

Moving beyond request-reply:
How smart APIs are different.

@berndruecker

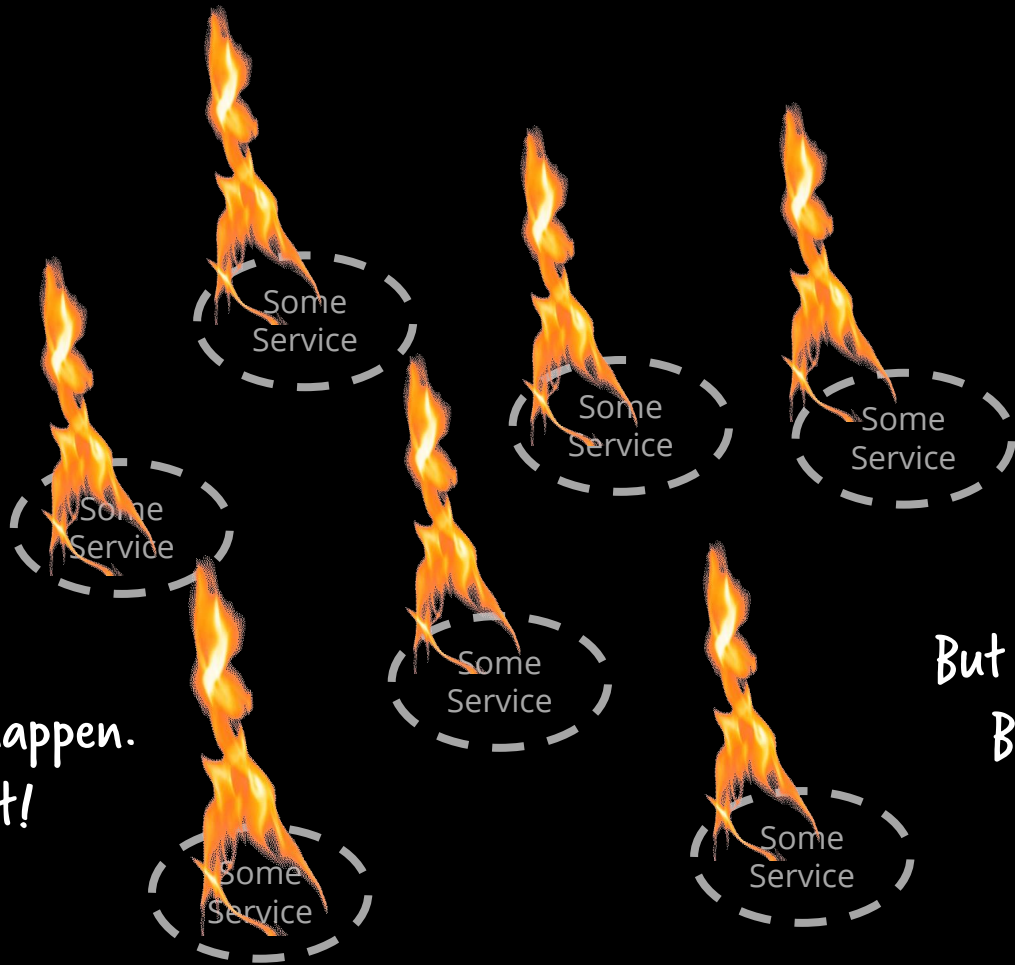


Software Development Architecture and Design 2019 Q1 Graph

<http://infoq.link/architecture-trends-2019>

InfoQ





Failure will happen.
Accept it!

But keep it local!
Be resilient.



Photo by [Tookapic](#), available under [Creative Commons CC0 1.0 license](#).

„There was an error
while sending your
boarding pass“

Home ▶ Mein Flug: My Eurowings ▶ Bordkarten anzeigen ▶ Meine Bordkarten

Ihre Bordkarten

Beim Versenden der Bordkarte ist ein Fehler aufgetreten.

Ihr Buchungscode **08HHSS**

Hinflug

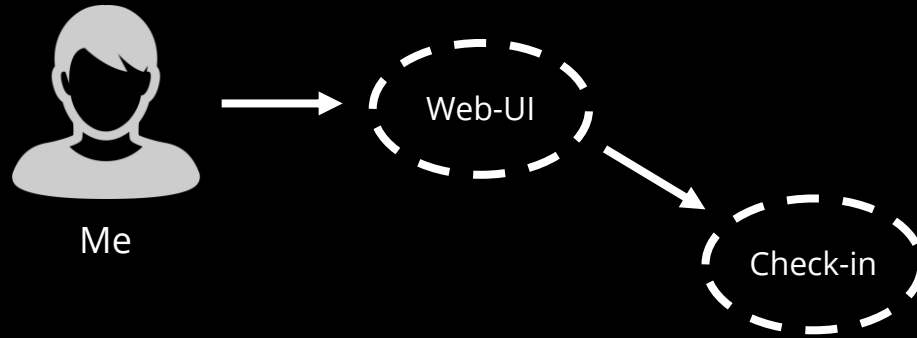
BERND RUECKER

Stuttgart (STR) - London-Stansted (STN)

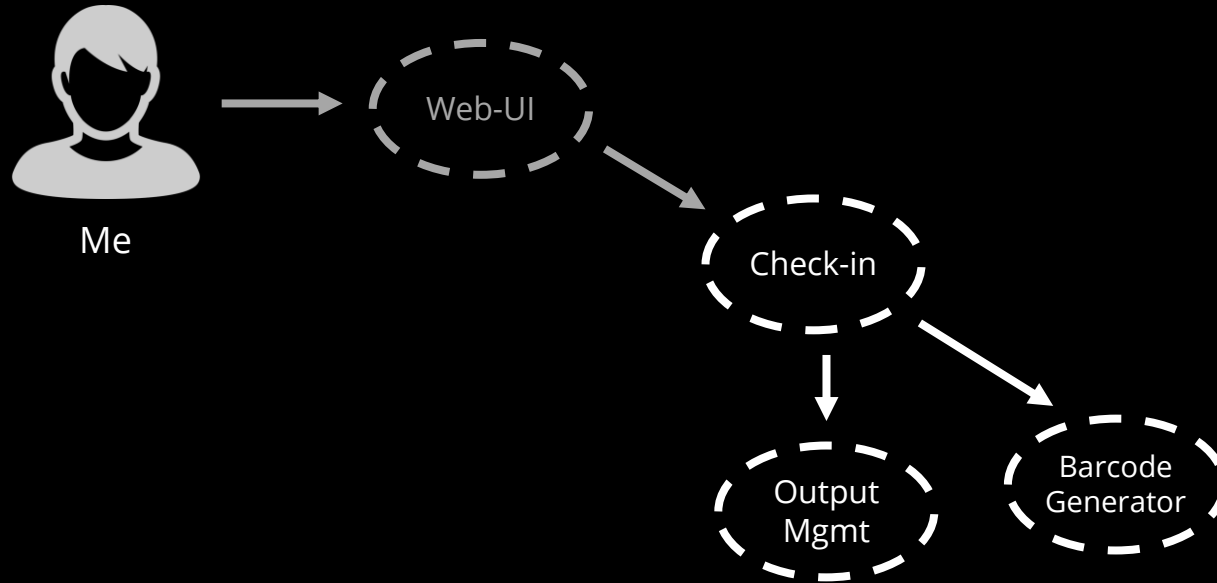


Mi 08.11.2017 10:10 - 10:15

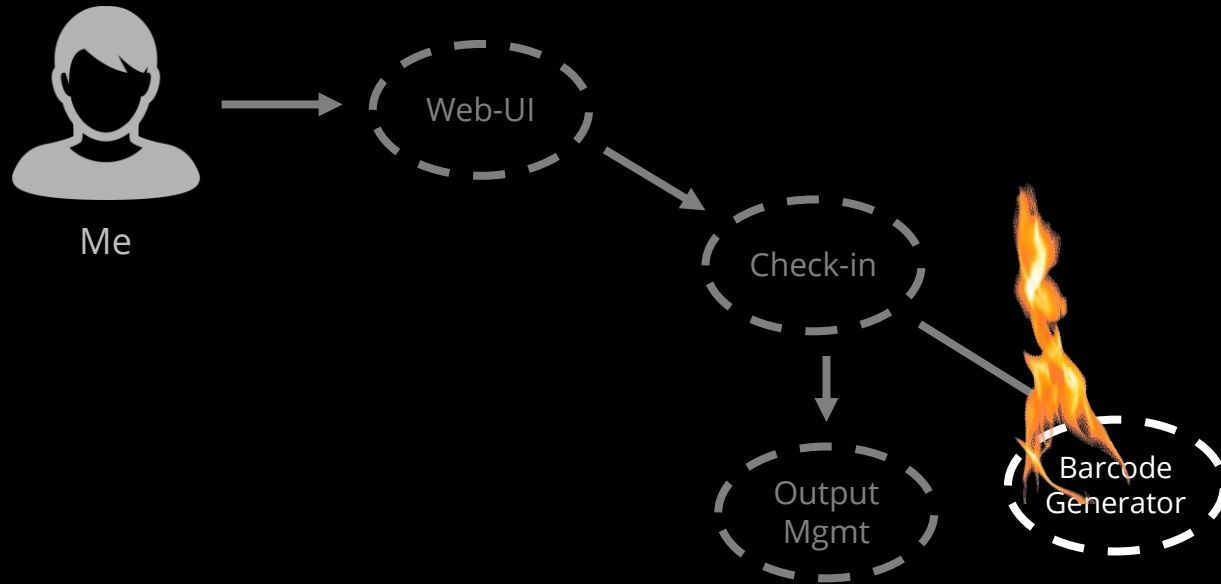
Current situation



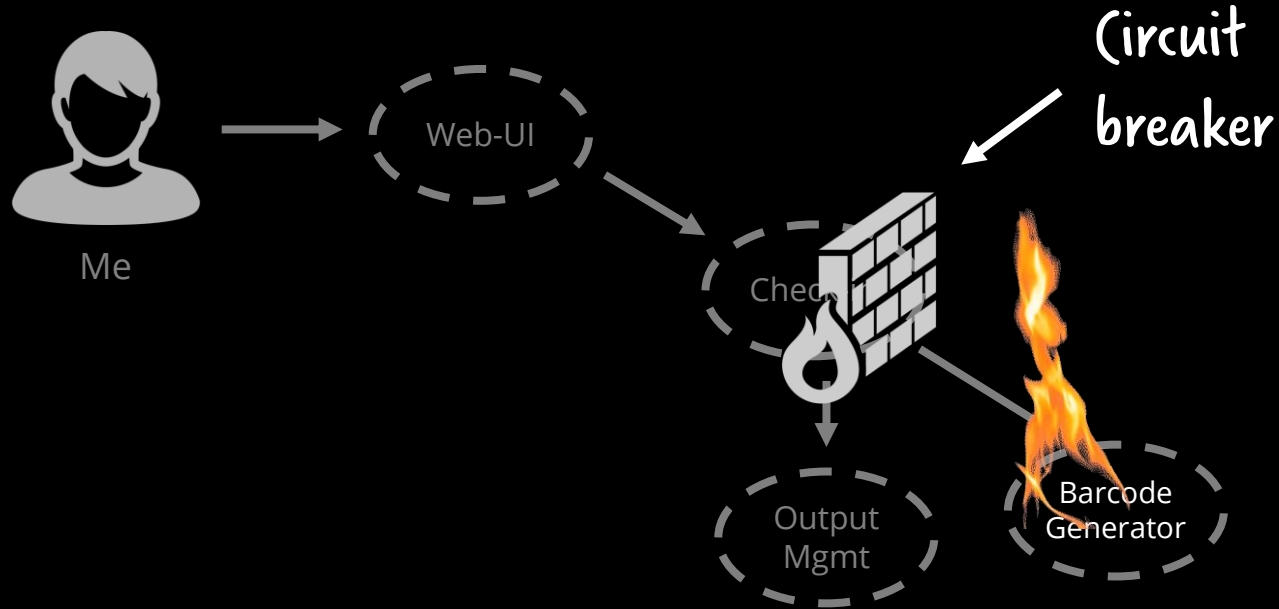
Current situation



Current situation



Current situation – the good part





Internal Server Error



https://www.united.com/travel/checkin/displayitinerary.aspx

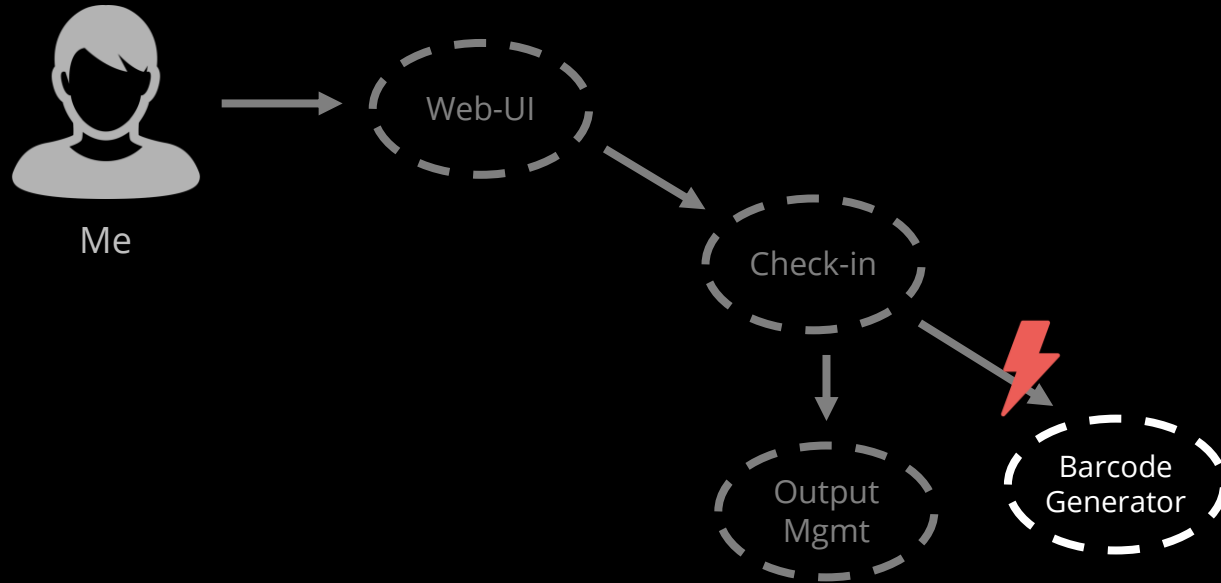


Internal Server Error - Read

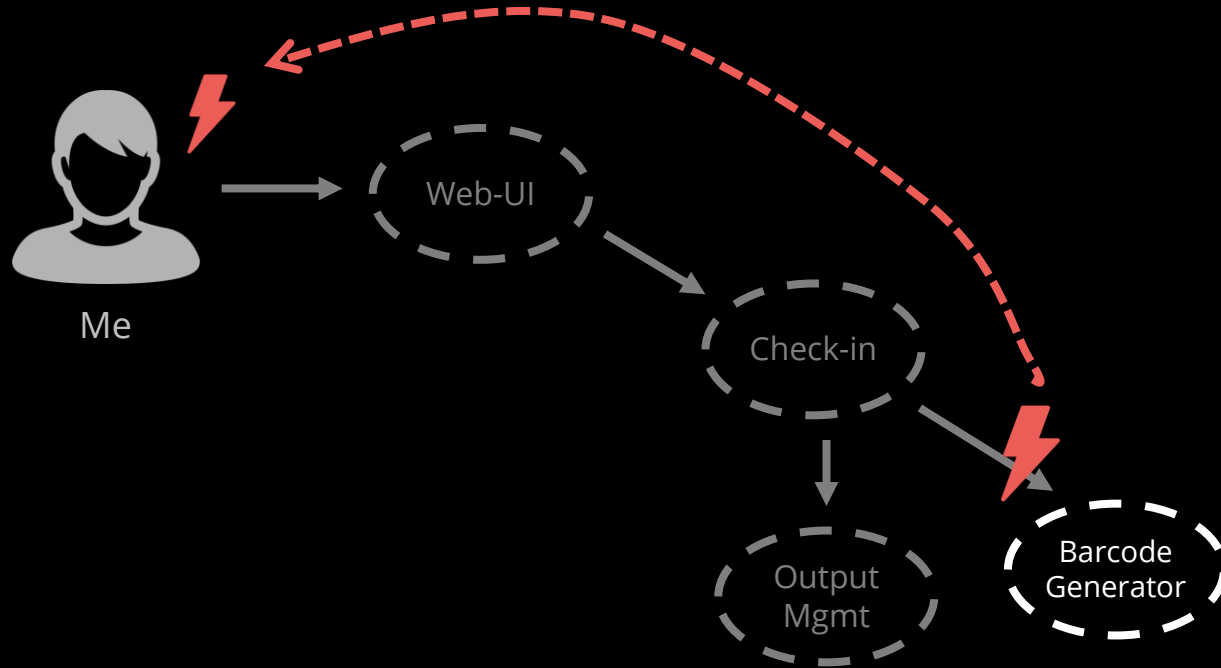
The server encountered an internal error or misconfiguration and was unable to complete your request.

Reference #3.1d079ccc.1519892932.9c55d68

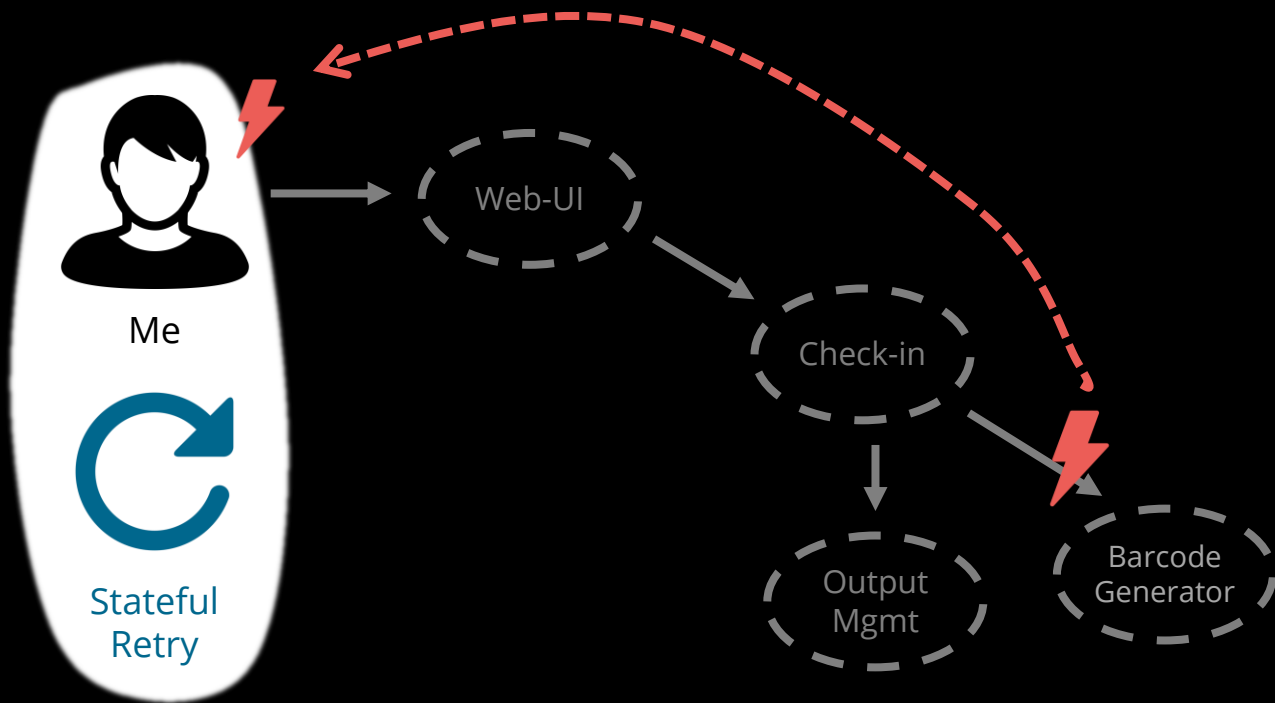
Current situation – the bad part



Current situation – the bad part



Current situation – the bad part



Ihre B

easyJet

Ihr Buchung

Hinflug

BERND RUEC

We're sorry

We are having some technical difficulties at the moment.

Please log on again via www.easyjet.com

If that doesn't work, please try again in five minutes.

We do actively monitor our site and will be working to resolve the issue, so there's no need to call

[Go to easyJet.com](http://www.easyjet.com)

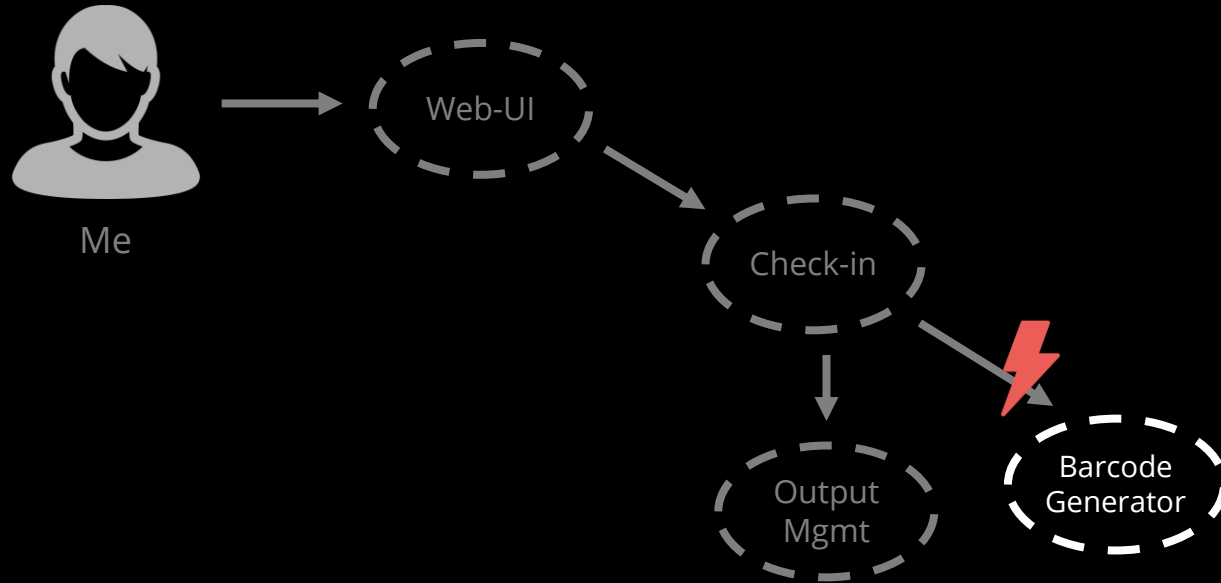
...I just made this up...

We're sorry

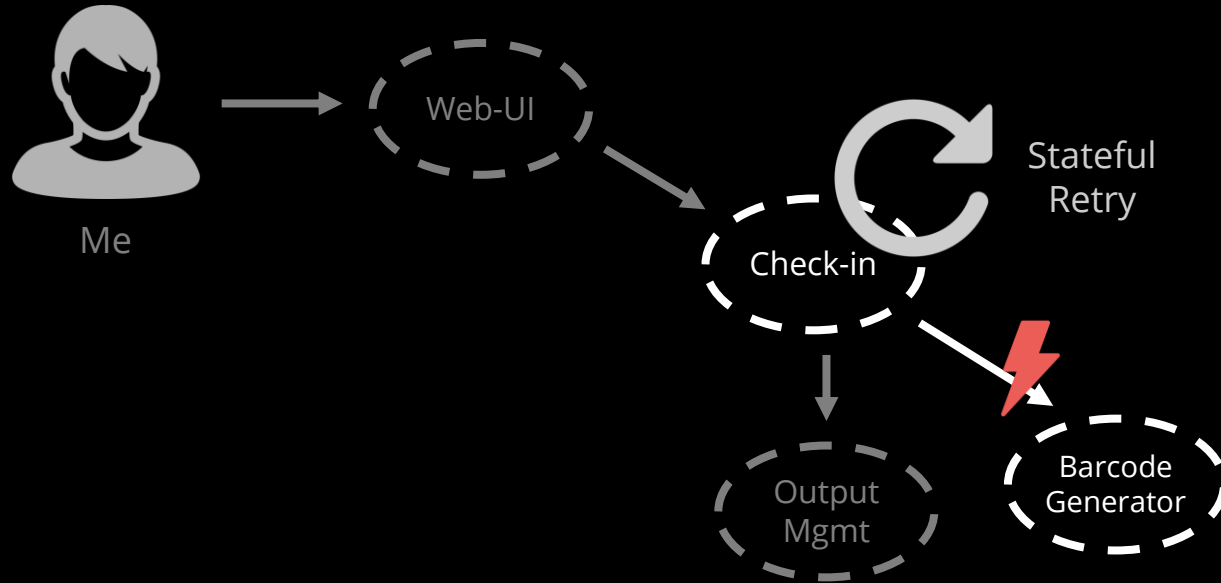
We are having some technical difficulties and cannot present you your boarding pass right away.

But we do actively retry ourselves, so lean back, relax and we will send it on time.

Possible situation – much better!



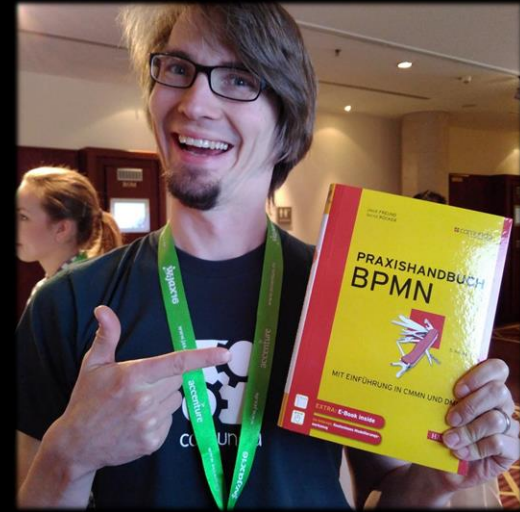
Possible situation – much better!



**Warning:
Contains Opinion**



Bernd Ruecker
Co-founder and
Chief Technologist of
Camunda

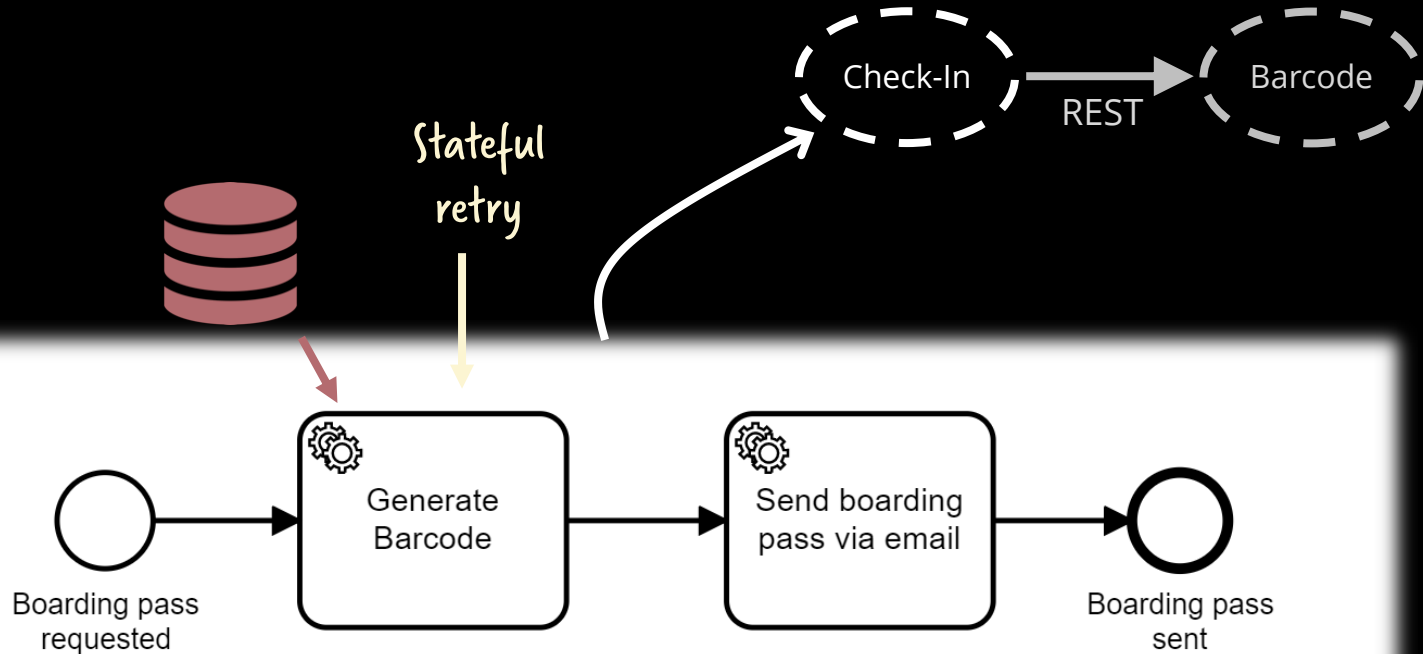


Berlin, Germany



<http://berndruecker.io/>
mail@berndruecker.io
[@berndruecker](#)

You can use a workflow engine (=durable state machine)!



Want to see code?

<https://github.com/berndruecker/flowing-retail>



Client

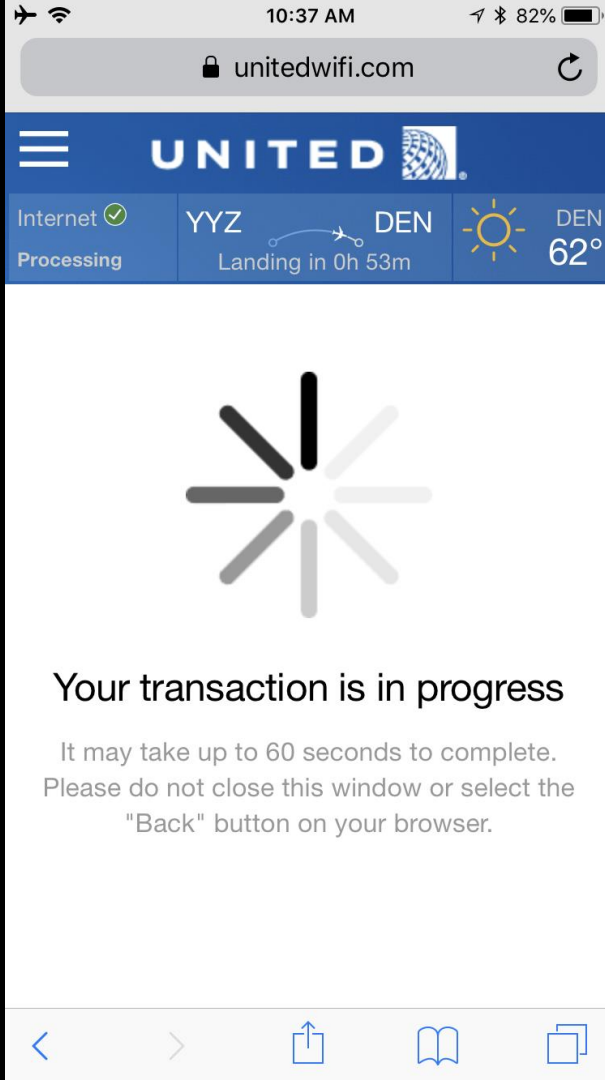
has to implement

Retry

Service Provider

has to implement

Idempotency





Your transaction is in progress

It may take up to 60 seconds to complete.
Please do not close this window or select the
"Back" button on your browser.



...I just made this up...

Your transaction is in progress

*Don't worry, it will happen safely –
even if you loose connection.
Feel free to reload this page any time!*



Photo by [pixabay](#), available under [Creative Commons CC0 1.0 license](#).

Requirement: Idempotency of services!



Photo by [pixabay](#), available under [Creative Commons CC0 1.0 license](#).

Requirement: Idempotency of services!

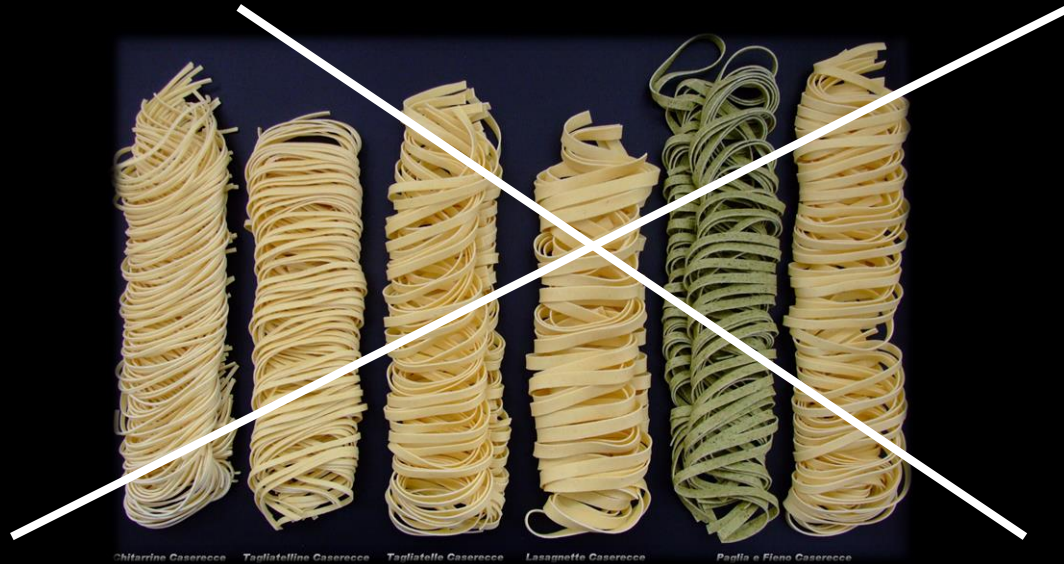
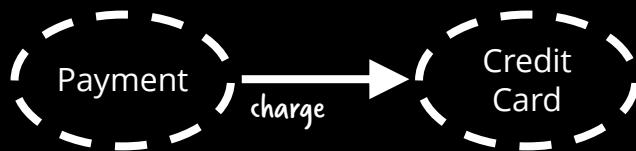


Photo by [Chr.Späth](#), available under [Public Domain](#).

Make every service idempotent!



Generally: create Ids
as soon as possible

Charge Credit Card
cardNumber
amount

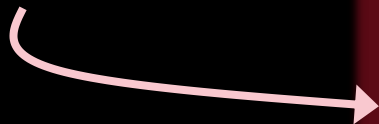


Not idempotent

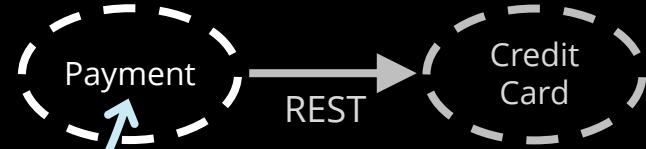
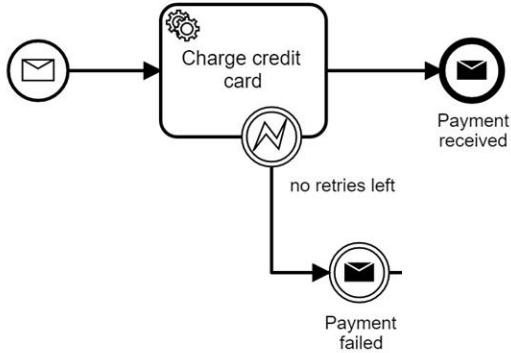
Charge Credit Card
cardNumber
amount
transactionId



Idempotent



Distributed systems introduce complexity you have to tackle!

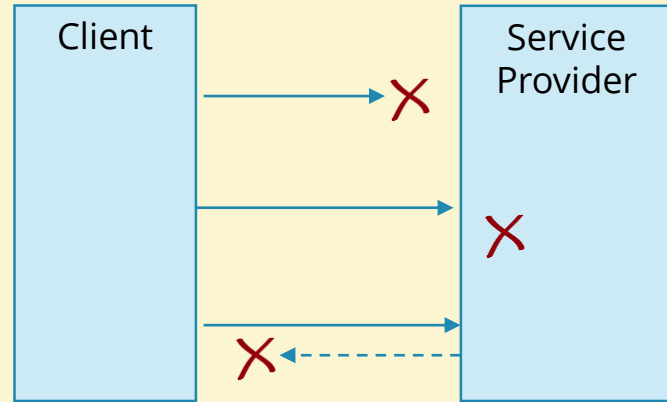


Distributed systems

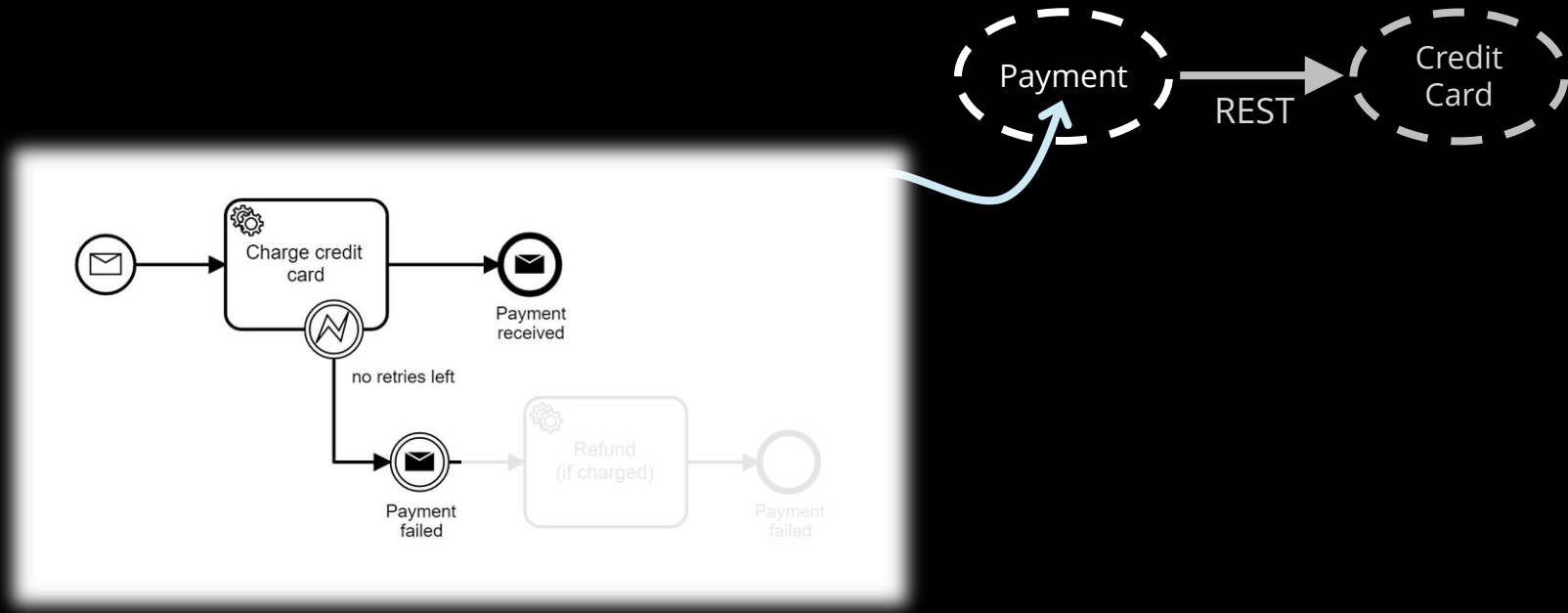


It is impossible to
differentiate certain
failure scenarios.

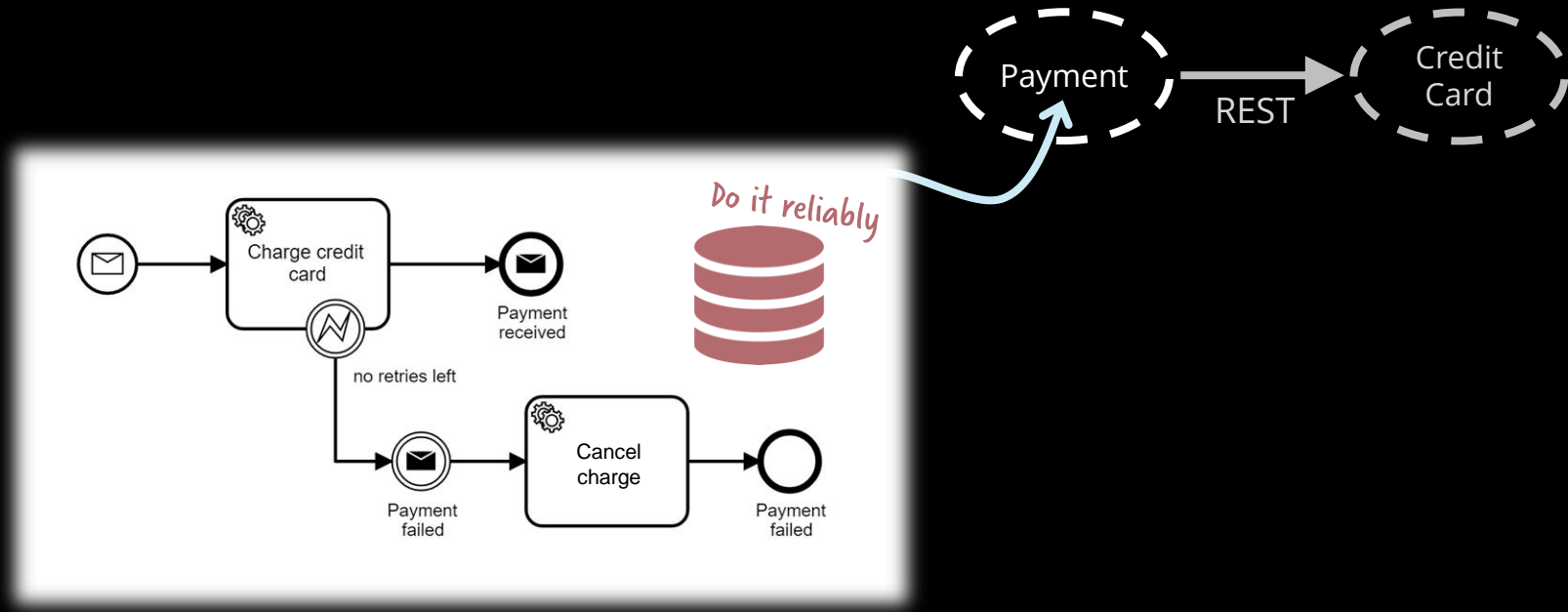
Independant of
communication style!



Distributed systems introduce complexity you have to tackle!



Distributed systems introduce complexity you have to tackle!

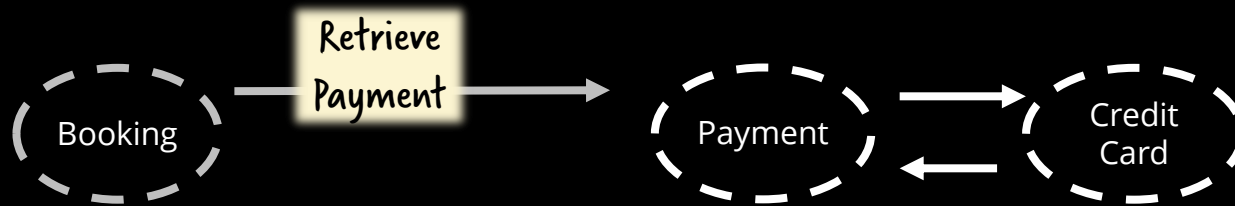


Being able to implement
long running services
is essential for smart APIs
(on a technical level)

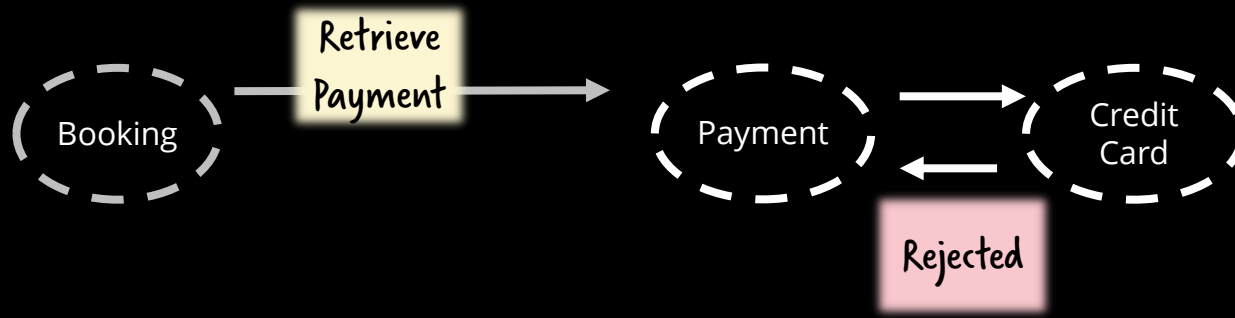
Example



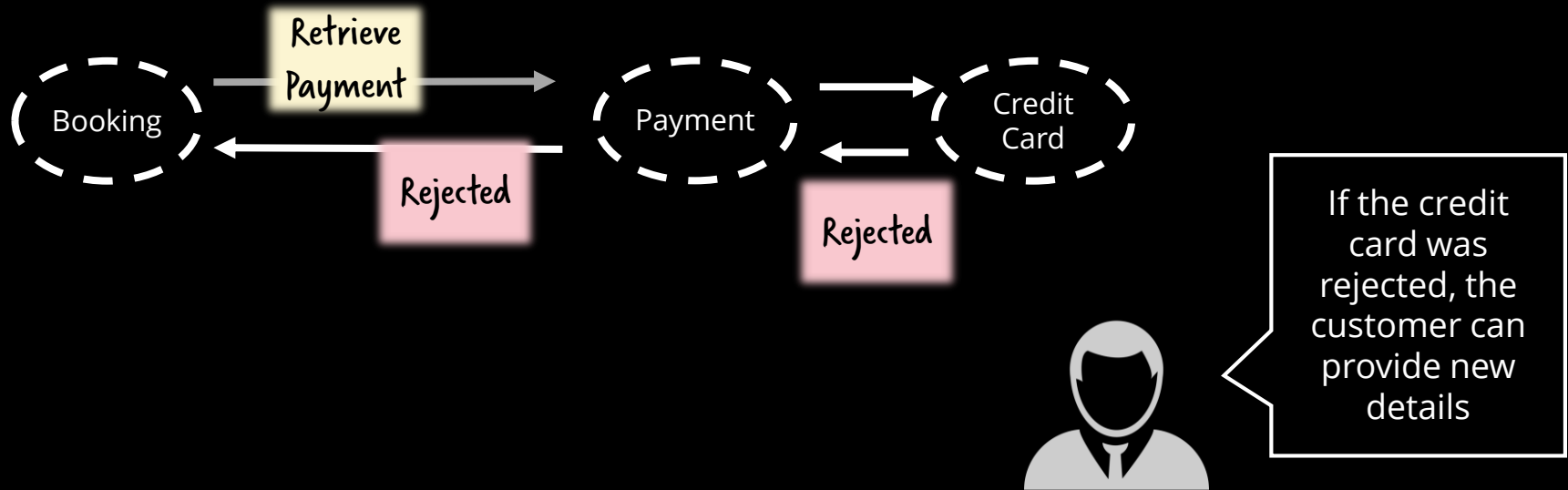
Example



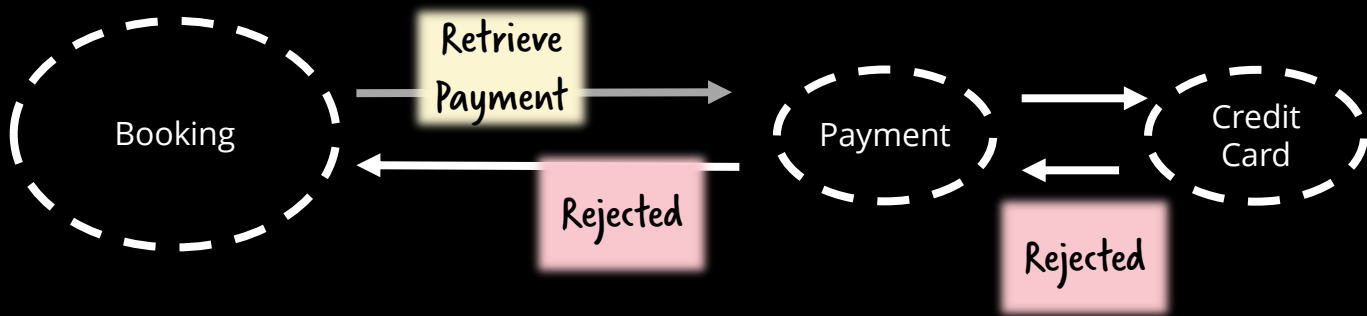
Example



Example



Example



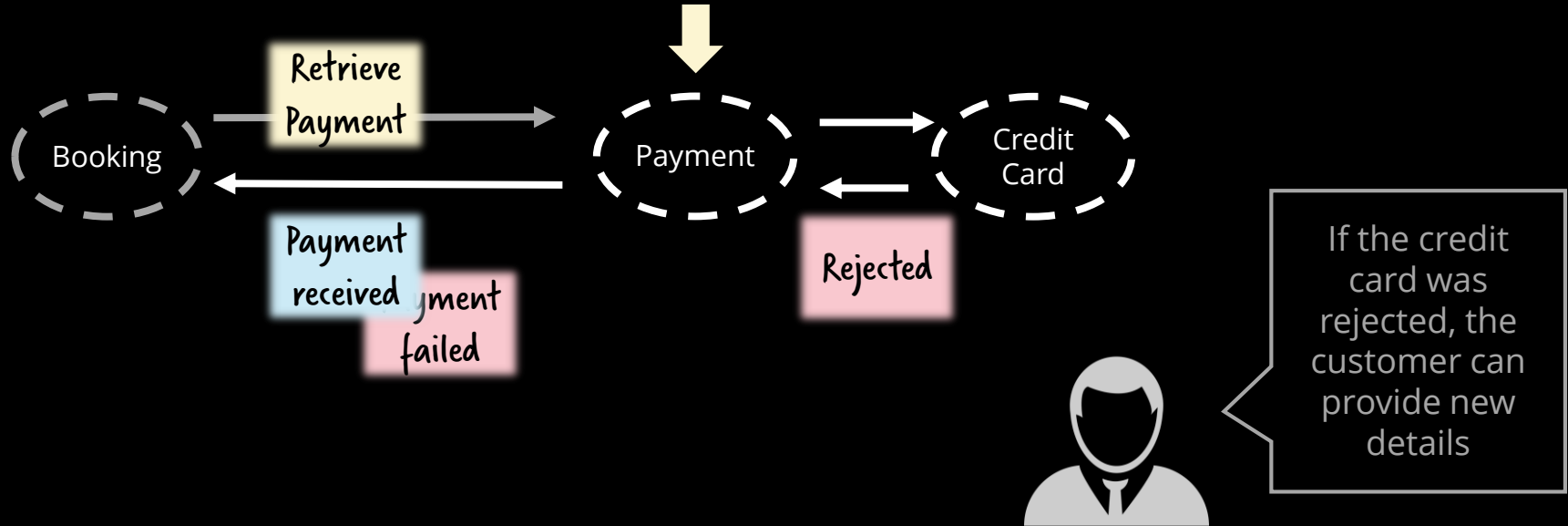
Sam Newmann

A few smart god services tell anemic CRUD services what to do

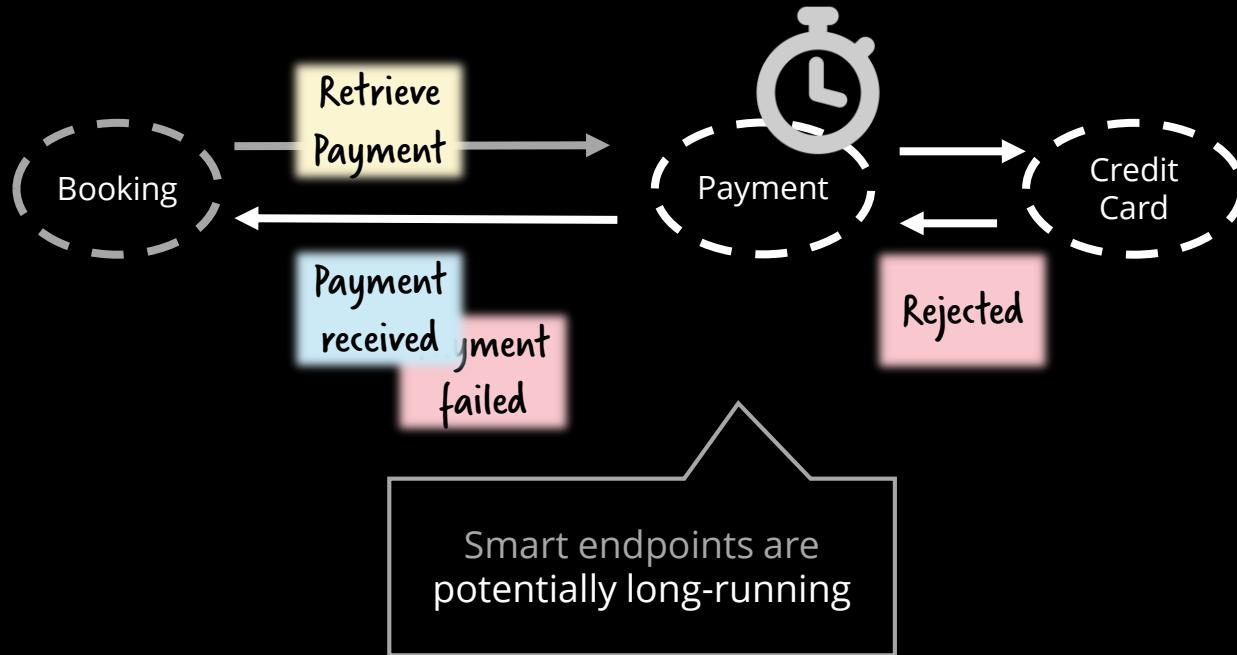


If the credit card was rejected, the customer can provide new details

Who is responsible to deal with problems?



Long running services



Being able to implement
long running services
is essential for smart APIs
(on a business level)

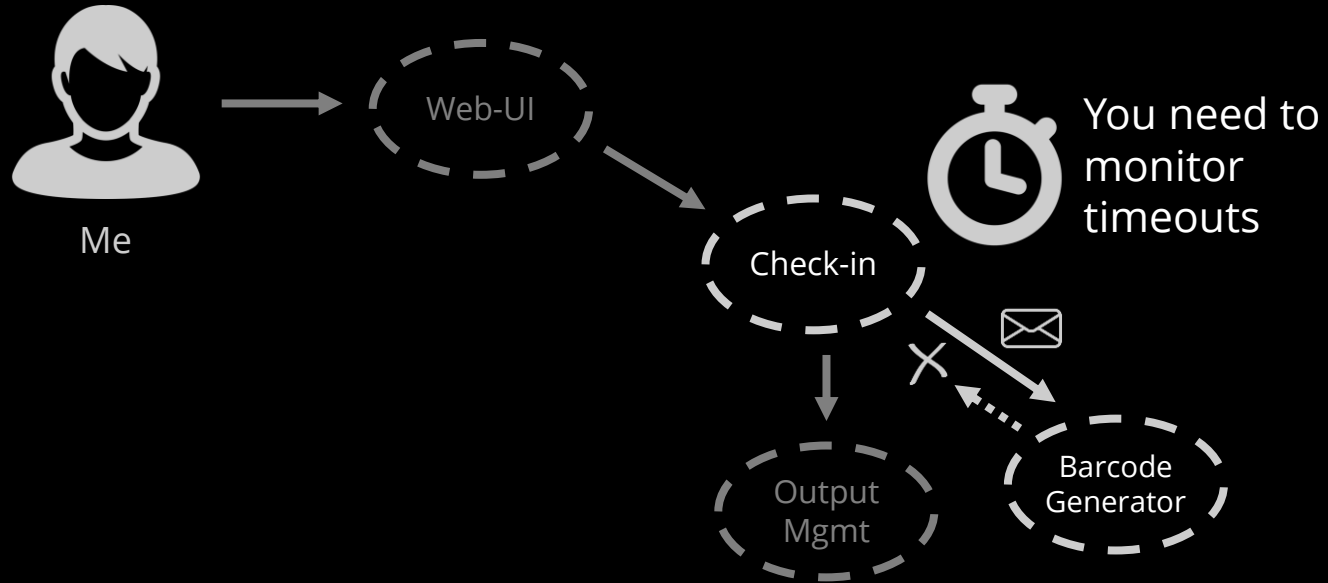
Long running services
require async communication

Synchronous communication

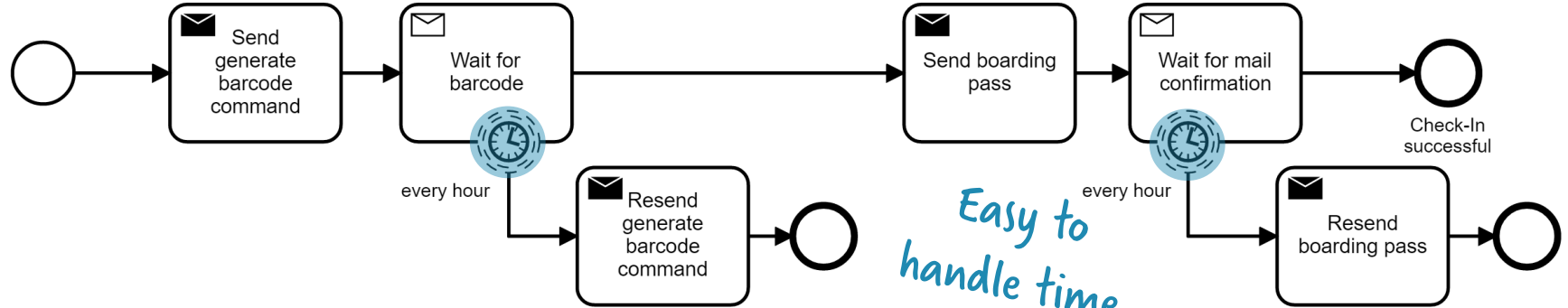
Synchronous communication
is the crystal meth of
distributed programming

Todd Montgomery and Martin Thompson
in "How did we end up here" at GoTo Chicago 2015

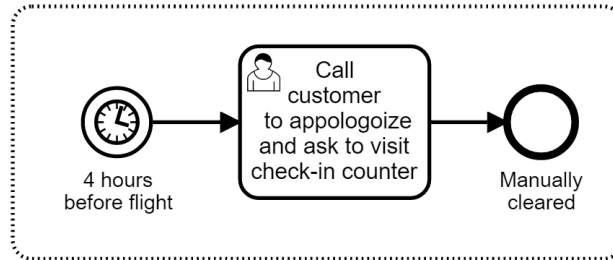
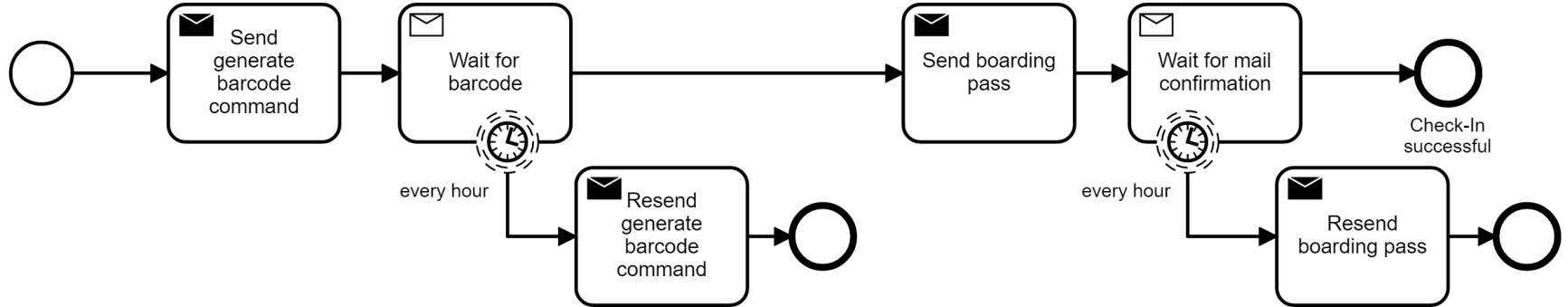
Asynchronous communication



Workflow...



Workflow...



Being able to implement
long running services
makes it easy to get async

Can your company
leverage your
hipster architecture?

You need to
change **business**
processes and
customer
experience!



Example

[Home](#) | [Contact](#) | [FAQs](#) | [A A](#)

Search

Select

Ticket & reservation

Payment

Check & book

Confirmation

My Bahn

Ticket and reservation

How would you like to receive your ticket?

☒

Digital ticket
 Save it as a PDF or load it in the DB Navigator app

☐

Order and receive ticket by post
 5,90 EUR
 Postage

Please note:

* Only valid for the passenger stated (and accompanying passengers if applicable). Not transferable. You must present your ID to the ticket inspector on the train.

You aren't travelling?

☐

Ticket for another person
 You have to login for this service

Our tip: reserve a seat now.

☐

Reservation of 1 seat

4,50 EUR

Back

Proceed

Your journey

Outward journey Mo, 09.09.2019
 15:37 Berlin Hbf (Ibf)
 20:42 München Hbf

Prices

Ticket, 2. class 75,90
 1 Adult

City-Ticket incl.
 Outward journey

Total 75,90 EUR

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Die Bahn DB

Bitte auf A4 ausdrucken

OnlineTicket

Fahrkarte ICE
 Gültigkeit: 06.11.2005 - 07.11.2005
Normalpreis (Einfache Fahrt)
 Klasse: 2
 Erw.: 1, mit 1 BICD0 Kinder: 0
 von: Köln
 nach: Ulm
 über: VIA (ICE/K* LMP UL)
 Hinfahrt: mit ICE
 Umtausch-Erstellung ab dem 1. Geltungstag: 15 Euro.

Zahlungspositionen und Preis

Kreditkartenzahlung	Positionen	1	EUR	47,00
Betrag	Fahrtkarten-Hinfahrt			
Datum	04.11.2005	Summe	EUR	47,00
Transaktions-Nr.	123456	Entgeltsteuer MwSt. (21) 10%	EUR	6,49
Vu-Nr.	081199123			
Gu-Nr.	012345			

Hinfahrt:
 Zertifikat: GBCD 1234 WXYZ 1
 Zertifikat kurz: GEF1 0A
 Gültig ab: 06.11.2005
 Zertifikatsdruck

Ihre Kreditkarte wurde mit dem oben genannten Betrag belastet. Die Buchung Ihres Online-Tickets erfolgt am 04.11.2005. DB Fernverkehr AG (DB Fernverkehr AG), Stephanstr. 1, 60326 Frankfurt, Steuernummer: 045 231 28042.

Herr Mustermensch
 Ausweis:
 Auftragsnummer: **BahnCard 1234**
 ZAB234

Ihre Reiseverbindung und Reservierung Hinfahrt am 06.11.2005

Stell	Datum	Zeit	Gleis	Reservierung	Fahrt	Zertifikat
Köln Hbf	ab 13:54	0			ICE 519	siehe oben
Ulm Hbf	an 17:05	2				

Hinweise:

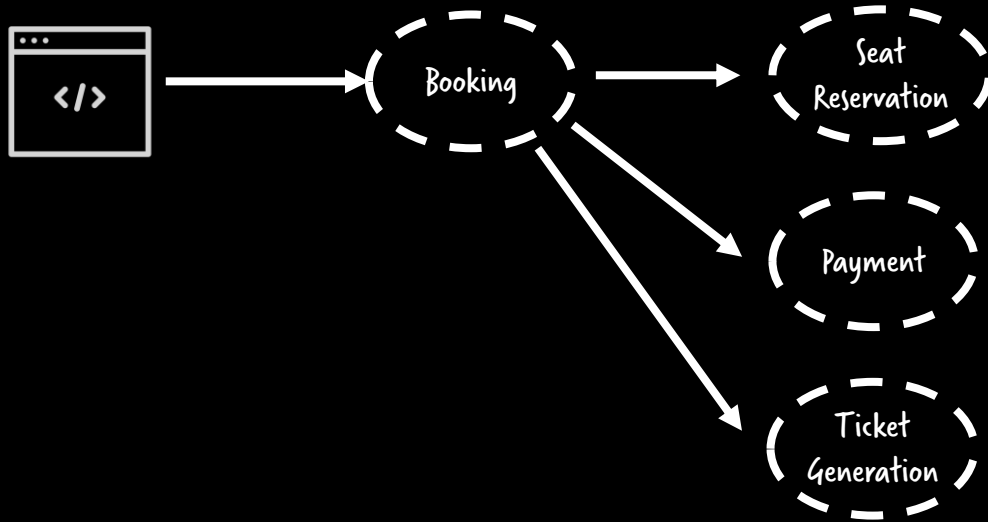
- Die Fahrkarte muss ausgecheckt vorliegen und gilt nur zusammen mit der beim Kauf angegebenen eigenen gültigen Ausweis-ID (BahnCard, Kreditkarte oder EC-Karte (Maestro)).
- Die Kartennummer und bei der Kontrolle zu Prüfziffern in ein Kontrollgerät eingeben.
- Bei Normalpreisen auch in anderen Zügen als in der Reservierung angegeben innerhalb der Geltungsdauer gültig (ggf. Aufpreis für anderen Sitz erforderlich).
- Bei Fragen und Problemen wenden Sie sich bitte an die in Ihrer Auftragsbestätigung angegebenen Servicenummern.
- Keine Einzahlung oder Rücknahme in DB ReiseCentern oder Reisebüros, sondern nur über www.bahn.de oder die Serviceadresse.
- Das Online-Ticket gilt nur für den unter "Fahrkarte" angegebenen Reiseabschnitt. Die Übersicht "Ihre Reiseverbindung" enthält zu Ihrer Information ggf. zusätzliche Teilstücke (z. B. Bus, Train zum Zweck, bei bis vor Ort noch ein Ticket erworben werden muss).
- Wenn Ihr Ticket die City-Option beinhaltet, gilt dieses nur am Anreisetag, der ebenfalls bzw. am Abreisetag der Rückfahrt (Reisekarte wie unter "Ihre Reiseverbindung" angegeben). Die Hinfahrt muss durch Zertifikatsdruck anerkannt sein.
- Die gültigen Bahnbilder-Organisationsregeln der DB AG sowie sonstige Reisebedingungen sind auf den jeweiligen Karten und deren jeweiligen Bedingungen.

Wir danken Ihnen für Ihre Buchung und wünschen Ihnen eine angenehme Reise!

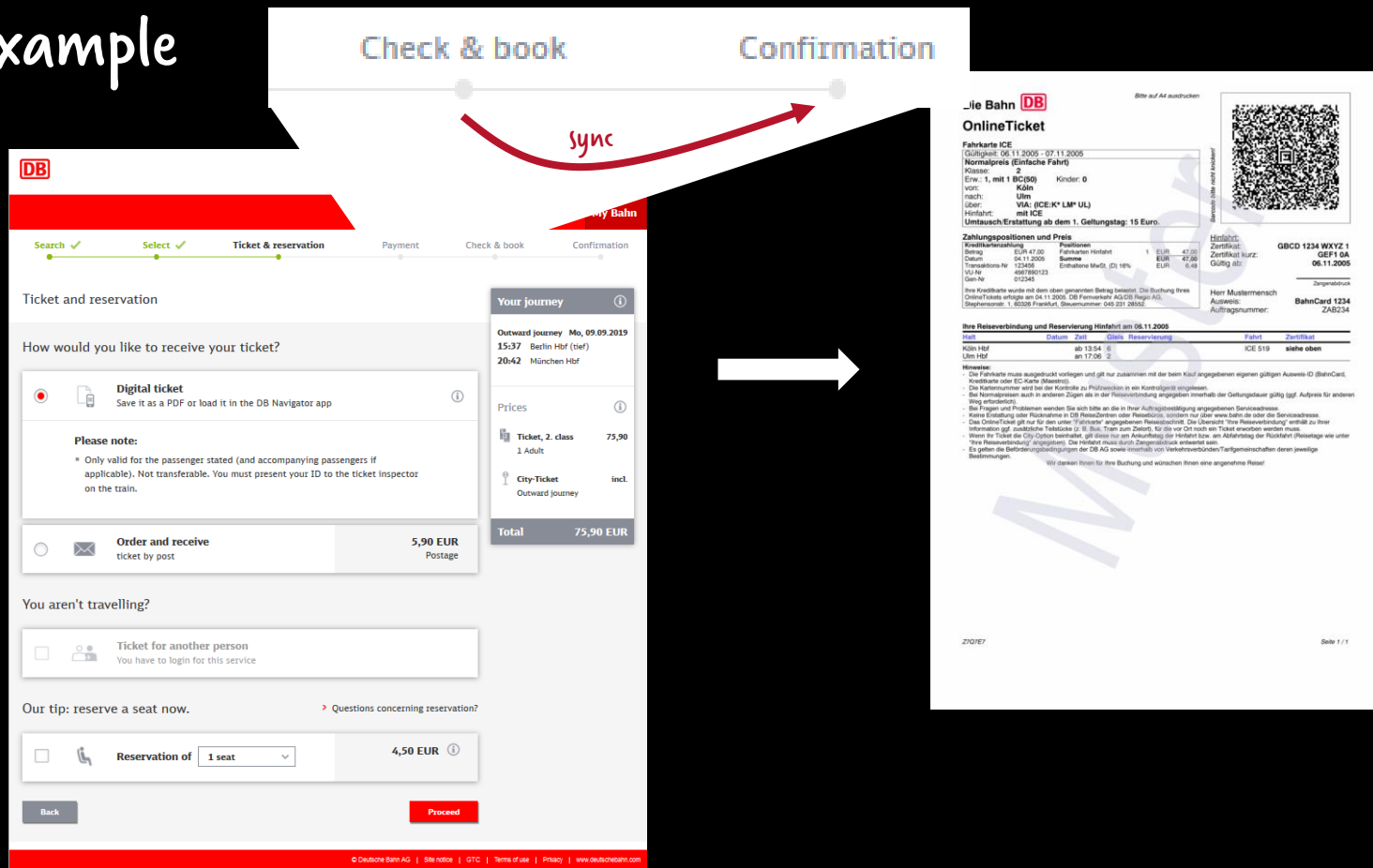
Z101767

Seite 1 / 1


Example



Example



Example


 Home | Contact | FAQs | A A A

My Bahn

Search ✓ Select ✓ Ticket & reservation Payment Check & book Confirmation


Ticket and reservation

How would you like to receive your ticket?

 **Digital ticket**
Save it as a PDF or load it in the DB Navigator app


Please note:

- * Only valid for the passenger stated (and accompanying passengers if applicable). Not transferable. You must present your ID to the ticket inspector on the train.


☐  **Order and receive**
ticket by post

5,90 EUR
Postage

You aren't travelling?

☐  **Ticket for another person**
You have to login for this service

Our tip: reserve a seat now. [Questions concerning reservation?](#)

☐  **Reservation of**

4,50 EUR


Back


Proceed

Your journey

Outward journey Mo, 09.09.2019
15:37 Berlin Hbf (Ibf)
20:42 München Hbf

Prices


 **Ticket, 2. class** 75,90
1 Adult

 **City-Ticket** Incl.
Outward journey

Total 75,90 EUR

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 Startseite | Kontakt | Häufige Fragen | A A A

Meine Bahn Logout

Hinweis

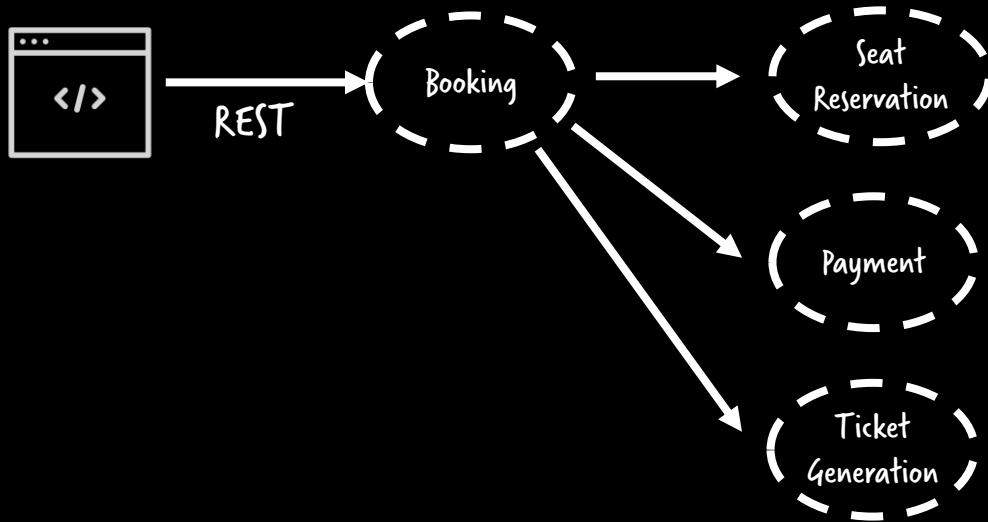
Sehr geehrte Kundin, sehr geehrter Kunde!

Bei der Verarbeitung Ihrer Anforderung ist ein Fehler aufgetreten. Vermutlich haben Sie mehrmals den gleichen Button angeklickt oder eine Funktion aus zwei Fenstern heraus doppelt aufgerufen. Bitte beachten Sie, daß Sie unsere Seiten nur aus einem einzelnen Browser-Fenster heraus bedienen sollten. Wir entschuldigen uns für die Unannehmlichkeiten.

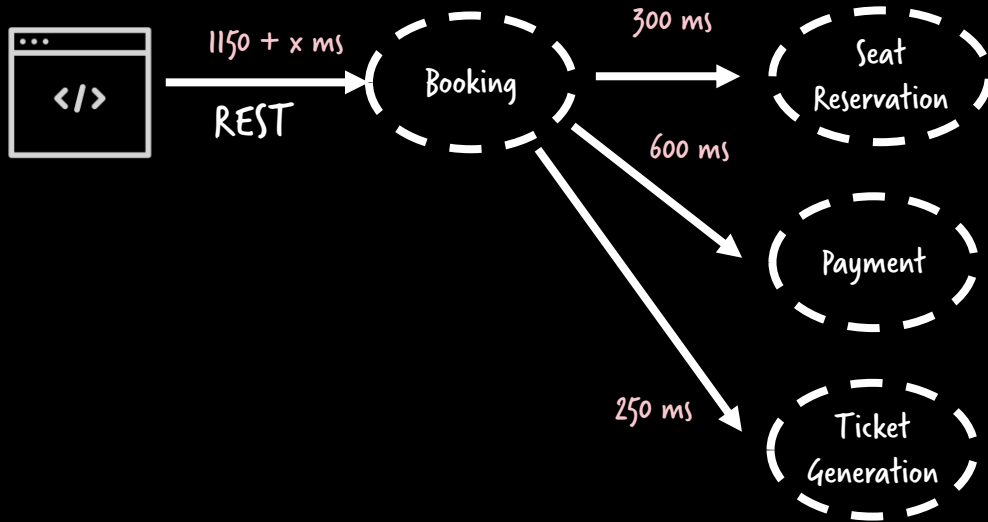
Deutsche Bahn AG

Weiter

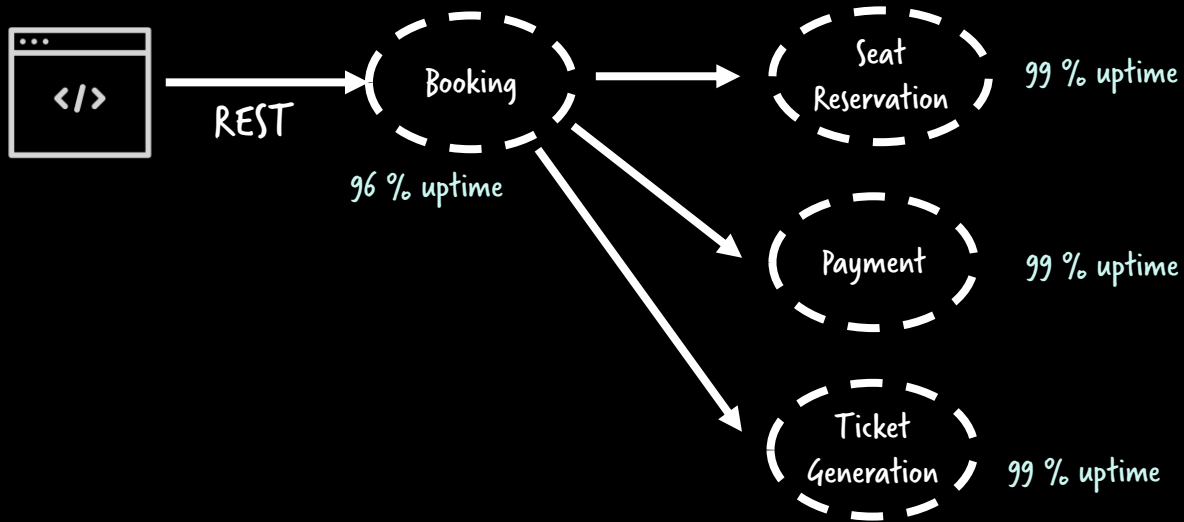
Weaknesses



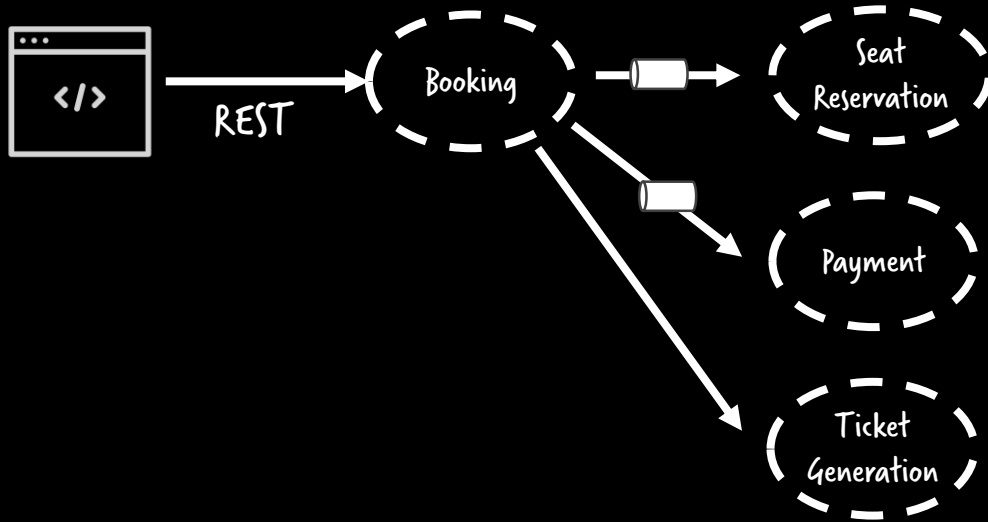
Weaknesses: Latency creep



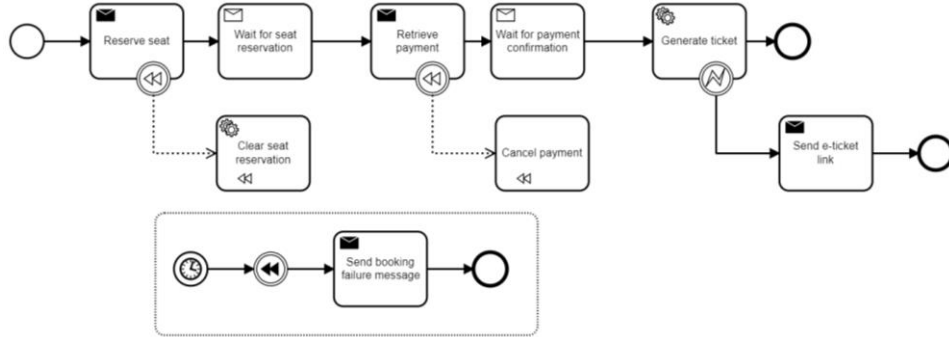
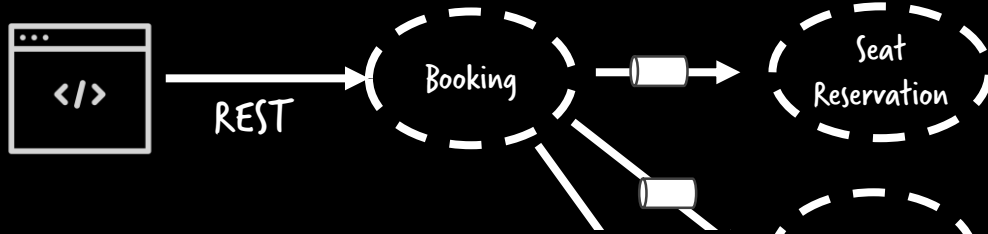
Weaknesses: Availability erosion



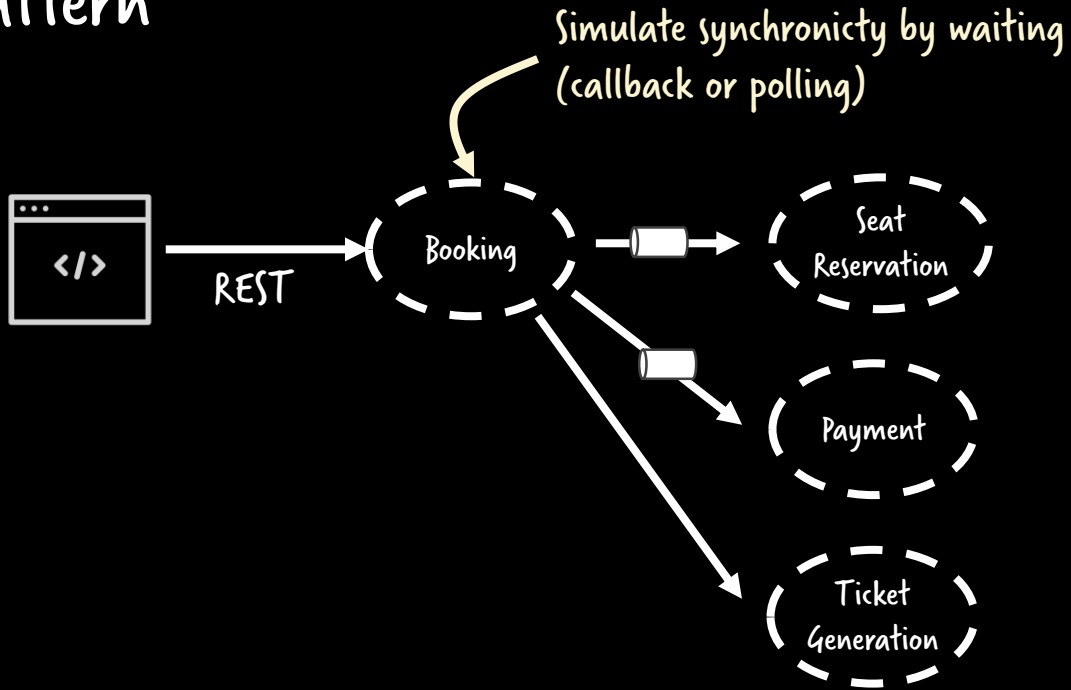
And it is even hard to implement



And it is even hard to implement



Typical pattern



Redesign your business process accordingly!

The screenshot shows the DB website's 'Ticket & reservation' process. The top navigation bar includes 'Home | Contact | FAQs | A A A' and a 'My Bahn' button. Below the navigation bar, a progress bar shows the steps: Search ✓, Select ✓, Ticket & reservation (current step), Payment, Check & book, and Confirmation. The main content area is titled 'Ticket and reservation' and asks 'How would you like to receive your ticket?'. There are two main options: 'Digital ticket' (selected) and 'Order and receive ticket by post'. The 'Digital ticket' option includes a 'Please note' section with a disclaimer and a 'Proceed' button. The 'Order and receive ticket by post' option includes a 'Postage' fee of 5,90 EUR. Below this, there is a section for 'You aren't travelling?' with a checkbox for 'Ticket for another person'. At the bottom, there is a section for 'Our tip: reserve a seat now.' with a checkbox for 'Reservation of 1 seat' and a 'Proceed' button. The footer contains copyright information for Deutsche Bahn AG.

happy
case



failure
case



Sync in happy case

or some interface
to poll for status

Async response

Redesign your business process accordingly!


DB Home | Contact | FAQs | A A A

My Bahn

Search ✓ Select ✓ Ticket & reservation Payment Check & book Confirmation


Ticket and reservation

How would you like to receive your ticket?


☒  **Digital ticket**
Save it as a PDF or load it in the DB Navigator app

Please note:


- Only valid for the passenger stated (and accompanying passengers if applicable). Not transferable. You must present your ID to the ticket inspector on the train.

☐  **Order and receive ticket by post** **5,90 EUR**
Postage

You aren't travelling?

☐  **Ticket for another person**
You have to login for this service

Our tip: reserve a seat now. [Questions concerning reservation?](#)

☐  **Reservation of** **4,50 EUR**

Your journey

Outward journey Mo, 09.09.2019
15:37 Berlin Hbf (Ibf)
20:42 München Hbf

Prices

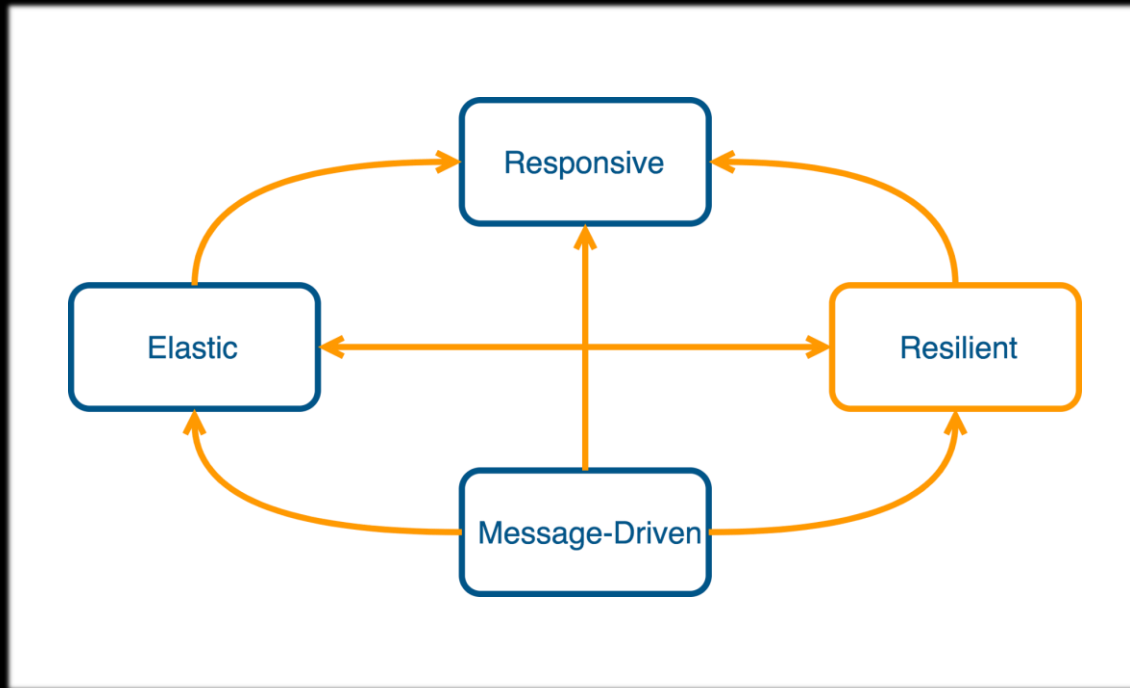
Ticket, 2. class 75,90
1 Adult
City-Ticket Incl.
Outward journey

Total 75,90 EUR

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Your business processes need to be more reactive!

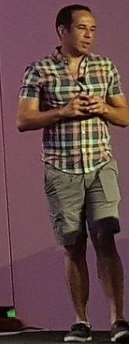


<https://www.reactivemanifesto.org/>

Yeah!
Let's go reactive.



We were suffering from
Pinball machine Architecture



„What the hell just happened?“



API

API

API

Microservices

API

Standard Software

API

API

External Services

API

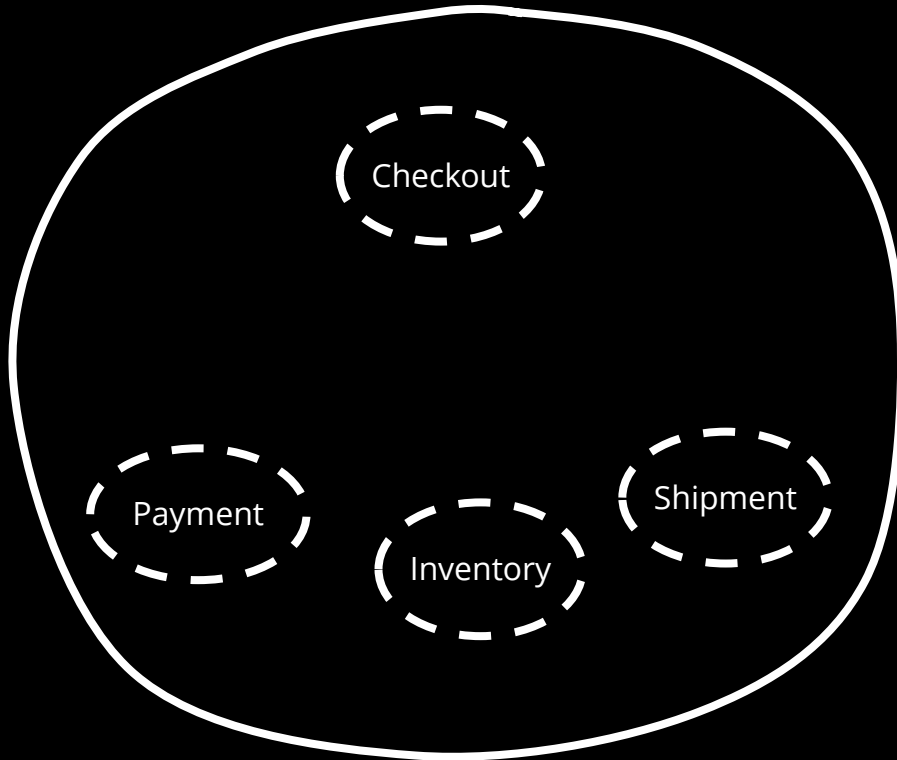
Example:
order fulfillment via
dash button



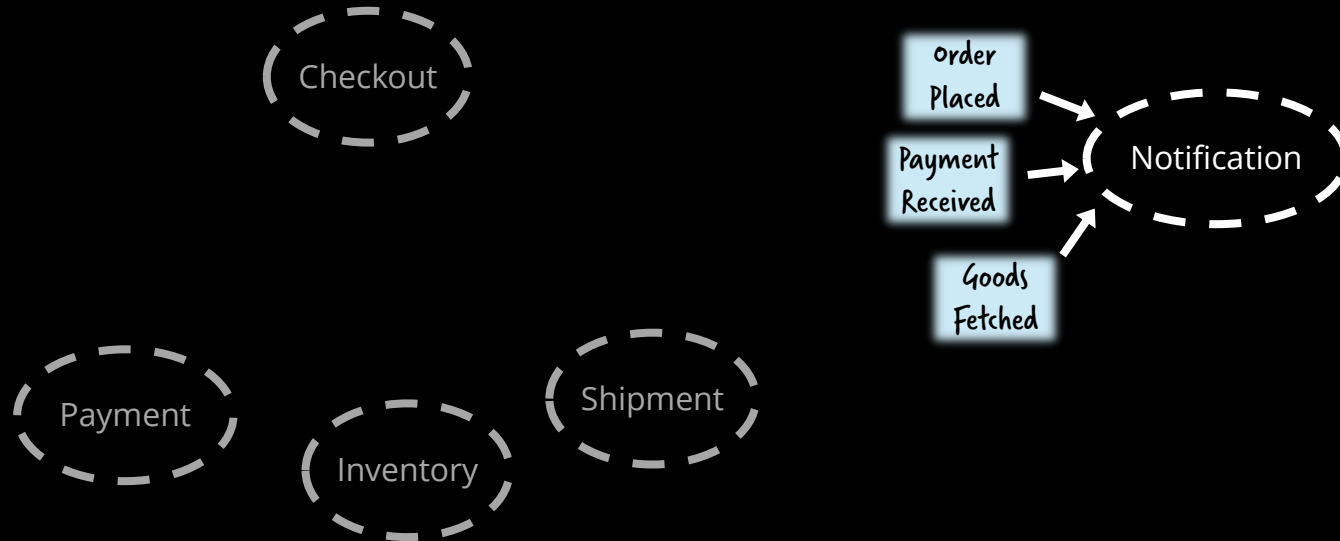
Three steps...



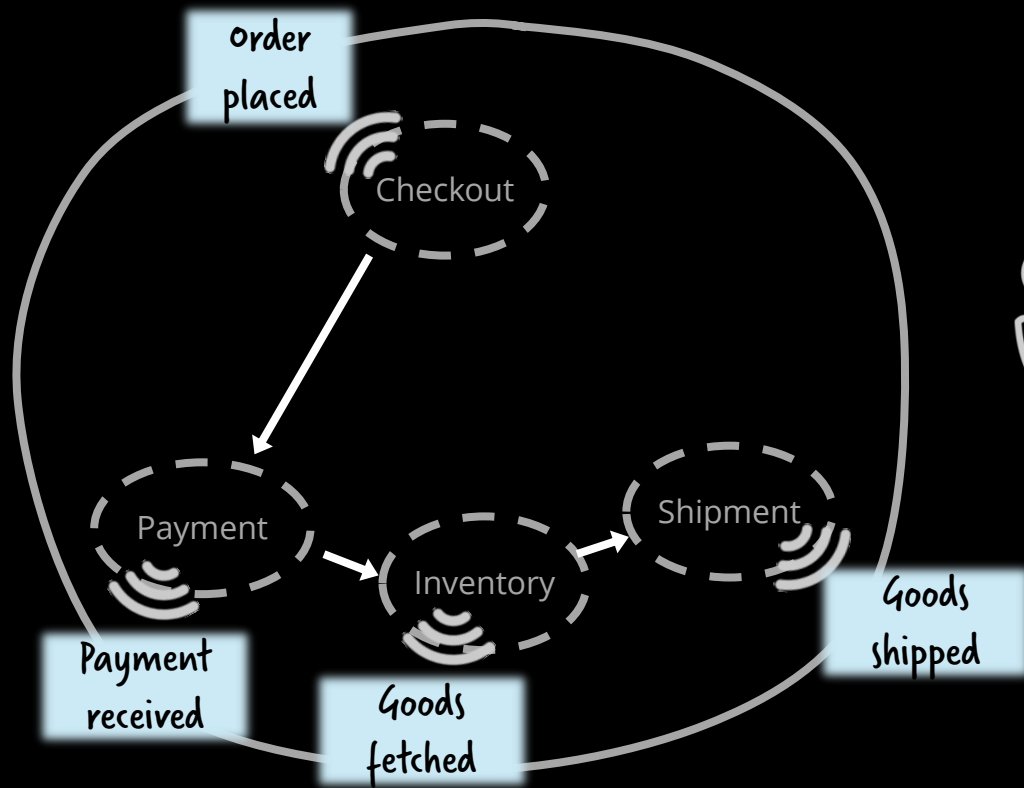
(Micro-)services



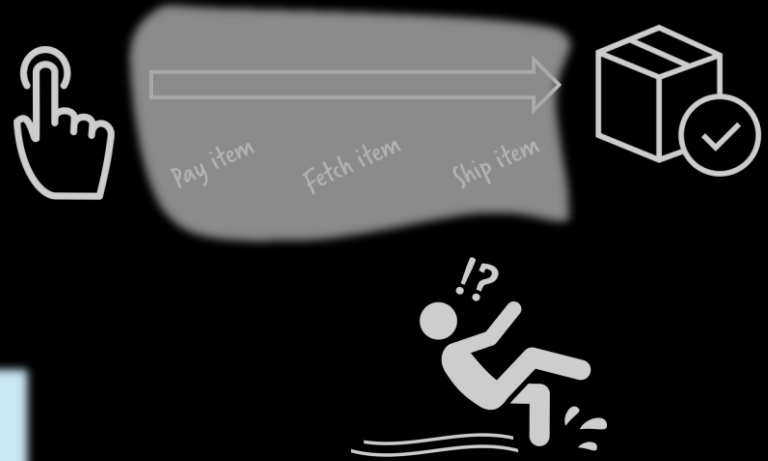
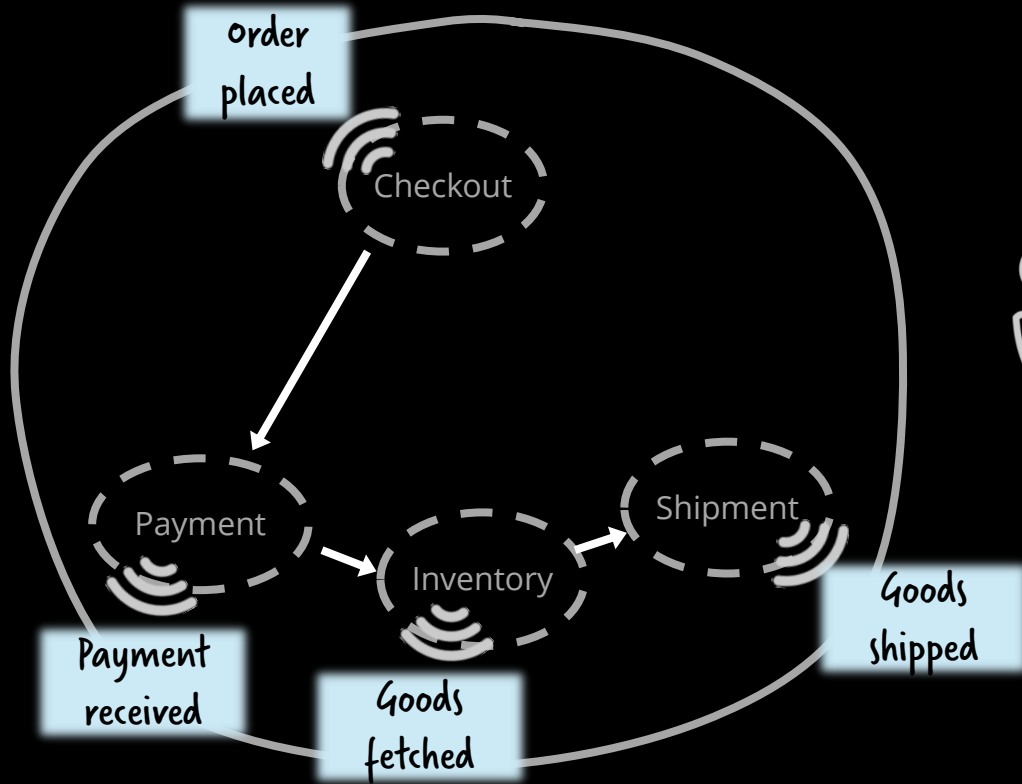
Event-driven architecture



Peer-to-peer event chains



Peer-to-peer event chains





The danger is that it's very easy to make nicely decoupled systems with event notification, without realizing that you're losing sight of that larger-scale flow, and thus set yourself up for trouble in future years.

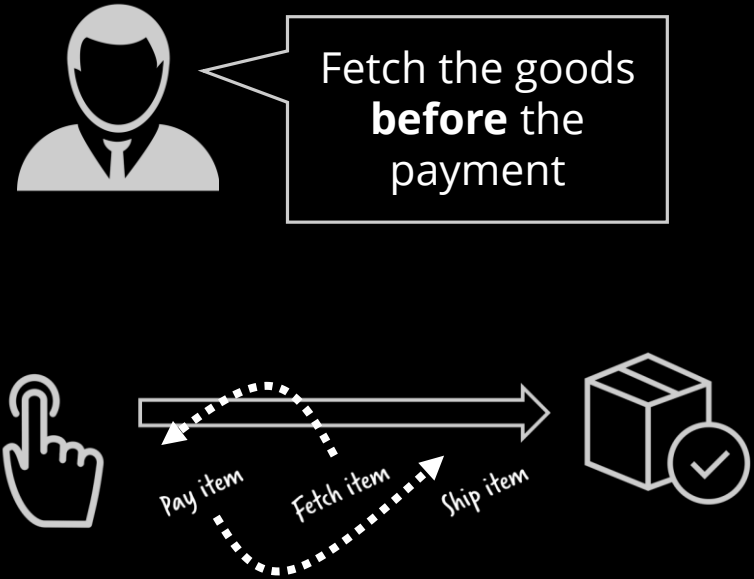
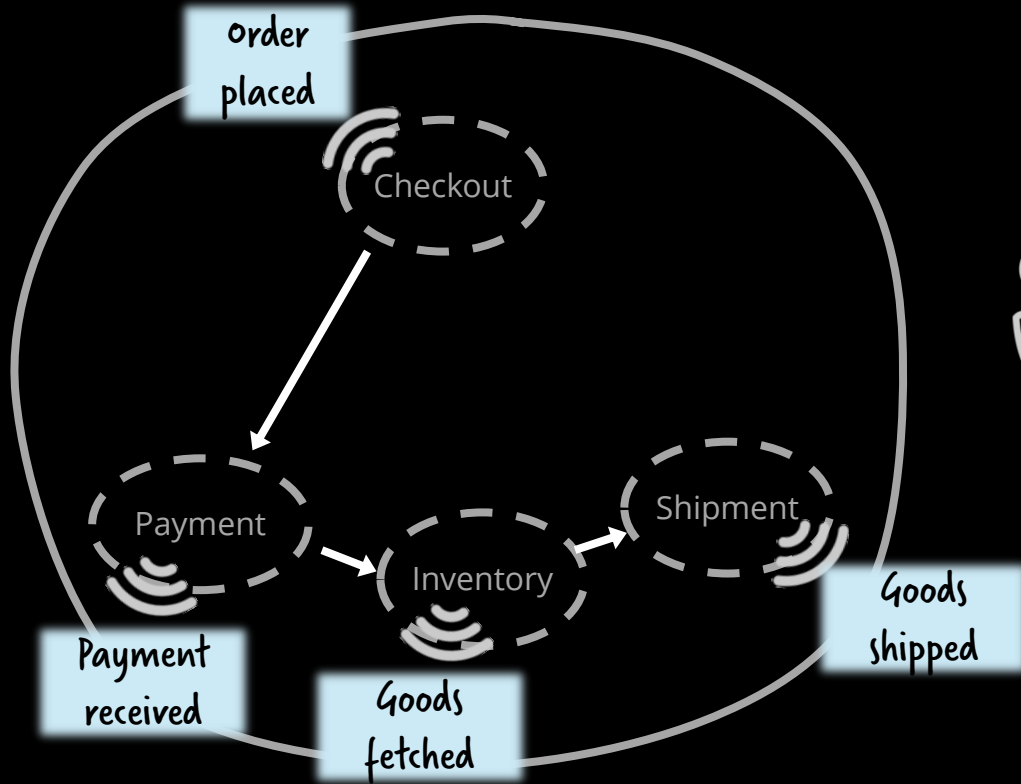


The danger is that it's very easy to make nicely decoupled systems with event notification, without realizing that you're losing sight of that larger-scale flow, and thus set yourself up for trouble in future years.

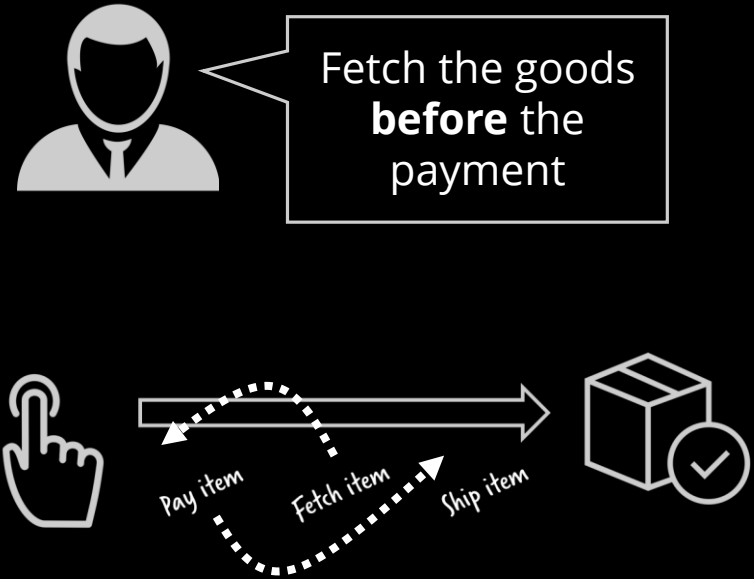
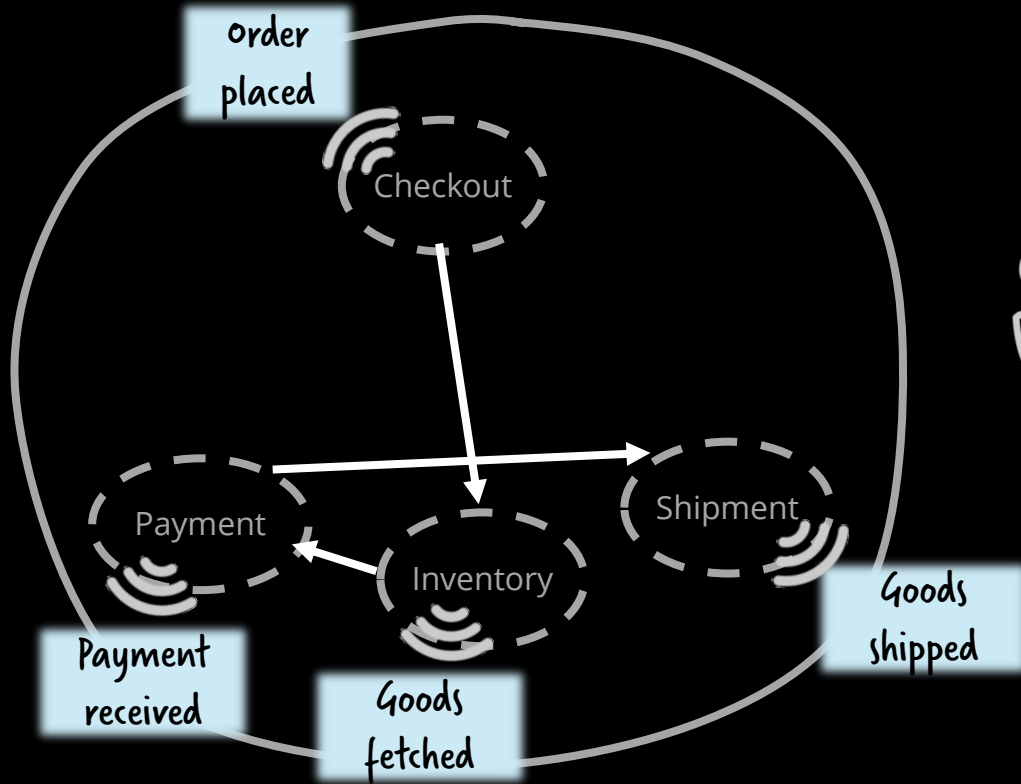


The danger is that it's very easy to make nicely decoupled systems with event notification, without realizing that you're losing sight of that larger-scale flow, and thus set yourself up for trouble in future years.

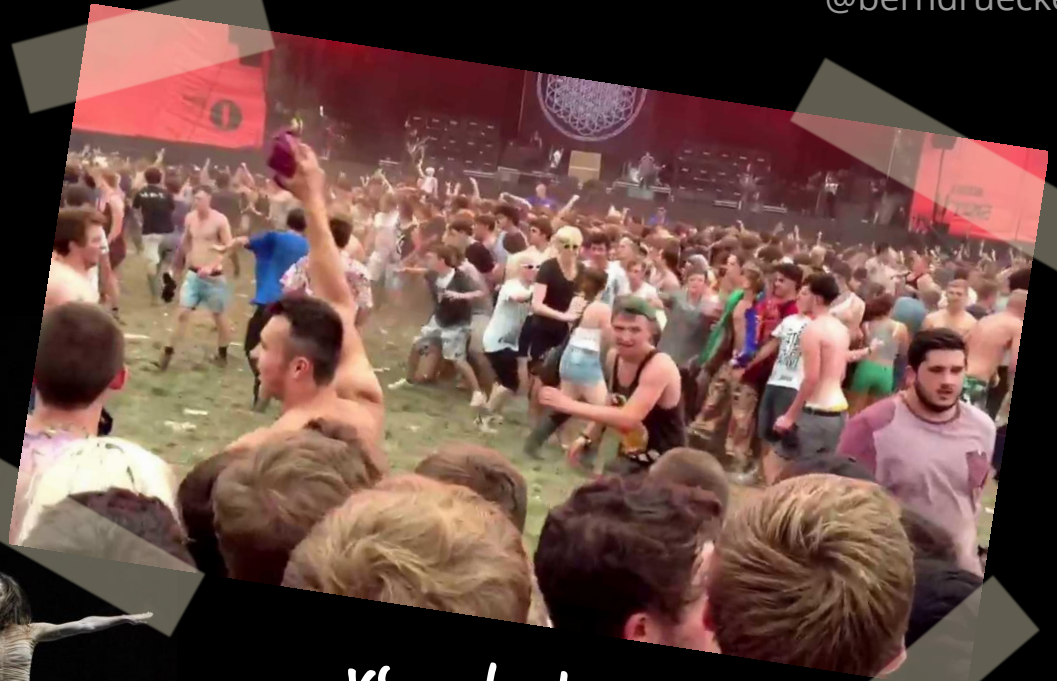
Peer-to-peer event chains



Peer-to-peer event chains

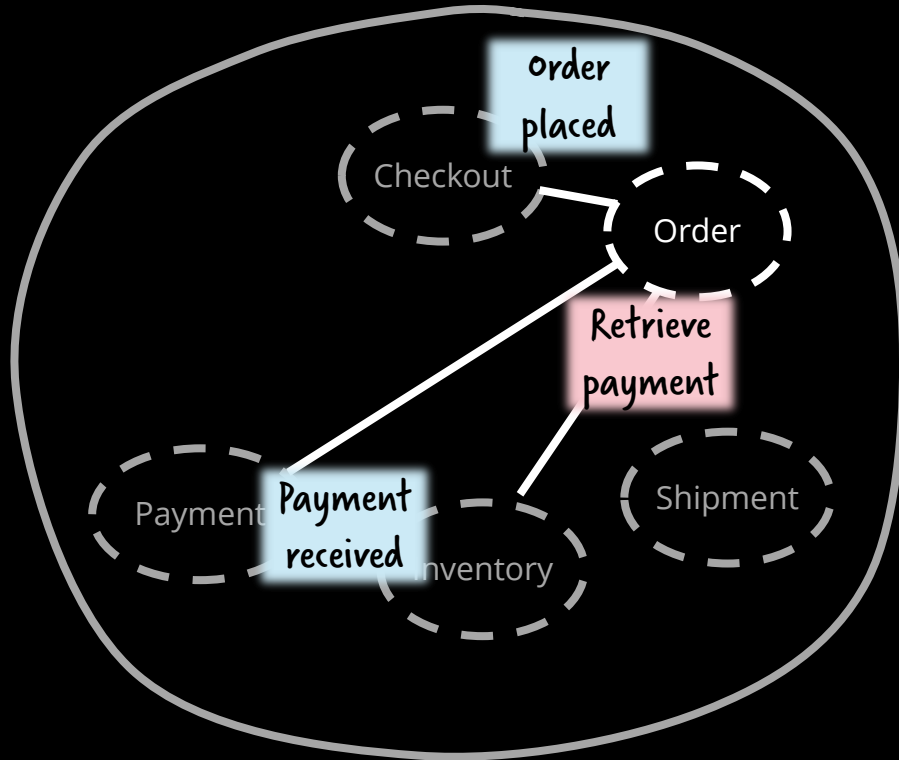


What we wanted

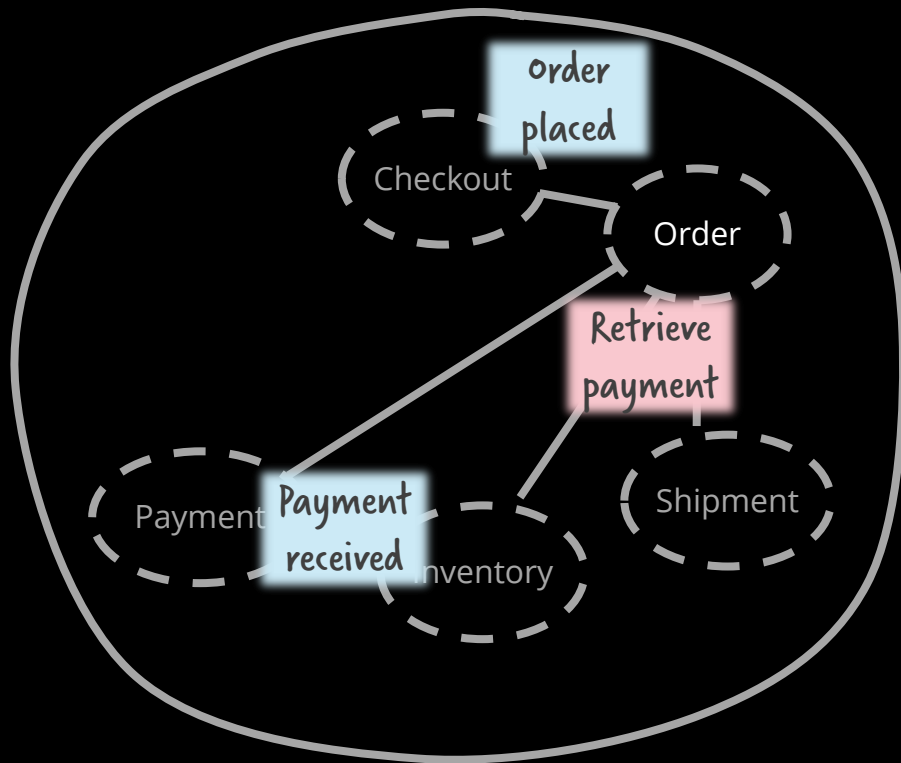


vs. what we got

Extract the end-to-end responsibility



Events & Commands



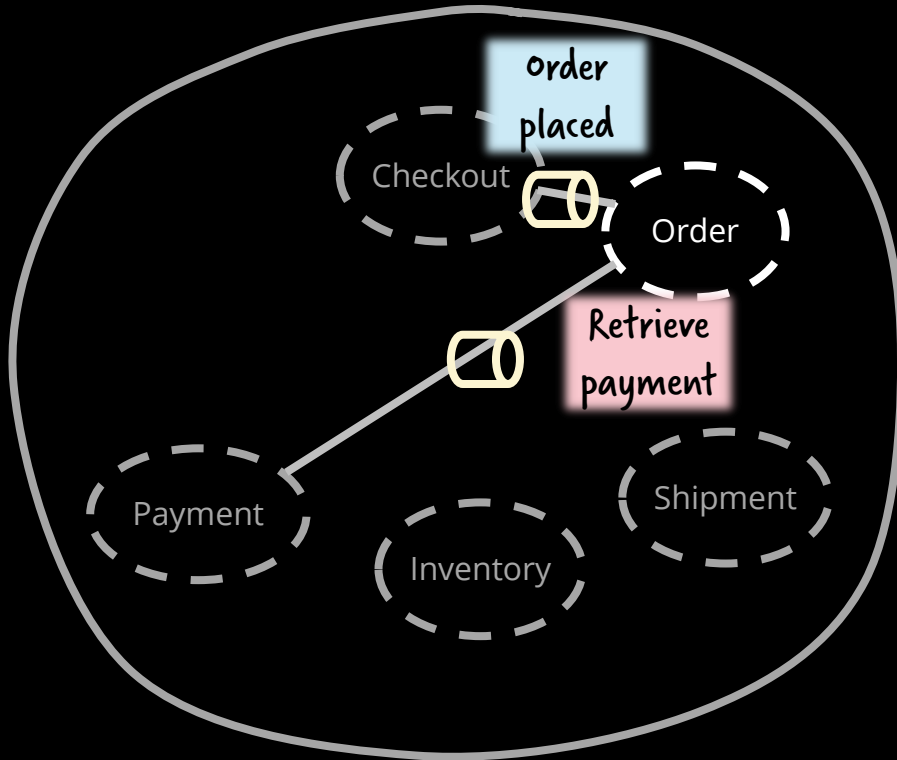
Event

Fact,
happened in the past,
immutable

Command

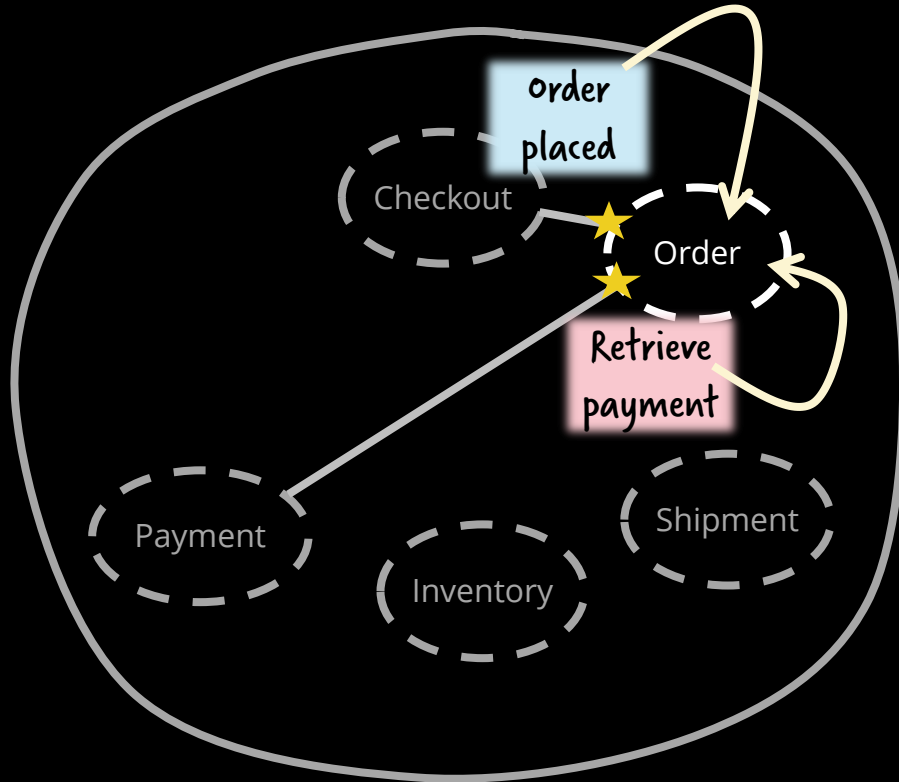
Intend,
Want s.th. to happen

It is not about the protocol!



It can still be messaging!

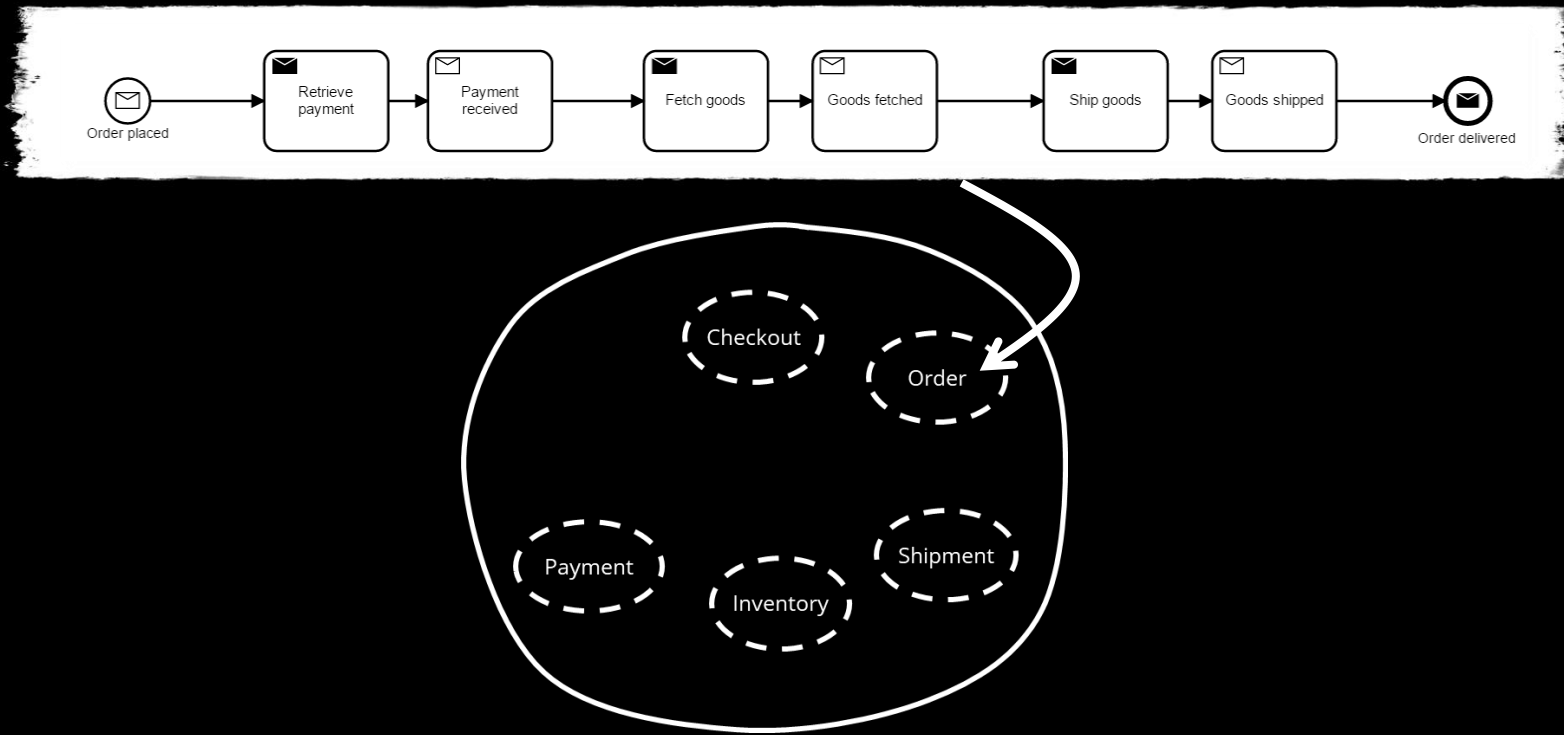
It is about where to decide about the coupling!



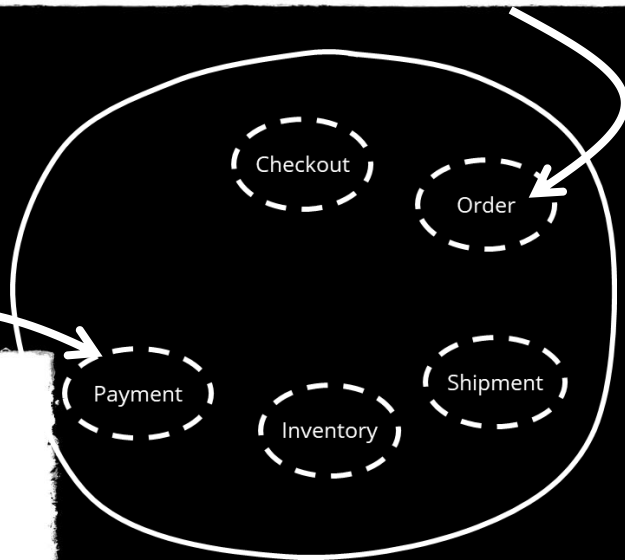
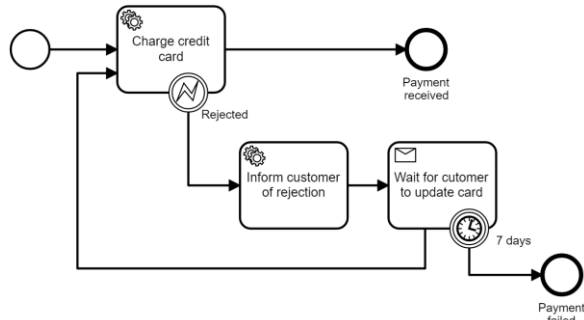
order decides

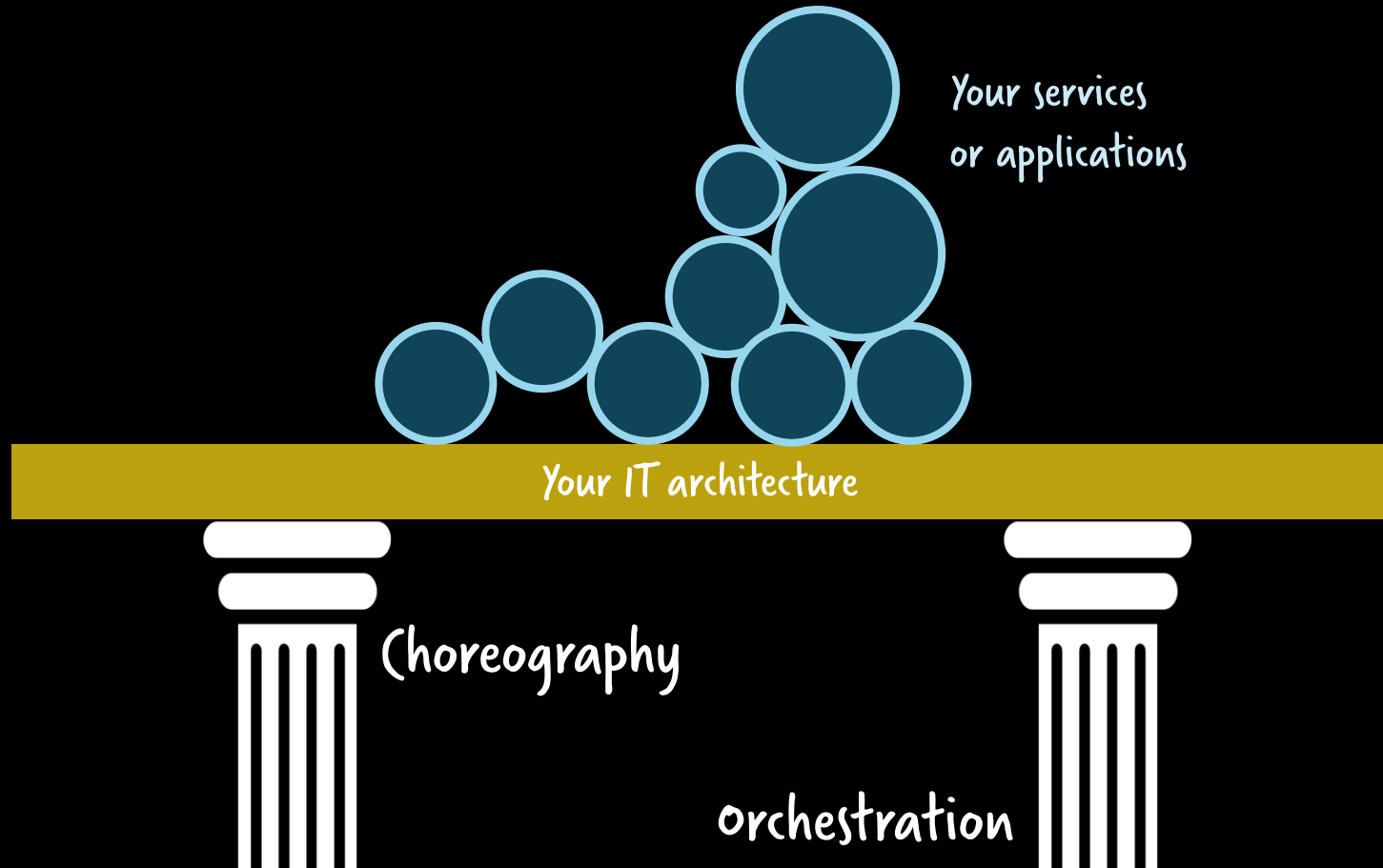
- . to listen to the event
- . to issue the command

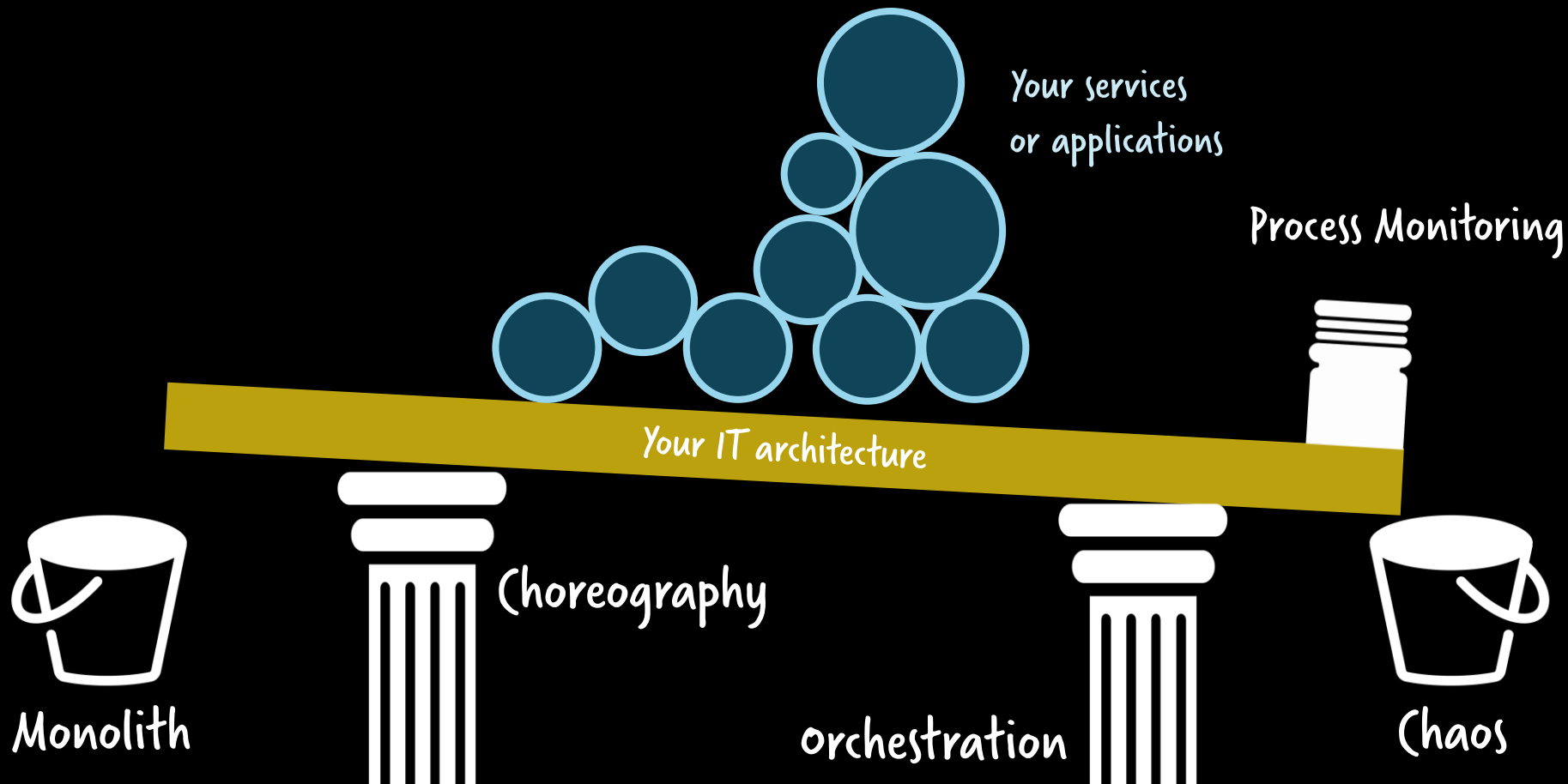
Extract orchestration logic



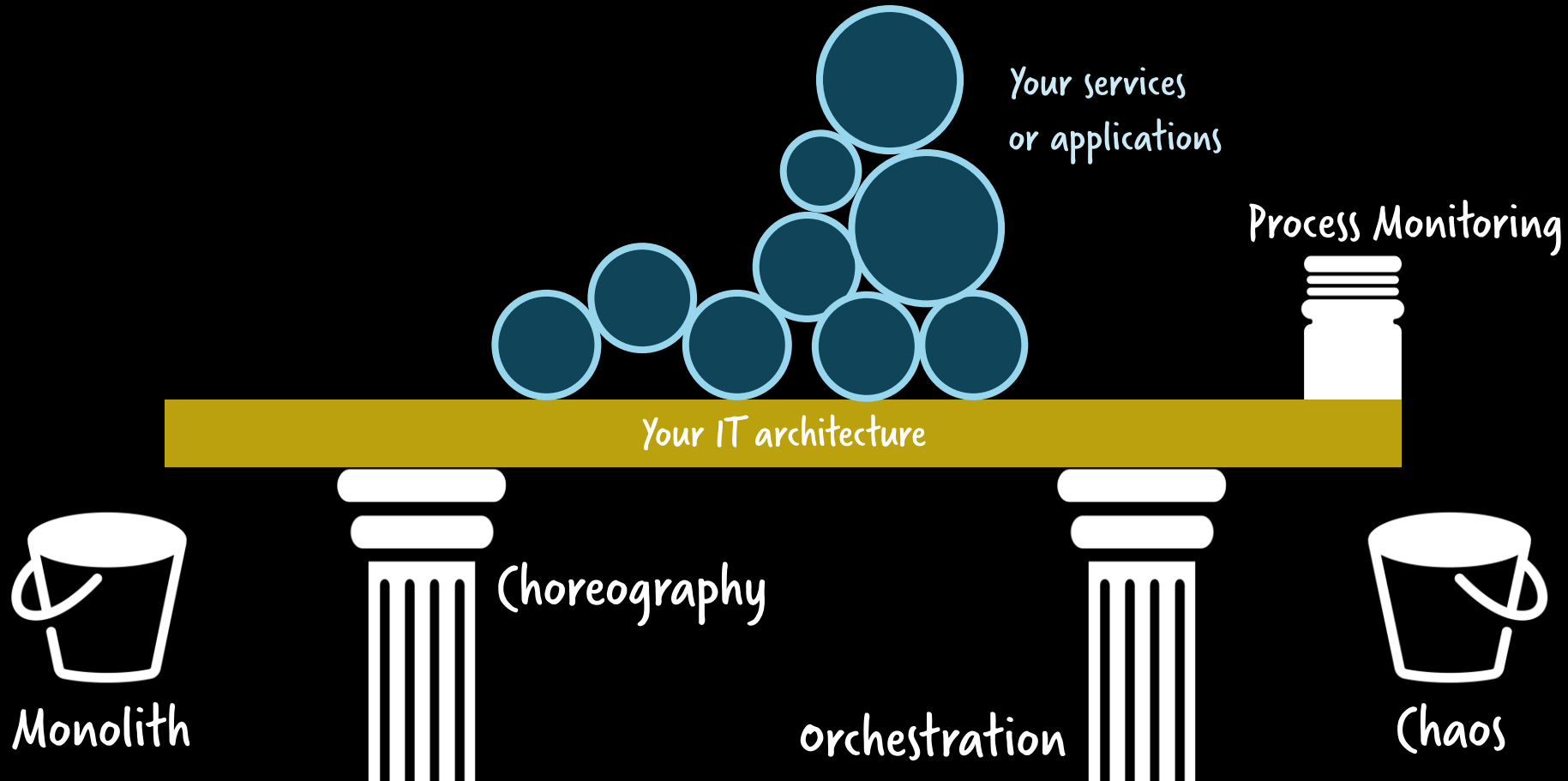
Workflows live inside service boundaries







Balance choreography and orchestration



- . Distributed systems are complex. At-least-once, retries and idempotency are here to stay. Embrace async!
- . Long-running services make your life easier and your API smarter.
- . Change business processes and customer experience accordingly
- . Use commands + events = balance choreography and orchestration

Thank you!



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Blog: <https://medium.com/berndruecker>

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