MASHR

A data pipeline framework for GCP

Overview

- What is Mashr
- What are data pipelines?
- Challenges of creating your own data pipelines
- Alternate Solutions for creating a data pipeline
- Discuss how Mashr solves the problem
- Design and Challenges of Mashr

What is Mashr?

Mashr is an easy-to-use data pipeline orchestration and monitoring framework for small applications which allows you to take data from multiple sources and combine it so that you can use it.

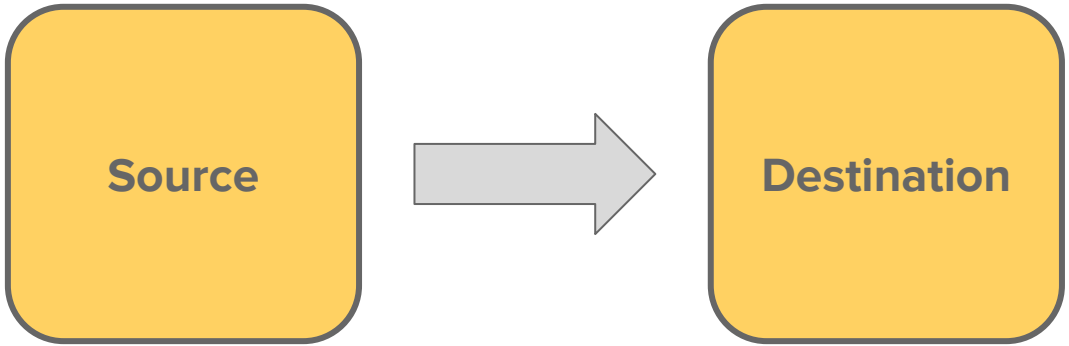
What is mashr

- CLI
- Node js
- Npm
- GCP
- Docker
- Embulk

Mashr Supports Google Cloud Platform

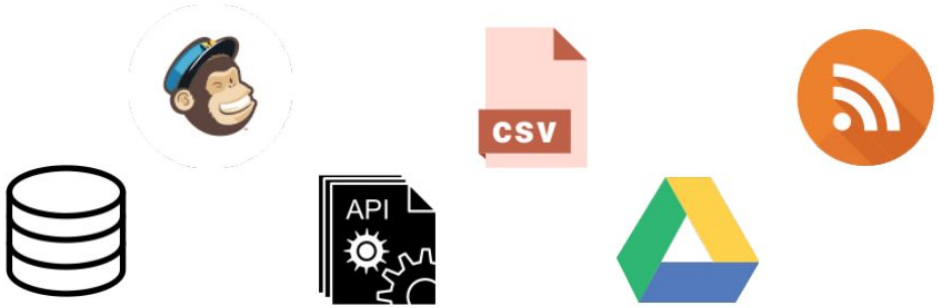
- GCP comes with a number of robust machine learning and analytics tools

Data pipelines

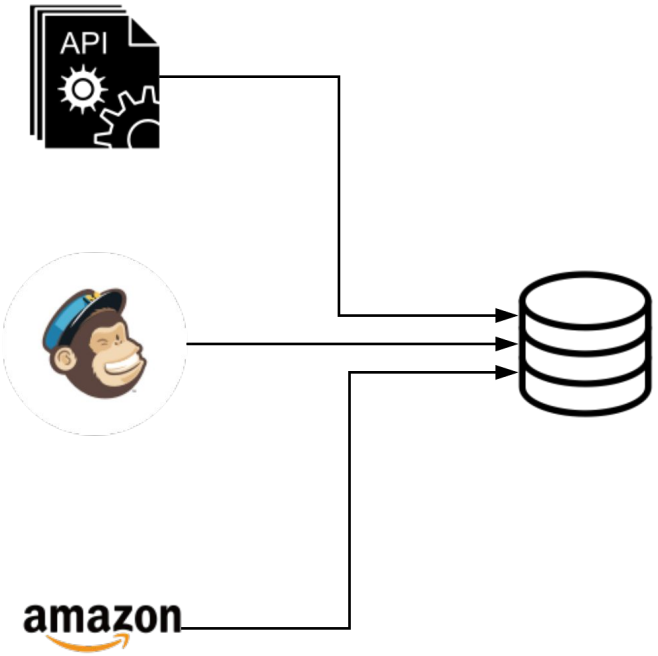


Use Case

You are a developer for a small application and you have data spread out in a variety of sources - a psql database, salesforce, other applications with REST api's, etc. You want to take data from multiple sources and combine it so that you can use it.



Use Case



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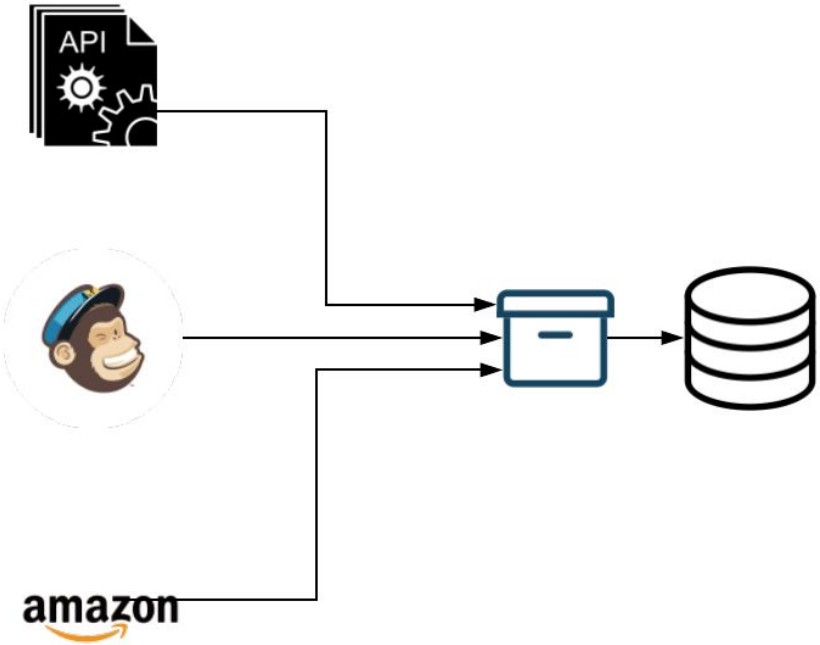

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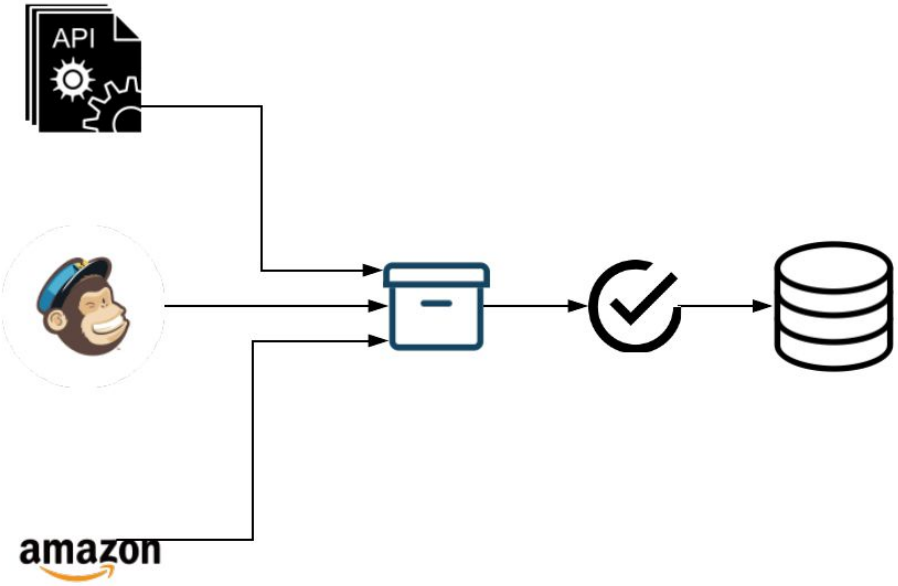

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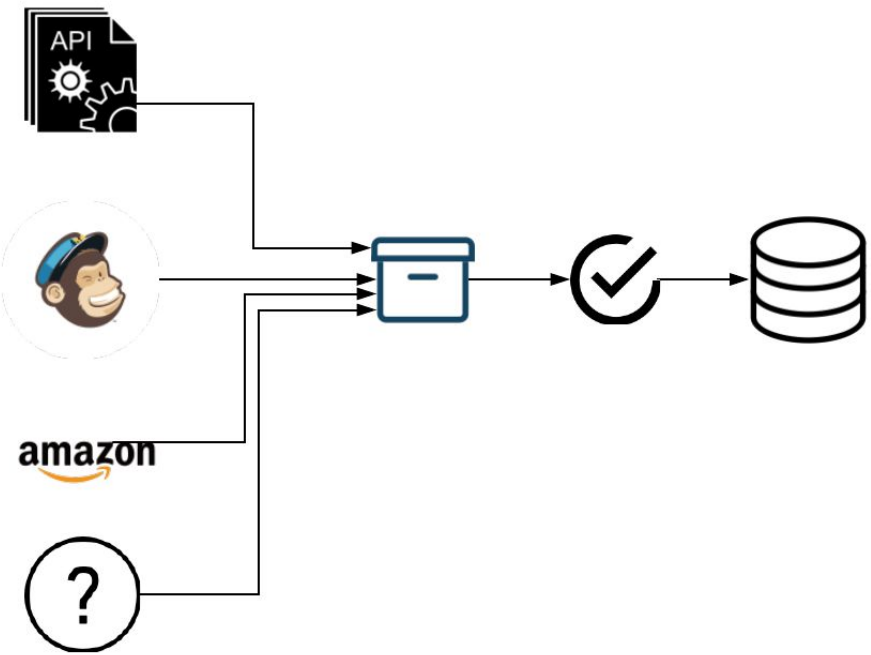


Principles of a good Data Pipeline

Principles of a good Data Pipeline

Extracting data from the source

- Extraction
- Formatting
- Scheduling

Principles of a good Data Pipeline

Validate

- Confirm whether data pulled from sources has the expected values
- Checking data integrity

Principles of a good Data Pipeline

Transform Data

- Removing extraneous or erroneous data (cleaning),
- Encoding free-form values
- Translating coded values
- Deriving a new calculated value
- Splitting a column into multiple columns

Principles of a good Data Pipeline

Stage / Archiving

- Audit reports & compliance
- Diagnose and debugging
- Failover

Principles of a good Data Pipeline

Publishing data to the target

- Decide method of loading data

Principles of a good Data Pipeline

Monitoring

Google Cloud Platform | mashr-mat

Stackdriver Logging

- Logs
- Logs-based metrics
- Exports
- Logs ingestion

CREATE METRIC | CREATE EXPORT

Filter by label or text search

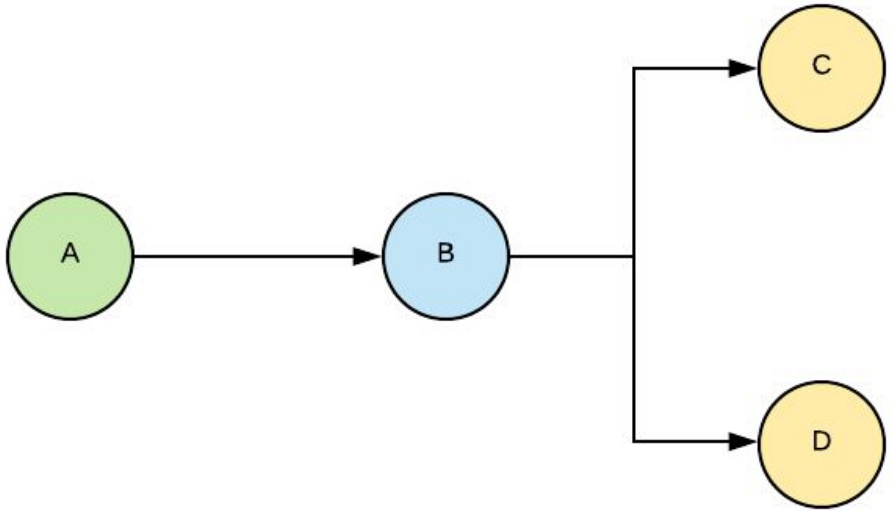
GCE VM Instance, test-date-005 | All logs | Any log level | No limit | Jump to now

Showing logs from all time (PDT) | Download logs | View Options

```
2019-05-04 13:10:52.321 PDT Compute Engine insert us-west1-b:test-date-005 mashr-mat2@mashr-mat.iam.gserviceaccount.com {"@type":"type.googleapis.com/go…
2019-05-04 13:10:53.891 PDT compute.instances.insert {"version":"1.2","user_agent":"gcloud-node-compute/0.12.0,gzip(gfe)","request":{"url":"https://www.go…
2019-05-04 13:11:05.929 PDT Compute Engine insert us-west1-b:test-date-005 mashr-mat2@mashr-mat.iam.gserviceaccount.com {"@type":"type.googleapis.com/go…
{                                                                                                                    Expand all | Collapse all
  insertId: "ezlzupd9n0y"
  logName: "projects/mashr-mat/logs/cloudaudit.googleapis.com%2Factivity"
  operation: {…}
  protoPayload: {…}
  receiveTimestamp: "2019-05-04T20:11:06.943234365Z"
  resource: {…}
  severity: "NOTICE"
  timestamp: "2019-05-04T20:11:05.929Z"
}
2019-05-04 13:11:06.054 PDT compute.instances.insert {"event_timestamp_us":"1557000666054970","actor":{"user":"mashr-mat2@mashr-mat.iam.gserviceaccount.co…
{                                                                                                                    Expand all | Collapse all
  insertId: "12kk85nfo5q4tw"
  jsonPayload: {…}
  labels: {…}
  logName: "projects/mashr-mat/logs/compute.googleapis.com%2Factivity_log"
  receiveTimestamp: "2019-05-04T20:11:06.095422736Z"
  resource: {…}
  severity: "INFO"
  timestamp: "2019-05-04T20:11:06.054970Z"
}
```

Principles of a good Data Pipeline

Orchestration and ordering of tasks



Principles of a good Data Pipeline

Performance

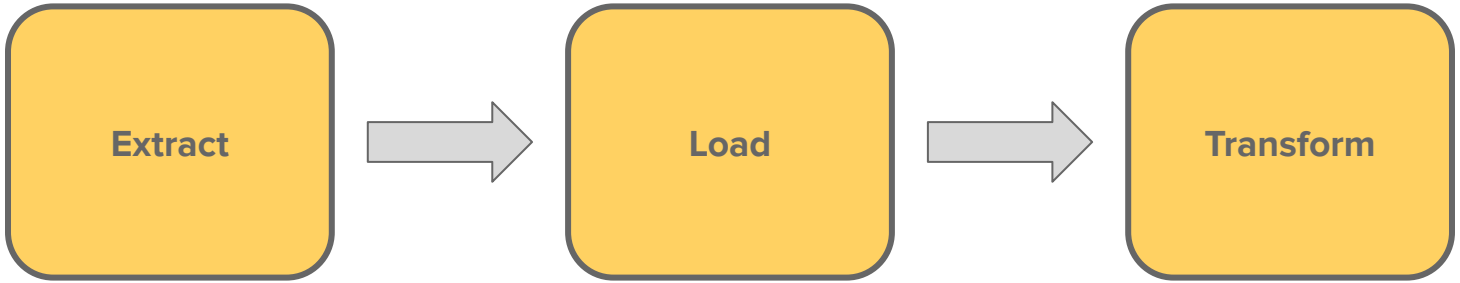
- Optimizations
- Bottlenecks

ETL

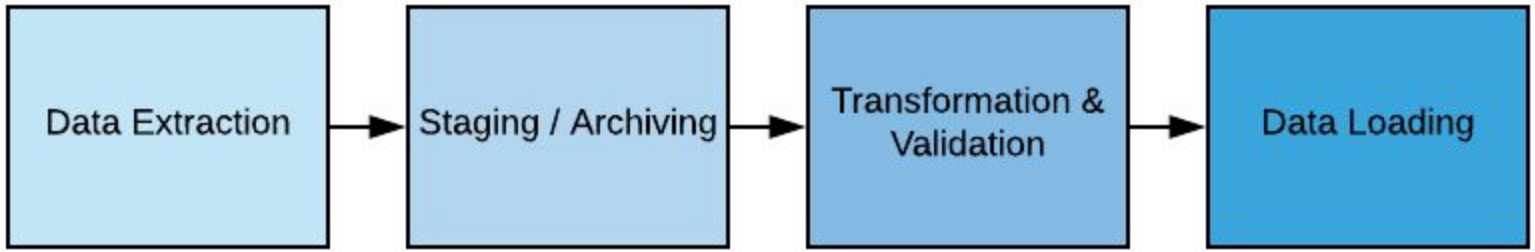
Extract, Transform, Load

ELT

Extract, Load, Transform



Components of a data pipeline



Principles of a good Data Pipeline

- Extraction
- Validation
- Transformation
- Staging / Archiving
- Publishing to target
- Monitoring
- Orchestration and Ordering
- Performance

Mashr Supports Google Cloud Platform

- GCP comes with a number of robust machine learning and analytics tools

Challenges of deploying your own data pipeline on GCP

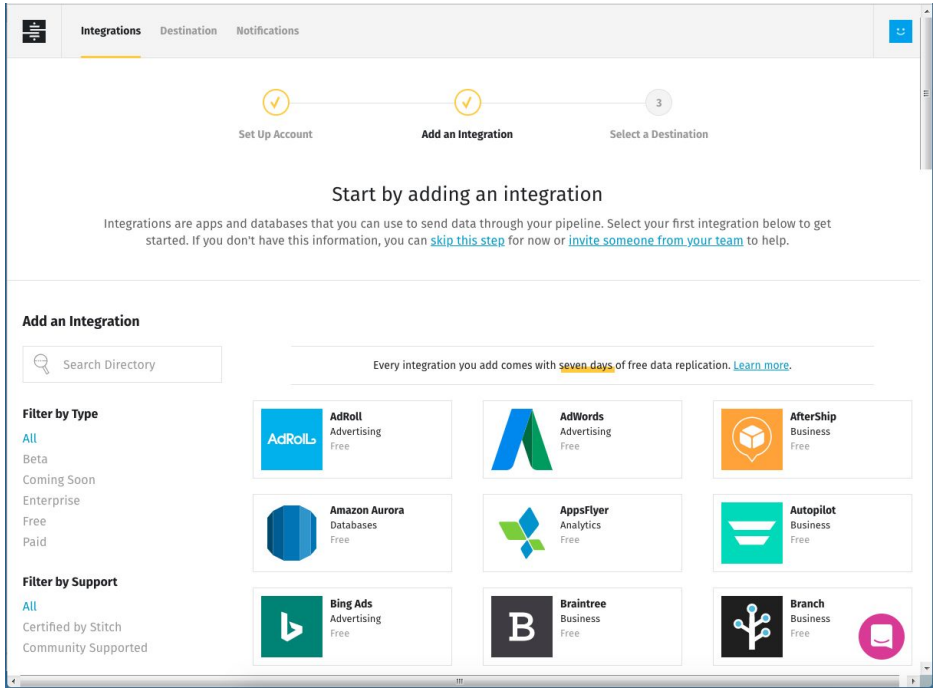
- Overwhelming number of configuration options
- Client libraries may not be complete
- Many “tasks” are actually comprised of a series of smaller tasks and decision points

Challenges of deploying your own data pipeline on GCP

Metric	Count
Number of API calls to GCP	23
Number of GCP services used	7

Hosted Solutions

Hosted Solutions



Hosted Solutions

Pros:

- Infrastructure is abstracted from user
- Manages failover and backup
- UI
- Time

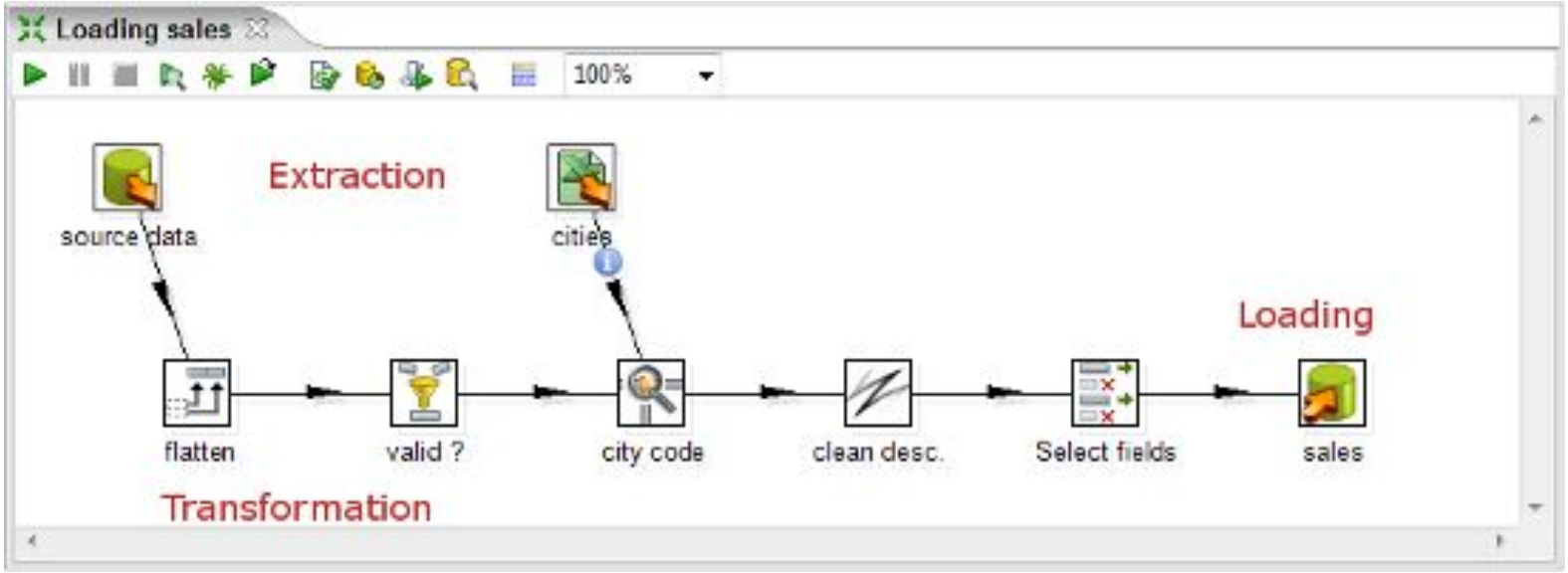
Cons:

- Costs money
- Privacy
- Control and customization

Self-Hosted Solutions

Self-Hosted Solutions

Pentaho Data Integration (PDI):



Self-Hosted Solutions

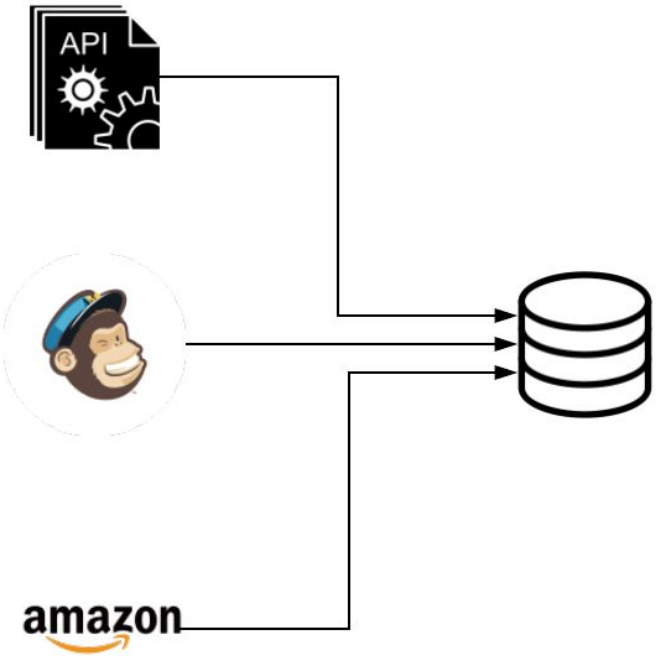
Pros:

- Customizable
- Cheap
- Data is yours

Cons:

- Not free
- Time
- Failover and backup

Use Case



Mashr


More abstracted
Less abstracted


Less customizable
More customizable

Mashr is an easy to use data pipeline framework that orchestrates moving data from external sources like salesforce, psql databases or REST apis into a single destination database where it can be used.

Mashr

Mashr

Pros:

- Data is yours
- Customizable
- Abstracted...mostly
- Manages archiving and failover

Cons:

- Still need to manage servers
- Not real-time
- Requires GCP account

Mashr

GCP Services

Icon	Name	Description
	GCE Instance	Virtual Machine Instance
	GCS	Data Storage Service
	Cloud Function	Function-as-a-Service
	BigQuery	Data Warehouse
	Stackdriver Logging	Logging Service

Mashr

Embulk

- We chose Embulk as the data extractor piece for the data pipeline
- Embulk is an open source plugin-based bulk data loader.

```
in:
  type: http
  url: https://jsonplaceholder.typicode.com/posts/42
  method: get
  parser:
    type: json
    schema:
      - { name: "userId", type: string }
      - { name: "id", type: long }
      - { name: "title", type: string }
      - { name: "body", type: string }
out:
  type: 'gcs'
  bucket: 'mashrintname'
  path_prefix: {{ env.DATE }}
  file_ext: '.json'
  auth_method: 'compute_engine'
  formatter:
    type: 'jsonl'
```

Mashr

Embulk

- embulk run config.yml
- embulk run config.yml -c diff.yml

```yaml
in:
    type: postgresql
    host: 55.55.55.555
    user: postgres
    password: "password"
    database: postgres
    table: users
    incremental: true
    incremental_columns: [created_at, id]
```

Mashr

Embulk

Pros:

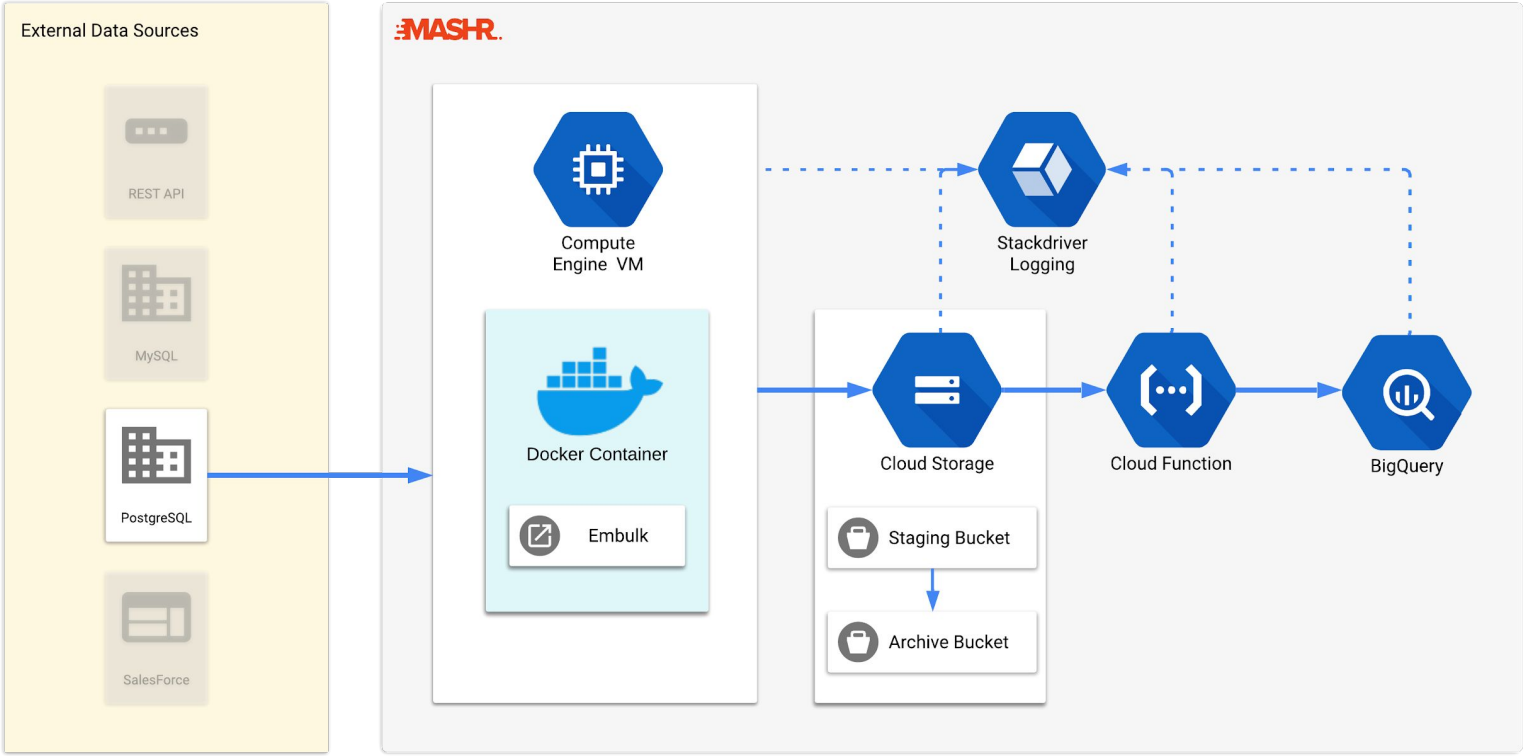
- Modular / plugin-based
- Well-maintained

Cons:

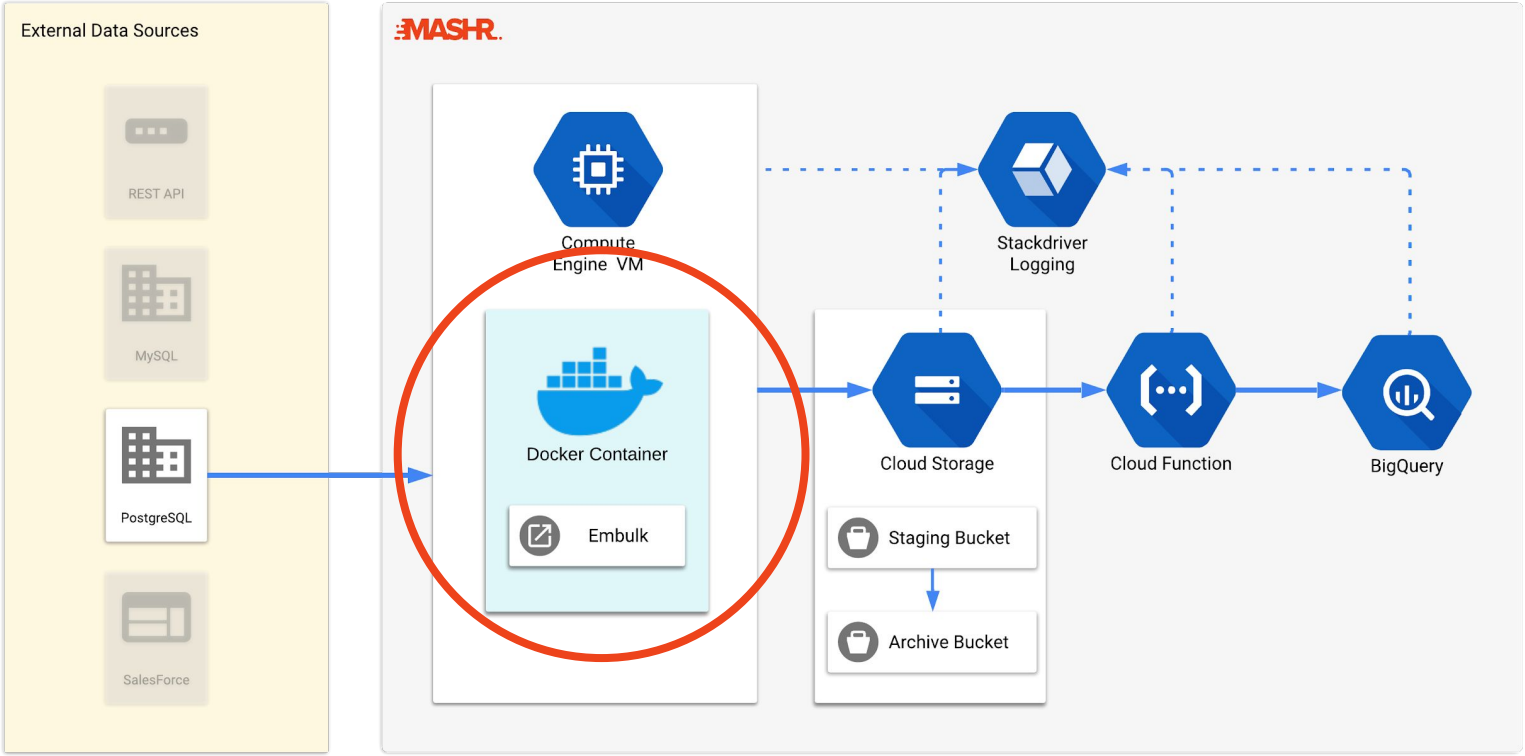
- Requires hosting

```
in:
  type: http
  url: https://jsonplaceholder.typicode.com/posts/42
  method: get
  parser:
    type: json
    schema:
      - { name: "userId", type: string }
      - { name: "id", type: long }
      - { name: "title", type: string }
      - { name: "body", type: string }
out:
  type: 'gcs'
  bucket: 'mashrintname'
  path_prefix: {{ env.DATE }}
  file_ext: '.json'
  auth_method: 'compute_engine'
  formatter:
    type: 'jsonl'
```

Mashr


External Data Sources
REST API
MySQL
PostgreSQL
SalesForce
MASHR.
Compute Engine VM
Docker Container
Embulk
Stackdriver Logging
Cloud Storage
Staging Bucket
Archive Bucket
Cloud Function
BigQuery

Mashr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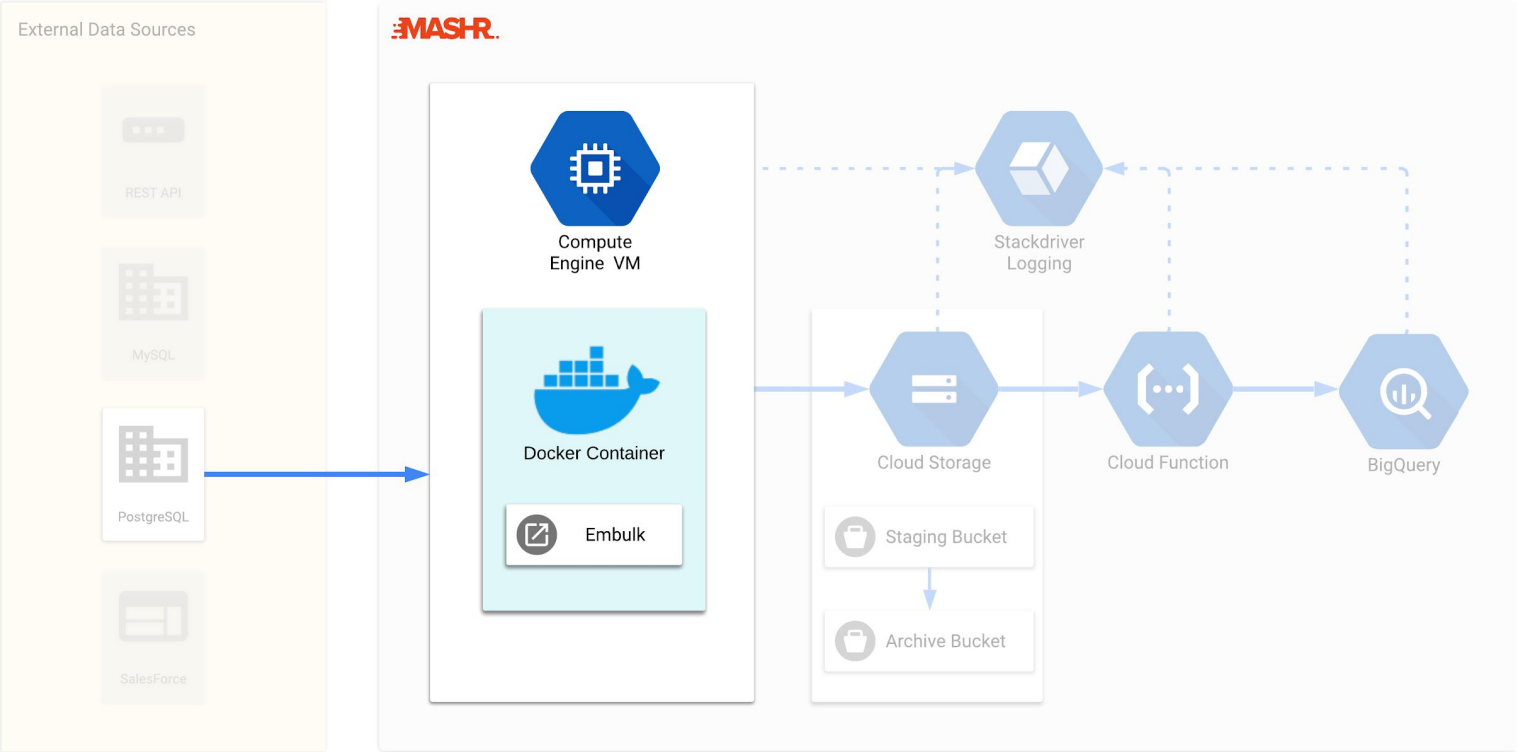
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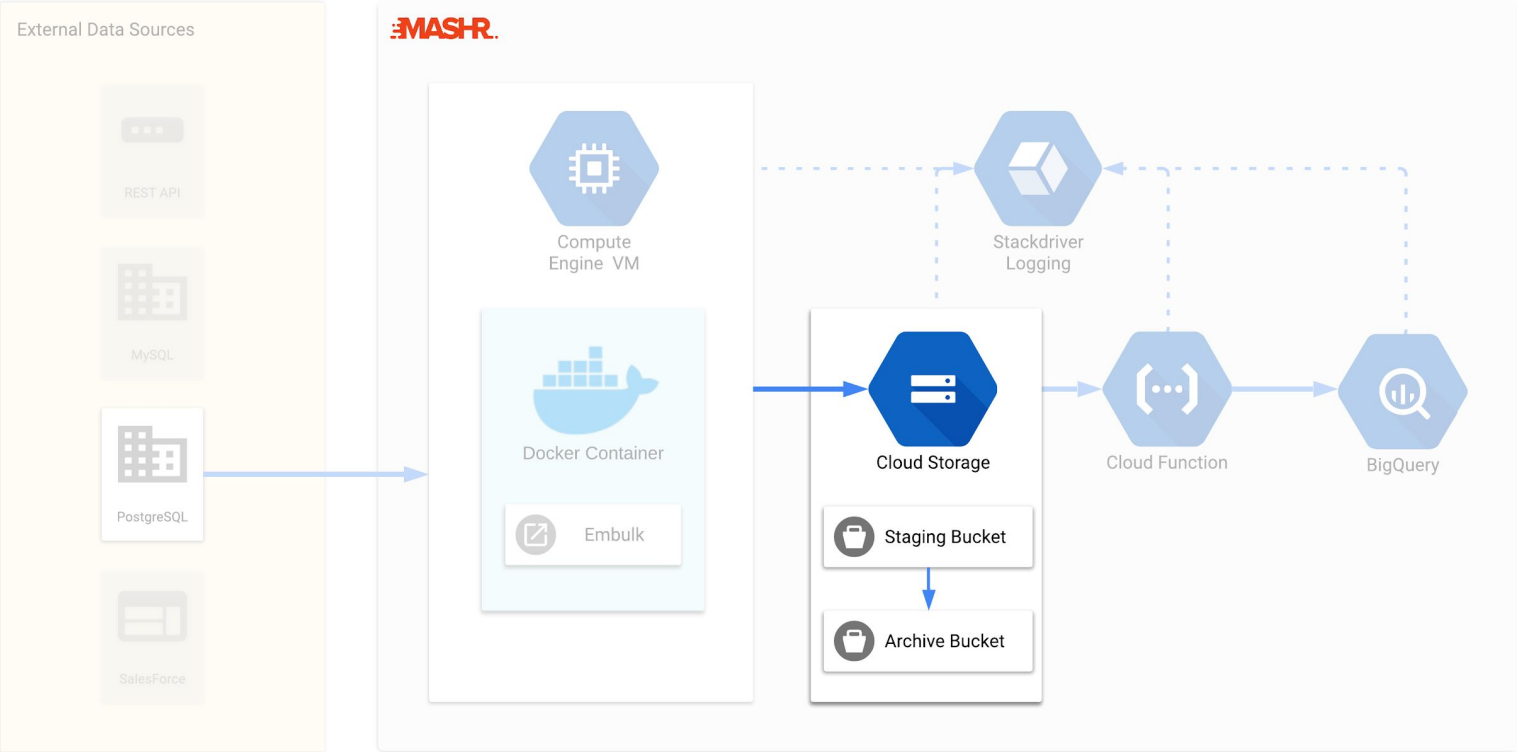
Docker

```
FROM openjdk:8-jre-stretch

RUN apt-get -y update && apt-get -y upgrade

RUN apt-get install -y vim git zip unzip less wget

ENV EMBULK_VERSION 0.9.17

RUN curl -o /usr/local/bin/embulk \
    --create-dirs -L "http://dl.embulk.org/embulk-${EMBULK_VERSION}.jar" && \
    chmod +x /usr/local/bin/embulk

WORKDIR /root
RUN mkdir mashr

RUN apt-get install cron -y
```

```
FROM jacobleecd/mashr:latest
WORKDIR /root
COPY mashr/ mashr/

RUN chmod +x mashr/install_gems.sh
RUN mashr/install_gems.sh
RUN embulk gem install embulk-output-gcs
RUN embulk gem install embulk-formatter-jsonl

# Copy and make executable embulkScript.sh
COPY embulkScript.sh /etc/cron.d/embulkScript.sh
RUN chmod +x /etc/cron.d/embulkScript.sh

# Copy and make executable crontab, mashr-cron
COPY crontab /etc/cron.d/mashr-cron
RUN chmod 0644 /etc/cron.d/mashr-cron

# activate crontab, mashr-cron
RUN crontab /etc/cron.d/mashr-cron

RUN touch /var/log/cron.log
CMD service cron start && tail -f /var/log/cron.log
```

Mashr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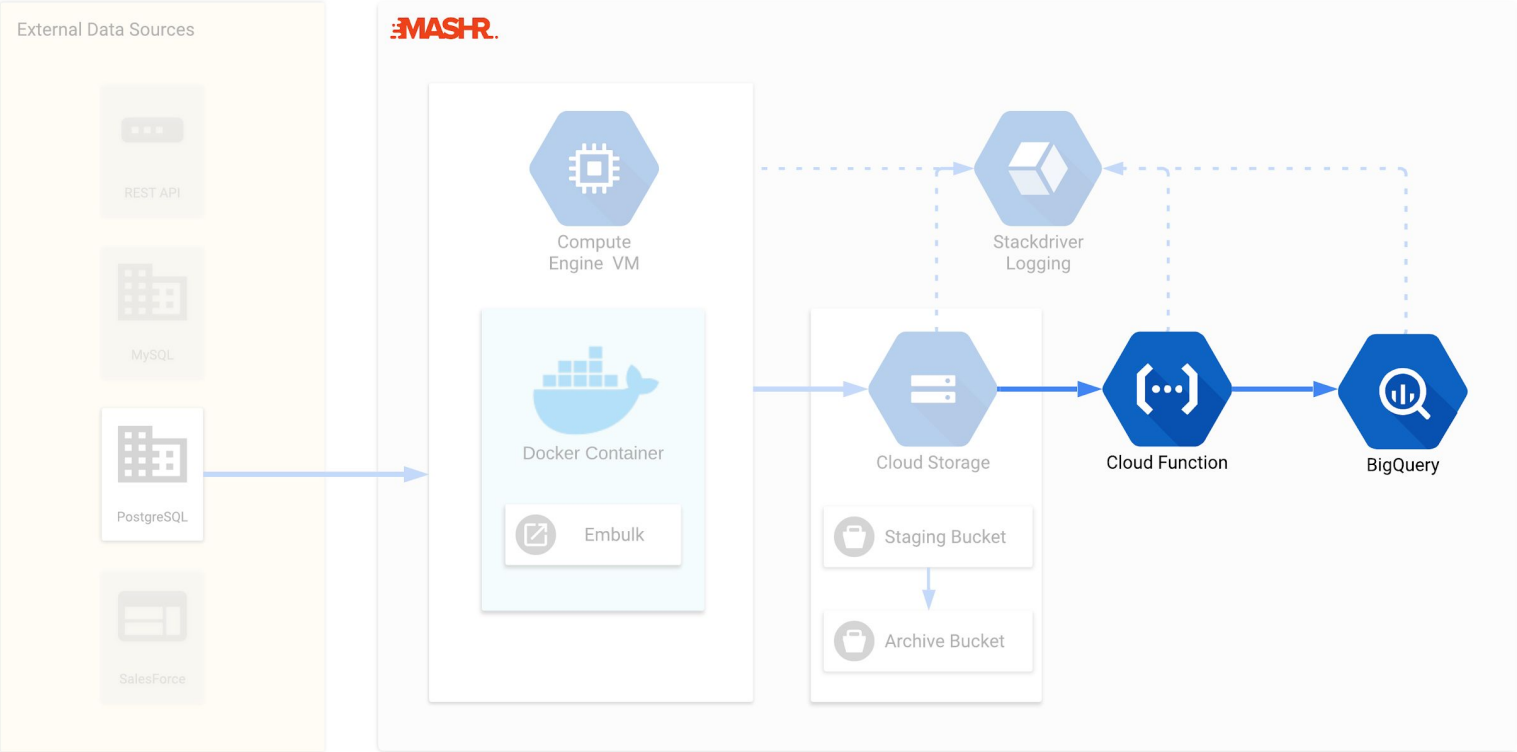
Mashr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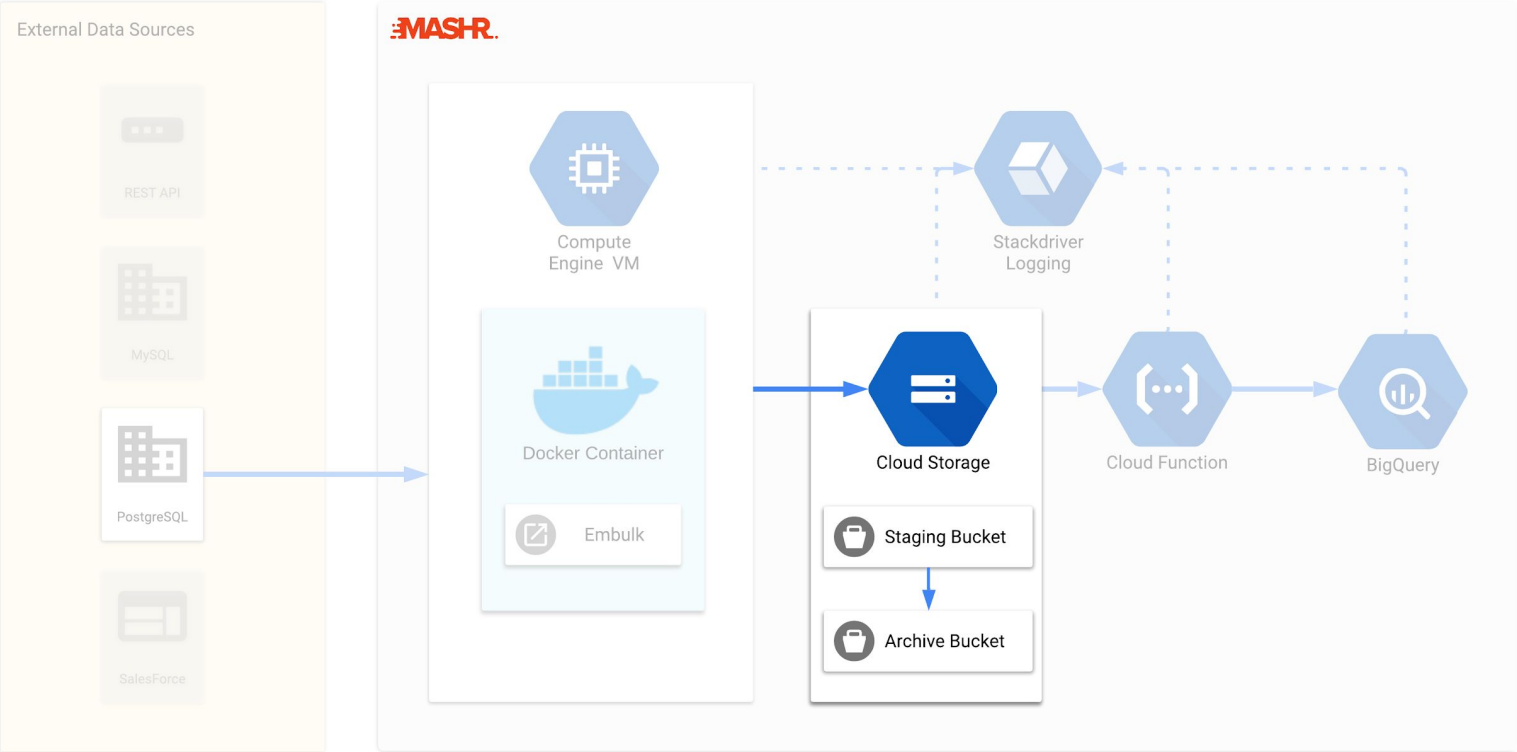
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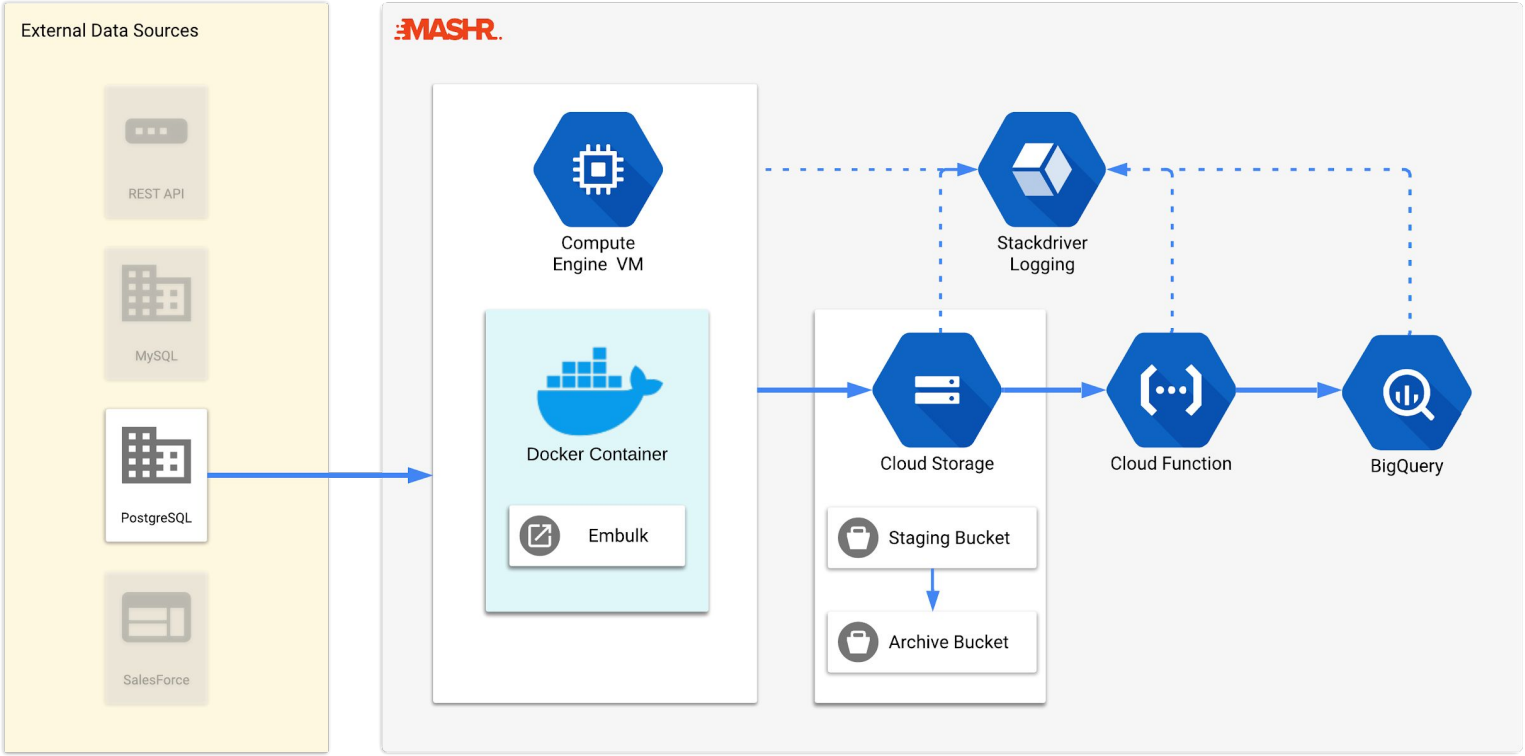
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Mashr commands

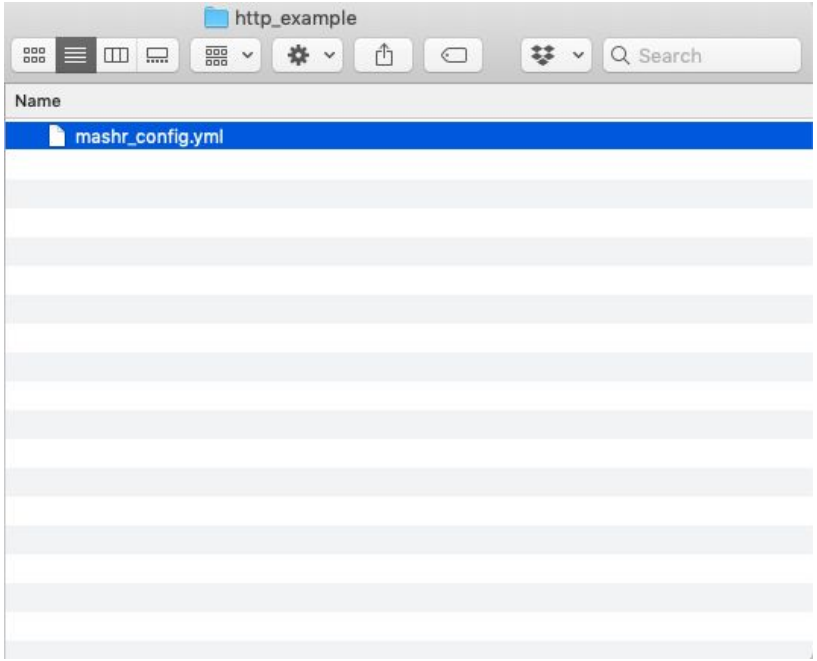
- `init` - creates a yaml configuration file in the users working directory
- `deploy` - launches all of the GCP resources to create the data pipeline
- `destroy` - destroys all of the GCP resources of a specific data pipeline
- `list` - lists your current data pipelines
- `help` - help text for Mashr

mashr init

mashr init

mashr_config.yml

```yaml
mashr:
  service_account_email: ''
  json_keyfile: ''
  table_id:      ''
  dataset_id:    ''
  project_id:    ''
  integration_name: ''
  embulk_run_command: 'embulk run embulk_config.yml'
  embulk_gems:
    - embulk-input-http
embulk:
  in:
    type: http
    url: https://jsonplaceholder.typicode.com/posts/42
    method: get
    parser:
      type: json
      schema:
        - { name: "userId", type: string }
        - { name: "id", type: long }
        - { name: "title", type: string }
        - { name: "body", type: string }
```



mashr init

mashr_config.yml

```yaml
mashr:
  service_account_email: 'example@example.iam.gserviceaccount.com'
  json_keyfile: 'keyfile.json'
  table_id:     'myTableId'
  dataset_id:   'myDatasetId'
  project_id:   'exampleProject'
  integration_name: 'exampleIntegrationName'
  embulk_run_command: 'embulk run embulk_config.yml'
  embulk_gems:
    - embulk-input-http
embulk:
  in:
    type: http
    url: https://jsonplaceholder.typicode.com/posts/42
    method: get
    parser:
      type: json
      schema:
        - { name: "userId", type: string }
        - { name: "id", type: long }
        - { name: "title", type: string }
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```
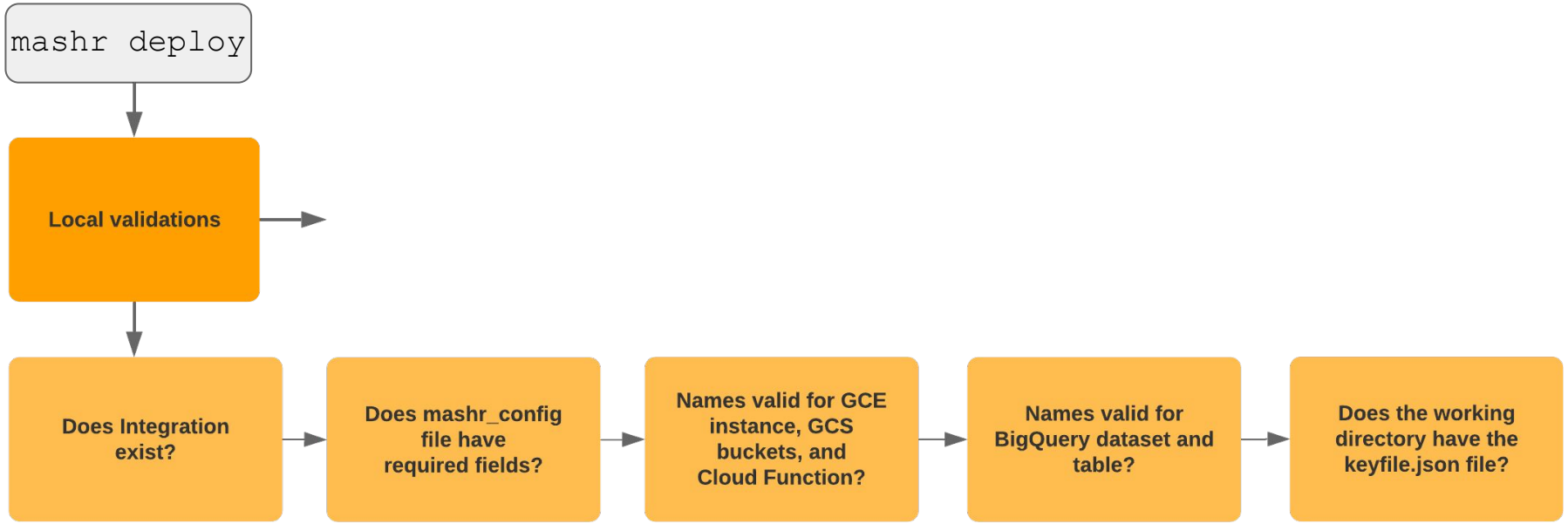

mashr deploy

mashr deploy



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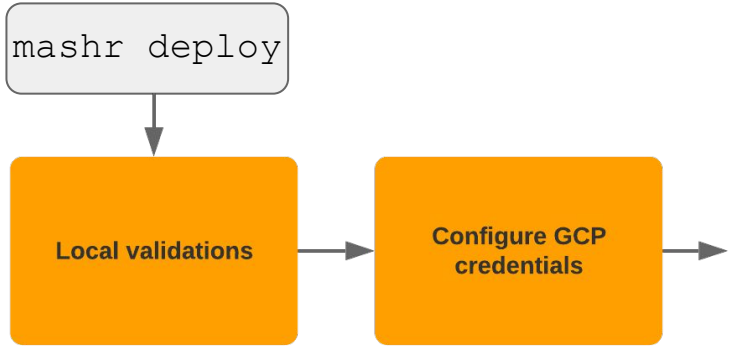

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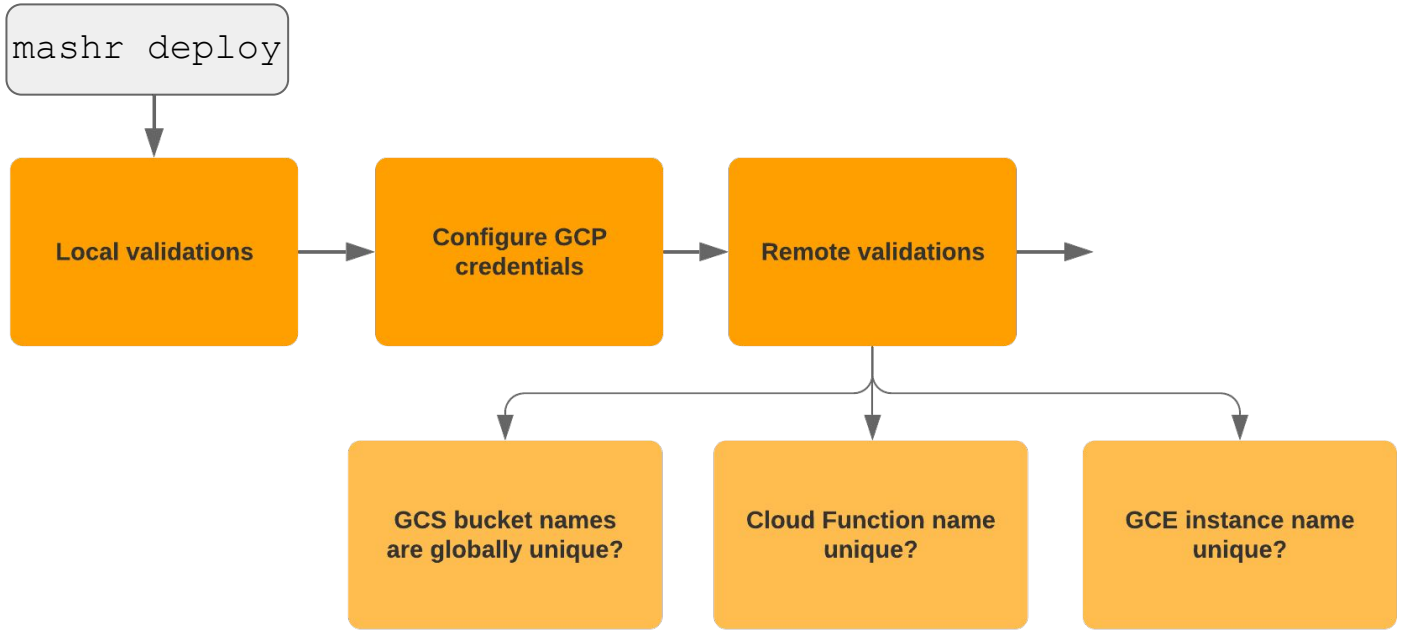

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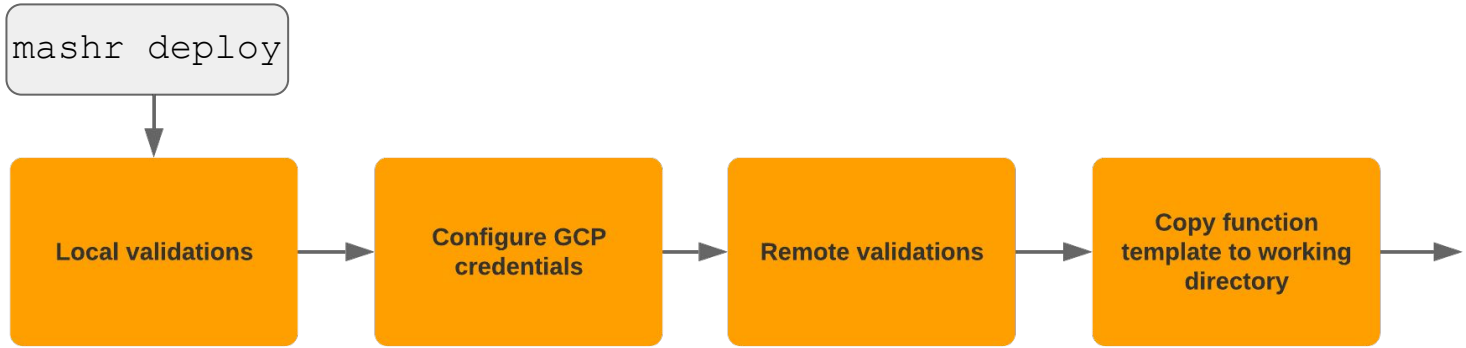

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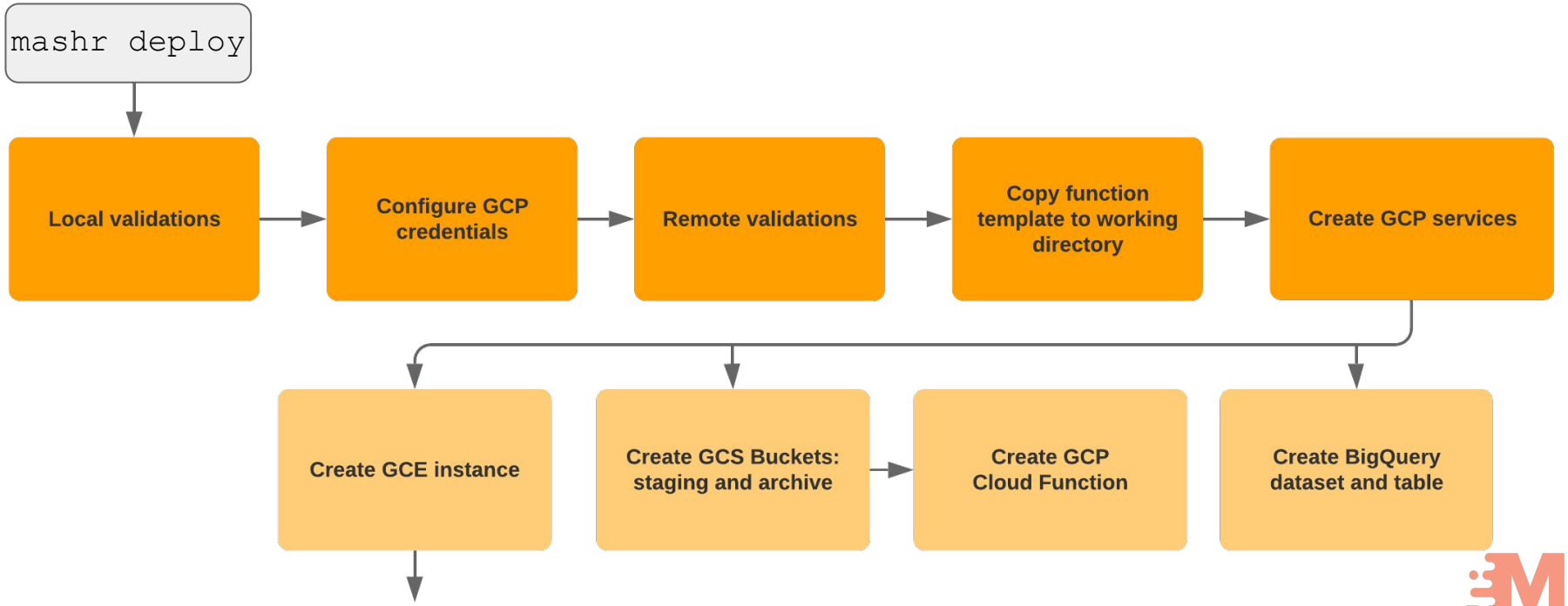
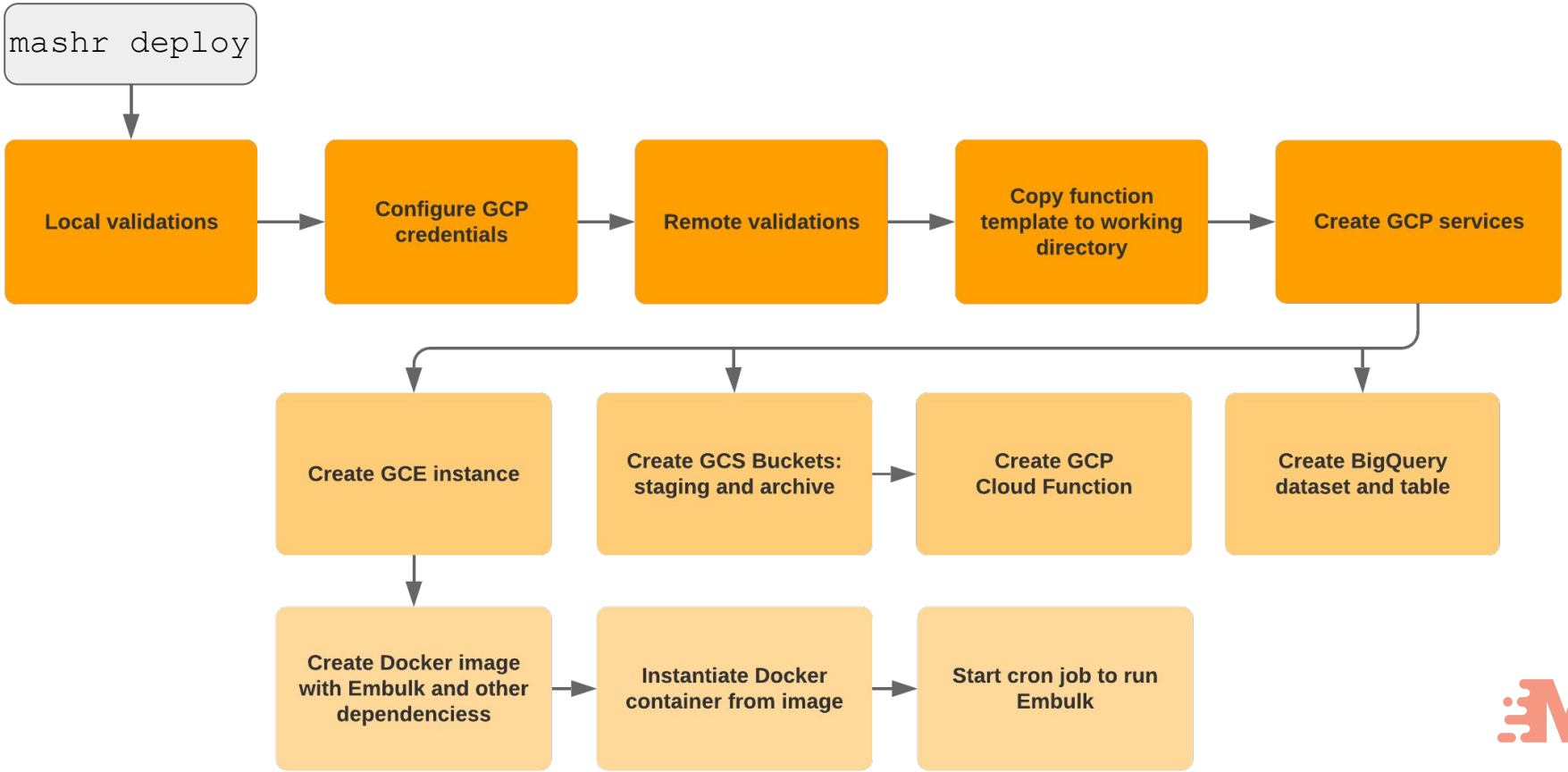
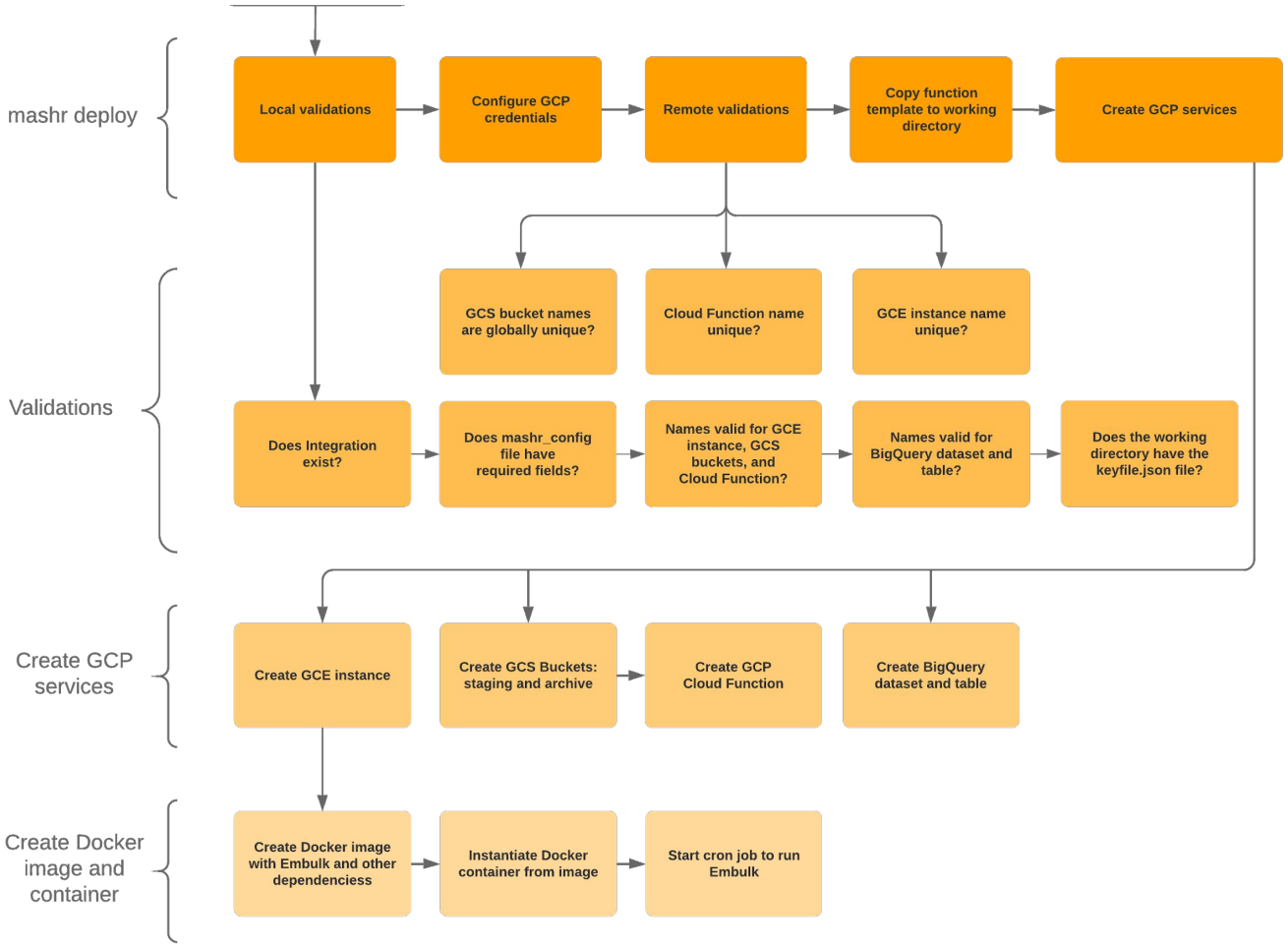


mashr deploy



Mashr Deploy Command



mashr destroy

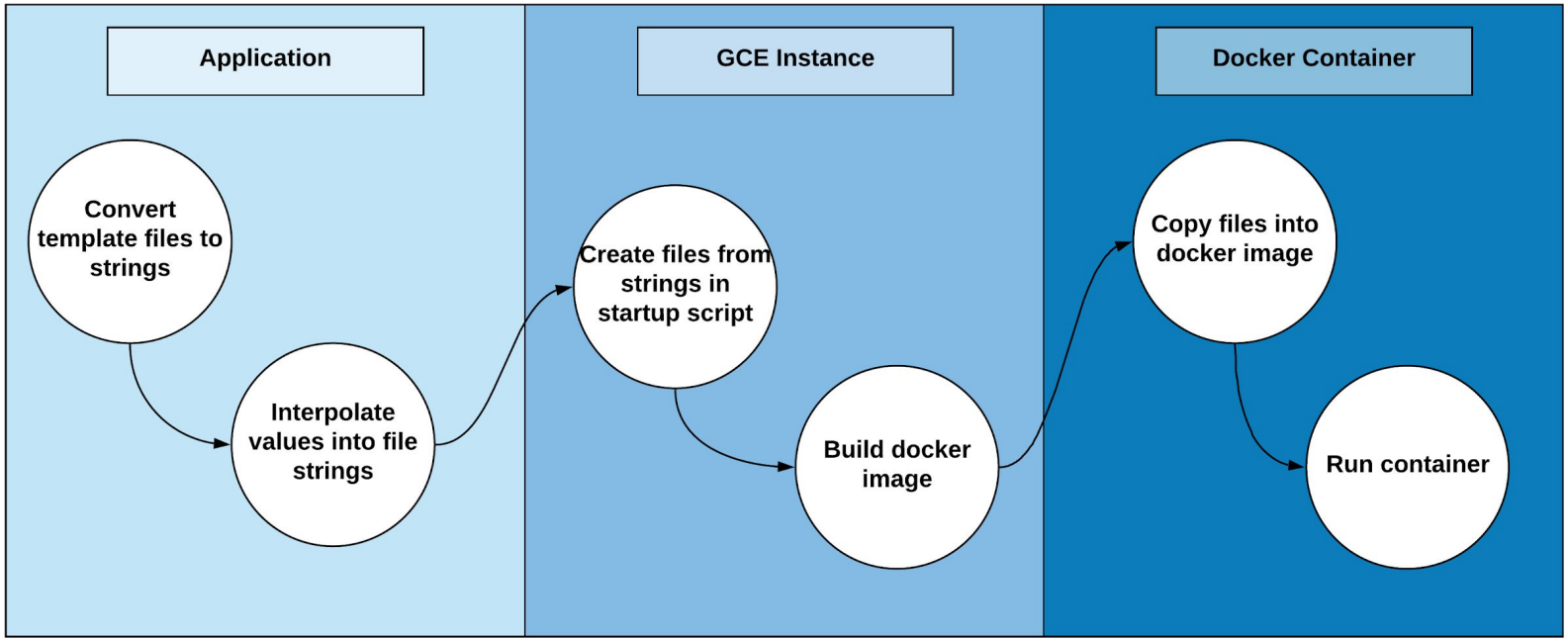
Mashr

Principles of a good Data Pipeline

- Extraction
- Validation
- Transformation
- Staging / Archiving
- Publishing to target
- Monitoring
- Orchestration and Ordering
- Performance

Challenges

Docker Containers



Challenges

Docker Cron Jobs

Where do we schedule embulk jobs to run at a regular interval?

Either:

A) A cron job on the virtual machine that the container runs on

B) Cloud Scheduler, GCP's built in cron service

C) A cron job that runs in a separate container

D) A cron job running inside the docker container itself

Challenges

Docker Cron Jobs

Either:

~~**A)** A cron job on the virtual machine that the container runs on~~

~~**B)** Cloud Scheduler, GCP's built in cron service~~

~~**C)** A cron job that runs in a separate container~~

D) A cron job running inside the docker container itself

```
CMD service cron start && tail -f /var/log/cron.log
```

Challenges

Docker Logging

How to get the output of cron jobs to Stackdriver

```
const createEmbulkScript = (runCommand) => {
  runCommand = runCommand.replace(
    'embulk_config.yml', '/root/mashr/embulk_config.yml.liquid');
  // sends logs of cron job to /proc/1/fd/1, where docker listens
  const script =
`#!/bin/bash
export DATE=$(date +"%Y-%m-%dT%H-%M-%S-%3N")

${runCommand} >> /proc/1/fd/1 2>&1
`;

  return script;
};
```

Future Work

- Enable cross platform support - AWS!
- Enable other target destinations
- Enable users authentication with OAuth instead of keyfiles.
- Automatic schema pre-check and creation to ensure that your input values will upload to BigQuery successfully
- Add a ‘redeploy’ command that allows users to overwrite existing integrations
- Explore the option of using Kubernetes to protect against GCE failover

Thanks!

Jacob Coker-Dukowitz

http://jacobcd.io

Mashr Github

https://mashr-framework.github.io/