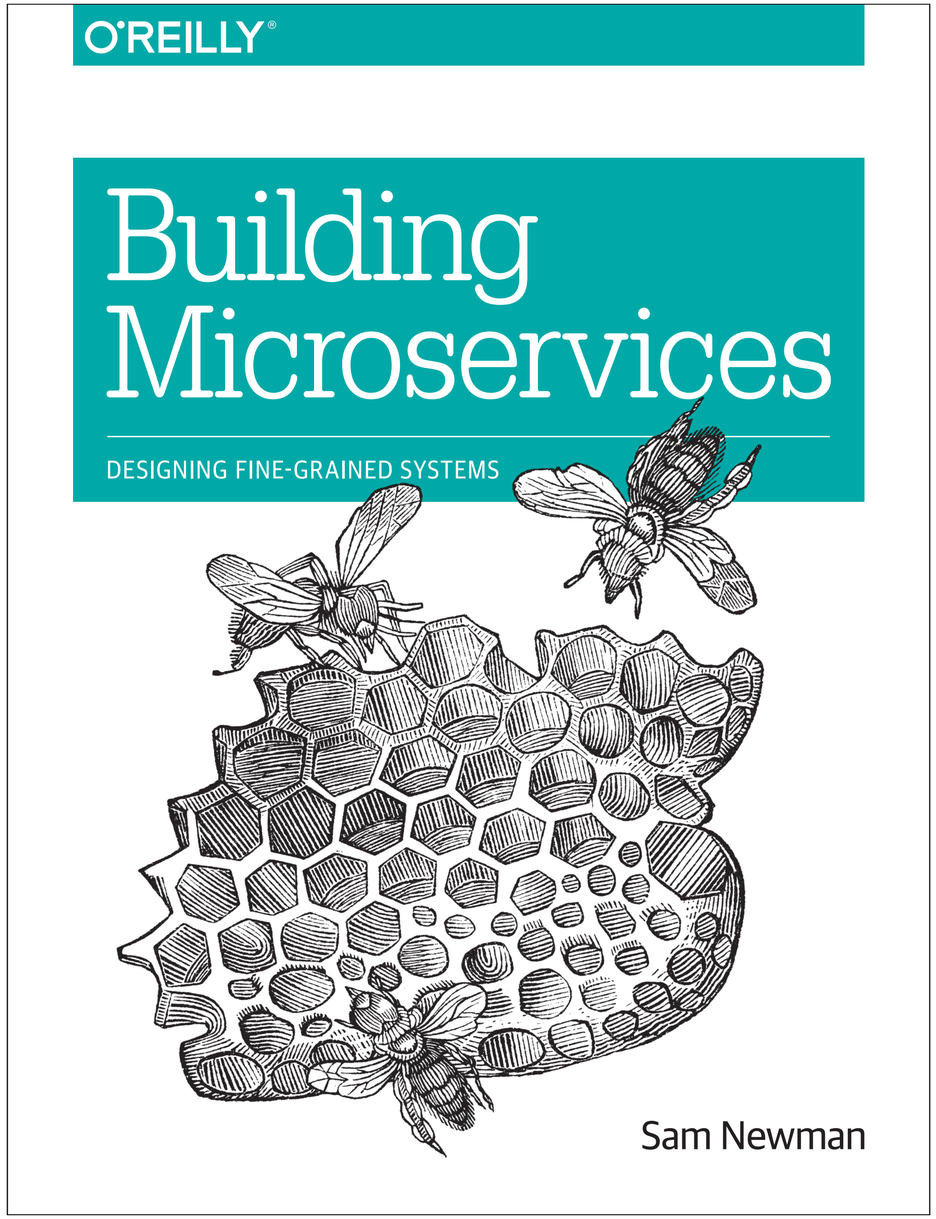
MICROSERVICE DECOMPOSITION PATTERNS

Sam Newman

https://www.flickr.com/photos/spongebabyalwaysfull/8793058944/



Sam Newman
& Associates

NEW BOOK!

Monolith To Microservices.

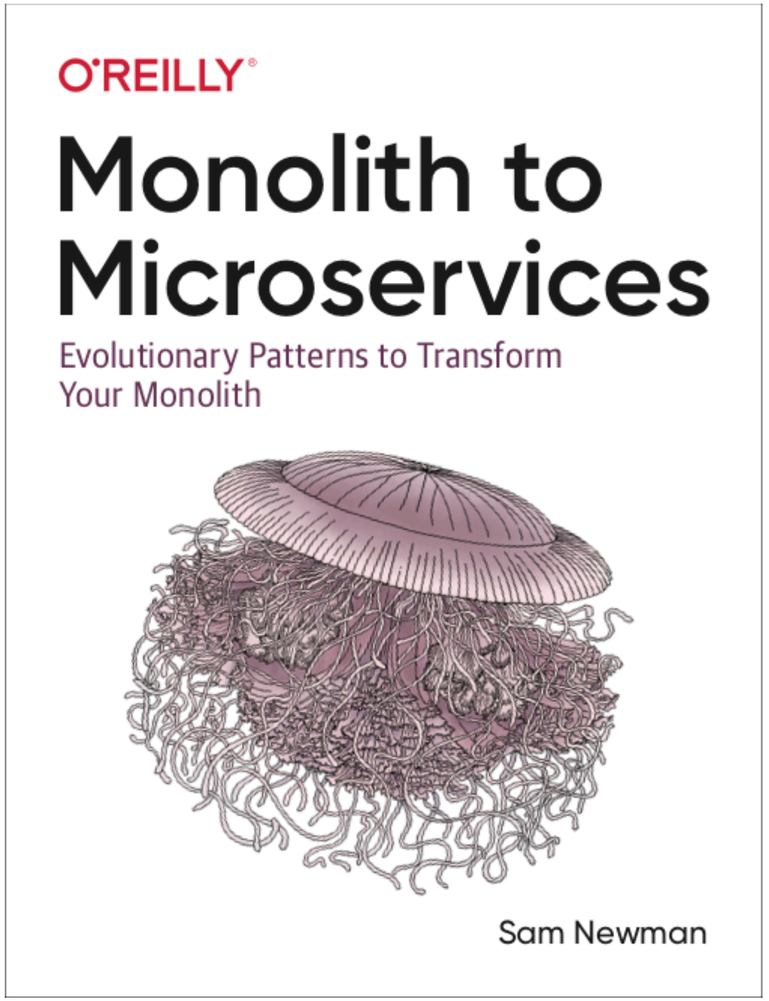
Monolith To Microservices is a forthcoming book on system decomposition from O'Reilly

How do you detangle a monolithic system and migrate it to a microservices architecture? How do you do it while maintaining business-as-usual? As a companion to Building Microservices, this new book details a multiple approaches for helping you transition from existing monolthic systems to microservice architectures. This book is ideal if you're looking to evolve your existing systems, rather than just rewriting everything from scratch.

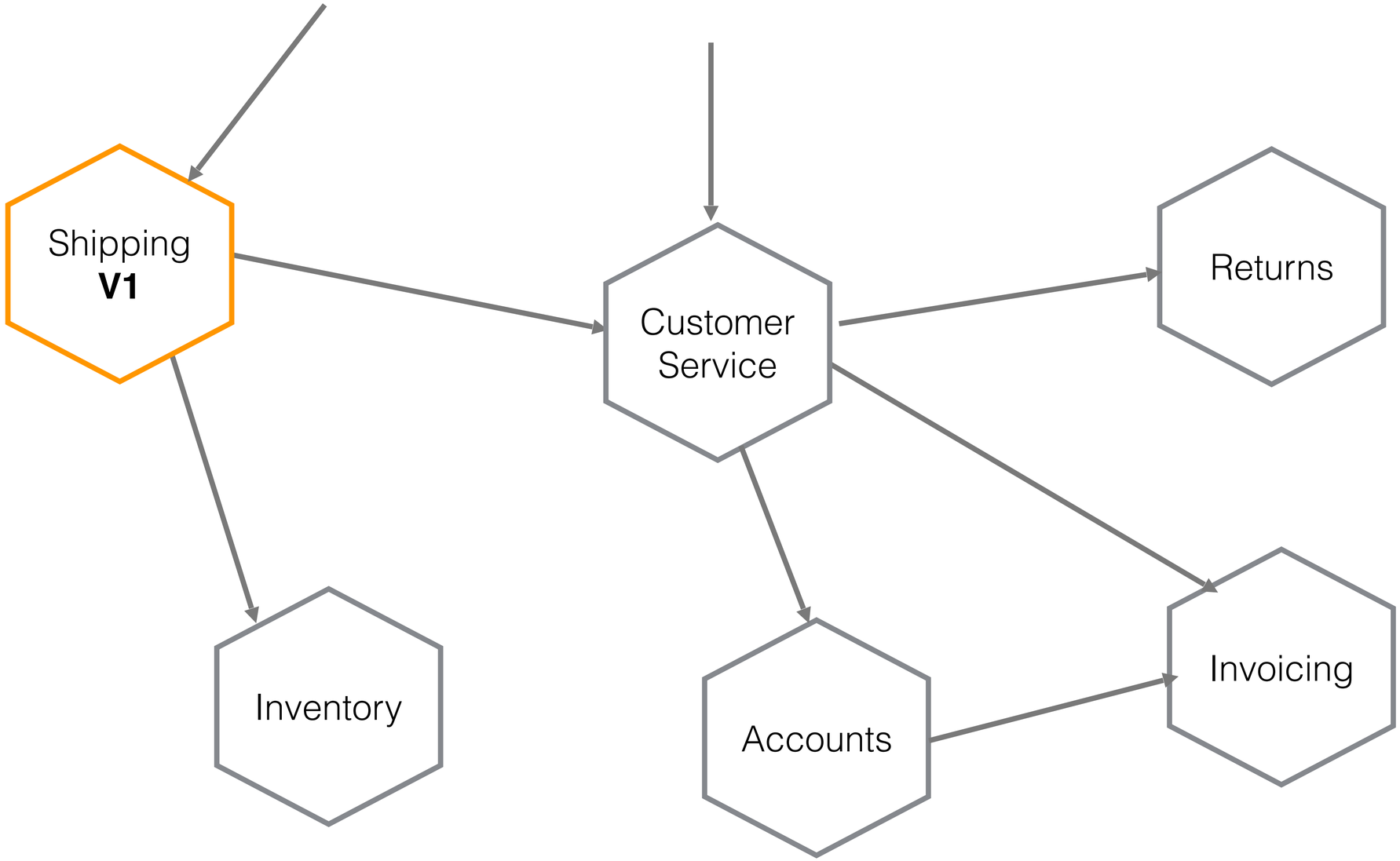
Topics include:

- Should you migrate to microservices, and if you should, how do you prioritise where to start
- How do you incrementally decompose an application
- Discusses multiple migration patterns and where they apply
- Delves into details of database decomposition, including the impact of breaking referential and transactional integrity, new failure modes, and more
- The growing pains you'll experience as your microservice architecture grows

Read The Early Access Version!



https://samnewman.io/books/monolith-to-microservices/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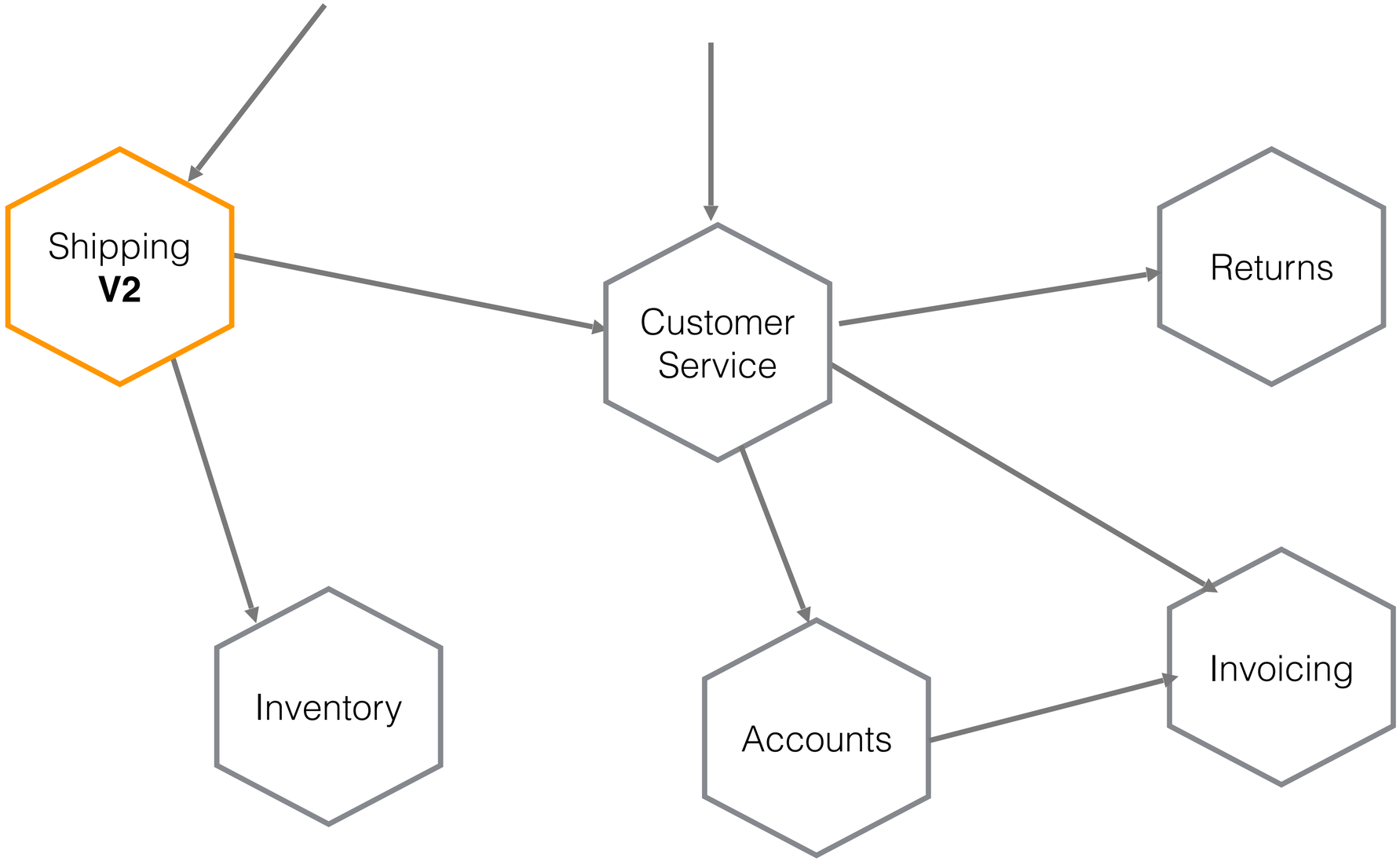
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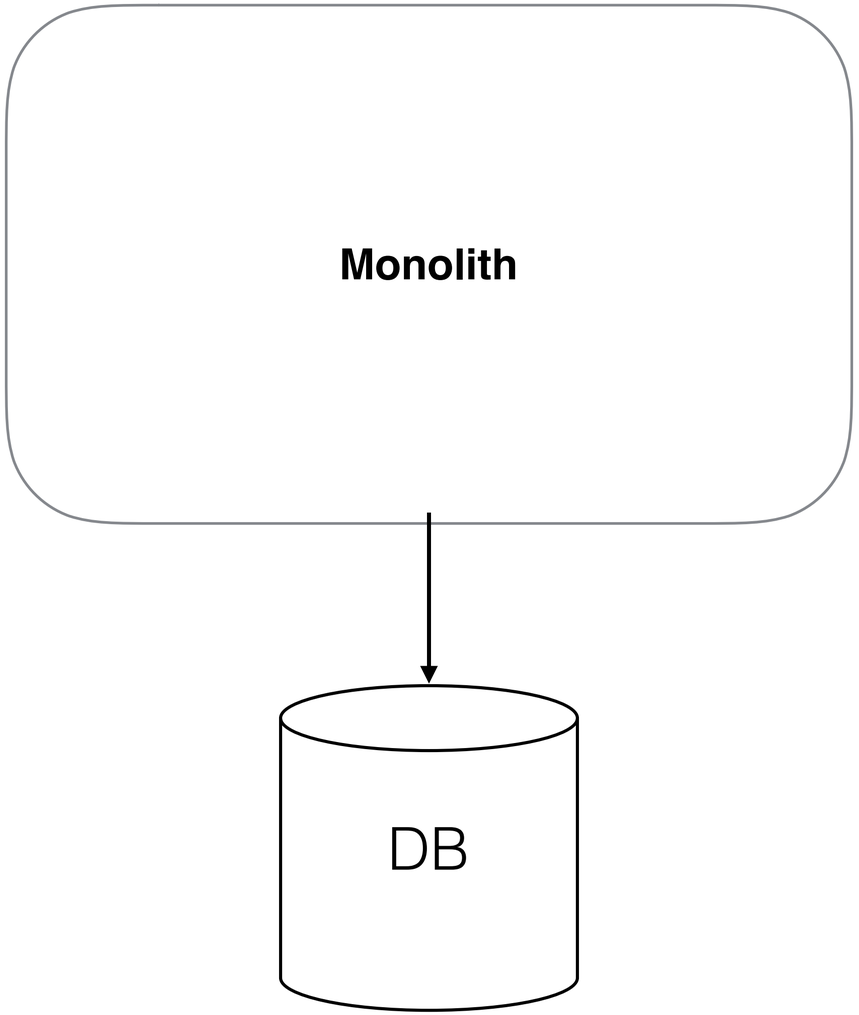
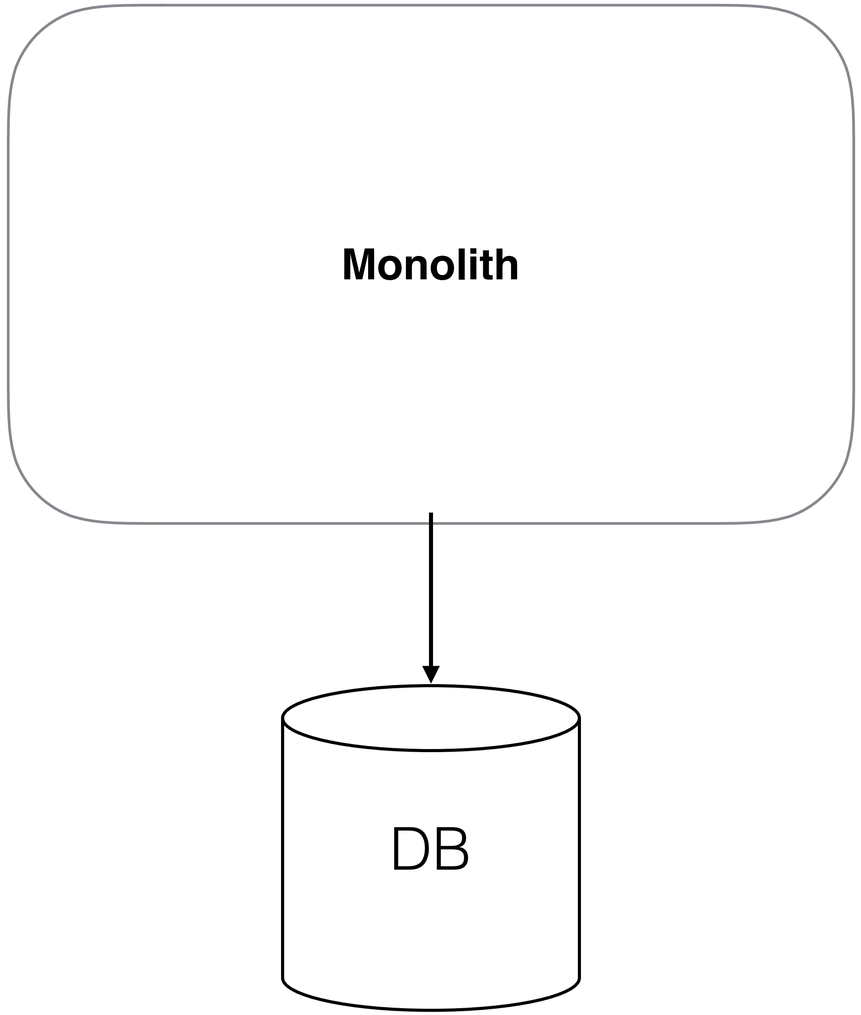
SINGLE PROCESS MONOLITH



SINGLE PROCESS MONOLITH

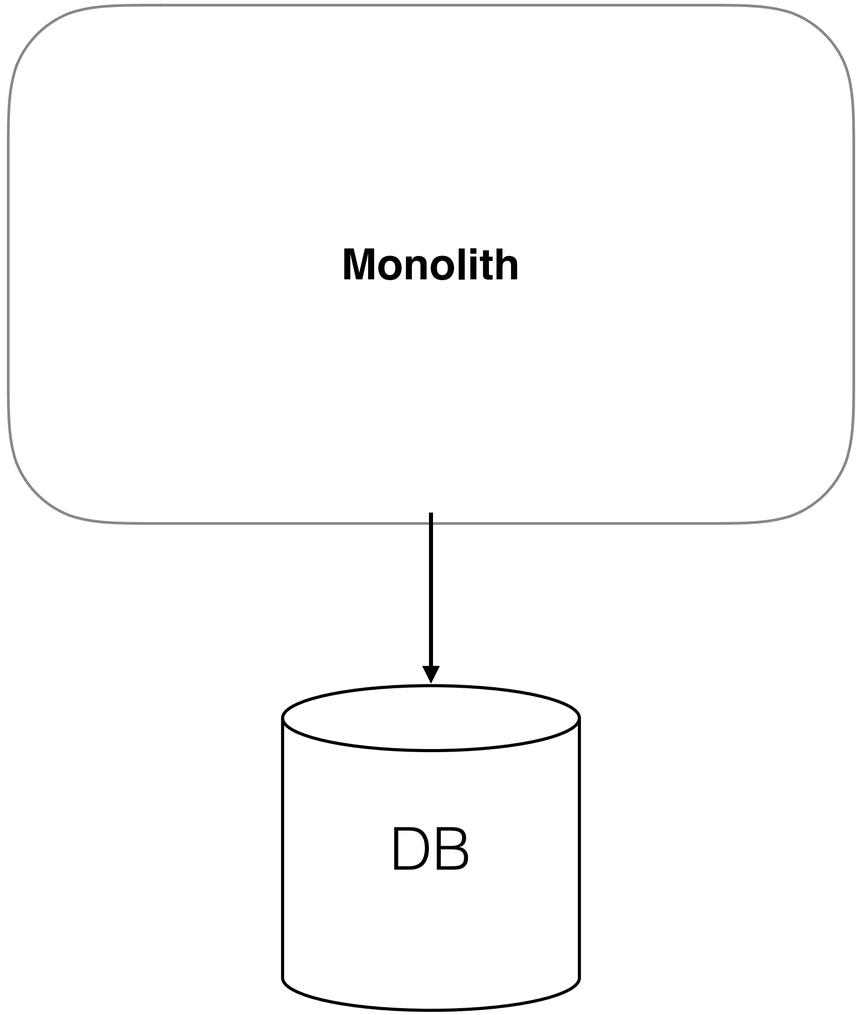
All code packaged into a single process



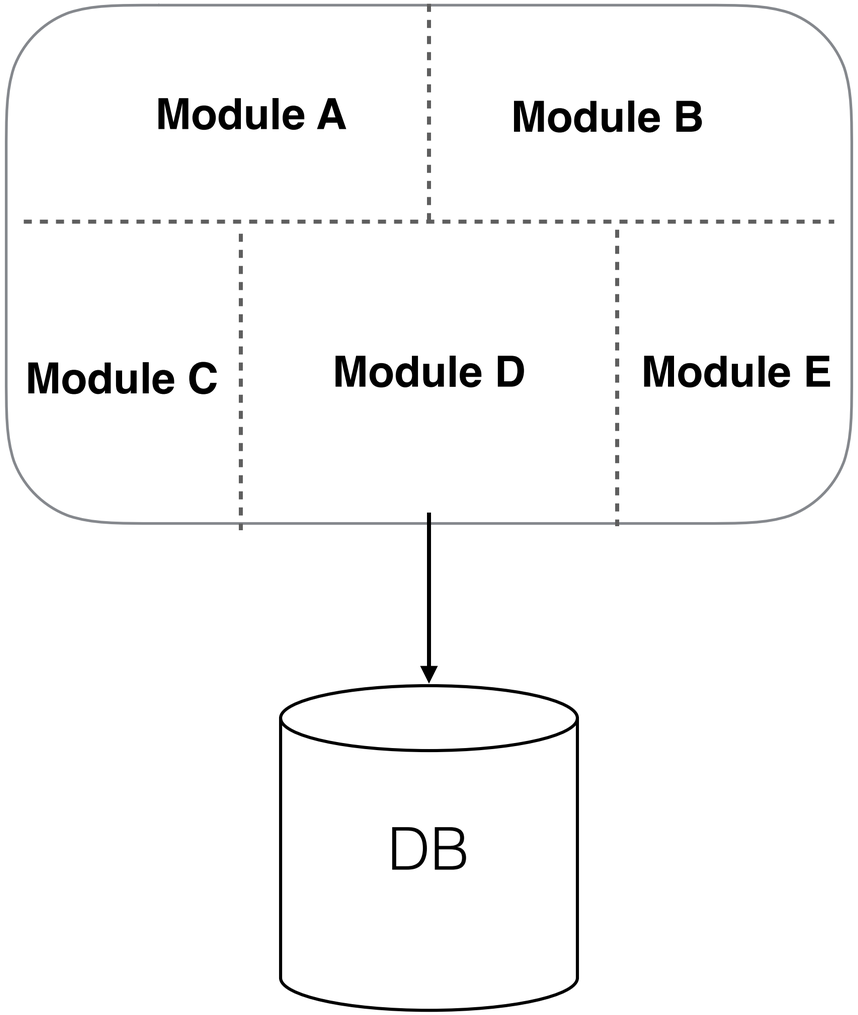
SINGLE PROCESS MONOLITH

All code packaged into a single process

All data stored in a single database

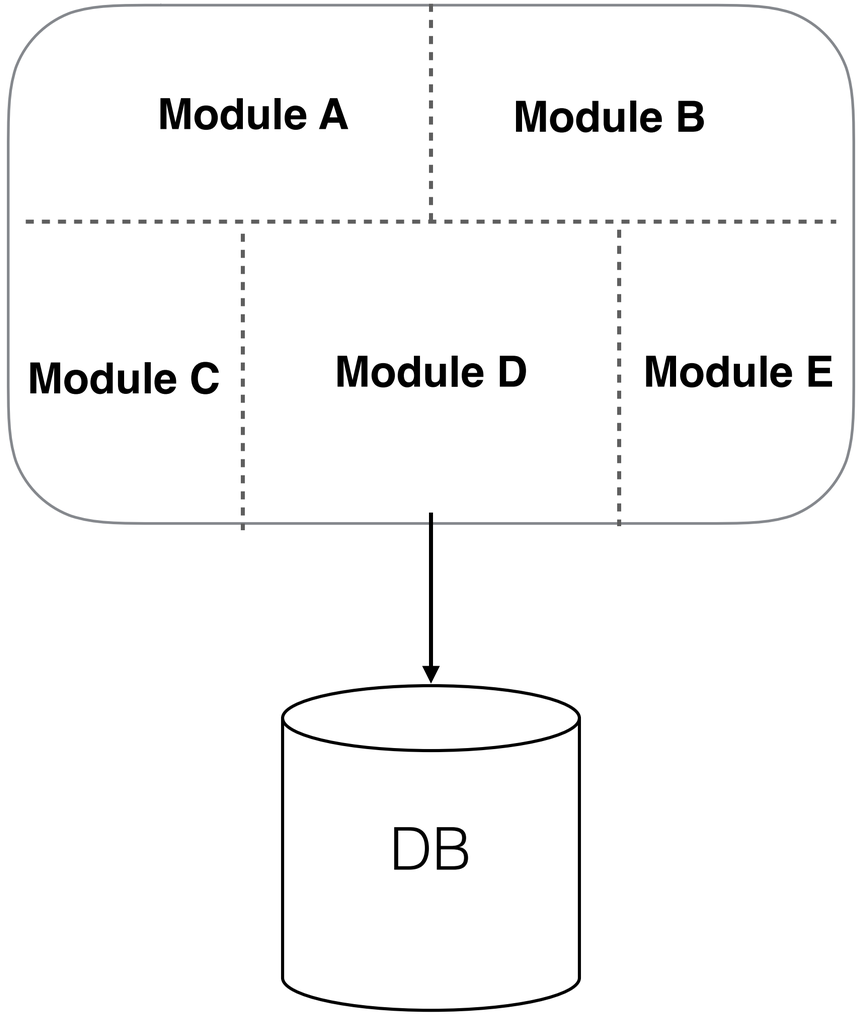


“MODULAR” MONOLITH



“MODULAR” MONOLITH

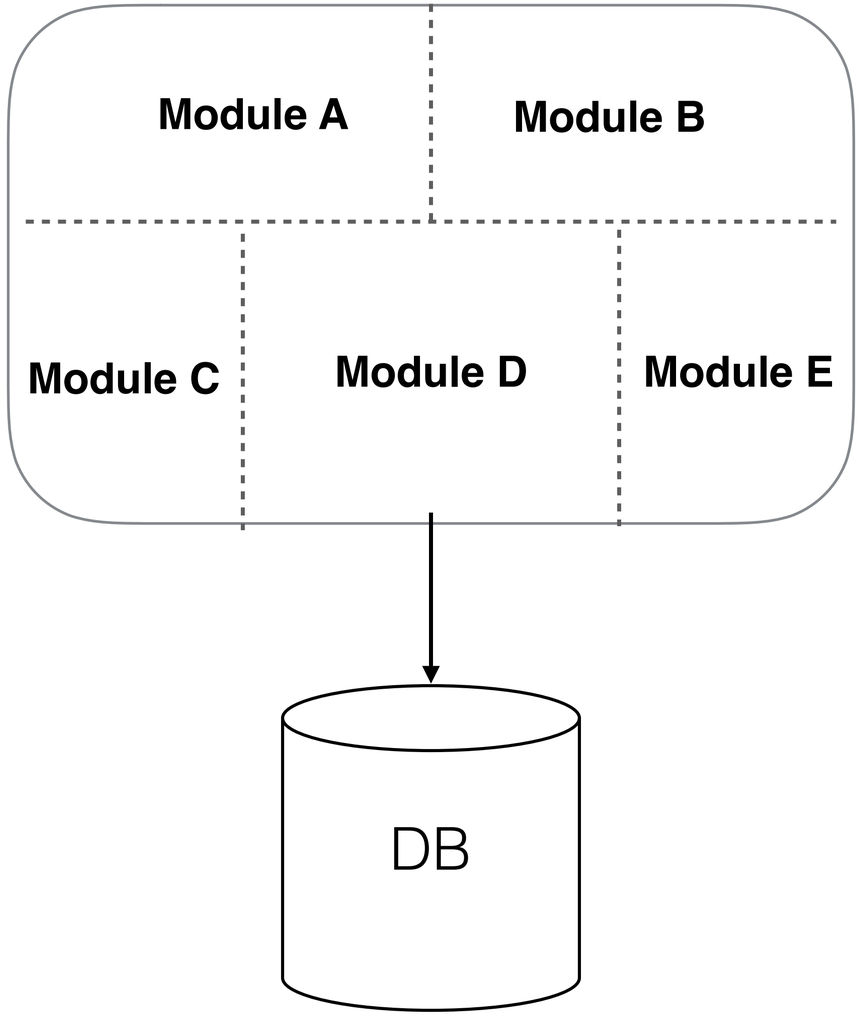
The code is broken into modules



“MODULAR” MONOLITH

The code is broken into modules

Each module packaged together into a single process



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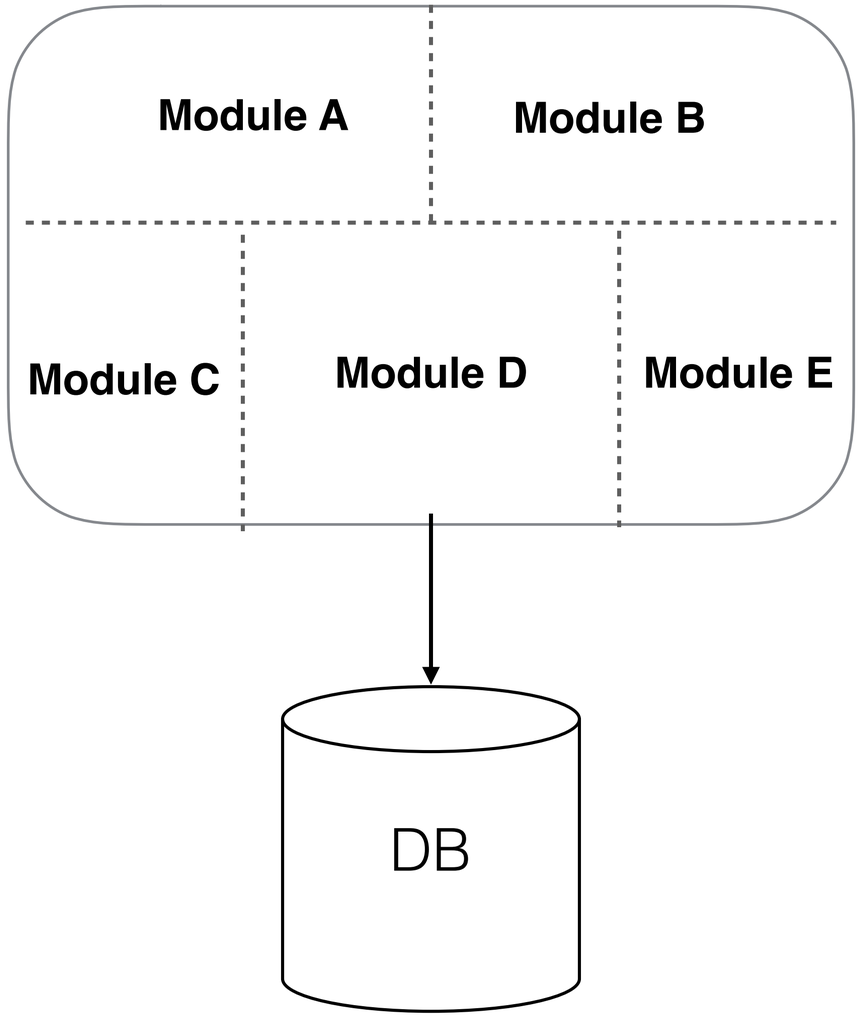
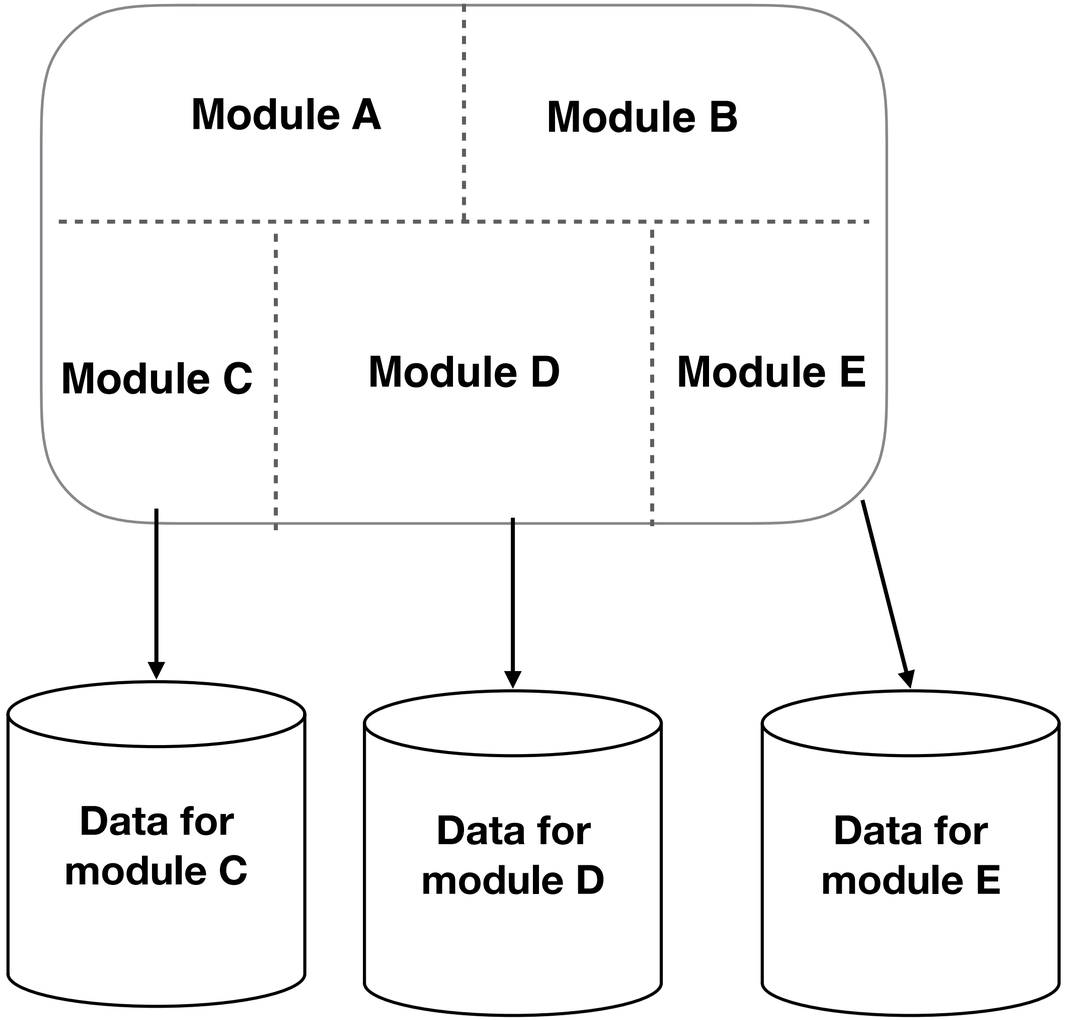
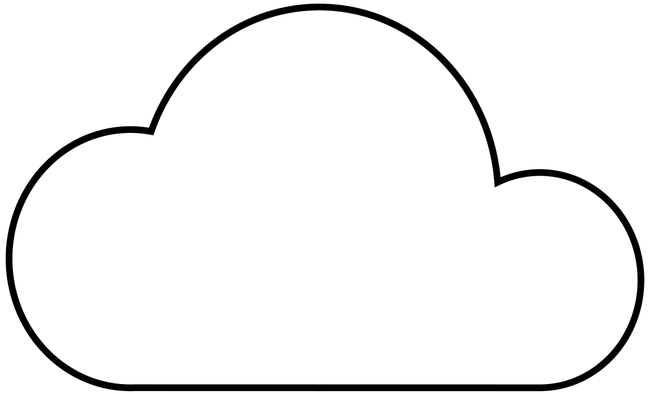


Highly underrated option

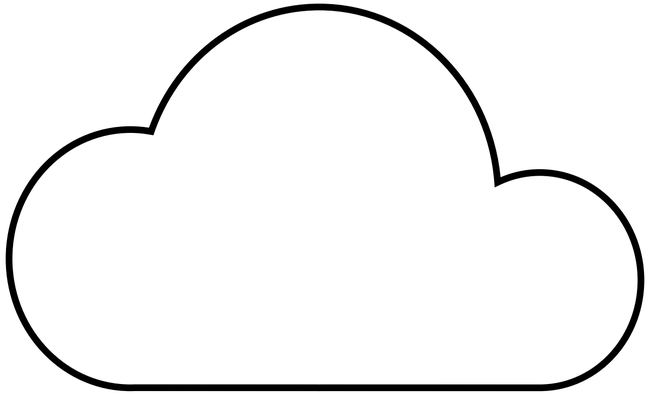

Module A
Module B
Module C
Module D
Module E
Data for module C
Data for module D
Data for module E

3RD PARTY MONOLITH



3RD PARTY MONOLITH

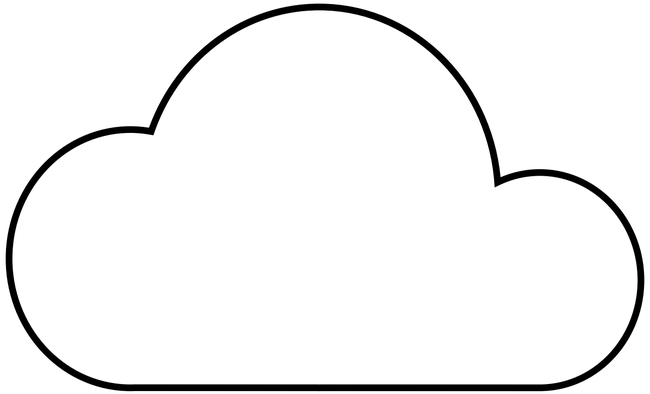
Could be on-prem software, or a SAAS product



3RD PARTY MONOLITH

Could be on-prem software, or a SAAS product

You have limited to no ability to change the core system



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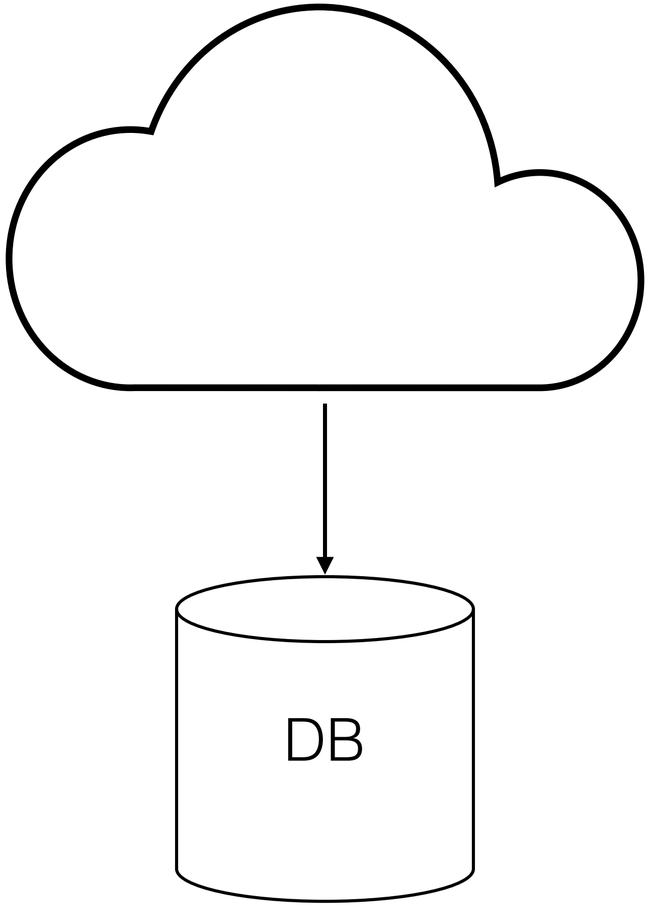

You *might* have access to underlying storage…

3RD PARTY MONOLITH

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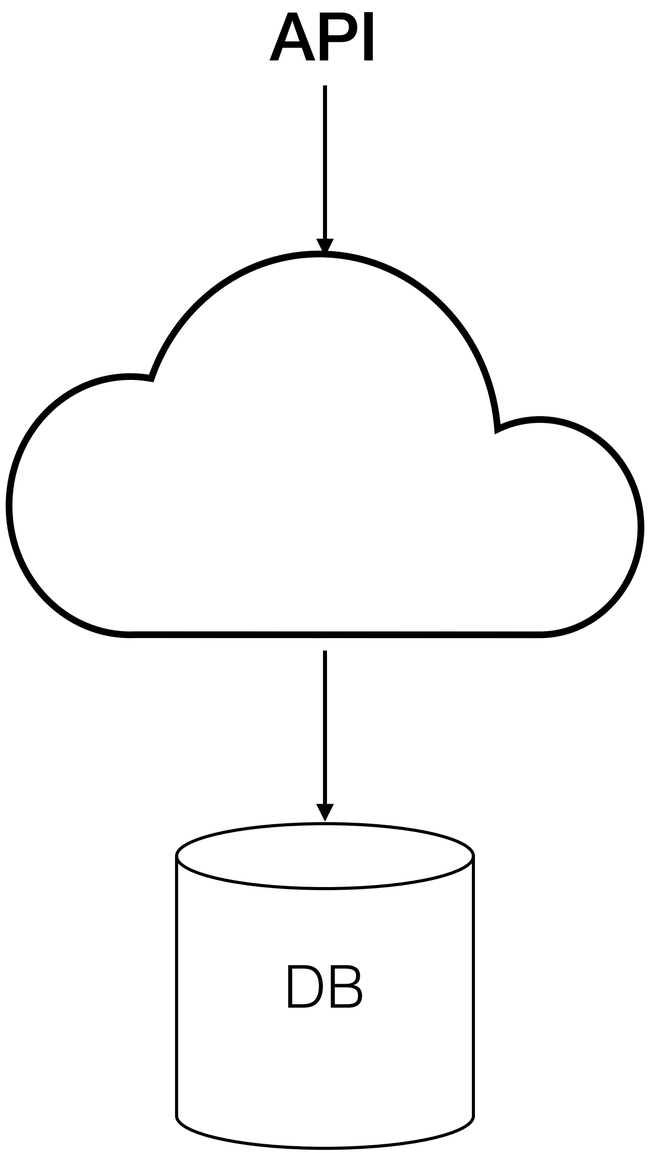
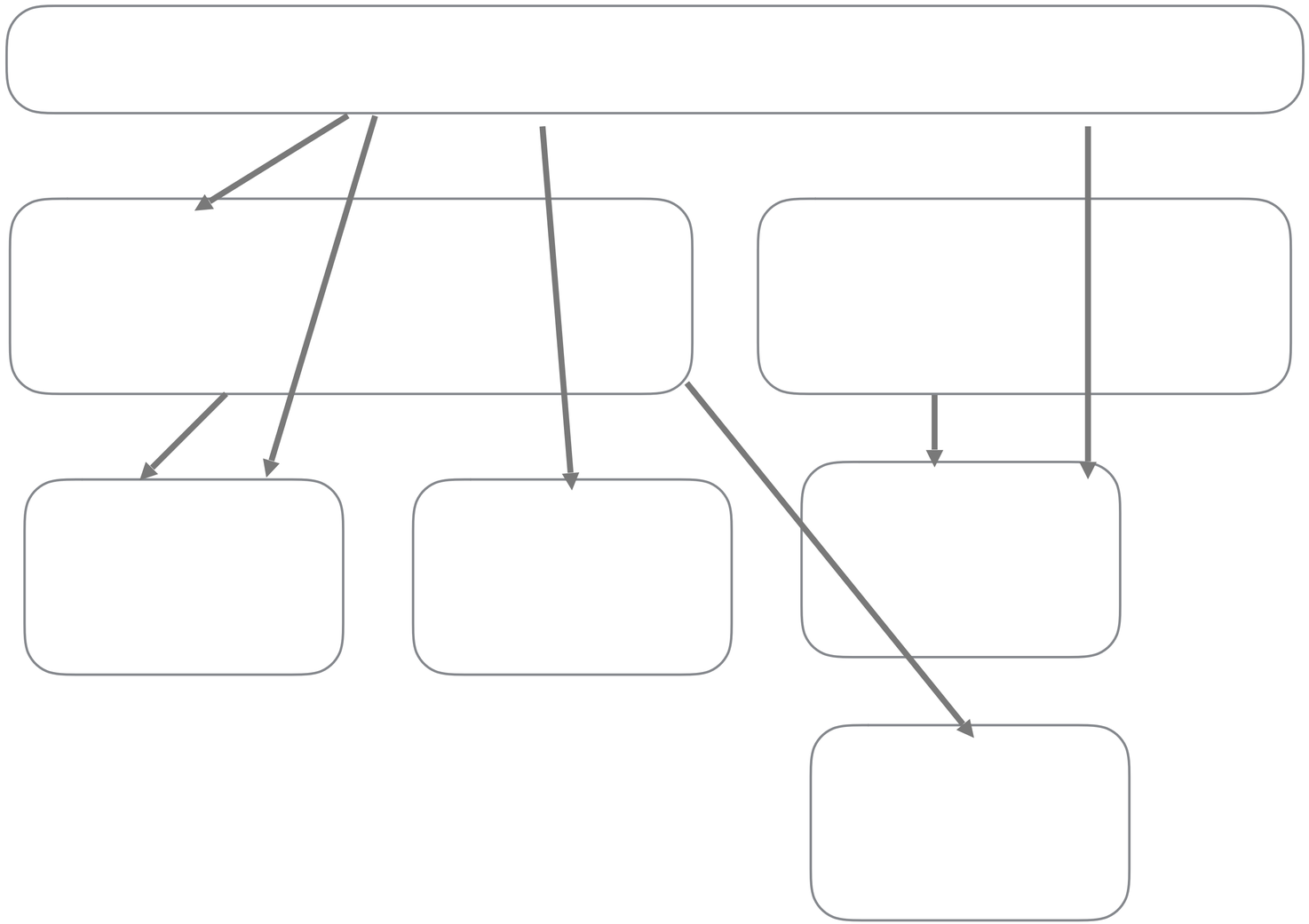


You *might* have access to underlying storage…

…or perhaps APIs

DISTRIBUTED MONOLITH



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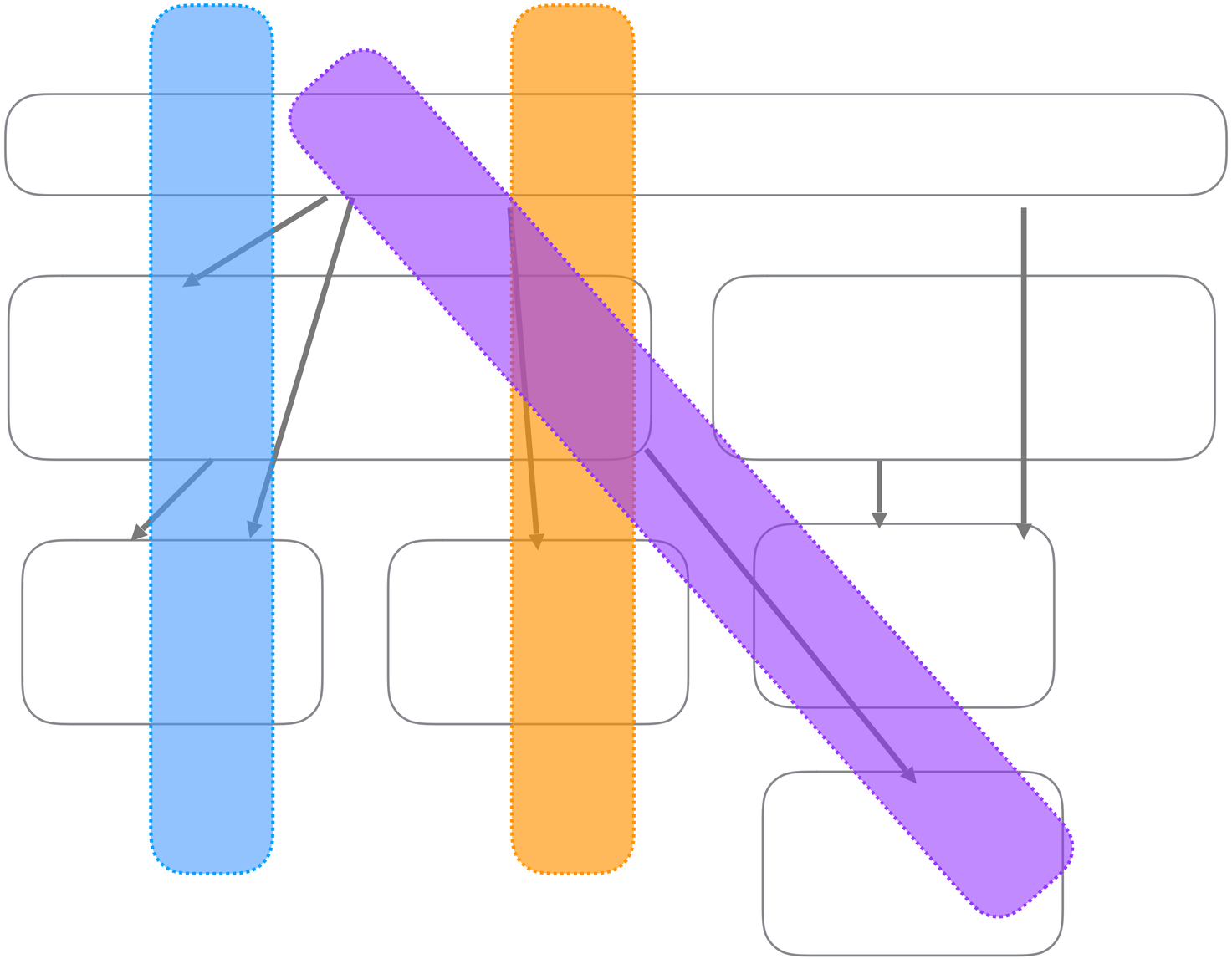

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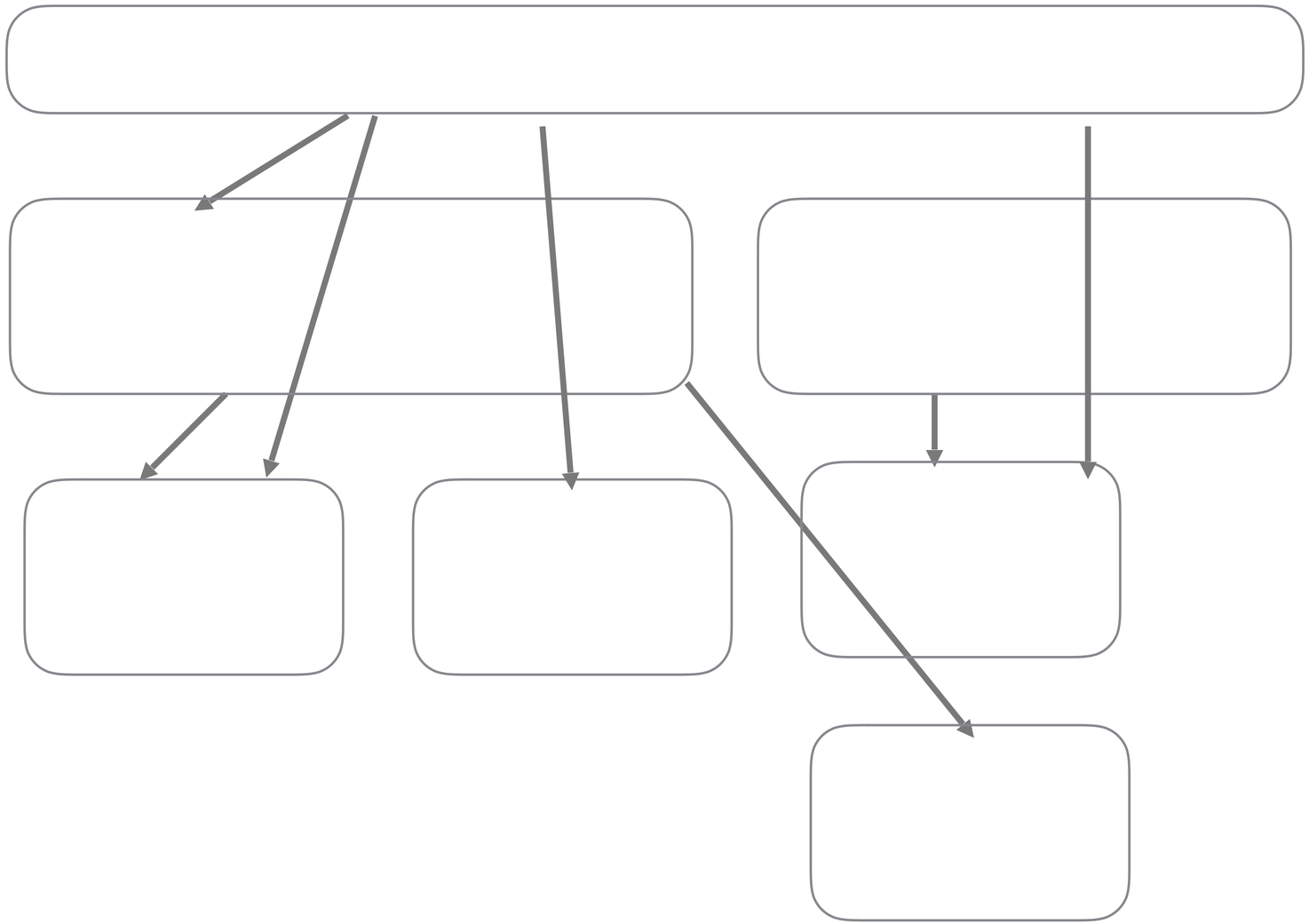

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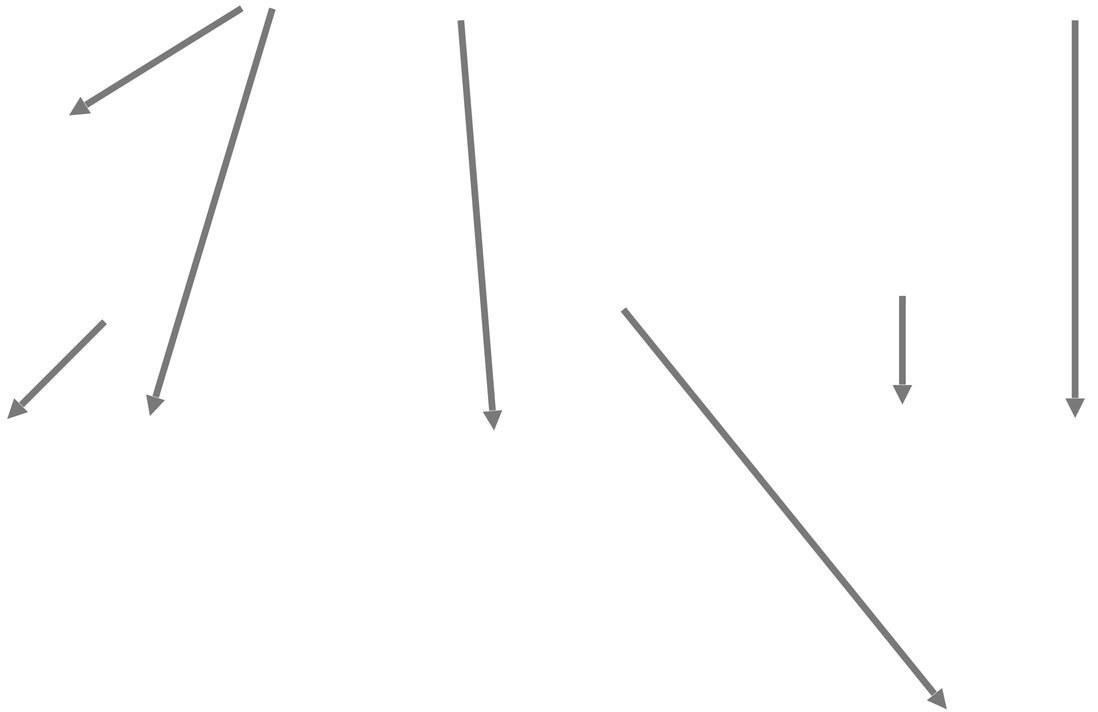

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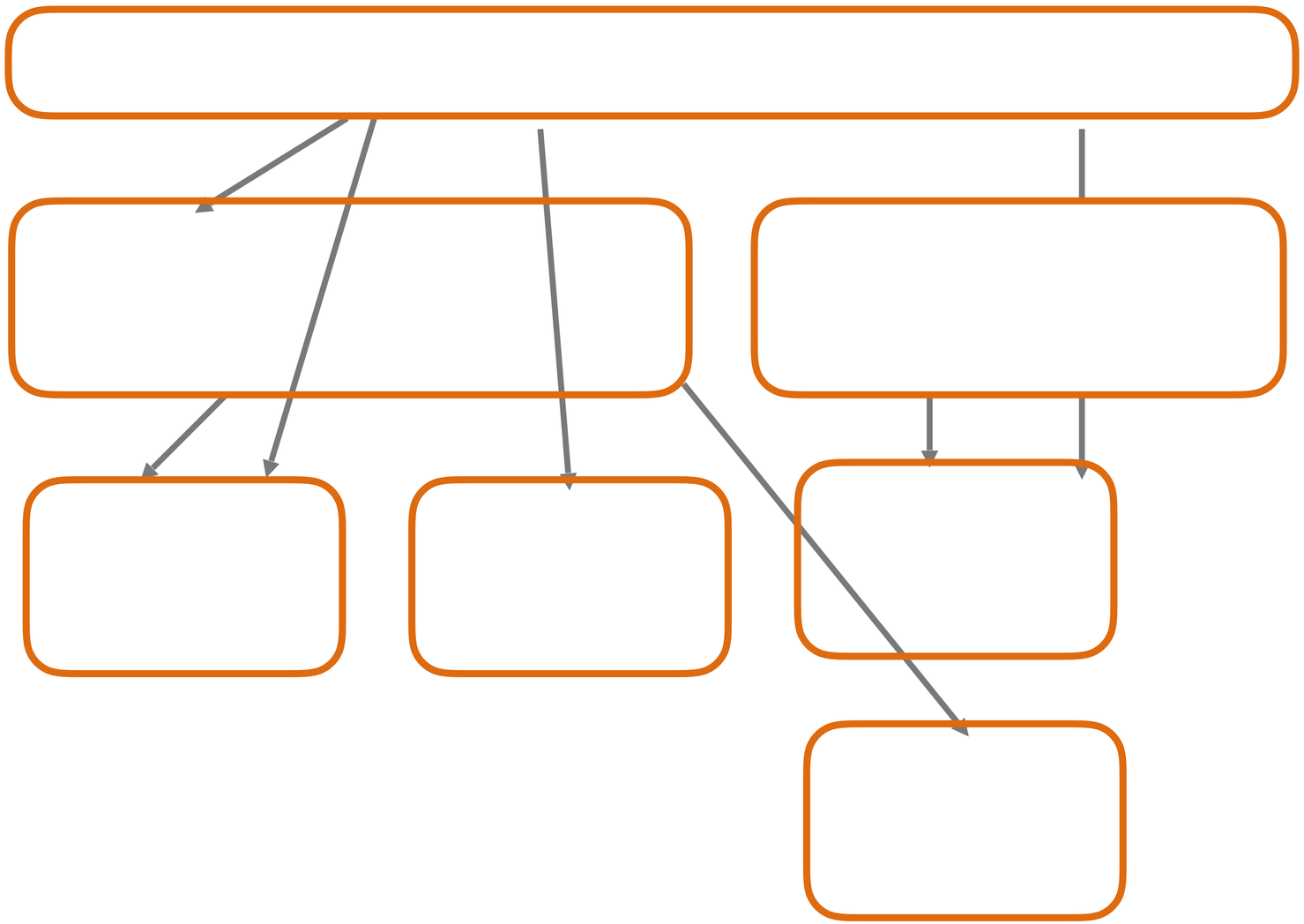

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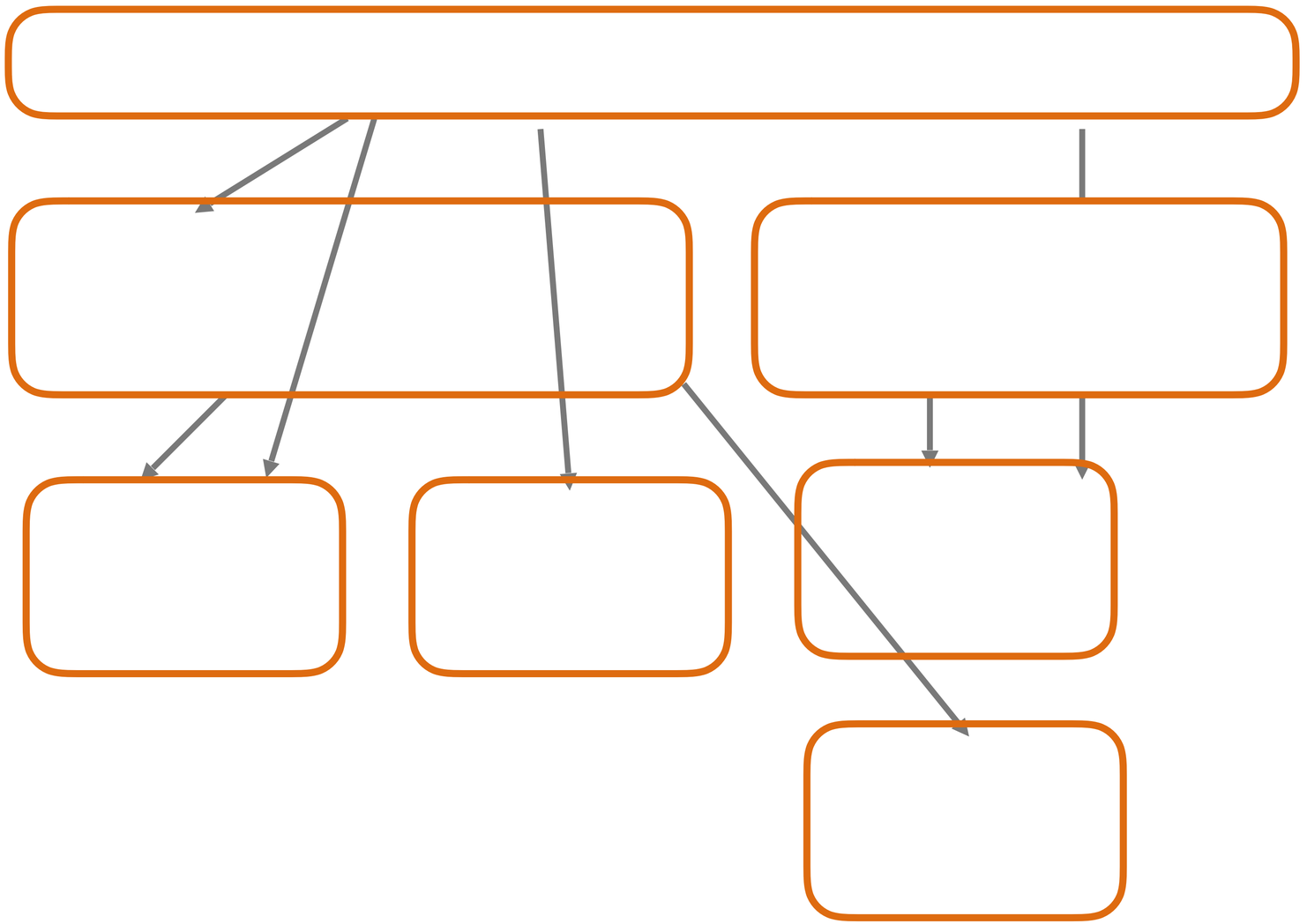
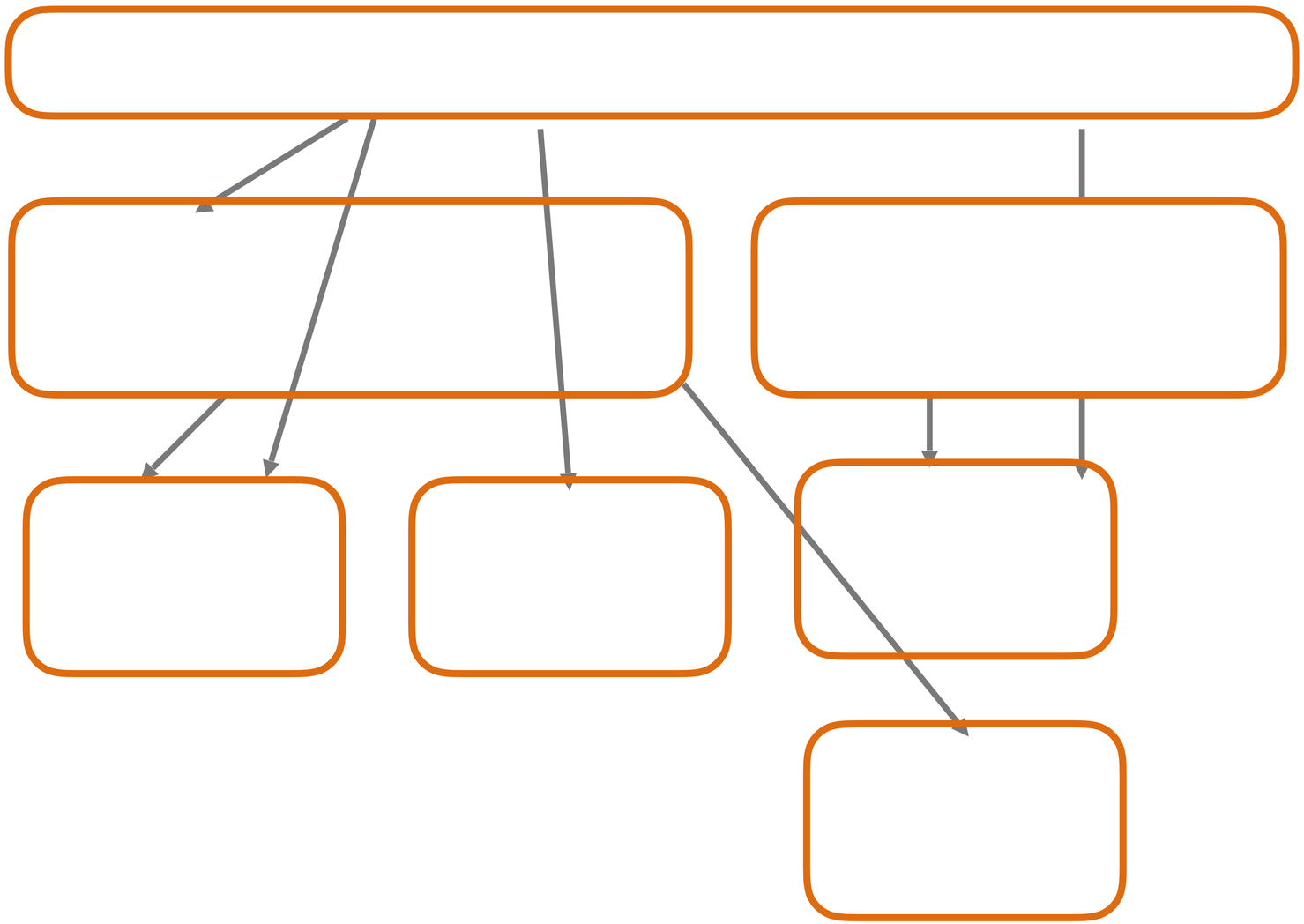


High cost of change

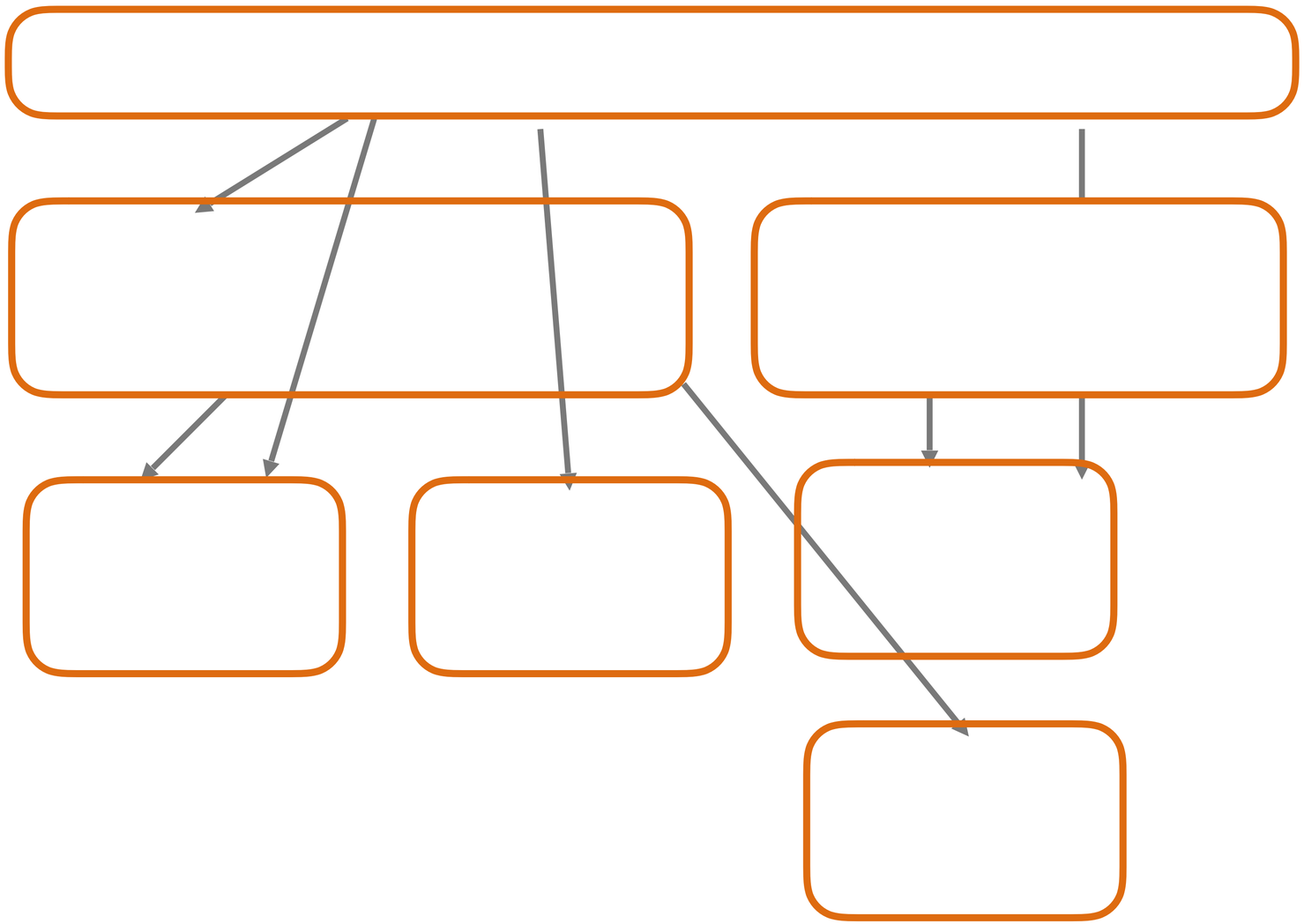
DISTRIBUTED MONOLITH



High cost of change

Larger-scoped deployments

DISTRIBUTED MONOLITH

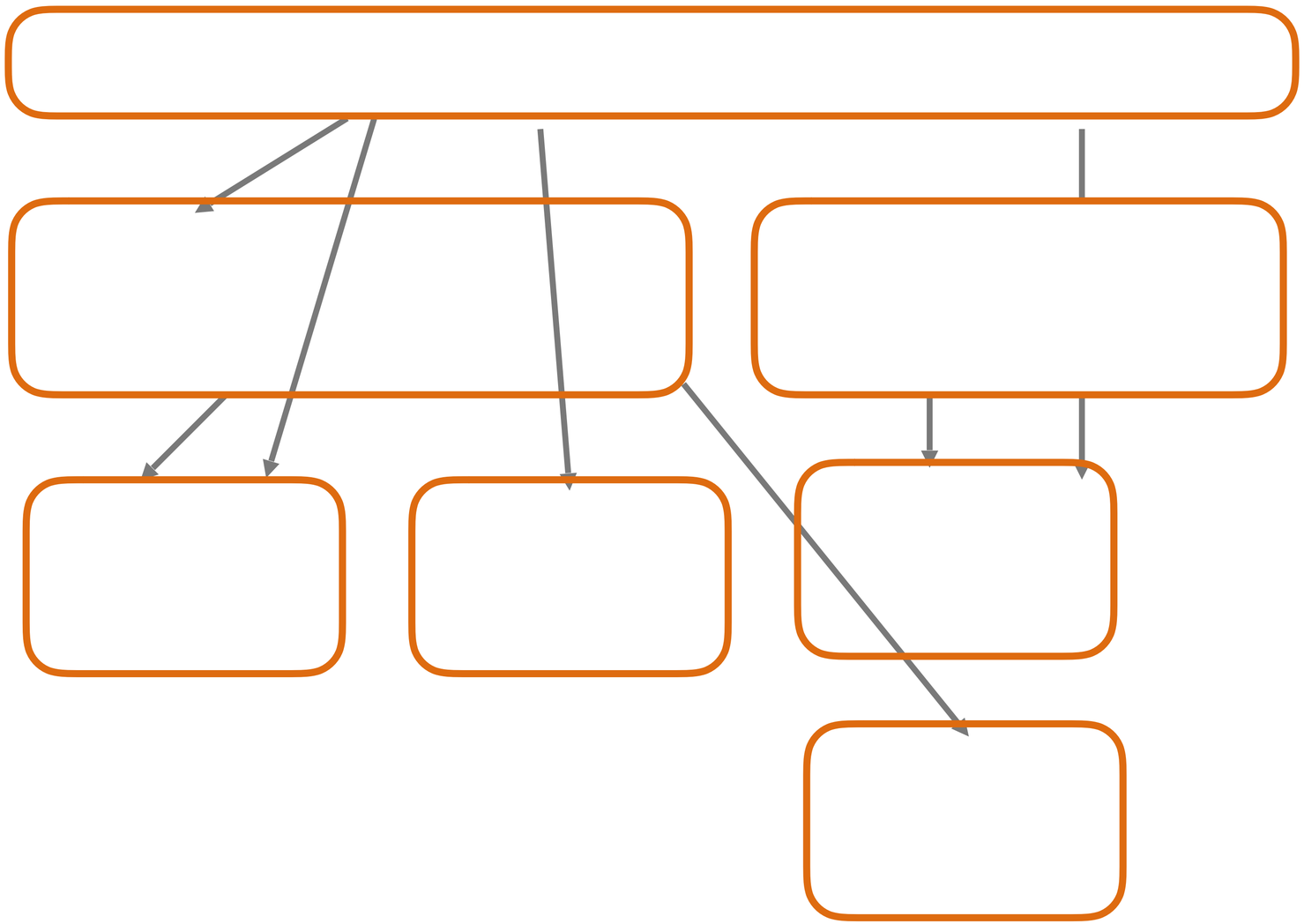


High cost of change

Larger-scoped deployments

More to go wrong

DISTRIBUTED MONOLITH



High cost of change

Larger-scoped deployments

More to go wrong

Release co-ordination

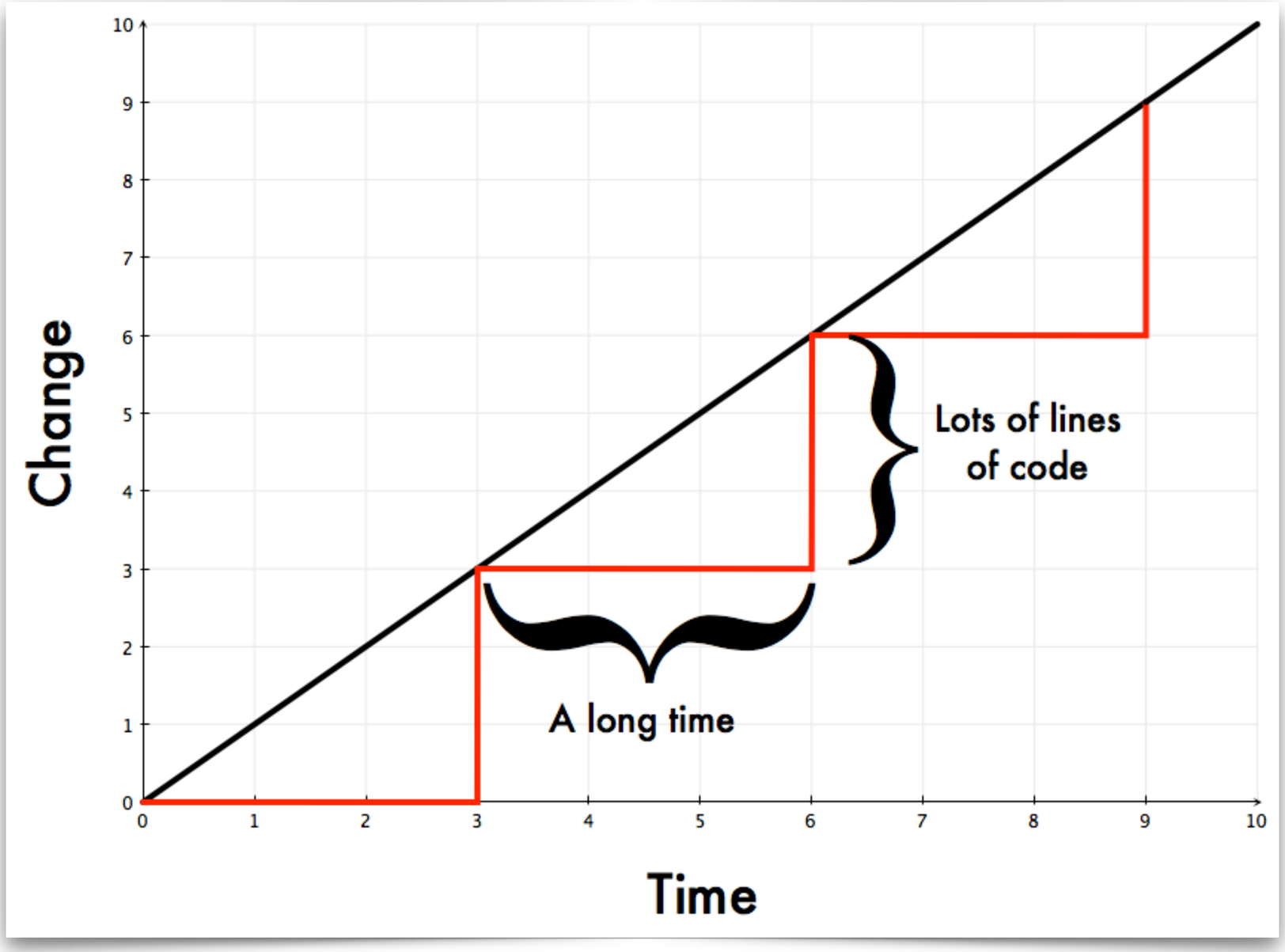
https://www.flickr.com/photos/kansasscanner/32189230183/

SAFE

SAFE

Watch out, there’s a release train coming!

http://www.slideshare.net/jallspaw/ops-metametrics-the-currency-you-pay-for-change-4608108



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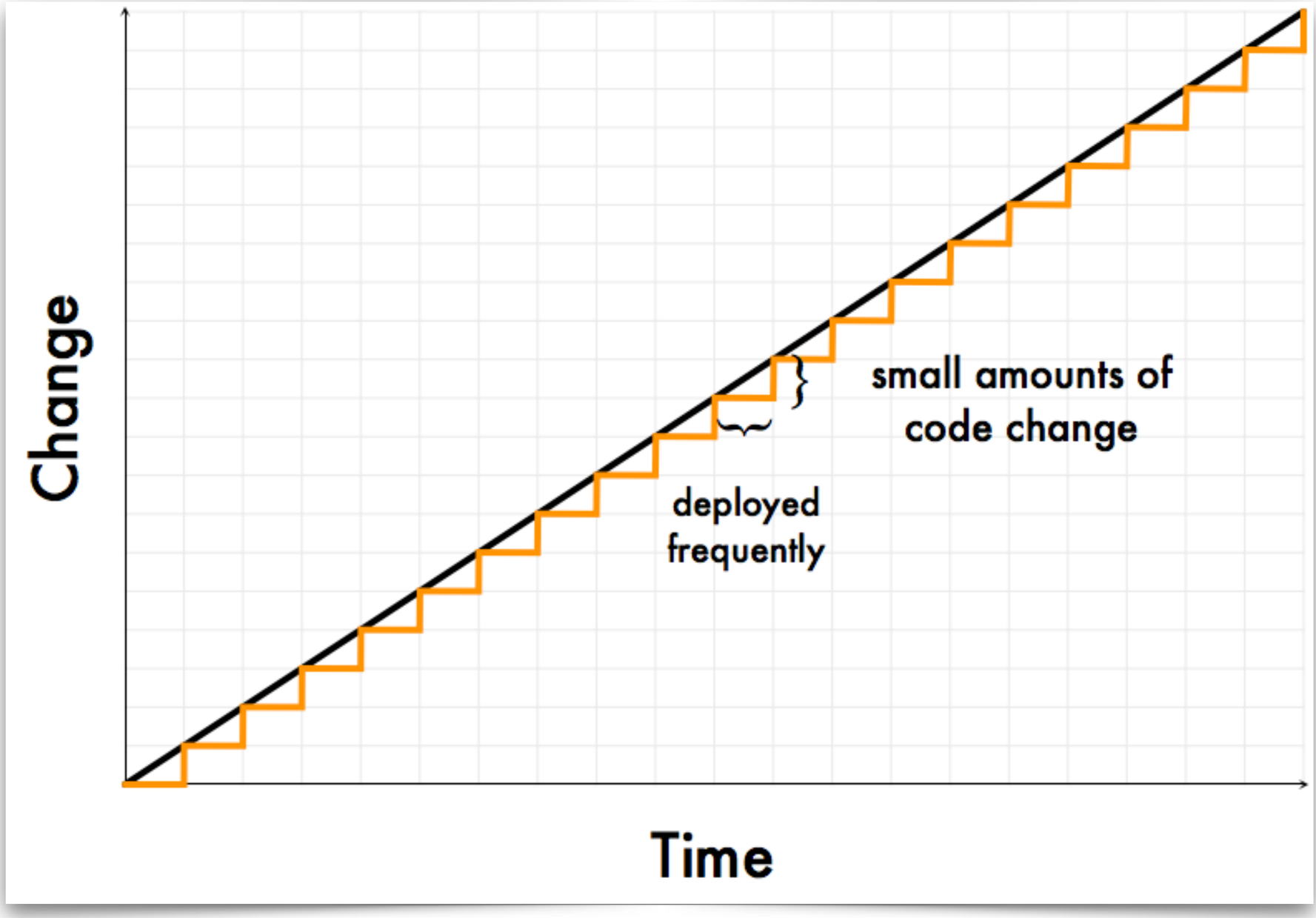


http://www.slideshare.net/jallspaw/ops-metametrics-the-currency-you-pay-for-change-4608108

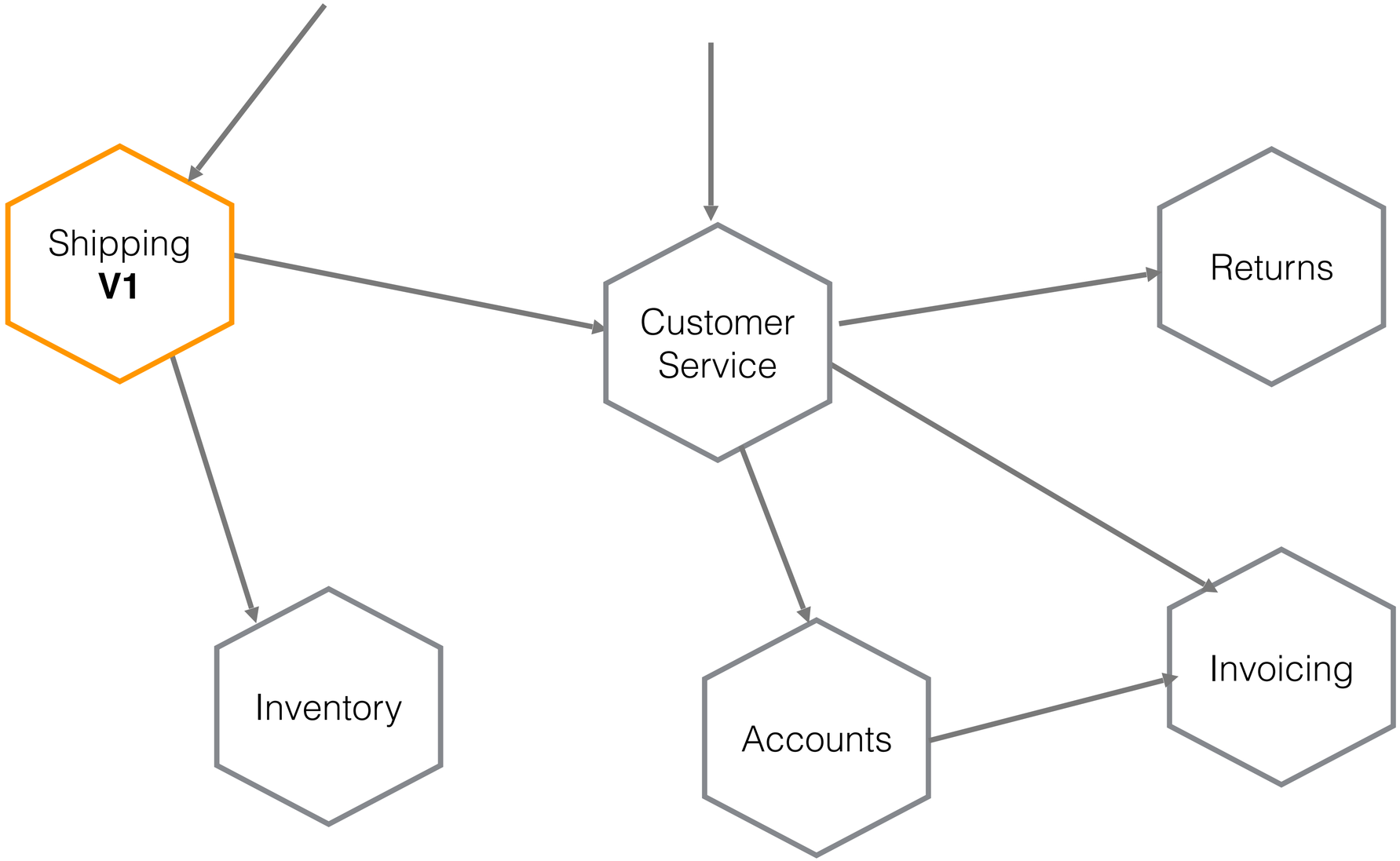
If you stick with a release train for too long, you'll end up with a distributed monolith

The Distributed Monolith

For when life isn't already complicated enough

Continuous Delivery

Release on demand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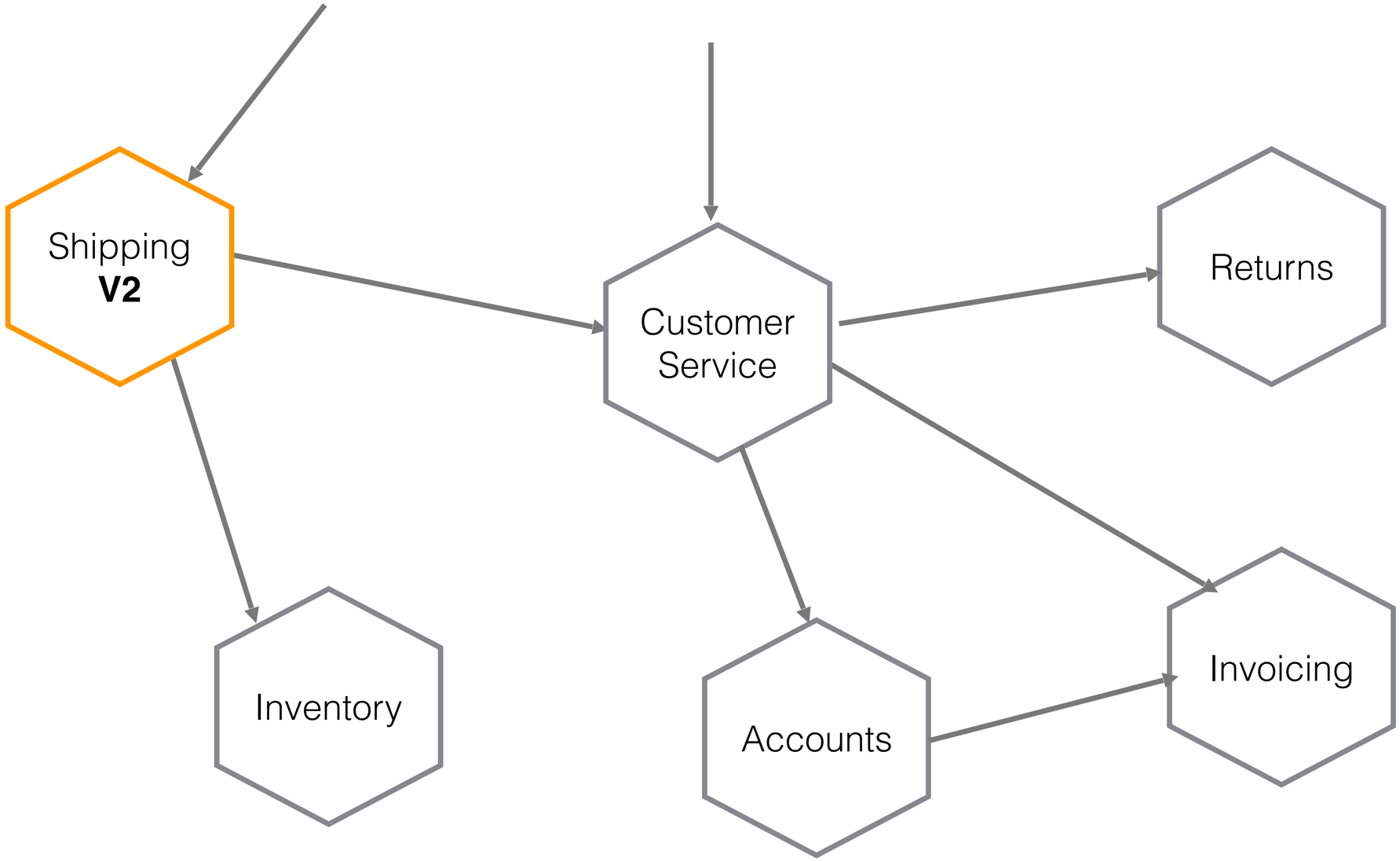
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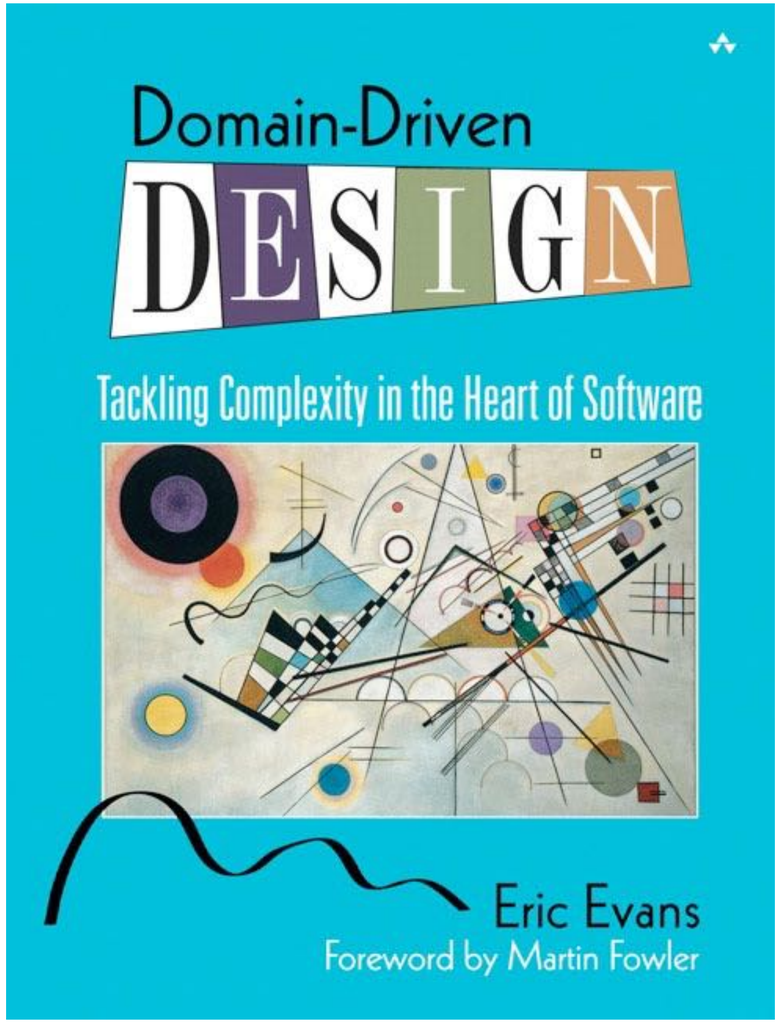
DOMAIN DRIVEN DESIGN



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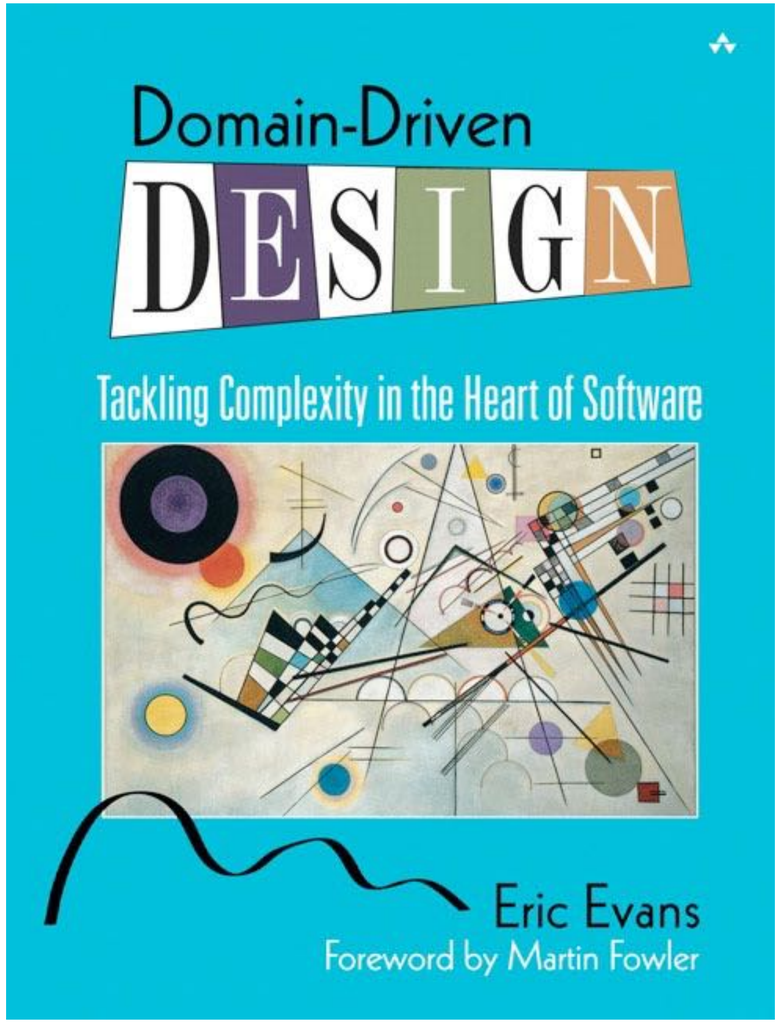
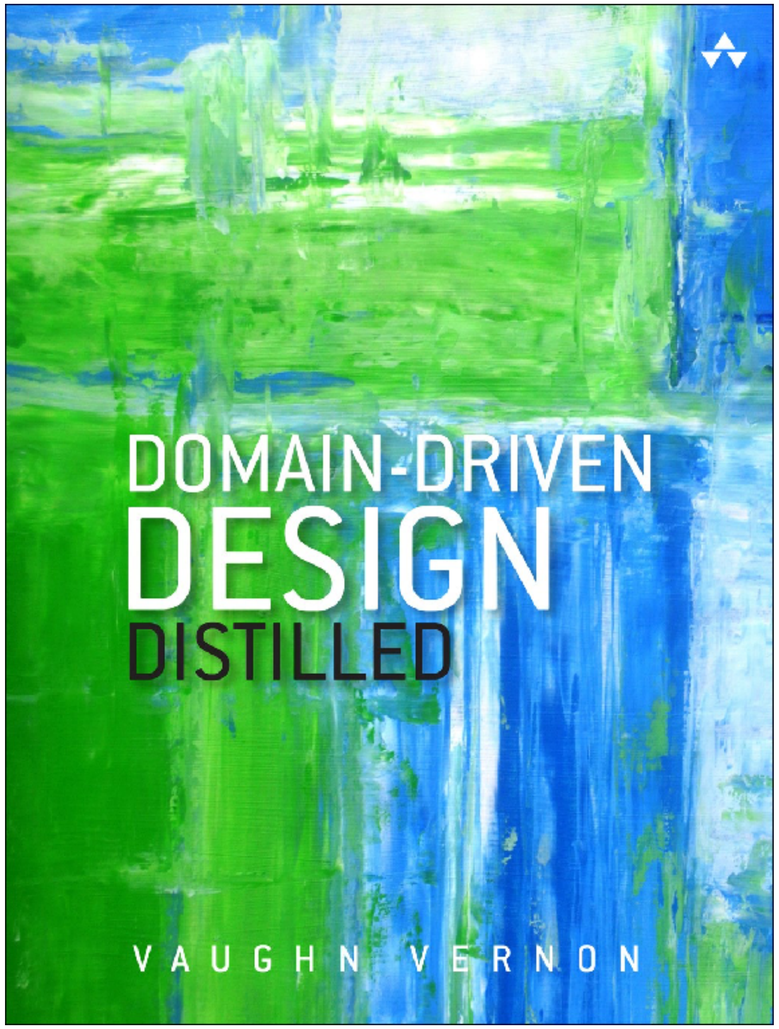
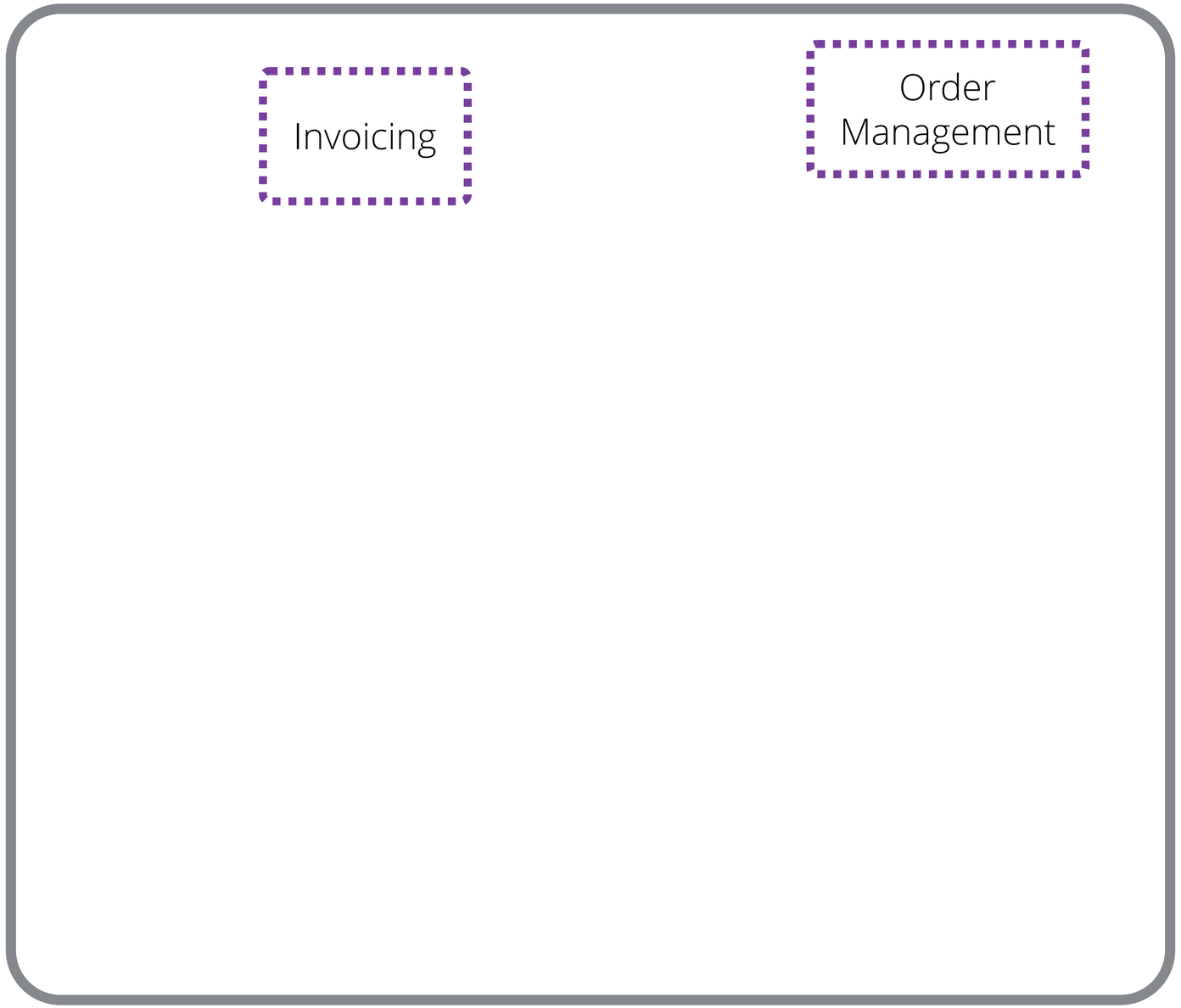





Order
Management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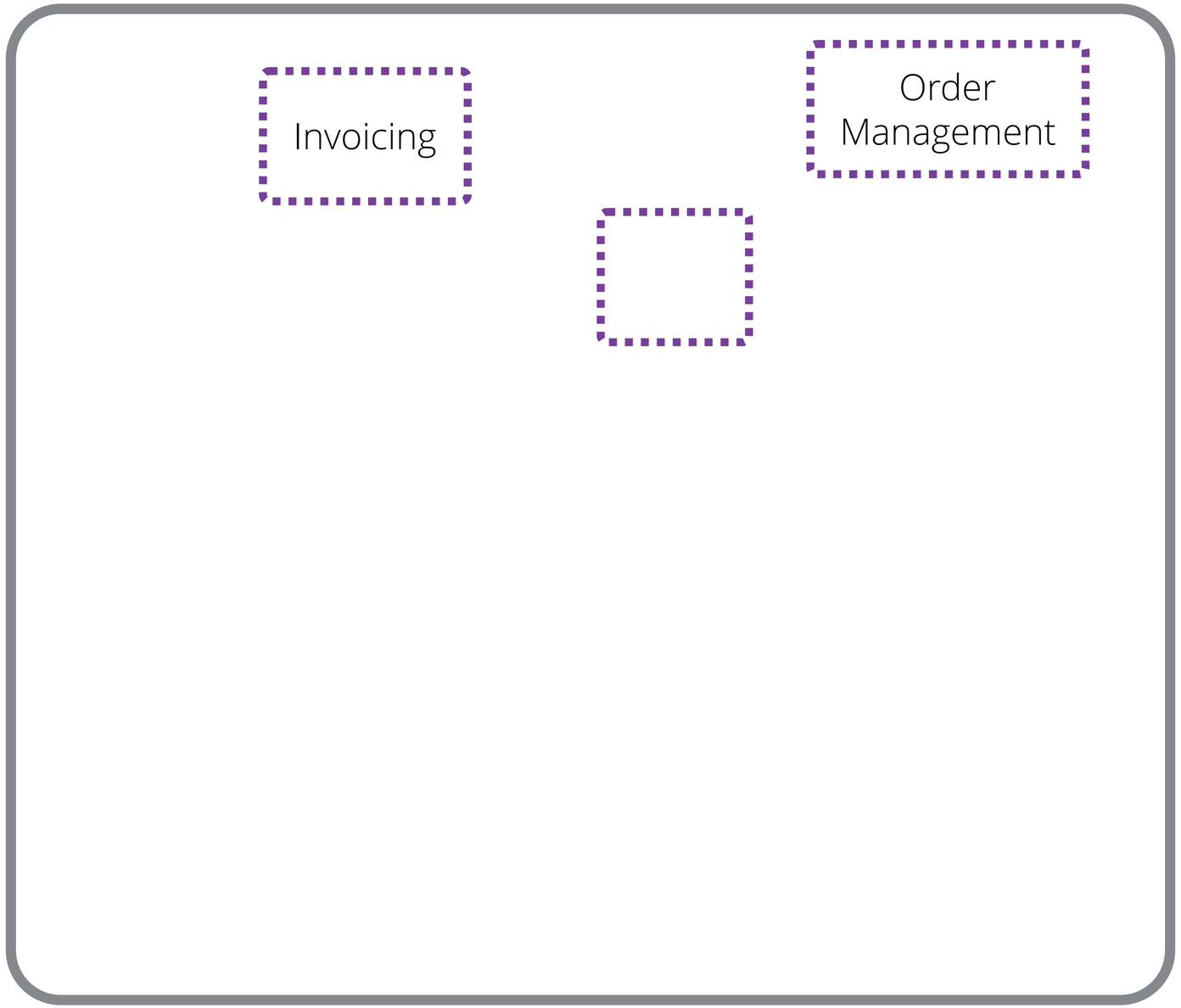
Order Management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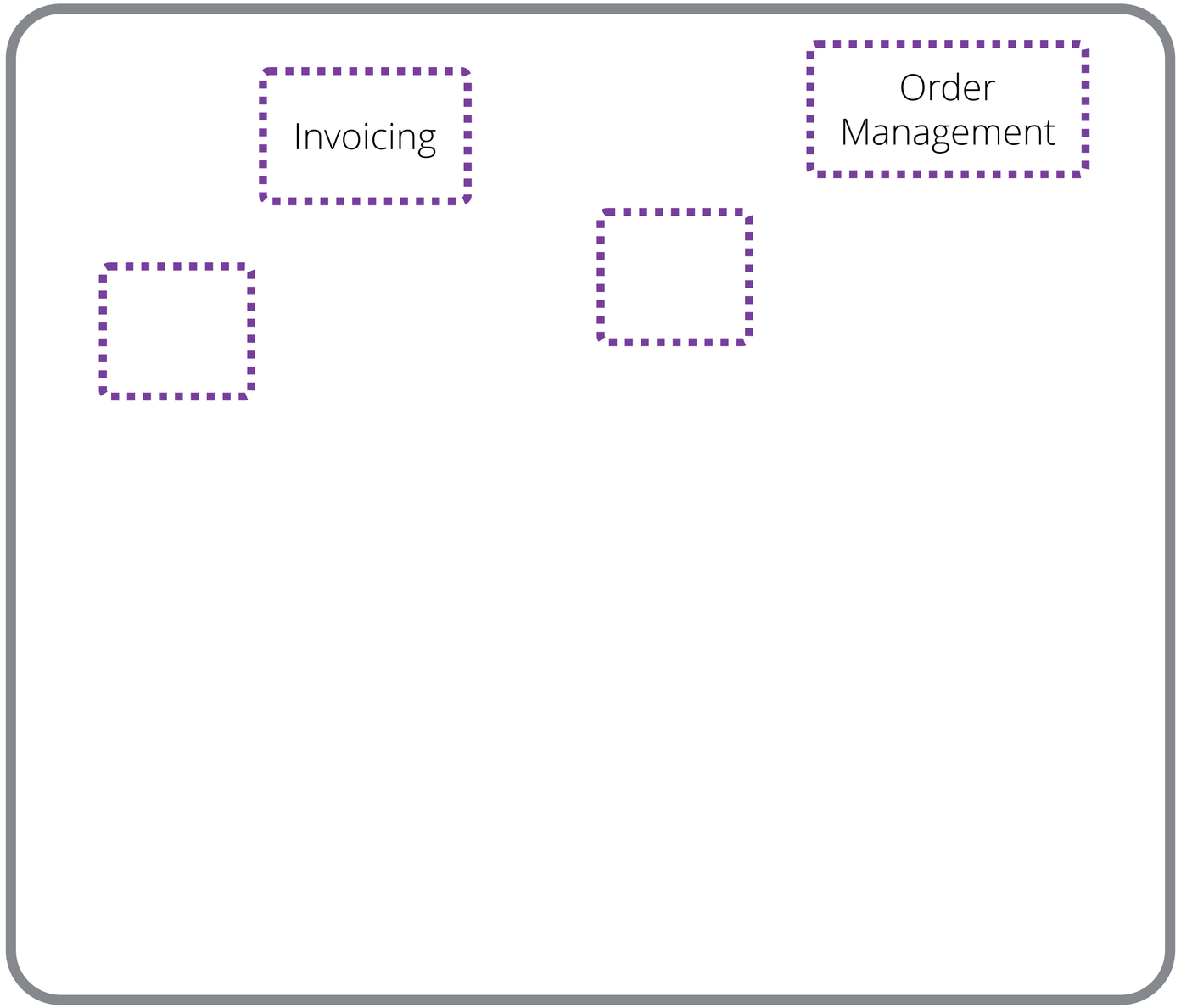
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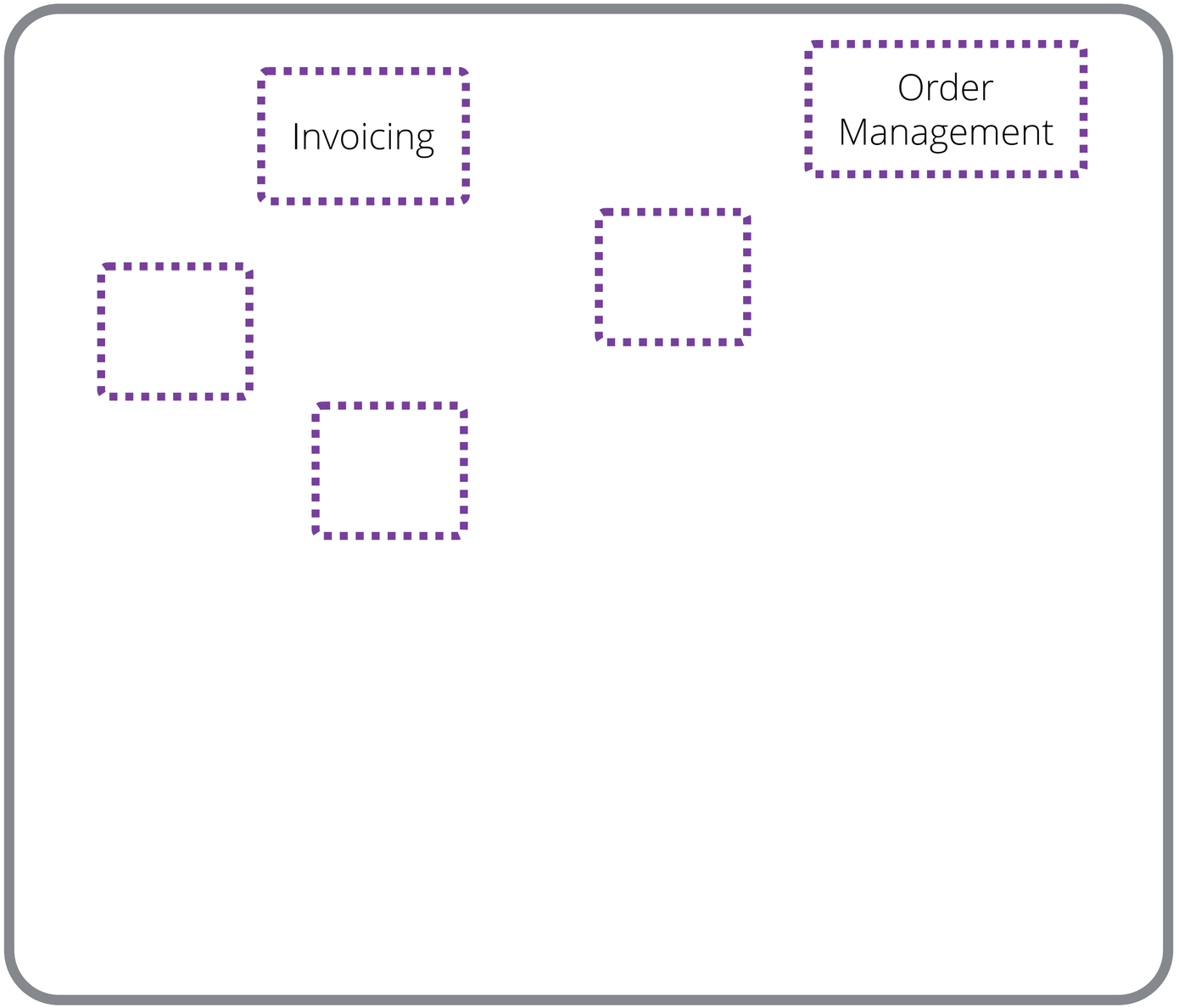
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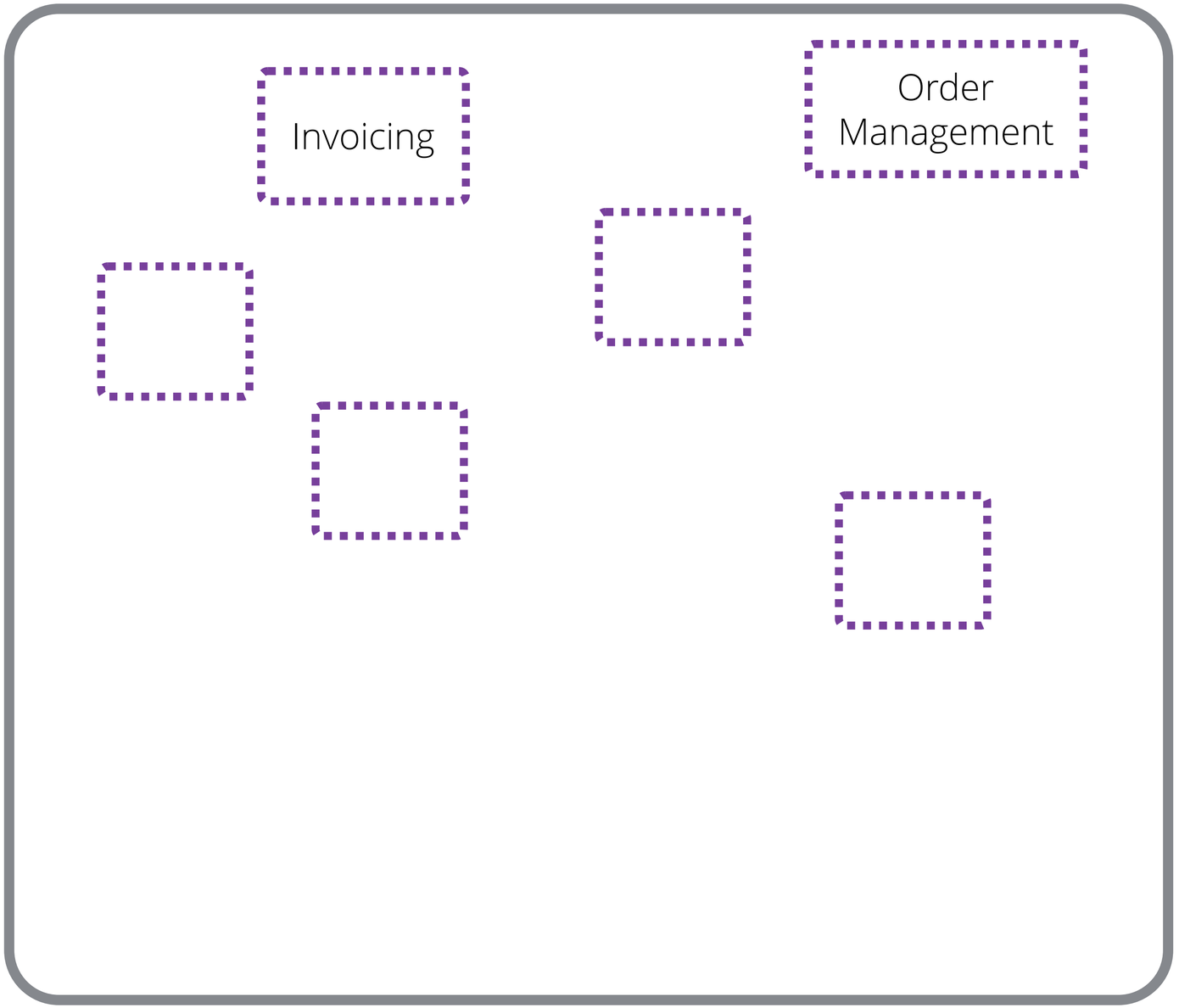
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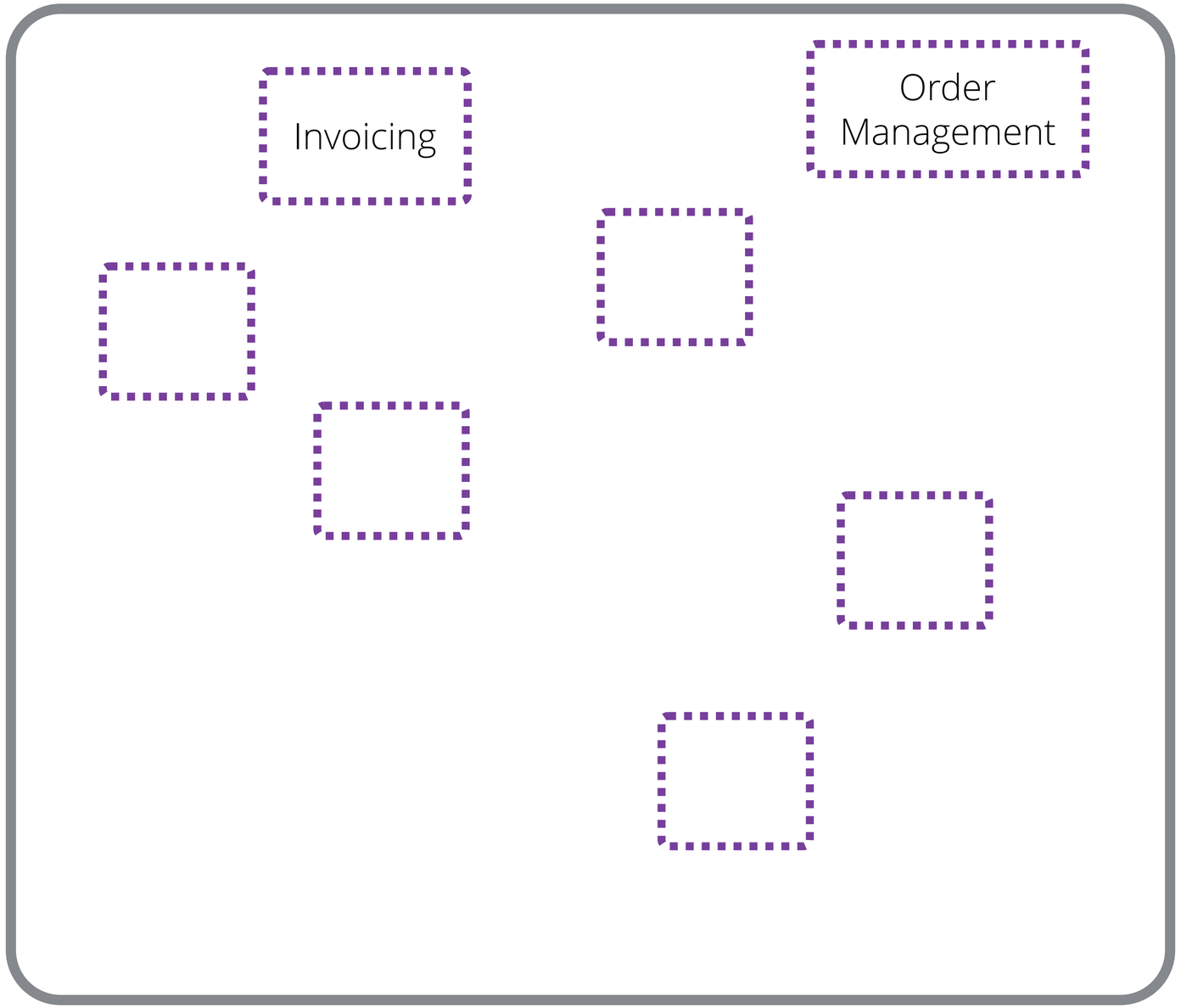
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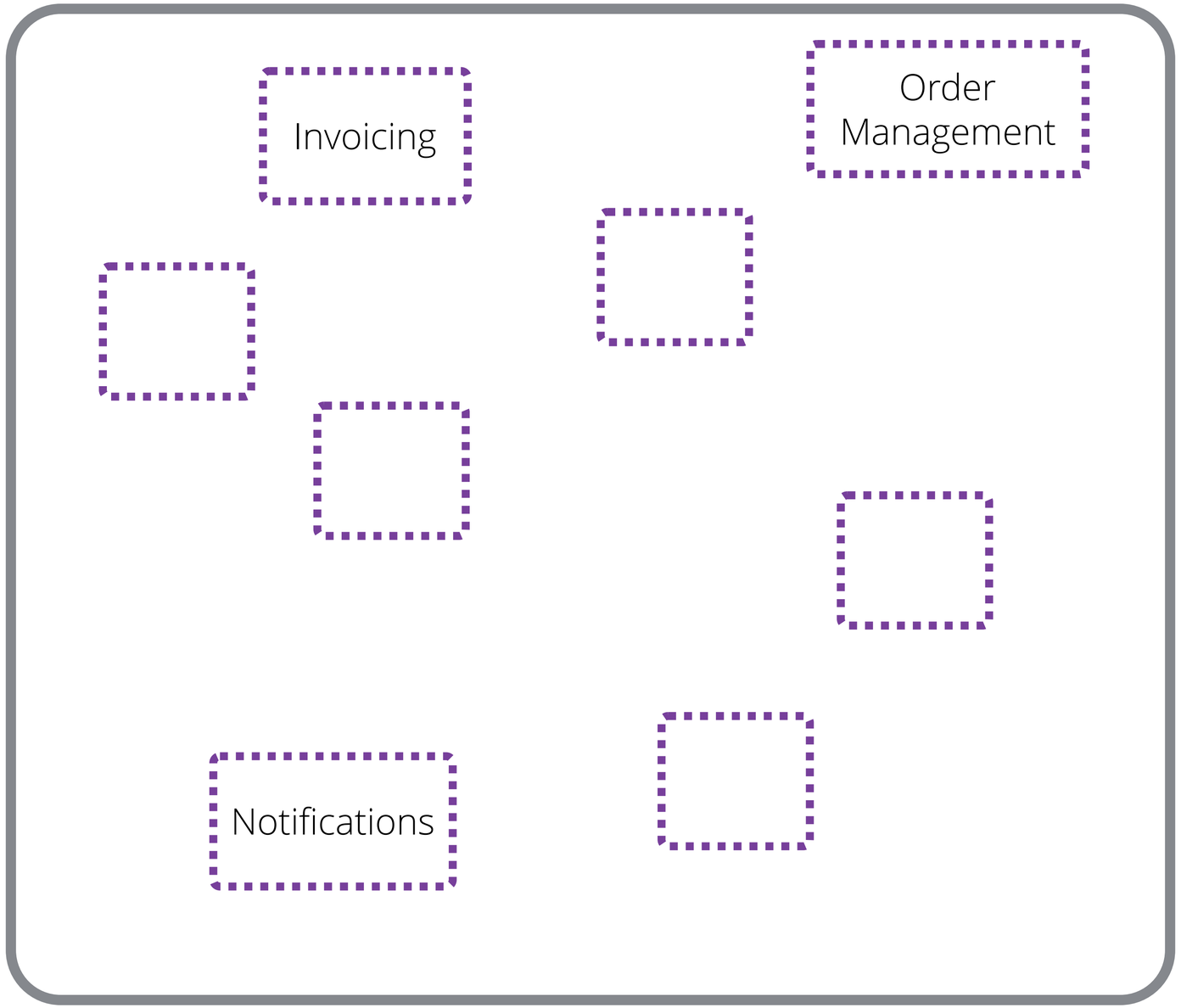
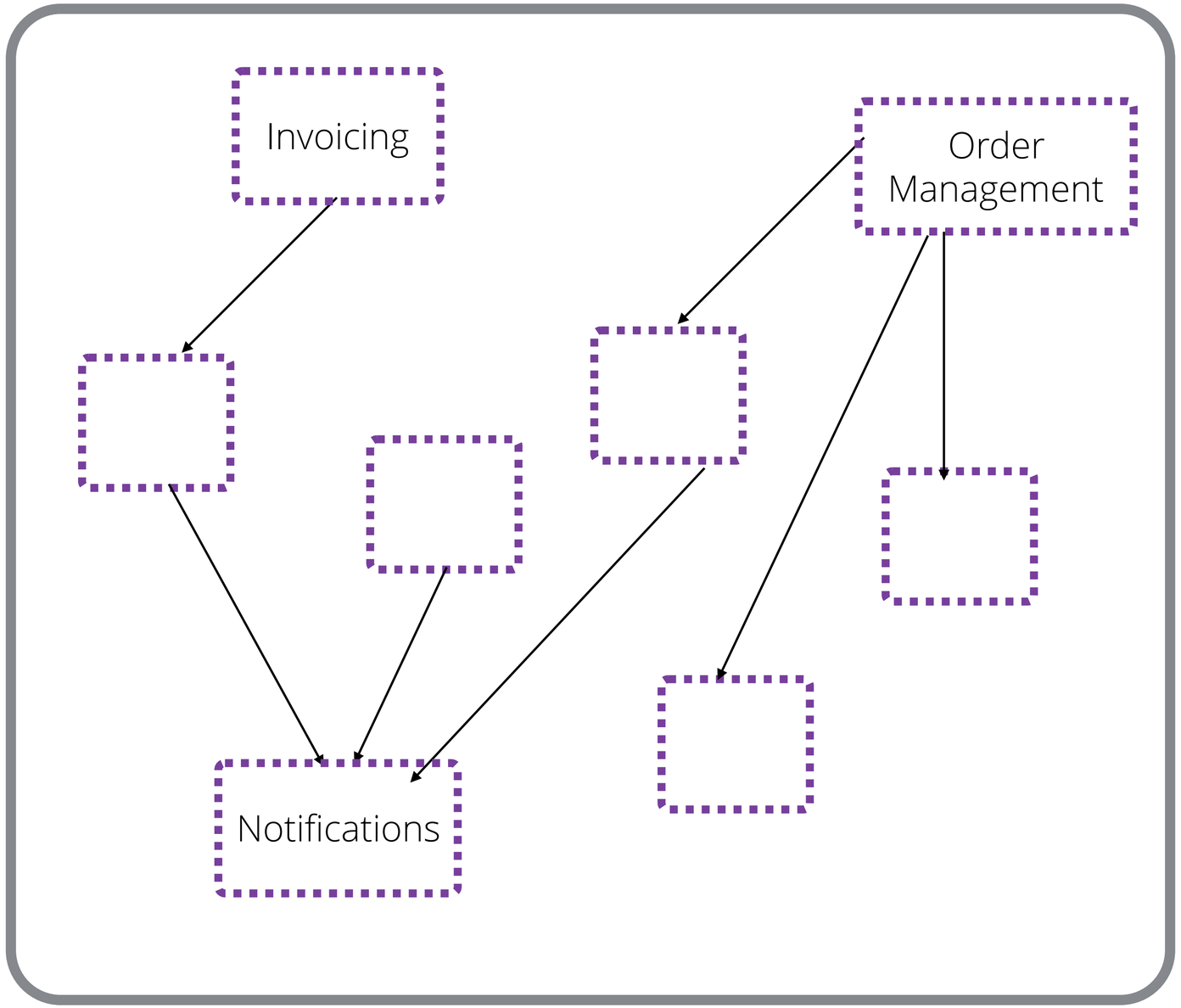

Invoicing
Order Management
Notifications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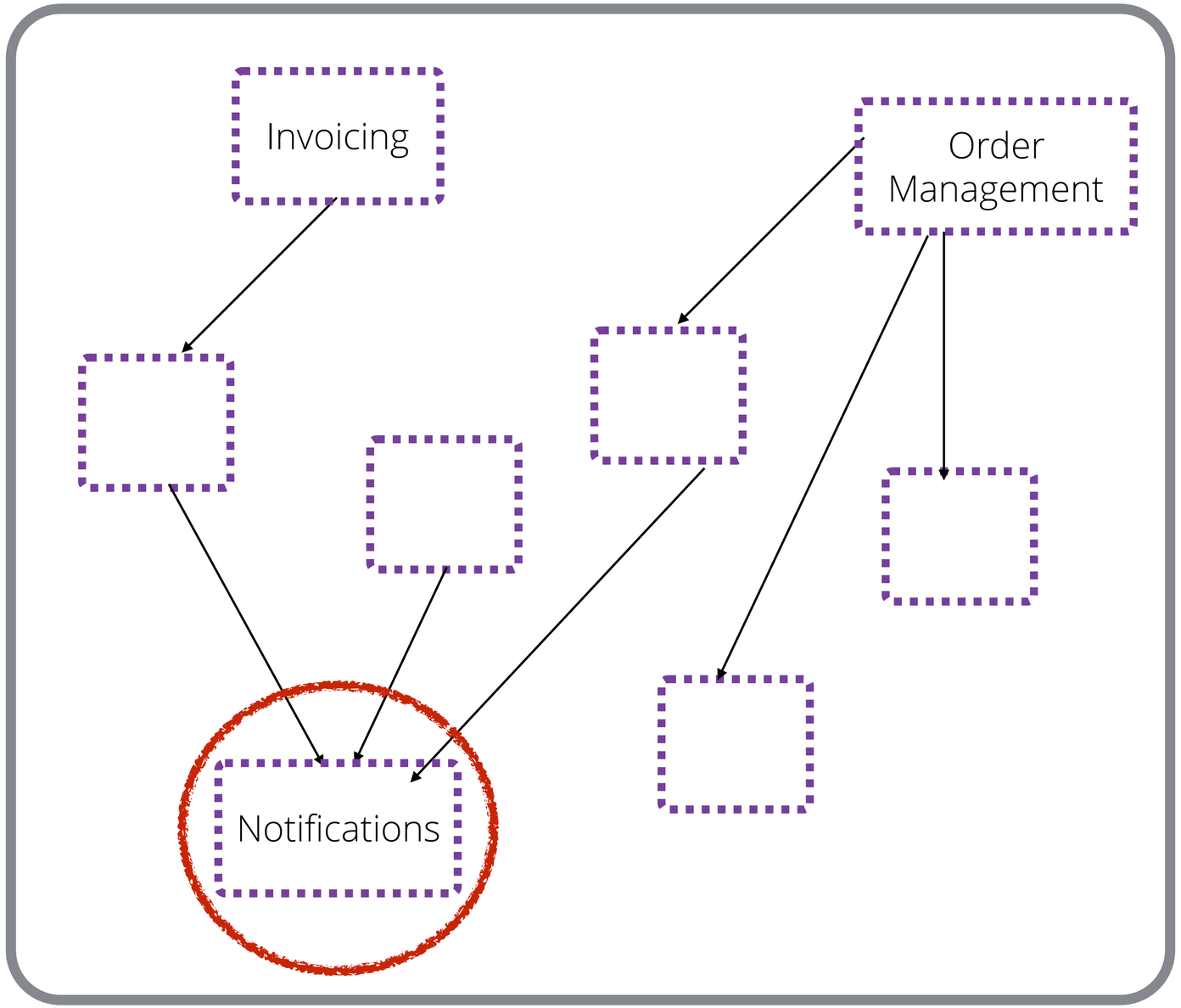
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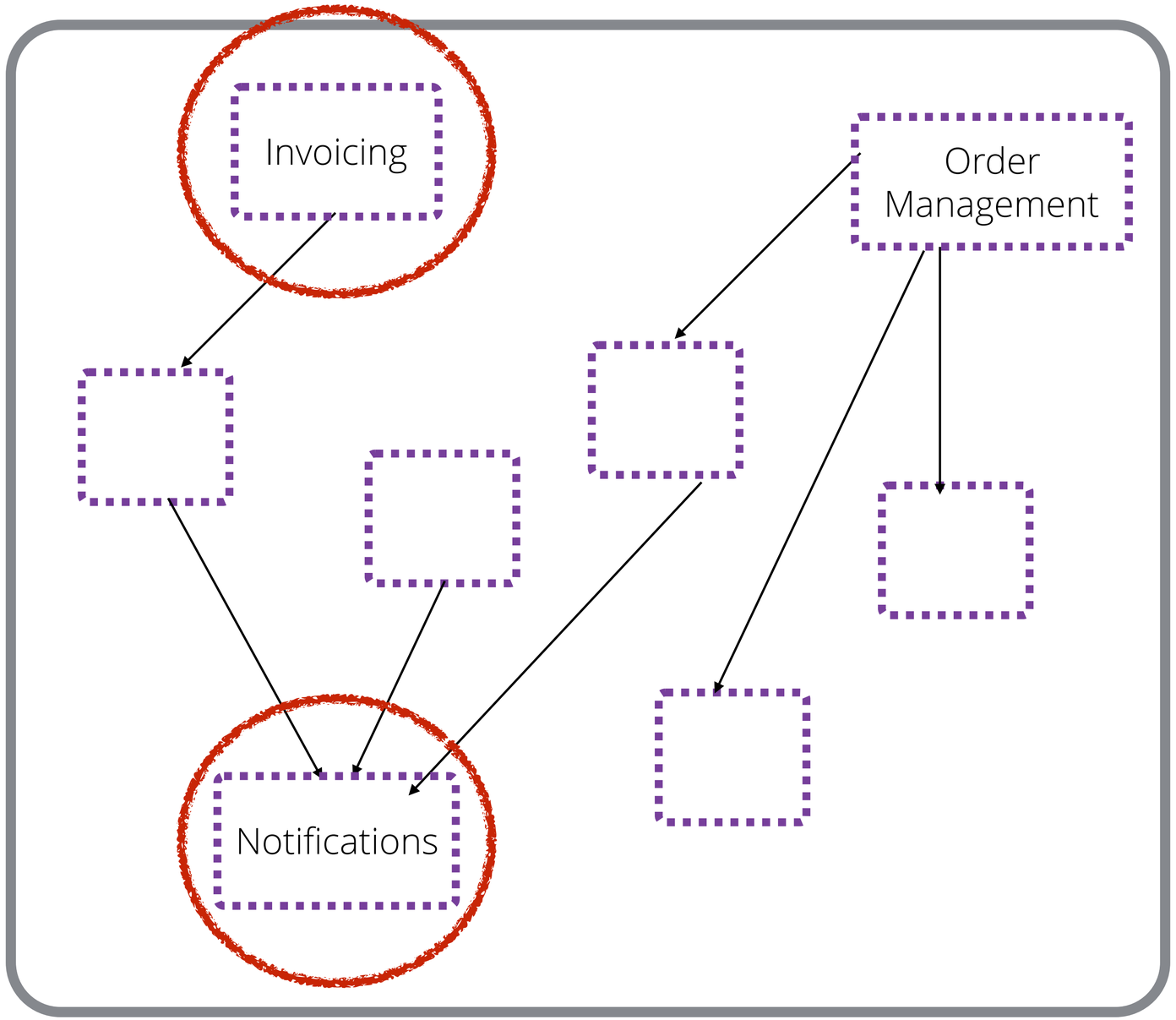
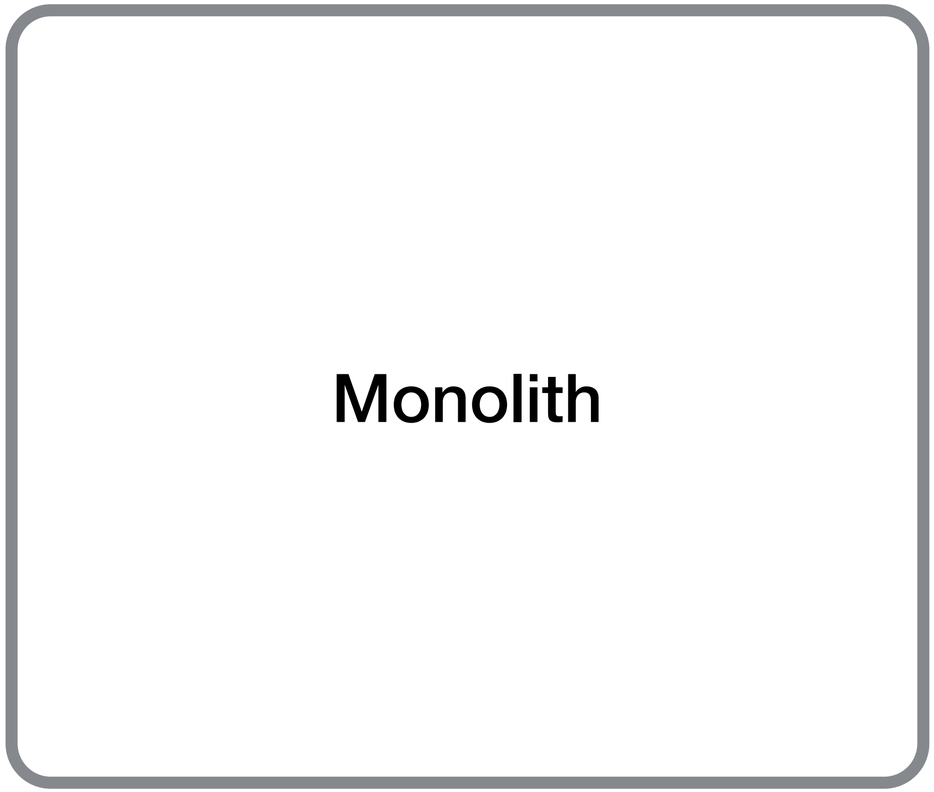

Invoicing
Order Management
Notifications

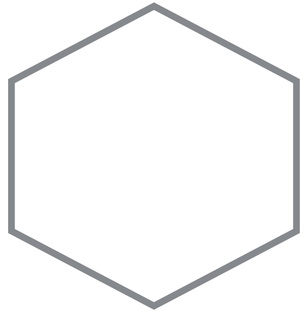
The problems you are trying to solve with microservices will drive *how* you decompose them

You need a clear idea of what you are trying to achieve with microservices

https://www.flickr.com/photos/orinrobertjohn/2911248047/

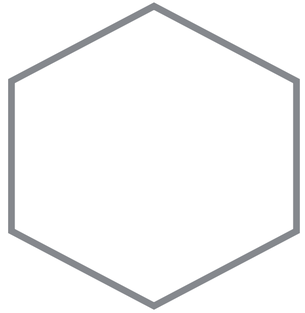

Monolith

Monolith

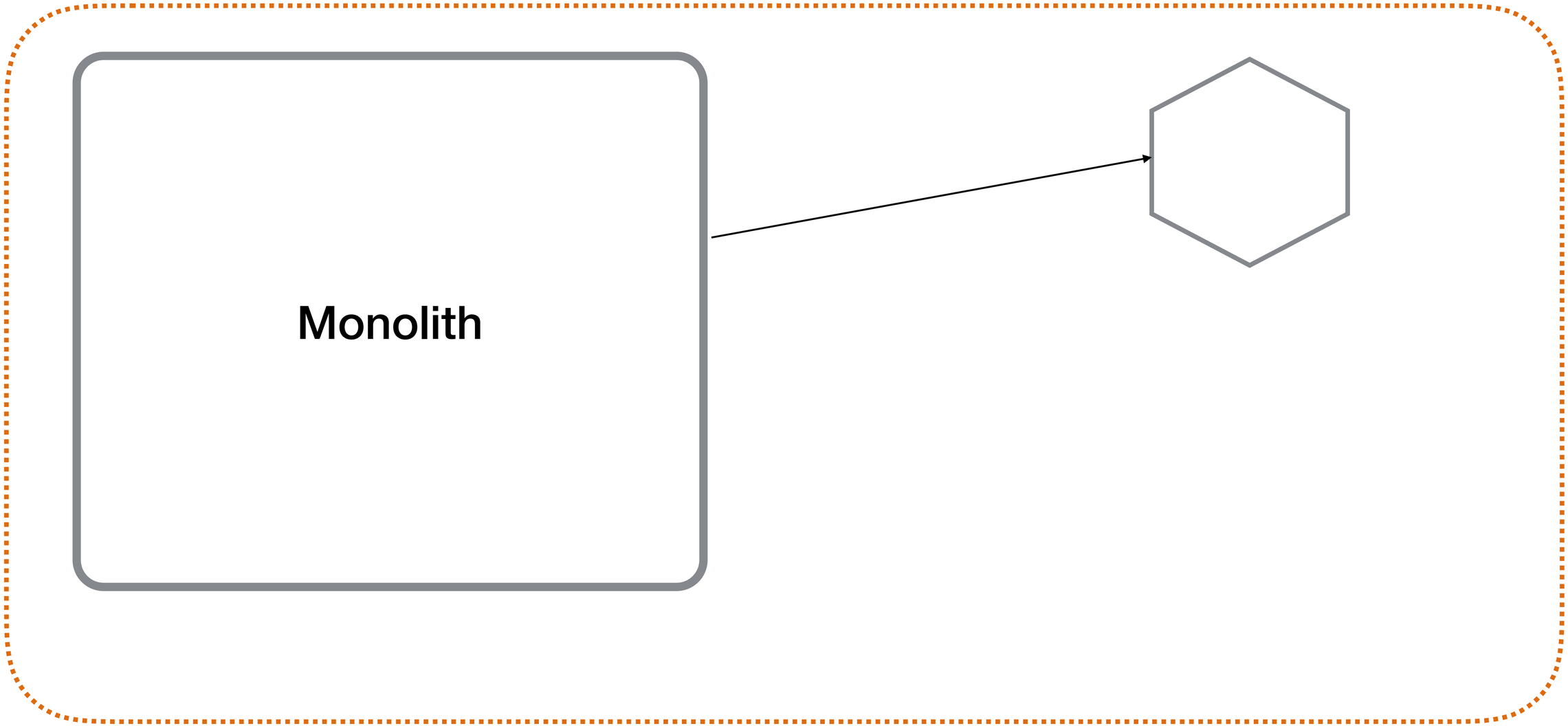


Production

Monolith



Production



You won’t appreciate the true horror, pain and suffering of microservices until you’re running them in production

“If you do a big bang rewrite, the only thing you’re certain of is a big bang”

- Martin Fowler (paraphrased)

https://www.flickr.com/photos/pahudson/3224209758/

So migration patterns we use must allow for incremental change

Patterns that allow for our architecture to evolve, whilst still delivering features

https://www.flickr.com/photos/cynren/16012074217/

IMPLEMENTING A STRANGLER FIG PATTERN

1. Asset capture:

Identify the functionality to move to a new microservice

IMPLEMENTING A STRANGLER FIG PATTERN

1. Asset capture:

Identify the functionality to move to a new microservice

2. Redirect calls

Intercept calls to old functionality, and redirect to the new service

“MOVING” FUNCTIONALITY?

“MOVING” FUNCTIONALITY?

It might be copy and paste

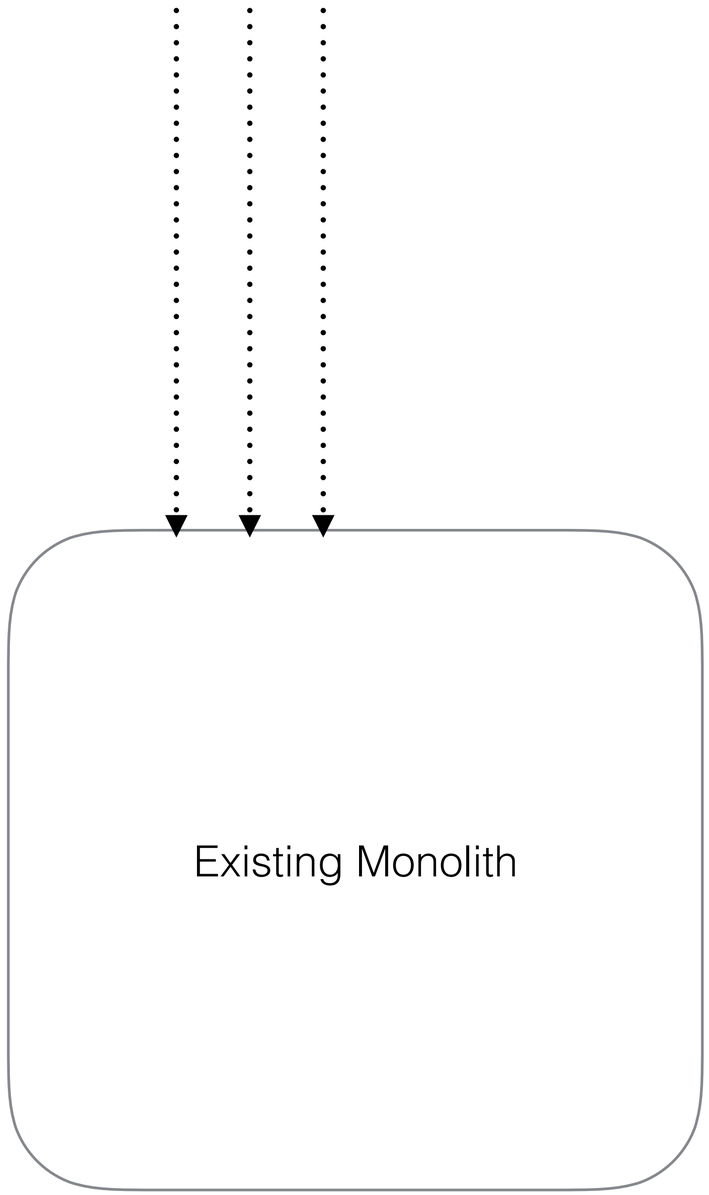
“MOVING” FUNCTIONALITY?

It might be copy and paste

More likely is a total or partial rewrite

HTTP PROXY

HTTP PROXY



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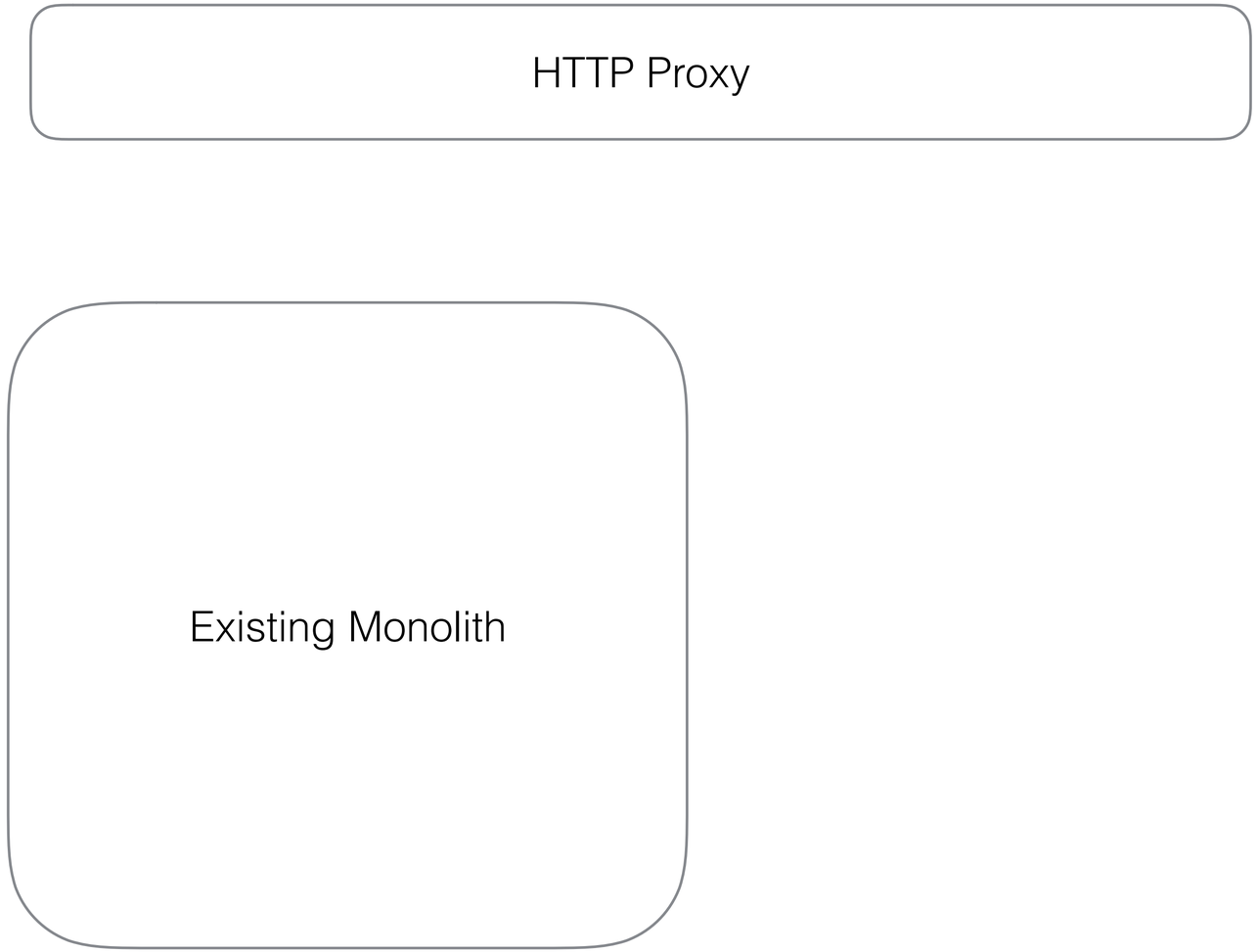
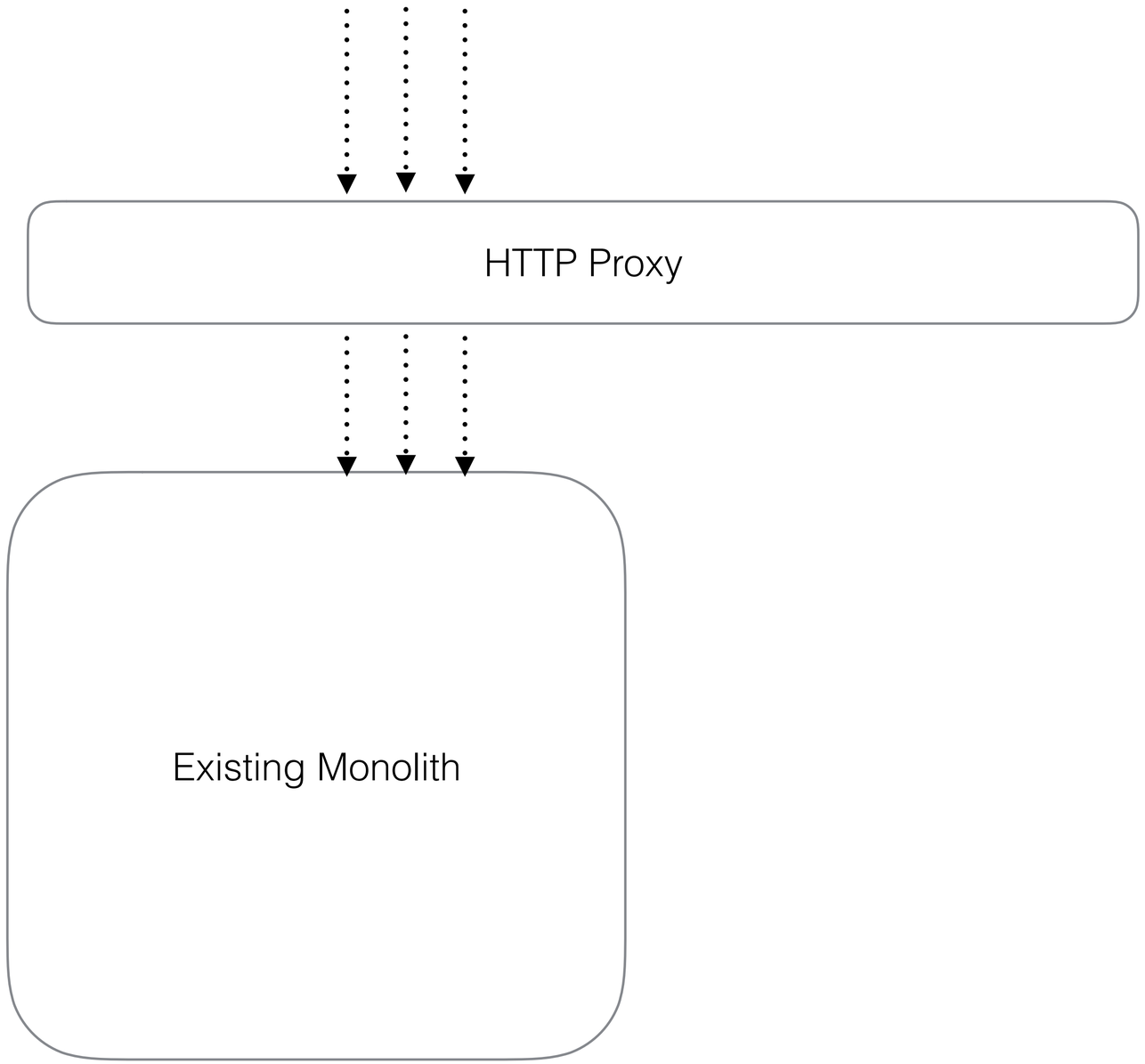


HTTP PROXY



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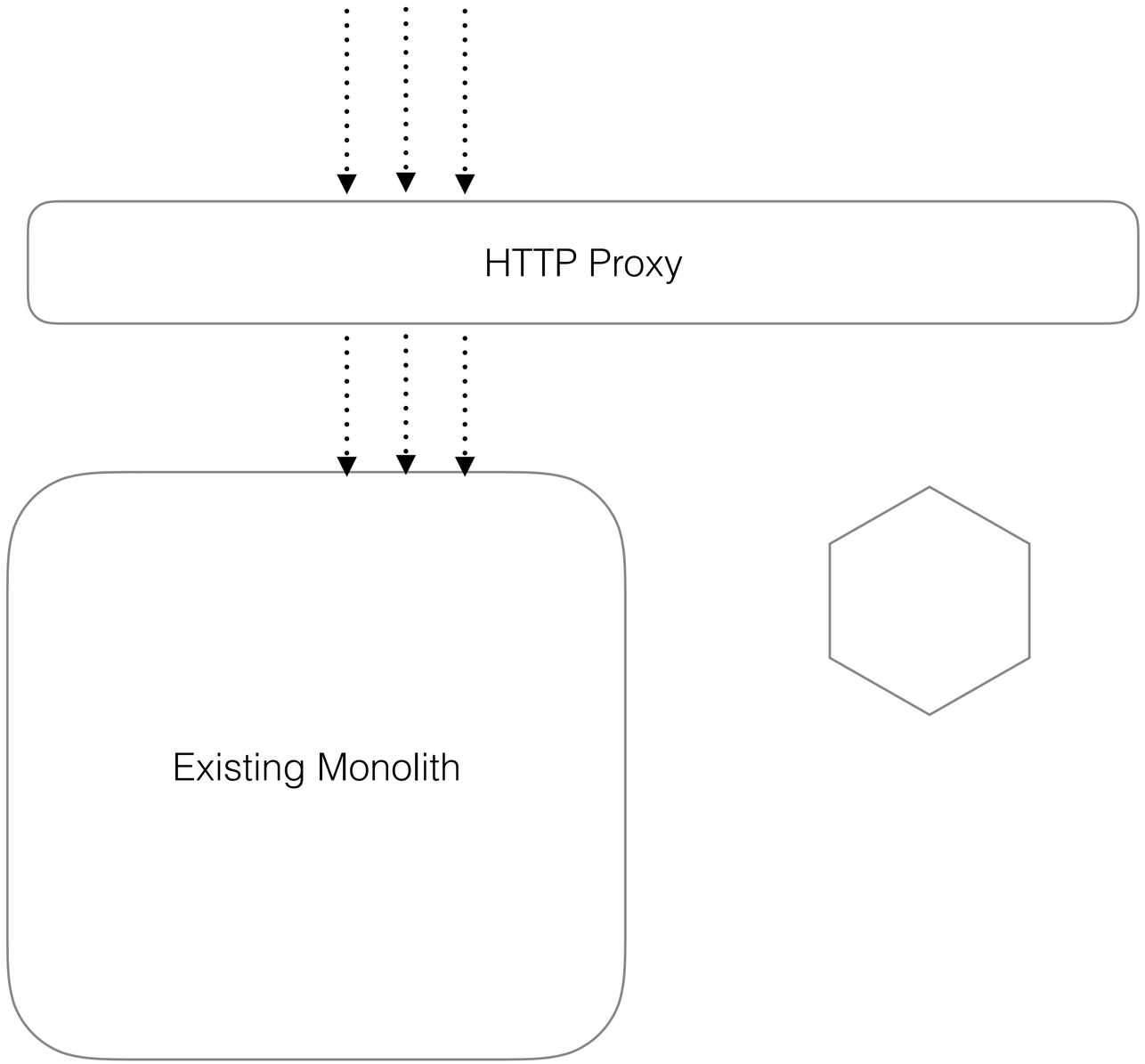

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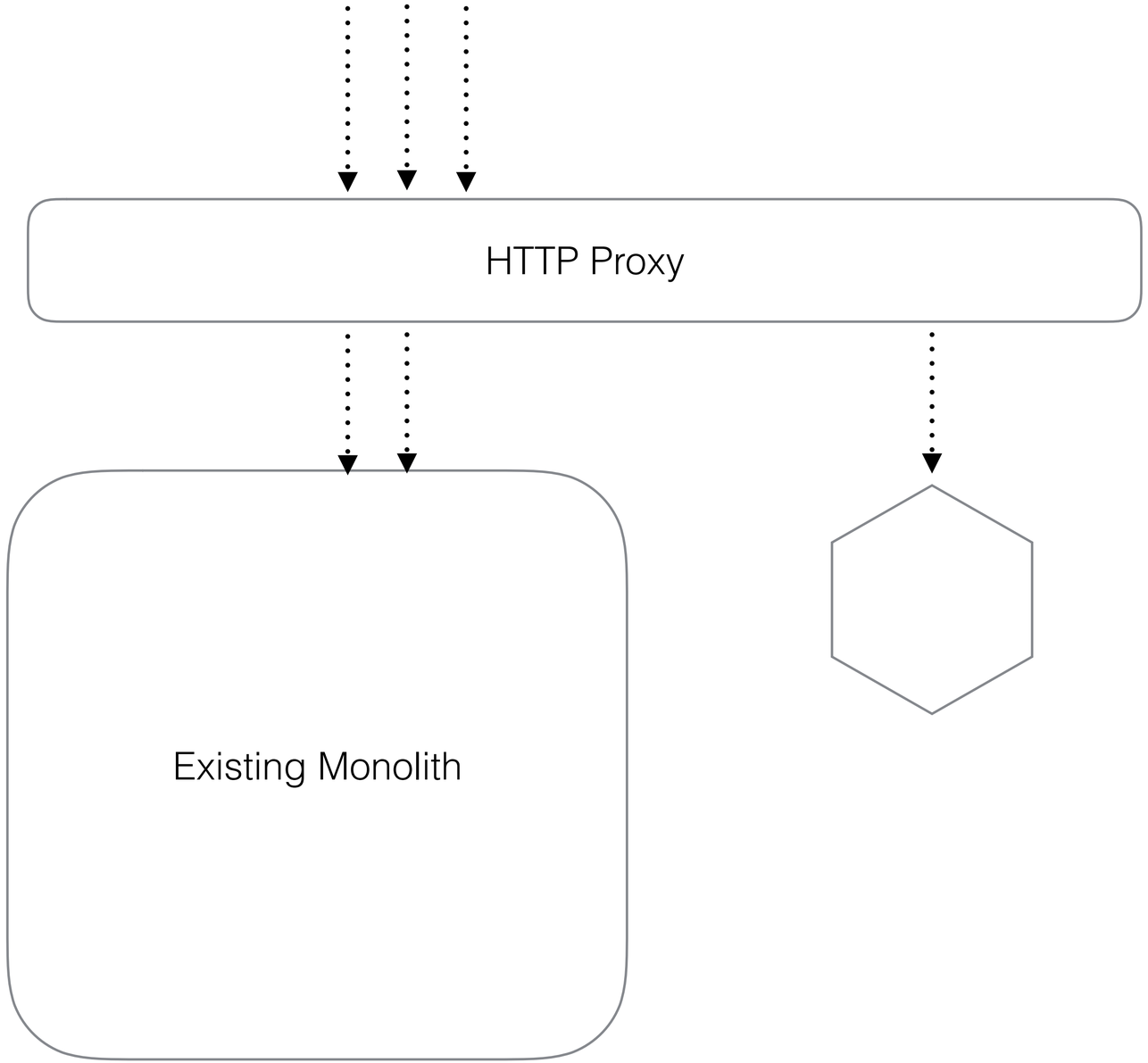

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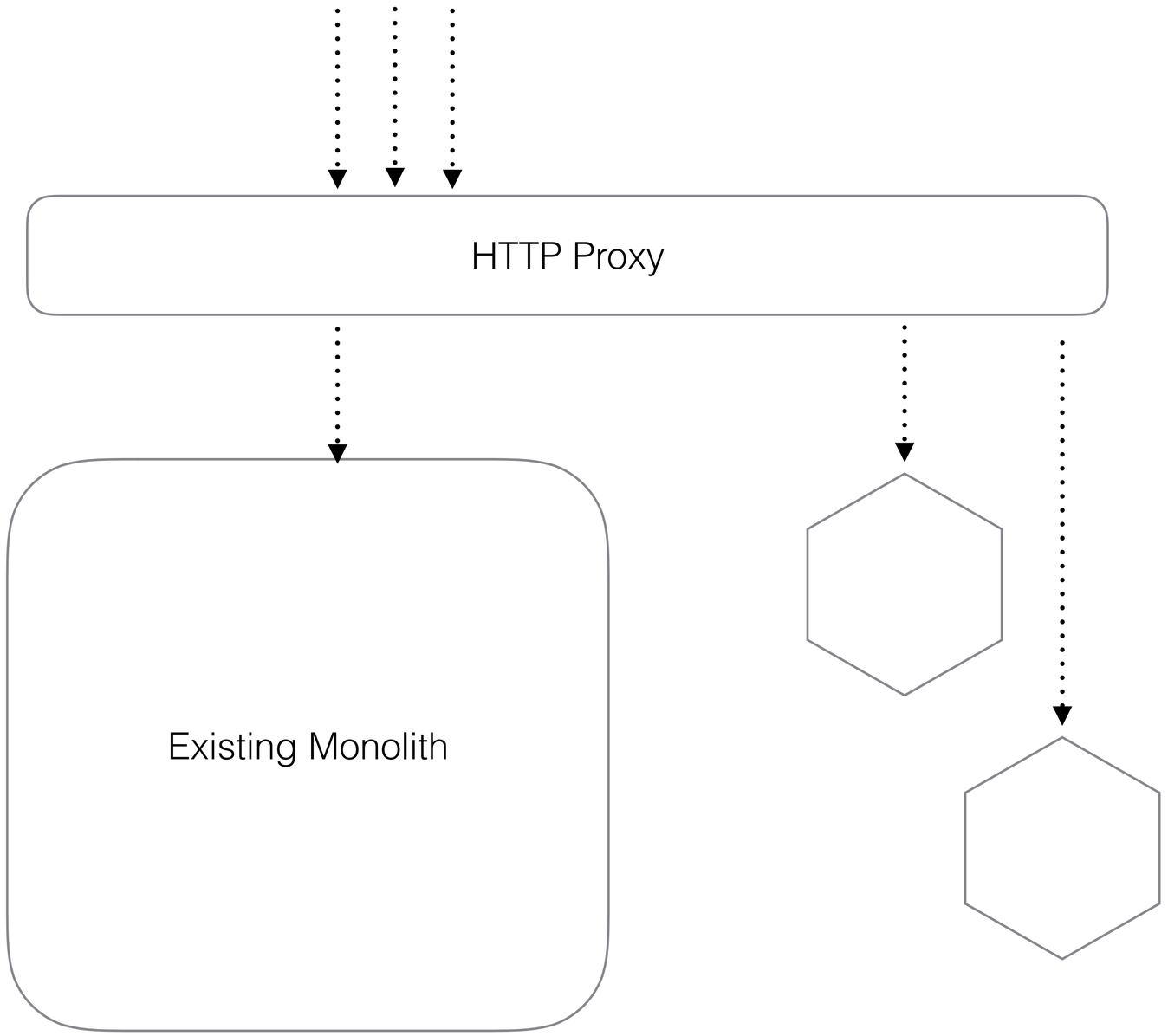
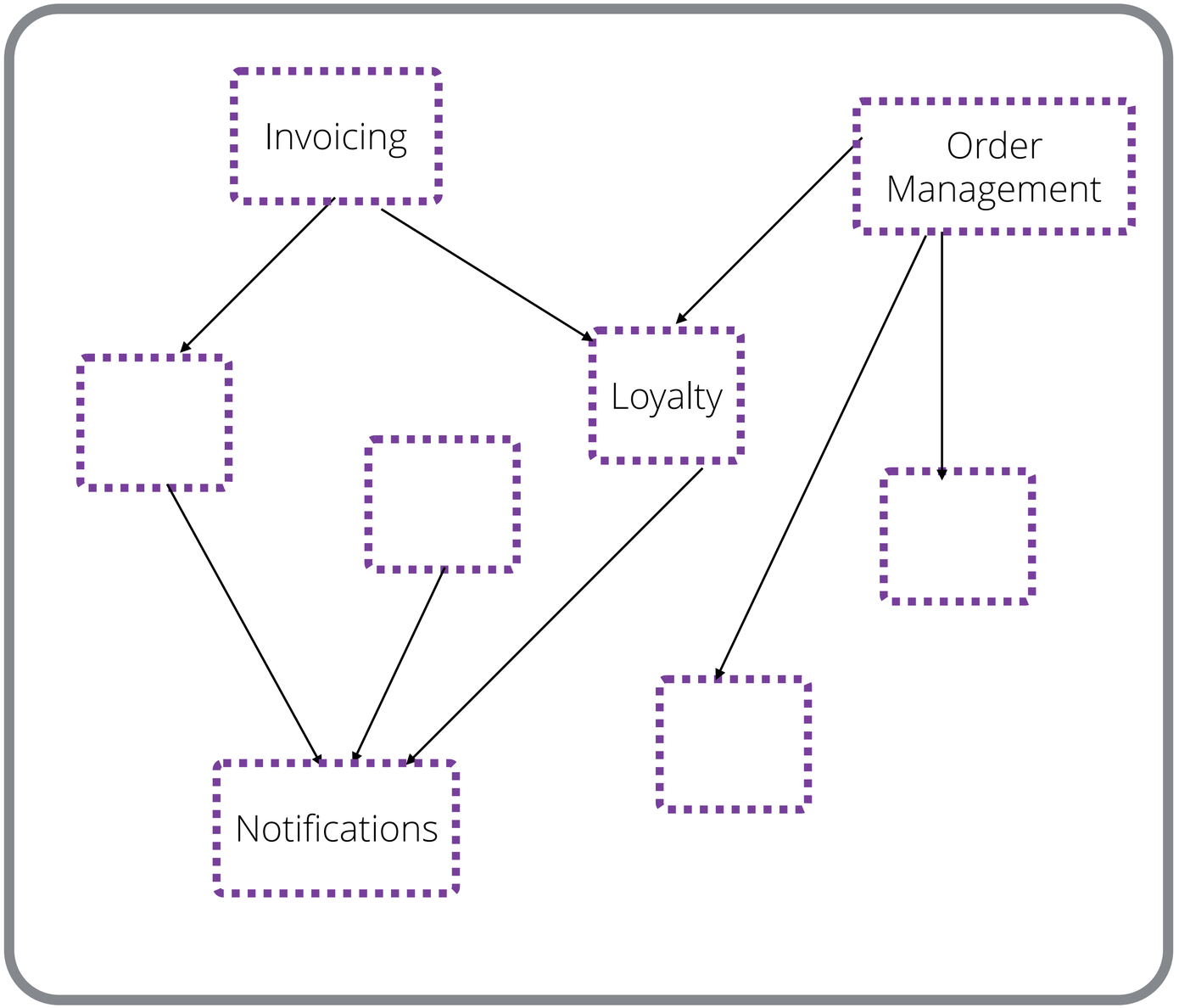
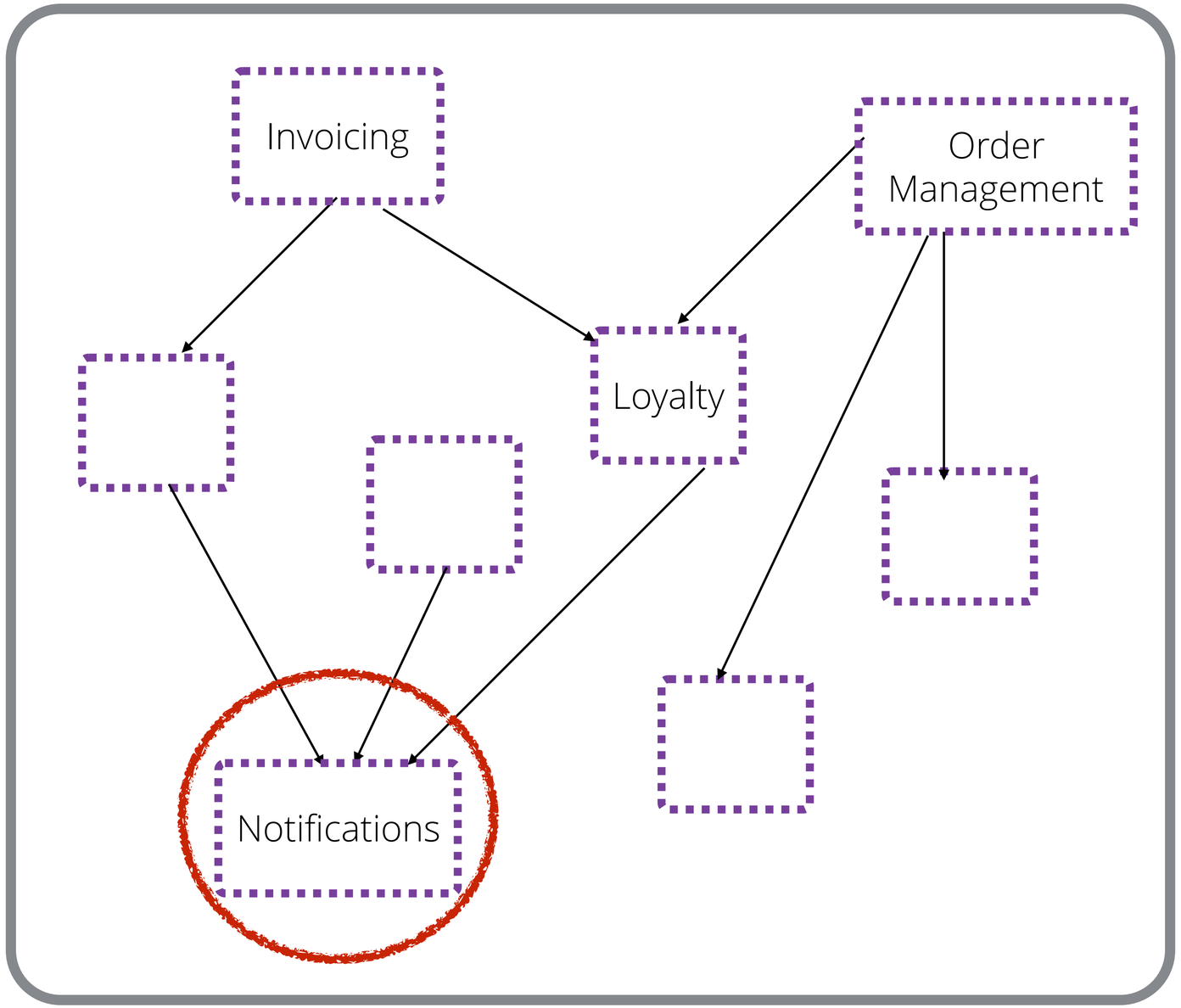



Invoicing
Order Management
Loyalty
Notifications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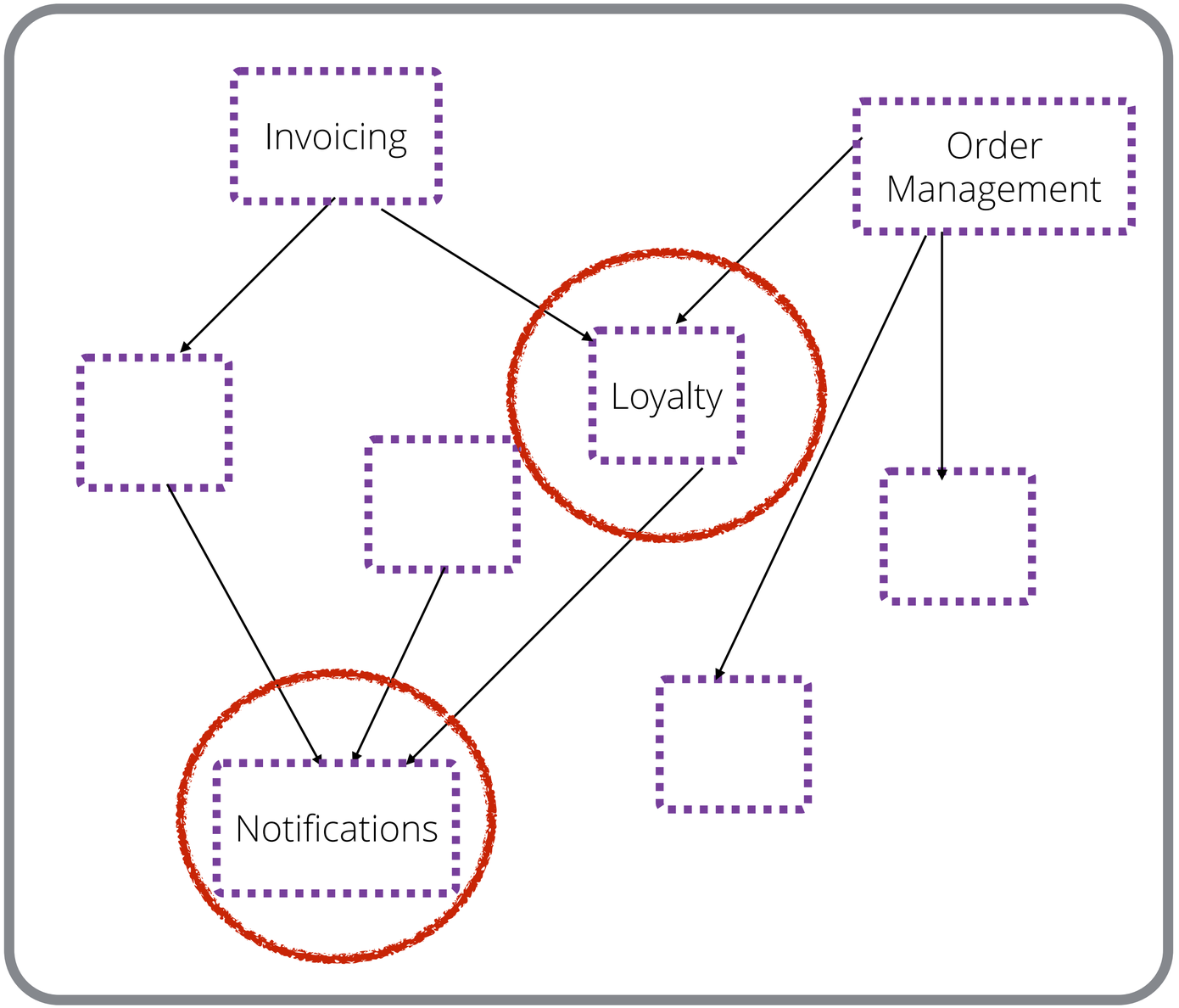
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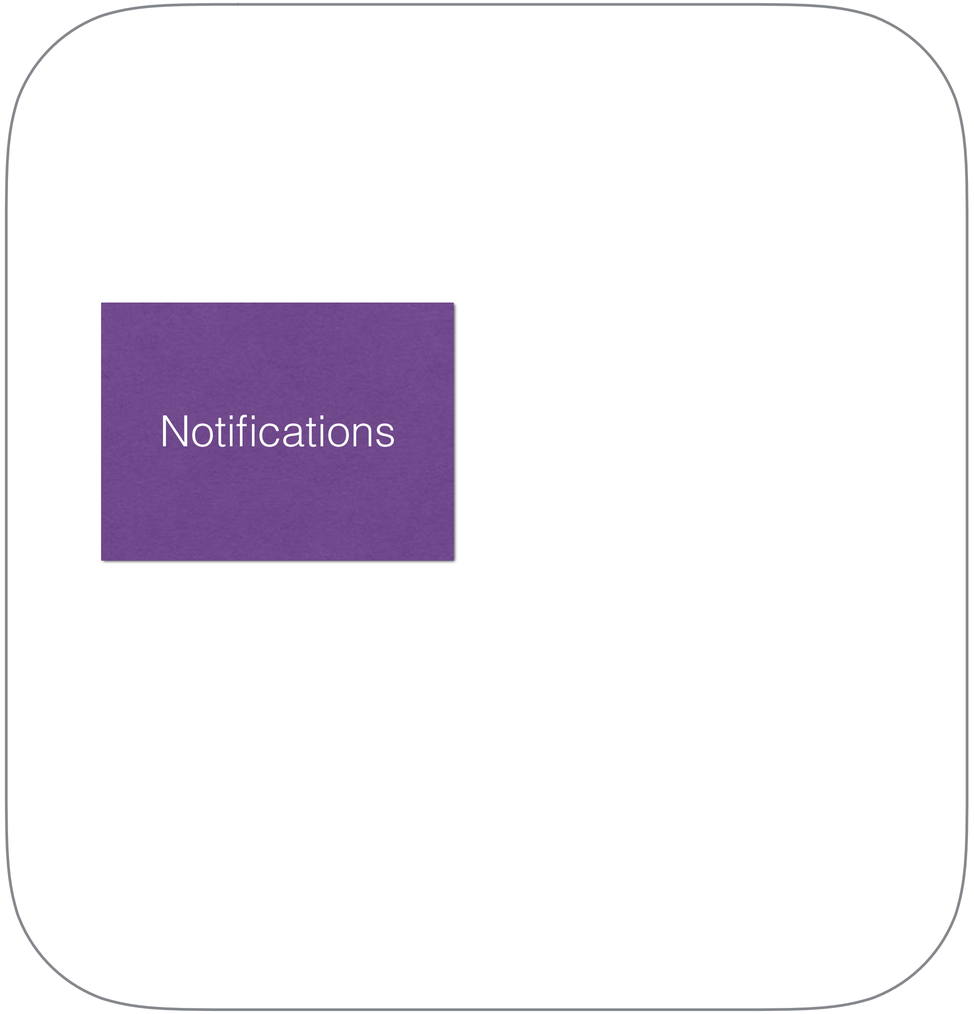
Branch By Abstraction

BRANCH BY ABSTRACTION



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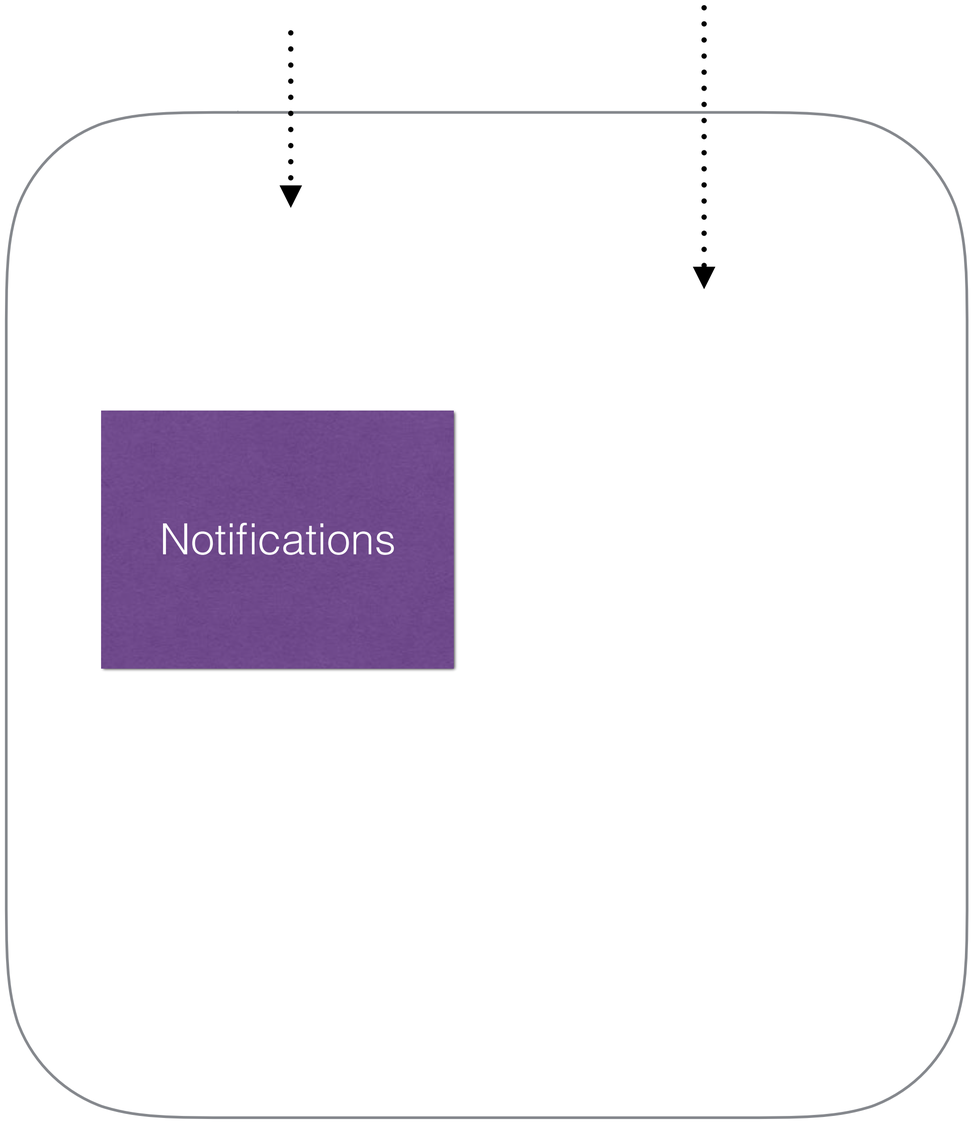

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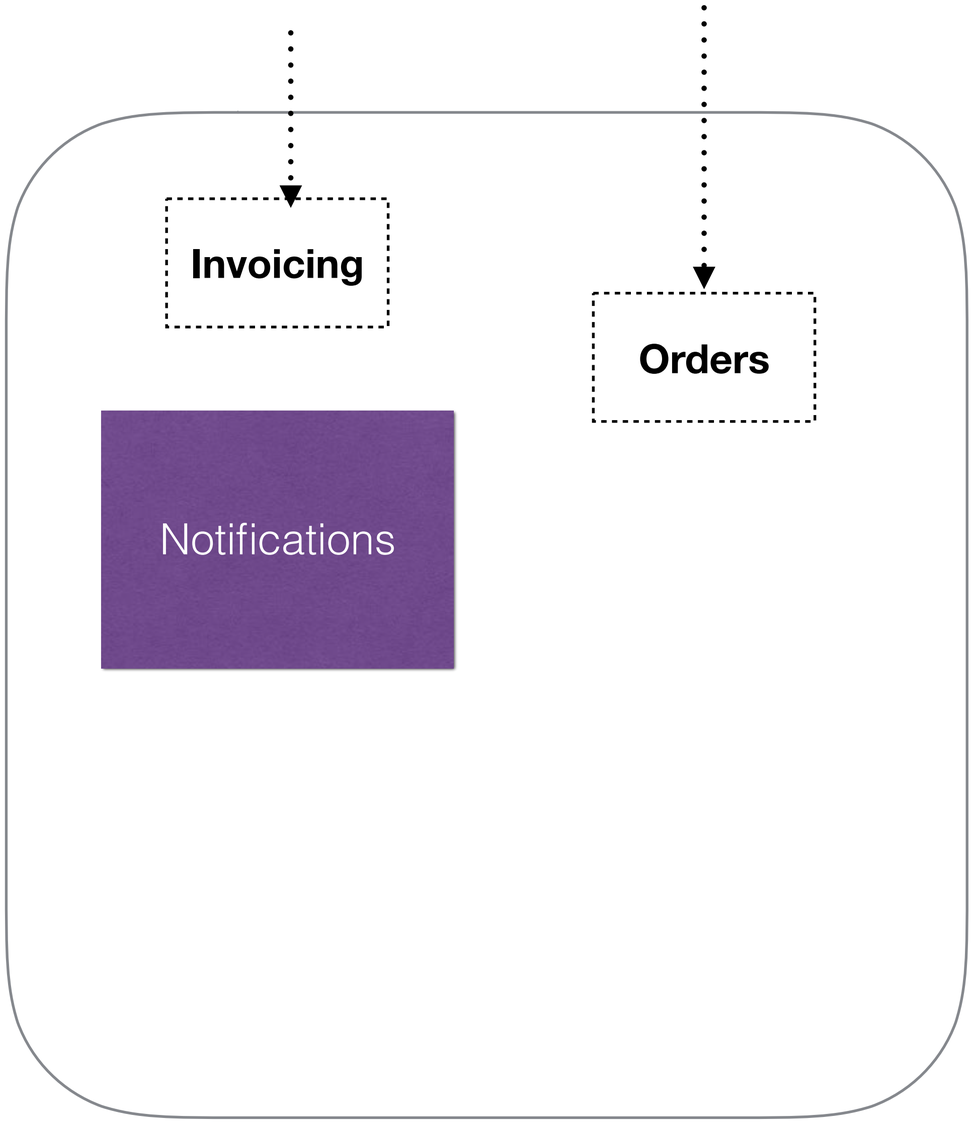

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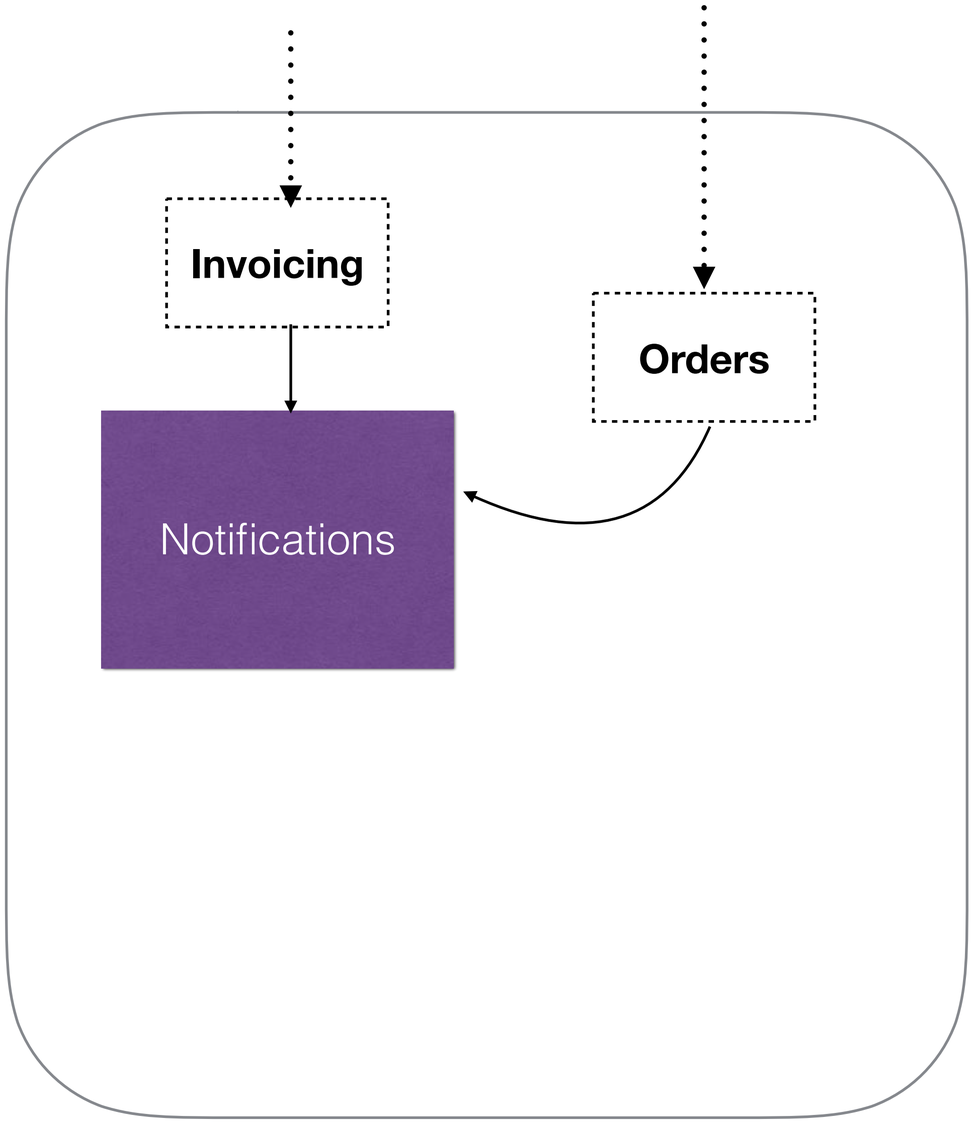

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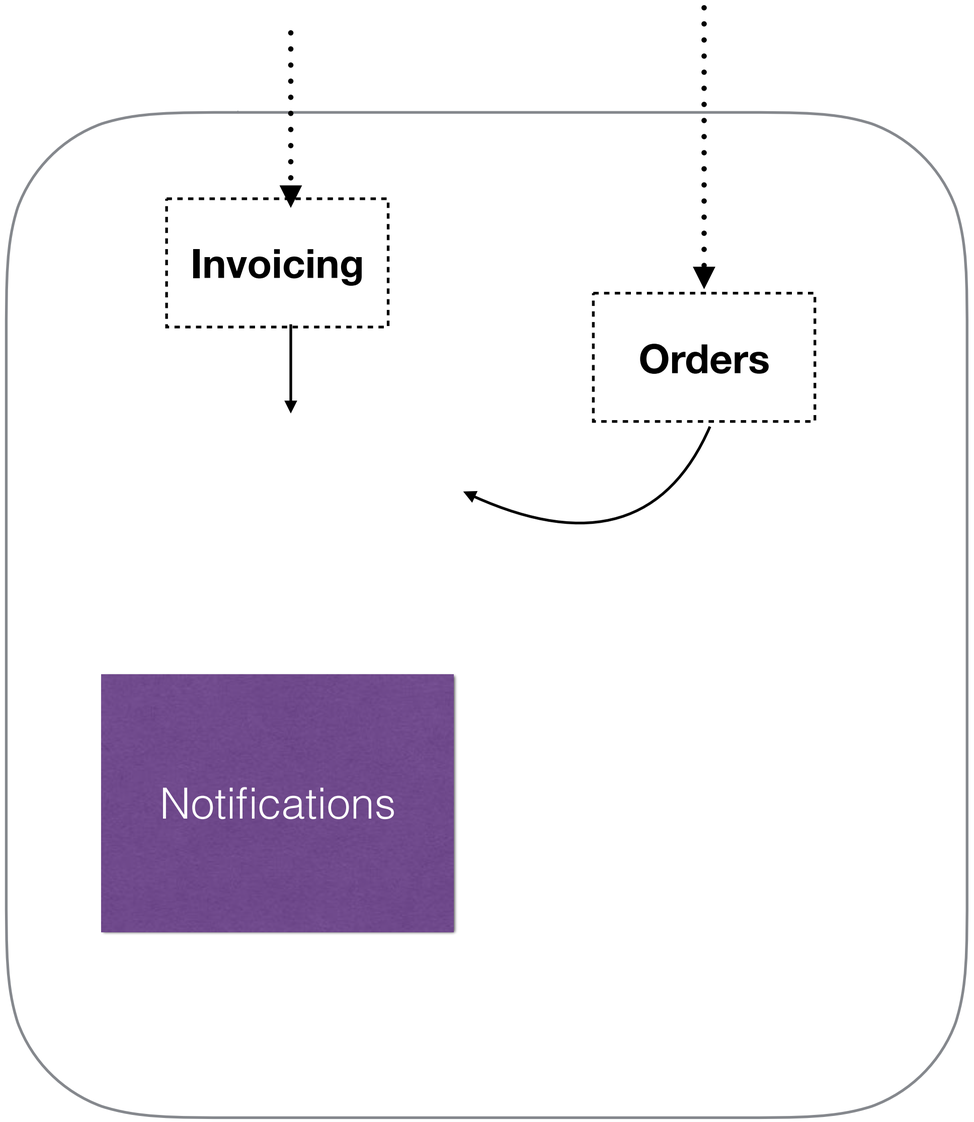
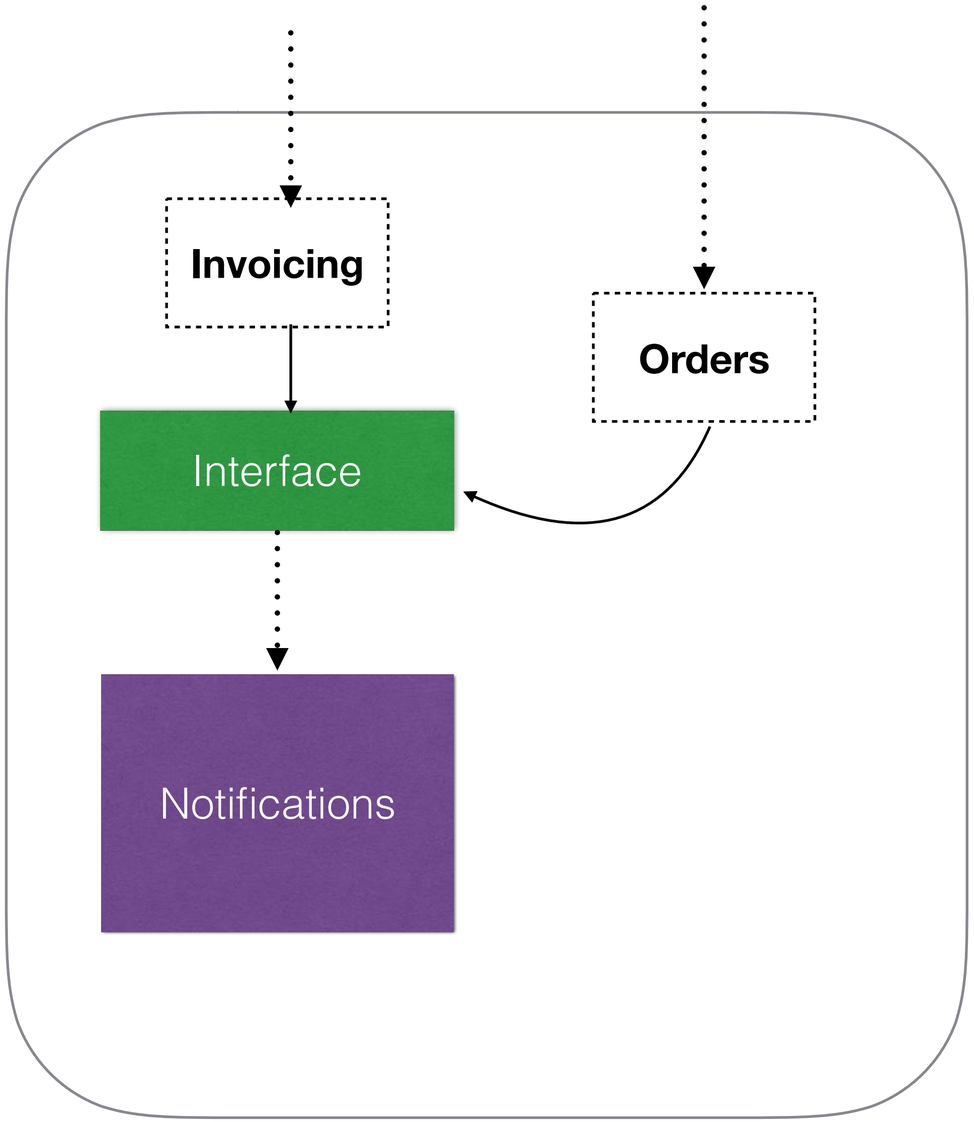


BRANCH BY ABSTRACTION

1. Create abstraction point



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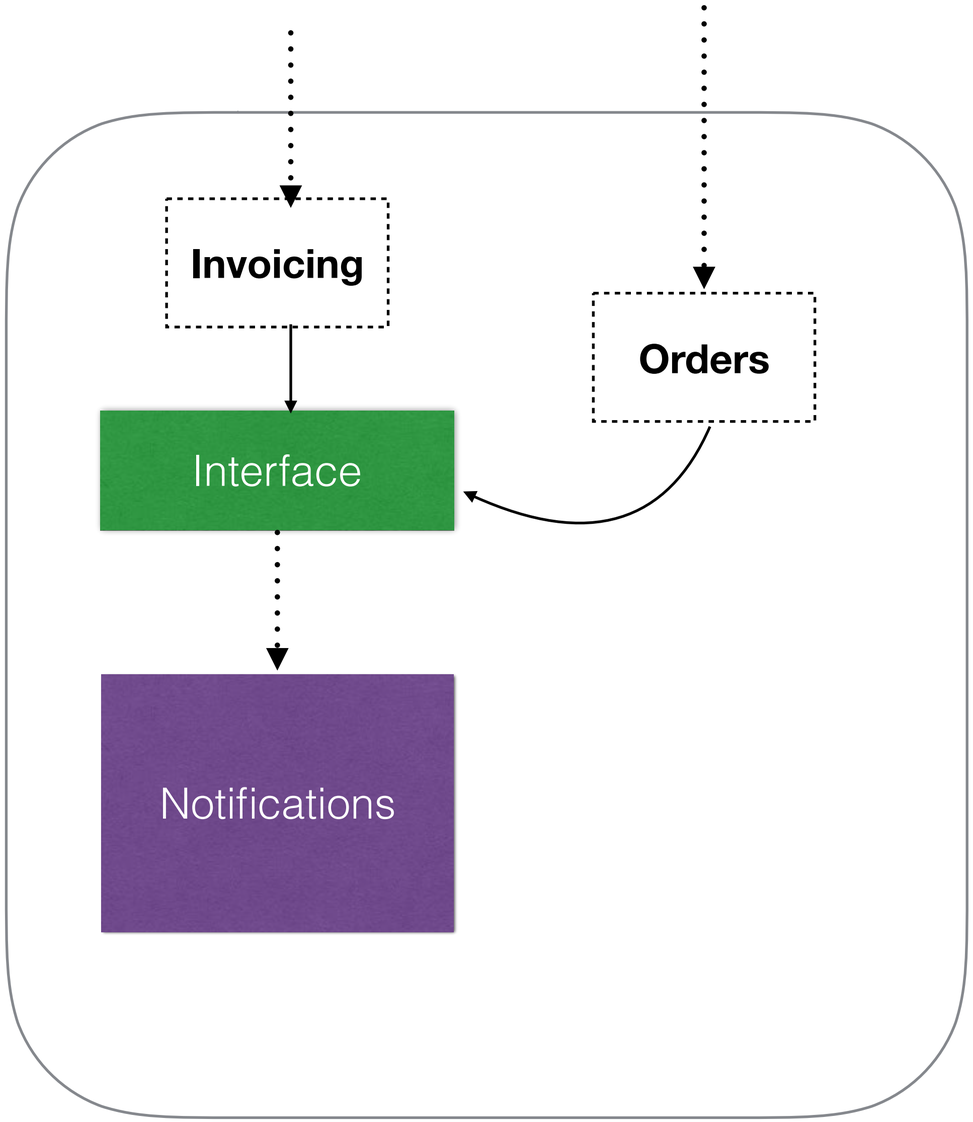
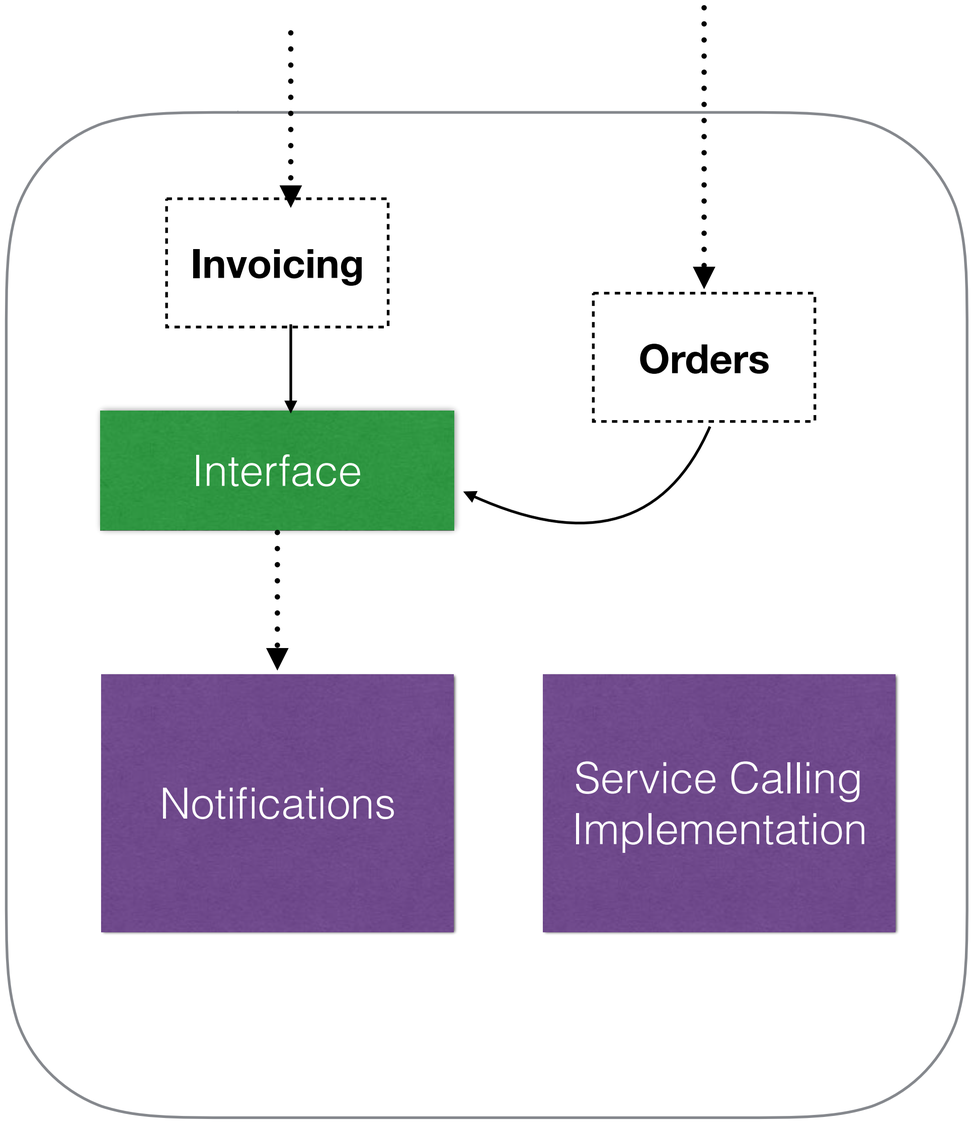


1. Create abstraction point

2. Start work on new service implementation

BRANCH BY ABSTRACTION



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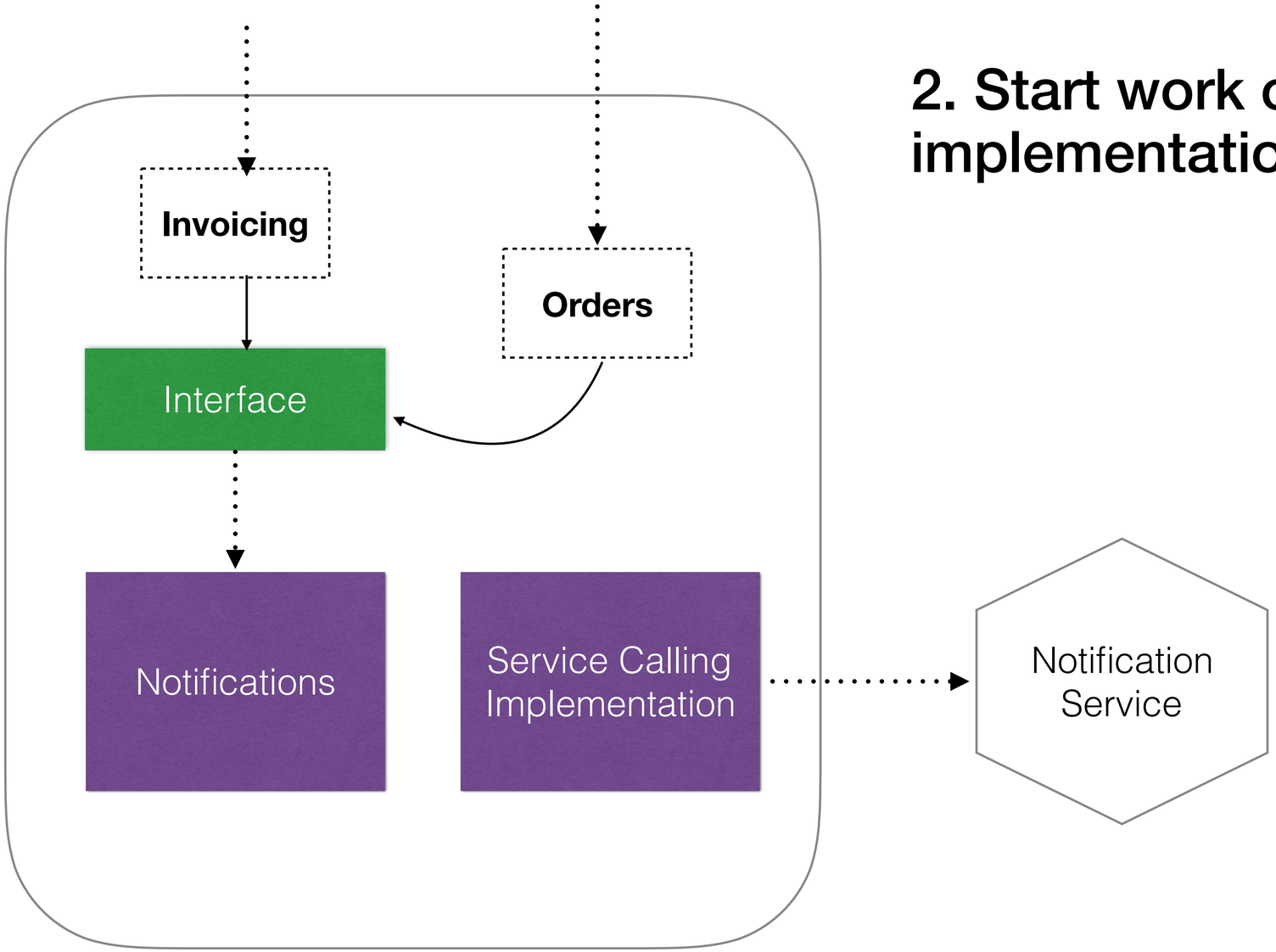

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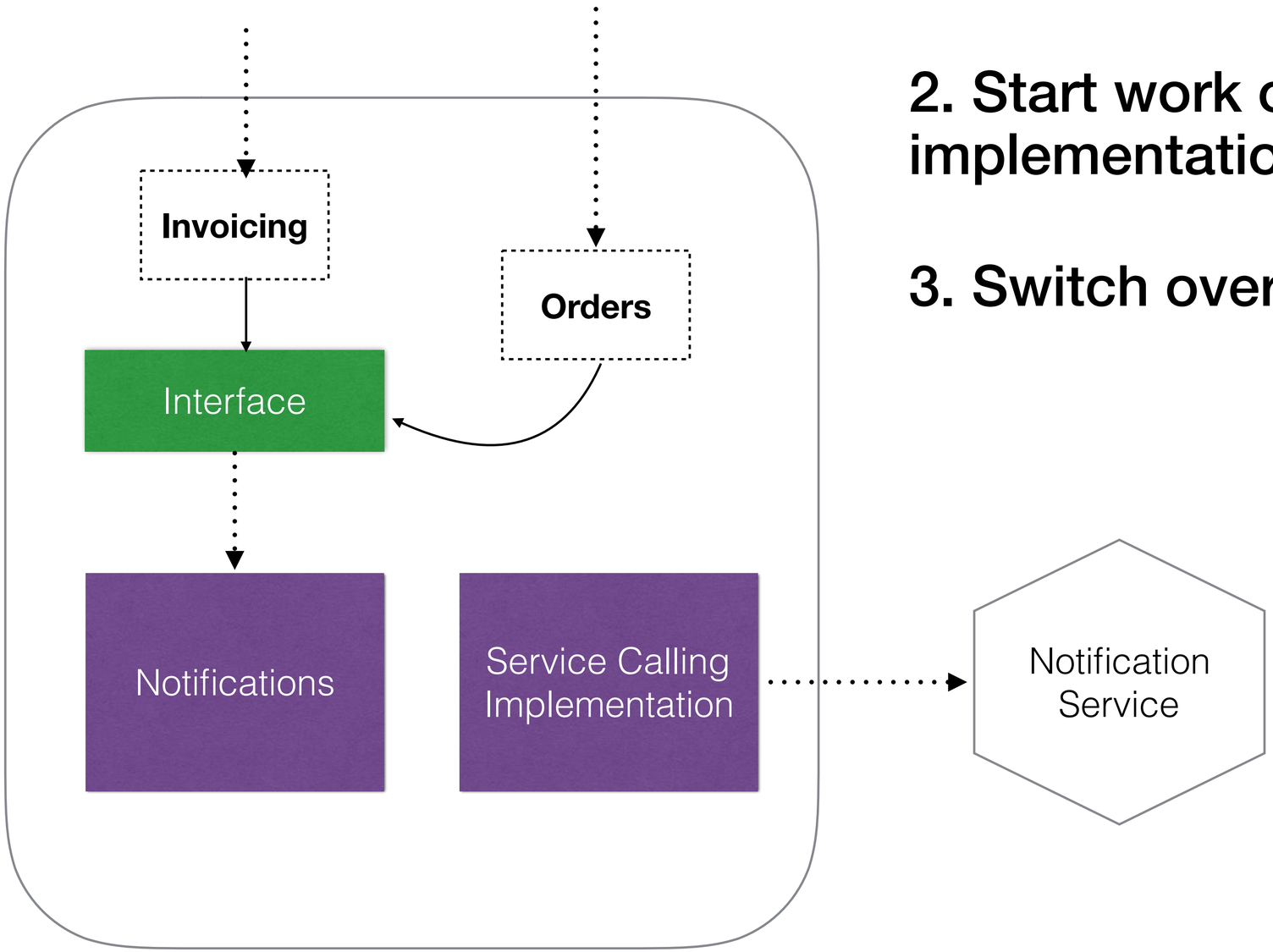

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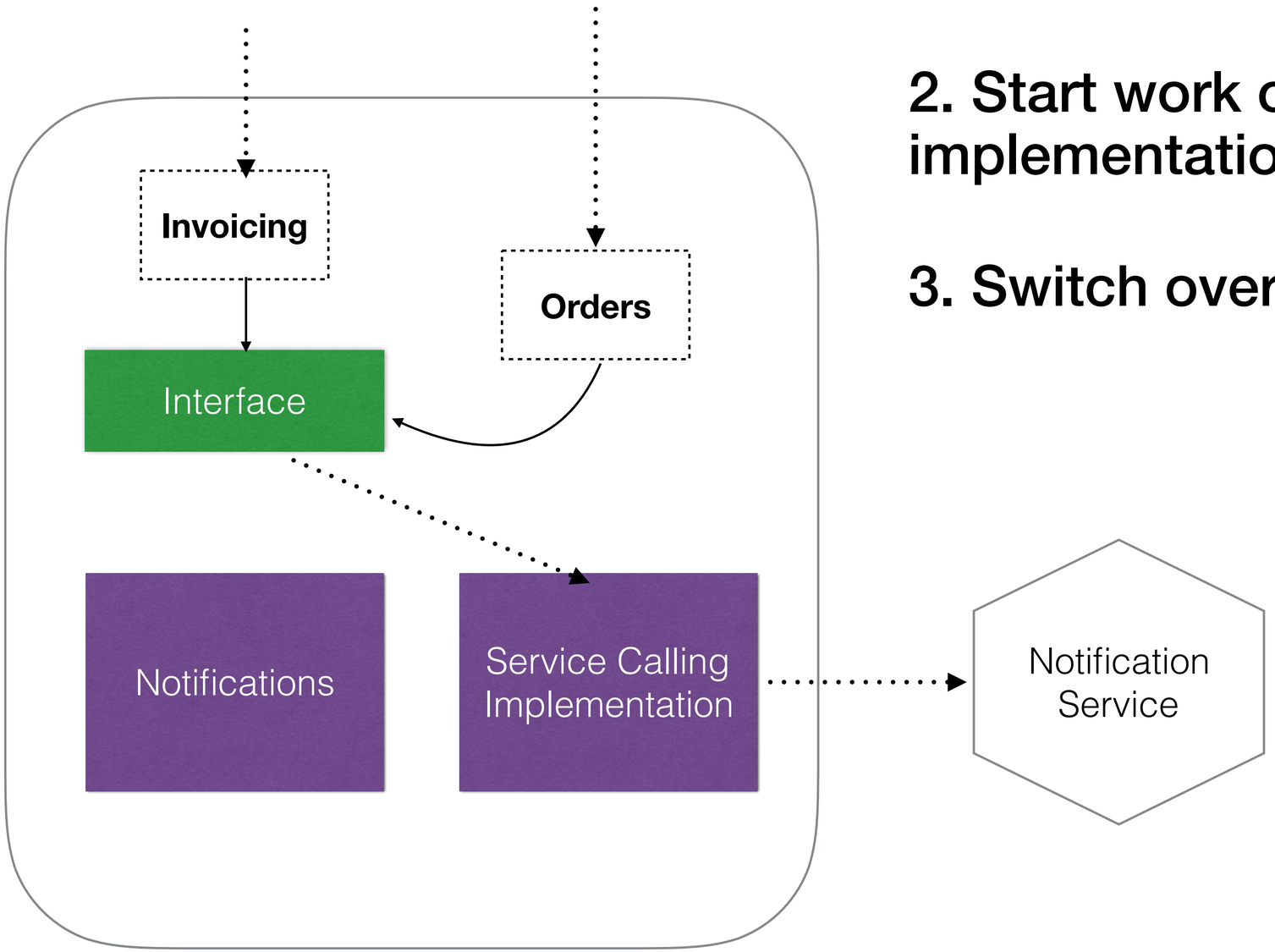
2. Start work on new service implementation

3. Switch over

BRANCH BY ABSTRACTION



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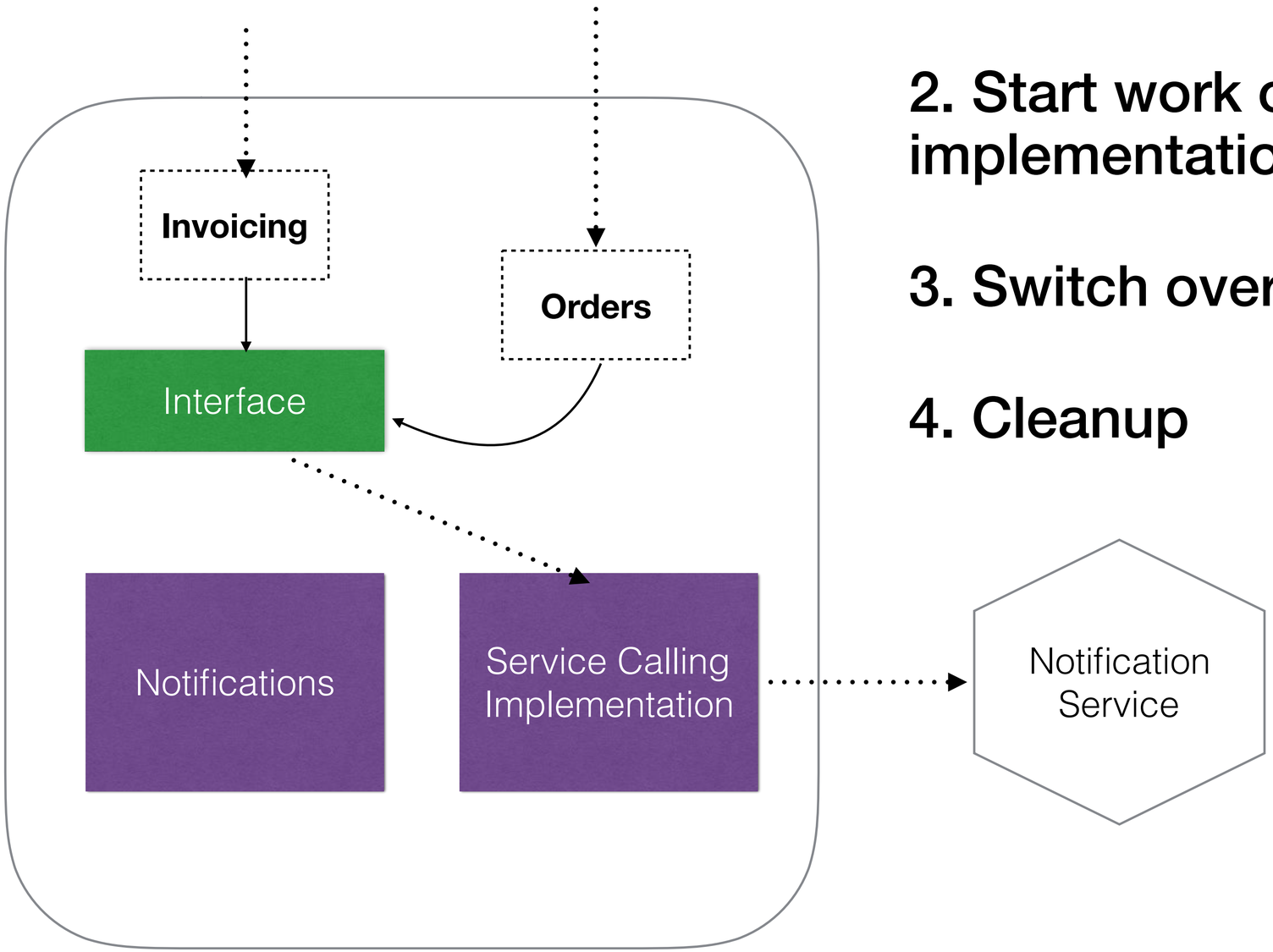

1. Create abstraction point
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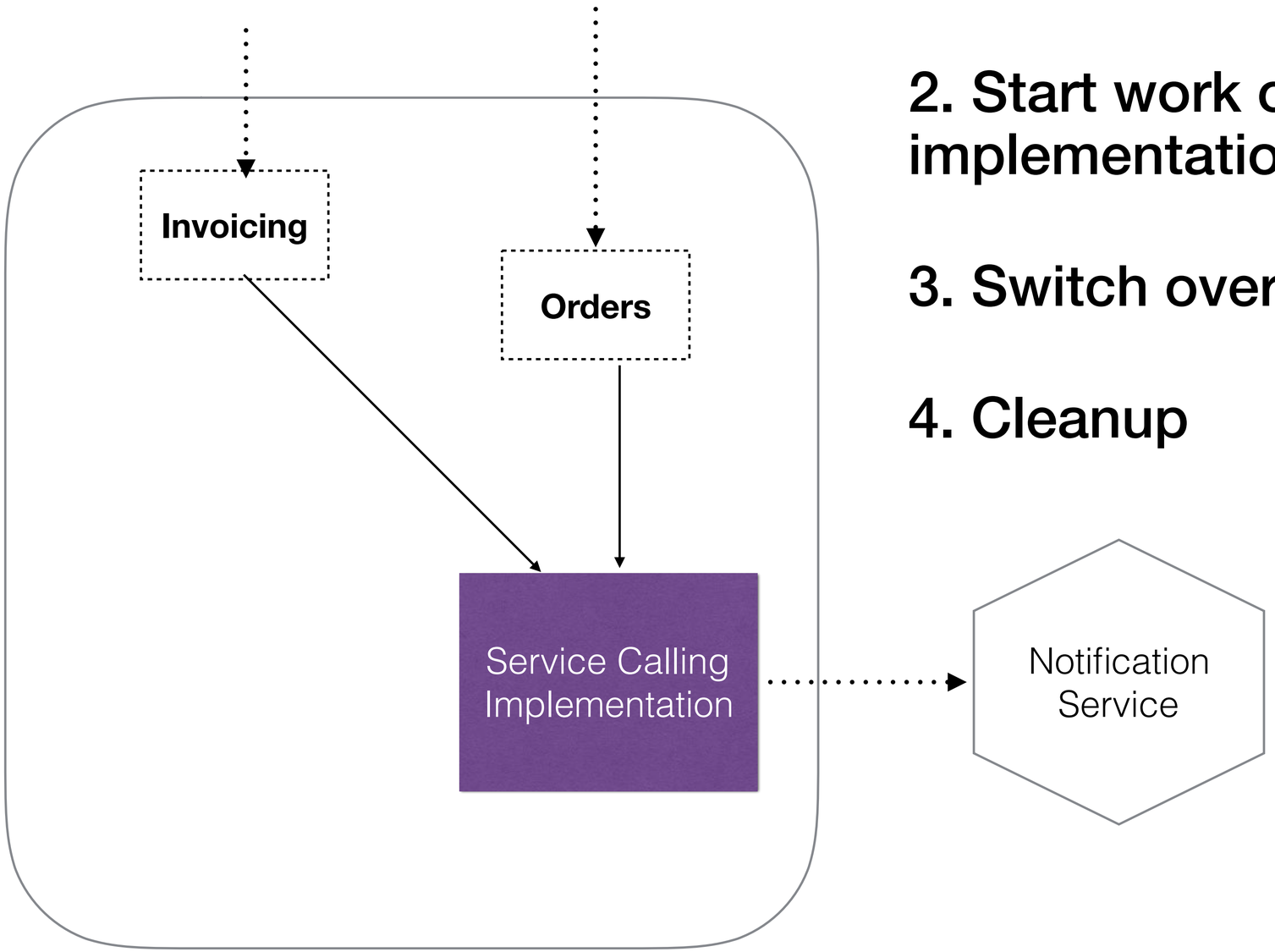

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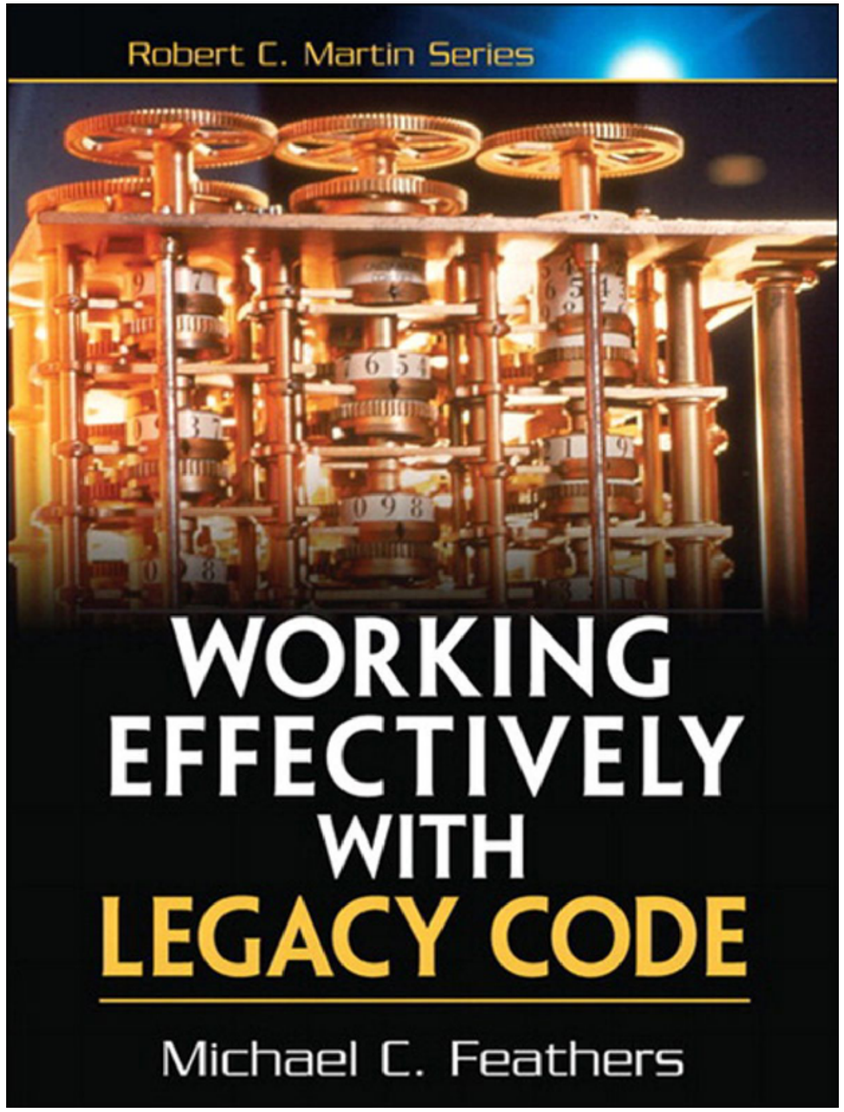
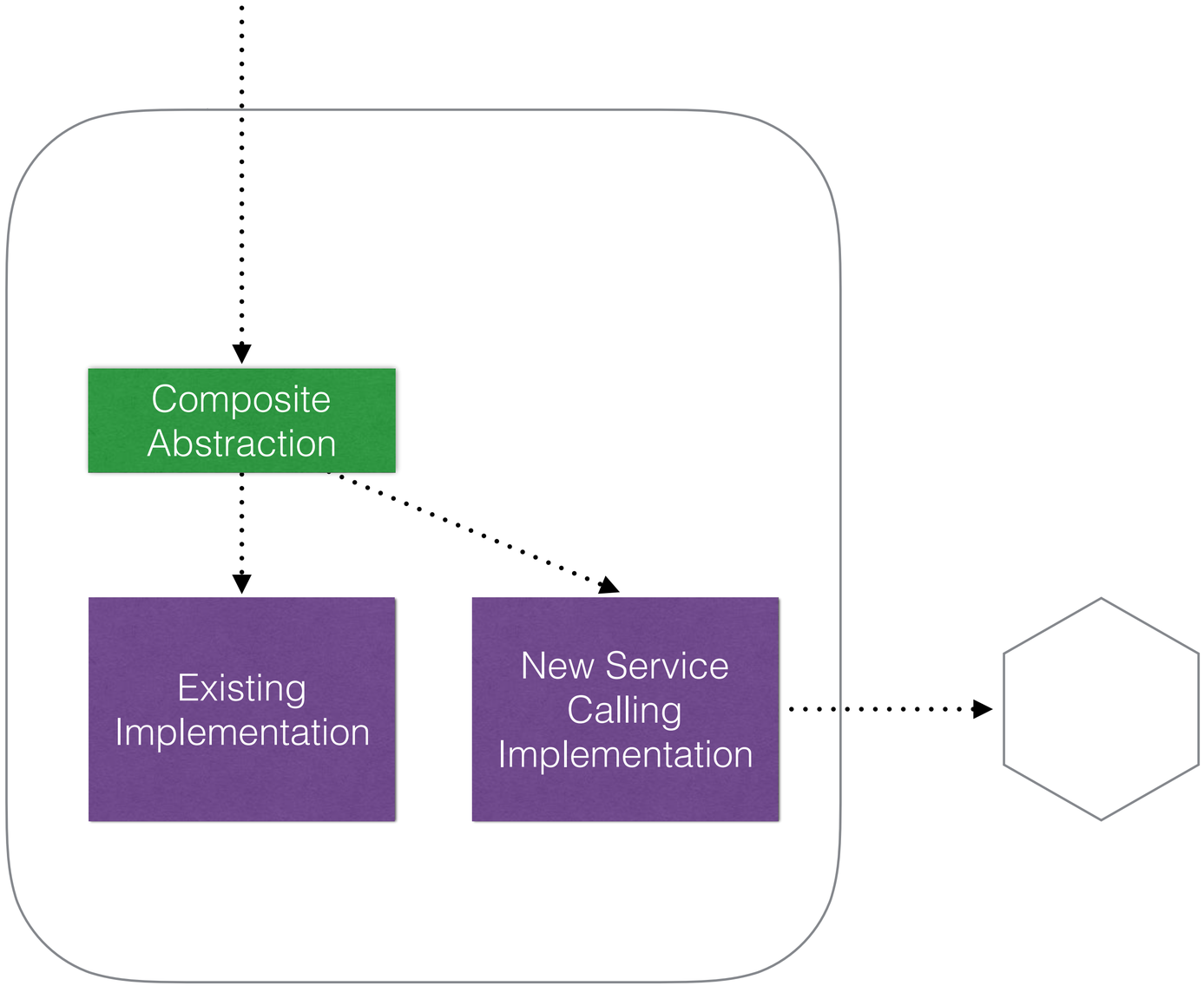
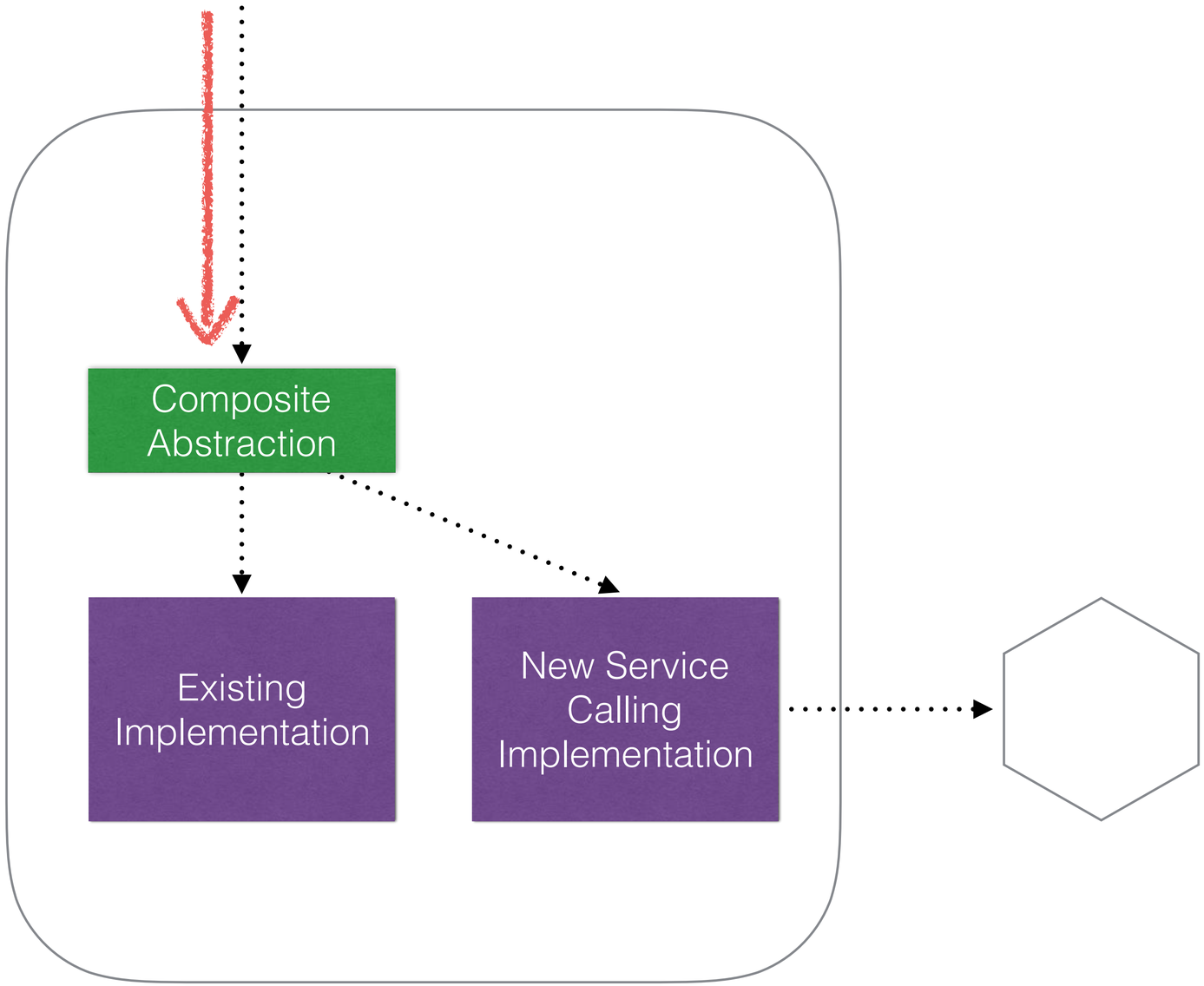
WORKING WITH LEGACY CODE



PARALLEL RUN



PARALLEL RUN



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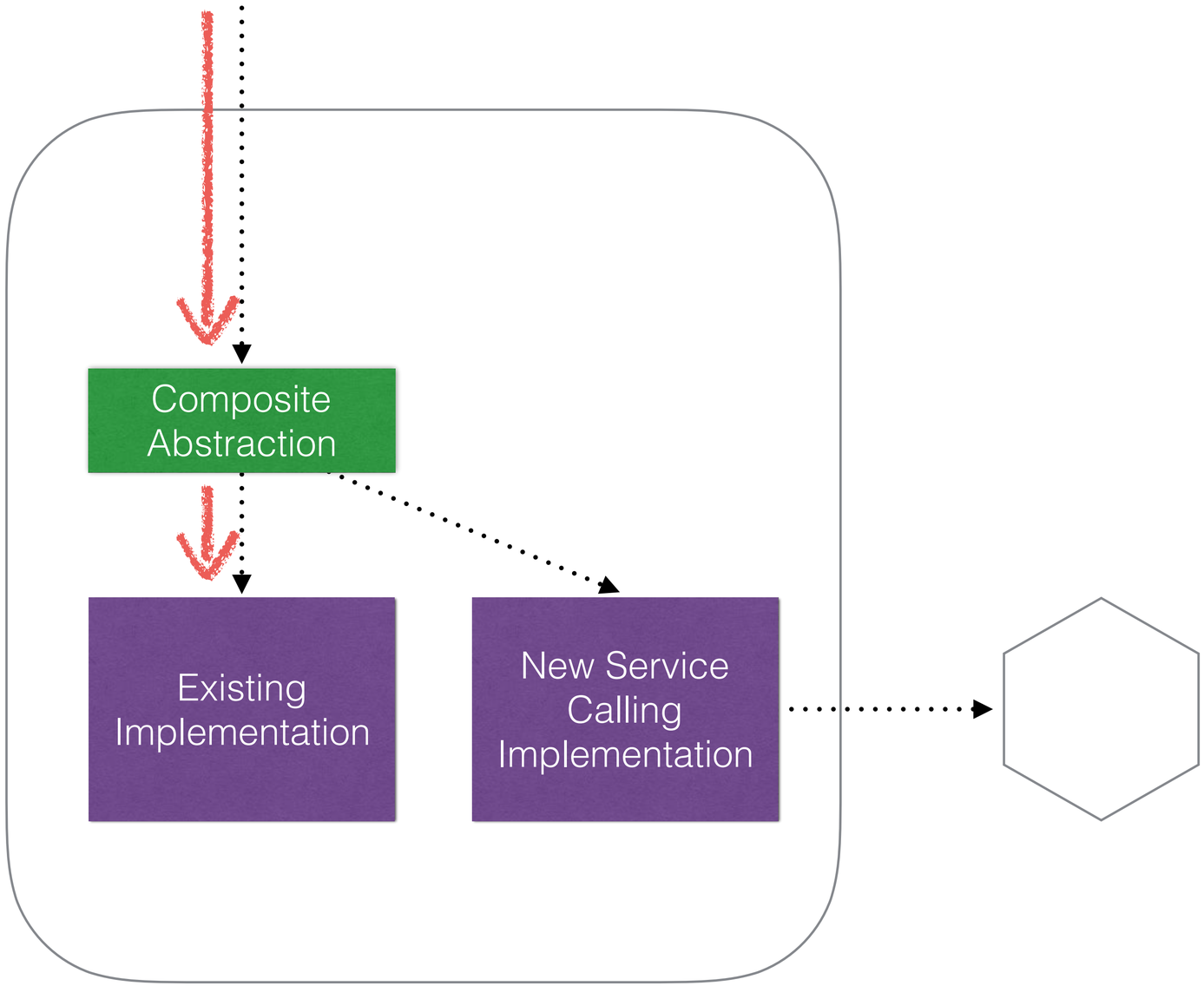

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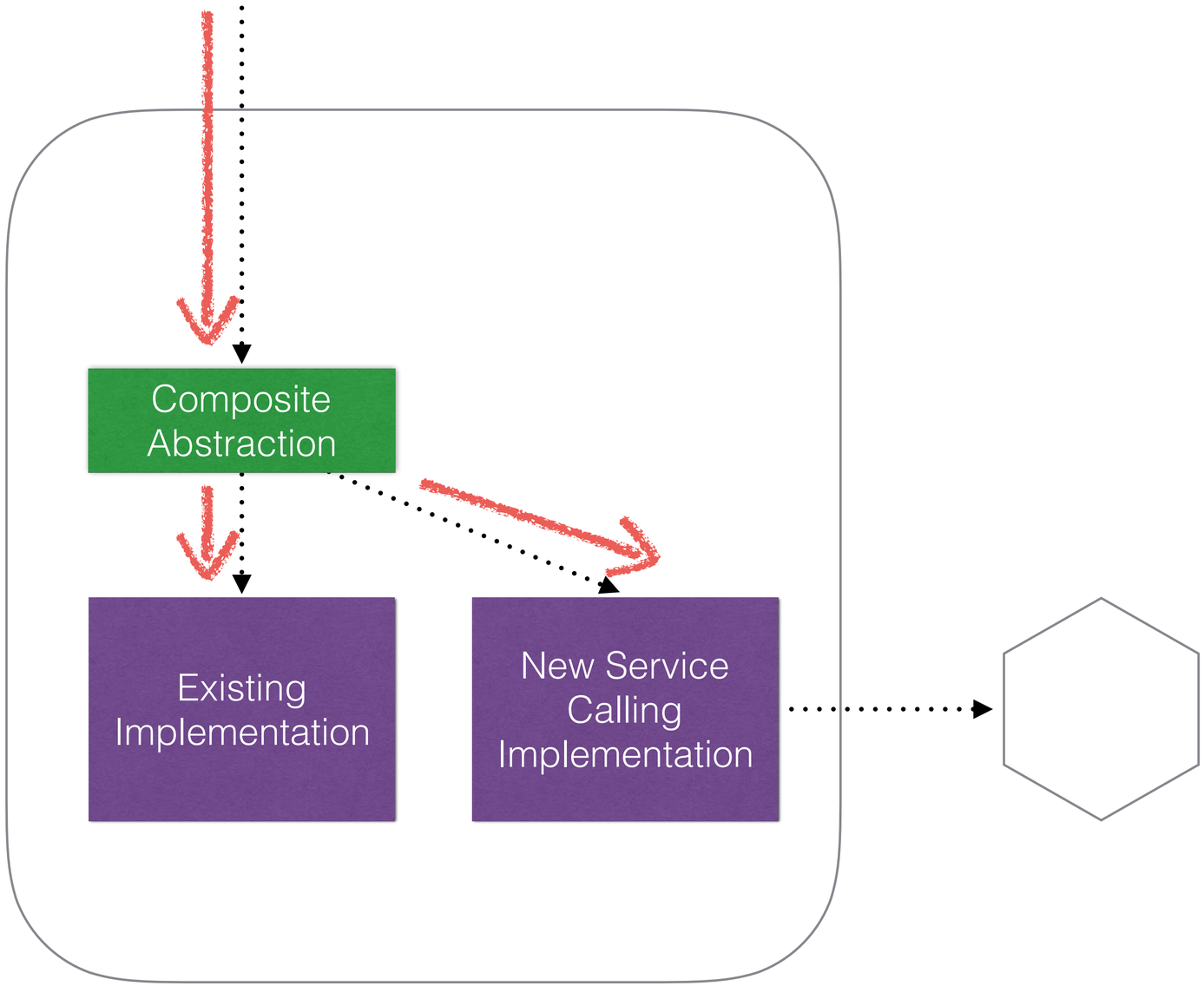

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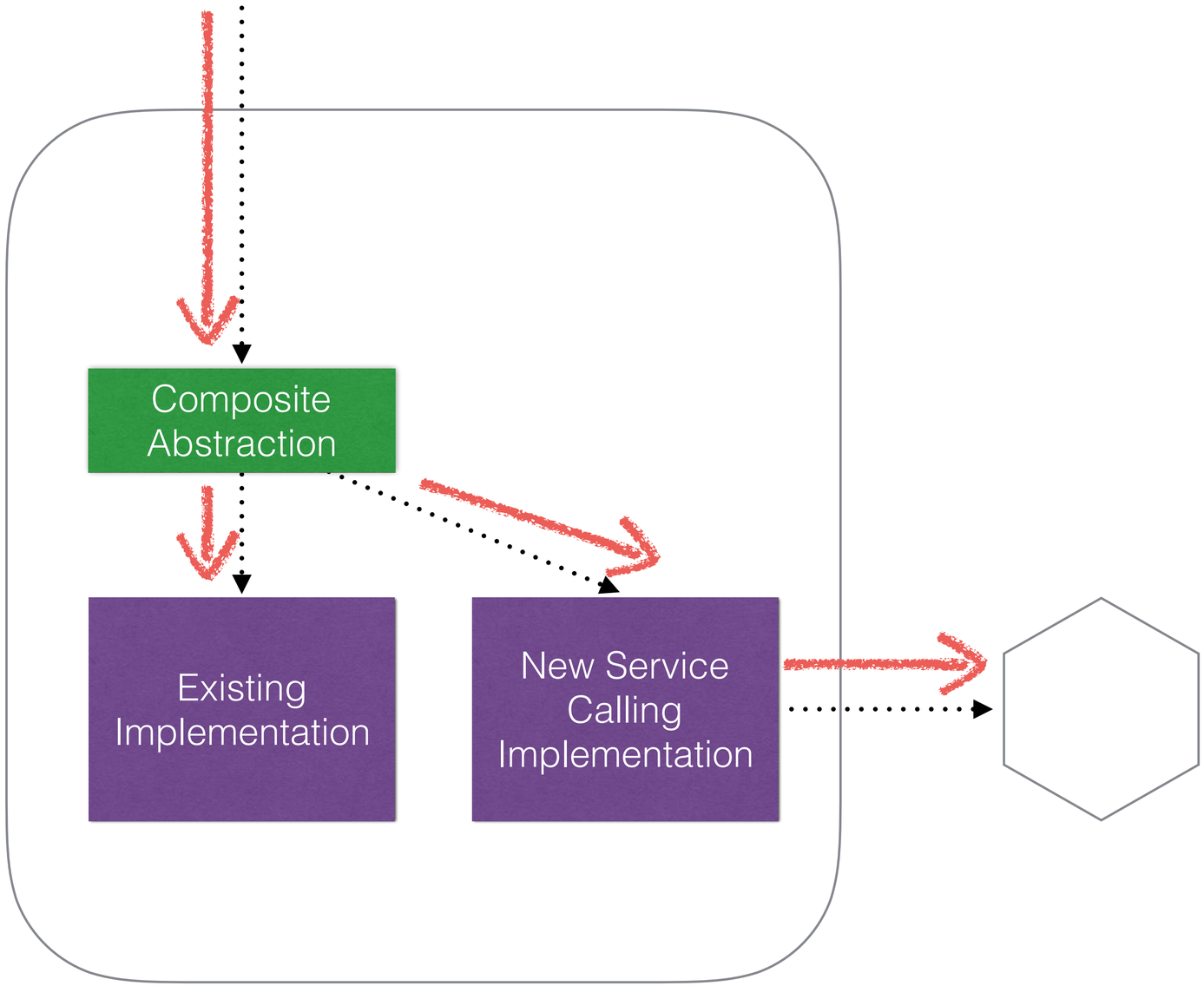
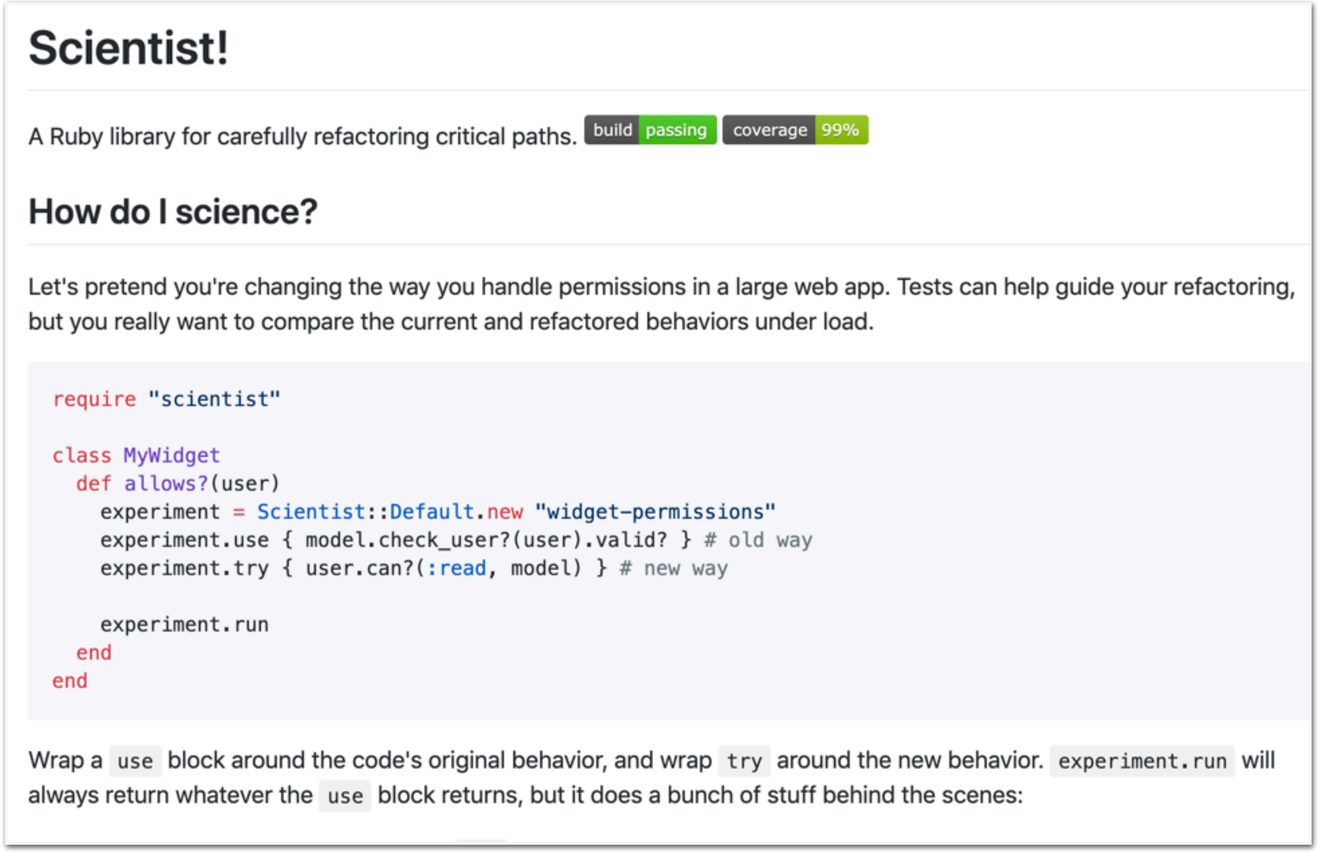


GITHUB SCIENTIST



Scientist!

A Ruby library for carefully refactoring critical paths. build passing coverage 99%

How do I science?

Let's pretend you're changing the way you handle permissions in a large web app. Tests can help guide your refactoring, but you really want to compare the current and refactored behaviors under load.

```
require "scientist"

class MyWidget
  def allows?(user)
    experiment = Scientist::Default.new "widget-permissions"
    experiment.use { model.check_user?(user).valid? } # old way
    experiment.try { user.can?(:read, model) } # new way

    experiment.run
  end
end
```

Wrap a `use` block around the code's original behavior, and wrap `try` around the new behavior. `experiment.run` will always return whatever the `use` block returns, but it does a bunch of stuff behind the scenes:

https://github.com/github/scientist

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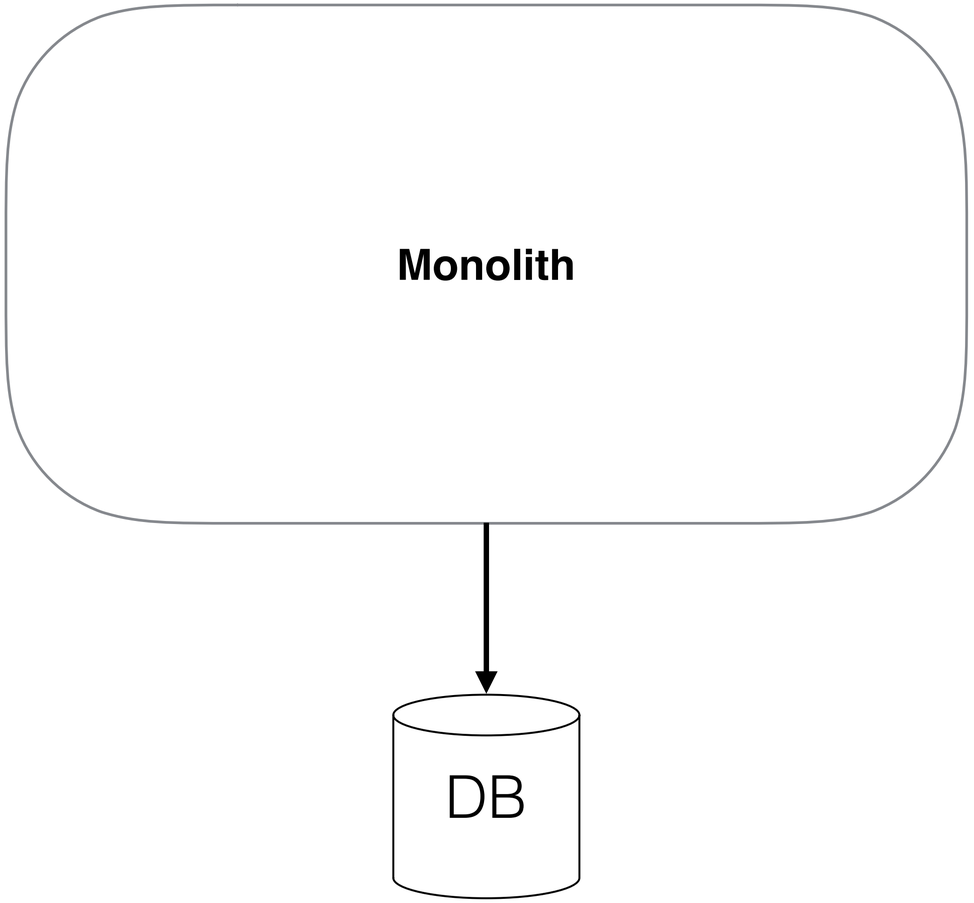
Alternatives

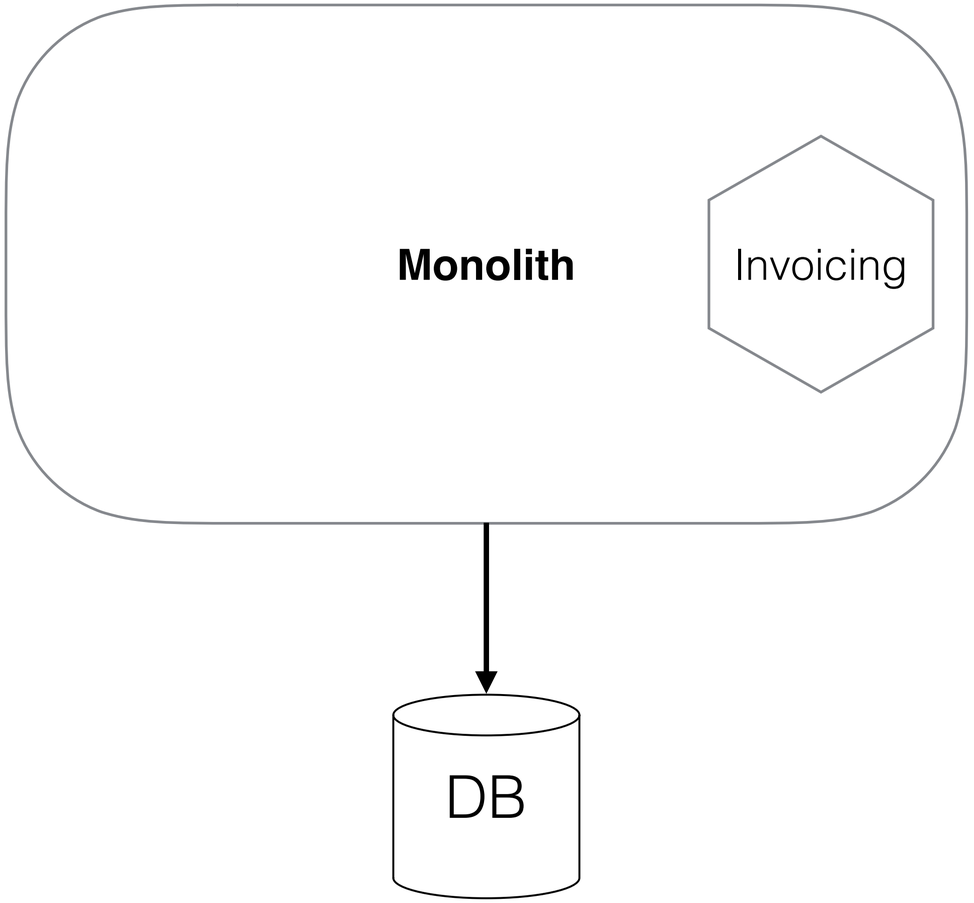
- daylerees/scientist (PHP)
- scientistproject/scientist.net (.NET)
- joealcorn/laboratory (Python)
- rawls238/Scientist4J (Java)
- tomiaijo/scientist (C++)
- trello/scientist (node.js)
- ziyasal/scientist.js (node.js, ES6)
- yeller/laboratory (Clojure)
- lancew/Scientist (Perl 5)
- lancew/ScientistP6 (Perl 6)
- MadcapJake/Test-Lab (Perl 6)
- cwbriones/scientist (Elixir)
- calavera/go-scientist (Go)
- jelmersnoeck/experiment (Go)
- spoptchev/scientist (Kotlin / Java)
- junkpiano/scientist (Swift)

https://github.com/github/scientist

ACCESSING DATA



ACCESSING DATA



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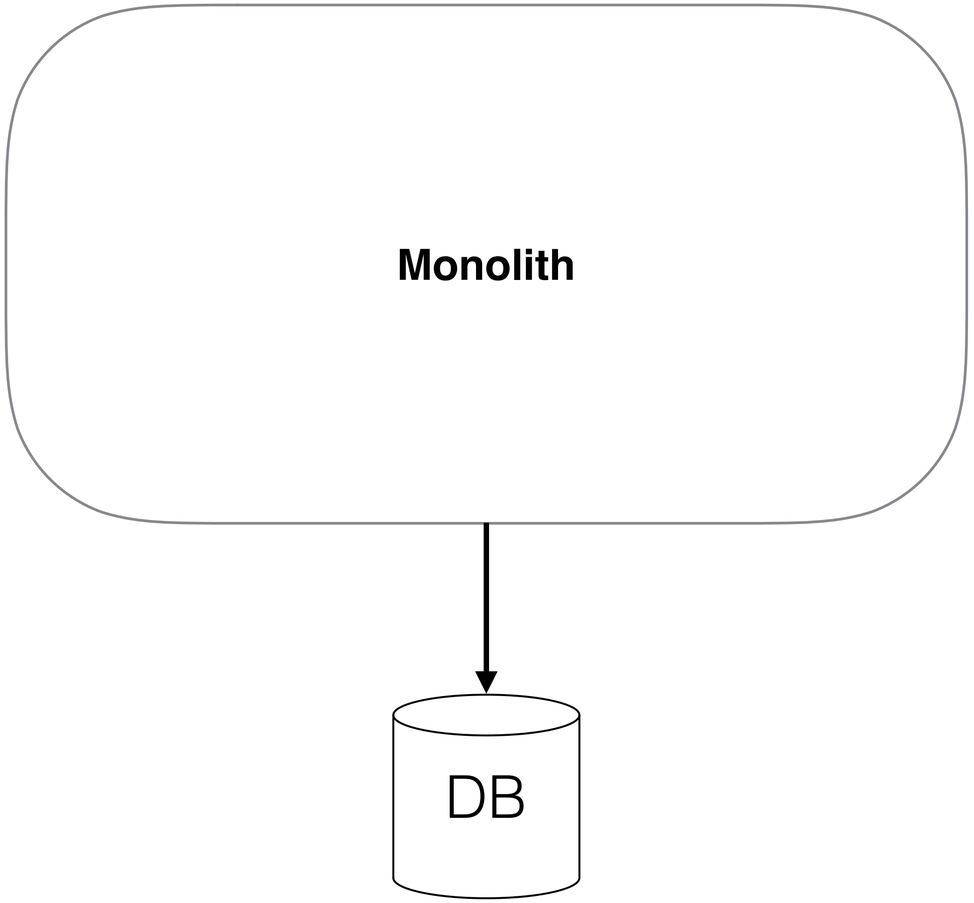

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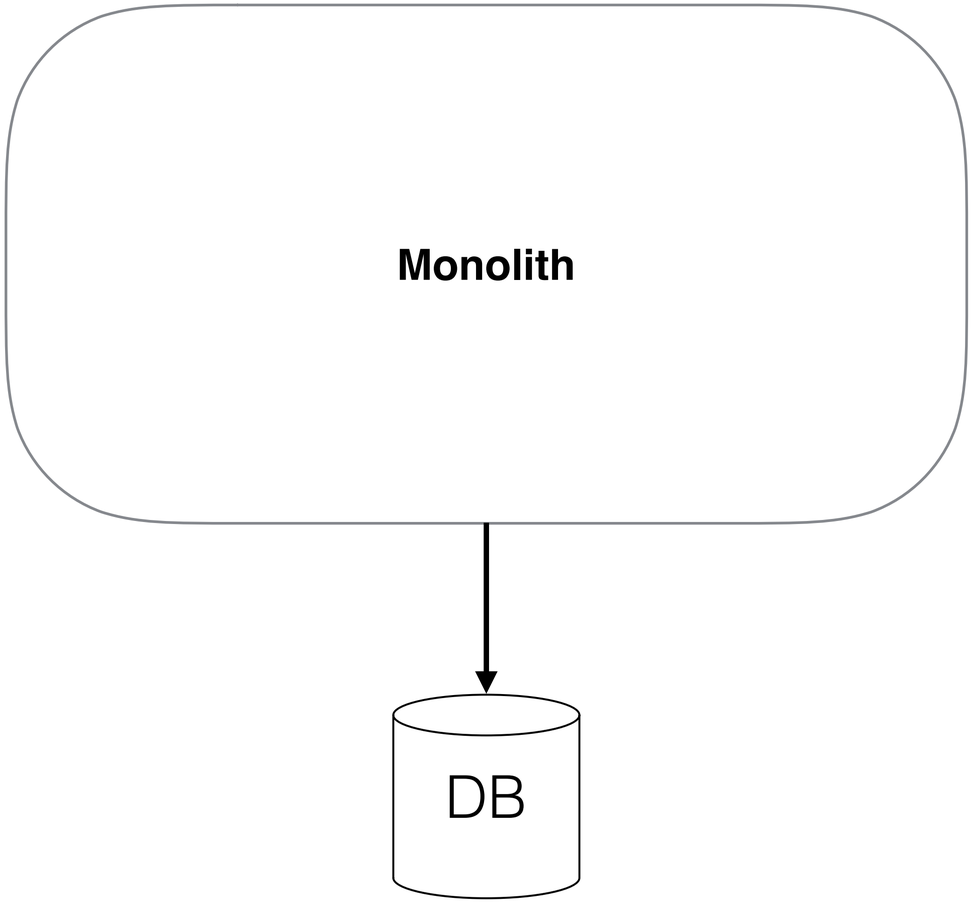
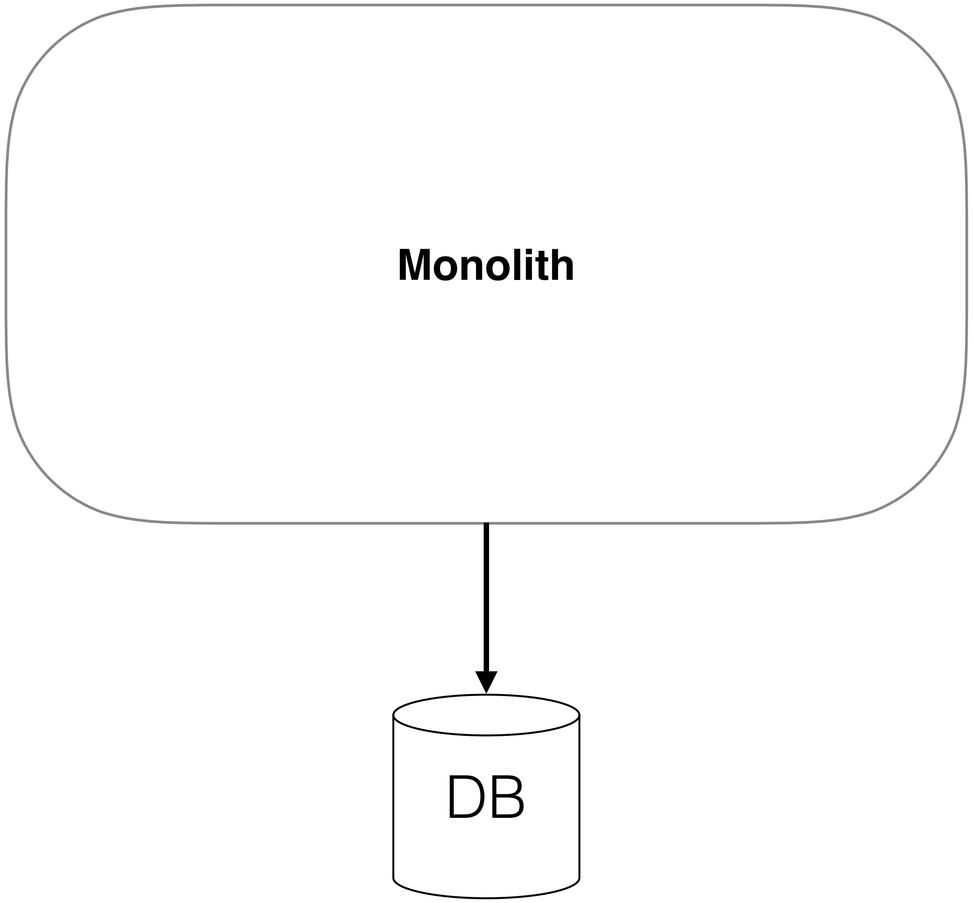


Our new service needs some data….

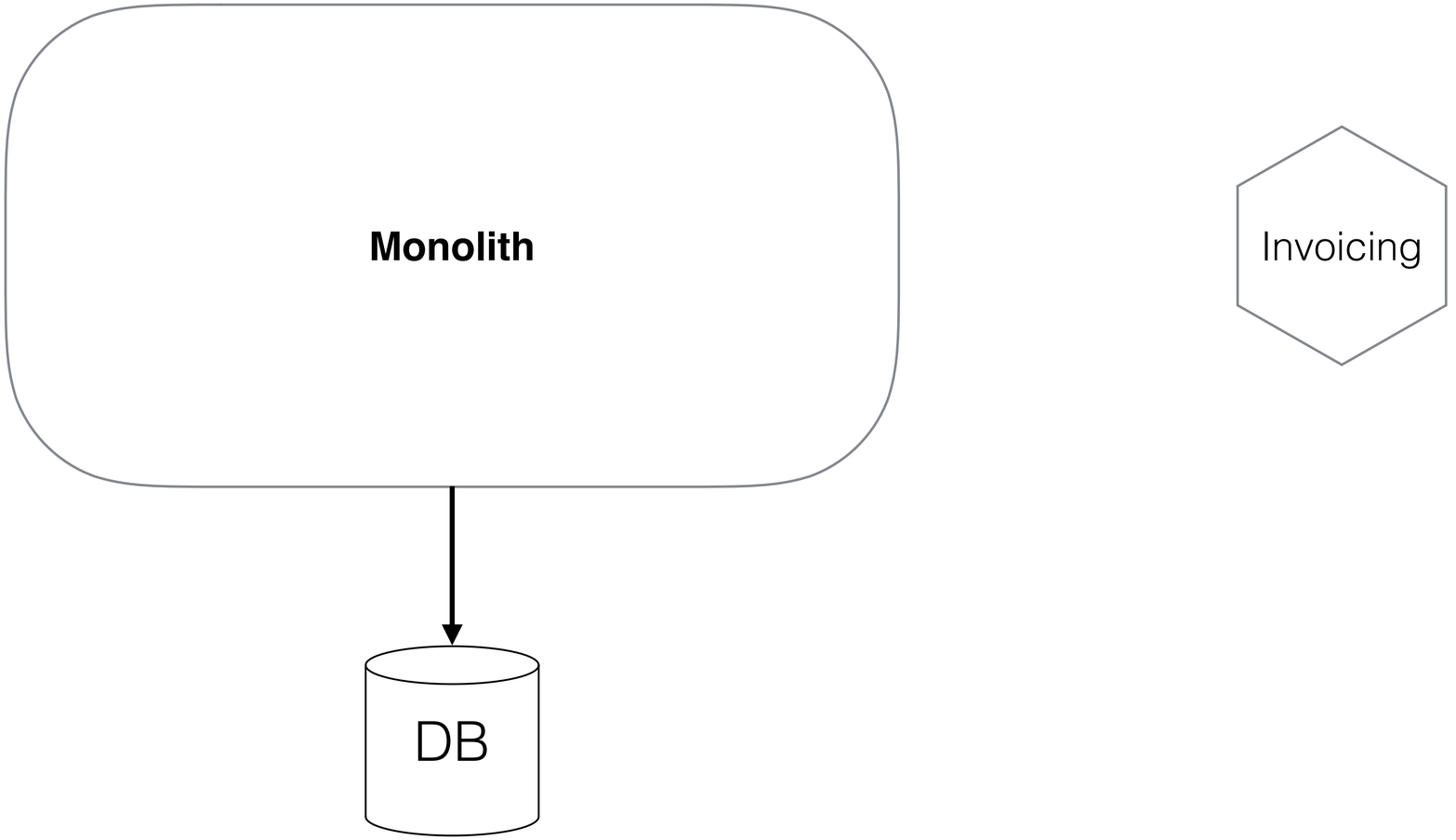
ACCESSING DATA



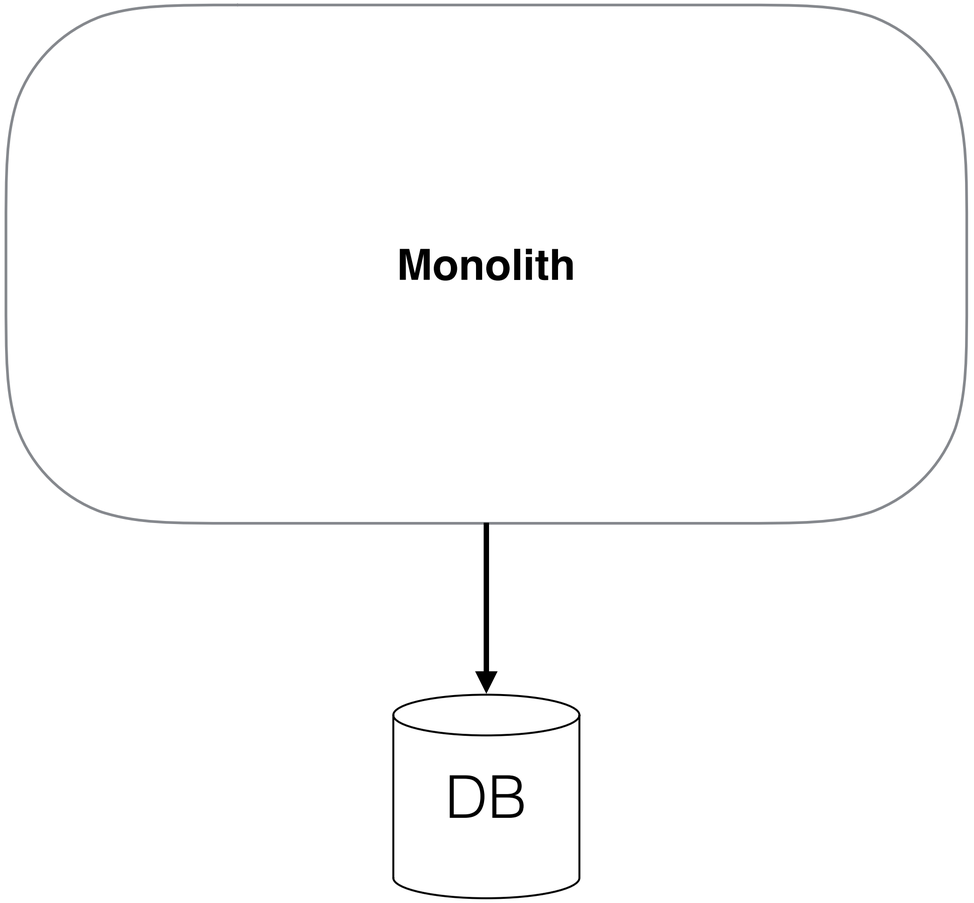
Our new service needs some data….

What are our options?

DATA REUSE?



DATA REUSE?



Directly access the data

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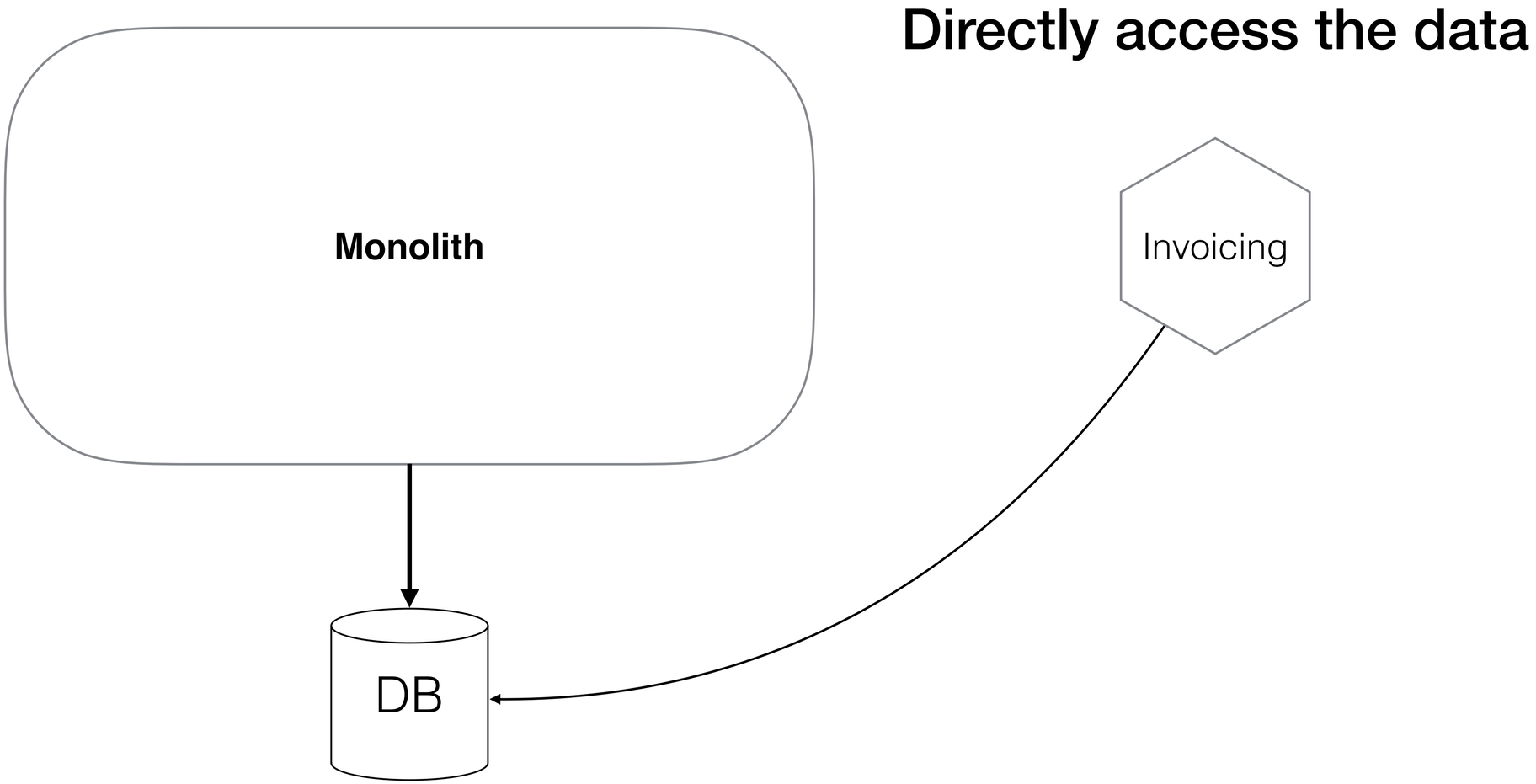

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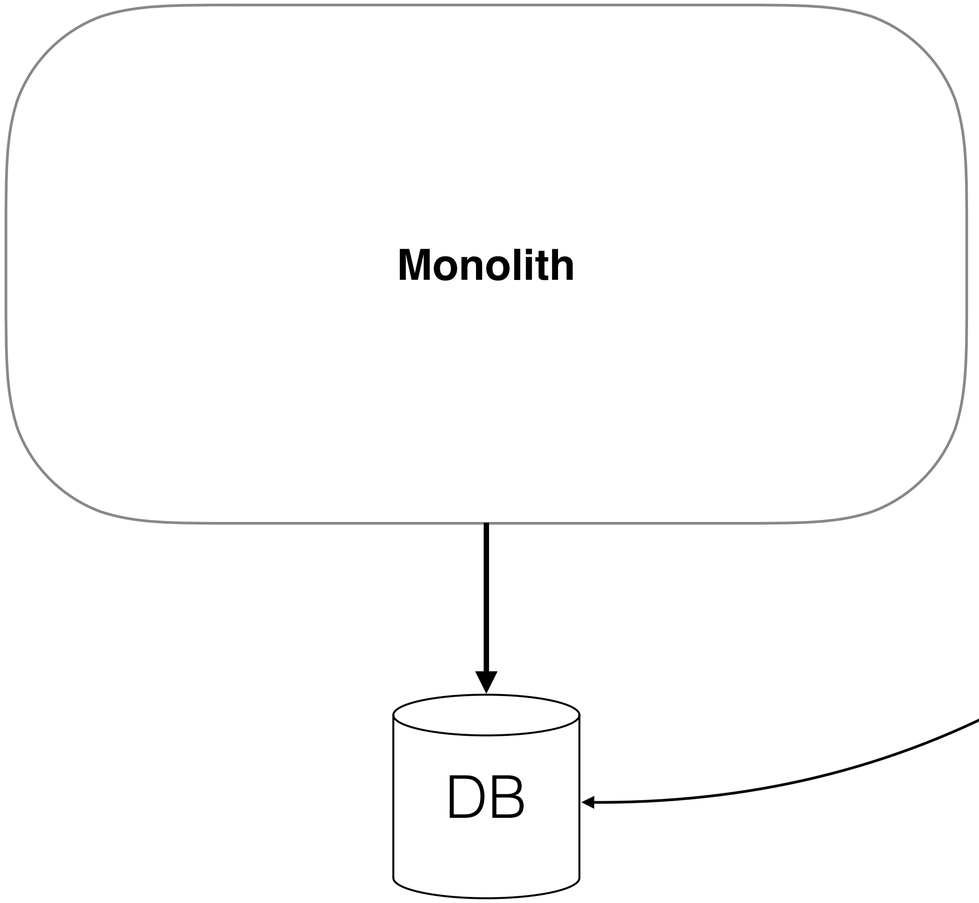

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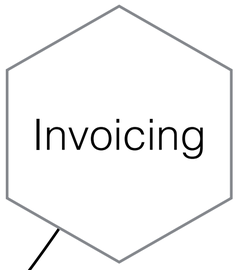
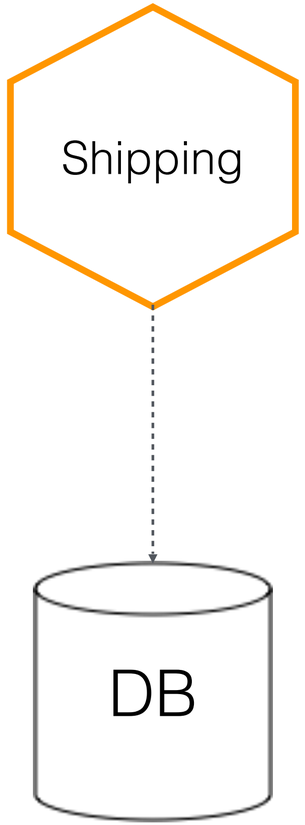


But coupling!

AVOID SHARING DATABASES!



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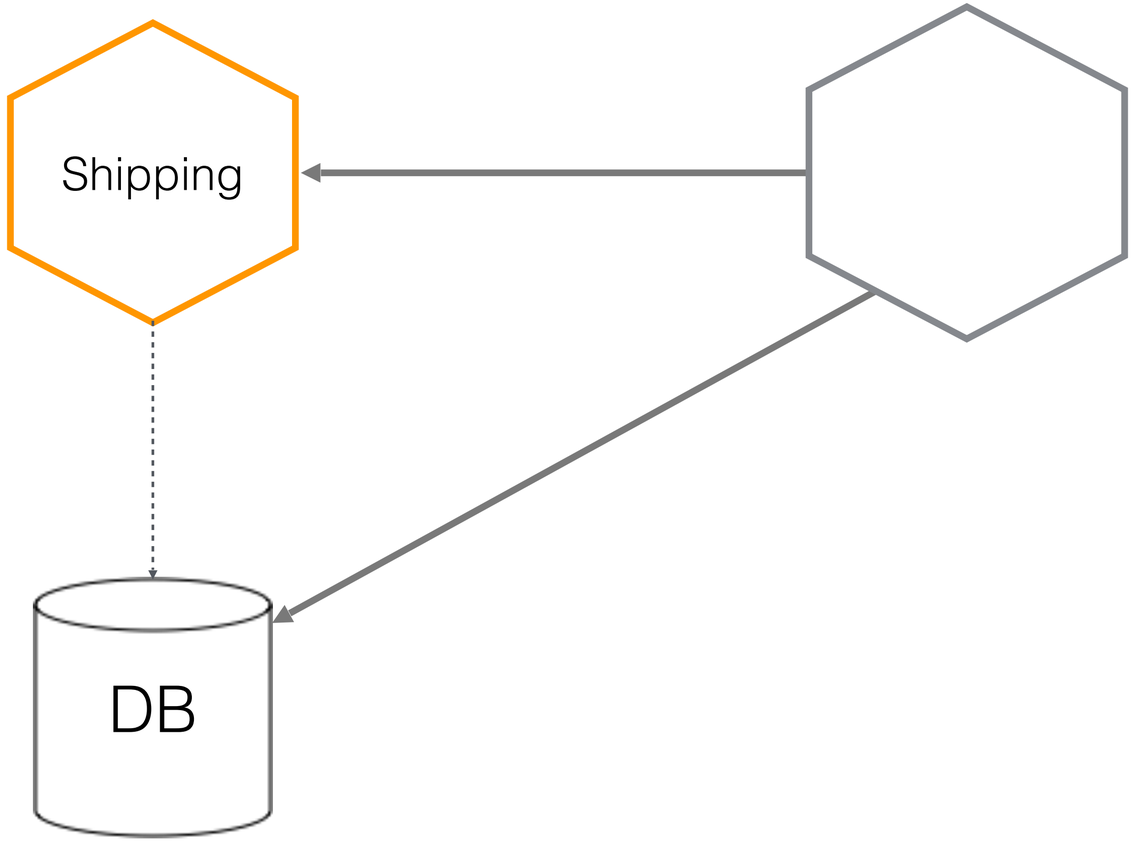

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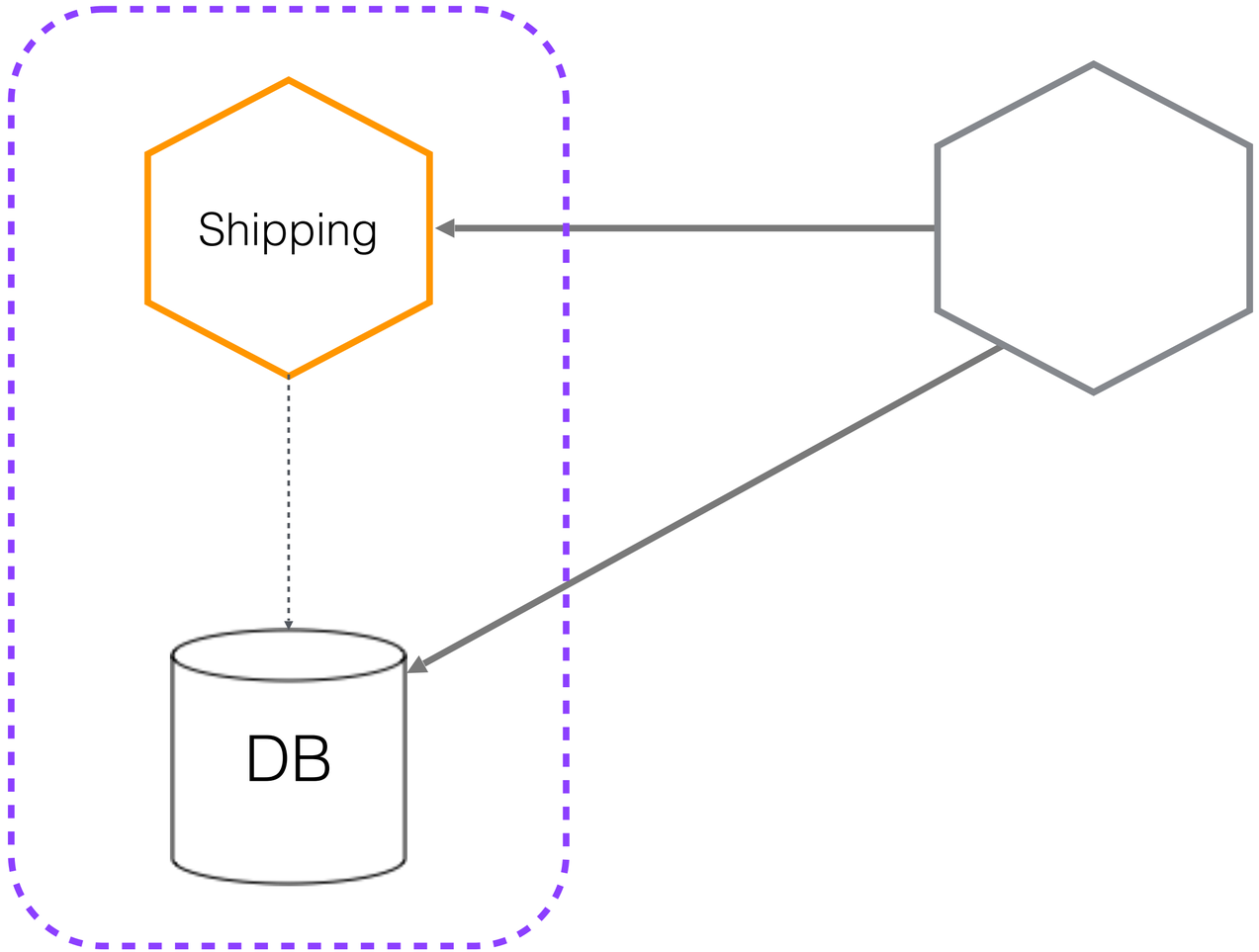

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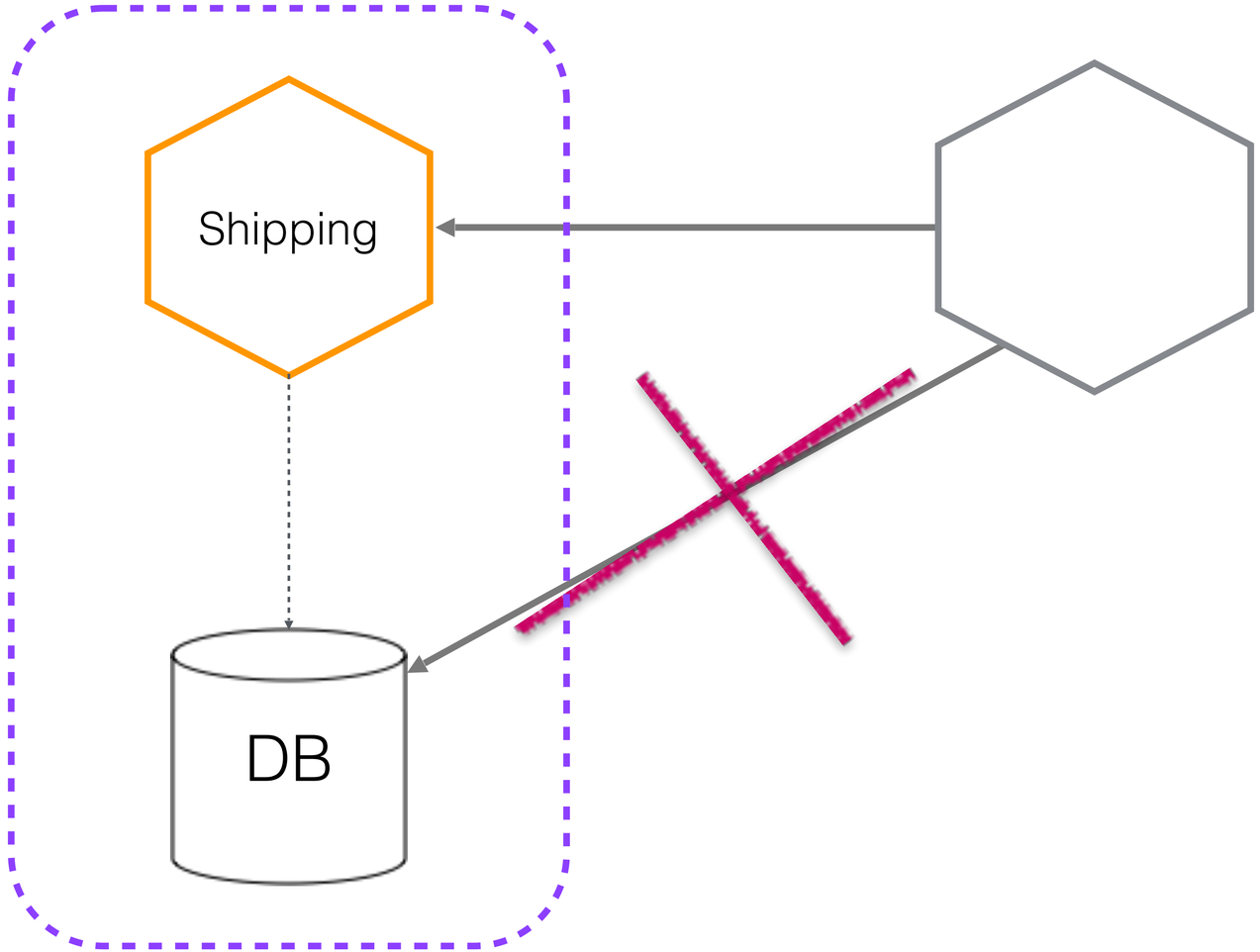

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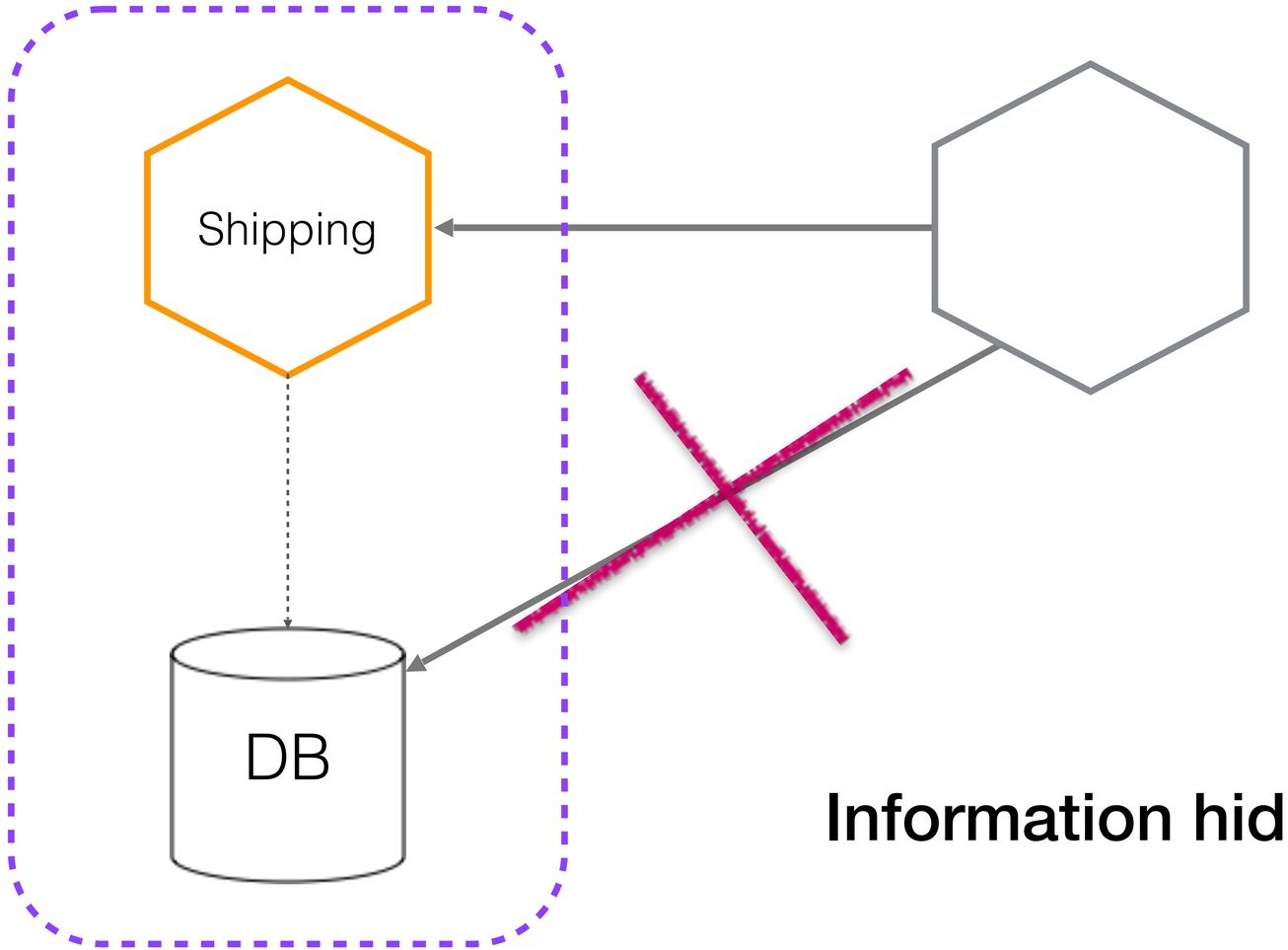
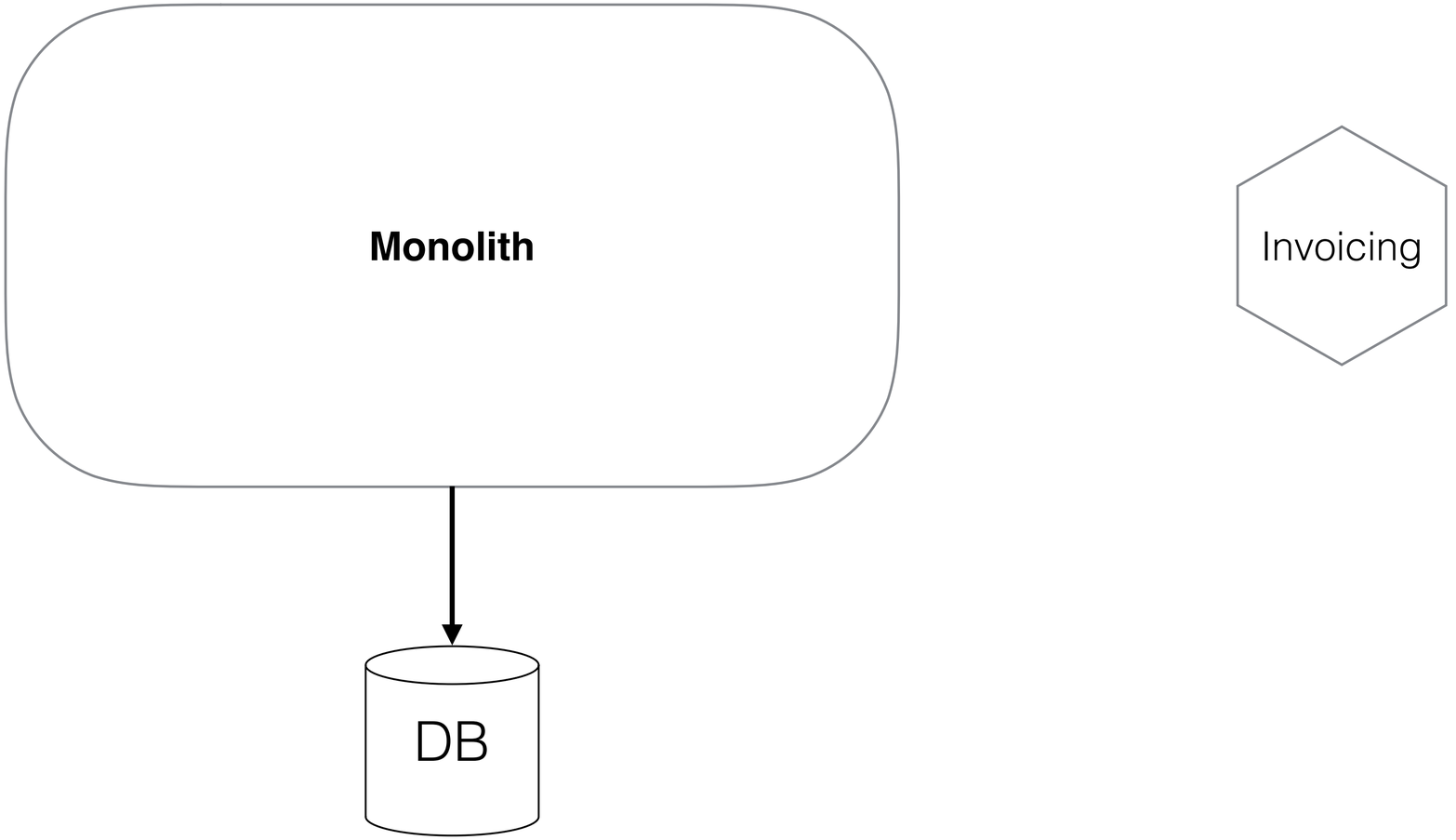


Information hiding!

EXPOSE DATA IN THE MONOLITH



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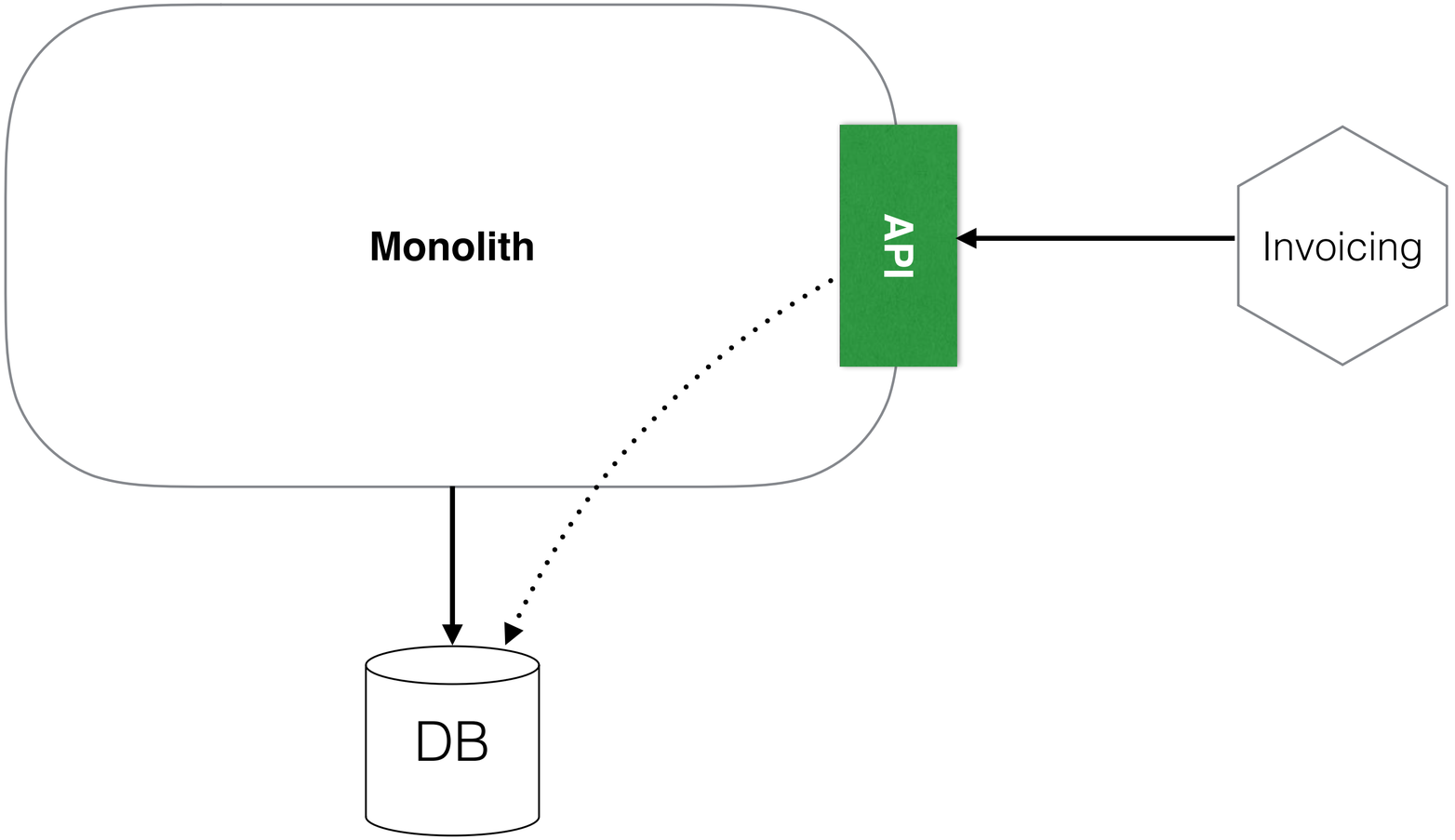

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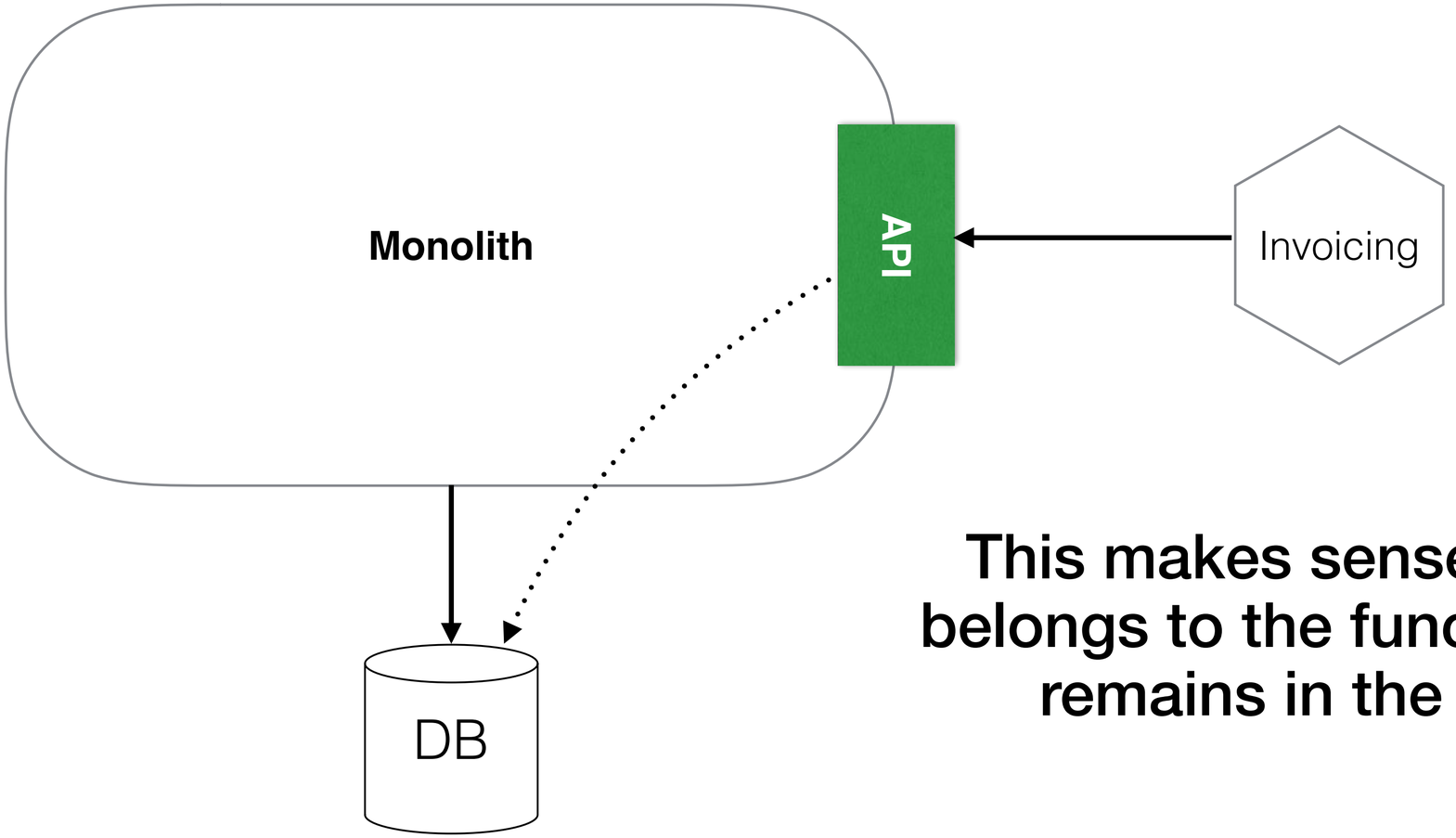
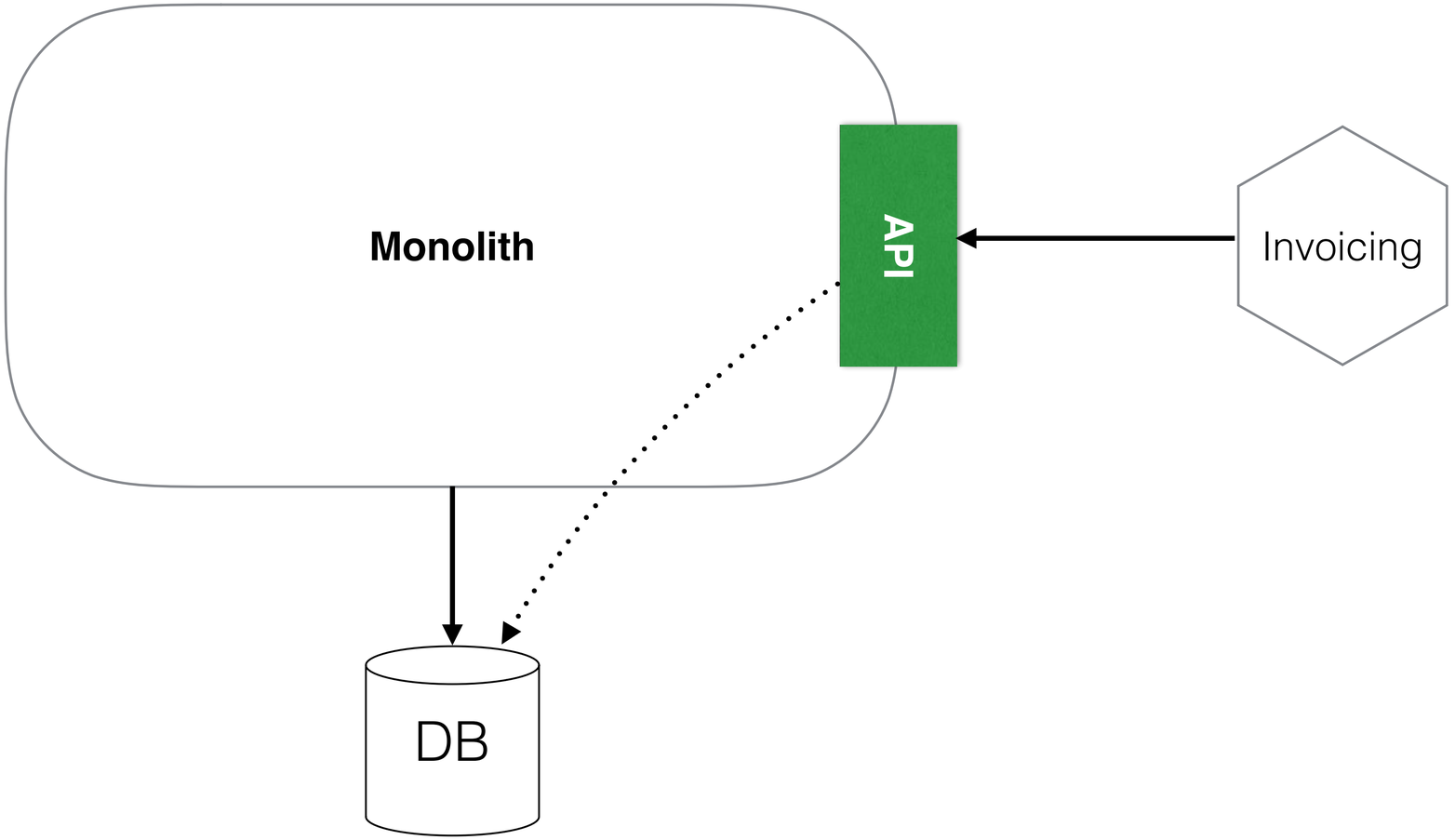
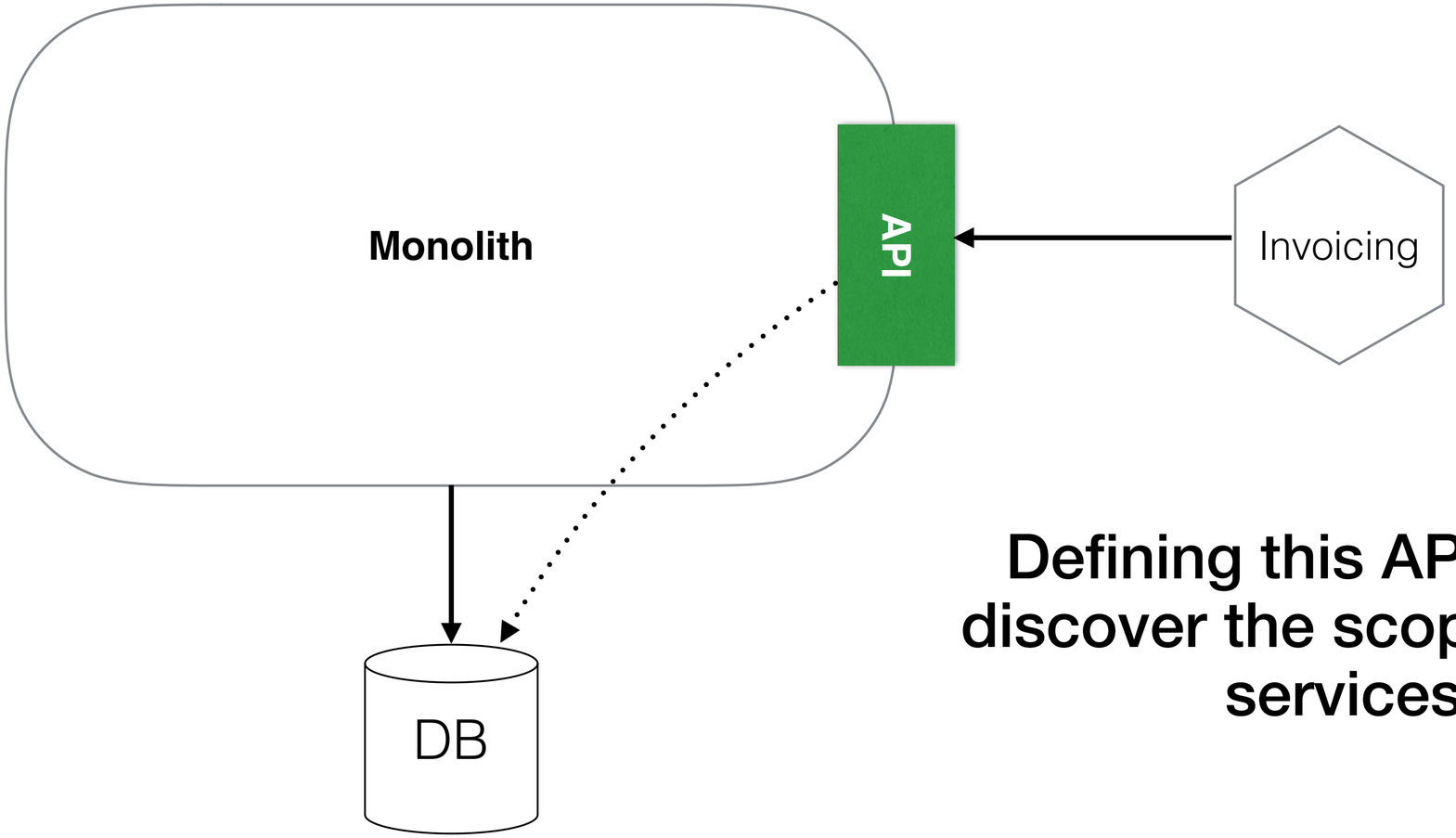


This makes sense if the data belongs to the functionality that remains in the monolith

EXPOSE DATA IN THE MONOLITH (CONT)

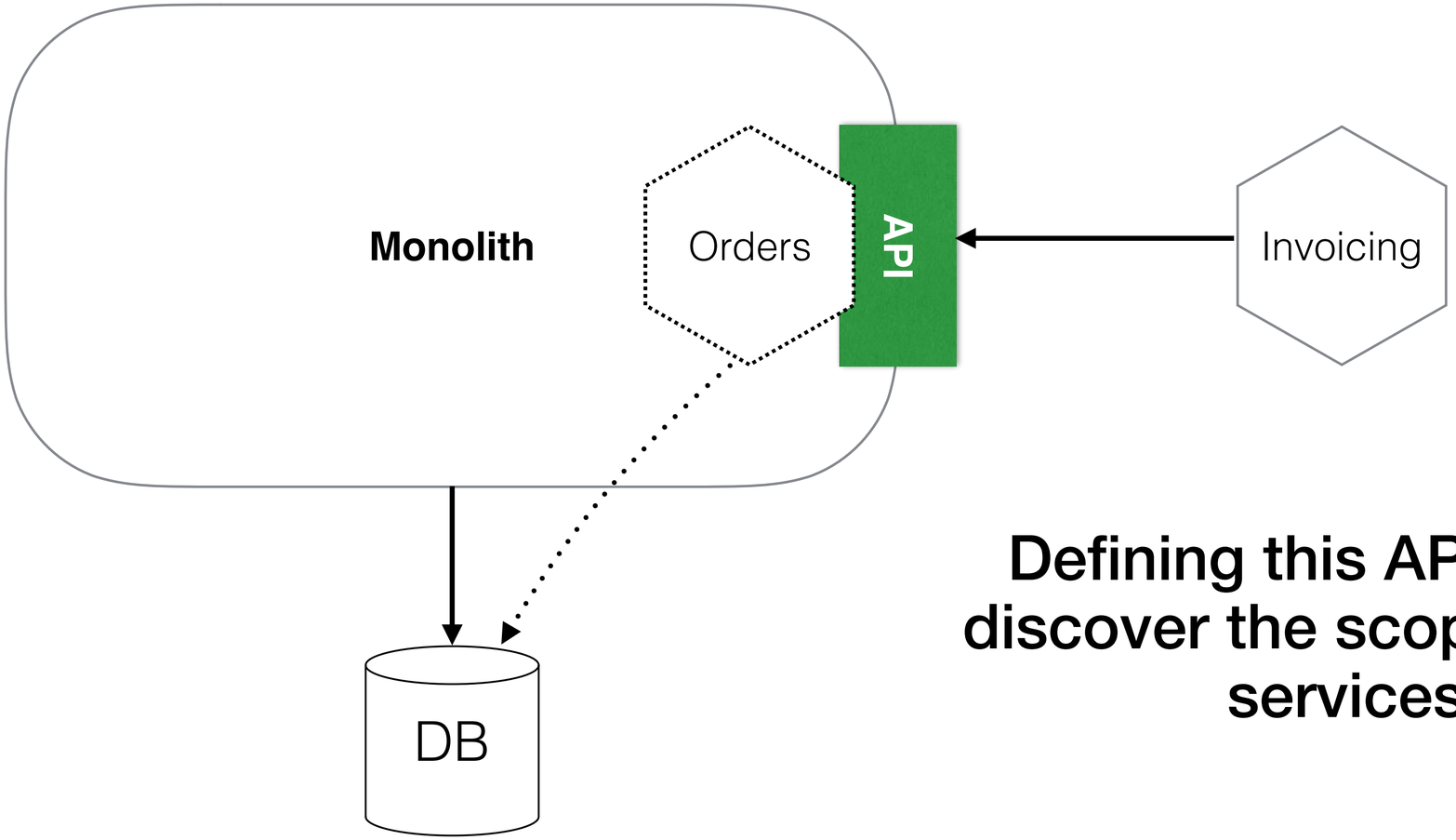


EXPOSE DATA IN THE MONOLITH (CONT)



Defining this API can help discover the scope of further services…

EXPOSE DATA IN THE MONOLITH (CONT)



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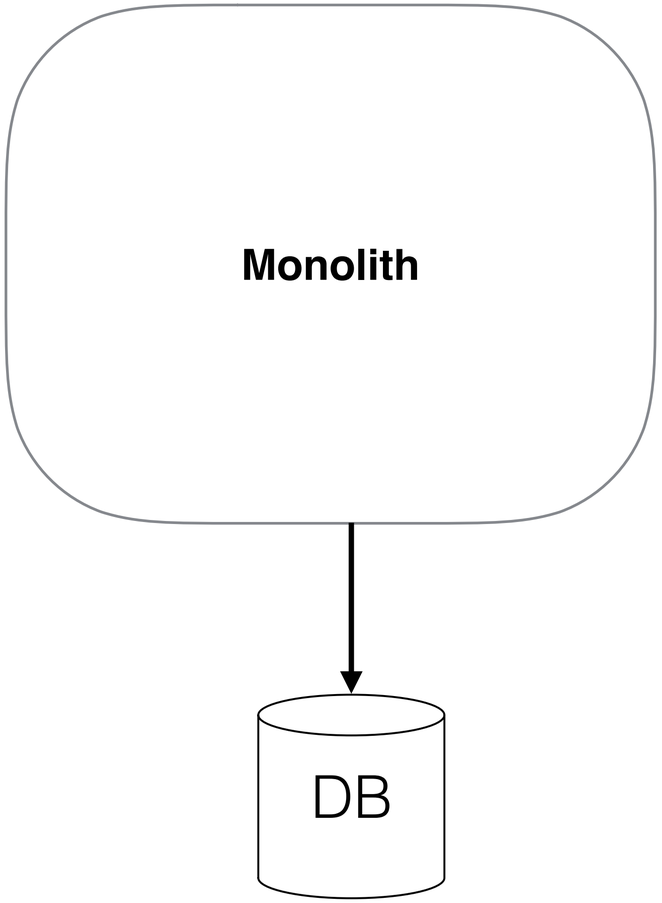
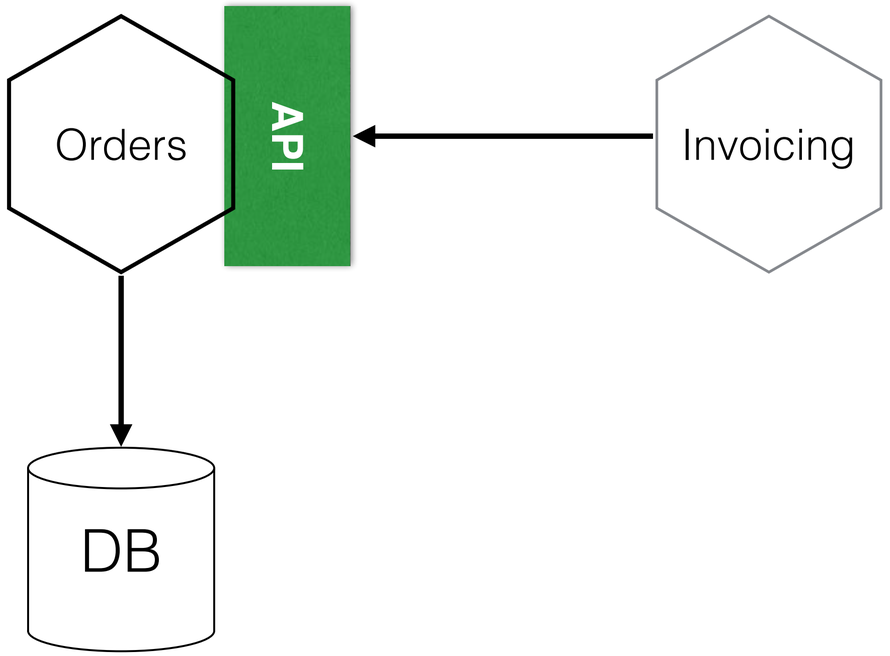
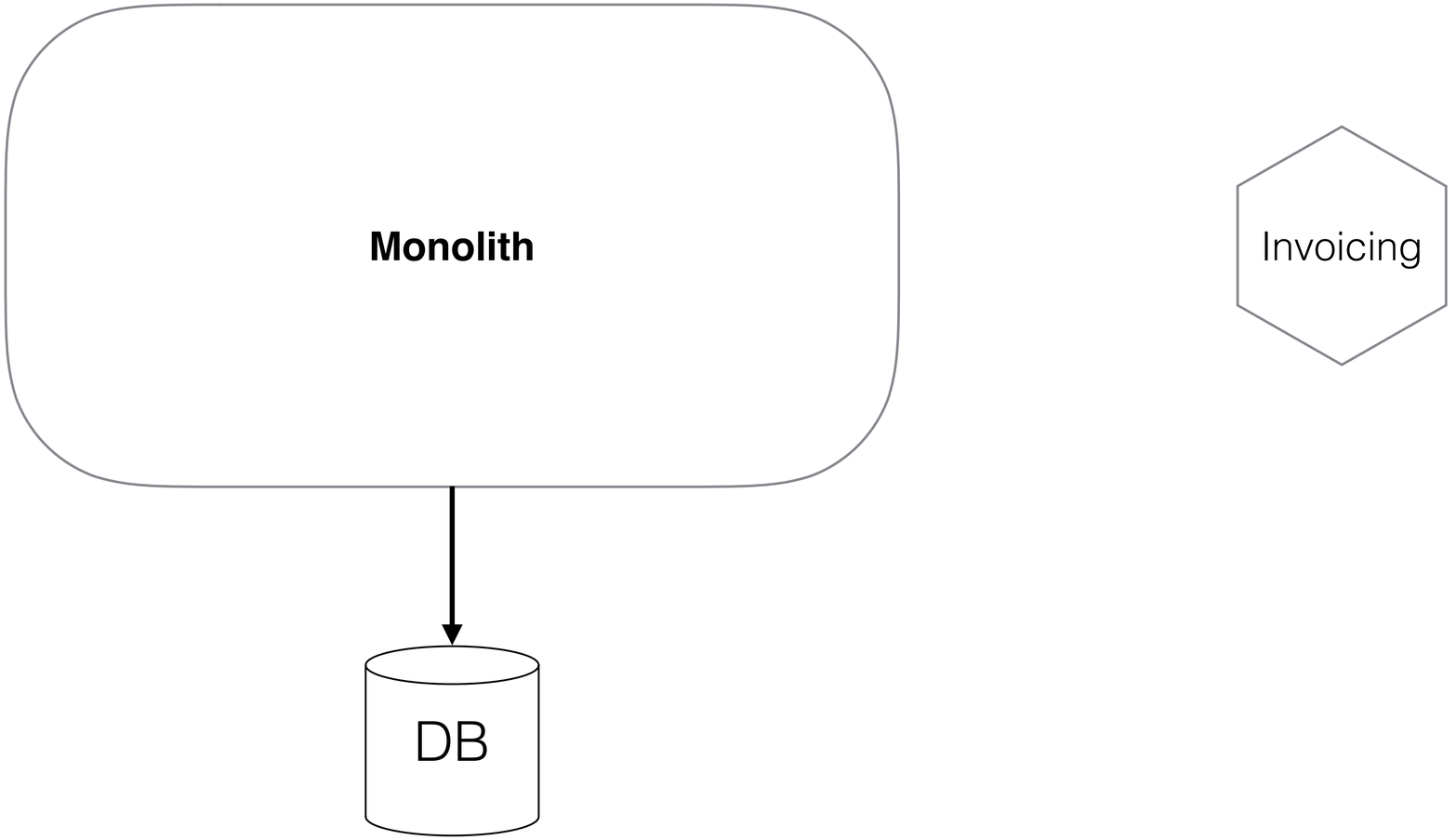




MOVE DATA TO THE NEW SERVICE



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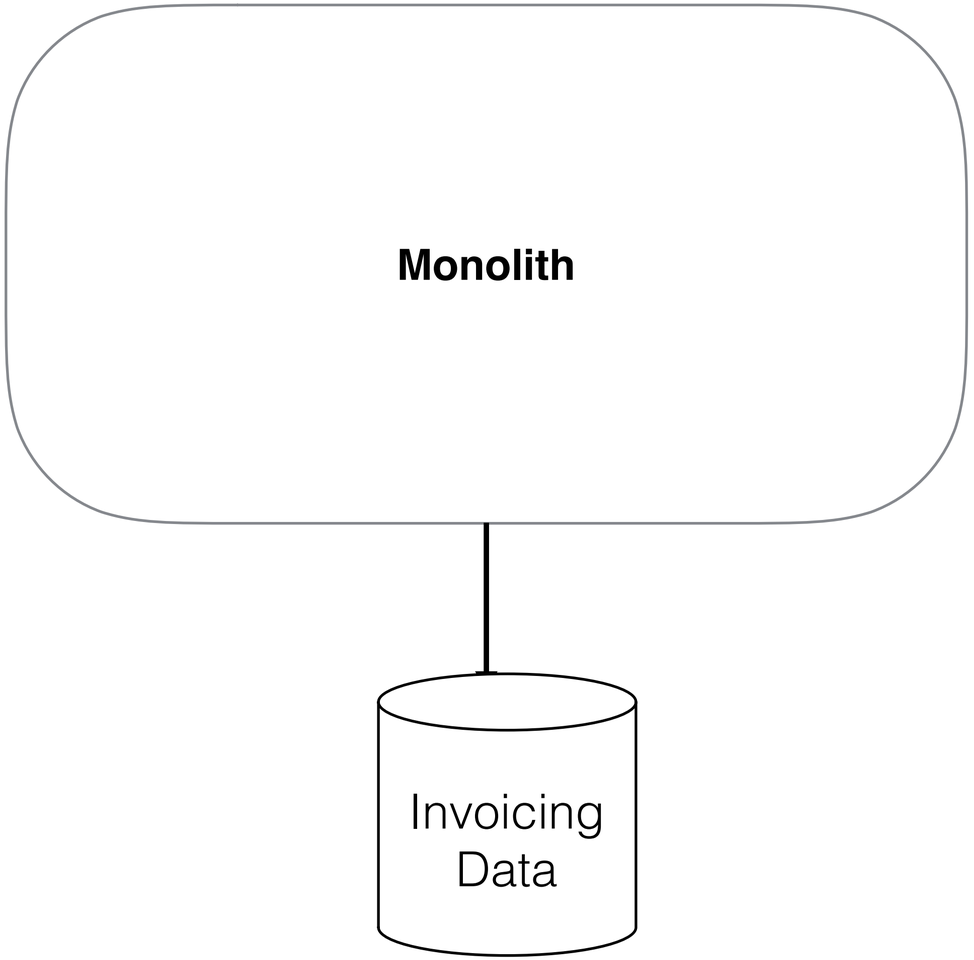
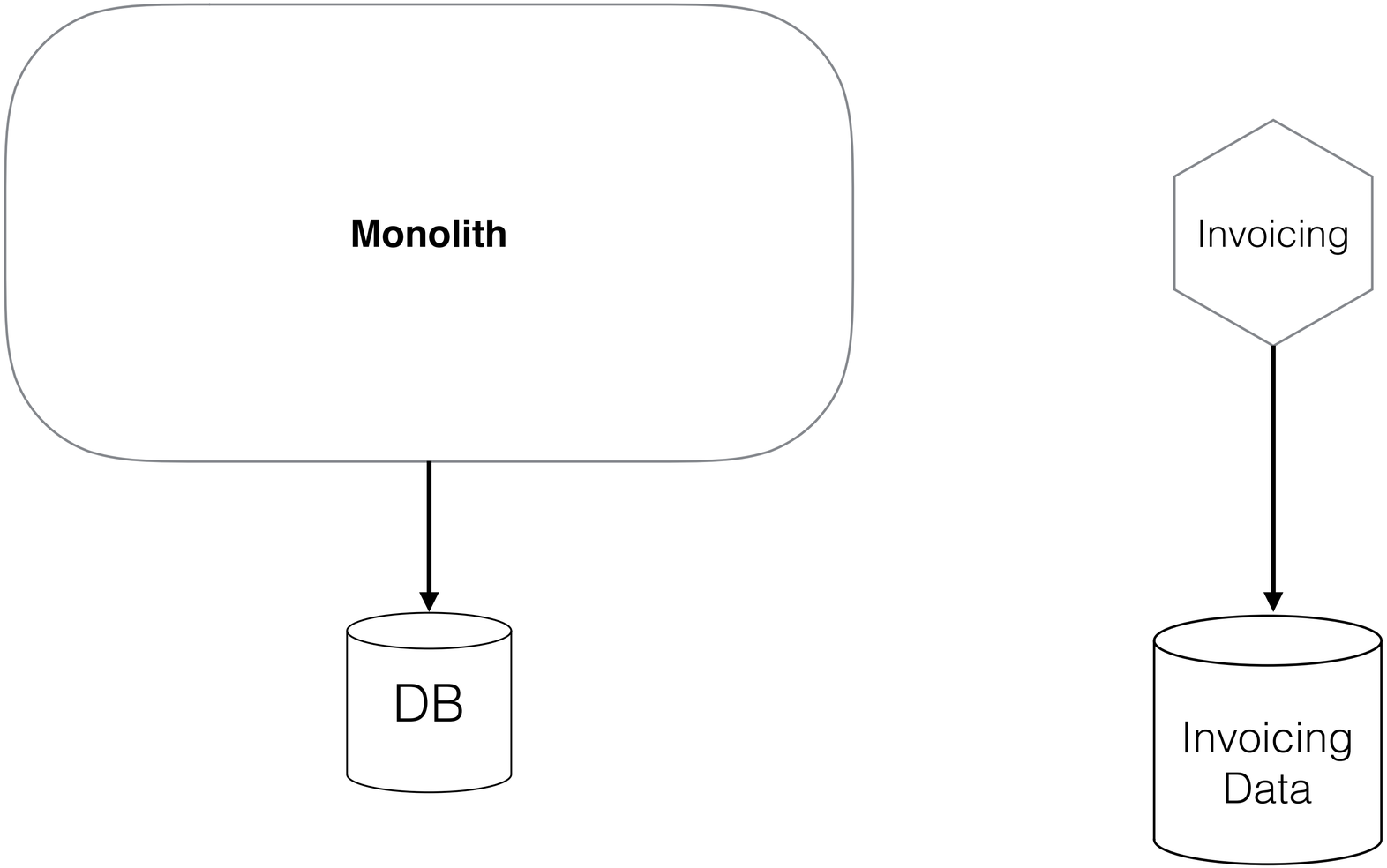
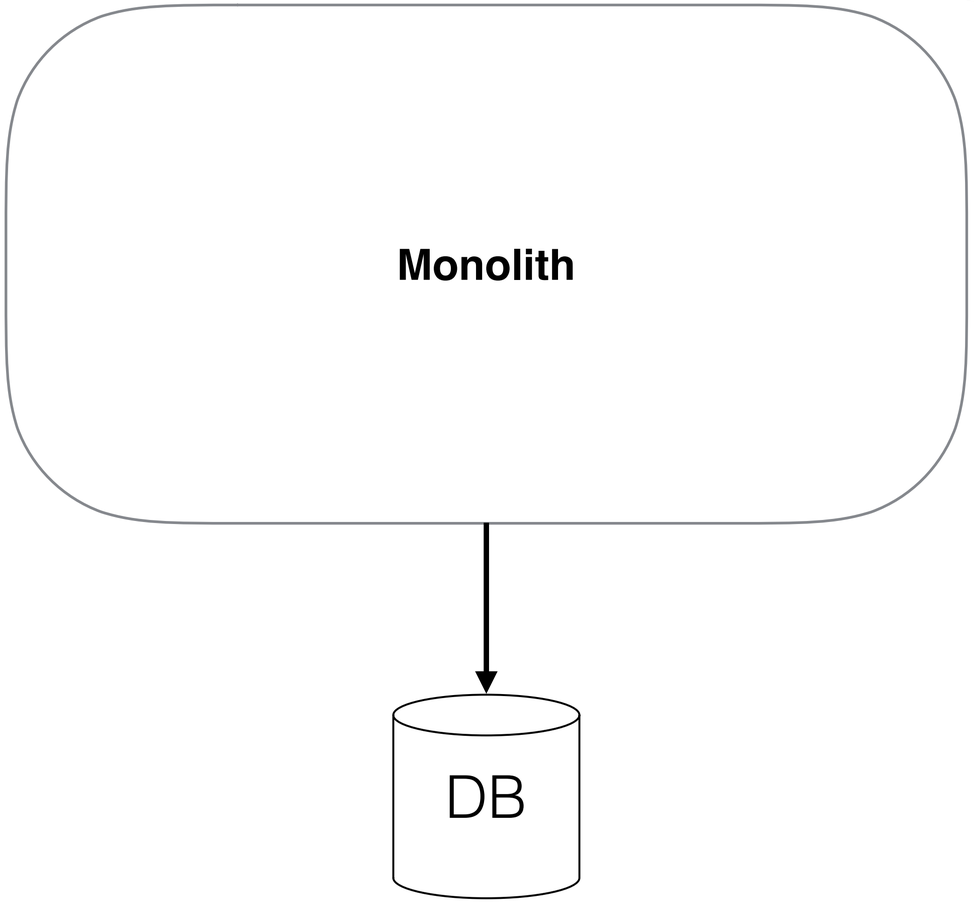


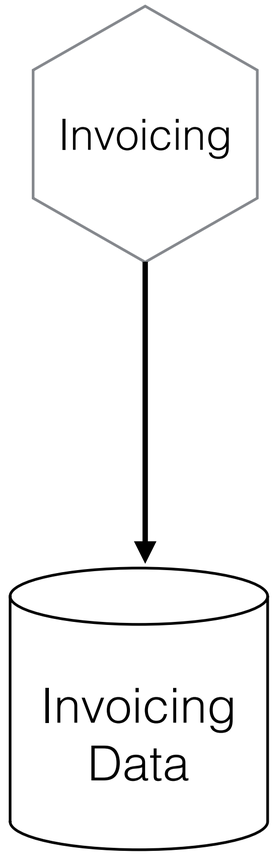
MOVE DATA TO THE NEW SERVICE



MOVE DATA TO THE NEW SERVICE

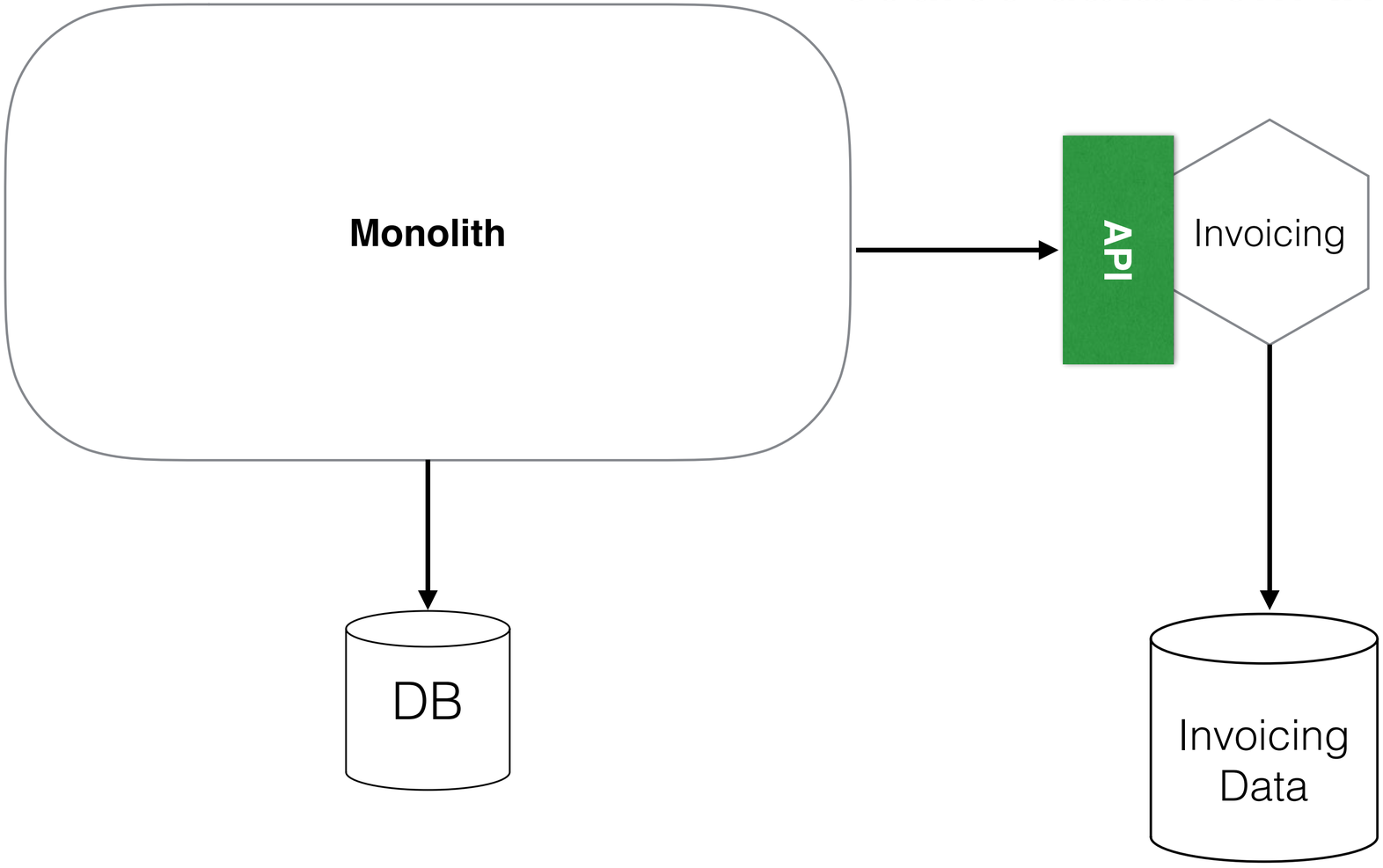
Monolith needs to be changed to source data from the new service



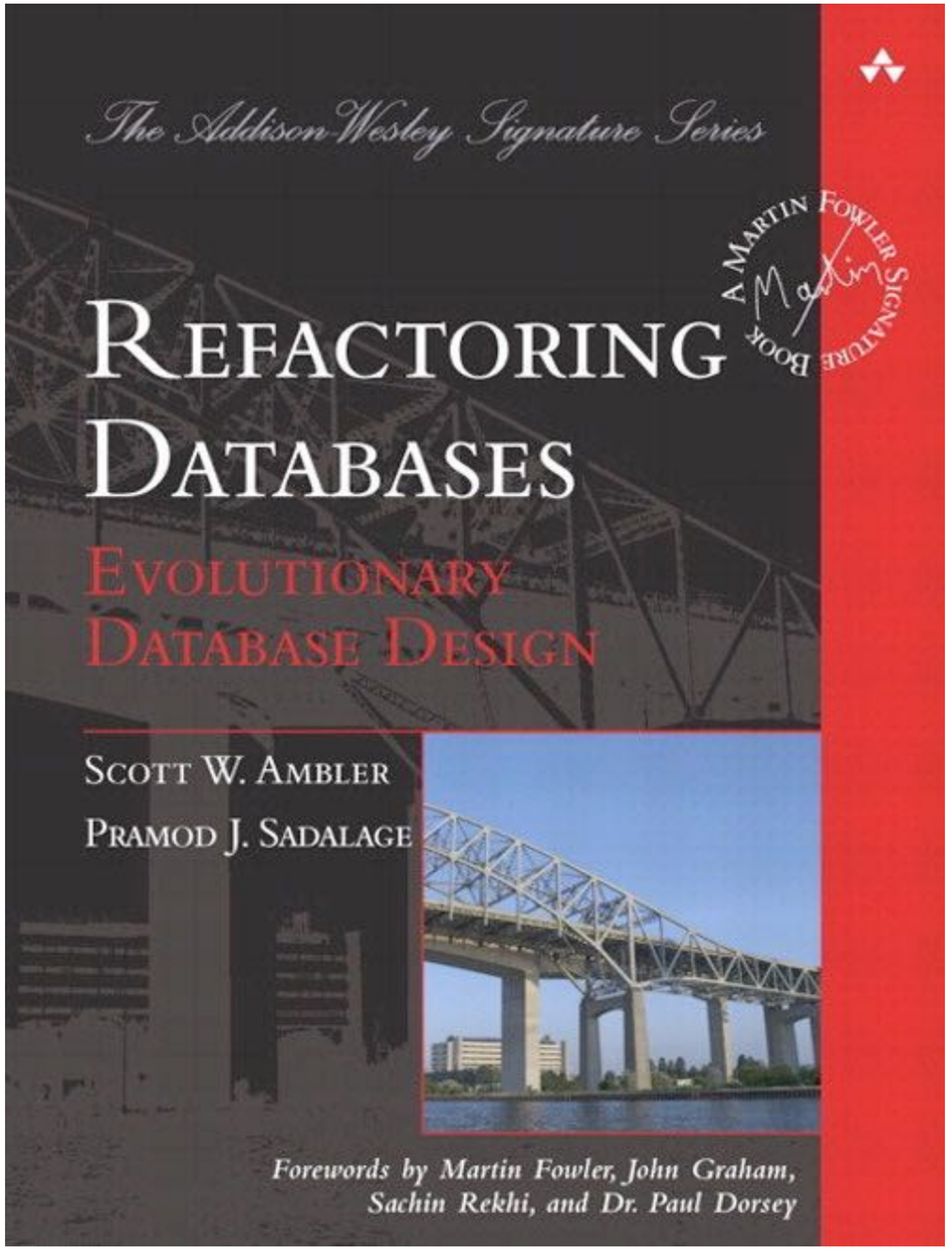


MOVE DATA TO THE NEW SERVICE

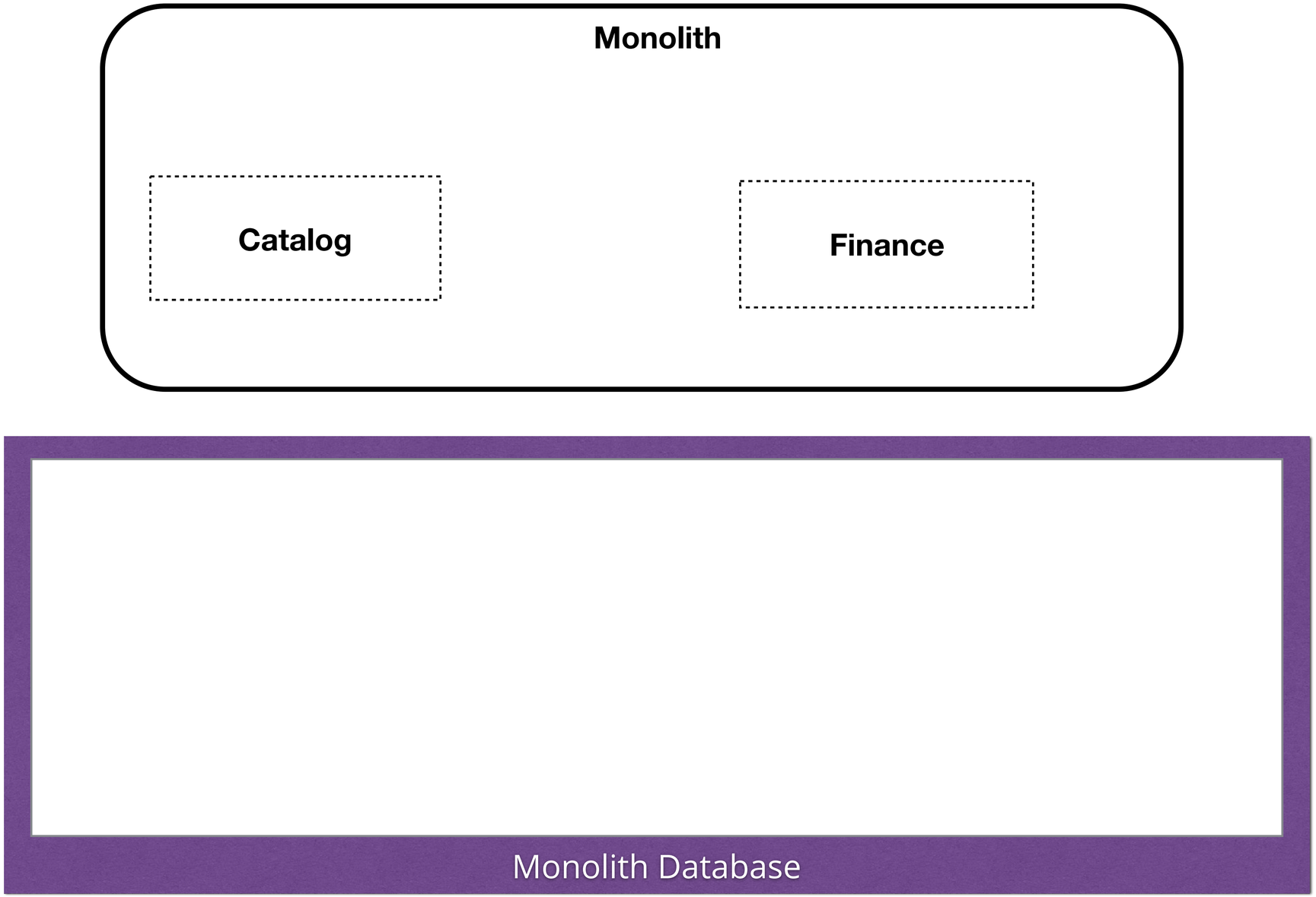
Monolith needs to be changed to source data from the new service



DB Refactoring Patterns


The Addison Wesley Signature Series
A Martin Fowler Signature Book
Refactoring Databases
Evolutionary Database Design
Scott W. Ambler
Pramod J. Sadalage
Forewords by Martin Fowler, John Graham, Sachin Rekhi, and Dr. Paul Dorsey

JOINS ACROSS TABLES



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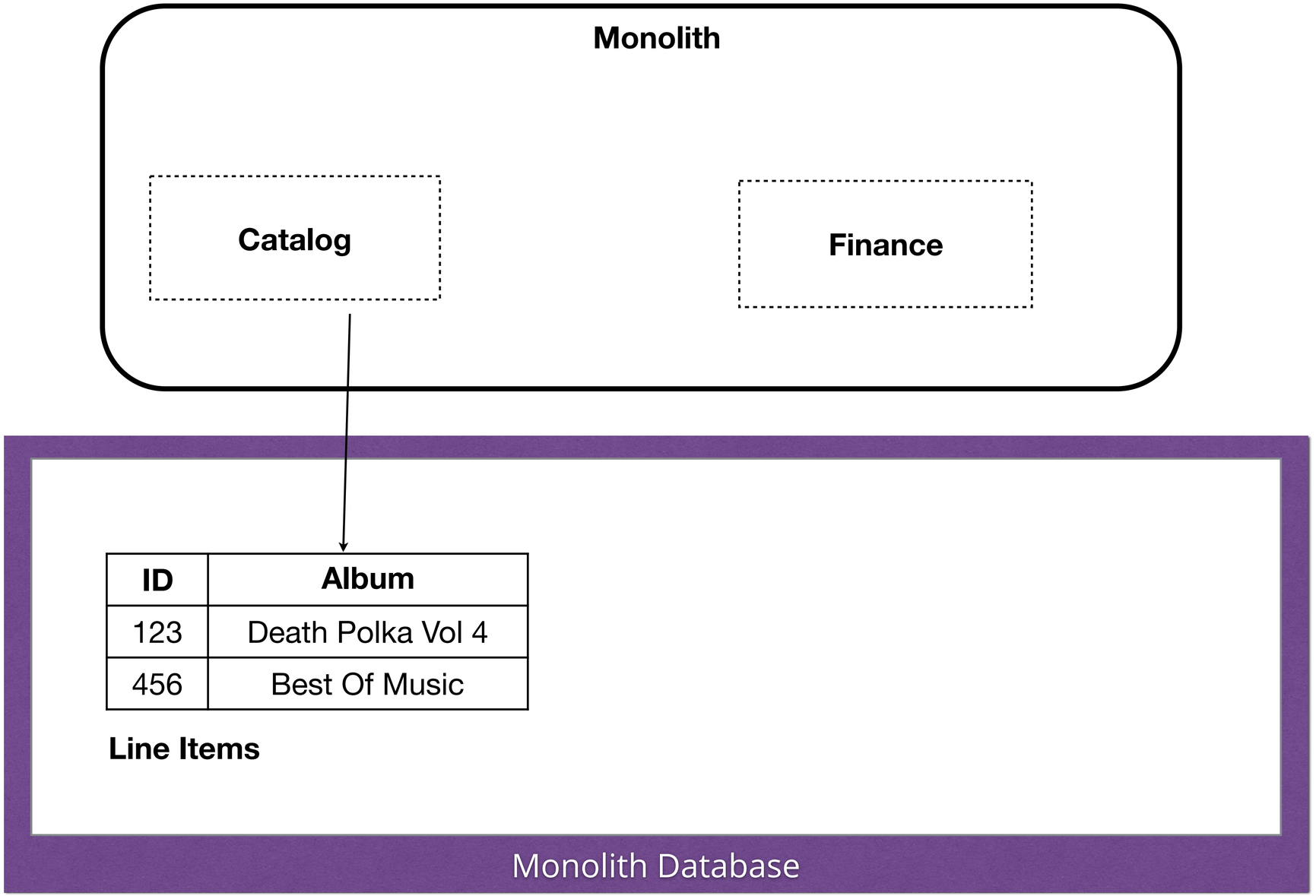

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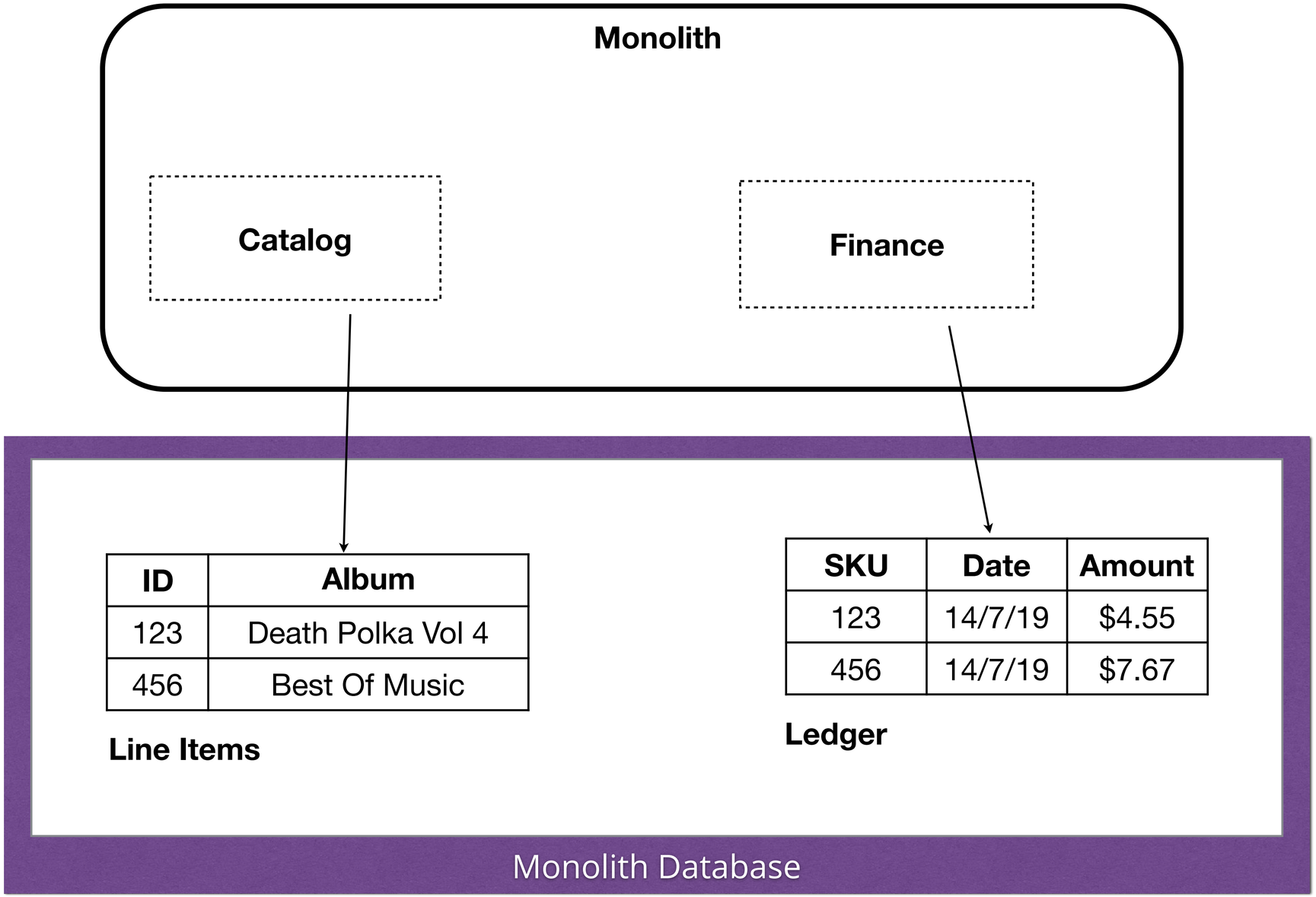

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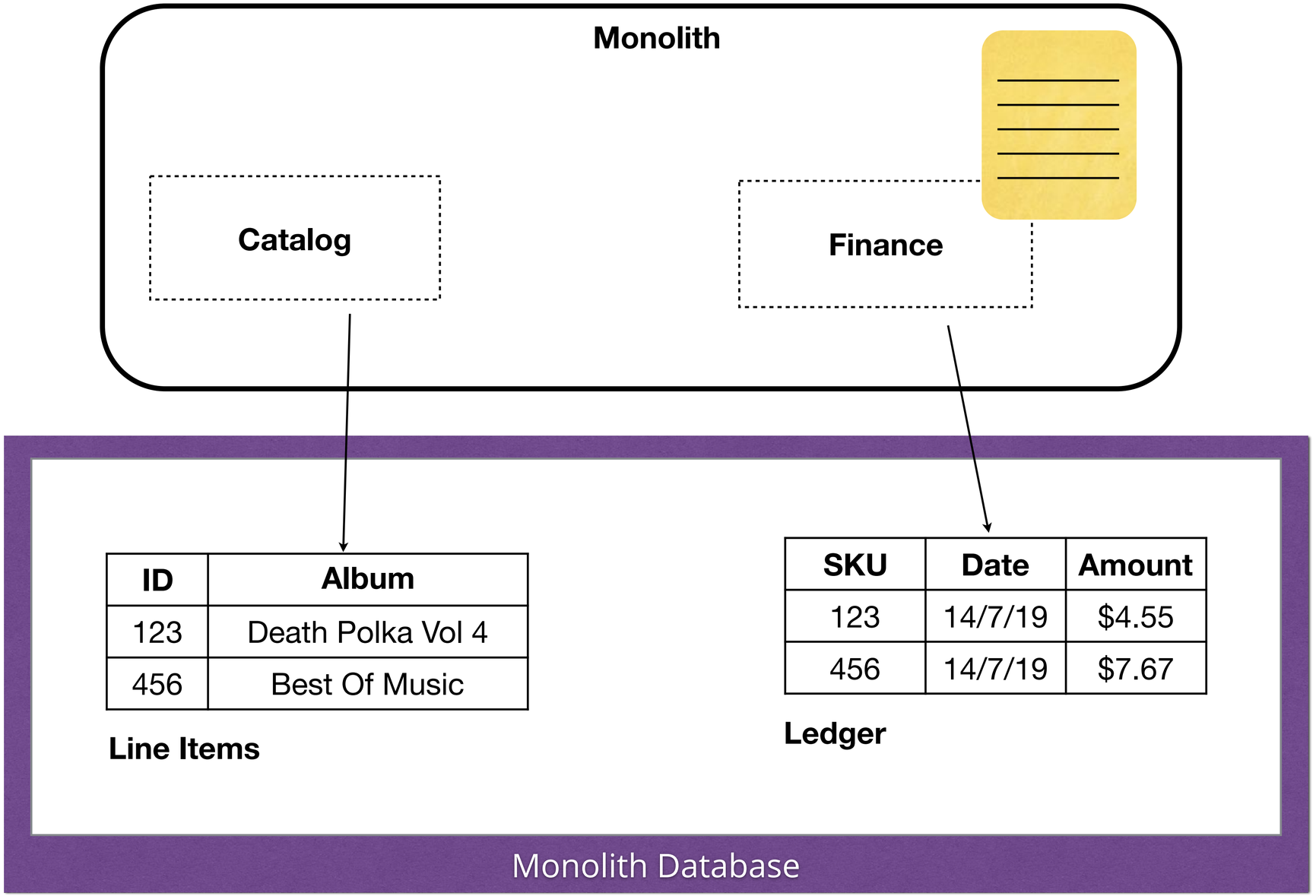

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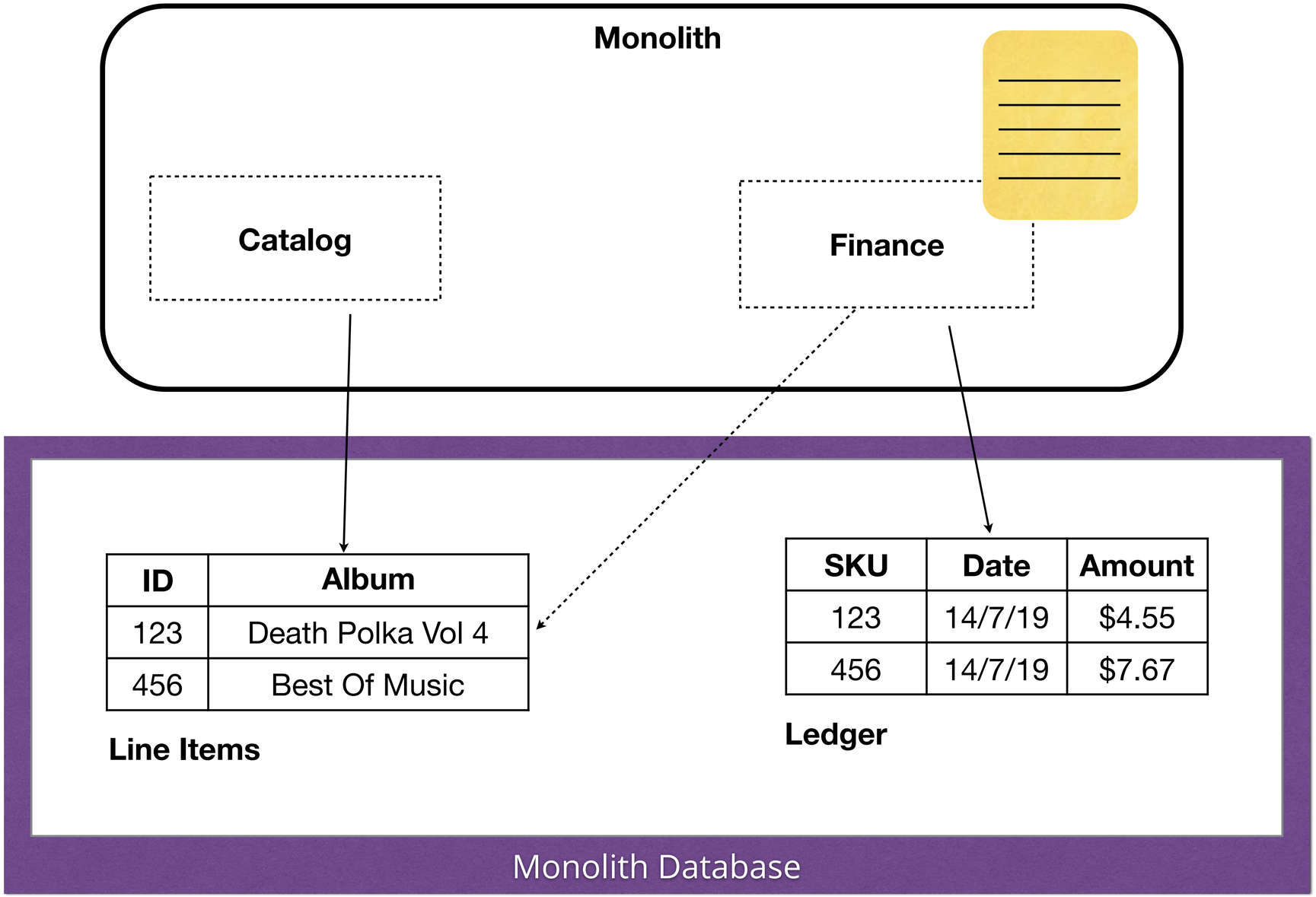

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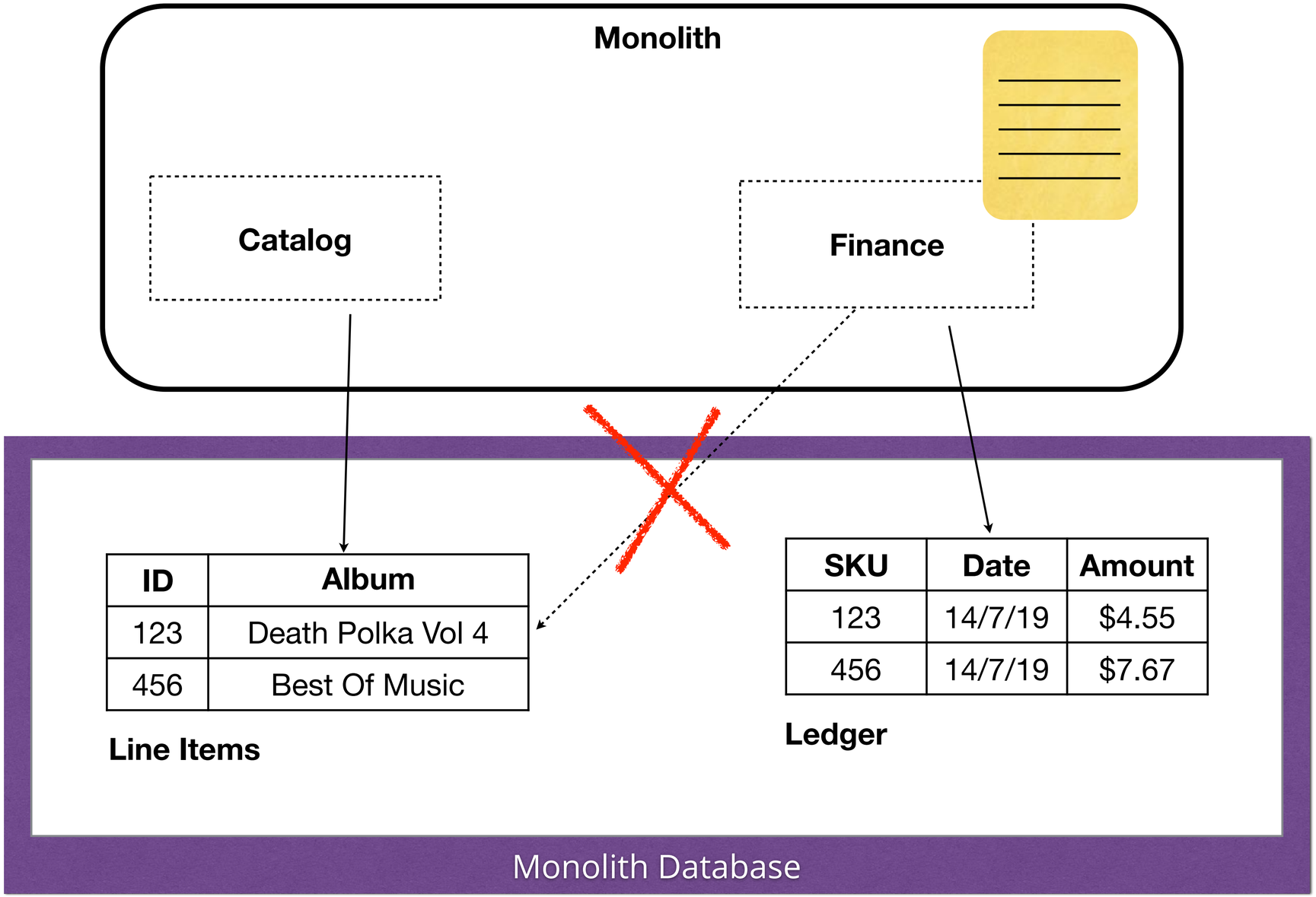

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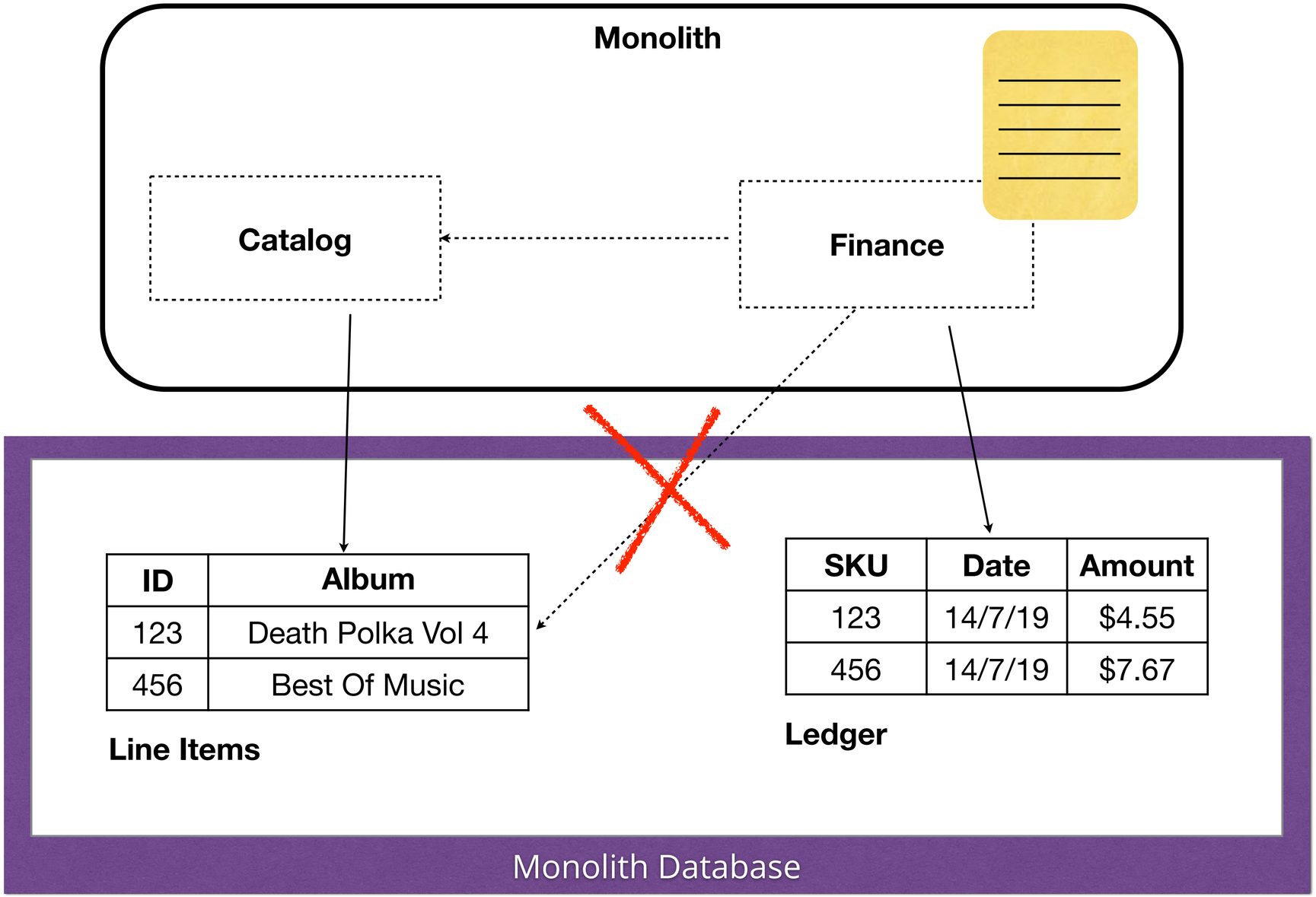
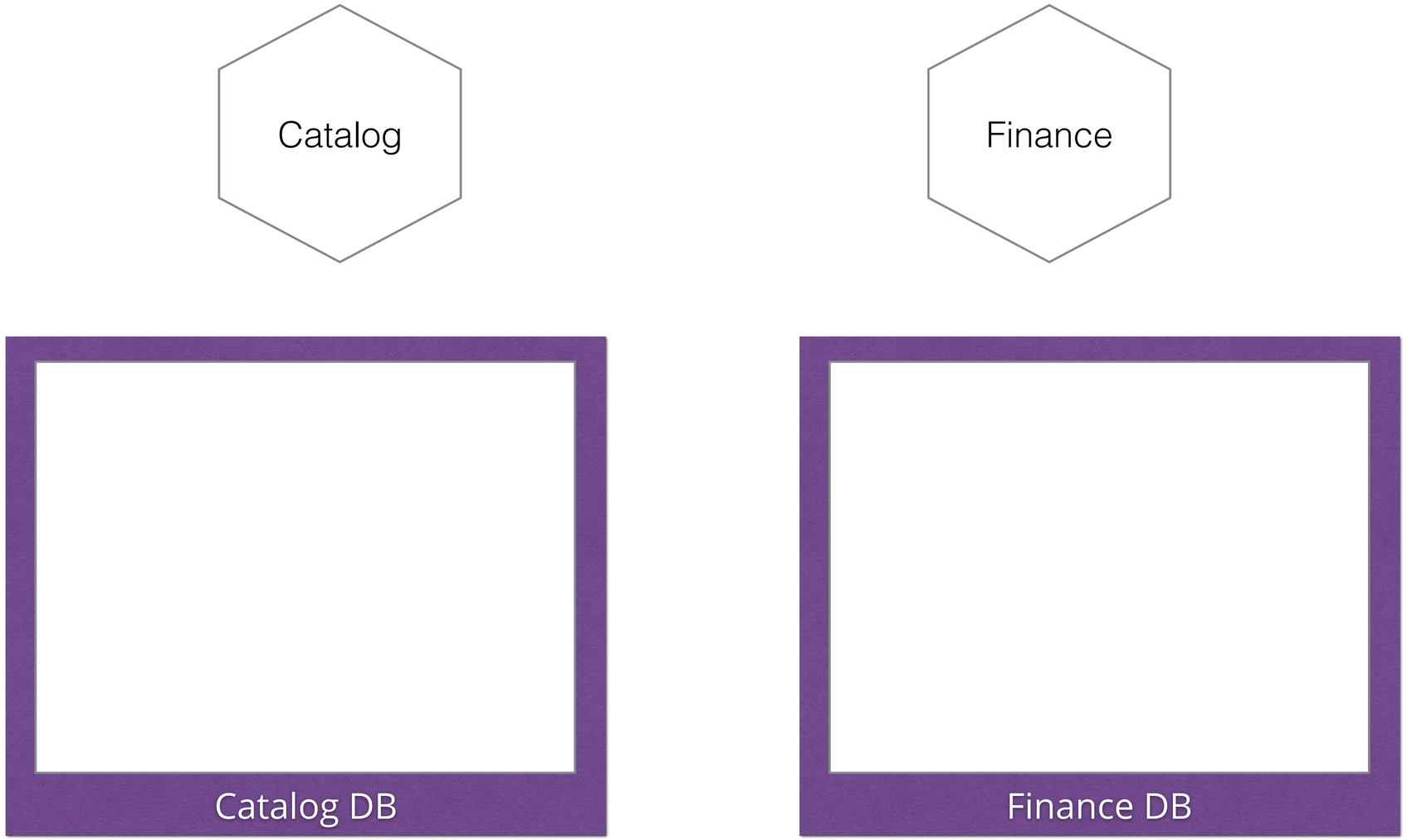
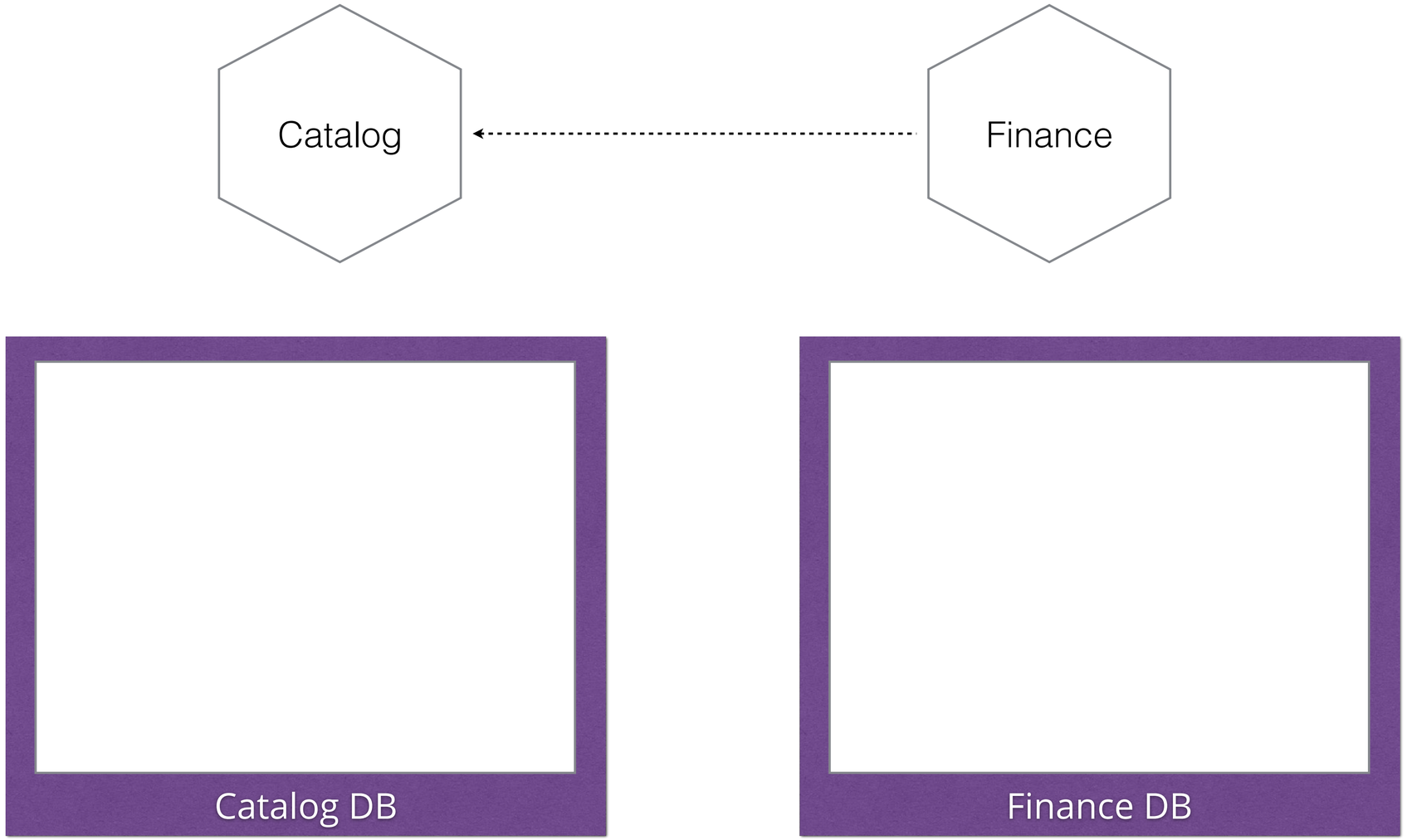



Catalog
Finance
Catalog DB
Finance DB


Catalog
Finance
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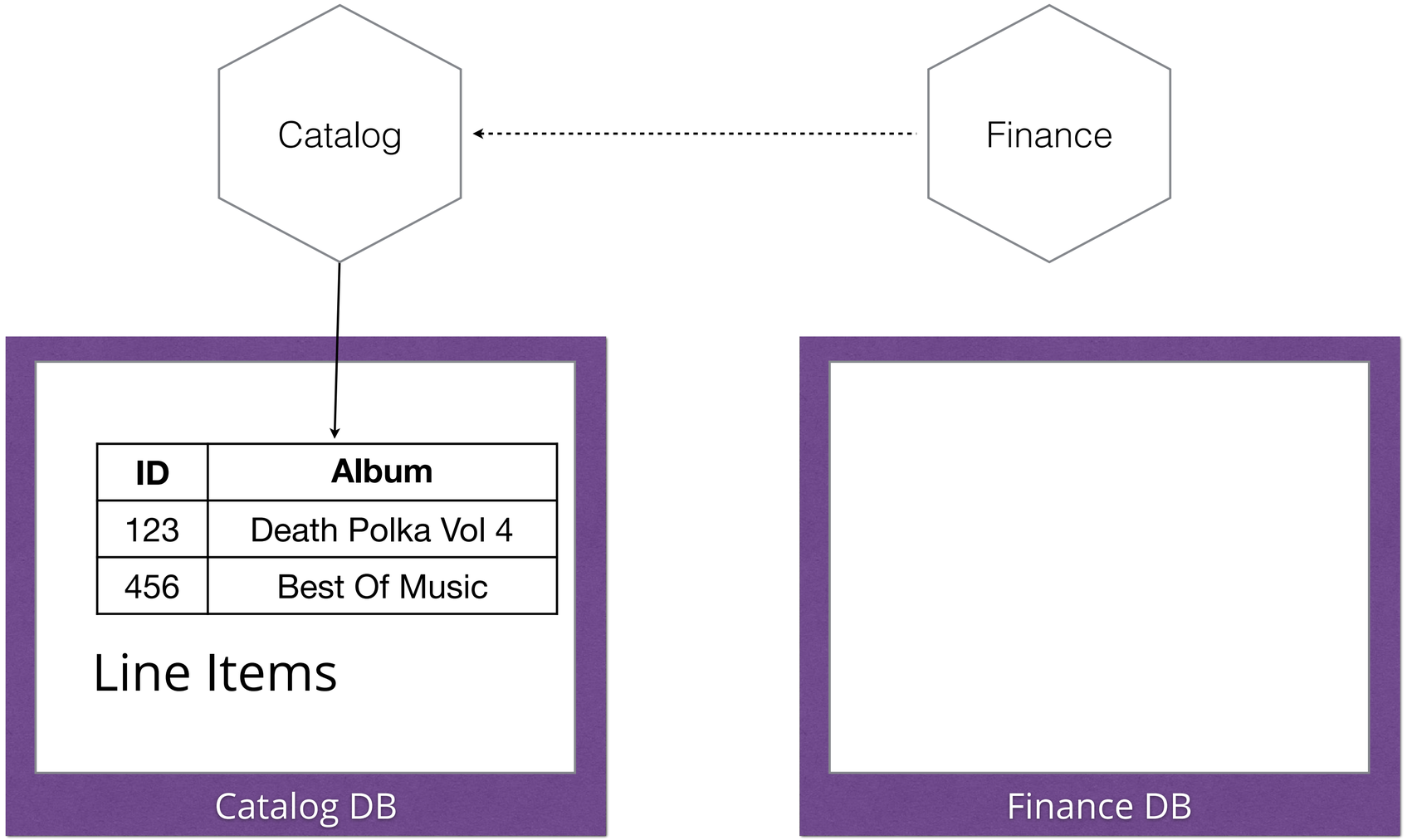
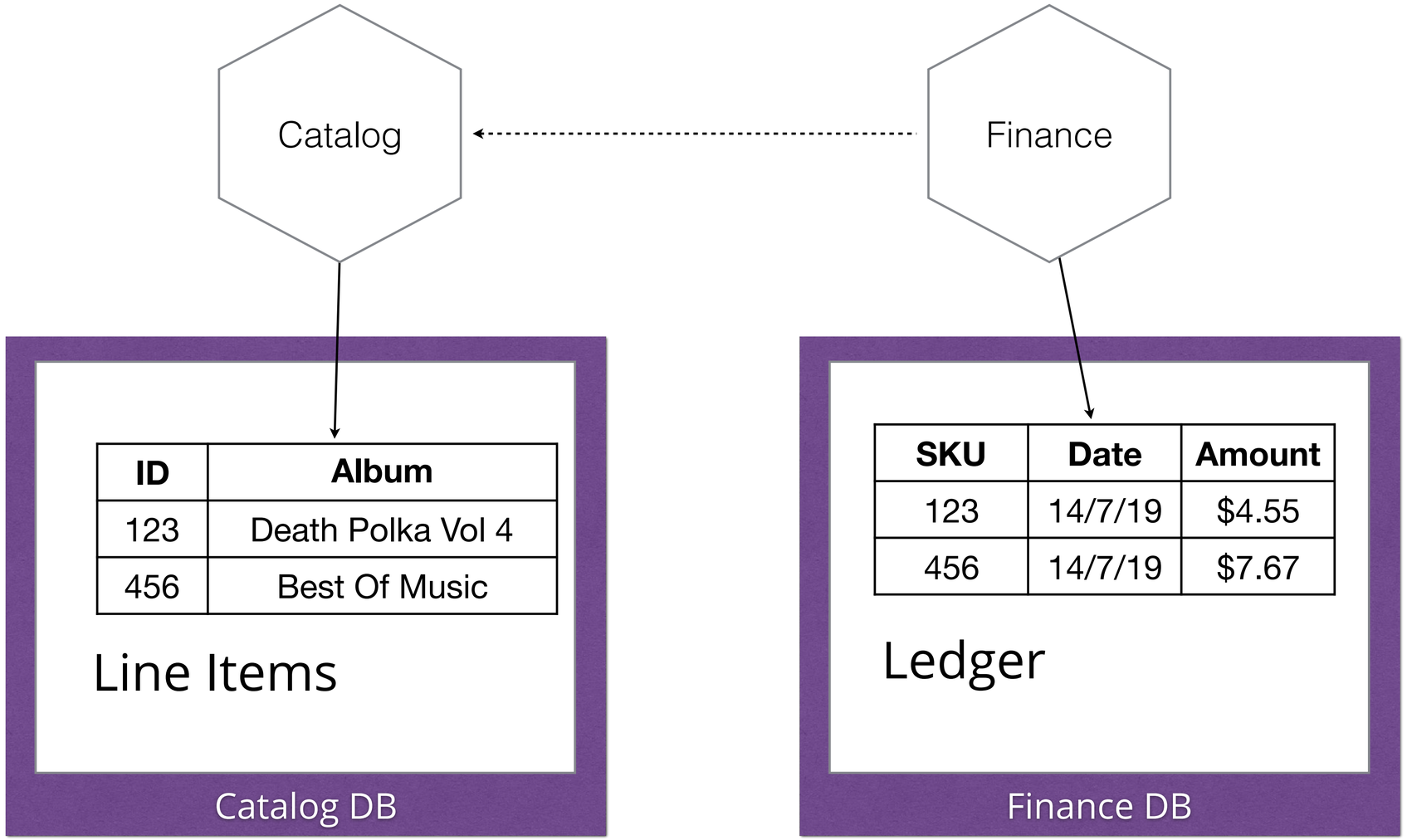

Catalog
Finance
ID
Album
123
Death Polka Vol 4
456
Best Of Music
Line Items
Catalog DB
Finance DB


Catalog
Finance
ID
Album
123
Death Polka Vol 4
456
Best Of Music
Line Items
Catalog DB
SKU
Date
Amount
123
14/7/19
$4.55
456
14/7/19
$7.67
Ledger
Finance DB

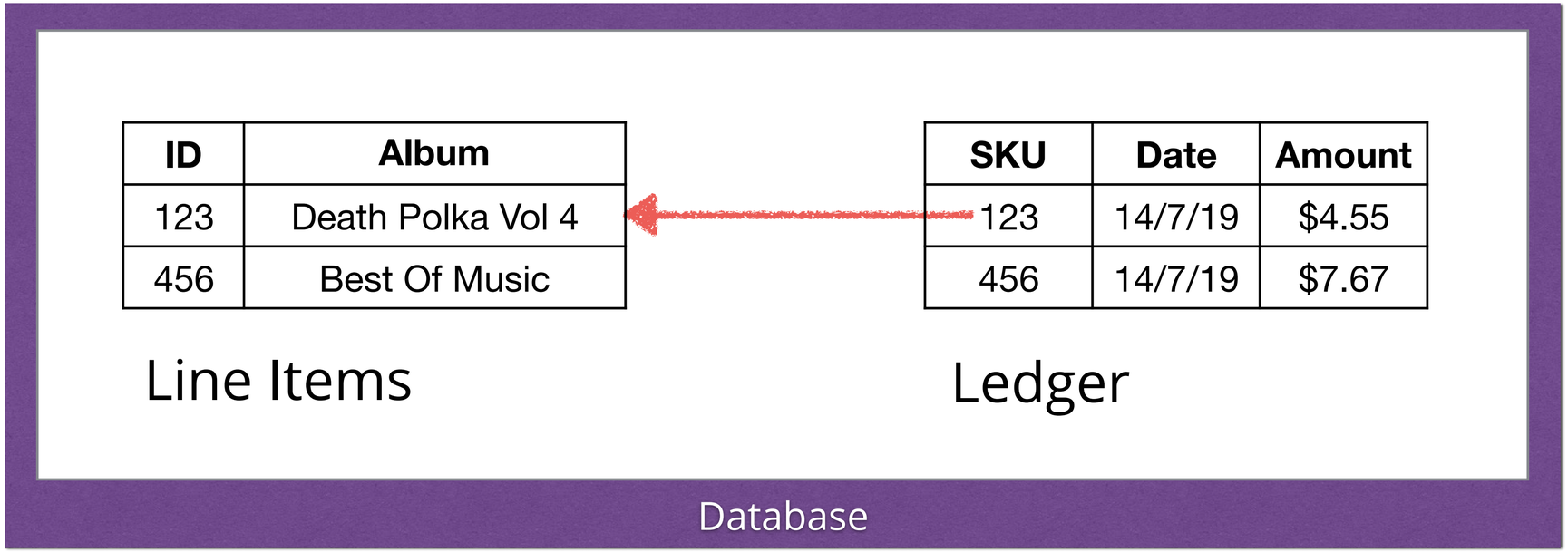
ID	Album
123	Death Polka Vol 4
456	Best Of Music

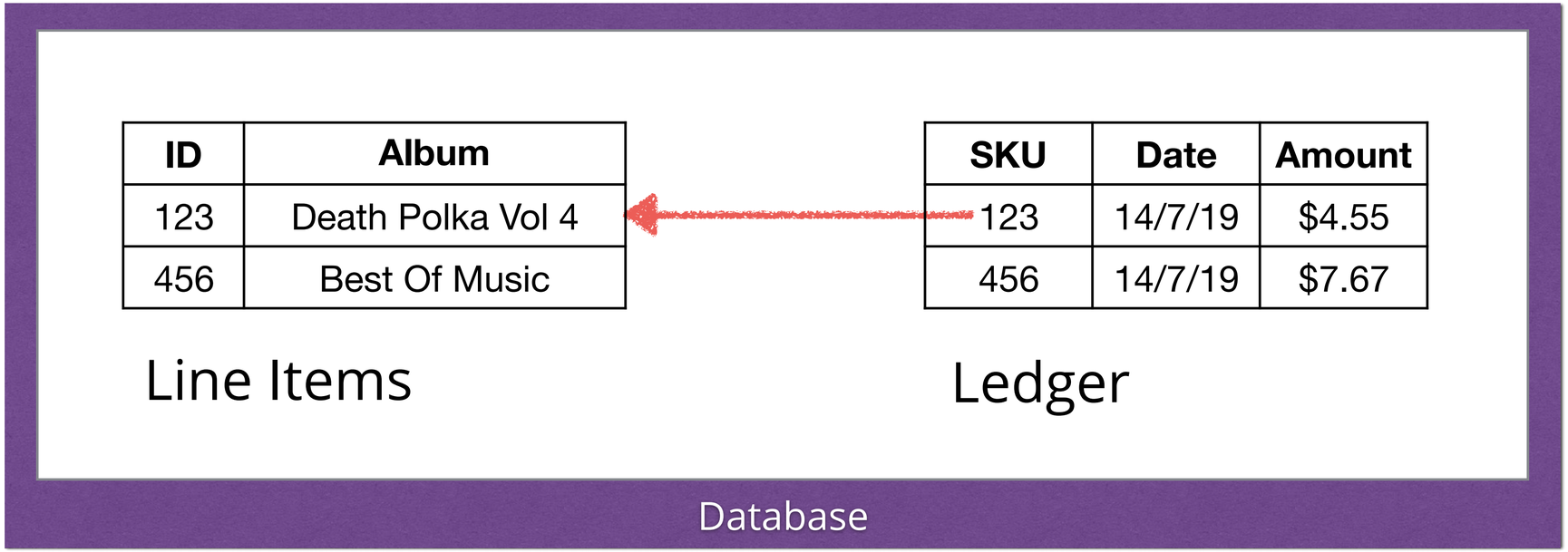
Line Items

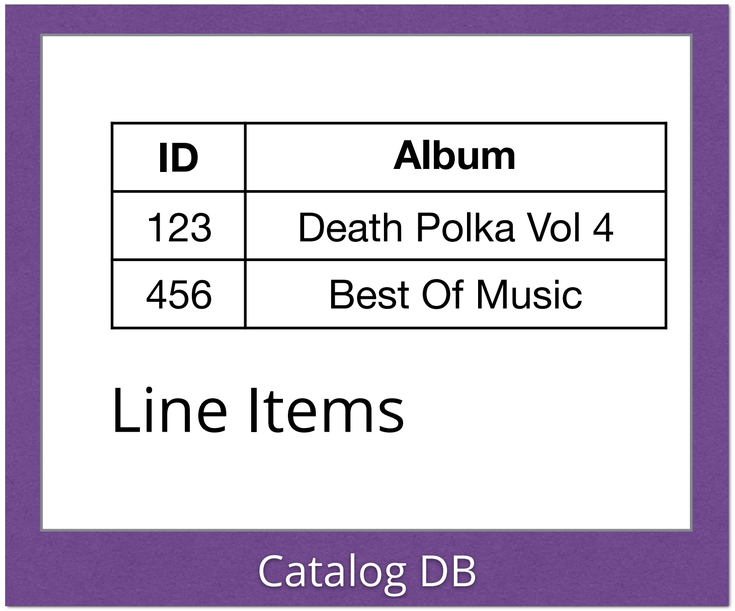
SKU	Date	Amount
123	14/7/19	$4.55
456	14/7/19	$7.67

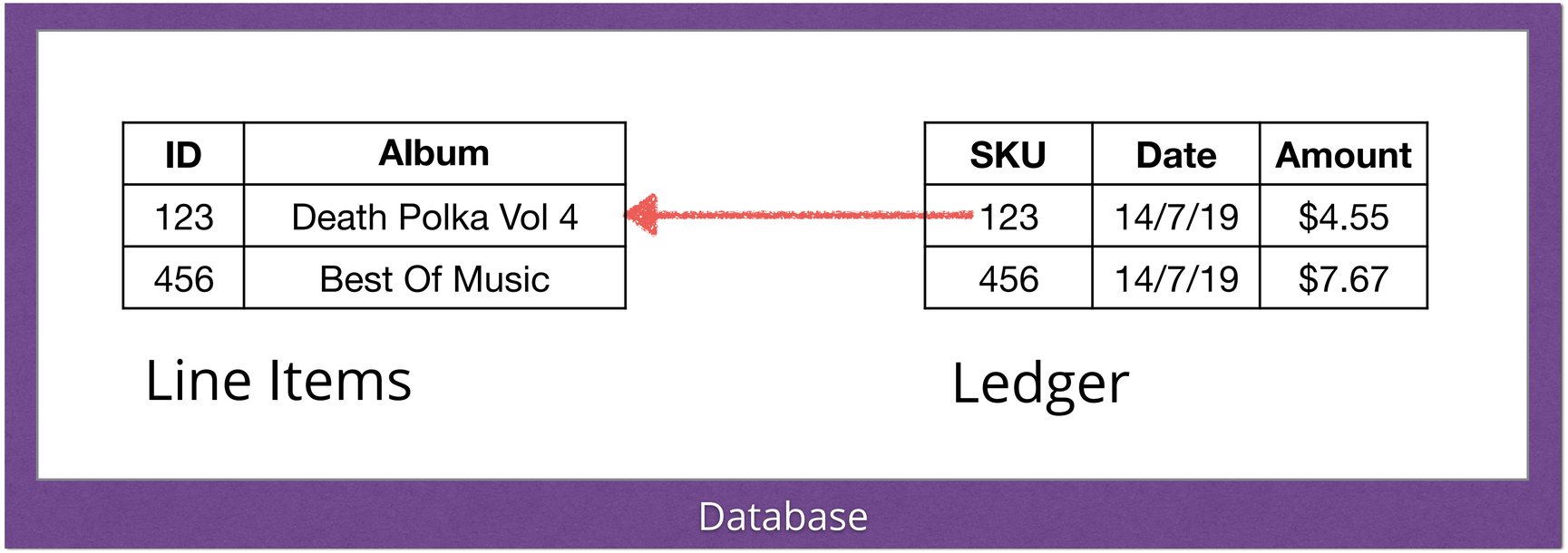
Ledger

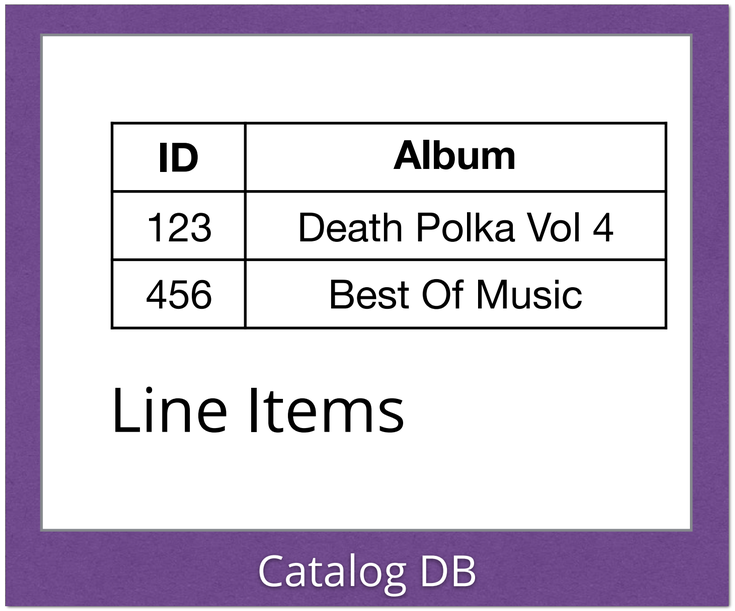
Database


ID
Album
123
Death Polka Vol 4
456
Best Of Music
SKU
Date
Amount
123
14/7/19
$4.55
456
14/7/19
$7.67
Line Items
Ledger
Database


ID
Album
123
Death Polka Vol 4
456
Best Of Music
SKU
Date
Amount
123
14/7/19
$4.55
456
14/7/19
$7.67
Line Items
Ledger
Database


ID
Album
123
Death Polka Vol 4
456
Best Of Music
Line Items
Catalog DB


ID
Album
123
Death Polka Vol 4
456
Best Of Music
SKU
Date
Amount
123
14/7/19
$4.55
456
14/7/19
$7.67
Line Items
Ledger
Database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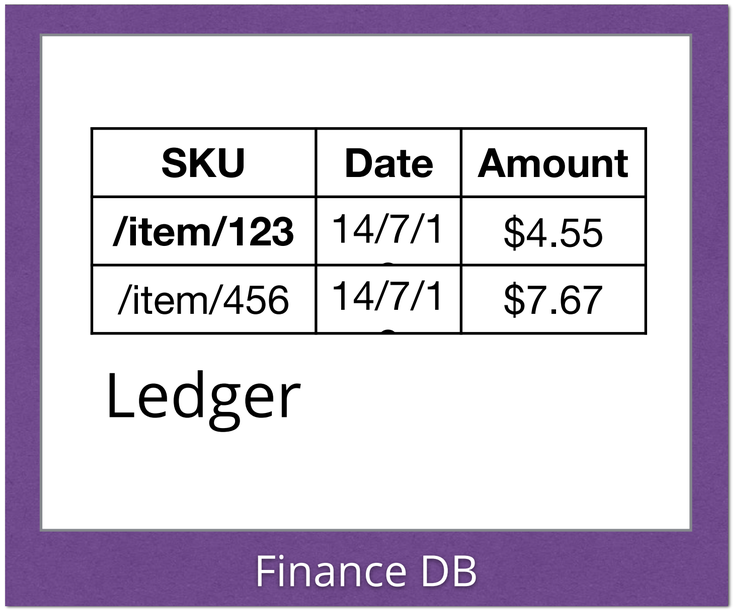
Album
123
Death Polka Vol 4
456
Best Of Music
Line Items
Catalog DB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Amount
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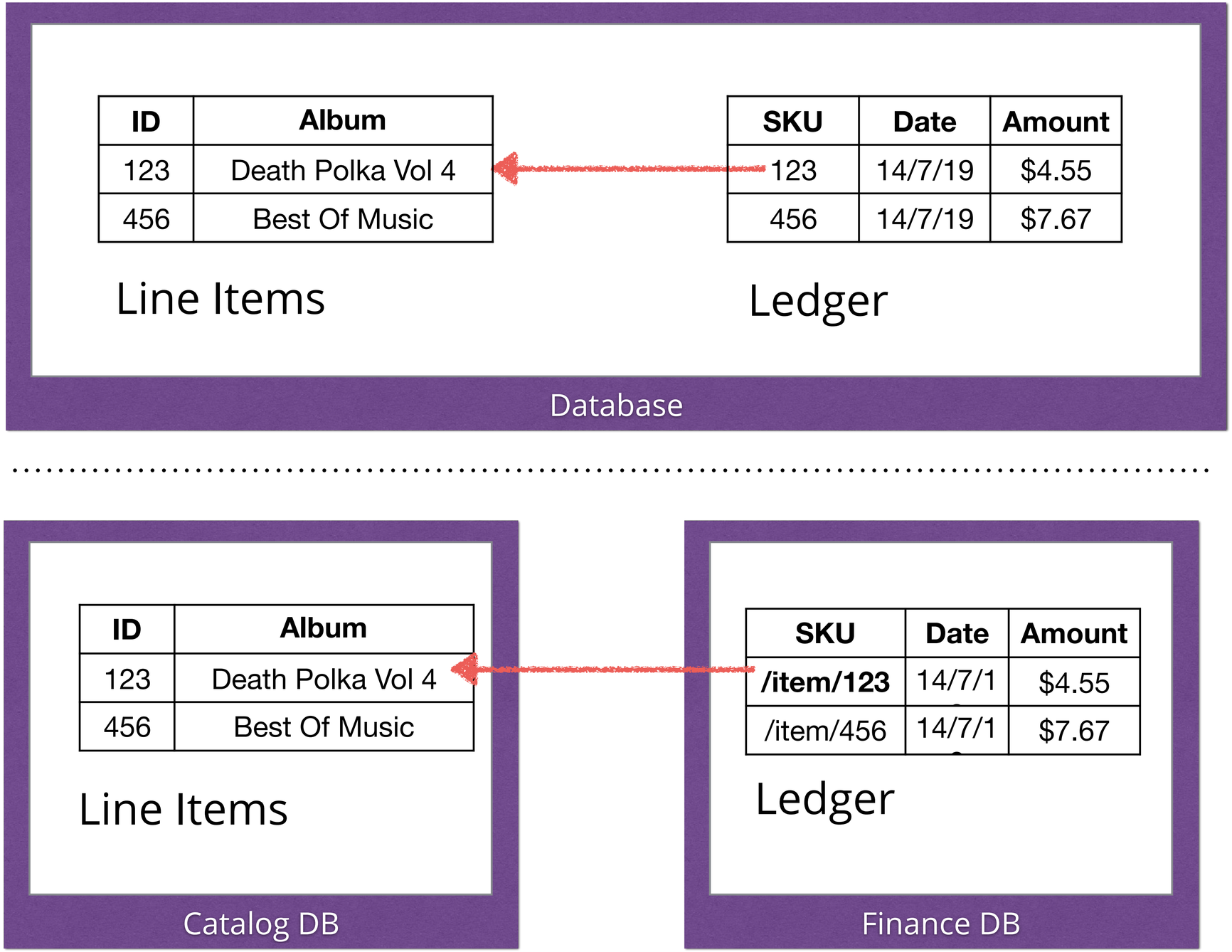
$7.67
Ledger
Finance DB


ID
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123
Death Polka Vol 4
456
Best Of Music
Line Items
SKU
Date
Amount
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14/7/19
$4.55
456
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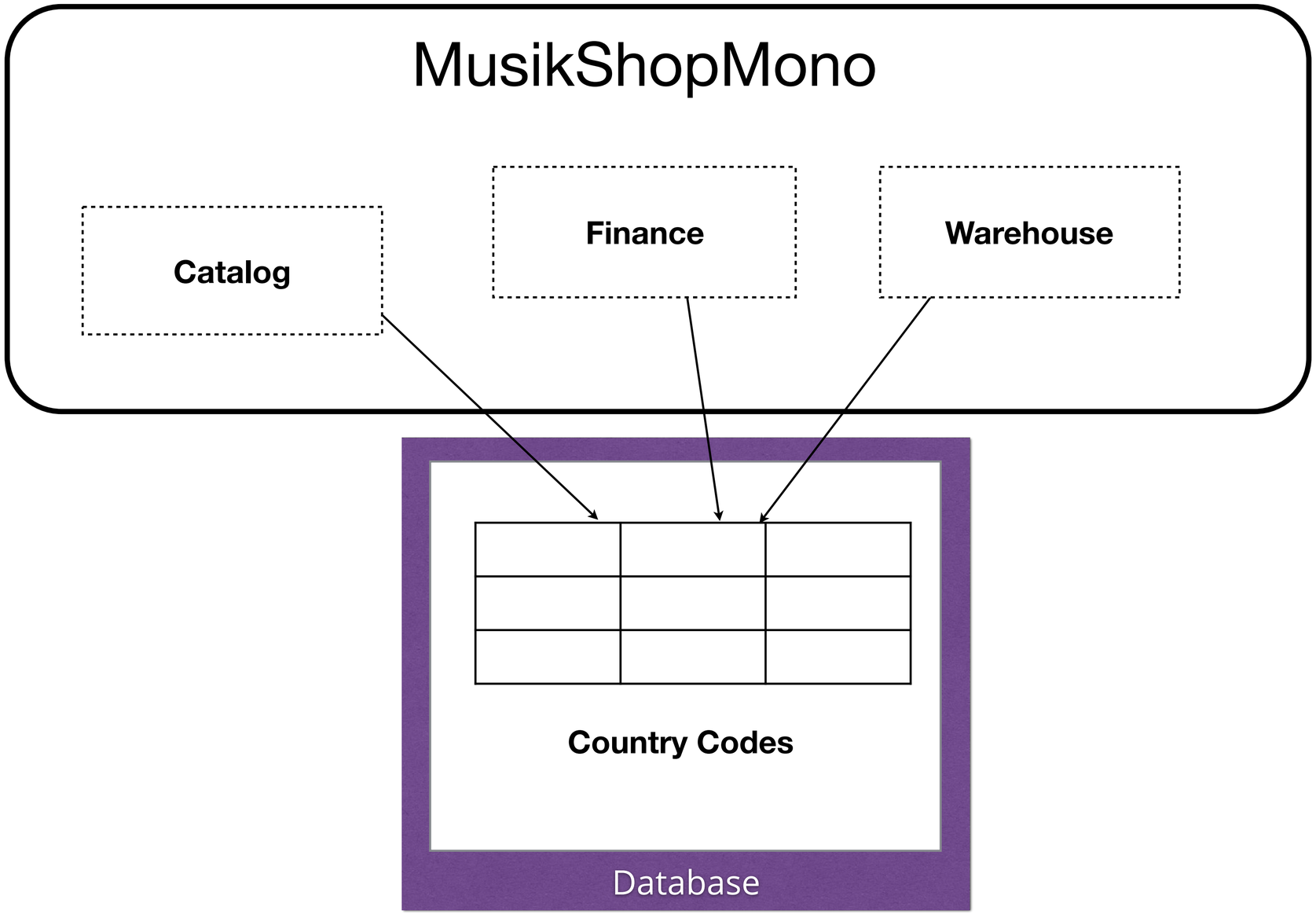
$7.67
Ledger
Database
ID
Album
123
Death Polka Vol 4
456
Best Of Music
Line Items
Catalog DB
SKU
Date
Amount
/item/123
14/7/1
$4.55
/item/456
14/7/1
$7.67
Ledger
Finance DB

MOVING JOINS TO SERVICE CALLS

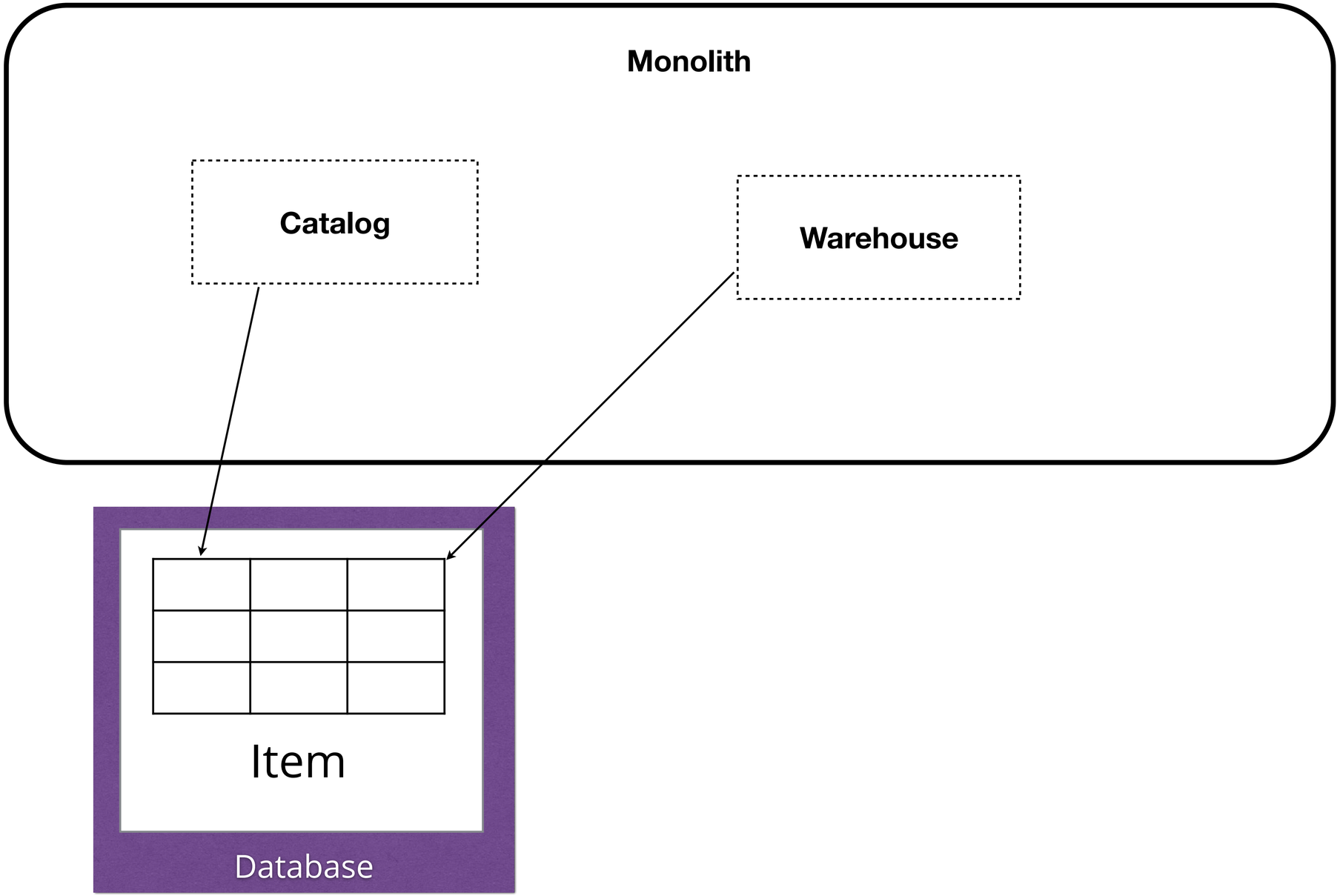
More network hops - latency can suffer

Lost enforcement of data consistency

STATIC REFERENCE DATA



SPLITTING TABLES



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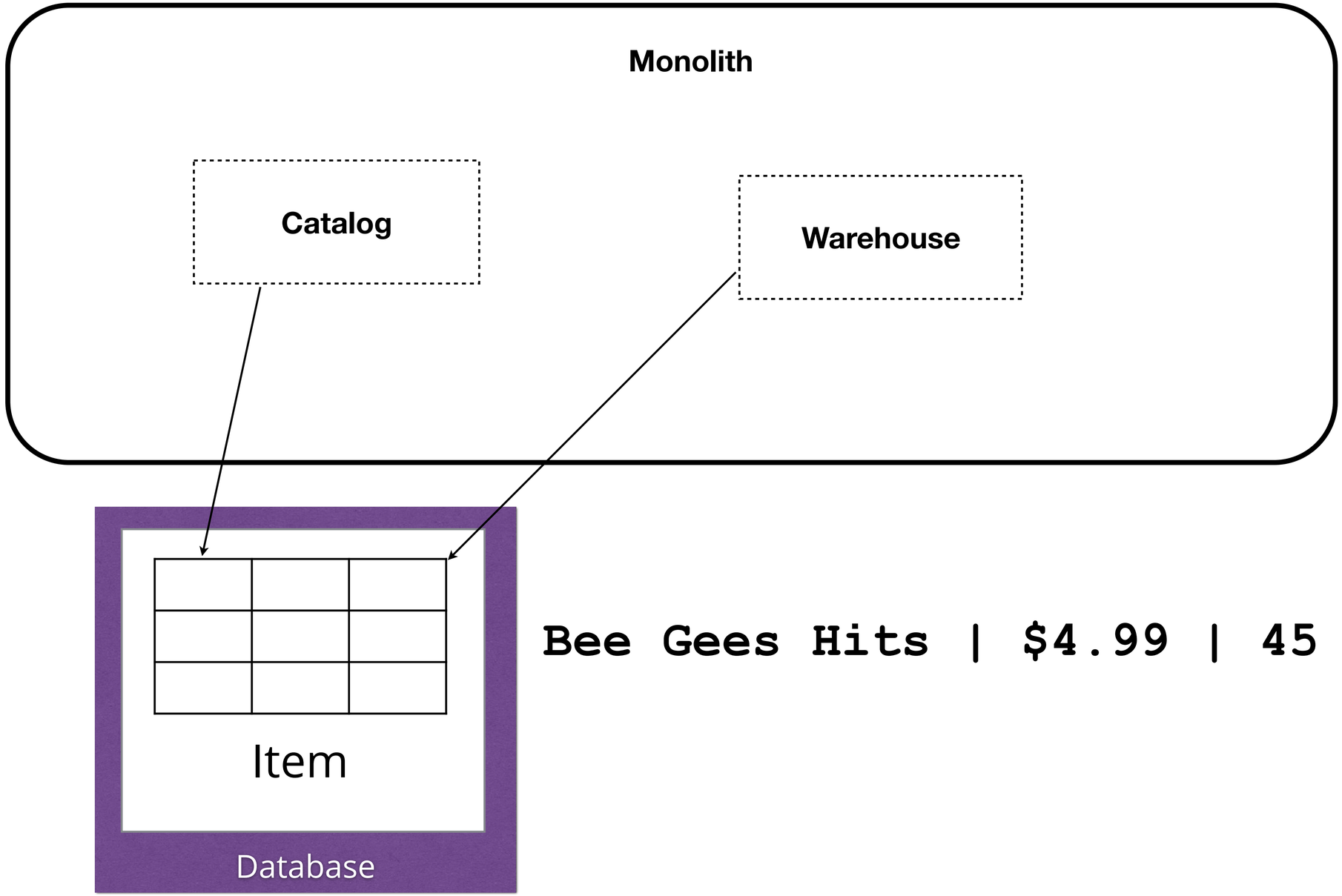
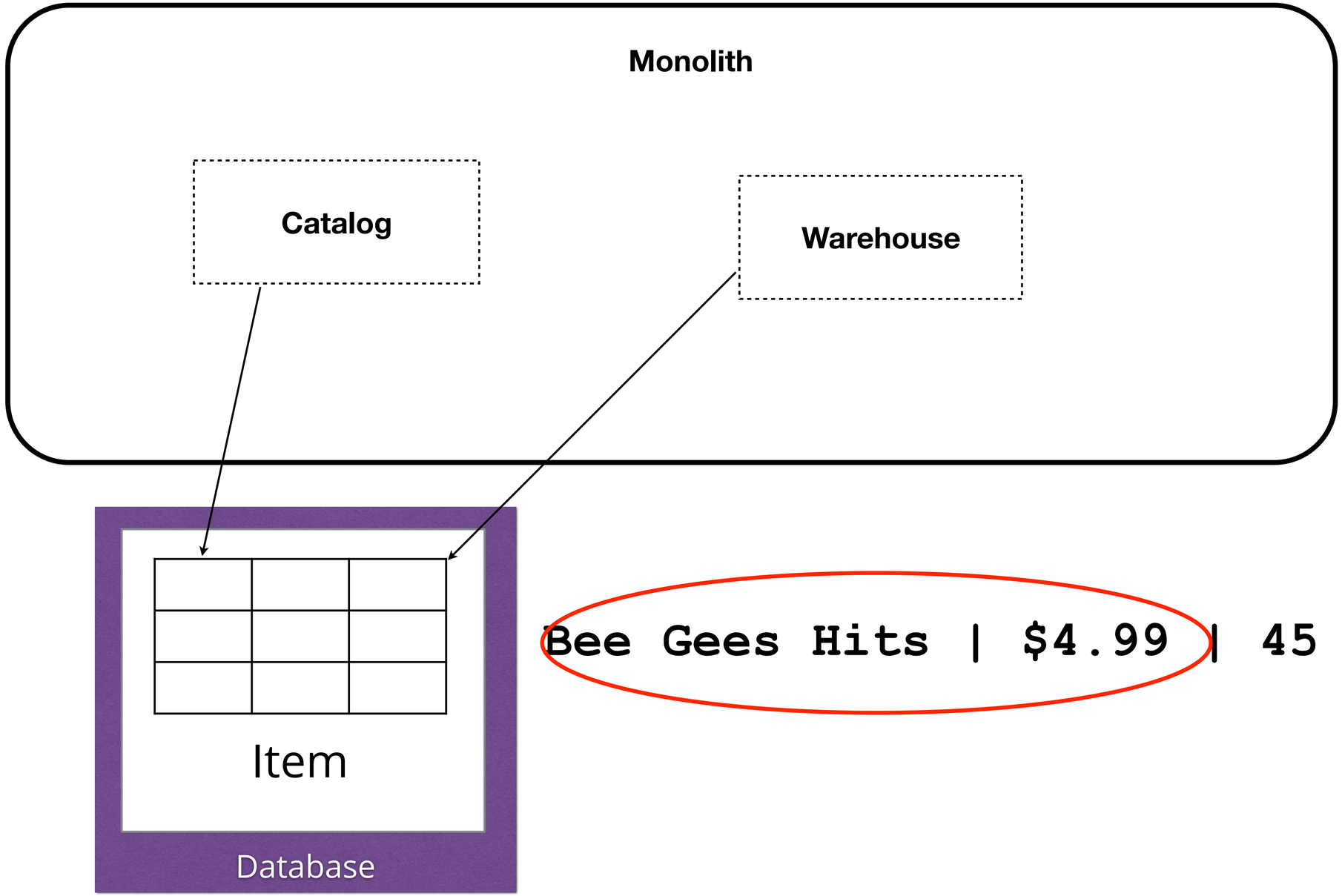



```
Bee Gees Hits | $4.99 | 45
```

SPLITTING TABLES



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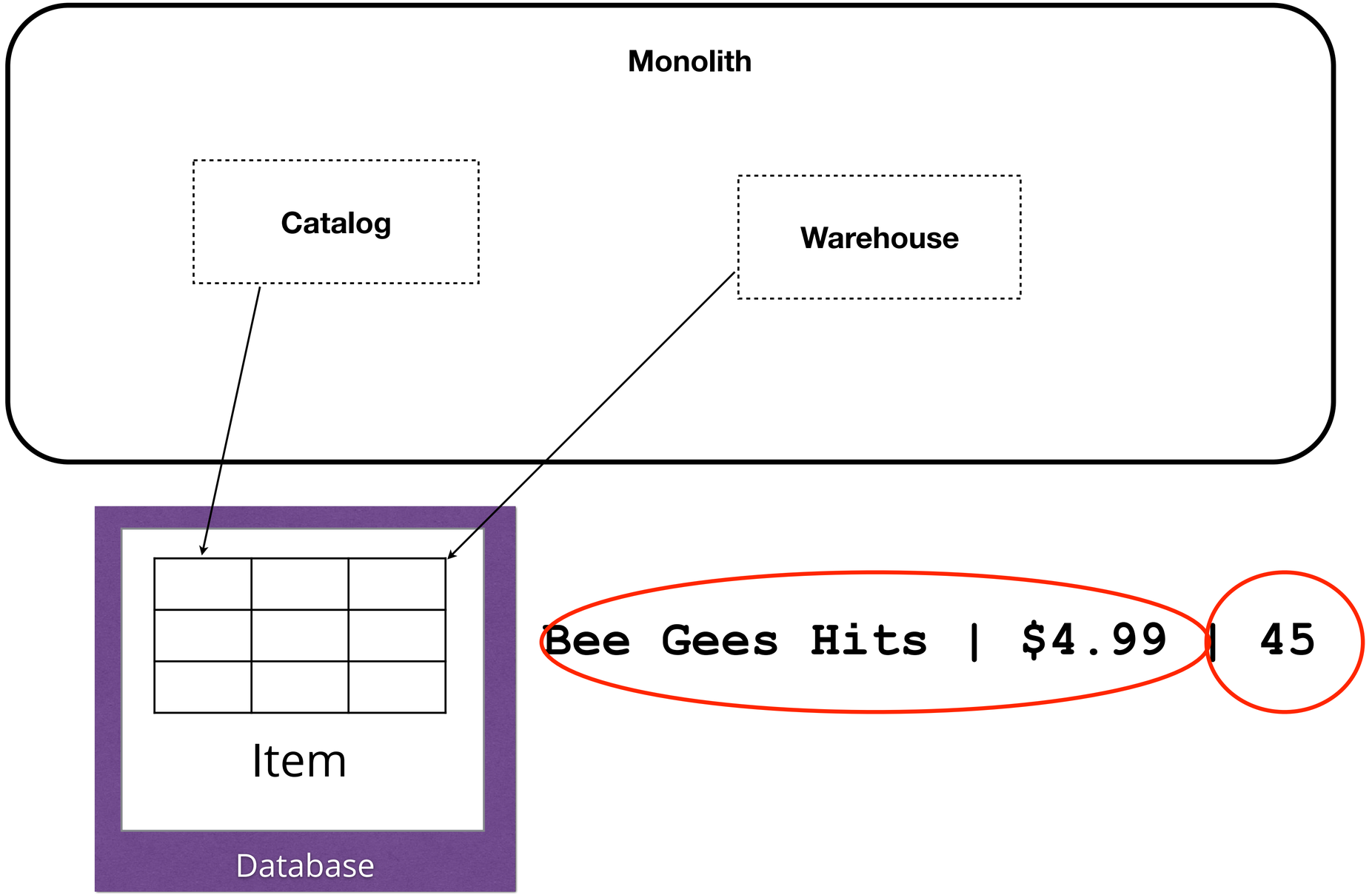
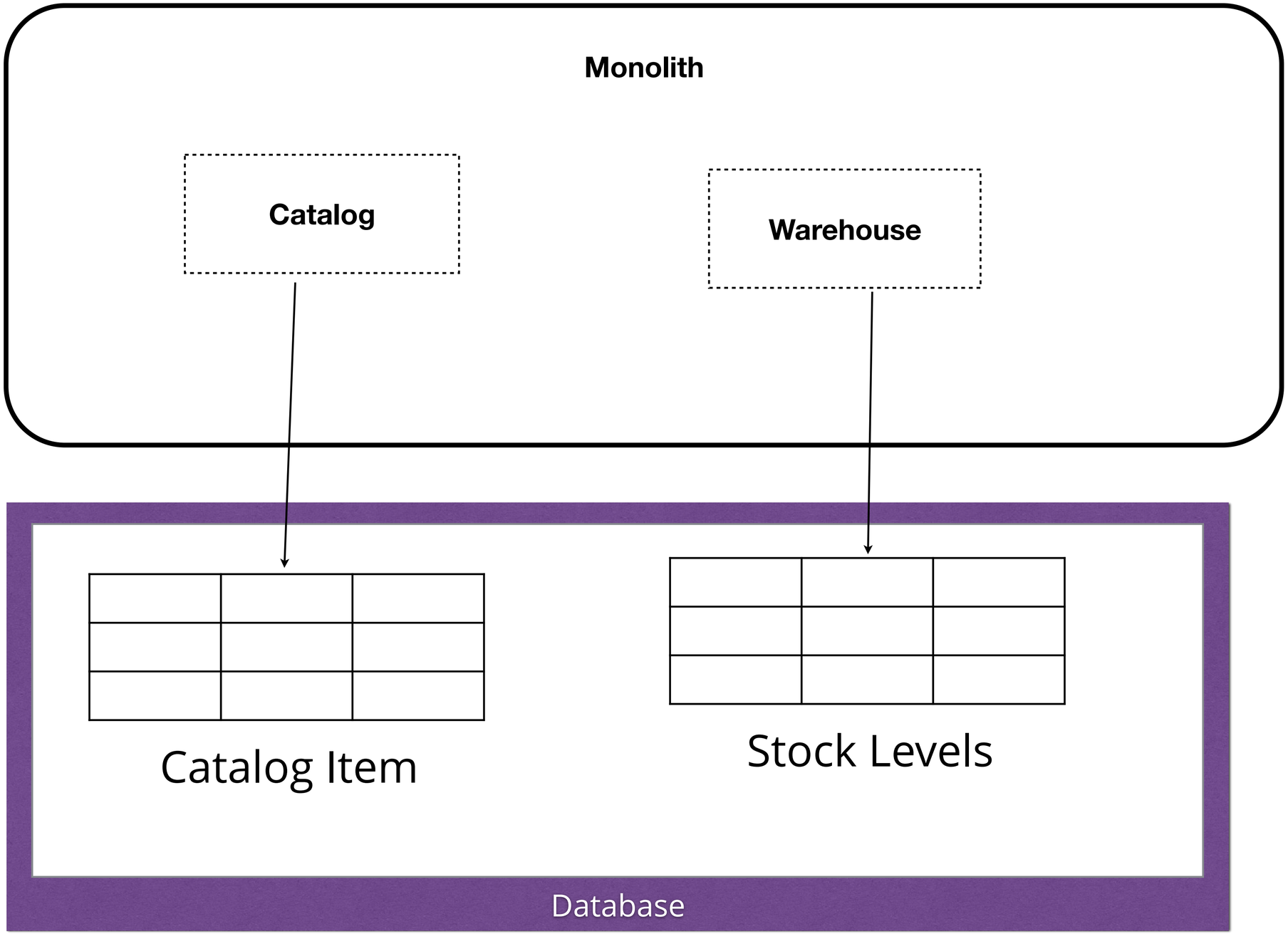
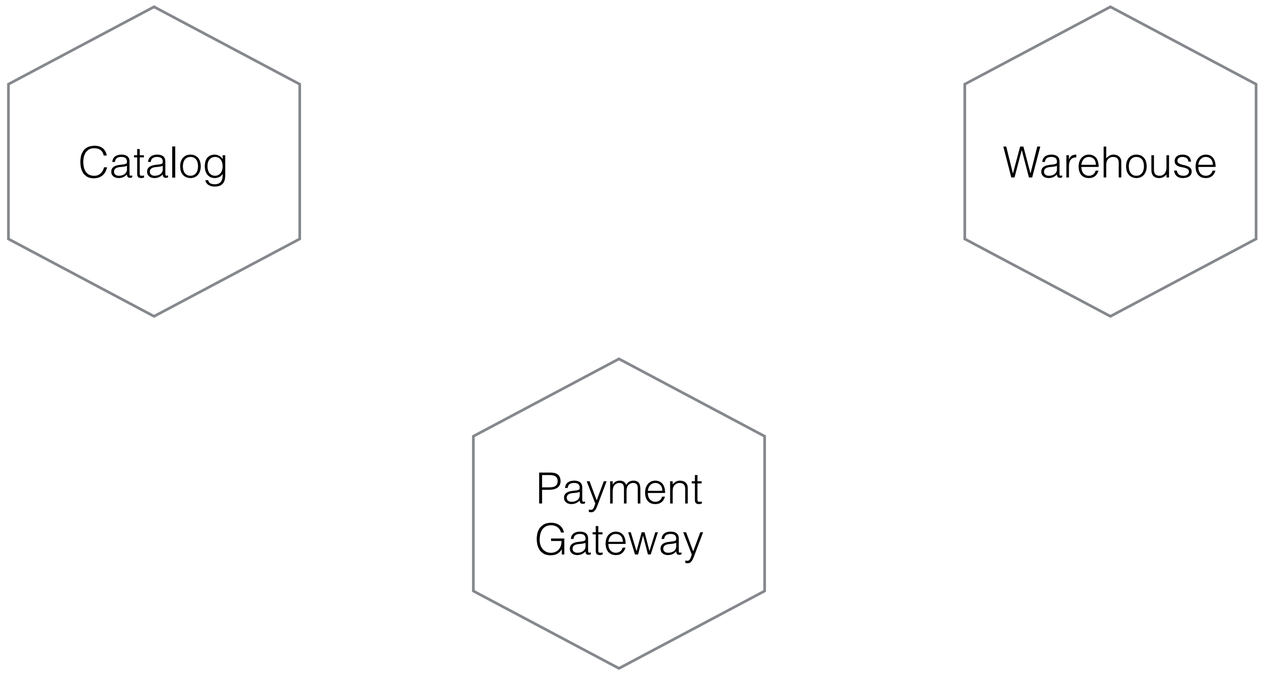
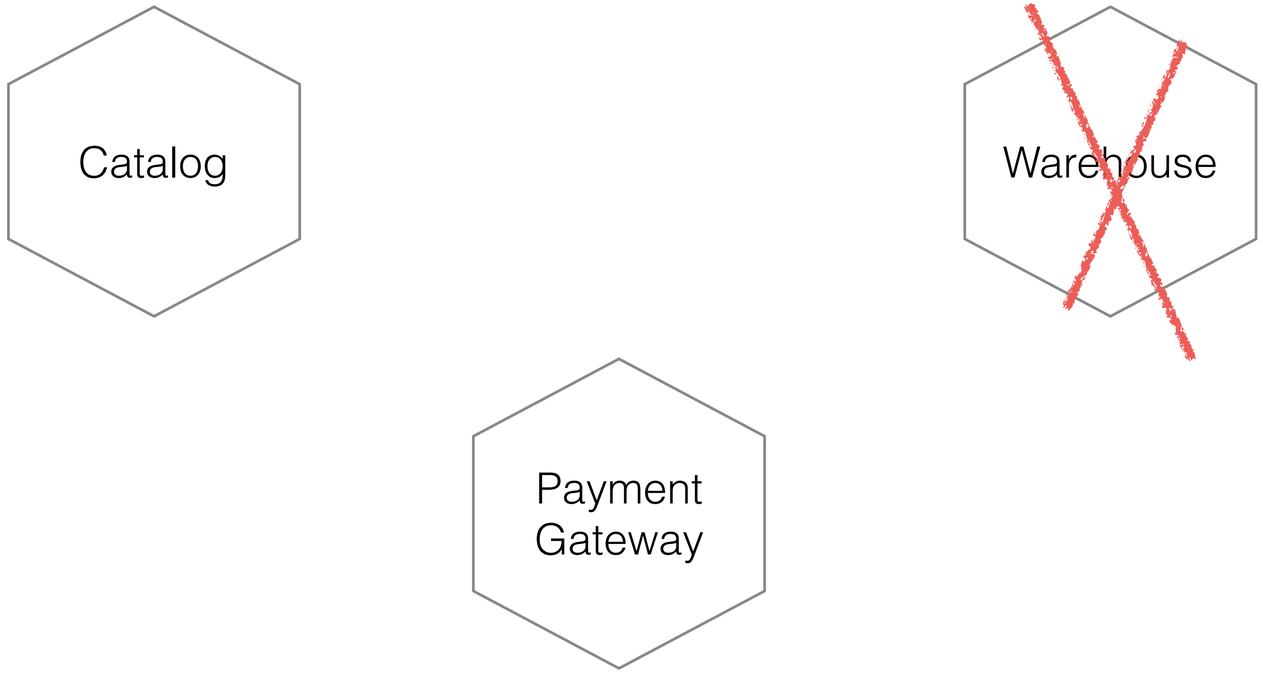
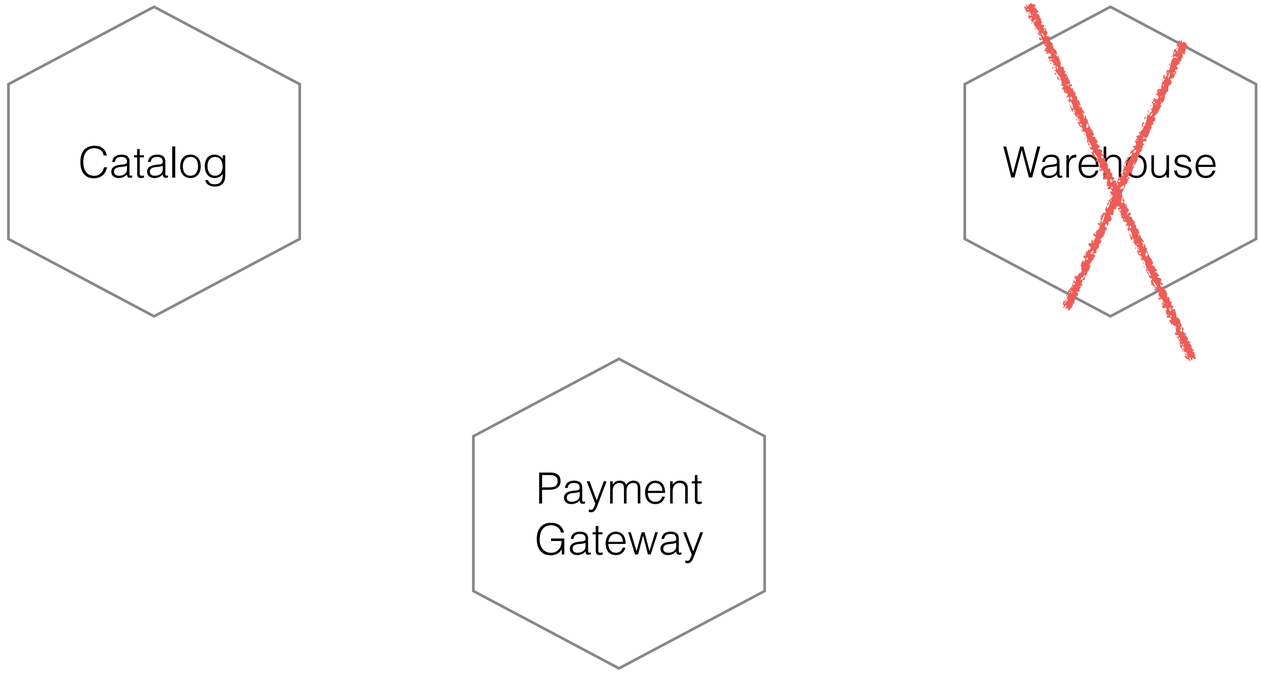



Monolith
Catalog
Warehouse
Catalog Item
Stock Levels
Database

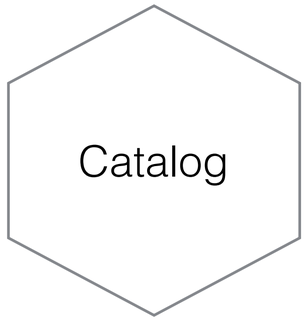

Catalog
Warehouse
Payment
Gateway

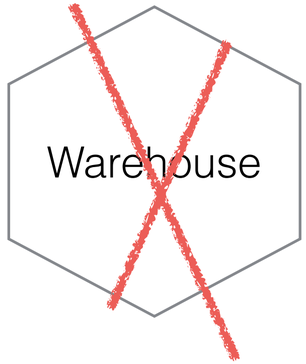

Catalog
Warehouse
Payment
Gateway

We can find out how much something costs…



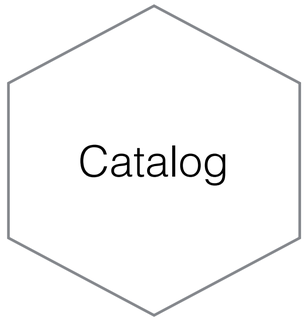
We can find out how much something costs…



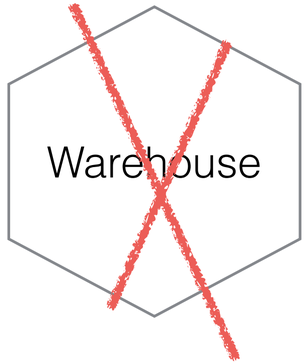


…and can take payment…

We can find out how much something costs…



…but can't check stock levels!



…and can take payment…

Should we keep selling CDs in this situation?

CAP Theory

CAP Theory

In a partition, you have to tradeoff between consistency and availability

Take the money?

Take the money?

Favouring availability over consistency

Don’t take the money?

Don’t take the money?

Favouring consistency over availability

This doesn’t have to be black and white…

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago
# Items:            100
```

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago    Sell item
# Items:            100
```

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago    Sell item
# Items:            100

Last view of stock: 1 hour ago
# Items:            1
```

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago
# Items:            100
```

Sell item

```
Last view of stock: 1 hour ago
# Items:            1
```

Don’t sell item

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago
# Items:            100
```

Sell item

```
Last view of stock: 1 hour ago
# Items:            1
```

Don’t sell item

```
Last view of stock: 2 days ago
# Items:            100
```

This doesn’t have to be black and white…

```
Last view of stock: 1 hour ago     Sell item
# Items:            100

Last view of stock: 1 hour ago     Don’t sell item
# Items:            1

Last view of stock: 2 days ago     Don’t sell item
# Items:            100
```

Memories, Guesses, and Apologies

Rate this article ☆☆☆☆☆

Pat Helland May 15, 2007

Well, here I am blogging on the bus with my newly installed Windows Live Writer!!!

This blog is a text version of a five minute "Gong Show" presentation I did at CIDR (Conference on Innovative Database Research) on Jan 8,2007.

All computing can be considered as: "Memories, Guesses, and Apologies". This is a personal opinion about how computers suck. Furthermore, it offers additional opinions about how we can take advantage of their sucki-ness. Lets dig into this...

Newton and Einstein

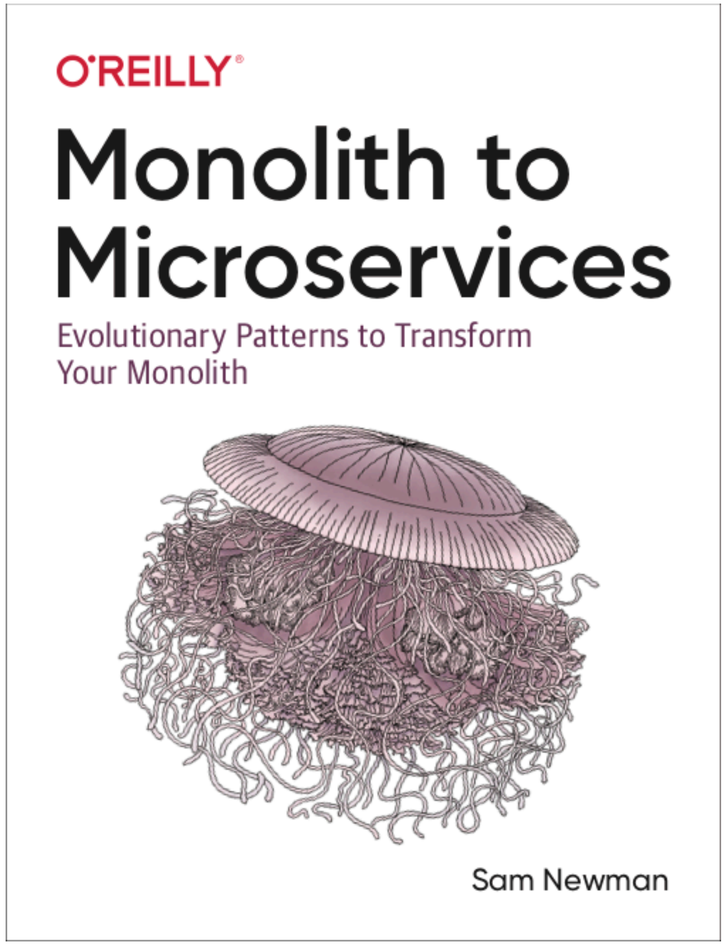
It used to be that we thought of computing as one big-ass mainframe. The database folks only thought about the database. Transactions (and transactional serializability) offered a crisp and clear perspective of how time marches forward uniformly. When working on transaction T(i), any other transaction T(j) can be perceived as occurring before T(i) or after T(i). If T(i) and T(j) are concurrently processed, the transaction system ensures that either order is correct without modifying the semantics. This offers a crisp and clear perspective of now. Time marches forward like a clock exactly as Newton envisaged his universe.

Nowadays, we have lots and lots of computers. Big ones, small ones, connected, disconnected, occasionally connected, etc. These computers each have their own perspective of time. When you see data, it is unlocked and an artifact of the past. *Time is subjective* with many different notions of now. This is very much the way Einstein revamped our understanding of the universe.

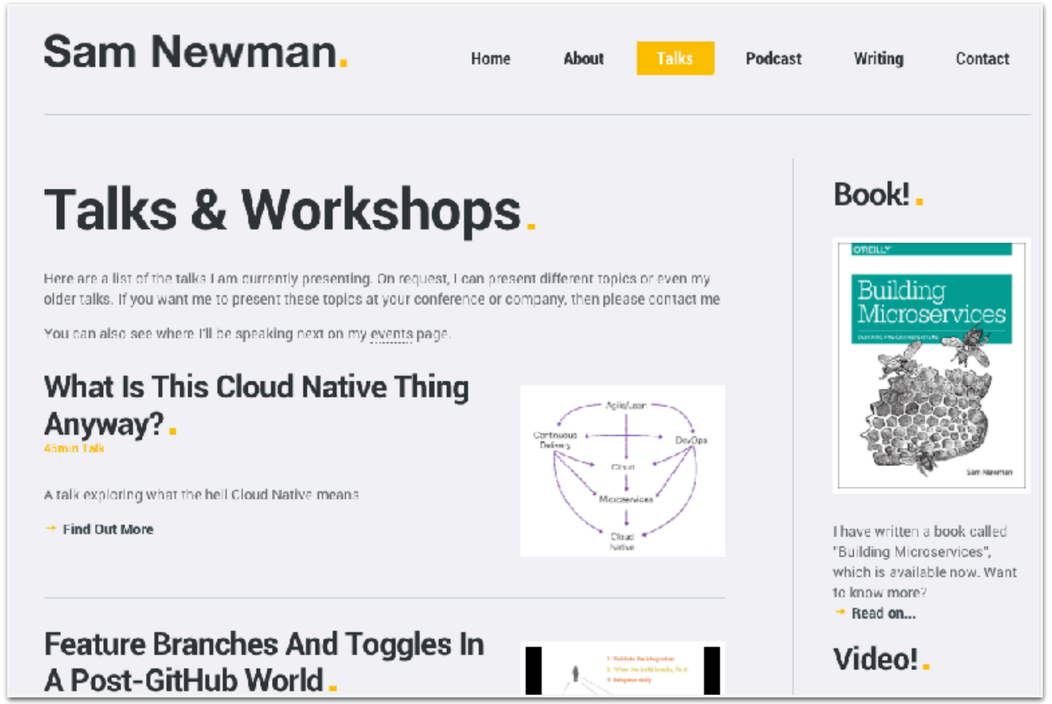
Moving to SOA is like moving from Newton's Universe to Einstein's Universe.

https://blogs.msdn.microsoft.com/pathelland/2007/05/15/memories-guesses-and-apologies/

THANKS!



Sam Newman & Associates



@samnewman

https://samnewman.io/