



Advanced EDA Patterns at The LEGO Group



Sarah Hamilton



@serverlesssarah



hamilton-sarah



08hamiltons





90
years
of play



Build a fire station ... that can take you to Mars

Why do we say there's a playground in every box? Because after 90 years, LEGO® sets are still inspiring builders of all ages to build and rebuild the world.

[Shop now >](#)[Learn more >](#)

New



Exclusives



Offers



Minecraft™



NINJAGO®



Animals

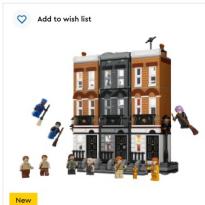


Ideas



VIP

Recommended For You



12 Grimmauld Place
★★★★★
£114.99

[Back order](#)

Hogwarts™: Dumbledore's Office
★★★★★
£69.99

[Add to Bag](#)

Optimus Prime
★★★★★
£149.99

[Add to Bag](#)

Loop Coaster
★★★★★
£344.99

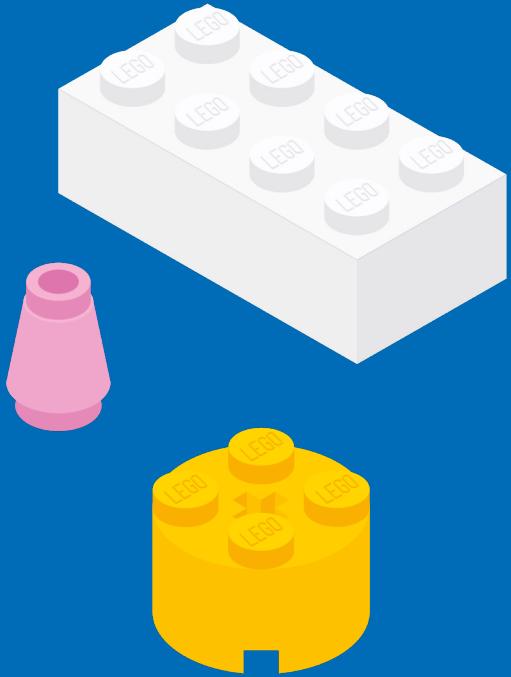
[Add to Bag](#)

Get this gift with purchases of £90 or more*

[Shop now >](#)

Topics

- Squad Organisation
- Serverless Use Cases & Demos
 - Streaming
 - Event Buses
 - Orchestration
- Benefits of Event Driven Architectures



Squad Organization

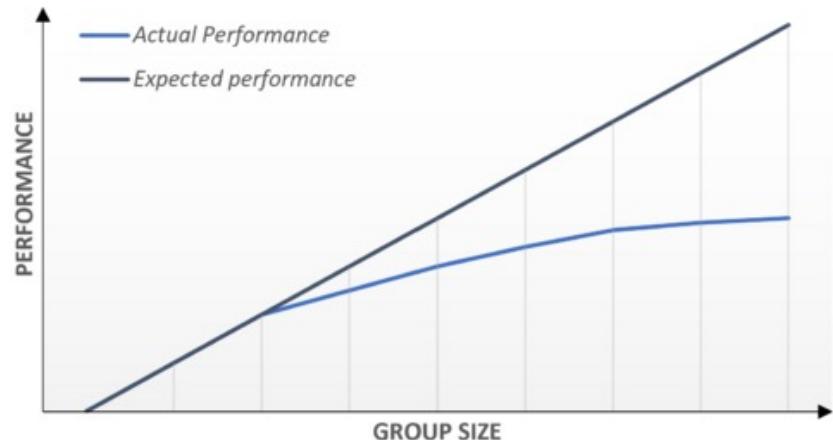


"We try to create teams that are no larger than can be fed by two pizzas," said Bezos.

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

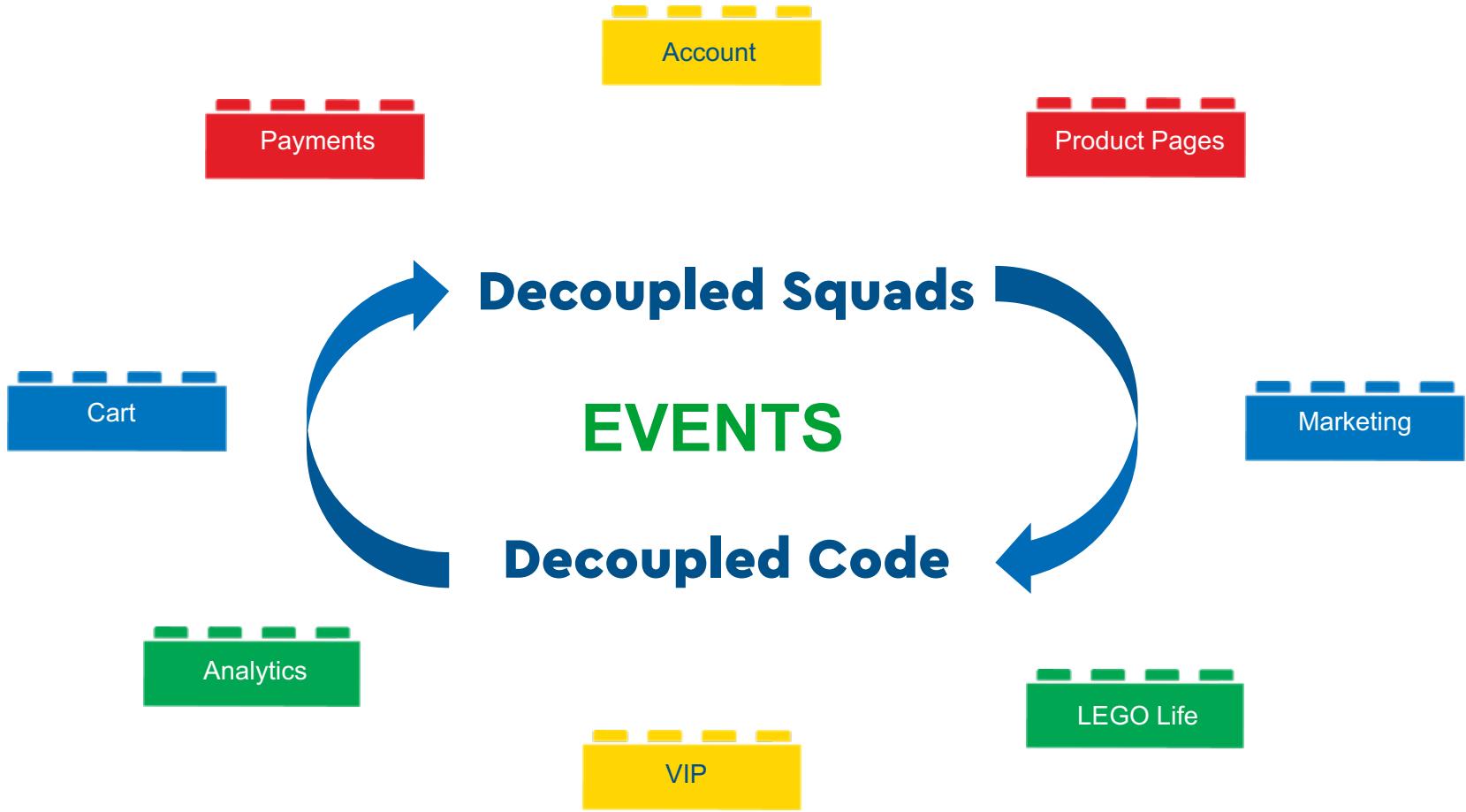


The Ringelmann effect is the tendency for individual members of a group to become increasingly less productive as the size of their group increases.

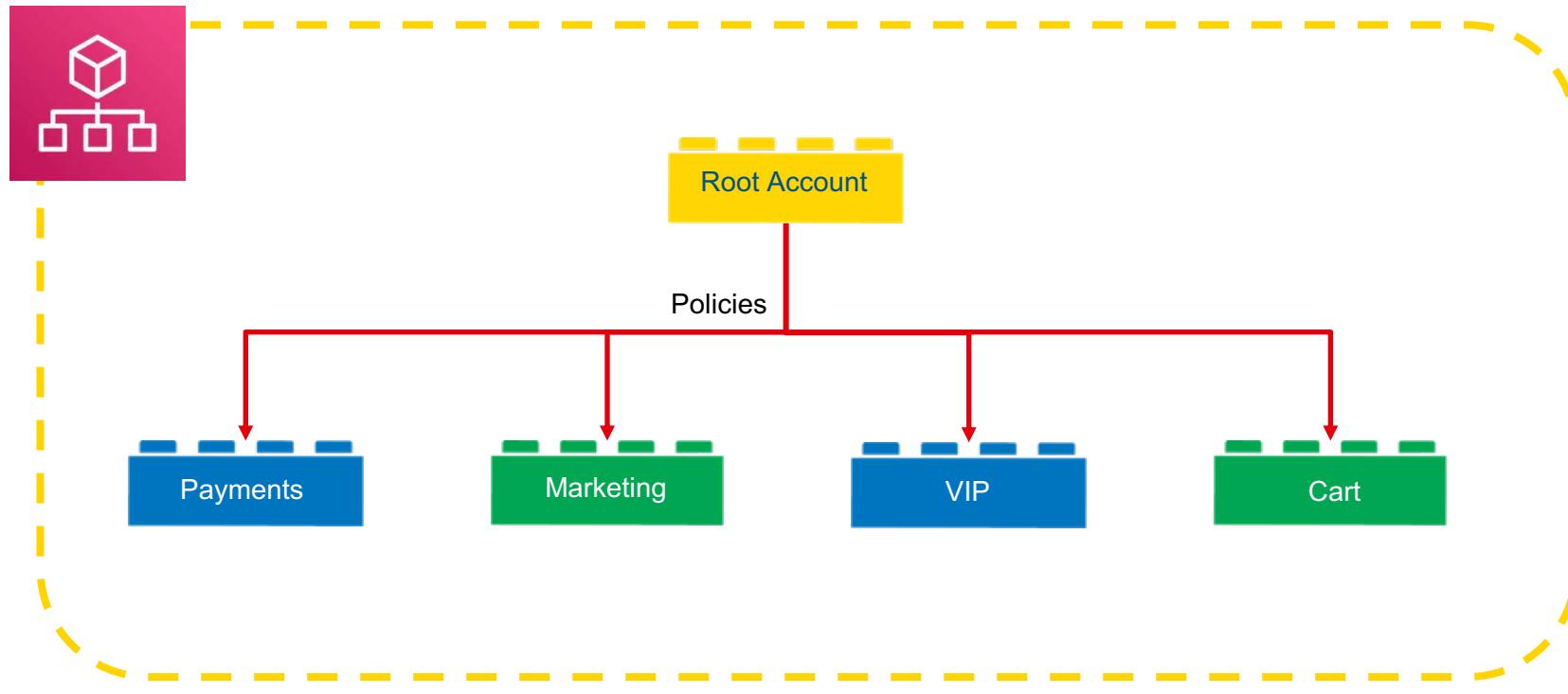


Lærke Viuff Petersen (2022)





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-constructor

service-data-layer-core

service-data-layer-datalake

service-data-layer-newrelic

service-data-layer-optimizely

service-data-layer-recsengine

service-element-import



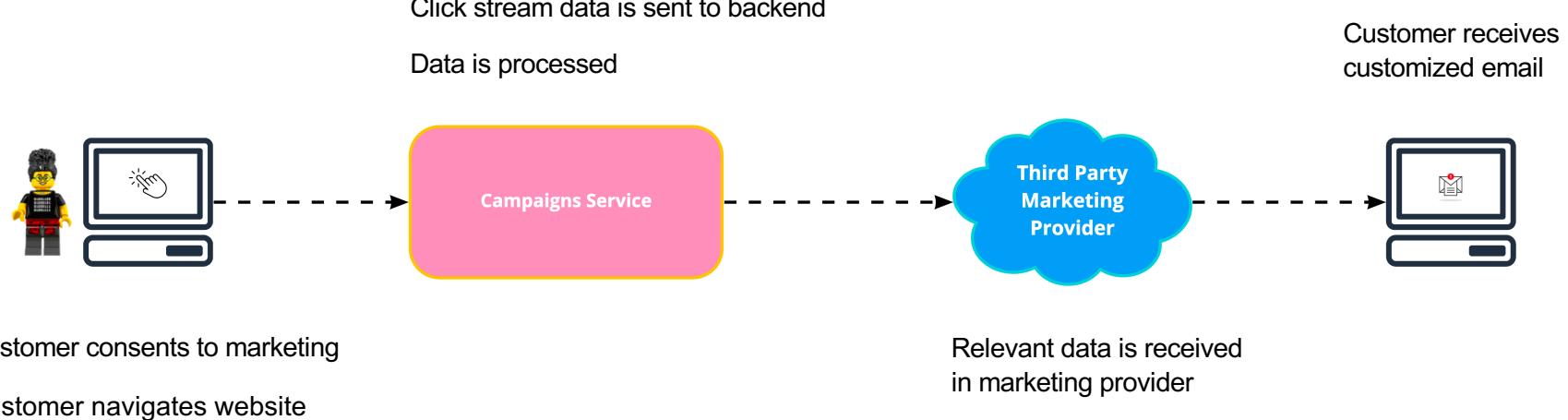
service:service-consent

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

Streaming Events



Use Case: Customer Emails



Use Case: Analytics

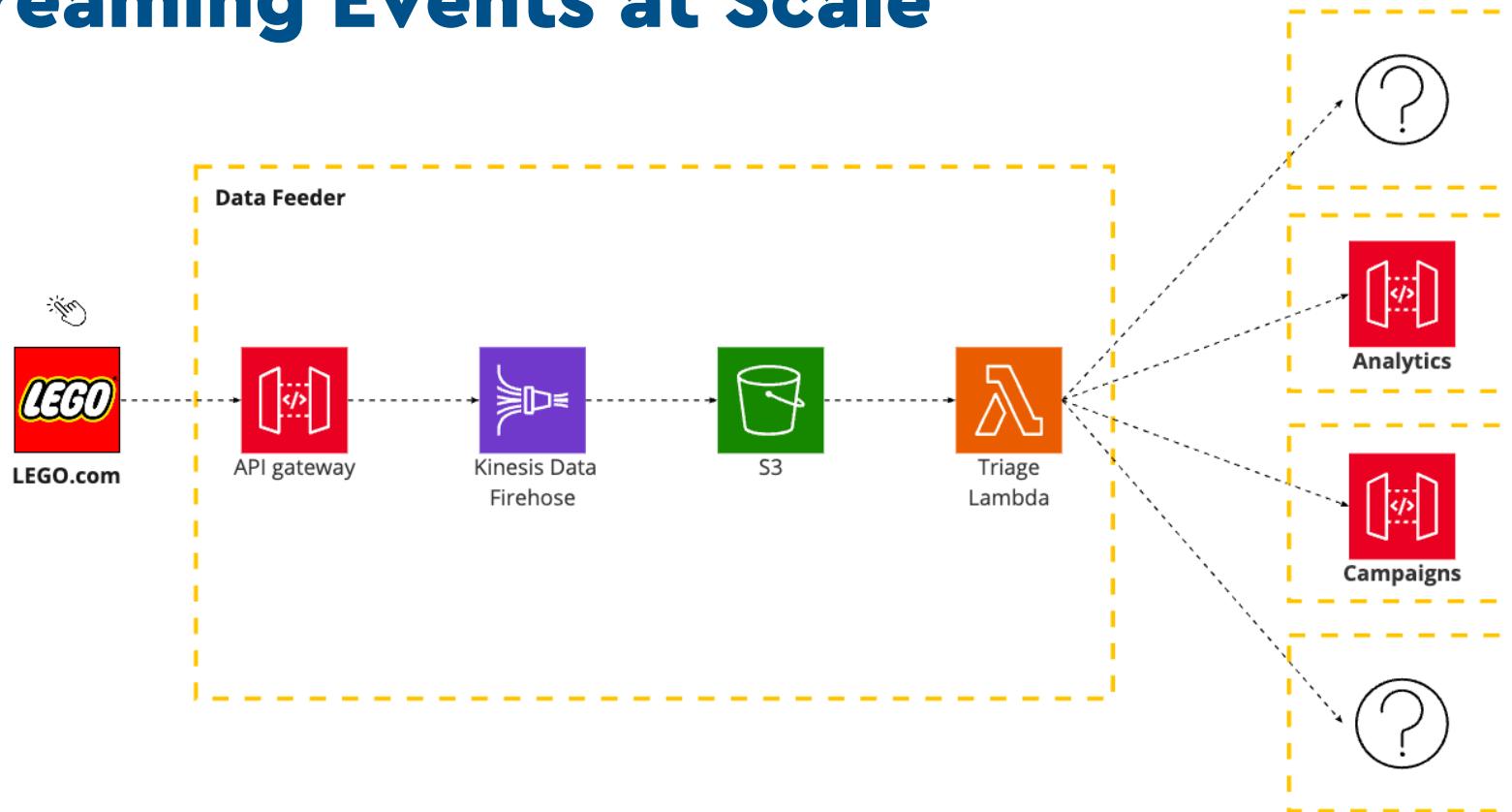


A dramatic photograph of a chessboard. A hand is shown from above, holding a white king chess piece by its neck. The white king is positioned directly above a black king chess piece, which is lying on its side on a light-colored square of the board. The background is dark, making the bright chess pieces stand out.

**One service to
power them all!**

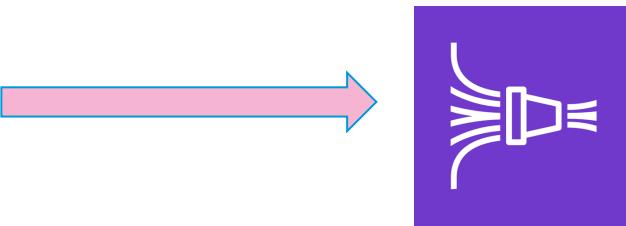
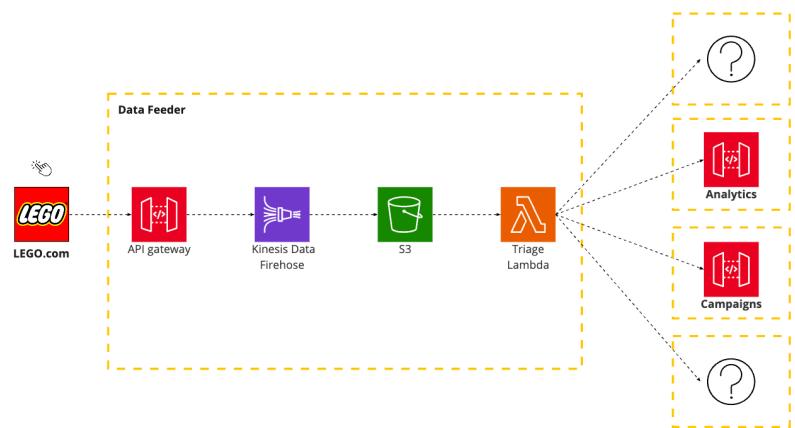


Streaming Events at Scale



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

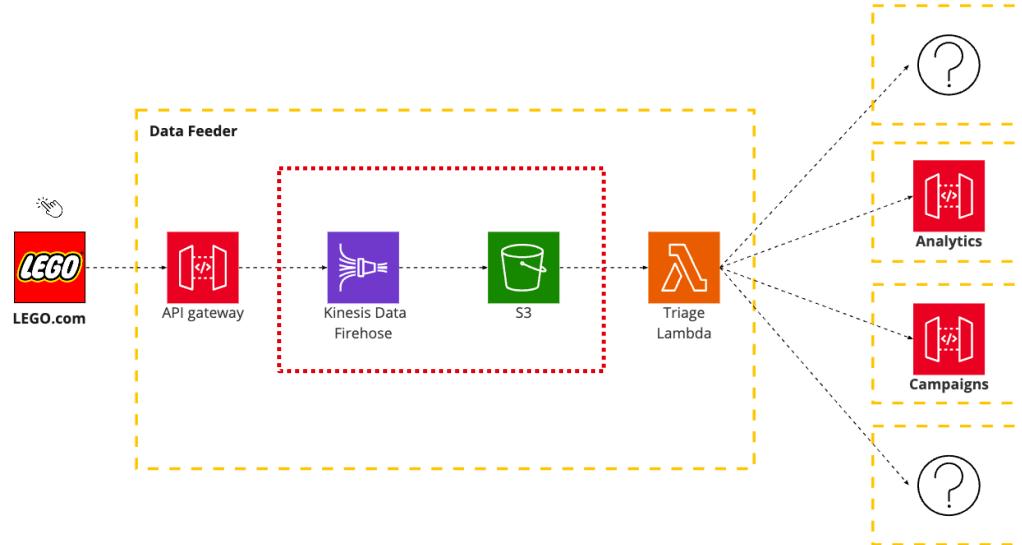
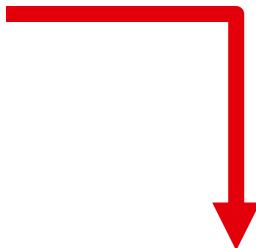
Buffer hints

Buffer size

1 MiB

Buffer interval

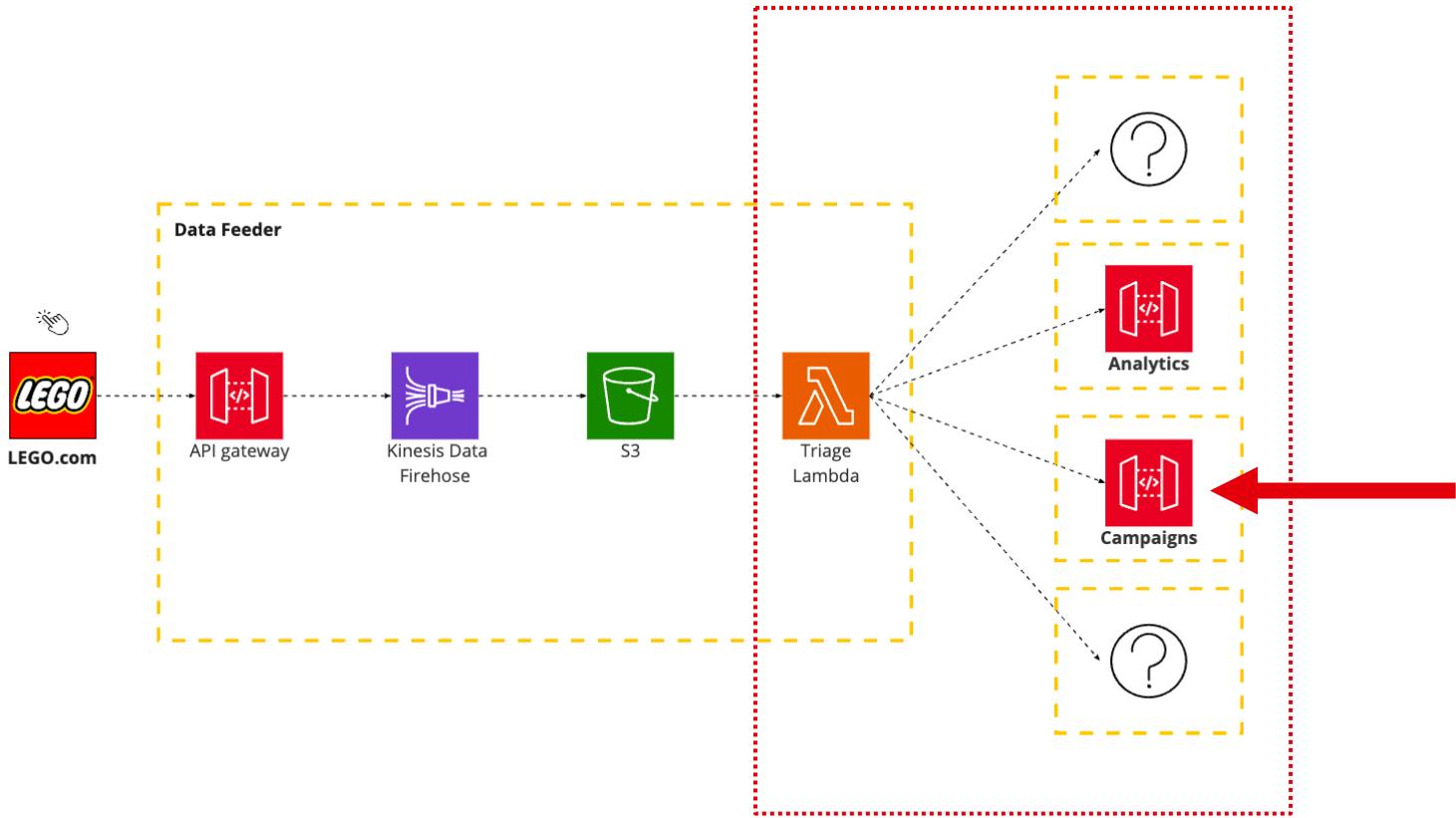
60 seconds



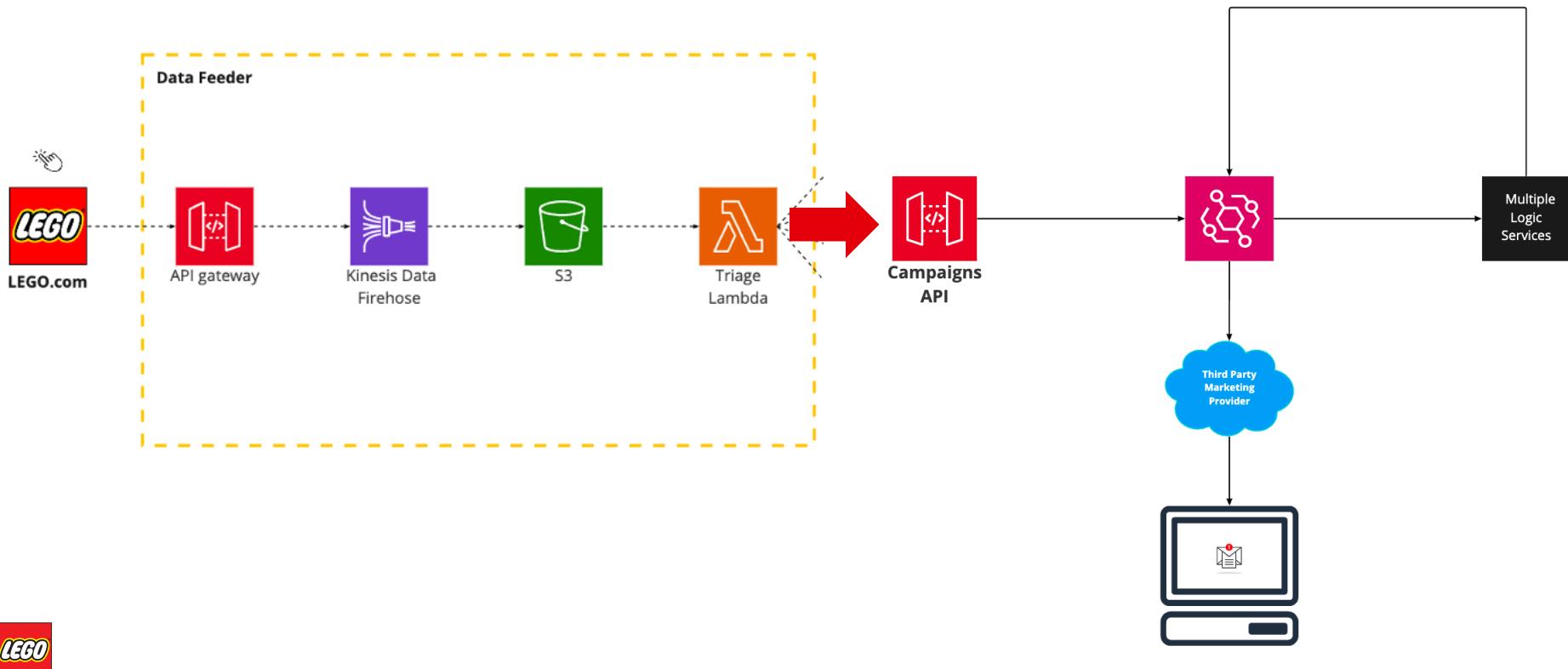
	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-04-55-99546351-b593-40ec-b590-329871e4ff0b	-	August 13, 2022, 08:05:58 (UTC+01:00)	257.7 KB	Standard
<input type="checkbox"/>	dl-event-stream-qa-4-2022-08-13-07-05-56-4a341cba-8d50-4929-9877-736d7883b2ea	-	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-4-2022-08-13-07-10-01-1c079ee28-11f3-420f-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

Demo – Event Streaming

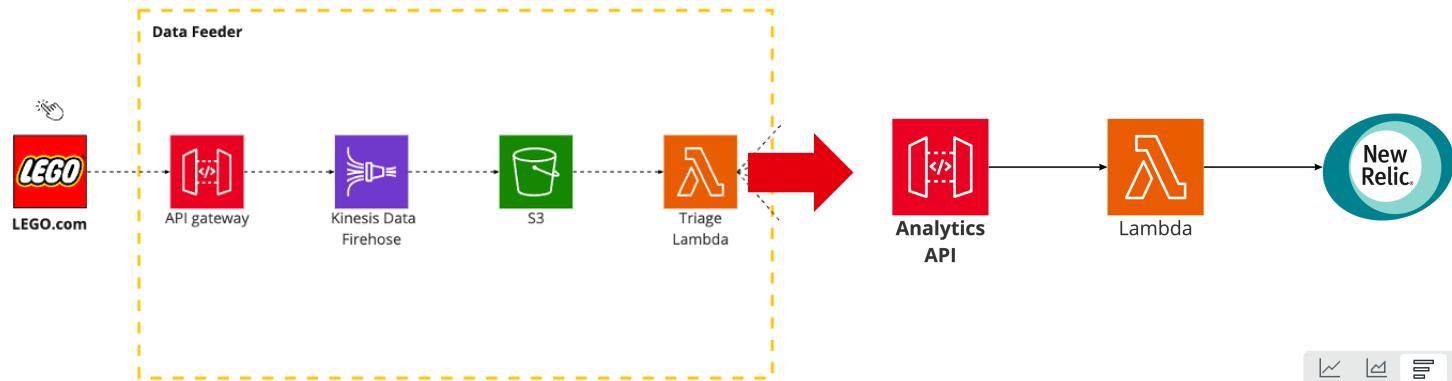




Campaigns Service



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

Credit Card PayPal

Card number

Expiry date CVV 

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

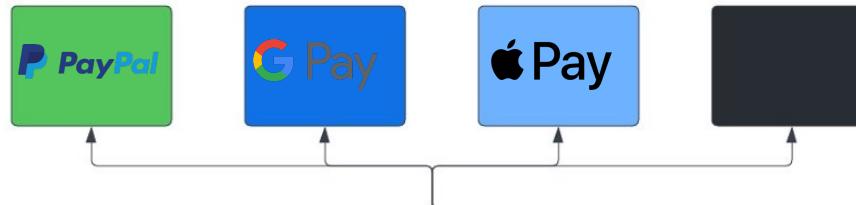
Available Now



Bakery

£34.99 Qty: 1

Payment Service Providers



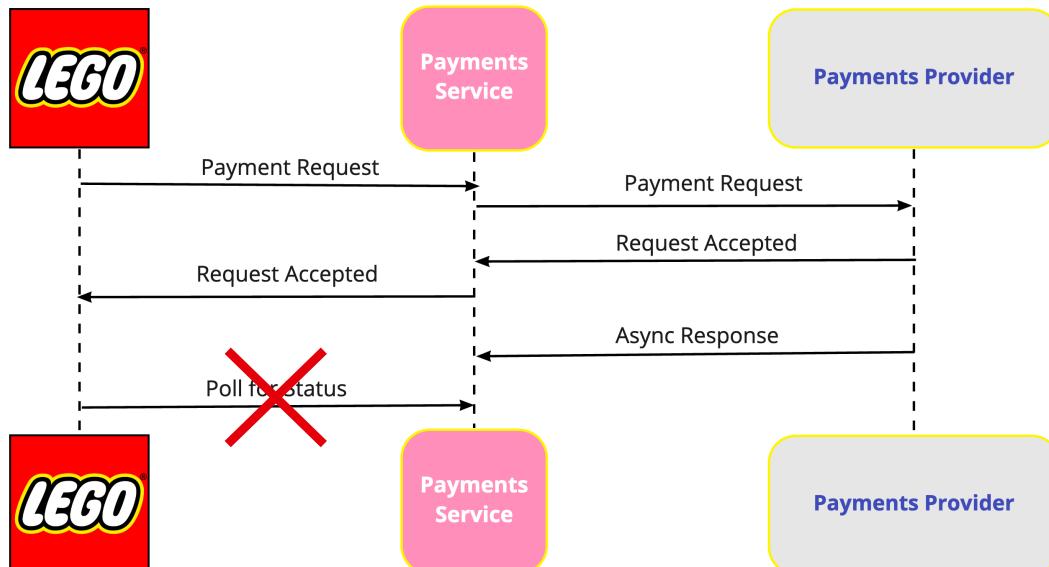
LEGO Payments Platform



LEGO Business Units

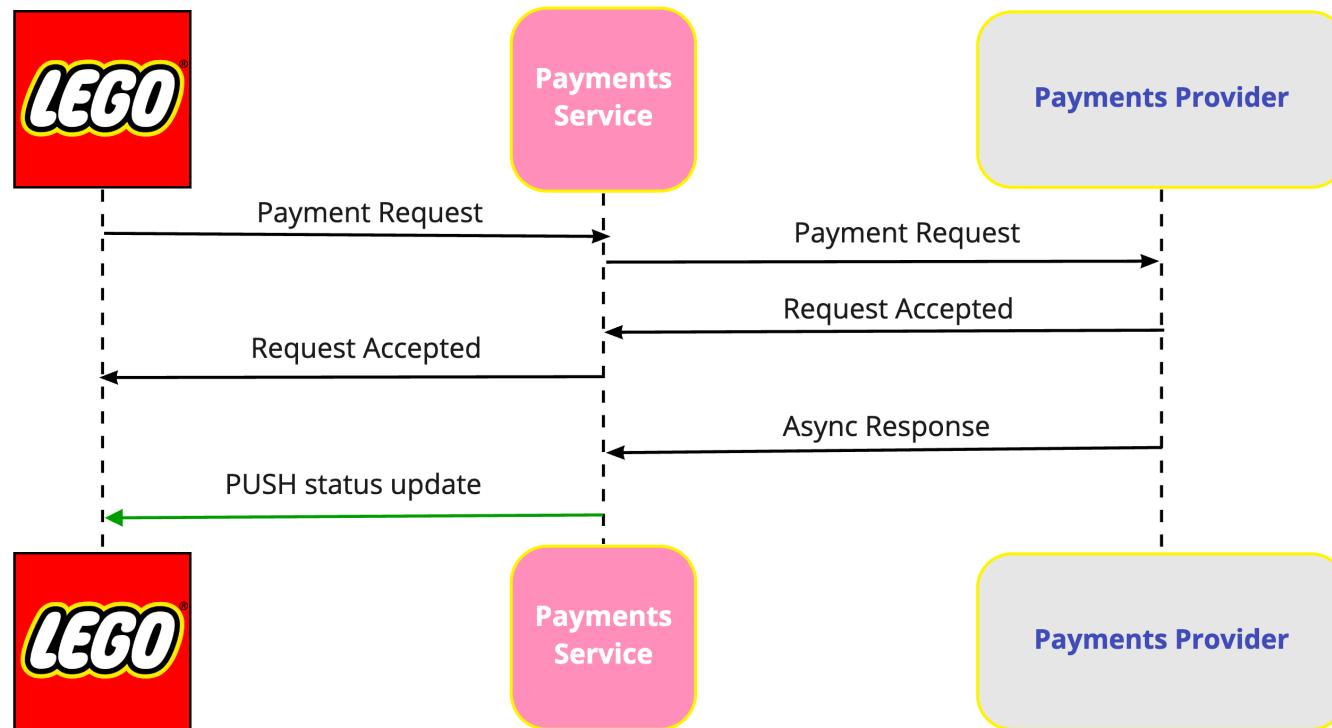


Use Case: Push Notifications – The Problem

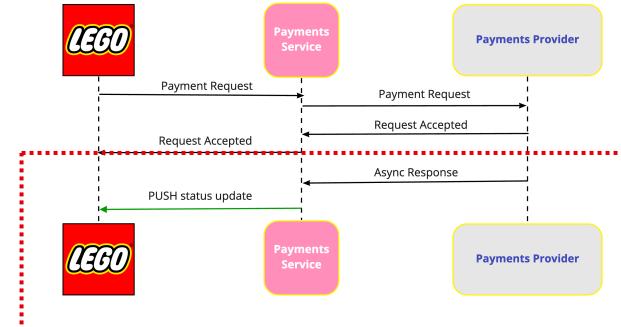


- Multiple Network Requests
- More requests to handle for Payments Service
- Polling is inefficient
- Slower

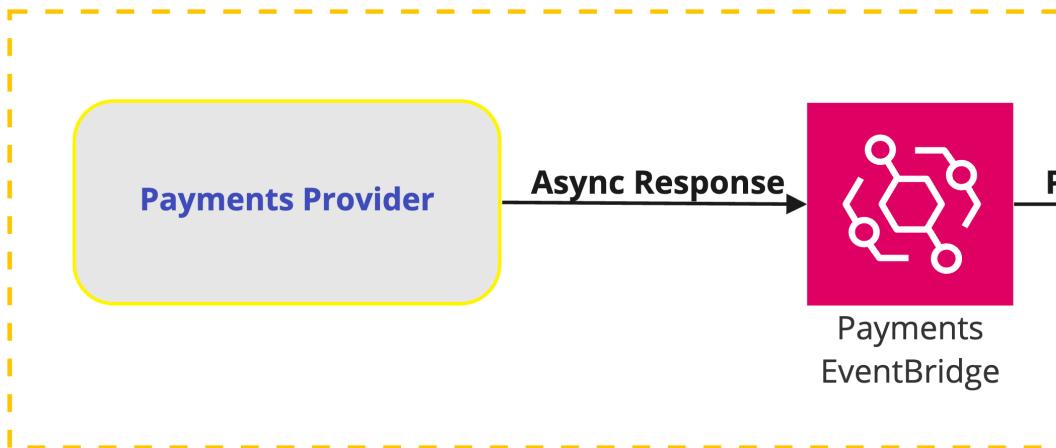
Use Case: Push Notifications – Solution



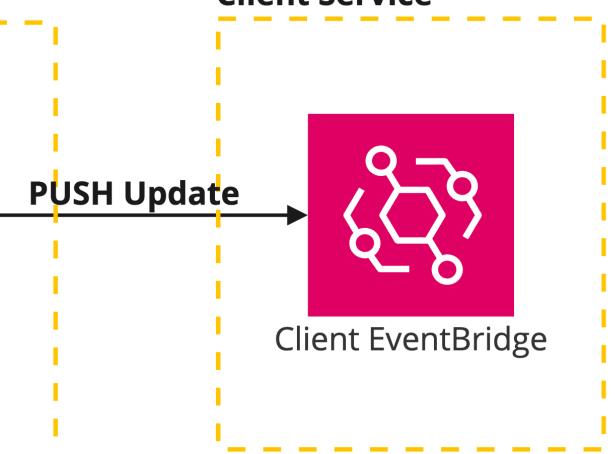
Use Case: Push Notifications



Payments Service



Client Service

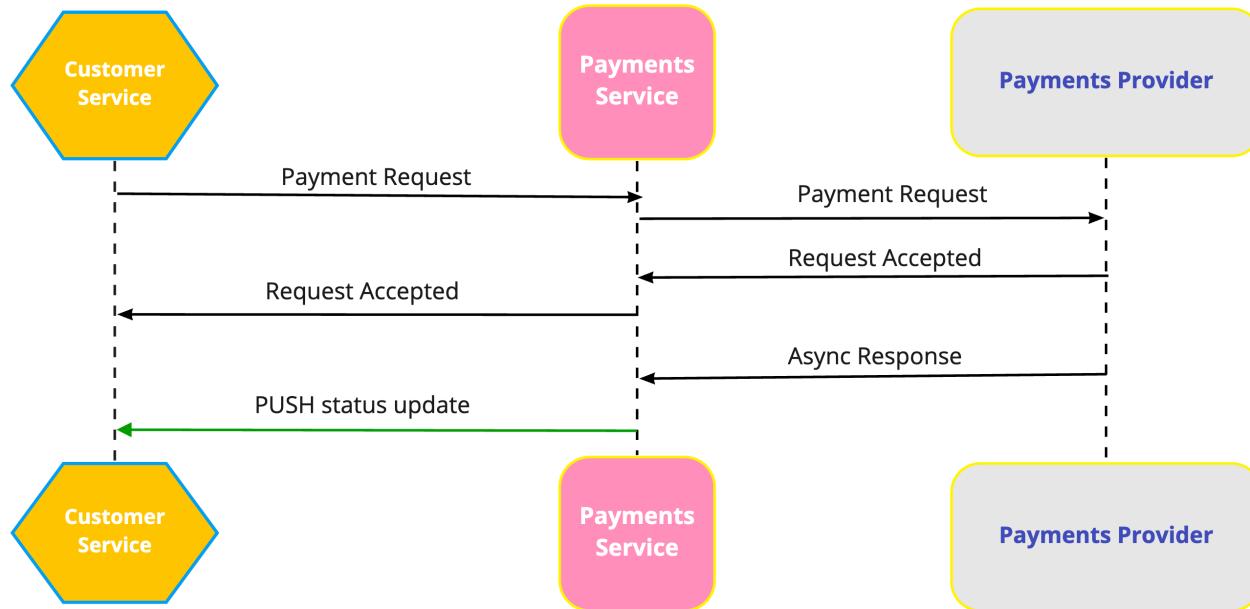


Use Case: Push Notifications

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



HTTP Endpoint

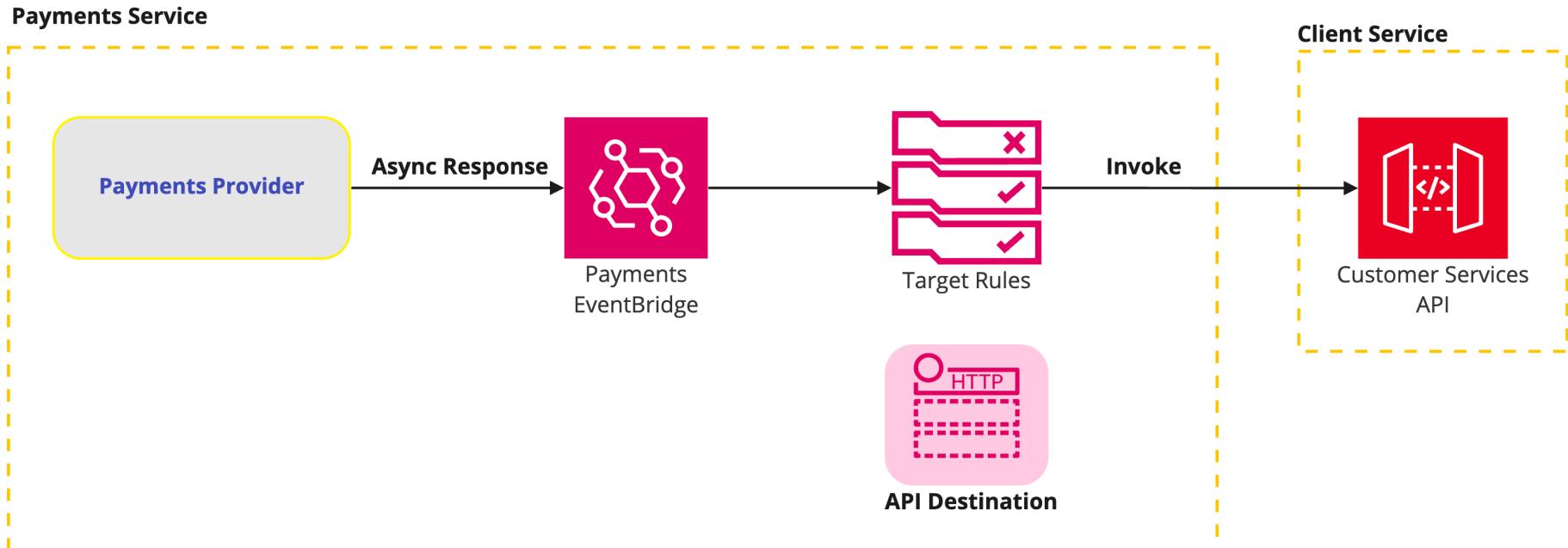


API Destinations

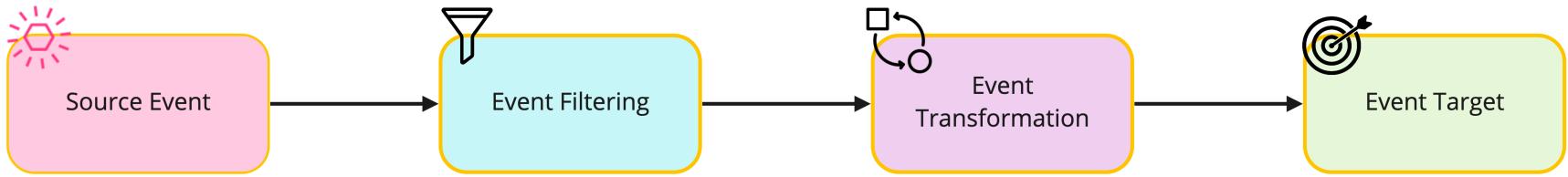
Sending events directly to HTTP Endpoints



API Destinations



API Destinations

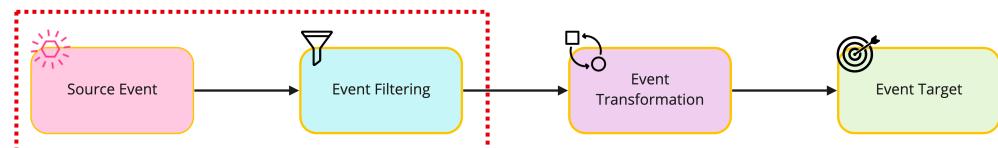


Event Filtering

```
{  
  "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"  
      ]  
    }  
  }  
}
```



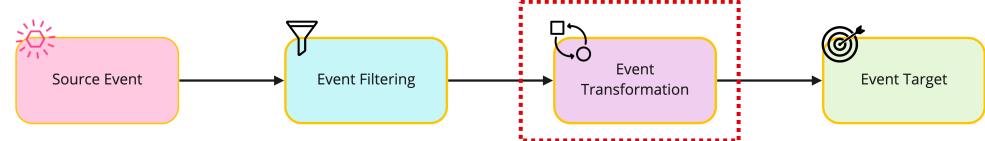
Event Transformation

```
{
  "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

The screenshot shows the LEGO Loyalty Platform homepage. At the top, there's a navigation bar with a "PLAY ZONE" button, a "Don't miss out on LEGO® deals and offers UK 1! Learn More" message, and user account information for "Sarah Hamilton" with 103 VIP Points. Below the bar, there's a yellow header with the LEGO logo, "SHOP", "DISCOVER", "HELP", and a "BLACK FRIDAY" button. A large blue banner with the word "VIP" is prominently displayed. Below the banner, there are five circular icons with labels: "VIP Home" (house icon), "Rewards" (gift icon), "Get More Points" (star icon), "VIP Account" (crown icon), and "Get a Digital VIP Card" (flag icon).

My VIP Account

My Details

Sarah Hamilton	Current VIP Points 103	Points Earned Since Joining 103
sarah.hamilton+vip@lego.com		

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:

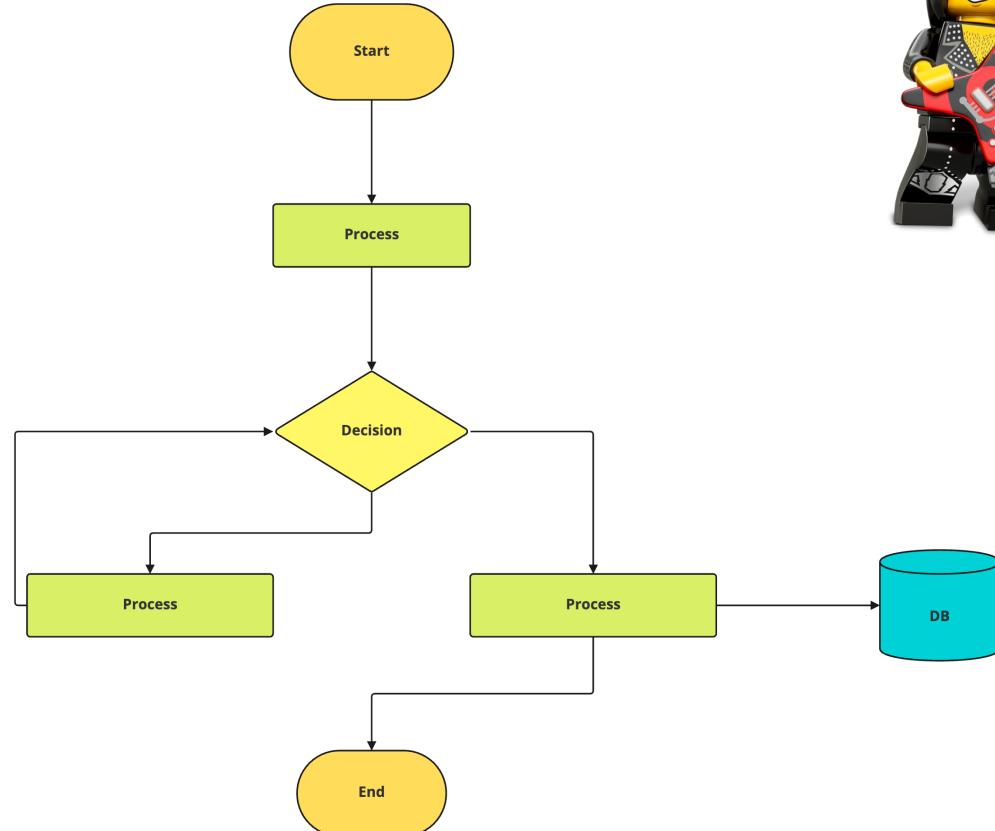
English

Edit

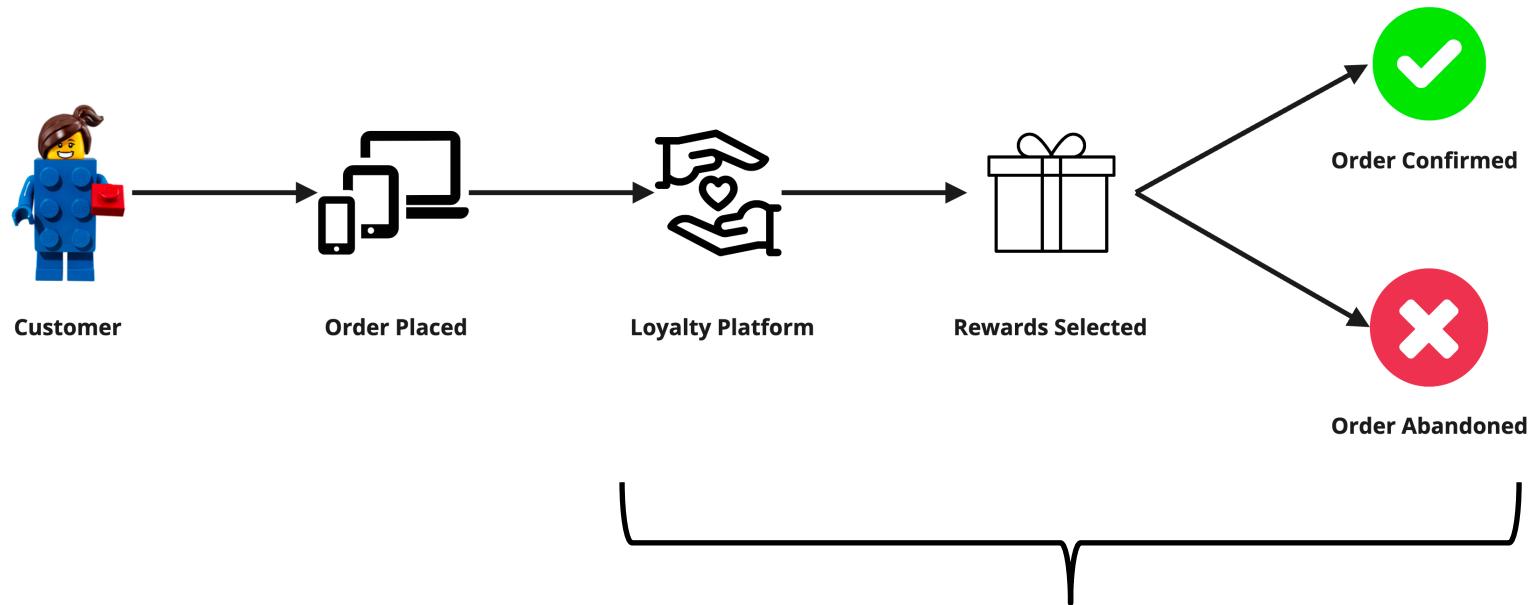


Orchestration

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

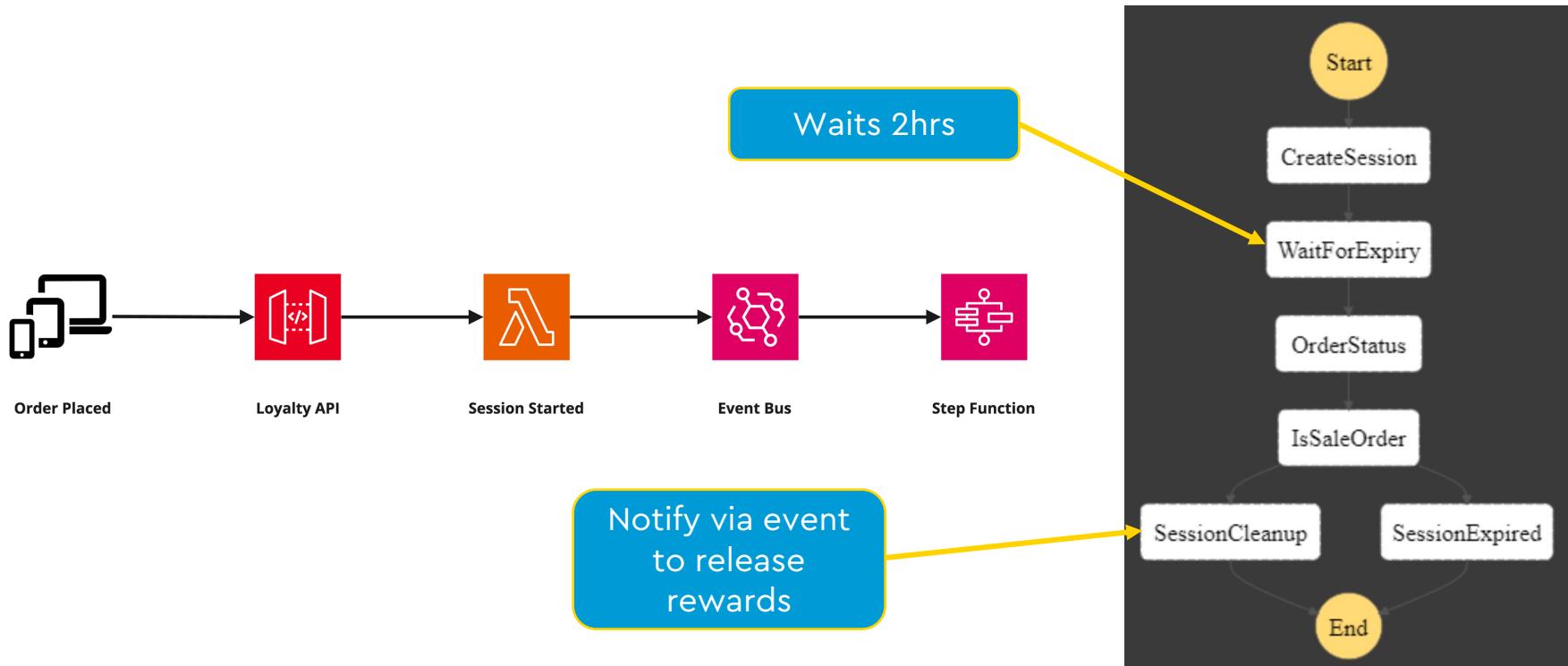


Use Case: User Session Monitoring



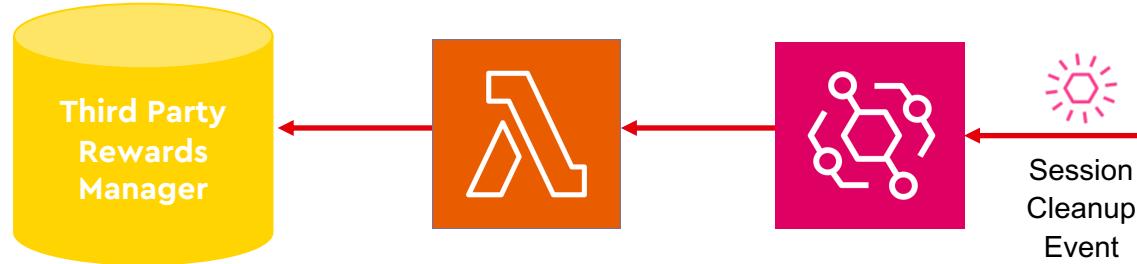
Maximum Duration: 2hrs

Use Case: User Session Monitoring

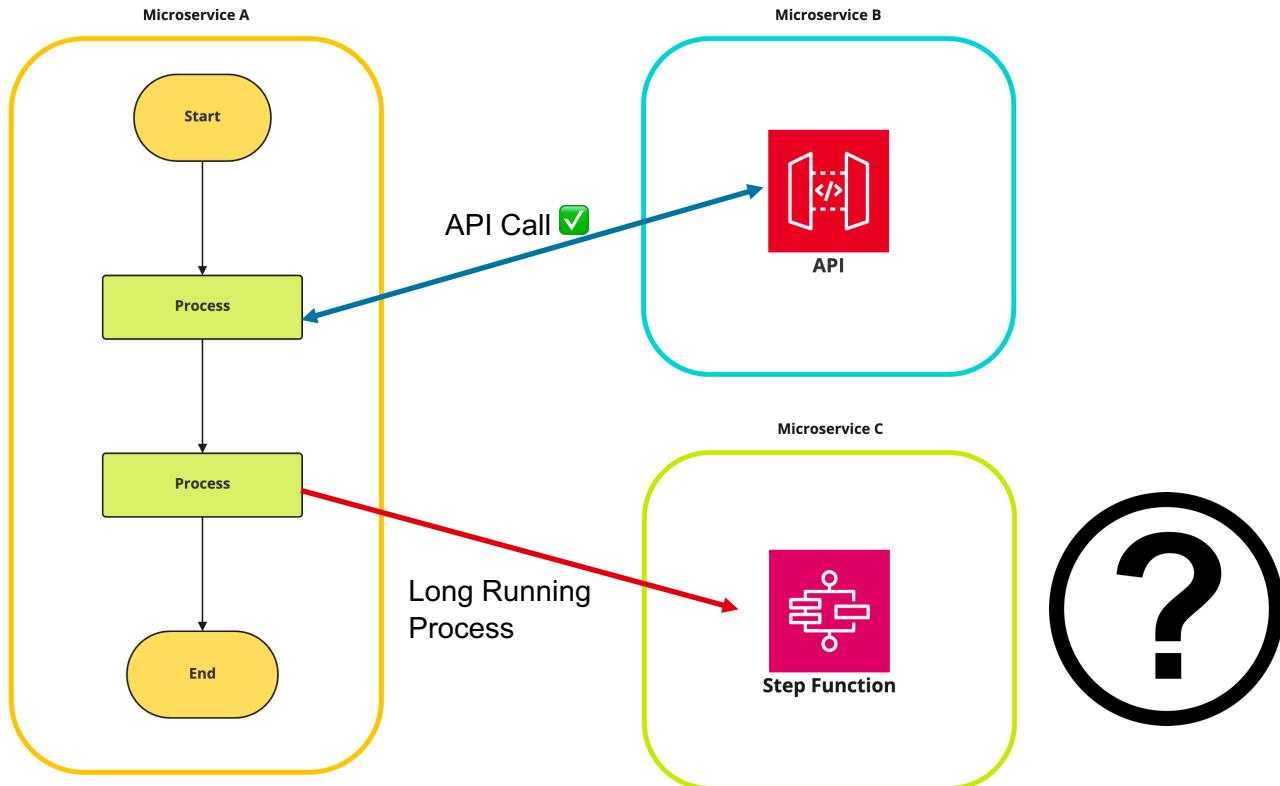


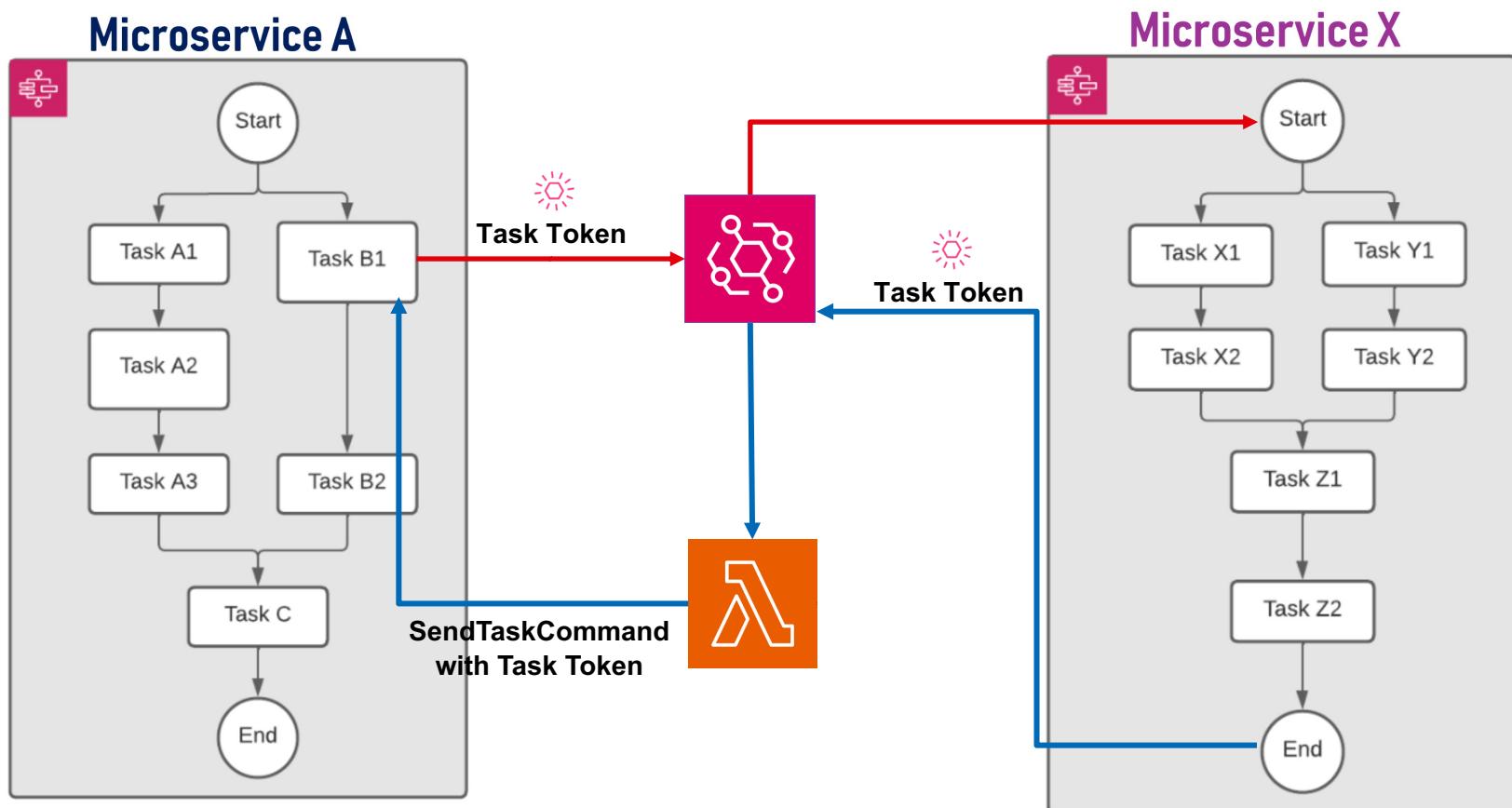
Session Clean-up

Rewards information is reflected across all systems



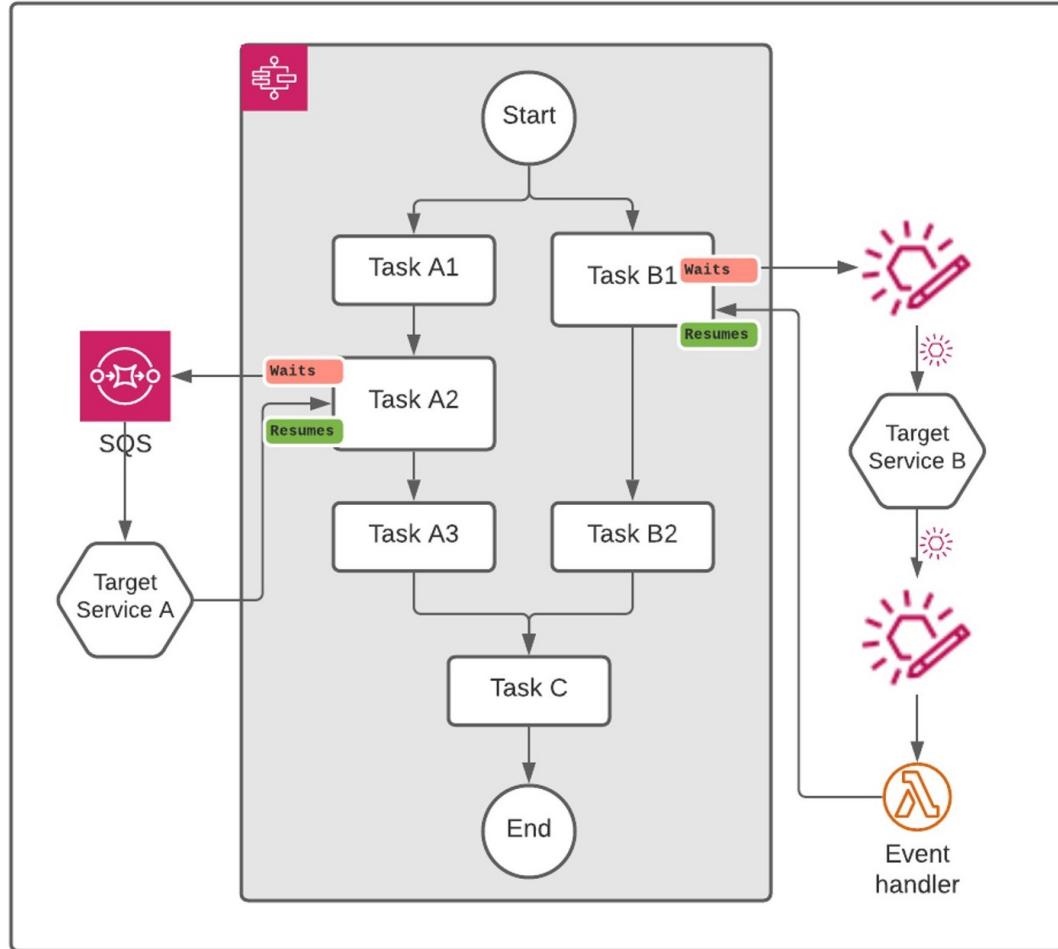
Use Case: Cross-service orchestration





Demo – Task Tokens





Benefits of Serverless 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



@serverlessSarah



hamilton-sarah



08hamiltons