Building a Bank with Go

Matt Heath, Monzo

Hi, I’m Matt

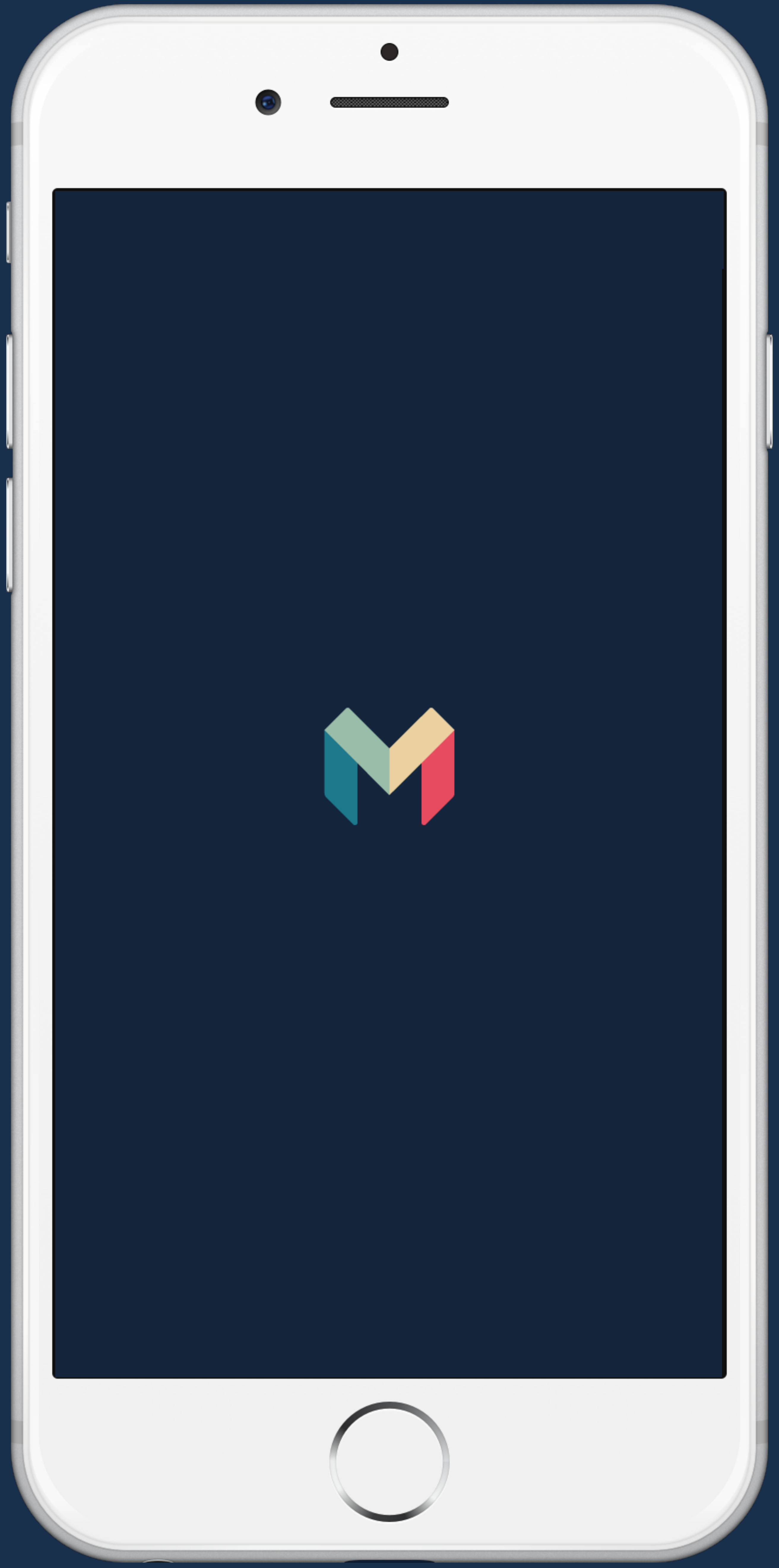
@mattheath

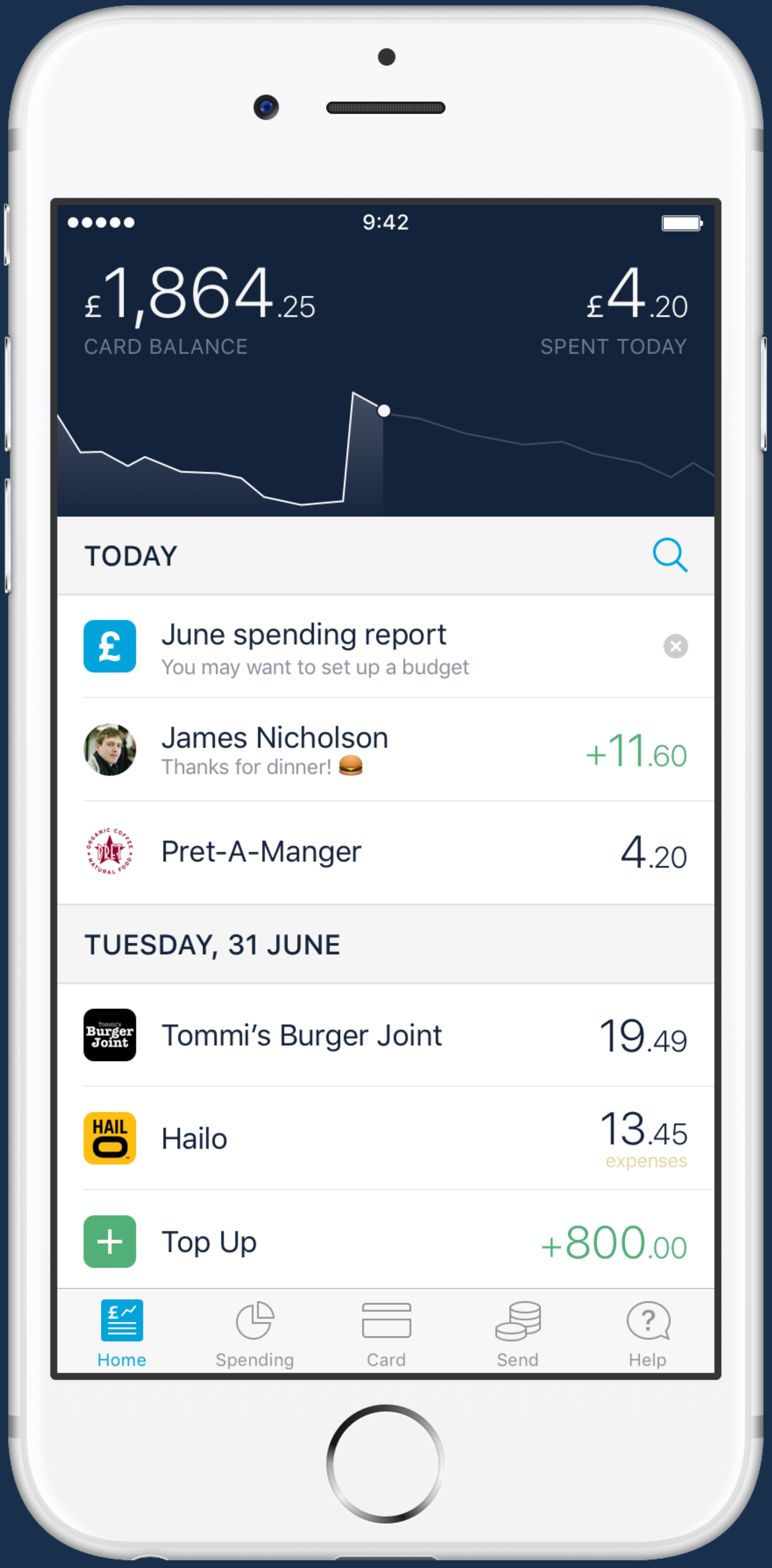
monzo
BETA
5354 2000 3058 3333
EXP END 08/1
PREPAID
469-624-882
MasterCard

COLLECT
PRESIDENT AND DIRECTORS

LICENCE WITH RESTRICTIONS
50K MAX DEPOSIT
WE ARE HERE
PRE APPLICATION
APPLICATION
MOBILISATION
LAUNCH
FEB 2015
MAR
APR
MAY
JUN
JUL
AUG
SEP
NOV
DEC
JAN 2016
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
NOV
DEC
JAN 2017
FEB
MAR
APR
MAY
JUN
JUL

EE 4G
£1.30
Top Up
Defrost Your Card
Order a replacement card
Home
Spend





9:42

£1,864.25
CARD BALANCE

£4.20
SPENT TODAY

TODAY

June spending report
You may want to set up a budget

James Nicholson +11.60
Thanks for dinner! 🍔

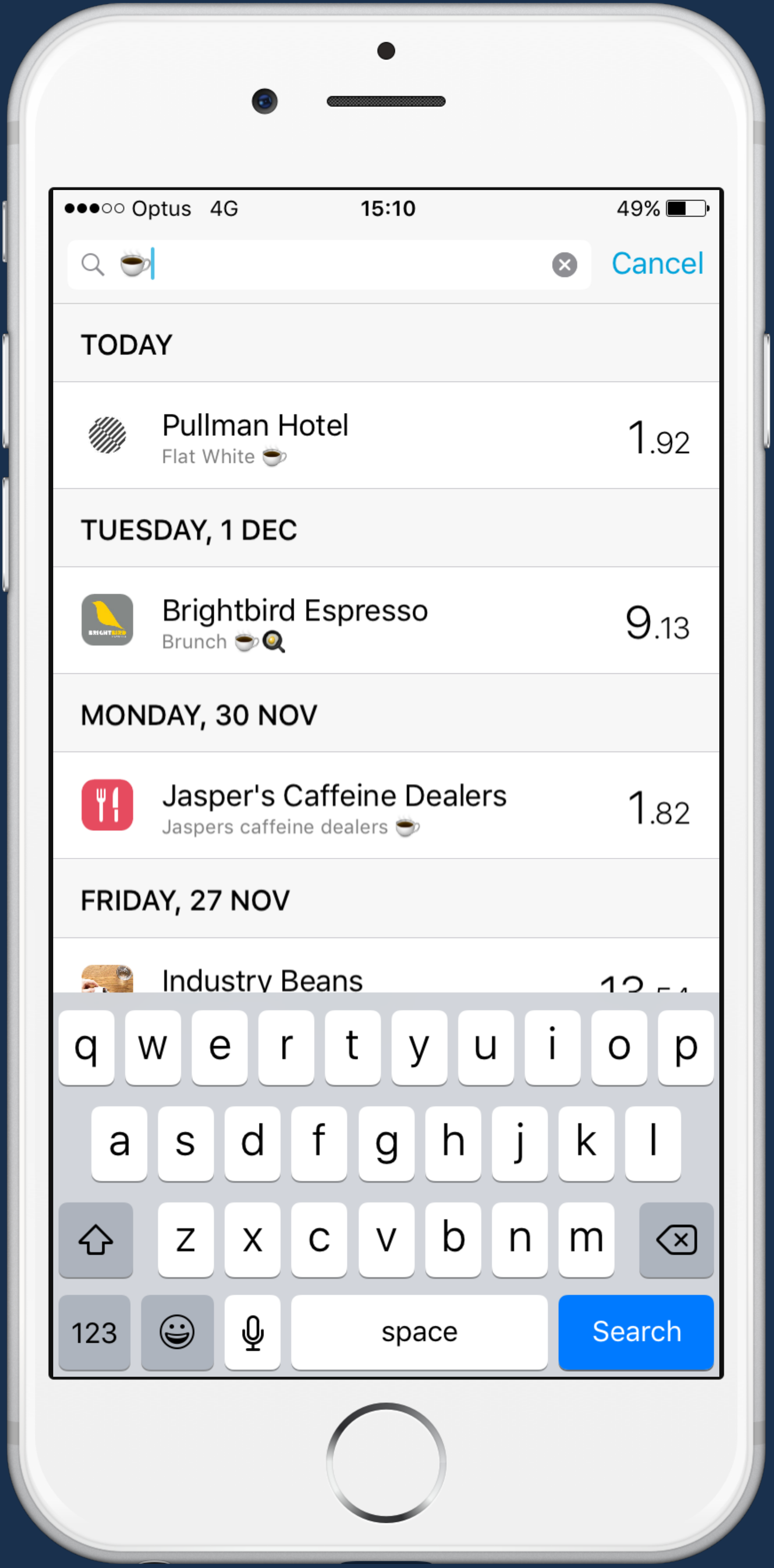
Pret-A-Manger 4.20

TUESDAY, 31 JUNE

Tommi's Burger Joint 19.49

Hailo 13.45
expenses

Top Up +800.00


●●●○○ Optus 4G 15:10 49%

☕ Cancel

TODAY

Pullman Hotel	Flat White ☕	1.92

TUESDAY, 1 DEC

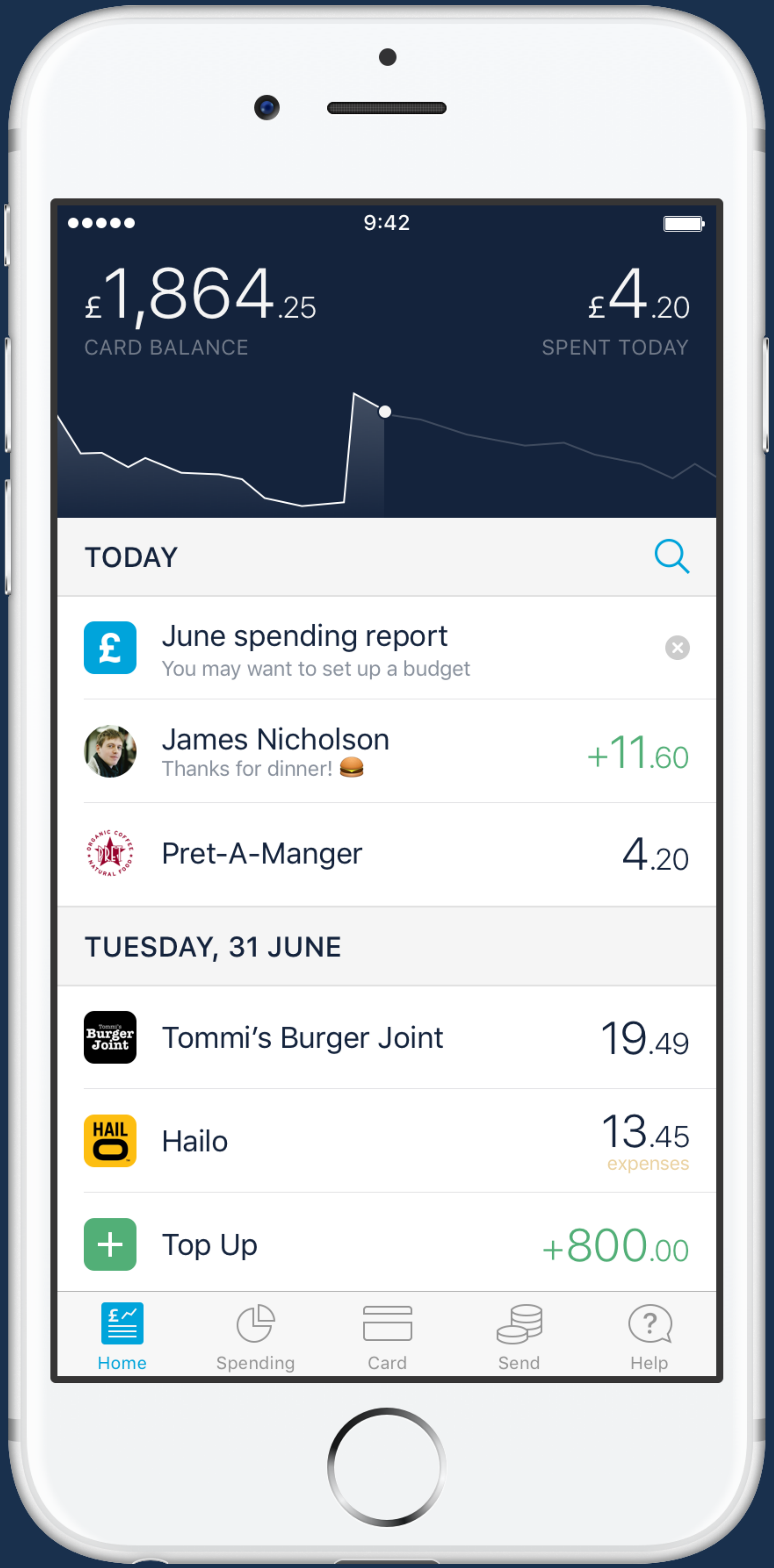
Brightbird Espresso	Brunch ☕🍳	9.13

MONDAY, 30 NOV

Jasper's Caffeine Dealers	Jaspers caffeine dealers ☕	1.82

FRIDAY, 27 NOV

Industry Beans


●●●●● 9:42

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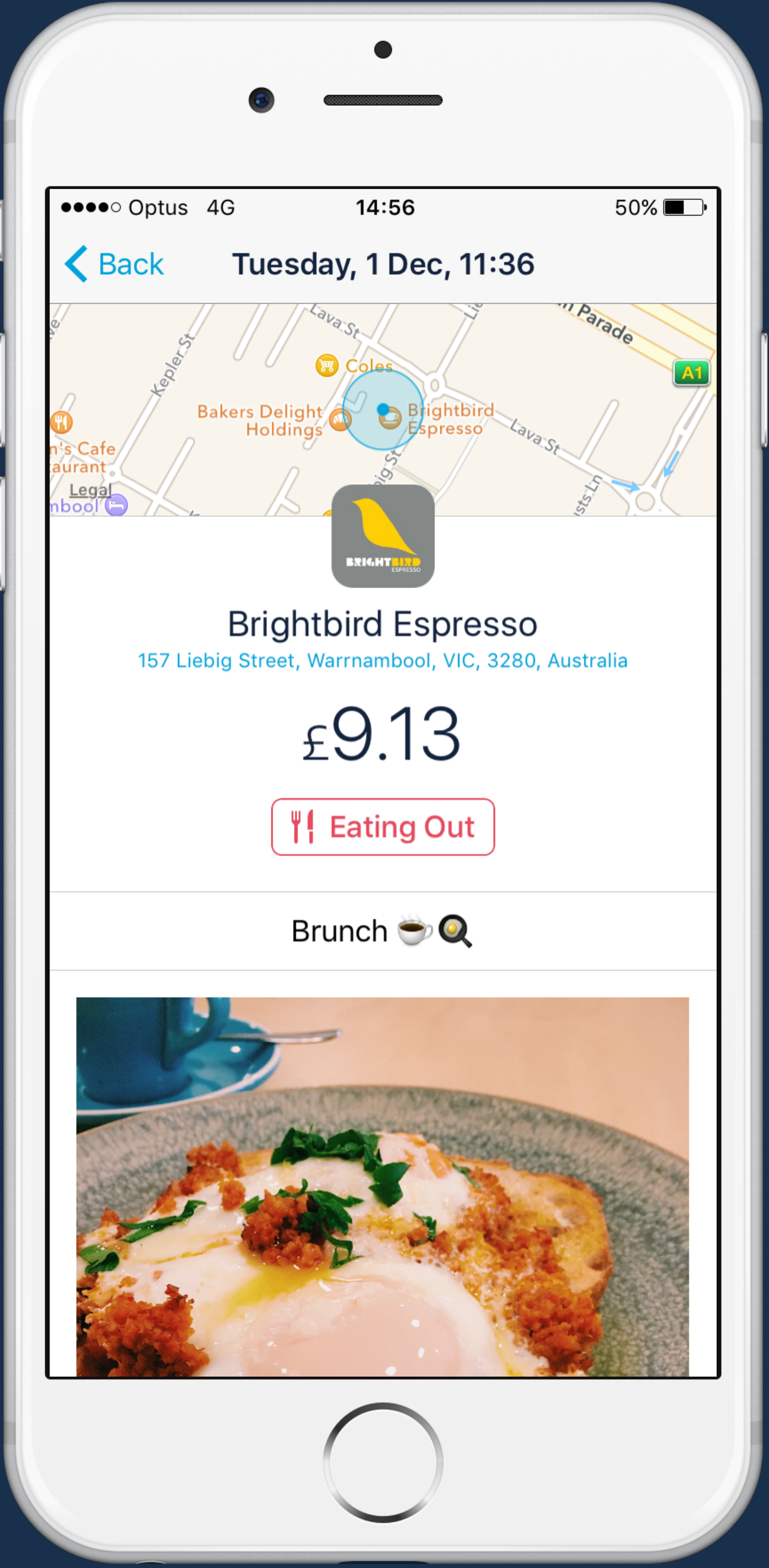

●●●●○ Optus 4G 14:56 50%

Back Tuesday, 1 Dec, 11:36

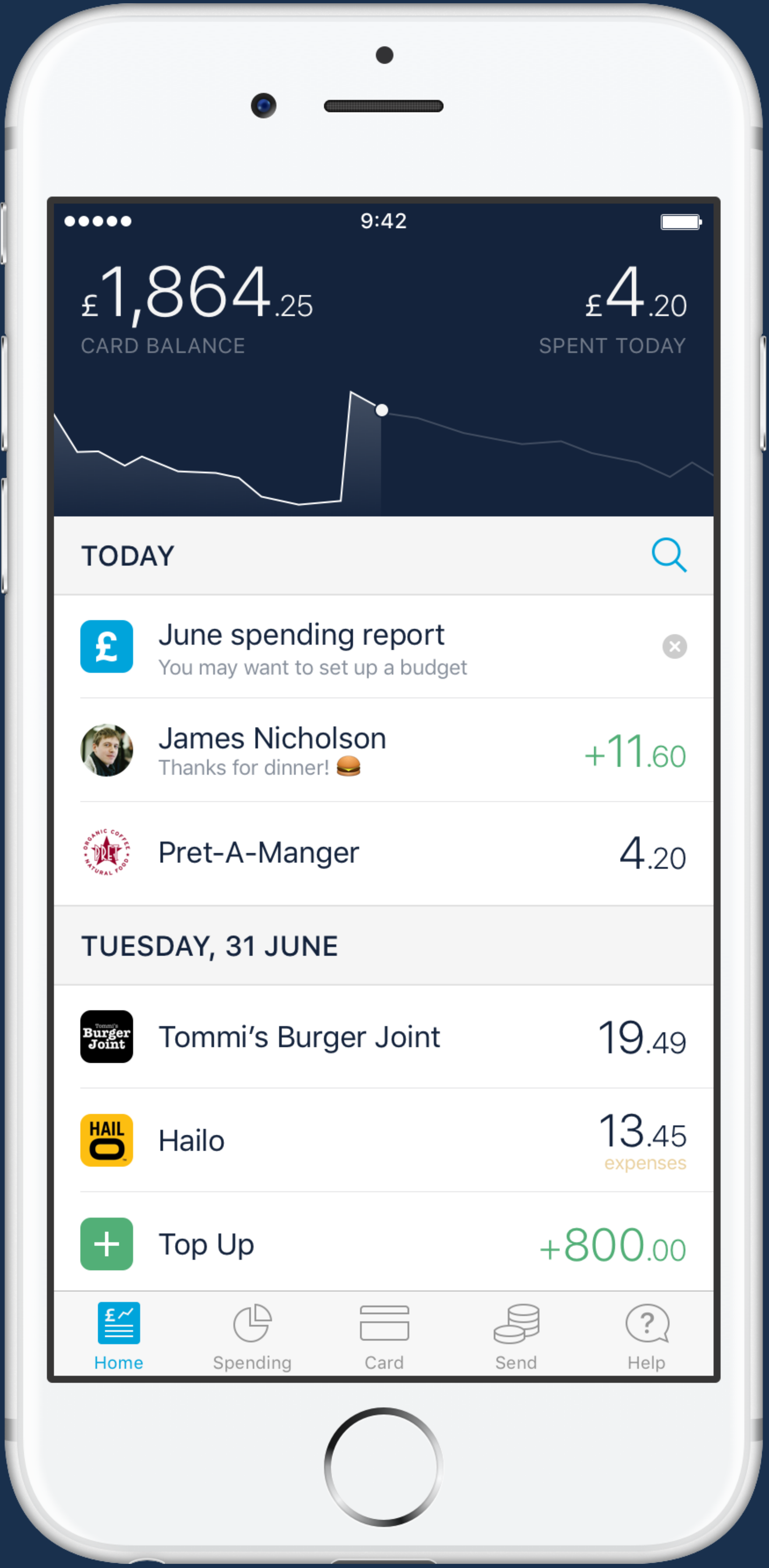
Brightbird Espresso

157 Liebig Street, Warrnambool, VIC, 3280, Australia

£9.13

Eating Out

Brunch ☕🍳


●●●●● 9:42

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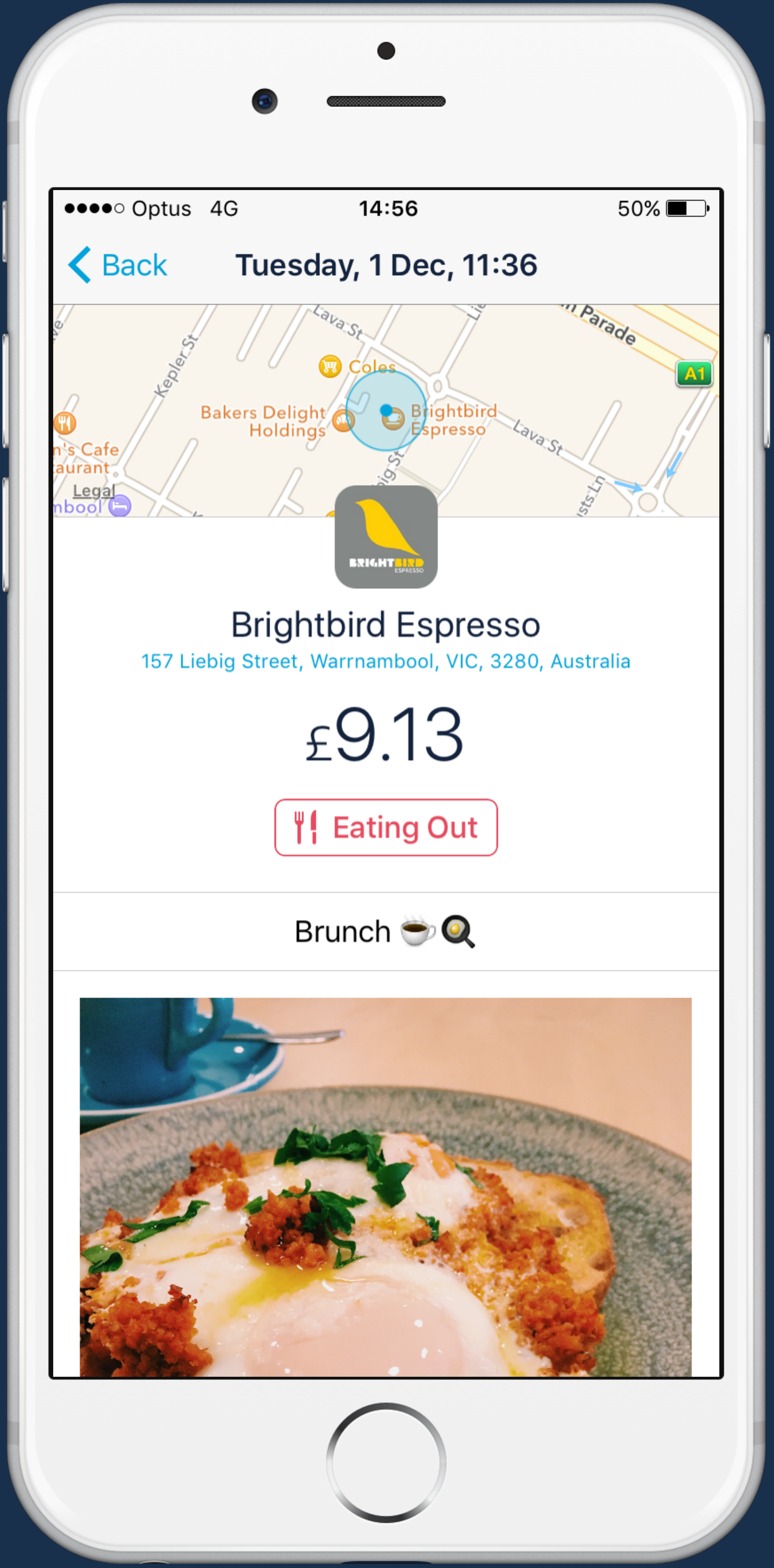
expenses

Top Up +800.00

Home Spending Card Send Help


●●●●○ Optus 4G 14:56 50%

< Back Tuesday, 1 Dec, 11:36

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157 Liebig Street, Warrnambool, VIC, 3280, Australia

£9.13

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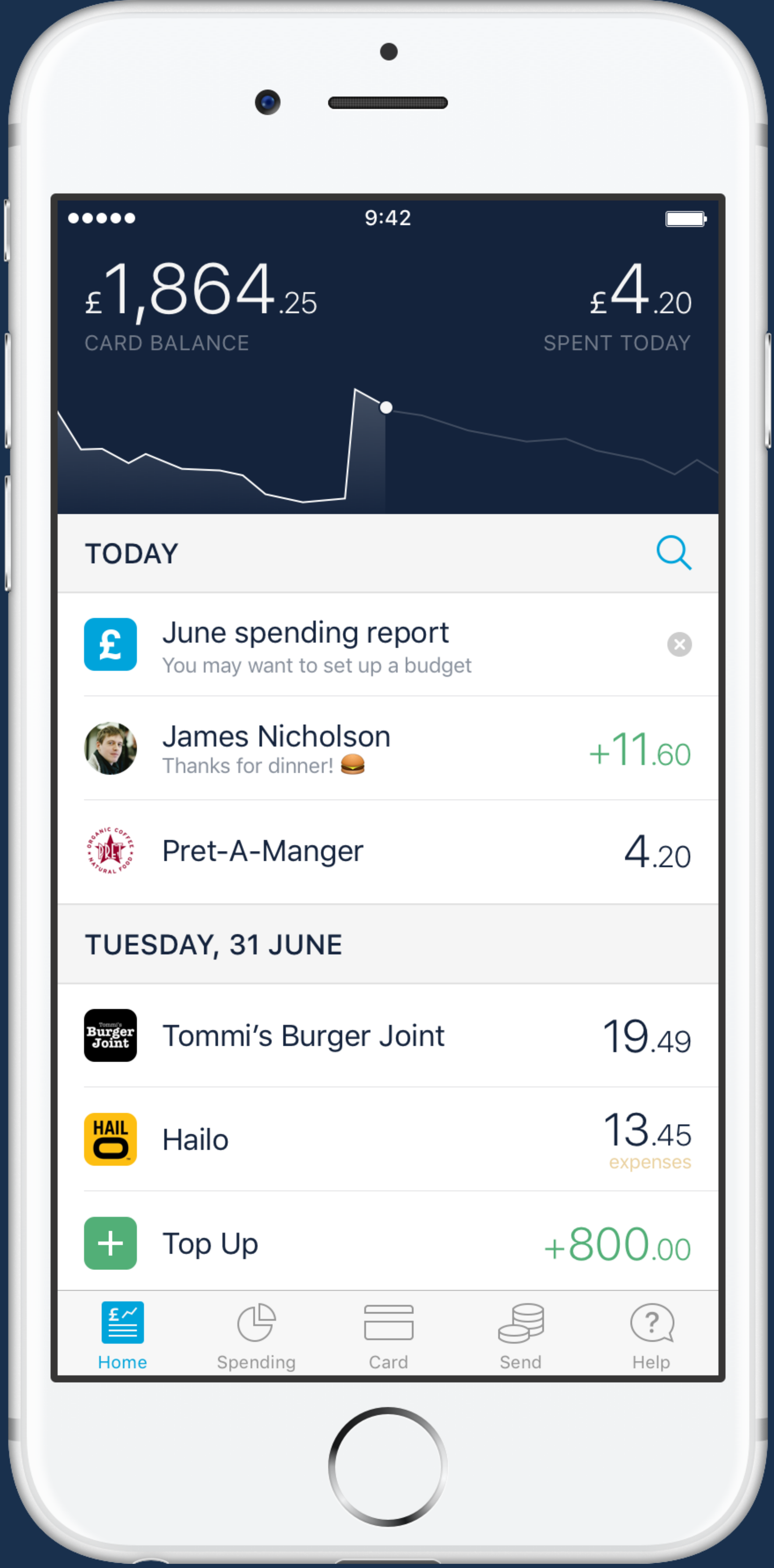
Brunch ☕🍳


●●●●● 9:42

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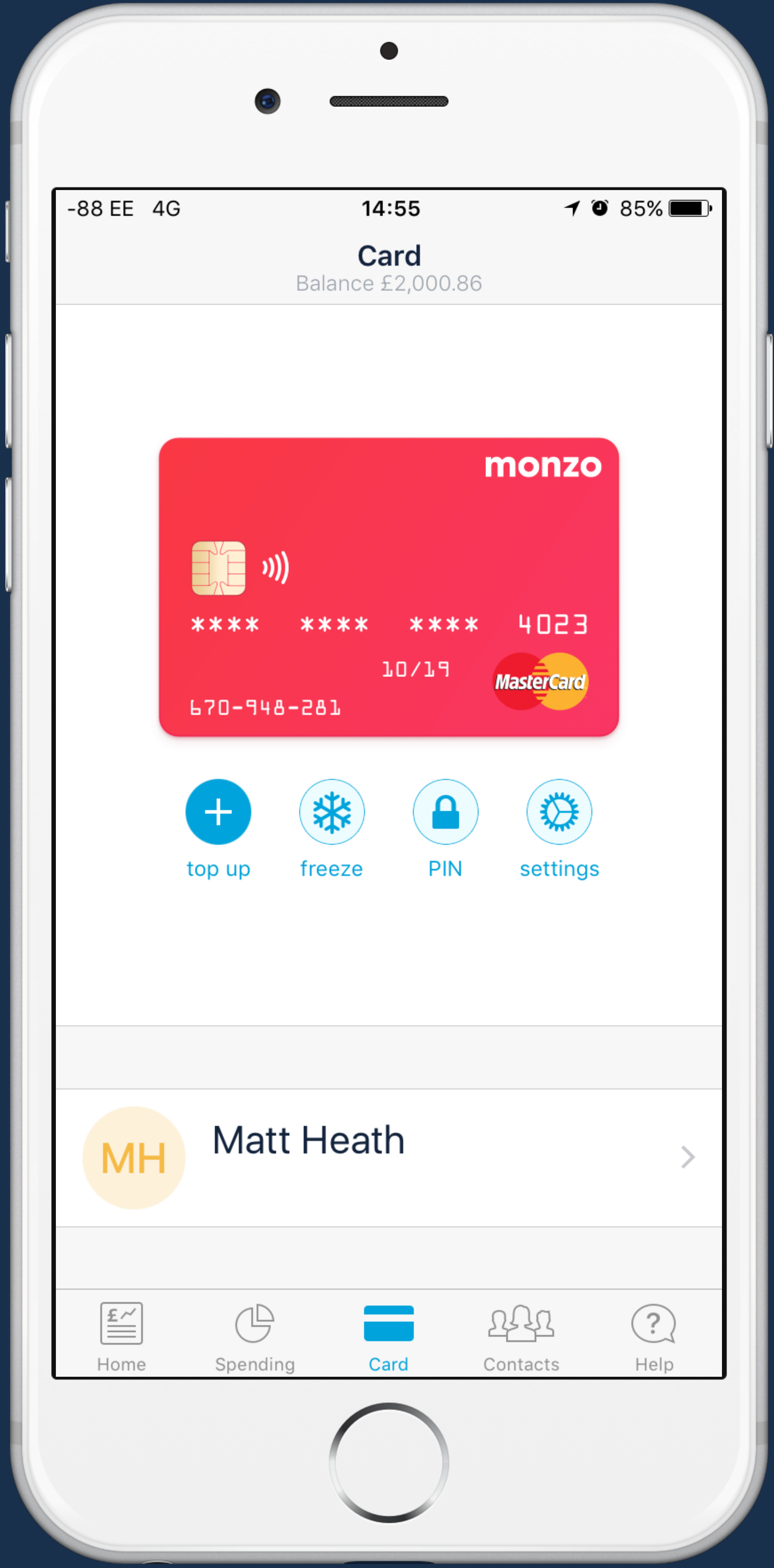
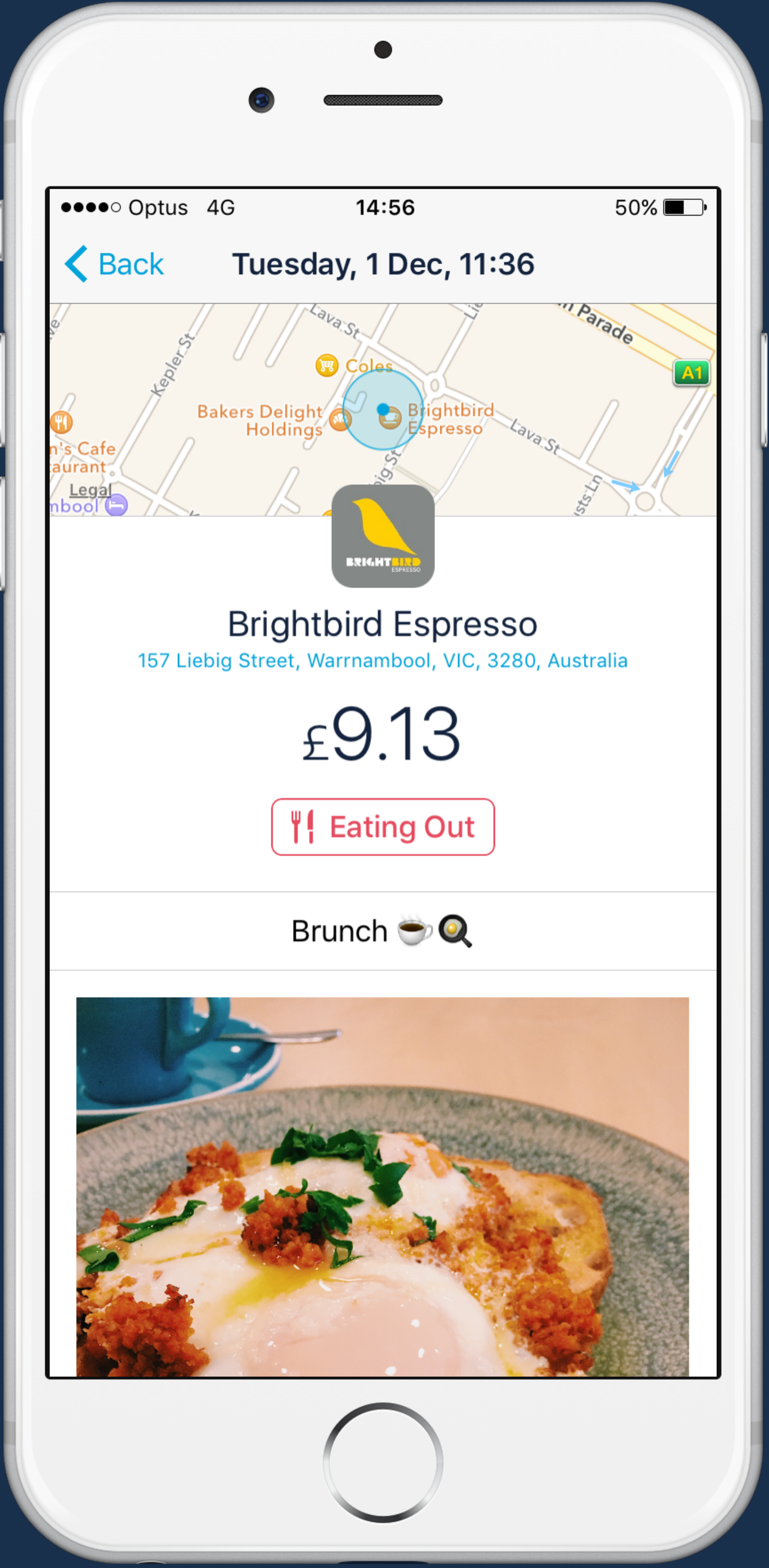

-88 EE 4G 14:55 85%

Card

Balance £2,000.86

MH Matt Heath


●●●●○ Optus 4G 14:56 50%

Back Tuesday, 1 Dec, 11:36

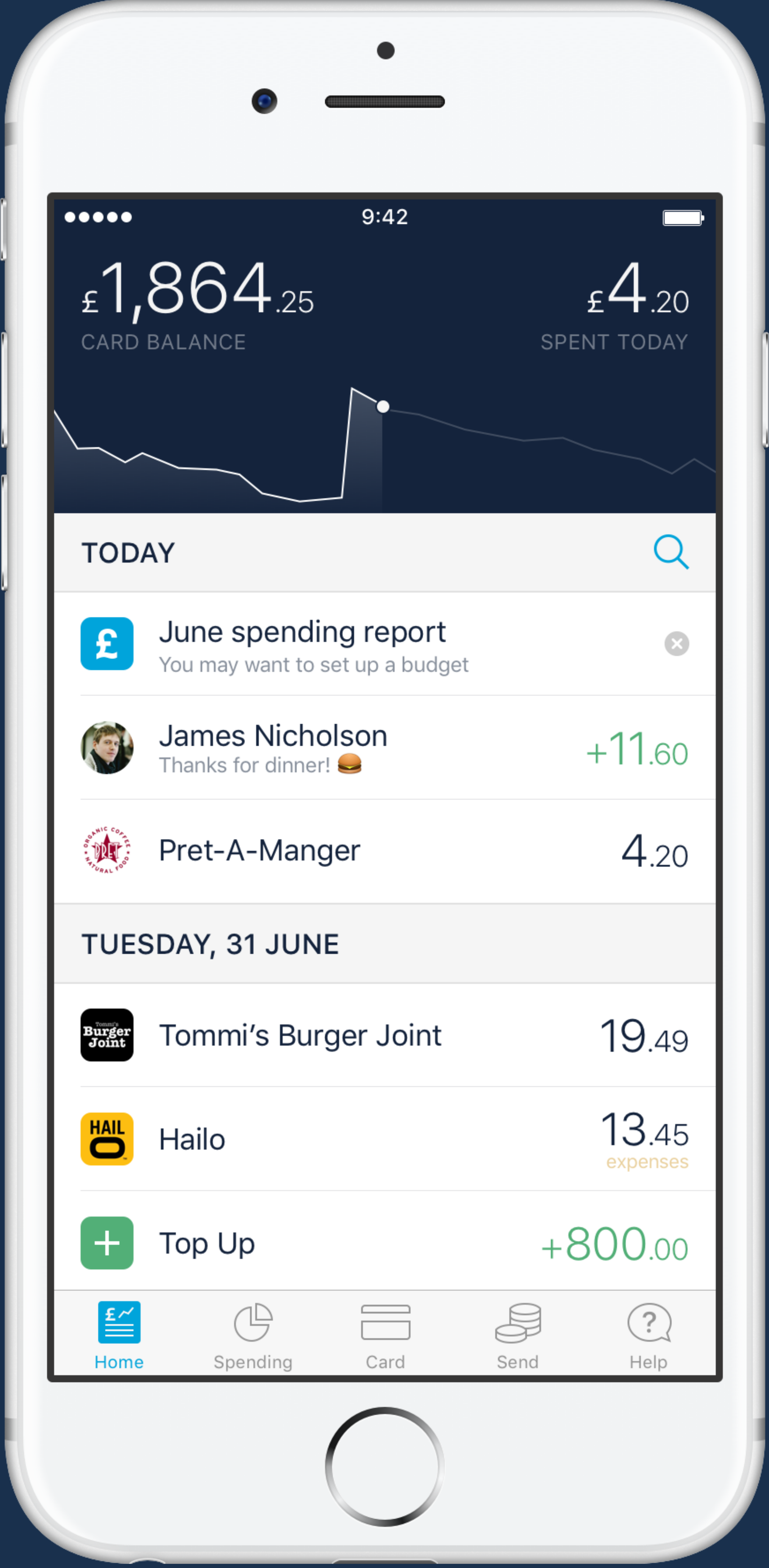
Brightbird Espresso

157 Liebig Street, Warrnambool, VIC, 3280, Australia

£9.13

Eating Out

Brunch ☕🍳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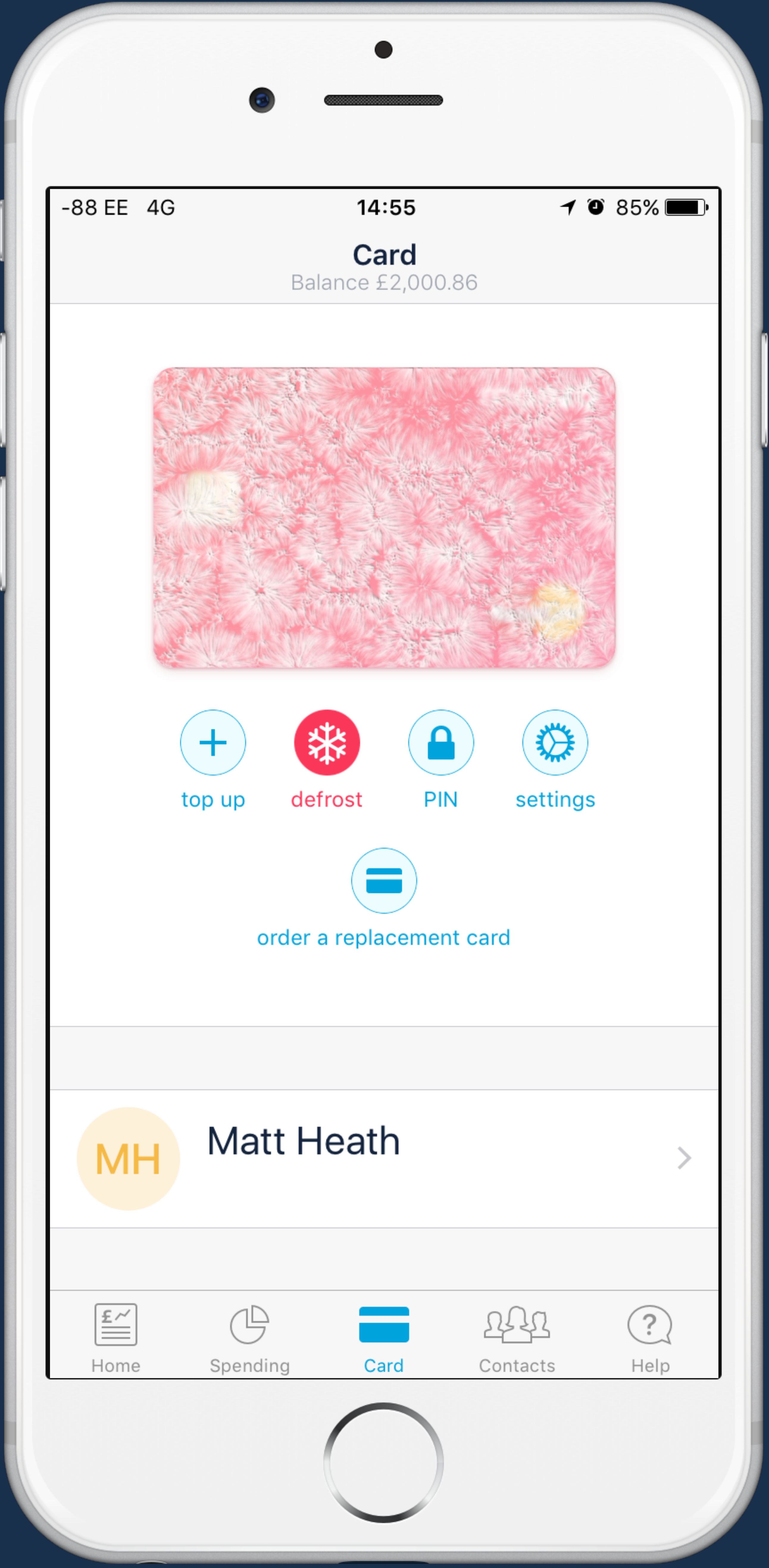
Home Spending Card Send Help


-88 EE 4G 14:55 85%

Card

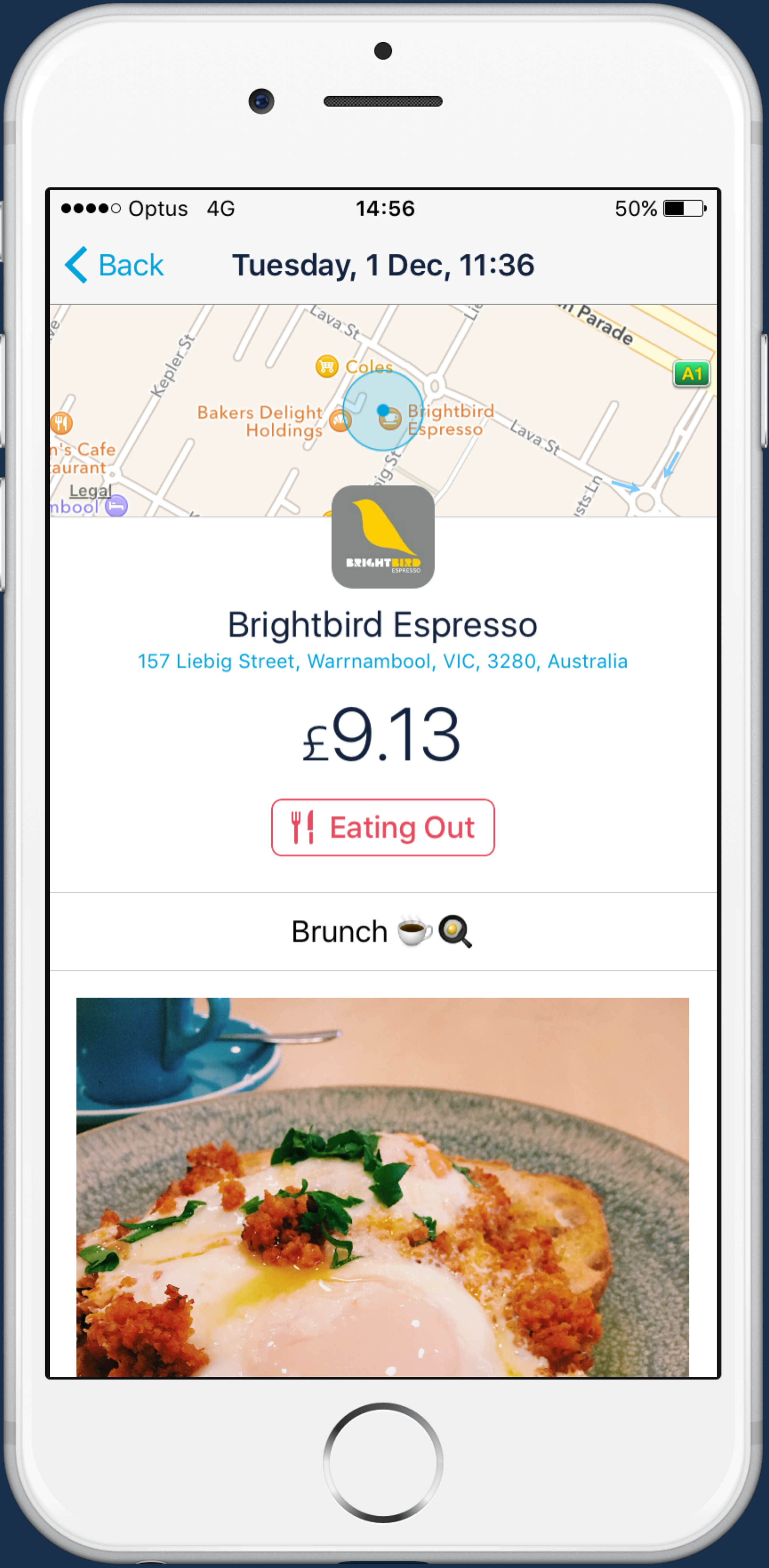
Balance £2,000.86

top up defrost PIN settings

order a replacement card

MH Matt Heath

Home Spending Card Contacts Help



Tuesday, 1 Dec, 11:36

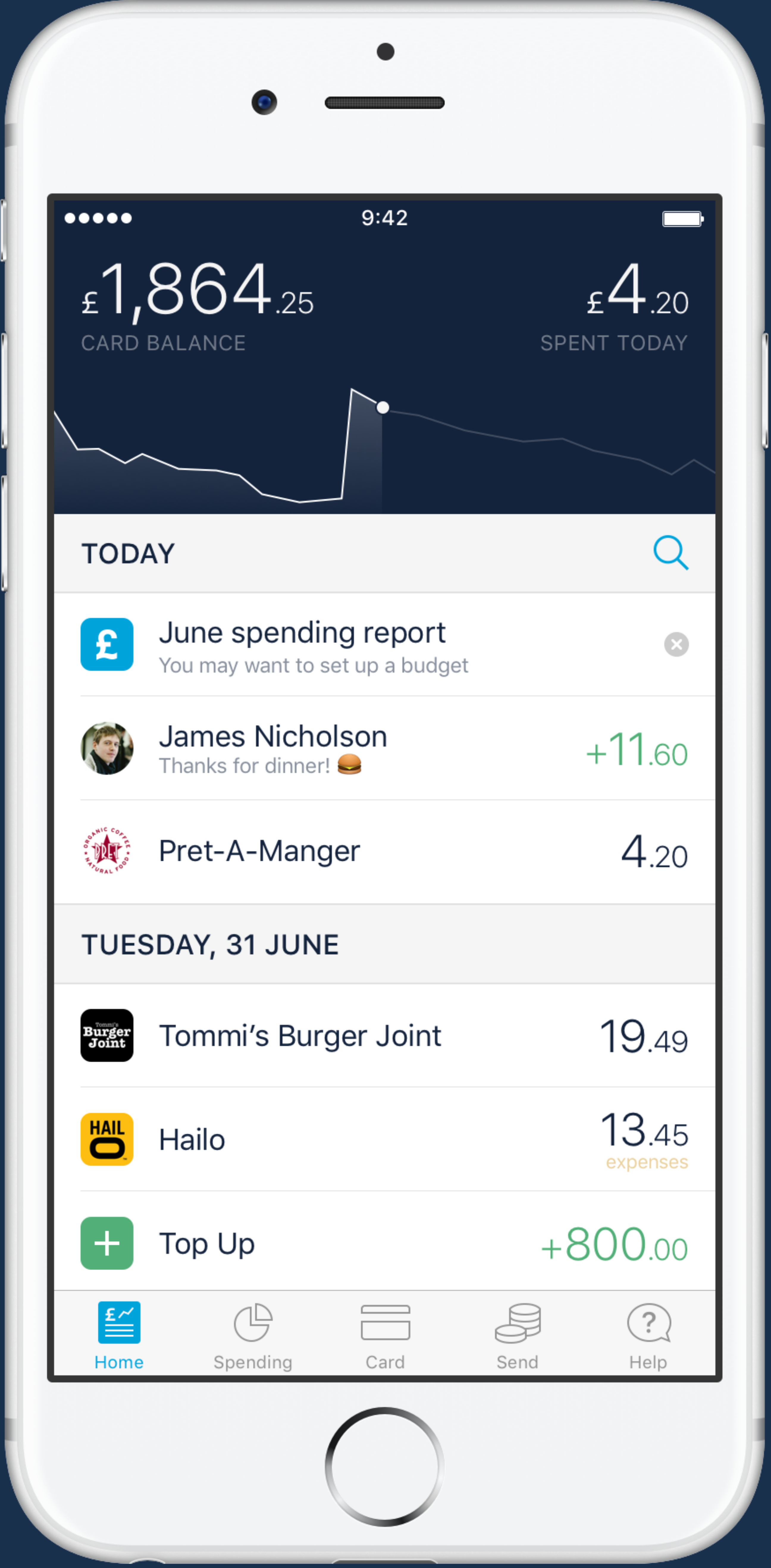
Brightbird Espresso

157 Liebig Street, Warrnambool, VIC, 3280, Australia

£9.13

Eating Out

Brunch ☕🍳



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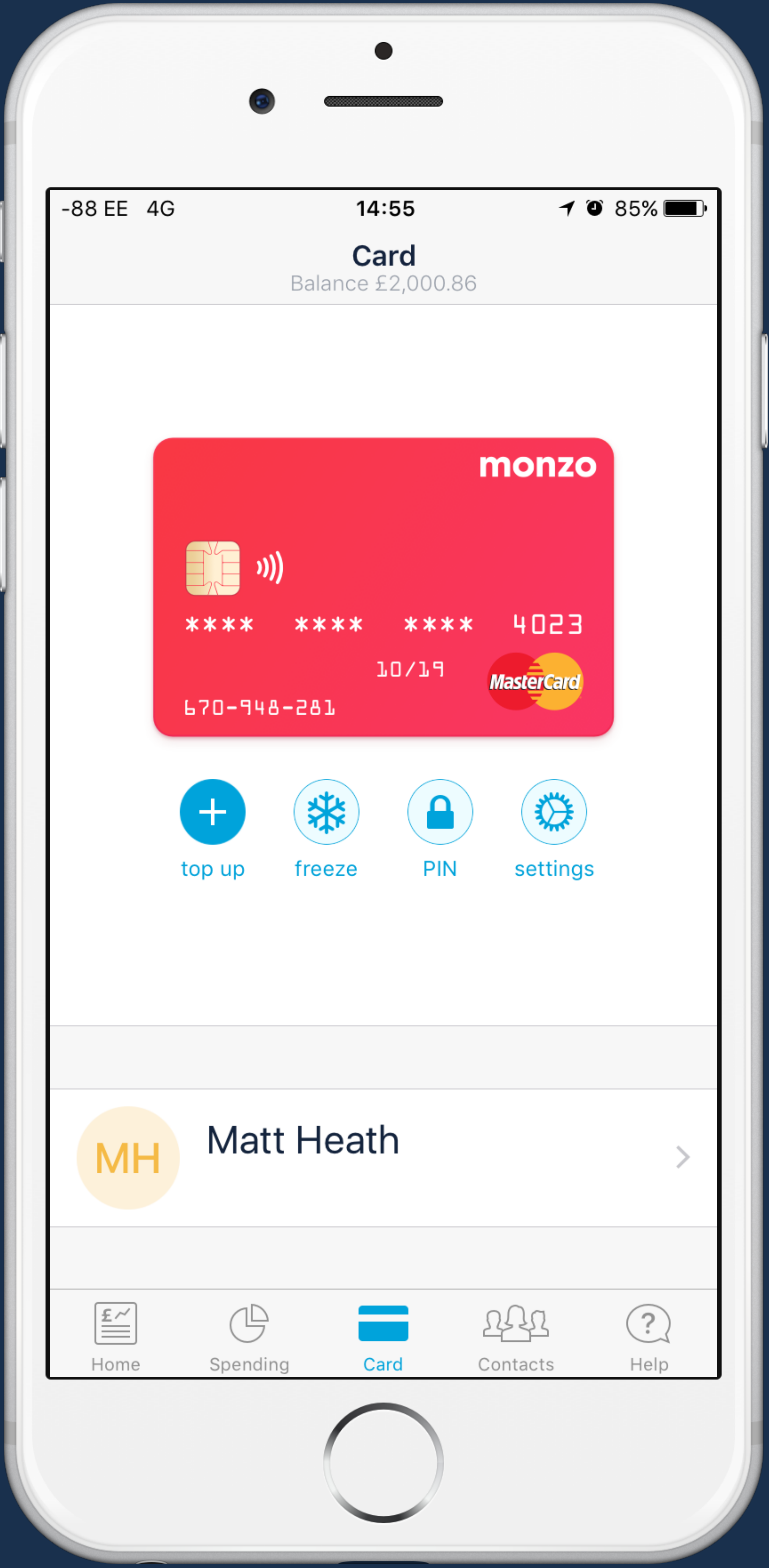
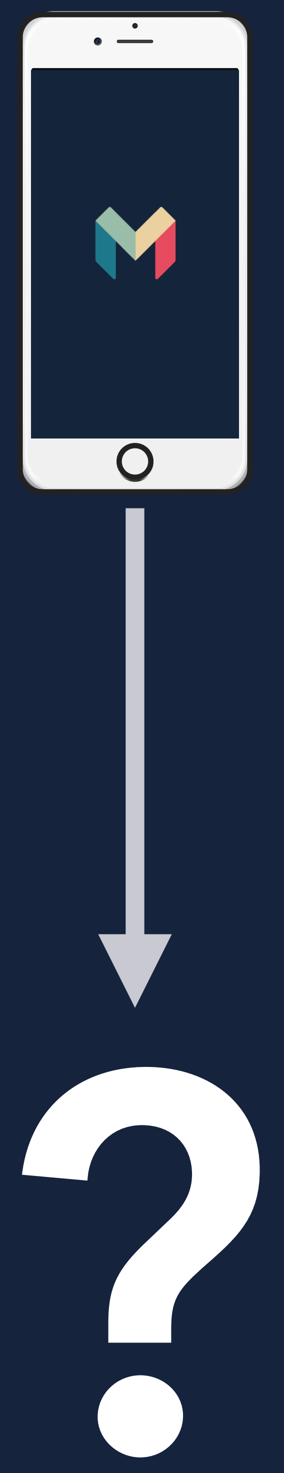
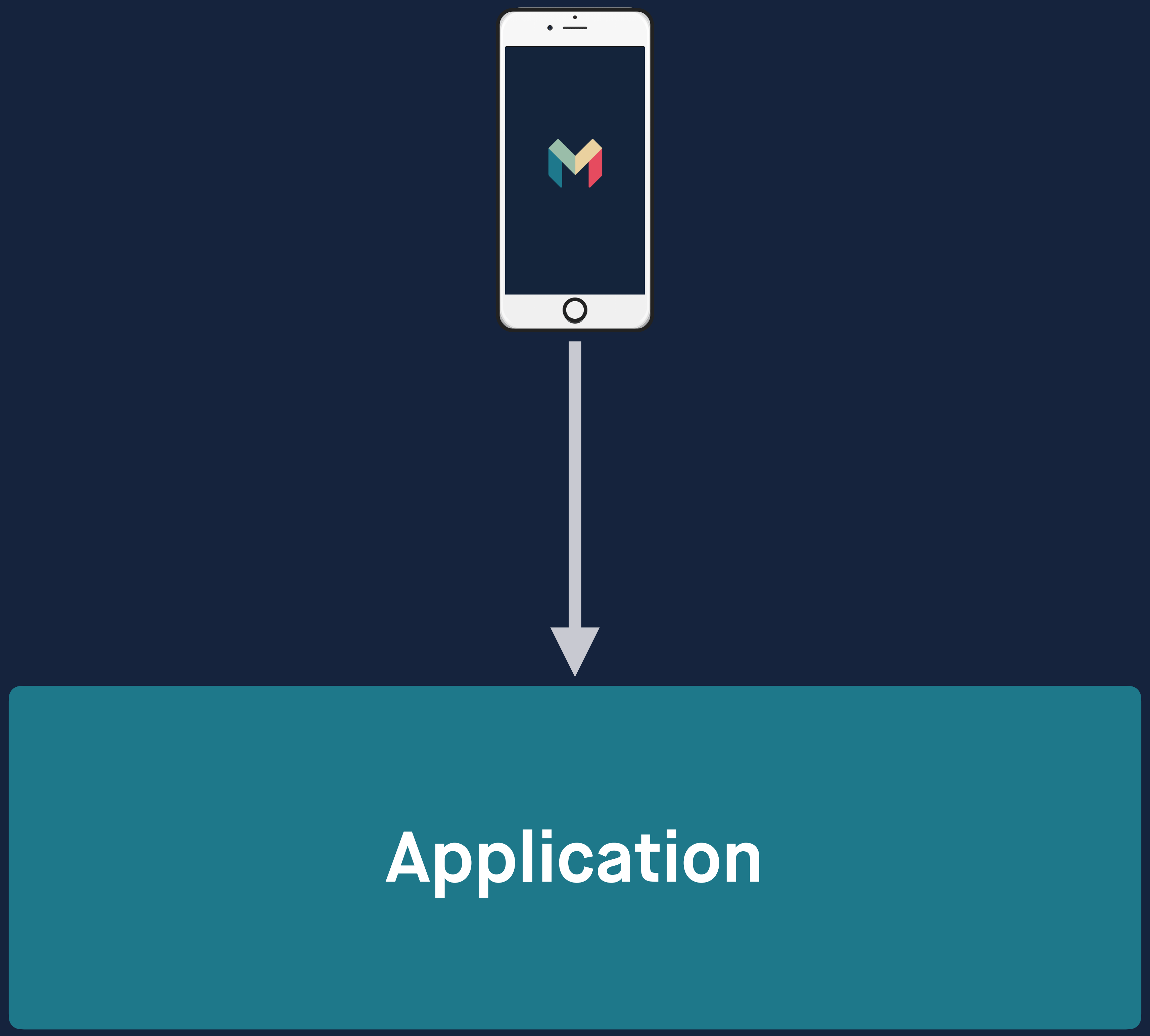


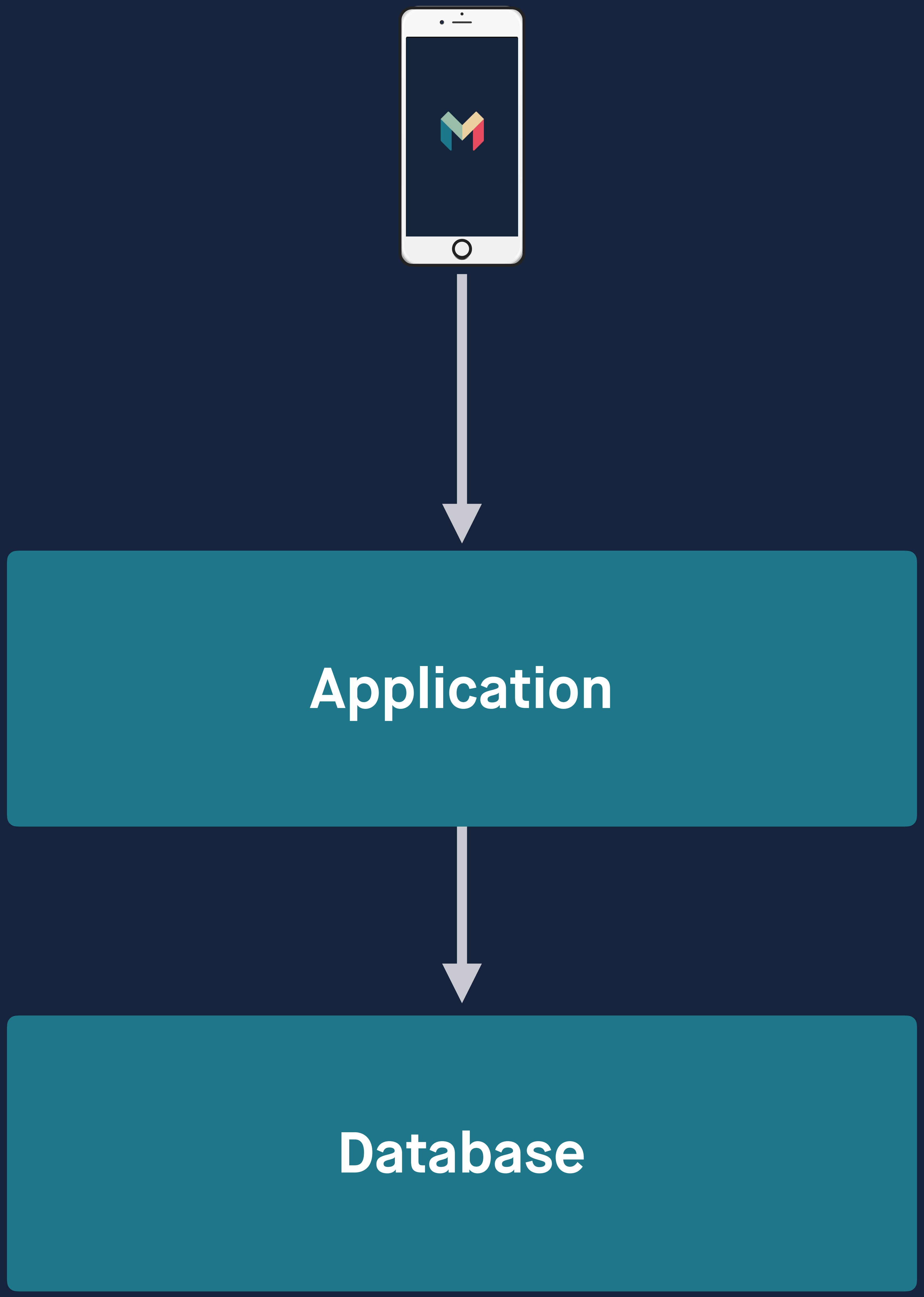
Card

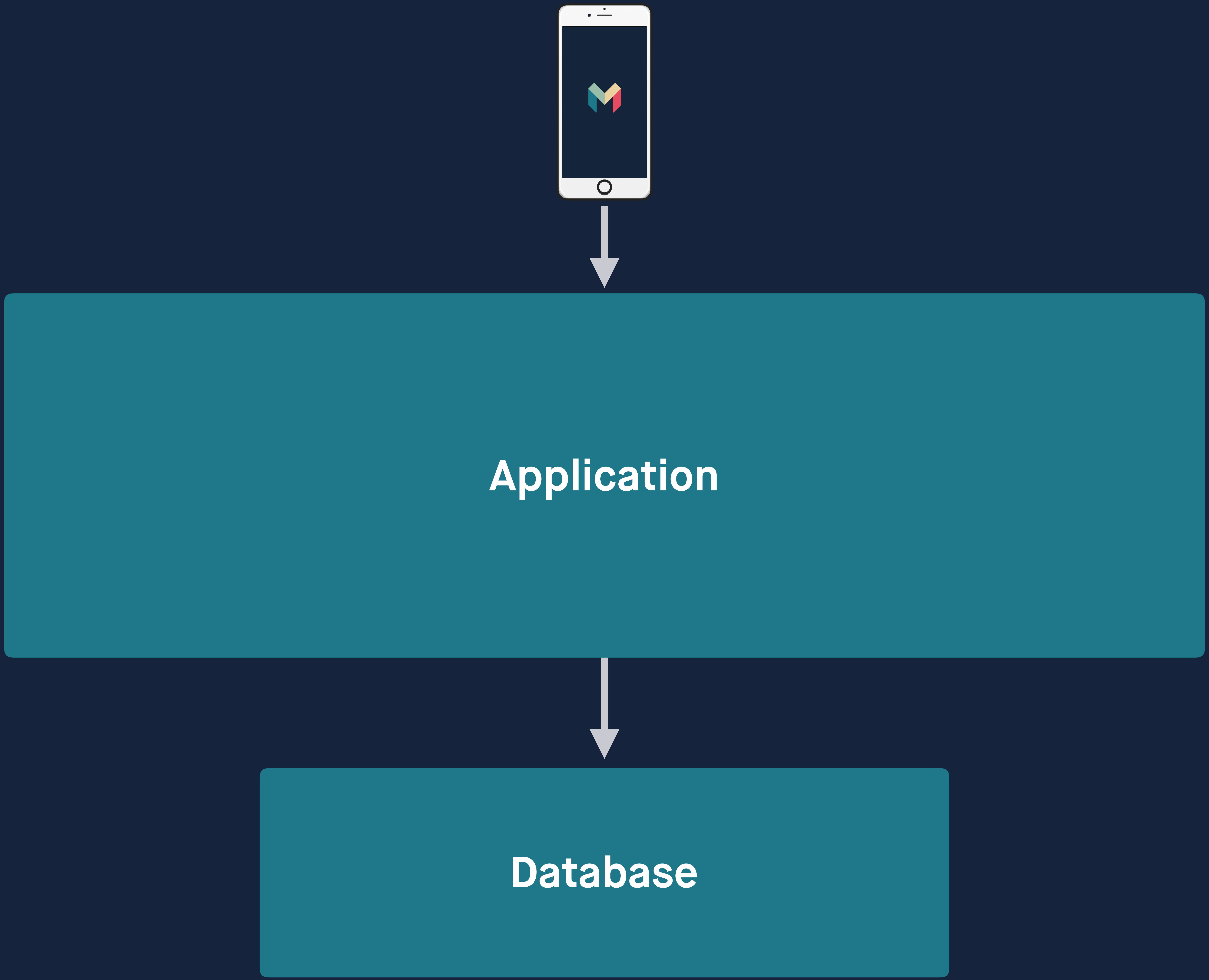
Balance £2,000.86

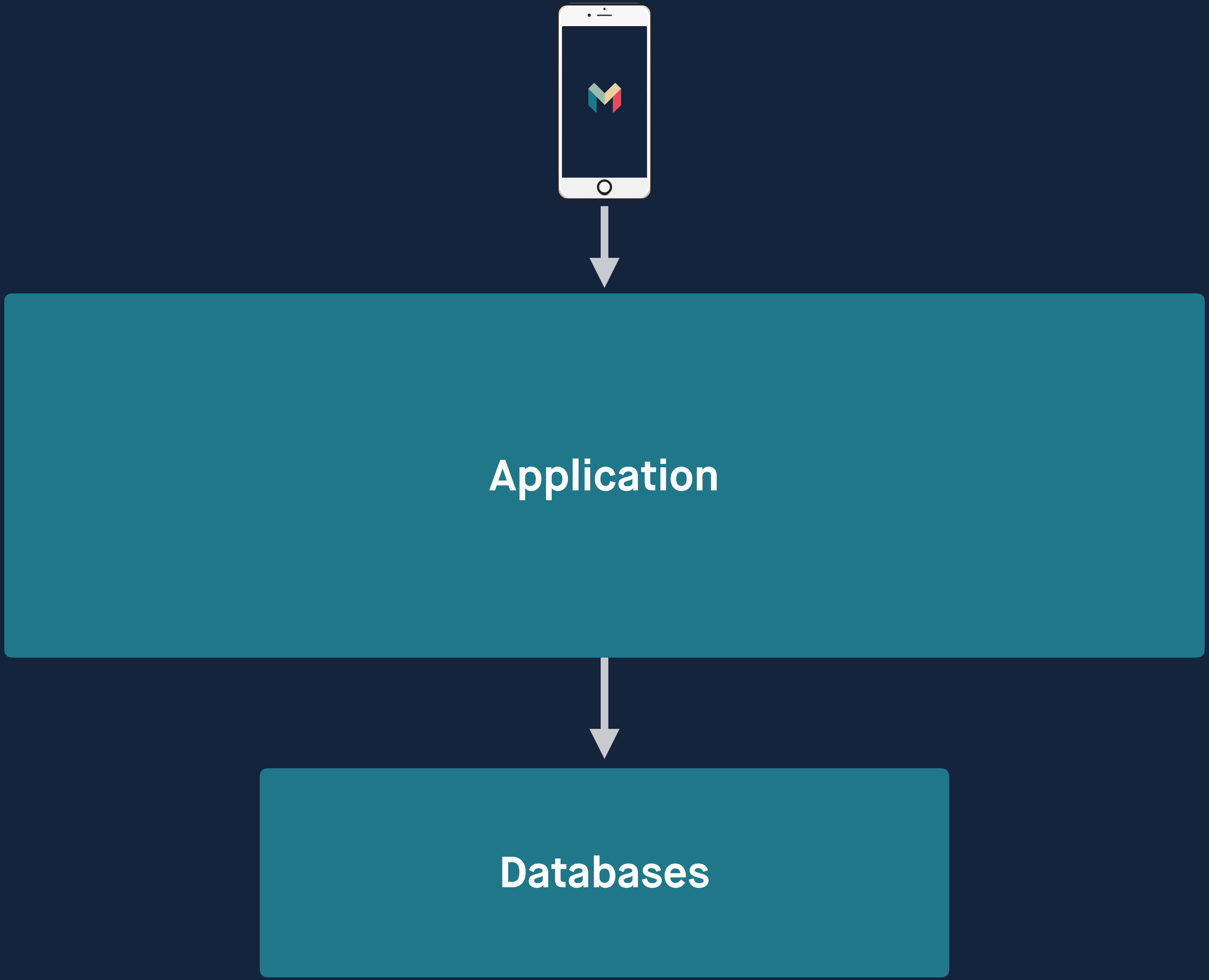
Matt Heath

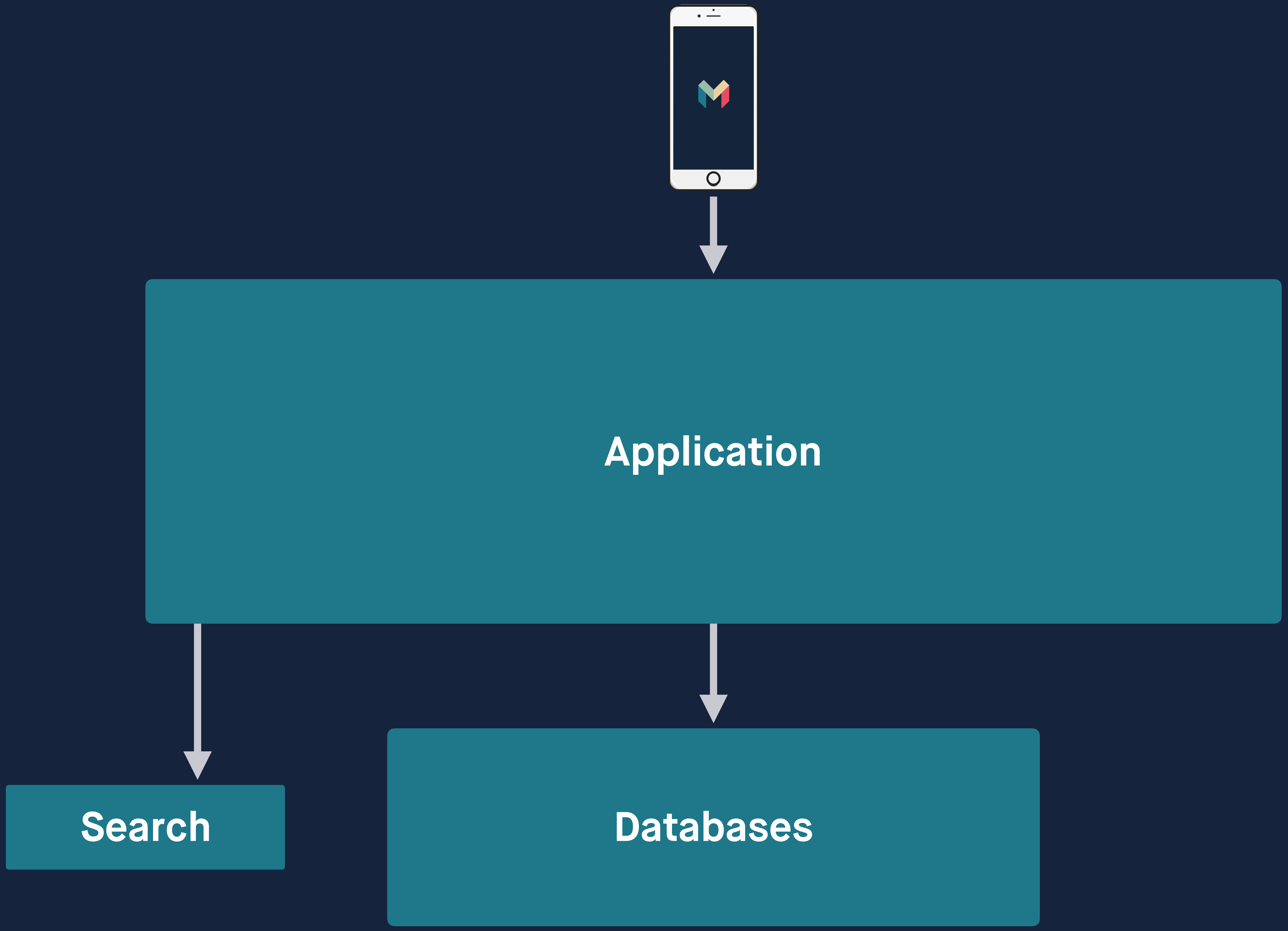


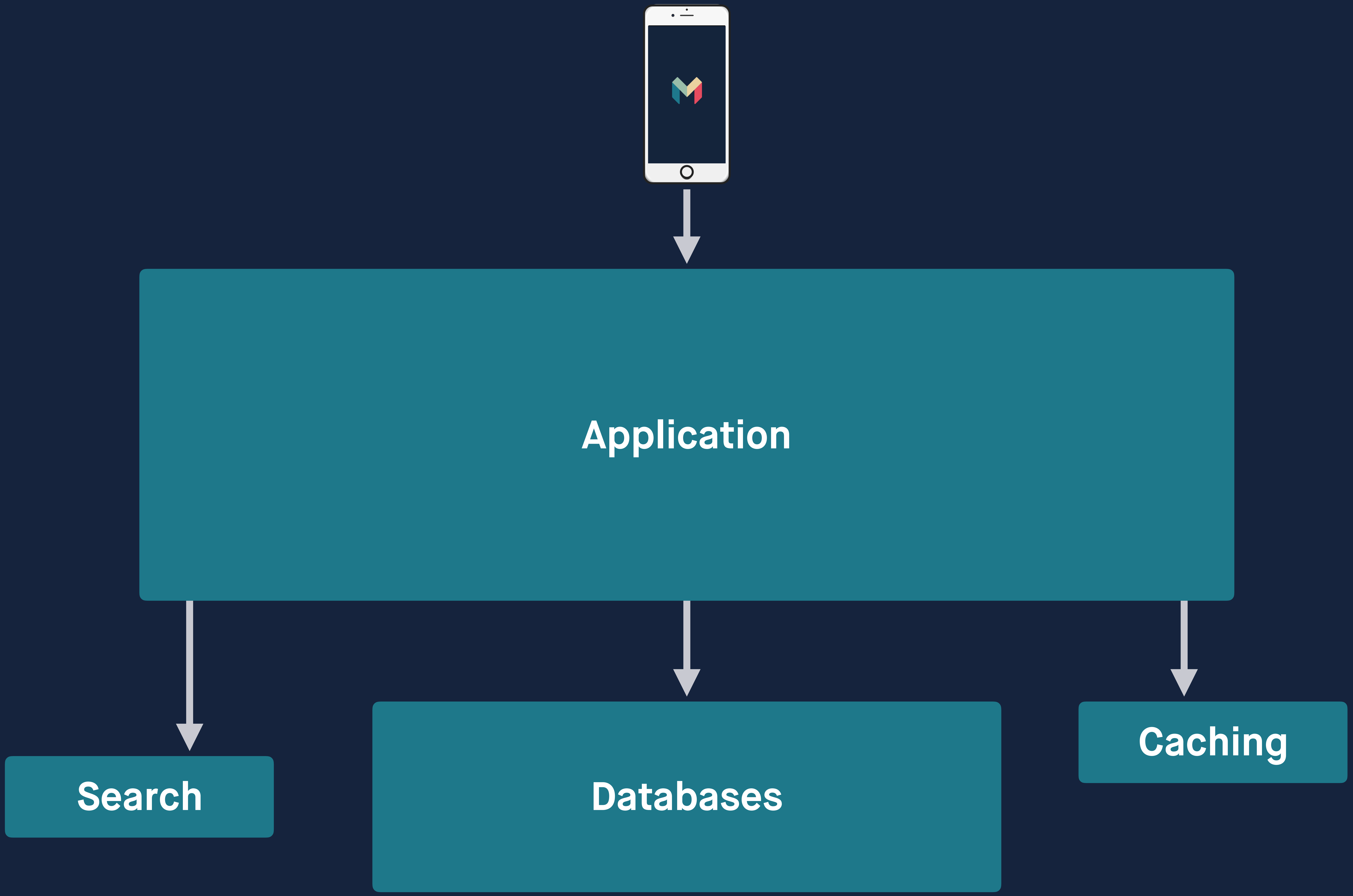

Application

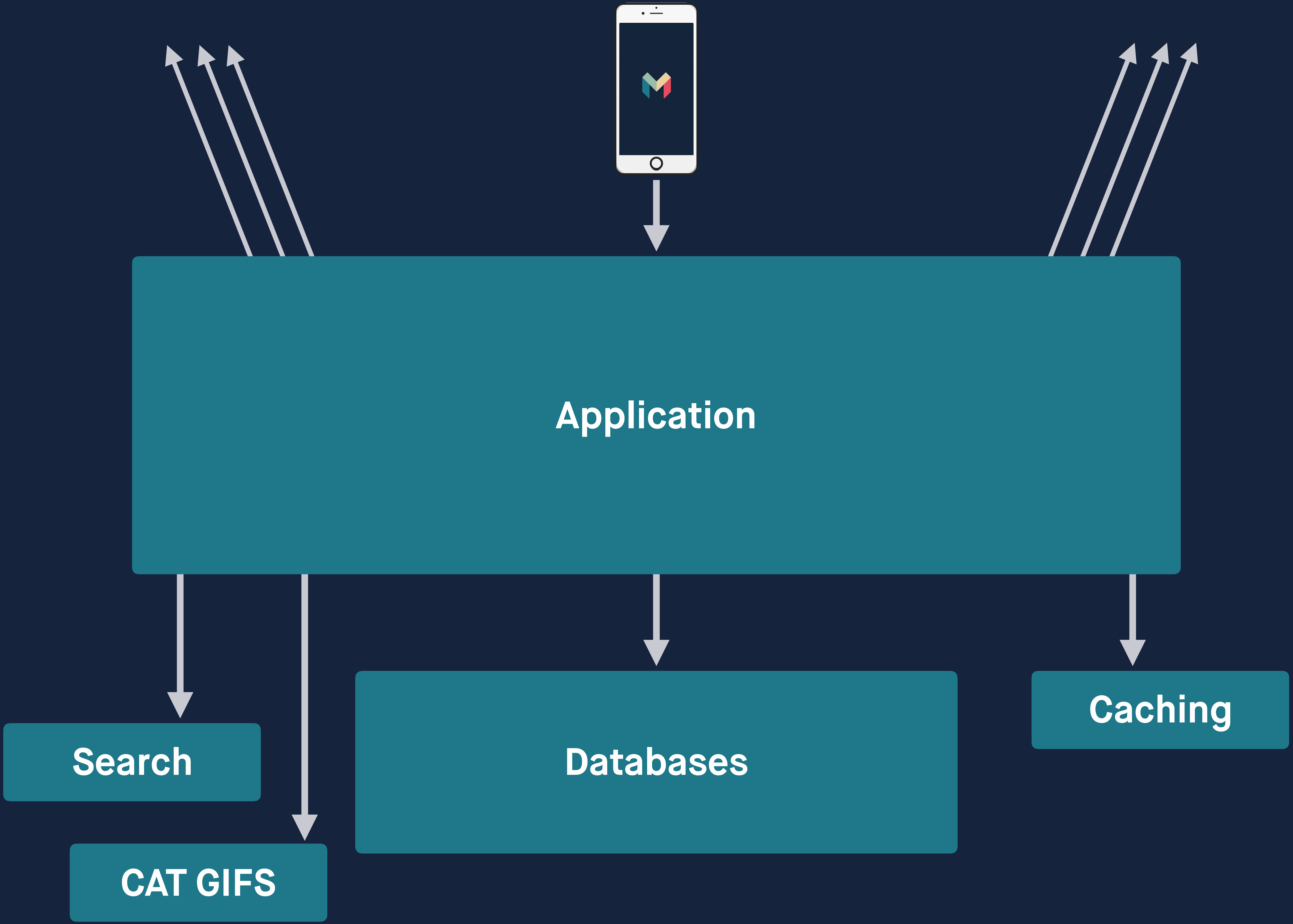

Application
Database


Application
Database

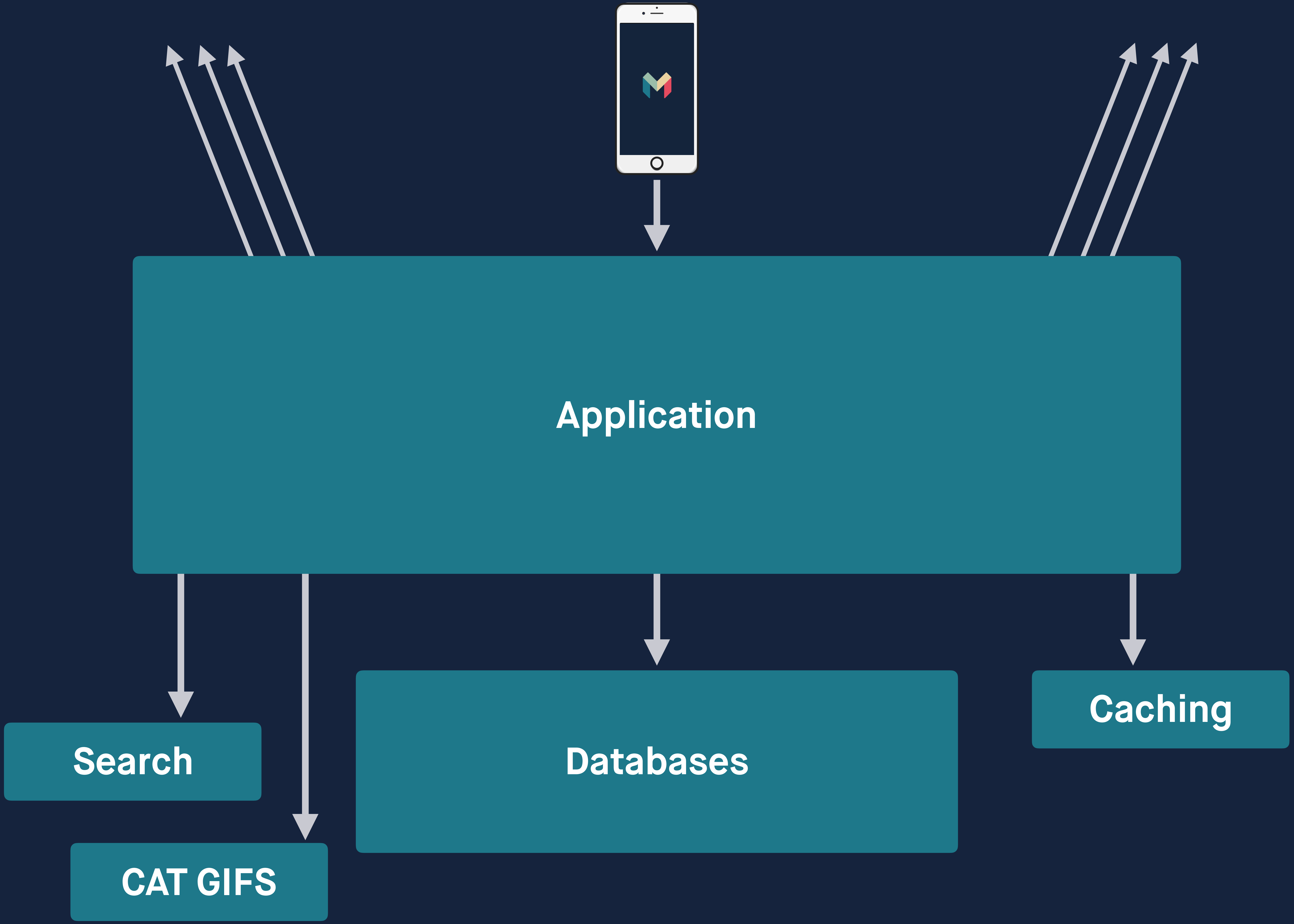

Application
Databases


Application
Search
Databases

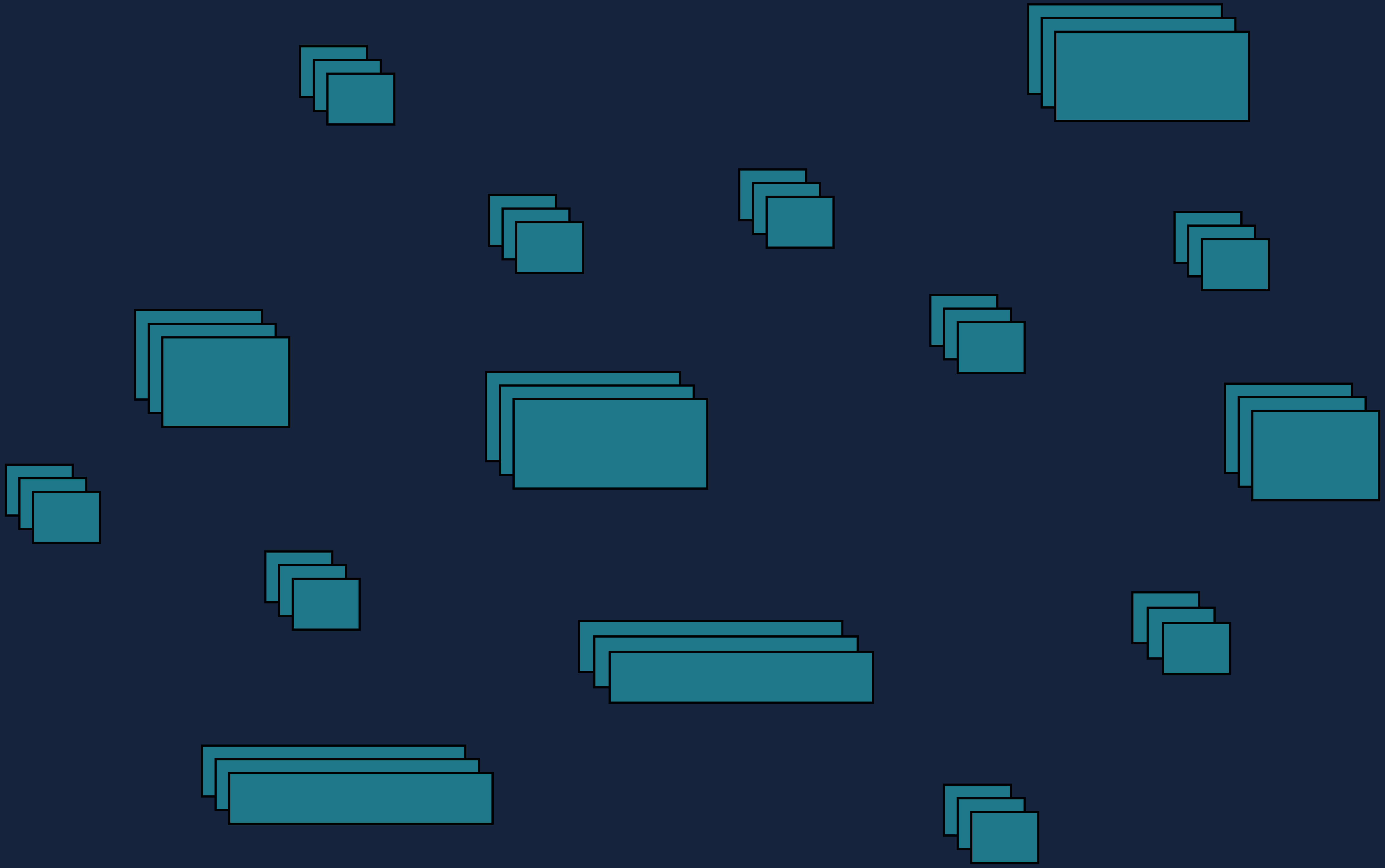

Application
Search
Databases
Caching

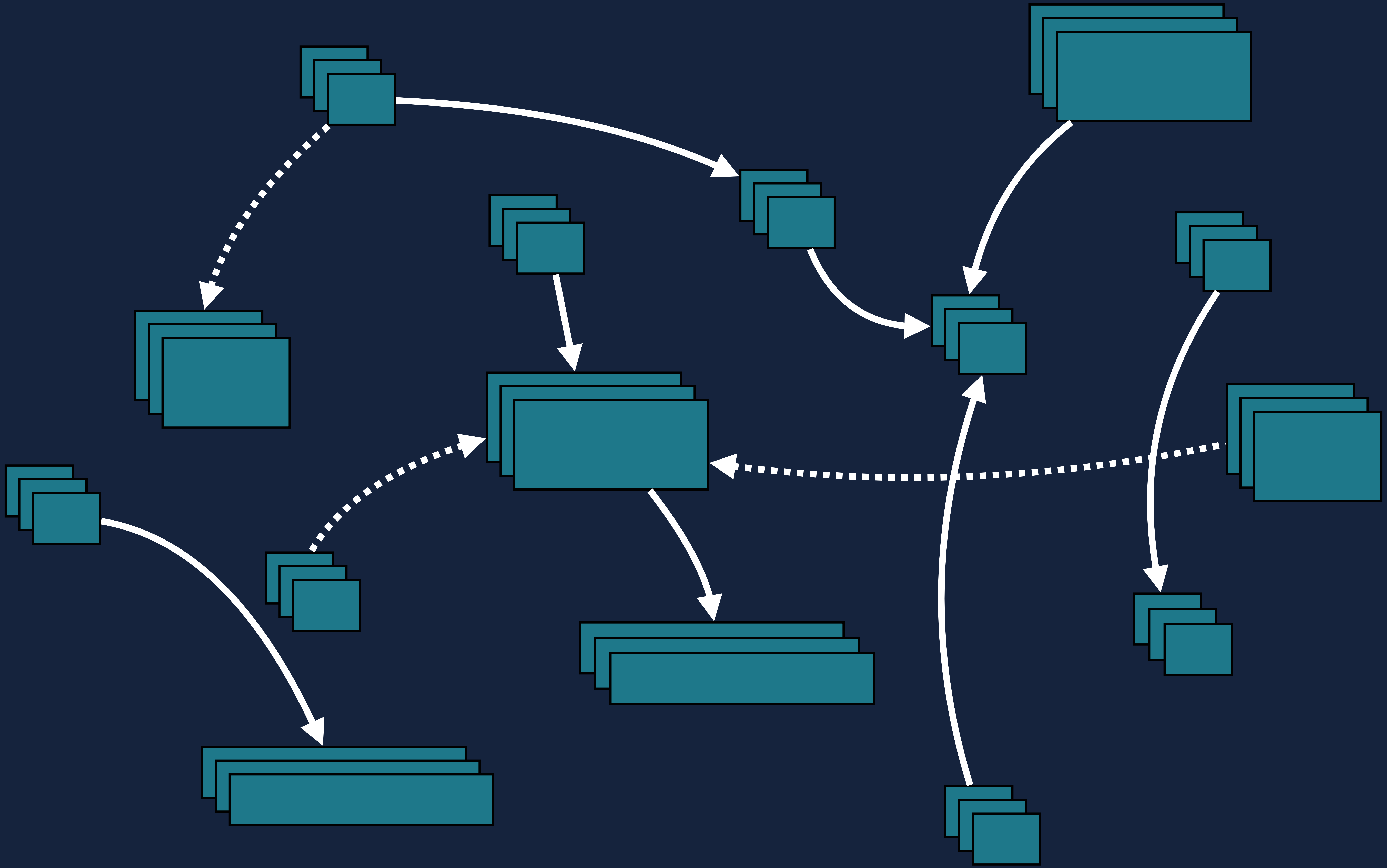

Application
Search
CAT GIFS
Databases
Caching

ALL HAIL THE MONOLITH


Application
Search
CAT GIFS
Databases
Caching

Application





Single Responsibility Principle

Bounded Context

Well defined Interfaces

Why Go?

Memory Managed

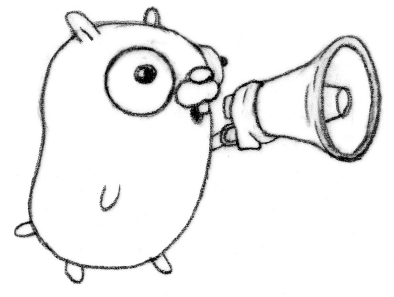
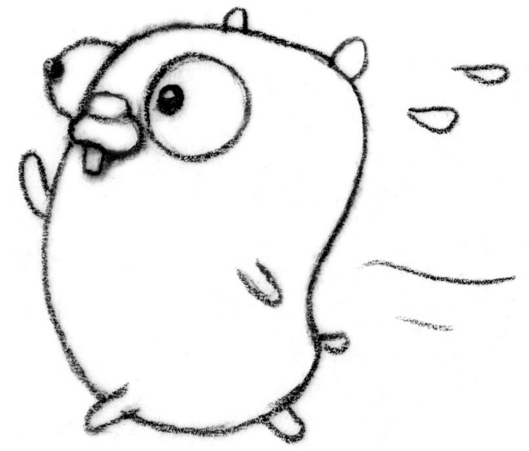
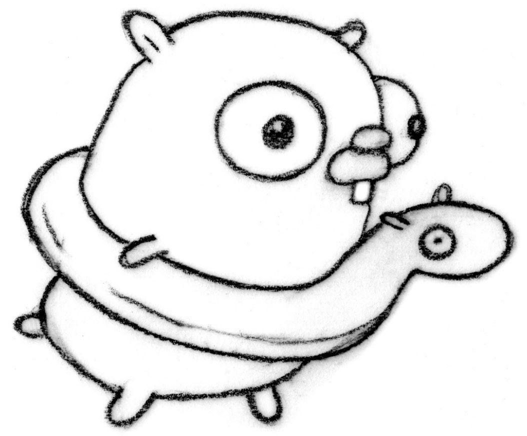
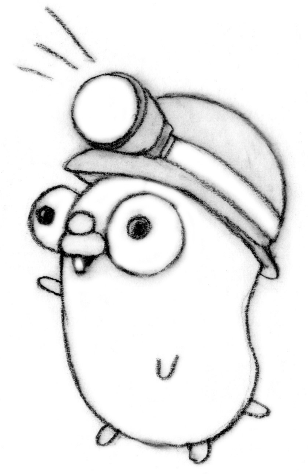
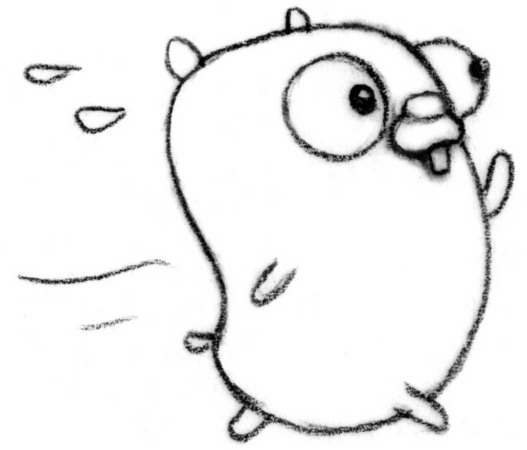
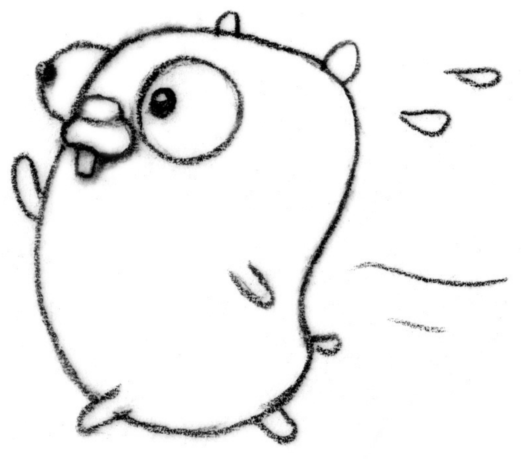
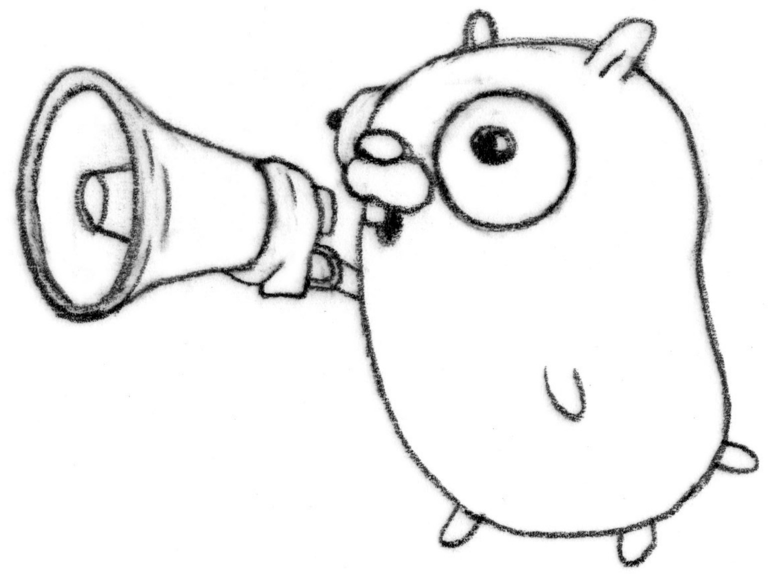
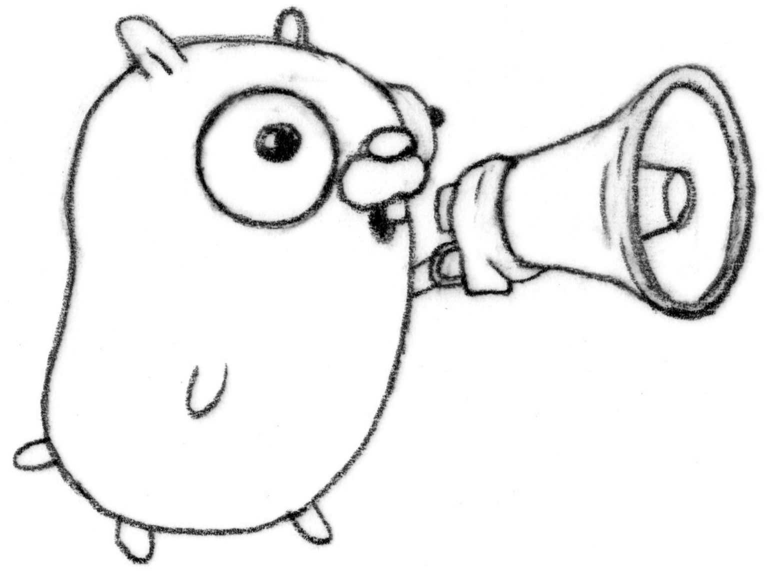
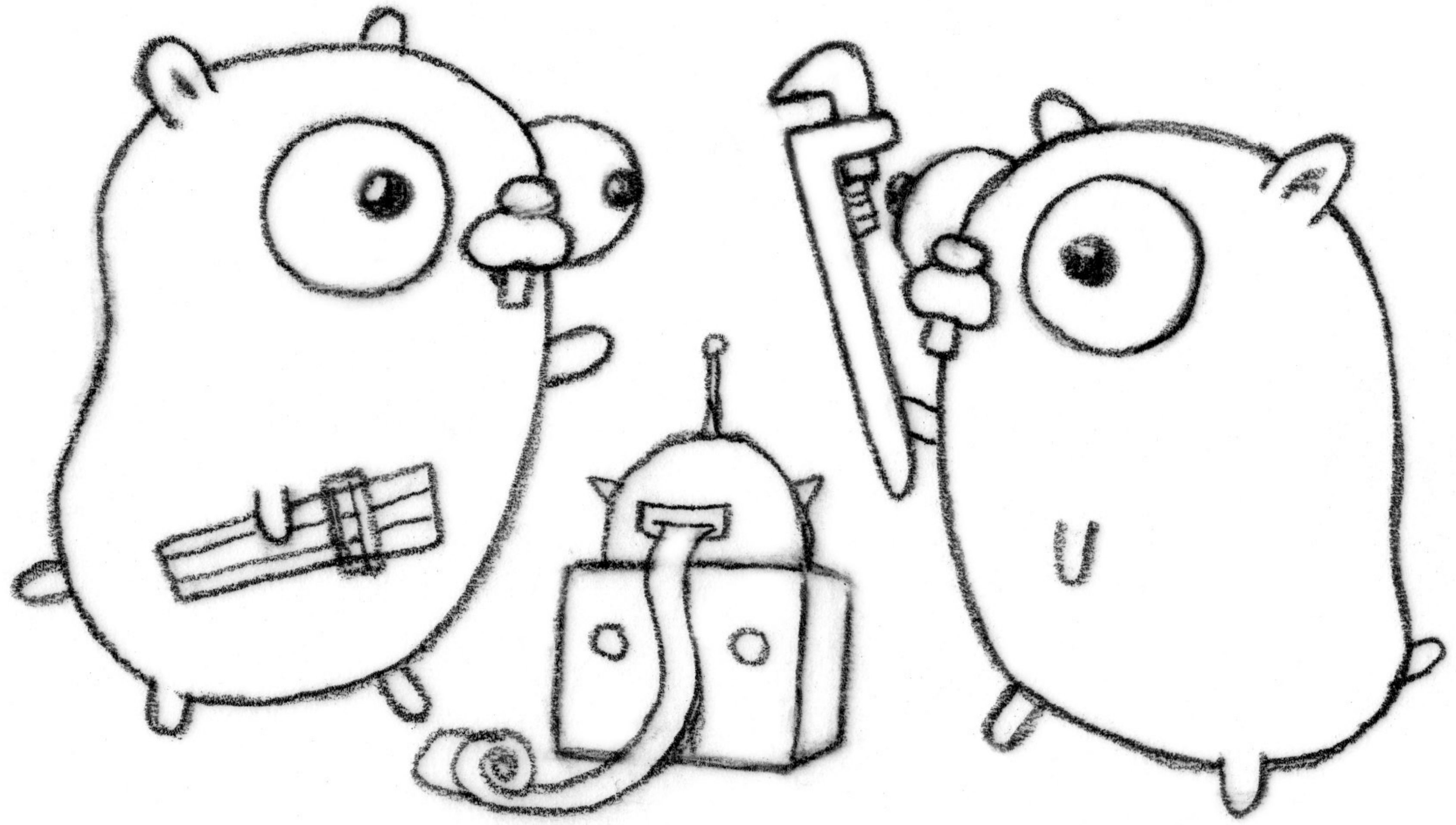
Statically Typed

Excellent Concurrency

Perfect for simple, small, network services

Lightweight Concurrency

Goroutines

```
// Blocking function call

handleRequest()
```

```go
// Function runs concurrently

go handleRequest()
```

```go
package main

func main() {

    go handleRequest()

    // …

}
```

```
package main

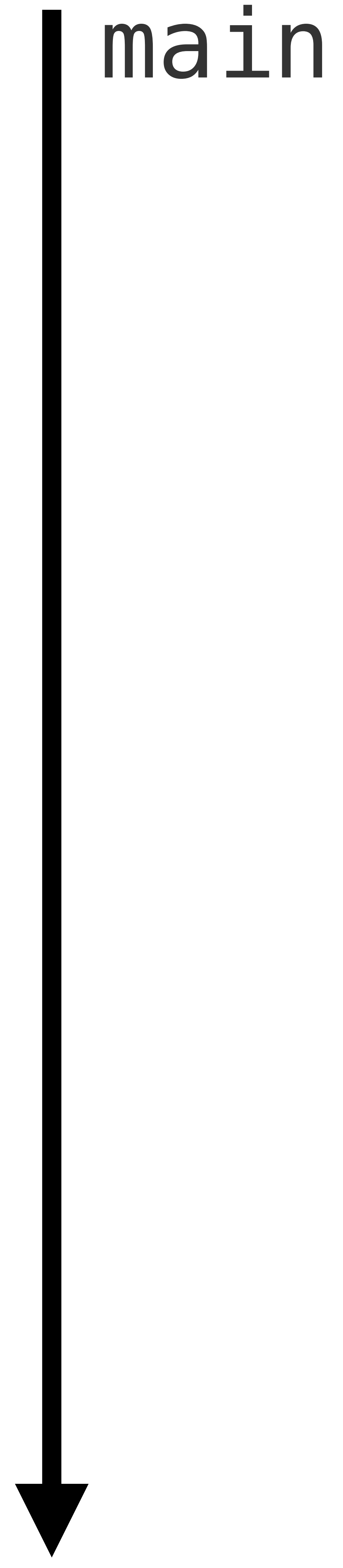
func main() {


    go handleRequest()



    // …

}
```



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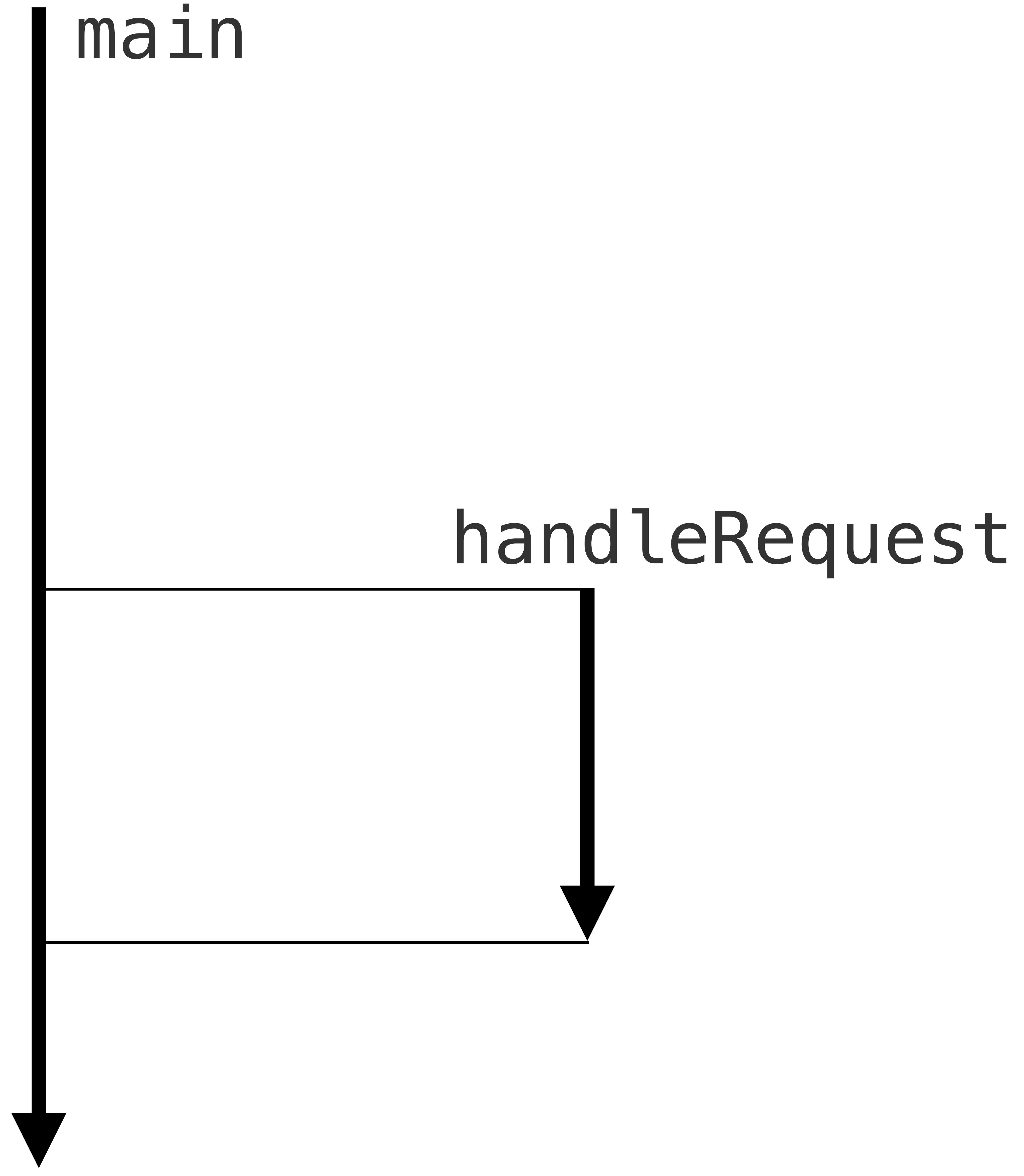
func main() {


    go handleRequest()



    // …

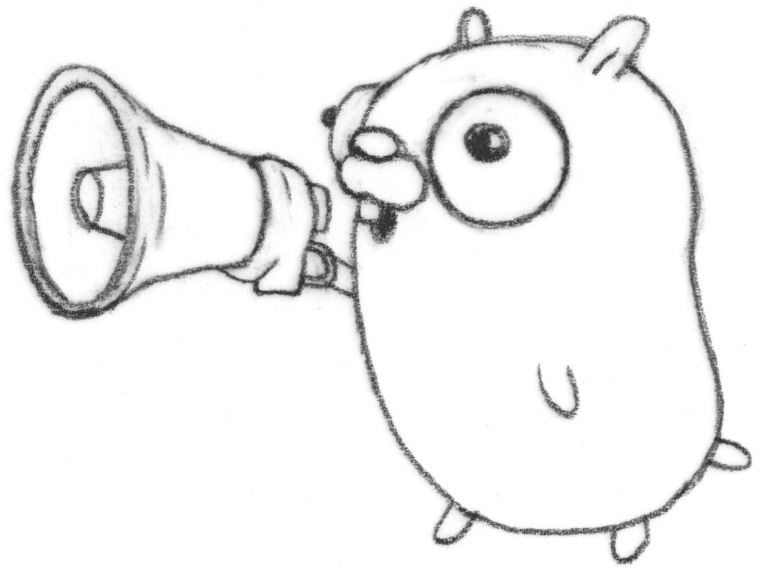
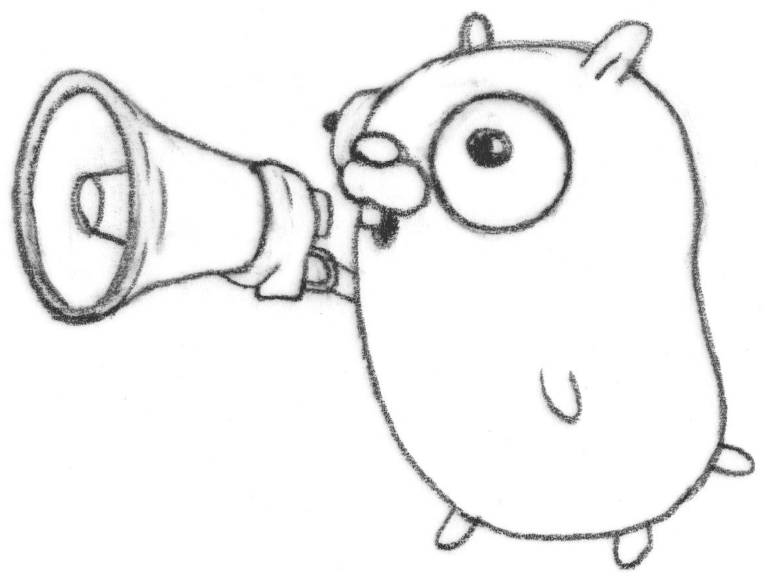
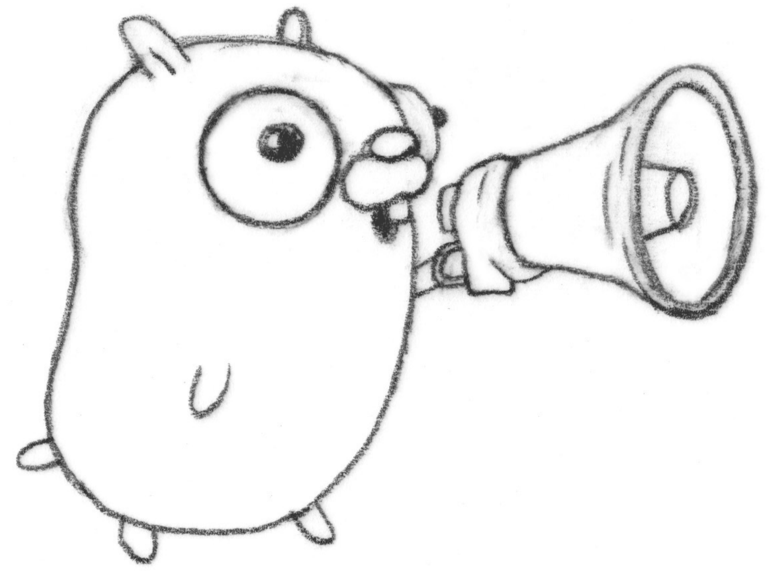
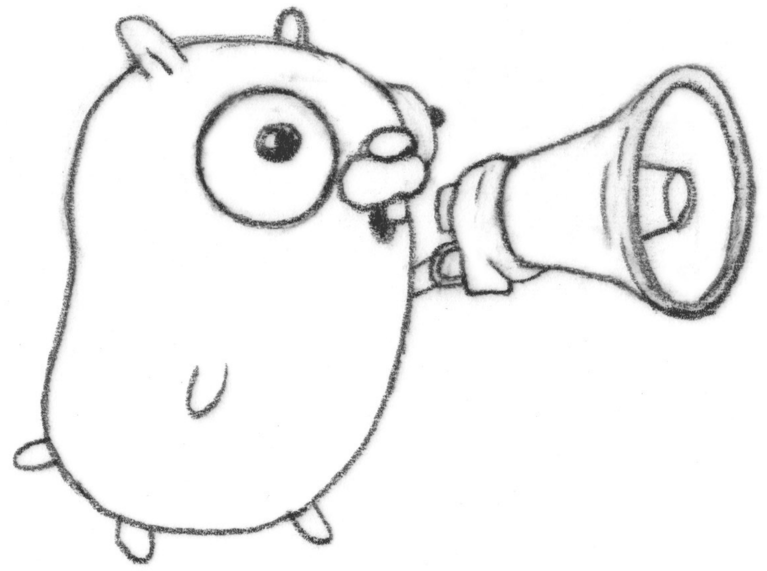
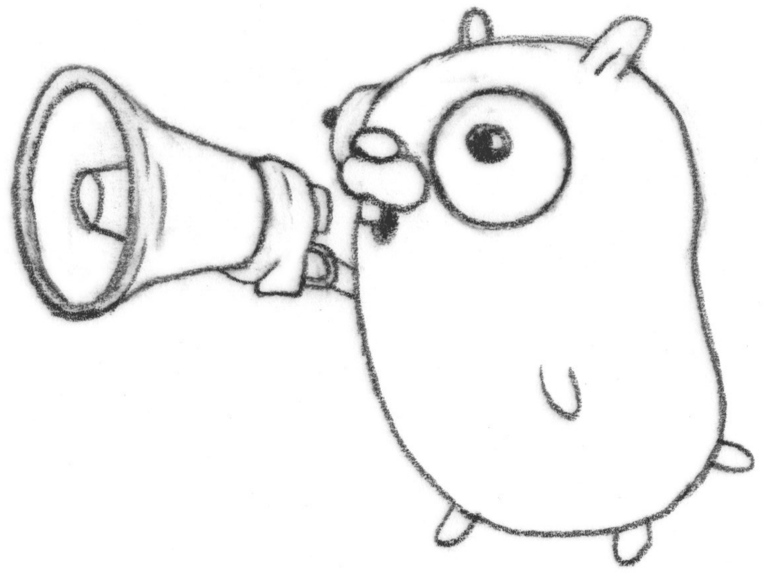
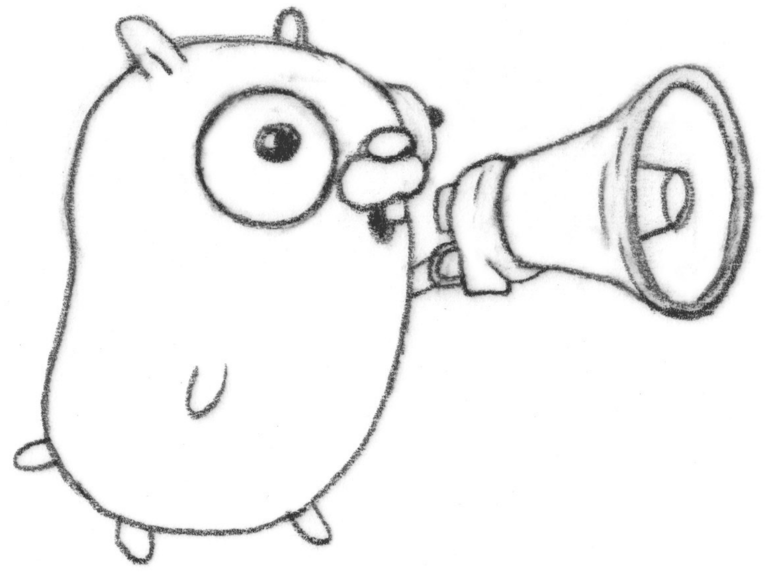
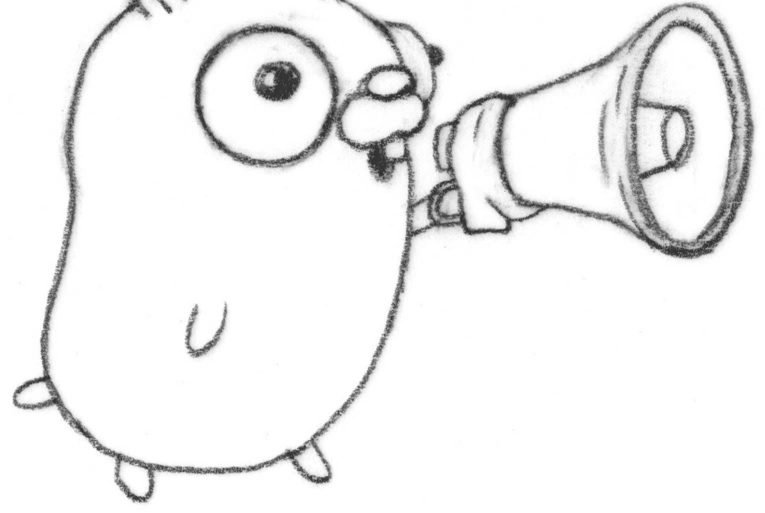
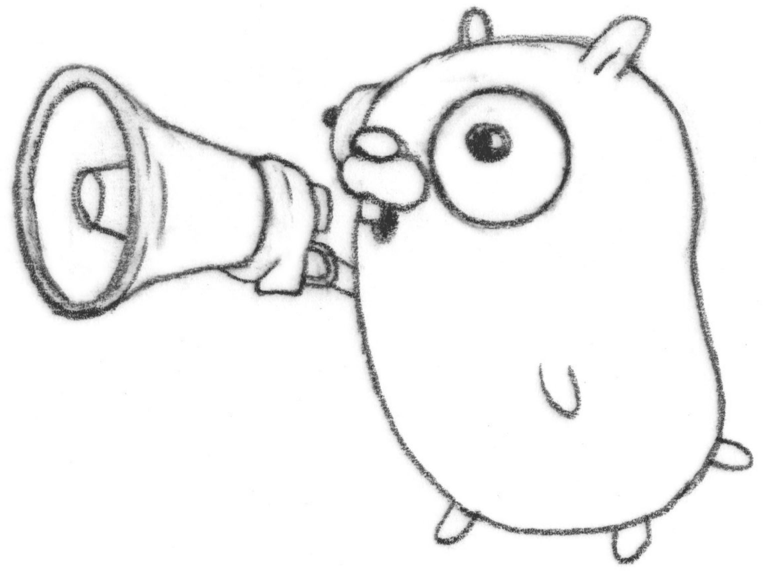
}
```

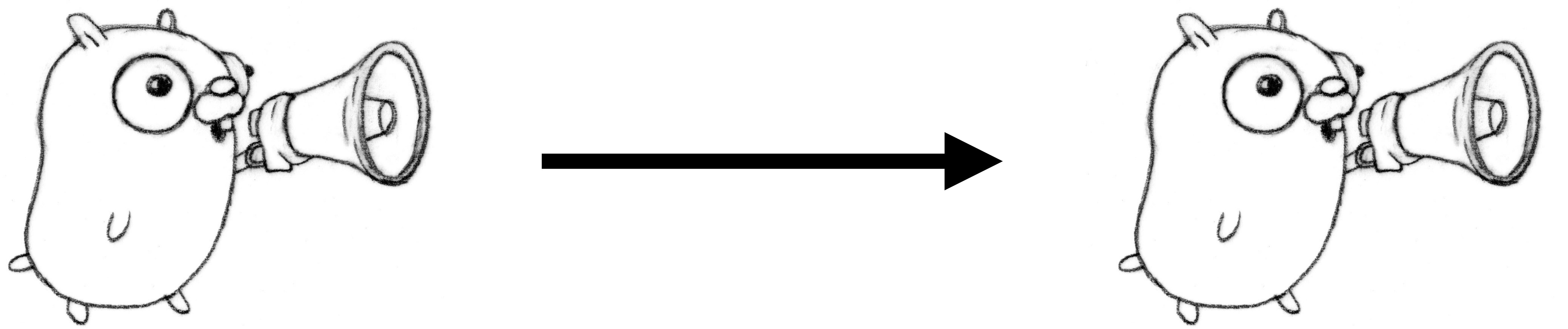


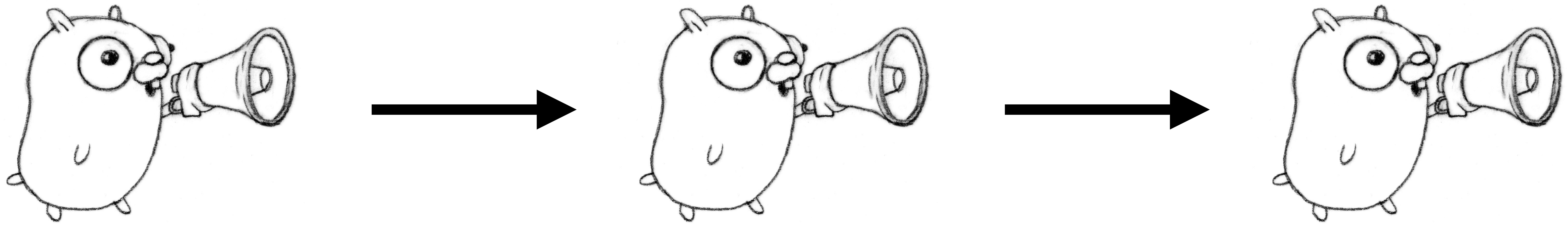
"Do not communicate by sharing memory; instead, share memory by communicating."

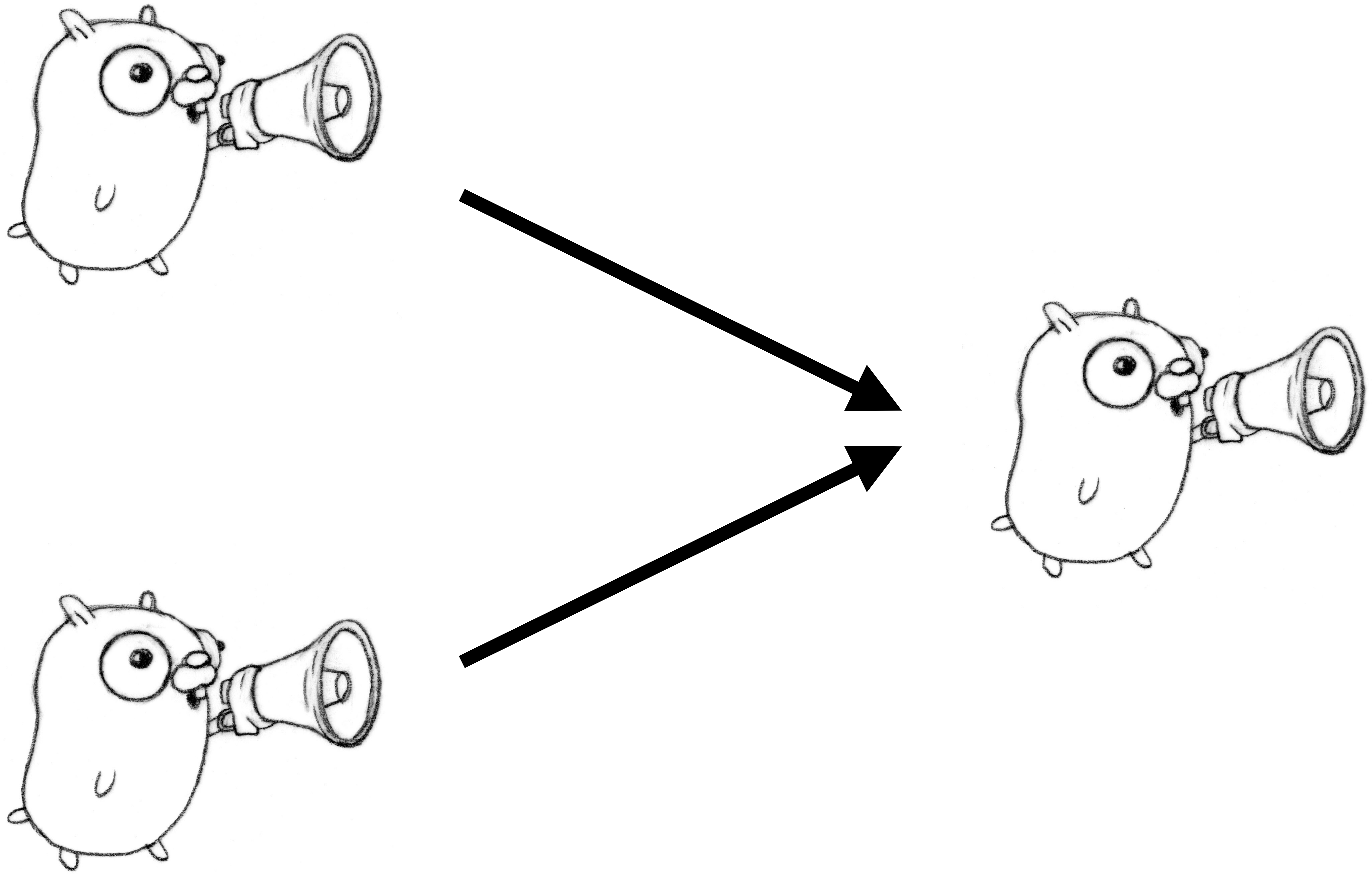
- Effective Go

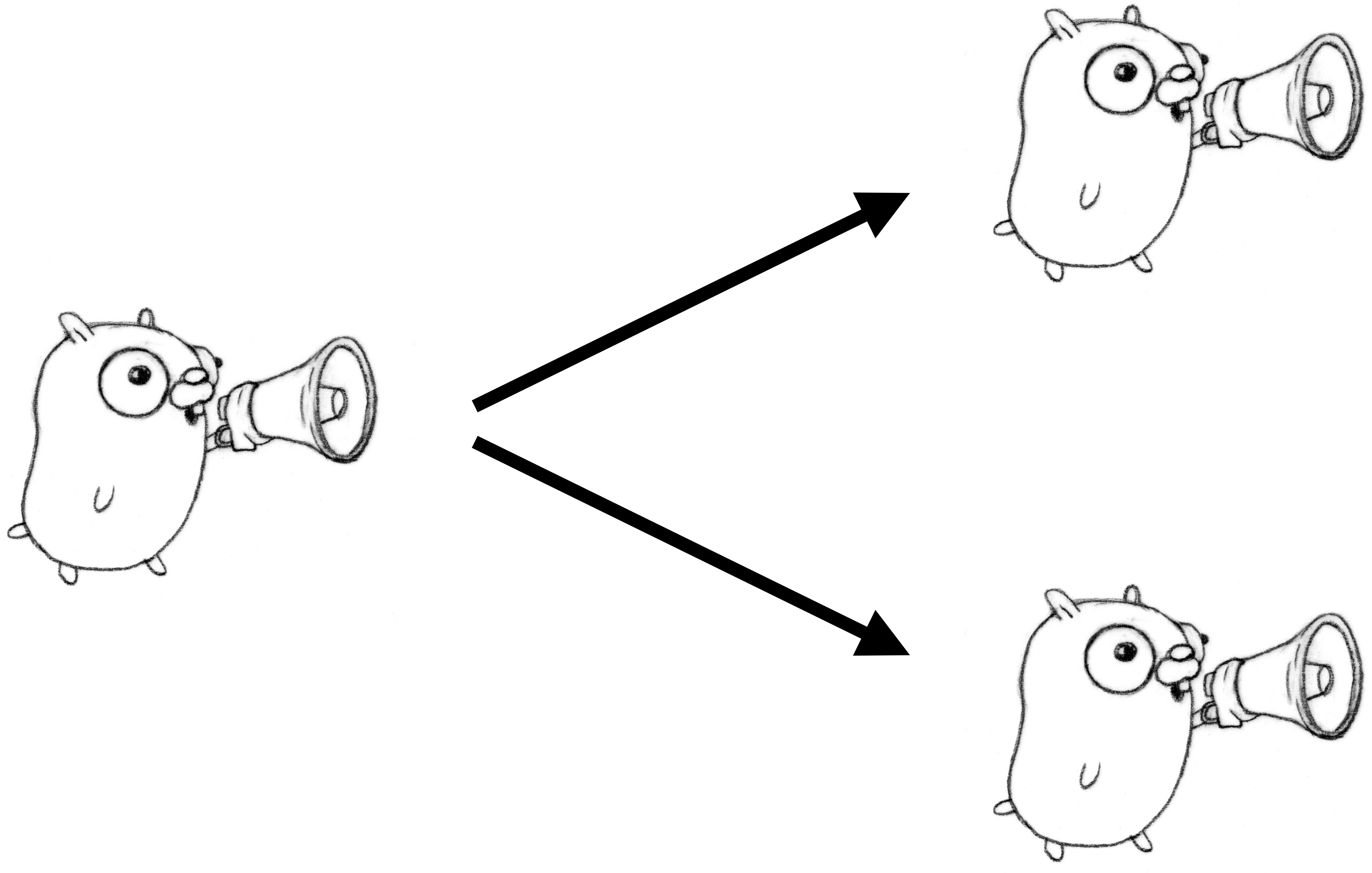
Channels

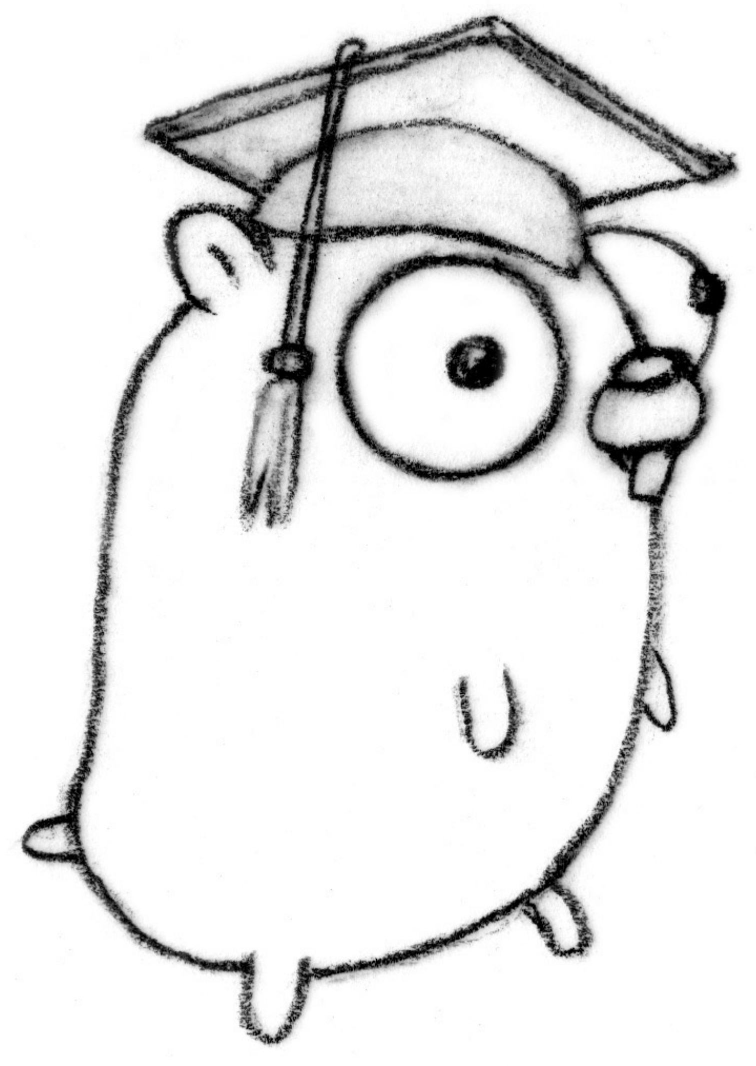




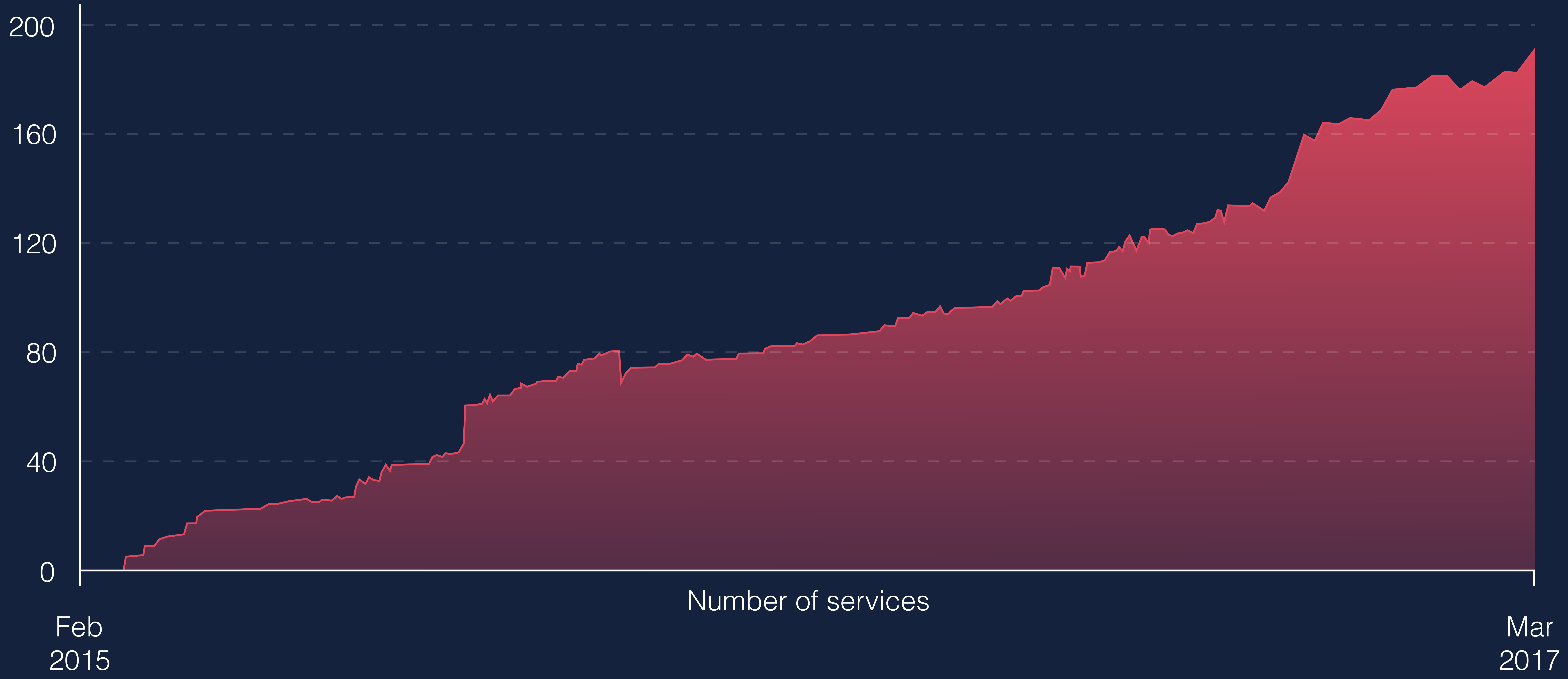


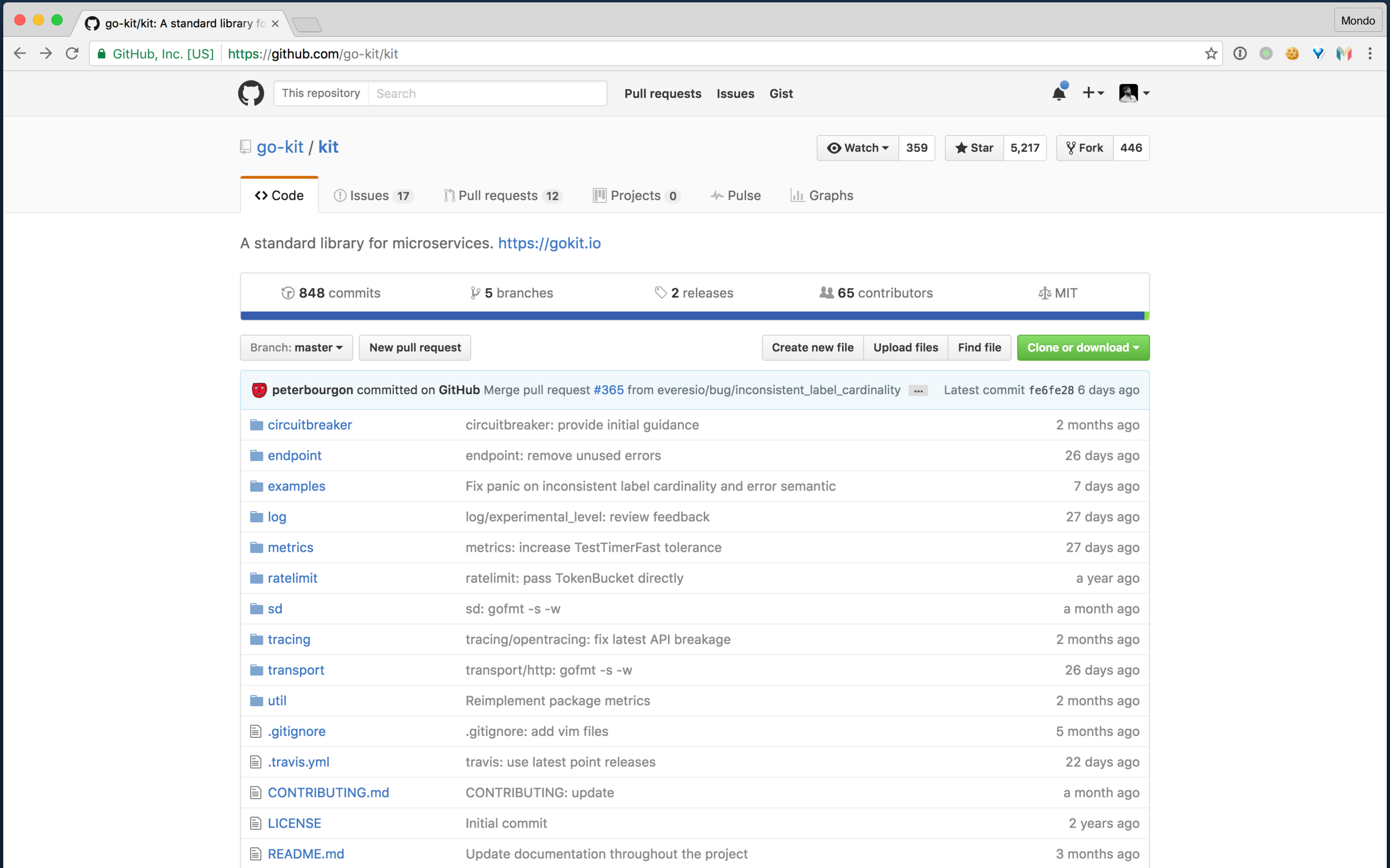


Simplicity



Static Linking
Stdlib
etc


200
160
120
80
40
0
Number of services
Feb 2015
Mar 2017

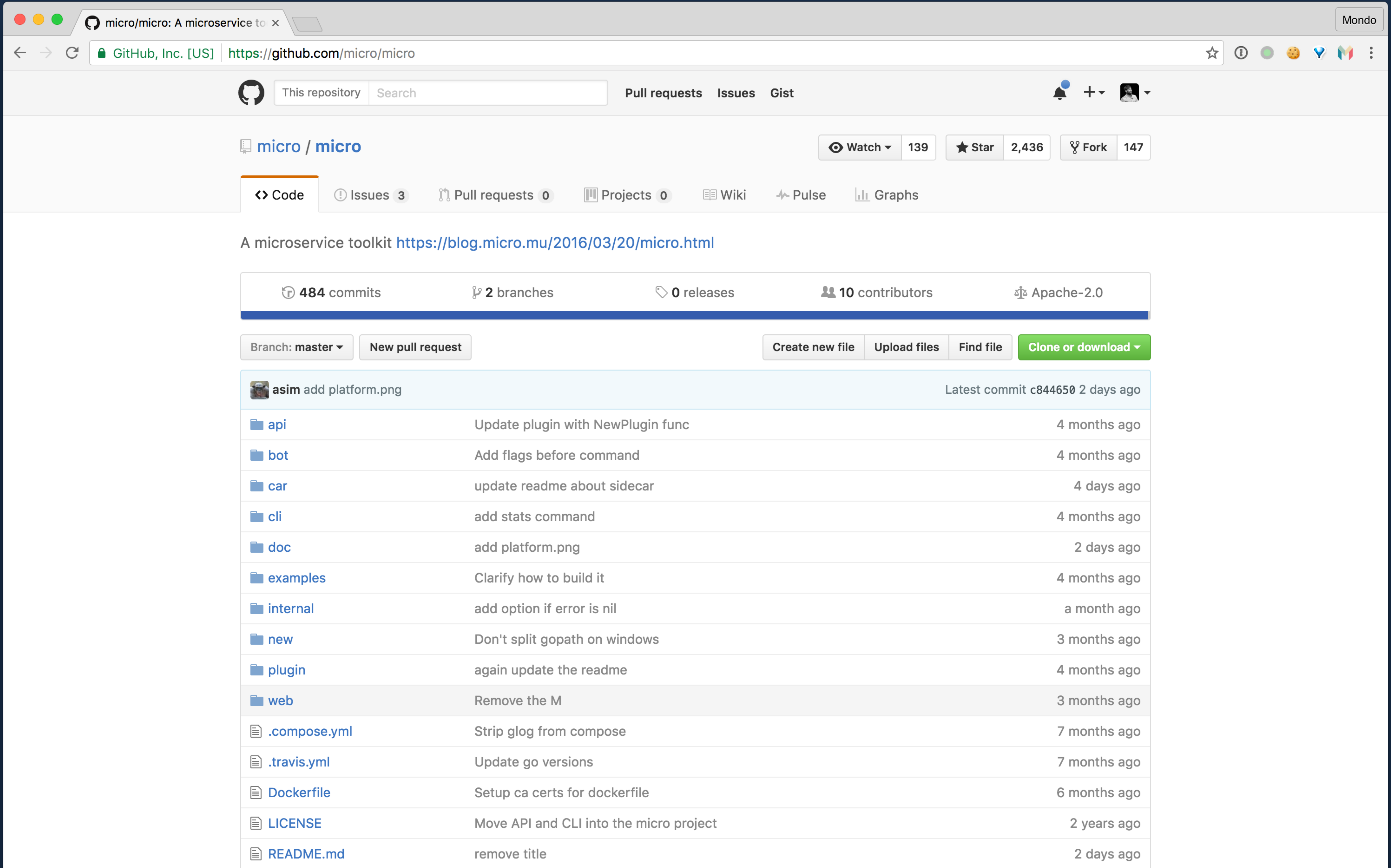


A standard library for microservices. https://gokit.io

848 commits · 5 branches · 2 releases · 65 contributors · MIT

peterbourgon committed on GitHub Merge pull request #365 from everesio/bug/inconsistent_label_cardinality … Latest commit fe6fe28 6 days ago

circuitbreaker	circuitbreaker: provide initial guidance	2 months ago
endpoint	endpoint: remove unused errors	26 days ago
examples	Fix panic on inconsistent label cardinality and error semantic	7 days ago
log	log/experimental_level: review feedback	27 days ago
metrics	metrics: increase TestTimerFast tolerance	27 days ago
ratelimit	ratelimit: pass TokenBucket directly	a year ago
sd	sd: gofmt -s -w	a month ago
tracing	tracing/opentracing: fix latest API breakage	2 months ago
transport	transport/http: gofmt -s -w	26 days ago
util	Reimplement package metrics	2 months ago
.gitignore	.gitignore: add vim files	5 months ago
.travis.yml	travis: use latest point releases	22 days ago
CONTRIBUTING.md	CONTRIBUTING: update	a month ago
LICENSE	Initial commit	2 years ago
README.md	Update documentation throughout the project	3 months ago



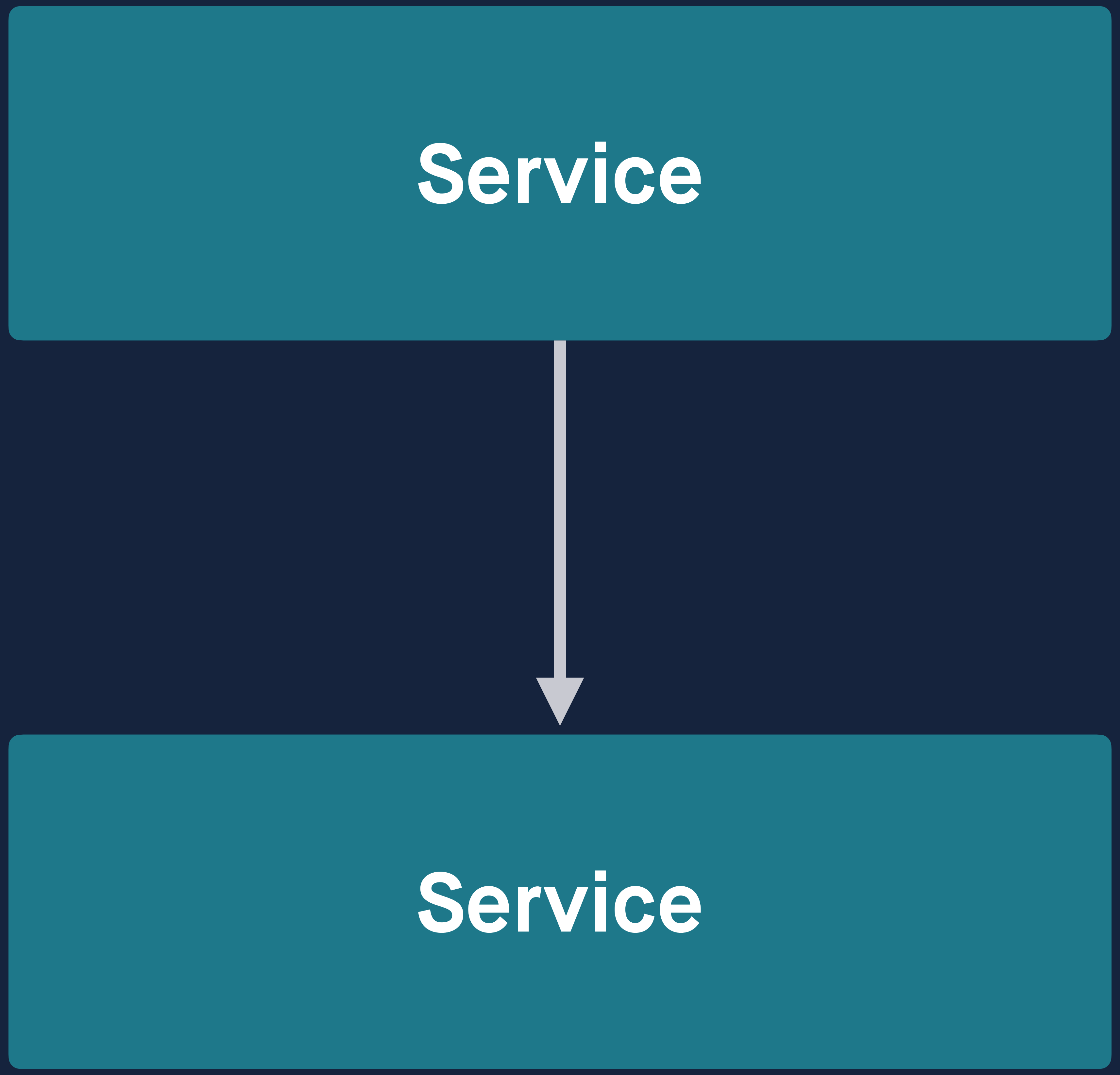
A microservice toolkit https://blog.micro.mu/2016/03/20/micro.html

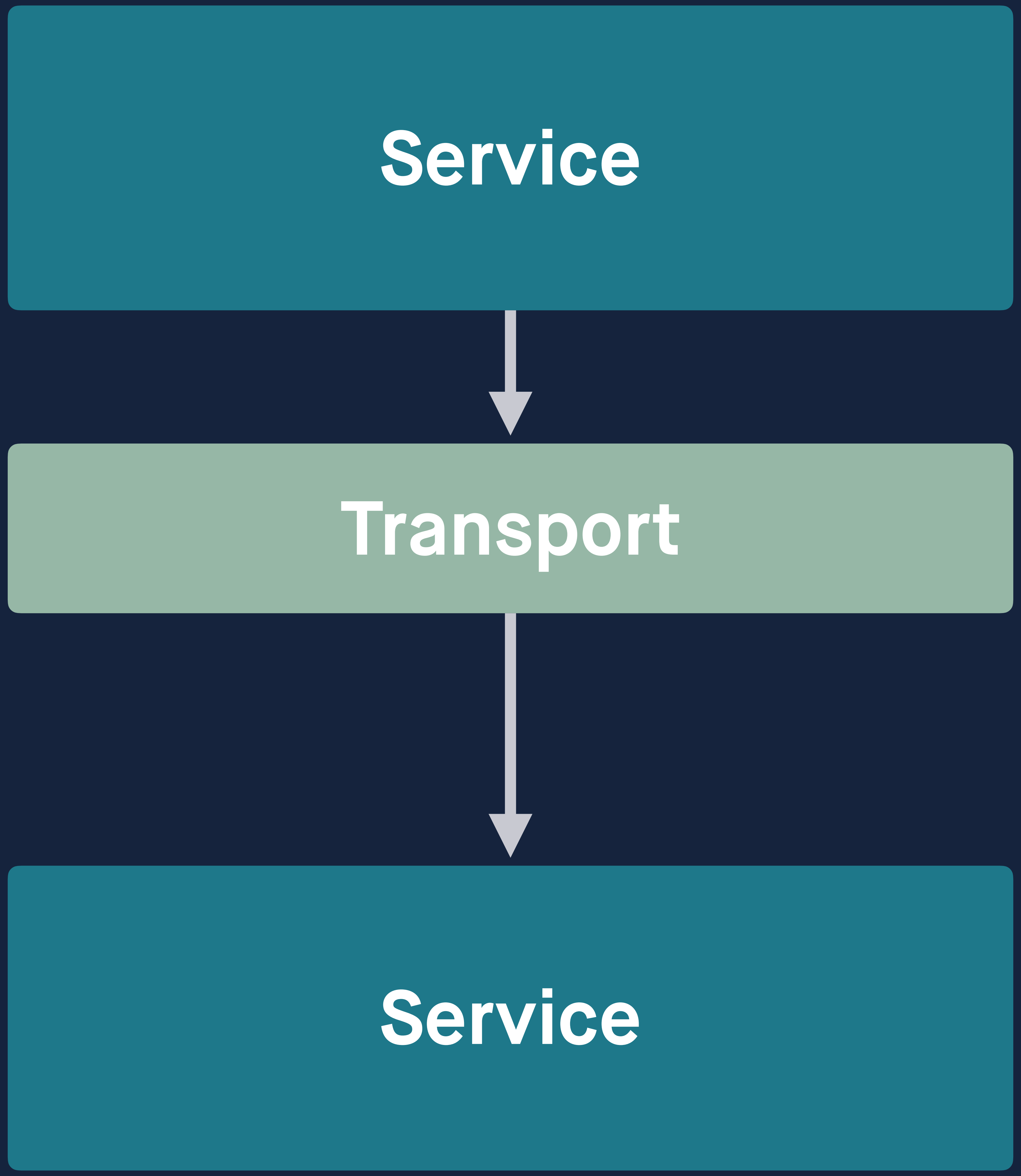
484 commits | 2 branches | 0 releases | 10 contributors | Apache-2.0

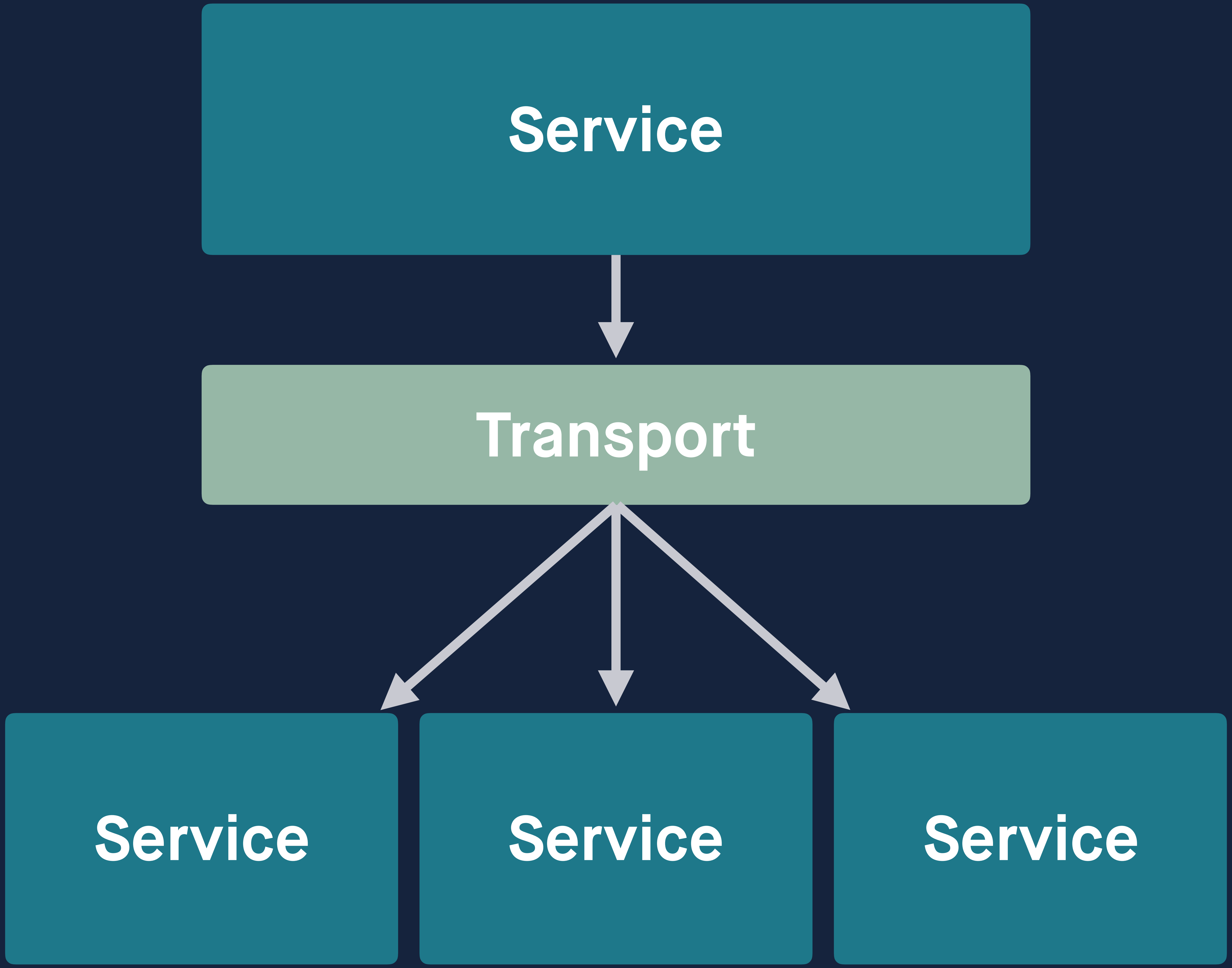
asim add platform.png — Latest commit c844650 2 days ago

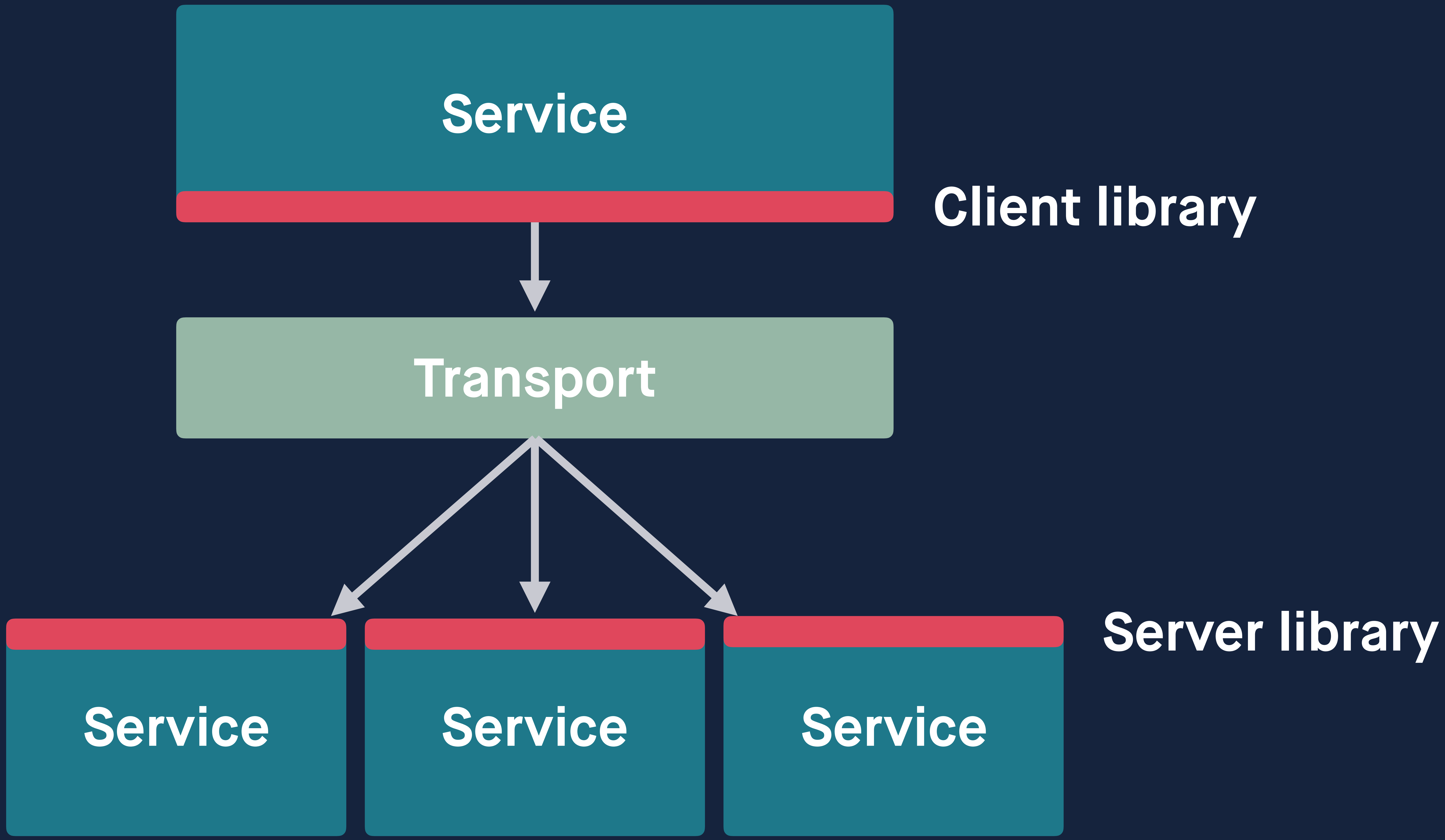
api	Update plugin with NewPlugin func	4 months ago
bot	Add flags before command	4 months ago
car	update readme about sidecar	4 days ago
cli	add stats command	4 months ago
doc	add platform.png	2 days ago
examples	Clarify how to build it	4 months ago
internal	add option if error is nil	a month ago
new	Don't split gopath on windows	3 months ago
plugin	again update the readme	4 months ago
web	Remove the M	3 months ago
.compose.yml	Strip glog from compose	7 months ago
.travis.yml	Update go versions	7 months ago
Dockerfile	Setup ca certs for dockerfile	6 months ago
LICENSE	Move API and CLI into the micro project	2 years ago
README.md	remove title	2 days ago

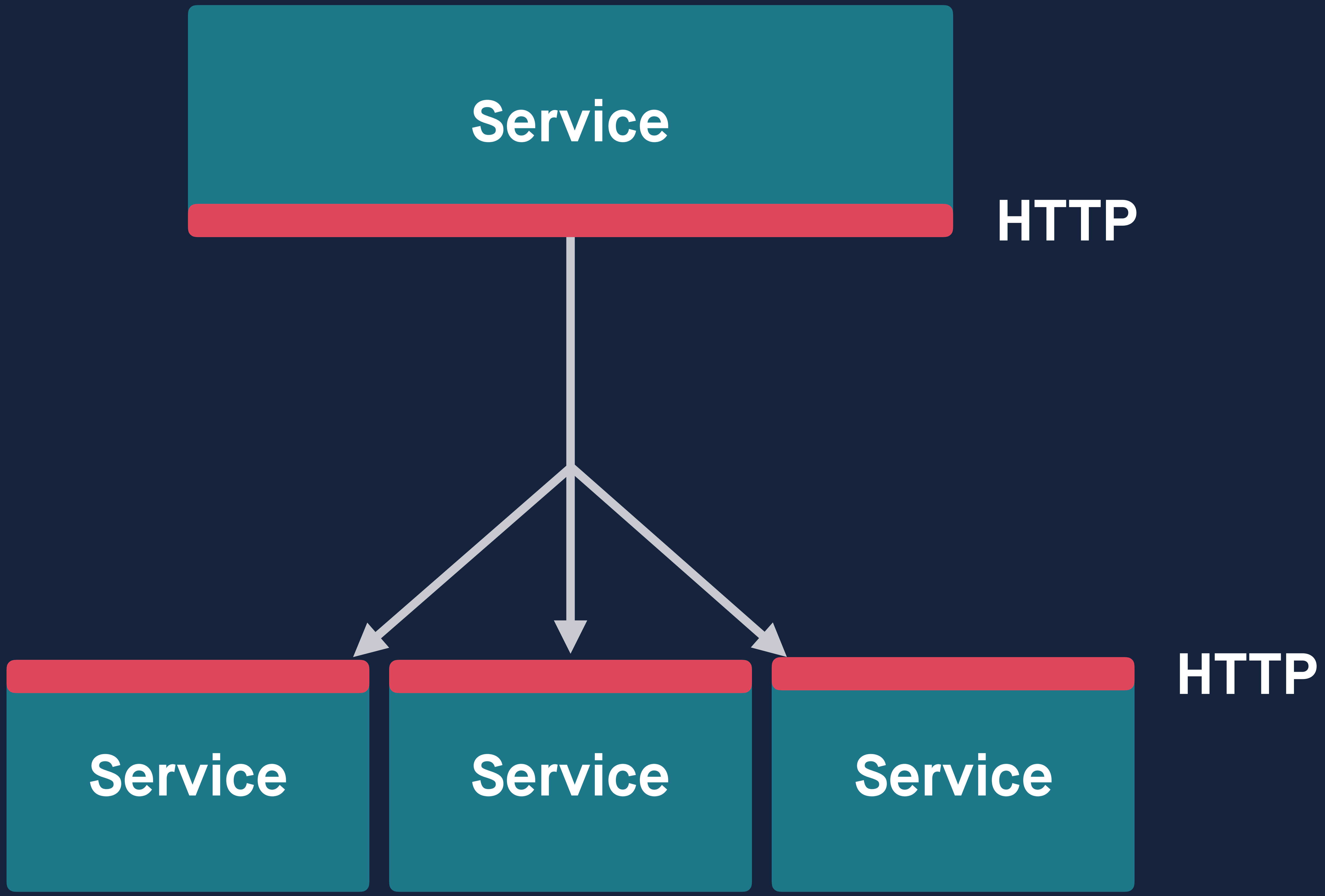
monzo/typhon


Service
Service

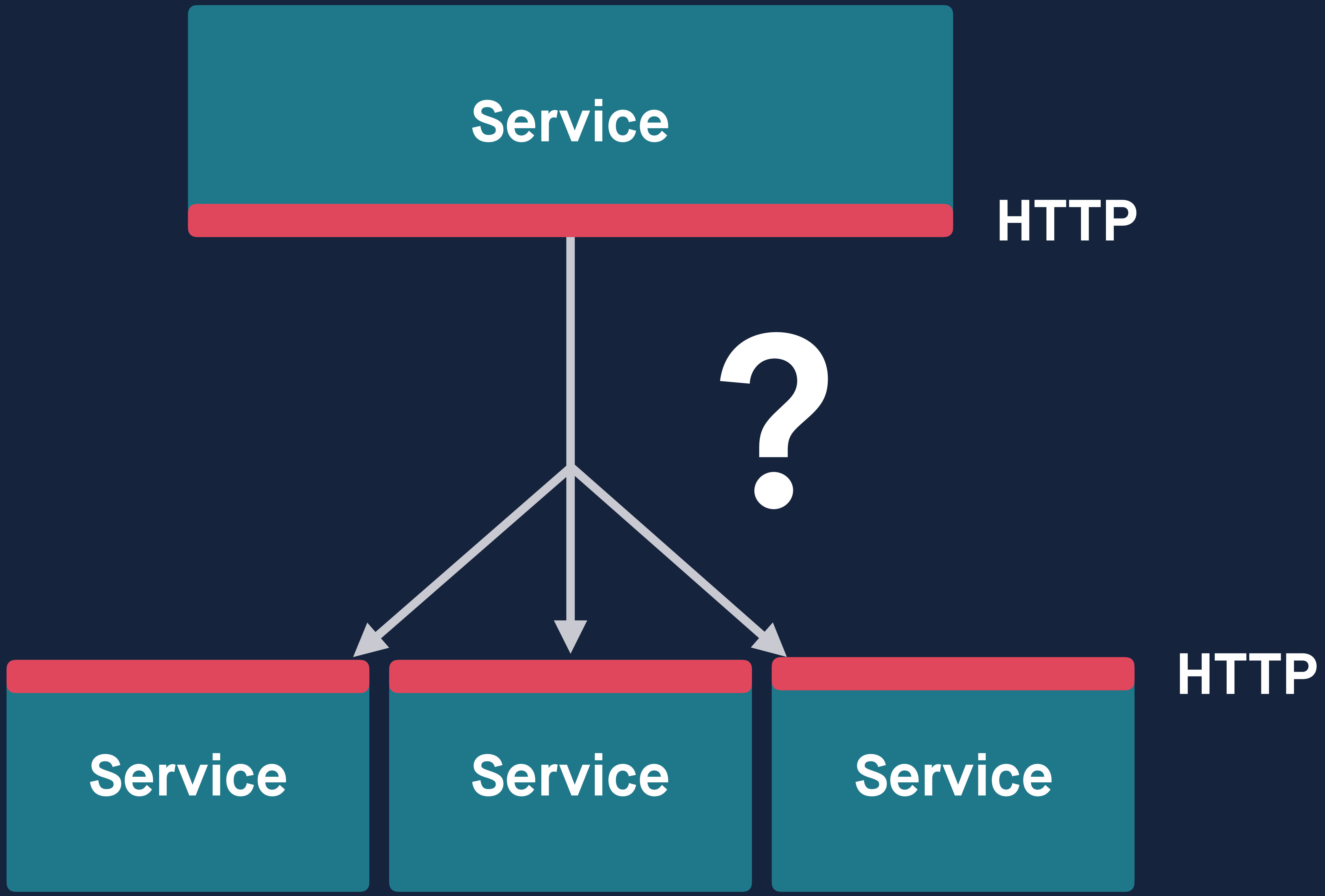

Service
Transport
Service

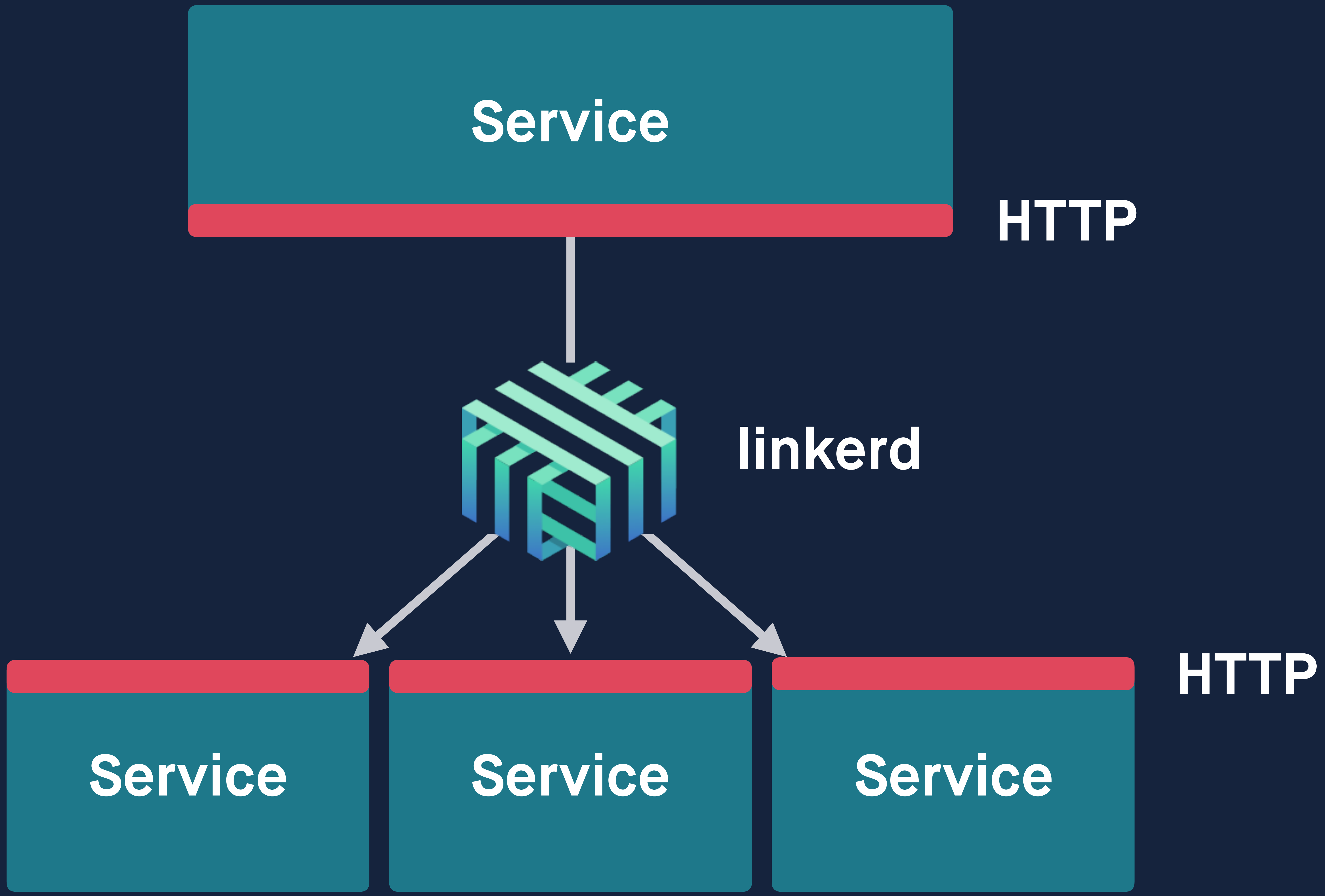

Service
Transport
Service
Service
Service


Service
Client library
Transport
Service
Service
Service
Server library

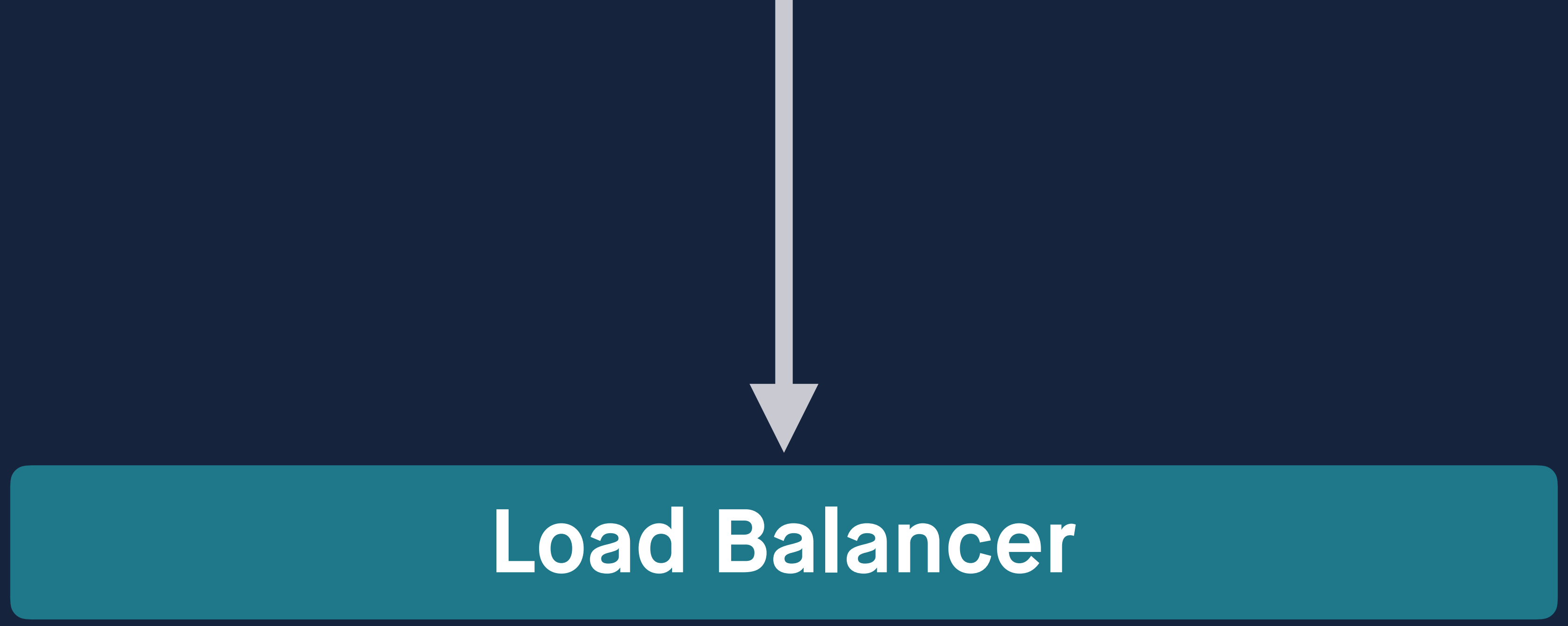

Service
HTTP
HTTP
Service
Service
Service

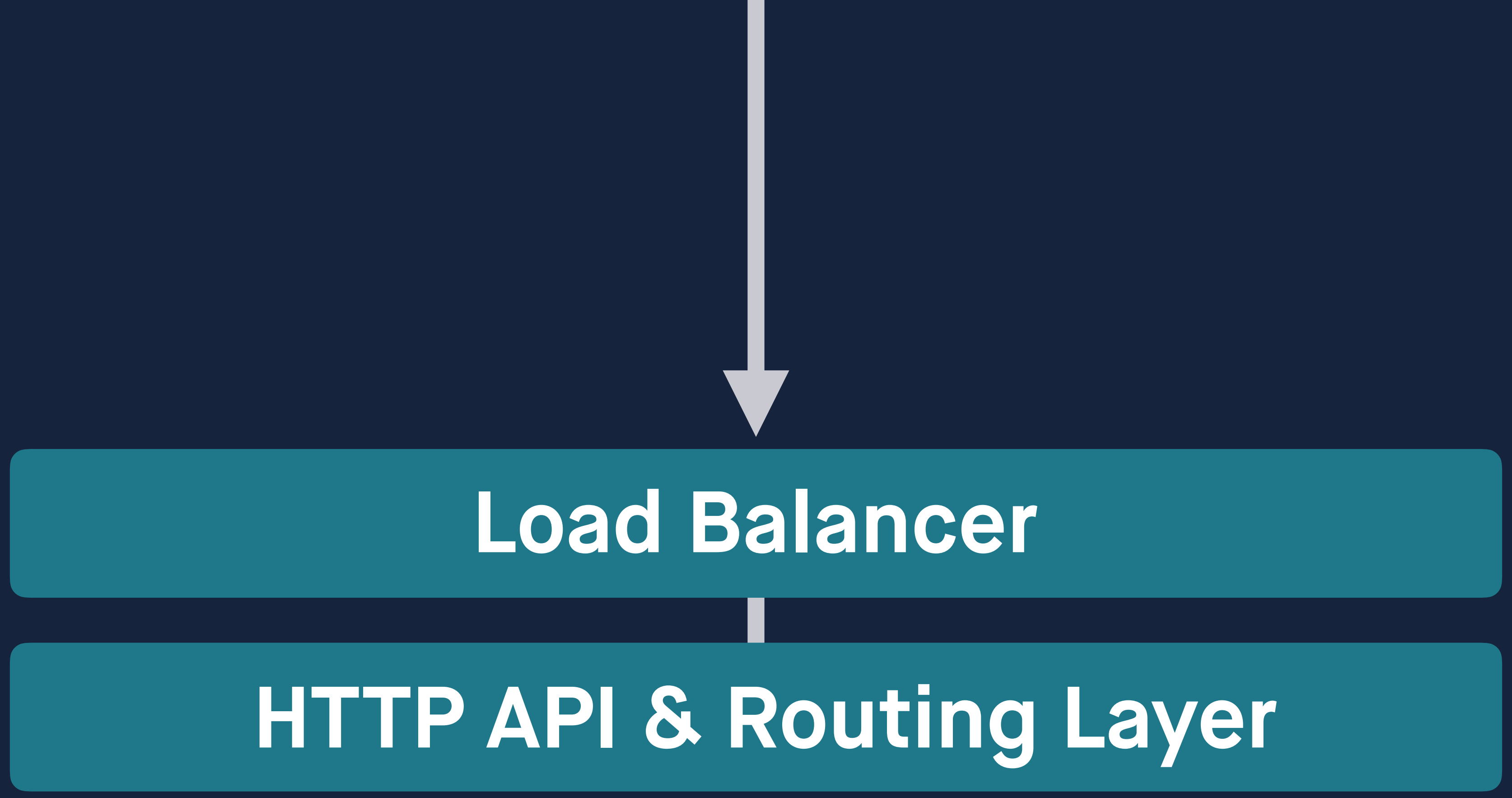
Service Discovery
Load Balancing
Timeouts and Expirations
Retries
Rate Limiting
Connection Pooling
Circuit Breaking
Failure Detection
Metrics and Tracing
Interrupts
Context Propagation

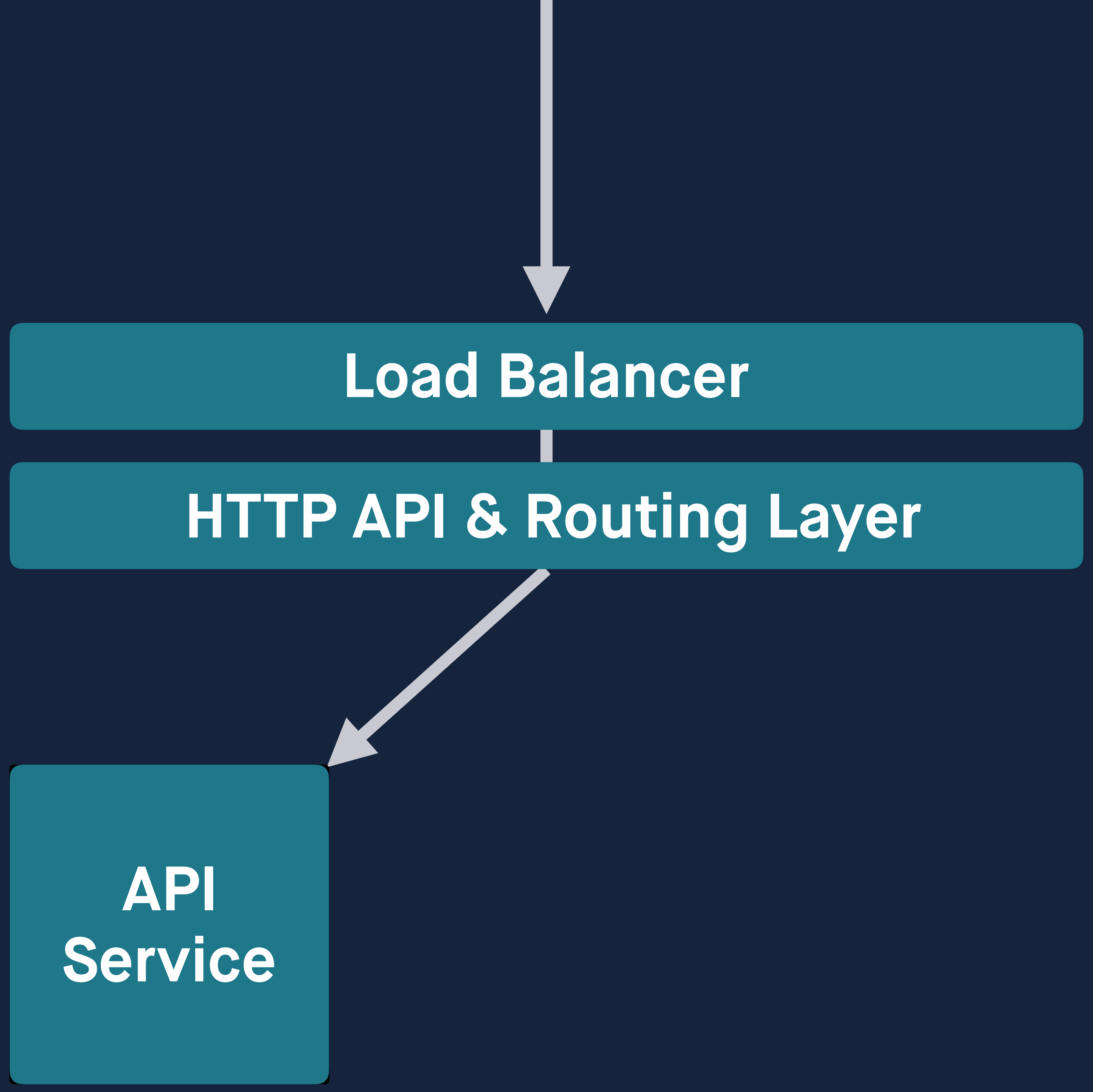

Service
HTTP
?
HTTP
Service
Service
Service

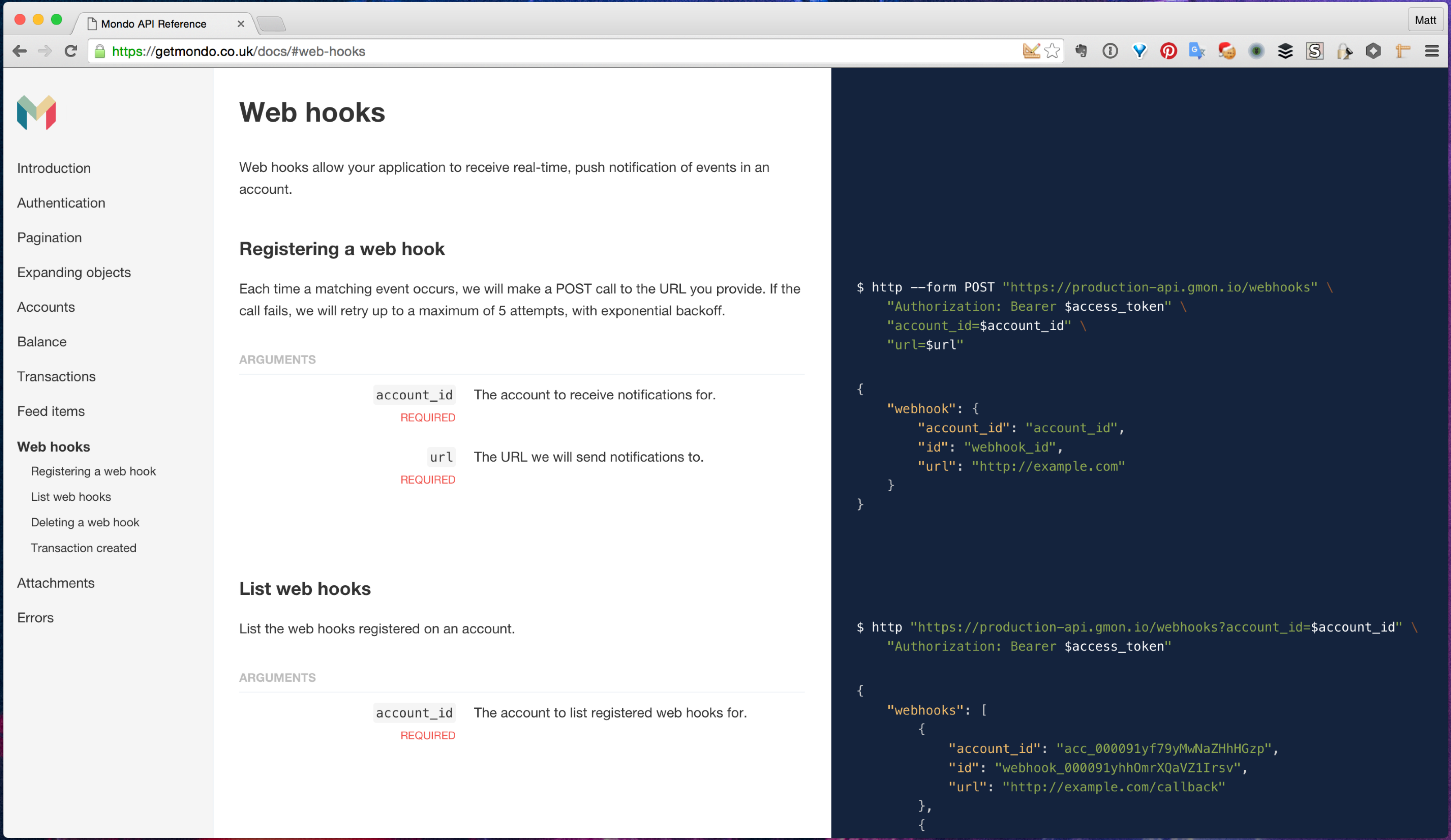

Service
HTTP
linkerd
Service
Service
Service
HTTP

Service Discovery
Load Balancing
Timeouts and Expirations
Retries
Rate Limiting
Connection Pooling
Circuit Breaking
Failure Detection
Metrics and Tracing
Interrupts
Context Propagation


Load Balancer


Load Balancer
HTTP API & Routing Layer


Load Balancer
HTTP API & Routing Layer
API Service



Web hooks

Web hooks allow your application to receive real-time, push notification of events in an account.

Registering a web hook

Each time a matching event occurs, we will make a POST call to the URL you provide. If the call fails, we will retry up to a maximum of 5 attempts, with exponential backoff.

ARGUMENTS

`account_id` REQUIRED	The account to receive notifications for.
`url` REQUIRED	The URL we will send notifications to.

```
$ http --form POST "https://production-api.gmon.io/webhooks" \
    "Authorization: Bearer $access_token" \
    "account_id=$account_id" \
    "url=$url"
```

```
{
    "webhook": {
        "account_id": "account_id",
        "id": "webhook_id",
        "url": "http://example.com"
    }
}
```

List web hooks

List the web hooks registered on an account.

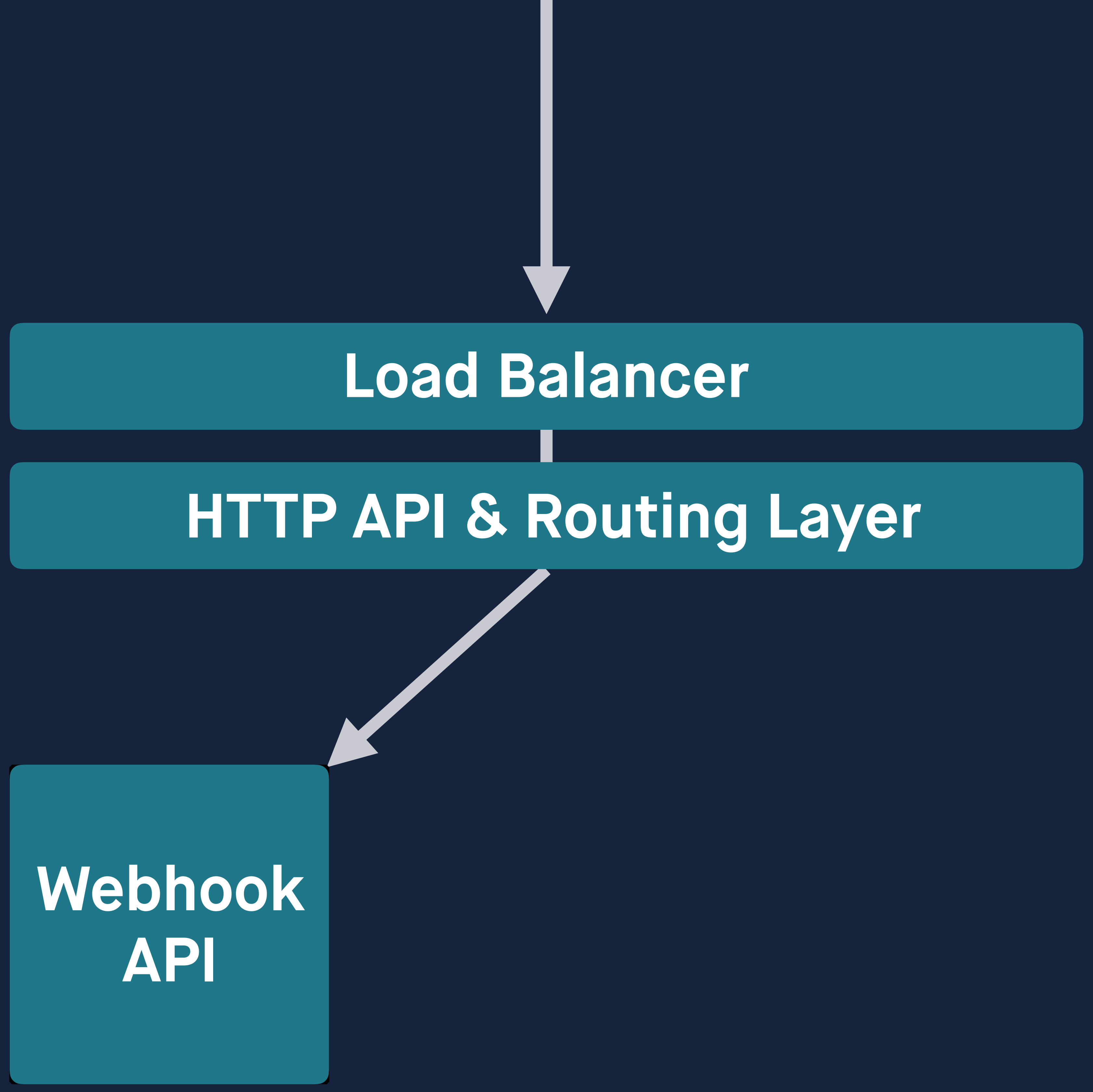
ARGUMENTS

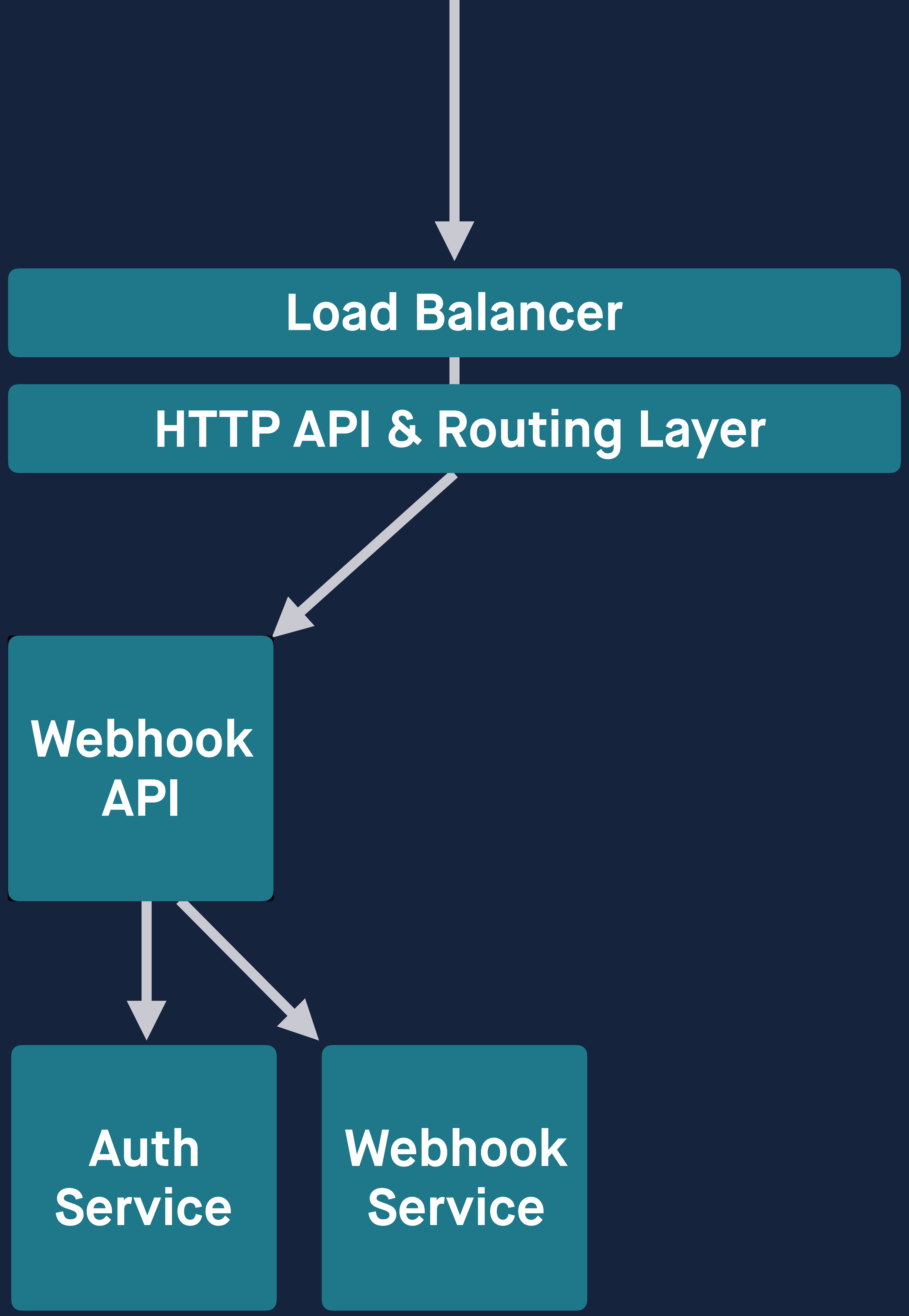
`account_id` REQUIRED	The account to list registered web hooks for.

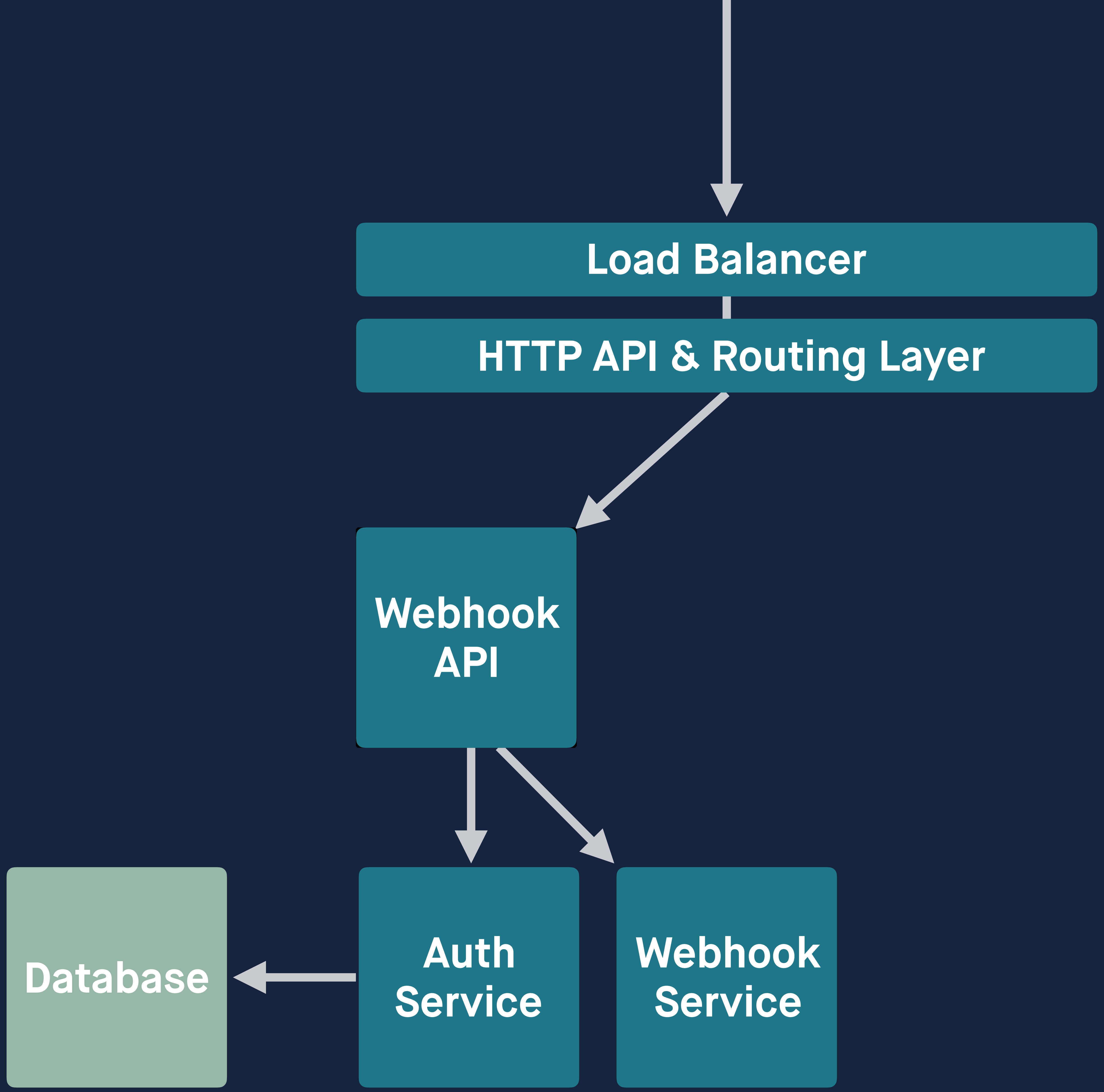
```
$ http "https://production-api.gmon.io/webhooks?account_id=$account_id" \
    "Authorization: Bearer $access_token"
```

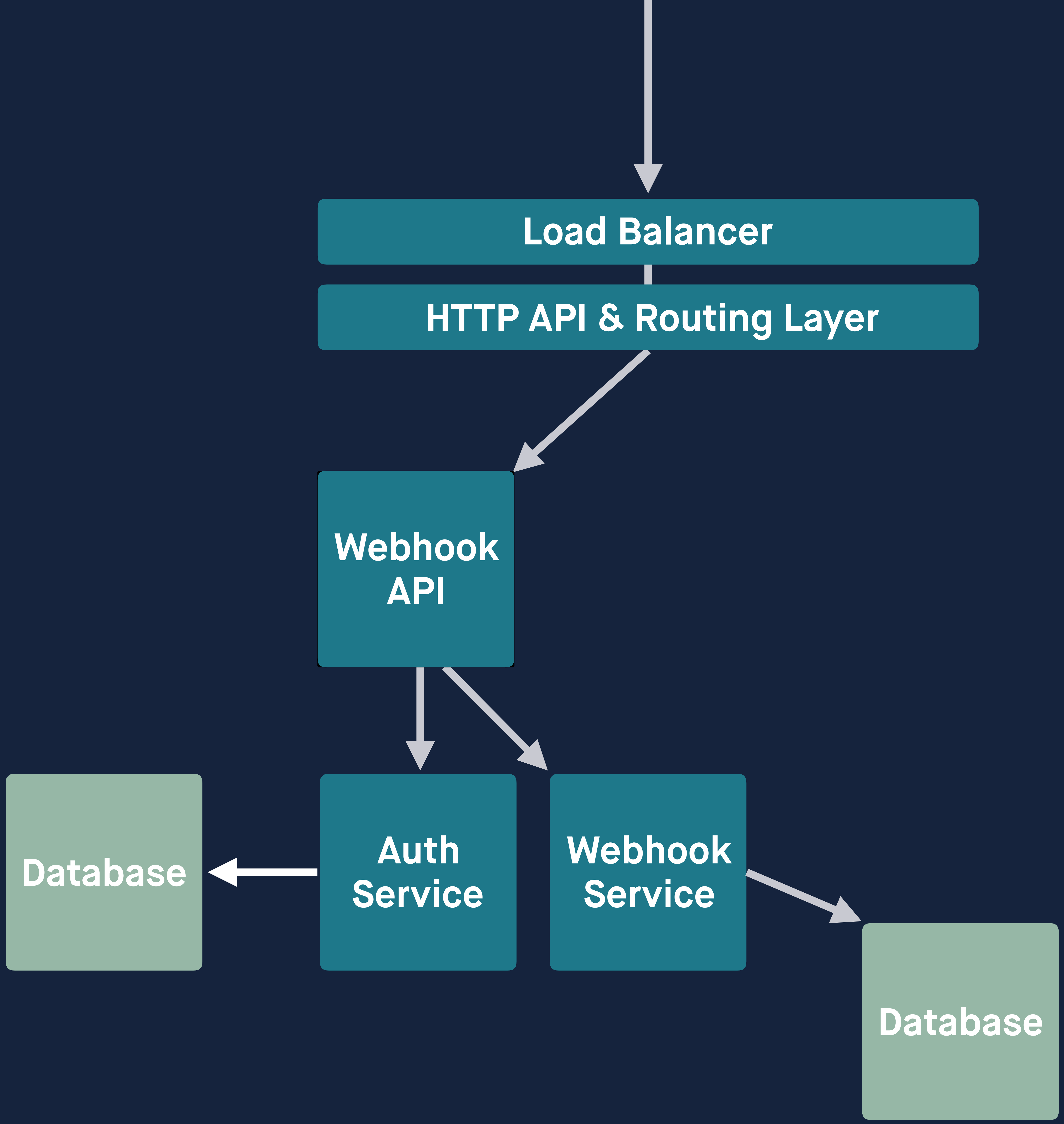
```
{
    "webhooks": [
        {
            "account_id": "acc_000091yf79yMwNaZHhHGzp",
            "id": "webhook_000091yhhOmrXQaVZ1Irsv",
            "url": "http://example.com/callback"
        },
        {
```

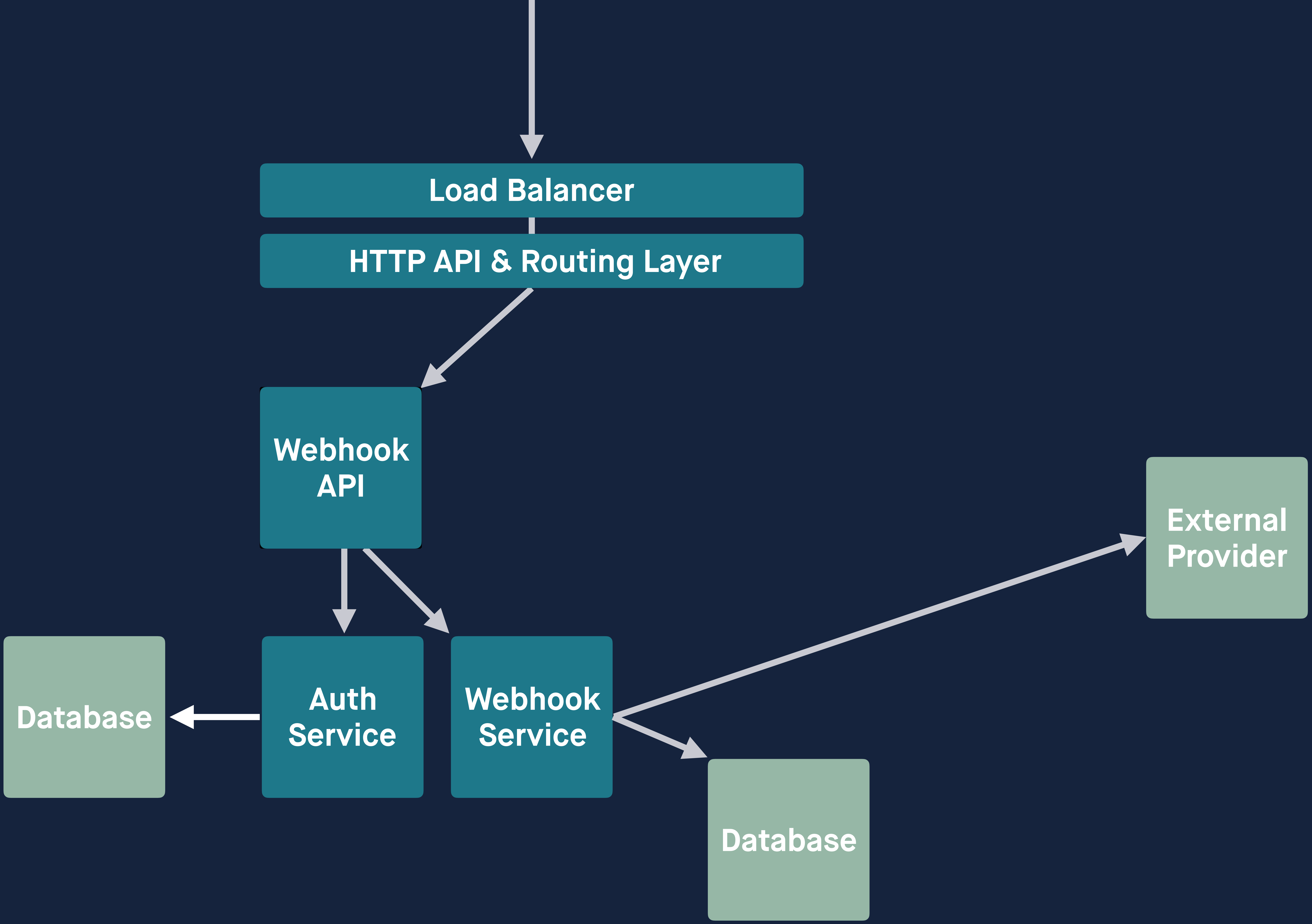
```
/webhooks ——> Webhook API
```


Load Balancer
HTTP API & Routing Layer
Webhook API


Load Balancer
HTTP API & Routing Layer
Webhook API
Auth Service
Webhook Service


Load Balancer
HTTP API & Routing Layer
Webhook API
Database
Auth Service
Webhook Service


Load Balancer
HTTP API & Routing Layer
Webhook API
Database
Auth Service
Webhook Service
Database

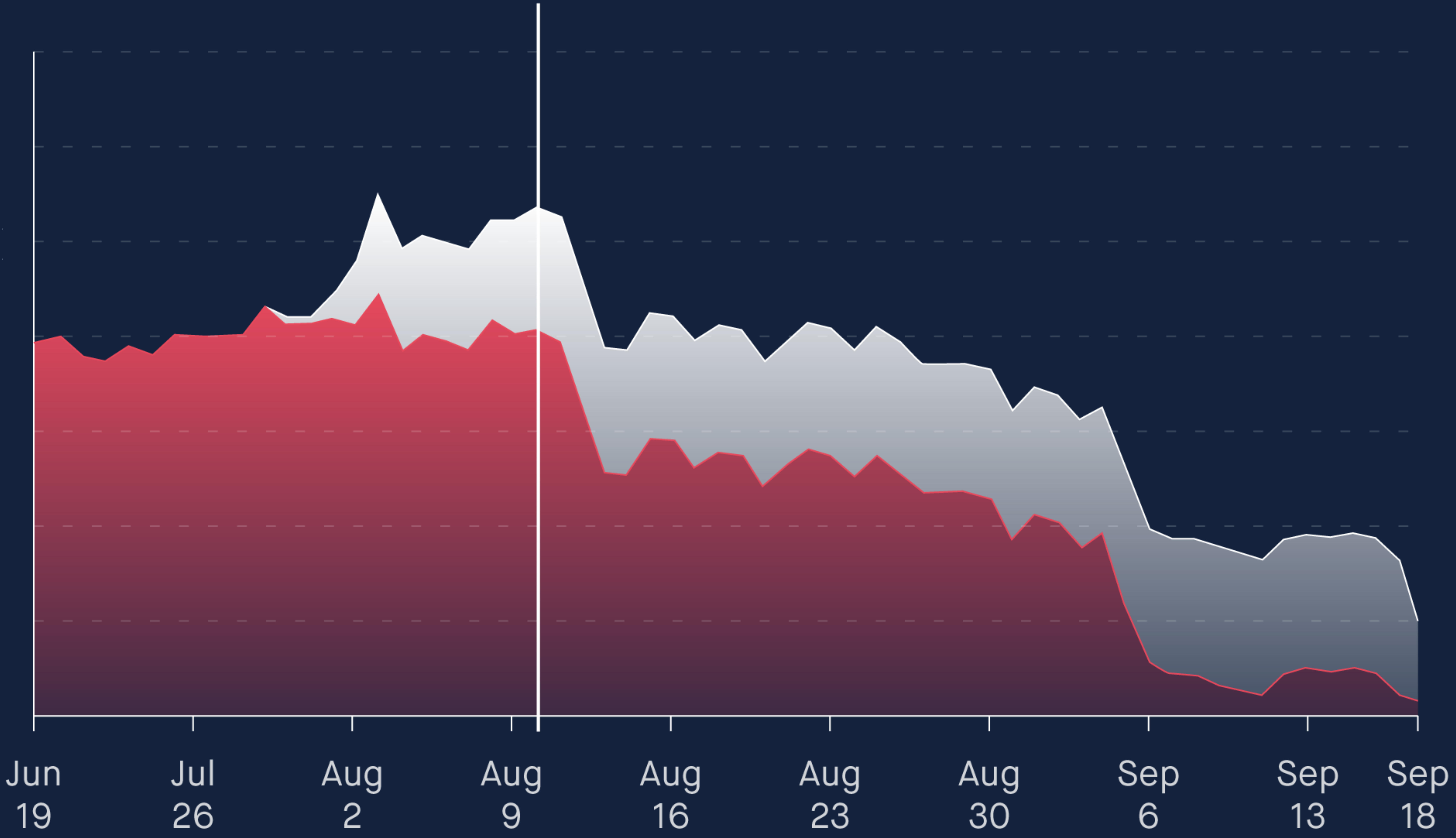

Load Balancer
HTTP API & Routing Layer
Webhook API
Database
Auth Service
Webhook Service
External Provider
Database

```
type Service func(req Request) Response
```

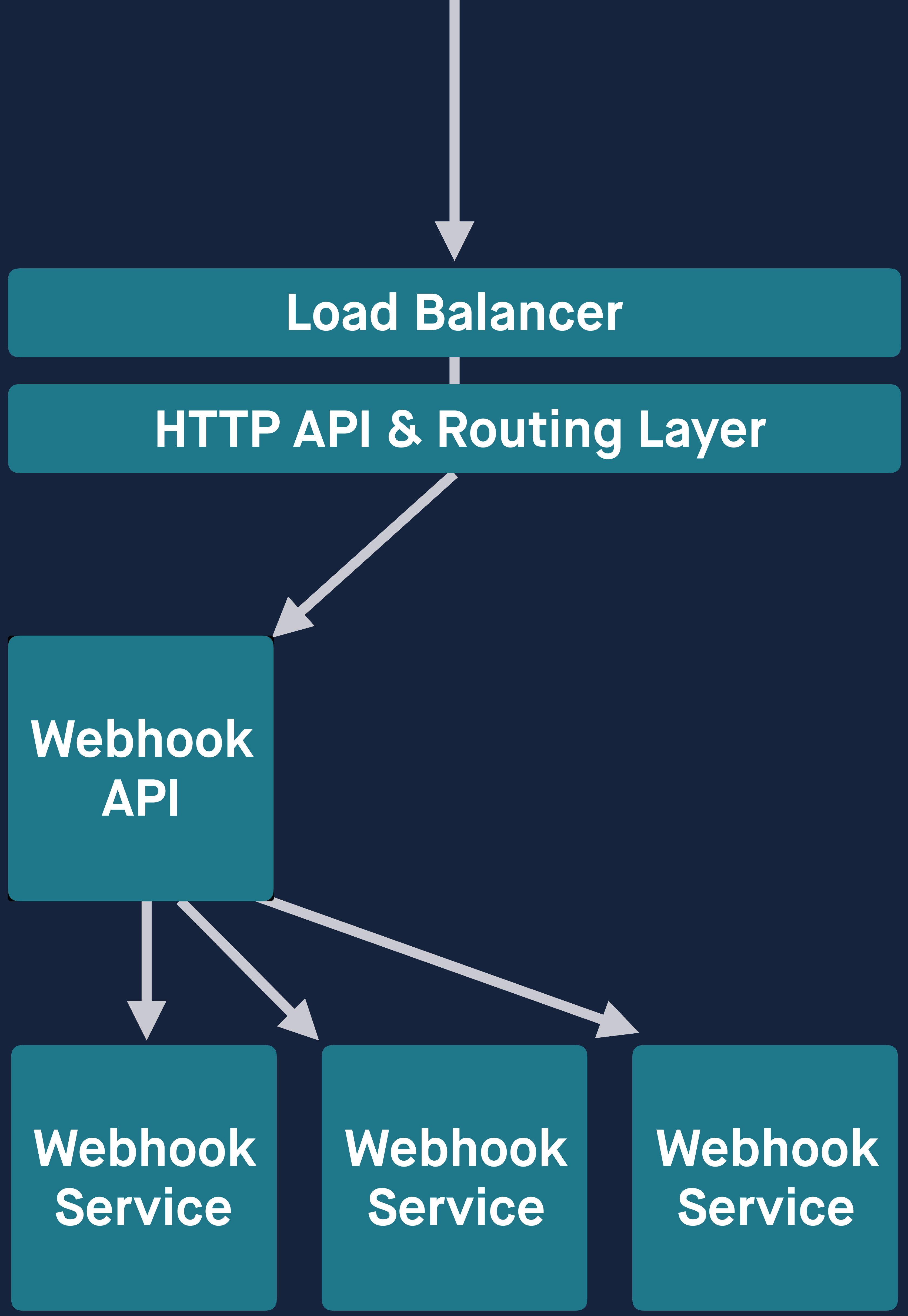
```
router.GET("/", List)
router.POST("/", Register)
router.DELETE("/:id", Deregister)
```

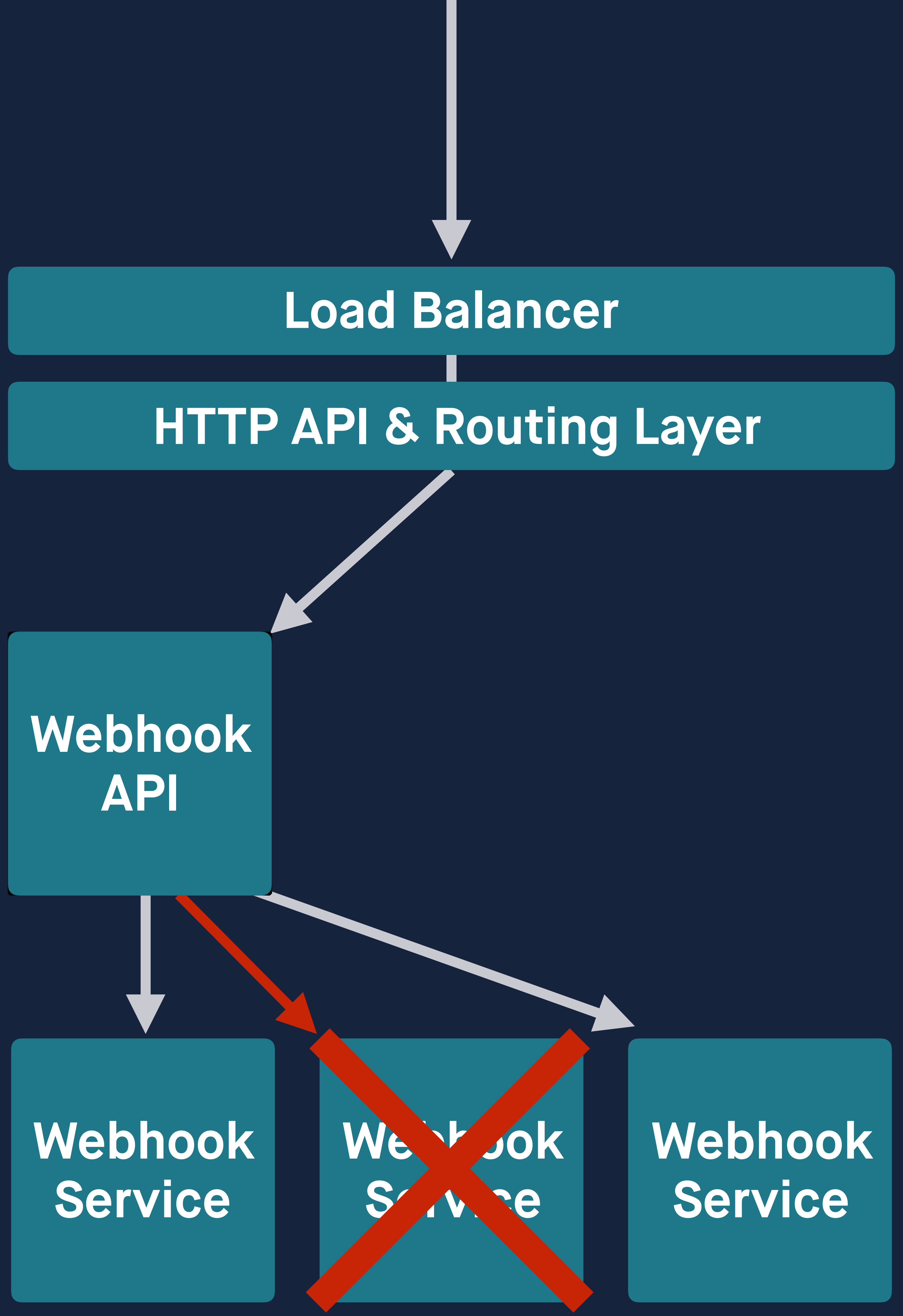
Making our service reliable

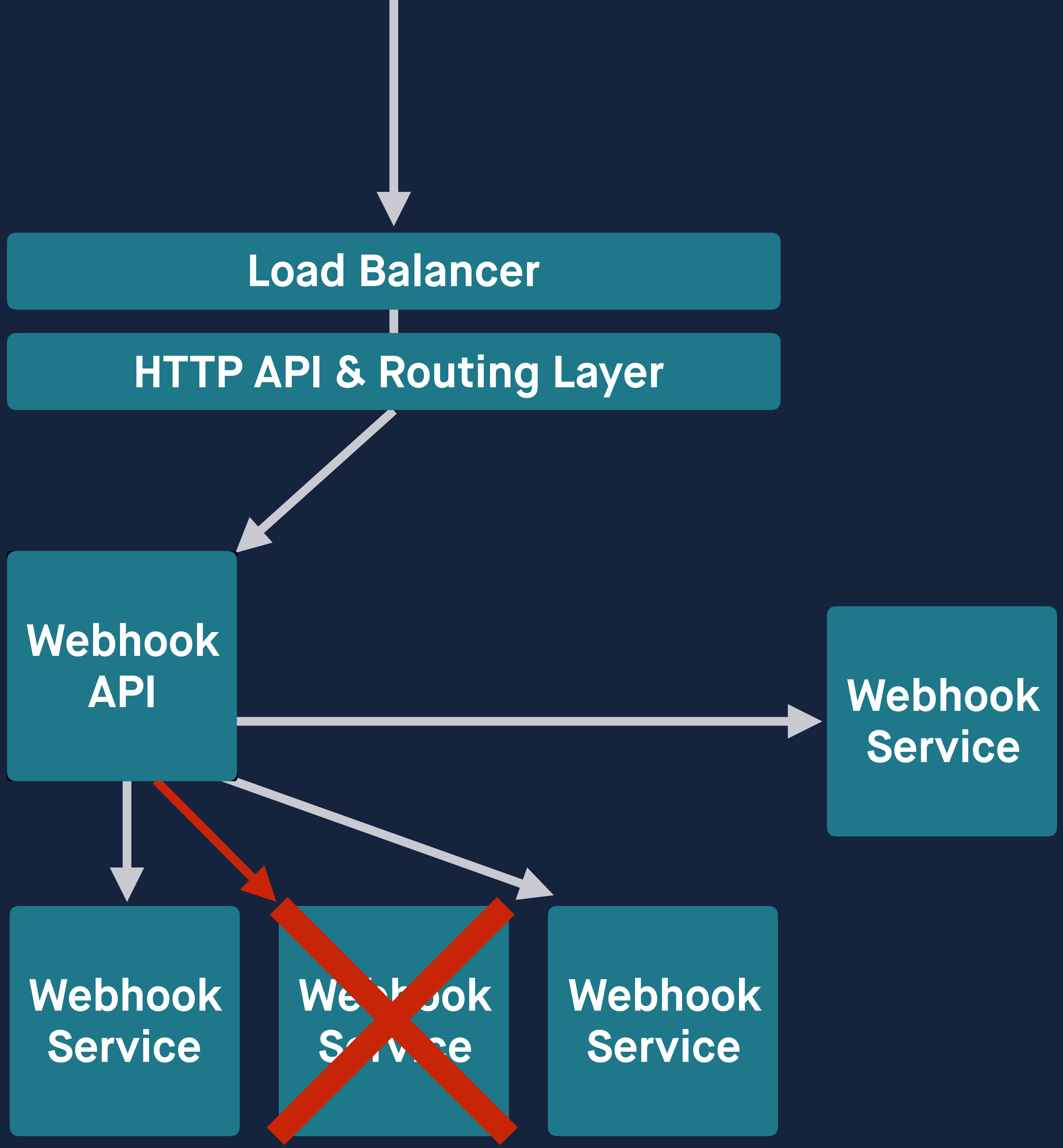
docker + ☸ = ❤️

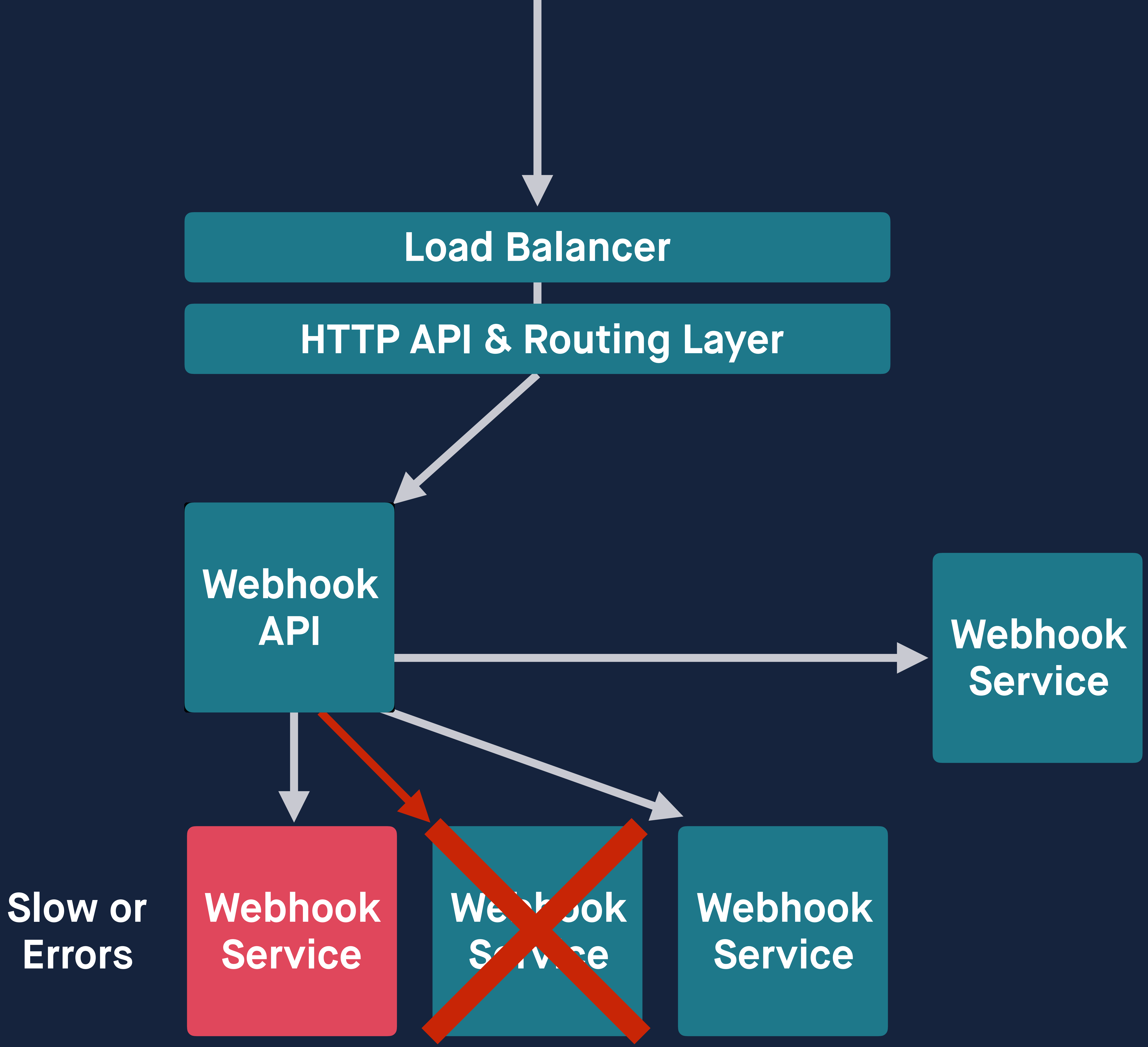


Jun 19
Jul 26
Aug 2
Aug 9
Aug 16
Aug 23
Aug 30
Sep 6
Sep 13
Sep 18

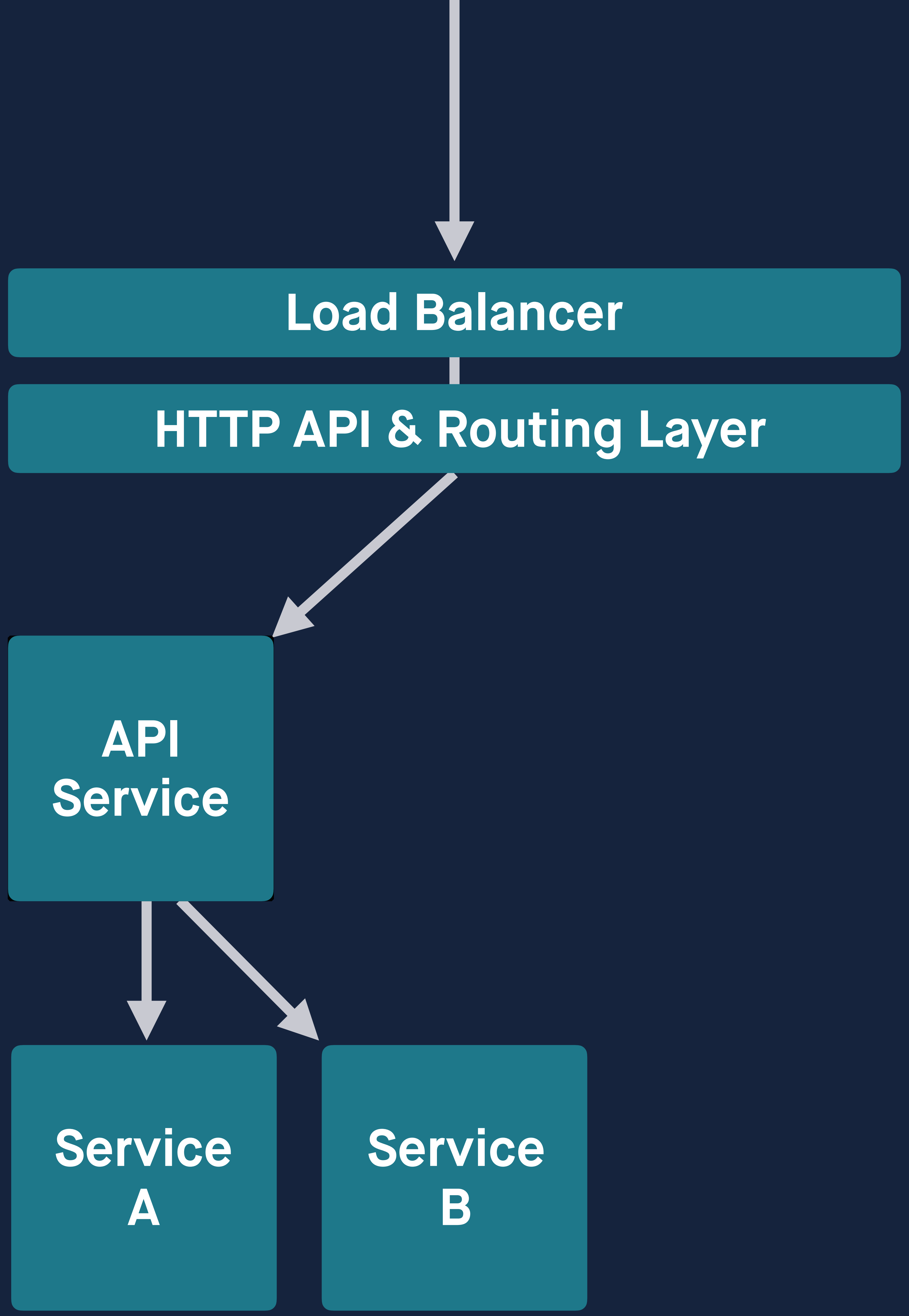

Load Balancer
HTTP API & Routing Layer
Webhook API
Webhook Service
Webhook Service
Webhook Service

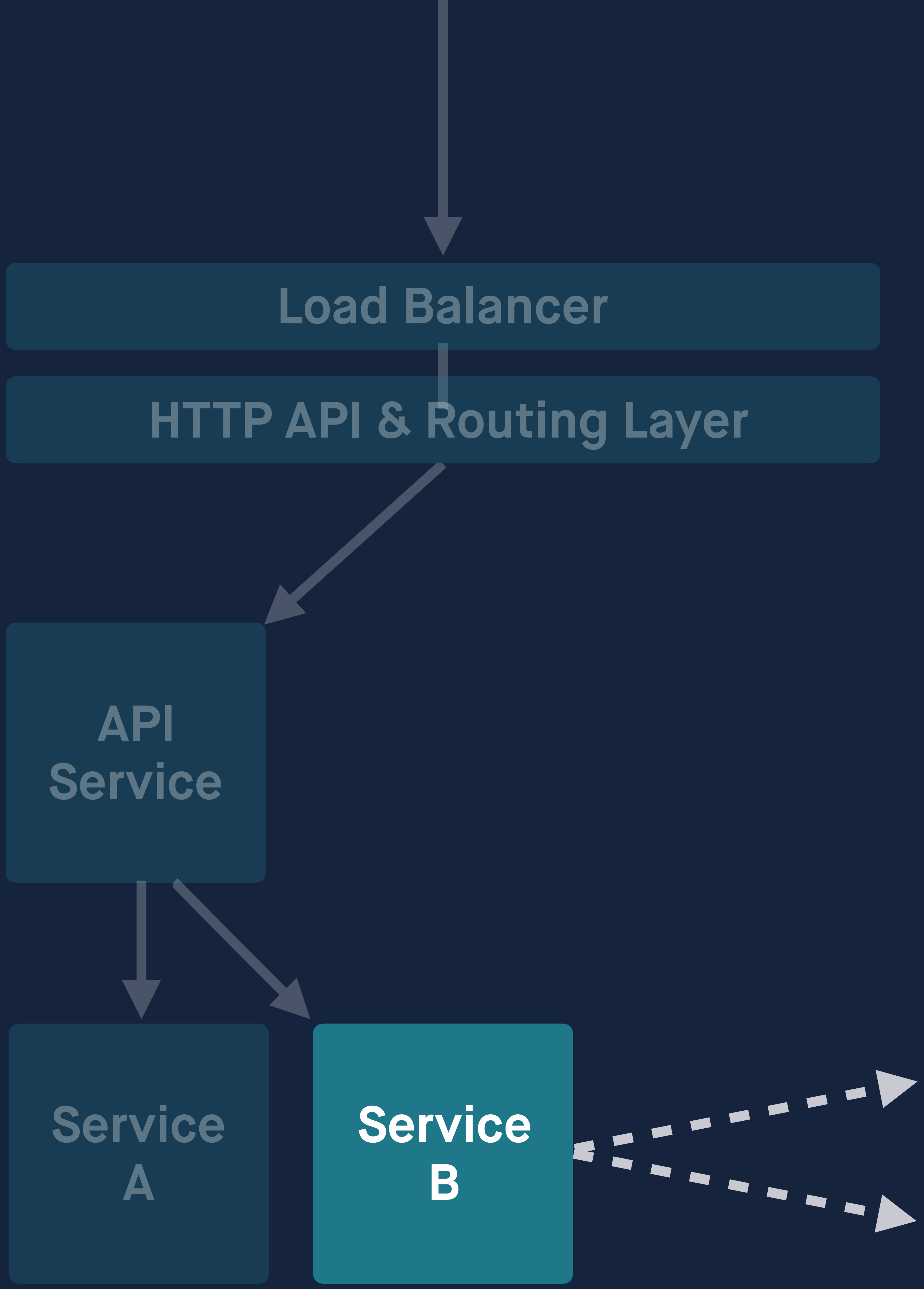

Load Balancer
HTTP API & Routing Layer
Webhook API
Webhook Service
Webhook Service
Webhook Service

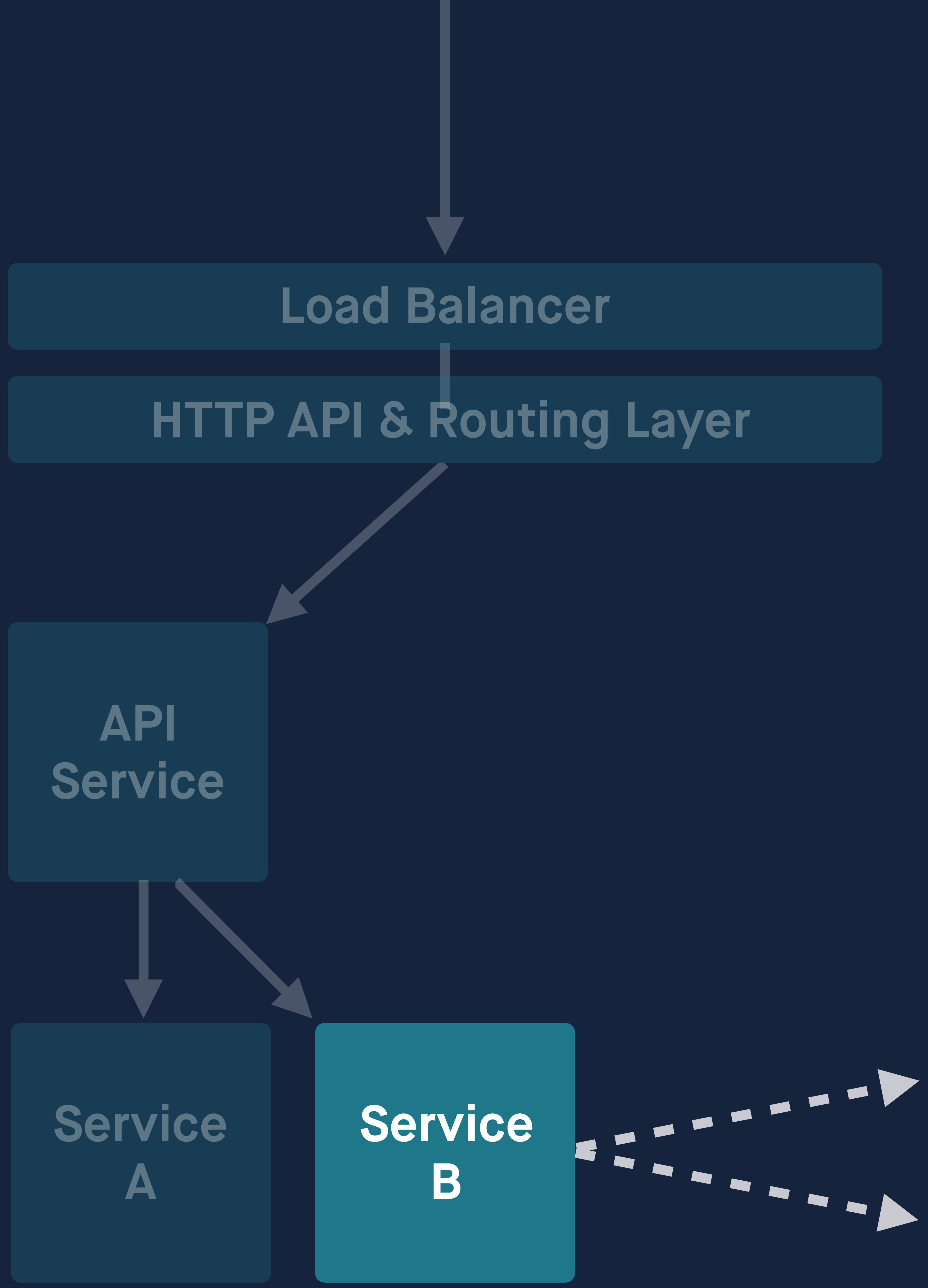

Load Balancer
HTTP API & Routing Layer
Webhook API
Webhook Service
Webhook Service
Webhook Service
Webhook Service

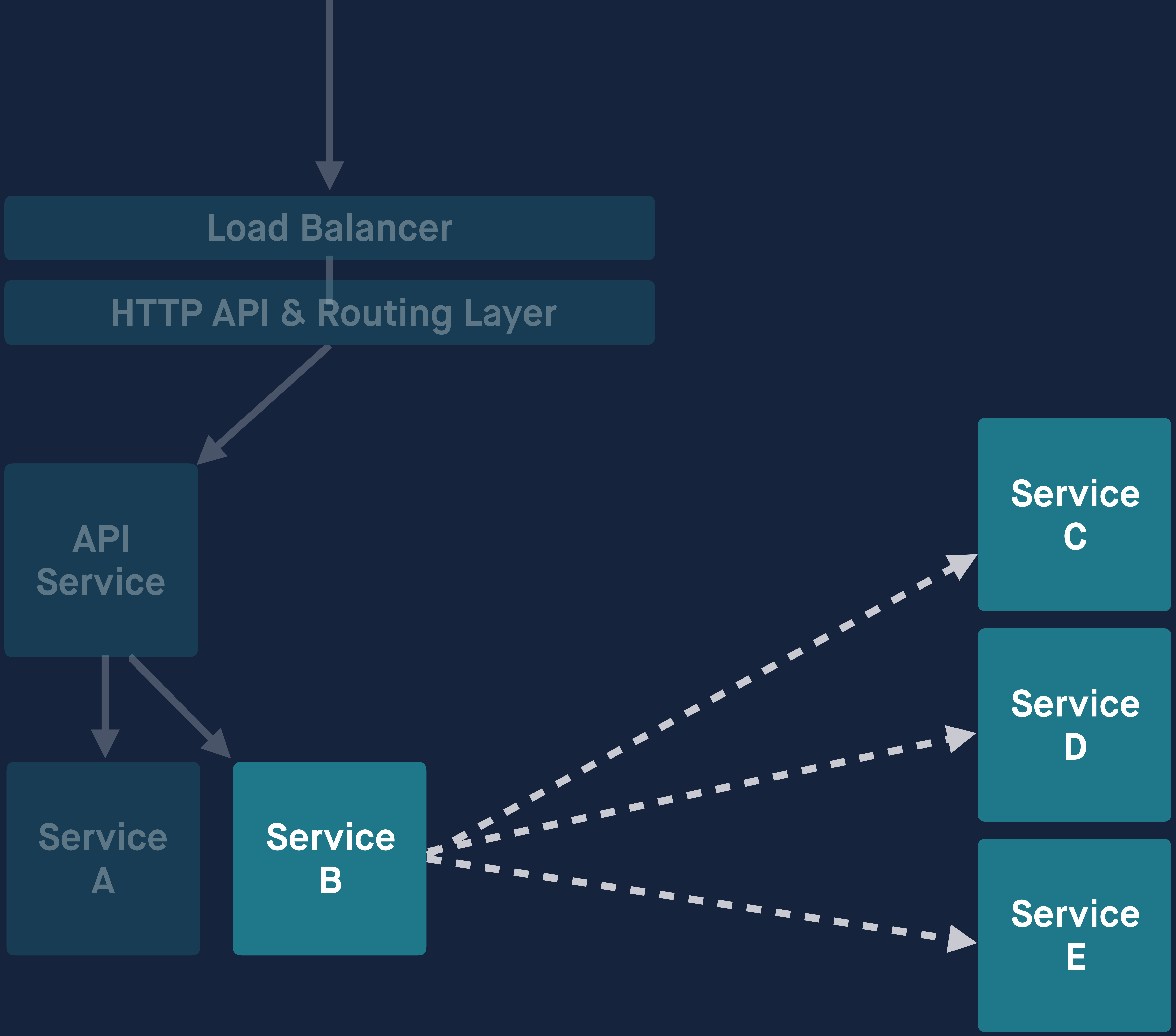

Load Balancer
HTTP API & Routing Layer
Webhook API
Webhook Service
Slow or Errors
Webhook Service
Webhook Service
Webhook Service

Event Driven Architecture

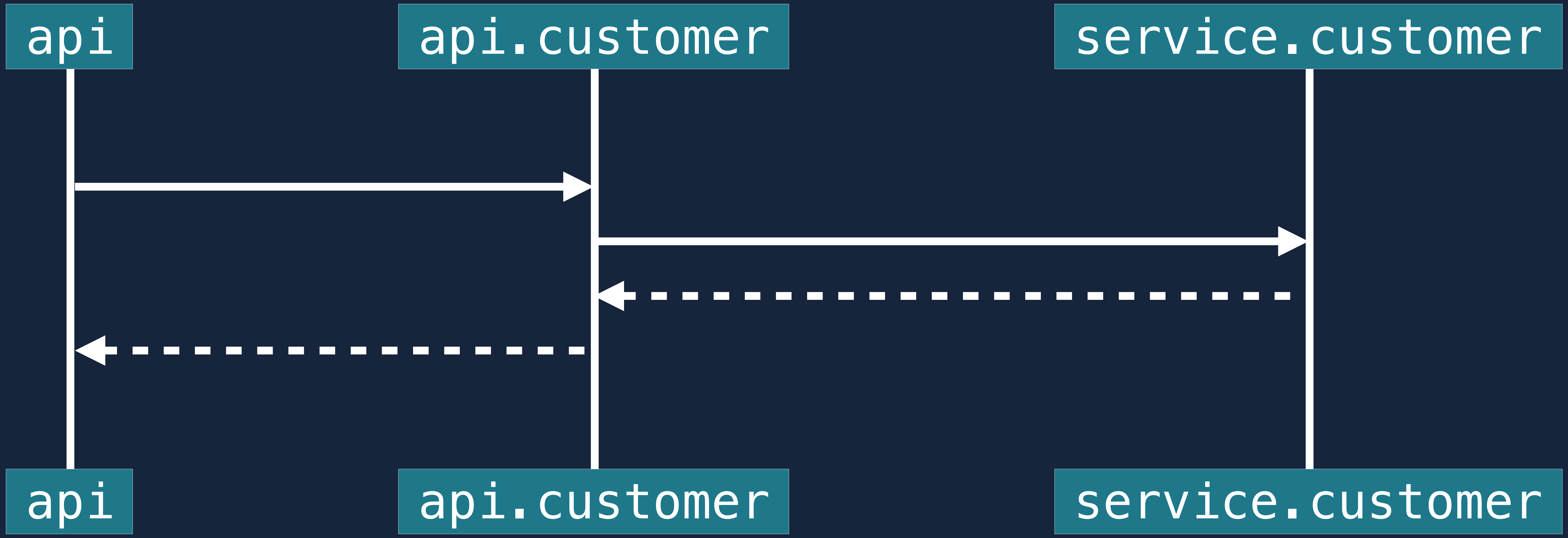

Load Balancer
HTTP API & Routing Layer
API Service
Service A
Service B

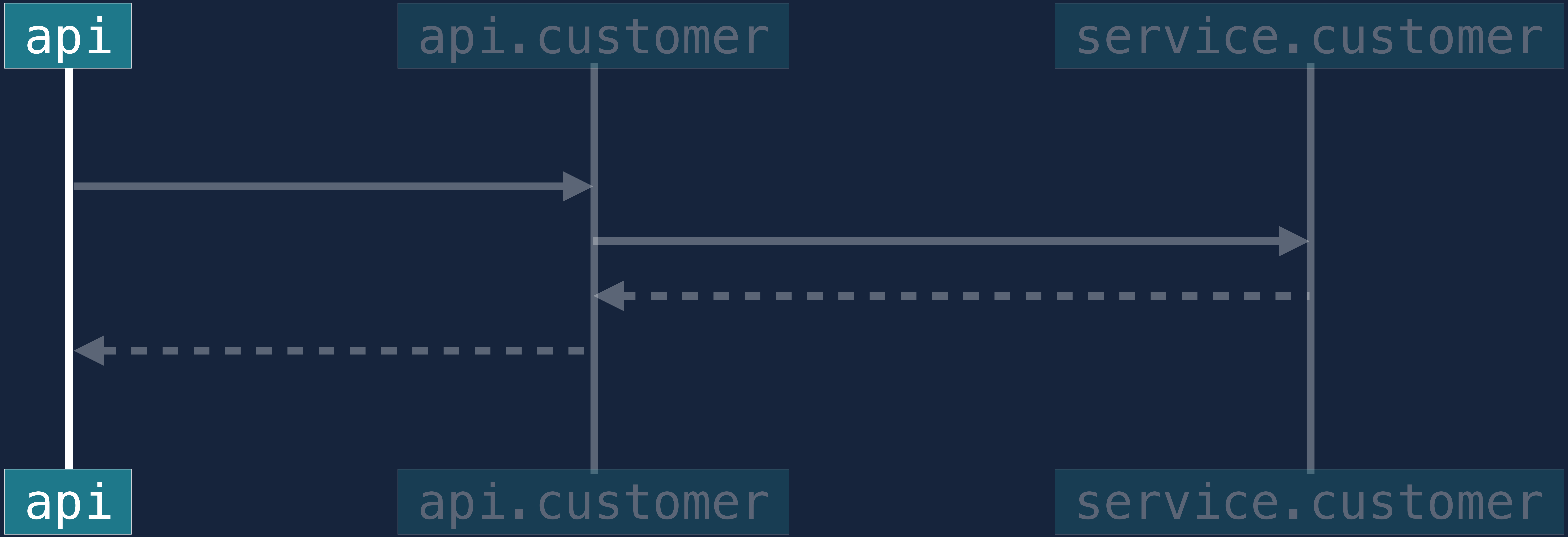

Load Balancer
HTTP API & Routing Layer
API Service
Service A
Service B


Load Balancer
HTTP API & Routing Layer
API Service
Service A
Service B


Load Balancer
HTTP API & Routing Layer
API Service
Service A
Service B
Service C
Service D
Service E

Context Propagation


api
api.customer
service.customer
api
api.customer
service.customer


api
api.customer
service.customer
api
api.customer
service.customer

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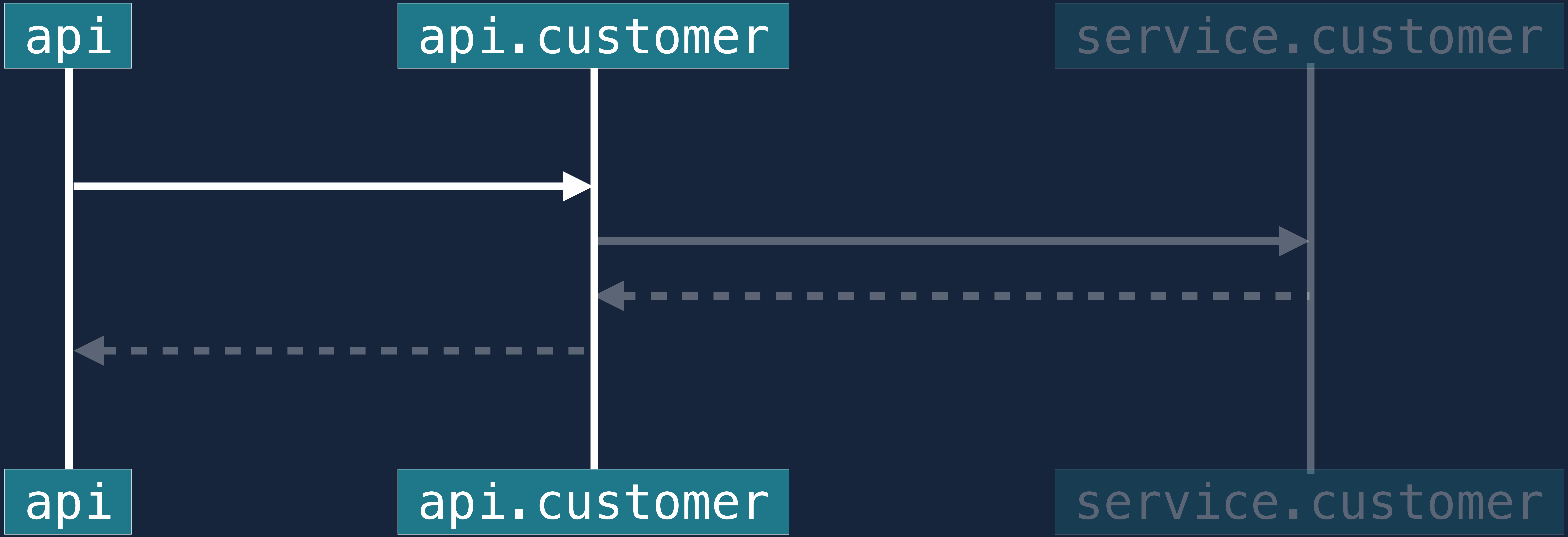
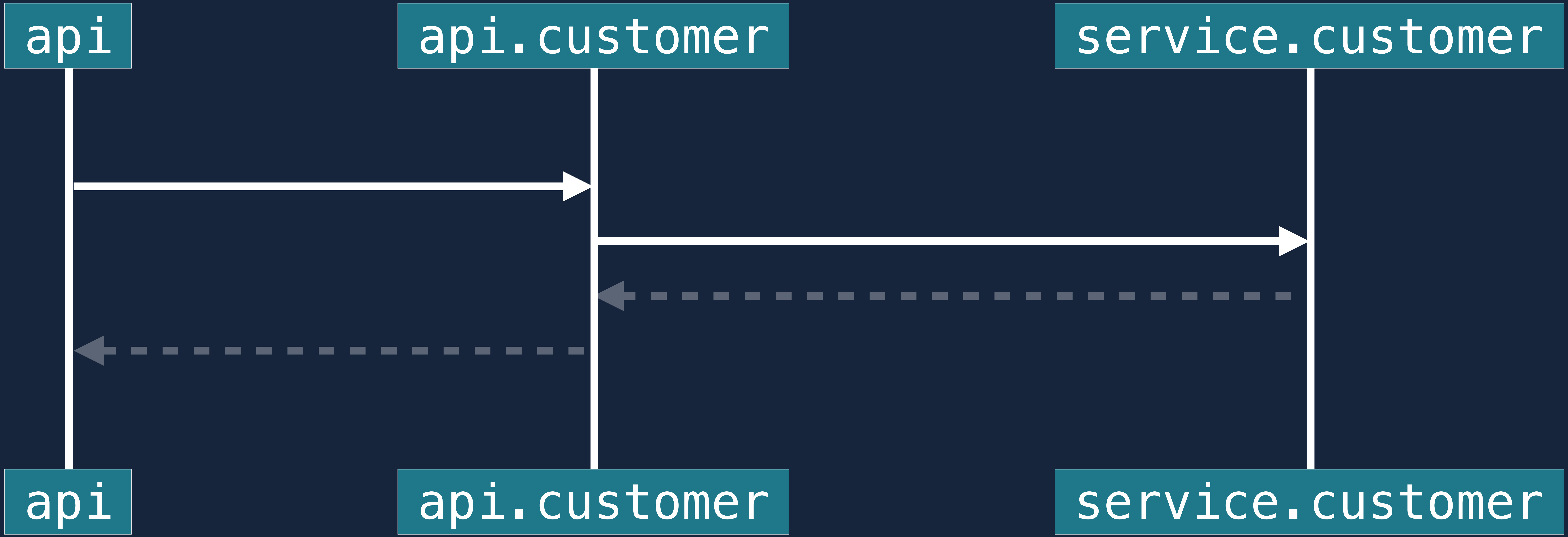

api
api.customer
service.customer
api
api.customer
service.customer


api
api.customer
service.customer
api
api.customer
service.customer

```go
package context

type Context interface {
    Deadline() (deadline time.Time, ok bool)
    Done() <-chan struct{}
    Err() error
    Value(key interface{}) interface{}
}
```

```
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    Deadline() (deadline time.Time, ok bool)
    Done() <-chan struct{}
    Err() error
    Value(key interface{}) interface{}
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    Done() <-chan struct{}
    Err() error
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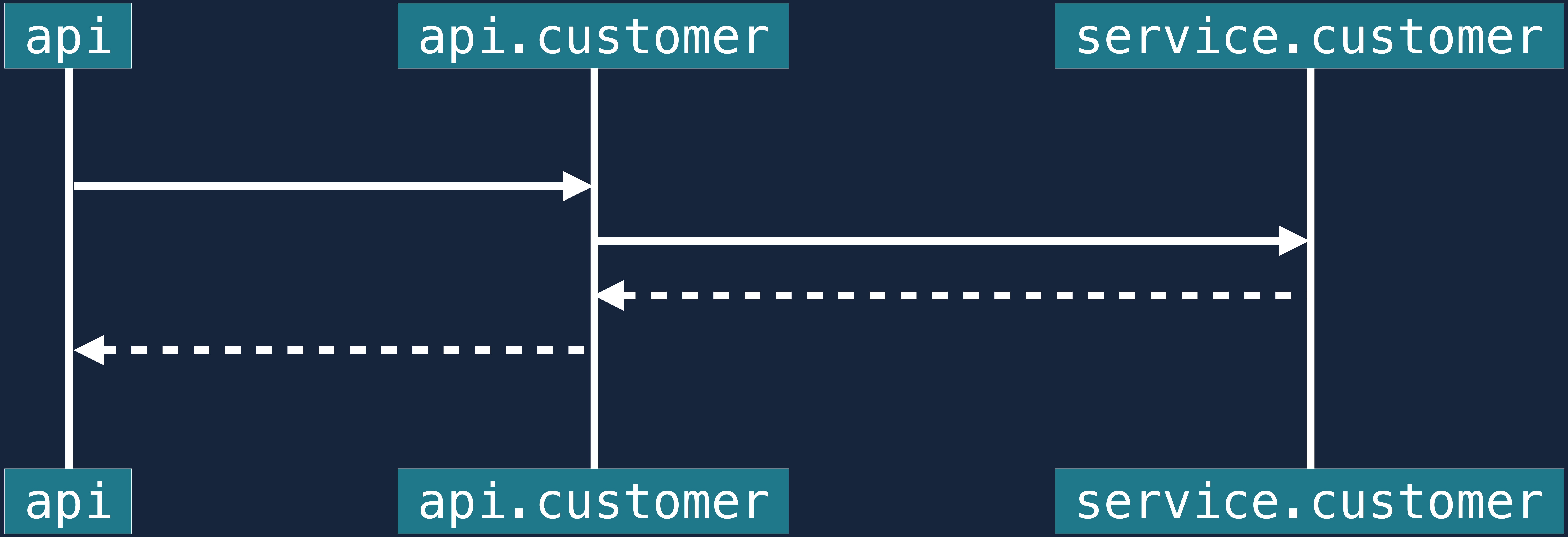
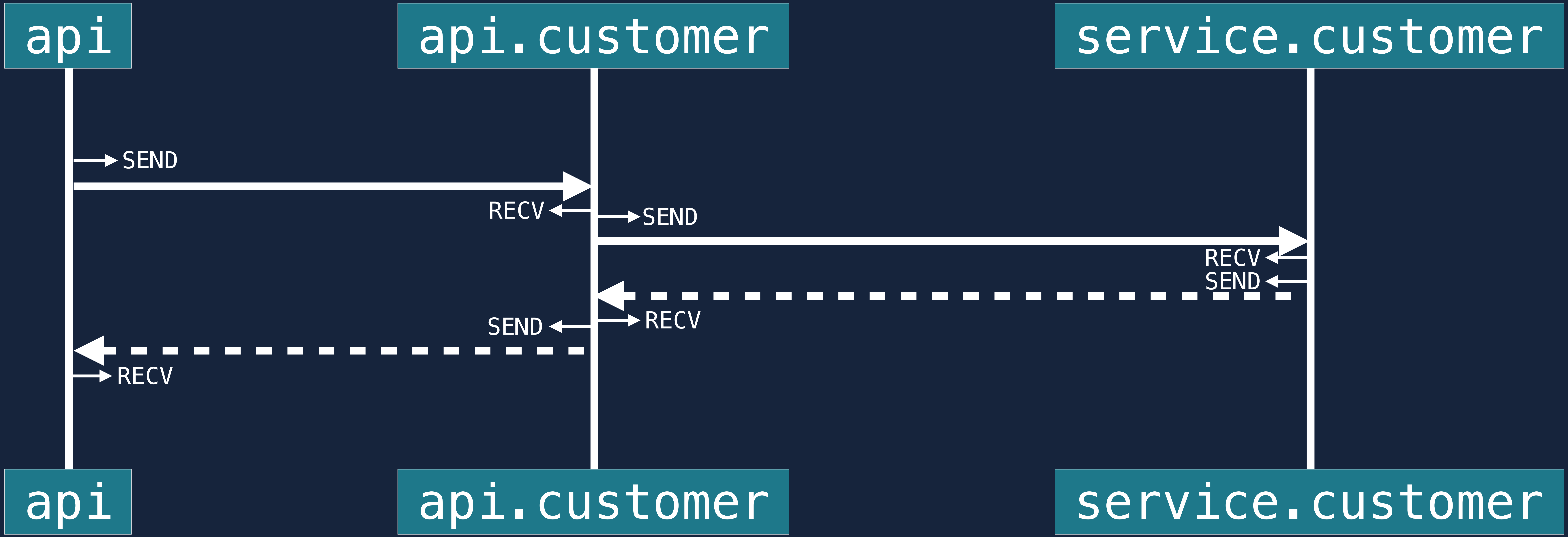
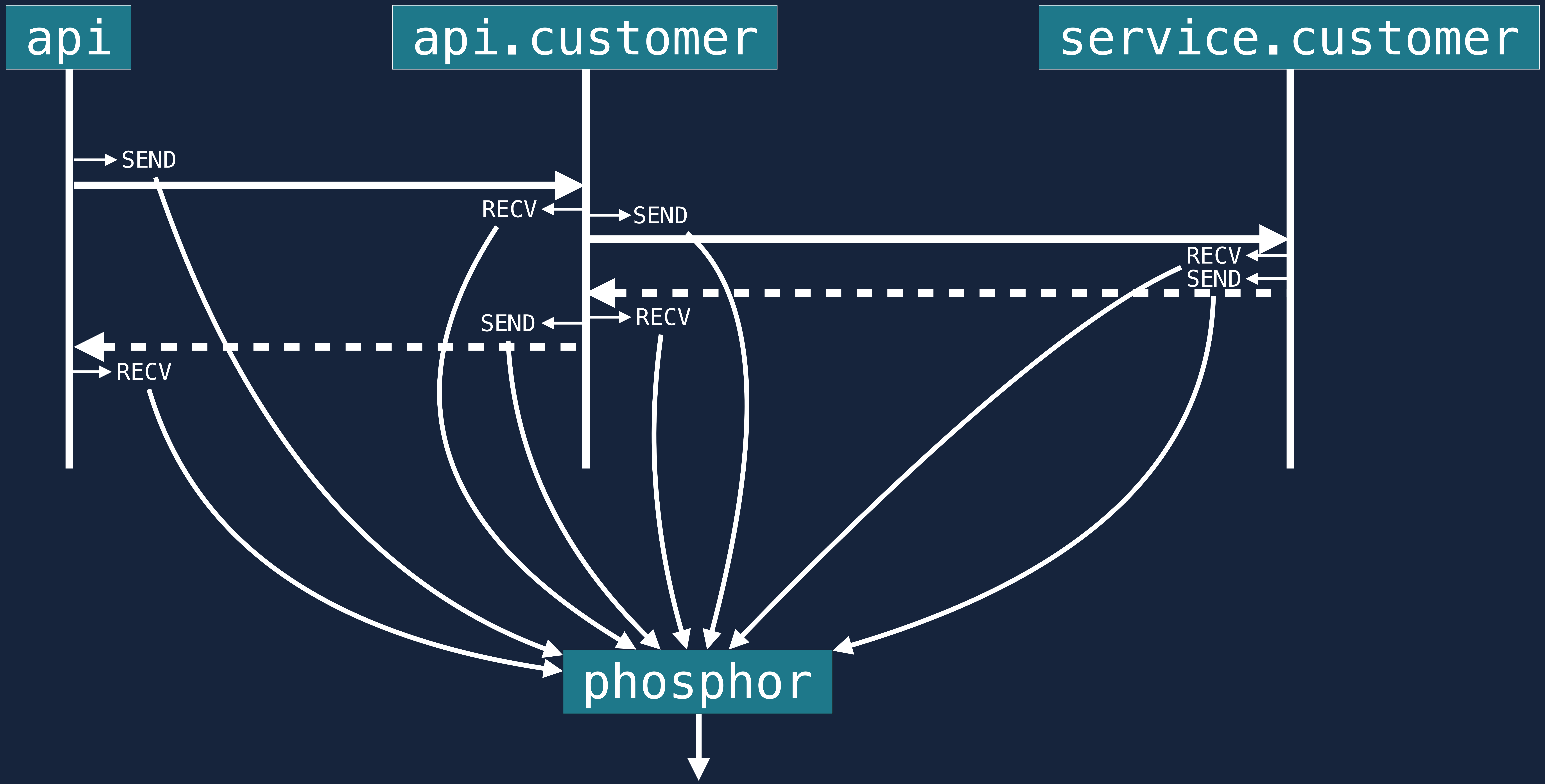
```


api
api.customer
service.customer
api
api.customer
service.customer


api
api.customer
service.customer
SEND
RECV
SEND
RECV
SEND
RECV
SEND
RECV
api
api.customer
service.customer



api
api.customer
service.customer
SEND
RECV
SEND
RECV
SEND
RECV
SEND
RECV
phosphor

```
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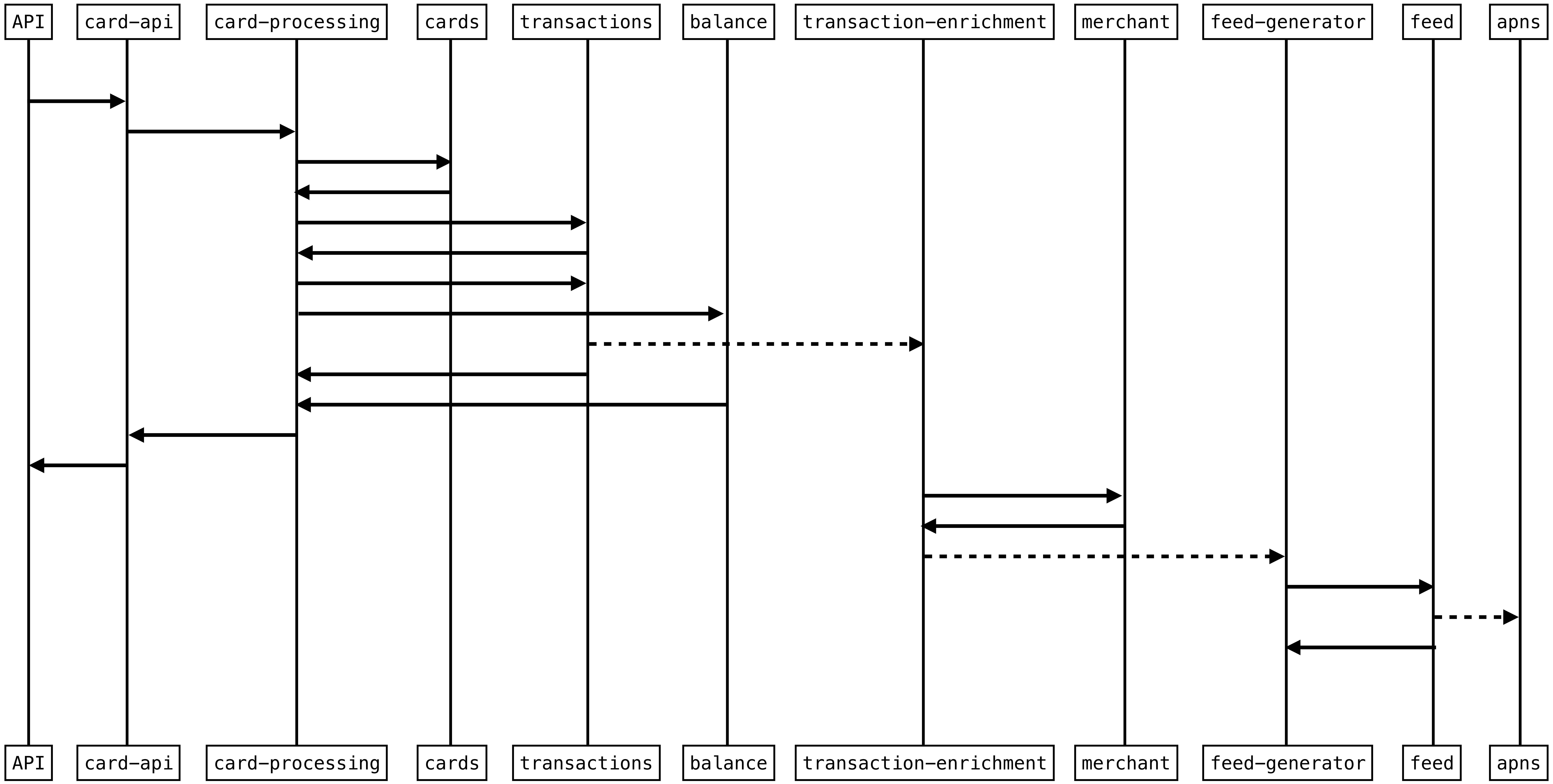
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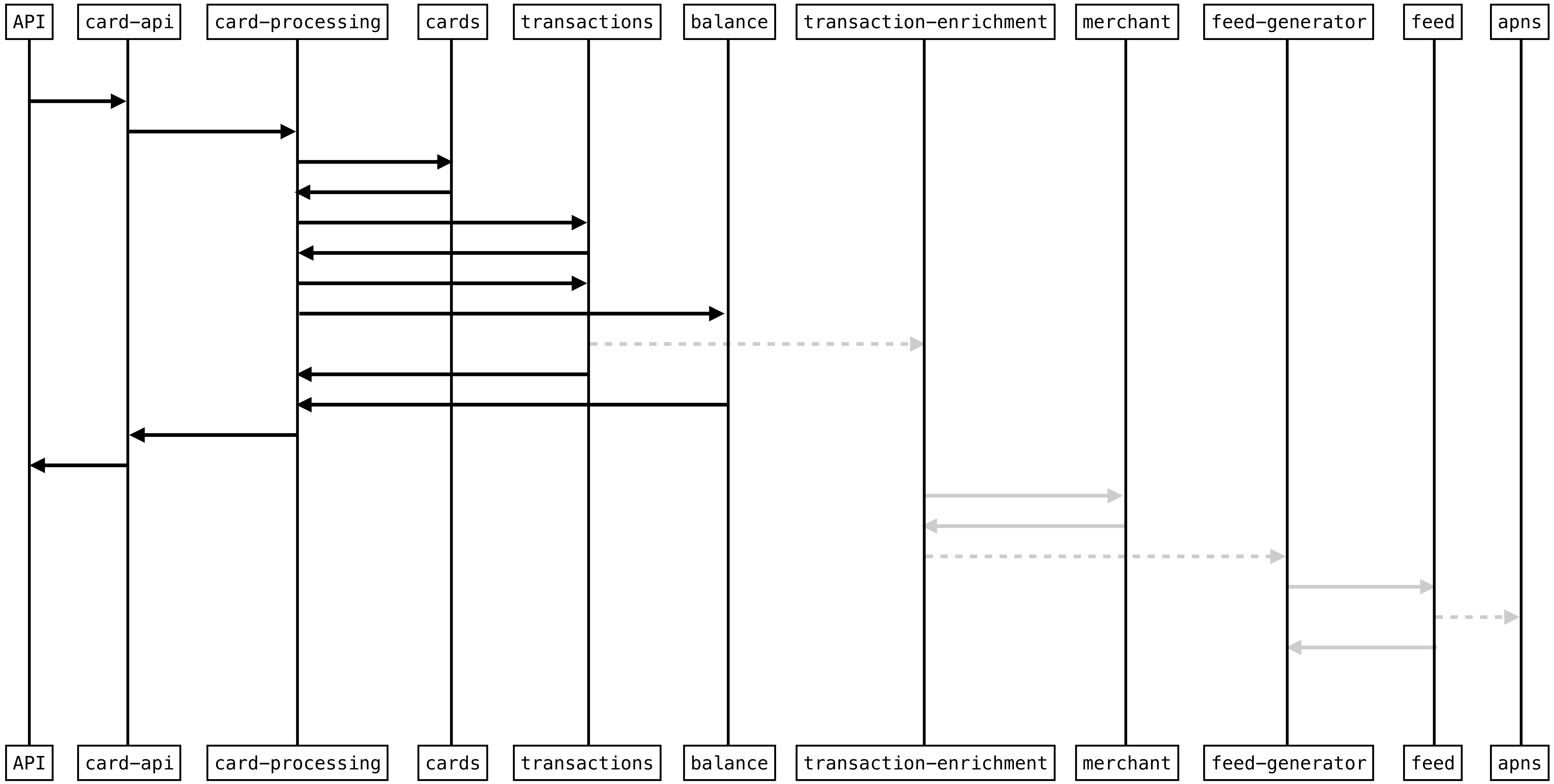
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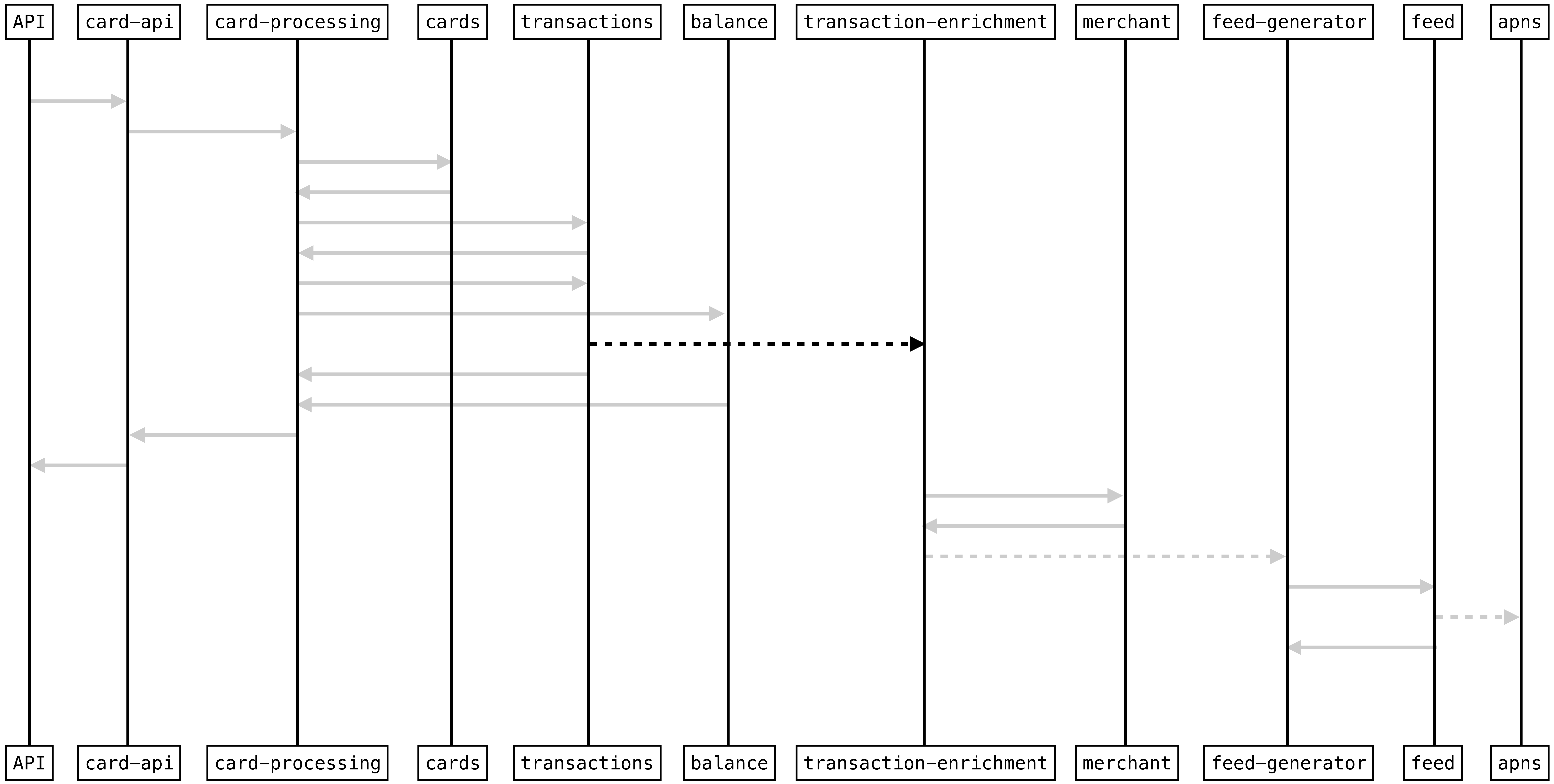
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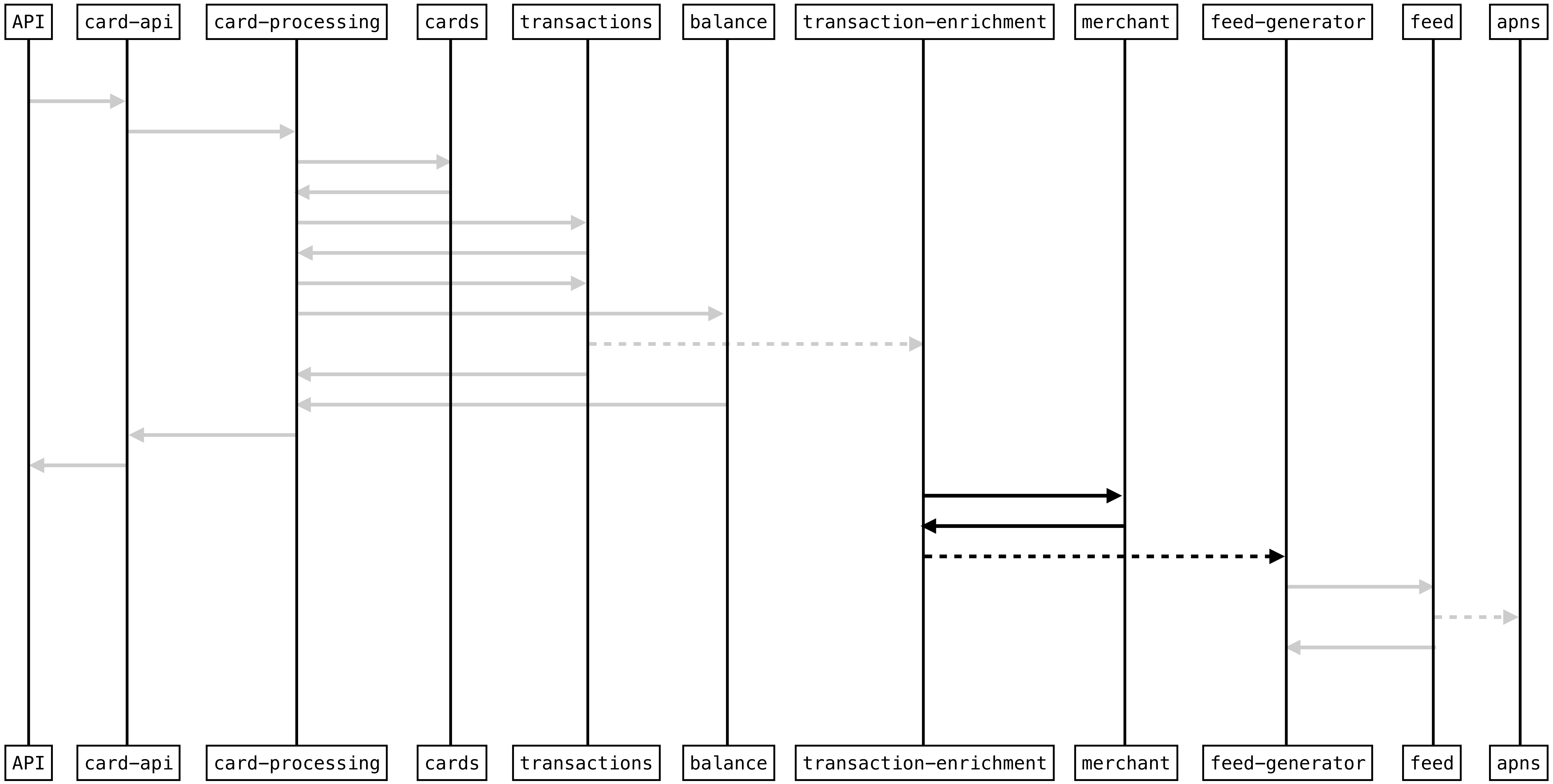
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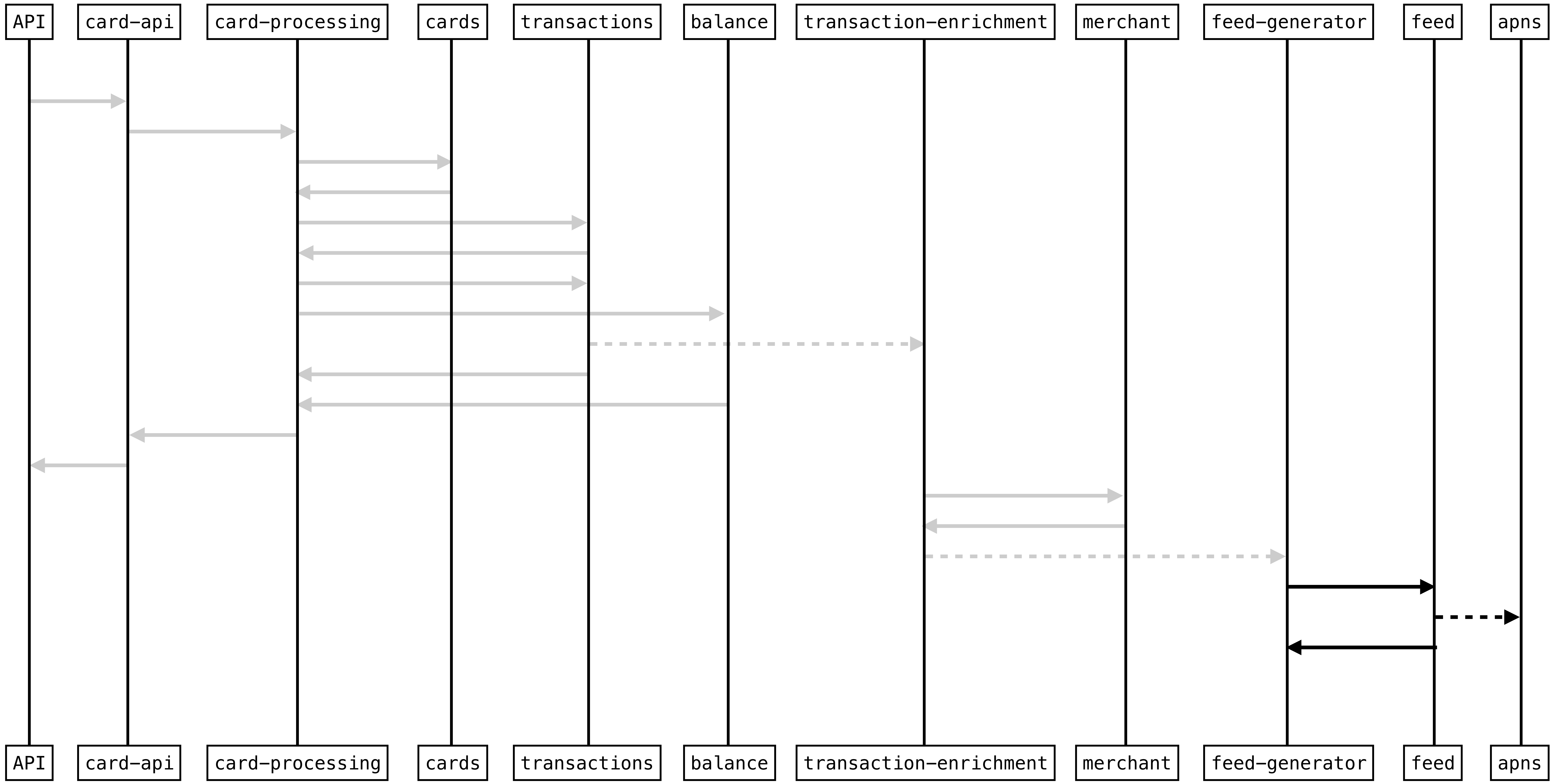
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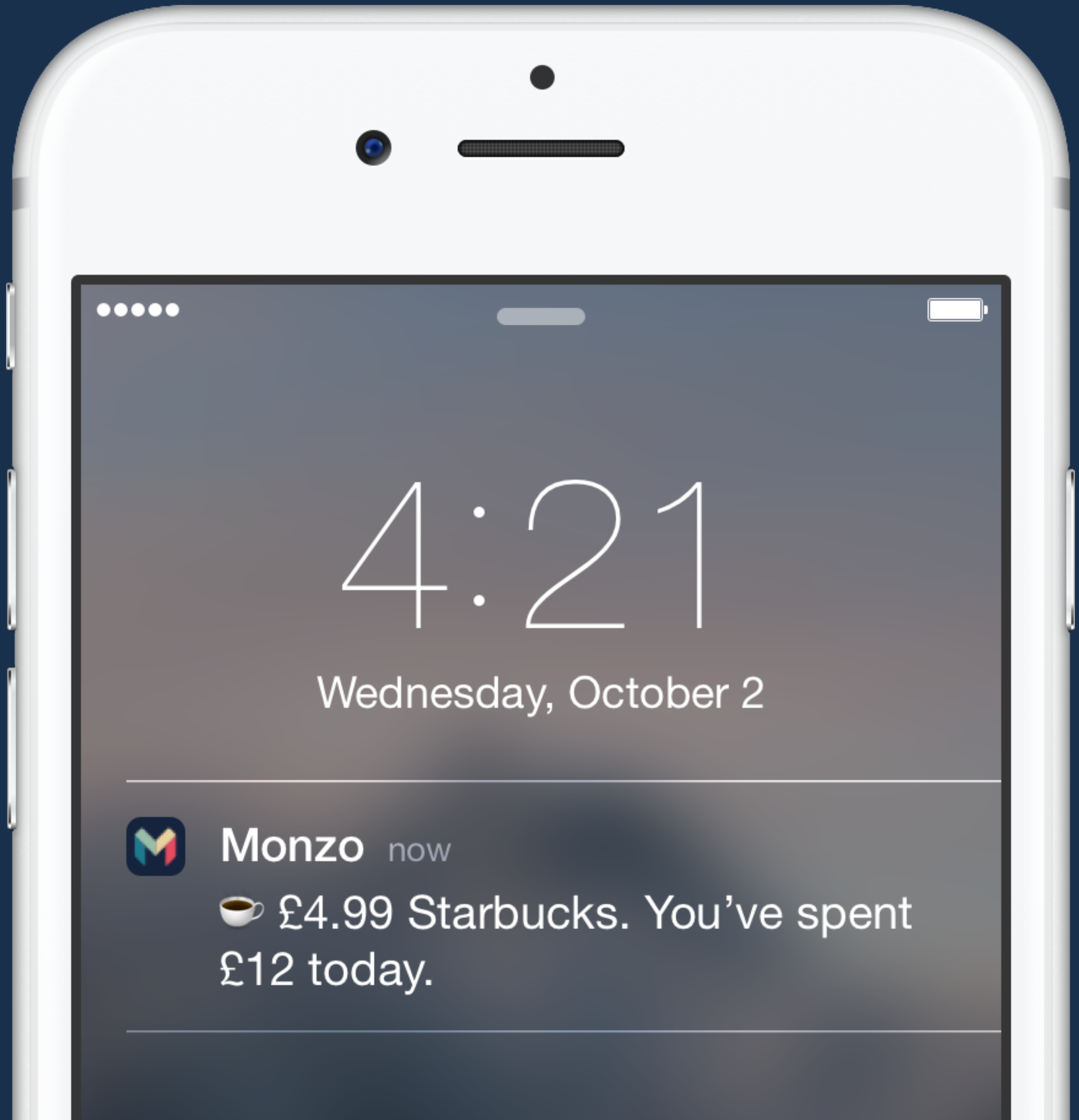

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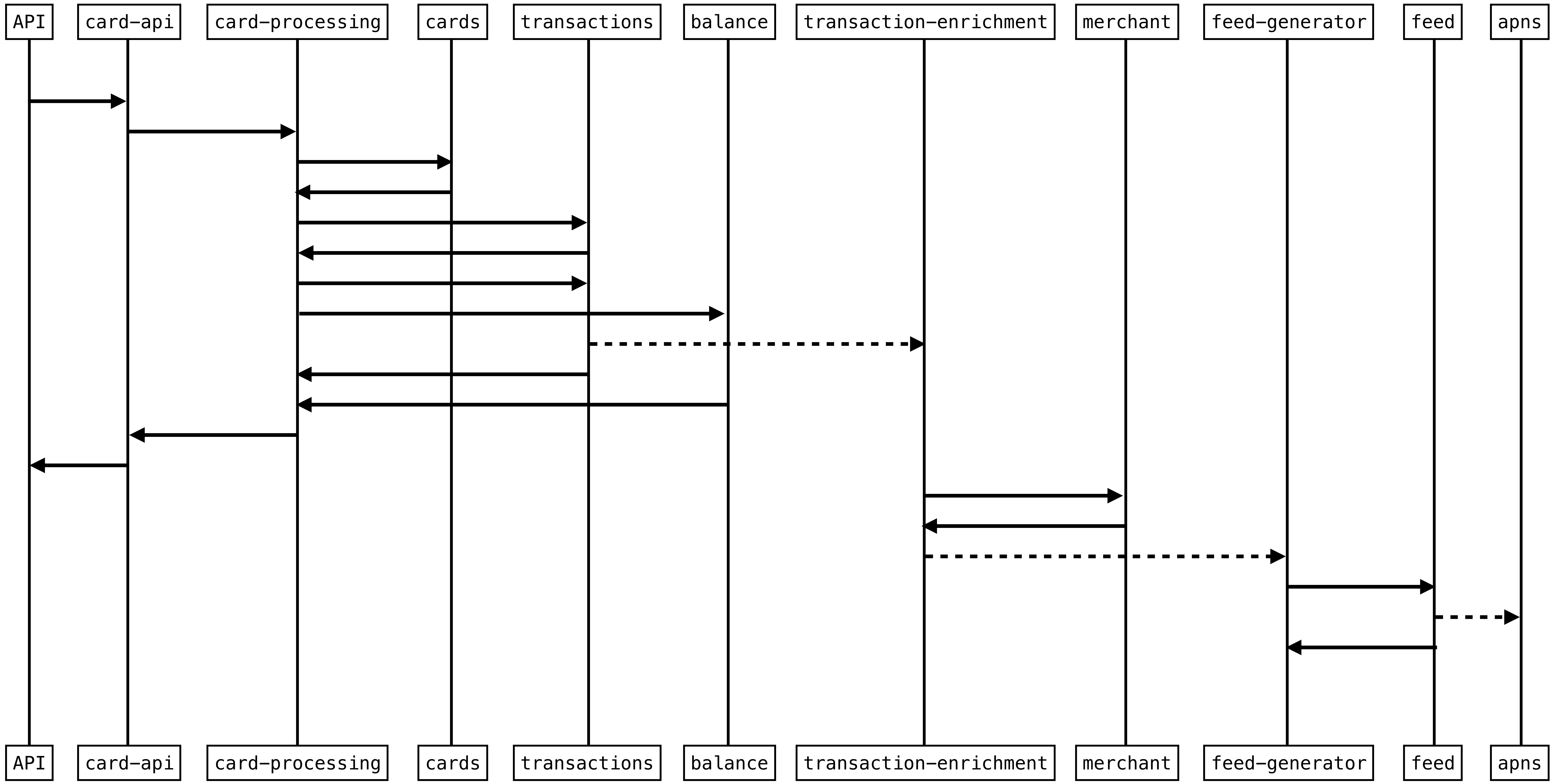
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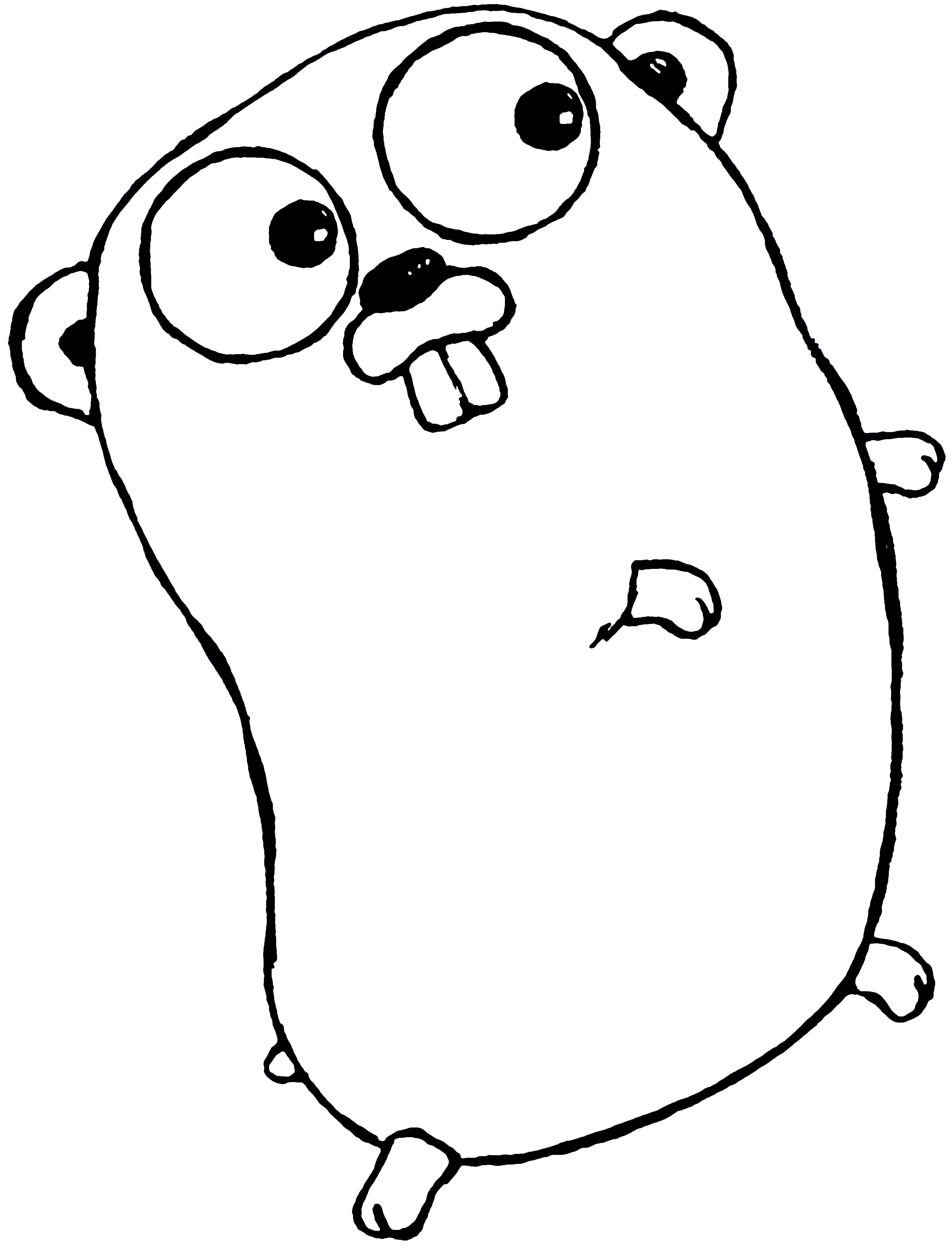
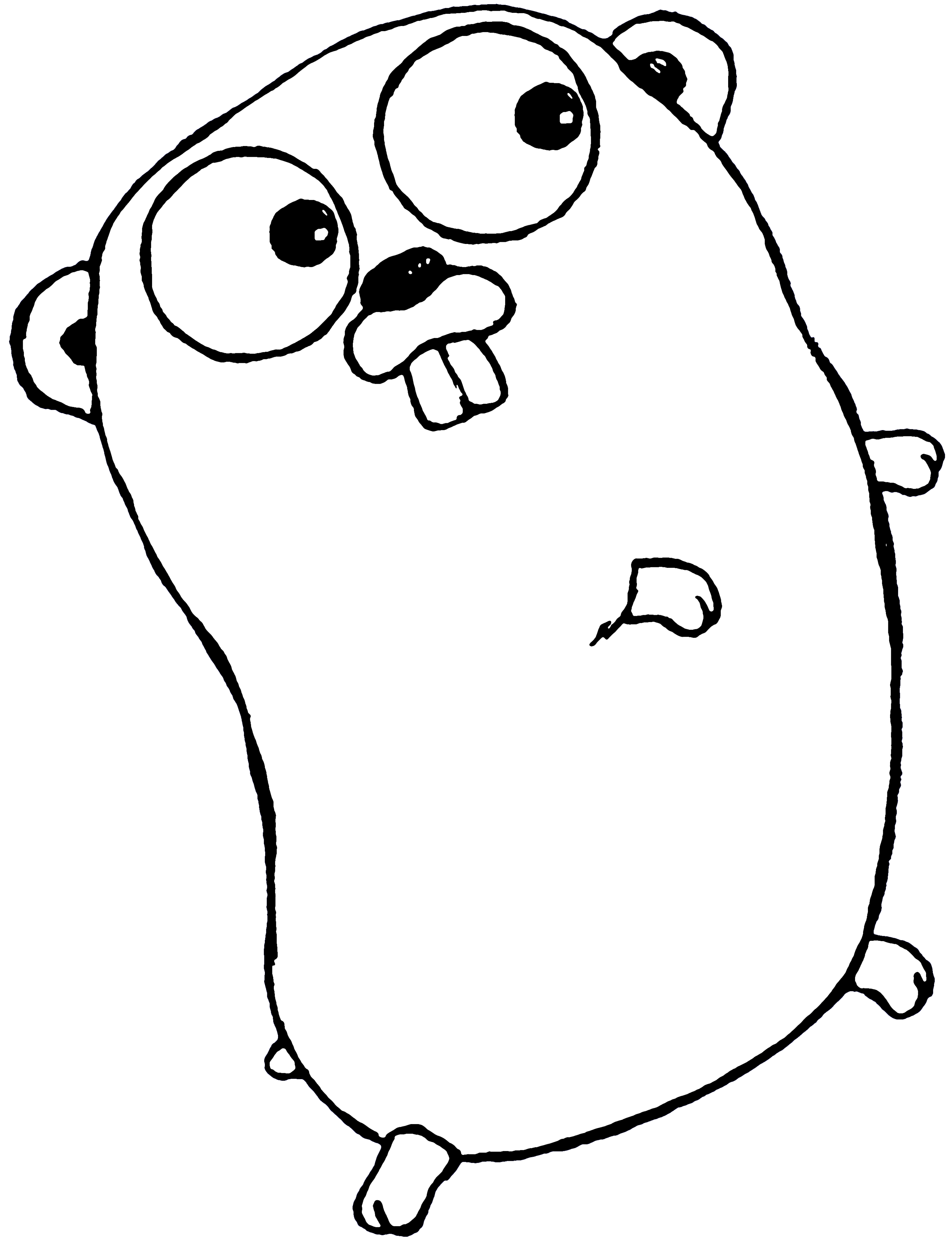
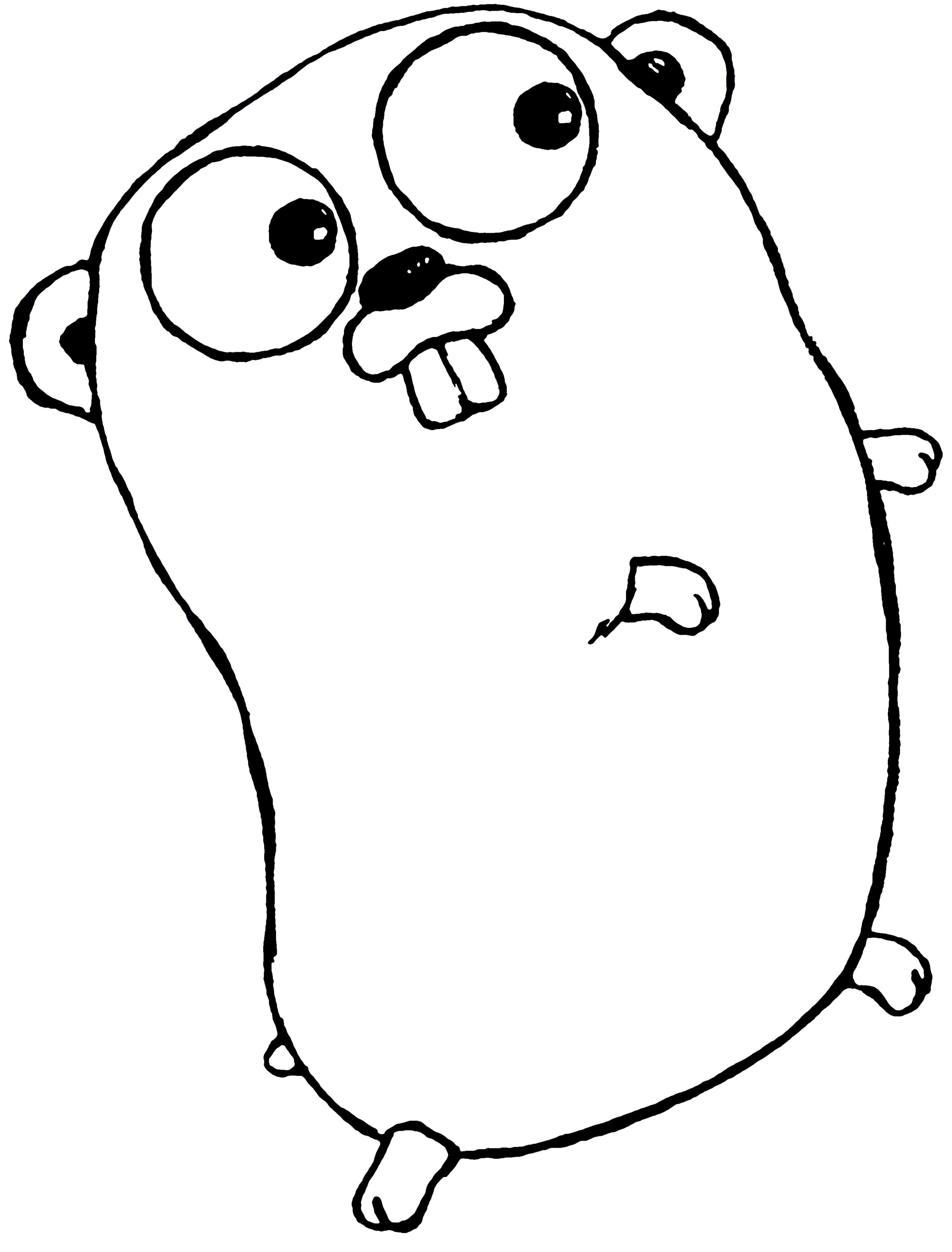
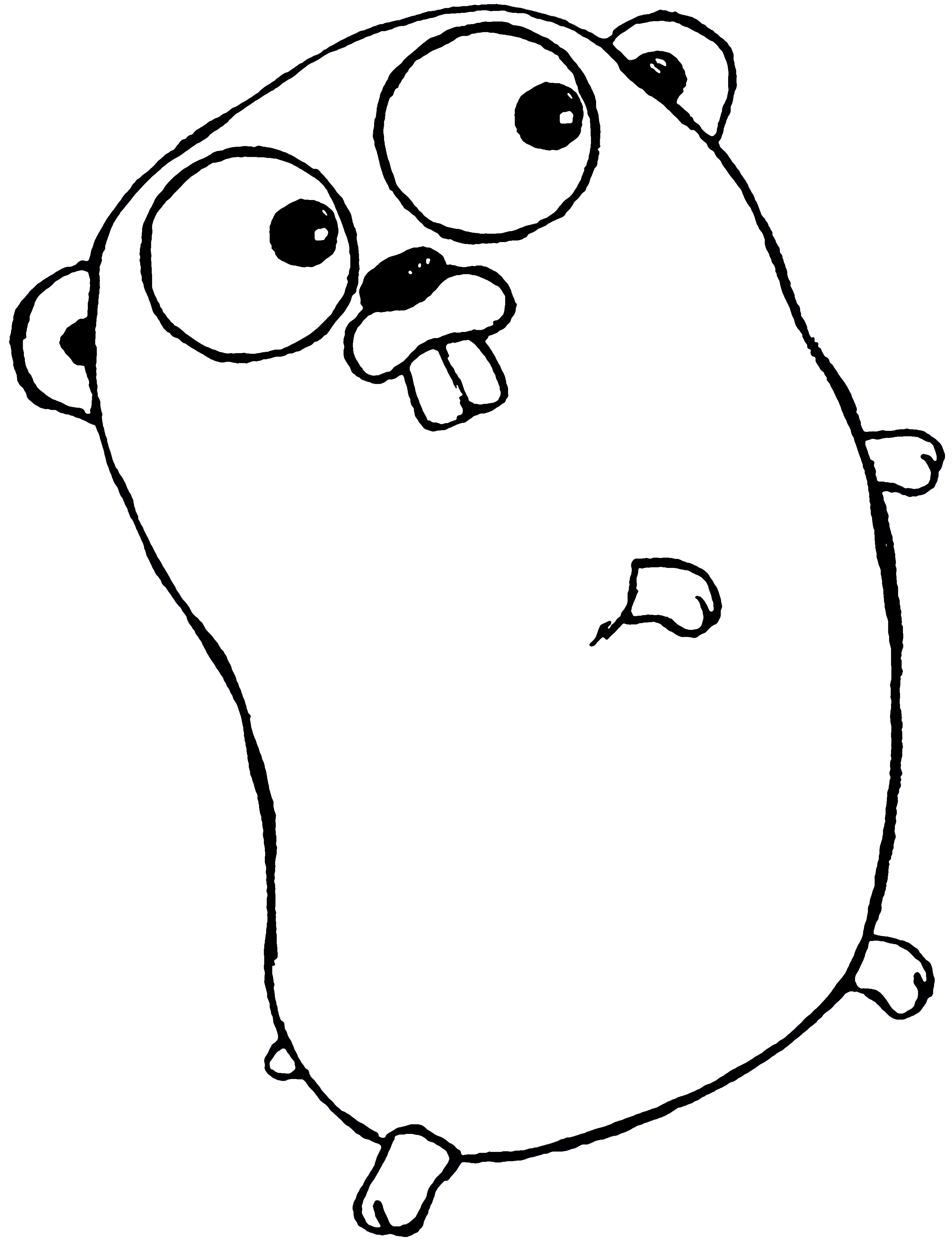




Perfect for microservice architectures



Concurrency: Goroutines Channels



Small
Simple
Easy

Thanks!

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