Software Architecture by Example

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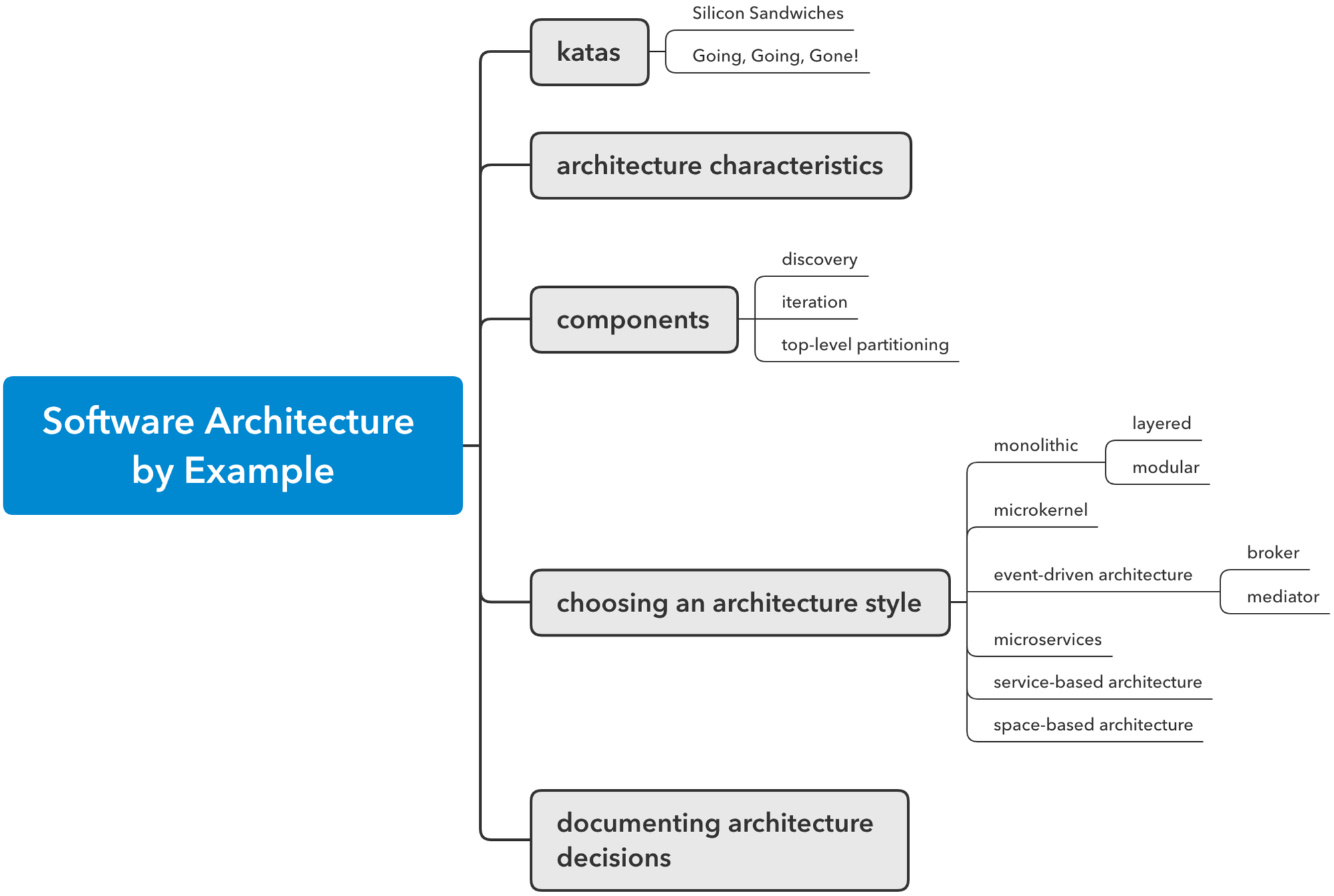
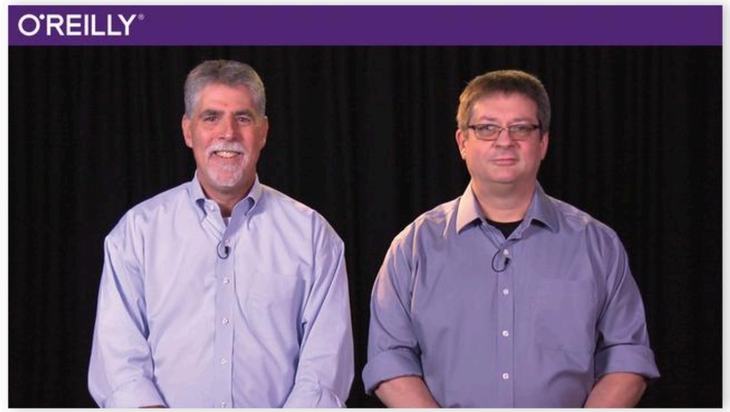

Software Architecture by Example
katas
Silicon Sandwiches
Going, Going, Gone!
architecture characteristics
components
discovery
iteration
top-level partitioning
choosing an architecture style
monolithic
layered
modular
microkernel
event-driven architecture
broker
mediator
microservices
service-based architecture
space-based architecture
documenting architecture decisions

course references



Software Architecture Fundamentals, Second Edition

★★★★★ 9 reviews

by Mark Richards, Neal Ford

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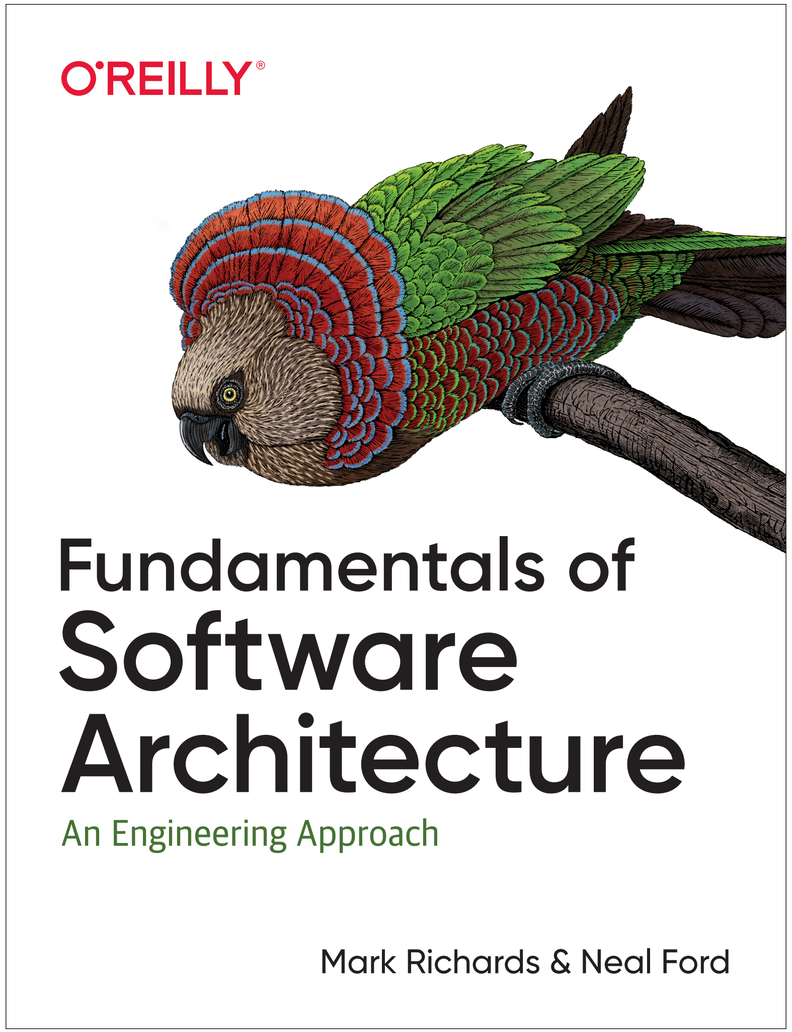
https://learning.oreilly.com/library/view/software-architecture-fundamentals/9781491998991/

course references



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Silicon Sandwiches

A national sandwich shop wants to enable internet-ordering (in addition to their current call-in service)

- ***Users:*** thousands, perhaps one day millions
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  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
  - Time to market is critical.

First Law of Software Architecture:

Everything in software architecture is a tradeoff.

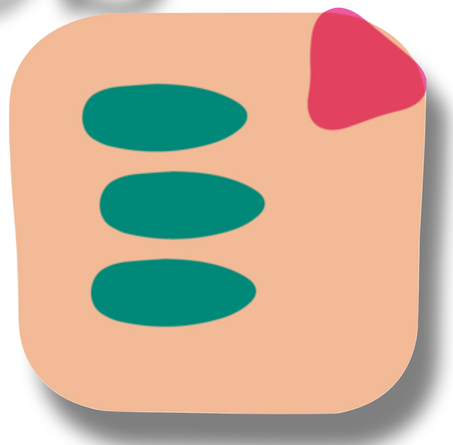
First Law of Software Architecture:

Everything in software architecture is a tradeoff.

First Corollary:

If you think you've found something that *isn't* a tradeoff, it just means you haven't identified the tradeoff…yet.

architecture characteristics



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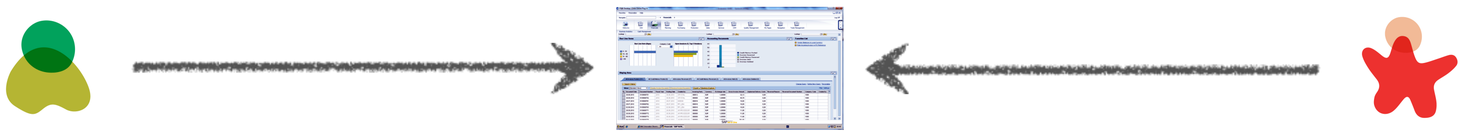

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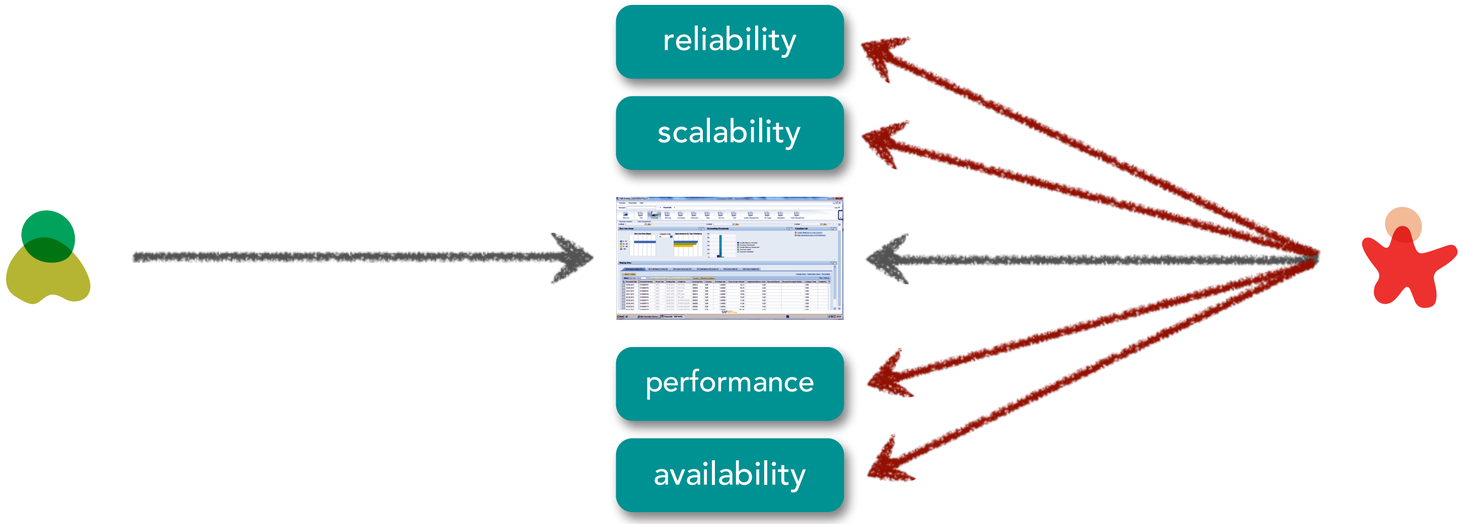

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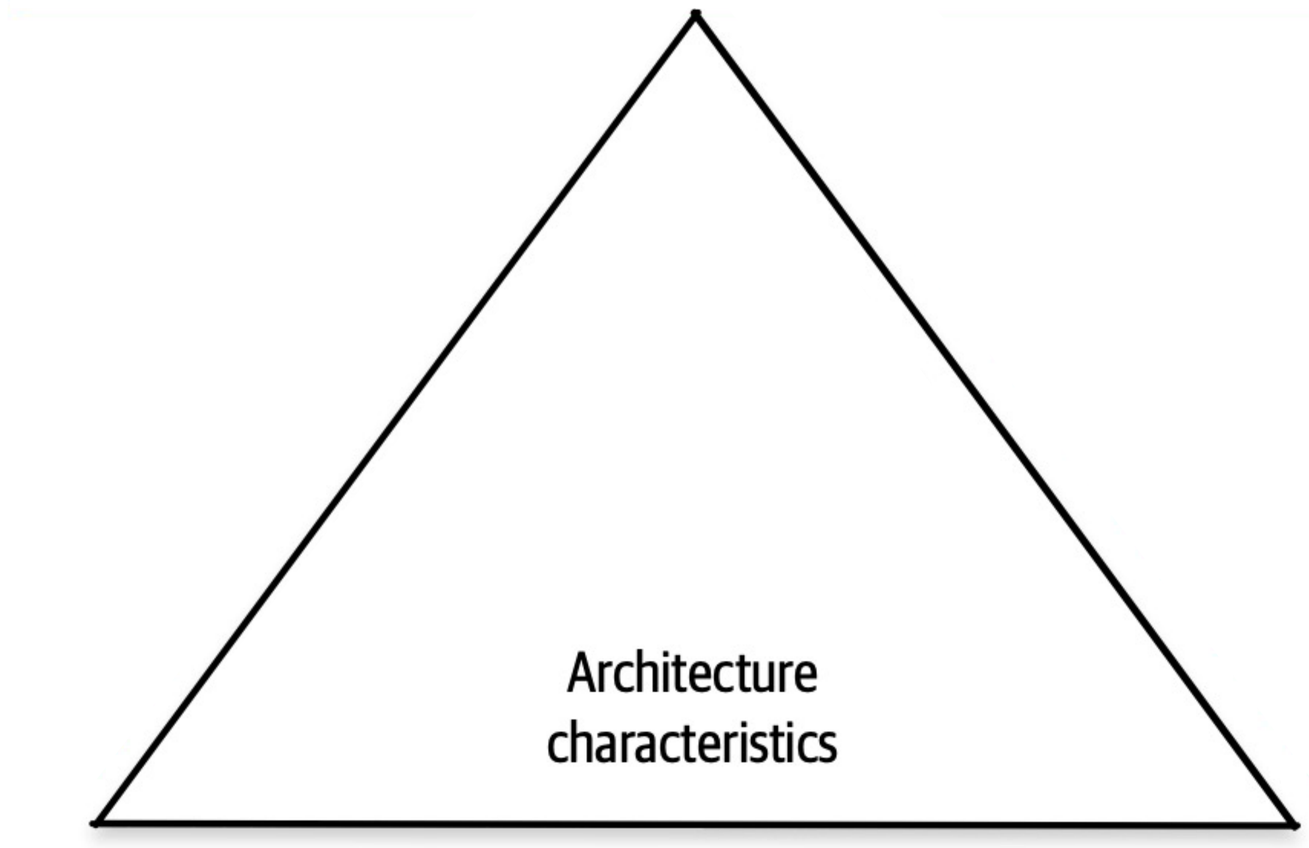
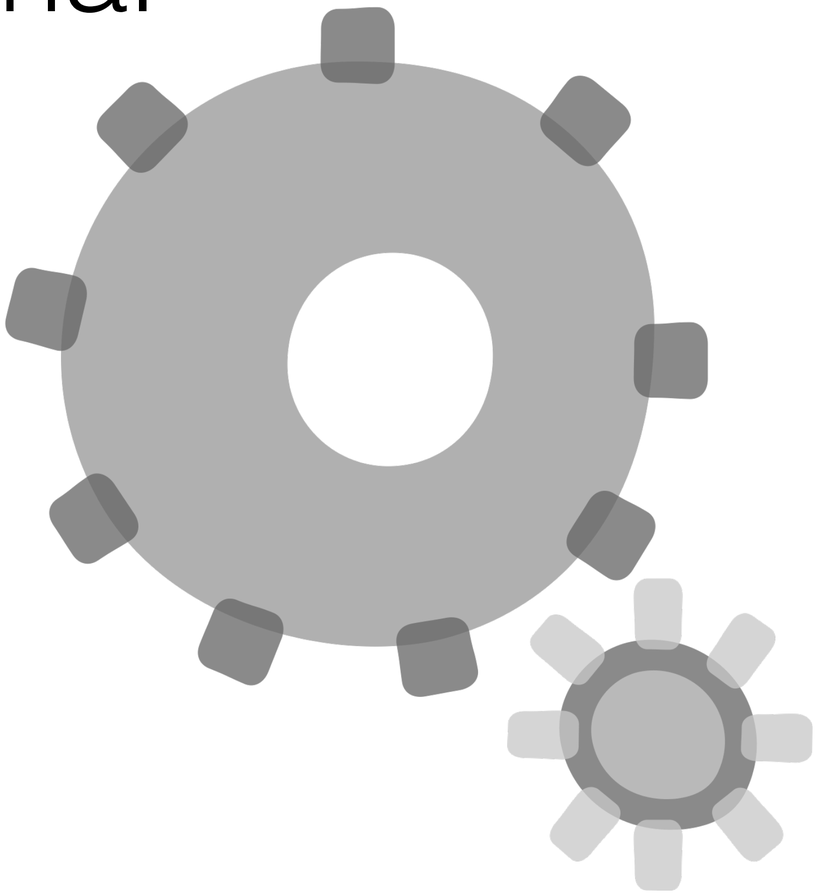


architecture characteristics

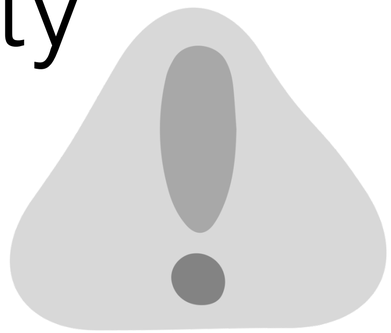
operational



Performance
Scalability
Elasticity
Reliability

architecture characteristics

quality



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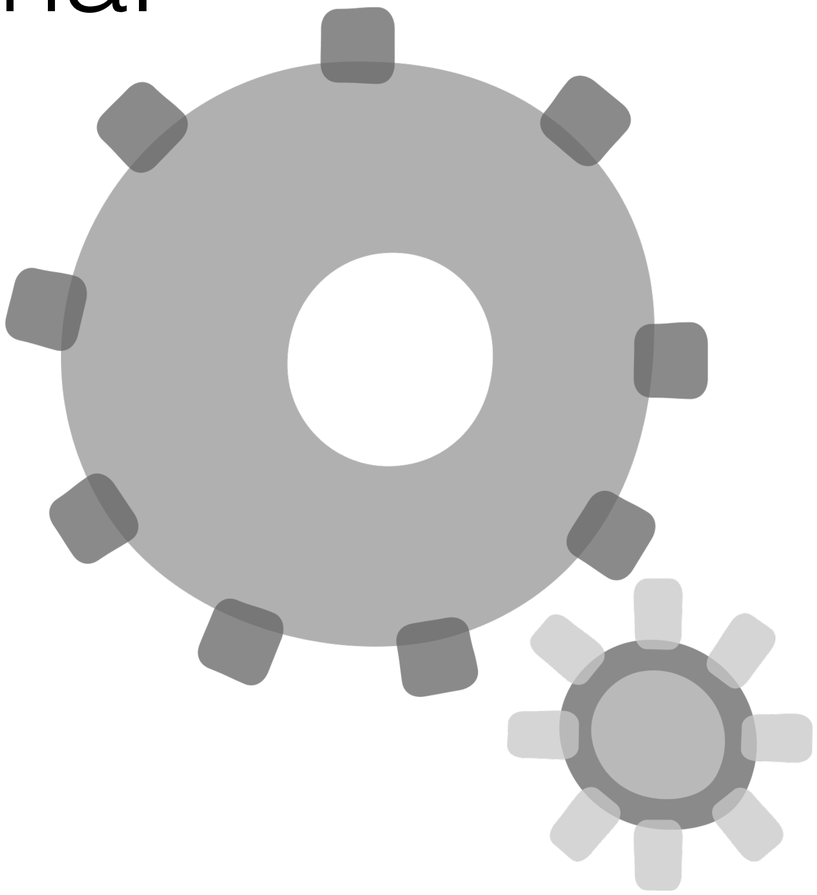

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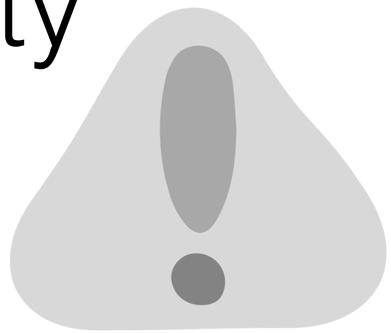

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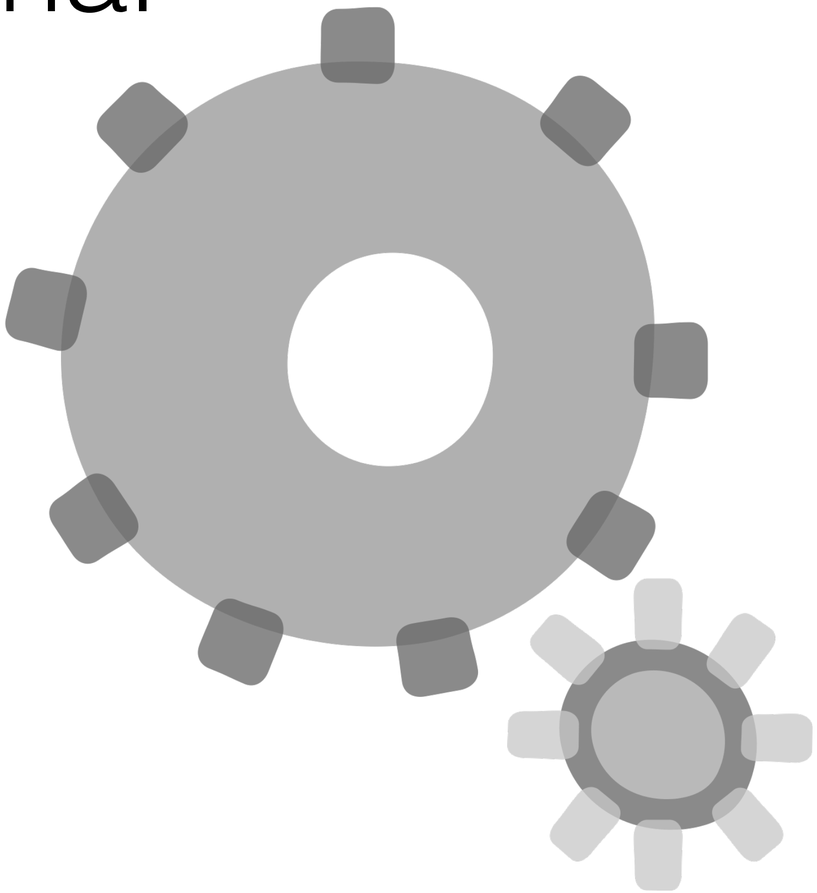
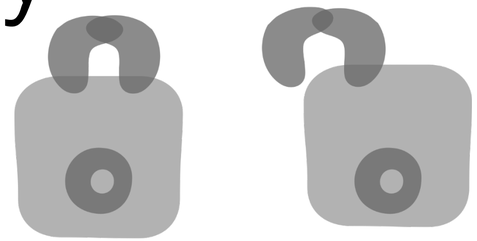
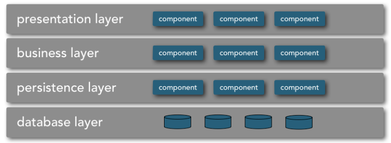


security

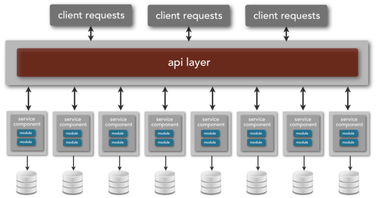


architecture characteristics

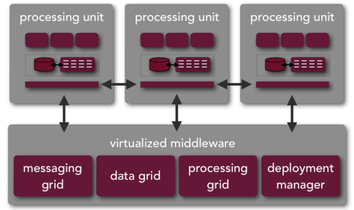
feasibility



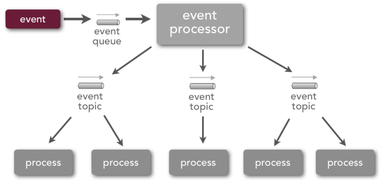
agility

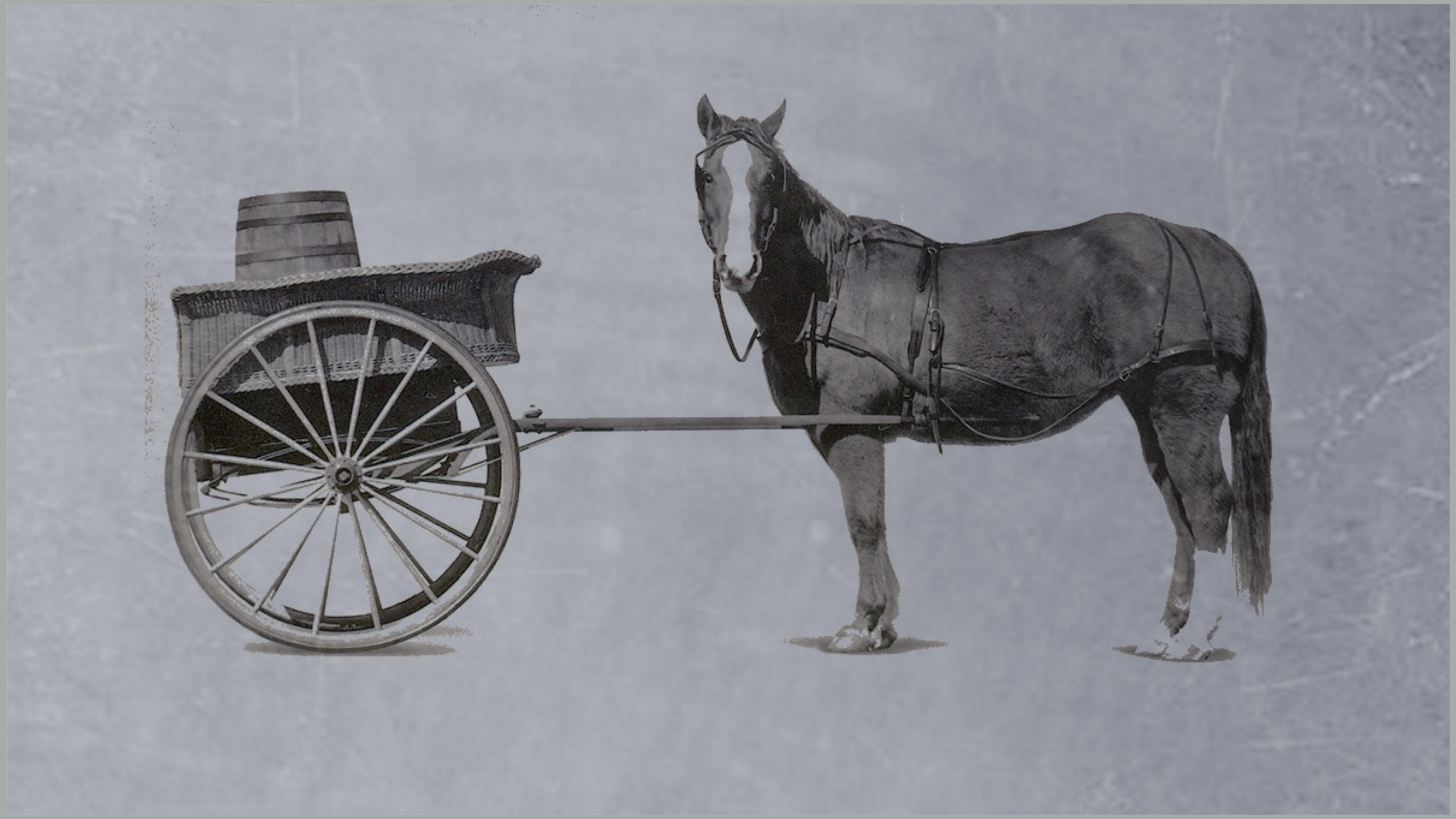


elasticity



scalability





architecture katas

identifying driving characteristics

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- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
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availability reliability performance

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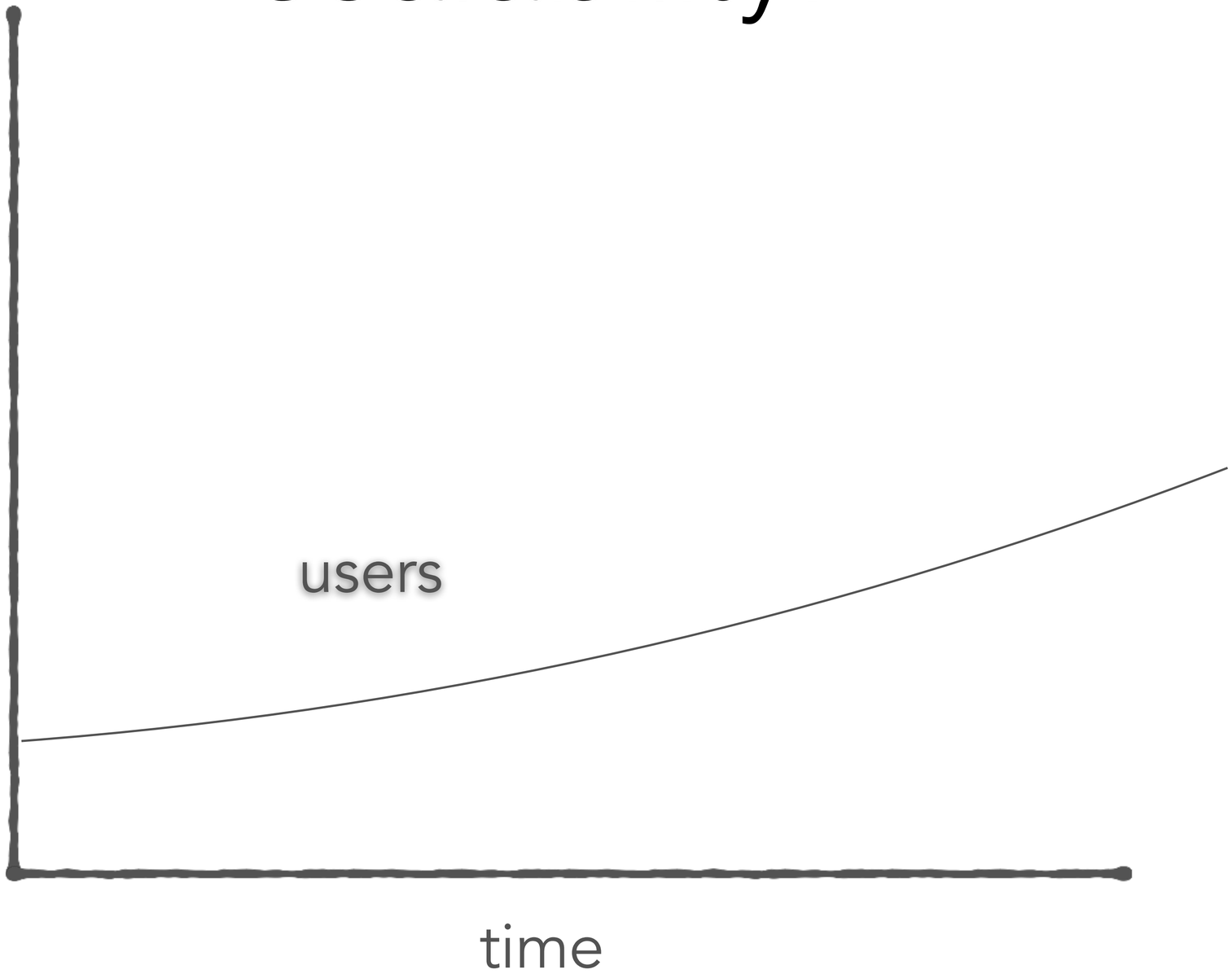
availability reliability performance scalability elasticity

scalability:



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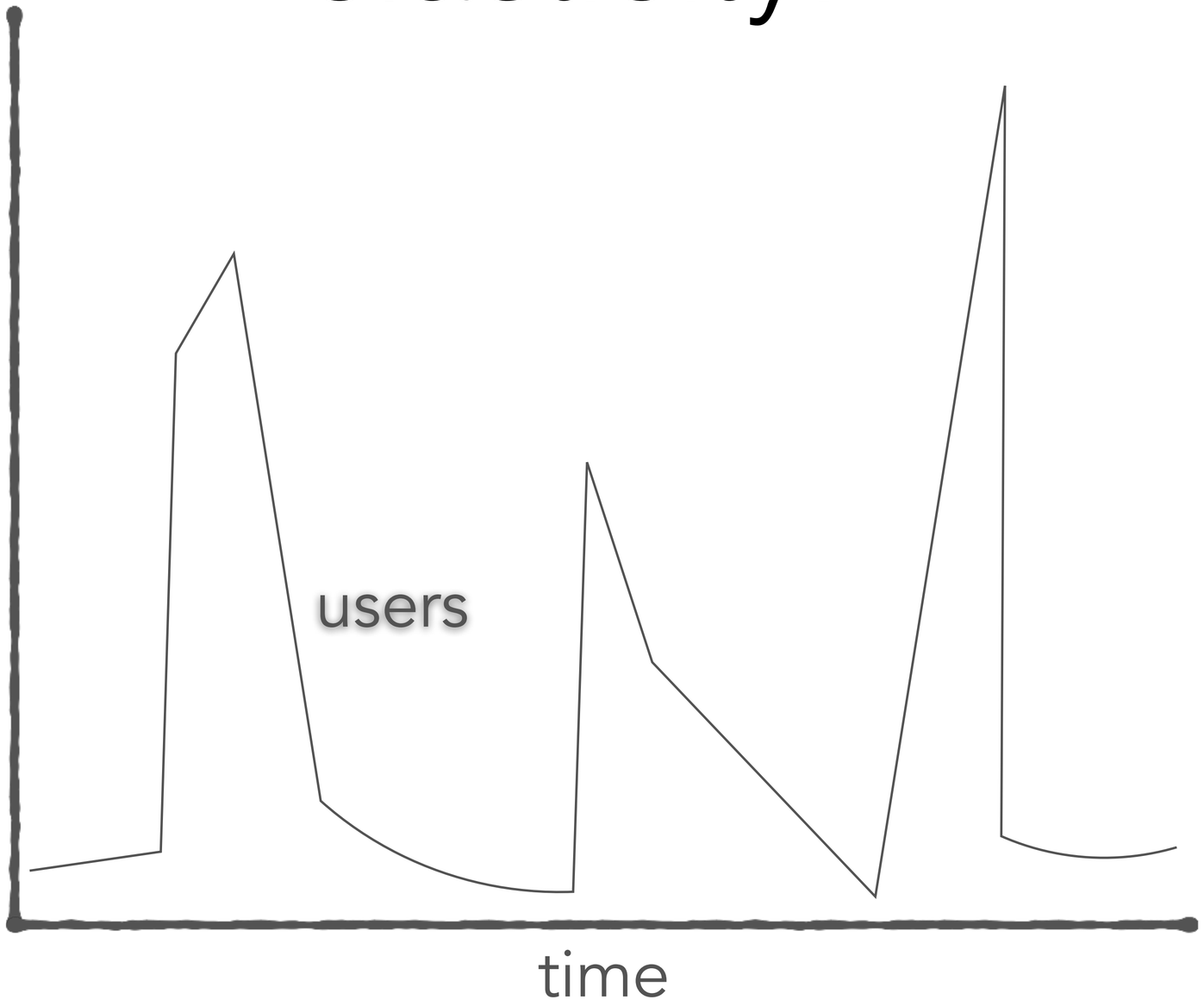

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availability reliability performance scalability elasticity (security)

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- ***Additional Context:***
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performance availability reliability

scalability elasticity i18n l10n

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performance availability reliability

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Global Customizability Local Customizability

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performance availability reliability

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Customizability { location, sales, recipe

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  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
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architecture katas

identifying major components

Your Architectural Kata is...

Going Going Gone!

An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotionals/specials
  - offer local daily promotionals/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
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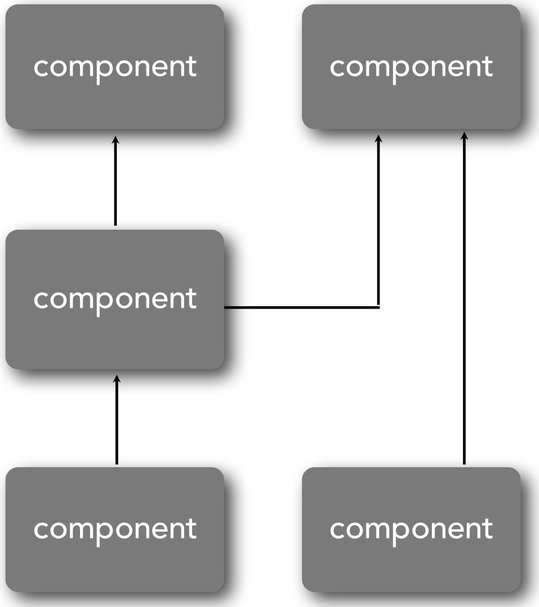
component identification

as an architect, you should think about the artifacts within the architecture in terms of *components*



component:

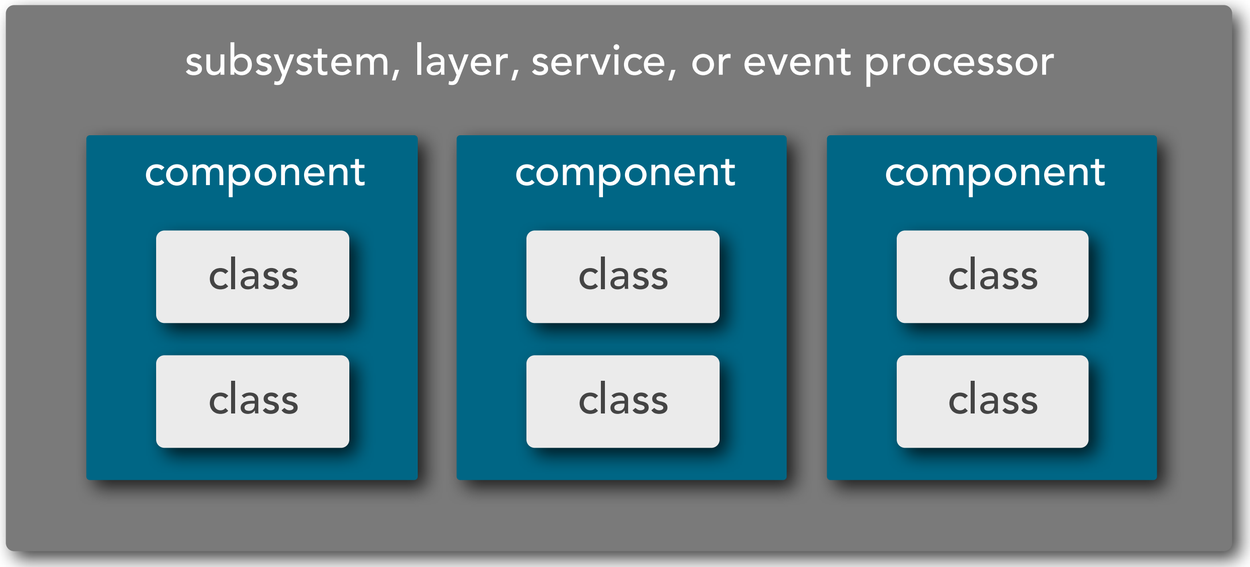
building block of the application

well defined set of operations

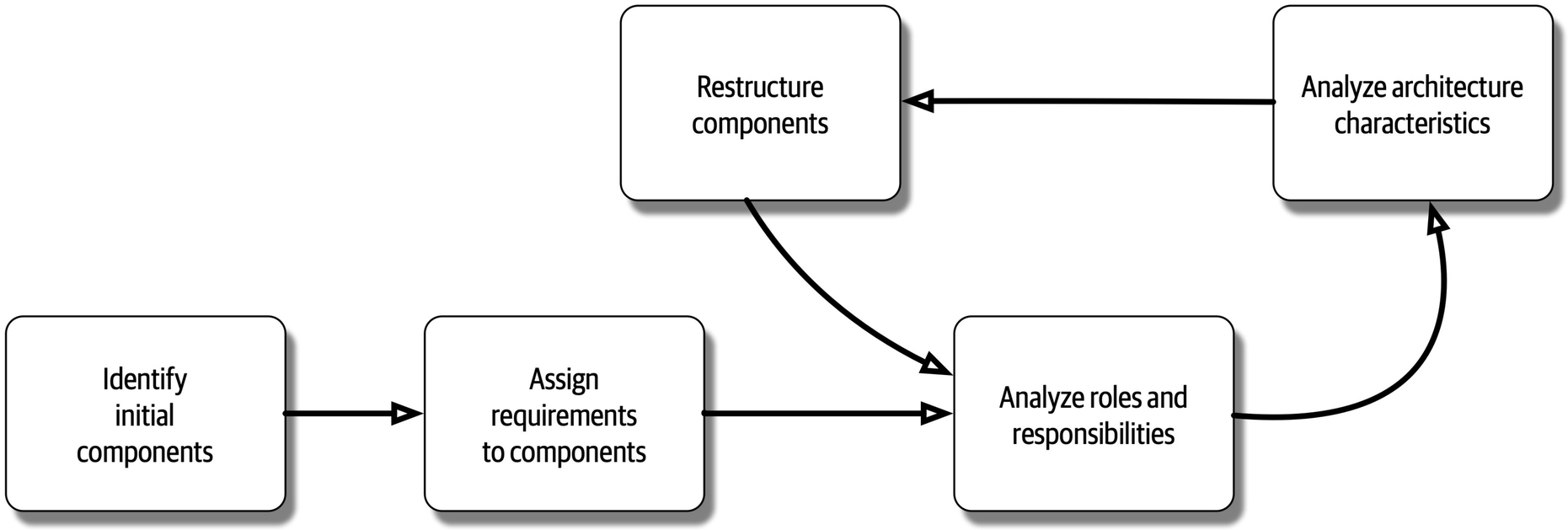
well defined role and responsibility

component identification

component scope



component identification



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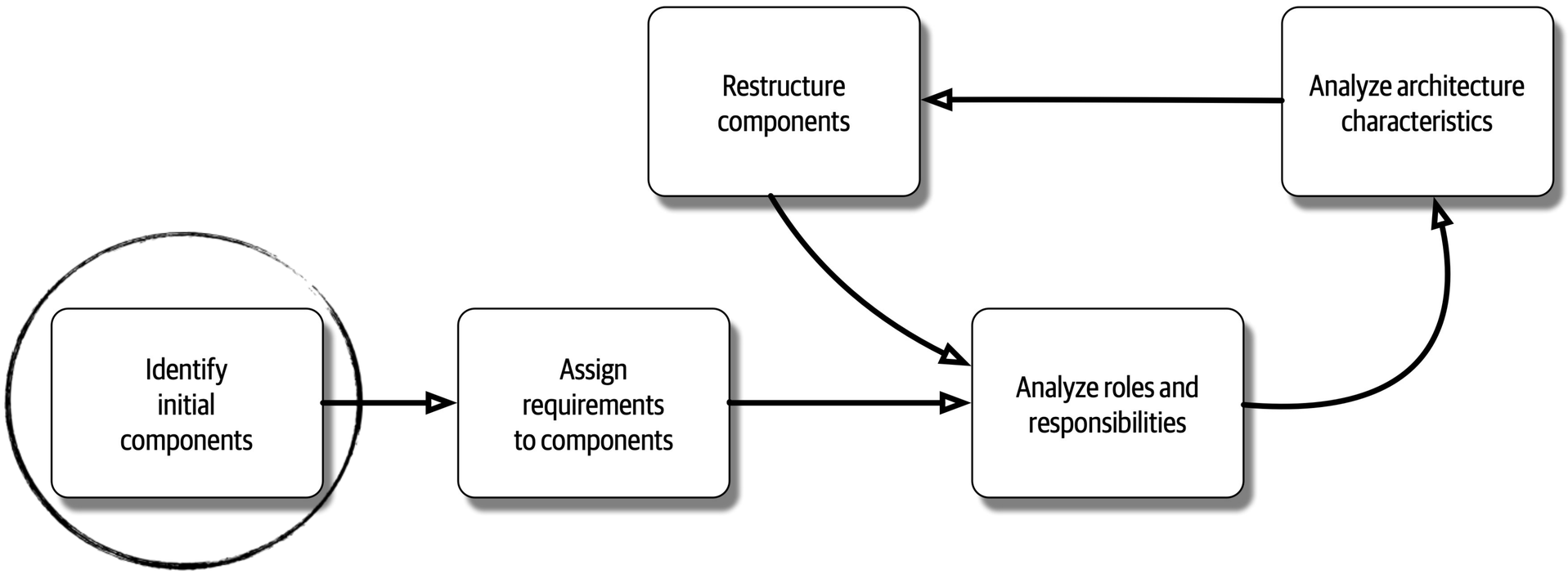


Your Architectural Kata is...

Going Going Gone!

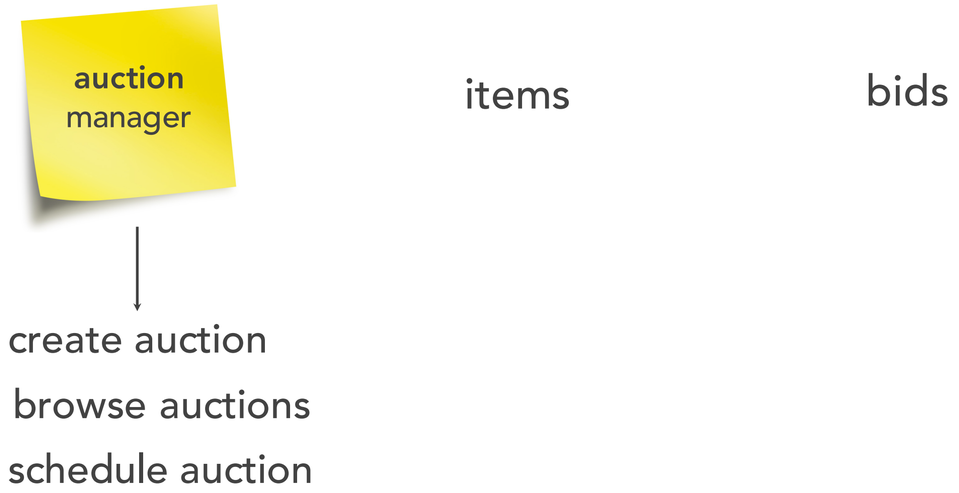
the “entity trap”

auctions items bids

Your Architectural Kata is...

Going Going Gone!

the “entity trap”



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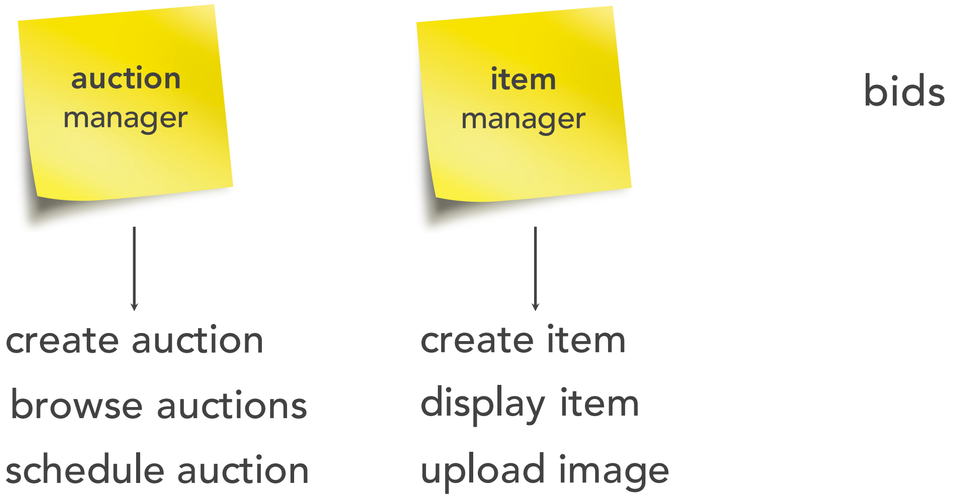

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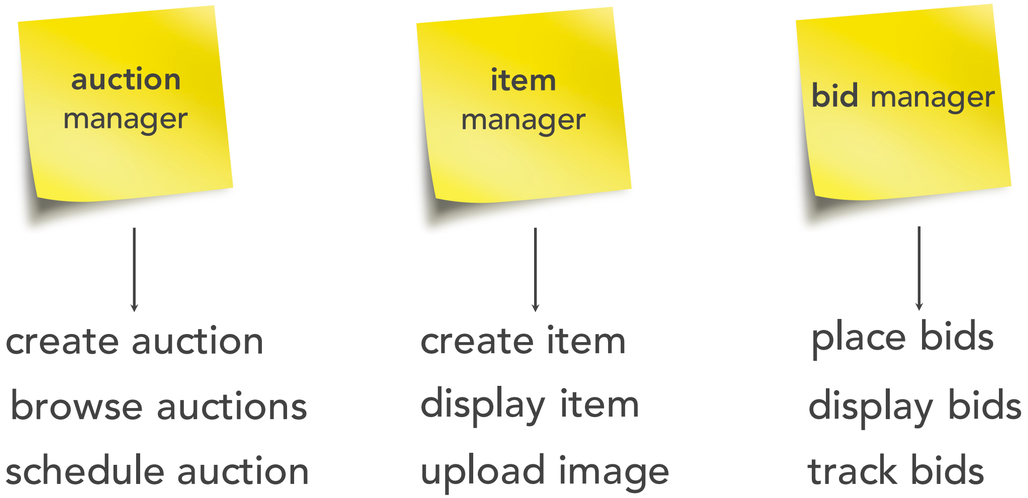

Your Architectural Kata is...

Going Going Gone!

workflow approach

create auction ⟶ find auction ⟶ sign up ⟶ watch auction ⟶ place bid

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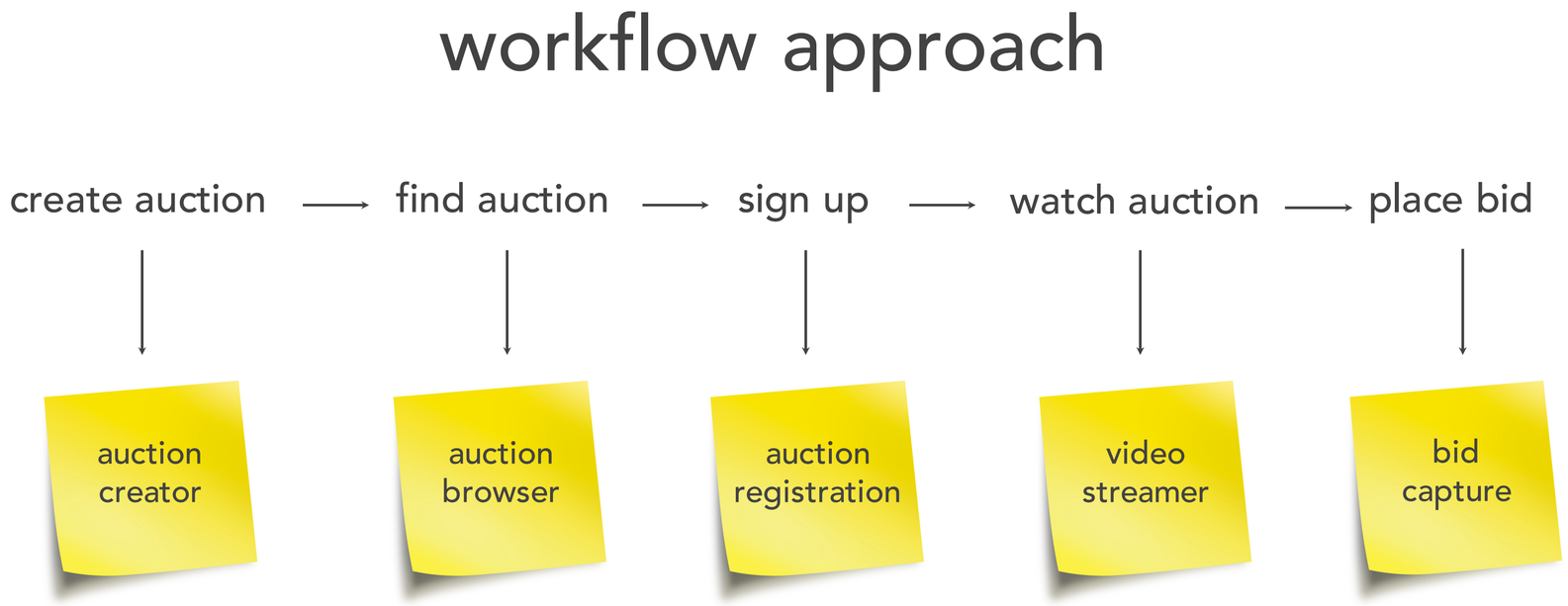

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

view live video stream

view live bid stream

place a bid

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

view live video stream
view live bid stream
place a bid

enter live bids into system
receive online bid
mark item as sold

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

view live video stream

view live bid stream

place a bid

auctioneer

enter live bids into system

receive online bid

mark item as sold

system

start auction

make payment

track bidder activity

Your Architectural Kata is...

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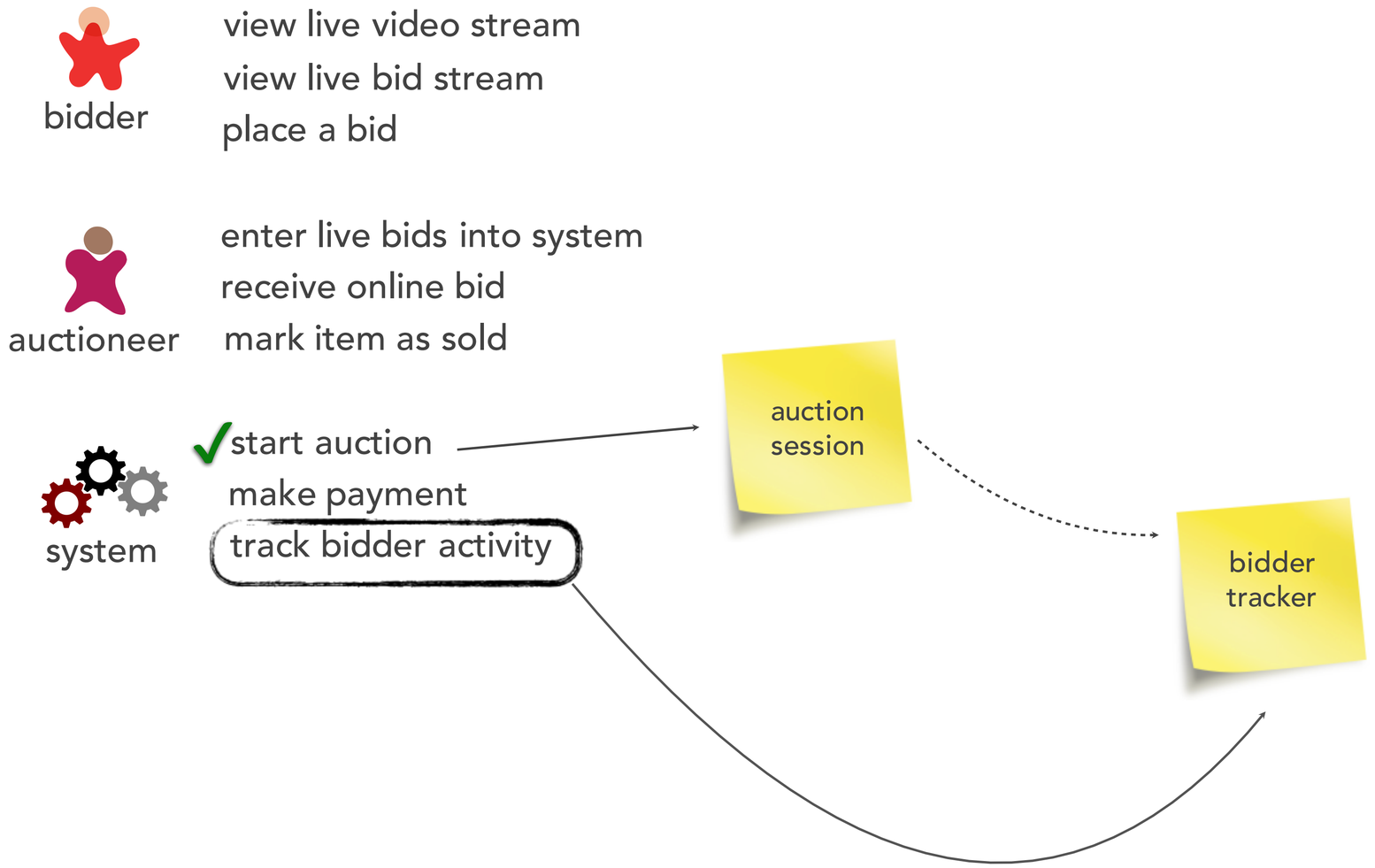

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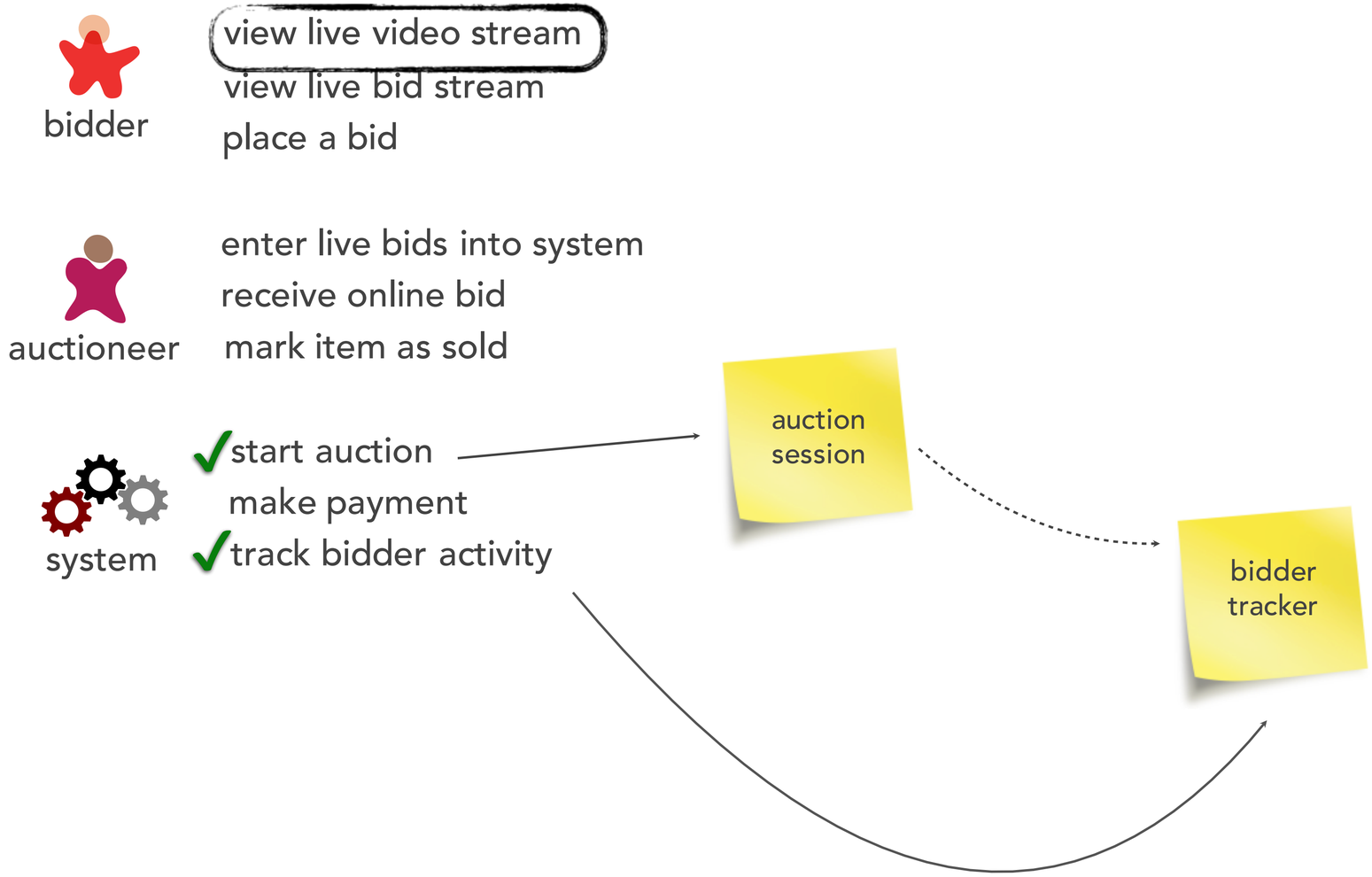

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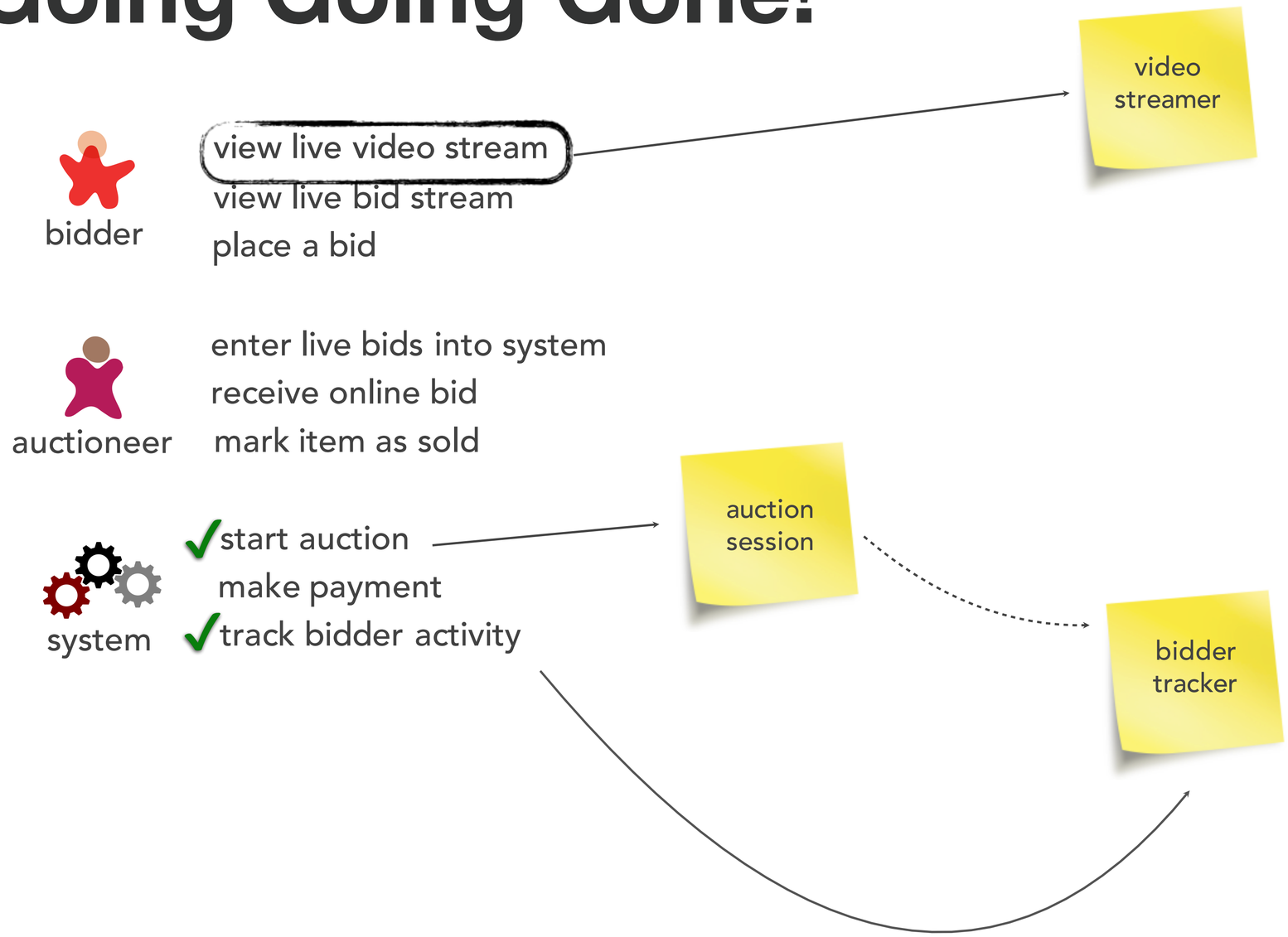

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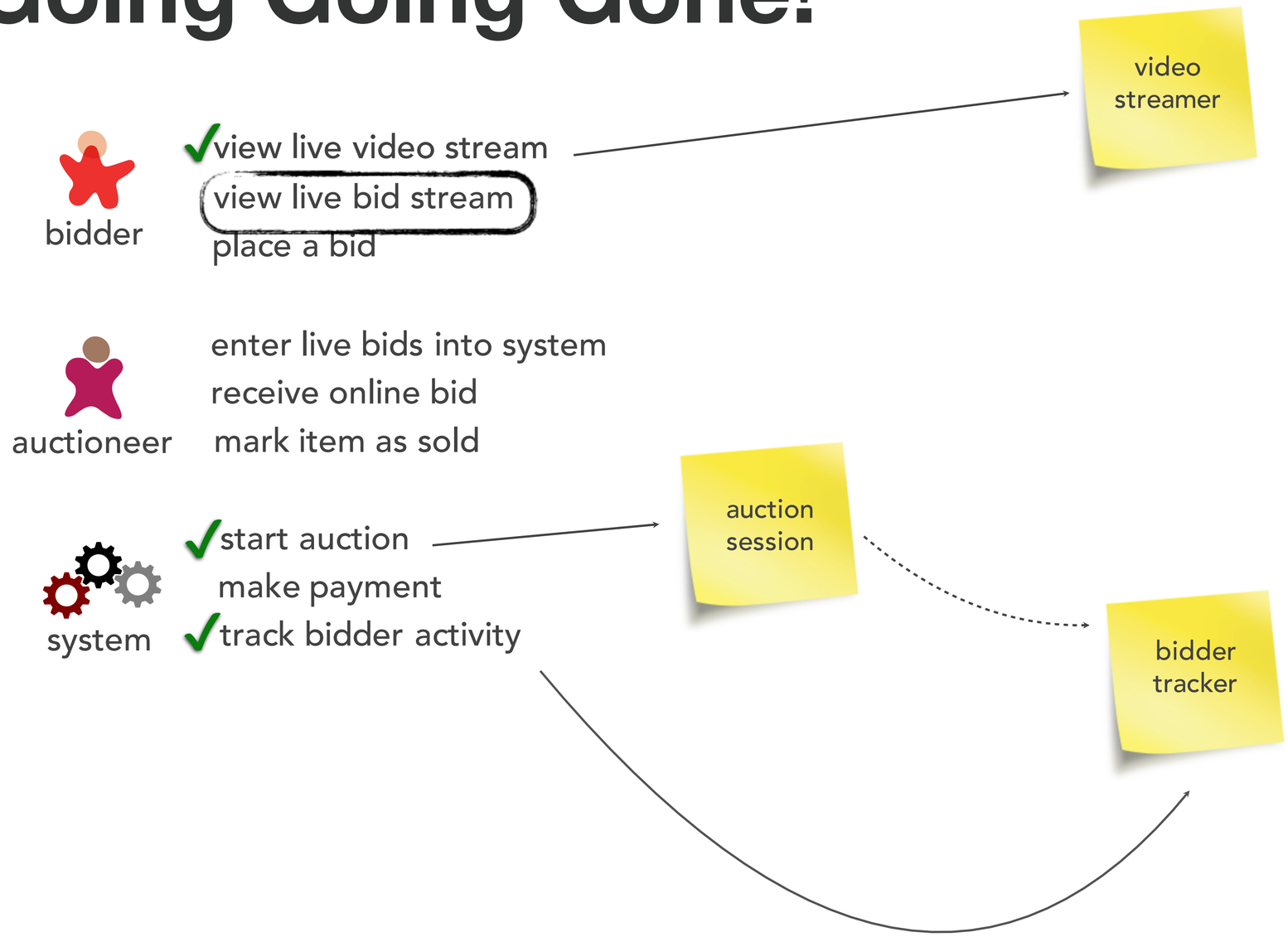

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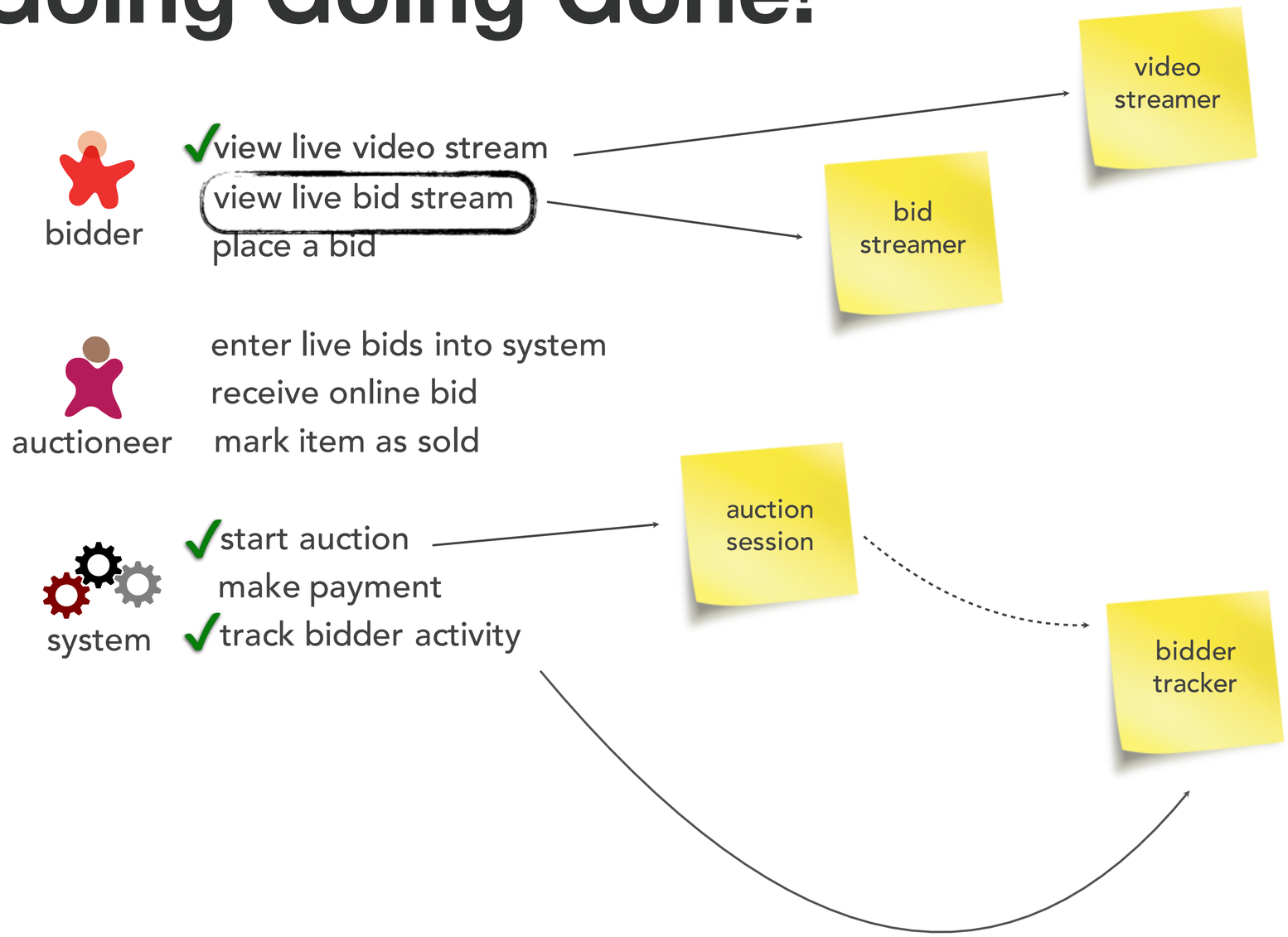

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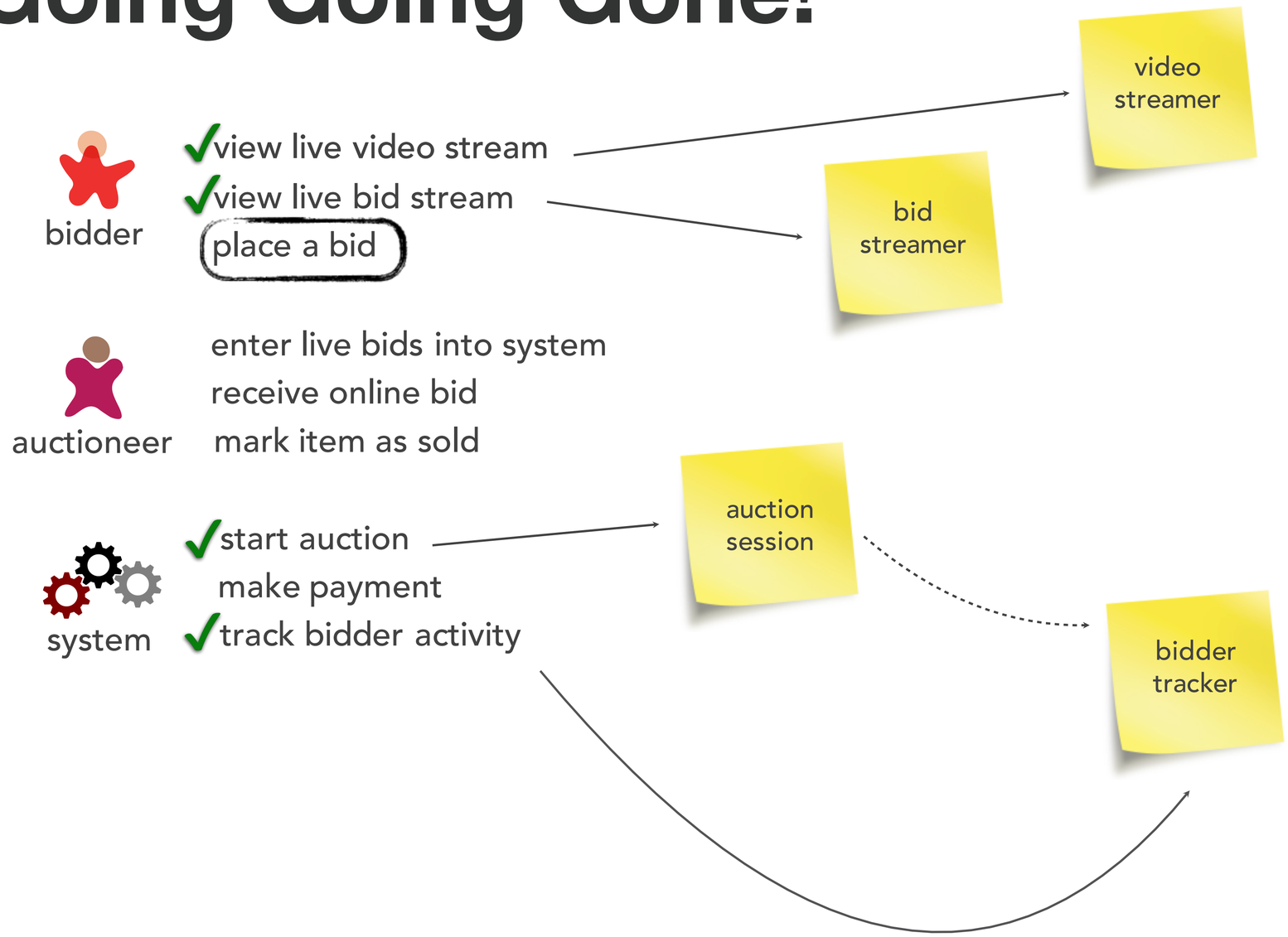

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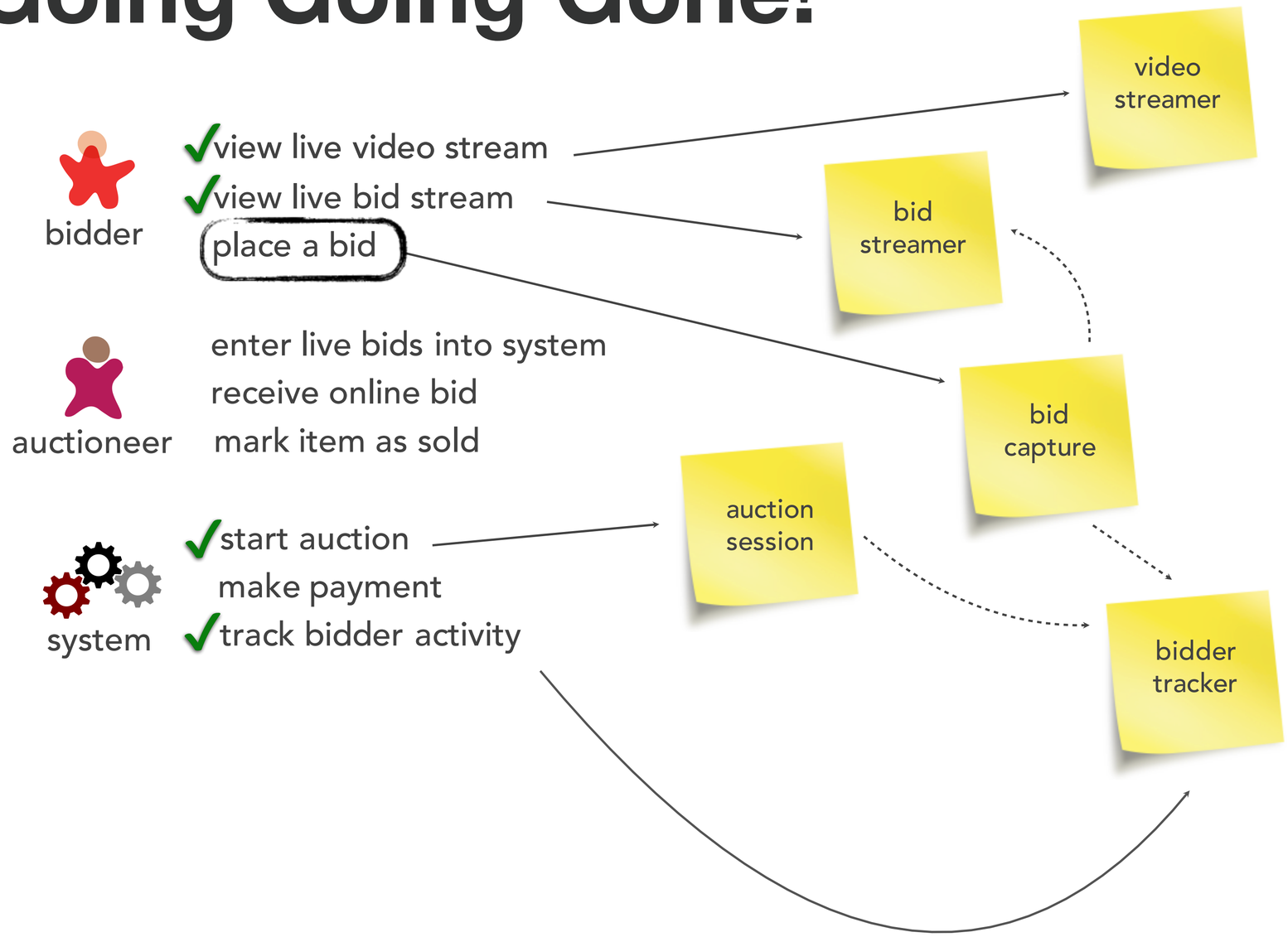

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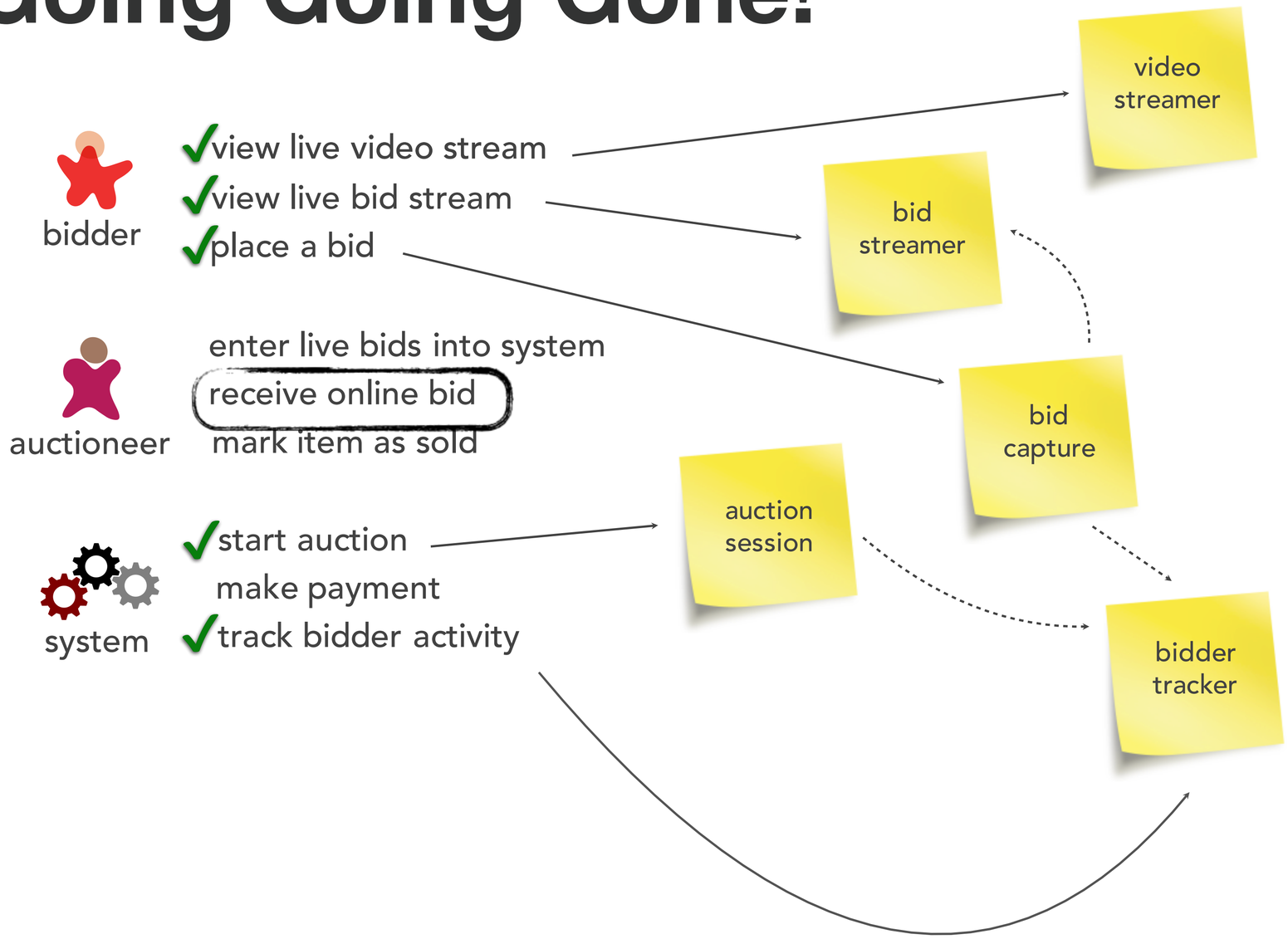

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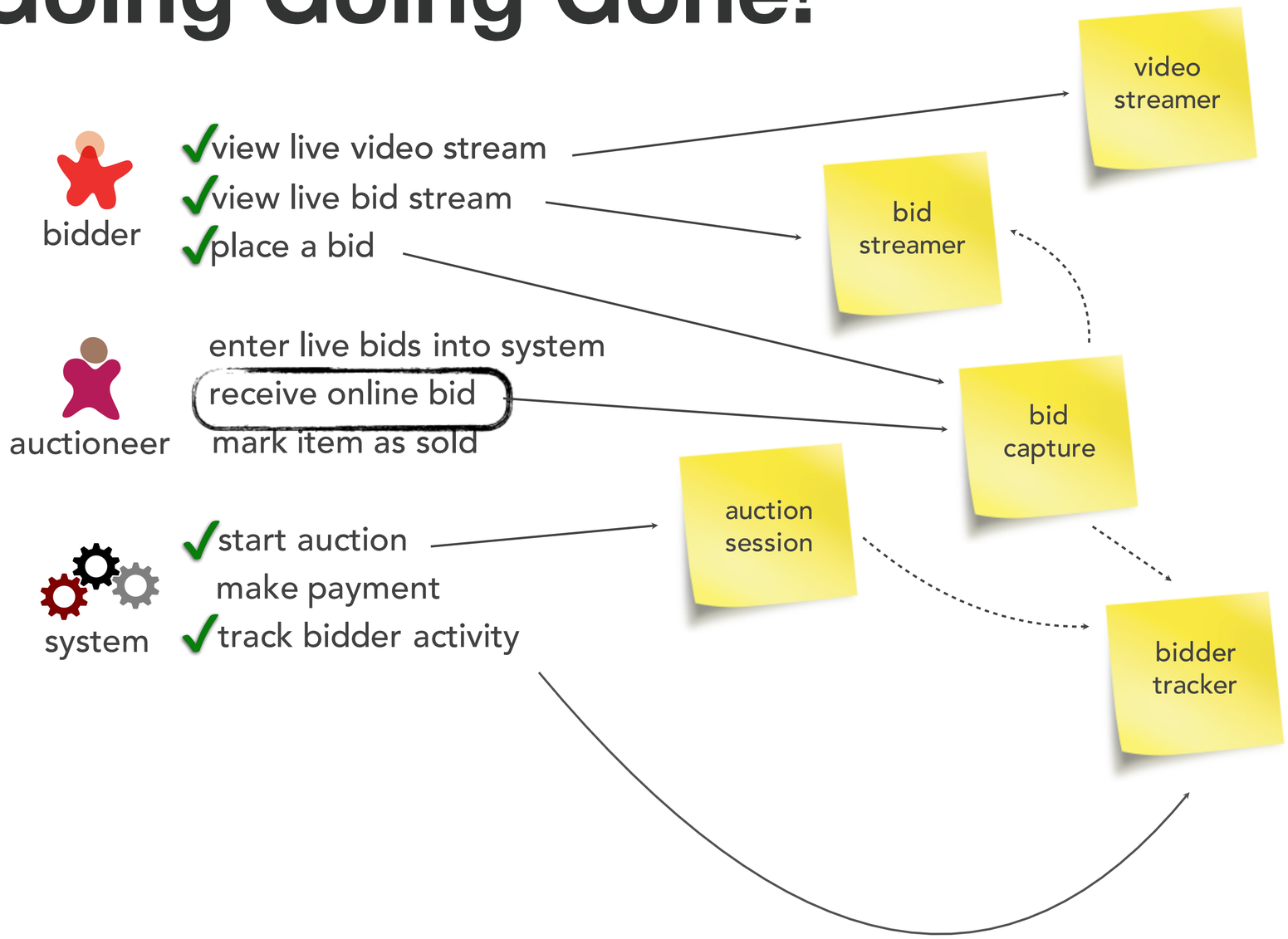

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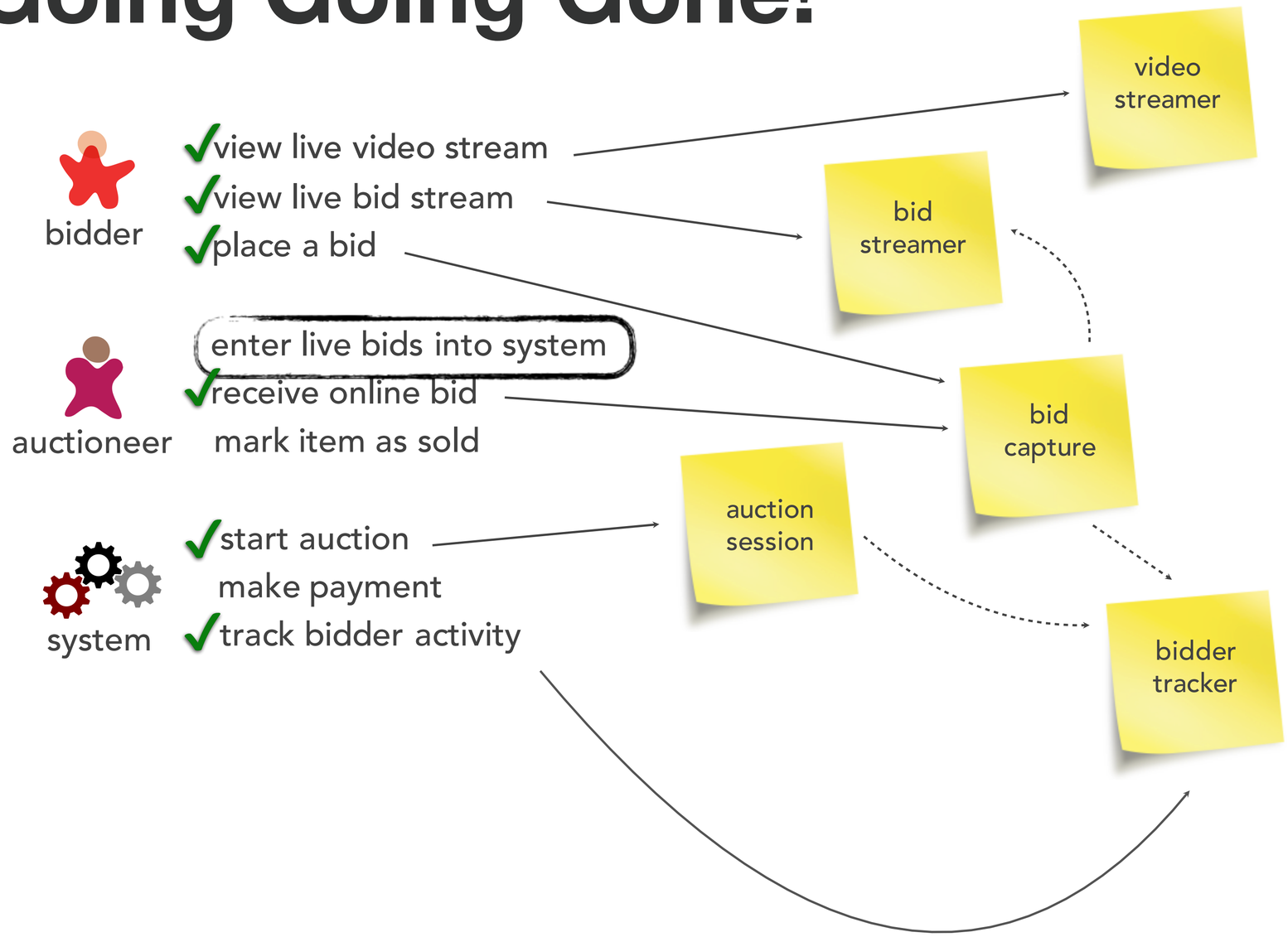

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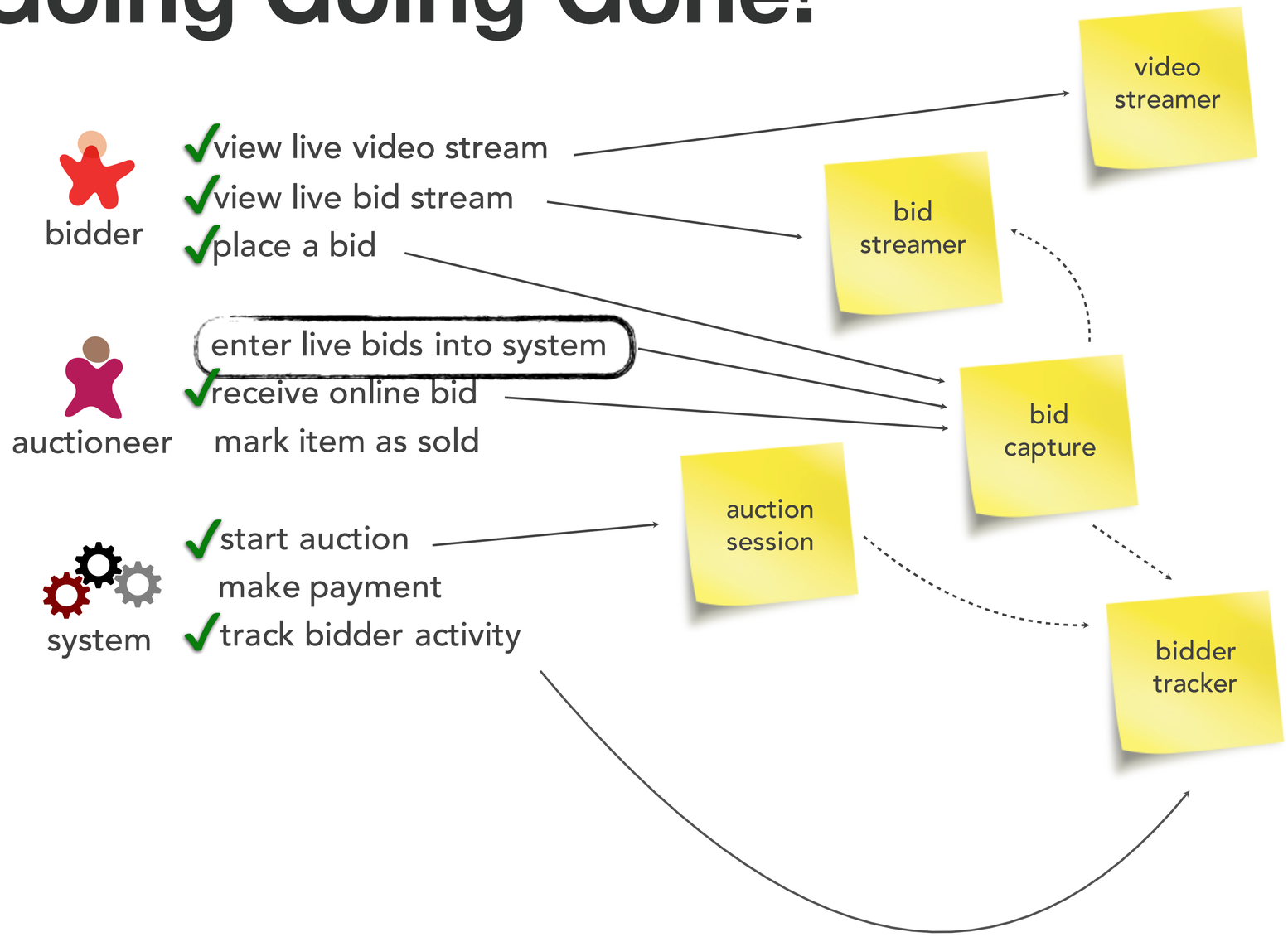

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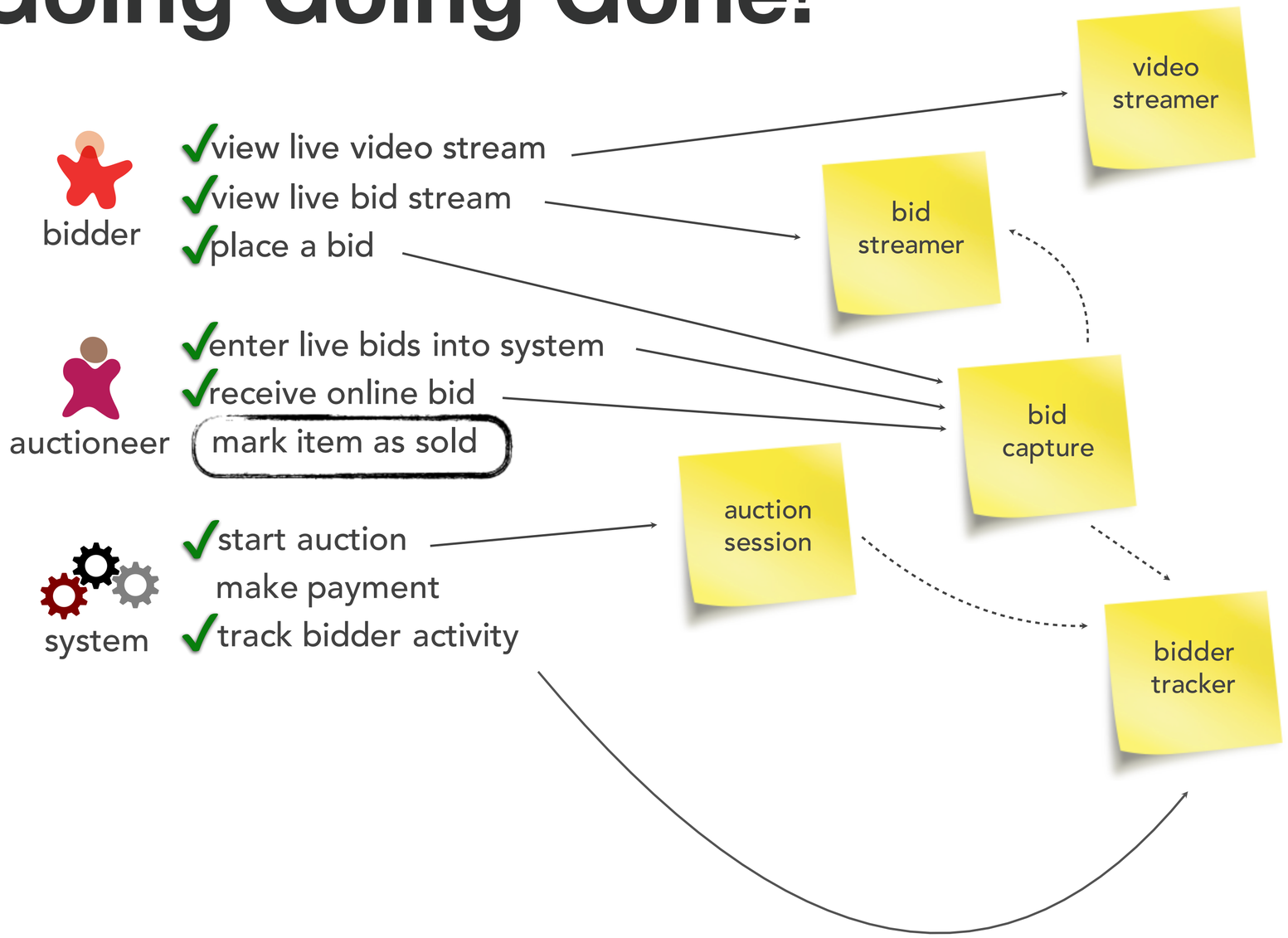

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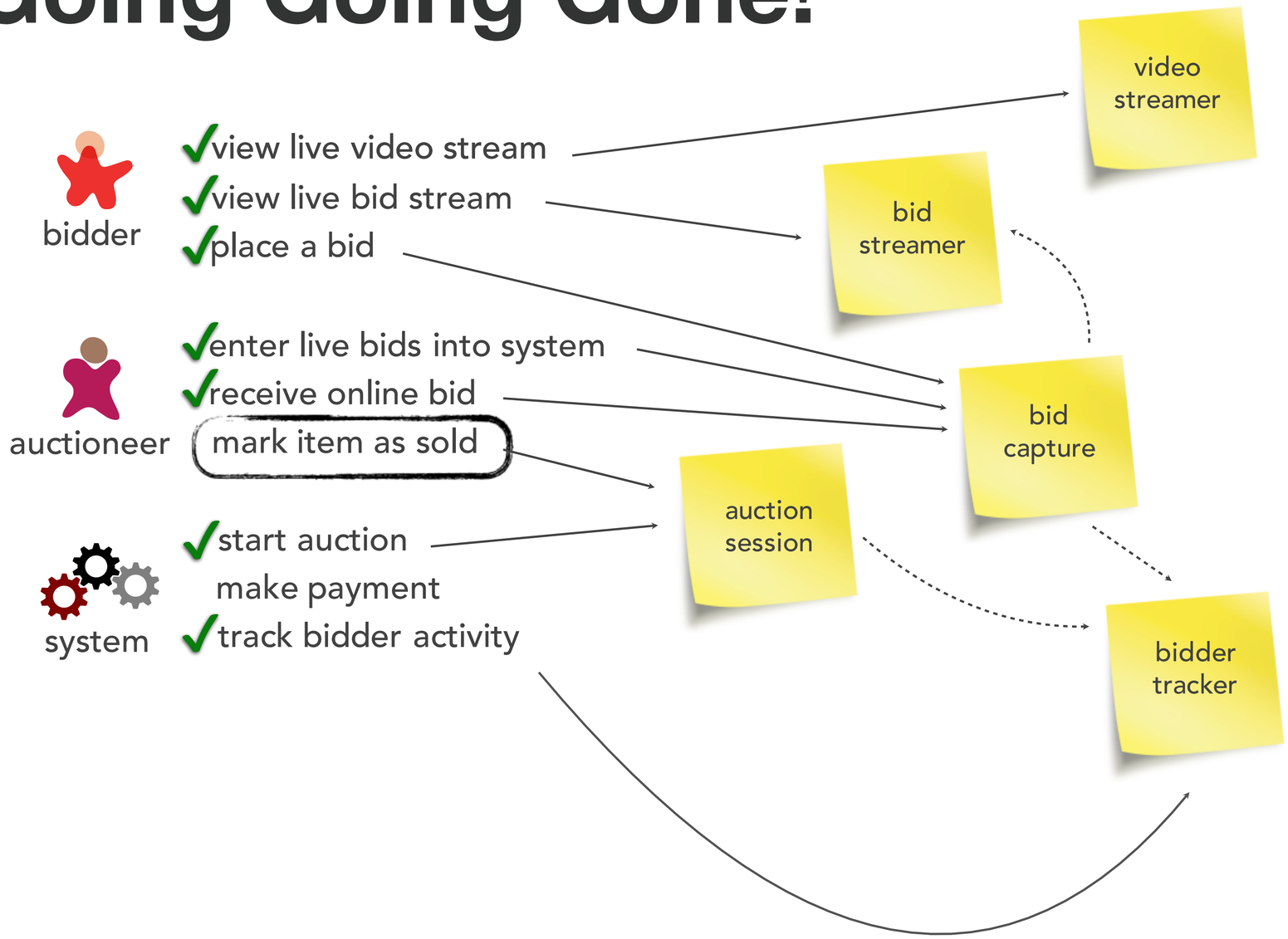

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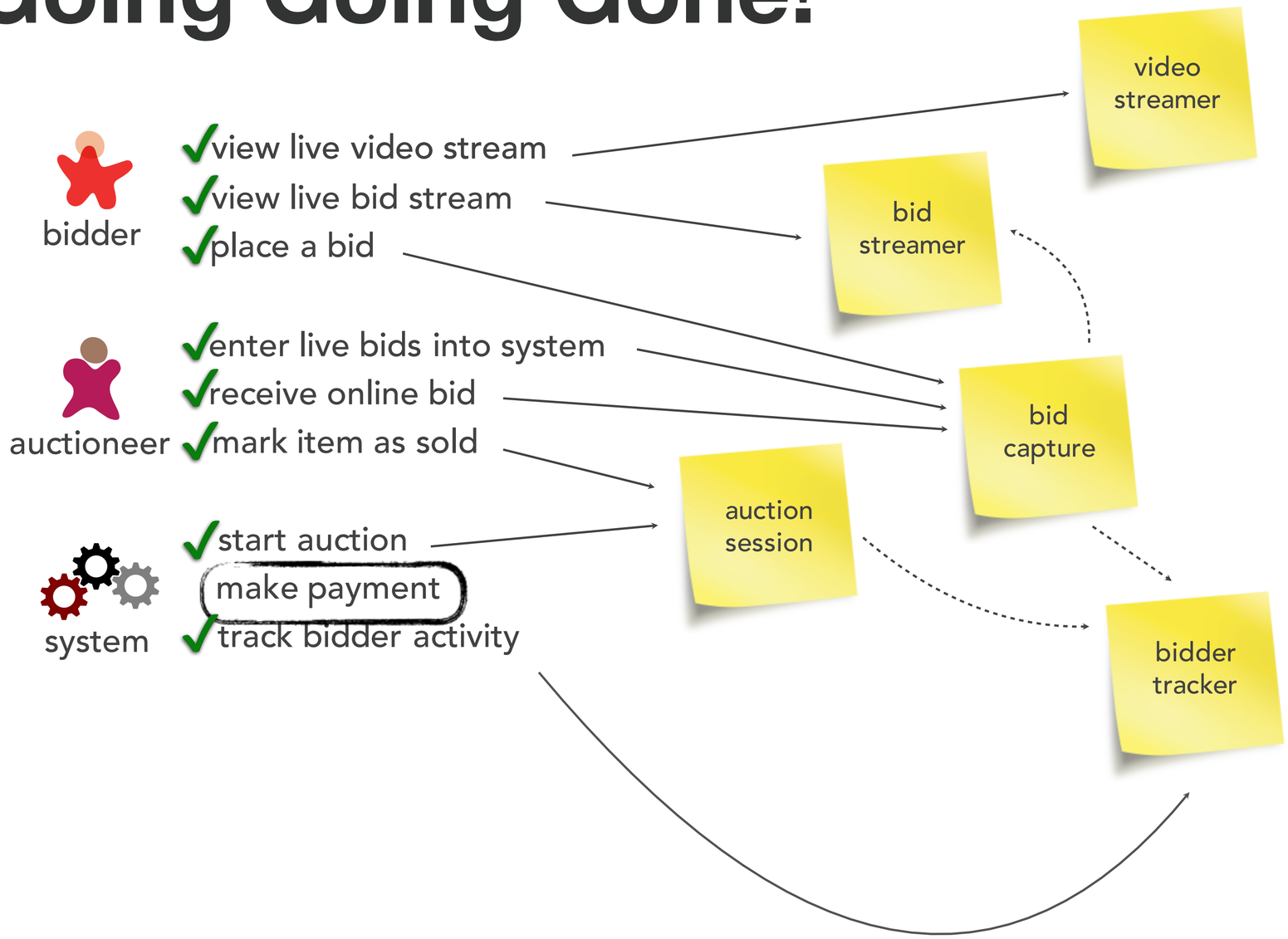

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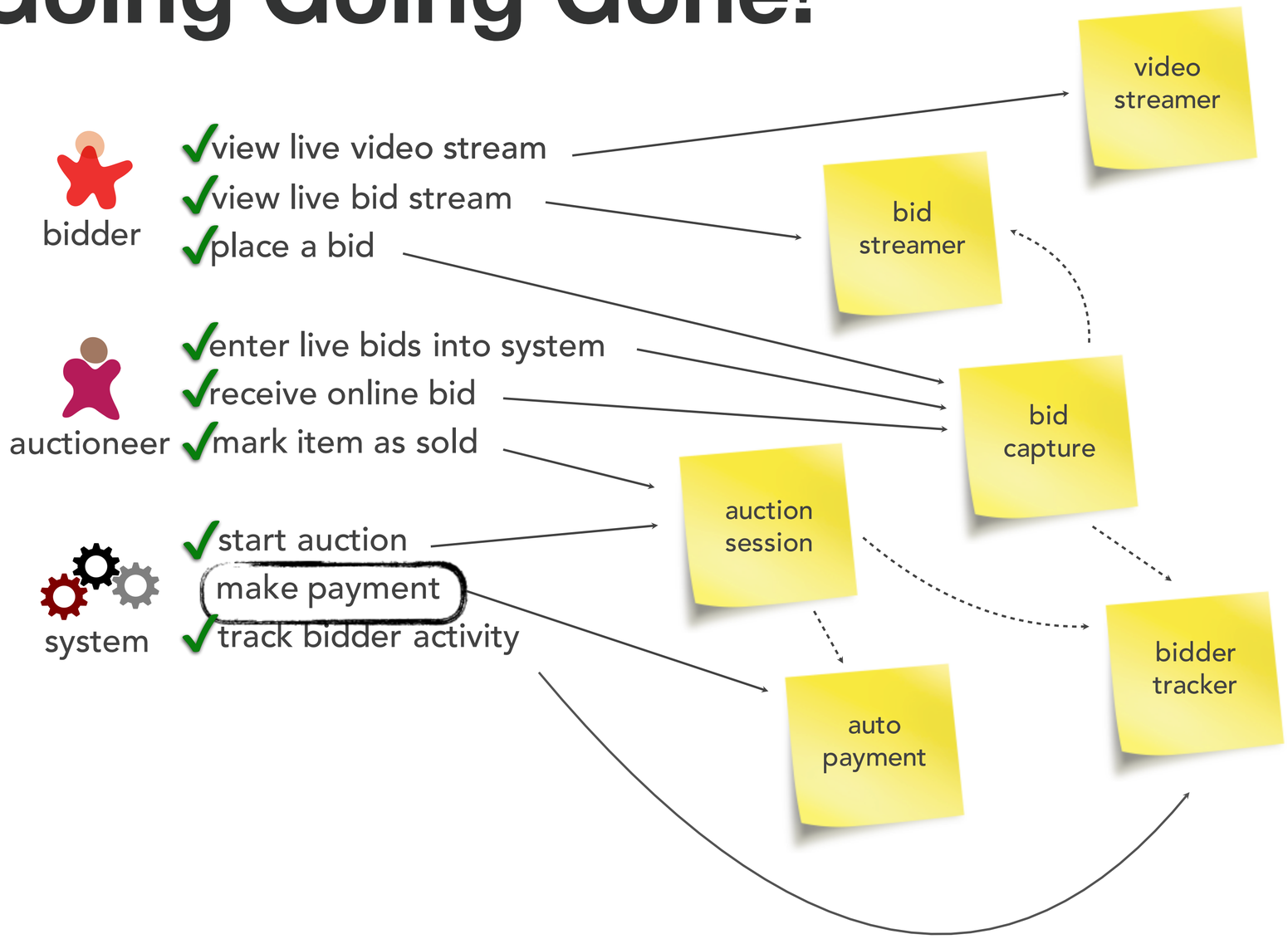

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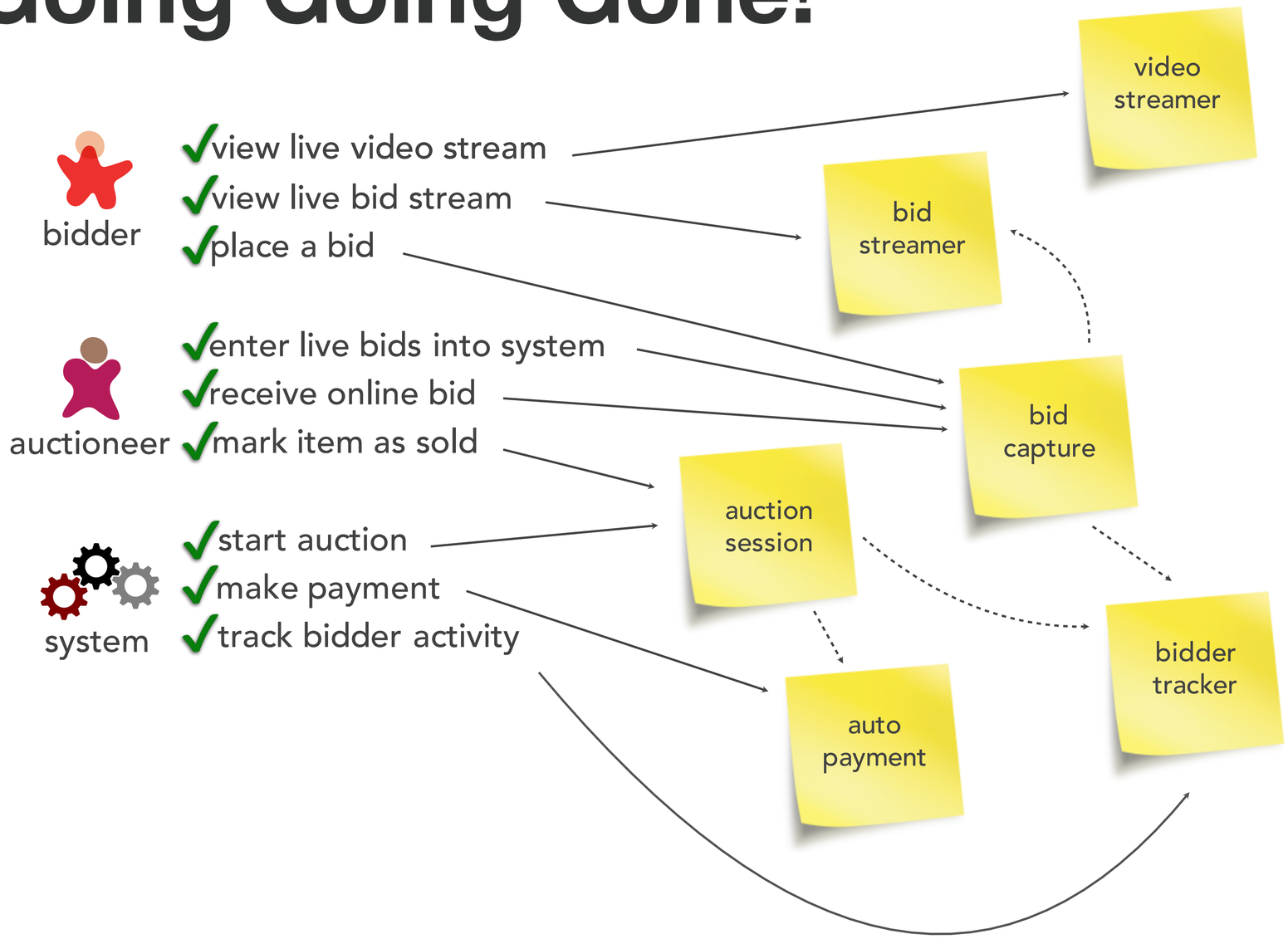

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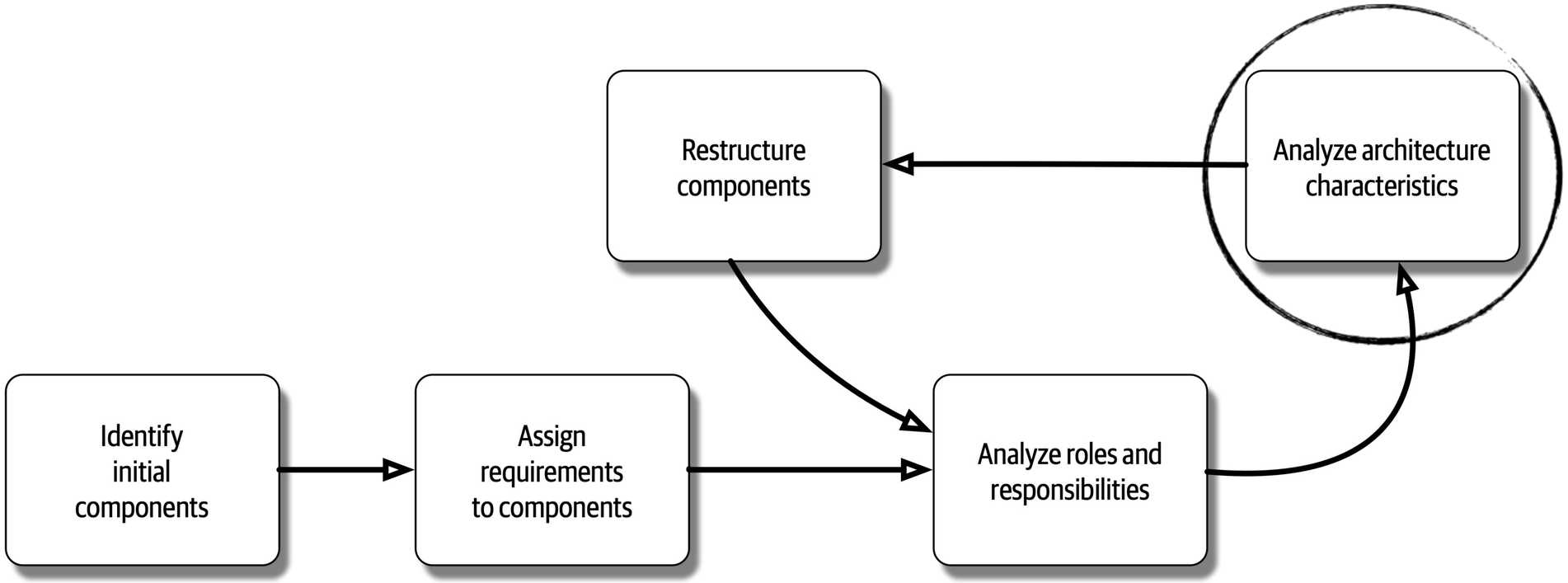

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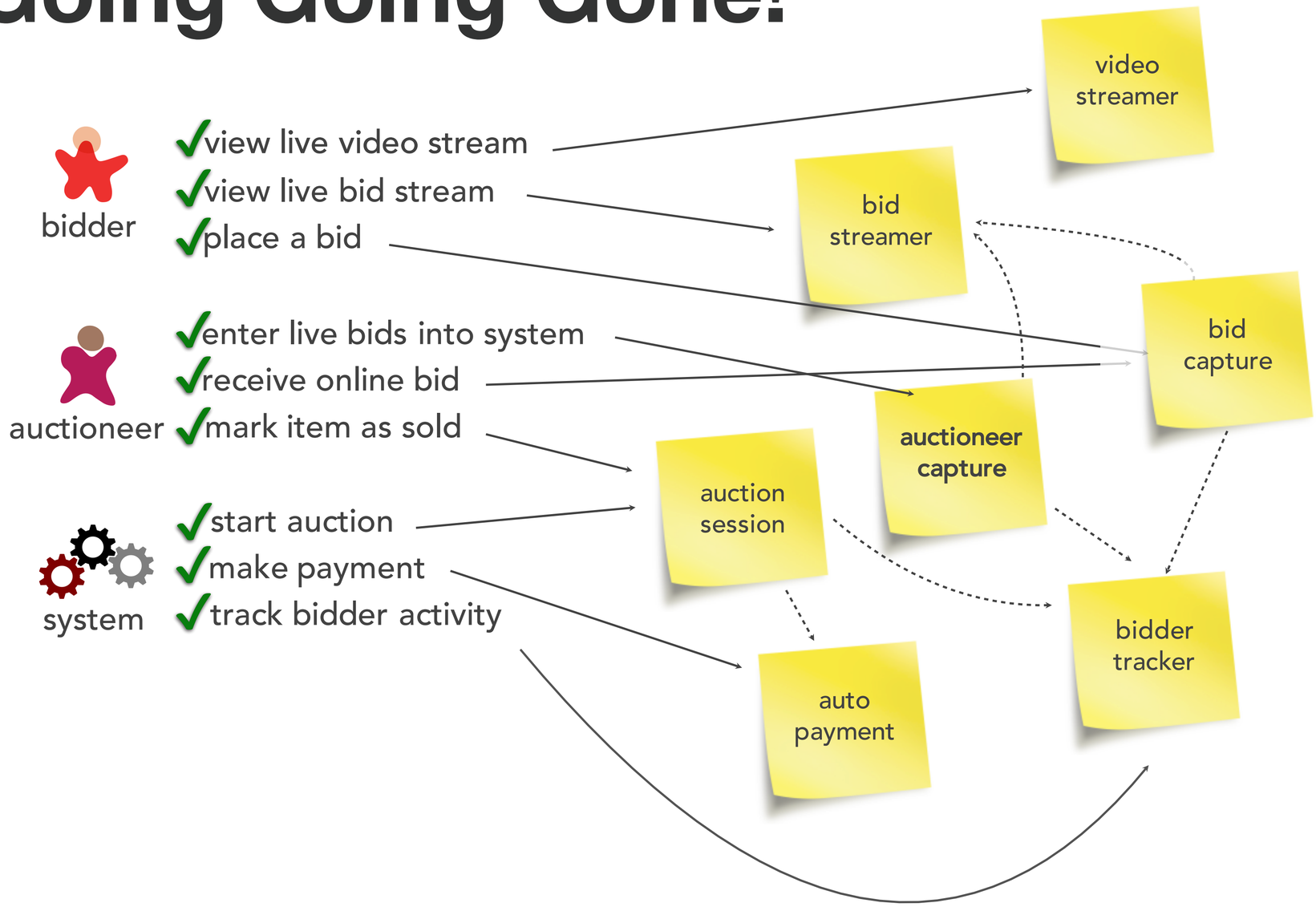

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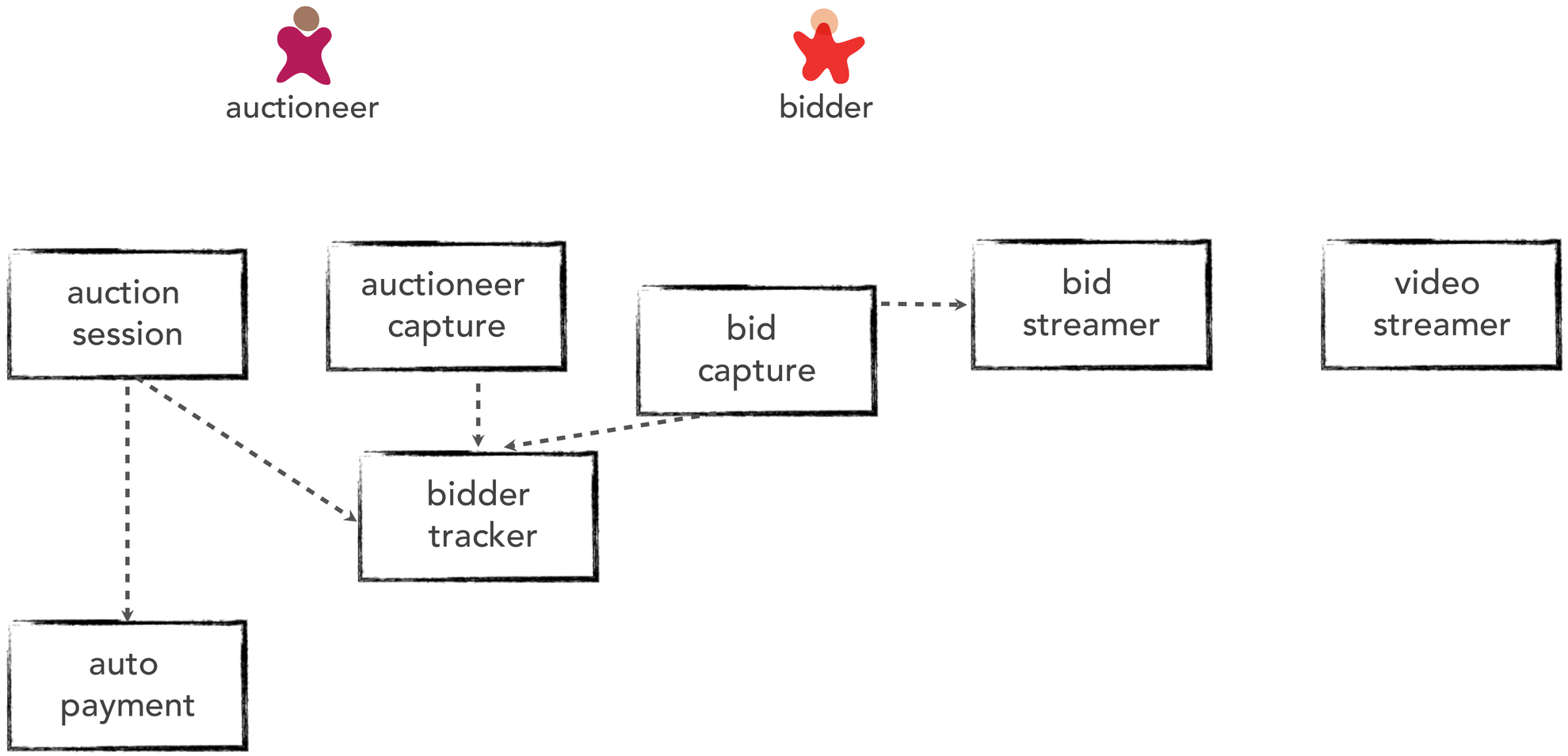

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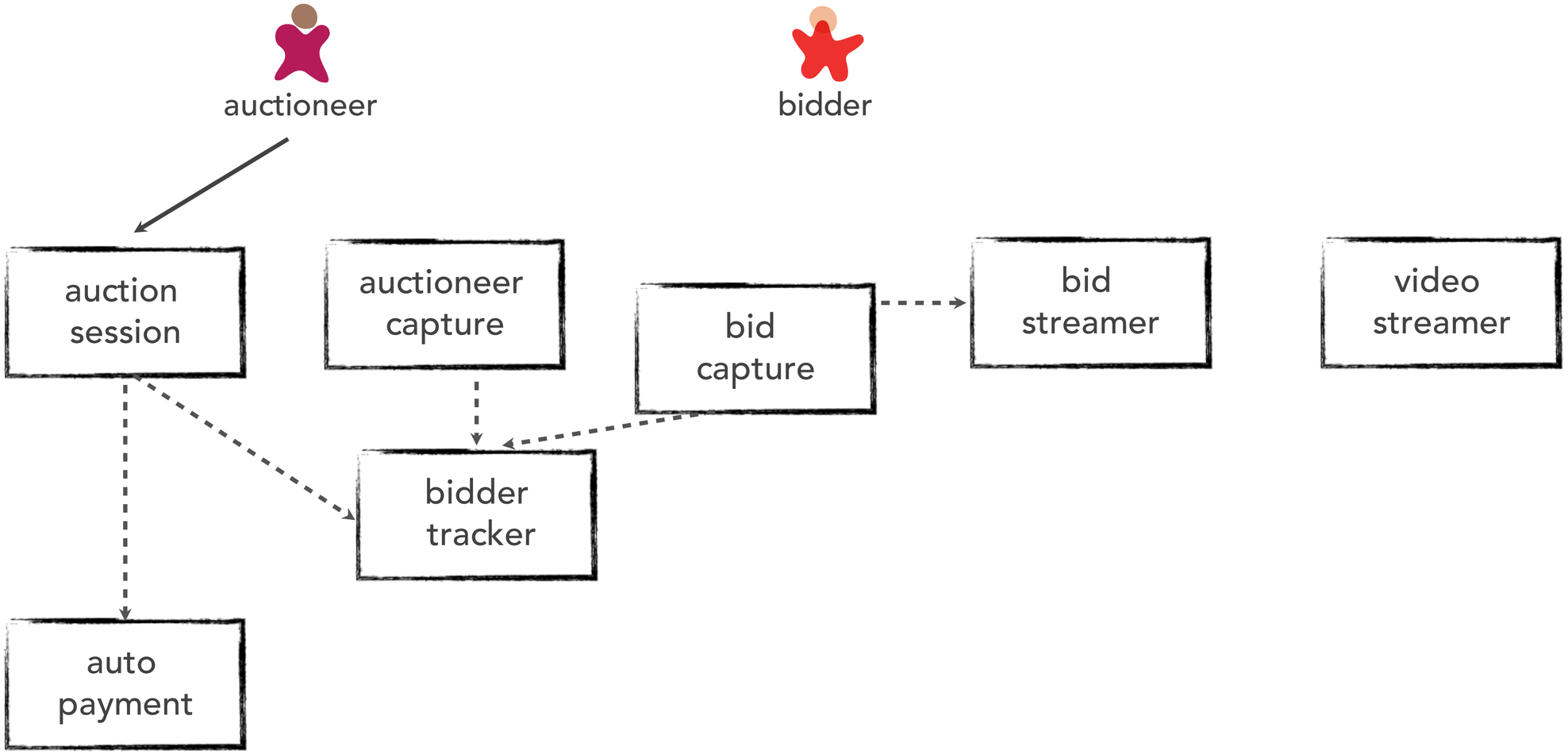

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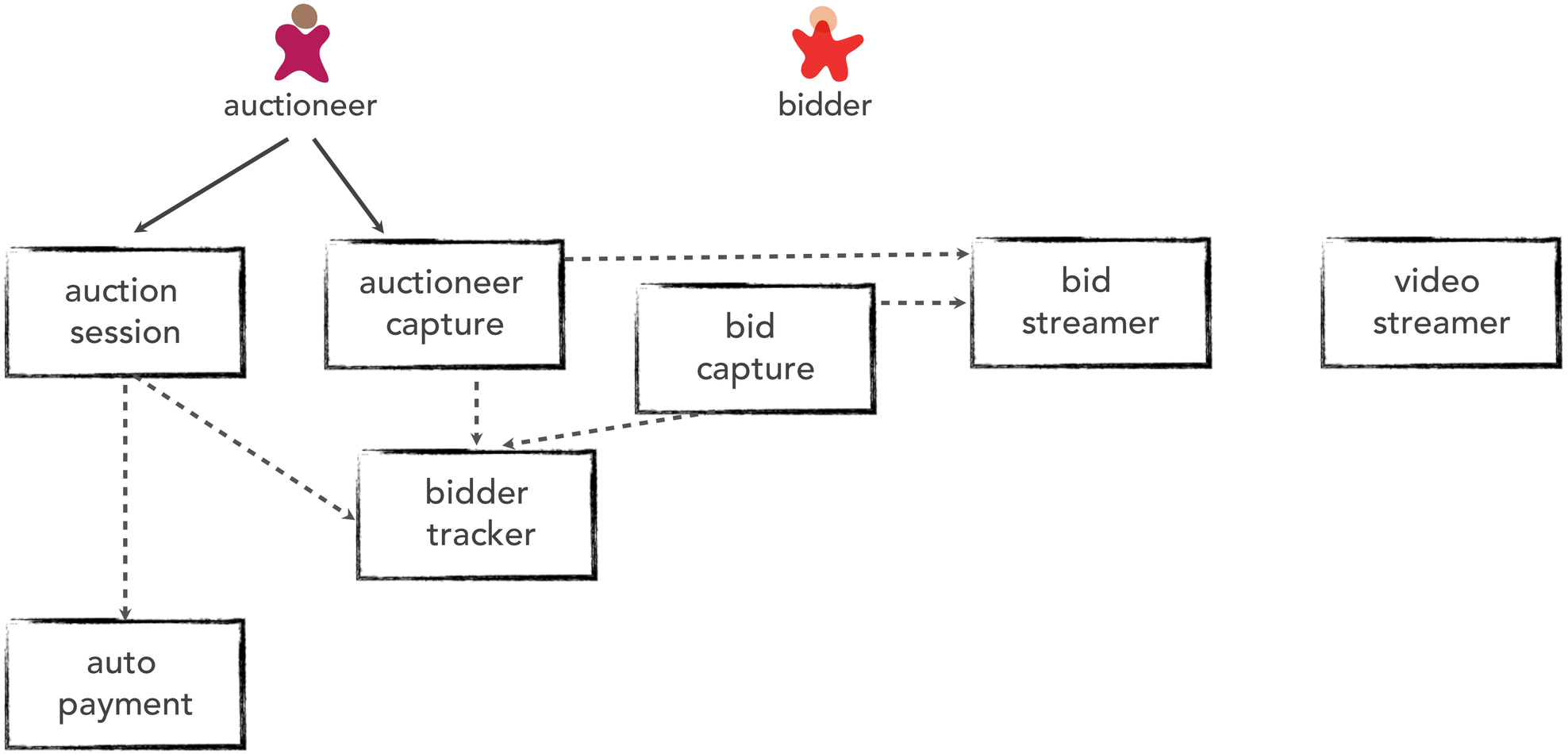

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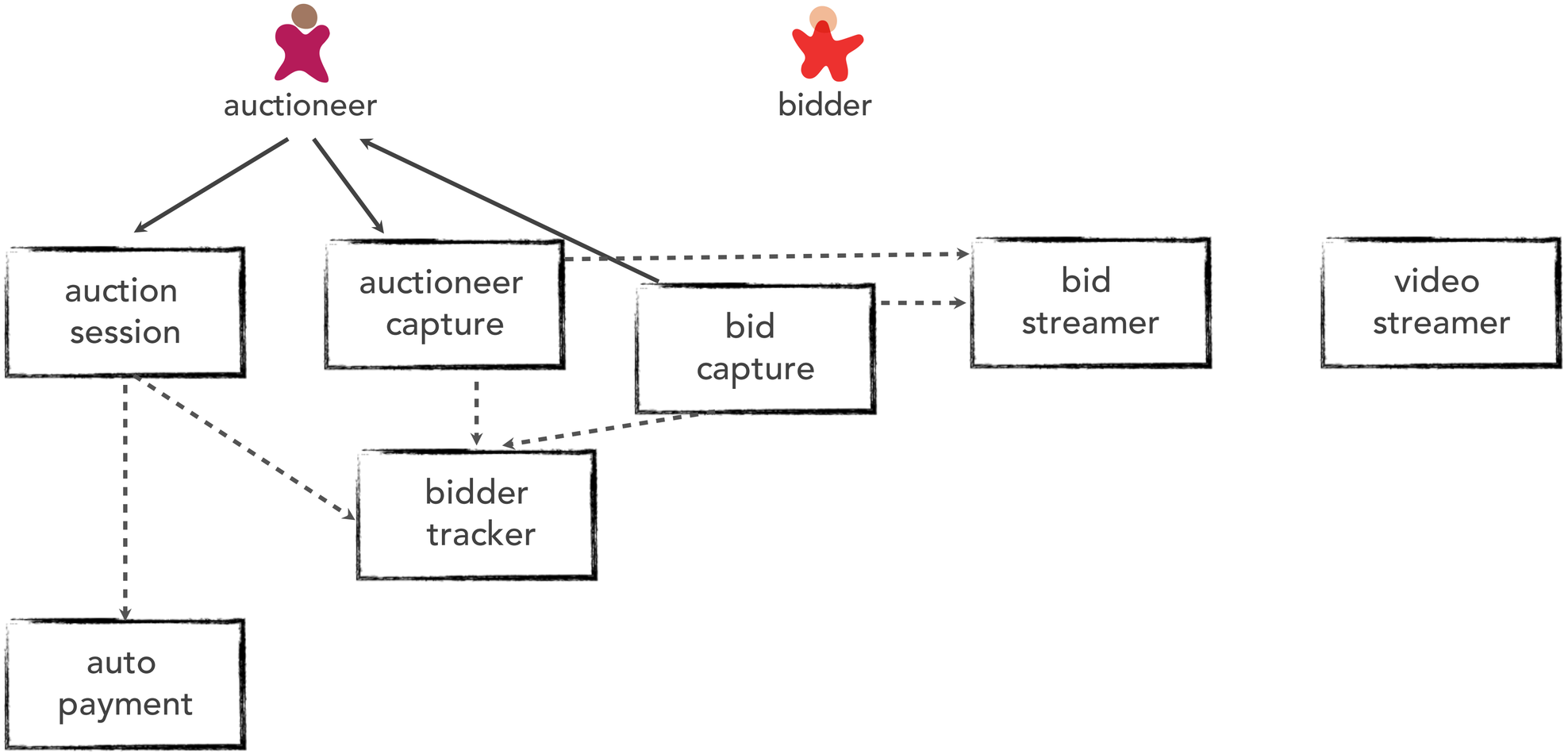

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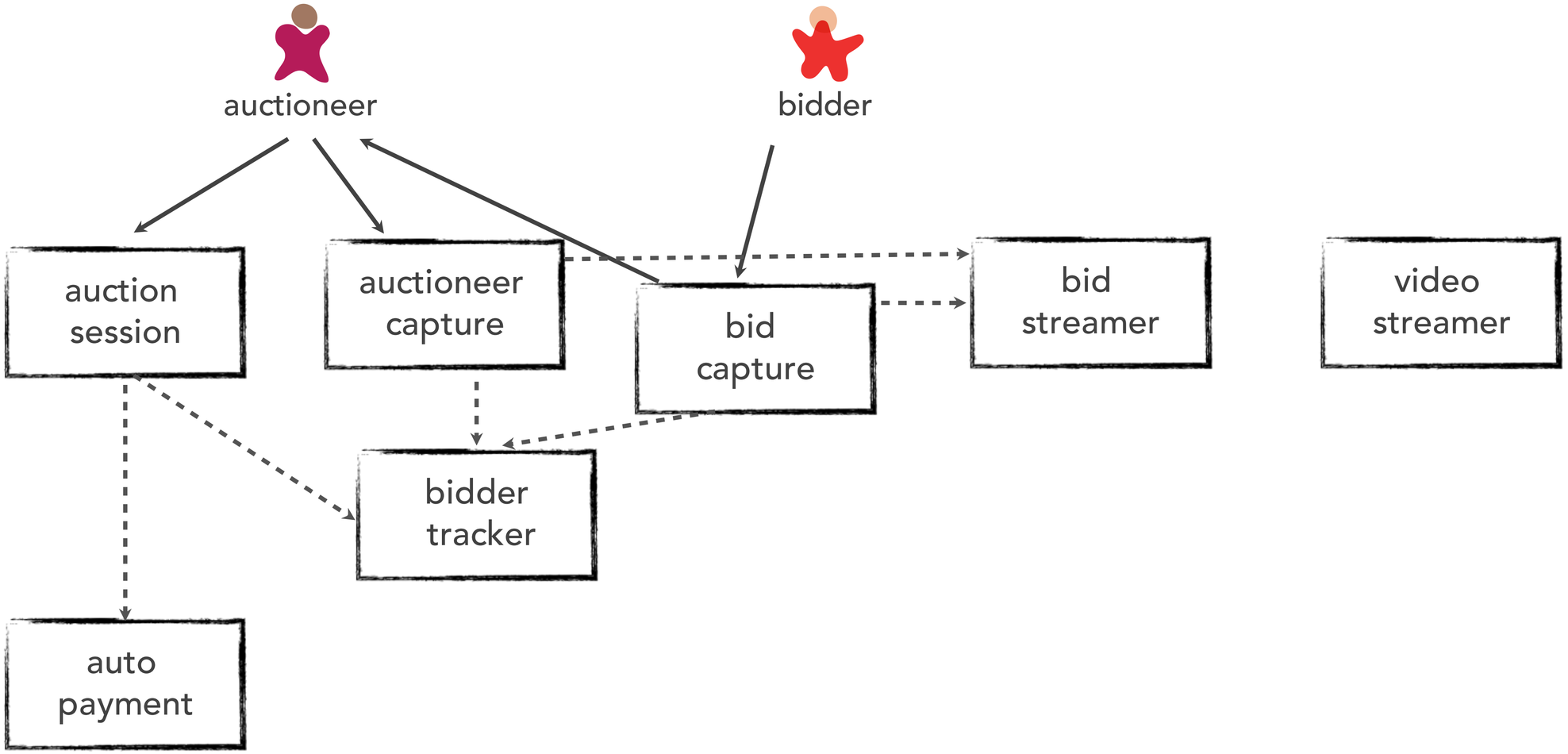

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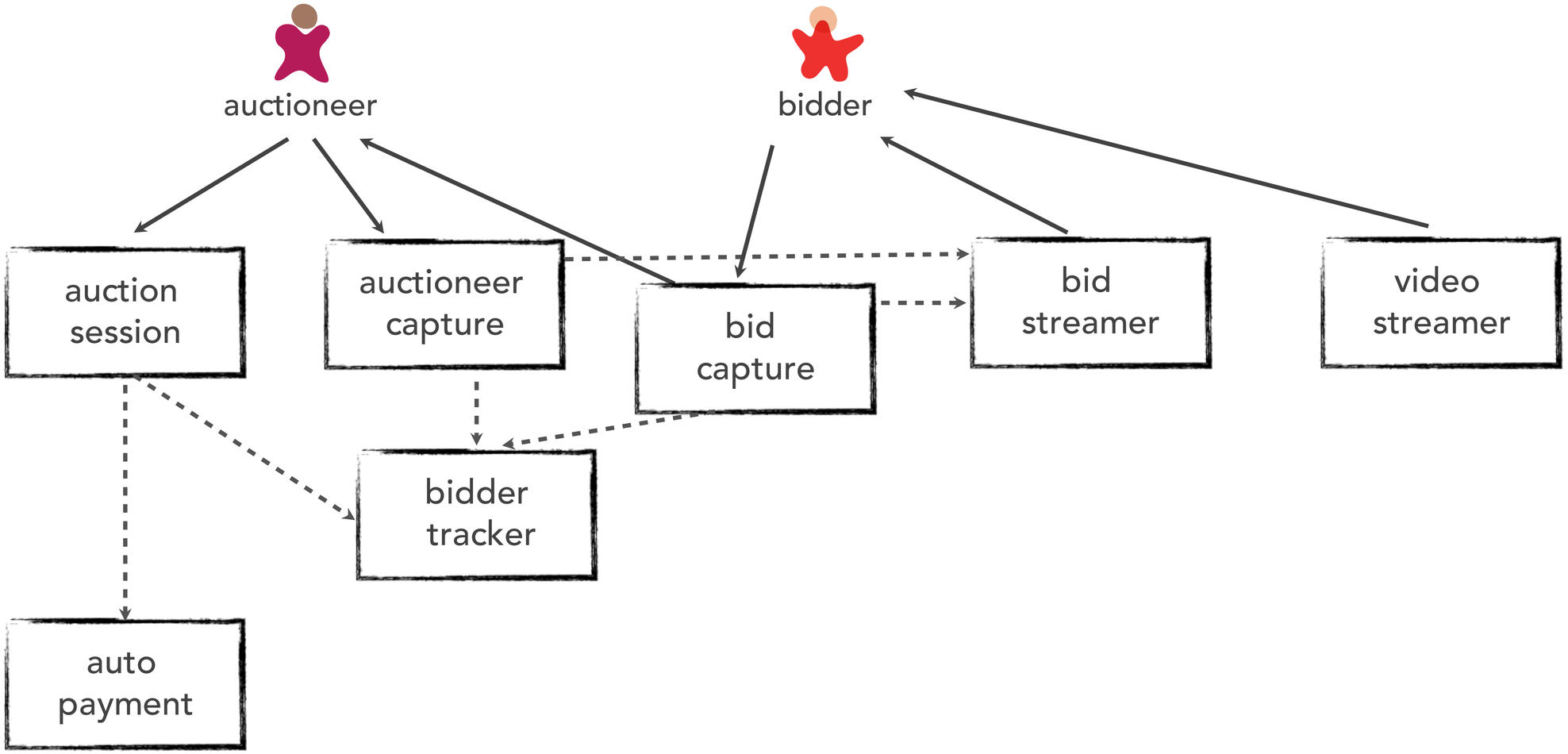

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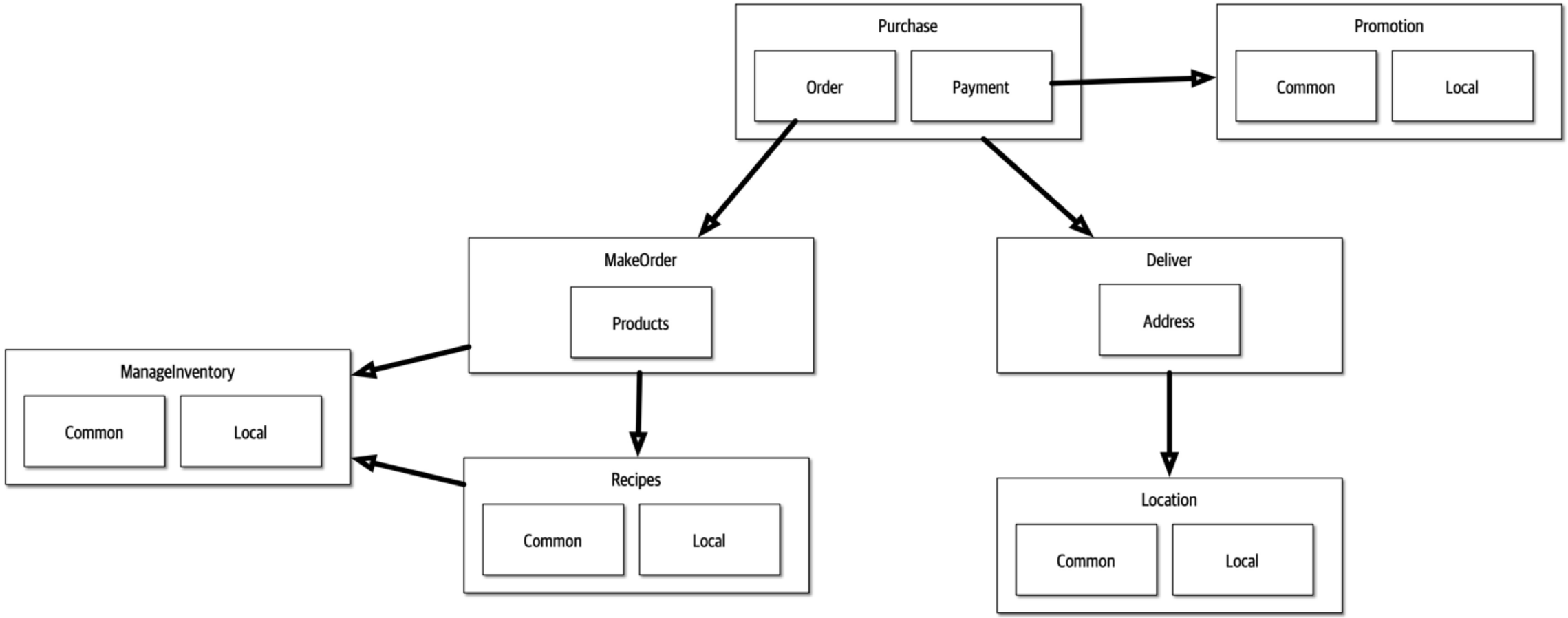

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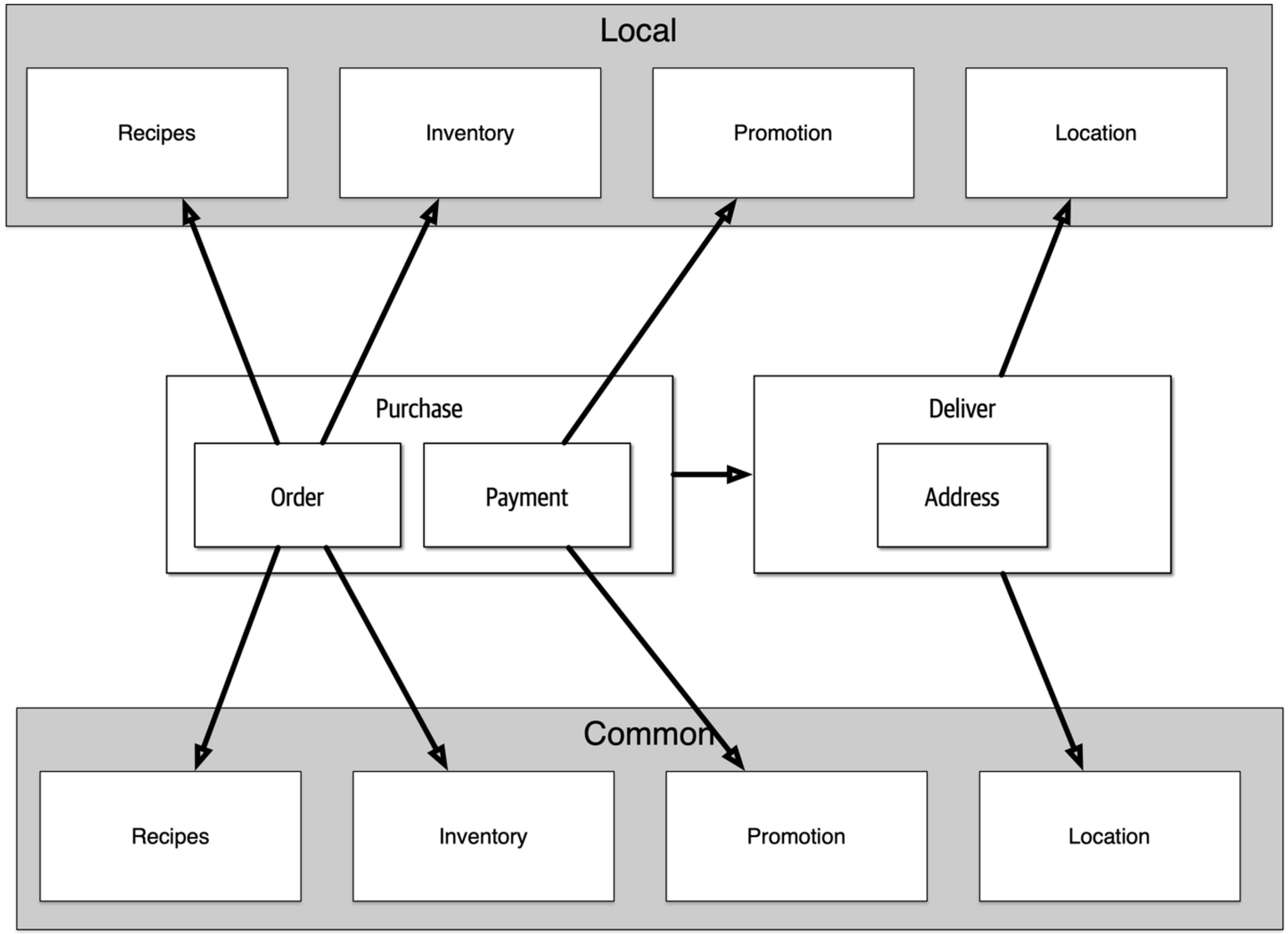
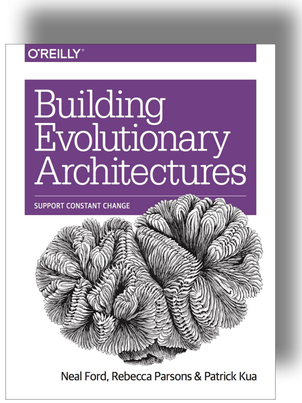
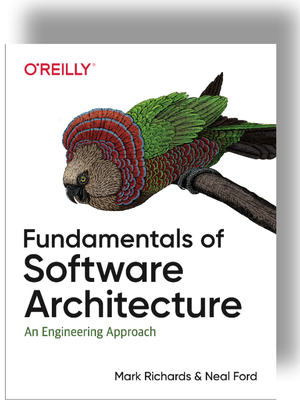
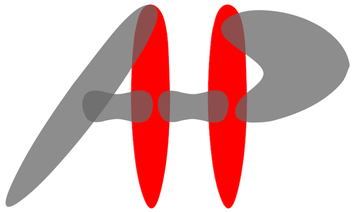


architecture quantum



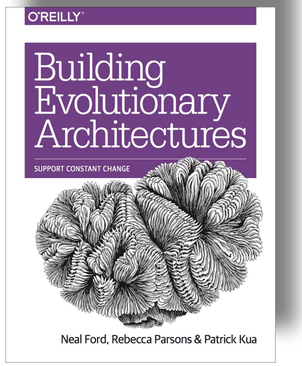


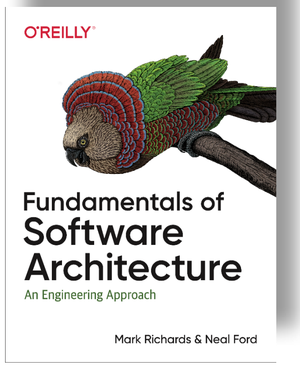


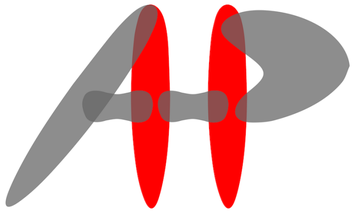
Architecture: The Hard Parts

an independently deployable component
with
high functional cohesion
and
synchronous coupling.

architecture quantum







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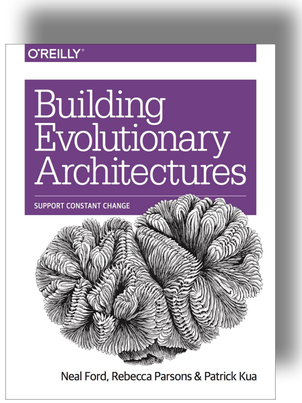

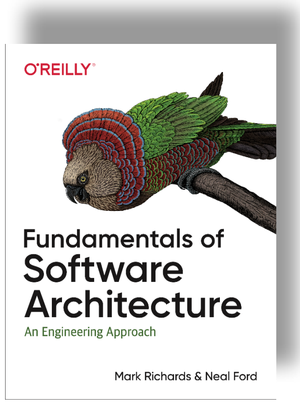

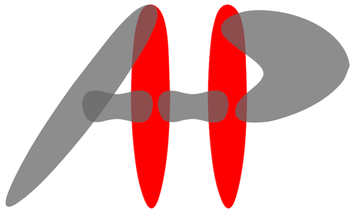

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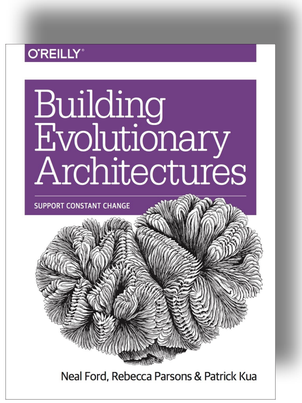
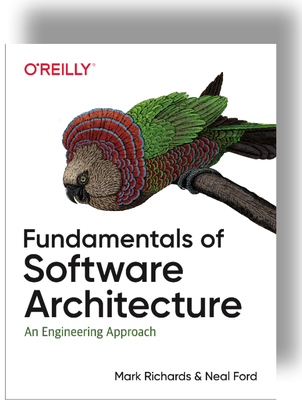
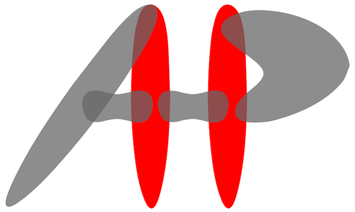
architecture quantum







Architecture: The Hard Parts

an independently deployable component
with
high functional cohesion
and
synchronous coupling.

architecture quantum ?

an independently deployable
component

Intersection between architecture & DevOps

Forces coupling considerations of
dependent components outside of code

architecture quantum ?

high functional cohesion

Less than the entire system

Well separated behavior and concerns

architecture quantum ?

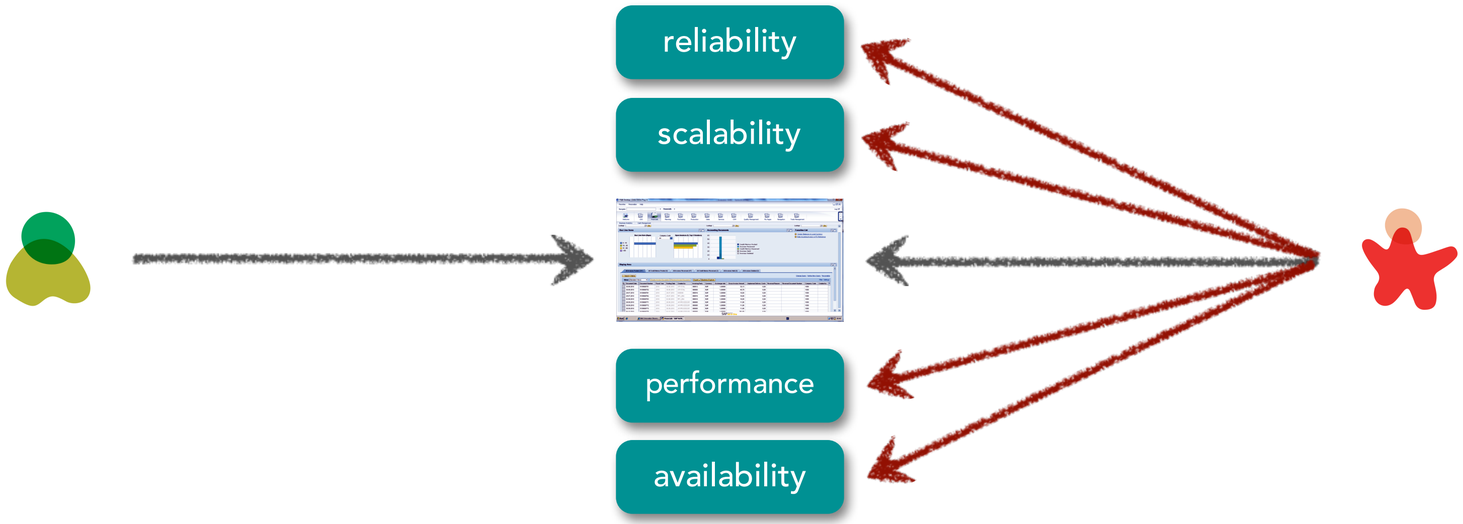
synchronous coupling

Synchronous calls impact operational architecture characteristics

Quantum measures static relationships (coupling) and run-time behavior (synchronicity)

architectural quantum?

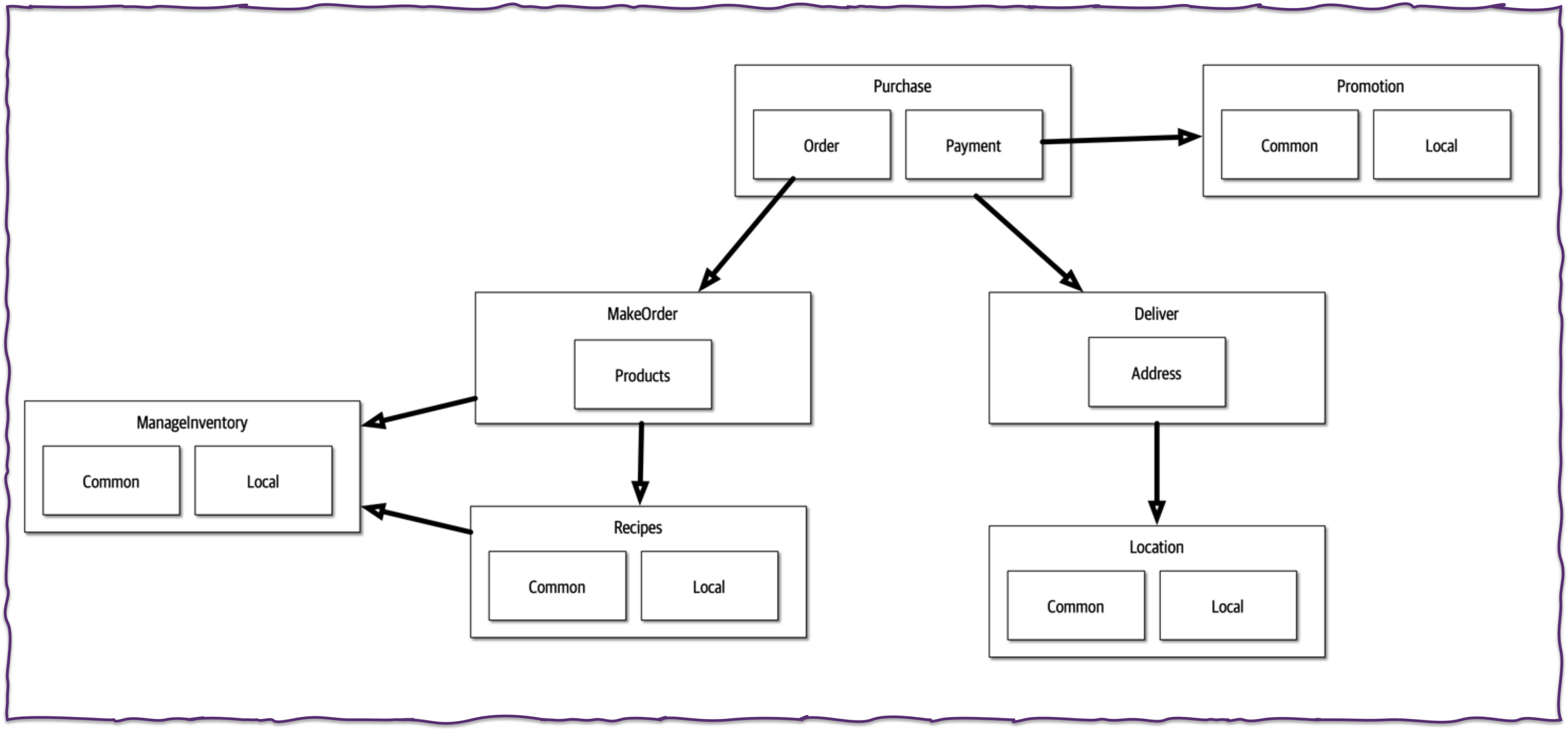
Architectural characteristics live at the quantum level.



Your Architectural Kata is...

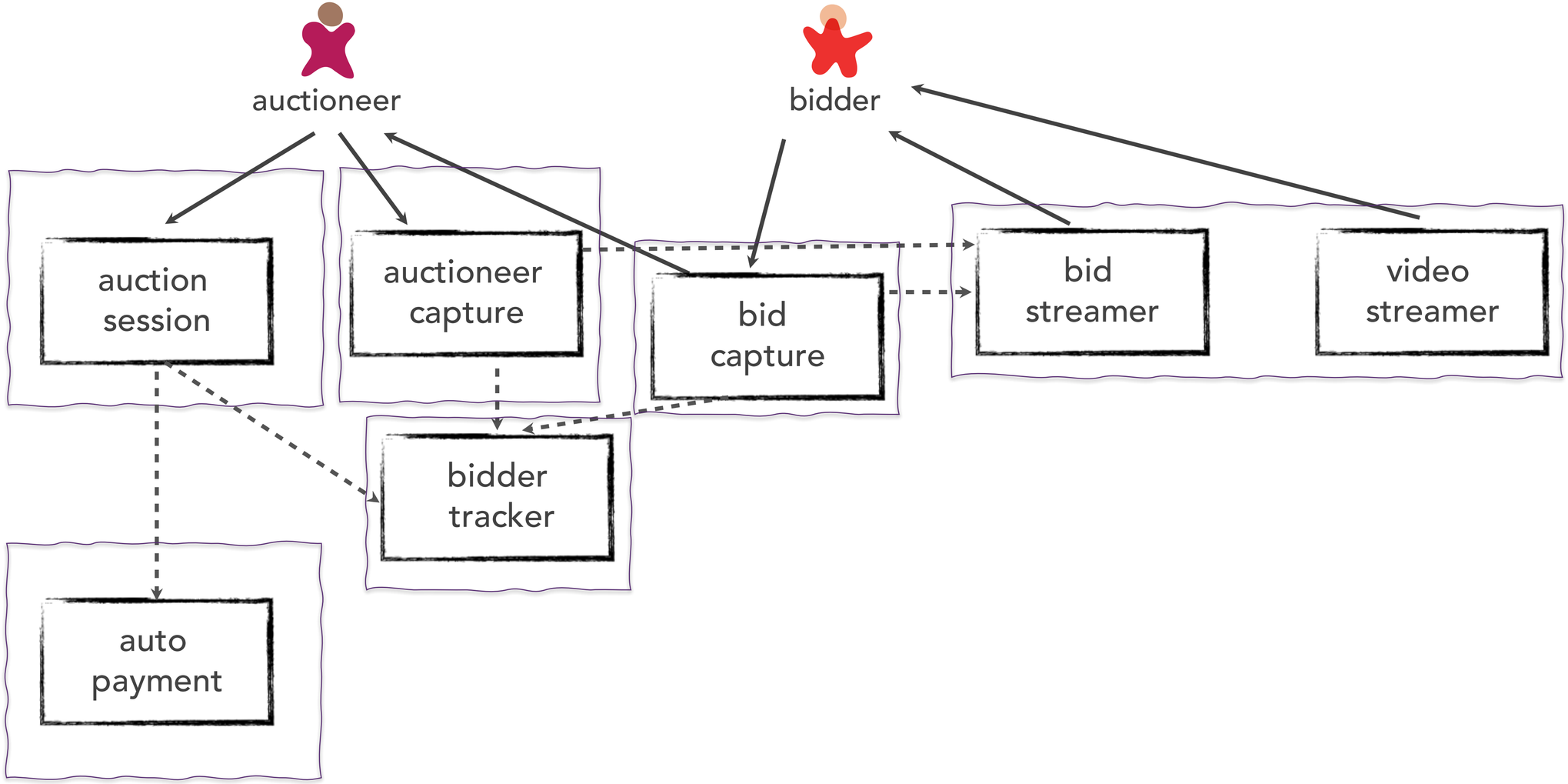
Silicon Sandwiches

quantum



Your Architectural Kata is...

Going Going Gone!



architecture katas

identifying architecture styles

Your Architectural Kata is...

Going Going Gone!

An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

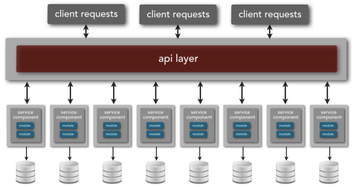
Your Architectural Kata is...

Silicon Sandwiches

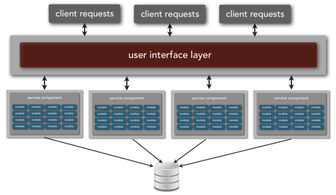
A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotionals/specials
  - offer local daily promotionals/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.

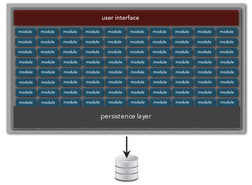
architecture patterns help define the basic characteristics and behavior of an application



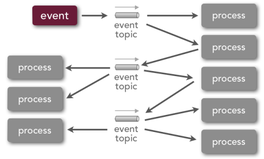
microservices architecture



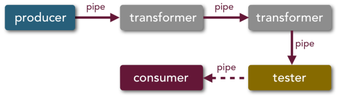
service-based architecture



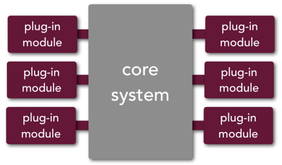
layered architecture



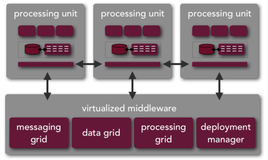
event-driven architecture



pipeline architecture



microkernel architecture



space-based architecture

Your Architectural Kata is...

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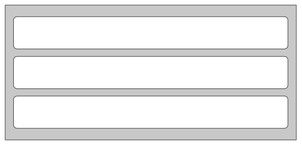
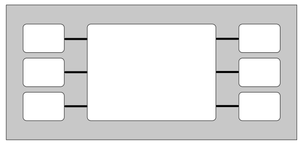
availability reliability performance scalability elasticity (security)

Your Architectural Kata is...

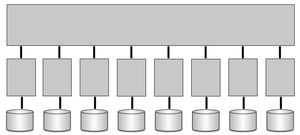
Going Going Gone!



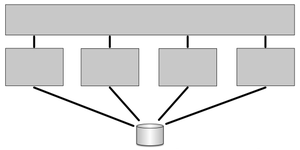
layered monolith



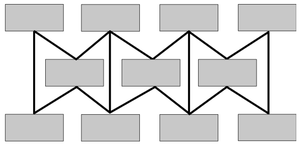
microkernel



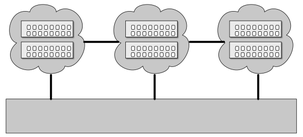
microservices



service-based



event-driven



space-based

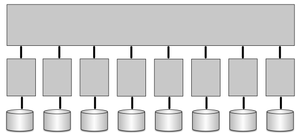
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

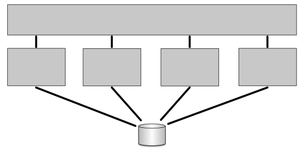
Going Going Gone!

layered monolith

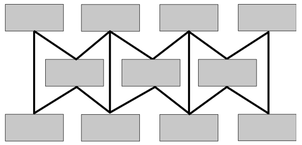
microkernel



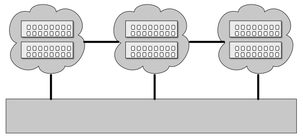
microservices



service-based



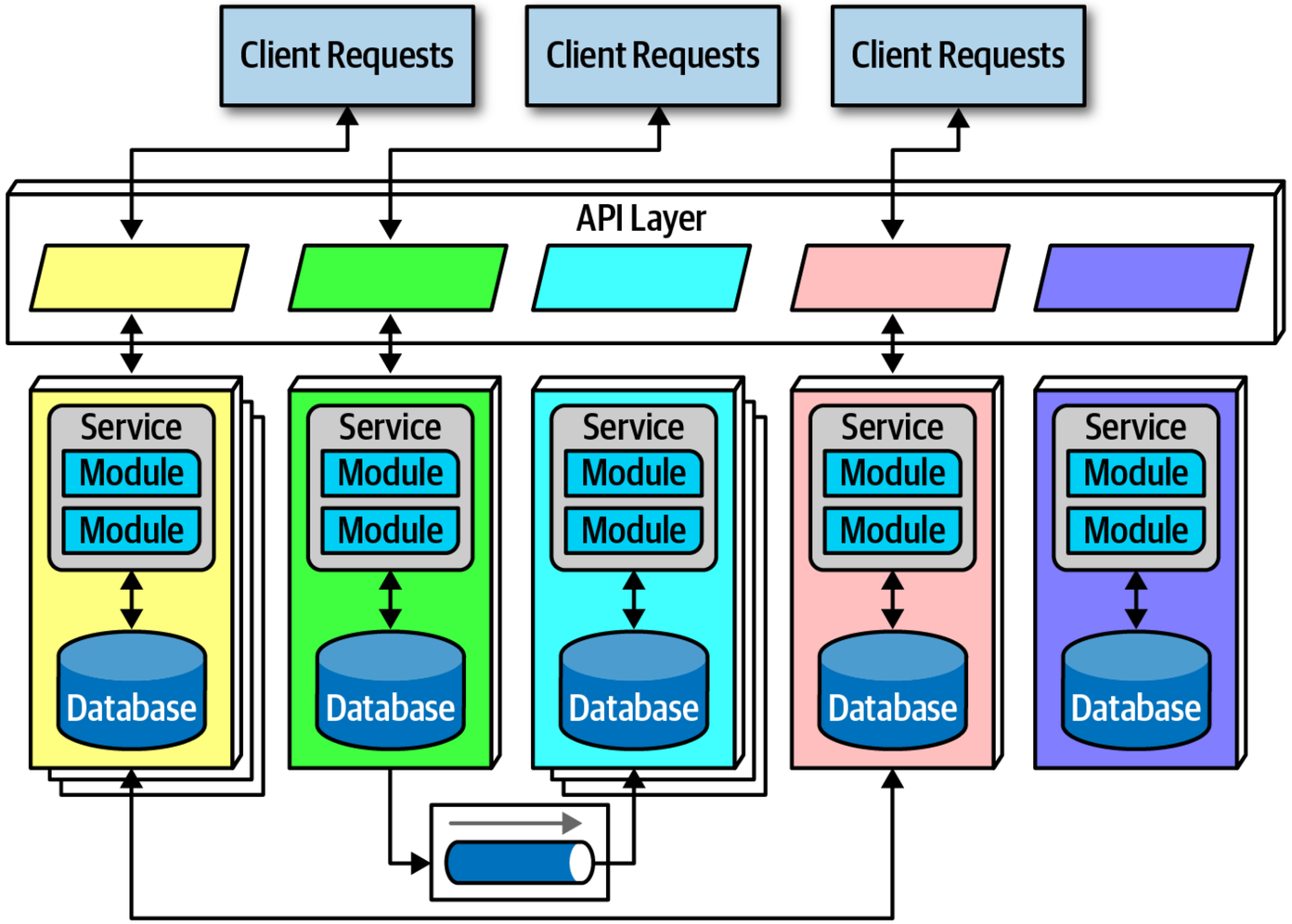
event-driven



space-based

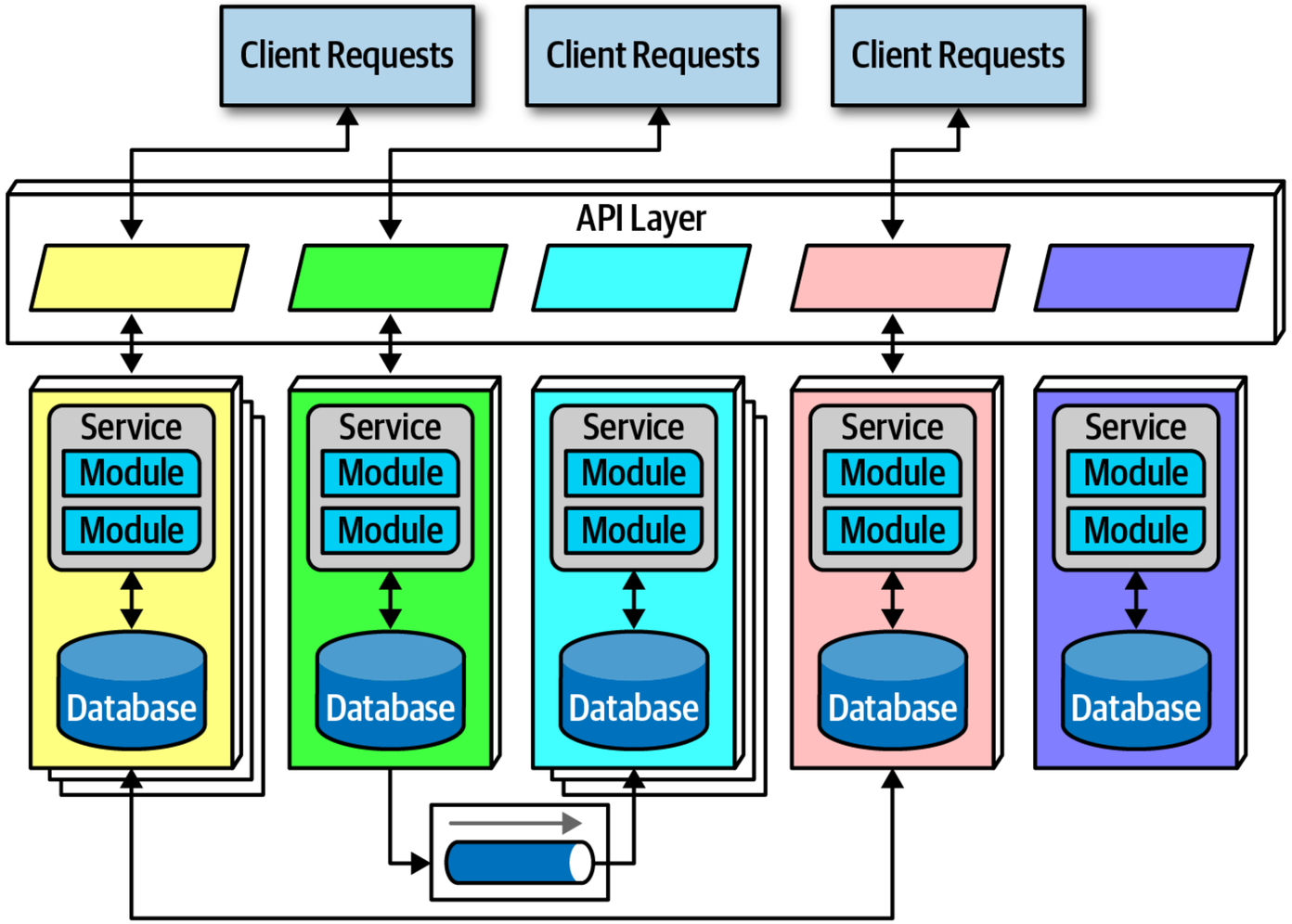
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

microservices

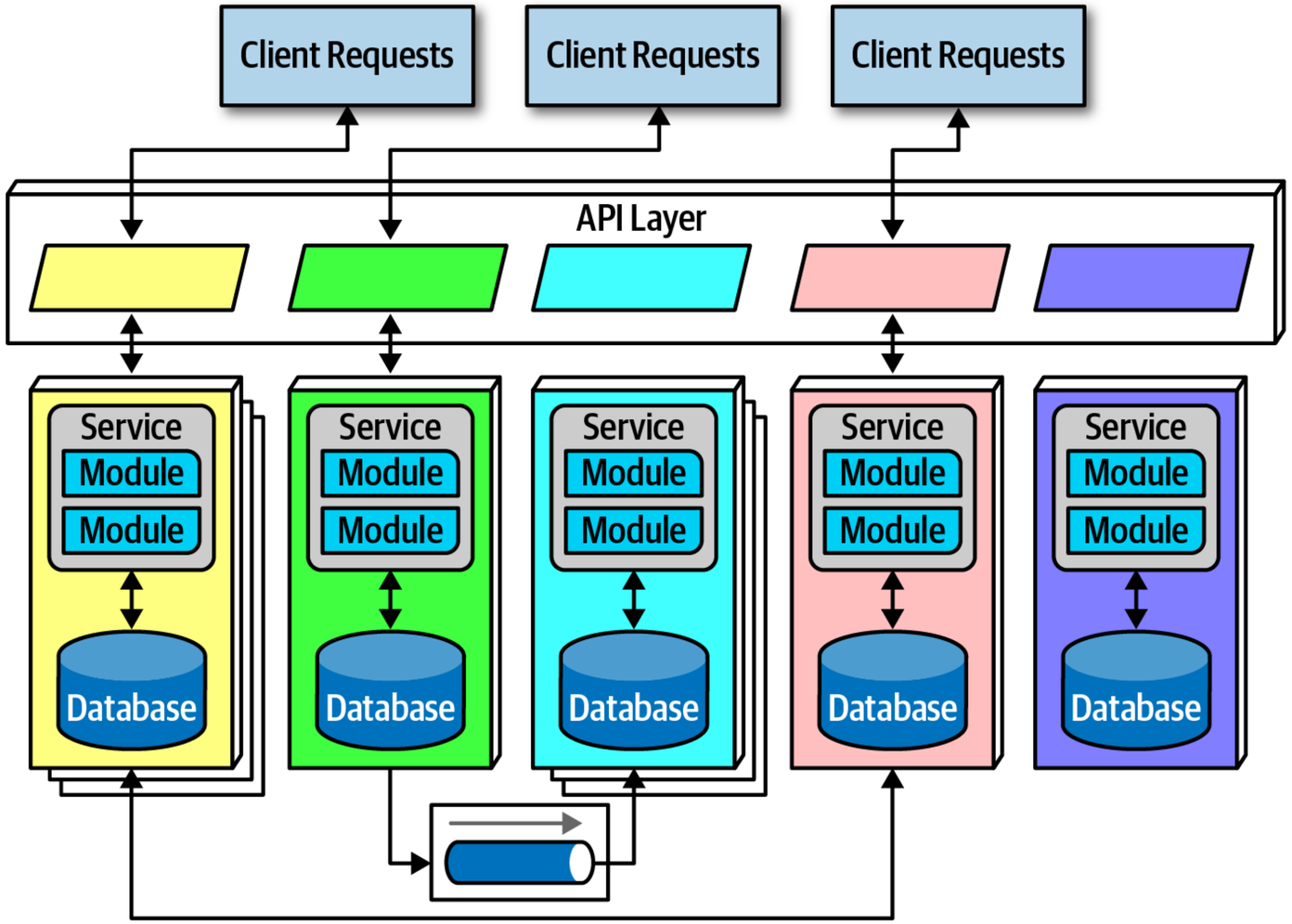


microservices

distributed architecture



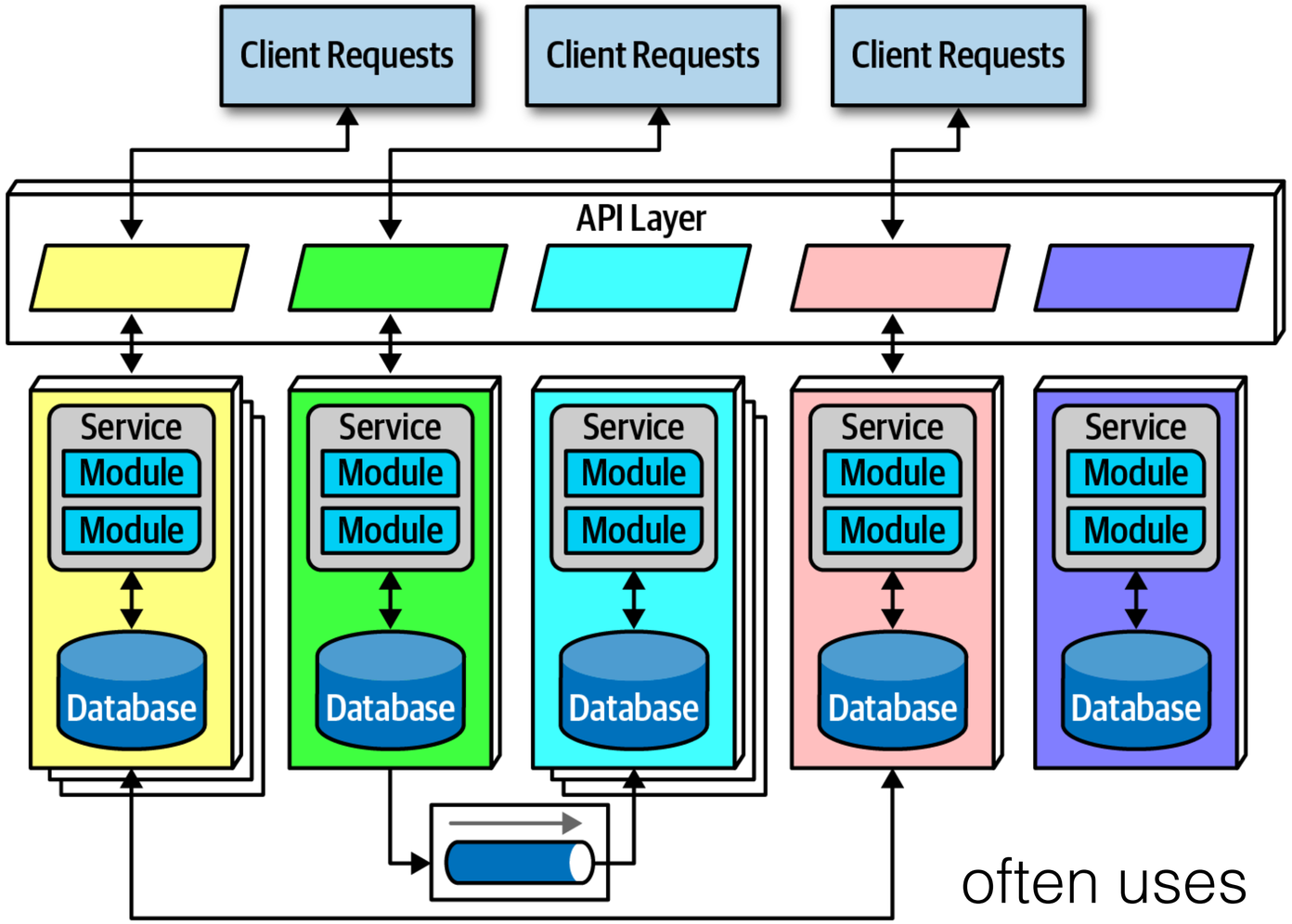
microservices



includes data

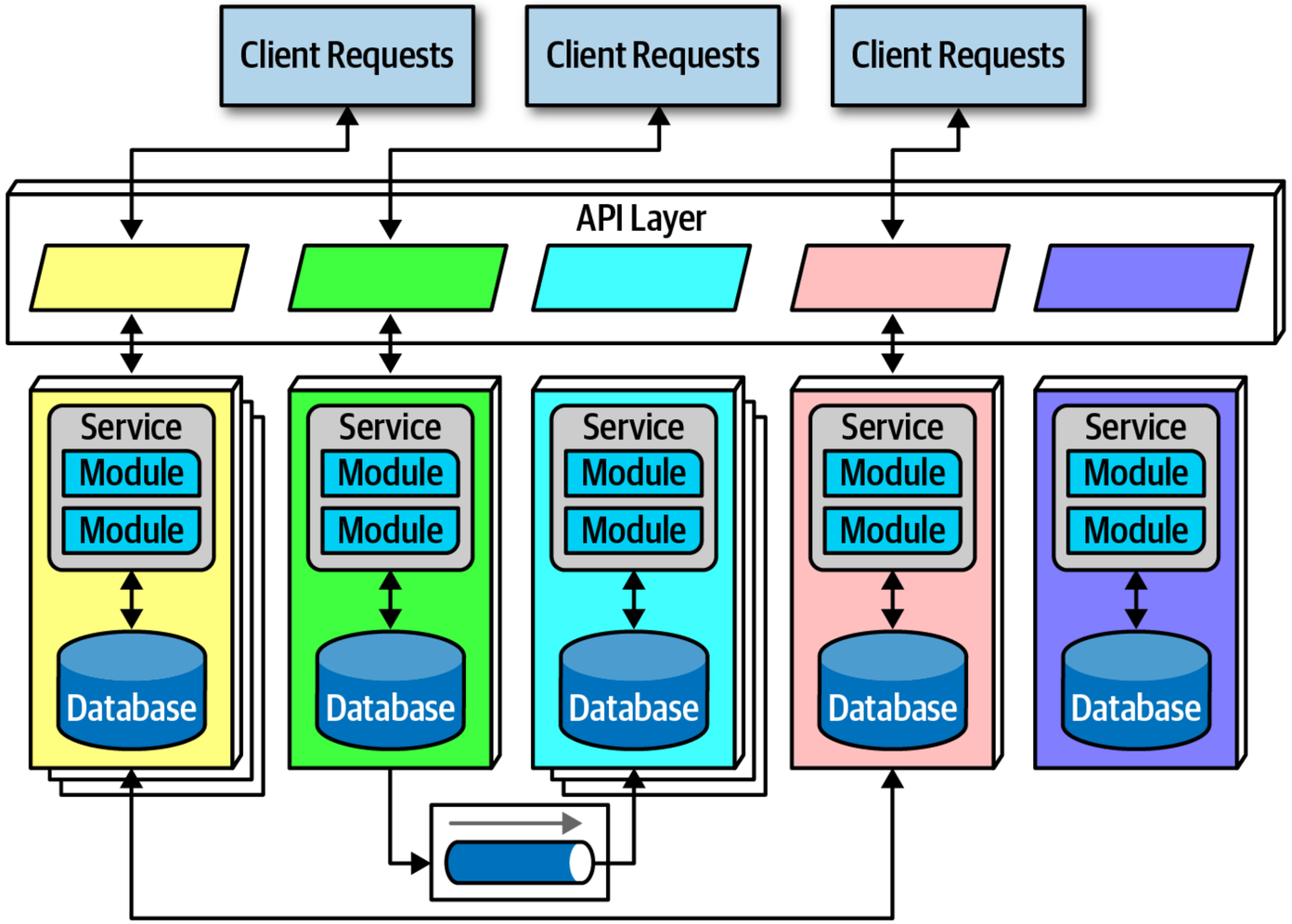
bounded context

microservices



often uses events

suitability: microservices ?

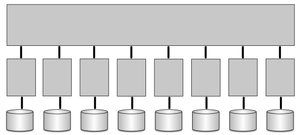


Your Architectural Kata is...

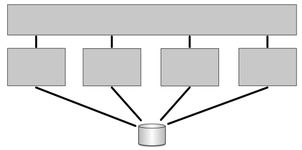
Going Going Gone!

layered monolith

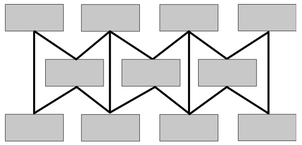
microkernel



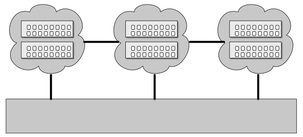
microservices



service-based



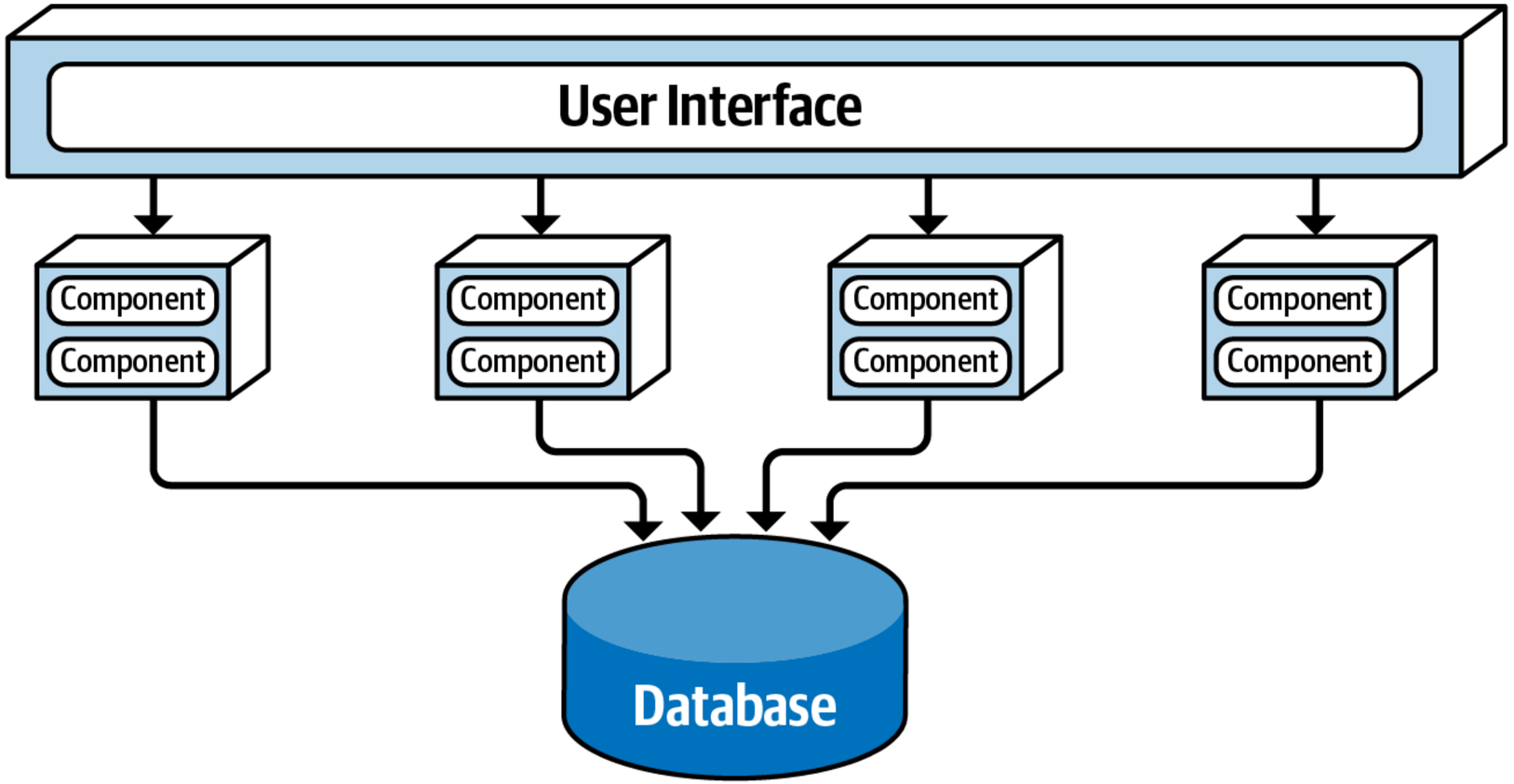
event-driven



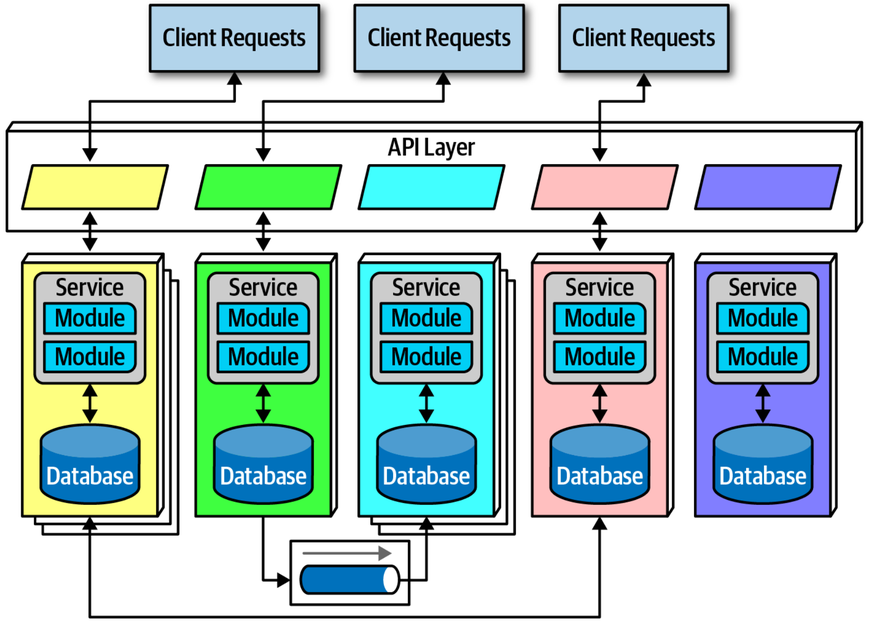
space-based

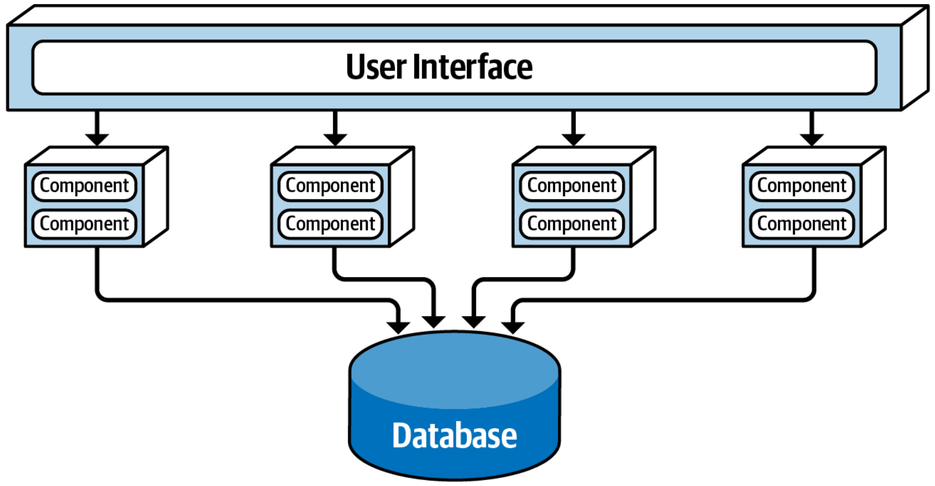
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

service-based architecture

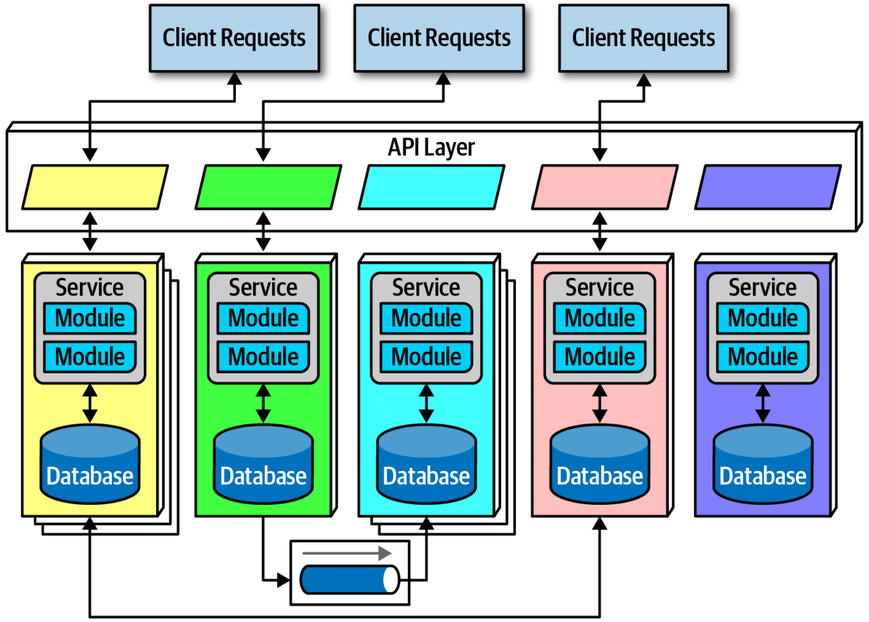


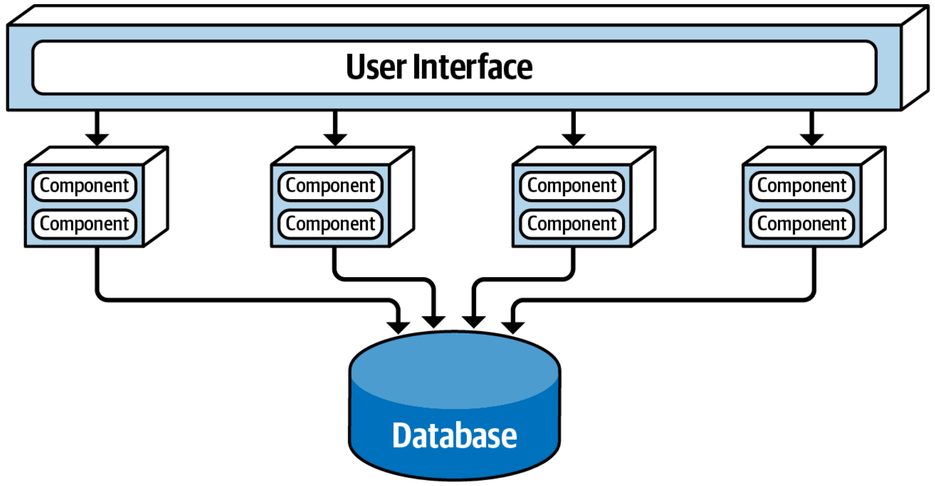
microservices vs service-based





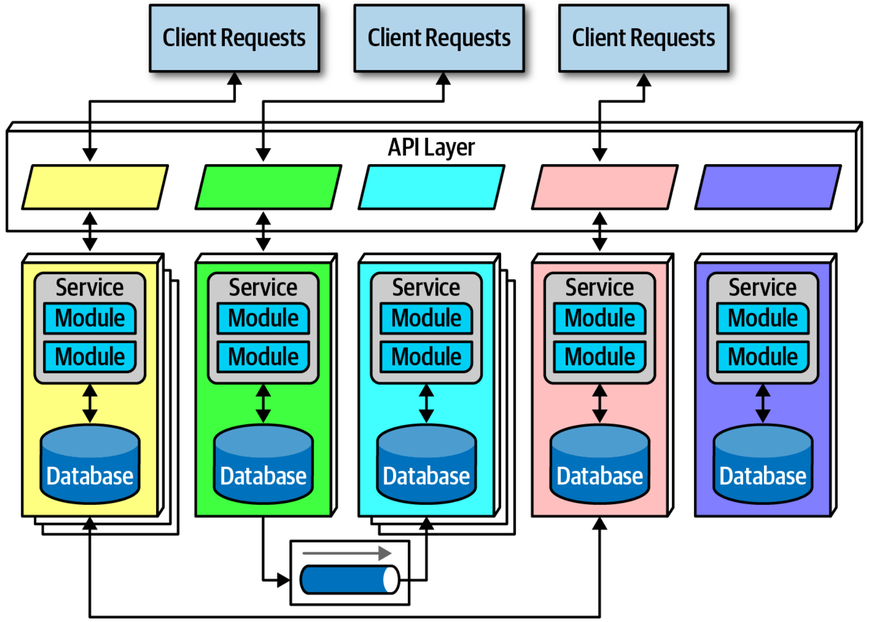
microservices vs service-based

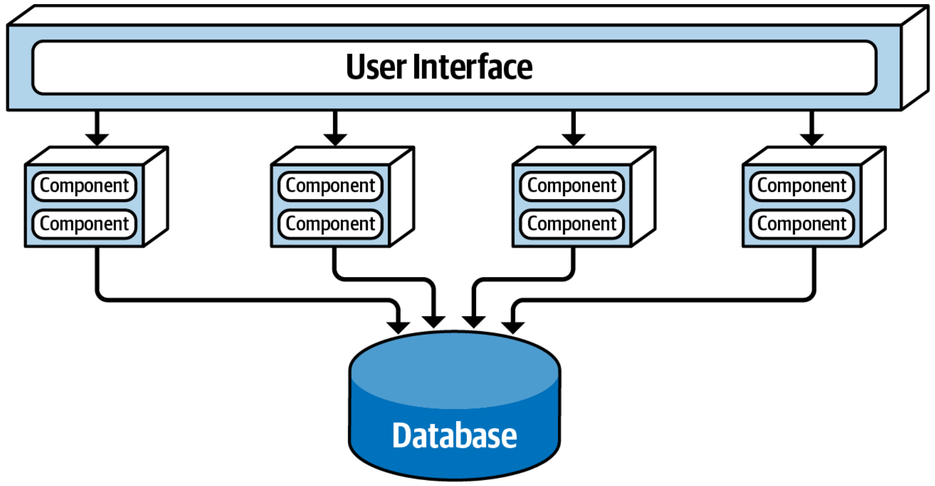




database(s)

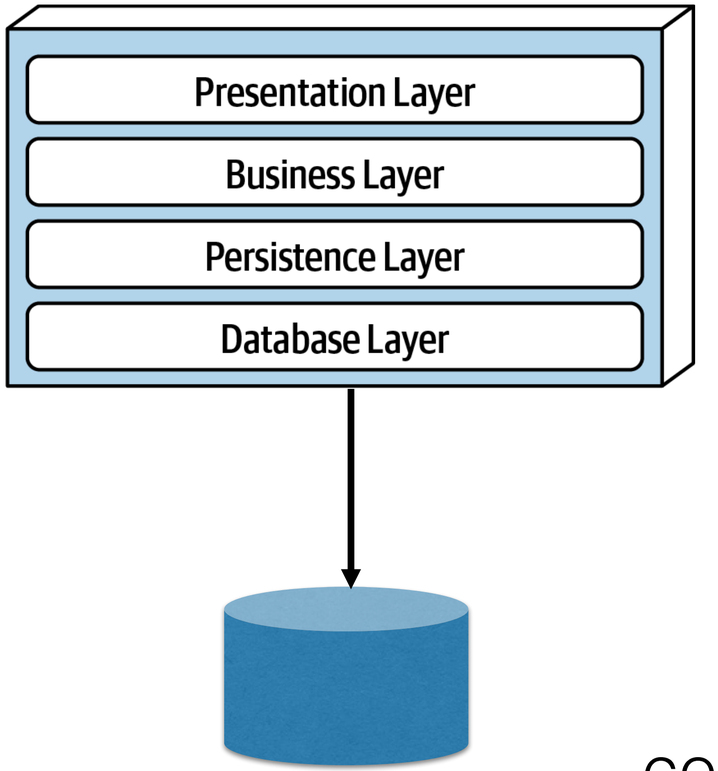
microservices vs service-based

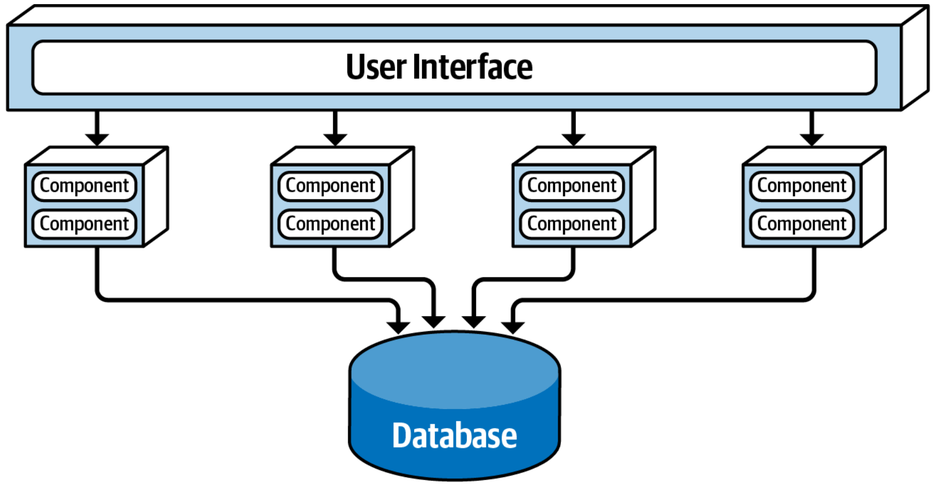




service granularity

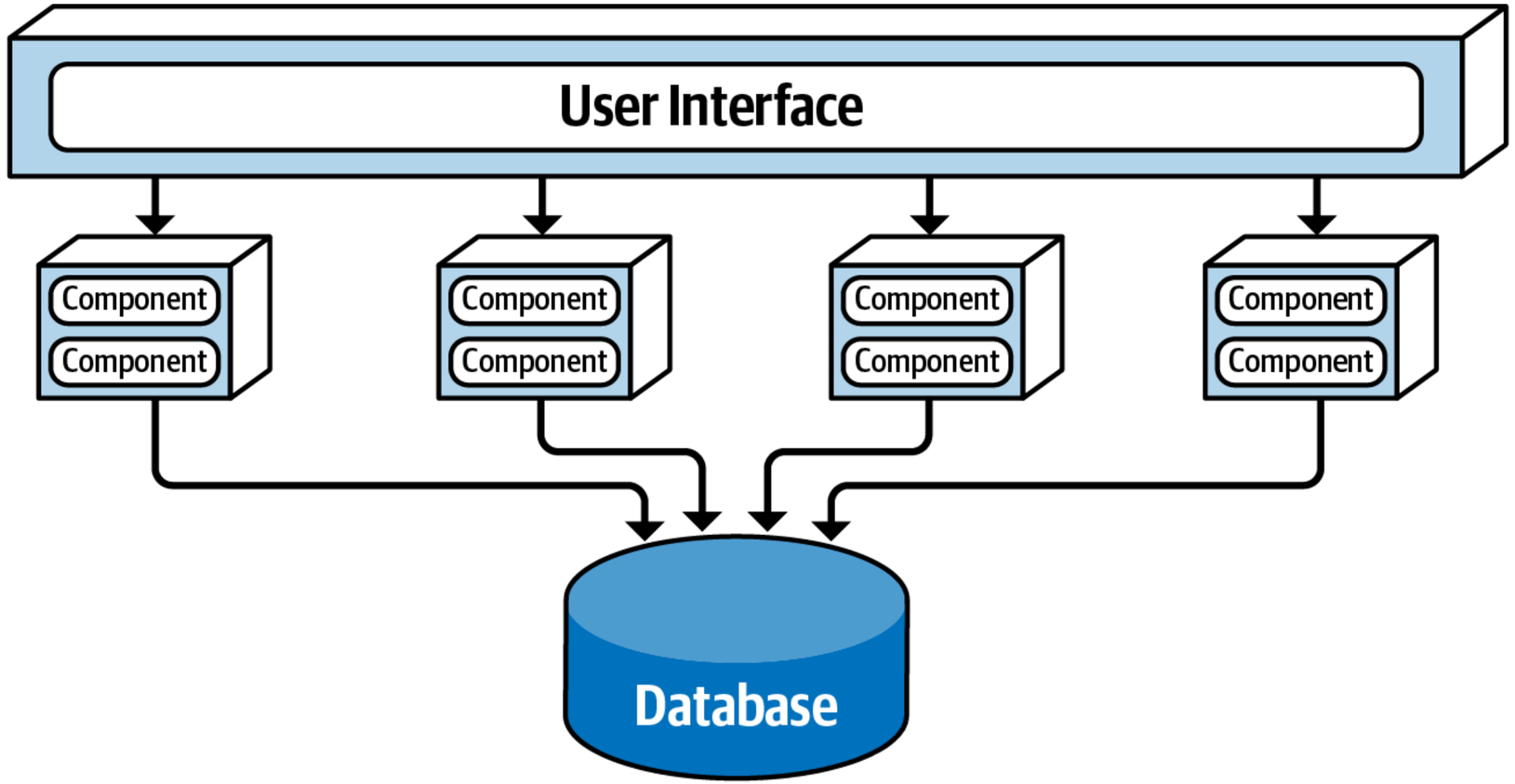
monolith => service-based





common migration target

suitability: service-based ?

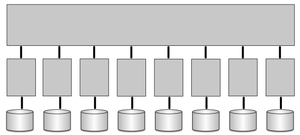


Your Architectural Kata is...

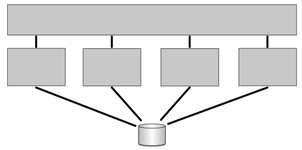
Going Going Gone!

layered monolith

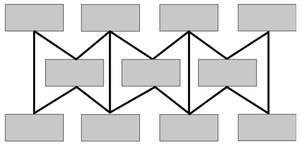
microkernel



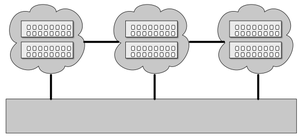
microservices



service-based



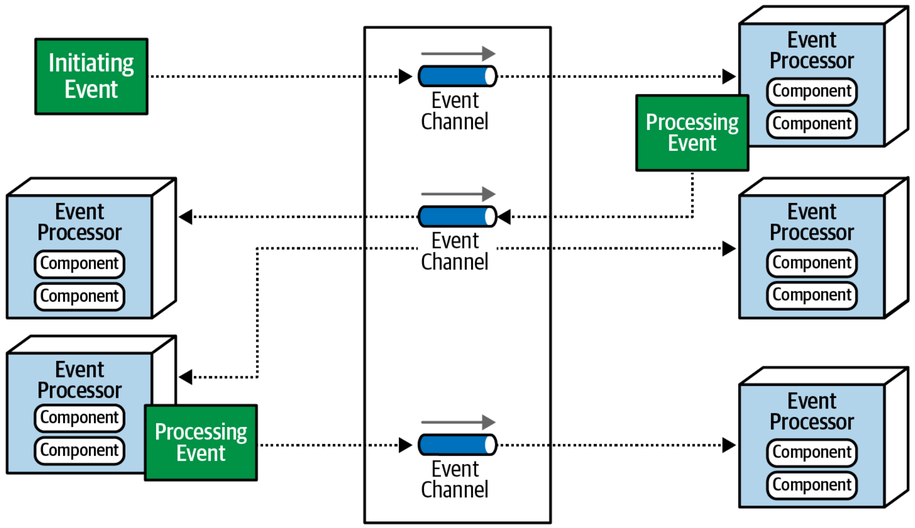
event-driven

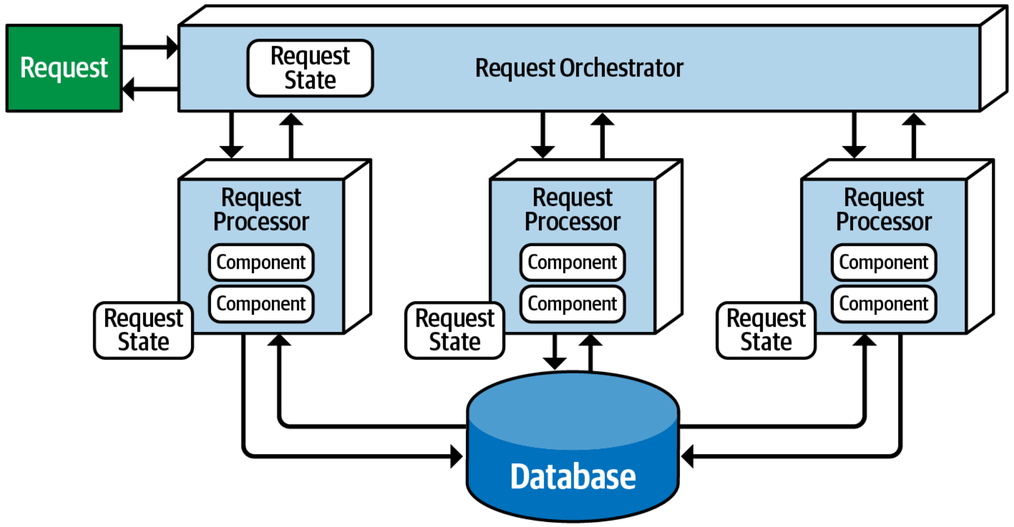


space-based

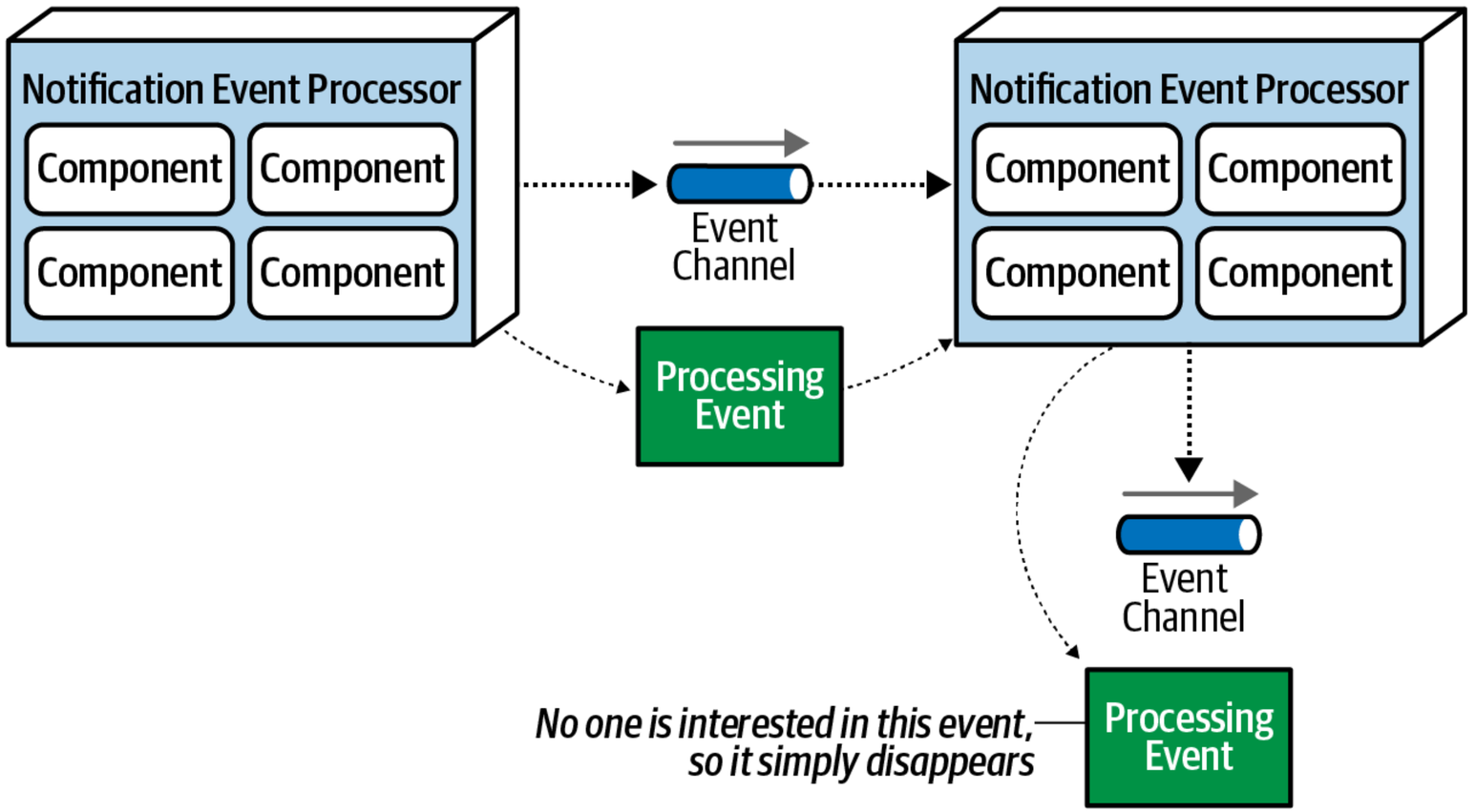
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

event-driven architecture

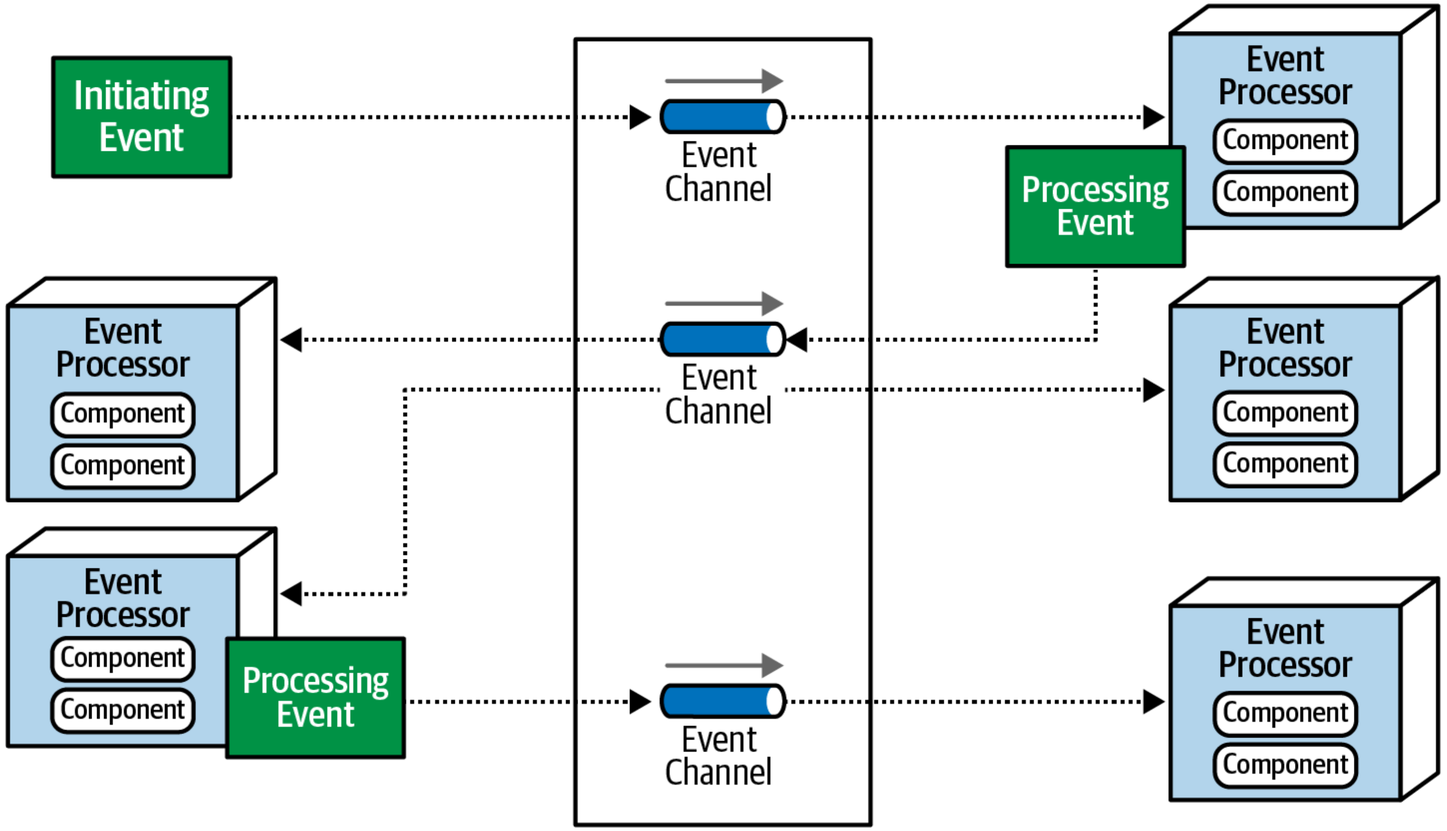




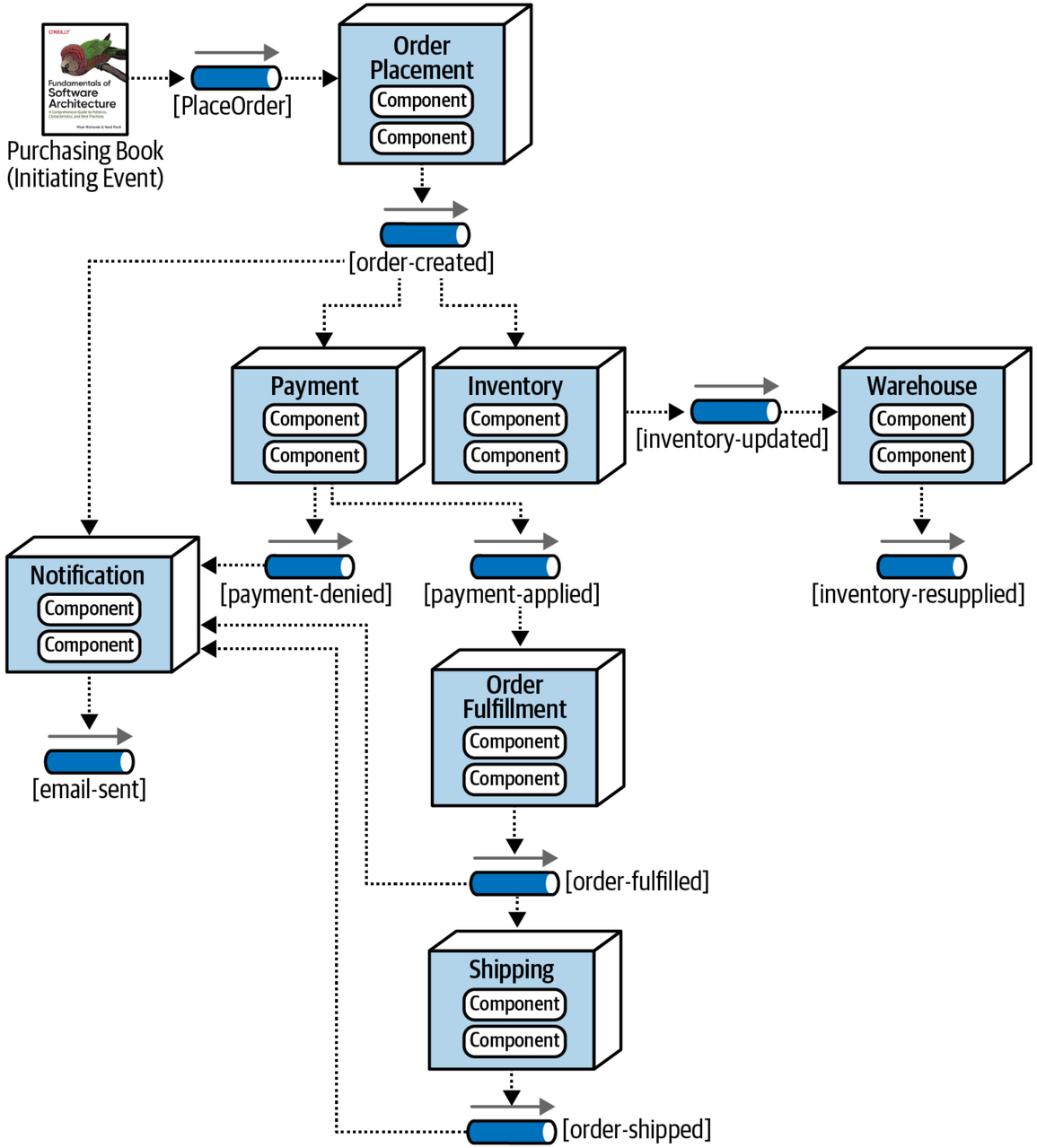
event-driven architecture



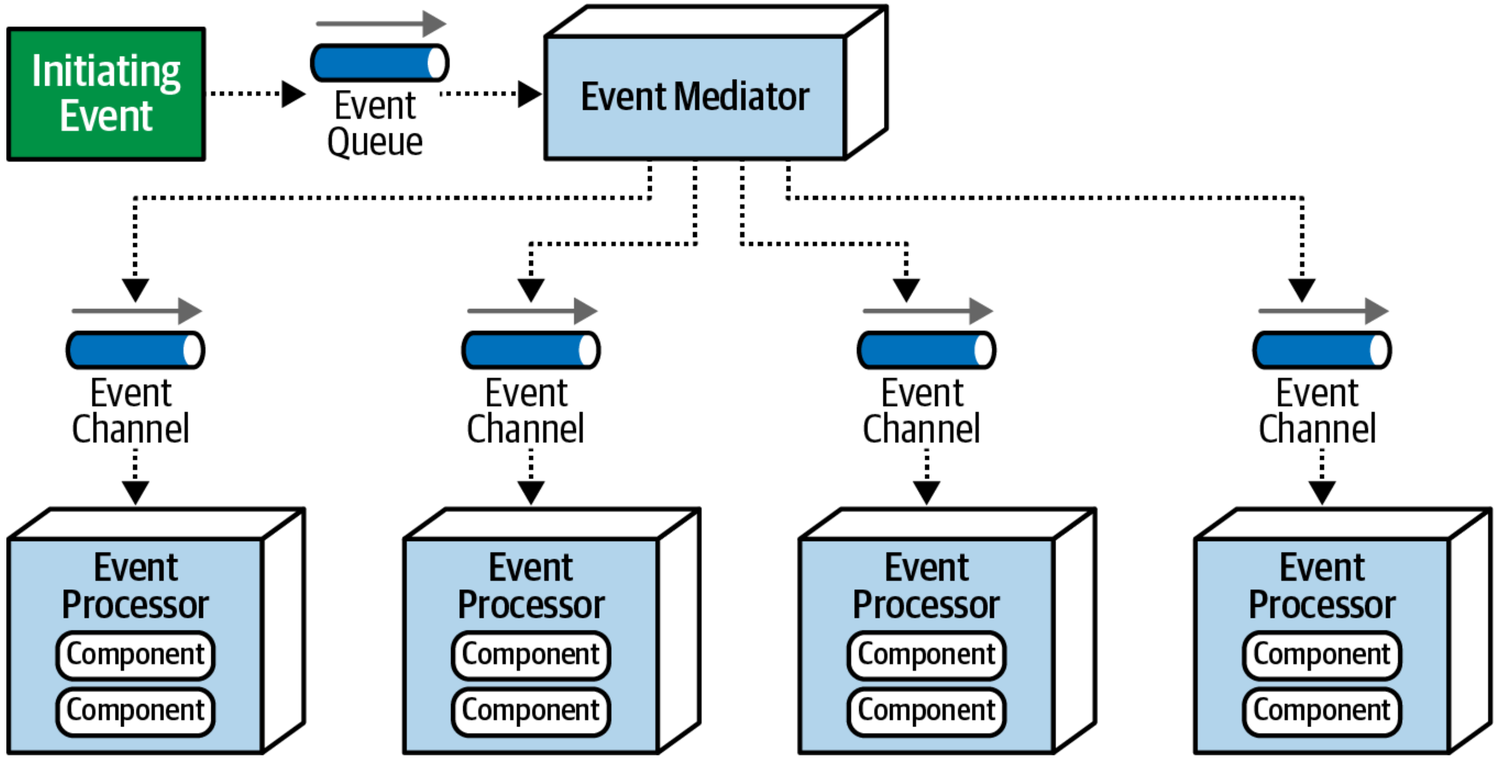
EDA: broker


Initiating Event
Event Channel
Event Channel
Event Channel
Processing Event
Processing Event
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component

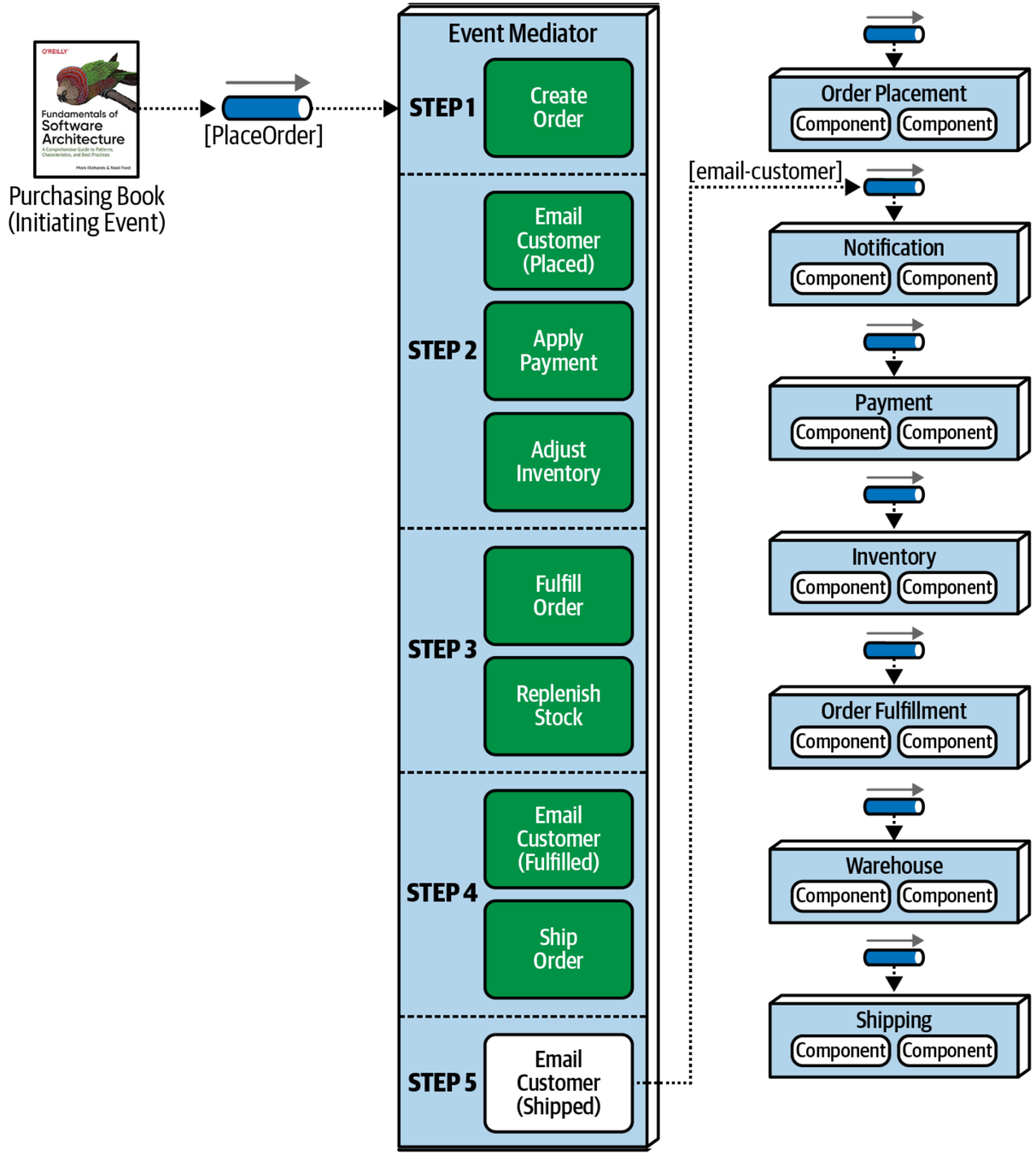
EDA: broker


Purchasing Book
(Initiating Event)
[PlaceOrder]
Order Placement
Component
Component
[order-created]
Payment
Component
Component
Inventory
Component
Component
[inventory-updated]
Warehouse
Component
Component
[inventory-resupplied]
Notification
Component
Component
[payment-denied]
[payment-applied]
[email-sent]
Order Fulfillment
Component
Component
[order-fulfilled]
Shipping
Component
Component
[order-shipped]

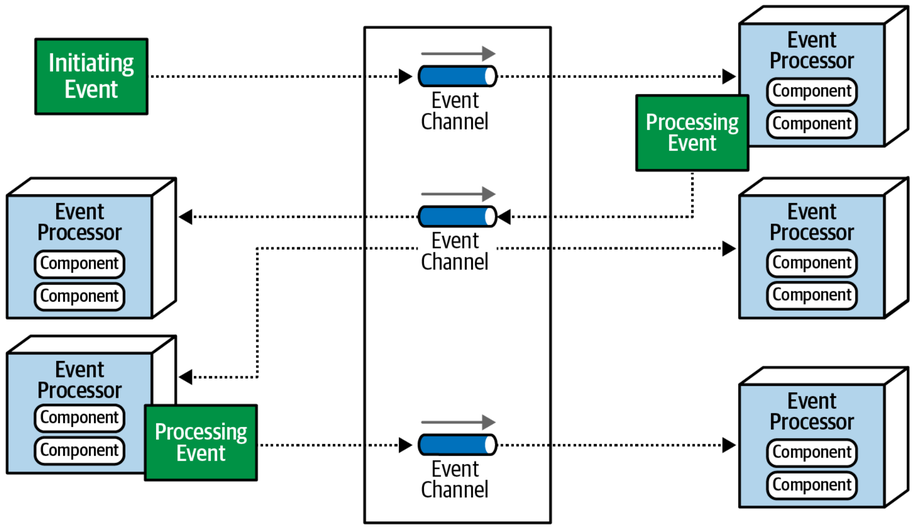
EDA: mediator

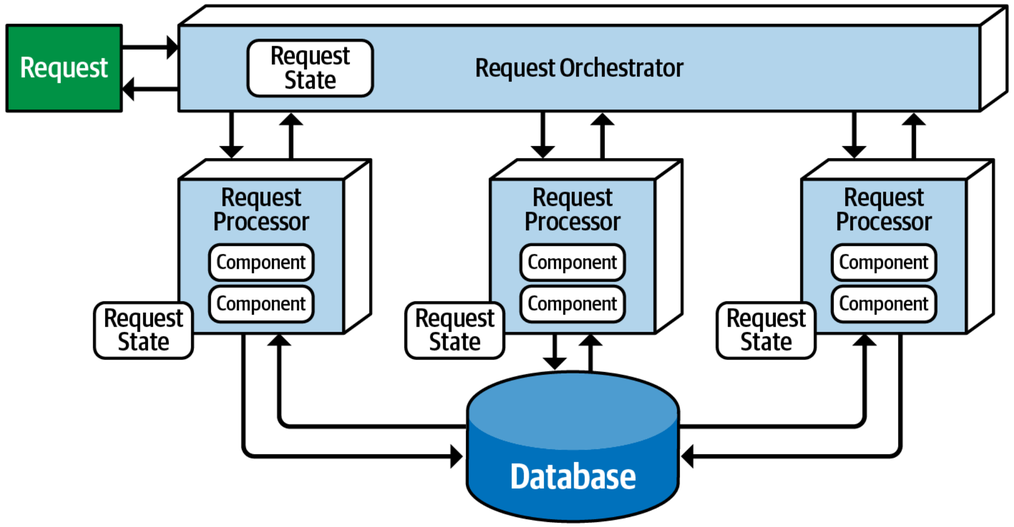


EDA: mediator



suitability: EDA ?



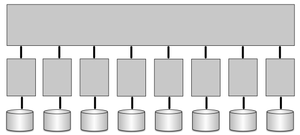


Your Architectural Kata is...

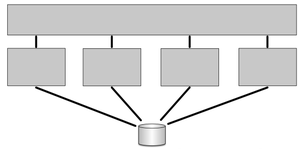
Going Going Gone!

layered monolith

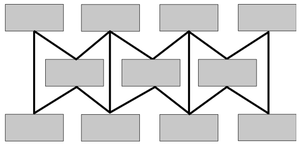
microkernel



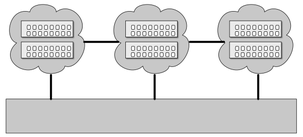
microservices



service-based



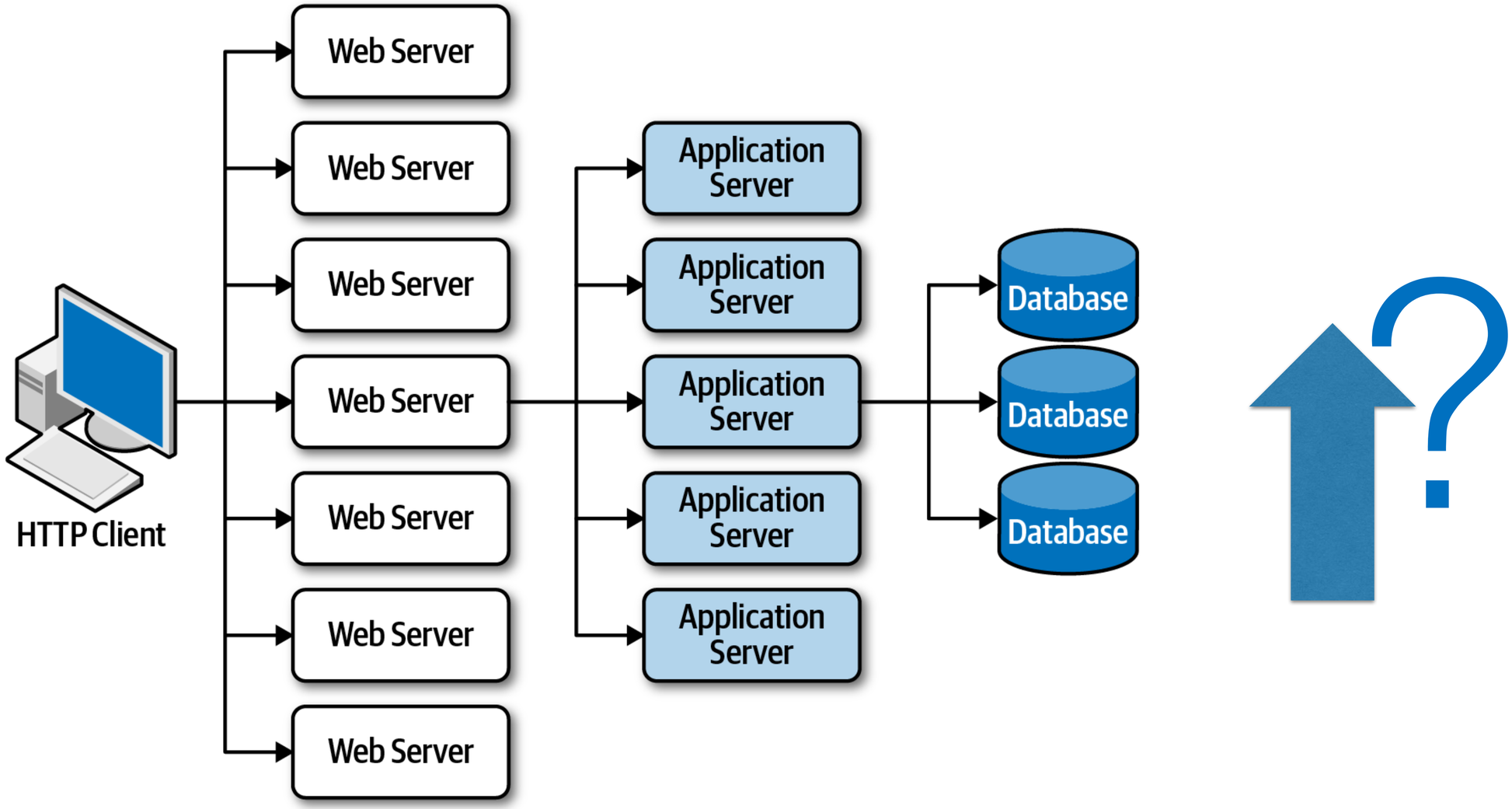
event-driven



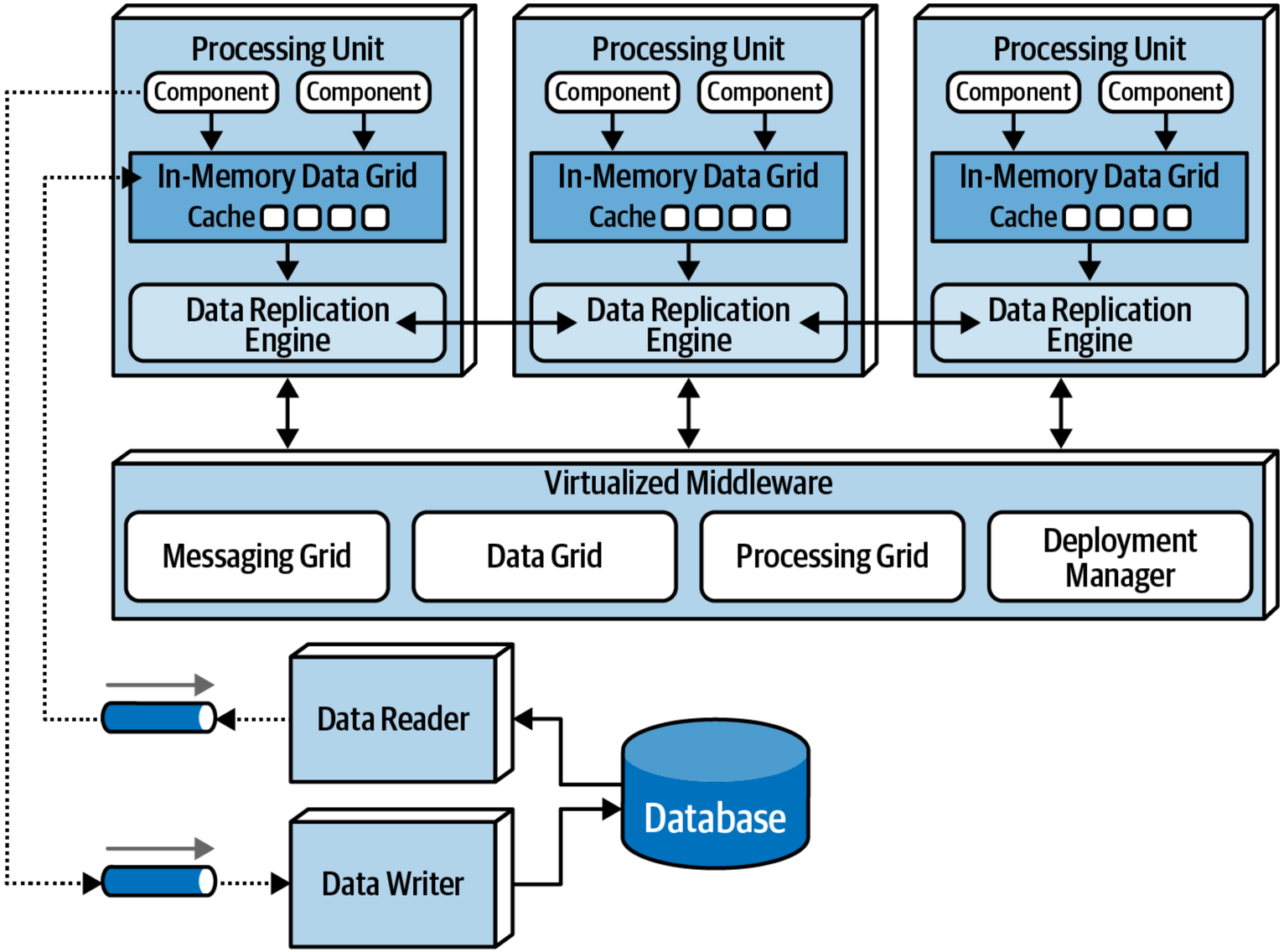
space-based

	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

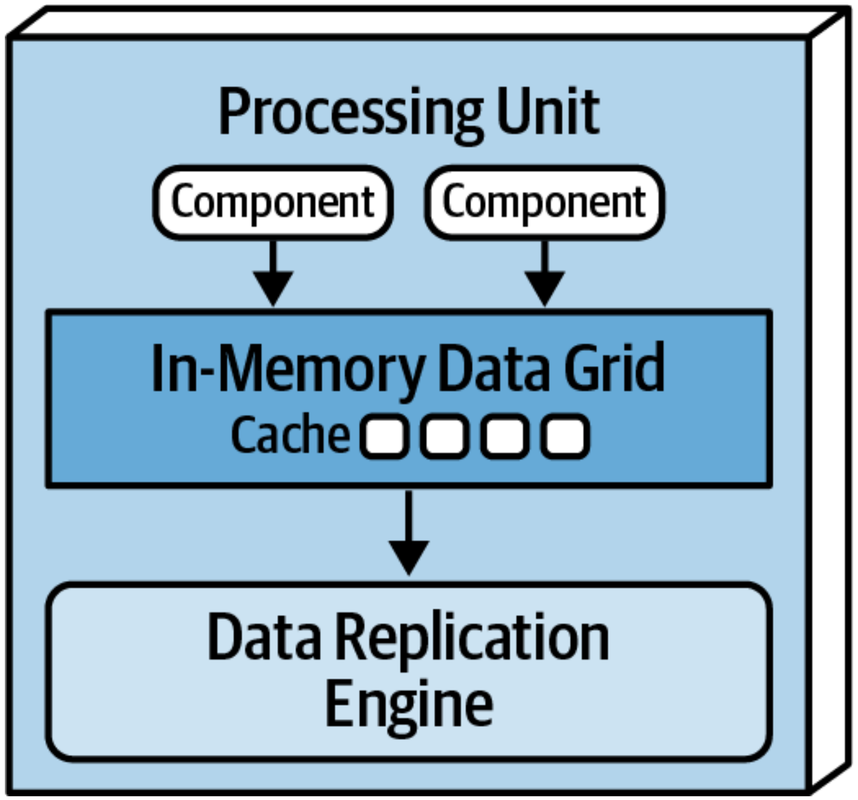
space-based architecture



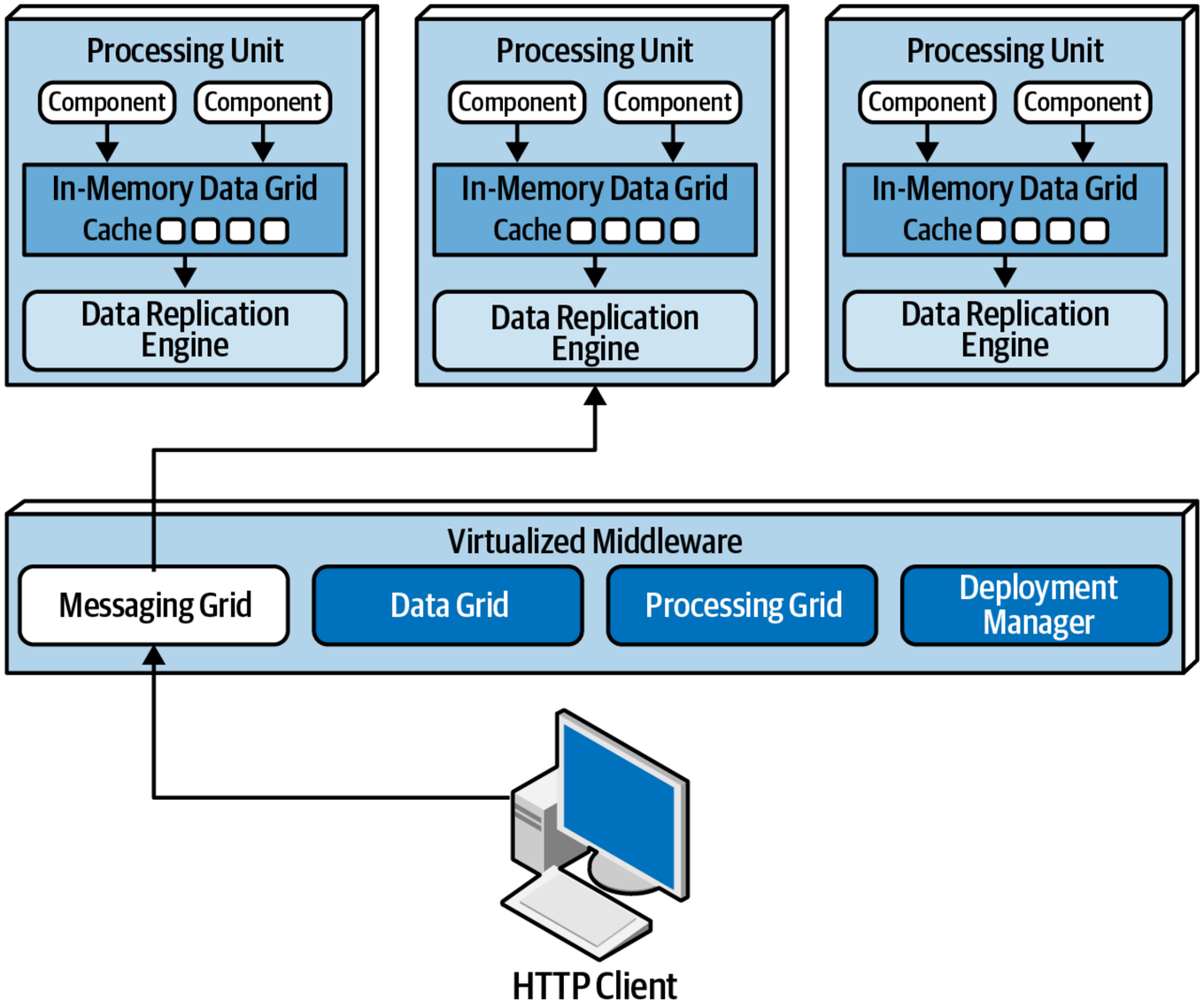
space-based architecture



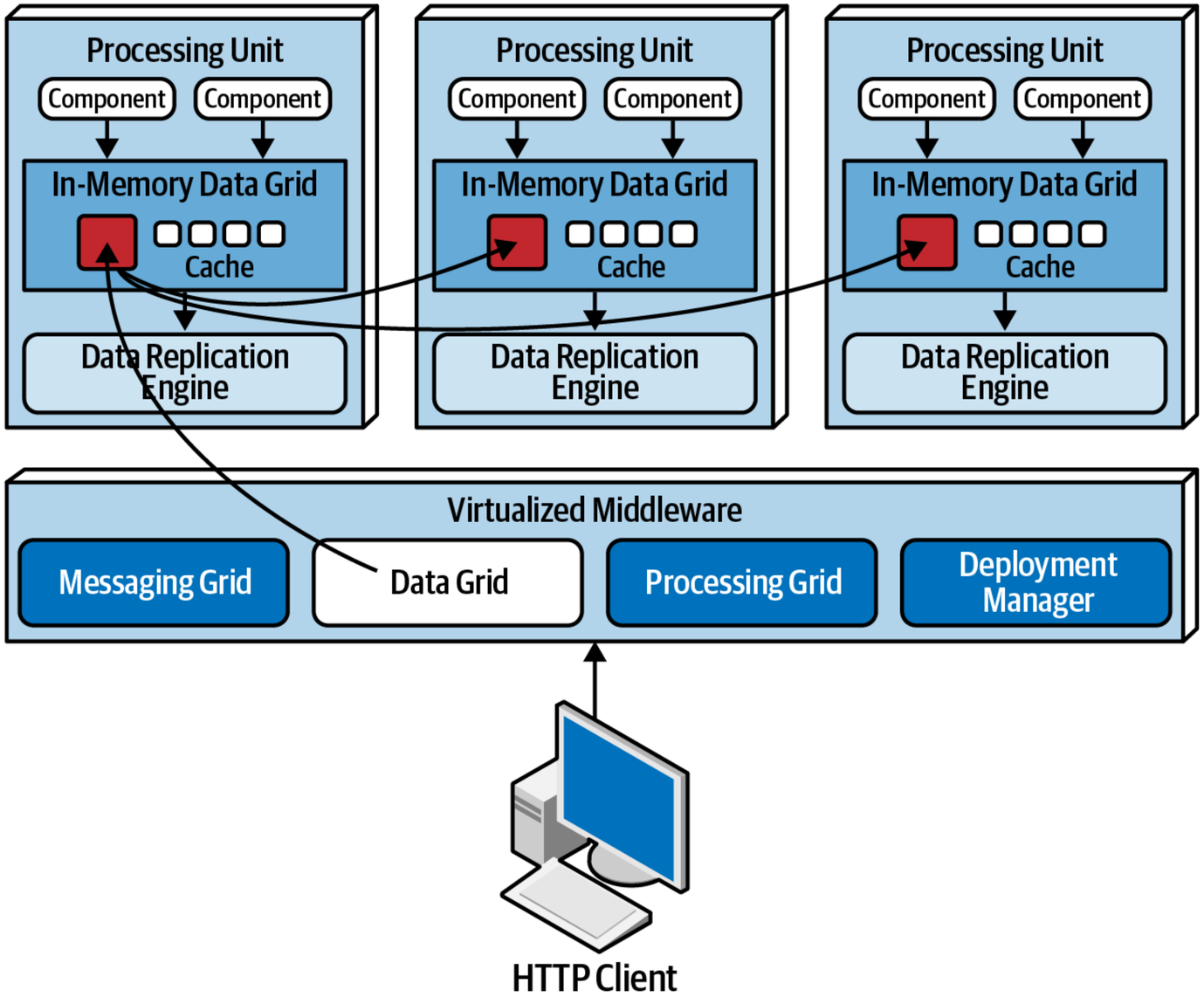
space-based architecture



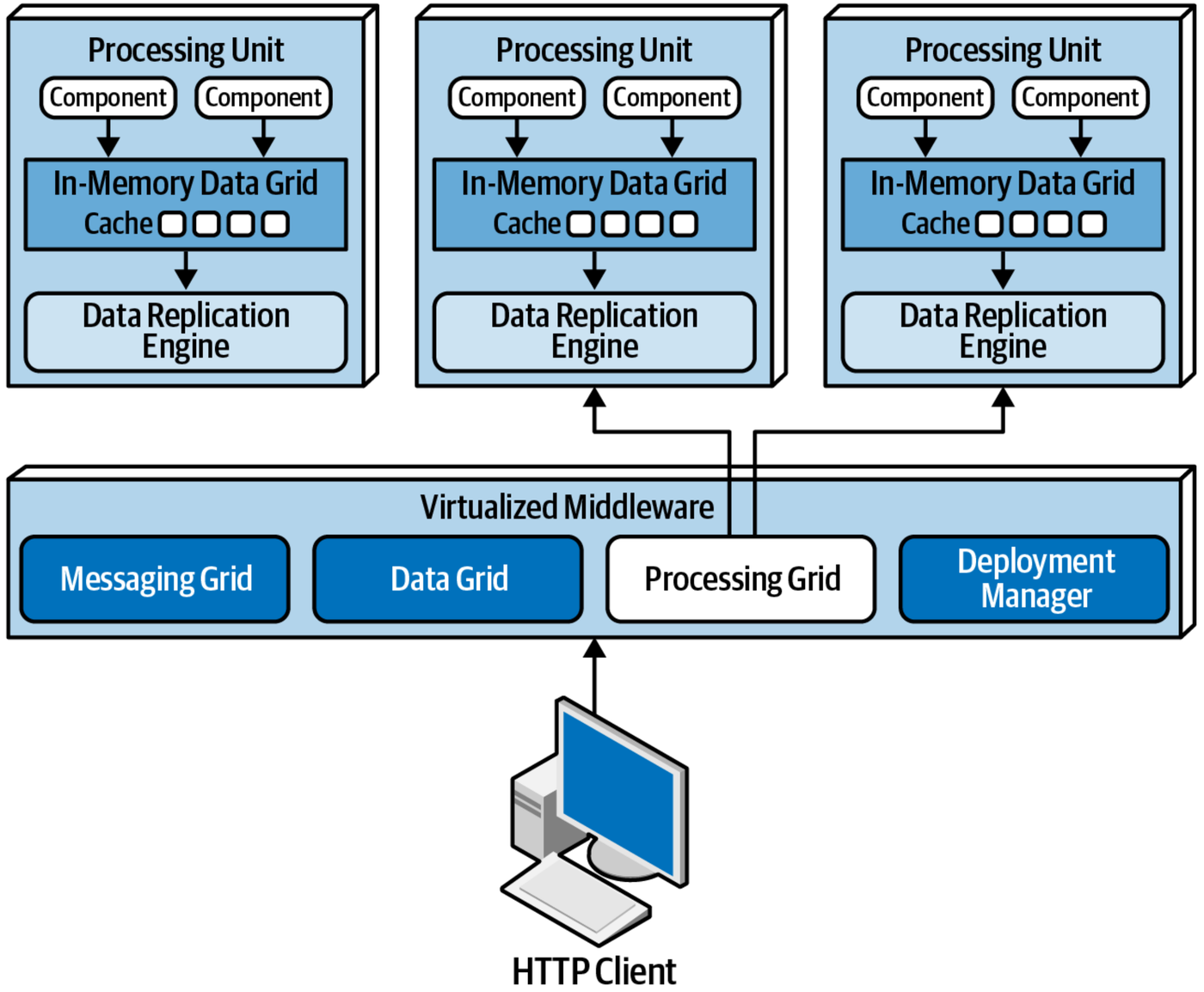
space-based architecture



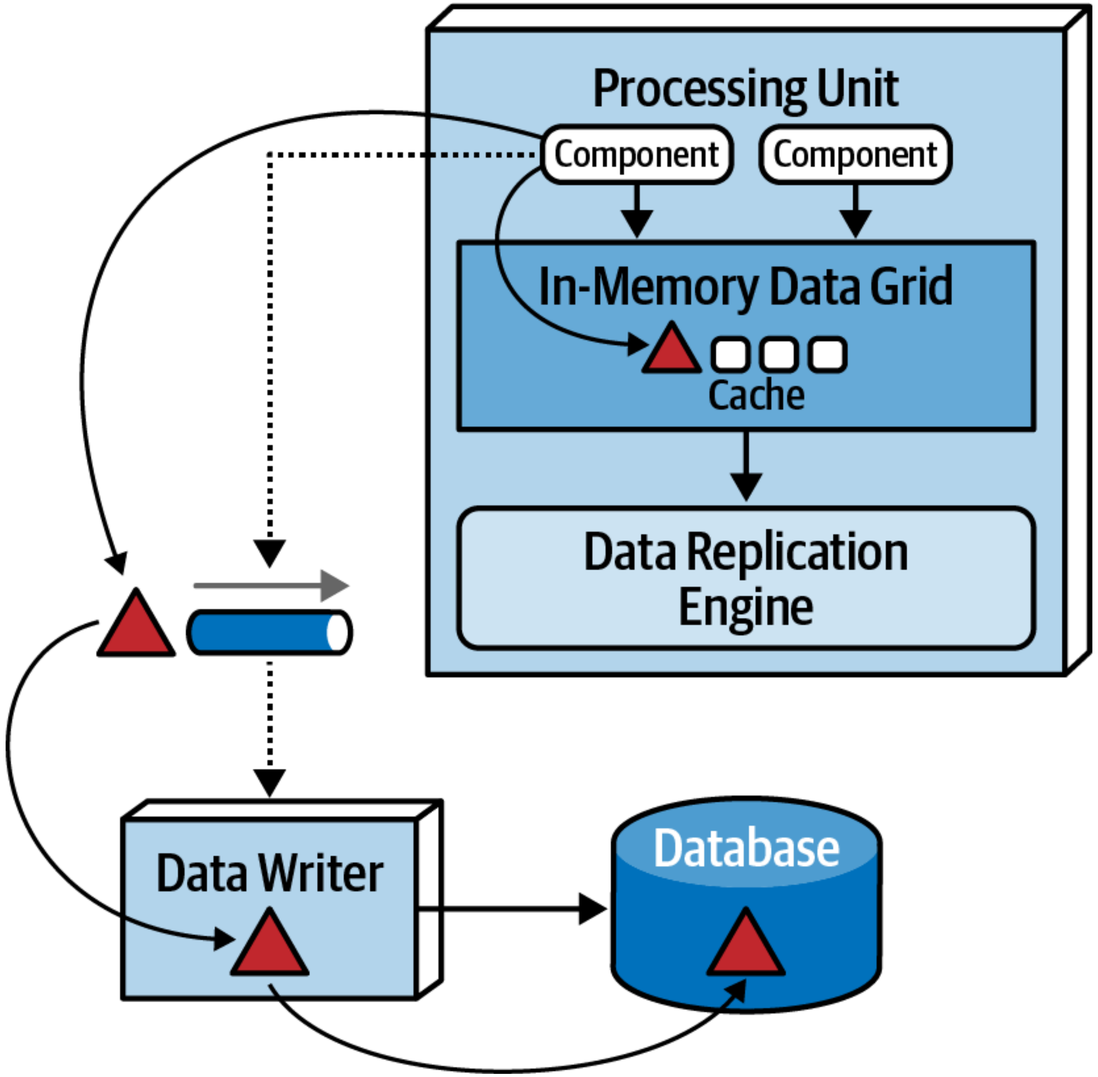
space-based architecture



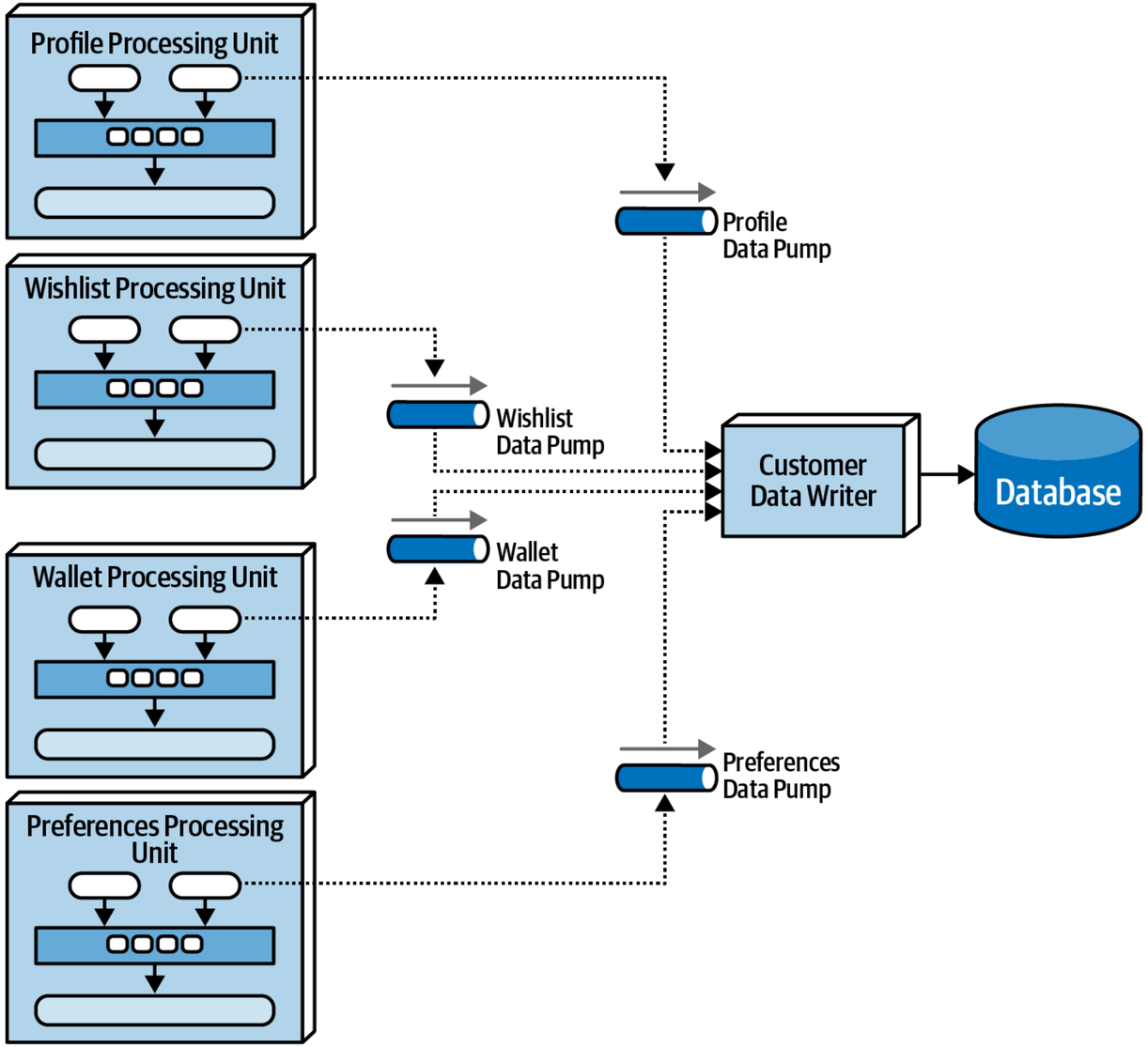
space-based architecture



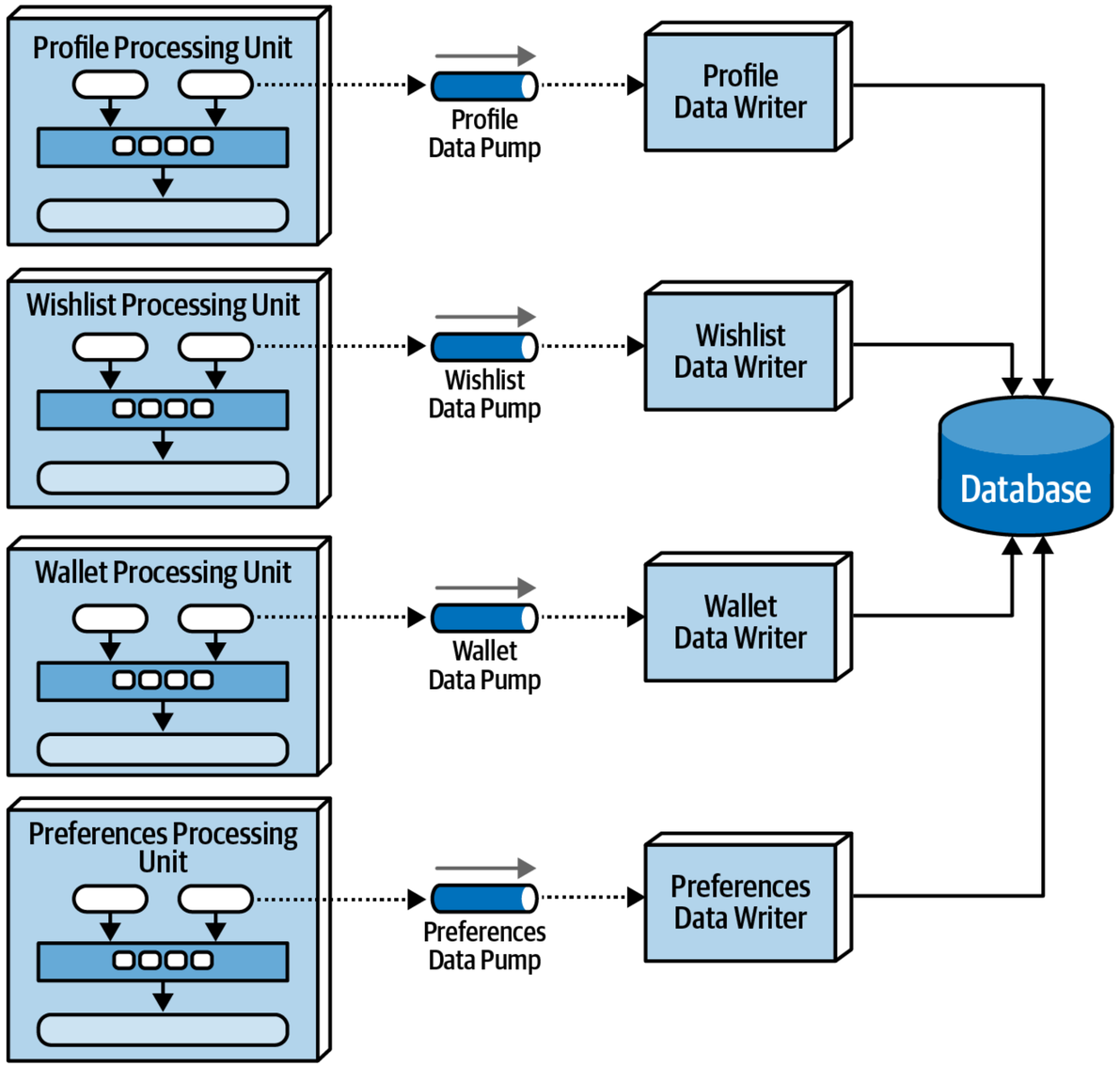
space-based architecture



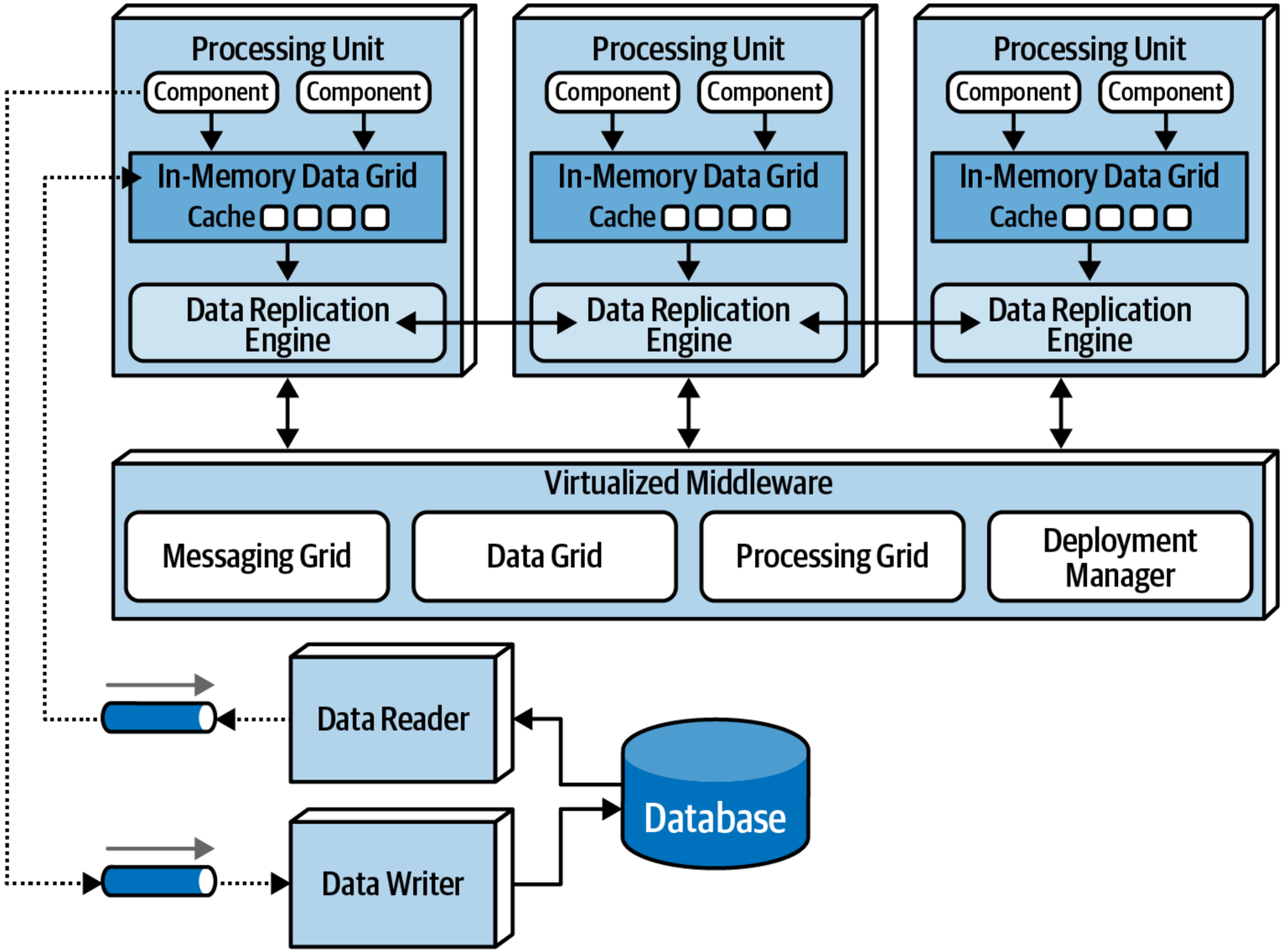
space-based architecture



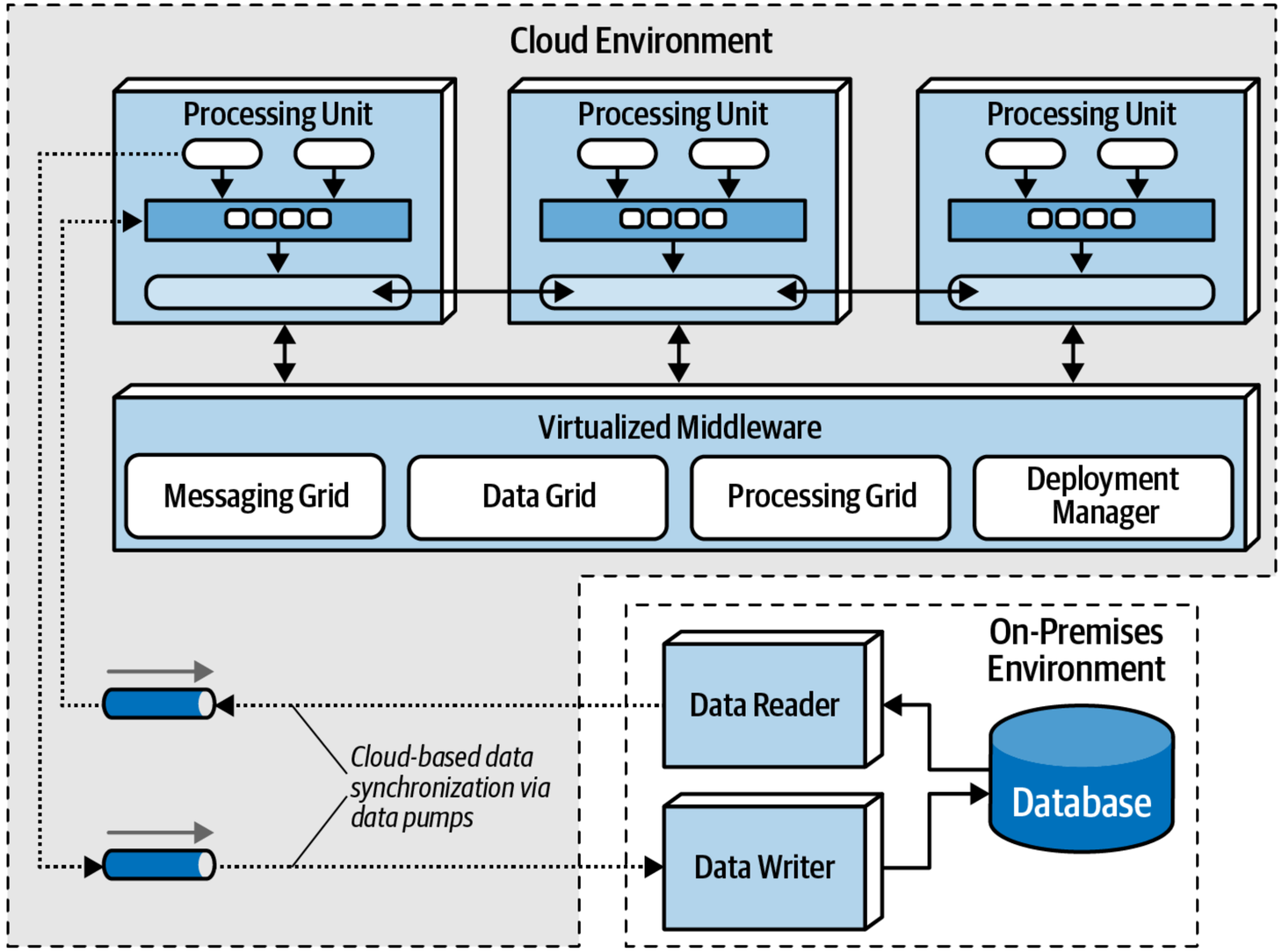
space-based architecture



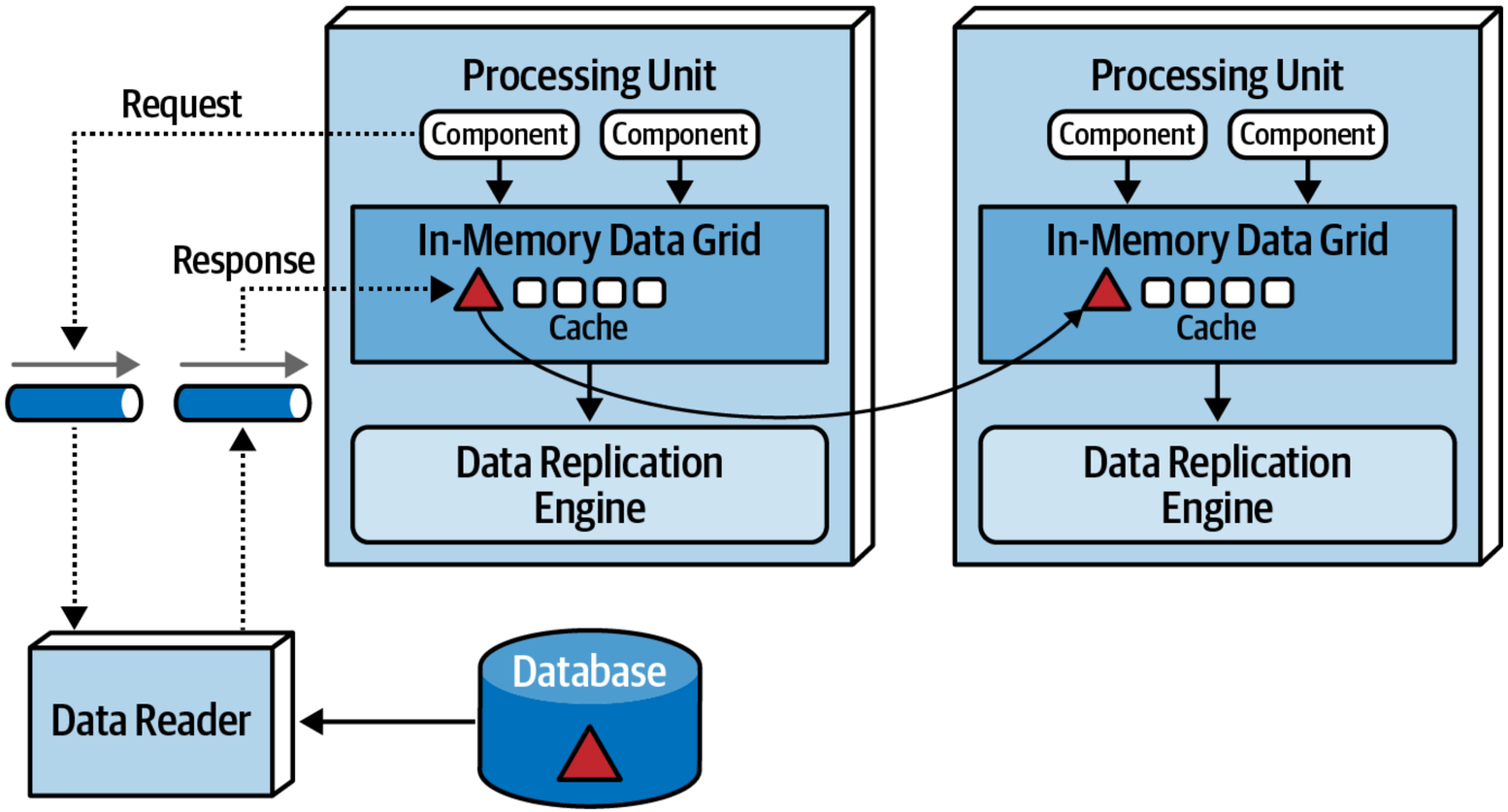
space-based architecture



space-based architecture



suitability: space-based ?

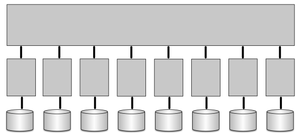


Your Architectural Kata is...

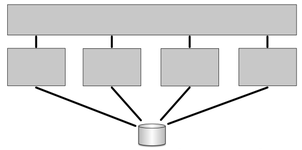
Going Going Gone!

layered monolith

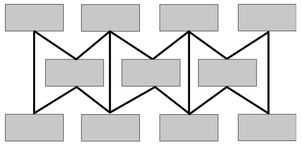
microkernel



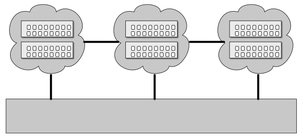
microservices



service-based



event-driven



space-based

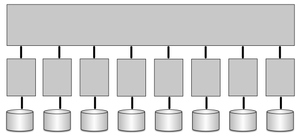
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

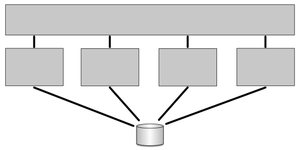
Going Going Gone!

layered monolith

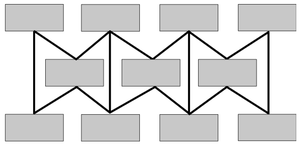
microkernel



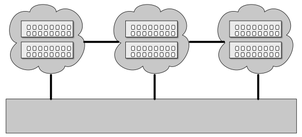
microservices



service-based



event-driven

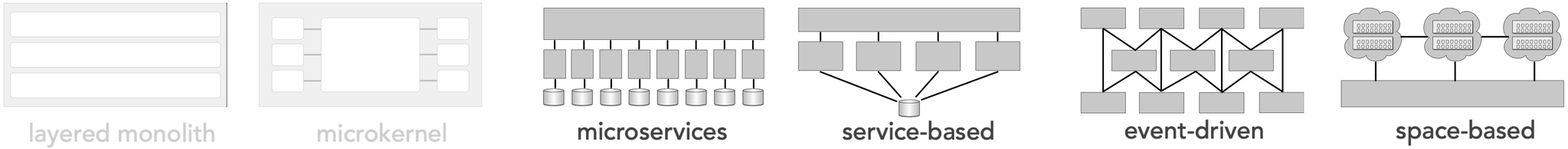


space-based

	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

Going Going Gone!



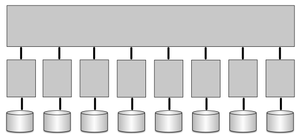
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

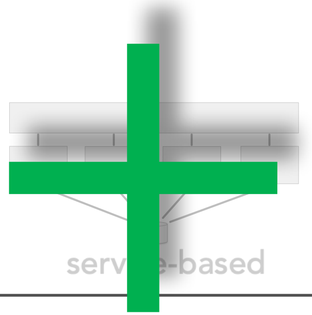
Going Going Gone!

layered monolith

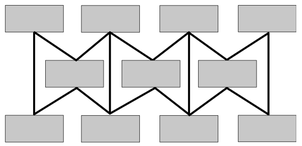
microkernel



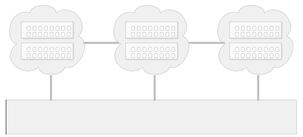
microservices



serv e-based



event-driven

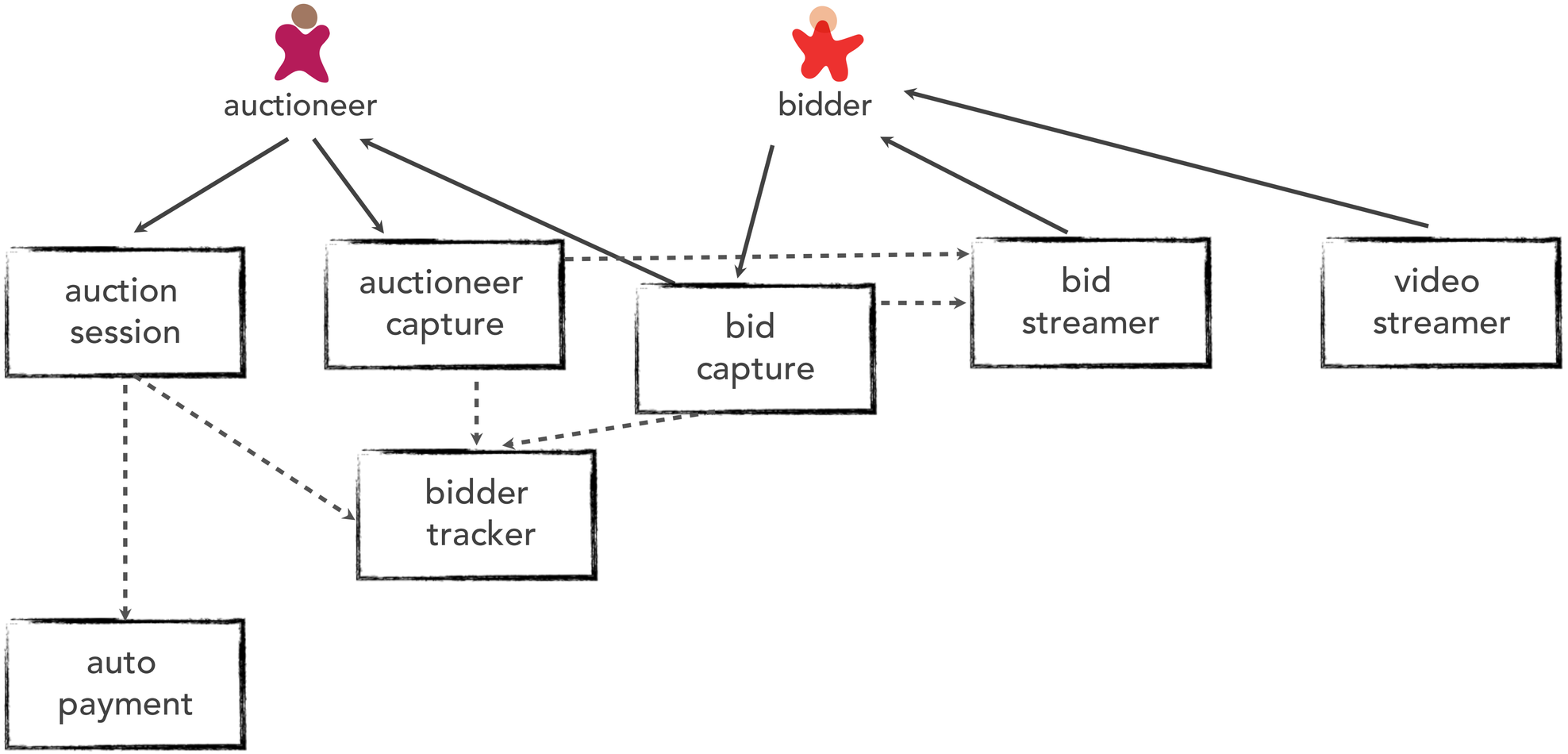


space-based

agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

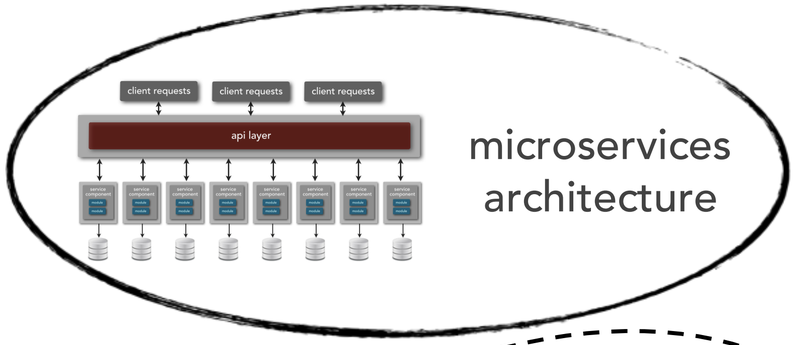
Your Architectural Kata is...

Going Going Gone!

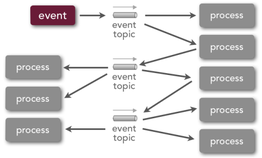


Your Architectural Kata is...

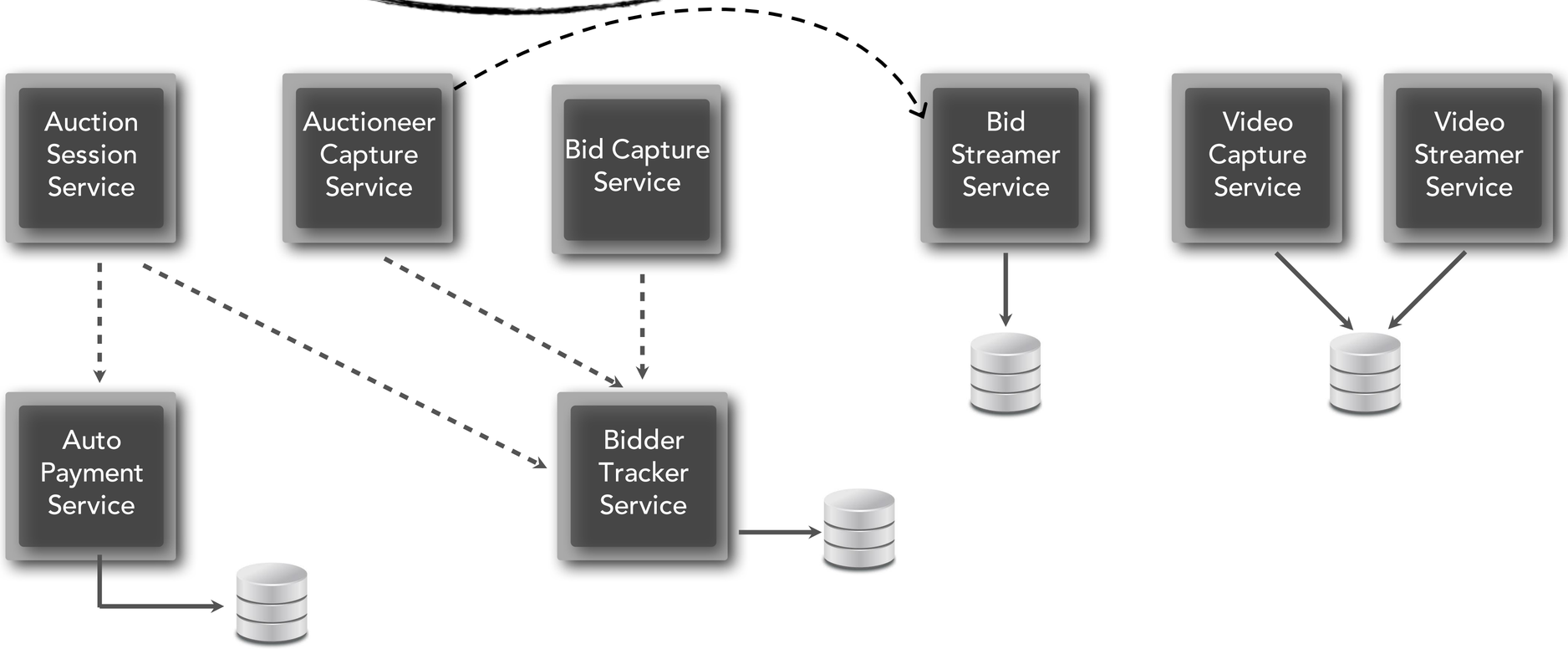
Going Going Gone!



microservices architecture

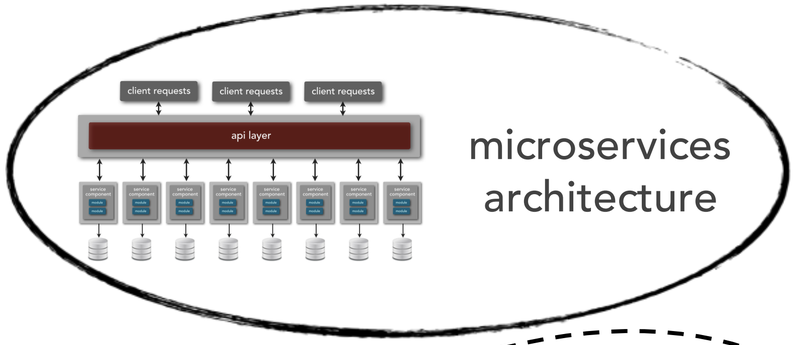


event-driven architecture

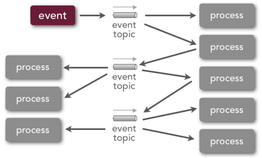


Your Architectural Kata is...

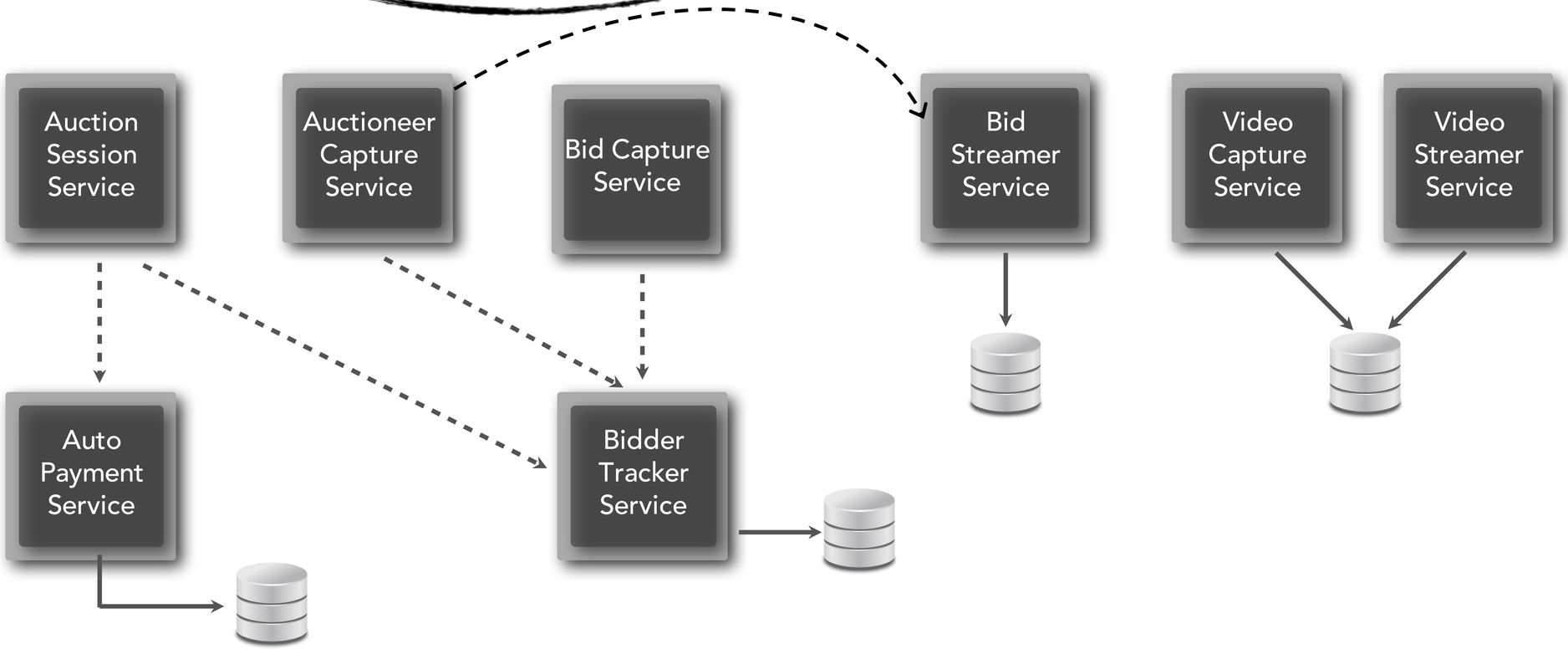
Going Going Gone!



microservices architecture

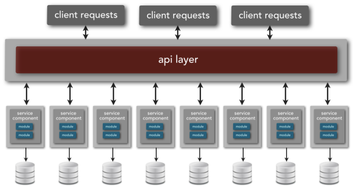


event-driven architecture

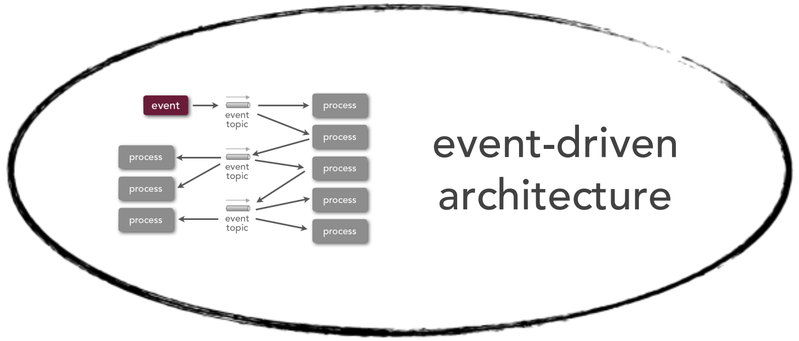


Your Architectural Kata is...

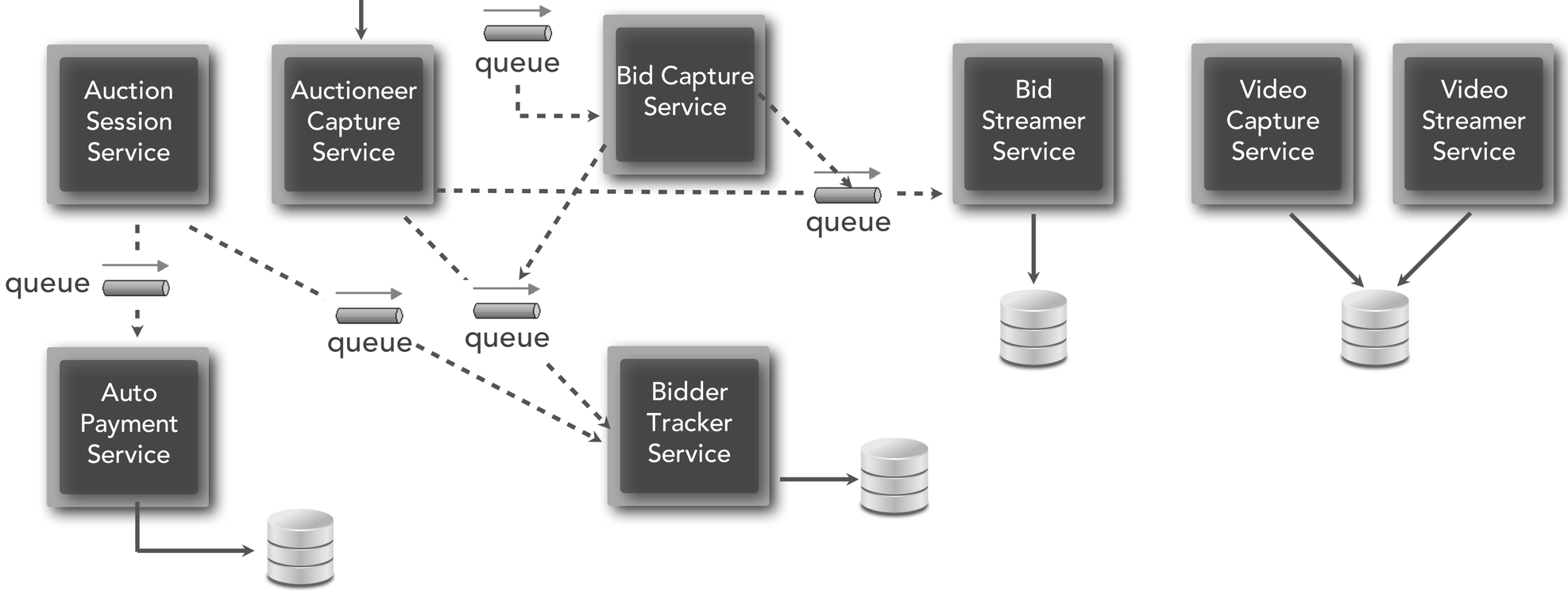
Going Going Gone!



microservices architecture



event-driven architecture



Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
  - Time to market is critical.

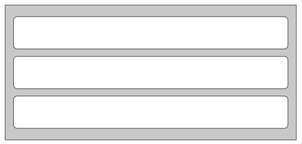
availability reliability

scalability

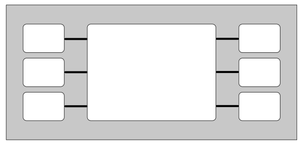
customizability { location, sales, recipe

Your Architectural Kata is...

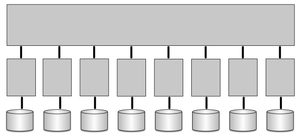
Silicon Sandwiches



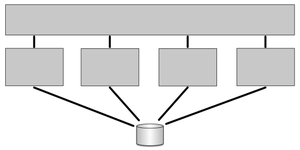
layered monolith



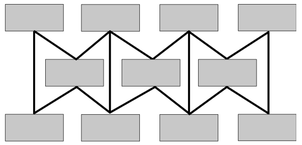
microkernel



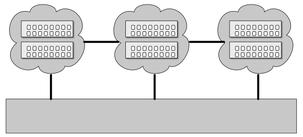
microservices



service-based



event-driven

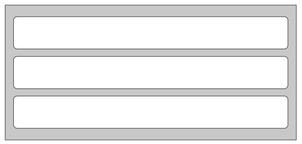


space-based

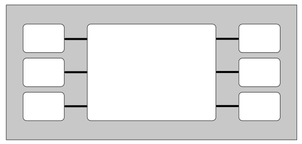
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

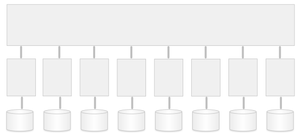
Silicon Sandwiches



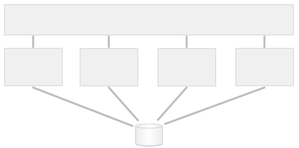
layered monolith



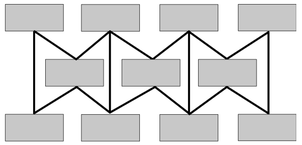
microkernel



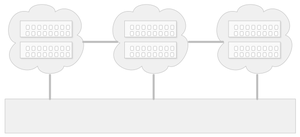
microservices



service-based



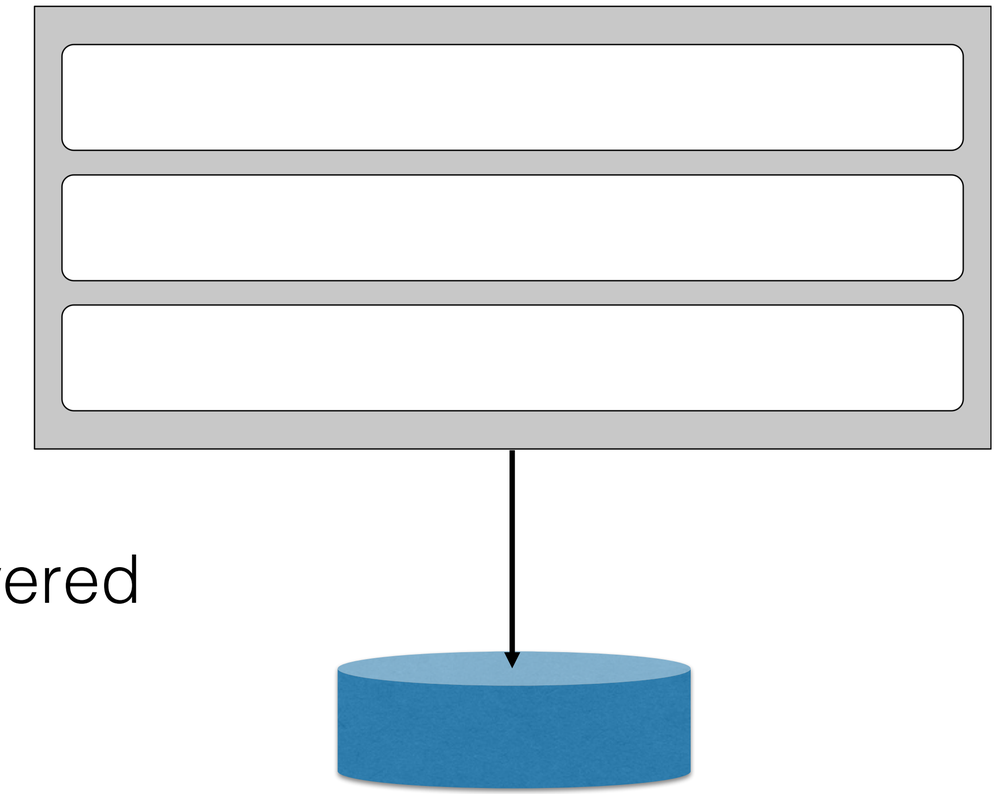
event-driven



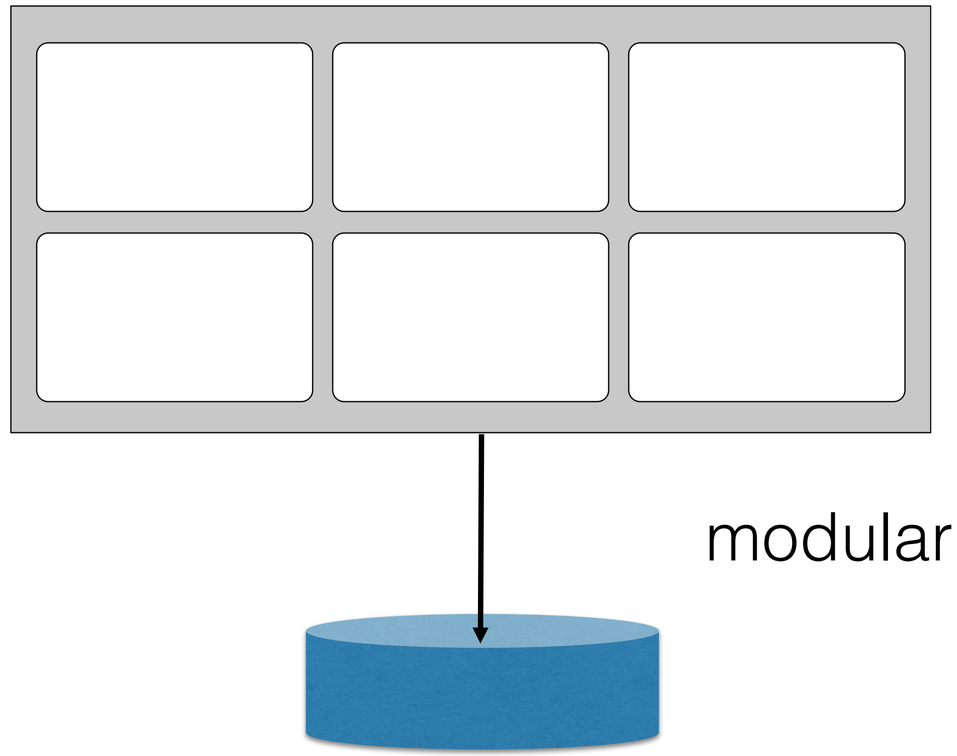
space-based

	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

monoliths



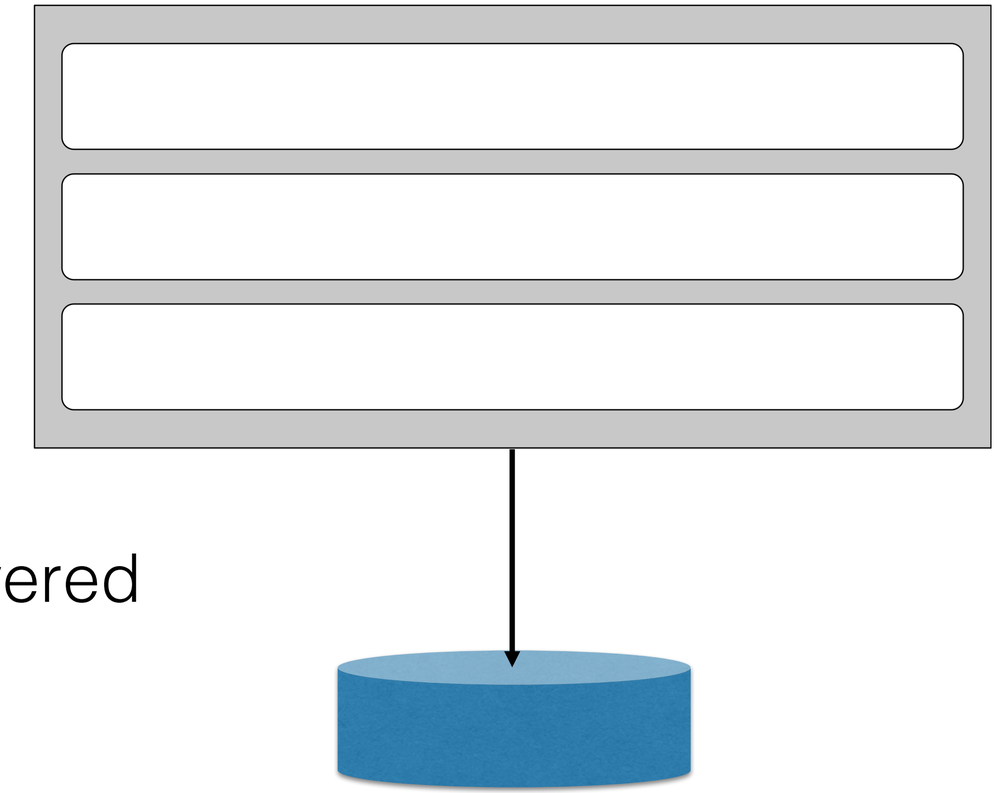
layered



modular

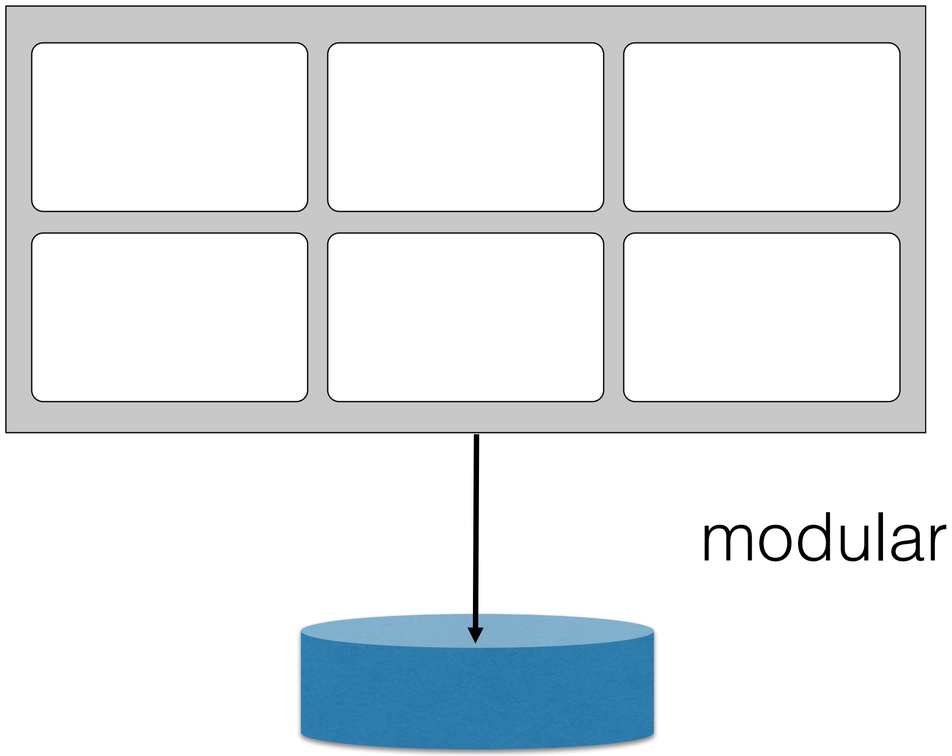
monoliths

technical partitioning



layered

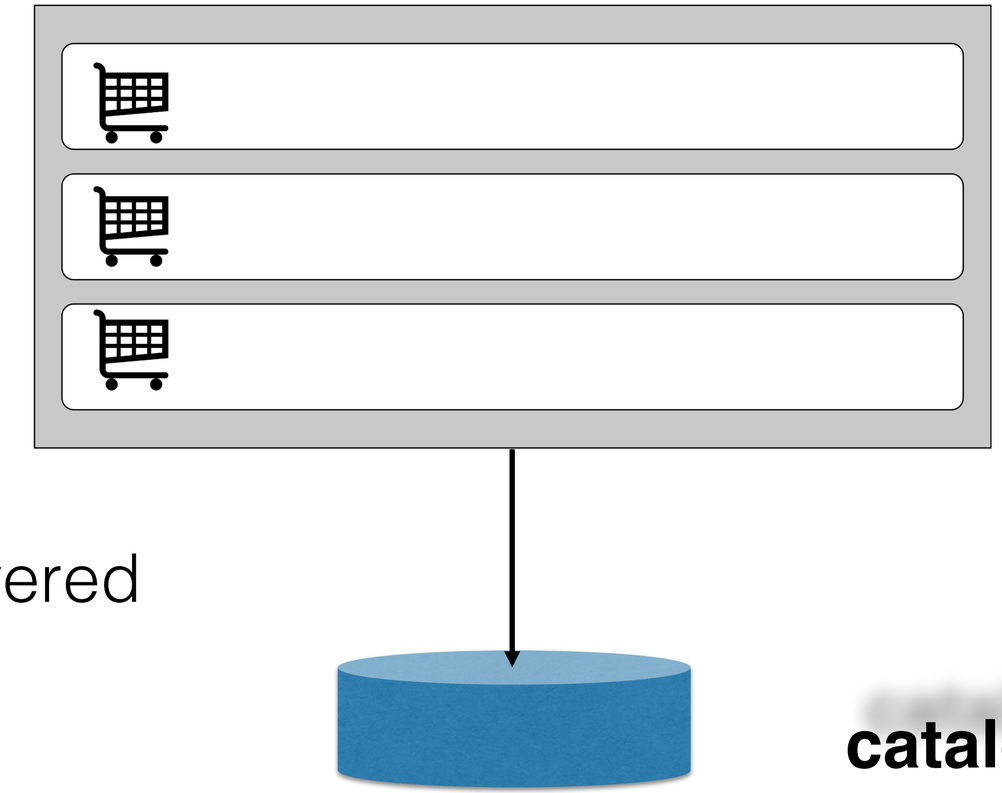
domain partitioning



modular

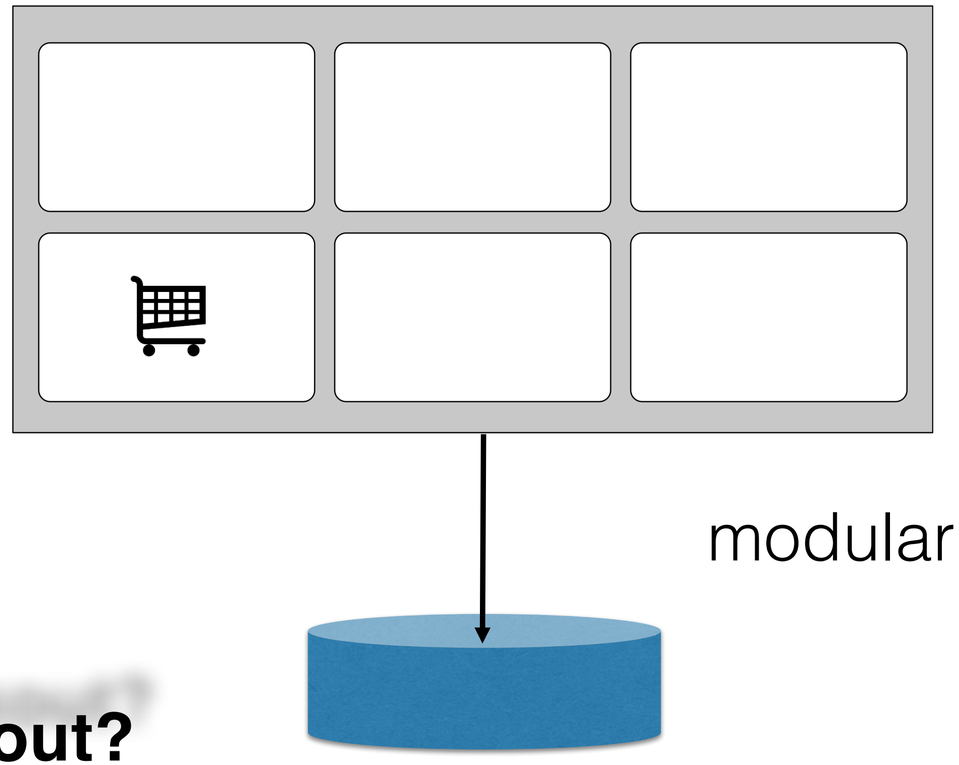
monoliths

technical partitioning



layered

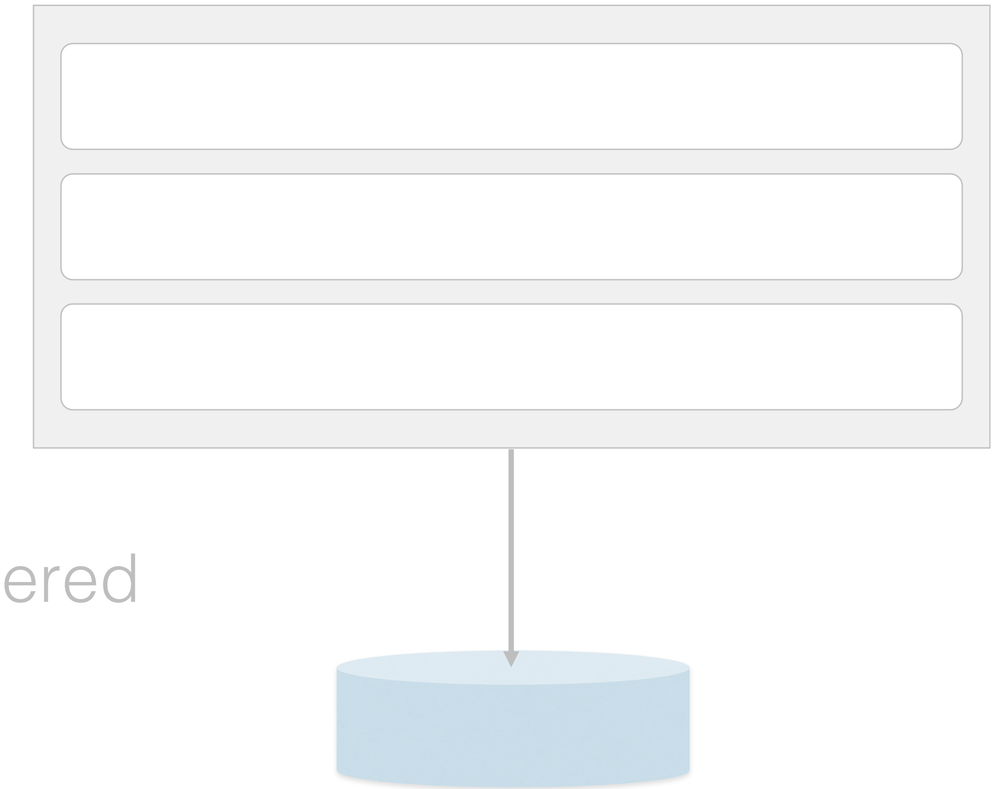
domain partitioning



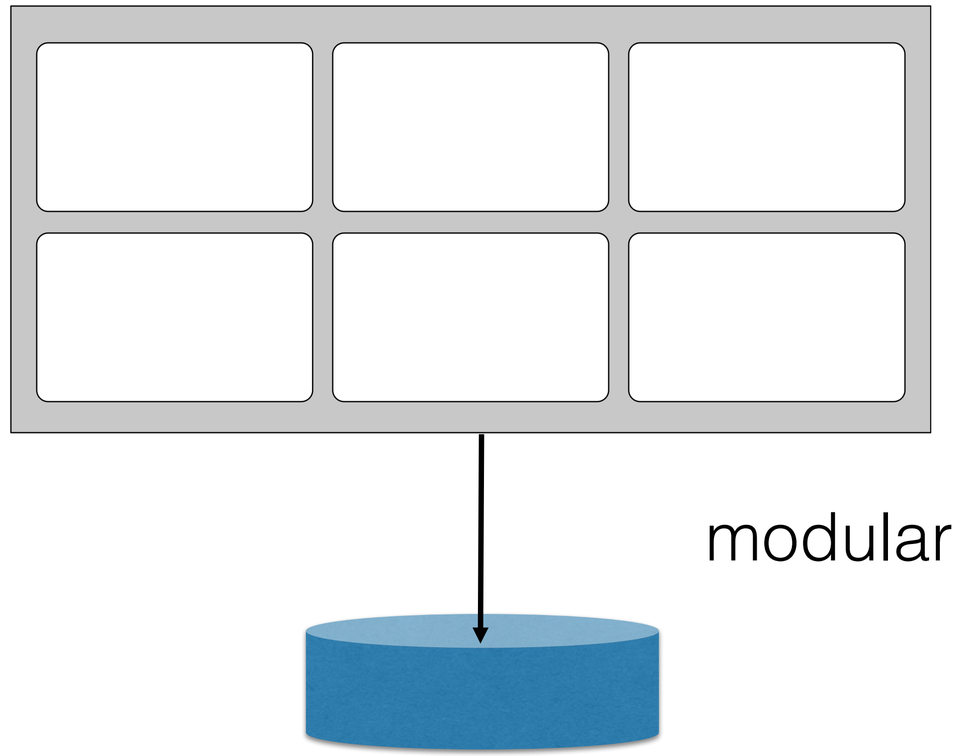
modular

catalog checkout?

monoliths

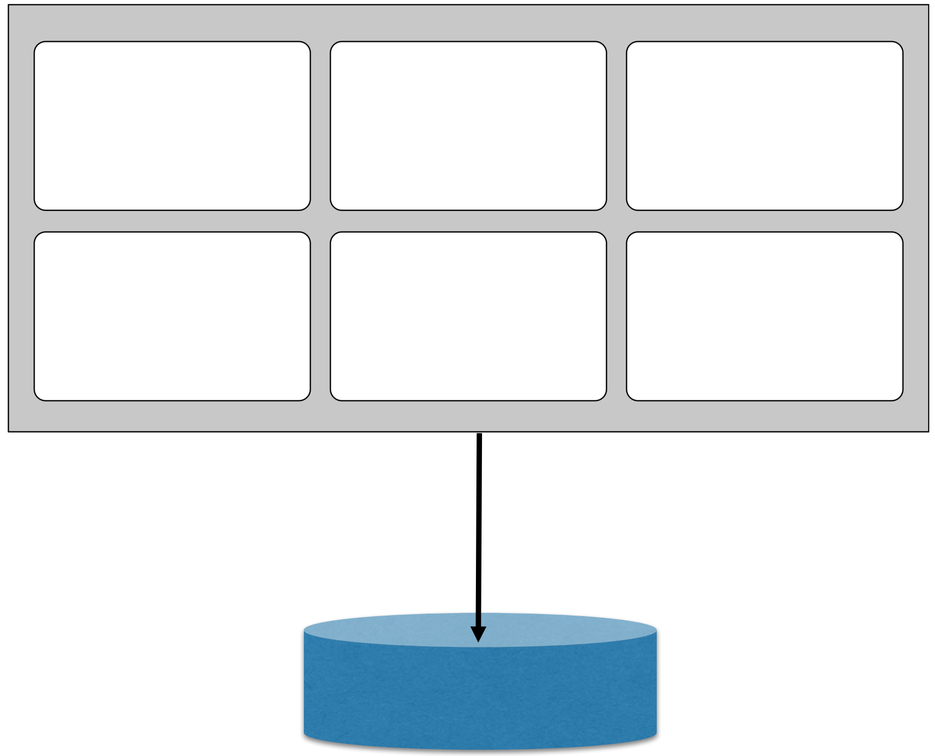


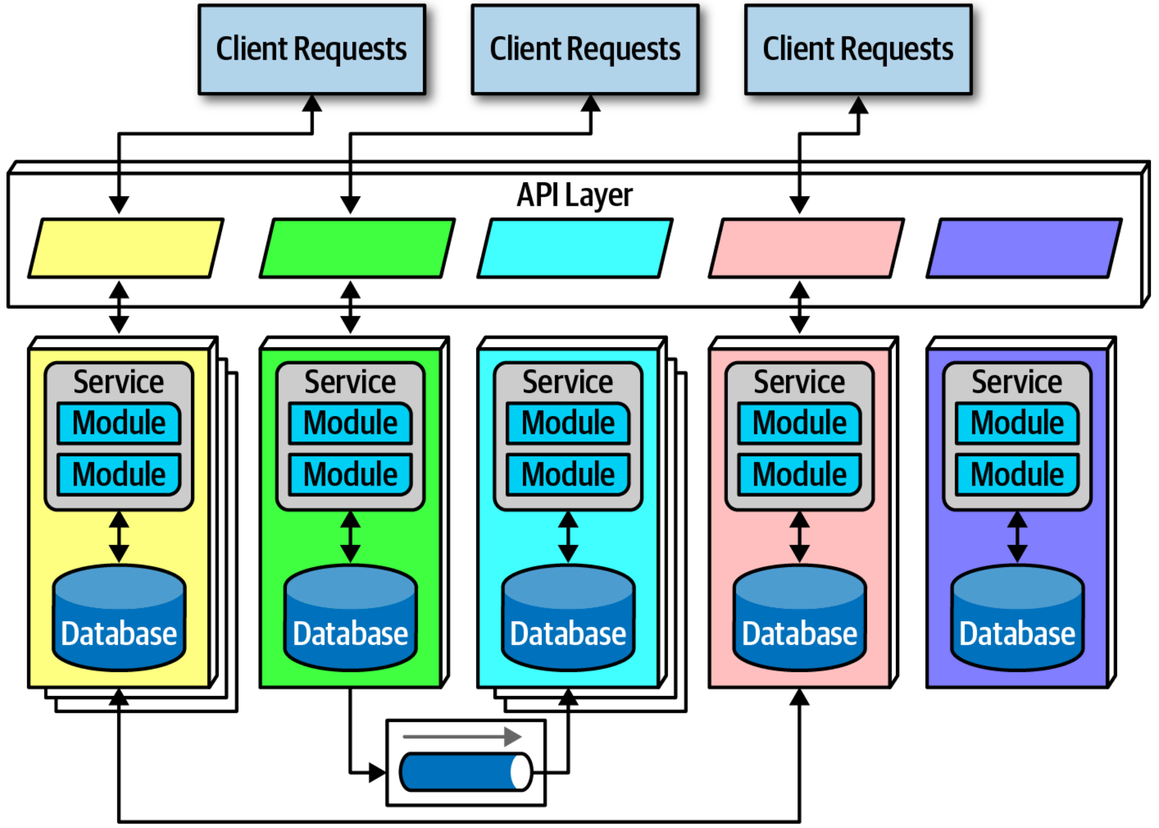
layered



modular

modular monoliths —> microservices

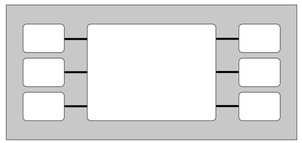




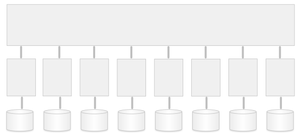
Your Architectural Kata is...

Silicon Sandwiches

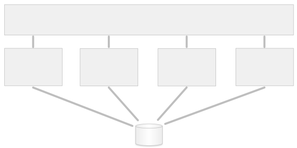
modular monolith



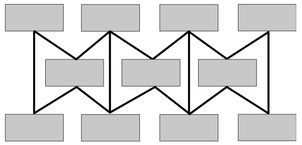
microkernel



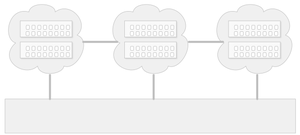
microservices



service-based



event-driven

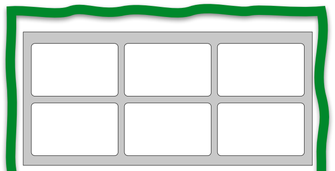


space-based

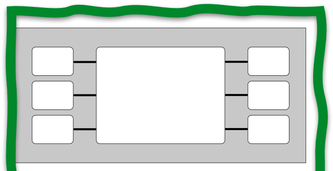
	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

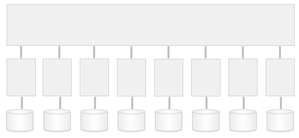
Silicon Sandwiches



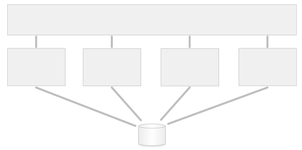
modular monolith



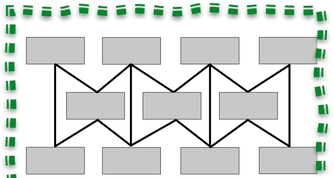
microkernel



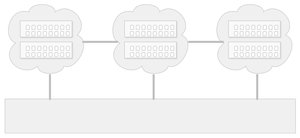
microservices



service-based



event-driven

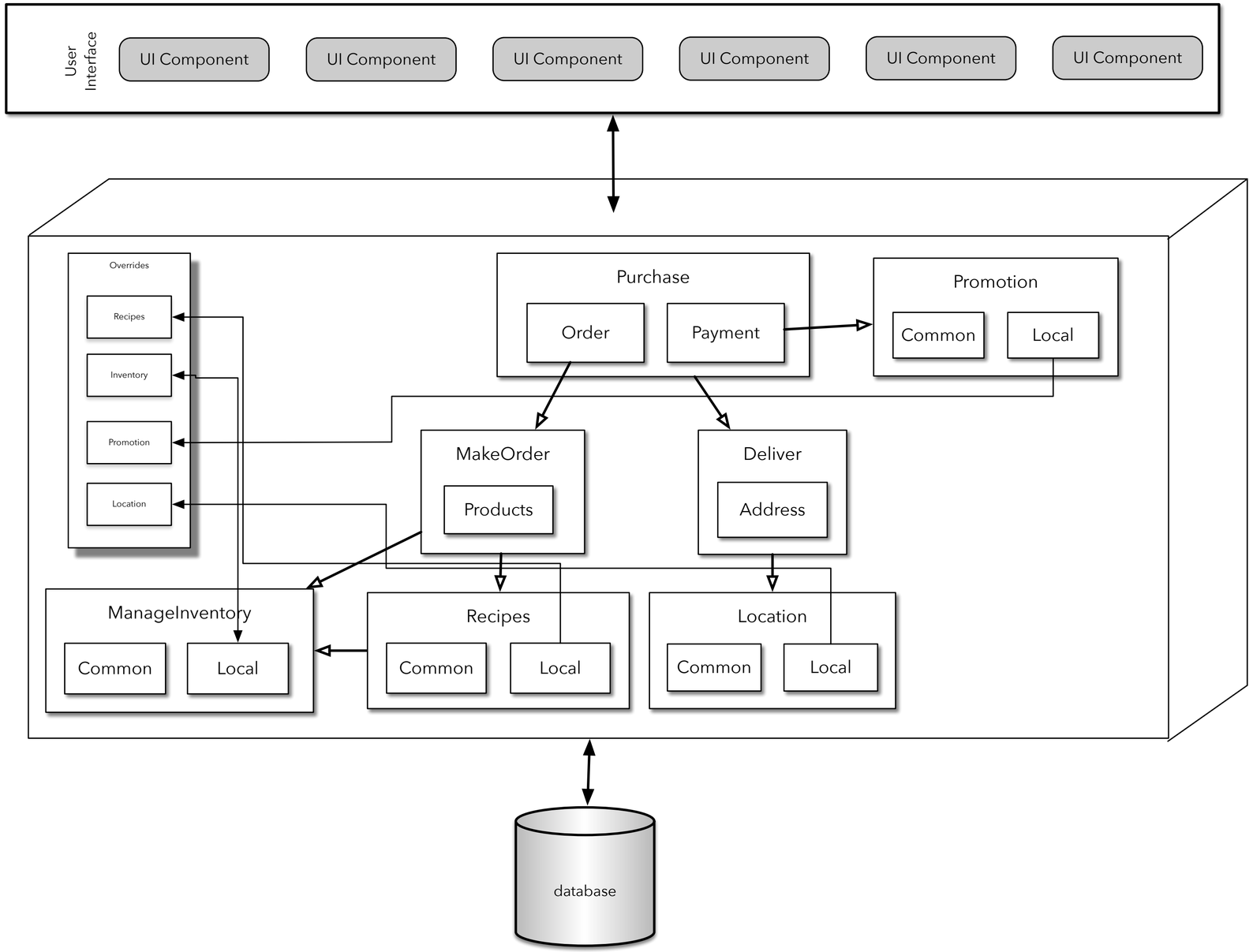


space-based

	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

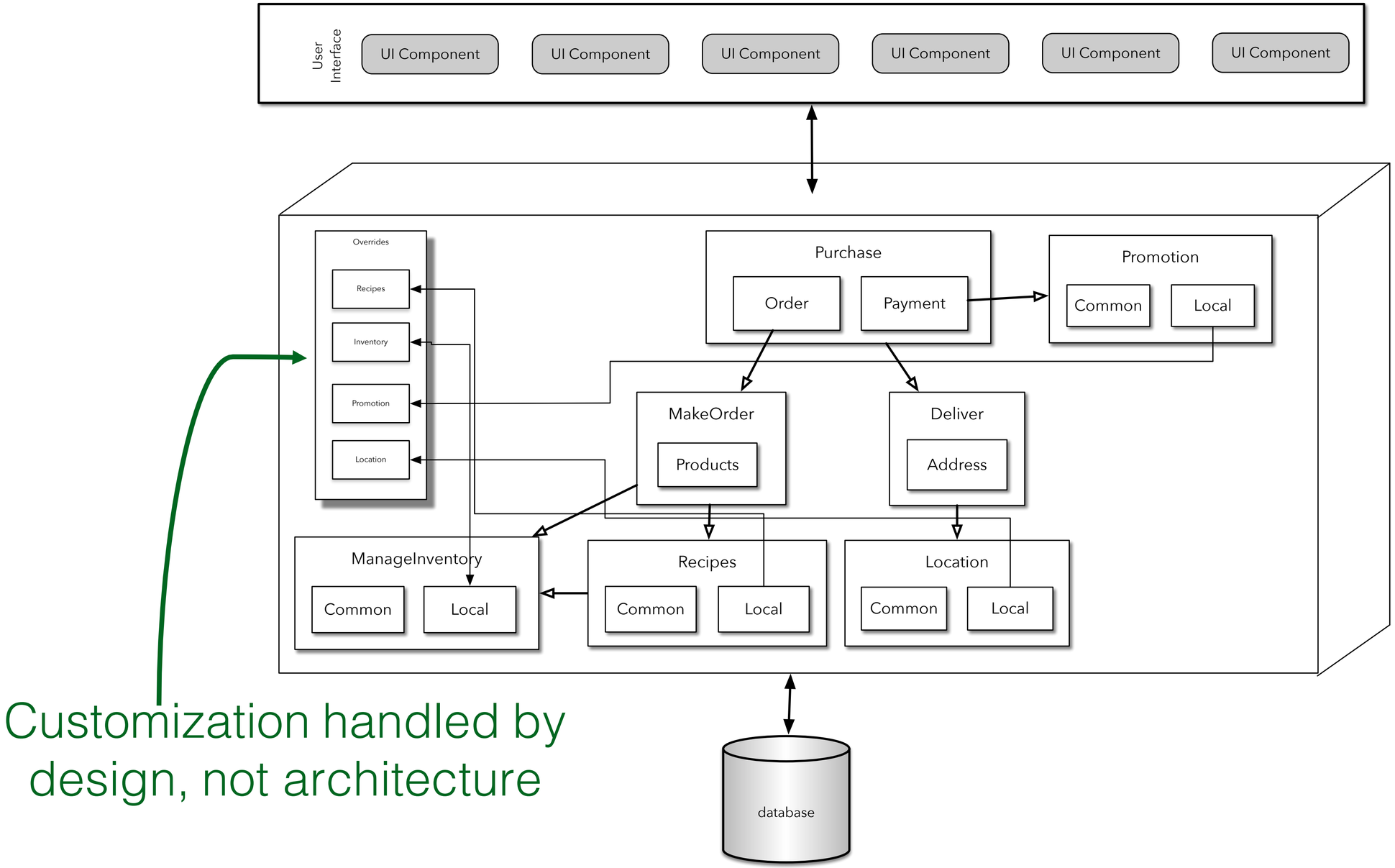
Your Architectural Kata is...

Silicon Sandwiches



Your Architectural Kata is...

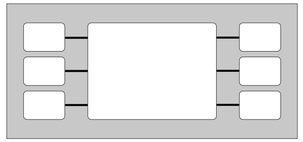
Silicon Sandwiches

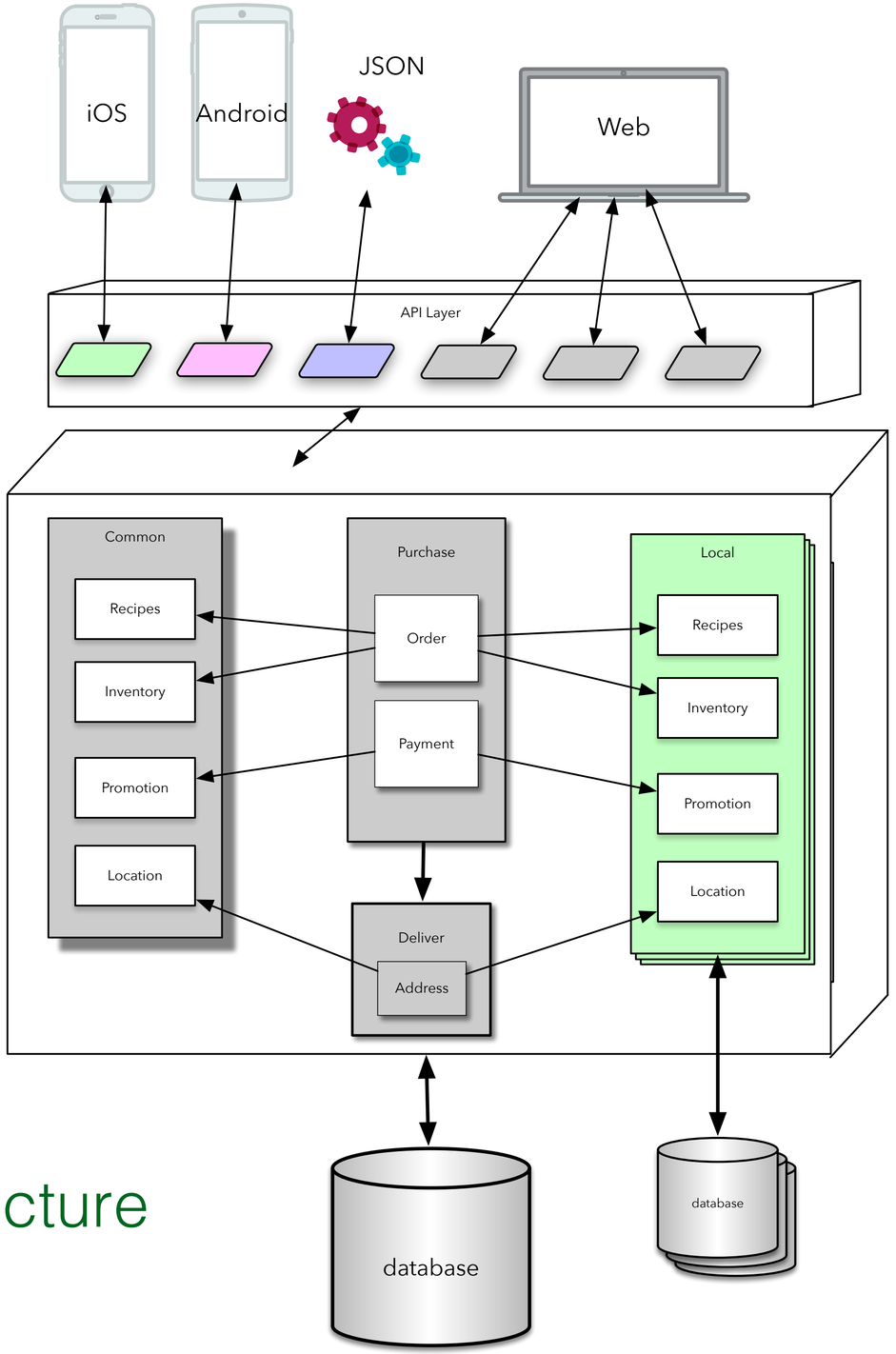


Customization handled by design, not architecture

Your Architectural Kata is...

Silicon Sandwiches



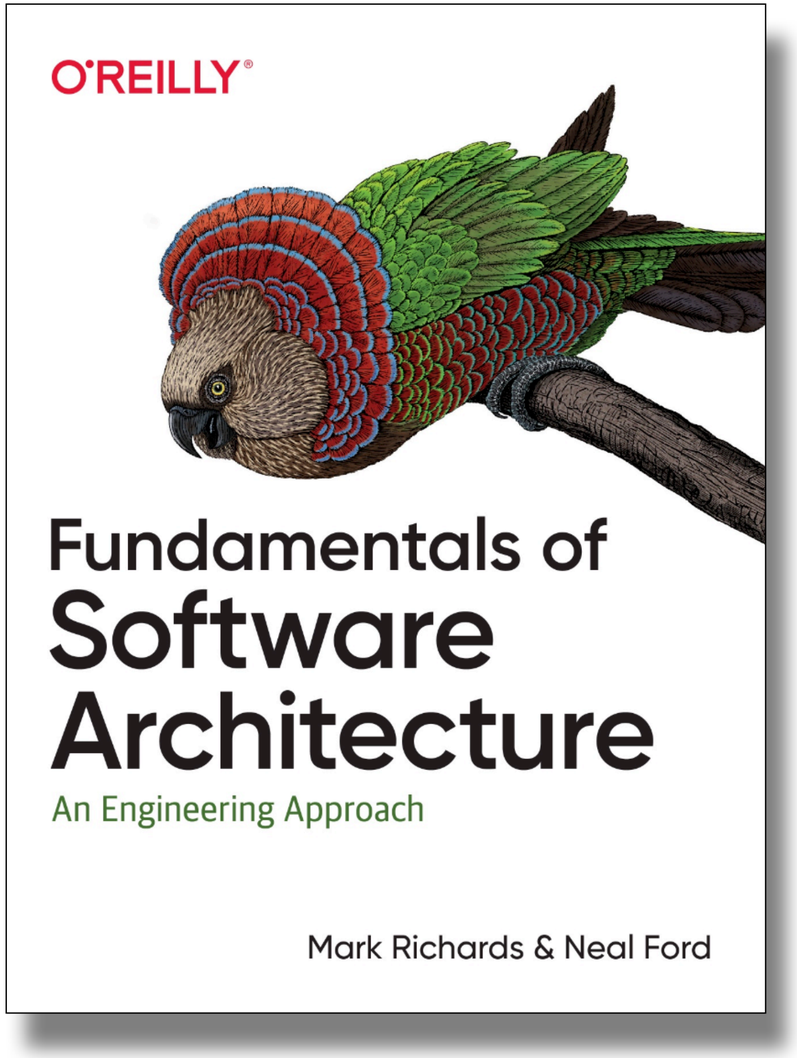


Customization handled by architecture

documenting software architecture

documenting software architecture

documenting software architecture



Second Law of Software Architecture

"Why is more important than how"

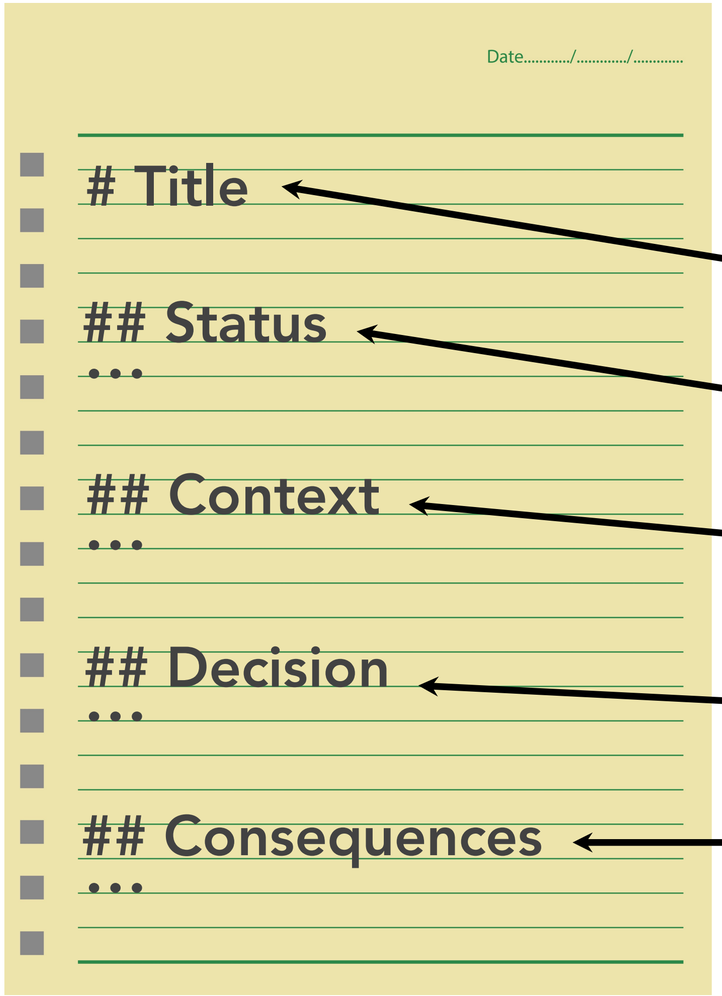
documenting software architecture

"We will keep a collection of records for *architecturally significant decisions*: those that affect the structure, non-functional characteristics, dependencies, interfaces, or construction techniques."

- Michael Nygard

http://thinkrelevance.com/blog/2011/11/15/documenting-architecture-decisions

documenting software architecture



short text file; 1-2 pages long, one file per decision
markdown, textile, asciidoc, plaintext, etc.

short noun phrase

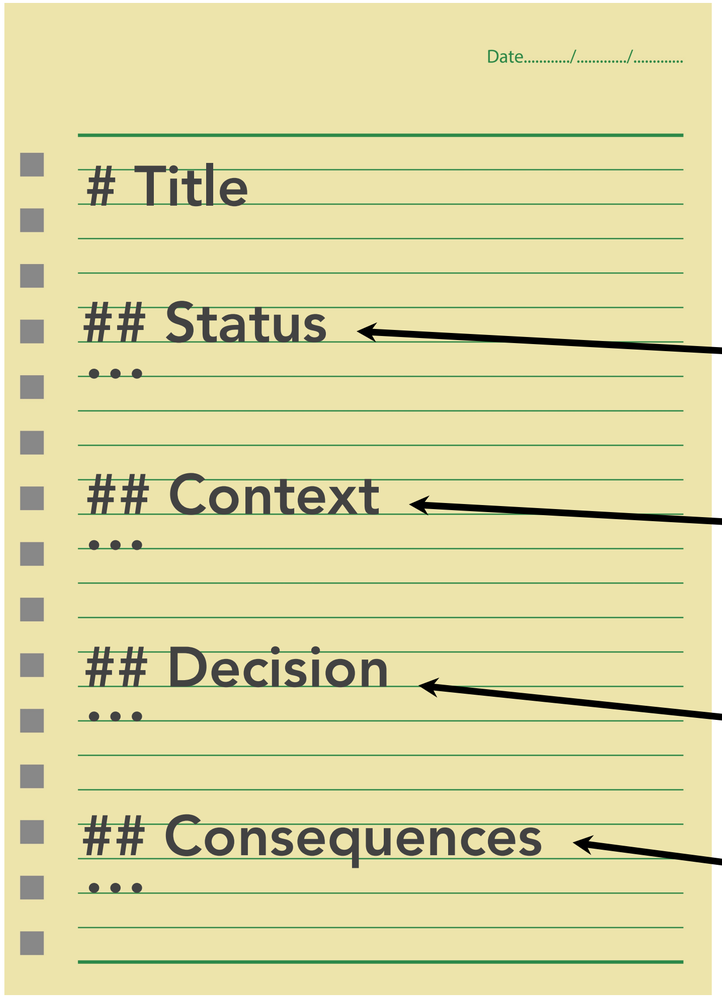
proposed, accepted, superseded

forces at play

response to forces

context after decision is applied

documenting software architecture



short text file; 1-2 pages long, one file per decision
markdown, textile, asciidoc, plaintext, etc.

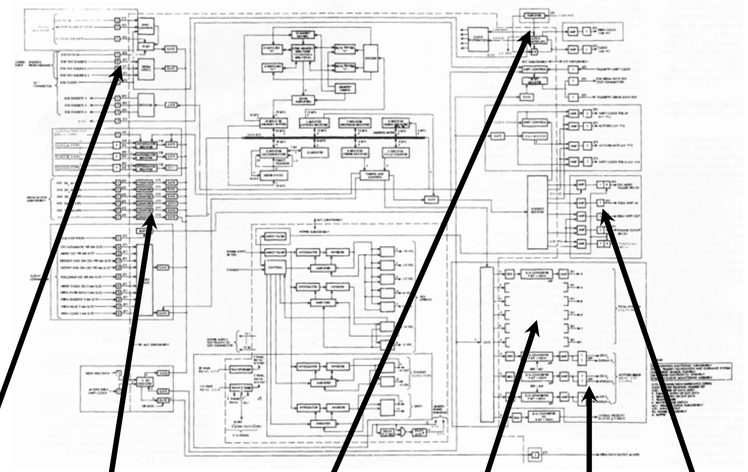
forces criteria for knowing when an architect must seek approval for a decision

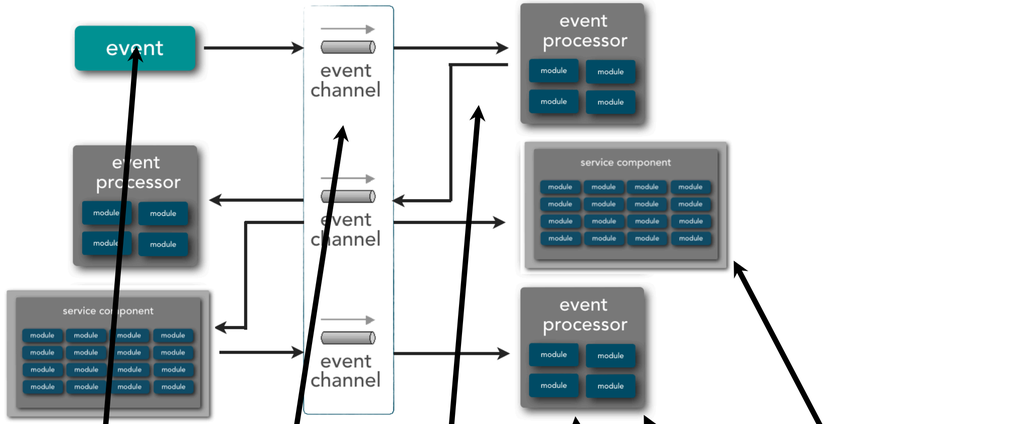
description of the problem and alternative solutions available (documentation)

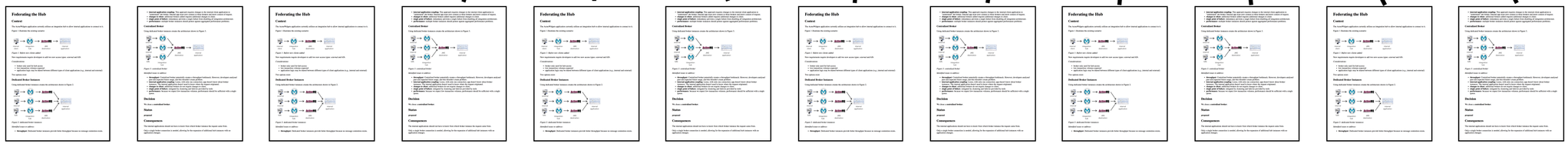
justification (the “why”)

tradeoffs and impact of decision

documenting software architecture







Your Architectural Kata is...

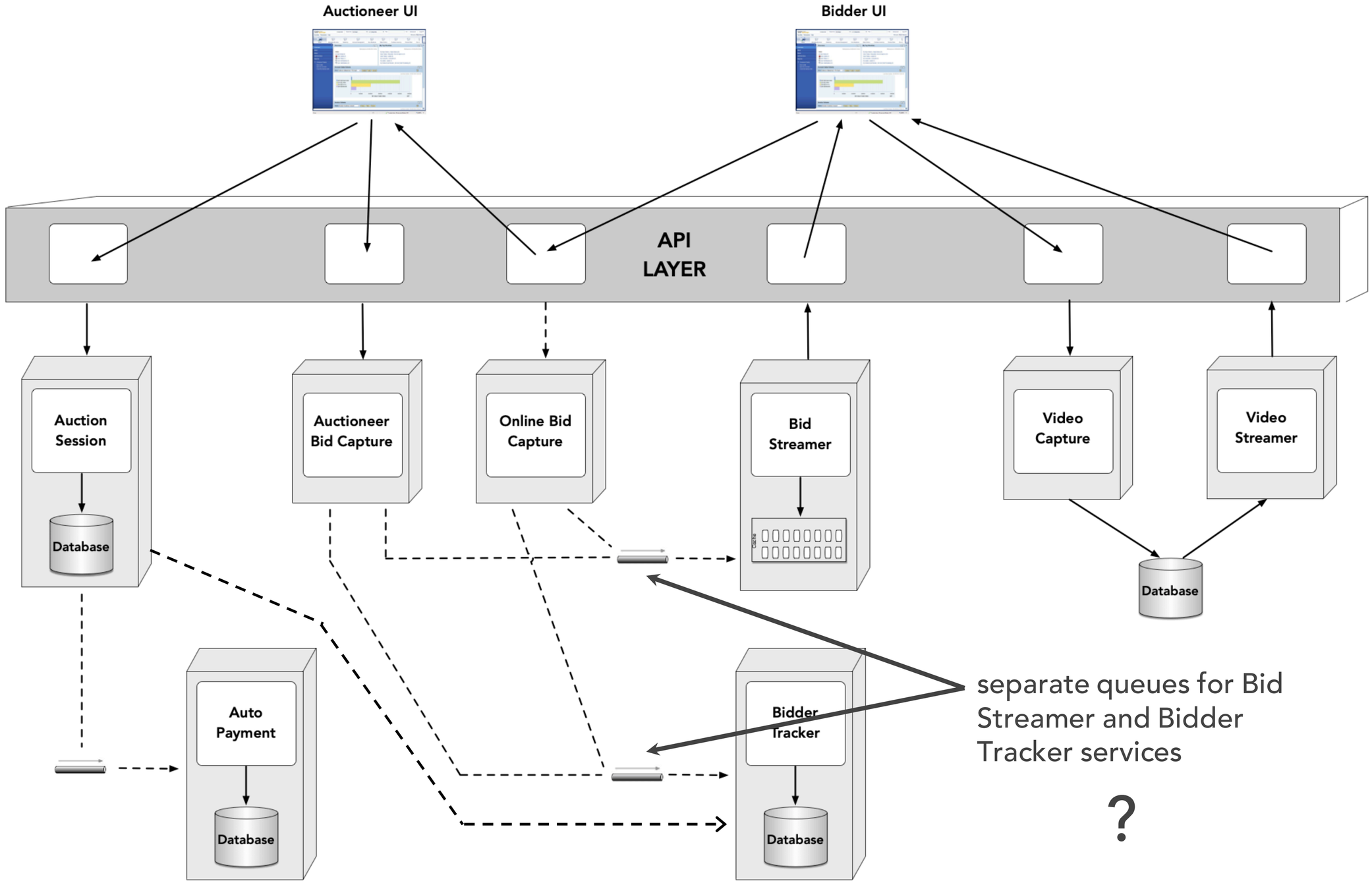
Going Going Gone!

An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

Your Architectural Kata is...

Going Going Gone!



1. Separate Queues for Bid Streamer and Tracker Services

Status

Accepted

Context

The Bid Capture Services, upon receiving a bid, must forward that bid to the Bid Streamer Service and the Bidder Tracker Service. This could be done using a single topic (pub/sub) or separate queues (p2p) for each service.

Decision

We will use separate queues for the Bid Streamer and Bidder Tracker services.

Multiple bids will come in for the same ask amount. The Streamer service only needs the first bid received for that amount, whereas the Bidder Tracker needs all bids received. Using a topic (pub/sub) would require the Bid Streamer to contain logic to ignore bids that are the same as the prior amount, forcing the Bid Streamer to store shared state between instances.

The Bid Streamer Service stores the bids for an item in an in-memory cache, whereas the Bidder Tracker stored bids in a database. The Bidder Tracker will therefore be slower and might require back pressure. Using a dedicated Bidder Tracker queue provides this dedicated back pressure point.

Consequences

This decision will require the Bid Capture services to send the same information to multiple queues.

Use of Micro-kernel Architecture

Status
PROPOSED

Context
Two key requirements of the system (_promotions_ anc

The current design features a modular monolith archite

![modular monolith](fig1_modular_monolith.jpg)
Figure 1: the current state architecture

Currently, stores must specify custom behavior (produc

All local customizations reside in one service and in on

To allow stores to most easily add and customize local

![microkernel architecture](fig2_microkernel.jpg)
Figure 2: proposed microkernel architecture

The new design allows easy update of global policy (pr

Decision
The architects decided to migrate the current monolith

Consequences
The architects take advantage of the restructuring oppo

The new design also incorporates the BFF patterns, dis

The new design will greatly improve the customization

- the local store plug-in architecture certifies customiza
- promotions within threshold values go live within 15 n
- all stores work with generic workflows via the core sys
  - promotions
  - location exemptions
  - local products

quirements.

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FTP. Operations must certify the JAR, leading to dela

ecome a tangled mess.

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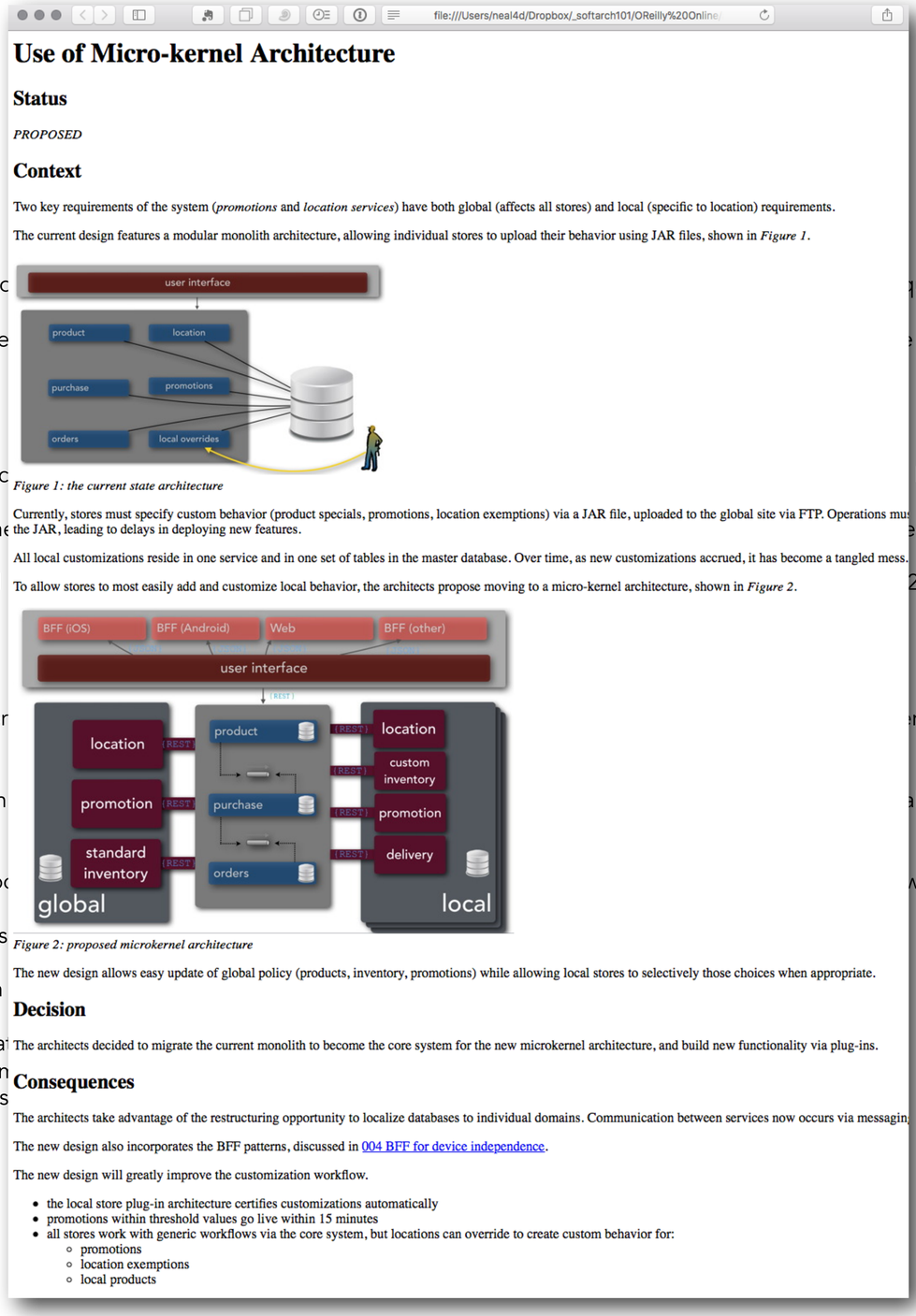

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Use of Micro-kernel Architecture

Status

PROPOSED

Context

Two key requirements of the system (*promotions* and *location services*) have both global (affects all stores) and local (specific to location) requirements.

The current design features a modular monolith architecture, allowing individual stores to upload their behavior using JAR files, shown in *Figure 1*.

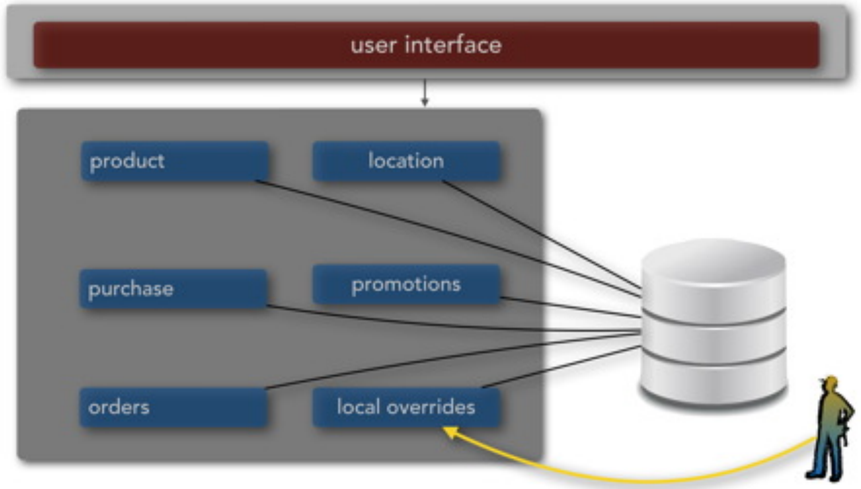


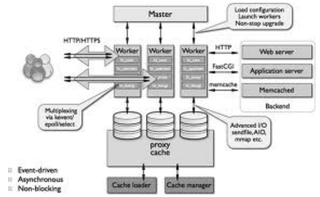
Figure 1: the current state architecture

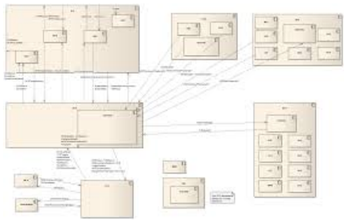
Currently, stores must specify custom behavior (product specials, promotions, location exemptions) via a JAR file, uploaded to the global site via FTP. Operations n
the JAR, leading to delays in deploying new features.

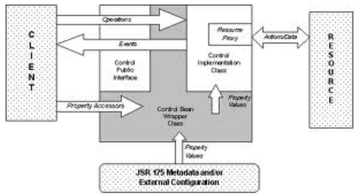
All local customizations reside in one service and in one set of tables in the master database. Over time, as new customizations accrued, it has become a tangled me

summary

summary

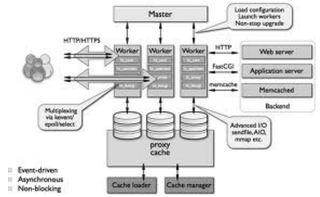


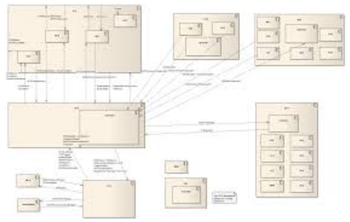


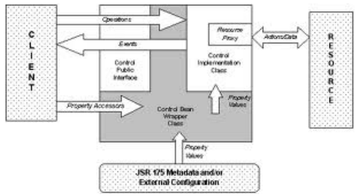


There are no right or wrong answers in architecture; rather, it's always about ***tradeoffs***

summary







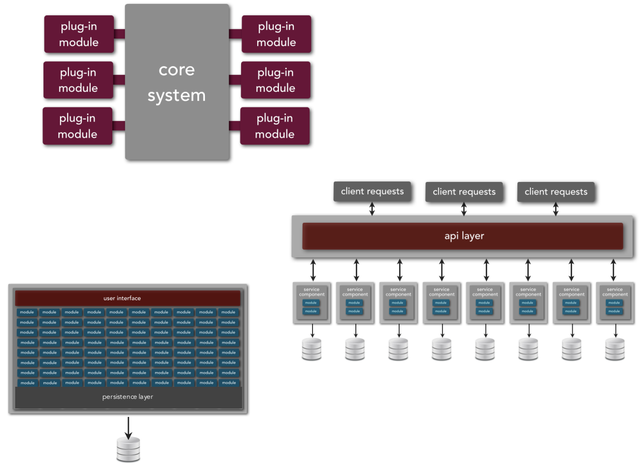
There are no right or wrong answers in architecture; ***only expensive ones***

summary

scalability

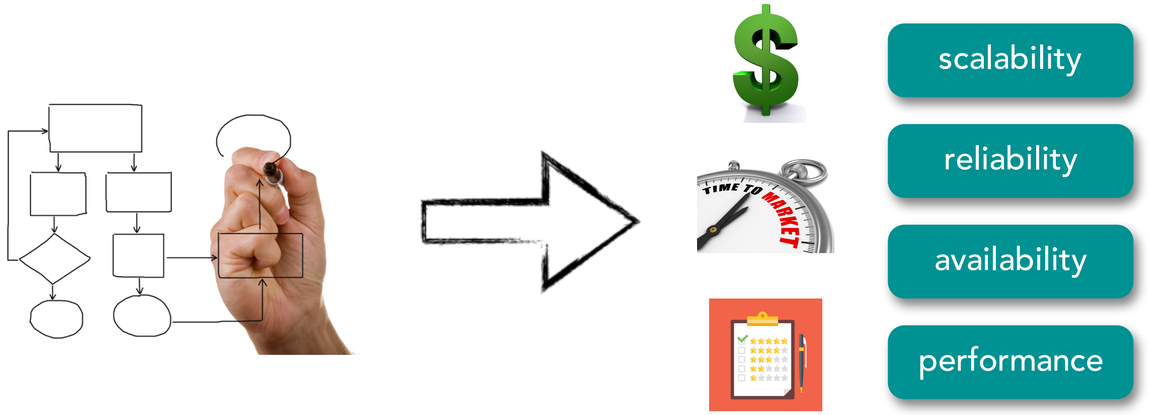
reliability

availability



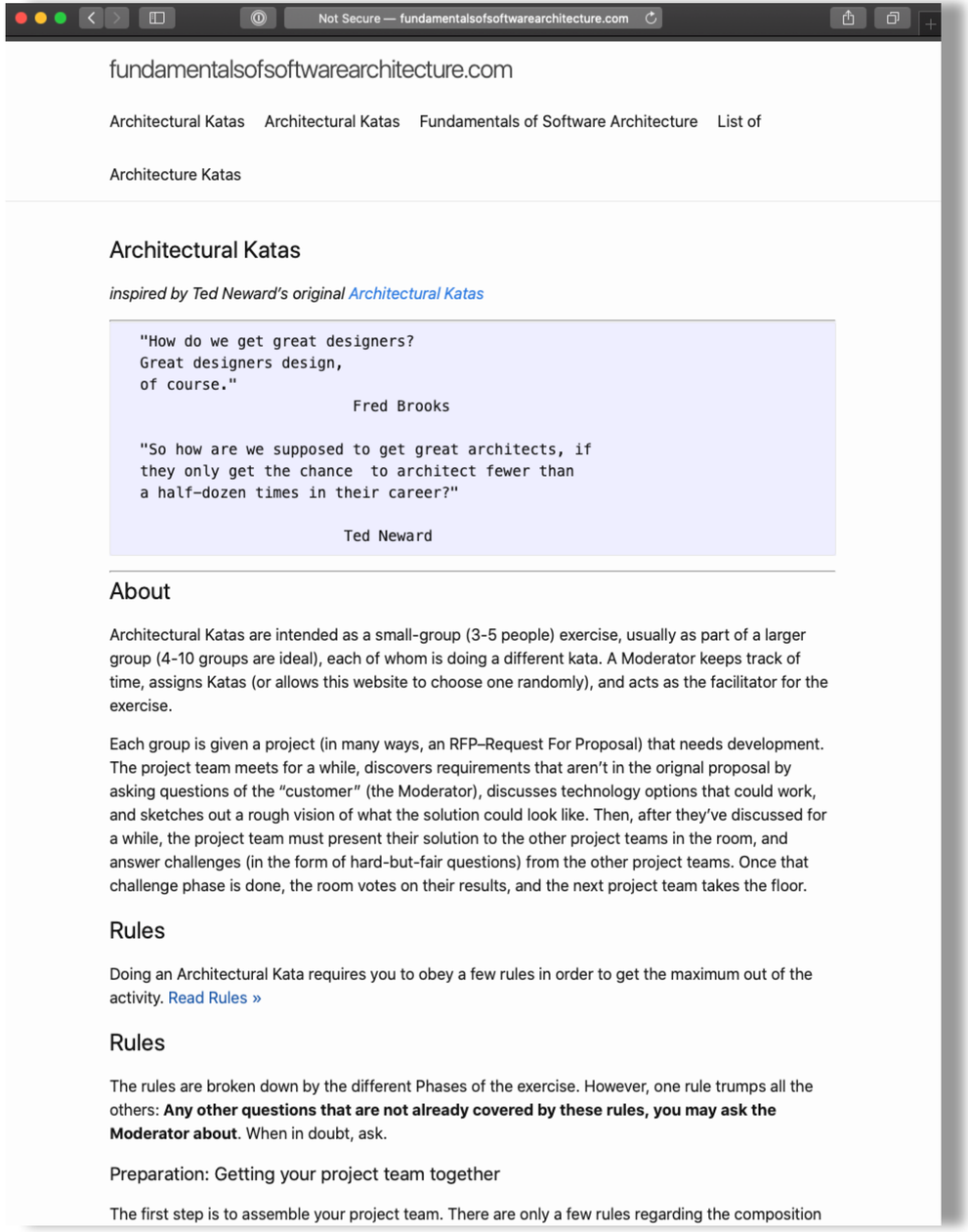
business needs and ***architectural characteristics*** are what drive the architecture!

summary



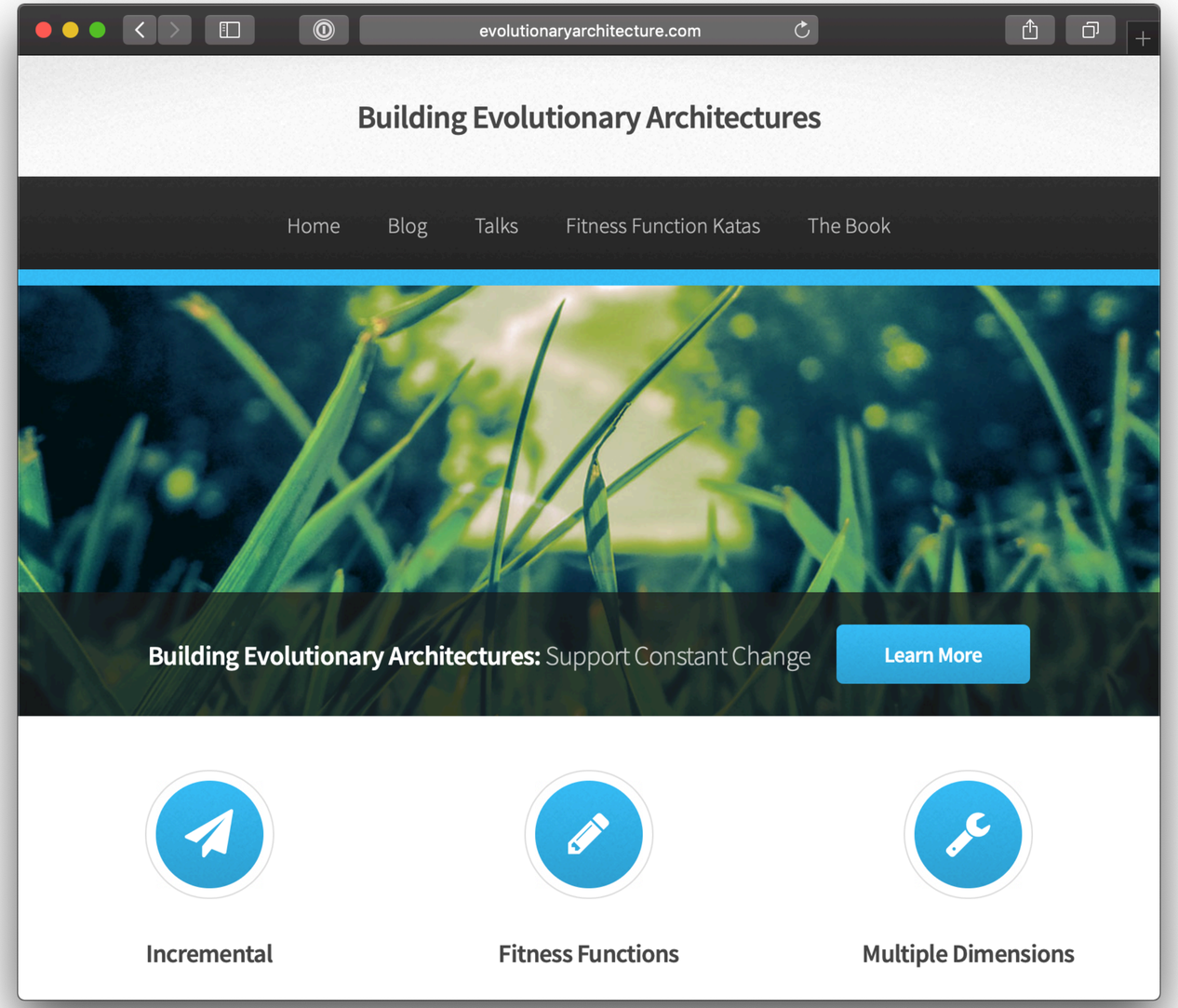
every architecture decision should be accompanied with a ***technical and business justification***

more resources



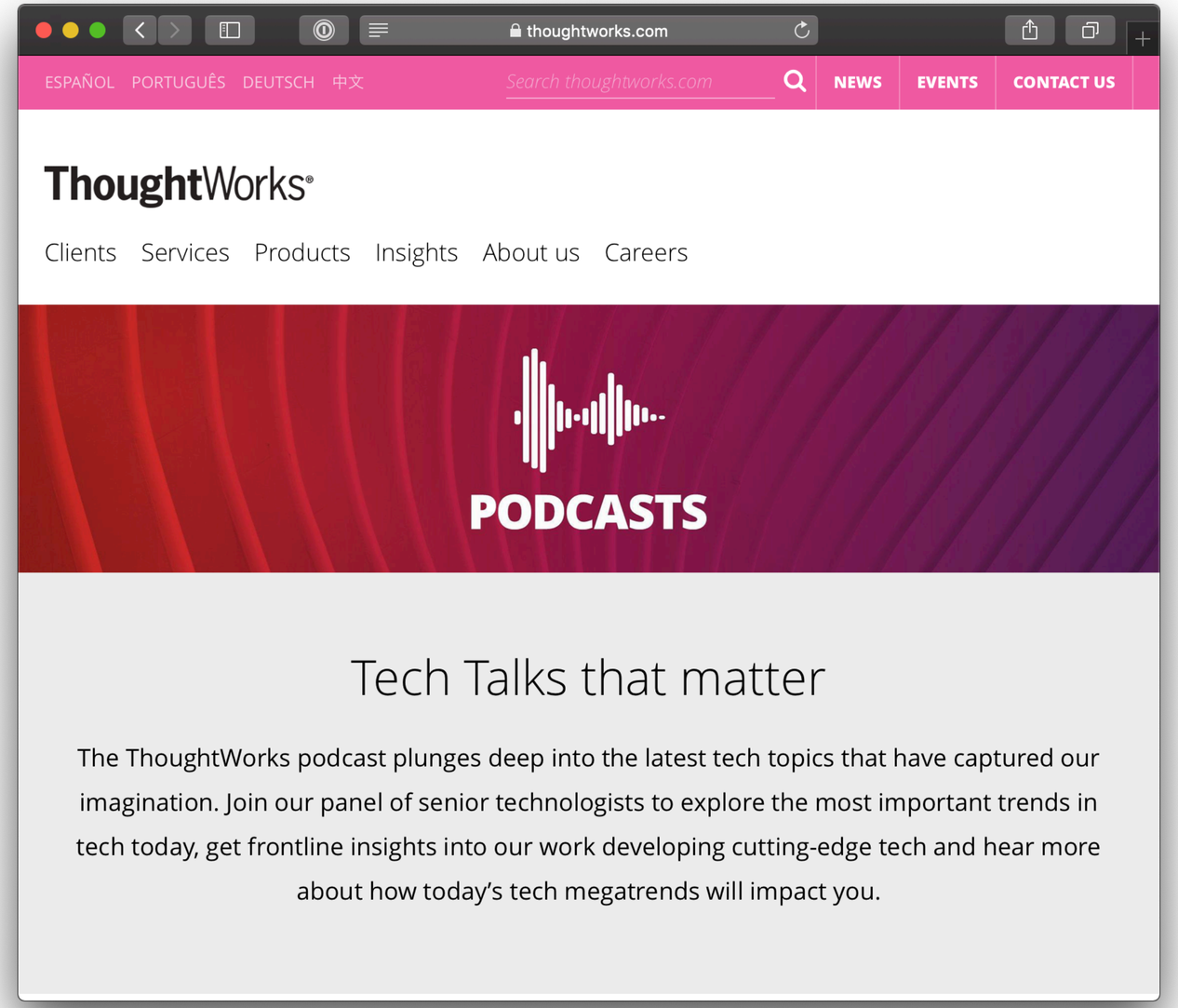
http://fundamentalsofsoftwarearchitecture.com/katas/

more resources



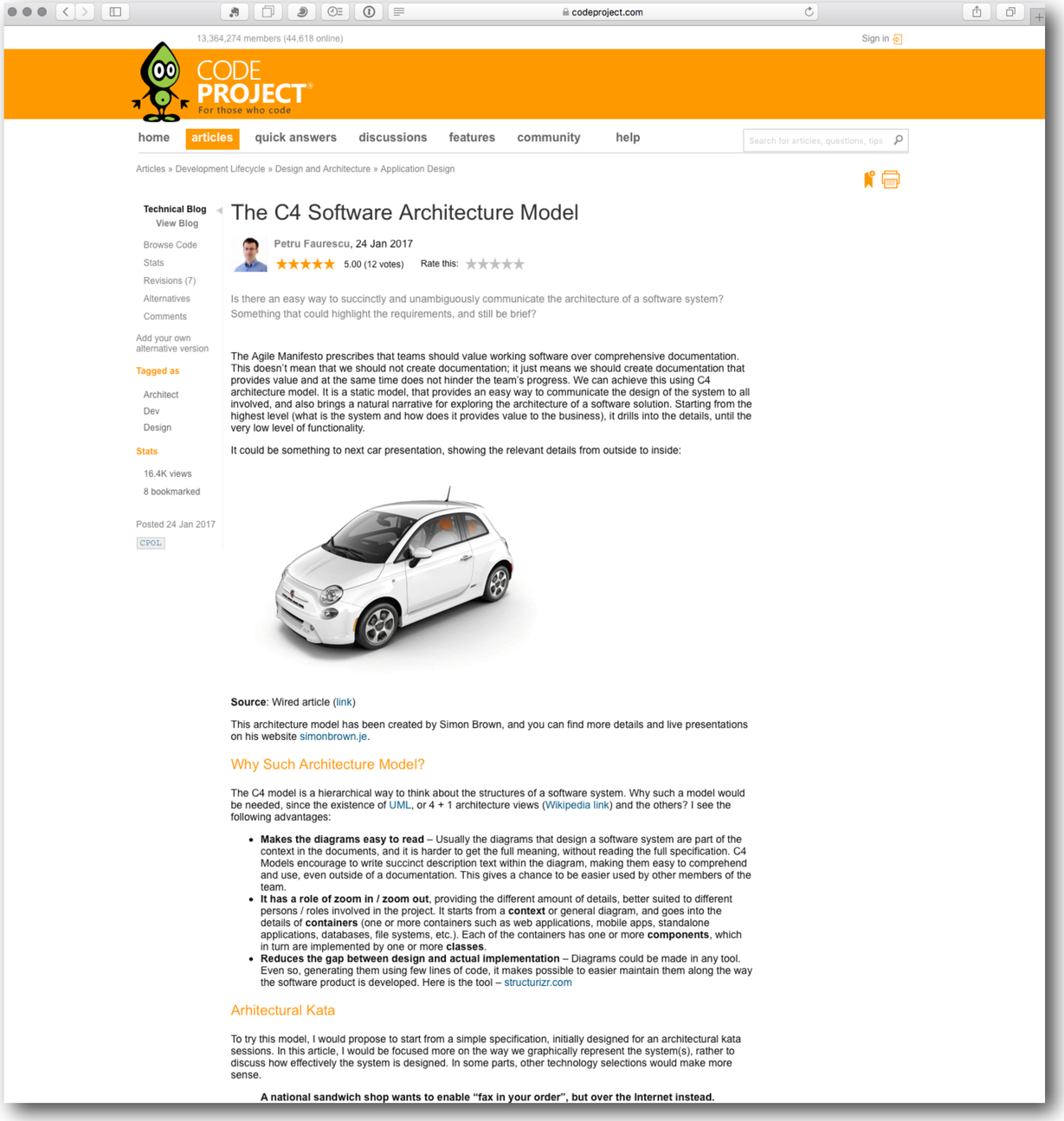
http://evolutionaryarchitecture.com

more resources



https://www.thoughtworks.com/podcasts

more resources



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Posted 24 Jan 2017

CPOL

The C4 Software Architecture Model

Petru Faurescu, 24 Jan 2017

5.00 (12 votes) Rate this:

Is there an easy way to succinctly and unambiguously communicate the architecture of a software system? Something that could highlight the requirements, and still be brief?

The Agile Manifesto prescribes that teams should value working software over comprehensive documentation. This doesn't mean that we should not create documentation; it just means we should create documentation that provides value and at the same time does not hinder the team's progress. We can achieve this using C4 architecture model. It is a static model, that provides an easy way to communicate the design of the system to all involved, and also brings a natural narrative for exploring the architecture of a software solution. Starting from the highest level (what is the system and how does it provides value to the business), it drills into the details, until the very low level of functionality.

It could be something to next car presentation, showing the relevant details from outside to inside:

Source: Wired article (link)

This architecture model has been created by Simon Brown, and you can find more details and live presentations on his website simonbrown.je.

Why Such Architecture Model?

The C4 model is a hierarchical way to think about the structures of a software system. Why such a model would be needed, since the existence of UML, or 4 + 1 architecture views (Wikipedia link) and the others? I see the following advantages:

- **Makes the diagrams easy to read** – Usually the diagrams that design a software system are part of the context in the documents, and it is harder to get the full meaning, without reading the full specification. C4 Models encourage to write succinct description text within the diagram, making them easy to comprehend and use, even outside of a documentation. This gives a chance to be easier used by other members of the team.
- **It has a role of zoom in / zoom out**, providing the different amount of details, better suited to different persons / roles involved in the project. It starts from a **context** or general diagram, and goes into the details of **containers** (one or more containers such as web applications, mobile apps, standalone applications, databases, file systems, etc.). Each of the containers has one or more **components**, which in turn are implemented by one or more **classes**.
- **Reduces the gap between design and actual implementation** – Diagrams could be made in any tool. Even so, generating them using few lines of code, it makes possible to easier maintain them along the way the software product is developed. Here is the tool – structurizr.com

Arhitectural Kata

To try this model, I would propose to start from a simple specification, initially designed for an architectural kata sessions. In this article, I would be focused more on the way we graphically represent the system(s), rather to discuss how effectively the system is designed. In some parts, other technology selections would make more sense.

A national sandwich shop wants to enable "fax in your order", but over the Internet instead.

https://www.codeproject.com/Articles/1167140/The-C-Software-Architecture-Model

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Mark Richards, Software Architect, Founder of DeveloperToArchitect.com

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Software Architecture Monday is a free bi-weekly video lesson series on some aspect of software architecture. These 10 minute YouTube videos contain various aspects of application, integration, and enterprise architecture.

Contact Me

To contact me regarding any public and private software architecture training classes I offer, you can reach me (Mark Richards) directly at info@developertoarchitect.com

Public Live Virtual Training

I'm excited to announce that during our current social situation I am conducting live, hands-on virtual workshops. See my Training page and Upcoming Events page for a complete listing of classes, details, dates, and how to register.

go do some architecture!

Architecture by Example

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