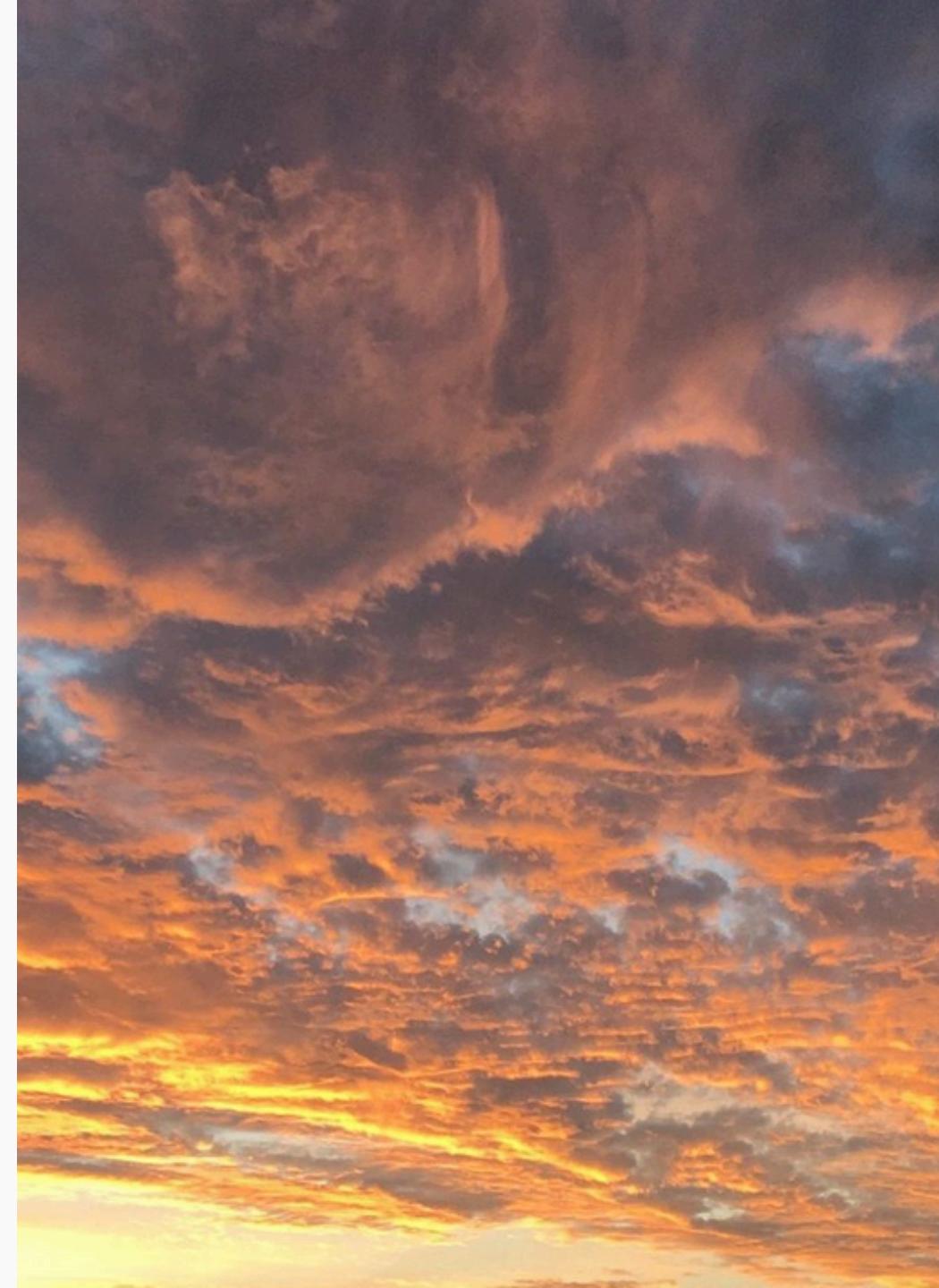


Esoon Ko
IT Högskolan

GCP and Cloud



Cloud Computing

The delivery of various services over the internet, including storage, processing power, databases, networking, software, and more.

These services are provided by **cloud service providers** (CSPs) such as **Google Cloud Platform (GCP)**, **Amazon Web Services (AWS)**, and **Microsoft Azure**.

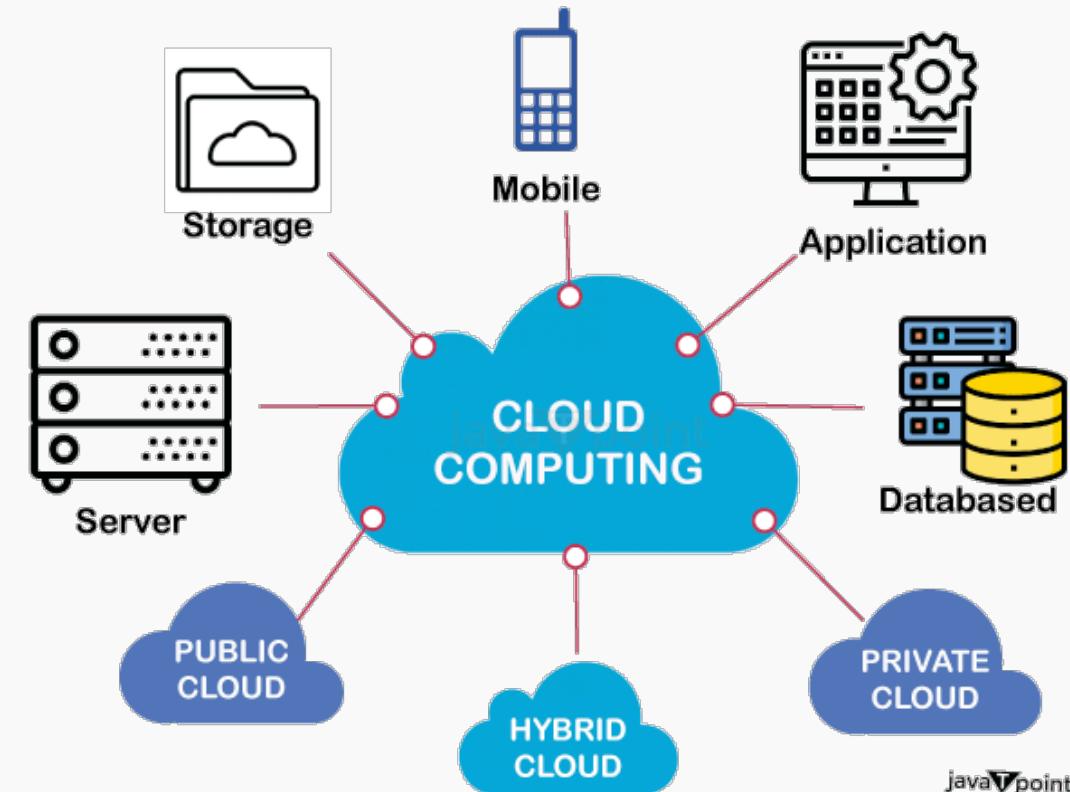


Image source: JavaPoint

What does Cloud Computing offer?

Scalability

- Cloud services can easily scale up or down based on demand without the need for significant upfront capital investment.

Cost-efficiency

- Users only pay for the resources they use, avoiding the costs associated with maintaining physical hardware and data centers.

Reliability

- Cloud providers often offer robust disaster recovery and backup solutions.

Accessibility

- Cloud resources can be accessed from anywhere with an internet connection, promoting remote work and global collaboration.

Performance

- Cloud providers typically use high-performance hardware and maintain global networks of data centers to ensure low latency and high availability.

Cloud Service Models - Infrastructure as a Service (IaaS)

IaaS provides virtualized computing resources over the internet. It includes compute, storage, networking, and virtualization. Customers don't have to manage, maintain, or update their own data center infrastructure, but are responsible for the operating system, middleware, virtual machines, and any apps or data.

This model is suitable for businesses that need control over their infrastructure without the need for physical maintenance or investment.

Examples:

Google Compute Engine

Amazon EC2

Microsoft Azure VMs

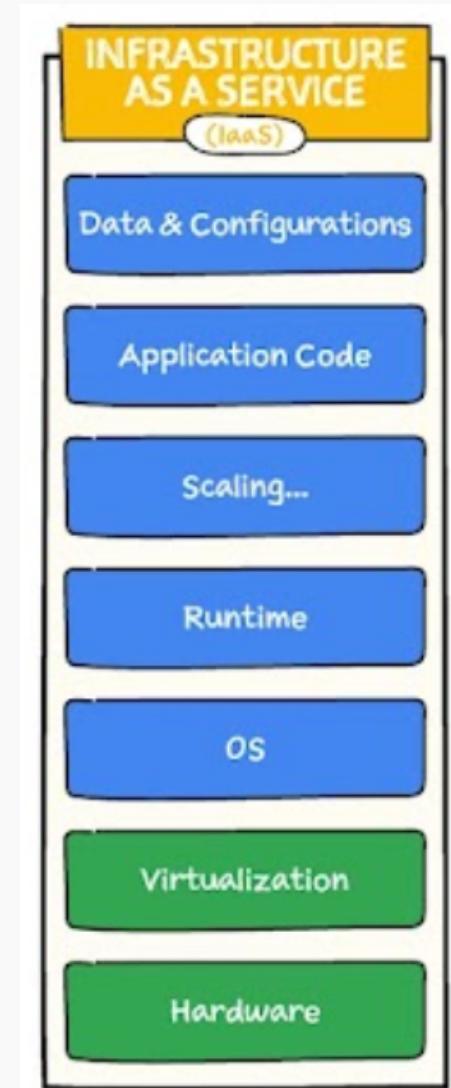
Hetzner



You Manage



Cloud Provider Manages



Cloud Service Models - Platform as a Service (PaaS)

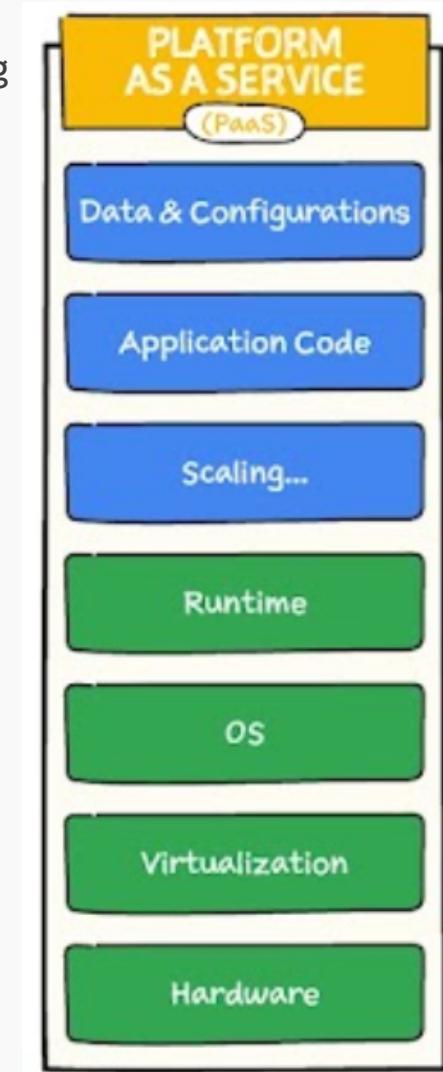
PaaS offers a platform allowing customers to develop, run, and manage applications without worrying about the underlying infrastructure. PaaS delivers and manages all the hardware and software resources to develop applications through the cloud. Customers still have to write the code and manage their data and applications, but the environment to build and deploy apps is managed and maintained by the cloud service provider.

This model is ideal for developers focusing on coding and deploying applications quickly.

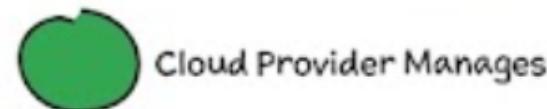
Examples:

Google Cloud Platform App Engine

Microsoft Azure App Service



You Manage



Cloud Provider Manages

Cloud Service Models - Software as a Service (SaaS)

SaaS delivers entire software application stack. The provider manages the infrastructure, security, and updates and come ready to use.

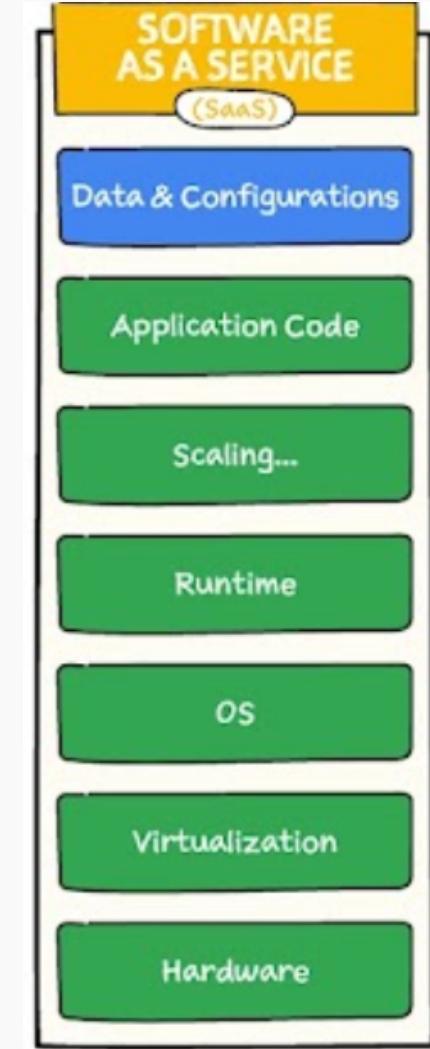
In most cases of SaaS the service automatically scales depending on the demand throughput.

Ideal for end-users who need access to software applications without the hassle of installation and maintenance.

Examples:

Google Cloud Platform

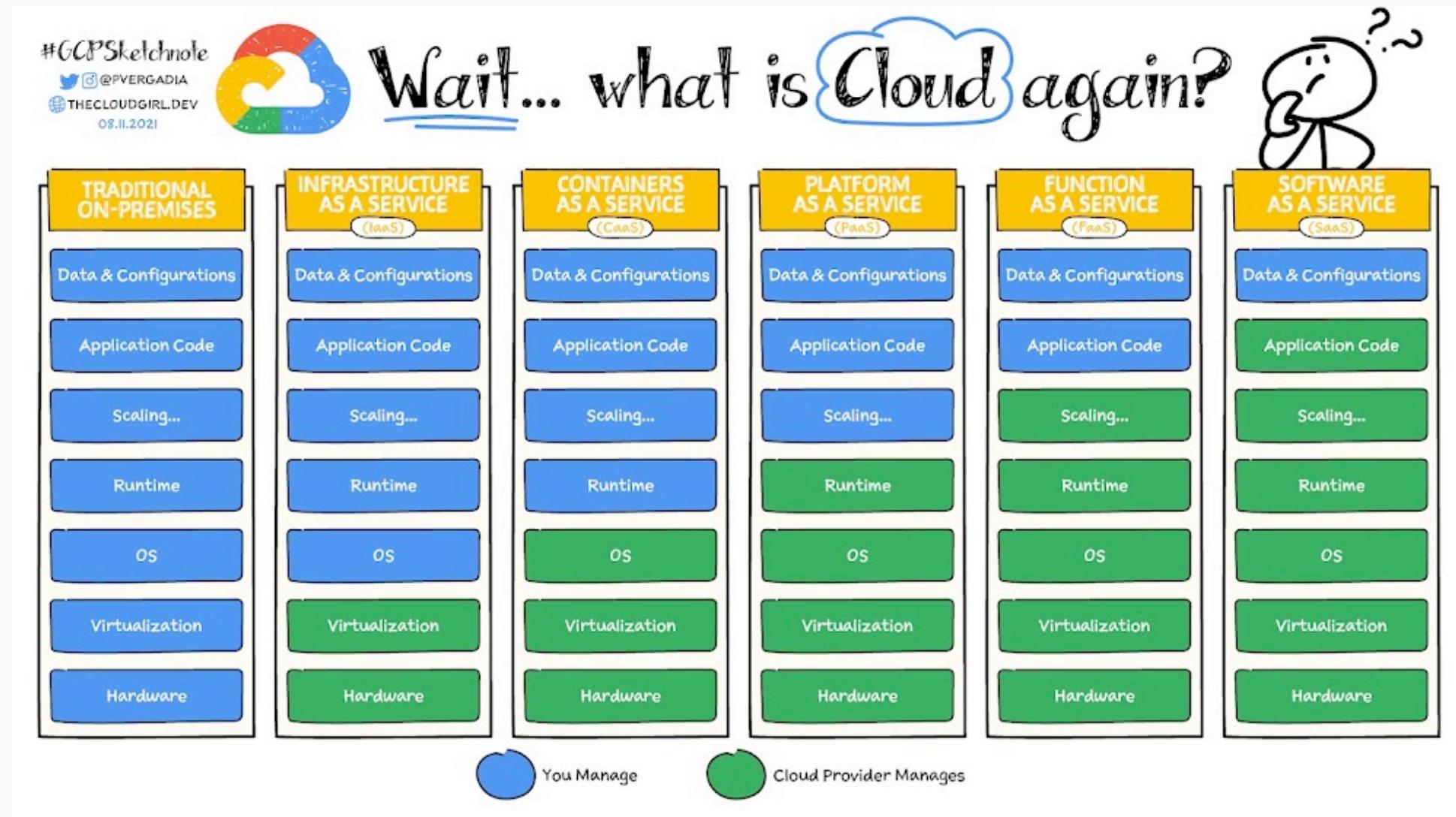
Microsoft Azure



Cloud Service Models

Image source:
www.thecloudgirl.dev

More reading:
[https://cloud.google.com/learn/paas-vs-iaas-vs-saas?
hl=en](https://cloud.google.com/learn/paas-vs-iaas-vs-saas?hl=en)



Cloud Computing benefits

Cost Savings

- Reduces the need for capital expenditure on hardware and software.

Flexibility

- Offers on-demand resources and services to meet varying workloads and demands.

Disaster Recovery

- Provides robust backup and recovery solutions, often built-in.

Automatic Updates

- Ensures systems and applications are always up-to-date.

Collaboration

- Enhances team collaboration with cloud-based tools and applications.

Cloud Computing challenges

Security and Privacy

- Concerns over data breaches and loss of control over sensitive information.

Downtime

- Potential for service outages, though many providers offer high uptime guarantees.

Compliance

- Ensuring compliance with various regulations (e.g., GDPR, HIPAA) can be complex.

Vendor Lock-in

- Risk of becoming dependent on a single cloud provider's services and technologies.

Cost Management

- Without proper monitoring, costs can quickly escalate due to on-demand usage.

So why is **Cloud Computing** used? A few **use cases**:

Serverless Computing

- Allows developers to build applications without managing servers, paying only for the compute time they use.

Edge Computing

- Brings computation and data storage closer to the data source to reduce latency and bandwidth use.

AI and ML Integration

- Cloud providers offering machine learning and artificial intelligence services to enhance data processing and analytics without need to invest in infrastructure.

Hybrid and Multi-Cloud Strategies

- Organizations leveraging multiple cloud environments for flexibility, risk management, and optimization.

So why is **Cloud Computing** used? A few **use cases**:

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Google Cloud Platform

Google Cloud Platform (GCP) is a suite of cloud computing services offered by Google, providing a wide range of tools and services for computing, storage, data analytics, machine learning, and application development.



Google Cloud Platform

Google Cloud Platform (GCP) is a suite of cloud computing services offered by Google, providing a wide range of tools and services for computing, storage, data analytics, machine learning, and application development.

As a suite of services, it offers the following services:

- **Compute Services**

- Google Compute Engine
- Google App Engine
- Google Kubernetes Engine

- **Storage Services**

- Google Cloud Storage
- Google Cloud Bigtable
- Google Cloud SQL

- **Databases**

- Google Cloud Spanner
- Google Cloud Datastore

- **Big Data Services**

- BigQuery
- Dataflow
- Dataproc

- **Machine Learning Services**

- AI Platform
- AutoML

- **Networking Services**

- Virtual Private Cloud (VPC)
- Cloud Load Balancing
- Cloud CDN

- **Management Tools**

- Cloud logging

AND MORE



Getting Started

Setting up an account

Google Cloud Console: Web-based interface to manage GCP resources, services, and projects.

Cloud Shell: Browser-based command-line tool for managing GCP resources directly from the console.

Getting Started



The image shows the top navigation bar of the Google Cloud website. It includes the Google Cloud logo, a search bar, and links for Overview, Solutions, Products, Pricing, Resources, Contact Us, Docs, Support, a language selector (English), Console, a user profile icon, and a 'Start free' button.

Get free hands-on experience with Google Cloud

[Get started for free](#)

[Contact sales](#)

Three ways to get started for free

\$300 in free credit for new customers

New customers get [\\$300 in free credit](#) to try Google Cloud products and build a proof of concept. You won't be charged until you activate your full paid account.

Start deploying pre-built solutions free

Apply your \$300 free credit toward deploying Google-recommended [pre-built solutions](#), such as a [dynamic website](#), [load-balanced VM](#), [three tier web app](#), and [more](#).

20+ products with free tier

Get free usage of [AI APIs](#), [Compute Engine](#), [BigQuery](#), and other popular products [up to monthly limits](#)—not charged against your \$300 free credit.

Getting Started

 Try Google Cloud for free

Step 1 of 2 Account Information

 Esoon
esoon.ko@iths.se [SWITCH ACCOUNT](#)

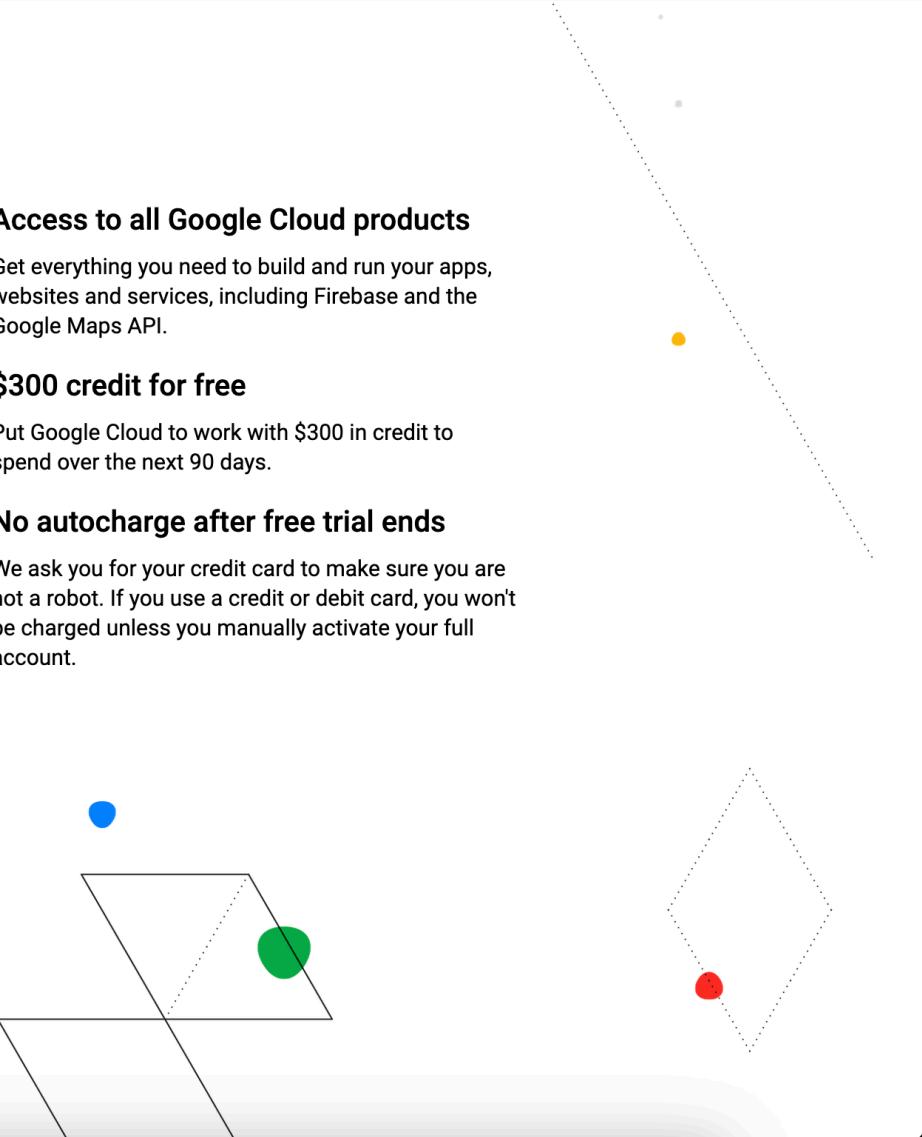
Country

Email updates
 I would like to receive periodic emails on news, product updates and special offers from Google Cloud and Google Cloud Partners.

By using this application, you agree to the [Google Cloud Platform](#), [Supplemental Free Trial](#), and [any applicable services and APIs](#) Terms of Service.

[AGREE & CONTINUE](#)

[Privacy policy](#) | [FAQs](#)



Getting Started

The screenshot shows the Google Cloud Platform 'Getting Started' page. At the top, there's a navigation bar with the Google Cloud logo, a dropdown for 'My First Project', a search bar, and various icons for account management.

The main area starts with a 'Welcome, Esoon' message. Below it, a box displays project details: 'You're working on project [My First Project](#)' (with a question mark icon), 'Number: 863193756816' (with a refresh icon), 'ID: inner-fx-432312-m6' (with a refresh icon), and links to 'Add people to your project', 'Set up budget alerts', and 'Review product spend'.

To the right, there's a callout for 'Try our most advanced model: Gemini 1.5 Pro' with a 'Try Gemini' button and an arrow icon. Above this, there's a decorative graphic of colored dots (blue, yellow, green) and a triangle.

Below these sections, a large box contains the heading 'Recommended based on your interest in Data, AI/ML -'. Under this, there's a section for 'Pre-built solution templates' with three items:

- Summarize large documents using Generative AI**
Generative AI, summarization, machine learning
- Create a data warehouse with BigQuery**
Data warehouse, dashboards, ETL, analytics, data analysis
- Create an analytics lakehouse**
Data science, IoT, streaming analytics

At the bottom left, there's a 'View all Solutions' button.

Getting Started

≡ Google Cloud My First Project ▾ Search (/) for resources, docs, products, and more Search

Notifications

- Create Project: DE-AI23 Just now
[SELECT PROJECT](#)
- Create Project: My First Project 5 minutes ago
[SELECT PROJECT](#)

[SEE ALL ACTIVITIES](#)

Welcome, Esoon

You're in Free Trial

0 out of kr3,253 credits used
Expires November 11, 2024
[What happens when trial ends?](#)

[ACTIVATE FULL ACCOUNT](#)

You're working on project [My First Project](#) ⓘ
Number: 863193756816 ID: inner-fx-432312-m6

[Add people to your project](#)
[Set up budget alerts](#)
[Review product spend](#)

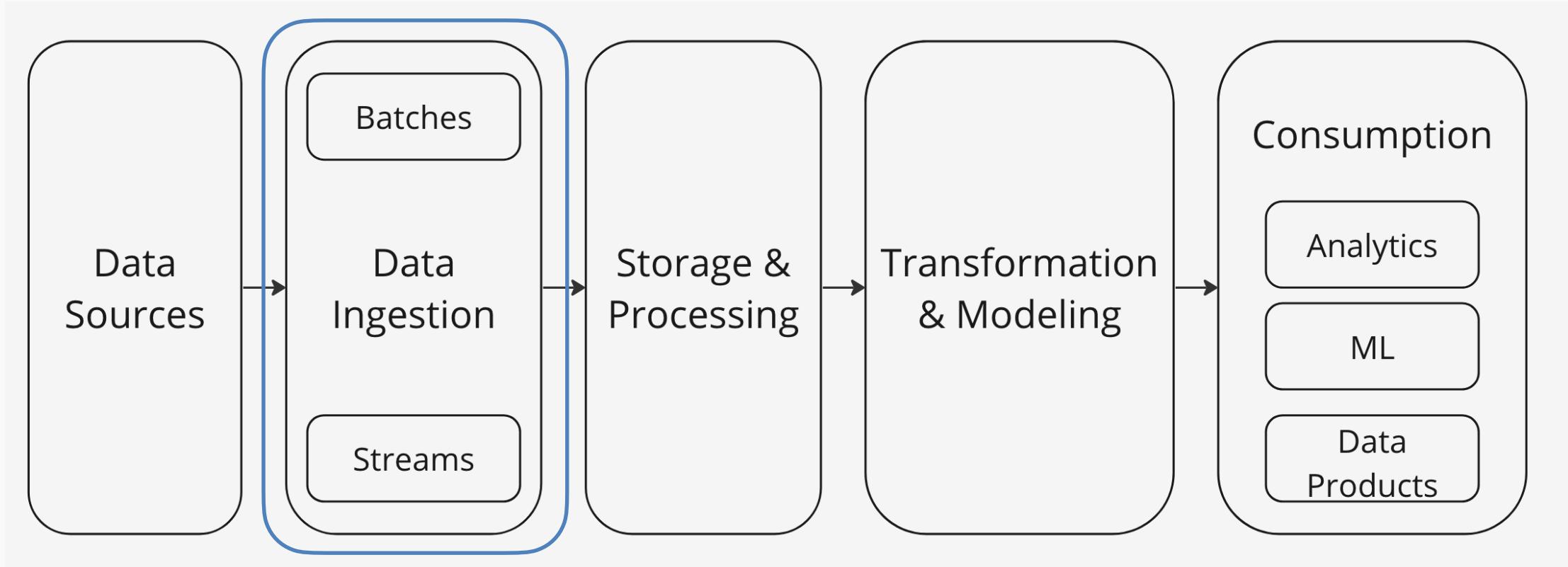
Try Gemini →

Recommended based on your interest in [Data, AI/ML](#) ▾

Pre-built solution templates ⓘ

- Summarize large documents using Generative AI
- Create a data warehouse with BigQuery
- Create an analytics lakehouse
Data science, IOT, streaming analytics

Going back to our stack: Data Ingestion



Google Cloud Functions



Google Cloud Functions

Google Cloud ith-de23ai cloud functions Search 4

Cloud Functions Functions + CREATE FUNCTION REFRESH LEARN RELEASE NOTES

Filter Filter functions

Cloud Functions API is disabled. You will be able to enable it once you create your first function.

Environment	Name ↑	Last deployed	Region	Recommendation	Trigger	Runtime	Memory allocated	Executed function	Actions
No rows to display									

Welcome to Cloud Functions!

Cloud Functions is a lightweight, event-based, asynchronous compute solution that allows you to create small, single-purpose functions that respond to cloud events - without the need to manage a server or a runtime environment.

[Learn More](#)

[CREATE FUNCTION](#) [TAKE A QUICK START](#)

Develop functions locally
Use Cloud Functions in your local dev environment

Testing Cloud Functions
Best practices for testing and deploying Cloud Functions

How-to Guides
Learn the main tasks for Cloud Functions

Tips and Tricks
Best practices for using Cloud Functions

Tutorials
Walkthrough of common applications

Billing and Product Resources
Pricing, quotas, and other information

Google Cloud Functions

Google Cloud Functions is a serverless execution environment for building and connecting cloud services.

Key Features:

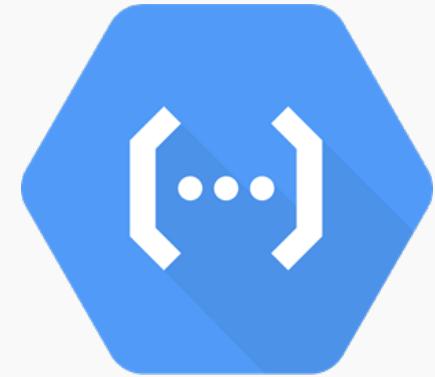
Serverless Architecture: No need to manage infrastructure; scales automatically.

Event-Driven: Functions are triggered by various events, such as HTTP requests, Cloud Pub/Sub messages, changes to Cloud Storage buckets, and more.

Support for Multiple Languages: Write functions in several programming languages, including JavaScript (Node.js), Python, Go, and Java.

Automatic Scaling: Functions automatically scale up or down in response to the number of incoming requests.

Easy Deployment: Deploy directly from your local development environment or via continuous integration pipelines.



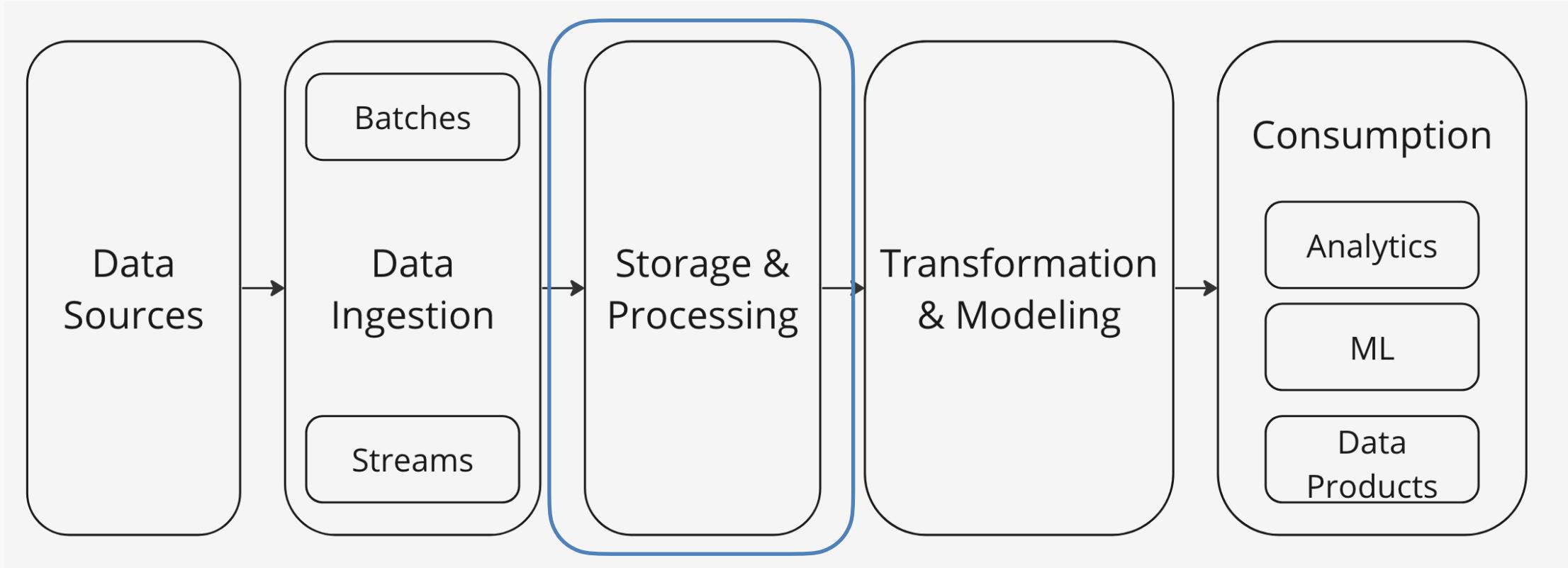
Use Cases:

Real-time Data Processing: Processing and transforming data in real-time, such as streaming data from IoT devices or handling log files as they are written to Cloud Storage.

Scheduled Tasks: Running periodic tasks using Cloud Scheduler to trigger Cloud Functions at specified times for tasks such as sending out reports or maintenance operations.

Webhooks and APIs: Creating lightweight APIs or handling webhook events from third-party services.

Data Storage & Processing



Cloud Storage: Googles Object Storage



Cloud Storage: Googles Object Storage

Google Cloud ith-de23ai google cloud storage Search

Cloud Storage Buckets + CREATE ⌂ REFRESH

Buckets Monitoring Settings

Transfer New Power near real-time analytics and replication with event-driven transfers You can now capture changes faster at your Google Cloud Storage and Amazon S3 sources via event-driven transfers, enabling you to act on your data in near real time. To get started, create a transfer job with a Pub/Sub- or AWS SQS-based event stream configured to send event notifications when objects are created or updated.

[CREATE TRANSFER JOB](#) [LEARN MORE](#)

Security New Introducing the folder browser and folder permissions (using Managed Folders) The object browser is now enhanced with a folder browser allowing you to easily manage and browse through folders inside your buckets. Using the folder browser you can edit the access for your folders, allowing you to manage access (including object listing) to folders and the objects inside them, without granting access to your whole bucket.

[LEARN MORE](#)

Security View security recommendations Improve security by applying security recommendations to your buckets.

[GET PREMIUM](#) [LEARN MORE](#)

Filter Filter buckets

	Name ↑	Created	Location type	Location	Default storage class	Last modified	Public access	Access control	Protection	Bucket retention	Lifecycle rules	Tags	Encryption	Security insights
No rows to display														

Store and retrieve your data Get started by creating a bucket — a container where you can organize and control access to your data and files in Cloud Storage.

[CREATE BUCKET](#) [TAKE QUICKSTART](#)

Cloud Storage: Googles Object Storage

Google Cloud Storage is an object storage service that offers high availability, scalability, and durability for storing and accessing data.

Key Features:

Storage Classes: Different classes for varying access needs (Standard, Nearline, Collin, Archive)

Global Accessibility: Data is accessible globally with strong consistency

Security: Data encryption at rest and in transit, IAM for access control.

Lifecycle management: Automated rules for data retention and deletion.

Performance: High-throughput access, suitable for big data workloads



Use Cases:

Data Lakes: Centralized storage for raw and processed data.

Backup and Recovery: Reliable storage for backups and archival.

Content Delivery: Media files, images, and static content for web and mobile applications.

BigQuery



BigQuery

Google Cloud ith-de23ai Search (/) for resources, docs, products, and more Search

BigQuery Explorer + ADD IK

Analysis

BigQuery Studio

Data transfers

Scheduled queries

Analytics Hub

Dataform

Partner Center

Orchestration

Migration

Assessment

SQL translation

Administration

Monitoring

Jobs explorer

Capacity management

BI Engine

Recommendations

Disaster recovery

Policy tags

SUMMARY

Nothing currently selected

Welcome to BigQuery Studio!

Viewing resources. SHOW STARRED ONLY

ith-de23ai

Queries Notebooks Data canvases External connections

SQL QUERY PYTHON NOTEBOOK DATA CANVAS

Create new

Try with sample data

Try the Google Trends Demo Query

This simple query generates the top search terms in the US from the Google Trends public dataset.

OPEN THIS QUERY VIEW DATASET

Try the Colab Demo Notebook

This notebook walks you through their basics and showcases BigQuery DataFrames.

OPEN THIS NOTEBOOK

Add your own data

Local file

Upload a local file LAUNCH THIS GUIDE

Google Drive

Google storage service LAUNCH THIS GUIDE

Google Cloud Storage

Google object storage service LAUNCH THIS GUIDE

Show welcome page on startup

BigQuery

BigQuery is a fully managed, serverless data warehouse that enables fast SQL queries using the processing power of Google's infrastructure.

Key Features:

Serverless: No need to manage infrastructure; scales automatically.

SQL Interface: Familiar SQL syntax for querying data.

Performance: Optimized for large-scale data analysis with columnar storage and parallel execution.

BigQuery ML: Built-in machine learning capabilities.

Data Transfer Service: Automates data transfer from various sources.

Use Cases:

Analytics: Real-time and batch analytics for large datasets.

Business Intelligence: Integration with BI tools like Looker and Tableau.

Machine Learning: Training and deploying models directly within BigQuery.



Google Cloud Platform - Other Key Concepts

Projects

Regions

Identity and Access Management(IAM)

Billing

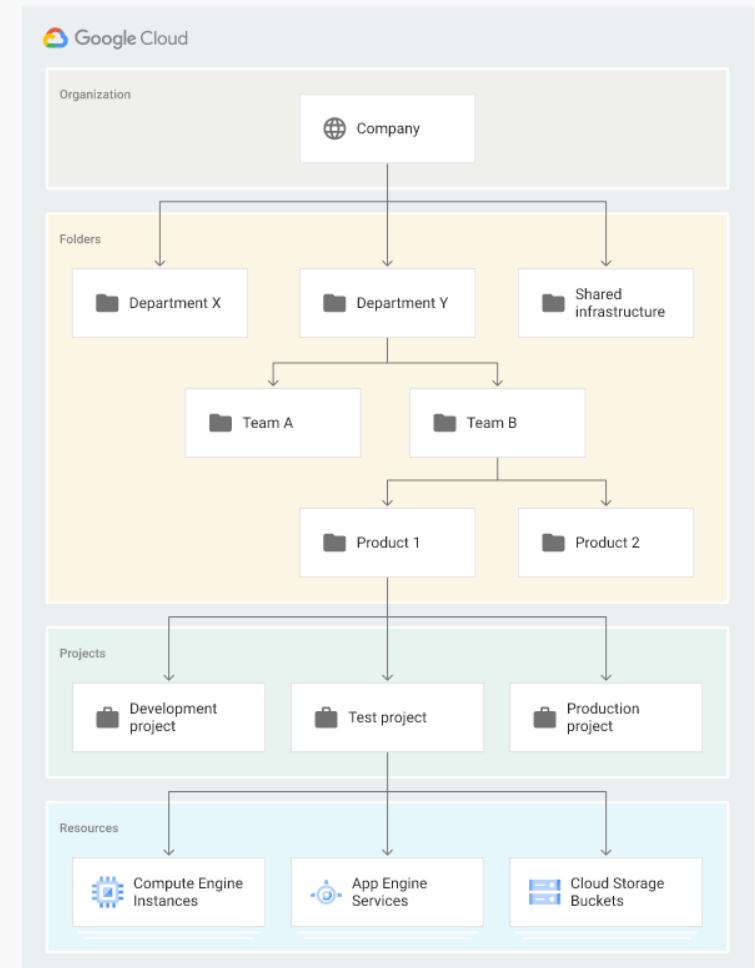
Networking

Security



Google Cloud Platform - Projects

Projects: The fundamental organizational unit in GCP. Projects contain resources and form the basis for enabling and using GCP services, managing APIs, and setting up billing. Each project has a unique project ID and project number.



Google Cloud Platform - Regions

Regions: specific geographic locations where Google hosts its data centers. Each region is a collection of zones, which are isolated locations within a region. By deploying resources in multiple regions and zones, you can enhance the availability and resilience of your applications.

Region: A specific geographical location where you can host your resources
(example `europe-west1`)

Zone: An isolated location within a region
(example `europe-west1-a`)

Multi-regional Services: Some GCP services are offered as multi-regional, operating across multiple regions for higher availability and fault tolerance.

Factors to consider:

Latency

Redundancy and availability

Compliance and data residency

Cost



Google Cloud Platform - Identity and Access Management (IAM)

IAM: IAM is a framework of policies and technologies that ensures the right individuals have the appropriate access to technology resources. In GCP, IAM lets you manage access control by defining who (**identity**) has what access (**role**) to which **resource** through “**policies**”.

Principals (Identities):

Users: Individual human users.

Groups: Collections of users.

Service Accounts: Accounts for applications and virtual machines to authenticate and make API requests.

Google Groups: Email-based groups managed through Google Groups.

Resources: GCP resources include projects, Compute Engine instances, Cloud Storage buckets, BigQuery datasets, and more.

Roles:

Primitive Roles: Basic roles that existed before IAM, including Owner, Editor, and Viewer.

Predefined Roles: Roles created and maintained by Google that grant a set of related permissions (e.g., roles/storage.objectViewer).

Custom Roles: User-defined roles with a specific set of permissions tailored to the needs of the organization.

IAM Policies: Define who (**identity**) has what type of access (**role**) to which **resource**. Policies are assigned at the project, folder, or organization level and can be inherited by resources within them.



Google Cloud Platform - Identity and Access Management (IAM)

The screenshot shows the Google Cloud IAM interface for the project "ith-de23ai". The search bar at the top contains "iam & admin".

The left sidebar menu includes:

- IAM & Admin
- IAM** (selected)
- PAM (NEW)
- Principal Access Boundary
- Identity & Organization
- Policy Troubleshooter
- Policy Analyzer (NEW)
- Organization Policies
- Service Accounts
- Workload Identity Federation
- Workforce Identity Federation
- Labels
- Tags
- Settings
- Privacy & Security
- Identity-Aware Proxy
- Roles
- Audit Logs
- Essential Contacts
- Asset Inventory
- Quotas & System Limits
- Groups

The main content area displays "Permissions for project 'ith-de23ai'". It shows two entries:

Type	Principal	Name	Role	Security insights	
<input type="checkbox"/>		1064298986383-compute@developer.gserviceaccount.com	Compute Engine default service account	Editor	
<input type="checkbox"/>		esoonko@gmail.com	Esoon Ko	Owner	

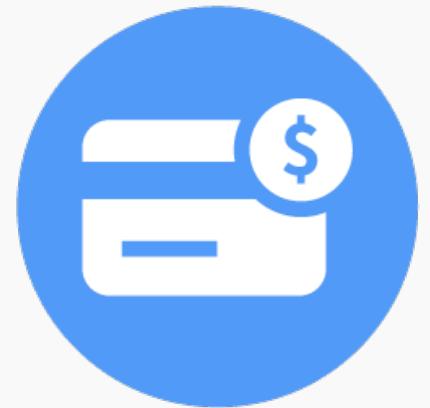
Google Cloud Platform - Billing

Billing: A collection of tools that help you track and understand your Google Cloud spending, pay your bill, and optimize your costs.

Billing account: Linked to projects and used to manage costs. You can set up billing alerts and export billing data to BigQuery for analysis

Cost Management: Monitoring tools to manage your billing costs.

Budgets and Alerts: Tools to track spending and set up alerts to notify when you approach or exceed your budget.



Google Cloud Platform - Billing

Google Cloud

billing x Search

Billing Overview PAID ACCOUNT MANAGE BILLING ACCOUNT

BILLING ACCOUNT OVERVIEW PAYMENT OVERVIEW

Overview PAID ACCOUNT MANAGE BILLING ACCOUNT

Your total cost (July 1 – 30, 2024) ?

Cost Credits used Total cost

kr0.00 – kr0.00 = kr0.00

View details LAST 7 DAYS CURRENT MONTH

Forecasted total cost Available once there is enough usage

Cost breakdown

Budgets & alerts

Billing export

Cost optimization

FinOps hub

Committed use discounts (CUD analysis)

Pricing

Cost estimation

Credits

Documents

Transactions

Payment settings

Payment method

Billing management

Account management

LAST 7 DAYS CURRENT MONTH

FinOps Hub with carbon tracking NEW

Optimize cloud spend and reduce carbon impact.

View details

Save up to kr0.00

0% of last month's total cost

FinOps score

FinOps maturity: Not available

→ View details on FinOps hub

Billing health checks

Check out your account health results to avoid common billing-related issues and adopt our best practice recommendations. [Learn more](#)

All issues resolved!

→ View all health checks

Top projects

July 1, 2023 – July 31, 2024

kr1

kr0.50

kr0

→ View report

Top services

July 1, 2023 – July 31, 2024

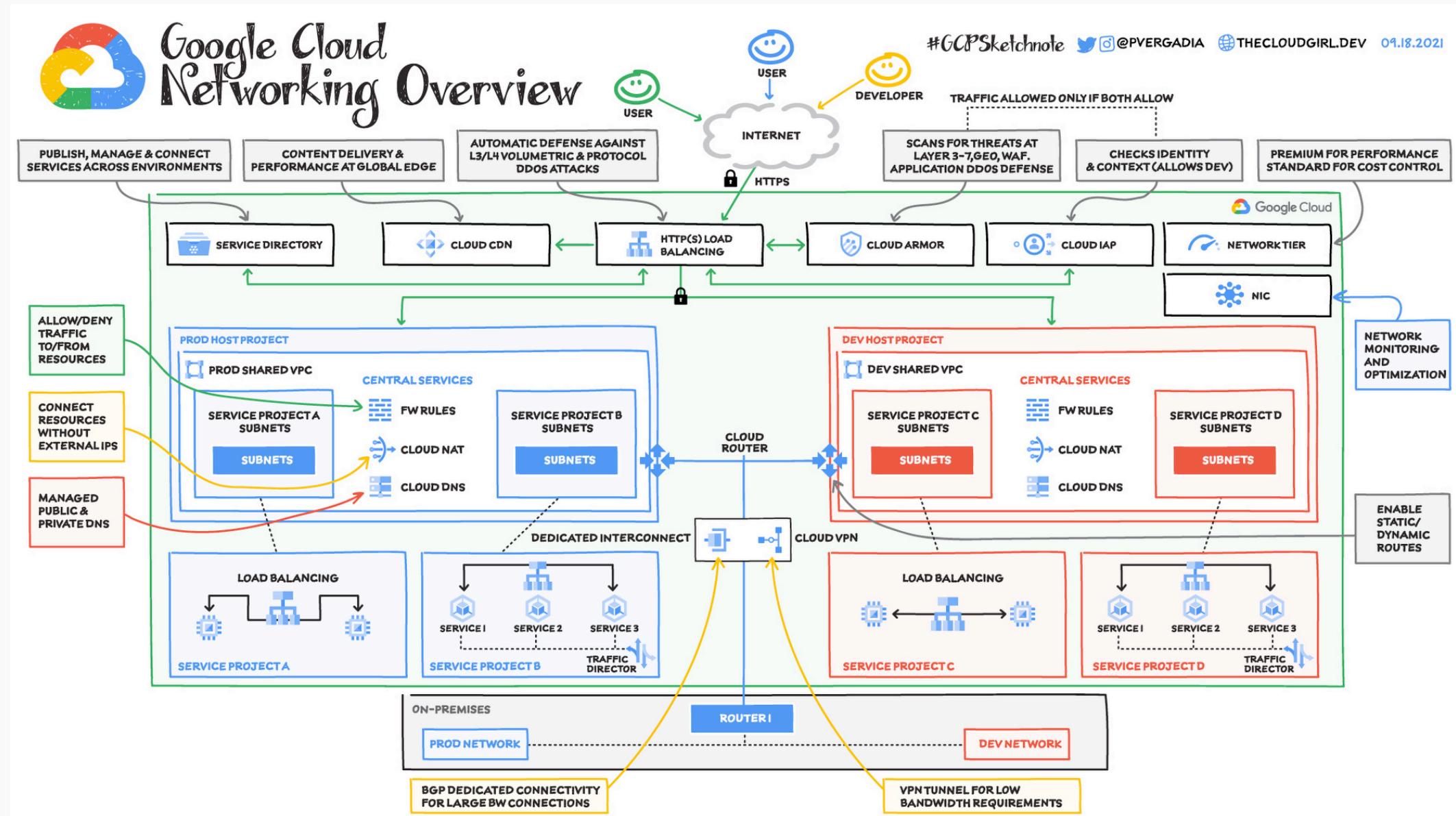
kr1

kr0.50

kr0

→ View report

Google Cloud Platform - Networking



Google Cloud Platform - Networking

Networking: Google offers networking services and products. Some of them are:

Virtual Private Cloud (VPC): Virtual networks that provide connectivity, provisioning and isolation for your GCP resources. VPC networks are global in scope and contain regional subnetworks (subnets).

Cloud Load Balancing: Distributes incoming traffic across multiple instances to ensure high availability and reliability.

Cloud Domain Naming System (DNS): A scalable, reliable, programmable, and managed authoritative domain naming system (DNS) service running on the same infrastructure as Google. Cloud DNS translates domain names like www.google.com into IP addresses like 74.125.29.101.

And more

Google Cloud Platform - Security



Google Cloud Security Controls



#GCPsketchnote [@PVERGADIA](#) [THECLOUDGIRL.DEV](#) 11.07.2021



GOVERNANCE, RISK & COMPLIANCE

Third-party audits and certifications
Google Vault for G Suite

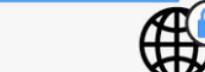
IDENTITY & ACCESS MANAGEMENT

Cloud Identity | Cloud IAM | Cloud IAP | CICP
Titan Security Key | Cloud Resource Manager | BeyondCorp Enterprise



ENDPOINT SECURITY

Safe Browsing | Device Management



DATA SECURITY

Encryption at Rest | Cloud KMS | Secret Manager | EKM | HSM | VPC SC | Cloud DLP

SECURE SOFTWARE SUPPLY CHAIN

Binary Authorization

APPLICATION SECURITY

Apigee | reCAPTCHA

NETWORK SECURITY

Cloud VPCs | Encryption in Transit | Cloud Armor | Cloud Load Balancing

INFRASTRUCTURE SECURITY

Cloud Infrastructure | Purpose-built Chips | Purpose-built Servers | Purpose-built Storage | Purpose-built Network | Purpose-built Data Centers



SECURITY MONITORING & OPERATIONS

Cloud Logging
Cloud Audit Logging

Cloud Security Command Center

Cloud IDS
G Suite Security Center
Access Transparency

Forseti

Google Cloud Platform - Security

Security: Applies to securing infrastructure, network, data, applications, and managing access and identities (IAM). Security is built on the different layers of the stack. Should not be lacking in any area.

Infrastructure Security: Cloud providers are responsible for providing infrastructure security, which includes security through the entire information processing life cycle including hardware infrastructure, service deployment, storage services, user identity, internet communications and operational and device security.

Network Security: VPC, Firewall rules, Cloud Intrusion Detection System (IDS) and so on.

Application Security: API Gateway, Cloud Load Balancing and so on.

Software Supply Chain Security: Securing your software through code, test & scans and deploy & runs.

Data Security: GCP provides built in security such as encryption at rest and in transit but the developer needs to secure their application data security.

Identity and Access Management

Endpoint security: Security towards users. DNS (Safe browsing) and API security.

Security monitoring and operations: Through monitoring detect, respond to and remediate threats in cloud.

Governance, risk and compliance: Understanding security risk, defining and enforcing policy. GDPR is included in here.

Read more at: <https://cloud.google.com/blog/topics/developers-practitioners/google-cloud-security-overview>