Amazon Athena

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GM, Amazon Athena & Amazon EMR

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Agenda

- Overview of Amazon Athena
- Key Features
- Customer Examples
- Q&A

Challenges Customers Faced

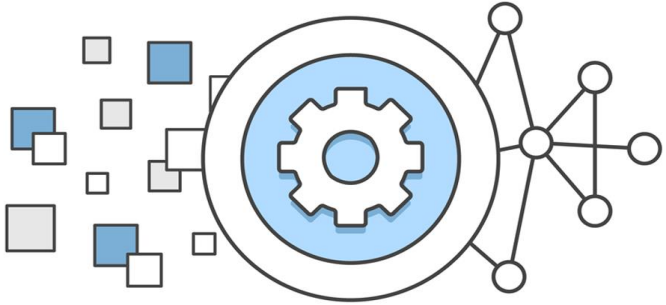
- Significant amount of work required to analyze data in Amazon S3
- Users often only have access to aggregated data sets
- Managing a Hadoop cluster or data warehouse requires expertise

Introducing Amazon Athena

Amazon Athena is an interactive query service that makes it easy to analyze data directly from Amazon S3 using Standard SQL

Athena is Serverless

- No Infrastructure or administration
- Zero Spin up time
- Transparent upgrades



Amazon Athena is Easy To Use

- Log into the Console
- Create a table
  - Type in a Hive DDL Statement
  - Use the console Add Table wizard
- Start querying

Amazon Athena is Highly Available

- You connect to a service endpoint or log into the console
- Athena uses warm compute pools across multiple Availability Zones
- Your data is in Amazon S3, which is also highly available and designed for 99.999999999% durability

Query Data Directly from Amazon S3

- No loading of data
- Query data in its raw format
  - Text, CSV, JSON, weblogs, AWS service logs
  - Convert to an optimized form like ORC or Parquet for the best performance and lowest cost
- No ETL required
- Stream data from directly from Amazon S3
- Take advantage of Amazon S3 durability and availability

Use ANSI SQL

- Start writing ANSI SQL
- Support for complex joins, nested queries & window functions
- Support for complex data types (arrays, structs)
- Support for partitioning of data by any key
  - (date, time, custom keys)
  - e.g., Year, Month, Day, Hour or Customer Key, Date

```sql
 WITH q21_tmp1_cached AS
  (SELECT l_orderkey,
          count(DISTINCT l_suppkey) AS count_suppkey,
          max(l_suppkey) AS max_suppkey
   FROM lineitem_parq
   WHERE l_orderkey IS NOT NULL
   GROUP BY l_orderkey),
      q21_tmp2_cached AS
  (SELECT l_orderkey,
          count(DISTINCT l_suppkey) count_suppkey,
                                    max(l_suppkey) AS max_suppkey
   FROM lineitem_parq
   WHERE l_receiptdate > l_commitdate
     AND l_orderkey IS NOT NULL
   GROUP BY l_orderkey)
SELECT s_name,
       count(1) AS numwait
FROM
  (SELECT s_name
   FROM
     (SELECT s_name,
             t2.l_orderkey,
             l_suppkey,
             count_suppkey,
             max_suppkey
      FROM q21_tmp2_cached t2
      RIGHT OUTER JOIN
        (SELECT s_name,
                l_orderkey,
                l_suppkey
         FROM
           (SELECT s_name,
                   t1.l_orderkey,
                   l_suppkey,
                   count_suppkey,
                   max_suppkey
            FROM q21_tmp1_cached t1
            JOIN
              (SELECT s_name,
                      l_orderkey,
                      l_suppkey
               FROM orders_parq o
               JOIN
                 (SELECT s_name,
                         l_orderkey,
                         l_suppkey
                  FROM nation_parq n
                  JOIN supplier s ON s.s_nationkey = n.n_nationkey
                  AND n.n_name = 'SAUDI ARABIA'
                  JOIN lineitem_parq l ON s.s_suppkey = l.l_suppkey
                  WHERE l.l_receiptdate > l.l_commitdate
                    AND l.l_orderkey IS NOT NULL) l1 ON o.o_orderkey = l1.l_orderkey
               AND o.o_orderstatus = 'F') l2 ON l2.l_orderkey = t1.l_orderkey) a
         WHERE (count_suppkey > 1)
           OR ((count_suppkey=1)
               AND (l_suppkey <> max_suppkey))) l3 ON l3.l_orderkey = t2.l_orderkey) b
   WHERE (count_suppkey IS NULL)
     OR ((count_suppkey=1)
         AND (l_suppkey = max_suppkey))) c
GROUP BY s_name
ORDER BY numwait DESC,
         s_name LIMIT 100;
```

Familiar Technologies Under the Covers

Used for SQL Queries

In-memory distributed query engine

ANSI-SQL compatible with extensions

Used for DDL functionality

Complex data types

Multitude of formats

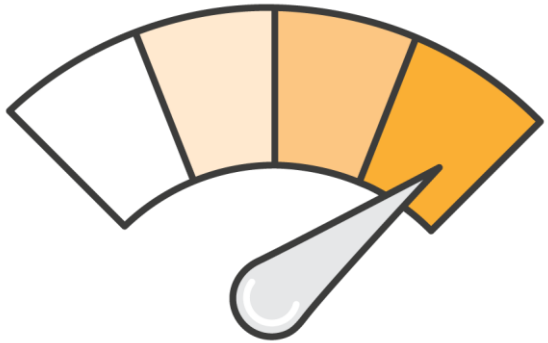
Supports data partitioning

Amazon Athena Supports Multiple Data Formats

- Text files, e.g., CSV, raw logs
- Apache Web Logs, TSV files
- JSON (simple, nested)
- Compressed files
- Columnar formats such as Apache Parquet & Apache ORC
- AVRO support

Amazon Athena is Fast

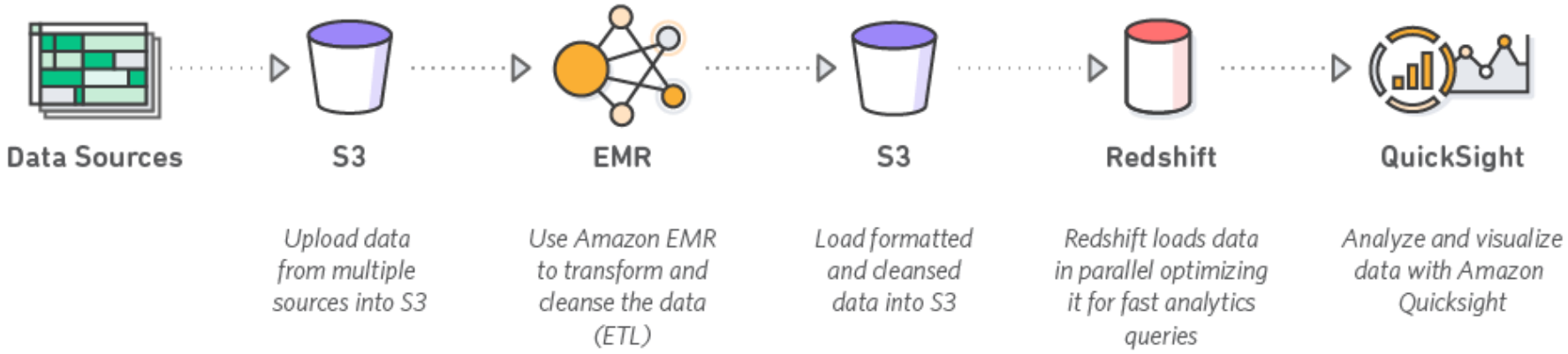
- Tuned for performance
- Automatically parallelizes queries
- Results are streamed to console
- Results also stored in S3
- Improve Query performance
    - Compress your data
    - Use columnar formats



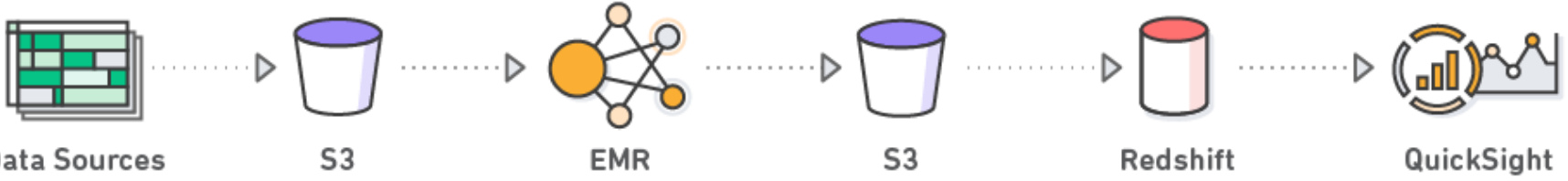
Amazon Athena is Cost Effective

- Pay per query
- $5 per TB scanned from S3
- DDL Queries and failed queries are free
- Save by using compression, columnar formats, partitions

A Sample Pipeline



A Sample Pipeline



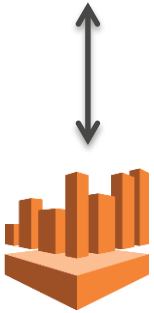
Upload data from multiple sources into S3

Use Amazon EMR to transform and cleanse the data (ETL)

Load formatted and cleansed data into S3

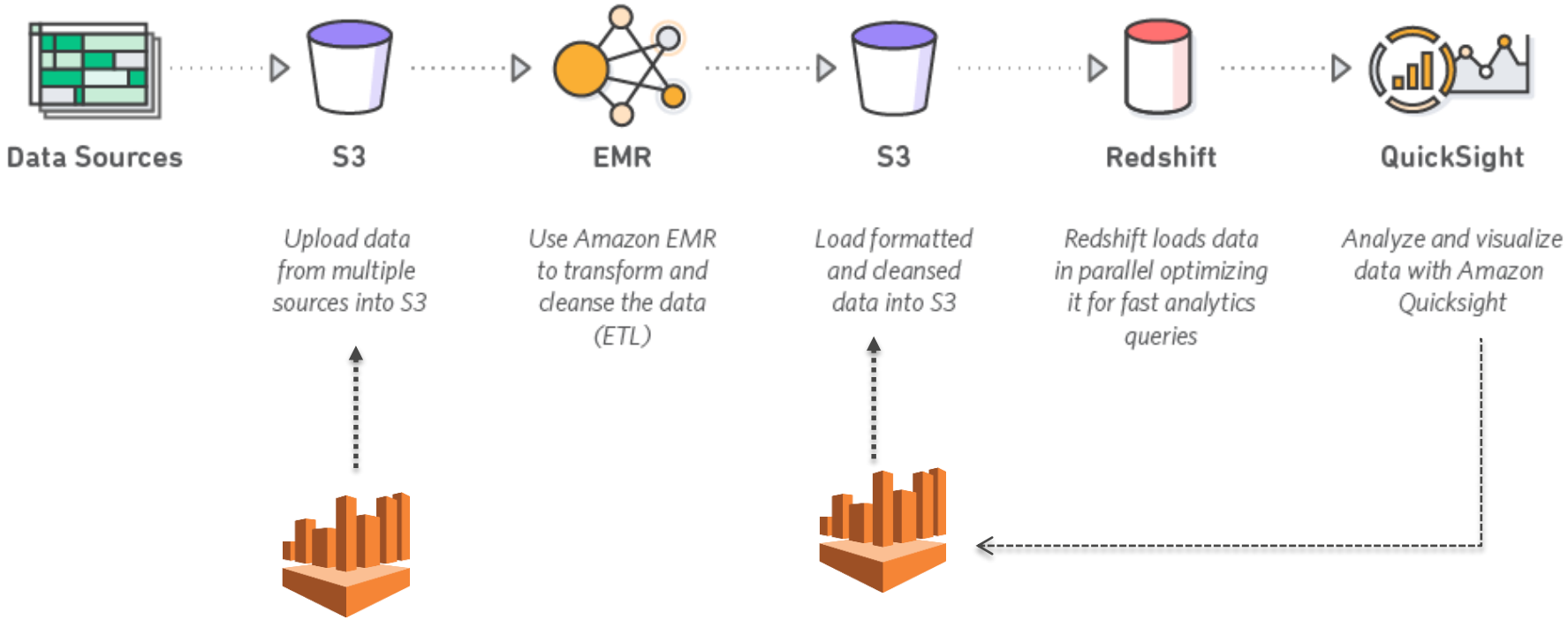
Redshift loads data in parallel optimizing it for fast analytics queries

Analyze and visualize data with Amazon Quicksight



Ad-hoc access to raw data using SQL

A Sample Pipeline



Accessing Amazon Athena

Simple Query editor with key bindings

AWS | Services | Edit | Select a Region | Support

Athena | Query Editor | Saved Queries | History | Catalog | Get Started

Catalog | Sample Queries

DATABASE

amplabs

Table Name

- adsfadsf
- documents
- documents_parq
- fadf
- rankings
- rankings_parq
- scratch
- tab
- test

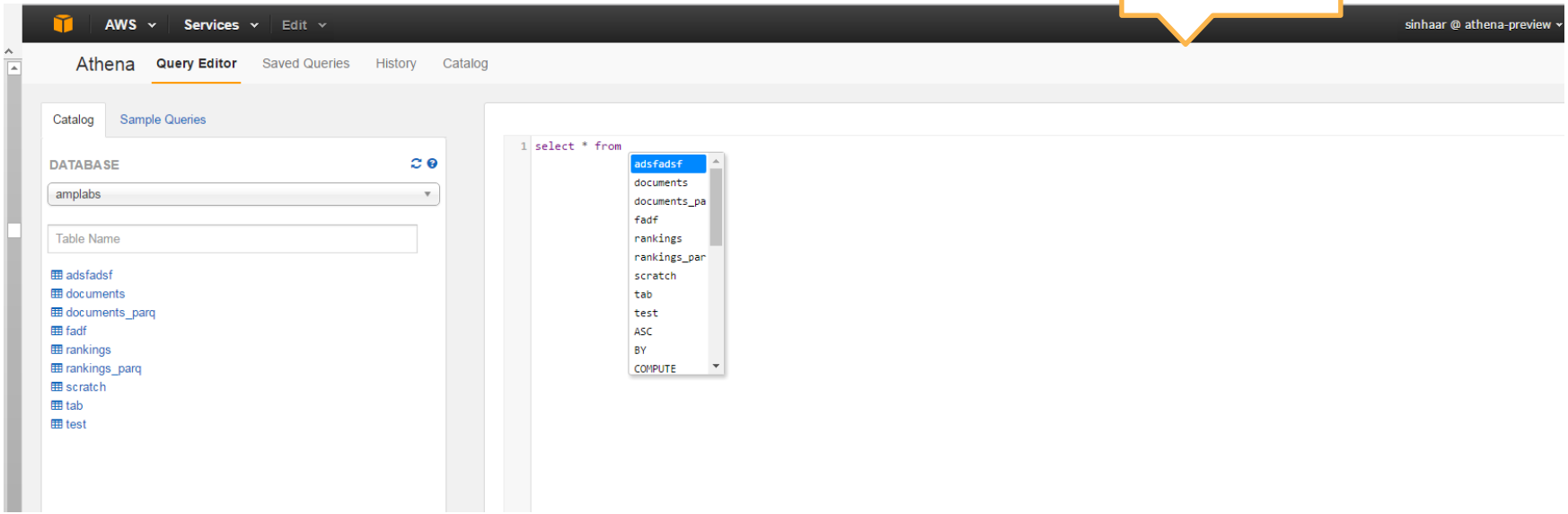
```
Example: SELECT * FROM tablename, or press CTRL + space
```

Execute | Save As | or create a | New Query

Recent Queries | Query | Columns | Results | Chart

Time	Query	Status	Result
07/07/16 00:19:16 GMT	select * from wikistats LIMIT 1	FAILED	~
07/07/16 00:18:06 GMT	SELECT * FROM custom_metadata_table_properties	SUBMITTED	~

Autocomplete functionality



AWS | Services | Edit | sinhaar @ athena-preview | Select a Region | Support

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Catalog | Sample Queries

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amplabs

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- scratch
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Catalog

```
1 Example: SELECT * FROM tablename, or press CTRL + space
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07/07/16 00:18:06 GMT	`SELECT * FROM custom_metadata_table_generation`	SUBMITTED	~

Athena **Query Editor** Saved Queries History Catalog

Catalog Sample Queries

DATABASE

default

Table Name

- adsads
- cloudfront_logs
- cloudtrailtable
- elb_logs
- ncc
- ncctest
- prestoinstance
- prestostat
- taxinyc_csv
- taxinyc_par
- test3
- test4
- wikistats
  - language (string)
  - page_title (string)
  - hits (bigint)
  - retrived_size (bigint)
- wikistats_parq

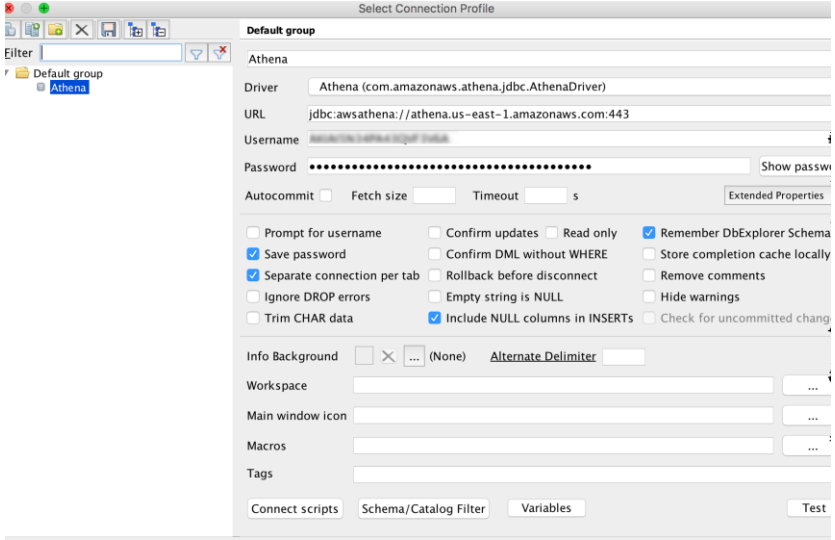
```
1 select sum(hits) as hits,language from default.wikistats
2 group by language
3 order by 1 desc
4 limit 10
```

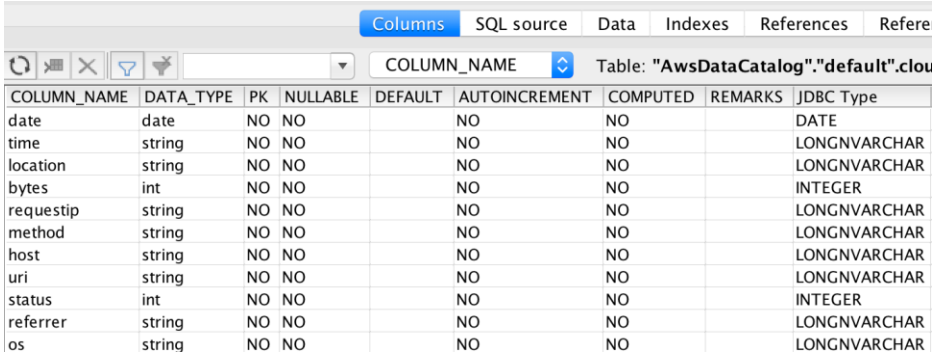
Execute Save As or create a New Query

Recent Queries Query Columns Results Chart

	hits	language
1	213917076	en
2	43673225	ja
3	25593194	es
4	16637343	de
5	10579788	fr
6	7958810	commons.m
7	6664552	pt
8	6108102	ru
9	5857921	pl
10	5783183	it

Use the JDBC Driver

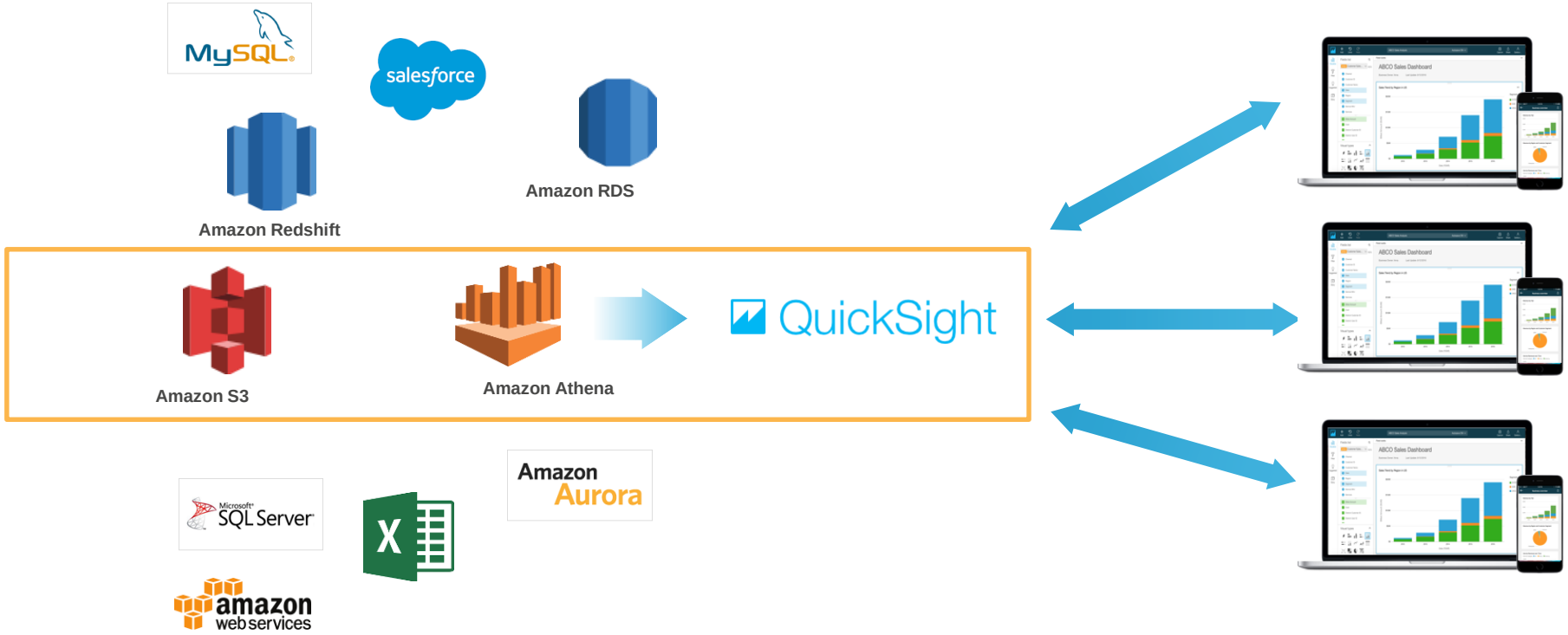




COLUMN_NAME	DATA_TYPE	PK	NULLABLE	DEFAULT	AUTOINCREMENT	COMPUTED	REMARKS	JDBC Type
date	date	NO	NO		NO	NO		DATE
time	string	NO	NO		NO	NO		LONGNVARCHAR
location	string	NO	NO		NO	NO		LONGNVARCHAR
bytes	int	NO	NO		NO	NO		INTEGER
requestip	string	NO	NO		NO	NO		LONGNVARCHAR
method	string	NO	NO		NO	NO		LONGNVARCHAR
host	string	NO	NO		NO	NO		LONGNVARCHAR
uri	string	NO	NO		NO	NO		LONGNVARCHAR
status	int	NO	NO		NO	NO		INTEGER
referrer	string	NO	NO		NO	NO		LONGNVARCHAR
os	string	NO	NO		NO	NO		LONGNVARCHAR

Using Amazon Athena with Amazon QuickSight

QuickSight allows you to connect to data from a wide variety of AWS, third-party, and on-premises sources including Amazon Athena



QuickSight

N. Virginia

wangluis...

Data sets

79.8MB of SPICE used of 141GB in N. Virginia

Create a Data Set

FROM NEW DATA SOURCES

- Upload a file (.csv, .tsv, .clf, .elf, .xlsx)
- Salesforce — Connect to Salesforce
- S3
- RDS
- Redshift — Auto-discovered
- Redshift — Manual connect
- Athena
- MySQL
- PostgreSQL
- SQL Server
- Aurora
- MariaDB

FROM EXISTING DATA SOURCES

- People Overview — Updated 2 days ago
- Web and Social Media A... — Updated 2 days ago
- Sales Pipeline — Updated 2 days ago

QuickSight

N. Virginia

wangluis...

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New Athena data source

Data source name

Enter a name for the data source

Create data source

Create a Data Set

FROM NEW DATA SOURCES

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QuickSight

N. Virginia

wangluis...

Data sets

21.7GB of SPICE used of 270GB in N. Virginia

Choose your table

My Athena Connection

Database: contain sets of tables.

Flight data

Tables: contain the data you can visualize.

- airport_id
- all_flights
- cancellation_id
- carrier_id
- delay_id

Edit/Preview data

Select

Create a Data Set

FROM NEW DATA SOURCES

- Upload a file (.csv, .tsv, .clf, .elf, .xlsx)
- RDS
- Athena
- SQL Server
- Aurora
- MariaDB

FROM EXISTING DATA SOURCES

- Sample Data
- test1111
- 47lining data

QuickSight

N. Virginia

wangluis...

Data sets

21.7GB of SPICE used of 270GB in N. Virginia

Finish data set creation

Database: Flight data
Table: all_flights
Data source: My Athena Connection

- Import to SPICE — ✓ 248.3GB available SPICE
- Directly query your data

Edit/Preview data | Visualize

RDS

Athena

SQL Server

Aurora

MariaDB

FROM EXISTING DATA SOURCES

Sample Data
Updated a month ago

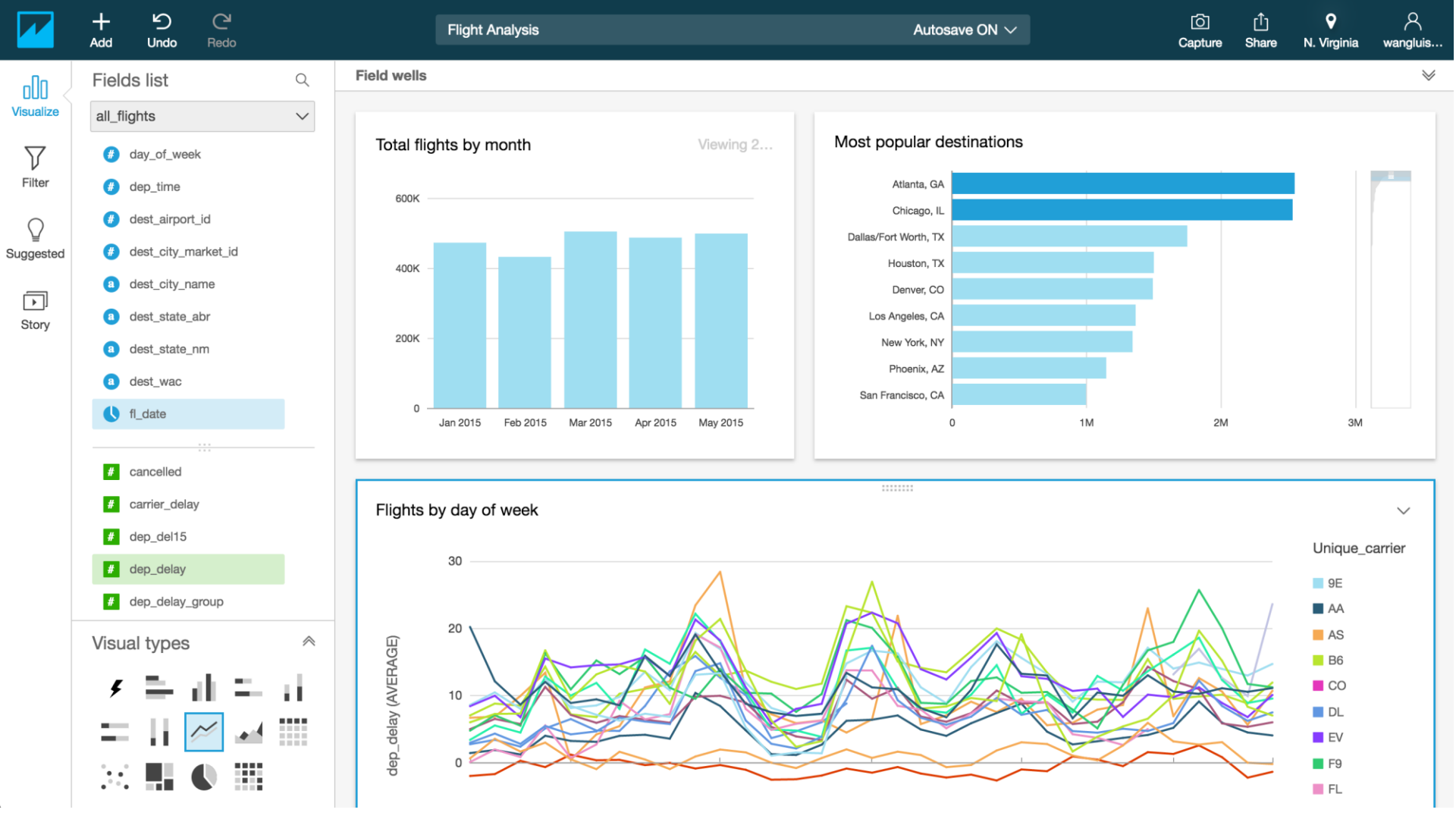
test1111
Updated a month ago

47lining data
Updated a month ago

Sample Data
Updated a month ago

SN-Cluster
Updated a month ago

47lining data
Updated a month ago


Add
Undo
Redo
Flight Analysis
Autosave ON
Capture
Share
N. Virginia
wangluis...
Visualize
Filter
Suggested
Story
Fields list
all_flights
day_of_week
dep_time
dest_airport_id
dest_city_market_id
dest_city_name
dest_state_abr
dest_state_nm
dest_wac
fl_date
cancelled
carrier_delay
dep_del15
dep_delay
dep_delay_group
Visual types
Field wells
Total flights by month
Viewing 2...
600K
400K
200K
0
Jan 2015
Feb 2015
Mar 2015
Apr 2015
May 2015
Most popular destinations
Atlanta, GA
Chicago, IL
Dallas/Fort Worth, TX
Houston, TX
Denver, CO
Los Angeles, CA
New York, NY
Phoenix, AZ
San Francisco, CA
0
1M
2M
3M
Flights by day of week
dep_delay (AVERAGE)
30
20
10
0
Unique_carrier
9E
AA
AS
B6
CO
DL
EV
F9
FL

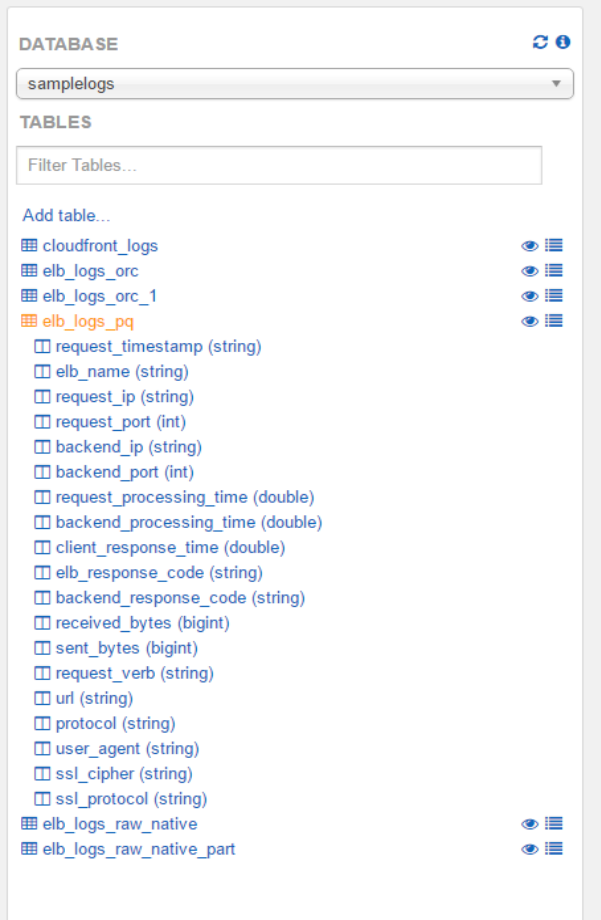
Creating Tables and Querying Data

Creating Tables - Concepts

- Create Table Statements (or DDL) are written in Hive
  - High degree of flexibility
  - Schema on Read
  - Hive is SQL like but allows other concepts such “external tables” and partitioning of data
  - Data formats supported – JSON, TXT, CSV, TSV, Avro, Parquet, and ORC (via SerDes)
  - Data in stored in Amazon S3
  - Metadata is stored in an a metadata store

Athena's Internal Metadata Store

- Stores Metadata
  - Table definition, column names, partitions
- Highly available and durable
- Requires no management
- Access via DDL statements
- Similar to a Hive Metastore



Running Queries is Simple

```
SELECT o_year,
        sum(case
    WHEN nation = 'PERU' THEN
    volume
    ELSE 0 end) / sum(volume) AS mkt_share
FROM
    (SELECT substr(o_orderdate,
        1,
        4) AS o_year,
         l_extendedprice * (1 - l_discount) AS volume,
         n2.n_name AS nation
    FROM lineitem_parq, orders_parq, part_parq, customer_parq, supplier_parq, nation_parq n1, nation_parq n2, region_parq
    WHERE p_partkey = l_partkey
            AND s_suppkey = l_suppkey
            AND l_orderkey = o_orderkey
            AND o_custkey = c_custkey
            AND c_nationkey = n1.n_nationkey
            AND n1.n_regionkey = r_regionkey
            AND r_name = 'AMERICA'
            AND s_nationkey = n2.n_nationkey
            AND o_orderdate
        BETWEEN '1995-01-01'
```

Run Query | Save As | Format Query | New Query (Run time: 17.34 seconds, Data scanned: 12.97GB)

Run time and data scanned

Use Ctrl + Enter to run query, Ctrl + Space to autocomplete

Results

	o_year	mkt_share
1	1995	0.04048235539866028
2	1996	0.03984664161294089

Apache Parquet and Apache ORC – Columnar Formats

PARQUET

- Columnar format
- Schema segregated into footer
- Column major format
- All data is pushed to the leaf
- Integrated compression and indexes
- Support for predicate pushdown

ORC

- Apache Top level project
- Schema segregated into footer
- Column major with stripes
- Integrated compression, indexes, and stats
- Support for Predicate Pushdown

Converting to ORC and PARQUET

- You can use Hive CTAS to convert data
  - CREATE TABLE new_key_value_store
  - STORED AS PARQUET
  - AS
  - SELECT col_1, col2, col3 FROM noncolumartable
  - SORT BY new_key, key_value_pair;

- You can also use Spark to convert the file into PARQUET / ORC

- 20 lines of Pyspark code, running on EMR
  - Converts 1TB of text data into 130 GB of Parquet with snappy conversion
  - Total cost $5

https://github.com/awslabs/aws-big-data-blog/tree/master/aws-blog-spark-parquet-conversion

Pay By the Query - $5/TB Scanned

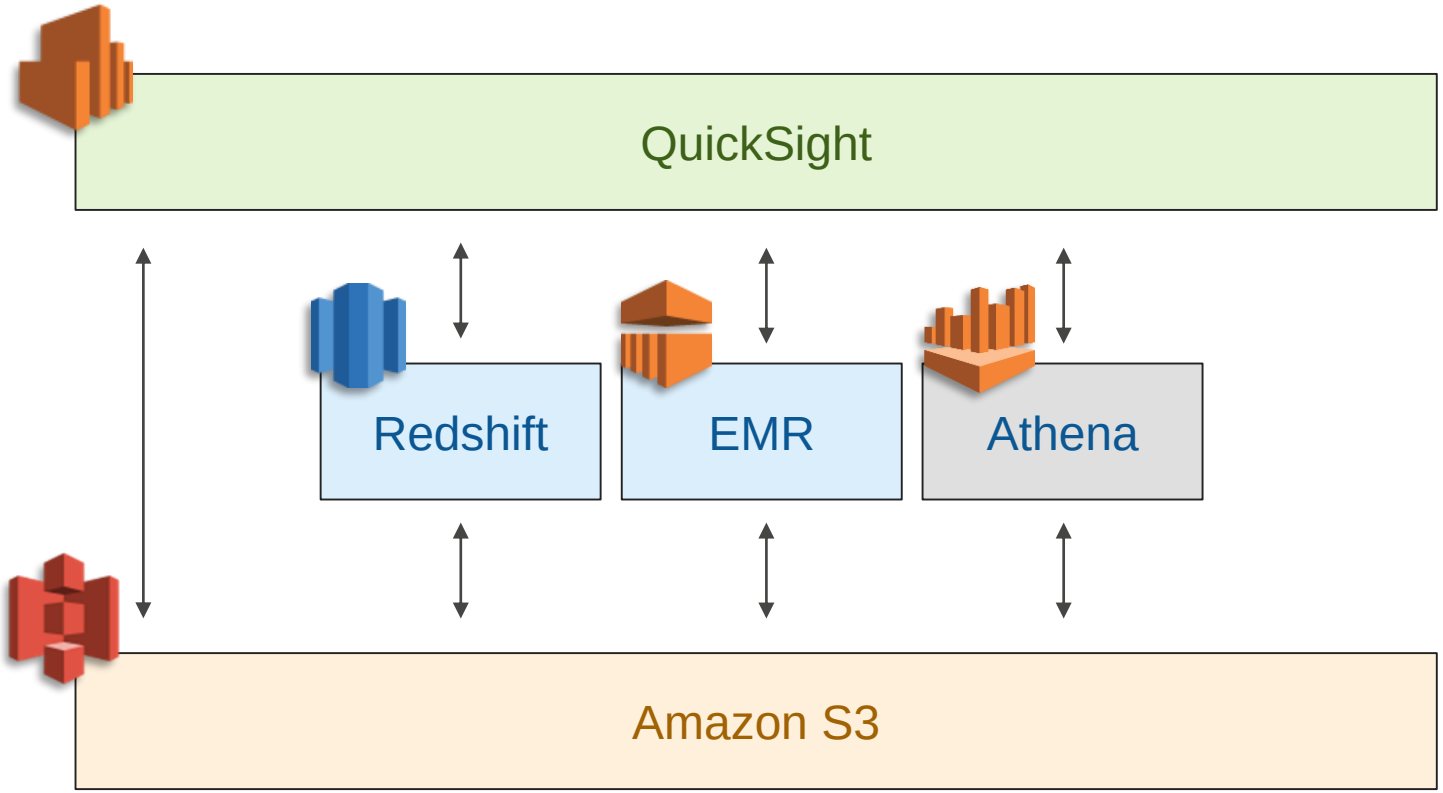
- Pay by the amount of data scanned per query
- Ways to save costs
  - Compress
  - Convert to Columnar format
  - Use partitioning
- Free: DDL Queries, Failed Queries

```
SELECT elb_name,
       uptime,
       downtime,
       cast(downtime as DOUBLE)/cast(uptime as DOUBLE) uptime_downtime_ratio
FROM
    (SELECT elb_name,
        sum(case elb_response_code
        WHEN '200' THEN
        1
        ELSE 0 end) AS uptime, sum(case elb_response_code
        WHEN '404' THEN
        1
        ELSE 0 end) AS downtime
    FROM elb_logs_raw_native
    GROUP BY  elb_name)
```

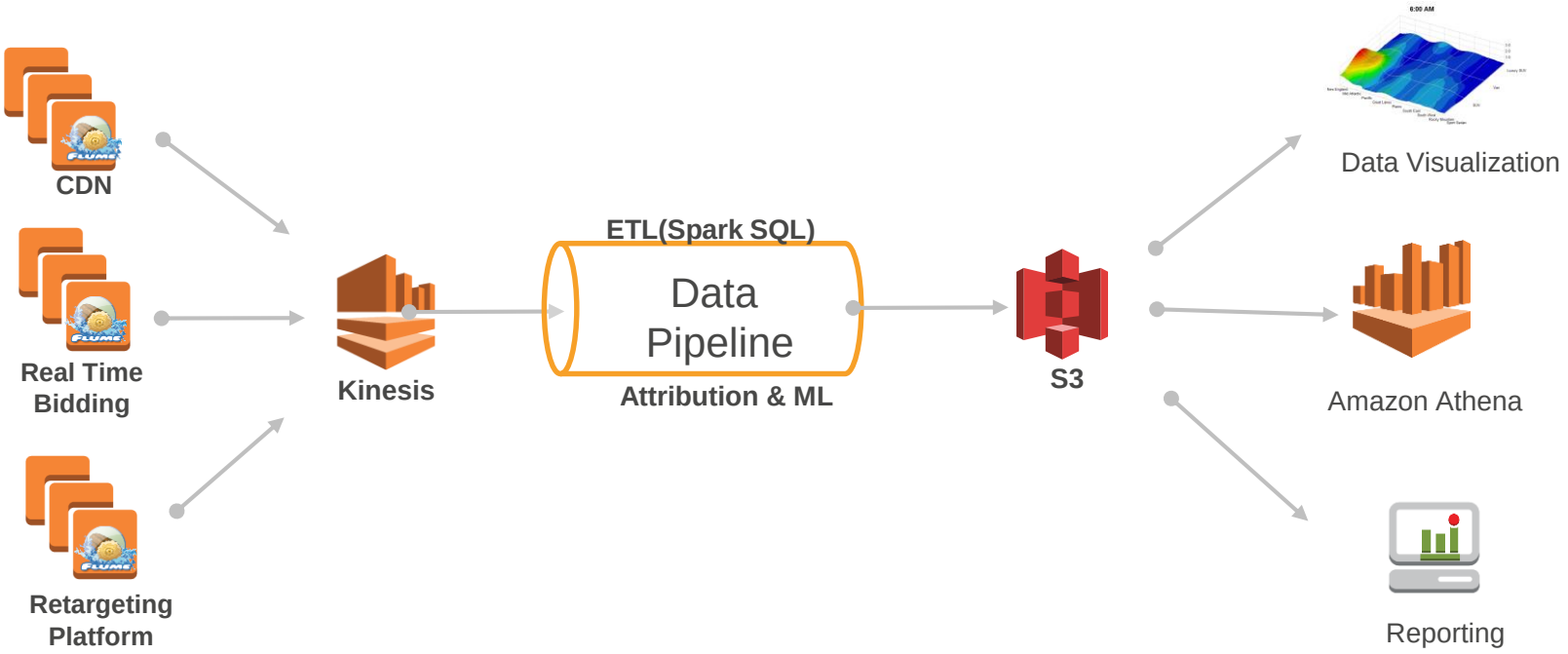
Dataset	Size on Amazon S3	Query Run time	Data Scanned	Cost
Logs stored as Text files	1 TB	237 seconds	1.15TB	$5.75
Logs stored in Apache Parquet format*	130 GB	5.13 seconds	2.69 GB	$0.013
Savings	**87% less with Parquet**	**34x faster**	**99% less data scanned**	**99.7% cheaper**

Use Cases

Athena Complements Amazon Redshift & Amazon EMR



DataXu – 180TB of Log Data per Day



AWS

Ecosystem of tools and services

Rob Harrop
@robertharrop

Following

Up and running with AWS Athena already, querying production performance data from logs in S3.

RETWEET 1 LIKES 4

10:24 AM - 30 Nov 2016

1 1 4

Thank you!