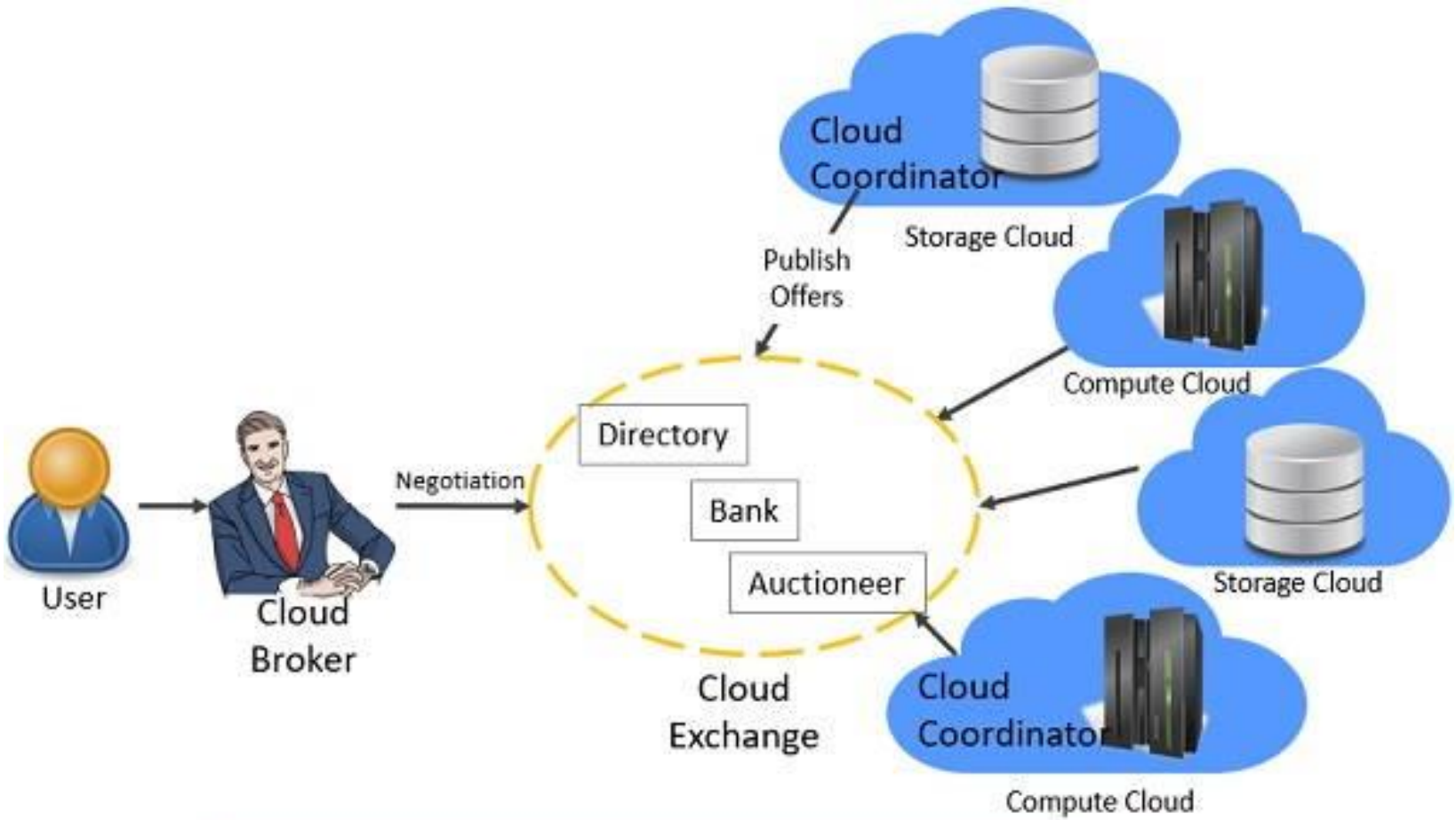
- Federated cloud is a seamless environment formed by connecting the cloud environment of two or more cloud service provider using a common standard.
- Federated cloud integrates heterogeneous cloud environment such as community cloud, public cloud, and private cloud in order to scale up the resources and services for the users.



Federated Cloud

- Federation means associating small divisions to a single group for performing a common task.
- **Federated cloud** is formed by connecting the cloud environment of several cloud providers using a common standard.
- This federation in the cloud helps the provider to easily scale up the resource to match business needs.

Federated Cloud Architecture



Federated Cloud Architecture

Federated Cloud Architecture

- The architecture has three basic components discussed below:
- **1. Cloud Exchange**
  The Cloud Exchange act as a moderator between cloud coordinator and cloud broker. The cloud exchange maps the demands of the cloud broker to the available services offered by the coordinator.
- The cloud exchange has the track record of what is the current cost, demand patterns and available cloud providers and this information is periodically updated by the cloud coordinator.

- The cloud brokers interact with cloud exchange to gain information about the existing SLA policies, availability of resources offered by the cloud providers.
- Services offered by cloud exchange to both cloud broker and cloud coordinator.

- **Database Repository:** Cloud exchange act as a database repository or **directory** where cloud broker announces their resources, service and the price they offer for the services.
- The customer then analyze this repository to search the most appropriate service and price suiting them and place a request for the service

- **Dealer:** The cloud exchanger always updates policies of its participants, they always act as a third party between broker and coordinator.
- **Bank:** Cloud exchanger facilitates the financial transaction between cloud vendors and its clients thus maintaining the trust.

- **2. Cloud Coordinato**r
  The cloud controller manages the cloud enterprises and their membership.
- The cloud coordinator allocates the cloud resources to the remote users based on the quality of service they demand and the credits they have in the cloud bank.
- Based on the policies of SLA the marketing and pricing policies are developed by the cloud coordinator.

- **3. Cloud Broker**
  On behalf of the customer, it is the cloud broker who interacts with the cloud coordinator, analyzes the SLA agreement, resources offered by different cloud providers in cloud exchange. Cloud broker finalized the most appropriate deal for their client.

Cloud Federation Properties

- Cloud federation properties can be classified into two categories i.e. **functional cloud federation** properties and **usage cloud federation** properties.

Functional Cloud Federation Properties

- **1. Authentication:** Cloud federation has the involvement of several foreign resources that have participated in the federation.
- To consume these foreign resource customer must be provided with the access credential relevant to the target foreign resource. However, the respective foreign resource must also have authentication information of the customer.

- **2. Integrity:** Integrity in the federated cloud offers and demand consistent resources by the providers participated in the federation. If the federated cloud environment lacks in providing the resources its purpose becomes questionable.
- To maintain the consistency of the environment management is needed by the providers they can even designate a federation administrative board or the provider can automate the process which will trigger the administrative action when any irregularity is detected.

- **3. Monitoring:** Federated cloud can be monitored in two ways global monitoring and monitoring as a service (MaaS). **Global monitoring** aids in maintaining the federated cloud. **MaaS** provides information that helps in tracking contracted services to the customer.

- **4. Object:** Marketing object in cloud computing are infrastructure, software, platform that are offered to the customer as a service. These objects have to pass through federation when consumed in the federated cloud.
- **5. Contracts:** In cloud computing, the agreement between provider and consumer i.e. service level agreement (SLA) has both technical as well as administrative commitments between provider and consumer.

- **6. Provisioning:** Allocating services and resources offered by the cloud provider to the customer through federation. It can be done manually or automatically. In an **automatic** way, the best provider is chosen to allocate the resources and services to the customer. In the **manual** way entity in the federation selects the provider to allocate the resources and services.

- **7. Service Management:** Service management discovers and publishes the services offered by the federated cloud.
- **8. Interoperability:** Interoperability is a mechanism with which the customer's system is able to interact with the cloud service or cloud service in the federation is able to interact with other cloud services.
- **9. Commercialization:** The providers participated in federation publish their offers to a central entity. The customer interacts with this central entity to verify the prices and propose an offer.

Types of Federation in Cloud

- **Permissive federation**
  Permissive federation allows the interconnection of the cloud environment of two service providers without the verifying identity of peer cloud using DNS lookups. This raises the chances of domain spoofing.

- **Verified Federation**
  Verified federation allows interconnection of the cloud environment, two service providers, only after the peer cloud is identified using the information obtained from DNS. Though the identity verification prevents spoofing the connection is still not encrypted and there are chances of DNS attack.

- **Encrypted Federation**
  Encrypted federation allows interconnection of the cloud environment of two services provider only if the peer cloud **supports** transport layer security (**TSL**).
- The peer cloud interested in the federation must provide the **digital certificate** which still provides **mutual authentication**. Thus encrypted federation results in **weak** identity verification.

- **Trusted Federation**
  Trusted federation allows two clouds from different provider to connect only under a **provision** that the peer cloud support **TSL** along with that it provides a **digital certificate** authorized by the **certification authority** (CA) that is trusted by the authenticating cloud.

Advantages of Federated Cloud

- Federated cloud allows scaling up of resources.
- Federated cloud increases reliability.
- Federated cloud has increased collaboration of cloud resources.
- Connects multiple cloud service provider globally to let providers buy and sell their services on demand.
- Dynamic scalability reduces the cost and time of providers.