

How Event Driven Architectures Go Wrong and How to Fix Them

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Serverless GTM UKIR
Amazon Web Services



What are we trying to achieve with Event Driven Architectures?

EDA system goals



Organization
scalability



Agility



Faster
feedback loop

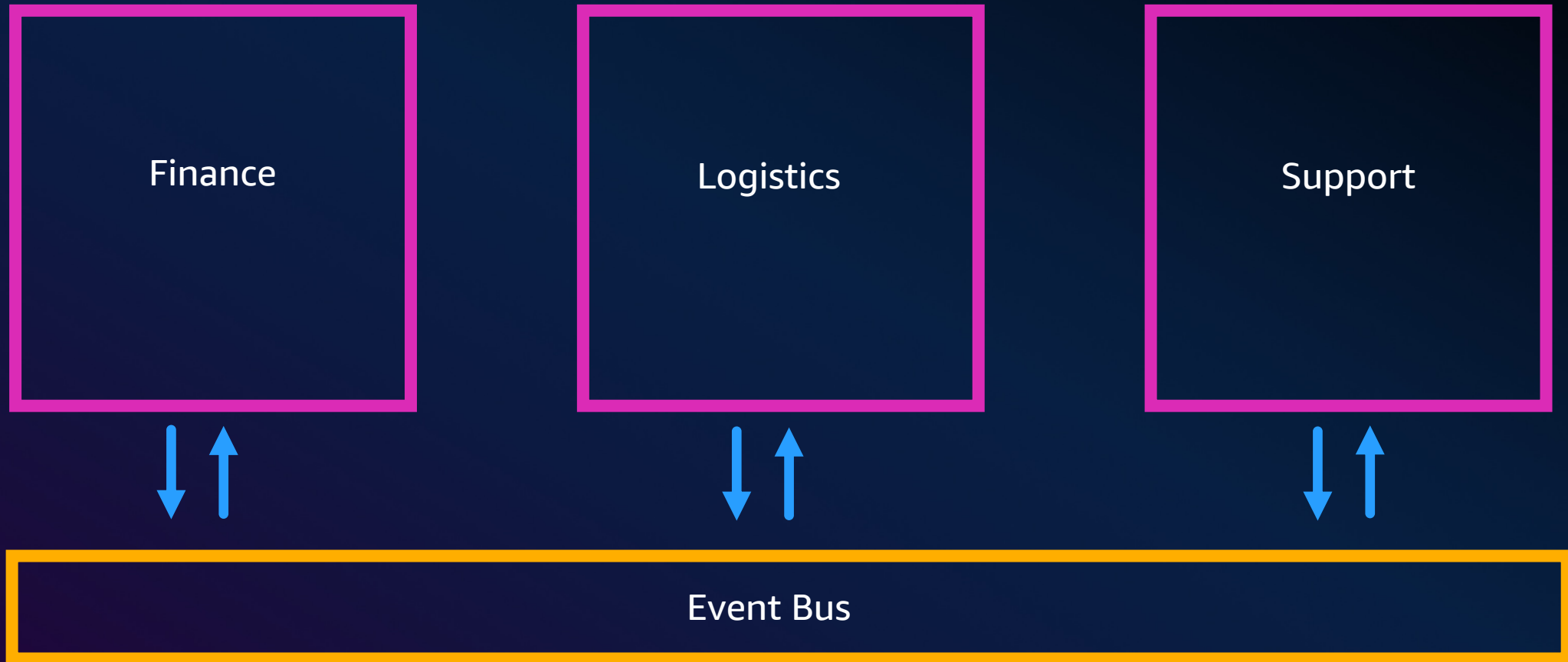


Reduce external
dependencies



Reducing
blast radius

Reduce coupling between teams



“

Ubiquitous Language is modeled within a limited context, where the terms and concepts of the business domain are identified, and there should be no ambiguity.

Felipe de Freitas Batista

The Domain Driven Design

What could possibly go wrong?

Hi 🖐️

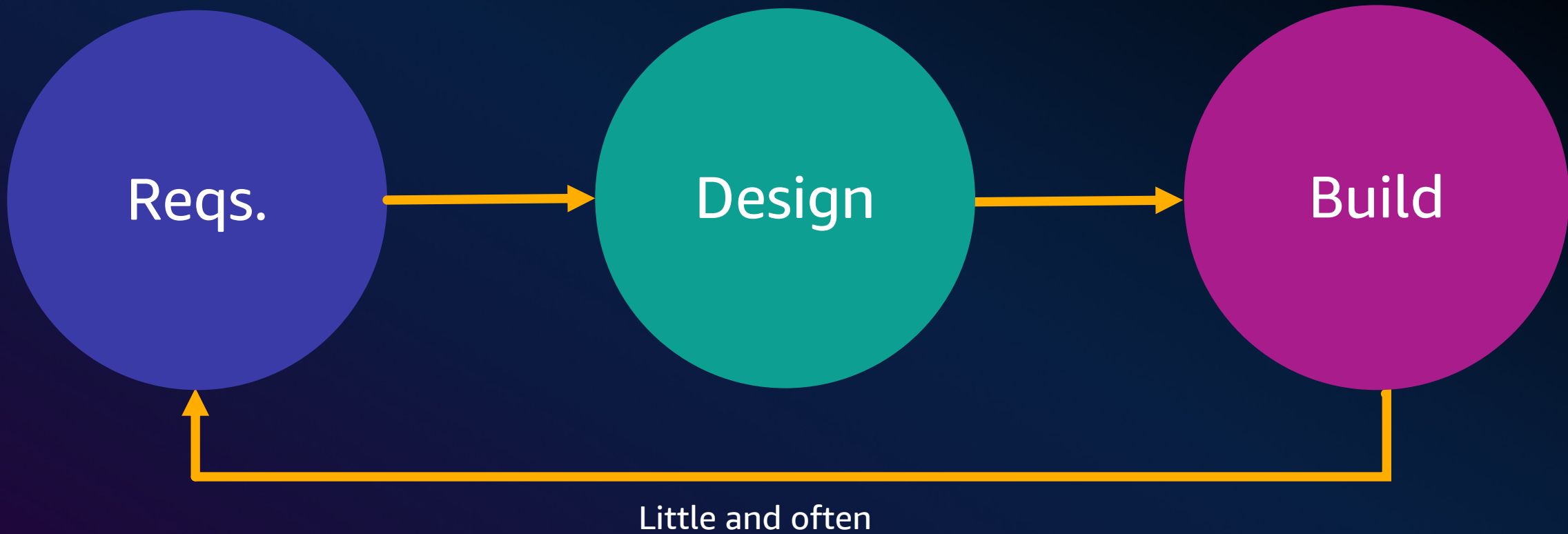
My name's Matt

Blue belt in Brazilian Jujitsu

Serverless stuff at AWS

Java Modernization, Serverless Platform Teams, EDA



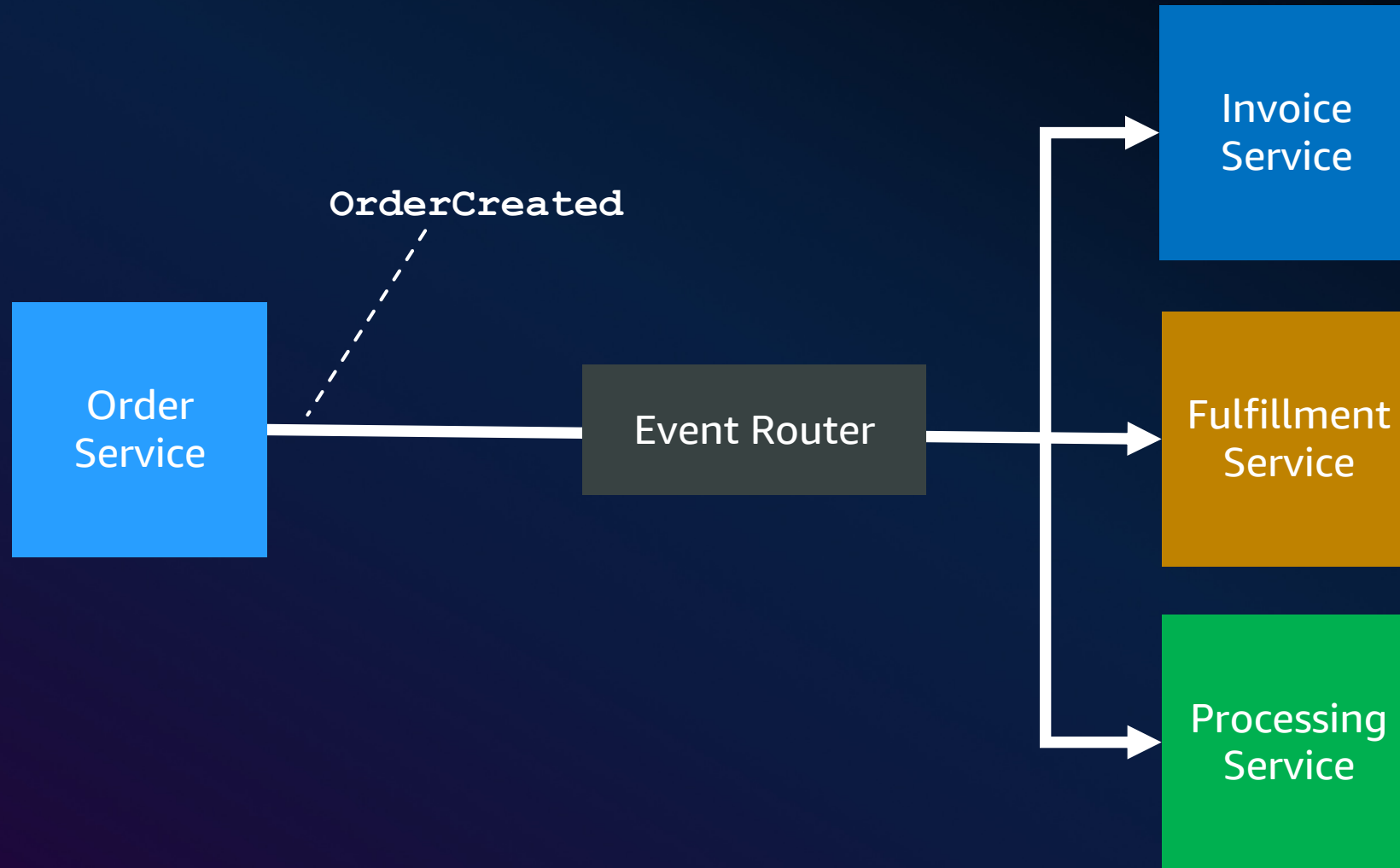


YOLO

YOLO Events



YOLO Events

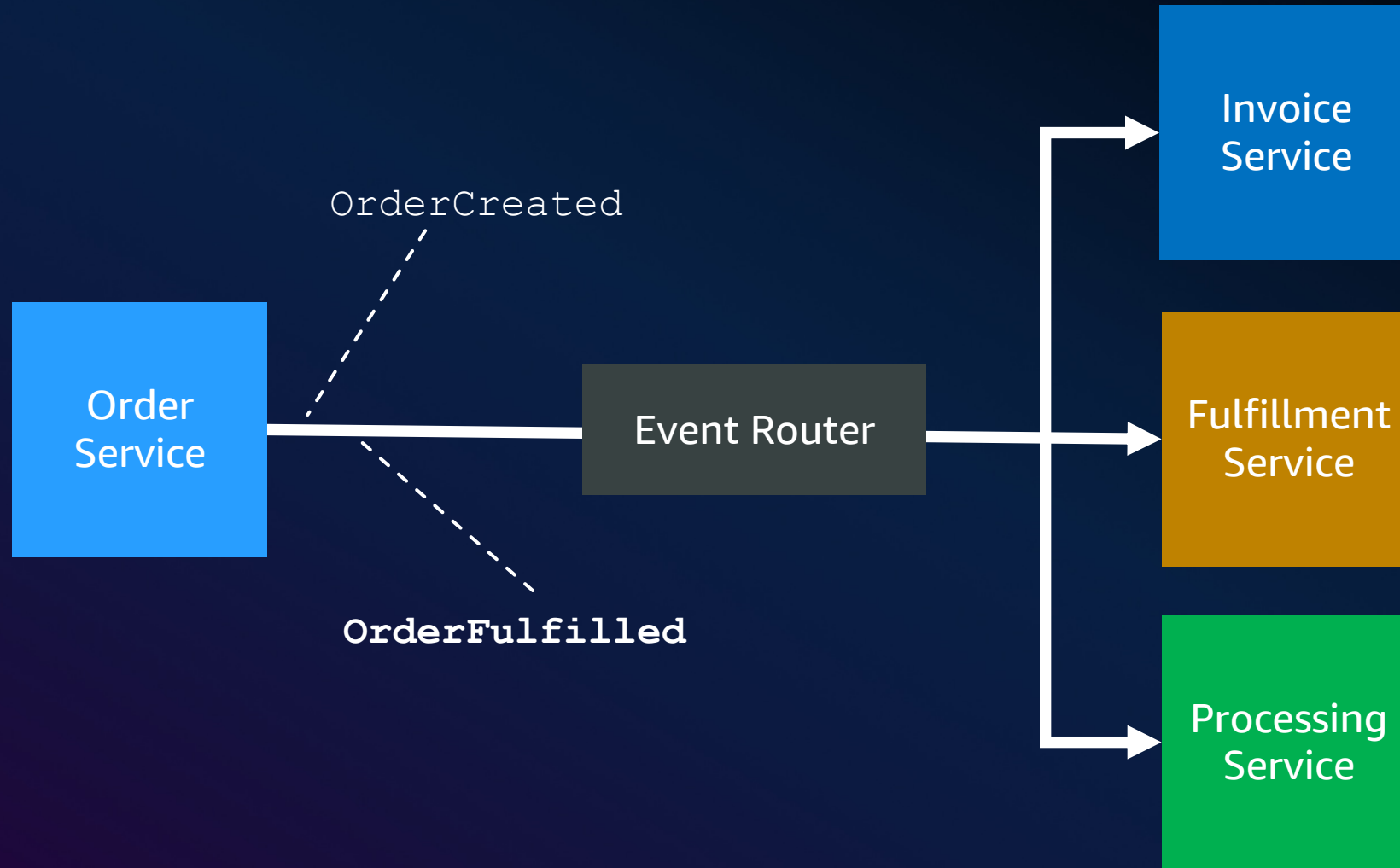


Order Created

```
{  
  "version": "1.0",  
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",  
  "detail-type": "OrderCreated",  
  "source": "com.orders",  
  "account": "123451235123",  
  "time": "2023-09-01T18:41:53Z",  
  "region": "eu-west-1",  
  "detail": {  
    "eventId": "e06d6321-806c-43da-9738-3a2161ac2788",  
    "orderId": "5cc7c7c3-536e-4311-aca6-19ea12177696",  
    "userId": "13f7861c-f1c6-4b00-b839-4f5db40574e1"  
  }  
}
```

Custom Data

YOLO Events



Order Fulfilled

```
{
  "version": "1.0",
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",
  "detail-type": "OrderFulfilled",
  "source": "com.orders",
  "account": "123451235123",
  "time": "2023-09-01T18:41:53Z",
  "region": "eu-west-1",
  "detail": {
    "metadata": {
      "idempotency-key": "e06d6321-806c-43da-9738-3a2161ac2788"
    },
    "data": {
      "order-id": "5cc7c7c3-536e-4311-aca6-19ea12177696",
      "user-id": "13f7861c-f1c6-4b00-b839-4f5db40574e1"
    }
  }
}
```

Order Fulfilled

```
{
  "version": "1.0",
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",
  "detail-type": "OrderFulfilled",
  "source": "com.orders",
  "account": "123451235123",
  "time": "2023-09-01T18:41:53Z",
  "region": "eu-west-1",
  "detail": {
    "metadata": {
      "idempotency-key": "e06d6321-806c-43da-9738-3a2161ac2788"
    },
    "data": {
      "order-id": "5cc7c7c3-536e-4311-aca6-19ea12177696",
      "user-id": "13f7861c-f1c6-4b00-b839-4f5db40574e1"
    }
  }
}
```

Split out metadata

Order Fulfilled

```
{
  "version": "1.0",
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",
  "detail-type": "OrderFulfilled",
  "source": "com.orders",
  "account": "123451235123",
  "time": "2023-09-01T18:41:53Z",
  "region": "eu-west-1",
  "detail": {
    "metadata": {
      "idempotency-key": "e06d6321-806c-43da-9738-3a2161ac2788"
    },
    "data": {
      "order-id": "5cc7c7c3-536e-4311-aca6-19ea12177696",
      "user-id": "13f7861c-f1c6-4b00-b839-4f5db40574e1"
    }
  }
}
```

Split out metadata

Added Idempotency Key

Order Fulfilled

```
{
  "version": "1.0",
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",
  "detail-type": "OrderFulfilled",
  "source": "com.orders",
  "account": "123451235123",
  "time": "2023-09-01T18:41:53Z",
  "region": "eu-west-1",
  "detail": {
    "metadata": {
      "idempotency-key": "e06d6321-806c-43da-9738-3a2161ac2788"
    },
    "data": {
      "order-id": "5cc7c7c3-536e-4311-aca6-19ea12177696",
      "user-id": "13f7861c-f1c6-4b00-b839-4f5db40574e1"
    }
  }
}
```

Split out metadata

Added Idempotency Key

Split out data

Order Fulfilled

```
{
  "version": "1.0",
  "id": "0d079340-135a-c8c6-95c2-41fb8f496c53",
  "detail-type": "OrderFulfilled",
  "source": "com.orders",
  "account": "123451235123",
  "time": "2023-09-01T18:41:53Z",
  "region": "eu-west-1",
  "detail": {
    "metadata": {
      "idempotency-key": "e06d6321-806c-43da-9738-3a2161ac2788"
    },
    "data": {
      "order-id": "5cc7c7c3-536e-4311-aca6-19ea12177696",
      "user-id": "13f7861c-f1c6-4b00-b839-4f5db40574e1"
    }
  }
}
```

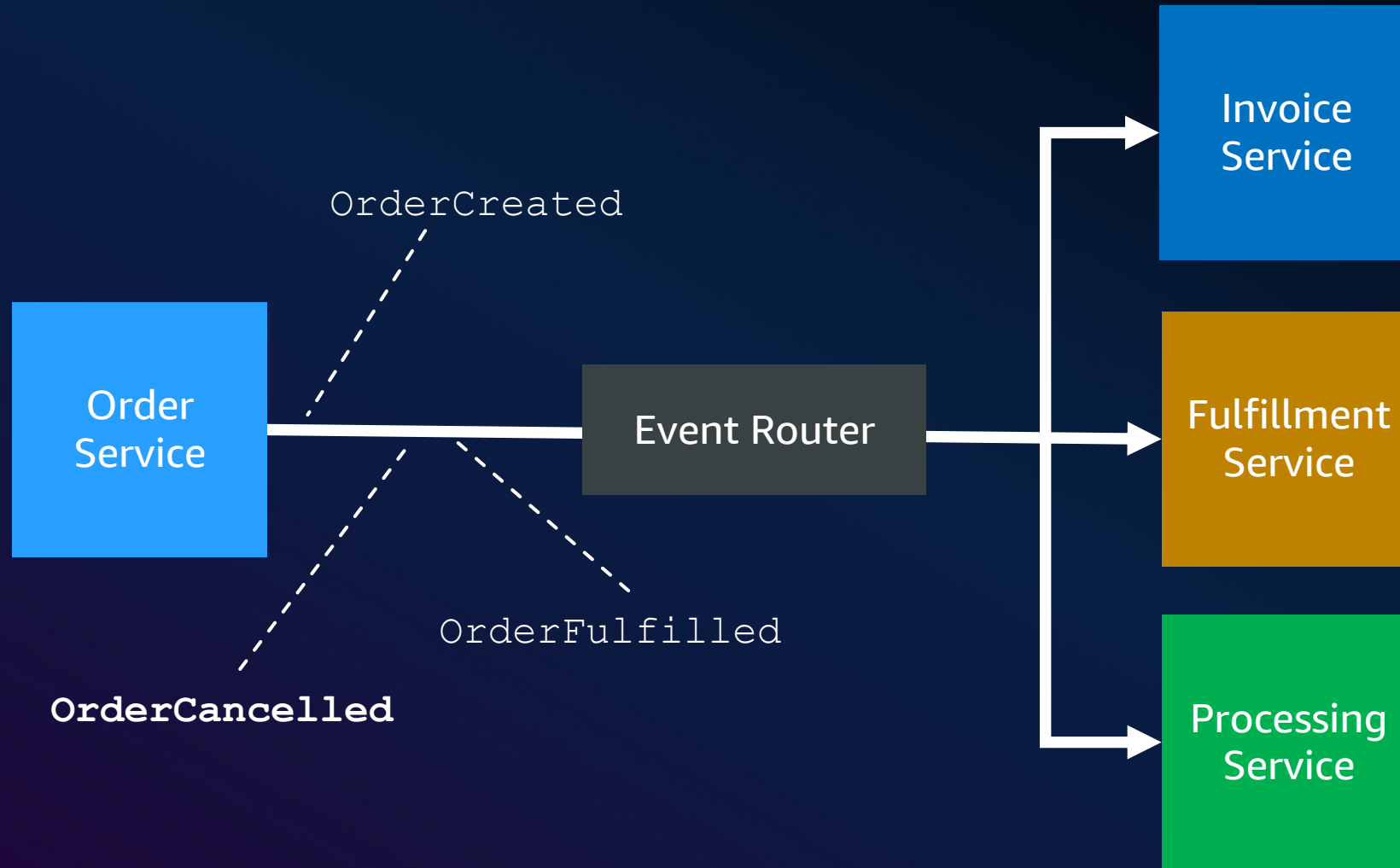
Split out metadata

Added Idempotency Key

Split out data

Hyphenated all keys

YOLO Events



Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Split out metadata ✓

Added Idempotency Key ✓

Split out data ✓

Hyphenated all keys ✓

Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Split out metadata ✓

Added Idempotency Key ✓

Split out data ✓

Hyphenated all keys ✓

Added type

Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Split out metadata ✓

Added Idempotency Key ✓

Split out data ✓

Hyphenated all keys ✓

Added type

Descriptive reason ???

Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Split out metadata ✓

Added Idempotency Key ✓

Split out data ✓

Hyphenated all keys ✓

Added type

Descriptive reason ???

Added user object

Order Cancelled

```
"detail": {  
  "metadata": {  
    "idempotency-key": "7b296913-5371-4ad0-8e3b-c99739e5f3bc"  
  },  
  "data": {  
    "id": "ed96e780-aa0c-4b98-9838-f01c487f80af",  
    "type": "T_W",  
    "cancellation-reason": "No longer needed",  
    "user": {  
      "id": "fde5698e-157a-4838-8a6f-51ce8c1e9227",  
      "first-name": "Matthew",  
      "surname": "Meckes"  
    }  
  }  
}
```

Split out metadata ✓

Added Idempotency Key ✓

Split out data ✓

Hyphenated all keys ✓

Added type

Descriptive reason ???

Added user object

Hyphenate first name

YOLO events

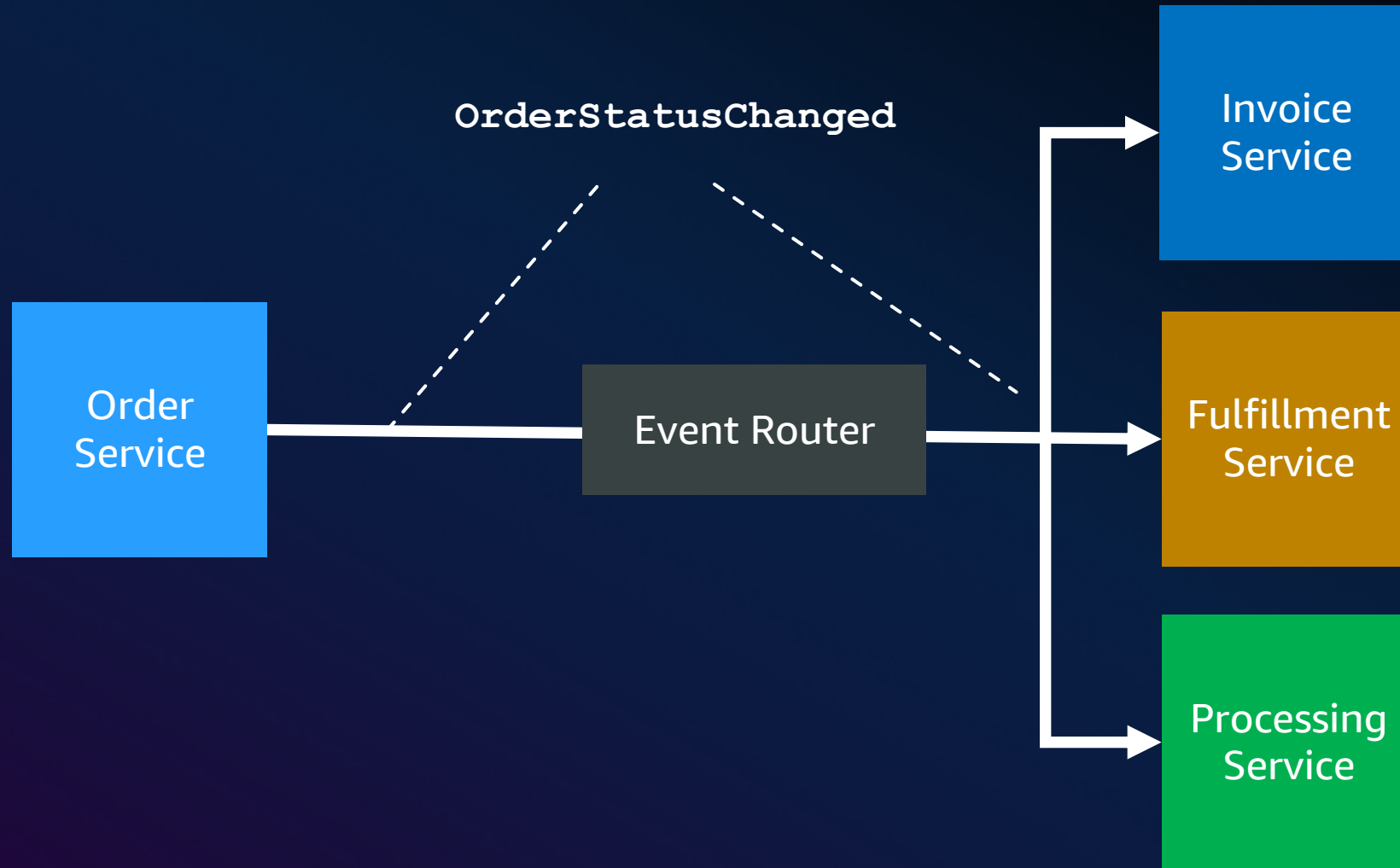
- Define and document standards and conventions
 - Capture in your Architecture Decision Record
- Have a process to review and ratify new event schemas
 - Schema RFC process
- Start with smaller sparse events
- Plan version update process
 - Avoid breaking changes until all consumers move to the new version
- Invest in maintenance



God Events



Event created whenever an entity changes status



God event

- Too much information in an event
- Knows too much about implementation details
- Many systems produce and consume the same event schema
- Difficult to maintain because changes introduce side effects
- Developers make “additive” changes to avoid refactoring

```
1 {
2   "version": "1.0",
3   "id": "cff53a87-cb53-441e-8c71-7c7c16a5f098",
4   "detail-type": "OrderStatusChanged",
5   "source": "com.order",
6   "account": "123451235123",
7   "time": "2023-09-01T18:41:53Z",
8   "region": "eu-west-1",
9   "detail": {
10    "metadata": {
11      "idempotency-key": "743cabdd-33dc-42d8-b1a2-52ea25256d4e"
12    },
13    "data": {
14      "id": "ed96e780-aa8c-4b98-9838-f01c487f80af",
15      "order-total": "2512.50",
16      "products": [
17        {
18          "body_html": "It's the small iPod with a big idea: Video.",
19          "created_at": "2012-02-15T15:12:21-05:00",
20          "handle": "ipod-nano",
21          "id": 632910392,
22          "images": [
23            {
24              "id": 850703190,
25              "product_id": 632910392,
26              "position": 1,
27              "created_at": "2018-01-08T12:34:47-05:00",
28              "updated_at": "2018-01-08T12:34:47-05:00",
29              "width": 110,
30              "height": 140,
31              "src": "http://example.com/burton.jpg",
32              "variant_ids": [
33                {}
34              ]
35            }
36          ],
37          "options": {
38            "id": 594680422,
39            "product_id": 632910392,
40            "name": "Color",
41            "position": 1,
42            "values": [
43              "Pink",
44              "Red",
45              "Green",
46              "Black"
47            ]
48          },
49          "product_type": "Cult Products",
50          "published_at": "2007-12-31T19:00:00-05:00",
51          "published_scope": "global",
52          "status": "active",
53          "tags": "Emotive, Flash Memory, MP3, Music",
54          "template_suffix": "special",
55          "title": "iPod Nano - 8GB",
56          "updated_at": "2012-08-24T14:01:47-04:00",
57          "variants": [
58            {
59              "barcode": "1234_pink",
60              "compare_at_price": null,
61              "created_at": "2012-08-24T14:01:47-04:00",
62              "fulfillment_service": "manual",
63              "grams": 567,
64              "weight": 0.2,
65              "weight_unit": "kg",
66              "id": 808950810,
67              "inventory_item_id": 341629,
68              "inventory_management": "shopify",
69              "inventory_policy": "continue",
70              "inventory_quantity": 10,
71              "option1": "Pink",
72              "position": 1,
73              "price": 199.99,
74              "product_id": 632910392,
75              "requires_shipping": true,
76              "sku": "IP002008PINK",
77              "taxable": true,
78              "title": "Pink",
79              "updated_at": "2012-08-24T14:01:47-04:00"
80            }
81          ],
82          "vendor": "Apple"
83        },
84        {
85          "weight": "1283",
86          "channel": "marketplace",
87          "channel": "channelD"
```

```

32      {}
33    ]
34  }
35 ],
36 "options": {
37   "id": 594680422,
38   "product_id": 632910392,
39   "name": "Color",
40   "position": 1,
41   "values": [
42     "Pink",
43     "Red",
44     "Green",
45     "Black"
46   ]
47 },
48 "product_type": "Cult Products",
49 "published_at": "2007-12-31T19:00:00-05:00",
50 "published_scope": "global",
51 "status": "active",
52 "tags": "Emotive, Flash Memory, MP3, Music",
53 "template_suffix": "special",
54 "title": "iPod Nano - 8GB",
55 "updated_at": "2012-08-24T14:01:47-04:00",
56 "variants": [
57   {
58     "barcode": "1234_pink",
59     "compare_at_price": null,
60     "created_at": "2012-08-24T14:01:47-04:00",
61     "fulfillment_service": "manual",
62     "grams": 567,
63     "weight": 0.2,
64     "weight_unit": "kg",
65     "id": 808950810,
66     "inventory_item_id": 341629,
67     "inventory_management": "shopify",
68     "inventory_policy": "continue",
69     "inventory_quantity": 10,
70     "option1": "Pink",
71     "position": 1,
72     "price": 199.99,
73     "product_id": 632910392,
74     "requires_shipping": true,
75     "sku": "IP007000011K",
76     "taxable": true,
77     "title": "Pink",
78     "updated_at": "2012-08-24T14:01:47-04:00"
79   }
80 ],
81 "vendor": "Apple"
82 },
83 "weight": "1203",
84 "channel": "marketplace",
85 "status": "shipped",
86 "fulfillment": {

```

Product data

```

70     "inventory_quantity": 10,
71     "option1": "Pink",
72     "position": 1,
73     "price": 199.99,
74     "product_id": 632910392,
75     "requires_shipping": true,
76     "sku": "IPOD2008PINK",
77     "taxable": true,
78     "title": "Pink",
79     "updated_at": "2012-08-24T14:01:47-04:00"
80   },
81   "vendor": "Apple"
82 },
83 "weight": "1203",
84 "channel": "marketplace",
85 "status": "shipped",
86 "fulfillment": {
87   "created_at": "2012-03-13T16:09:54-04:00",
88   "id": 255858046,
89   "line_items": [
90     {
91       "id": 466157049,
92       "variant_id": 39072856,
93       "title": "iPod Nano - 8gb",
94       "quantity": 1,
95       "price": "199.00",
96       "grams": 200,
97       "sku": "IPOD2008GREEN",
98       "variant_title": "green",
99       "vendor": null,
100      "fulfillment_service": "manual",
101      "product_id": 632910392,
102      "requires_shipping": true,
103      "taxable": true,
104      "gift_card": false,
105      "name": "iPod Nano - 8gb - green",
106      "variant_inventory_management": "shopify",
107      "properties": [],
108      "product_exists": true,
109      "fulfillable_quantity": 1,
110      "total_discount": "0.00",
111      "fulfillment_status": null,
112      "fulfillment_line_item_id": 274098237,
113      "tax_lines": [],
114      "duties": [
115        {
116          "id": "2",
117          "harmonized_system_code": "520300",
118          "country_code_of_origin": "CA",
119          "shop_money": {
120            "amount": "164.86",
121            "currency_code": "CAD"
122          },
123          "presentment_money": {
124            "amount": "105.31",

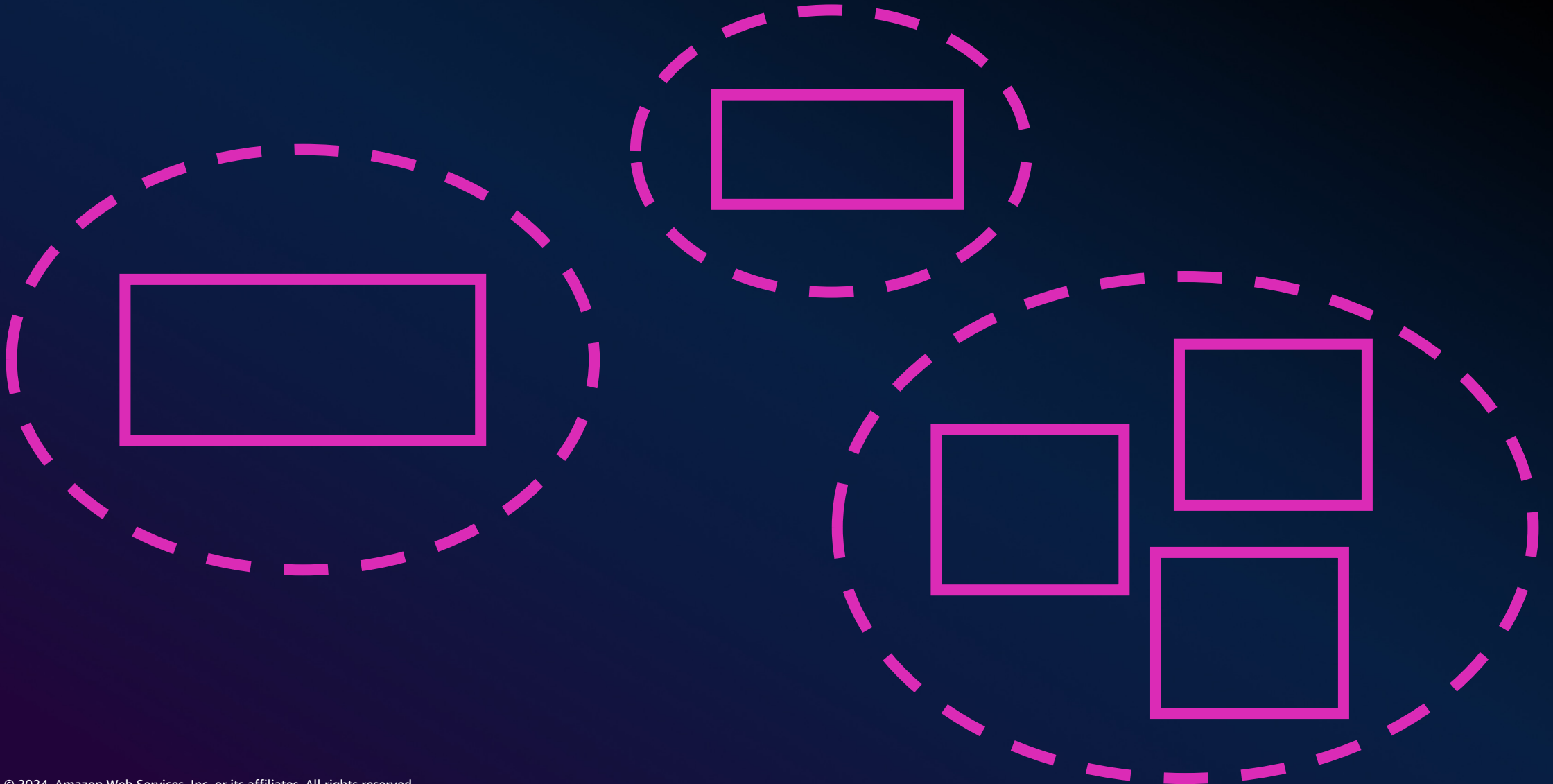
```

Fulfilment data

Support data

```
12 "order_id": 450789469,  
13 "origin_address": [  
14   {  
15     "address1": "1 Rue des Carrieres",  
16     "address2": "Suite 1234",  
17     "city": "Montreal",  
18     "country_code": "CA",  
19     "province_code": "QC",  
20     "zip": "G1R 4P5"  
21   }  
22 ],  
23 "receipt": {  
24   "testcase": true,  
25   "authorization": "123456"  
26 },  
27 "service": "manual",  
28 "shipment_status": "confirmed",  
29 "status": "failure",  
30 "tracking_company": "China Post",  
31 "tracking_numbers": [  
32   "112345Z2345",  
33   "1Z001985Yw99744790"  
34 ],  
35 "tracking_number": "112345Z2345",  
36 "tracking_urls": [  
37   "http://track-chinapost.com/startairmail.php?code=112345Z2345",  
38   "http://wwwapps.ups.com/etracking/tracking.cgi?InquiryNumber1=1Z001985Yw99744790&TypeOfInquiryNumber=T&AcceptUPSLicenseAgreement=yes&submit=Track"  
39 ],  
40 "tracking_url": "http://track-chinapost.com/startairmail.php?code=112345Z2345",  
41 "updated_at": "2012-05-01T14:22:25-04:00",  
42 "variant_inventory_management": "shopify"  
43 },  
44 "support-tickets": [  
45   {  
46     "id": "9f873919-f0c5-4a83-89b6-9c91b266df67",  
47     "title": "support 1",  
48     "status": "open",  
49     "notes": "customer called for an order update. Requested call back"  
50   },  
51   {  
52     "id": "cff53a87-cb53-441e-8c71-7c7c16a5f098",  
53     "title": "support 2",  
54     "notes": "Called customer to tell them the item had shipped update. Shared shipping ID"  
55   }  
56 ]  
57 }  
58 }
```

Avoiding God events



Event types



Domain events

`<Noun><PastTenseVerb>`

`OrderCreated`



Notification events

`<Event>Notify`

`OrderCreatedNotify`



Event carried state transfer

`<Event>Fact`

`OrderCreatedFact`



Local Events

`<Namespace>@Event`

`Order@Created`



(Too) Sparse Events

Sparse 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

Considerations with sparse events

Order 123 was
created by
customer 456



What are the
details for
order 123?

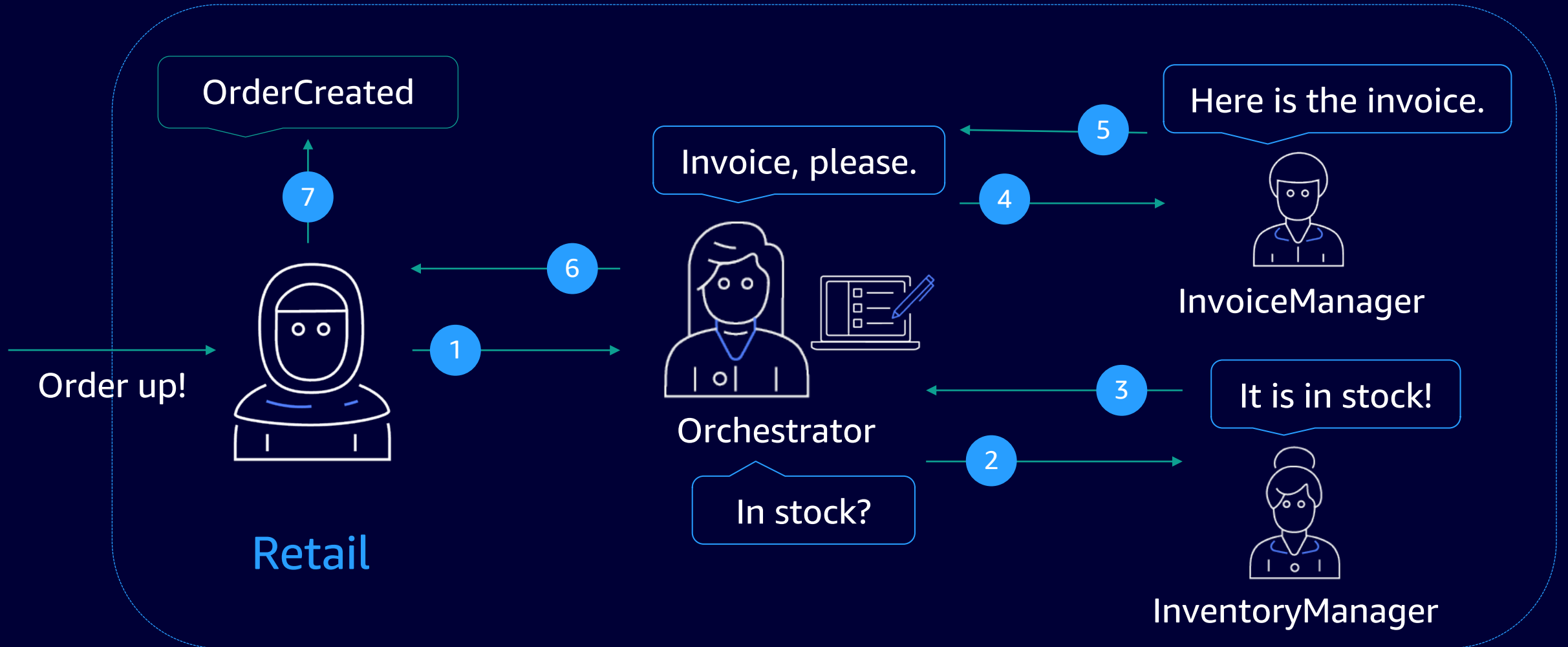




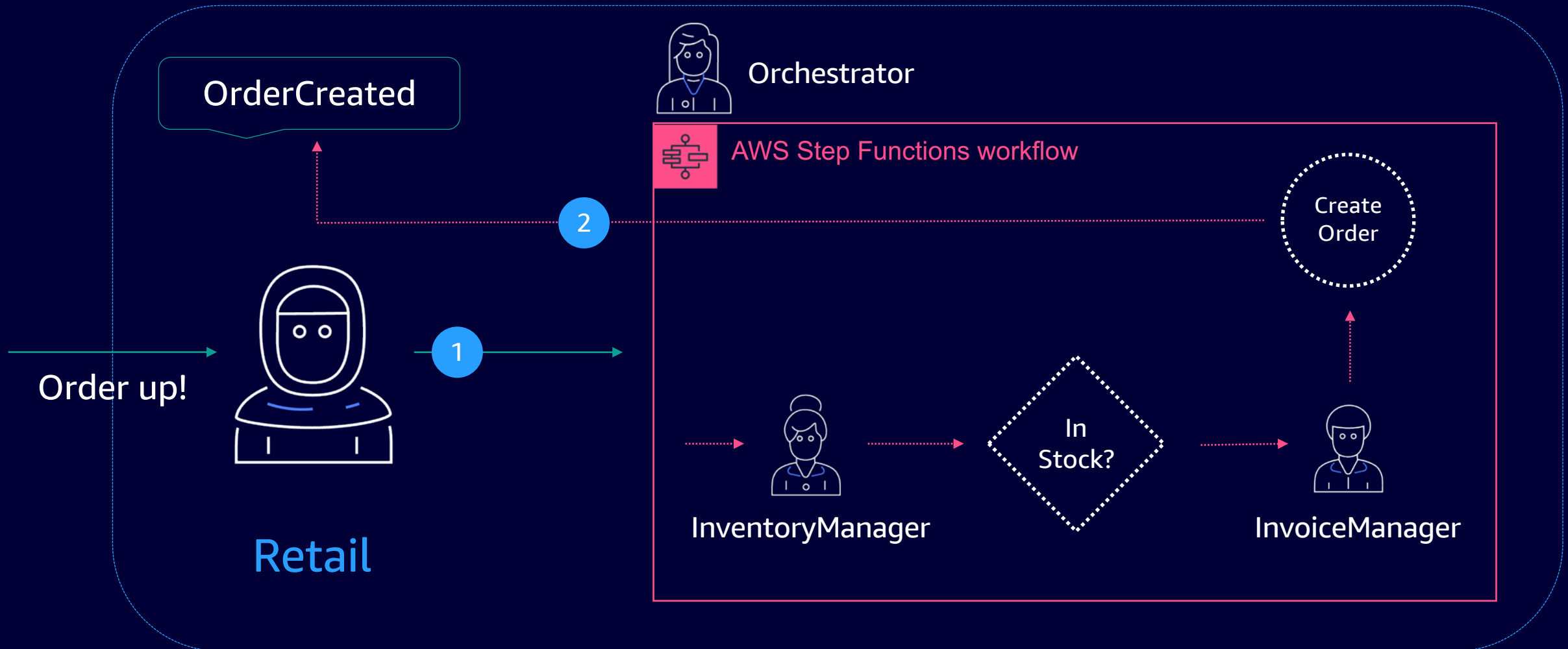
Pinball Events



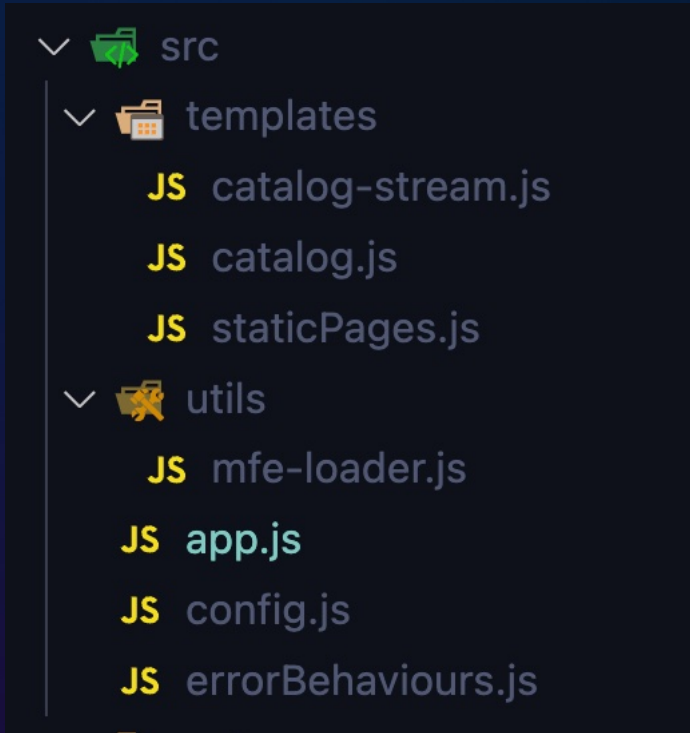
Events are just **part** of your **toolkit**



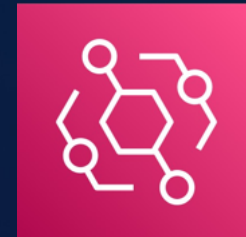
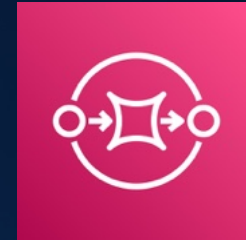
Orchestrate a business process *within a domain*, resulting in a published event



Don't be afraid of essential complexity

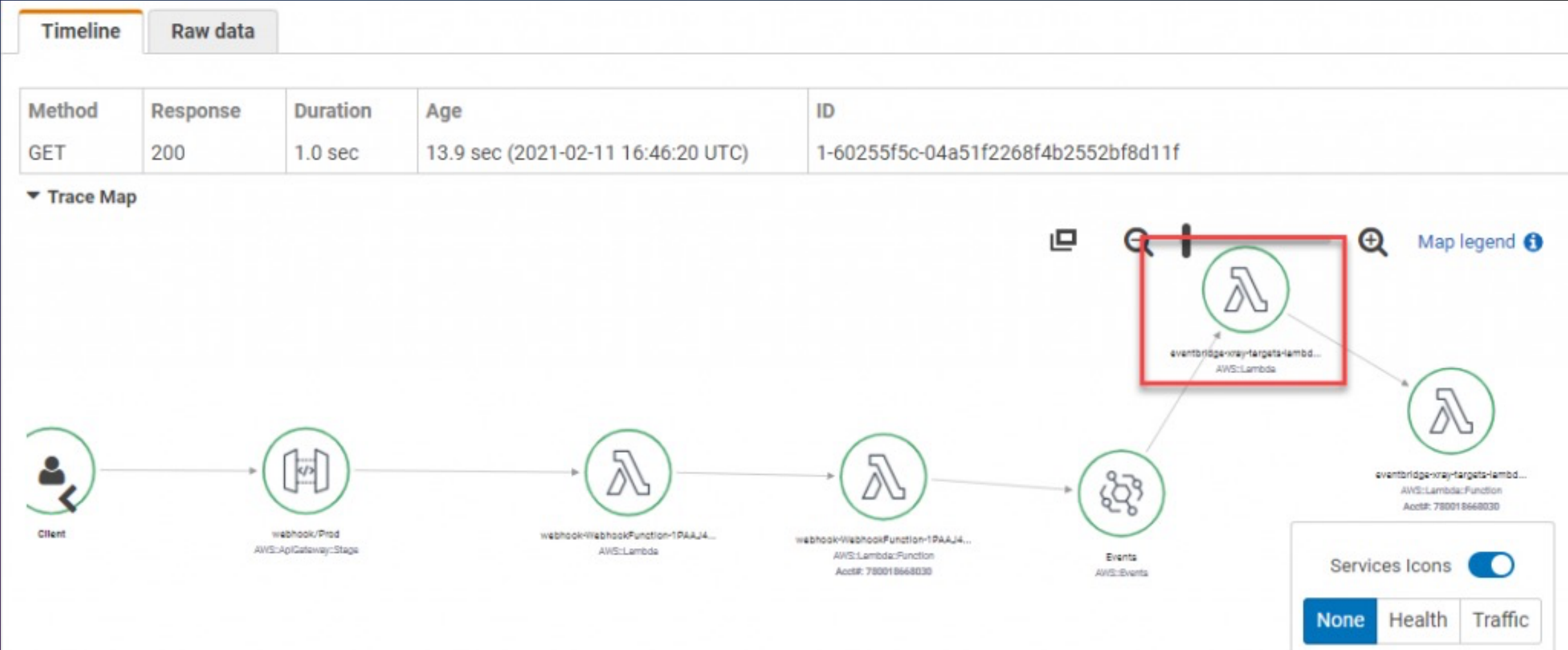


Code



Infrastructure

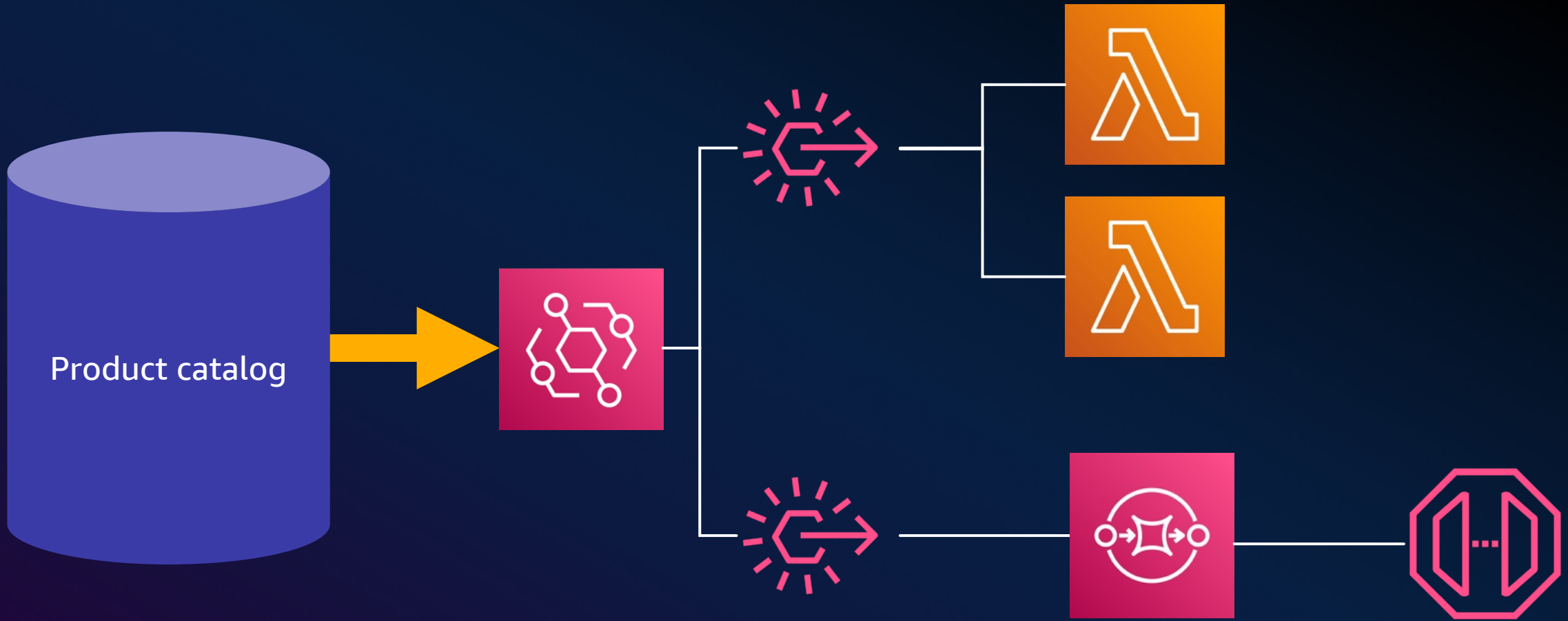
Invest in observability



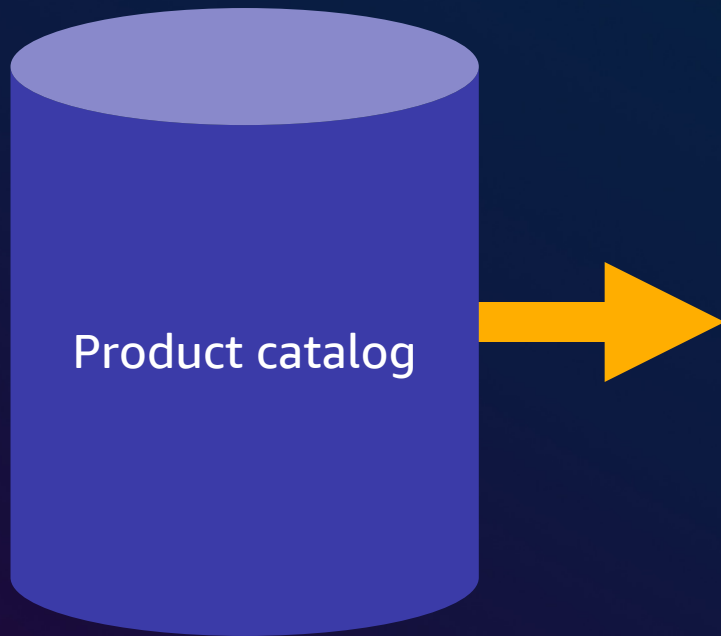


Leaky domains

Modernizing via Eventification

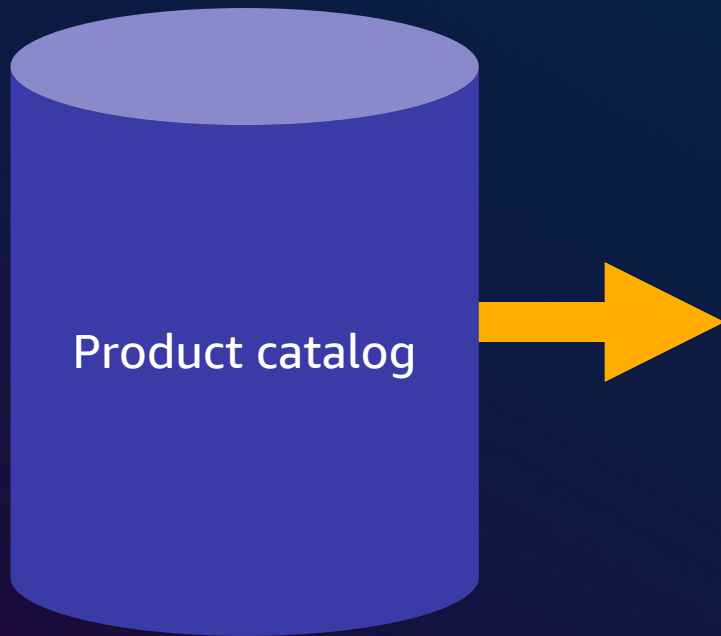


Eventification of the old domain



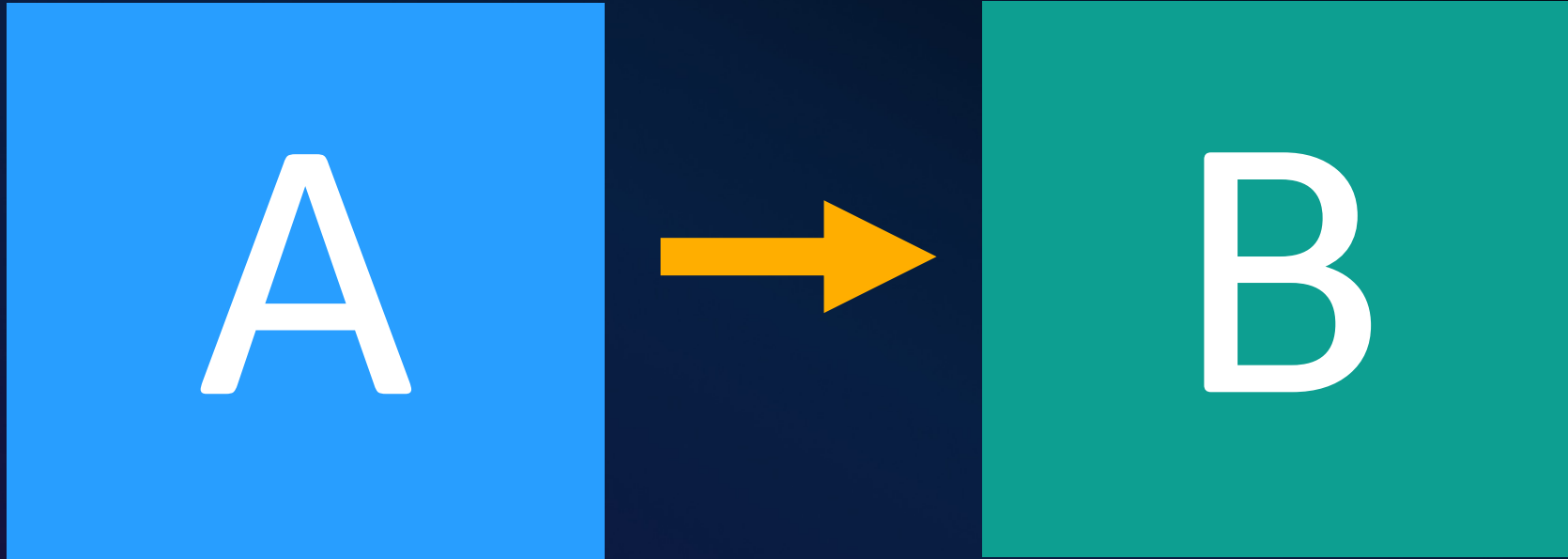
```
1  {
2    "id": "https://api.ibm.com/product/schema.json#",
3    "$schema": "http://json-schema.org/draft-06/schema#",
4    "title": "A schema to represent the IBM specific API configuration",
5    "type": "object",
6    "additionalProperties": false,
7    "required": [
8      "product",
9      "info"
10   ],
11   "patternProperties": {
12     "^_": {}
13   },
14   "properties": {
15     "product": {
16       "type": "string",
17       "enum": [
18         "1.0.0"
19       ]
20     },
21     "info": {
22       "$ref": "#/definitions/InfoSection"
23     },
24     "visibility": {
25       "type": "object",
26       "additionalProperties": false,
27       "required": [
28         "name"
```

Eventification of the old domain



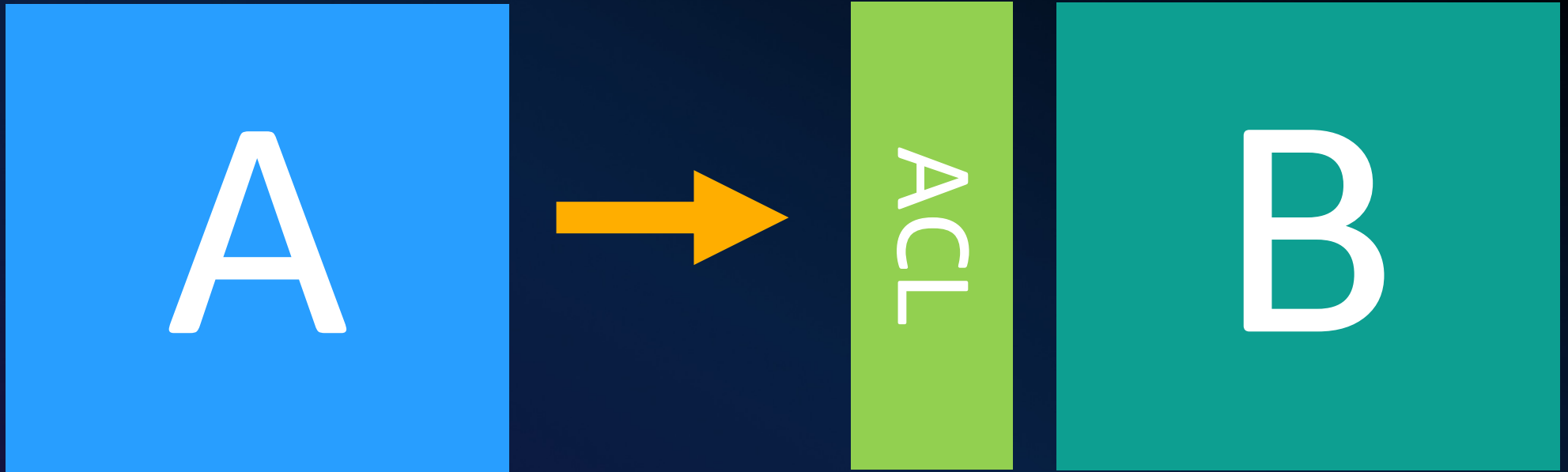
```
243 },
244 "additionalProperties": {
245   "type": "object",
246   "additionalProperties": false,
247   "properties": {
248     "operations": {
249       "type": "array",
250       "items": {
251         "type": "object",
252         "additionalProperties": false,
253         "properties": {
254           "operationId": {
255             "type": "string"
256           },
257           "path": {
258             "type": "string"
259           },
260           "operation": {
261             "type": "string"
262           },
263           "rate-limit": {
264             "$ref": "#/definitions/RateLimitSection"
265           },
266           "rate-limits": {
267             "$ref": "#/definitions/RateLimitsSection"
268           }
269         }
270       }
271     },
272     "graphql-schema-options": {
273       "$ref": "#/definitions/GraphQLSchemaOptions"
274     }
275   }
276 }
277 }
278 }
```

Conformist Pattern



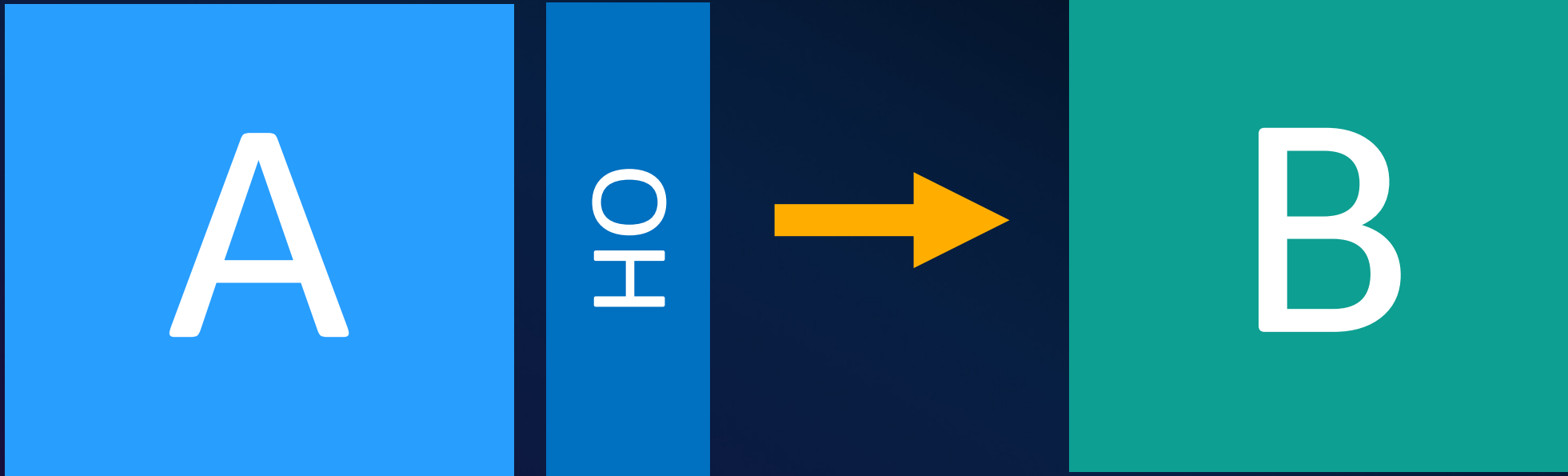
System B conforms to the message of system A.
No translation is done. Takes as is.

Anti-Corruption Layer



System B does not want to conform to the contract.
Message translated into own context/domain.

Open-Host Service



System A conforms to "published language"
Implementation details of System A not exposed.
Producer does the translation rather than the consumer.



Inside Out Events



Teams with different maturity and resources

Finance

Order
Management

Asset
Management

Logistics

CRM

ERP

Loyalty

Warehouse
Management

Teams with different maturity and resources

Finance

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Teams with different maturity and resources

ERP

Loyalty

Warehouse Management

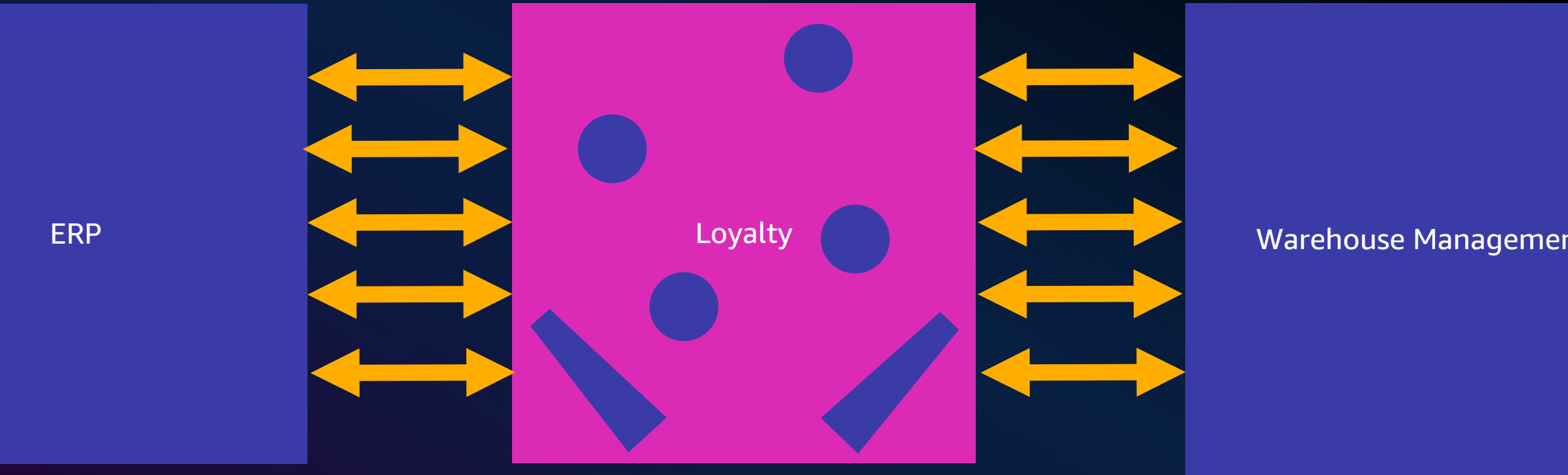
Teams with different maturity and resources

ERP

Loyalty

Warehouse Management

Teams with different maturity and resources



Horizontal and vertical investment





Domain-driven design to the rescue

Domain-driven design (DDD) targets the reasons software projects fail from a different angle

Effective communication is the central theme of the DDD tools and practices

Vlad Khononov

Author of *Learning Domain-Driven Design*



Photo by [Jason Goodman](#) on [Unsplash](#)

Benefits of domain-driven design

- Increase business understanding across the organization
- Enhance collaboration between teams
- Identify and categorize business domains inside a system
- Helps revisiting the organization structure and business decisions



“

It's developers' (mis)understanding,
not domain experts' knowledge,
that gets released in production.

Alberto Brandolini

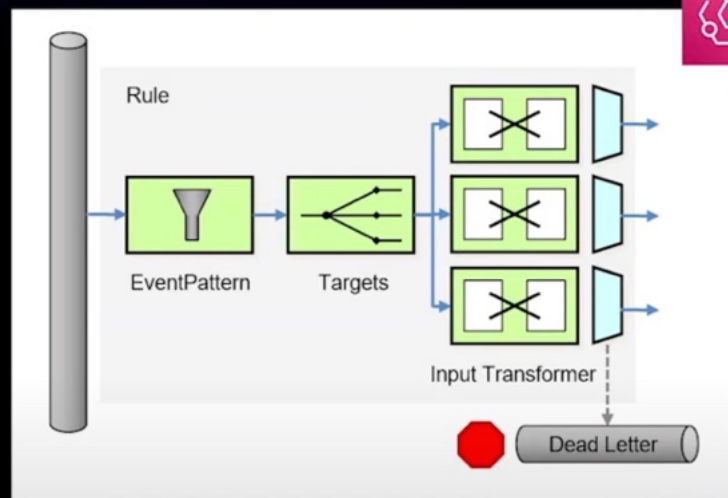
Author of *EventStorming*

THINK in design PATTERNS

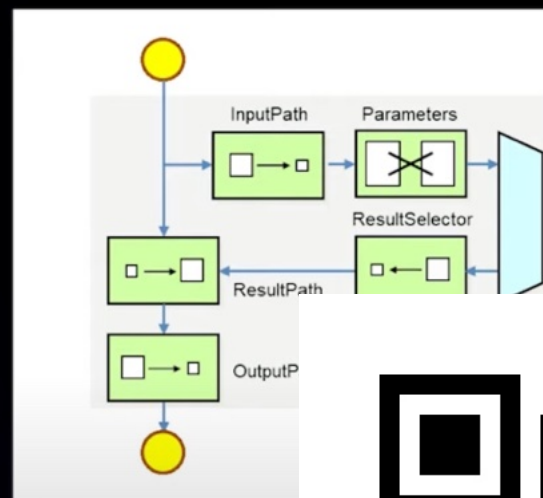


Gregor Hohpe
Enterprise Strategist
AWS

Integration Patterns in AWS Serverless



Amazon EventBridge



AWS Step Functions



<https://s12d.com/JkSY5zb7>

Thank you

Matthew Meckes

Serverless GTM UKIR
Amazon Web Services



