
Klarna.
Brave New World
Haskell ~~and PureScript~~ in Production

Yet another talk about how you should be using X and how it solves all your problems*

*No, not really.

Me

• Research Fellow	EPFL	2016
• Lab Engineer	EPFL	2016-2017
• Senior Engineer	Klarna	2017-

Klarna.

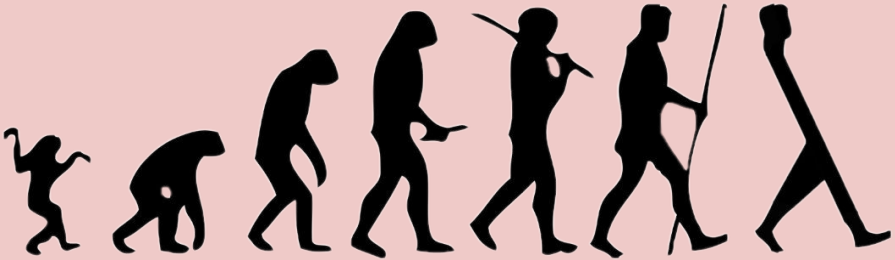
Write Haskell for Snoop Dogg


Get smoooth.


SMOOTH

How our teams went from zero to Monad*

*Or how we tried to go the full route with Scala.



But first, a survey!

- Immutable Data

- Immutable Data
- Lambdas

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- Pattern matching

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- Algebraic Data Types

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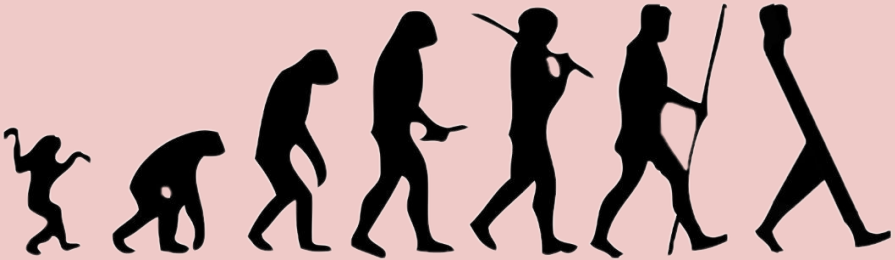
- Functional Dependencies
- Profunctor Optics

How our teams went from zero to Monad*

*Or how we tried to go the full route with Scala.



Java

-2014


Java
Scala is introduced
-2014
2015


Basically Java
without semicolons
Java
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Starts building own framework for event sourcing
Basically Java without semicolons
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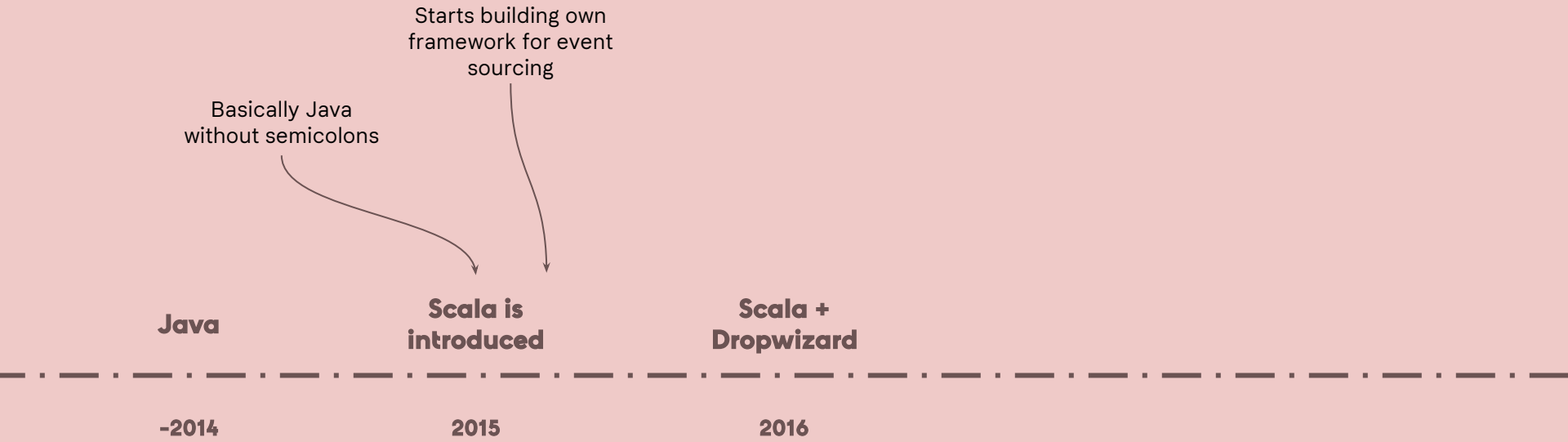
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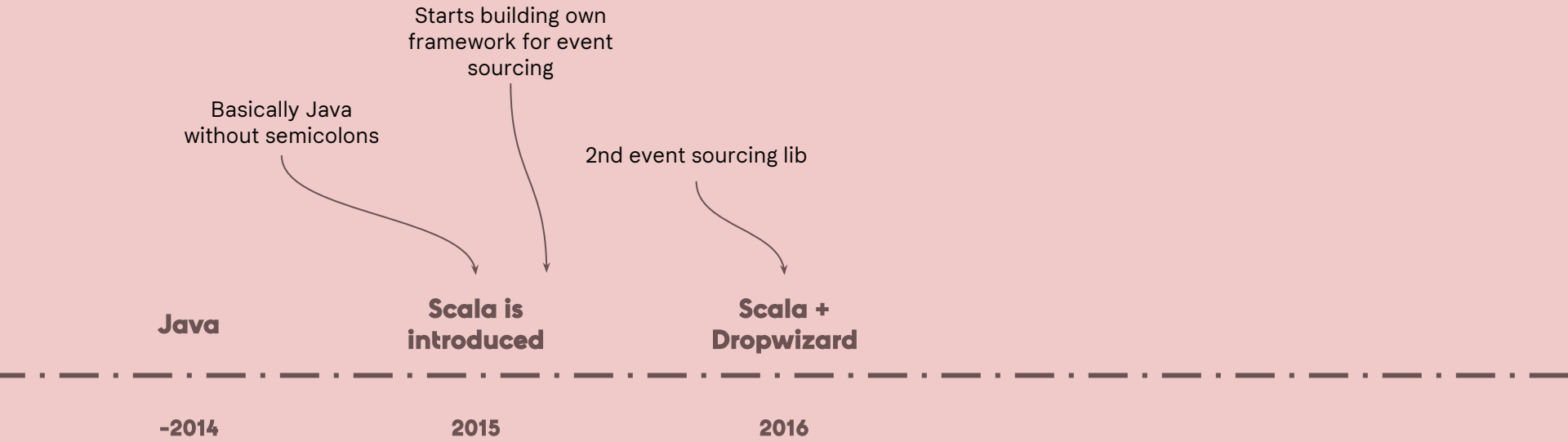
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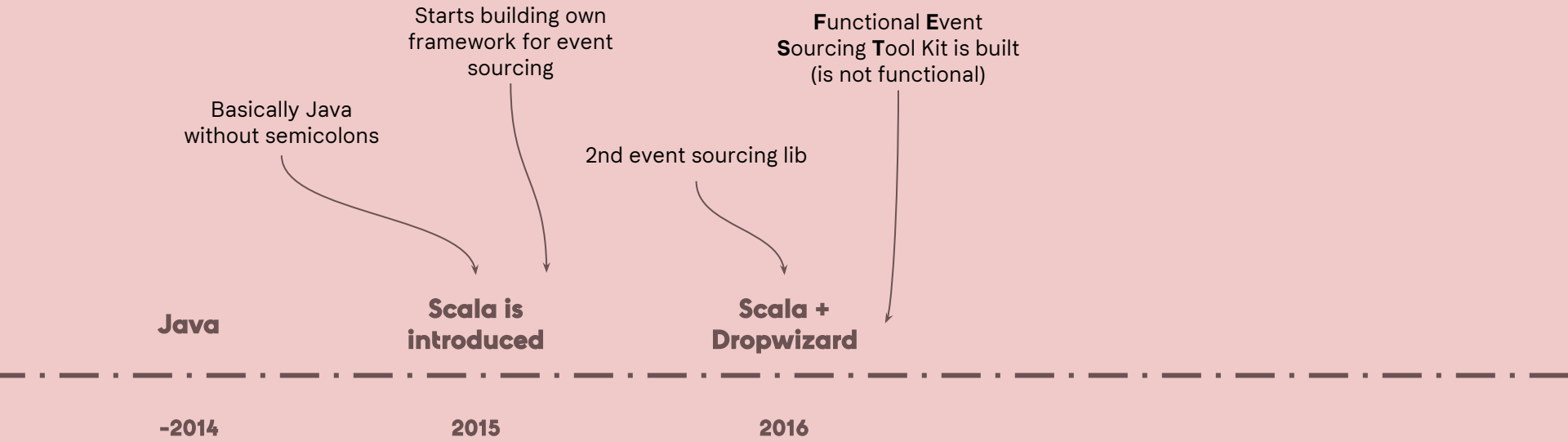
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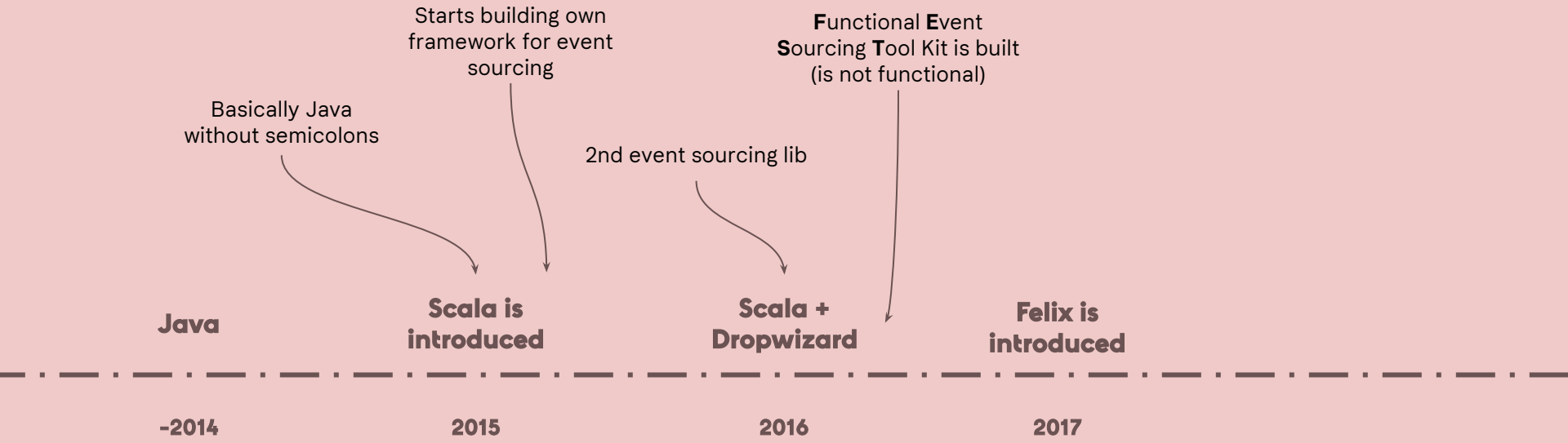
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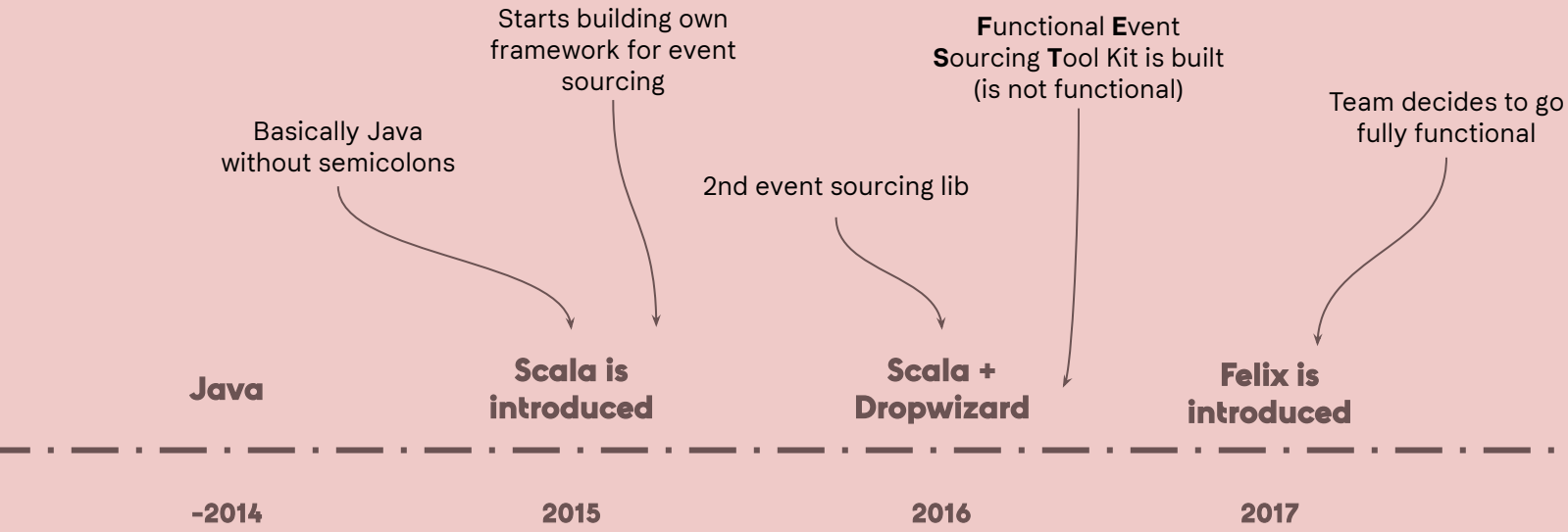
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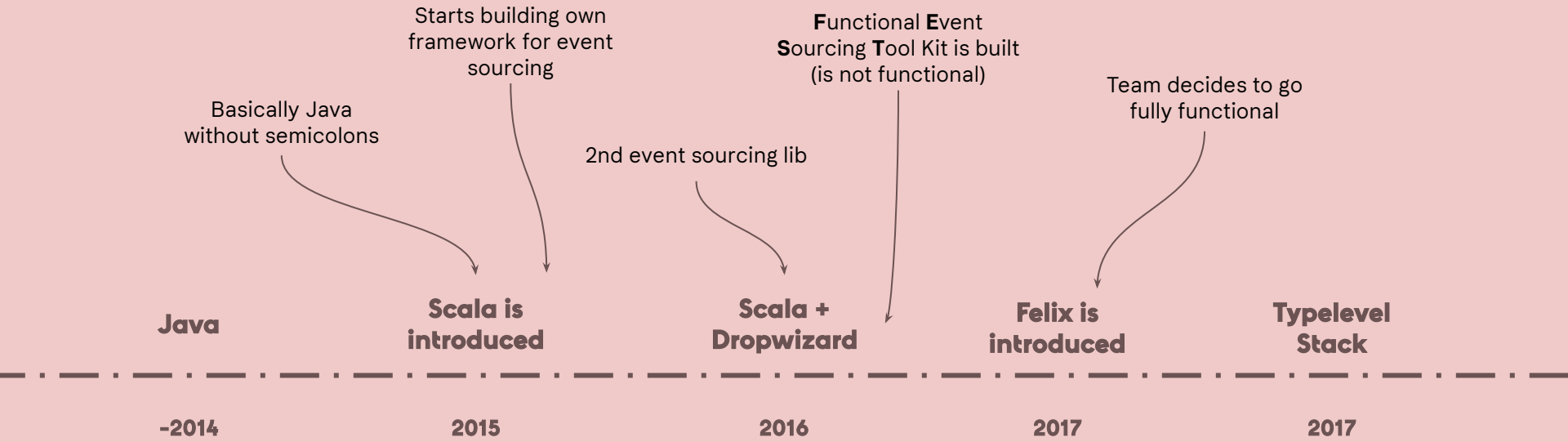
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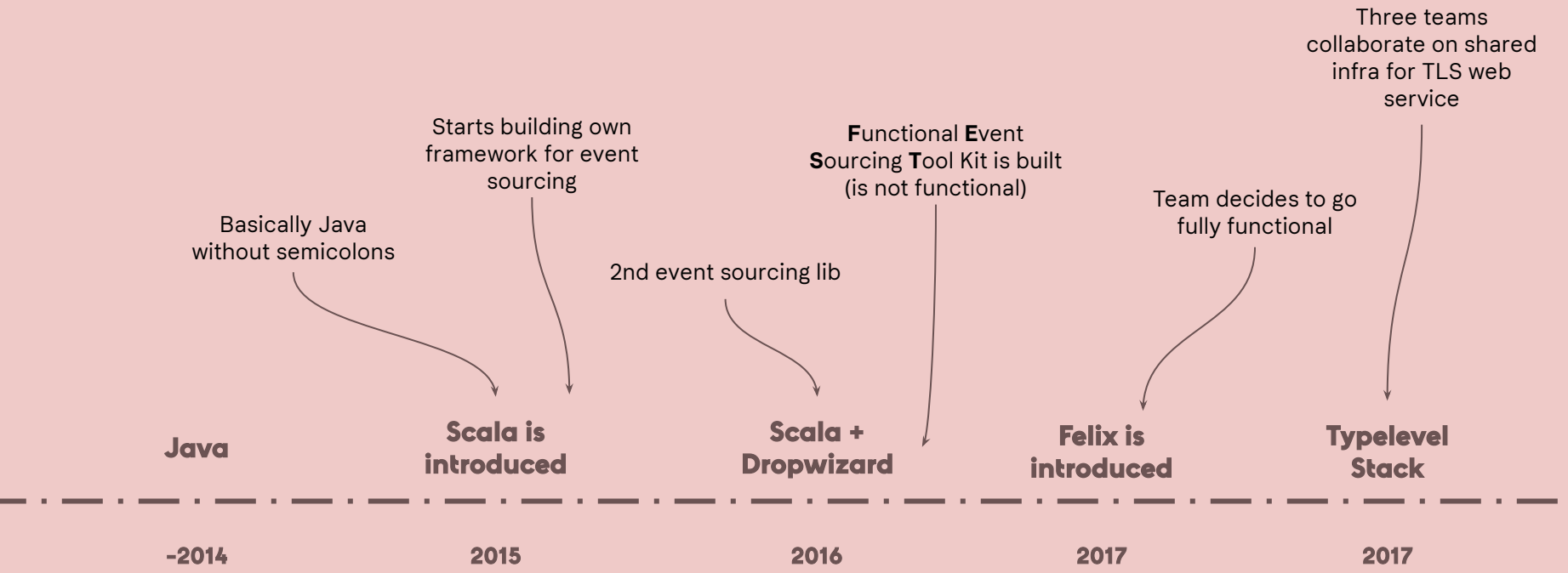
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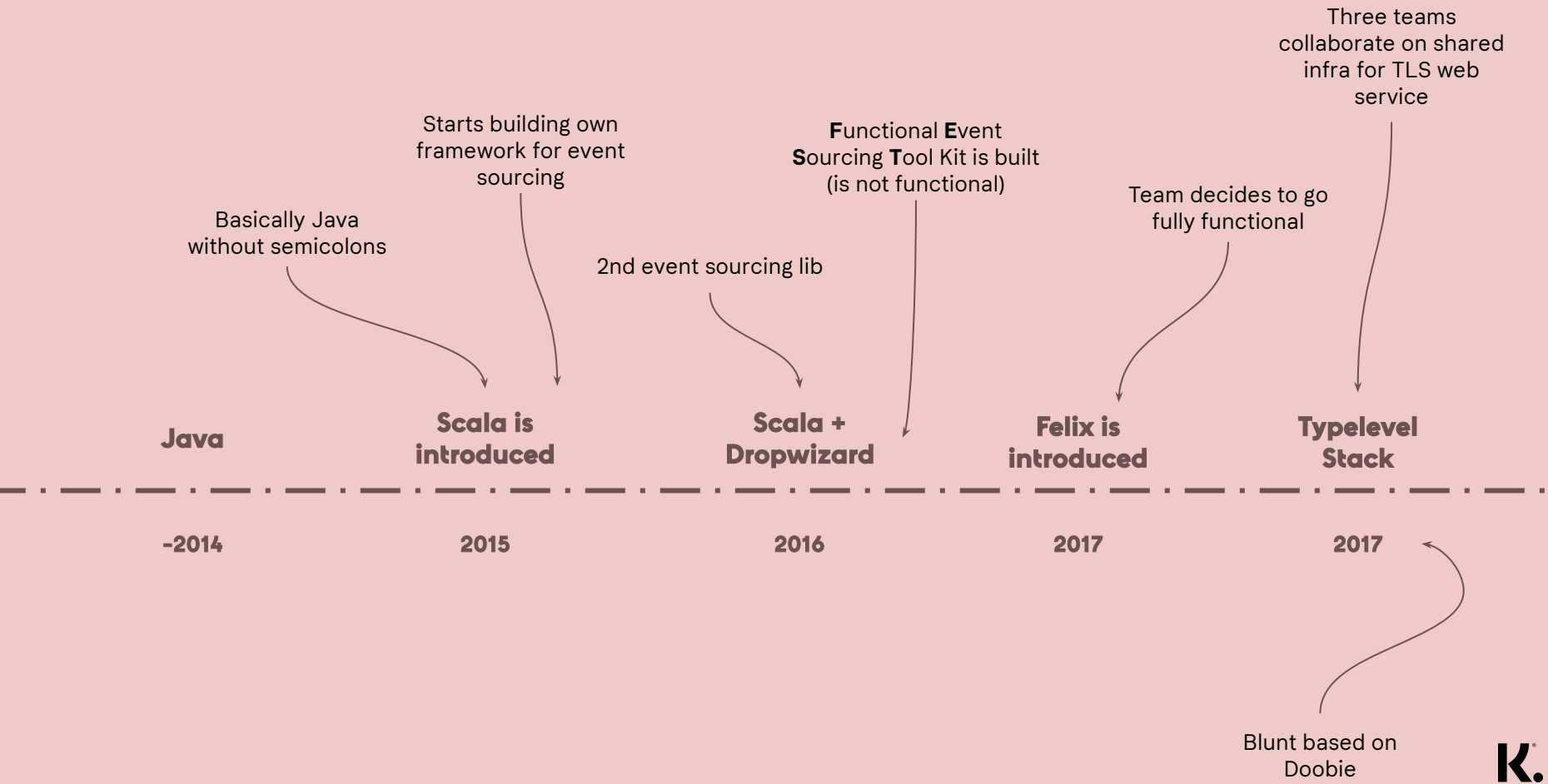
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Blunt based on Doobie

You had us at purely functional.

Yeah, I guess we're all pretty much convinced by now.

Disclaimer: I still  Scala

Brace yourselves for the bashing.

Pros

- Java and JVM
- Type Safety
  - Explicit errors
  - Newtypes
- Edge validation
- Strong community around TLS

Cons

- Java and JVM
- Hard to teach
  - Syntax & Extensions
  - Unopinionated
- Unclear threading model
- Type Inference and FP in Scala
- Mix paradigms

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Felix Mulder
@FelixMulder

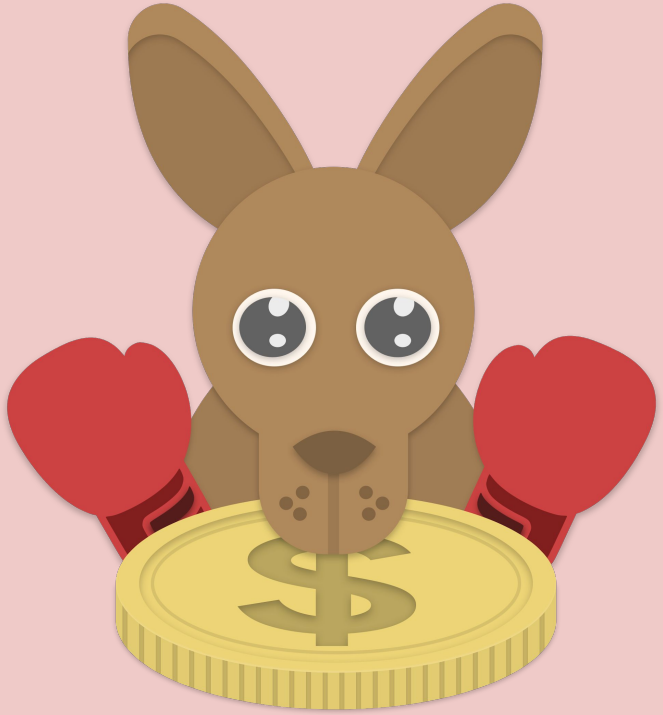
Unpopular opinion: I don't think purely functional programming is idiomatic to Scala the way it's currently done. The techniques pioneered in Haskell should not be used verbatim in Scala 🤷

2:48 PM - 30 Apr 2019

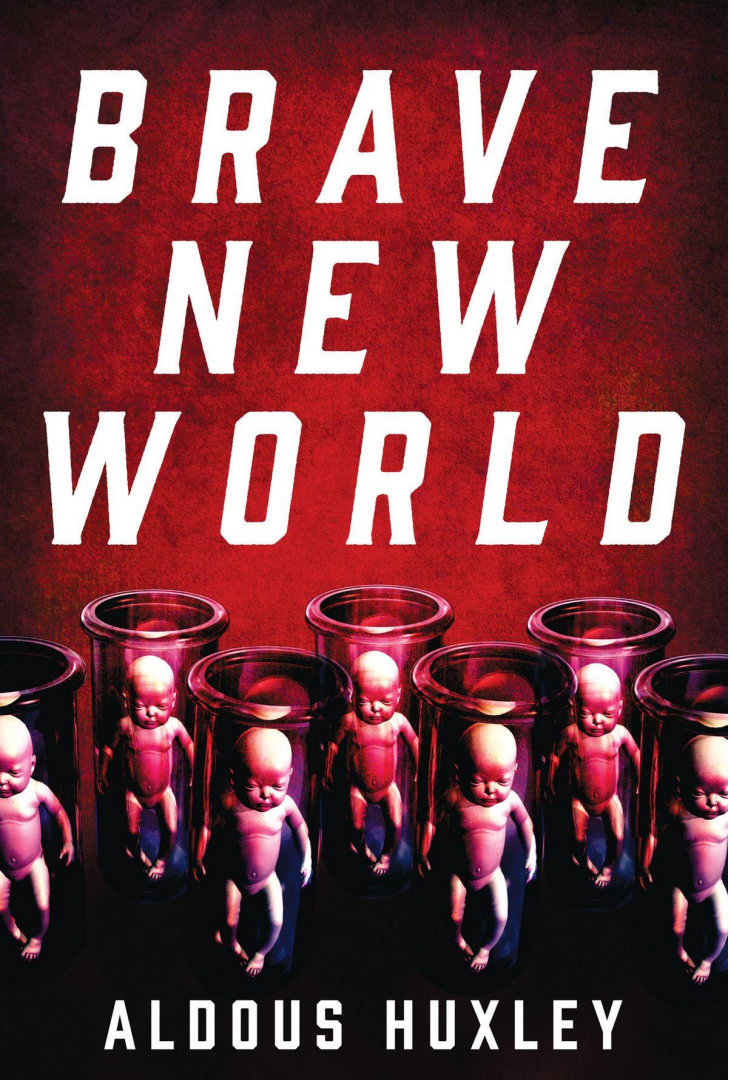
Disclaimer:
I still  Scala

Sorry for all the bashing.

“Klarna is going to be the AWS of banking”



BUCKAROOS

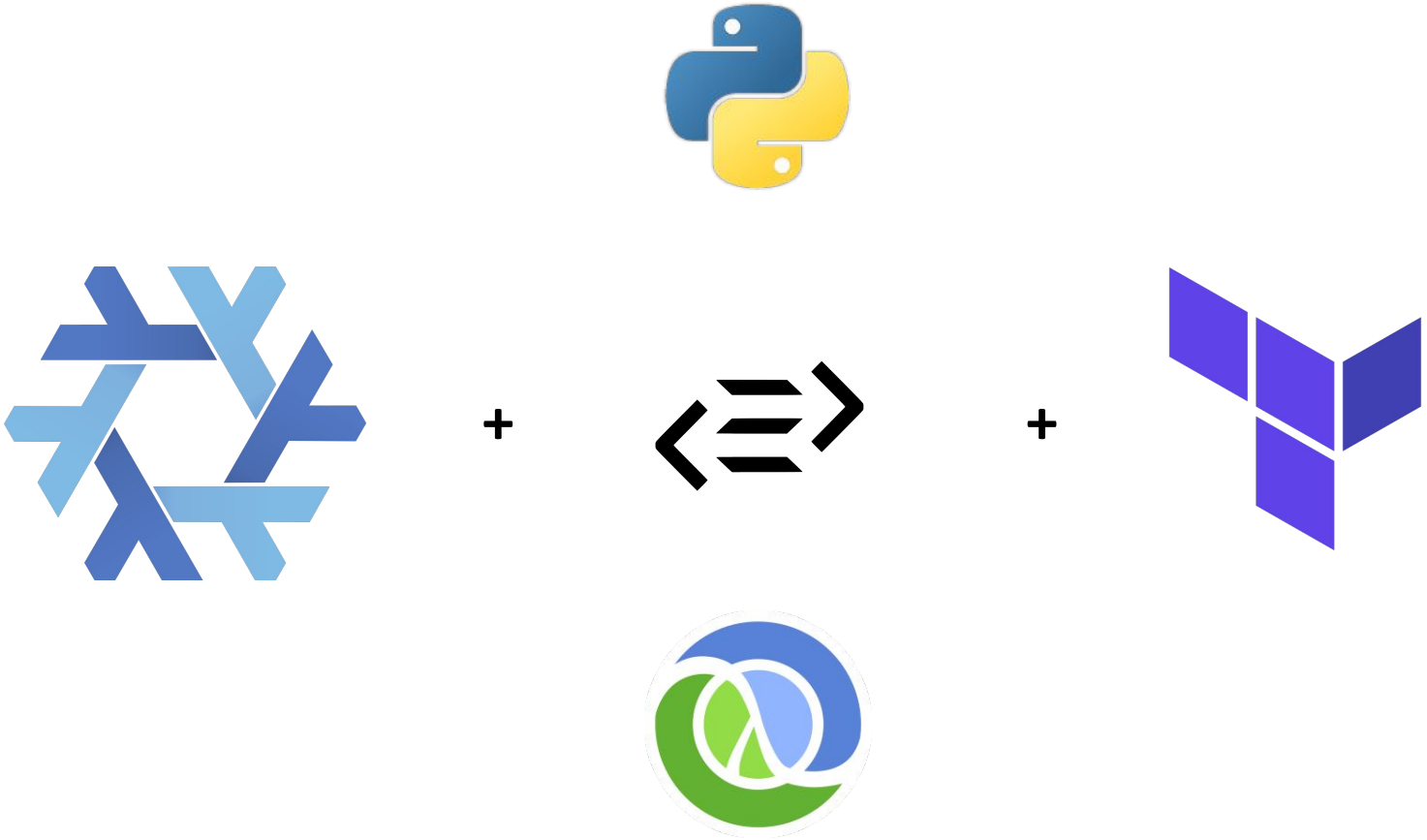


We know what we as a team liked about the TLS in Scala.

We know what we didn’t like.

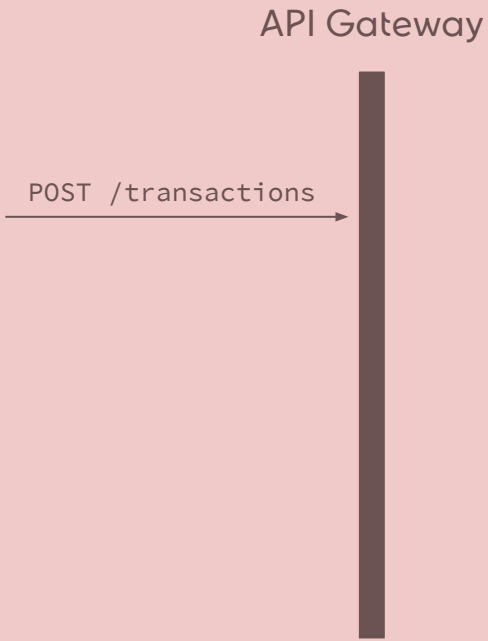
A pure FP language seems to be the next step in that evolution.

Purely Functional and Serverless



Serverless Architecture

API Gateway


API Gateway
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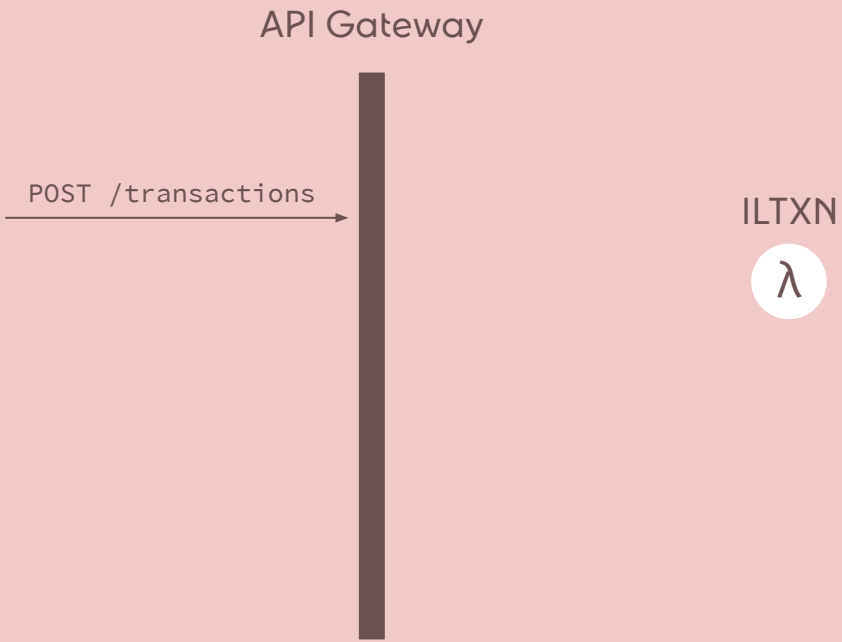
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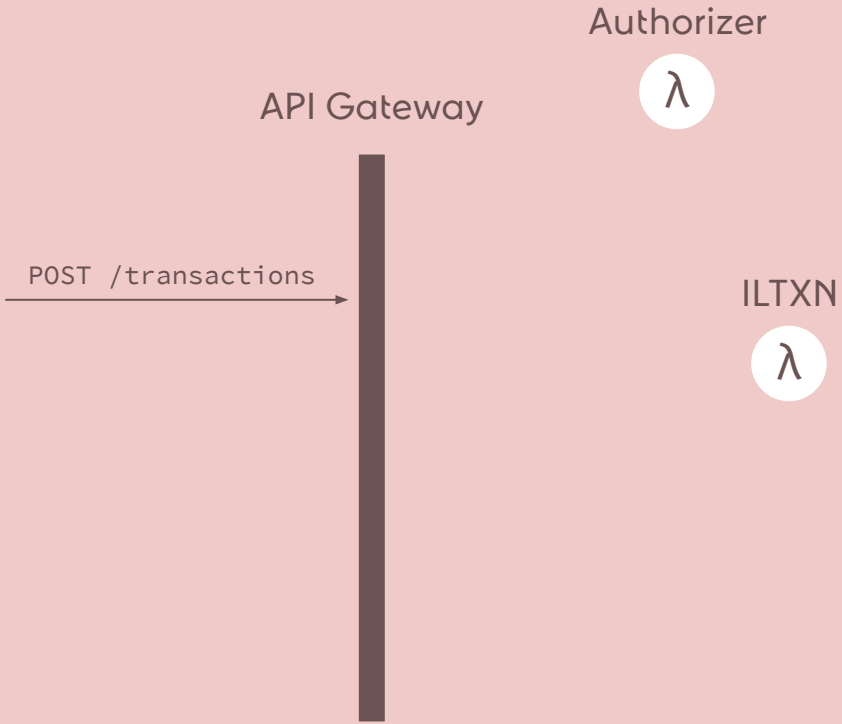
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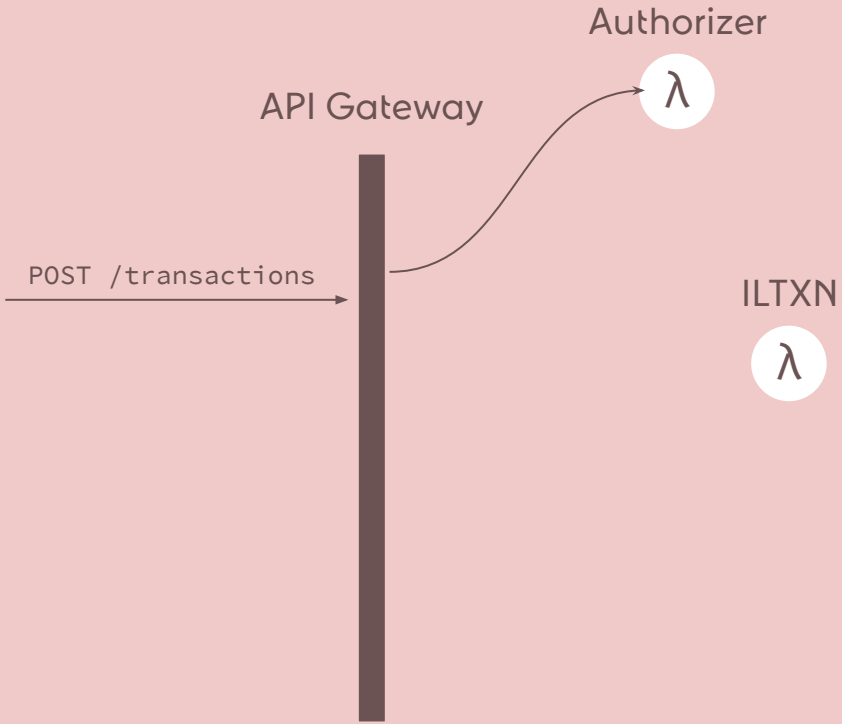
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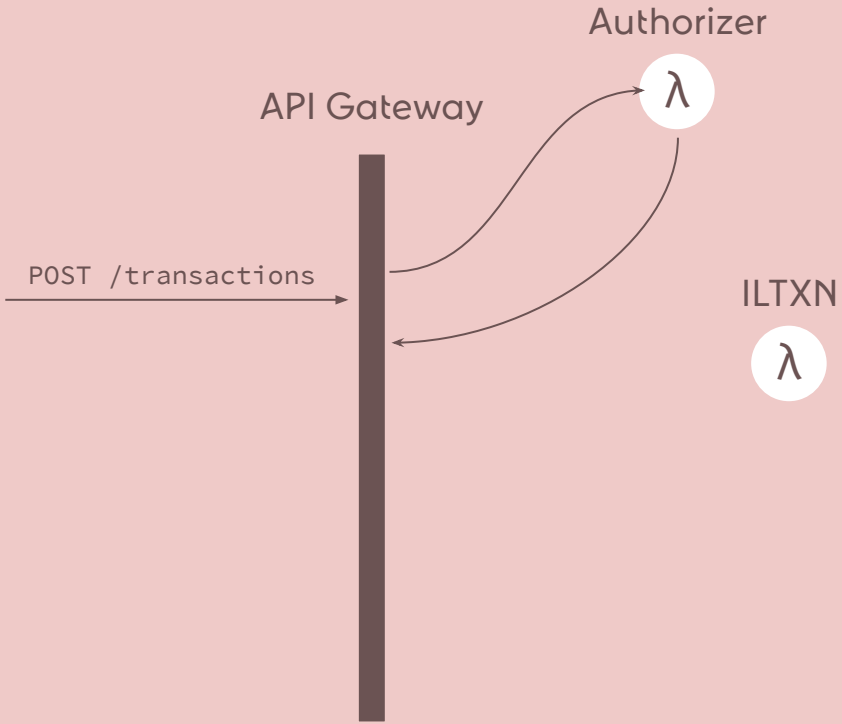
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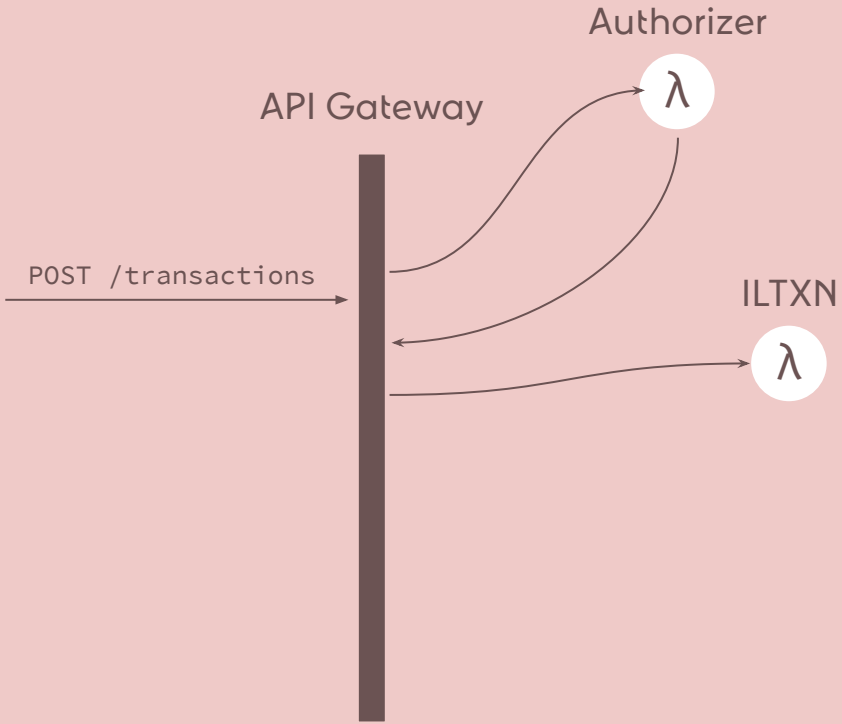
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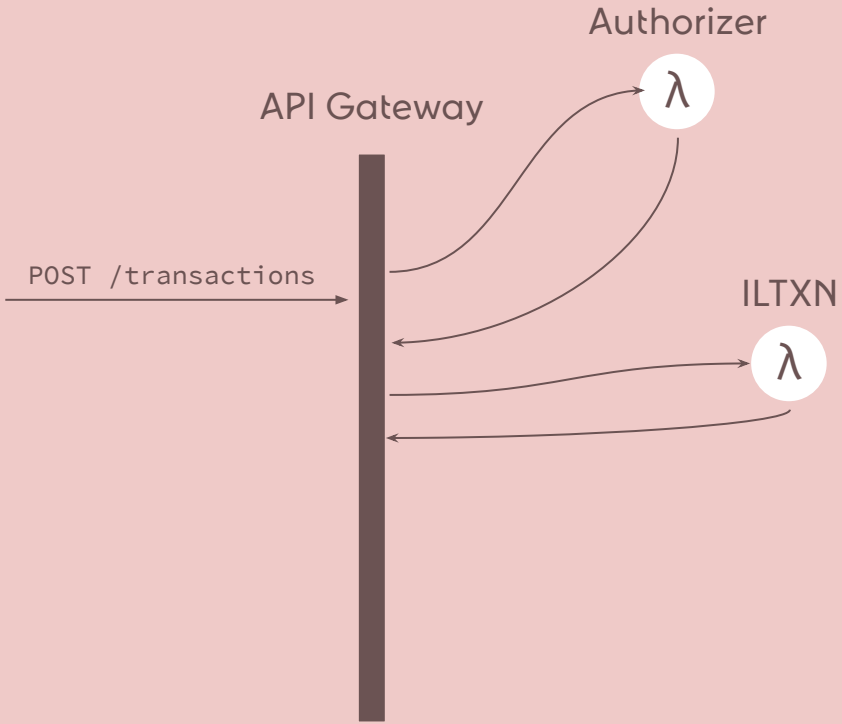
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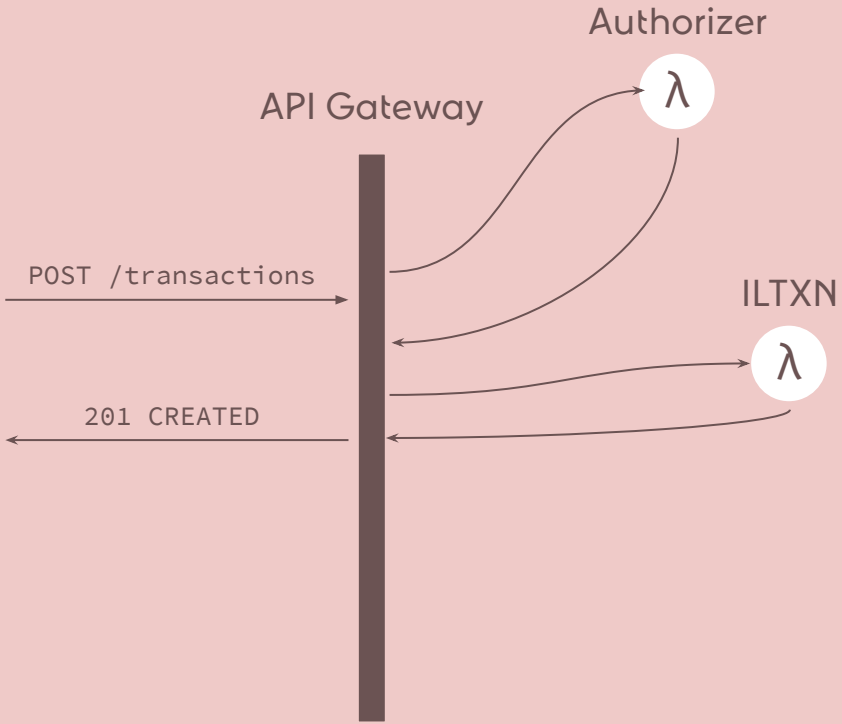
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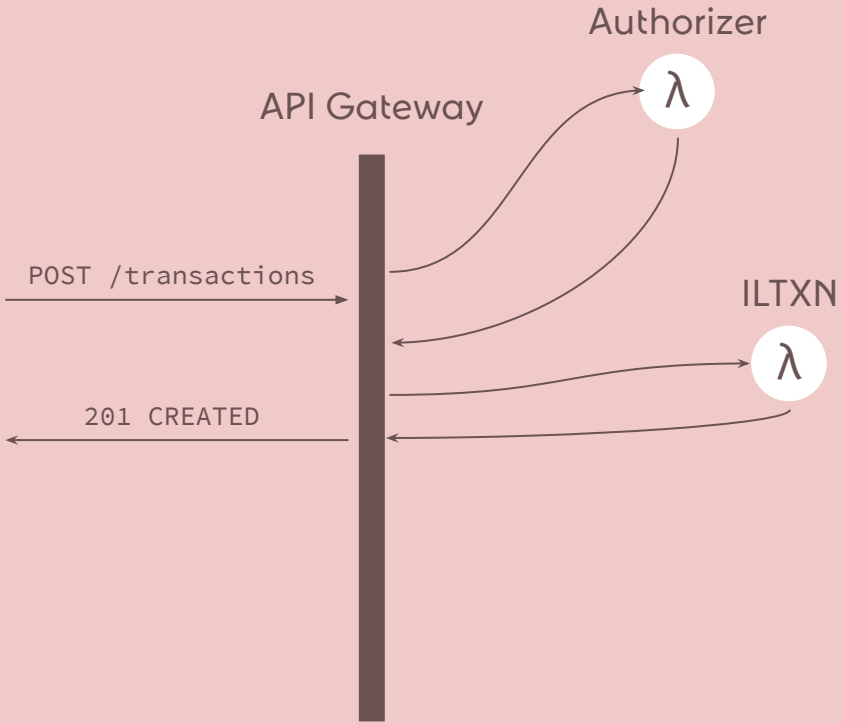
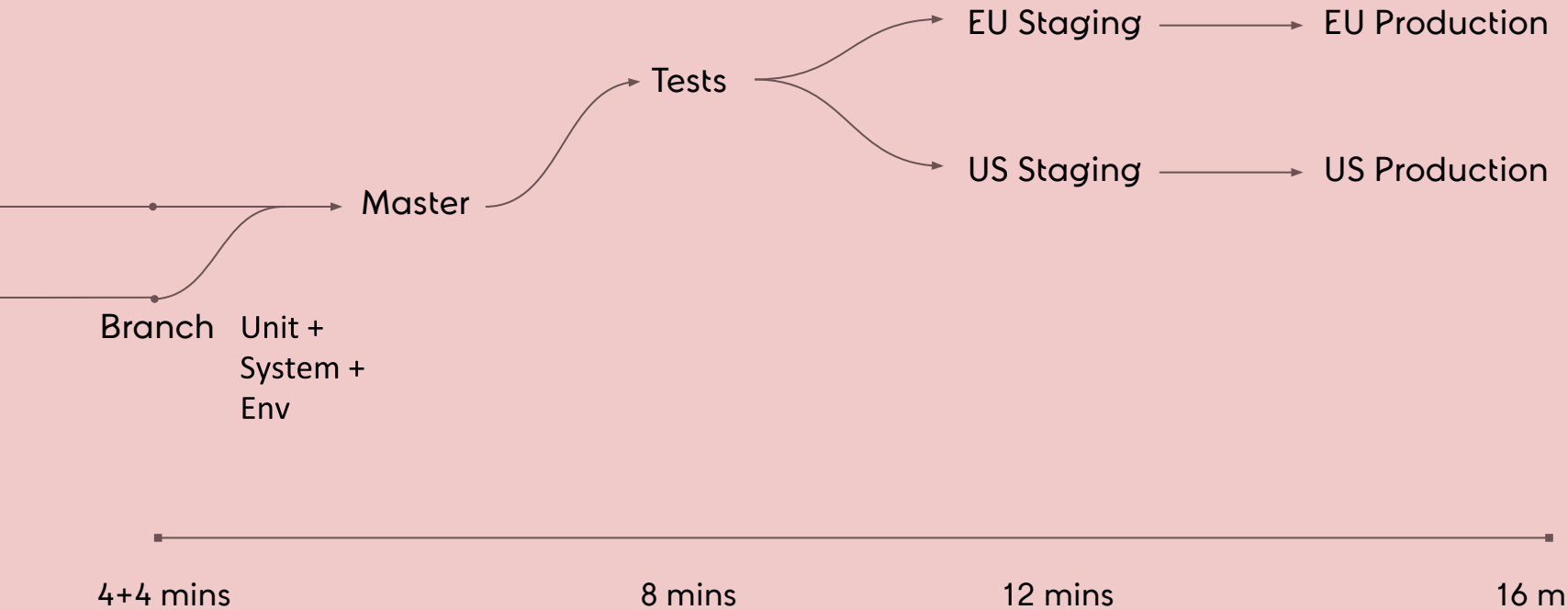


- Fast to deploy
- Immutable artefacts
- Simple interface
- API GW Proxy is the way to go


EU Staging
EU Production
Tests
US Staging
US Production
Master
Branch
Unit +
System +
Env
4+4 mins
8 mins
12 mins
16 mins

How to FP

Tagless Final?
MTL?
Free Monads?
Handler Pattern?

All diets work*

They all reduce caloric intake by limiting or removing one of the primary sources of energy, be it carbohydrates or fats.

Novelty Budget

- Handler Pattern
- Readers
- Rowtype Polymorphic Functions
- Tagless Final

Handler Pattern

```
module Kafka (send) where

newtype Persist a = Persist
  { persist :: a -> Aff Unit }

persistPayment :: Persist Payment
persistPayment = …

persistMock :: forall a. Persist a
persistMock = Persist { persist: const $ pure unit }
```

Readers

```
persistAndCallback ::
     forall r m
   . Has (Persist Payment) r
  => Has Callback r
  => MonadAff m
  => MonadRead r m
  => Payment
  -> m Unit
peristAndCallback = do
  getter asks >>= persist
  getter asks >>= callback
```

Rowtype Polymorphism

```
type Persistable a =
  (persist :: a -> Aff Unit)

doPersist :: Record (Persistable Payment) -> Payment -> Aff Unit
doPersist r = r.persist

doPersistAndCallback ::
     forall r
   . Record (Persistable Payment | Callbackable | r)
  -> Payment
  -> Aff Unit
doPersistAndCallback r p =
  r.persist p *> r.callback Success
```

Tagless Final

```
class Monad m => Persist m where
  persist :: Payment -> m Unit

class Monad m => Callback m where
  callback :: m Unit

persistAndCallback ::
  forall m. Persist m => Callback m => Payment -> m Unit
persistAndCallback =
  persist >>> const callback
```

Tagless Final

```
instance ( Has DynamoDB r
         , MonadAff m
         ) => Persist (ReaderT r m) where
  persist p = asks getter >>= persist' p

persist' :: MonadAff m => Payment -> DynamoDB -> m Unit
persist' = …


runReaderT (persistAndCallback payment)
  {dynamo: myDynamo, callback: myCallback}
```

So why did we switch to Haskell?

Novelty Budget

```purescript
-- Kafka.purs
module Kafka (send) where

foreign import _send ::
    forall k v
  . KafkaProducer -> k -> v -> Effect (Promise Unit)
```

```purescript
-- Kafka.purs
module Kafka (send) where

foreign import _send ::
    forall k v
  . KafkaProducer -> k -> v -> Effect (Promise Unit)
```

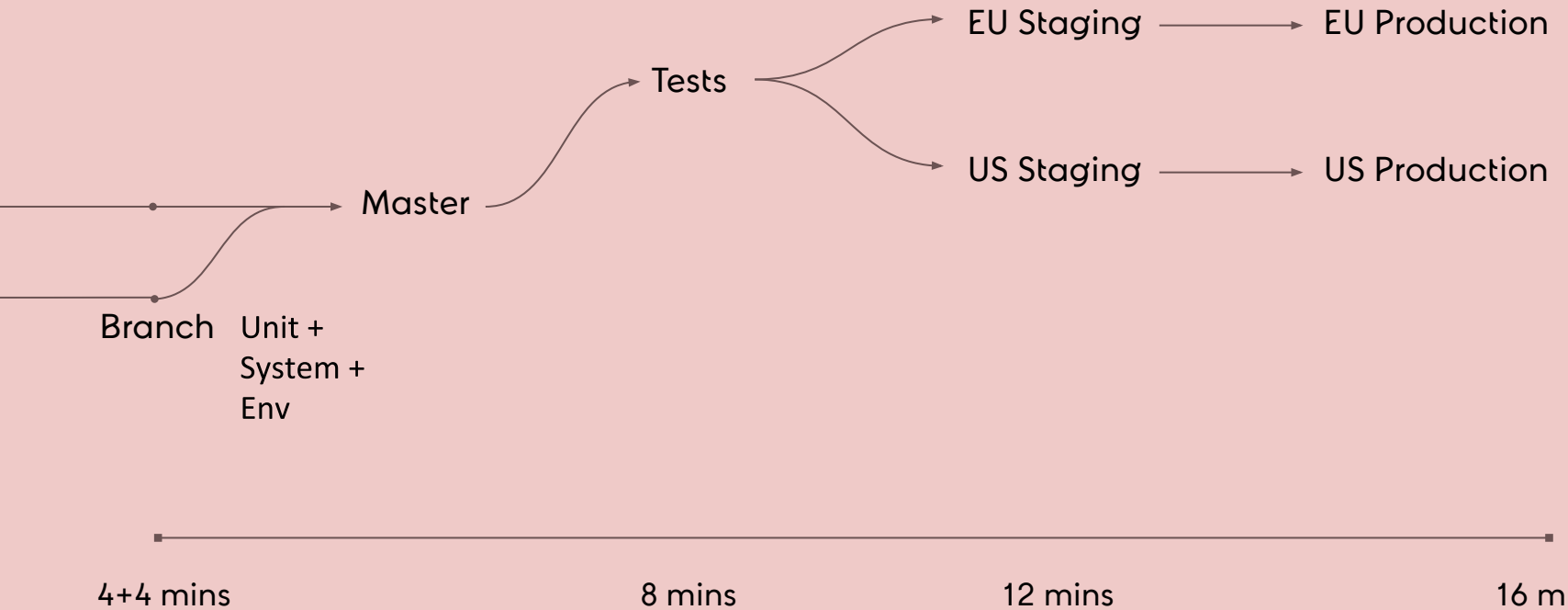
```javascript
// Kafka.js
exports._send = function (kafkaProducer) {
  return function (k) {
    return function (v) {
      return function () {
        return kafkaProducer.send(..., k, v);
      };
    };
  };
};
```

```purescript
-- Kafka.purs
module Kafka (send) where

foreign import _send ::
    forall k v
  . KafkaProducer -> k -> v -> Effect (Promise Unit)

send ::
    forall k v
  . KafkaProducer -> k -> v -> Aff Unit
send producer key value =
  toAffE $ _send producer key value
```

Haskell is just that much more mature

Serverless considered harmful*

*Not really.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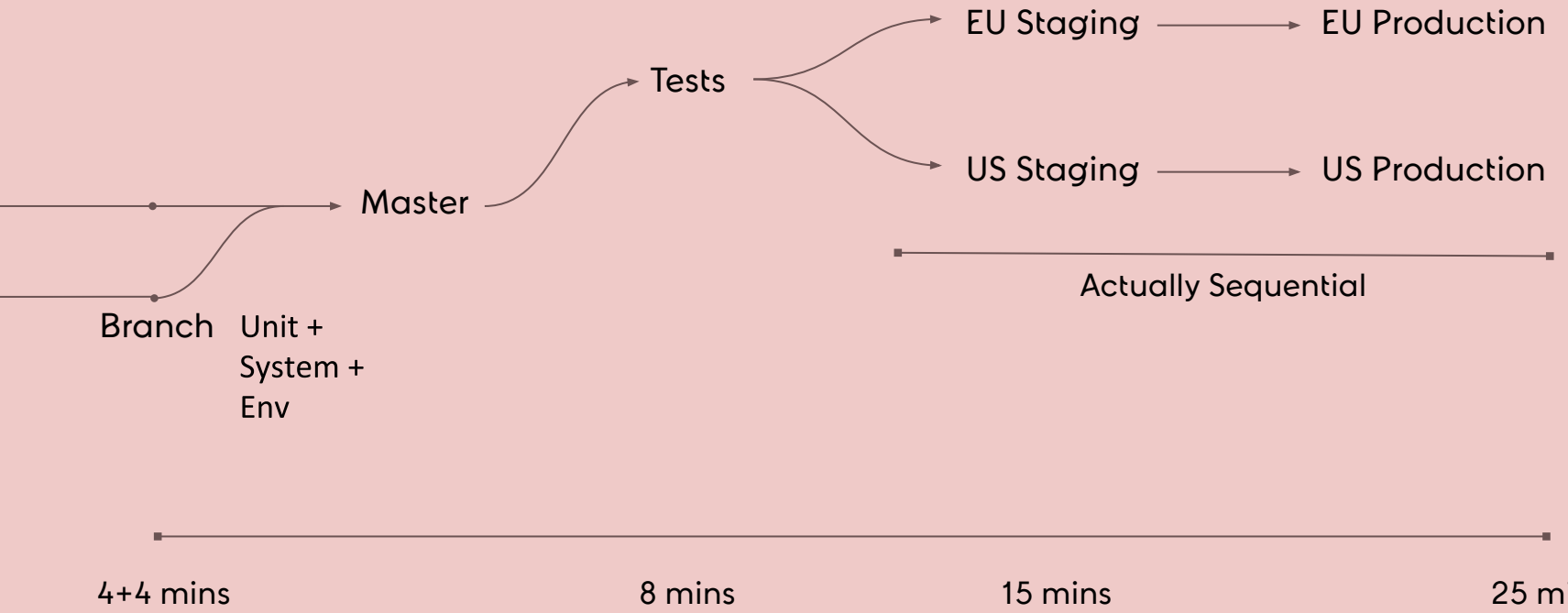
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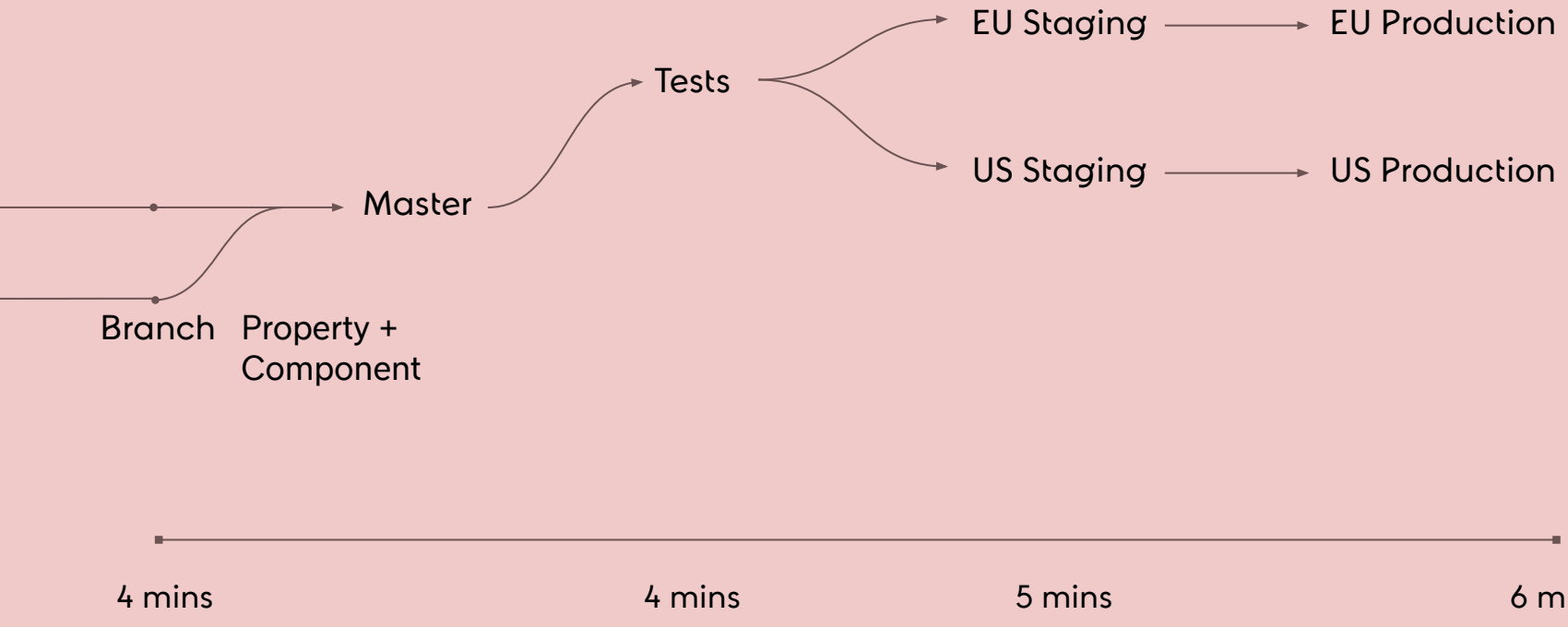
EU Staging
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US Staging
US Production
Master
Branch
Property +
Component
4 mins
4 mins
5 mins
6 mins

```haskell
-- Handler.hs
module RequestHandler
  ( handleRequest_
  , handleRequest
  ) where

type EventHandler = KafkaConsumer -> IO ()

handleRequest_ :: KafkaProducer -> HttpClient -> EventHandler
handleRequest_ = …

handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest = …
```

```haskell
handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest = …

class MonadPersist m where
  persistTransaction :: Transaction -> m (Persisted Transaction)

class MonadRespond m where
  respond :: Response -> m Response

class MonadLog m where
  log :: LogLine -> m ()
```

```haskell
-- persistTransaction :: Transaction -> m (Persisted Transaction)
-- respond :: Response -> m Response
-- log :: LogLine -> m ()

handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest = undefined
```

```haskell
-- persistTransaction :: Transaction -> m (Persisted Transaction)
-- respond :: Response -> m Response
-- log :: LogLine -> m ()

handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest (Request Create transaction) =
  undefined
```

```haskell
-- persistTransaction :: Transaction -> m (Persisted Transaction)
-- respond :: Response -> m Response
-- log :: LogLine -> m ()

handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest (Request Create transaction) = do
  persistTransaction transaction >>=
  _andThen
```

```haskell
-- persistTransaction :: Transaction -> m (Persisted Transaction)
-- respond :: Response -> m Response
-- log :: LogLine -> m ()

handleRequest ::
     MonadPersist m
  => MonadRespond m
  => MonadLog m
  => Request -> m Response
handleRequest (Request Create transaction) = do
  persistTransaction transaction >>=
  respond . bifoldMap Error Created
```

```haskell
class MonadPersist m where
  persistTransaction :: Transaction -> m (Persisted Transaction)
```

```haskell
class MonadRespond m where
  respond :: Response -> m Response
```

```haskell
class MonadLog m where
  log :: LogLine -> m ()
```

```haskell
class MonadPersist m where
  persistTransaction :: Transaction -> m (Persisted Transaction)

instance ( Has DB.Connection r
         , MonadLog m
         , MonadIO m
         ) => MonadPersist (ReaderT r m) where
  persistTransaction transaction = do
    -- Read the DB connection from 'r'
    database <- asks getter

    -- Log some info using 'MonadLog'
    log $ "going to persist transaction: " <> show transaction

    -- Try to insert the transaction
    insertRes <- try @SqlError (DB.persist database transaction)

    -- Log the result
    log insertRes

    -- Wrap in return ADT
    pure . either PersistenceError Persisted $ insertRes
```

```haskell
newtype TestT r m a = TestT { runTestT :: ReaderT r m a }
  deriving (Functor, Applicative, Monad, MonadReader r)


type Test r = TestT r Identity


instance Monad m => MonadPersist (TestT r m) where
  persistTransaction = pure . Persisted
```

A Brave New World

Great & not so great things about Haskell.

Cons

- Records
- Extensions
- Cabal vs Stack vs Nix
- Gotchas when using Kafka

Pros

- Refactor without fear
- Very performant, no cold starts
- Great ecosystem
- Training is *shockingly* easier


Klarna.
What are you optimizing for?

Klarna.