Serverless on AWS

Immersion Day

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2021

Event-Driven Architectures

event

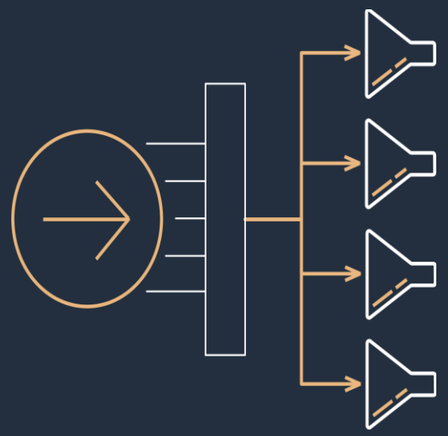
[i-’vent] **noun**

A thing that happens, particularly one of importance.

aws

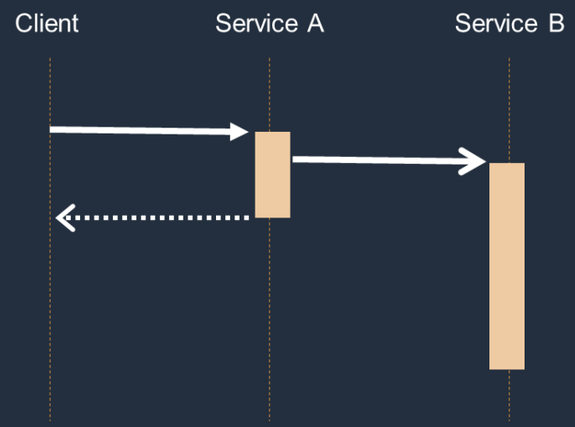
Event-driven architectures drive reliability and scalability

Event Routers



Abstract producers and consumers from each other

Asynchronous Events



Improve responsiveness and reduce dependencies

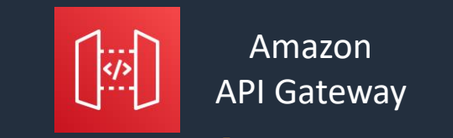
Event Stores

Buffer messages until services are available to process

Lambda can be invoked via three different methods

All methods deliver an event payload

Synchronous



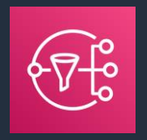
Amazon
API Gateway

/order

event

Lambda
Function

Asynchronous



Amazon
SNS

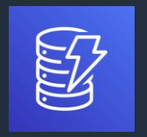
Amazon
S3

reqs

event

Lambda
Function

Poll-Based



Amazon
DynamoDB

Amazon Kinesis

AWS Lambda
Service

event

Lambda
Function

aws

Events enable interaction between services

Managed services provide routing, storage, and distribution of events

Amazon SQS

Messaging

Durable and scalable
Fully managed
Comprehensive security

Amazon SNS

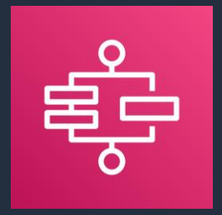
Eventing

Performance at scale
Fully managed
Enterprise-ready

EventBridge

Choreography

Event filtering
Managed & scalable
SaaS integration



Step Functions

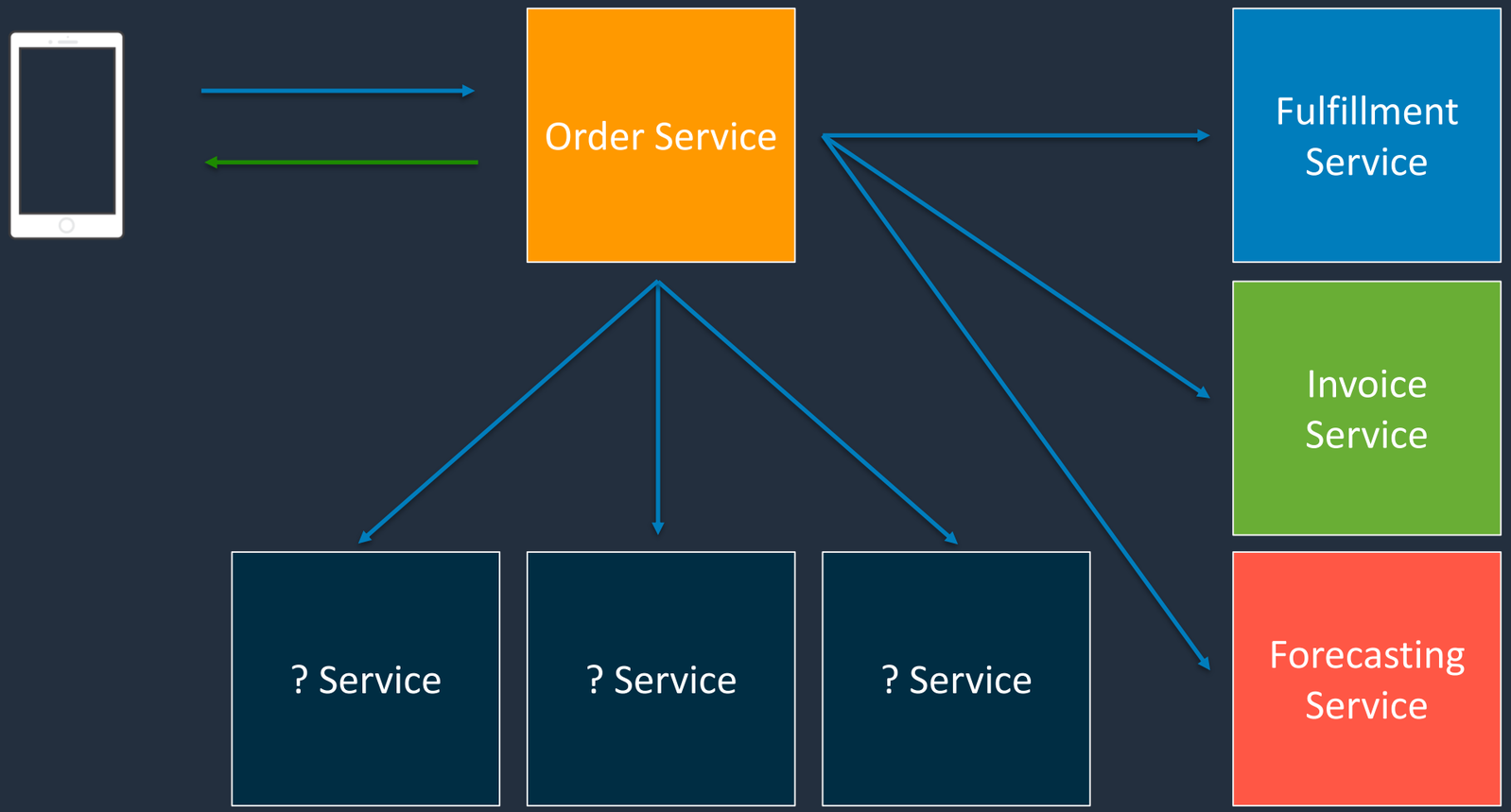
Orchestration

Sequencing
Parallel execution
State management

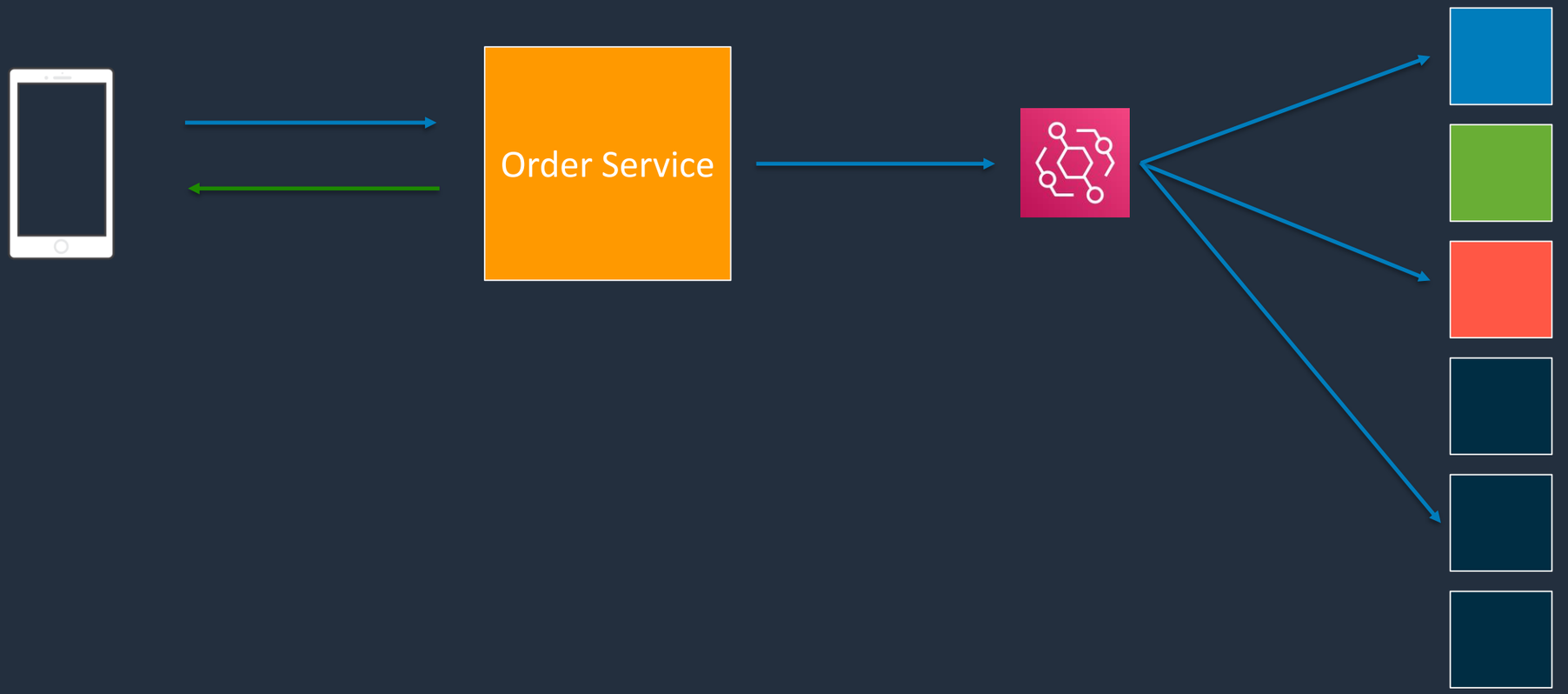
aws

Let’s launch an eCommerce site…

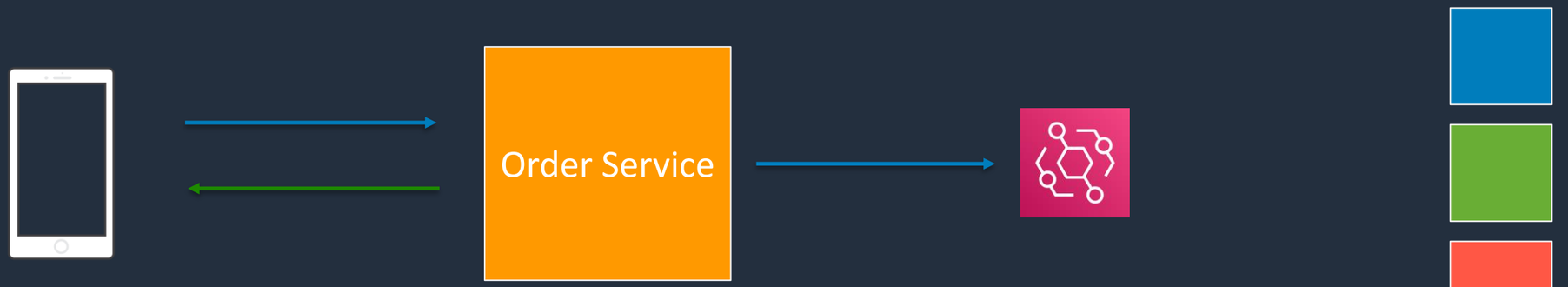
Growing our business…



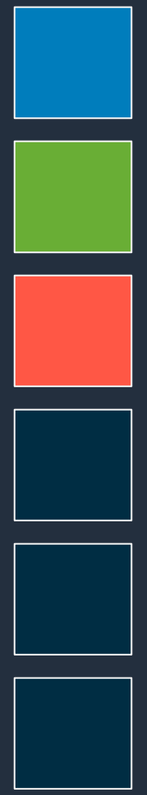
Building an event-driven architecture



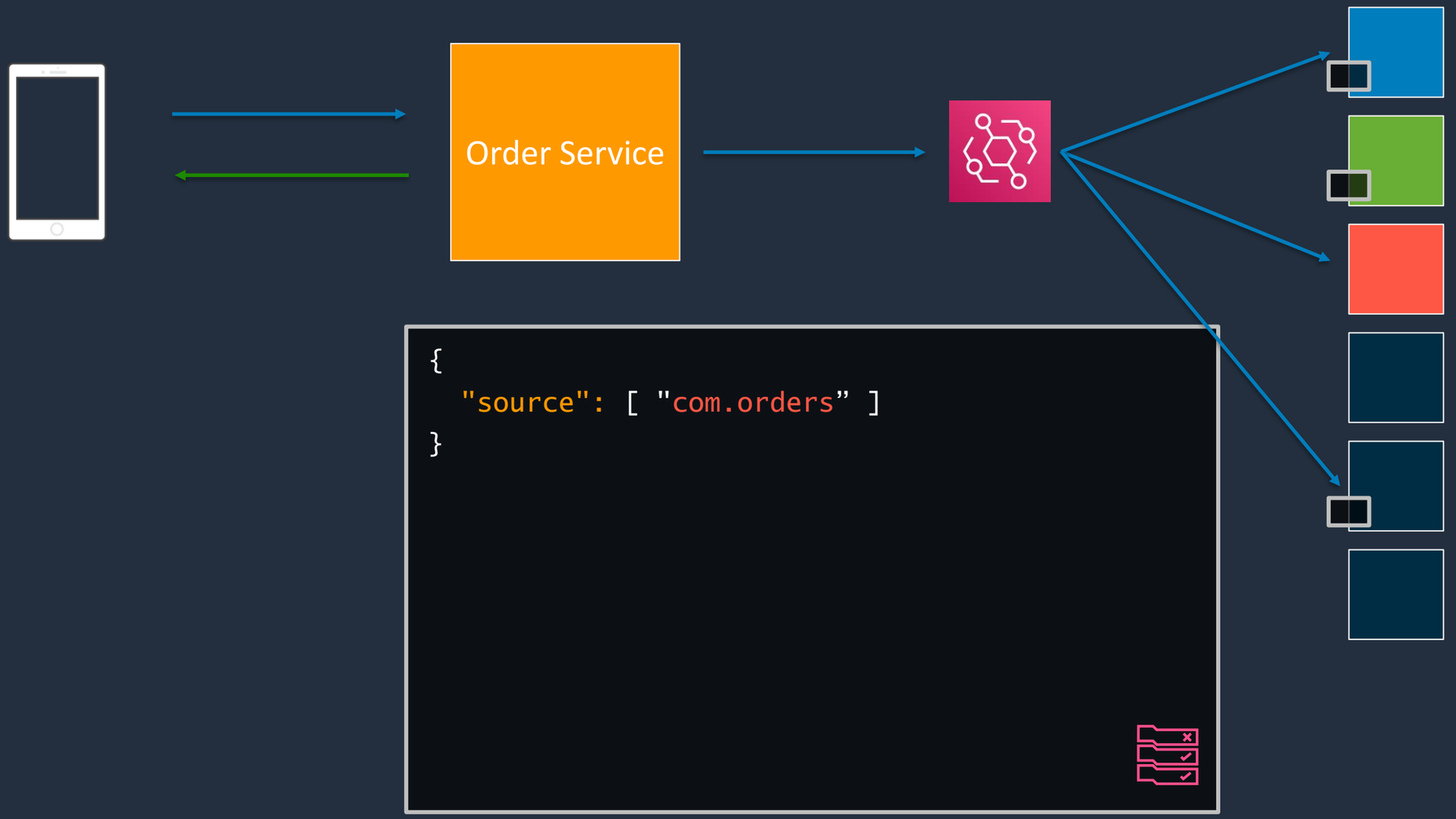
On an “Order Created” event



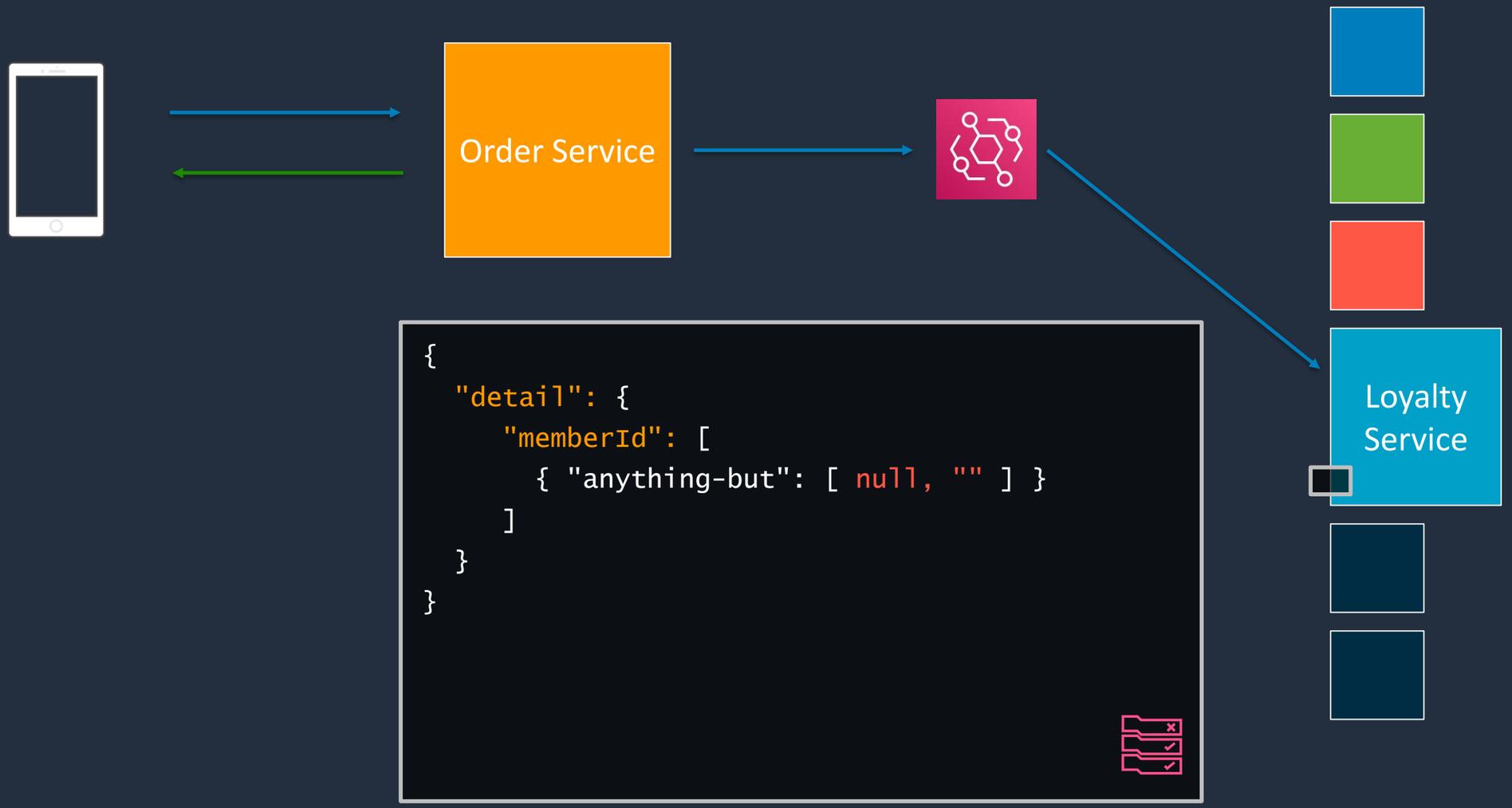

```
{
  "detail-type": "Order Created",
  "source": "com.orders",
  "detail": {
    "order_id": "1073459984",
    "created_at": "2020-08-28T14:17:09-05:00",
    "price": 24.62
    "currency": ”USD",
    ”memberId": ”USD",
    ...
  }
}
```



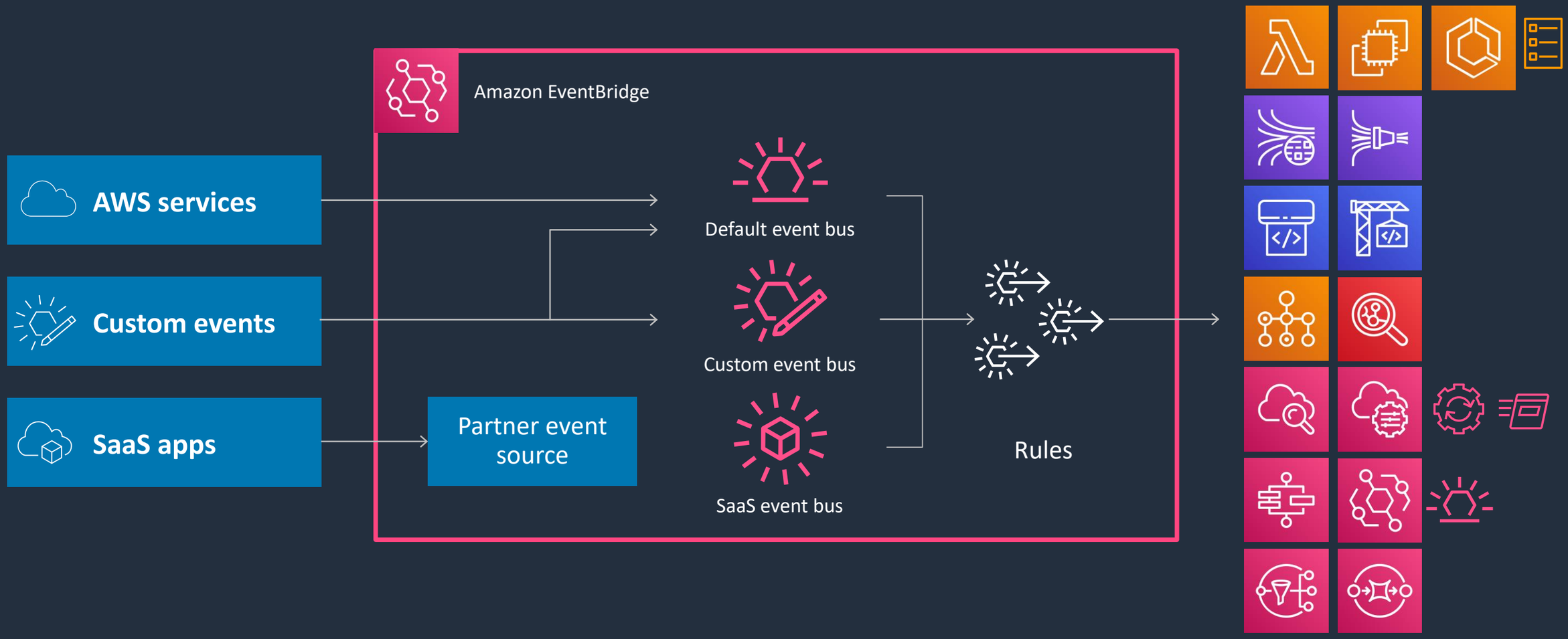
Route orders to appropriate services



Event-driven, serverless applications are flexible

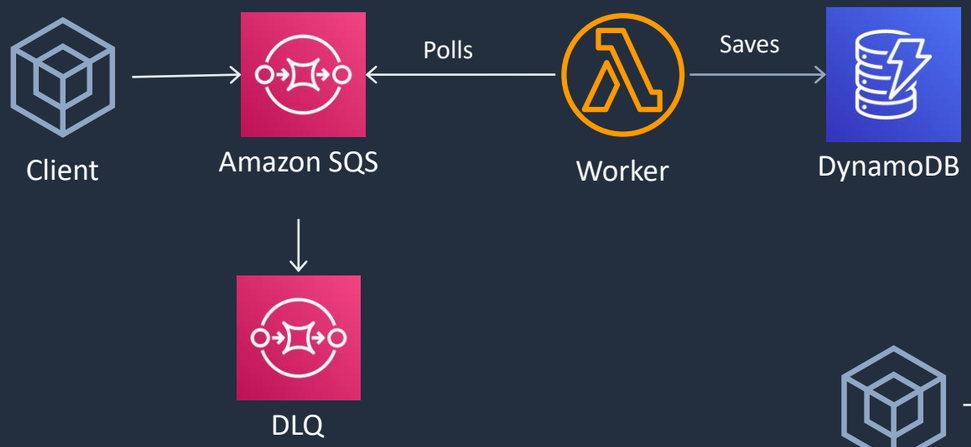


Amazon EventBridge architecture

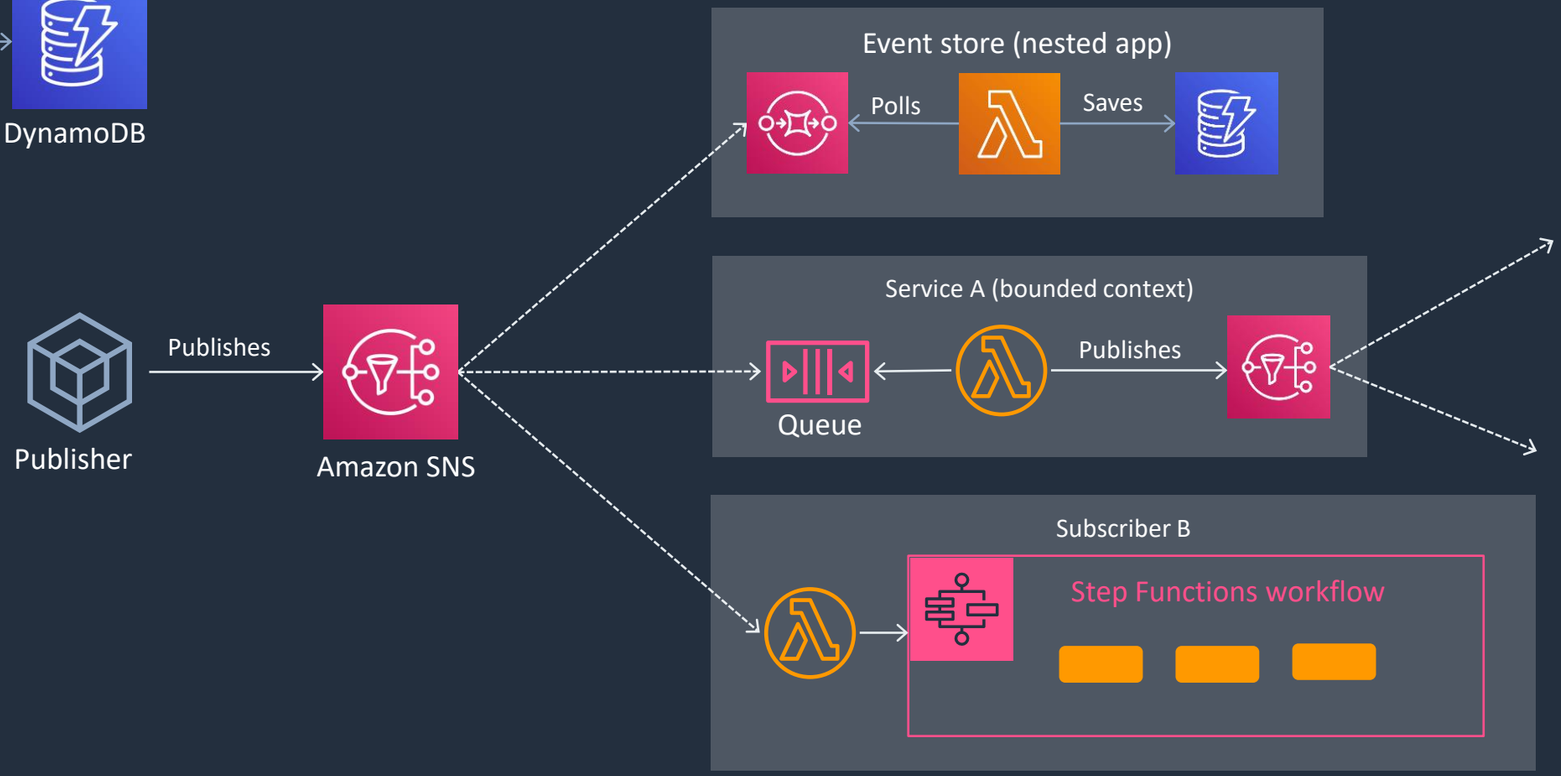


Event-driven architectural patterns

Decoupled messaging

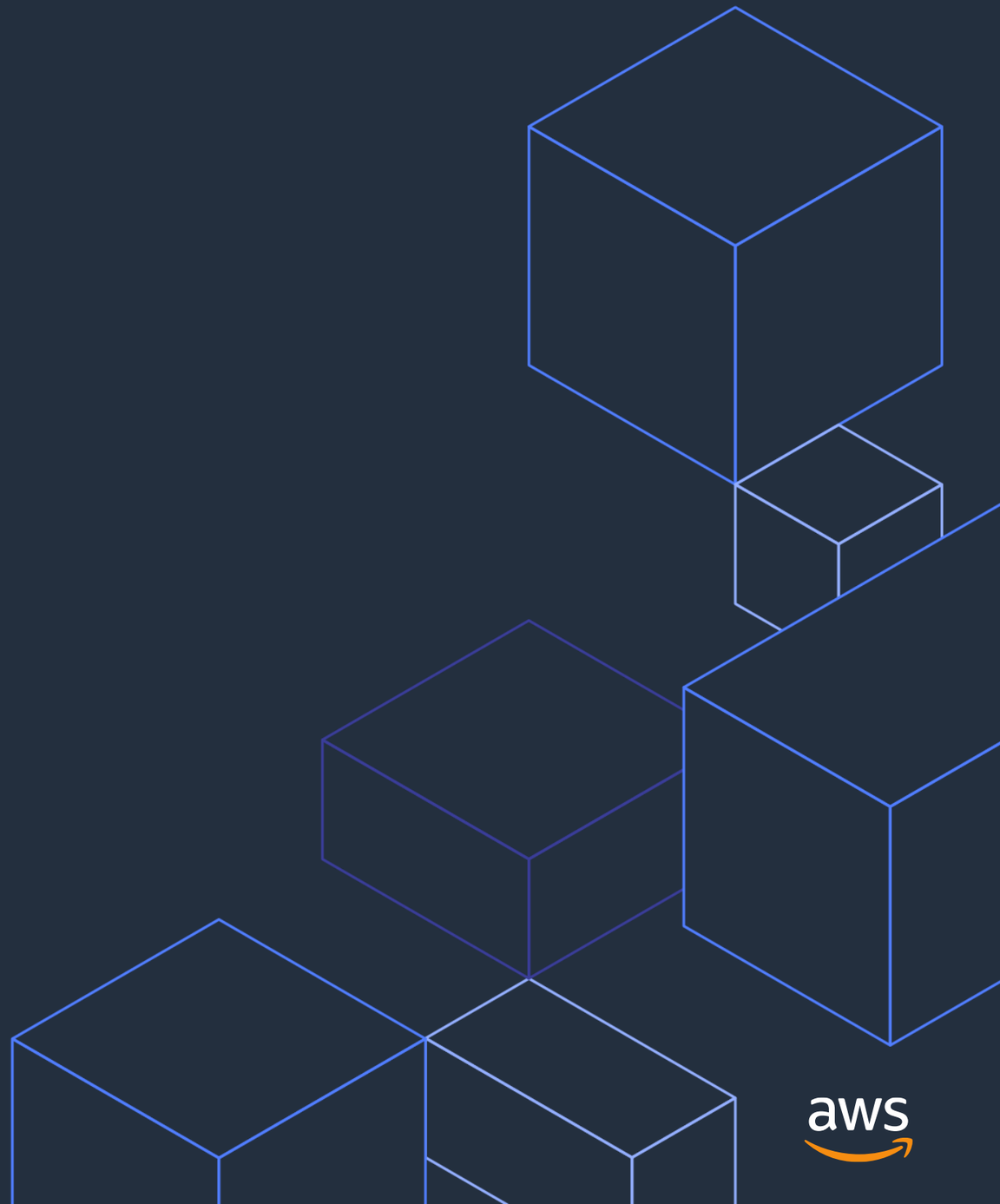


Publish/subscribe



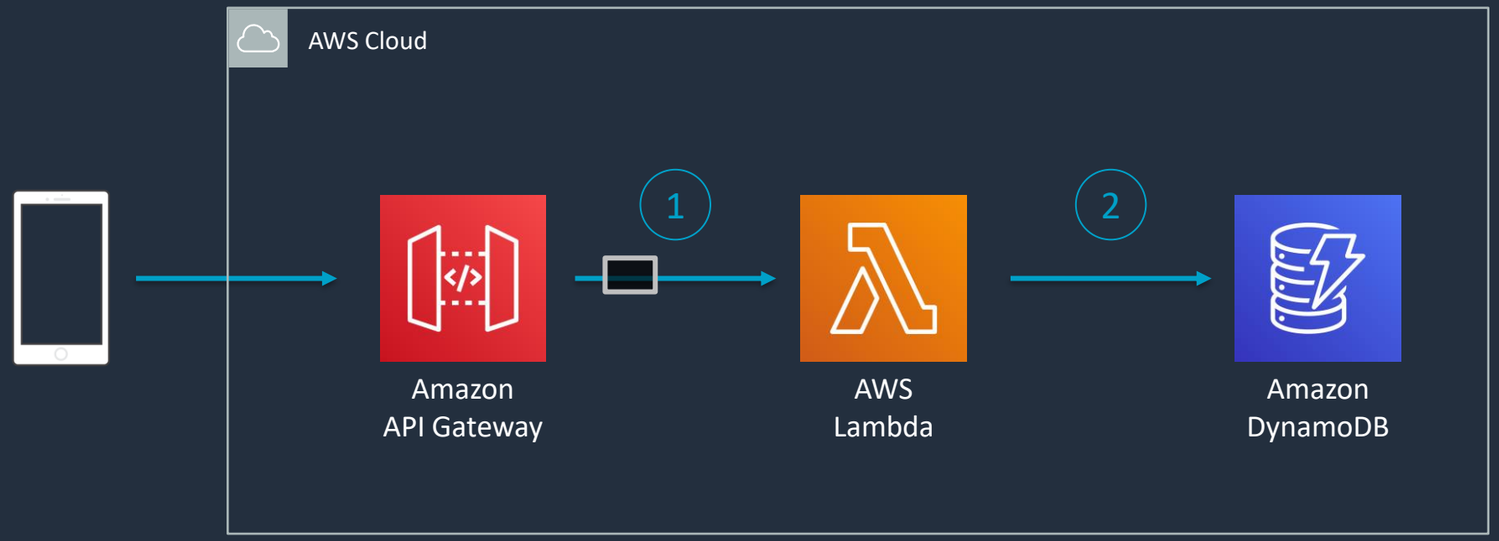
API-Driven Use Cases

Also event driven, synchronously processed



RESTful Microservices

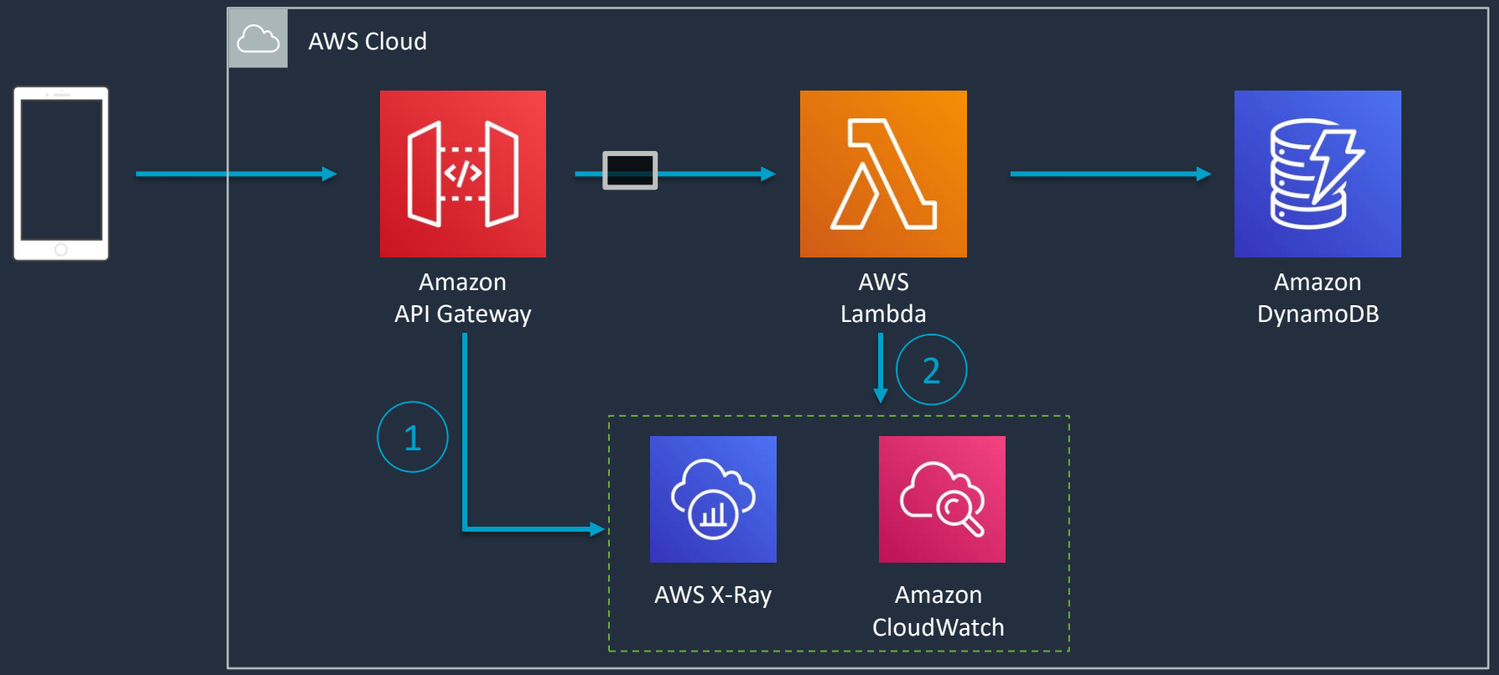
Highly-scalable microservices



1. API Gateway “translates” incoming HTTP request to event payload
2. Lambda reads / writes data from data store

RESTful Microservices with enhanced observability

Enable access logs, structured logging, and instrument code

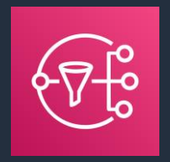
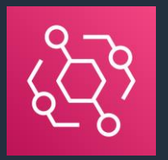


1. Enable access logs and tracing
2. Instrument code and create metrics asynchronously with CloudWatch Embedded Metric Format

Choreography

Streams, Topics, and Queues

AWS Messaging and Event Services

	Event Store		Event Router	
	Queues	Streams	Topics	Bus
Cloud Native	 Amazon SQS	 Amazon Kinesis	 Amazon SNS	 Amazon EventBridge
Managed Open Source	 Amazon MQ	 Amazon MSK	 Amazon MQ	

Comparing messaging and event services

Scale / Concurrency Controls

Durability

Persistence

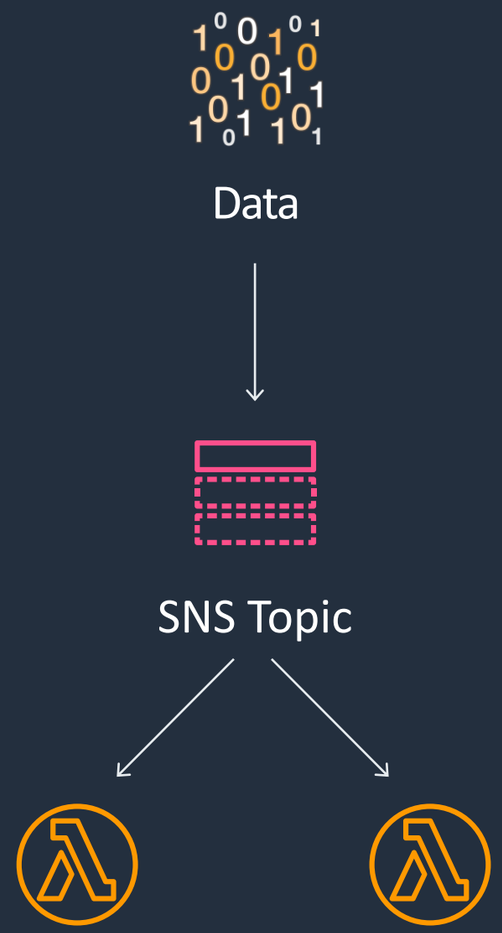
Consumption Models

Retries

Pricing

aws

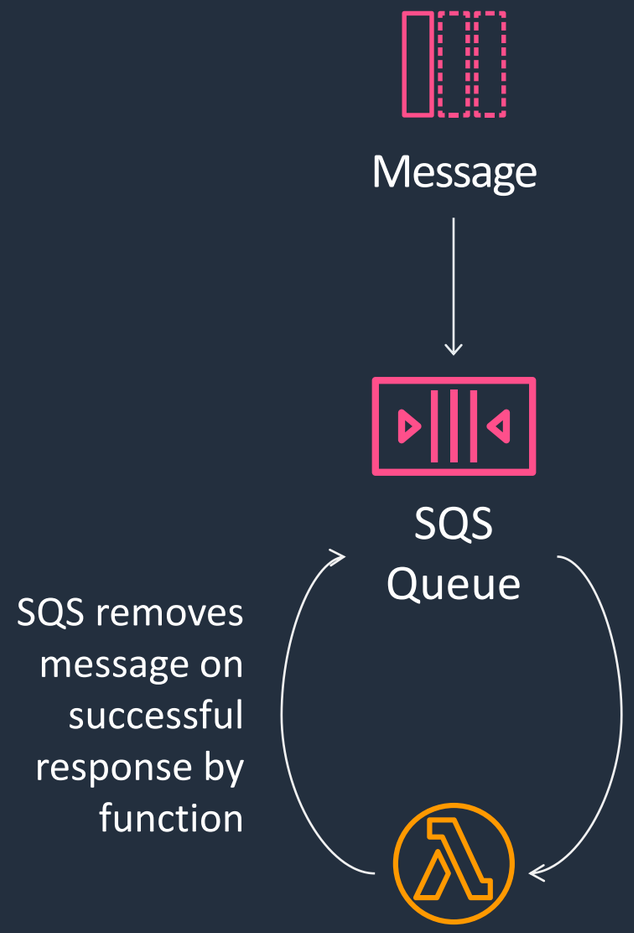
Amazon Simple Notification Service (SNS)



- Publish / subscribe messaging
- High throughput, highly reliable message delivery
- Messages are published to a Topic with multiple subscribers – “fan out”
- Messages can be filtered and only sent to certain subscribers
- Asynchronous Lambda invocation

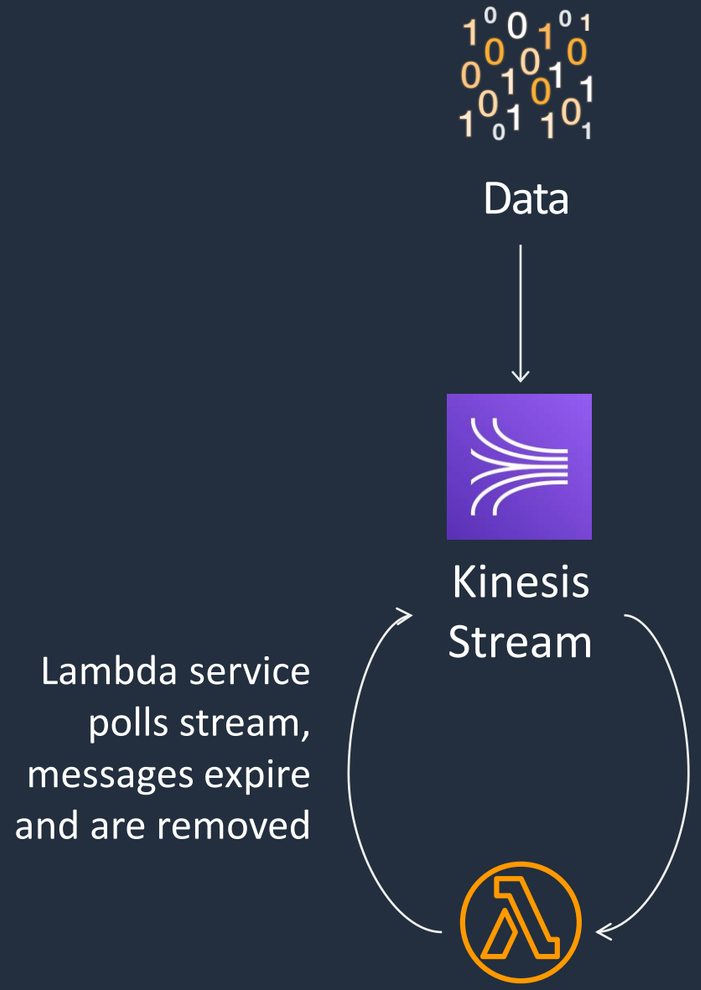
aws

Amazon Simple Queue Service (SQS)



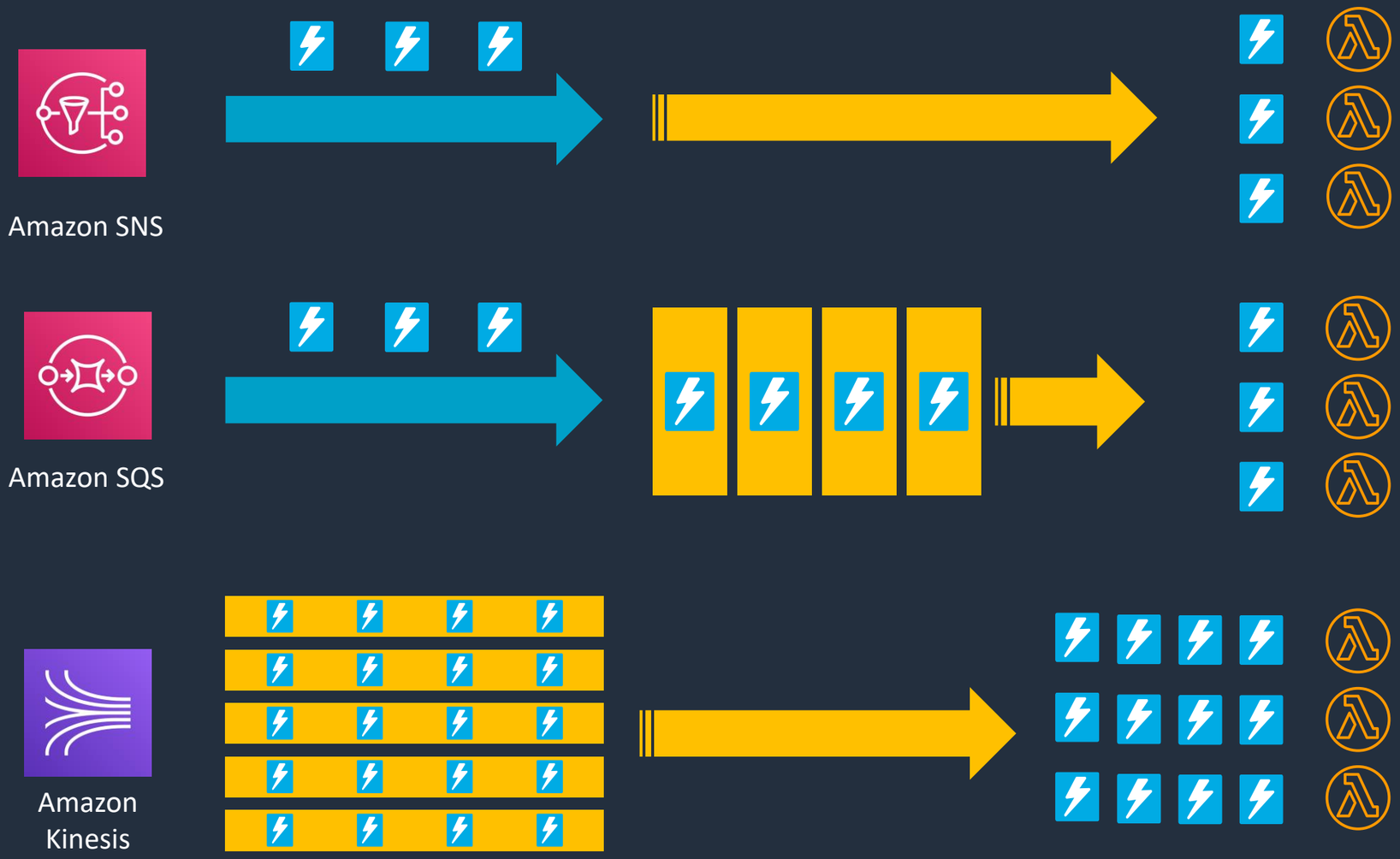
- Any volume of messages
- Messages processed in batches
- At least once delivery
- Visibility timeout allows handling failures
- Synchronous Lambda invocation
- Service long-polls queues

Amazon Kinesis Data Streams



- Real-time data streams for analytics and machine learning
- At least once delivery
- Function receives batch of data and potentially batches of batches
- Synchronous Lambda invocation
- Service long-polls queues

Lambda function concurrency across models



No event store

“Fire and forget”

Message delivery and processing durability

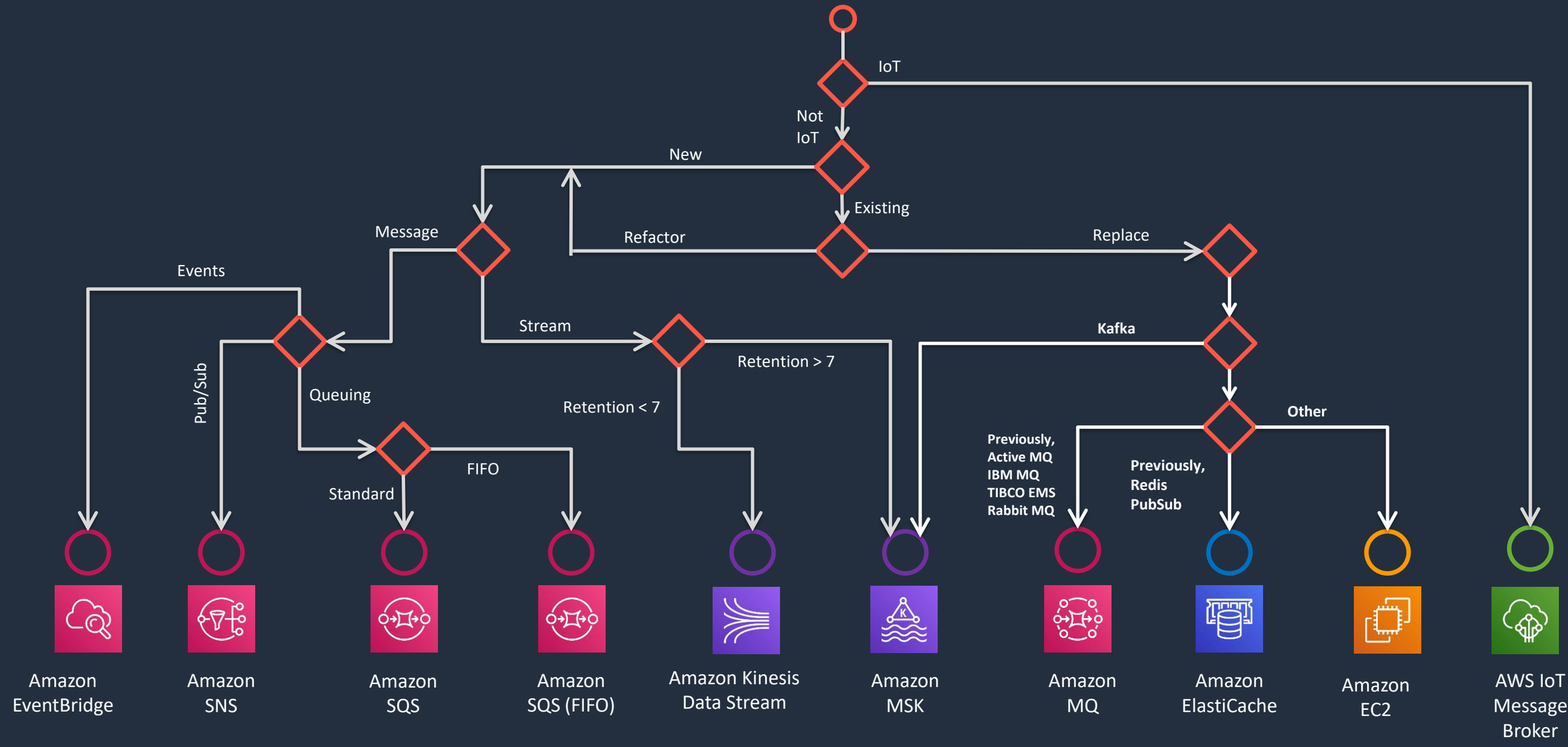
FIFO for ordering

Message durability

Speed

Ordering

A decision tree?



Event-Driven Use Cases

Processing file uploads

Resize photo, extract text, translate, etc.

1. Object uploaded to Amazon S3 Bucket

2. Asynchronous invoke of Lambda function, event payload includes:
   - Bucket name
   - Object key

Processing file uploads, quickly add new functionality

Add image analysis and metadata storage

3. Analyze photo with Amazon Rekognition

4. Store image details and results of analysis

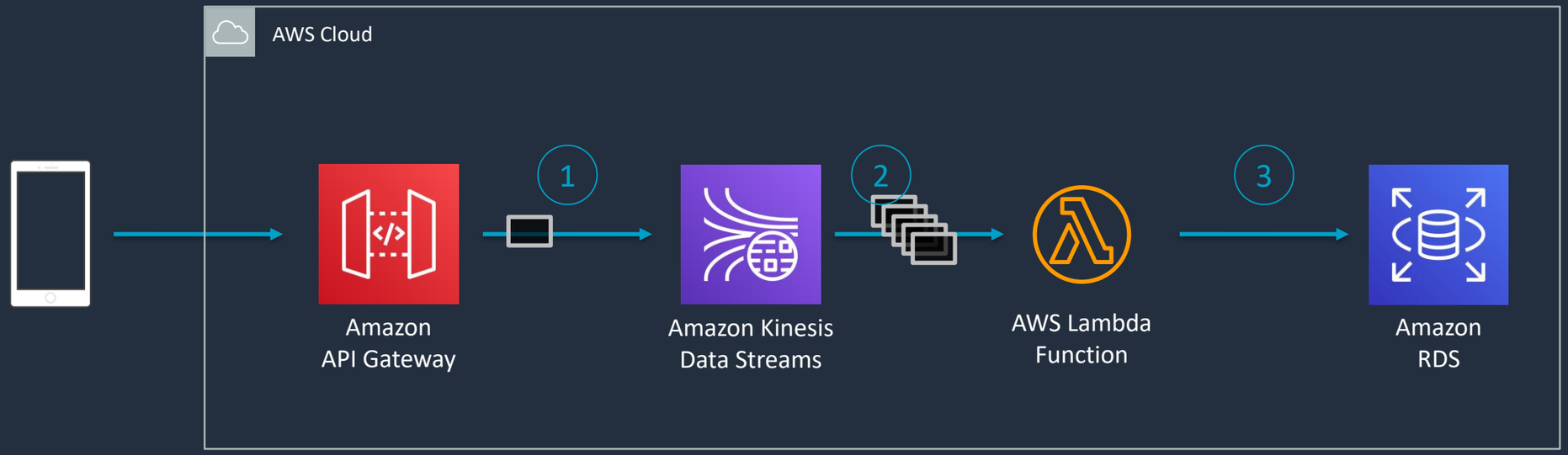
Streaming data ingestion and storage

Consume, process, and store data

1. Lambda service polls Kinesis Data Stream for messages
2. Function is synchronously invoked with batches of messages
3. Function processes and/or pushes data to downstream data stores

“Semi-Serverless” Webhook

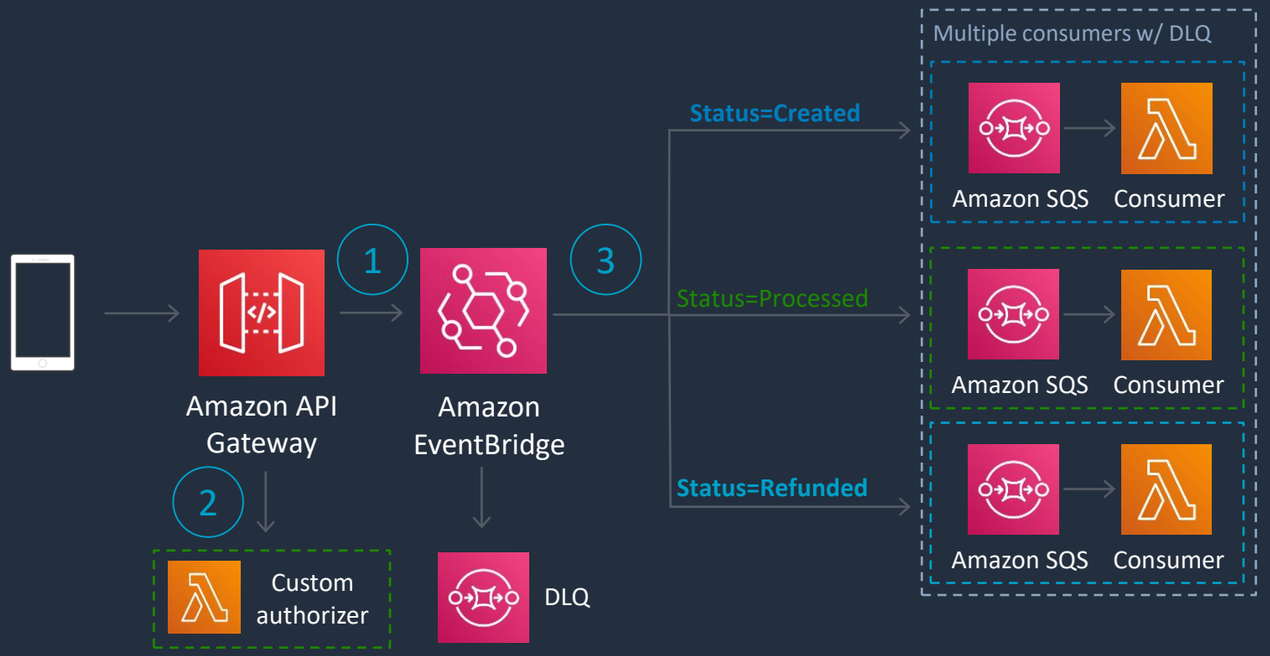
Scalable, resilient. Buffer downstream concurrency.



1. “Storage-first” pattern: API Gateway writes directly to Kinesis Data Stream
2. Kinesis as a buffer to limit concurrency downstream
3. Perform transaction(s) on batch

Fan out

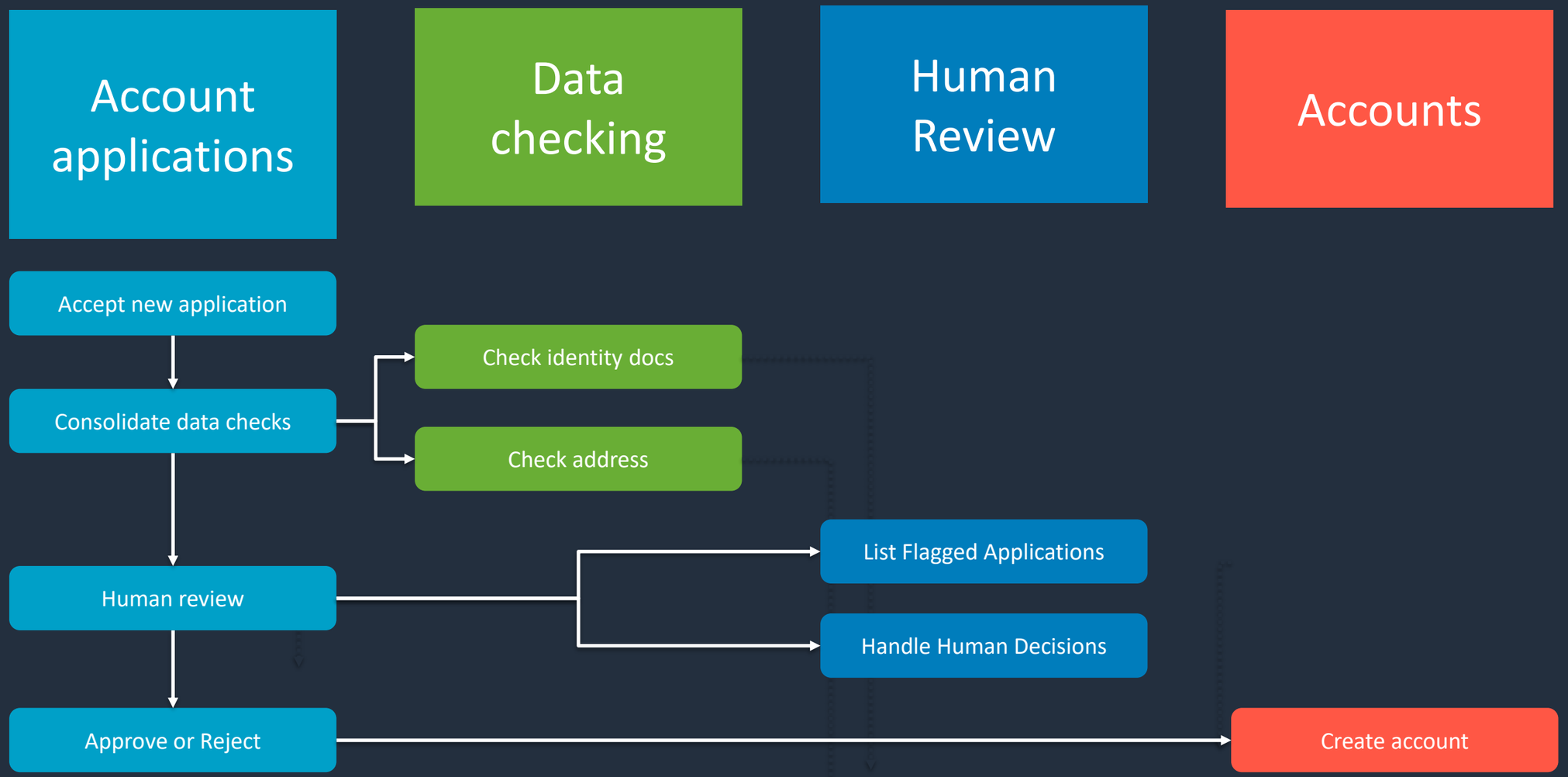
Push updates to multiple subscribers



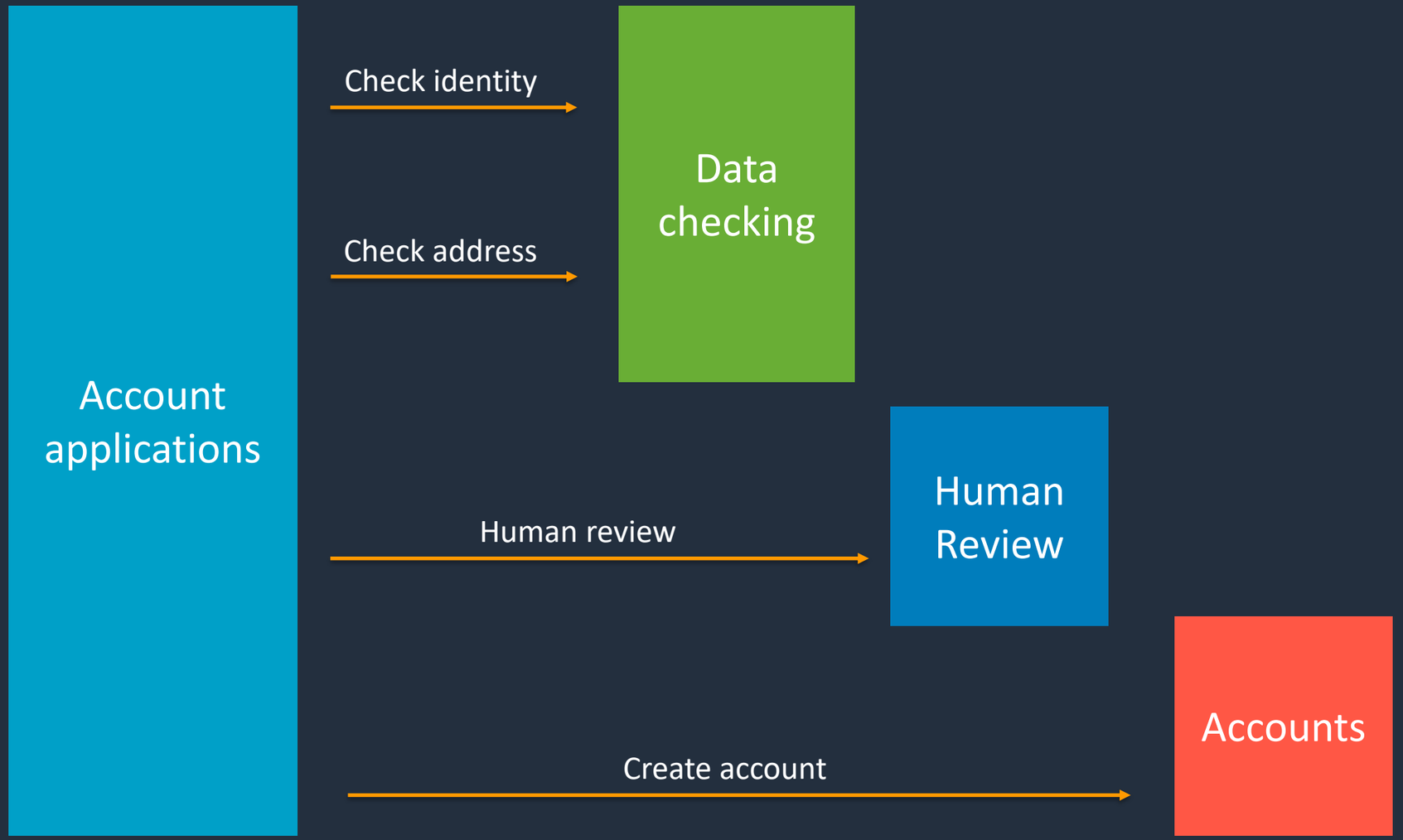
1. “Storage first”: integrate API Gateway directly to EventBridge
2. Enforce authorization
3. Use routing for efficient processing

Orchestration

Simplified banking system: Processing a new account requires coordination



Orchestration: one process manages workflow state and calls appropriate services in turn



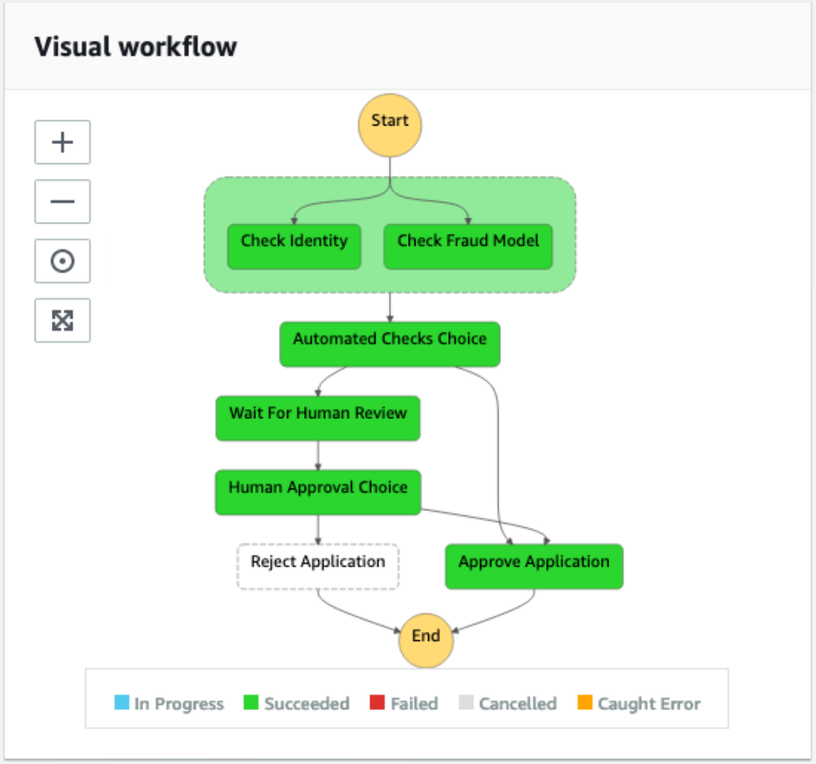
Modeling as a State Machine

- Describes a collection of computational steps split into discrete states
- Has one starting state and always one active state (while executing)
- The active state receives input, takes some action, and generates output
- Transitions between states are based on state outputs and rules that we define

AWS Step Functions

Serverless state machines

- Resilient workflow automation
- Built-in error handling
- Powerful AWS service integrations
- Integrate with your own services
- Auditable history, visual monitoring
- Defined with JSON



Execution event history

ID	Type	Step	Resource
1	ExecutionStarted		-
2	ParallelStateEntered	Perform Automated Checks	-
3	ParallelStateStarted	Perform Automated Checks	-
4	TaskStateEntered	Check Identity	-
5	LambdaFunctionScheduled	Check Identity	Lambda | CloudWatch logs
6	PassStateEntered	Check Fraud Model	-

Hands-on Workshop

Get hands-on with serverless messaging

- SNS
- EventBridge
- Filtering
- Asynchronous processing