

Cloud Reference Architectures







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Introduction

- A **Reference Architecture (RA)** “should” provide a blueprint or template architecture that can be reused by others wishing to adopt a similar solution.
 - A **Reference Model (RM)** should explain the concepts and relationships that underlie the RA.
 - **Reference Framework (RF)** is a container for both.
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Generalized Reference Framework

Reference Framework

Reference Model

Principles

Glossary

Meta Model

Life Cycle

Maturity Model

Capability Model

Process

Decomposition

Sequence

Reference Architecture

Views

Business

Specification

Implementation

Deployment

Technology

Best Practice

Policy

Models

Deliverables

Techniques

Patterns

Standards

Capabilities

Organization

Roles &
Responsibilities

Skills

Cloud Computing Elements Placed in Generic Reference Frameworks

Cloud Computing Reference Framework

Cloud Computing Reference Model

Principles

Elastic
Self-Service
Measured
Resource Pooling
...

Maturity Model

Level 1
Level 2
Level 3
Level 4

Meta Model

Concepts
Packages
Business
Specification
Implementation
Deployment
Service
...

Life Cycle

Planned
Specified
Provisioned
Certified
Deployed
Operational
Retired

Capability Model

Architecture
Framework & Process
Lifecycle Infrastructure
Operational Infrastructure
Projects & Programs
Management

Deployment Model

Public
Private
Community
Hybrid

Process

Streams

Consume
Provide
Manage
Enable

Organization

Roles (organization)

Cloud Consumer
Cloud Provider
Cloud Broker
Cloud Auditor
Cloud Carrier

Roles (individuals)

Cloud Provisioner
Cloud Manager
Cloud Architect
Cloud ...

Cloud Computing Reference Architecture

Views

Business
Specification
Implementation
Deployment
Technology

Best Practice

Policy
Deliverables
Techniques
Patterns
Standards

Architectures

Service
Software
Technology

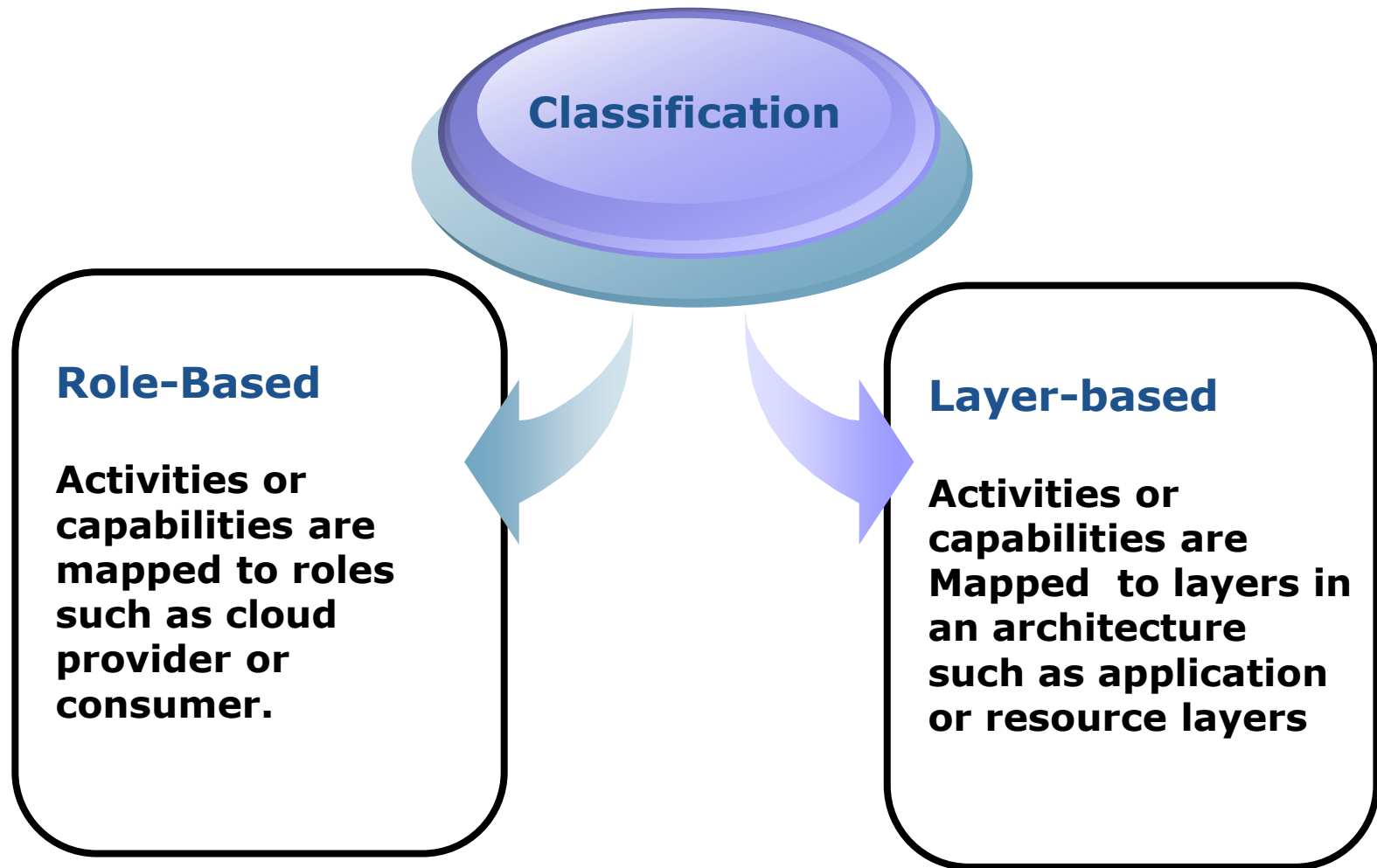
Service Layers

...aaS
SaaS
PaaS
IaaS

Computing Layers

Client
Service
Application
Platform
Storage
Infrastructure

Classification Cloud Reference Models



Classification of Cloud Reference Models

Role-Based Cloud Computing RA

Distributed Management Task Force

NIST

IBM

DMTF

National Institute of Standards and Technology

Classification of Cloud Reference Models

Layer-Based Cloud Computing RA

Cloud Security Alliance

CISCO

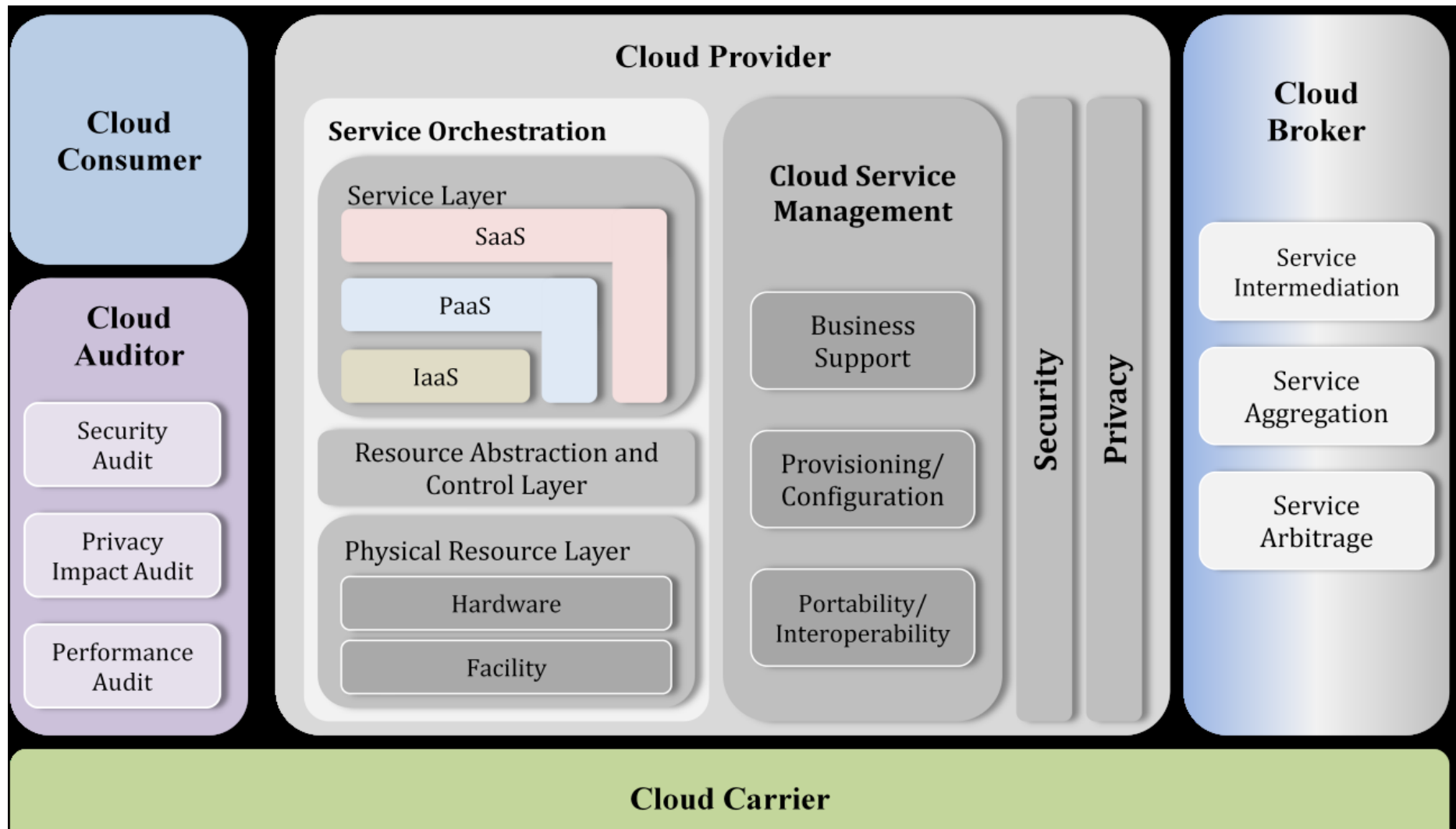
IEFT

CSA

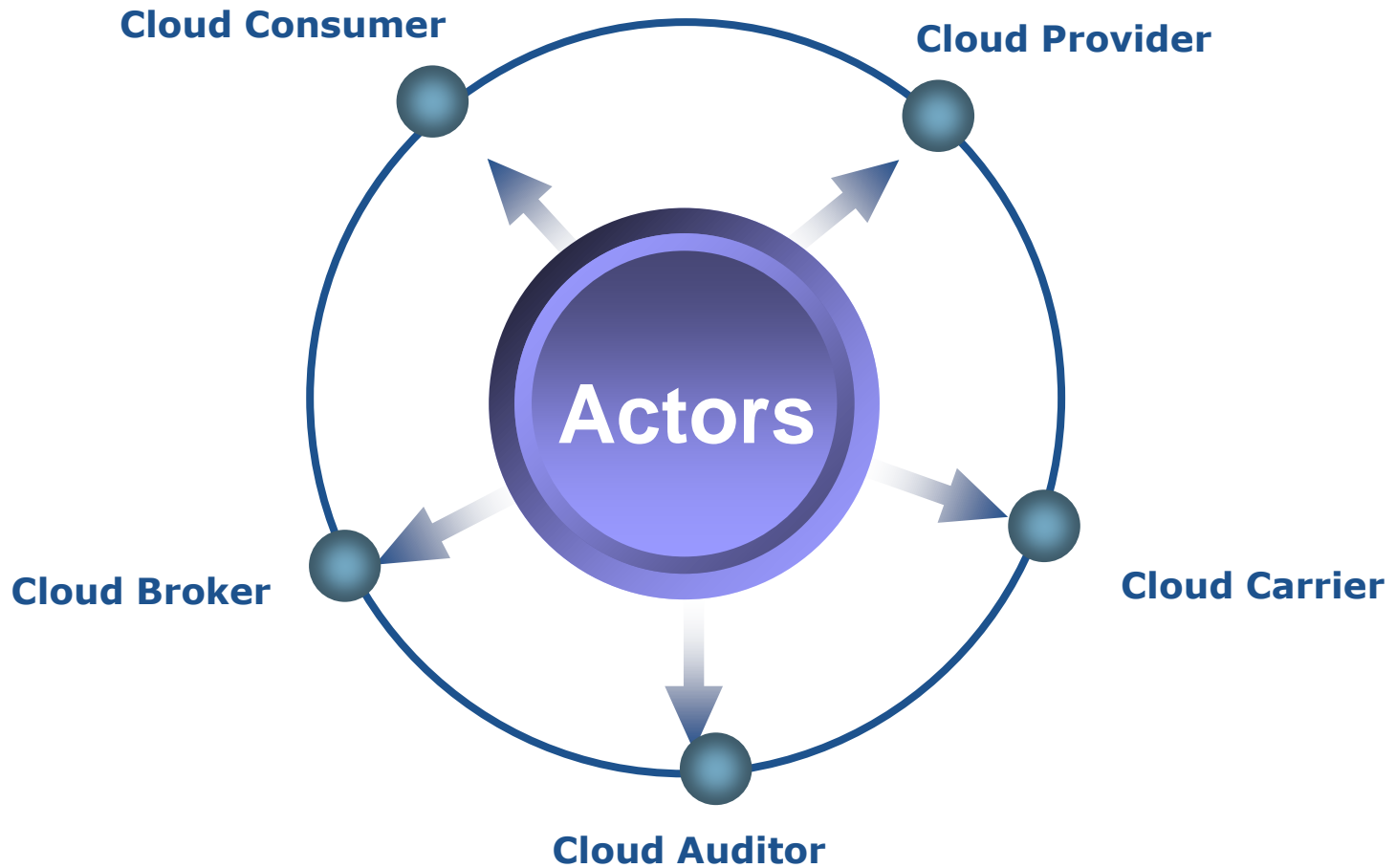
San Francisco

Internet Engineering Task Force

NIST CC RA Reference Architecture



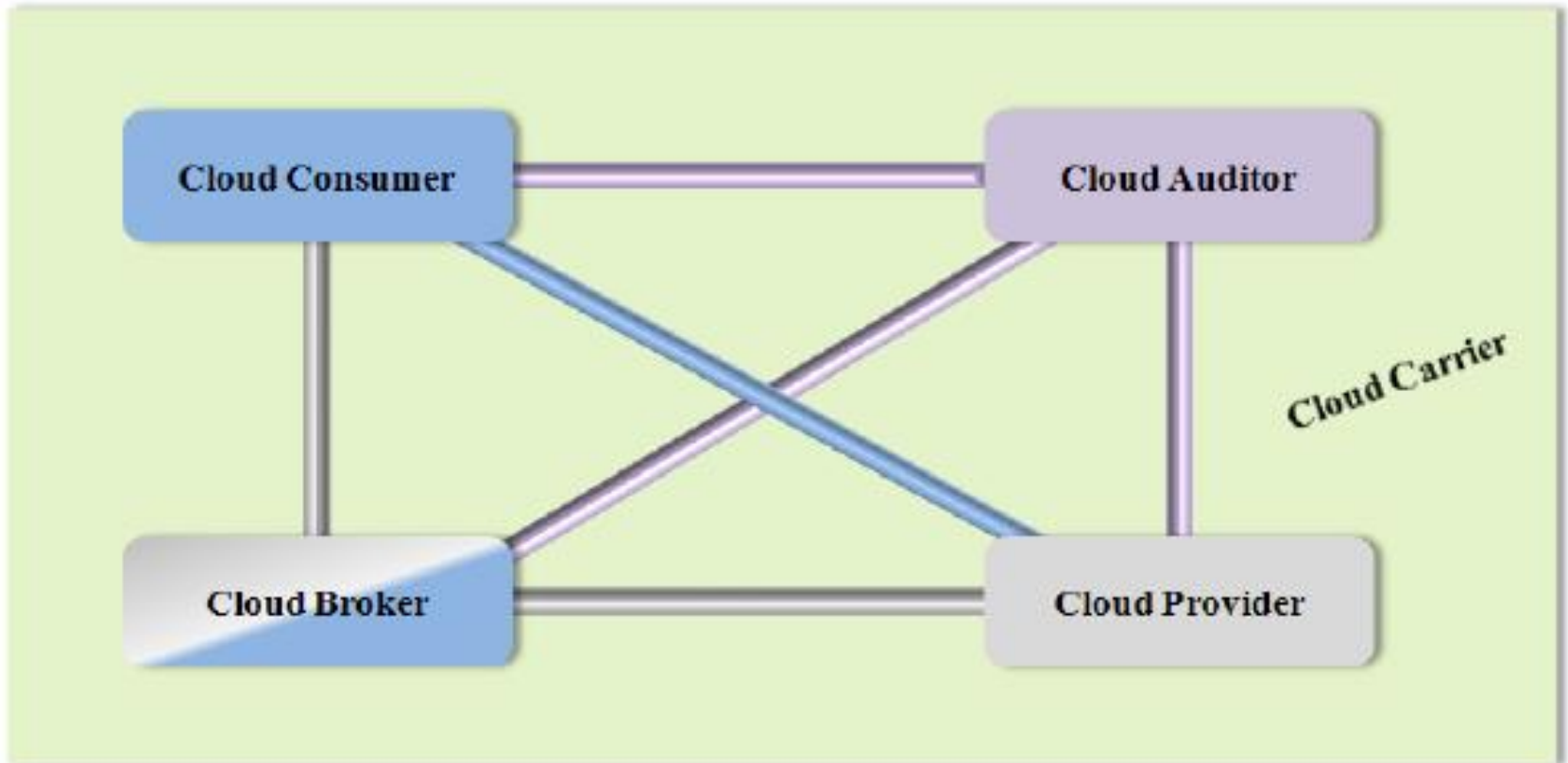
Actors



Actors

- ❖ **Cloud Broker:** An entity manages the use, performance and delivery of cloud services, and ***negotiates*** relationships between Cloud Providers and Cloud Consumers.
 - ❖ **Cloud Carrier:** The intermediary that provides ***connectivity and transport*** of cloud services from Cloud Providers to Cloud Consumers.
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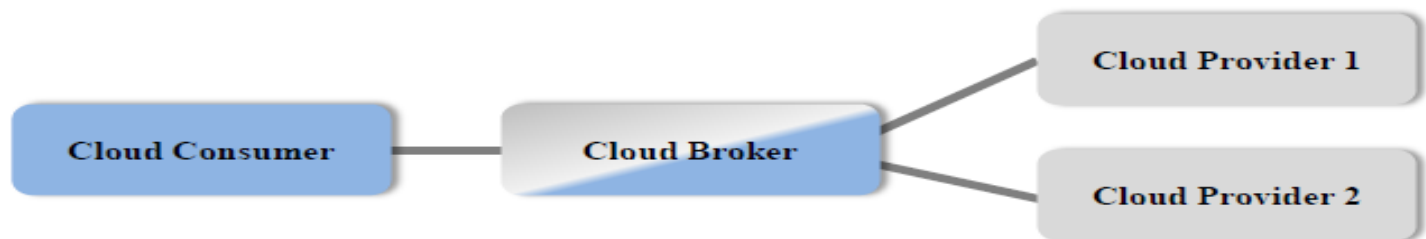
Interactions between the Actors



Example Usage Scenarios



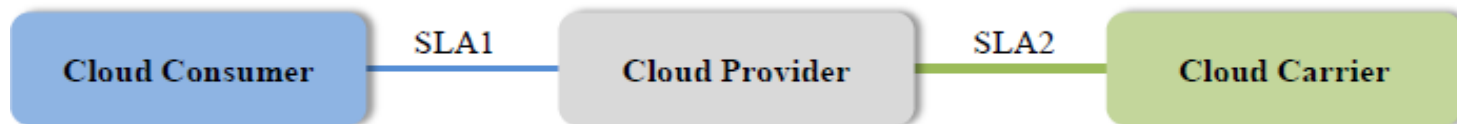
A cloud consumer may request service from a cloud broker instead of contacting a cloud provider directly. The cloud broker may create a new service by combining multiple services or enhance an existing service. In this example, the cloud providers are invisible to the cloud consumer.



Example Usage Scenarios



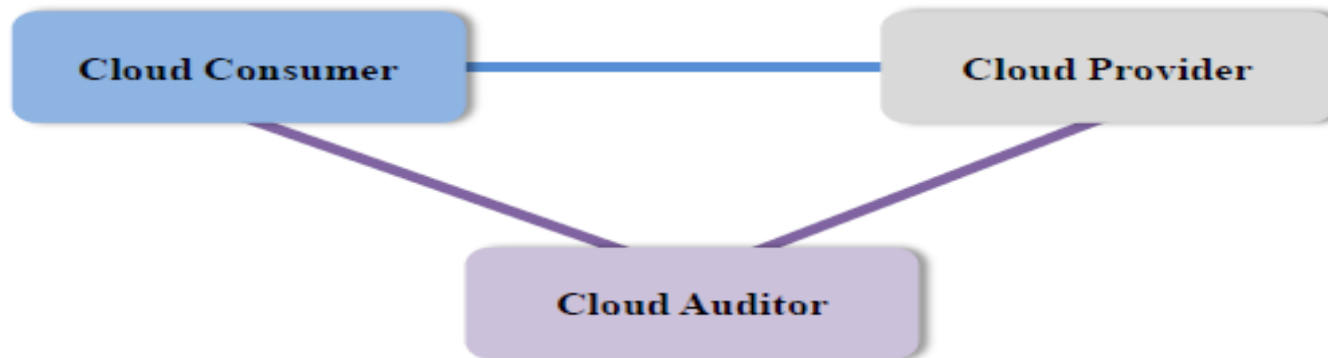
Cloud carriers provide connectivity and transport of cloud services from cloud providers to cloud consumers. A cloud provider will set up **Service Level Agreements (SLAs)** with a cloud carrier and may request dedicated and encrypted connections.



Example Usage Scenarios



For a cloud service, a cloud auditor conducts independent assessments of the operation and security of the cloud service implementation.



Cloud Consumer

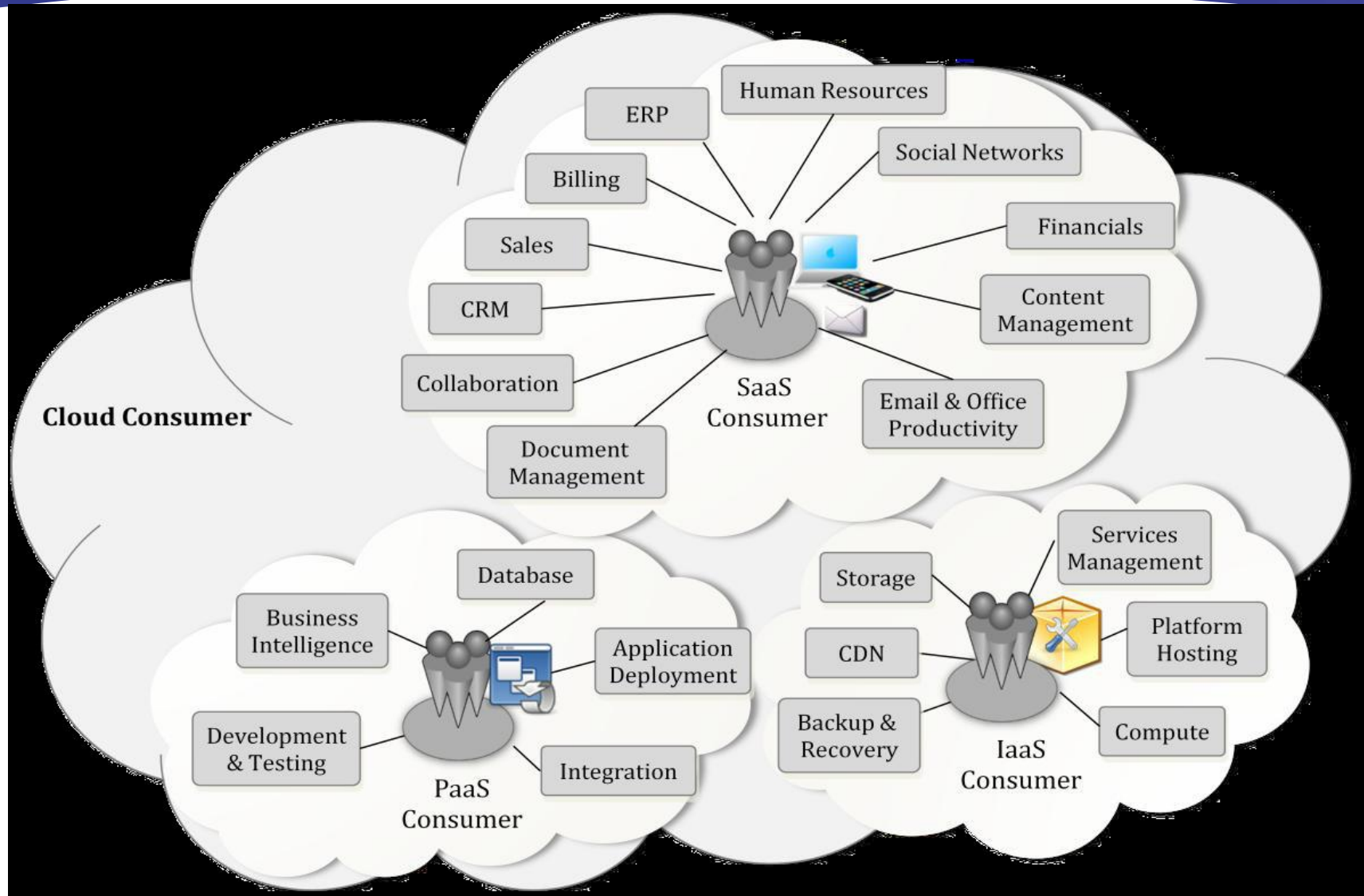
- ❖ Person or organization that maintains a business relationship with, and **uses services** from, Cloud Providers.
- ❖ Cloud consumers are categorized into **three groups** based on their different application/usage scenarios.



Cloud Consumer

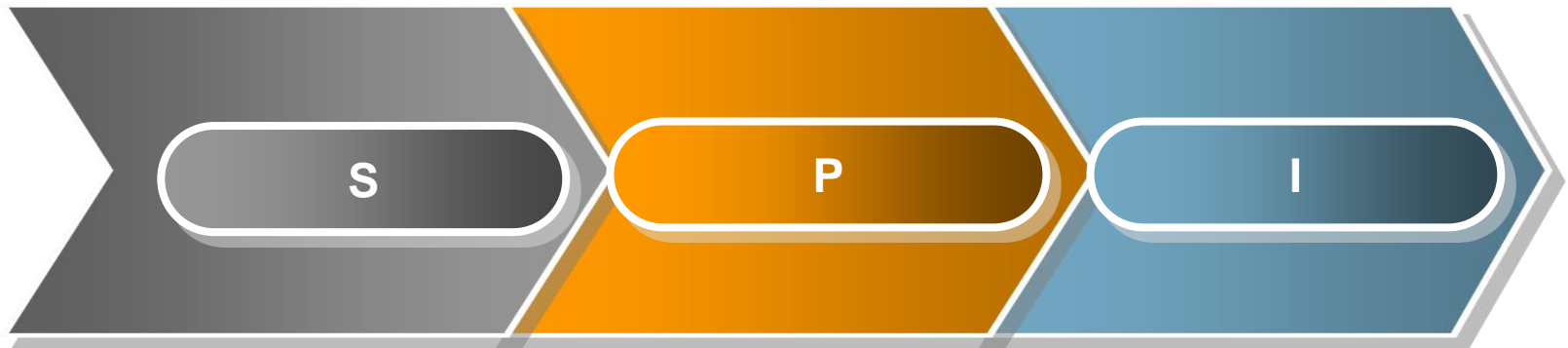
Consumer Type	Major Activities	Example Users
SaaS	Uses application/service for business process operations	Business users, software application administrators
PaaS	Develops, tests, deploys and manages applications hosted in a cloud environment	Application developers, testers and administrators
IaaS	Creates/installs, manages and monitors services for IT infrastructure operations	System developers, administrators, IT managers

Services Available to a Cloud Consumer

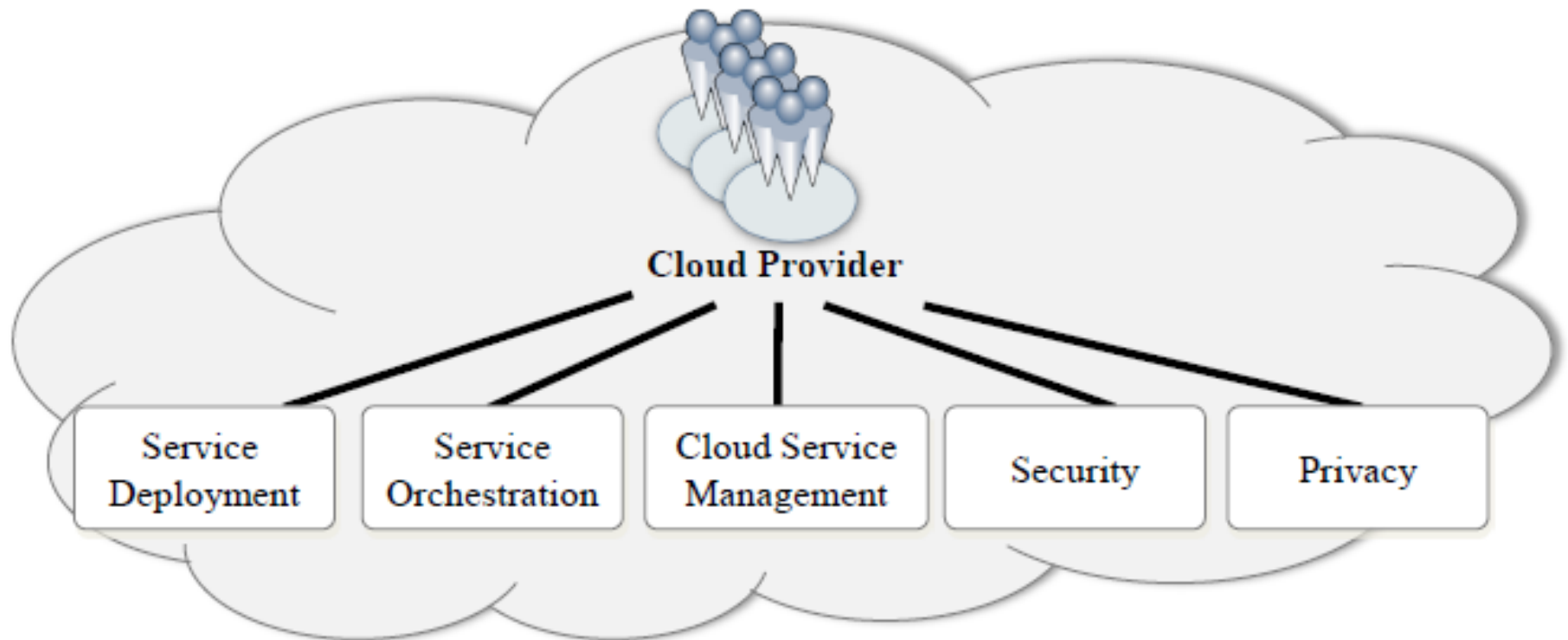


Cloud Provider

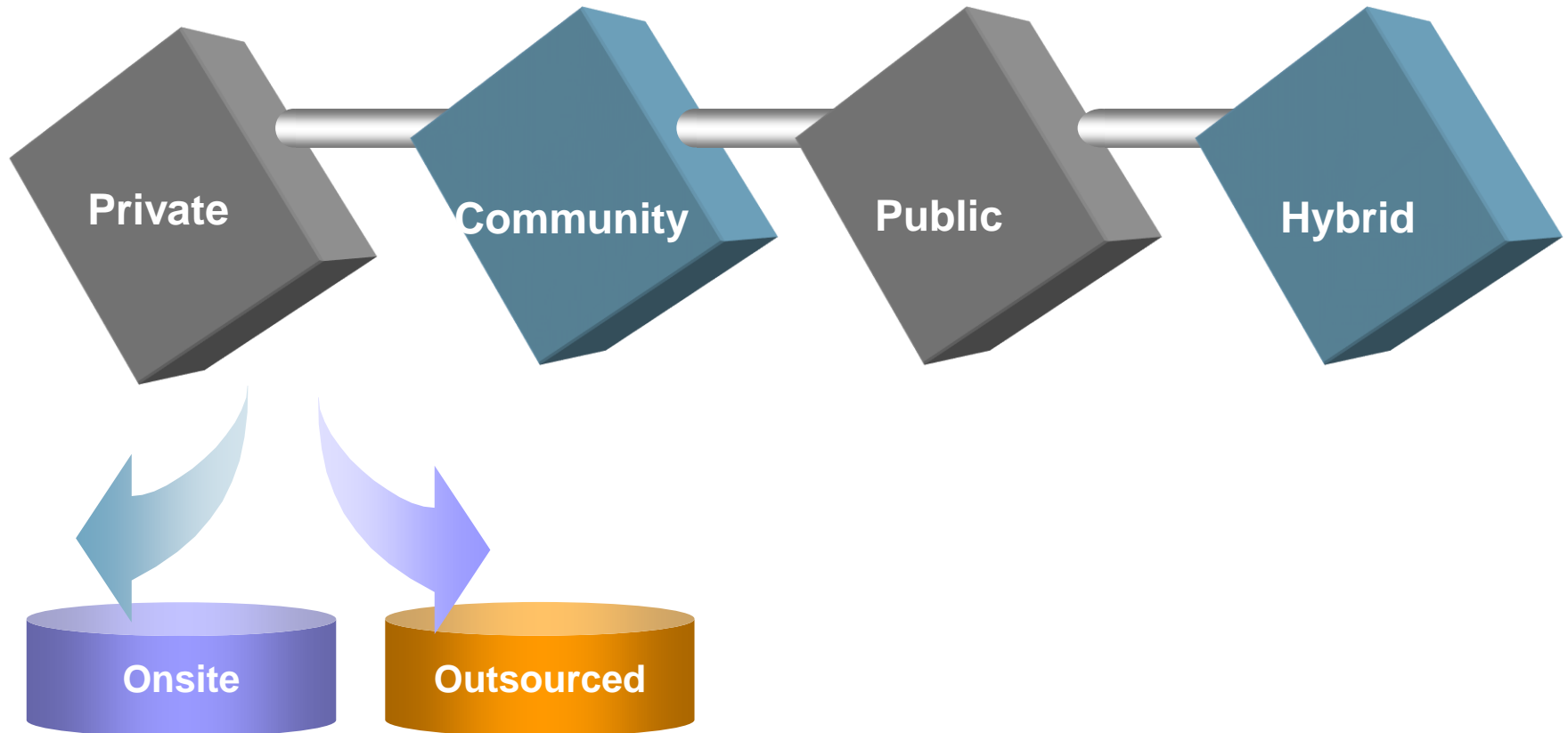
Person, organization or entity **responsible for making a service available** to Cloud Consumers.



Cloud Provider - Top-level View



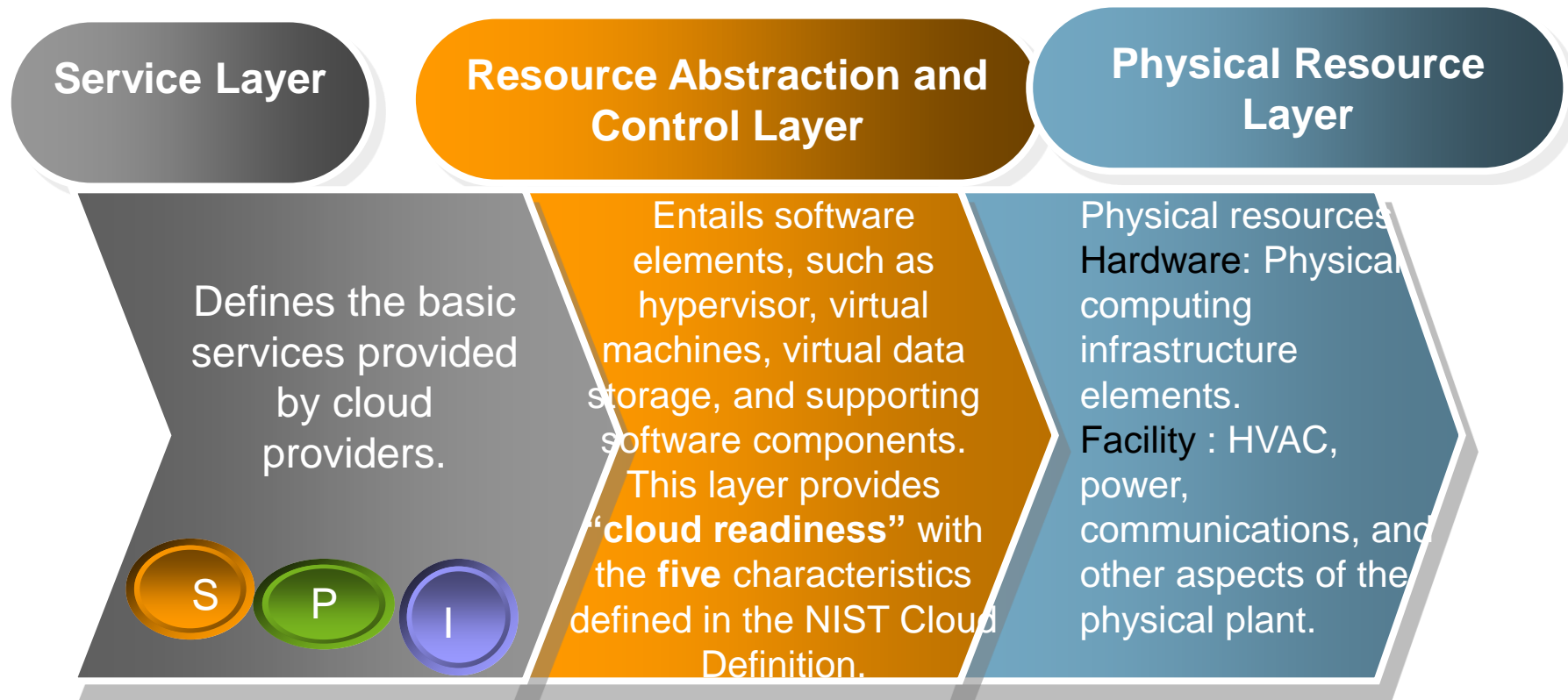
Cloud Provider – Service Deployment



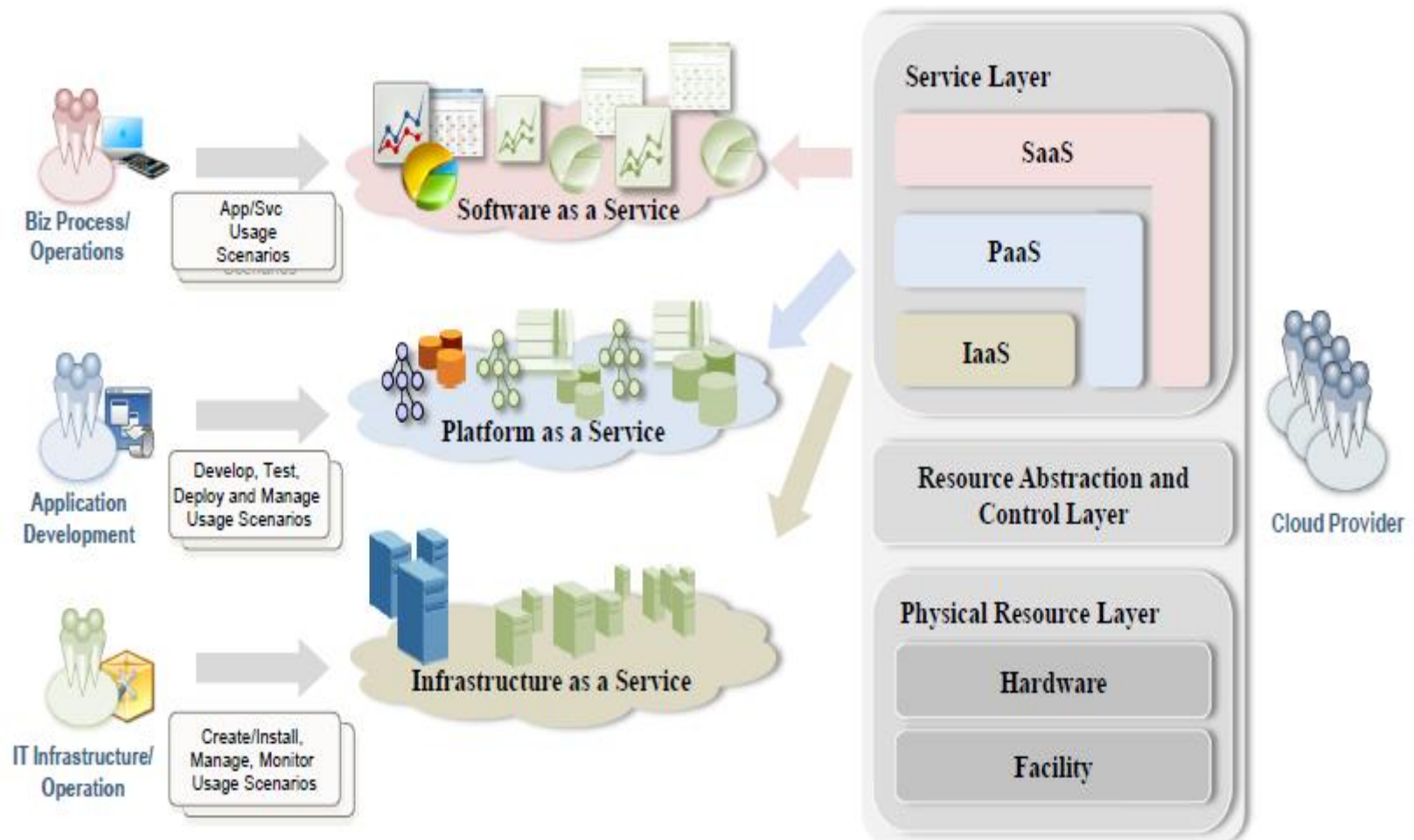
Cloud Provider – Service Orchestration

Refers to the arrangement, coordination and management of cloud infrastructure to provide different cloud services to meet IT and business requirements.

The three conceptual layers of a generalized cloud environment

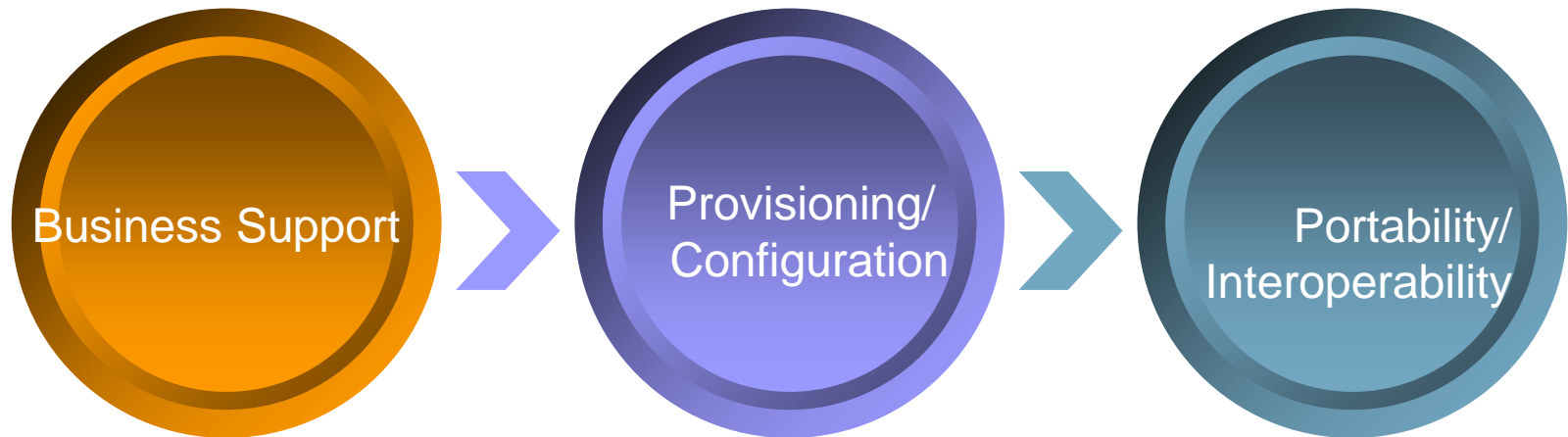


Cloud Provider – Service Orchestration

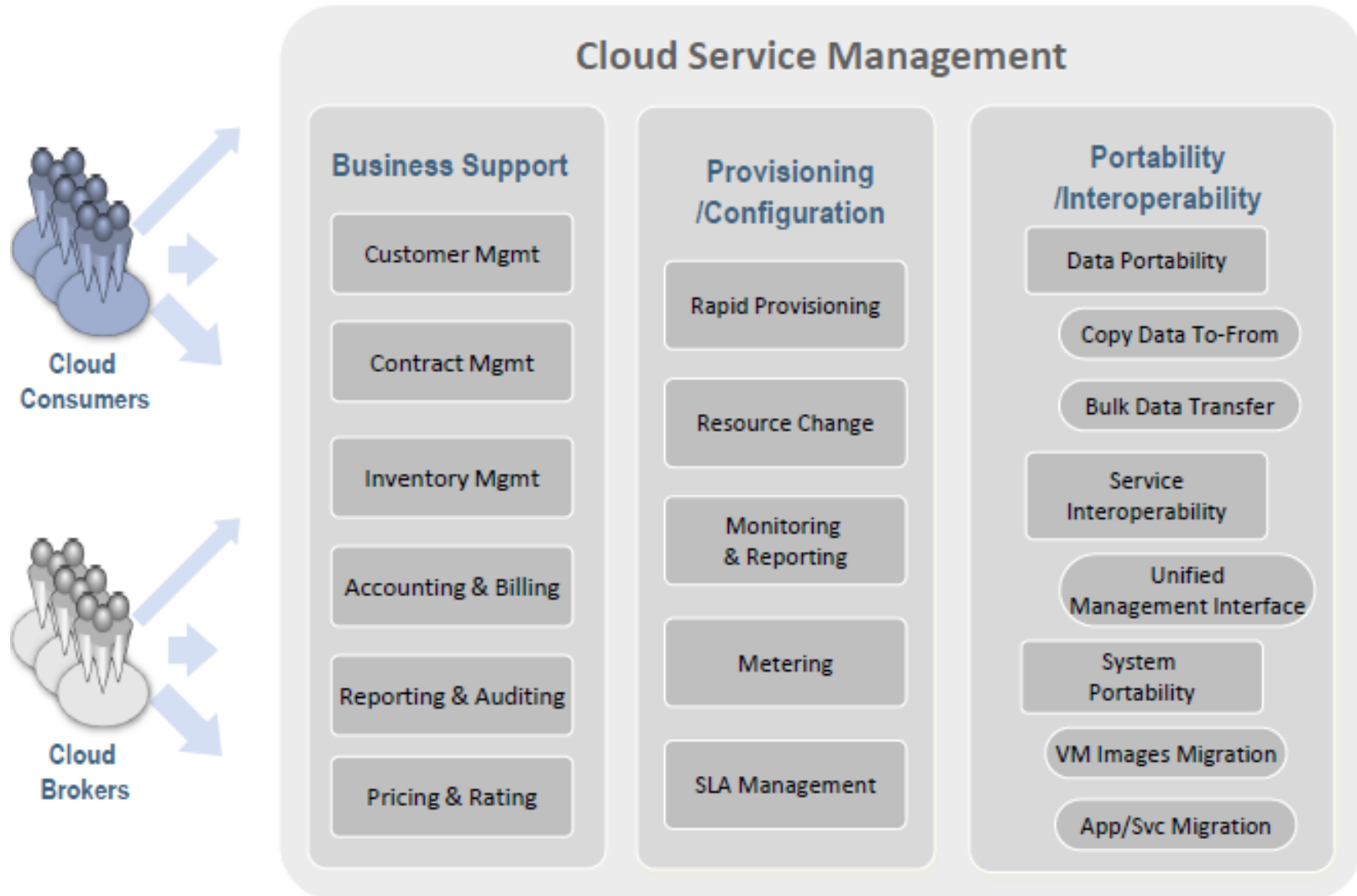


Cloud Provider –Cloud Service Management

A cloud provider performs the following functions to support cloud service management



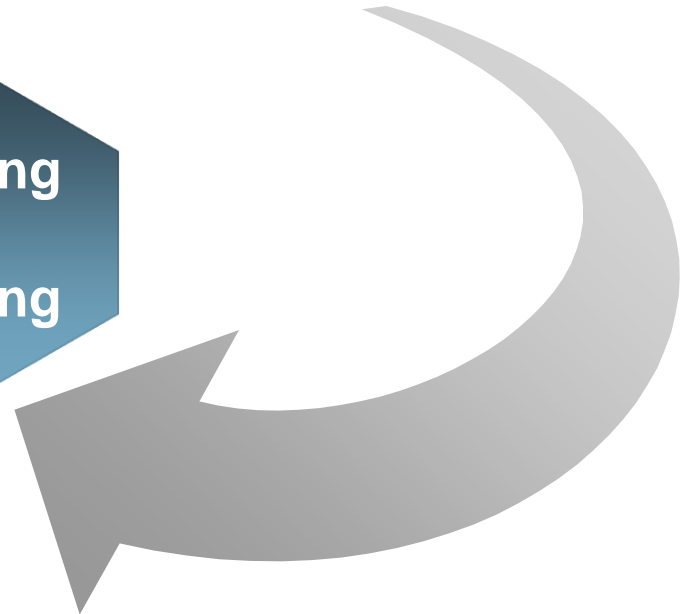
Cloud Provider –Cloud Service Management



Business Support



Business Support



Provisioning/Configuration

Rapid provisioning: Automatically deploying cloud systems based on the requested service/resources/capabilities.

Resource changing: Adjusting configuration/resource assignment for repairs, upgrades and joining new nodes into the cloud.

Monitoring and Reporting: Discovering and monitoring virtual resources, monitoring cloud operations and events and generating performance reports.

Metering: Providing a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts).

SLA management: Encompassing the SLA contract definition (basic schema with the QoS parameters), SLA monitoring and SLA enforcement according to defined policies.

Portability/Interoperability

Portability

1. The ability to transfer data from one system to another without being required to recreate or reenter data descriptions or to modify significantly the application being transported.
2. The ability of software or of a system to run on more than one type or size of computer under more than one operating system.

Interoperability

The capability to communicate, execute programs, or transfer data among various functional units under specified conditions.

Portability/Interoperability

Cloud Providers should provide mechanisms to support:

❖ **Data Portability**

- **Copy data to-from:** Copy data objects into/out of a cloud.
- **Bulk data transfer:** Use a disk for bulk transfer.

❖ **Service Interoperability**

- Allow cloud consumers to use their data and services across multiple cloud providers with a unified and enhanced management interface.

❖ **System portability**

- **VM images migration:** Migrate a fully-stopped VM instance or machine image from one provider to another provider.
 - **Application/Service migration:** Migrate application/service and current contents from one service provider to another provider.
-

Cloud Providers –Security & Privacy

Security

- Authentication and Authorization
- Availability
- Confidentiality
- Identity management
- Integrity
- Security monitoring & Incident Response
- Security policy management

Privacy

- Protect the assured, proper, and consistent collection, processing, communication, use and disposition of personal information **(PI)** and personally identifiable information **(PII)** on the cloud.
-

Cloud Auditor

- ❖ A party that can conduct **independent assessment** of cloud services, information system operations, performance and security of the cloud implementation.
- ❖ A cloud auditor can **evaluate** the services provided by a cloud provider in terms of security controls, privacy impact, performance, etc.

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Cloud Broker

- ❖ An entity that manages the use, performance and delivery of cloud services and **negotiates relationships** between Cloud Providers and Cloud Consumers.
-

Cloud Broker

- ❖ The major services provided by a cloud broker include:
 - **Service Intermediation:** A cloud broker enhances a given service by improving some specific capability and provides the value-added service to cloud consumers.
 - **Service Aggregation:** A cloud broker combines and integrates multiple services into one or more new services. The broker will provide data integration and ensure the secure data movement between cloud consumer and multiple cloud providers.
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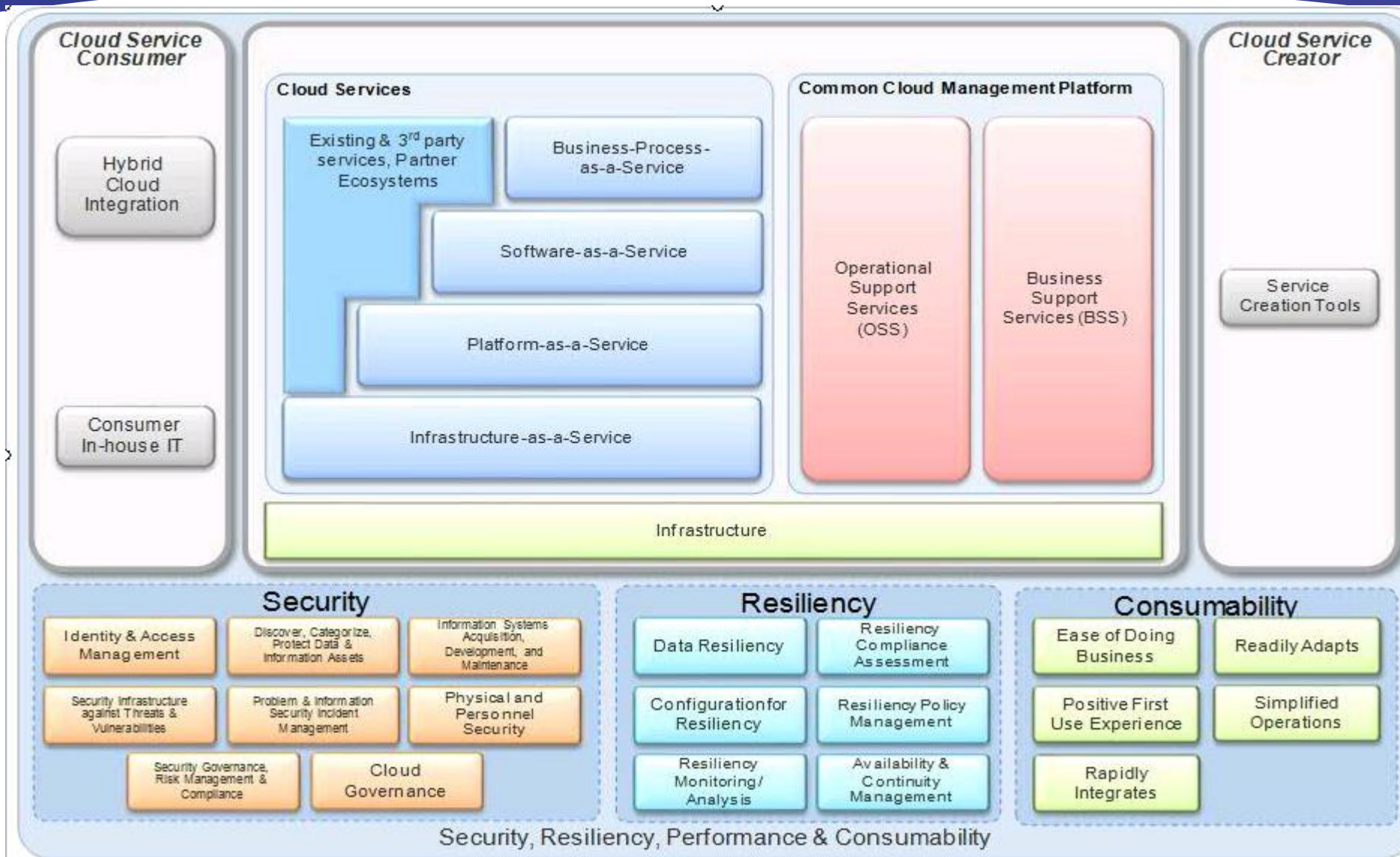
Cloud Broker

- ❖ The major services provided by a cloud broker include:
 - **Service Arbitrage:** Service arbitrage is **similar to service aggregation**, with the difference in that the services being **aggregated aren't fixed**. Service arbitrage **allows flexible and opportunistic choices** for the broker.
 - For example, the cloud broker can use a credit-scoring service and select the best score from multiple scoring agencies.
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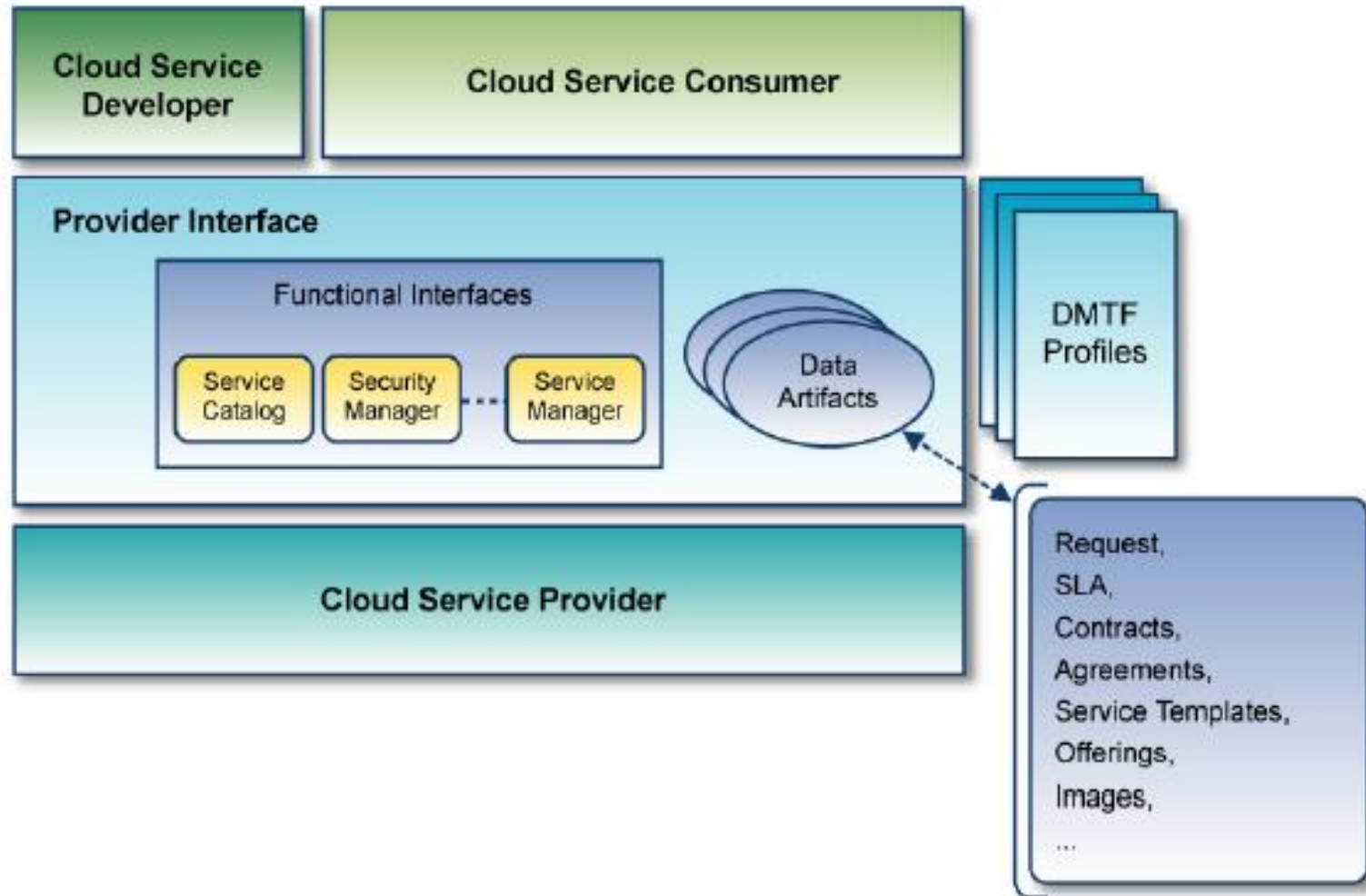
Cloud Carrier

- ❖ The intermediary that provides **connectivity** and transport of cloud services between Cloud Providers and Cloud Consumers.
 - Provide access to cloud consumers through network, telecommunication and other access devices.
 - Distribution can be provided by network and telecomm carriers or a transport agent.
 - **Transport agent:** A business organization that provides physical transport of storage media such as high-capacity hard drives.
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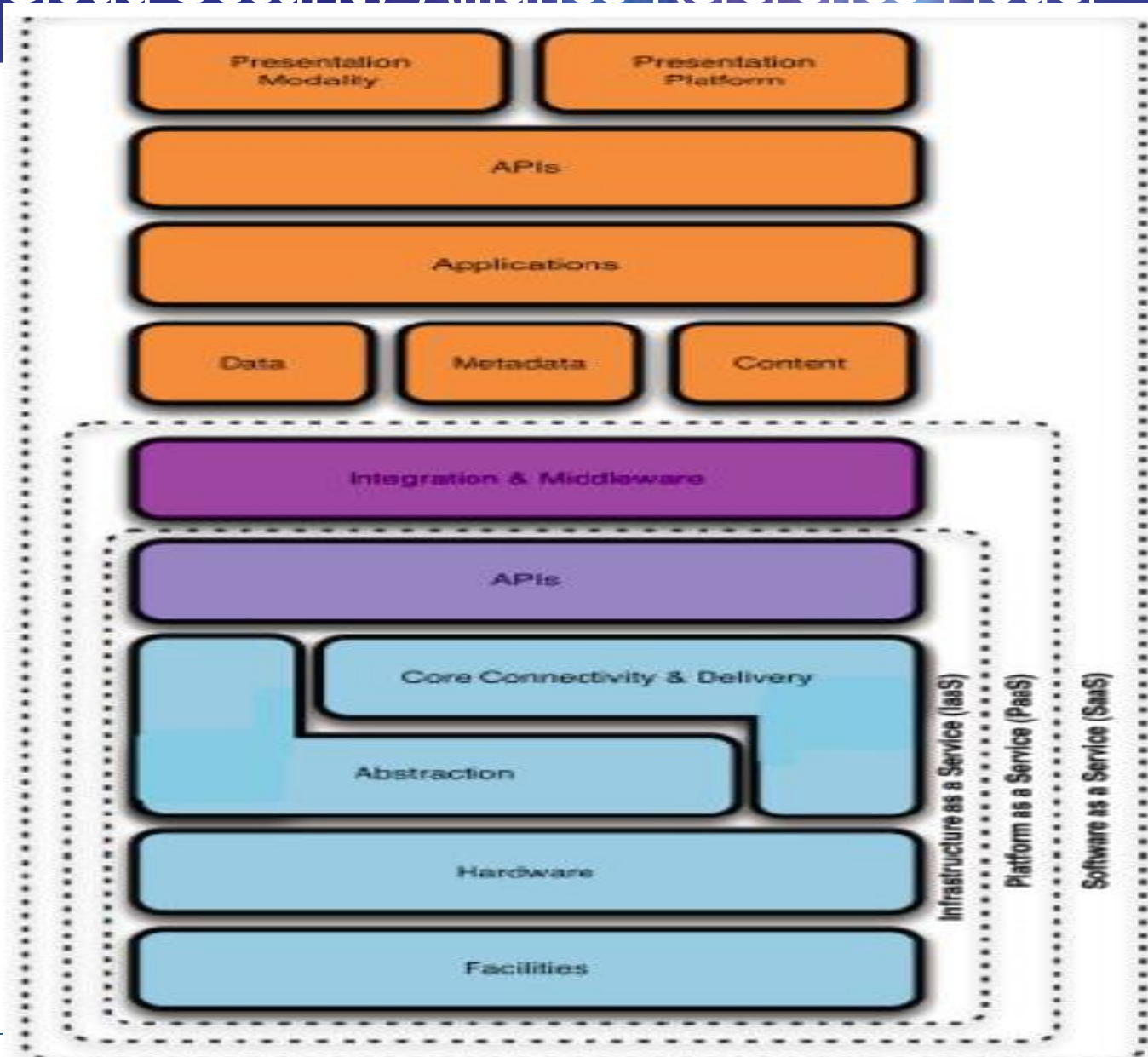
IBM Cloud Computing Reference Architecture



DMTF Cloud Service Reference Architecture



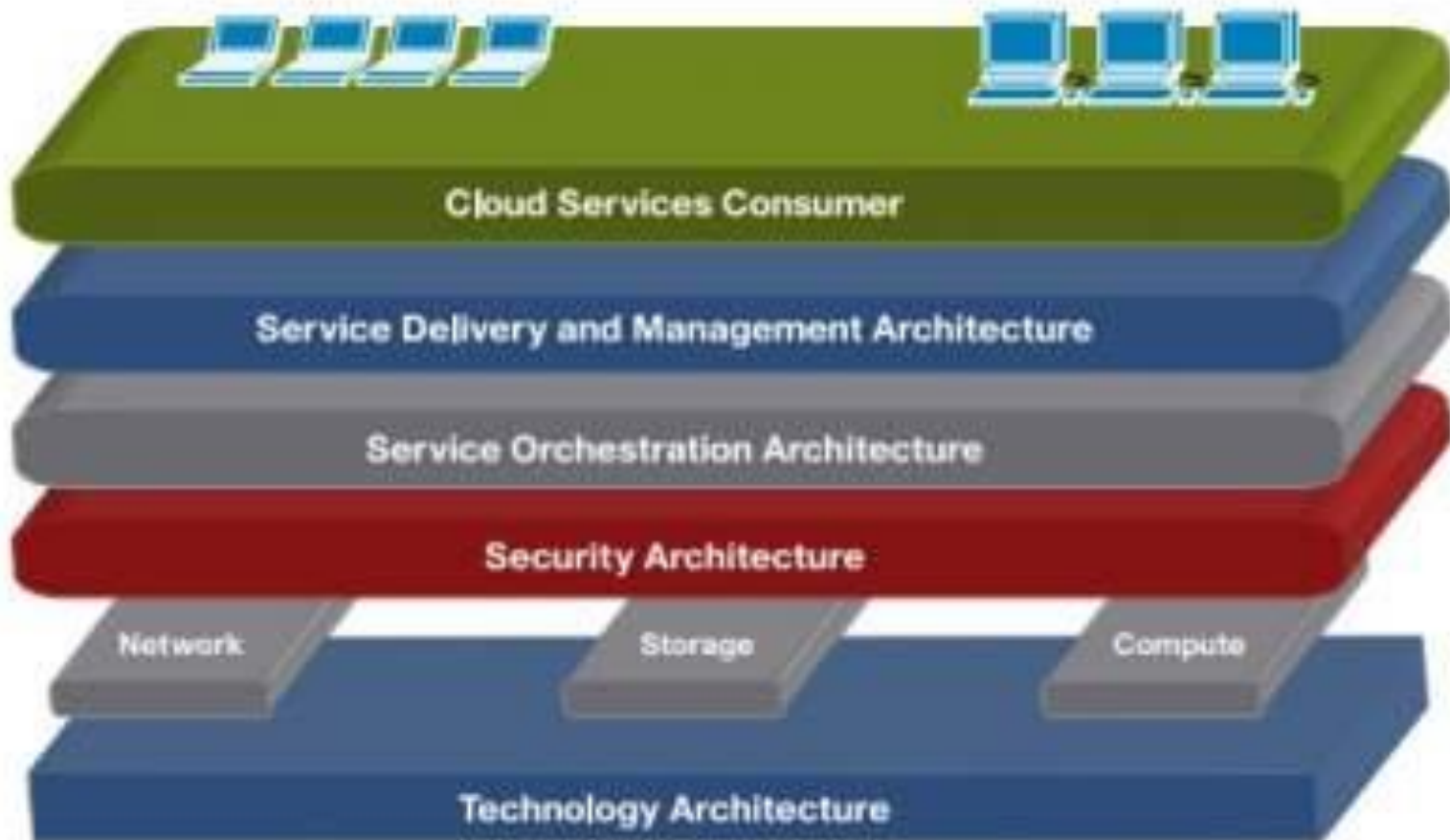
Cloud Security Alliance Reference Model



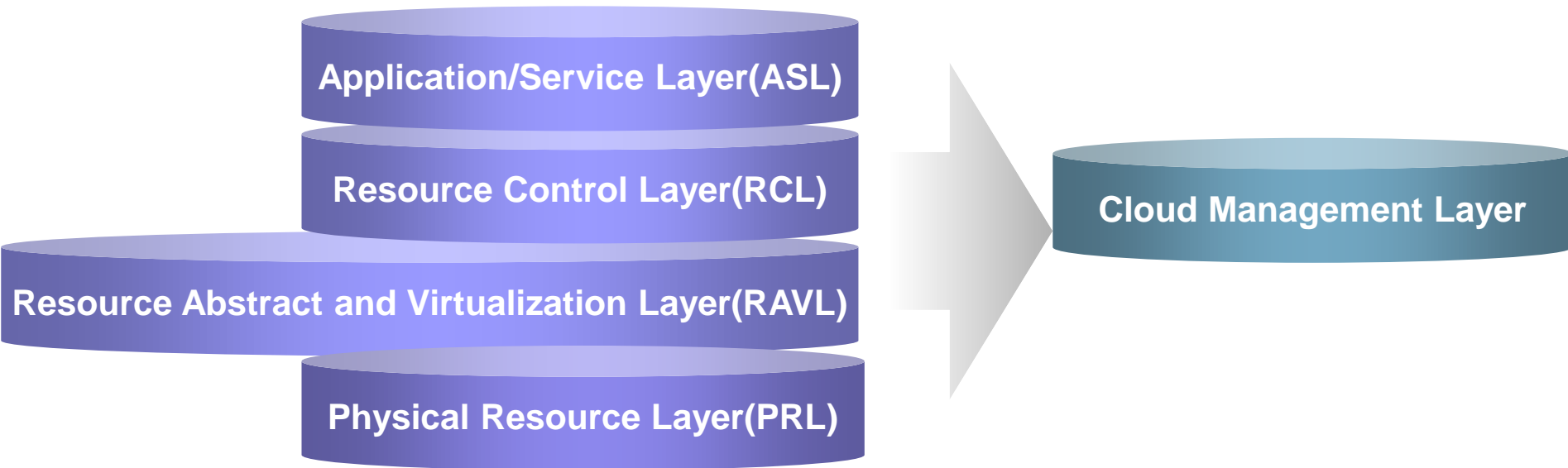
CISCO Cloud Reference Architecture Framework

Cisco Cloud Reference Architecture Framework

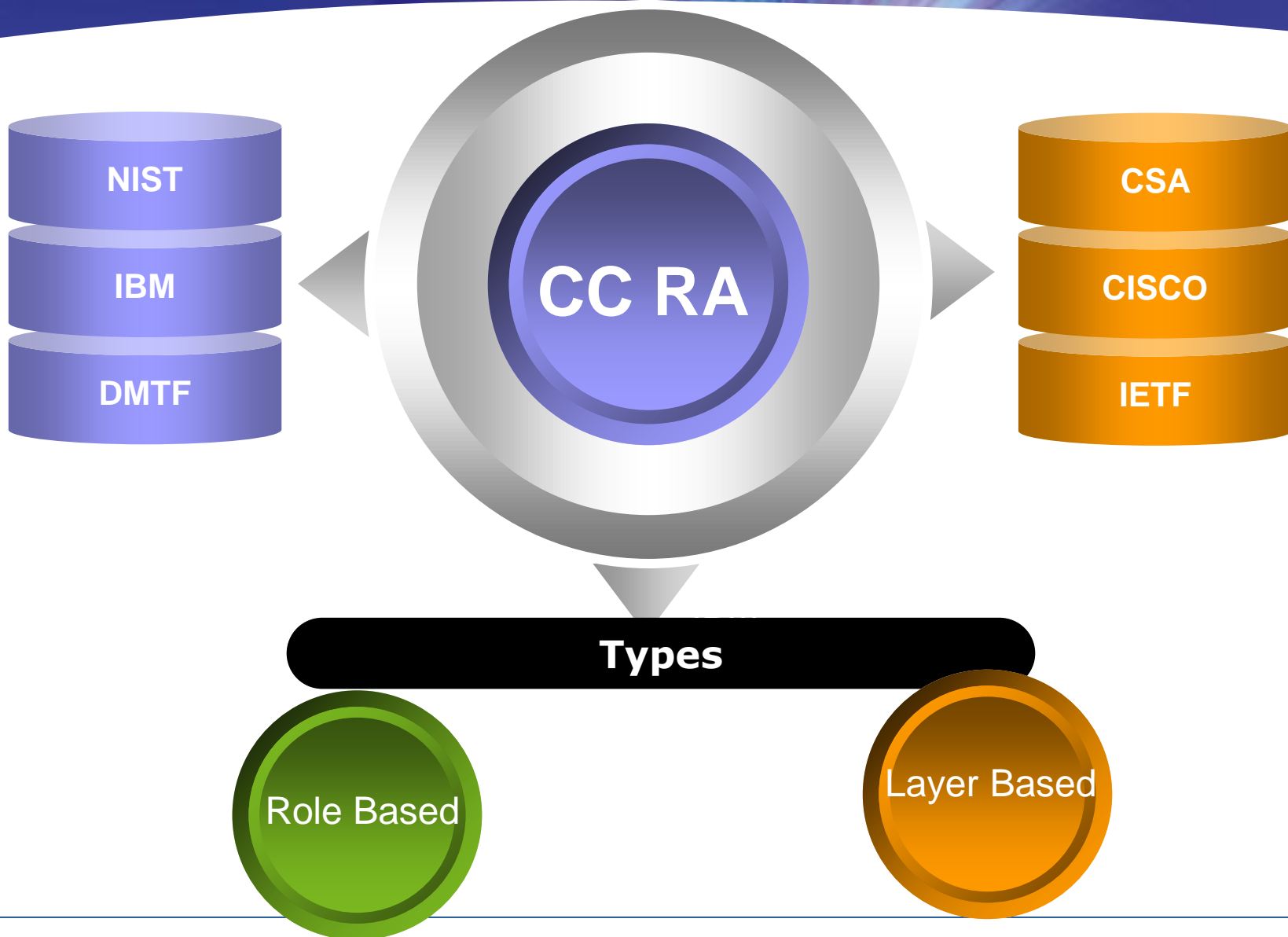
Figure Cisco Cloud Reference Architecture Framework



IETF Cloud Reference Framework



Summary



An abstract graphic featuring a glowing blue and purple sphere with a bright light source, creating a lens flare effect. The sphere is positioned in the center of the image, with light rays emanating from it. The background is a gradient of blue and purple.

Thank You !



EVERY CLOUD HAS A SILVER LINING

PictureQuotes.com