Dataflow Logging

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Outline

Introduce Dataflow's logging & error reporting integration -- we make it easy to bring the best of Cloud Logging with your Dataflow application

Find the logging panel at the bottom

- Step logs vs. worker logs
- Severity types of logs
- Show them Cloud Logging interface
- Explain indicators for specific log name

Diagnostics tabs

- Show Error Reporting interface
- Show them links to platform errors

Advanced things you can do with logs:

- Custom logs using SLF4J

Discuss costs:

- Dataflow service logs are not chargeable
- Which logs are chargeable?
- How do you control that?

Demo

- Walk them through the Logging Panel
- Show them the step logs vs. worker logs
- Show them filtering severity levels of logs
- Click over to Cloud Logging -- show a sample query for logs
- Click over to Error Reporting -- show them diagnostics for errors

Logging & Error Reporting

Every SRE best practices book will emphasize the importance of having robust logging & error reporting capabilities

Google Cloud offers an end-to-end suite for these needs with Operations Suite

- Cloud Monitoring
- Cloud Logging
- Error Reporting
- Cloud Profiler
- Cloud Trace
- Cloud Debugger
- … and several more

What do I need to do to extend these to our Dataflow applications?

Dataflow + Logging & Error Reporting

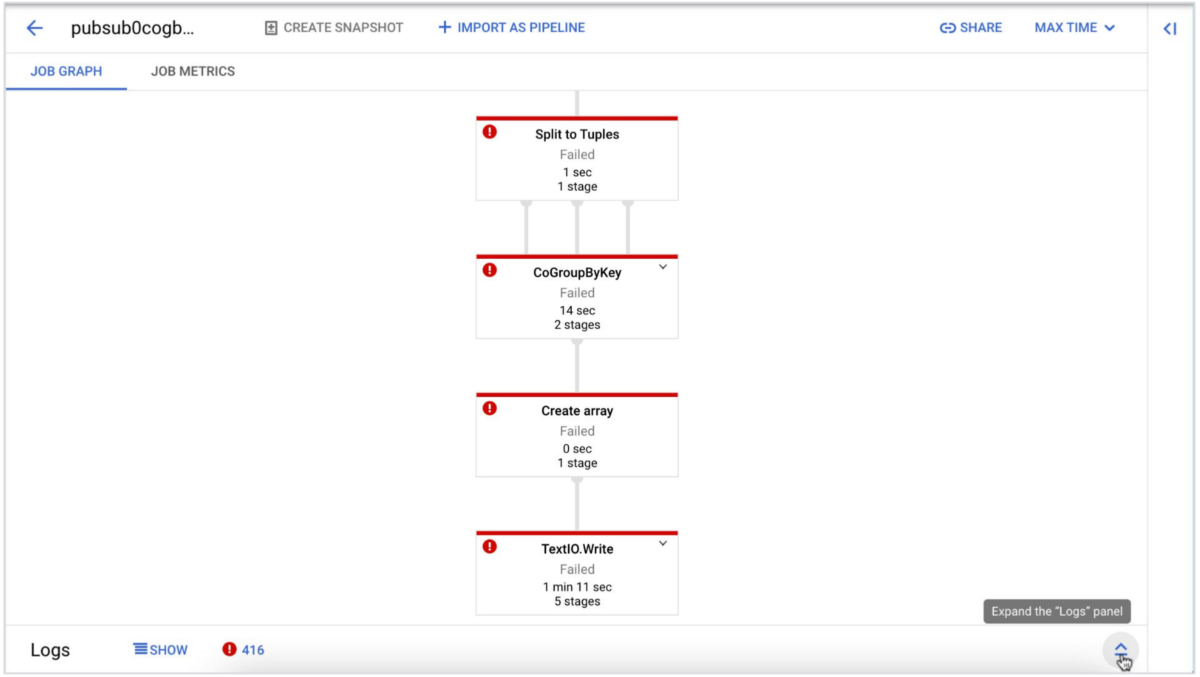
Nothing at all!

Dataflow offers native integration with Cloud Logging and Error Reporting

Dataflow Logging

Logging Panel

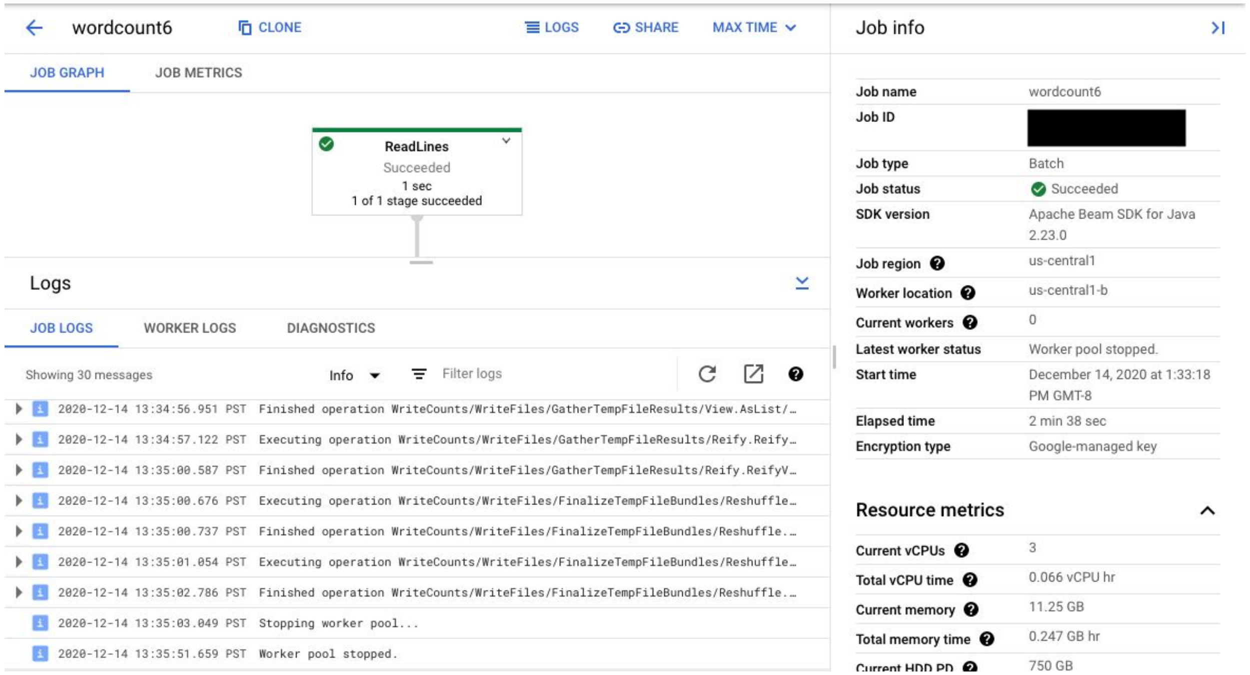
You'll find the logging panel at the bottom of your Job Details page:



Logging Panel

You'll find three panels:

- Job Logs
- Worker Logs
- Diagnostics



```
2020-12-14 13:34:56.951 PST  Finished operation WriteCounts/WriteFiles/GatherTempFileResults/View.AsList/…
2020-12-14 13:34:57.122 PST  Executing operation WriteCounts/WriteFiles/GatherTempFileResults/Reify.Reify…
2020-12-14 13:35:00.587 PST  Finished operation WriteCounts/WriteFiles/GatherTempFileResults/Reify.ReifyV…
2020-12-14 13:35:00.676 PST  Executing operation WriteCounts/WriteFiles/FinalizeTempFileBundles/Reshuffle…
2020-12-14 13:35:00.737 PST  Finished operation WriteCounts/WriteFiles/FinalizeTempFileBundles/Reshuffle.…
2020-12-14 13:35:01.054 PST  Executing operation WriteCounts/WriteFiles/FinalizeTempFileBundles/Reshuffle…
2020-12-14 13:35:02.786 PST  Finished operation WriteCounts/WriteFiles/FinalizeTempFileBundles/Reshuffle.…
2020-12-14 13:35:03.049 PST  Stopping worker pool...
2020-12-14 13:35:51.659 PST  Worker pool stopped.
```

Job name	wordcount6
Job ID	[redacted]
Job type	Batch
Job status	Succeeded
SDK version	Apache Beam SDK for Java 2.23.0
Job region	us-central1
Worker location	us-central1-b
Current workers	0
Latest worker status	Worker pool stopped.
Start time	December 14, 2020 at 1:33:18 PM GMT-8
Elapsed time	2 min 38 sec
Encryption type	Google-managed key

Resource metrics

Current vCPUs	3
Total vCPU time	0.066 vCPU hr
Current memory	11.25 GB
Total memory time	0.247 GB hr
Current HDD PD	750 GB

Logs

Job Logs

Messages that report the status of a job as a whole

Worker Logs

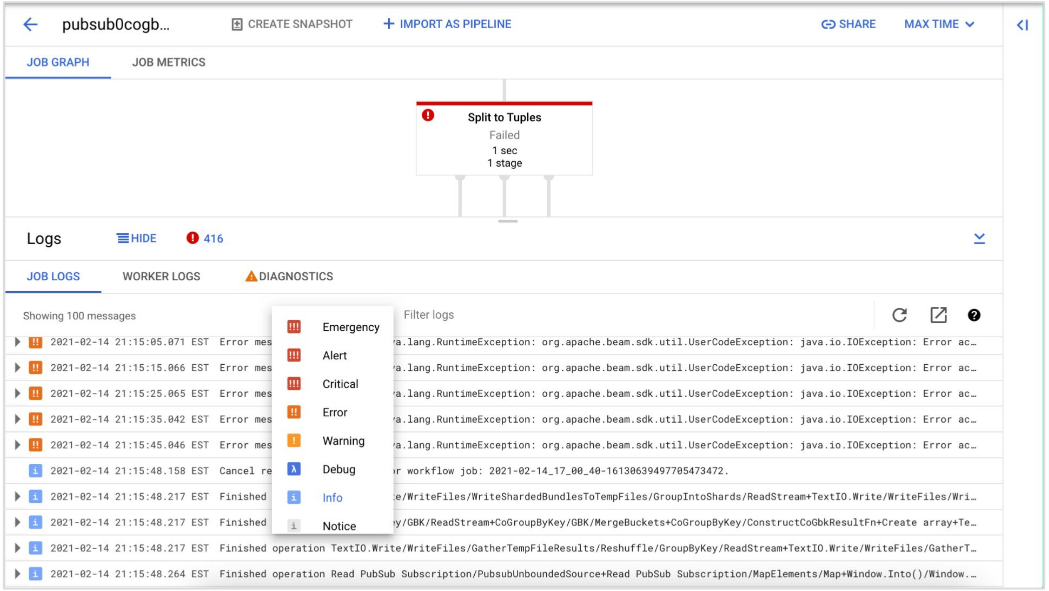
Messages that are produced by the worker instances

Diagnostics

Frequency of each error across time observed in your job

Logging Panel - A Closer Look

- Filter for minimum severity
- Search for specific strings

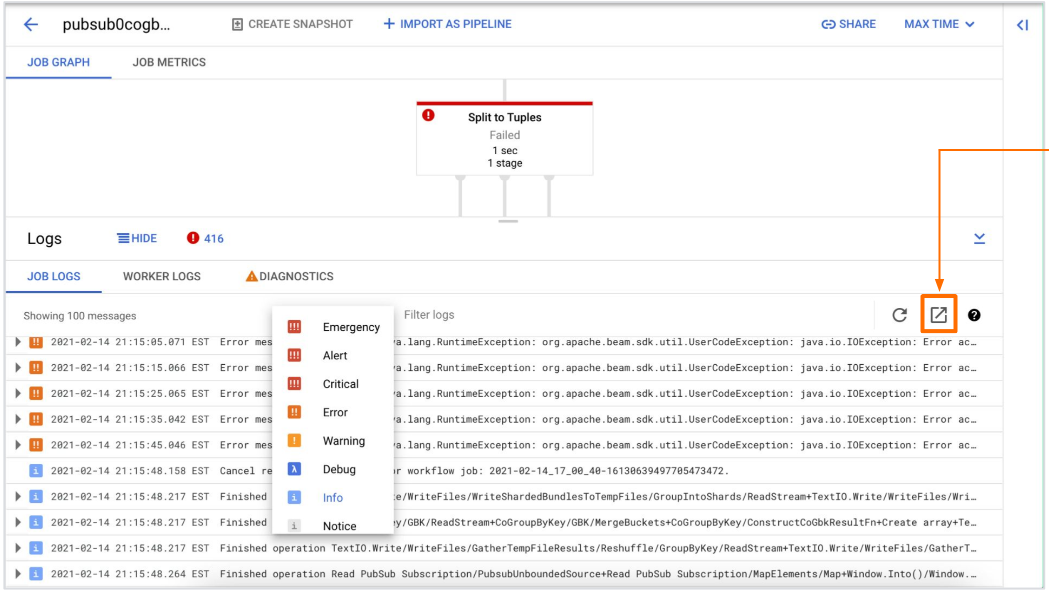


```
2021-02-14 21:15:05.071 EST Error mes          a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:15.066 EST Error mes          a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:25.065 EST Error mes          a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:35.042 EST Error mes          a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:45.046 EST Error mes          a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:48.158 EST Cancel re          r workflow job: 2021-02-14_17_00_40-16130639497705473472.
2021-02-14 21:15:48.217 EST Finished           e/WriteFiles/WriteShardedBundlesToTempFiles/GroupIntoShards/ReadStream+TextIO.Write/WriteFiles/Wri…
2021-02-14 21:15:48.217 EST Finished           y/GBK/ReadStream+CoGroupByKey/GBK/MergeBuckets+CoGroupByKey/ConstructCoGbkResultFn+Create array+Te…
2021-02-14 21:15:48.217 EST Finished operation TextIO.Write/WriteFiles/GatherTempFileResults/Reshuffle/GroupByKey/ReadStream+TextIO.Write/WriteFiles/GatherT…
2021-02-14 21:15:48.264 EST Finished operation Read PubSub Subscription/PubsubUnboundedSource+Read PubSub Subscription/MapElements/Map+Window.Into()/Window.…
```

Searching Logs

Initialization failure?	`Worker jar file misconfiguration`	
Memory pressure?	`Out of memory: Kill process`	`Shutting down JVM after consecutive periods of measured GC thrashing`
Slow processing?	`Lengthy operation in step`	`Hot key detected`
Large amount of data?	`Commit Key request Exceeds Size Limit`	
Too much logging?	`Throttling logger worker`	

Logs Explorer



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2021-02-14 21:15:15.066 EST  Error mes    a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:25.065 EST  Error mes    a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
2021-02-14 21:15:35.042 EST  Error mes    a.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error ac…
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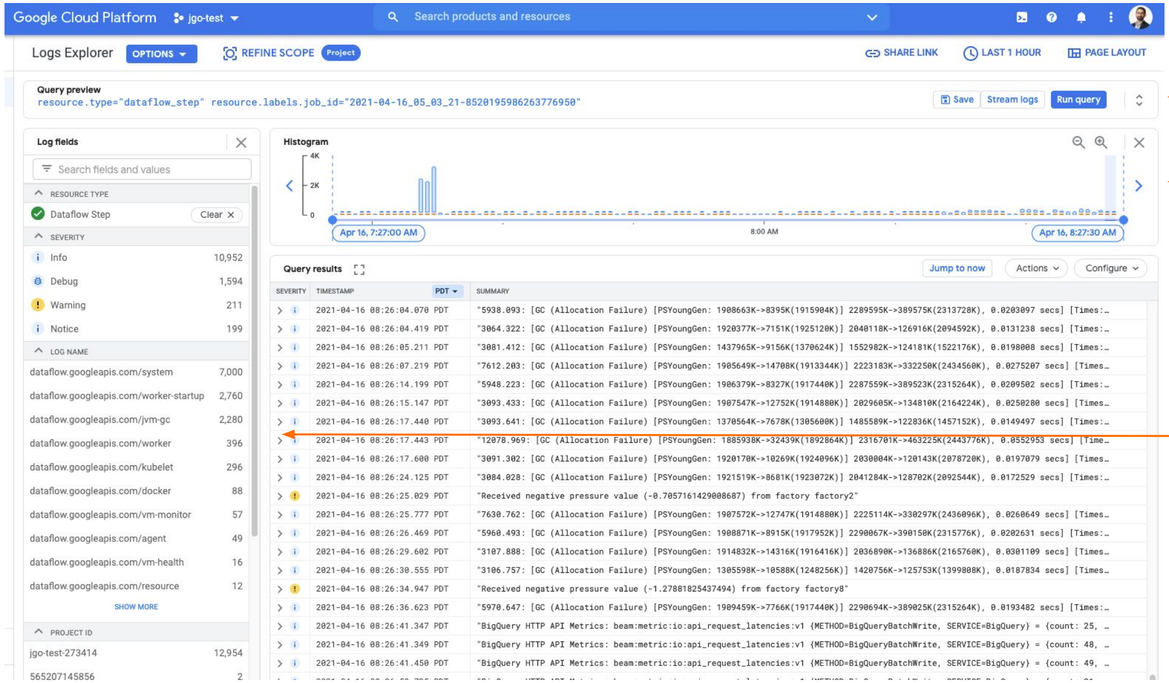
2021-02-14 21:15:48.158 EST  Cancel re    r workflow job: 2021-02-14_17_00_40-16130639497705473472.
2021-02-14 21:15:48.217 EST  Finished     e/WriteFiles/WriteShardedBundlesToTempFiles/GroupIntoShards/ReadStream+TextIO.Write/WriteFiles/Wri…
2021-02-14 21:15:48.217 EST  Finished     y/GBK/ReadStream+CoGroupByKey/GBK/MergeBuckets+CoGroupByKey/ConstructCoGbkResultFn+Create array+Te…
2021-02-14 21:15:48.217 EST  Finished operation TextIO.Write/WriteFiles/GatherTempFileResults/Reshuffle/GroupByKey/ReadStream+TextIO.Write/WriteFiles/GatherT…
2021-02-14 21:15:48.264 EST  Finished operation Read PubSub Subscription/PubsubUnboundedSource+Read PubSub Subscription/MapElements/Map+Window.Into()/Window.…
```

Link to Logs Explorer

Logs Explorer



Query preview

```
resource.type="dataflow_step" resource.labels.job_id="2021-04-16_05_03_21-8520195986263776950"
```

Log fields

RESOURCE TYPE	
Dataflow Step	
SEVERITY	
Info	10,952
Debug	1,594
Warning	211
Notice	199
LOG NAME	
dataflow.googleapis.com/system	7,000
dataflow.googleapis.com/worker-startup	2,760
dataflow.googleapis.com/jvm-gc	2,280
dataflow.googleapis.com/worker	396
dataflow.googleapis.com/kubelet	296
dataflow.googleapis.com/docker	88
dataflow.googleapis.com/vm-monitor	57
dataflow.googleapis.com/agent	49
dataflow.googleapis.com/vm-health	16
dataflow.googleapis.com/resource	12
PROJECT ID	
jgo-test-273414	12,954
565207145856	2

Query results

```
SEVERITY  TIMESTAMP                    PDT  SUMMARY
          2021-04-16 08:26:04.070 PDT  "5938.093: [GC (Allocation Failure) [PSYoungGen: 1908663K->8395K(1915904K)] 2289595K->389575K(2313728K), 0.0203097 secs] [Times:…
          2021-04-16 08:26:04.419 PDT  "3064.322: [GC (Allocation Failure) [PSYoungGen: 1920377K->7151K(1925120K)] 2040118K->126916K(2094592K), 0.0131238 secs] [Times:…
          2021-04-16 08:26:05.211 PDT  "3081.412: [GC (Allocation Failure) [PSYoungGen: 1437965K->9156K(1370624K)] 1552982K->124181K(1522176K), 0.0198008 secs] [Times:…
          2021-04-16 08:26:07.219 PDT  "7612.203: [GC (Allocation Failure) [PSYoungGen: 1905649K->14708K(1913344K)] 2223183K->332250K(2434560K), 0.0275207 secs] [Times…
          2021-04-16 08:26:14.199 PDT  "5948.223: [GC (Allocation Failure) [PSYoungGen: 1906379K->8327K(1917440K)] 2287559K->389523K(2315264K), 0.0209502 secs] [Times:…
          2021-04-16 08:26:15.147 PDT  "3093.433: [GC (Allocation Failure) [PSYoungGen: 1907547K->12752K(1914880K)] 2029605K->134810K(2164224K), 0.0250280 secs] [Times…
          2021-04-16 08:26:17.440 PDT  "3093.641: [GC (Allocation Failure) [PSYoungGen: 1370564K->7678K(1305600K)] 1485589K->122836K(1457152K), 0.0149497 secs] [Times:…
          2021-04-16 08:26:17.443 PDT  "12078.969: [GC (Allocation Failure) [PSYoungGen: 1885938K->32439K(1892864K)] 2316701K->463225K(2443776K), 0.0552953 secs] [Time…
          2021-04-16 08:26:17.600 PDT  "3091.302: [GC (Allocation Failure) [PSYoungGen: 1920170K->10269K(1924096K)] 2030004K->120143K(2078720K), 0.0197079 secs] [Times…
          2021-04-16 08:26:24.125 PDT  "3084.028: [GC (Allocation Failure) [PSYoungGen: 1921519K->8681K(1923072K)] 2041284K->128702K(2092544K), 0.0172529 secs] [Times:…
          2021-04-16 08:26:25.029 PDT  "Received negative pressure value (-0.7057161429008687) from factory factory2"
          2021-04-16 08:26:25.777 PDT  "7630.762: [GC (Allocation Failure) [PSYoungGen: 1907572K->12747K(1914880K)] 2225114K->330297K(2436096K), 0.0260649 secs] [Times…
          2021-04-16 08:26:26.469 PDT  "5960.493: [GC (Allocation Failure) [PSYoungGen: 1908871K->8915K(1917952K)] 2290067K->390150K(2315776K), 0.0202631 secs] [Times:…
          2021-04-16 08:26:29.602 PDT  "3107.888: [GC (Allocation Failure) [PSYoungGen: 1914832K->14316K(1916416K)] 2036890K->136886K(2165760K), 0.0301109 secs] [Times…
          2021-04-16 08:26:30.555 PDT  "3106.757: [GC (Allocation Failure) [PSYoungGen: 1305598K->10588K(1248256K)] 1420756K->125753K(1399808K), 0.0187834 secs] [Times…
          2021-04-16 08:26:34.947 PDT  "Received negative pressure value (-1.27881825437494) from factory factory8"
          2021-04-16 08:26:36.623 PDT  "5970.647: [GC (Allocation Failure) [PSYoungGen: 1909459K->7766K(1917440K)] 2290694K->389025K(2315264K), 0.0193482 secs] [Times:…
          2021-04-16 08:26:41.347 PDT  "BigQuery HTTP API Metrics: beam:metric:io:api_request_latencies:v1 {METHOD=BigQueryBatchWrite, SERVICE=BigQuery} = {count: 25, …
          2021-04-16 08:26:41.349 PDT  "BigQuery HTTP API Metrics: beam:metric:io:api_request_latencies:v1 {METHOD=BigQueryBatchWrite, SERVICE=BigQuery} = {count: 48, …
          2021-04-16 08:26:41.450 PDT  "BigQuery HTTP API Metrics: beam:metric:io:api_request_latencies:v1 {METHOD=BigQueryBatchWrite, SERVICE=BigQuery} = {count: 49, …
```

Create custom queries for your logs

Observe the frequency different types of logs

Filter for different types of logs

Different Types of Logs

- **job-message:** job-level messages that various components of Dataflow generate (i.e. autoscaling configuration, when workers start up or shut down, progress on job step, and job errors). Worker-level errors that originate from crashing user cude and that are present in **worker** logs also propagate up to the job-message logs.
- **worker:** messages produced by Dataflow workers. Workers do most of the pipeline work (i.e. they are the only applying ParDos to data). Worker logs contain messages logged by your code and Dataflow.
- **worker-startup:** captures messages related to the startup process. This includes downloading a job's jars from Cloud Storage, then starting the workers. If there is a problem starting workers, these logs are a good place to look.
- **shuffler:** messages from workers that consolidate the results of parallel pipeline operations.
- **docker & kubelet:** messages related to processes by Dataflow service

Custom Logging

You can also (and should!) write custom logs to track events of note

Java

Apache Beam provides the open source SLF4J library

Python

Apache Beam provides the `logging` library package

```
PCollectionTuple eventsTuple = events
                .apply("Filter bad events", ParDo.of(new DoFn<Event, Event>() {

                    private final Counter counter = Metrics.counter(EventProcessingPipeline.class,
"bad-counter");

                    @ProcessElement
                    public void processElement(ProcessContext ctx) {
                        Event event = ctx.element();
                        Double dataValue = event.getDataValue();
                        if (dataValue < 10) {
                            counter.inc();
                            if (dataValue < 0) {
                                LOG.warn("Received negative pressure value ({}) from factory {}",
dataValue, event.getFactoryCode());
                            }
                            ctx.output(badEventsTupleTag, event);
                        }
                        else {
                            ctx.output(goodEventsTupleTag, event);
                        }
                    }
                }).withOutputTags(goodEventsTupleTag, TupleTagList.of(badEventsTupleTag)));
```

Custom Logs in Logs Explorer

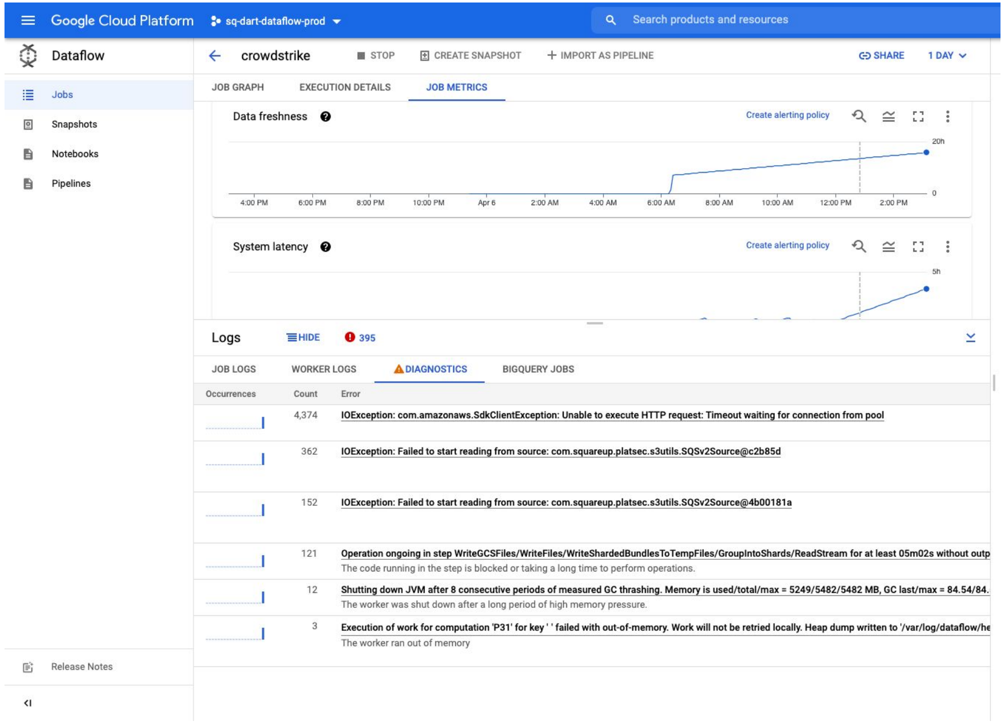
- You can find custom logs in the Logs Explorer with:
  - resource.type: dataflow_step
  - logName: dataflow.googleapis.com%2Fworker

Dataflow Error Reporting

Diagnostics Tab

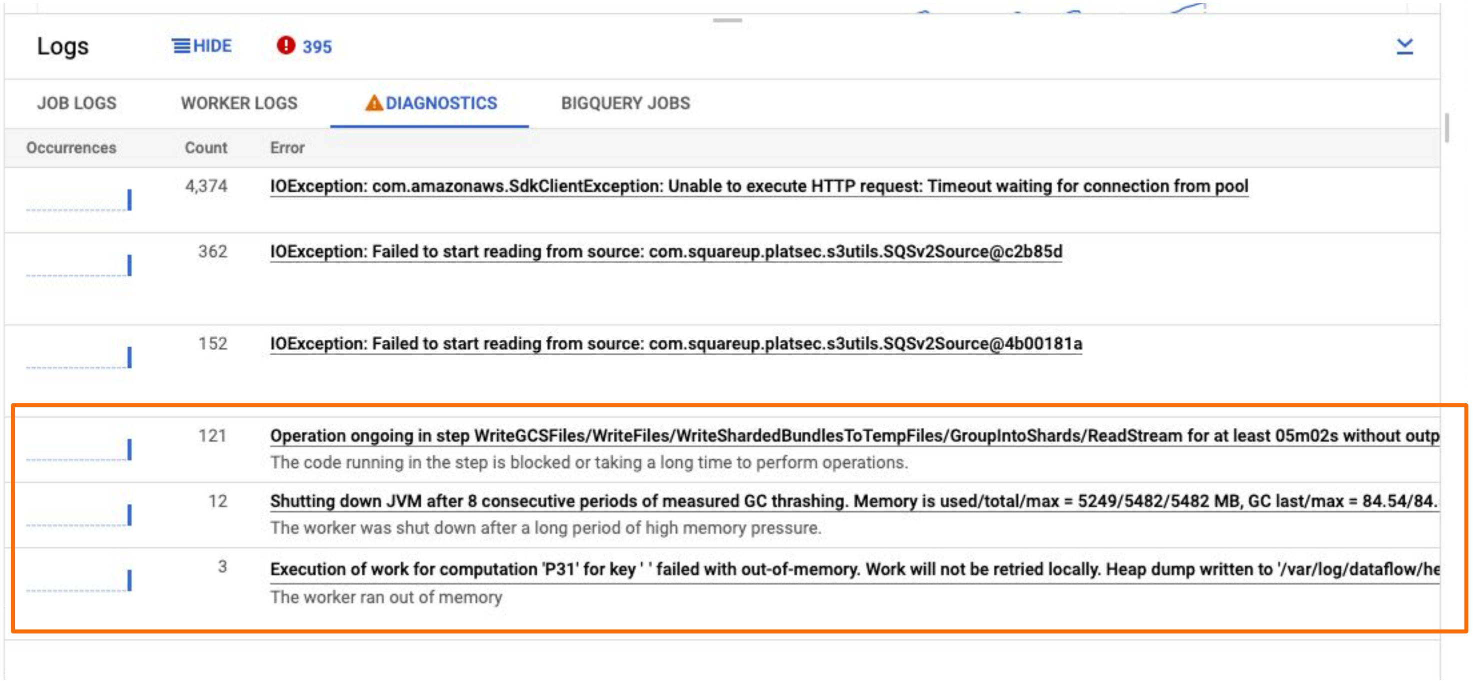
Diagnostics tab shows:

- Where errors occurred along the chosen timeline
- Count of all logged errors
- Possible recommendations for your pipeline



Occurrences	Count	Error
	4,374	IOException: com.amazonaws.SdkClientException: Unable to execute HTTP request: Timeout waiting for connection from pool
	362	IOException: Failed to start reading from source: com.squareup.platsec.s3utils.SQSv2Source@c2b85d
	152	IOException: Failed to start reading from source: com.squareup.platsec.s3utils.SQSv2Source@4b00181a
	121	Operation ongoing in step WriteGCSFiles/WriteFiles/WriteShardedBundlesToTempFiles/GroupIntoShards/ReadStream for at least 05m02s without outp The code running in the step is blocked or taking a long time to perform operations.
	12	Shutting down JVM after 8 consecutive periods of measured GC thrashing. Memory is used/total/max = 5249/5482/5482 MB, GC last/max = 84.54/84. The worker was shut down after a long period of high memory pressure.
	3	Execution of work for computation 'P31' for key ' ' failed with out-of-memory. Work will not be retried locally. Heap dump written to '/var/log/dataflow/he The worker ran out of memory

Diagnostics Tab - Recommendations



Logs HIDE 395

JOB LOGS WORKER LOGS DIAGNOSTICS BIGQUERY JOBS

Occurrences	Count	Error
	4,374	IOException: com.amazonaws.SdkClientException: Unable to execute HTTP request: Timeout waiting for connection from pool
	362	IOException: Failed to start reading from source: com.squareup.platsec.s3utils.SQSv2Source@c2b85d
	152	IOException: Failed to start reading from source: com.squareup.platsec.s3utils.SQSv2Source@4b00181a
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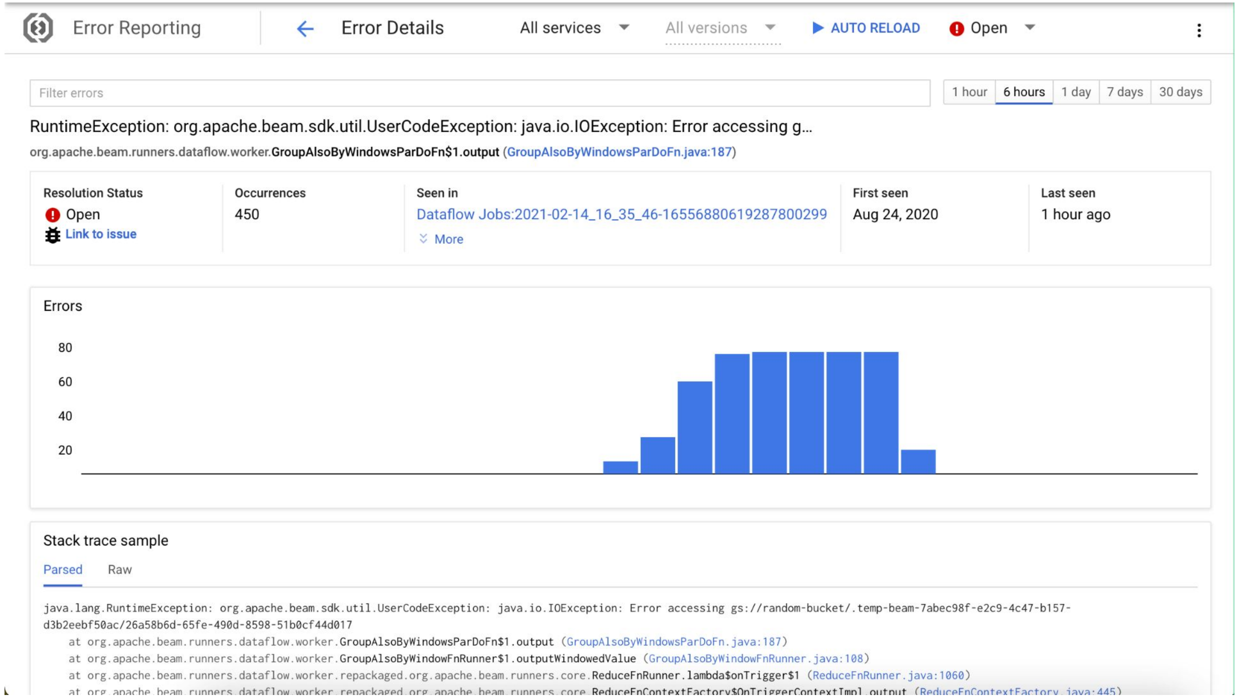
Error Reporting Interface



RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error accessing g...

org.apache.beam.runners.dataflow.worker.GroupAlsoByWindowsParDoFn$1.output (GroupAlsoByWindowsParDoFn.java:187)

Resolution Status	Occurrences	Seen in	First seen	Last seen
Open Link to issue	450	Dataflow Jobs:2021-02-14_16_35_46-16556880619287800299 More	Aug 24, 2020	1 hour ago

Errors

Stack trace sample

Parsed Raw

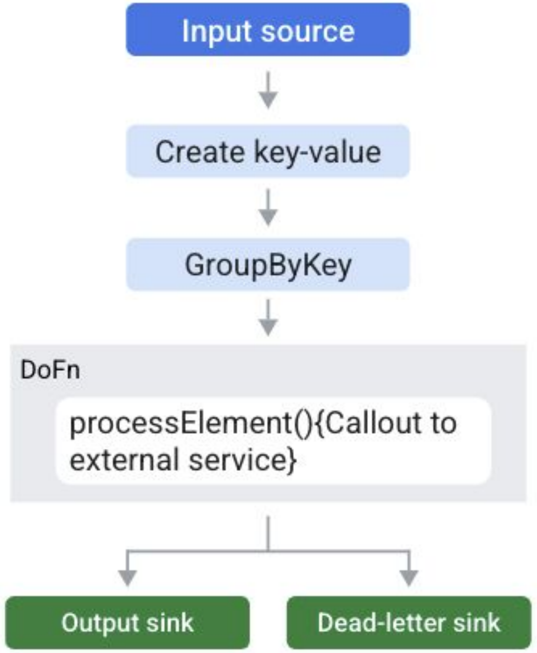
```
java.lang.RuntimeException: org.apache.beam.sdk.util.UserCodeException: java.io.IOException: Error accessing gs://random-bucket/.temp-beam-7abec98f-e2c9-4c47-b157-
d3b2eebf50ac/26a58b6d-65fe-490d-8598-51b0cf44d017
    at org.apache.beam.runners.dataflow.worker.GroupAlsoByWindowsParDoFn$1.output (GroupAlsoByWindowsParDoFn.java:187)
    at org.apache.beam.runners.dataflow.worker.GroupAlsoByWindowFnRunner$1.outputWindowedValue (GroupAlsoByWindowFnRunner.java:108)
    at org.apache.beam.runners.dataflow.worker.repackaged.org.apache.beam.runners.core.ReduceFnRunner.lambda$onTrigger$1 (ReduceFnRunner.java:1060)
    at org.apache.beam.runners.dataflow.worker.repackaged.org.apache.beam.runners.core.ReduceFnContextFactory$OnTriggerContextImpl.output (ReduceFnContextFactory.java:445)
```

- Histogram showing errors across your Dataflow project
- Different time ranges
- Look at errors across jobs
- Examine stack traces
- Link to internal issue tracker

Best Practices

Dead-letter queues & Error logging

- Write erroneous records to a dead-letter queue
- Use an exception block that allows you to log an issue & send the raw data as a SideOutput to store unprocessable data



```
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.
PCollection success = outputTuple.get(successTag);
```

```
final TupleTag successTag;
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Demo

BEAM

COLLEGE

Thank you!

Q & A