Real World Evidence (RWE) Using AWS Services

Healthcare is undergoing dramatic change and drug payments are in the crosshairs of industry reform.

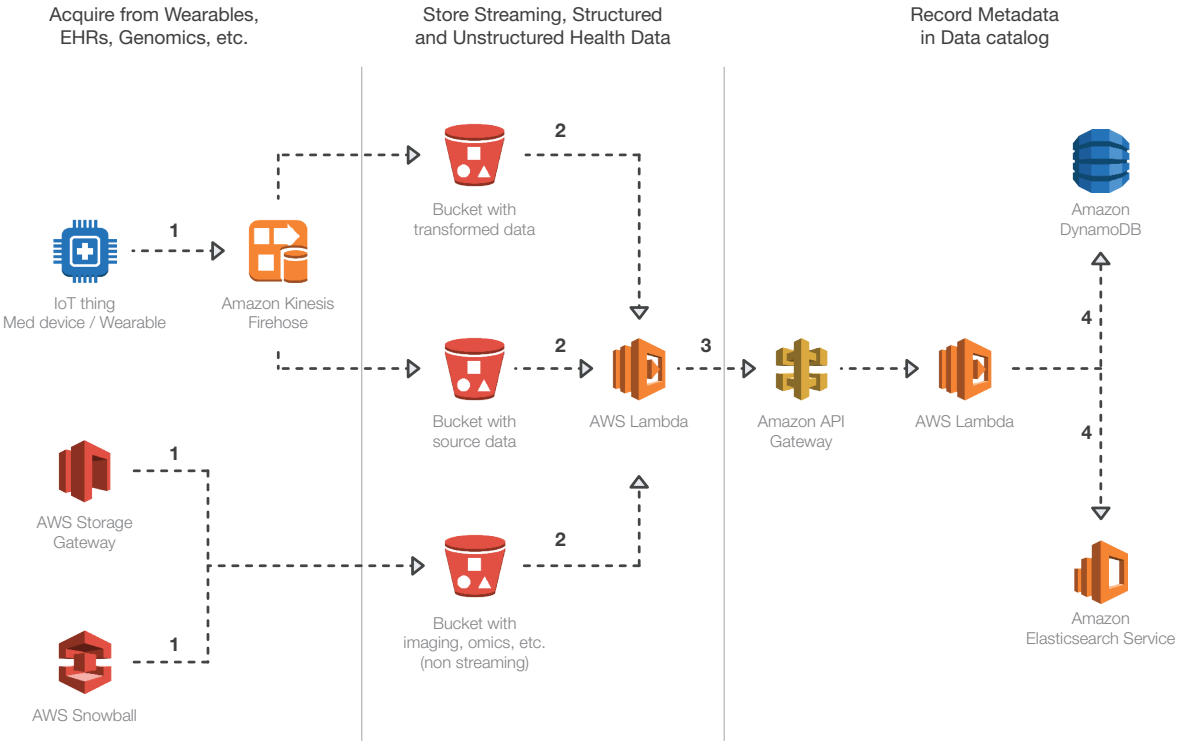
Life science companies are responding with Real World Evidence (RWE) to capture data from clinical through post-market activities to prove drug products are efficacious, to maintain formulary preference, and to maximize reimbursement.

Key design criteria for a RWE platform should include:

- Flexible ingestion of data
- Scalability and durability
- Options for global deployment
- Self-service capabilities that accommodate both technical and non-technical users
- Robust security and compliance

In order to help customers build their own RWE platforms, the following diagrams are reference architectures for data acquisition, data processing and data consumption using AWS Services.

Data Acquisition



STEP 1: Streaming (e.g. wearables), structured, and unstructured data is acquired from myriad devices and services.

Depending on the data size, you may want to use AWS IoT (streaming), AWS Storage Gateway (mid-size/continual batch), and AWS Snowball (large, legacy datasets, such as imaging).

AWS IoT writes to Amazon Kinesis Firehose, which transforms the telemetry data in-flight to land both transformed and raw data in Amazon S3.

STEP 2: Upon landing in S3 buckets, an AWS Lambda function is invoked (either by trigger or manually).

STEP 3: This Lambda function writes to a Data Catalog, fronted by Amazon API Gateway, containing metadata about all of the object data in S3, as well as data residing in databases, such as Amazon Redshift.

STEP 4: AWS Lambda writes the appropriate metadata about the objects into Amazon Elasticsearch Service and/or Amazon DynamoDB.

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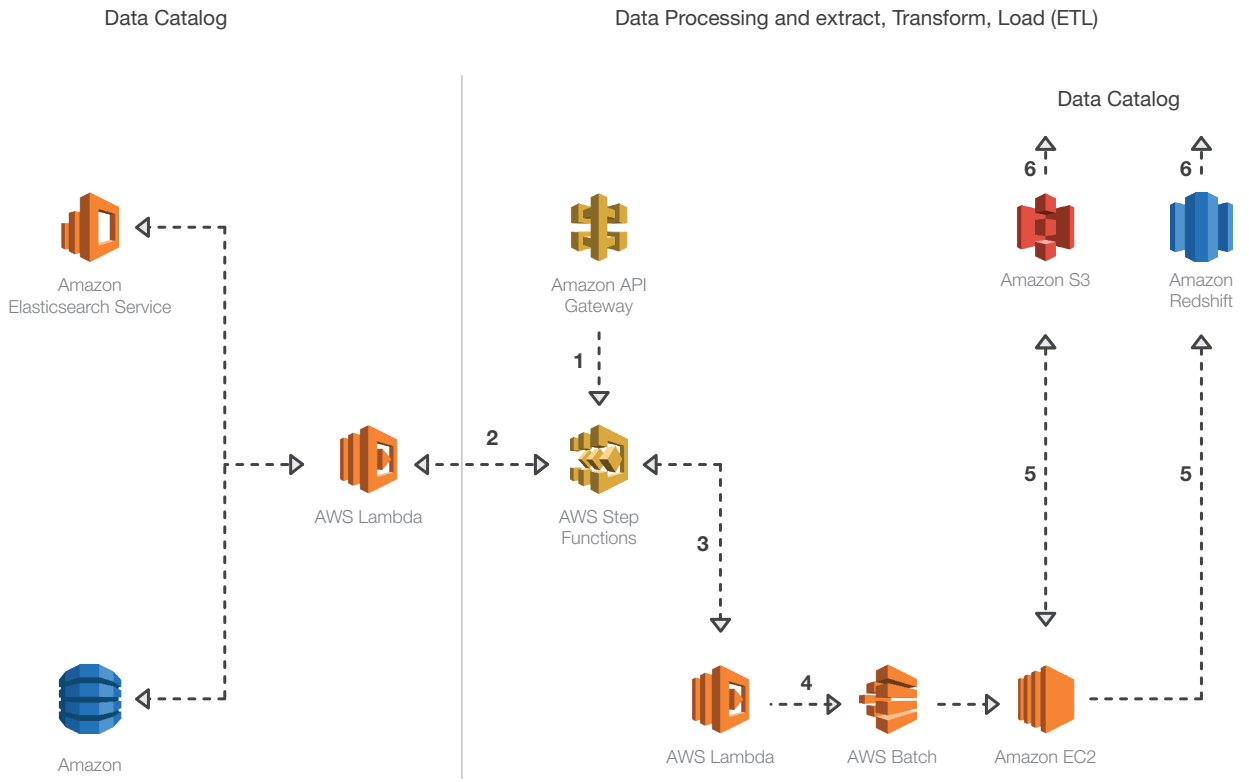
Data Processing



STEP 1: User, or automated process, submits a POST request through Amazon API Gateway to process or transform a set of data. AWS Step Functions orchestrates the ETL Process.

STEP 2: An AWS Lambda function queries the data catalog and builds a manifest containing the location of the data interest.

STEP 3: The manifest is passed to a downstream Lambda function in the Step Functions state machine that orchestrate the batch workflow to process the data specified in the manifest.

STEP 4: These Lambda functions submit jobs to AWS Batch to execute batch jobs on Amazon EC2

STEP 5: Amazon EC2 processes the data (e.g. data normalization) and stores results back into Amazon S3 and/or Amazon Redshift.

STEP 6: Results data is then logged in the data catalog, using the process show in the Data Acquisition diagram.

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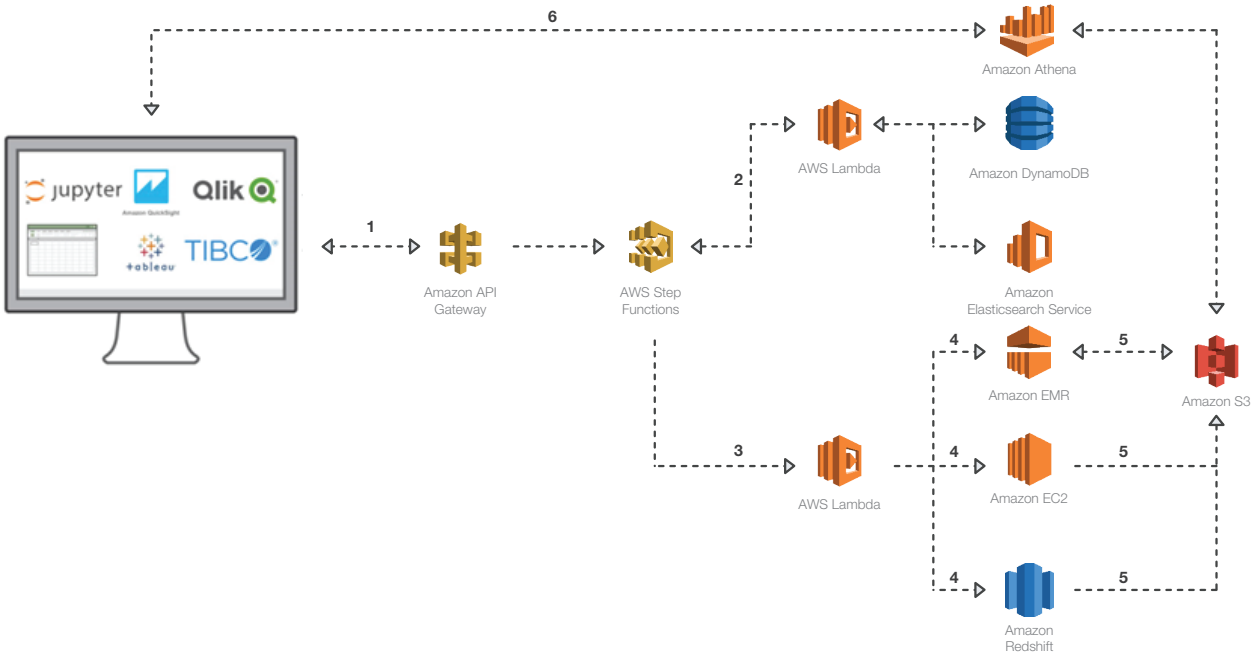
Data Consumption



STEP 1: User initiates a query on a dataset. In the context of Real World Evidence, this is largely analyzing a cohort in the context of a specific indication (drug response, etc)

STEP 2: AWS Step Functions invokes an AWS Lambda function to query the Data Catalog and build a manifest of data

STEP 3: The manifest is passed to a subsequent Lambda functions, which orchestrate the data analysis through different AWS services

STEP 4: These analyses may include Amazon EMR for population-scale genomics, Amazon EC2 for high-performance computing and machine learning, and/or Amazon Redshift for your healthcare data warehouse

STEP 5: Results from each analysis is stage back in Amazon S3 and logged in the data catalog

STEP 6: Business intelligence tools, such as Amazon Quiksight or Tableau, or data analysis workbooks, such as Jupyter, can query Amazon S3 to visualize results, such as through Amazon Athena

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