# Domain 1. Designing and planning a cloud solution architecture – 21%

- 🧠 Google Professional Cloud Architect Certification
  - ✅ Exam Duration: 2 hours
  - ✅ Question Format: Multiple choice and multiple select
  - ✅ Delivery Method: Online proctored or in-person
  - ✅ Recommended Experience: 3+ years of industry experience including 1+ years designing and managing GCP solutions
  - 1. Designing and planning a cloud solution architecture – 21%
- 📌 1.1 Understand Business and Technical Requirements
  - 👔 Business Requirements
    - Understand the organization's goals, KPIs, SLAs, and regulatory constraints
    - Identify pain points and opportunities for cloud transformation
    - Use case studies to practice analyzing requirements
  - 💻 Technical Requirements
    - Determine application architecture patterns (e.g., microservices, monolith)
    - Identify compute, storage, database, and networking needs
    - Understand current infrastructure and what will be migrated vs. modernized
- 📌 1.2 Design a Solution Infrastructure
  - 🧱 Architectural Principles
    - Modular Design: Use loosely coupled components
    - High Availability: Use managed services across regions/zones
    - Scalability: Leverage autoscaling (App Engine, GKE, Instance Groups)
    - Resilience: Use failover mechanisms, global load balancing
    - Cost-efficiency: Use preemptible VMs, sustained-use discounts, committed use
  - 🧰 GCP Services

| Need | GCP Service |
|---|---|
| Compute | GCE, GKE, App Engine, Cloud Run |
| Storage | Cloud Storage, Filestore, Persistent Disk |
| Database | Cloud SQL, Firestore, Bigtable, BigQuery |
| Networking | VPC, Cloud Load Balancing, Cloud NAT |
| Monitoring & Logging | Cloud Monitoring, Cloud Logging |

- 📌 1.3 Design for Security and Compliance
  - 🔐 Security Concepts
    - Principle of Least Privilege: Design IAM policies accordingly
    - VPC Service Controls: Mitigate data exfiltration
    - Data Encryption: At rest (Cloud KMS), in transit (TLS), and optionally client-managed keys
    - Identity-Aware Proxy (IAP): Secure access to web apps
  - 📜 Compliance Considerations
    - Use Cloud DLP for sensitive data inspection
    - Understand regulatory frameworks: GDPR, HIPAA, PCI DSS
    - Audit logs with Cloud Audit Logging
- 📌 1.4 Analyze and Optimize Technical and Business Processes
  - 📊 Process Optimization
    - Replace batch jobs with streaming pipelines (Dataflow, Pub/Sub)
    - Automate CI/CD with Cloud Build, Artifact Registry, Deploy
  - 💰 Cost Optimization
    - Choose right-sized machines
    - Apply committed use or sustained use discounts
    - Use Billing Reports and Budgets + Alerts
- 📌 1.5 Design for Availability and Reliability
  - ⚙️ Availability Strategies
    - Multi-zone and Multi-region deployments
    - Cloud Load Balancing across instances and regions
    - Instance Groups with auto-healing
    - Database replication and backups (Cloud SQL HA, Bigtable replication)
  - 🛟 Reliability Tools
    - Design for failure domains
    - Uptime checks and alerting policies
    - Implement graceful degradation and retry logic
- 📌 1.6 Design for Scalability and Performance
  - ⬆️ Scalability Strategies
    - Horizontal scaling: Instance groups, Kubernetes pods
    - Caching: Cloud CDN, Memorystore
    - Sharding and partitioning for databases (Bigtable, BigQuery)
  - ⚡ Performance Optimization
    - Choose regional locations close to users
    - Use VPC Peering or Private Service Connect to reduce latency
    - Optimize query performance in BigQuery (partitioning, clustering)
- 📌 1.7 Design for Cost Optimization
  - 💵 Optimization Tactics
    - Right-size compute instances (GCE → n1/n2/e2, preemptible for batch)
    - Use Autoscaler to avoid overprovisioning
    - Storage classes: Standard vs. Nearline vs. Coldline vs. Archive
    - Monitor spend with Billing dashboards, budgets, alerts
  - ✅ Practice Tip:
    - Study real-world case studies provided in the official GCP study guide. Pay attention to:
    - Business requirements → Cloud architecture design
    - Trade-offs between services (e.g., Cloud SQL vs. Bigtable)
    - Decision-making under constraints (cost, performance, compliance)
- 🔁 Recap Checklist
  - ✅ Can you map business needs to GCP services? ✅ Can you design a multi-region, high-availability architecture? ✅ Do you know when to choose App Engine vs. Cloud Run vs. GKE? ✅ Can you explain IAM policy best practices? ✅ Do you understand data encryption methods in GCP?
  - 📘 Suggested Study Resources:
    - Official Study Guide (GCP Professional Cloud Architect) – by Dan Sullivan
    - Google Cloud Skills Boost (Architecting with GCP series)
  - GCP Whitepapers:
    - Google Cloud Architecture Framework
    - Site Reliability Engineering
    - Case Studies: https://cloud.google.com/certification/guides/cloud-architect

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