
AWS
re:Invent

PNU201

Utility meter data analytics and Quick Start walk-through

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WW Tech Leader
Power & Utilities

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Solutions Architect
Power & Utilities

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Agenda

1. Why does smart meter data analytics matter?
   - Customer expectation and value gaps
   - Bridging the value gap

2. What does the MDA Quick Start cover?
   - 50,000-foot view on the Quick Start architecture
   - Data lake and extract, transform and load (ETL) pipeline unpacked
   - Machine Learning pipeline architecture

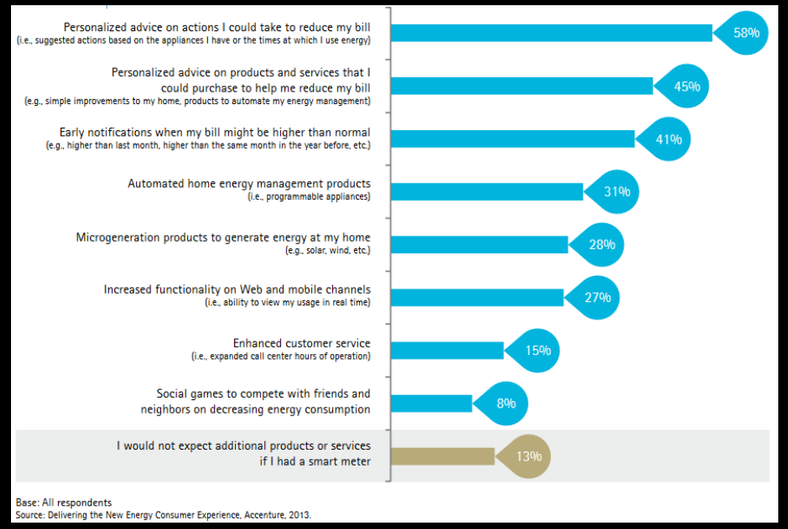
3. Benefits summary

4. How do I get started?

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Customer expectations after smart meter installation

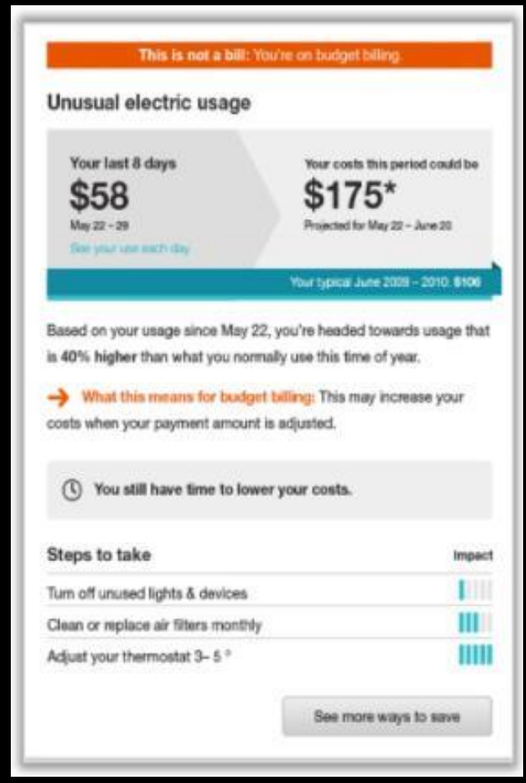
Top 3 customer expectations



1) "Personalized advice on **actions** I could take to reduce my bill"

2) "Personalized advice on **products and services** that I could purchase to help me reduce my bill"

3) "Early **notifications** when my bill might be higher than normal"



#3

#1/2

Best practice mock-up:
Proactive UEU notification and recommendations

Even today – AMI data is still not being used effectively

ACEE

American Council for an Energy-Efficient Economy

" We find that many utilities are underexploiting AMI capabilities and attendant benefits, thus missing a key tool to deliver value to their customers and systems.

Utilities are largely missing the opportunity to utilize AMI data to improve their energy efficiency and demand response offerings, in part due to regulatory, administrative, and technological barriers.

AMI data can help utilities and third parties create better, more compelling, more cost-effective demand-side offerings ."

Jan 2020 AMI Report – American Council for an Energy-Efficient Economy

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AWS meter data analytics (MDA): Unlocking AMI benefits and customer value



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Value-add functions have been small or nil



Customer info. system

Geo. info. system

Meter



Head end

Traditional MDM

Distribution marketplace

Enable supplier switching

Never done before

Rate and pricing optimization

DER planning and simulation

Volt/VAR optimization

Predictive outage planning

Almost never supported today

Load forecasting

Customer outage reporting

Energy usage alerts

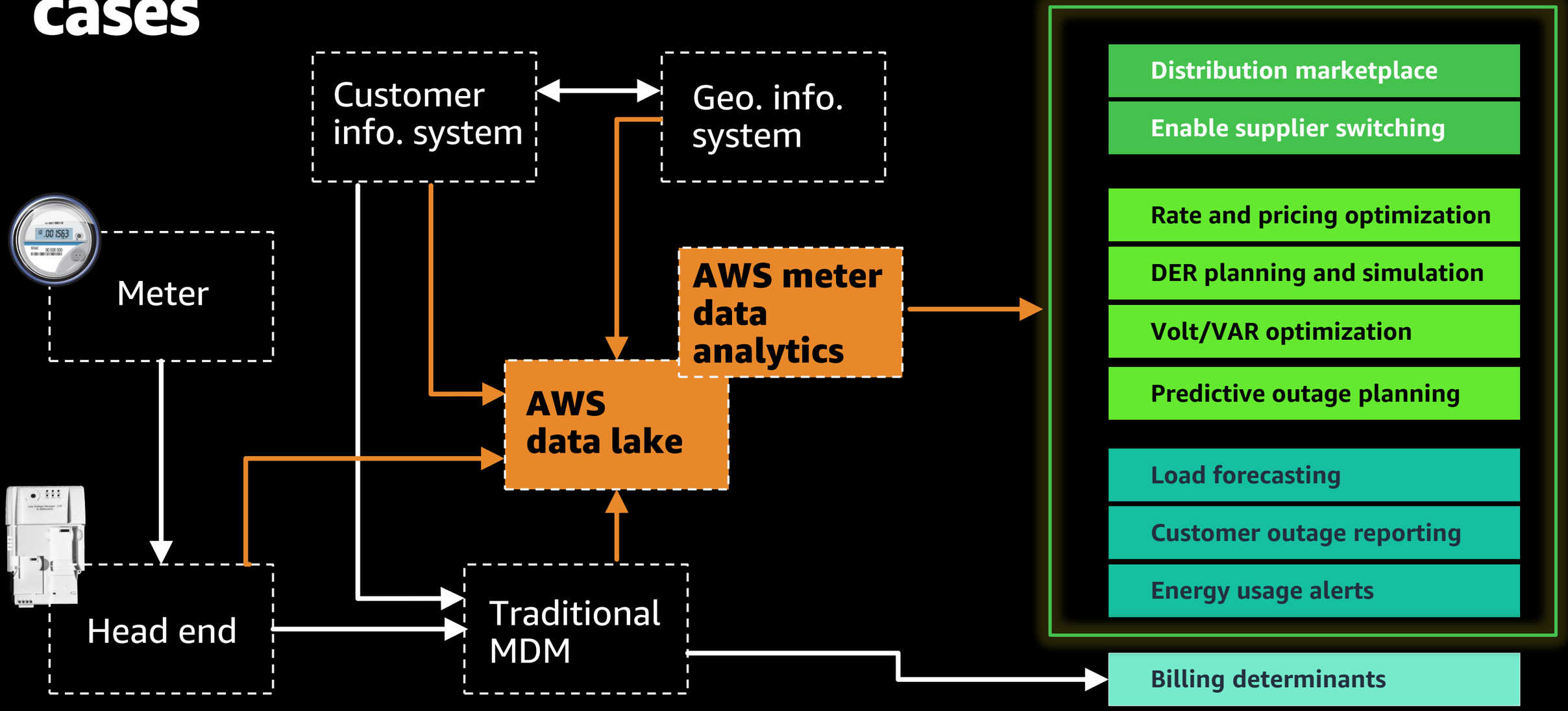
Sometimes supported

Billing determinants

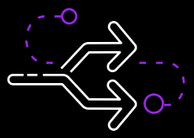
Always supported

https://www.energycentral.com/c/iu/meter-data-management-system-what-why-when-and-how

AWS MDA unlocks your data and value-add use cases



How the AWS solution bridges the value gap

	 Design	 Costs	 Data retention	 Data processing & integration
Traditional MDM solution	Basic Daily Meter Data	High	Only billing-related data	Batch-oriented & Stand-alone
AWS Meter data analytics solution	Any data, at any frequency and volume	Low	All data at full resolution	Real time and batch; Integrated

A solution architecture using low cost AWS Cloud storage and highly scalable AWS Analytics and Machine Learning overcomes many of the limitations of traditional MDM systems

Meter data analytics systems already on AWS

- Data lake for 50 million smart meters
- C3 on AWS is already processing data from 32 million meters today every 15 minutes

Link

- Smart metering data for 2.5 million customers at a rate of 200k messages every 10 seconds
- 80% reduction in cost as installed base grew

Link

- Smart metering data lake for 1.2 million meters on AWS
- Used AI / ML for a number of use cases like fault detection and on-site inspection planning

Link

- Smart metering data in real time from its 22,000 sites all over the world (embassies, consuls, etc.) and performance of remote power quality monitoring and facilities management

Link

- Deployed a “smart building” solution in Italy encompassing 3,500 buildings managing 160,000 sensors and meters

Link

- Host for 50 million smart meters deploying across the UK
- Used by all utilities in the UK as common meter data lake

Link

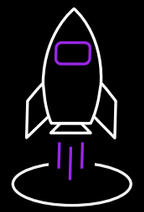
Getting started: Meter data analytics Quick Start



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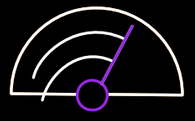
AWS Quick Starts



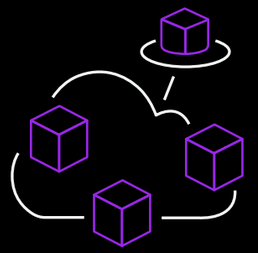
Automated, gold-standard deployments



Built by AWS solutions architects and partners

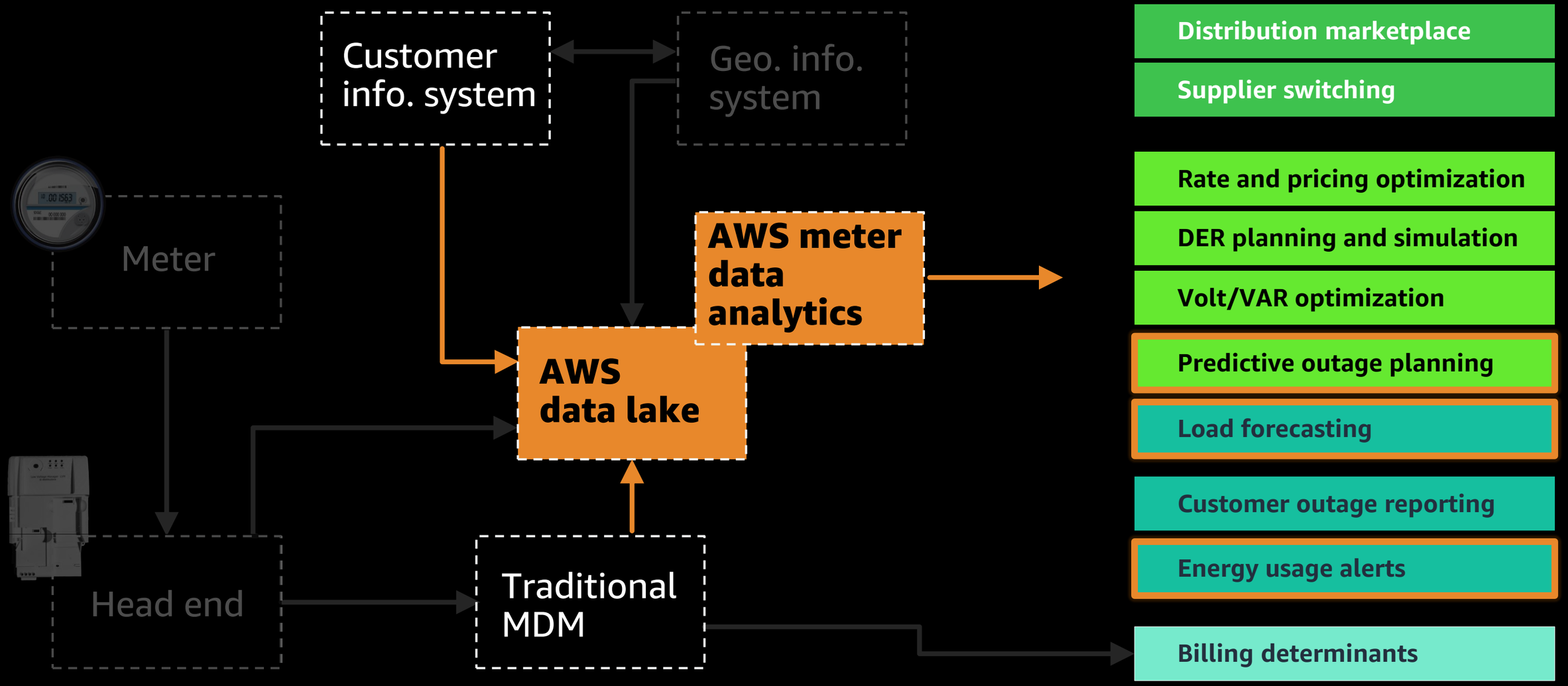


These accelerators reduce hundreds of manual procedures into just a few steps

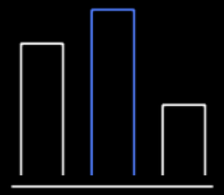


Each Quick Start includes AWS CloudFormation templates that automate the deployment

MDA Quick Start: Initial release



MDA Quick Start enables four initial use cases



Actual usage

Actual usage; aggregated daily, weekly or monthly



Forecasted energy usage

ML-driven energy usage forecast at the household level



Unusual usage alerts

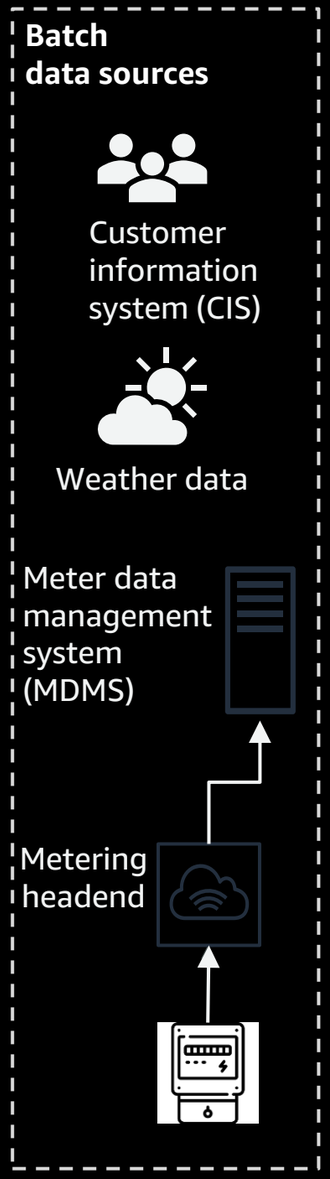
Usage anomaly detection

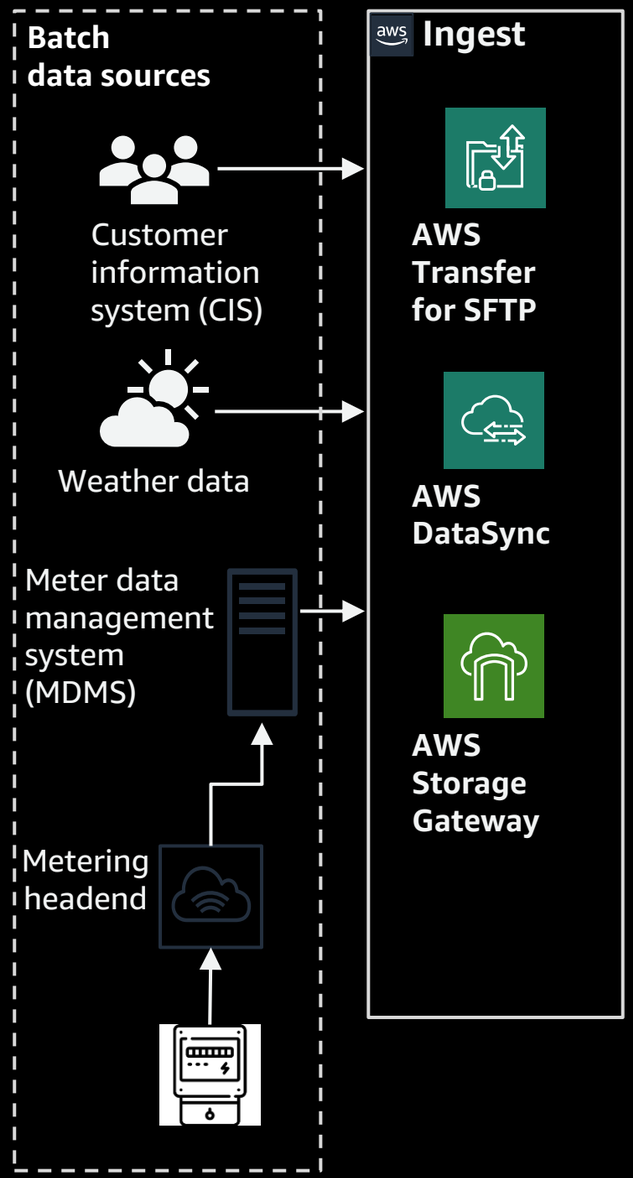


Momentary outage heat map

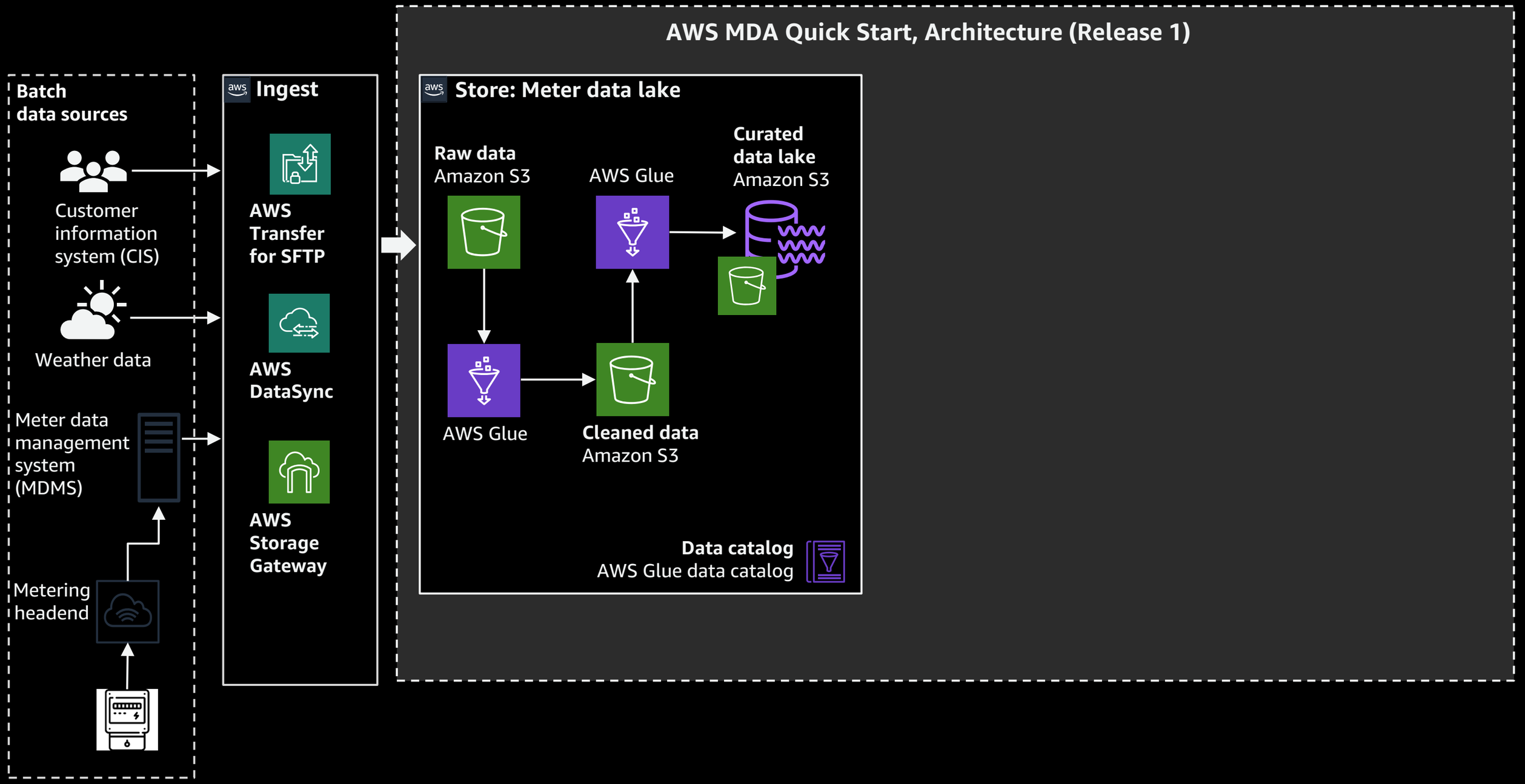
Meter outages / errors with latitude / longitude coordinates

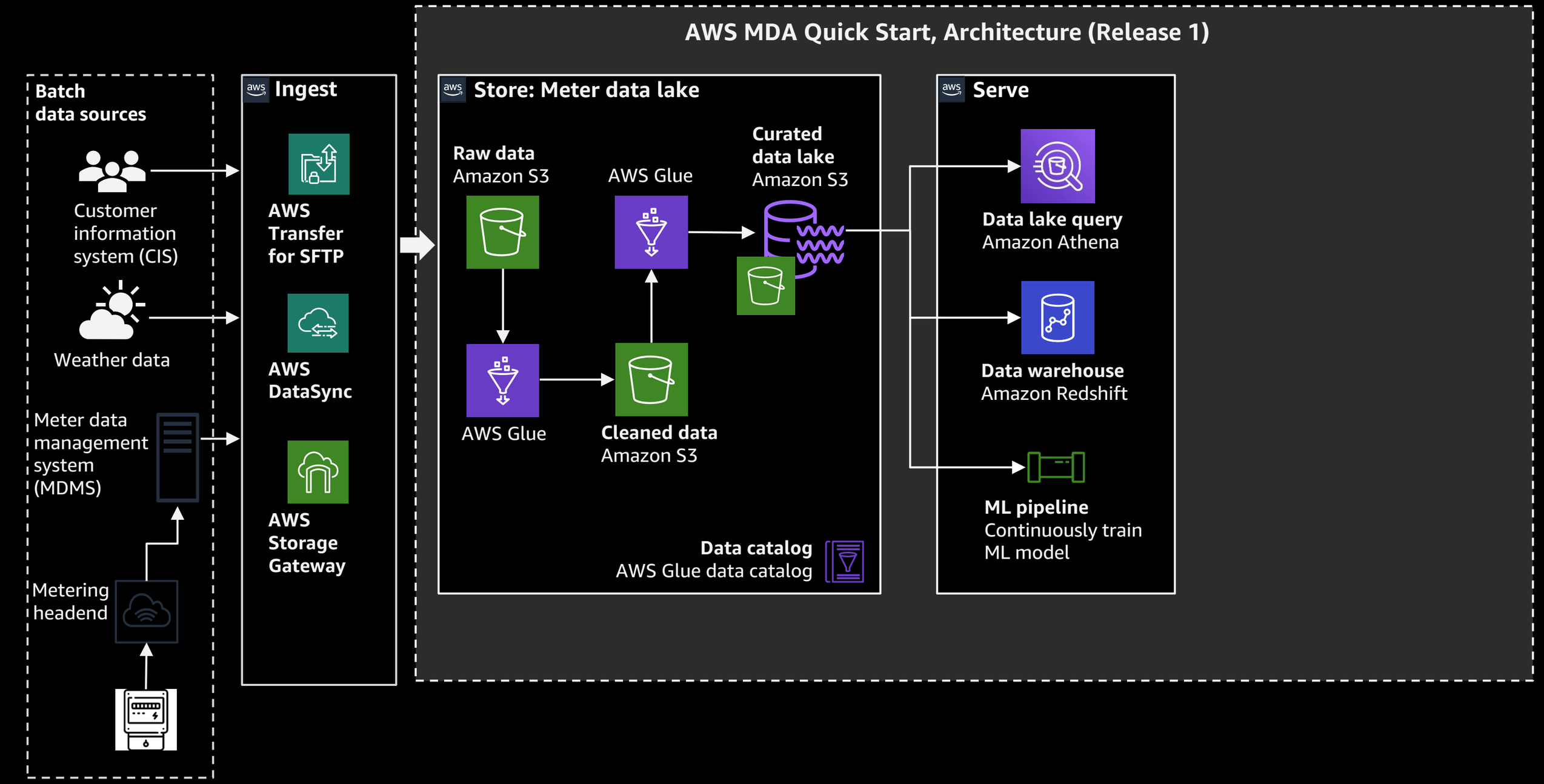
Batch
data sources

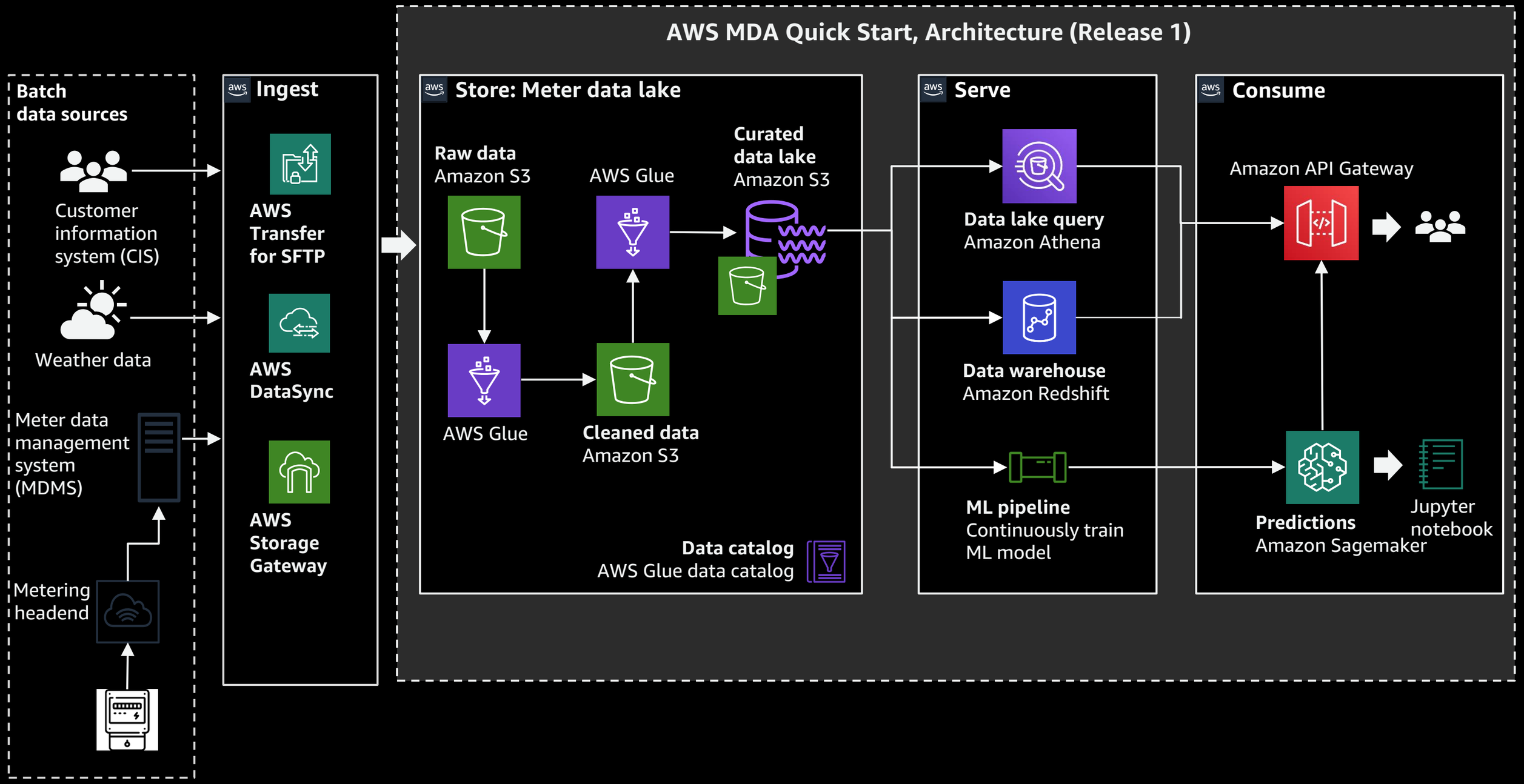

Batch
data sources
Customer
information
system (CIS)
Weather data
Meter data
management
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(MDMS)
Metering
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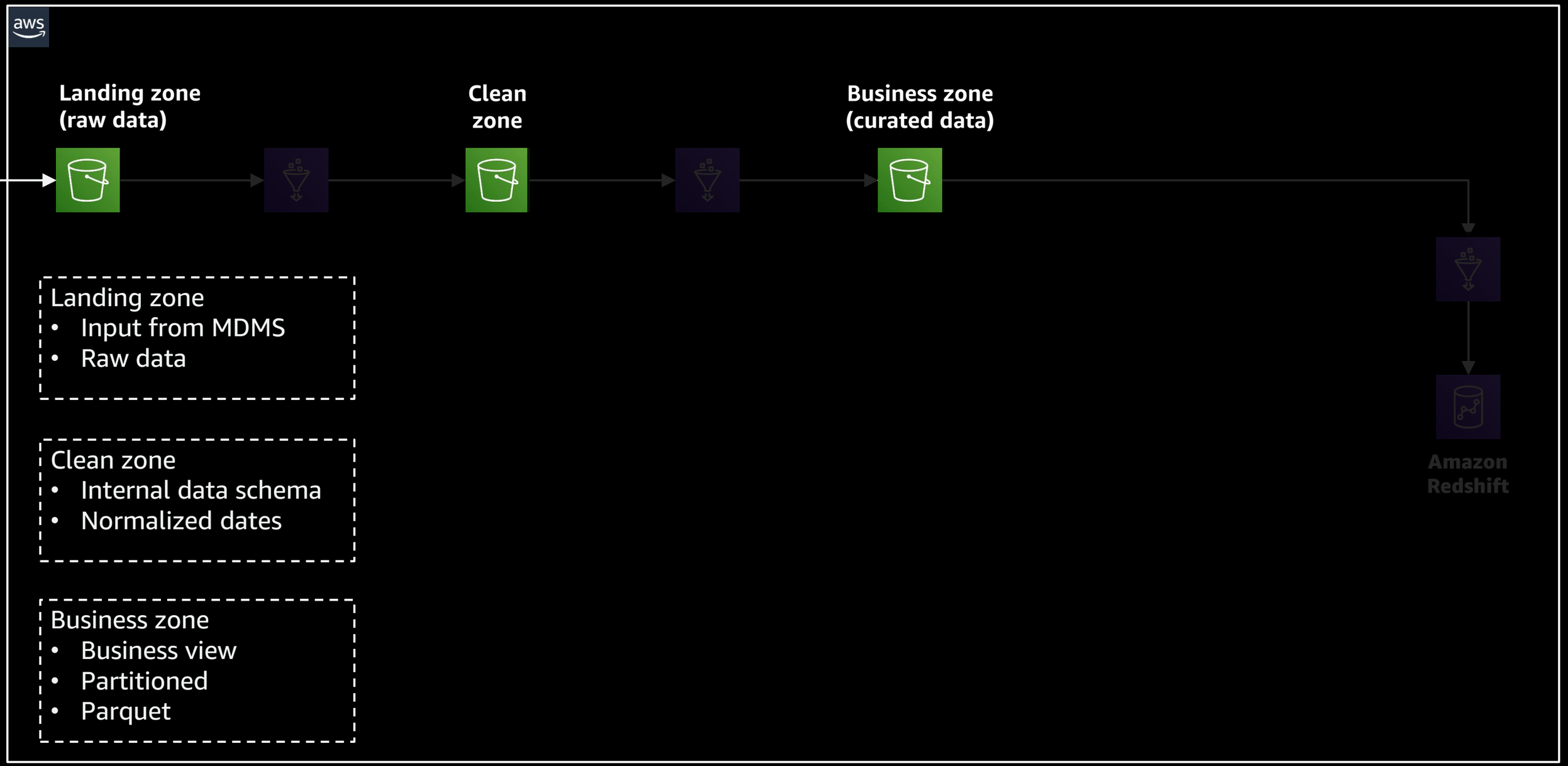
Ingest
AWS
Transfer
for SFTP
AWS
DataSync
AWS
Storage
Gateway


AWS MDA Quick Start, Architecture (Release 1)
Batch data sources
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Weather data
Meter data management system (MDMS)
Metering headend
Ingest
AWS Transfer for SFTP
AWS DataSync
AWS Storage Gateway
Store: Meter data lake
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Amazon S3
AWS Glue
Curated data lake
Amazon S3
AWS Glue
Cleaned data
Amazon S3
Data catalog
AWS Glue data catalog

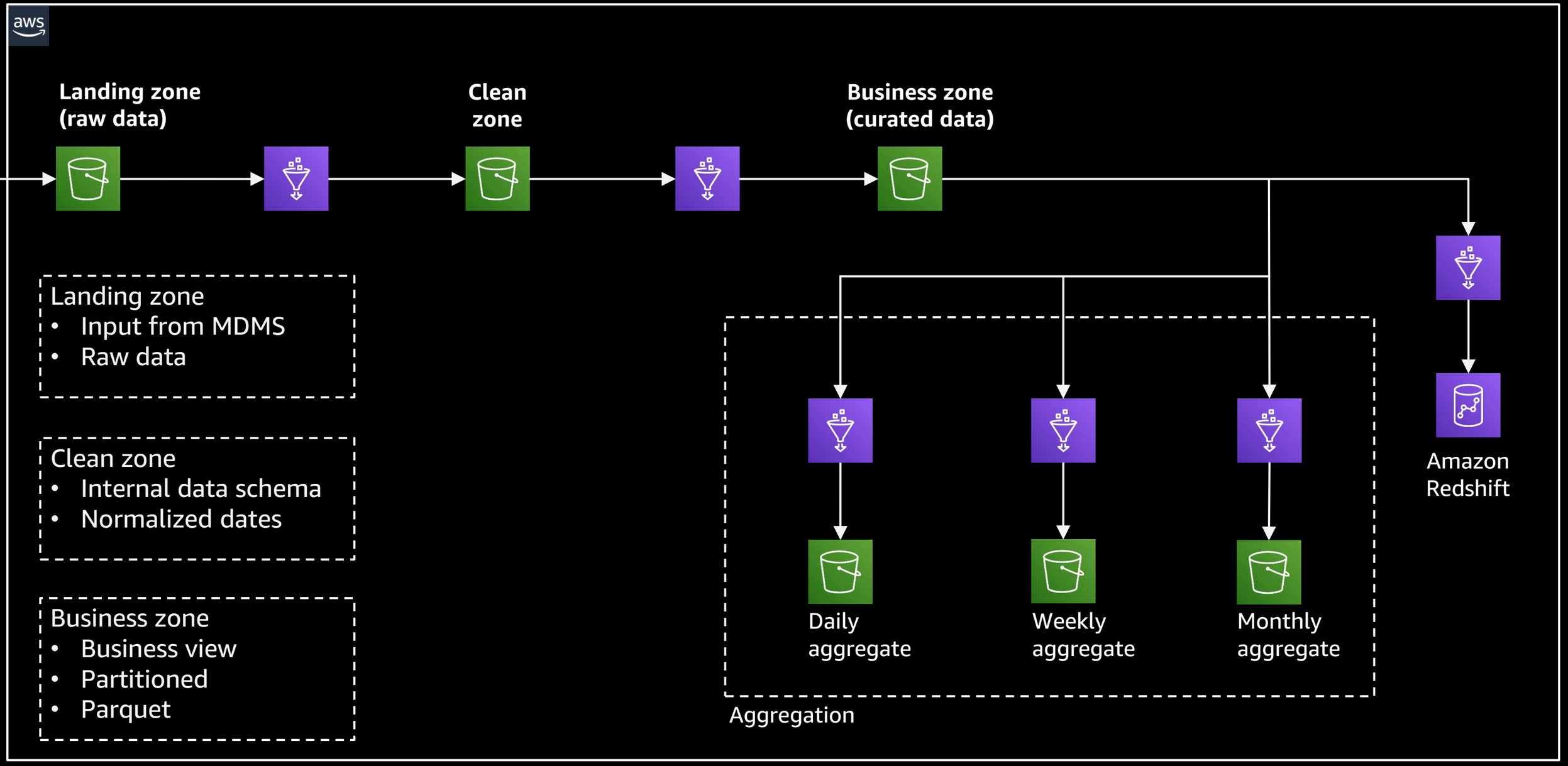

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Amazon Athena
Data warehouse
Amazon Redshift
ML pipeline
Continuously train ML model


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ML pipeline
Continuously train ML model
Consume
Amazon API Gateway
Predictions
Amazon Sagemaker
Jupyter notebook

The meter data lake



The meter data lake



A story about ‘late data’

Day 1

 2020/01/01; 0.58

 2020/01/01; 0.45

 2020/01/01; 0.70

Day 2

 2020/01/02; 0.21

 2020/01/02; 0.50

Day 3

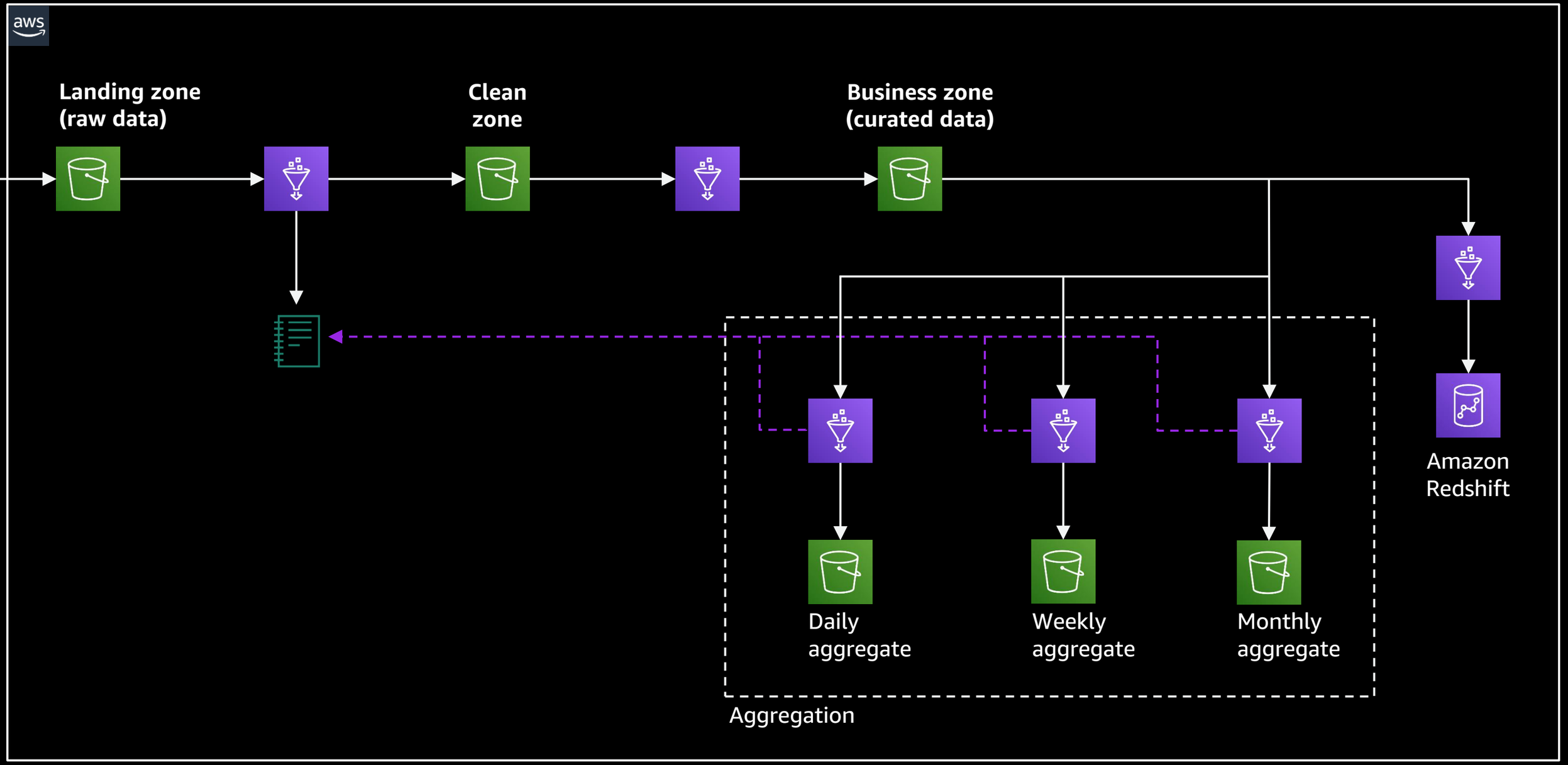
 2020/01/03; 0.46

 2020/01/03; 0.31

 2020/01/03; 0.73

 **2020/01/02; 0.67**

A story about ‘late data’



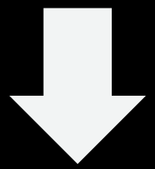
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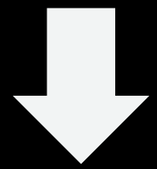


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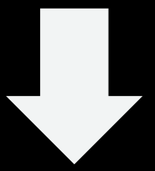
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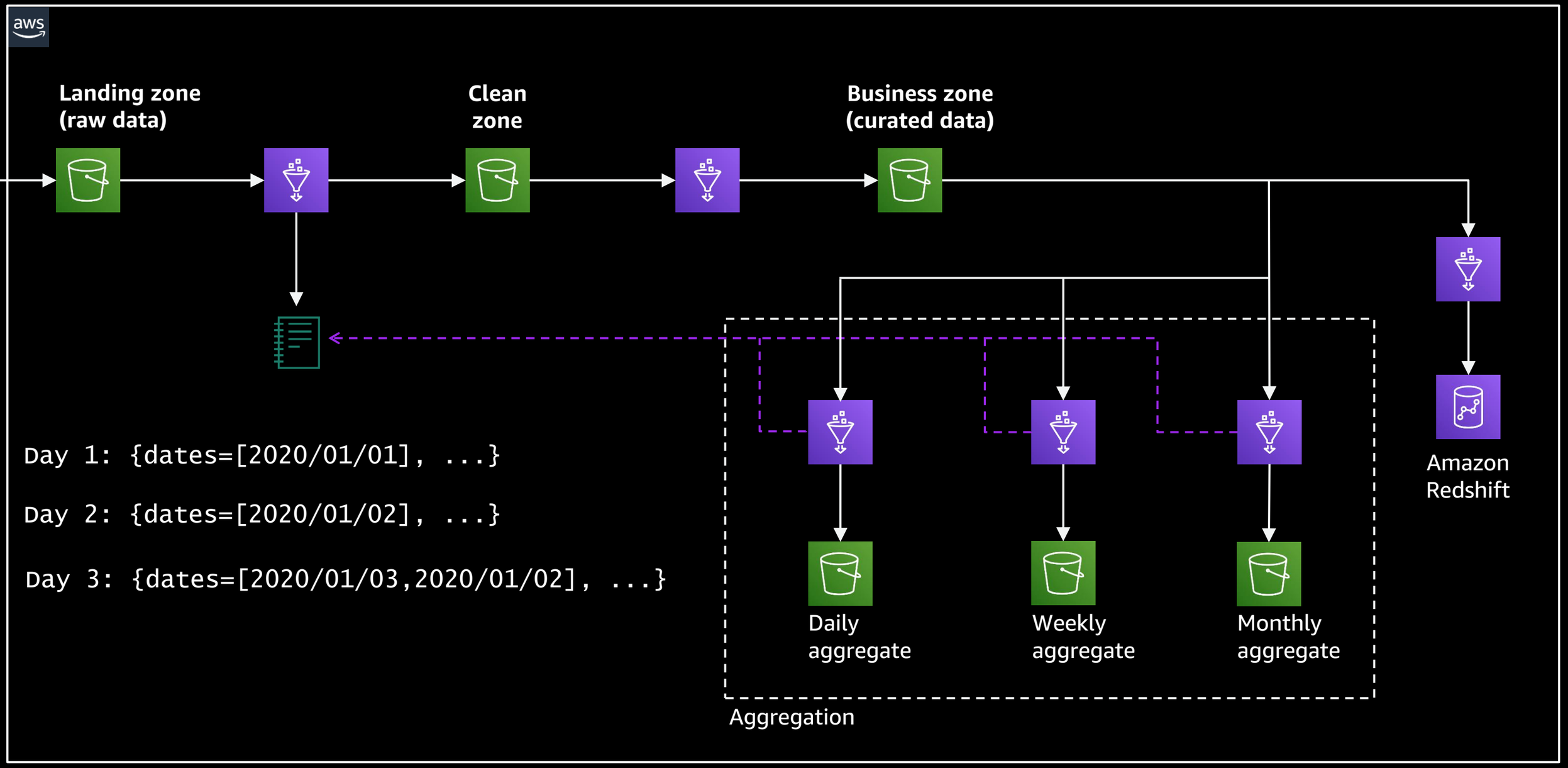

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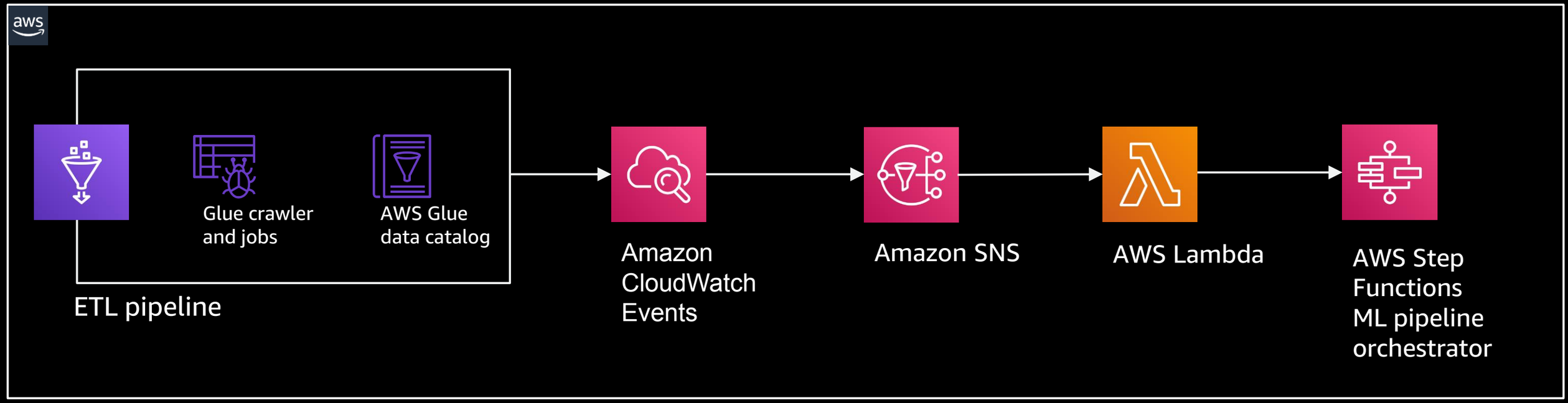


[2020/01/03,
2020/01/02]

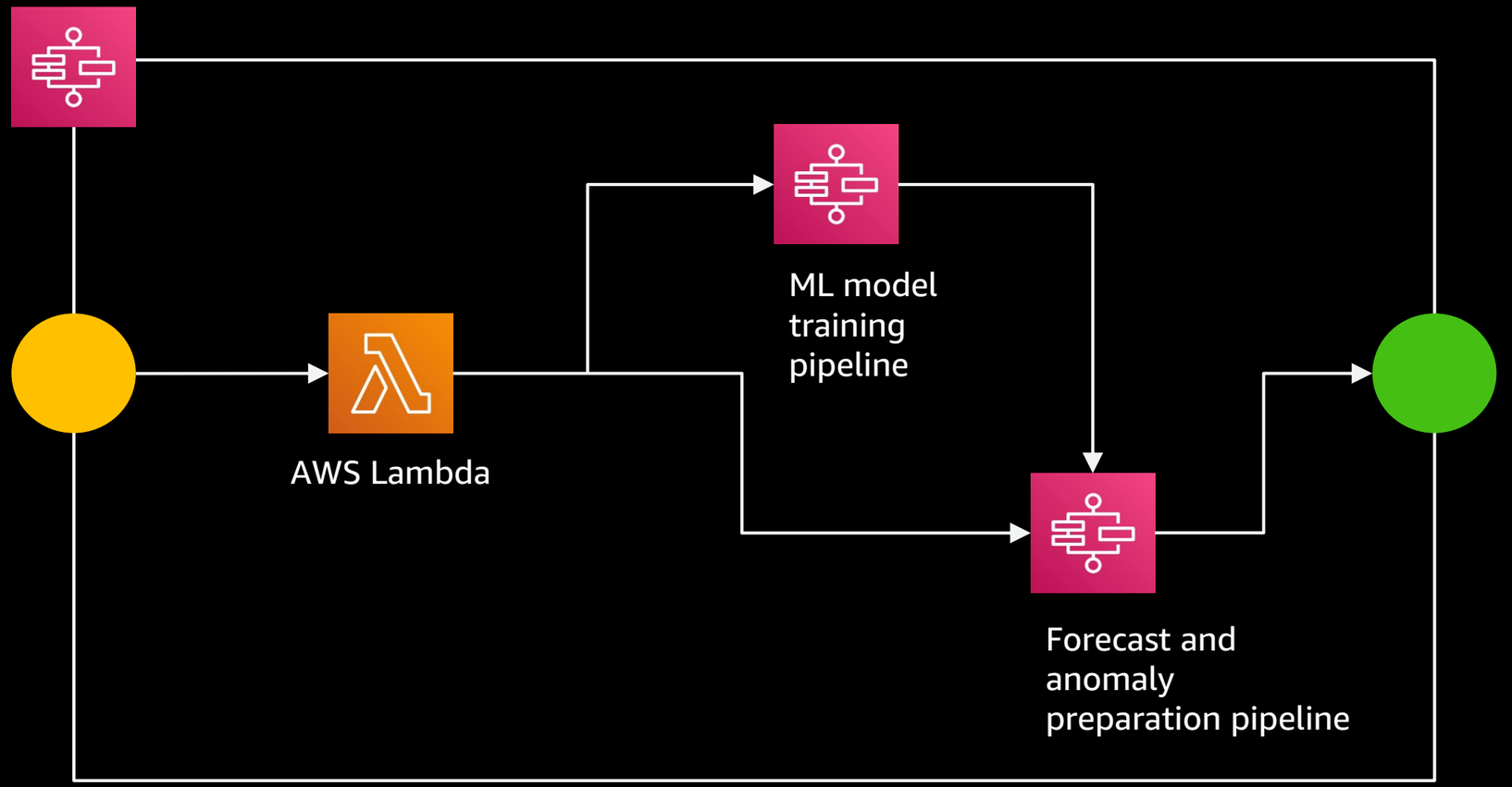
A story about ‘late data’



Machine Learning pipeline



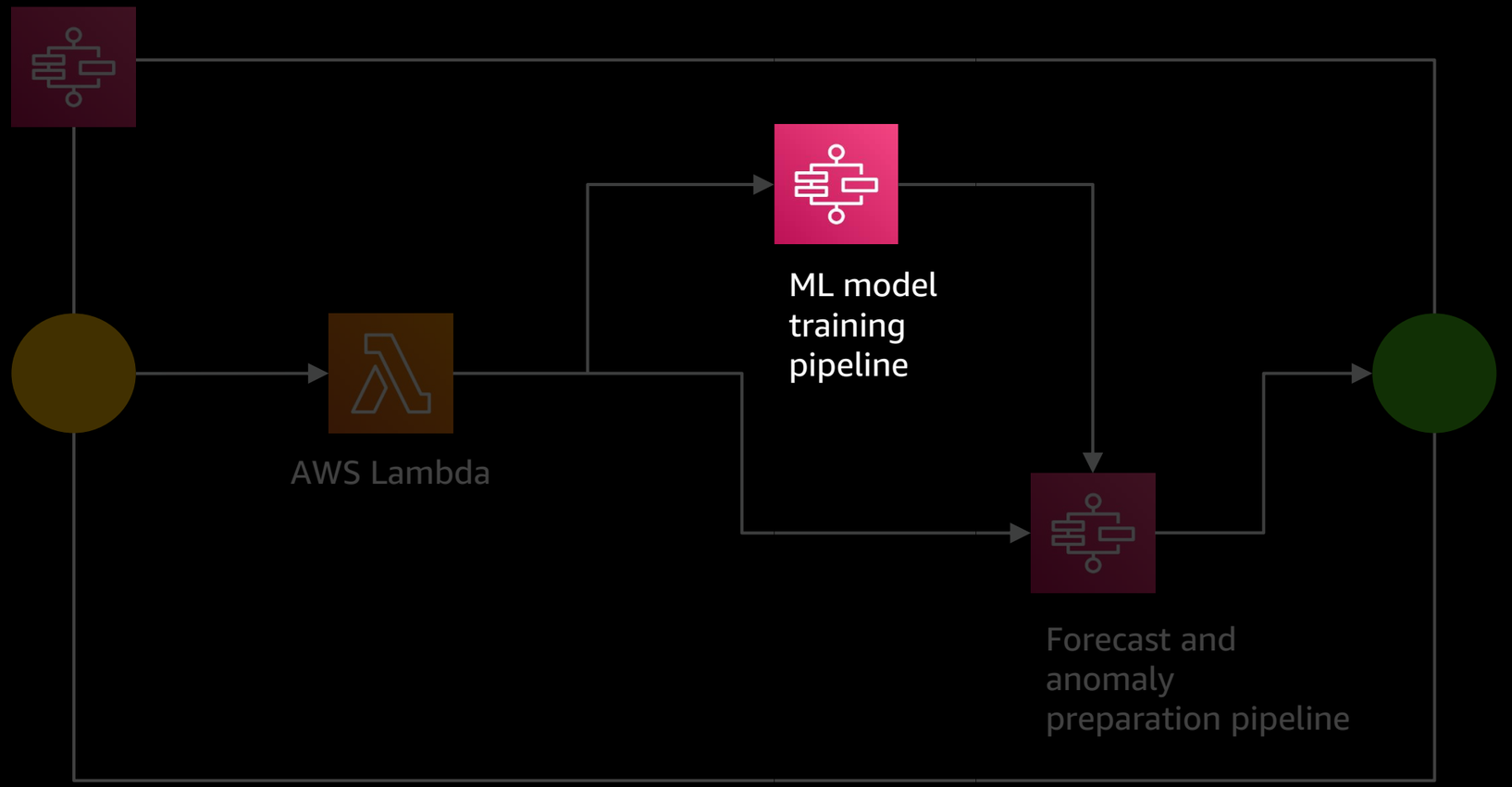
Machine Learning pipeline orchestrator



Machine Learning pipeline composed of independent state machines to

- Trigger model training on business needs
- Trigger forecast and anomaly pre-calculation as needed

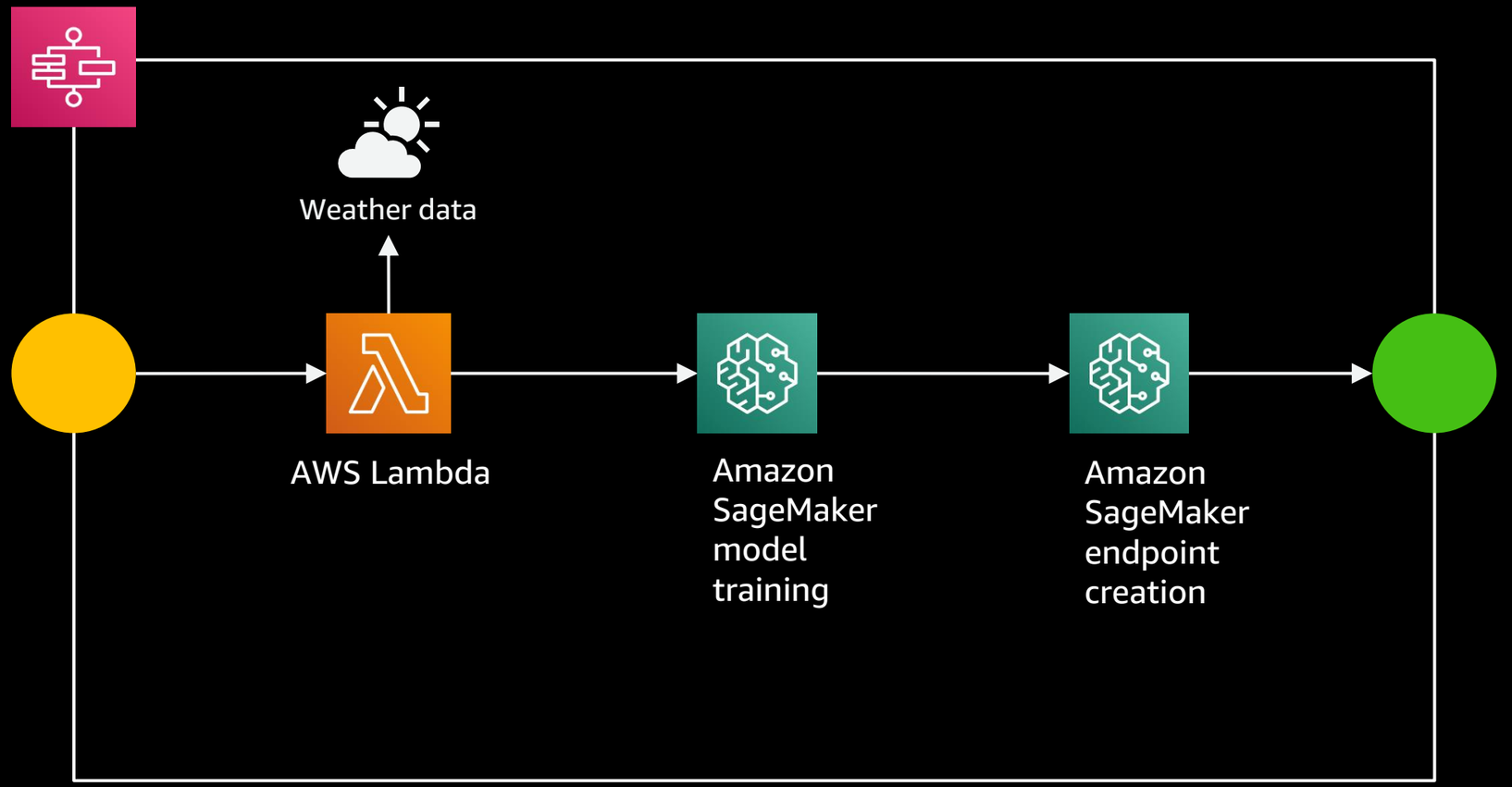
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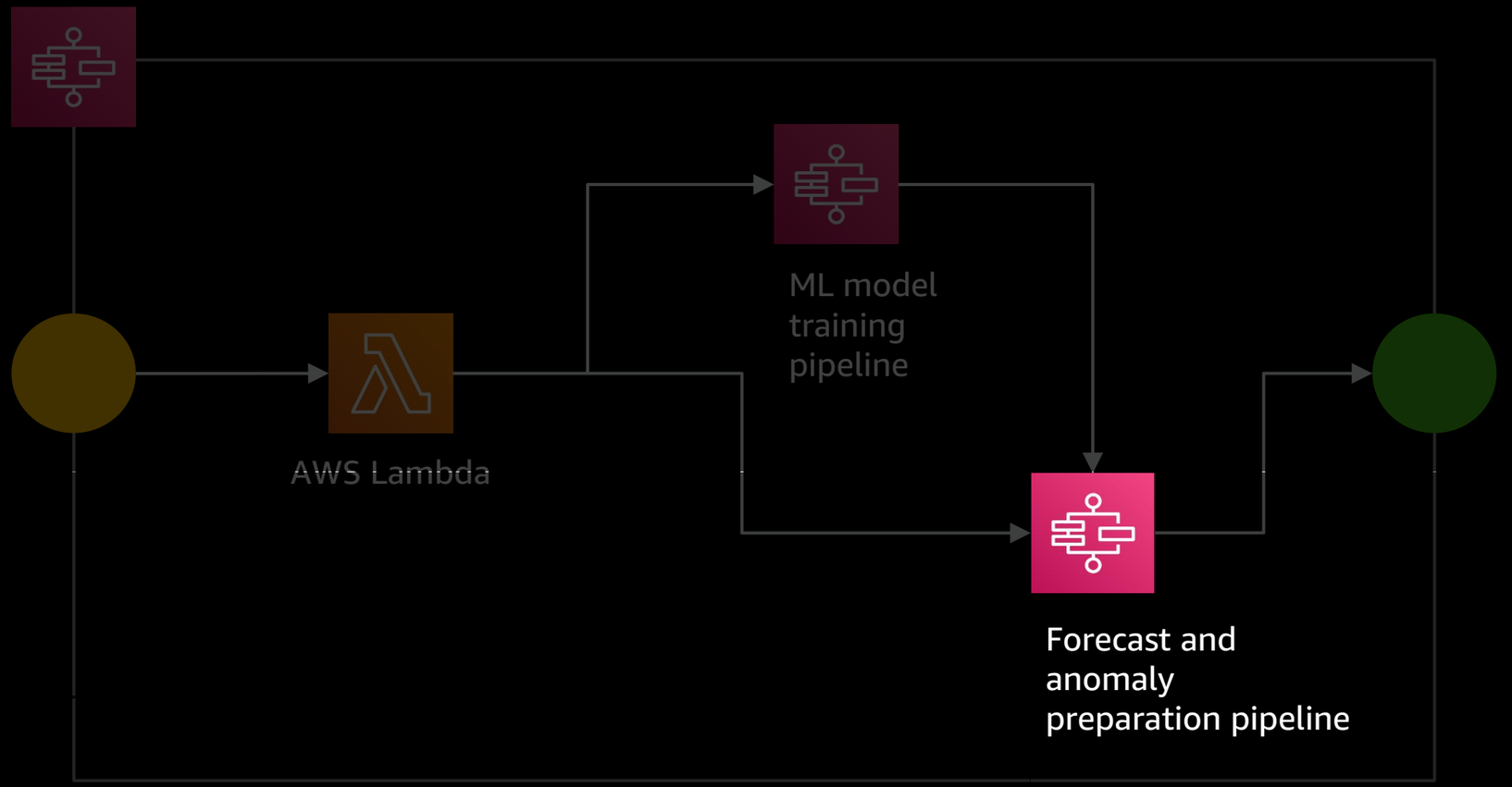
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Model training



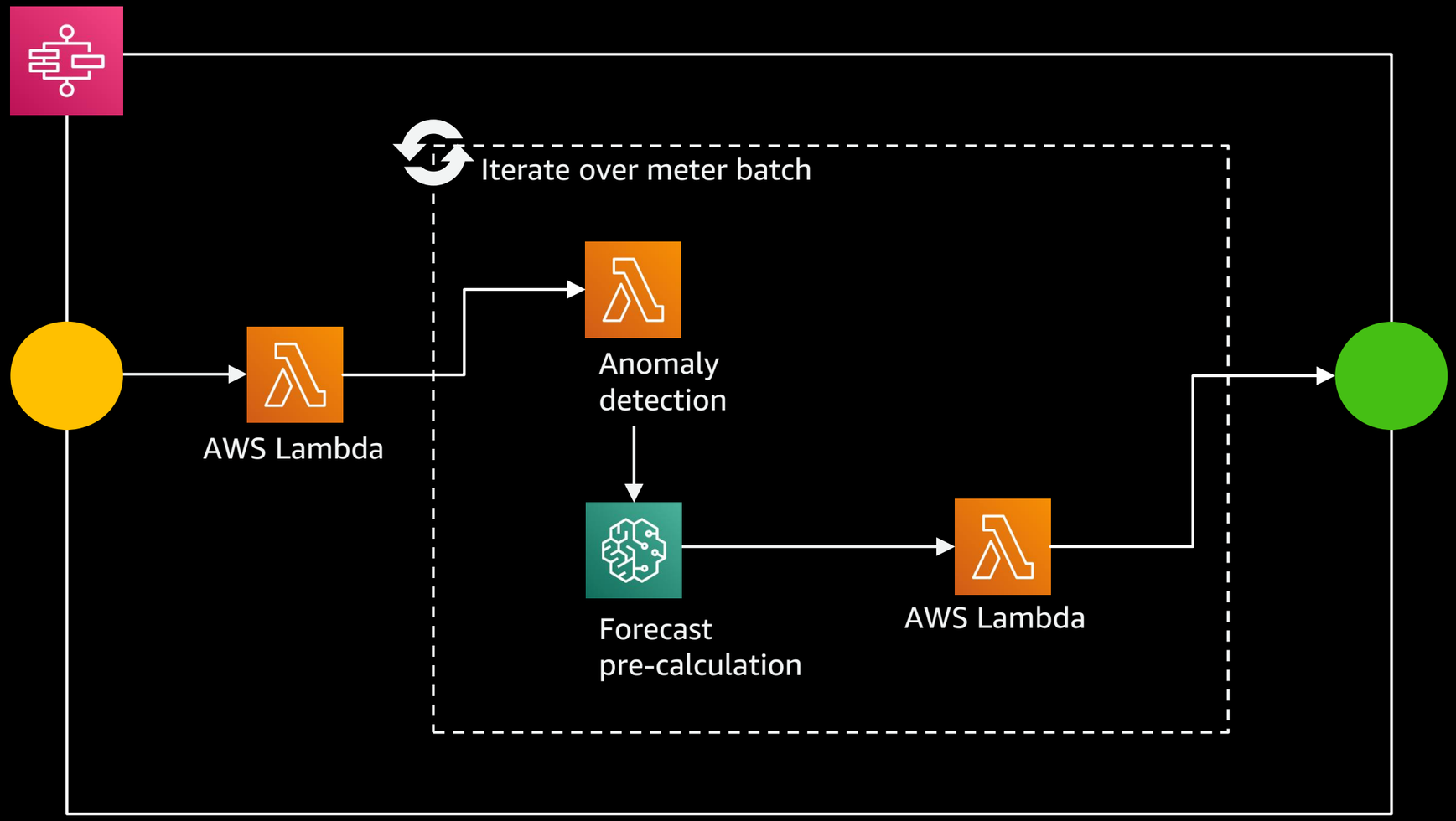
- Uses weather data in conjunction with meter reads
- DeepAR forecasting algorithm
- Creates one model jointly over all Smart Meters
- Endpoint for online inferences

Forecast and anomaly pre-calculation



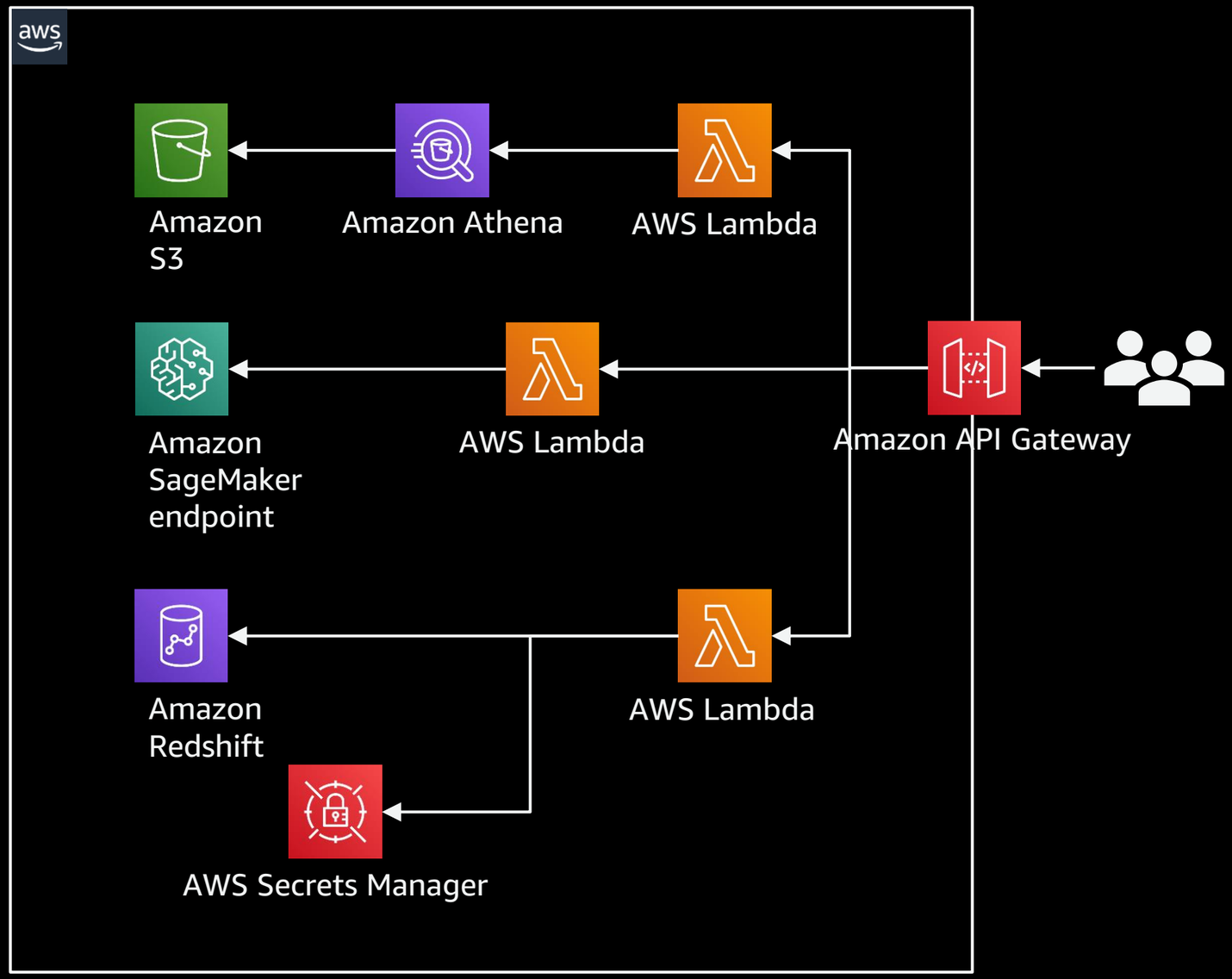
- Pre-calculation of consumption forecast and anomalies
- Efficiently query forecasts and anomalies from Amazon S3

Forecast and anomaly pre-calculation



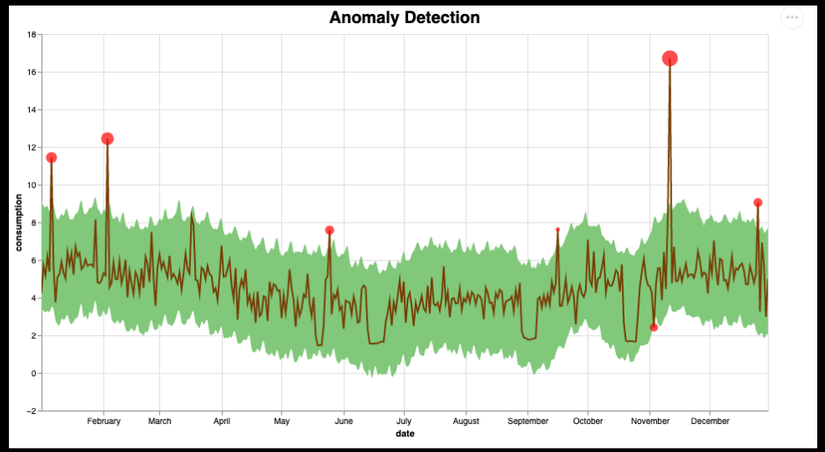
- Calculate forecasts and anomalies in parallel
- Anomaly detection – Third party library
- Forecast calculation – SageMaker transform job
- Results stored on Amazon S3

Using the MDA





- Explore meter reads
- Fulfill data science tasks
- Plot diagrams



Get started . . .

1

Checkout MDA Quick Start and documentation

2

Deploy the MDA platform to your account

3

Start building your solution on top of the MDA



AWS meter data analysis benefits



Customers get a more personalized experience with timely, tailored information

- Detailed energy usage and cost savings information vs. “just a bill”
- Energy efficiency information that is actionable
- Reduction in electricity outages



Utilities get timely operational information to drive reduced cost

- Predictive analytics on equipment failure
- Reduction in unplanned outages
- Reduction in truck rolls for false alarms and unexpected failures
- Energy theft reduction



Energy retailers sell more, gain new customers and reduce churn

- Opportunity to provide / upsell energy efficiency services and products
- Reduction in customer churn
- Improved CSAT scores

Resources

Published MDA Reference Architecture

MDA Reference Architecture
(https://d1.awsstatic.com/architecture-diagrams/ArchitectureDiagrams/meter-data-analytics-platform-ra.pdf?did=wp_card&trk=wp_card)

Documentation to quickly get started with the MDA

MDA Quick Start documentation
(https://aws-quickstart.github.io/quickstart-aws-utility-meter-data-analytics-platform/)

Quick Start GitHub repository

MDA Quick Start
(https://github.com/aws-quickstart/quickstart-aws-utility-meter-data-analytics-platform)

AWS Power & Utilities industry page

AWS Power & Utilities
(https://aws.amazon.com/power-and-utilities/)

Thank you!

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