Reliability

Vince Gonzalez

Strategic Cloud Engineer,
Google Cloud

Agenda

Course Intro

Monitoring

Logging and Error Reporting

Troubleshooting and Debugging

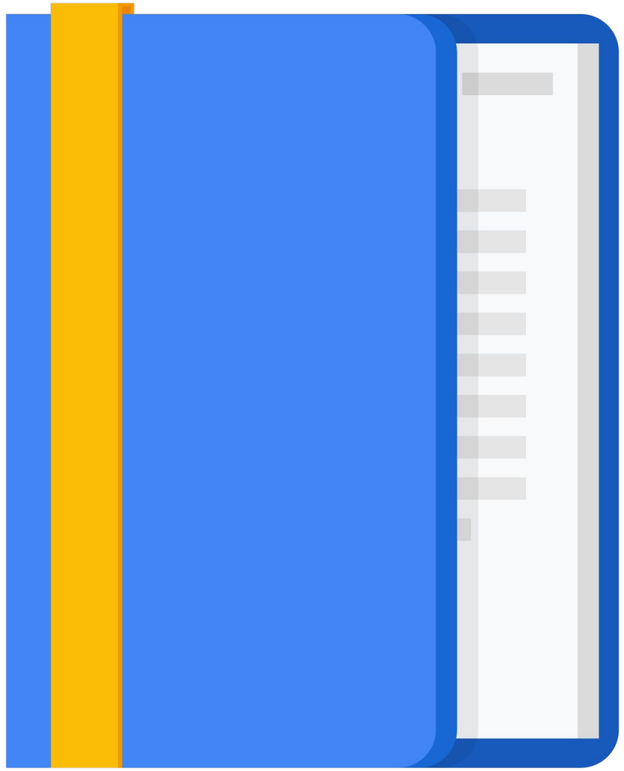
Performance

Testing and CI/CD

Reliability

Flex Templates

Course Summary



Introduction to reliability

Batch

- Rerun pipeline if a job fails
- Source data is not lost, and partial data written to sinks can be rewritten

Introduction to reliability

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- Source data is not lost, and partial data written to sinks can be rewritten

Streaming

- Protect against various failure modes
- Minimize / eliminate data loss
- Minimize downtime

Reliability failure modes

User code and data shape

Outages

Reliability failure modes

User code and data shape

- Transient errors
- Corrupted data

Outages

Reliability failure modes

User code and data shape

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Outages

- Service outage
- Zonal outage
- Regional outage

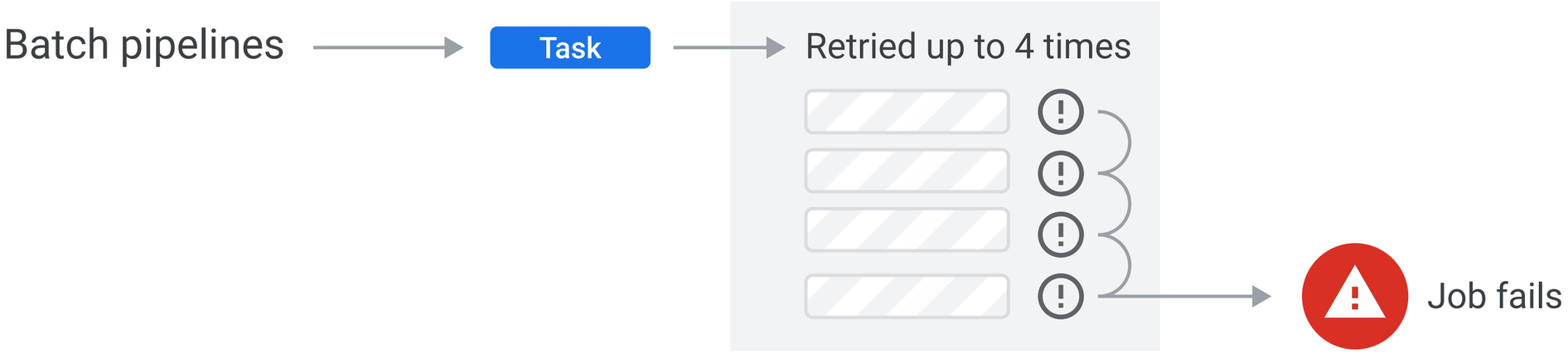
Reliability

Agenda

- Monitoring
- Geolocation
- Disaster recovery
- High availability

Failure during pipeline execution

Batch vs streaming



Failure during pipeline execution

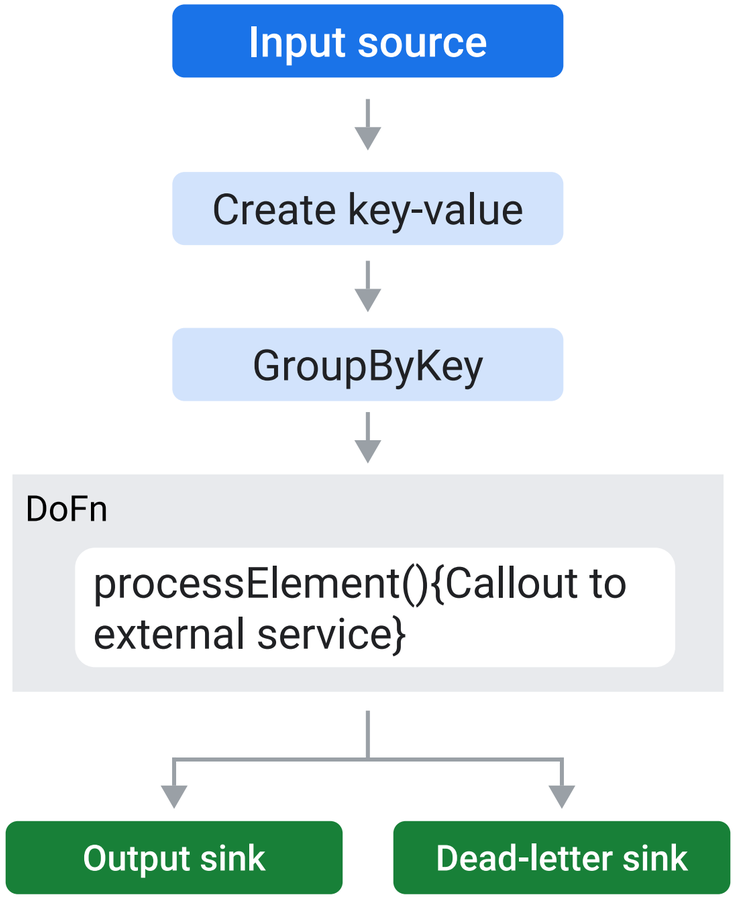
Batch vs streaming

Batch pipelines → Task → Retried up to 4 times → Job fails

Streaming pipelines → Task → Stall indefinitely →

- High data freshness
- Job logs
- Cloud Monitoring
- Metrics for pipeline progress and error count

Dead-letter sinks and error logging



Dead-letter sinks and error logging

Java

```
final TupleTag successTag;
final TupleTag deadLetterTag;
PCollection input = /* ... */;

PCollectionTuple outputTuple = input.apply(ParDo.of(new DoFn(){
    @Override
    void processElement(ProcessContext ctxt) {
        try {
            c.output(process(c.element));
        } catch(MyException ex) {
            // Optional Logging at debug level
            c.sideOutPut(deadLetterTag, c.element);
        }
    }
})).writeOutPutTags(successTag, TupleTagList.of(deadLetterTag));

// Write dead letter elements to separate sink
outputTuple.get(deadLetterTag).apply(BigQuery.write(...));

// Process the successful element differently.
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Monitoring and alerting policies

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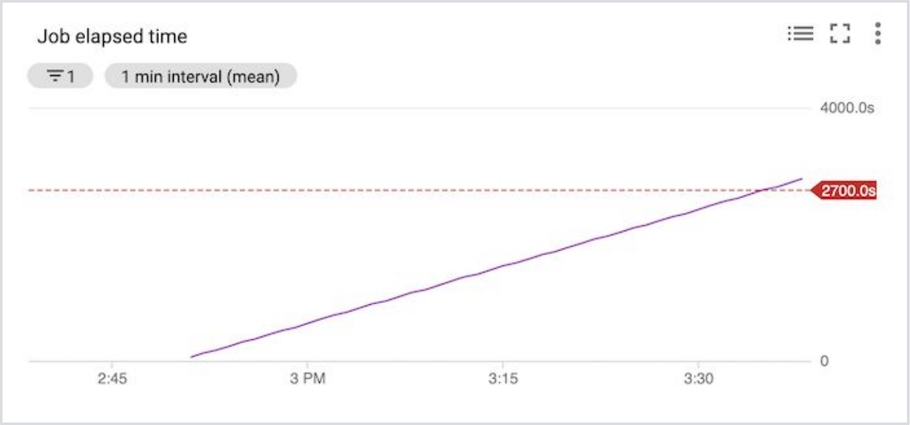
- Catch issues before they bring down production systems
- Dataflow's Job Metrics tab provides an integrated monitoring experience
- Cloud Monitoring integration extends capabilities

Monitoring and alerting policies

Batch

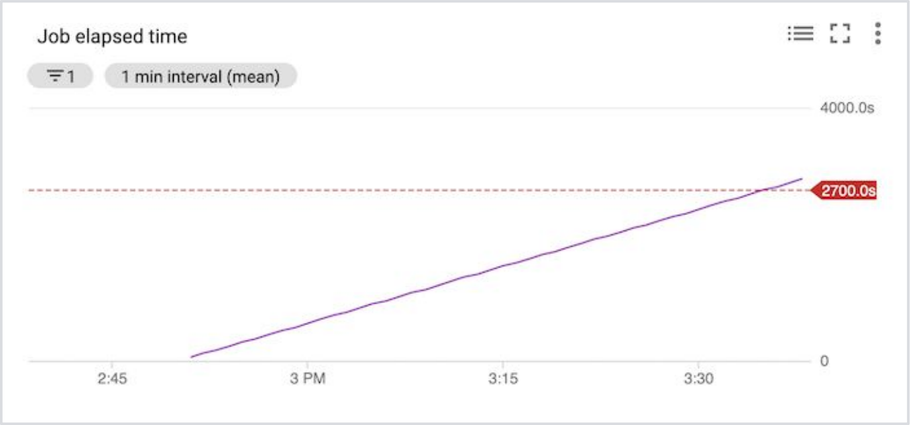


Potential metrics to alert on:

- Job status
- Elapsed time

Monitoring and alerting policies

Batch



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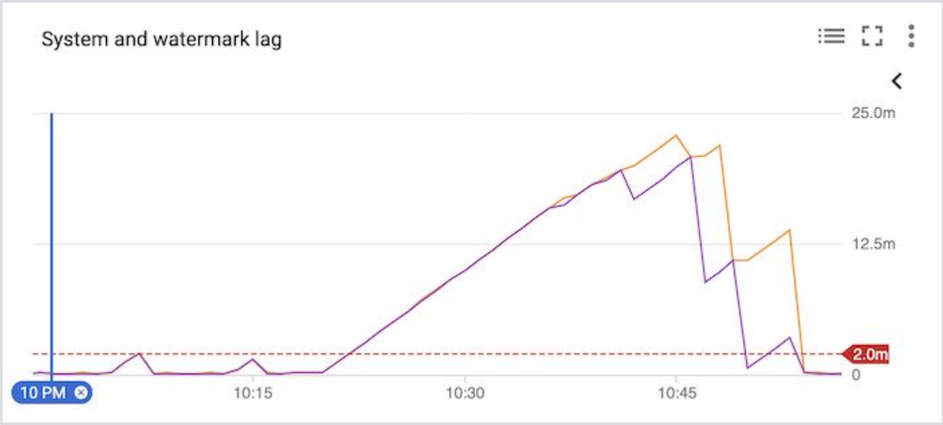
Streaming



Potential metrics to alert on:

- Data freshness
- System latency

Reliability

Agenda

- Monitoring
- Geolocation
- Disaster recovery
- High availability

Worker region

DO: Specify **region**

```
$ python3 -m apache_beam.examples.wordcount
\
  --input
gs://dataflow-samples/shakespeare/kinglear.t
xt \
  --output gs://$BUCKET/results/outputs
--runner DataflowRunner  \
  --project $PROJECT  --temp_location
gs://$BUCKET/tmp/  \
  --region $REGION
```

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```

Warning: You cannot change the location of a job after it has started.

Follow isolation principles

DO: Isolate processing in one region

Storage
us-central1

↓

Dataflow
us-central1

↓

BigQuery
us-central1

Follow isolation principles

DO: Isolate processing in one region

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DO: Use multi-regional locations for sources and sinks

Storage
us

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DO: Use multi-regional locations for sources and sinks

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us

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Dataflow
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BigQuery
us

DON'T: Deploy cross-region dependencies

Storage
us-central1

↓

Dataflow
us-central1

↓

BigQuery
us-east4

Reliability

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- Disaster recovery
- High availability

Disaster recovery on Dataflow

Disaster recovery (DR)

Disaster recovery (DR) protects you from losing your most precious asset: data.

Disaster recovery on Dataflow

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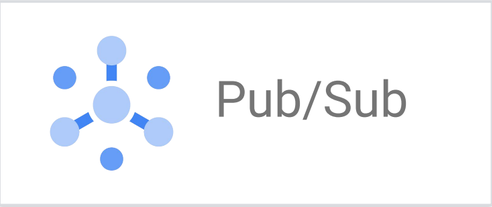
Source snapshots

Source snapshots are one way of preempting data loss in the case of pipeline failure.

Pub/Sub Snapshots

Google Cloud Pub/Sub supports this capability



Snapshots and Seek

Pub/Sub Snapshots

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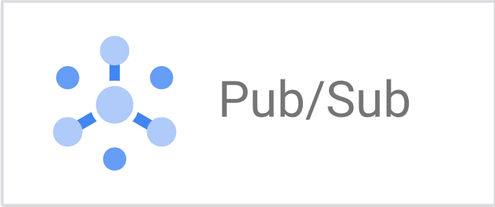
Snapshots

Save your subscription's acknowledgement state



Snapshots and Seek

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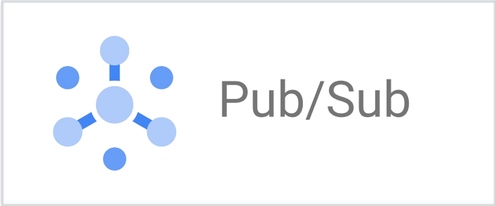
Snapshots

Save your subscription's acknowledgement state

Seek

Revert messages to a prior acknowledgement state



Snapshots and Seek

Using Pub/Sub Snapshots for disaster recovery

1. Make a snapshot of a subscription*

```
gcloud pubsub snapshots create
my-snapshot --subscription=my-sub
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*These steps also can be accomplished in the Console UI

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```

4. Resubmit the pipeline*

```
gcloud dataflow jobs run my-job-name
--gcs_location =my_gcs_bucket
```

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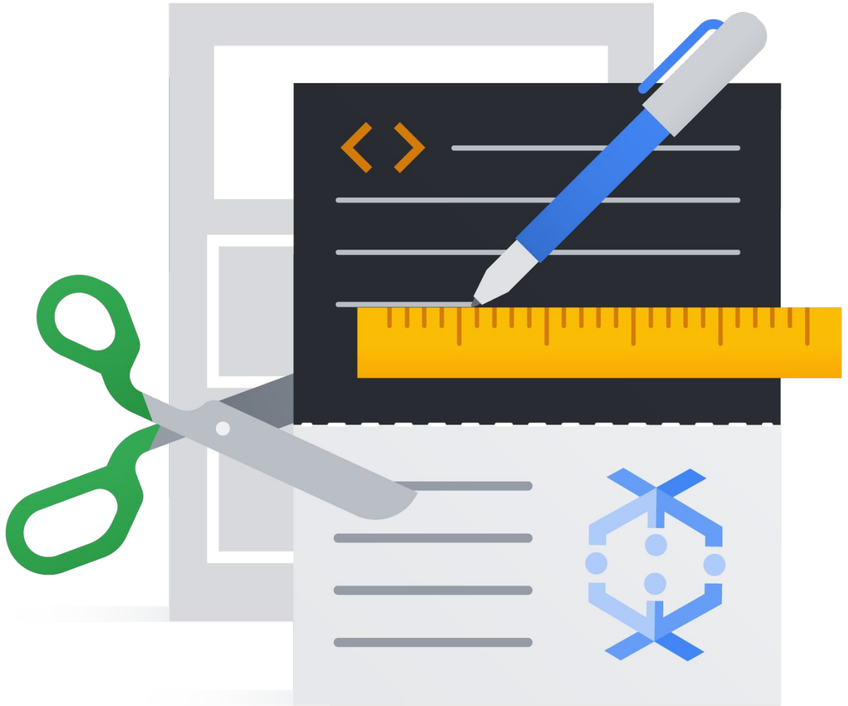
Using Pub/Sub Snapshots for disaster recovery

Best practices

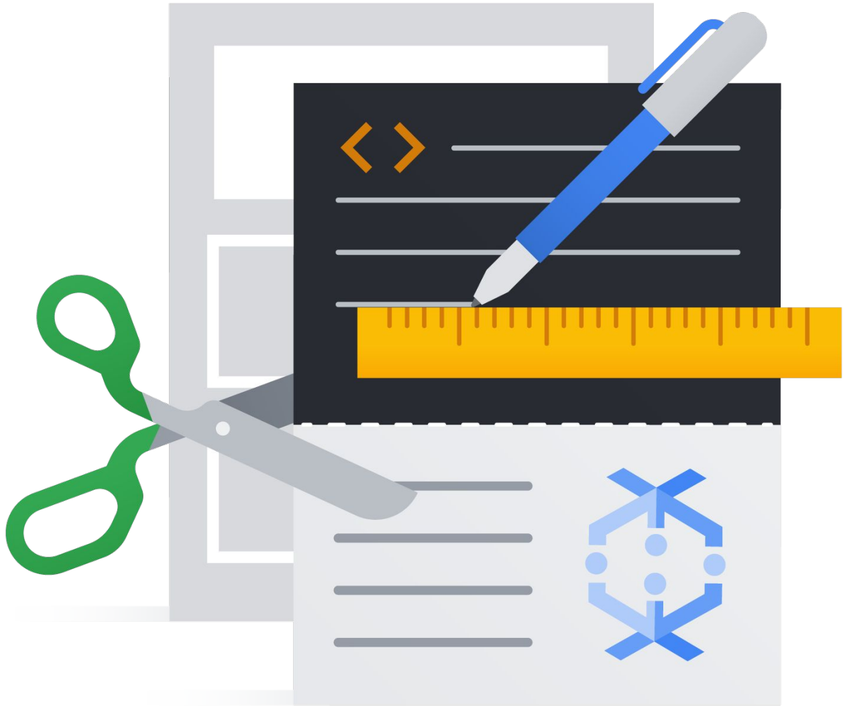
Pub/Sub messages have a maximum data retention of 7 days



Using Pub/Sub Snapshots for disaster recovery

Best practices

Pub/Sub messages have a maximum data retention of 7 days—so take a Pub/Sub Snapshot at least weekly to ensure no data loss



Dataflow Snapshots

Pub/Sub

Snapshots and Seek

Caveats for using Pub/Sub Snapshots and Seek:

Dataflow Snapshots

Pub/Sub

Snapshots and Seek

Caveats for using Pub/Sub Snapshots and Seek:

- Reconciliation of data written to sink

Dataflow Snapshots

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Dataflow

Snapshots

Dataflow Snapshots saves the state of streaming pipelines:

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Pub/Sub

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Pub/Sub

Snapshots and Seek

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Dataflow

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Dataflow Snapshots saves the state of streaming pipelines:

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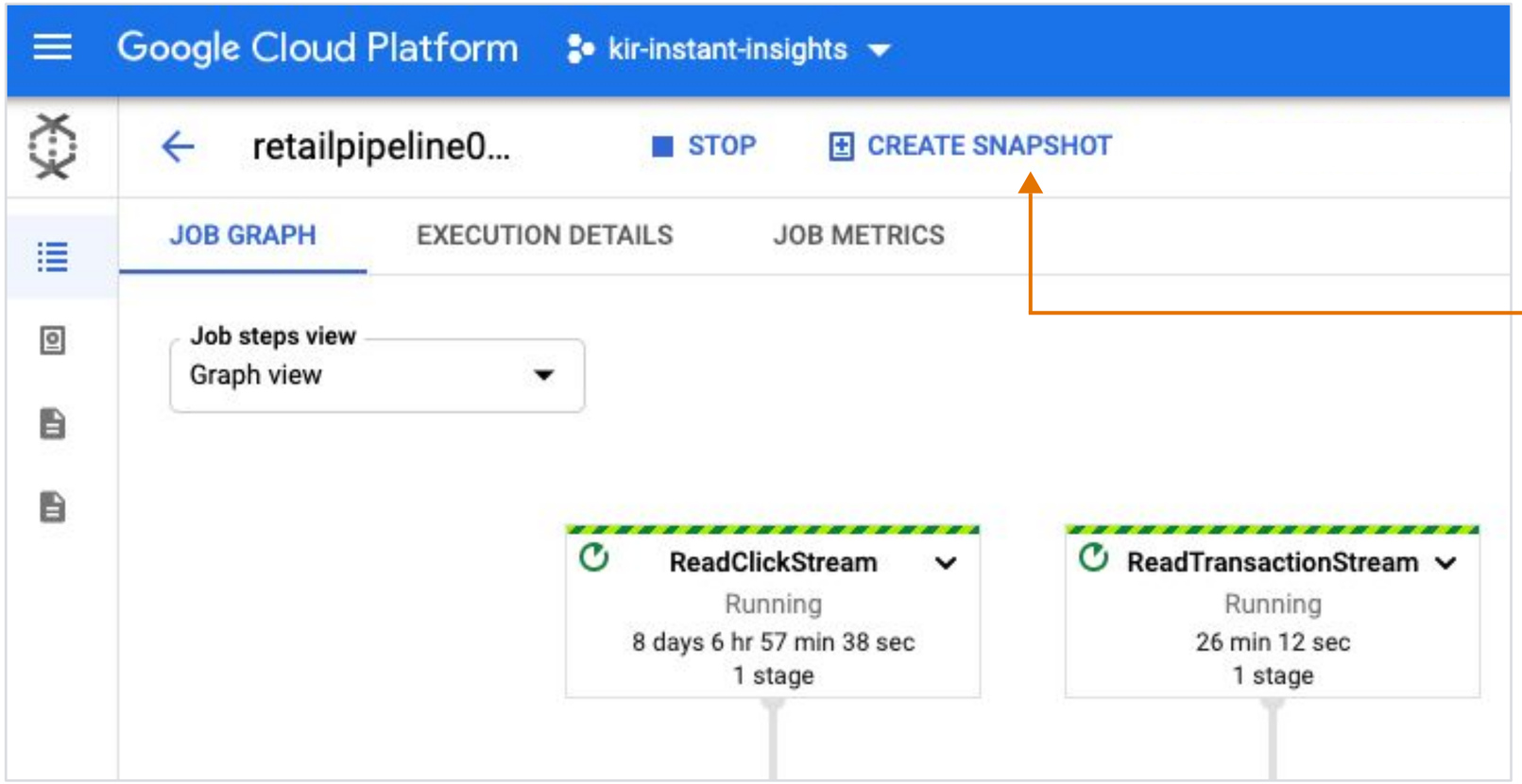
- Option to create a snapshot with Pub/Sub source

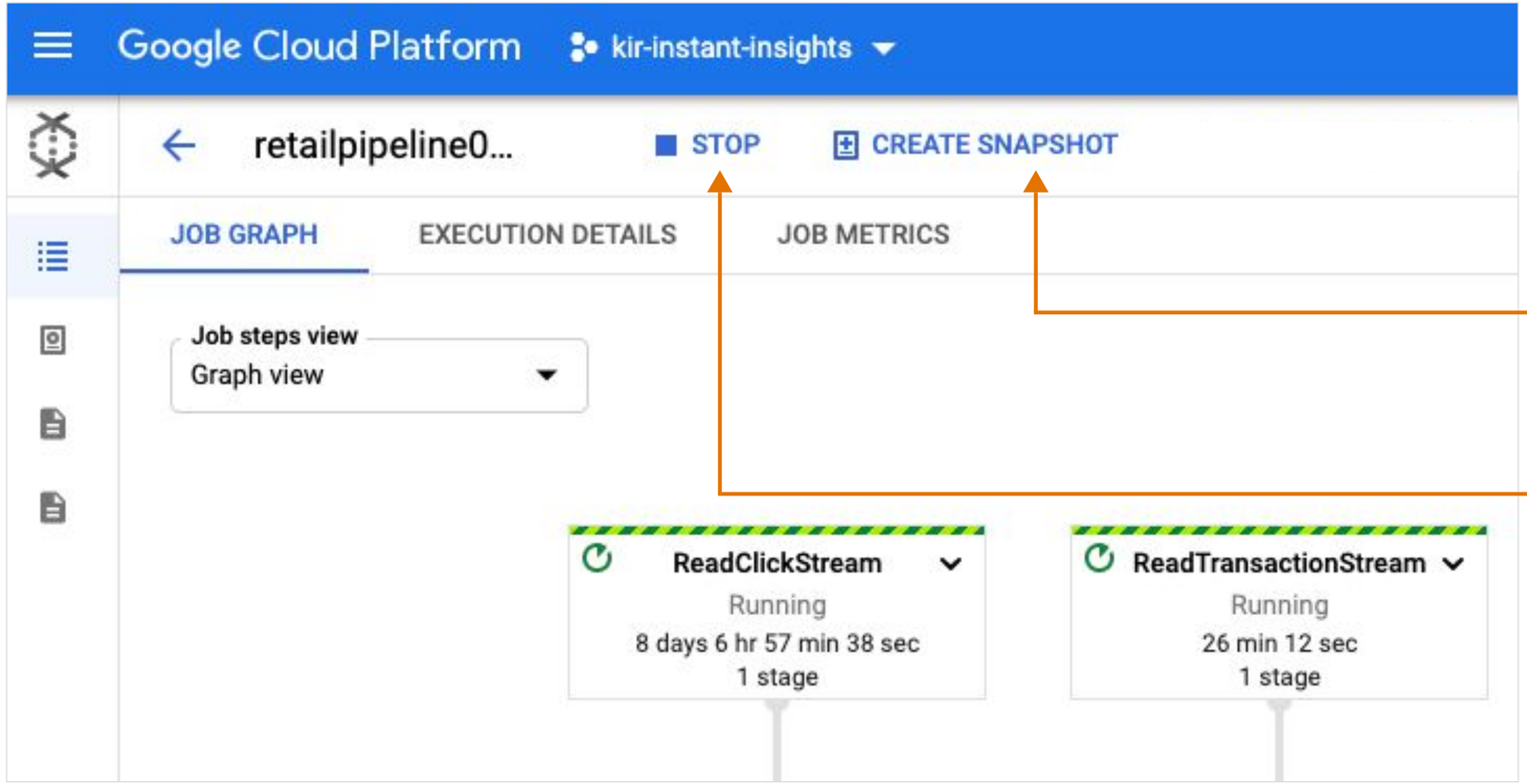
Using Dataflow Snapshots for disaster recovery



1 Take Dataflow snapshots with Pub/Sub sources*

*These steps also can be accomplished with the command line interface

Using Dataflow Snapshots for disaster recovery



1. Take Dataflow snapshots with Pub/Sub sources*
2. Stop and drain your Dataflow job*

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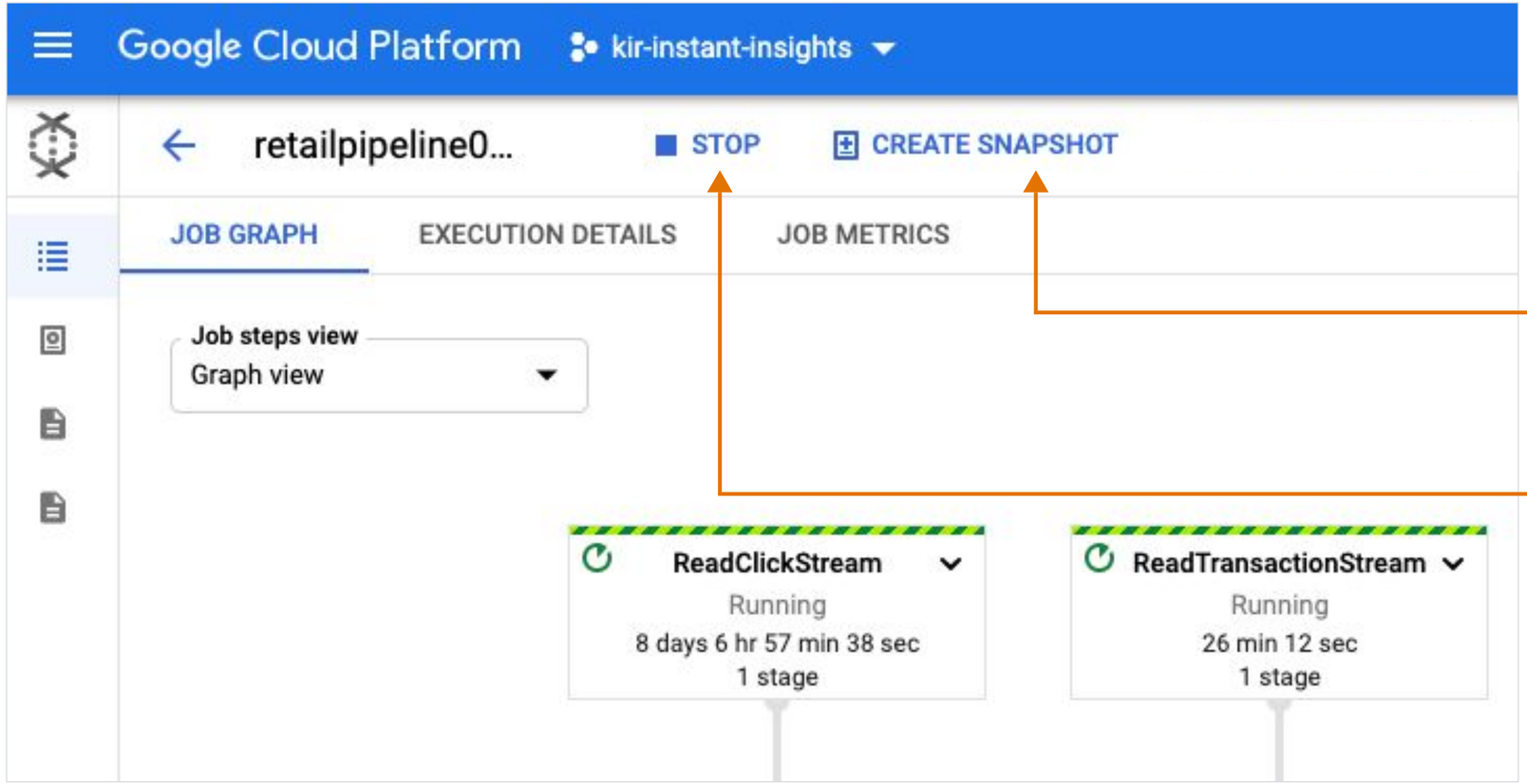
Using Dataflow Snapshots for disaster recovery



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2. Stop and drain your Dataflow job*
3. Create job with snapshot from your IDE

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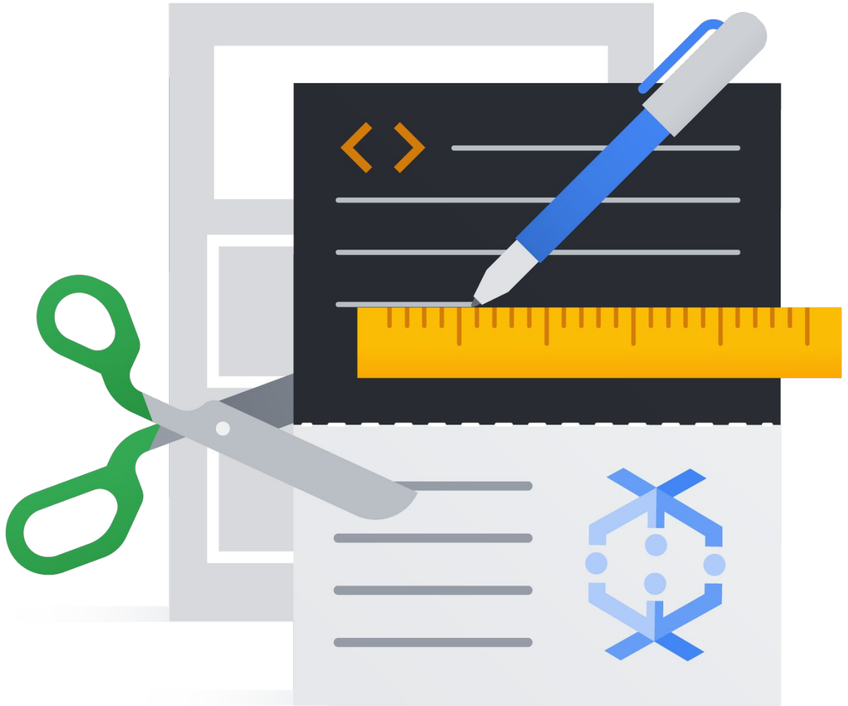
Using Dataflow Snapshots for disaster recovery

Best practices

- Schedule a Dataflow snapshot at least once a week using **Cloud Composer** or **Cloud Scheduler** to ensure you never lose data in the event of an outage.



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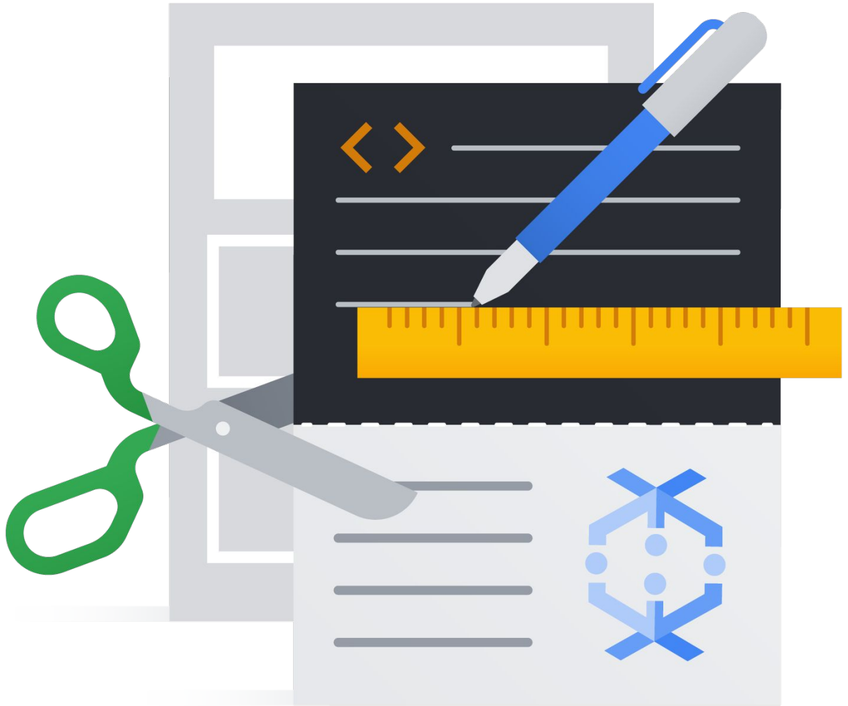

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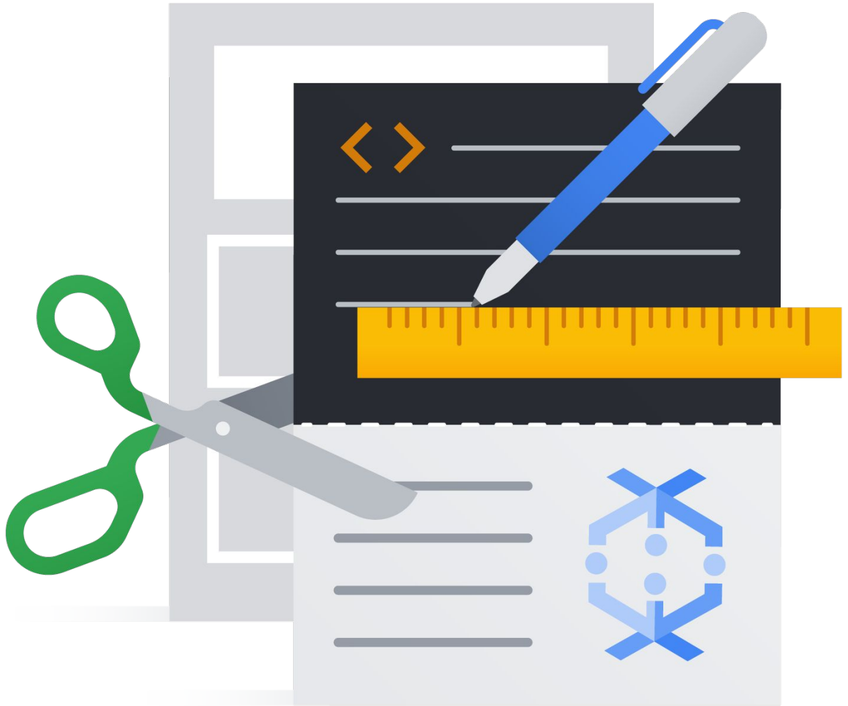
- In case of regional outage, wait for the region to come back online.



Reliability

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- High availability

High availability on Dataflow

High availability (HA) requirements come from your business needs.

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High availability on Dataflow

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Three considerations when determining your HA needs:

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High Availability on Dataflow

High availability (HA) requirements come from your business needs.

Three considerations when determining your HA needs:

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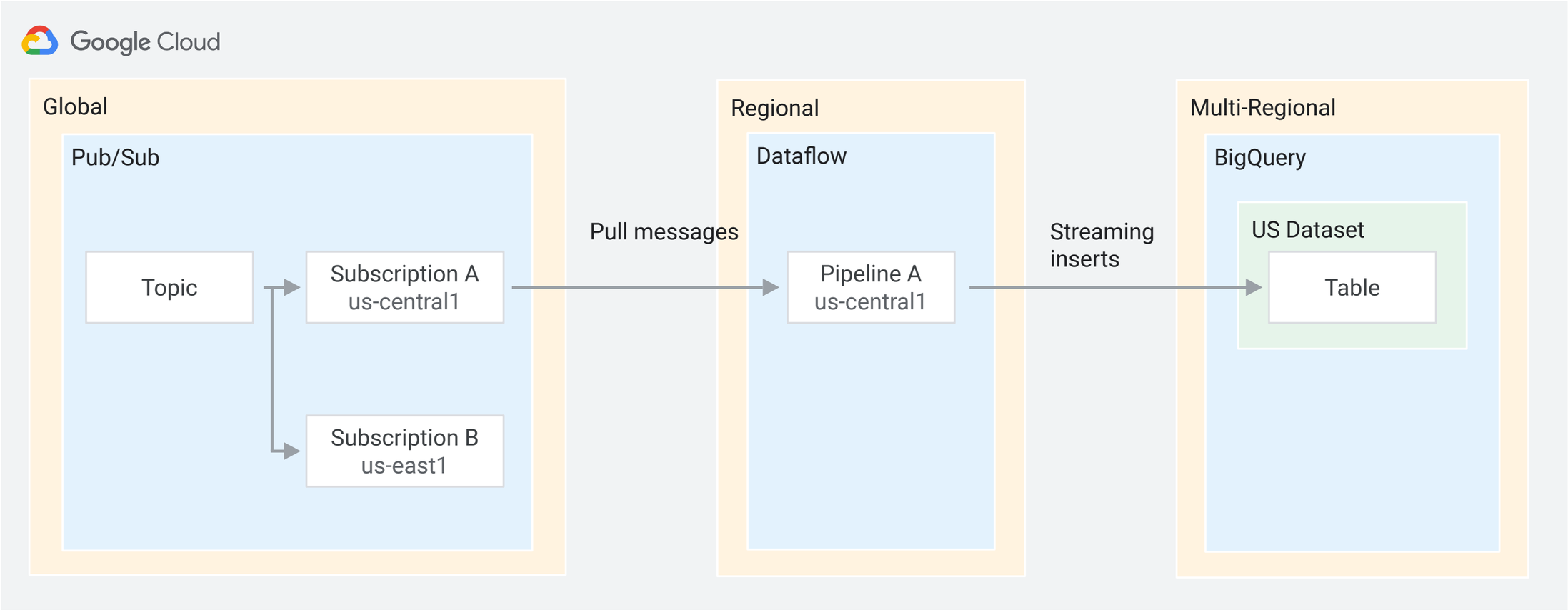
- Data loss
- Cost

High availability: Configuration 1

Redundant sources

✓ Downtime ✗ Data loss ✓ Cost



High availability: Configuration 2

Redundant pipelines

✓ Downtime ✓ Data loss ✗ Cost