

Application Infrastructure Services

Elastic Cloud Infrastructure: Containers and Services

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

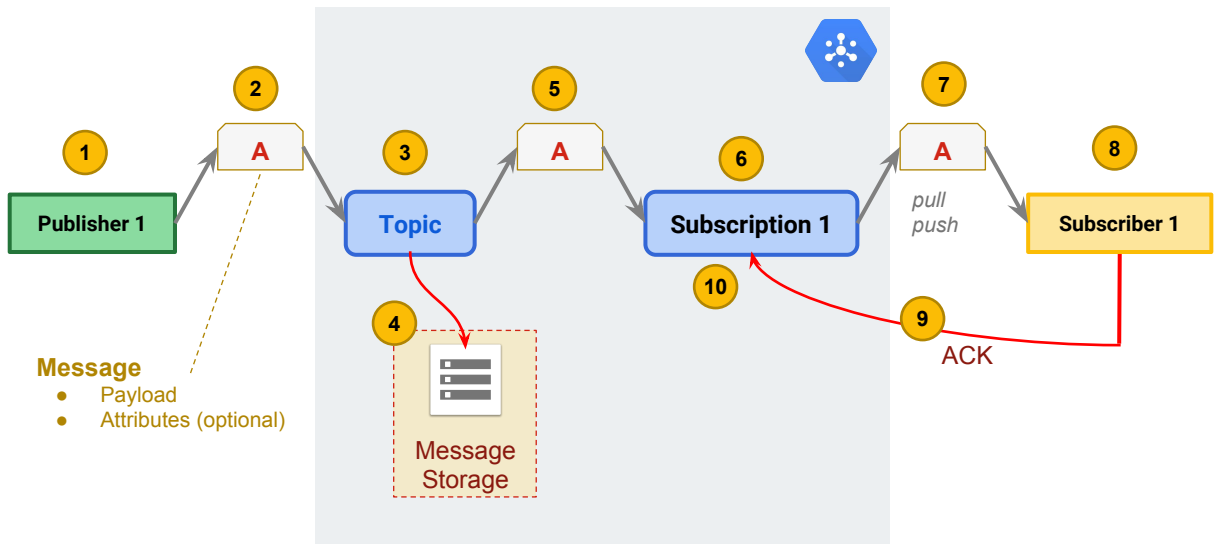
- Scales globally
- Low latency
 - Dynamic rate limiting
- Availability
 - Durability - replicated storage of messages
 - Reliability
 - End-to-end reliability via application ACKs
- Security
 - Encryption in motion and at rest
- Maintenance free



Cloud Pub/Sub

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

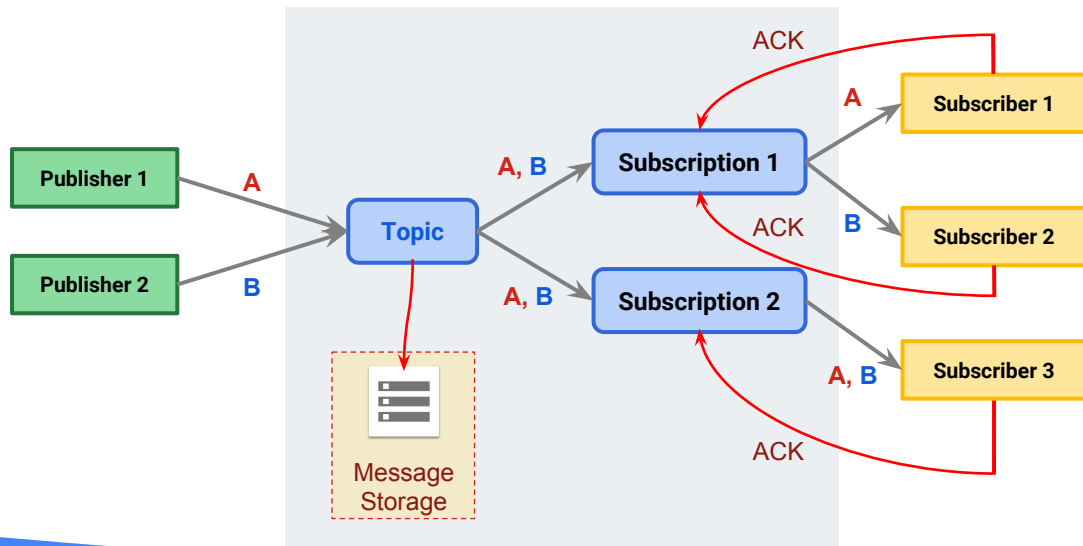
Cloud Pub/Sub: the basics



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.

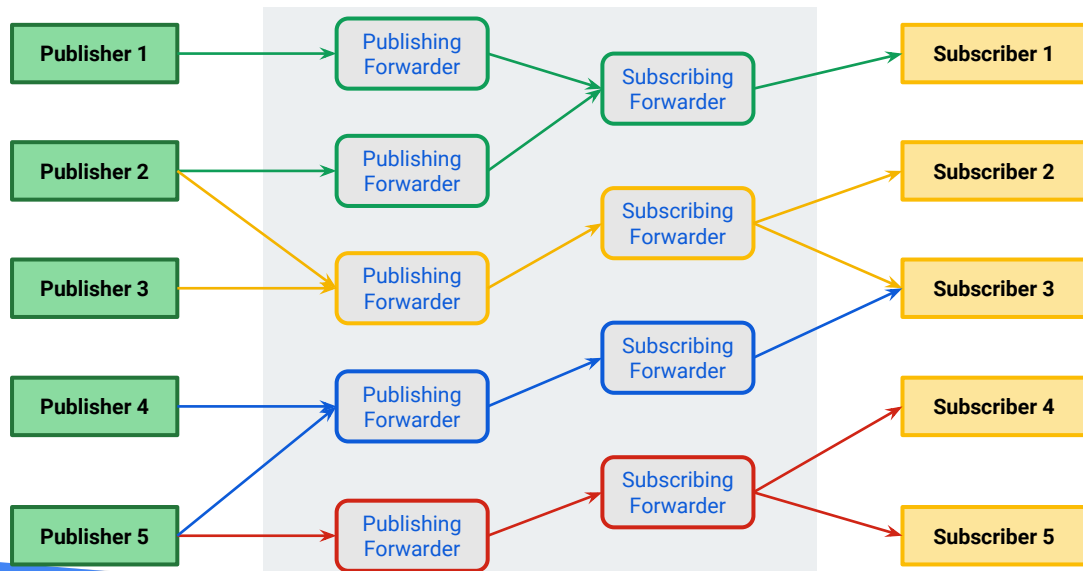
- (1) A publisher wishes to publish a message. A message is simply data in transit through the system.
- (2) The message consists of a payload and optional attributes that describe the payload.
- (3) The message is published to a specific topic. A topic is a feed of messages.
- (4) The topic stores the 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



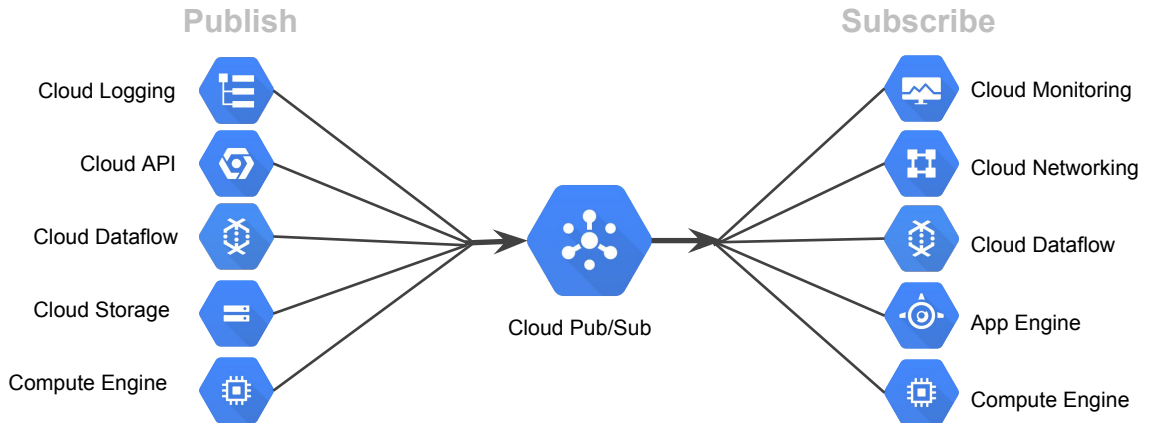
- (1) Two publishers publish messages on a single topic. Publisher 1 sends message A, Publisher 2 sends message B.
- (2) The topic aggregates their messages. The messages are stored before they are delivered.
- (3) The messages are sent to specific subscriptions. In this example there are two subscriptions, 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.

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- Cloud Source Repositories
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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

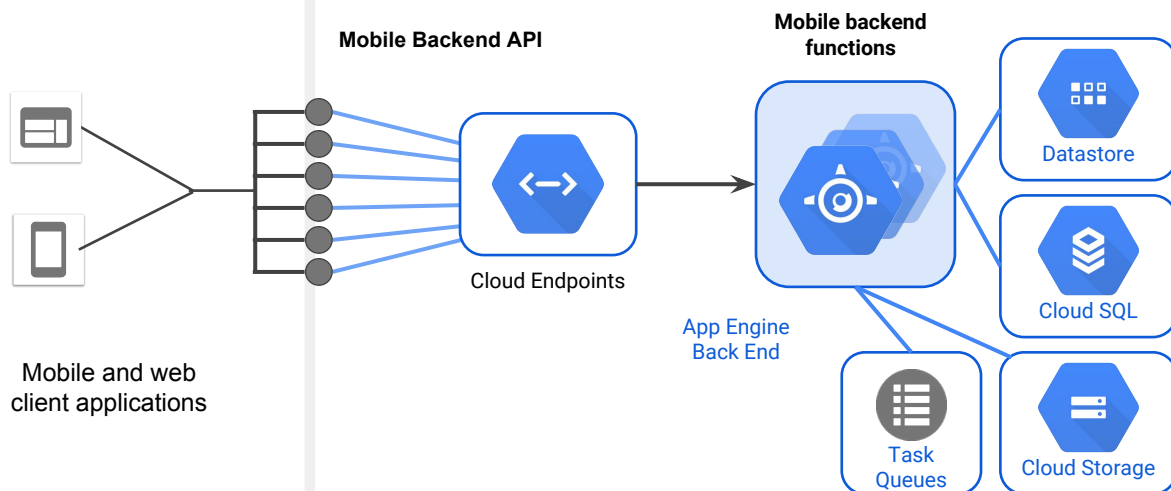


Cloud Endpoints

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^{BETA}

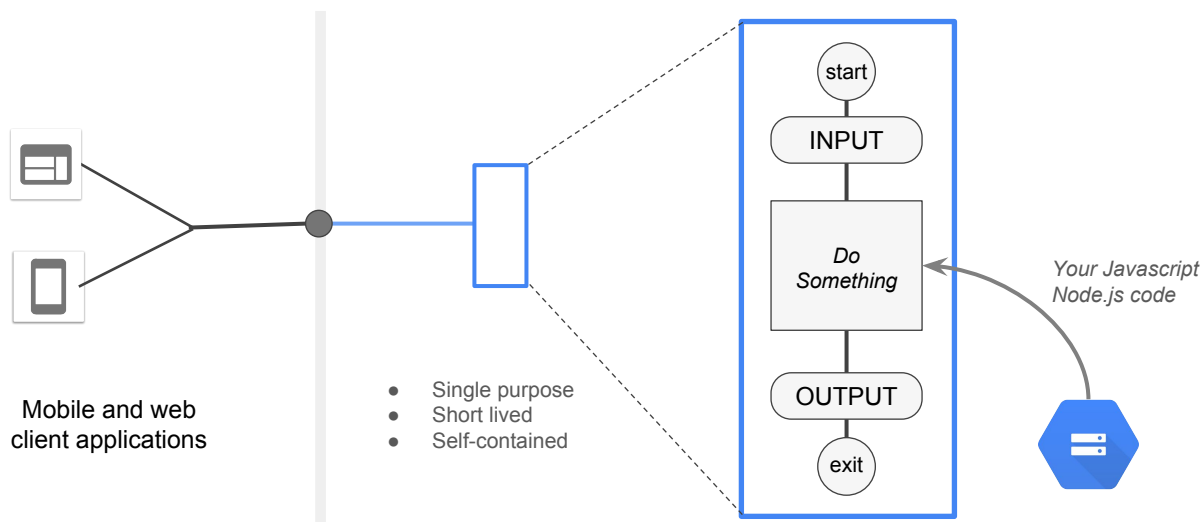
- Event-based microservices
- Fully managed, serverless, secure
- Triggers
 - Cloud Pub/Sub, HTTP, Cloud Storage
- Code
 - Deploy functions from a Cloud Storage bucket, Github or Bitbucket repo
 - Written in Javascript and runs in Node.js
- Stackdriver integration



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

- 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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More...

Cloud Pub/Sub

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Cloud Endpoints

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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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