

# Application Infrastructure Services

## Architecting with GCP Fundamentals: Infrastructure

CLOUD PUB/SUB, CLOUD ENDPOINTS, CLOUD FUNCTIONS, CLOUD SOURCE REPOSITORIES, ML APIS

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## Application Infrastructure Services

- Services commonly required by applications and systems
- Services that can be provided by an infrastructure better than by the application itself
- Communication between distributed parts of an application
- API exposure and management
- Functions that run without an explicit server

## Agenda

- **Cloud Pub/Sub**
- API Management
- Cloud Functions
- Cloud Source Repositories
- Specialty APIs
- Quiz

## Cloud Pub/Sub

- Cloud Pub/Sub is a fully-managed real-time messaging service that allows you to send and receive messages between independent applications
- Decouples the sender and receiver
  - Asynchronous communications
- Many benefits over direct communication



Cloud Pub/Sub

<https://cloud.google.com/pubsub/architecture>

Google Cloud Pub/Sub is a fully-managed real-time messaging service that allows you to send and receive messages between independent applications.

## Benefits of Cloud Pub/Sub

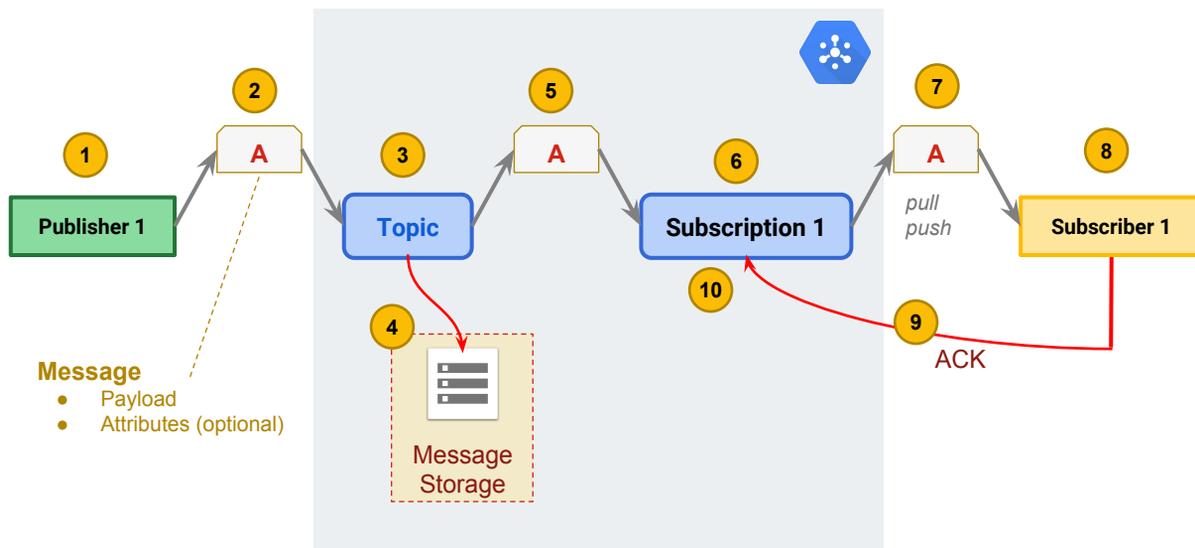
- Scales globally
- Low latency
  - Dynamic rate limiting
- Availability
  - Durability - replicated storage of messages
  - Reliability
  - End-to-end reliability via application ACKs
- Security
  - Encryption in motion and at rest
- Maintenance free



Cloud Pub/Sub

<https://cloud.google.com/pubsub/architecture>

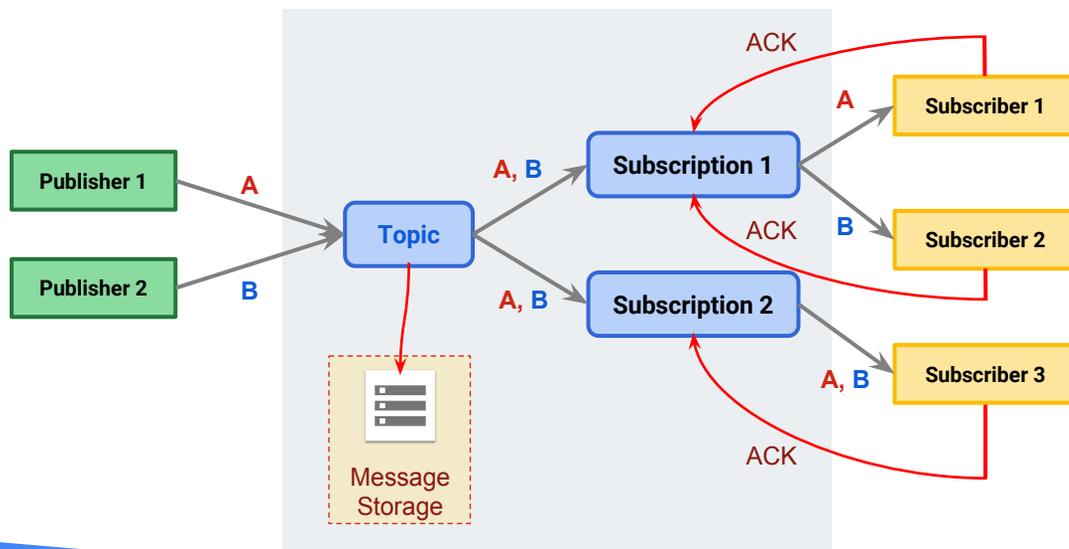
## Cloud Pub/Sub: the basics



Cloud Pub/Sub uses two levels of indirection between the publisher (producer) and the subscriber (consumer). This decouples the sender's transmission of the message from the receiver's receipt of the message.

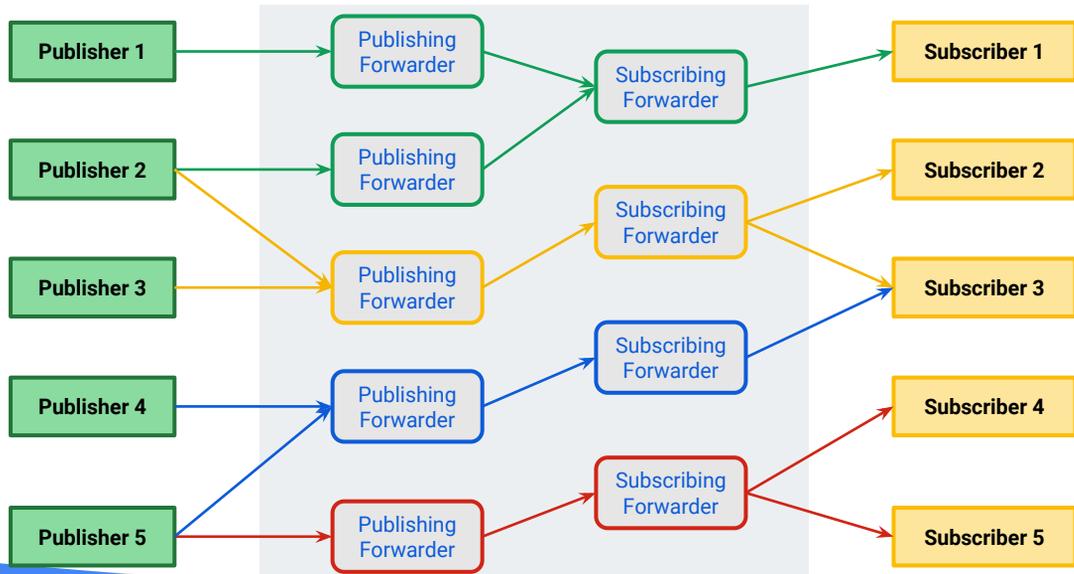
- (1) A publisher wishes to publish a message. A message is simply data in transit through the system.
- (2) The message consists of a payload and optional attributes that describe the payload.
- (3) The message is published to a specific topic. A topic is a feed of messages.
- (4) The topic stores the message, ensuring availability and reliability.
- (5) The message is transmitted to one or more subscriptions. A subscription is an entity that represents interest in receiving messages.
- (6) The subscription determines which subscribers are registered to receive the message, and queues up the message to be sent.
- (7) Subscribers can either receive the message through pull or push. The subscribers either receive messages by Pub/Sub *pushing* them to the subscriber's endpoint, or by *pulling* them from the service. Pull subscribers use HTTPS requests to google APIs. Push subscribers use Webhook endpoints that can accept POST requests over HTTPS
- (8) The message arrives at the subscriber, where it is consumed.
- (9) After the message is consumed, the subscriber sends an acknowledgement (ACK) to the subscription.
- (10) The subscription registers each delivery. When all of the deliveries are complete, it removes the message from the queue.

## Multiple Publishers and Subscribers



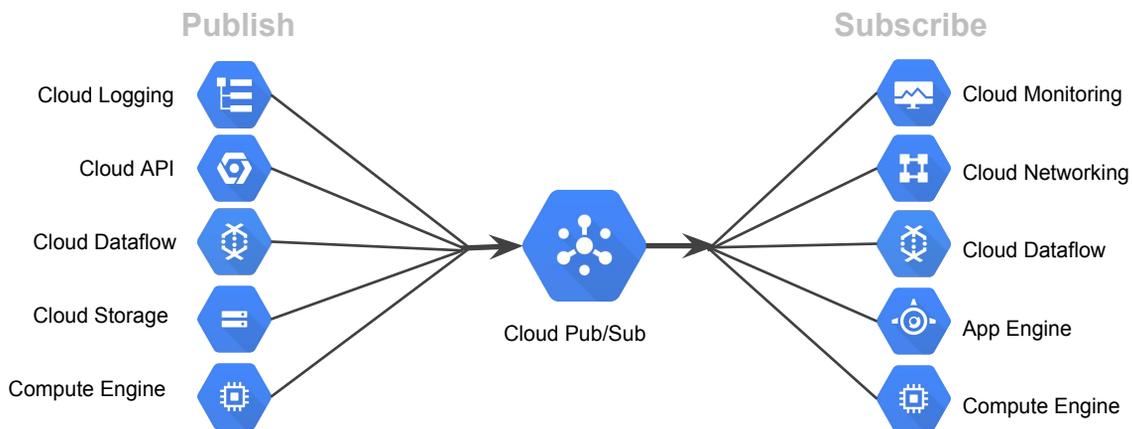
- (1) Two publishers publish messages on a single topic. Publisher 1 sends message A, Publisher 2 sends message B.
- (2) The topic aggregates their messages. The messages are stored before they are delivered.
- (3) The messages are sent to specific subscriptions. In this example there are two subscriptions, 1 and 2.
- (4) Each subscription forwards the information to the Subscriber -- and only the information requested.
- (5) Subscriber 1 gets message "A", subscriber 2 get message "B".
- (6) Subscriber 3 gets both messages "A" and "B".
- (7) For each message received, the subscriber sends an acknowledgement (ACK).
- (8) The subscription responds to the ACK by removing the message from the queue.

# Cloud Pub/Sub: Complexity



This diagram illustrates the flow of messages through connections. The system that receives the message from the publisher on behalf of the topic is called the Publishing Forwarder. And the system that receives the message from the Publishing Forwarder and ensures delivery to subscribers is the Subscribing Forwarder.

# Integrations



## Use Cases

- Balancing workloads in network clusters
- Implementing asynchronous workflows
- Distributing event notifications
- Refreshing distributed caches
- Logging to multiple systems
- Data streaming from various processes or devices
- Reliability improvement

- Balancing workloads in network clusters. For example, a large queue of tasks can be efficiently distributed among multiple workers, such as Google Compute Engine instances.
- Implementing asynchronous workflows. For example, an order processing application can place an order on a topic, from which it can be processed by one or more workers.
- Distributing event notifications. For example, a service that accepts user signups can send notifications whenever a new user registers, and downstream services can subscribe to receive notifications of the event.
- Refreshing distributed caches. For example, an application can publish invalidation events to update the IDs of objects that have changed.
- Logging to multiple systems. For example, a Google Compute Engine instance can write logs to the monitoring system, to a database for later querying, and so on.
- Data streaming from various processes or devices. For example, a residential sensor can stream data to backend servers hosted in the cloud.
- Reliability improvement. For example, a single-zone Compute Engine service can operate in additional zones by subscribing to a common topic, to recover from failures in a zone or region.

## Agenda

- Cloud Pub/Sub
- **API Management**
- Cloud Functions
- Cloud Source Repositories
- Specialty APIs
- Quiz

## Cloud Endpoints

- Exposes an API for front-end client for mobile or web-application to make use of cloud-based application services
- Frees developers from writing wrapper to access App Engine resources from a mobile or web client

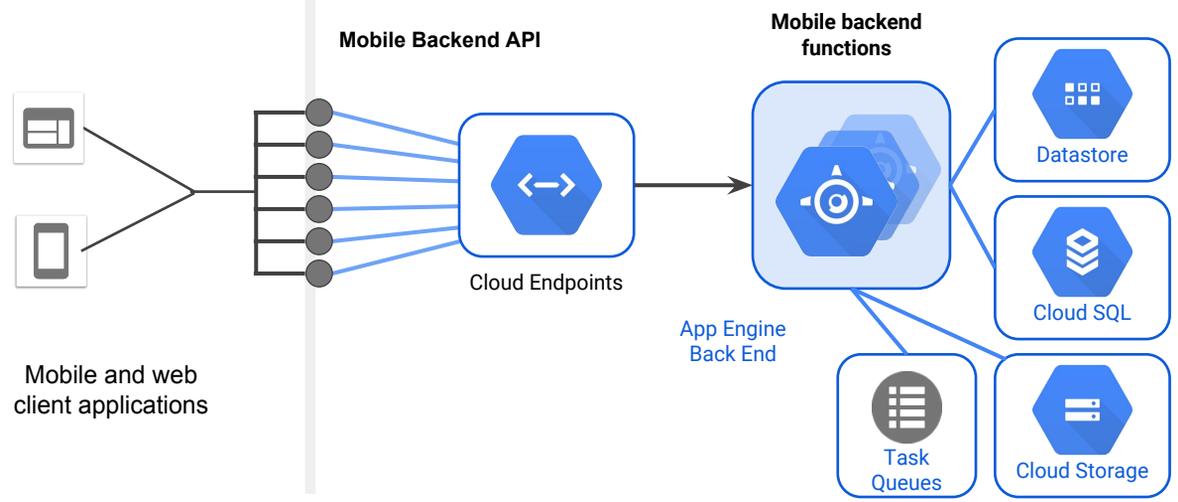


Cloud Endpoints

Cloud Endpoints is recommended for new development of Google App Engine applications.

# Cloud Endpoints

Sometimes called BaaS -- Backend as a Service



Cloud endpoints enables you to establish a standardized API for mobile or web client applications to enable them to connect to and use a backend application on App Engine.  
It give the mobile or web application access to the full resources of App Engine.

## Apigee



- API interface, wraps your APIs
  - Analytics
  - Data transformation and validation
- Provides API management
  - Version control
  - Granular access control - credentials token/keys
  - Scales
  - Global distribution, multiple clouds, SW, SOA, SOAP
  - Cache support for performance improvement
  - Limits (rate limits) to prevent DDOS or runaway bad code

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## GCP Compute & Processing Options

					
	Compute Engine	Kubernetes Engine	App Engine Standard	App Engine Flexible	Cloud Functions
Language support	Any	Any	Python Java PHP Go	Python Java Node.js Go Ruby PHP .NET Custom Runtimes	Node.js
Usage model	IaaS	IaaS PaaS	PaaS	PaaS	Microservices Architecture
Scaling	Server Autoscaling	Cluster	Autoscaling managed servers		Serverless
Primary use case	General Workloads	Container Workloads	Scalable web applications Mobile backend applications		Lightweight Event Actions

## Cloud Functions

Google **Cloud Functions** is a lightweight compute solution for developers to create single-purpose, stand-alone functions that respond to Cloud events without the need to manage a server or runtime environment.

## Cloud Functions <sup>BETA</sup>

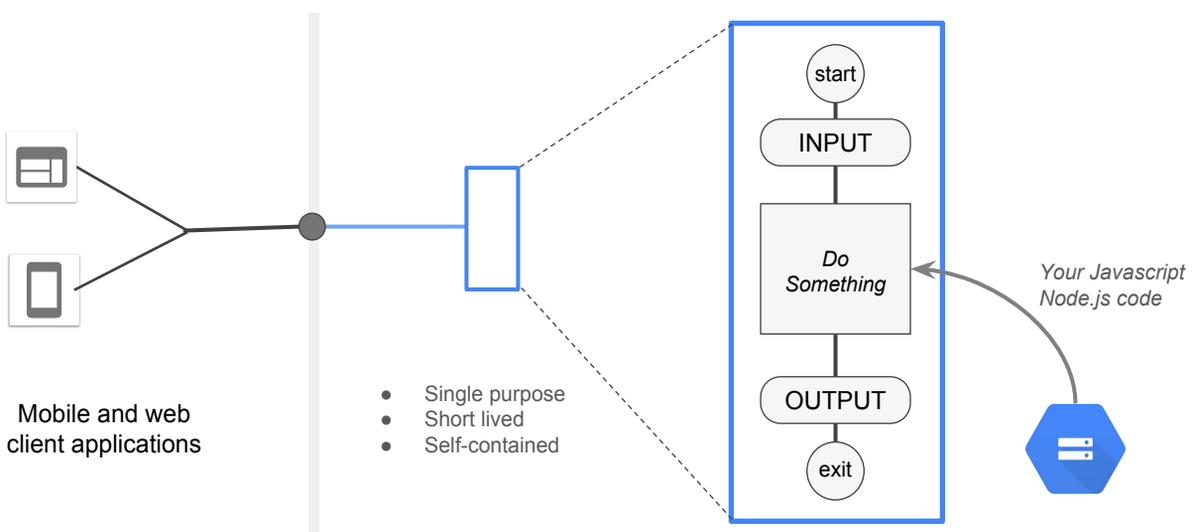
- Event-based microservices
- Fully managed, serverless, secure
- Triggers
  - Cloud Pub/Sub, HTTP, Cloud Storage
- Code
  - Deploy functions from a Cloud Storage bucket, Github or Bitbucket repo
  - Written in Javascript and runs in Node.js
- Stackdriver integration



Cloud Functions

Cloud Functions (Beta) 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.

# Cloud Functions



Compare Cloud Functions with Cloud Endpoints. Cloud Endpoints exposes an array of endpoint or API functions, whereas Cloud Functions exposes a single endpoint. The Cloud Endpoints backend is an App Engine backend, so you have a long-running programming environment with full access to complex data and storage services. In Cloud Functions, you have one single piece of code that accepts a limited input, executes rapidly, produces some output, and exits.

[https://en.wikipedia.org/wiki/Anonymous\\_function](https://en.wikipedia.org/wiki/Anonymous_function)

- The equivalent of a literal in data types for a function.
- Produces one and only one result for any given set of inputs.
- Produces no side effects

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## Cloud Source Repositories

- Private Git *remote* on GCP
  - IAM roles: owner, editor, viewer
  - Stackdriver integration
  - Console source code browser
- Create repo
  - `gcloud init`
  - `gcloud alpha source repos create REPO_NAME`
- Can be a mirror of a hosted github or bitbucket repo

Git remote is a URL that tells Git *where your code is stored*.

Stackdriver integration enables developers to do "live" debugging. Instead of setting breakpoints, developers can set watchpoints and get values from running applications.

## Cloud Source Repositories

You can connect **Cloud Source Repositories** to a hosted repository on GitHub or Bitbucket. When you push a change to the connected repository, it is automatically synced to the Cloud Platform repository.

The Beta release of Cloud Source Repositories provides free hosting of up to 1GB of storage.

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# Leverage

## Popular APIs



### Google Cloud APIs

[Compute Engine API](#)  
[BigQuery API](#)  
[Cloud Storage Service](#)  
[Cloud Datastore API](#)  
[Cloud Deployment Manager API](#)  
[Cloud DNS API](#)  
[More](#)



### Google Cloud Machine Learning

[Vision API](#)  
[Natural Language API](#)  
[Speech API](#)  
[Translation API](#)  
[Machine Learning Engine API](#)



### Google Maps APIs

[Google Maps Android API](#)  
[Google Maps SDK for iOS](#)  
[Google Maps JavaScript API](#)  
[Google Places API for Android](#)  
[Google Places API for iOS](#)  
[Google Maps Roads API](#)  
[More](#)



### Google Apps APIs

[Drive API](#)  
[Calendar API](#)  
[Gmail API](#)  
[Sheets API](#)  
[Google Apps Marketplace SDK](#)  
[Admin SDK](#)  
[More](#)



### Mobile APIs

[Google Cloud Messaging](#)  
[Google Play Game Services](#)  
[Google Play Developer API](#)  
[Google Places API for Android](#)



### Social APIs

[Google+ API](#)  
[Blogger API](#)  
[Google+ Pages API](#)  
[Google+ Domains API](#)



### YouTube APIs

[YouTube Data API](#)  
[YouTube Analytics API](#)  
[YouTube Reporting API](#)



### Advertising APIs

[AdSense Management API](#)  
[DCM/DFA Reporting And Trafficking API](#)  
[Ad Exchange Seller API](#)  
[Ad Exchange Buyer API](#)  
[DoubleClick Search API](#)  
[DoubleClick Bid Manager API](#)



### Other popular APIs

[Analytics API](#)  
[Custom Search API](#)  
[URL Shortener API](#)  
[PageSpeed Insights API](#)  
[Fusion Tables API](#)  
[Web Fonts Developer API](#)

You can easily get amazing functionality into your applications by leveraging the services and APIs already supported in the larger "Google Cloud" beyond the Google Cloud Platform APIs.

## Cloud Machine Learning

Add prediction and AI to your application

- Cloud Machine Learning Engine
- Cloud Job Discovery
- Cloud Natural Language API
- Cloud Speech API
- Cloud Translation API
- Cloud Vision API

You can add these specialty functions to your applications with amazingly little coding.

You can add cool features to your application by leveraging the Machine Learning API and specialty APIs.

Some demonstrations consist of as few as six lines of code.

Cloud Speech API: The API provides speech-to-text functionality in over 80 languages and variants in real-time streaming or batch modes

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## Quiz

### What is Cloud Pub/Sub?

1. A feature of Google Maps that identifies bars and sandwich restaurants.
2. A feature of Google console that allows you to subscribe to Cloud news feeds.
3. A fully-managed distributed real-time messaging services for applications.
4. A mutex-based metadata sharing system that serializes access to shared data.

## Quiz

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### **Explanation:**

Cloud Pub/Sub is a fully-managed real-time messaging service that allows you to send and receive messages between independent applications

## Quiz

### What is the purpose of Cloud Endpoints and APIgee API Management?

1. Provides a method to publish APIs into Google's Cloud API marketplace.
2. Provides a point of redirection where policy, licensing, authorization, and security can be implemented around a shared API.
3. Changes API calling semantics constantly as a security measure.
4. It is an internal call-back mechanism used with Cloud Pub/Sub for internal applications.

## Quiz

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### **Explanation:**

It's a single "choke point" for API management and administration.

## Quiz

### What is a Cloud Source Repository?

1. It is how Google shares Open Source software with the world.
2. A memory cache system similar to Memcached.
3. Another term used for Google Cloud Storage.
4. A private Git repository on GCP.

## Quiz

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### **Explanation:**

It's a Git repository on GCP.

## More...

Cloud Pub/Sub

- <https://cloud.google.com/pubsub/docs/>

Cloud Functions

- <https://cloud.google.com/functions/docs/>

Cloud Endpoints

- <https://cloud.google.com/endpoints/docs/>

Cloud Source Repositories

- <https://cloud.google.com/source-repositories/docs/>

More to learn on this subject. Here are some suggestions and links.



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