How Monzo tolerates full cloud outages

Andrew Lawson
ENGINEER

Daniel Chatfield
ENGINEER

In the last two years 9 major UK retail banks suffered from a total of 803 hours of downtime caused by IT failures

TREASURY COMMITTEE, MARCH 2025
https://committees.parliament.uk/committee/158/treasury-committee/news/205611

If your bank was down and you couldn’t access your money

How would you pay your bills or pay for your food shop?

How would you get home?

How would you know for sure your money is safe?

The basics of cloud platform resiliency

is the practical limit for most of us

Replication between servers

AZ-1
AZ-2
AZ-3
Replication between Availability Zones

Basic cloud platform resiliency does quite well in a few scenarios

- Solves for failure of a host machine / node
- Solves for failure of a data centre / availability zone
- Is there anything else?

Failure of a Region or failure of a whole Cloud Provider

Failure of a Region or failure of a whole Cloud Provider

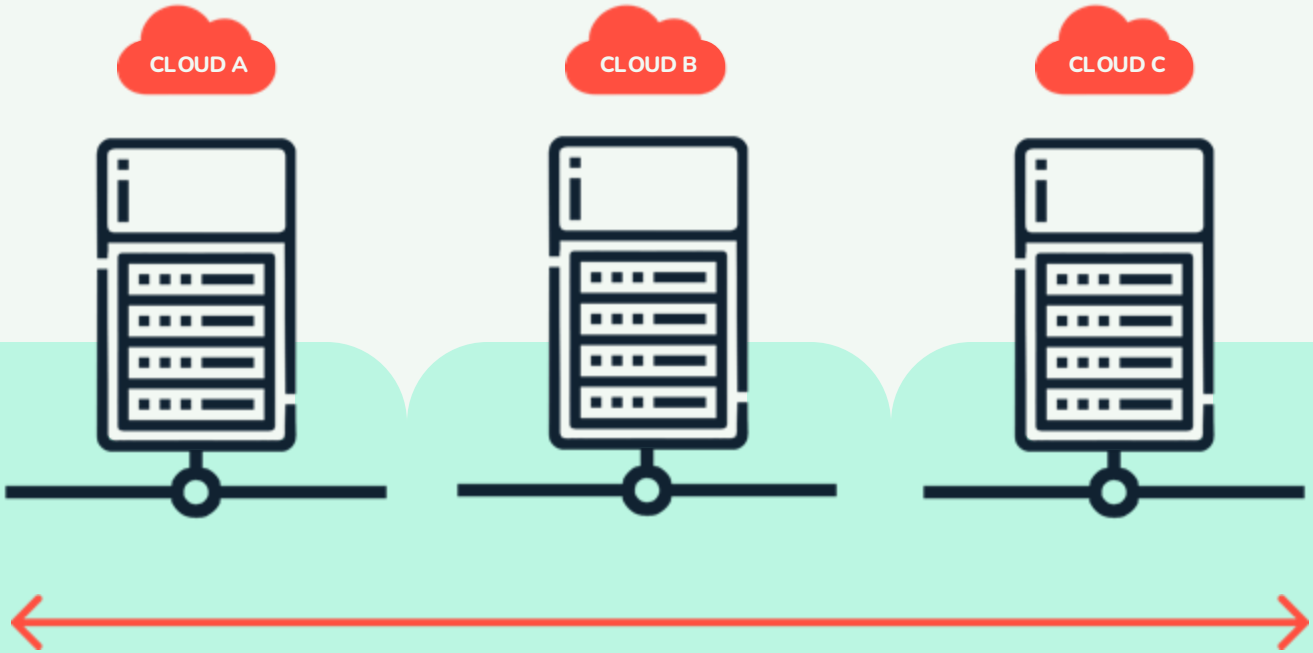
Failure of the software deployed within the Platform

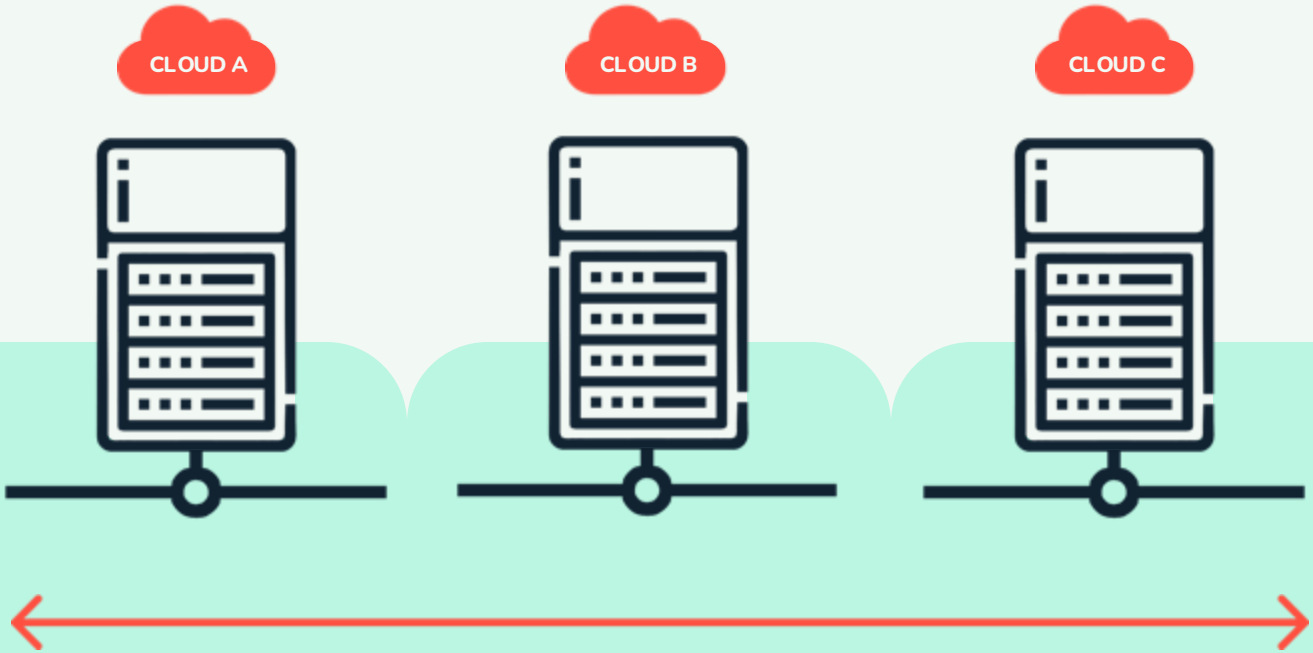
Failure of a Region or failure of a whole Cloud Provider

Failure of the software deployed within the Platform

Active-Active
Multi-Cloud Platforms
aren’t practical

AZ-1
AZ-2
AZ-3
Replication between Availability Zones


CLOUD A
CLOUD B
CLOUD C
Replication across Cloud providers


CLOUD A
CLOUD B
CLOUD C
Replication across Cloud providers

Active-Active Multi-Cloud Platforms can work, but they come with significant drawbacks at scale.

Failure of a Region or failure of a whole Cloud Provider

Failure of the software deployed within the Platform

Traditional Disaster Recovery

don’t solve the problem

The NATS incident of August 2023 wasn’t prevented by their secondary site

- Service downtime for 3 hours, impact continued for 3 days
- Cancellations and delays impacted over 700,000 passengers
- Estimated total cost of £100 million to the industry

> “ Despite having created a critical exception error in the primary system, the same flight plan details were presented to the secondary system which went through the same process of trying to identify a valid route through UK airspace but with the same result: namely, a second critical exception error and disconnection of the secondary system from NAS. ”

TREASURY COMMITTEE, MARCH 2025
https://committees.parliament.uk/committee/158/treasury-committee/news/205611

Failure of a Region or failure of a whole Cloud Provider

Failure of the software deployed within the Platform

We built a system we call Monzo Stand-in

with different software, data and infrastructure

Monzo Stand-in takes over our most important services when the primary fails

Additional layer of defence, not a substitute for a reliable primary

Only serves the most important things to our customers

Maximum independence from the primary platform

Monzo Stand-in takes over our most important services when the primary fails

Additional layer of defence, not a substitute for a reliable primary

Only serves the most important things to our customers

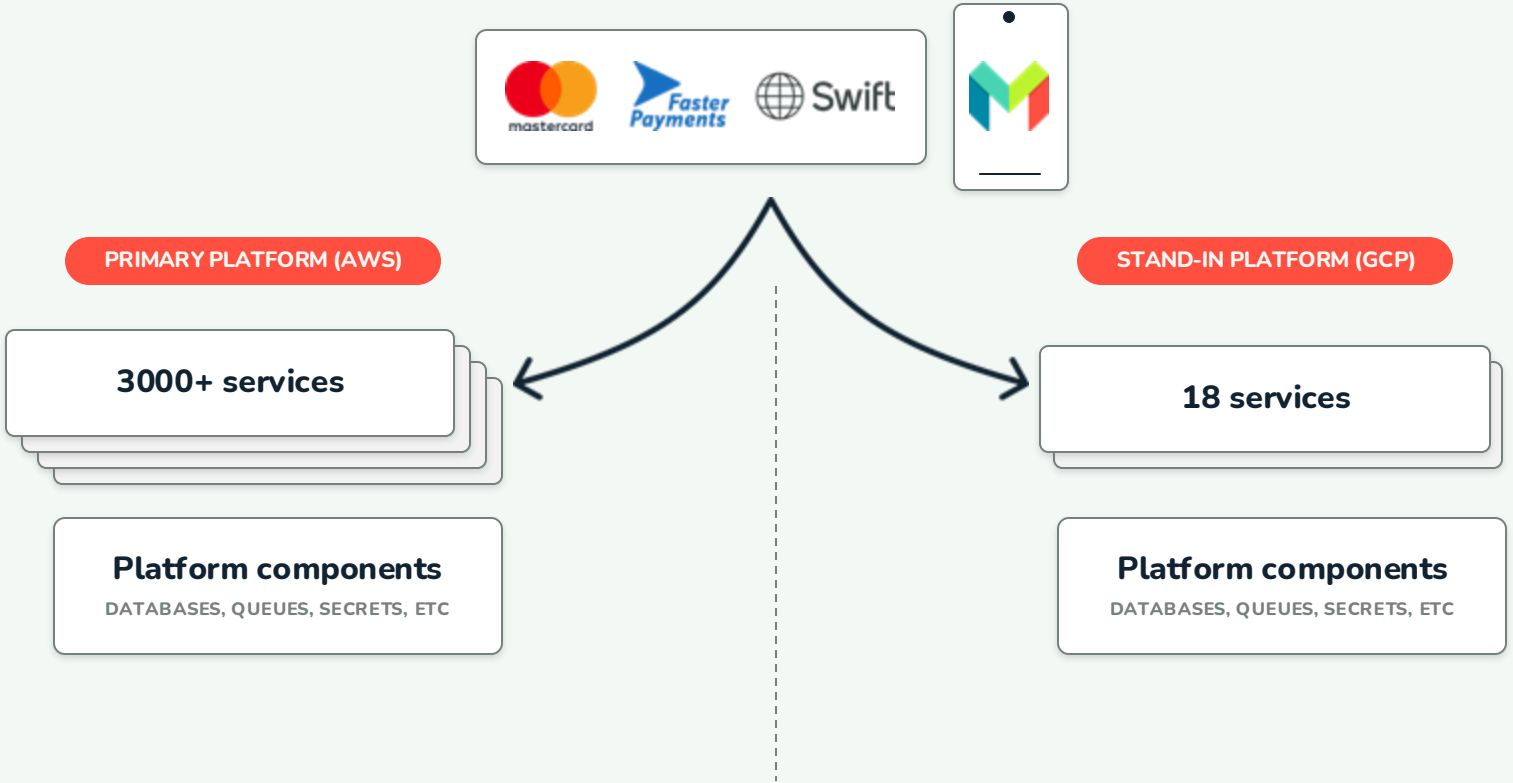
Maximum independence from the primary platform

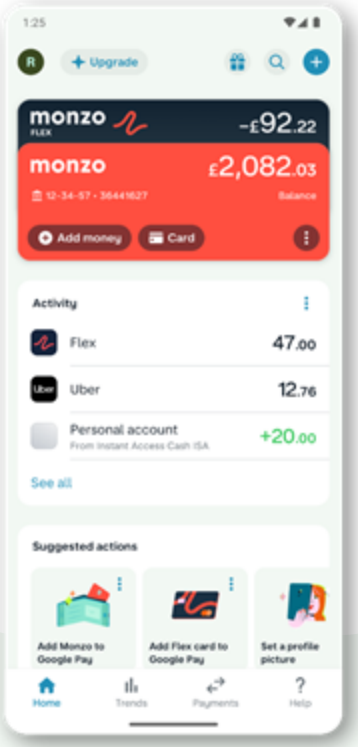
Monzo Stand-in takes over our most important services when the primary fails

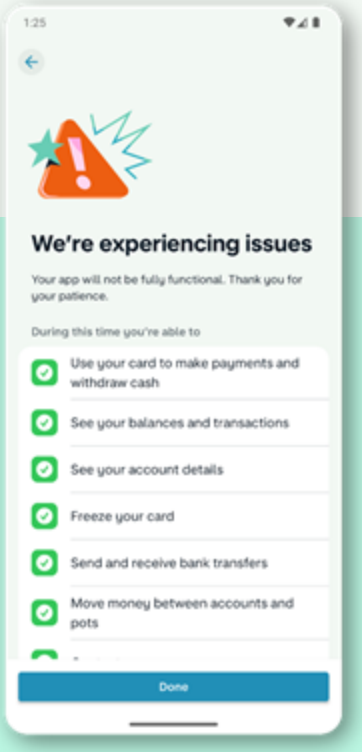
Additional layer of defence, not a substitute for a reliable primary

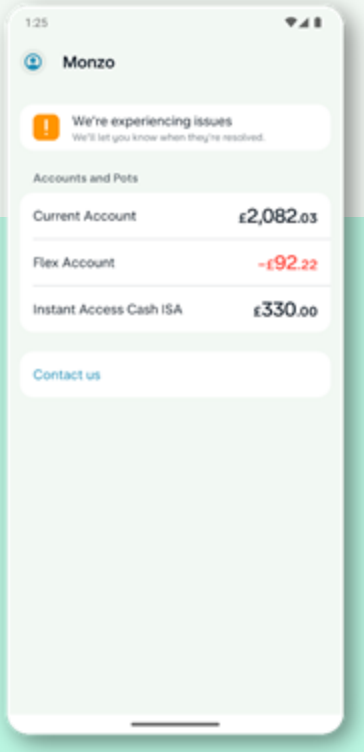
Only serves the most important things to our customers

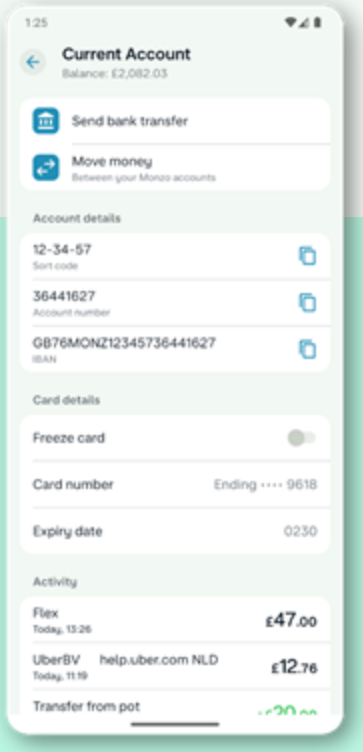
Maximum independence from the primary platform


mastercard
Faster Payments
Swift
PRIMARY PLATFORM (AWS)
STAND-IN PLATFORM (GCP)
3000+ services
18 services
Platform components
DATABASES, QUEUES, SECRETS, ETC
Platform components
DATABASES, QUEUES, SECRETS, ETC


1:25
Upgrade
monzo FLEX
-£92.22
monzo
£2,082.03
12-34-57 · 36441627
Balance
Add money
Card
Activity
Flex
47.00
Uber
12.76
Personal account
From Instant Access Cash ISA
+20.00
See all
Suggested actions
Add Monzo to Google Pay
Add Flex card to Google Pay
Set a profile picture
Home
Trends
Payments
Help

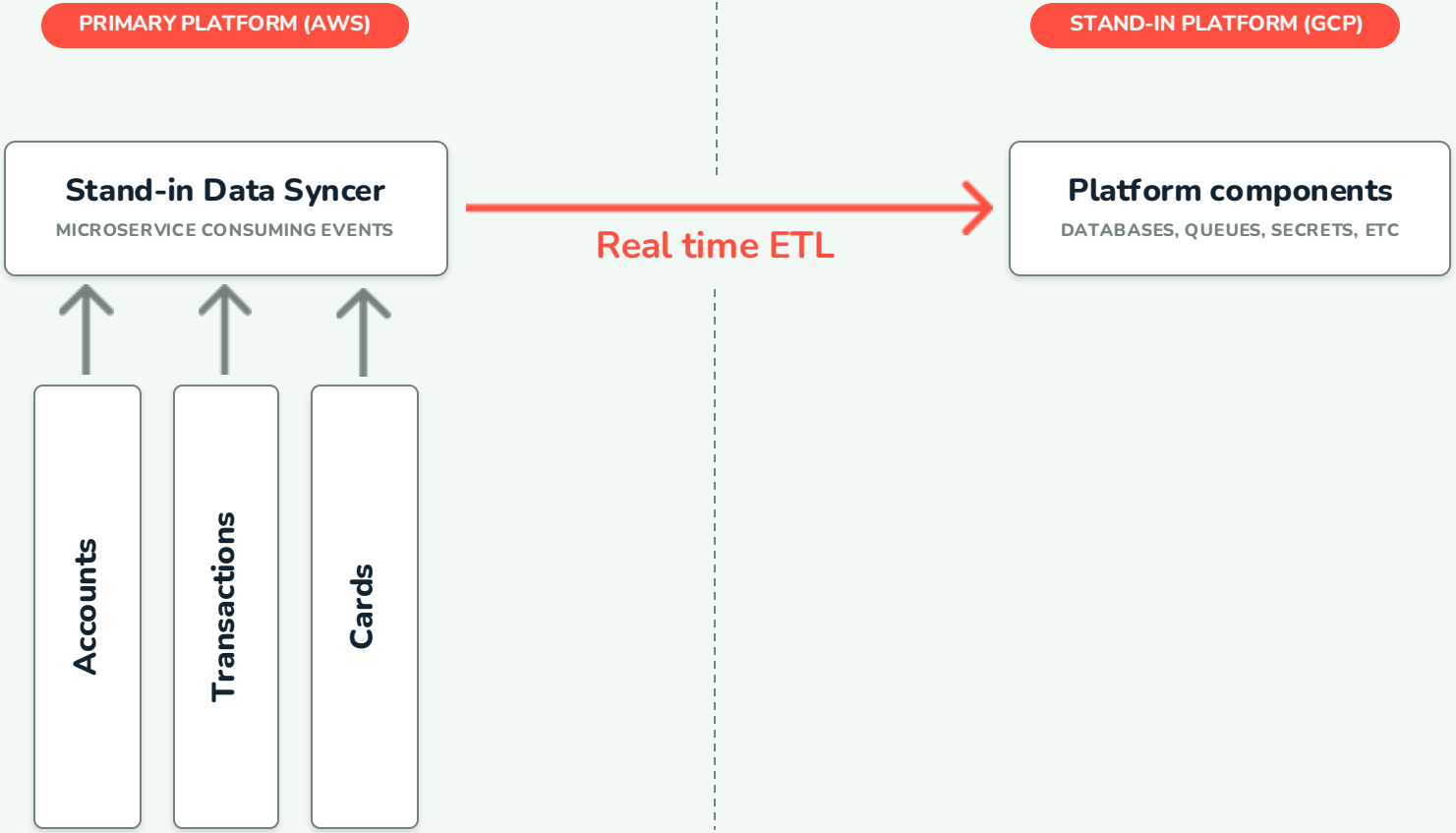

1:25
We're experiencing issues
Your app will not be fully functional. Thank you for your patience.
During this time you're able to
Use your card to make payments and withdraw cash
See your balances and transactions
See your account details
Freeze your card
Send and receive bank transfers
Move money between accounts and pots
Done


1:25
Monzo
We're experiencing issues
We'll let you know when they're resolved.
Accounts and Pots
Current Account
£2,082.03
Flex Account
-£92.22
Instant Access Cash ISA
£330.00
Contact us


1:25
Current Account
Balance: £2,082.03
Send bank transfer
Move money
Between your Monzo accounts
Account details
12-34-57
Sort code
36441627
Account number
GB76MONZ12345736441627
IBAN
Card details
Freeze card
Card number
Ending ···· 9618
Expiry date
0230
Activity
Flex
Today, 13:26
£47.00
UberBV help.uber.com NLD
Today, 11:19
£12.76
Transfer from pot

Updating the data in the Stand-in Platform

with eventual consistency


PRIMARY PLATFORM (AWS)
STAND-IN PLATFORM (GCP)
Stand-in Data Syncer
MICROSERVICE CONSUMING EVENTS
Real time ETL
Platform components
DATABASES, QUEUES, SECRETS, ETC
Accounts
Transactions
Cards

Processing payments in Monzo Stand-in

without depending on a single consistent ledger

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	£0
TOTAL BALANCE	£150
HAS BALANCE FOR TRANSACTION	£100 < 150?

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	£0
TOTAL BALANCE	£150
HAS BALANCE FOR TRANSACTION	£100 < 150?

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	£0
TOTAL BALANCE	£150
HAS BALANCE FOR TRANSACTION	£100 < 150?

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	£0
TOTAL BALANCE	£150
HAS BALANCE FOR TRANSACTION	£100 < 150?

STAND-IN TRANSACTIONS

-£100 spent at M&S

PROCESSING PAYMENTS IN STAND-IN

		STAND-IN TRANSACTIONS
SYNCED BALANCE	£150	-£100 spent at M&S
ANY STAND-IN TRANSACTIONS	-£100	
TOTAL BALANCE	£50	
HAS BALANCE FOR TRANSACTION	£100 < 50?	

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	-£100
TOTAL BALANCE	£50
HAS BALANCE FOR TRANSACTION	£100 < 50?

STAND-IN TRANSACTIONS

-£100 spent at M&S

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	-£100
TOTAL BALANCE	£50
HAS BALANCE FOR TRANSACTION	£100 < 50?

STAND-IN TRANSACTIONS

-£100 spent at M&S

PROCESSING PAYMENTS IN STAND-IN

SYNCED BALANCE	£150
ANY STAND-IN TRANSACTIONS	-£100
TOTAL BALANCE	£50
HAS BALANCE FOR TRANSACTION	£100 < 50?

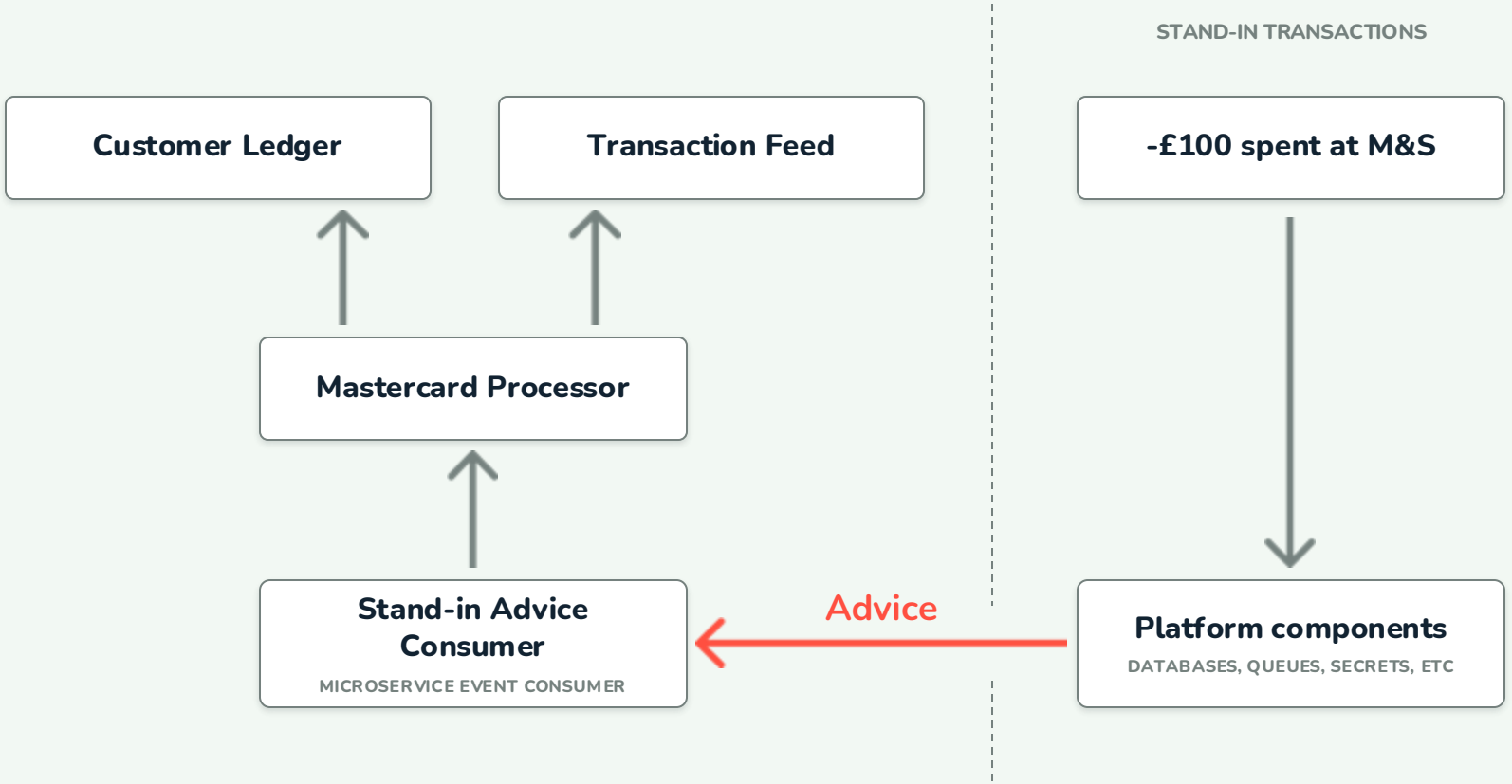
STAND-IN TRANSACTIONS

-£100 spent at M&S

Replaying data to the Primary Platform

without conflicts

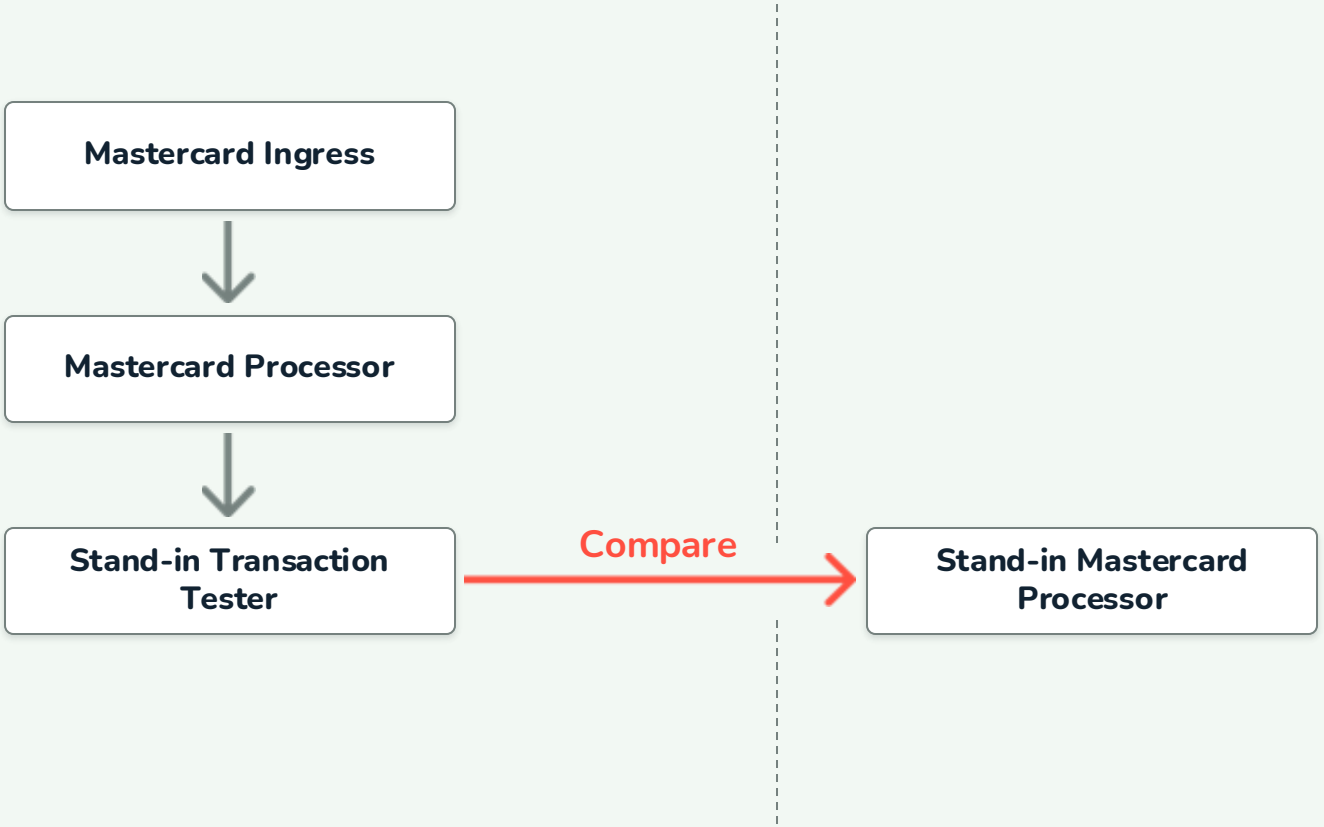
REPLAYING FROM STAND-IN



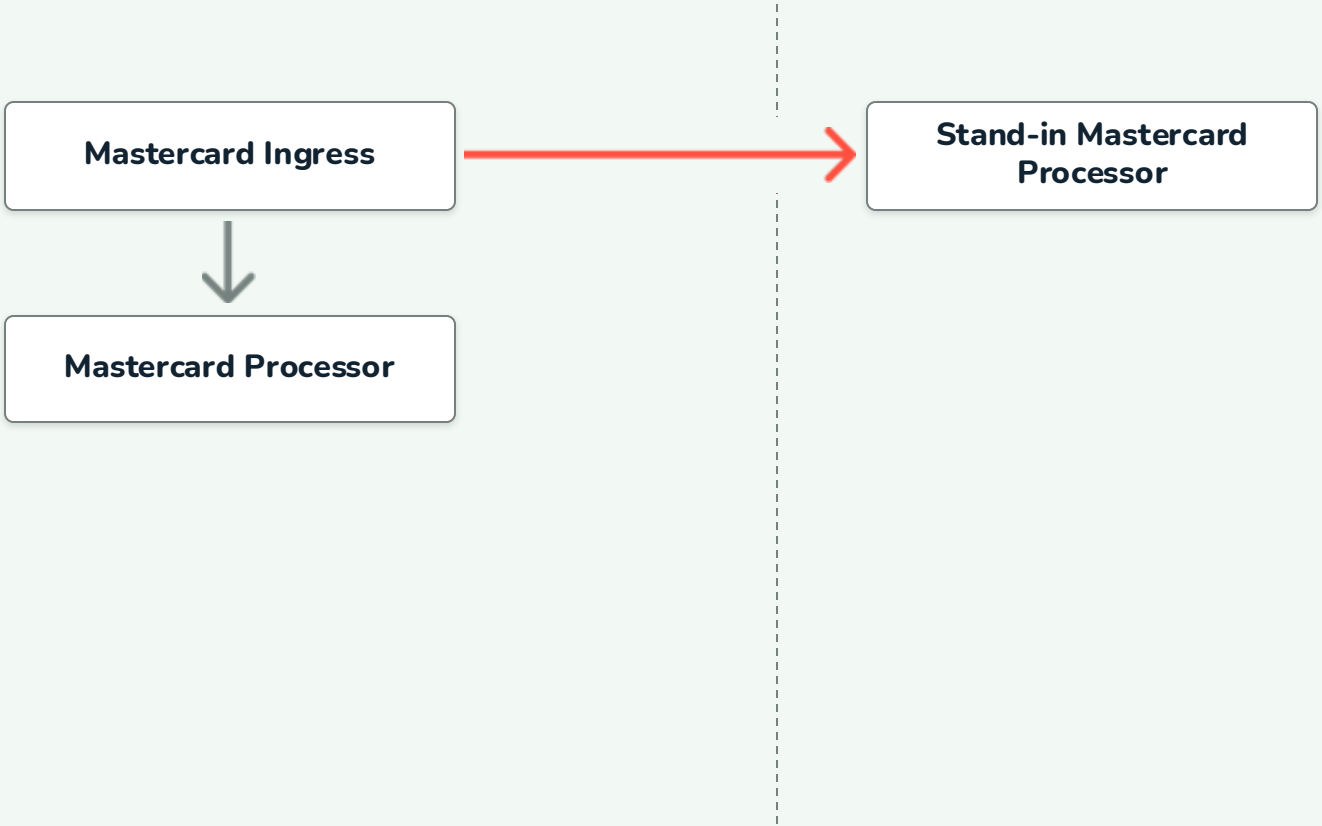
Testing the Stand-in Platform in production

using real customers making real payments

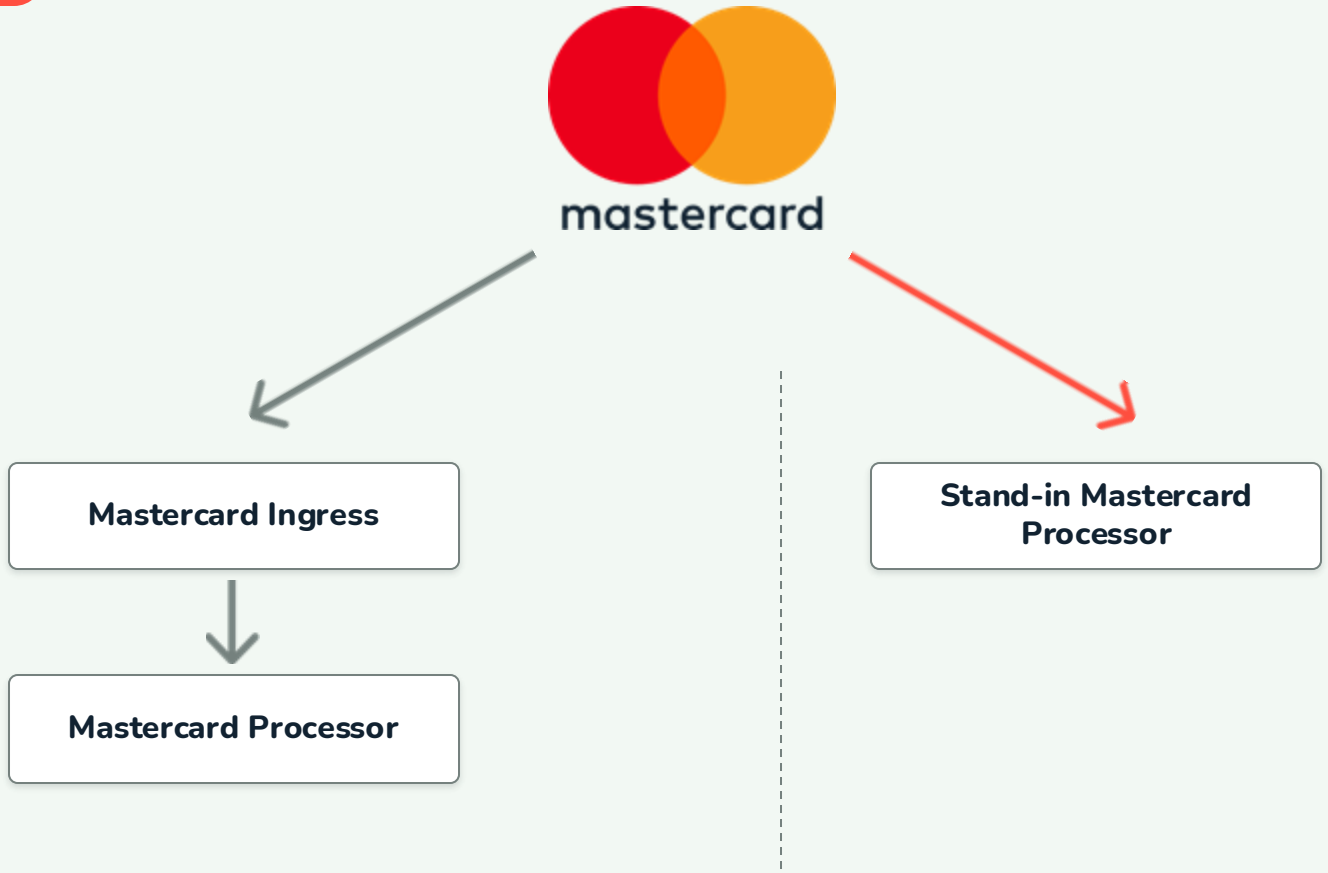
SHADOW TESTING



CUSTOMER TESTING



CONNECTIVITY TESTING



We made some really difficult trade-offs

to deliver a complex programme of work on budget

We focussed on delivering on what was critically important to our success criteria

We had to get comfortable with testing with customers

Incident leads have high confidence, ability and authority to enable

Empowered a small team, removed stakeholders, killed scope creep

Some features of our most important services didn’t make the final cut

Payments with gambling merchants would be immediately declined

Our customer experience is more functional, less delightful

Some niche products were simply not supported

We are really happy with Monzo Stand-in

and the extra layer of defence it offers our operational resiliency

Doesn’t this cost a fortune to run?

Running costs are about 1% of our total cloud platform spend

What about the maintenance burden?

Fewer than 1% of our changes were those shipped to Stand-in

Secondary platforms are never really used

We've used ours most notably during a 2-hour critical incident

We believe there are lessons to learn for most, but this design might not fit you

Most applicable if you control both server and client side

Most practical if a 2 hour outage is completely intolerable

Most cost effective at large scale

Andrew Lawson
ENGINEER

Daniel Chatfield
ENGINEER

ICONS BY FREEPIK
flaticon.com