Going Serverless - an Introduction to AWS Glue

Michael Rainey | Oaktable World 2018

what is serverless

what is

serverless == function as a service

what is
serverless == fully managed

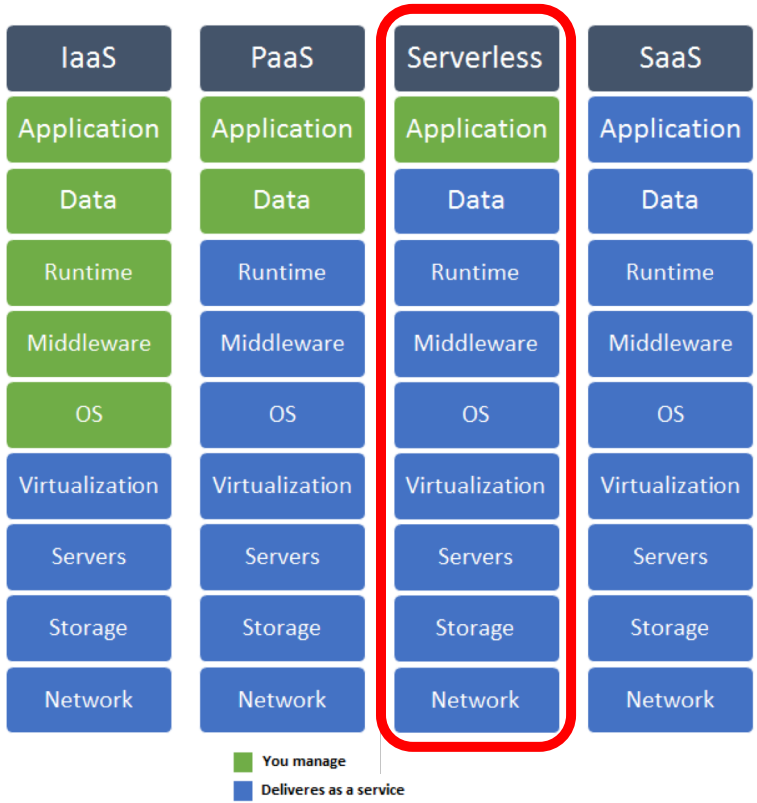
what is

serverless == allowing developers to focus on …development

“…any platform that provides utility while completely abstracting scaling and reliability”

Nick Rockwell, NYTimes CTO

Where serverless fits



Source: http://gunnarpeipman.com/2018/03/serverless-architecture/

In the beginning…

- AWS Lambda in 2014
  - Function as a Service (FaaS)
- Others
  - Google Cloud Functions, Microsoft Azure Functions, The Fn Project (Oracle)
  - Amazon Athena, Google BigQuery, Snowflake, etc.

- Why serverless?
  - Pay as you go
  - Zero administration - “fully managed”
    - You’re not provisioning infrastructure, but you’re still in charge of the compute
  - Scale automatically
  - Ship code faster

- Serverless use cases
  - Websites
  - Post processing updates
  - Data ingestion pipelines
  - Backups/log analysis/etc
  - Capture customer social media data to store in your CRM

Serverless: challenges / limitations

- Monitoring and debugging
- Integration testing can be difficult
- Maintaining state of application across multiple functions is tricky
- Startup latency
- Built for small, short processes (FaaS typically <5 min)
- Vendor lock-in
  - Access to multi-cloud data can be difficult

AWS Glue

Serverless ETL

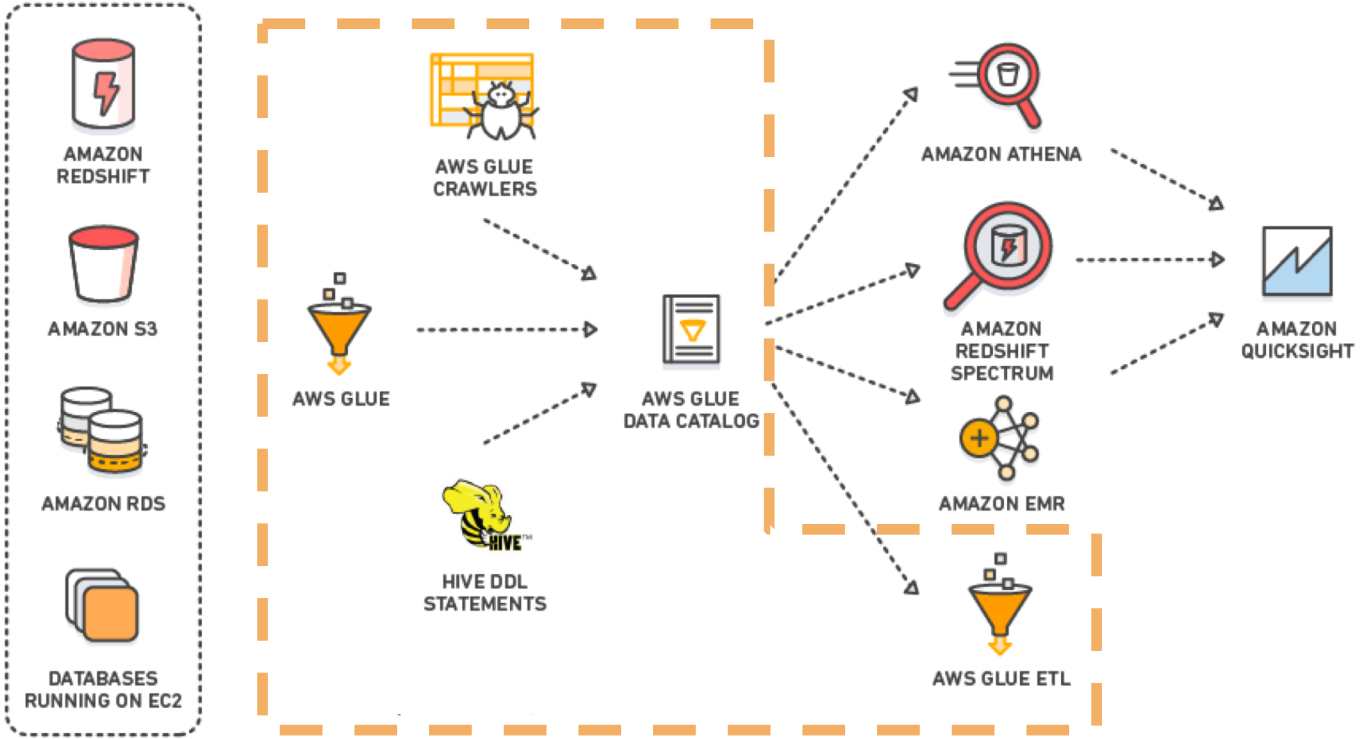
AWS Glue

“…a fully managed extract, transform, and load (ETL) service…”

- Components:
  - Data Catalog
  - Crawlers
  - ETL jobs/scripts
  - Job scheduler

- Useful for…
  - …running serverless queries against S3 buckets and relational data
  - …creating event-driven ETL pipelines
  - …automatically discovering and cataloging your enterprise data assets

AWS Glue architecture



Source: https://docs.aws.amazon.com/athena/latest/ug/glue-athena.html

Data catalog

“…a central repository to store structural and operational metadata for all your data assets.”

- Apache Hive Metastore compatible
  - Can act as metadata repository for EMR, Athena, Redshift Spectrum
- Tables
  - Organized in databases
  - Structure and metadata
  - Add using the wizard or run a crawler
- Data sources:
  - Amazon S3, Oracle, PostgreSQL, Amazon Redshift, Amazon Aurora, MySQL, MariaDB, MS SQL Server, custom JDBC

Name	Database	Location	Classification
10_45_0_23	int12102_sh	s3://gluent.backup/user/gluent/backup/10.45.0.23/	orc
10_45_1_88	int12102_sh	s3://gluent.backup/user/gluent/backup/10.45.1.88/	parquet
channels	int12102_sh	s3://gluent.backup/user/gluent/backup/sh.db/chan…	orc
channels_4179ce4c147…	int12102_sh	s3://gluent.backup/user/gluent/backup/sh_test.db/c…	parquet
countries	int12102_sh	s3://gluent.backup/user/gluent/backup/internal_de…	parquet
countries_8541194d2ae…	int12102_sh	s3://gluent.backup/user/gluent/backup/sh_test.db/c…	parquet
customers	int12102_sh	s3://gluent.backup/user/gluent/backup/internal_de…	parquet

Crawlers

“…connects to one or more data stores, determines the data structures, and writes tables into the Data Catalog.”

- Include/exclude specific objects
- Detect Hive style partitions
- Detect schema changes as structures evolve

- Classifiers - automatic schema inference
  - Detects format of the data to generate the correct schema
  - Built-in and custom (written in Grok, JSON, or XML)
  - Can invoke list of classifiers

Cast a `num` field to an `int` data type

```
%{NUMBER:num:int}
```

Jobs

“A job is the business logic that performs the extract, transform, and load (ETL) work in AWS Glue.”

- PySpark or Scala scripts, generated by AWS Glue
  - Use Glue generated scripts or provide your own
- Built-in transforms to process data
  - The data structure used, called a DynamicFrame, is an extension to an Apache Spark SQL DataFrame
- Visual dataflow can be generated
- Development endpoint available to write scripts in a notebook or IDE

Jobs - built-in transforms

- **ApplyMapping**
  - Maps source and target columns
- **Filter**
  - Load new DynamicFrame based on filtered records
- **Join**
  - Joins two DynamicFrames
- **Map**
  - Applies a function to the records in a DynamicFrame
- **SelectFields**
  - Output selected fields to new DynamicFrame
- **Spigot**
  - Sampling of data written to S3
- **SplitFields**
  - Split fields into two new DynamicFrames
- **SplitRows**
  - Split rows into two new DynamicFrames based on a predicate

```
# Join the frames to create history
l_history = Join.apply(persons, memberships, 'id’, 'person_id’)
```

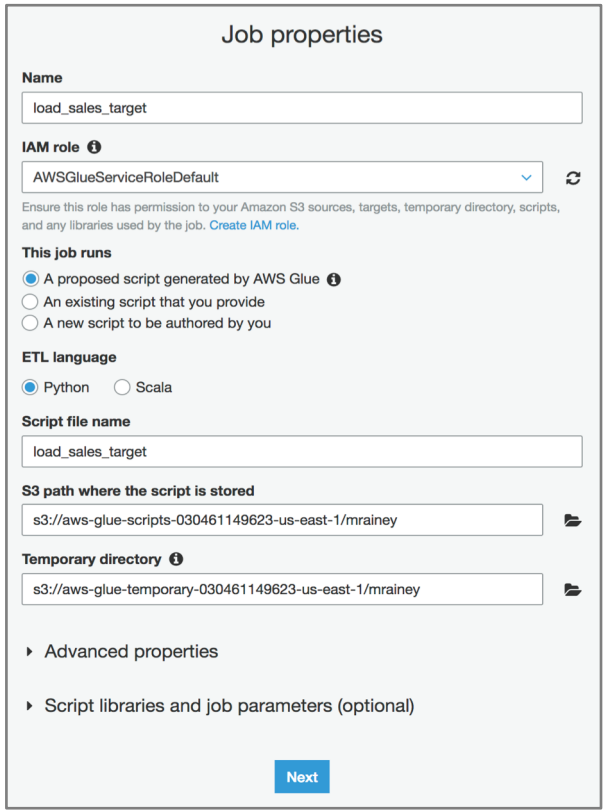
Running a job in AWS Glue

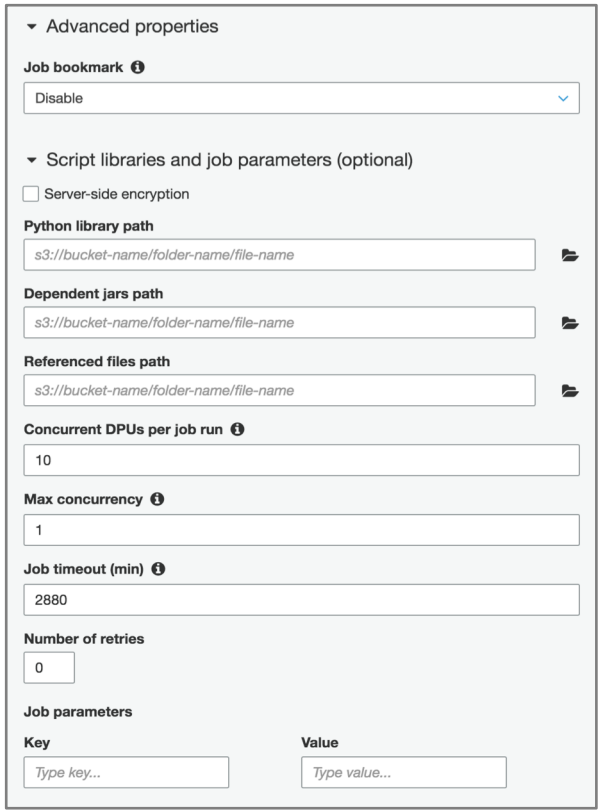
“With AWS Glue, you only pay for the time your ETL job takes to run.”

- Fire off the ETL using the job scheduler, events, or manually invoke
- Data processing units (DPUs) used to calculate processing capacity & cost
  - A single DPU = 4 vCPUs compute and 16 GB of memory
  - Can be a custom set value from 2 - 100
  - Billed $0.44 per DPU-Hour in increments of 1 second
  - 10-minute minimum duration for each job

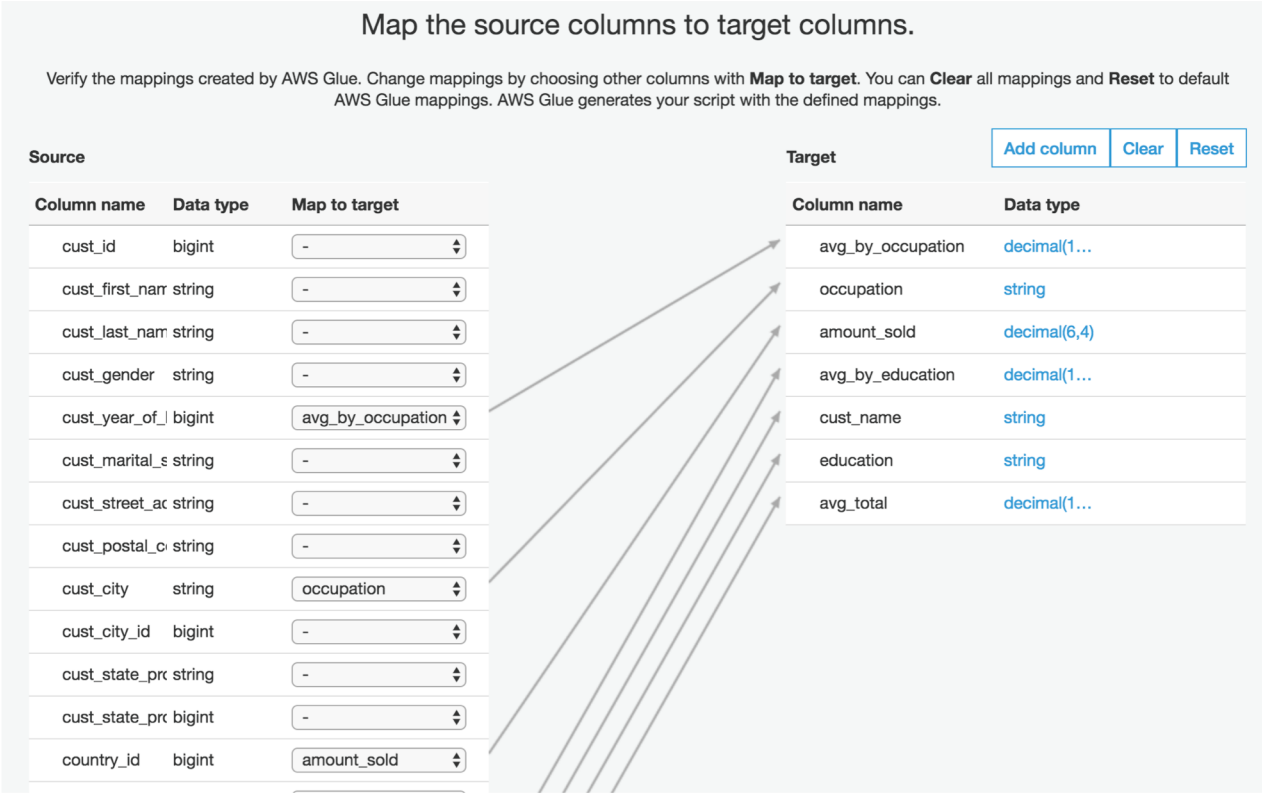
ETL job example:
Consider an ETL job that runs for 10 minutes and consumes 6 DPUs.
Since your job ran for 1/6th of an hour and consumed 6 DPUs, you will be billed **6 DPUs * 1/6 hour** at $0.44 per DPU-Hour or a total of **$0.44**.

Creating a job via the wizard

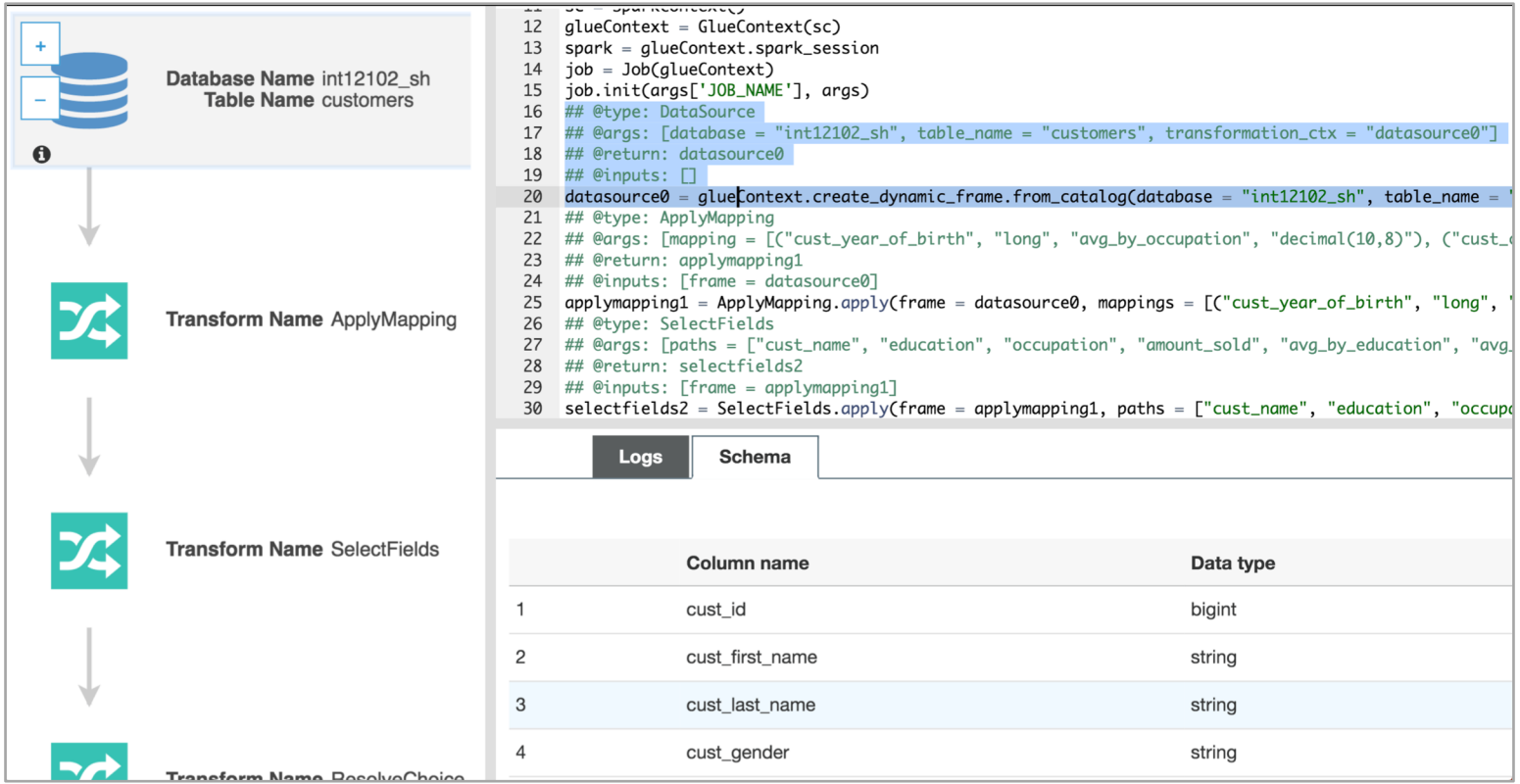


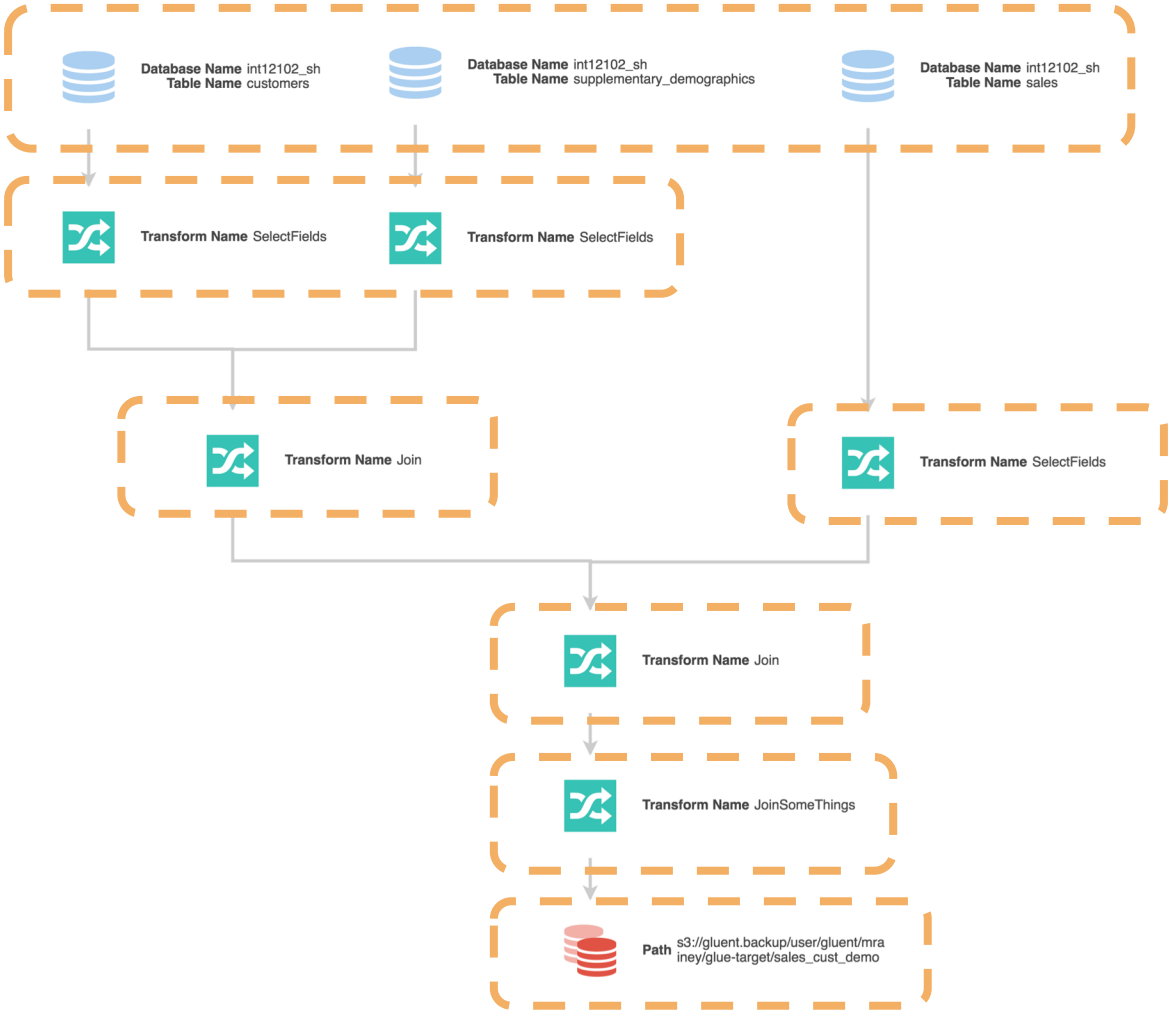


Creating a job via the wizard



Creating a job via the wizard





Job script editing

```
cust_demo_sales_t = cust_demo_sales.toDF()
```

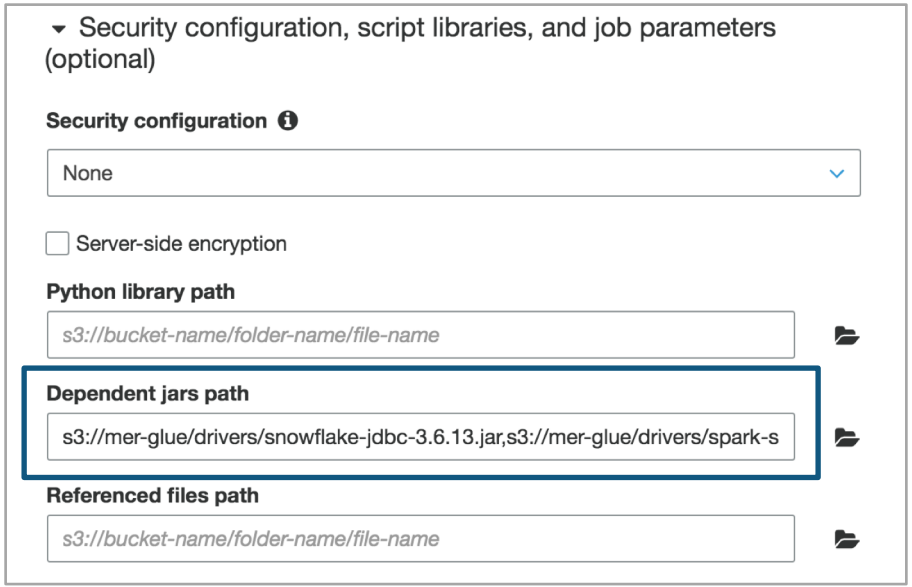
```
cust_demo_sales_sql = spark.sql("SELECT concat(cust_last_name, ', `,
  cust_first_name) cust_name, education, occupation, amount_sold,
  avg(amount_sold) OVER (partition by education) avg_by_education,
  avg(amount_sold) OVER (partition by occupation) avg_by_occupation,
  avg(amount_sold) OVER () avg_total
  FROM cust_demo_sales_tbl
  WHERE cast(cust_city as varchar) = 'Coventry'")
```

```
cust_demo_sales_final =
     DynamicFr.fromDF(cust_demo_sales_sql,
     glueContext, "cust_demo_sales_final")
```

AWS Glue in action
Connecting to Snowflake 

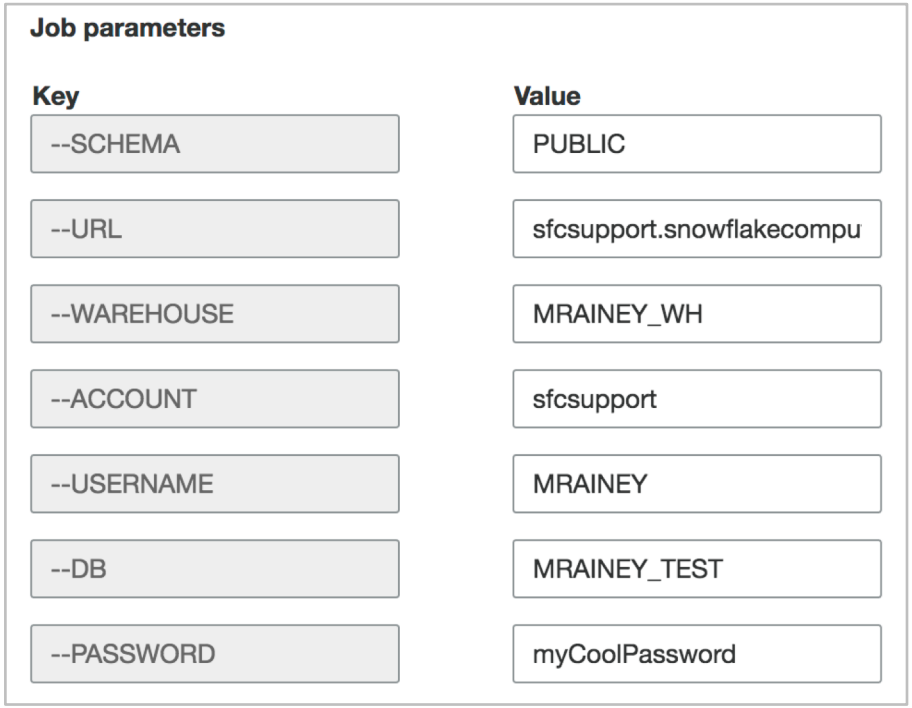
Setup AWS Glue and Snowflake

- Drop the Snowflake Spark Connector and Snowflake JDBC Driver JAR files somewhere Glue can access them – like an S3 bucket
- Add path to “dependent jars” in job properties



Setup

- Add parameters for connection to Snowflake



Connecting to Snowflake

```
import sys
from awsglue.transforms import *
from awsglue.utils import getResolvedOptions
from pyspark.context import SparkContext
from awsglue.context import GlueContext
from awsglue.job import Job
from py4j.java_gateway import java_import
SNOWFLAKE_SOURCE_NAME = "net.snowflake.spark.snowflake"

## @params: [JOB_NAME, URL, ACCOUNT, WAREHOUSE, DB, SCHEMA, USERNAME, PASSWORD]
args = getResolvedOptions(sys.argv, ['JOB_NAME', 'URL', 'ACCOUNT', 'WAREHOUSE', 'DB', 'SCHEMA', 'USERNAME', 'PASSWORD'])
sc = SparkContext()
glueContext = GlueContext(sc)
spark = glueContext.spark_session
job = Job(glueContext)
job.init(args['JOB_NAME'], args)
java_import(spark._jvm, "net.snowflake.spark.snowflake")

## enable query pushdown to Snowflake
spark._jvm.net.snowflake.spark.snowflake.SnowflakeConnectorUtils.enablePushdownSession( \
    spark._jvm.org.apache.spark.sql.SparkSession.builder().getOrCreate())

sfOptions = {
"sfURL" : args['URL'],
"sfAccount" : args['ACCOUNT'],
"sfUser" : args['USERNAME'],
"sfPassword" : args['PASSWORD'],
"sfDatabase" : args['DB'],
"sfSchema" : args['SCHEMA'],
"sfWarehouse" : args['WAREHOUSE'],
}
```

Running a Glue job

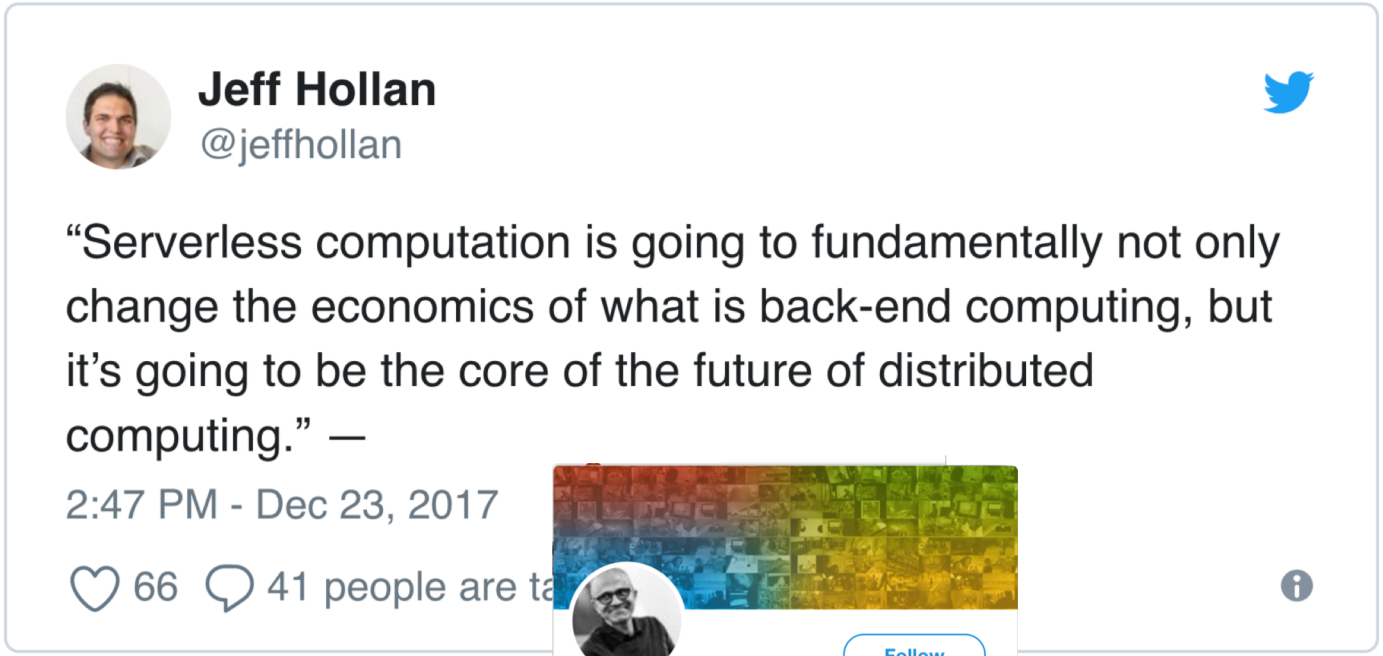
```
34  ## Read from S3 file - employee.csv - into a Spark Data Frame
35  dfEmployee = glueContext.create_dynamic_frame \
36      .from_catalog(database = "oggdata", table_name = "employee").toDF()
37
38  ## Rea
39  dfMont
40      .c
41      .c
42
43  ## Agg
44  dfGrou
45
46  ## Joi
47  dfEmpl                                                                    ee_id)
48
49  ## Sel
50  dfEmpl                                                                    m(AMOUNT)")
51
52  ## Wri
53  dfEmpl
54      .options(**sfOptions) \
55      .option("dbtable", "MRAINEY_TEST.PUBLIC.EMPLOYEE_ANNUAL_SALES").mode("overwrite").save()
56  job.commit()
57
```

Row	FIRST_NAME	LAST_NAME	MONTH	sum(AMOUNT)
1	Lex	De Haan	Jan	5500
2	Lex	De Haan	Mar	1000
3	Alexander	Hunold	Jan	2500
4	Alexander	Khoo	Mar	600
5	Steven	King	Jan	10500
6	Steven	King	Mar	500
7	Neena	Kochhar	Feb	1000
8	Neena	Kochhar	Jan	8500
9	Luis	Popp	Mar	200
10	Ismael	Sciarra	Apr	18000

Why use AWS Glue with Snowflake?

- Event Driven ETL Pipelines
  - Process and land data in S3
  - Trigger script to move data to Snowflake (COPY)
- ETL – S3 as a source, Snowflake as target
  - Process using Spark within Glue
- ETL – Snowflake as a source and target
  - Process using Spark within Glue or pushdown processing to Snowflake
- ETL – Multiple sources
  - Read data from Snowflake and join with Data from S3 (and/or other sources)
  - Write back to Snowflake (using pushdown)
- ~~Understand data assets – Data Catalog~~

serverless
fully managed
ETL



THANK YOU

Going Serverless - an Introduction to AWS Glue

Reach out for more info!

- Email: michael.rainey@snowflake.com
- Twitter: @mRainey

AWS Glue resources

- Docs:
  - http://aws.amazon.com/documentation/glue
- Forums:
  - https://forums.aws.amazon.com/forum.jspa?forumID=262
- Presentations:
  - Serverless ETL with AWS Glue
  - How to Build a Data Lake with AWS Glue Data Catalog
- Blogs
  - How To Use AWS Glue With Snowflake