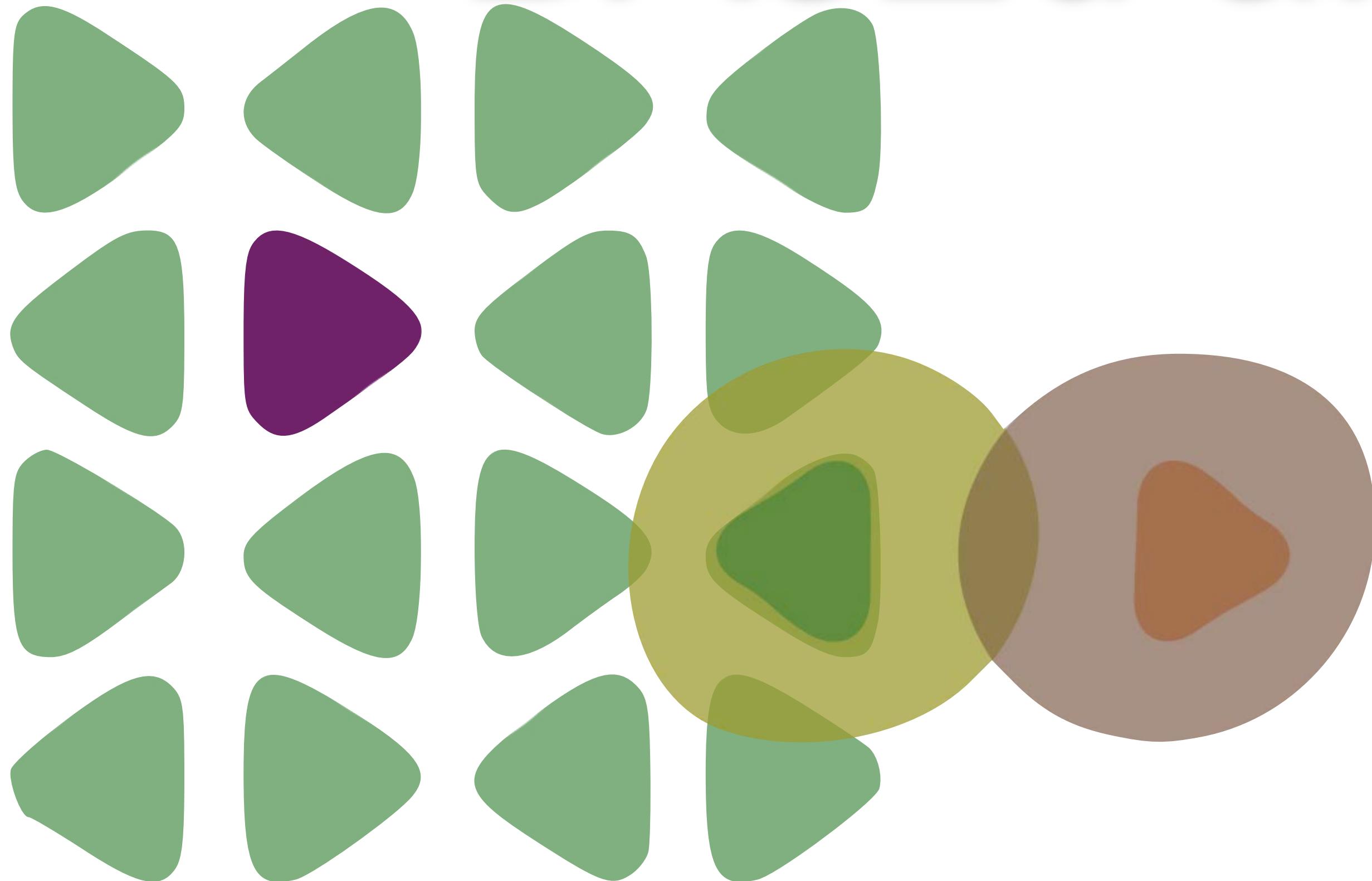
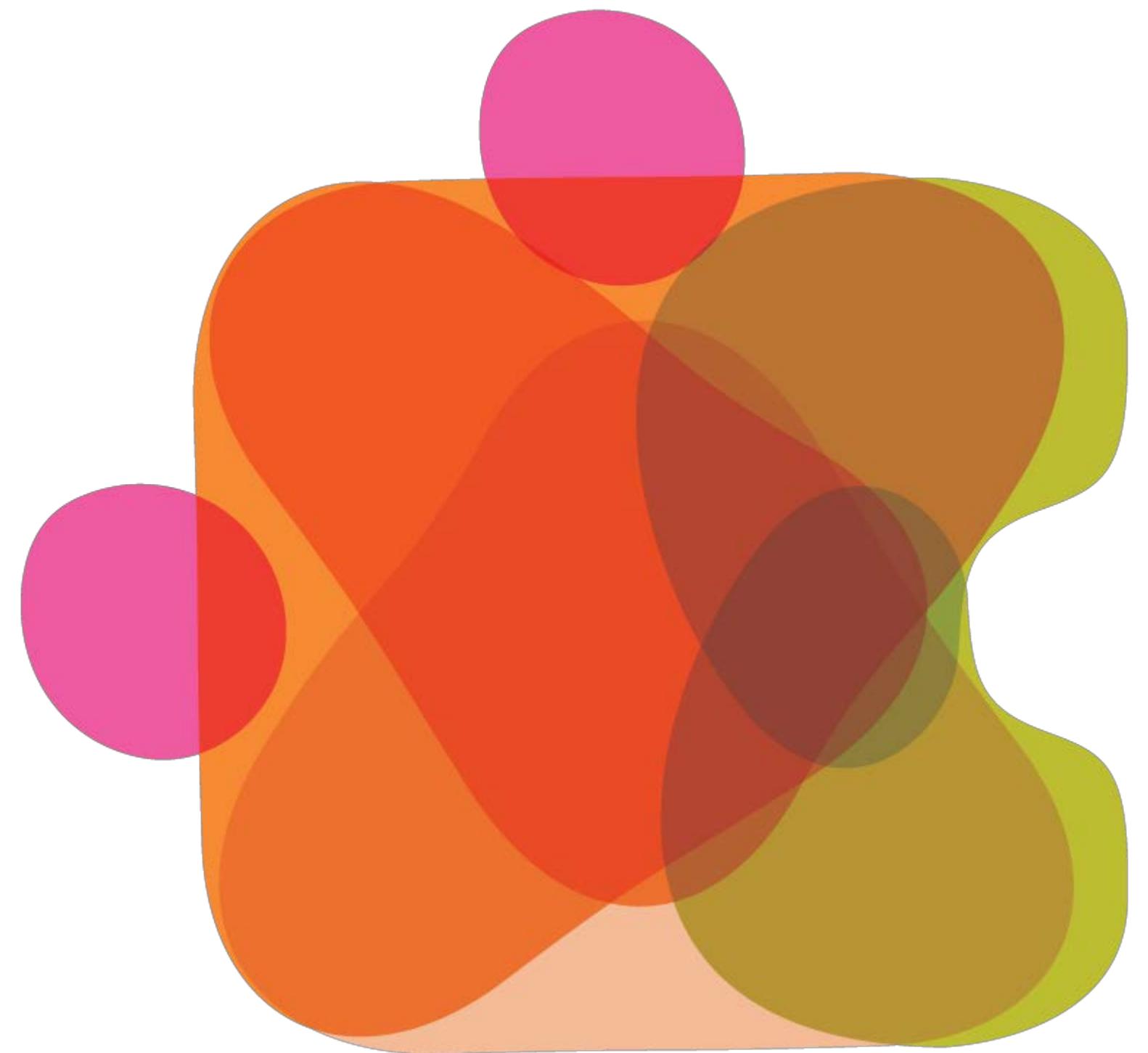
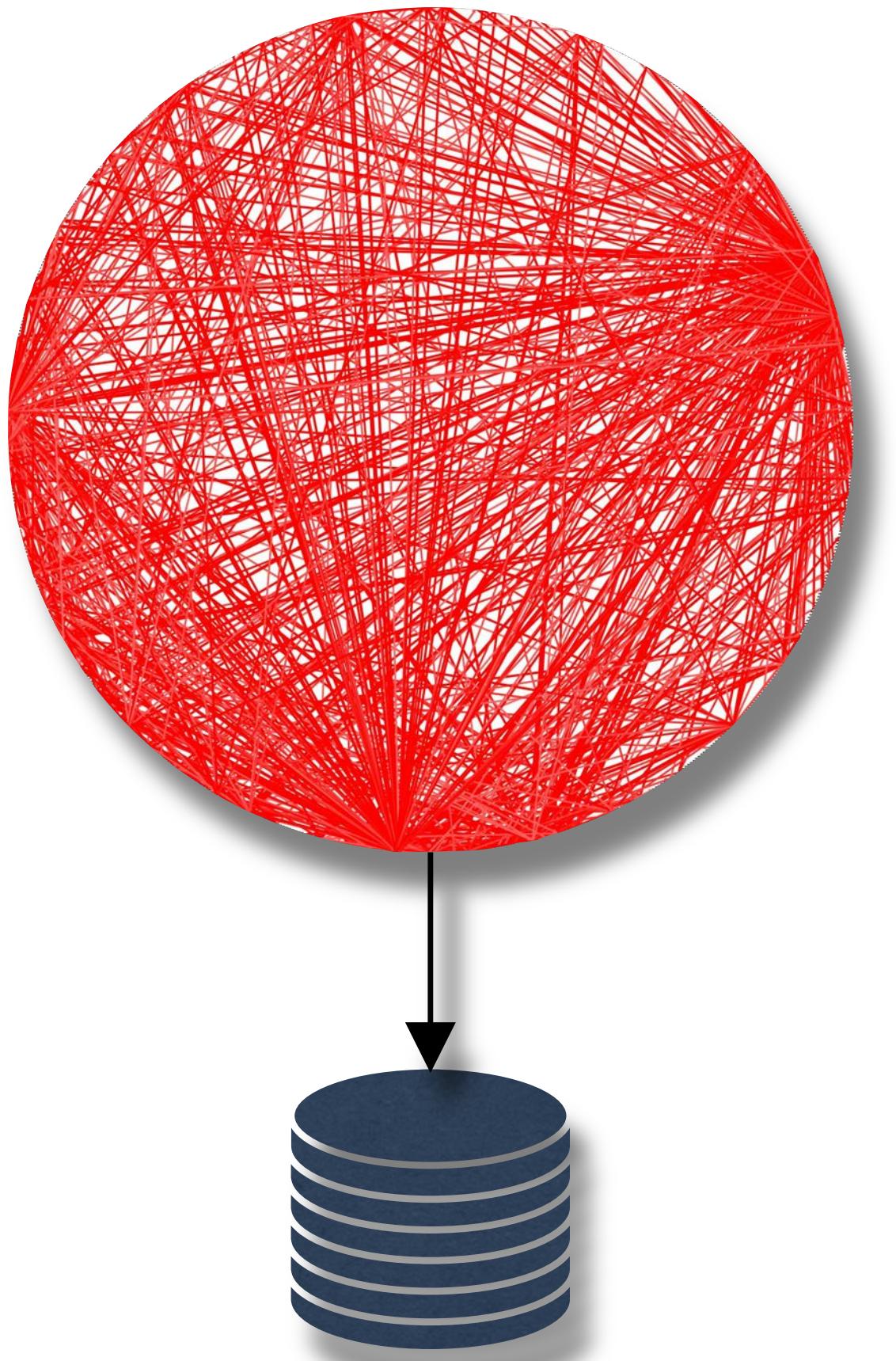


# eVEnt-DRivEn & seRViCE- BASeD aRCHiTECTUrEs



# Monoliths

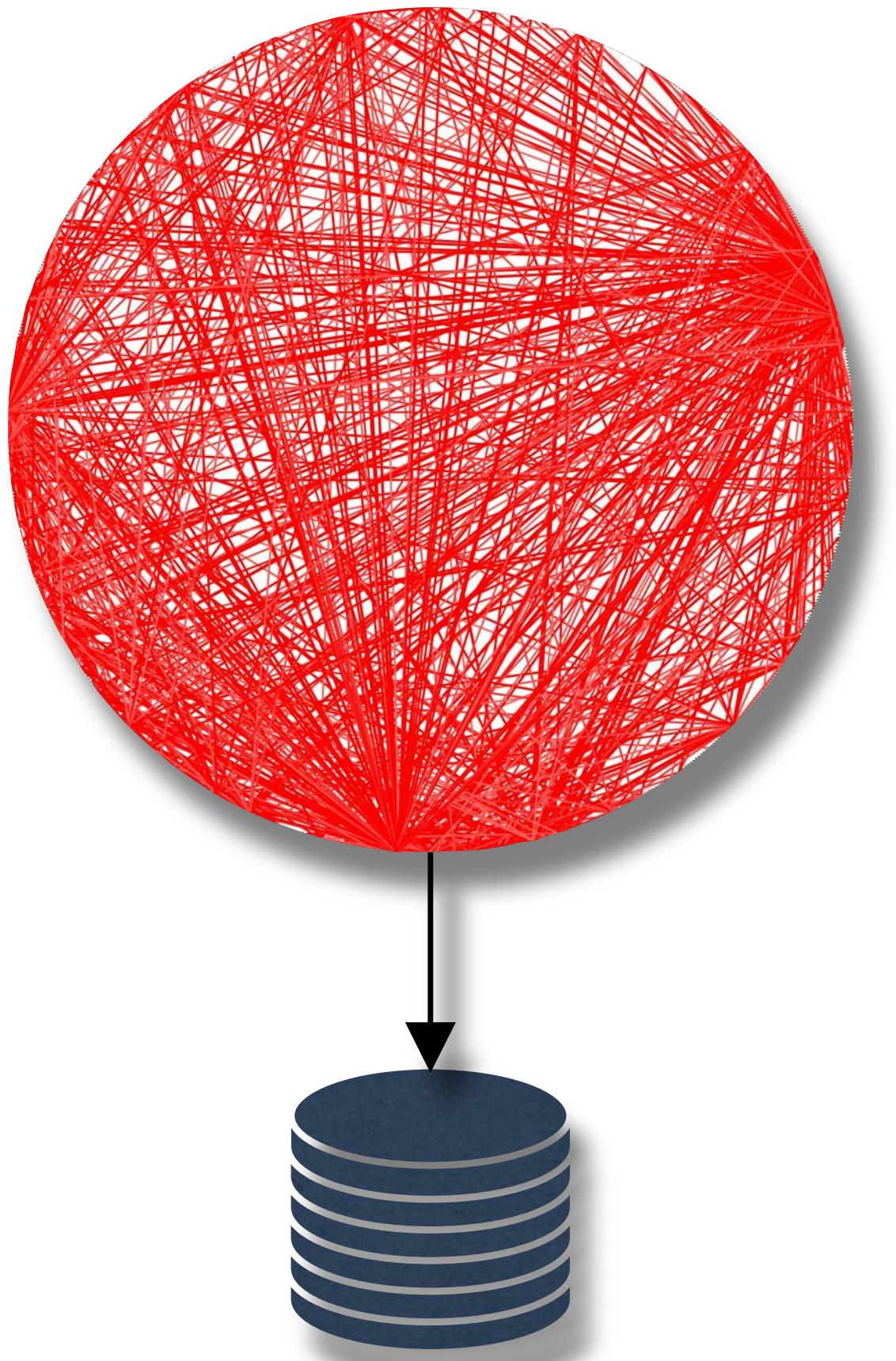




# monoliths

“Big Ball of Mud”

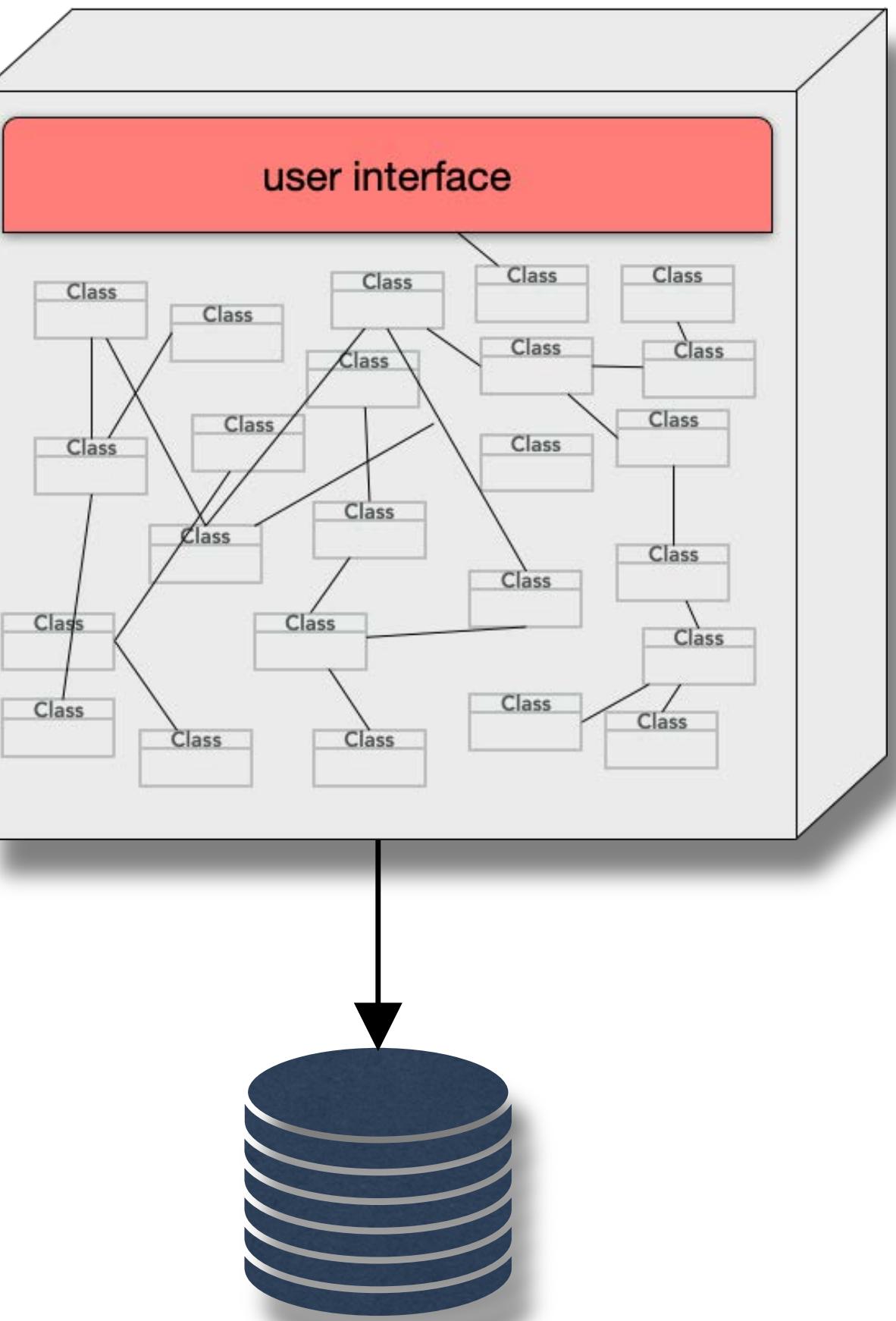
[https://en.wikipedia.org/wiki/Big\\_ball\\_of\\_mud](https://en.wikipedia.org/wiki/Big_ball_of_mud)



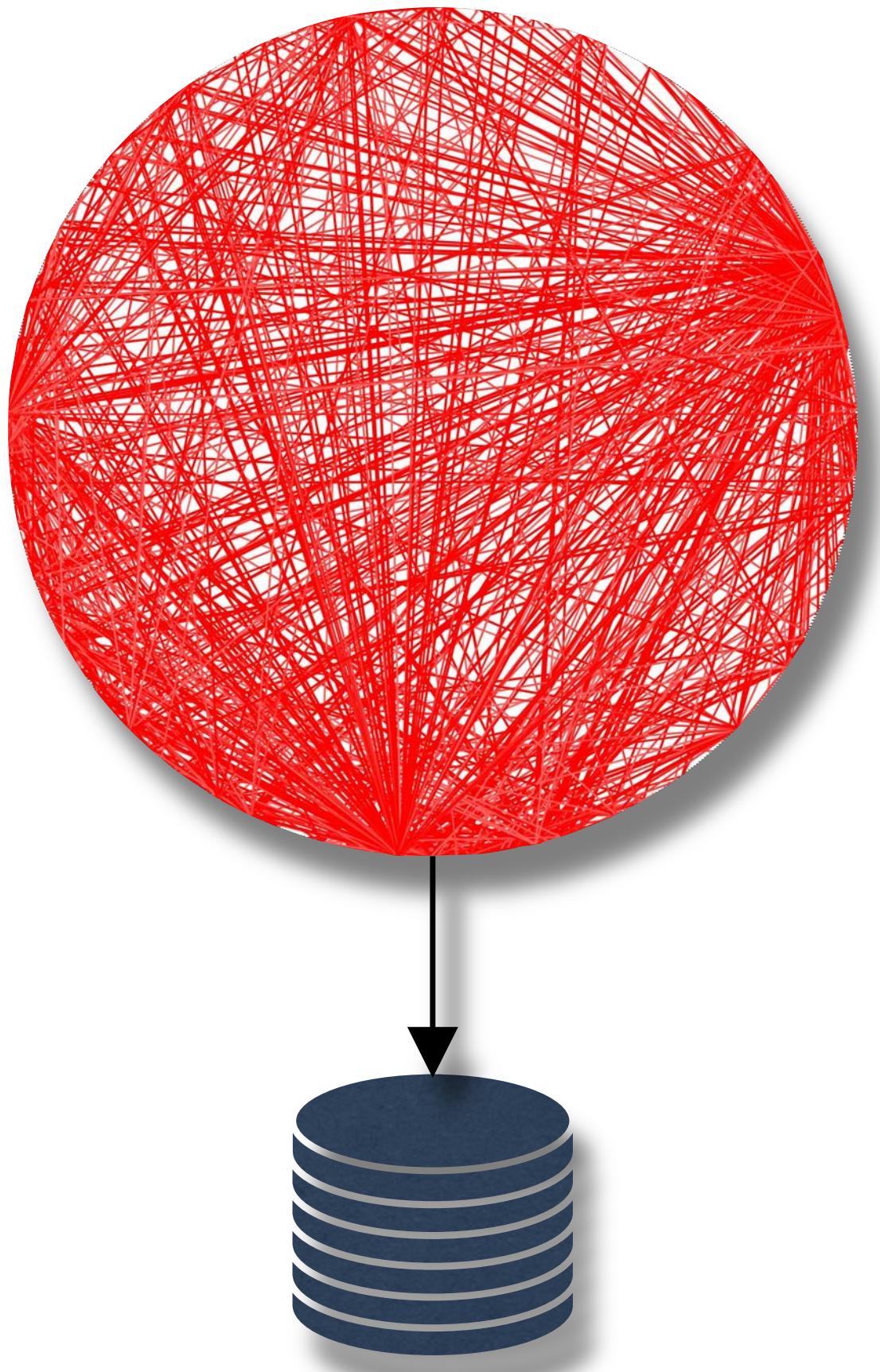
## “Big Ball of Mud”

[https://en.wikipedia.org/wiki/Big\\_ball\\_of\\_mud](https://en.wikipedia.org/wiki/Big_ball_of_mud)

# monoliths

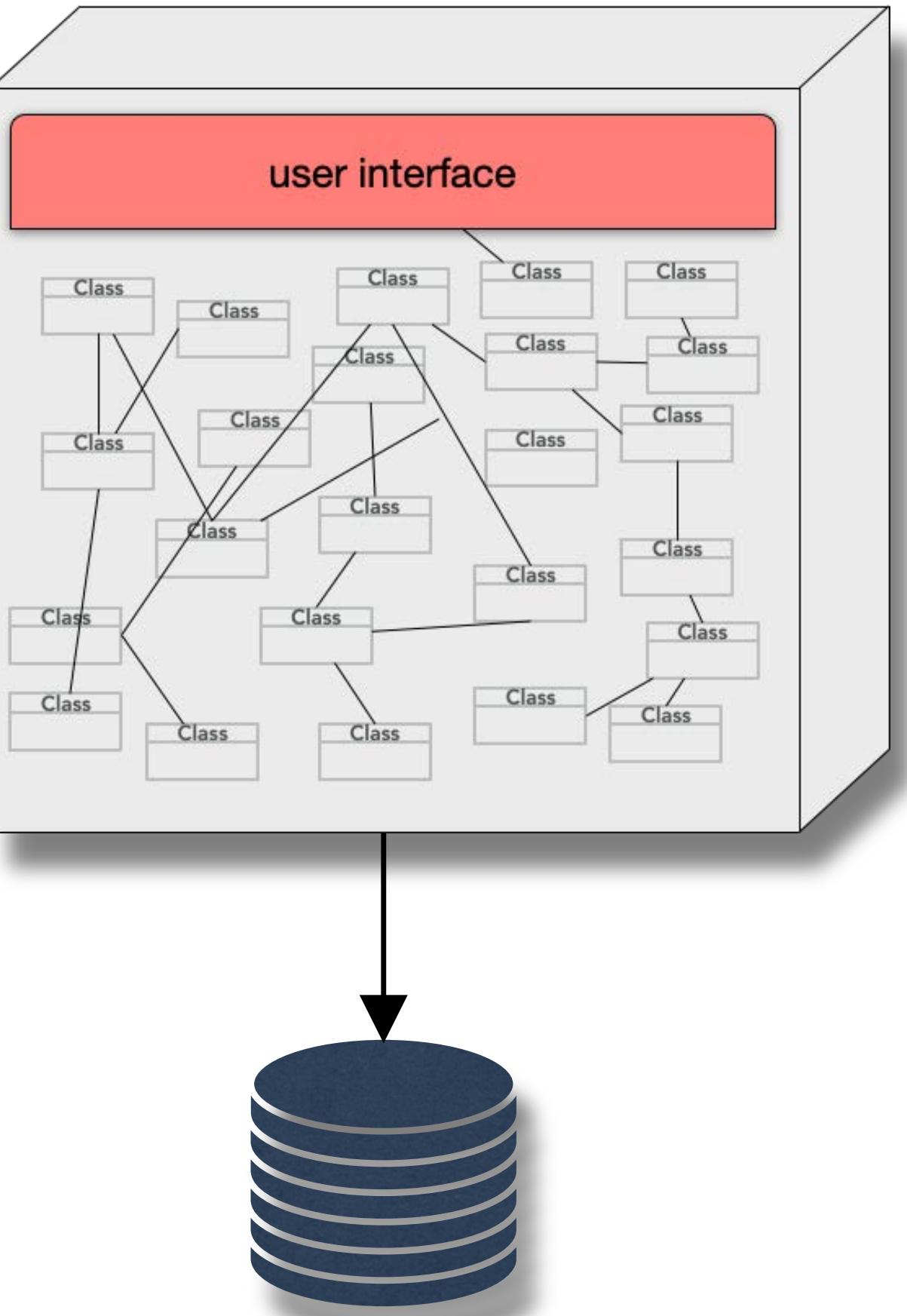


unstructured  
monolith



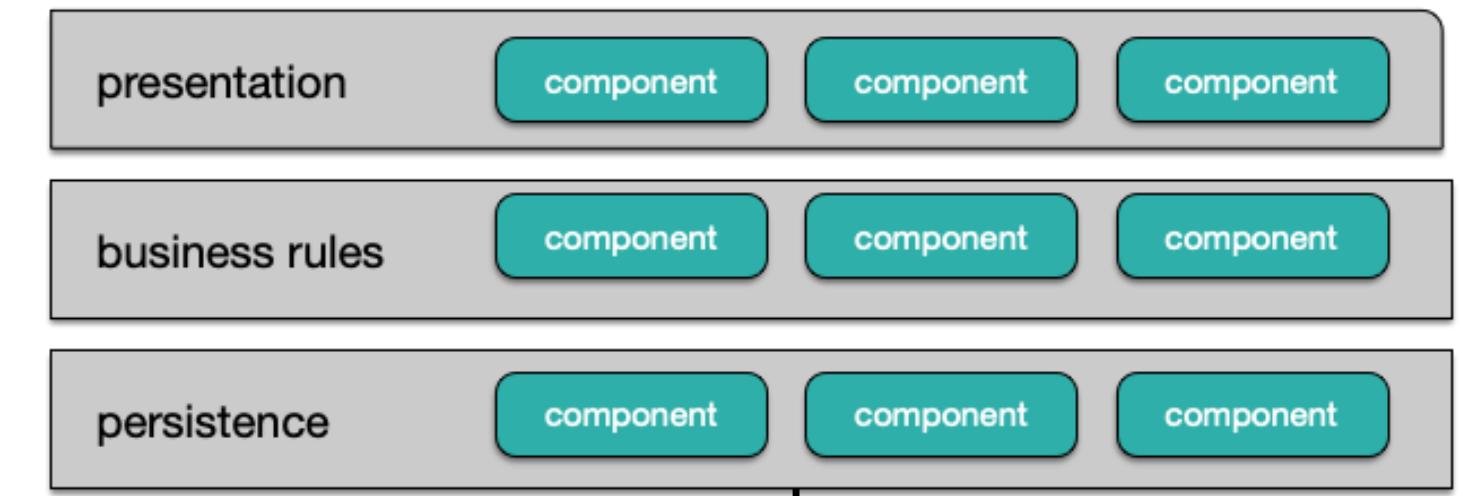
## “Big Ball of Mud”

[https://en.wikipedia.org/wiki/Big\\_ball\\_of\\_mud](https://en.wikipedia.org/wiki/Big_ball_of_mud)

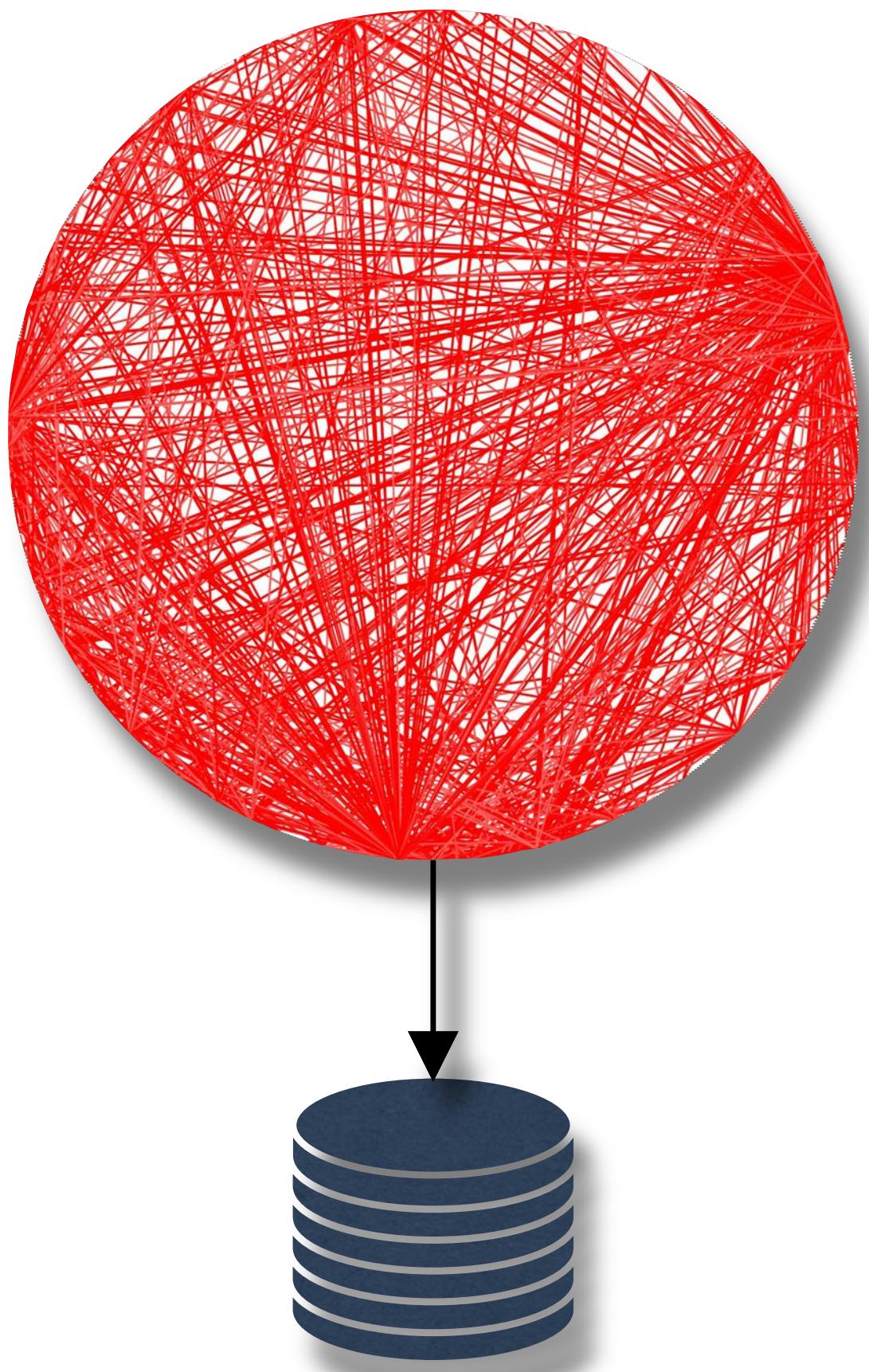


unstructured  
monolith

## monoliths

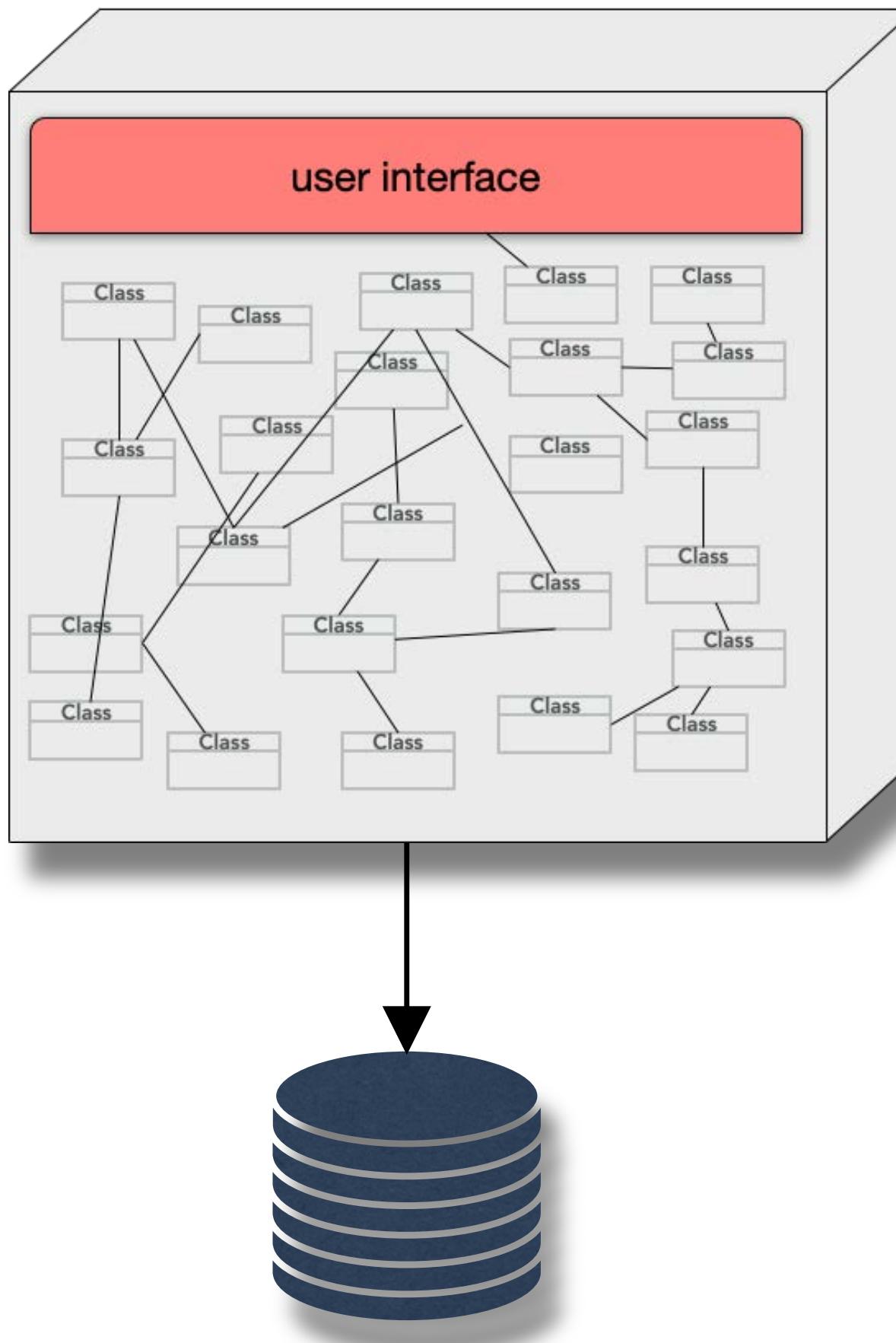


layered  
architecture



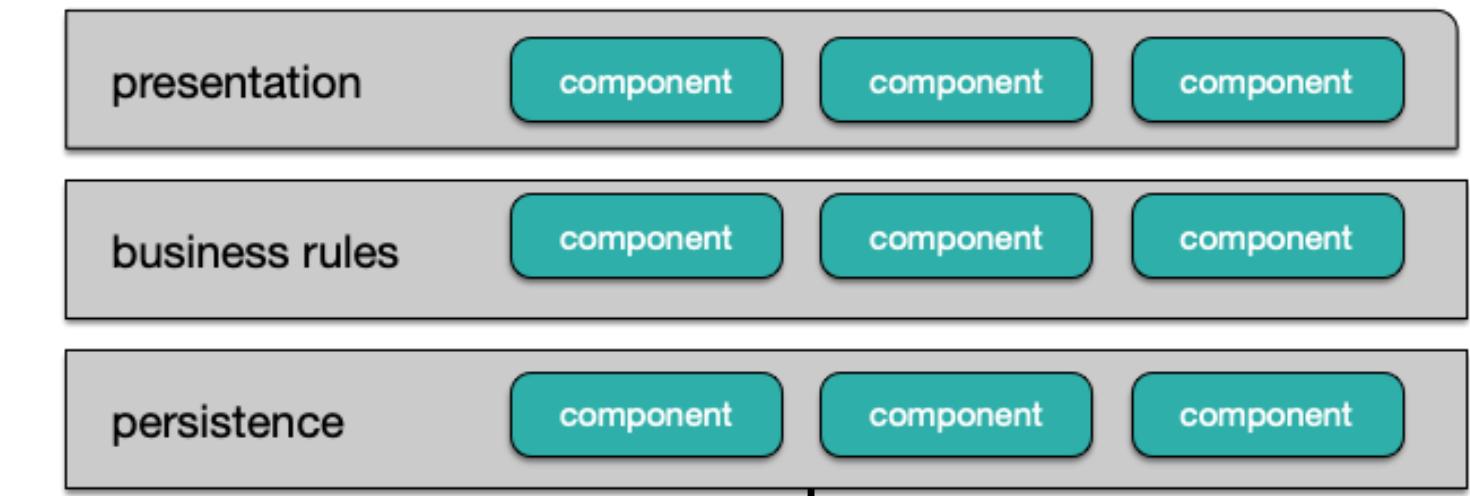
**“Big Ball of Mud”**

[https://en.wikipedia.org/wiki/Big\\_ball\\_of\\_mud](https://en.wikipedia.org/wiki/Big_ball_of_mud)

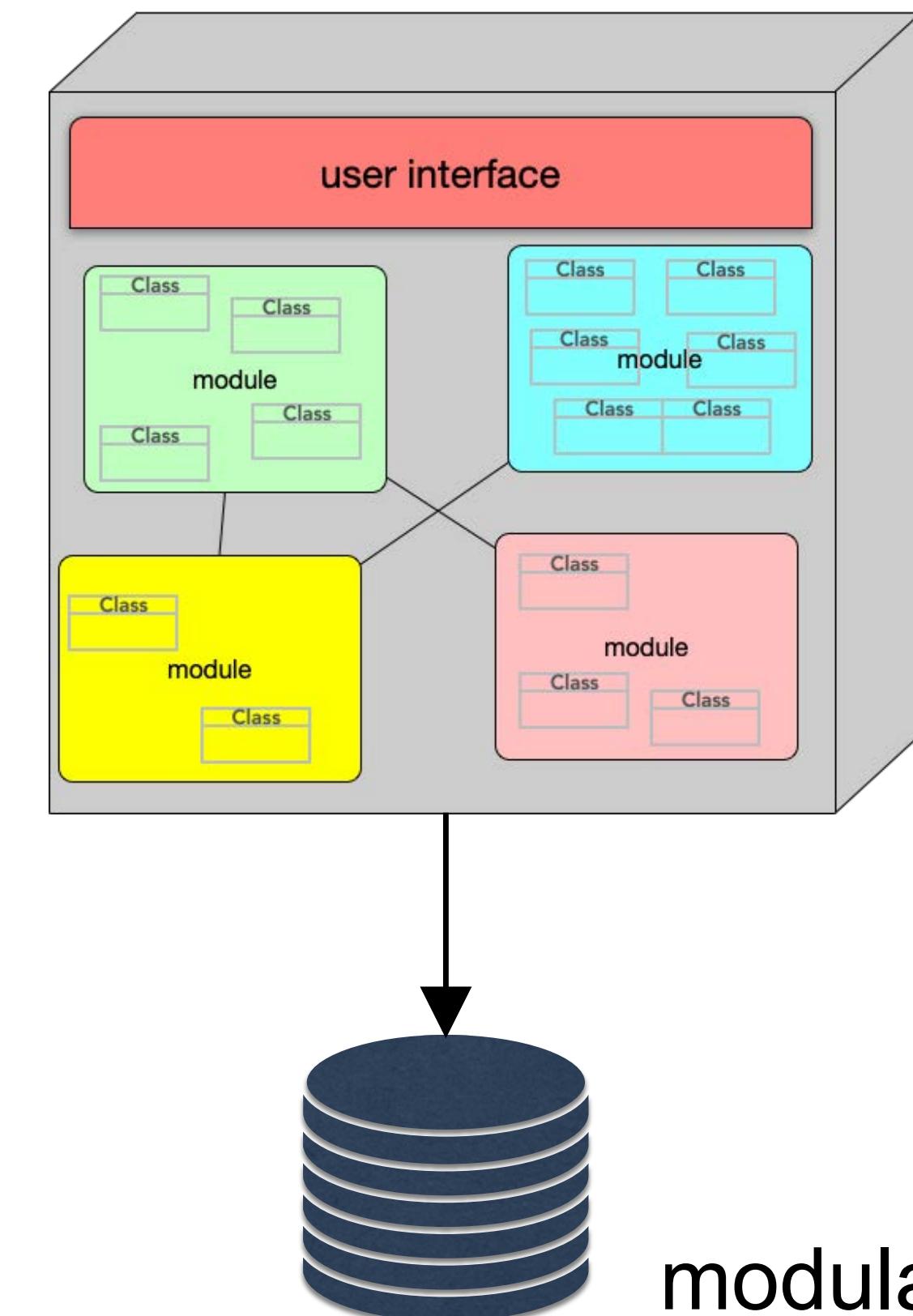


unstructured  
monolith

# monoliths

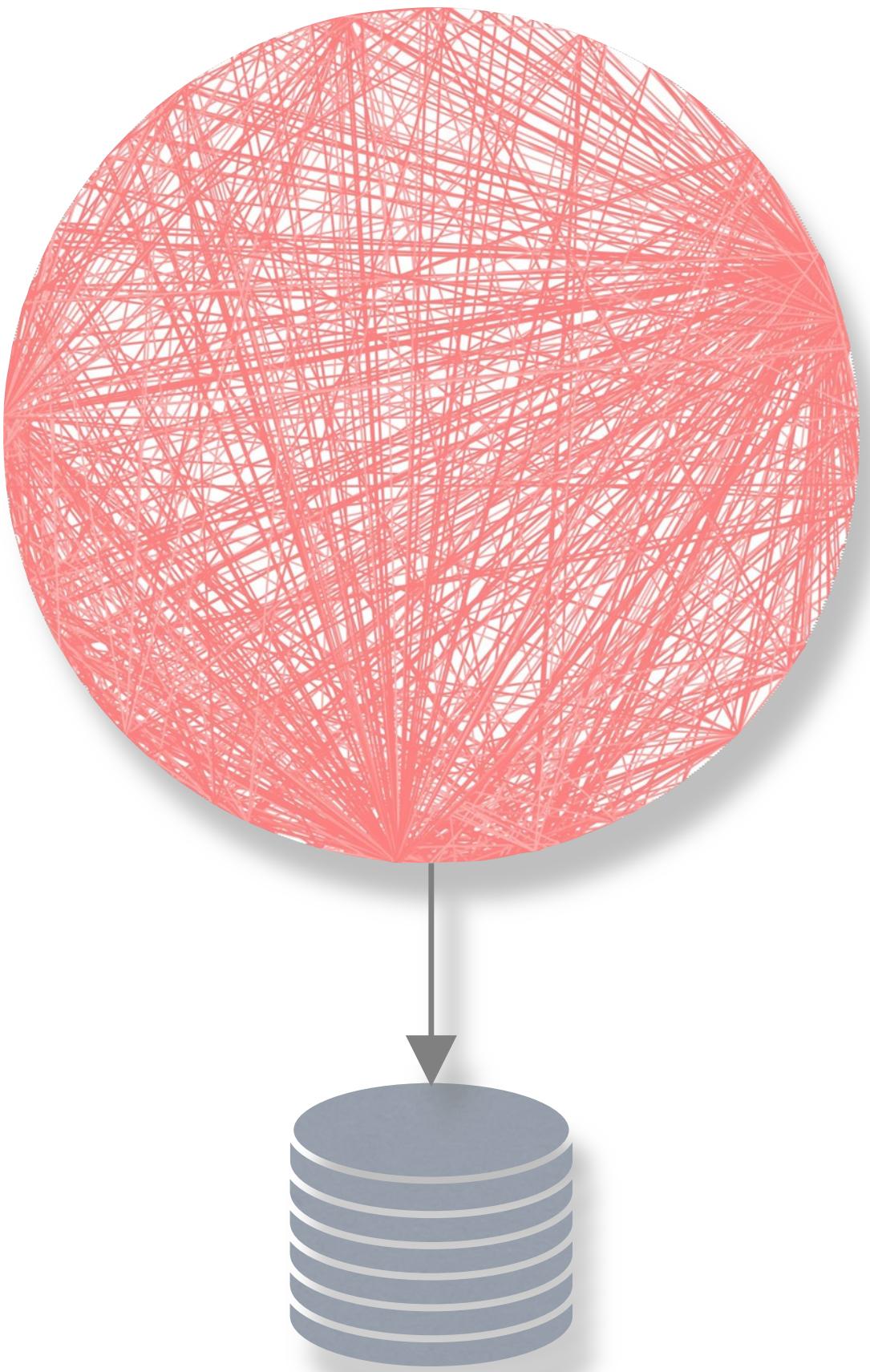


layered  
architecture



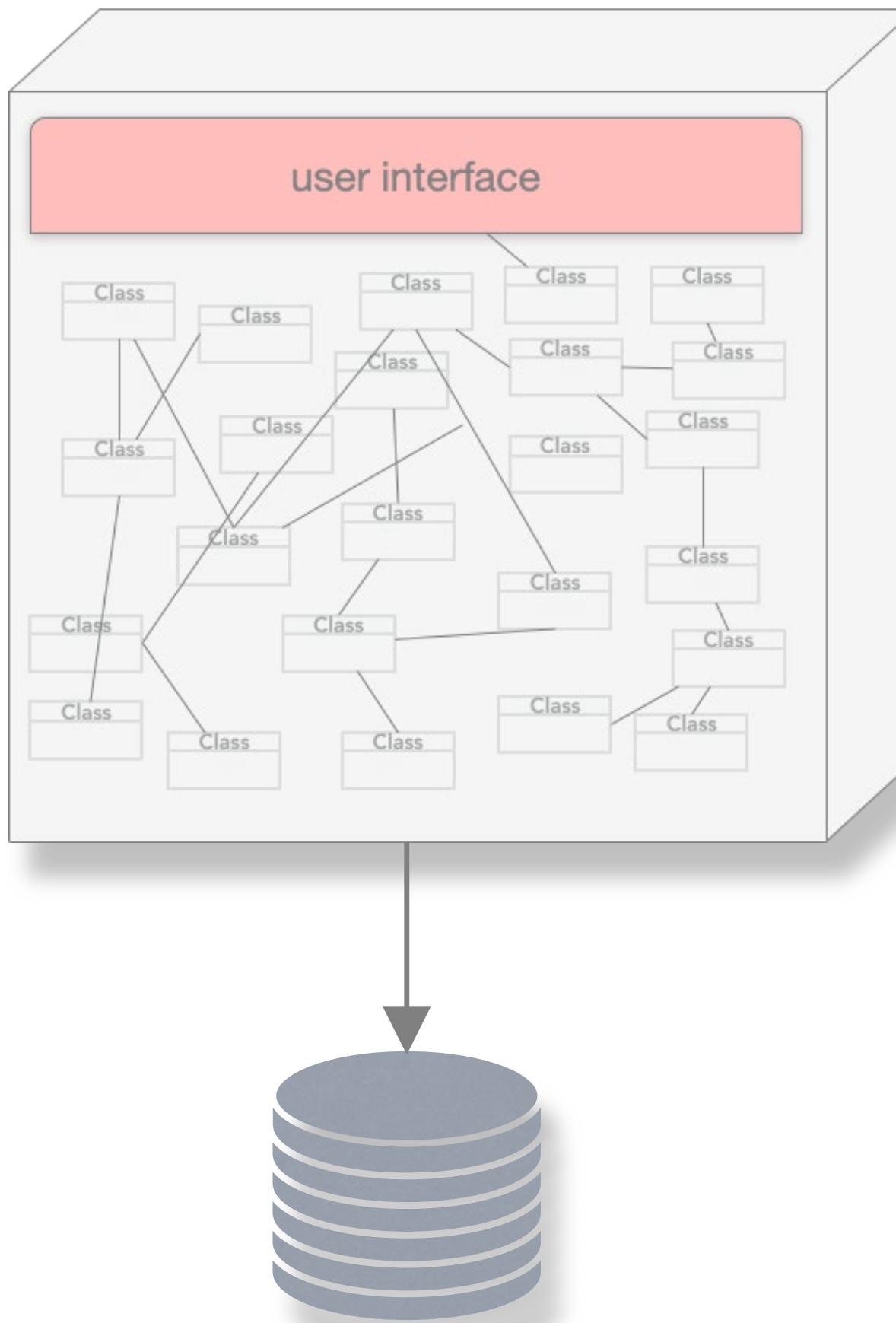
modular monolith

<http://www.codingthearchitecture.com/presentations/sa2015-modular-monoliths>



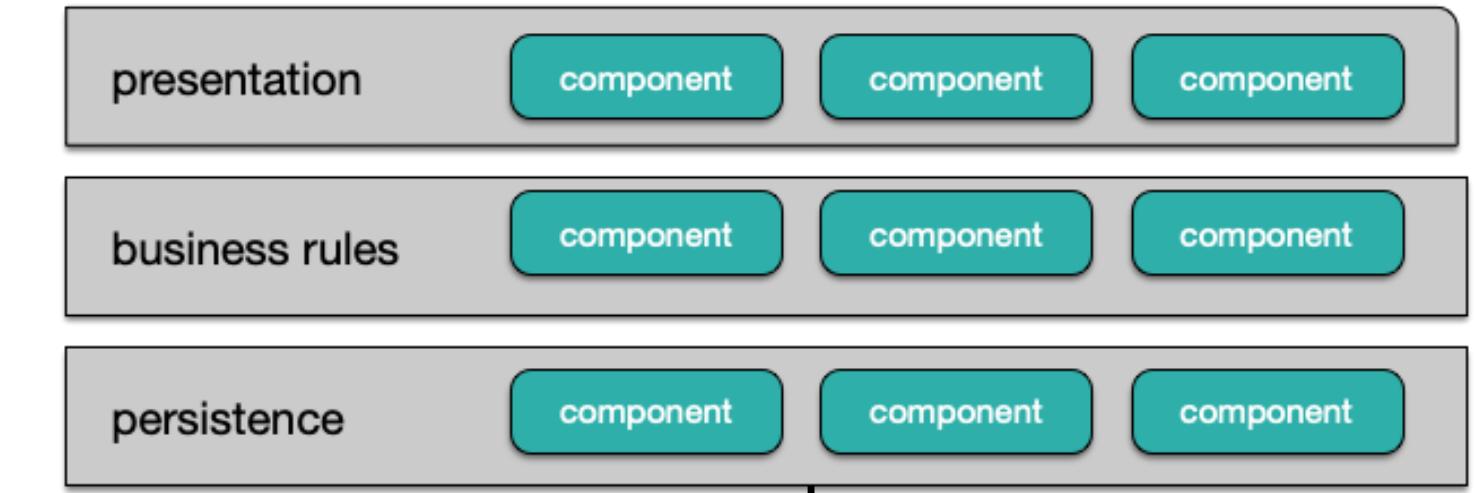
## “Big Ball of Mud”

[https://en.wikipedia.org/wiki/Big\\_ball\\_of\\_mud](https://en.wikipedia.org/wiki/Big_ball_of_mud)

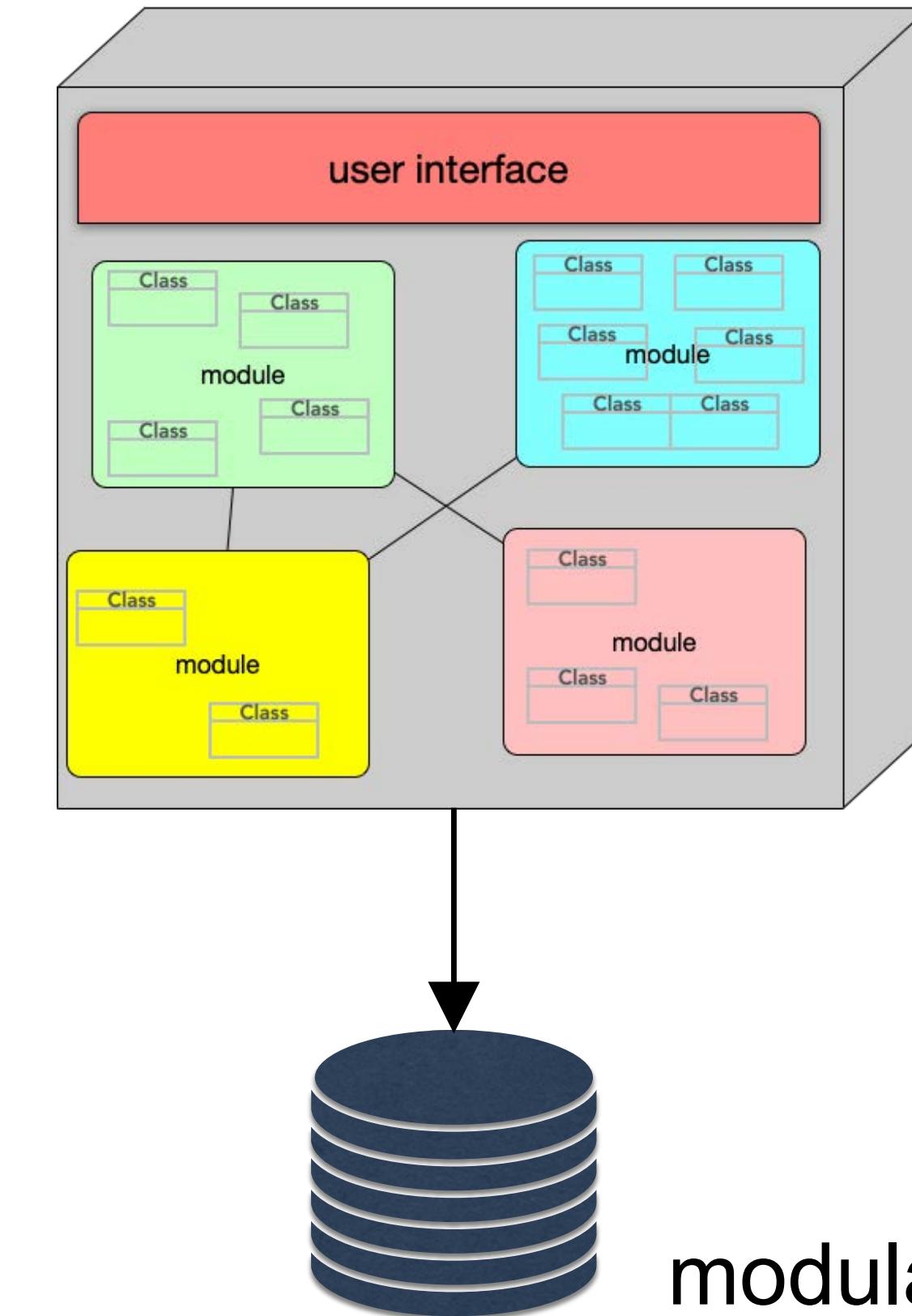


unstructured  
monolith

# monoliths



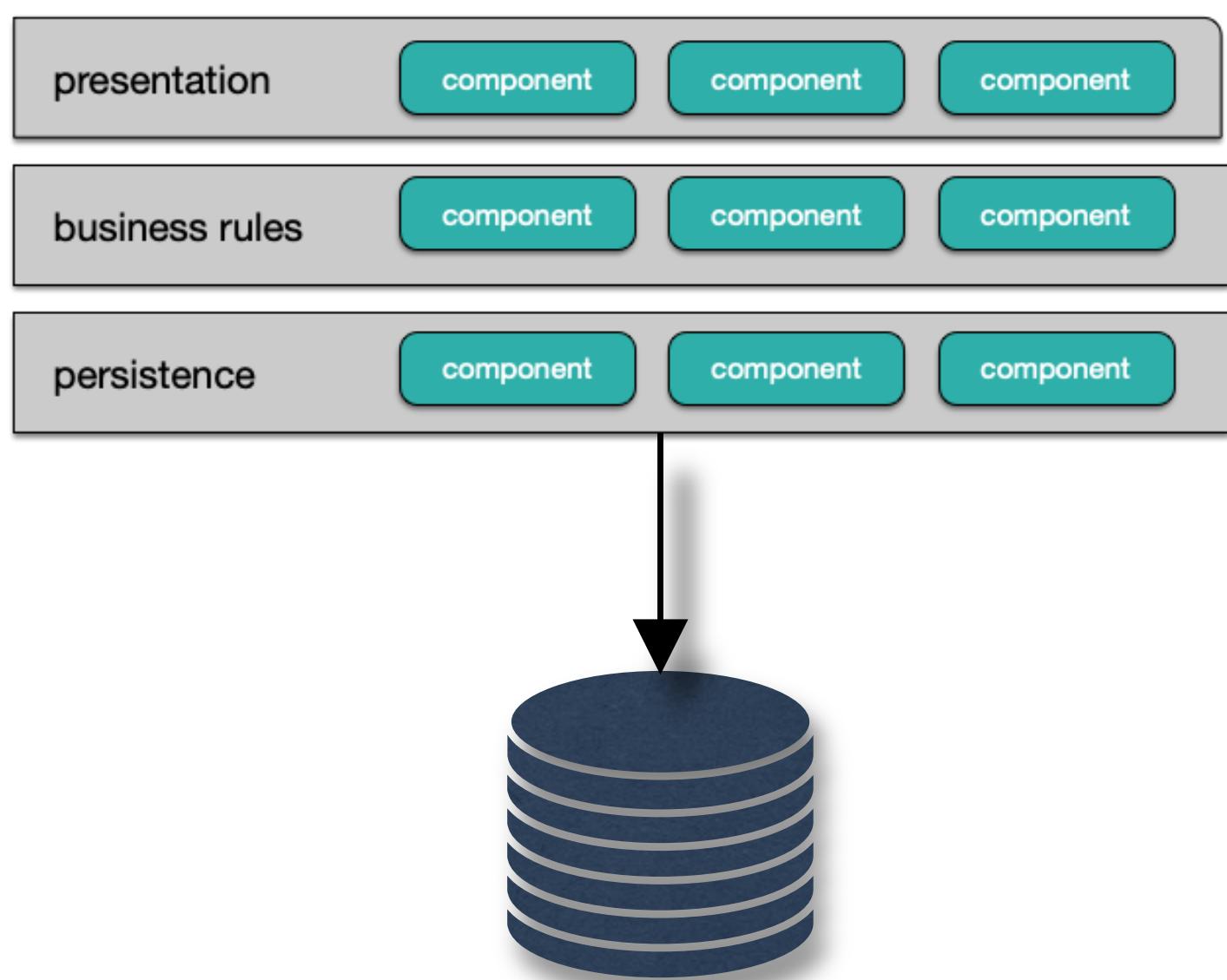
layered  
architecture



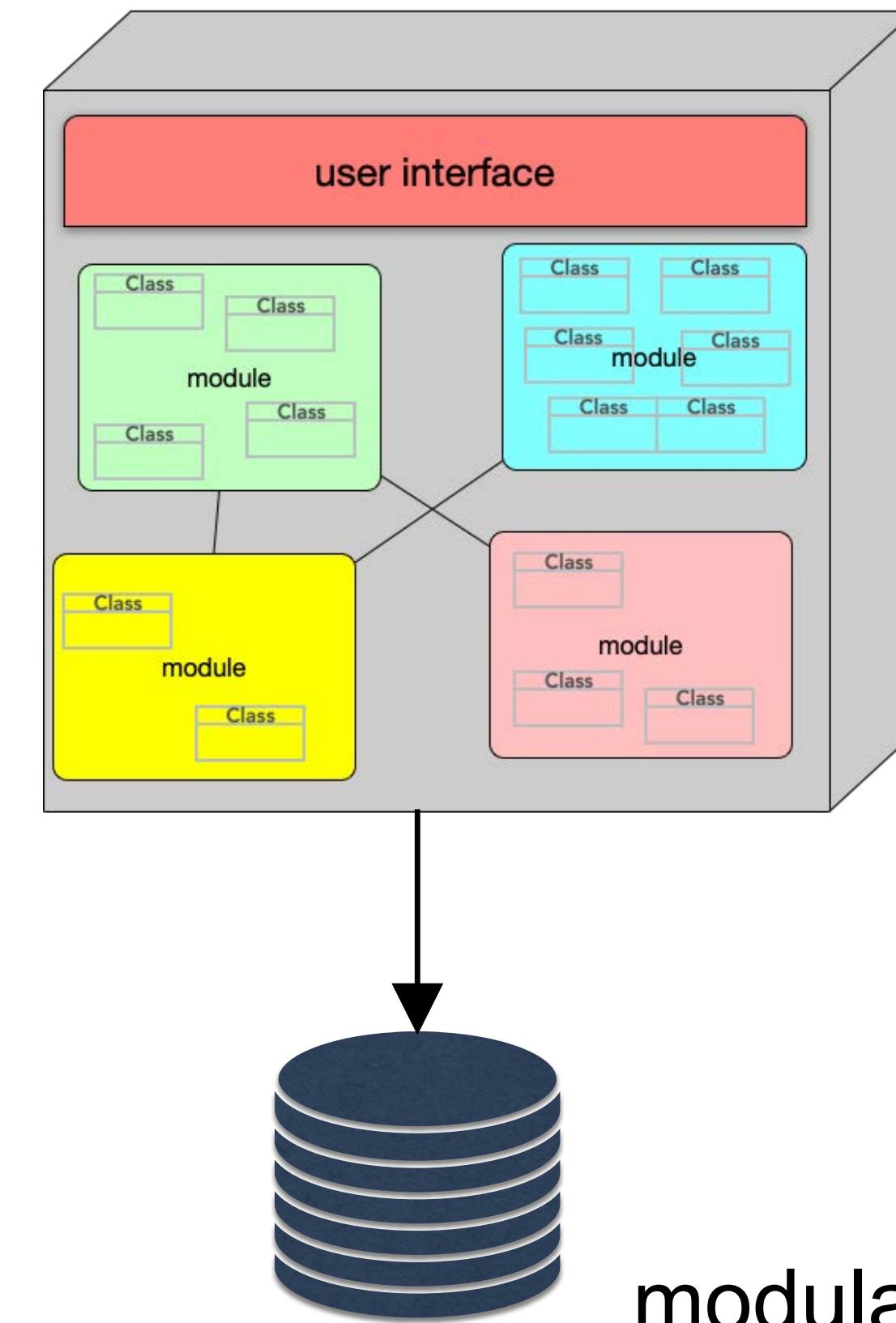
modular monolith

<http://www.codingthearchitecture.com/presentations/sa2015-modular-monoliths>

# monoliths



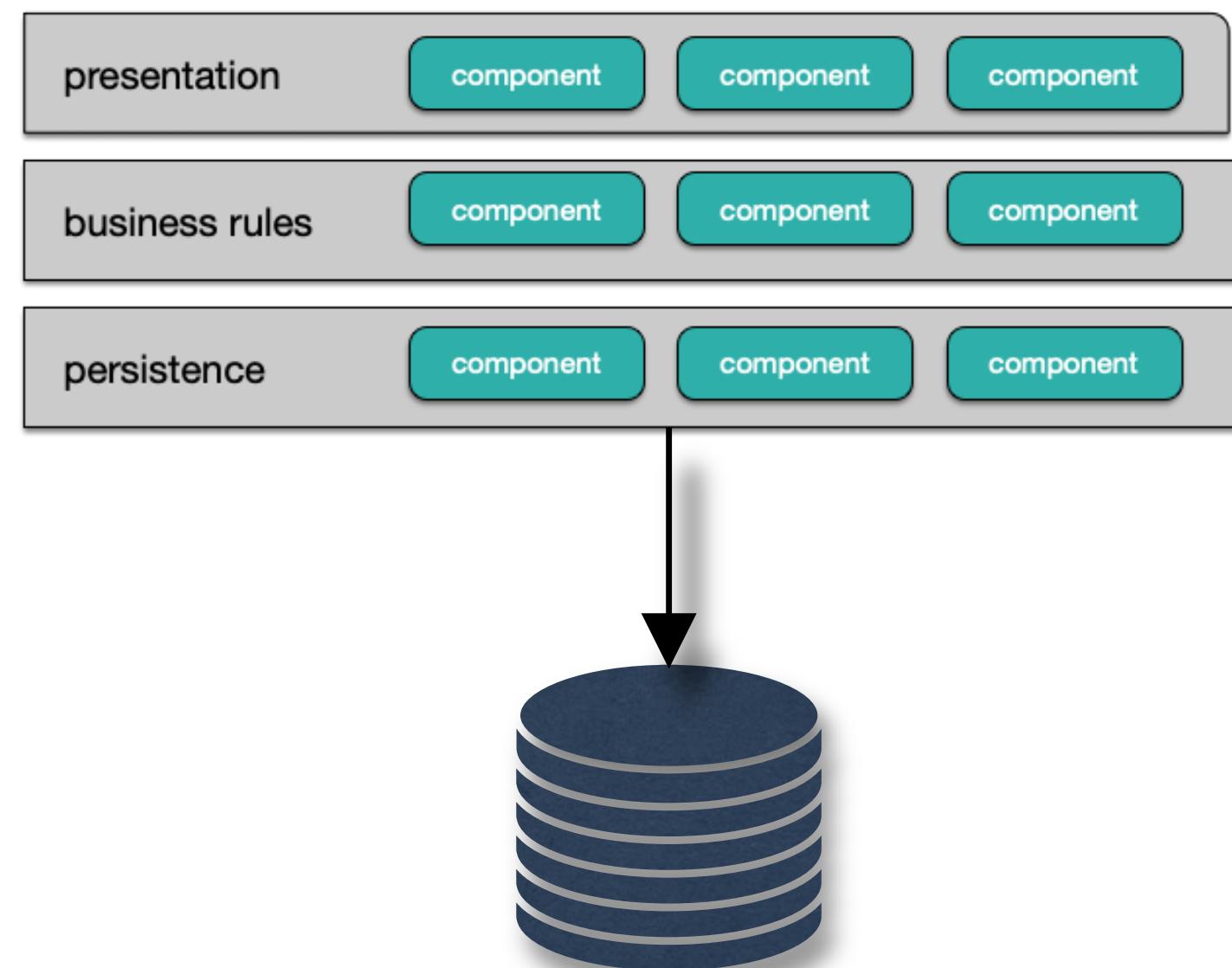
layered  
architecture



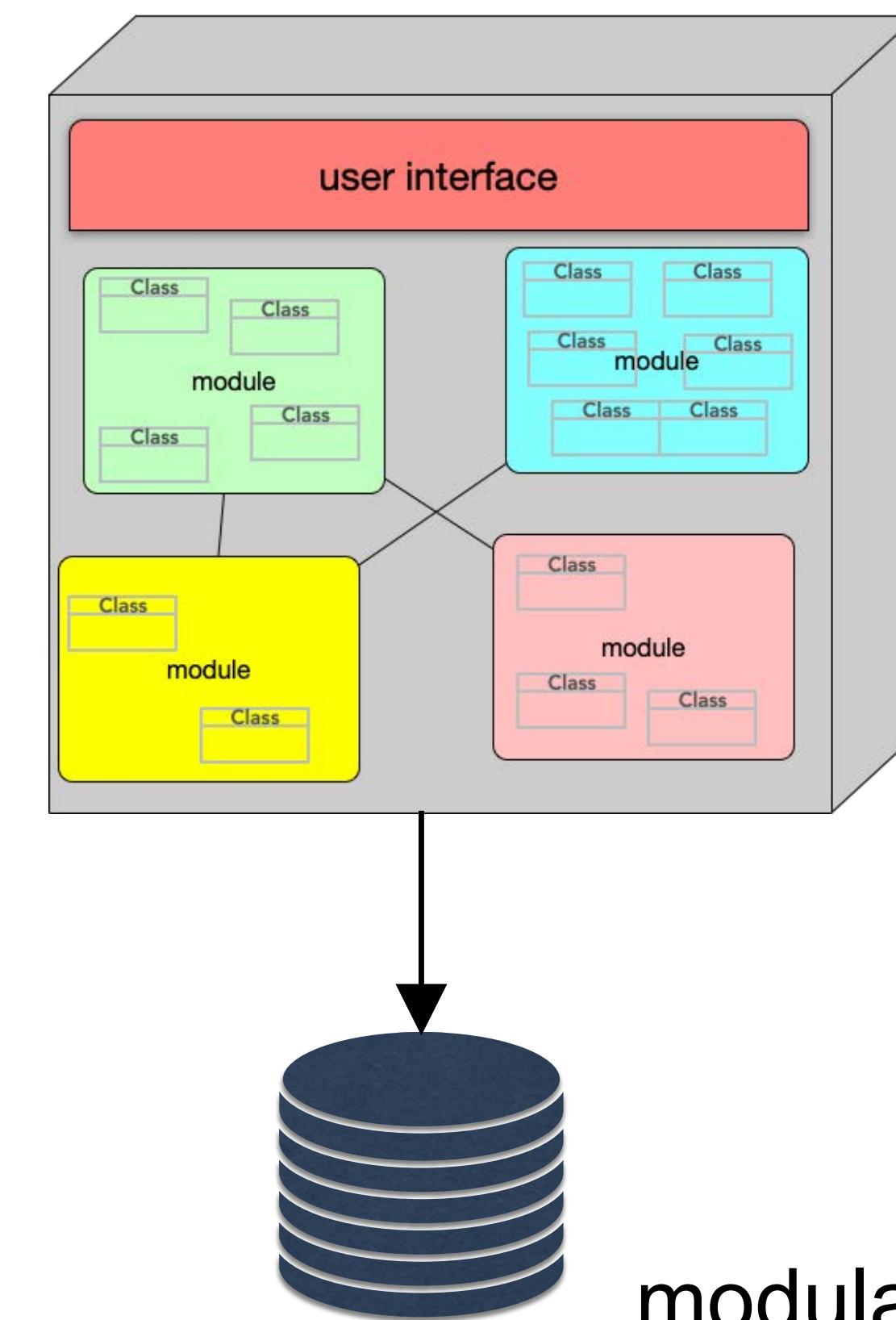
modular monolith

# monoliths

technical partitioning



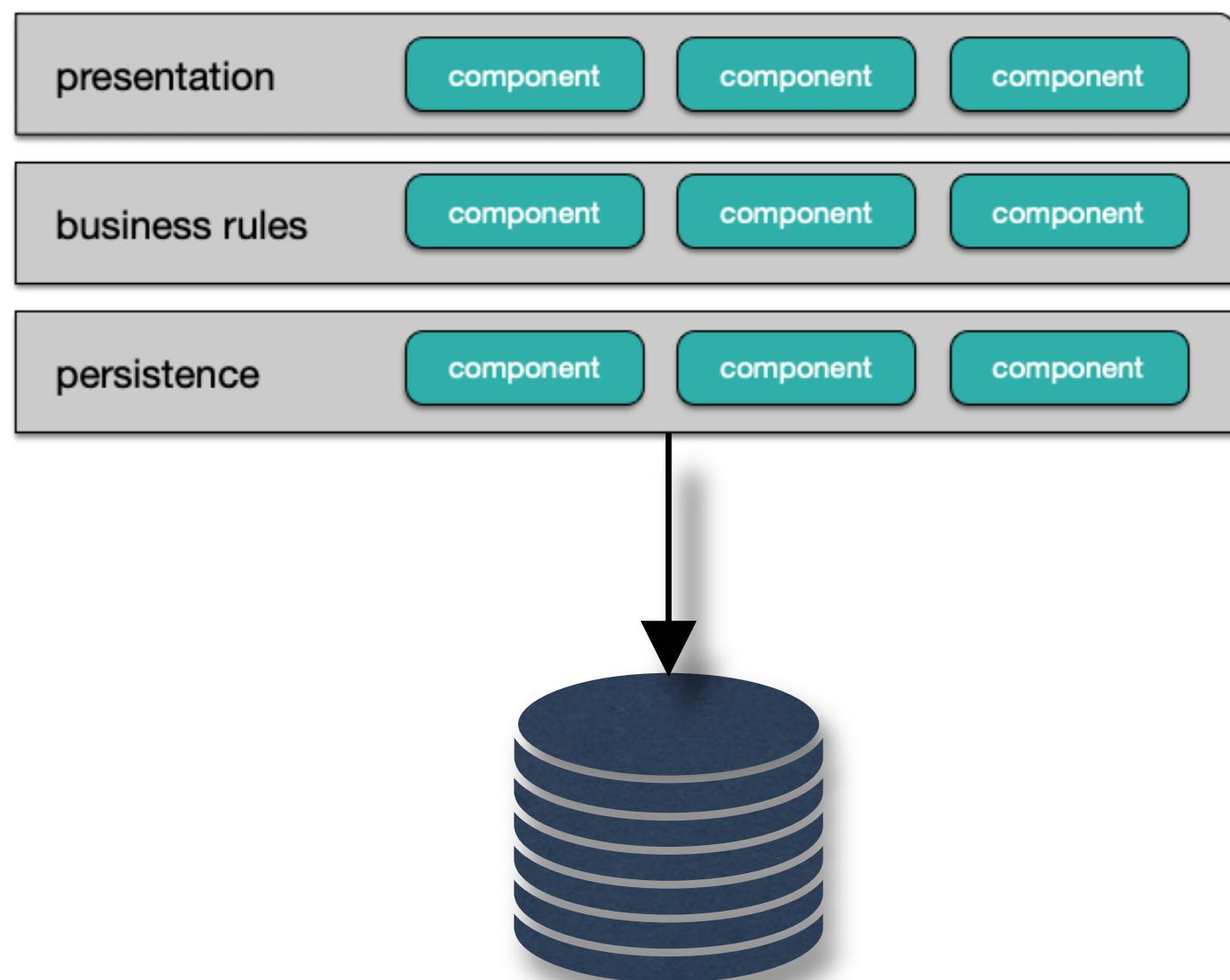
layered  
architecture



modular monolith

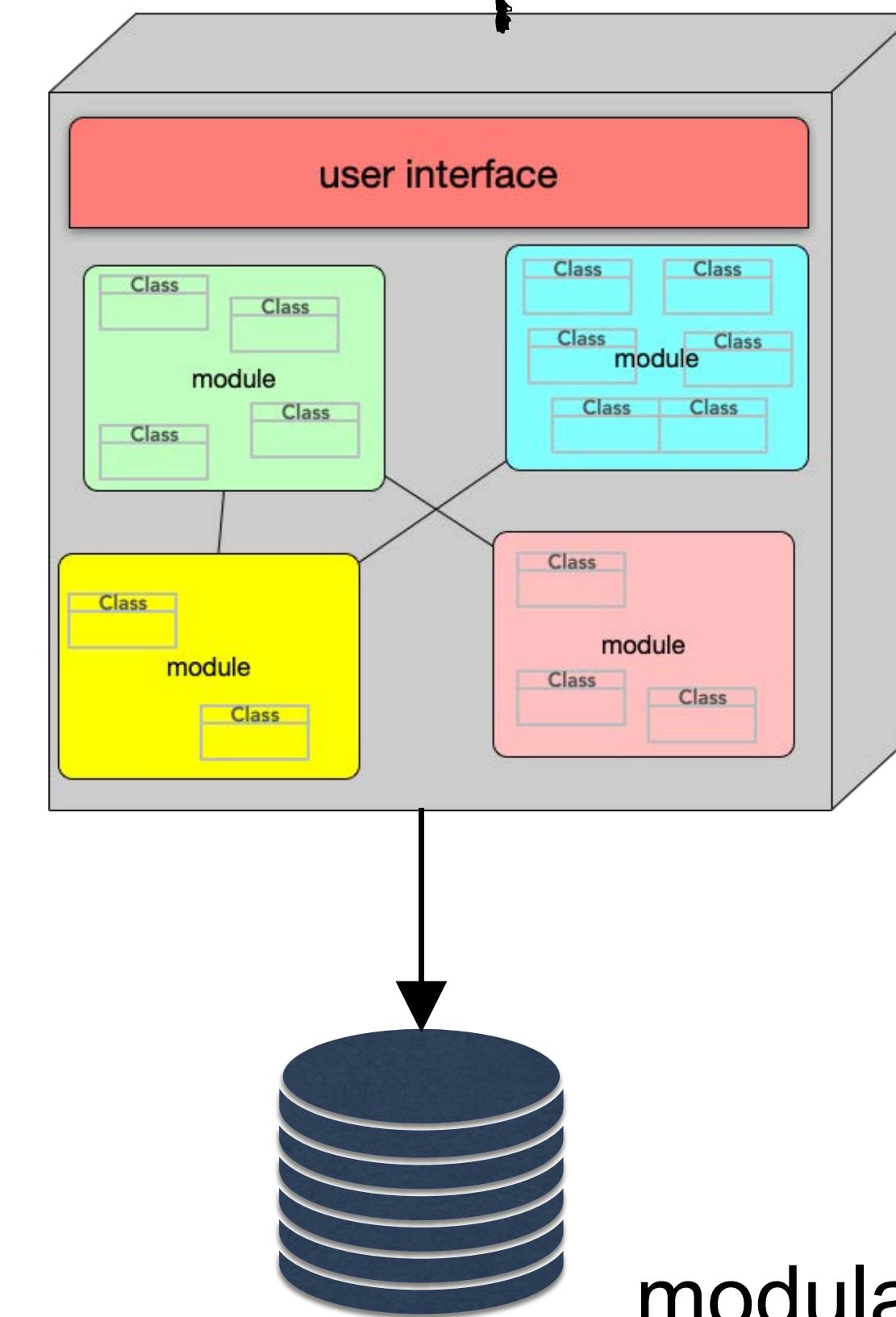
# monoliths

technical partitioning

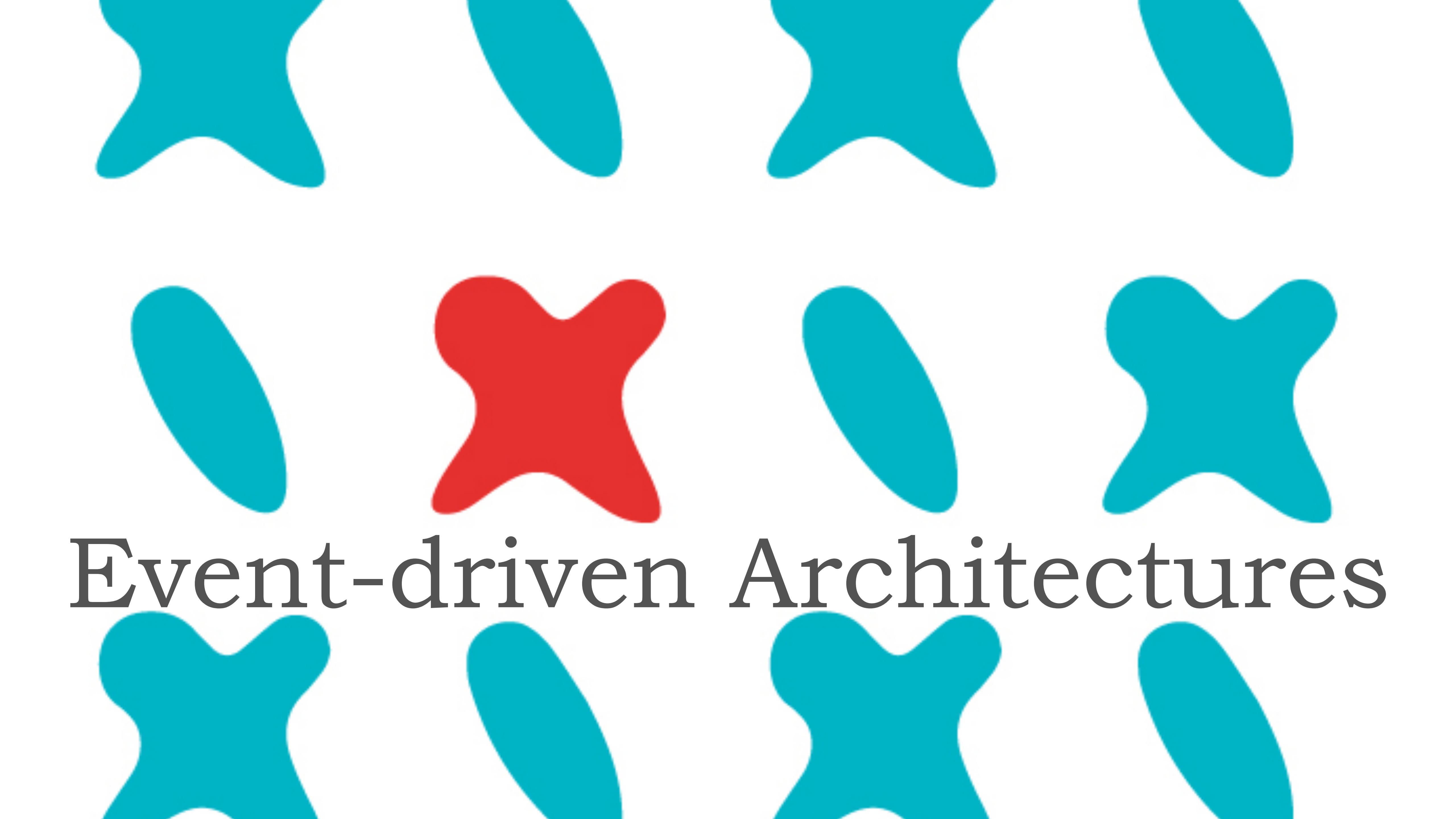


layered  
architecture

domain partitioning

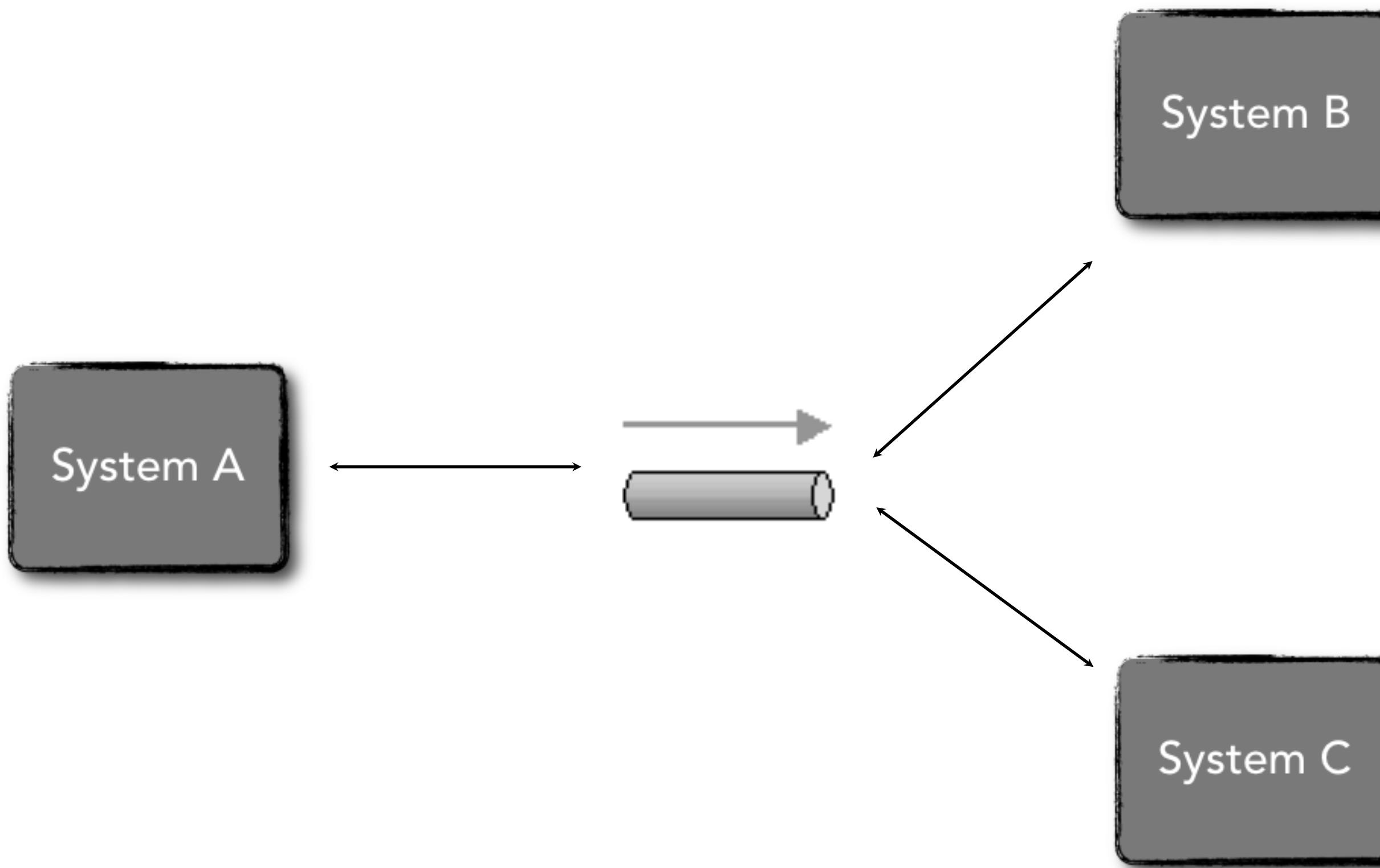


modular monolith

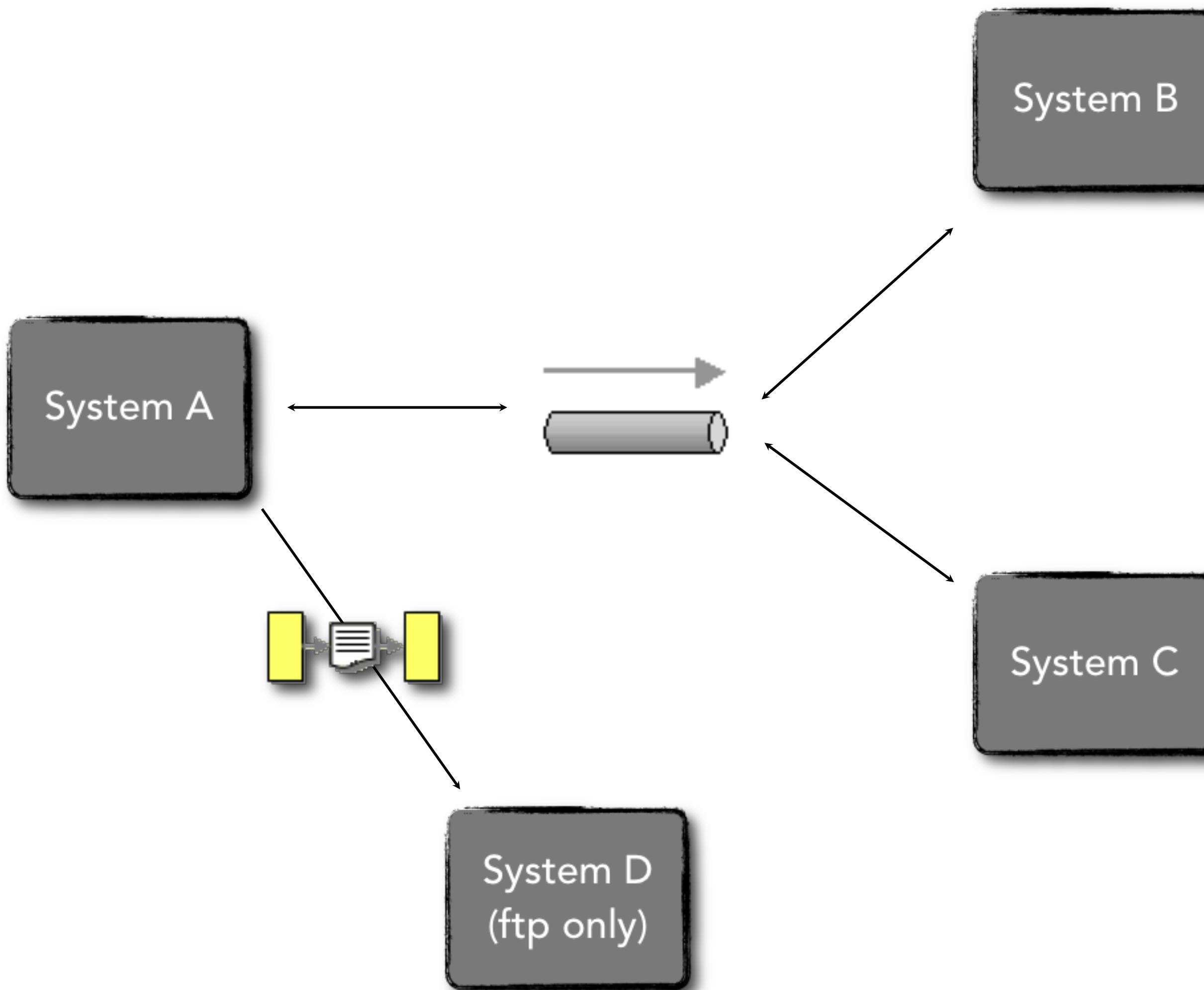


# Event-driven Architectures

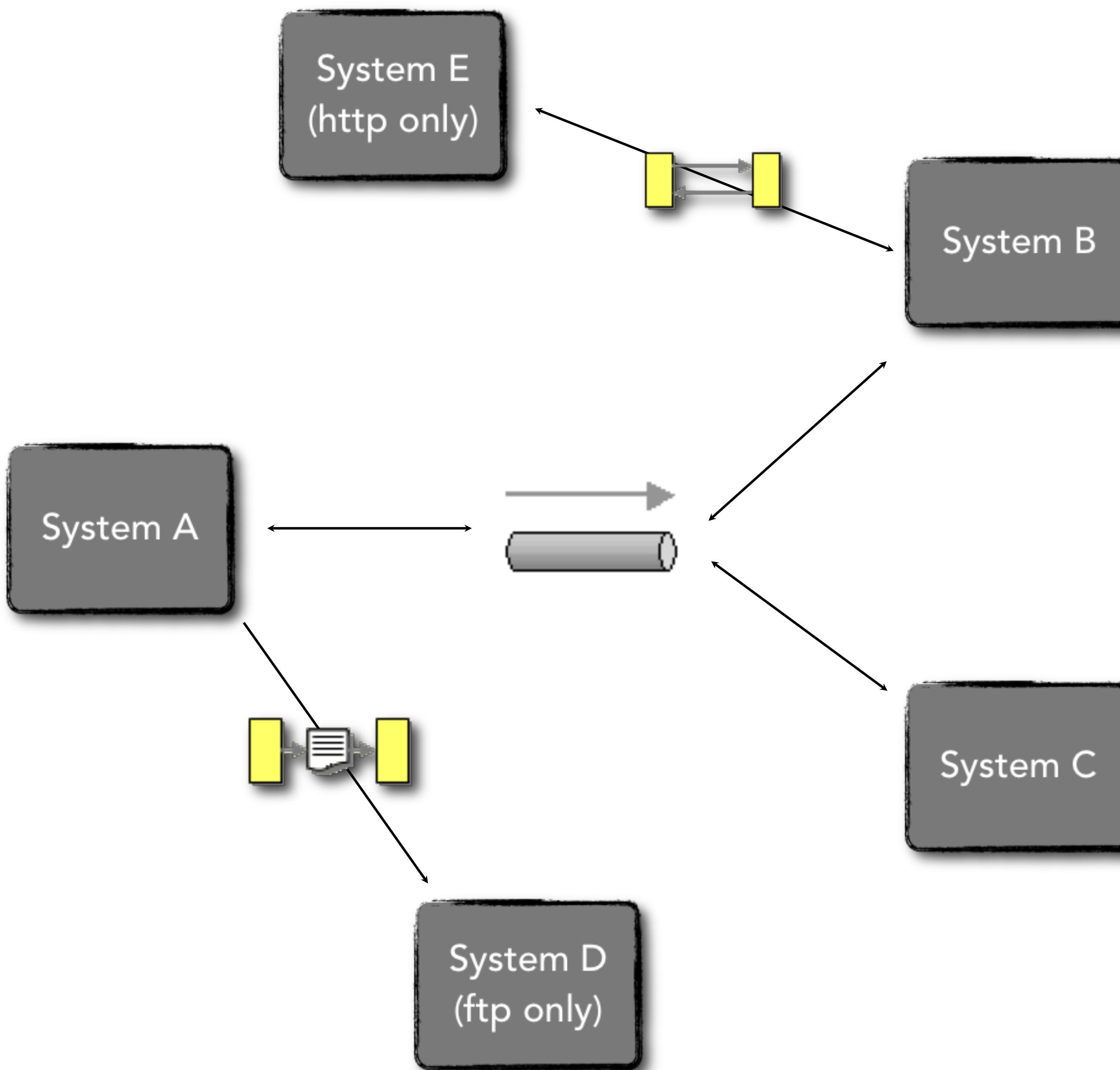
# origins: hubs



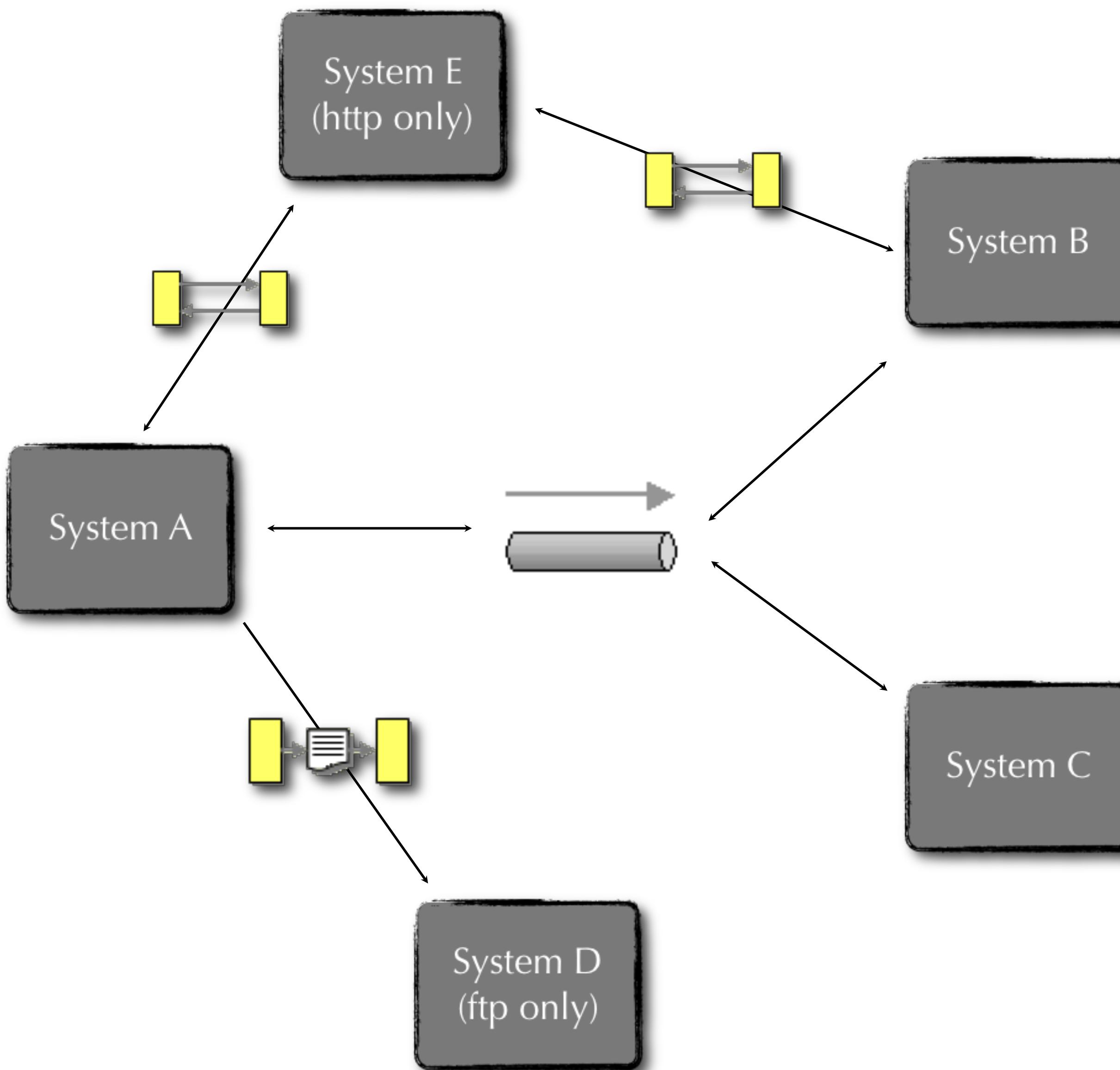
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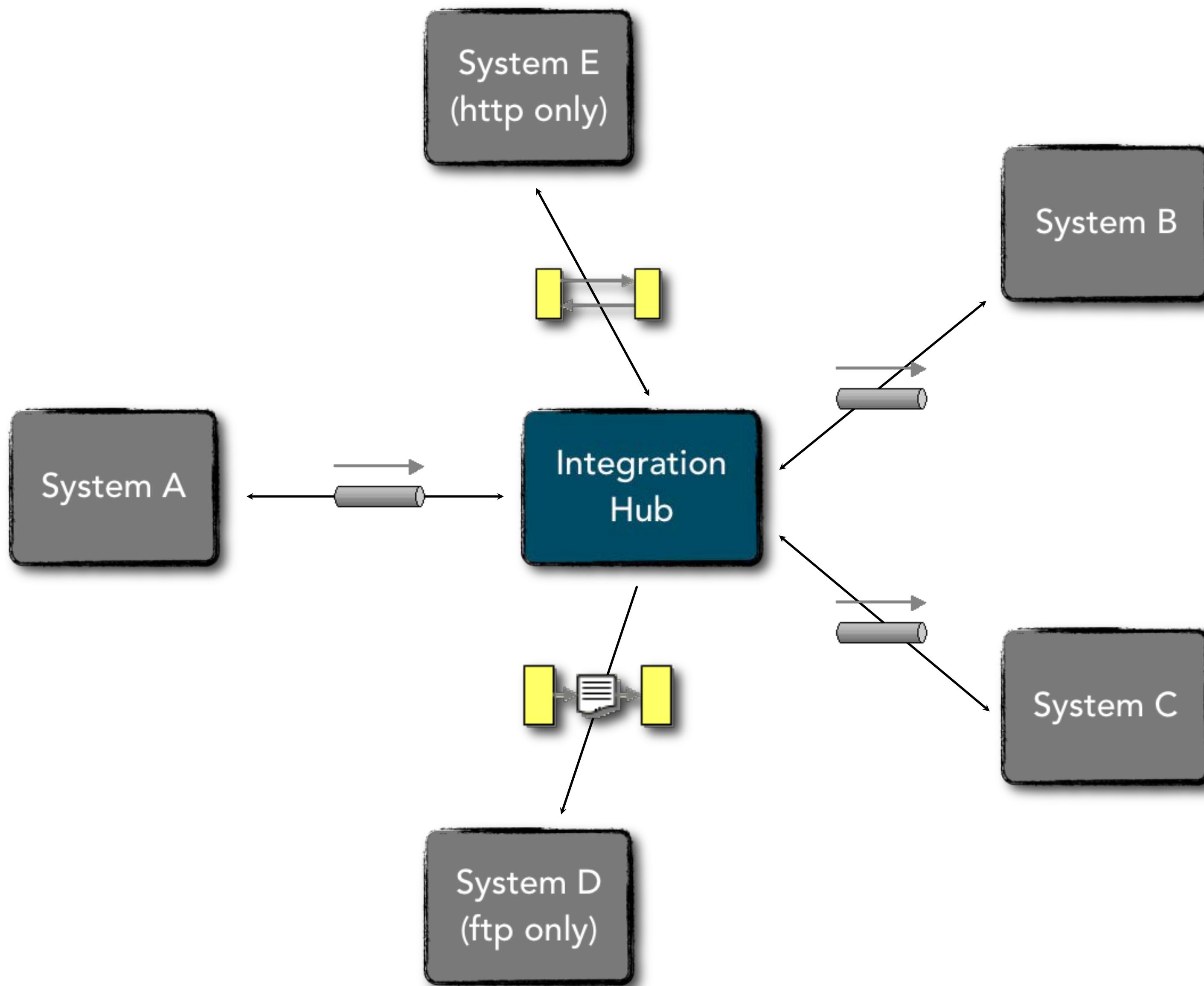
# origins: hubs



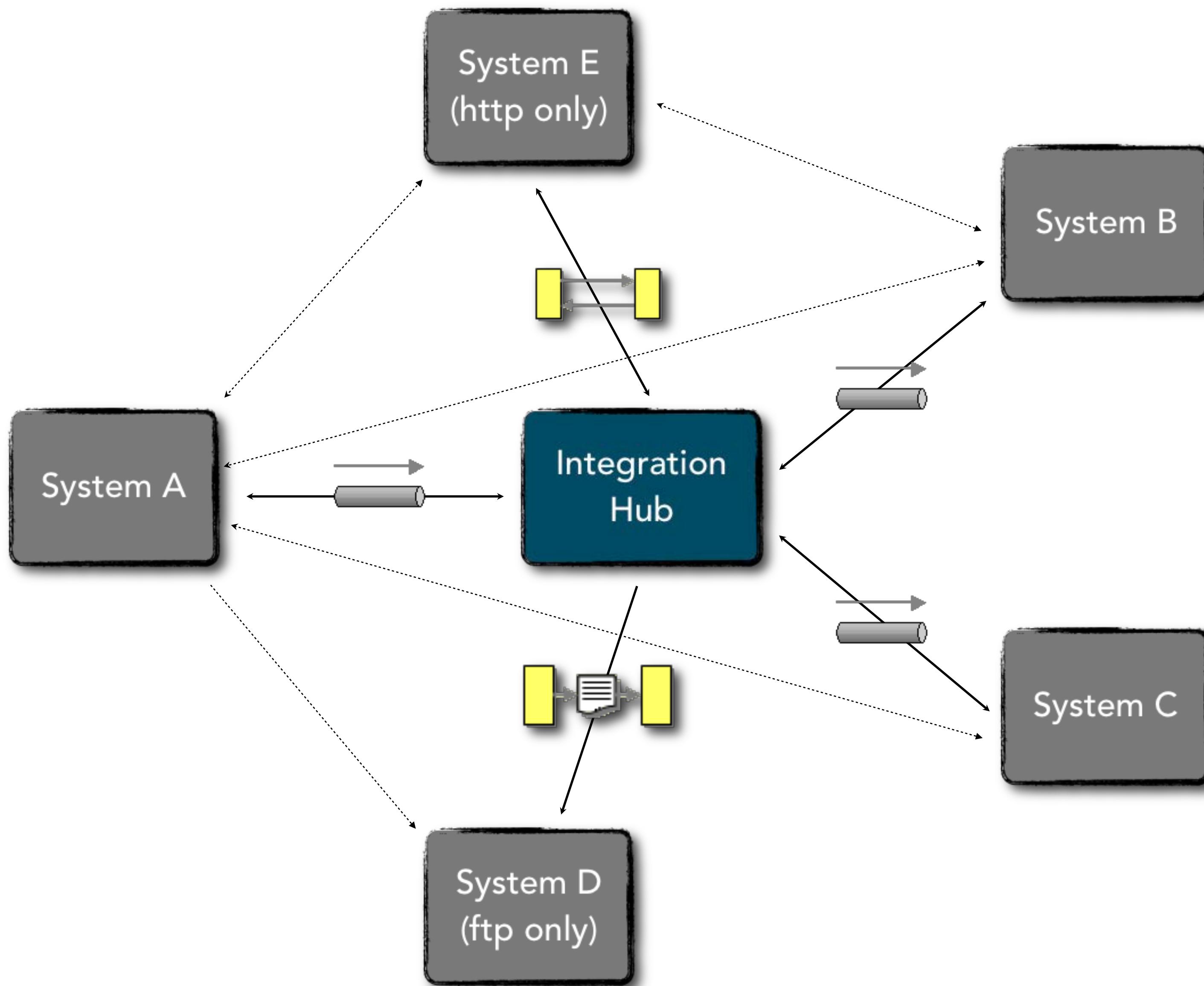
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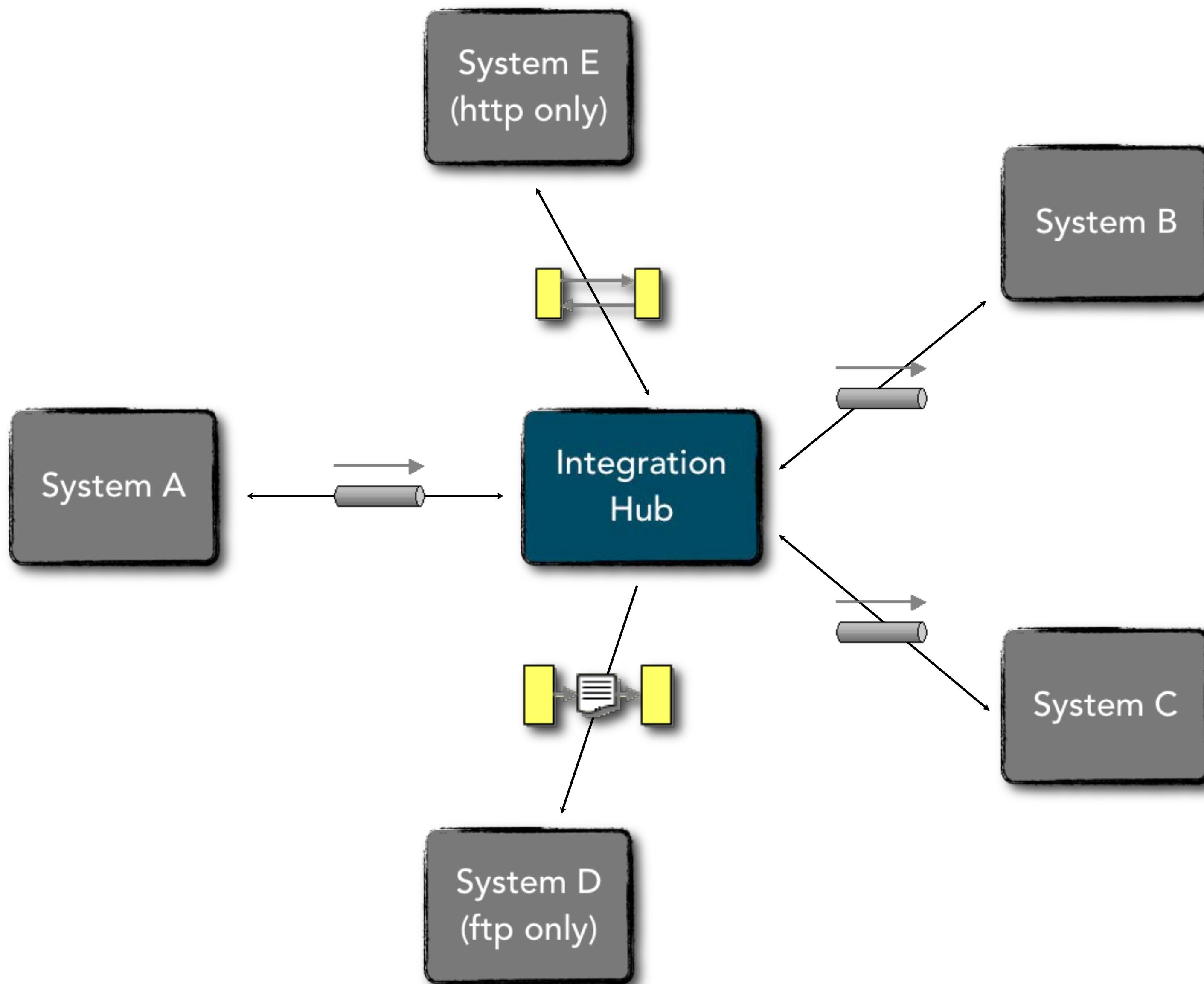
# origins: hubs



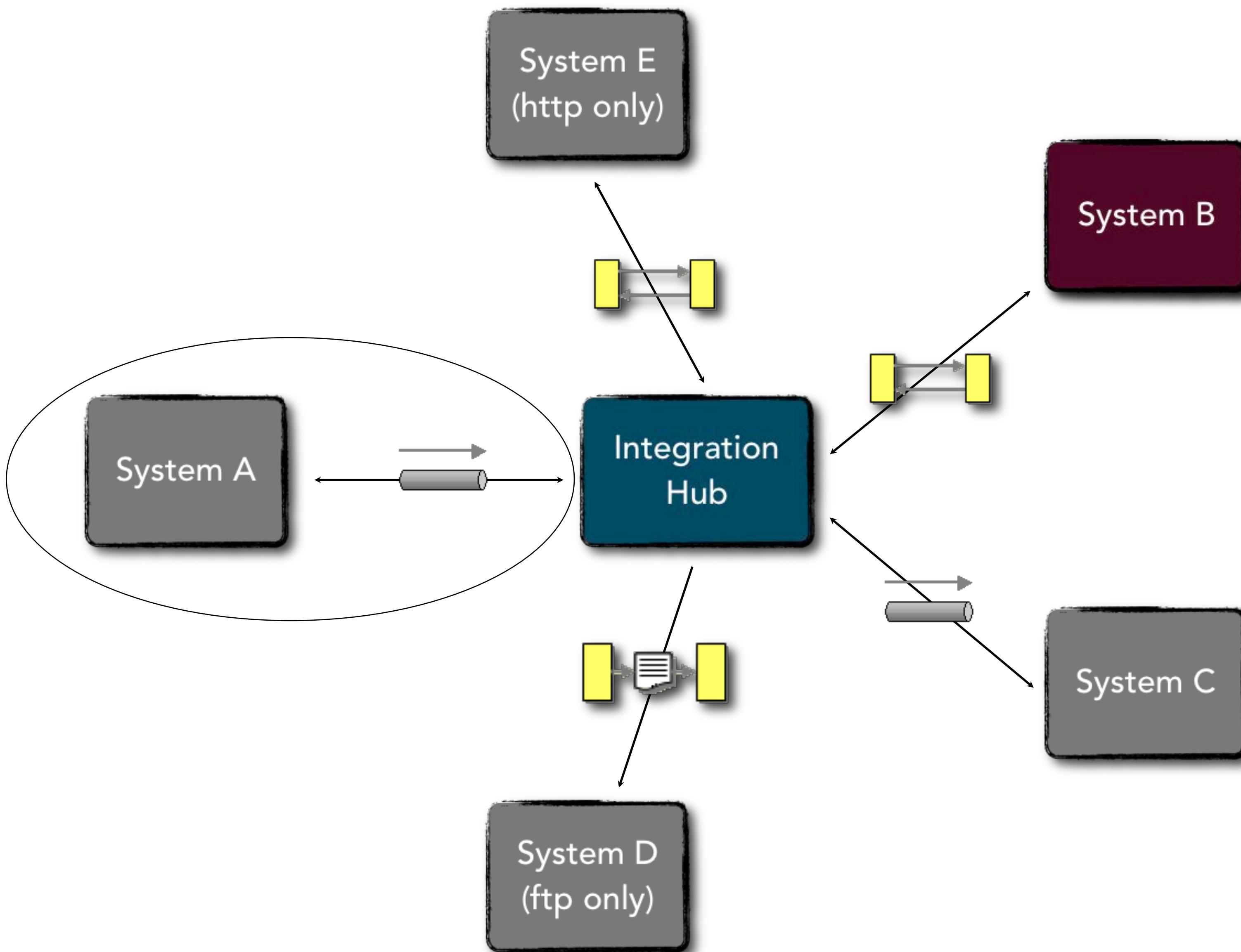
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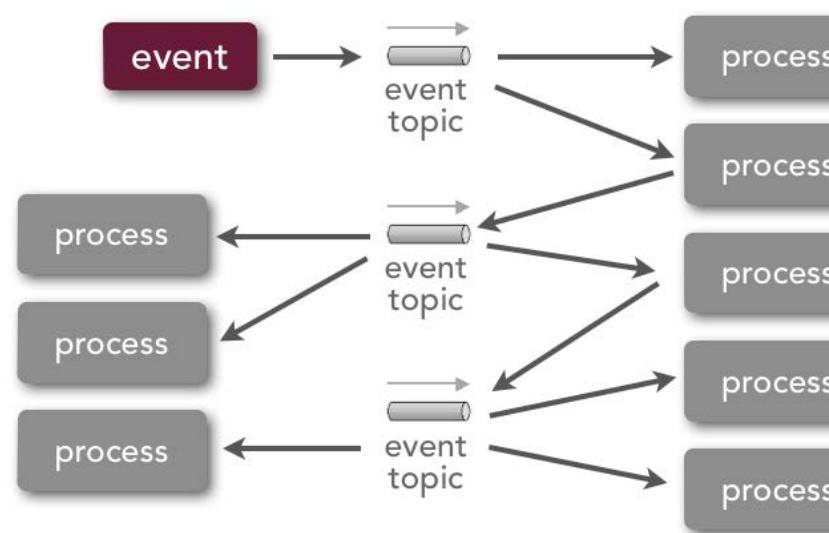
# origins: hubs



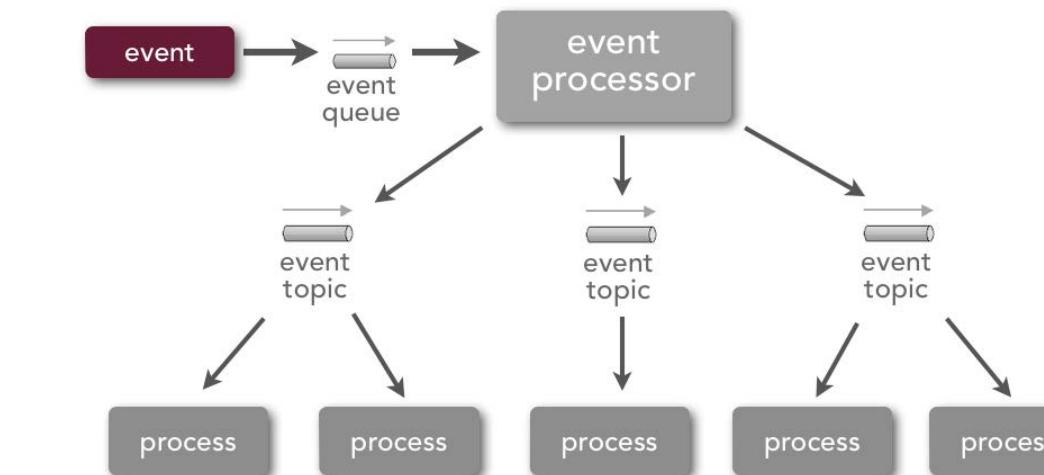
# origins: hubs



# Event-driven Architectures

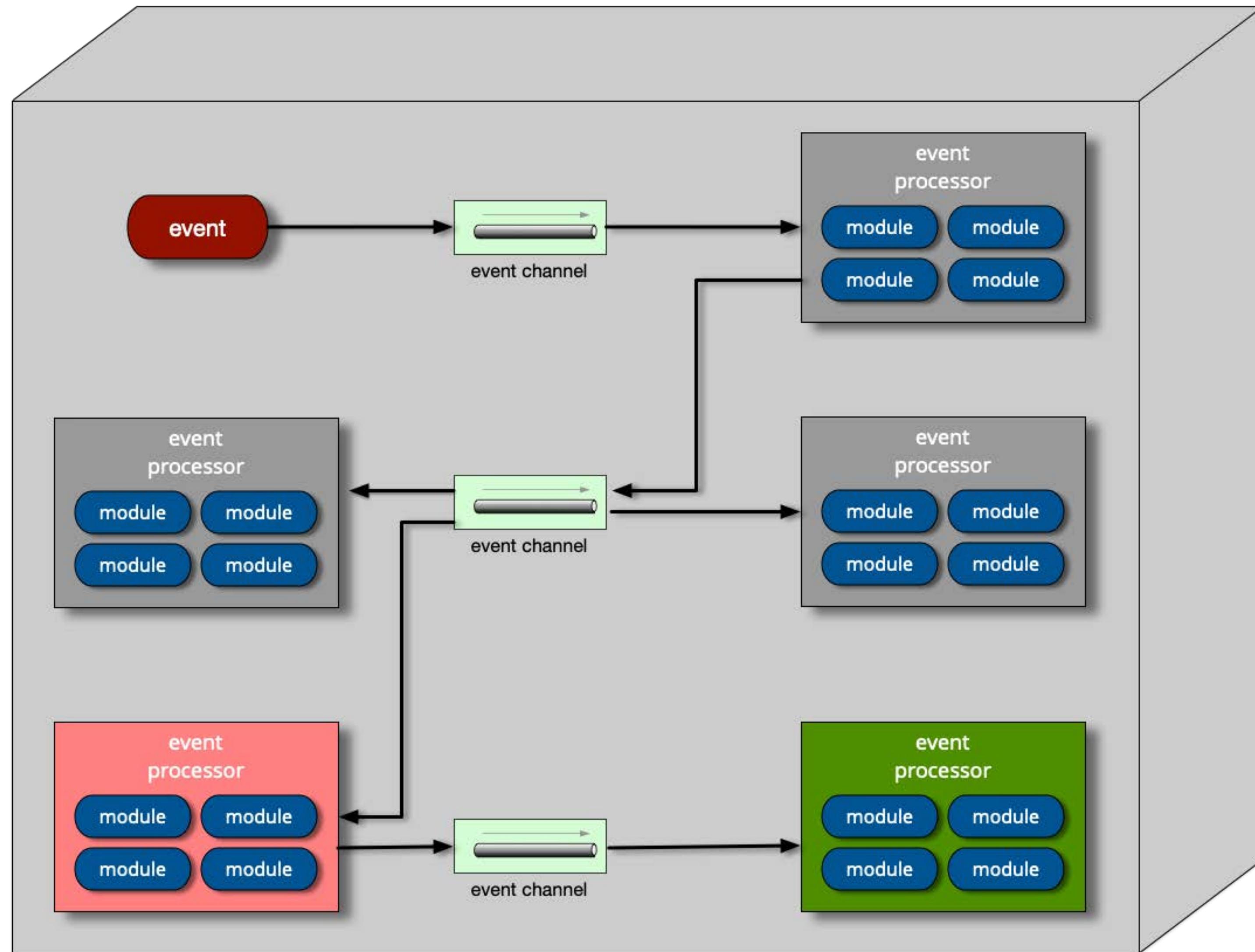


broker topology

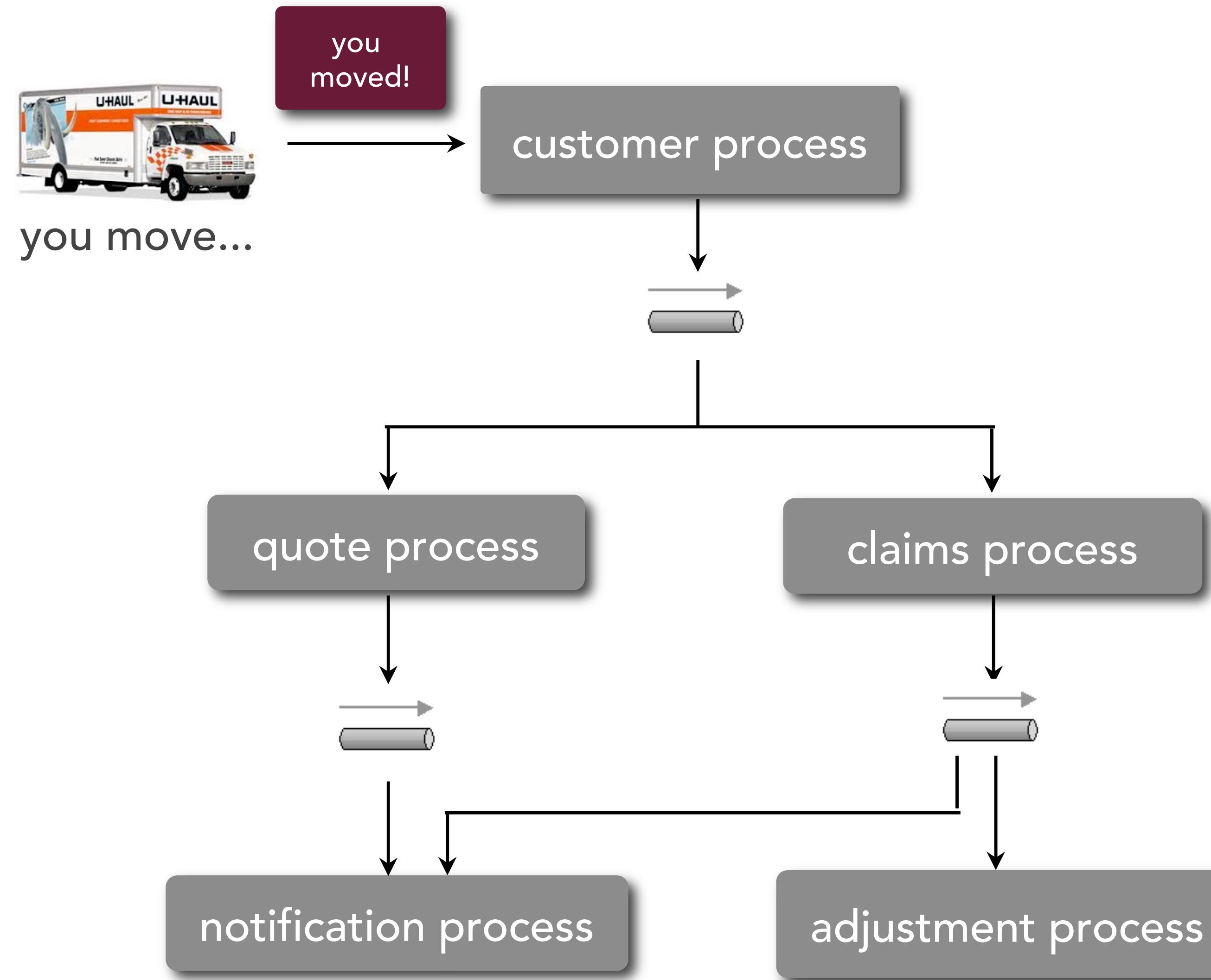


mediator topology

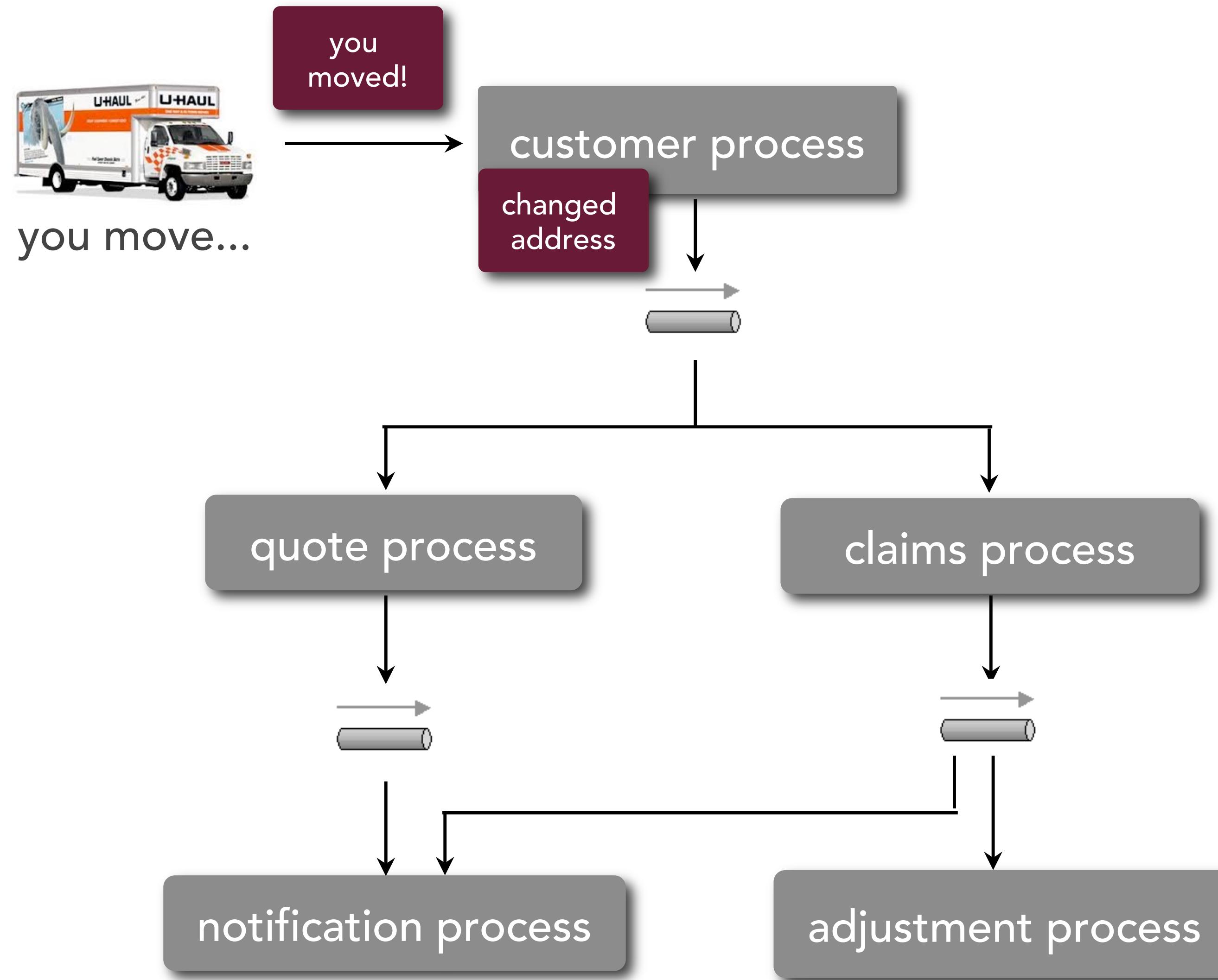
# Broker Base Architecture



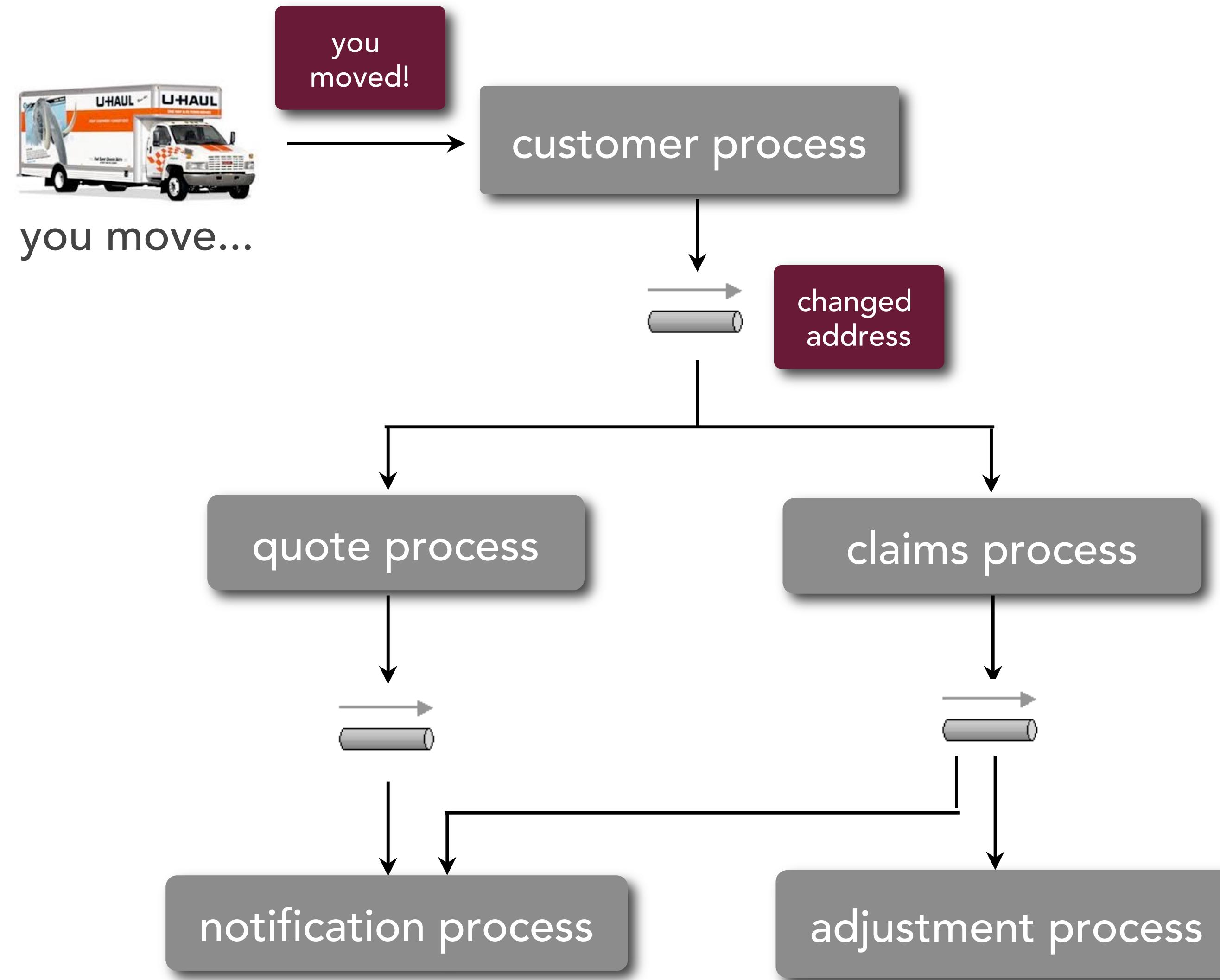
# Broker Message Passing



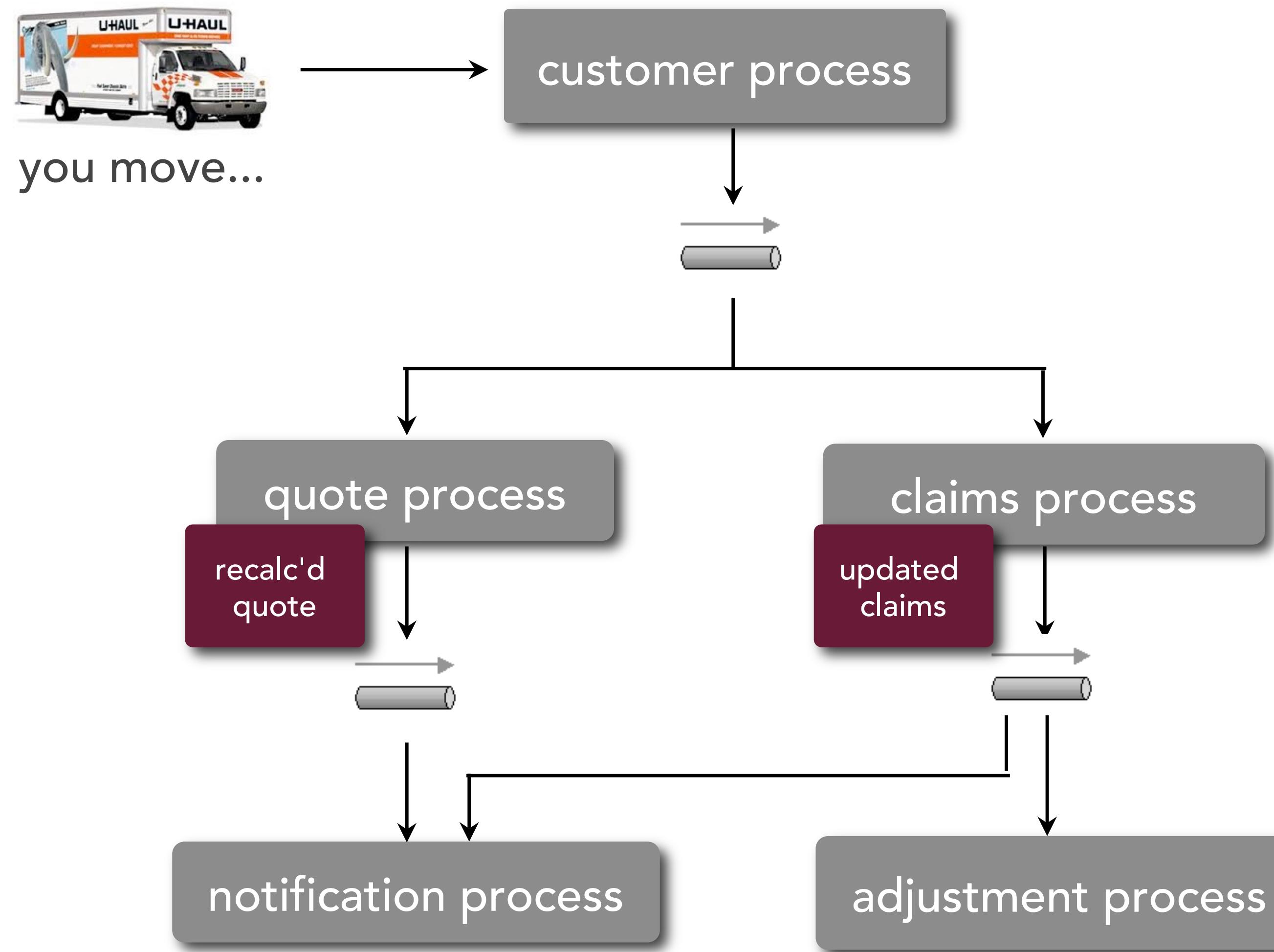
# Broker Message Passing



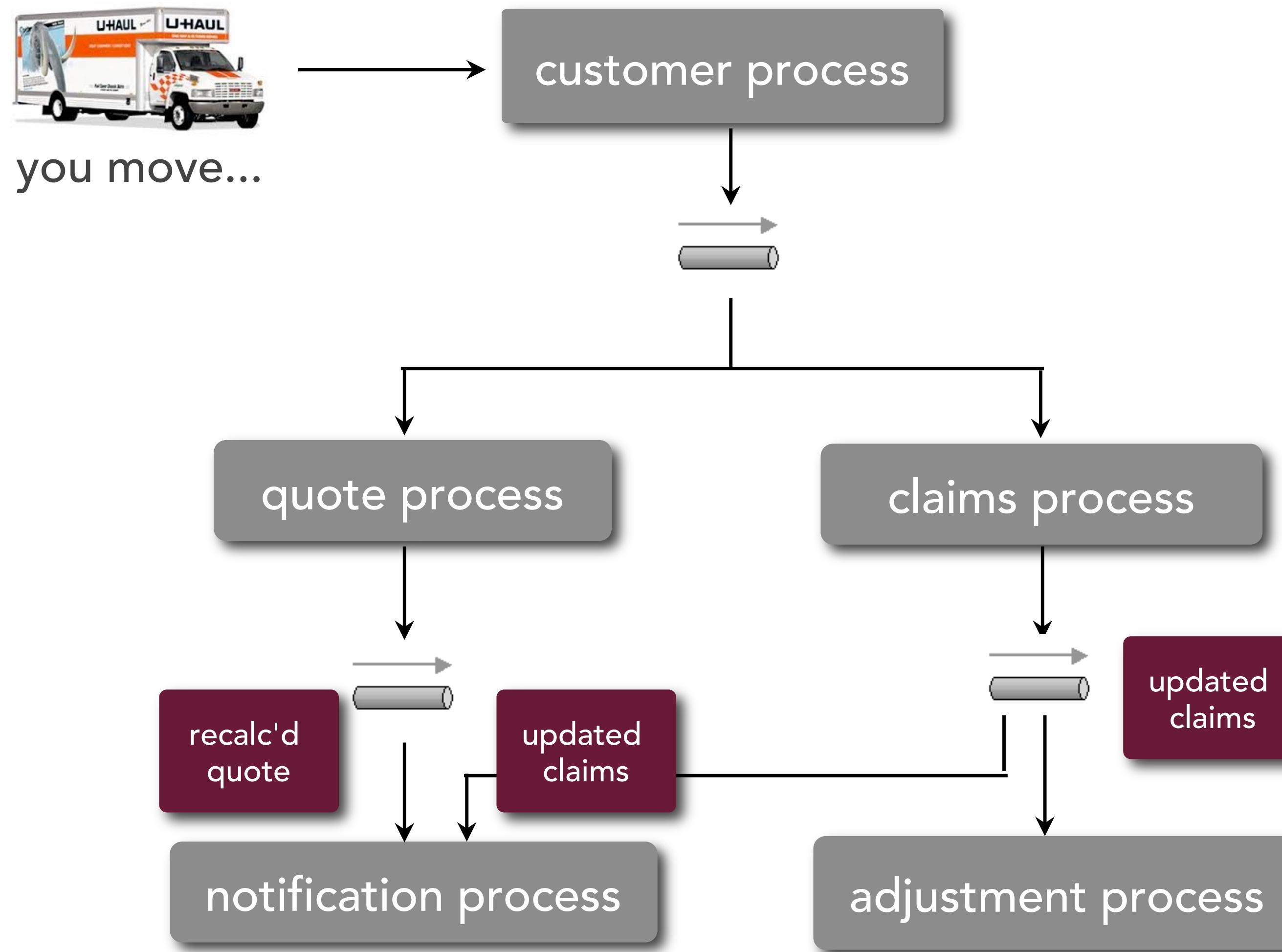
# Broker Message Passing



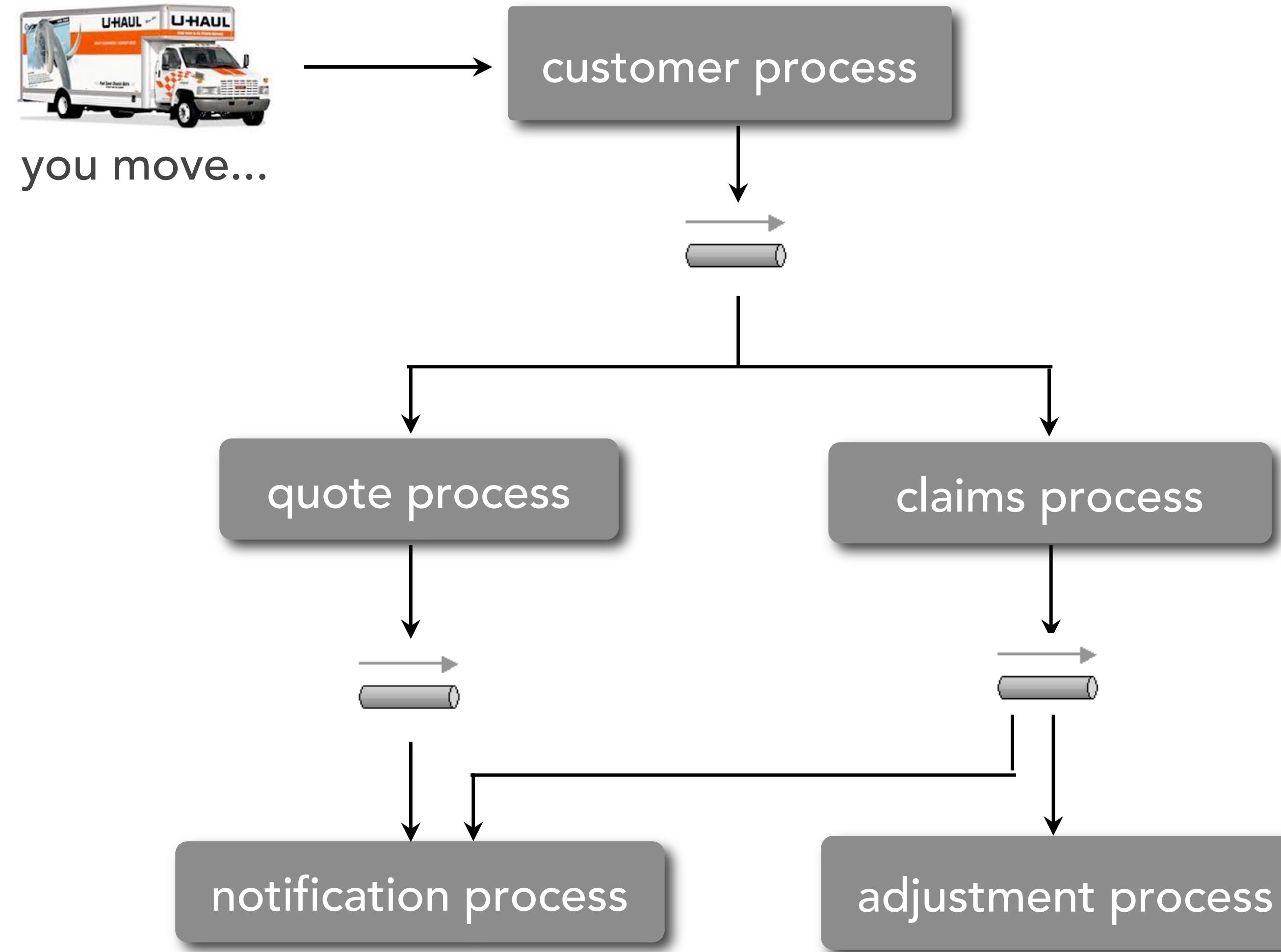
# Broker Message Passing



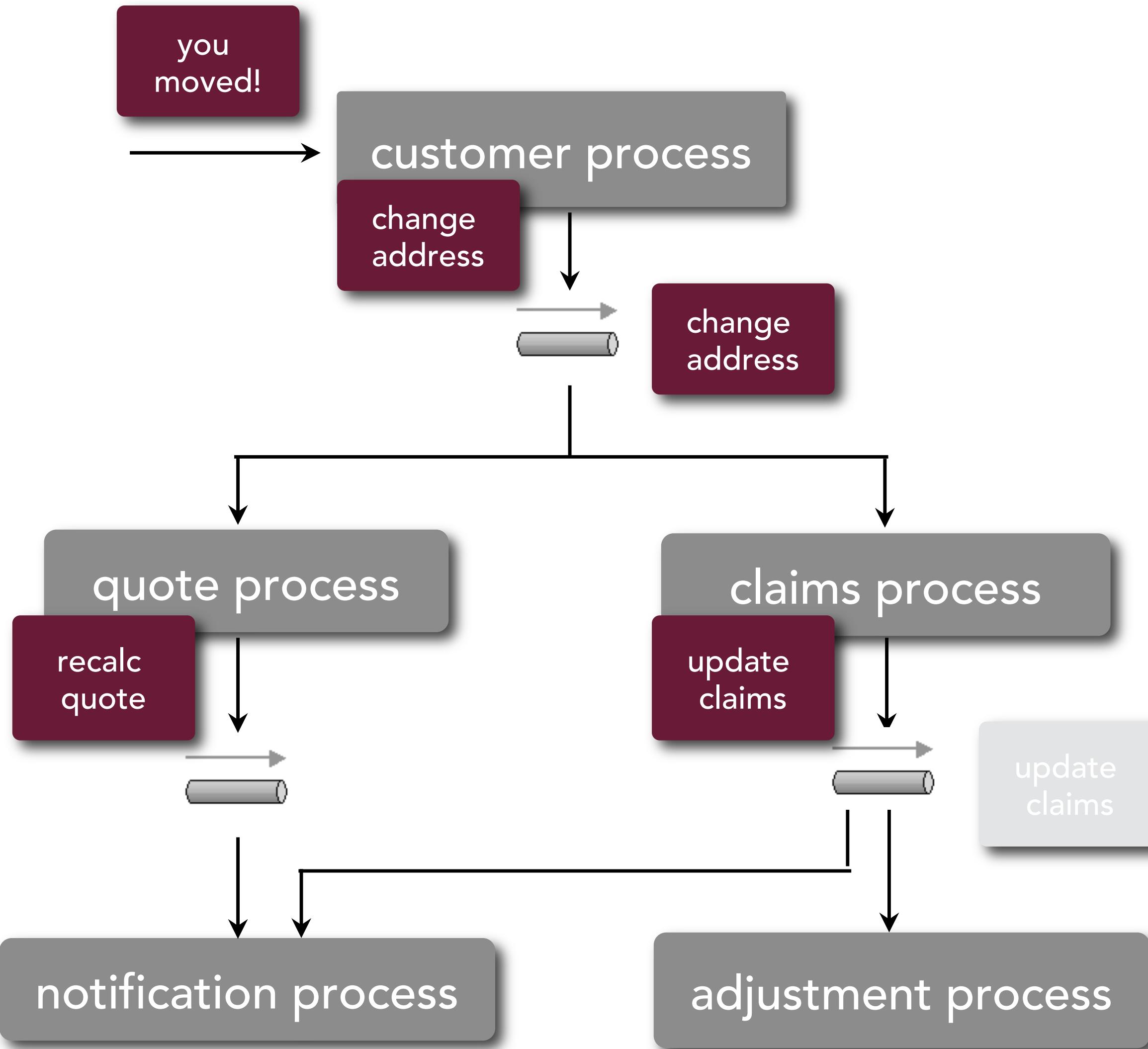
# Broker Message Passing



# Broker: Choreography

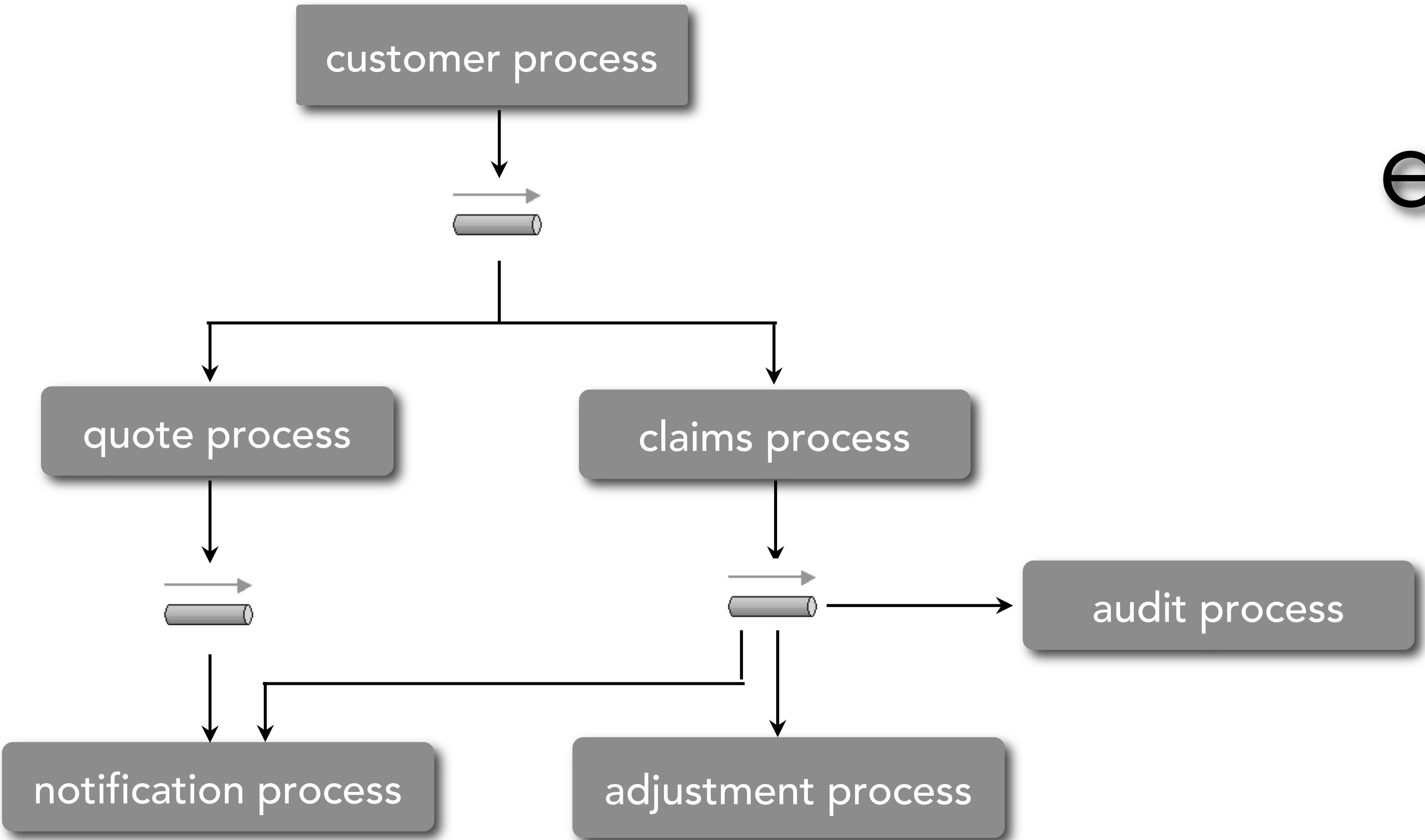


# Broker: Errors?



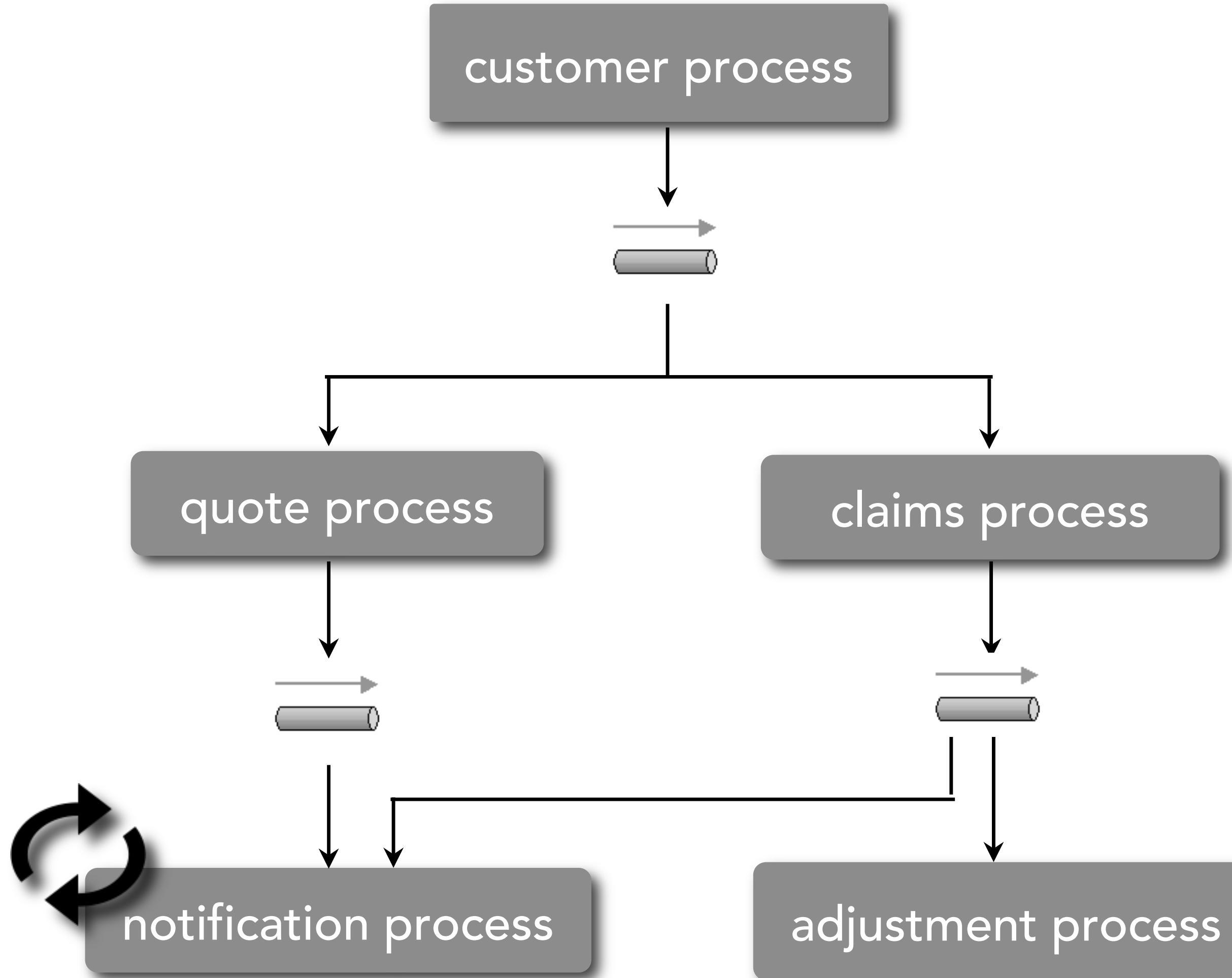
Error handling?

# Broker: Evolution



# evolution

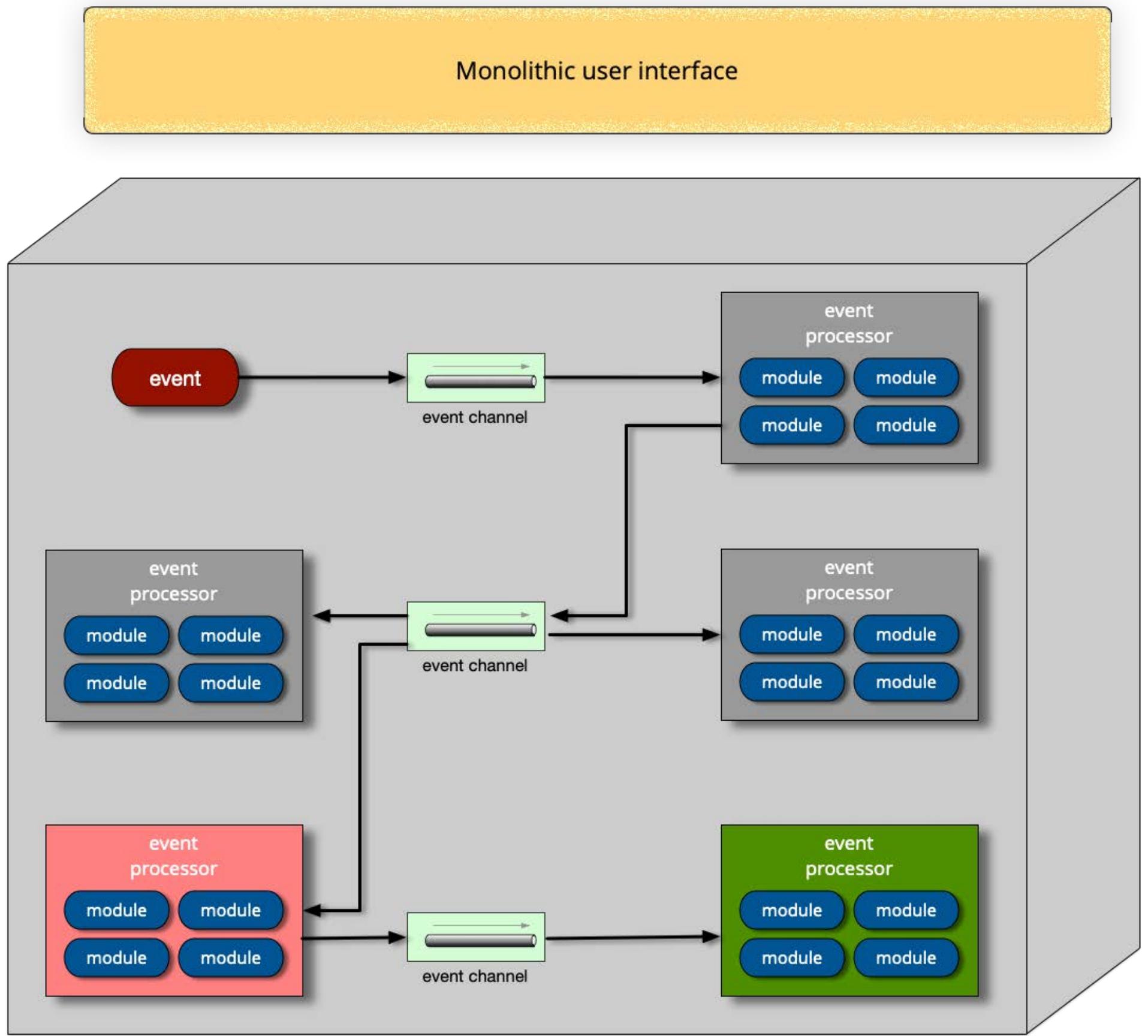
# Broker: Asynchronous Notification



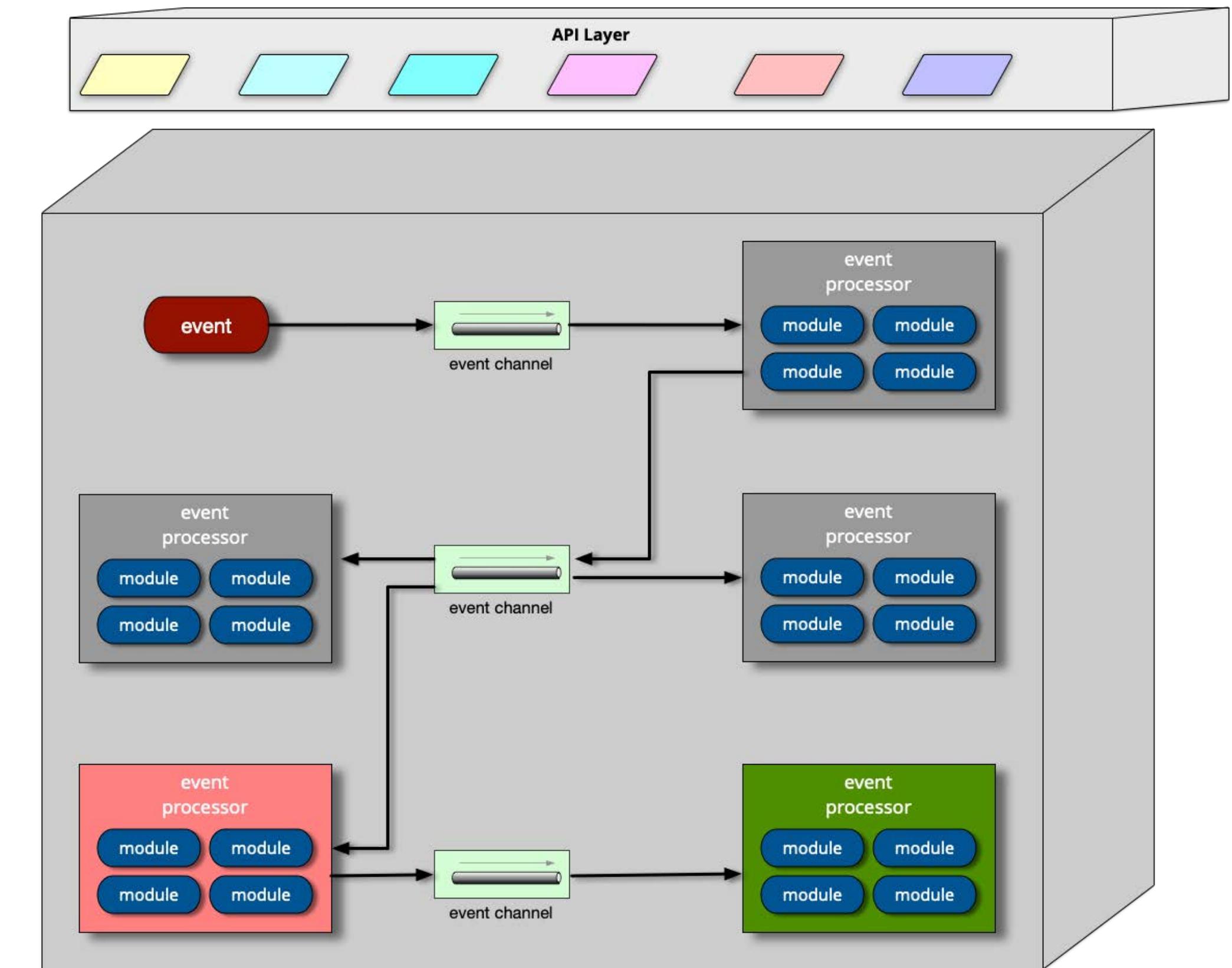
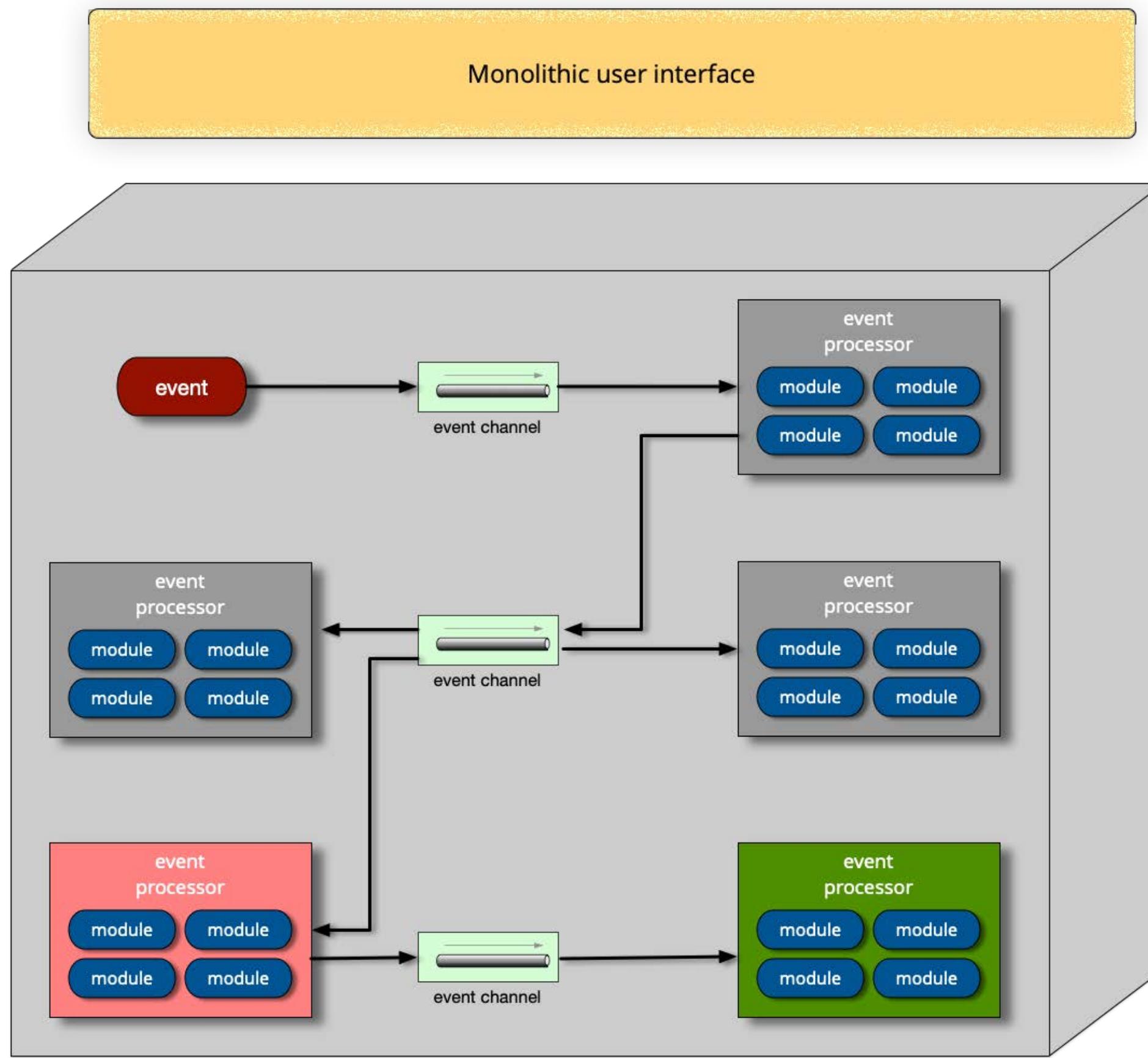
Unified notification  
message to customer?

In asynchronous systems,  
coordination happens at the end

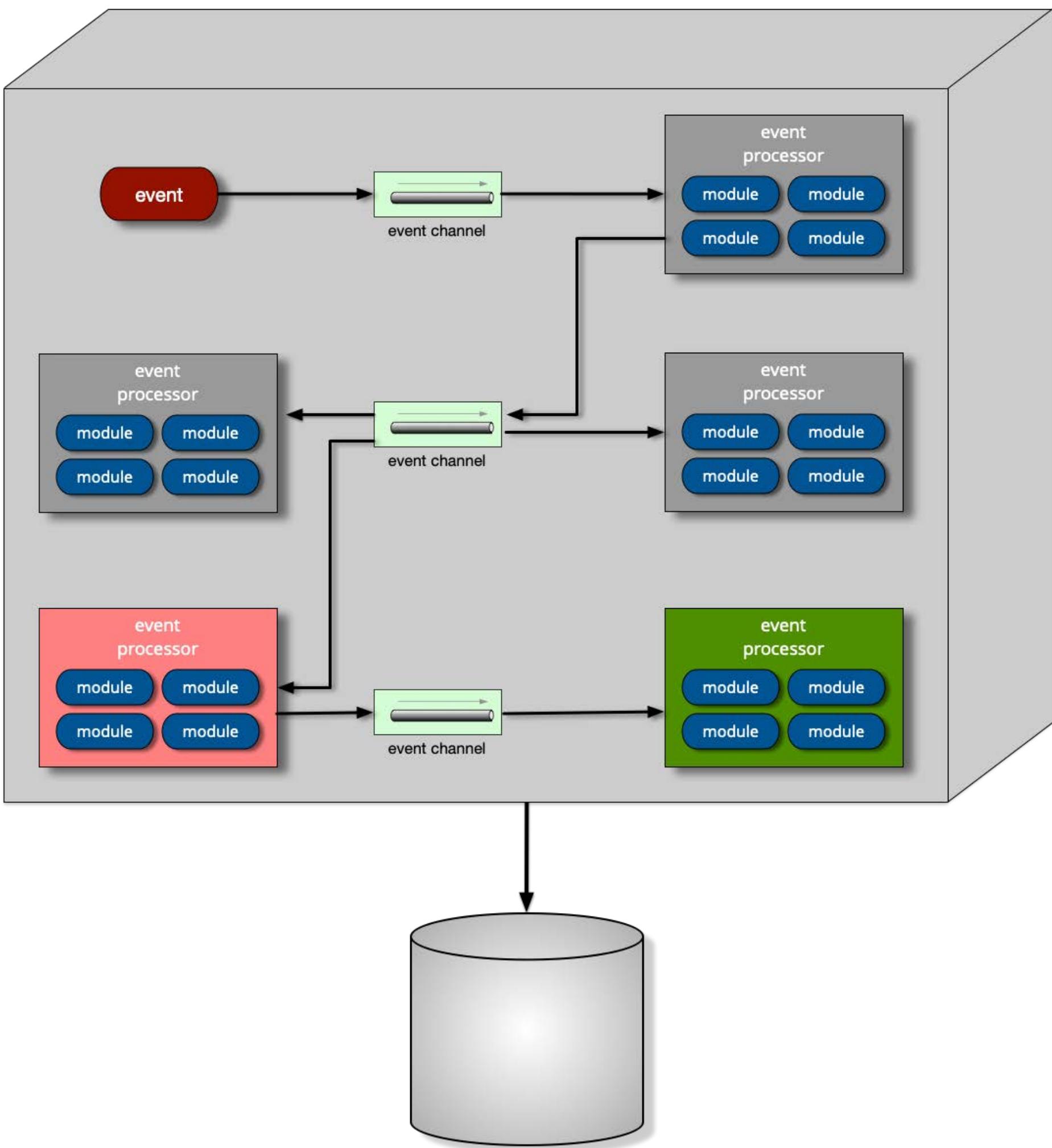
# Broker: UI



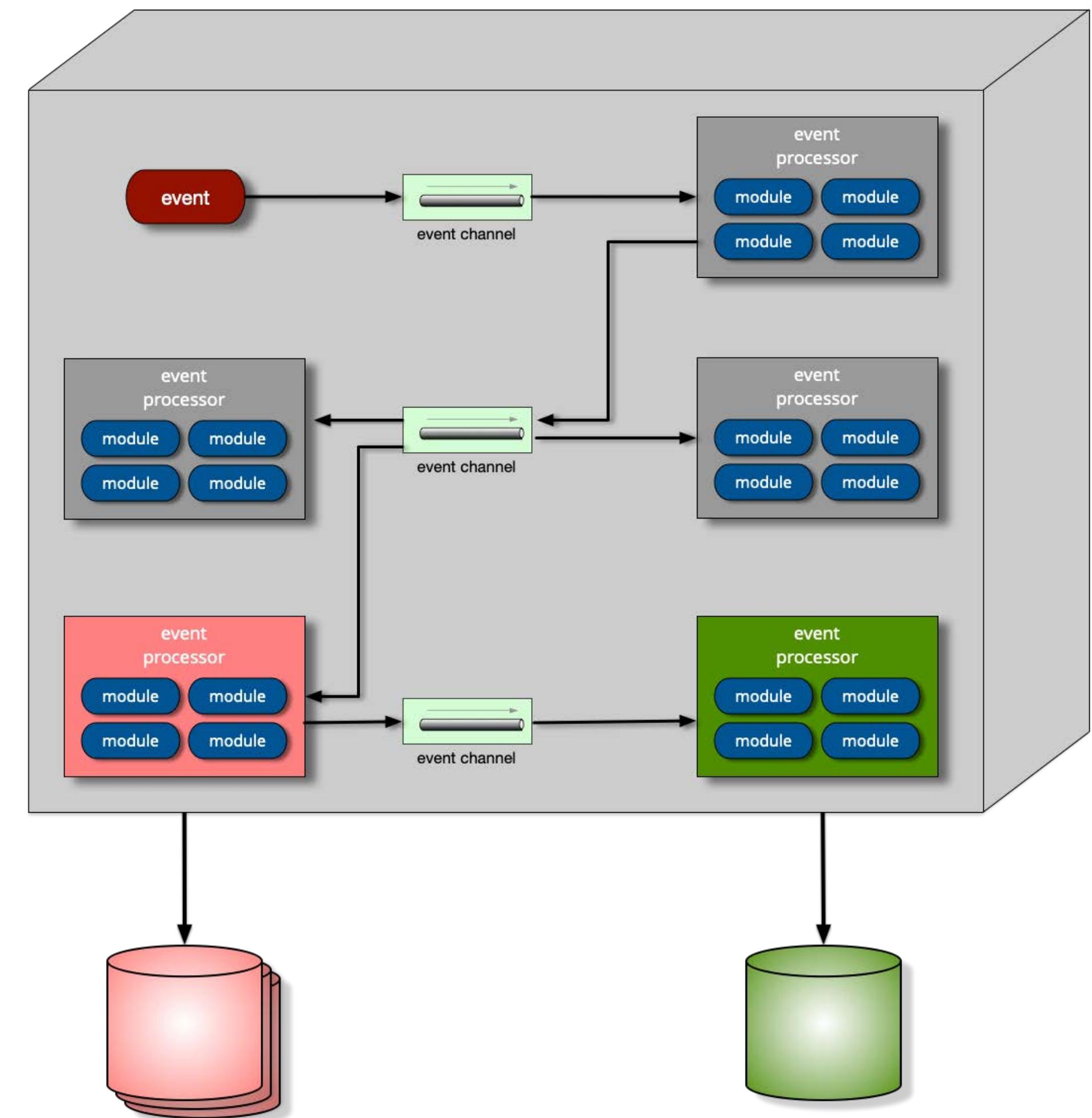
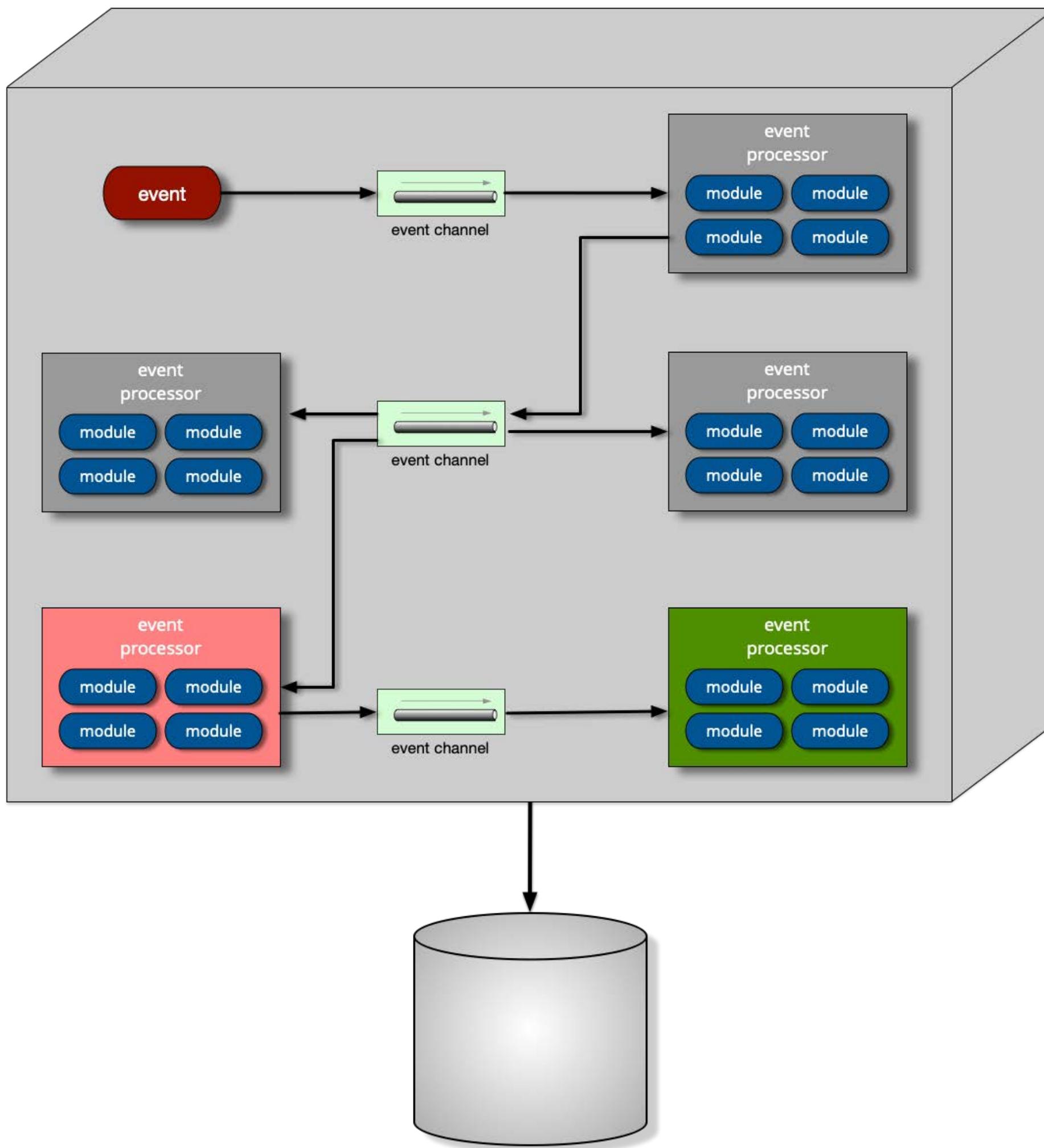
# Broker: UI



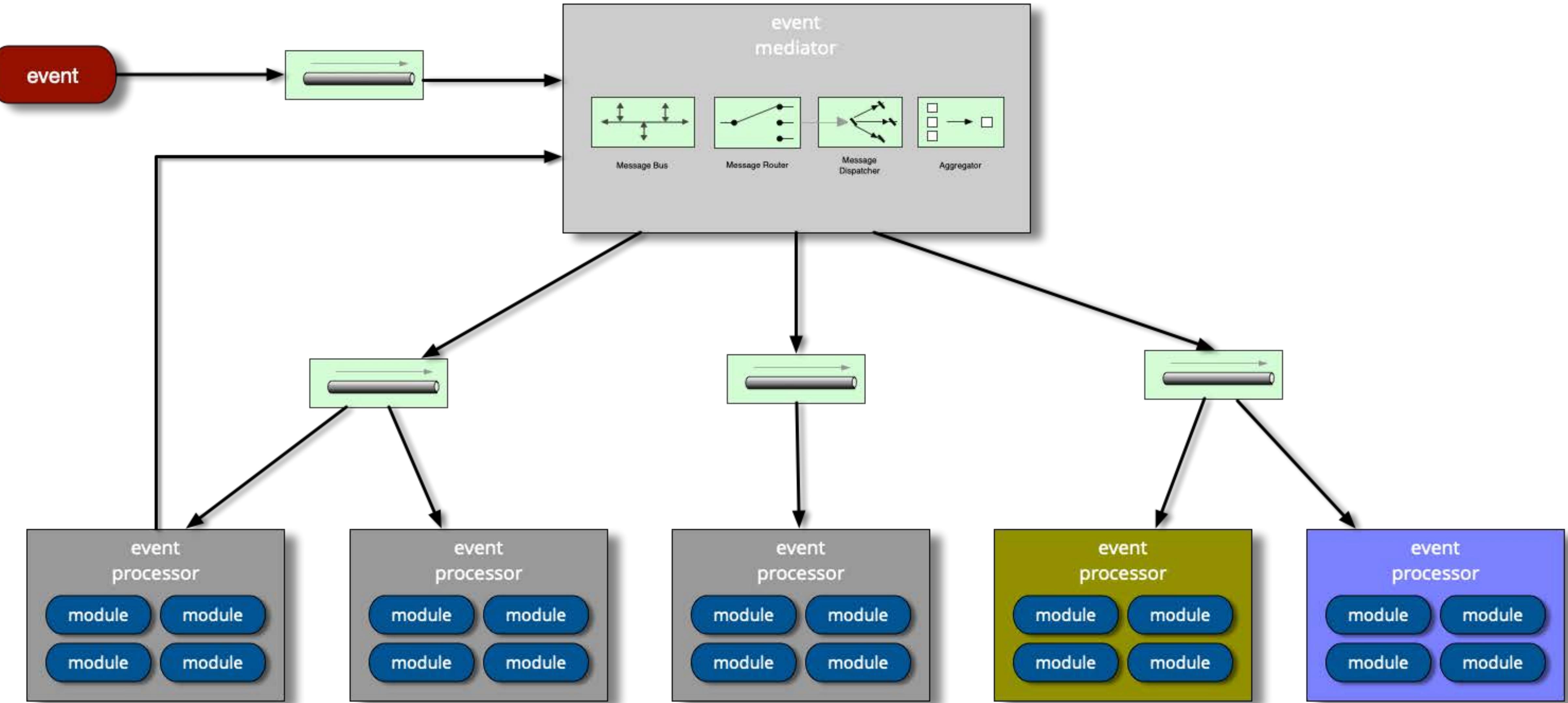
# Broker: Data



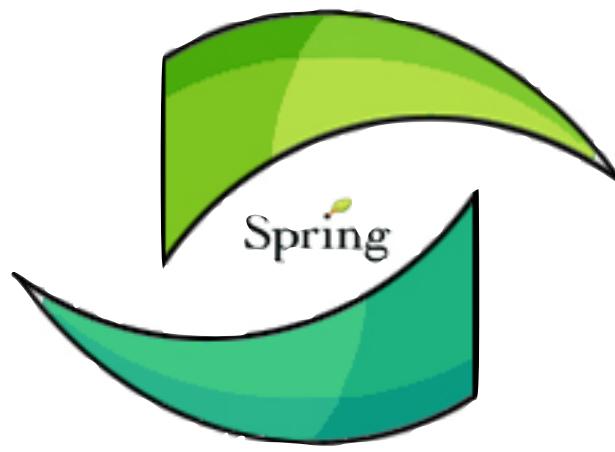
# Broker: Data



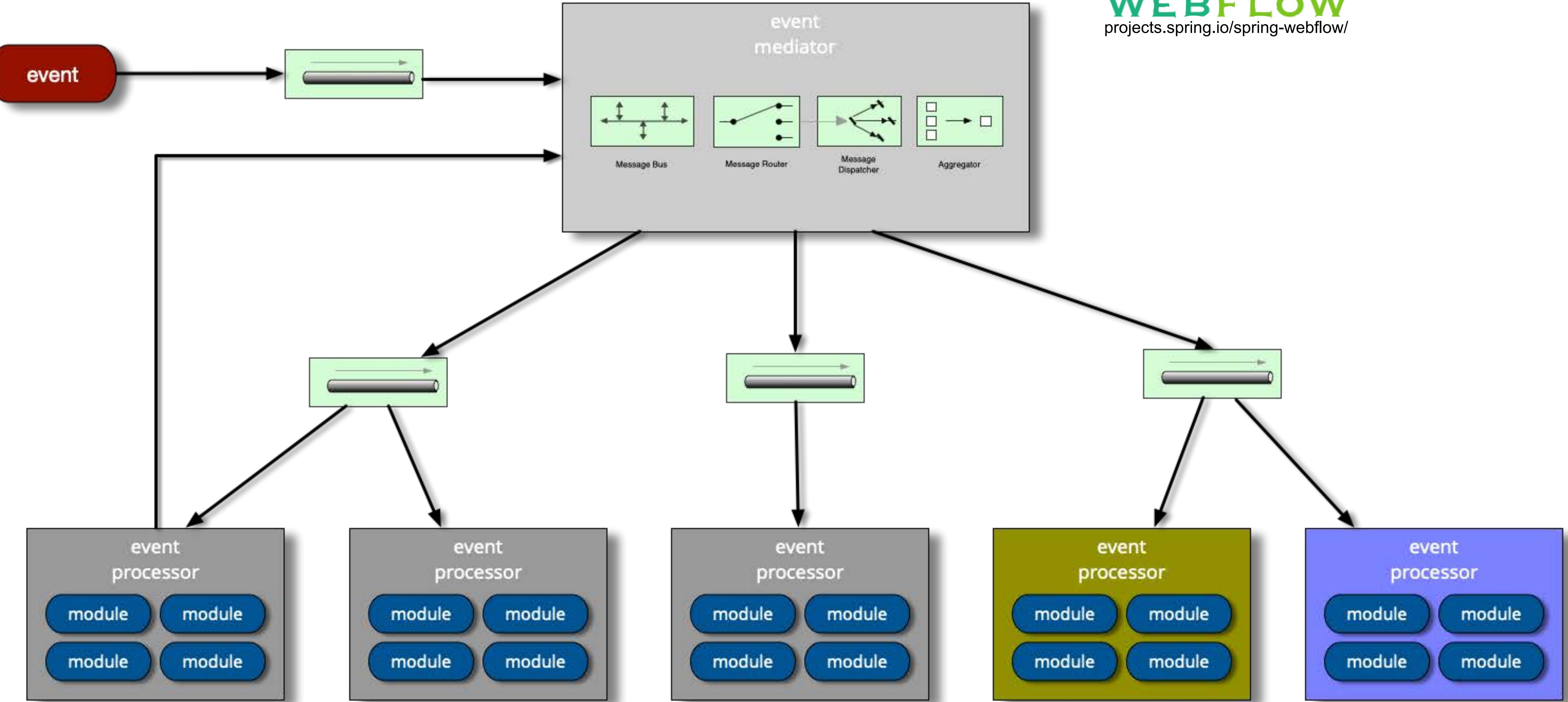
# Mediator EDA



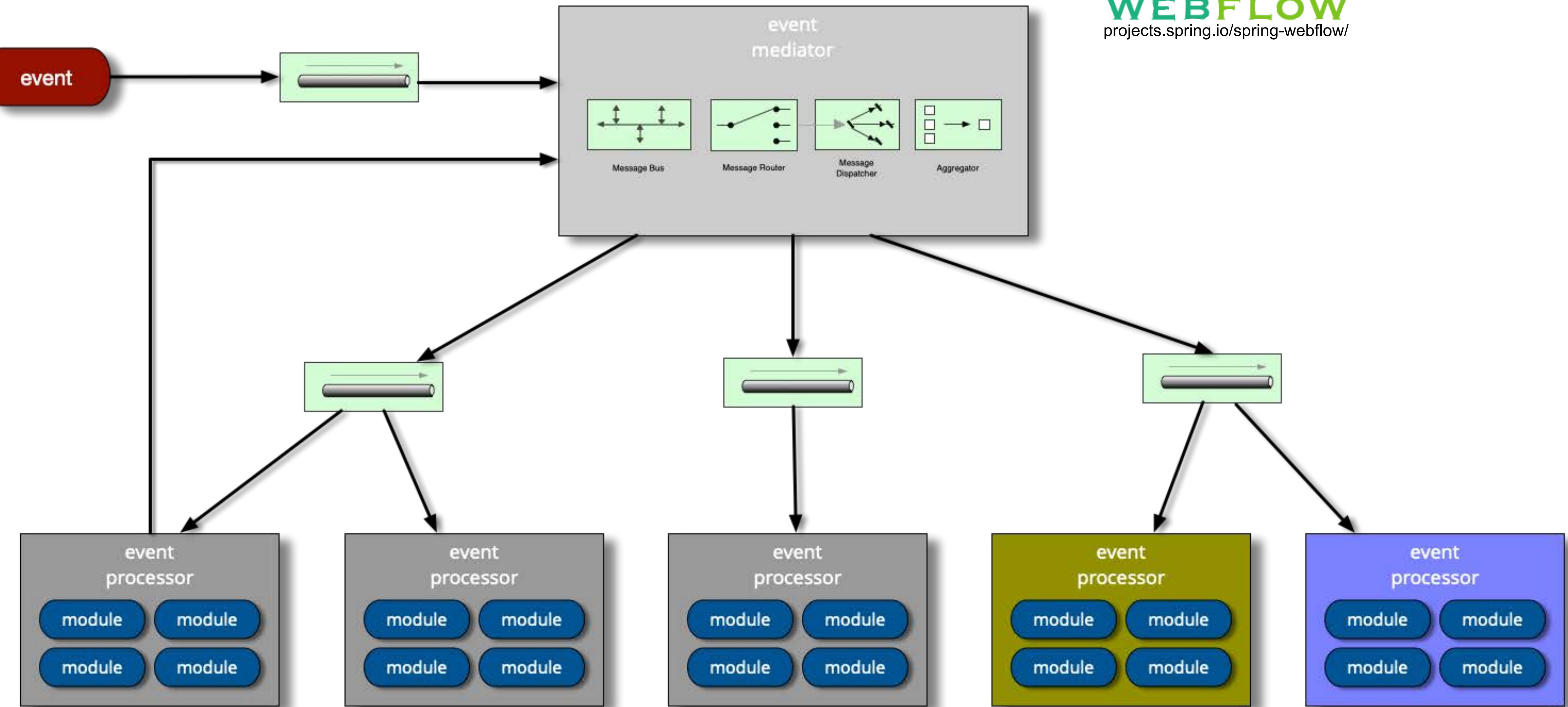
# Mediator EDA



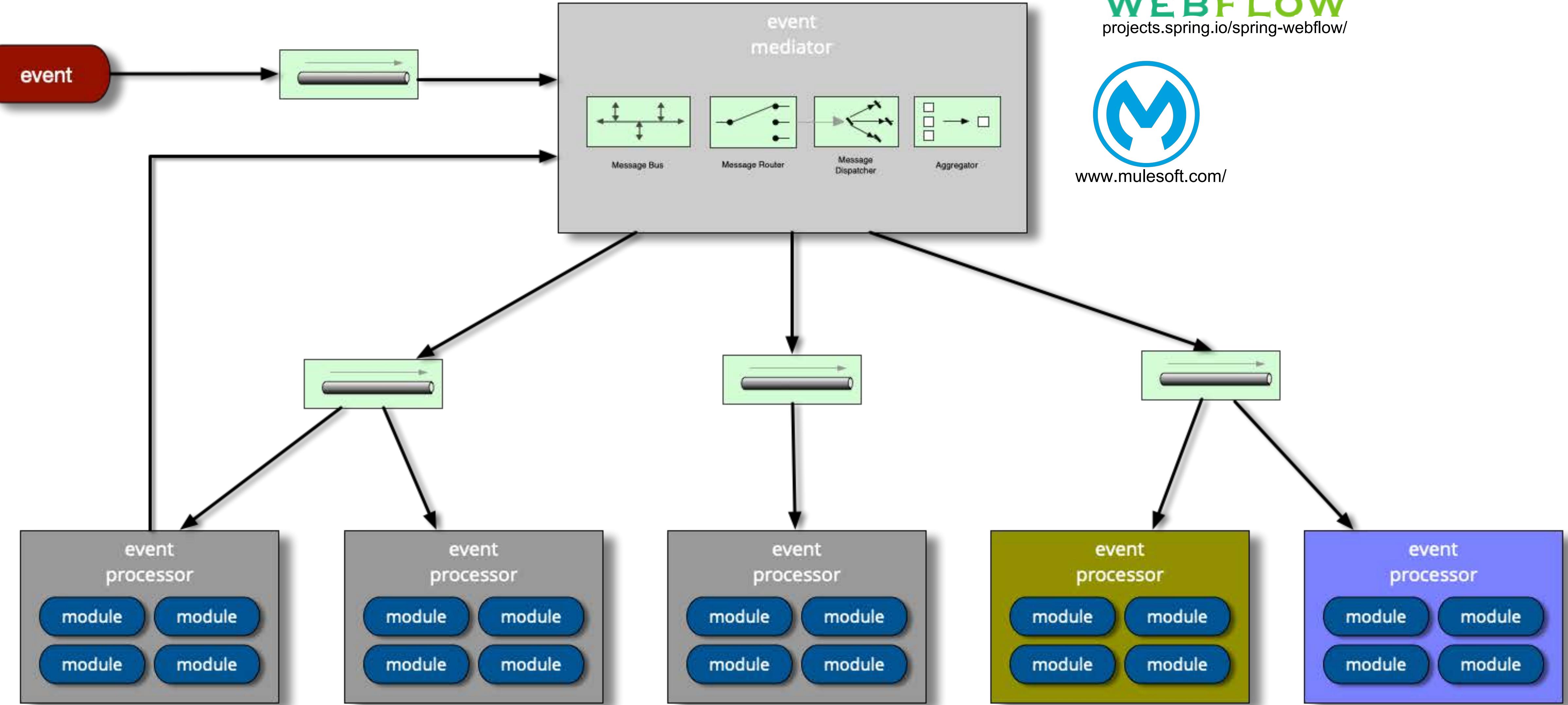
**WEBFLOW**  
[projects.spring.io/spring-webflow/](http://projects.spring.io/spring-webflow/)



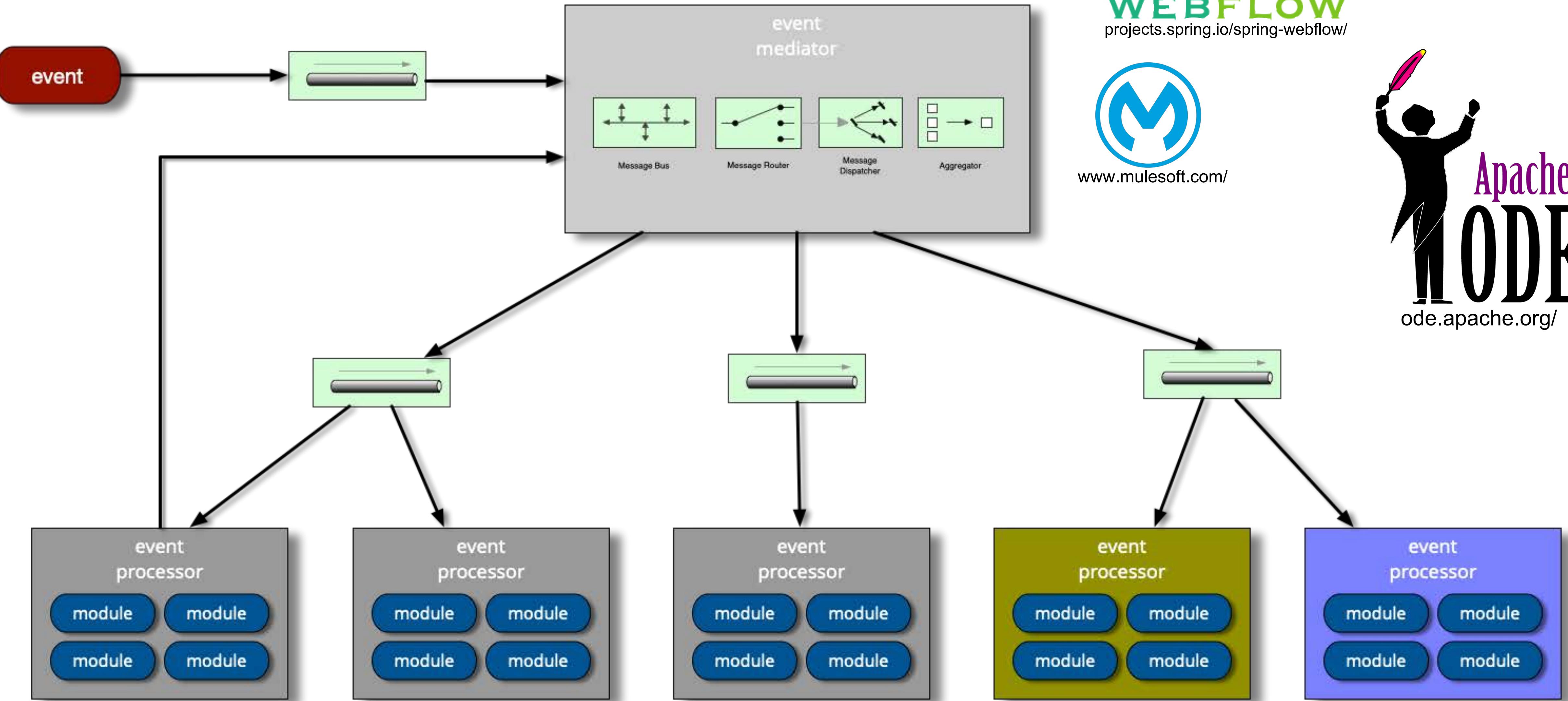
# Mediator EDA



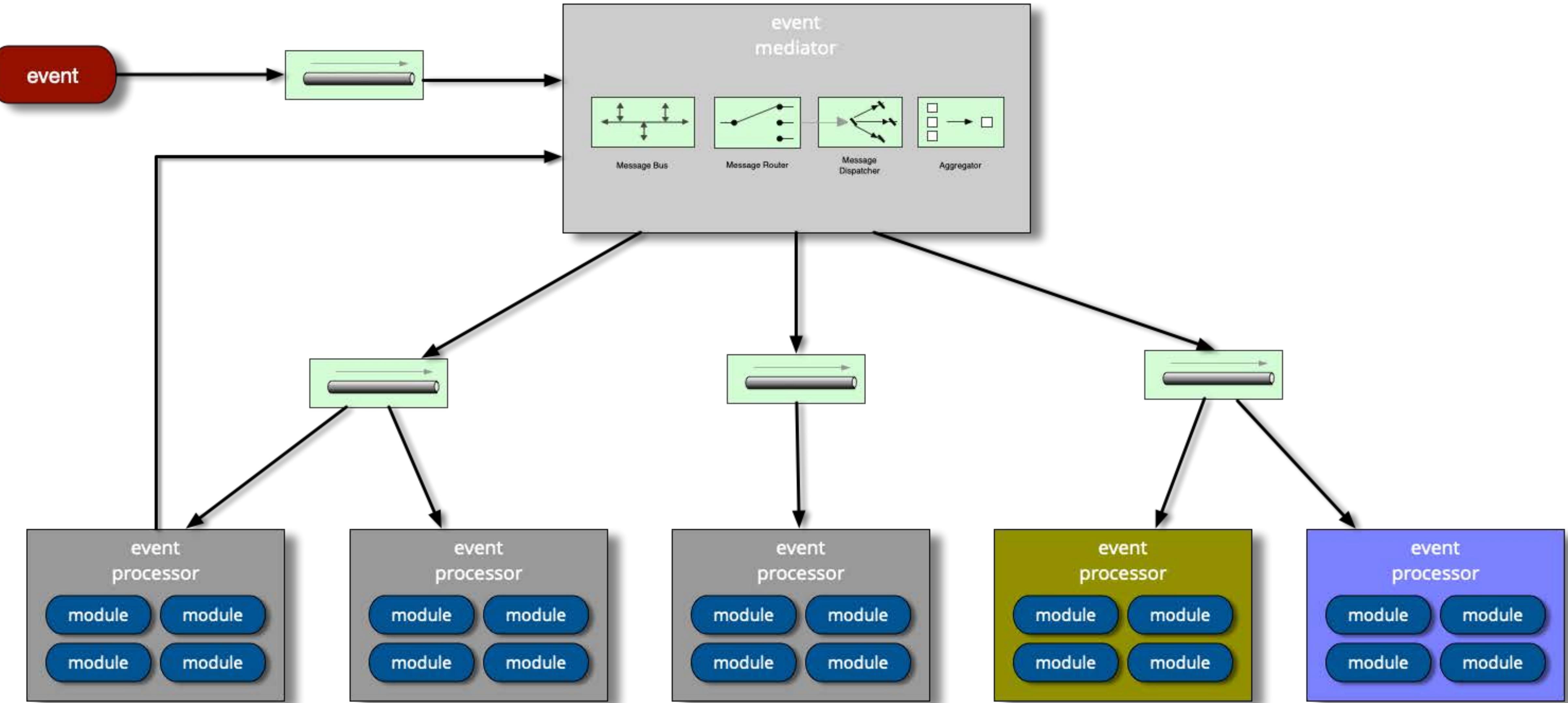
# Mediator EDA



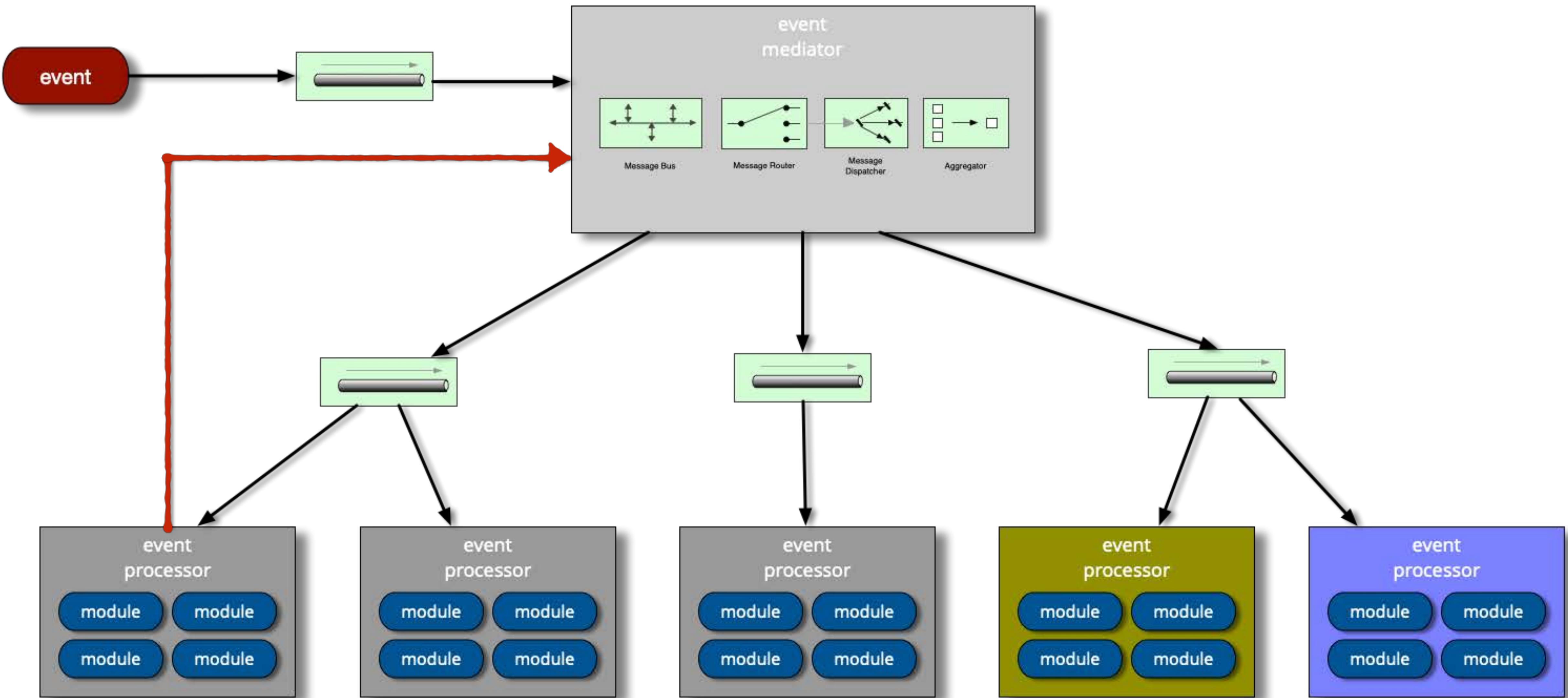
# Mediator EDA



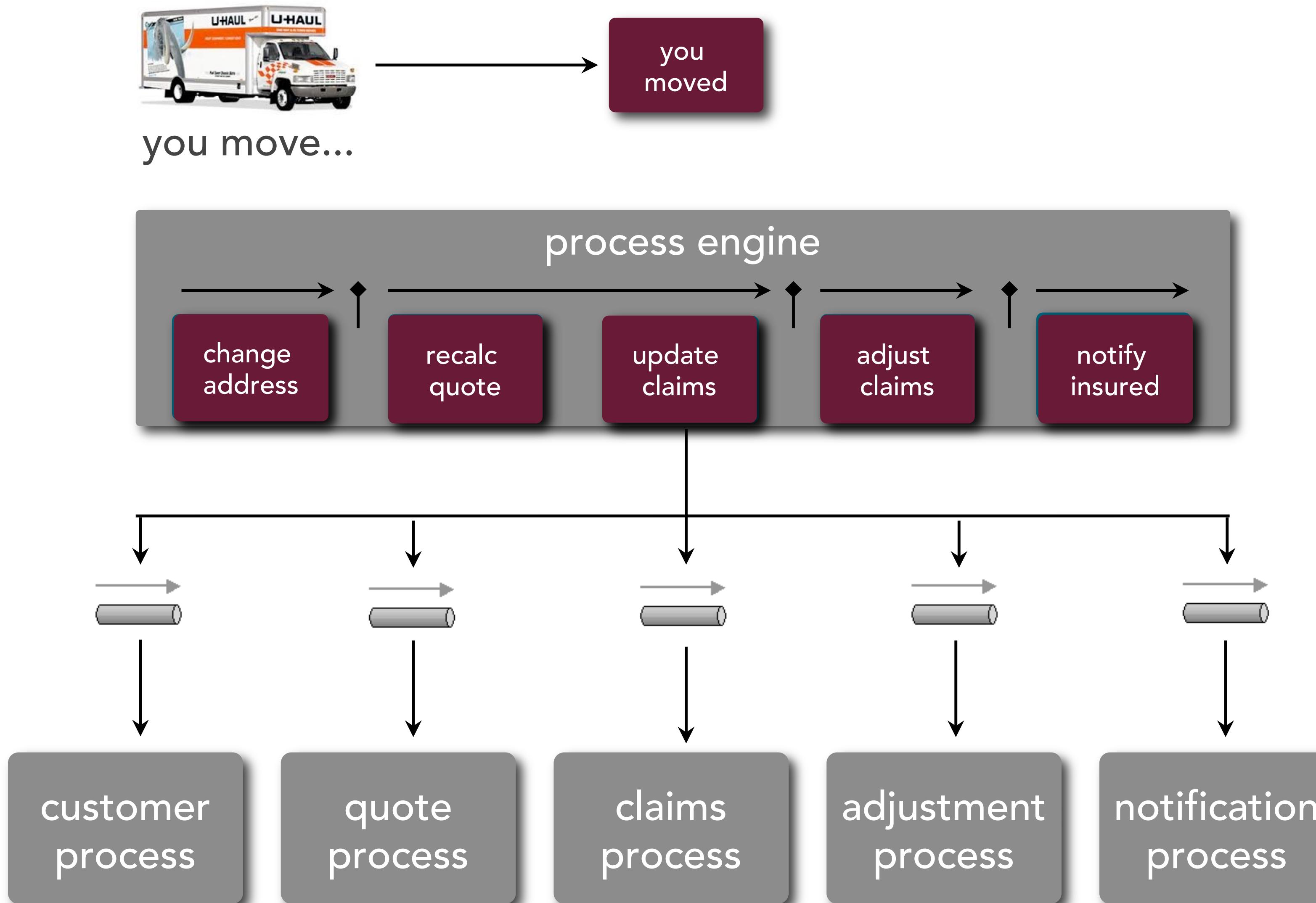
# Mediator EDA



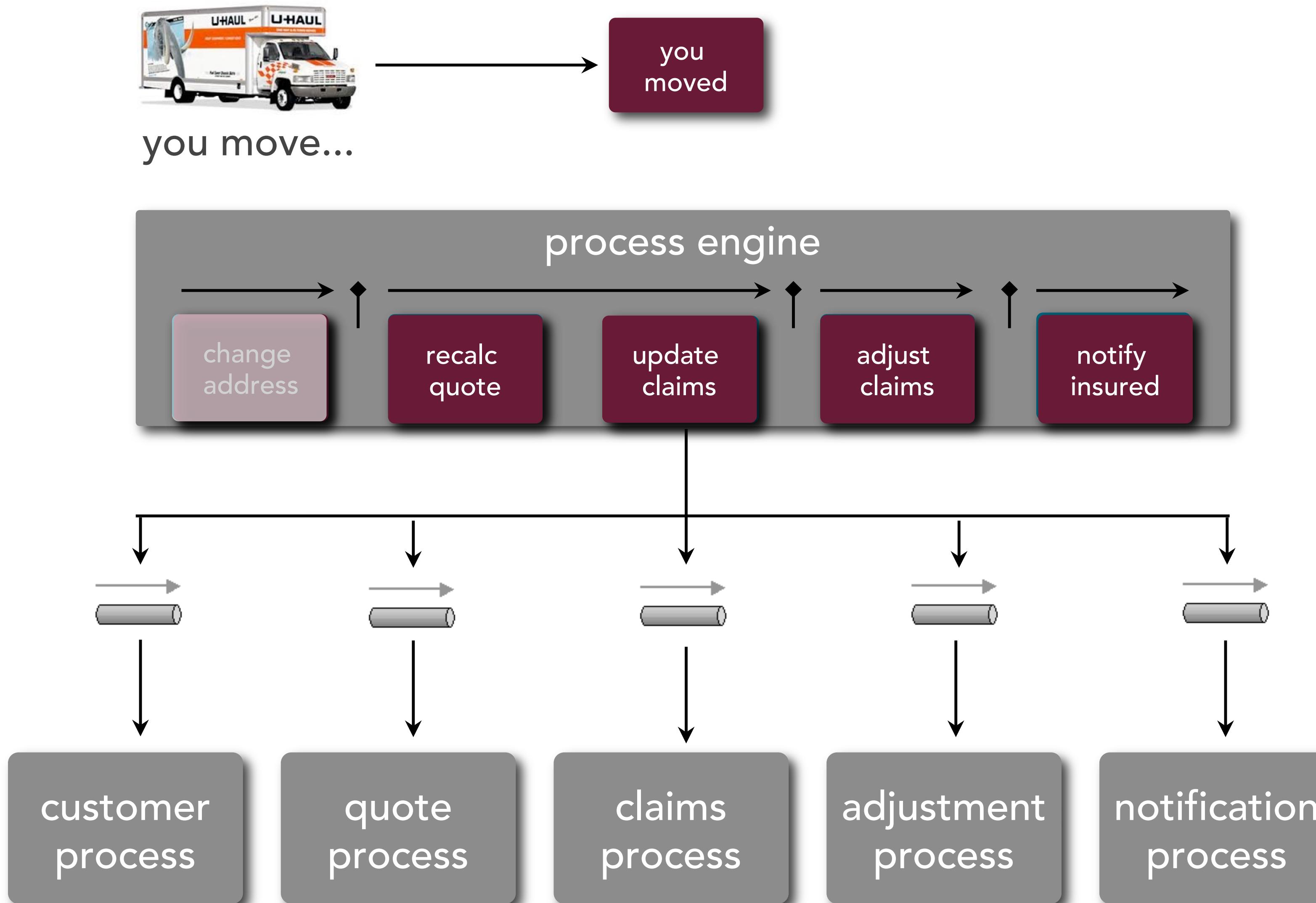
# Mediator EDA



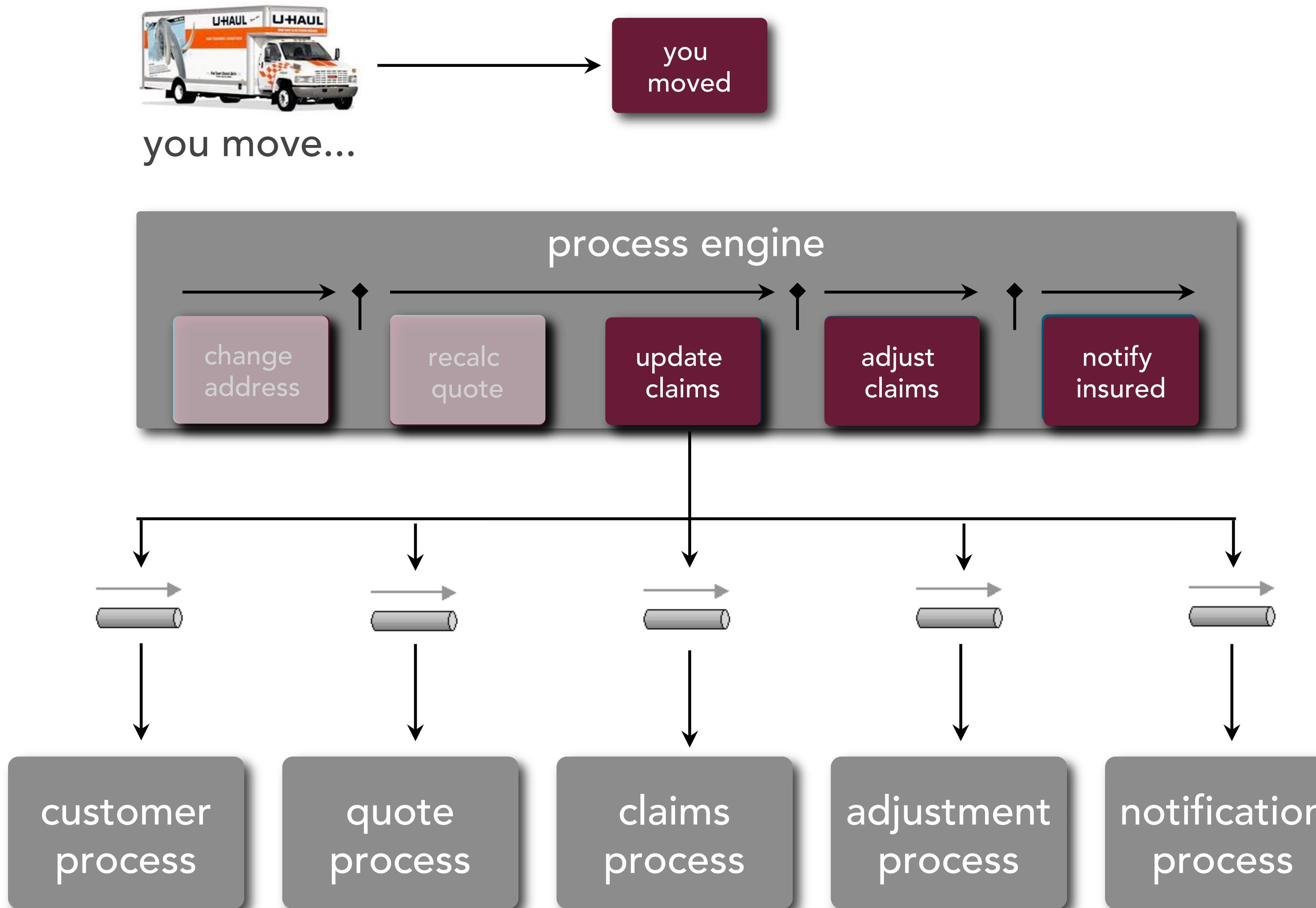
# Mediator Message Flow



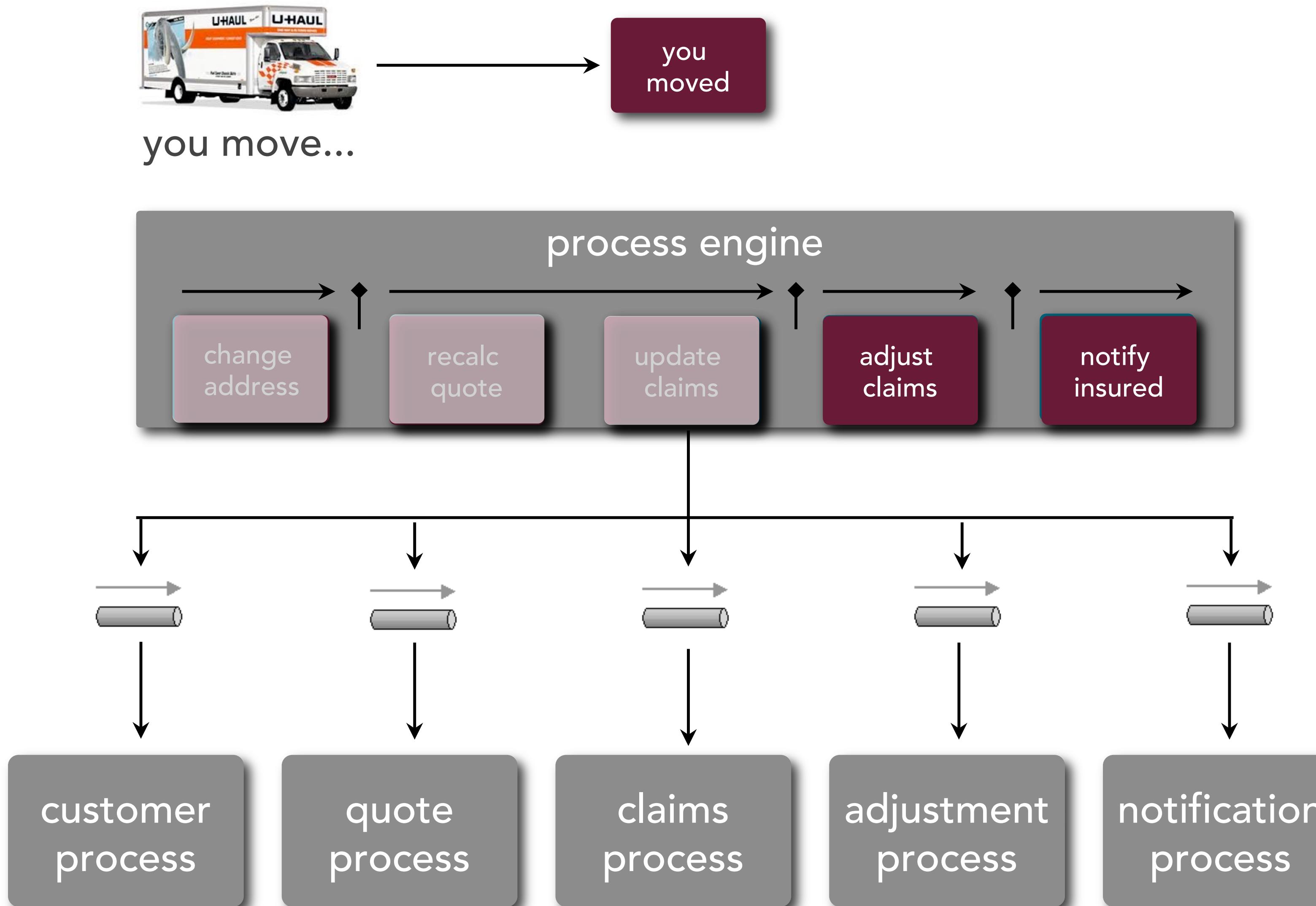
# Mediator Message Flow



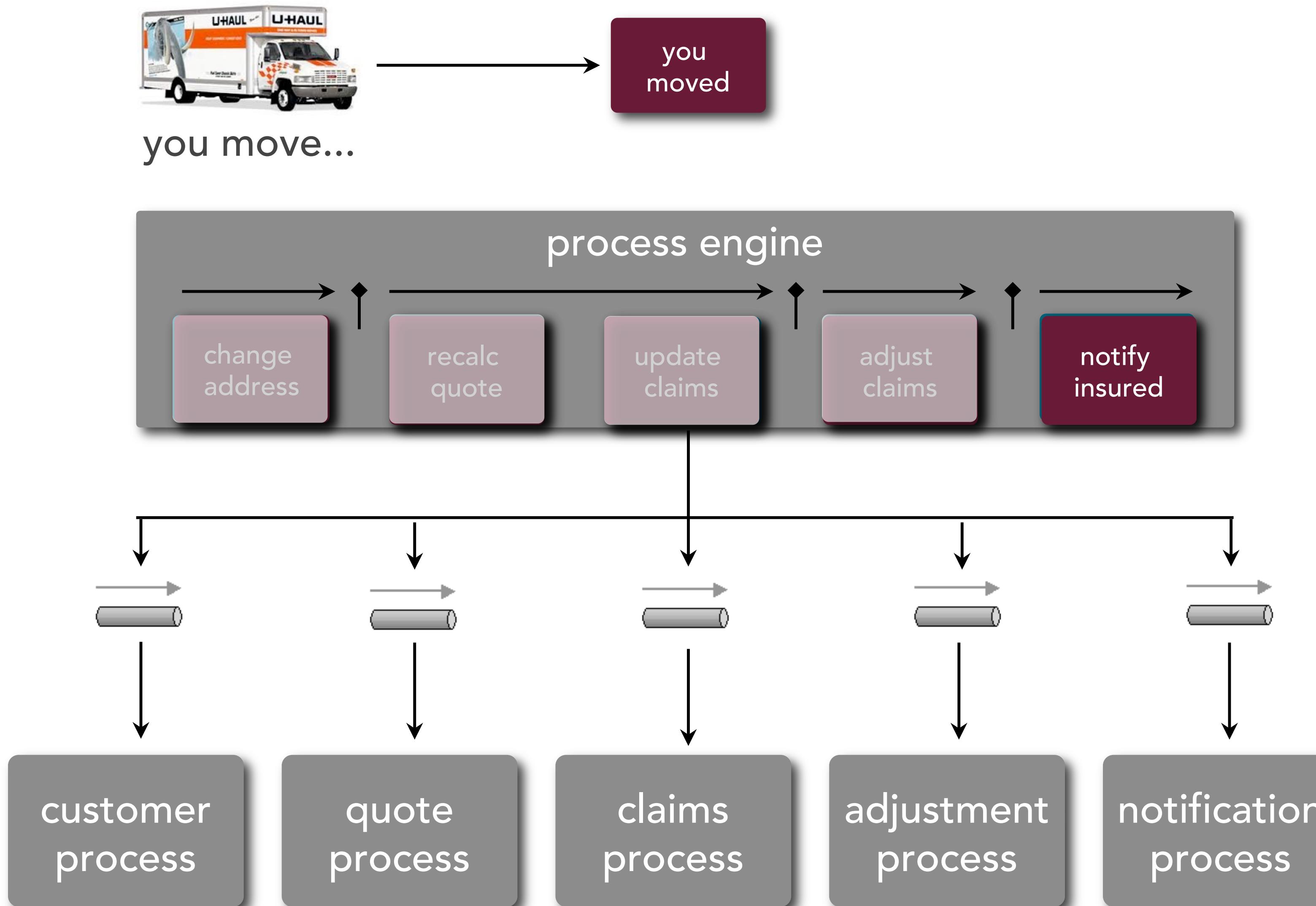
# Mediator Message Flow



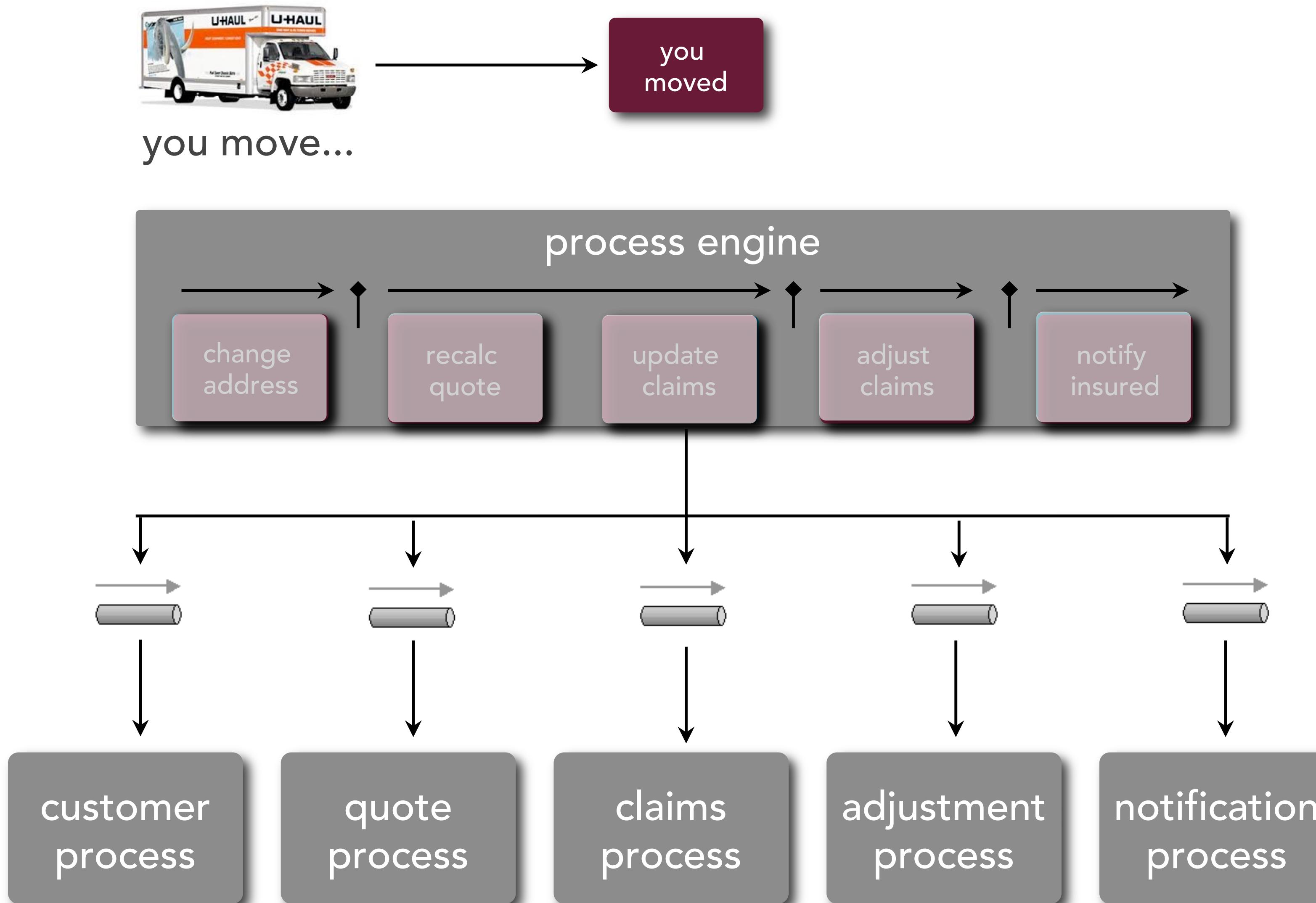
# Mediator Message Flow



# Mediator Message Flow



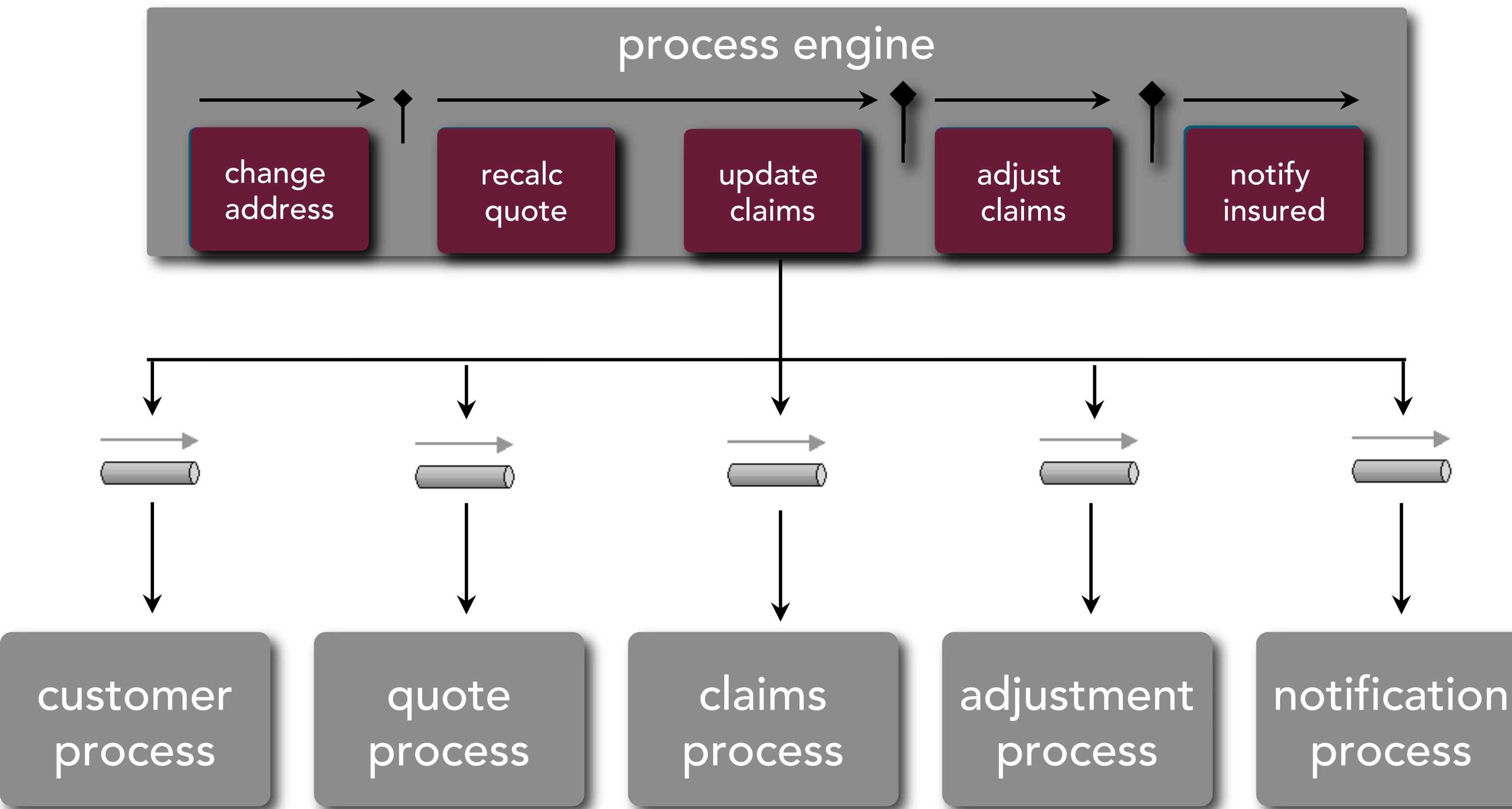
# Mediator Message Flow



# event-driven architecture



you move...



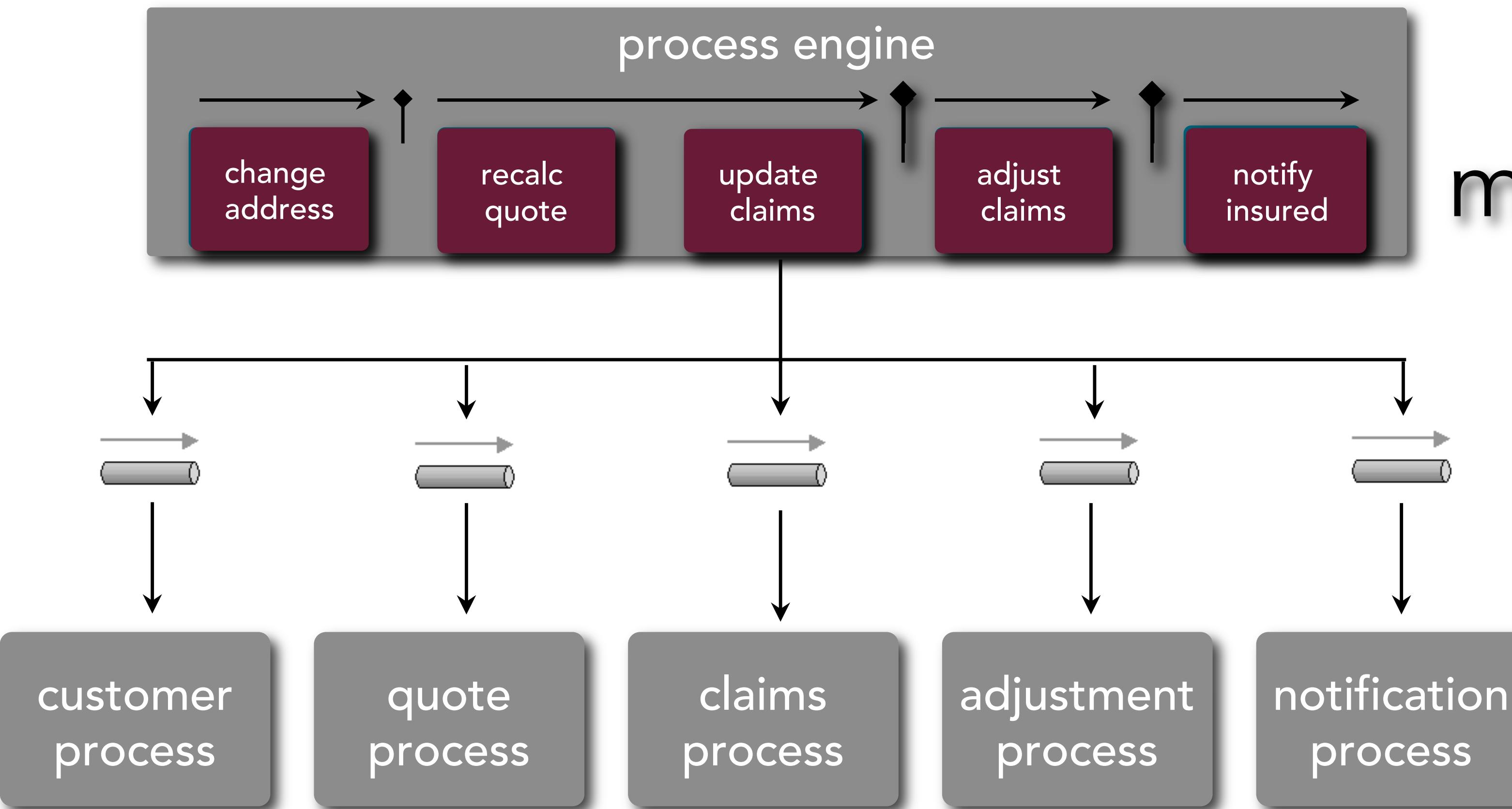
Error handling?

# event-driven architecture



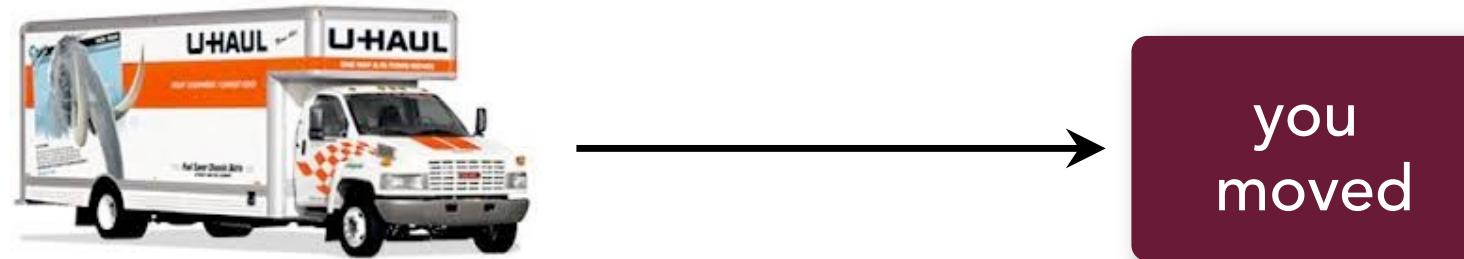
you move...

you  
moved

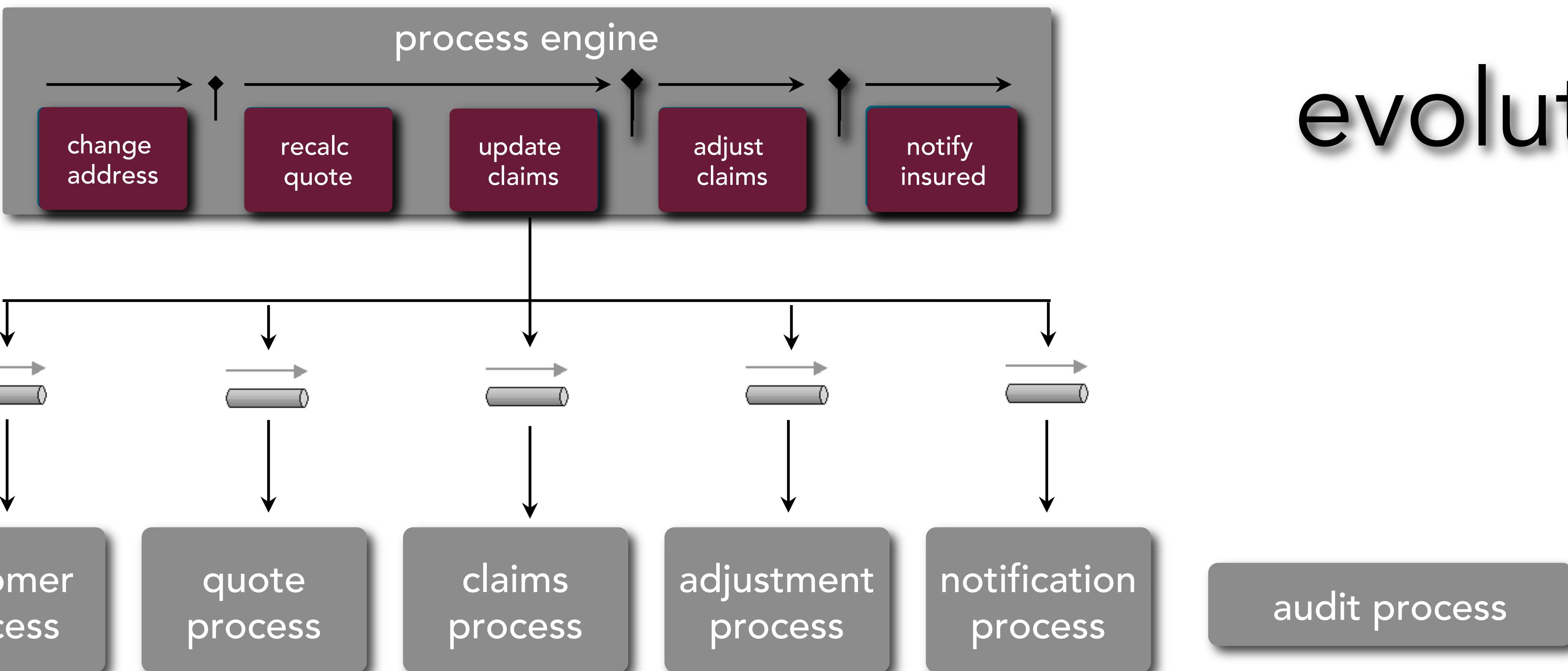


Unified notification  
message to customer?

# event-driven architecture



you move...

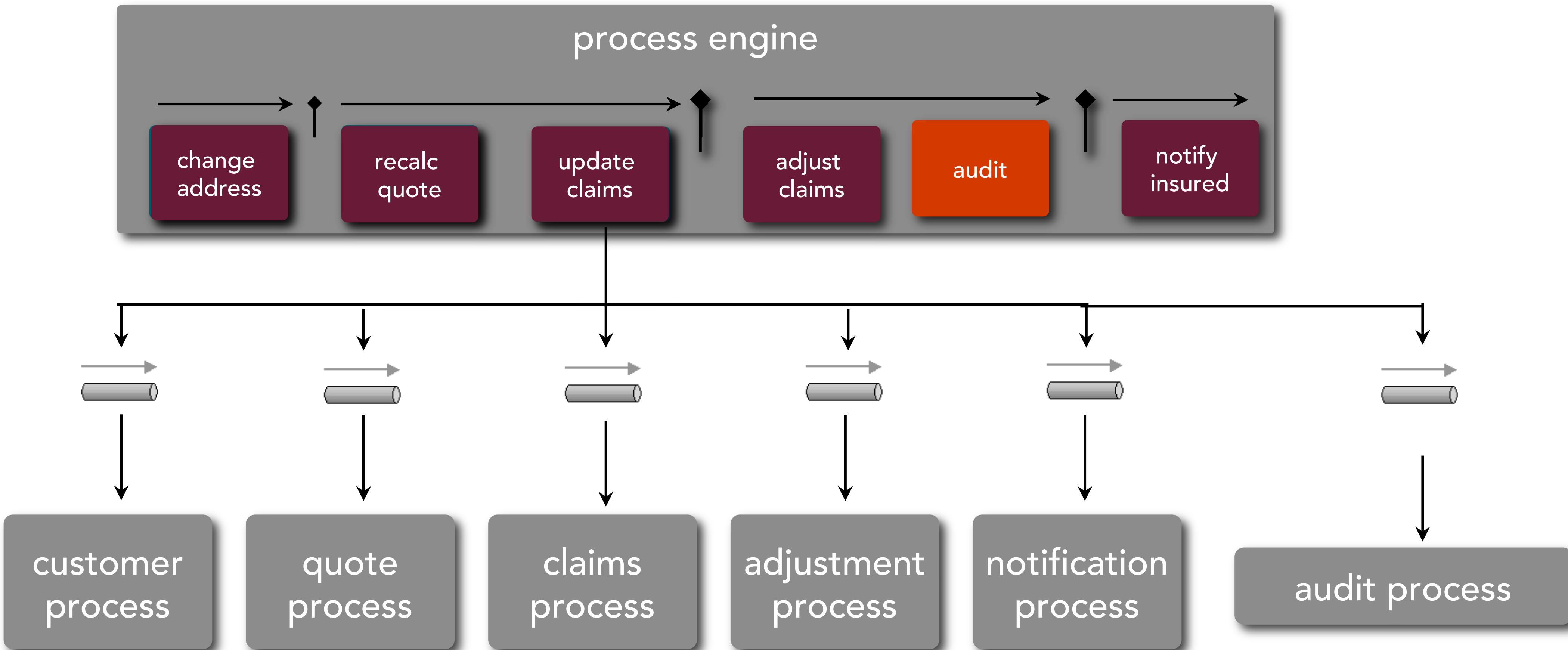


# event-driven architecture

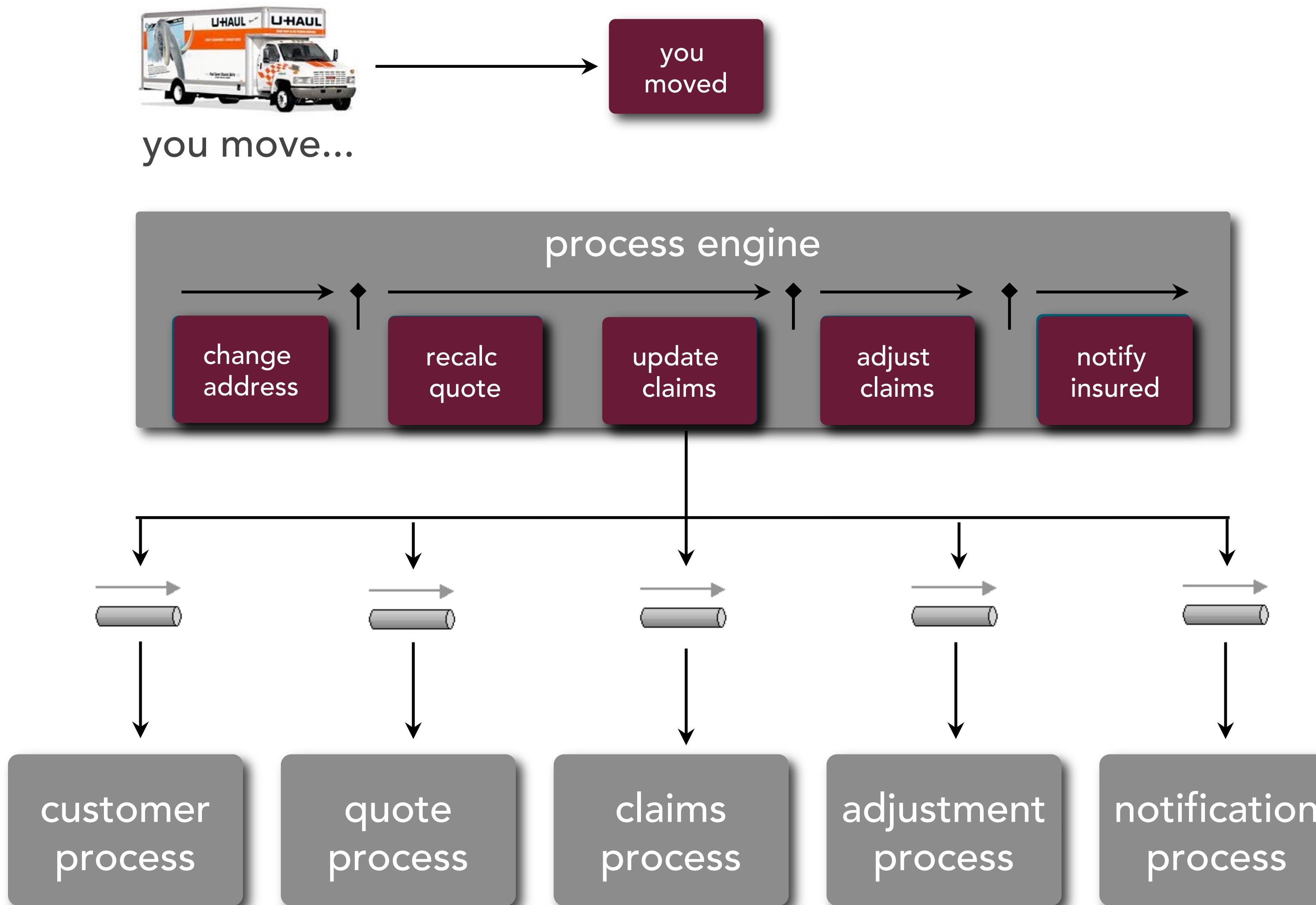
evolution



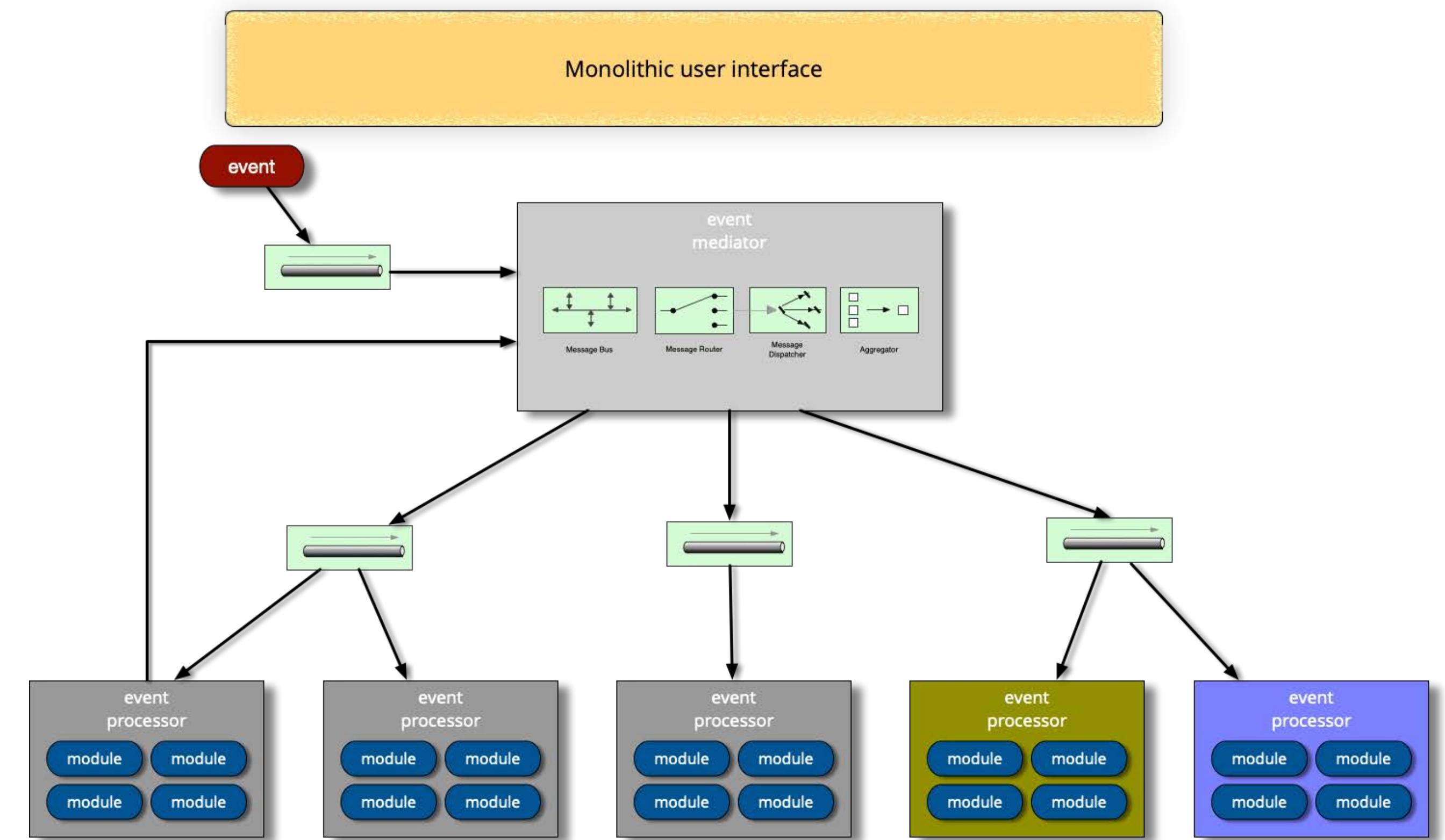
you move...



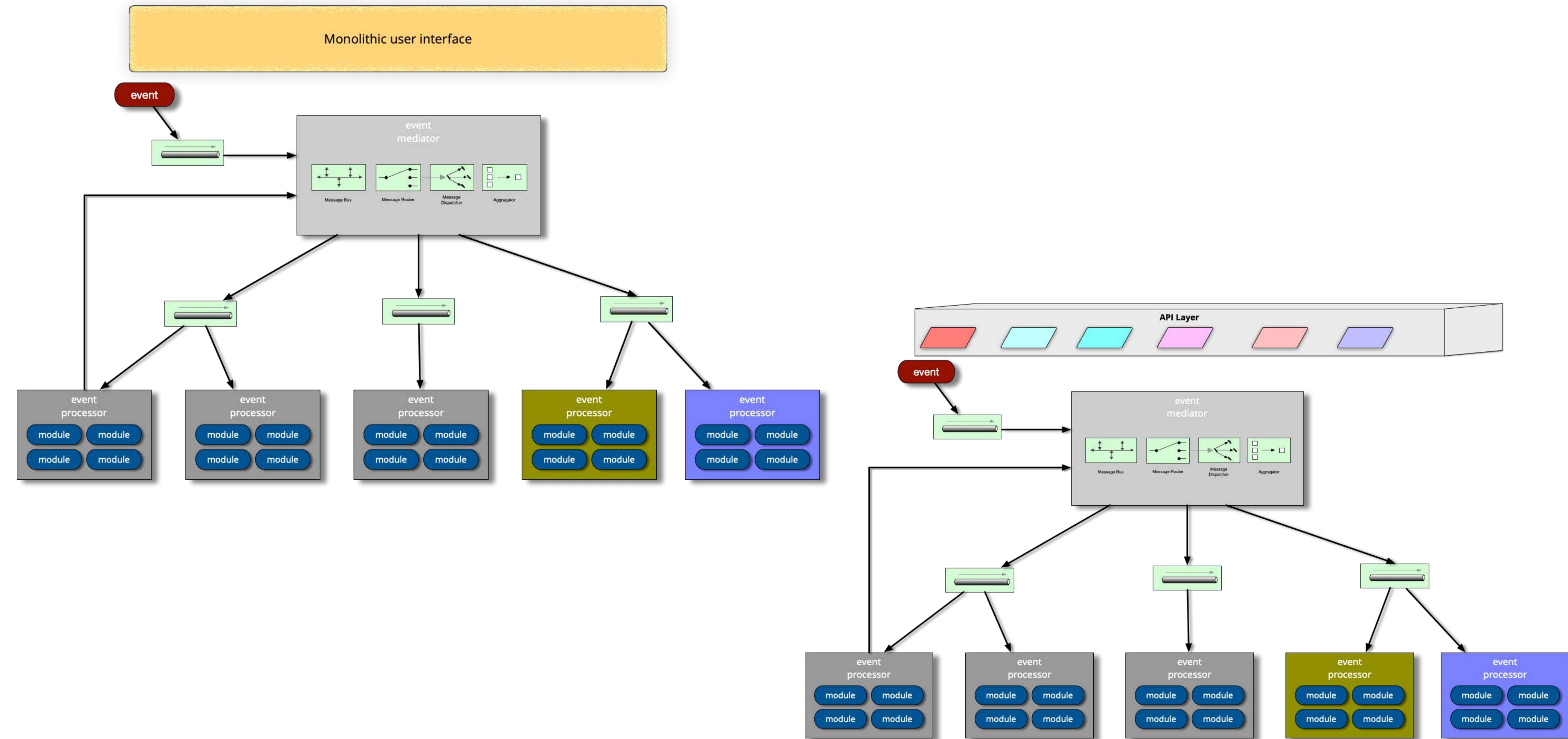
# Mediator: Orchestration



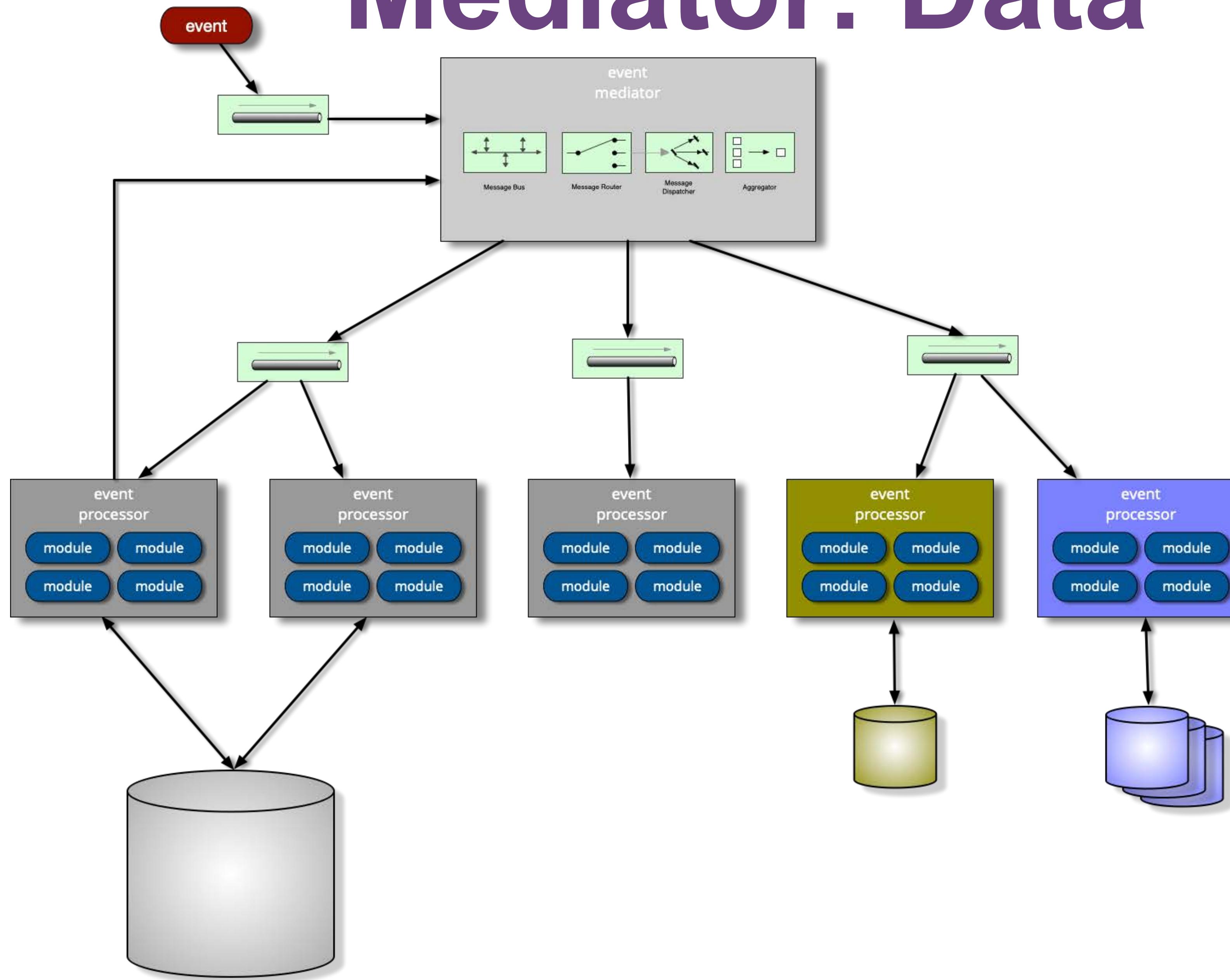
# Mediator: UI



# Mediator: UI

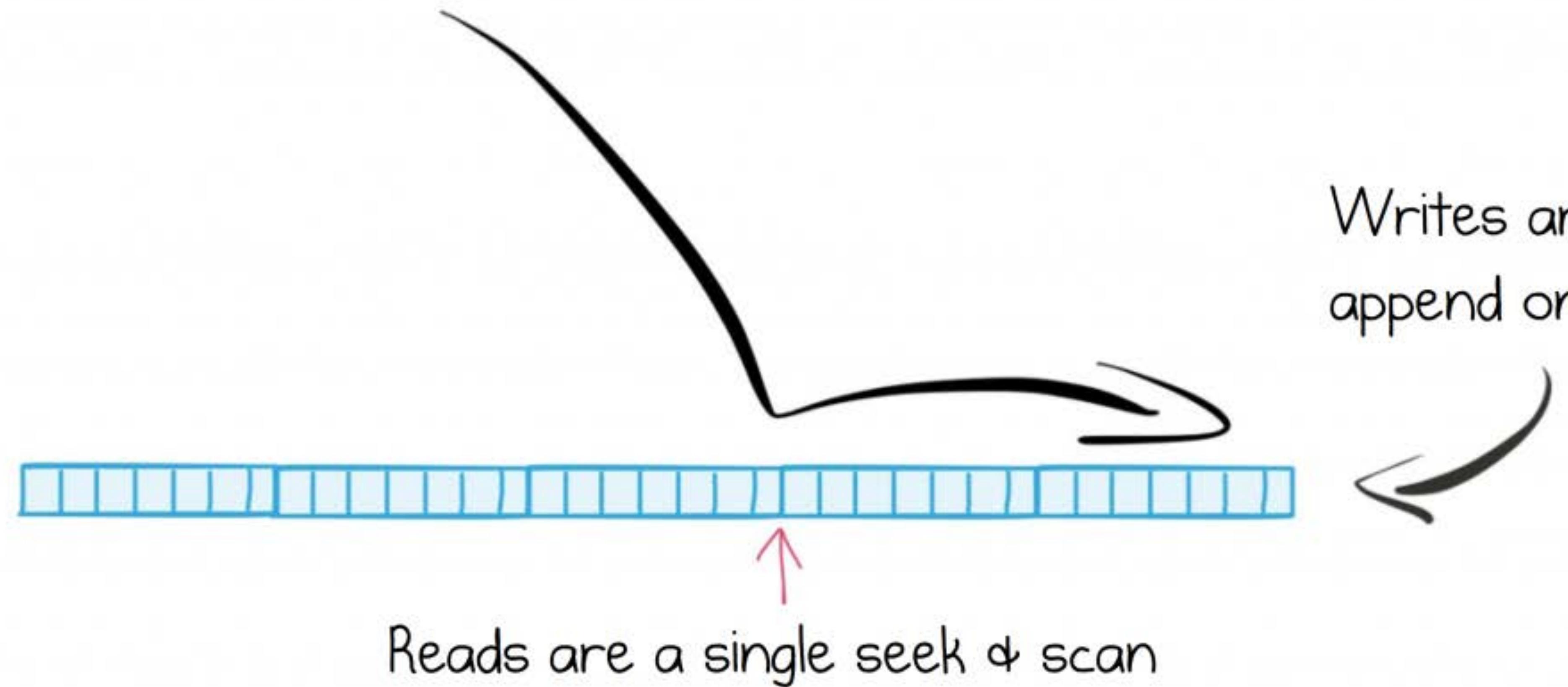


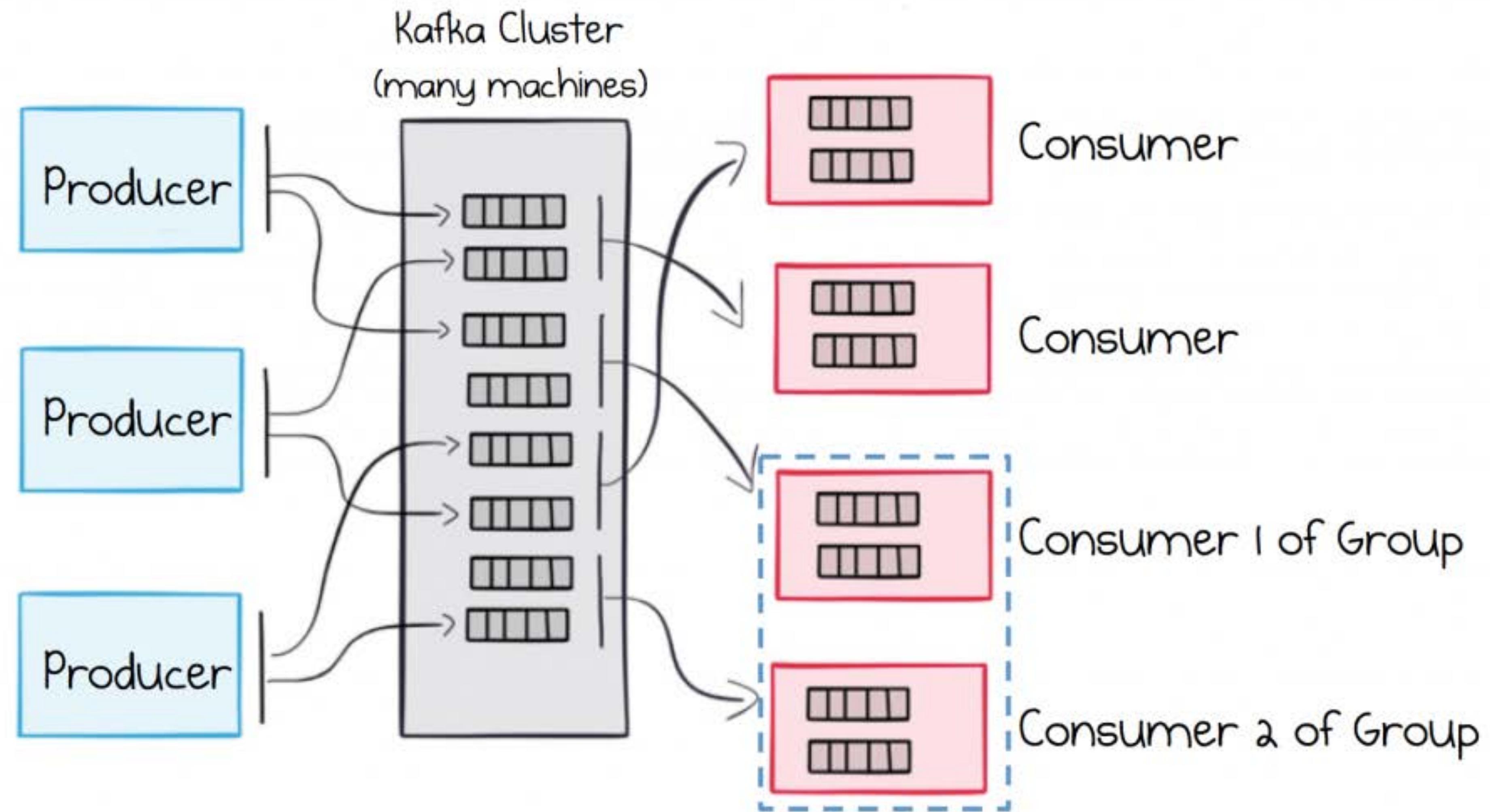
# Mediator: Data

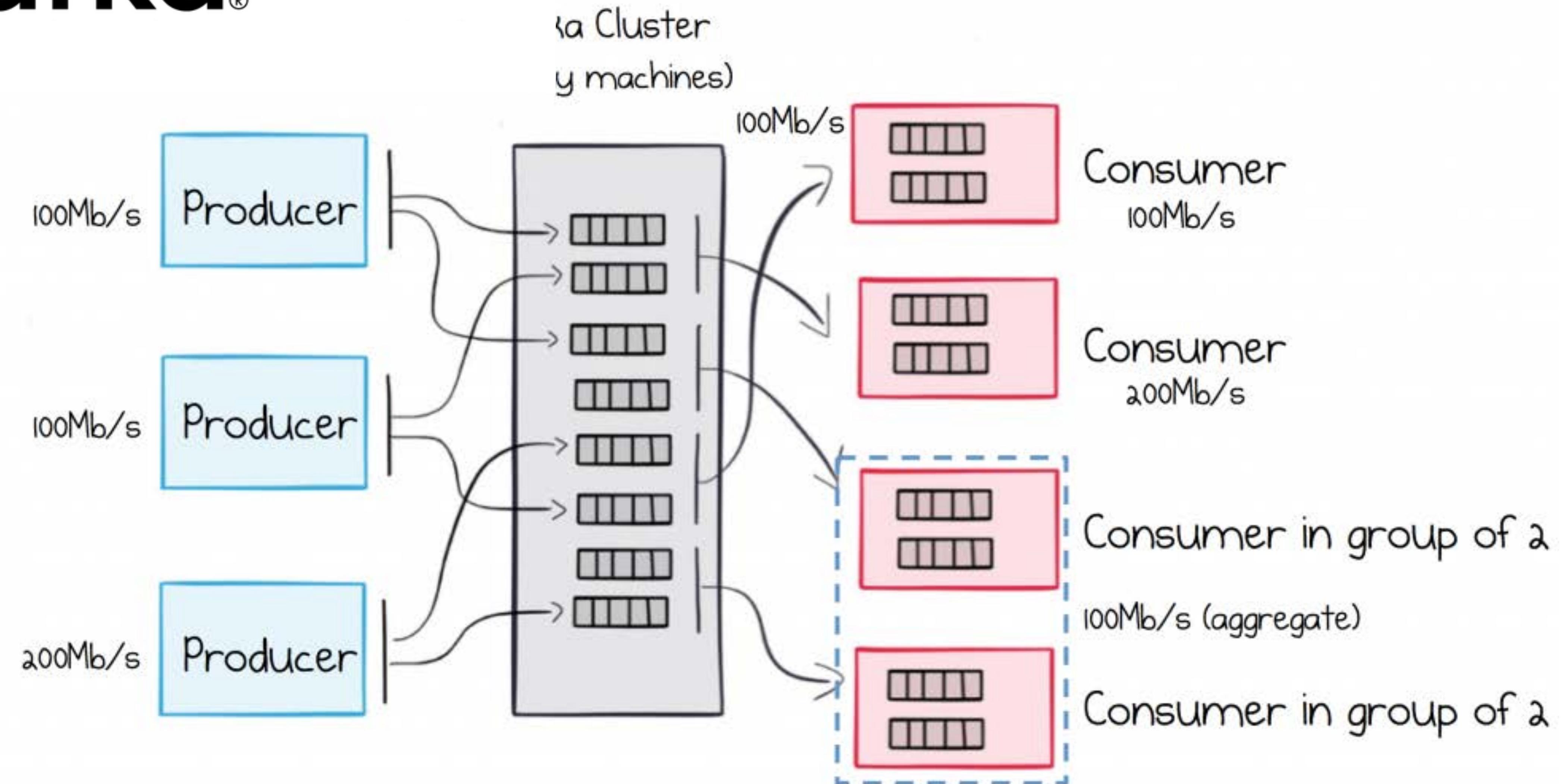


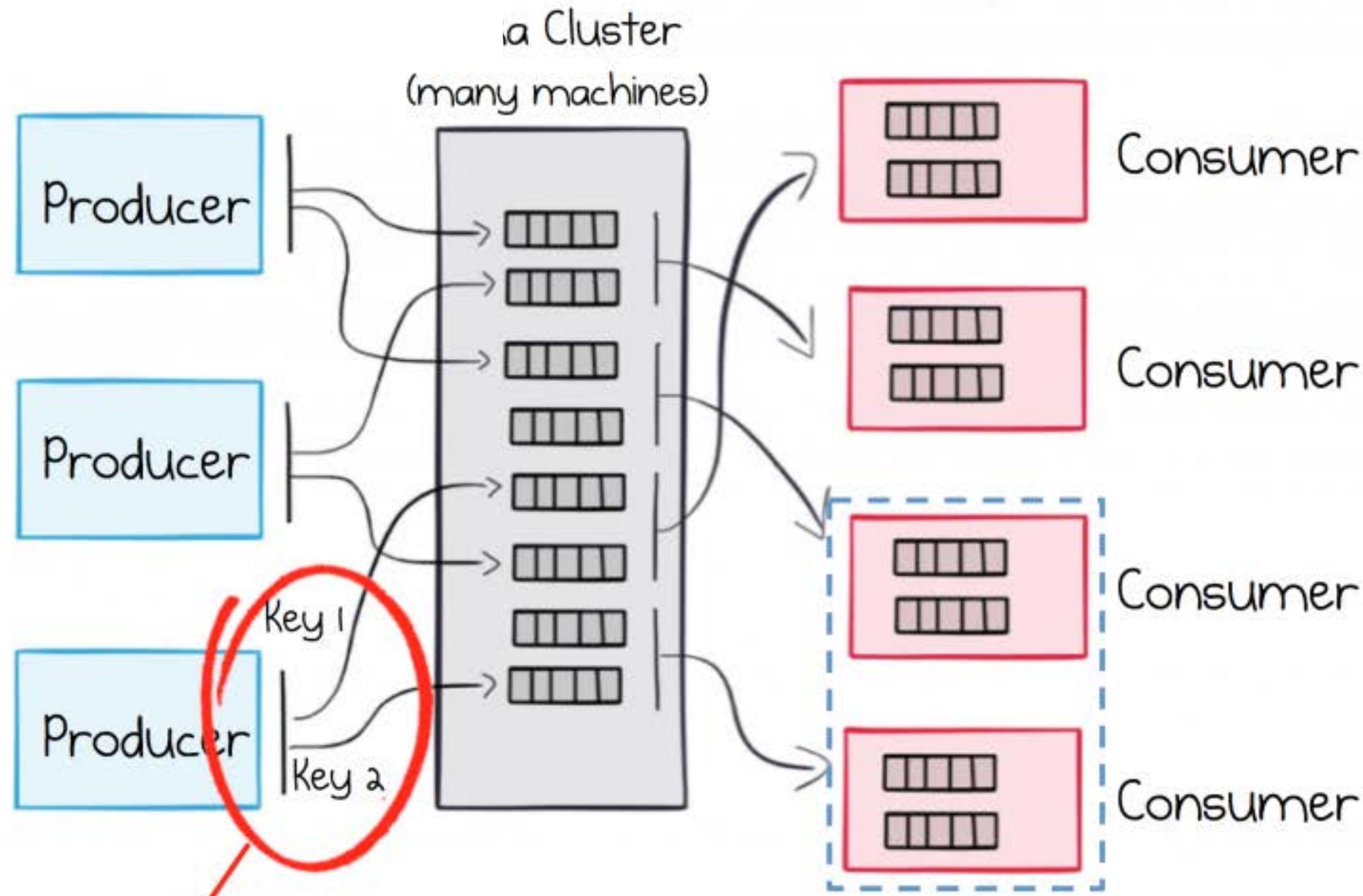


# Structured logs











A screenshot of a web browser window showing the header of martinfowler.com. The address bar at the top right shows the URL "martinfowler.com". The main header features the text "MARTIN FOWLER.COM" in white, with "MARTIN" in a smaller font above "FOWLER.COM". To the right of the header is a search bar with a magnifying glass icon and a three-line menu icon.

## Event Sourcing

*Capture all changes to an application state as a sequence of events.*

---



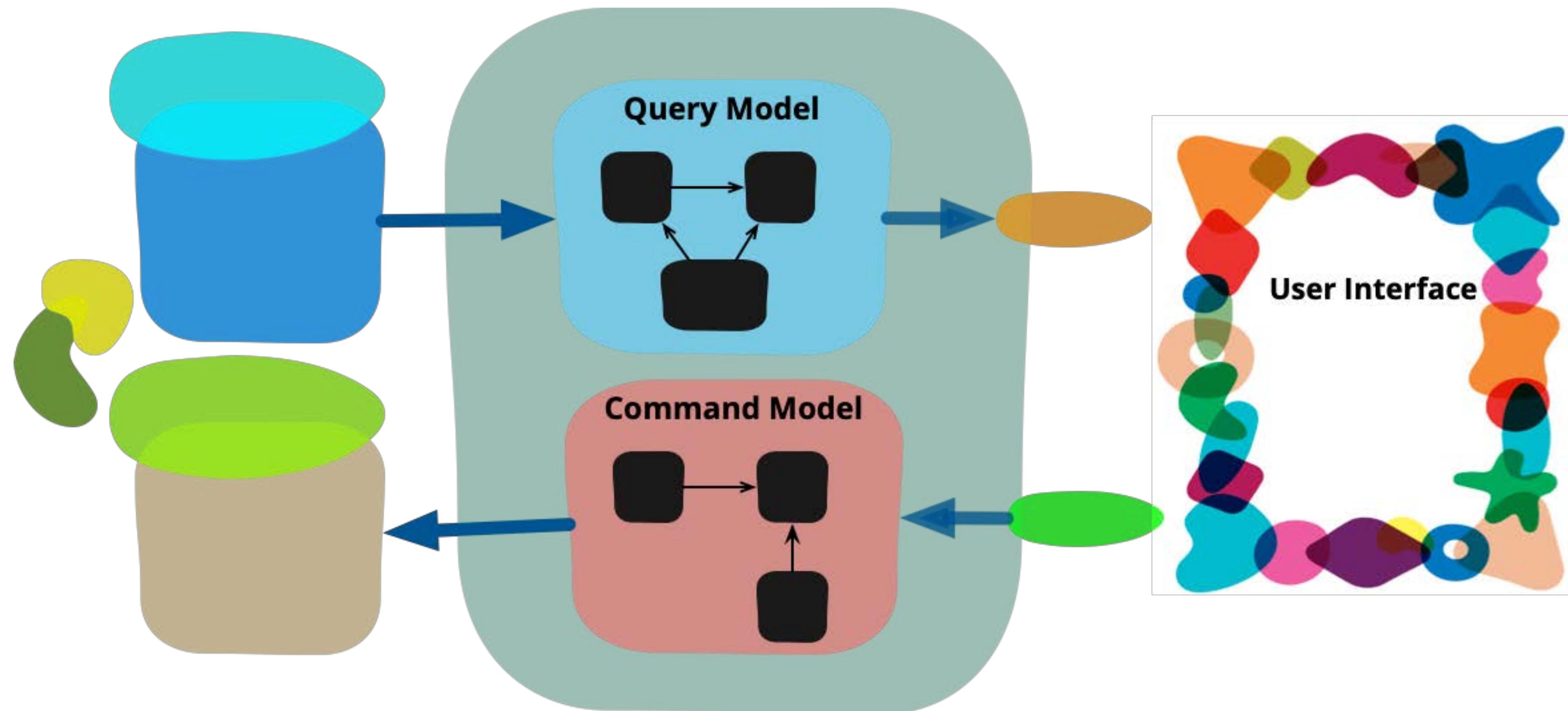
Martin Fowler

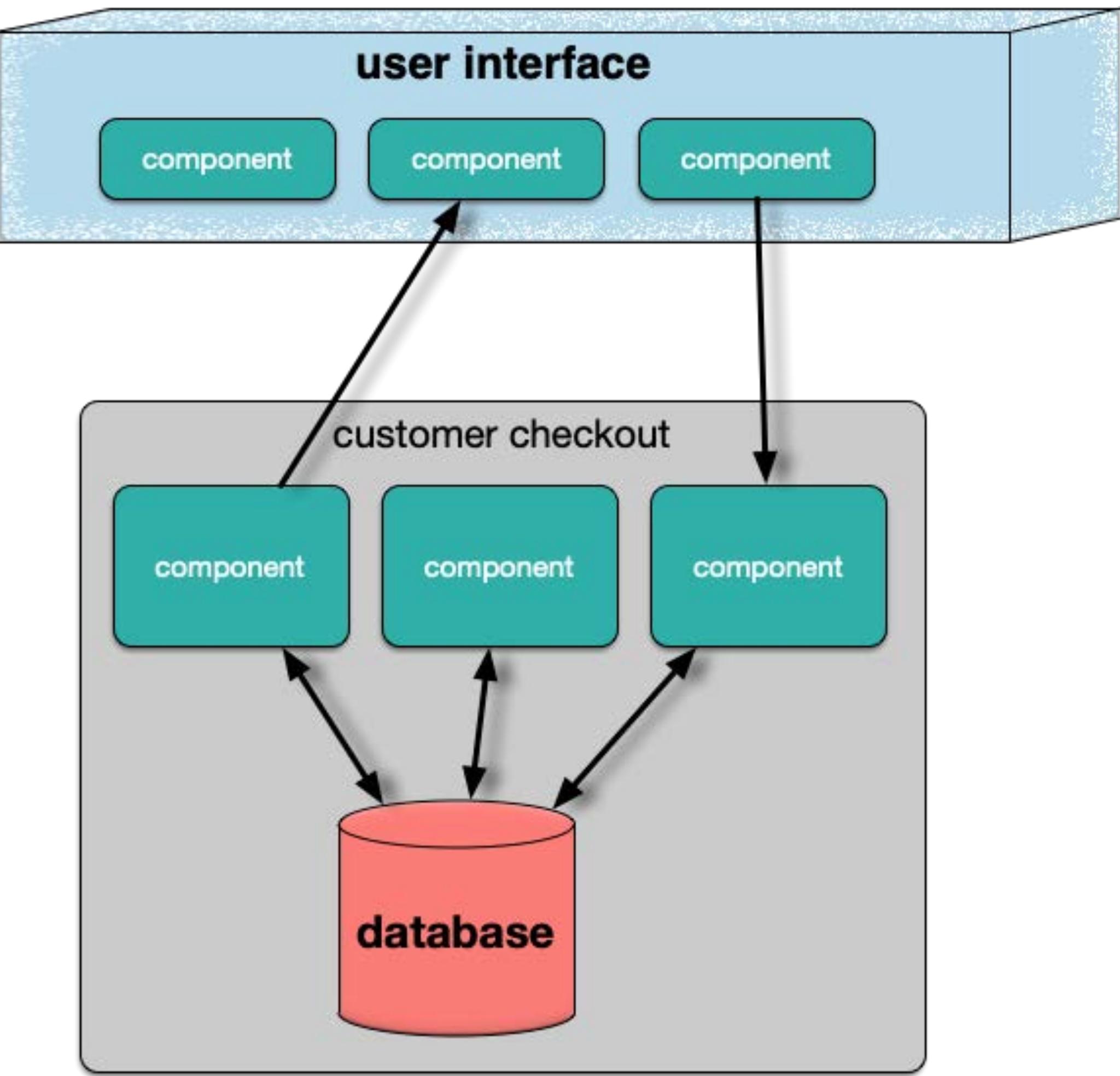
12 December 2005

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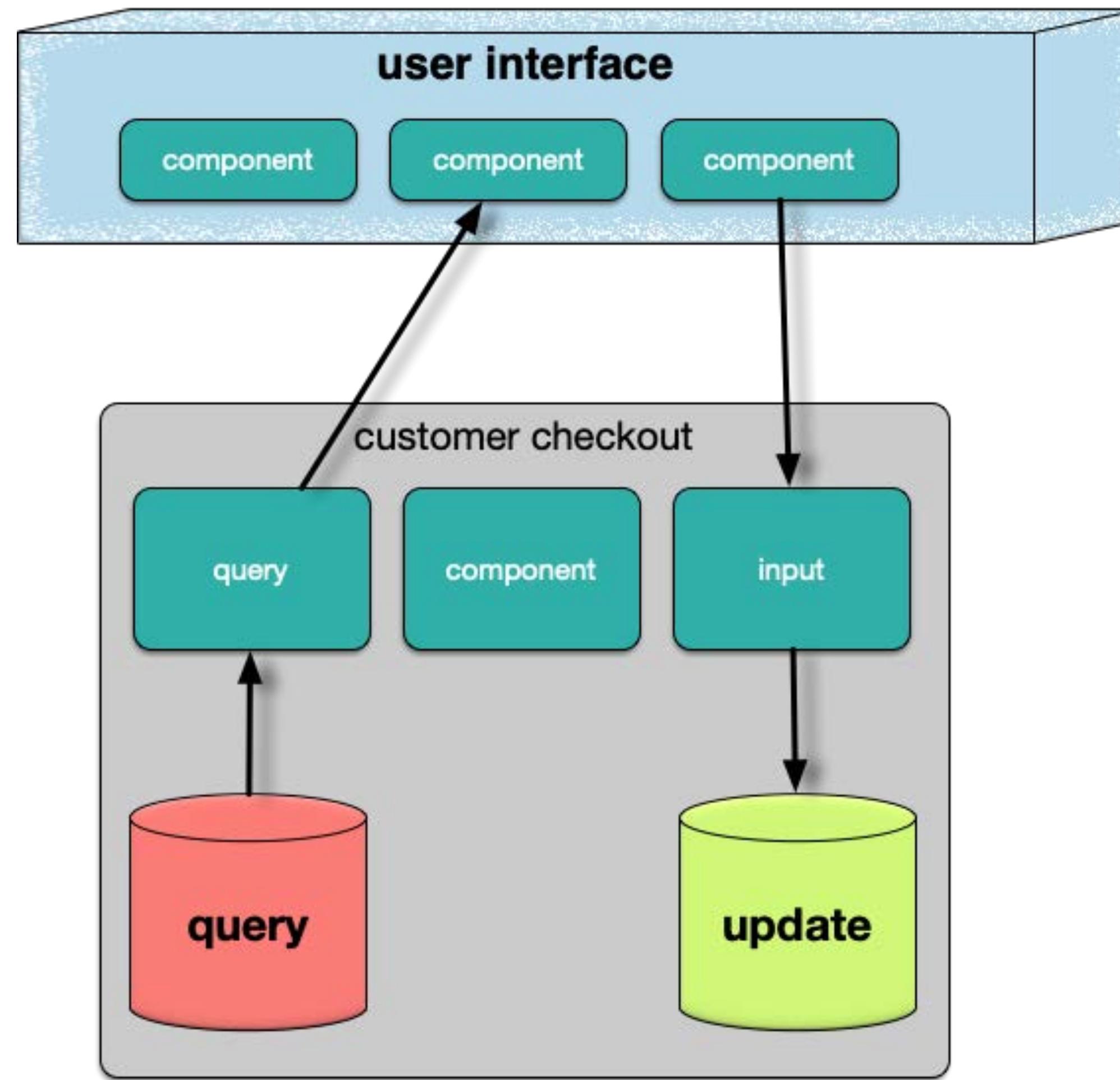
This is part of the [Further Enterprise Application Architecture development](#) writing that I was doing in the mid 2000's. Sadly too

# CQRS



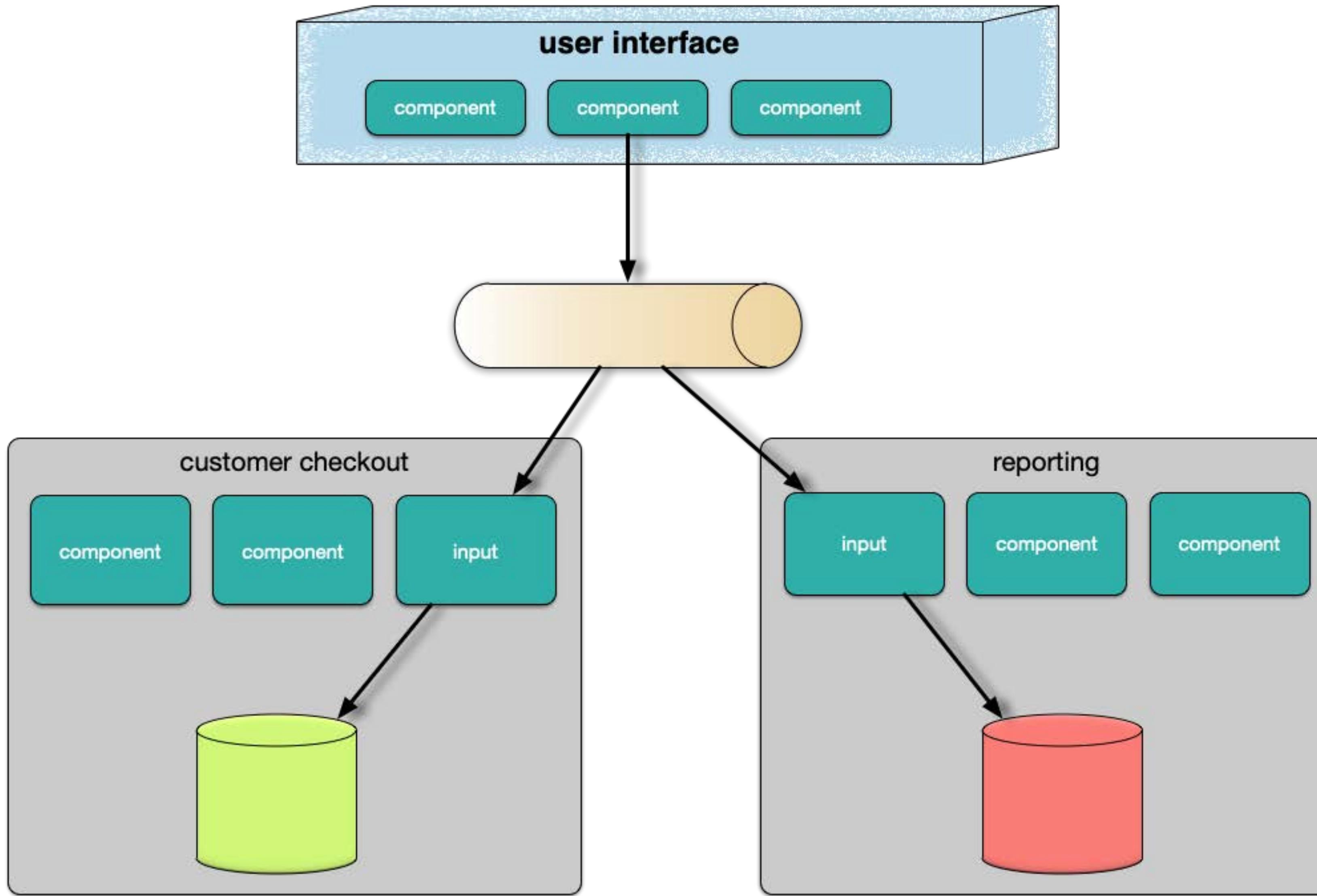


traditional



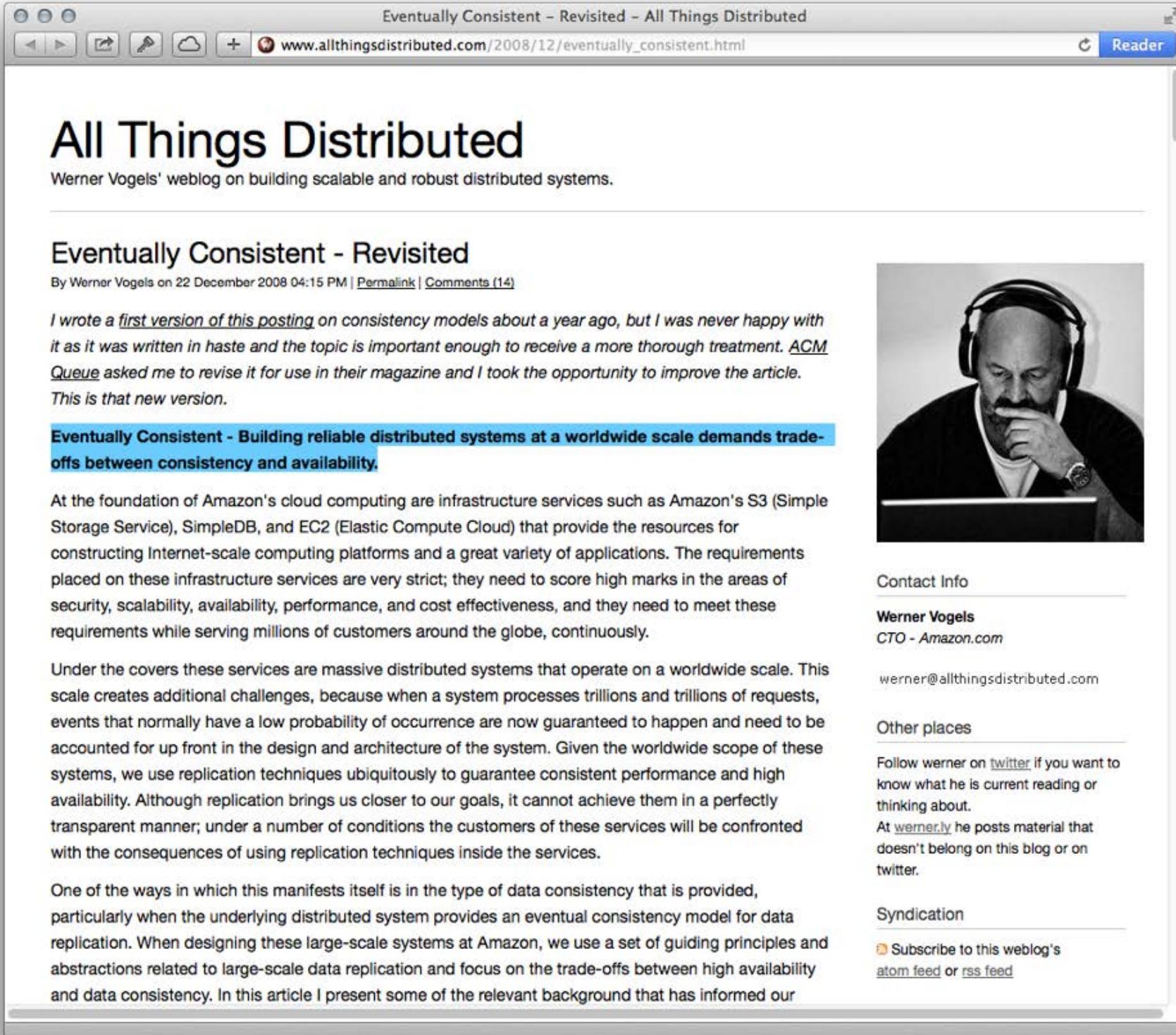
**CQRS**

Command Query Responsibility Separation



eventual consistency, events, & reports

# eventual consistency

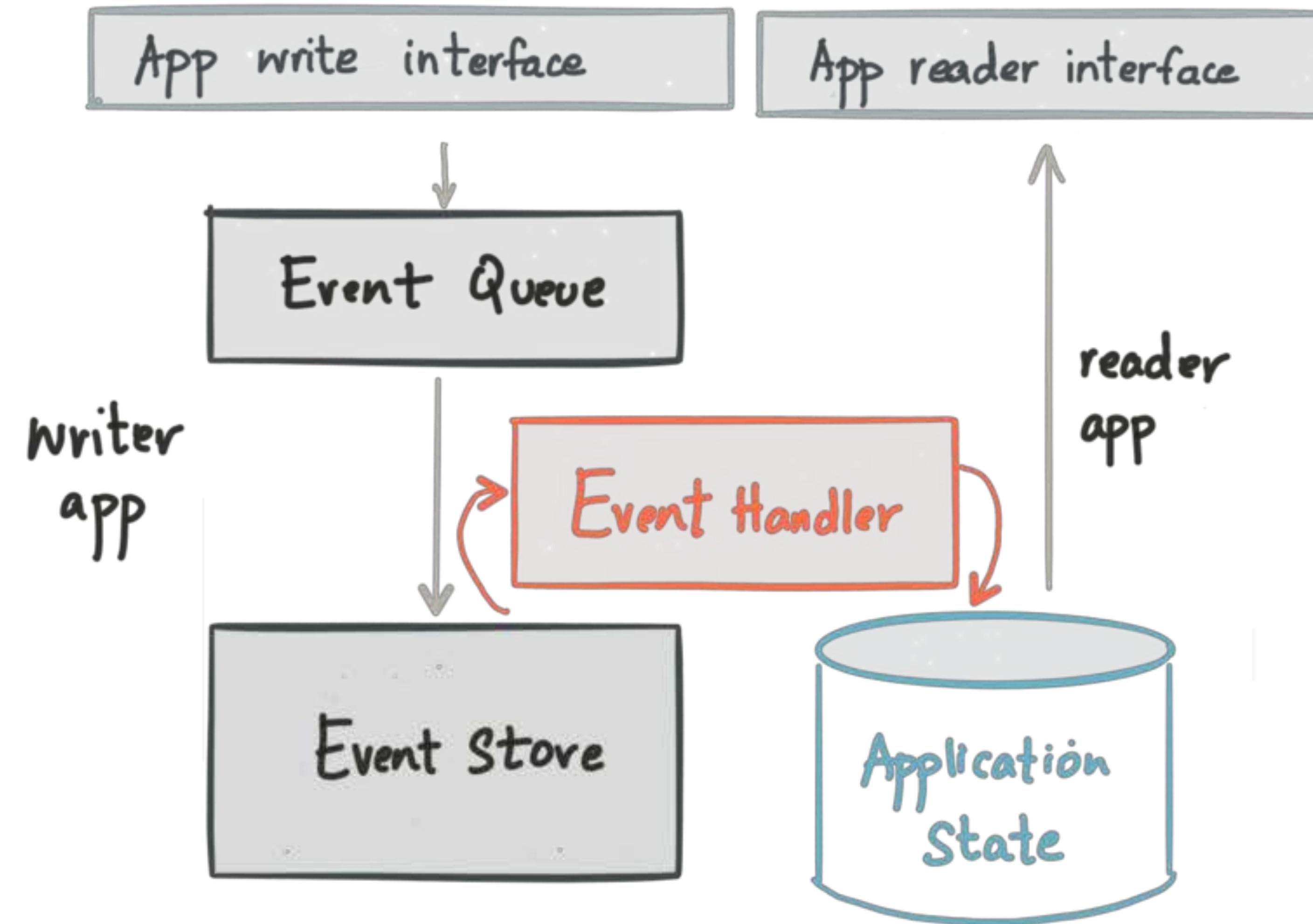


The screenshot shows a web browser window with the title "Eventually Consistent - Revisited - All Things Distributed". The page content includes a header "All Things Distributed" and a sub-header "Werner Vogels' weblog on building scalable and robust distributed systems.". Below this is the main article titled "Eventually Consistent - Revisited", dated December 22, 2008, 04:15 PM. The article discusses the revision of a previous post on consistency models. It features a black and white photo of Werner Vogels wearing headphones and looking down at a laptop. To the right of the article is a sidebar with "Contact Info" (Werner Vogels, CTO - Amazon.com, email: werner@allthingsdistributed.com), "Other places" (links to Twitter and another blog), and "Syndication" (links to Atom and RSS feeds).

“Building reliable distributed systems at a worldwide scale demands trade-offs between consistency and availability.”

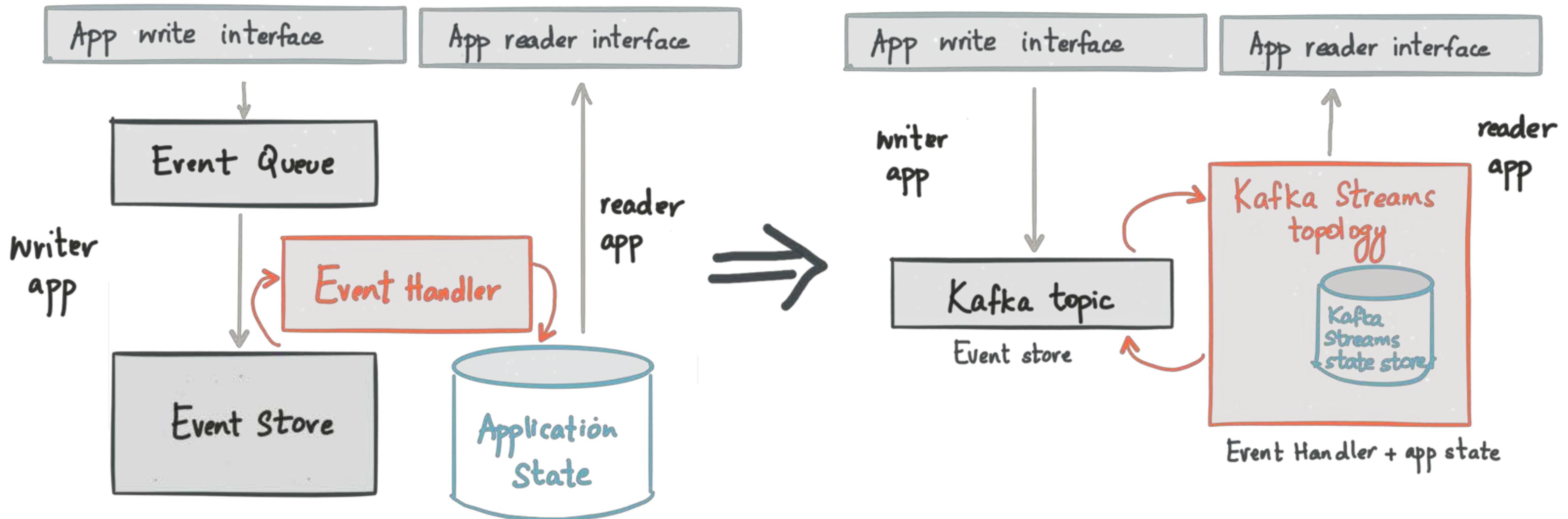
[http://www.allthingsdistributed.com/2008/12/eventually\\_consistent.html](http://www.allthingsdistributed.com/2008/12/eventually_consistent.html)

# CQRS





# CQRS





# Mediator or Broker?

business services

BS

BS

BS

BS

BS

BS

message bus

# sERViCe-oRIEnTEd ArchiTecTuRe

enterprise services

ES

ES

ES

ES

ES

ES

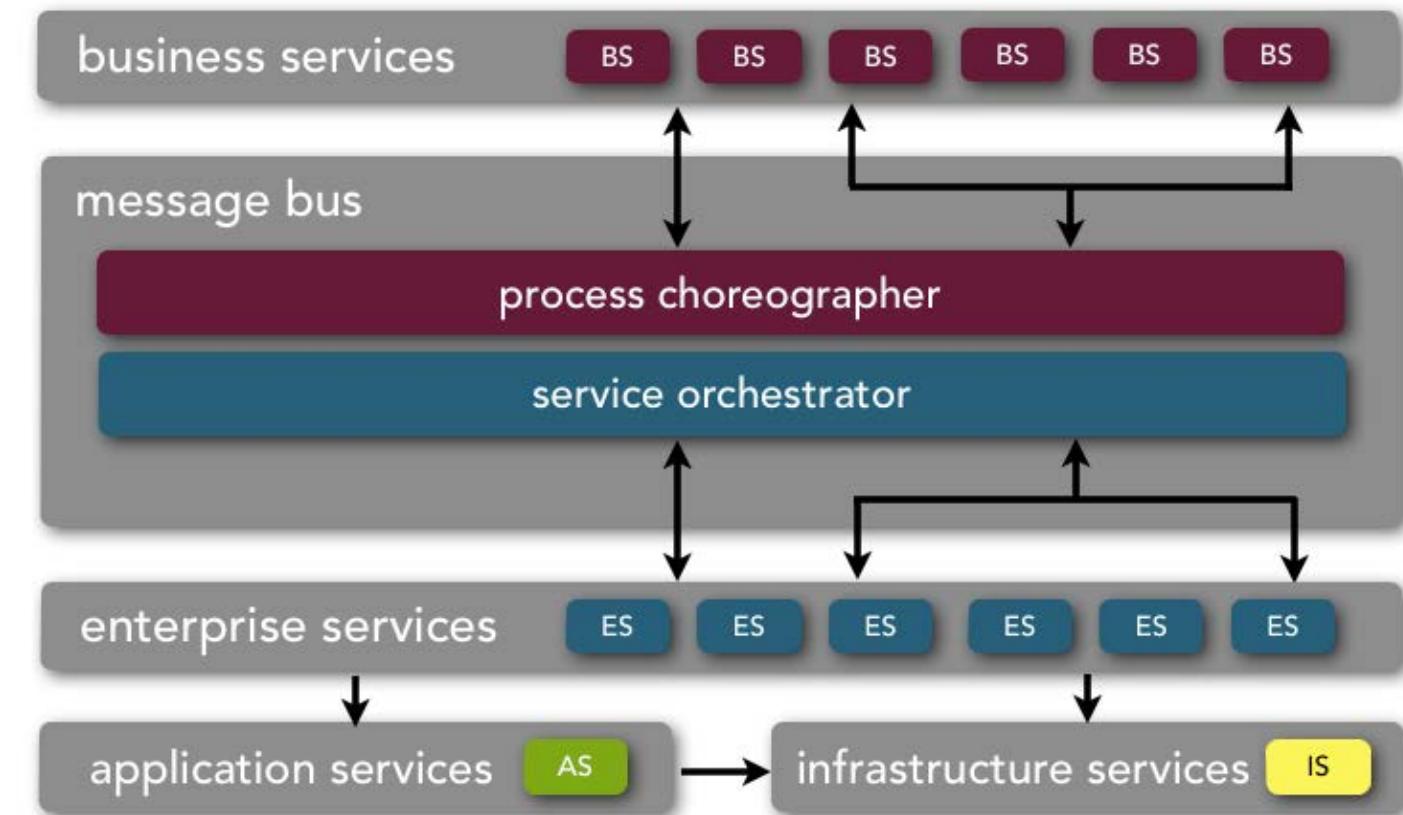
application services

AS

infrastructure services

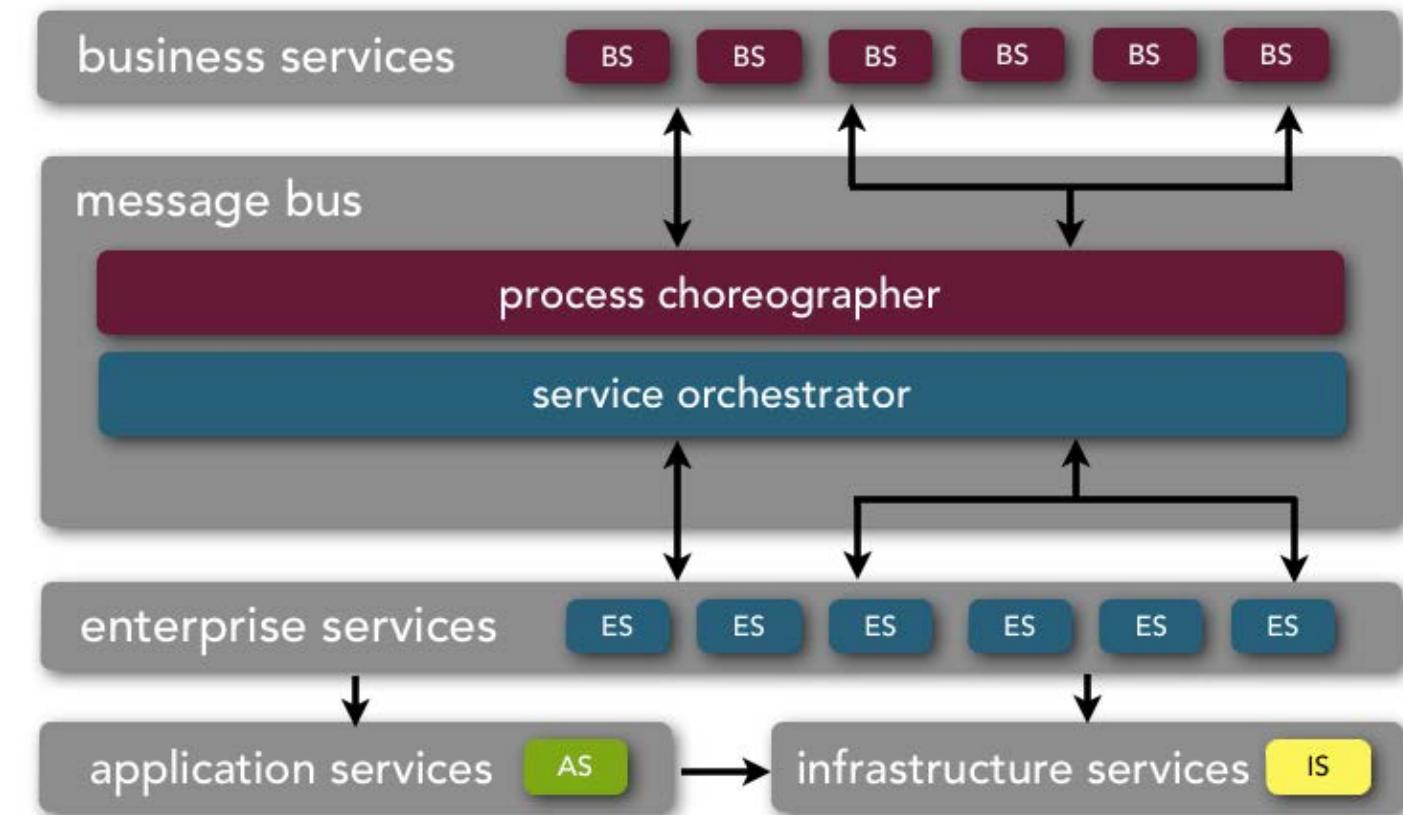
IS

# service-oriented architecture



abstraction

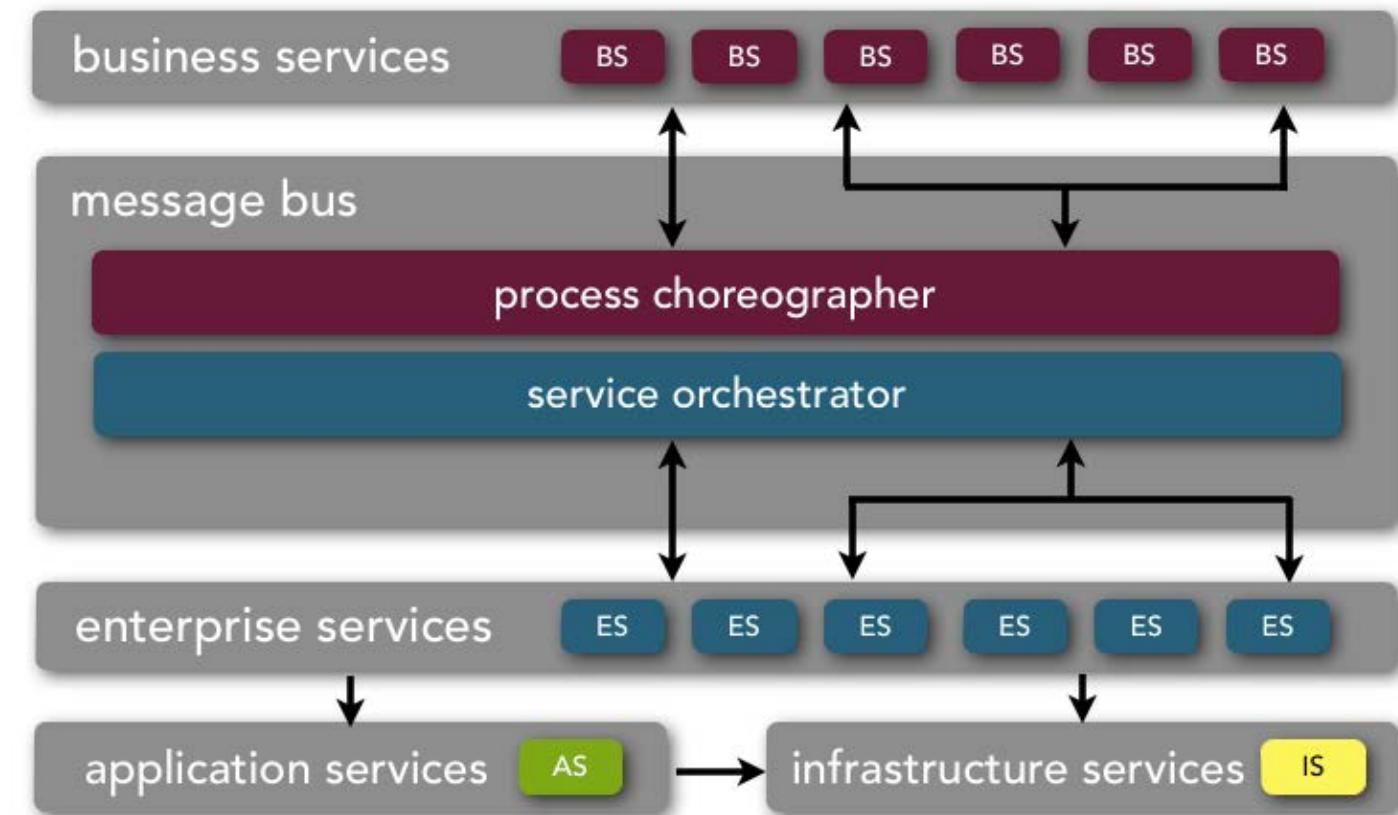
# service-oriented architecture



abstraction

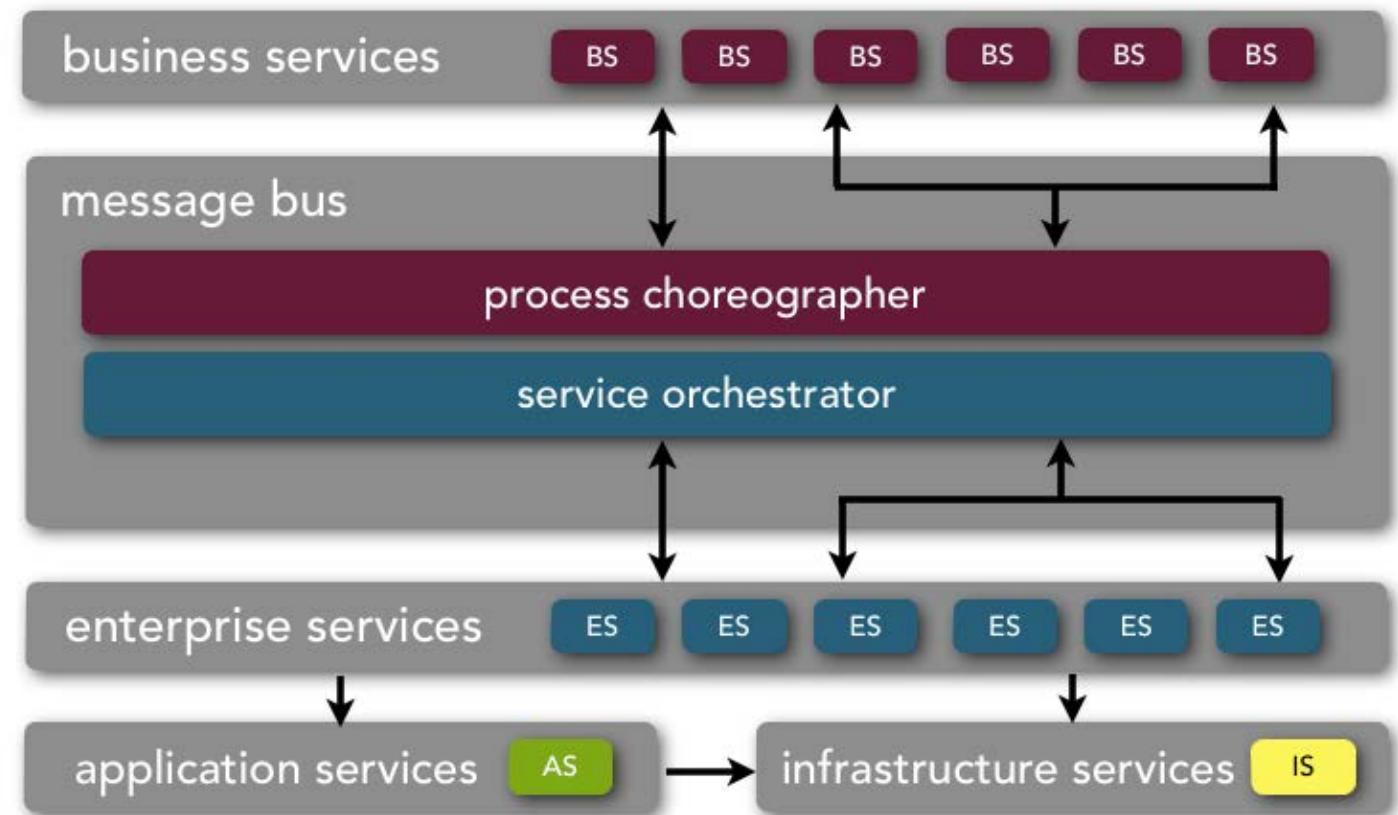
service taxonomy

# service-oriented architecture



abstraction  
service taxonomy  
shared resources

# service-oriented architecture



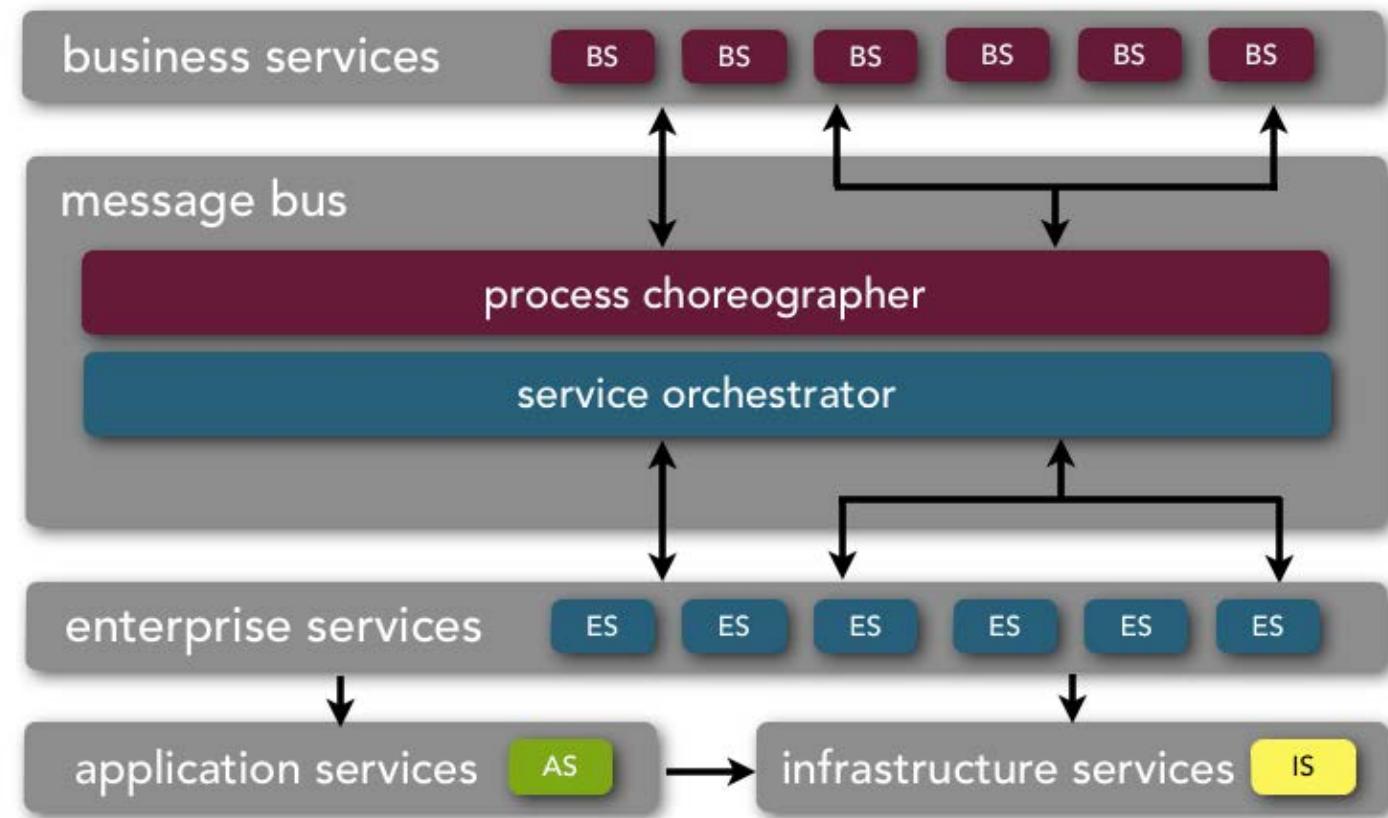
abstraction

service taxonomy

shared resources

middleware

# service-oriented architecture



abstraction

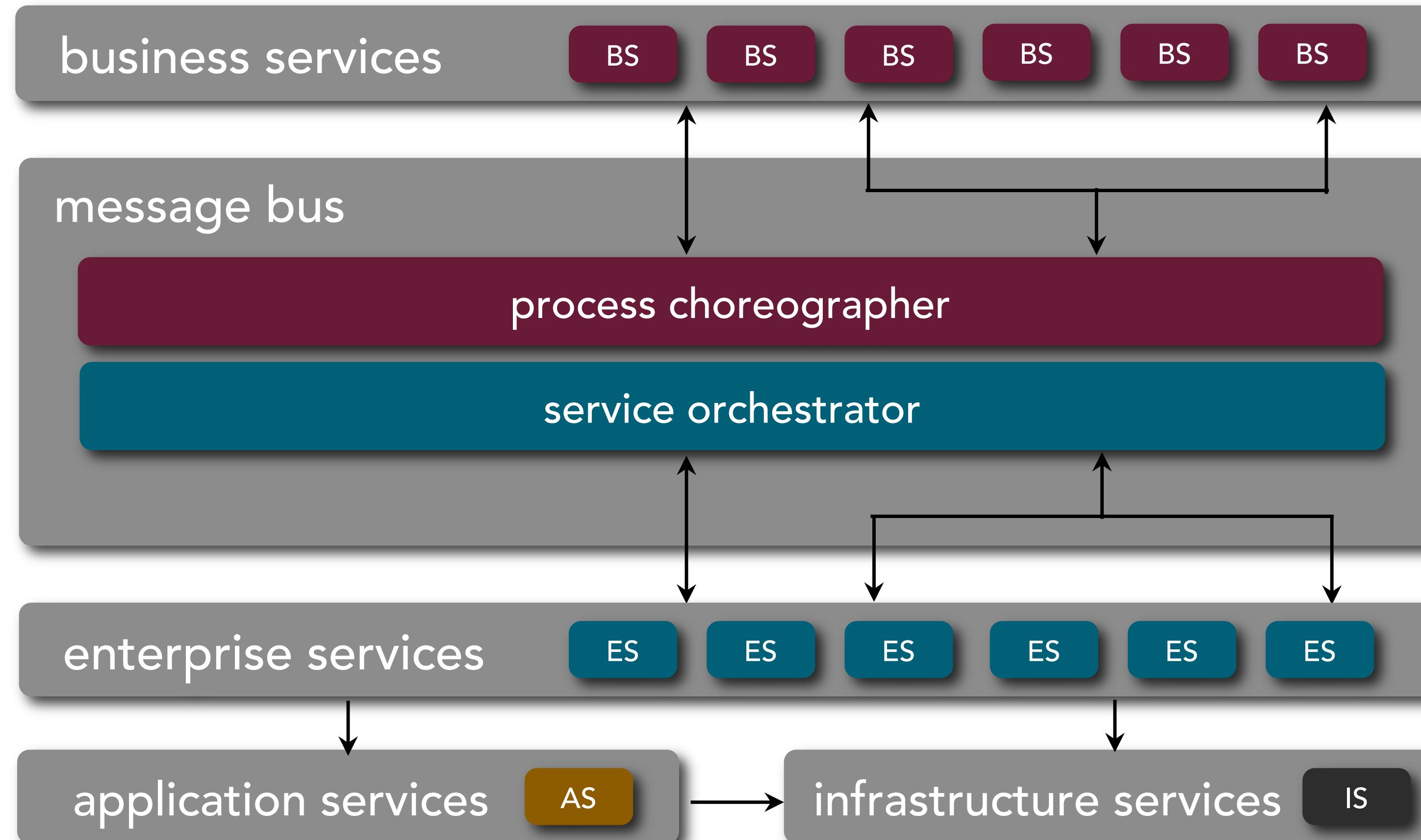
service taxonomy

shared resources

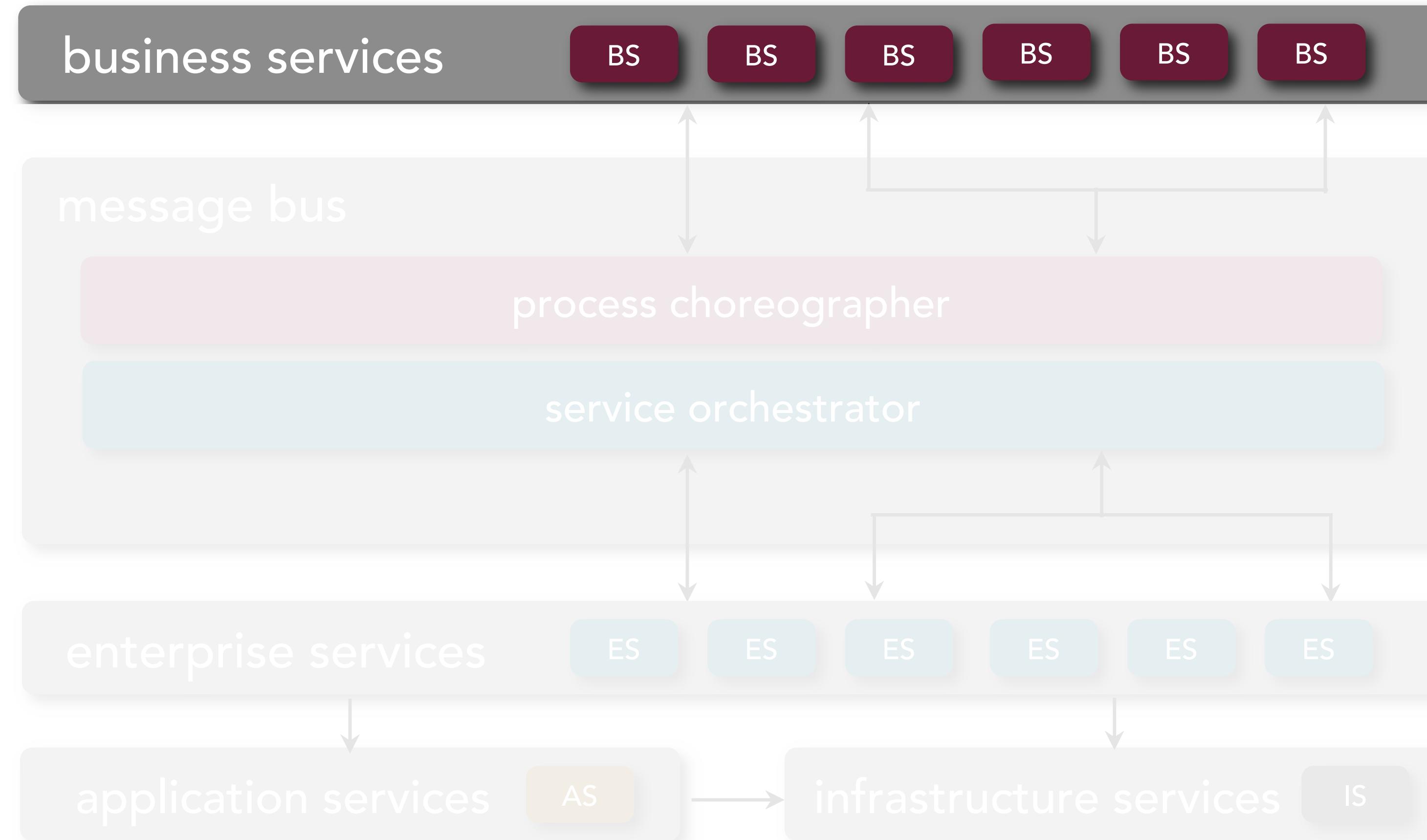
middleware

interoperability

# service-oriented architecture



# service-oriented architecture



# service-oriented architecture



coarse-grained

# service-oriented architecture



abstract

coarse-grained

# service-oriented architecture

business services

BS

BS

BS

BS

BS

BS

abstract

enterprise-level

coarse-grained

# service-oriented architecture

business services

BS

BS

BS

BS

BS

BS

abstract

enterprise-level

coarse-grained

owned and defined by business users

data represented as WSDL, BPEL, XML, etc.

# service-oriented architecture

business services

BS

BS

BS

BS

BS

BS

abstract

enterprise-level

coarse-grained

owned and defined by business users

data represented as WSDL, BPEL, XML, etc.

no implementation - only name, input, and output

ExecuteTrade

PlaceOrder

ProcessClaim

# service-oriented architecture

business services

BS

BS

BS

BS

BS

BS

abstract

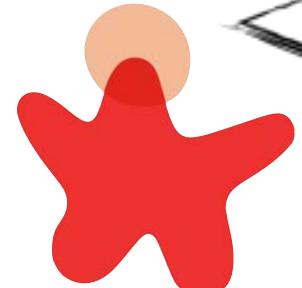
enterprise-level

coarse-grained

owned and defined by business users

data represented as WSDL, BPEL, XML, etc.

no implementation - only name, input, and output



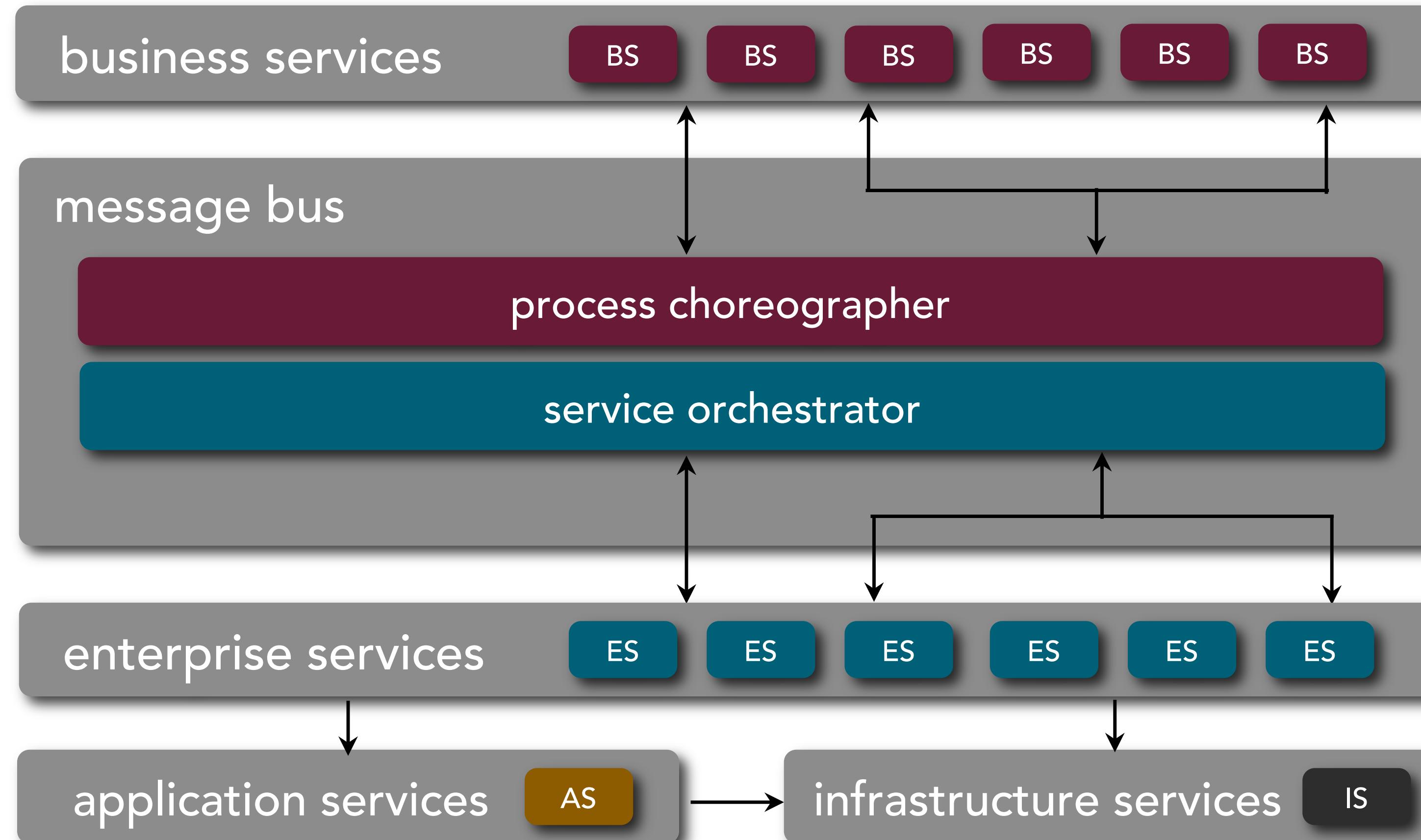
Are we in the business of...?

ExecuteTrade

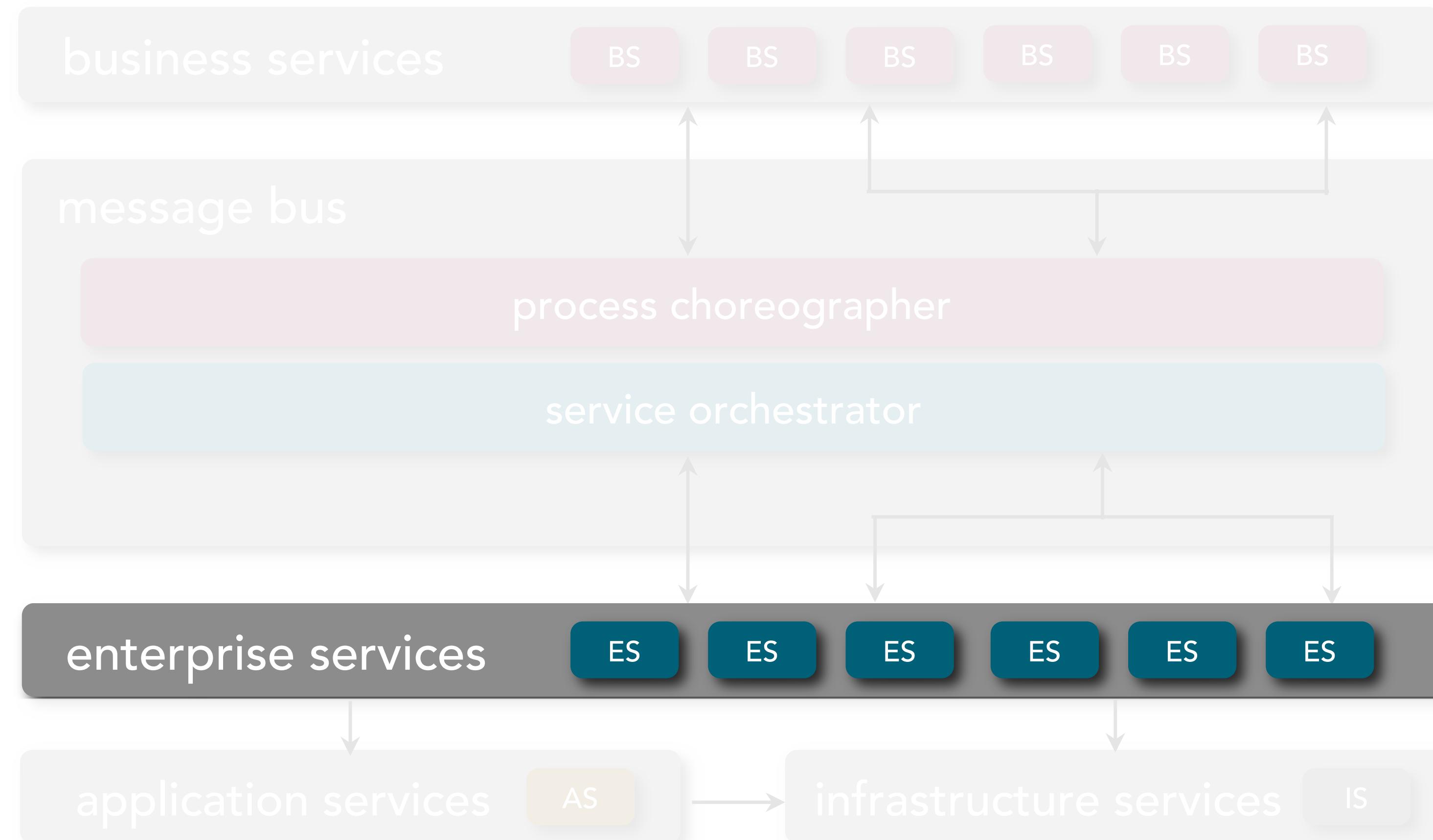
PlaceOrder

ProcessClaim

# service-oriented architecture



# service-oriented architecture



# service-oriented architecture

owned by shared services teams

enterprise services

ES

ES

ES

ES

ES

ES

# service-oriented architecture

owned by shared services teams

coarse-grained

enterprise services

ES

ES

ES

ES

ES

ES

# service-oriented architecture

owned by shared services teams

enterprise-level

coarse-grained

enterprise services

ES

ES

ES

ES

ES

ES

# service-oriented architecture

owned by shared services teams

concrete

enterprise-level

coarse-grained

enterprise services

ES

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ES

ES

ES

ES

# service-oriented architecture

owned by shared services teams

concrete

enterprise-level

coarse-grained

custom or vendor implementations that are one-to-one  
or one-to-many relationship with business services

enterprise services

ES

ES

ES

ES

ES

ES

# service-oriented architecture

owned by shared services teams

concrete

enterprise-level

coarse-grained

custom or vendor implementations that are one-to-one  
or one-to-many relationship with business services

enterprise services

ES

ES

ES

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ES

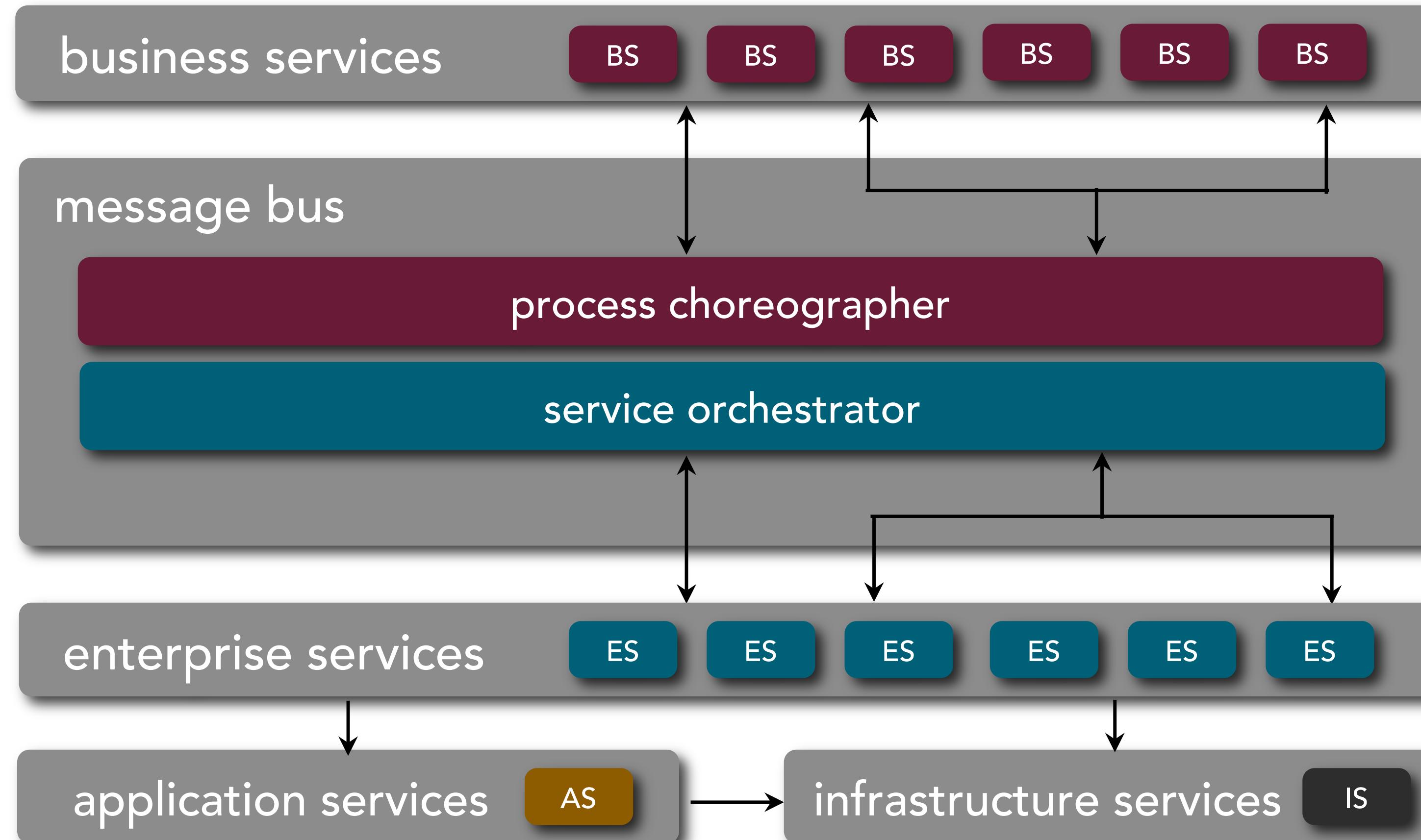
ES

CreateCustomer

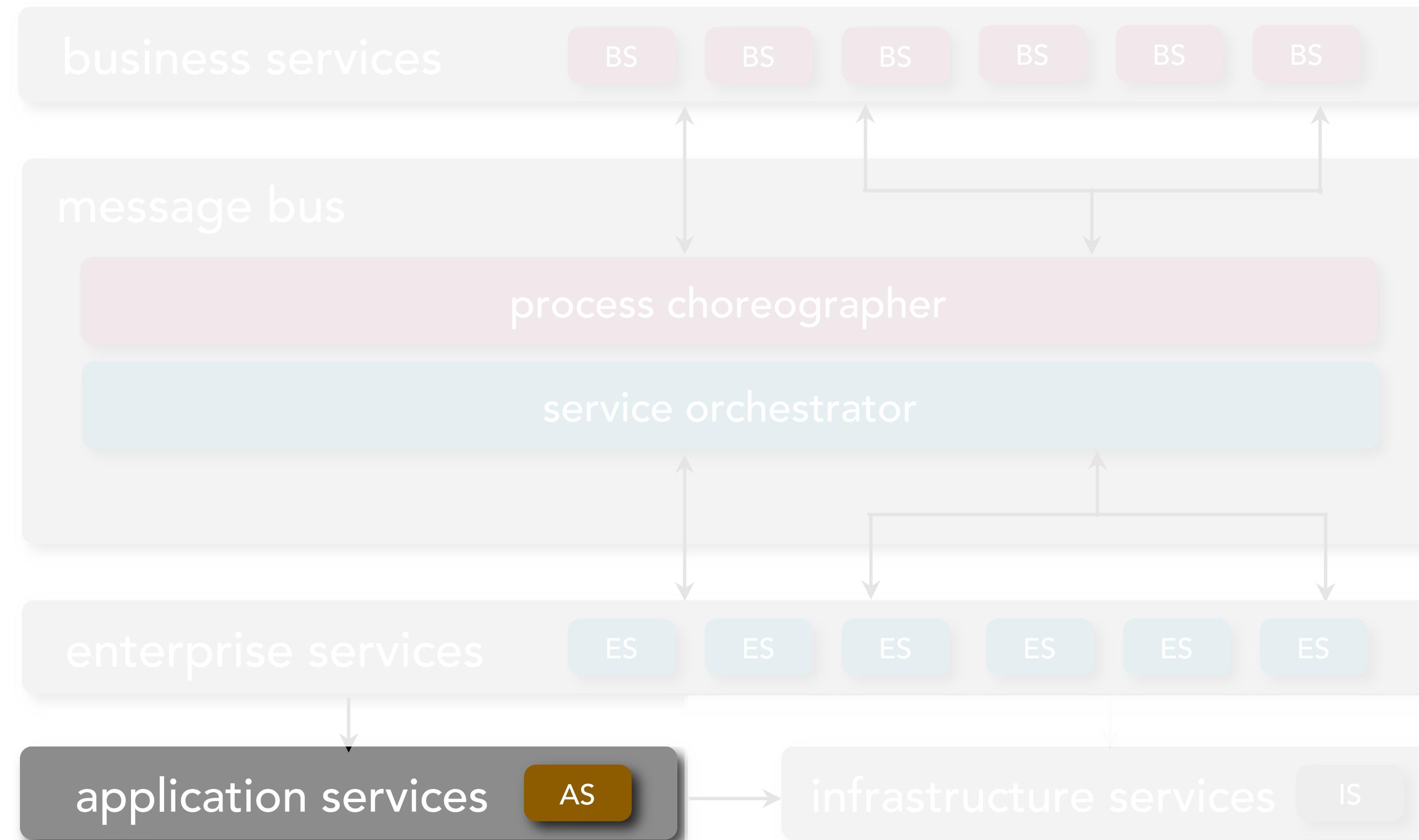
CalcQuote

ValidateTrade

# service-oriented architecture



# service-oriented architecture



# service-oriented architecture

owned by application teams

application services AS

# service-oriented architecture

owned by application teams

fine-grained

application services AS

# service-oriented architecture

owned by application teams

concrete

fine-grained

application services AS

# service-oriented architecture

owned by application teams

concrete

application-level

fine-grained

application services AS

# service-oriented architecture

owned by application teams

concrete

application-level

fine-grained

bound to a specific application context

application services AS

# service-oriented architecture

owned by application teams

concrete

application-level

fine-grained

bound to a specific application context

AddDriver

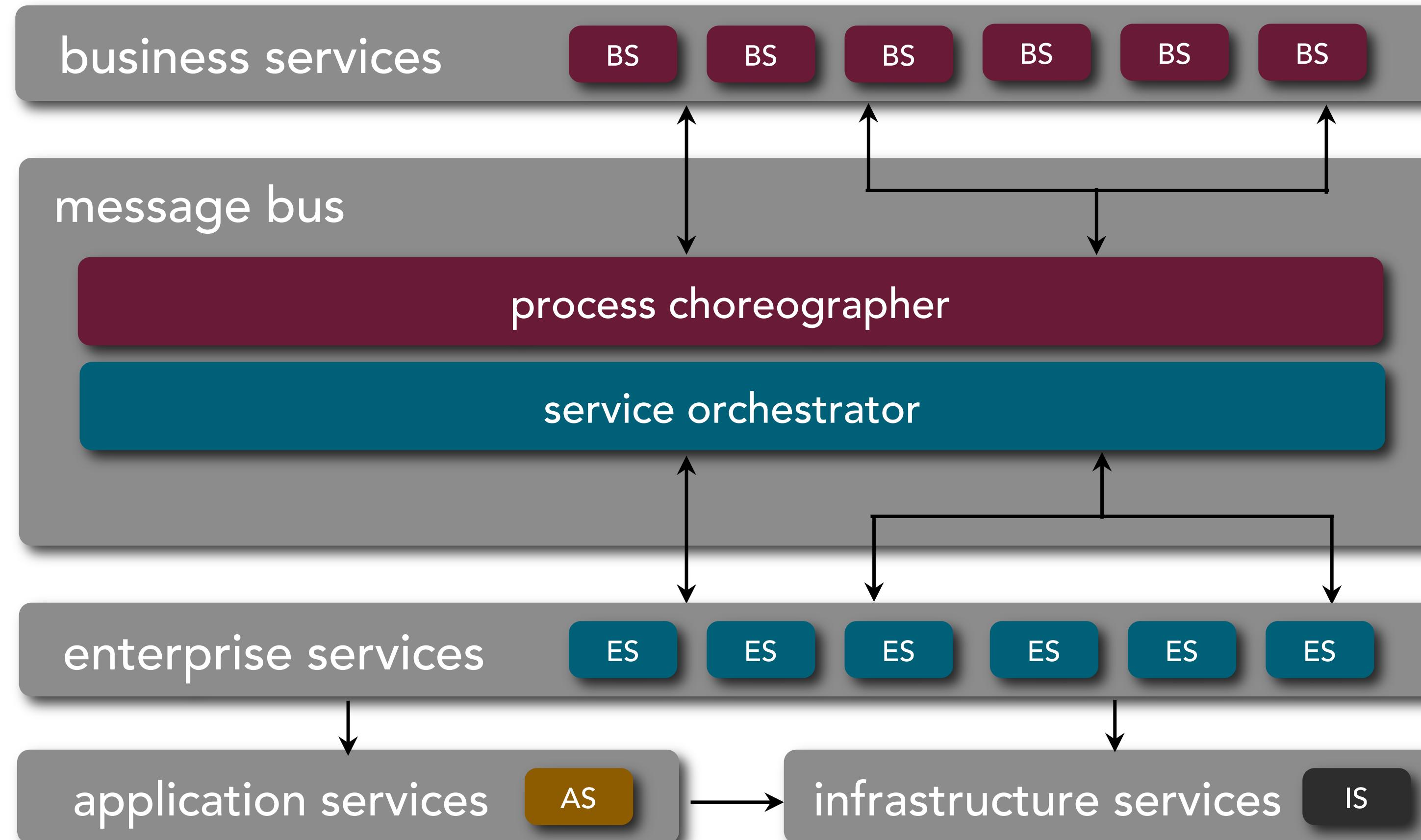
UpdateAddress

CalcSalesTax

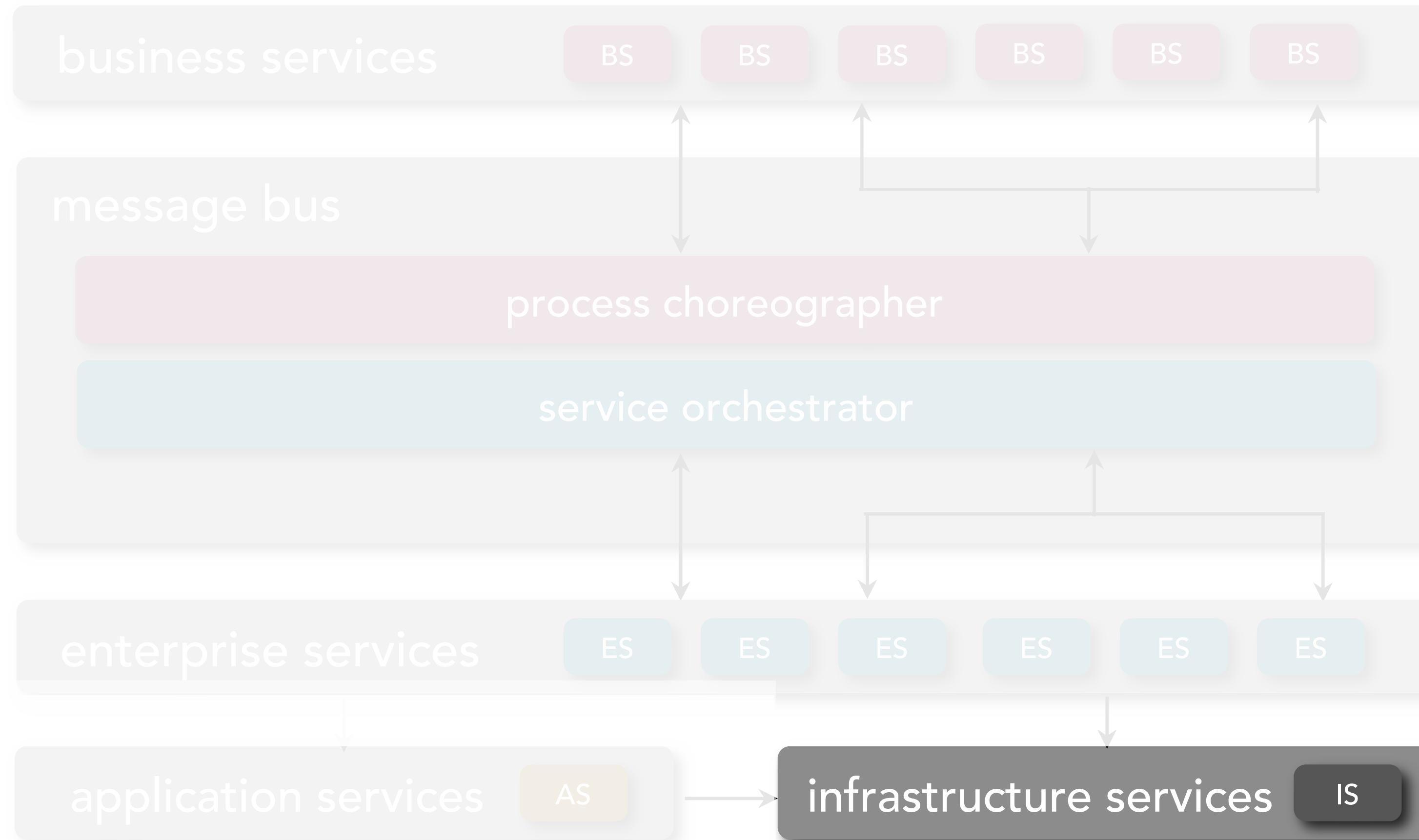
application services

AS

# service-oriented architecture



# service-oriented architecture



# service-oriented architecture

owned by infrastructure or shared services teams

infrastructure services IS

# service-oriented architecture

owned by infrastructure or shared services teams

fine-grained

infrastructure services IS

# service-oriented architecture

owned by infrastructure or shared services teams

enterprise-level

fine-grained

infrastructure services IS

# service-oriented architecture

owned by infrastructure or shared services teams

concrete

enterprise-level

fine-grained

infrastructure services IS

# service-oriented architecture

owned by infrastructure or shared services teams

concrete

enterprise-level

fine-grained

implements non-business functionality to support both enterprise and business services

infrastructure services IS

# service-oriented architecture

owned by infrastructure or shared services teams

concrete

enterprise-level

fine-grained

implements non-business functionality to support both enterprise and business services

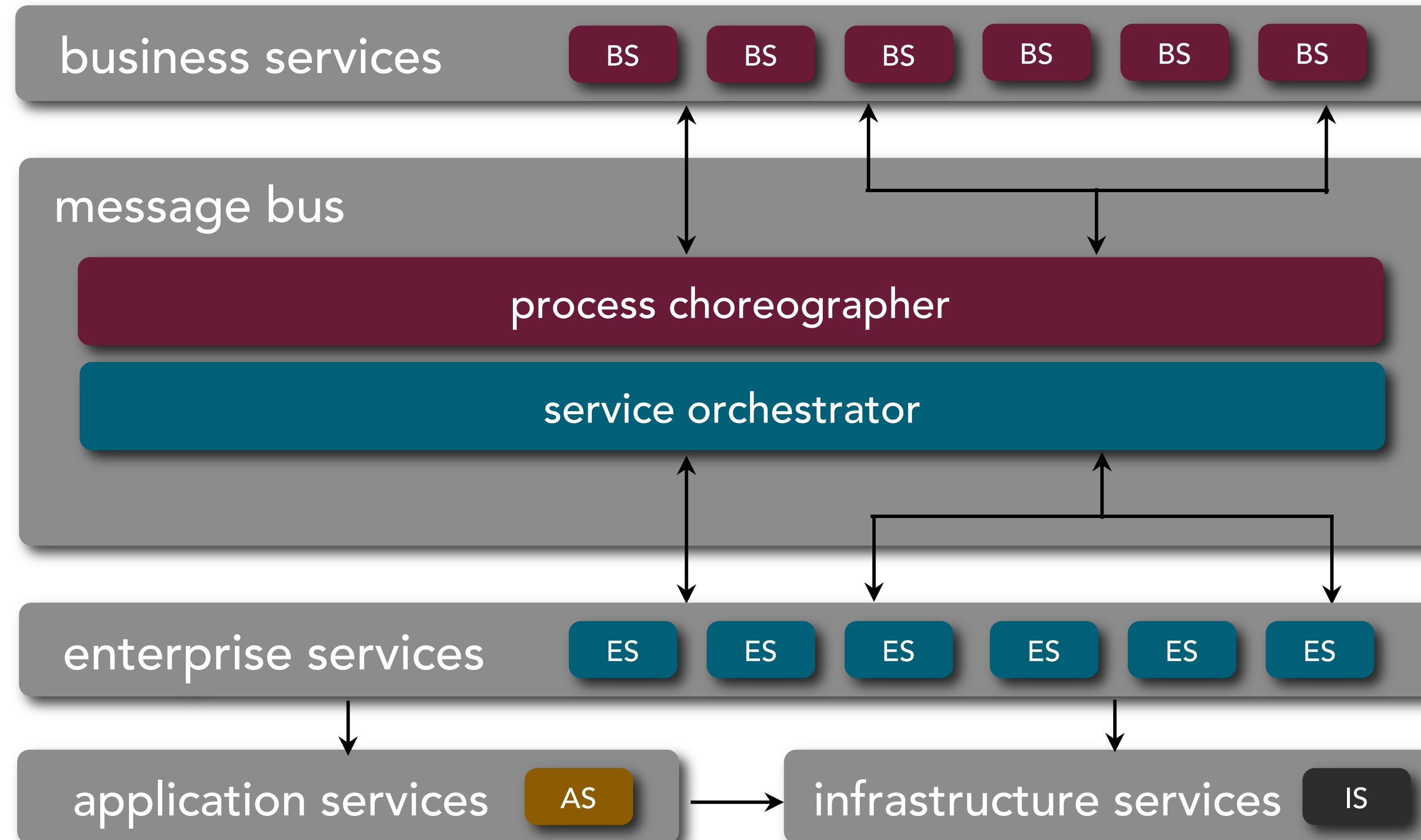
WriteAudit

CheckUserAccess

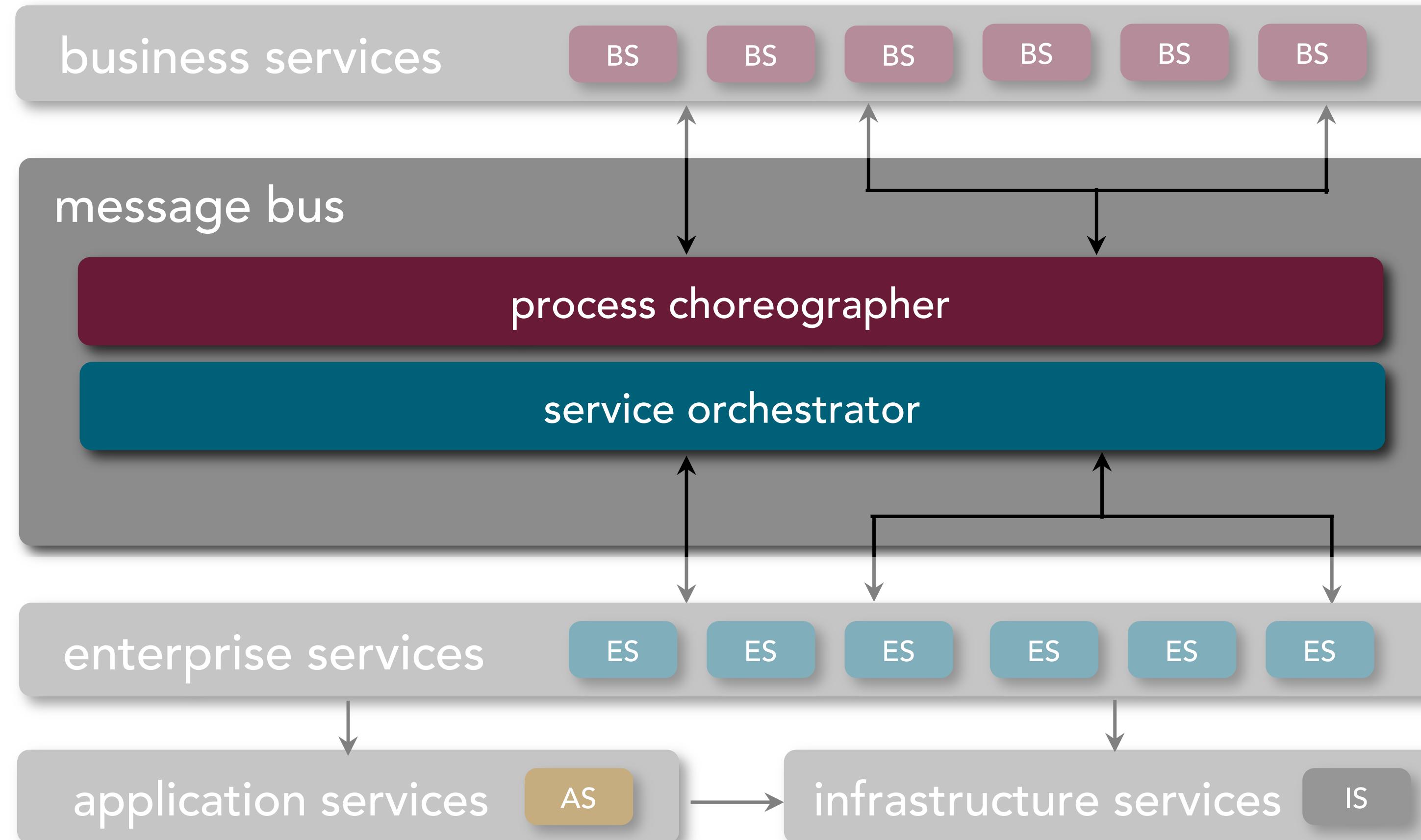
LogError

infrastructure services IS

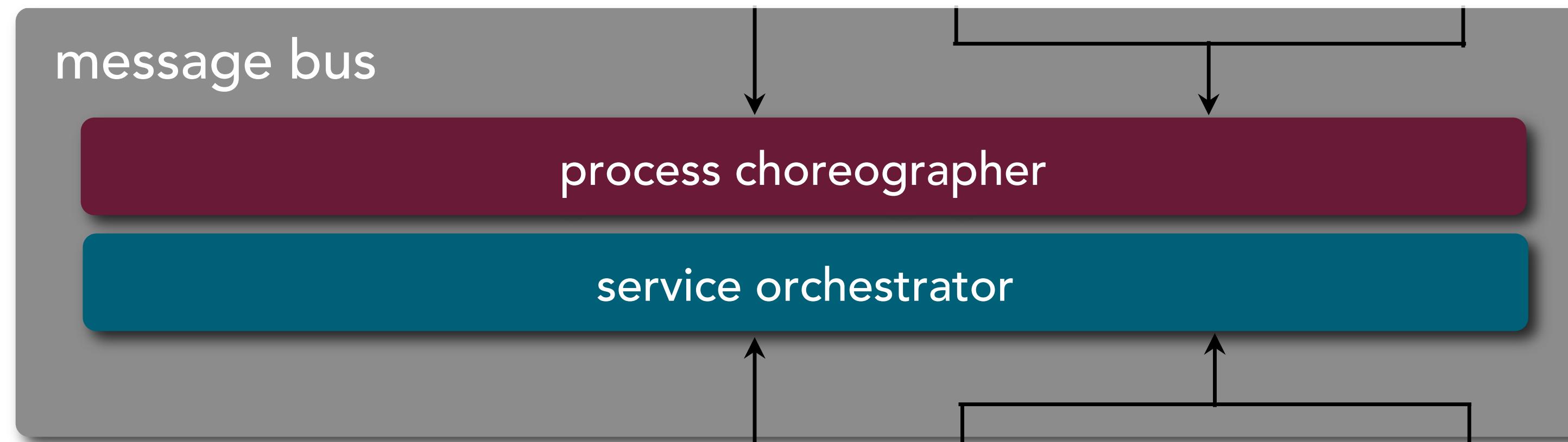
# service-oriented architecture



# service-oriented architecture



# service-oriented architecture



mediation and routing

process choreography

service orchestration

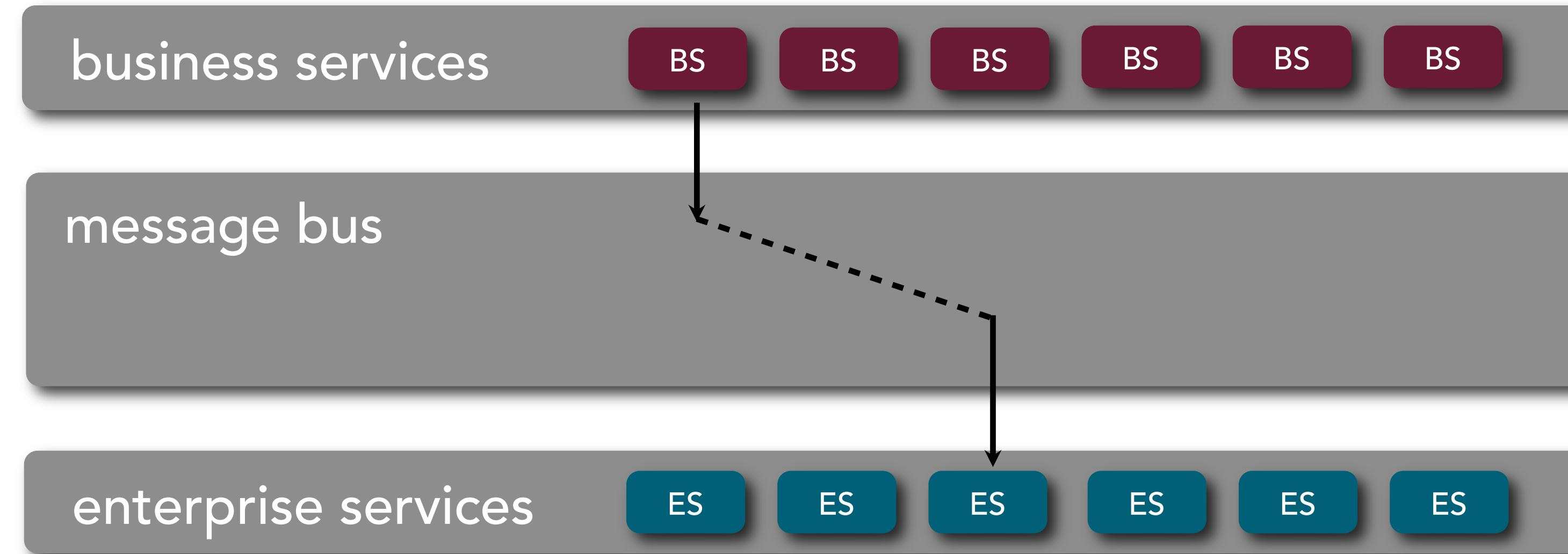
message enhancement

message transformation

protocol transformation

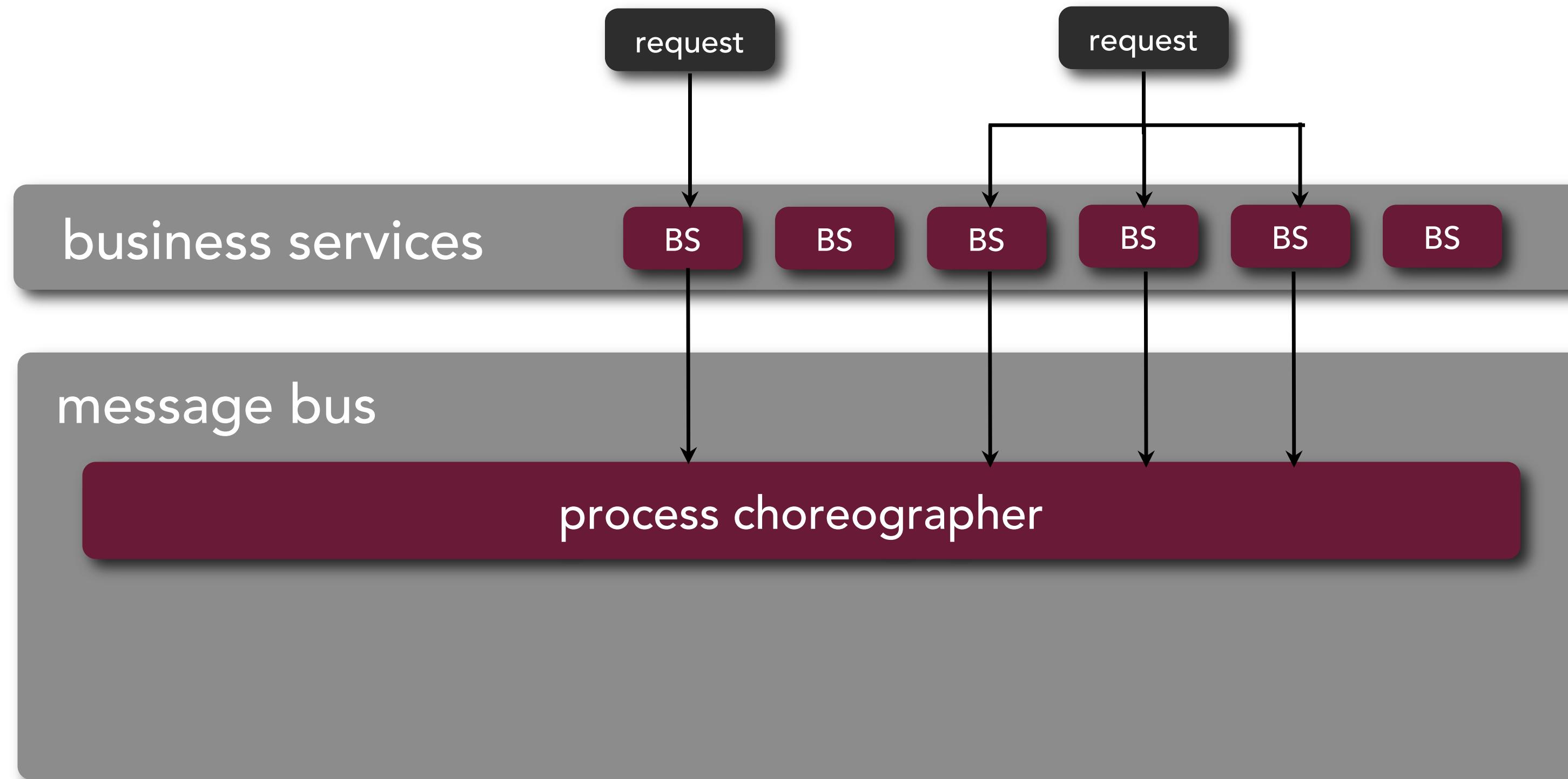
# service-oriented architecture

## mediation and routing



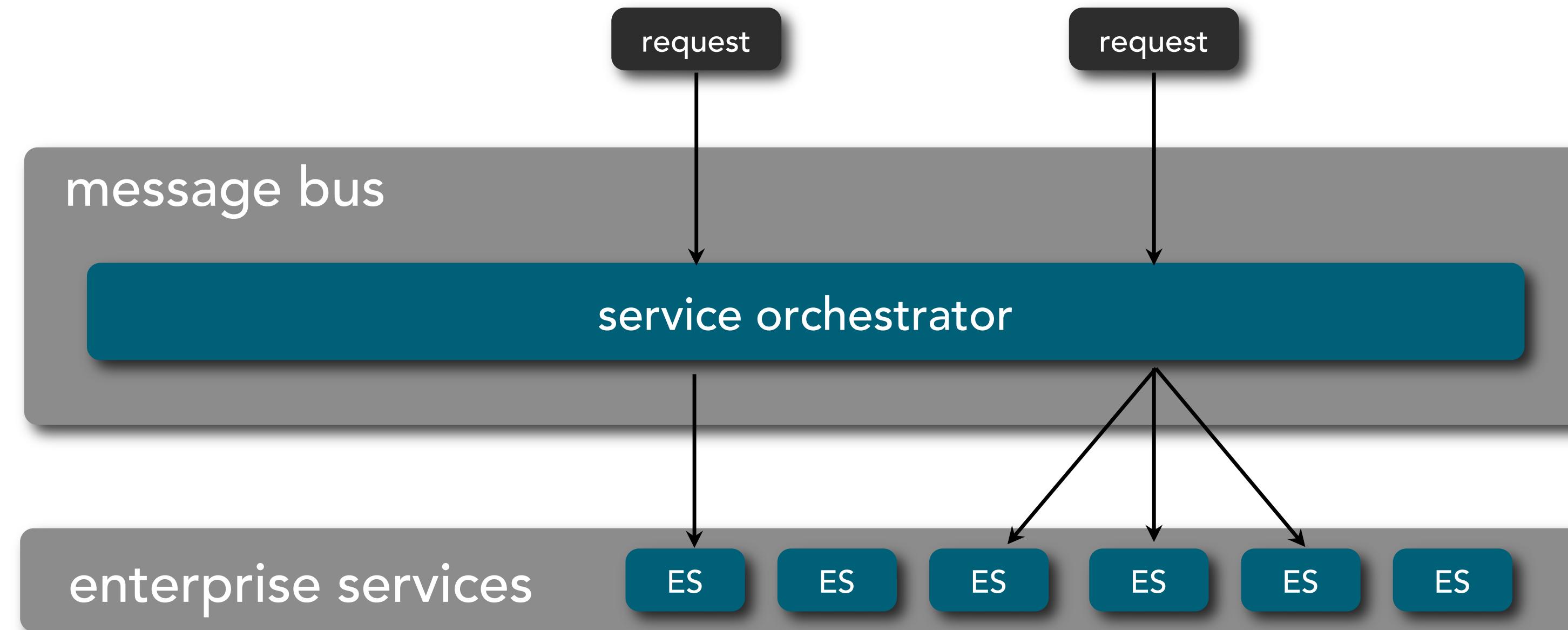
# service-oriented architecture

## process choreography



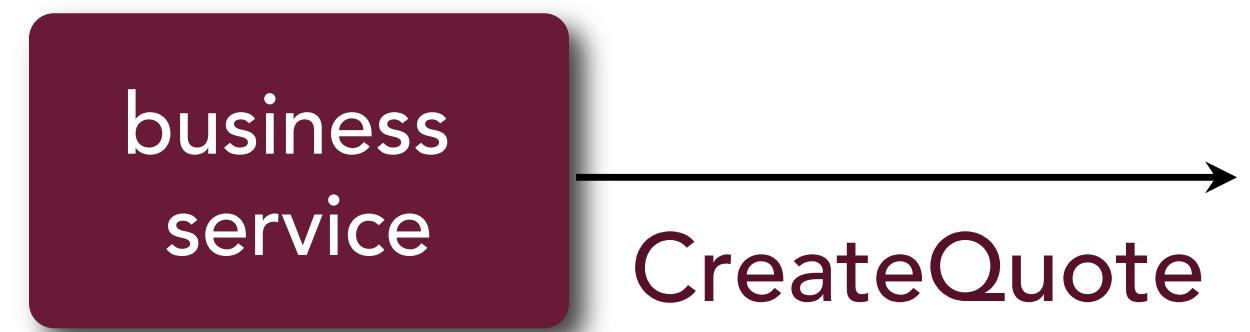
# service-oriented architecture

## service orchestration



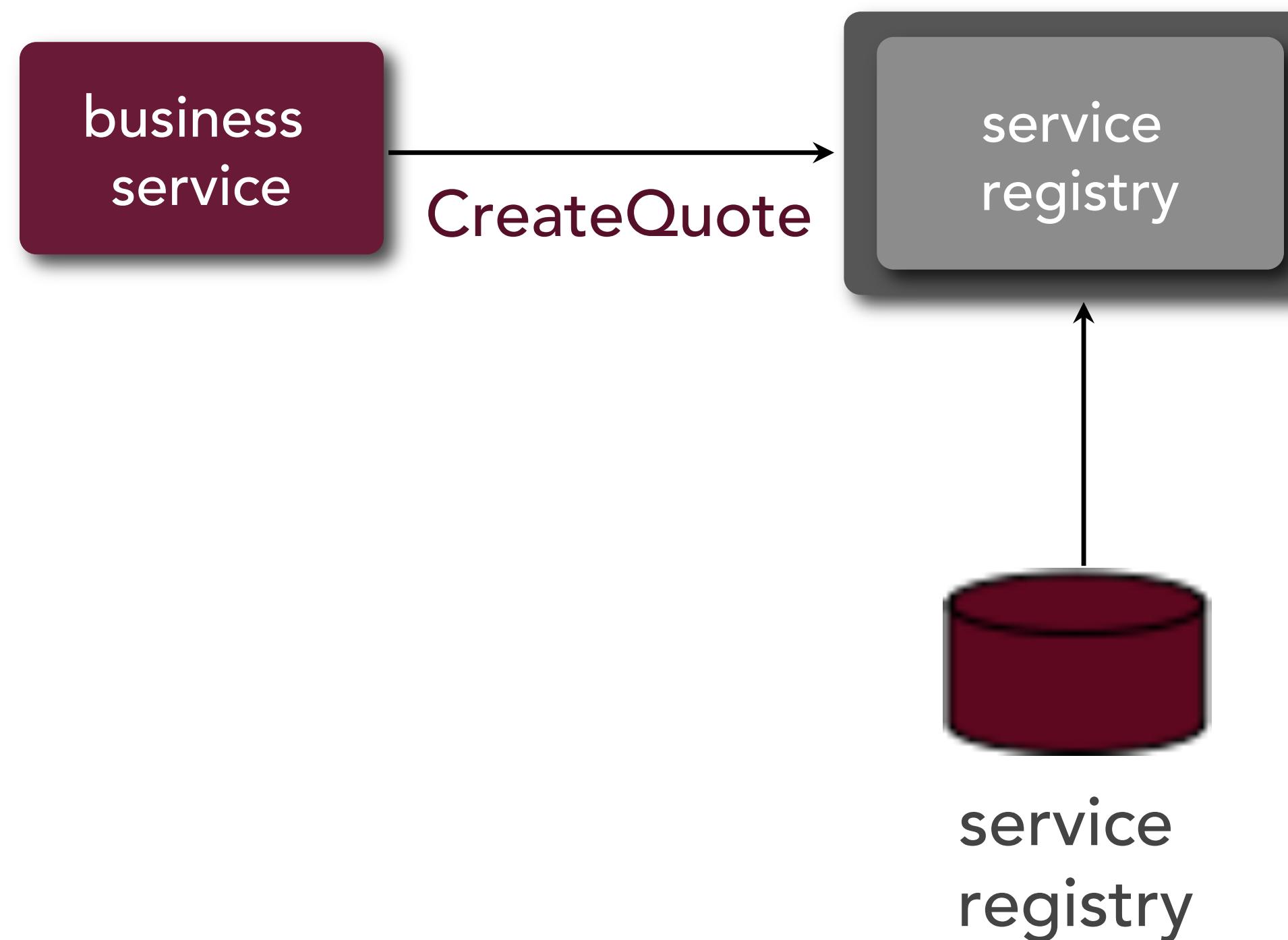
# service-oriented architecture

## service registry



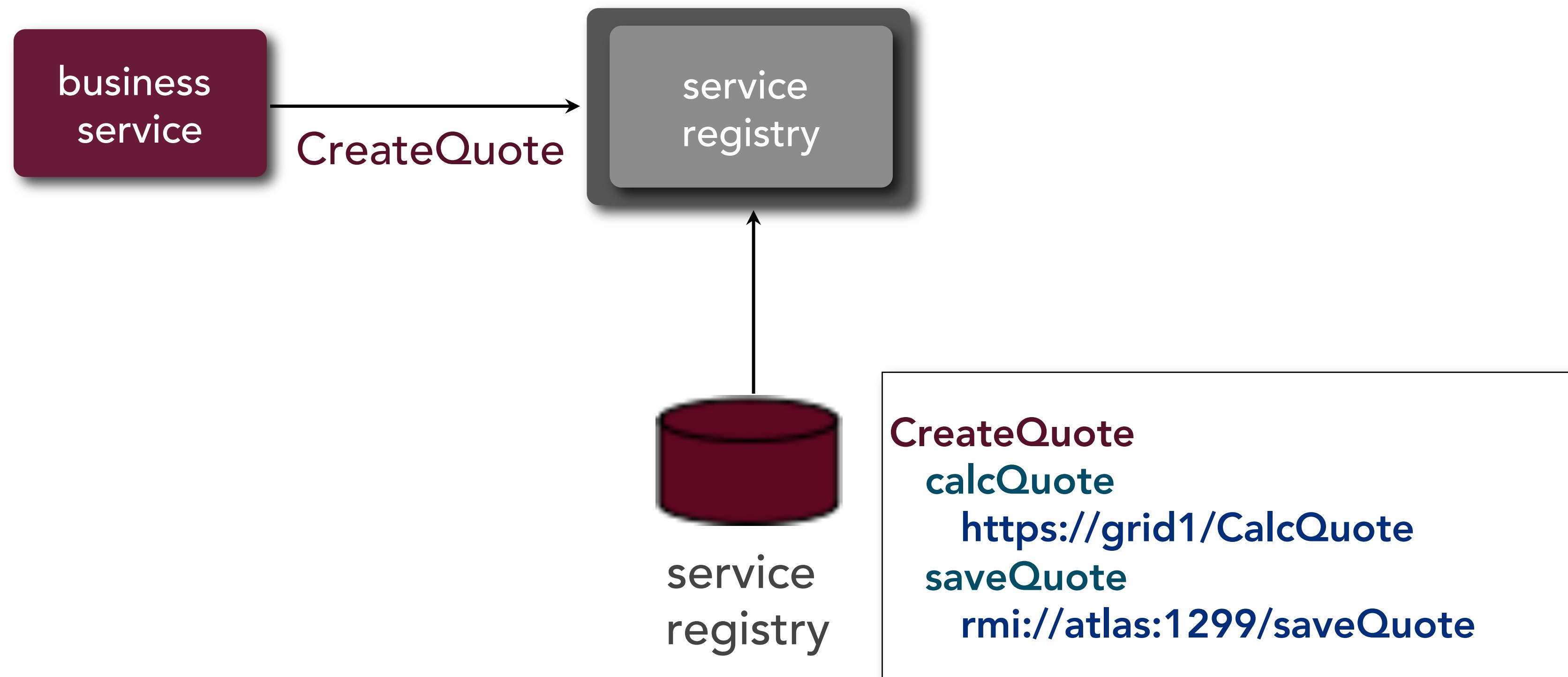
# service-oriented architecture

## service registry



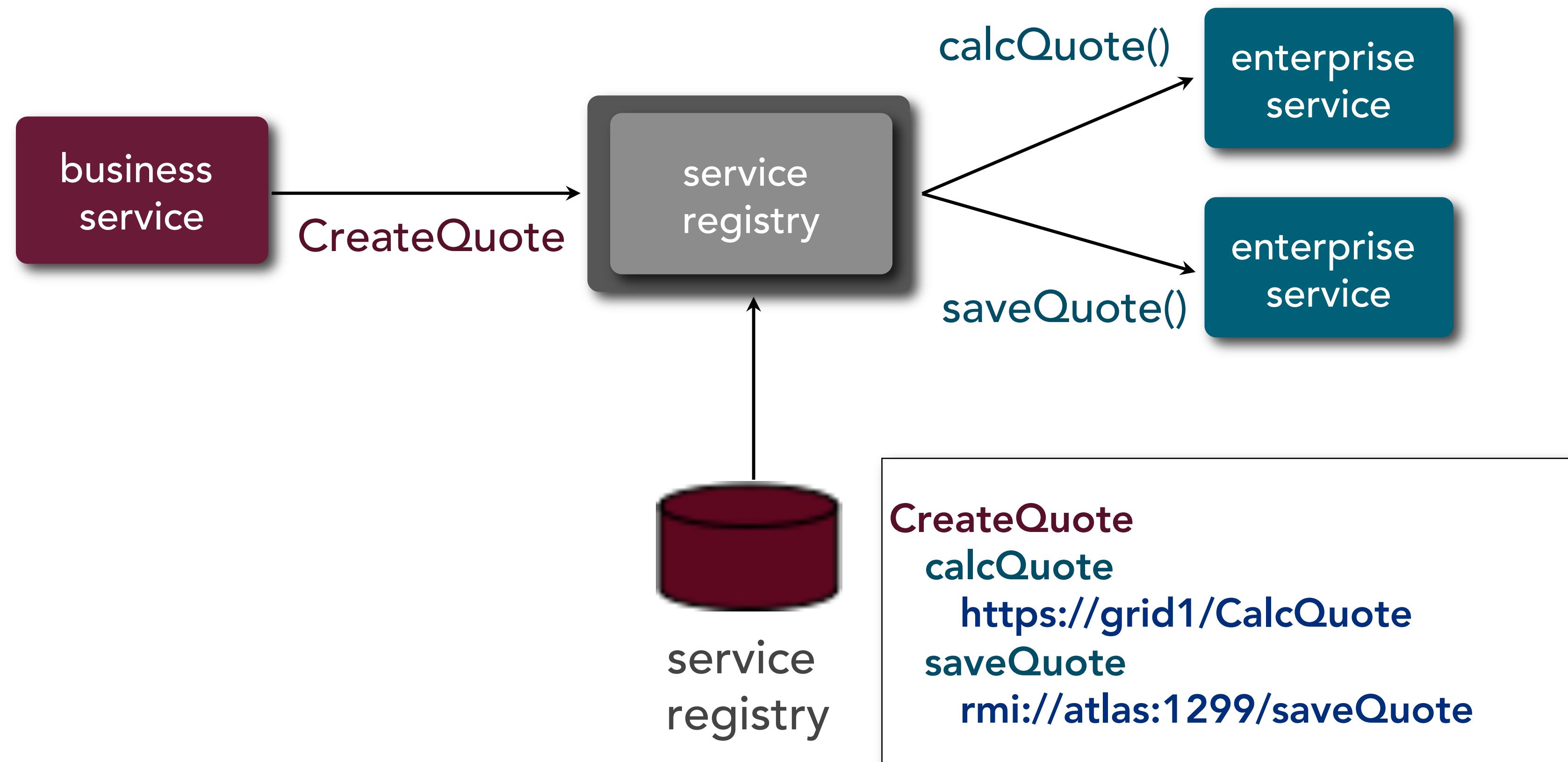
# service-oriented architecture

## service registry



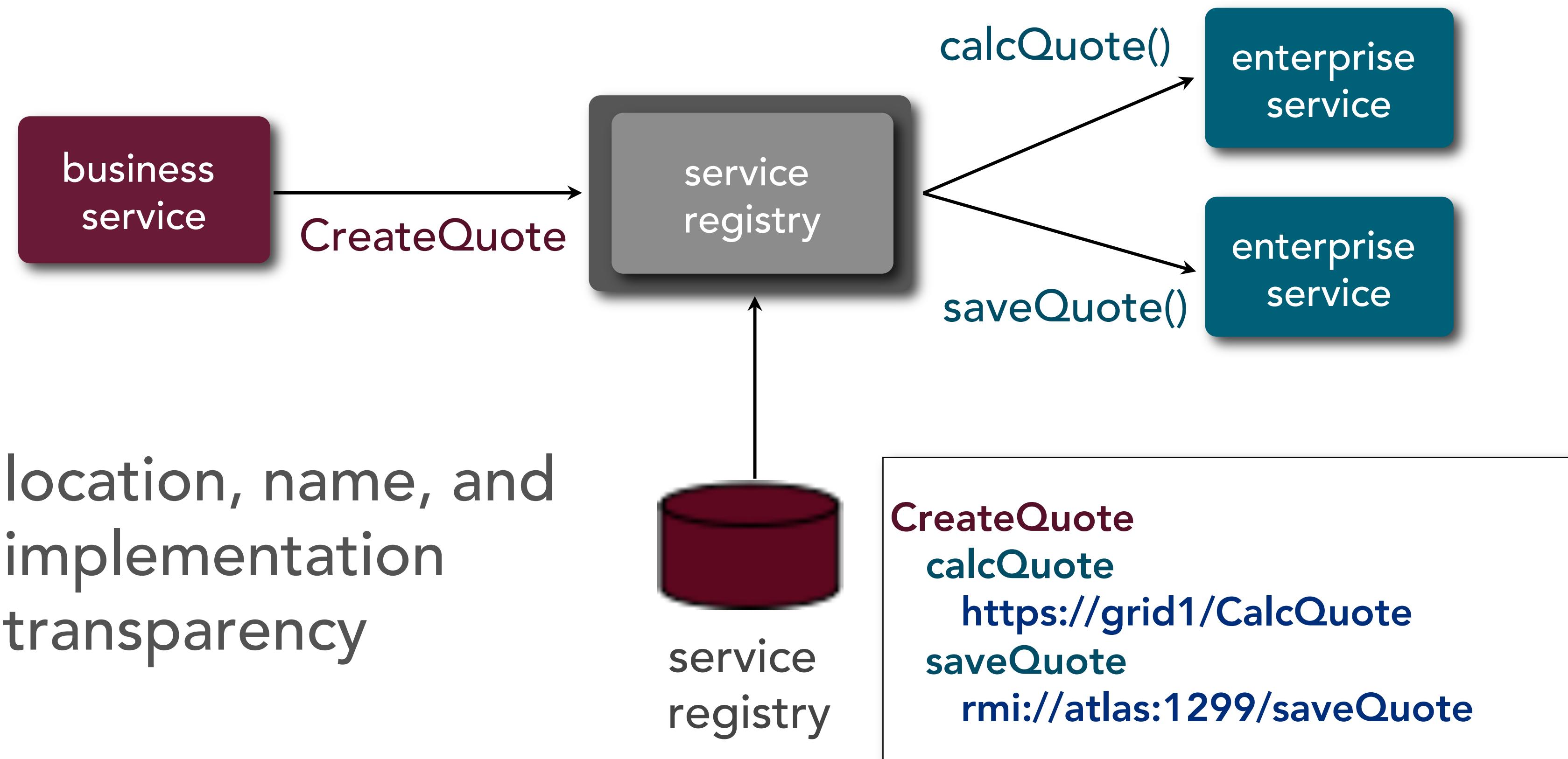
# service-oriented architecture

## service registry



# service-oriented architecture

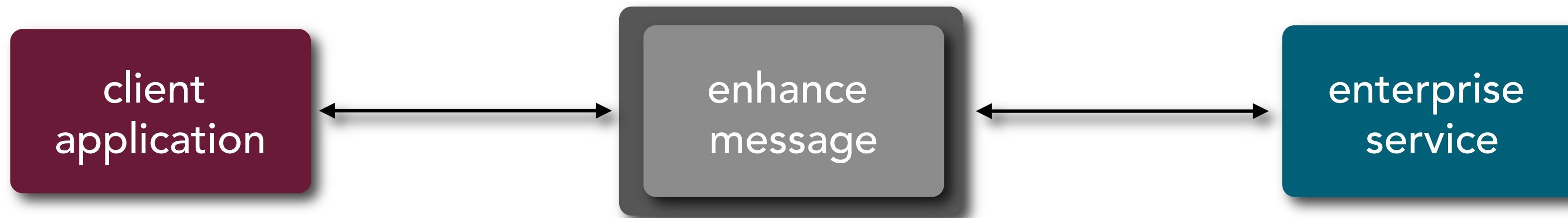
## service registry



location, name, and  
implementation  
transparency

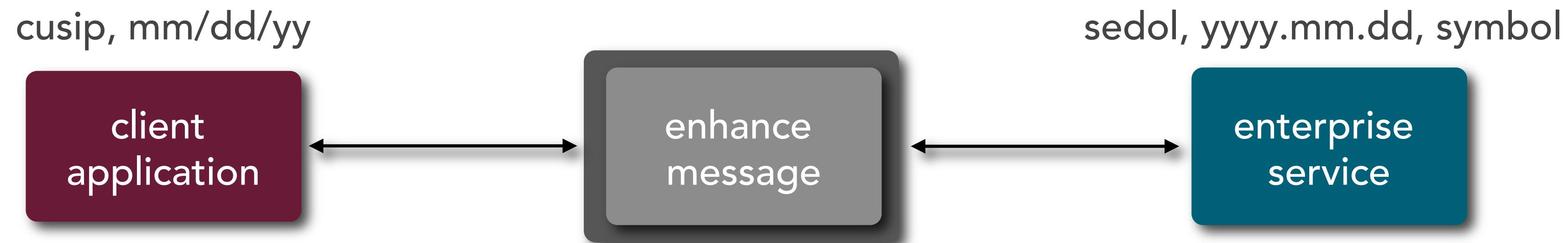
# service-oriented architecture

## message enhancement



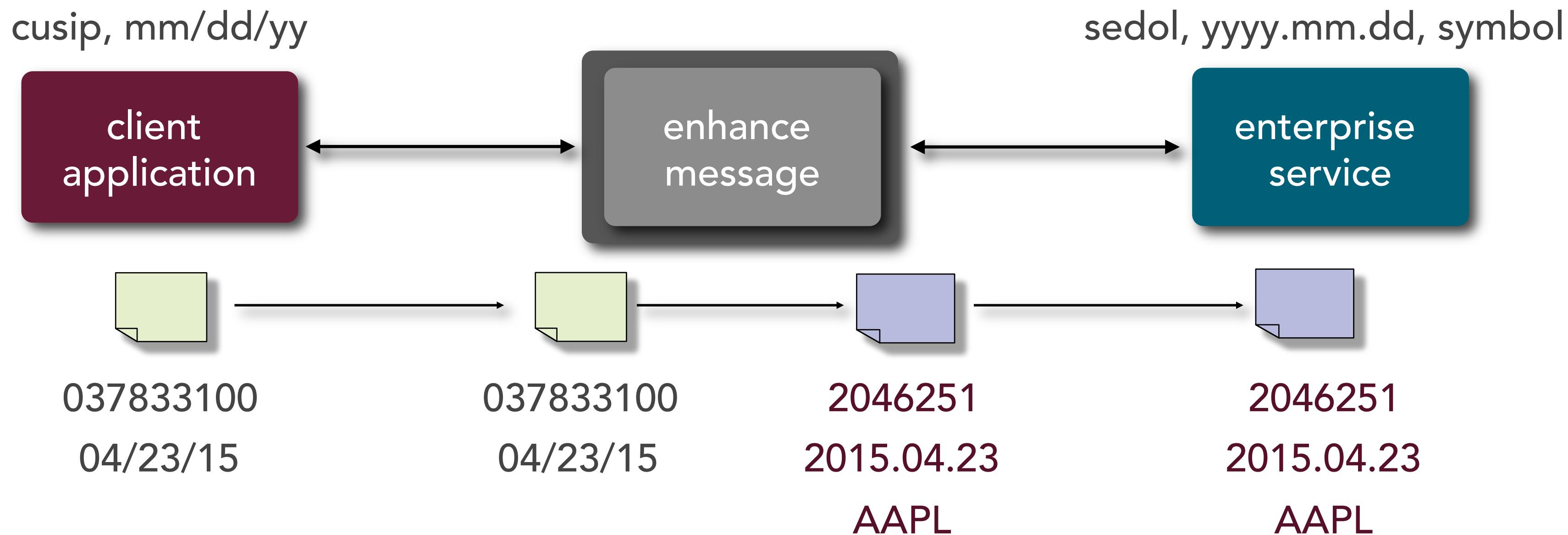
# service-oriented architecture

## message enhancement



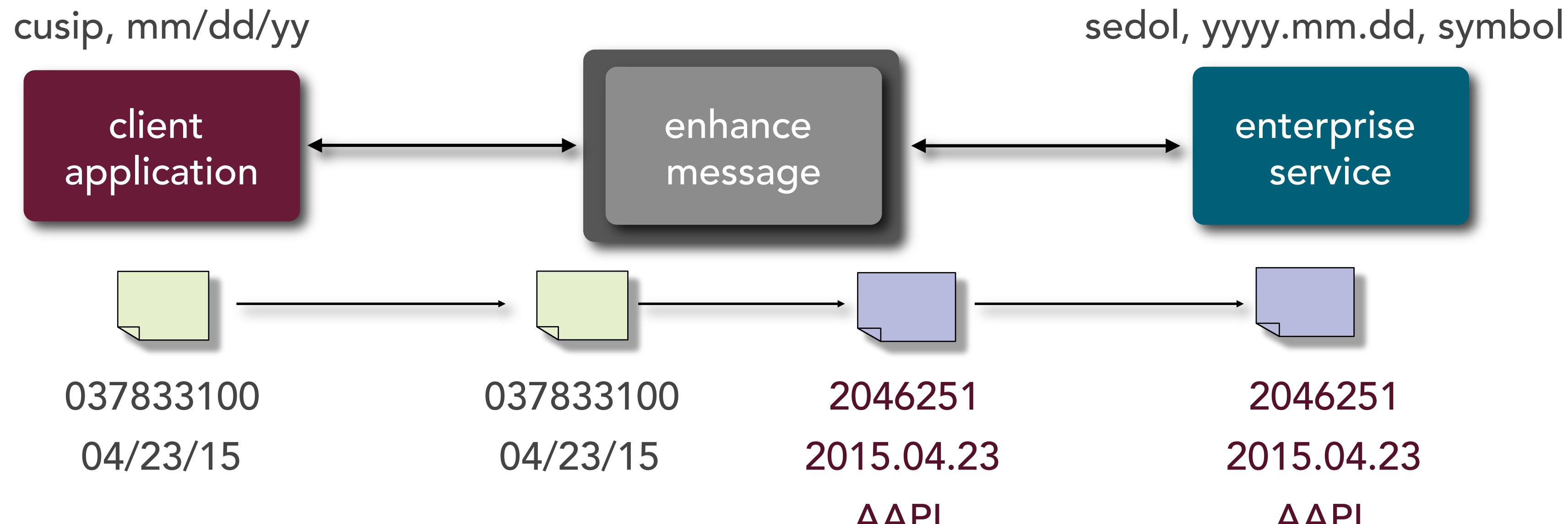
# service-oriented architecture

## message enhancement



# service-oriented architecture

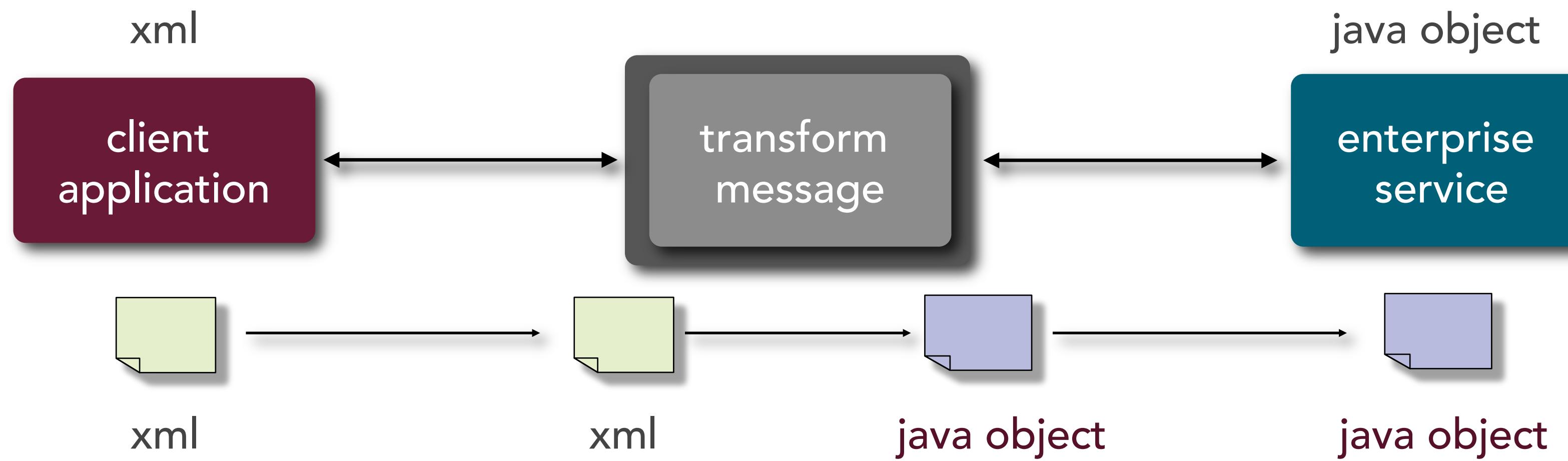
## message enhancement



contract decoupling

# service-oriented architecture

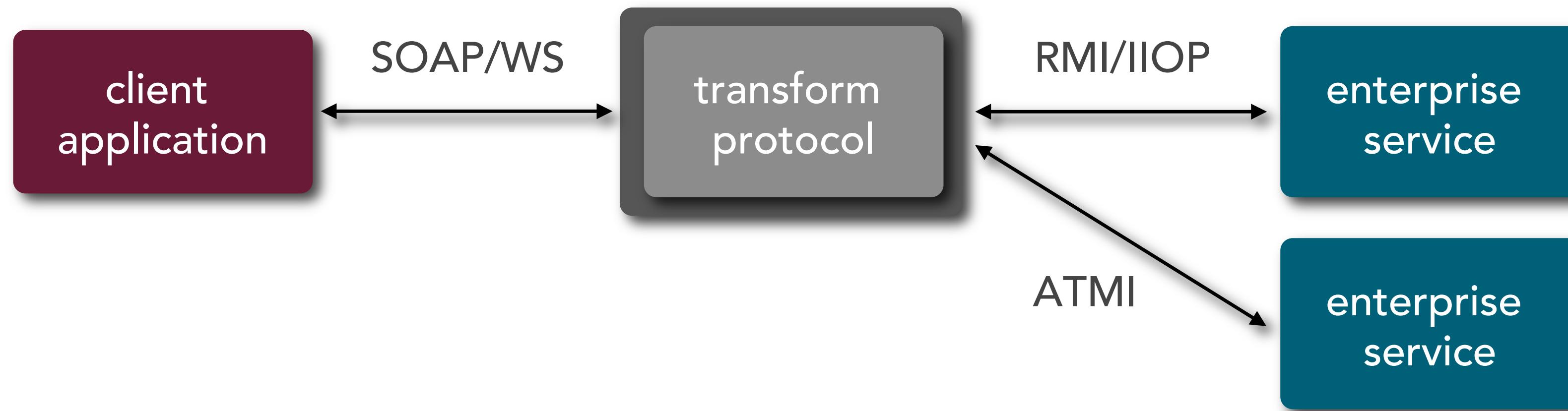
## message transformation



contract decoupling

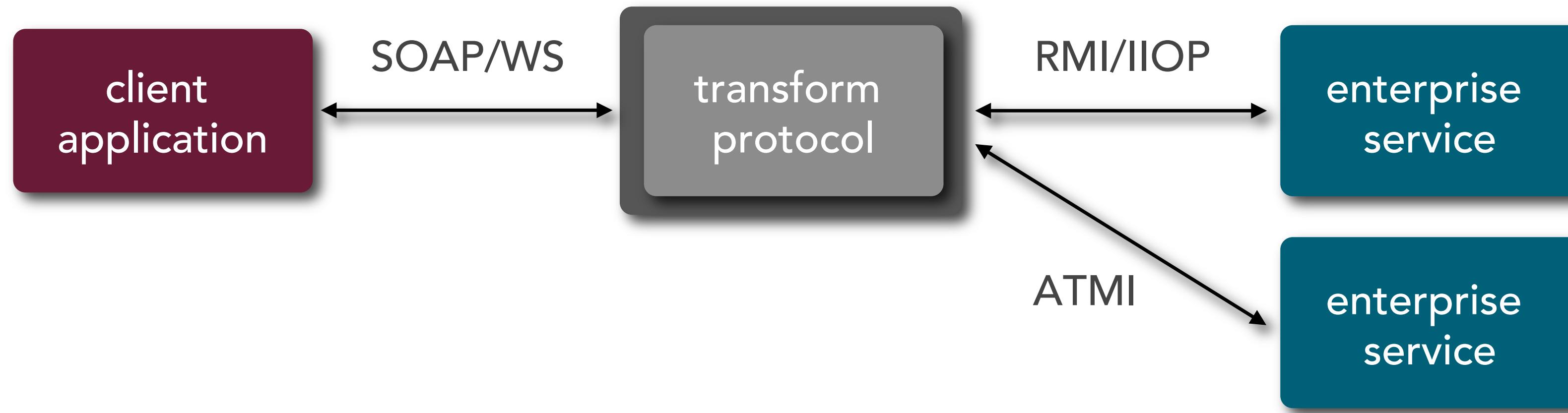
# service-oriented architecture

## protocol transformation



# service-oriented architecture

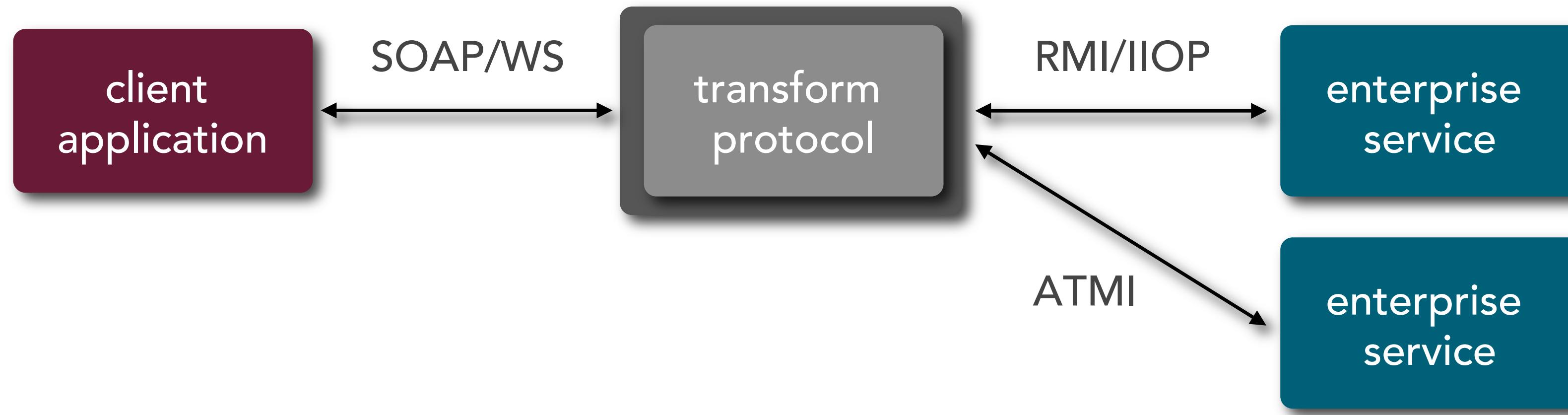
## protocol transformation



access decoupling

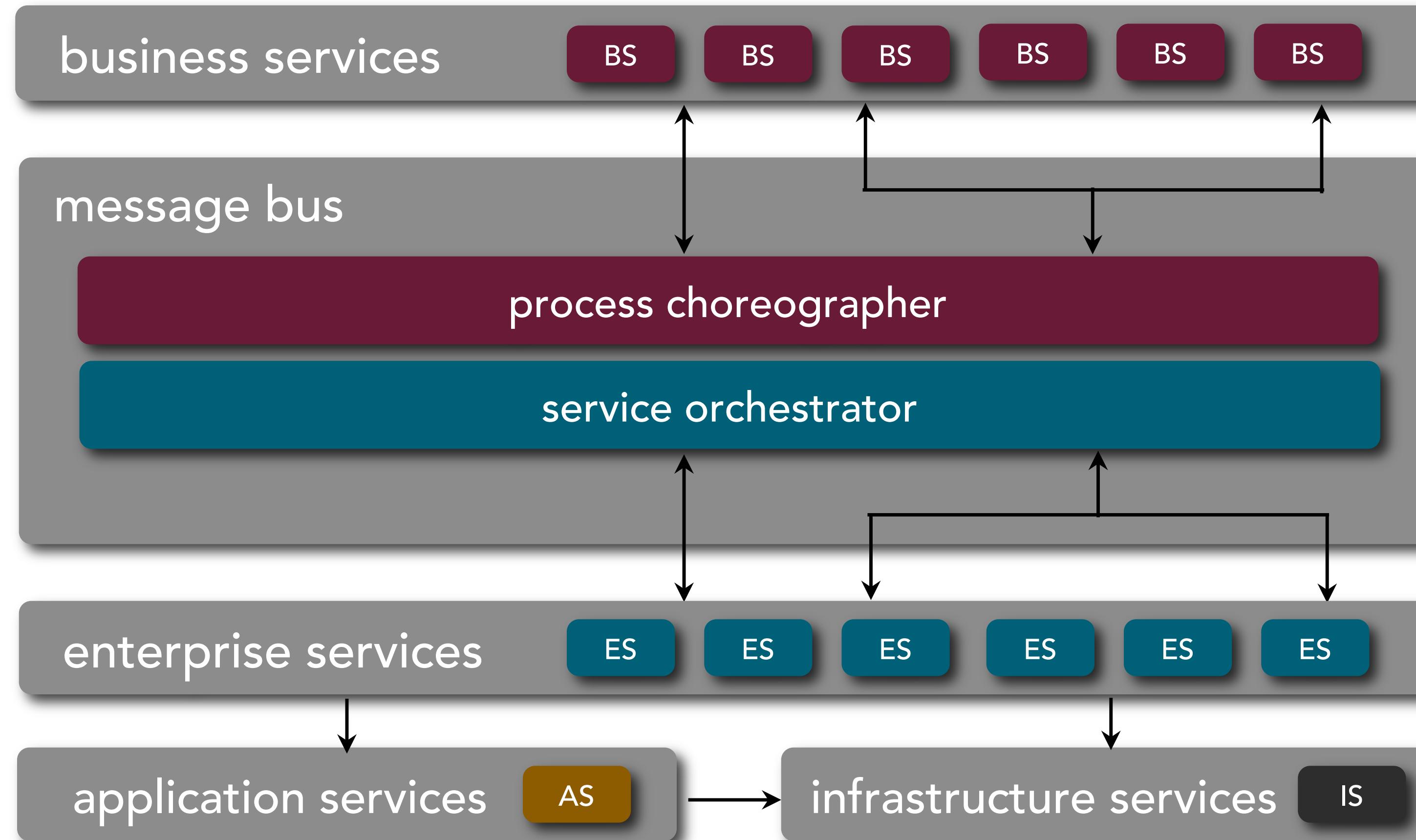
# service-oriented architecture

## protocol transformation

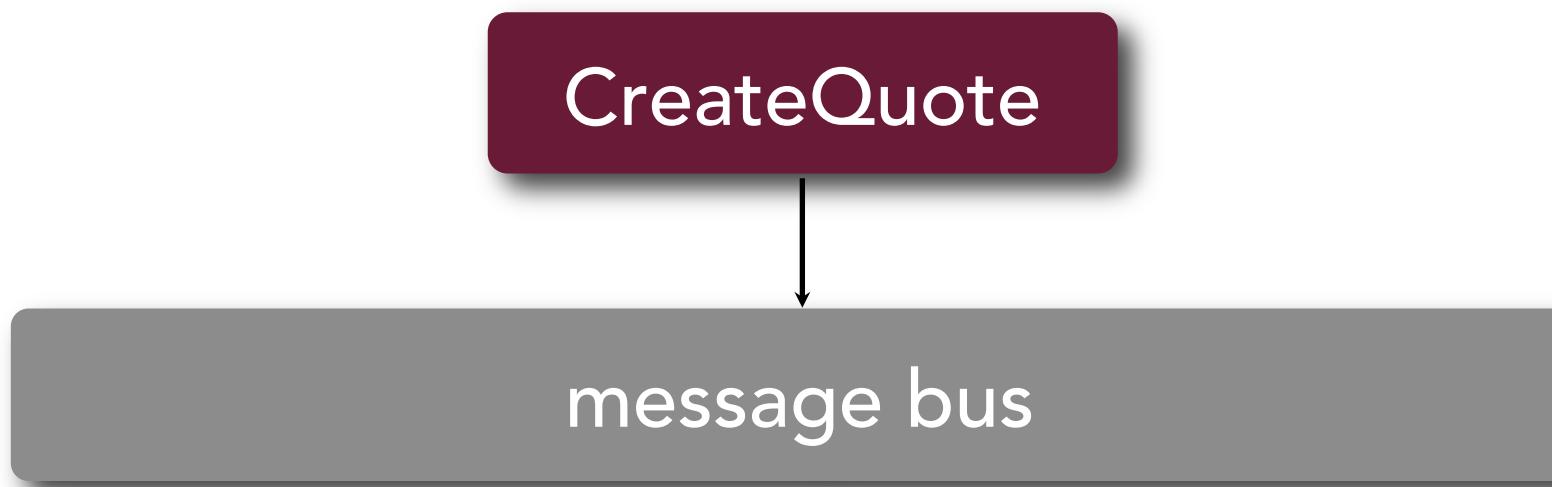


access decoupling  
implementation transparency

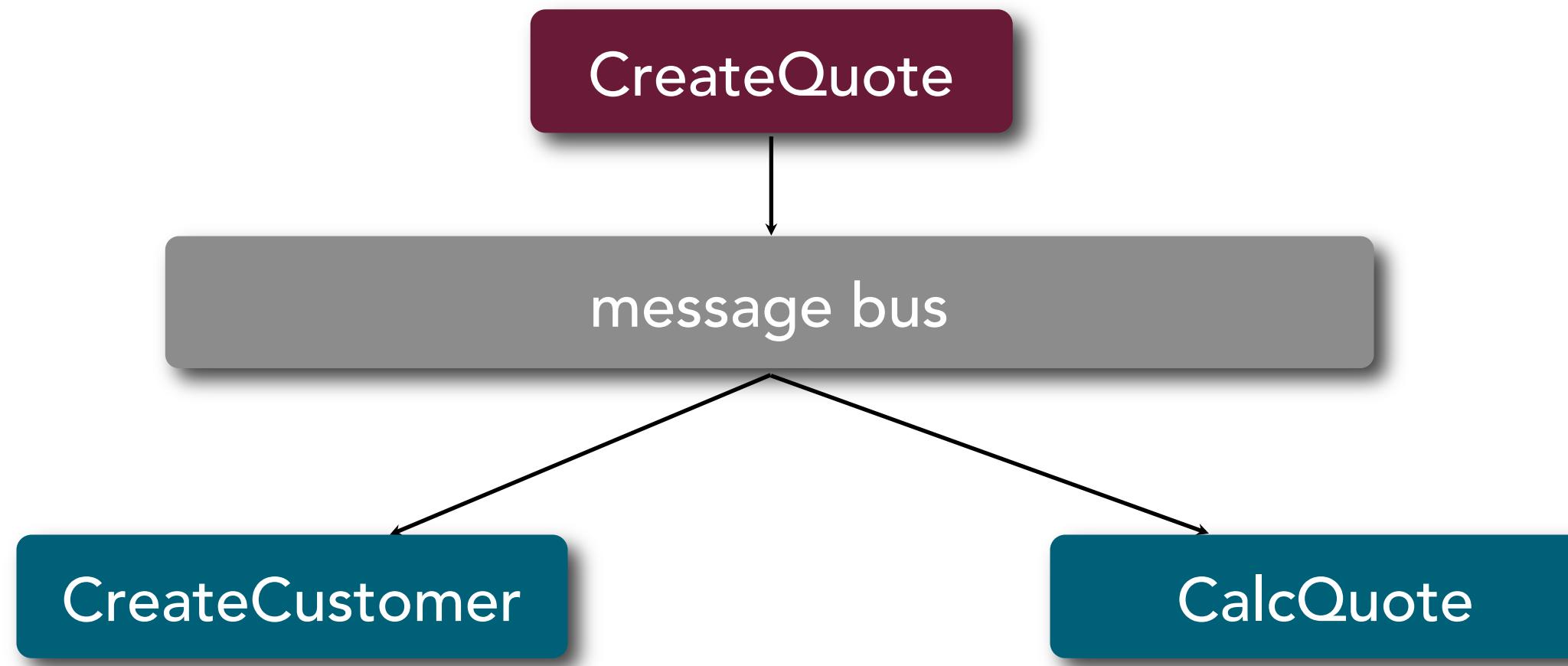
# service-oriented architecture



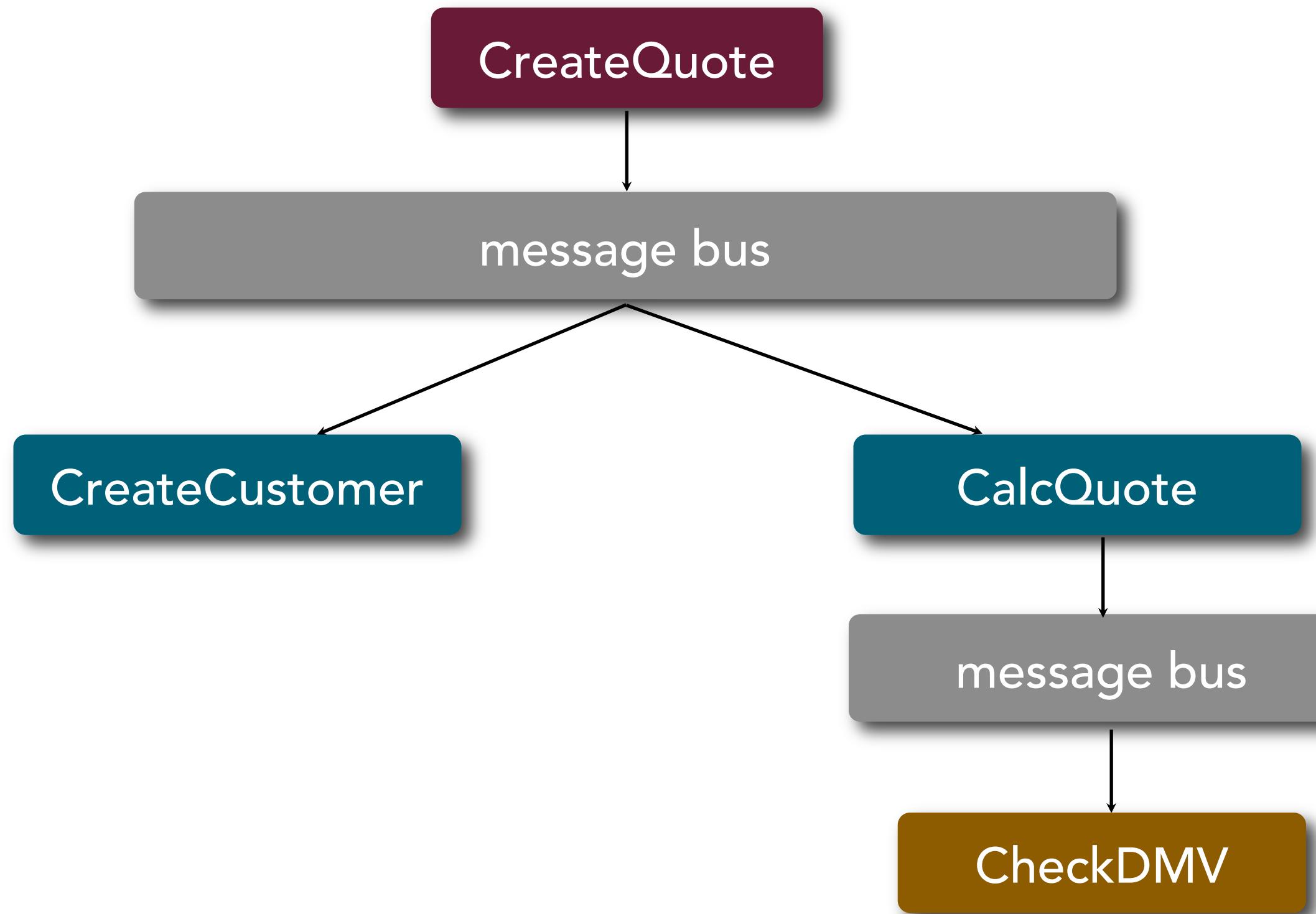
# service-oriented architecture



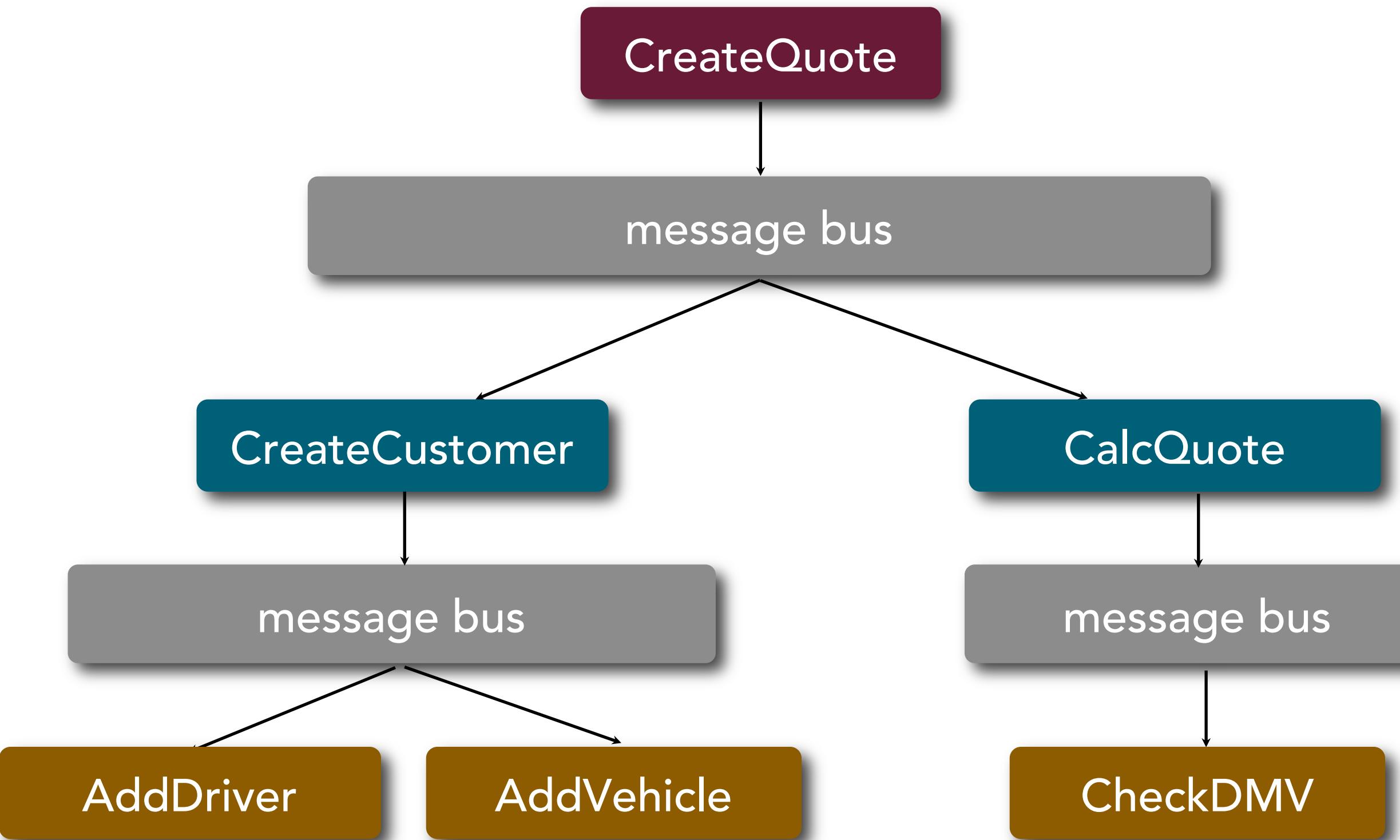
# service-oriented architecture



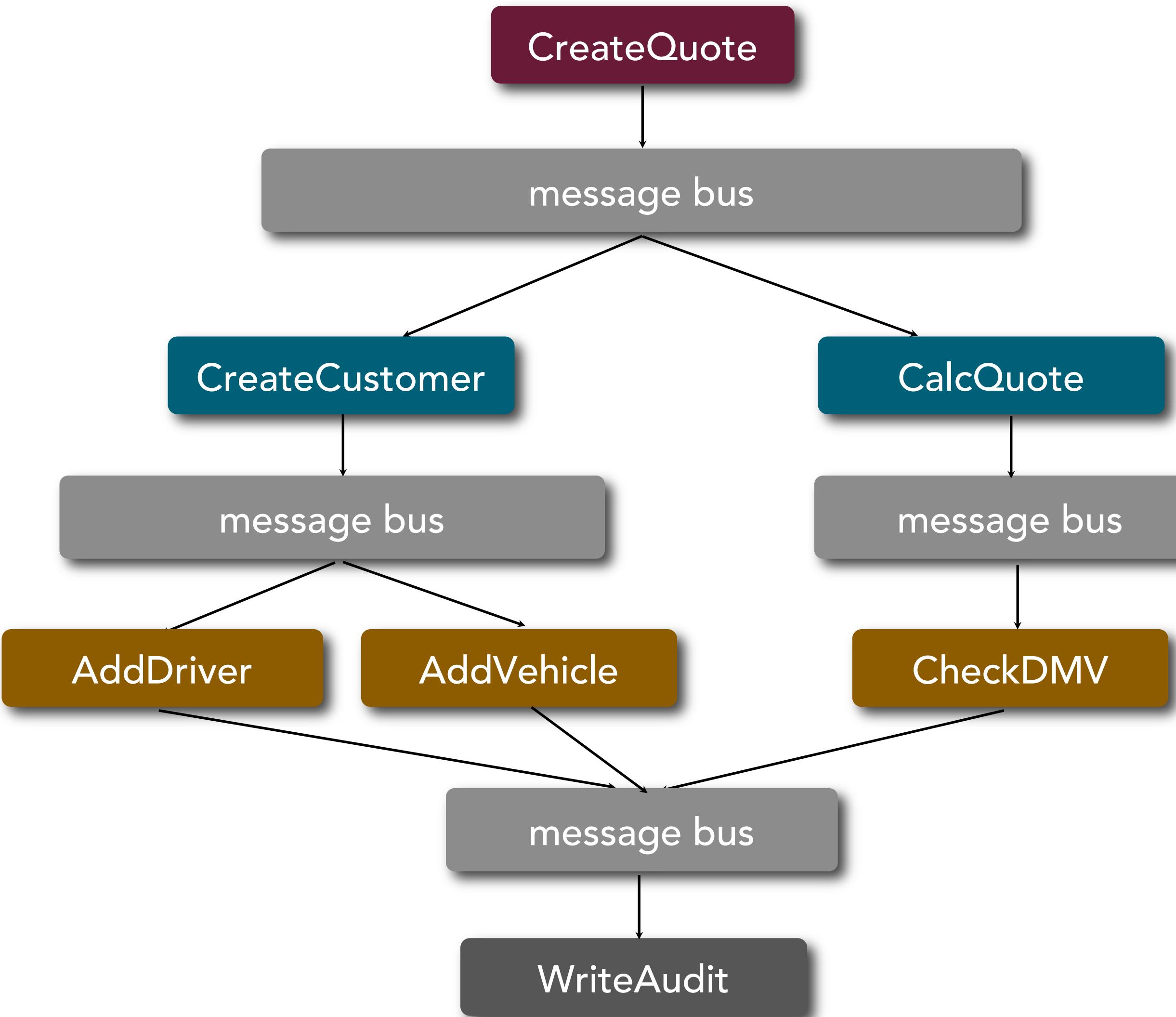
# service-oriented architecture



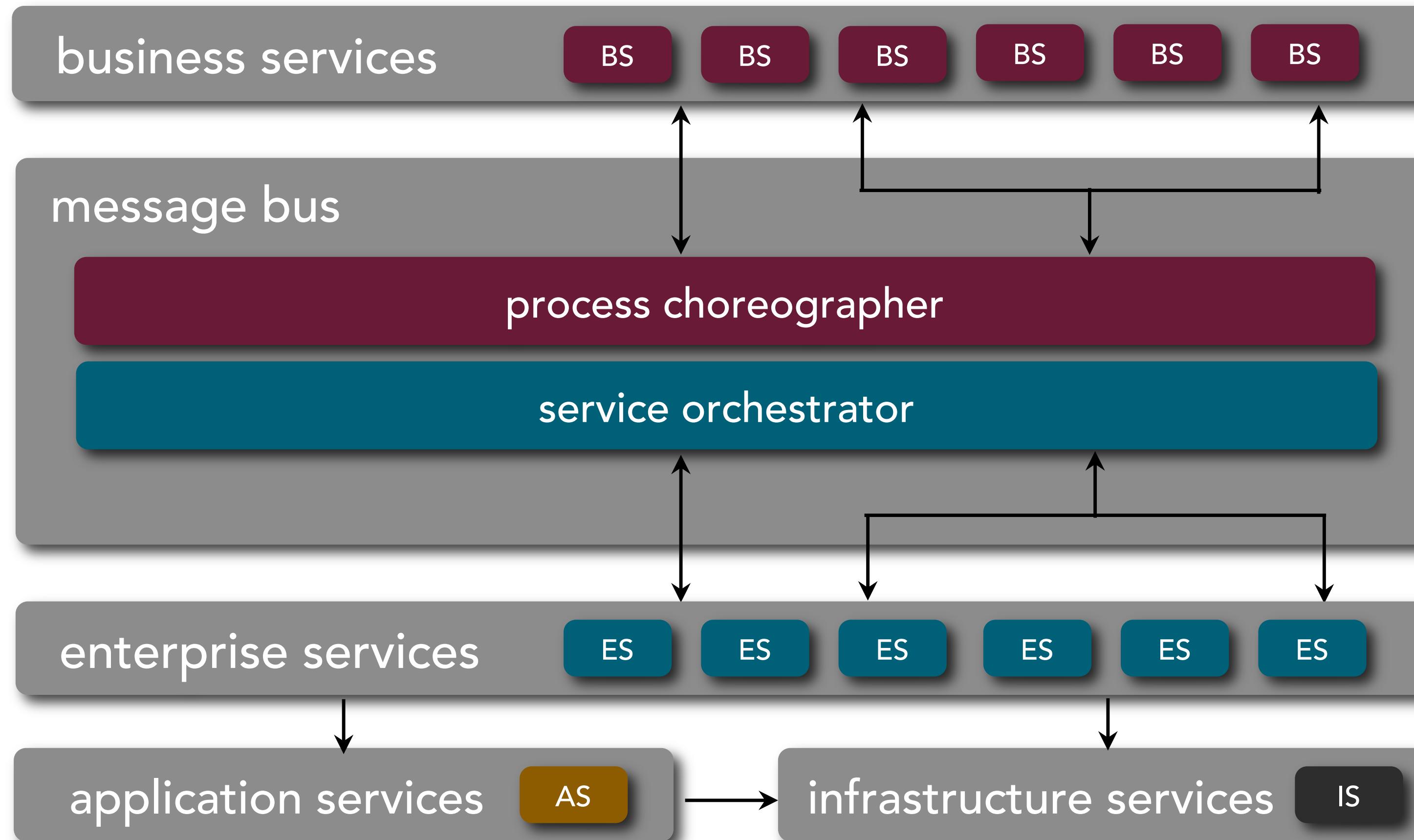
# service-oriented architecture



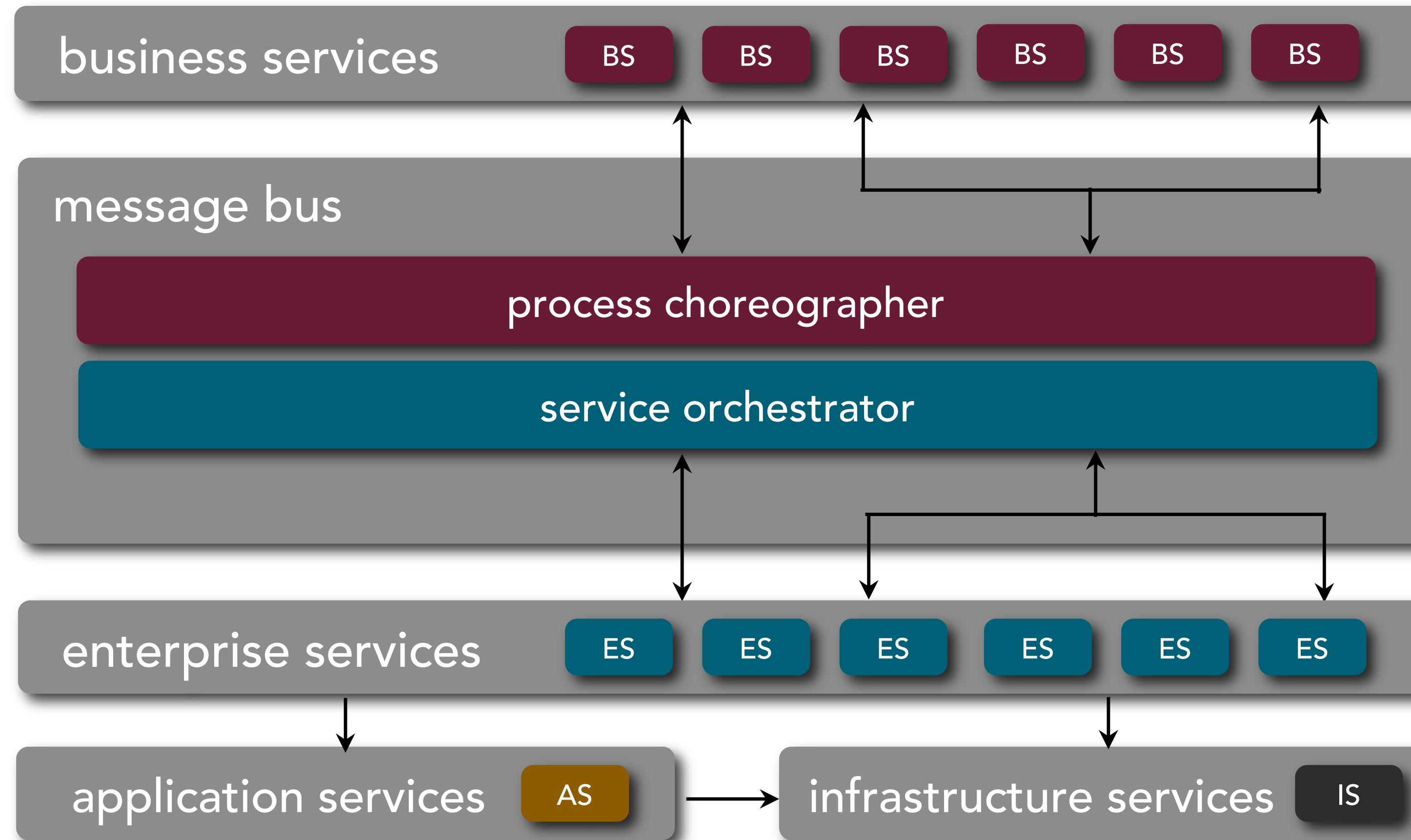
# service-oriented architecture



# service-oriented architecture

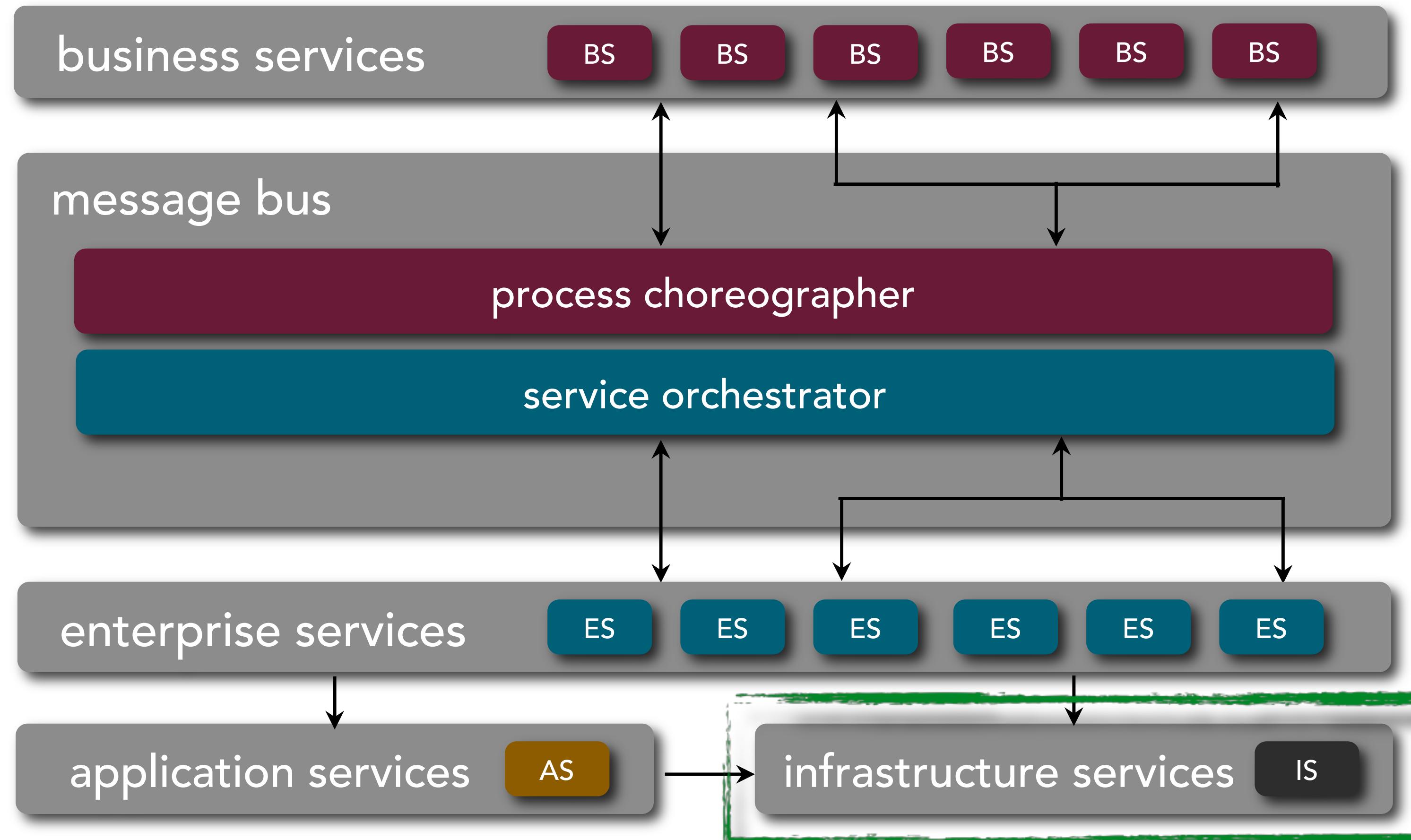


# service-oriented architecture



maximize canonicity

# service-oriented architecture



 **maximize canonicity**

 **maximize reuse**

auto and  
homeowners  
insurance  
division

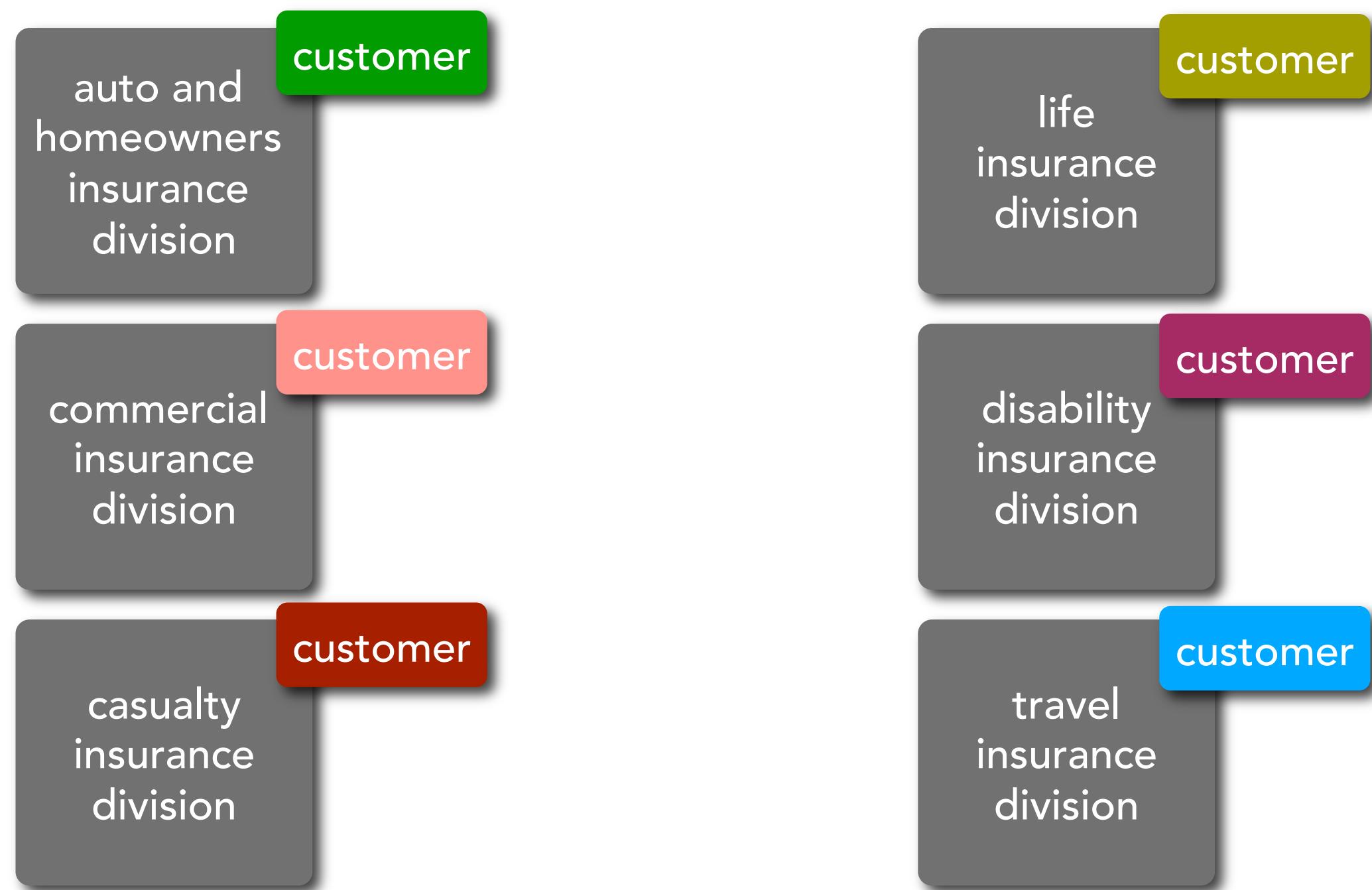
commercial  
insurance  
division

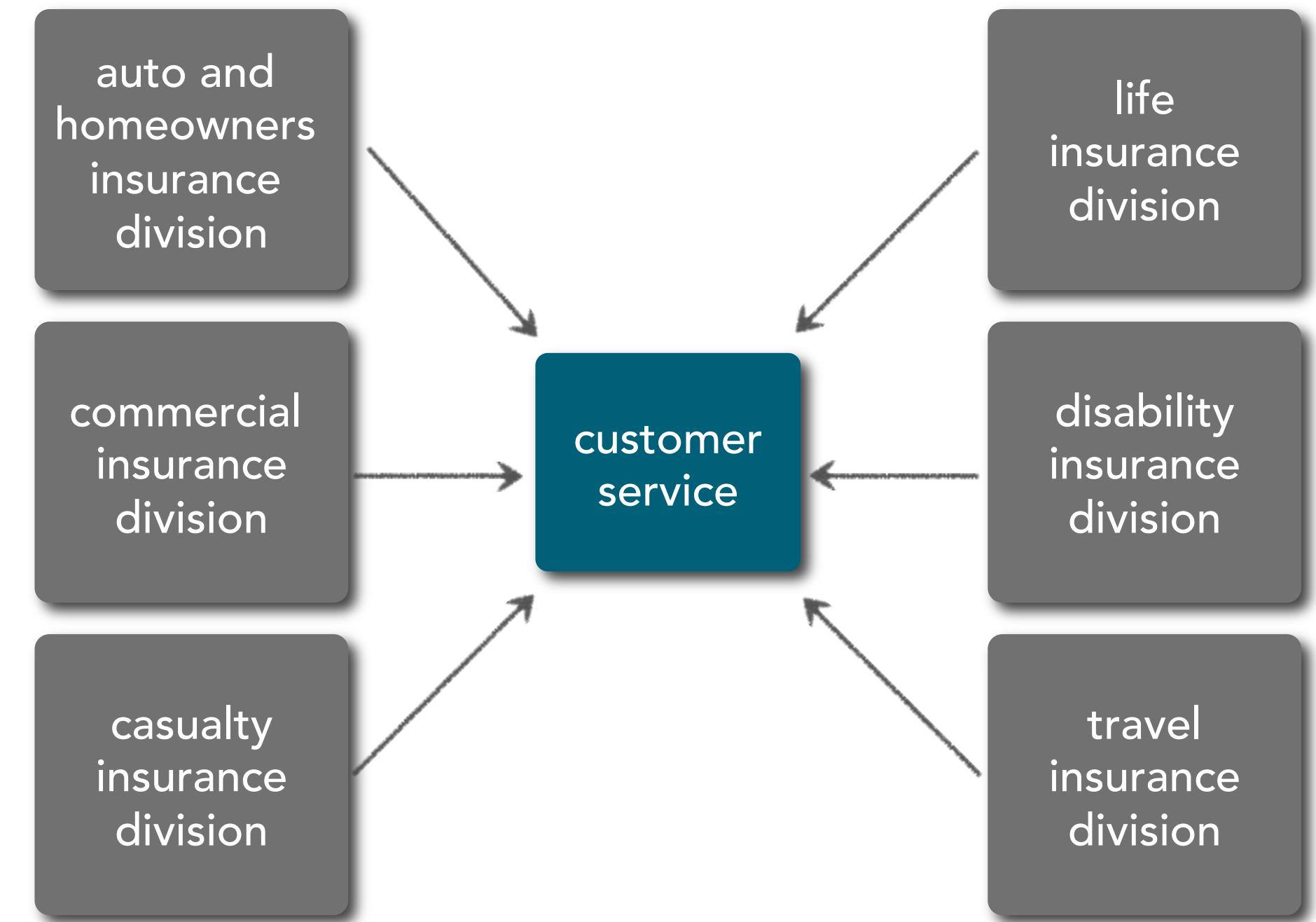
casualty  
insurance  
division

life  
insurance  
division

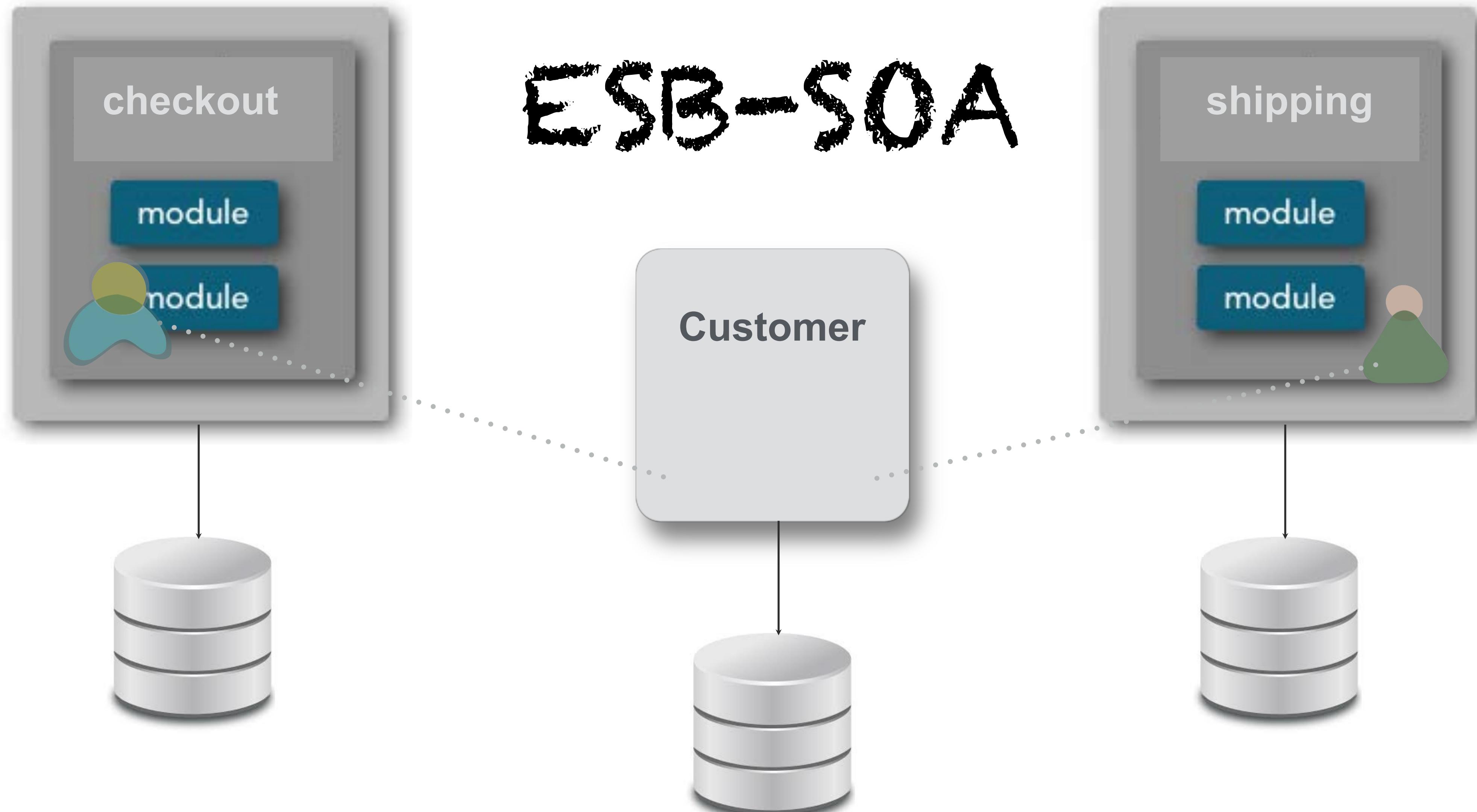
disability  
insurance  
division

travel  
insurance  
division

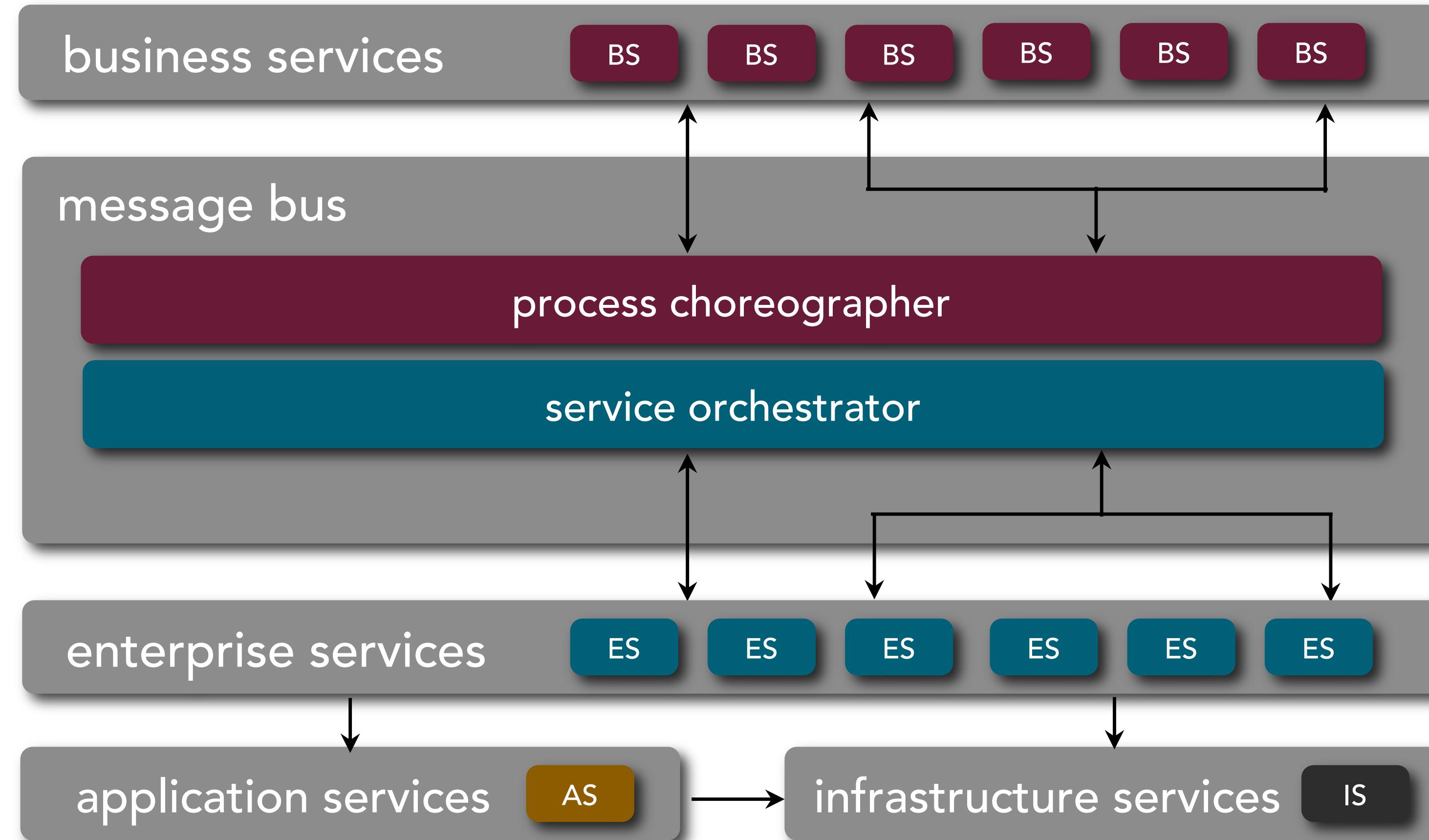




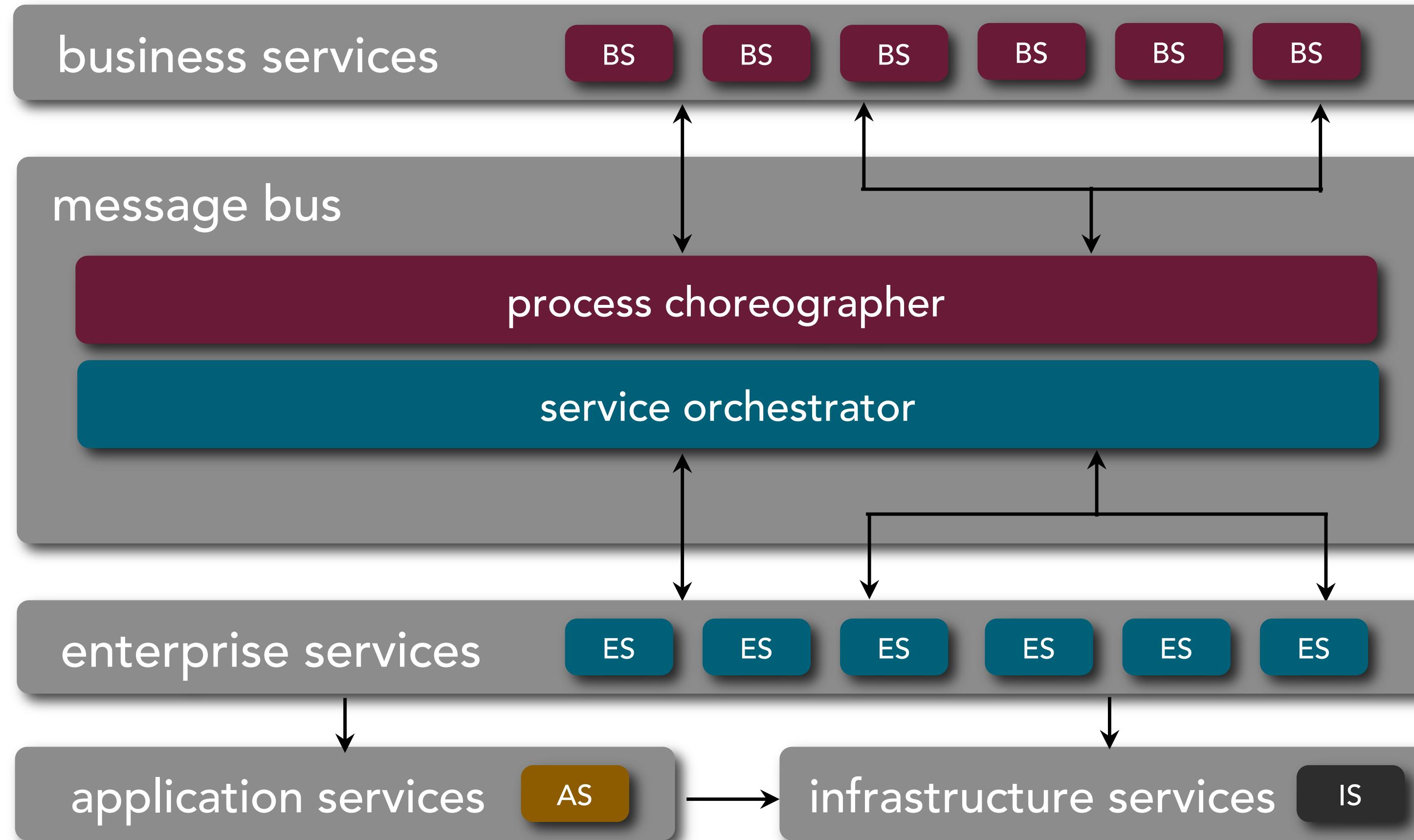
# Code Reuse (Over Time)



# service-oriented architecture

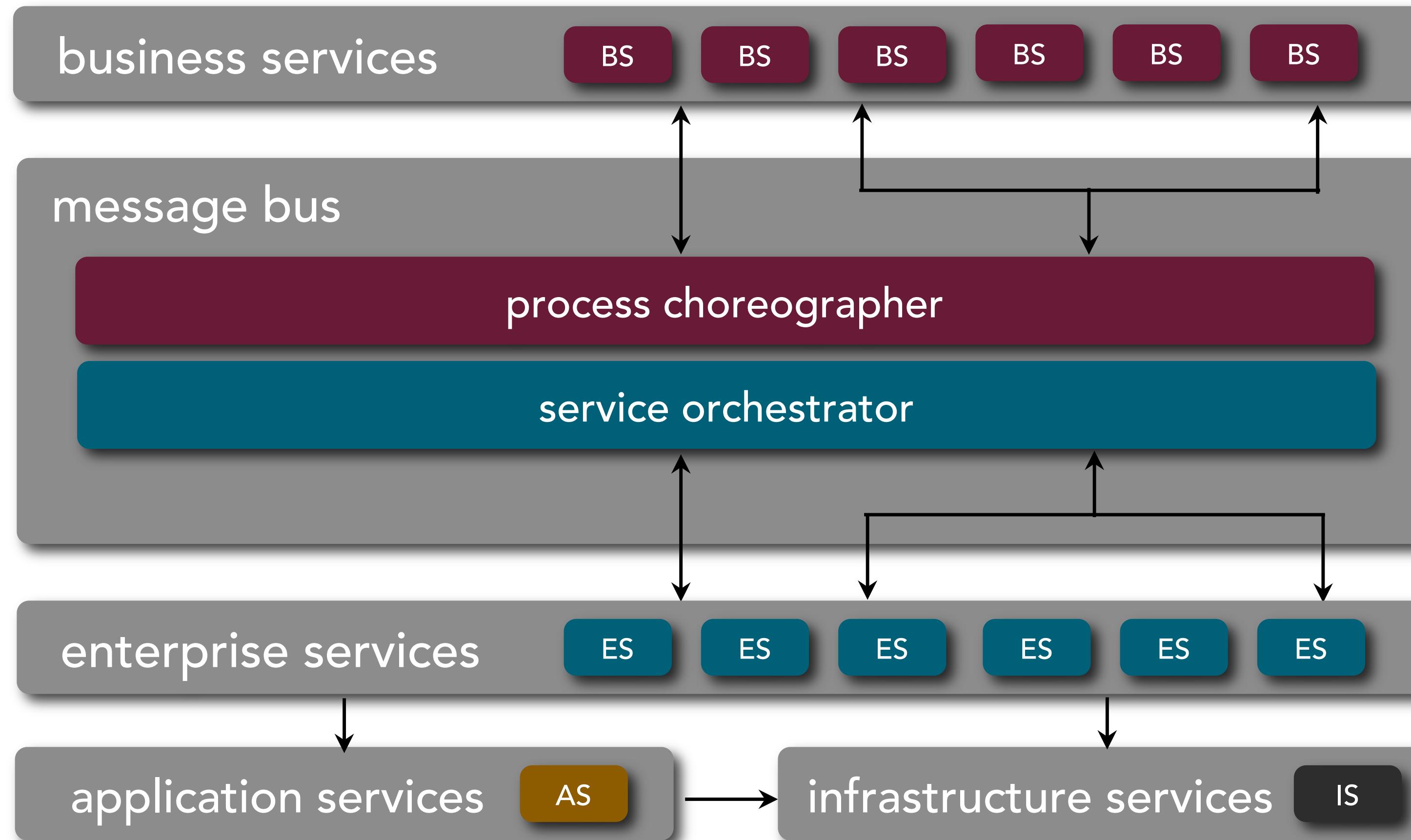


# service-oriented architecture



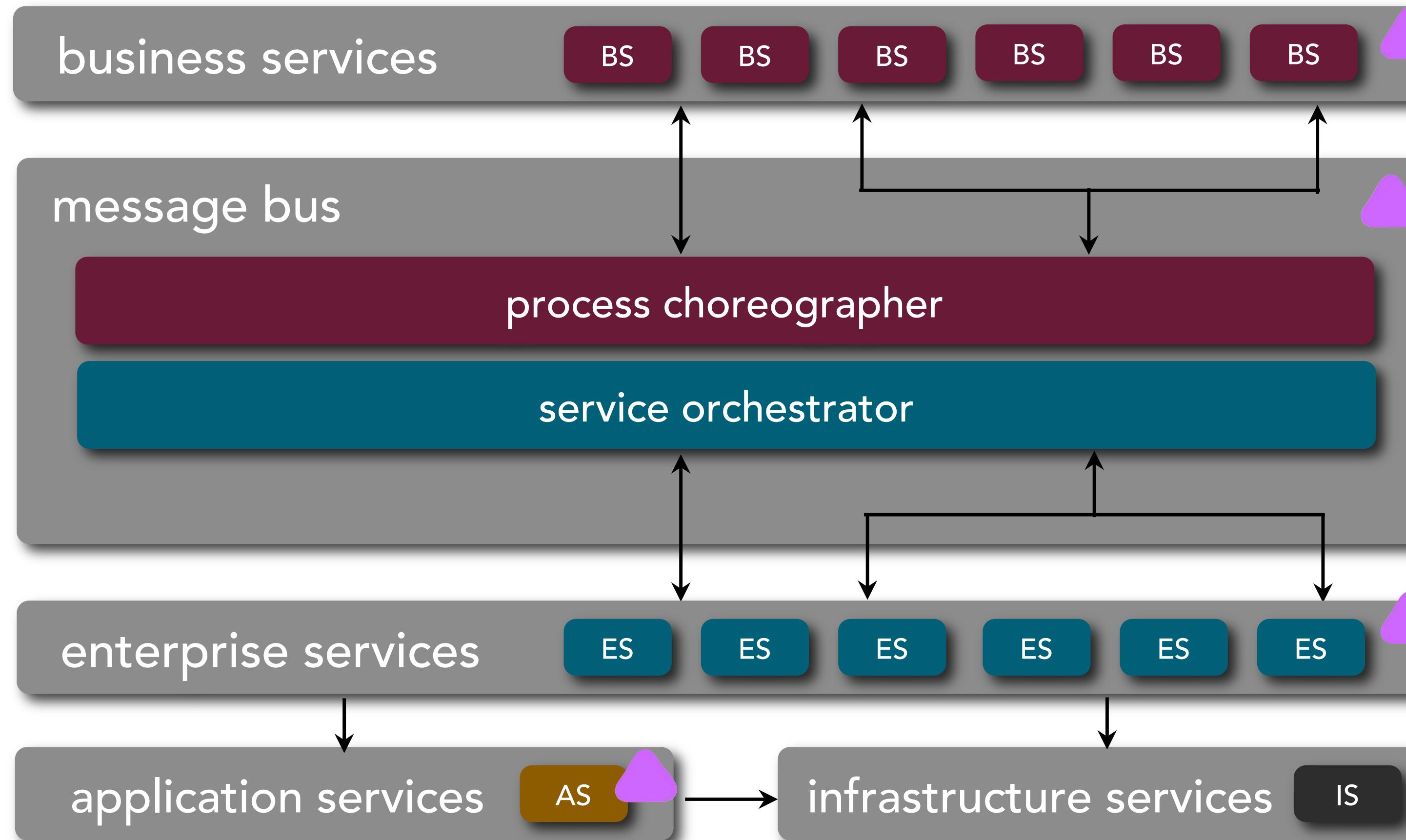
**operationally coupled**

# service-oriented architecture



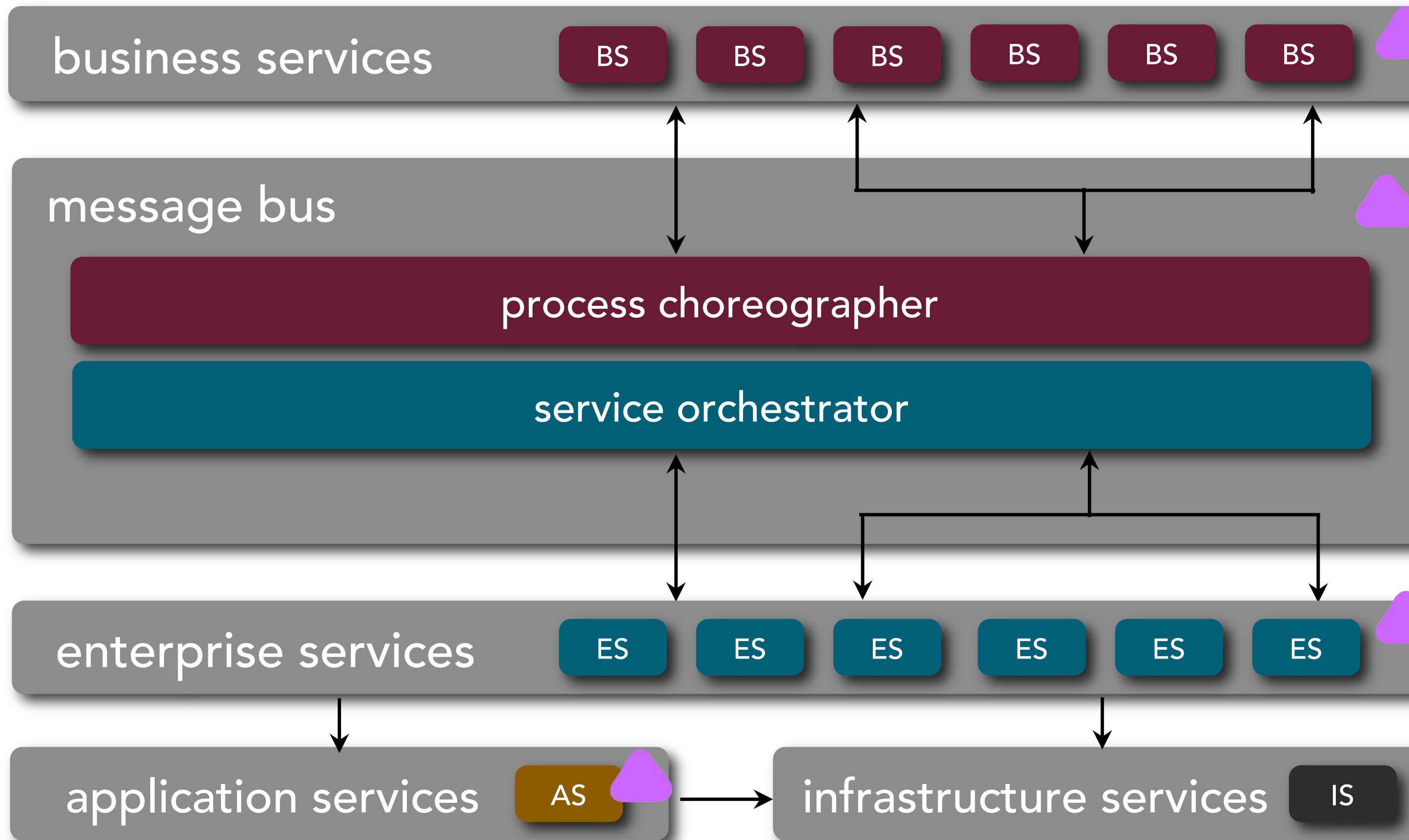
✖ **operationally coupled**  
✖ **incremental change**

# service-oriented architecture



**✖ operationally coupled**  
**✖ incremental change**

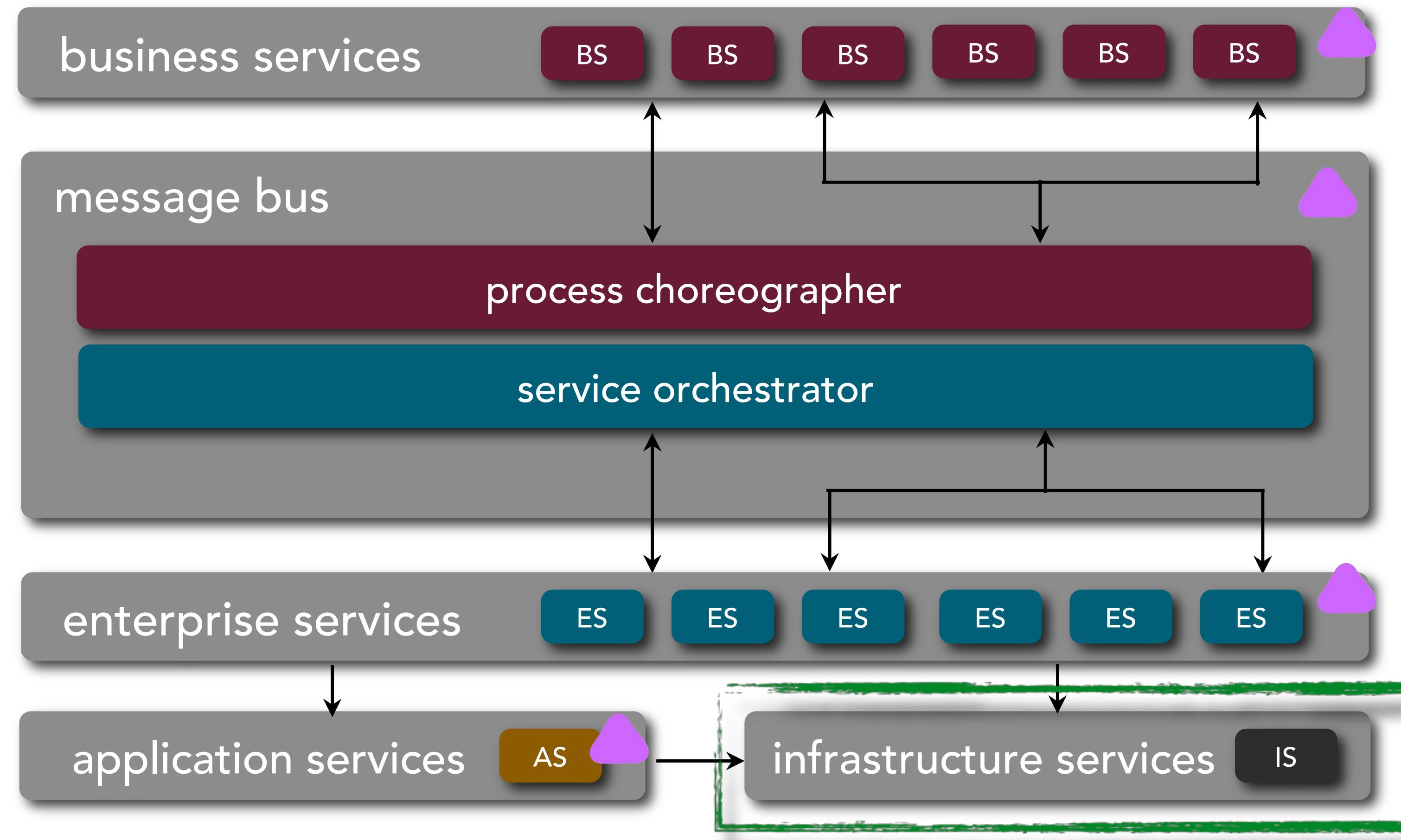
# service-oriented architecture



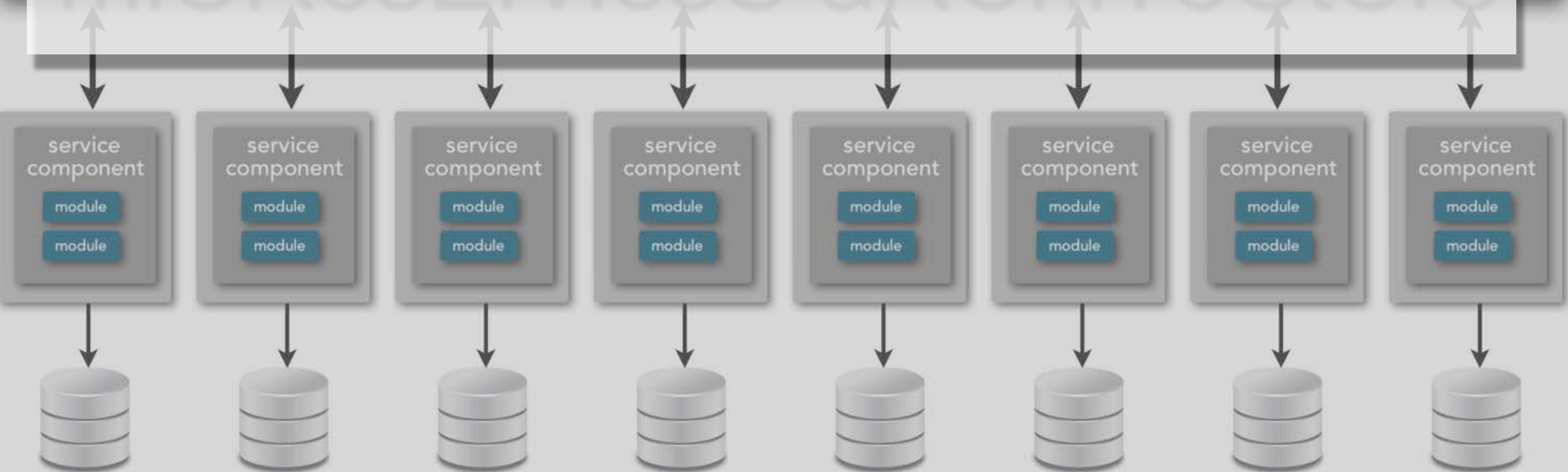
- ✖ **operationally coupled**
- ✖ **incremental change**

functional partitioning

# service-oriented architecture

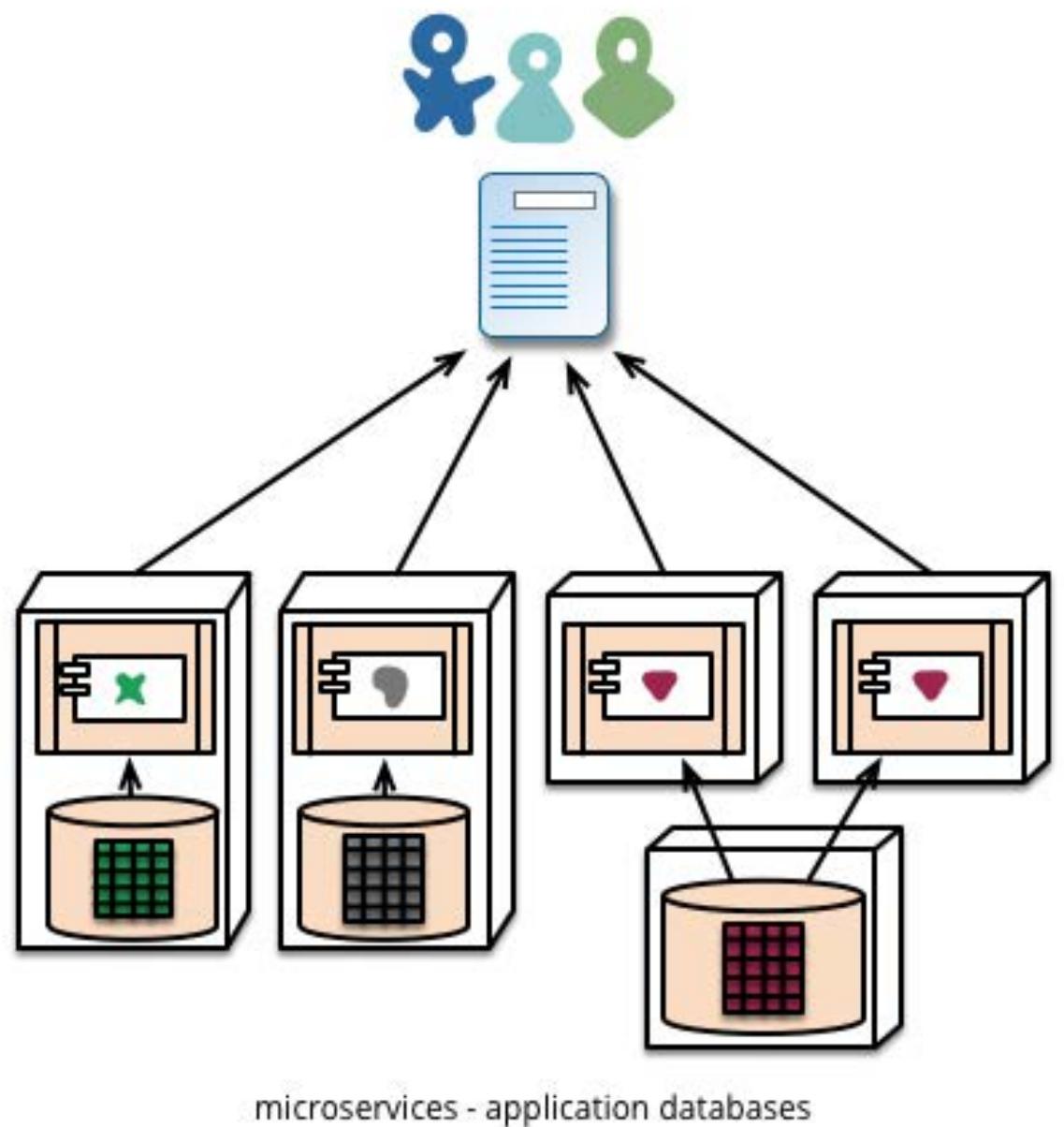


# miCRoSErviceS aRChiTeCture



# microservices

<https://martinfowler.com/articles/microservices.html>



https://martinfowler.com/articles/microservices.html

MARTINFOWLER.COM

Contents

## Microservices

a definition of this new architectural term

*The term "Microservice Architecture" has sprung up over the last few years to describe a particular way of designing software applications as suites of independently deployable services. While there is no precise definition of this architectural style, there are certain common characteristics around organization around business capability, automated deployment, intelligence in the endpoints, and decentralized control of languages and data.*

25 March 2014

 **James Lewis**  
James Lewis is a Principal Consultant at ThoughtWorks and member of the Technology Advisory Board. James' interest in building applications out of small collaborating services stems from a background in integrating enterprise systems at scale. He's built a number of systems using microservices and has been an active participant in the growing community for a couple of years.

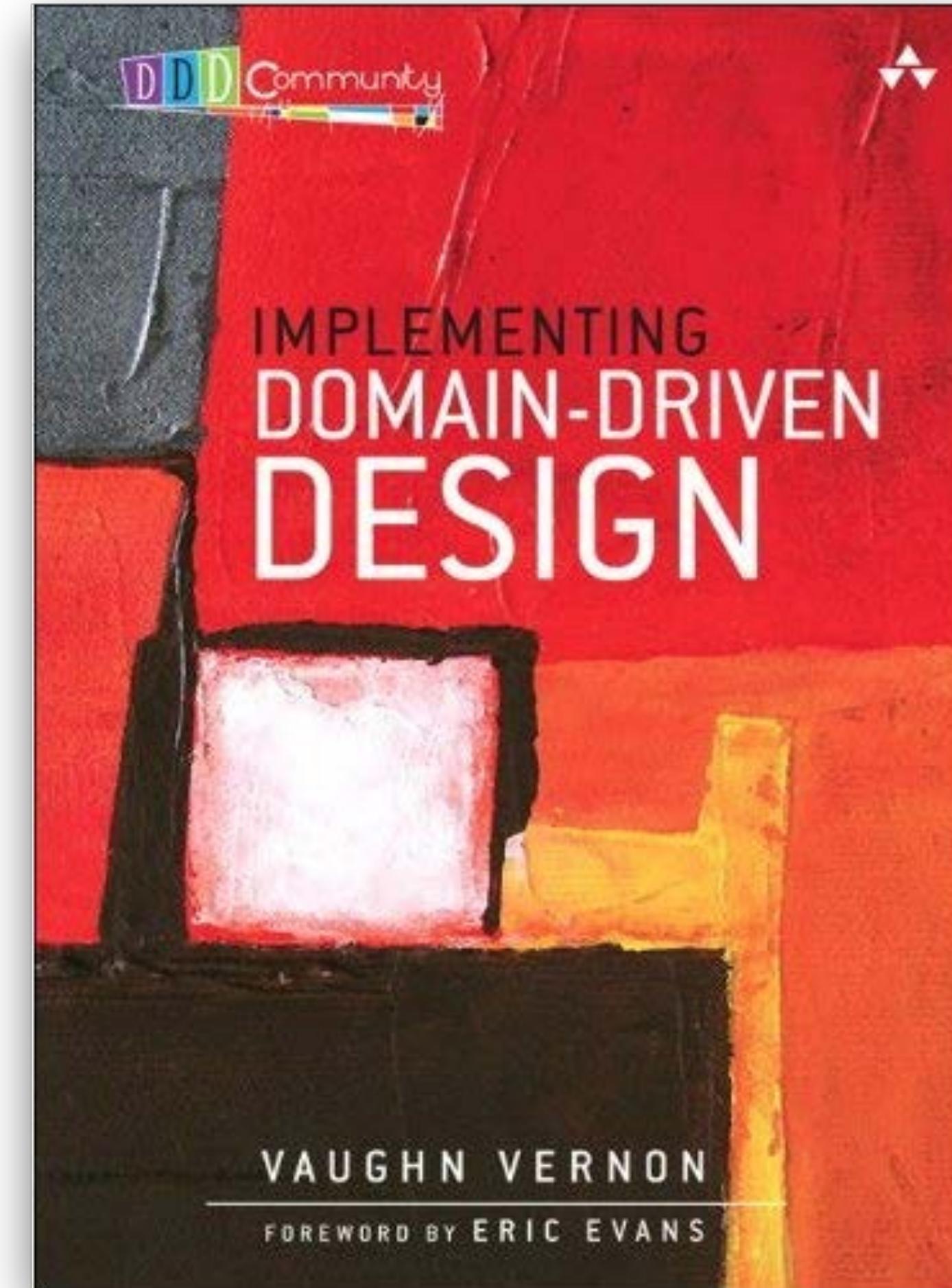
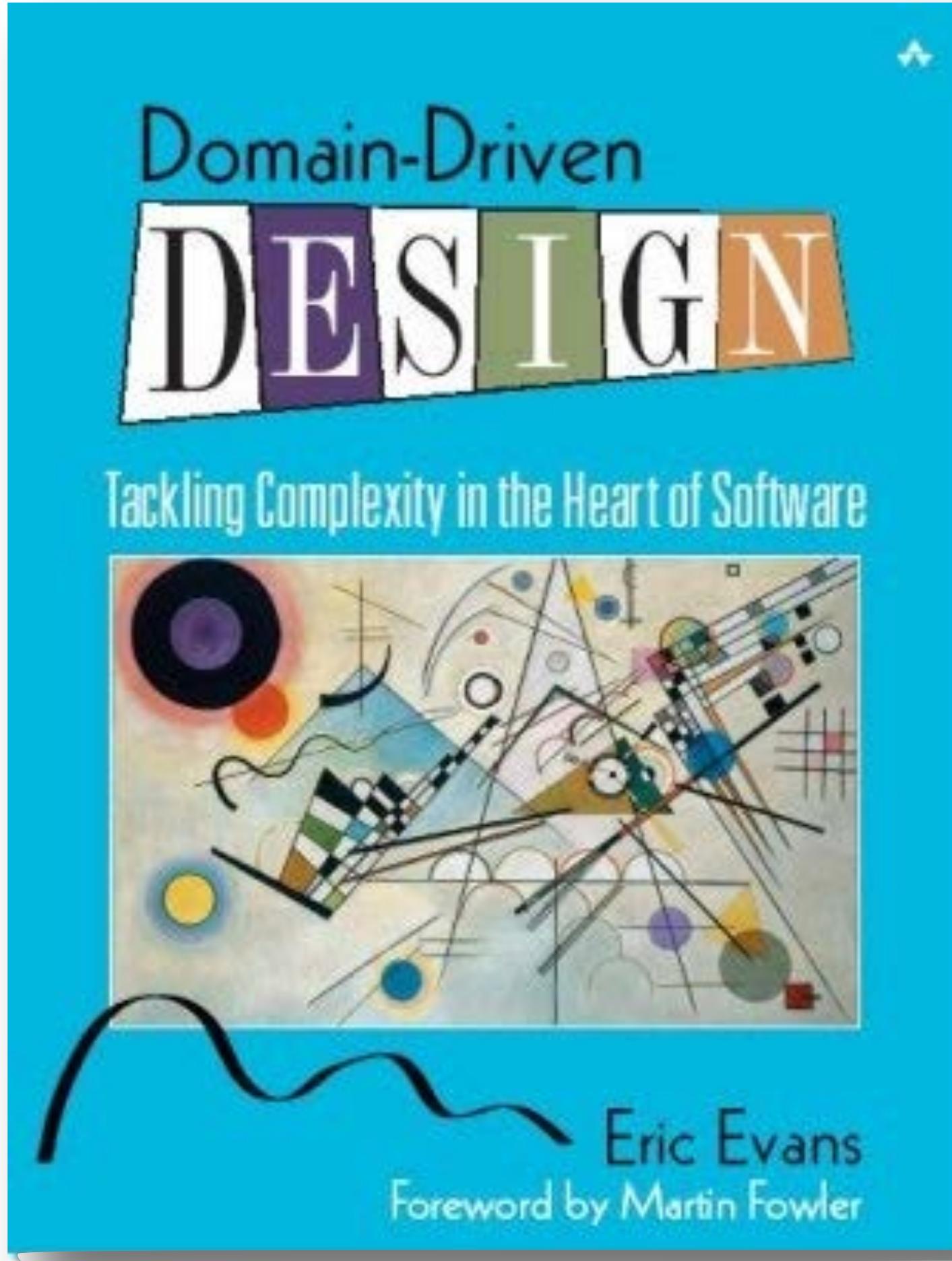
 **Martin Fowler**  
Martin Fowler is an author, speaker, and general loud-mouth on software development. He's long been puzzled by the problem of how to componentize software systems, having heard more vague claims than he's happy with. He hopes that microservices will live up to the early promise its advocates have found.

**Translations:** [Japanese](#) · [Russian](#) · [Korean](#) · [Portuguese](#) · [Simplified Chinese](#) · [Simplified Chinese](#) · [Persian](#)

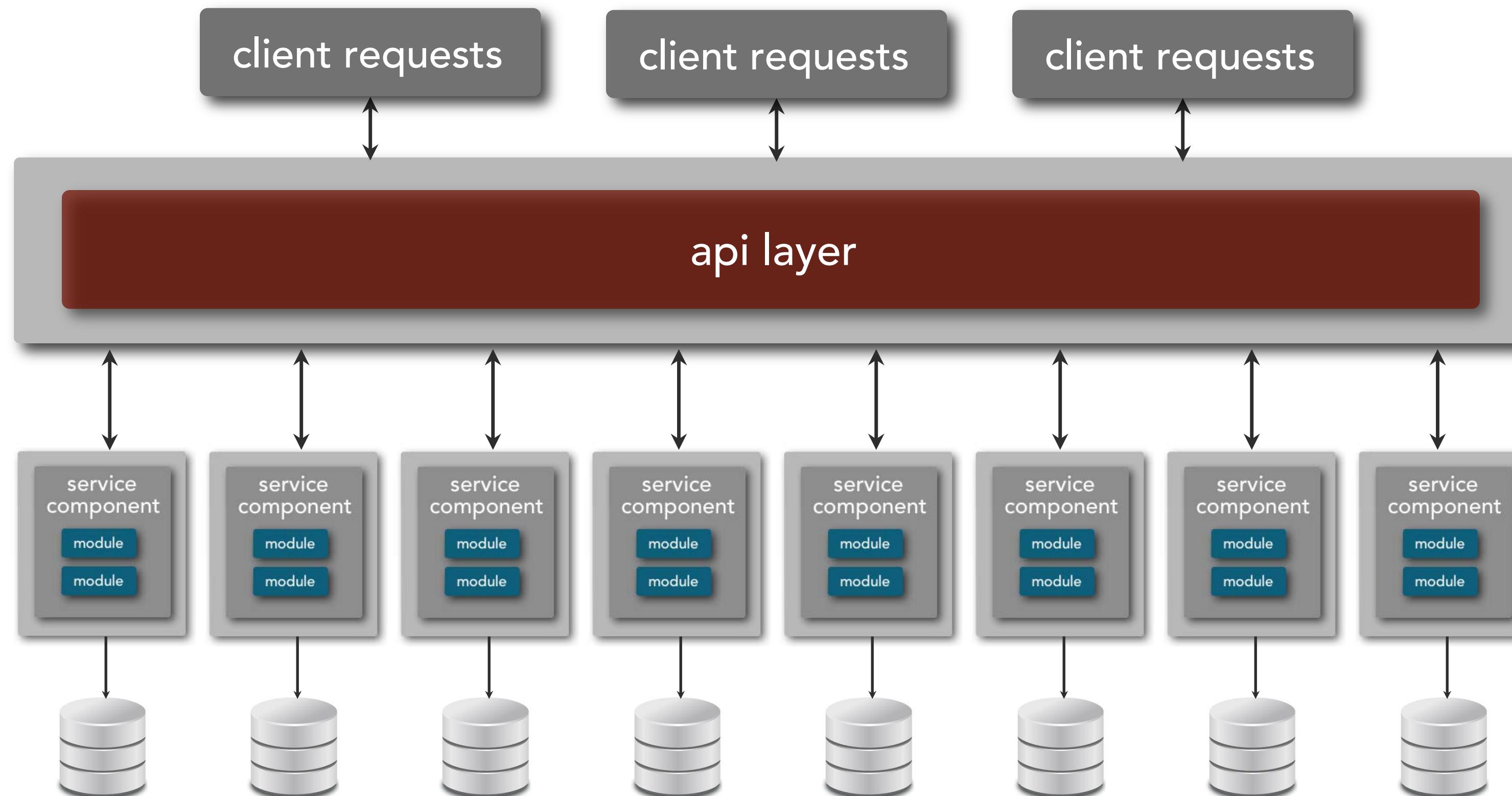
Find **similar articles** to this by looking at these tags: [popular](#) · [application architecture](#) · [web services](#) · [microservices](#)

"Microservices" - yet another new term on the crowded streets of software architecture. Although our natural inclination is to pass such things by with a contemptuous glance, this bit of terminology describes a style of software systems that we are finding more and more appealing. We've seen many projects use this style in the last few years, and results so far have been positive, so much so that

# domain driven design

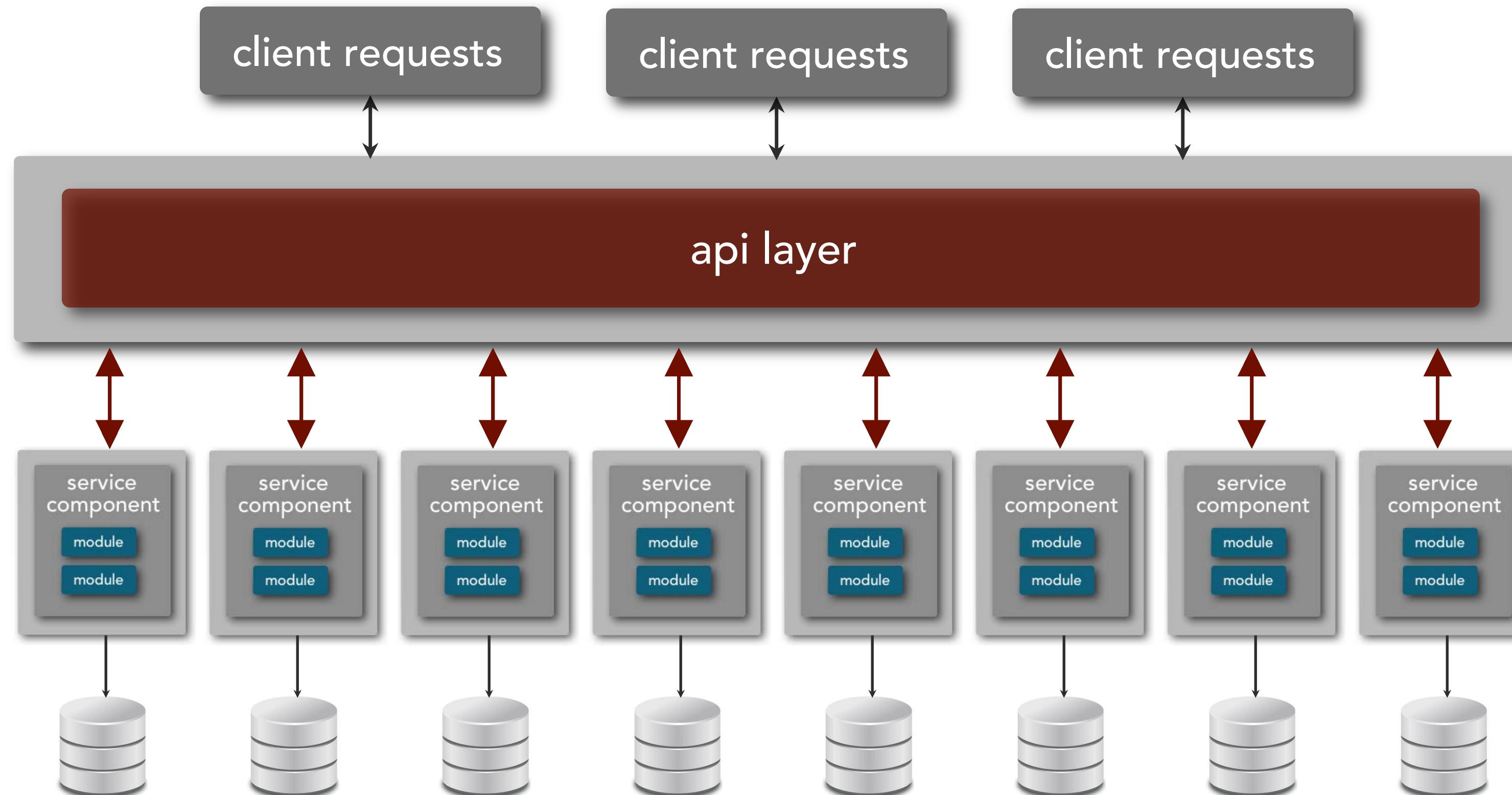


# microservices architecture



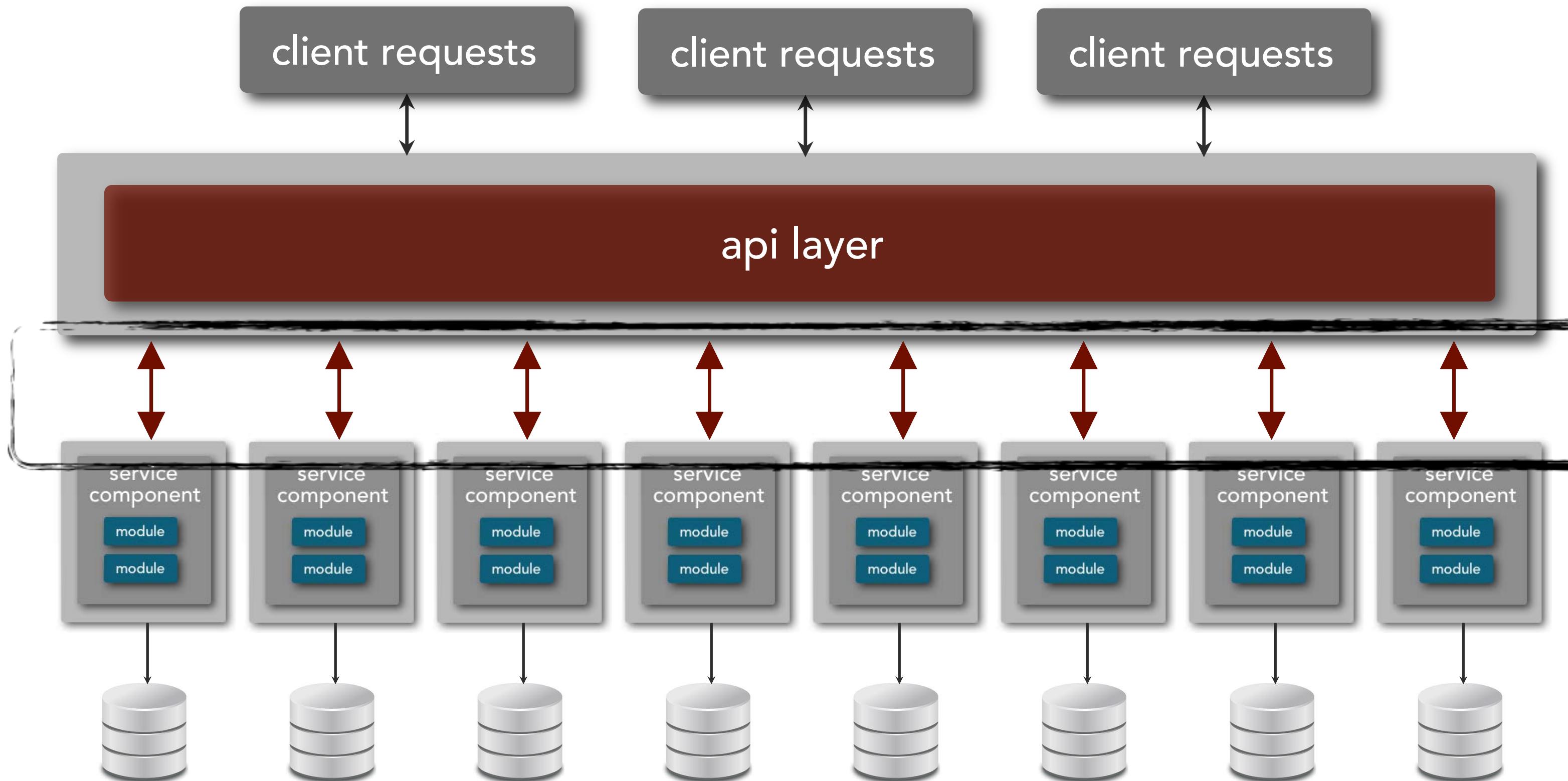
# microservices architecture

## distributed architecture



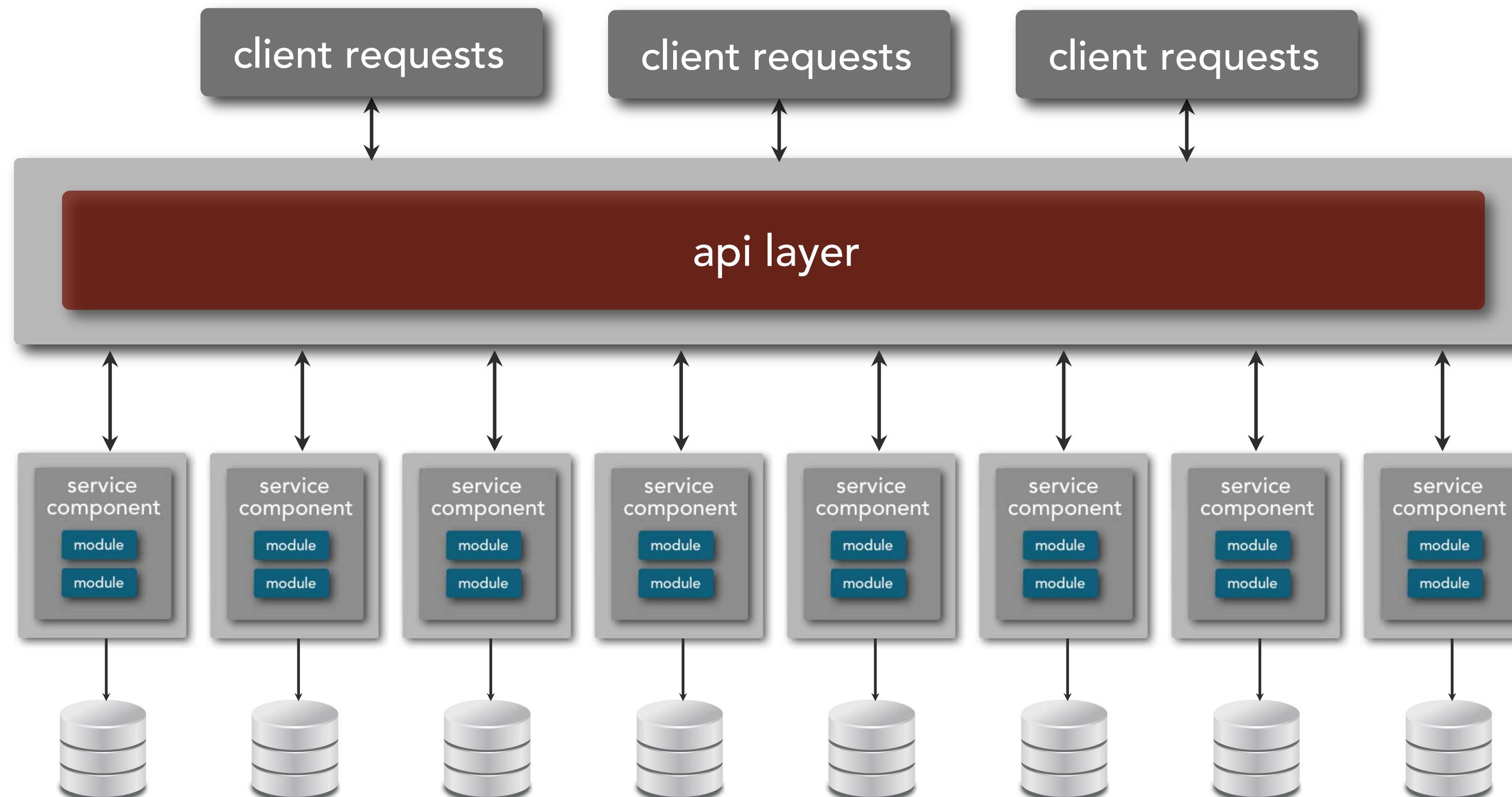
# microservices architecture

## distributed architecture



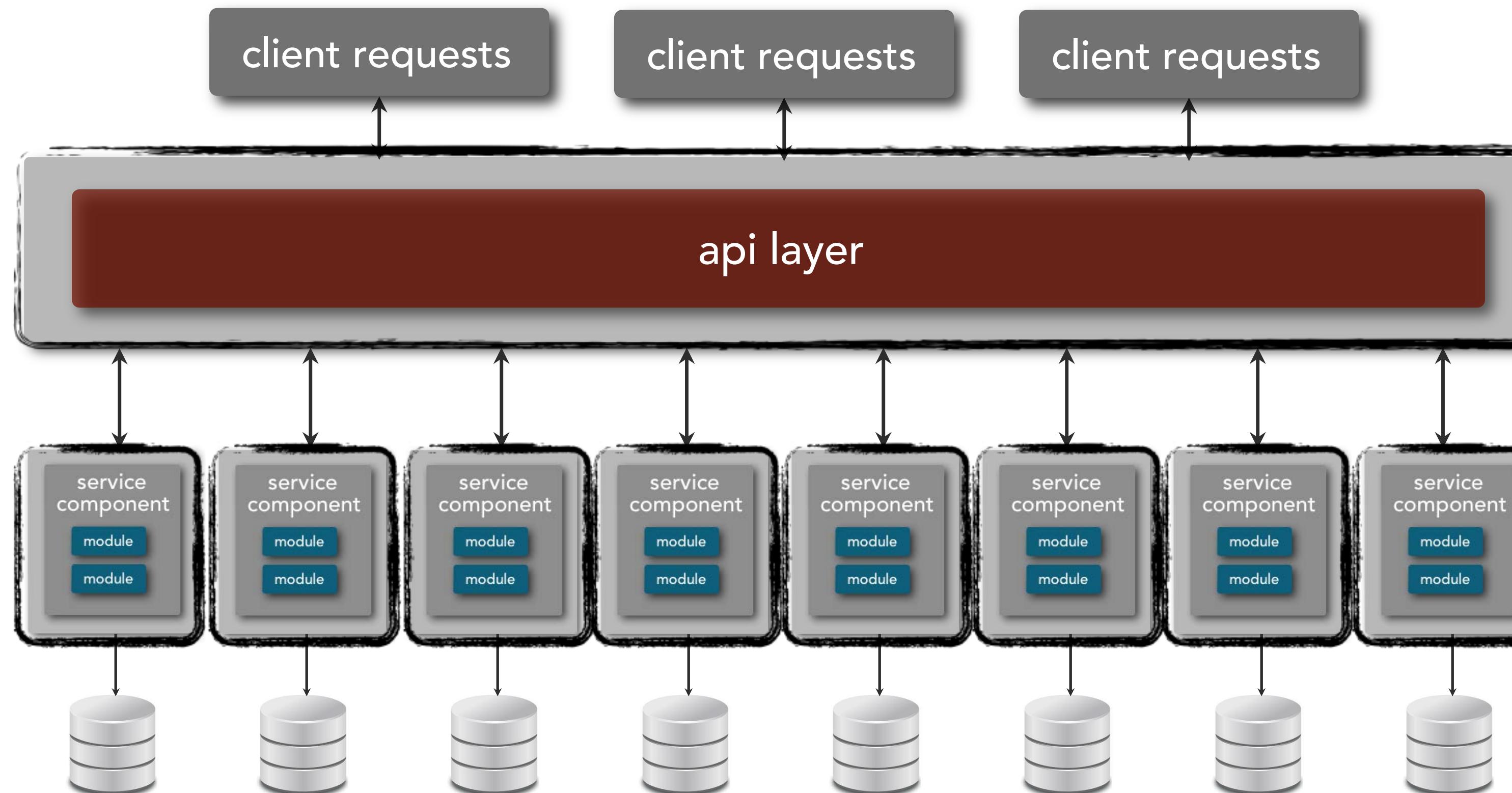
# microservices architecture

separately deployed components



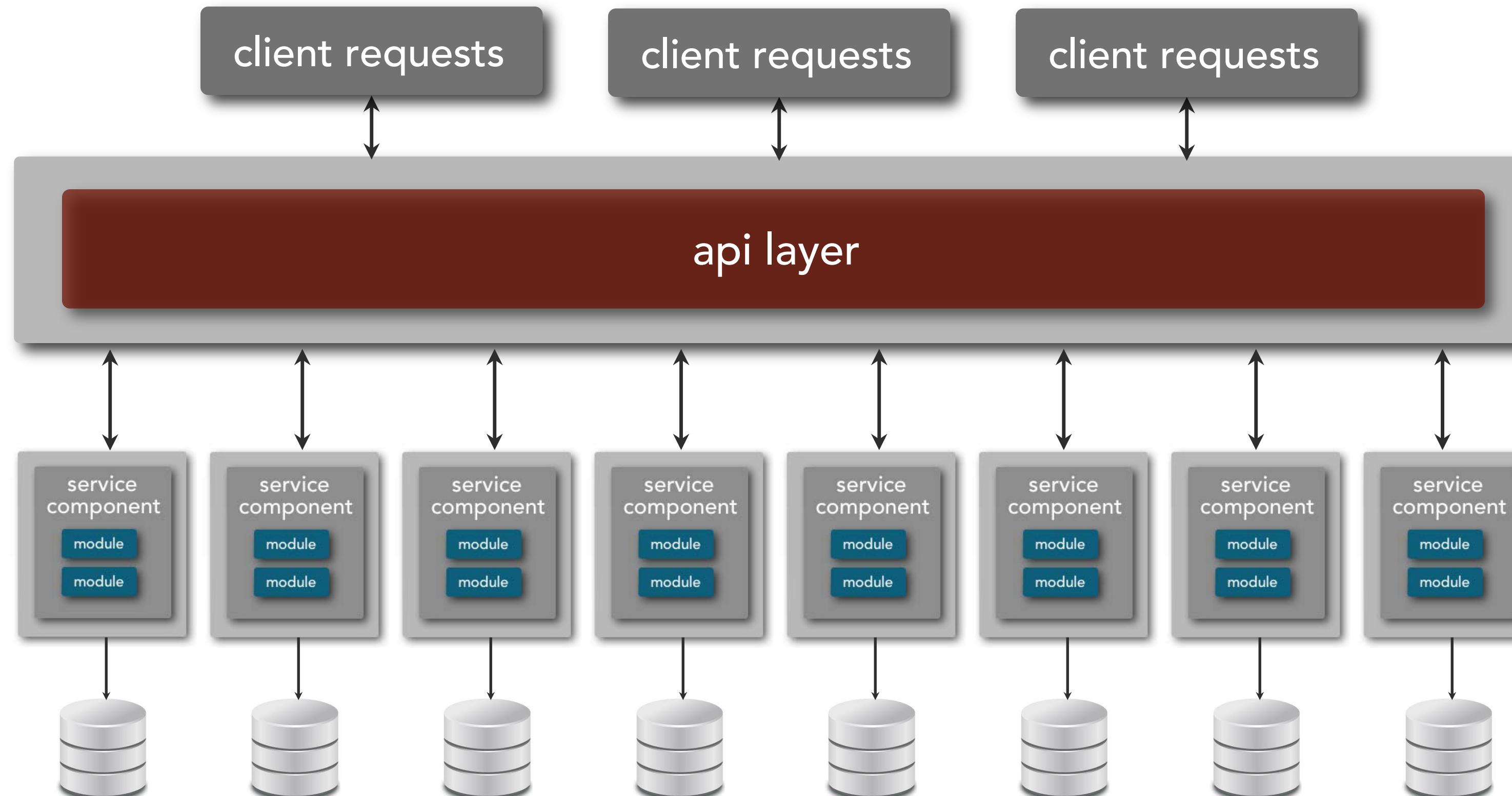
# microservices architecture

separately deployed components



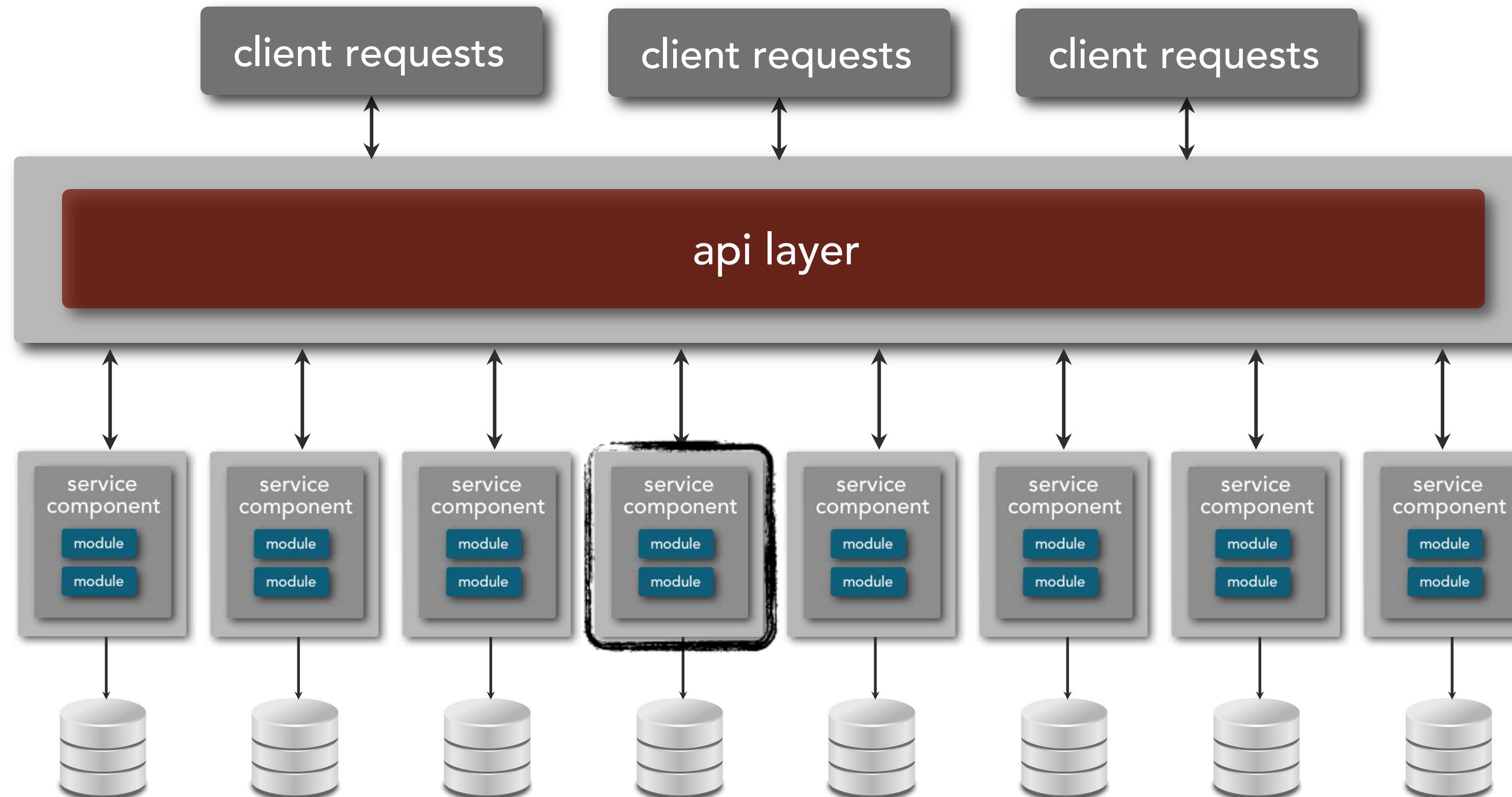
# microservices architecture

## service component



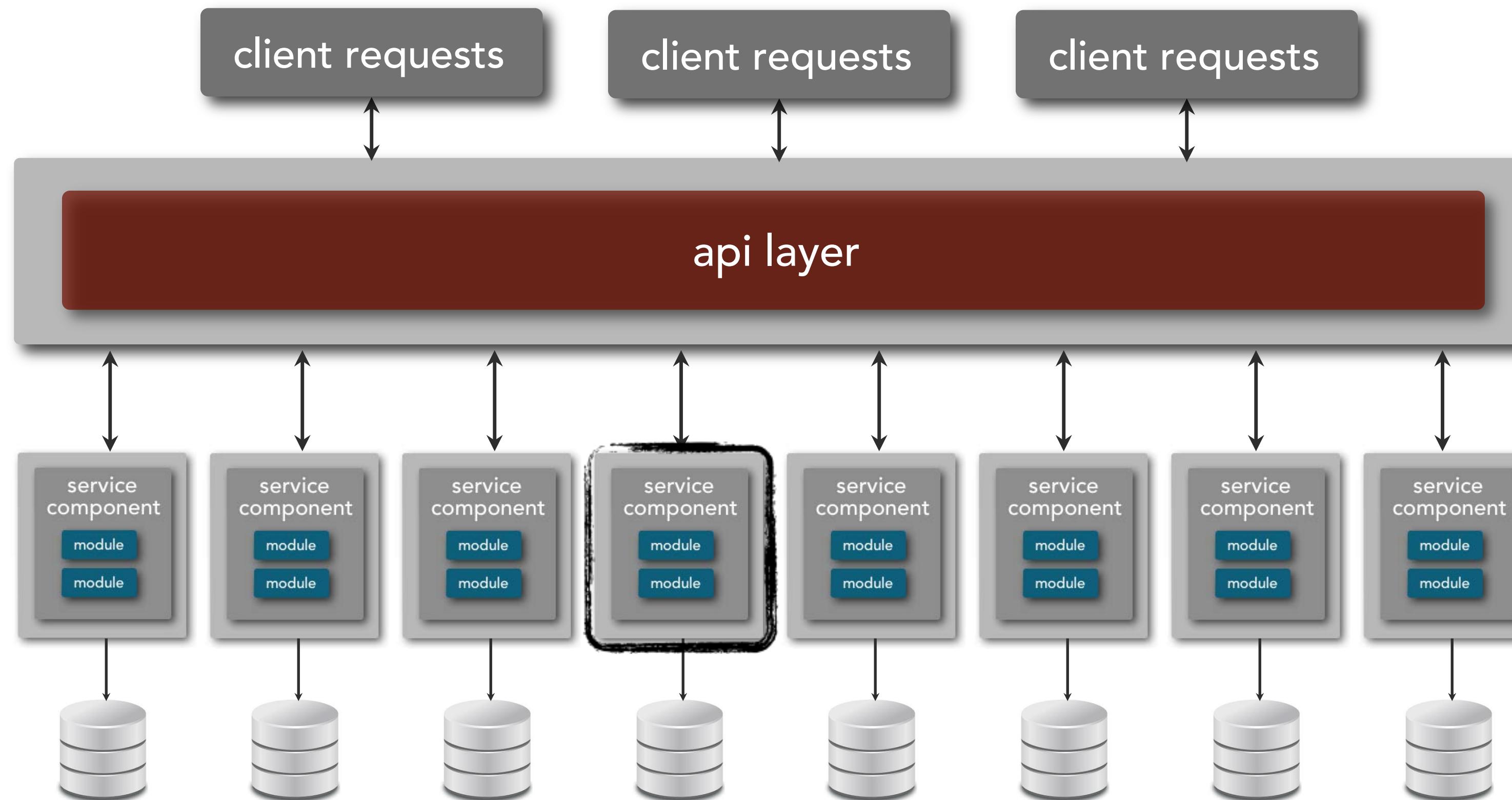
# microservices architecture

## service component



# microservices architecture

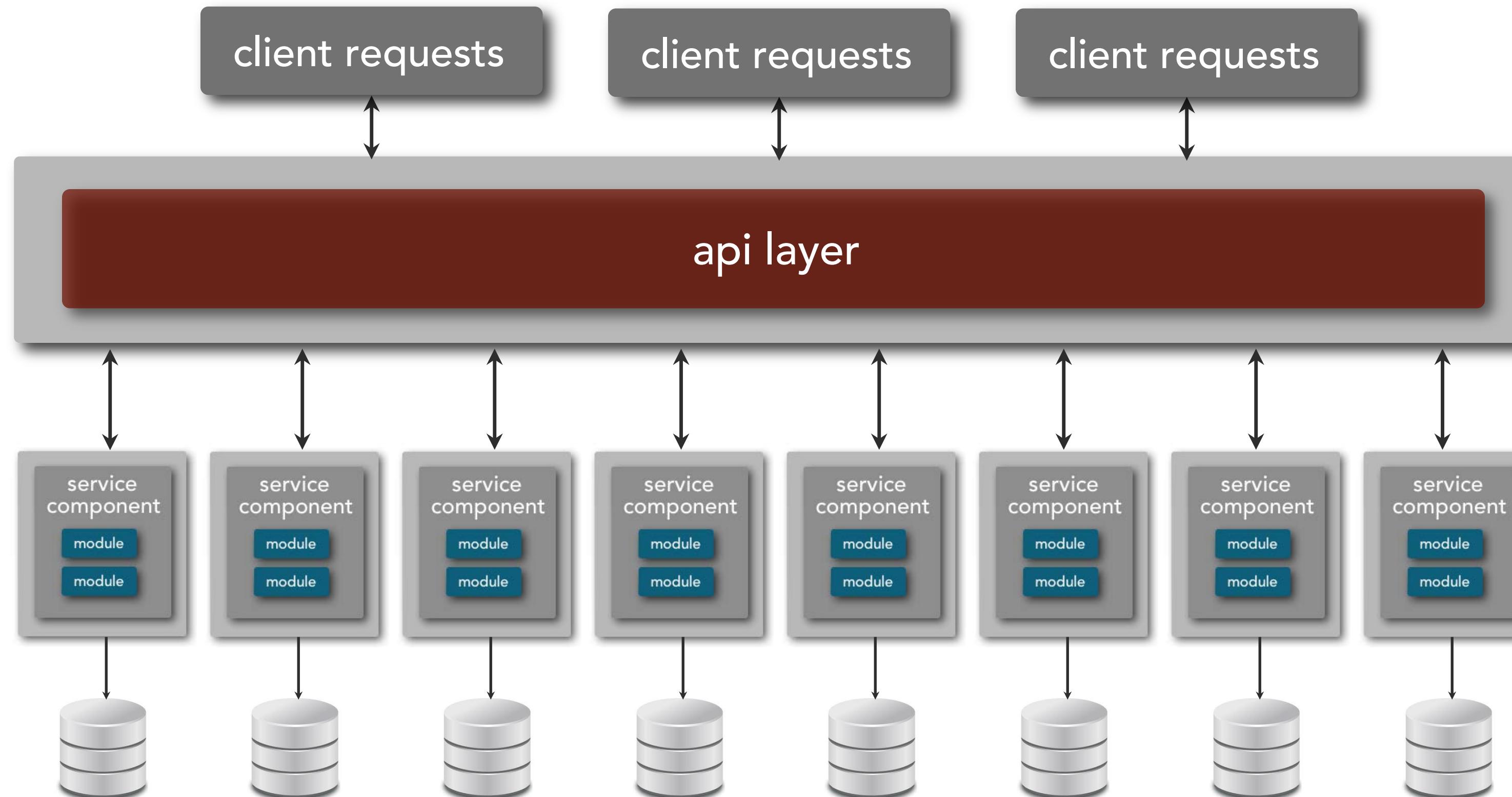
## service component



*microservices is a label, not a description.*

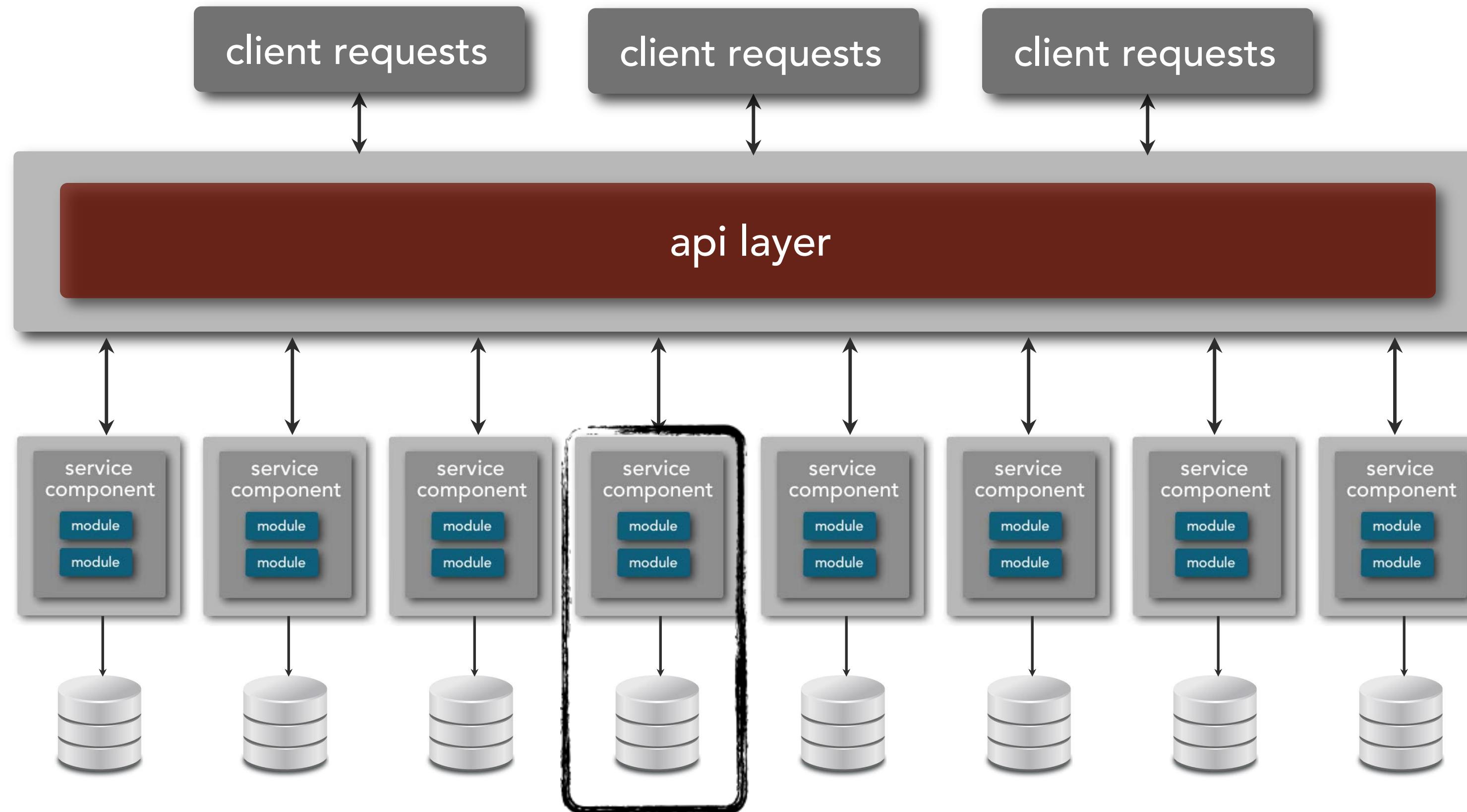
# microservices architecture

## bounded context



# microservices architecture

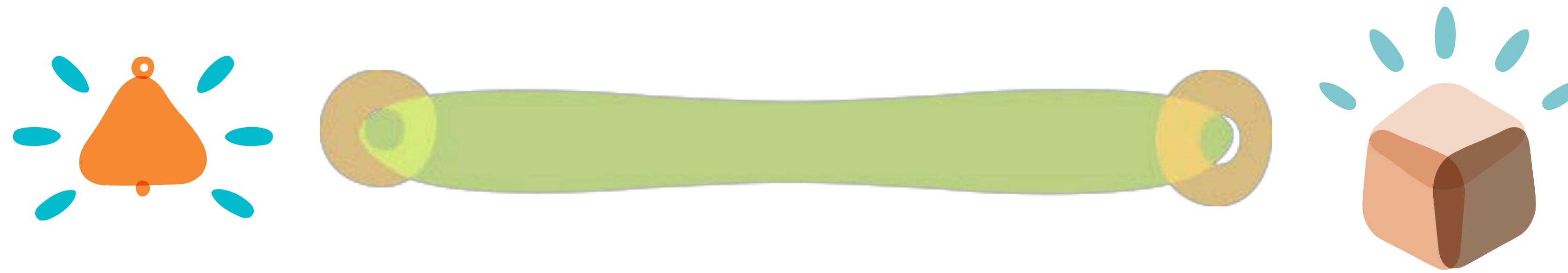
## bounded context



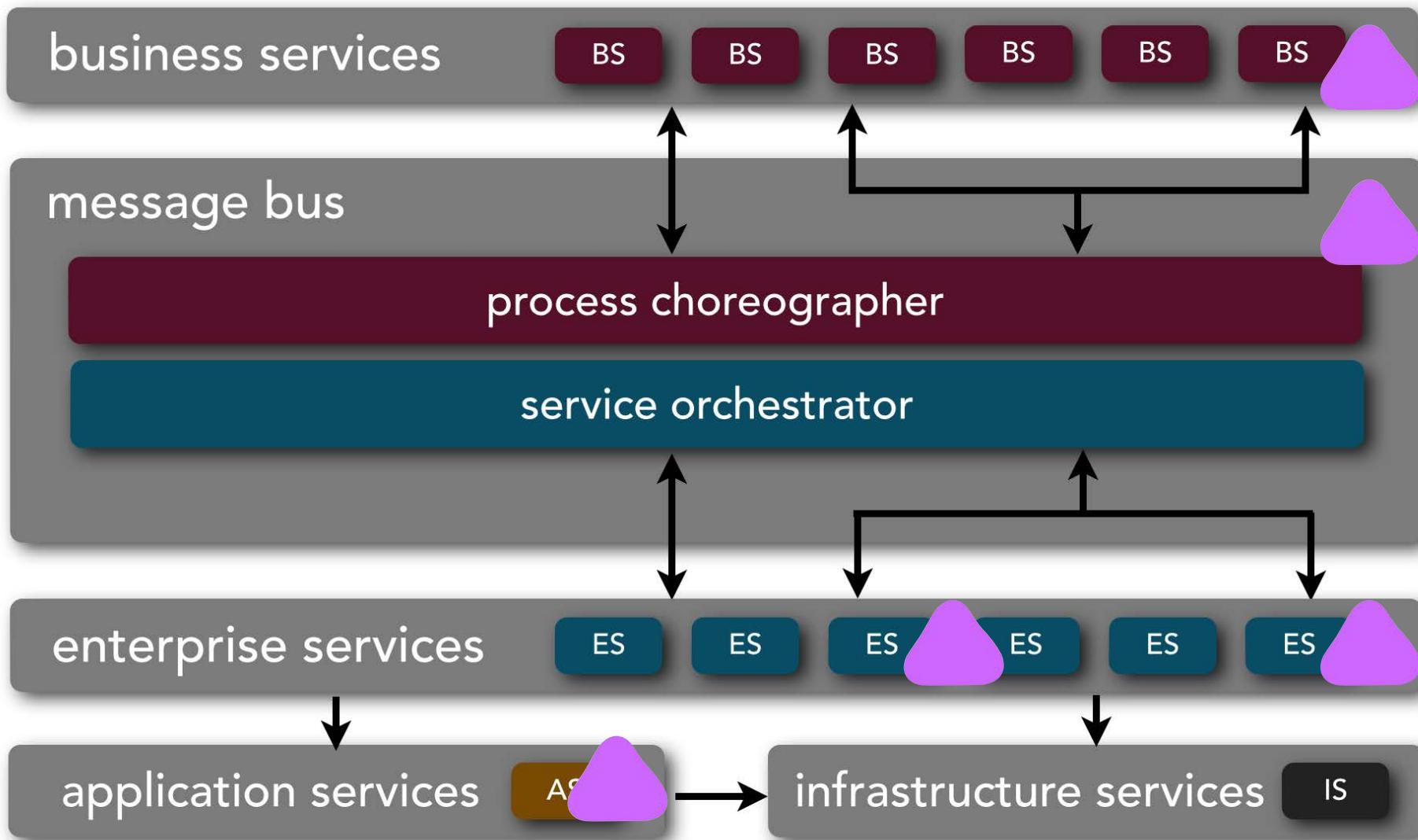
# bounded context ≠ entity



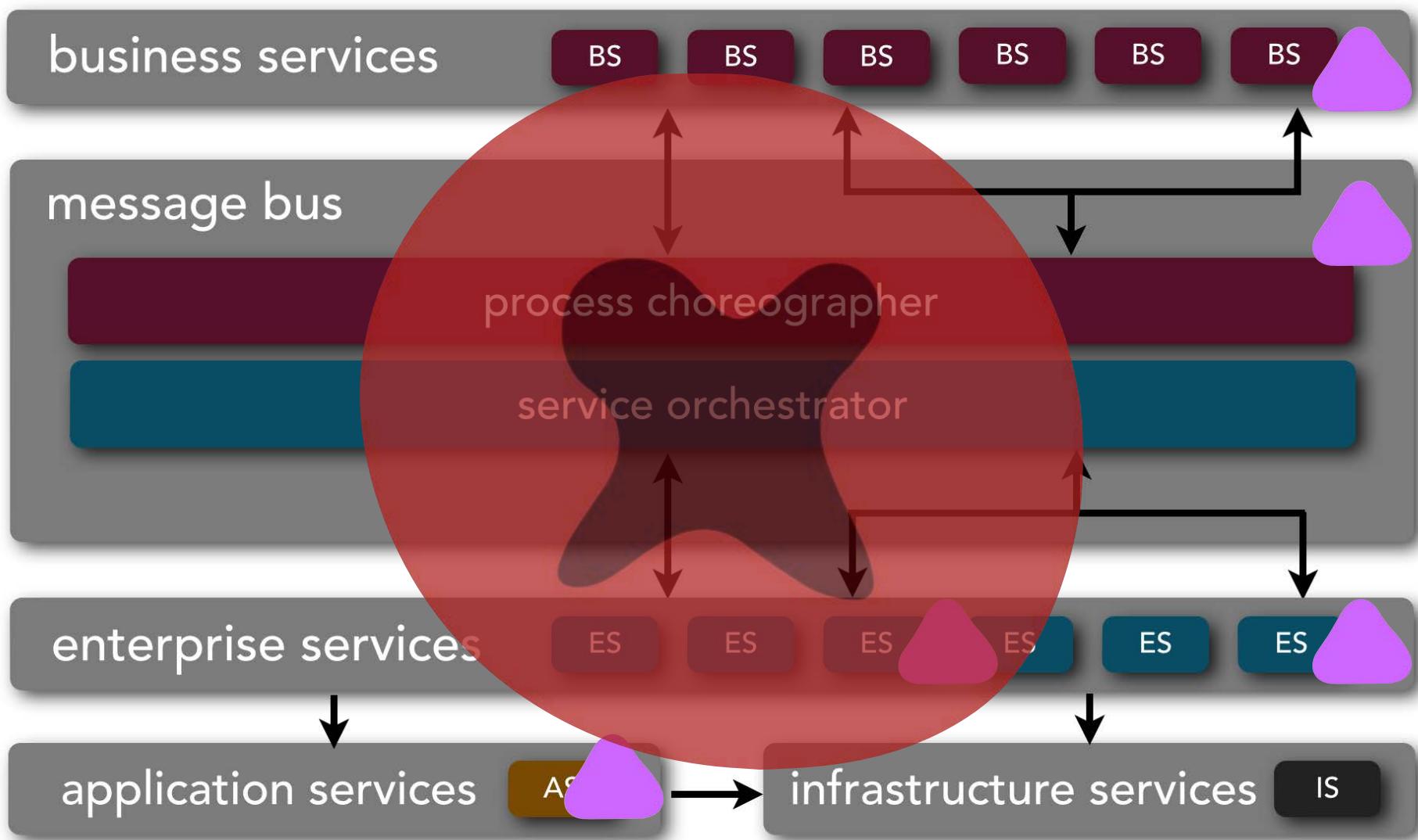
# smart endpoints, dumb pipes



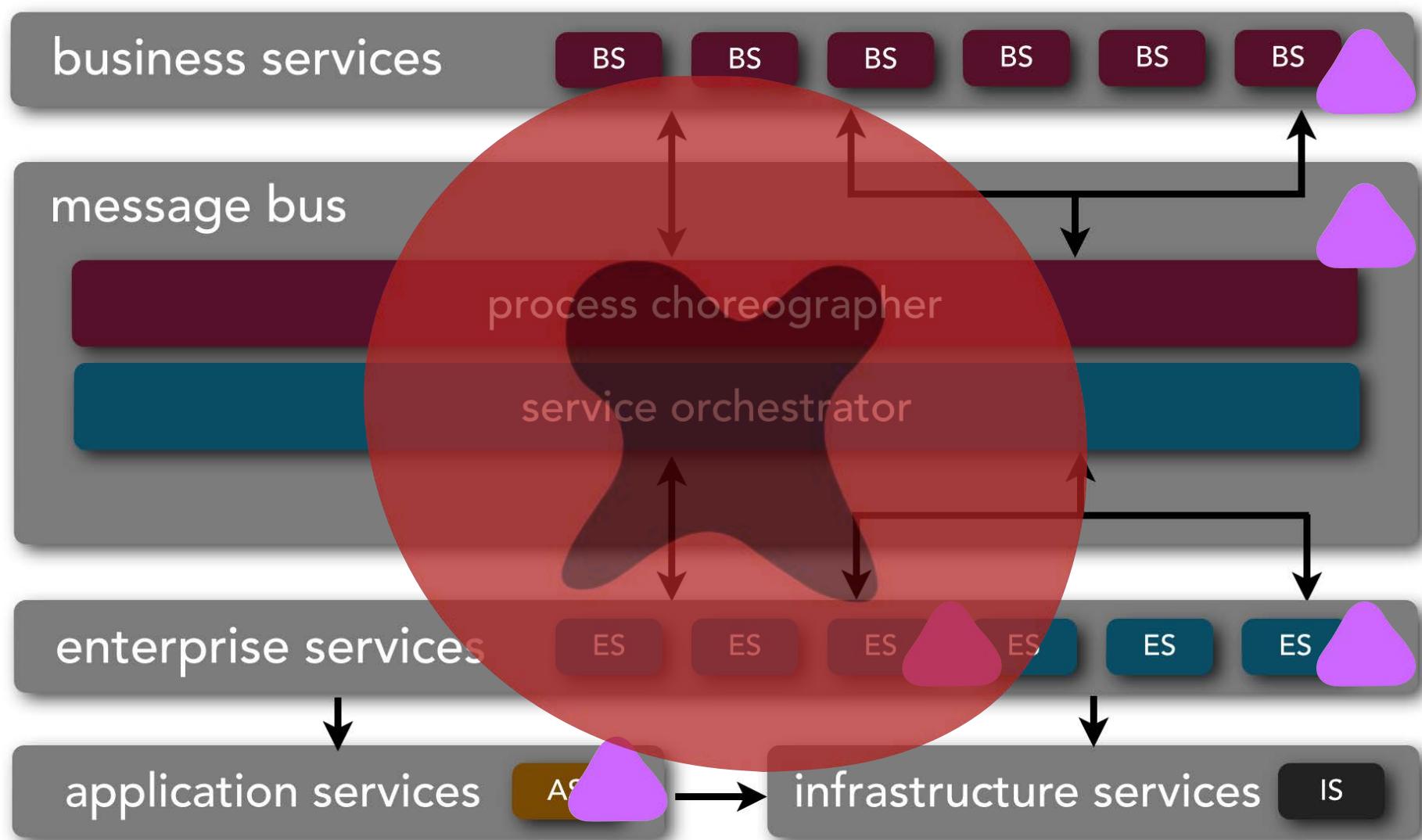
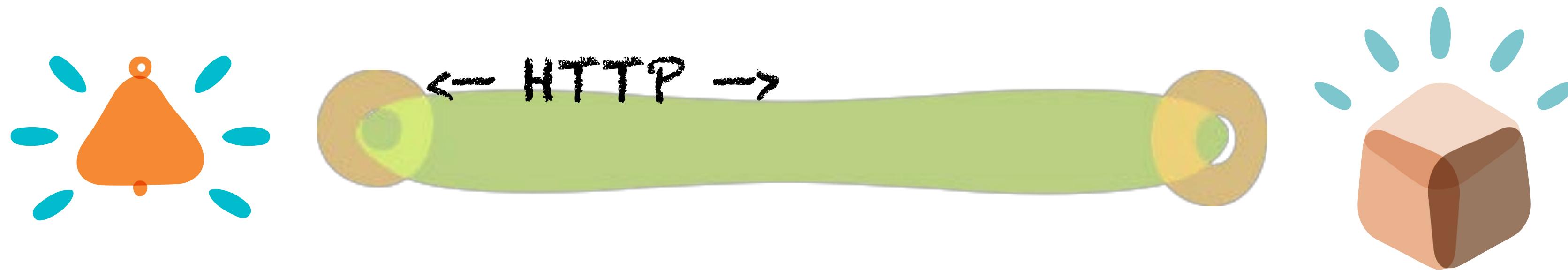
# smart endpoints, dumb pipes



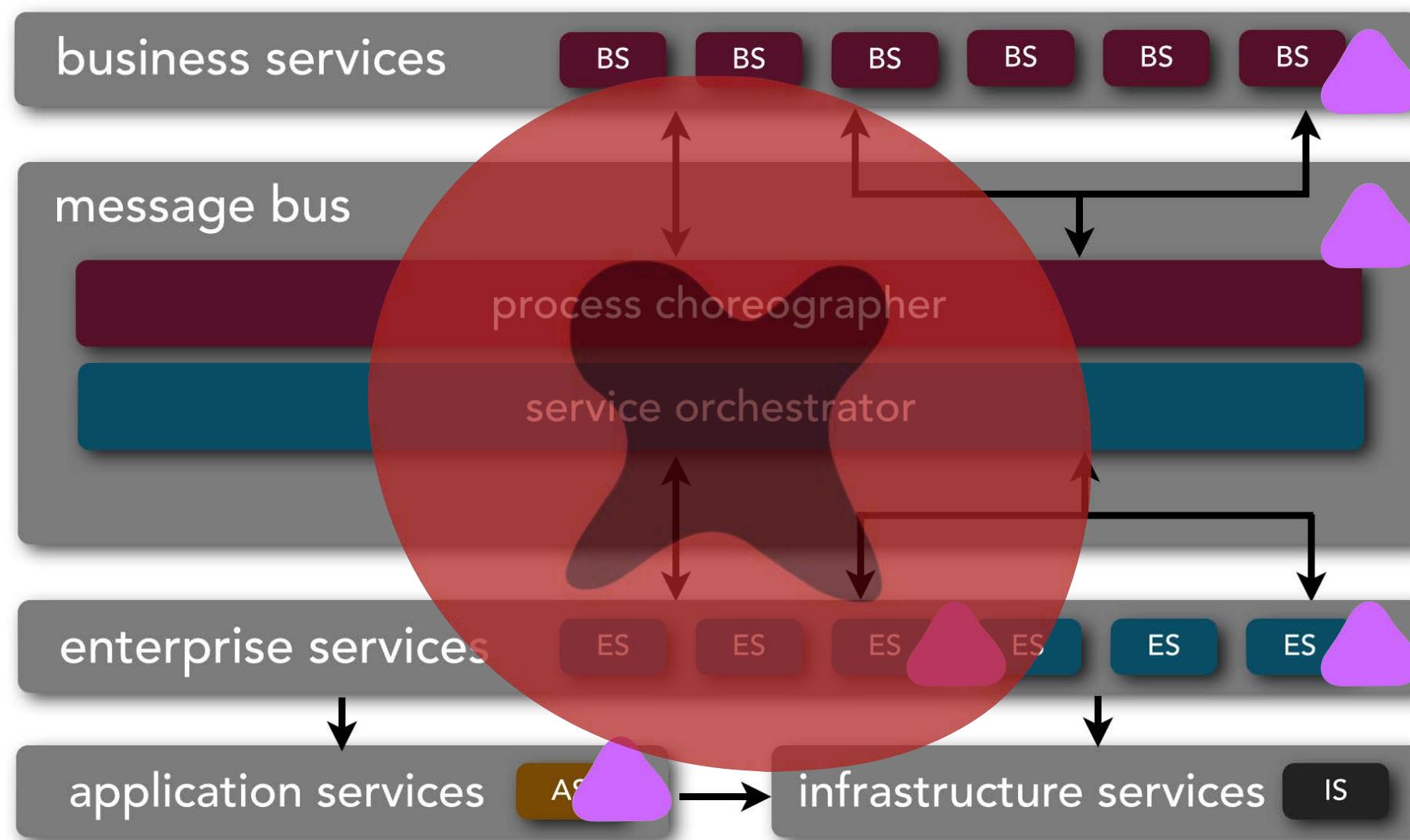
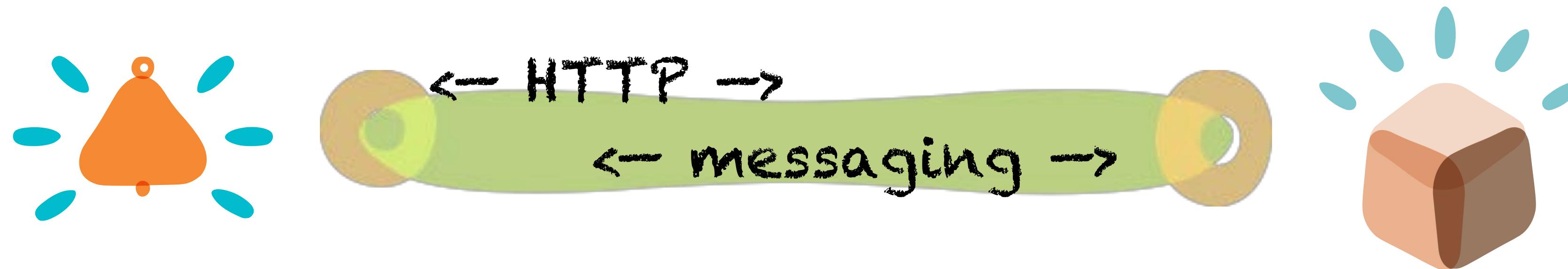
# smart endpoints, dumb pipes



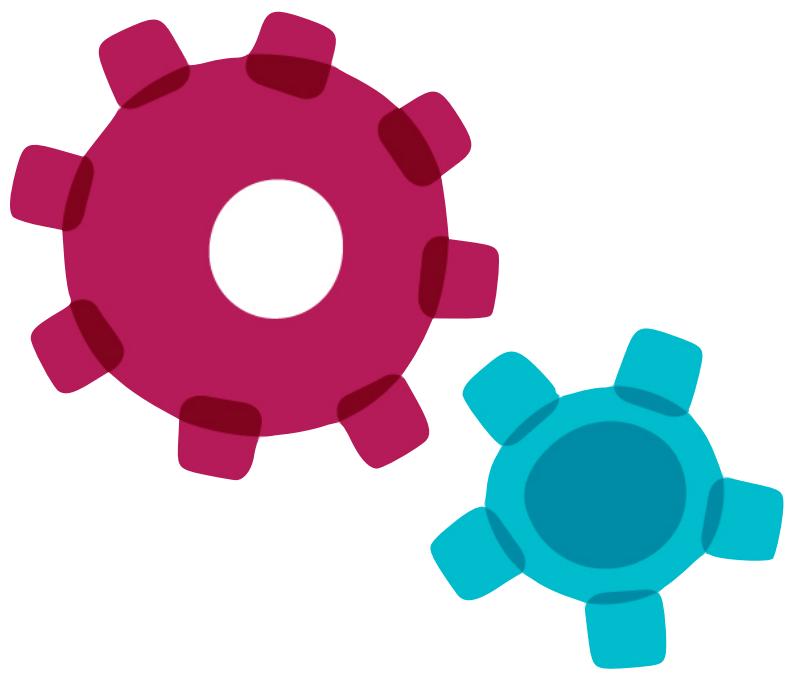
# smart endpoints, dumb pipes



# smart endpoints, dumb pipes

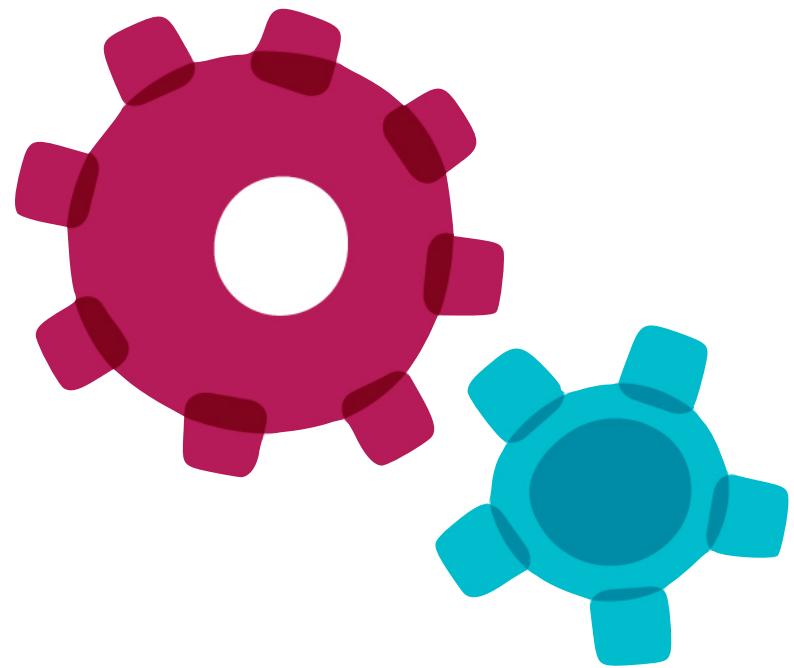


standardize on integration, not platform



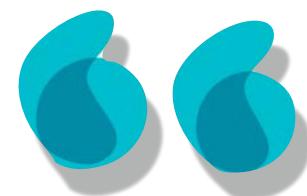
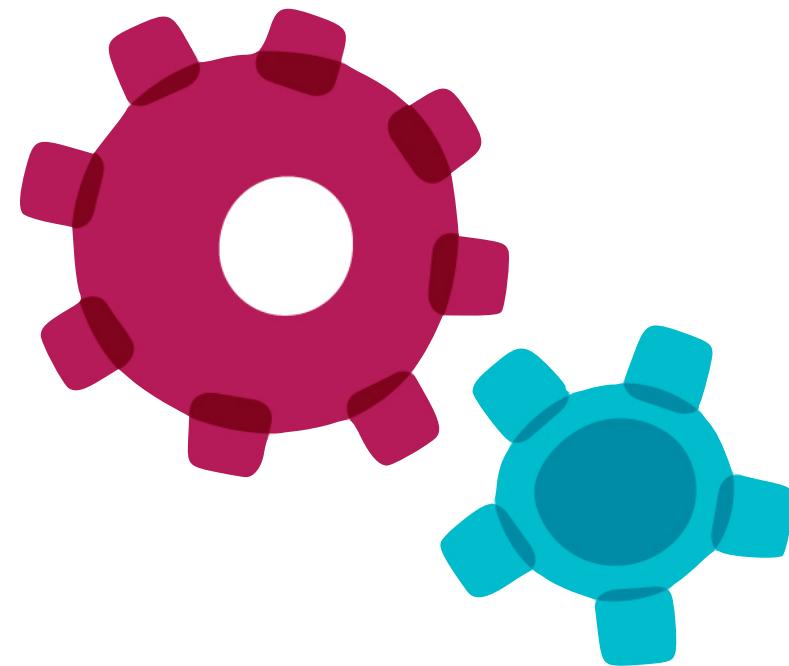
standardize on integration, not platform

embrace polyglot solutions  
where sensible



# standardize on integration, not platform

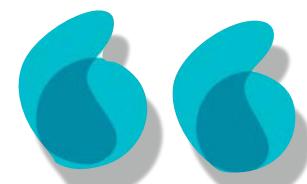
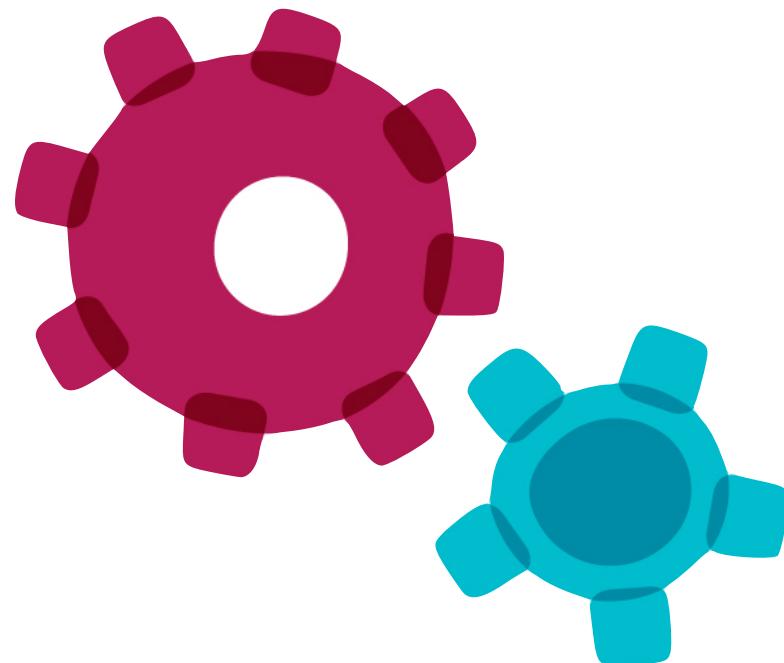
embrace polyglot solutions  
where sensible



*Standardize in the gaps  
between services - be flexible  
about what happens inside the  
boxes*

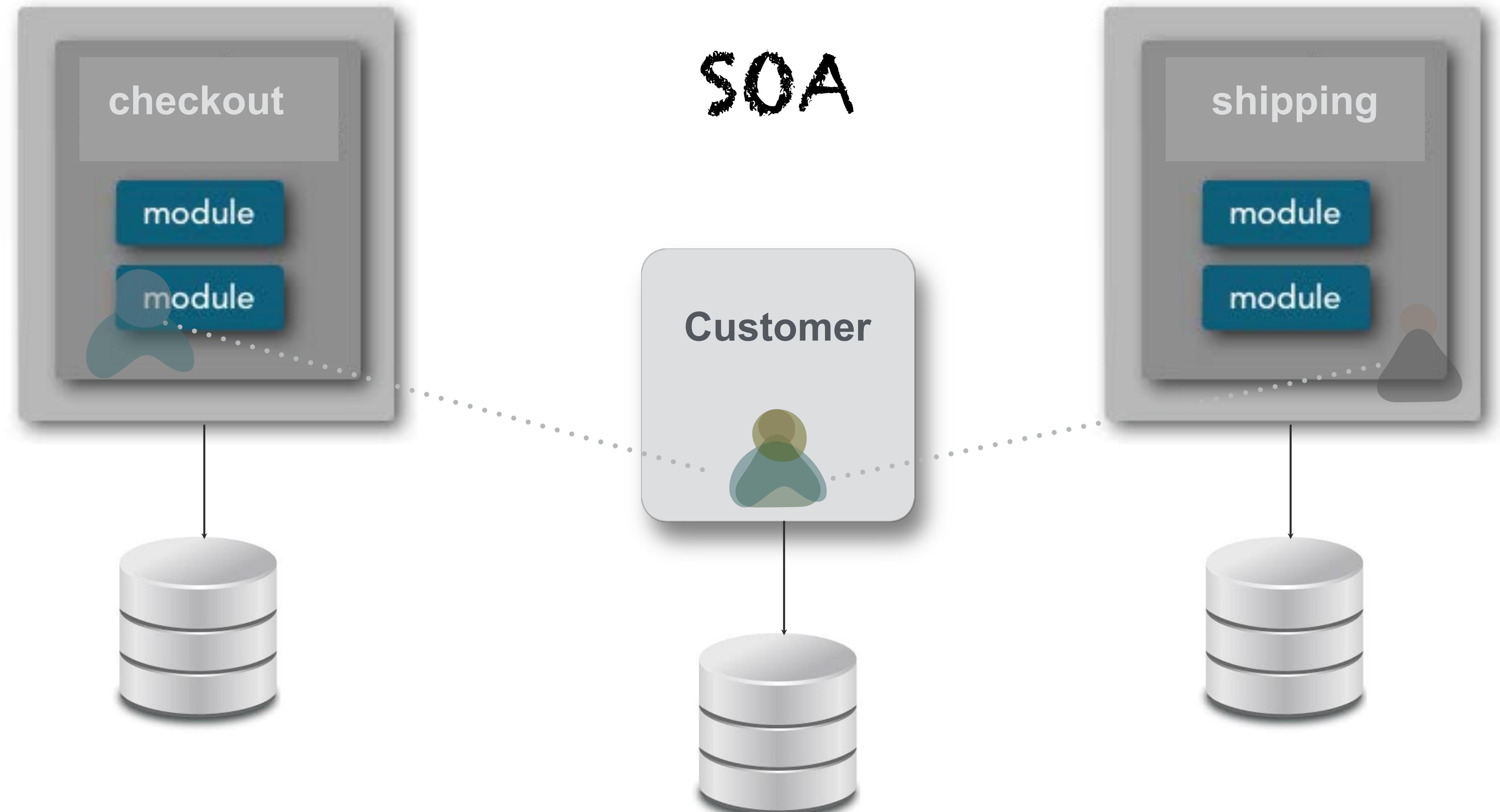
# standardize on integration, not platform

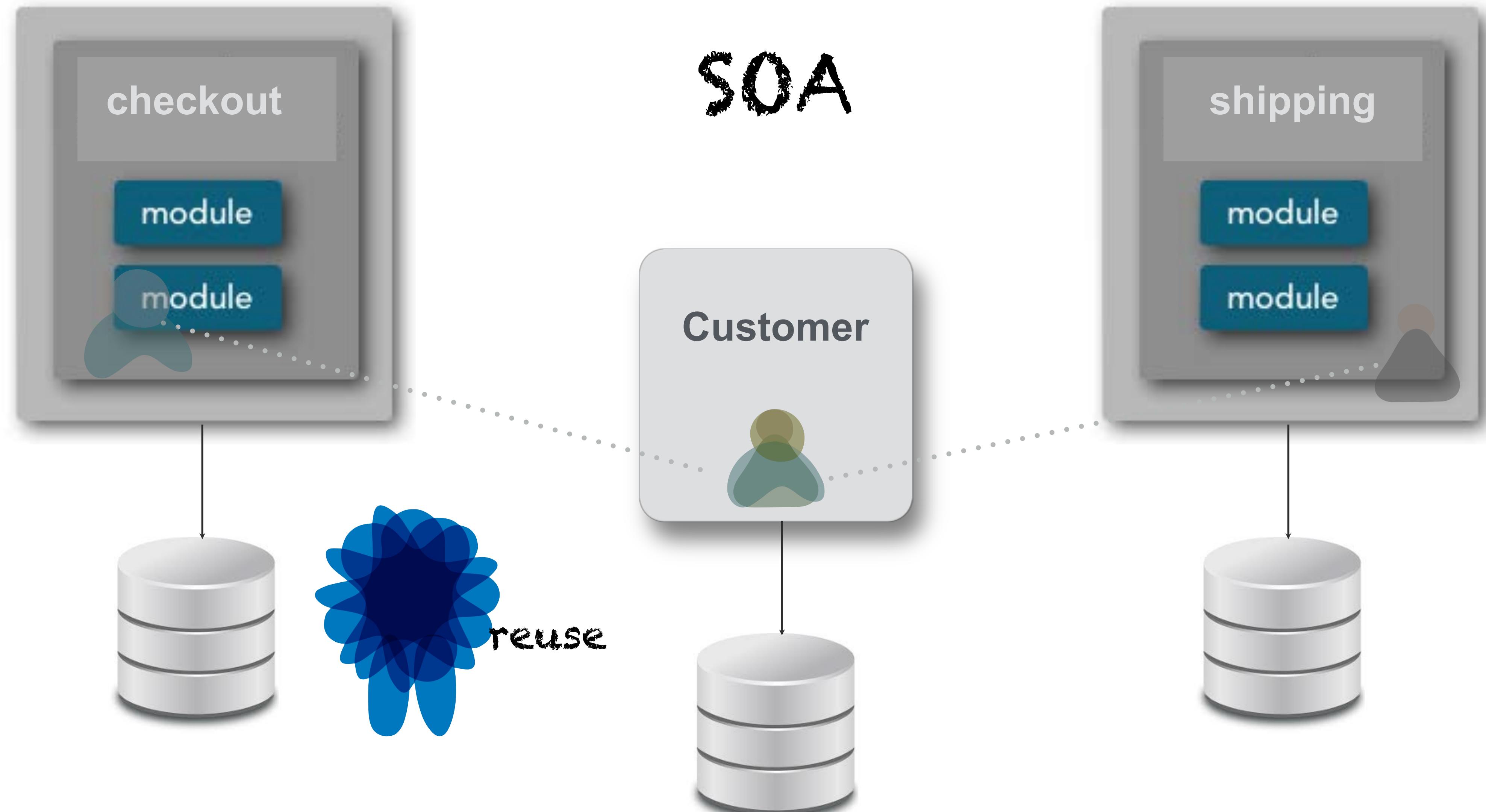
## embrace polyglot solutions where sensible

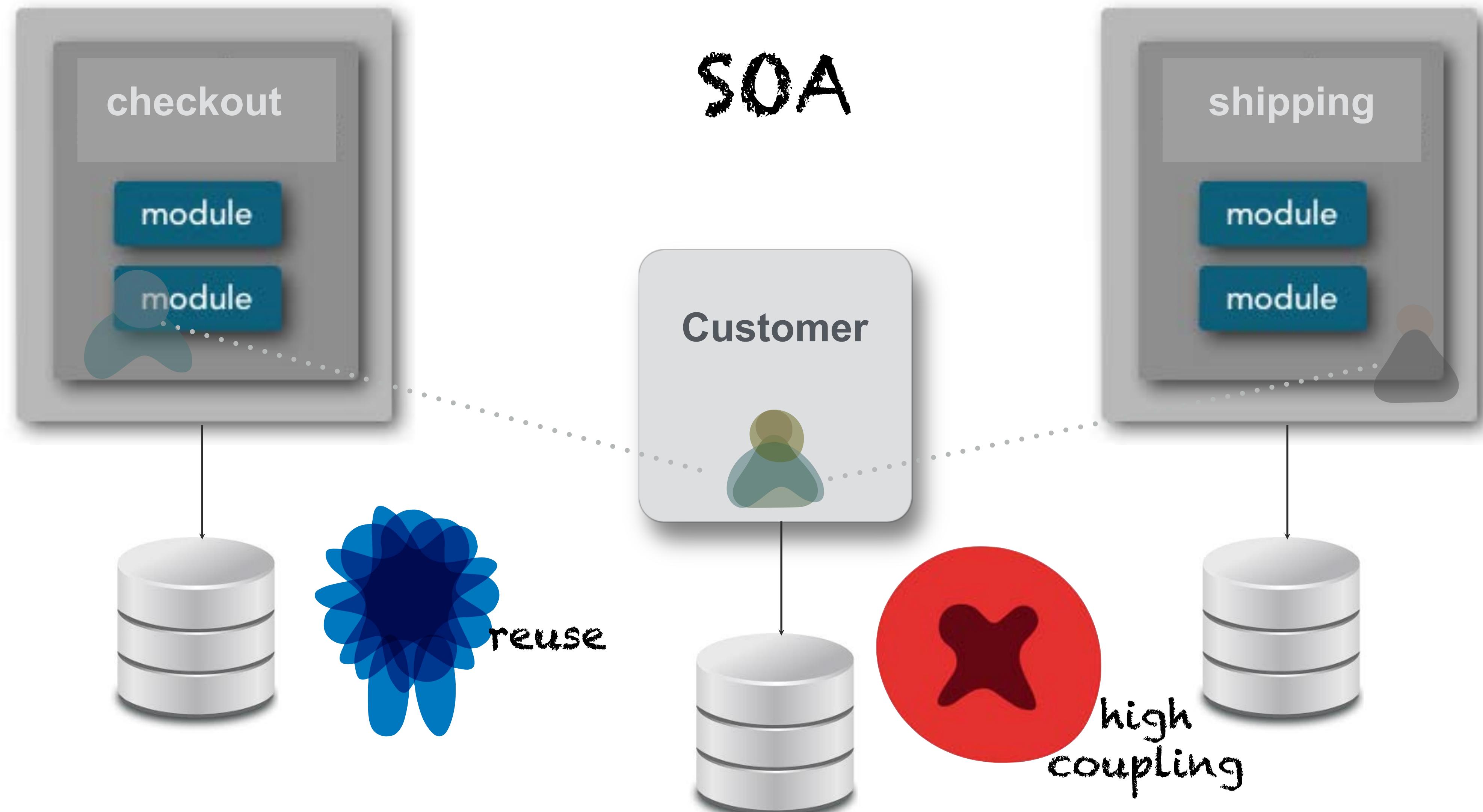


**SOA**

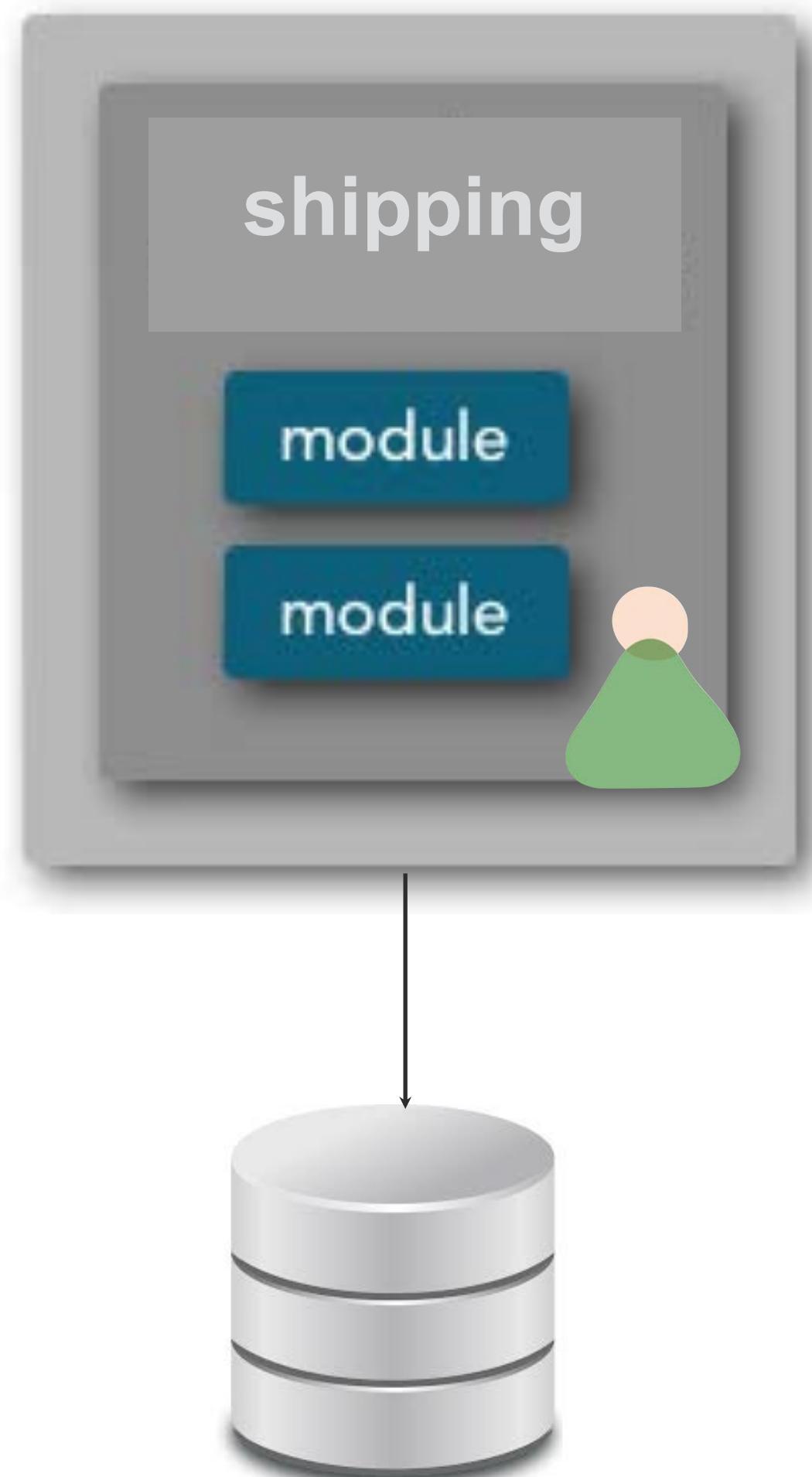
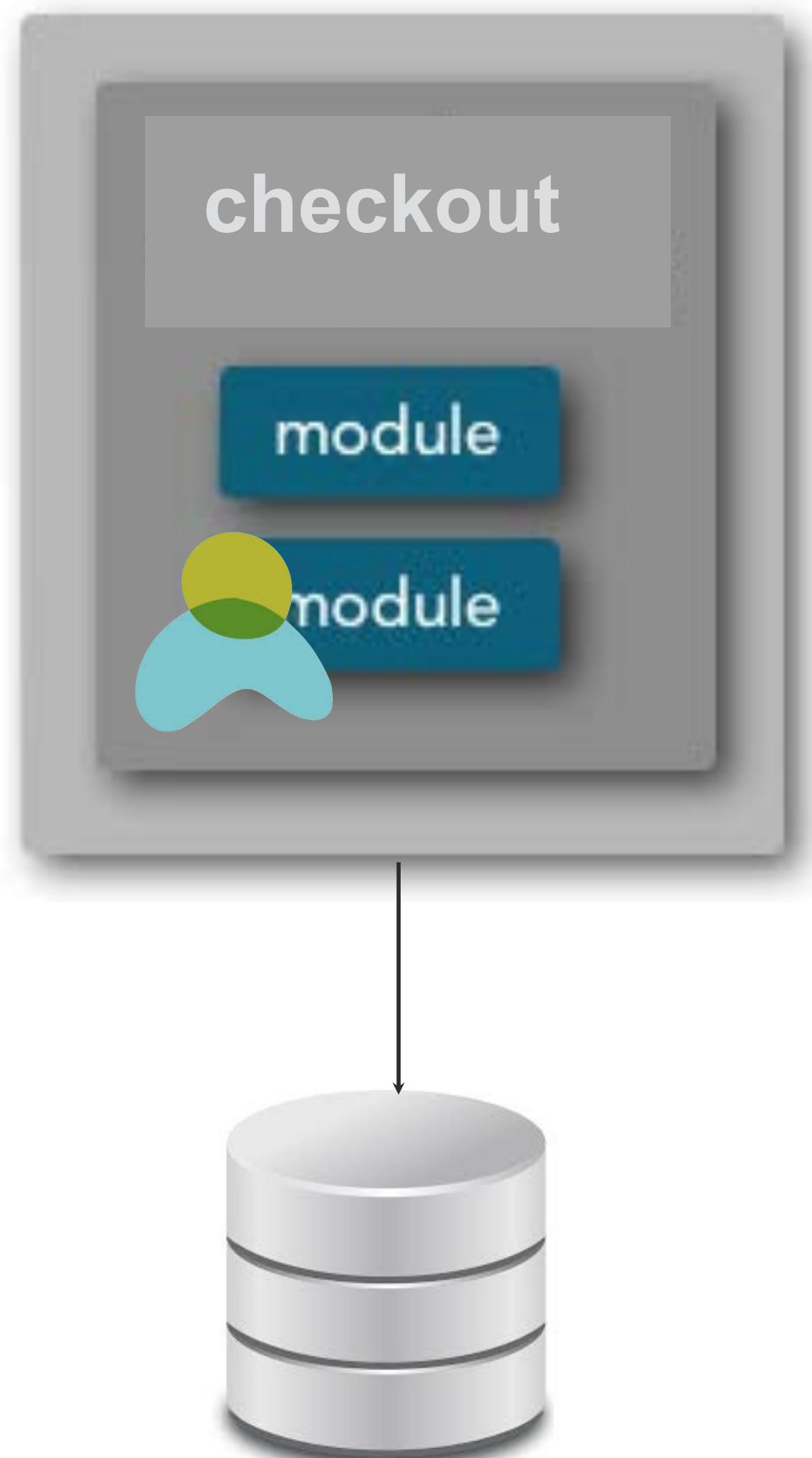








# microservices





# prefer duplication over coupling

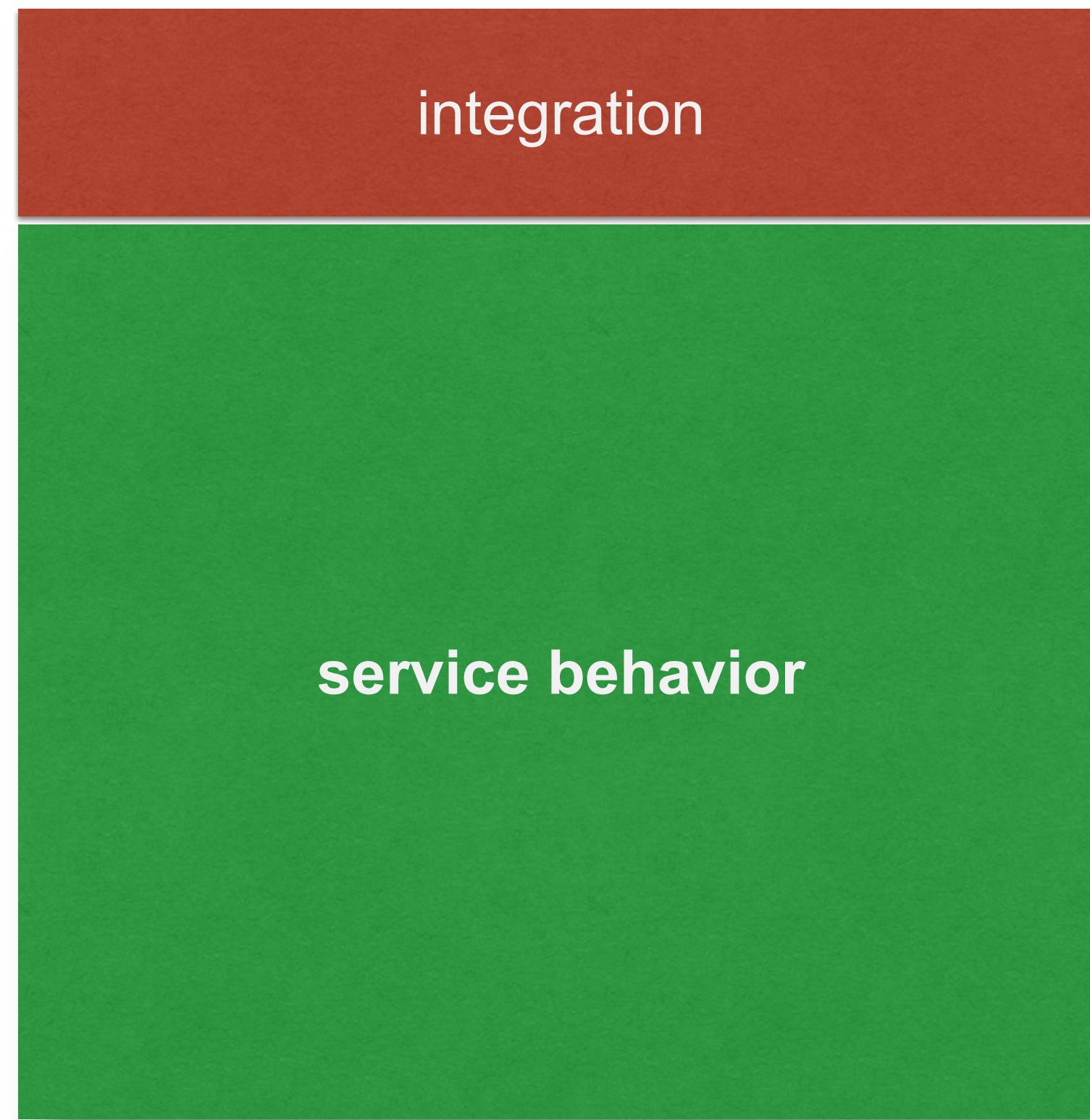


# technical consistency

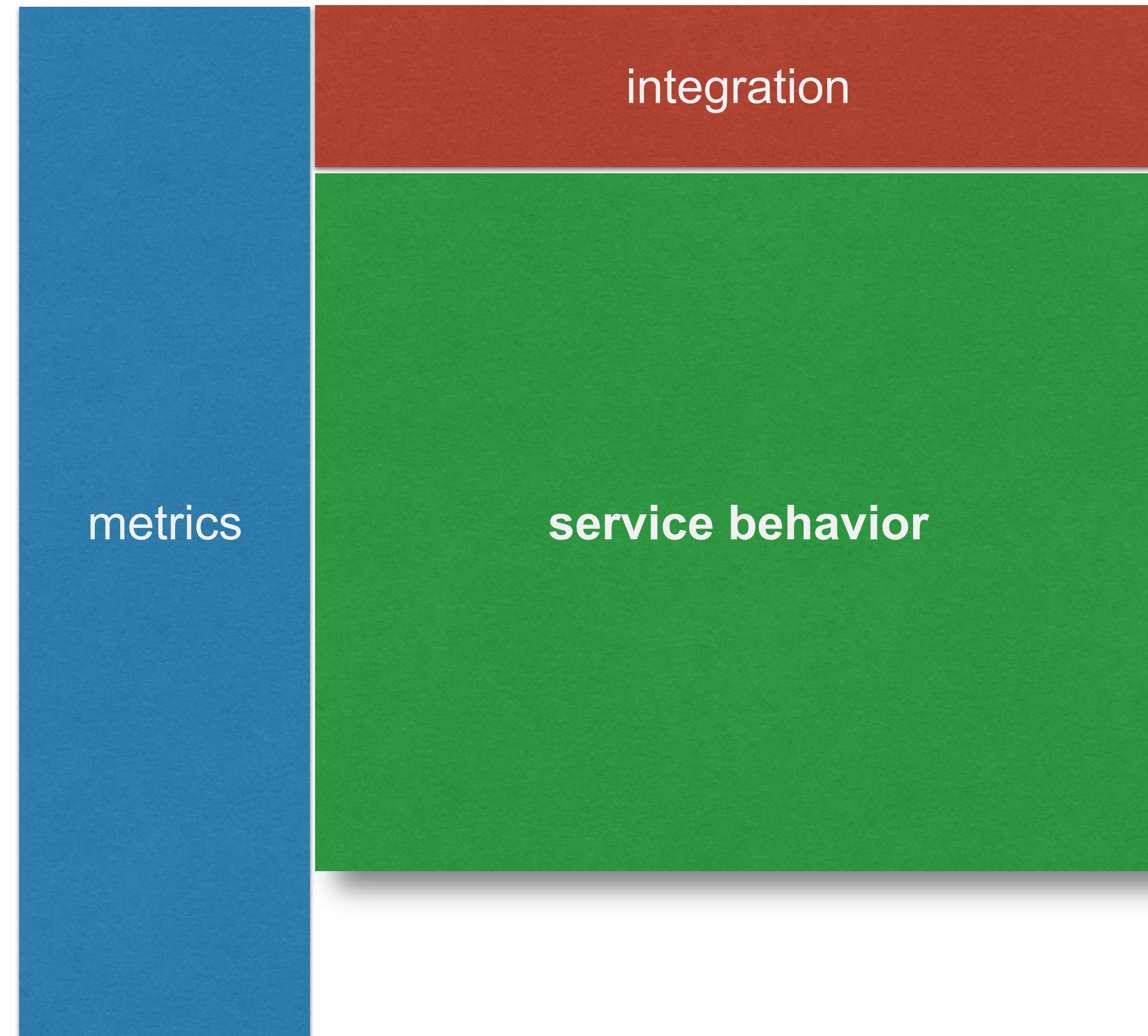


**service behavior**

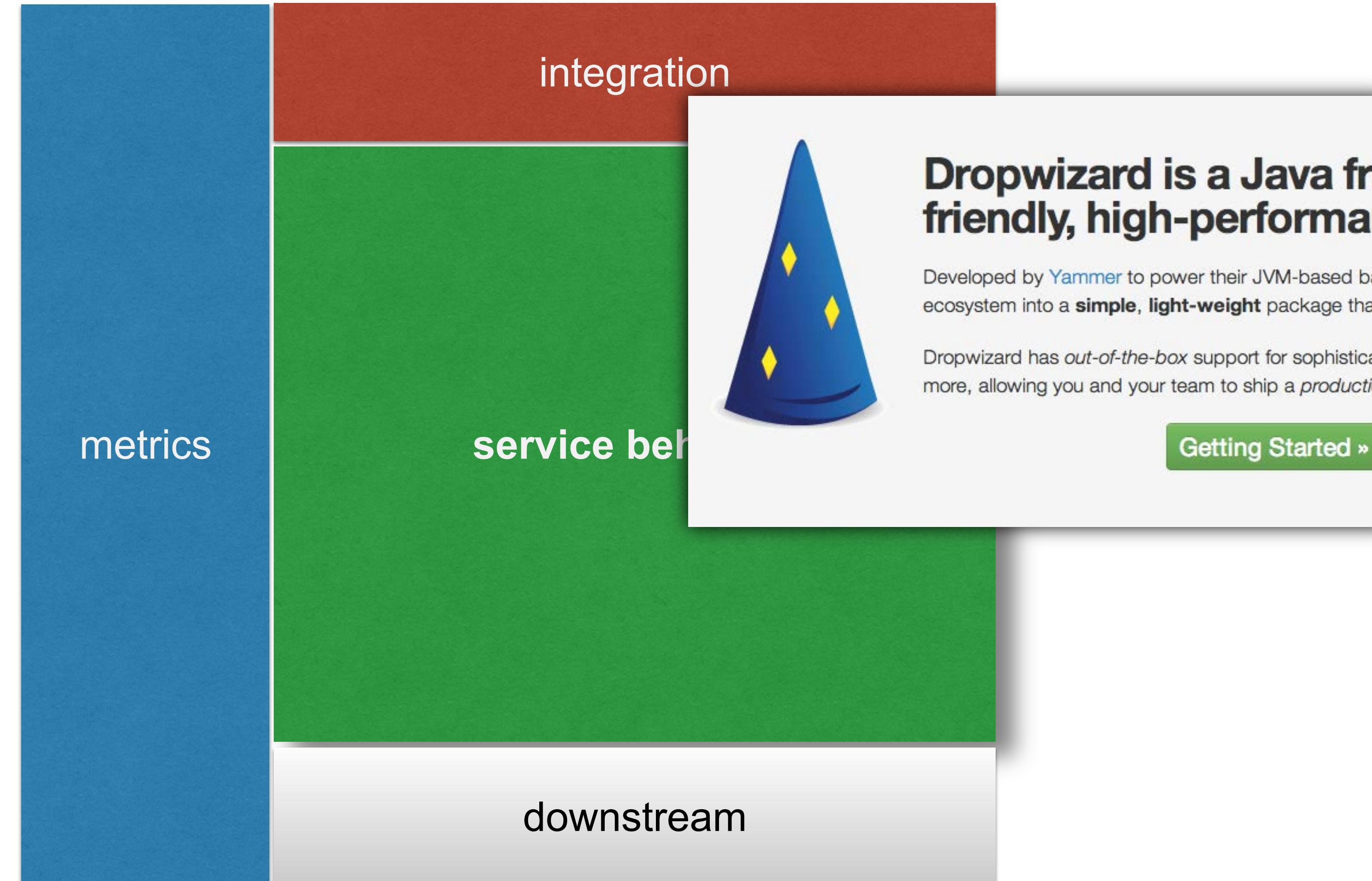
# technical consistency



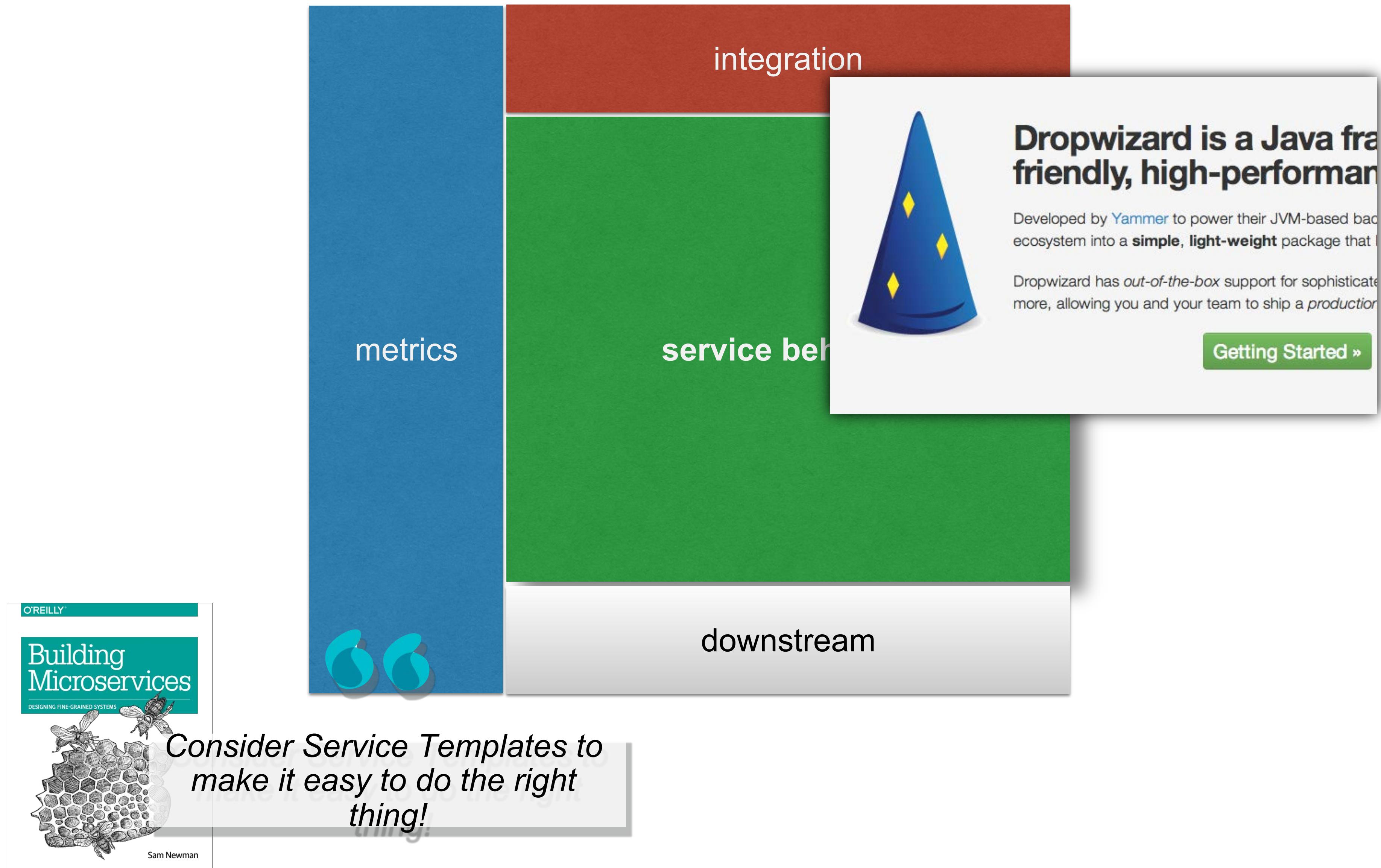
# technical consistency



# technical consistency



# technical consistency



# the rise of service meshes

Phil Calçado

Microservices Patterns About

## Pattern: Service Mesh

Aug 3, 2017

• Microservices • Distributed Systems • Service Mesh • Patterns •

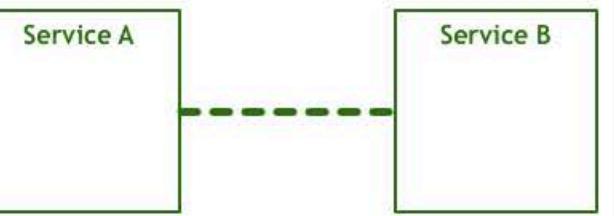
Since their first introduction many decades ago, we learnt that distributed systems enable use cases we couldn't even think about before them, but they also introduce all sorts of new issues.

When these systems were rare and simple, engineers dealt with the added complexity by minimising the number of remote interactions. The safest way to handle distribution has been to avoid it as much as possible, even if that meant duplicated logic and data across various systems.

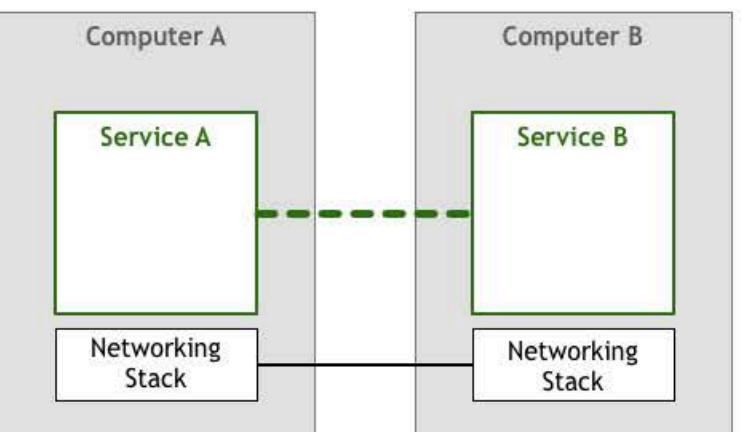
But our needs as an industry pushed us even further, from a few larger central computers to hundreds and thousands of small services. In this new world, we've had to start taking our head out of the sand and tackling the new challenges and open questions, first with ad-hoc solutions done in a case-by-case manner and subsequently with something more sophisticated. As we find out more about the problem domain and design better solutions, we start crystallising some of the most common needs into patterns, libraries, and eventually platforms.

### What happened when we first started networking computers

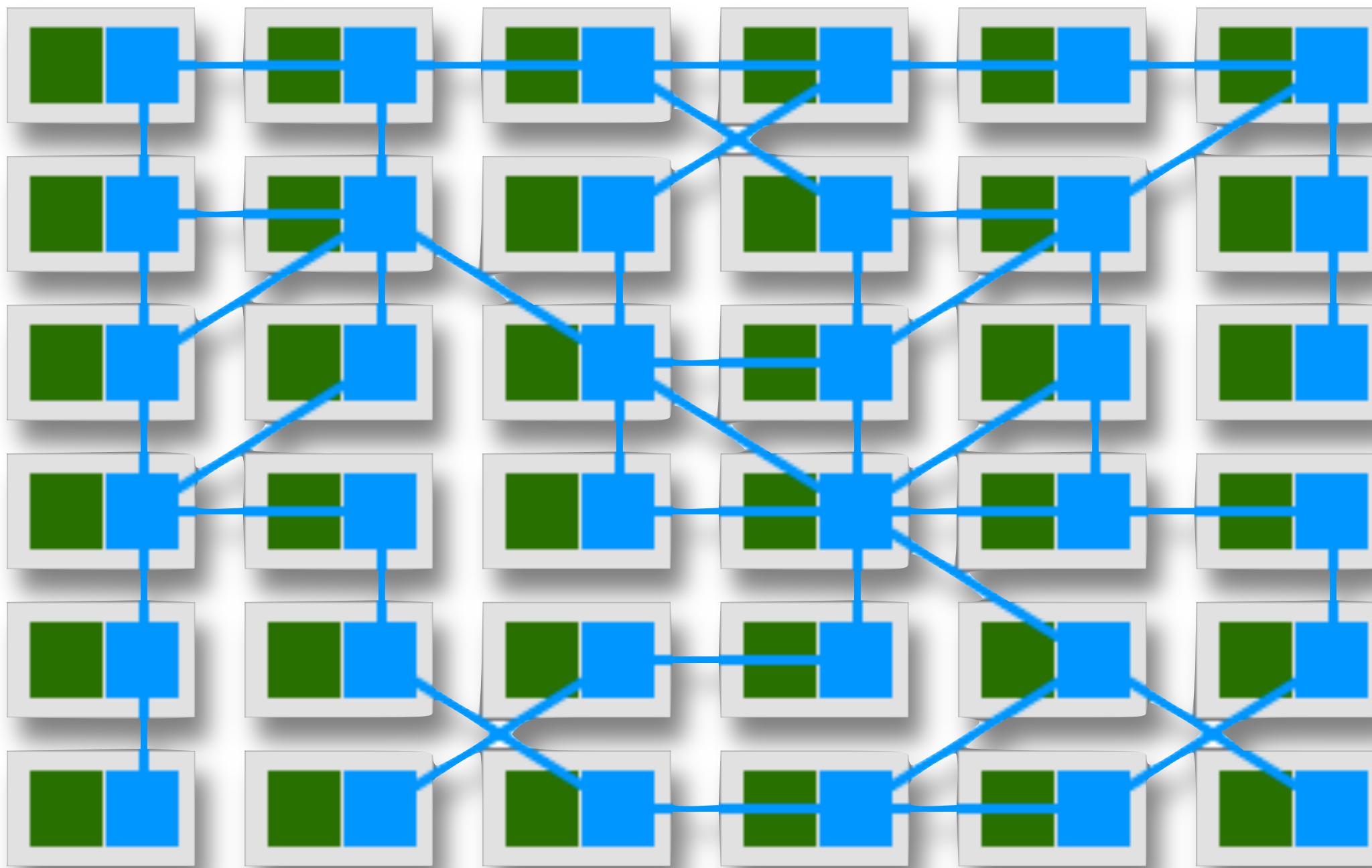
Since people first thought about getting two or more computers to talk to each other, they envisioned something like this:



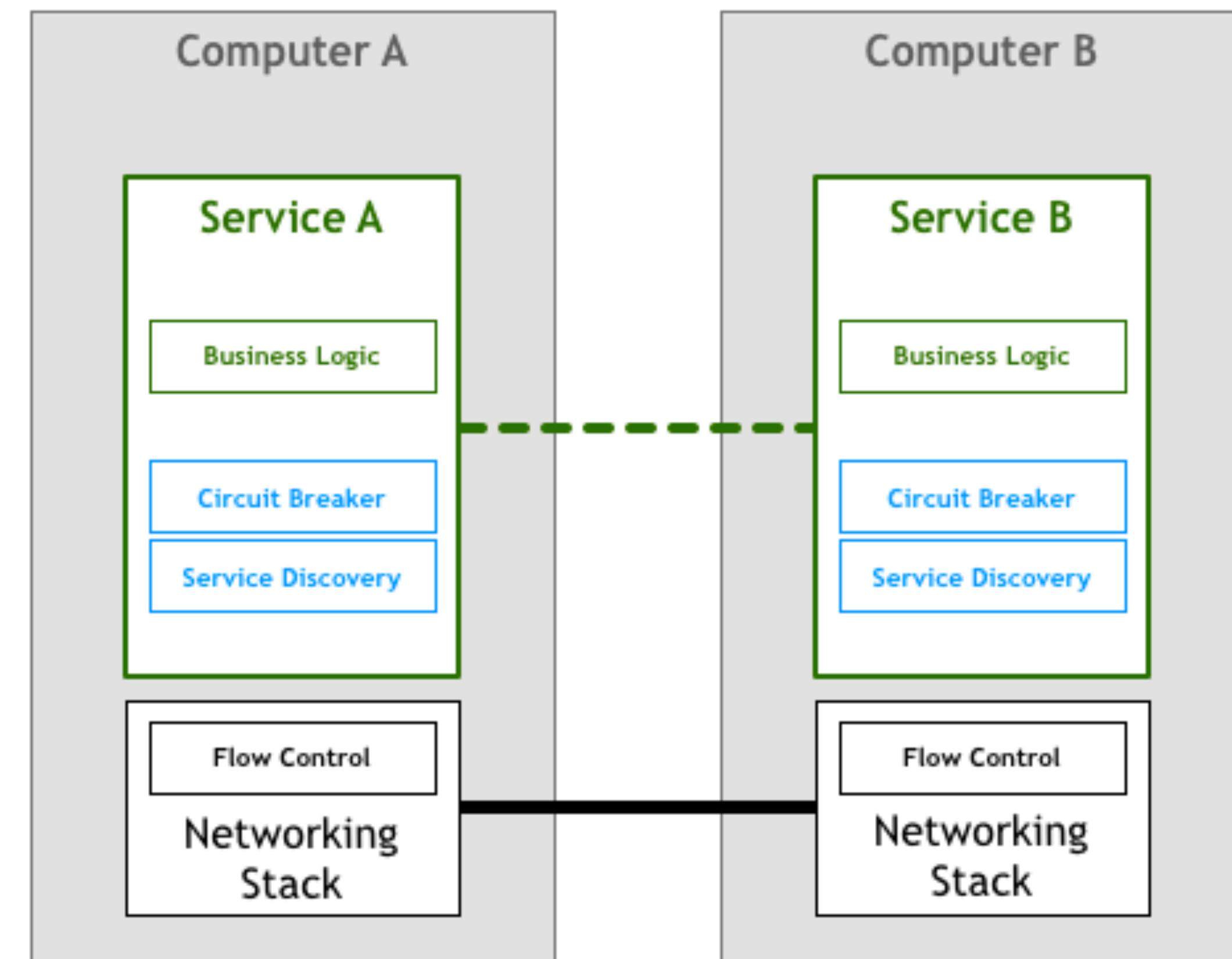
A service talks to another to accomplish some goal for an end-user. This is an obviously oversimplified view, as the many layers that translate between the bytes your code manipulates and the electric signals that are sent and received over a wire are missing. The abstraction is sufficient for our discussion, though. Let's just add a bit more detail by showing the networking stack as a distinct component:



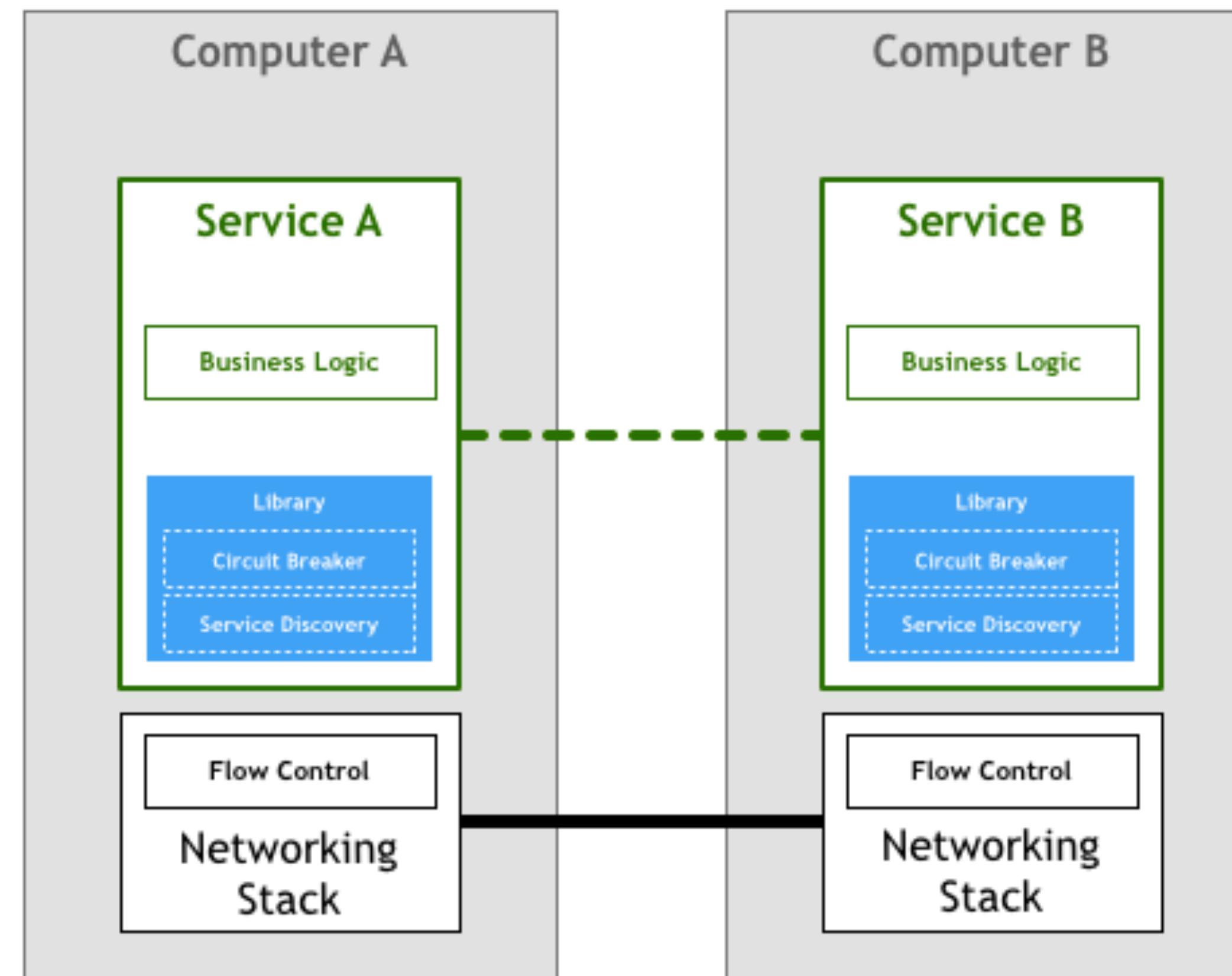
Version of this diagram published in 1950. In the beginning...



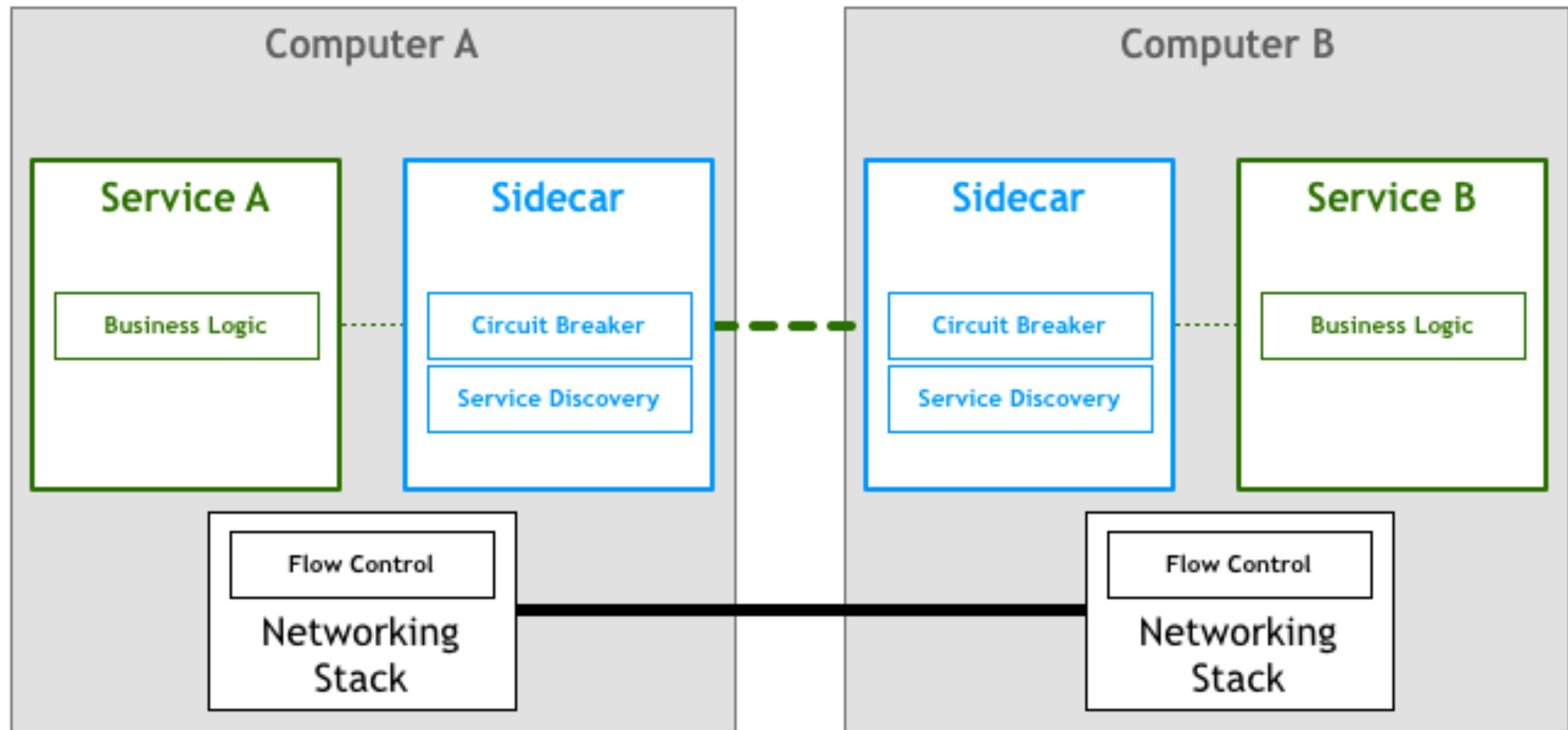
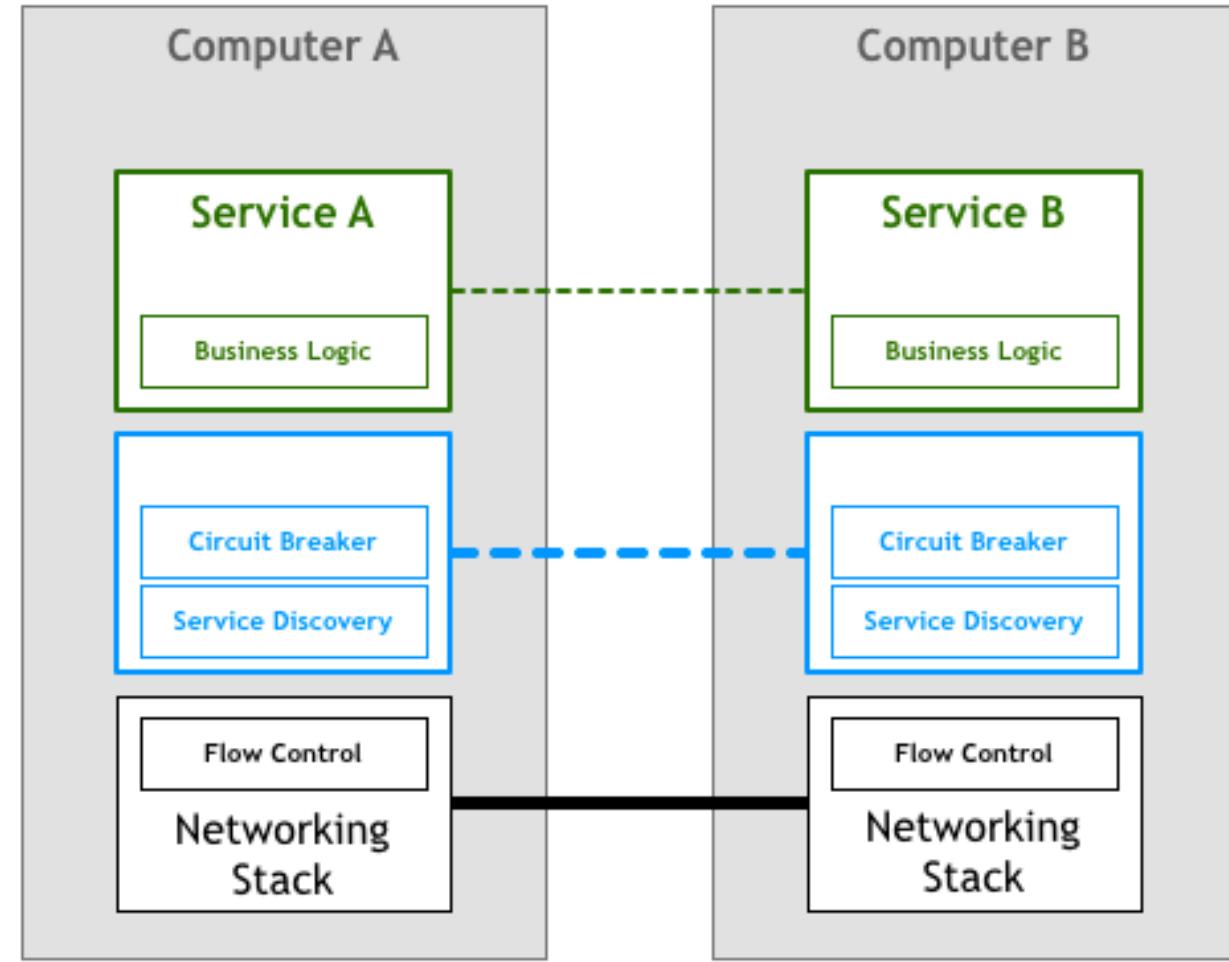
# the rise of service meshes



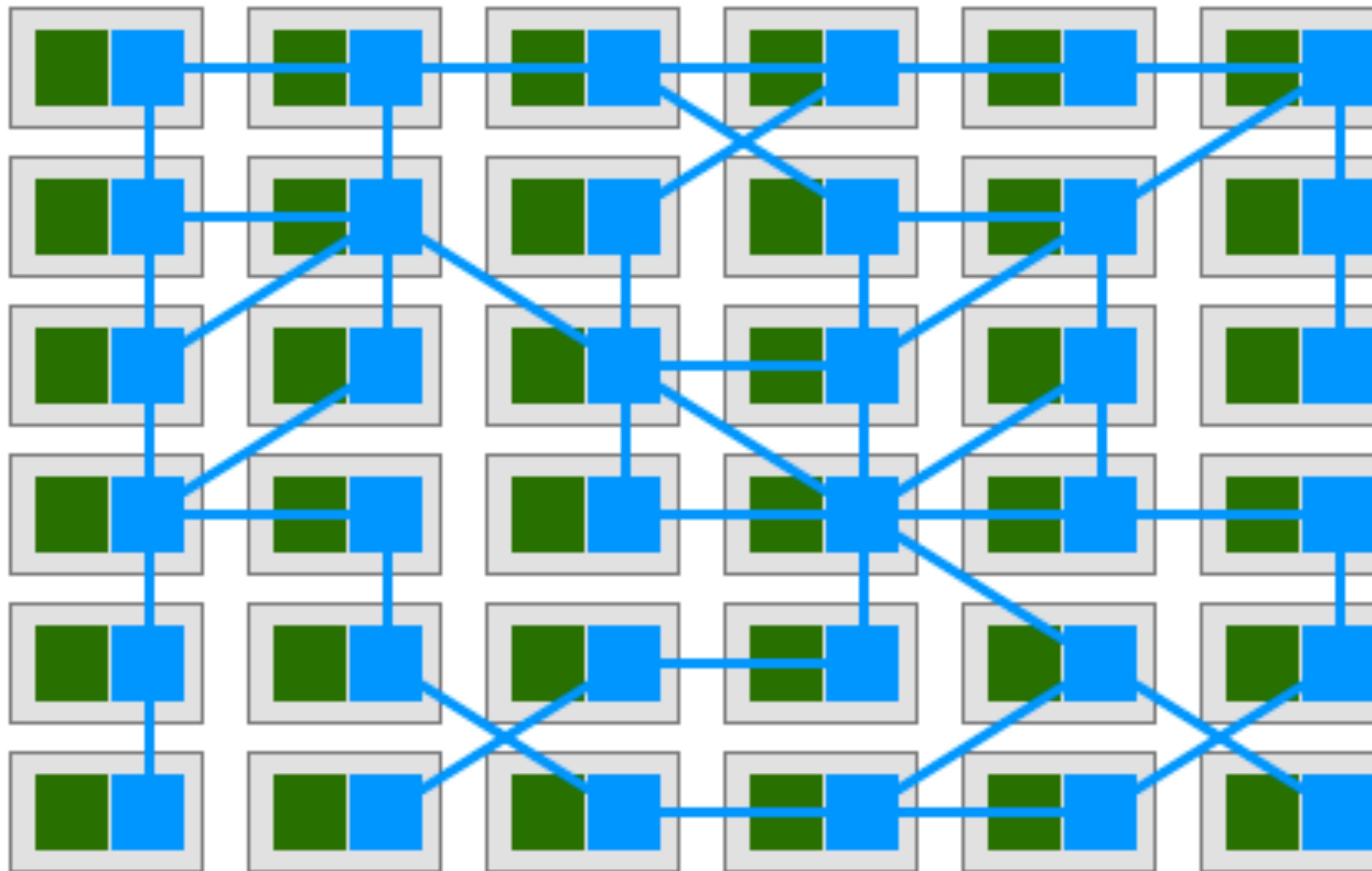
# the rise of service meshes



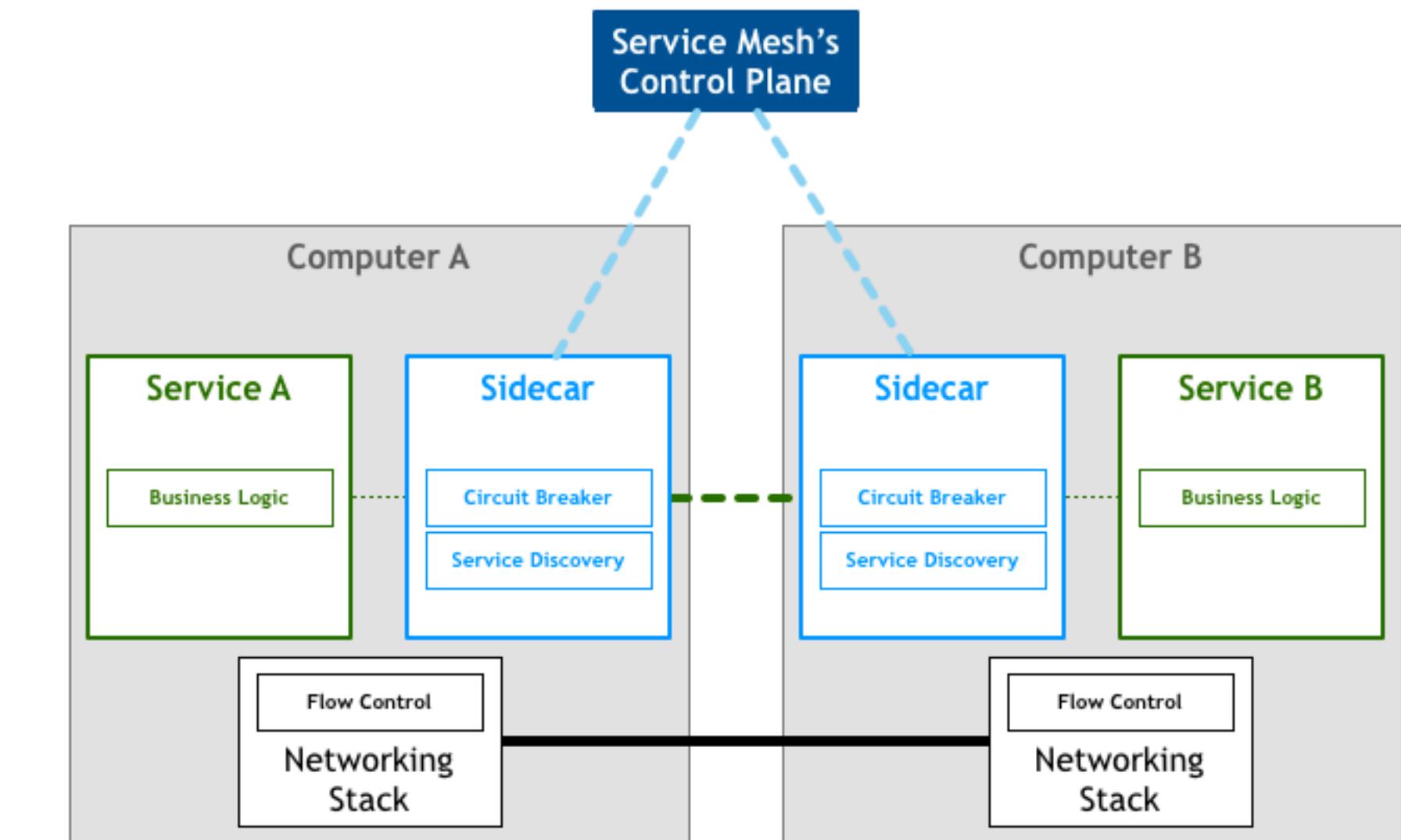
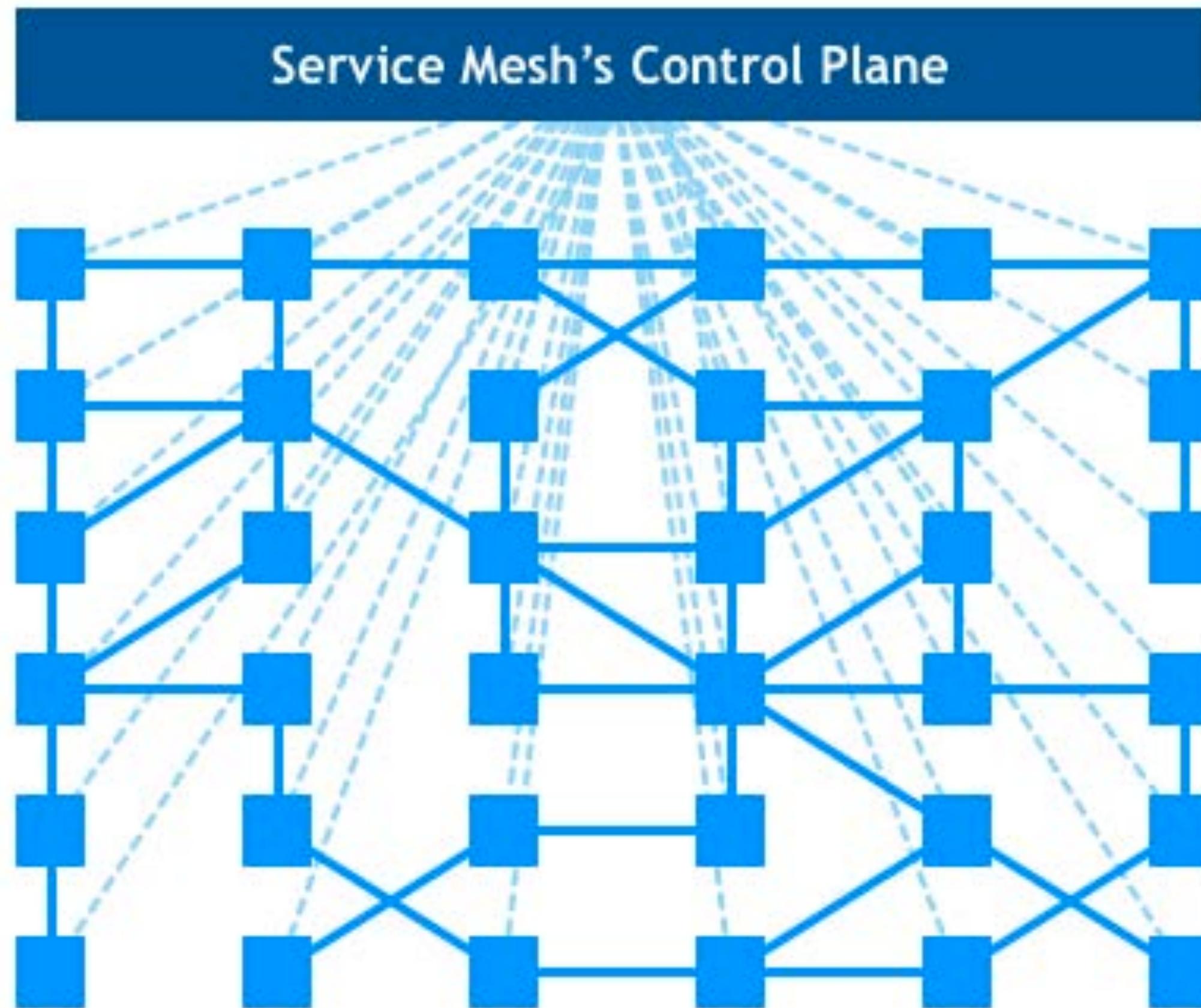
# the rise of service meshes



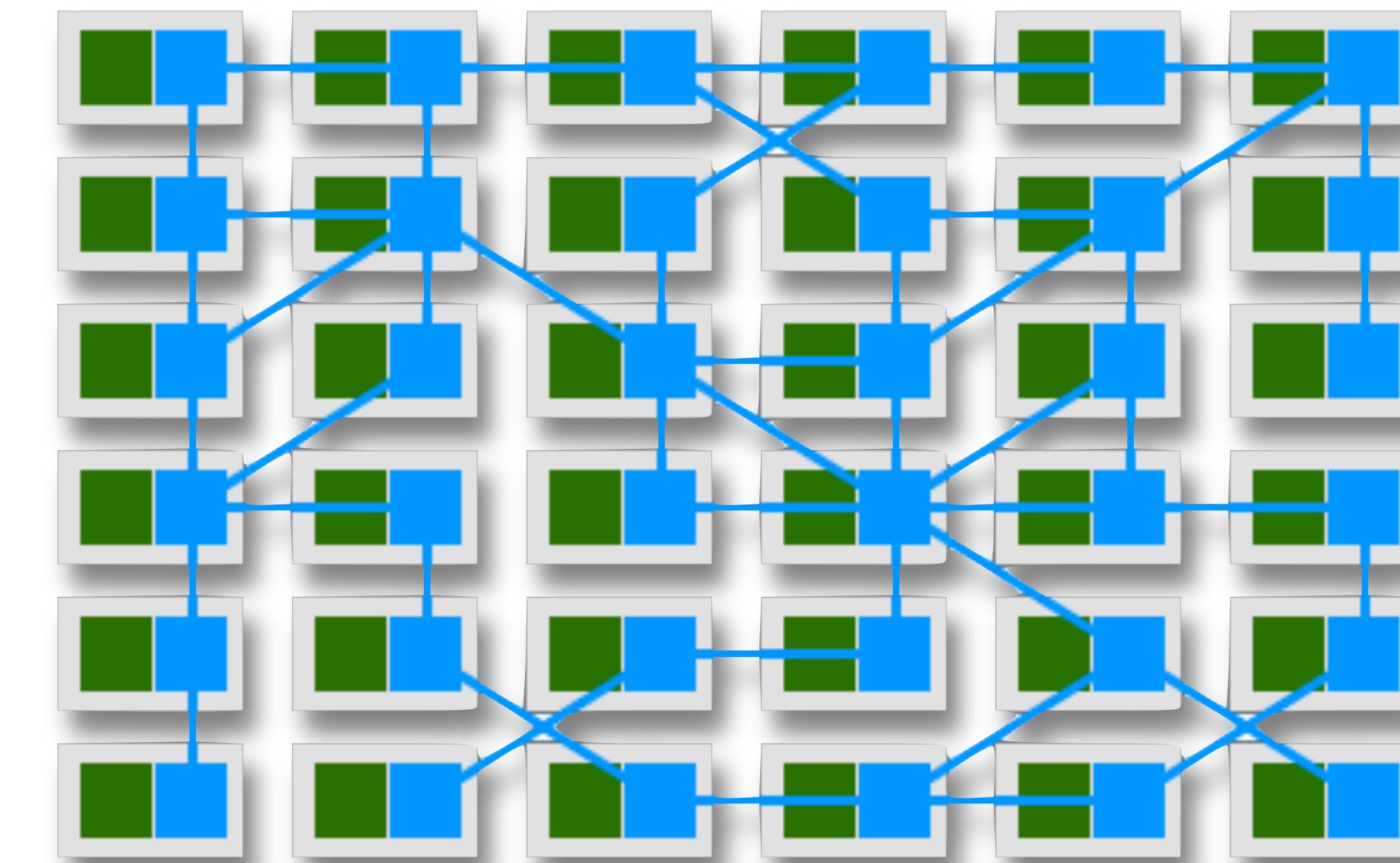
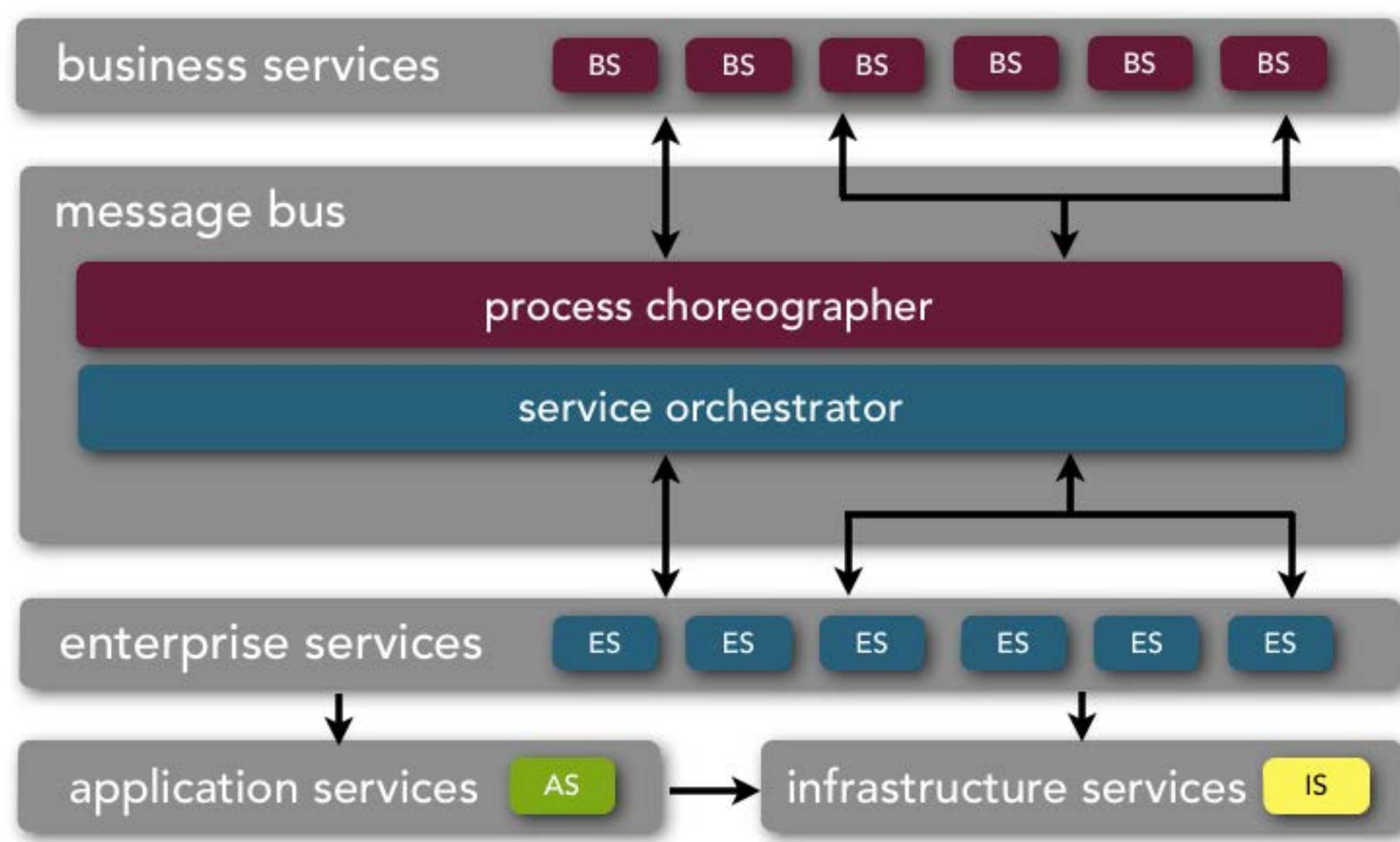
# the rise of service meshes



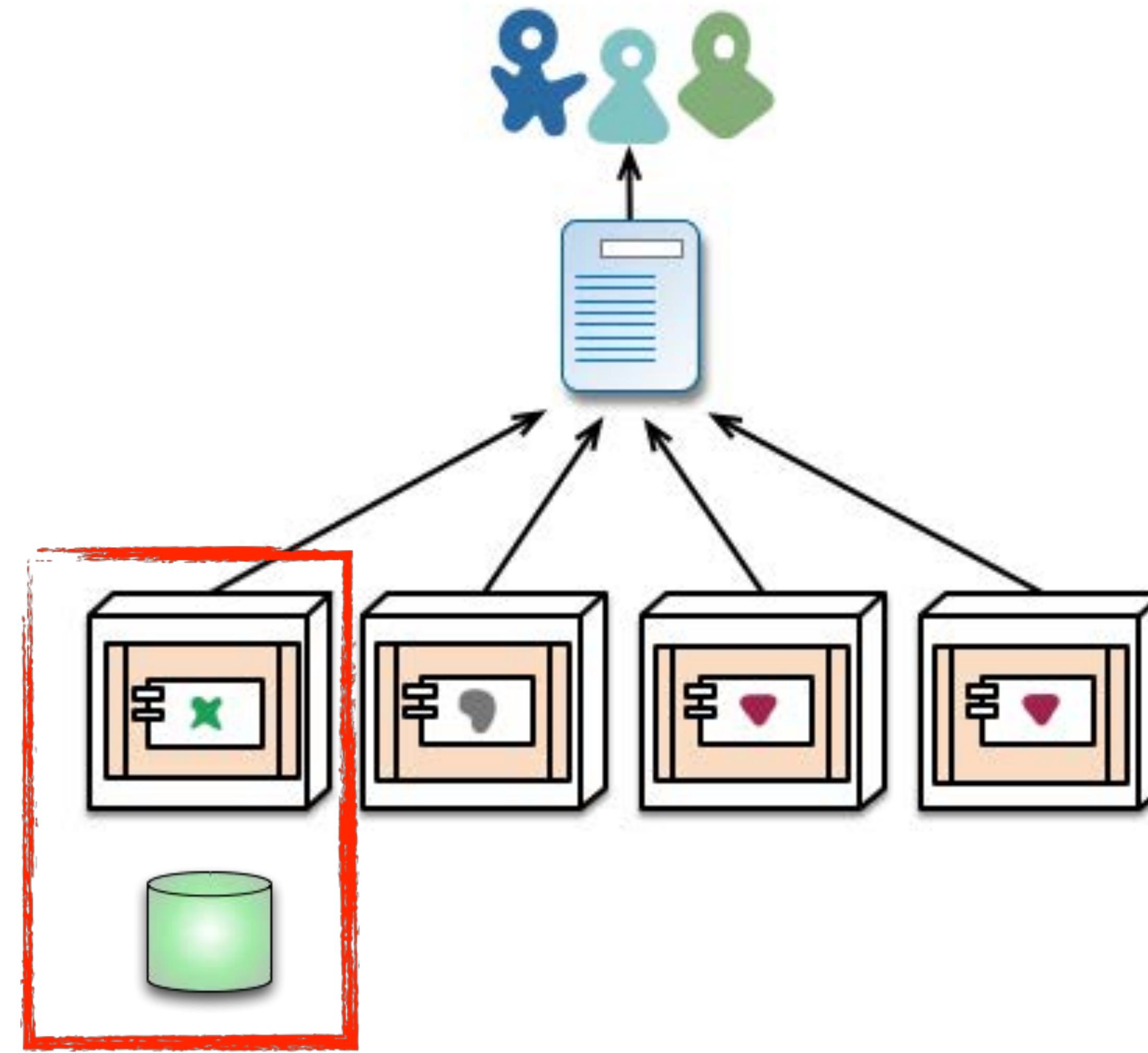
# the rise of service meshes



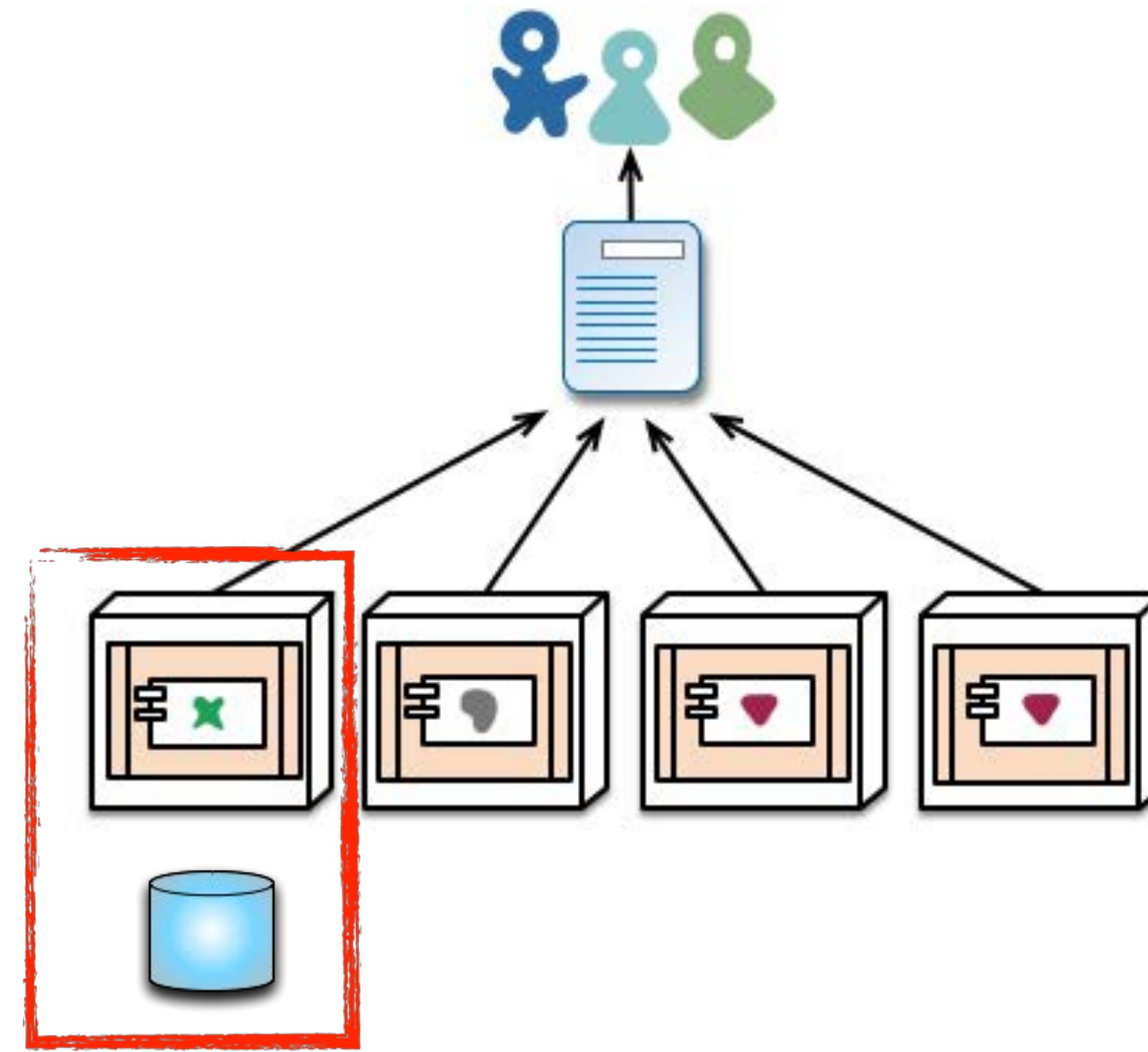
# two reuse solutions



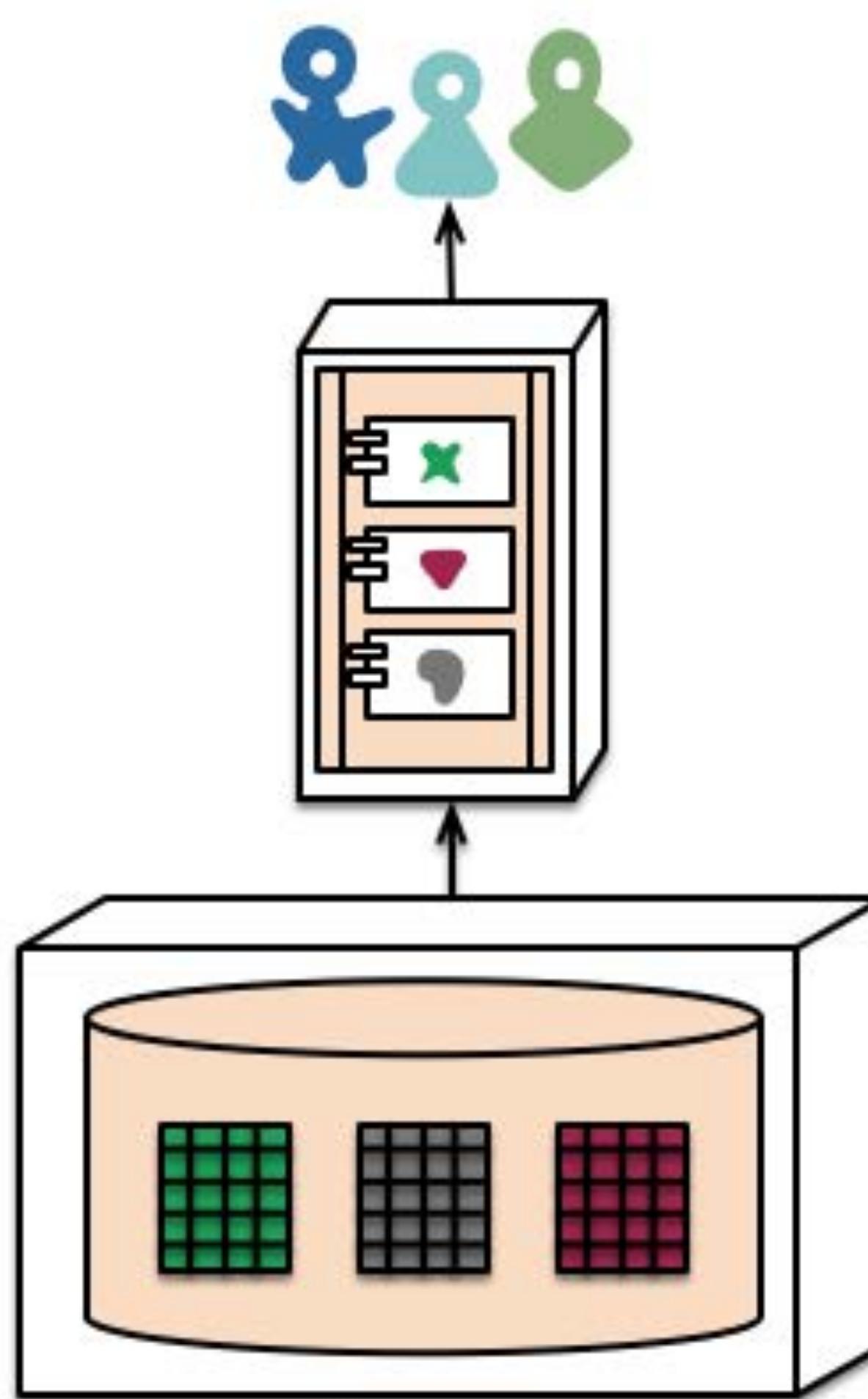
# decentralized governance



# decentralized governance

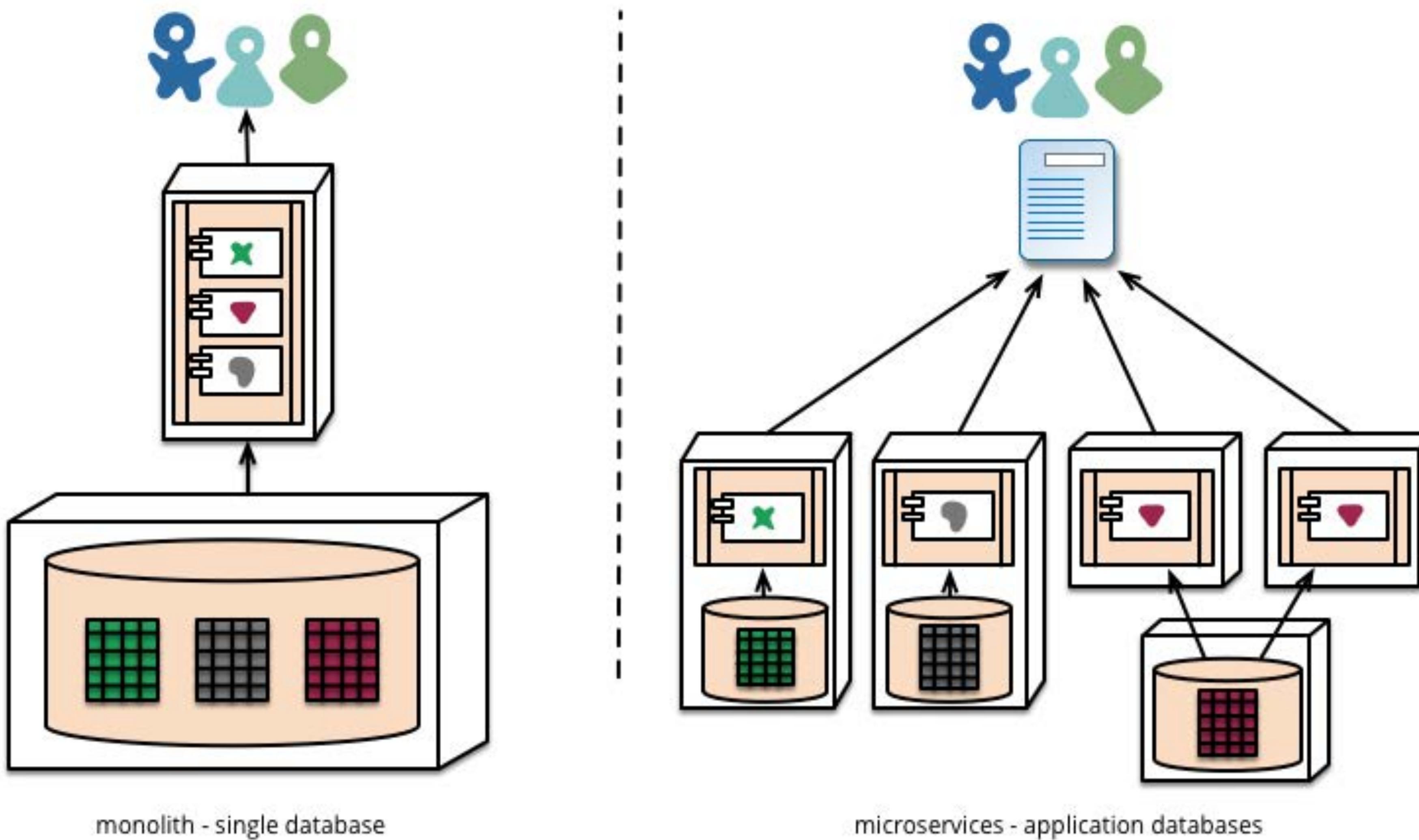


# decentralized data management

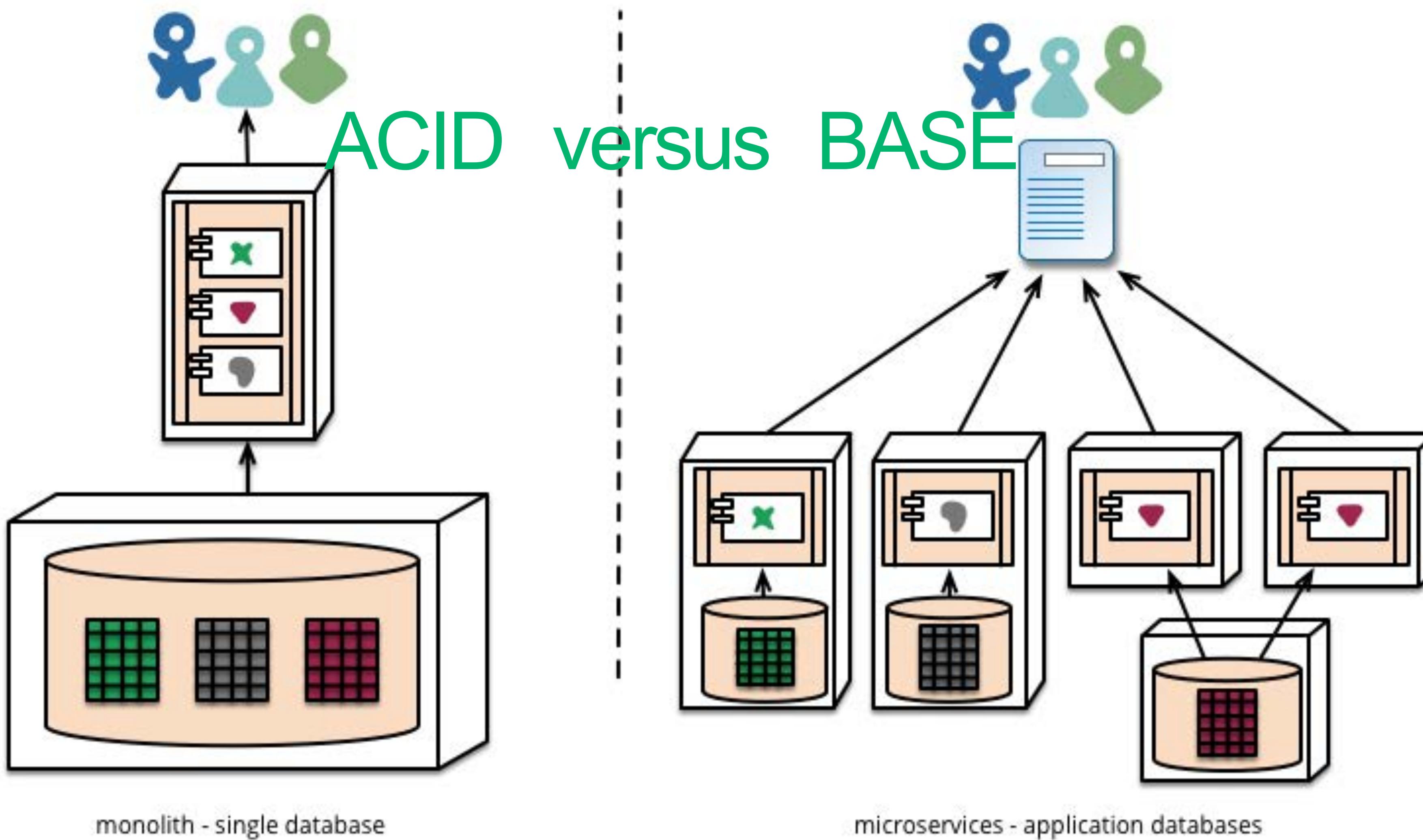


monolith - single database

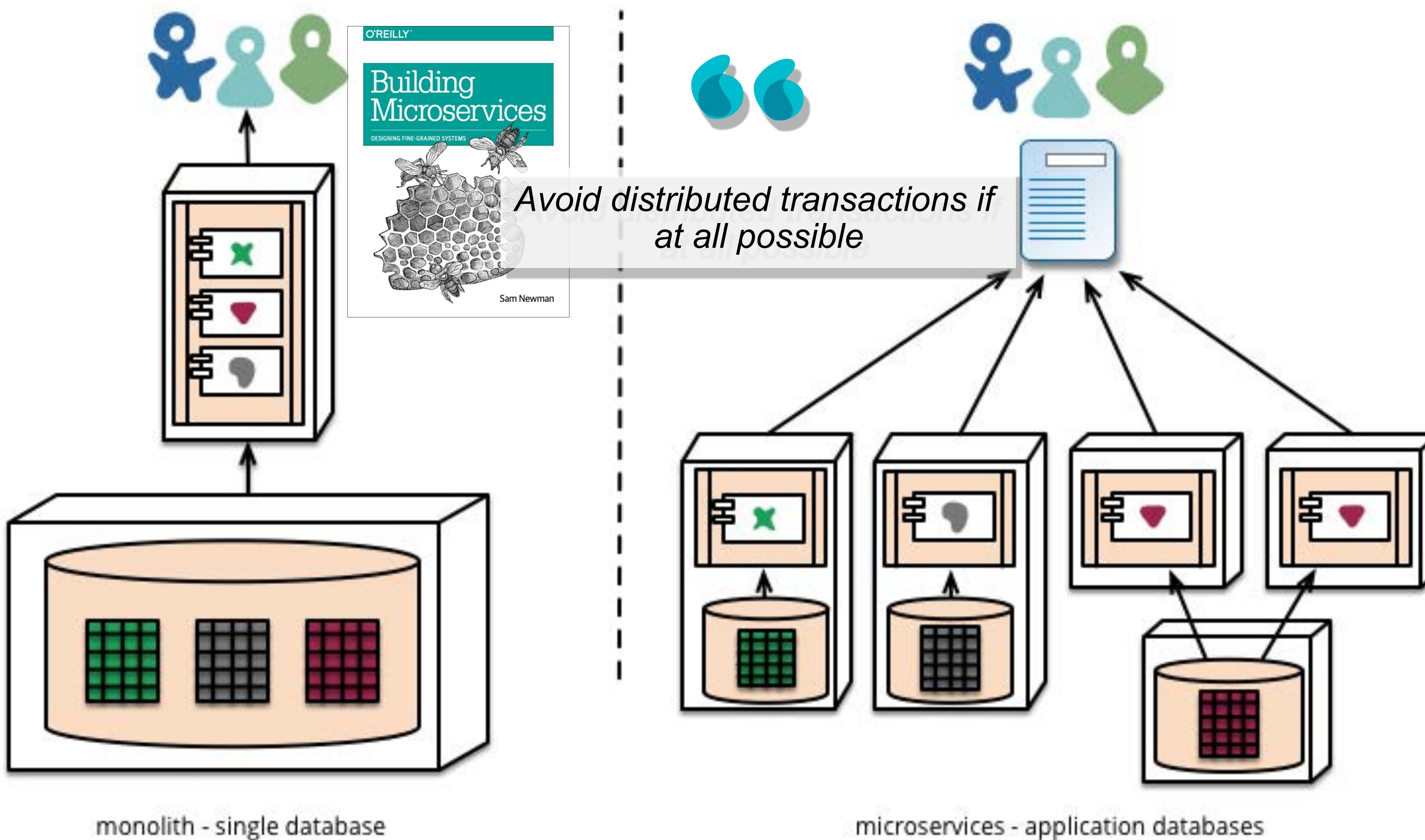
# decentralized data management



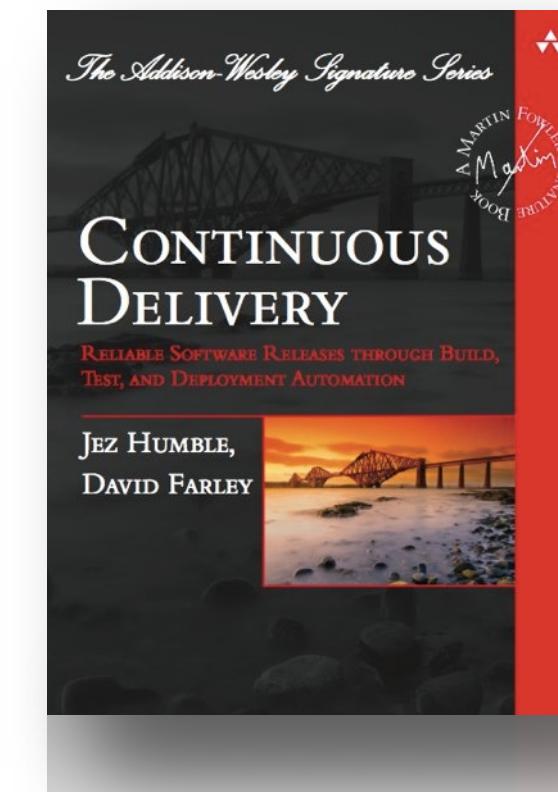
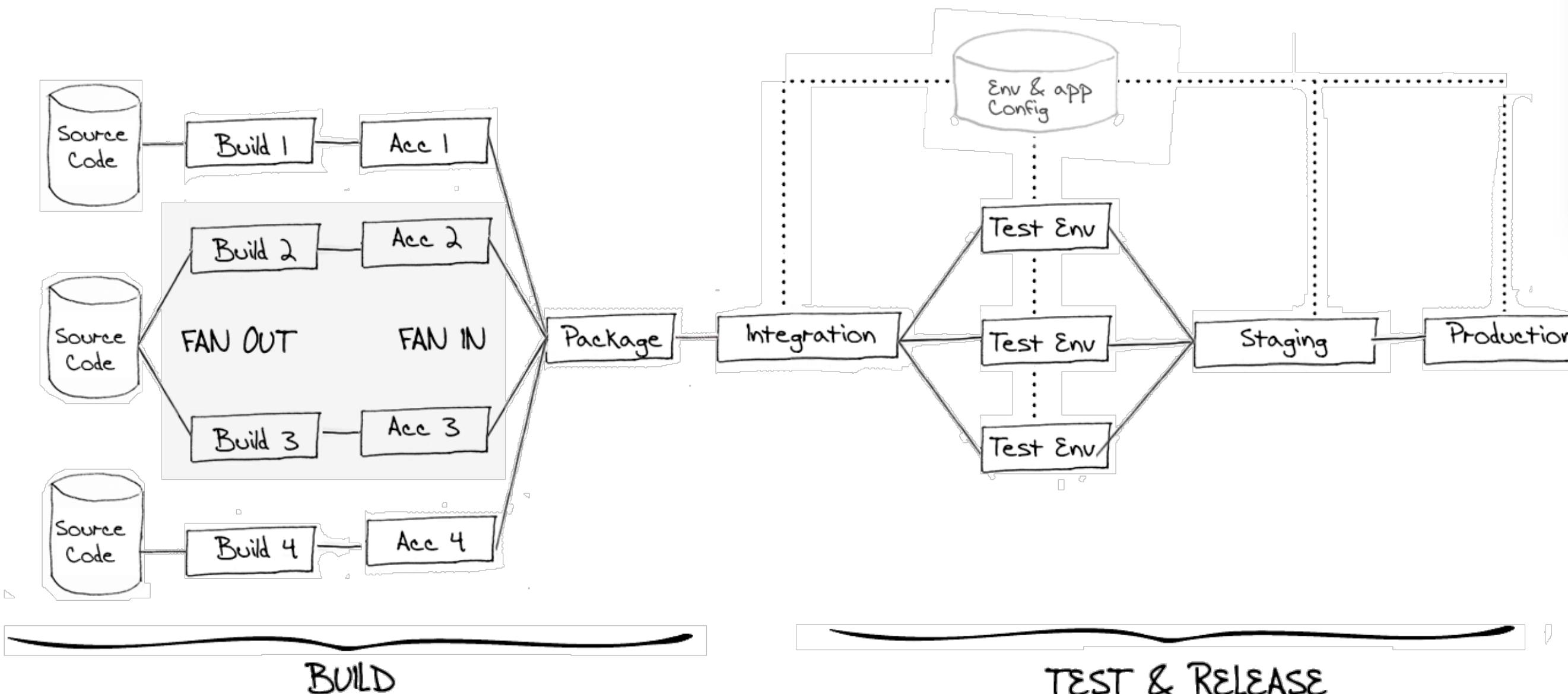
# decentralized data management



# decentralized data management

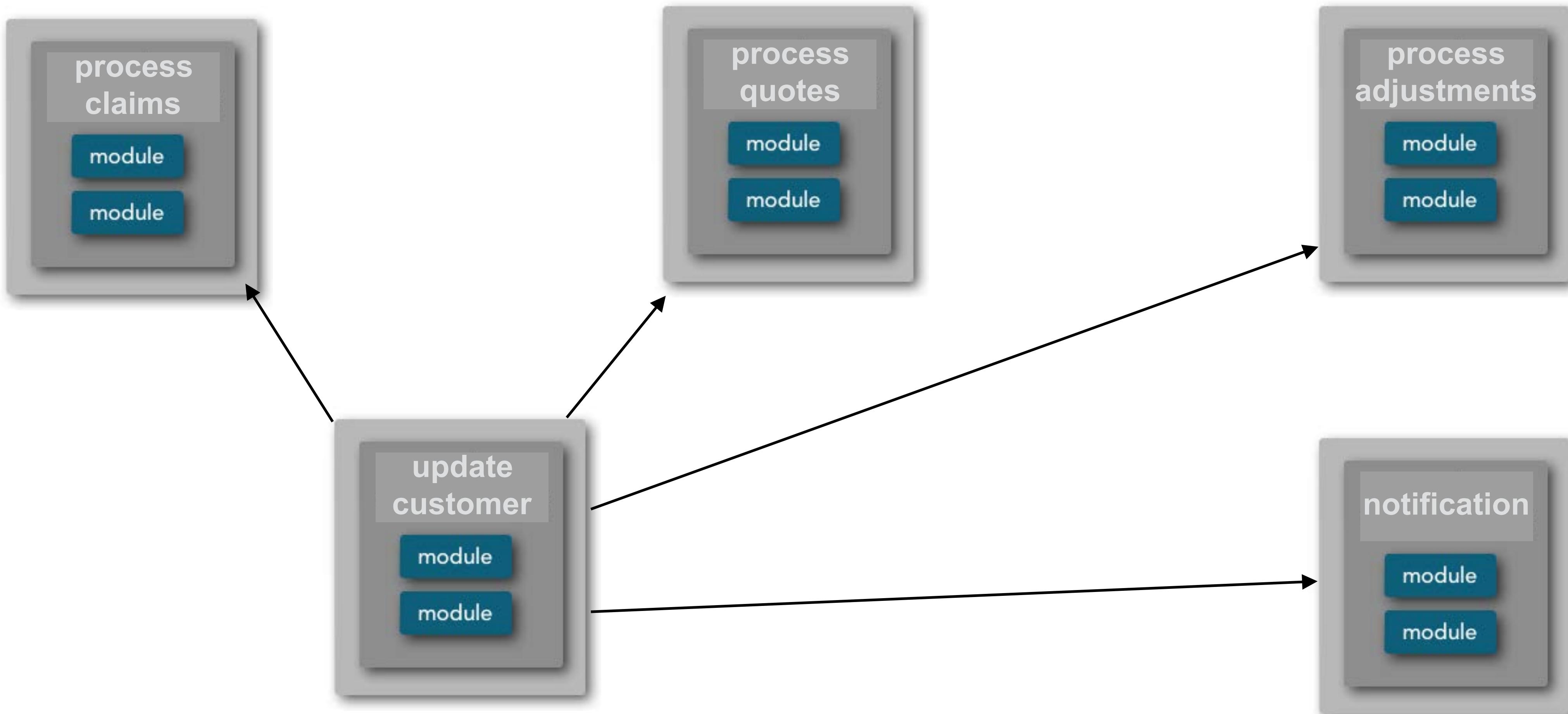


# infrastructure automation



# microservices architecture

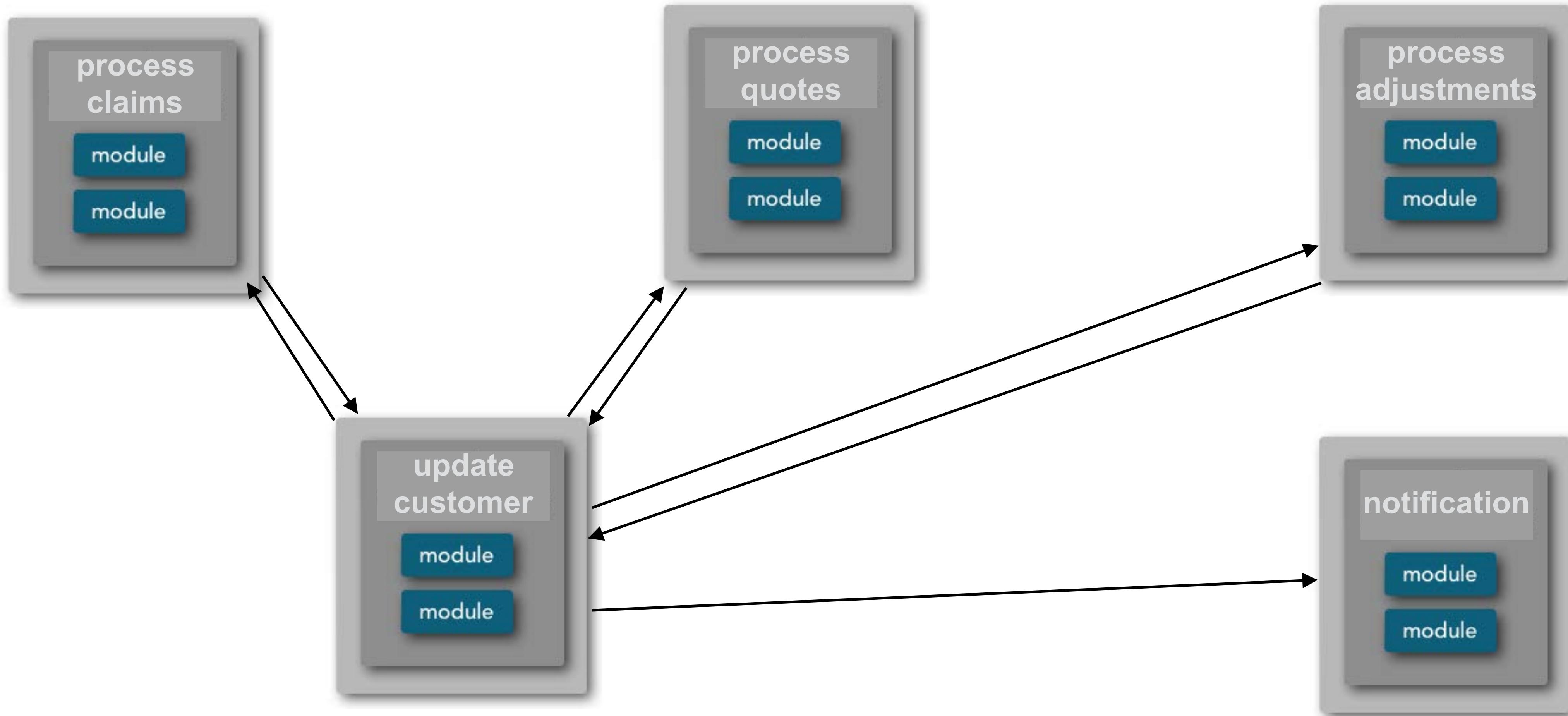
## service orchestration



front orchestrator

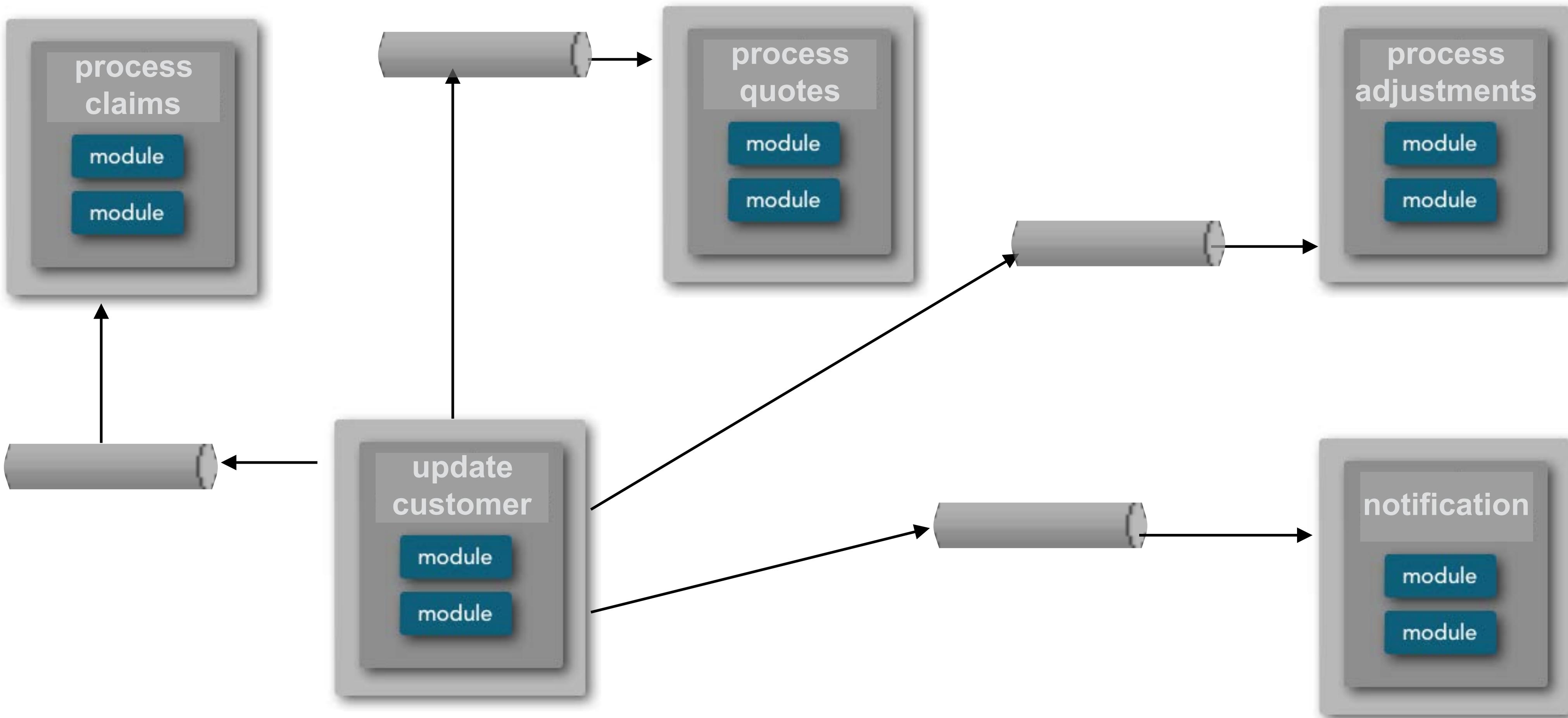
# microservices architecture

## service orchestration



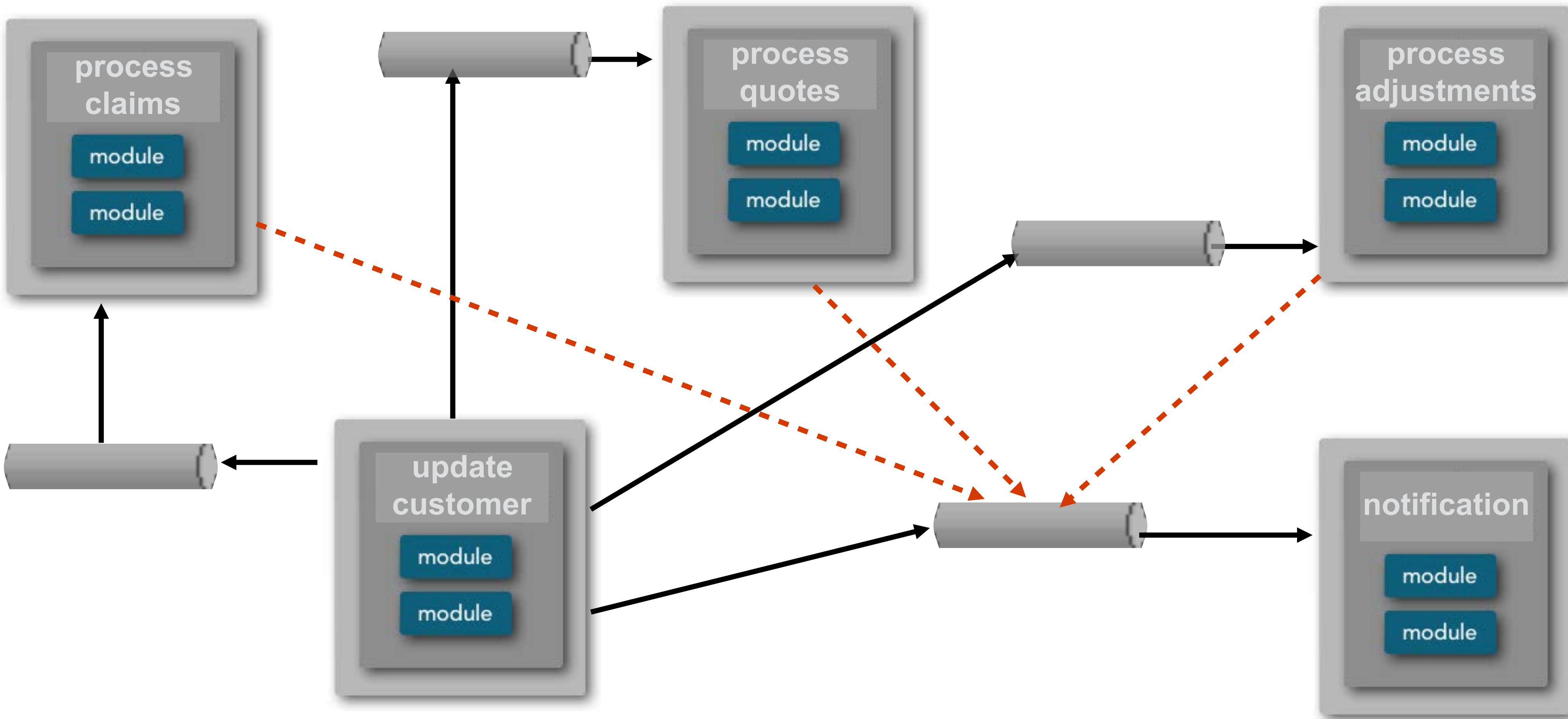
# microservices architecture

## service orchestration



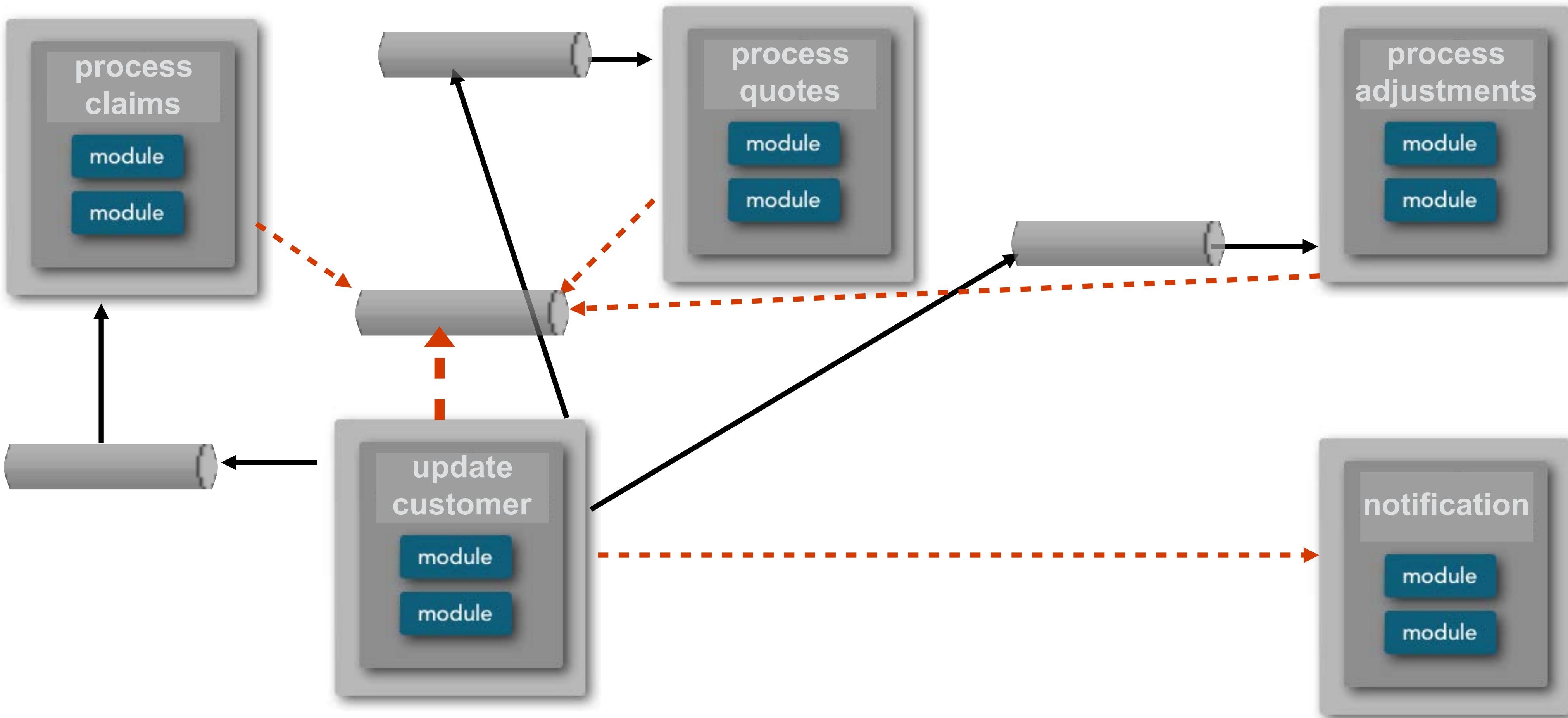
# microservices architecture

## service orchestration

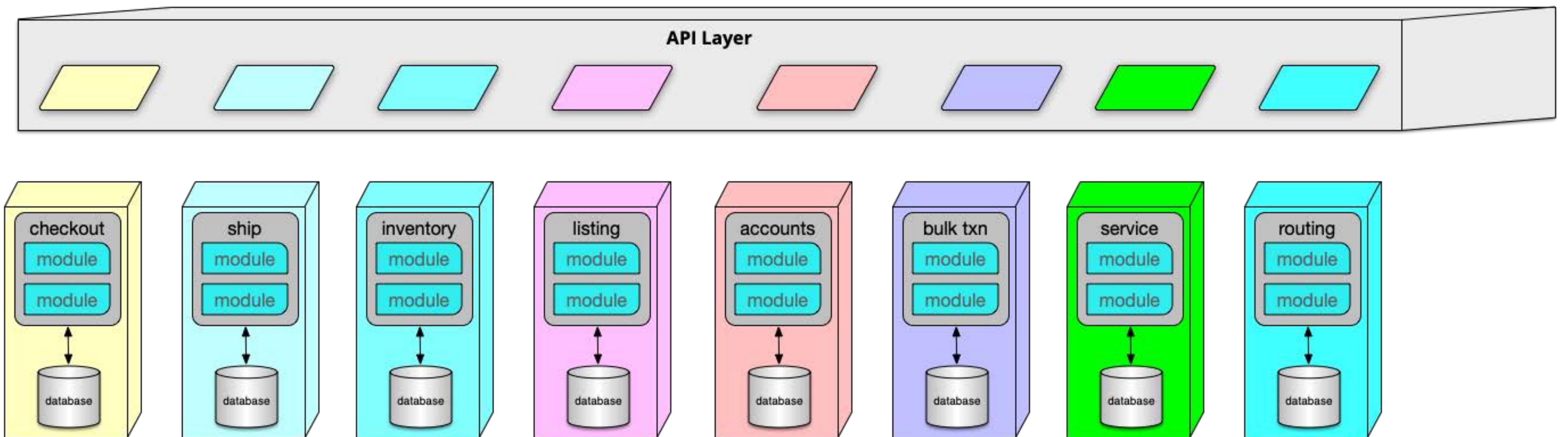


# microservices architecture

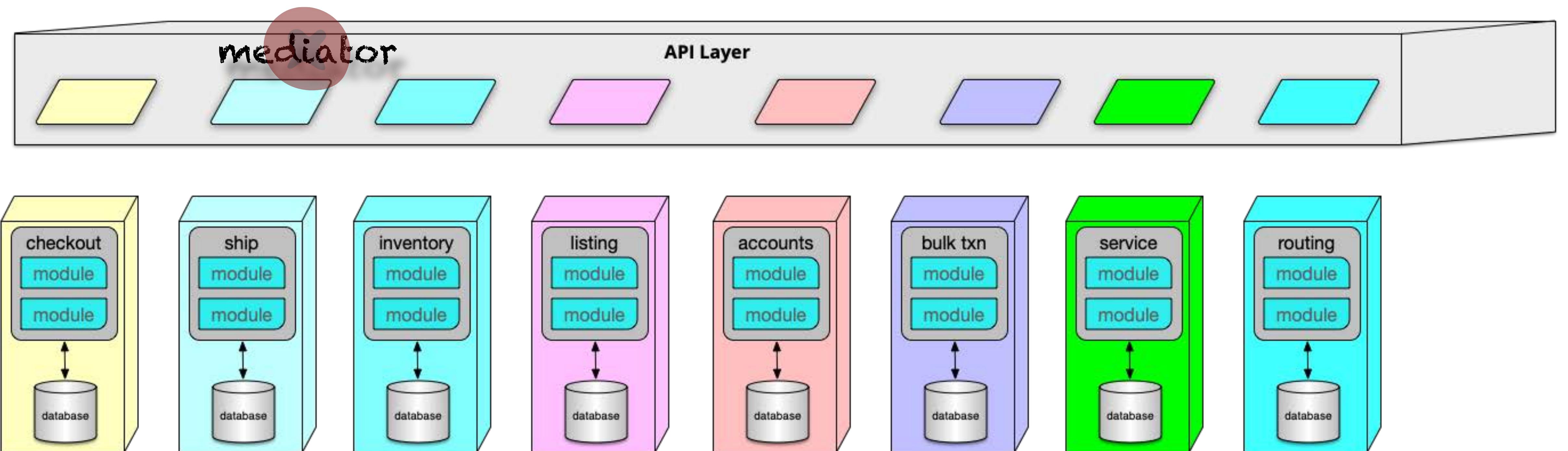
## service orchestration



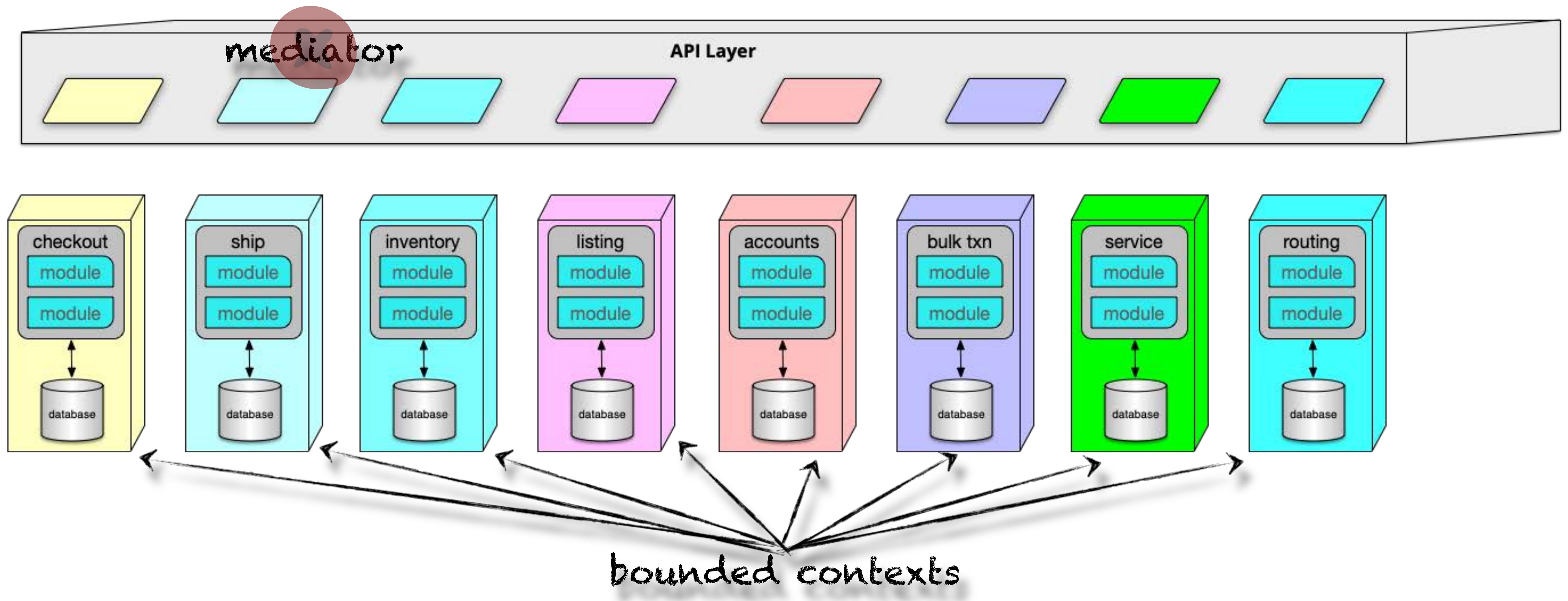
# Microservices



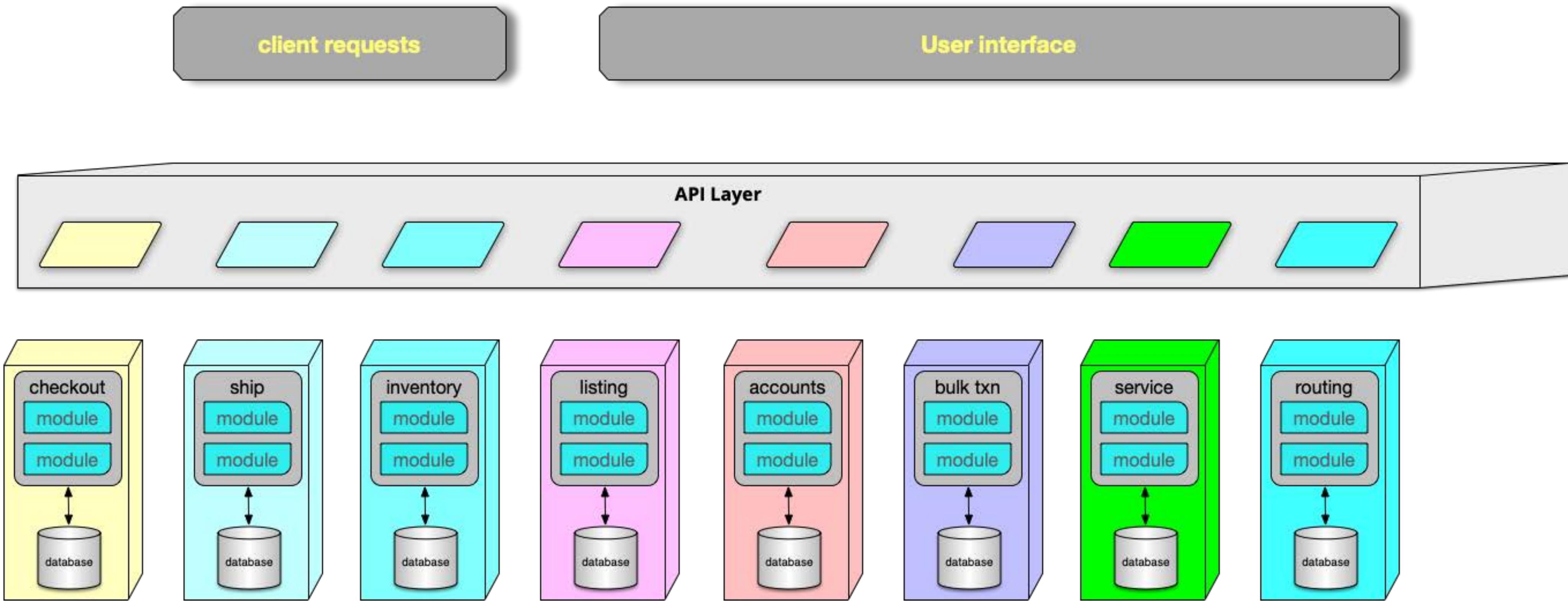
# Microservices



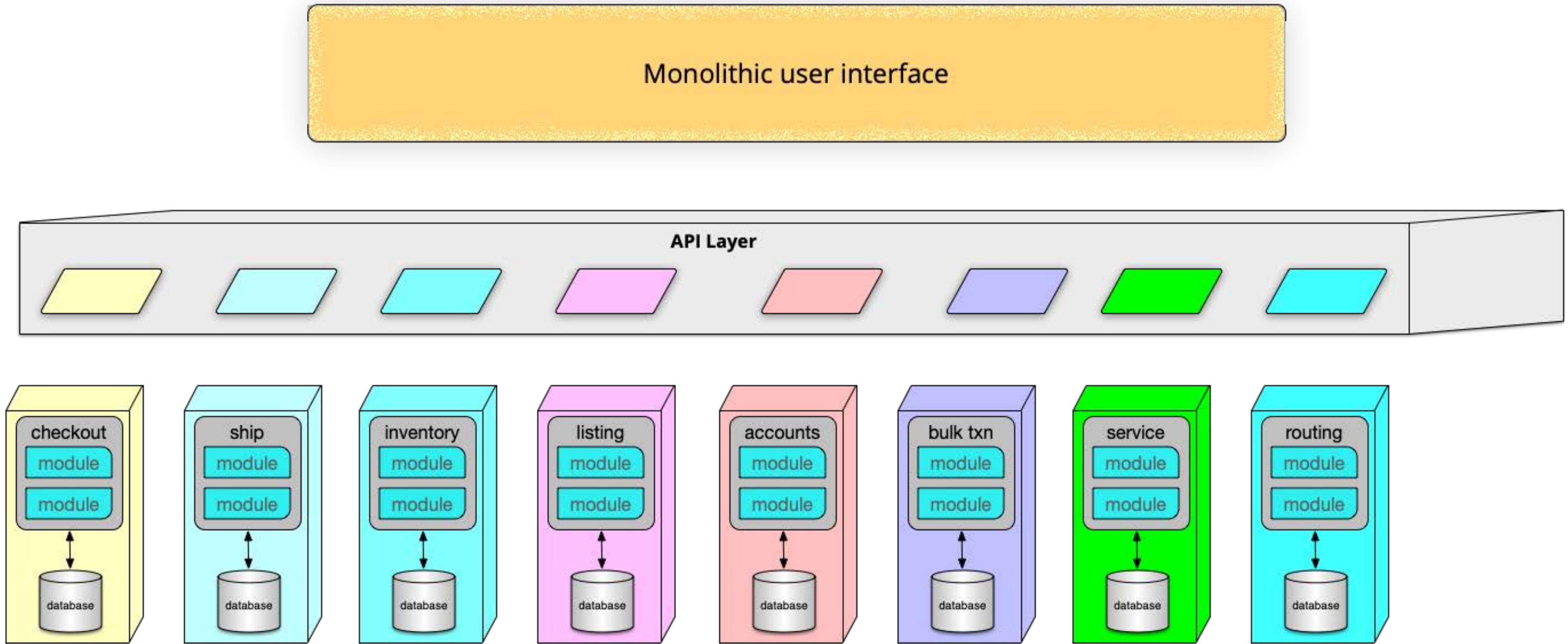
# Microservices



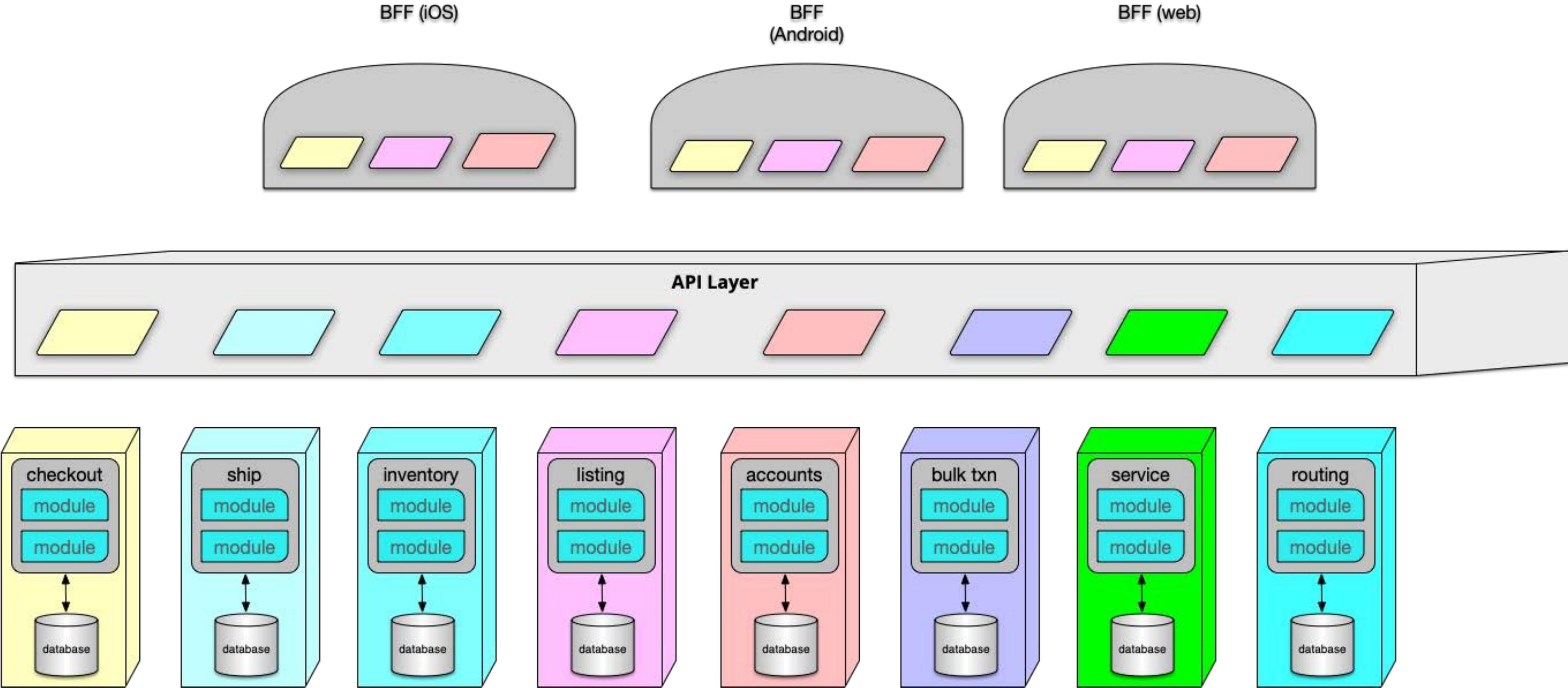
# Microservices



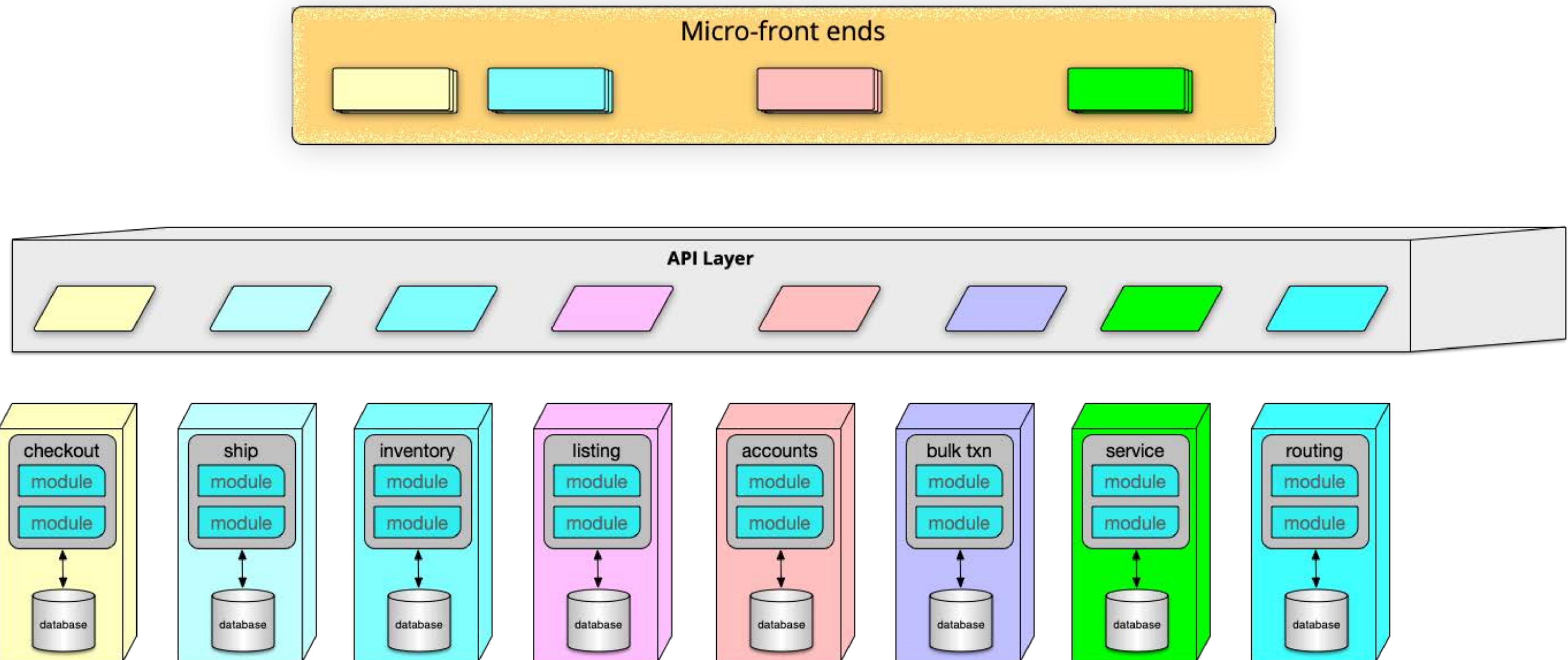
# Microservices: Monolithic UI



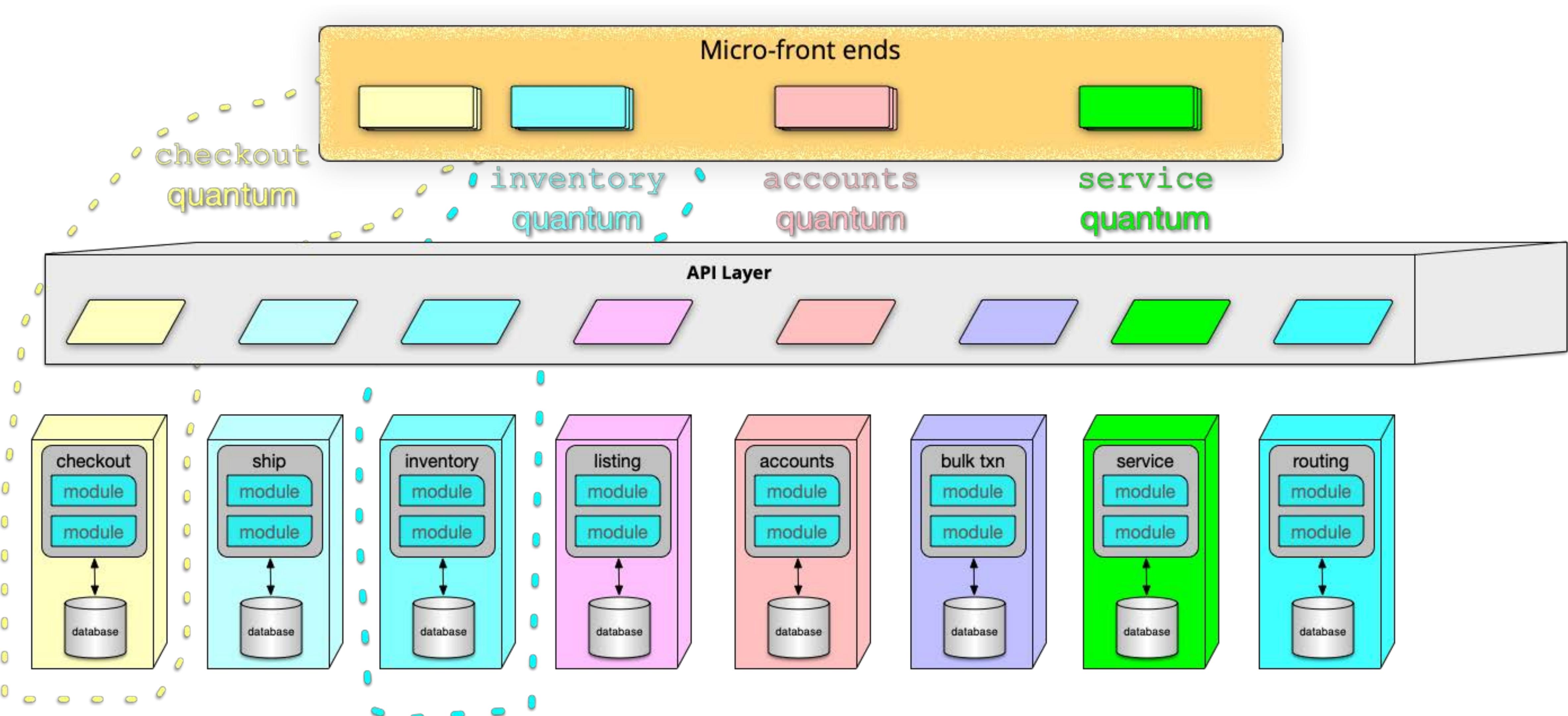
# Microservices :BFF

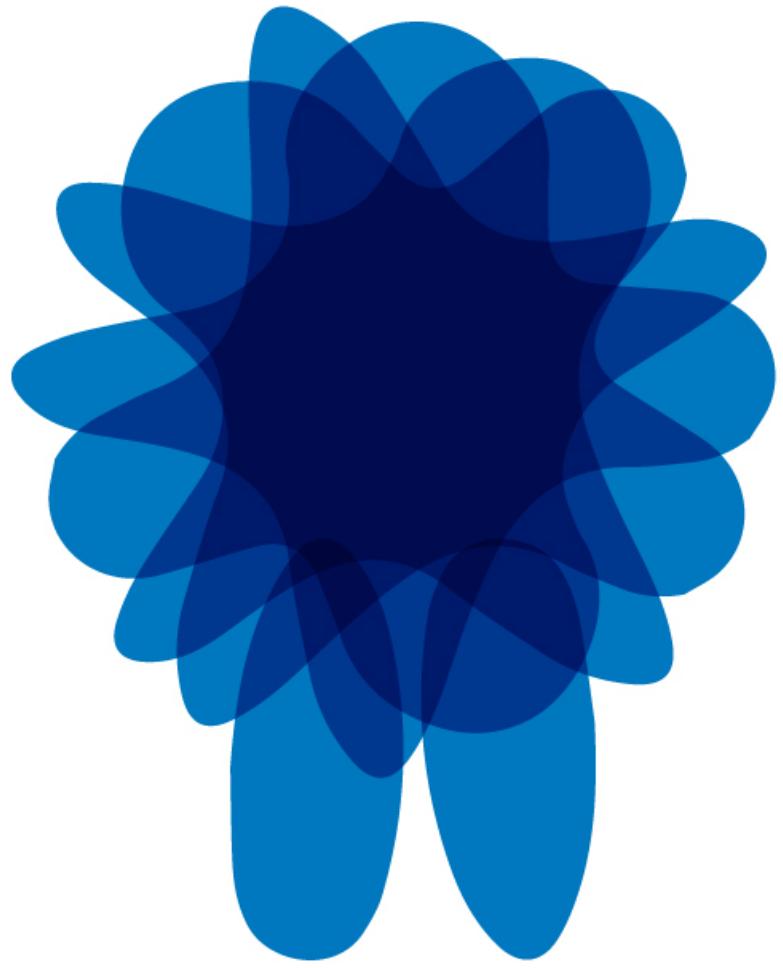


# Microservices



# Microservices

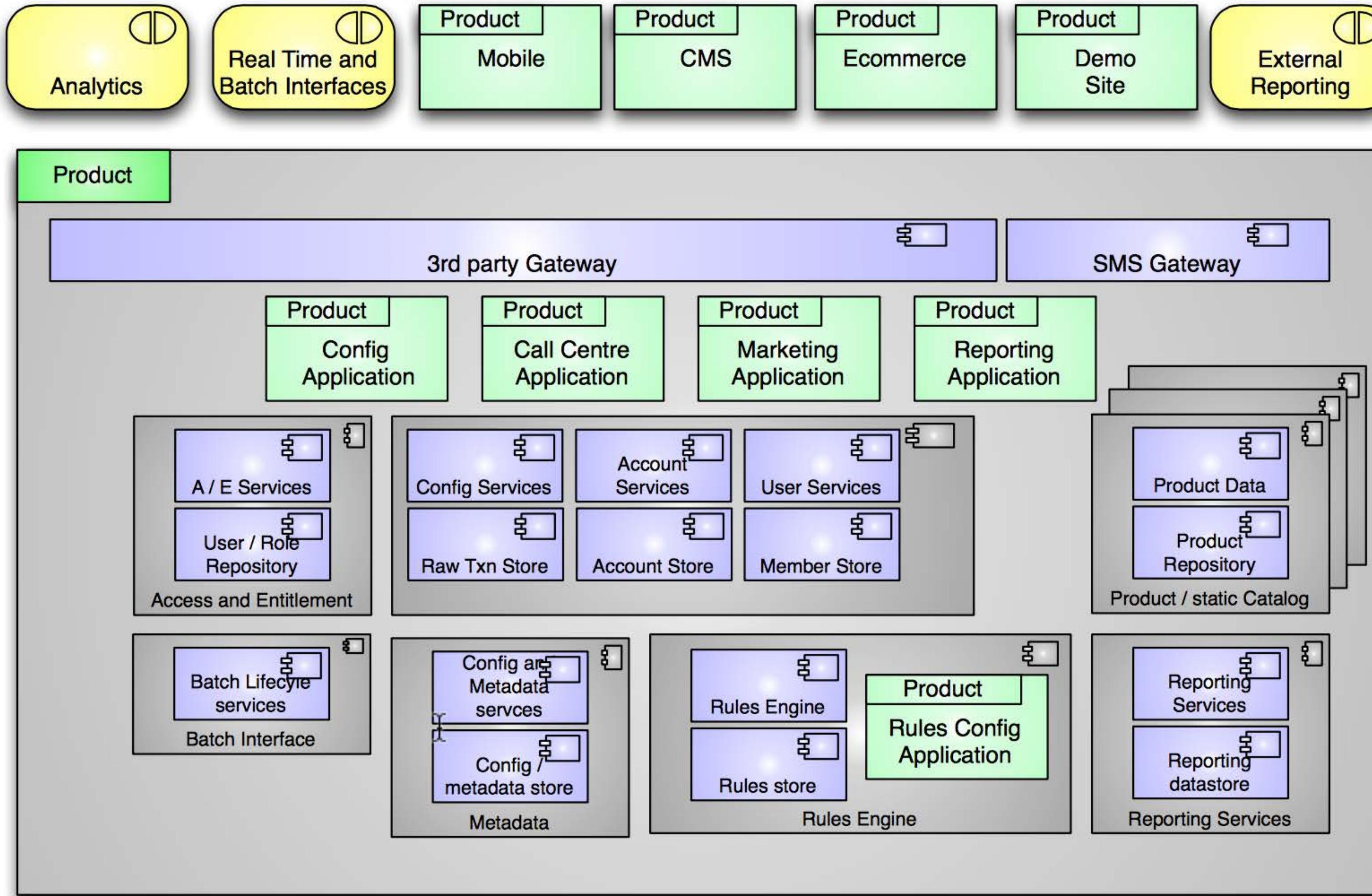




# Support △

*Microservice* is the first  
architectural style developed  
post-Continuous Delivery.

# microservice implementation



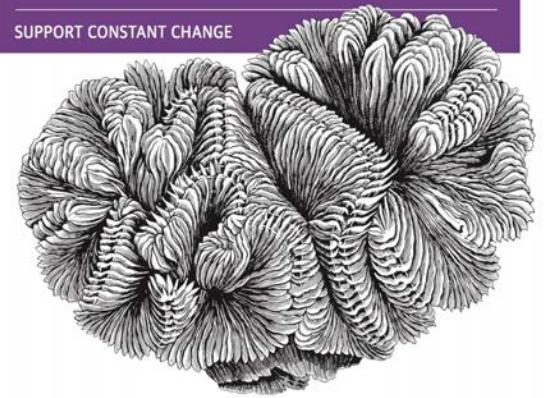
<http://2012.33degree.org/pdf/JamesLewisMicroServices.pdf>

<http://www.infoq.com/presentations/Micro-Services>

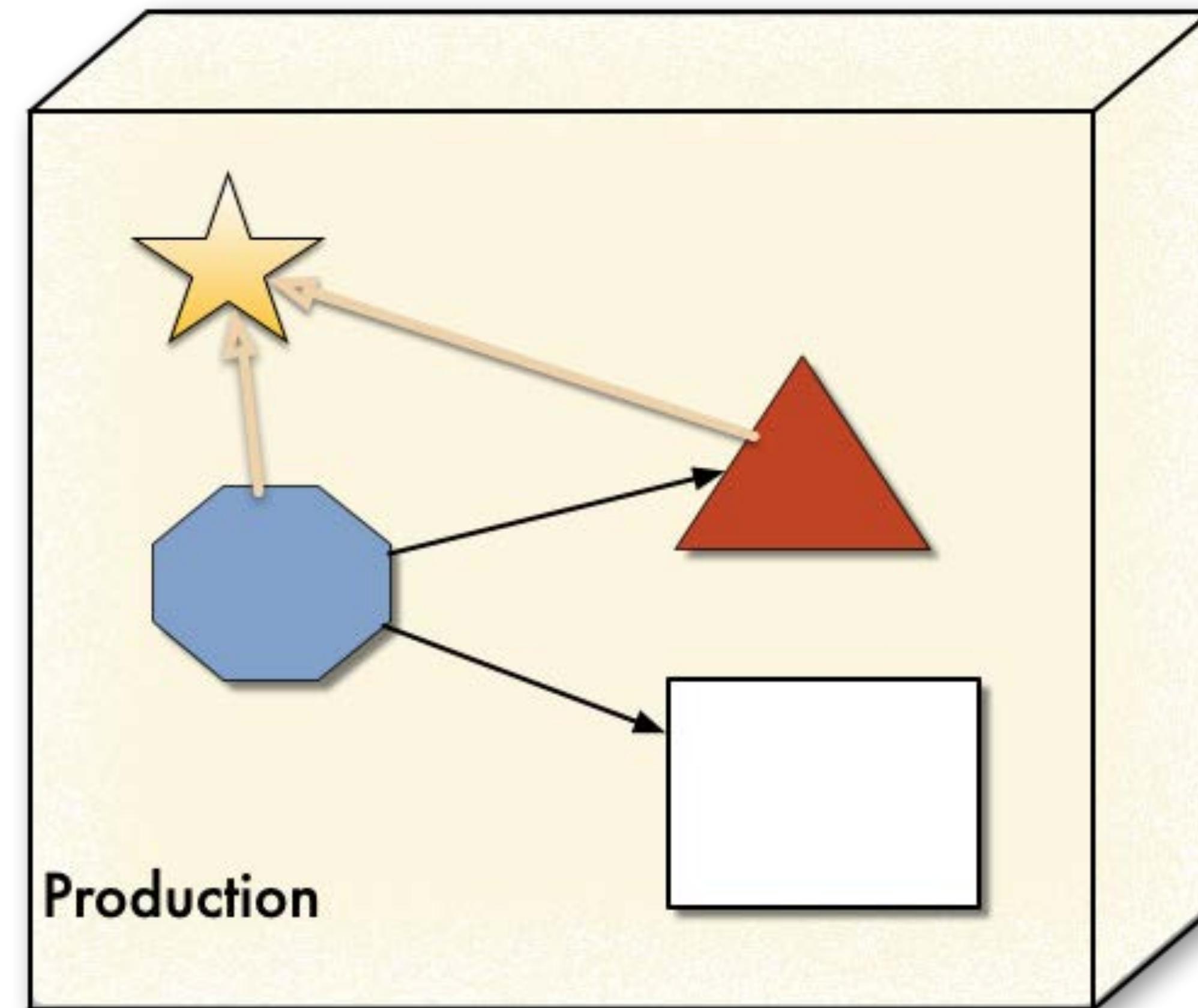
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# Building Evolutionary Architectures

SUPPORT CONSTANT CHANGE

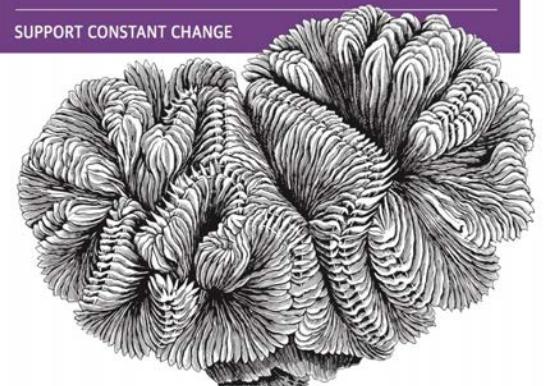


Neal Ford, Rebecca Parsons & Patrick Kua

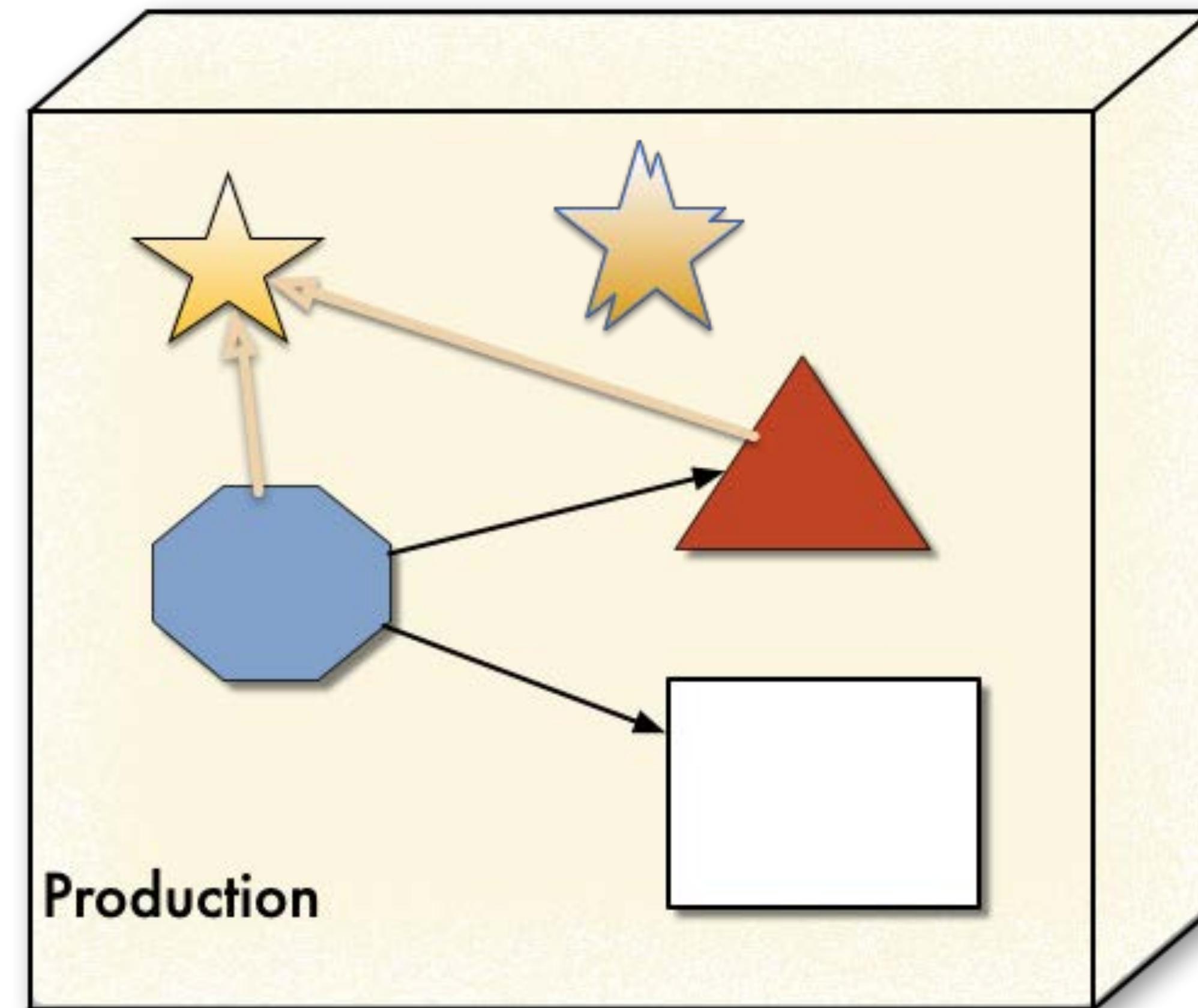


# Building Evolutionary Architectures

SUPPORT CONSTANT CHANGE



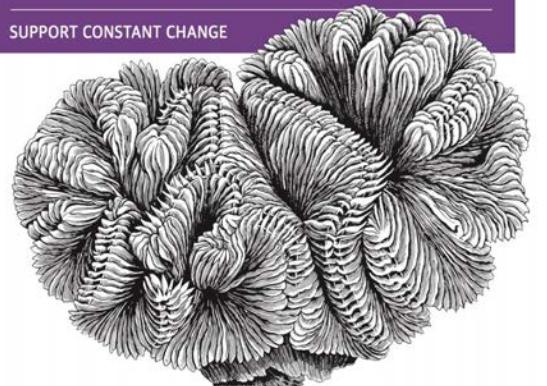
Neal Ford, Rebecca Parsons &amp; Patrick Kua



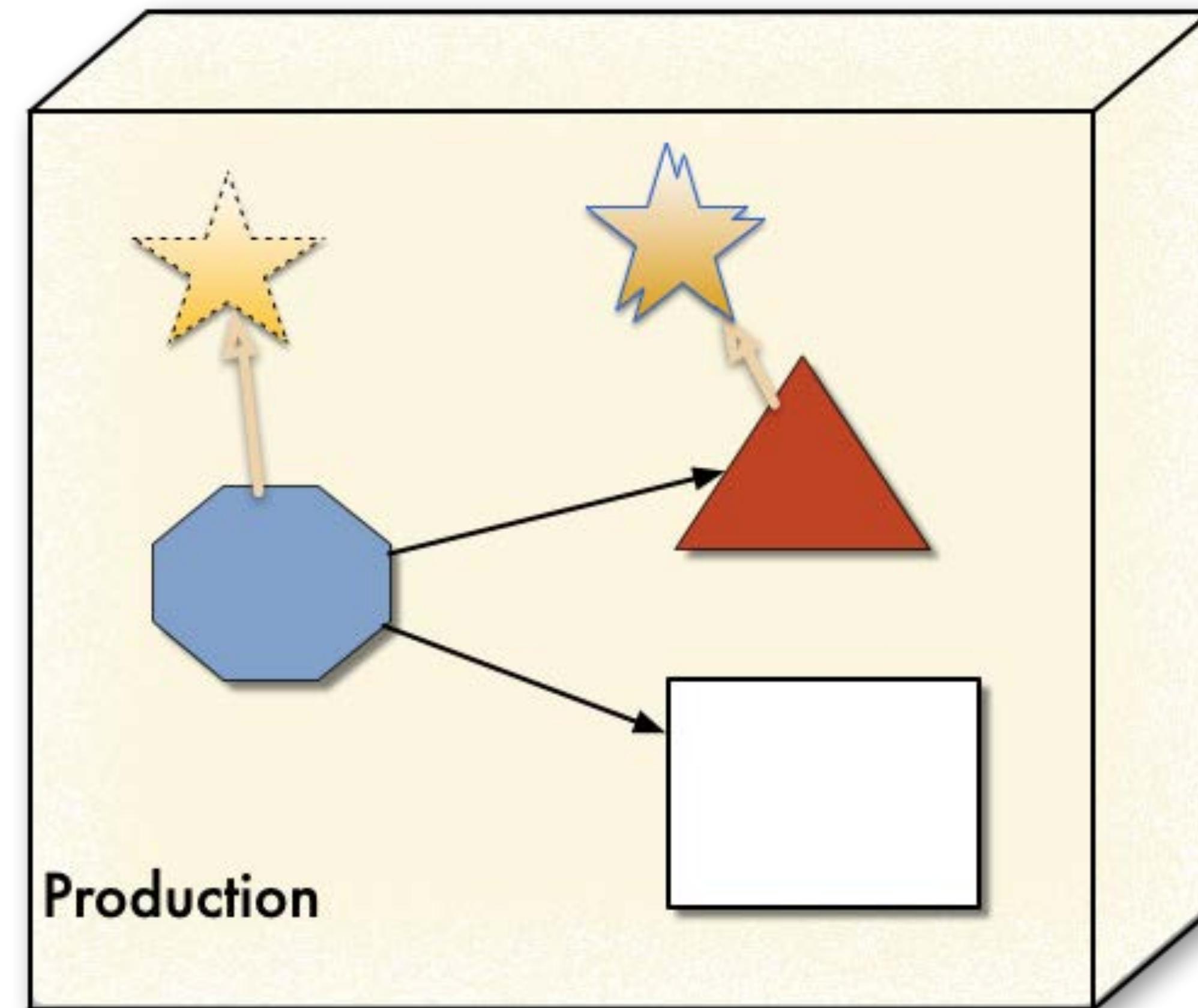
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# Building Evolutionary Architectures

SUPPORT CONSTANT CHANGE



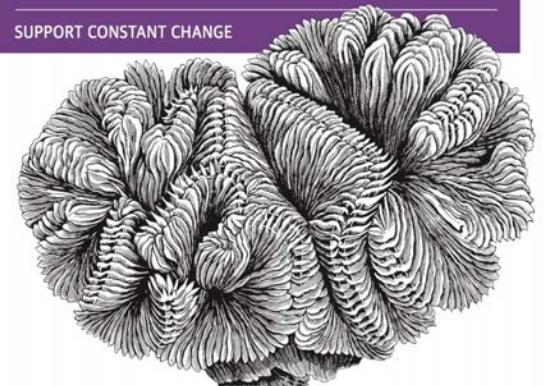
Neal Ford, Rebecca Parsons & Patrick Kua



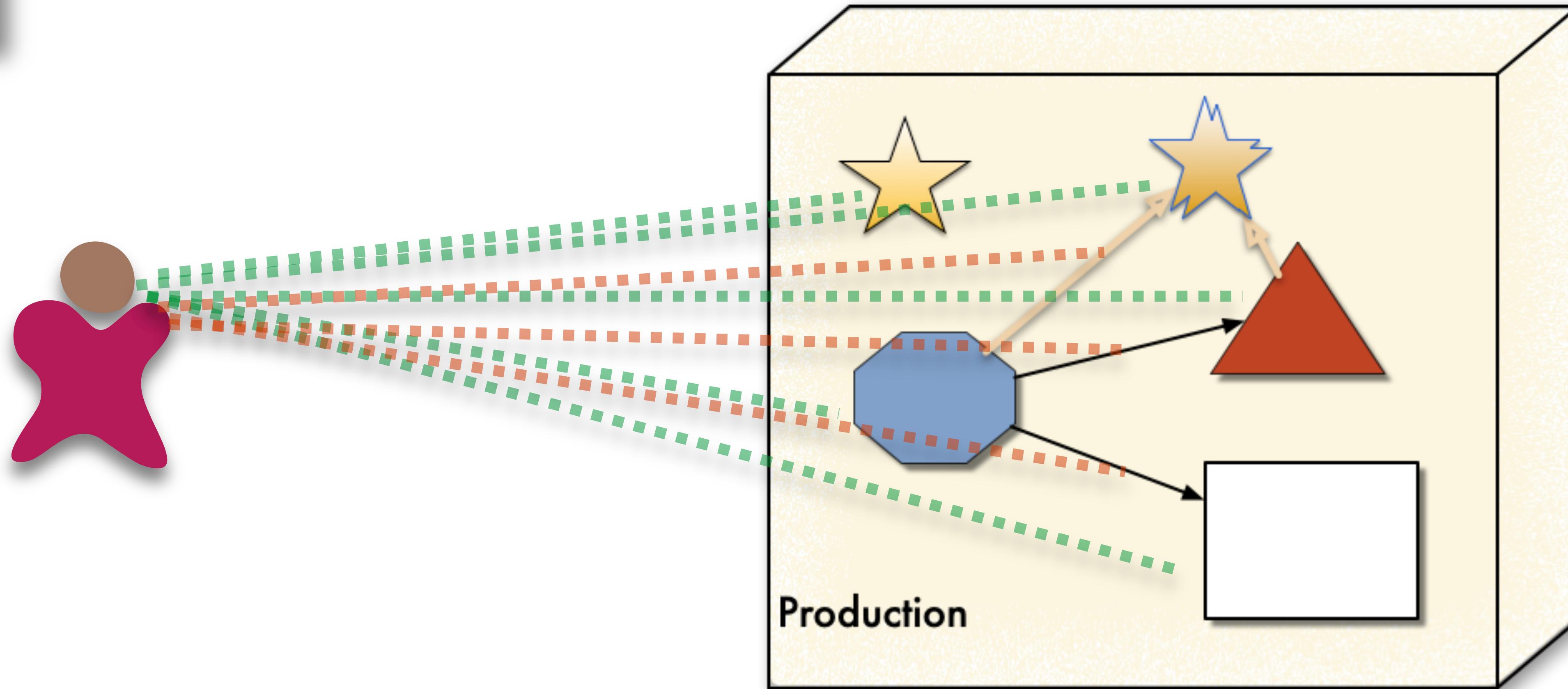
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# Building Evolutionary Architectures

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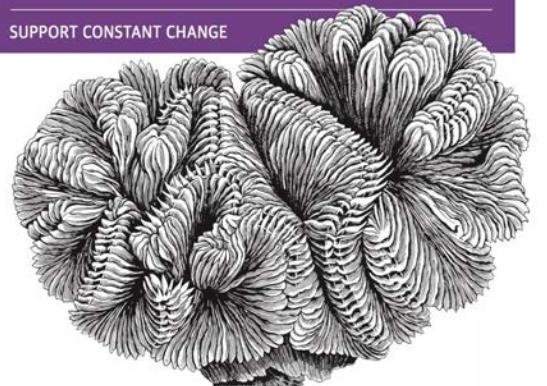
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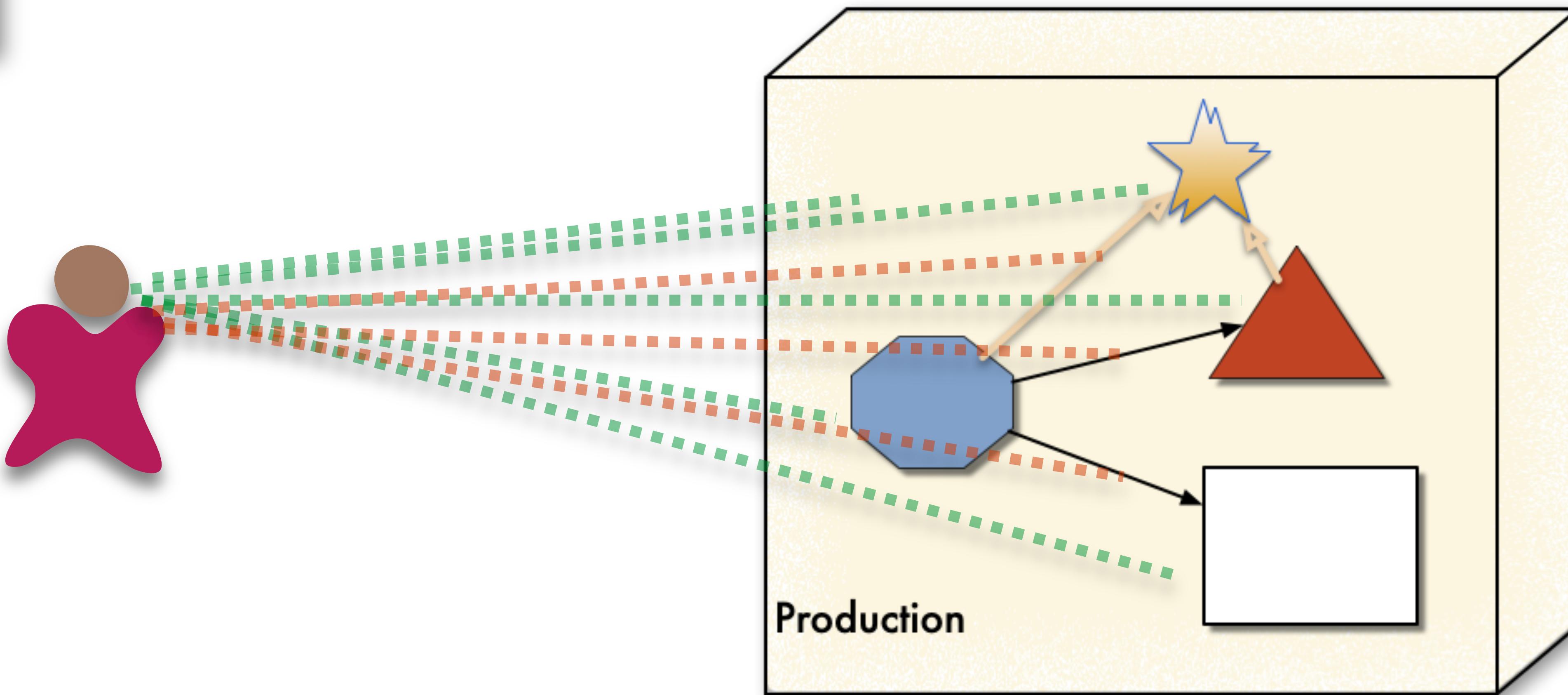
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# Building Evolutionary Architectures

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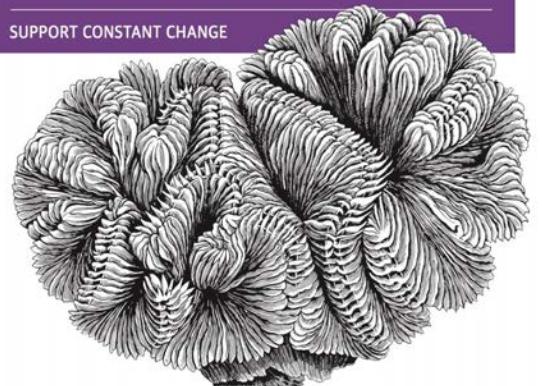


Neal Ford, Rebecca Parsons & Patrick Kua

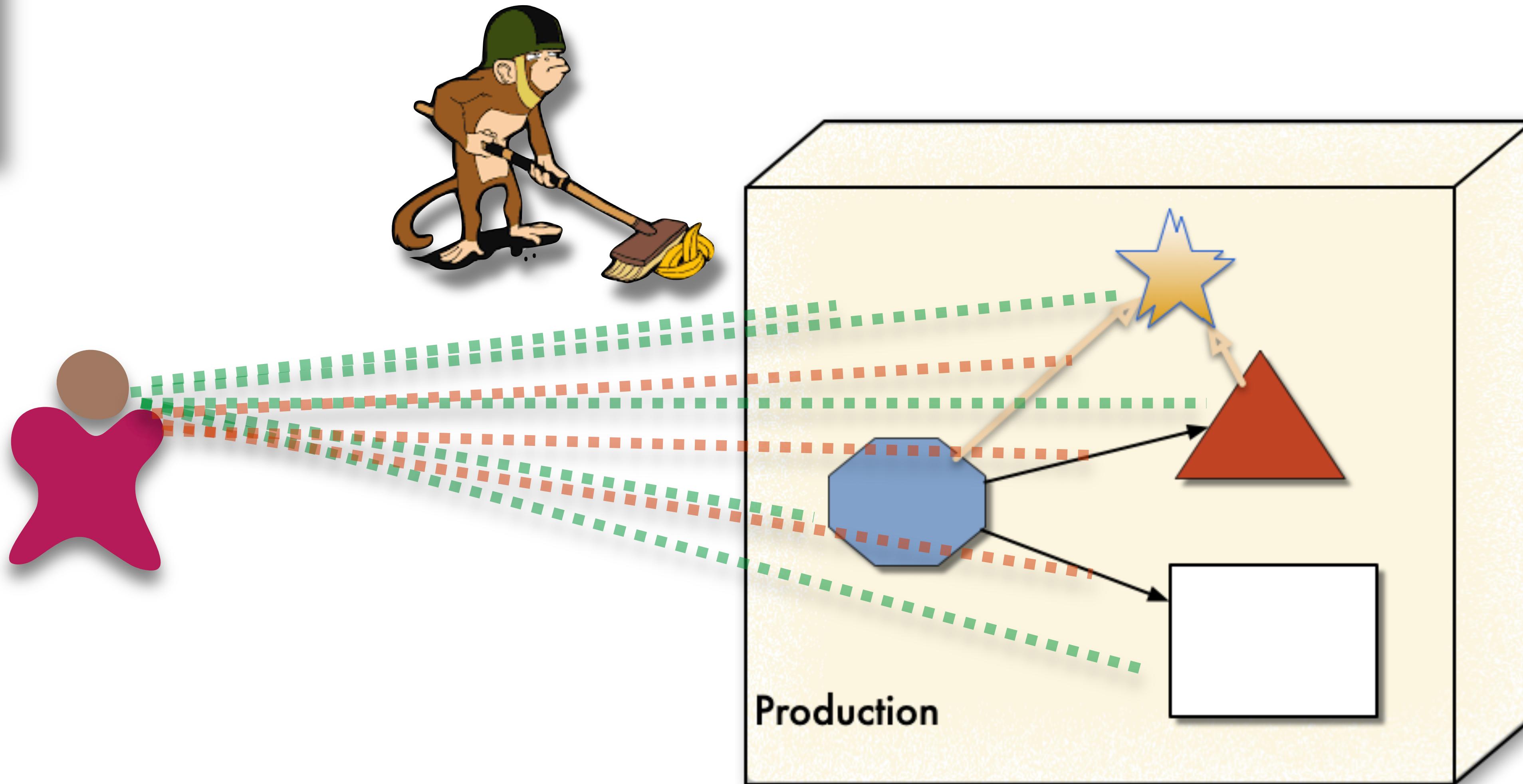


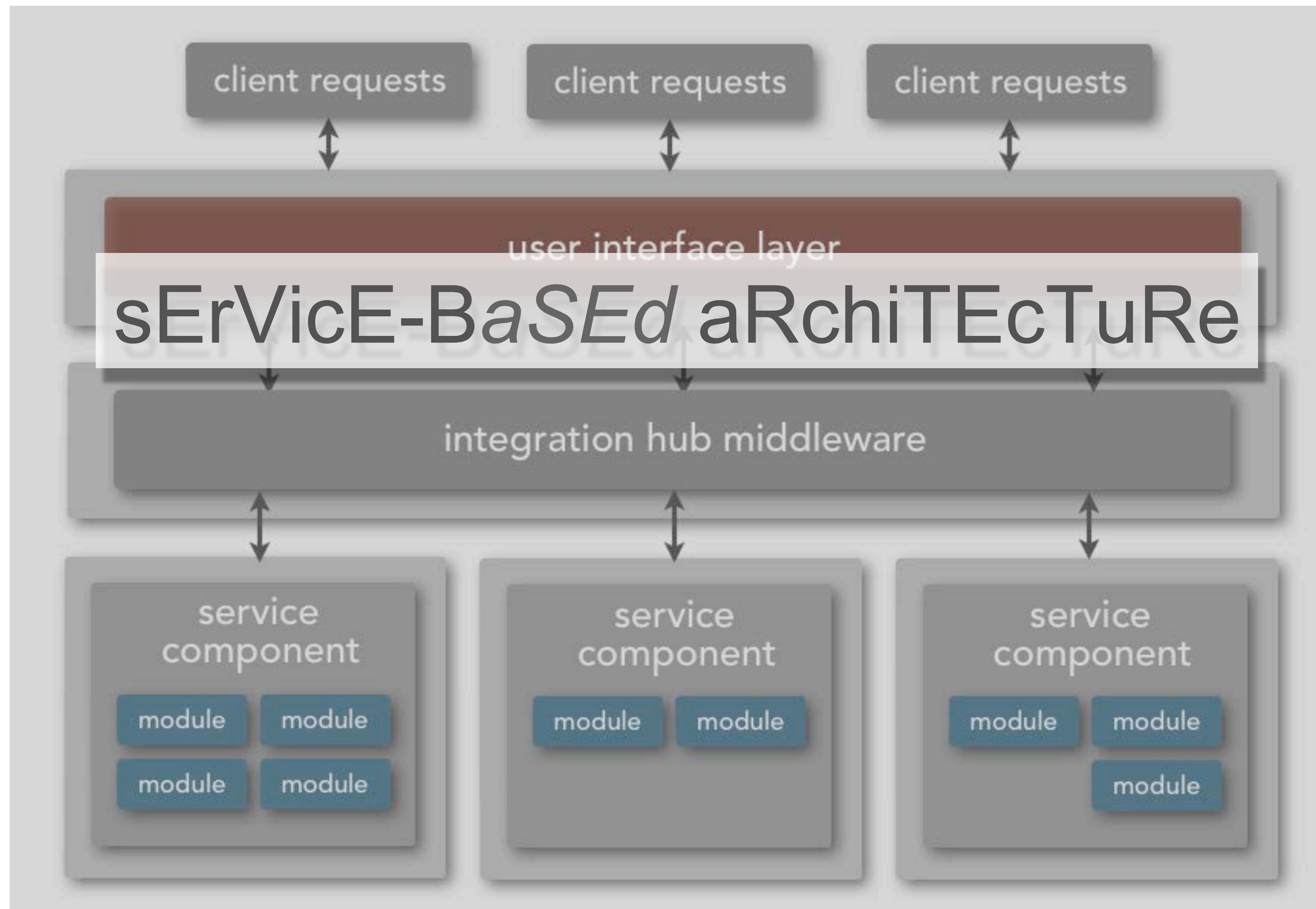
# Building Evolutionary Architectures

SUPPORT CONSTANT CHANGE



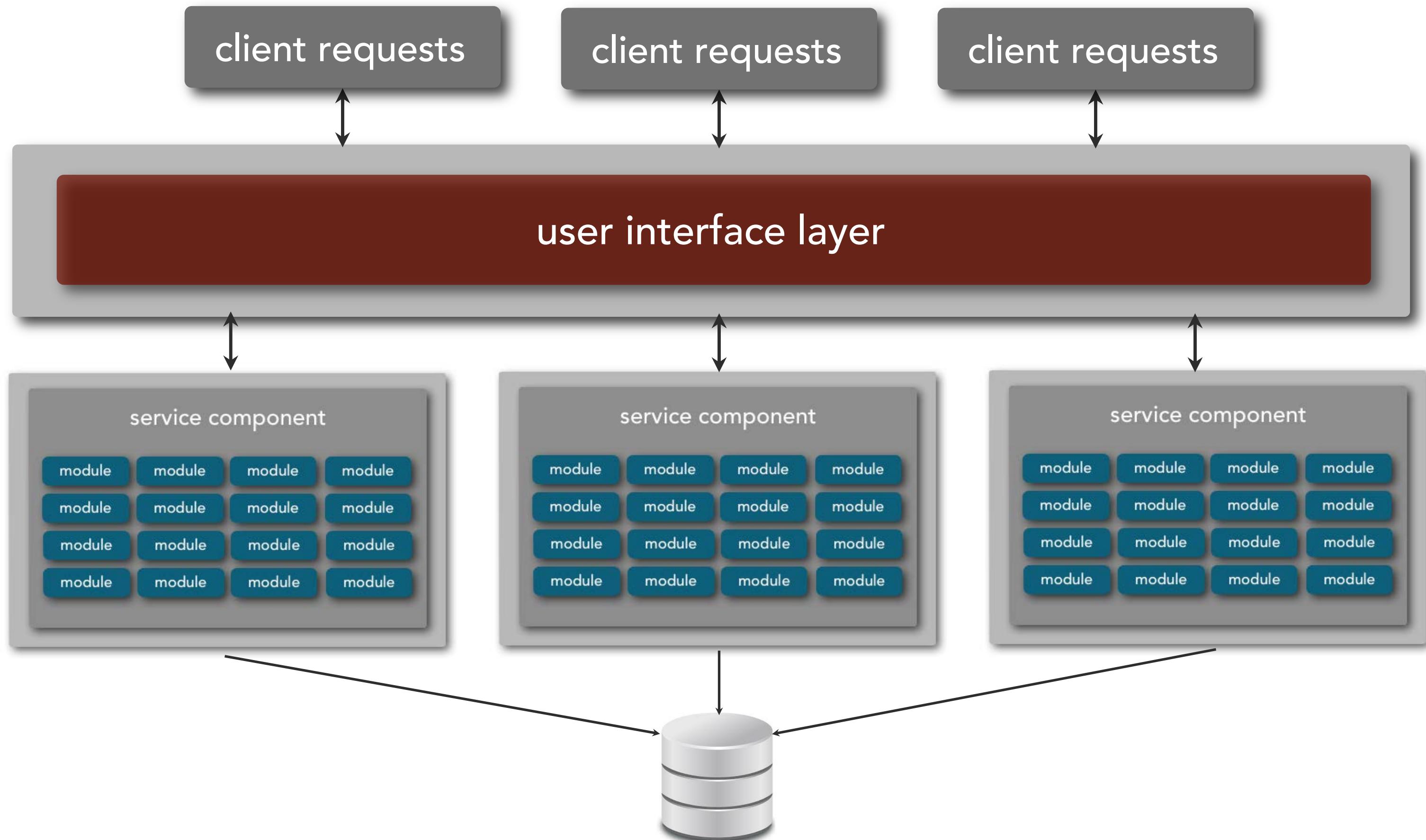
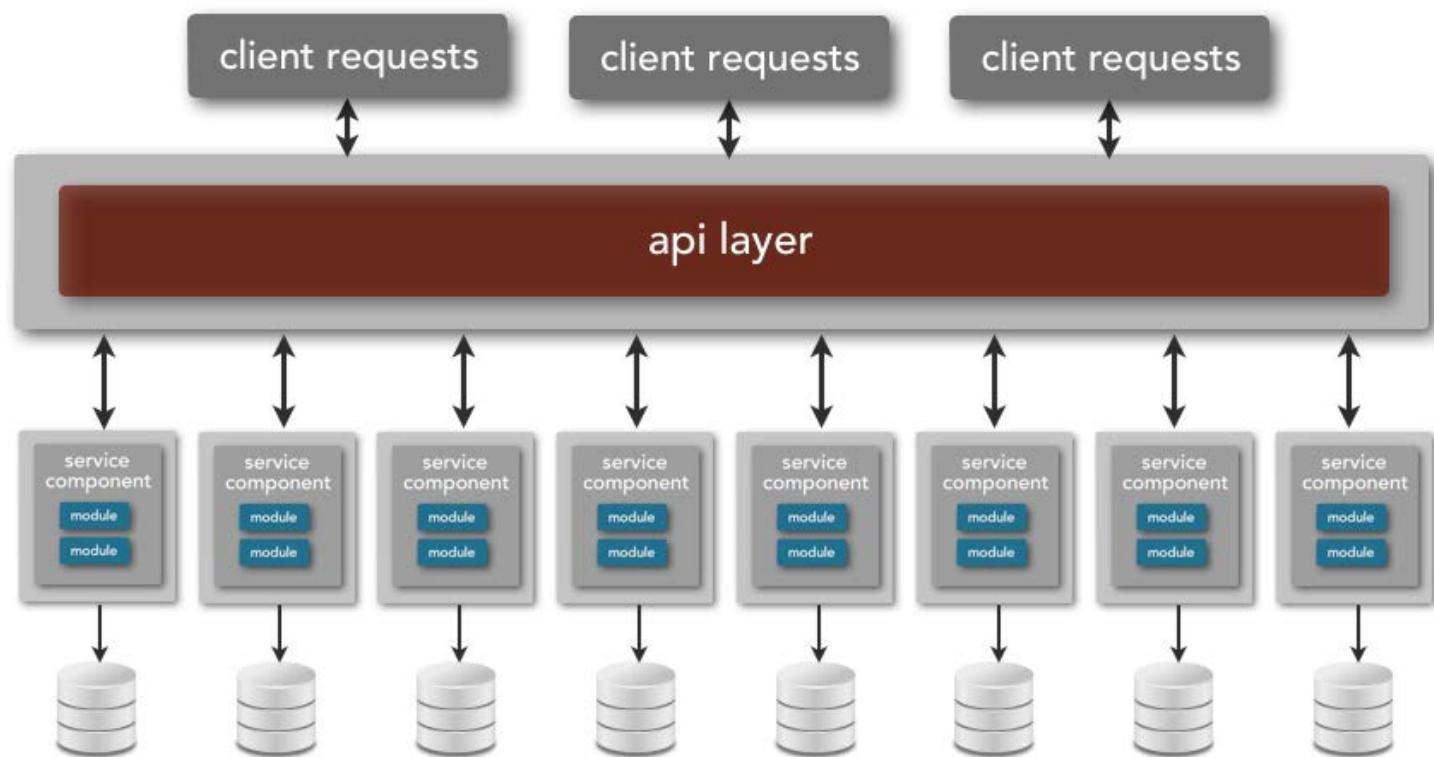
Neal Ford, Rebecca Parsons &amp; Patrick Kua





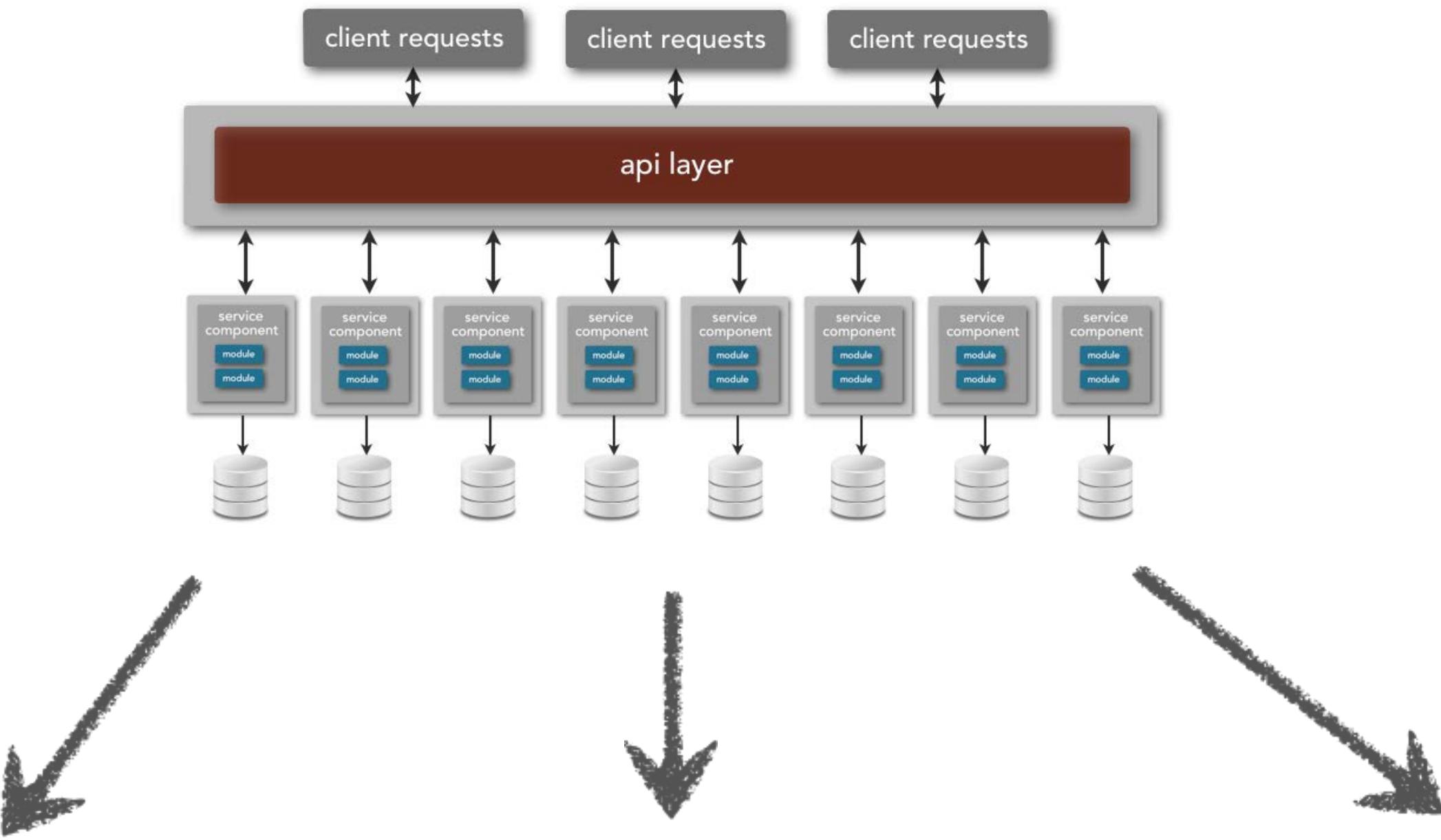
# service-based architecture

the goals of microservices...

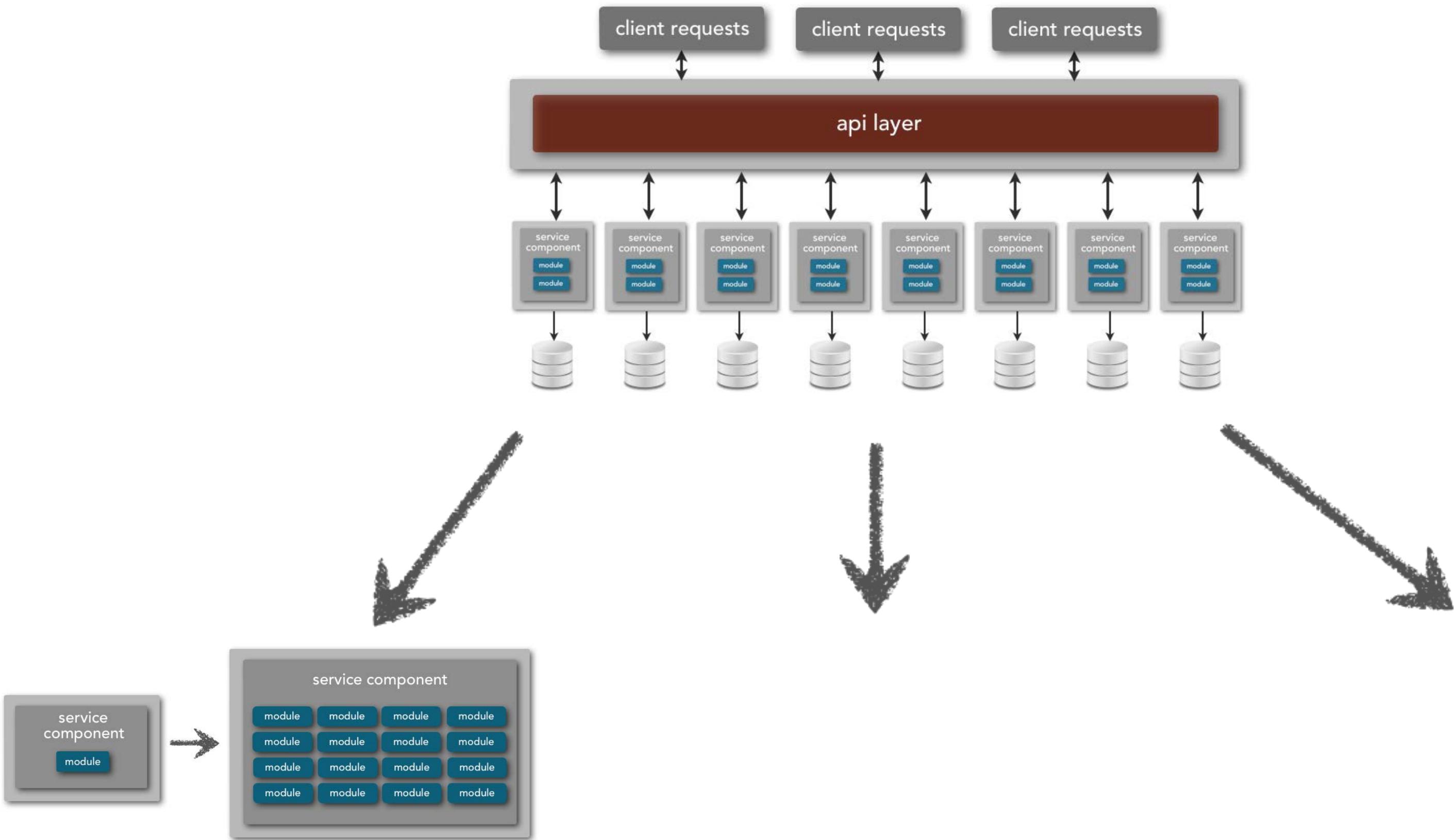


...with real-world constraints.

# service-based architecture

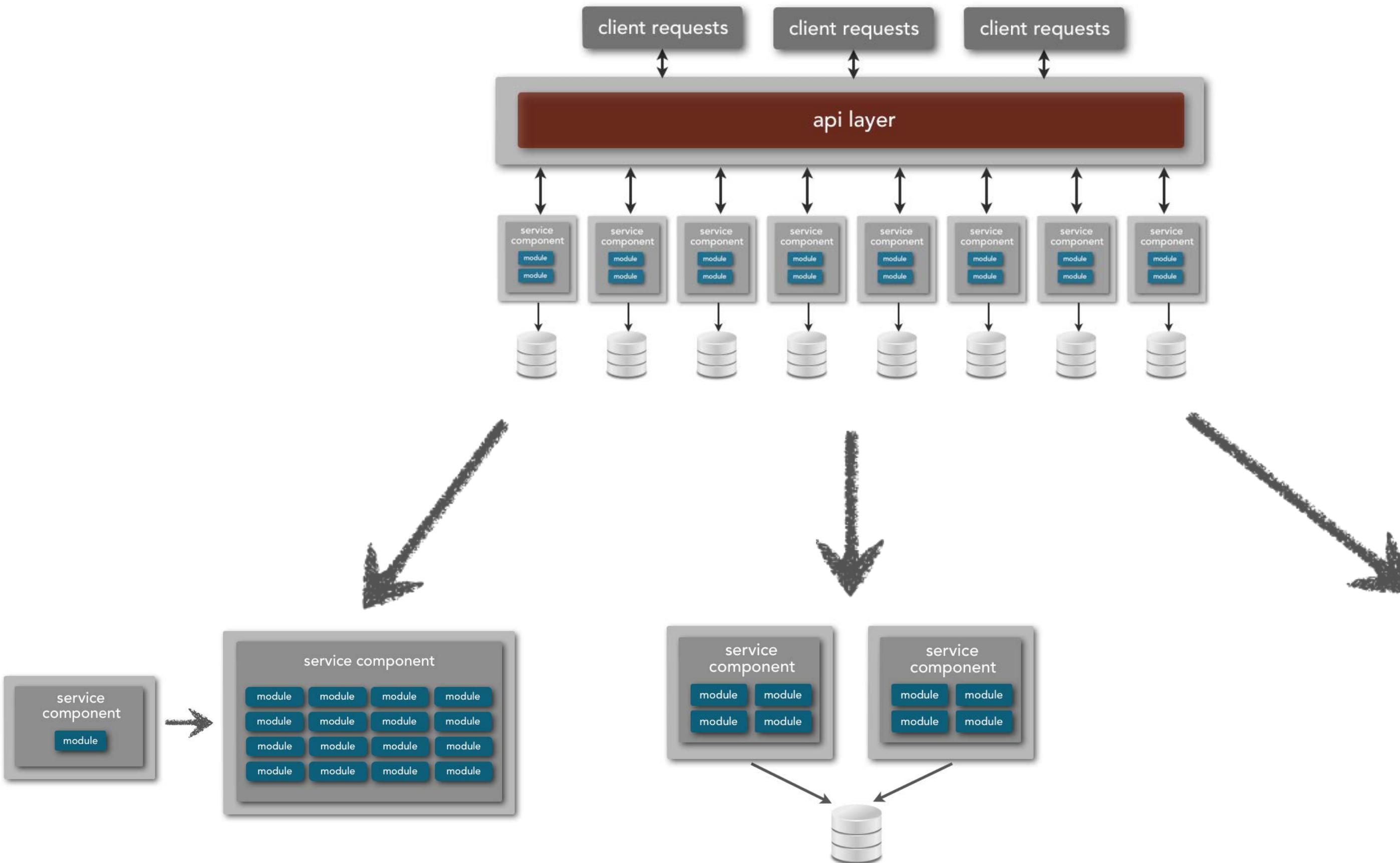


# service-based architecture



service  
granularity

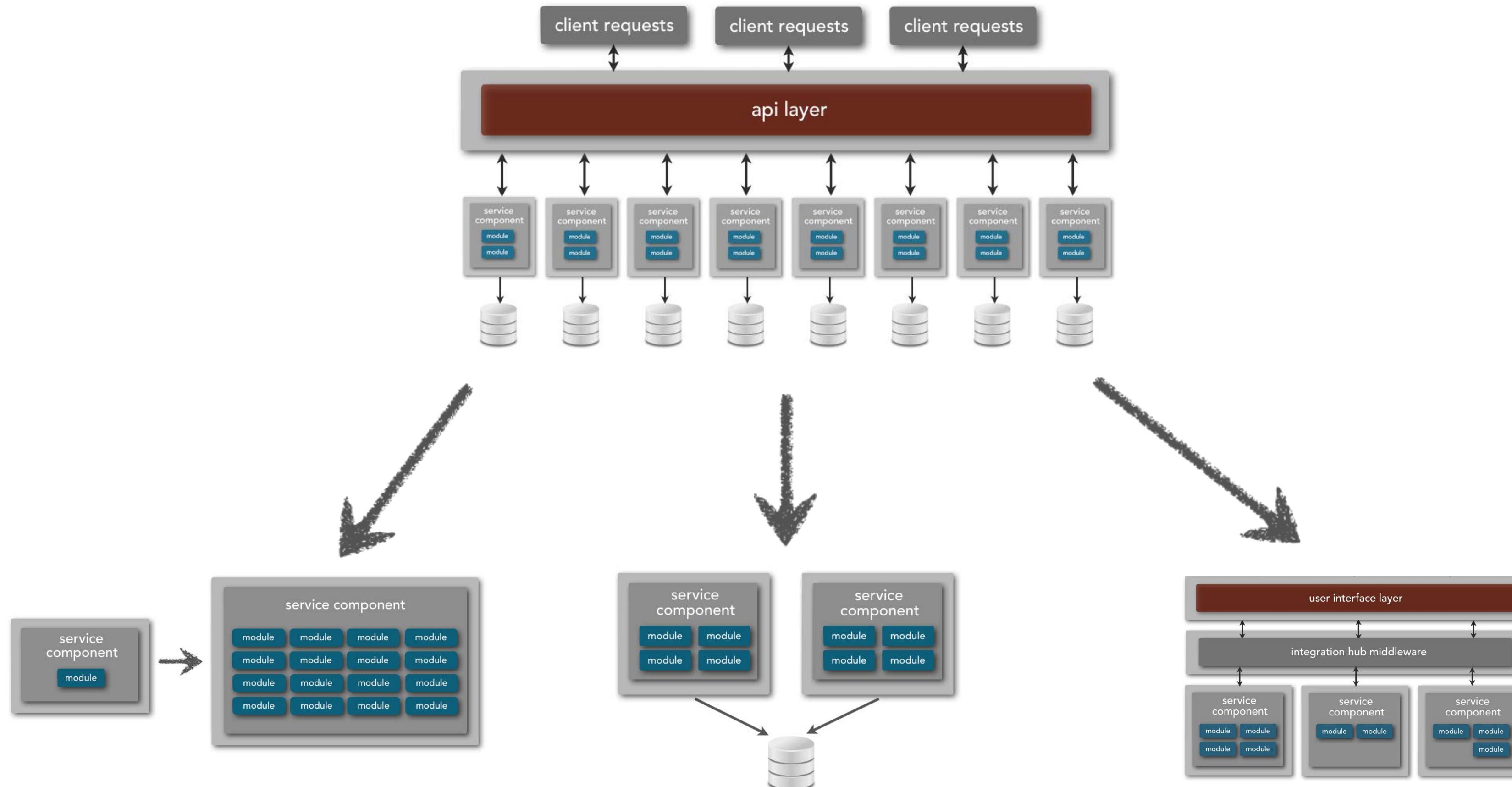
# service-based architecture



service  
granularity

database  
scope

# service-based architecture



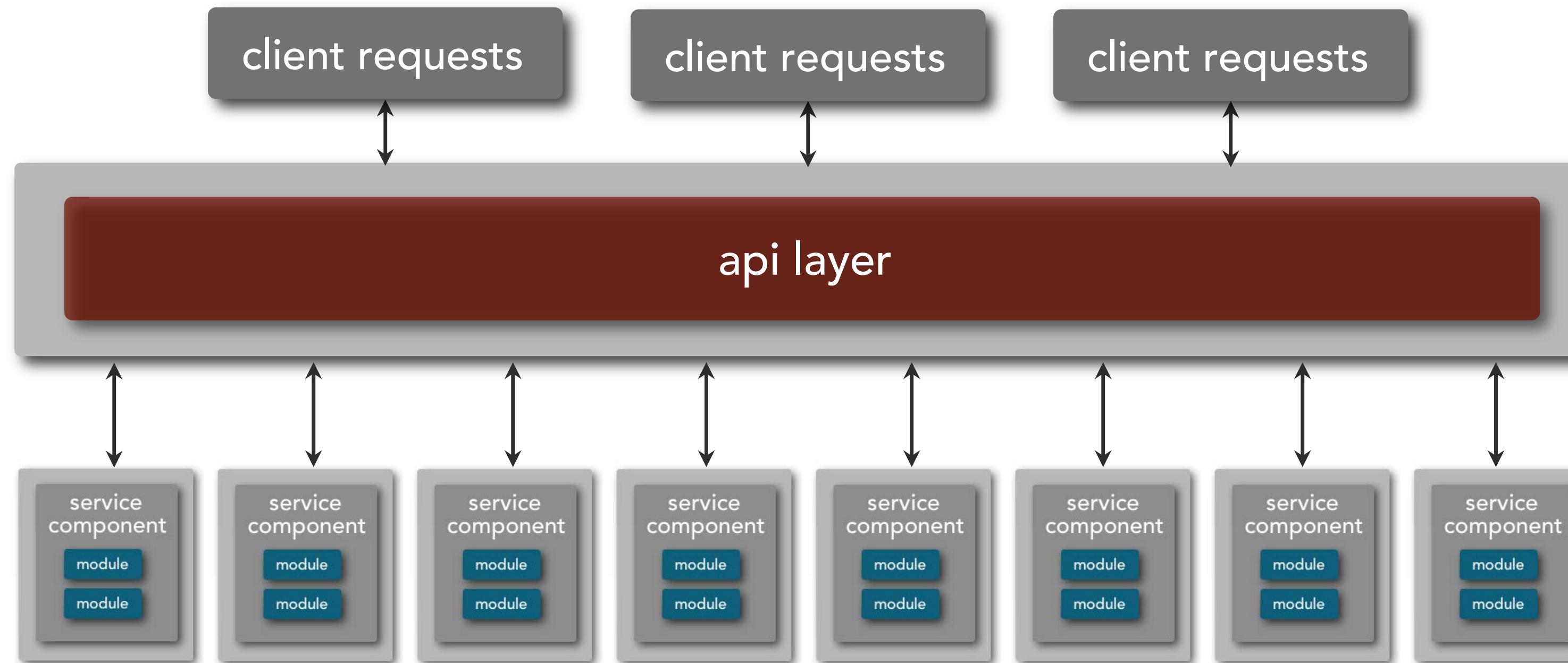
service  
granularity

database  
scope

integration  
hub

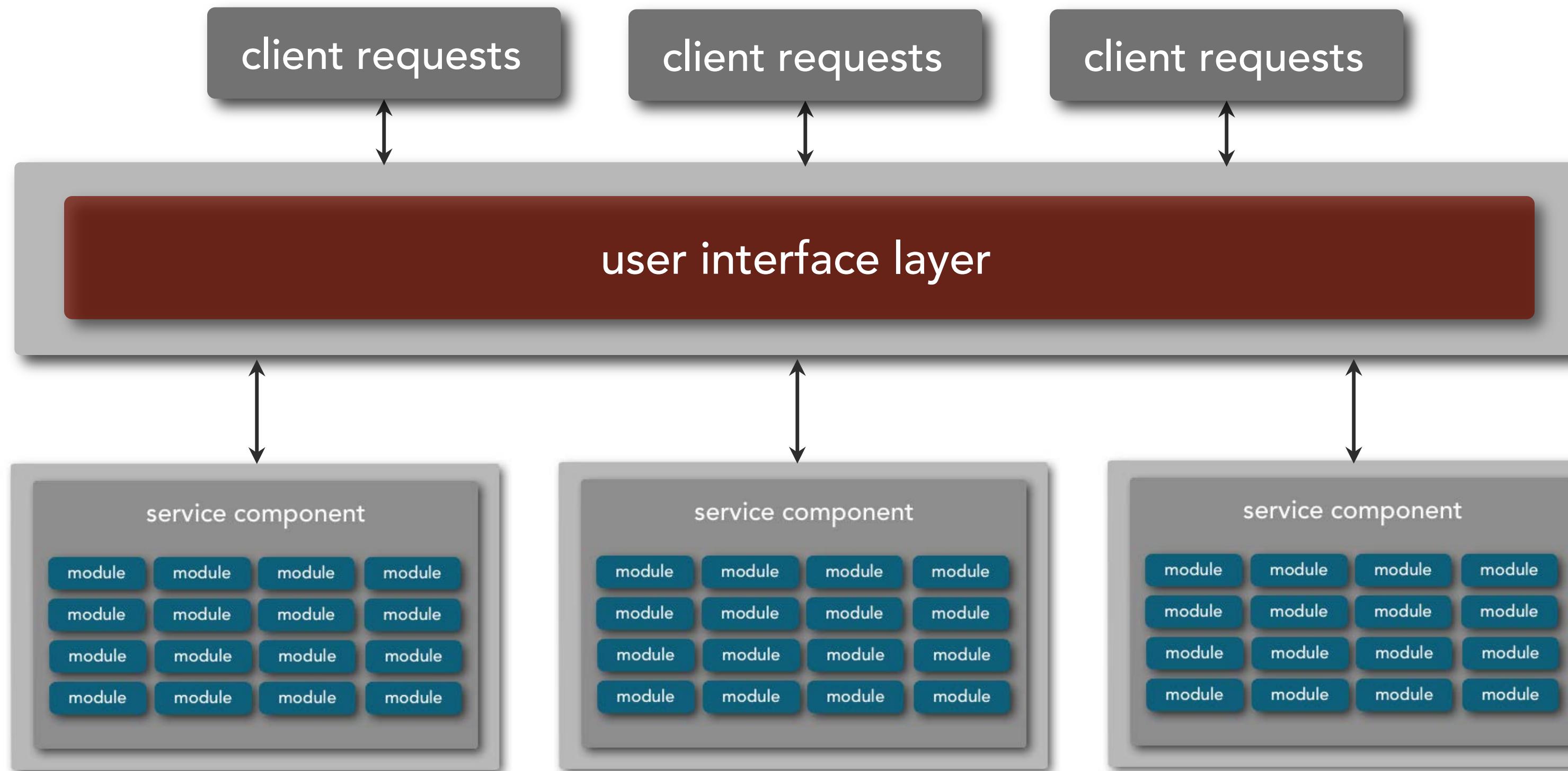
# service-based architecture

## service granularity



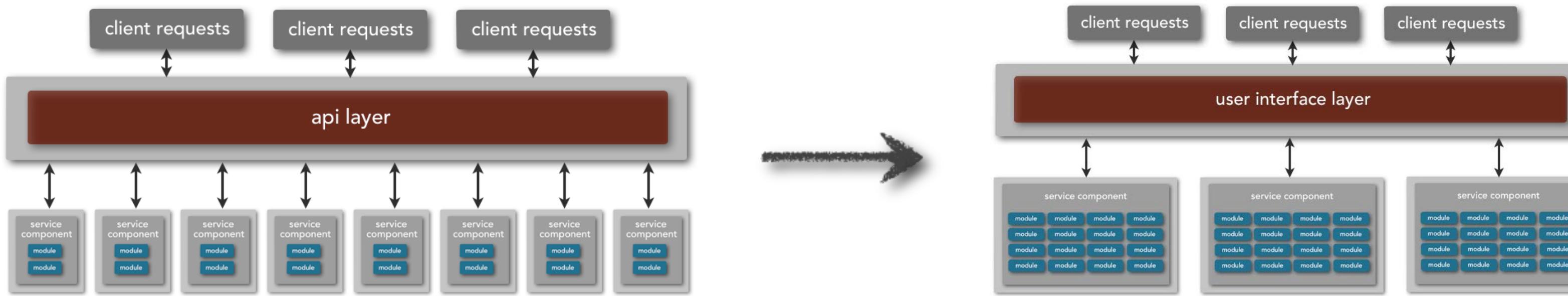
# service-based architecture

## service granularity



# service-based architecture

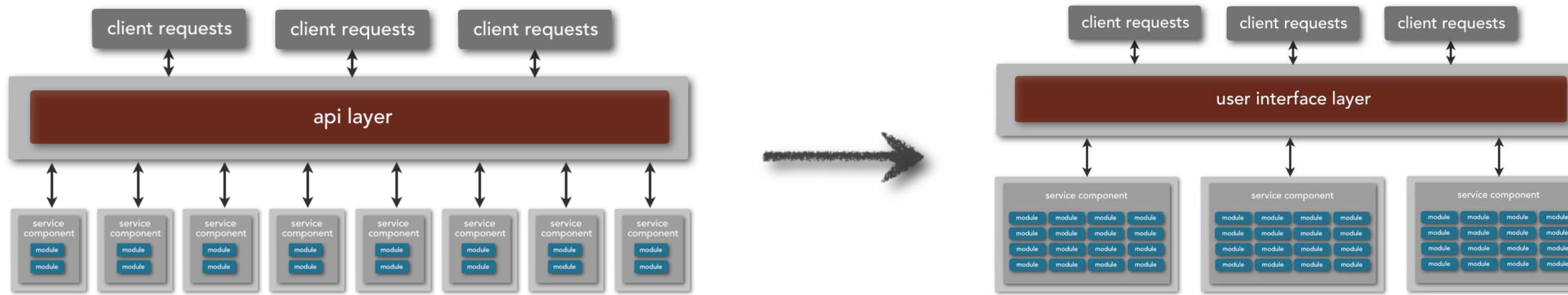
## service granularity



single-purpose micro-service to "portion of the application"  
macro-service

# service-based architecture

## service granularity



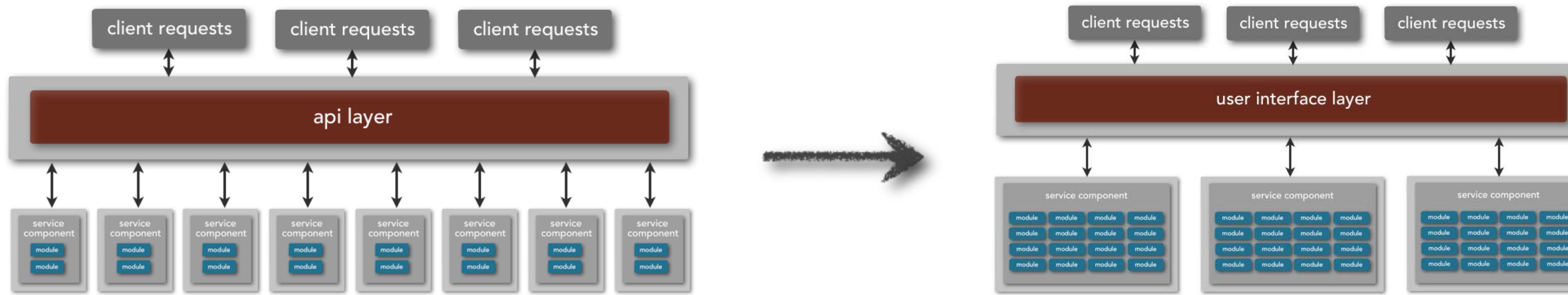
single-purpose micro-service to "portion of the application"  
macro-service



macro-services resolves orchestration and transactional issues

# service-based architecture

## service granularity



single-purpose micro-service to "portion of the application"  
macro-service



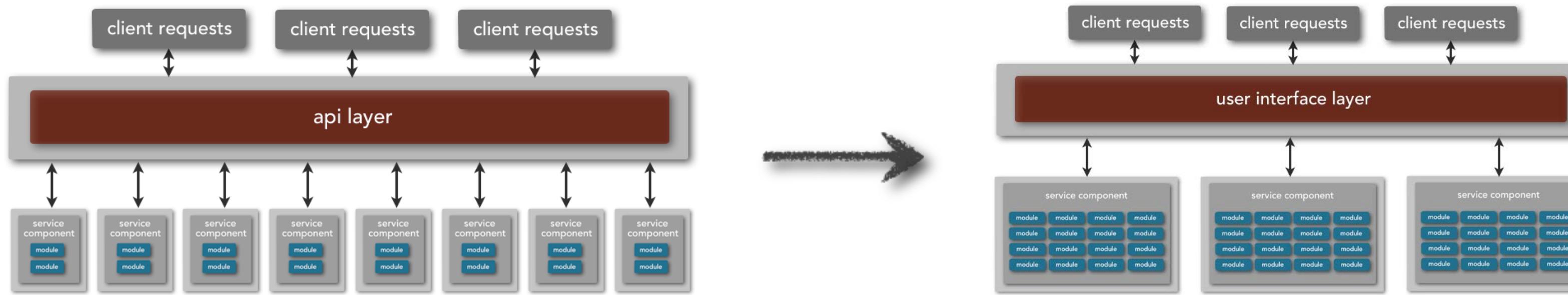
macro-services resolves orchestration and transactional issues



allows for complex business processing within a service context

# service-based architecture

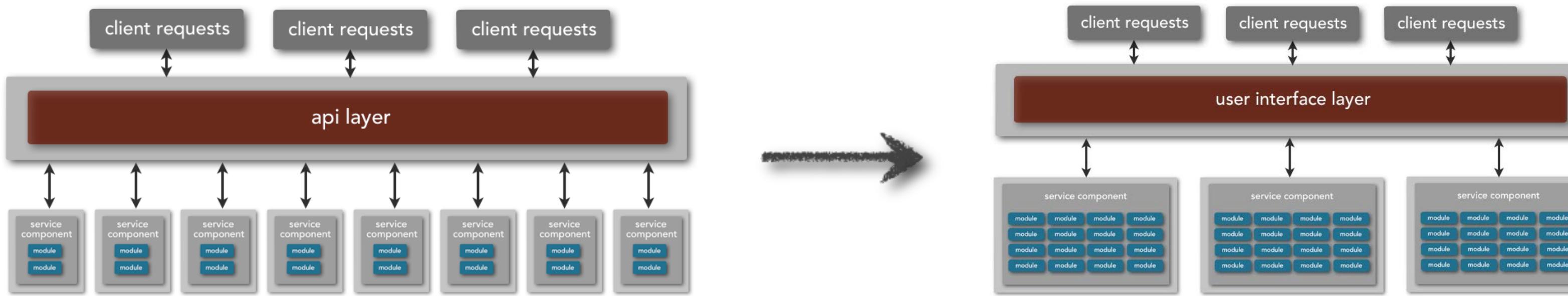
## service granularity



single-purpose micro-service to "portion of the application"  
macro-service

# service-based architecture

## service granularity



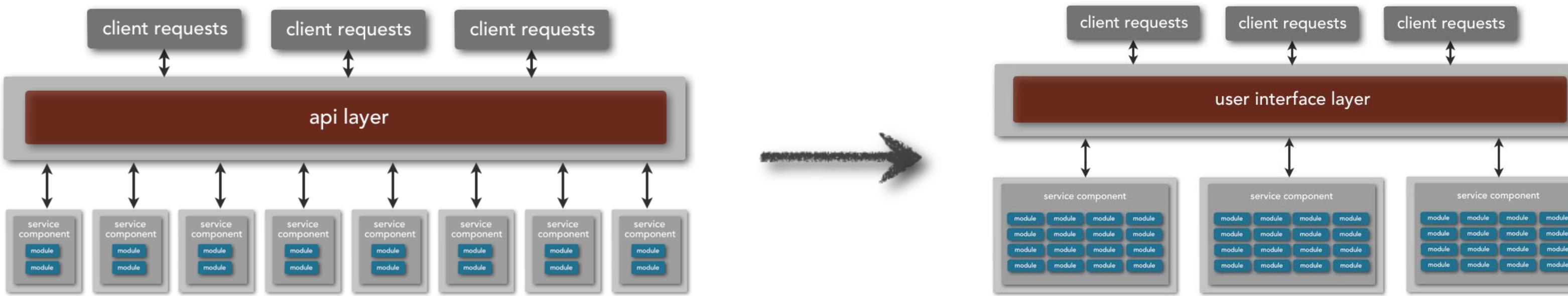
single-purpose micro-service to "portion of the application"  
macro-service



services become harder to develop and test

# service-based architecture

## service granularity

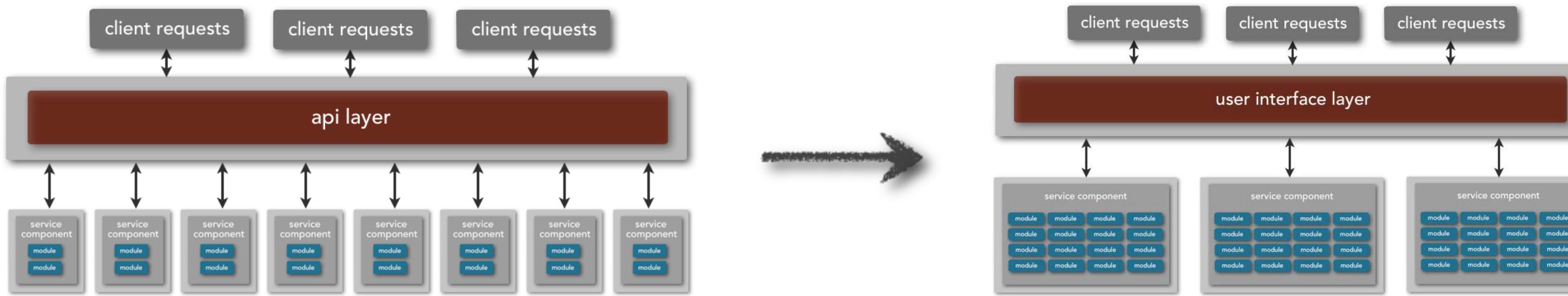


single-purpose micro-service to "portion of the application"  
macro-service

- 👎 services become harder to develop and test
- 👎 deployment pipeline requires more planning

# service-based architecture

## service granularity

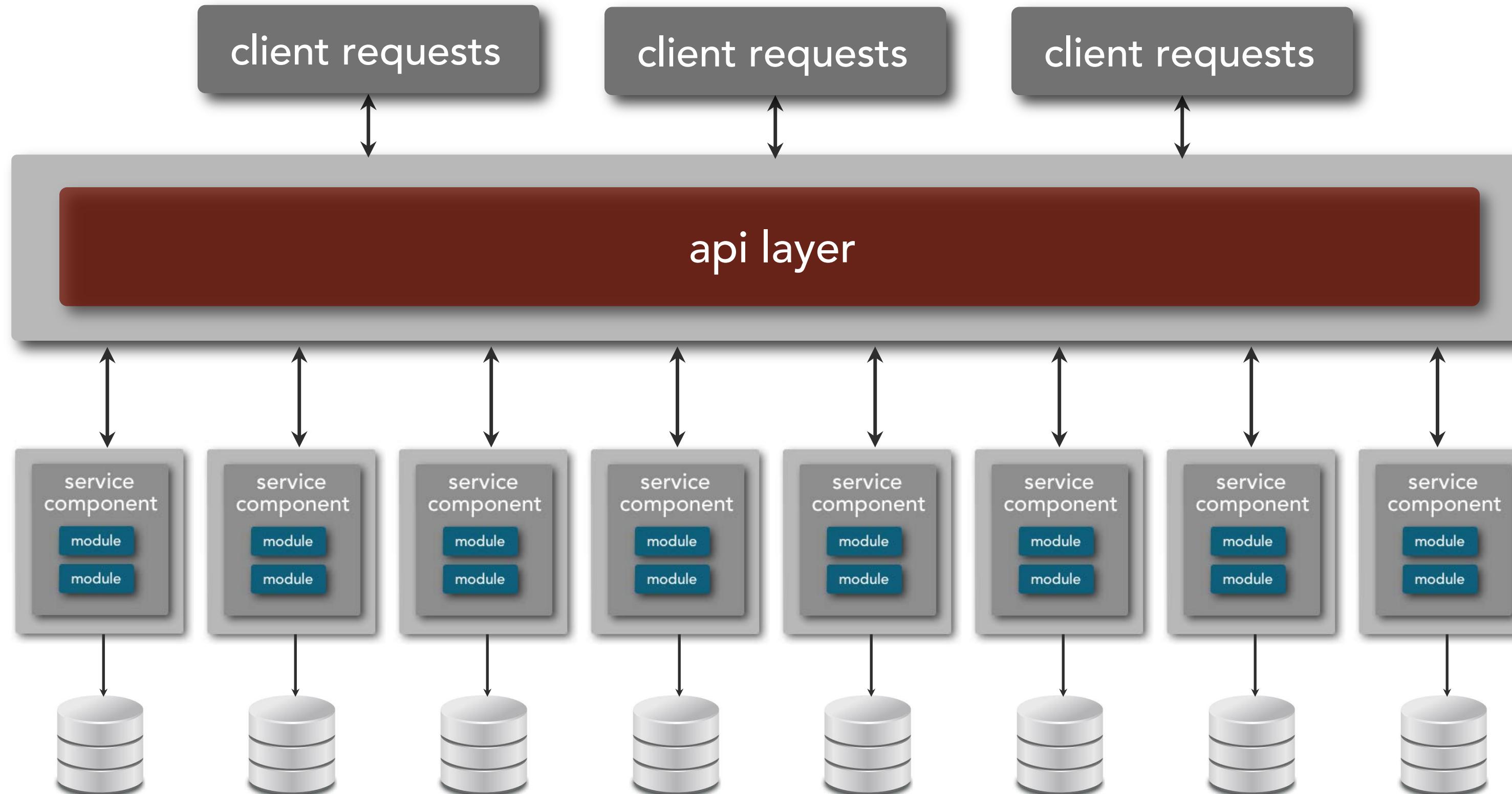


single-purpose micro-service to "portion of the application"  
macro-service

- 👎 services become harder to develop and test
- 👎 deployment pipeline requires more planning
- 👎 change control becomes more difficult

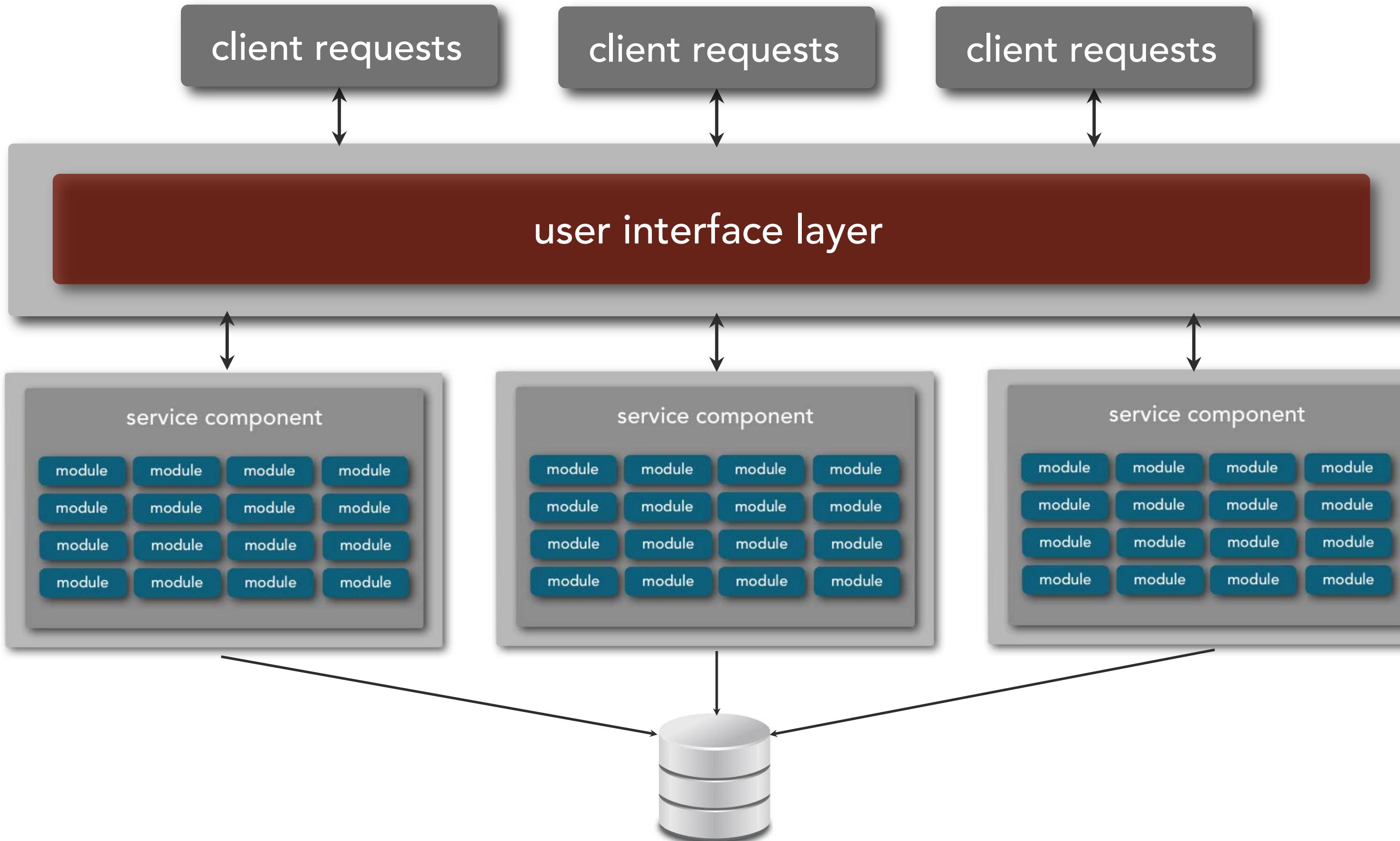
# service-based architecture

## database scope



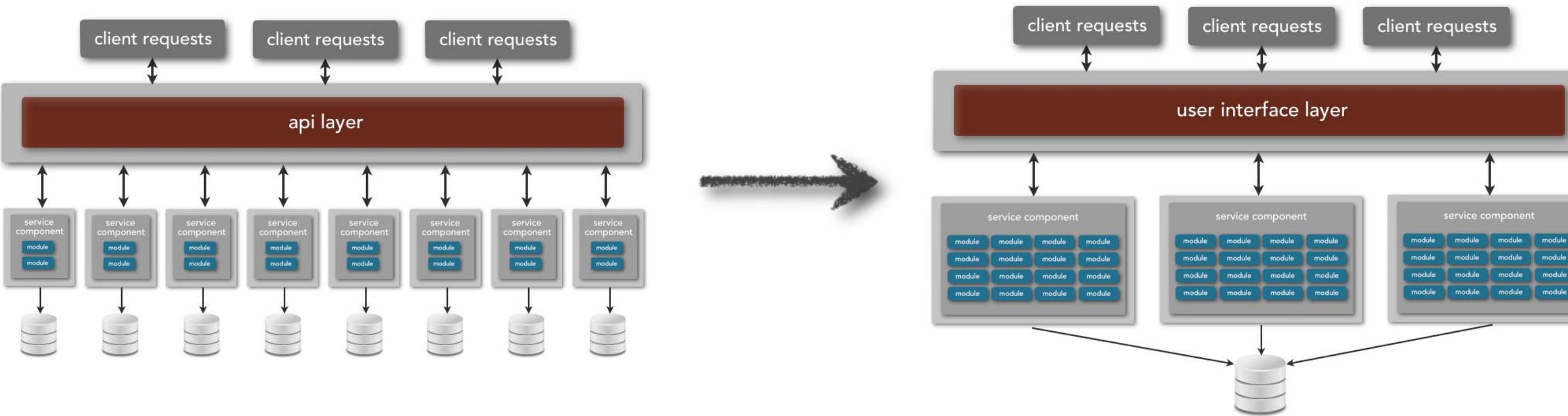
# service-based architecture

## database scope



# service-based architecture

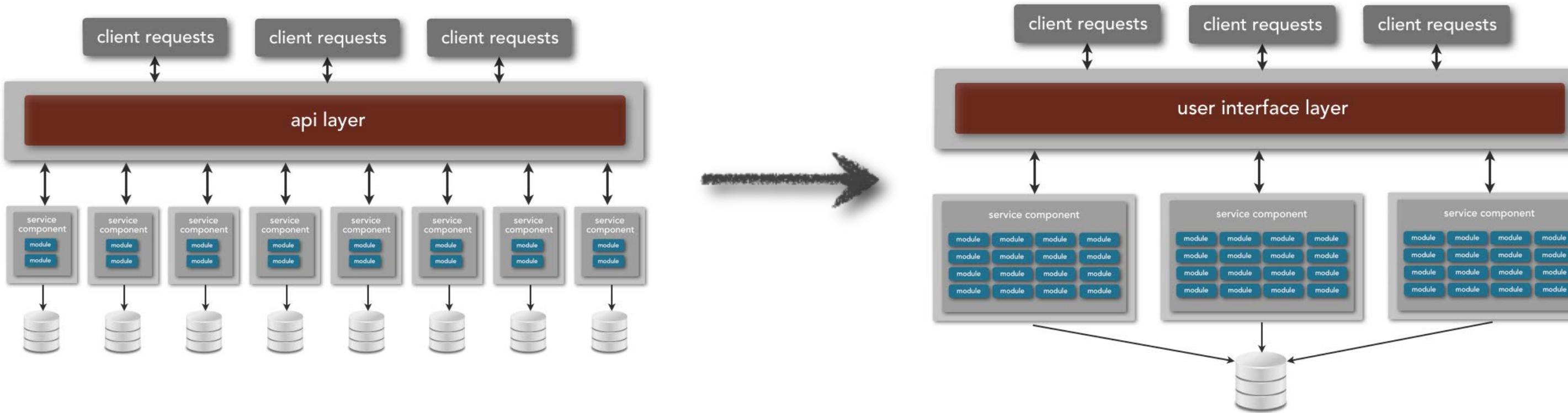
## database scope



single-purpose service-based database to globally shared application database

# service-based architecture

## database scope



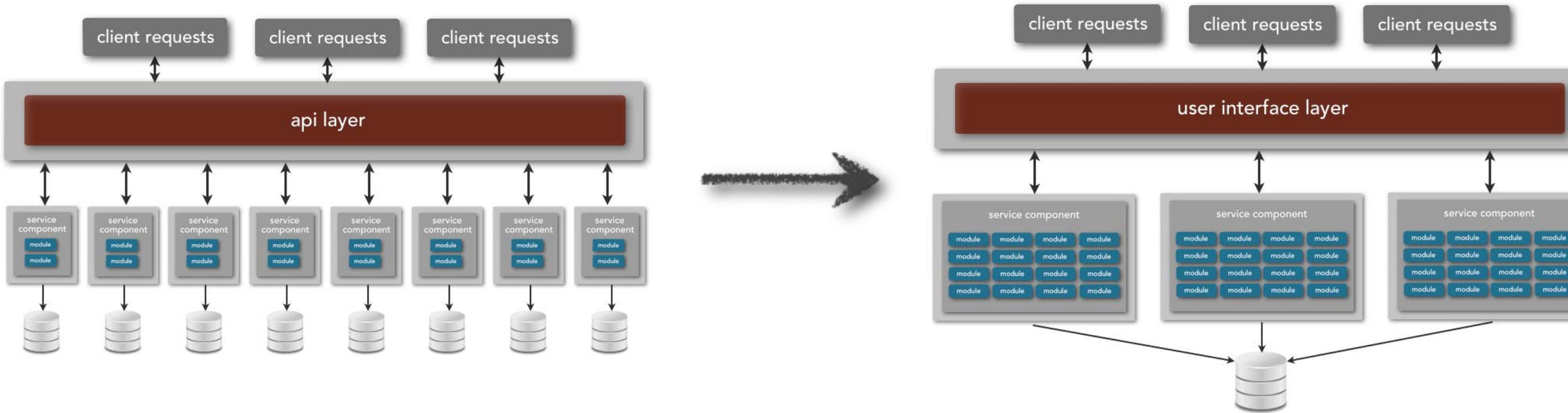
single-purpose service-based database to globally shared application database



reduces service orchestration and contract dependencies

# service-based architecture

## database scope



single-purpose service-based database to globally shared application database



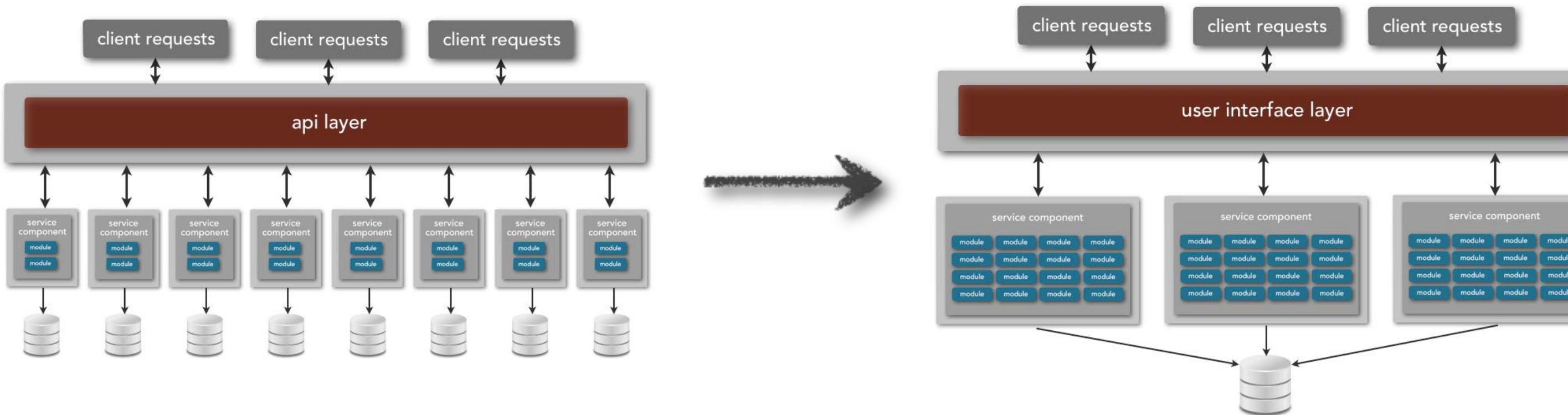
reduces service orchestration and contract dependencies



improves performance due to fewer remote calls

# service-based architecture

## database scope

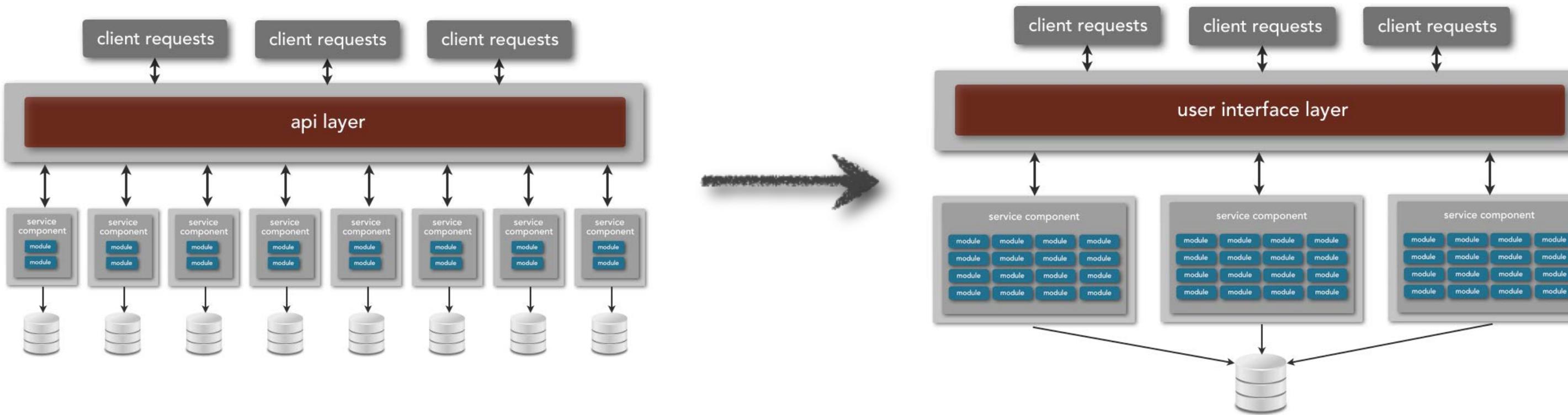


single-purpose service-based database to globally shared application database

- 👍 reduces service orchestration and contract dependencies
- 👍 improves performance due to fewer remote calls
- 👍 refactoring entire database may not be feasible or possible

# service-based architecture

## database scope

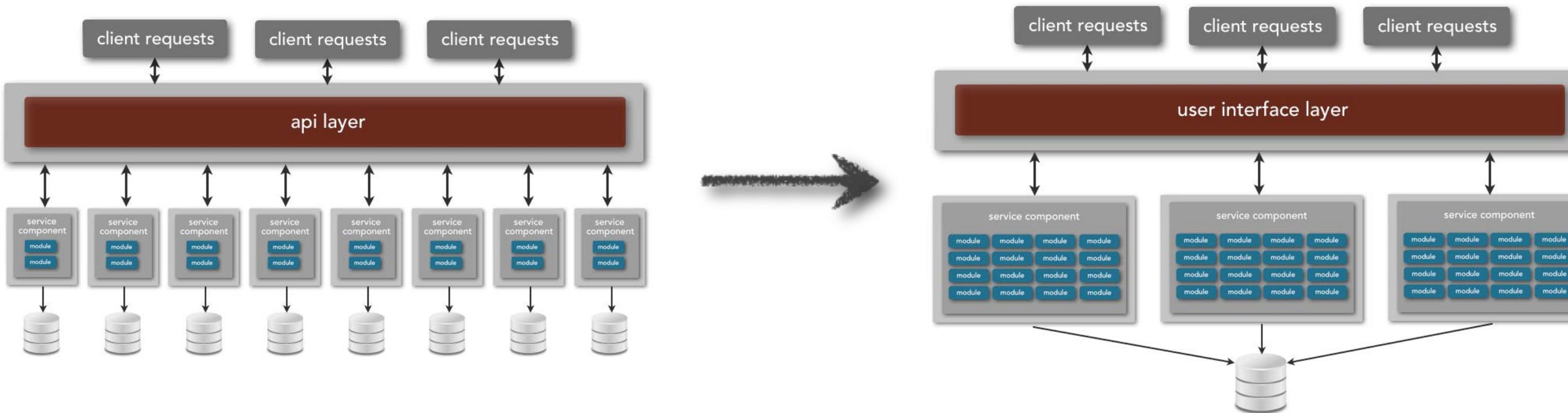


single-purpose service-based database to globally shared application database

👎 looser bounded context of services

# service-based architecture

## database scope

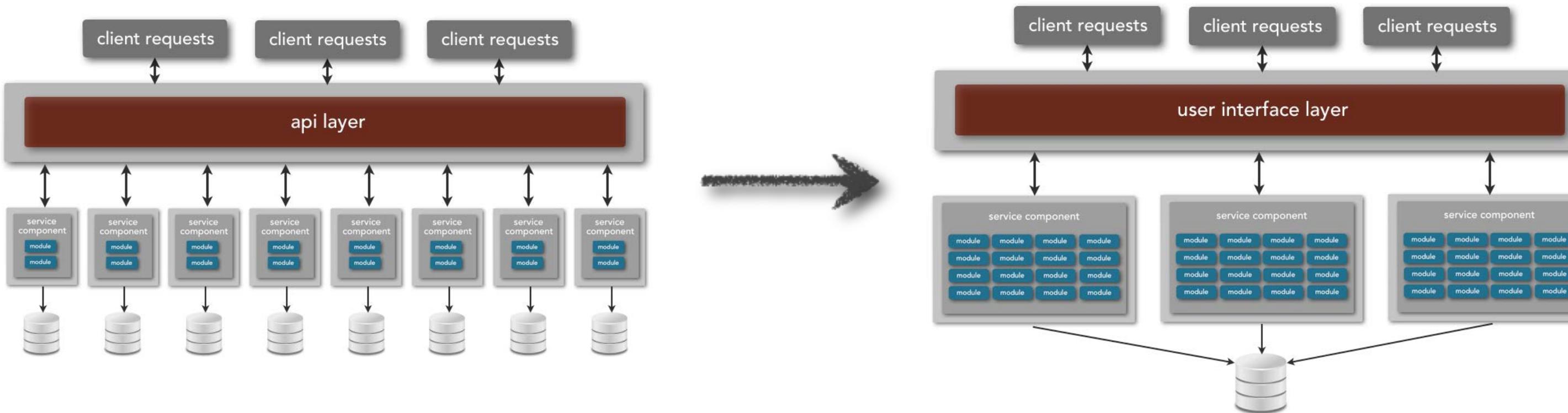


single-purpose service-based database to globally shared application database

- 👎 looser bounded context of services
- 👎 tighter service coupling based on schema

# service-based architecture

## database scope

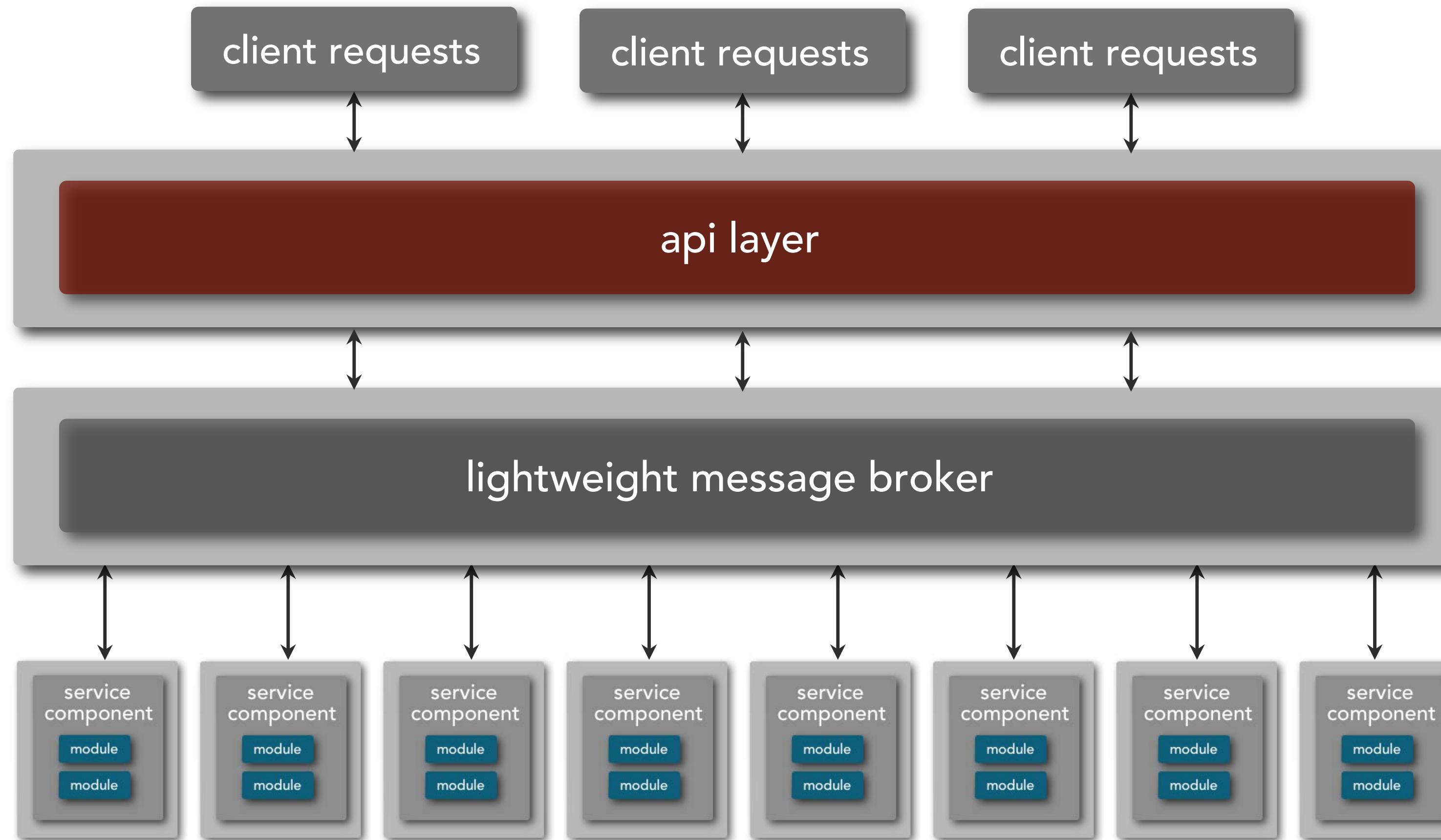


single-purpose service-based database to globally shared application database

- 👎 looser bounded context of services
- 👎 tighter service coupling based on schema
- 👎 schema changes become expensive and difficult

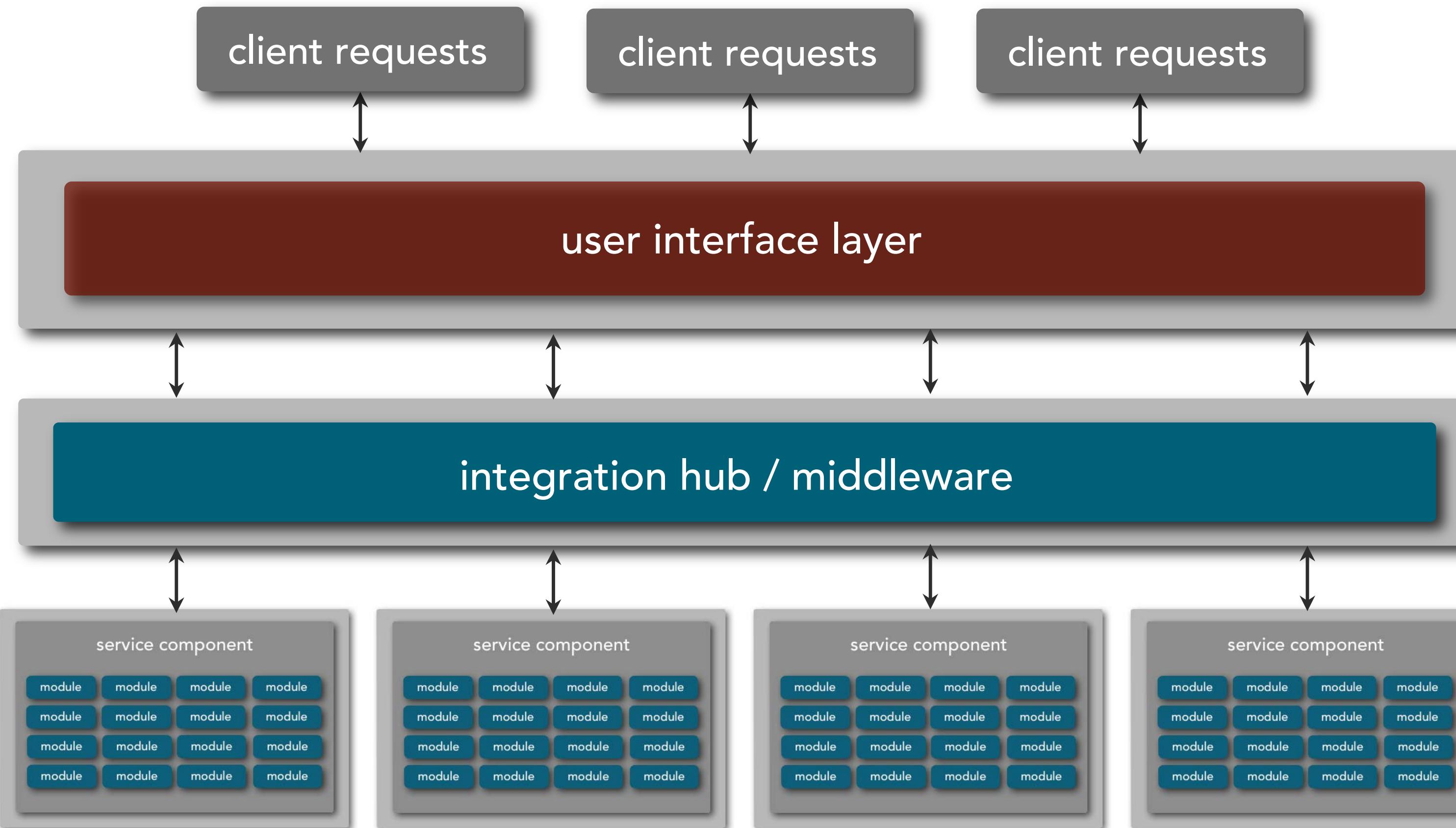
# service-based architecture

## integration hub



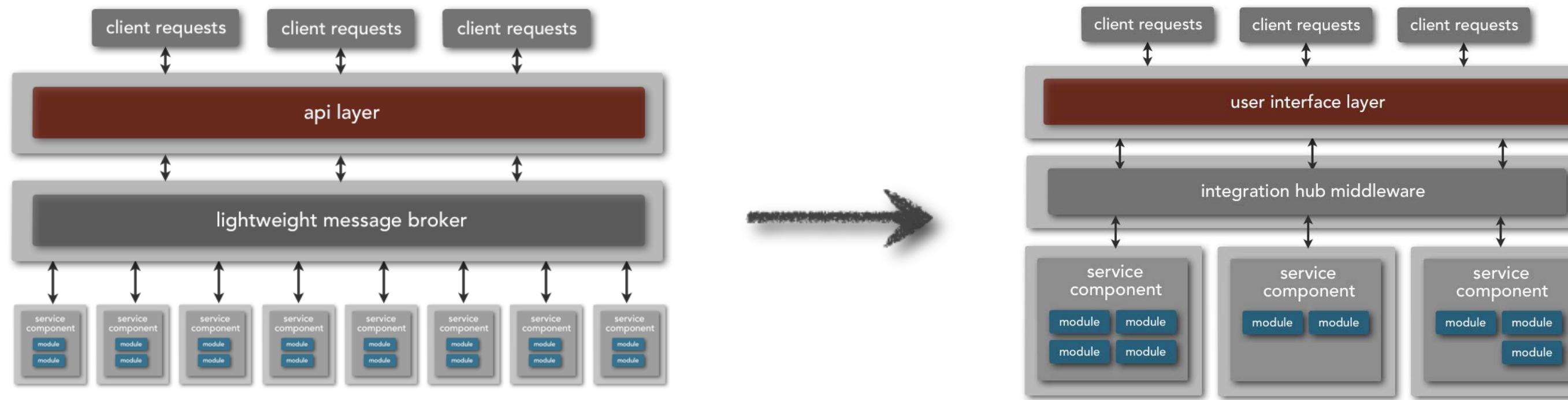
# service-based architecture

## integration hub



# service-based architecture

## integration hub



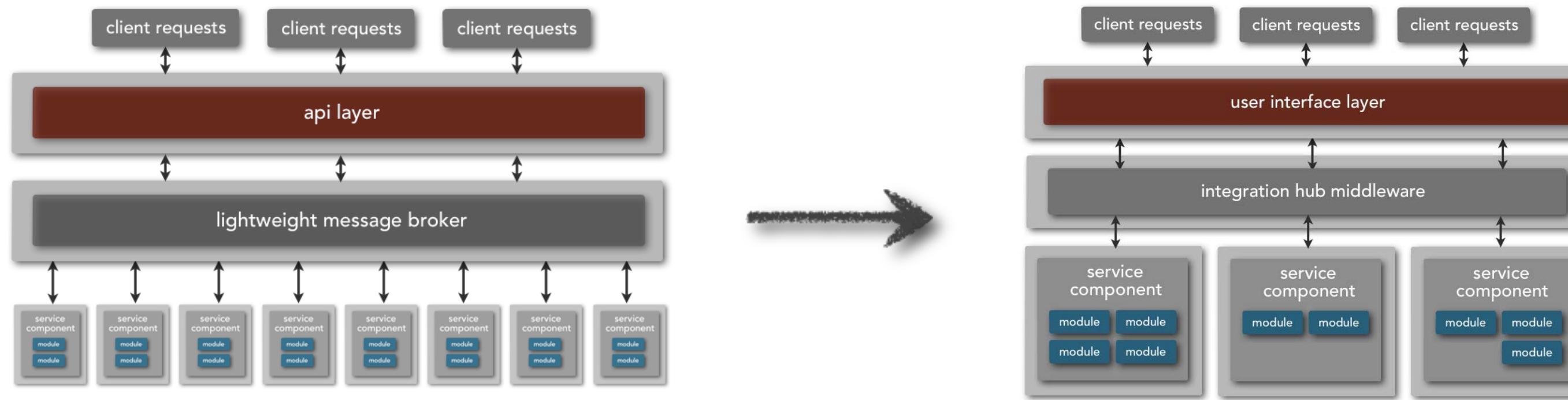
lightweight message broker to heavier integration hub



allows for transformation of contract differences

# service-based architecture

## integration hub

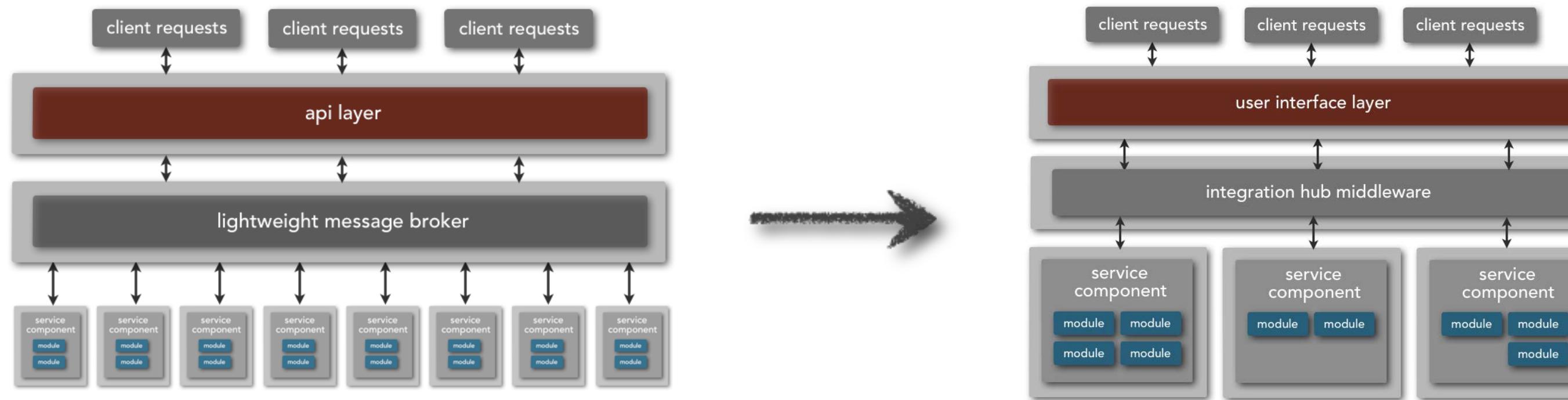


lightweight message broker to heavier integration hub

- 👍 allows for transformation of contract differences
- 👍 allows for non-transactional orchestration of services

# service-based architecture

## integration hub

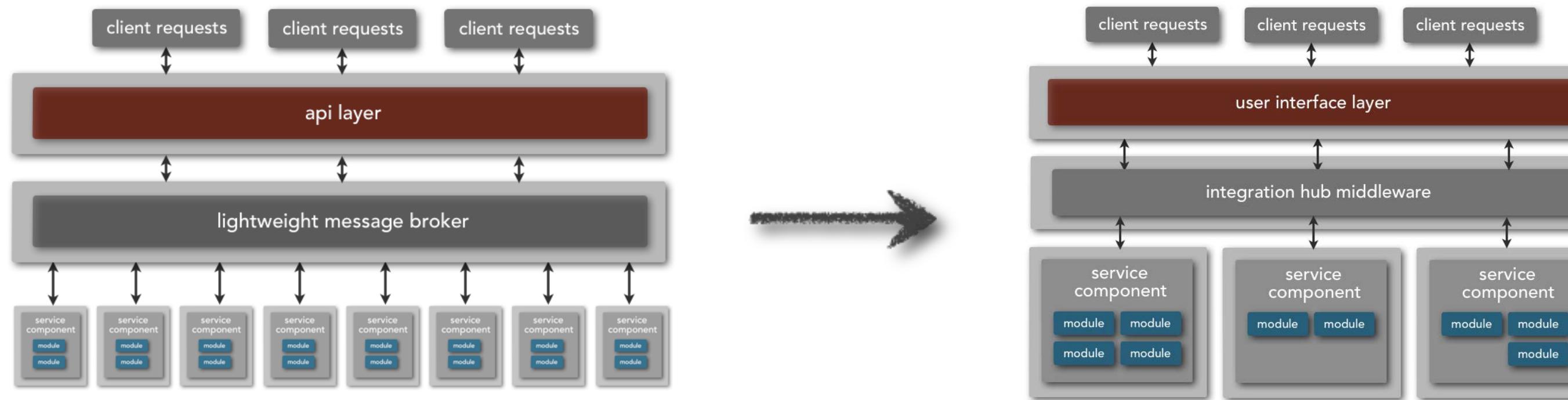


lightweight message broker to heavier integration hub

- 👍 allows for transformation of contract differences
- 👍 allows for non-transactional orchestration of services
- 👍 allows for protocol-agnostic heterogeneous interoperability

# service-based architecture

## integration hub

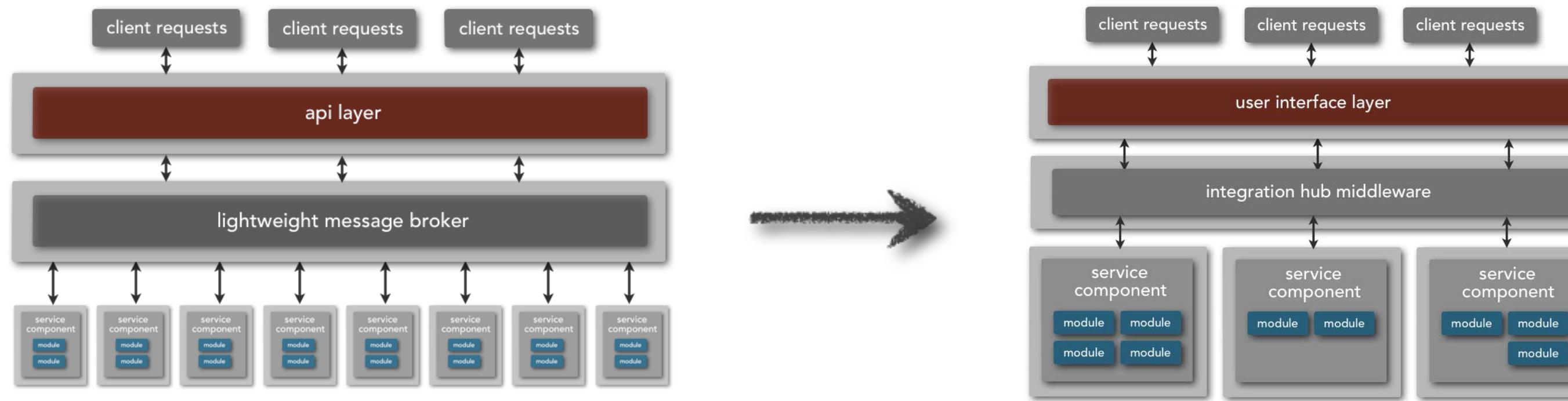


lightweight message broker to heavier integration hub

- 👍 allows for transformation of contract differences
- 👍 allows for non-transactional orchestration of services
- 👍 allows for protocol-agnostic heterogeneous interoperability
- 👍 allows for common processing logic across all services

# service-based architecture

## integration hub



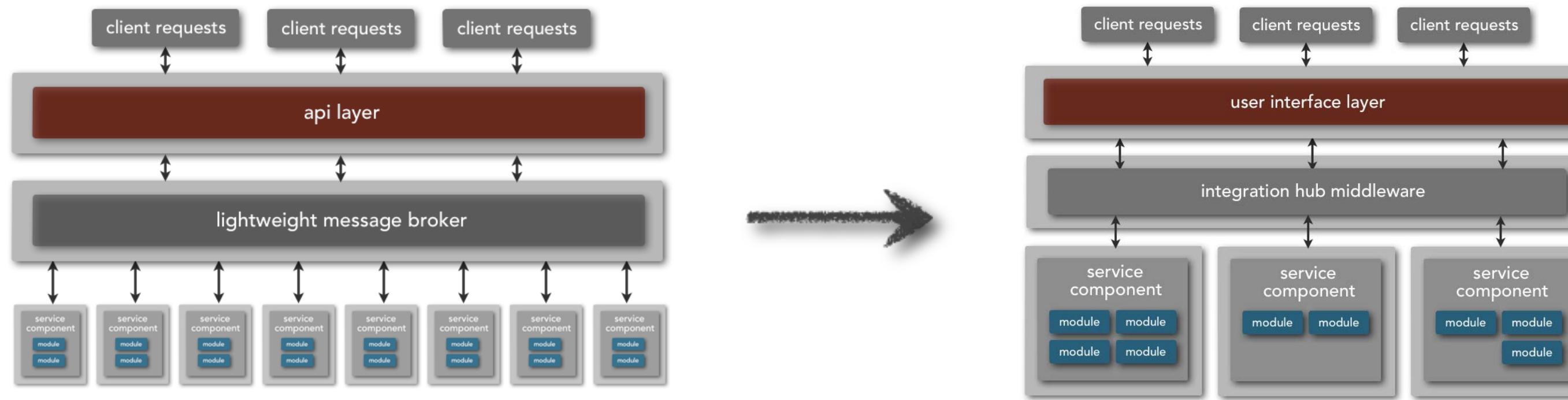
lightweight message broker to heavier integration hub



decrease in overall performance

# service-based architecture

## integration hub



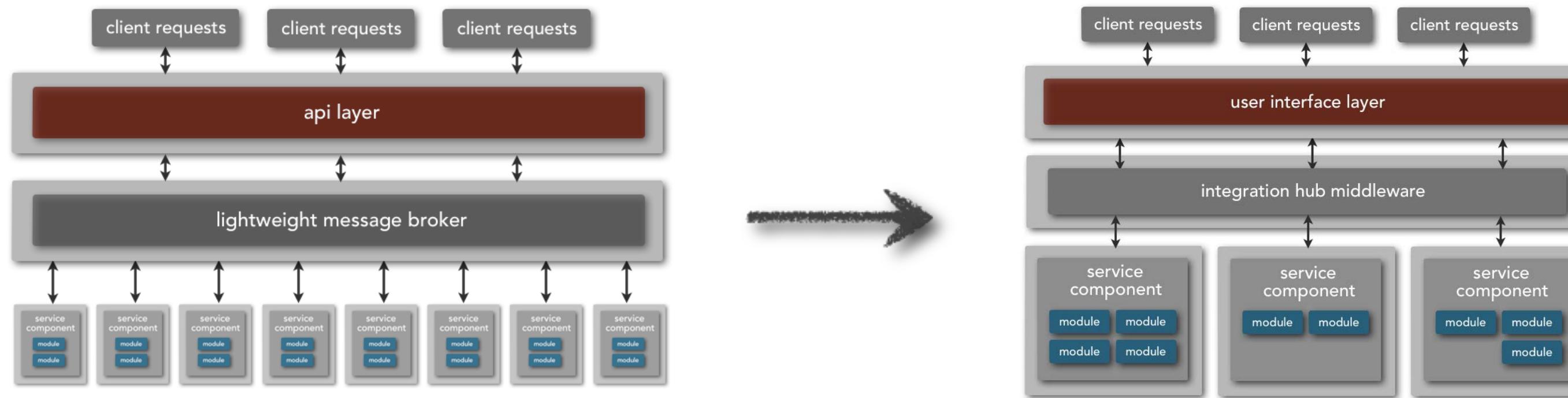
lightweight message broker to heavier integration hub

👎 decrease in overall performance

👎 added complexity and cost

# service-based architecture

## integration hub

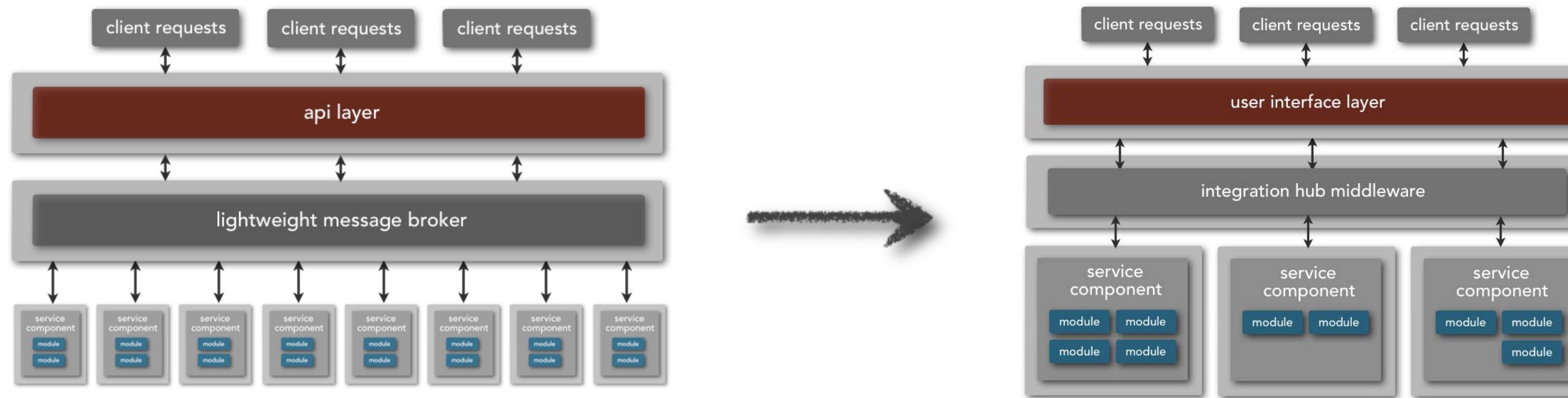


lightweight message broker to heavier integration hub

- 👎 decrease in overall performance
- 👎 added complexity and cost
- 👎 increased need for governance

# service-based architecture

## integration hub

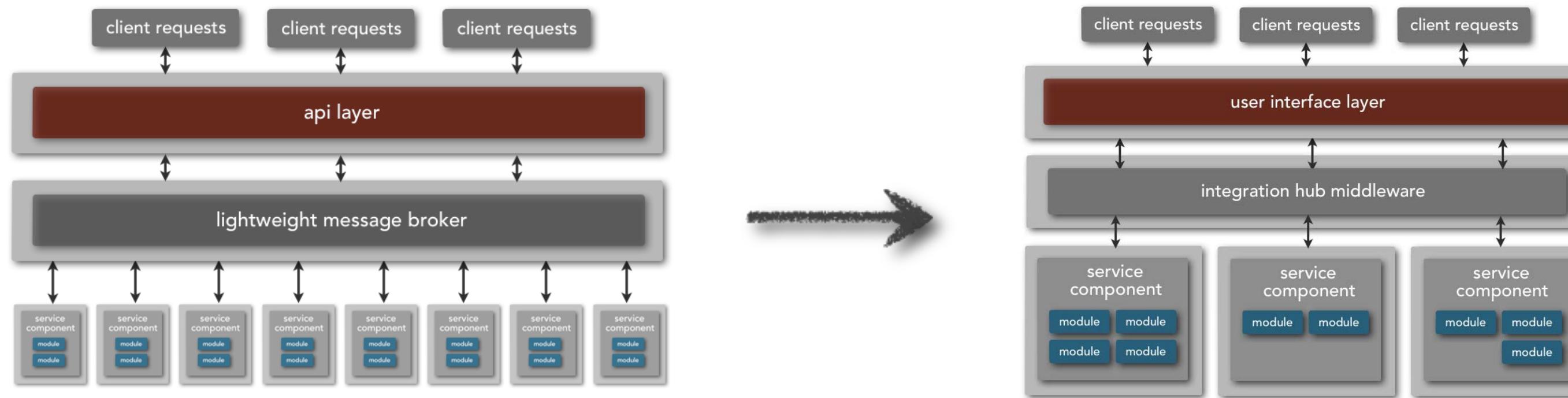


lightweight message broker to heavier integration hub

- 👎 decrease in overall performance
- 👎 added complexity and cost
- 👎 increased need for governance
- 👎 deployment pipeline requires much more planning

# service-based architecture

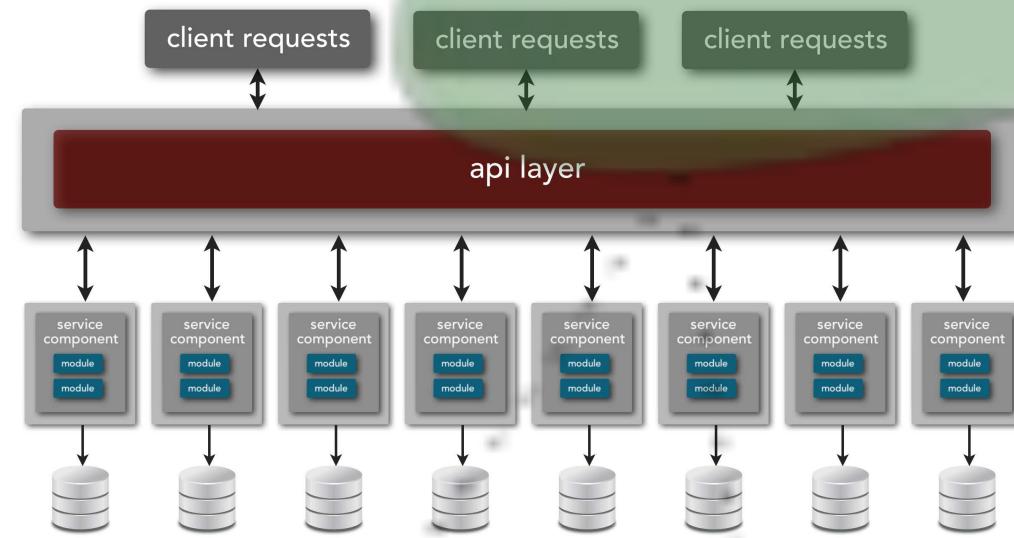
## integration hub



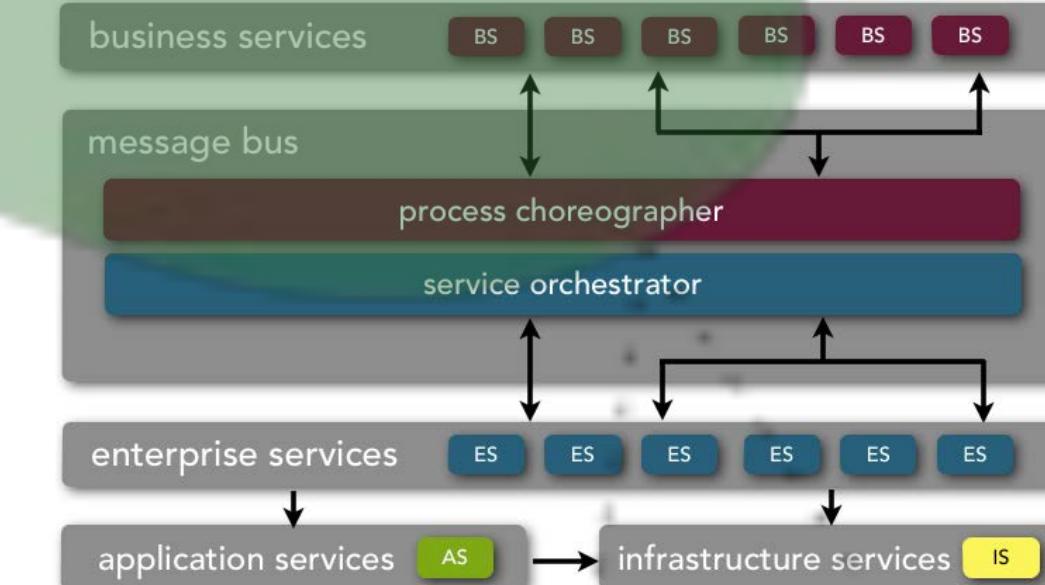
lightweight message broker to heavier integration hub

- 👎 decrease in overall performance
- 👎 added complexity and cost
- 👎 increased need for governance
- 👎 deployment pipeline requires much more planning
- 👎 services become harder to develop and test

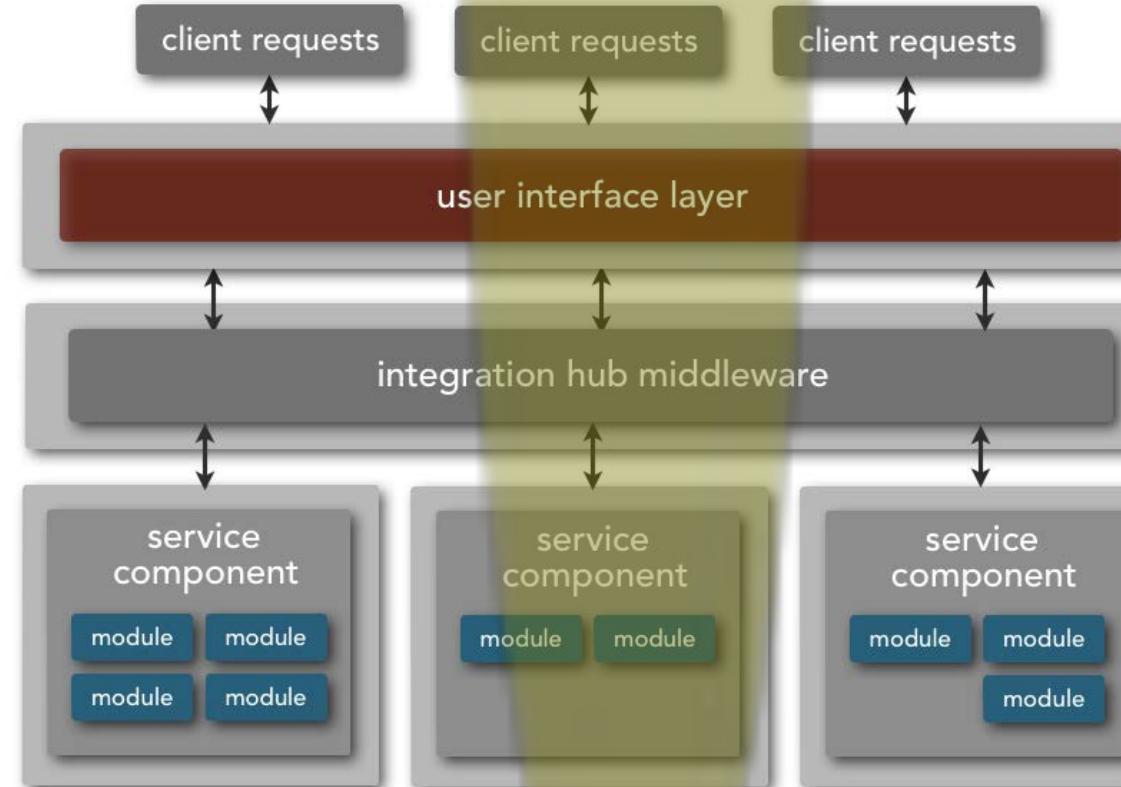
# comparing:



Micro



Service-oriented

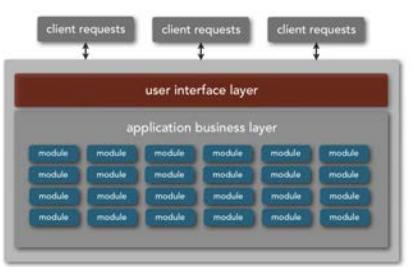


Service-based

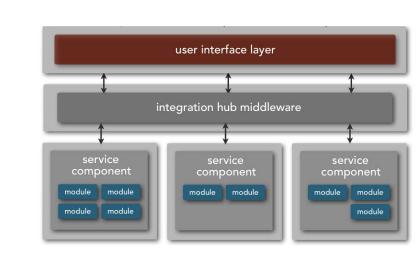
# characteristics differences

## overall agility

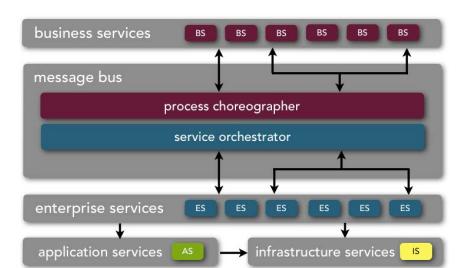
ability to respond quickly to constant change in both business and technology



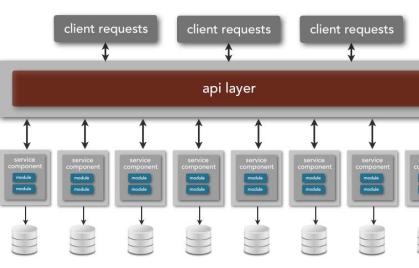
monolithic architecture



service-based architecture



service-oriented architecture



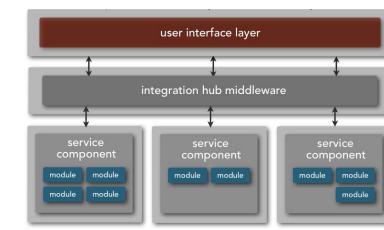
microservices architecture



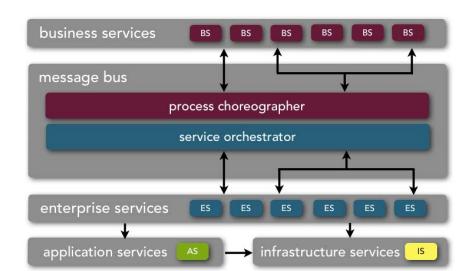
# characteristics differences

# overall agility

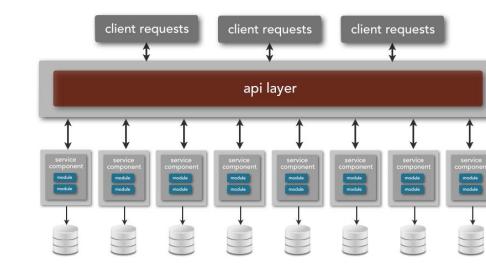
ability to respond quickly to  
constant change in both  
business and technology



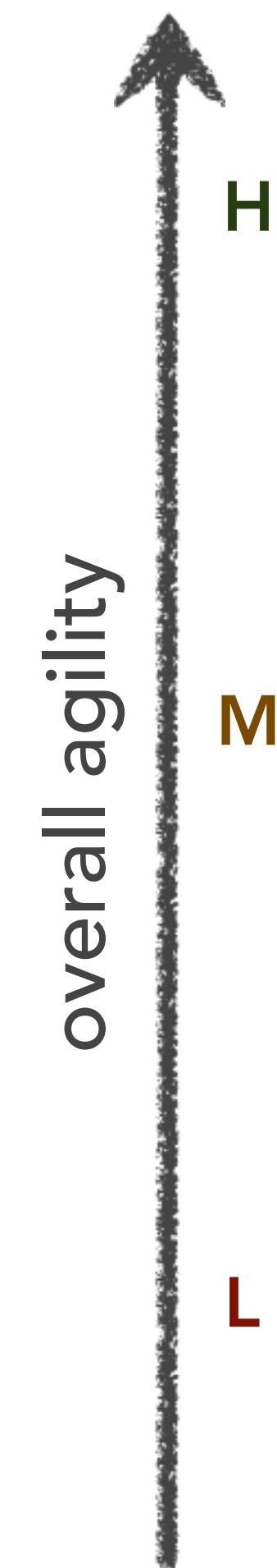
# service-based architecture



# service-oriented architecture



# microservices architecture



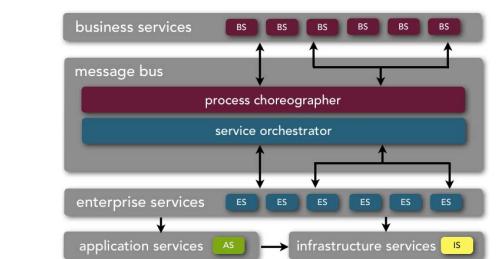
The diagram illustrates a monolithic architecture. At the top, three grey boxes labeled "client requests" are connected by arrows pointing down to a central brown box labeled "user interface layer". This layer connects via arrows to a bottom grey box labeled "application business layer", which in turn contains a 3x5 grid of blue boxes, each labeled "module".

# monolithic architecture

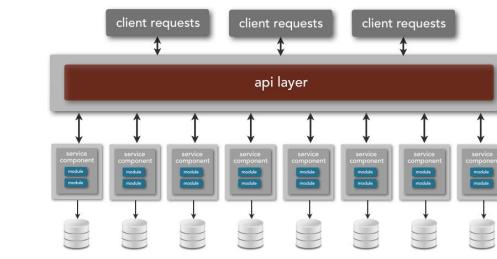
# characteristics differences

## overall agility

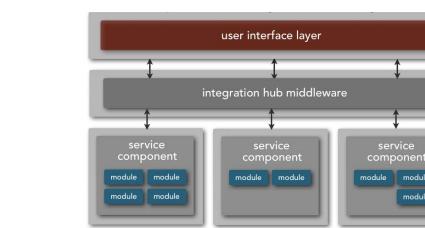
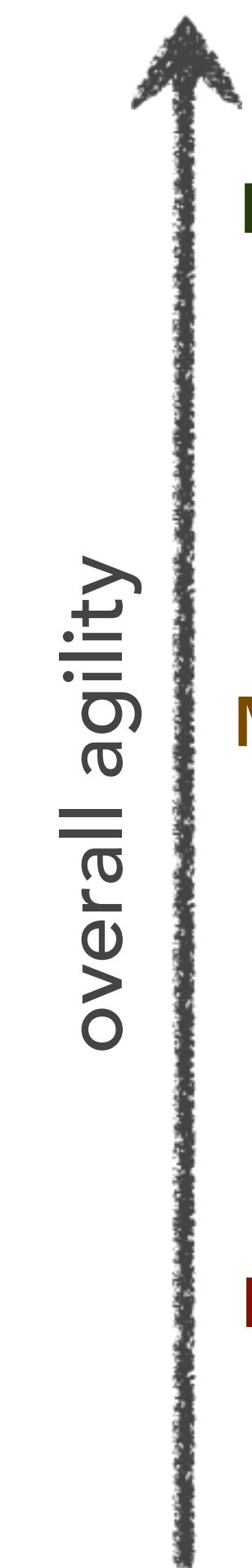
ability to respond quickly to constant change in both business and technology



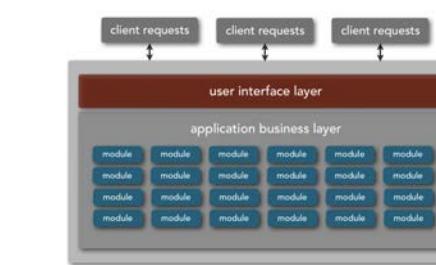
service-oriented  
architecture



microservices  
architecture



service-based  
architecture

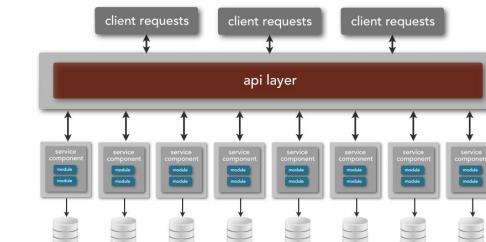


monolithic  
architecture

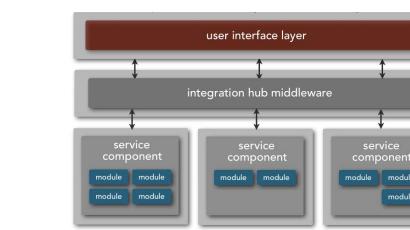
# characteristics differences

## overall agility

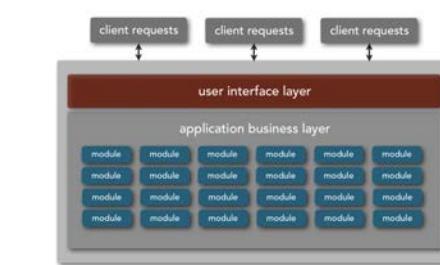
ability to respond quickly to constant change in both business and technology



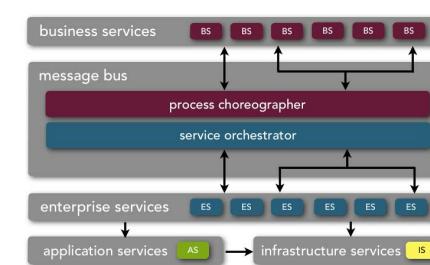
microservices  
architecture



service-based  
architecture



monolithic  
architecture

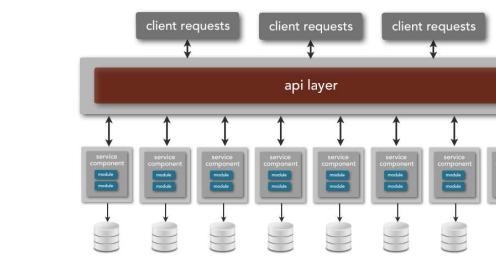


service-oriented  
architecture

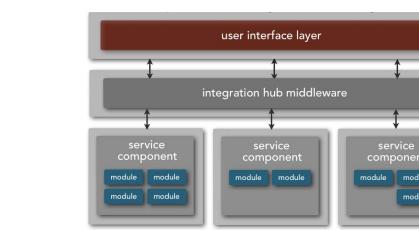
# characteristics differences

overall agility

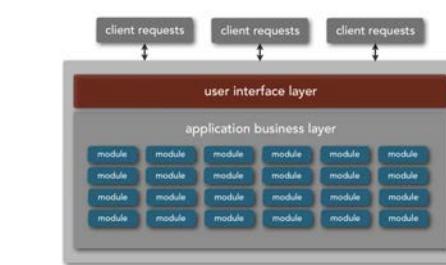
ability to respond quickly to  
constant change in both  
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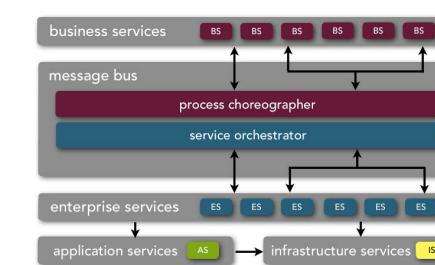
microservices  
architecture



service-based  
architecture



monolithic  
architecture

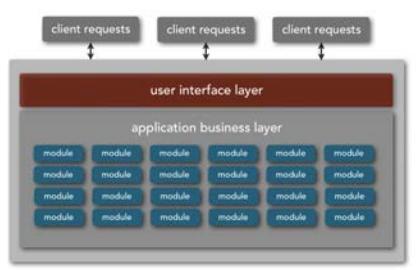


service-oriented  
architecture

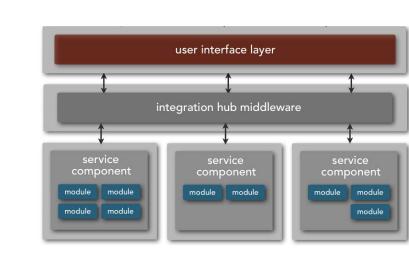
# characteristics differences

## ease of deployment

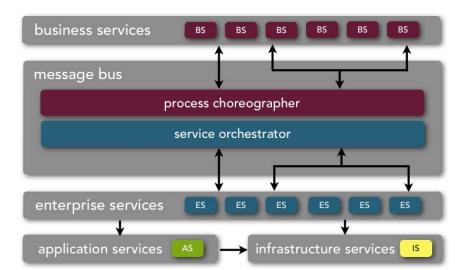
promotes an effective and fast deployment pipeline; features are quick and easy to deploy



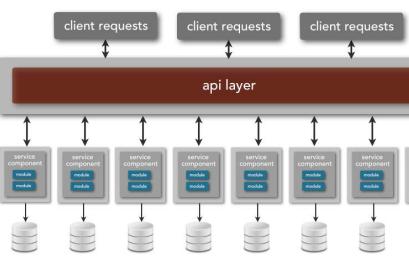
monolithic  
architecture



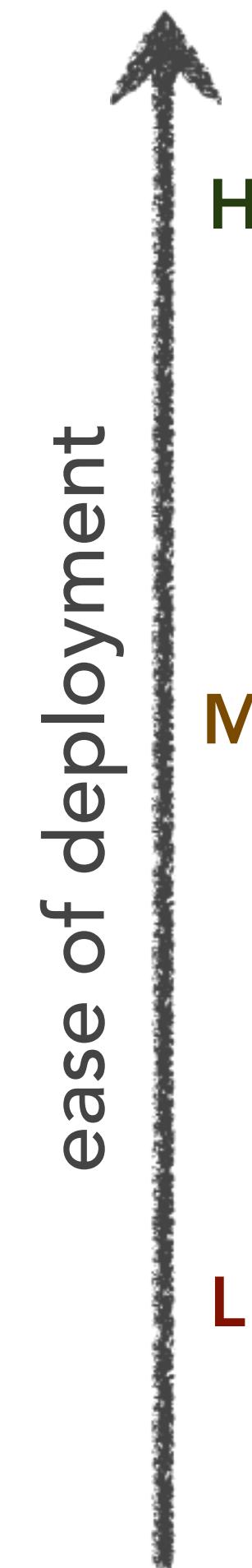
service-based  
architecture



service-oriented  
architecture



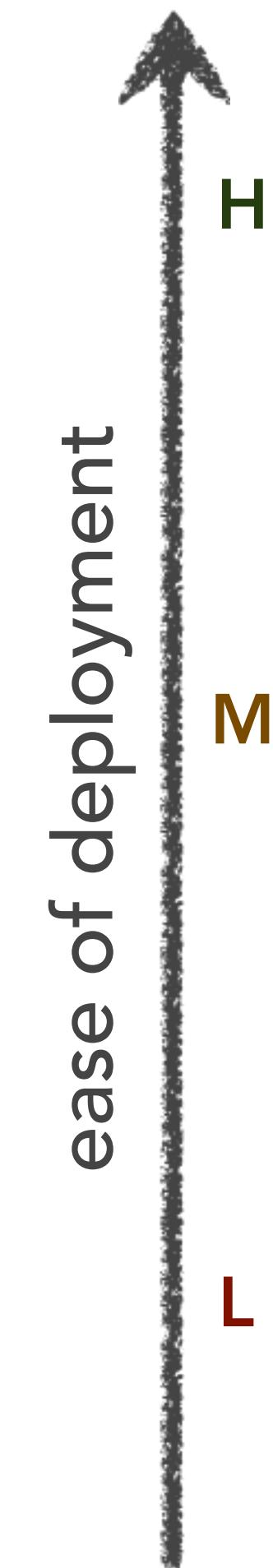
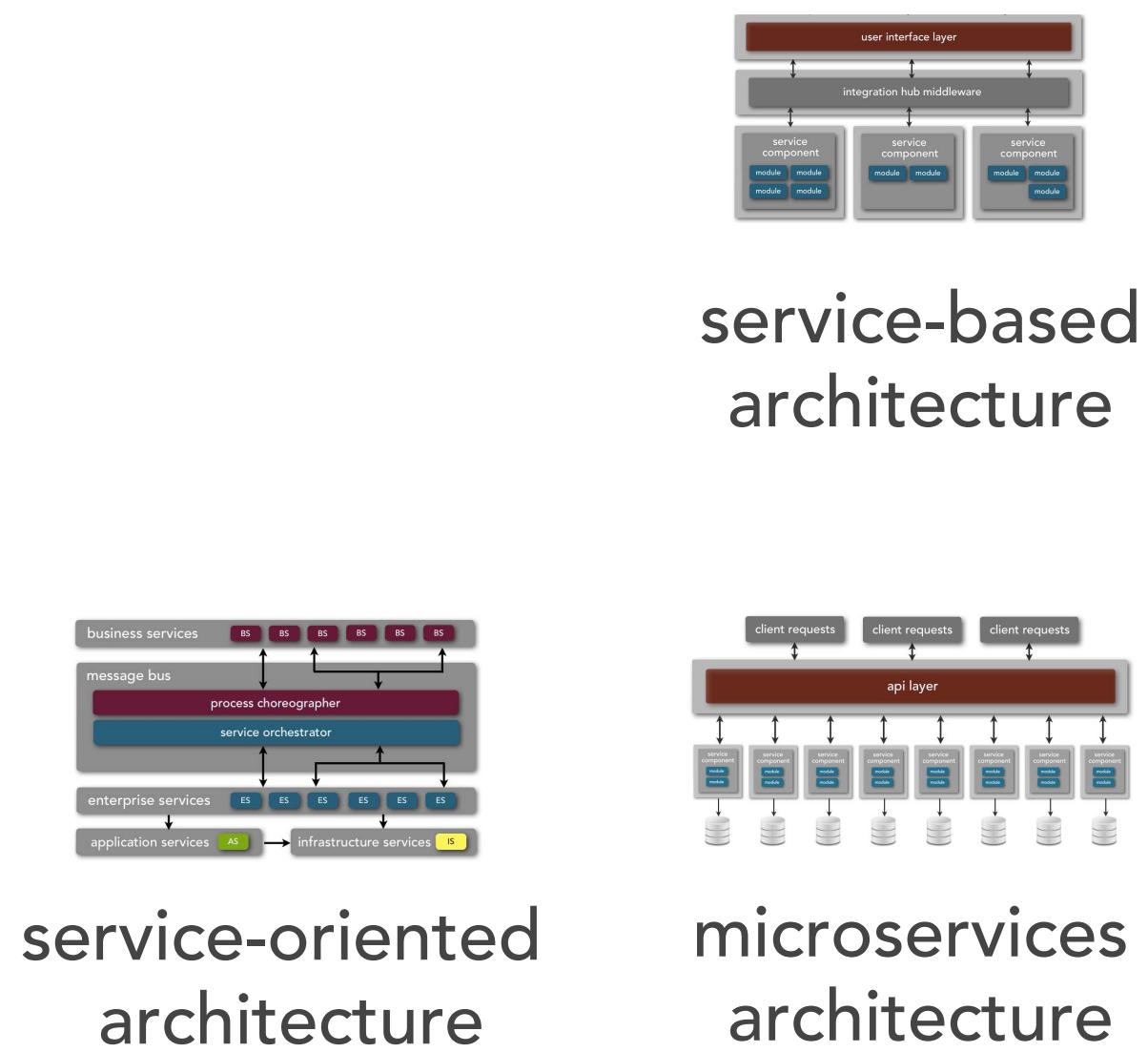
microservices  
architecture



# characteristics differences

## ease of deployment

promotes an effective and fast deployment pipeline; features are quick and easy to deploy

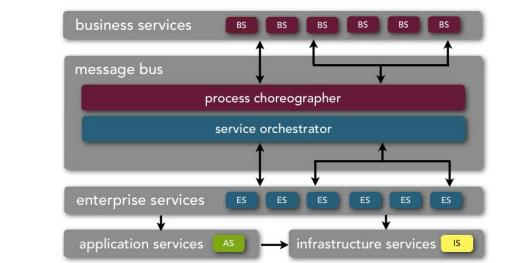


monolithic  
architecture

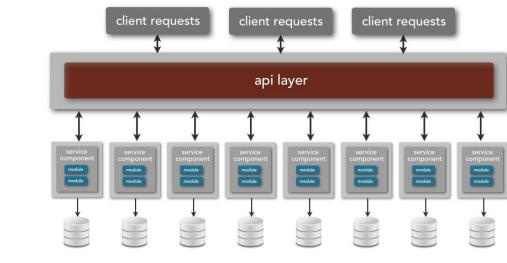
# characteristics differences

## ease of deployment

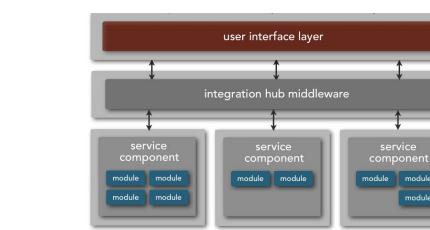
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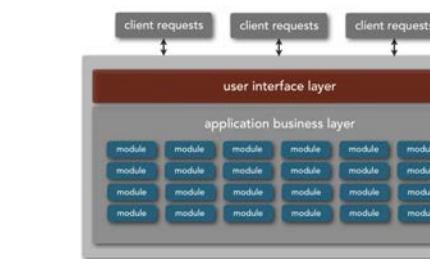
service-oriented  
architecture



microservices  
architecture



service-based  
architecture

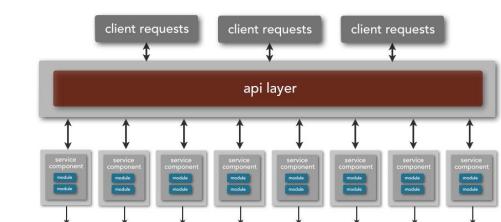


monolithic  
architecture

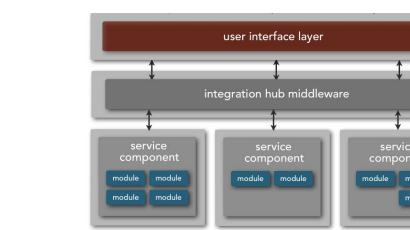
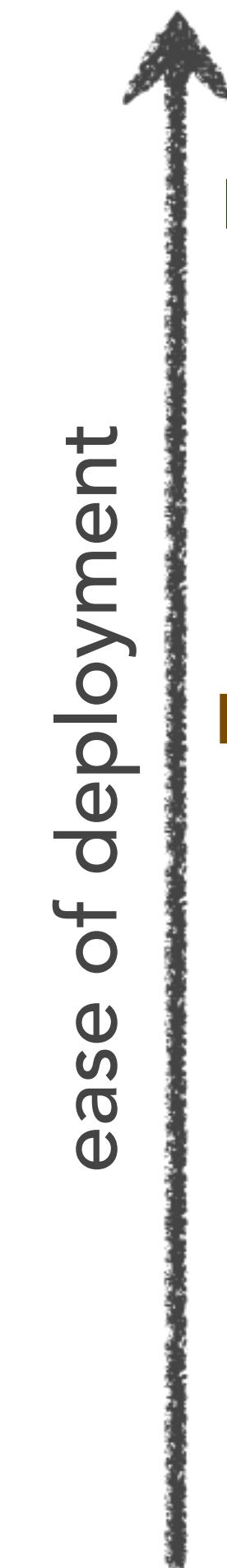
# characteristics differences

## ease of deployment

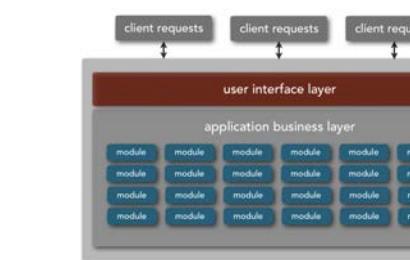
promotes an effective and fast deployment pipeline; features are quick and easy to deploy



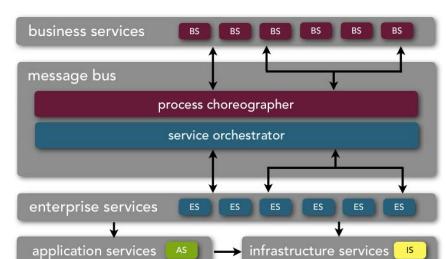
microservices  
architecture



service-based  
architecture



monolithic  
architecture

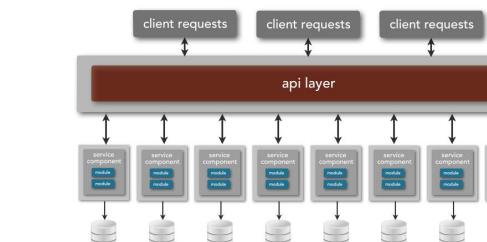


service-oriented  
architecture

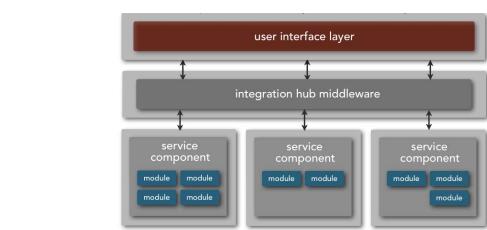
# characteristics differences

# ease of deployment

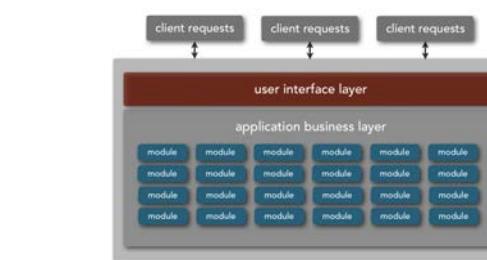
promotes an effective and fast deployment pipeline; features are quick and easy to deploy



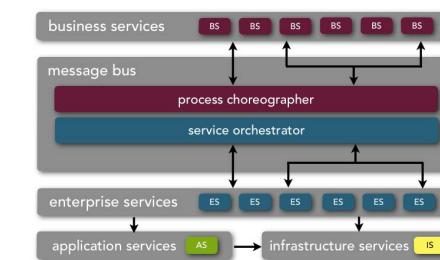
# microservices architecture



# service-based architecture



# monolithic architecture

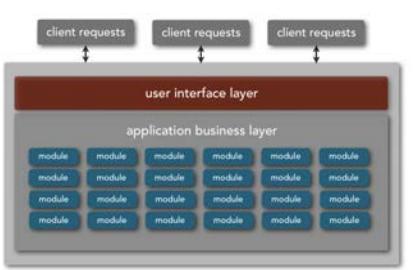


# service-oriented architecture

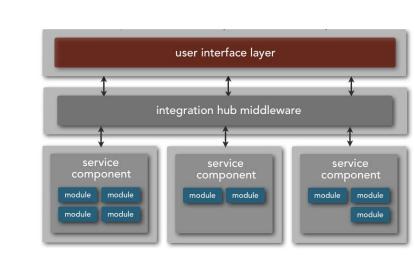
# characteristics differences

## ease of testing

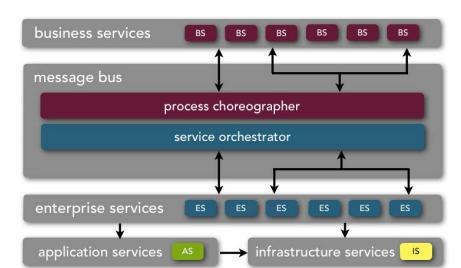
ease at which features can be tested and verified; confidence level in completeness of testing



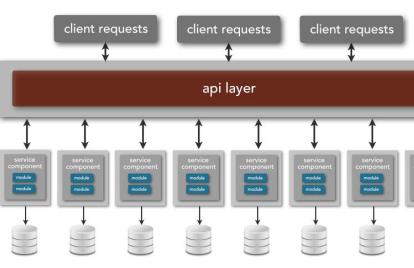
monolithic  
architecture



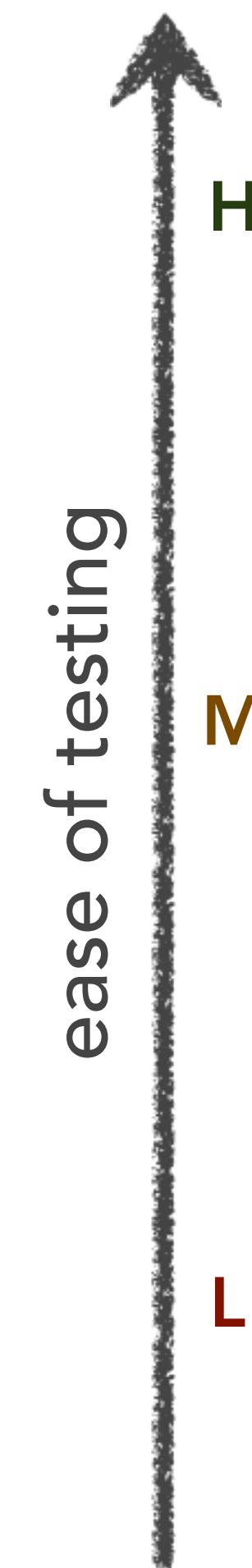
service-based  
architecture



service-oriented  
architecture



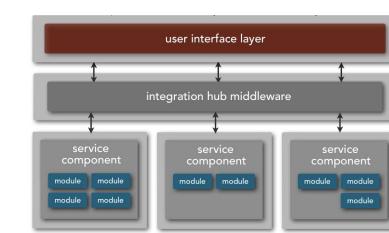
microservices  
architecture



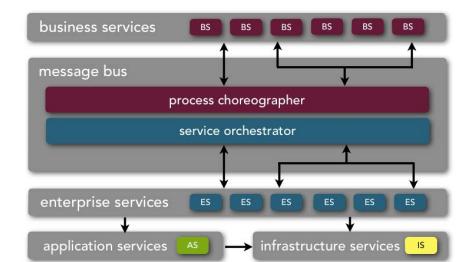
# characteristics differences

# ease of testing

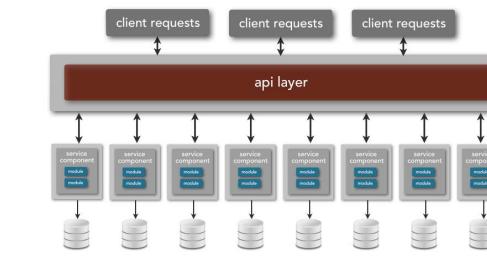
ease at which features can be tested and verified; confidence level in completeness of testing



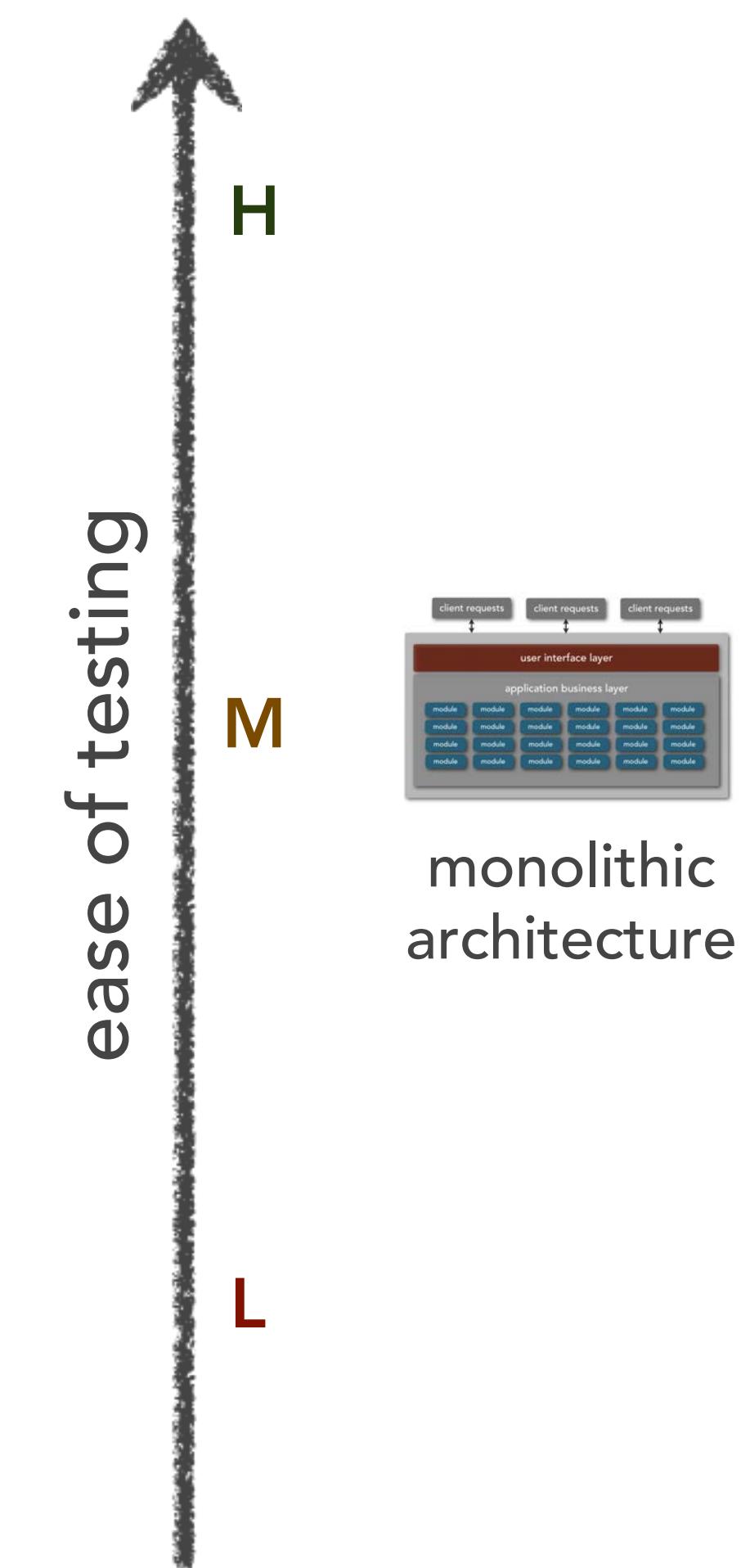
# service-based architecture



# service-oriented architecture



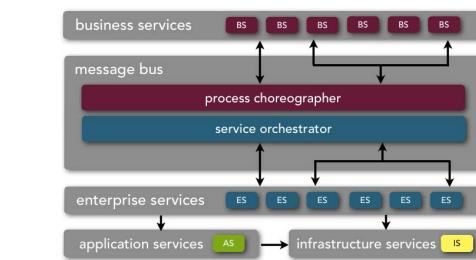
# microservices architecture



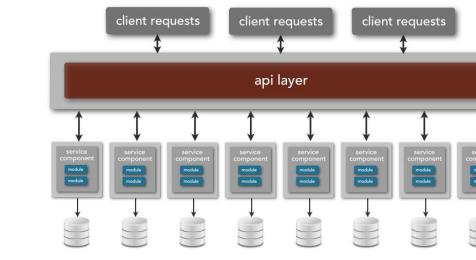
# characteristics differences

## ease of testing

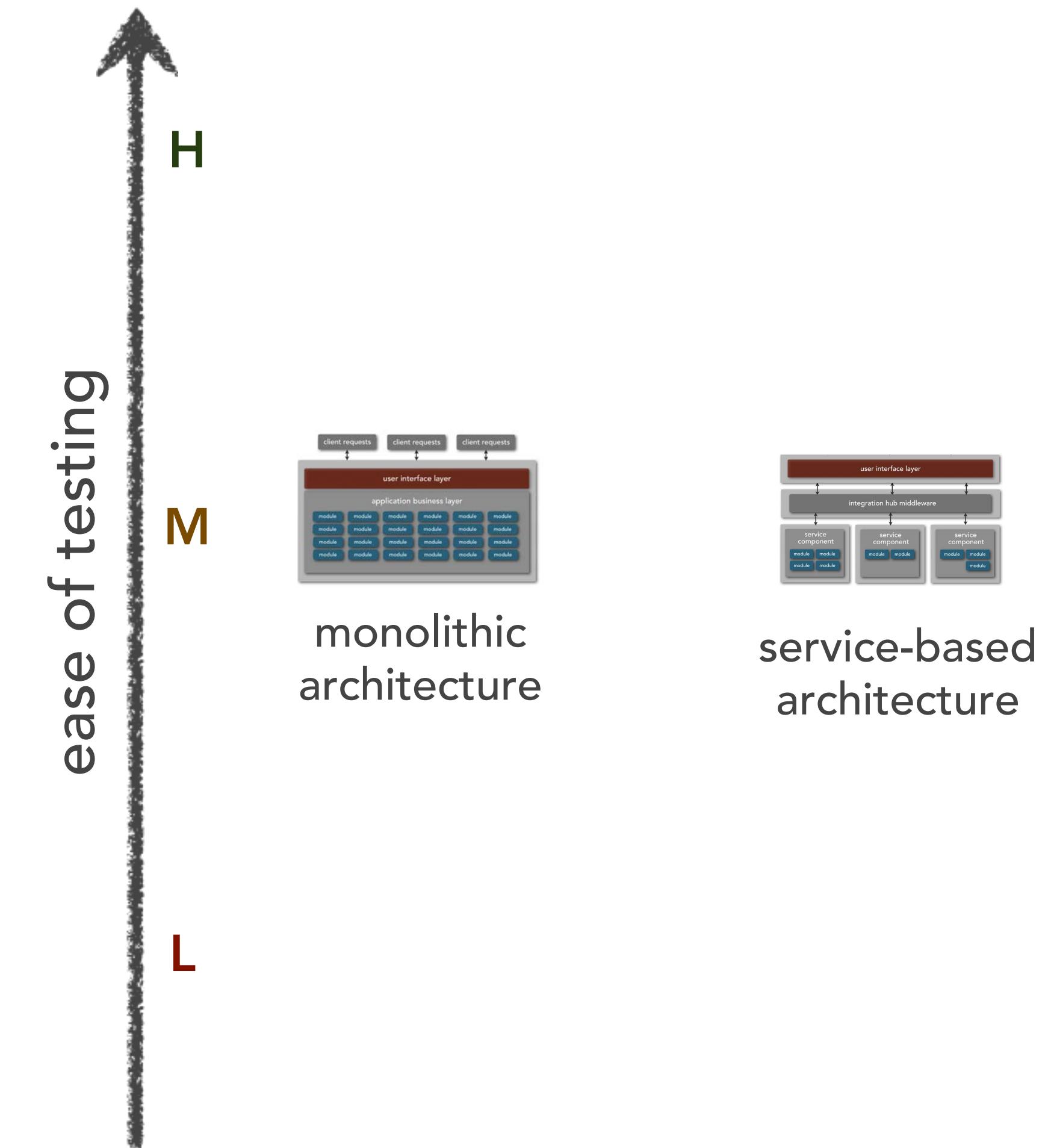
ease at which features can be tested and verified; confidence level in completeness of testing



service-oriented  
architecture



microservices  
architecture



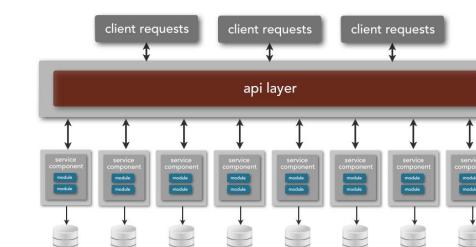
monolithic  
architecture

service-based  
architecture

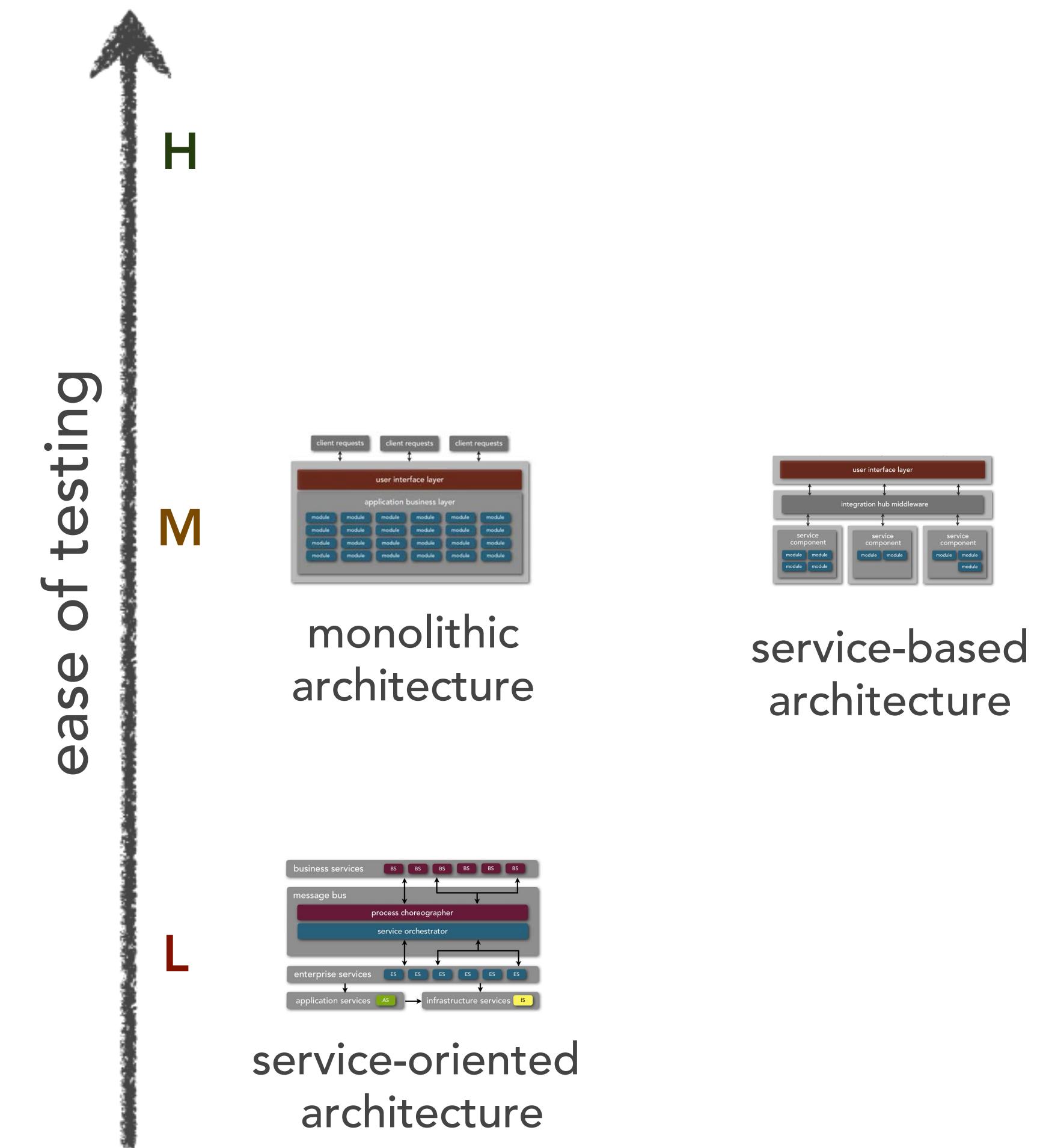
# characteristics differences

## ease of testing

ease at which features can be tested and verified; confidence level in completeness of testing



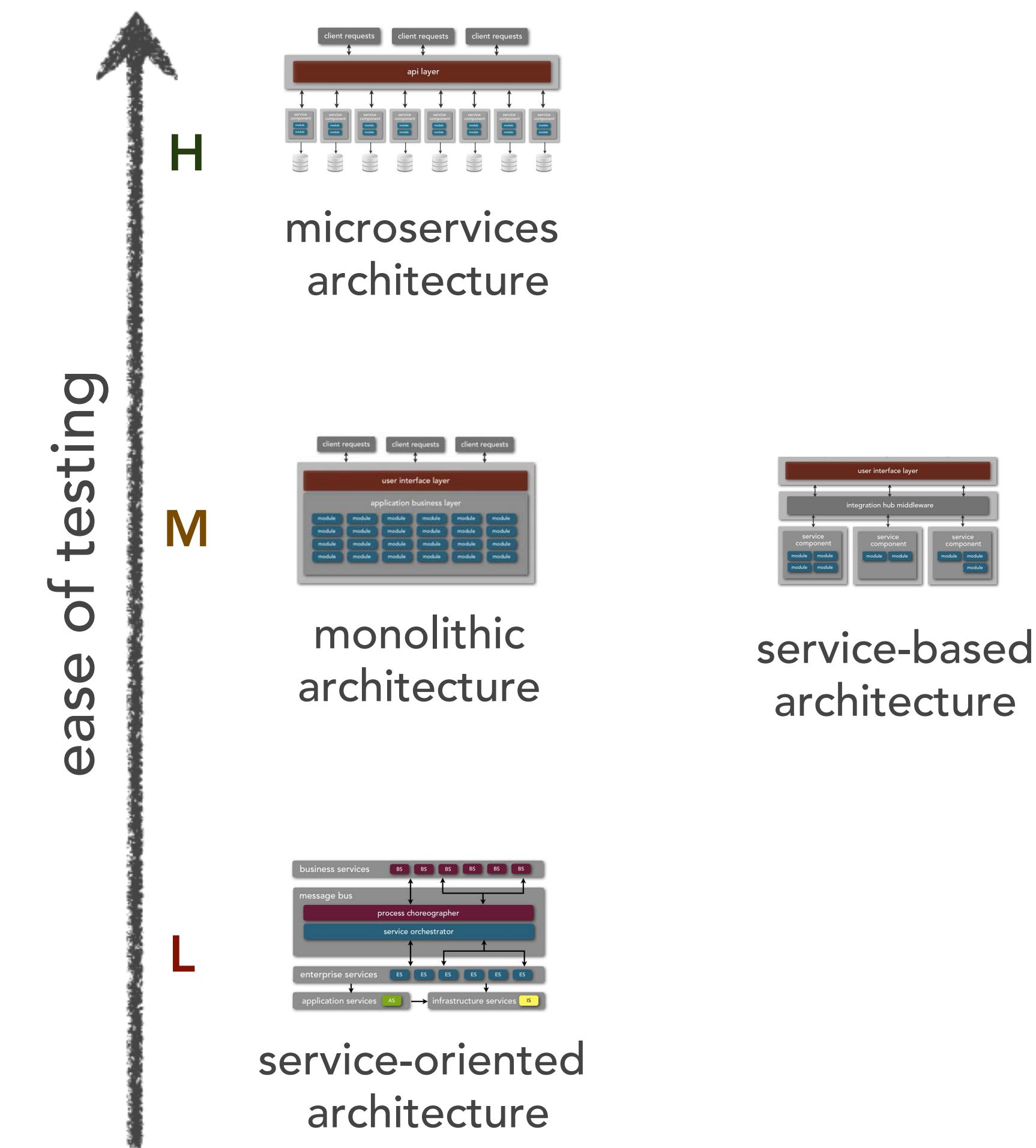
microservices  
architecture



# characteristics differences

## ease of testing

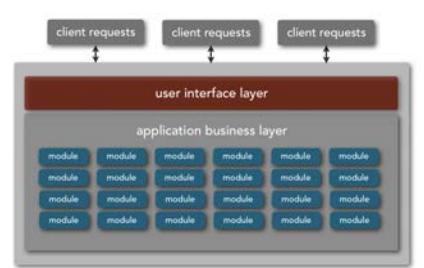
ease at which features can be tested and verified; confidence level in completeness of testing



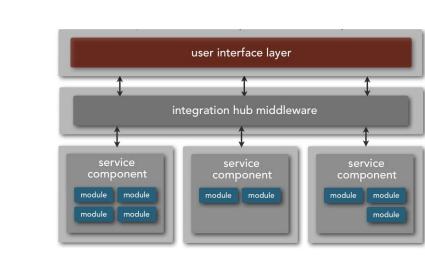
# characteristics differences

## overall performance

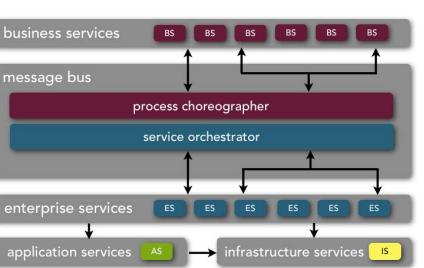
which patterns relatively promote better performing applications?



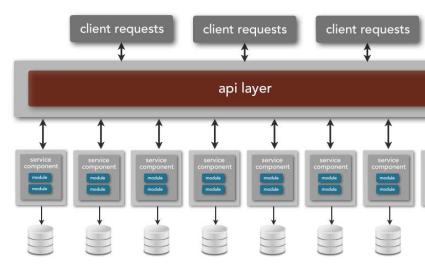
monolithic architecture



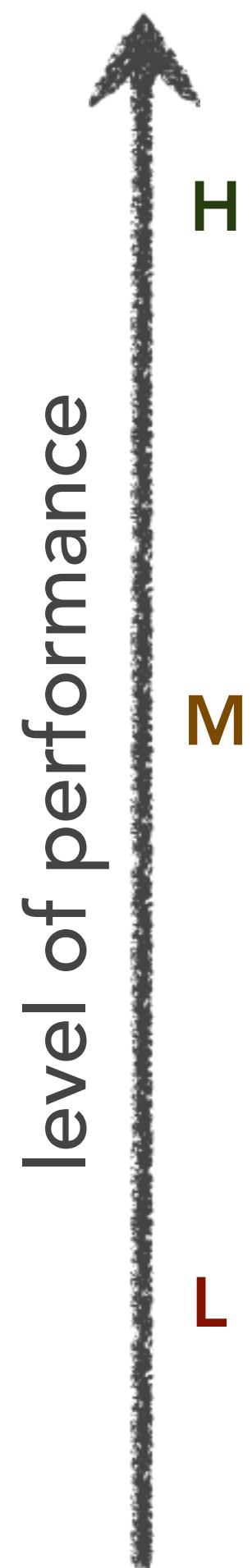
service-based architecture



service-oriented architecture



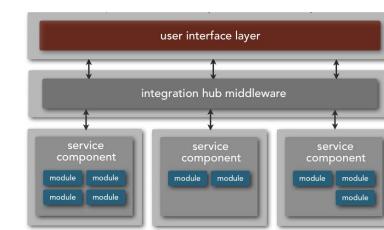
microservices architecture



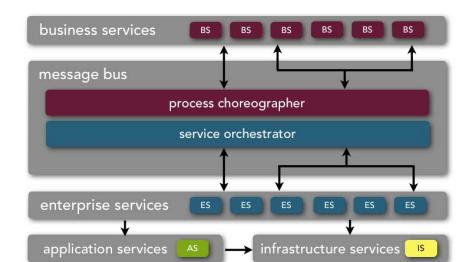
# characteristics differences

# overall performance

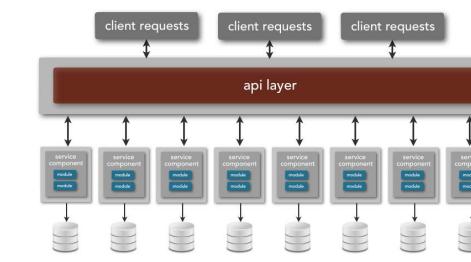
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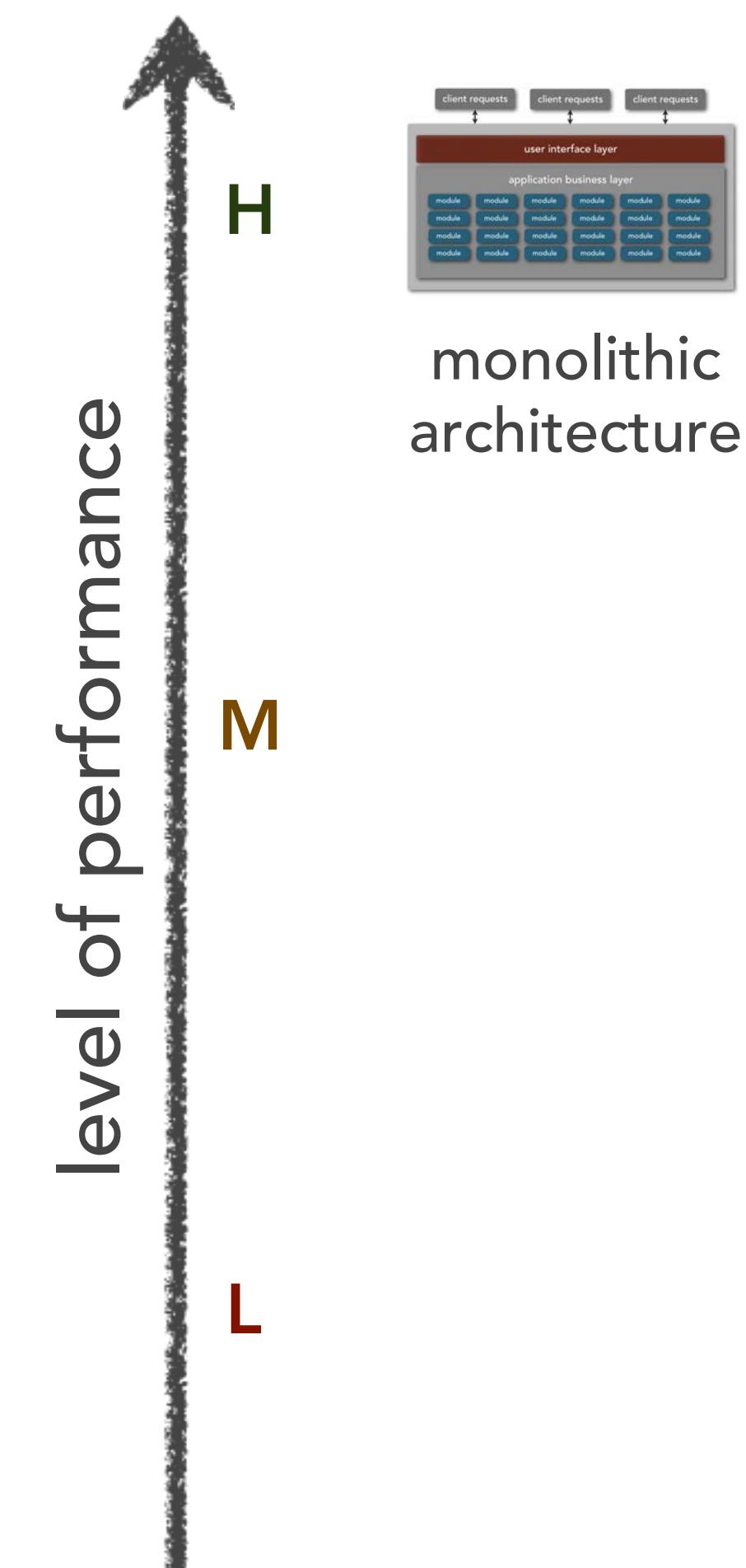
# service-based architecture



# service-oriented architecture



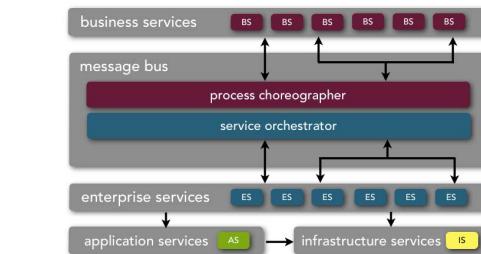
# microservices architecture



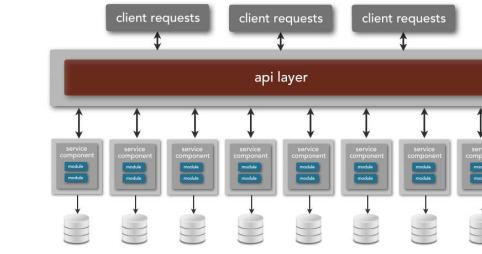
# characteristics differences

overall performance

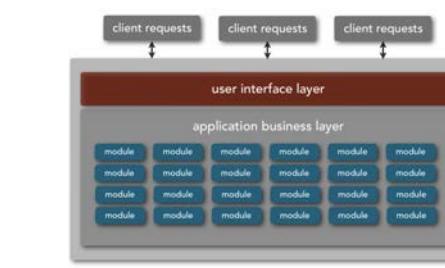
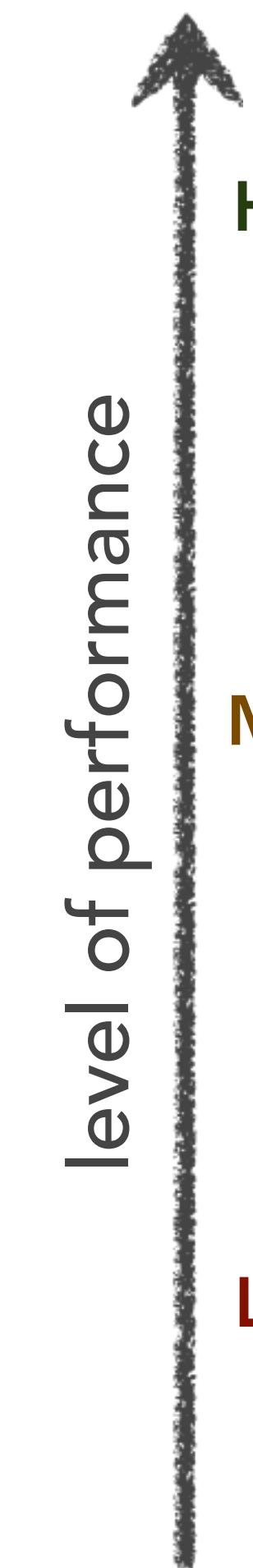
which patterns relatively promote better performing applications?



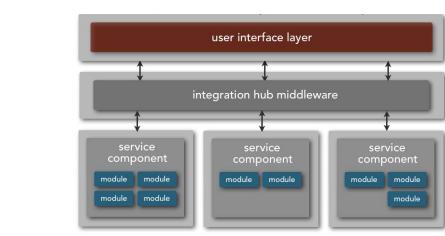
service-oriented  
architecture



microservices  
architecture



monolithic  
architecture

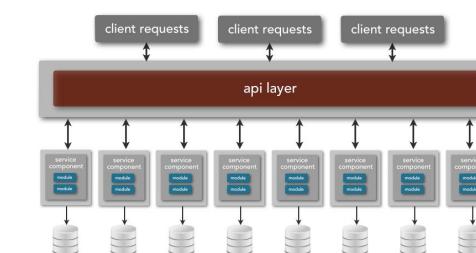


service-based  
architecture

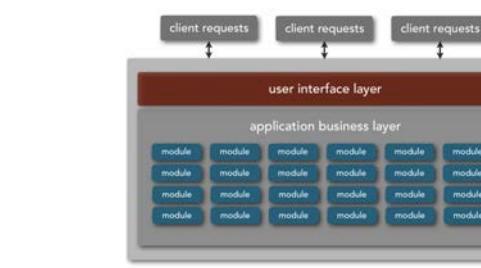
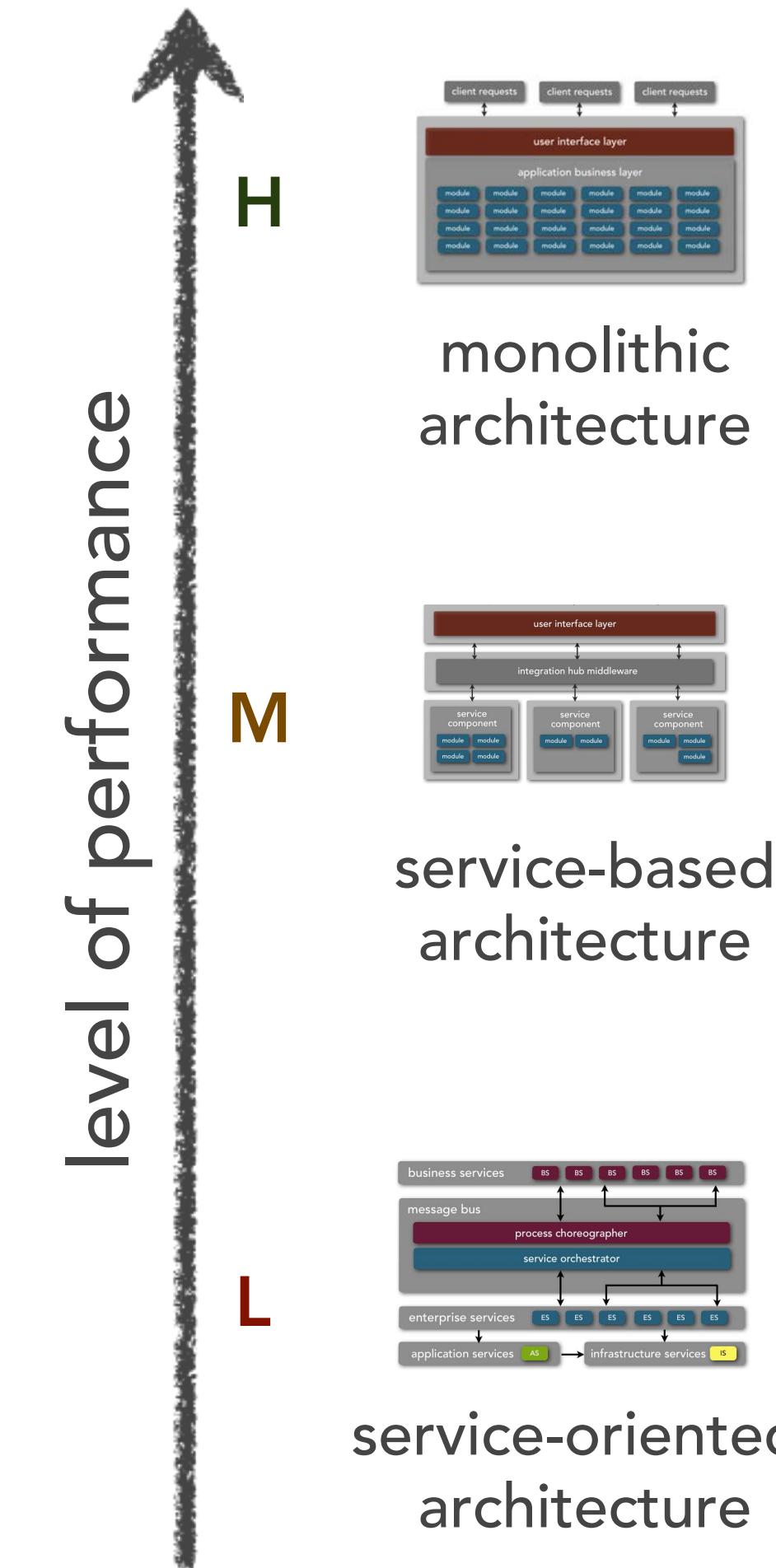
# characteristics differences

overall performance

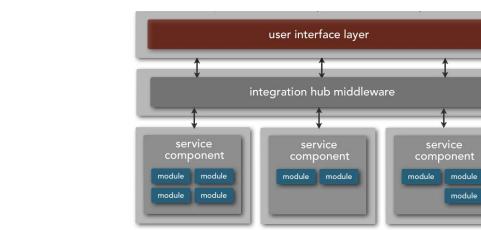
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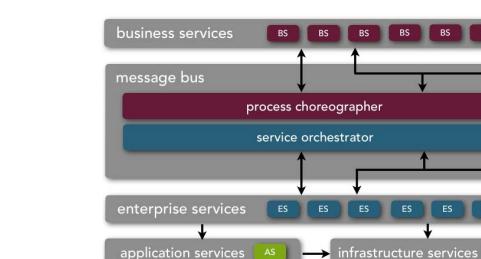
microservices  
architecture



monolithic  
architecture



service-based  
architecture

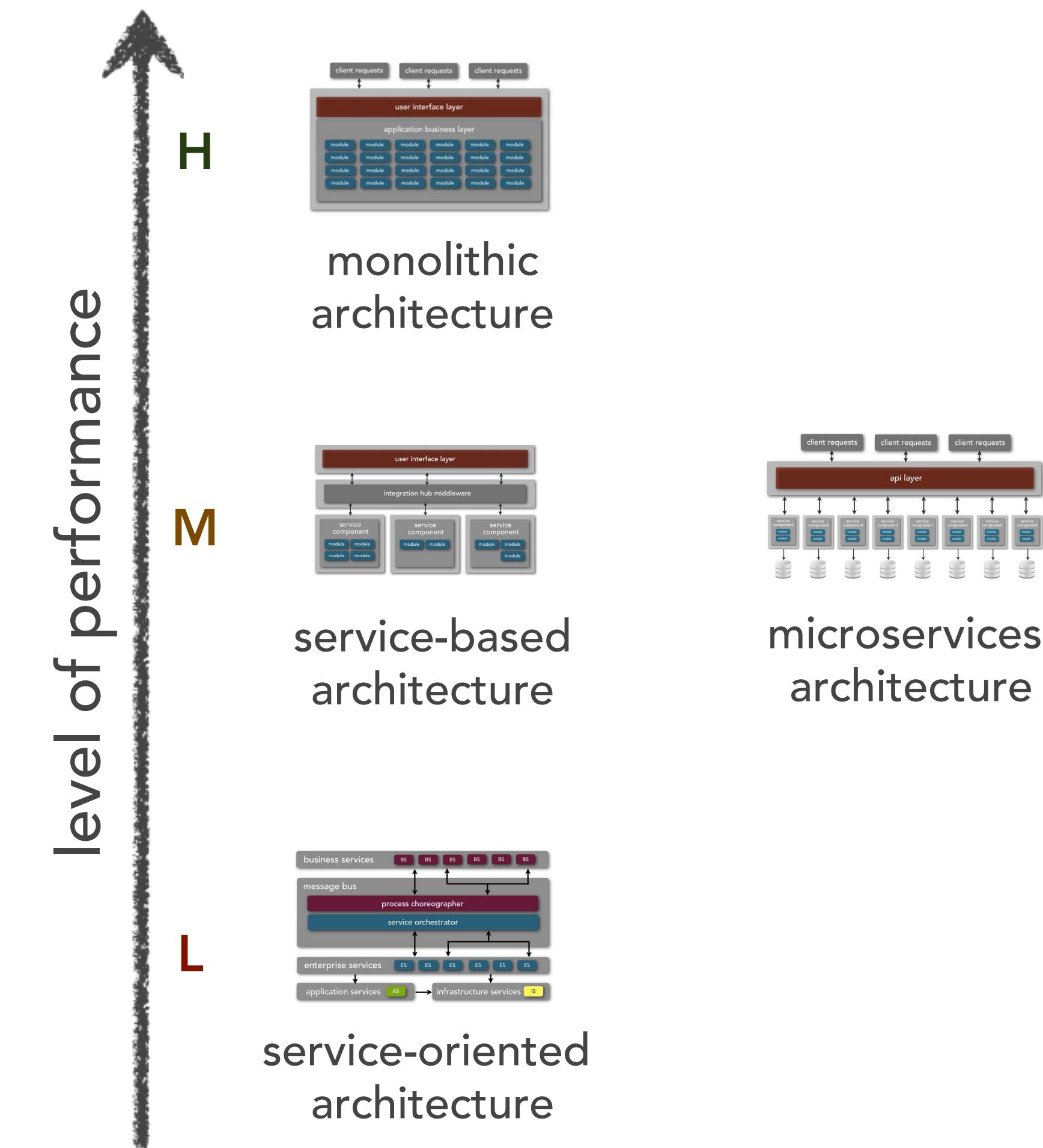


service-oriented  
architecture

# characteristics differences

overall performance

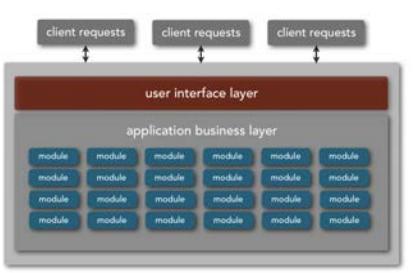
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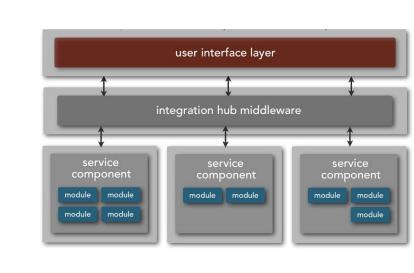
# characteristics differences

## overall scalability

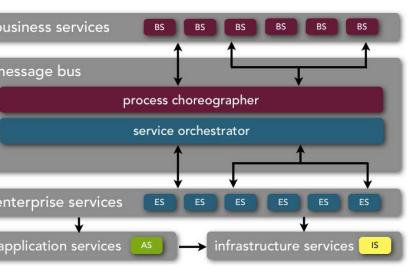
how well does the architecture pattern lend itself to highly scalable applications?



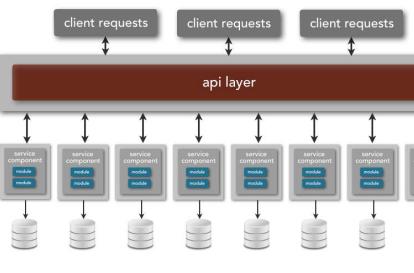
monolithic  
architecture



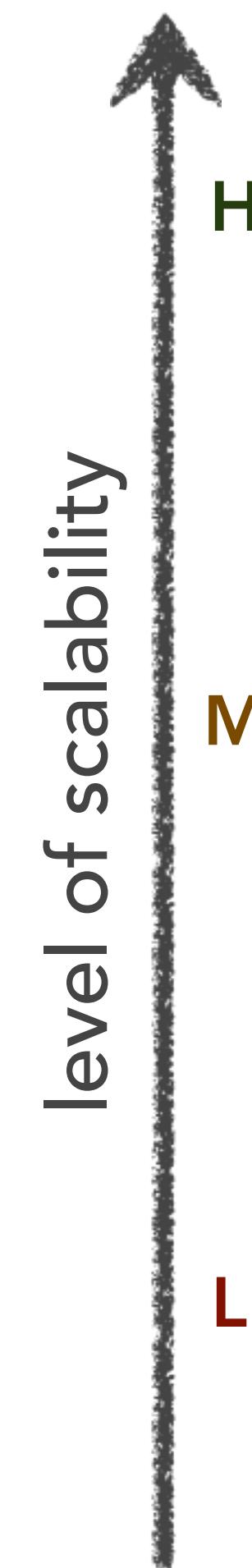
service-based  
architecture



service-oriented  
architecture



microservices  
architecture



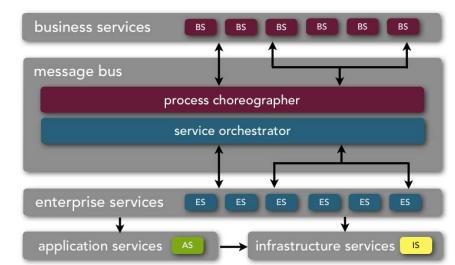
# characteristics differences

## overall scalability

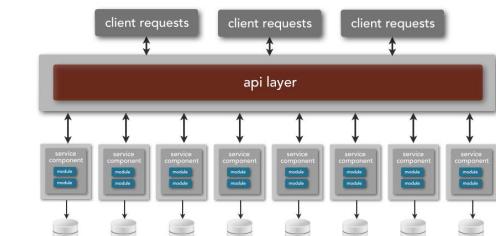
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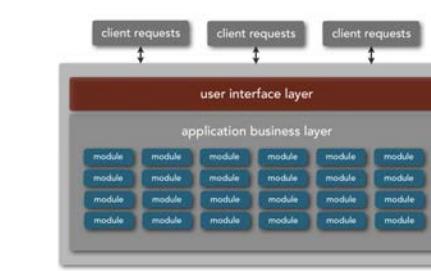
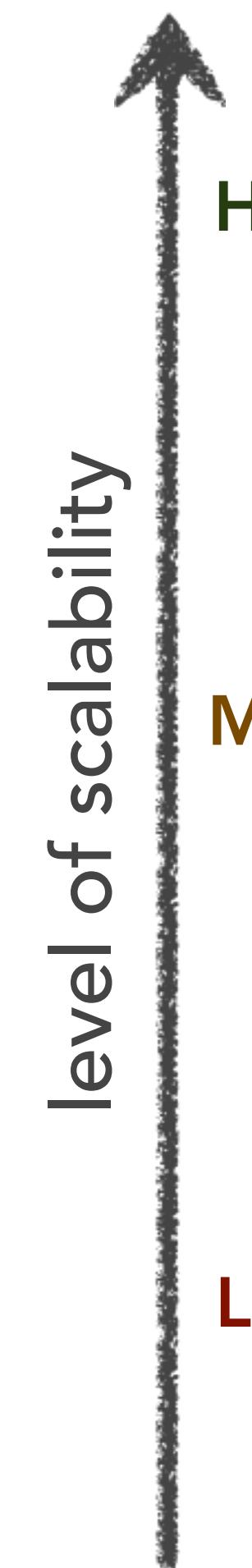
service-based  
architecture



service-oriented  
architecture



microservices  
architecture

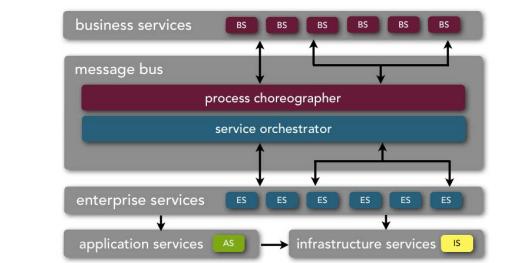


monolithic  
architecture

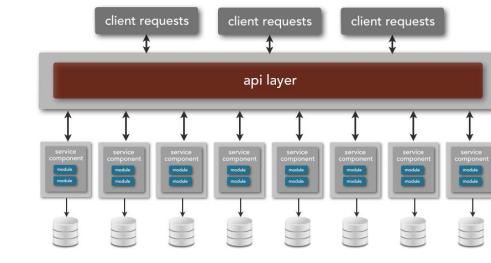
# characteristics differences

## overall scalability

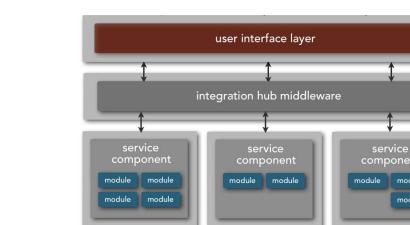
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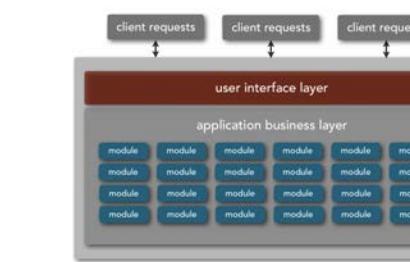
service-oriented  
architecture



microservices  
architecture



service-based  
architecture

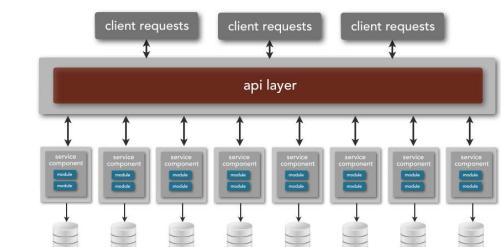


monolithic  
architecture

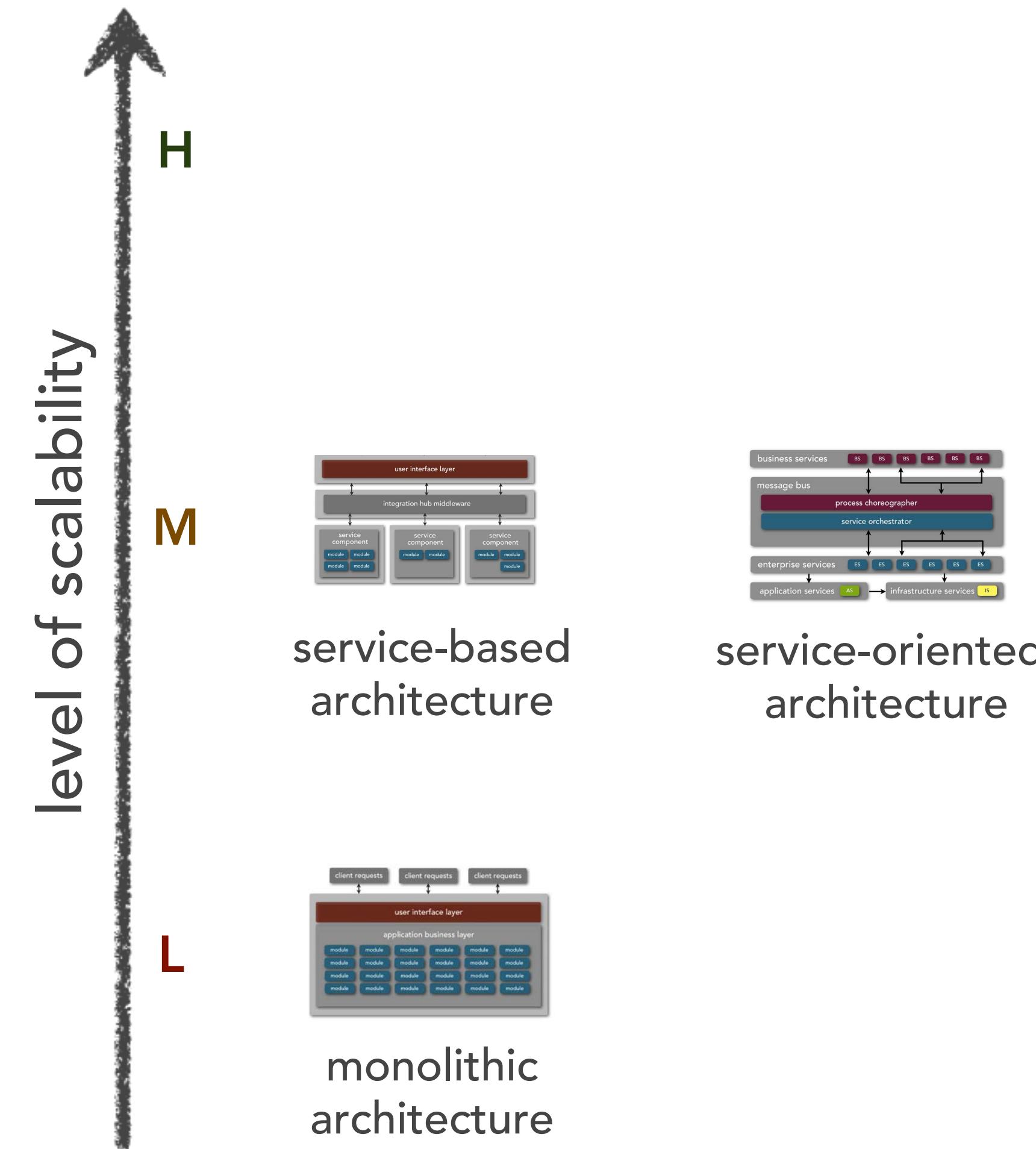
# characteristics differences

## overall scalability

how well does the architecture pattern lend itself to highly scalable applications?



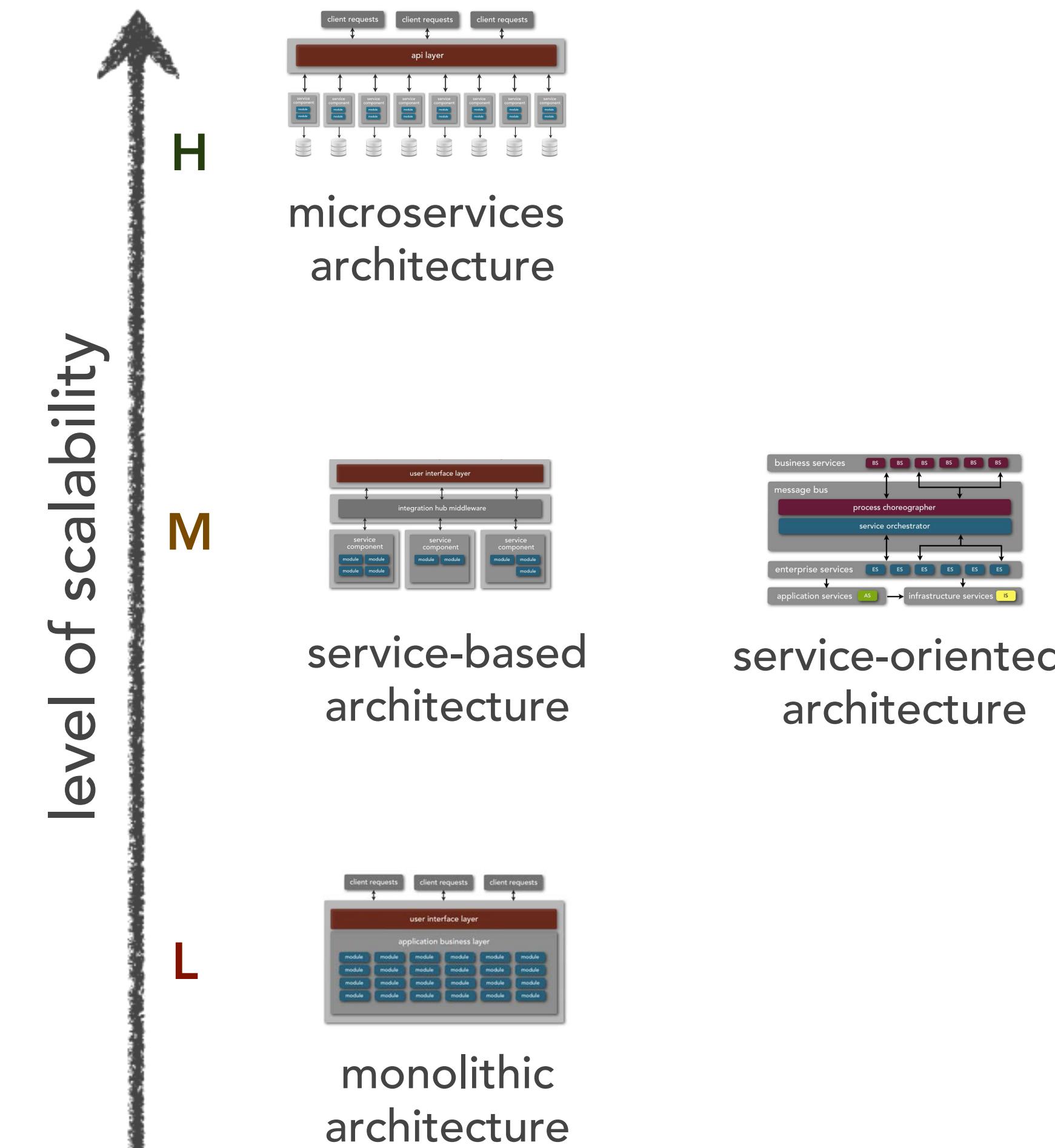
microservices  
architecture



# characteristics differences

## overall scalability

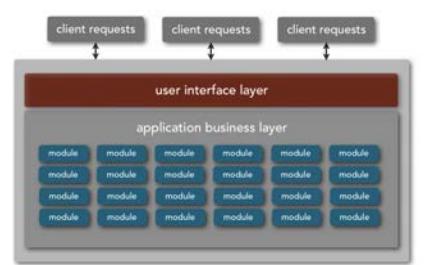
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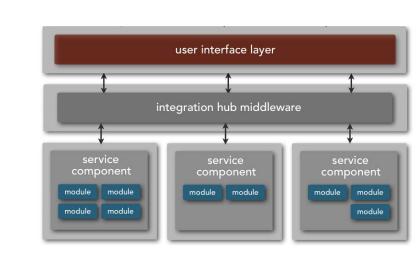
# characteristics differences

overall simplicity

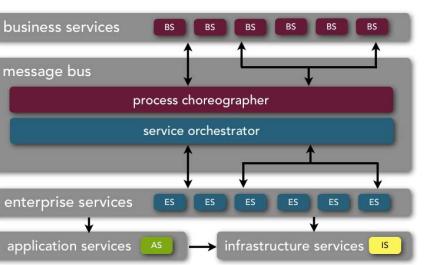
level of complexity in  
applications implemented  
using the architecture pattern



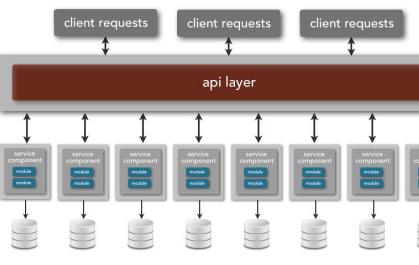
monolithic  
architecture



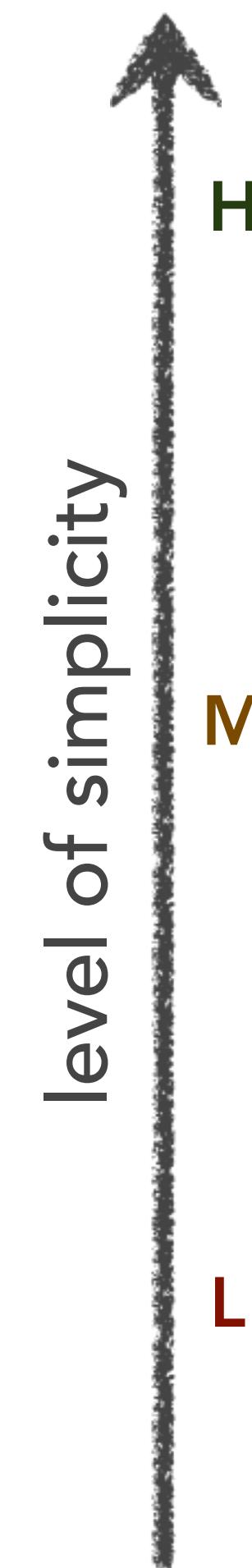
service-based  
architecture



service-oriented  
architecture



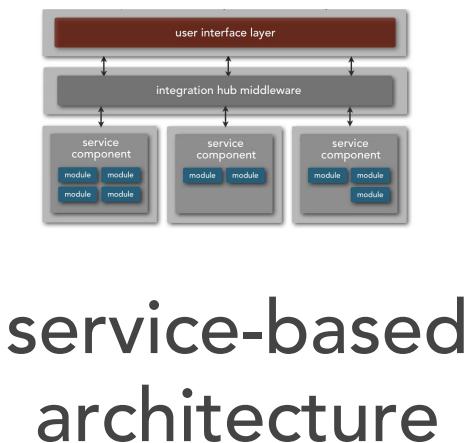
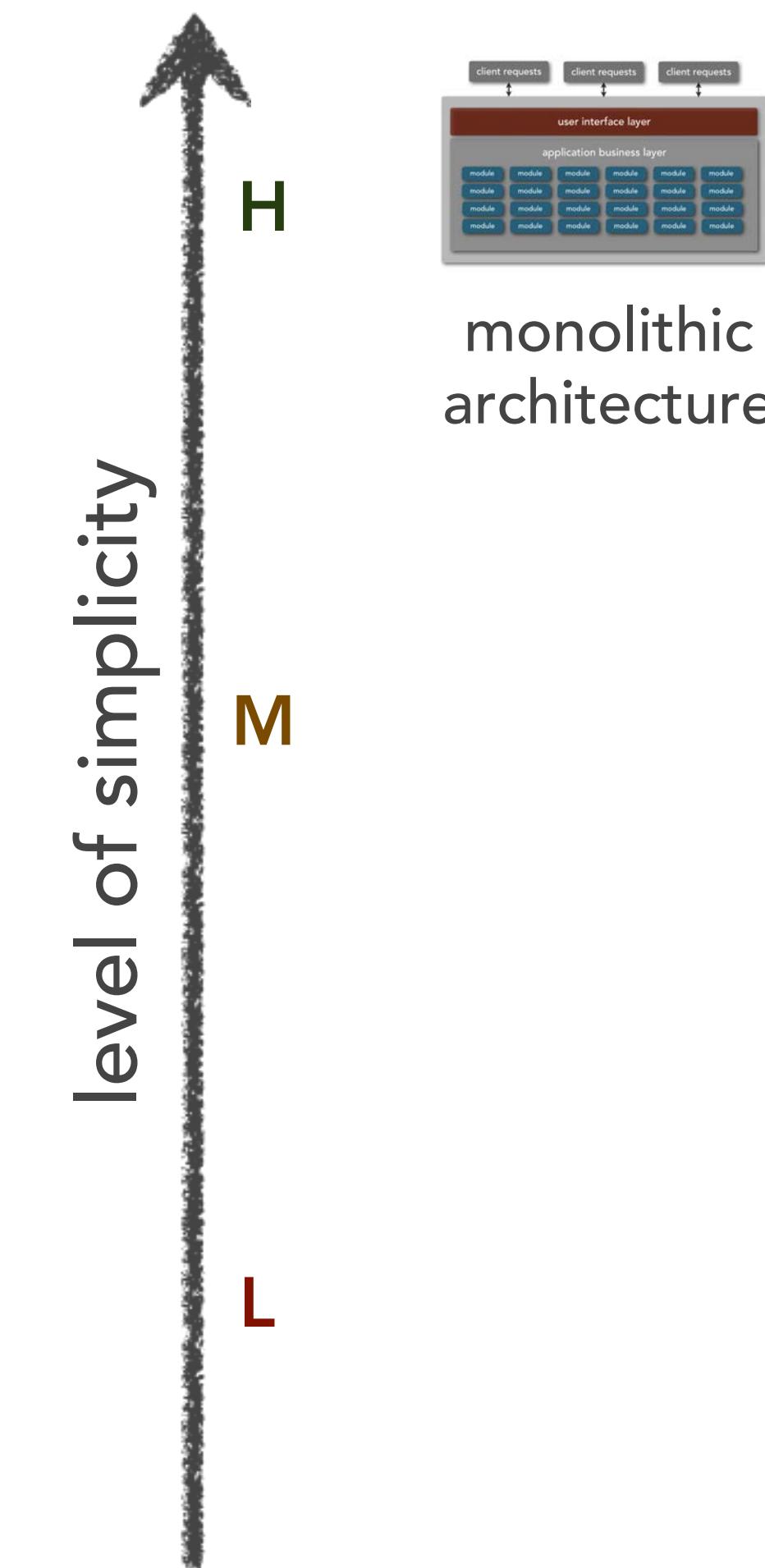
microservices  
architecture



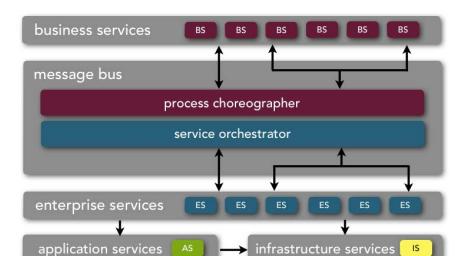
# characteristics differences

overall simplicity

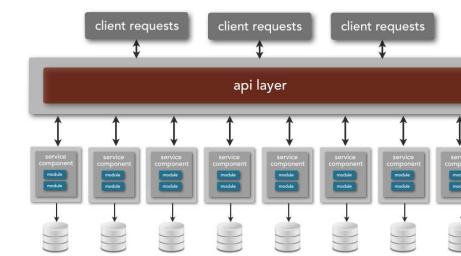
level of complexity in  
applications implemented  
using the architecture pattern



service-based  
architecture



service-oriented  
architecture

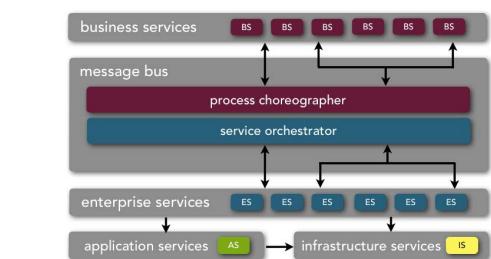


microservices  
architecture

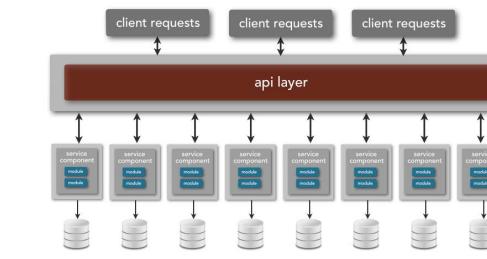
# characteristics differences

overall simplicity

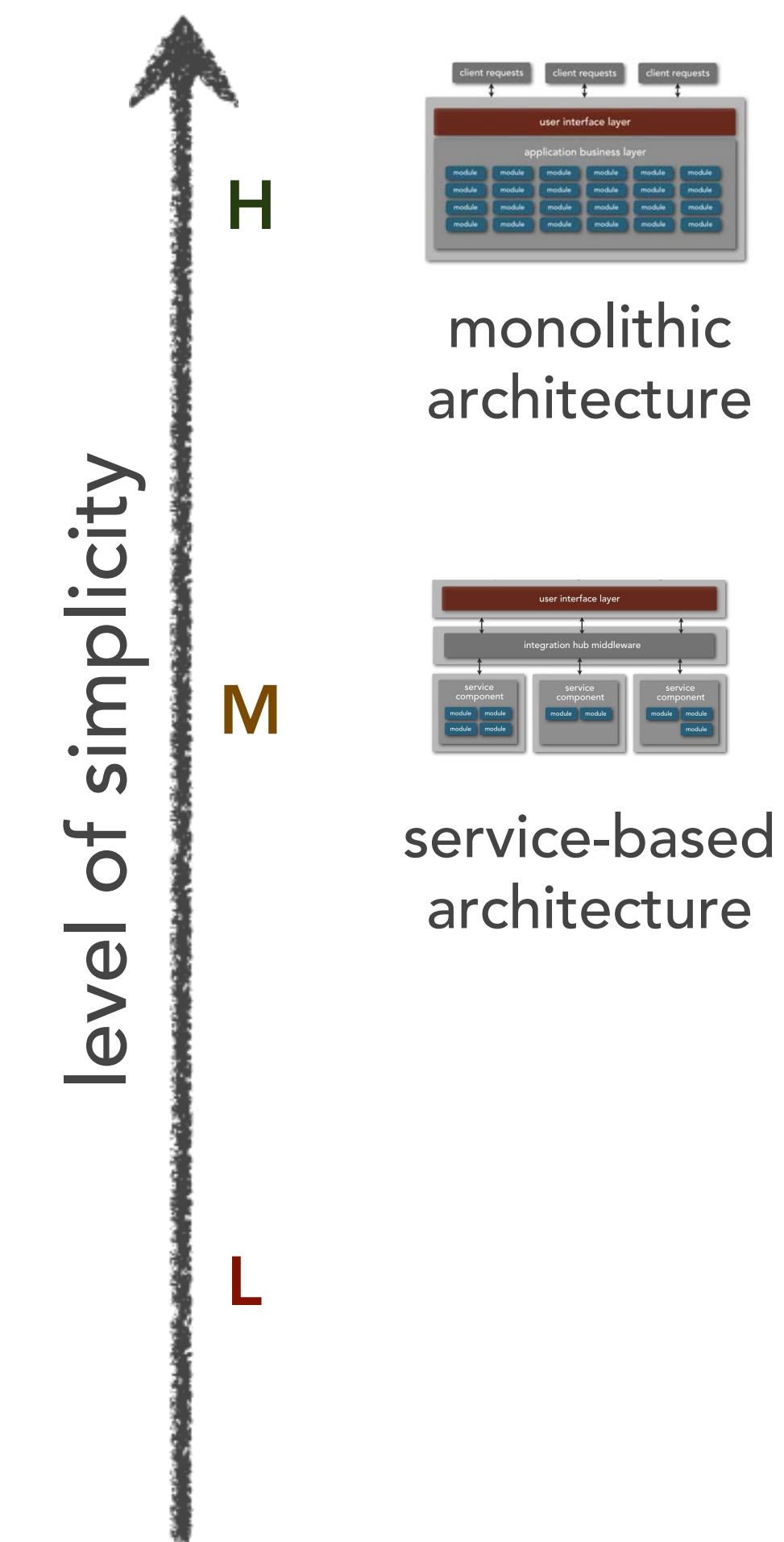
level of complexity in  
applications implemented  
using the architecture pattern



service-oriented  
architecture



microservices  
architecture



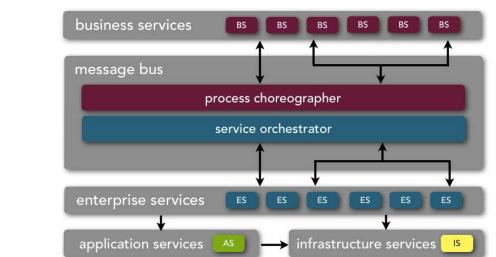
monolithic  
architecture

service-based  
architecture

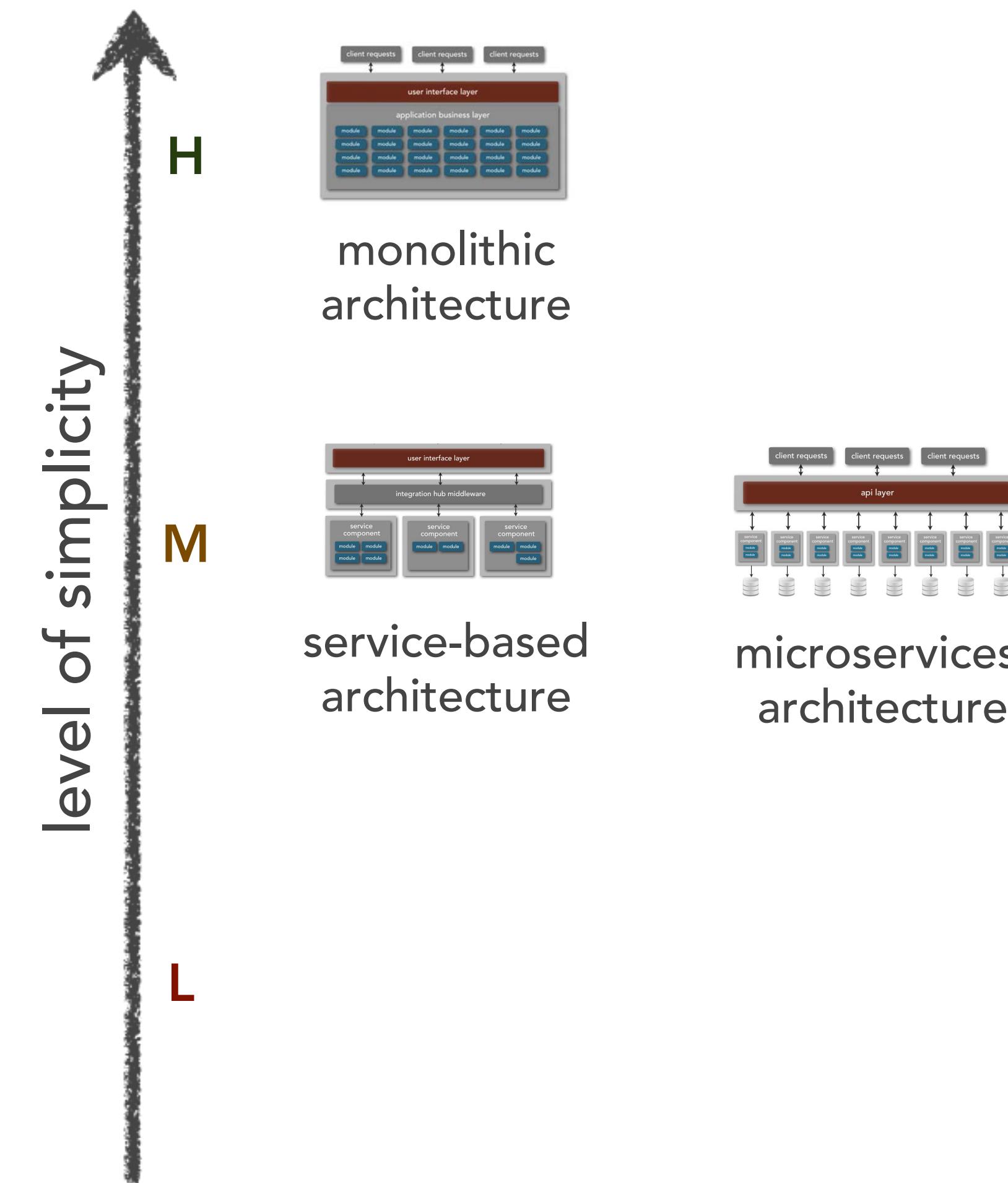
# characteristics differences

overall simplicity

level of complexity in  
applications implemented  
using the architecture pattern



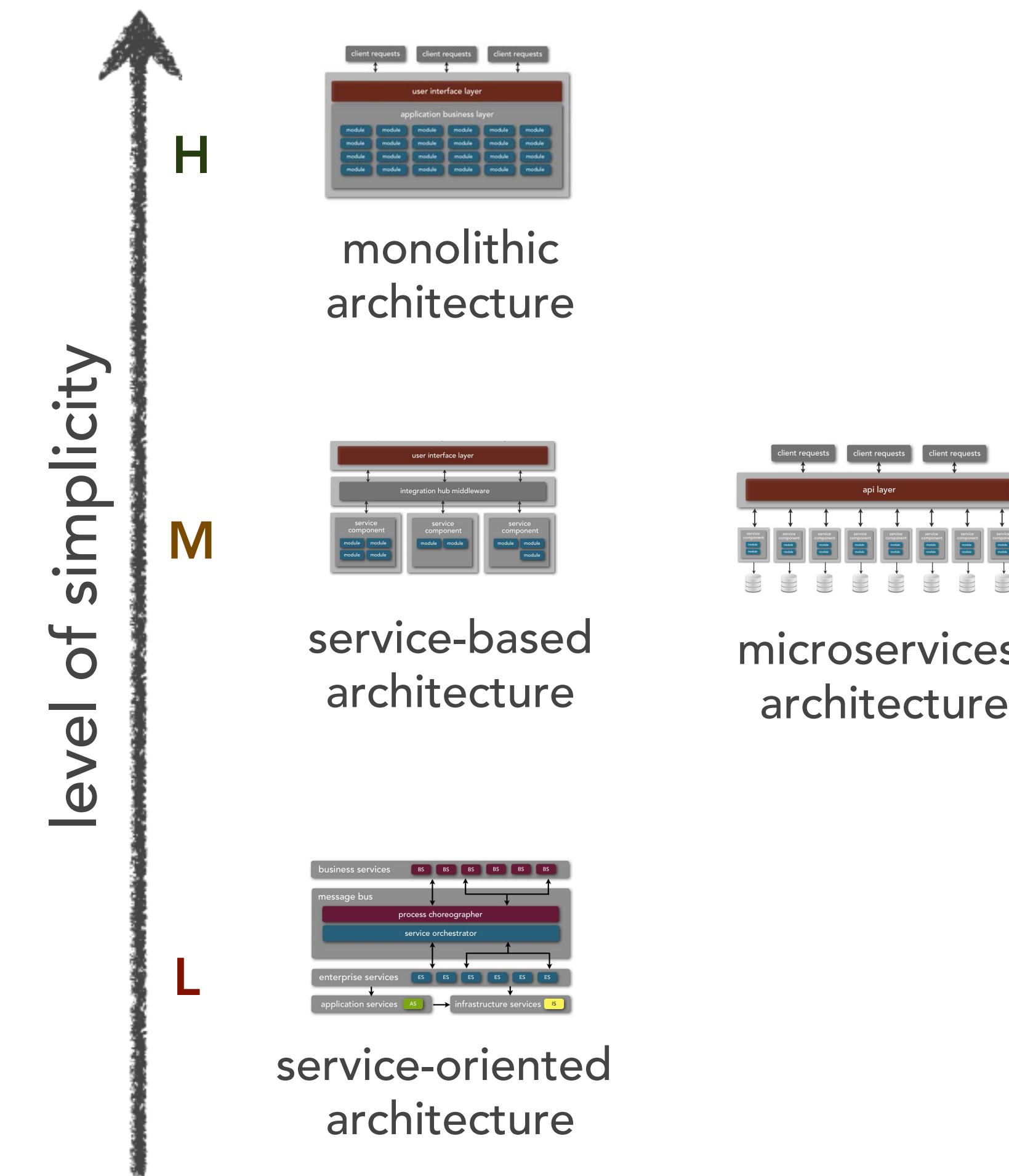
service-oriented  
architecture



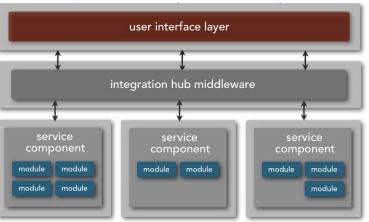
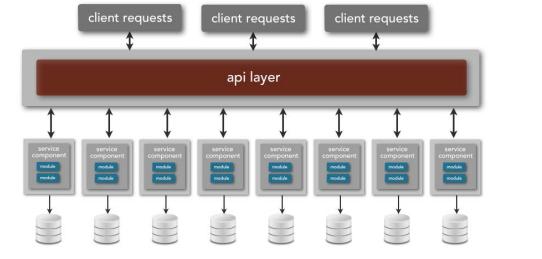
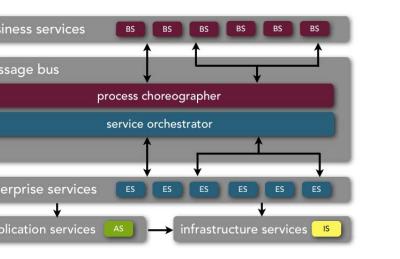
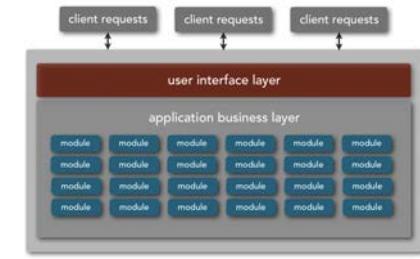
# characteristics differences

overall simplicity

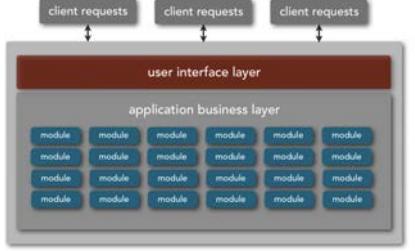
level of complexity in  
applications implemented  
using the architecture pattern



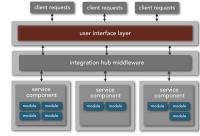
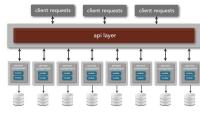
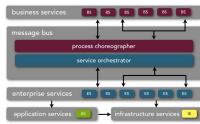
# Which ?!?



# Which ?!?



Monolith

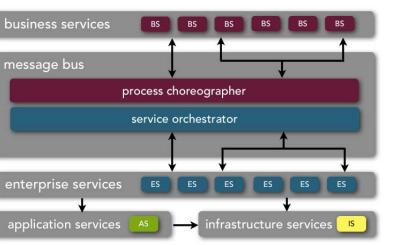
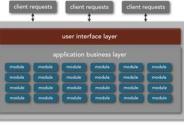


default

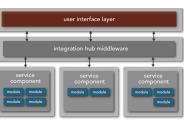
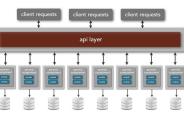
easy to understand/build

doesn't scale well in any dimension

# Which ?!?



Service-oriented



service taxonomy

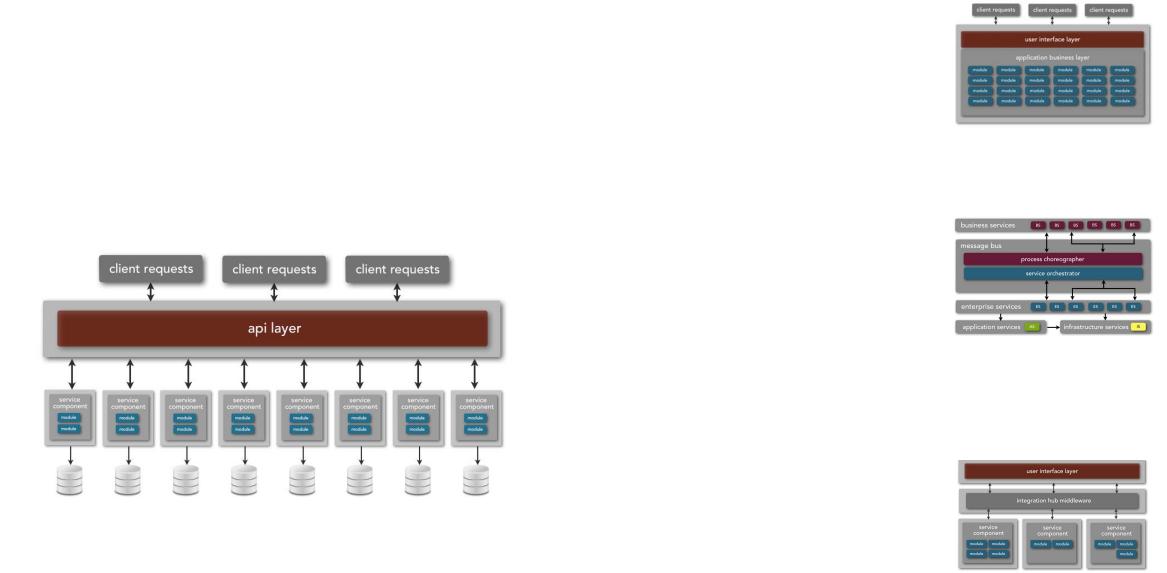
high degree of (potential) reuse

highly compatible in integration-heavy environments

operationally complex

# Which ?!?

Microservices

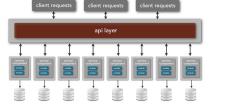
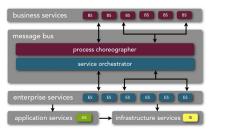
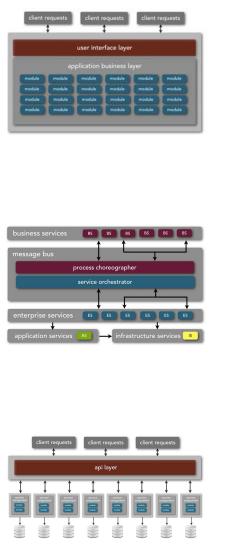


incremental change

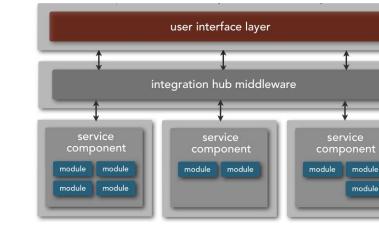
highly evolvable

complex interactions

# Which ?!?



service-based

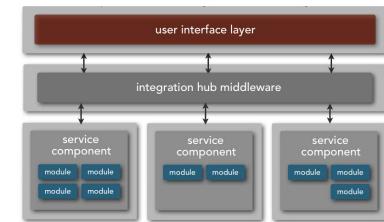
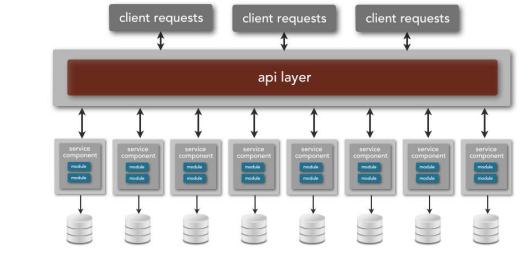
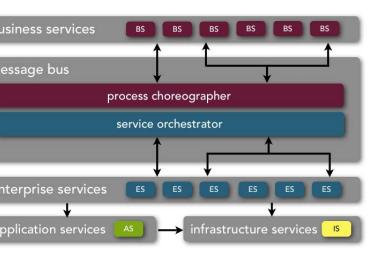
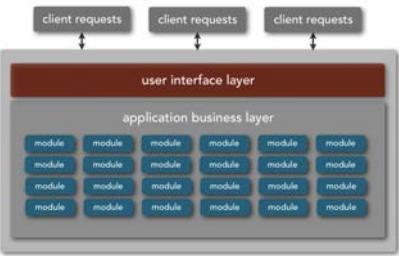


best target for migration

good compromise

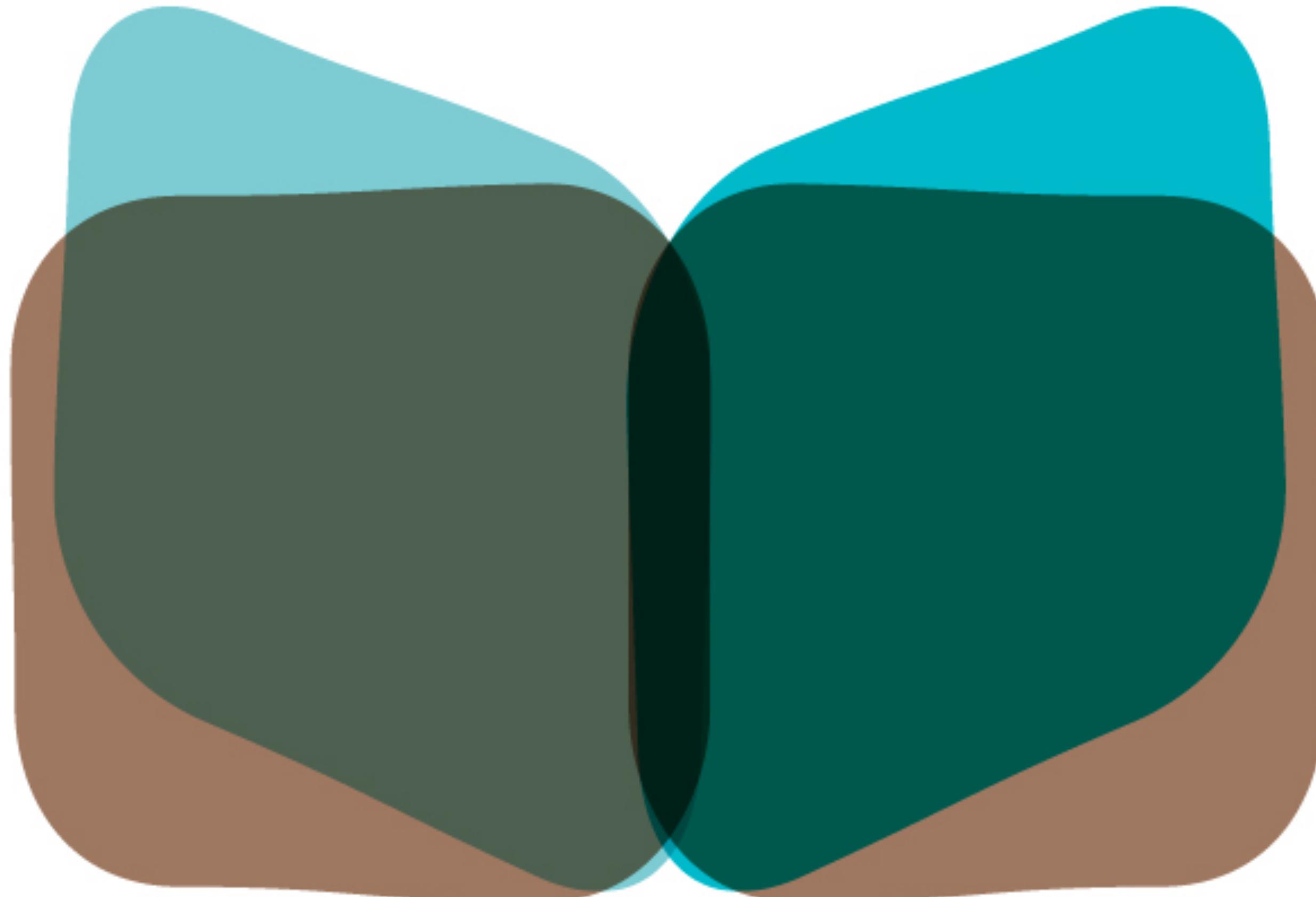
domain-centric without going  $\mu$ service

# Which ?!?



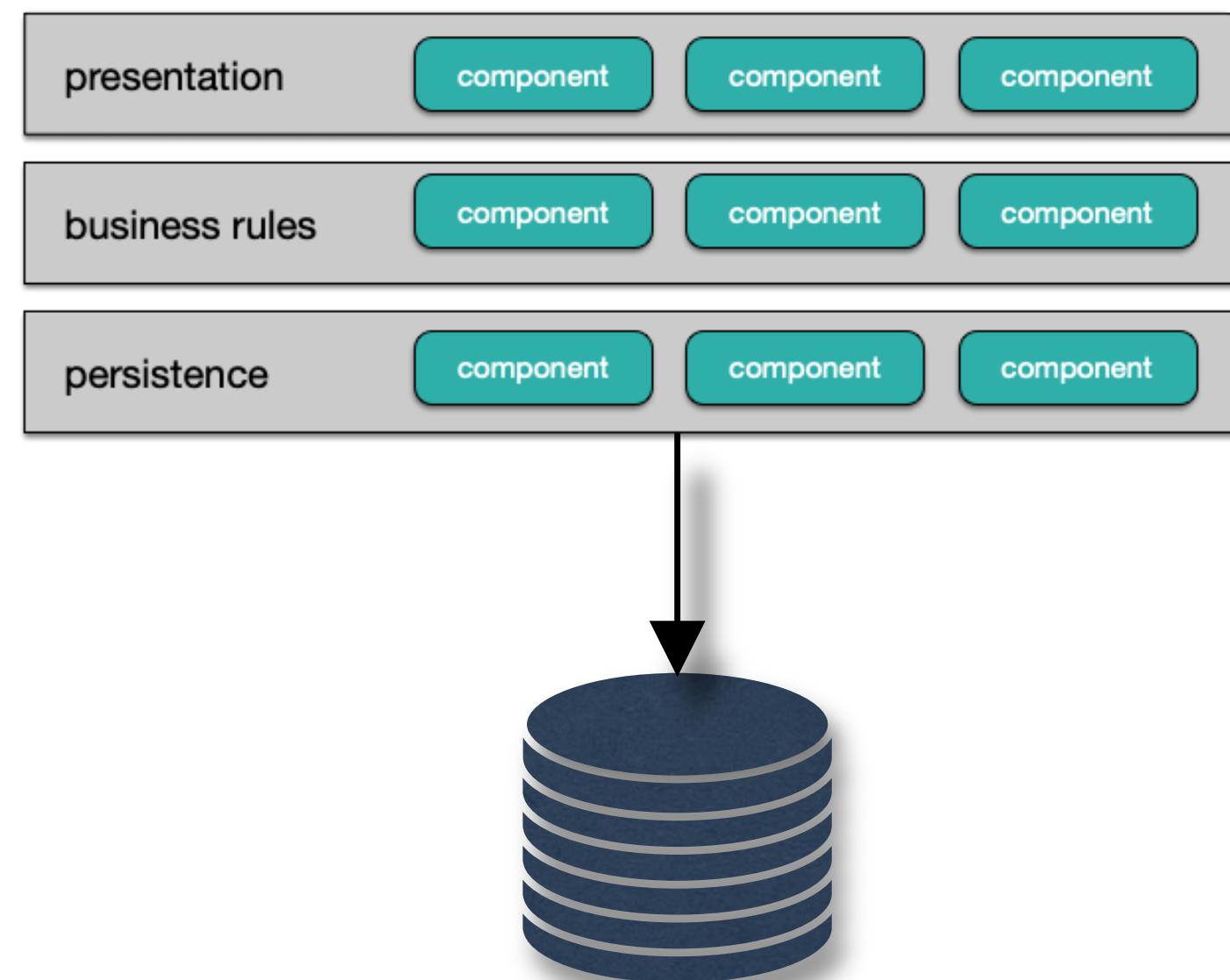
microservices

# Lessons Learned



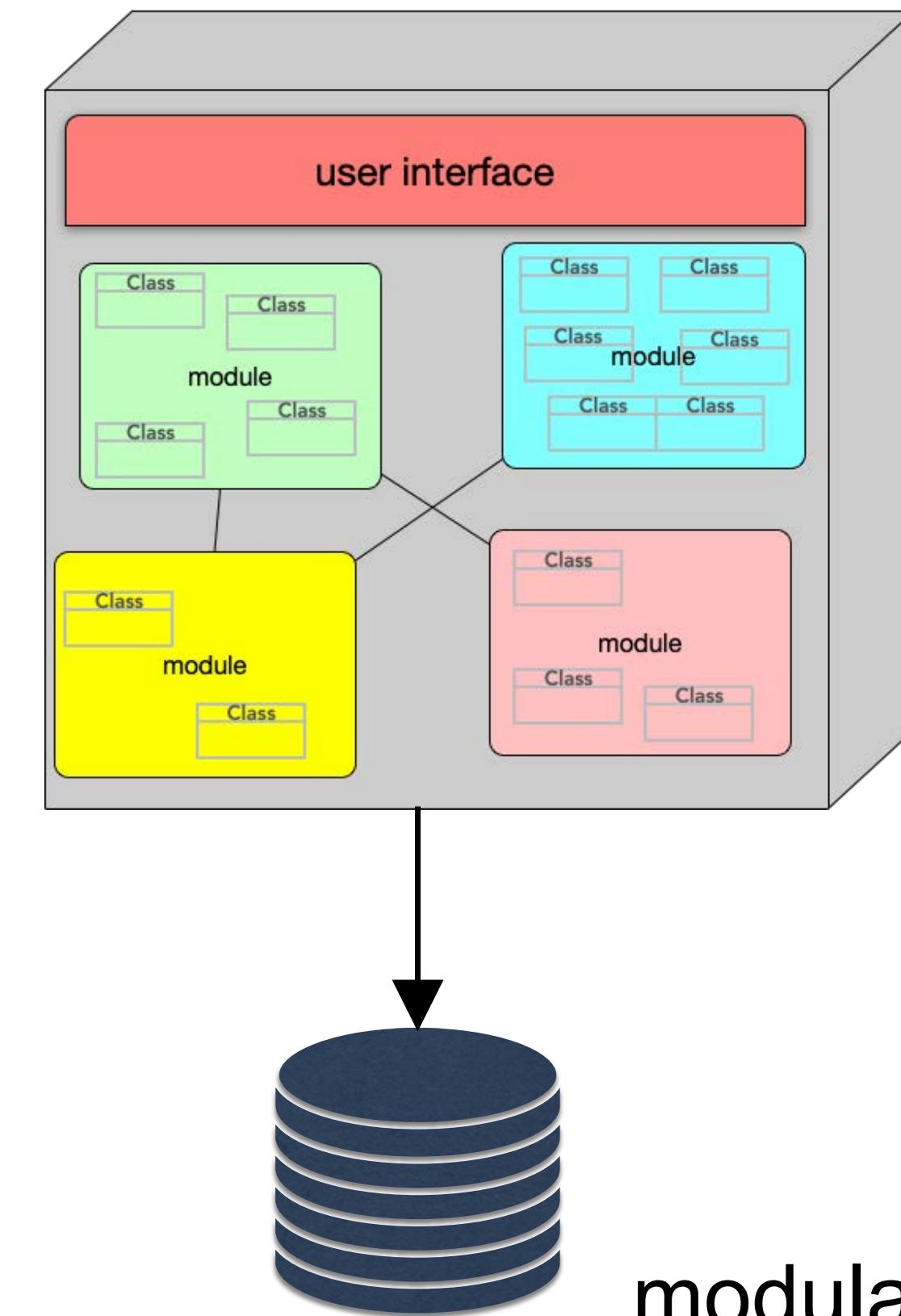
# Partitioning

*technical partitioning*



layered  
architecture

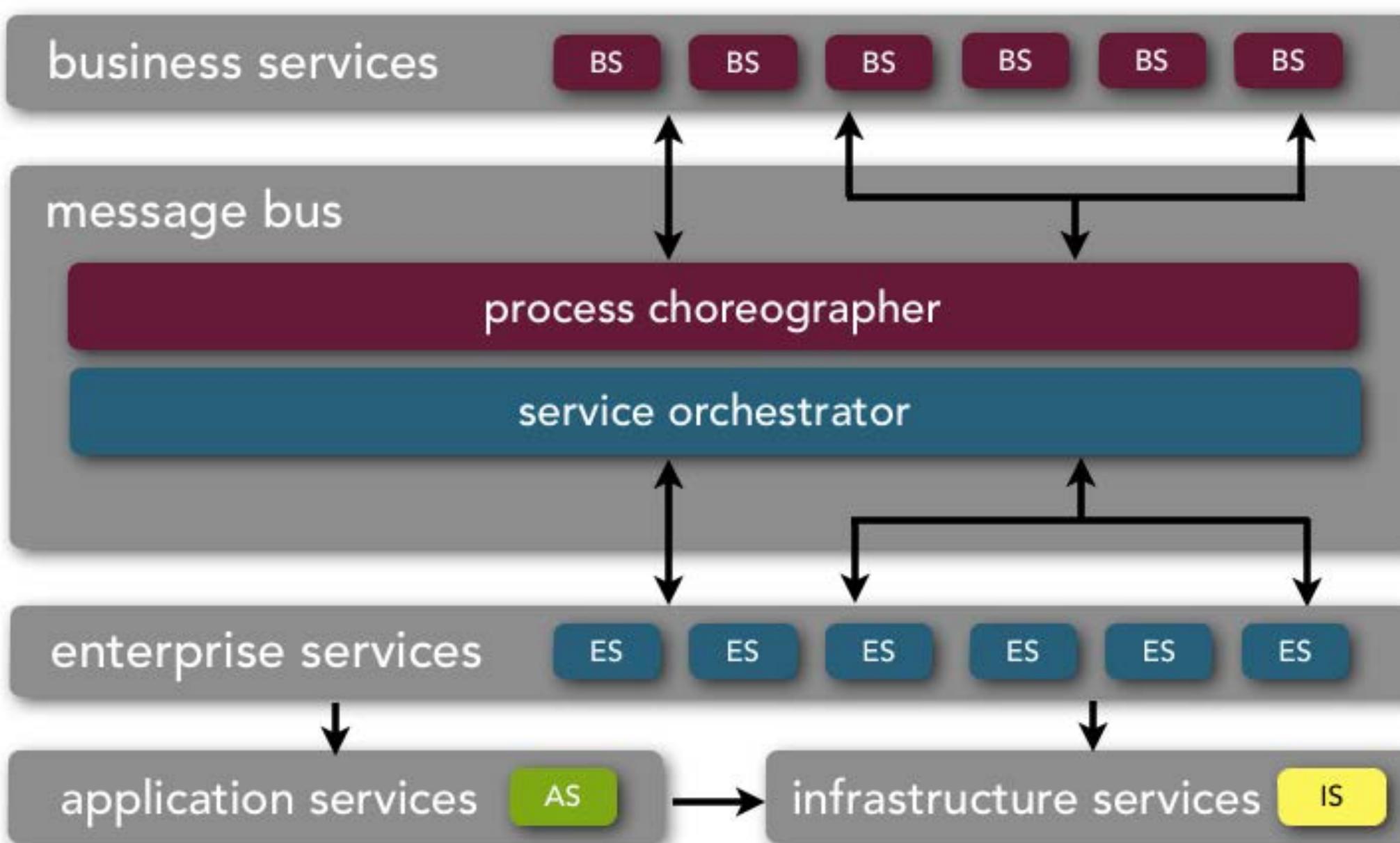
*domain partitioning*



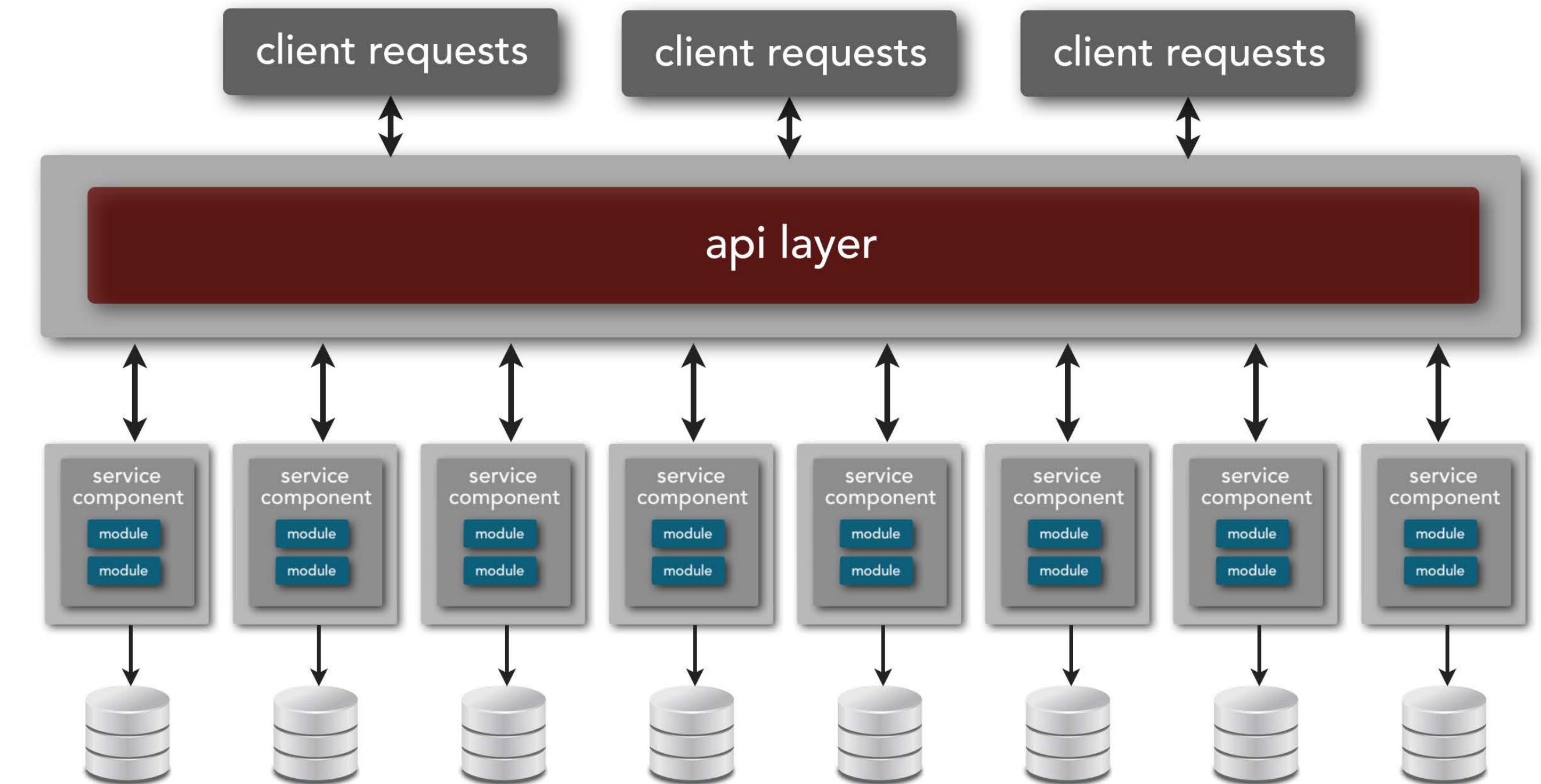
modular monolith

# Partitioning

*technical partitioning*



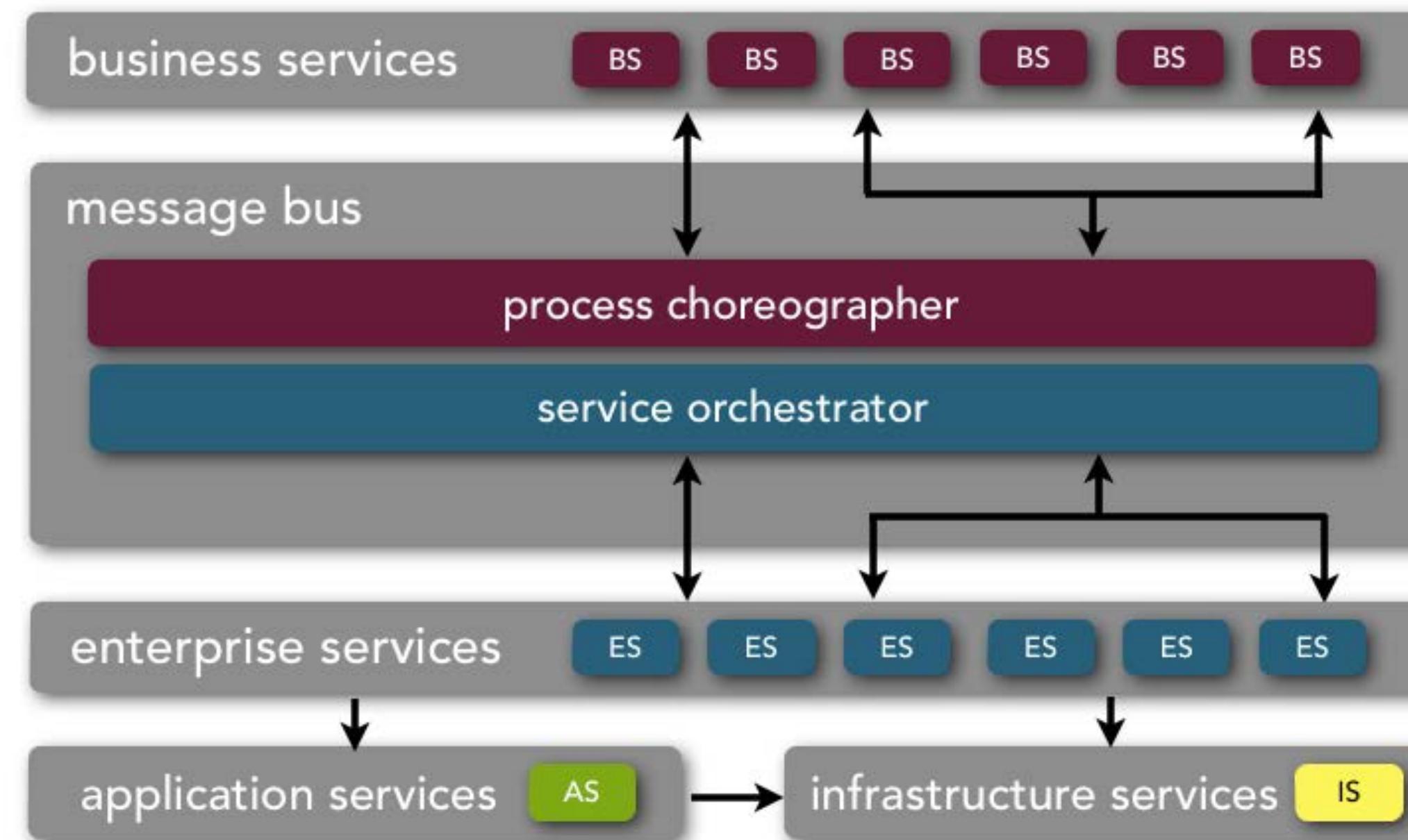
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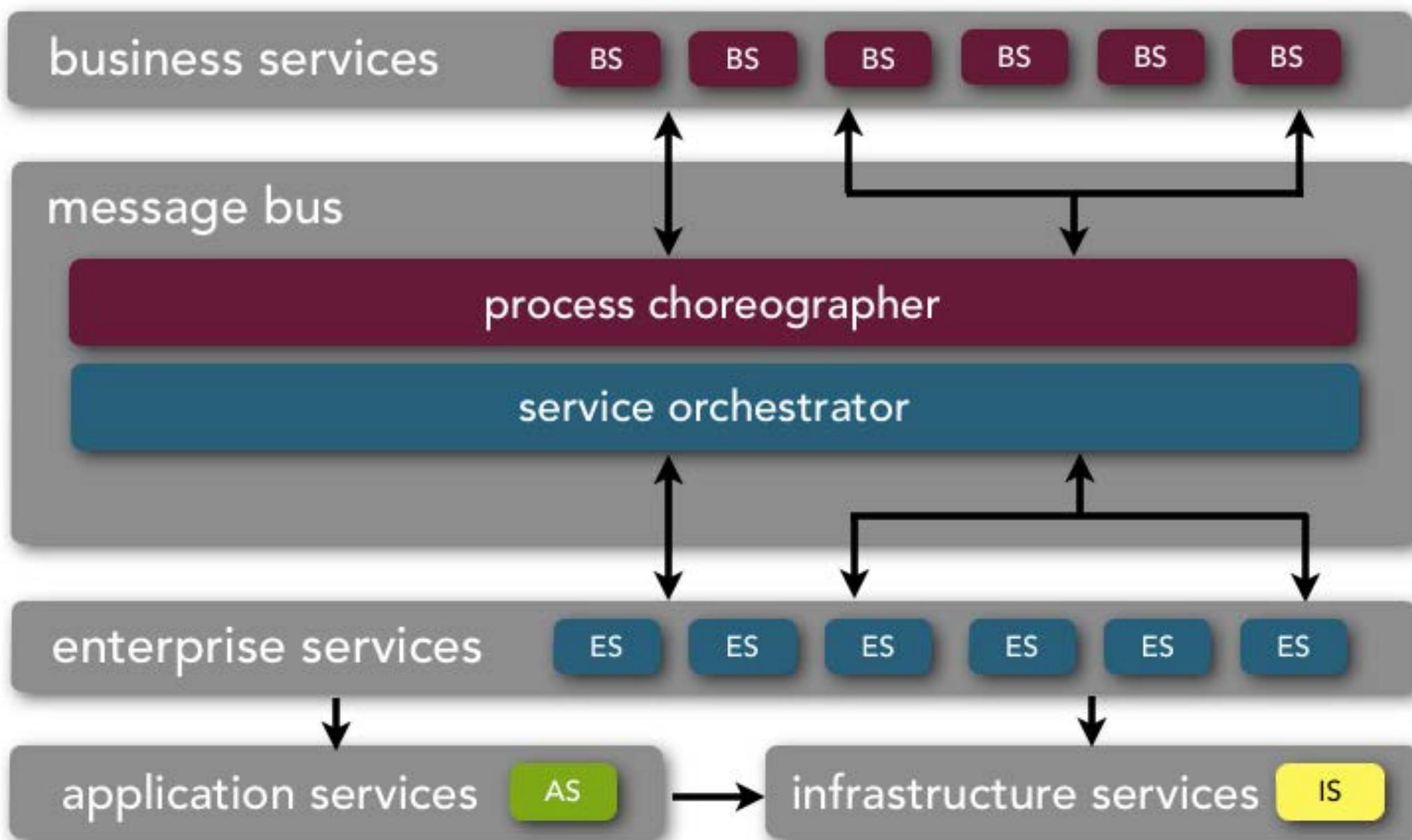


# Mediator or Broker?

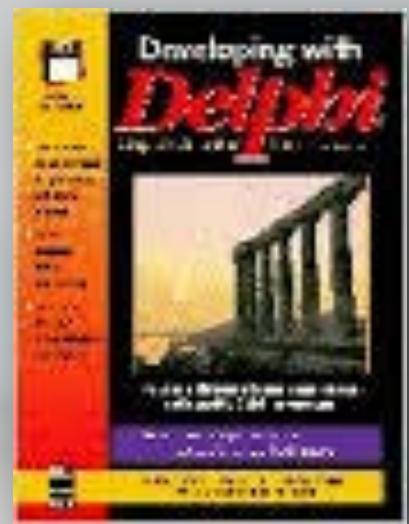
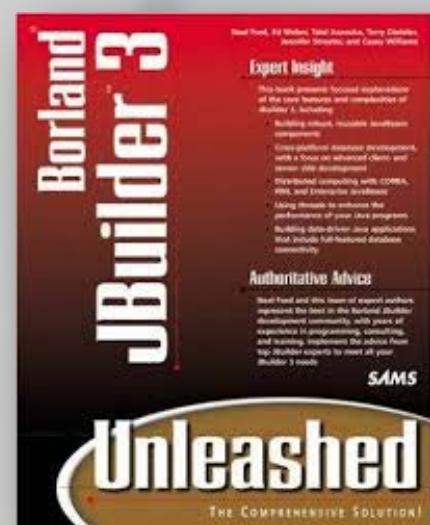
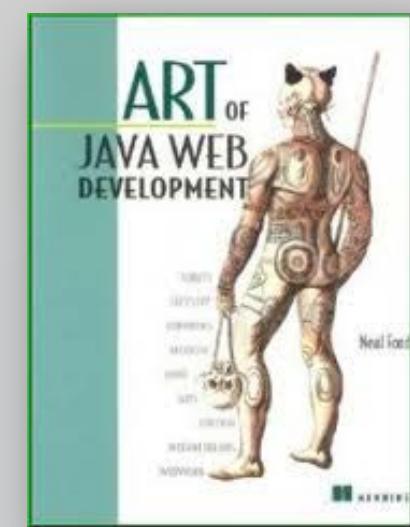
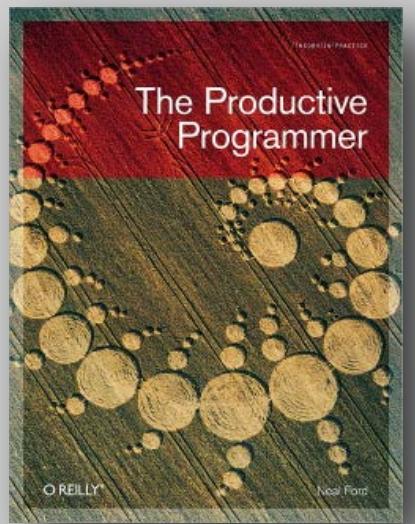
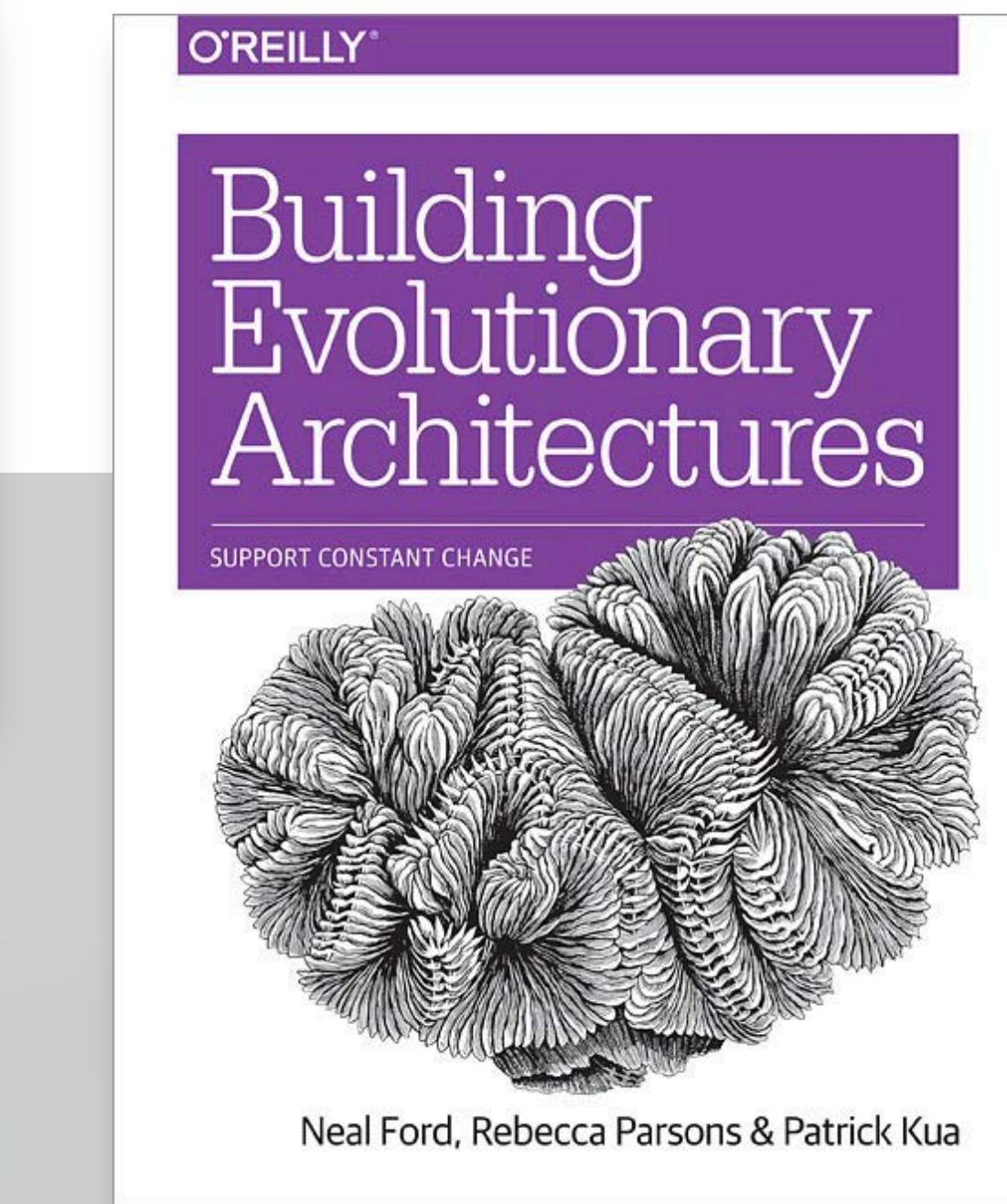
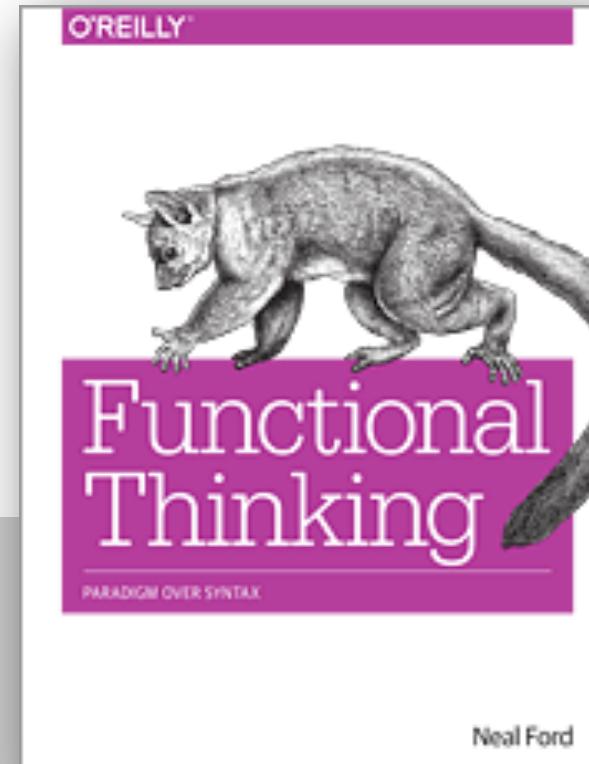
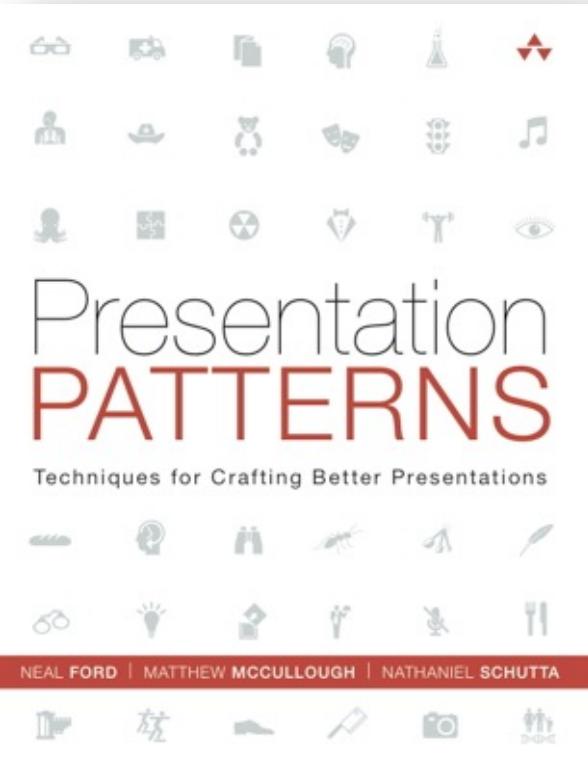
# Everything tends towards high coupling!



# Everything tends towards high coupling!



Don't recreate  
Enterprise Service Buses



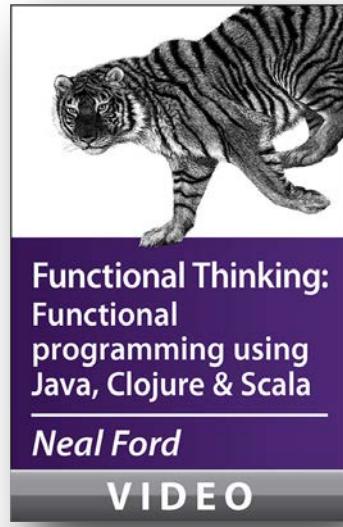
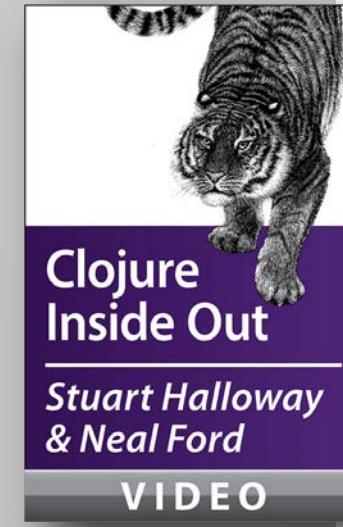
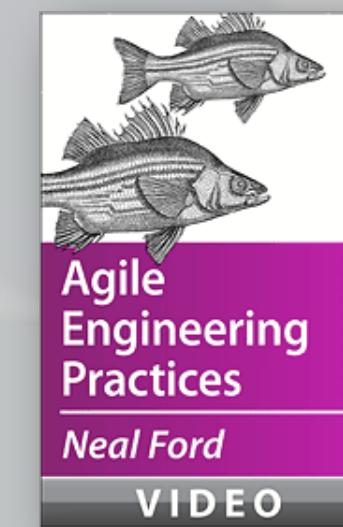
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