Project Overview

Working backwards, from "what does my customer need"

The requirement from (our simulated) customer:

- Launching new data-driven campaign
- Main advertising channel : YouTube
- Initial questions to answer:
  - "how to categorise videos, based on their comments and statistics"
  - "What factors affect how popular a YouTube video will be"

Why YouTube?

Top three most-visited websites (monthly)

- Google: 92.5 billion
- YouTube: 34.6 billion
- Facebook: 25.5 billion

Source: visualcapitalist.com/the-50-most-visited-websites-in-the-world/

Goals and Success Criteria

How my customer will measure success?

Data Ingestion

Ingest data, one-offs and incrementally

Data Lake

Design and build a new Data Lake architecture

AWS Cloud

AWS as the cloud provider

ETL Design

Extract, transform and load data efficiently

Scalability

The data architecture should scale efficiently

Reporting

Build a Business Intelligence tier, incl. Dashboards

What you will learn in this course

- To build a data lake from scratch in Amazon S3

  Joining semi-structured and structured data

- Lake House architecture design

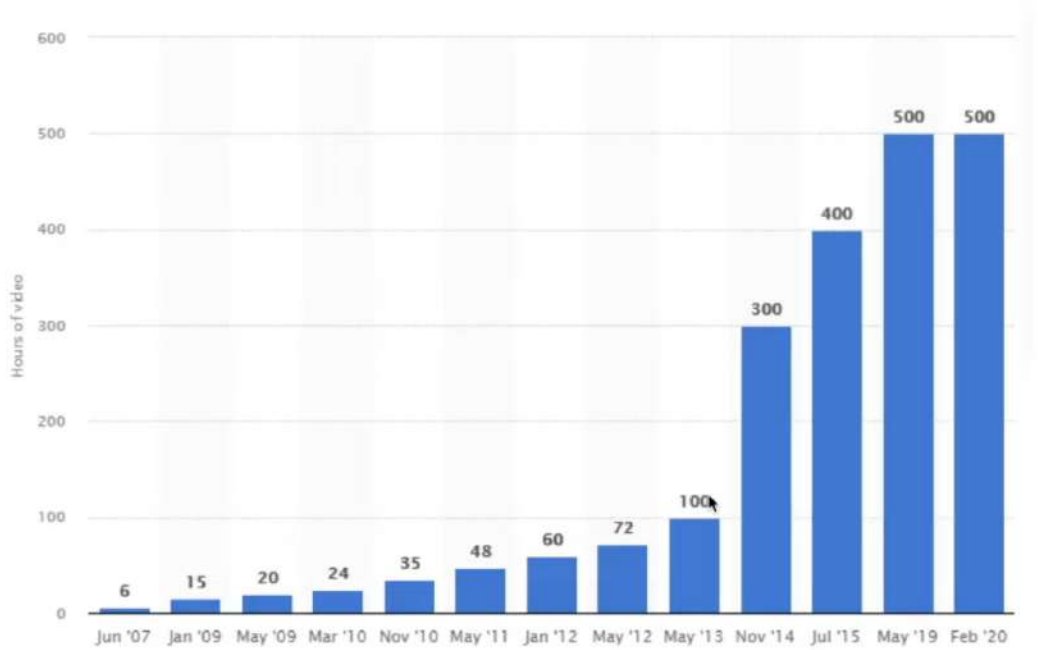
  Best practices —> cost and performance.

- Data Lake vs. Data Warehouse

What is Big Data

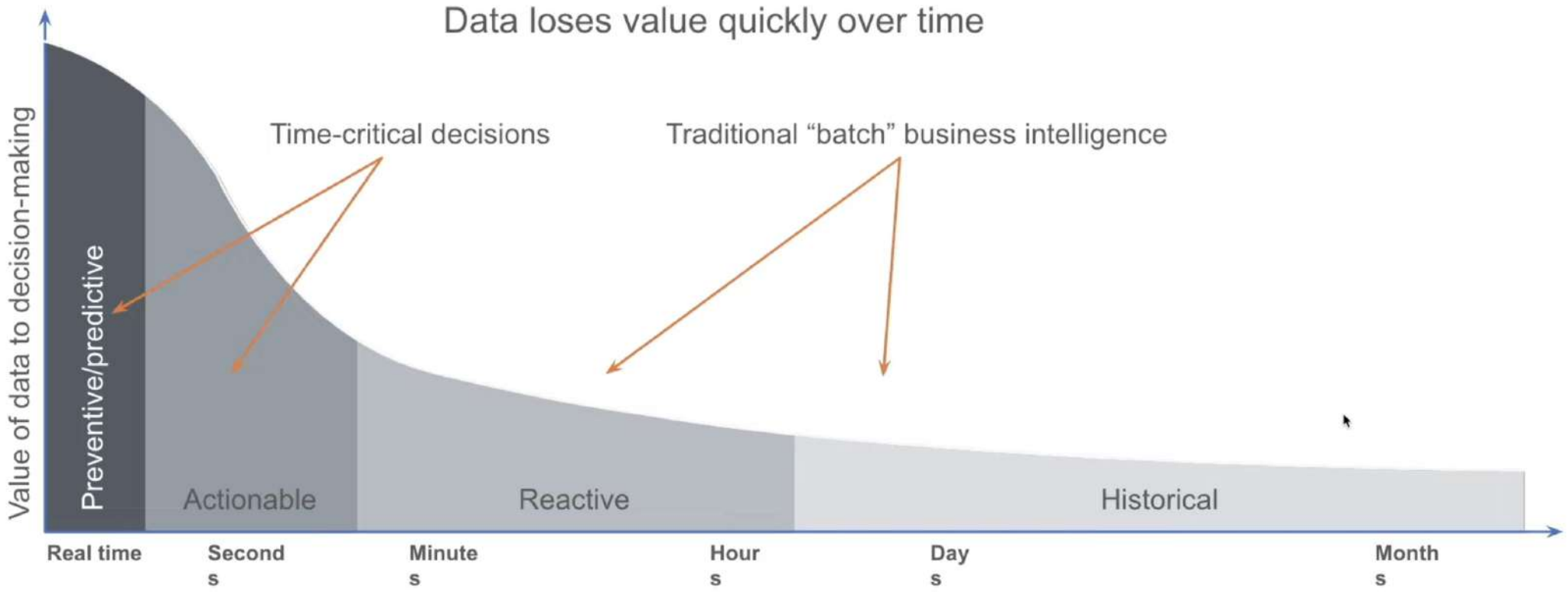
Big data is a term for:

- massive data sets, with varied and complex structure
- with the difficulties of storing and analysing
- visualizing for further processes or results.



Source: Big data: A review. IEEE, 2013, DOI: 10.1109/CTS.2013.6567202

Timely decisions require new data in minutes

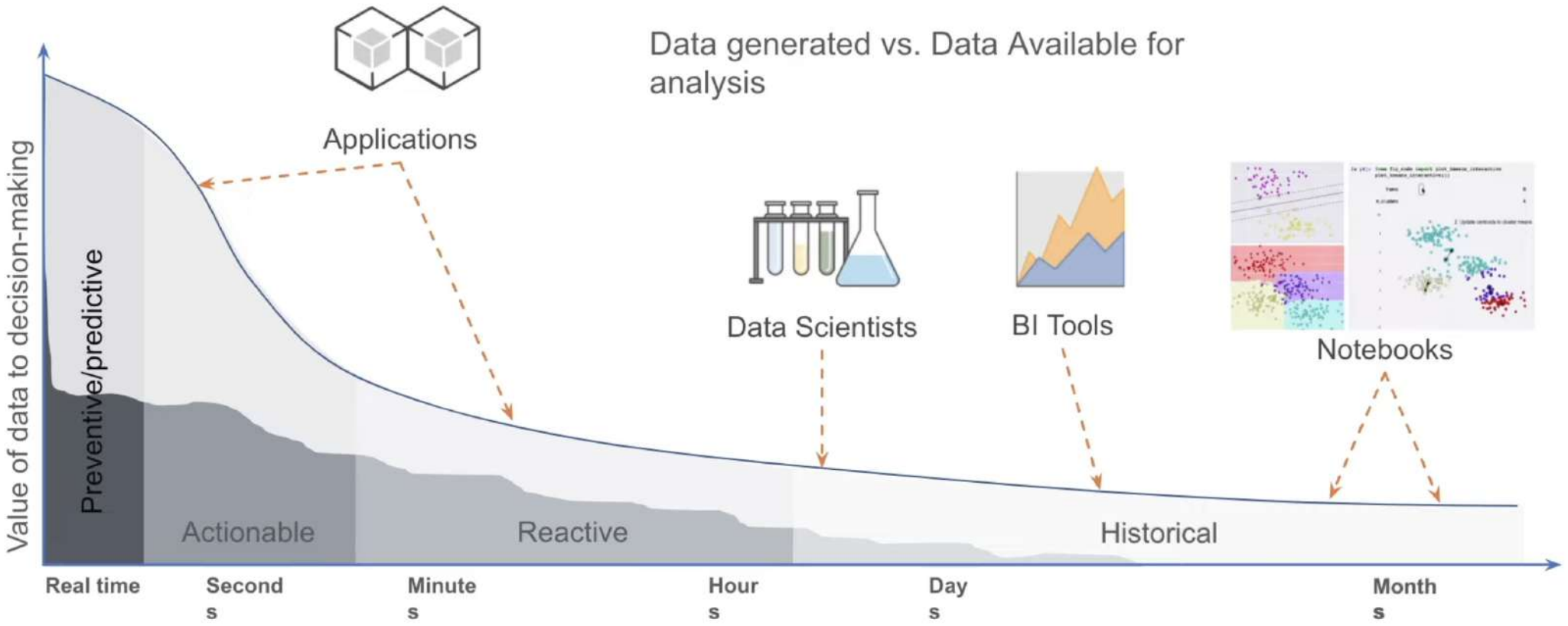


Source: Perishable insights, Mike Gualtieri, Forrester

Challenges working with data

Do you think a single Production DB can handle all these users?

Data generated vs. Data Available for analysis



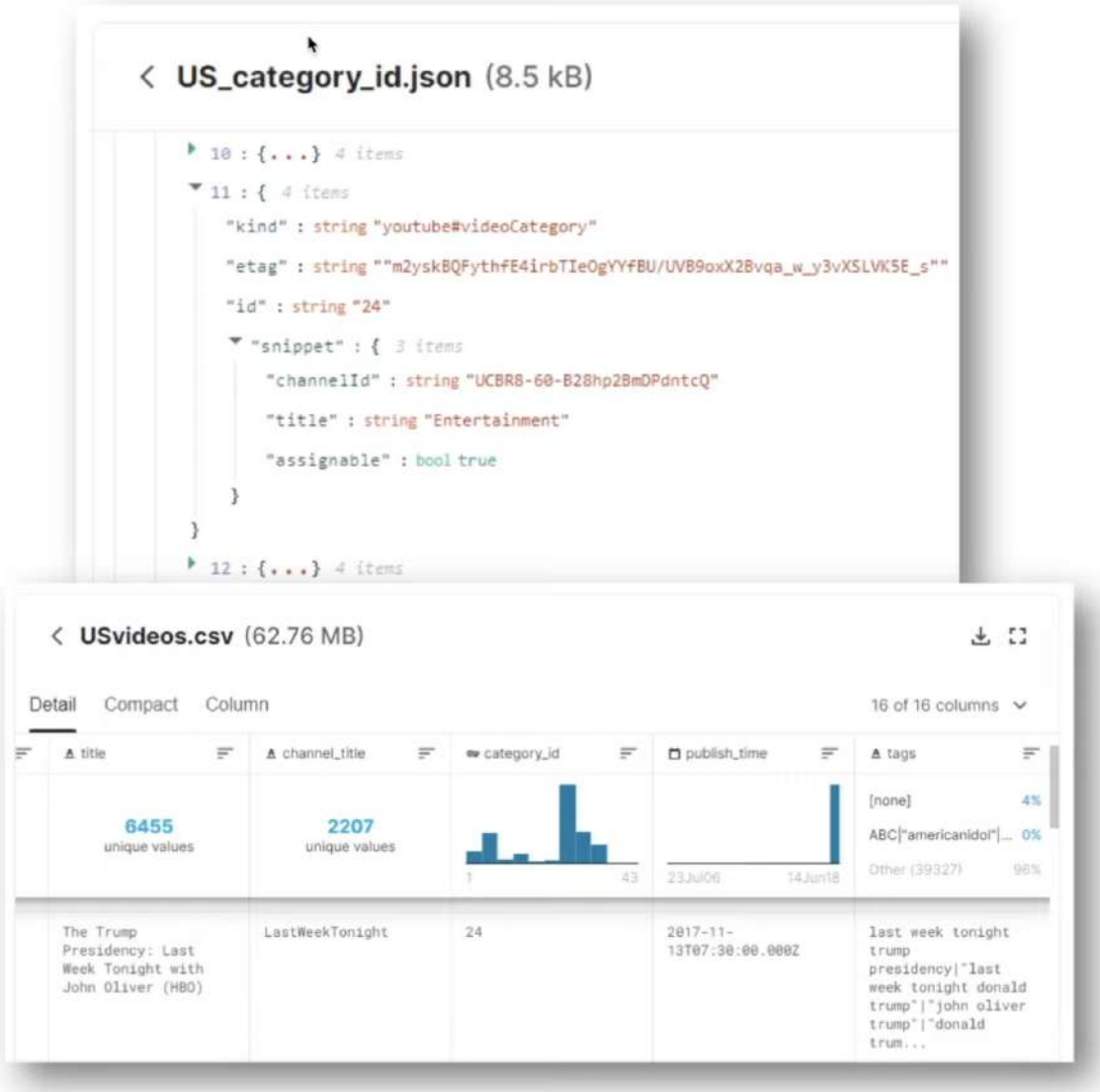
Our dataset from YouTube

- Top trending videos
- What is "*Trending*"?

  YouTube uses factors, including users interactions
  e.g. number of views, shares, comments and likes.

  Not the most-viewed videos overall for the calendar year

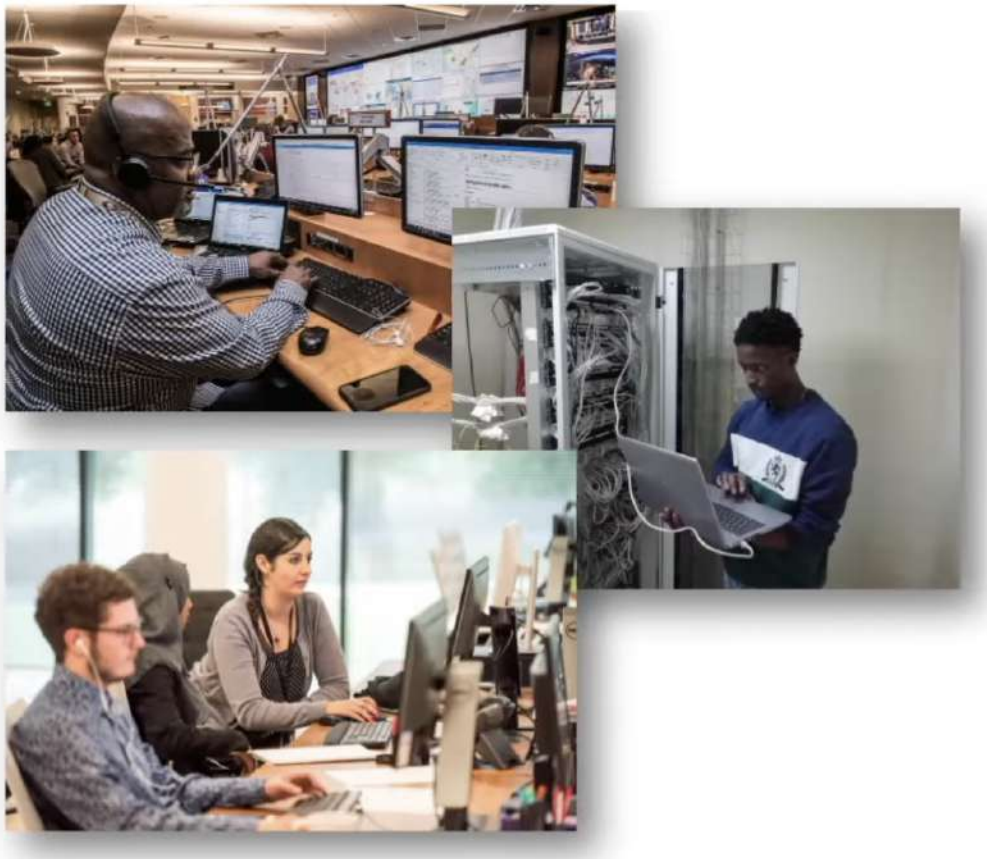
- Source: Kaggle. Data collected using YouTube API



Source: https://www.kaggle.com/datasnaek/youtube-new

What is an on-premise data centre

- You / your company has its own hardware
- You will need to maintain it; e.g.
  - Purchase, fix and upgrade hardware
  - Install and maintain Operating Systems and other software



What is the cloud?

- Applications delivered as services over the Internet
- Hardware and systems software in data centres, that provide those services

Image source: techspot.com,

Image source: amazon.com, 2021

Source: “A view of cloud computing”; doi.acm.org/10.1145/1721654.1721672

Why the cloud is being so disruptive

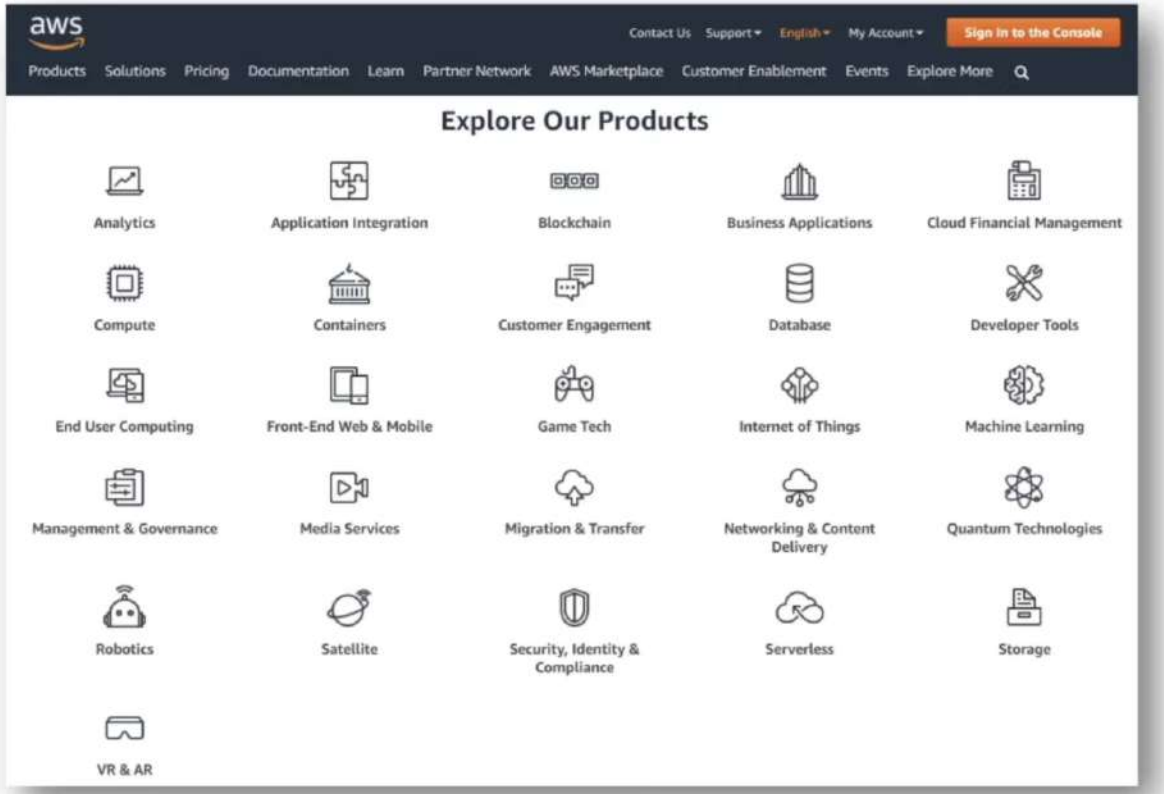
"A 10-node cluster running for 10 hours costs the same, as a 100-node cluster running for one hour"

On-premise, extra-hardware for a cluster means…

- Procurement, approval, licensing
- Shipping, installation, electricity, cooling systems,…
- Underutilized vs overutilized
- Pay even when nobody is using the hardware
- Sustainability issues

[Cont.] Why the cloud is being so disruptive

- 81% of enterprises have, at least, one application in the cloud
- 13% of +1k employees enterprises have migrated their entire IT environment to the cloud.



Source: “32% Of IT Budgets Will Be Dedicated To The Cloud By 2021”. Forbes, 2020

Steps to get our data

- Download from kaggle.com/datasnaek/youtube-new

- Create an Amazon S3 bucket, for our landing bucket
  e.g.

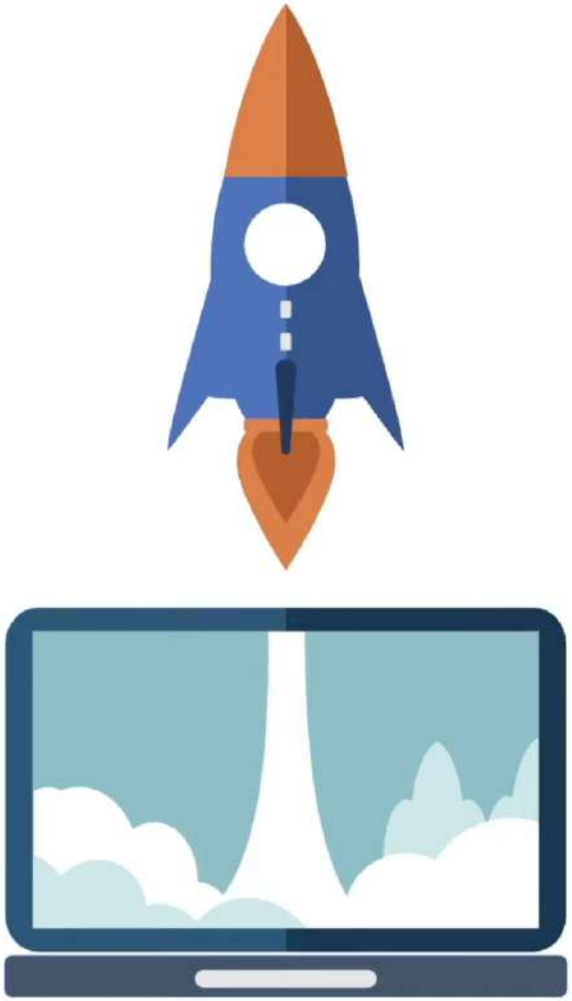
```
s3://company-raw-awsregion-awsaccountID-
env/source/source_region/tablename/year=yyyy/
month=mm/day=dd/table_<yearmonthday>.<file_format>

env = dev, test, prod
source = name or indicator of source
source_region = region of data source
```

- Copy the data to S3, using our AWS CLI

Agenda

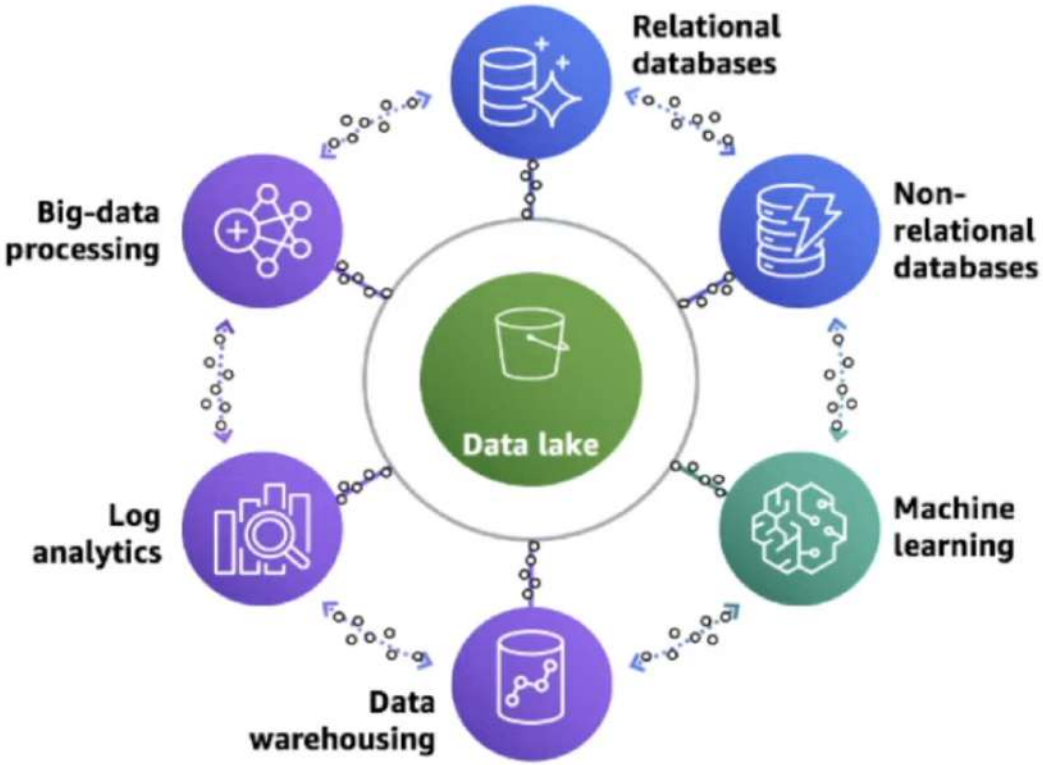
- Basics of Lake House architecture
- What is the AWS Glue Data Catalog
- Catalog our YouTube data



What is a Lake House architecture

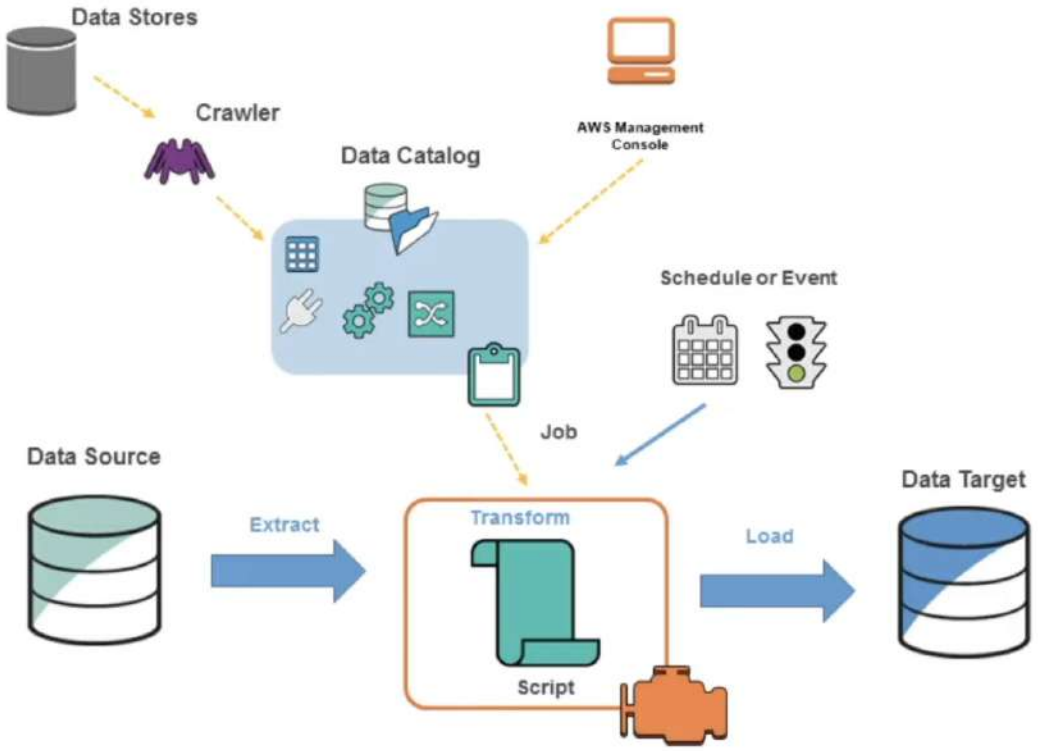
Key elements:

- Scalable Data Lakes
- Purpose-built Data Services
- Seamless Data Movement
- Unified Governance
- Performant and Cost-effective

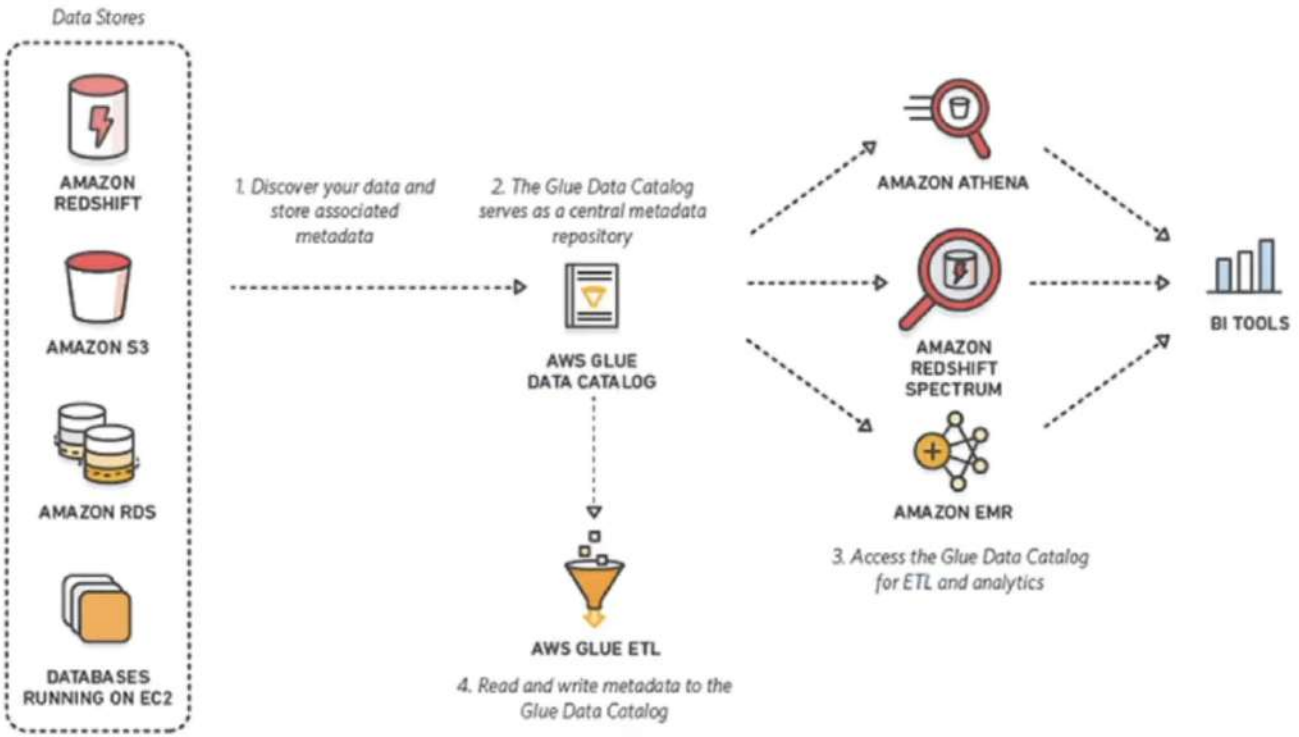


Source: aws.amazon.com/blogs/big-data/build-a-lake-house-architecture-on-aws/

What is the AWS Glue Catalog

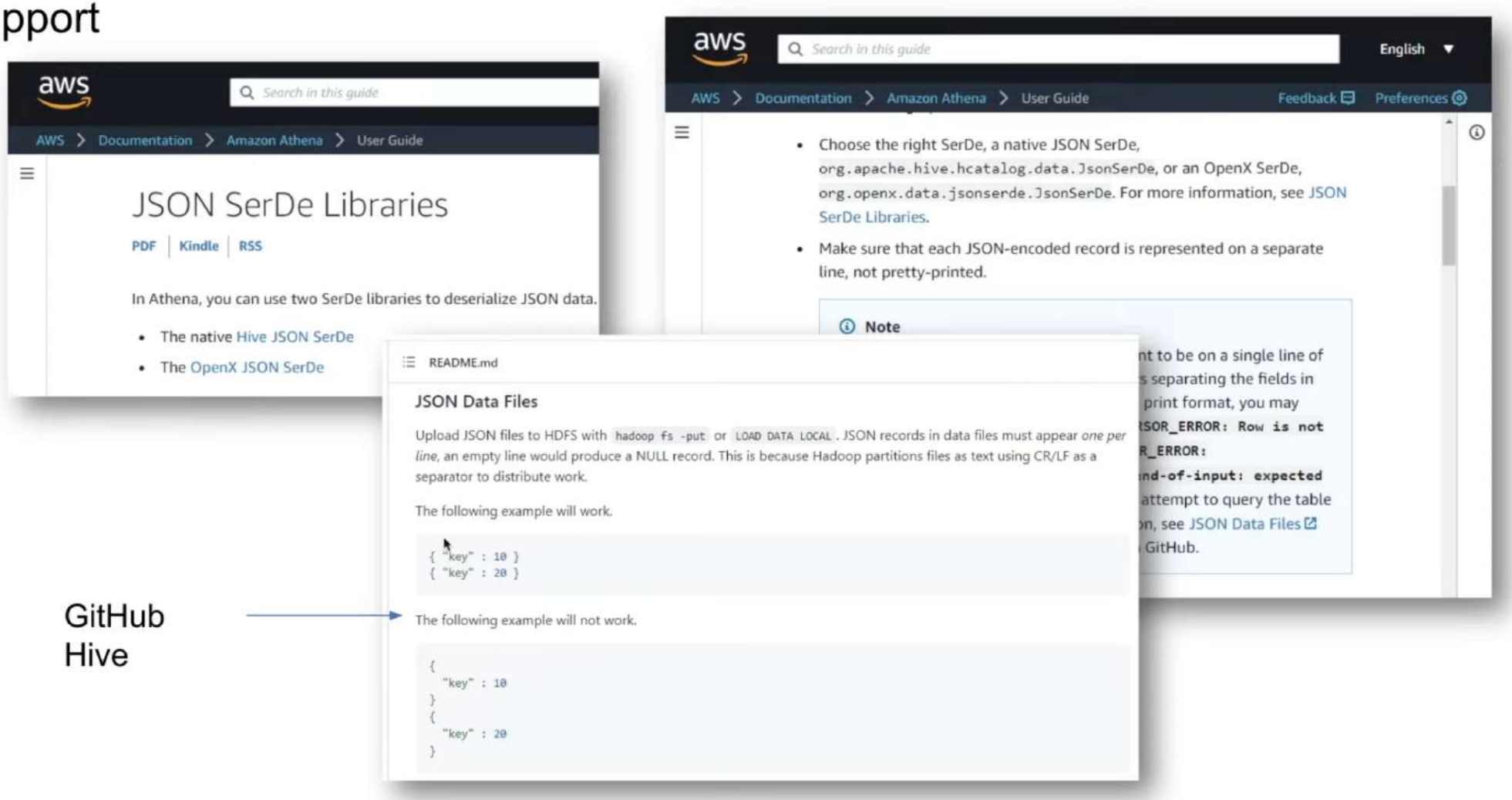


What is the AWS Glue Catalog

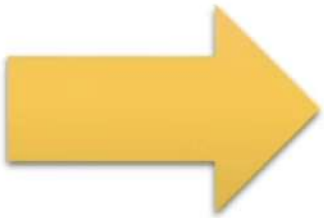


Source: aws.amazon.com/blogs/big-data/harmonize-query-and-visualize-data-from-various-providers-using-aws-glue-amazon-athena-and-amazon-quicksight/

JSON SerDe Libraries and Support

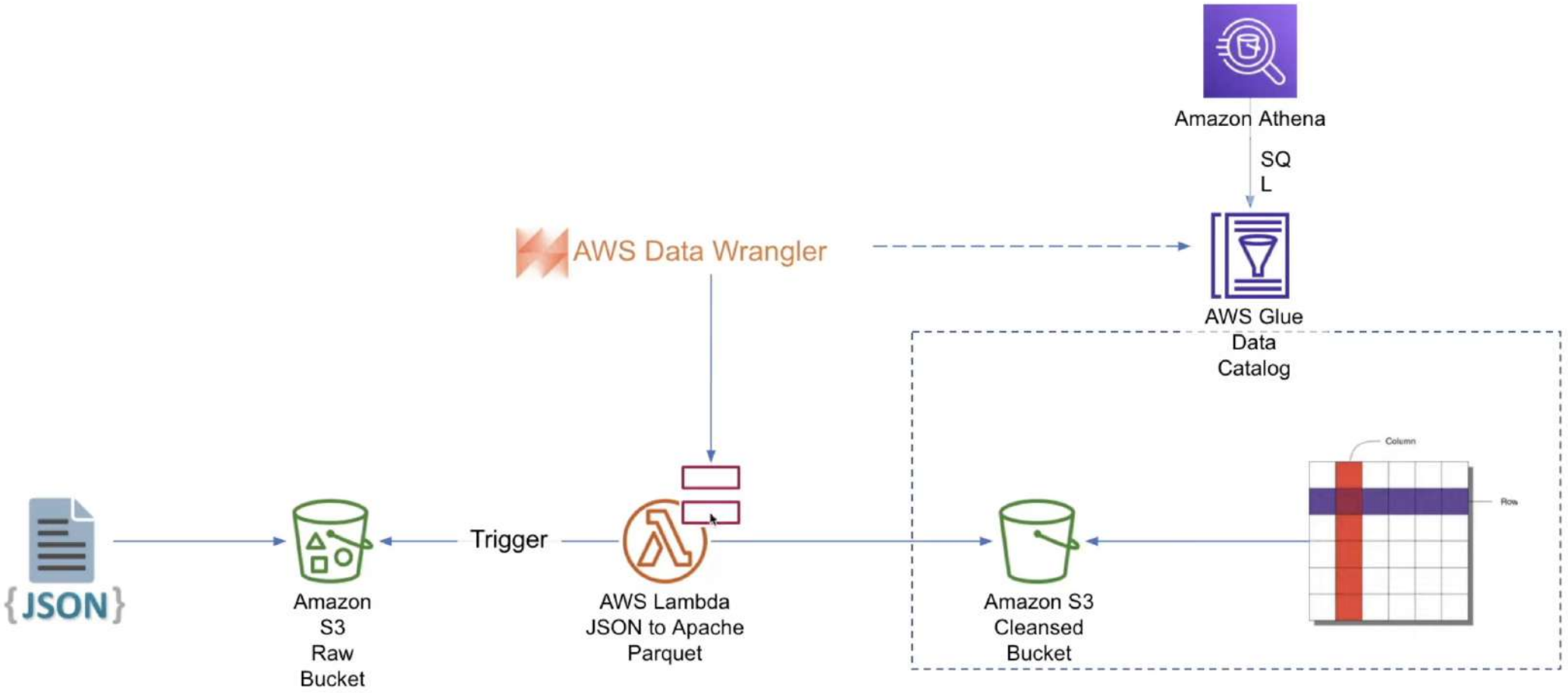


Goal: Data Cleansing
Create our light ETL: JSON to Apache Parquet



a	b	c	...	zf
a1	b1	c1	...	zf1
a2	b2	c2	...	zf2
a3	b3	c3	...	zf3
a4	b4	c4	...	zf4
a5	b5	c5	...	zf5
a6	b6	c6	...	zf6
a7	b7	c7	...	zf7

Data Cleansing
Semi-structured data to Structured pipeline



Data Wrangler: aws-data-wrangler.readthedocs.io/en/stable/what.html

Why Lambda to process our JSON payload?

- One of the AWS compute services
- Serverless
- High available and scalable

- Limits at this moment:
  - Deployment package is 50MB
    - You can use /tmp or mount EFS volumes: more storage and share it across executions
  - 10 GB for memory
  - 6 vCPUs
  - 15 min timeout

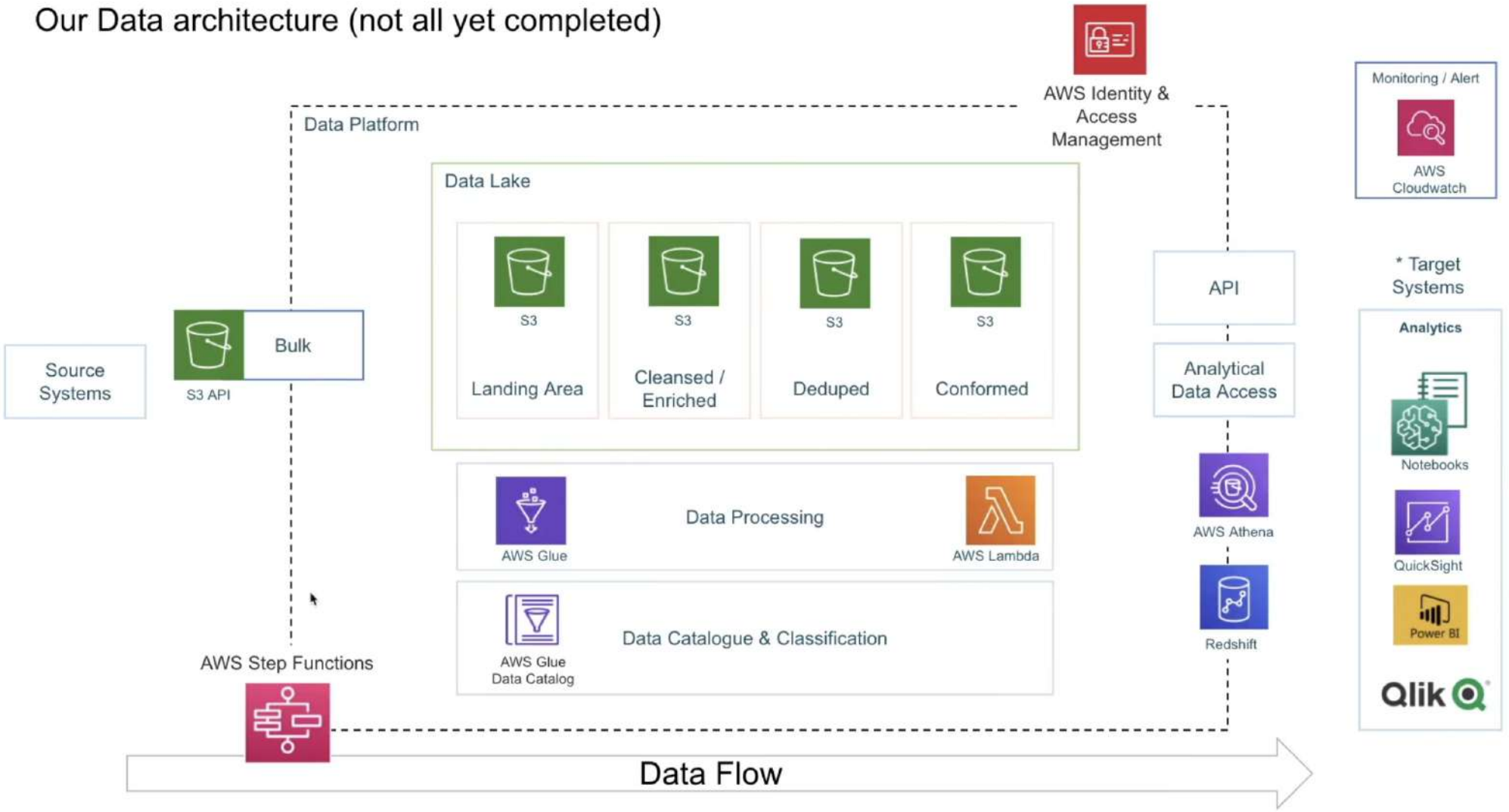
Comparing the different data storage options

This table compares the characteristics of these four different data storage options for Lambda:

	Amazon S3	/tmp	Lambda Layers	Amazon EFS
Maximum size	Elastic	512 MB	50 MB (direct upload; larger if from S3).	Elastic
Persistence	Durable	Ephemeral	Durable	Durable
Content	Dynamic	Dynamic	Static	Dynamic
Storage type	Object	File system	Archive	File system
Lambda event source integration	Native	N/A	N/A	N/A
Operations supported	Atomic with versioning	Any file system operation	Immutable	Any file system operation
Object tagging	Y	N	N	N
Object metadata	Y	N	N	N
Pricing model	Storage + requests + data transfer	Included in Lambda	Included in Lambda	Storage + data transfer + throughput
Sharing/permissions model	IAM	Function-only	IAM	IAM + NFS
Source for AWS Glue	Y	N	N	N
Source for Amazon QuickSight	Y	N	N	N
Relative data access speed from Lambda	Fast	Fastest	Fastest	Very fast

Source: aws.amazon.com/blogs/compute/choosing-between-aws-lambda-data-storage-options-in-web-apps/

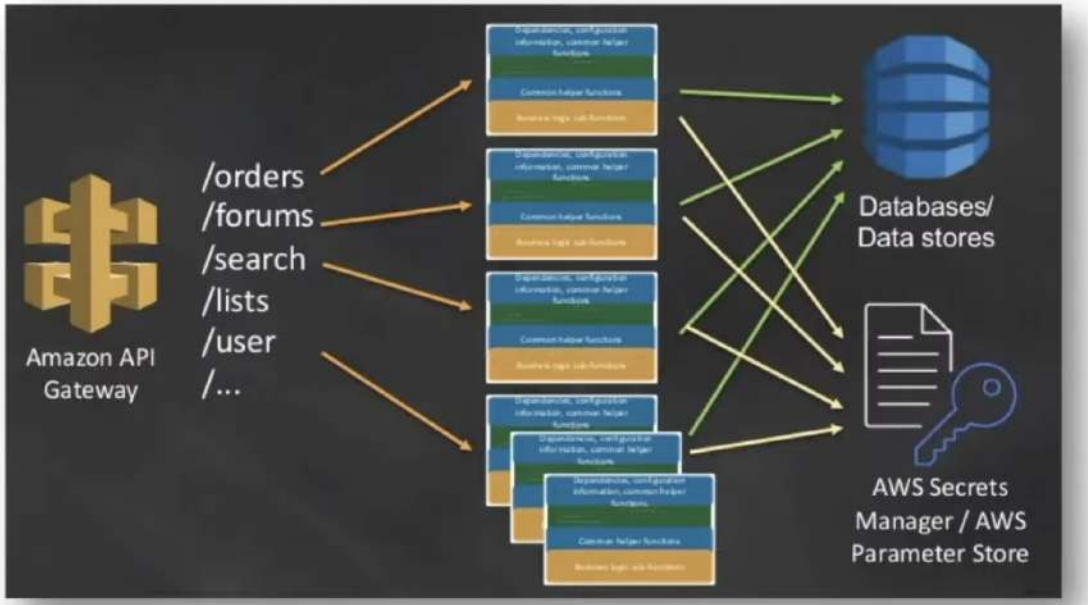
Our Data architecture (not all yet completed)



* Not all target services will be used

Lambda layers

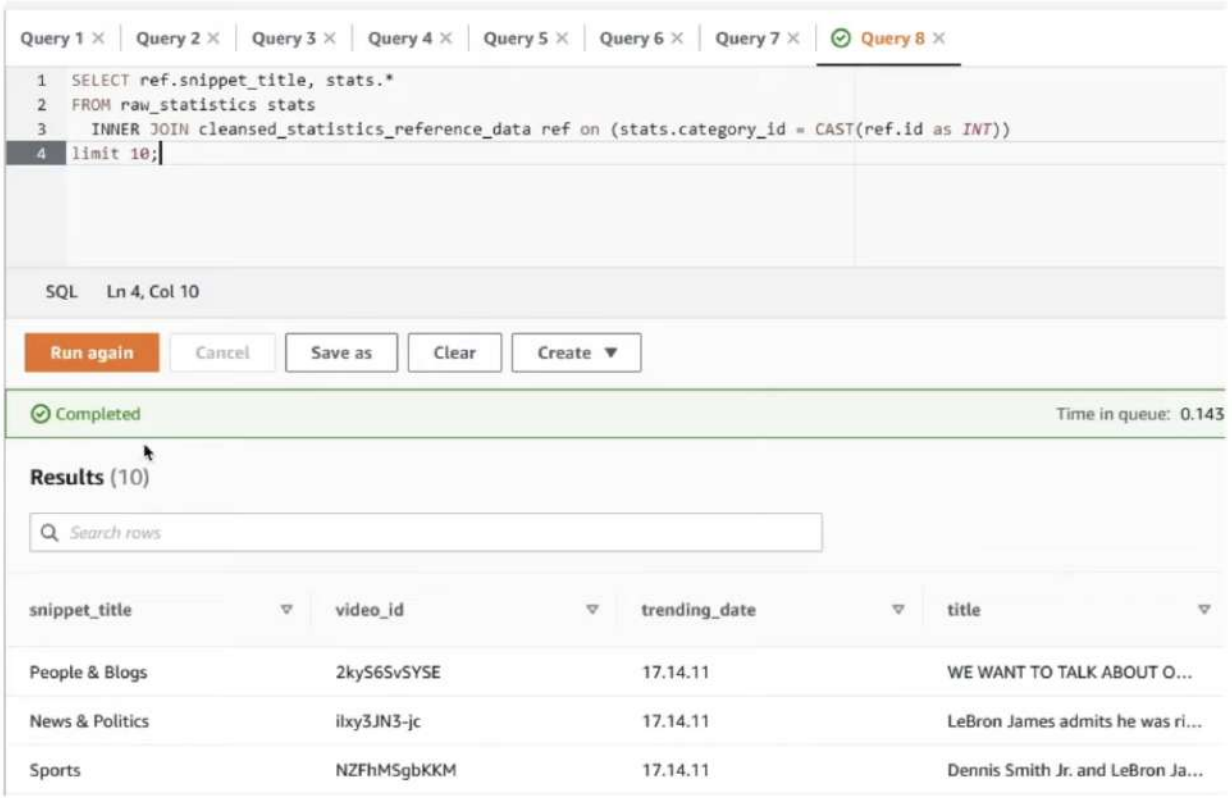
- convenient way to package libraries and other dependencies
- reduces the size of uploaded deployment, so it's faster to deploy your code
- promote code sharing and separation of responsibilities
    - Simpler iterations, so faster on writing business logic.



Press esc to exit full screen

Steps

- Try changing the data type in the data catalog!
  - Error? See next slide

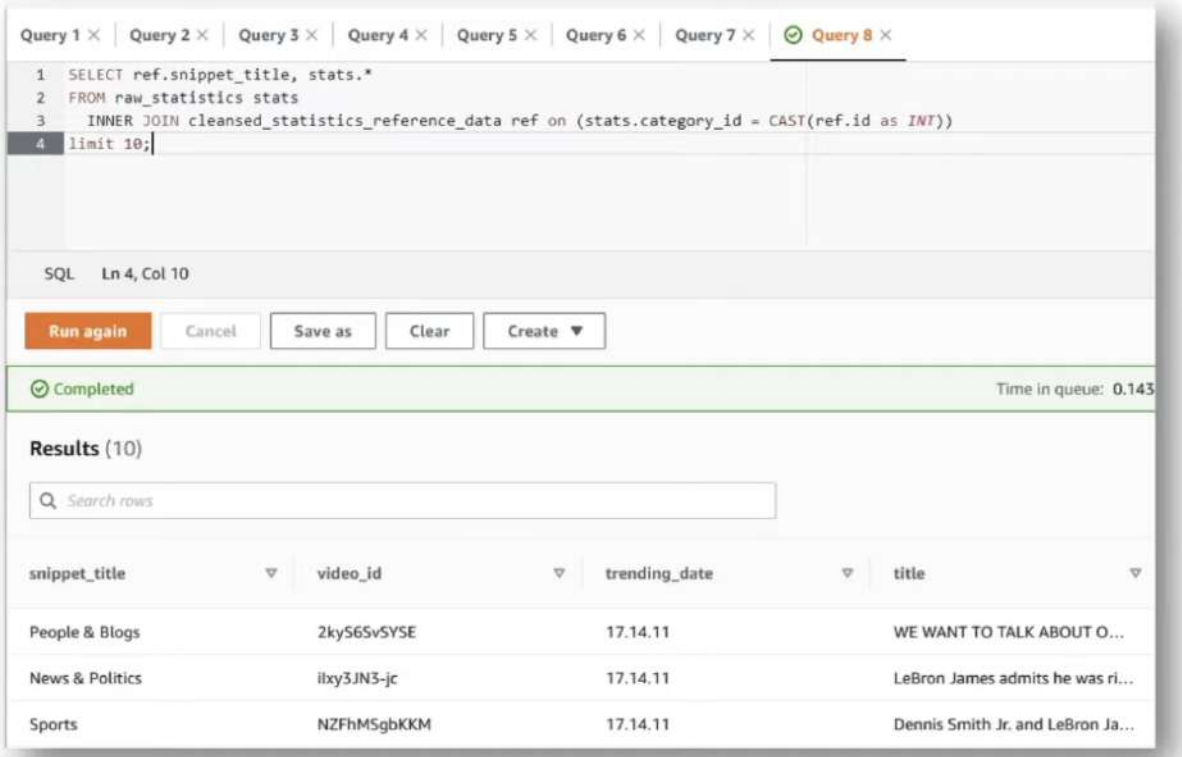


Apache Parquet

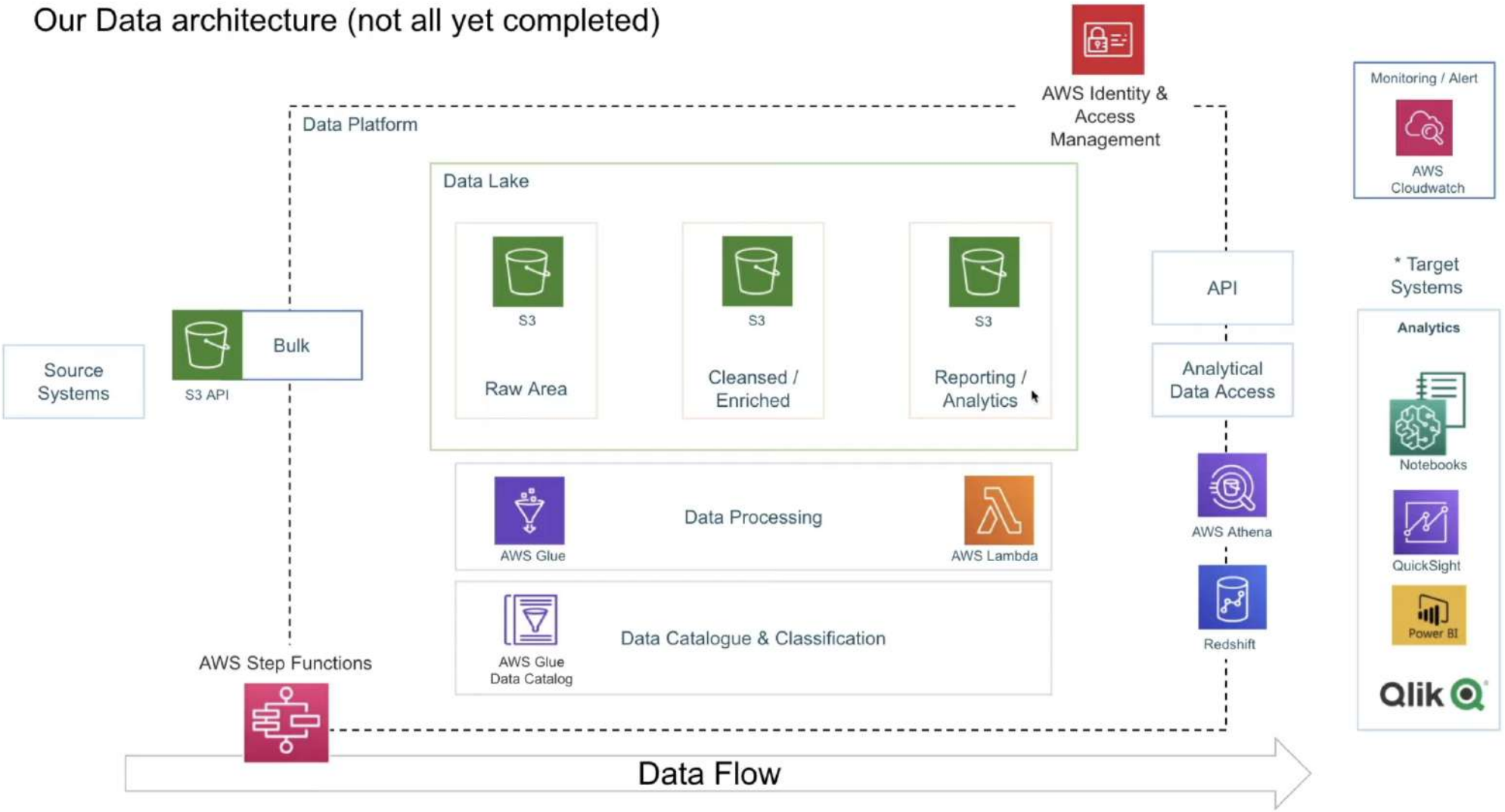
Apache Parquet files have headers!

Steps

1. Keep the data type change in the data catalogue
2. Delete our testing JSON file
3. Confirm APPEND in Lambda
4. Run Test event in Lambda
5. Copy again our data, from our laptops (AWSCLI)
6. Add the S3 Trigger to Lambda



Our Data architecture (not all yet completed)



* Not all target services will be

Cleansed vs Analytics layer

Using Cleansed Layer

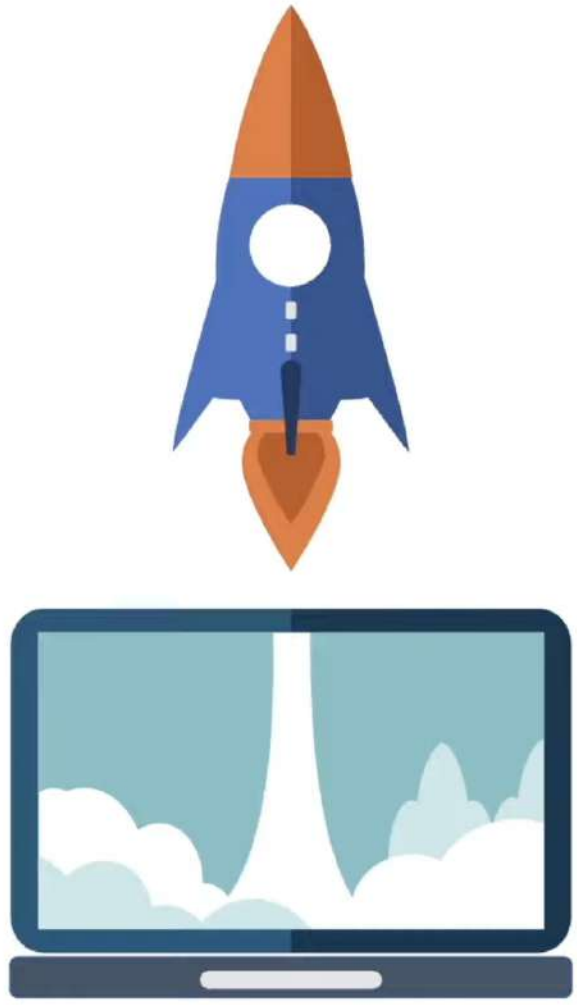
```sql
SELECT ref.snippet_title, stats.title, stats.title
FROM raw_statistics stats
  INNER JOIN cleansed_statistics_reference_data ref on (stats.category_id = ref.id)
WHERE ref.id=2
```

Using Reporting Layer

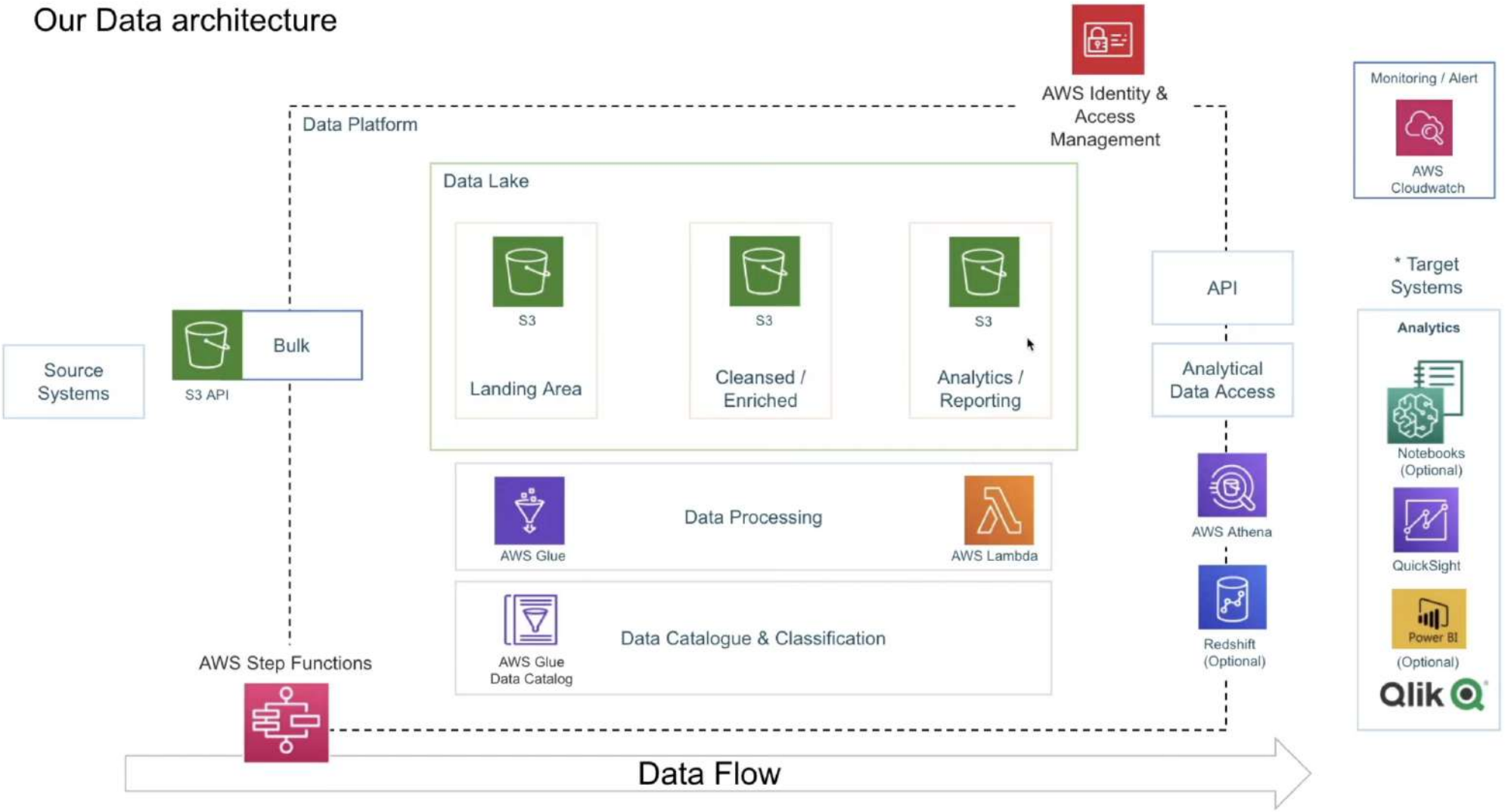
```sql
SELECT snippet_title, title, title
FROM rpt_youtube_statistics_categories
WHERE id=2
```

Agenda

- Business Intelligence, using Amazon QuickSight



Our Data architecture



* Not all target services will be