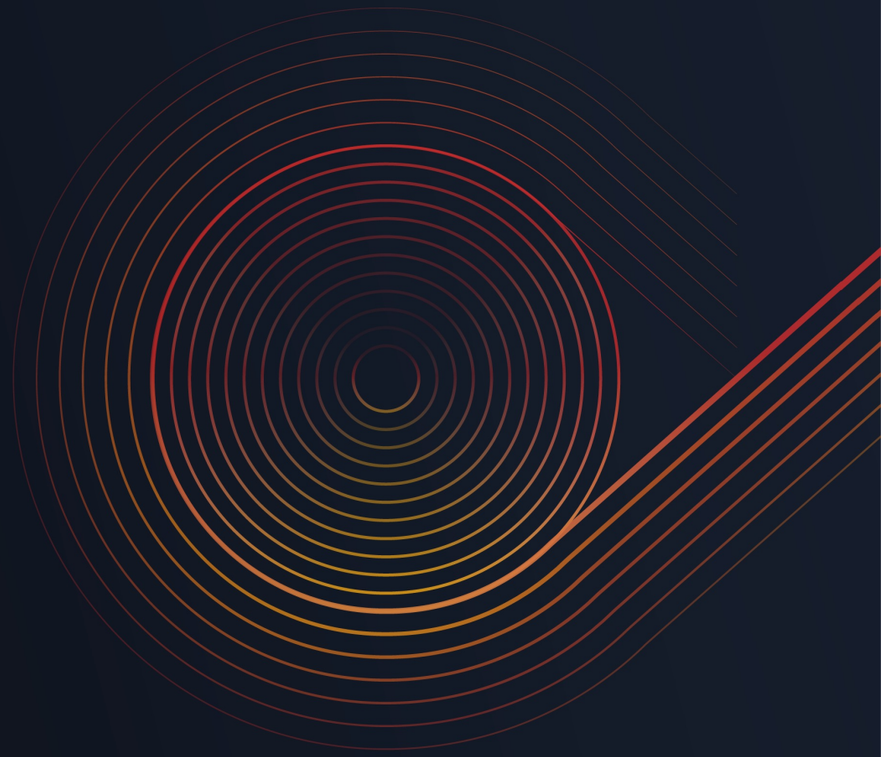
Building event-driven architectures on AWS

Iaroslav Ustinov, Enterprise Solutions Architect



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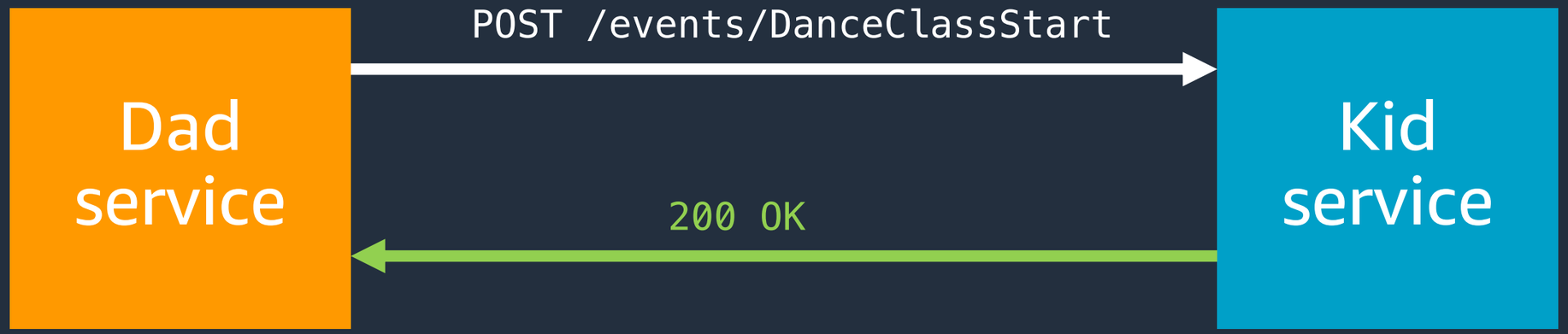
Event-driven kids



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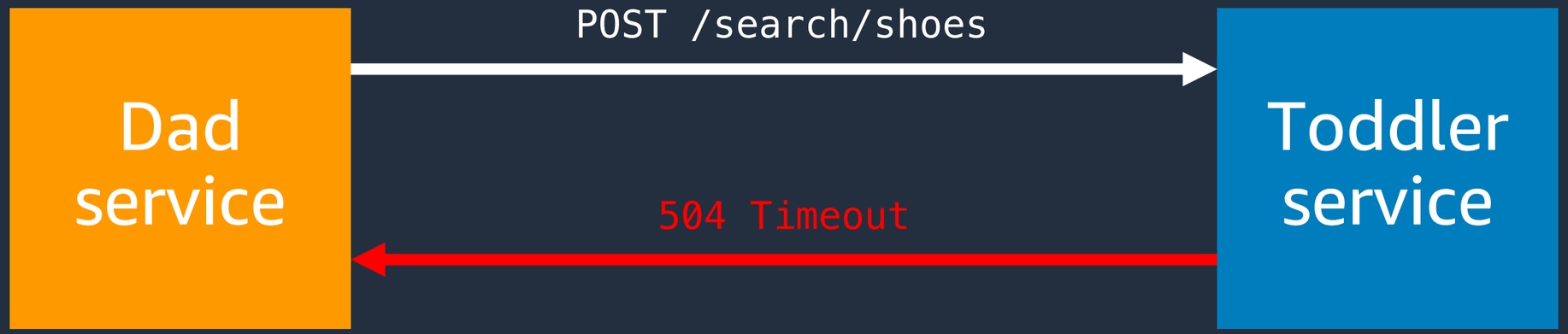

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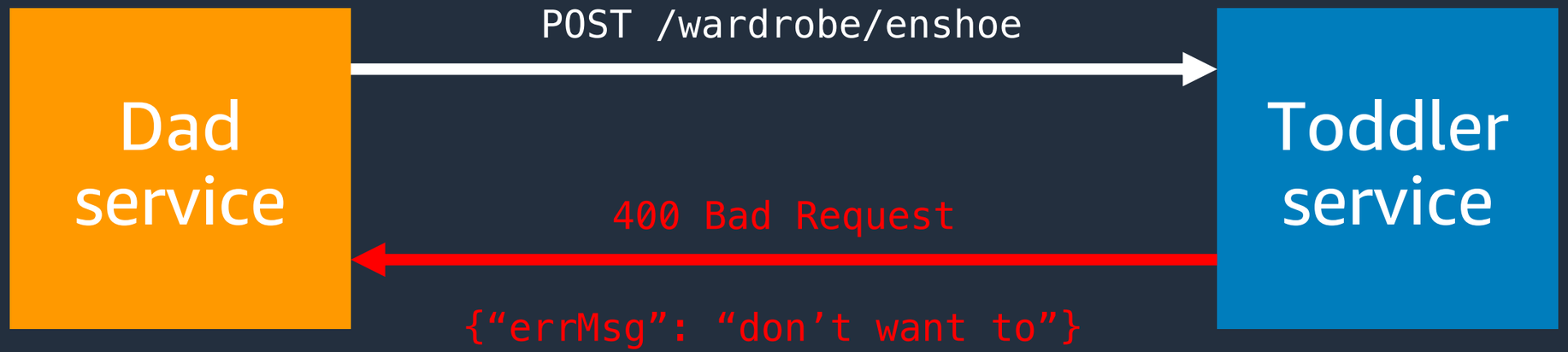

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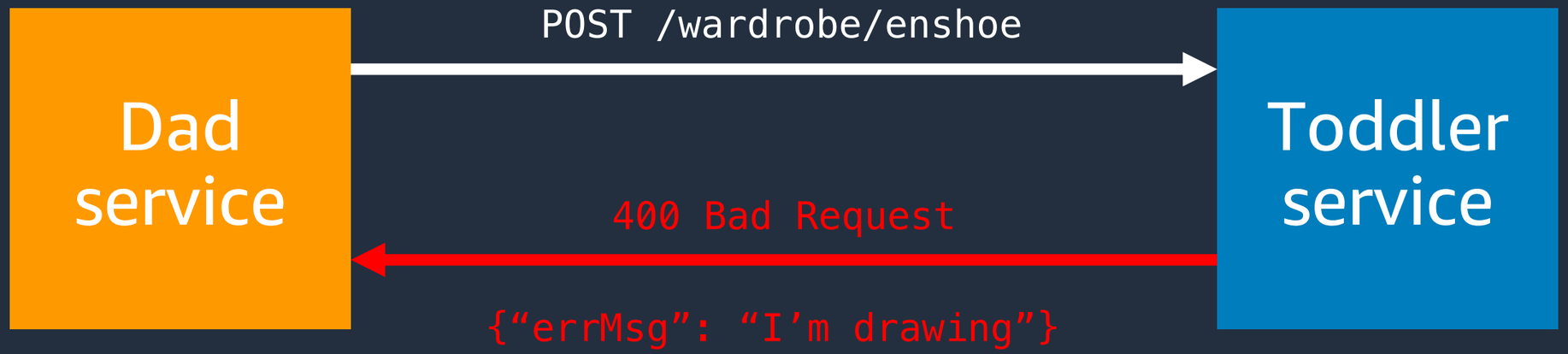

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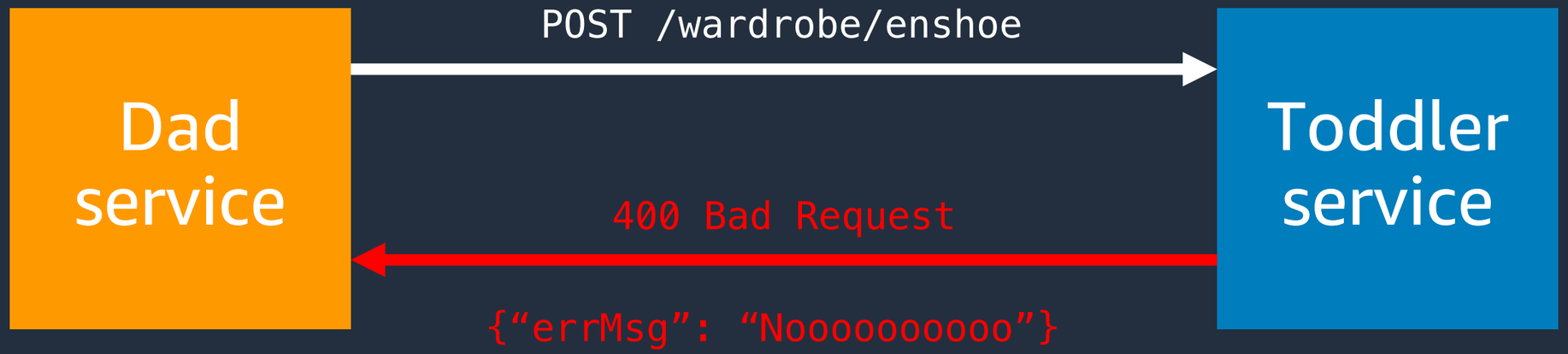
Event-driven kids



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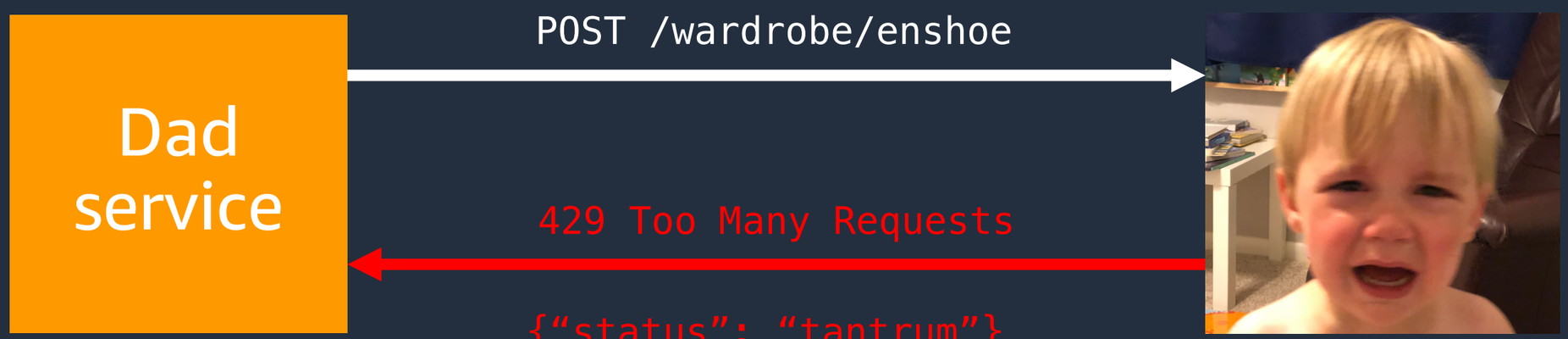
Event-driven kids



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Challenges with distributed systems

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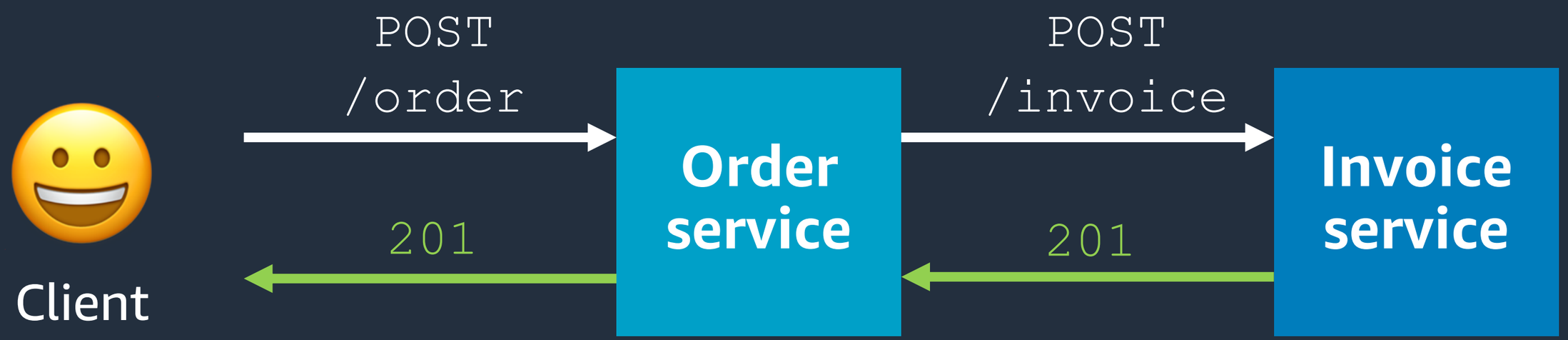
Microservices start simple



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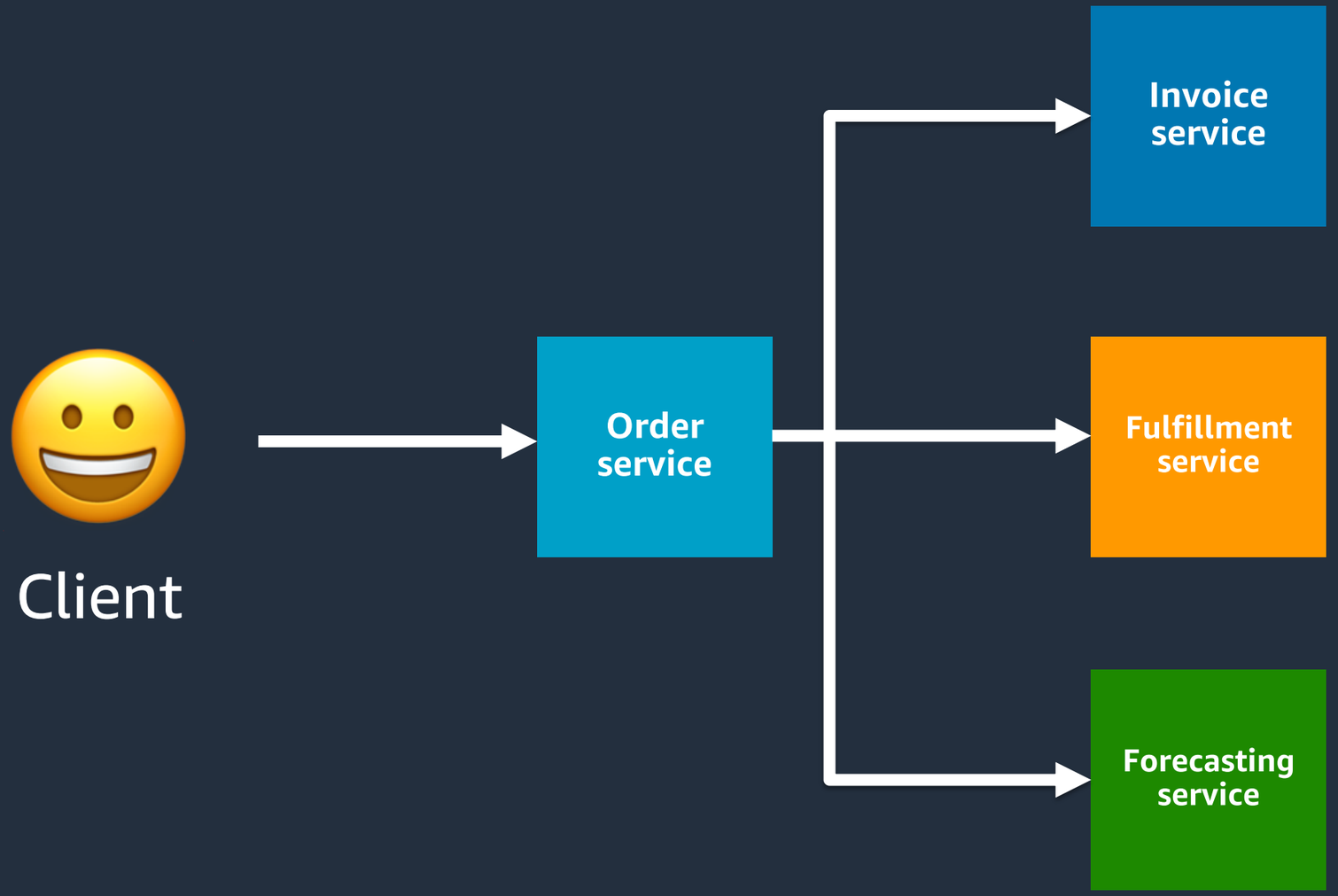
Synchronous API



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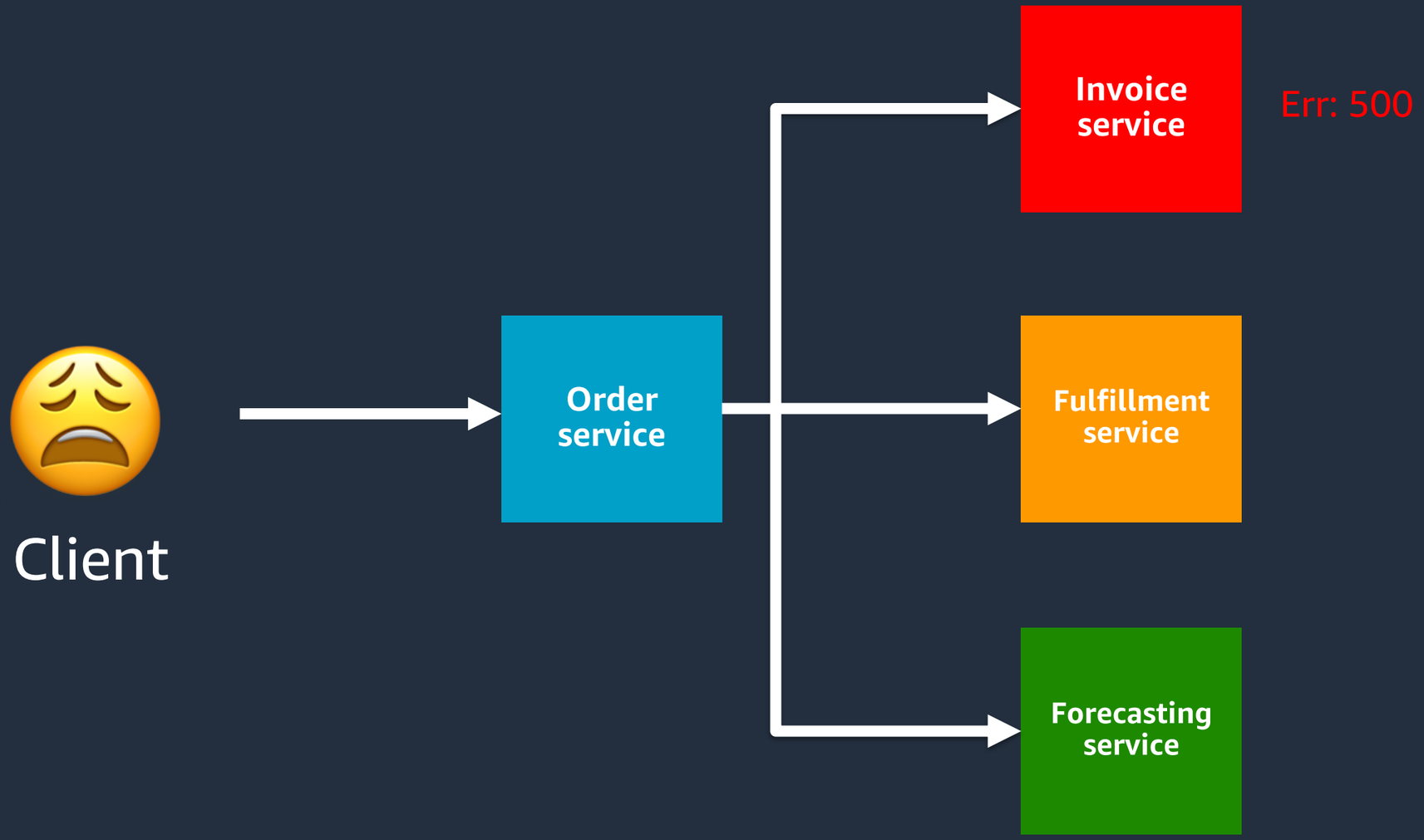
Synchronous API



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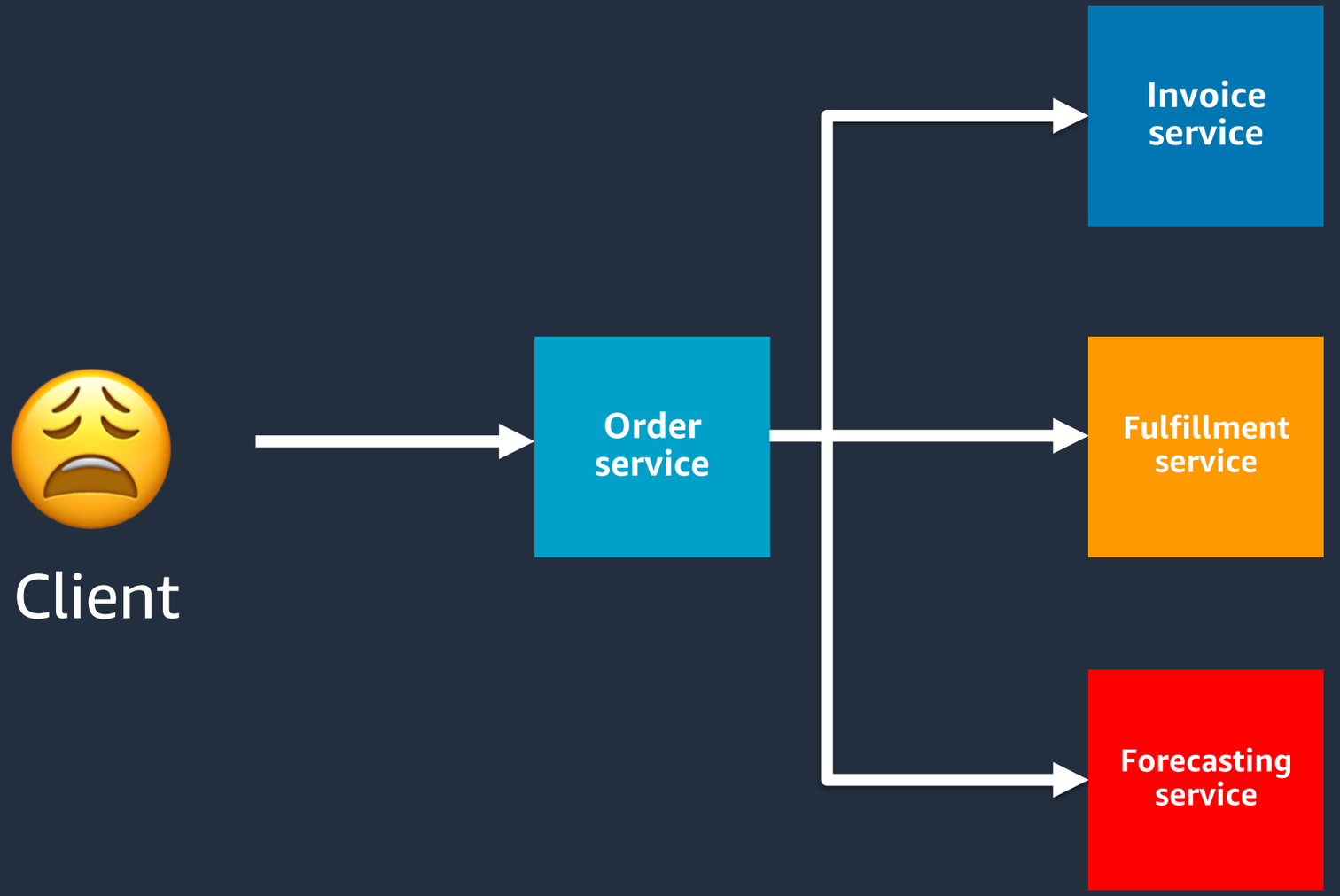
Synchronous API



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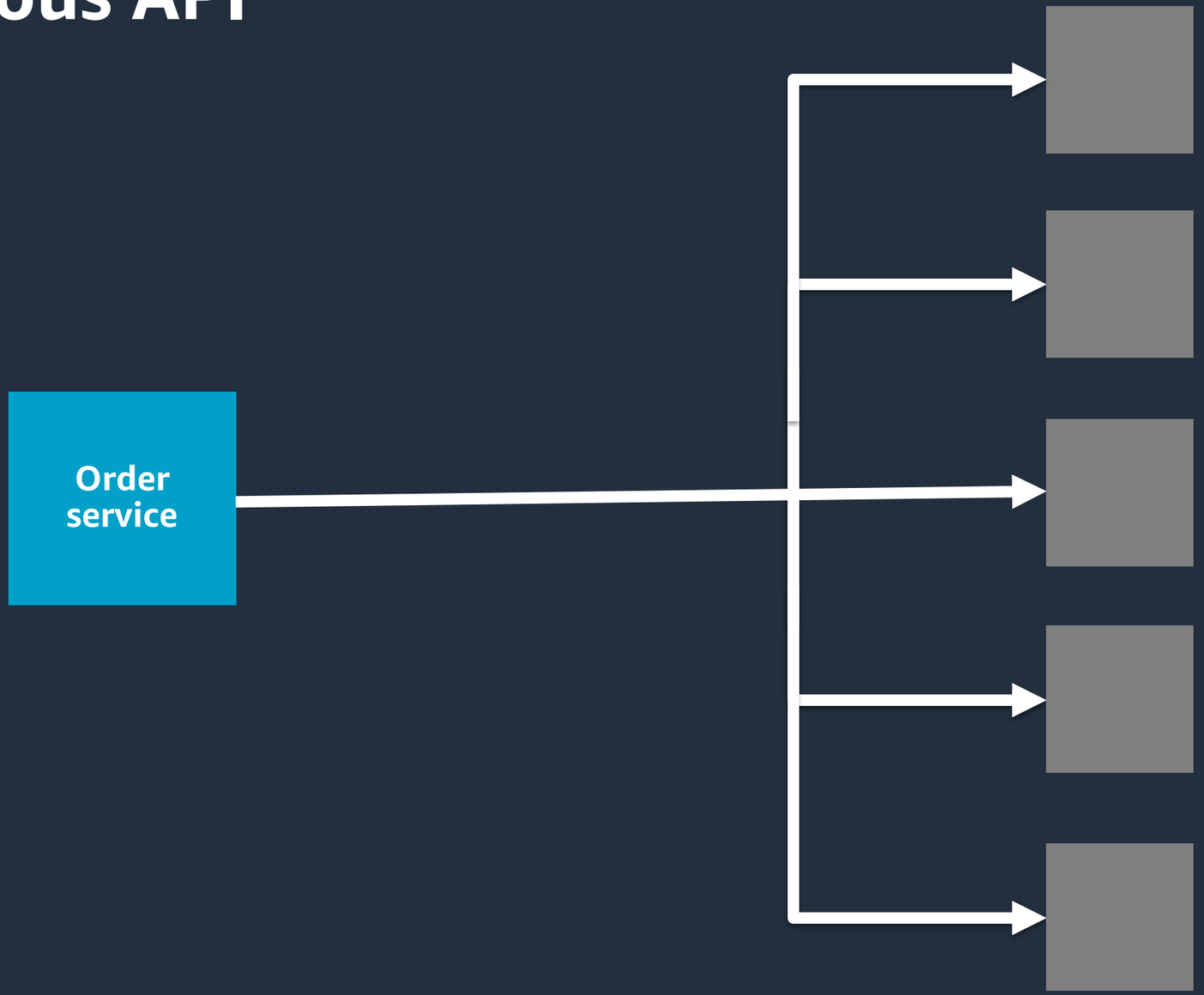
Synchronous API



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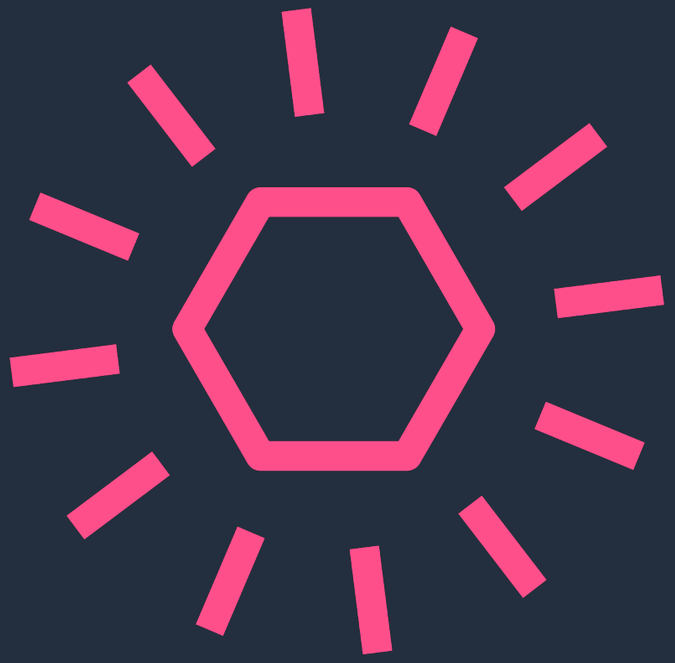

event

[i-’vent] **noun**

A signal that a system’s state has changed.

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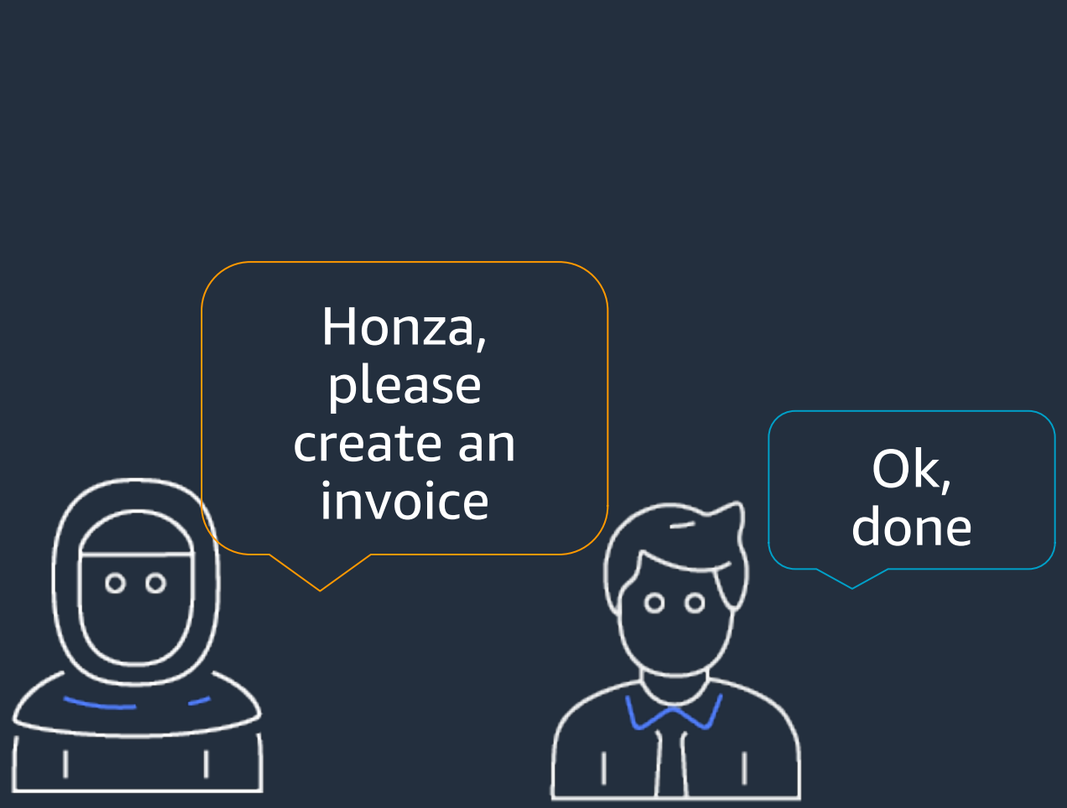
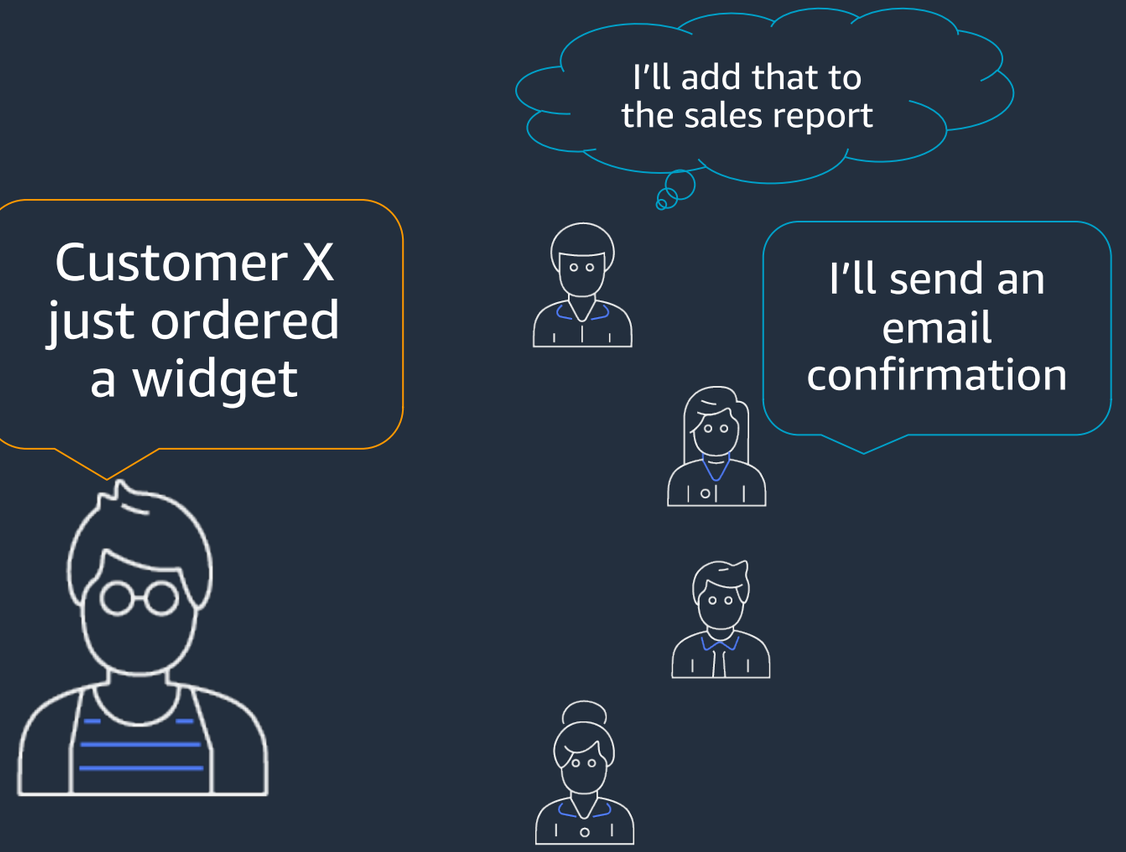
Events are observable, not directed



Directed commands



Observable events

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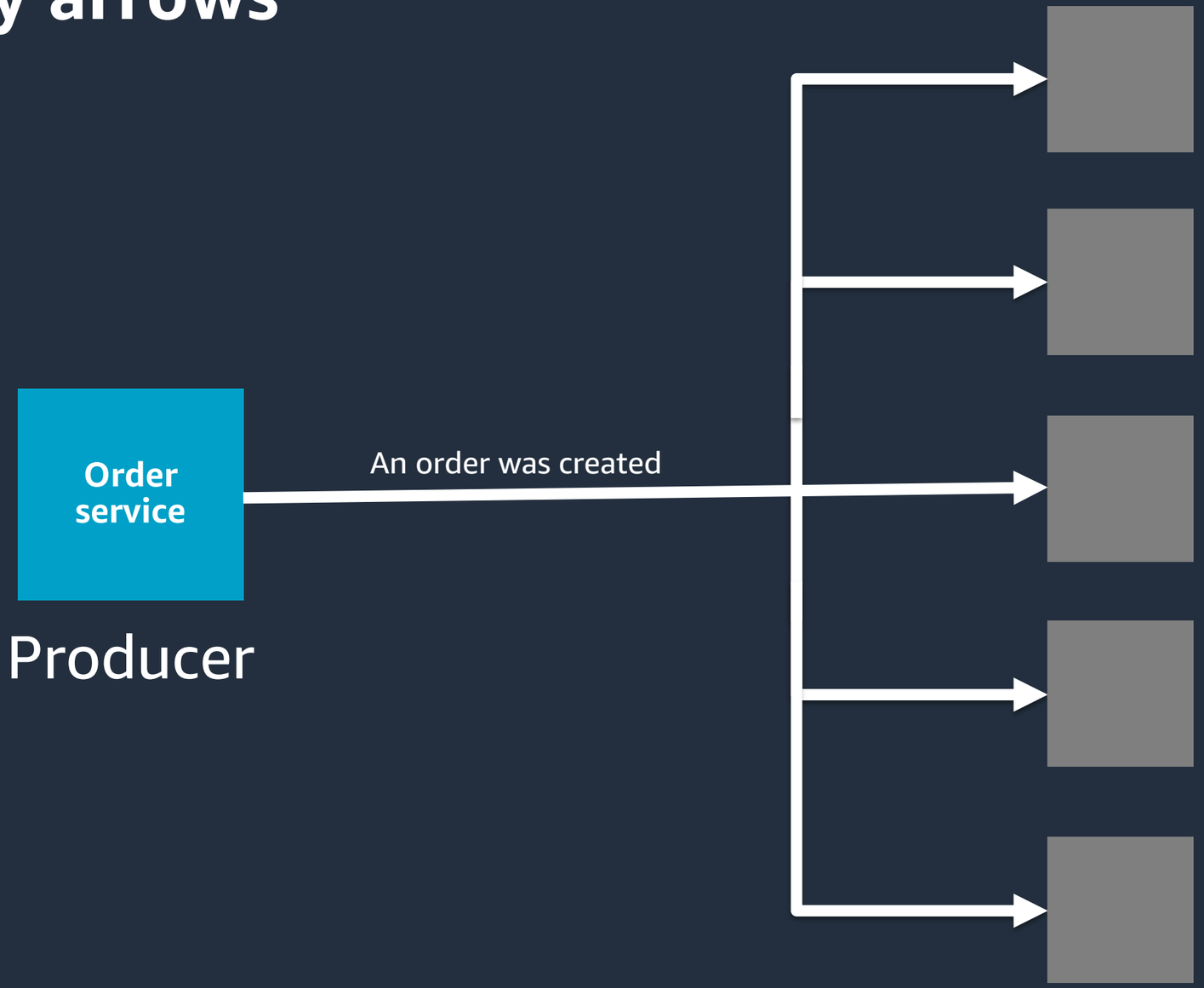
Still many arrows



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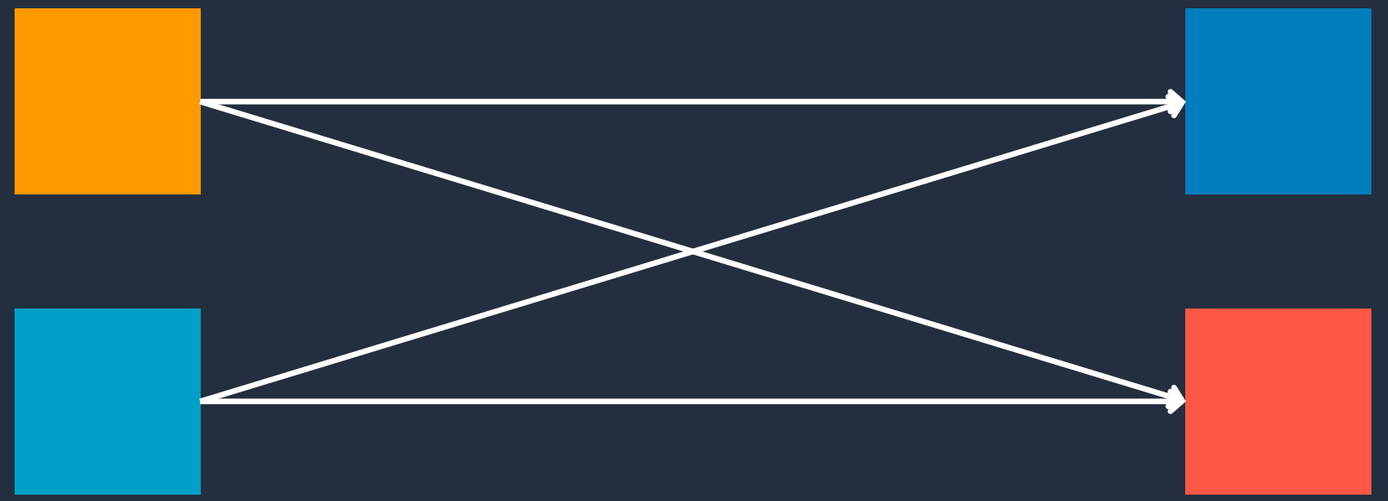
Why do you need a router?



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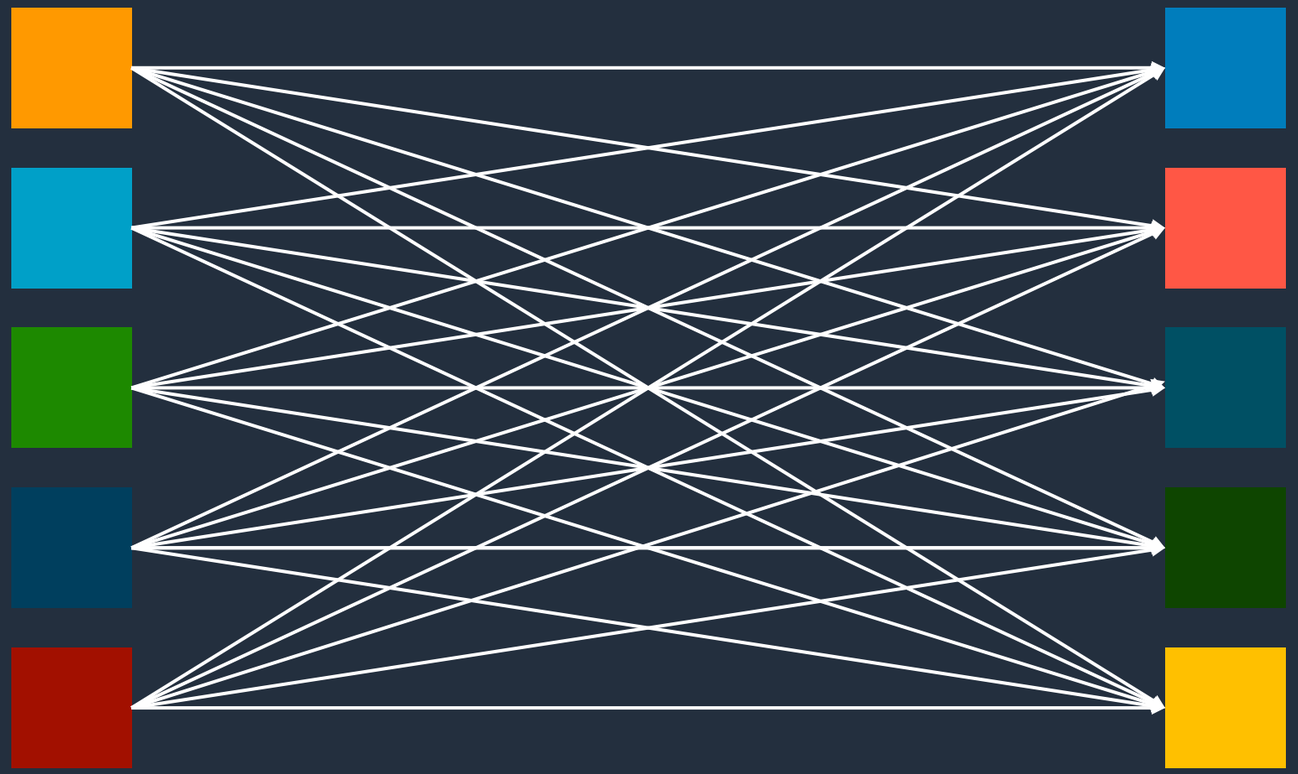
Why do you need a router?



Producers

Consumers

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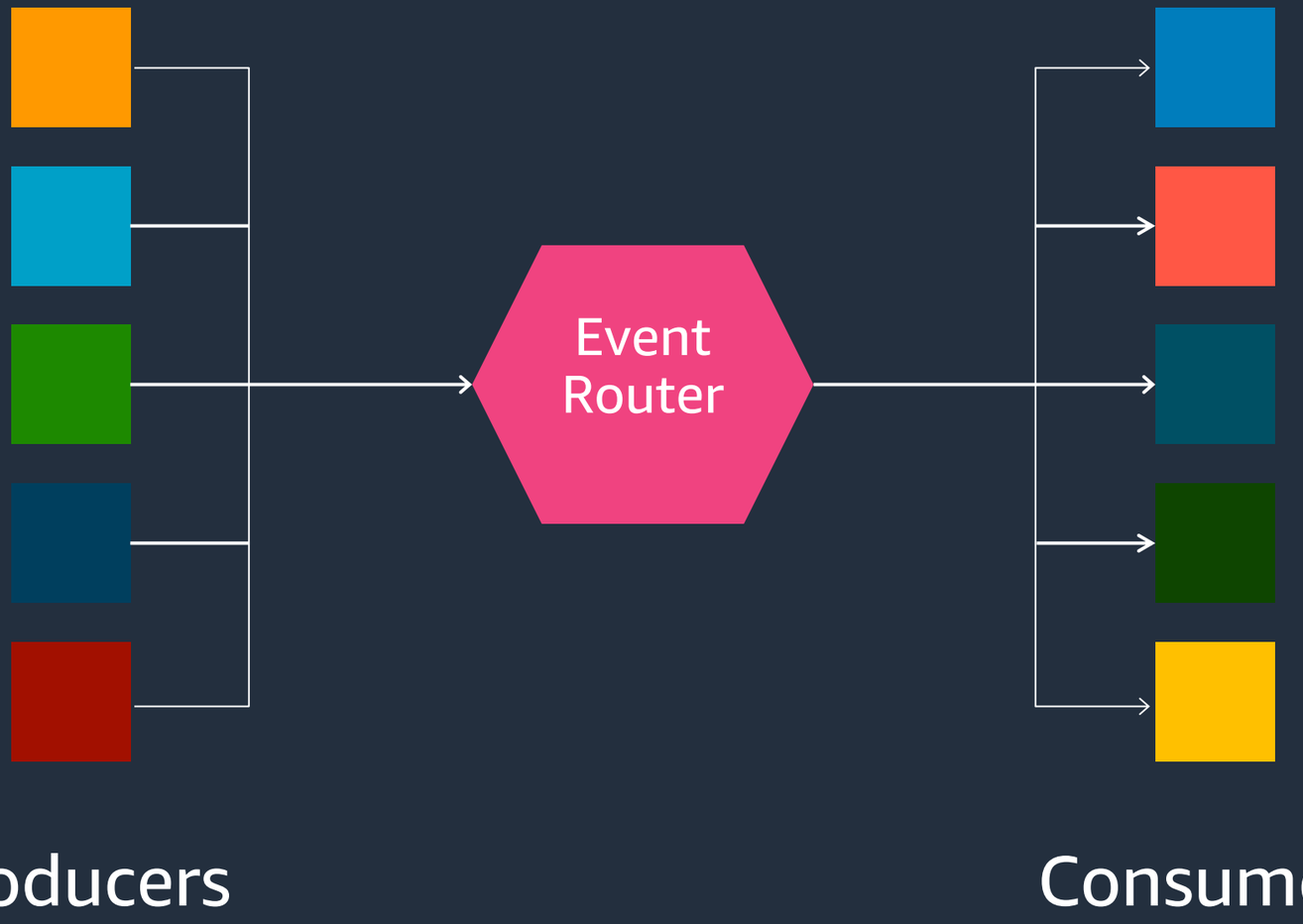
Why do you need a router?



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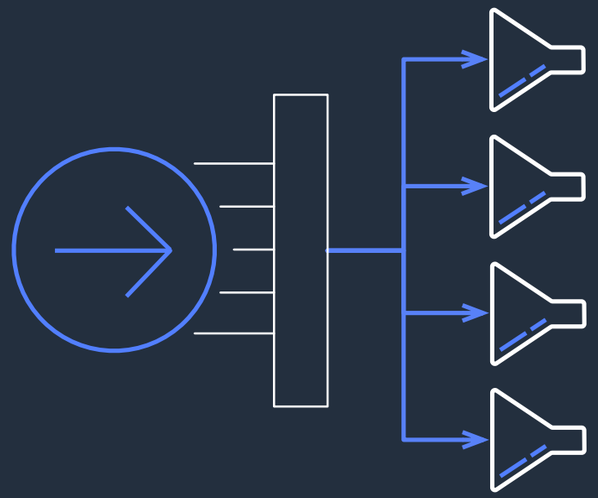
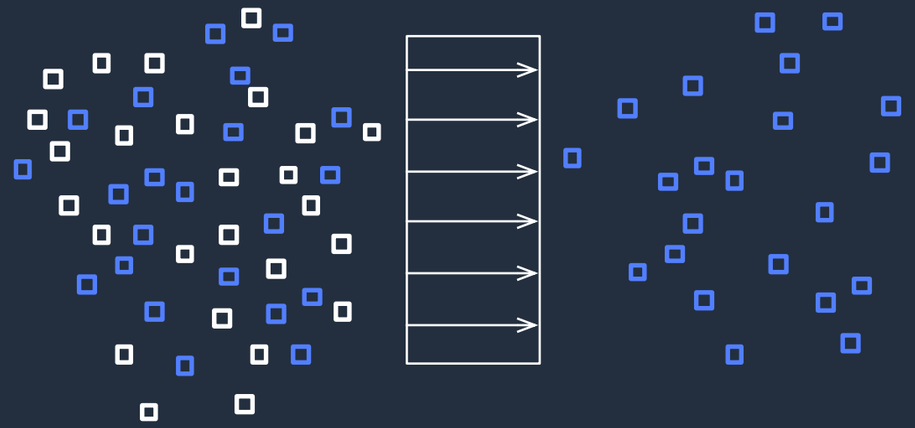
Event Routers



Abstracts producers and consumers



Selects and filters events

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Event Routers in AWS

	AWS Service	Characteristics
Topics	 Amazon Simple Notification Service	AWS Lambda/Amazon SQS/HTTP targets Millions of subscriptions Filter on event metadata
Event buses	 Amazon EventBridge	Over 35 targets Native SaaS event sources Metadata and payload routing

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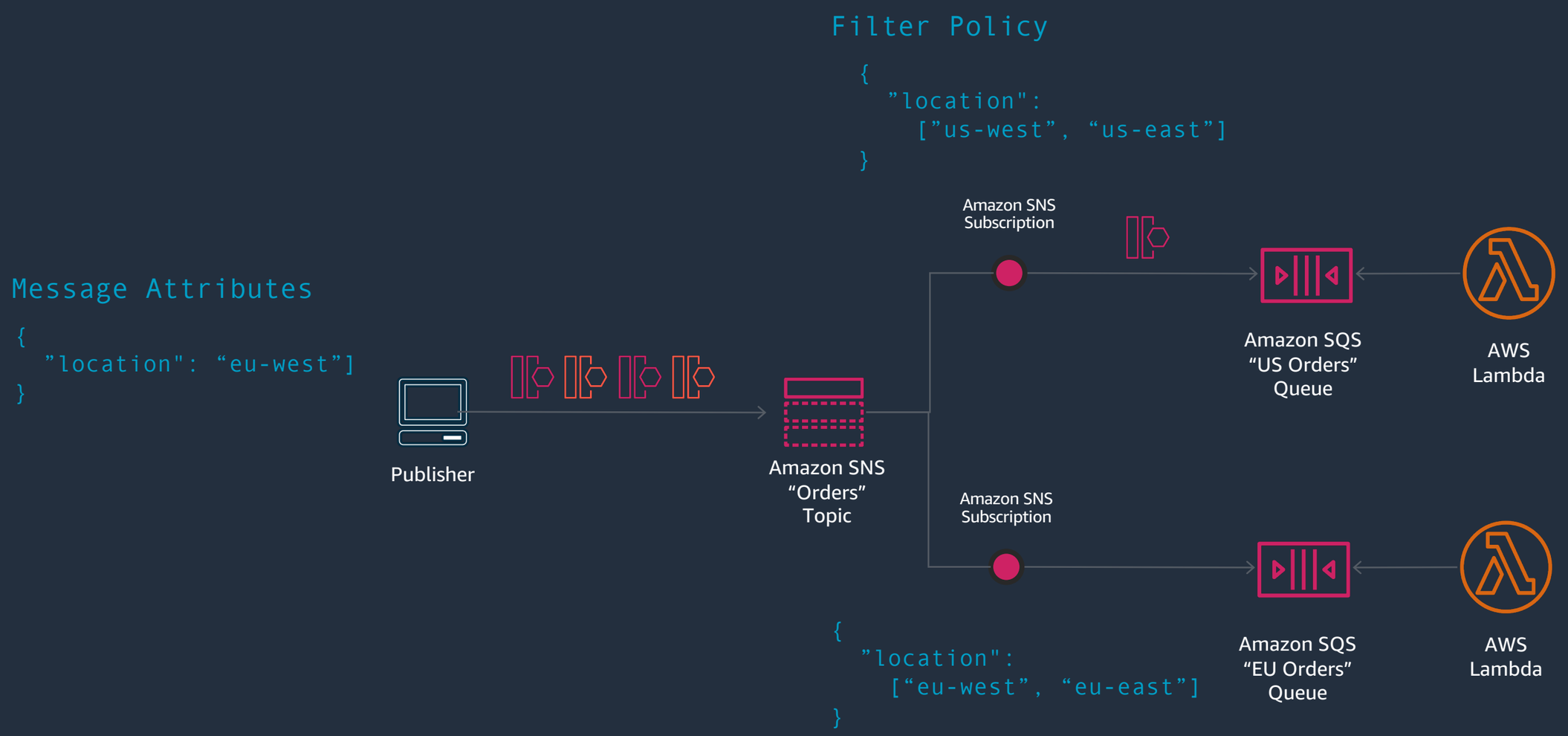
Amazon SNS Message Filters



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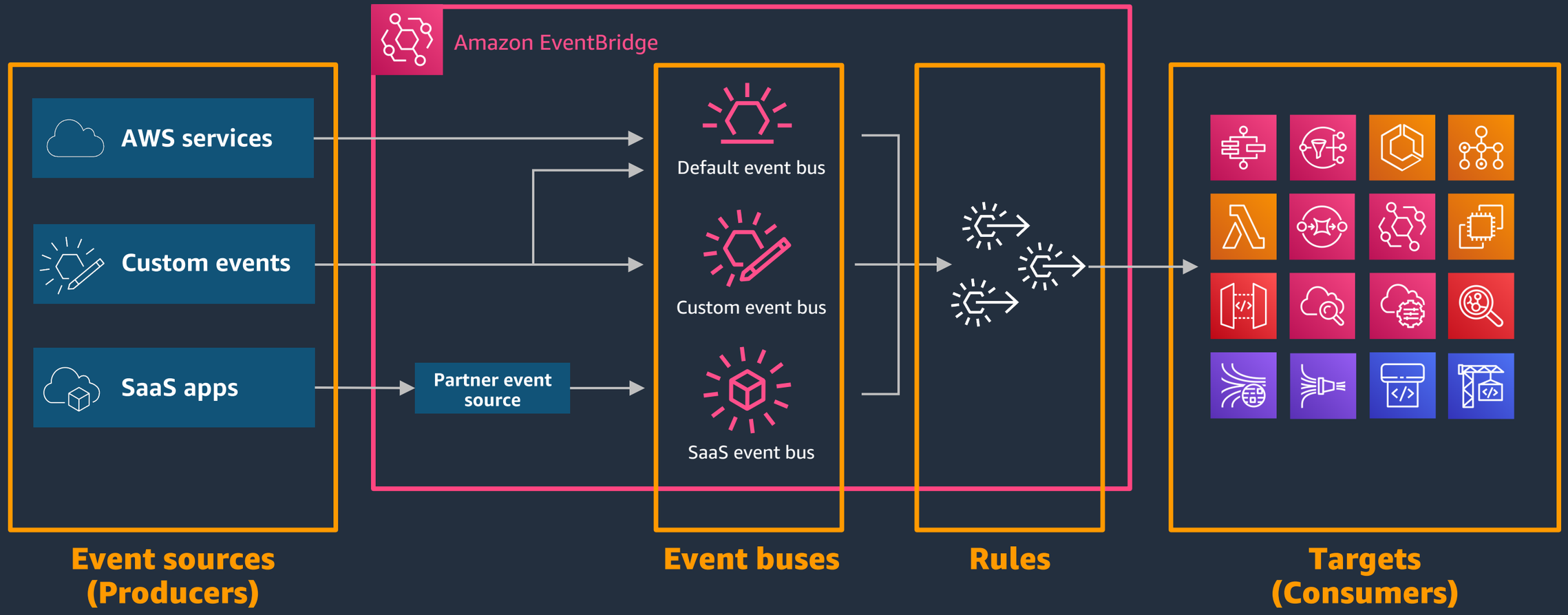
What is Amazon EventBridge?



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Amazon EventBridge

Example event:

```
{
  "detail-type": "Ticket Created",
  "source": "aws.partner/example.com/orders",
  "detail": {
    "ticketId": ”987654321",
    "department": "billing",
    "creator": "user12345"
    ...
  }
}
```

Example rule:

```
{
  "source": ["aws.partner/example.com/orders"]
}
```

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Amazon EventBridge

Example event:

```
{
  "detail-type": "Ticket Created",
  "source": "aws.partner/example.com/orders",
  "detail": {
    "ticketId": ”987654321",
    "department": "billing",
    "creator": "user12345"
    ...
  }
}
```

Example rule:

```
{
  "detail": {
    "department": ["billing", "fulfillment"]
  }
}
```

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Amazon EventBridge

Example event:

```
{
  "detail-type": "Ticket Created",
  "source": "aws.partner/example.com/orders",
  "detail": {
    "ticketId": ”987654321",
    "department": "billing",
    "creator": "user12345"
    ...
  }
}
```

Example rule:

```
{
  "detail-type": ["Ticket Resolved"]
}
```

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Type of Event Buses

Default Bus

Events from AWS services

Scheduled events

Custom events

Custom Buses

Custom events

SaaS Buses

3rd party SaaS events

Datadog

New Relic

Zendesk

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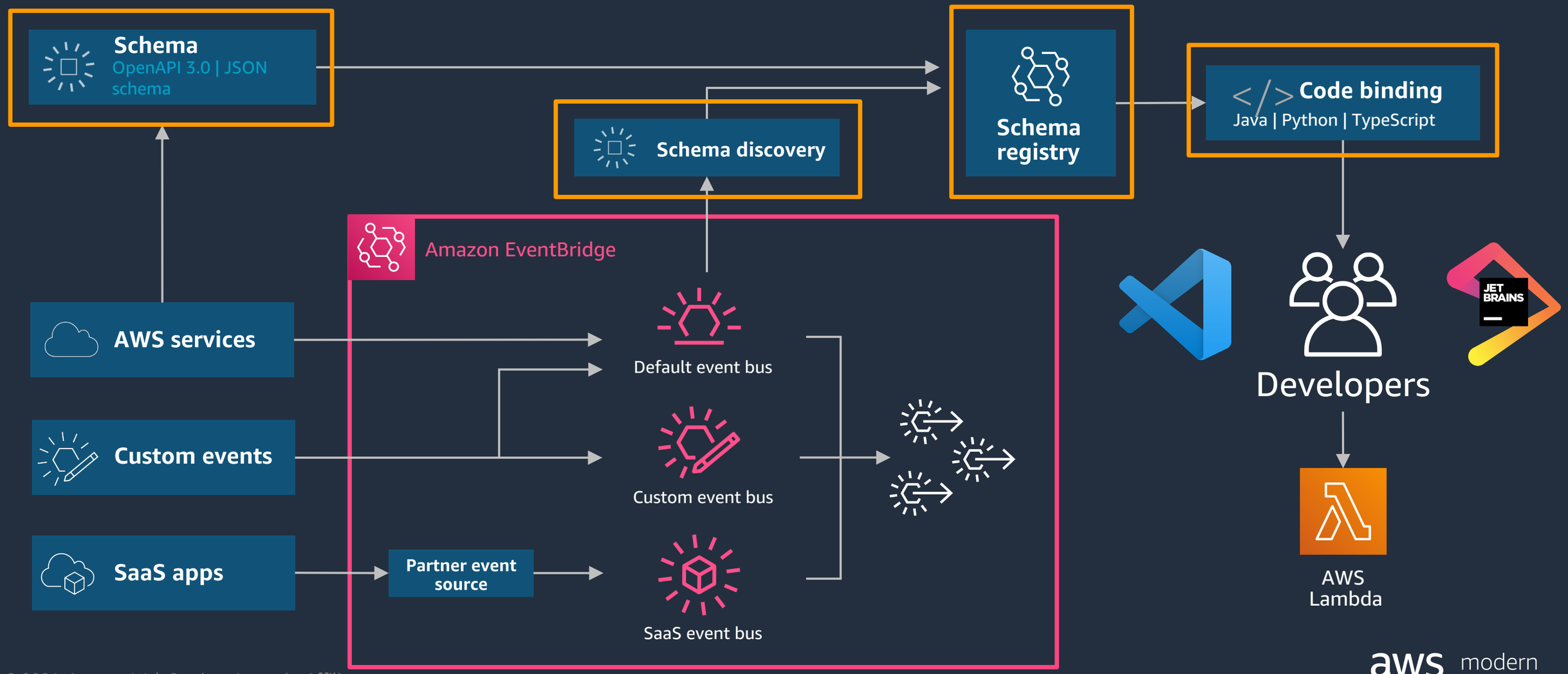
Amazon EventBridge architecture

Amazon EventBridge Schema Registry



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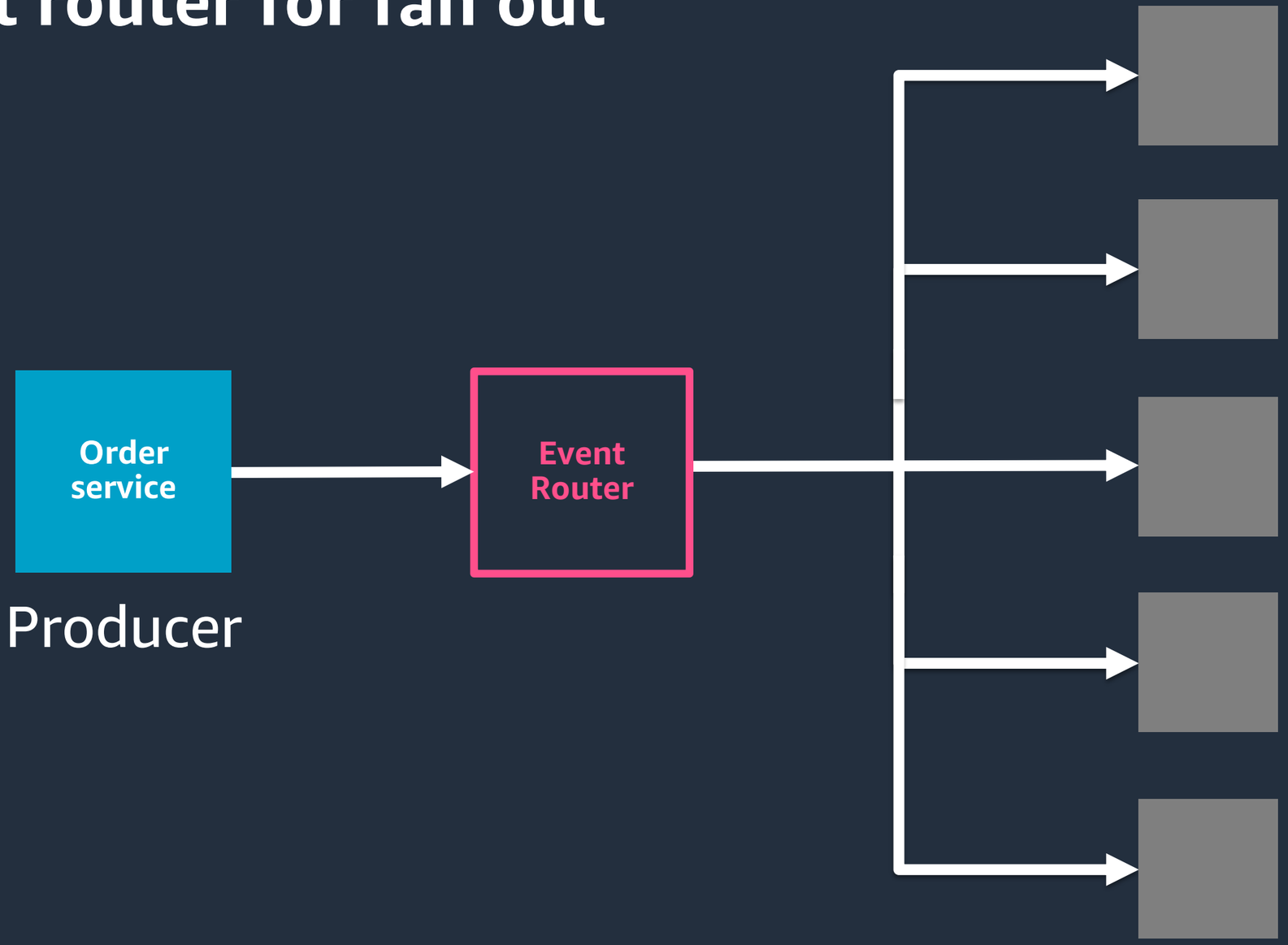
Event router for fan out



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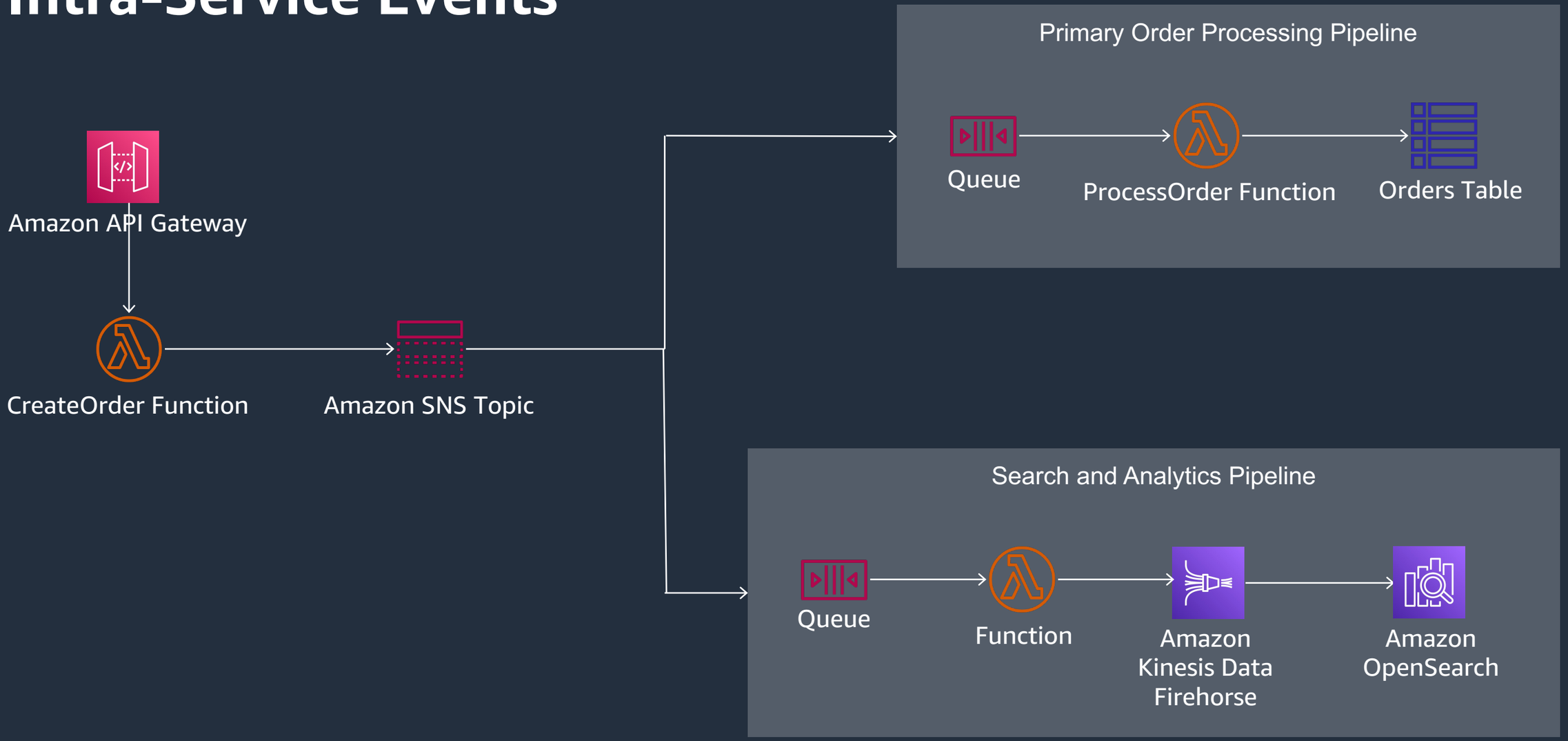
Intra-Service Events



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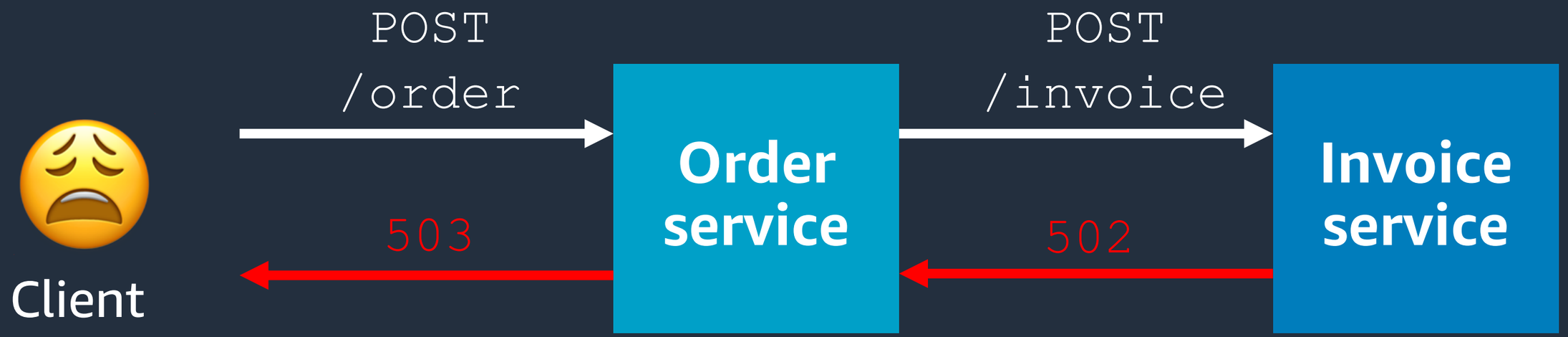
Downstream Failures



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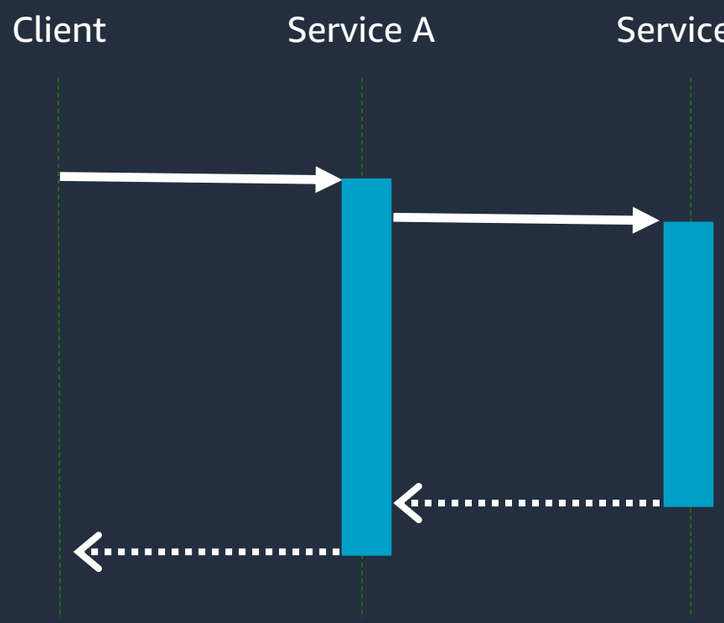
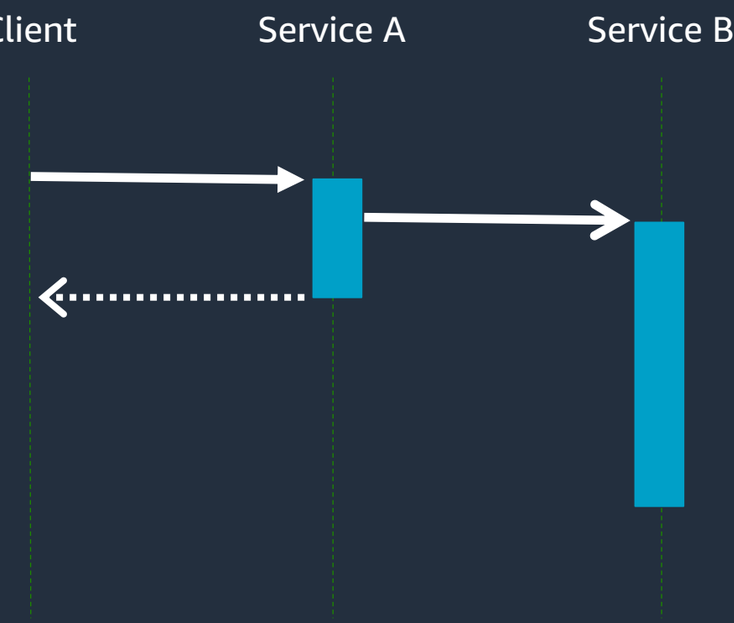
Events are asynchronous



Synchronous commands



Asynchronous events

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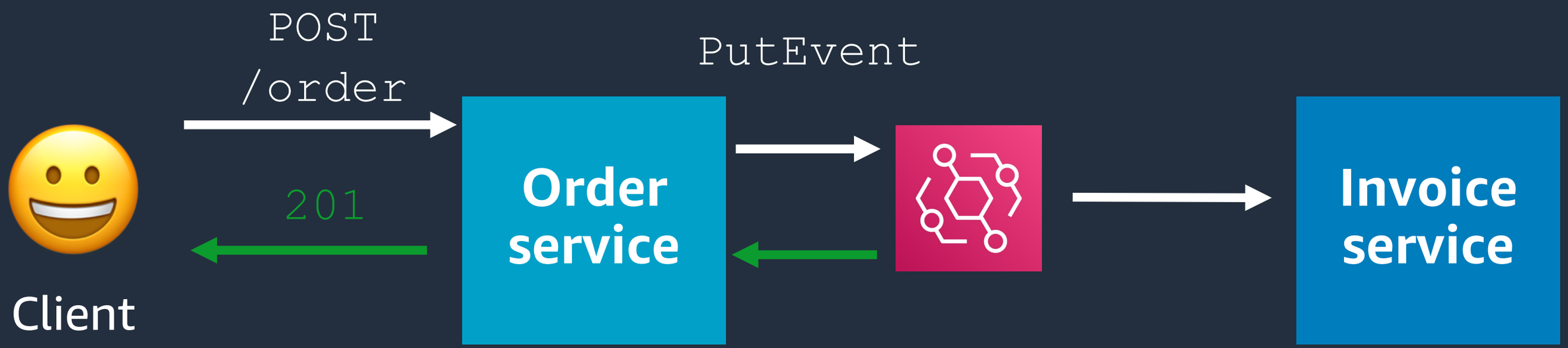
Asynchronous events



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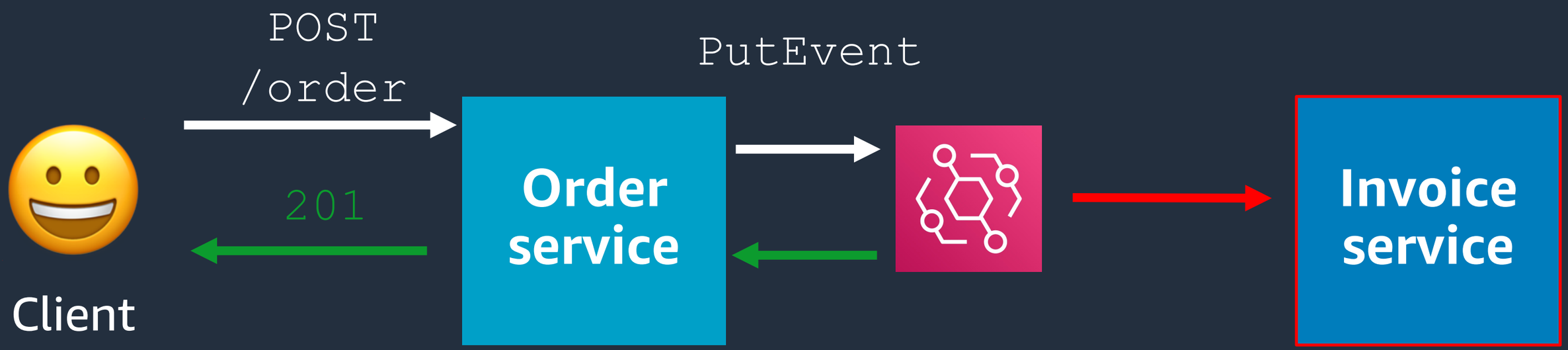
Asynchronous events



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But wait, now the customer won’t get their invoice!

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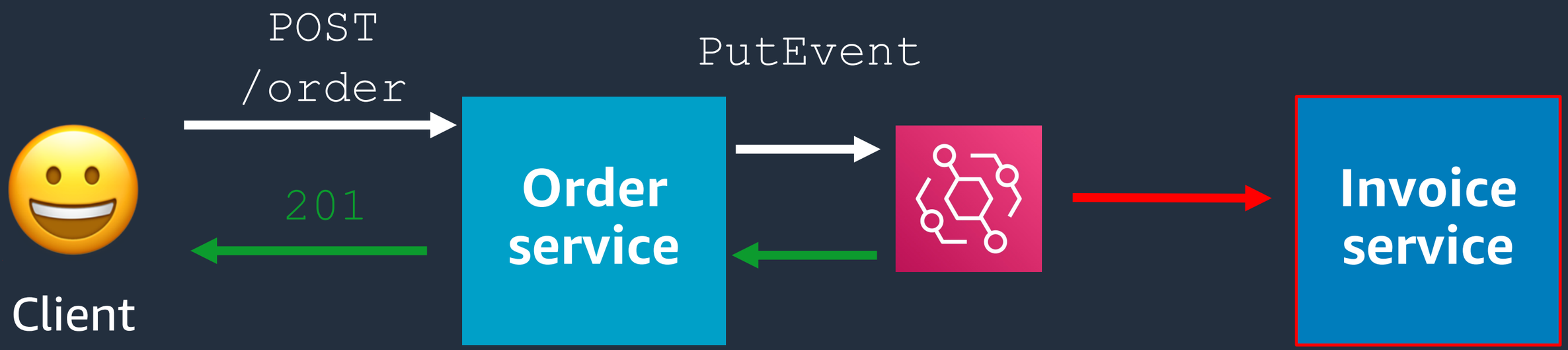
Asynchronous events



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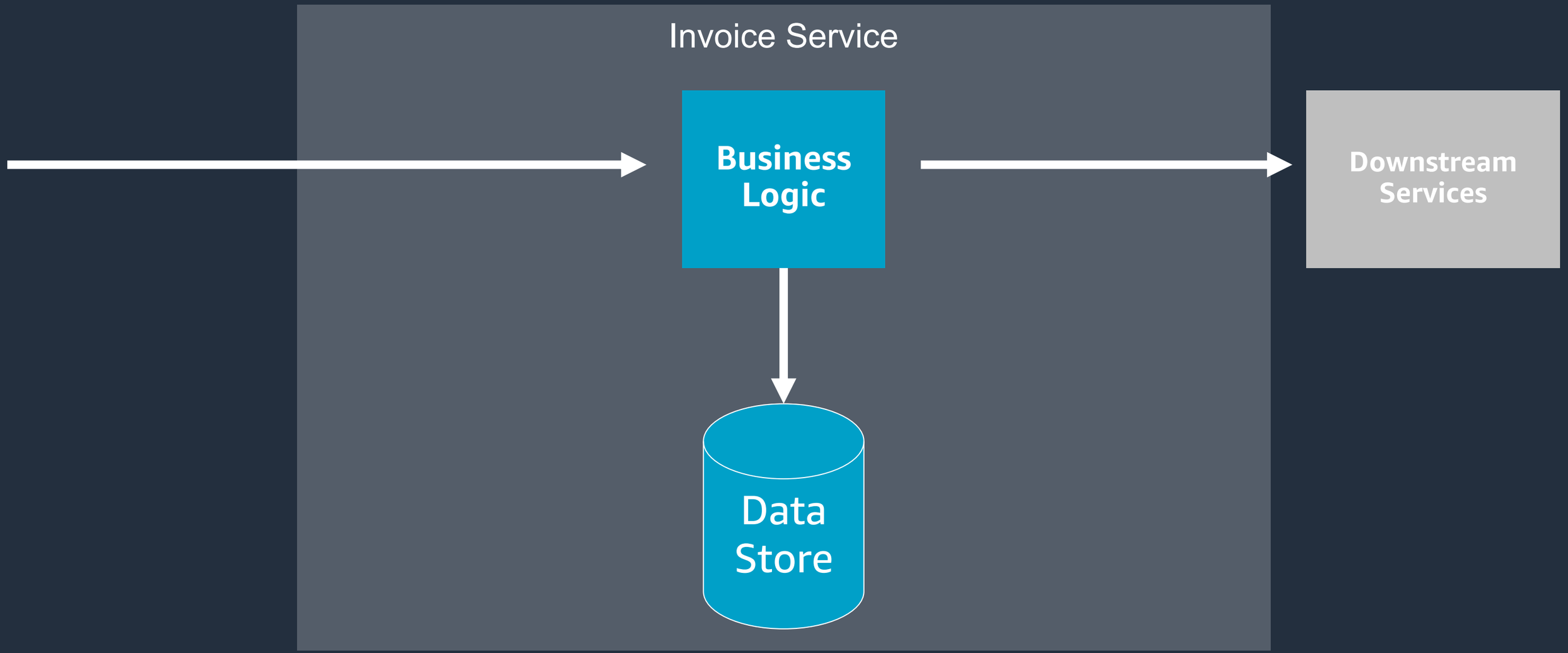
Inside the Invoice Service



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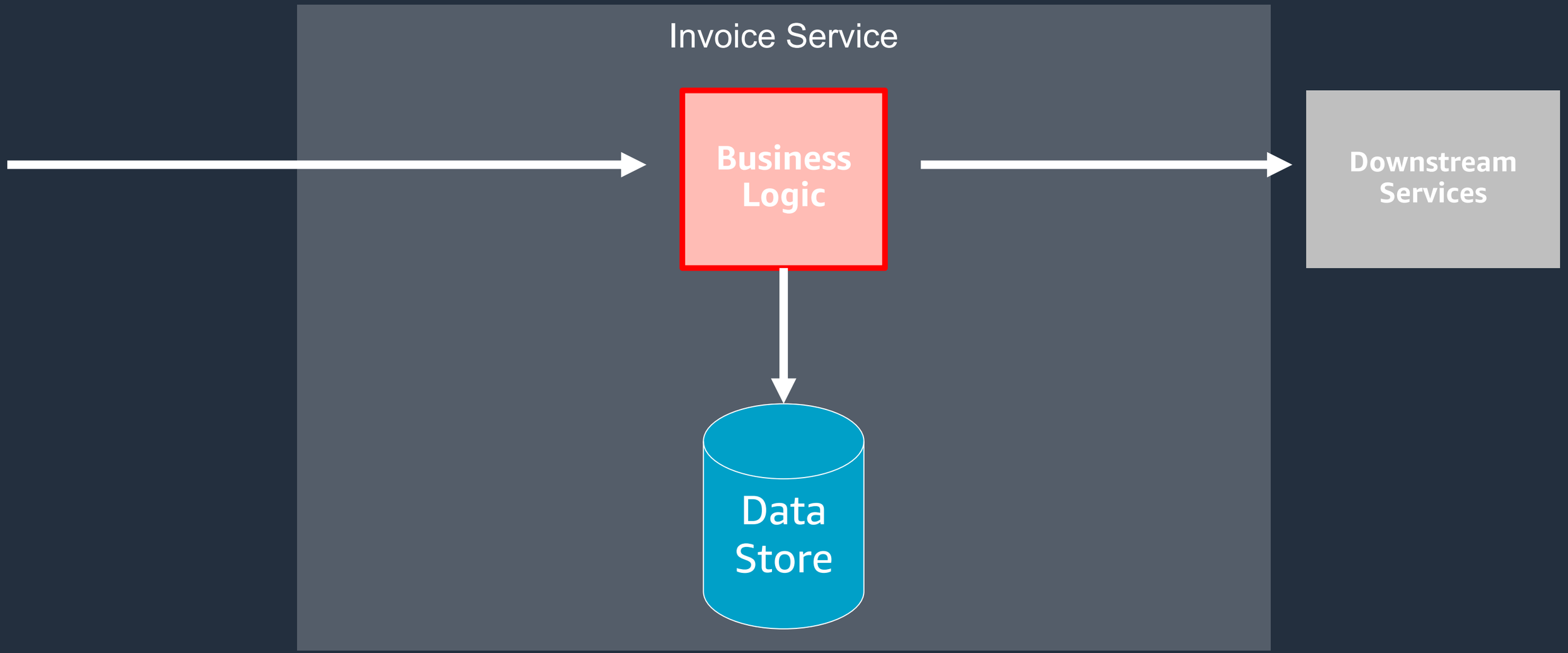
Inside the Invoice Service



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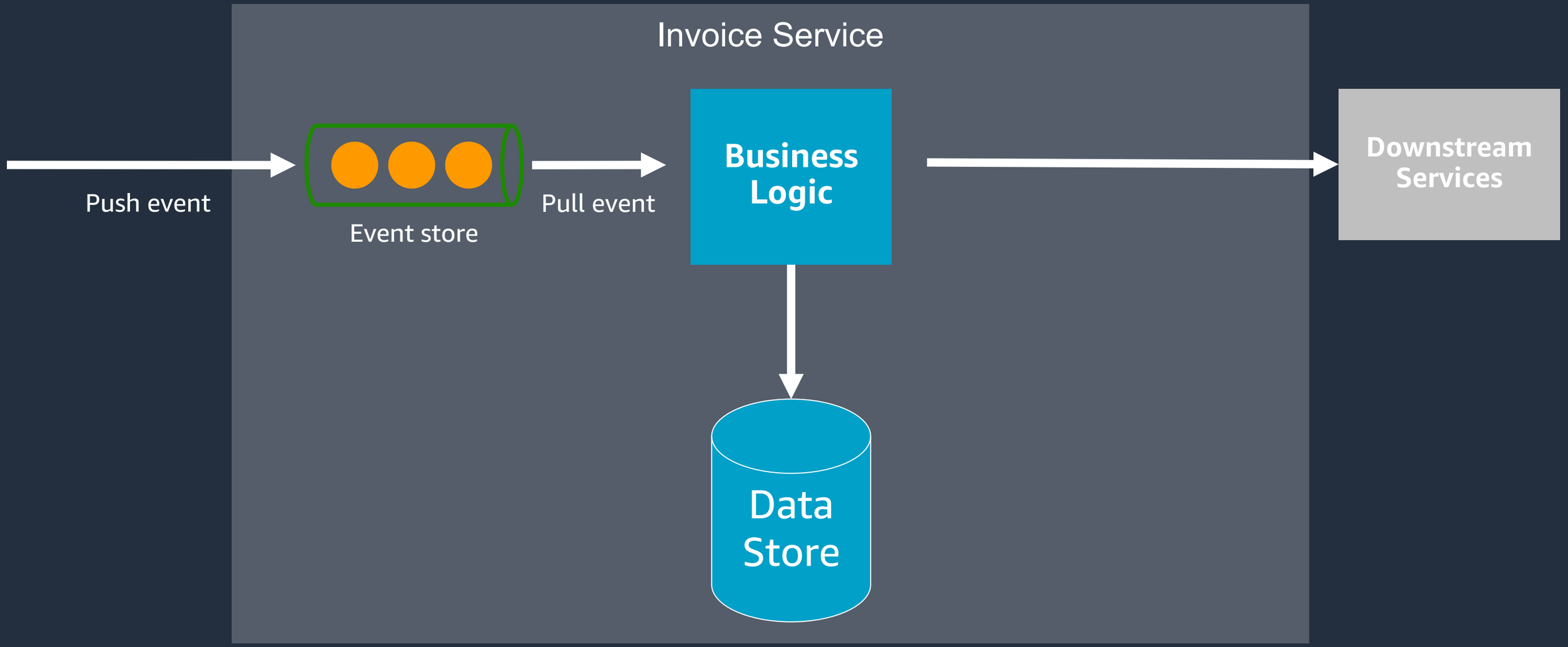
Inside the Invoice Service



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Event Stores in AWS

	AWS Native Service	Managed Open Source
Queues	 Amazon Simple Queue Service	 Amazon MQ
Streams	 Amazon Kinesis Data Streams	 Amazon MSK

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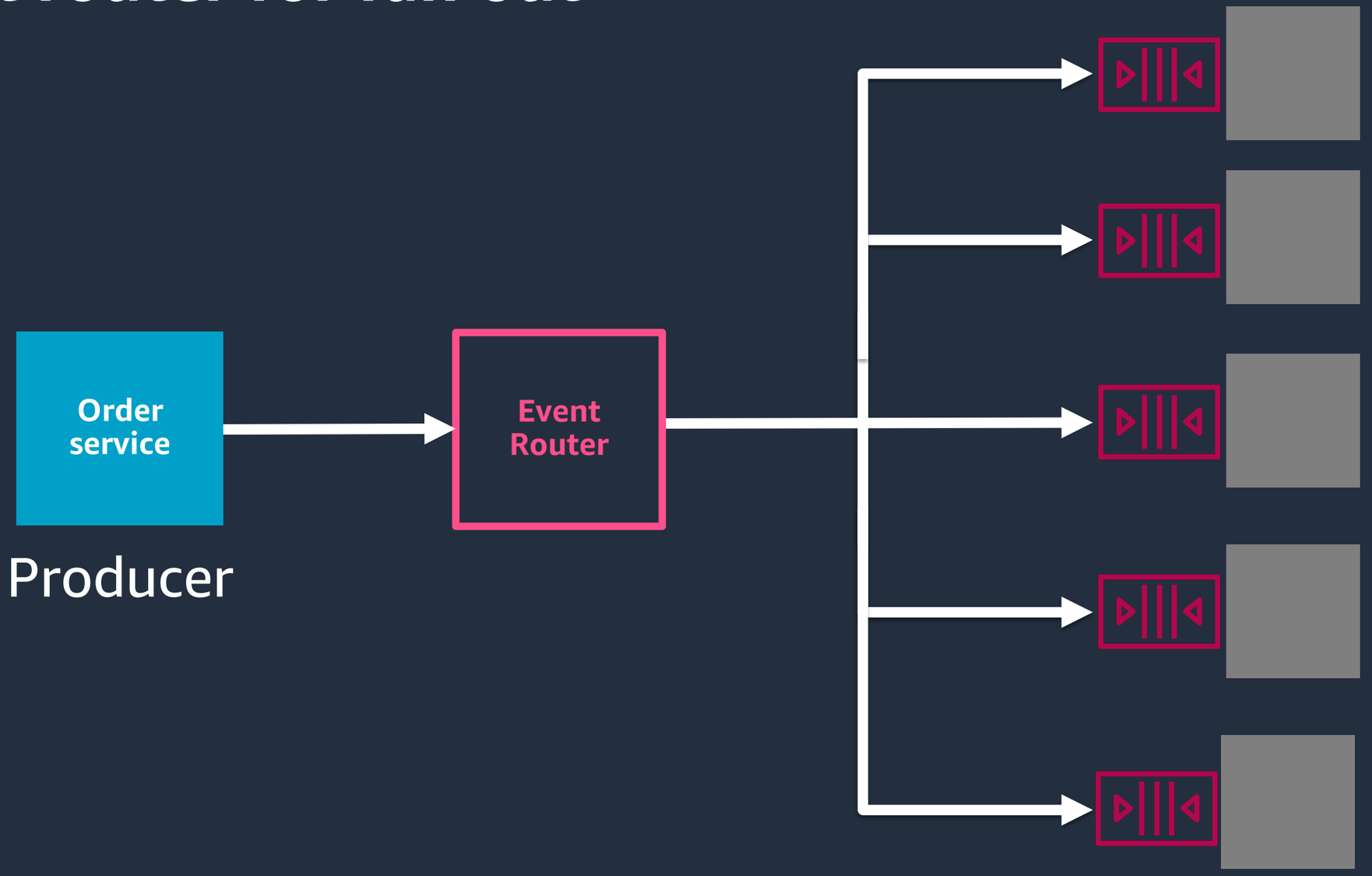
Event router for fan out



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Structuring Events

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Events vs. full state descriptions

Order 123 was created at 10:47 a.m. by customer 456

Events

Order 123 was created at 10:47 a.m. by customer 456. The current status is Open, the total was $237.51, the items were …

Full state description

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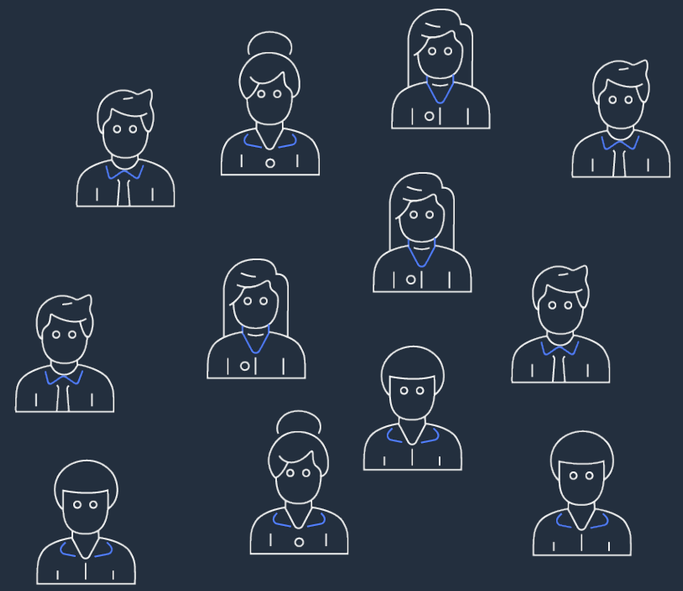
Considerations with sparse events

Order 123 was created by customer 456

What are the details for order 123?



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Versioning events

```
{
  "version": "1.0",
  "productId": "7ba35e6b",
  "salesPrice": 39.95,
  "costPrice": 18.76
}
```

```
{
  "version": "2.0",
  "productId": "7ba35e6b",
  "salesPrice": 3995,
  "costPrice": 1876
}
```

Original Version

New Version

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Anatomy of an event

```
{
    "version": "0",
    "id": "adeacade-c34c-ce58-c4a0-74f106398c4e",
    "account": "123456789012",
    "region": "us-east-1",
    "time": "2019-12-02T21:46:19Z",
    "source": "order-service",
    "detail-type": "New Order",
    "resources": [],
    "detail": {
        "orderId": "cfb2ae566f9b",
        "customerId": "C12345",
        ...
    }
}
```

Envelope metadata

Payload

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Anatomy of an event

```
{
    "version": "0",
    "id": "adeacade-c34c-ce58-c4a0-74f106398c4e",
    "account": "123456789012",
    "region": "us-east-1",
    "time": "2019-12-02T21:46:19Z",
    "source": "order-service",
    "detail-type": "New Order",
    "resources": [],
    "detail": {
        "orderId": "cfb2ae566f9b",
        "customerId": "C12345",
        ...
    }
}
```

Managed attributes

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Anatomy of an event

```
{
    "version": "0",
    "id": "adeacade-c34c-ce58-c4a0-74f106398c4e",
    "account": "123456789012",
    "region": "us-east-1",
    "time": "2019-12-02T21:46:19Z",
    "source": "order-service",
    "detail-type": "New Order",
    "resources": [],
    "detail": {
        "orderId": "cfb2ae566f9b",
        "customerId": "C12345",
        ...
    }
}
```

Service that created the event

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Anatomy of an event

```
{
    "version": "0",
    "id": "adeacade-c34c-ce58-c4a0-74f106398c4e",
    "account": "123456789012",
    "region": "us-east-1",
    "time": "2019-12-02T21:46:19Z",
    "source": "order-service",
    "detail-type": "New Order",
    "resources": [],
    "detail": {
        "orderId": "cfb2ae566f9b",
        "customerId": "C12345",
        ...
    }
}
```

Event type

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Anatomy of an event

```
{
    "version": "0",
    "id": "adeacade-c34c-ce58-c4a0-74f106398c4e",
    "account": "123456789012",
    "region": "us-east-1",
    "time": "2019-12-02T21:46:19Z",
    "source": "order-service",
    "detail-type": "New Order",
    "resources": [],
    "detail": {
        "orderId": "cfb2ae566f9b",
        "customerId": "C12345",
        ...
    }
}
```

Any valid JSON object

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Design Considerations

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Delivery semantics

At-least once delivery

Events can be delivered to a target more than once. Include logic to detect duplicate events by tracking the state of processed events (idempotent).

- Amazon EventBridge
- Amazon SNS Standard
- Amazon SQS Standard

Exactly-once delivery*

Specify an identifier used by the AWS service for deduplication.

- Amazon MQ
- Amazon MSK
- Amazon Kinesis
- Amazon SQS FIFO

** outside of application error handling*

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Ordering semantics*

Unordered

Events can be delivered out of order.

- Amazon EventBridge
- Amazon SNS Standard
- Amazon SQS Standard

Ordered

Events are delivered in order within a partition, message group, etc (no global order).

- Amazon MQ
- Amazon MSK
- Amazon Kinesis
- Amazon SQS FIFO

** Out-of-order event handling logic is highly a pplication specific. If the application cannot be designed to handle out-of-order events, consider orchestration instead.*

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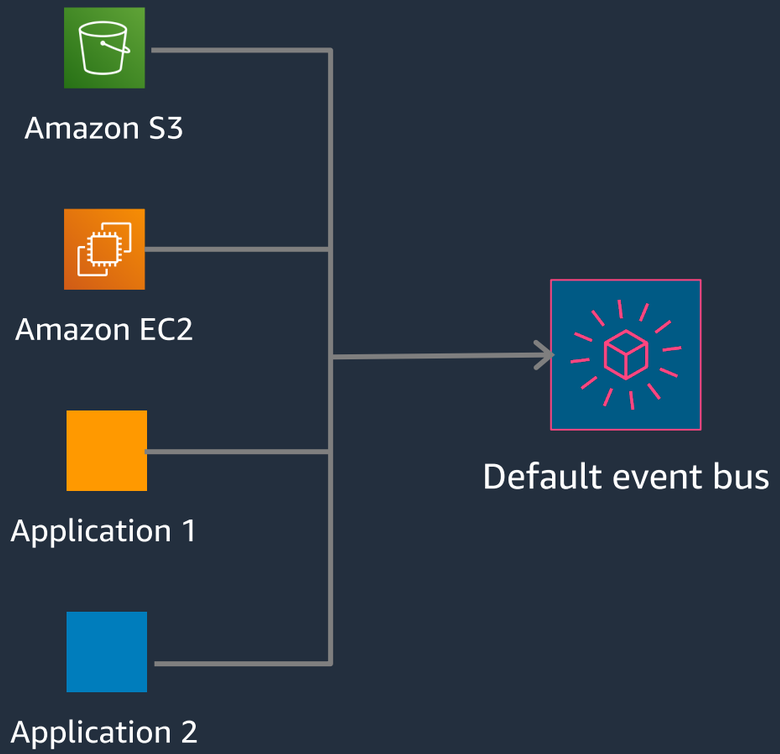
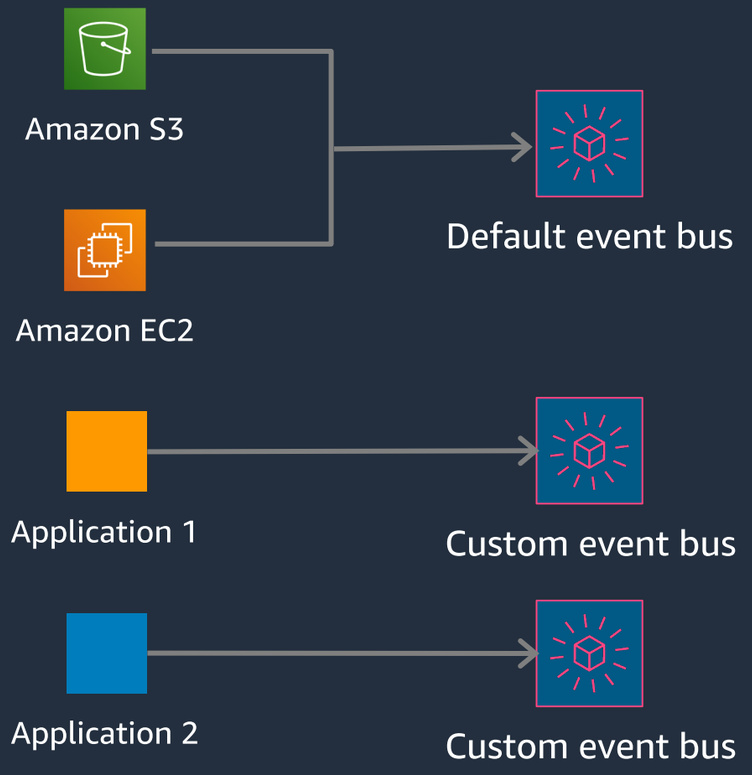
How many event buses should I have?





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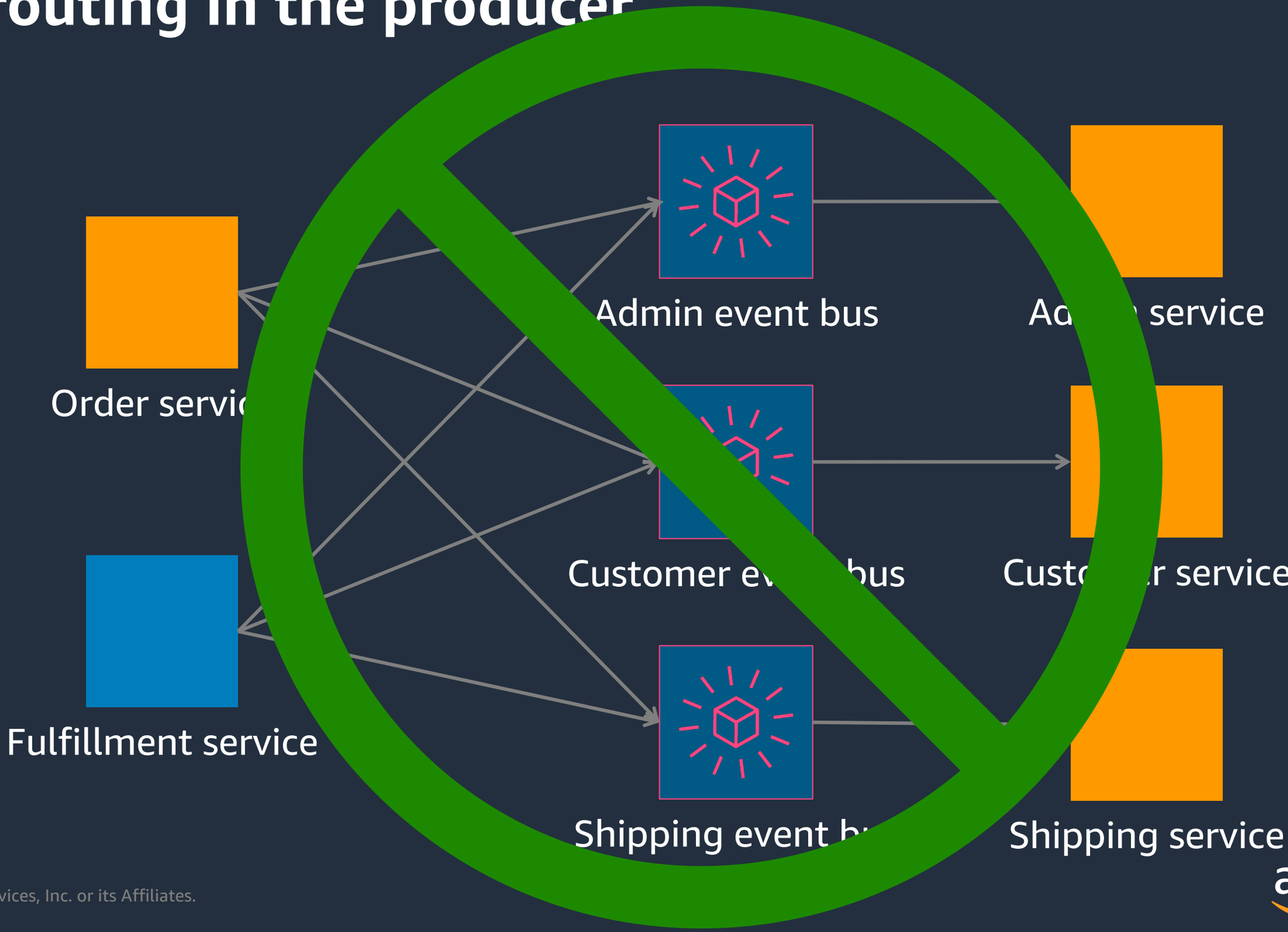
Avoid routing in the producer



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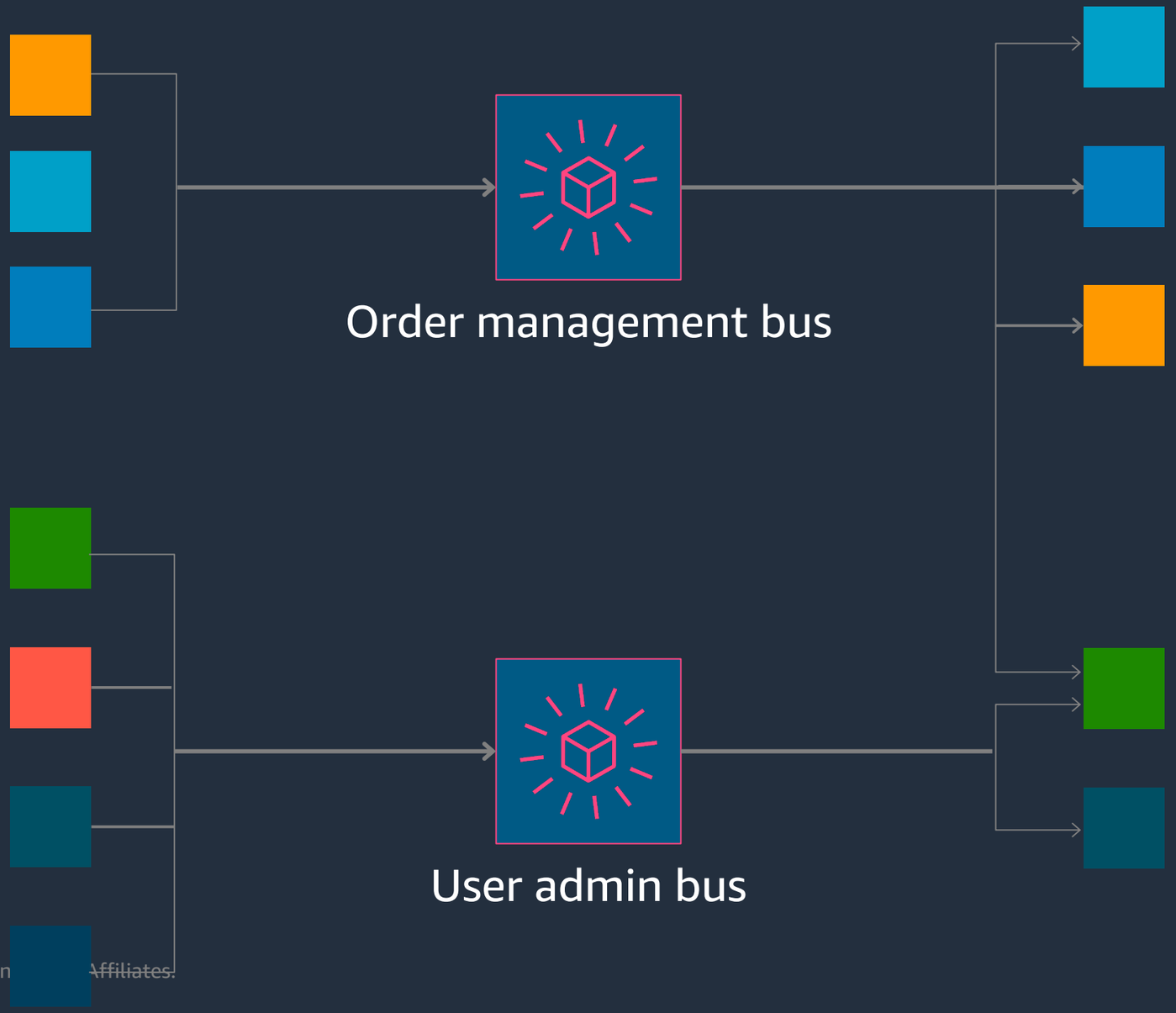
Event bus domain alignment



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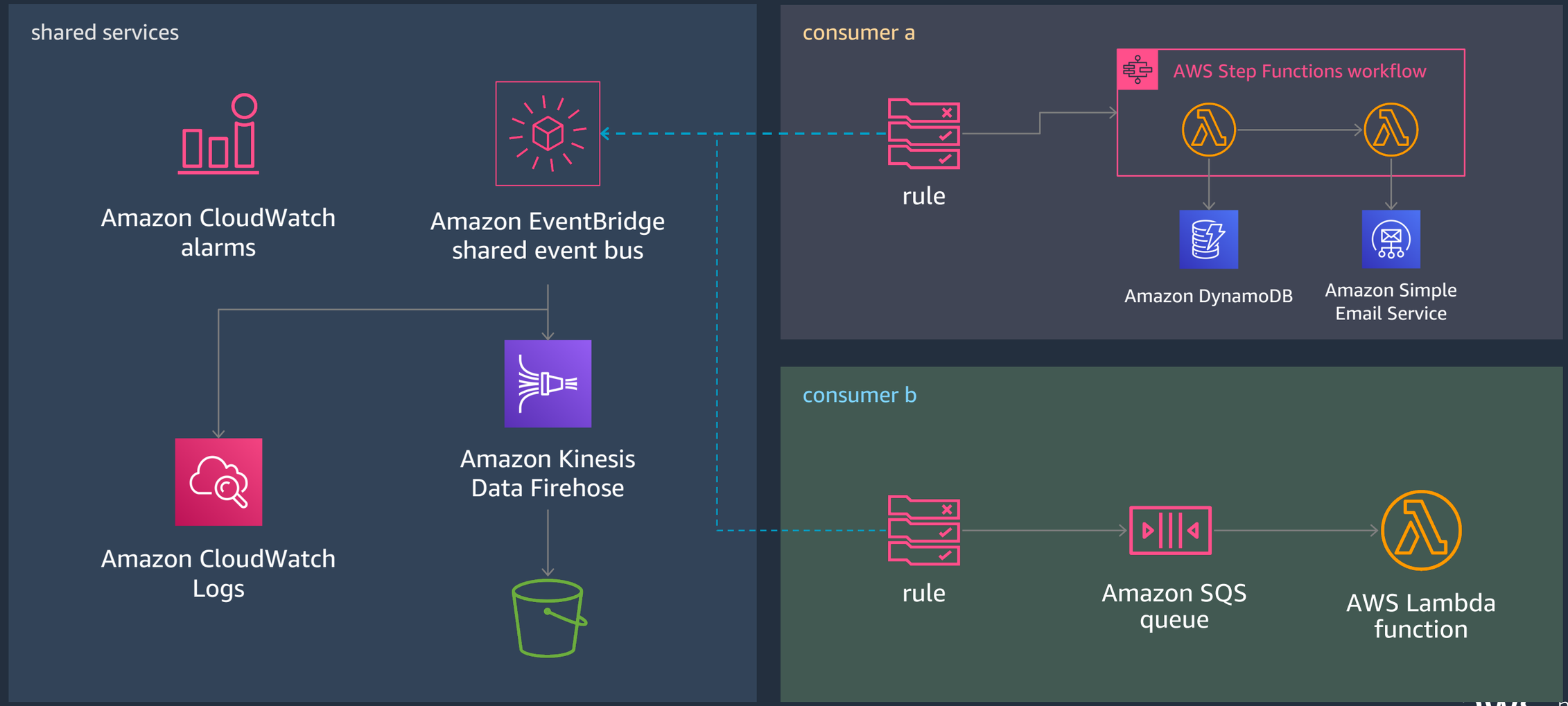
Event bus provisioning



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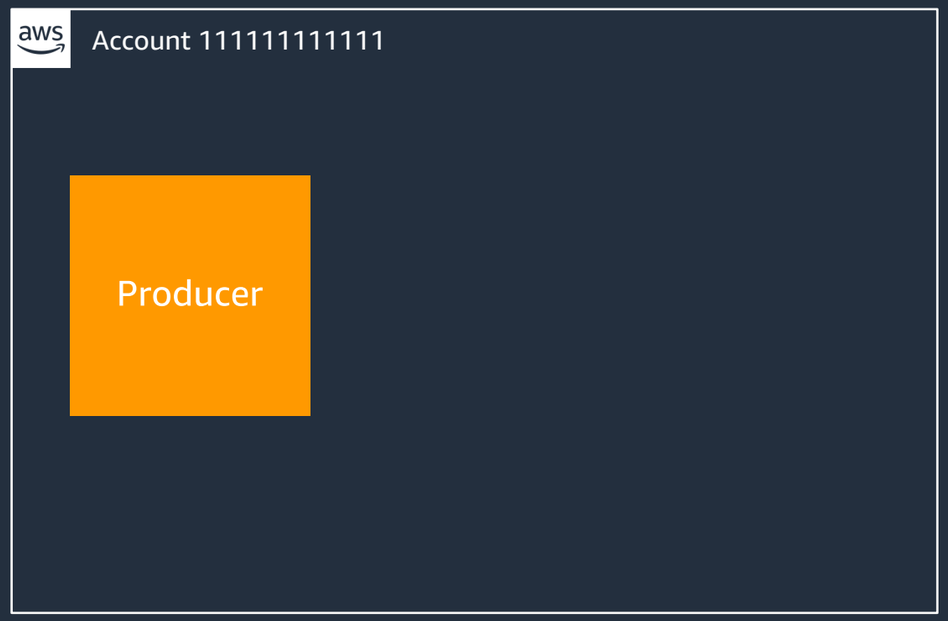
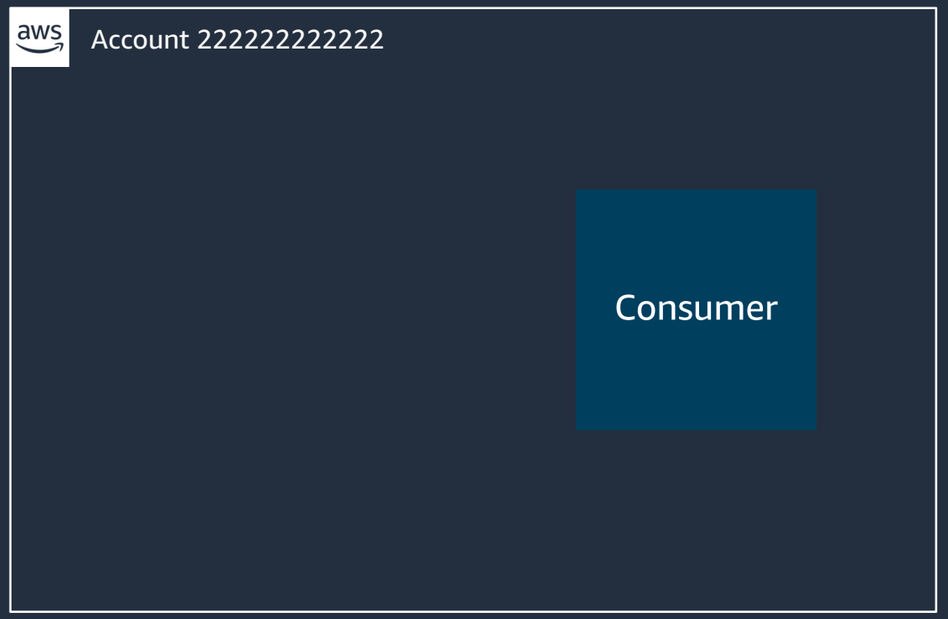
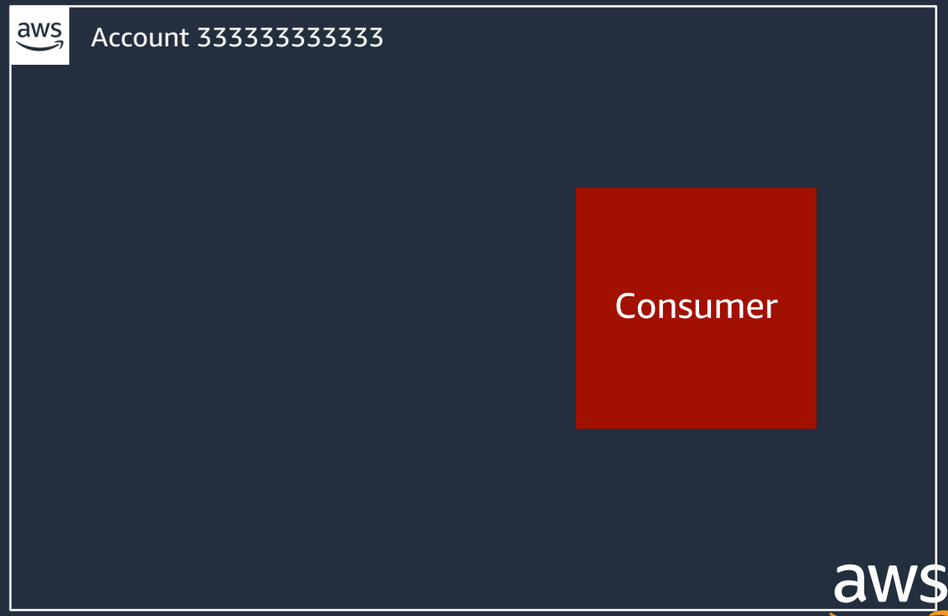
Cross-account events







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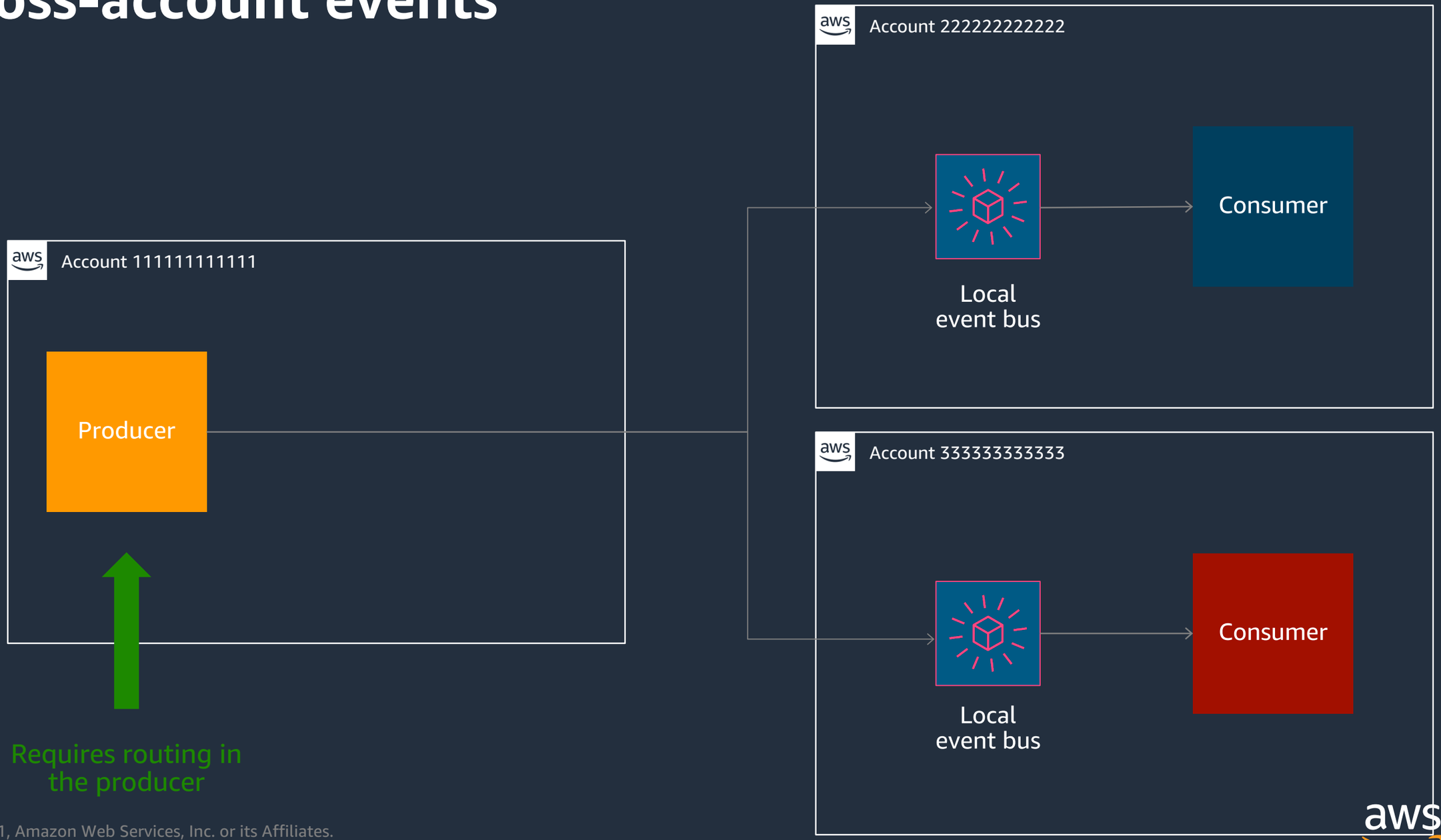
Cross-account events



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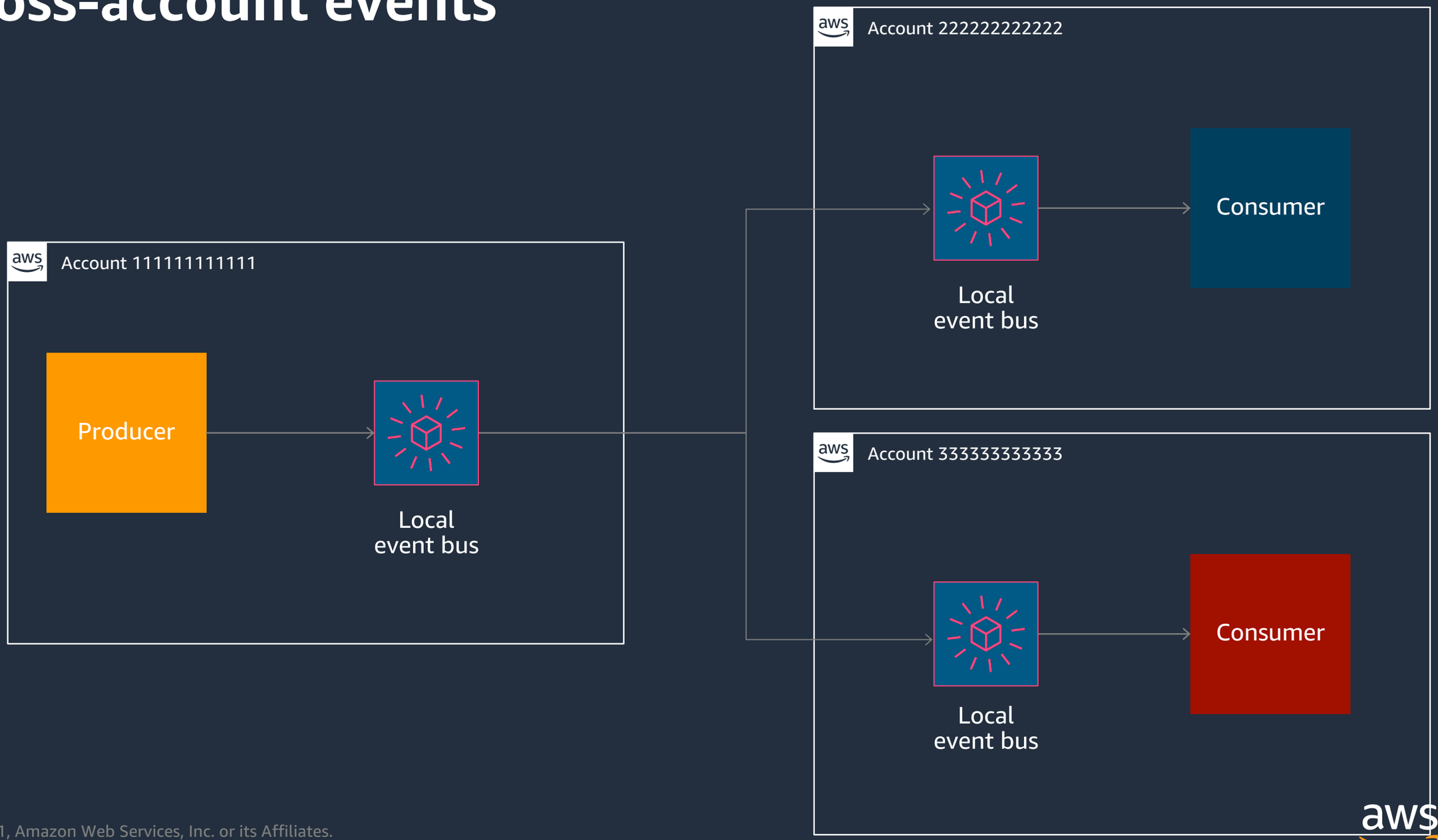
Cross-account events



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Demo

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Conclusion

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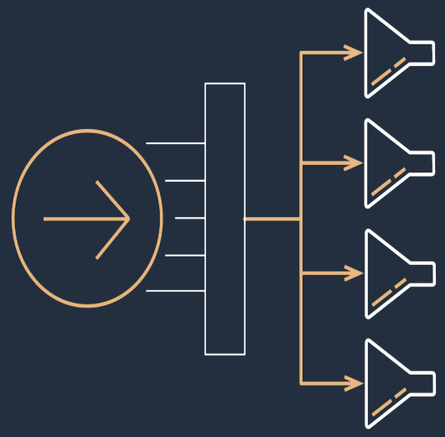
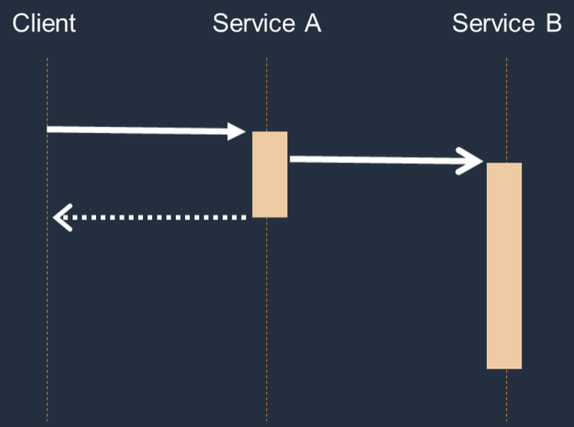
Event-driven architectures drive reliability and scalability



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

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Event-driven benefits

Scale and fail independently

Develop with agility

Audit with ease

Cut costs

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Thanks!

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