INNOVATE

AI/ML EDITION

24 February 2022

Build an organization’s financial forecast

Darshit Vora
Startup Solutions Architect
AISPL

Agenda

- Why forecasting, current landscape and customer expectations
- Overview of time series forecasting, business benefits & use cases
- What’s the solution?
- Amazon Forecast overview
- Architecture walkthrough
- Demo
- Resources

Forecasting – integral part of your daily life

Instant & Cheap access

Data complexity

Accuracy

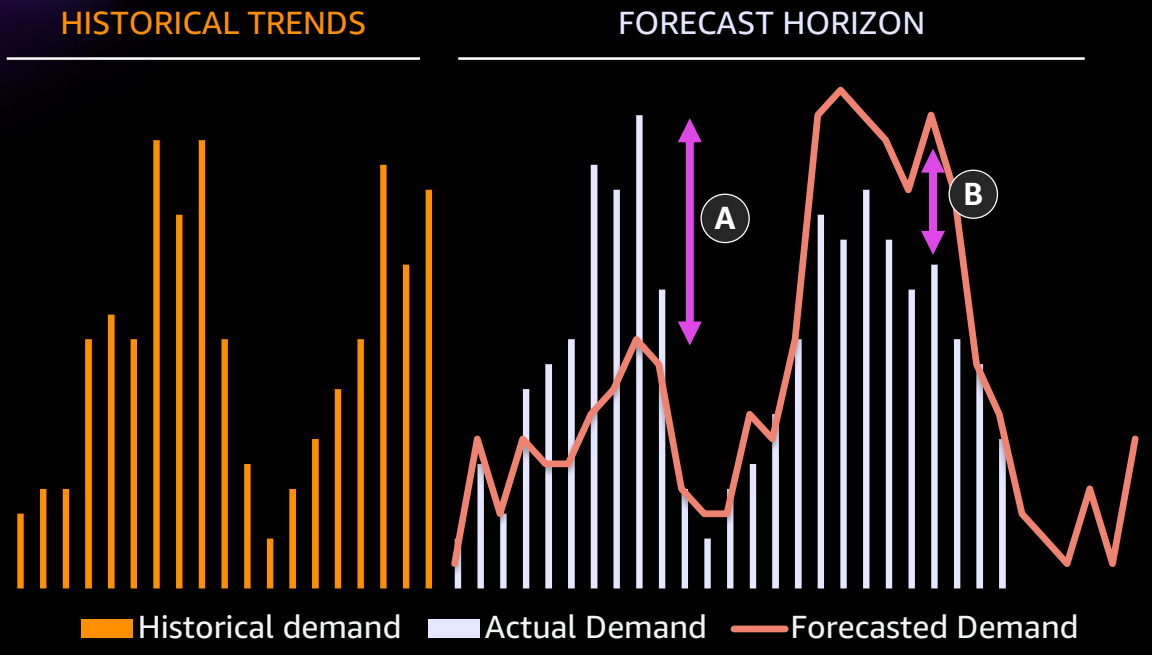
Agile

Variety

Increasing demand signals

Time series forecasting overview

THE SCIENCE OF PREDICTION BASED ON HISTORICAL TRENDS



Forecasting seeks to minimize:

A Under-forecast errors that results in missed opportunity

B Over-forecast errors that result in wasted resources

Market leaders are investing in ML-driven forecasting to more effectively meet demand

Improving business outcomes

THE POWER OF FORECASTING

INVENTORY PLANNING

Improve demand planning at granular levels

Reduce waste, increase inventory turns, and improve in-stock availability

WORKFORCE PLANNING

More effectively staff to meet varying demand levels

Improve utilization, time to serve, and customer satisfaction

CAPACITY PLANNING

Make longer term decisions with more confidence

Improve capital utilization

FINANCIAL PLANNING

Plan for sales and top-line revenue

Effectively manage cash flows

Over-forecasting

- Excess inventory
- Unutilized labor
- Overtime costs
- Lost sale

Under-forecasting

- Unmet demand
- Undercutting
- Depleted cash reserves
- Uncapitalized infrastructure

Time series forecasting process

THREE STANDARD STEPS INVOLVED IN FORECASTING

- Looking backward
  - begin with baseline historical data (small to large dataset) - contains a timestamp, an item, a value
- Identifying trends
  - Using statistical, deep learning, or other approaches, look at historical data to determine trends that hopefully continue into the future
- Projecting forward
  - Given the trends identified, take each item and predict in increments the expected future values

aws

The AWS ML Stack

BROADEST AND MOST COMPLETE SET OF MACHINE LEARNING CAPABILITIES

AI SERVICES

SPECIALIZED

Business processes
- Amazon Personalize
- Amazon Forecast
- Amazon Fraud Detector
- Amazon Lookout for Metrics

Search
- Amazon Kendra

Code + DevOps
- Amazon CodeGuru
- Amazon DevOps Guru

Industrial
- Amazon Monitron
- Amazon Lookout for Equipment
- Amazon Lookout for Vision

Healthcare
- Amazon HealthLake
- Amazon Comprehend Medical
- Amazon Transcribe Medical

CORE

Text & Documents
- Amazon Translate
- Amazon Comprehend
- Amazon Textract

Chatbots
- Amazon Lex

Speech
- Amazon Polly
- Amazon Transcribe
- Amazon Transcribe Call Analytics

Vision
- Amazon Rekognition
- AWS Panorama

ML SERVICES

Label data

SAGEMAKER CANVAS
No-code ML for business analysts

SAGEMAKER STUDIO LAB
Learn ML

AMAZON SAGEMAKER STUDIO IDE

Prepare data | Store features | Detect bias | Build with notebooks | Train models | Tune parameters | Deploy in production | Explain predictions | Manage & monitor

CI/CD

Manage edge devices

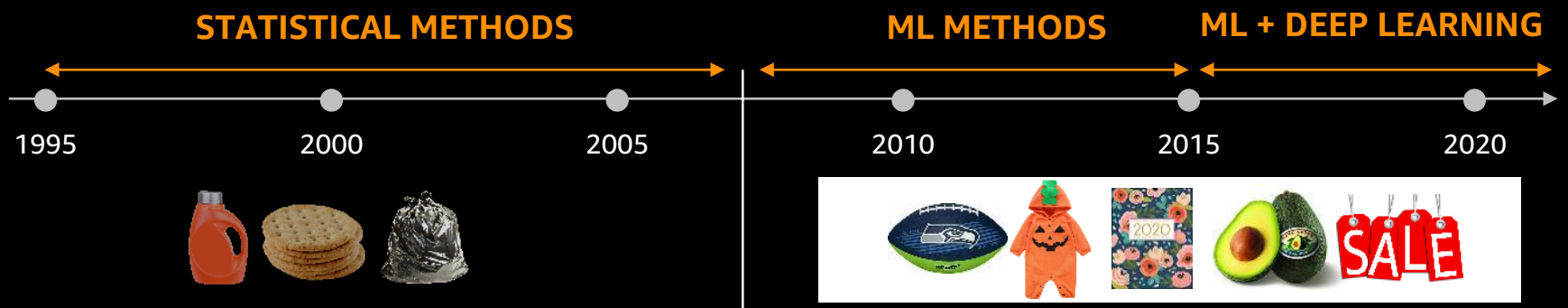
ML FRAMEWORKS & INFRASTRUCTURE

PyTorch, Apache MXNet, TensorFlow | Amazon EC2 | CPUs | GPUs | AWS Inferentia | AWS Trainium | Habana Gaudi | FPGA | Elastic inference

Amazon Forecast - Overview

Based on the technology that powers Amazon.com

THE EVOLUTION OF FORECASTING OVER 20+ YEARS



Best for few or independent data (e.g., aggregate demand)

- Aggregate demand
- Everyday household products
- Basic trends
- Repeated seasonal patterns

Best for complex and inter-related data (e.g., thousands of SKUs at hundreds of stores)

- Regional vs national demand
- Subtle seasonal patterns
- Relationships between products
- New products
- Slow moving products
- Changing prices or promotions
- External events

Amazon Forecast

AUTOMATED MACHINE LEARNING SERVICE FOR ACCURATE FORECASTING

Fully managed service

Automatically sets up data pipeline, training, and prediction

Highly accurate

50% improvement in accuracy over traditional methods

Easy to use

No deep learning experience required

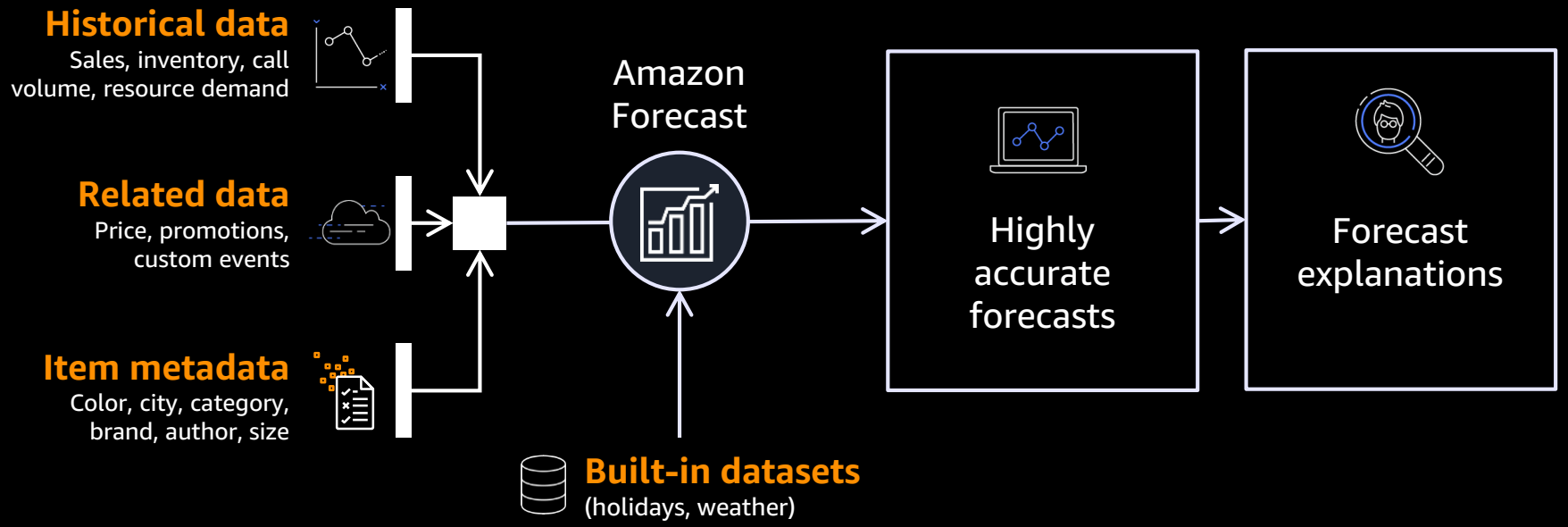
Your data, your models

Encrypted with customer keys through AWS KMS

aws

Amazon Forecast

HOW IT WORKS?



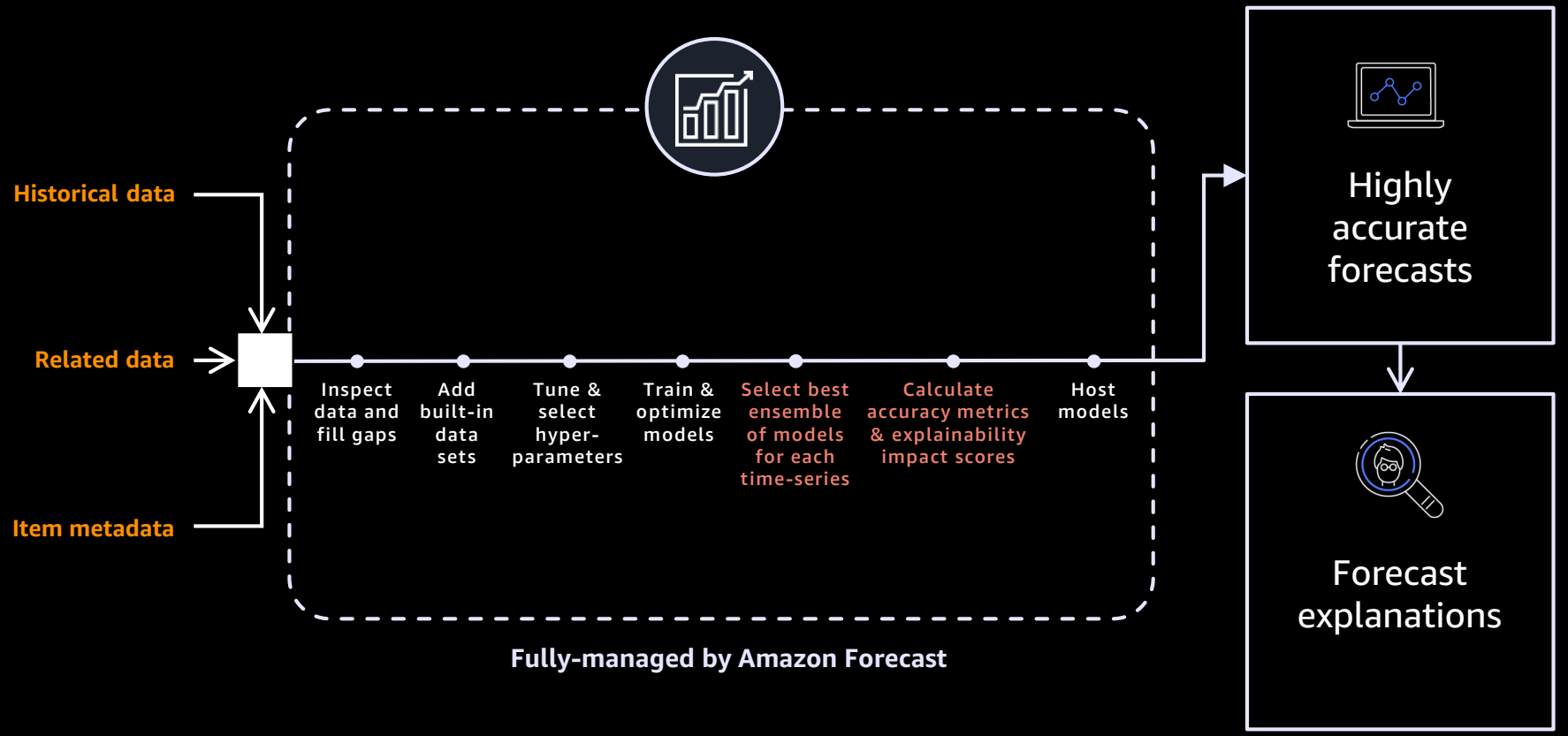
Get started with the console or API
Point Amazon Forecast to your data stored in Amazon Simple Storage Service (Amazon S3)

Automatically train your custom ML model
Let Amazon Forecast auto select the best one for your data through AutoML

Generate accurate forecasts
Retrieve forecasts through the console or private API

Amazon Forecast

BEHIND THE SCENES



Amazon Forecast customers

ML FORECASTING USECASE ACROSS INDUSTRIES

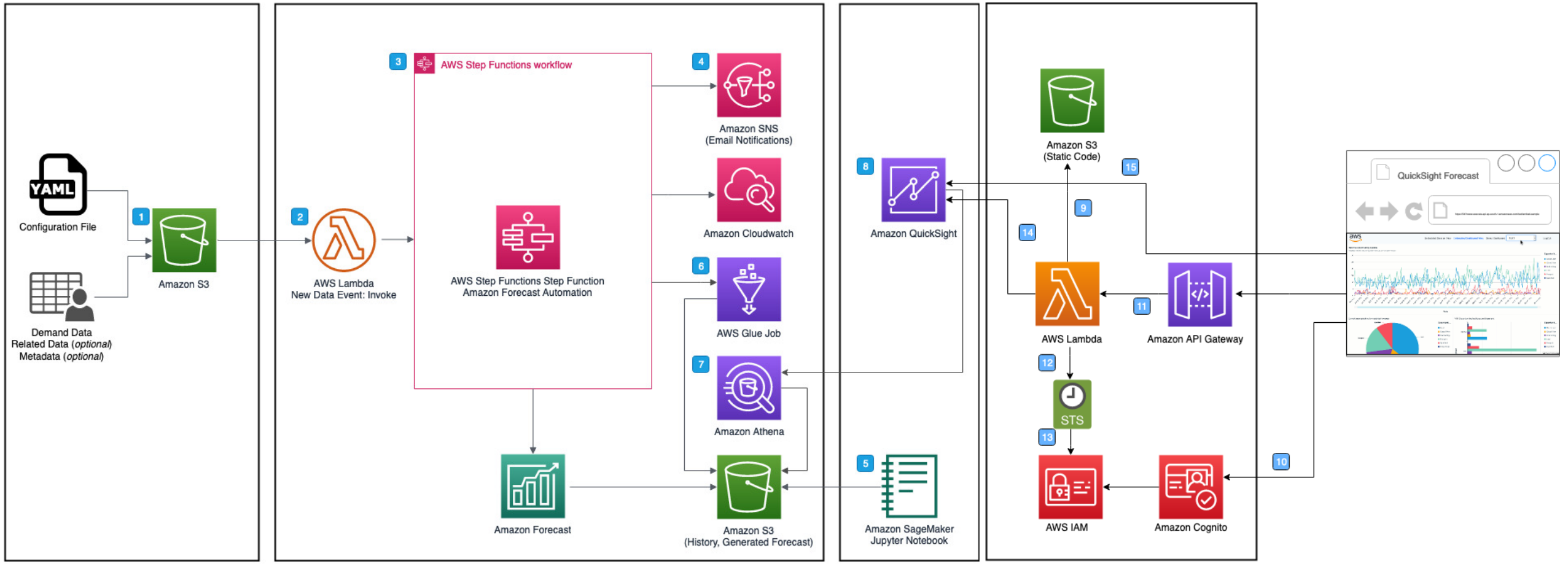
https://aws.amazon.com/forecast/customers/

Organization’s financial forecast web application

- Amazon Forecast, Amazon QuickSight and Serverless services on AWS

Architecture

BUILDING FULLSTACK FORECASTING WEB APPLICATION



Fullstack forecasting web app

BEHIND THE SCENES ANATOMY

```yaml
Default:
  DatasetGroup:
    Domain: RETAIL

  Datasets:
    - Domain: RETAIL
      DatasetType: TARGET_TIME_SERIES
      DataFrequency: D
      TimestampFormat: yyyy-MM-dd
      Schema:
        Attributes:
          - AttributeName: item_id
            AttributeType: string
          - AttributeName: timestamp
            AttributeType: timestamp
          - AttributeName: demand
            AttributeType: float

  AutoPredictor:
    MaxAge: 604800
    ForecastHorizon: 72
    ForecastFrequency: D

  Forecast:
    ForecastTypes:
      - "0.10"
      - "0.50"
      - "0.90"
```

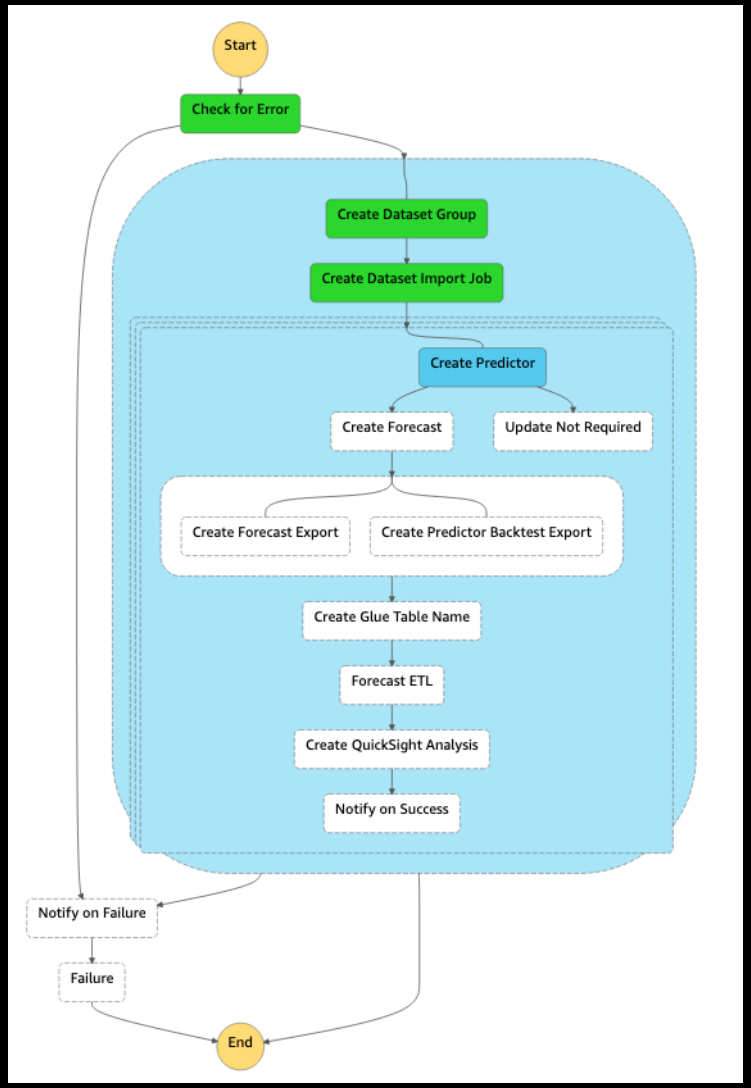
Amazon Forecast configuration

+

Vertical	Date	Sales
Consumer	31/07/19	2309.65
Corporate	05/02/20	3709.395
Consumer	17/10/20	5175.171
Subscription	28/01/20	2892.51
Consumer	05/11/20	2832.96
Corporate	28/06/20	2862.675
Consumer	07/11/18	1822.08

Demand input csv

triggers



Amazon Step Functions state machine

Important AWS Lambda functions

```
config = Config.from_sfn(event)
dataset_file = DatasetFile(event.get("dataset_file"), event.get("bucket"))
dataset_group_name = event.get("dataset_group_name")

predictor = config.predictor(dataset_file, dataset_group_name)

if predictor.status == Status.DOES_NOT_EXIST:
    # TODO: publish predictor stats to CloudWatch prior to create
    logger.info("Creating predictor for %s" % dataset_file.prefix)
    predictor.create()

return predictor.status, predictor.arn
```

Create/Monitor Amazon Forecast predictor creation

```
dataset_file = DatasetFile(event.get("dataset_file"), event.get("bucket"))
dataset_group_name = event.get("dataset_group_name")
predictor_arn = event.get("PredictorArn")

forecast = config.forecast(dataset_file, dataset_group_name, predictor_arn)

if forecast.status == Status.DOES_NOT_EXIST:
    # TODO: publish predictor stats to CloudWatch prior to create
    logger.info("Creating forecast for %s" % dataset_group_name)
    forecast.create()

return forecast.status, forecast.arn
```

Create/monitor Amazon Forecast forecast creation

```
dataset_file = DatasetFile(event.get("dataset_file"), event.get("bucket"))
dataset_group_name = event.get("dataset_group_name")
predictor_arn = event.get("PredictorArn")

forecast = config.forecast(dataset_file, dataset_group_name, predictor_arn)

if forecast.status == Status.ACTIVE:
    logger.info("Creating forecast export for %s" % dataset_file.prefix)
    export = forecast.export(dataset_file)
else:
    raise ValueError("forecast status must be ACTIVE to export a forecast")

return export.status, forecast.arn
```

Export forecast to Amazon S3 bucket

Amazon QuickSight dashboard embed in web app

```
<script src="https://unpkg.com/amazon-quicksight-embedding-sdk@1.18.0/dist/quicksight-embedding-js-sdk.min.js"></script>
```

Amazon QuickSight Embedding SDK

Authenticate with Cognito and get token

```
function getOpenIdToken(){
    writeDebugInfo('In getOpenIdToken func');
    //Check for token in url as well as in Cookie
    var idToken = getParameterValues('id_token','#','&') ?? getCookieField('openIdToken');
    writeDebugInfo(idToken)
    if (idToken ) {
      writeDebugInfo('Token found');
      //Remove the url fragment with token details. This will be stored into a local cookie.
      window.location.hash='';
      getQuickSightInfo(idToken);
    }
    else {
      writeDebugInfo('Token not found, Redirecting to Cognito');
      window.location.href = awsData.cognitoDomainUrl+'/login?client_id='+awsData.cognitoClientId+'&response_type=token&scope=openid+profile&redirect_uri='+awsData.staticPageUrl;
    }
}
```

```
var containerDiv = document.getElementById(embedDiv);

if (entity == 'Dashboard'){
  var params = {
    url: embedUrl,
    container: containerDiv,
    width:"100%",
    height:"100%",
    undoRedoDisabled: true,
    resetDisabled: true
  };
  awsData.dashboard = QuickSightEmbedding.embedDashboard(params);
}
```

Embed Amazon QuickSight Dashboard in front end

Console Demo Walkthrough

Resources

1. Documentation, videos and blogs - https://aws.amazon.com/forecast/resources/
2. Solution implementation - https://aws.amazon.com/solutions/implementations/improving-forecast-accuracy-with-machine-learning/
3. Amazon Forecast samples - https://github.com/aws-samples/amazon-forecast-samples
4. Amazon Forecast Whitepaper - https://d1.awsstatic.com/whitepapers/time-series-forecasting-principles-amazon-forecast.pdf
5. Amazon QuickSight Embedding SDK - https://github.com/awslabs/amazon-quicksight-embedding-sdk
6. Amazon Athena and Amazon QuickSight Workshop - https://athena-in-action.workshop.aws/30-basics.html

Visit the AI & Machine Learning resource hub for more resources

Dive deeper into these resources, get inspired and learn how you can use AI and machine learning to accelerate your business outcomes.

- The machine learning journey e-book
- 7 leading machine learning use cases e-book
- A strategic playbook for data, analytics, and machine learning e-book
  Accelerate machine learning innovation with the right cloud services & infrastructure e-book
- Choosing the right compute infrastructure for machine learning e-book
- Improving service and reducing costs in contact centers e-book
- Why ML is essential in your fight against online fraud e-book
- … and more!

https://bit.ly/3mwi59V

Visit resource hub

AWS Machine Learning (ML) Training and Certification

AWS is how you build machine learning skills

Courses built on the curriculum leveraged by Amazon's own teams. Learn from the experts at AWS.

aws.training/machinelearning

Flexibility to learn your way

Learn online with on-demand digital courses or live with virtual instructor-led training, plus hands-on labs and opportunities for practical application.

explore.skillbuilder.aws/learn

Validate your expertise

Demonstrate expertise in building, training, tuning, and deploying machine learning models with an industry-recognized credential.

aws.amazon.com/certification

aws

Thank you for attending AWS Innovate – AI/ML Edition

We hope you found it interesting! A kind reminder to **complete the survey.**
Let us know what you thought of today's event and how we can improve the event experience for you in the future.


aws-apj-marketing@amazon.com


twitter.com/AWSCloud


facebook.com/AmazonWebServices


youtube.com/user/AmazonWebServices


slideshare.net/AmazonWebServices


twitch.tv/aws

Thank you!

Darshit Vora