✅ AWS Cloud Practitioner Exam Notes (CLF-C02)

🧠 Domain 1: Cloud Concepts (24%)

1.1 What is Cloud Computing?

- **Cloud computing** is the on-demand delivery of IT resources over the internet with pay-as-you-go pricing.
- No need for owning physical hardware or data centers.

1.2. 6 Benefits of Cloud Computing (Mnemonic: GOESTE):

Benefit	Description
Global Reach	Deploy anywhere in the world instantly
On-Demand	Access resources when you need them
Elasticity	Scale up/down based on demand
Speed	Deploy and build faster
Trade capital for operational expense	No upfront cost; pay for what you use
Economies of scale	AWS offers lower prices due to large-scale operations

1.3 Cloud Deployment Models

Model	Description
Public Cloud	Services offered over the public internet (e.g., AWS)
Private Cloud	Cloud infrastructure used by a single organization
Hybrid Cloud	Combination of on-prem and public cloud

1.4 Cloud Service Models

Model	Example	Description
IaaS	EC2, EBS, VPC	Basic building blocks (compute, network, storage)
PaaS	Elastic Beanstalk	Focus on deploying apps without managing infrastructure
SaaS	Gmail, Dropbox	Complete applications over the internet

1.5 Shared Responsibility Model (Introduction)

In AWS, **security is a shared responsibility** between the customer and AWS.

Responsibility Type	AWS is Responsible For	Customer is Responsible For
Security of the Cloud	Physical infrastructure, networking, data centers	—
Security in the Cloud	—	Data, IAM, OS configuration, encryption, apps

🔐 *Tip: AWS protects the infrastructure; you secure what you build on top of it.*

1.6 AWS Global Infrastructure

Component	Description
Region	A physical location in the world with multiple data centers (e.g., us-east-1)
Availability Zone (AZ)	A data center within a region — used for high availability and fault tolerance
Edge Locations	Content delivery points for Amazon CloudFront
Local Zones	Extend AWS services closer to end users in specific locations
Wavelength Zones	Bring AWS to mobile 5G networks
Outposts	Run AWS services in your own on-premises data center

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🔐 Domain 2: Security and Compliance (30%)

D**omain 2: Security and Compliance**, covers the following: understanding **shared responsibility, access control, compliance programs**, and **security support** on AWS.

2.1 AWS Shared Responsibility Model

Responsibility Type	AWS is Responsible For	Customer is Responsible For
Security *of* the Cloud	Hardware, software, networking, and facilities running AWS services Physical infrastructure, networking, hardware, global infrastructure	Data, identity, operating systems, applications, firewalls
Security *in* the Cloud	—	IAM, patching, permissions, encryption, applications Data, IAM, OS configurations, encryption, applications

🧠 💡**Key Tip:**

- AWS secures the cloud infrastructure. You secure your data, identity, applications, and configuration.
- AWS protects infrastructure; you protect what you run in it.

2.2 AWS Identity and Access Management (IAM)

- **IAM** allows you to manage access to AWS services securely.

✅ Core IAM Concepts

Component	Description
User	Represents an individual account or service needing access
Group	A collection of users with shared policies
Policy	A JSON document that defines permissions (e.g., allow/deny access)
Role	Grants temporary access to resources for AWS services or federated users
MFA	Adds an extra layer of authentication using a device or app

🔐 IAM Best Practices

- Use **least privilege access**
- **Enable MFA** for all accounts
- Use **roles** for temporary access
- **Never** use the root account for daily operations

2.3 AWS Organizations & Service Control Policies (SCPs)

🔷 AWS Organizations

Manage multiple AWS accounts from a **single master account**, typically grouped by department or environment.

🔷 Service Control Policies (SCPs)

Used to define **permission boundaries** across your organization. They do **not grant** permissions — they only limit them.

> Example: An SCP could restrict all accounts in a department from using certain services (e.g., EC2).

2.4 Compliance and Governance

AWS helps customers meet regulatory requirements.

📋 Common Compliance Standards Supported:

- **HIPAA**
- **GDPR**
- **SOC 1, 2, 3**
- **ISO 27001**
- **FedRAMP**

🛠️ Governance Tools

Tool	Purpose
AWS Artifact	Access AWS compliance reports and certifications
AWS Config	Tracks configuration changes to resources
AWS CloudTrail	Logs all API calls and user activity
AWS Trusted Advisor	Gives best practice recommendations (cost, performance, security)

2.5 Security Support and Protection Services

Service	Purpose
AWS Shield	DDoS protection (Standard = free, Advanced = paid)
AWS WAF	Web Application Firewall — filters HTTP traffic
Amazon GuardDuty	Threat detection using ML and threat intel
AWS Inspector	Scans EC2 instances for vulnerabilities
AWS Security Hub	Aggregates security findings from across AWS accounts

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2.6 Data Protection

- **Encryption at Rest**: Uses AWS Key Management Service (KMS), S3 Server-Side Encryption (SSE), etc.
- **Encryption in Transit**: Uses TLS (HTTPS)
- **Key Management**:
    - **AWS KMS**: Manage and use encryption keys
    - **AWS CloudHSM**: Hardware-based key management

⚙️ Domain 3: Cloud Technology and Services (34%)

▶️ **Domain 3: Cloud Technology and Services (34%)** — Covers core services like compute (EC2, Lambda), storage (S3, EBS), networking (VPC), and databases (RDS, DynamoDB).

3.1 🔧 Compute Services

🖥️ Amazon EC2 (Elastic Compute Cloud)

- Provides **virtual machines (VMs)** in the cloud.
- You choose the **OS, CPU, memory, storage, and networking**.
- Use cases: Web apps, backend processing, databases, game servers.

✅ EC2 supports features like:

- **Elastic IPs**
- **Auto Scaling**
- **• Load Balancing**
- **• Spot, On-Demand, Reserved pricing models**

📦 AWS Lambda

- Serverless compute — run code **without provisioning servers**.
- Supports many languages: Python, Node.js, Java, Go, etc.
- **Triggers**: S3 uploads, API Gateway, EventBridge, DynamoDB Streams.

  🧠 Billed per request and runtime in milliseconds. Ideal for microservices and automation.

📤 AWS Batch

- Run large-scale **batch computing jobs** (e.g., data processing, simulations).
- Dynamically provisions EC2 and EC2 Spot resources.

🧱 AWS Fargate

- **Serverless compute engine for containers**.
- Works with ECS and EKS.
- You define the container specs, AWS handles provisioning and scaling.

🚀 AWS App Runner

- Deploy web applications and APIs from code or containers — **no infrastructure management**.
- Automatically builds and scales your app.

📈 AWS Auto Scaling

- Monitors applications and **automatically adjusts compute capacity** to maintain performance and reduce cost.

Supports:

- EC2 instances
- ECS tasks
- DynamoDB read/write throughput
- Aurora replicas

Service	Description
Amazon EC2 (Elastic Compute Cloud)	Virtual machines (VMs) in the cloud. You choose OS, CPU, memory, storage, networking.
Auto Scaling	Automatically add/remove EC2 instances based on demand.
Elastic Load Balancing (ELB)	Distributes incoming traffic across multiple EC2s.
AWS Lambda	Serverless functions. Run code without managing servers.
Amazon Lightsail	Simplified compute service with pre-configured environments (good for beginners, small businesses).
AWS Elastic Beanstalk	Platform-as-a-Service (PaaS) to deploy applications quickly without managing infrastructure.

3.2 Storage Services

🗃️ Amazon S3 (Simple Storage Service)

- Object storage for any type of data (images, videos, logs, backups).
- **Highly durable (99.999999999%)** and scalable.
- Lifecycle policies to archive or delete old data.

Storage classes:

- S3 Standard
- S3 IA (Infrequent Access)
- S3 One Zone-IA
- S3 Glacier / Glacier Deep Archive
- S3 Intelligent-Tiering

📂 Amazon EBS (Elastic Block Store)

- Block-level storage for EC2.
- Like a **hard drive** that can attach to EC2 instances.

Use cases:

- Boot volumes
- Databases
- File systems

📁 Amazon EFS (Elastic File System)

- Fully managed **shared file storage** for Linux EC2 instances.
- Automatically scales storage capacity.
- Use case: Content management systems, shared file workloads.

🗂️ Amazon FSx

- High-performance, fully managed file systems.

Variants:

- **FSx for Windows File Server** – SMB protocol support.
- **FSx for Lustre** – High-performance computing (HPC) and machine learning.

🔢 Amazon S3 Glacier

- Archive storage for data that is **rarely accessed**.
- **Very low-cost** with retrieval times from minutes to hours.

Service	Description
Amazon S3 (Simple Storage Service)	Scalable object storage (files, backups, media, etc.)
Amazon EBS (Elastic Block Store)	Block storage for EC2 instances (like a hard drive)
Amazon EFS (Elastic File System)	Scalable, shared file storage for Linux instances
Amazon Glacier / S3 Glacier	Low-cost, long-term archive storage
AWS Storage Gateway	Hybrid cloud storage (connects on-prem to cloud)

3.3 Database Services

🗃️ Amazon RDS (Relational Database Service)

- Managed relational database service for:
    - **MySQL**
    - **PostgreSQL**
    - **MariaDB**
    - **Oracle**
    - **SQL Server**

Features:

- Automated backups • Read Replicas for scaling
- High availability with **Multi-AZ**

⚡ Amazon Aurora

- High-performance, cloud-optimized database compatible with MySQL and PostgreSQL.
- Offers up to **5x performance** over standard MySQL.

🔄 Amazon DynamoDB

- Managed **NoSQL database** — key-value and document model.
- Scales automatically with **millisecond latency**.
- **DAX** (DynamoDB Accelerator) adds caching.

📊 Amazon Redshift

- **Data warehouse** — optimized for complex **OLAP** queries and analytics.
- Handles **petabyte-scale** structured data.

⚙️ Amazon ElastiCache

- In-memory data store compatible with **Redis** and **Memcached**.
- Reduces DB load and improves app speed.

🧠 Choosing Between Databases:

Use Case	Recommended AWS Service
Traditional SQL database	Amazon RDS
High-speed NoSQL	DynamoDB
Big data analytics	Redshift
Real-time caching	ElastiCache
High-performance RDBMS	Aurora

Service	Description
Amazon RDS	Managed relational database service (supports MySQL, PostgreSQL, SQL Server, etc.)
Amazon DynamoDB	Fully managed NoSQL database service
Amazon Aurora	High-performance, MySQL/PostgreSQL-compatible relational DB
Amazon Redshift	Data warehouse for complex analytics (OLAP)
Amazon ElastiCache	In-memory caching for performance (supports Redis, Memcached)
Amazon Neptune	Managed graph database service

3.4 Networking Services

🔐 Amazon VPC (Virtual Private Cloud)

- Isolated network in the AWS cloud.
- You control:
    - IP ranges
    - Subnets (Public vs Private)
    - Route tables
    - Internet/NAT Gateways
    - Security Groups & NACLs

📡 Subnets & Routing

- **Public subnet**: Accessible from the internet.
- **Private subnet**: Internal-only, no direct internet access.
- **Route Tables**: Control how traffic flows in/out.

🌍 Internet Gateway / NAT Gateway

- **Internet Gateway**: Enables internet access for public subnets.
- **NAT Gateway**: Allows private subnet instances to access the internet (for software updates, etc.) without being exposed.

🛜 AWS Direct Connect

- Dedicated private network connection from on-prem to AWS.
- Use case: Large data transfer, hybrid cloud.

🌐 Amazon CloudFront

- Global **Content Delivery Network (CDN)**.
- Caches content at edge locations for **faster delivery**.

📍 Elastic IP Address

- Static public IP address that you can attach to instances or services.

Service	Description
Amazon VPC (Virtual Private Cloud)	Isolated network for your AWS resources
Subnets	Divide VPC into public and private networks
Route Tables	Direct network traffic
Internet Gateway / NAT Gateway	Allow internet access to/from VPC
AWS Direct Connect	Private dedicated network link from your data center to AWS
Amazon CloudFront	CDN (Content Delivery Network) to cache and deliver content globally
Elastic IP Address	Static, public IP address you can assign to resources

3.5 Content Delivery and Edge Services

Service	Purpose
Amazon CloudFront	Global CDN to cache and serve content close to users
AWS Global Accelerator	Routes traffic through AWS edge locations for improved speed
AWS Local Zones	Brings compute closer to users (gaming, video, etc.)
AWS Wavelength	Brings AWS to telecom 5G networks
AWS Outposts	Run AWS infrastructure in your own data center

Service	Description
Amazon CloudFront	Speeds up delivery of content globally
AWS Global Accelerator	Improves performance and availability using AWS edge locations
AWS Local Zones / Outposts / Wavelength	Bring AWS services closer to users/devices physically

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3.6 Management and Monitoring Services

Service	Purpose
Amazon CloudWatch	Monitoring and logging for AWS resources and apps
AWS CloudTrail	Tracks user activity and API usage
AWS Config	Tracks configuration changes to AWS resources
AWS Trusted Advisor	Provides cost, security, and performance recommendations

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3.7 🚚 Migration and Transfer Services

Service	Purpose
AWS Migration Hub	Central place to Track and manage application migrations to AWS
AWS Database Migration Service (DMS)	Migrate on-prem or cloud databases to AWS
AWS Snowball	Physical device to transfer large amounts of data to AWS (terabytes/petabytes)
AWS Transfer Family	Secure file transfers using SFTP, FTP, FTPS

3.8 Application Integration Services

Service	Purpose
Amazon SQS	Simple Queue Service for decoupling services (message queues) Message queues — decouple components in microservices architecture
Amazon SNS	Simple Notification Service (email, SMS, Lambda triggers) Pub/Sub messaging — email, SMS, Lambda triggers
Amazon EventBridge	Event-driven architecture (connect services via events) Event bus — connect services using events (formerly CloudWatch Events)
Amazon Step Functions	Coordinate components of distributed apps via workflows Orchestration of workflows using state machines

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💰 Domain 4: Billing, Pricing, and Support (12%)

4.1 AWS Pricing Concepts

🧾 Key Pricing Principles:

- **Pay-as-you-go**: Pay only for what you use.
- **Save when you commit**: Use Reserved Instances or Savings Plans.
- **Pay less by using more**: Volume discounts apply for services like S3 and data transfer.

Principle	Explanation
Pay-as-you-go	Only pay for what you use — no upfront costs
Save when you commit	Save money with **Reserved Instances** or **Savings Plans**
Pay less as you use more	Volume discounts apply for high usage (e.g., S3 storage)

📦 Core Pricing Models:

Model	Description
On-Demand	No long-term commitment, pay per hour/second
Reserved	1–3 year commitment, significant discount
Spot	Bid on unused capacity, up to 90% cheaper, can be interrupted
Savings Plans	Commit to a consistent usage level (e.g., $10/hour) for 1–3 years across services

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4.2 Free Tier Offerings

- **12-Month Free Tier**: For new accounts (e.g., 750 hours EC2, 5 GB S3)
- **Always Free**: Services like AWS Lambda (1M free requests/month)
  Trials: Limited-time trials for services

Free Tier Type	Includes
12-Month Free Tier	New AWS customers (e.g., 750 hours EC2, 5 GB S3 per month)
Always Free	Certain services like AWS Lambda (1M requests/month), CloudWatch metrics
Trials	Time-limited trials (e.g., Amazon SageMaker Studio Lab)

💡 *Tip: Always monitor usage to avoid unexpected charges.*

4.3 Cost Management Tools

Tool	Purpose
AWS Billing Dashboard	Overview of bills, usages and account charges
AWS Cost Explorer	Visualize usage and costs over time
AWS Budgets	Set custom budgets and alerts
AWS Cost and Usage Report (CUR)	Detailed spreadsheet of usage
AWS Pricing Calculator	Estimate monthly AWS costs

4.4 Support Plans

Plan	Use Case	Features
Basic	Free, for all users	Billing support, docs, forums
Developer	Testing/non-production	Email access to support, general guidance
Business	Production workloads	24/7 access to engineers, Trusted Advisor checks
Enterprise	Business-critical	Technical Account Manager (TAM), concierge support

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4.5 AWS Marketplace & Billing Consolidation

🛍️ AWS Marketplace

- Buy and deploy **third-party software and services** on AWS.
- Billing is integrated into your AWS bill.

🧾 Consolidated Billing

- Combine multiple AWS accounts into a single **payer account** using AWS Organizations.
  • Benefits include:
    - Shared **volume discounts**
    - **Centralized payment** and budget control
    - **Separation of environments** (e.g., dev, prod)

4.6 🧮 Total Cost of Ownership (TCO) & Cost Optimization

- **TCO Calculator**: Compares on-prem costs vs AWS **cloud-based** infrastructure costs.

💡 Cost Optimization Best Practices

- Use **Auto Scaling** to avoid overprovisioning
- Choose the **right pricing model** (e.g., Reserved, Spot)
- **Clean up unused resources** (e.g., orphaned EBS volumes)
- Set **budgets and alerts**
- Monitor with **Cost Explorer** and **Trusted Advisor**

✅ Summary: Key Focus Areas (All Domains Recap)

Domain	Key Focus Areas
1. Cloud Concepts	Benefits of cloud, deployment models, IaaS/PaaS/SaaS, shared responsibility
2. Security & Compliance	IAM, MFA, compliance, WAF, GuardDuty, KMS, roles & policies
3. Core Services	EC2, S3, RDS, VPC, Lambda, DynamoDB, CloudFront, CloudWatch, migration tools
4. Billing & Support	Pricing models, Free Tier, cost tools, support plans, billing consolidation

Domain	Key Focus
1: Cloud Concepts	Understand benefits, models (IaaS, PaaS, SaaS), and deployment types
2: Security	Shared responsibility model, IAM, compliance, protection tools
3: Services	Core services in compute, storage, networking, and databases
4: Billing & Support	Pricing models, cost management tools, and support plans

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✅ That concludes the **complete AWS Cloud Practitioner exam study notes**. These notes are designed to be concise but comprehensive enough for exam success.