



Advanced EDA Patterns at The LEGO Group



Sarah Hamilton



@serverlessSarah



hamilton-sarah



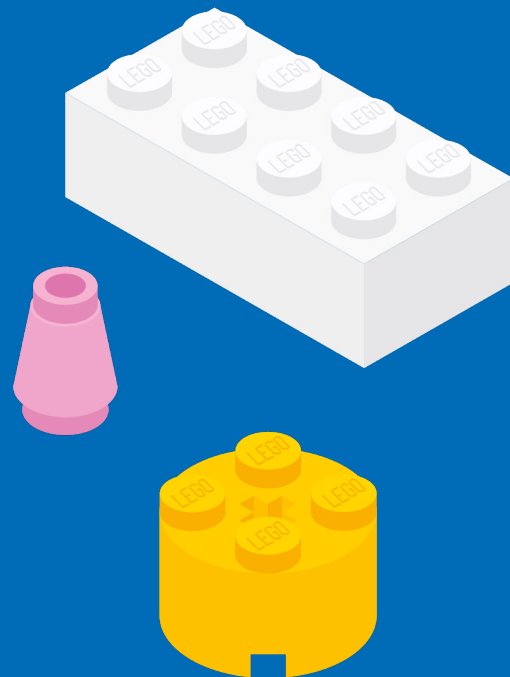
08hamiltons





Topics

- ❑ Squad Setups
- ❑ Event Driven Use Cases
 - ❑ Streaming
 - ❑ Event Buses
 - ❑ Orchestration
- ❑ Benefits of Event Driven Architectures



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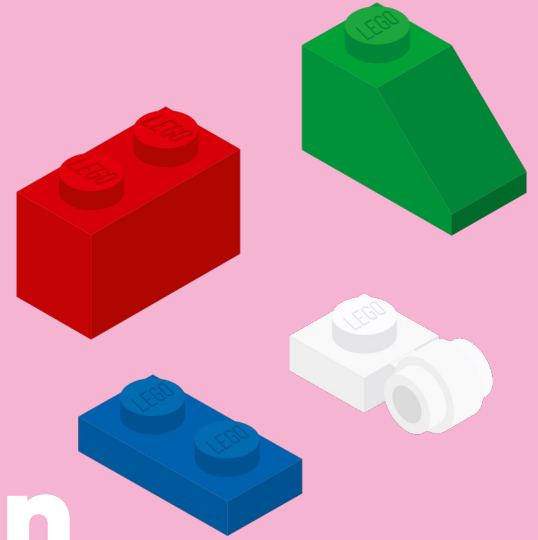
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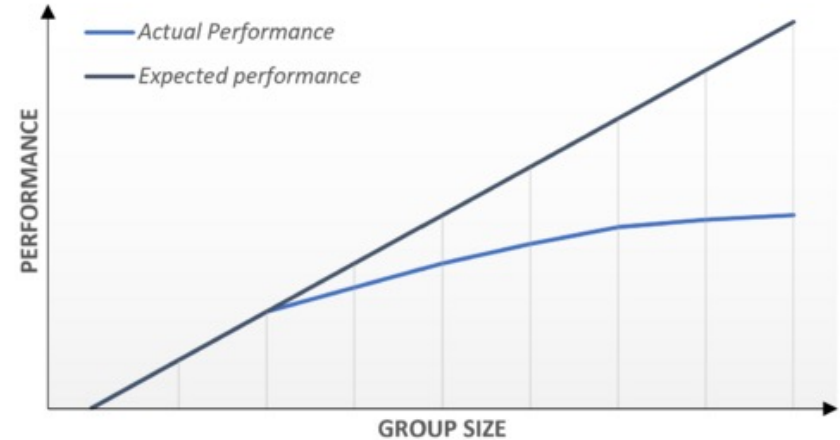
Squad Organization

"We try to create teams that are no larger than can be fed by two pizzas," said Bezos.

"We call that the two-pizza team rule."

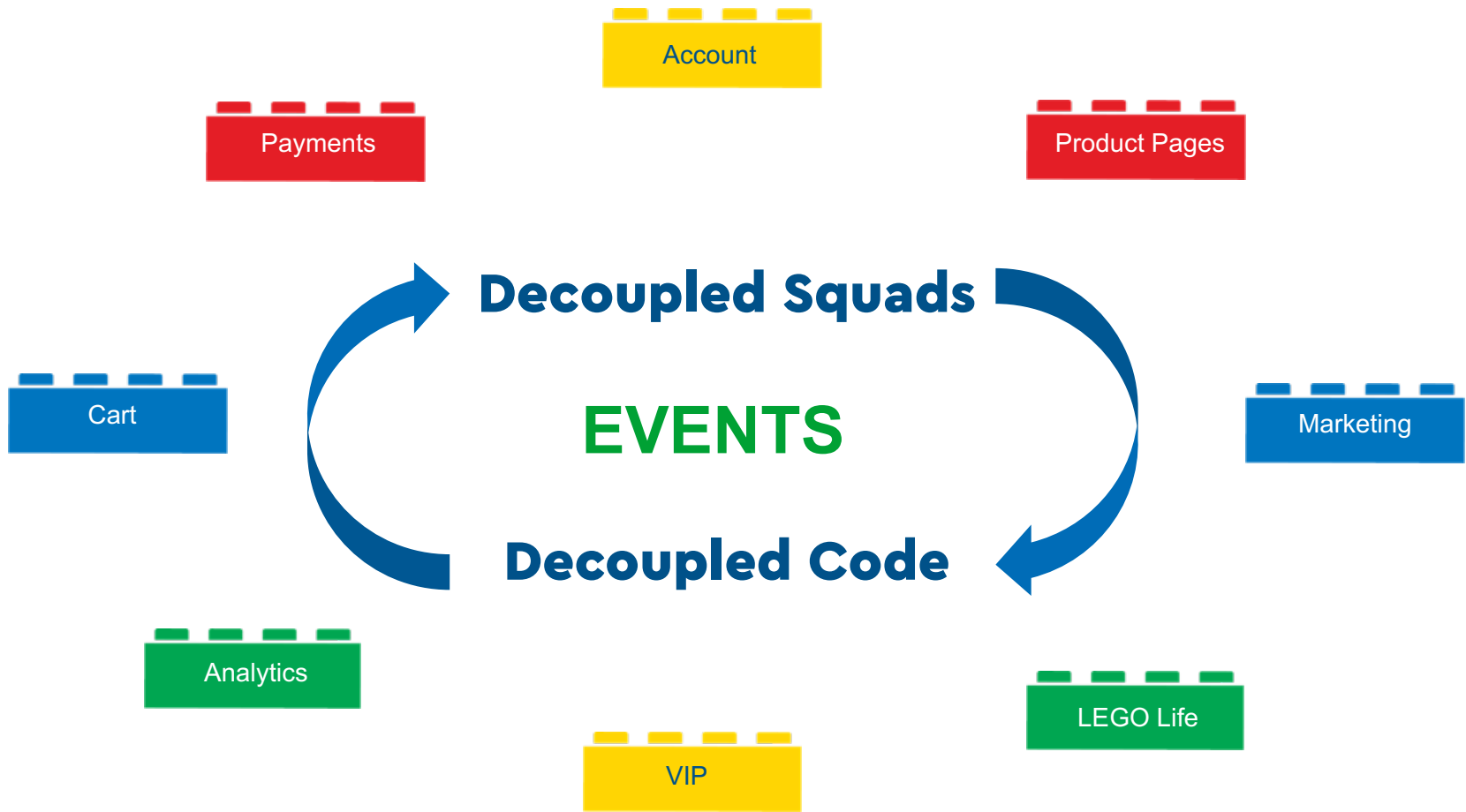


The Ringelmann effect is the tendency for individual members of a group to become increasingly less productive as the size of their group increases.

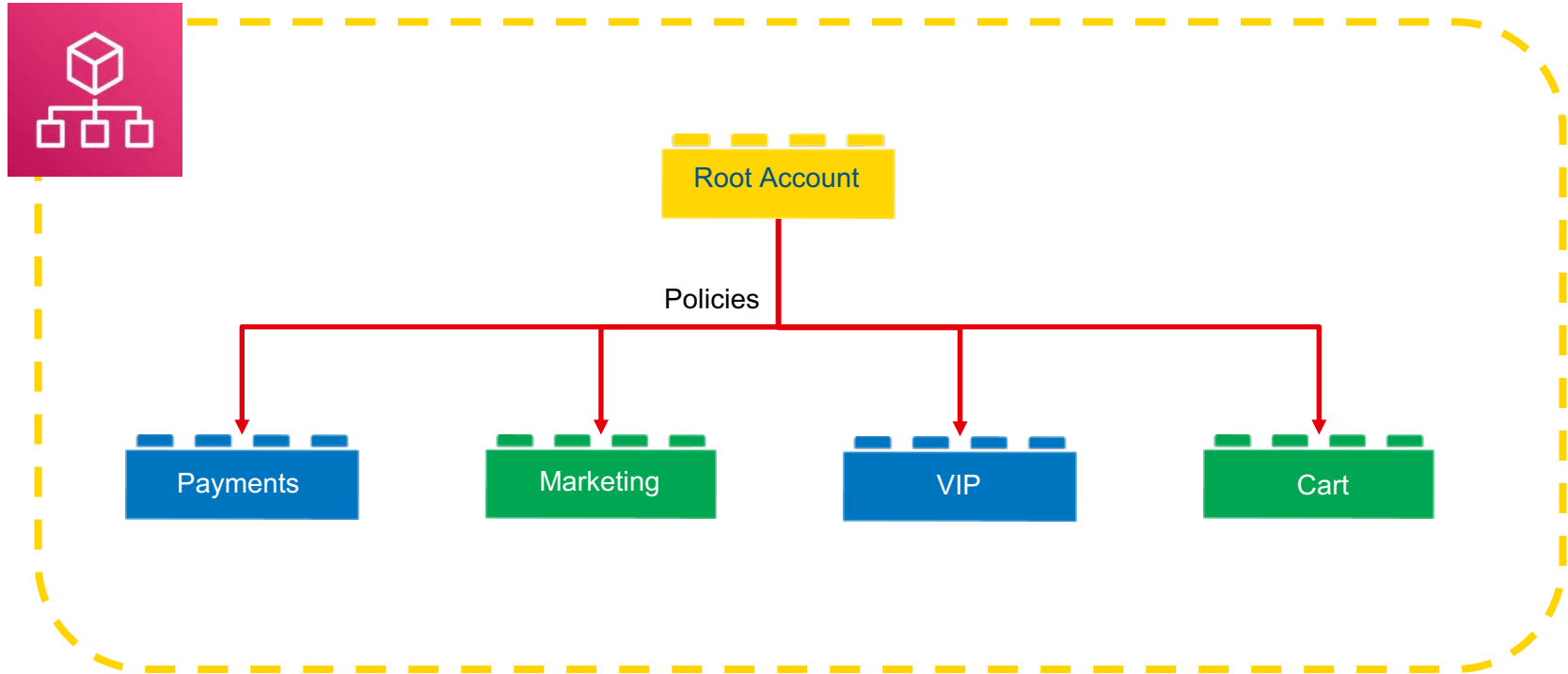


Lærke Viuff Petersen (2022)

How to Decouple Squads



Cloud Accounts



Multi-Repo Approach

- ❑ Separation of concerns
- ❑ Well defined access control
- ❑ Team Autonomy
- ❑ Independent library versioning



Team owns CI/CD Pipeline

- ❑ Less waiting around 🕒
- ❑ Far more likely to pass first time ✅
- ❑ Less frustration 😡
- ❑ Autonomy over pipeline ★

✅ All checks have passed			Hide all checks
134 successful checks			
✅	PR Checks / build (pull_request)	Successful in 3m	Required Details
✅	PR Health / Danger JS (pull_request)	Successful in 1m	Details
✅	PR Checks / lint (pull_request)	Successful in 2m	Required Details
✅	PR Checks / unit-test (pull_request)	Successful in 7m — unit-test	Required Details
✅	PR Checks /nock-test (payment-service) (pull_request)	Successful in 1m	Details
✅	PR Checks /nock-test (service-paypal-webhook) (pull_request)	Successful in 35s	Details

Deployments

service-checkout

service-cloudwatch-setup

service-collection-points

service-component-usage

service-connector-endpoints

service-consent

service-consent-management

service-country-config

service-customer

service-customer-sync

service-data-layer-creator

service-data-layer-core

service-data-layer-datalake

service-data-layer-newrelic

service-data-layer-optimizely

service-data-layer-recsengine

service-element-import

service:service-consent

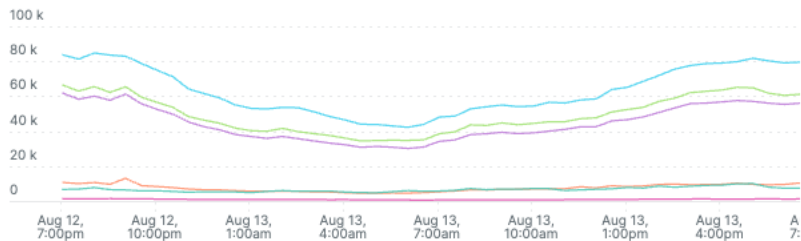
Commit	qa	perf	acc	prod
<div>chore: CCE-751 Update logs in updateEmail (#18847) 9784746a</div> <div>2022-08-12</div>	<div>✓ 2022-08-12</div> <div>Workflow</div>		<div>✓ 2022-08-12</div> <div>Workflow</div>	<div>✓ 2022-08-15</div> <div>Workflow</div>
<div>fix: CCE-743 Switch from CAPI to TAPI for subscription flow (#18823) 5430d1a6</div> <div>2022-08-12</div>	<div>✓ 2022-08-12</div> <div>Workflow</div>		<div>✓ 2022-08-12</div> <div>Workflow</div>	<div>Waiting to be deployed.</div> <div>Deploy</div>
<div>feat: CCE-746 logging to debug production errors (#18805) 33f0259c</div> <div>2022-08-11</div>	<div>✓ 2022-08-11</div> <div>Workflow</div>		<div>✓ 2022-08-11</div> <div>Workflow</div>	<div>✓ 2022-08-11</div> <div>Workflow</div>
<div>fix: CCE-679 Fix integration test setup (#18779) e59fb740</div> <div>2022-08-11</div>	<div>✓ 2022-08-11</div> <div>Workflow</div>		<div>✓ 2022-08-11</div> <div>Workflow</div>	<div>Waiting to be deployed.</div> <div>Deploy</div>
<div>feat: CCE-679 Delta Load: Wrap all logic in step function (#18646) afeaa7c6</div> <div>2022-08-10</div>	<div>✓ 2022-08-10</div> <div>Workflow</div>			
<div>feat: CCE-676 Integrate S3 bucket with SFMC automation to receive csv (#18710) a9c9a7de</div> <div>2022-08-10</div>	<div>✓ 2022-08-10</div> <div>Workflow</div>		<div>✓ 2022-08-10</div> <div>Workflow</div>	<div>✓ 2022-08-10</div> <div>Workflow</div>



Monitoring & Analytics

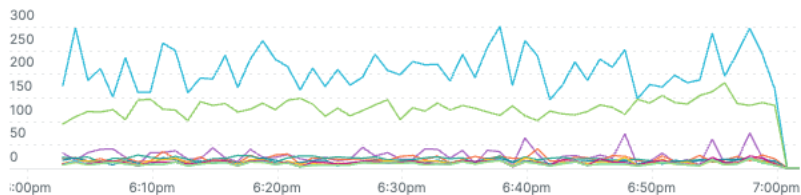
GraphQL Transactions

Since 1 day ago



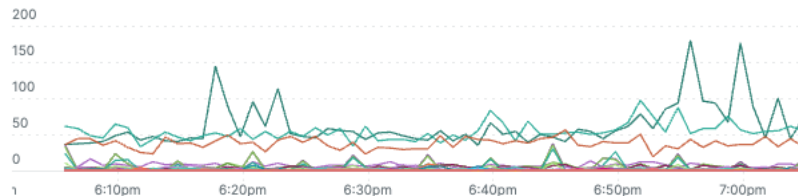
Lambda Invocations

Since 1 hour ago



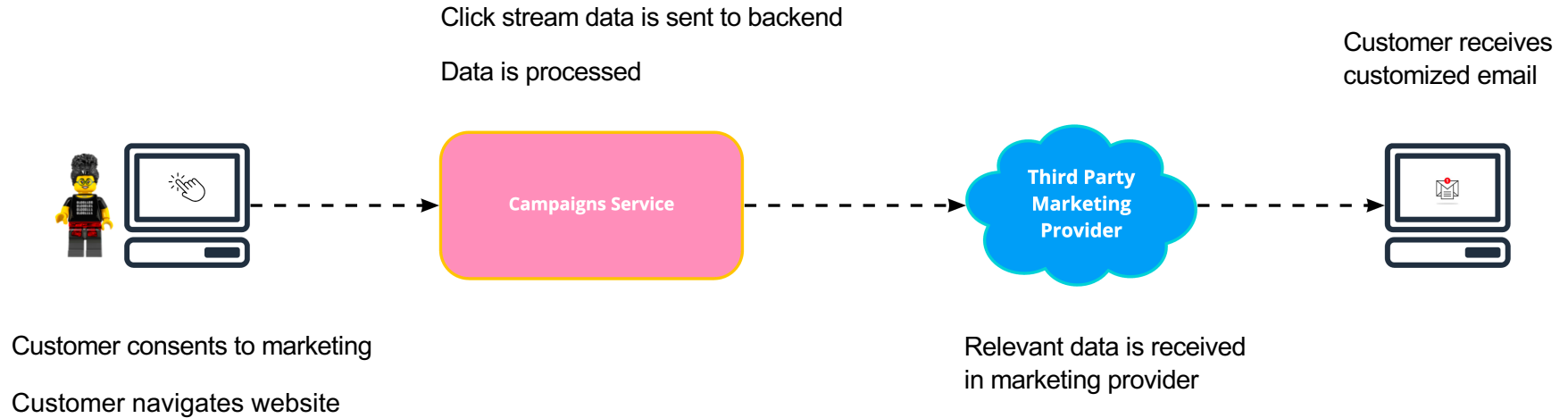
Service Invocations

Since 1 hour ago



Streaming Events

Use Case: Customer Emails



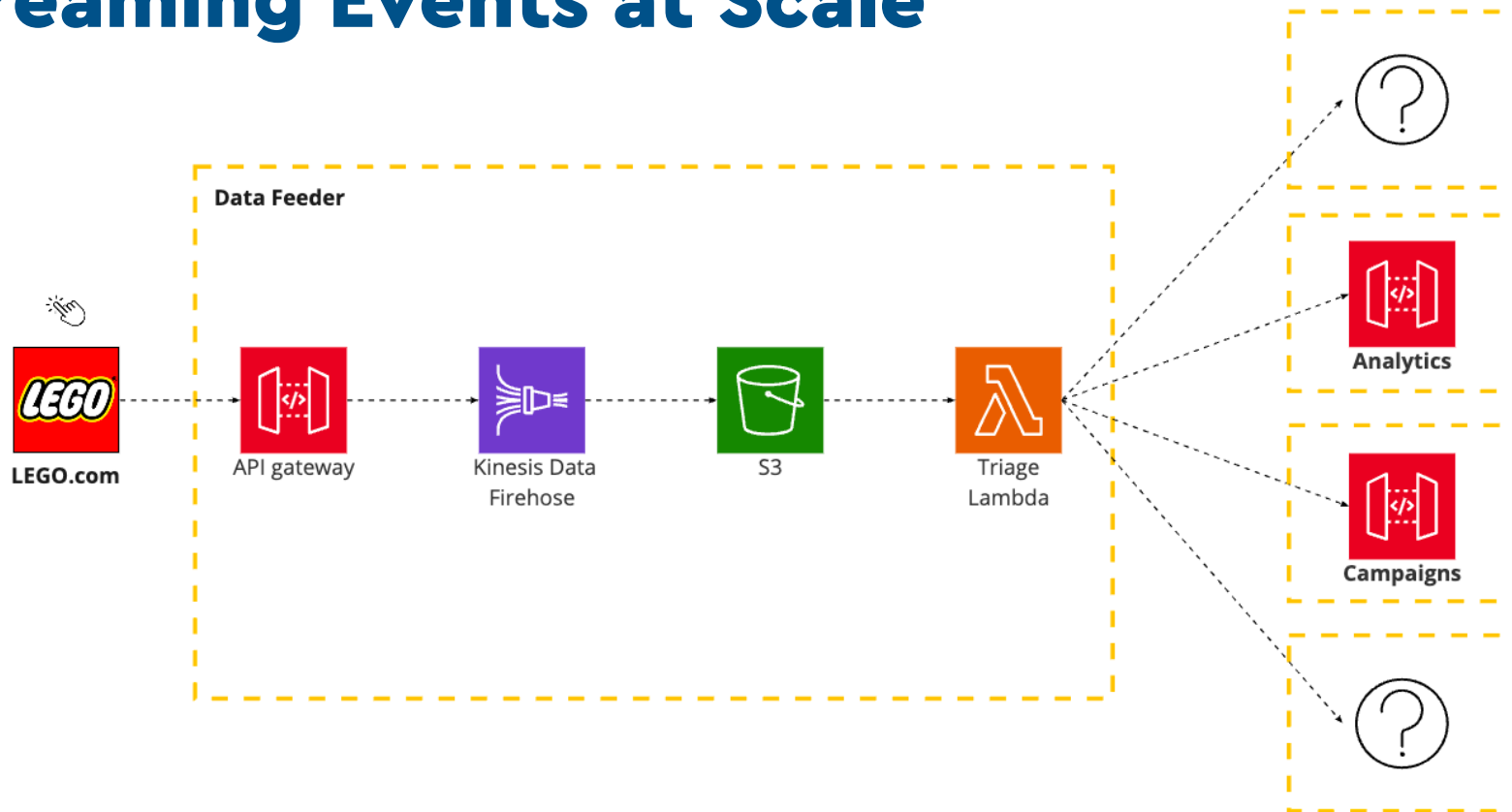
Use Case: Analytics



A close-up photograph of a hand holding a white chess king piece, poised to move it. Below it, a black king piece stands on a checkered chessboard. The scene is dramatically lit from the side, creating strong shadows and highlights on the pieces and the board. The background is dark and out of focus.

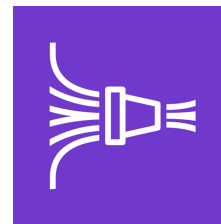
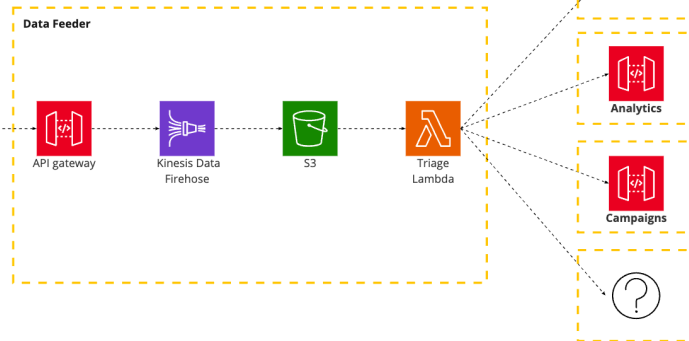
**One service to
power them all!**

Streaming Events at Scale



Events

```
{
  "Event": {
    "meta_data": {
      "site_id": "shop.lego.com",
      "session_cookie_id": "9e9d2dd3-9ba7-419e-aa...",
      "cross_session_cookie_id": "050a0cb5-78ca-412f-96e2..",
      "timestamp": 153477344234318,
      "locale": "en-GB",
      "event_type": "page_event",
      "event_subtype": "page_load",
      "event_source": "browser",
      "event_url": "Hogwarts-Castle-71043",
      "user_agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X ...)"
    },
    "data": {
      "page_type": "product",
      "page_id": "71043"
    }
  }
}
```



Kinesis Firehose

Kinesis Firehose

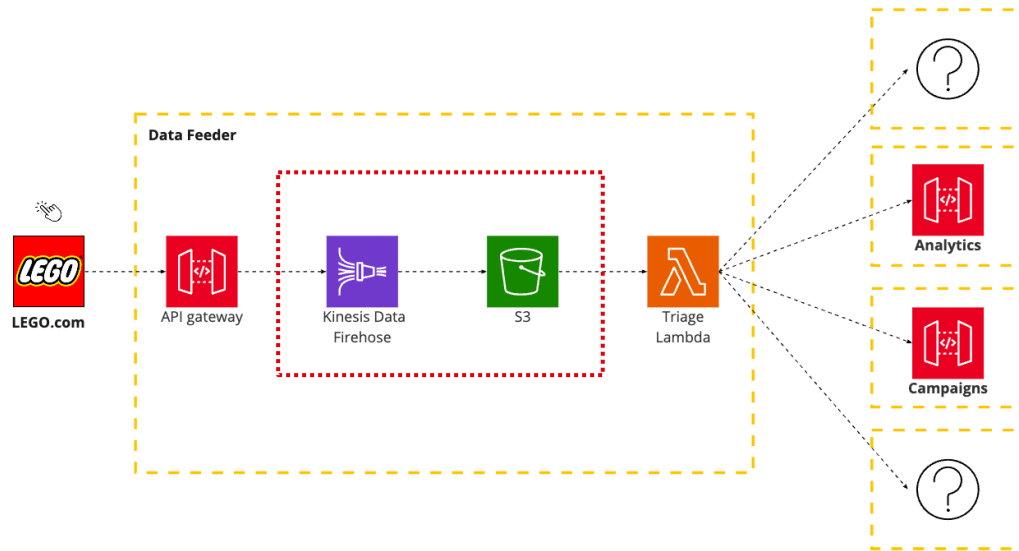
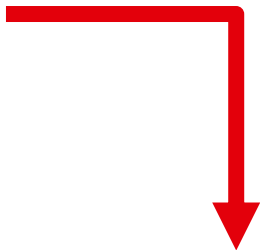
Buffer hints

Buffer size

1 MiB

Buffer interval

60 seconds



<input type="checkbox"/>	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-04-55-99546351-b593-40ec-b590-329871e4ff0b	-	August 13, 2022, 08:05:58 (UTC+01:00)	257.7 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-05-56-4a341cba-8d50-4929-9877-736d7883b2ea	-	August 13, 2022, 08:06:59 (UTC+01:00)	622.1 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-06-57-24f19732-0159-4c1c-93a3-2c716ebc14a5	-	August 13, 2022, 08:08:00 (UTC+01:00)	762.0 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-07-58-abd9fd4c-82d5-4bf3-b774-d5df349c226c	-	August 13, 2022, 08:09:01 (UTC+01:00)	736.8 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-08-59-d5f8a61d-d36e-4d7c-a55a-a9dba7aac8a9	-	August 13, 2022, 08:10:02 (UTC+01:00)	709.4 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-10-01-1c079e28-11f3-420f-9be7-03b82f85da3c	-	August 13, 2022, 08:11:04 (UTC+01:00)	667.3 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-11-02-2cdbfec9-f8fd-42c1-8be2-a2ebdc87a23c	-	August 13, 2022, 08:12:05 (UTC+01:00)	640.5 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-12-03-1071ee98-891a-47cf-afc8-b732e535bb44	-	August 13, 2022, 08:13:06 (UTC+01:00)	546.6 KB	Standard

S3 Lifecycle Policies

Lifecycle rules (1)

Use lifecycle rules to define actions you want Amazon S3 to take during an object's lifetime such as transitioning objects to another storage class, archiving them, or deleting them.



View details

Edit

Delete

Actions ▼

Create lifecycle rule


 Find lifecycle rules by name

	Lifecycle rule name ▼	Status ▼	Scope ▼	Current version actions ▼	Noncurrent versions actions ▼	Expiration marker
<input type="radio"/>	Expire objects after 5 days	✔ Enabled	Entire bucket	Expires	-	-



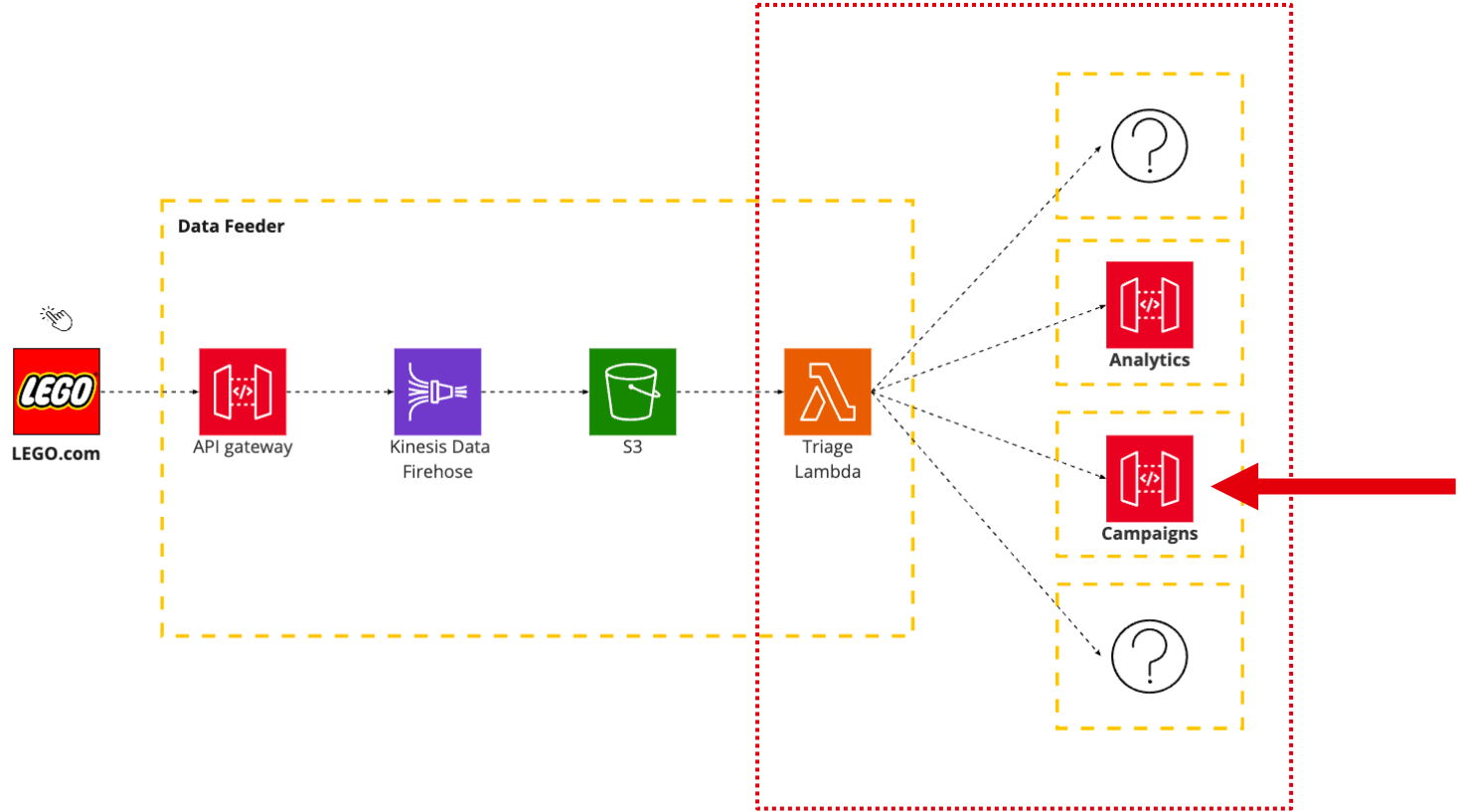
S3 bucket triggers event triager lambda

```
functions:
  triager:
    name: ${self:service}-triager-${self:provider.stage}
    handler: src/functions/triager/triager.default
    memorySize: ${file(./config.json):${self:provider.configEnv}.MEMORY_SIZE}
    timeout: ${file(./config.json):${self:provider.configEnv}.TIMEOUT}
    environment:
      STAGE: ${self:provider.stage}
      SSM_DL_TRIAGE_RULES: ${self:provider.environment.SSM_KEY_PREFIX}/SSM_DL_TRIAGE_RULES
      SSM_DL_REPLAY_TRIAGE_RULES: ${self:provider.environment.SSM_KEY_PREFIX}/SSM_DL_REPLAY_TRIAGE_RULES
    events:
      - s3:
          bucket: ${self:provider.environment.S3_SOURCE_BUCKET}
          events:
            - s3:ObjectCreated:*
          rules:
            - prefix: ECOM/EVENTS
          existing: true
```

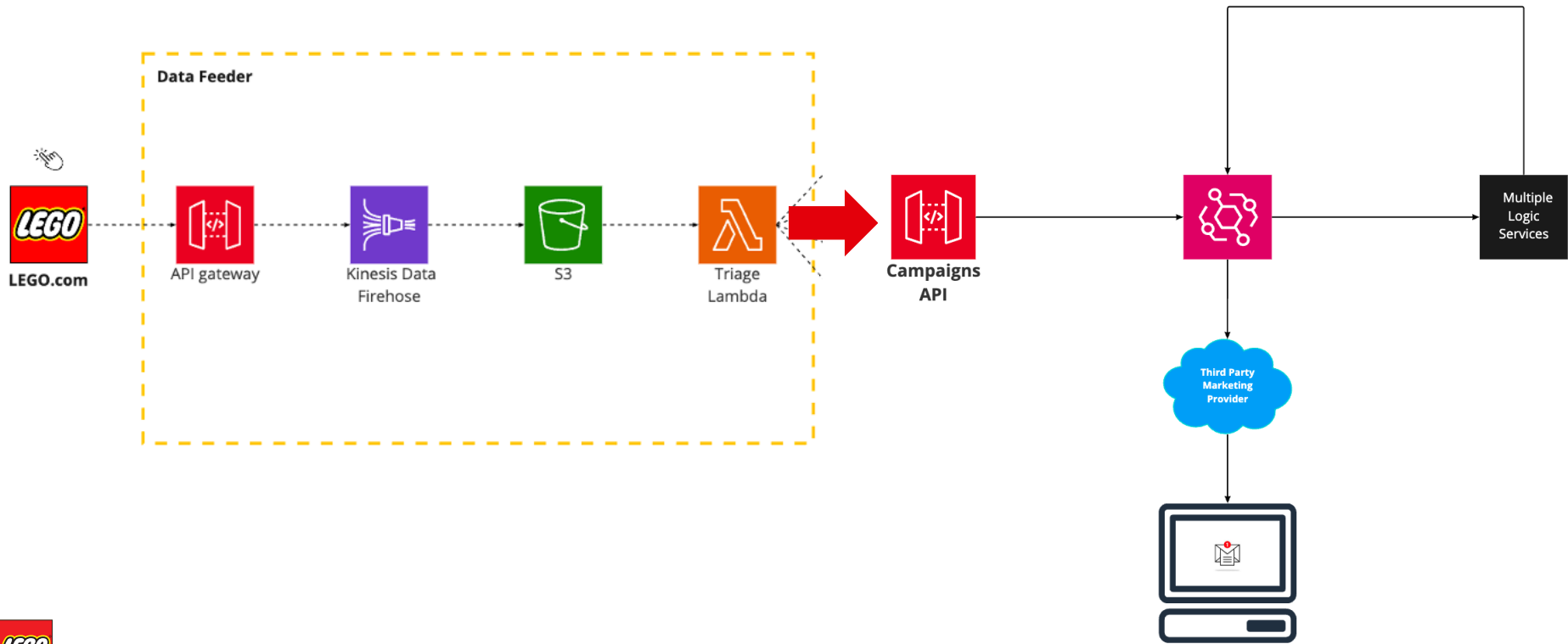


Demo – Event Streaming

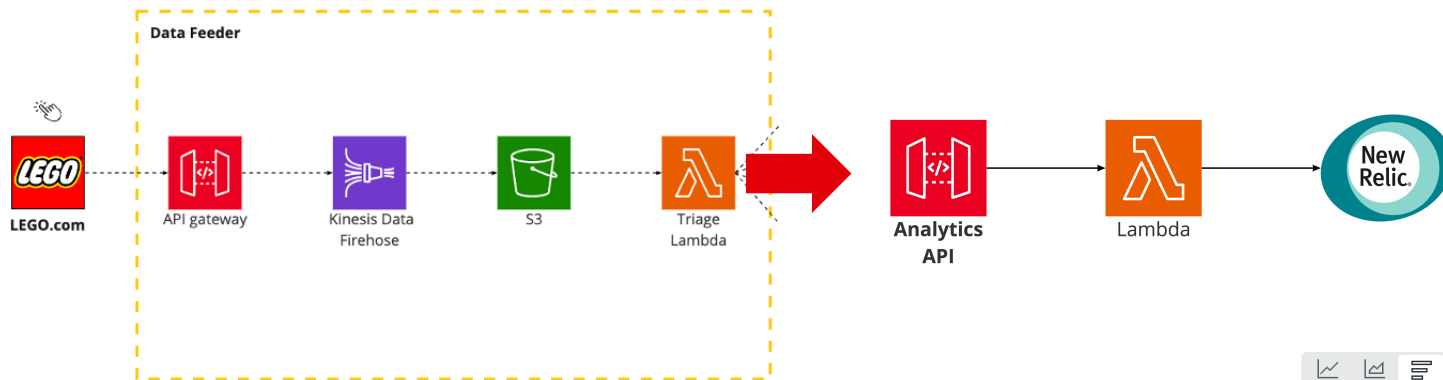




Campaigns Service



Analytics



PageAction



https://www.lego.com/nl-nl/product/airbus-h175-rescue-helicopter-42145	307 k
https://www.lego.com/de-de/product/off-road-buggy-42124	304 k
https://www.lego.com/es-es/vip/join	240 k
https://www.lego.com/it-it/product/the-ultimate-bundle-5007062	49.9 k
https://www.lego.com/cs-cz/product/inquisitor-transport-scythe-75336	49.3 k



EventBridge

The heart of Event-Driven Serverless Applications




Payments Service

In a minute:

- ☐ 1000 orders
- ☐ 200,000 API Requests
- ☐ 150 concurrent Lambda Executions

Credit Card PayPal



☐ Save Card Details

☐ I agree to the [Terms and Conditions](#)

When you agree to the terms and conditions, you also consent to our use of your personal information to process, deliver and support your order. We may also use your personal information to mail you a product catalog and gather feedback on our services. To see how to control your personal data, please see our [privacy policy](#).

Place Order & Pay



Order Summary

Order Value:	£34.99
Standard delivery	£3.95
Total	£38.94
Inclusive of £6.49 VAT	

Order Details

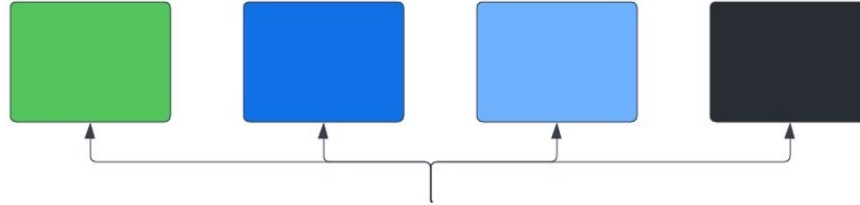
Available Now



Bakery

£34.99 Qty: 1

Payment Service Providers

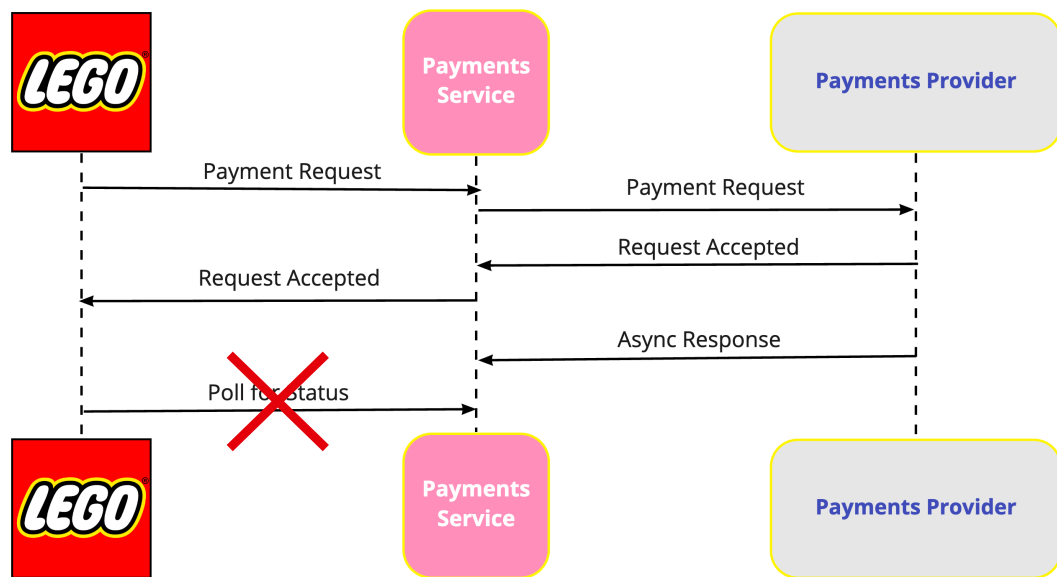


LEGO Payments Platform



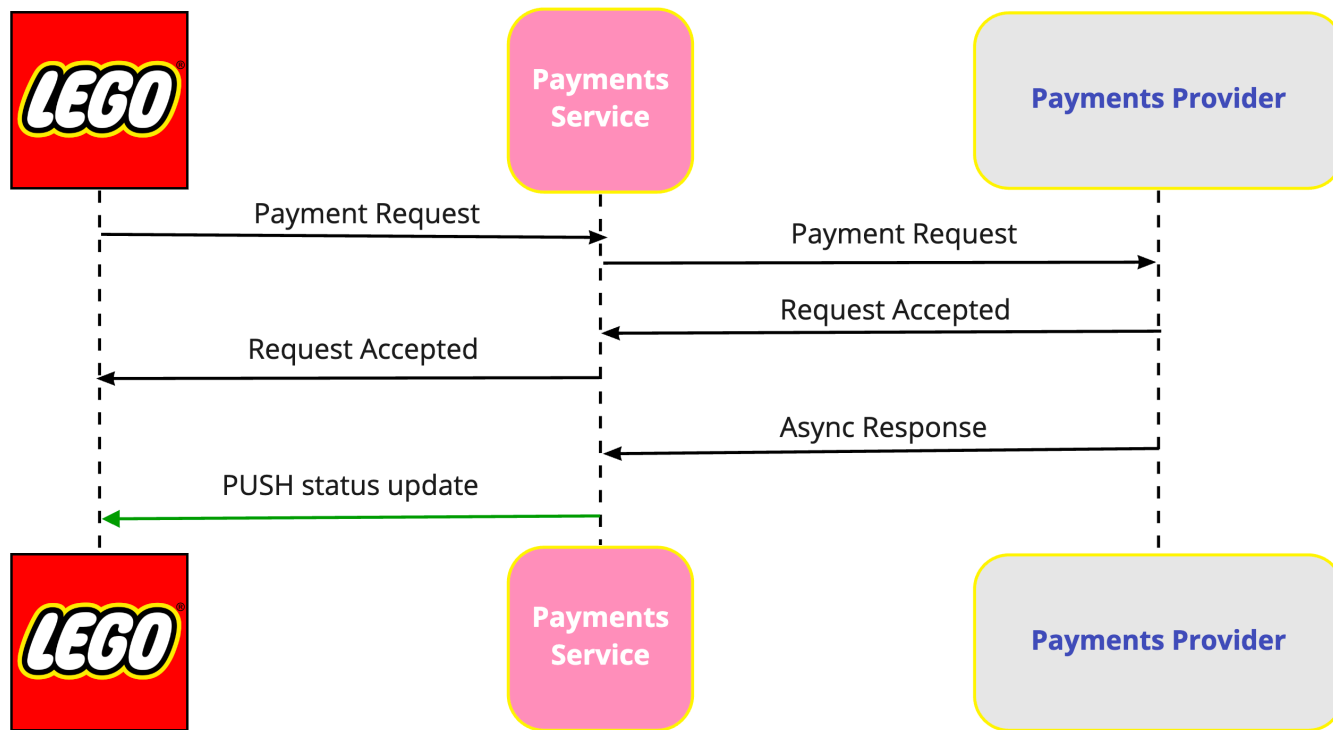
LEGO Business Units

Use Case: Push Notifications – The Problem

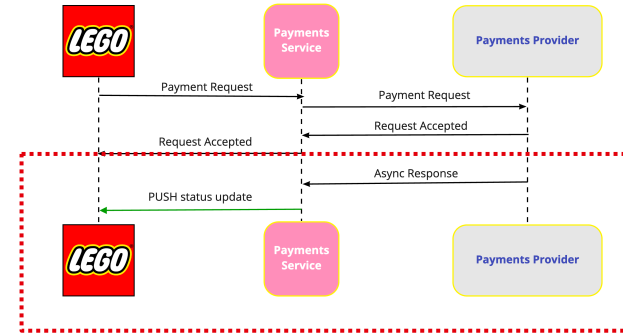


- ❑ Multiple Network Requests
- ❑ More requests to handle for Payments Service
- ❑ Polling is inefficient
- ❑ Slower

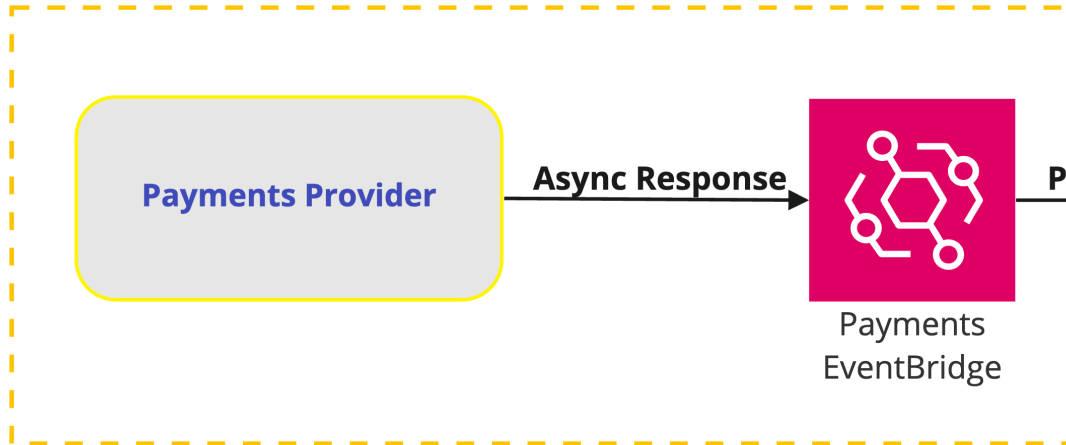
Use Case: Push Notifications - Solution



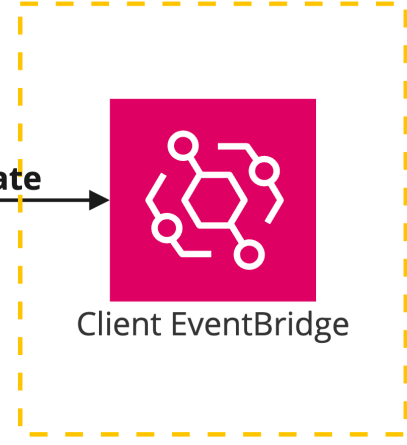
Use Case: Push Notifications



Payments Service



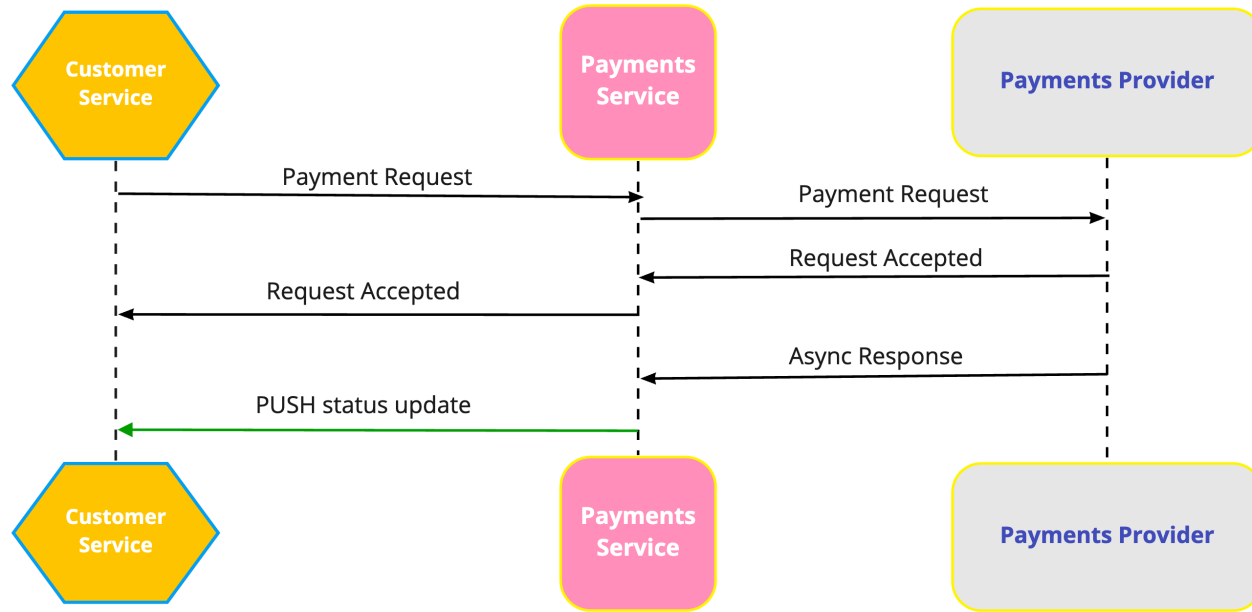
Client Service



Use Case: Push Notifications

**What if the client requires us to push
to a HTTP endpoint?**

HTTP Endpoint



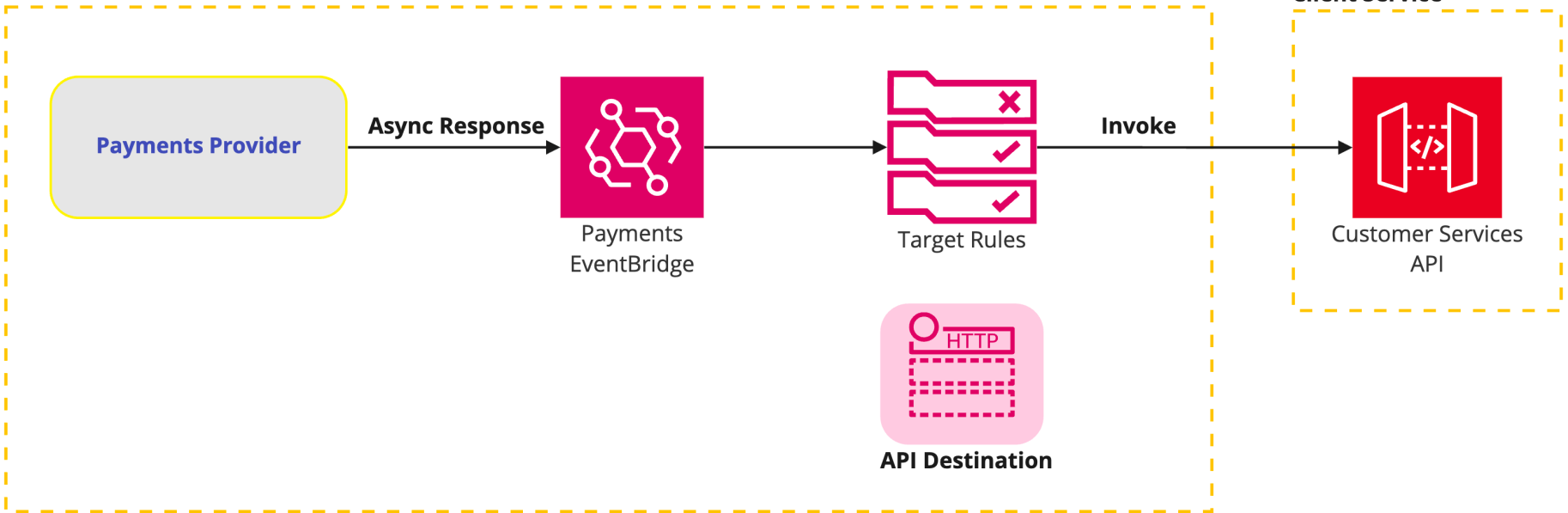
API Destinations

Sending events directly to HTTP Endpoints

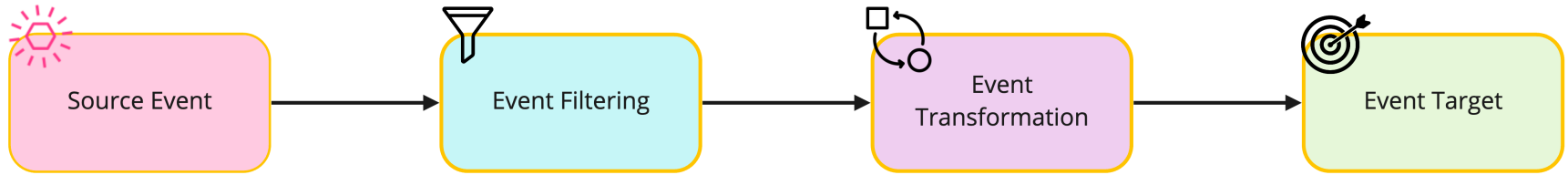


API Destinations

Payments Service



API Destinations

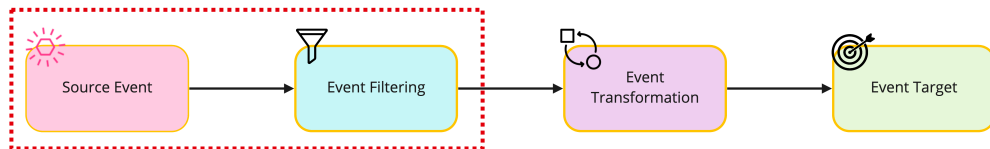


Event Filtering

```
{
  "detail": {
    "metadata": {
      "domain": "LEGO-PAYMENTS",
      "service": "service-payments",
      "type": "AUTHORISATION",
      "status": "true",
    },
    "data": {
      "currency": "GBP",
      "amount": "1200",
      "paymentReference": "T365781650",
      "eventDate": "2020-11-23T02:20:41+01:00",
      "merchantAccount": "merchantAccountCode",
      "legoPaymentId": "merchantReference",
      "countryCode": "en-GB"
    }
  }
}
```

Filtering

```
{
  "detail": {
    "metadata": {
      "domain": [
        "LEGO-PAYMENTS"
      ],
      "type": [
        "AUTHORISATION"
      ],
      "status": [
        "true"
      ]
    }
  }
}
```



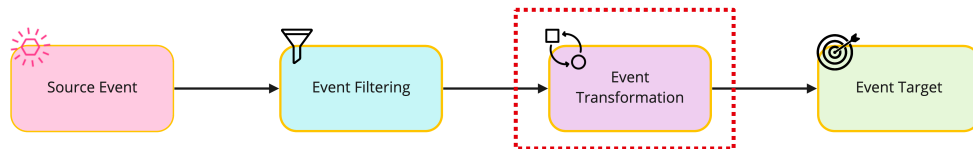
Event Transformation

```
{
  "detail": {
    "metadata": {
      "domain": "LEGO-PAYMENTS",
      "service": "service-payments",
      "type": "AUTHORISATION",
      "status": "true",
    },
    "data": {
      "currency": "GBP",
      "amount": "1200",
      "paymentReference": "T365781650",
      "eventDate": "2020-11-23T02:20:41+01:00",
      "merchantAccount": "merchantAccountCode",
      "legoPaymentId": "merchantReference",
      "countryCode": "en-GB"
    }
  }
}
```



```
{
  "legoPaymentId": "merchantReference",
  "countryCode": "en-GB",
  "time": "2020-11-23T02:20:41+01:00",
}
```

```
{
  "legoPaymentId": "$.detail.data.legoPaymentId",
  "countryCode": "$.detail.data.countryCode",
  "time": "$.detail.data.eventDate"
}
```



Demo – API Destinations



Orchestration


Step functions, task tokens and more EventBridge

Loyalty Platform

← PLAY ZONE

Don't miss out on LEGO® deals and offers UK 1! [Learn More](#)

Sarah Hamilton | 103 VIP Points


SHOPDISCOVERHELPBLACK FRIDAY


Q


♥


🛒 (0)


VIP

VIP Home

Rewards

Get More Points

VIP Account


Get a Digital VIP Card

My VIP Account

My Details

<div>Sarah Hamilton sarah.hamilton+vip@lego.com</div>	<div>Current VIP Points</div> <div>103</div>	<div>Points Earned Since Joining</div> <div>103</div>
--	--	---

VIP Card Number 600099694

 VIP points are only applied to your VIP point balance once the order has been shipped. To track your open orders please visit our [Order status page](#).

Language Preference:

English

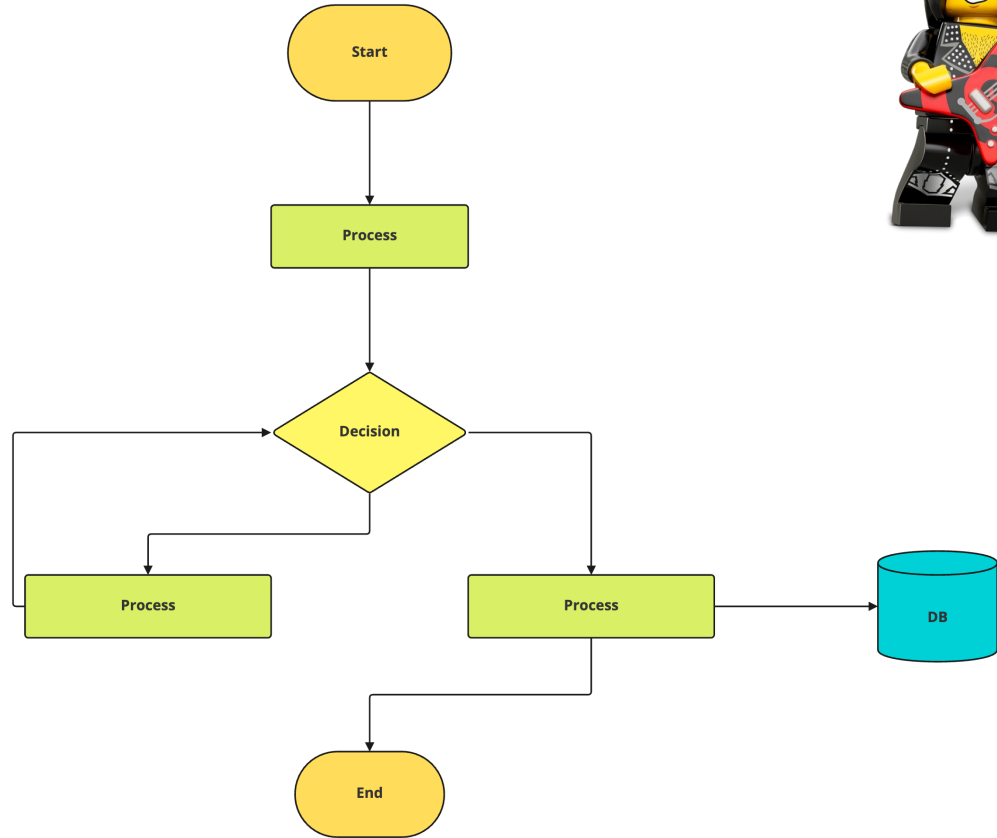


Edit

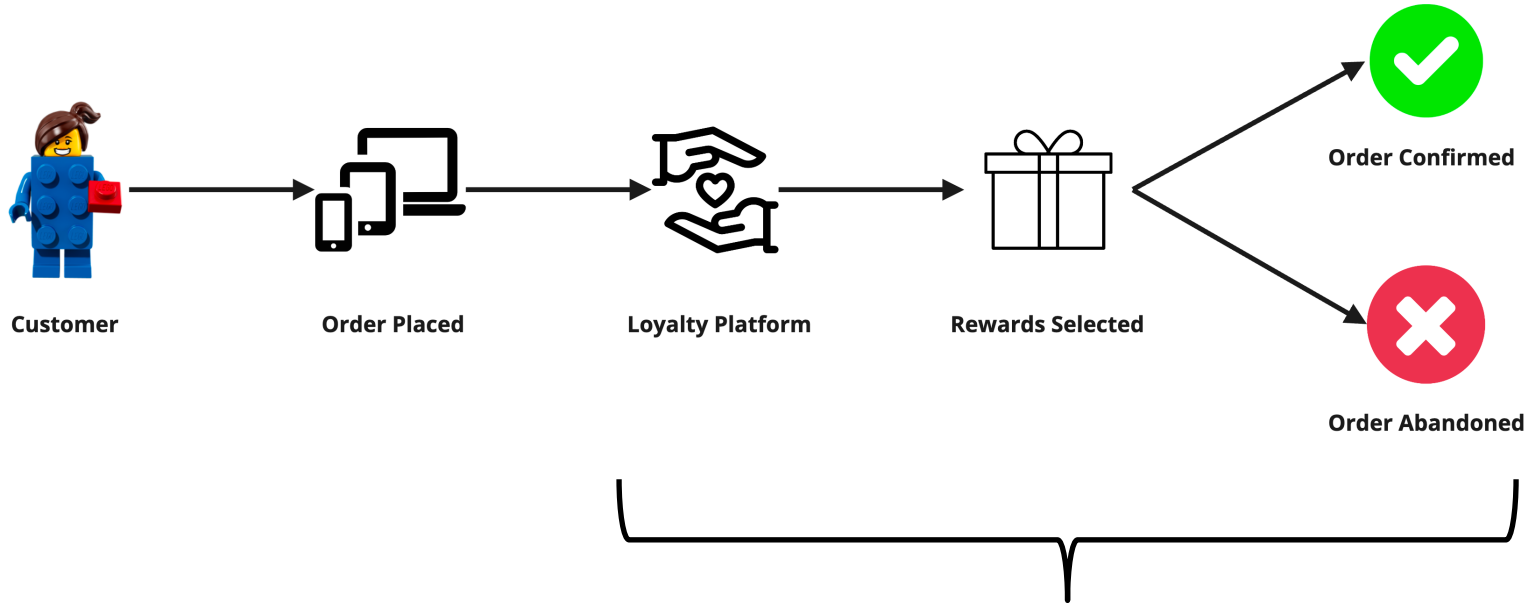


Orchestration

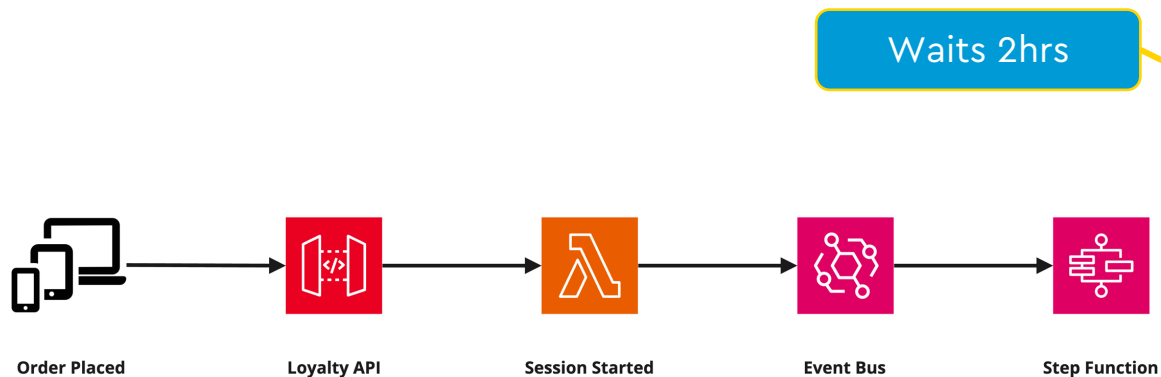
- ❑ Coordinating Tasks
- ❑ Low code
- ❑ Human element
- ❑ Pause & resume



Use Case: User Session Monitoring

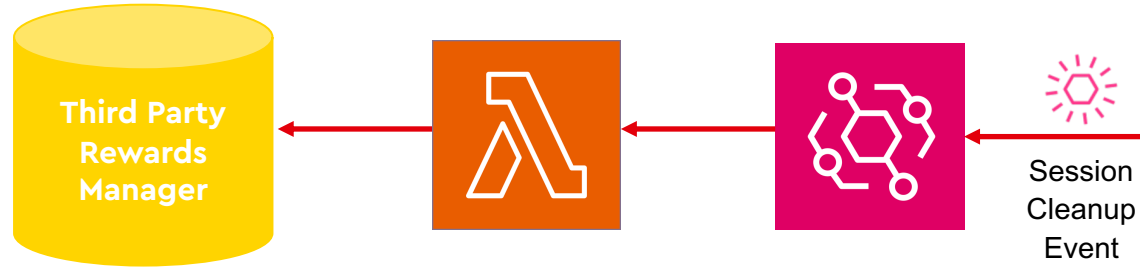


Use Case: User Session Monitoring

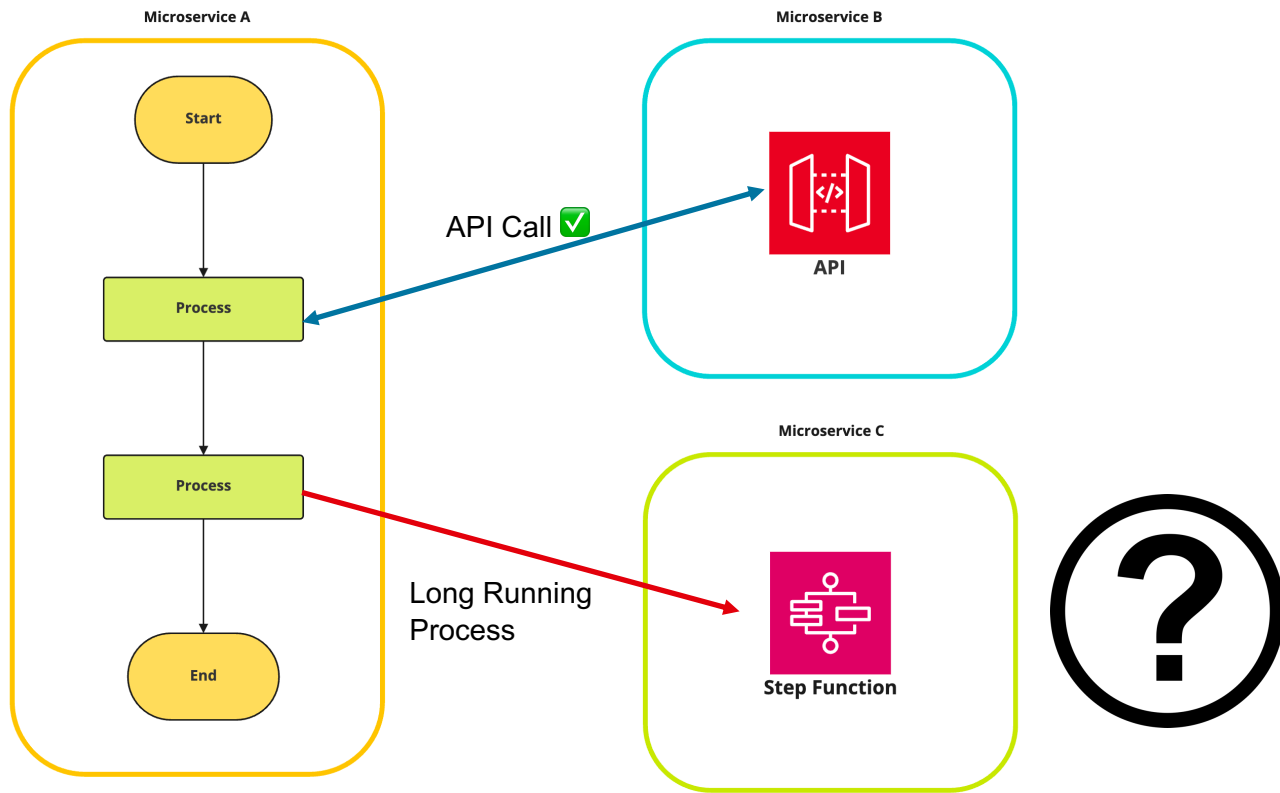


Session Clean-up

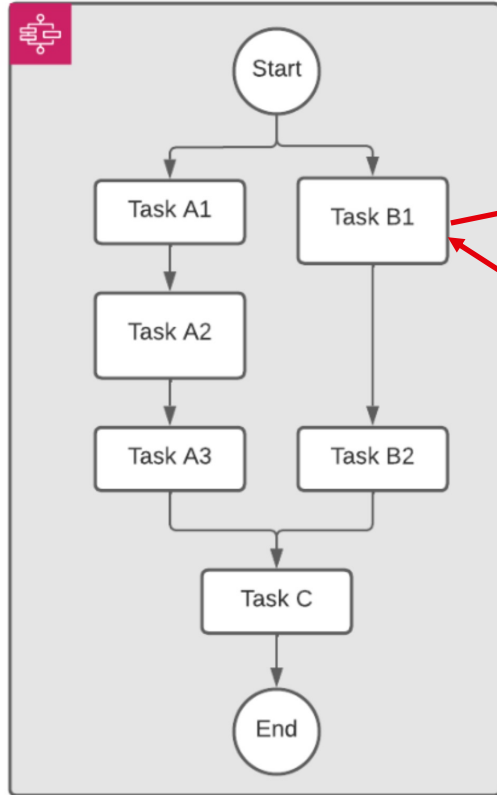
Rewards information is reflected across all systems



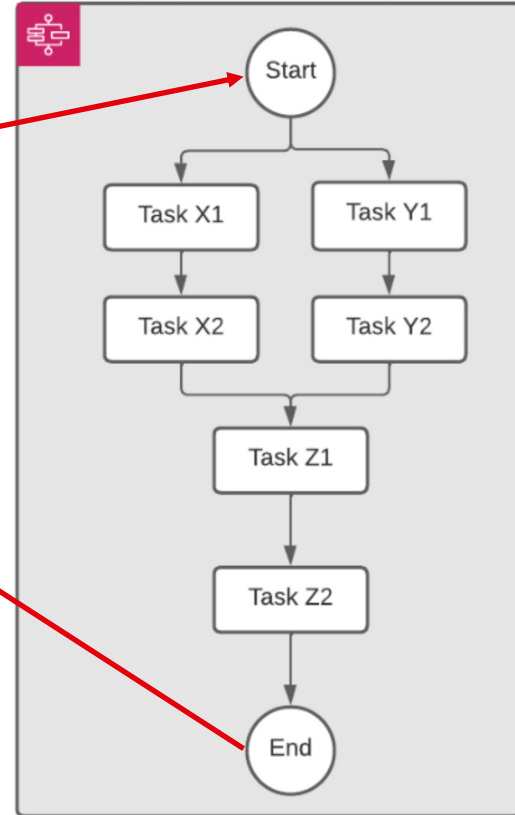
Use Case: Cross-service orchestration



Microservice A



Microservice X

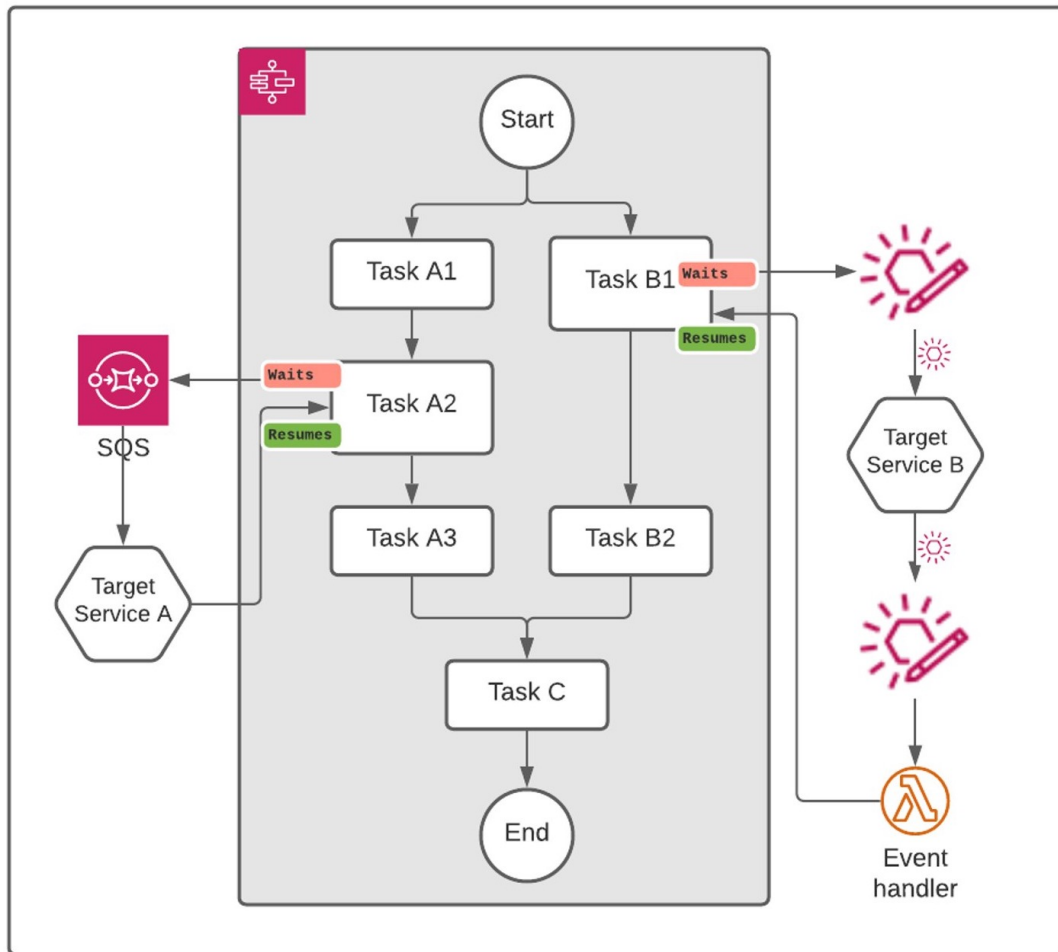


Task Token

Response with Task Token

Demo – Task Tokens





Benefits of Event Driven Patterns

Scalability!

- ❑ Serverless and Event Driven Architectures go hand in hand
- ❑ Events are handled asynchronously - services can work at their own rate
- ❑ Additional services can be plugged in without affecting the existing system



See you at Black Friday 2022

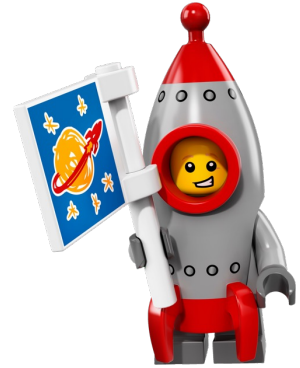
Join LEGO® VIP to enjoy access to rewards and discounts throughout the year. It's free!

Shop now >



Resilience & Fault Tolerance!

- ❑ In the case of downtime, messages reprocessed with no data loss
- ❑ If one service fails, other services are unaffected



Fast Development!

- ❑ Quick to onboard new developers
- ❑ Developers don't need to overthink the system
- ❑ Quick to spin up new services

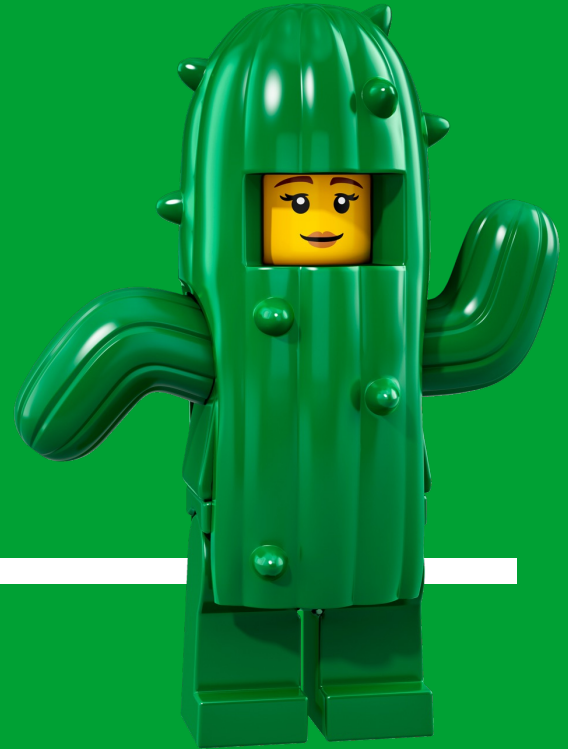


Code Examples



Wrapping Up!

Special thanks to Sheen Brisals



@serverlessarah



hamilton-sarah



08hamiltons