Google Cloud Deployment Guide

Developing and executing a multi-phase cloud migration strategy

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Table of Contents

Google Cloud

Introduction

Transitioning workloads and systems to the cloud can be a daunting task, especially when it includes migrating hundreds of users, thousands of virtual machines, and petabytes of data at enterprise scale. Luckily, Google supports customers throughout their migration journey with dynamic products, tools, services, and partners.

The purpose of this document is to help guide enterprise customers with deploying workloads and systems to Google Cloud. Whether a lift-and-shift, application re-architecture, or a hybrid deployment - this document will outline procedures, considerations, and recommendations for before, during, and after a move to Google Cloud.

Disclaimer

This guide is for informational purposes only. Google does not intend the information or recommendations in this guide to constitute legal advice. Each customer is responsible for independently evaluating its own particular use of the services as appropriate to support its legal compliance obligations.

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Pre-Deployment: Cloud Adoption Strategy

Google was one of the first organizations to operate entirely in the cloud. Having experienced all of the benefits and risks cloud has to offer, we've defined a Cloud Adoption Framework to help organizations assess their cloud readiness, enabling them to move to the cloud with confidence.

Cloud Maturity

Prior to moving resources to the cloud, it's important to first establish a plan that will develop your organization's cloud maturity. Google outlines (4) themes that a cloud-first organization should excel in:

01:	02:	03:	04:
LEARN	**LEAD**	**SCALE**	**SECURE**
Programs and training plans are in place to help upskill technical teams	Executive Sponsorship and Leadership support migration to the cloud	Cloud native services are used to reduce operational costs and to automate manual processes	A multi-layered, identity-centric security model is in place to protect services from unauthorized or inappropriate access

Each of these (4) themes will align with one of the below cloud readiness phases, which indicates the current stance of your organization:

01:	02:	03:
TACTICAL	**STRATEGIC**	**TRANSFORMATIONAL**
Individual workloads are in place but there isn't a strategy for future build-out or provisioning for scale. Moving to the cloud is focused on reducing financial costs and having minimal disruption.	Workloads are designed and developed with future needs and scale in mind. People and processes have begun to embrace change, IT teams are efficient and effective in the new technology.	Cloud operations run smoothly and your organization is focused on gaining data insights and performing data analysis. IT has become a business partner, not just a cost center. People and processes are transformed.
Short-term goal focused	*Mid-term goal focused*	*Long-term goal focused*

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Figure 1 - Cloud Maturity Scale[1]

Create short-term, mid-term, and long-term goals for your organization's cloud maturity across all (4) themes, relative to each of the (3) cloud maturity phases. With these goals set, your organization will be on track to gradually transform, drive innovation, update and streamline processes. Once **transformational** status is achieved across the Learn, Lead, Scale, and Secure themes, you have successfully evolved into a cloud-first organization.

Transform with Google

Google offers curated support for customers that need assistance with defining and reaching a cloud readiness state.

Google's Transformation Advisory service helps organizations define business goals and drive change. Additionally, Google's **Cloud Adoption Framework - Cloud Maturity Assessment (CMA)** will pair customers with a Technical Account Manager (TAM) to help lead your organizations' CMA process. Deliverables from this engagement include an overview presentation of the Cloud Adoption Framework, templated CMA forms for your organization to complete, a delivery guide, and a final report assessing your organization's cloud maturity and goals.

For more information about these and other services, contact Google Cloud Sales for Professional Services Consulting.

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[1] Source: Google Cloud Adoption Framework

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Deployment: Cloud Migration Journey

The cloud migration journey is defined by (4) key phases: Assess, Plan, Deploy, and Optimize. In the following sections we'll outline the fundamental steps and considerations for successfully navigating through the cloud migration process.
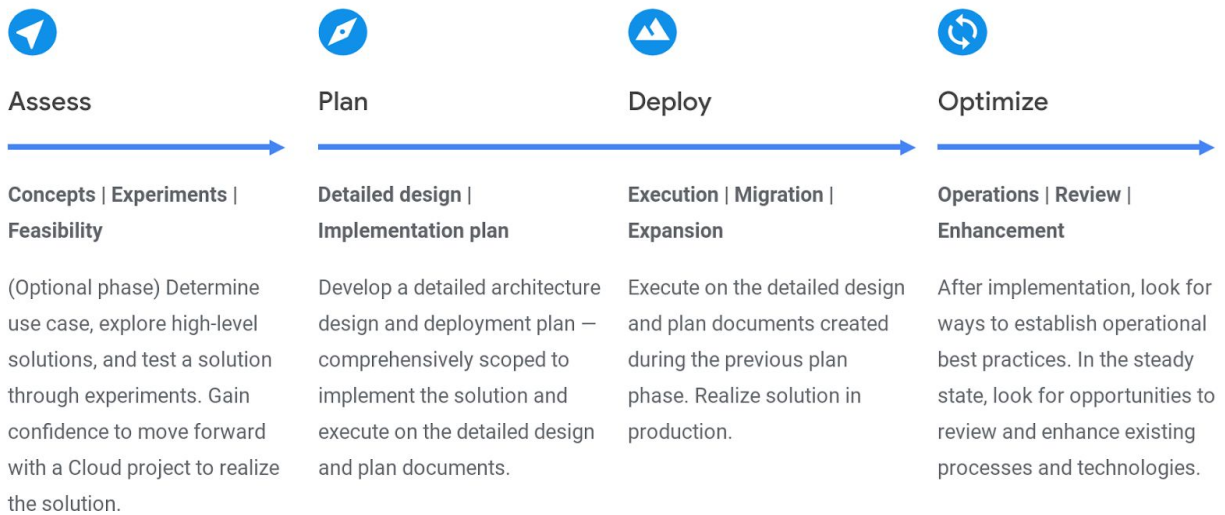
Assess → **Plan** → **Deploy** → **Optimize**

Concepts | Experiments | Feasibility	**Detailed design | Implementation plan**	**Execution | Migration | Expansion**	**Operations | Review | Enhancement**
(Optional phase) Determine use case, explore high-level solutions, and test a solution through experiments. Gain confidence to move forward with a Cloud project to realize the solution.	Develop a detailed architecture design and deployment plan — comprehensively scoped to implement the solution and execute on the detailed design and plan documents.	Execute on the detailed design and plan documents created during the previous plan phase. Realize solution in production.	After implementation, look for ways to establish operational best practices. In the steady state, look for opportunities to review and enhance existing processes and technologies.

Figure 2 - Professional Services Methodology[2]

Phase I: Assess & Discover

Cloud migrations should be preceded by a Cloud Maturity Assessment (CMA). The CMA will help organizations facilitate the decision making process, understand their current environment, set goals, define requirements, and understand the feasibility of moving to the cloud.

Once a cloud assessment has been performed, organizations can focus on the discovery process. This includes mapping out the current environment, applications and networks, identifying workloads to move to the cloud, generating high level solutions and concept documentation.

Below, the primary steps for phase I of the cloud migration journey are outlined:

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[2] Source: Google Cloud Consulting Services

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Phase I Checklist - Assess & Discover

❏ **Assessment**
- ❏ Define your organization's tactical, strategic, and transformational goals
- ❏ Establish training plans to upskill teams
- ❏ Obtain buy-in from leadership
- ❏ Analyze current operational expenses (opex) and capital expenses (capex)
- ❏ Explore how cloud native services can reduce opex, capex, and manual tasks

❏ **Discovery**
- ❏ Determine feasible cloud use cases
- ❏ Define use case and solution requirements
- ❏ Generate maps of application dependencies and networks
- ❏ Explore SaaS, PaaS, IaaS options
- ❏ Document high level solutions & proofs of concept
- ❏ Assemble internal teams & partner teams for execution
- ❏ Craft a plan for multi-layered cloud security & modern identity management

Partner Assisted Assessment & Discovery

A self-service system assessment requires that organizations assemble internal teams that can piece together disparate and convoluted infrastructure components. Google recommends working with handpicked, certified partners that can help guide organizations through the assessment, planning, and migration phases.

With a partner-assisted assessment and discovery, agents that can automatically map servers, application clusters, and networks are deployed to the customer's environment. This alleviates the tediousness of a manual discovery process, accelerates the overall assessment, and makes it easy for customers to develop a subsequent migration plan.

Google gives customers access to hundreds of partners that can help lead the migration assessment process. A few recommended partners to leverage for assessment, discovery, and planning include: Cloudamize, Cloud Physics, and ATADATA.

Assess & Discover with Google

Google's Professional Services Organization (PSO) offers on-site consulting services to assist customers with phase I of the migration journey. The PSO Cloud Start engagement allows technical teams to work with Google subject matter experts (SMEs) for a 3-day consultative workshop. During this workshop organizations will engage in whiteboard sessions and Q&A for architecture design, explore GCP functionality, receive recommendations and define next steps.

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The Cloud Discover: Security engagement will aid customers in understanding security considerations and controls for GCP, while helping organizations identify key security requirements, gaps, and implementation plans. Cloud Discover: Machine Learning assists customers that are new to Machine Learning with understanding ML concepts, identifying potential business problems that can be solved using ML, and defining next steps for technical implementation.

For more information about these services, contact Google Cloud Sales.

Phase II: Plan & Test

Once a cloud migration feasibility assessment and discovery have been completed, the next phase of the cloud migration journey is planning and testing.

Planning covers setting up the Google Cloud Platform foundation elements for development and production environments. This includes instantiating components for administration, cloud identity and access management, networking, monitoring, and billing.

☑ **Admin Console**

Google accounts, domains, users, directory sync, conflict accounts, authentication options, SSO configuration

☑ **Cloud IAM**

Identities, service accounts, roles and scopes, resource manager, hierarchy, projects

☑ **Network**

Regions and zones, GCP networking overview, Cloud VPN, Cloud Router, internal DNS, network security, connectivity

☑ **Monitoring**

Stackdriver, resources, alerting performance, logging, audit, compliance

☑ **Billing**

Billing accounts, budgets, resource manager integration

Through testing, a proof of concept should be set up in the development environment on GCP. This means selecting a small application or workload that addresses a line of business or technology needs, and deploying it to the GCP development environment. This first deployment serves as a real learning experience for establishing cloud development processes, best practices, public cloud feasibility, and technical requirements.

Organizations must consider the following when planning for a cloud migration:

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Phase II Checklist - Planning & Testing

- ❏ **Planning**
  - ❏ Identify first-mover applications, data, and workloads
  - ❏ Define application migration strategy: lift & shift, re-architect, hybrid model
  - ❏ Document approach and technical design documents
  - ❏ Identify key GCP infrastructure considerations and best practices
  - ❏ Create cost models and cost estimates
  - ❏ Identify which virtual resources, machine types, and cloud services to leverage
  - ❏ Create cloud migration timeline and schedule
  - ❏ Define test criteria and success requirements

- ❏ **Setup administrative GCP components**
  - ❏ Establish an Organization Domain - Cloud Identity or G Suite Enterprise
  - ❏ Create Google Accounts - Cloud Identity and/or G Suite Admin Console
  - ❏ Sync users, groups, folders, OUs, and contacts from on-premise Active Directory or LDAP Directories - Google Cloud Directory Sync
  - ❏ Resolve conflicting accounts in Google Directory vs On-premise directory
  - ❏ Configure and enable Google authentication mechanisms - Cloud Identity & G Suite Admin Console
  - ❏ Configure and enable Single Sign On - Cloud Identity & G Suite Admin Console

- ❏ **Establish Cloud Billing**
  - ❏ Complete billing onboarding checklist and establish Billing Accounts
  - ❏ Setup budget alerts and notifications
  - ❏ Implement billing access control

- ❏ **Establish Cloud Identity & Access Management**
  - ❏ Setup identities and service accounts in Google Cloud - Cloud Identity, Cloud IAM, and G Suite Admin Console
  - ❏ Define role based access controls, access policies and scopes - Cloud IAM
  - ❏ Organize the Cloud Resource Hierarchy for the Organization with folders, projects, and project-level resources - Cloud Resource Manager

- ❏ **Create Cloud Networks and Networking Components**
  - ❏ Identify cloud geography and regions to host resources in; consider global, regional, and zonal resource limitations.
  - ❏ Setup VPC networks and components such as Cloud Router, Cloud Load Balancers, and Cloud DNS
  - ❏ Implement hybrid connectivity mechanisms such as Cloud VPN, Cloud Interconnect, Direct Peering or Carrier Peering
  - ❏ Implement distributed data mechanisms such as Cloud Content Delivery Networks (CDN), and CDN Interconnect

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❏ **Implement logging and monitoring across the cloud environment**
  ❏ Configure Cloud Operations Suite to manage all GCP projects:
    ❏ Cloud Logging to store, search, analyze, monitor, and alert on log data and events in GCP, AWS, or On-prem environments
    ❏ Cloud Monitoring for full-stack metrics and monitoring of GCP, AWS, and Hybrid deployments
    ❏ Application Performance Management (APM) to trace, debug, and profile applications

❏ **Testing**
  ❏ Choose a small application or workload to establish a cloud proof of concept
  ❏ Instantiate the application or workload in the GCP development environment using lift & shift, re-architecture, or hybrid implementation
  ❏ Migrate test application or workload to GCP
  ❏ Measure costs, performance, health & metrics against success criteria and requirements
  ❏ Perform smoke tests, sanity tests, functional tests, regression tests, and disaster recovery tests

Partner Assisted Planning & Testing

While self-serve planning and testing requires organizations to create internal teams to forecast cloud costs, assess which cloud resources to use, and manually deploy test workloads, this can be more easily accomplished by leveraging a certified cloud partner.

Many of the partners that assist with the assessment and discovery phase, have tool sets that make it easy for organizations to execute planning and testing as well. For instance, Cloudamize, Cloud Physics, and ATADATA agents not only execute environment discovery, they also suggest appropriate GCP machine types to handle existing workloads, making it easy to perform cost estimation and modeling. In addition, agentless tools like Velostrata make it easy for customers to migrate test workloads to the cloud in an automated way with right-sizing, pre-migration validation and testing, and on-premise stateful rollback enabled.

Plan & Test with Google

As part of the **Cloud Plan** engagement, Google's PSO consulting team provides hands-on support to help customer organizations set up their Google Cloud environment.

Over the span of 24 full time equivalent days, Google SMEs will work on-site and remotely with customers to conduct a technical kickoff workshop, a technical operations workshop, setup

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GCP core foundational elements, create architecture and design documents, perform a first-mover assessment and develop a migration plan.

The Cloud Plan engagement is available in (3) different flavors:

- Cloud Plan: Foundations and Infrastructure
- Cloud Plan: Application Development
- Cloud Plan: Data & Analytics

Contact Google Cloud Sales for more information about these and other consulting services.

Phase III: Migrate

In phase II, a proof of concept migration helps build confidence for a major move to the public cloud. In phase III, a migration strategy is formulated and executed, using what was learned from planning and testing to ensure success. This includes executing detailed design and plan documentation that was created during the previous phase. The goal of migration is to realize solutions in production.

When facilitating a migration to the cloud, organizations should adhere to the following steps:

Phase III Checklist - Migration

- ❏ **Migration Strategy**
    - ❏ Define how your applications and workloads will be moved to the cloud:
        - ❏ Identify **Lift & Shift** applications that can simply be rehosted with automated tools
        - ❏ Identify **Replatformed** applications that will require a few optimizations in order to achieve the benefits of the cloud
        - ❏ Identify applications that will be **Moved to a new SaaS platform**, such as Customer Relationship Management (CRM) systems, HR systems, Customer Management Systems (CMS)
        - ❏ Identify applications that will be **Refactored or Re-architected** to leverage cloud native features, serverless infrastructure, etc.
        - ❏ Identify applications or workloads that will be **Retained** on-premise and revisited for cloud migration at a later date
        - ❏ Identify applications that will be **Retired** and removed from your environment

- ❏ **Move Data**
    - ❏ Calculate how much data will be moved per dataset

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- ❏ Consider all storage options and their dependencies on locality, compute, and access.
    - ❏ [Estimate storage costs](#)
- ❏ Define which [storage options](#) will be used for which datasets
- ❏ Identify how datasets will be moved: batch, offline disk imports, database dumps, streaming, etc.
- ❏ [Define how long](#) it will take to move each dataset and what [transfer methods](#) will be used
- ❏ [Decrease data sizes](#) by deduping and compressing it at the source
- ❏ [Increase network bandwidth](#) by leveraging public Internet connections, Direct Peering, or Cloud Interconnect
- ❏ Transfer data to Google Cloud
    - ❏ Transfer "very close" data first - [data from other clouds](#)
    - ❏ Transfer "close" data [from colocations or on-premise](#) storage
    - ❏ Transfer "far" data that requires [offline transfer](#) or a transfer appliance

- ❏ **Move Applications**
    - ❏ Execute migration strategy to move applications to the cloud
    - ❏ Move applications in order of least complex to most complex; move lift & shift applications first and refactored applications last
    - ❏ Leverage migration tools and partners wherever possible

Partner Assisted Migration

There are a range of migration tools available for deploying workloads and data to GCP. For self-service migrations, GCP customers can leverage [CloudEndure](#) to [move VMs to Google Compute Engine](#). CloudEndure is a free service and is ideal for moving small workloads to the cloud.

For deploying systems to production at enterprise-scale, partners like [Sureline Systems](#) and [Velostrata](#) can help get corporate applications up and running in Google Cloud. Velostrata can help enterprises reduce migration labor and complexity with it's real-time streaming of stateful workloads, while Sureline Systems' SUREdge also provides enterprise-class cloud migration, disaster recovery, data center consolidation, and application mobility capabilities.

Check out Google's cloud migration partners [here](#).

Migrate with Google

Google can help enable enterprise customers in their move to the cloud with a Cloud Deploy engagement. Over the course of (16) full-time equivalent days, Google SMEs and partners will work on-site and remotely with customers to support cloud migration projects. This includes

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developing a project charter that encompasses a plan of deployment activities, conducting regular status meetings to track progress against deployment timelines, providing architecture design reviews and advice, bringing in technical expertise and implementing Google's best practice methodologies.

Cloud Deploy engagements are available for all cloud migration projects and workloads, with a specialized version available for [Machine Learning models](#). Additionally, [Cloud Sprint](#) is a (25) full-time equivalent day engagement that accelerates a customer's application migration to GCP. The Cloud Sprint workshop covers working through detailed design considerations, setting up the foundational infrastructure in GCP, migrating a target application to GCP, and summarizing the next steps.

For more information about these services, contact [Google Cloud Sales](#) for [Professional Services Consulting](#).

Phase IV: Optimize & Validate

Despite having applications and data live in a cloud production environment, the migration journey doesn't stop there. After implementation, operational best practices should be established. Existing processes and technologies should be reviewed and enhanced once a steady state is reached.

Key components for phase IV of the cloud migration journey are highlighted below:

Phase IV Checklist - Optimization & Validation

- ❏ **Validation**
  - ❏ Confirm that all required data and applications have been migrated
  - ❏ Compare migration metrics with expected and planned downtimes
  - ❏ Confirm that data schemas have been properly updated and accurately formatted
  - ❏ Test migrated data with and/or against migrated applications
  - ❏ Ensure that user, application, and data access security has been properly implemented
  - ❏ Perform smoke tests, sanity tests, functional tests, regression tests, and disaster recovery tests
  - ❏ Test interfaces between cloud components and applications
  - ❏ Verify that new and legacy systems can interact as required
  - ❏ Verify application performance and usability, perform health checks and benchmarking
  - ❏ Document lessons learned

- ❏ **Optimization**

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- ❏ Add redundancy across availability zones
- ❏ Implement elasticity with autoscaling groups
- ❏ Implement enhanced monitoring with Cloud Operations Suite, if not already incorporated
- ❏ Offload static application assets to Google Cloud Storage
- ❏ Decouple application tiers using Cloud Pub/Sub
- ❏ Leverage Google Deployment Manager to launch and scale new application instances
- ❏ Use deployment templates and standardized configurations wherever possible for consistency
- ❏ Spread configurations across multiple regions to insulate from regional outages
- ❏ Set limits and quotas on cloud resources and billing
- ❏ Create new user groups, roles and accounts to carry out administrative tasks using least privilege
- ❏ Implement cloud-native and managed services wherever possible
- ❏ Setup continuous monitoring, threat detection, security dashboards and alerts for real-time IT operations management
- ❏ Continue to create and pursue tactical goals in an effort to become a cloud-first organization

Partner Assisted Optimization & Validation

Google's global resource network includes a collection of Specialization Partners that are trained, certified, and have demonstrated success in their areas of expertise. Premier, Specialized Cloud Migration partners like Maven Wave, Deloitte, Accenture, and many more, can help enterprises throughout all phases of the cloud migration journey, including optimization and validation.

Review all of Google's Cloud Migration Specialization Partners in the Partner Directory.

Optimize with Google

Google's Professional Services Consulting is available for customers throughout all phases of the cloud migration process. In addition to Cloud Start, Cloud Discover, Cloud Plan (three options - 1 | 2 | 3), Cloud Sprint, and Cloud Deploy (ML option) engagements for hands on guidance and implementation, Google offers several tiers of cloud support.

Customers can sign up for Role-Based support for in-depth development and investigation or for quick support with live solutions. Additionally, customers can get Enterprise support with Technical Account Management, which includes quarterly business reviews, cloud strategy and roadmap sessions, implementation guidance, and technical support escalations.

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Enterprise support with Technical Account Management is recommended for all enterprise GCP customers, ensuring 24/7 hands-on help for all customer support cases. Learn more about Google Cloud Support options [here](#).

Deployment Recommendations & Considerations

Configuring each cloud infrastructure element detailed in the assess, plan, migrate, and optimize phases of the migration journey are necessary no matter what type of workload is being deployed to the cloud. However, there are additional recommendations and considerations for workflow-specific cloud implementations.

In general, core public cloud use cases can fall into one of five categories:

01	02	03	04	05
Development and Testing	**Hybrid Computing**	**Disaster Recovery**	**Web and Mobile Applications**	**Cloud Native Applications (SaaS)**

In the following sections, the shared security model and recommendations associated with implementing each public cloud use case will be outlined. This will enable organizations to configure additional, Google-prescribed best practices for their cloud environment.

Shared Security Model

Security has increasingly become another draw for enterprises to take advantage of the cloud. With cloud computing, organizations can offload some of the security requirements to the provider, compared to on-premise where the organization must enforce all of its own security. With this shared responsibility model of cloud computing, providers are responsible for securing the infrastructure, and entities are responsible for securing their data.

There are three cloud service models that make up the shared responsibility model for cloud security. At each level, provider and customer accountability varies as such:

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Cloud Service Model	Provider Security Responsibility	Customer Security Responsibility
Infrastructure as a Service (IaaS)	1. Audit logging 2. Network 3. Storage & encryption 4. Hardened Kernel & Internal Process Communication 5. Boot 6. Hardware	1. Content 2. Access policies 3. Usage 4. Deployment 5. Web application security 6. Identity 7. Operations 8. Access and authentication 9. Network security 10. Guest OS data & content
Platform as a Service (PaaS)	1. Identity 2. Operations 3. Access and authentication 4. Network security 5. Guest OS data & content 6. Audit logging 7. Network 8. Storage & encryption 9. Hardened Kernel & Internal Process Communication 10. Boot 11. Hardware	1. Content 2. Access policies 3. Usage 4. Deployment 5. Web application security
Software as a Service (SaaS)	1. Deployment 2. Web application security 3. Identity 4. Operations 5. Access and authentication 6. Network security 7. Guest OS data & content 8. Audit logging 9. Network 10. Storage & encryption 11. Hardened Kernel & Internal Process Communication 12. Boot 13. Hardware	1. Content 2. Access policies 3. Usage

The *Infrastructure as a Service* model gives customers the most freedom to customize their cloud environment, while also requiring that customers implement a greater level of security. In contrast, the *Software as a Service* model places a majority of the security responsibility on the provider, while customers are only responsible for security related to consuming the cloud service.

Every use case for cloud computing will fall into one of these service models, with customers and providers responsible for implementing security accordingly. Luckily, cloud service

providers like Google have best practices, templates, products and solutions that help customers implement security at any level.

Cloud Use Case #1 – Development & Testing

Development and Test environments are prime candidates for a move to the public cloud. By instantiating dev/test environments in the cloud, companies and individuals can leverage the cloud to gain easy, fast, on-demand resources for innovation, without the upfront capital expense. Development and Test environments typically fall under the **IaaS** or **PaaS** service models, where entities either have a customized cloud IT stack or simply develop code and pipelines in the cloud.

When instantiating a development or test environment in the cloud, Google recommends the implementation and consideration of the following:

✓ Use Cloud SDK - contains tools and libraries that enable you to easily create and manage resources for App Engine, Compute Engine, Cloud Storage, BigQuery, Cloud SQL, and Cloud DNS

✓ Manage GCP projects and resources using Cloud Shell, without having to install the Cloud SDK and other tools on your system

✓ Add Cloud Platform as a backend to your Android app directly from the Android Studio IDE

✓ Use Cloud Tools for Visual Studio to enable ASP.NET development in Visual Studio on GCP

✓ Use Cloud Tools for PowerShell cmdlets for Windows PowerShell, to manage Google Cloud Platform resources

✓ Implement continuous delivery with containers: Automatically build, test, and deploy containers to a Kubernetes cluster using Cloud Build, Spinnaker, and Google Kubernetes Engine

✓ Use Cloud Source Repositories, a fully-featured Git repository hosted on GCP, for collaborative development of any application or service

✓ Cloud Debugger lets you inspect the state of your applications running on App Engine or Compute Engine without stopping or slowing it down

✓ Cloud Trace enables you to view the remote procedure calls (RPCs) invoked by your App Engine application

✓ Quickly deploy hundreds of pre-made software packages and system configurations using the GCP Marketplace

✓ Use Deployment Manager to easily and consistently deploy static or dynamic system configuration templates that you define

✓ Configure automatic serverless deployments: Use Cloud Build and Cloud Functions to automatically deploy apps to App Engine

Additional resources: Google Cloud Development Solutions, Google Cloud Test Solutions

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Cloud Use Case #2 – Hybrid Computing

Cloud computing makes it easy to geographically expand existing applications by extending infrastructure to the cloud. Many organizations leverage hybrid computing to gradually transition workloads and services to the cloud, having bi-directional portability. Hybrid computing environments commonly fall under the **IaaS** and **PaaS** service models, where organizations either manage customized VMs and workloads in the cloud, or offload data processing, front ends, storage, or other platforms to a cloud service.

Google recommends considering and implementing the following in a hybrid cloud environment:

✓ Manage containerized applications on-premises and in the cloud, using highly available and scalable Kubernetes clusters on Google Cloud

✓ Containerize on-premise applications and get cloud-ready with GKE On-Prem

✓ Use Knative to build source-centric, container-based applications that can run on-premises, in the cloud, or in a third-party data center

✓ Leverage Google's Cloud Services Platform - hybrid cloud software that combines Kubernetes, Istio, Google Cloud security, infrastructure and operations, to modernize your applications

✓ Use Compute Engine to Scale high-performance virtual machines with per-second billing, customizable CPU and memory, managed instance groups and autoscaling

✓ Connect on-premises or cloud workloads and applications directly to GCP via Cloud Interconnect, IPSec VPN, Direct Peering or Carrier Peering

✓ Use Apigee to design, secure, deploy, monitor, and scale APIs for cloud, legacy, consumer, employee, and partner applications

✓ Use Cloud Operations Suite to monitor and manage services, containers, applications, and infrastructure for multiple cloud, and integrate with on-premise systems

✓ Federate GCP with Active Directory to establish consistent authentication and authorization mechanisms

Additional resources: Google Cloud: Hybrid Solutions

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Cloud Use Case #3 – Disaster Recovery

Disaster Recovery in the cloud gives organizations a flexible, scalable, and modern way to minimize downtime in the event of outages, failures or service disruptions. Instead of buying collections of on-premise servers with under-utilized capacity, cloud computing allows organizations to pay only for the capacity they need, while gaining access to tiered storage and archival options.

Cloud-based disaster recovery solutions typically fall under the **PaaS** cloud service model. Organizations take advantage of backup and archive solutions in the cloud, with data security and access control becoming the customer's primary concern.

Google's recommendations for implementing disaster recovery in the cloud include:

- ✓ Set the delete protection flag on GCE instances to prevent accidental deletion of VMs

- ✓ Use GCE instance templates to save the configuration details of the VM and then create instances from existing instance templates

- ✓ Use managed instance groups work with Cloud Load Balancing to distribute traffic to groups

- ✓ Use Persistent disks for built-in data redundancy and create snapshots of persistent disks to protect against data loss

- ✓ Enable live migration on VMs to keep them running when a host system event occurs

- ✓ Leverage multi-regional and regional storage optimized for geo-redundancy

- ✓ Use GKE to orchestrate high-availability systems; enable node auto repair, multi-zone and regional clusters, and persistent volumes

- ✓ Use Cloud Load Balancing for high availability compute, distributing user requests among instances

- ✓ Programmatically manage DNS entries with Cloud DNS as part of an automated recovery process

- ✓ Transfer data to and from GCP using Cloud Interconnect, Cloud VPN, or Peering

- ✓ Use Cloud Deployment Manager to create repeatable environment deployment templates

- ✓ Use nearline and coldline storage for backup and archival

Additional resources: Google Disaster Recovery Solutions

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Cloud Use Case #4 – Web & Mobile Applications

Modern applications and websites need to be globally accessible, fast, and secure, with the ability to scale for data-intensive processes and unexpected spikes in traffic. The cloud is designed to meet these requirements, delivering automated, high-quality service to end users.

Web and mobile applications in the cloud fall under the **IaaS** or **PaaS** service models, depending on the level of customization and access organizations need to core infrastructure services.

When implementing applications in the cloud, Google recommends customers:

✓ Leverage App Engine to build managed web applications, allowing developers to focus on code

✓ Use GKE for container-based development to automate deployment and scaling

✓ Use Compute Engine for high performance VMs that are customizable

✓ Use Firebase and GCP to provide backend compute and storage for mobile apps

✓ Use Cloud Storage or Firebase to host static websites on GCP

✓ Use Firebase as a unified app platform for iOS, Android, and the web, to build mobile apps that grow your business

✓ Build a managed PaaS with Google App Engine

✓ Build IaaS applications using GCE virtual machines

✓ Use GKE to serve containerized applications for portability and rapid deployment

✓ Use Cloud Functions to write single-purpose functions that respond to cloud events

✓ Leverage Cloud SQL for fully managed relational databases - MySQL and PostgreSQL

✓ Store cloud-native app data globally with Cloud Firestore, a fully managed, serverless, cloud-native, NoSQL database

✓ Implement HTTP load balancing to distribute application serving

✓ Host application servers in multiple regions and zones, using instance templates, managed instance groups, and autoscalers to build resilient and scalable application

Additional Resources: Google Cloud **Web Solutions** & **Mobile Solutions**

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Cloud Use Case #5 – Cloud Native Applications

With more and more companies transitioning to a mobile workforce, end users want to access data from any device at any time. Cloud-native applications and licensing make it possible to replace legacy on-premises applications, enabling users to be productive from anywhere.

Cloud-native applications are part of the **SaaS** cloud computing model, where providers are responsible for IT infrastructure, the platforms that sit on top of that infrastructure, and much of the environment's security. With SaaS, the key responsibility of the customer is content security, access control, and regulation of usage.

Google offers nearly half-a-dozen cloud-native application services with G Suite, enabling customers to connect, create, access, and control data from anywhere. Google also makes it easy to regulate single sign on (SSO), multi-factor authentication (MFA), and identities for other 3rd party applications with Cloud Identity - Google's identity as a service offering. Cloud Identity supports hundreds of pre-integrated 3rd Party applications for SAML-based SSO.

When utilizing cloud-native applications and services, Google recommends the following:

✓ Keep your account secure by setting strong passwords with numbers, symbols, capital & lowercase letters, and at least 8 characters.

✓ Don't use the same password for more than one service

✓ Never entering your credentials after clicking on an untrusted; go directly to the source you are trying to access

✓ Update your operating system and browser regularly to keep your accounts more secure.

✓ Enable two-step verification (2SV), to sign in with something that you know (such as a password) and something that you have (such as a security key or phone code)

✓ Configure activity notifications to report on suspicious activity

✓ Enforce least-privileged, role based access controls through identity and access management

✓ Implement application and data controls such as data loss prevention mechanisms, encryption in transit and at rest, and secrets management with crypto keys

✓ Enable logging and monitoring controls to track user activity, administrative actions, infrastructure events, and data access

✓ Have a central or federated identity management system, with a single source of truth for users, groups, devices, and application

Additional Resources: G Suite Solutions for **Startups**, **Small Businesses**, **Enterprises**, and **Education**

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Summary
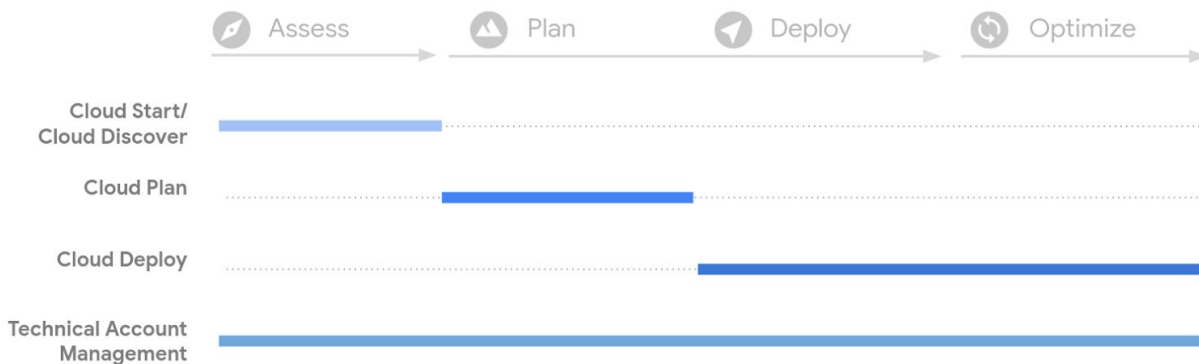
The Cloud Migration Journey starts with organizations performing a cloud maturity assessment, establishing a clear image of the business posture today and the vision for the future. Through defining and executing short-term, mid-term, and long-term goals, organizations work towards developing a tactical business equipped with learning and training vehicles, leadership support, scalability, and layered security for the cloud.

Equipped with a strategy, organizations can then execute a phased cloud deployment. Phase one includes the assessment and discovery of on-premise applications and network structures to understand architectures and requirements. Next is planning and testing for a proof of concept in the public cloud, which encompases setting up the cloud development and production environments. After testing out a pilot application in the cloud, production workloads can be migrated, moving data first and applications second, in the order of least complex to most complex workload. The final phase of the cloud migration journey is a continuous one; cloud workloads should be validated and optimized for peak performance, reliability, availability, and security on a regular basis.

Through each phase of the migration journey, Google has tools, partners, and consulting services that make it easier for enterprise customers to be successful.

We support you through each phase — Google Cloud Platform

Assess · Plan · Deploy · Optimize

Cloud Start/ Cloud Discover
Cloud Plan
Cloud Deploy
Technical Account Management

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Migrating to the cloud makes it possible for individuals, start-ups, and enterprises to access on-demand IT resources at low-cost and global scale. No matter the use case, cloud service providers offer shared support and security for Infrastructure as a Service, Platform as a Service, and Software as a Service customers.

With Google Cloud, organizations can continue to drive development, modernization and innovation across groups large and small. Leverage this deployment guide to move to the cloud with confidence.

Resources

- The five phases of migrating to Google Cloud Platform | GCP blog post
- How to Lift-and-Shift a Line of Business Application onto Google Cloud Platform | Whitepaper
- Migrate data & workloads to the cloud | One-page Summary
- Best Practices for Enterprise Organizations | Google Documentation
- Google Cloud Migration Center | Reference
- Google Cloud Migration Center | Google Resources
- Migrating VMs to Google | Google Resources

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