

Microservices





Somkiat Puisungnoen

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**https://github.com/up1/
course_microservices-3-days**



Module 1 : Design

Cloud Native Application

Evolution of architecture

Microservice architecture

How to decompose app to Microservice

Communication between service

Data consistency

Workshop



Module 2 : Develop

Recap Microservice

Properties of Microservice

Microservice 1.0 - 4.0

How to develop Microservice ?

How to test Microservice ?

12-factors app

Workshop



Module 3 : Deploy

How to deploy Microservice ?
Continuous Integration and Delivery
Practices of Continuous Integration
Deployment strategies
Working with containerization (Docker)
Workshop



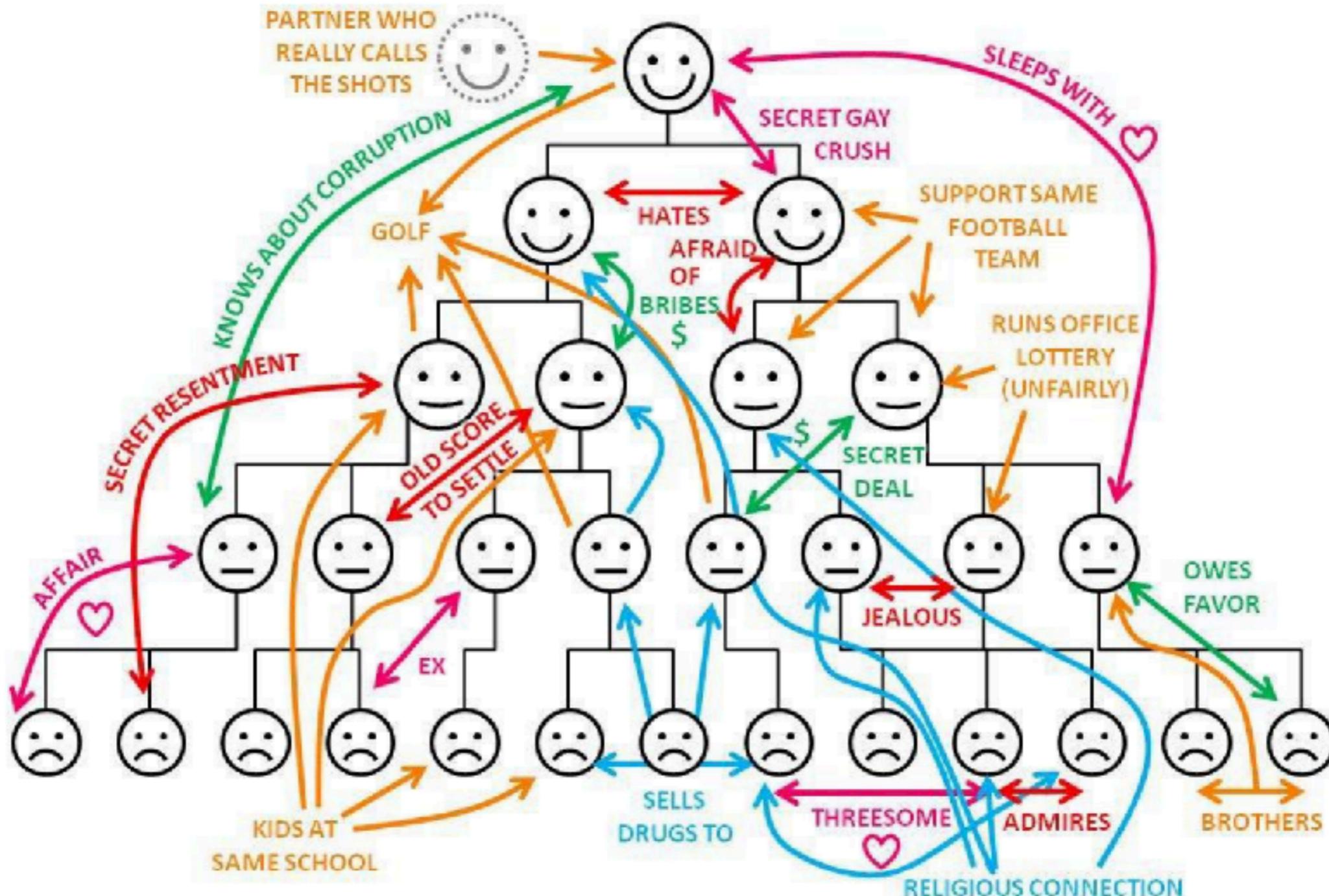
Module 1 : Design

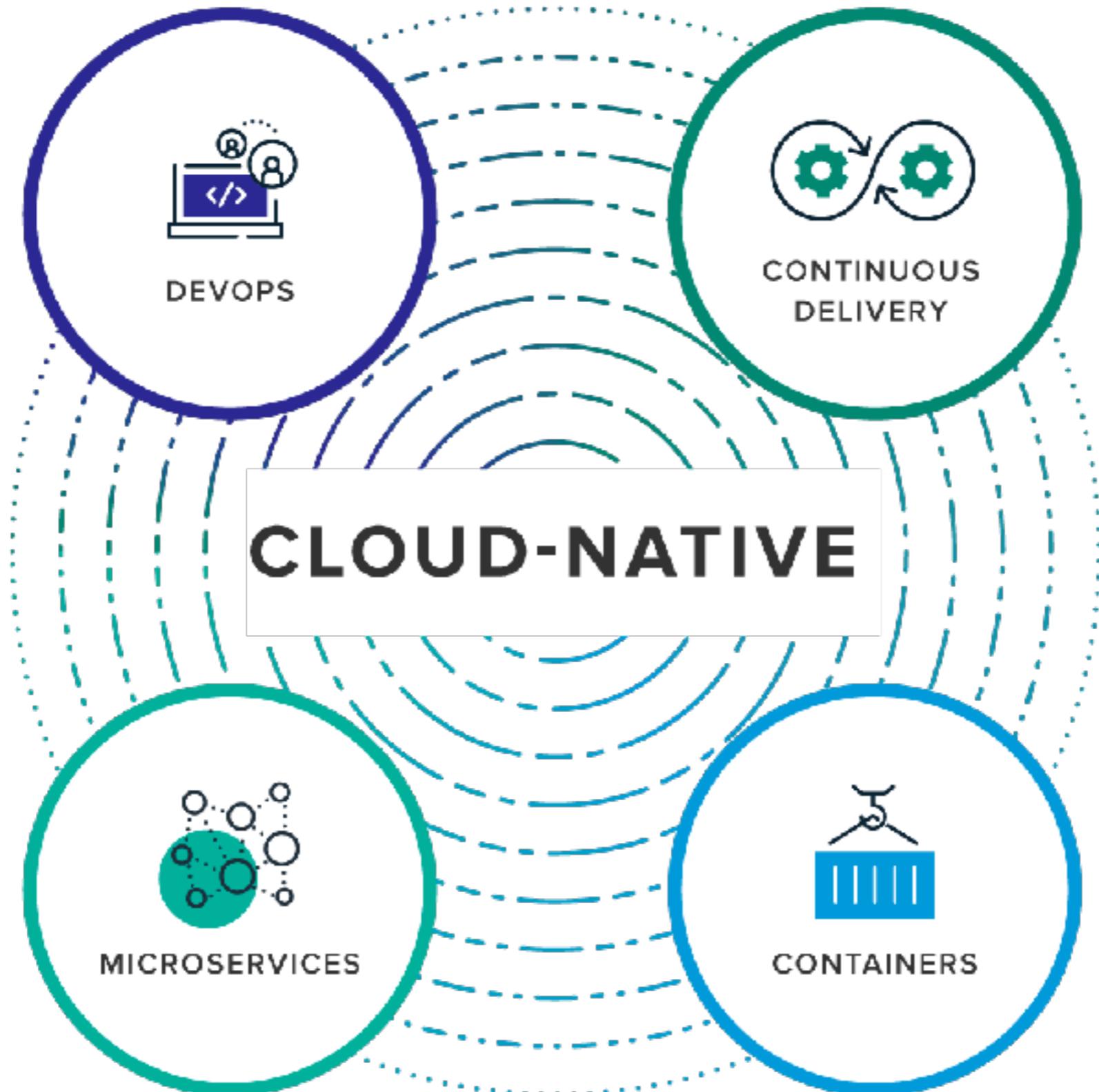


“organizations which design systems ... are constrained to produce designs which are copies of the communication structures of these organizations”

- *Melvin Conwey, 1968* -







<https://pivotal.io/cloud-native>



Evolution of Architecture

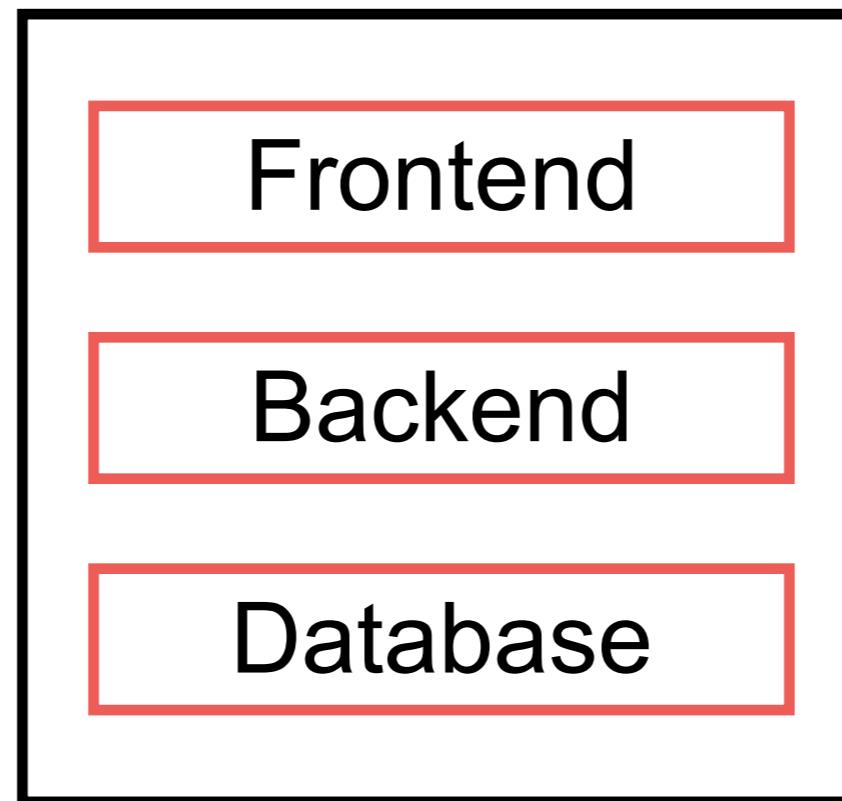


Monolith

App



Layer



Layer

Frontend

Backend

Database

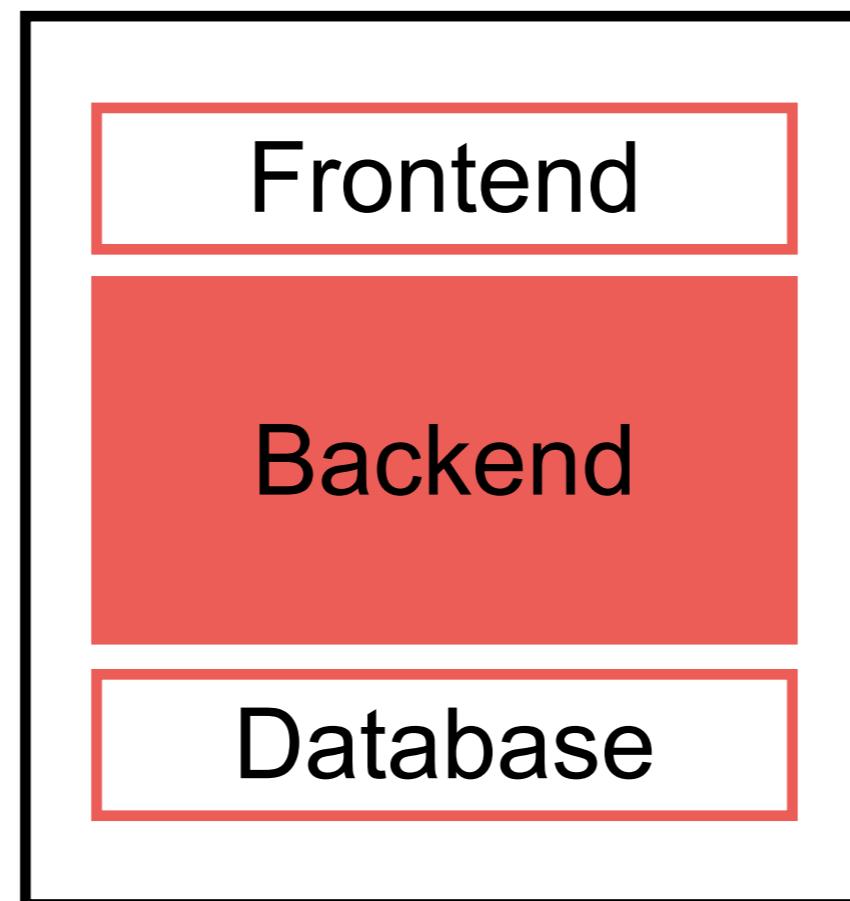


Monolith

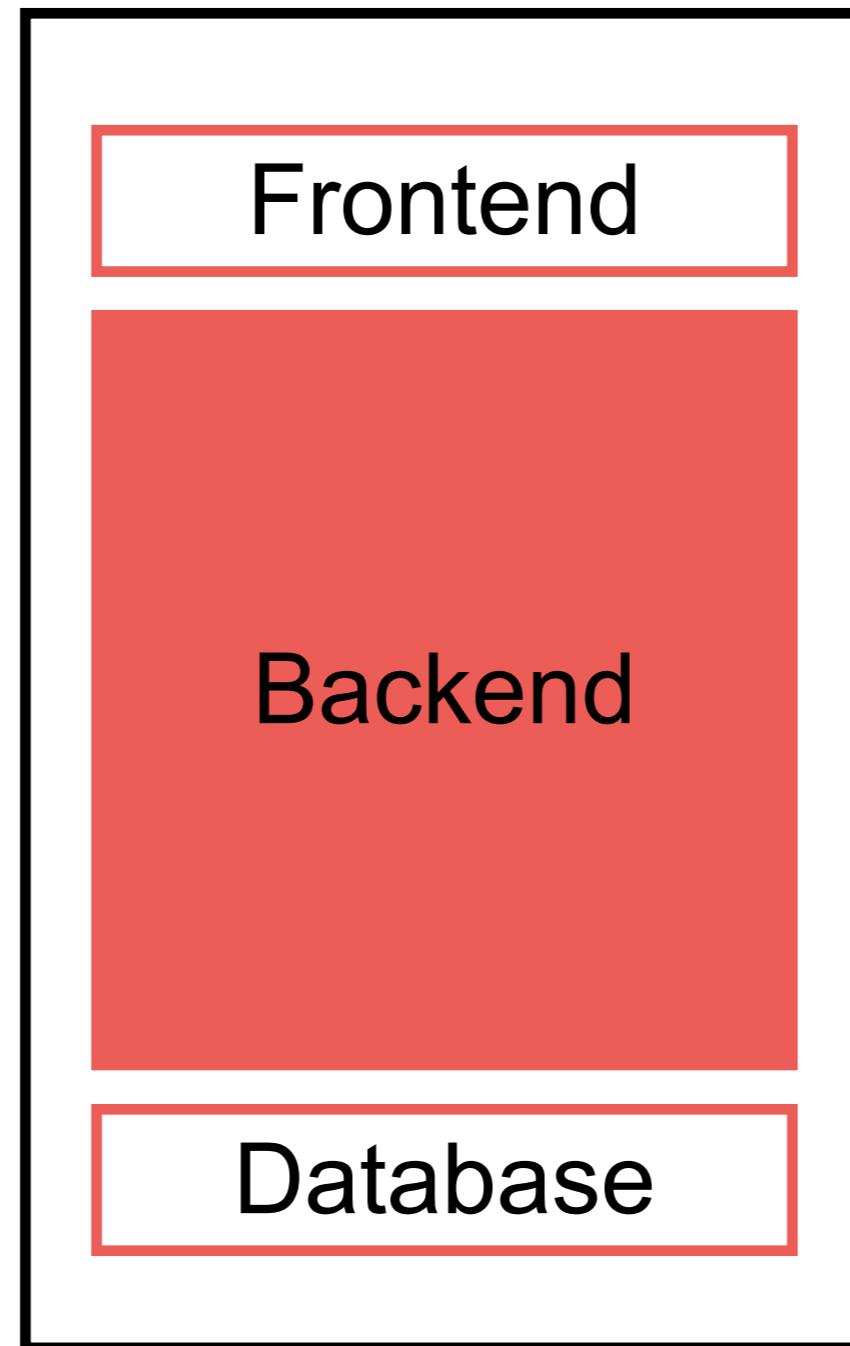
Easy to develop
Easy to change
Easy to testing
Easy to deploy
Easy to scale



More features ...



More features ...



More features ...

Frontend



In spaghetti code, the relations between the pieces of code are so tangled that it is nearly impossible to add or change something without unpredictably breaking something somewhere else.

Database

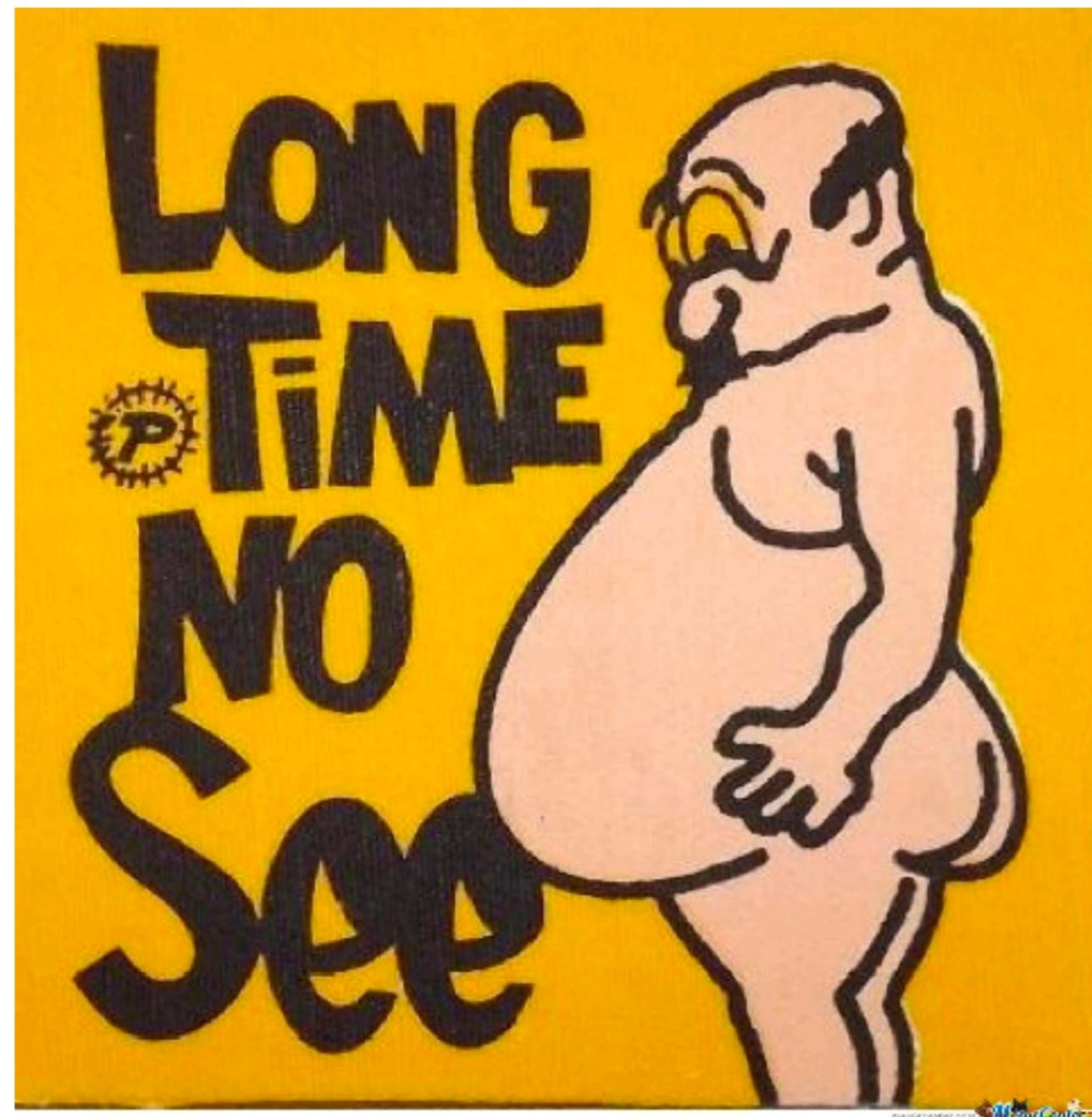


Microservices

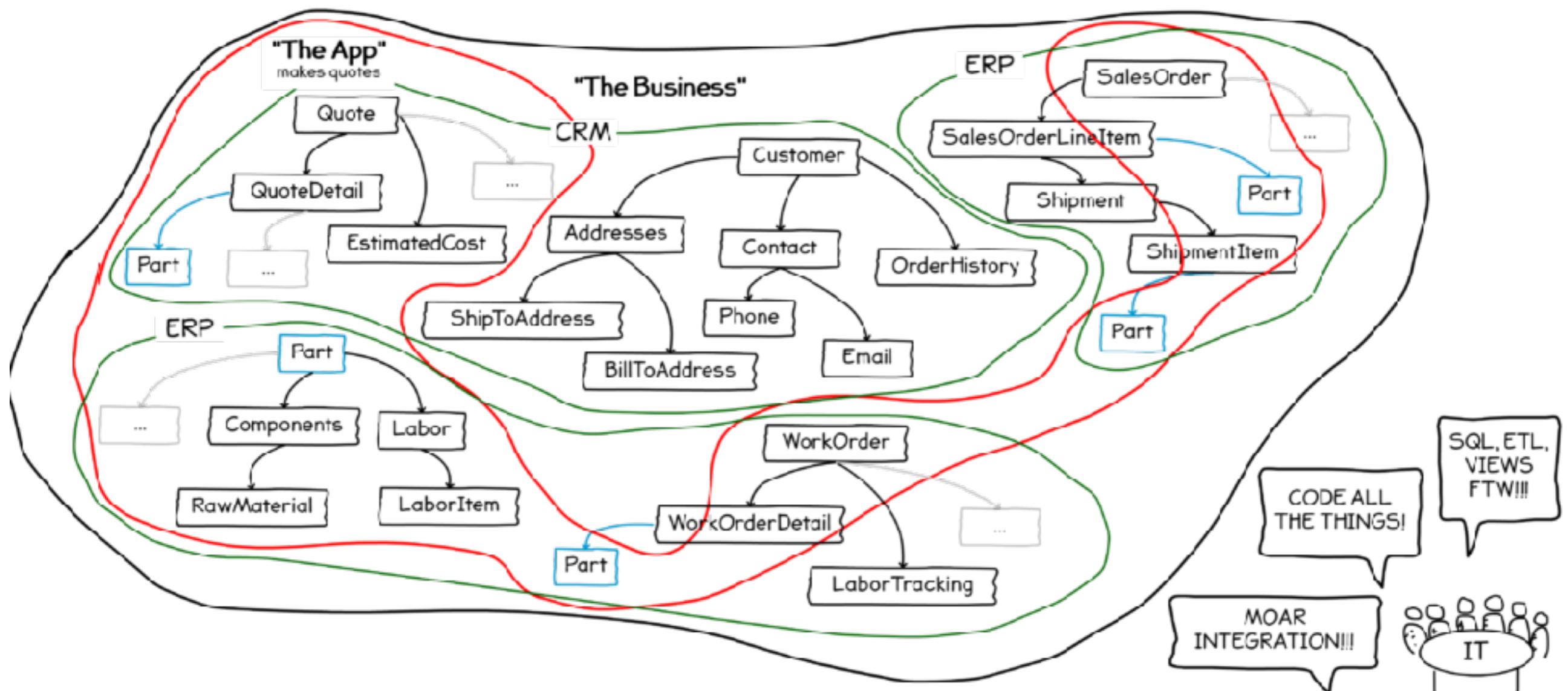
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More features ...





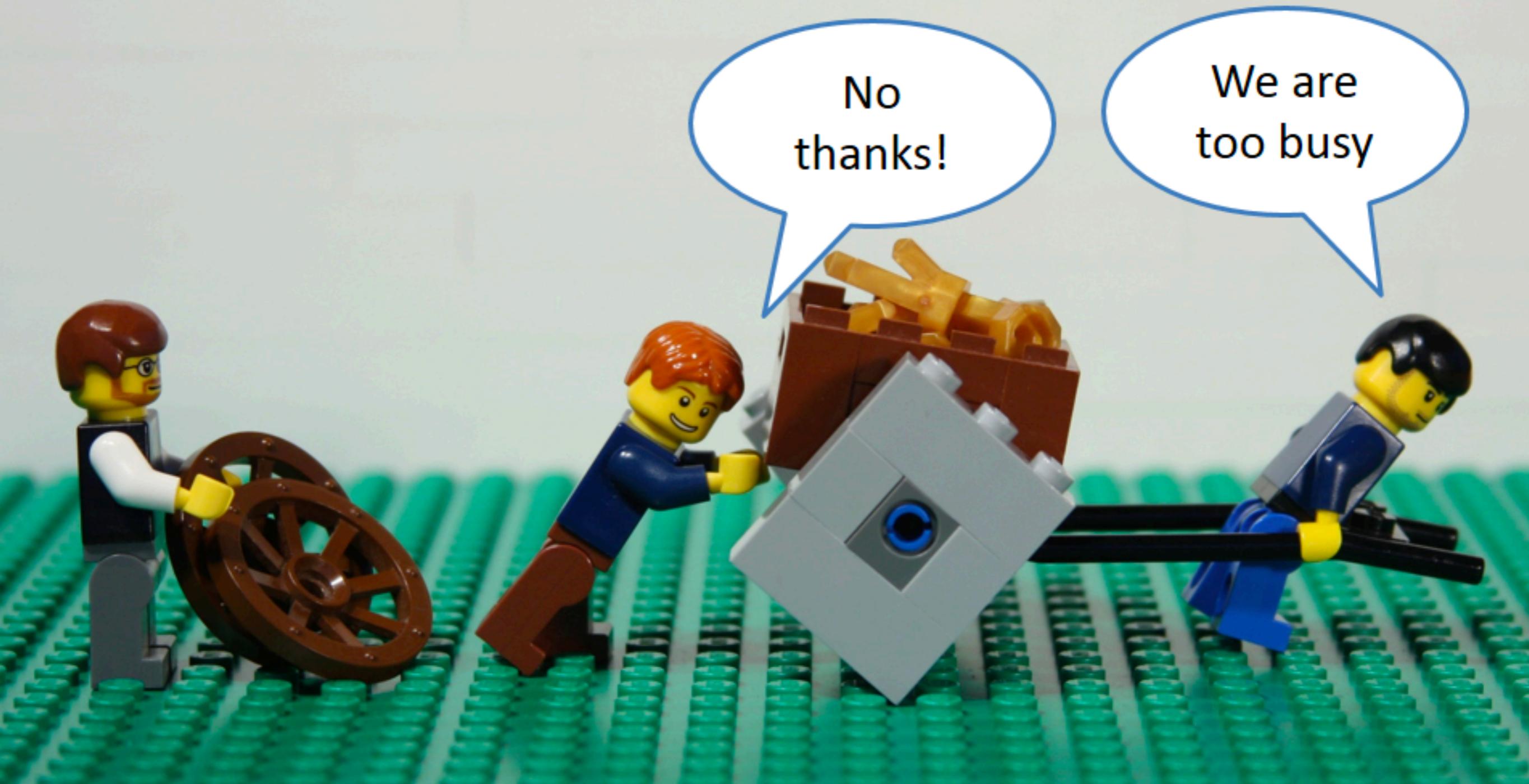
Monolith Hell



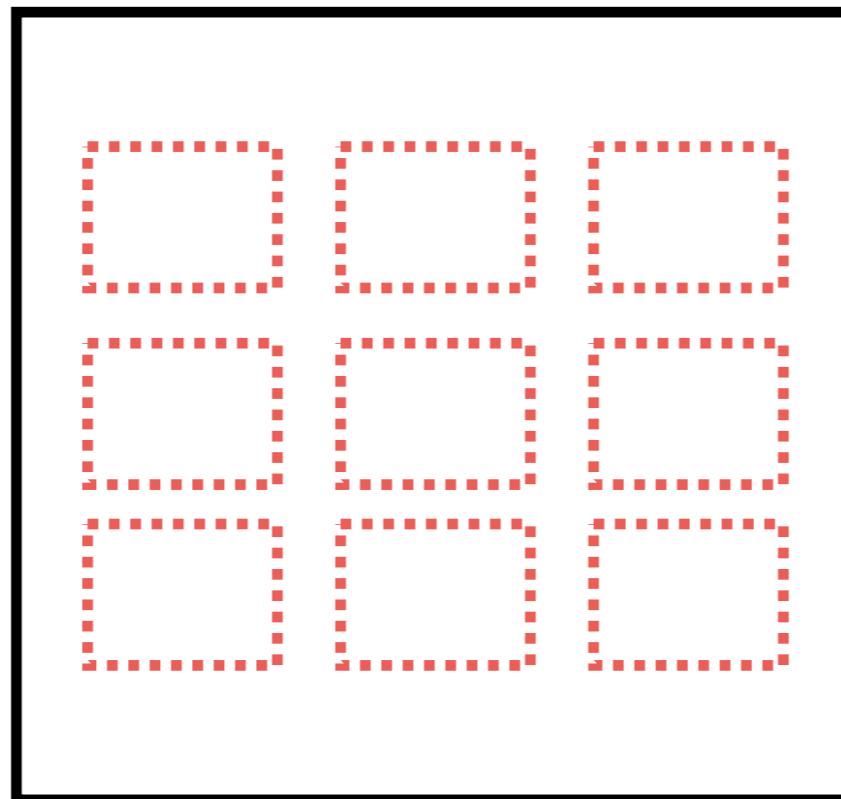
We need to improve

We need to get better

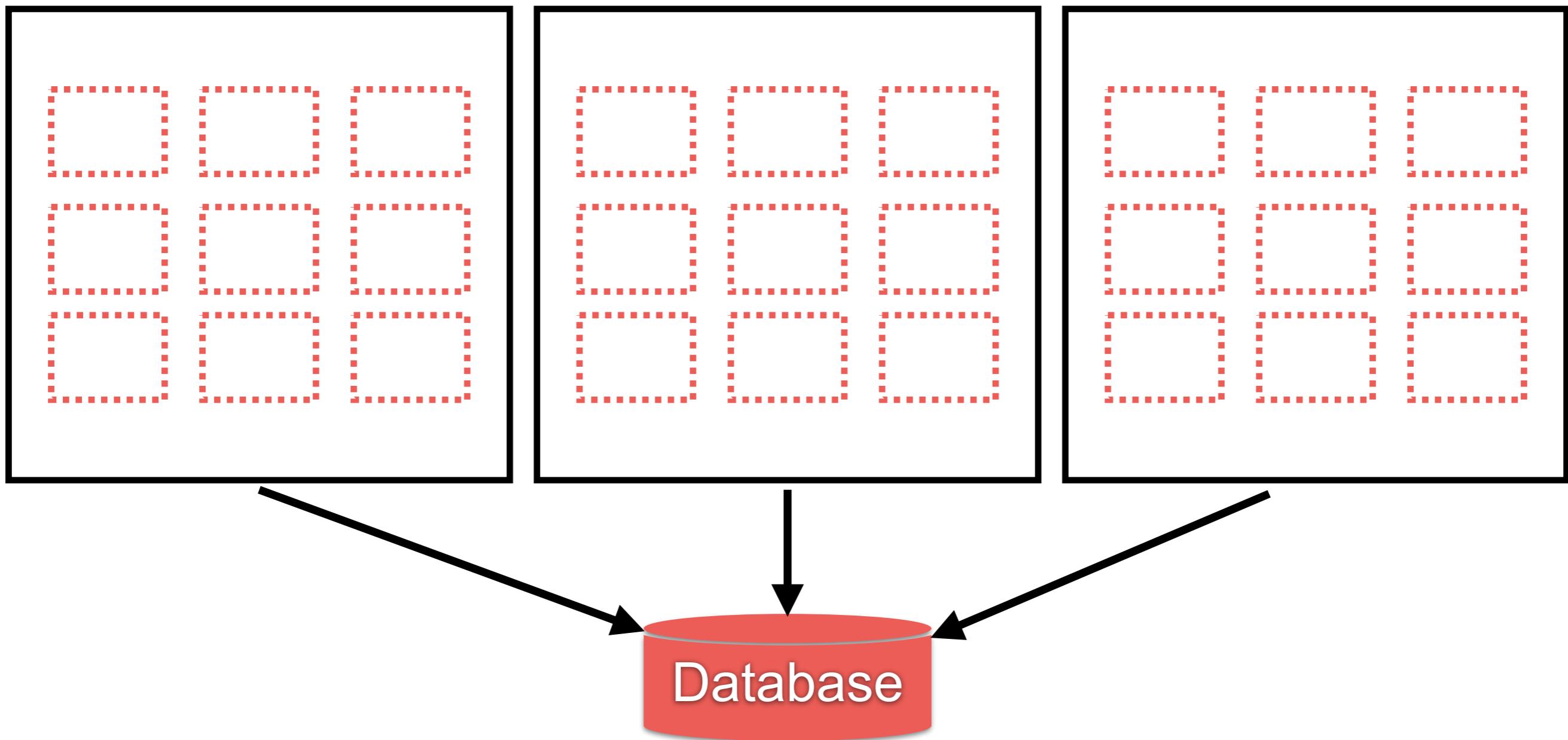




Modules



How to scale ?



What happens when we need more servers ?



What if we don't use all modules equally ?



How can we update individual models/database ?



**Do all modules need to use the
same Database, Language and
Runtime ... ?**



We need to improve

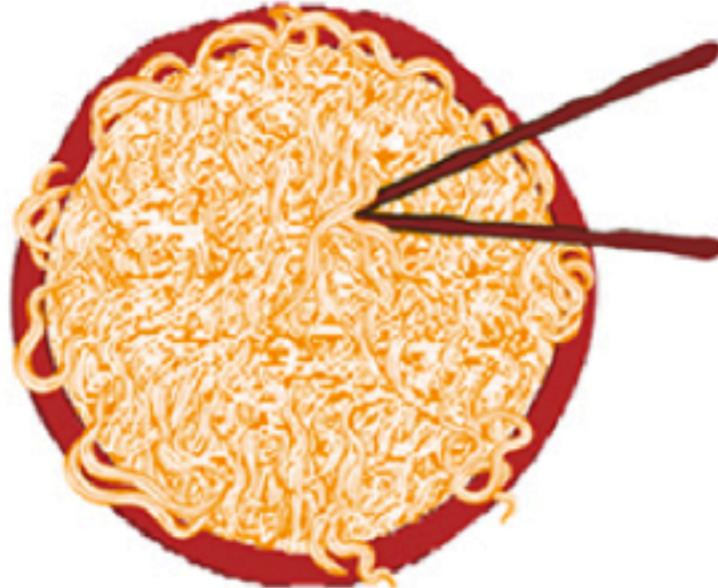
We need to get better



SOA

1990s and earlier

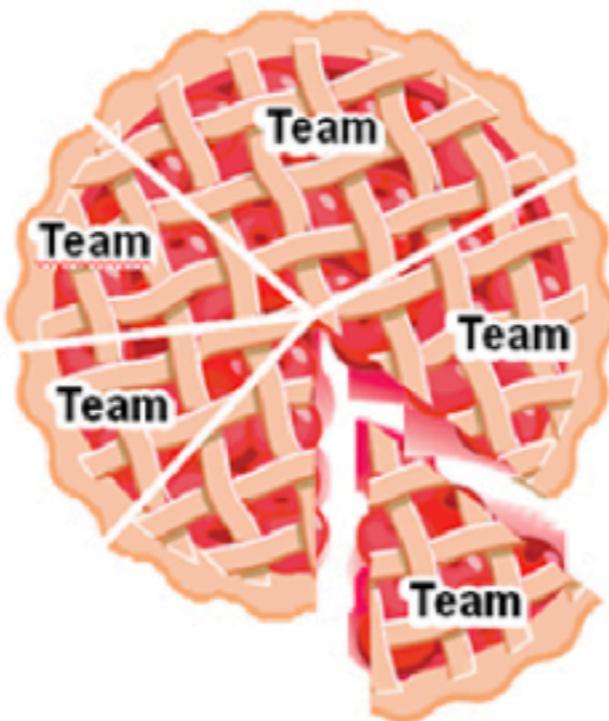
Pre-SOA (monolithic)
Tight coupling



For a monolith to change, all must agree on each change. Each change has unanticipated effects requiring careful testing beforehand.

2000s

Traditional SOA
Looser coupling



Elements in SOA are developed more autonomously but must be coordinated with others to fit into the overall design.

2010s

Microservices
Decoupled



Developers can create and activate new microservices without prior coordination with others. Their adherence to MSA principles makes continuous delivery of new or modified services possible.



Service-Oriented Architecture



What is service ?

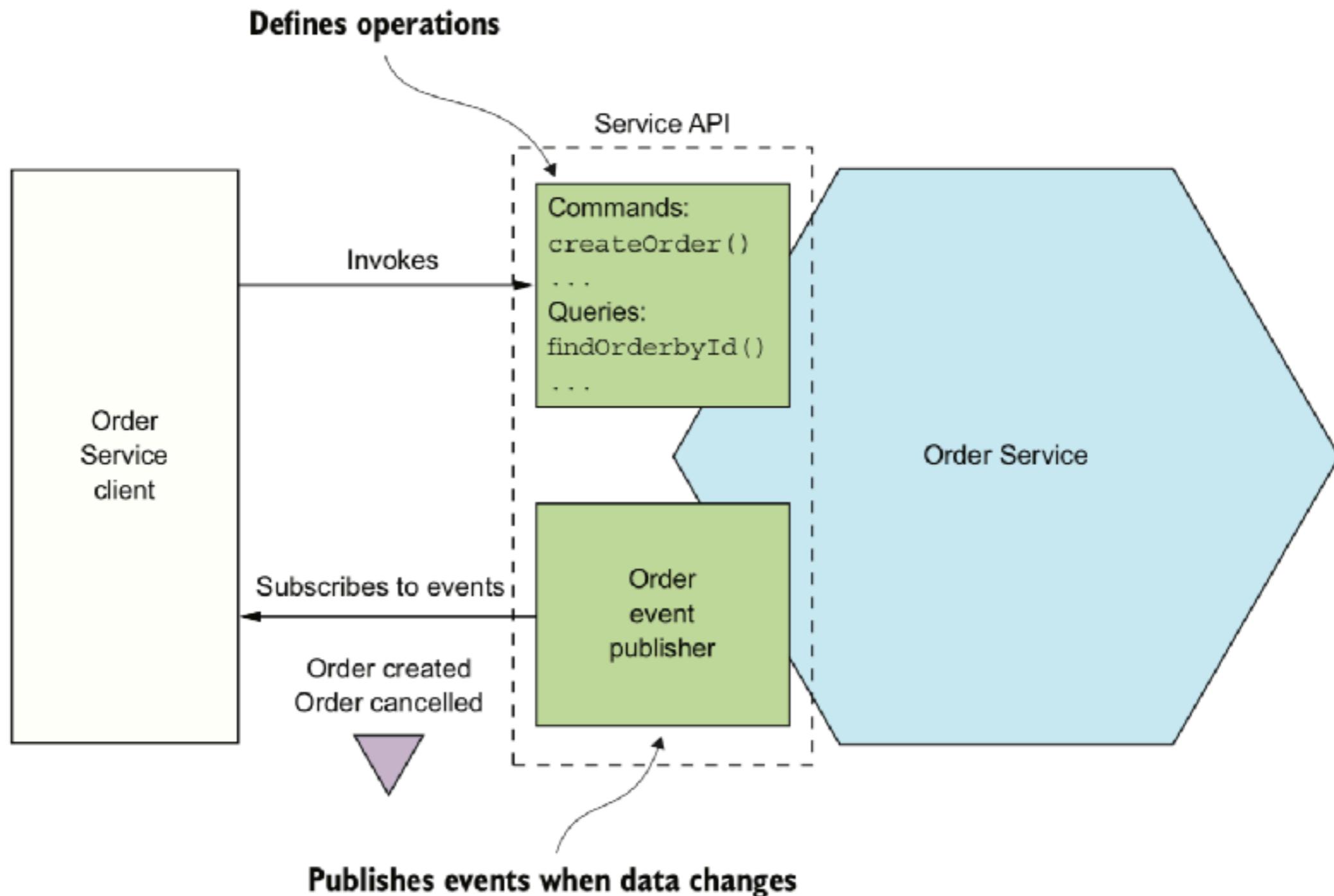
Standalone and loosely couple

Independently deployable software component

Implement some useful functionality



Example of service



Service-Oriented Architecture

SOA Manifesto

Service orientation is a paradigm that frames what you do.
Service-oriented architecture (SOA) is a type of architecture
that results from applying service orientation.

We have been applying service orientation to help organizations
consistently deliver sustainable business value, with increased agility
and cost effectiveness, in line with changing business needs.

<http://www.soa-manifesto.org/>



Microservices

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Service-Oriented Architecture

Through our work we have come to prioritize:

Business value over technical strategy

Strategic goals over project-specific benefits

Intrinsic interoperability over custom integration

Shared services over specific-purpose implementations

Flexibility over optimization

Evolutionary refinement over pursuit of initial perfection

<http://www.soa-manifesto.org/>



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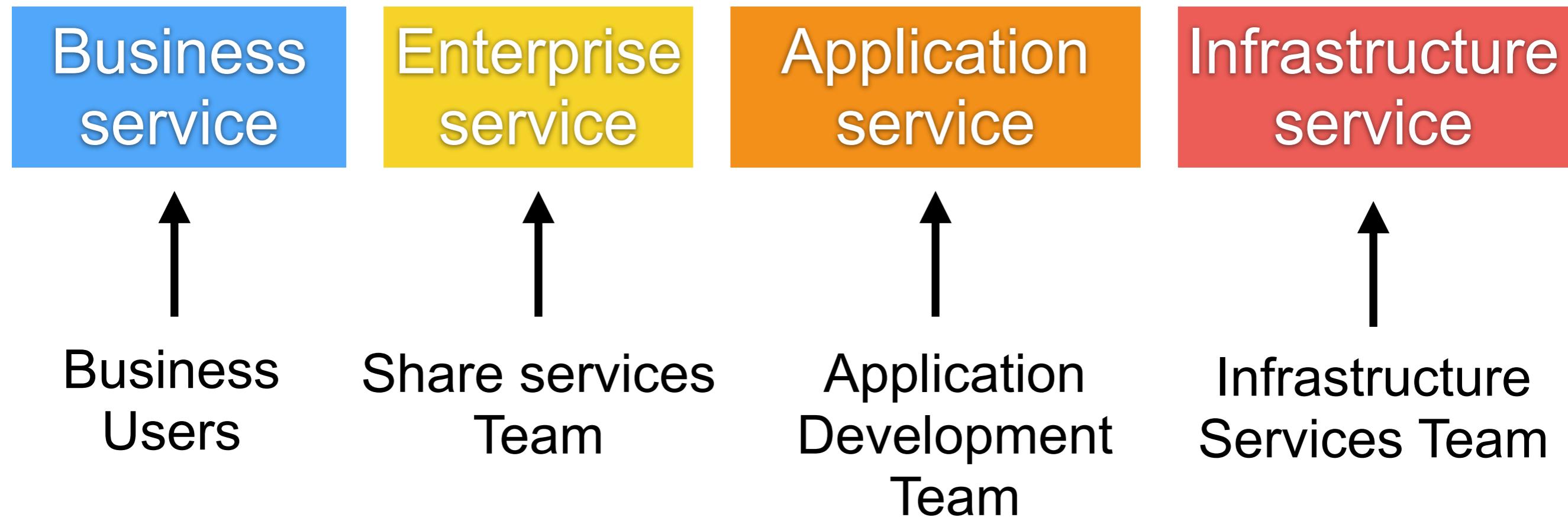
<http://www.soa-manifesto.org/>



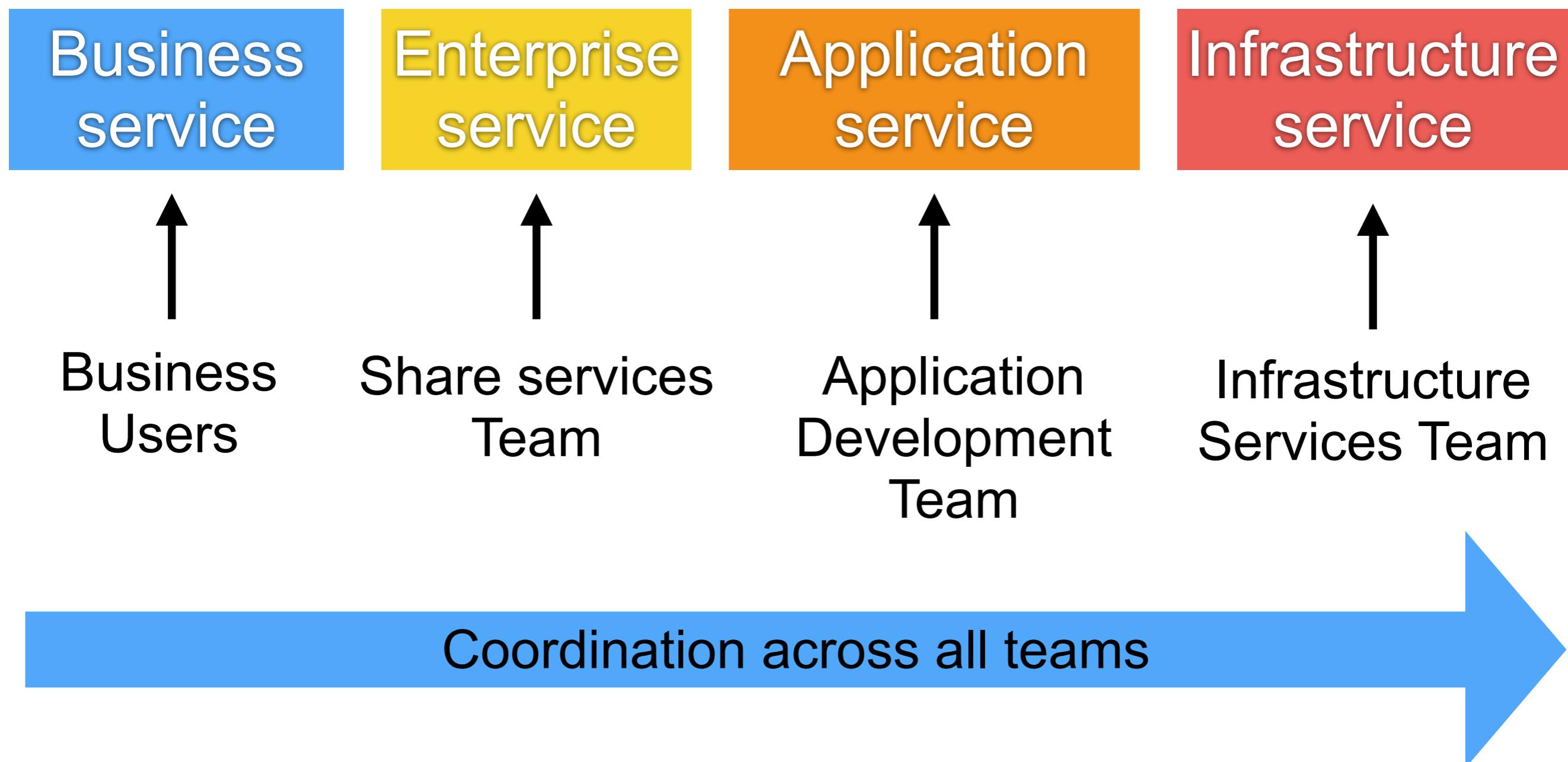
Microservices

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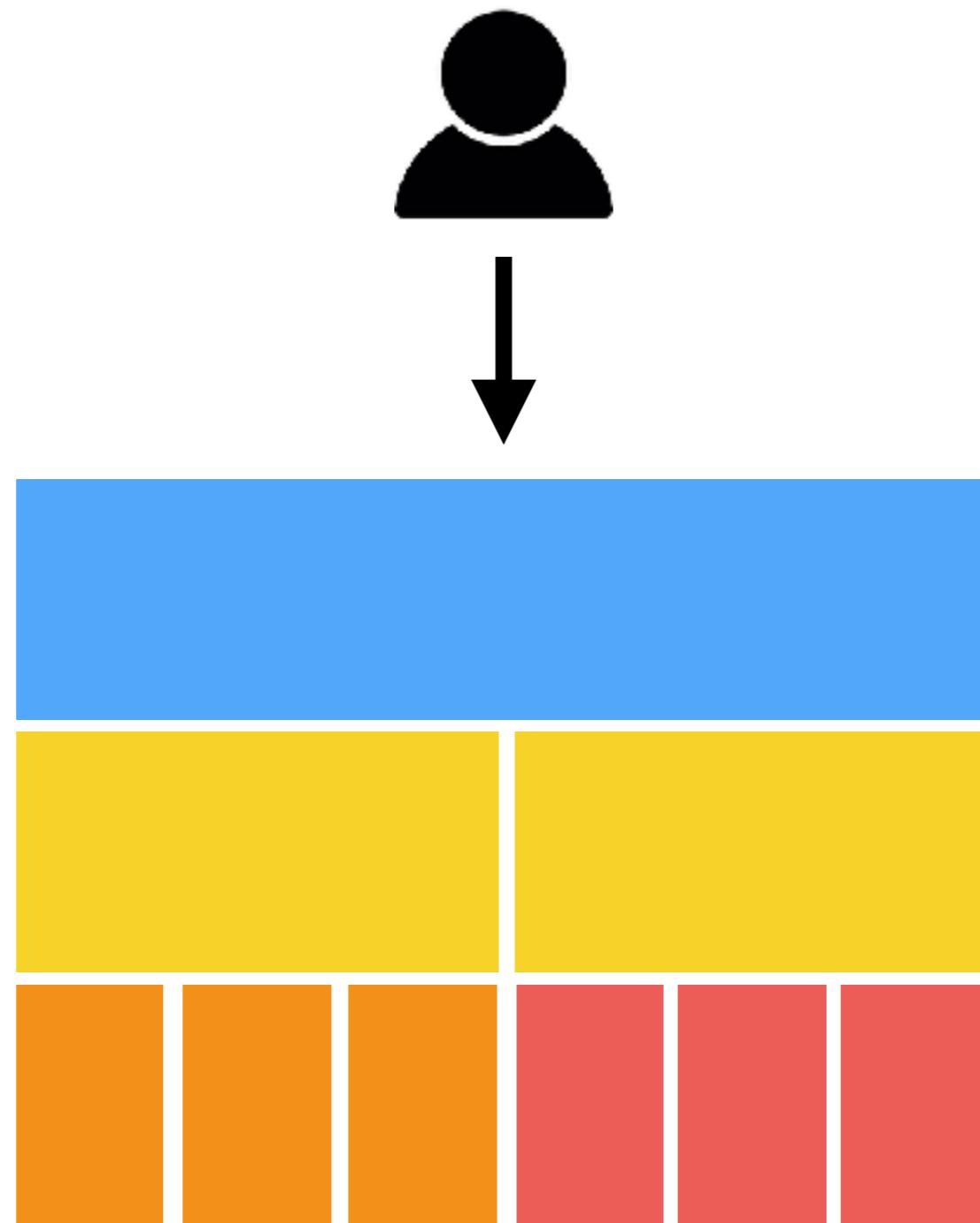
Service-Oriented Architecture



Service-Oriented Architecture



Service-Oriented Architecture



We need to improve

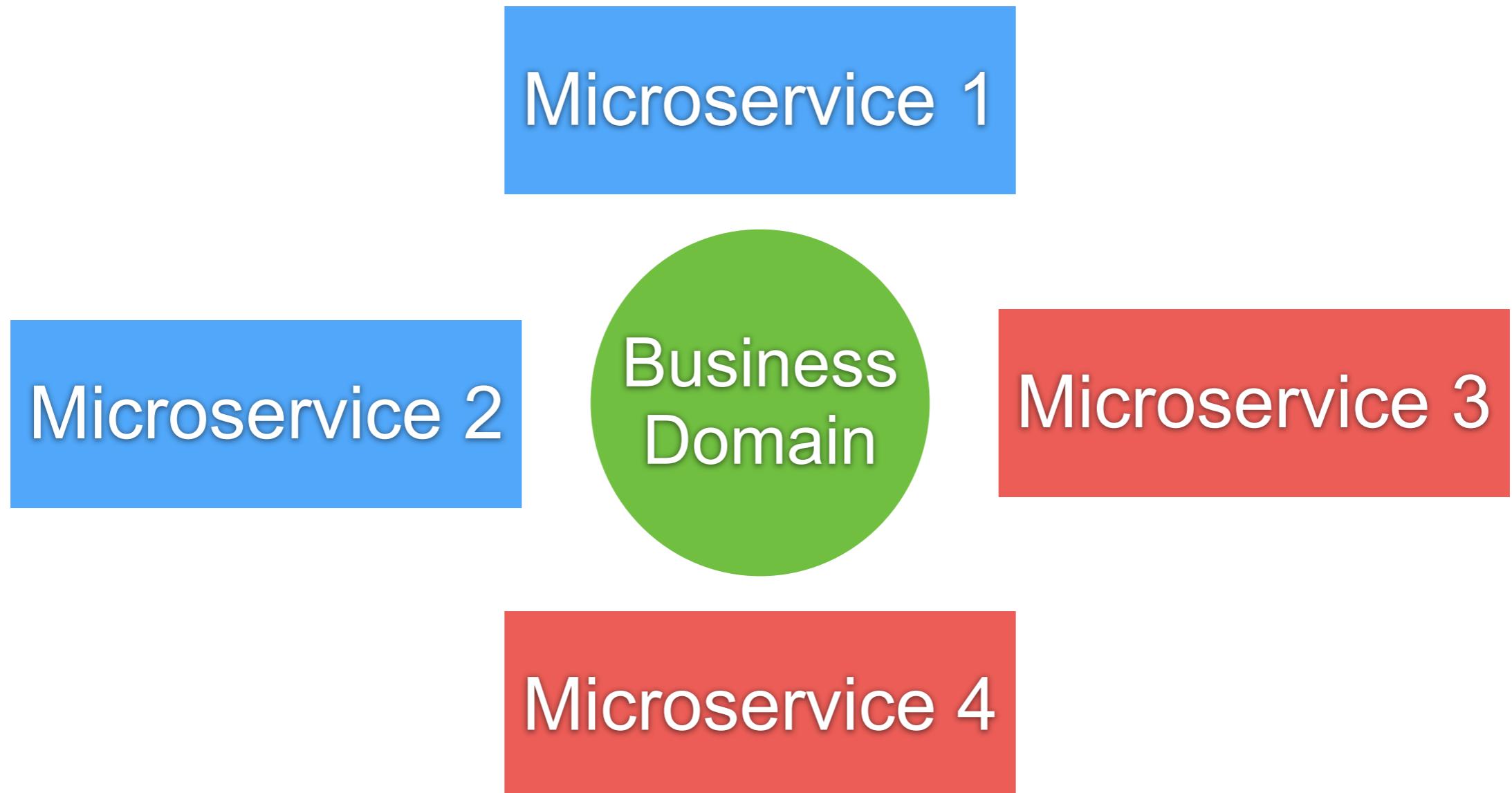
We need to get better



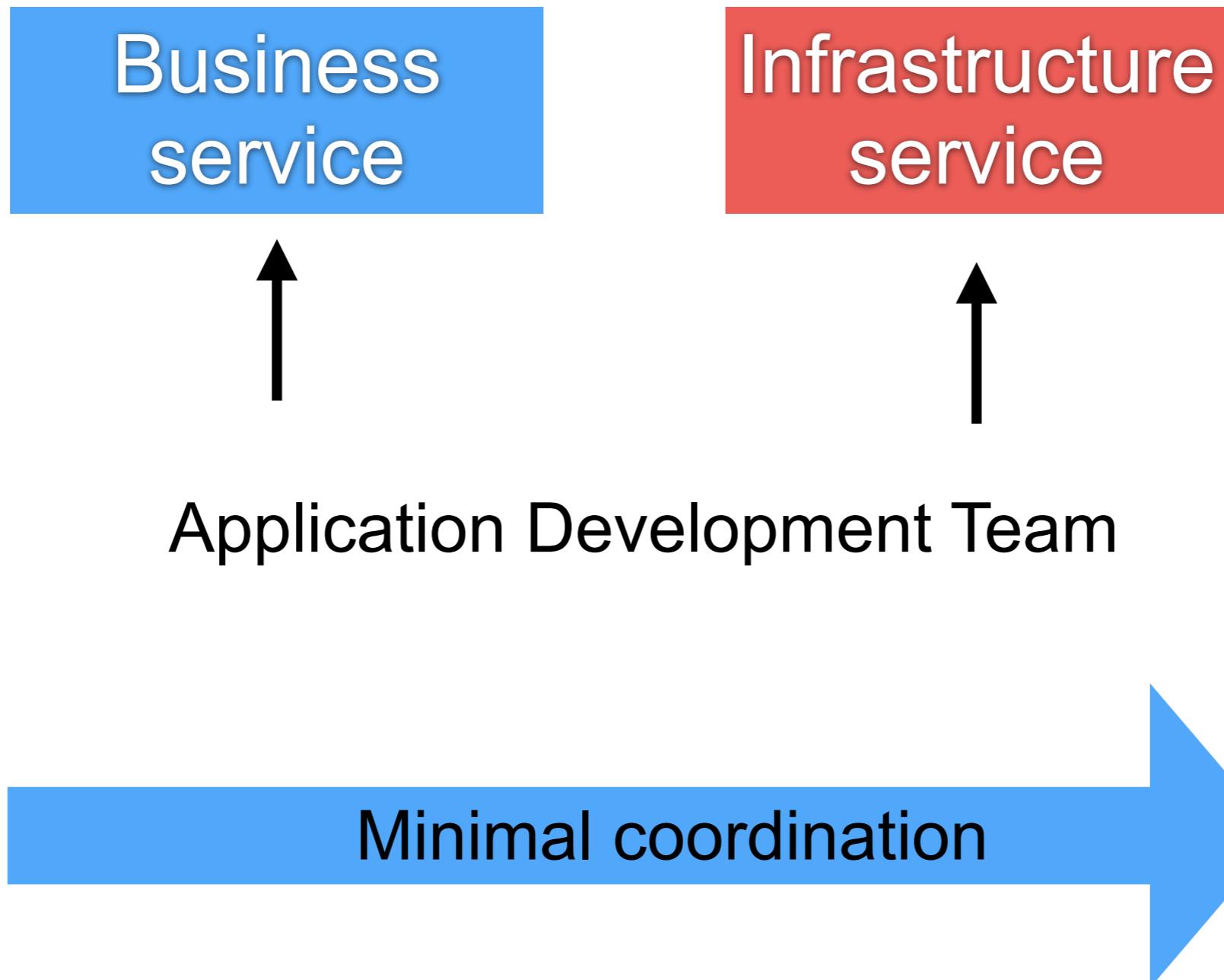
Microservice



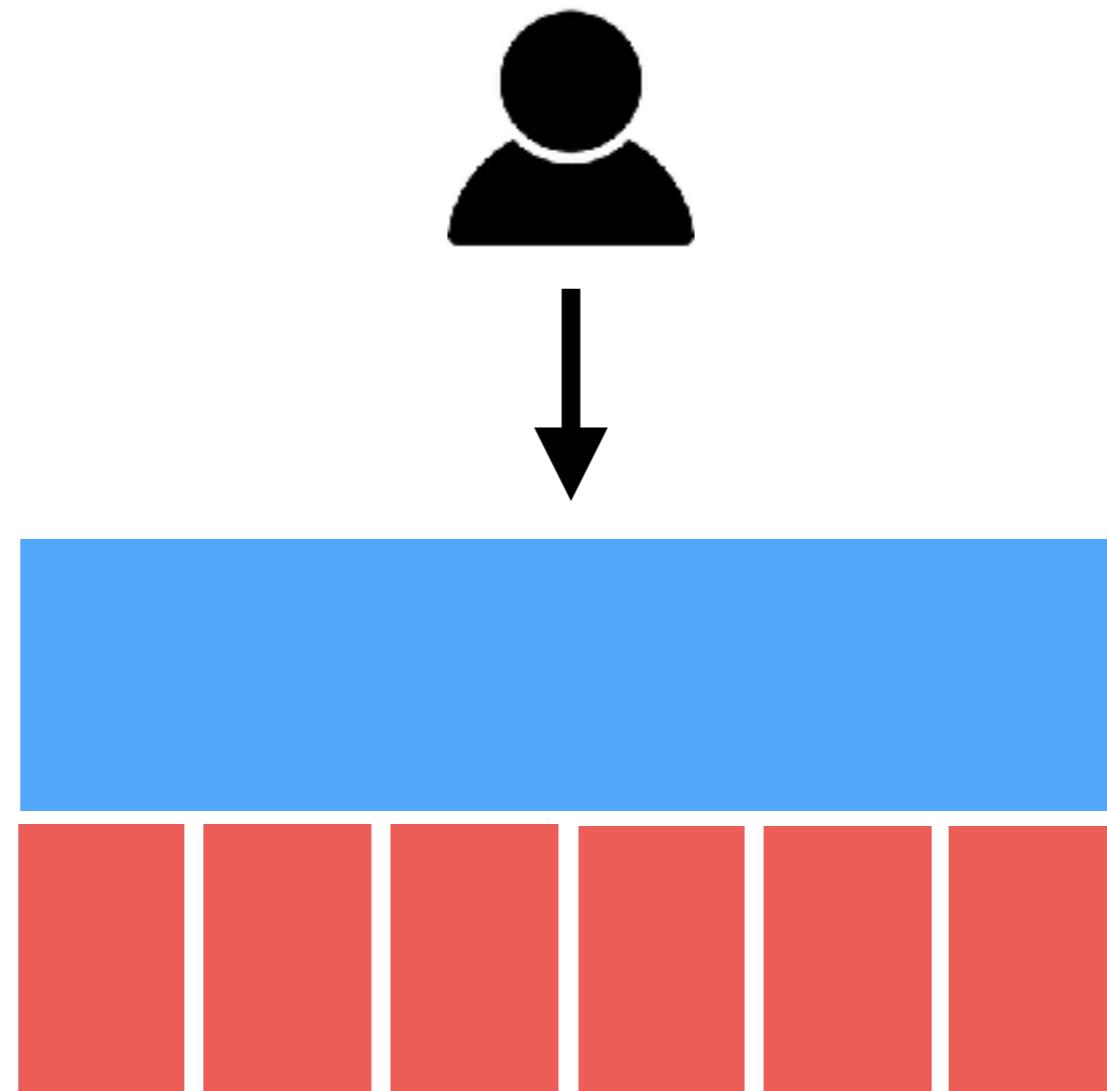
Microservice



Microservice



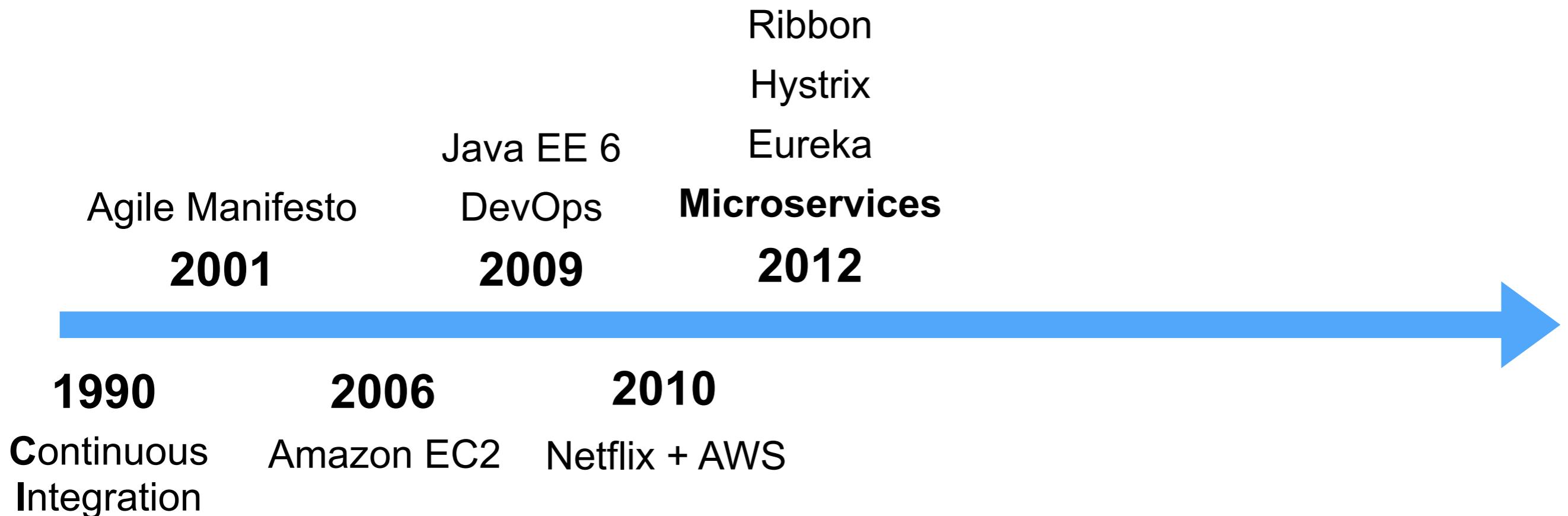
Microservice



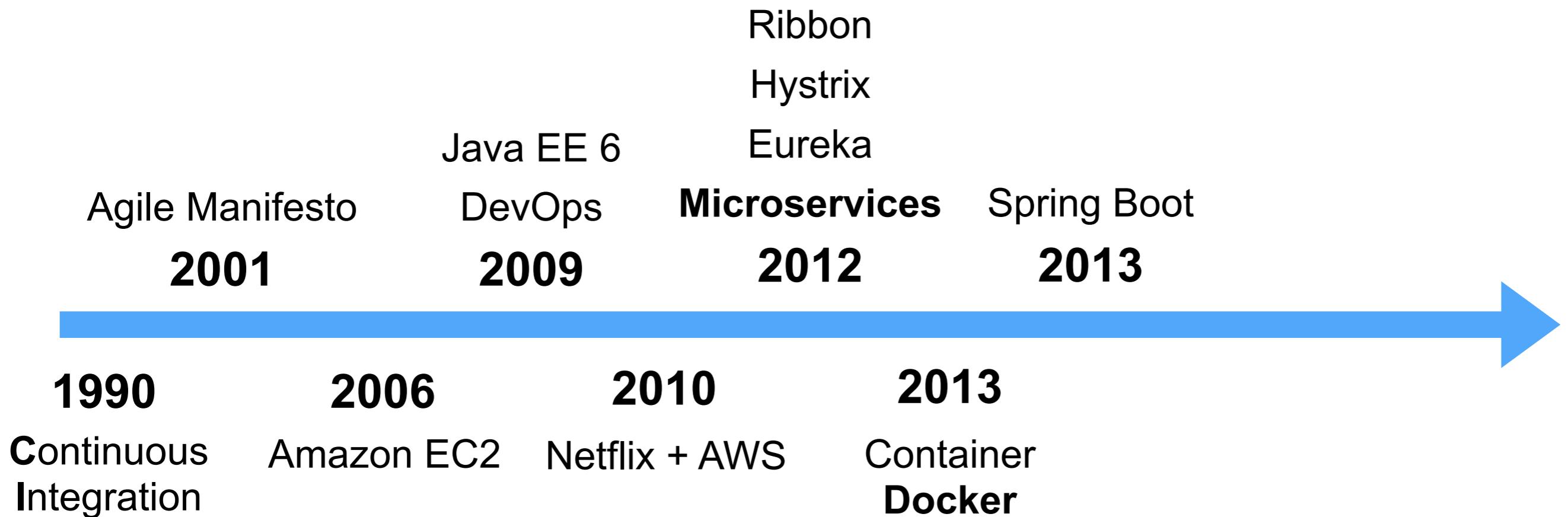
Microservice history



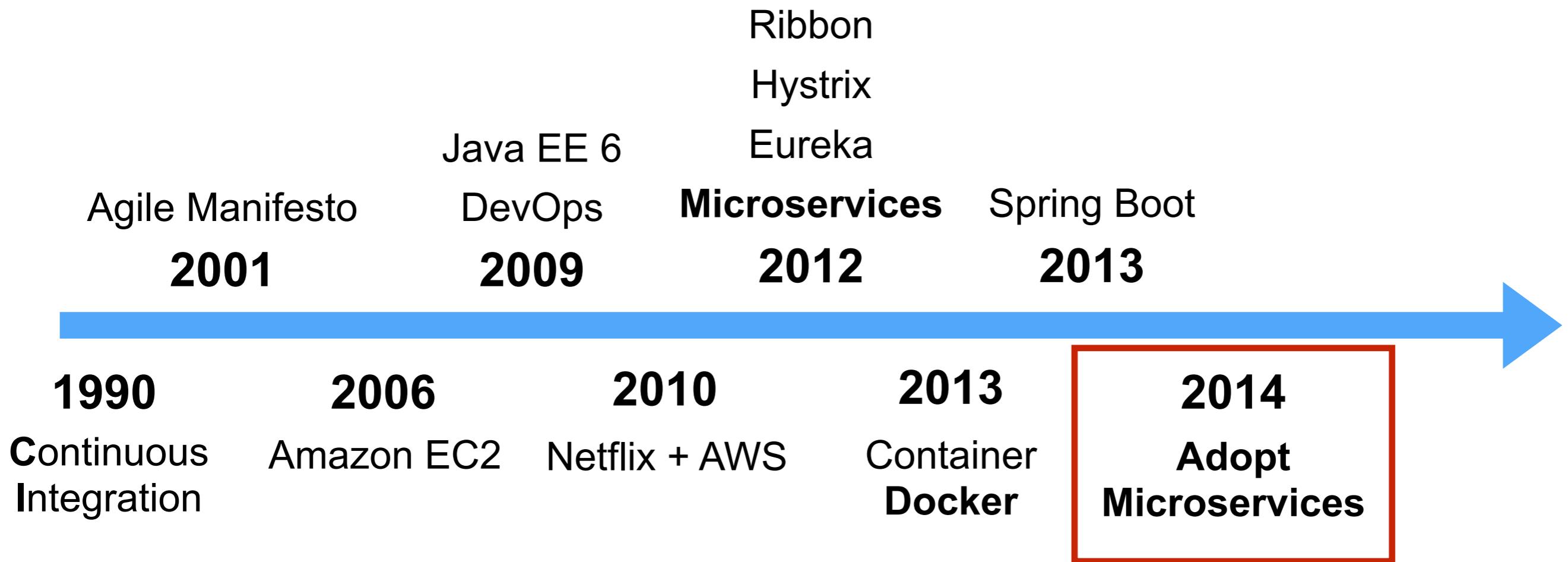
Microservice history



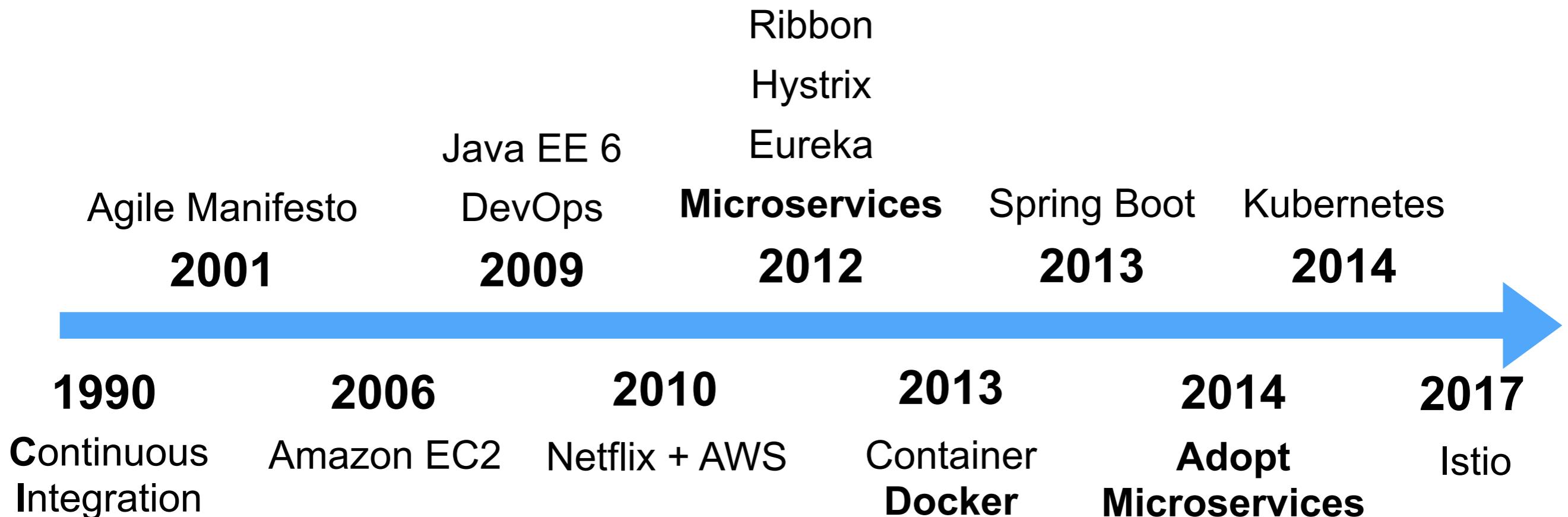
Microservice history



Microservice history



Microservice history



Microservice

Small, Do one thing (Single Responsibility)

Modular

Easy to understand

Easy to develop

Easy to deploy

Easy to maintain

Scale independently



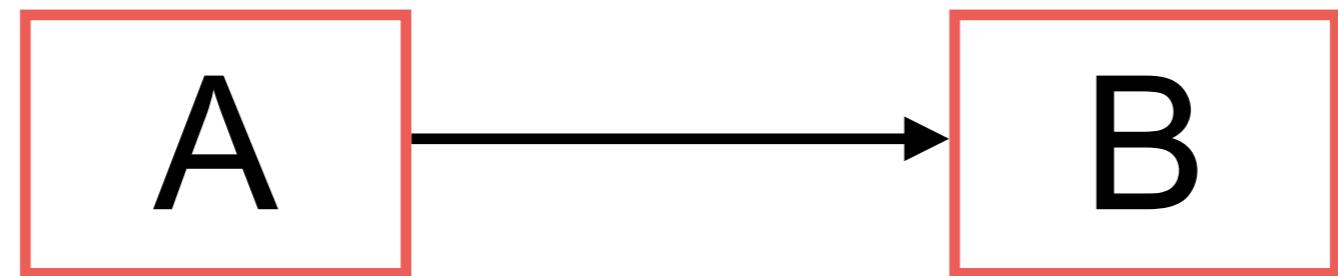
Goals

Increase the **velocity** of application release
By decomposing app to **small services**
Autonomous services
Deploy independently



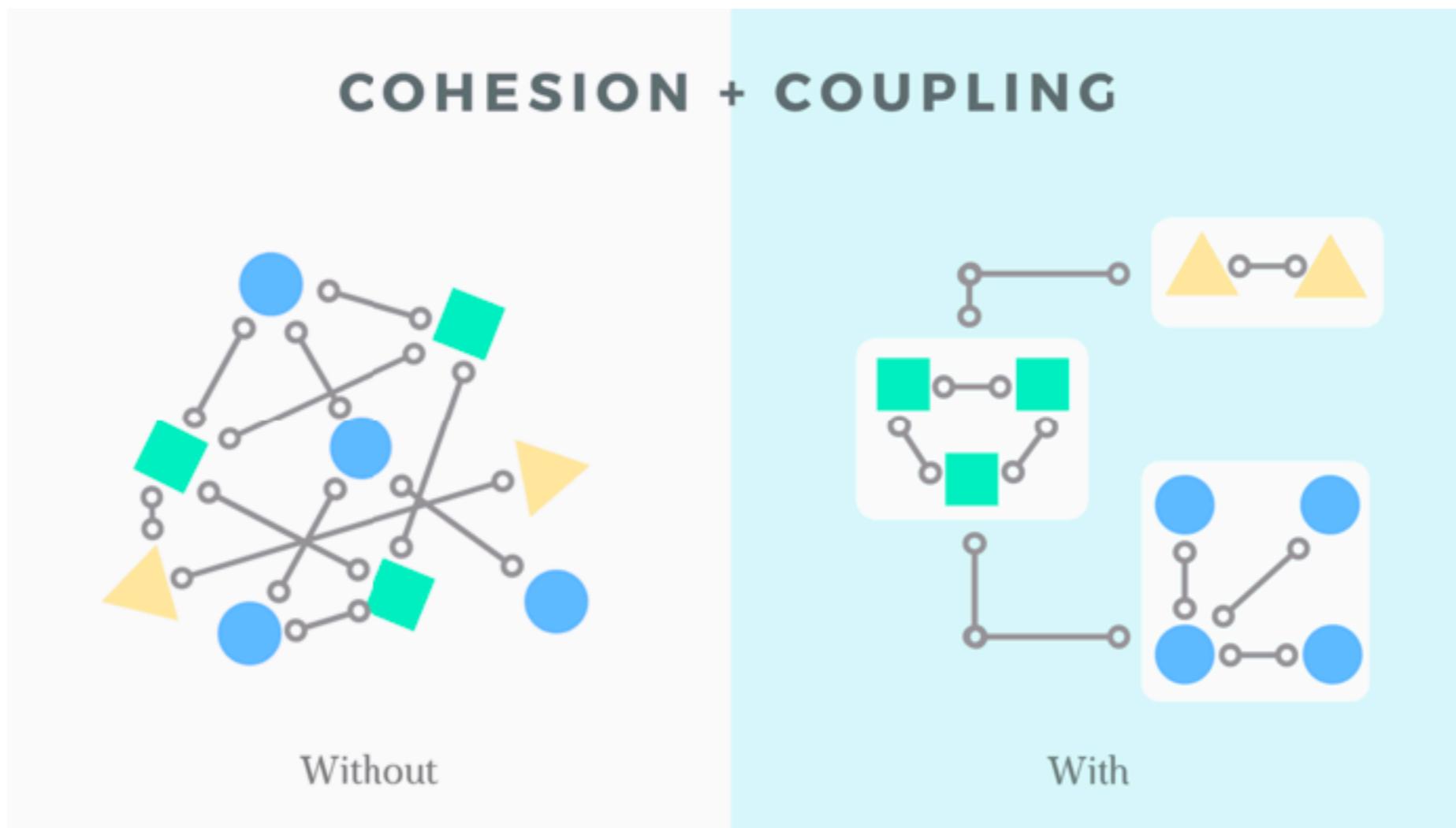
Independent

Replicable Updatable Scalable Deployable

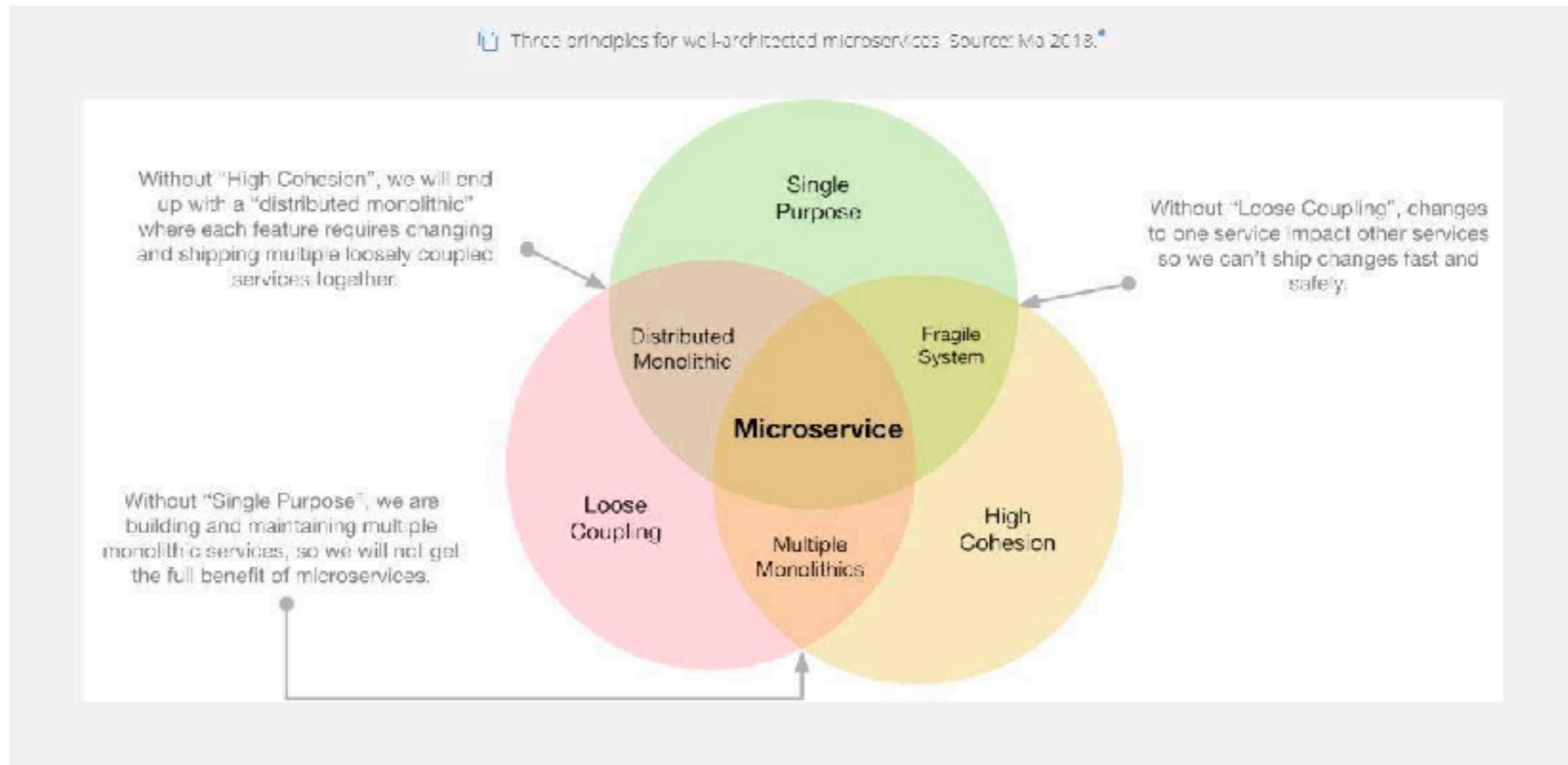


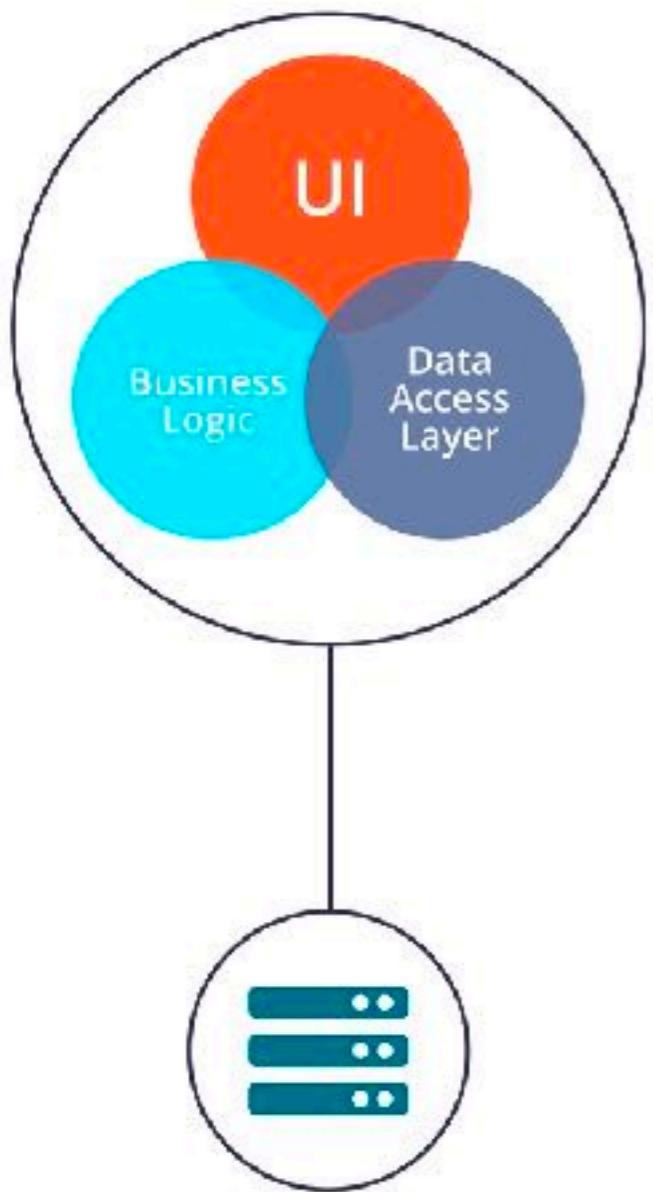
Better Architecture

Loose coupling
High cohesion

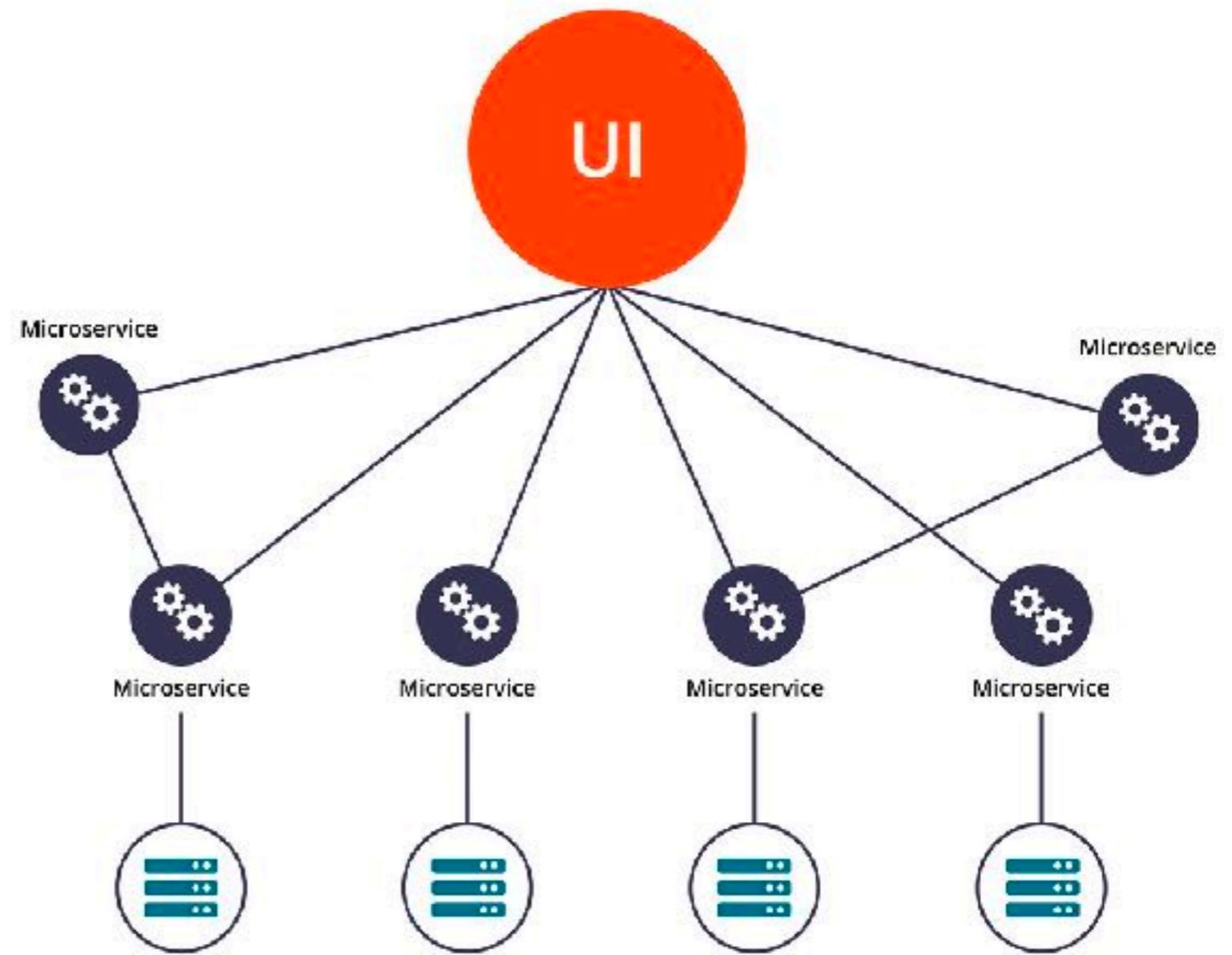


Better Architecture





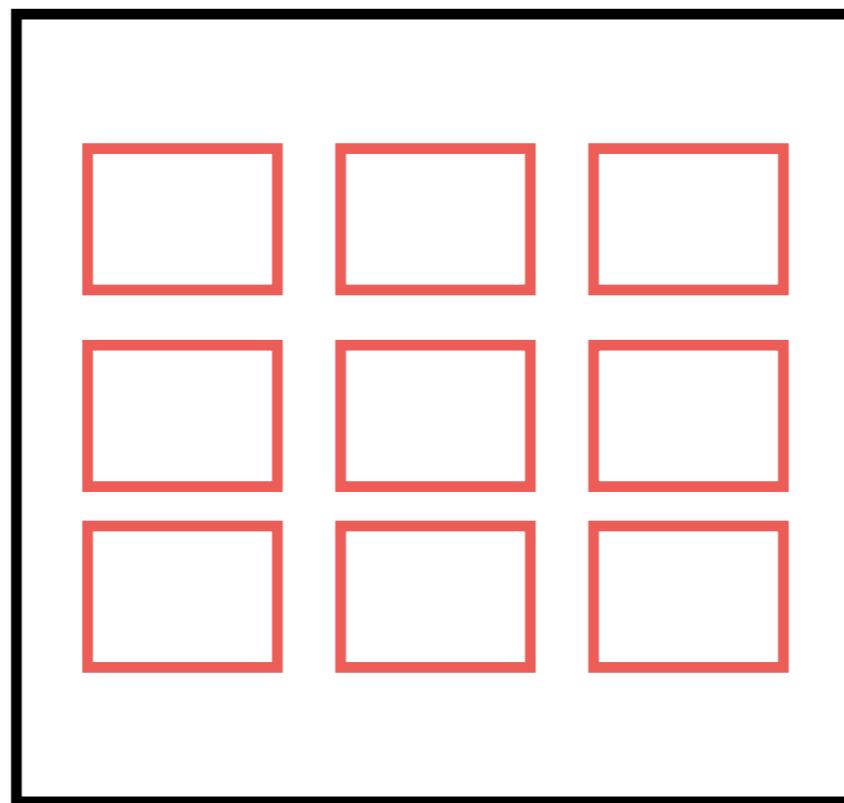
Monolithic Architecture



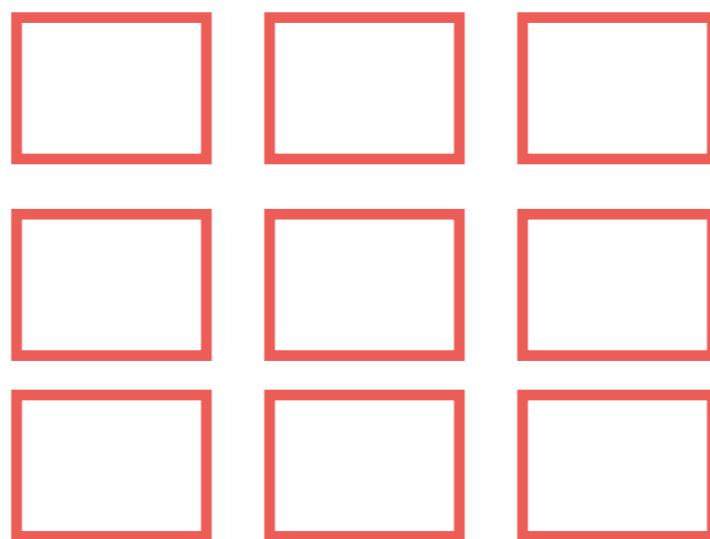
Microservice Architecture



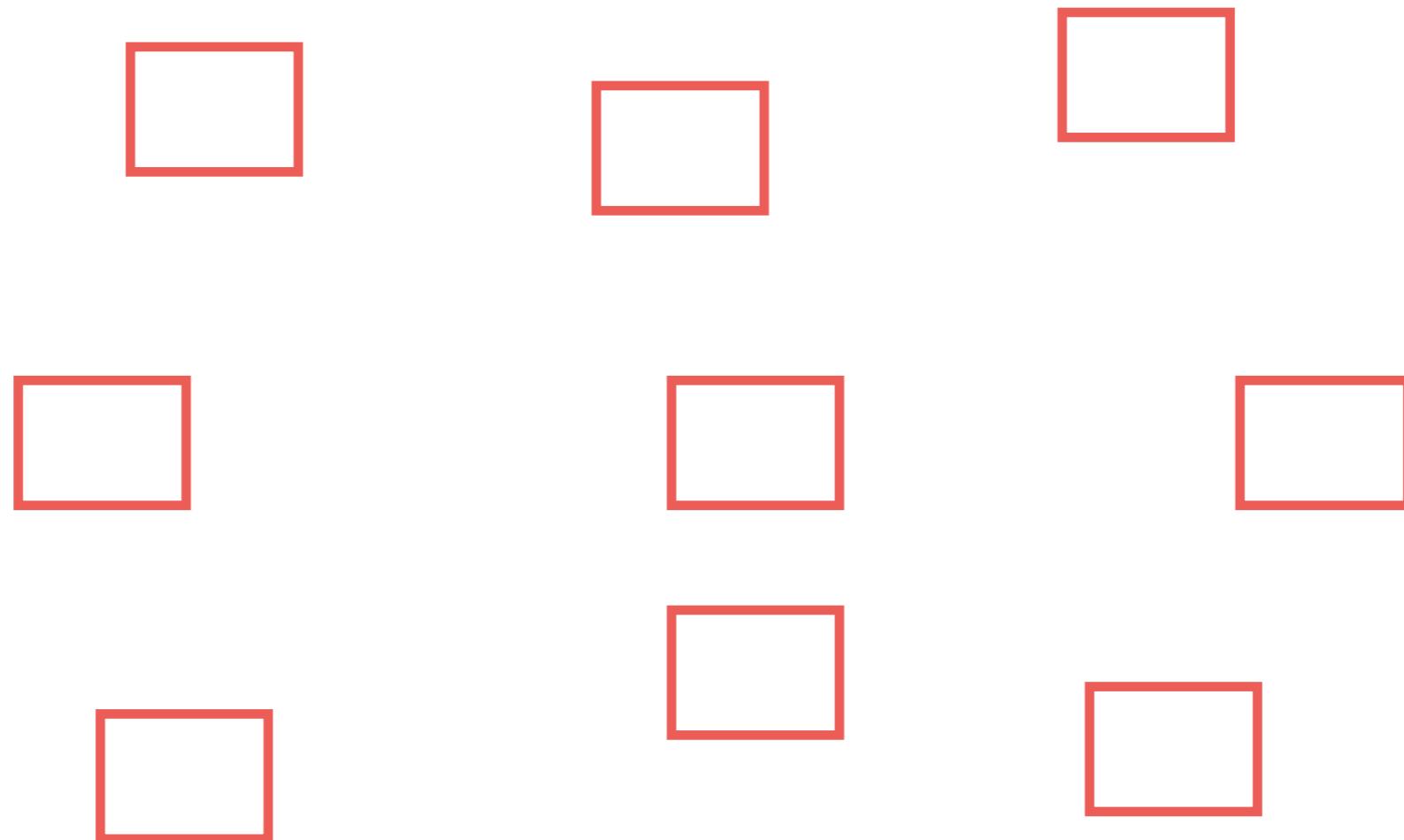
Microservice



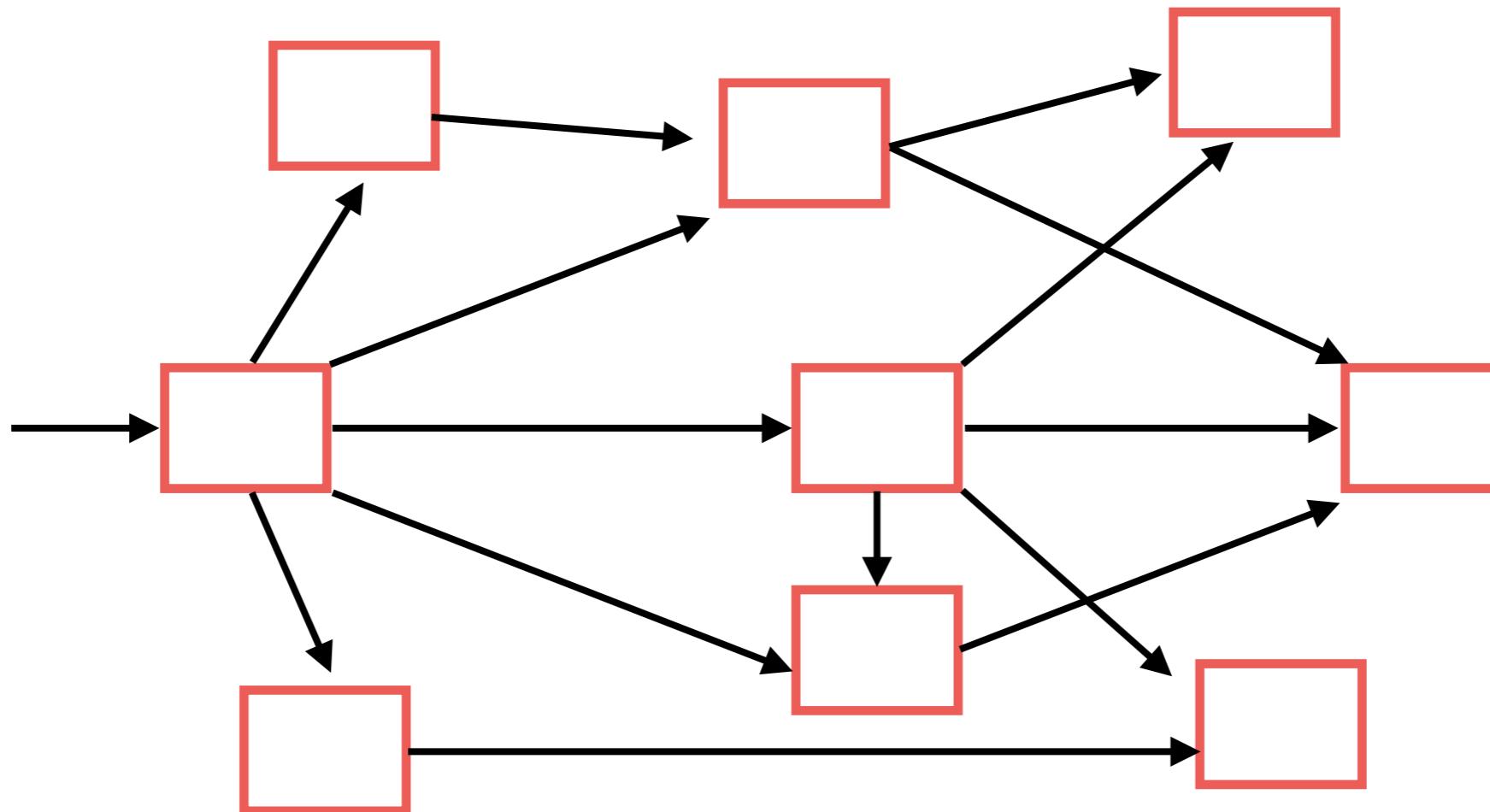
Microservice



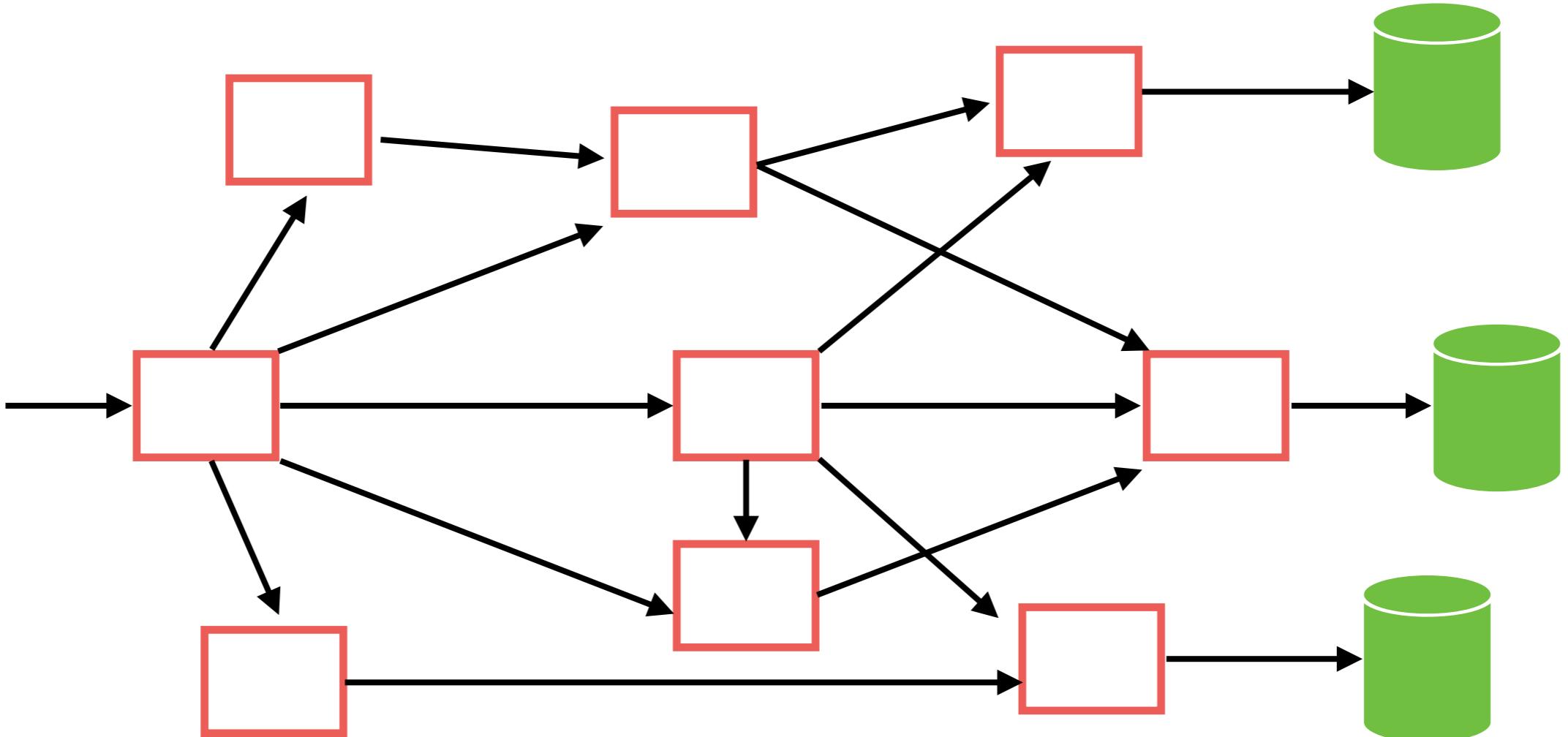
Microservice



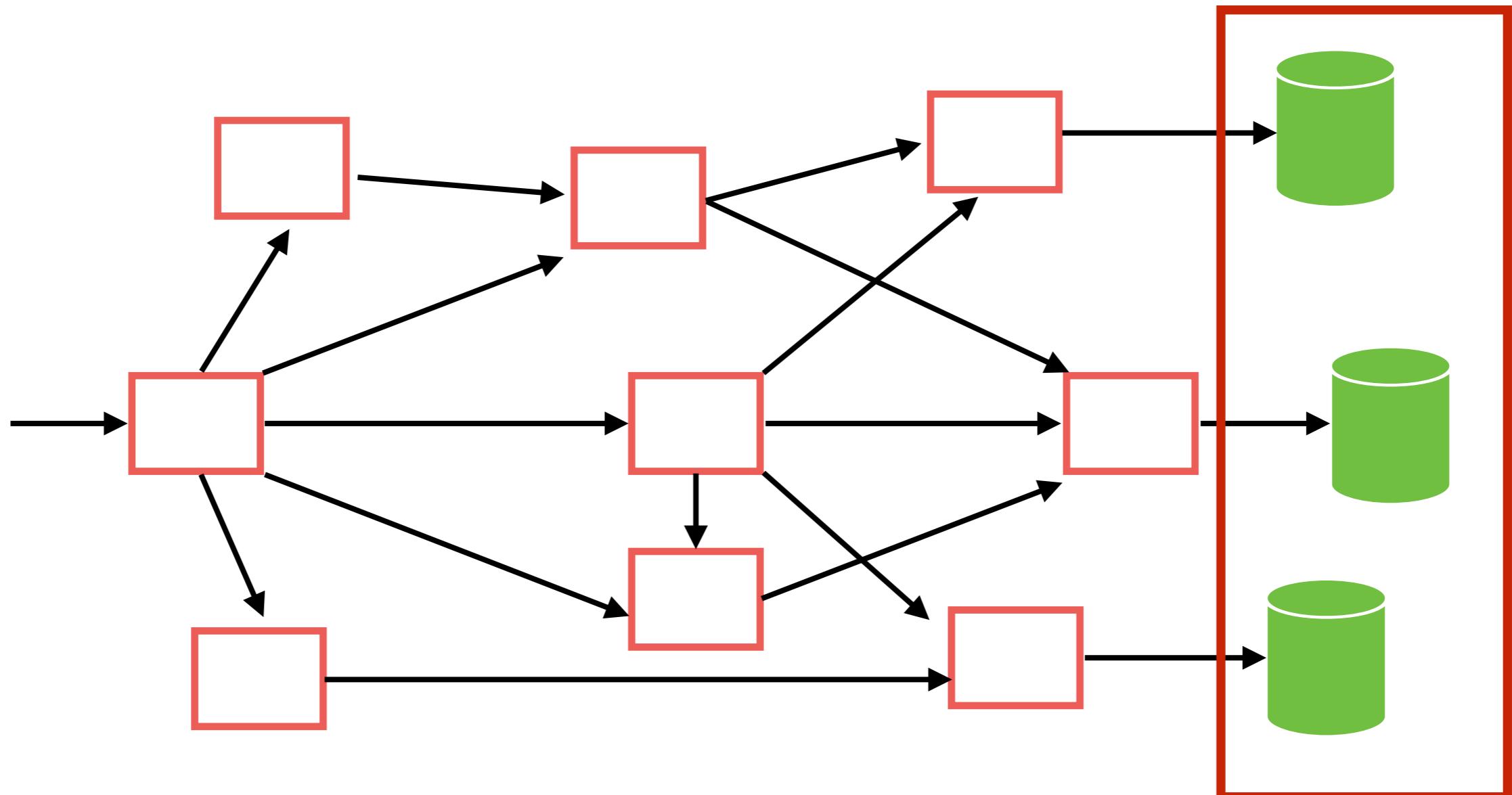
Microservice == Distributed



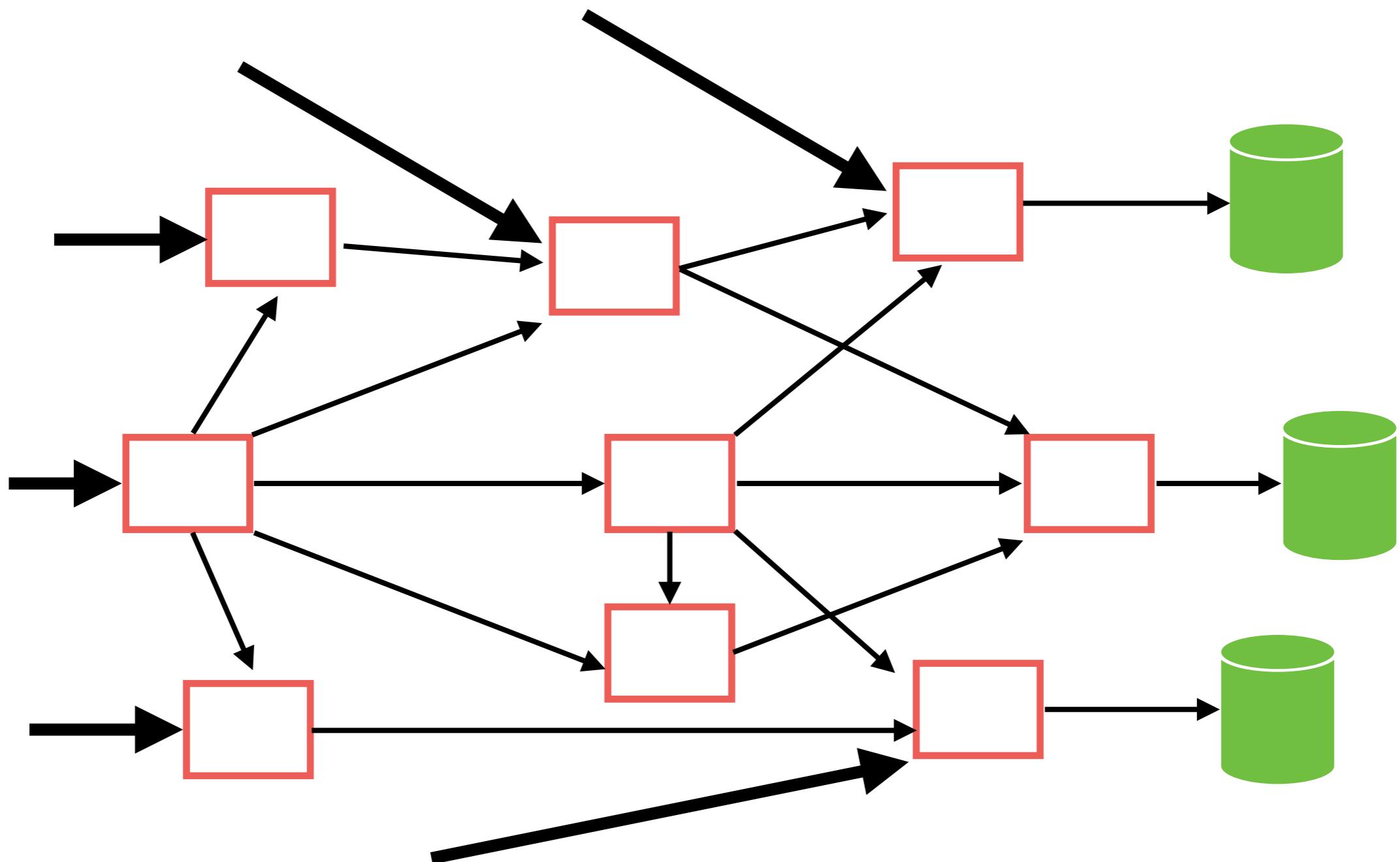
Own data



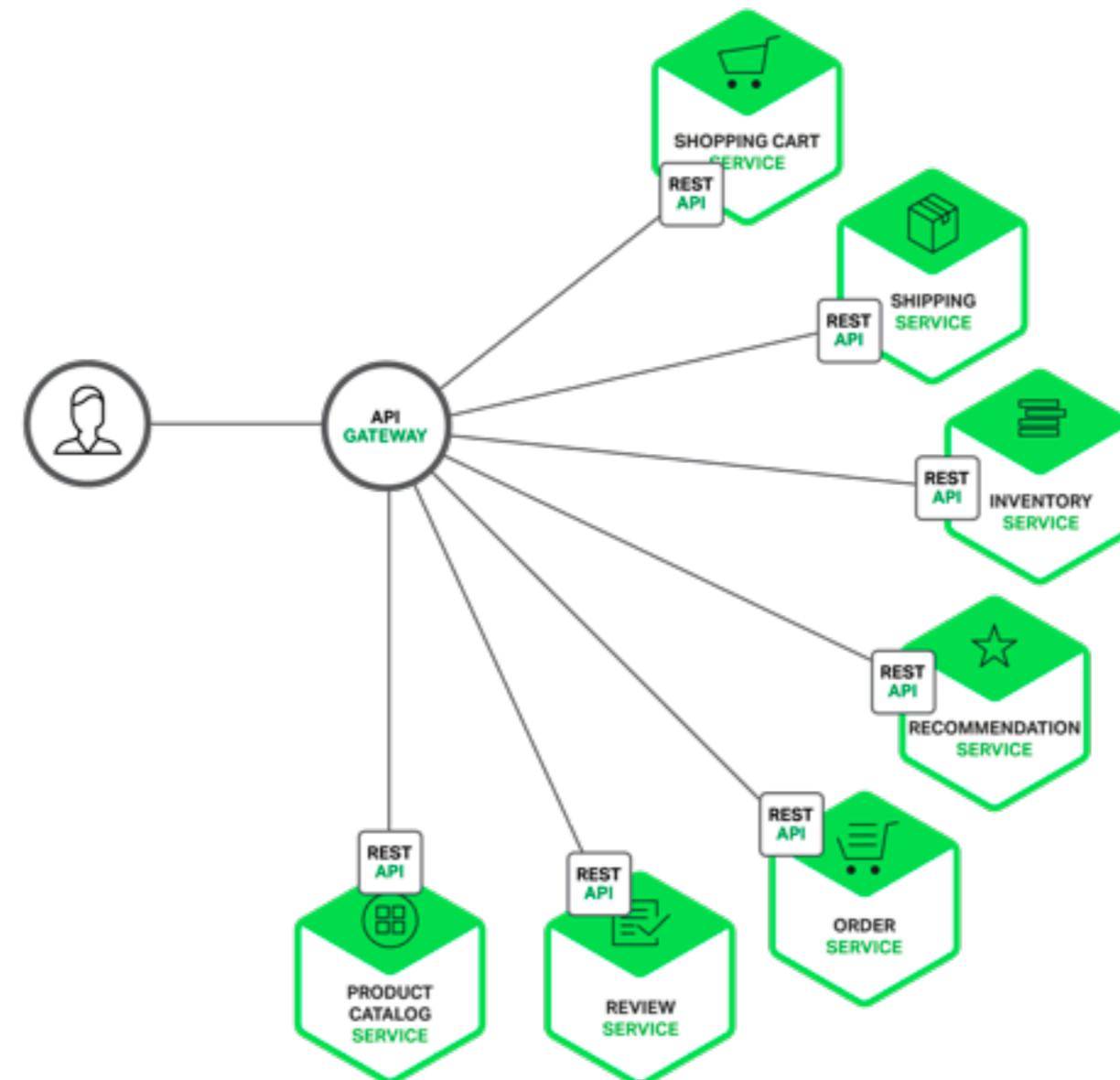
Data consistency !!



Multiple entry points



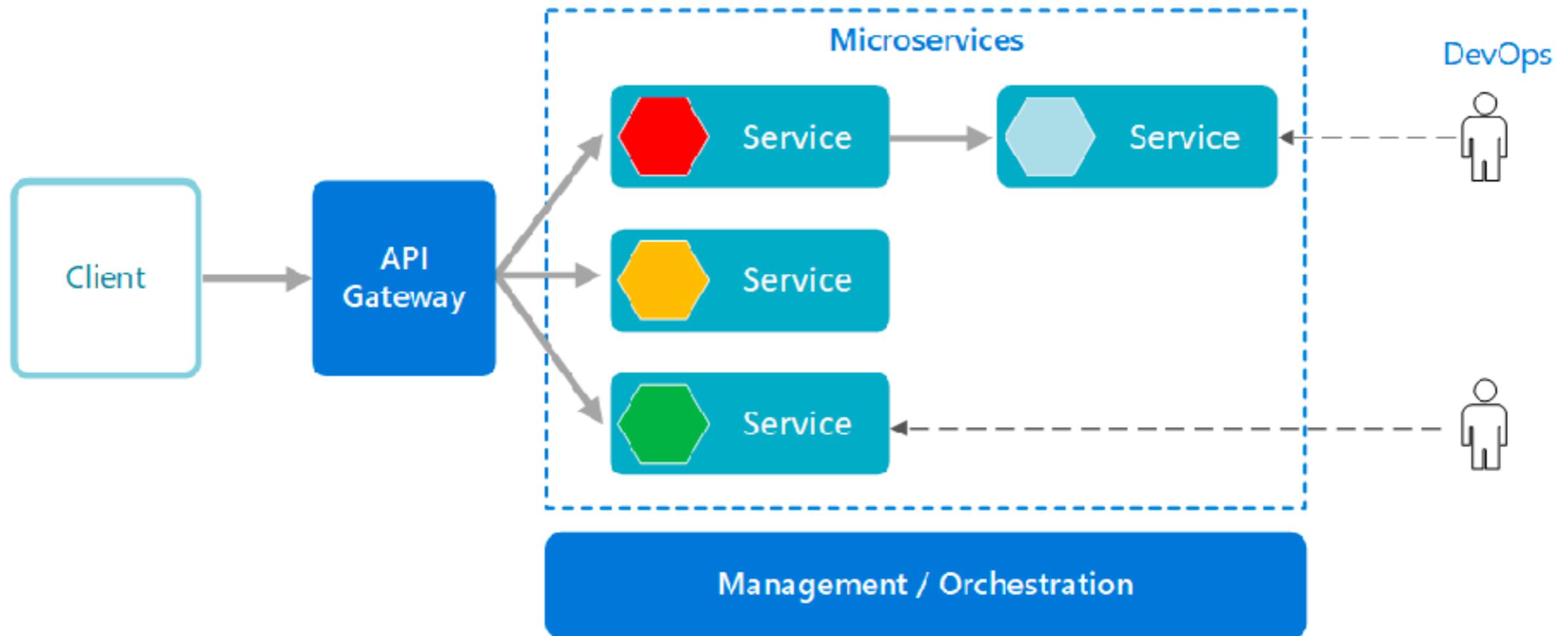
Working with API gateway



<https://www.nginx.com>



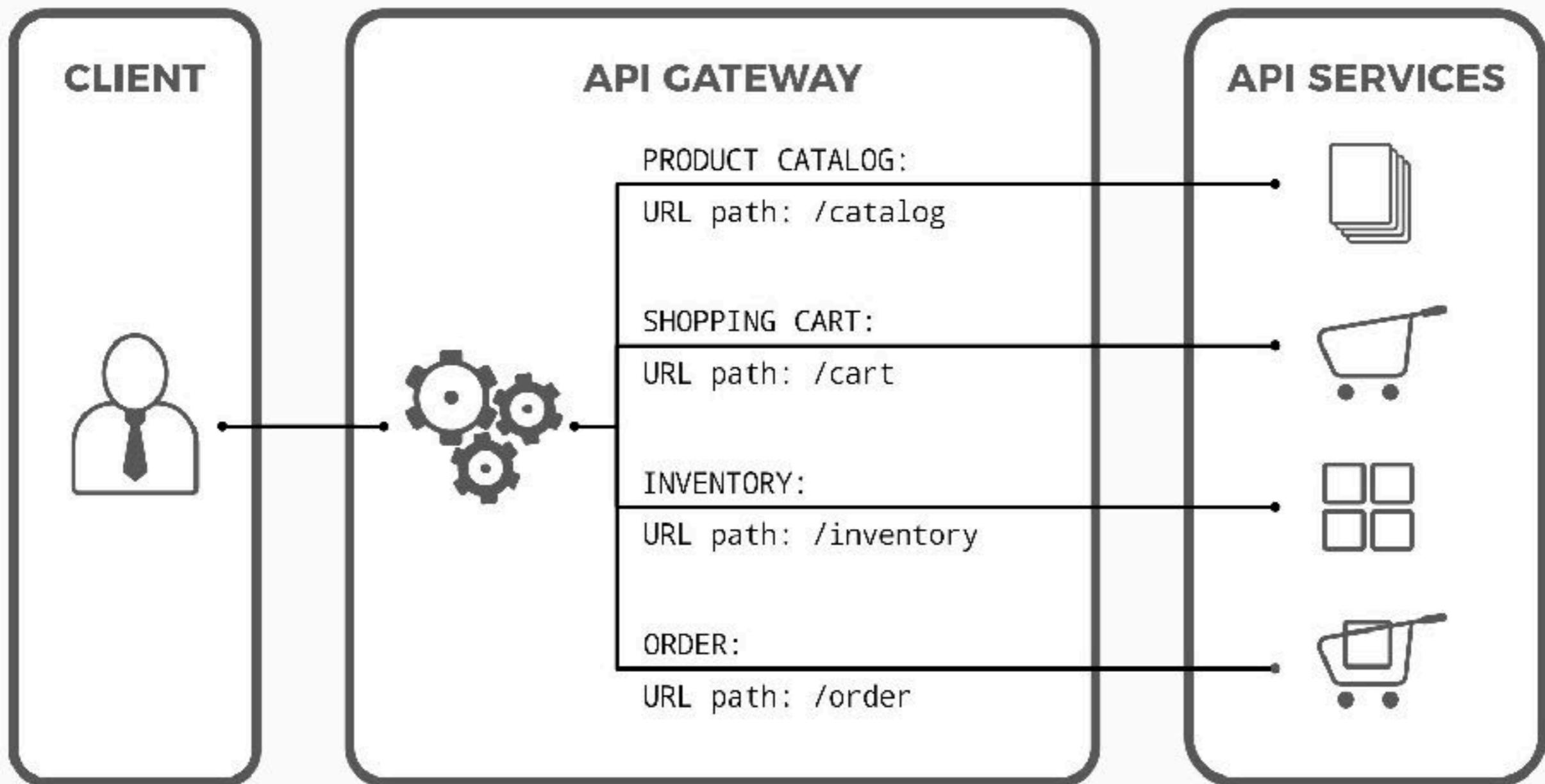
Working with API gateway



<https://docs.microsoft.com/en-us/azure/architecture/guide/architecture-styles/microservices>



Working with API gateway



Functions of API gateway

- Authentication
- Authorization
- Rate limiting
- Caching
- Metrics collection
- Request logging
- Load balancing
- Circuit breaking



Benefits

Encapsulation interface structure
Client talk to service via gateway
Reduce round trip between service

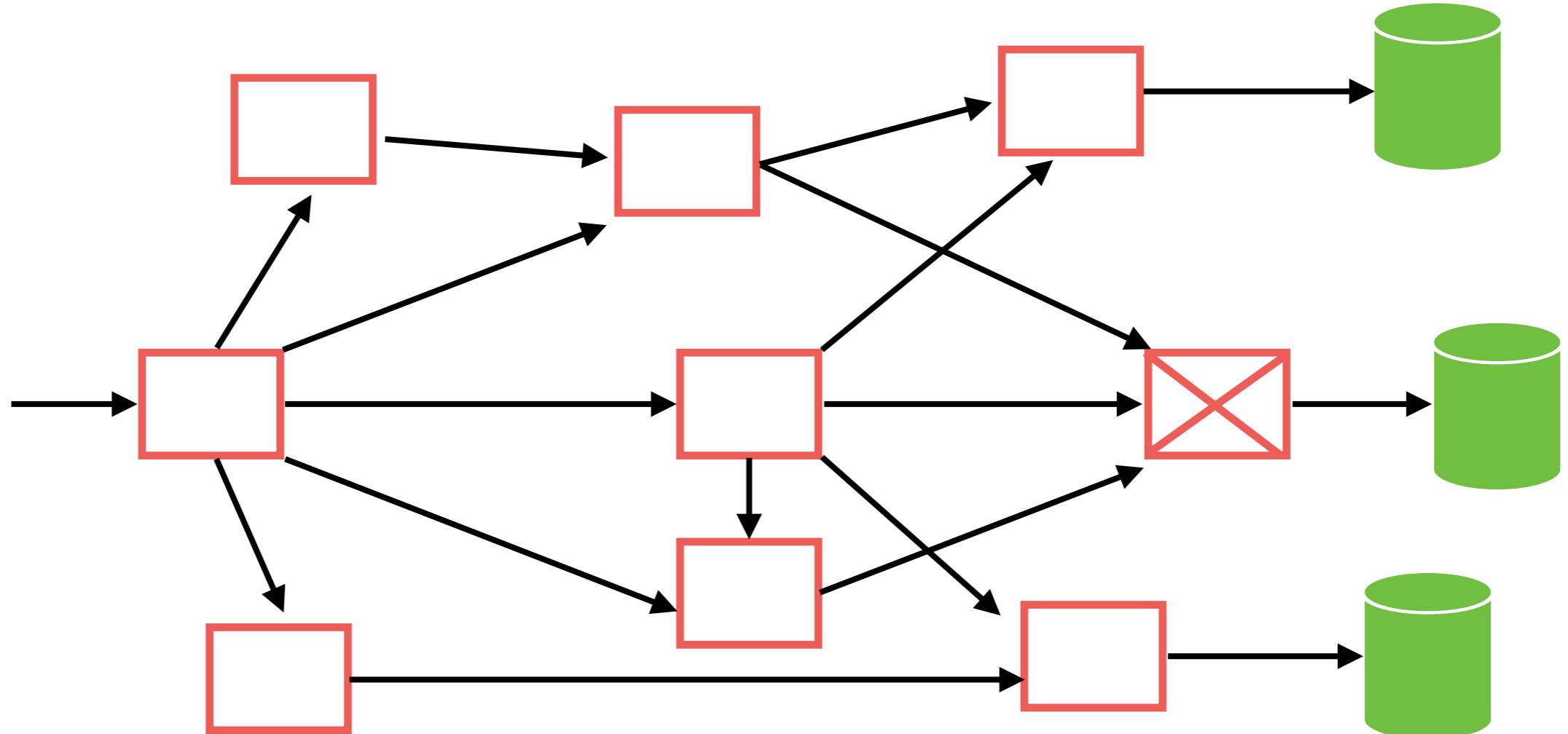


Drawbacks

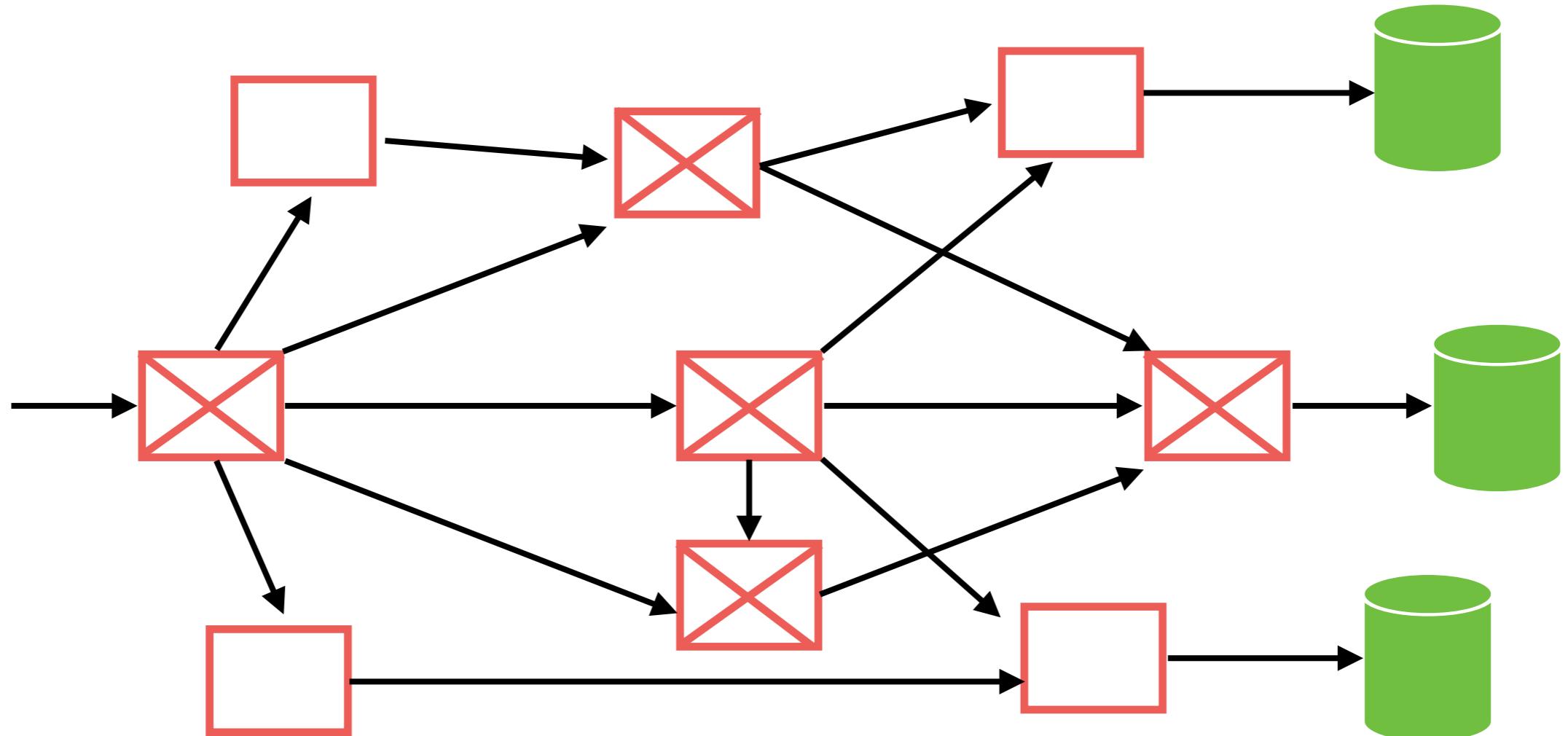
Development/Performance bottleneck
Single point of failure
Waiting for update data in gateway



Failure !!



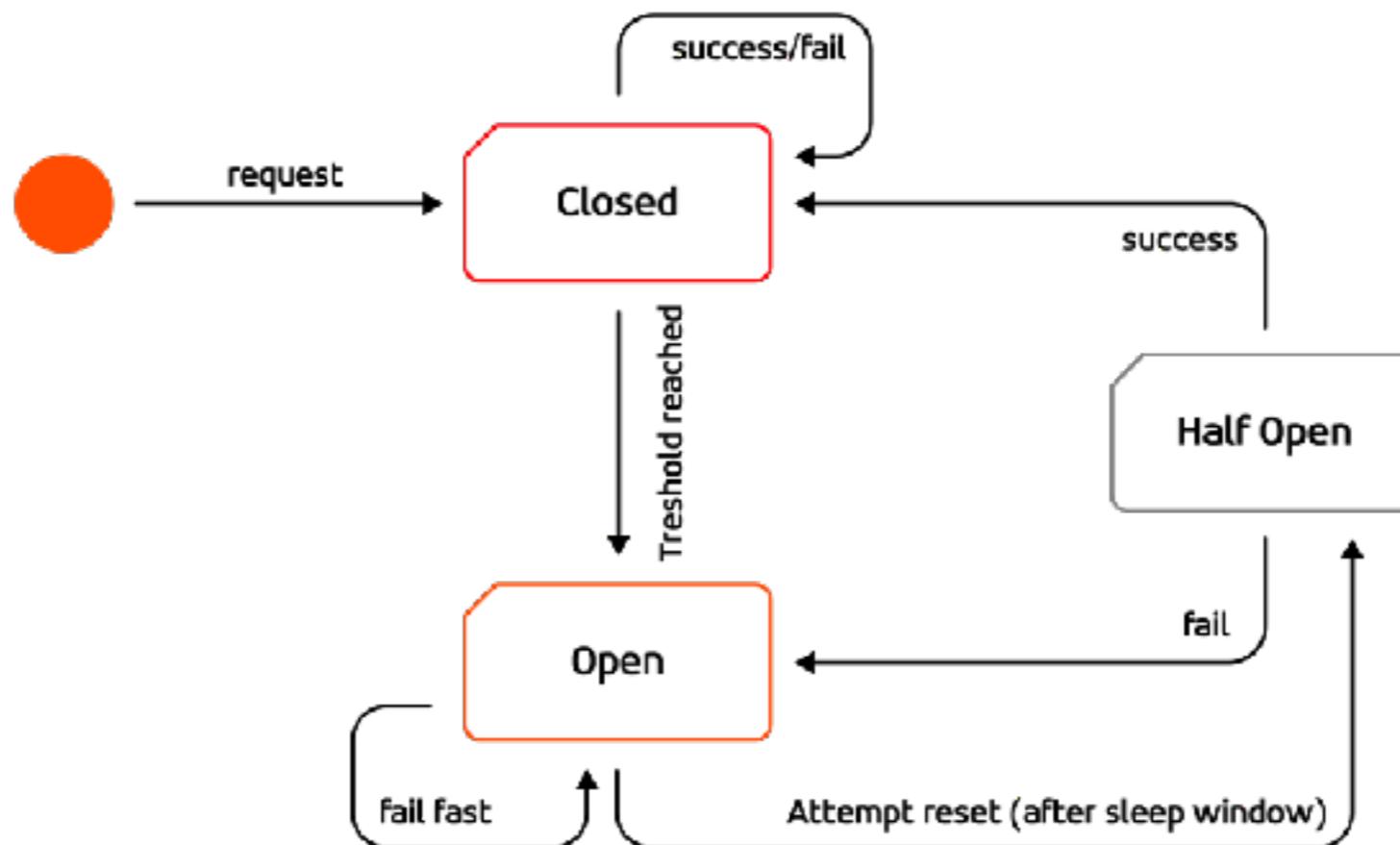
Cascading Failure !!



Circuit Breaker pattern

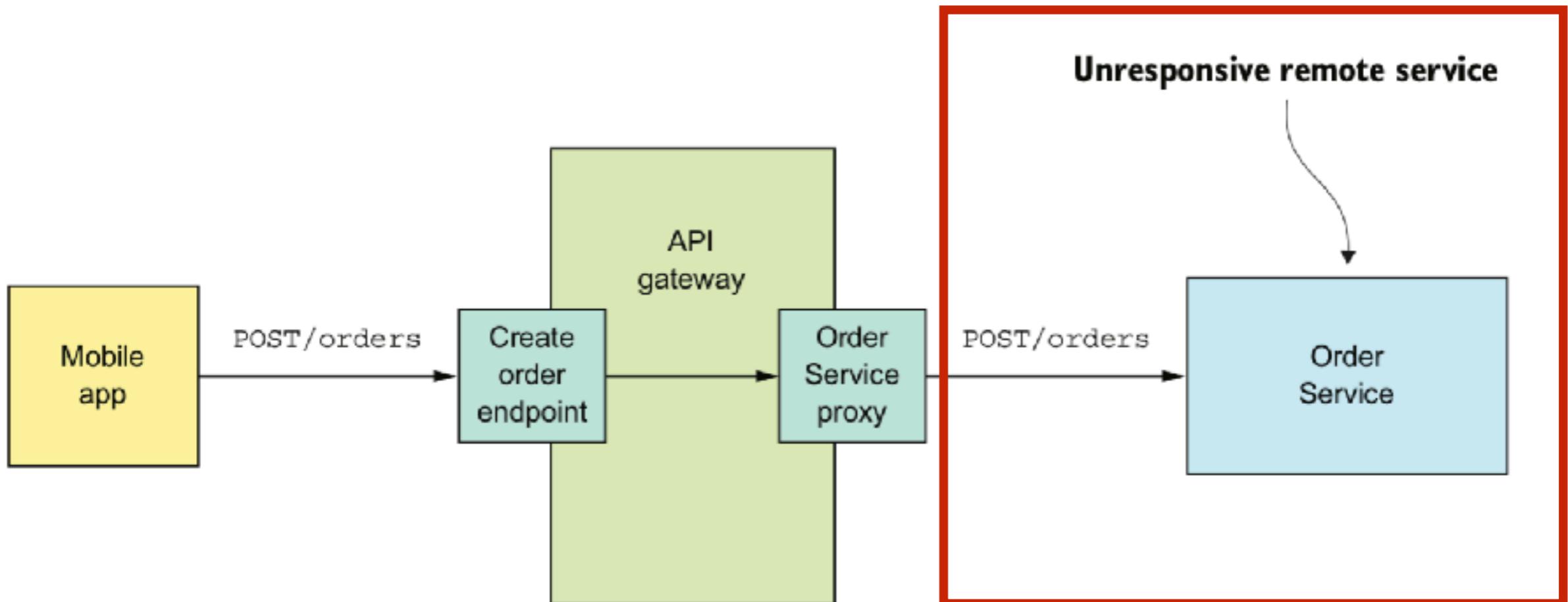
Track the number of success and failure

***If error rate exceed some threshold
then enable circuits breaker***



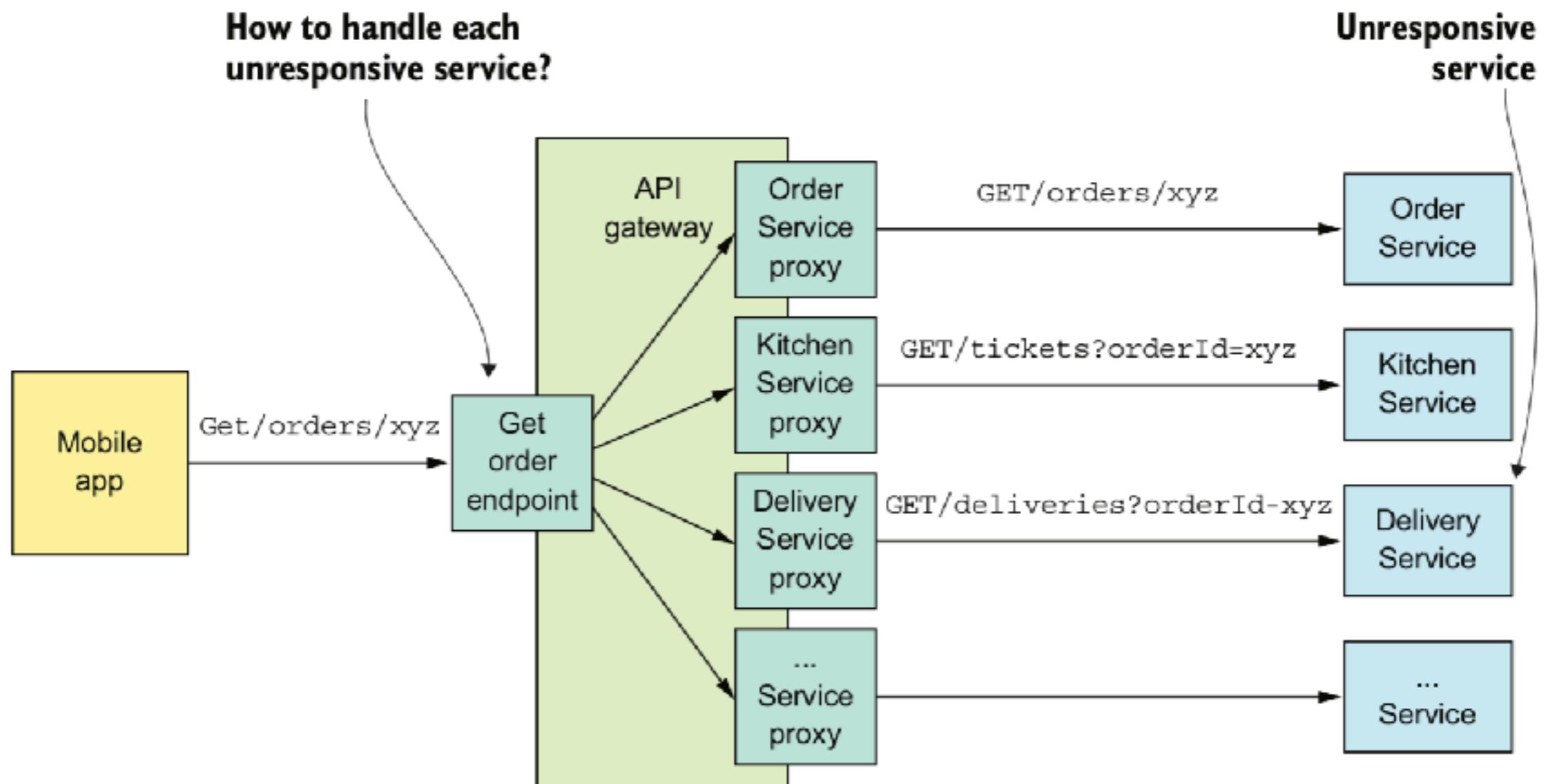
Circuit Breaker pattern

How to handling partial failure ?

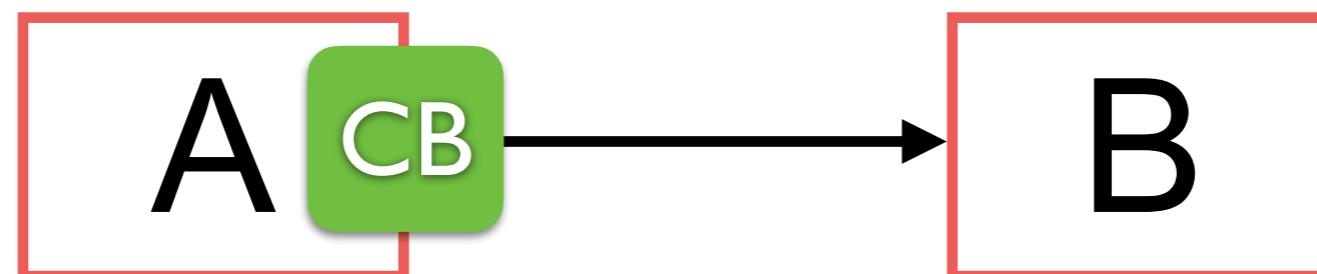
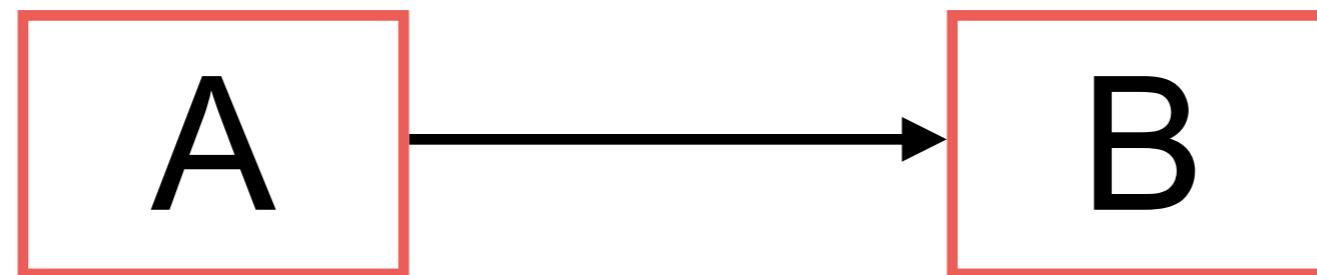


Circuit Breaker pattern

How to handling partial failure ?



Circuit Breaker pattern

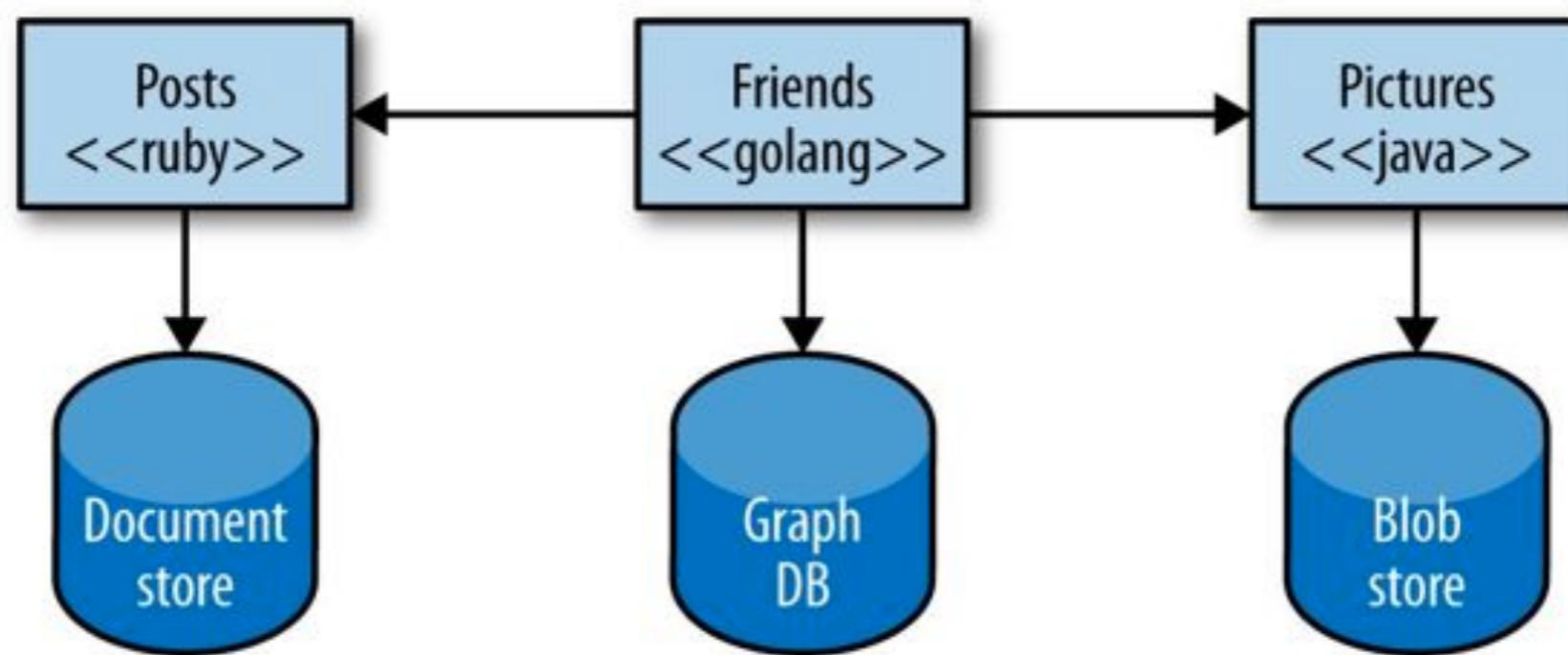


Key Benefits

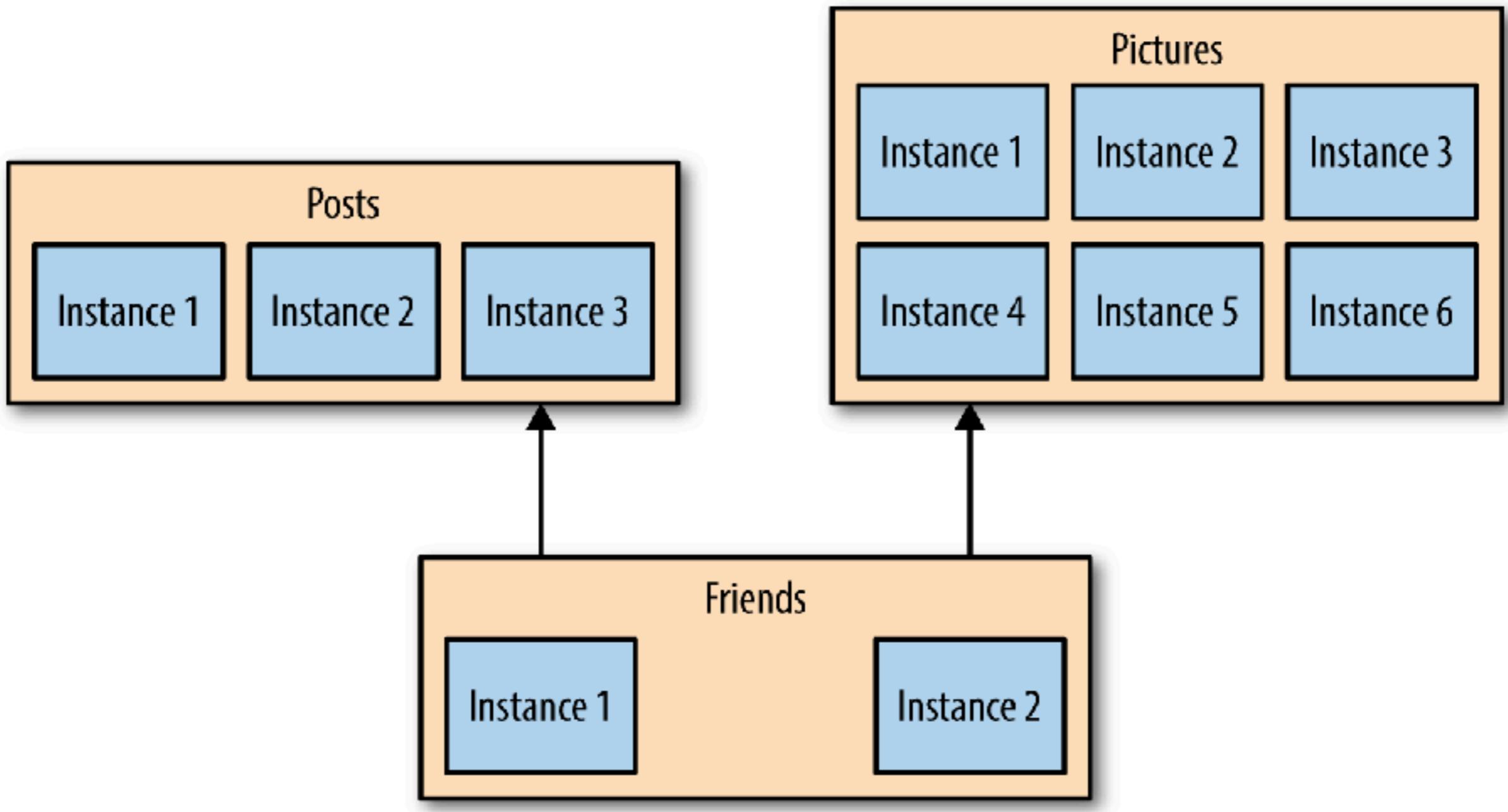


1. Technology heterogeneous

The right tool for each job
Allow easy experimenting and adoption of new technology

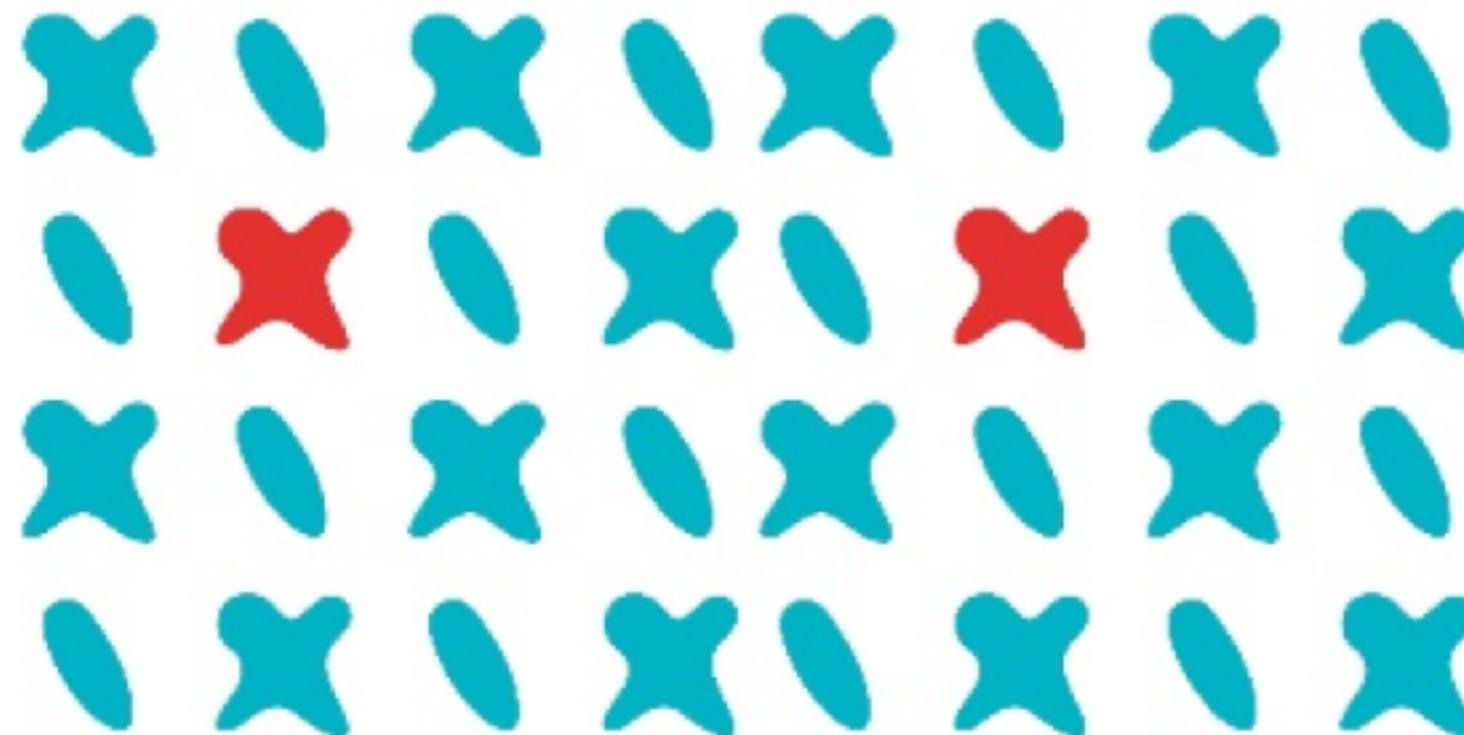


2. Scaling

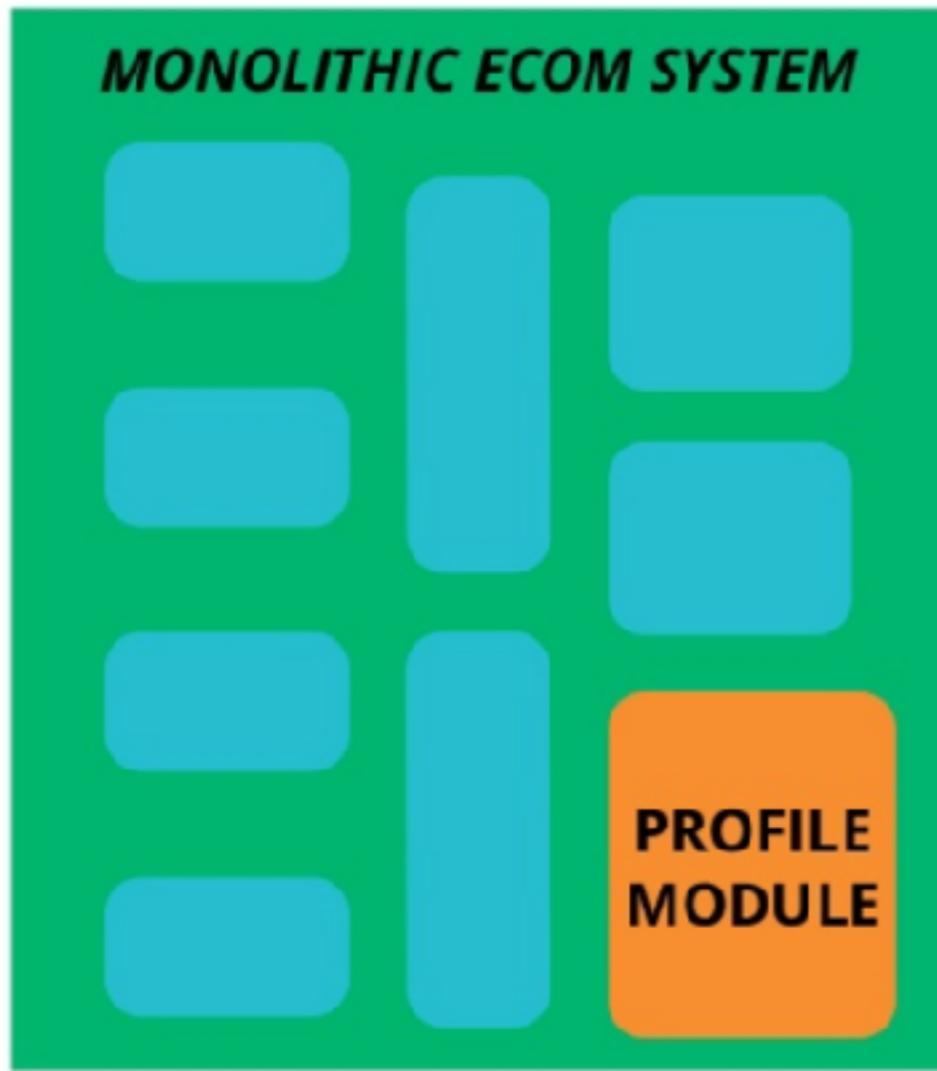


3. Ease of deployment

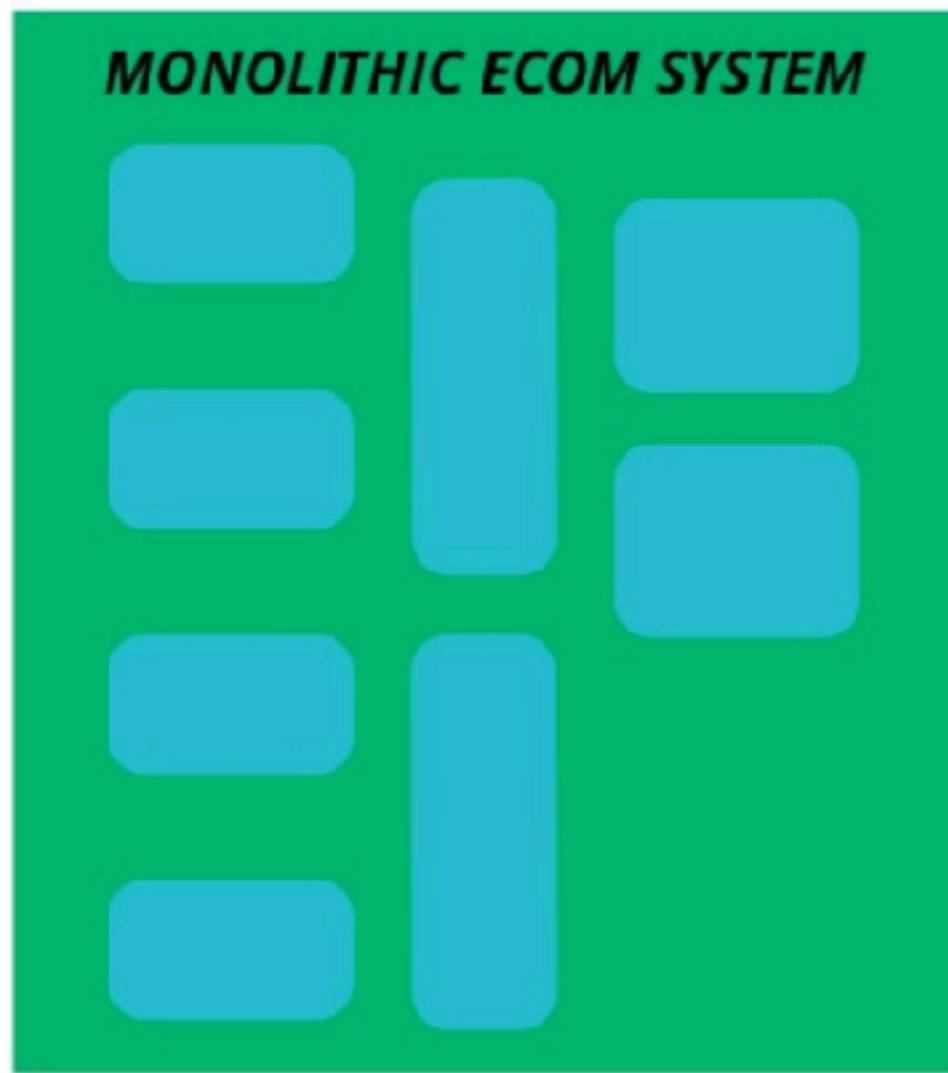
Deploys are faster, independent and problems can be isolated more easily



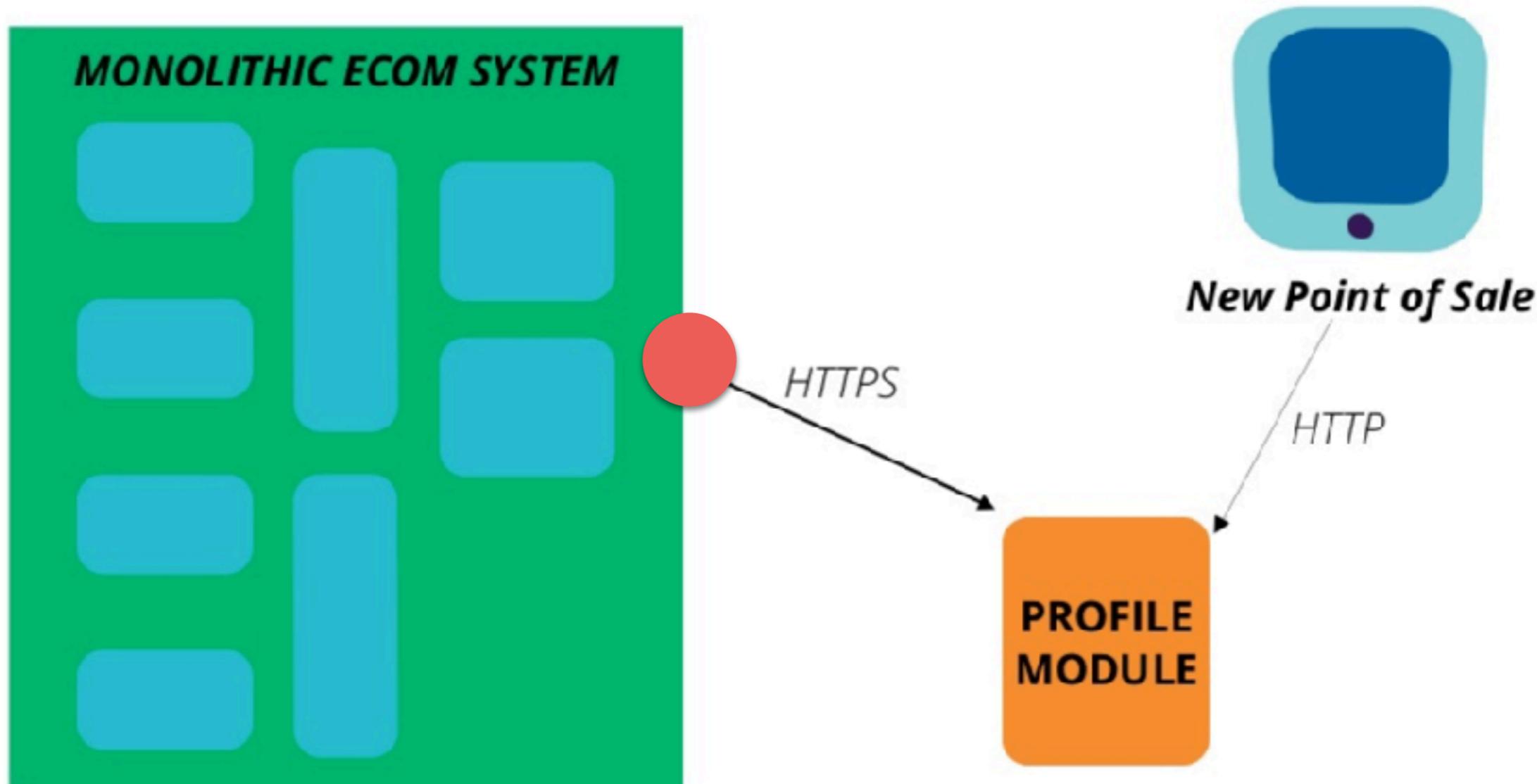
4. Composability and replaceability



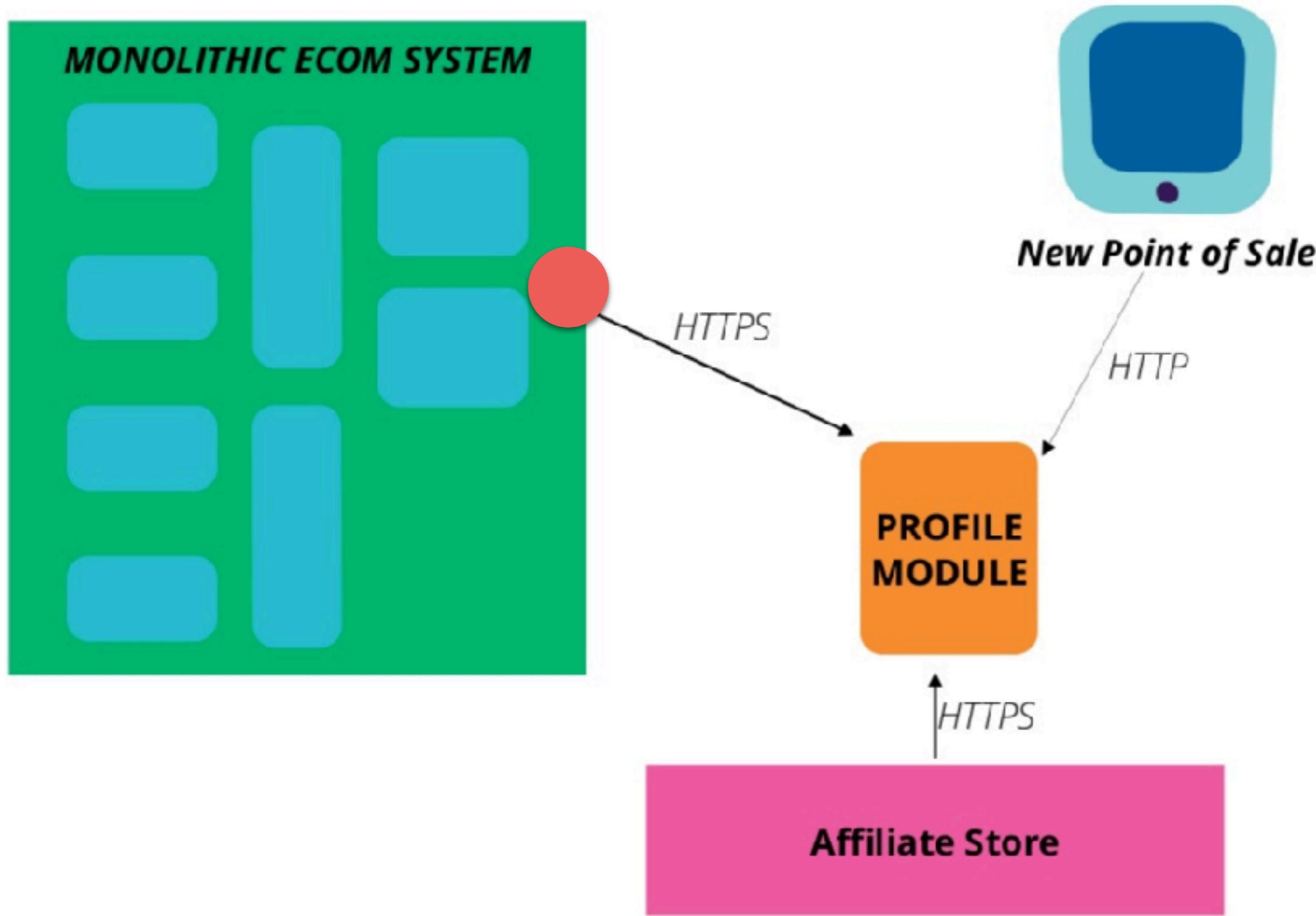
4. Composability and replaceability



4. Composability and replaceability



4. Composability and replaceability

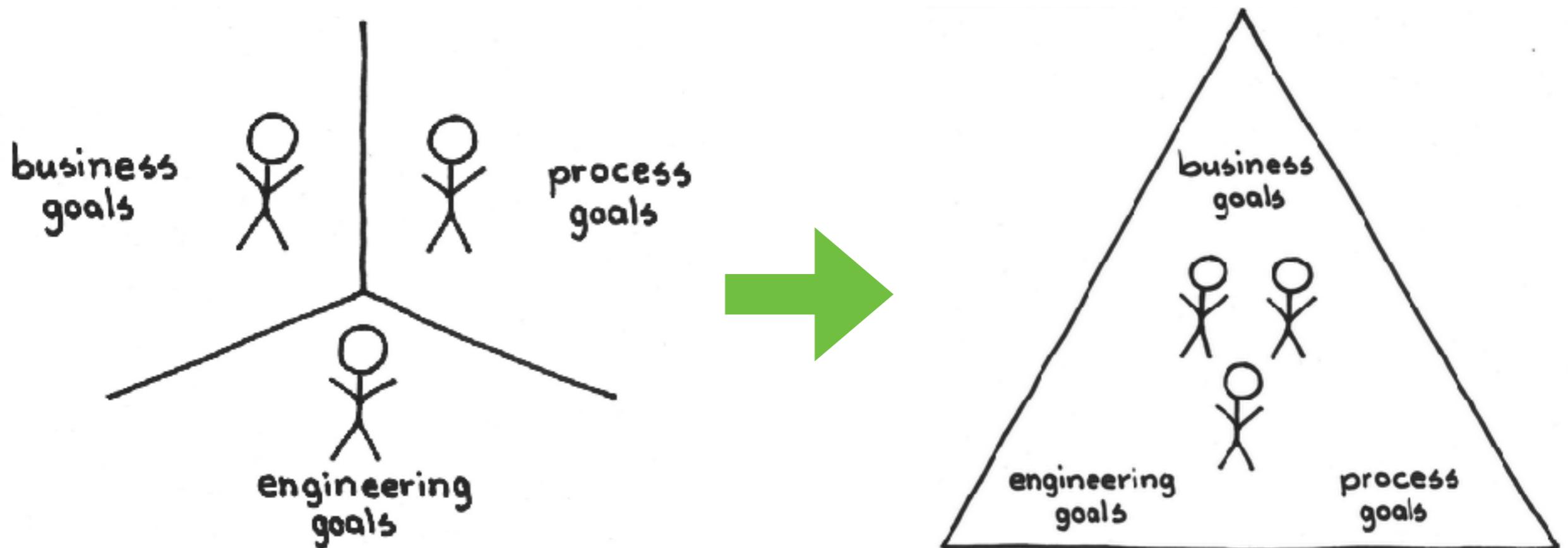


5. Organization alignment

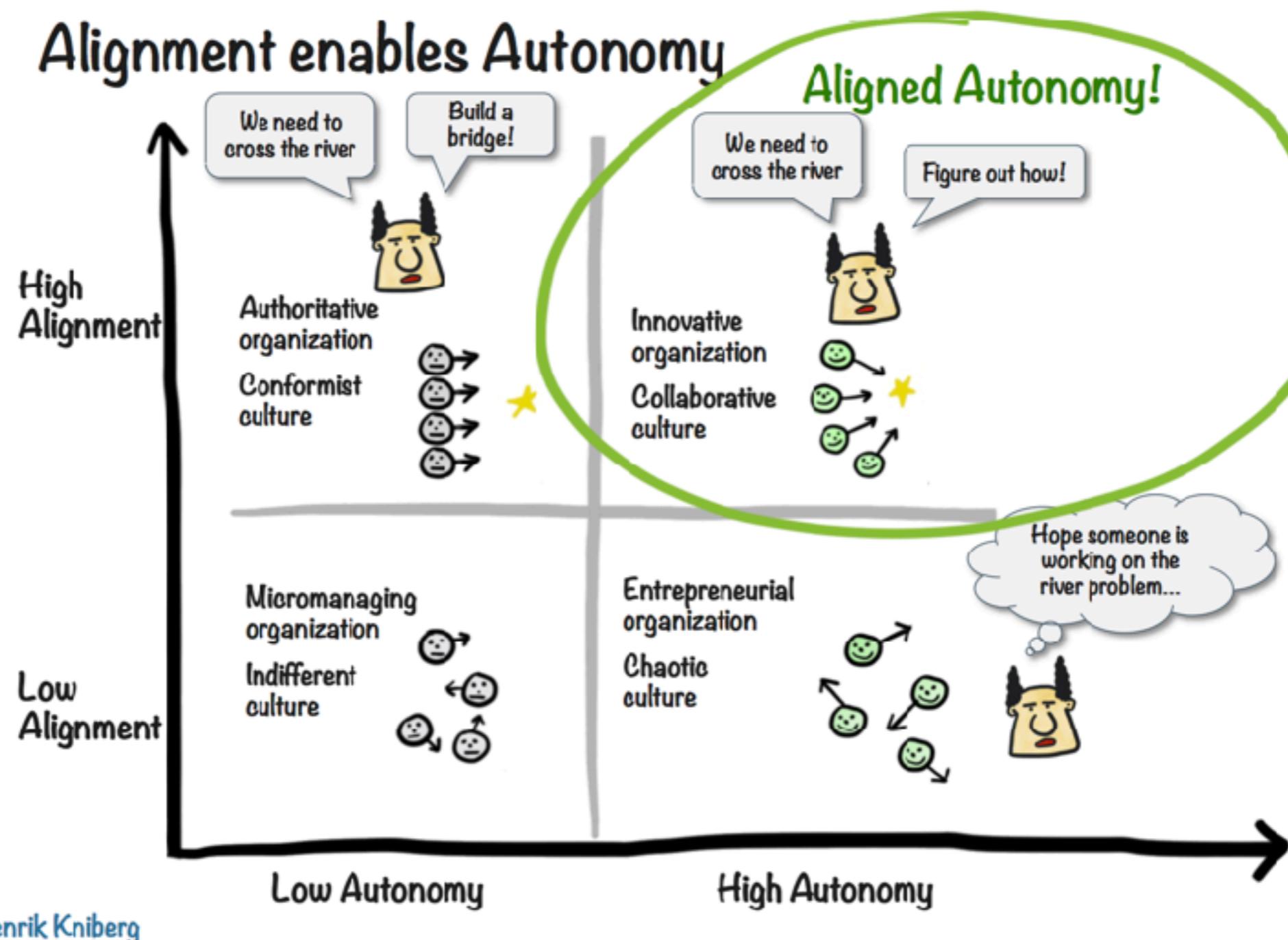
Small teams and smaller codebases



Autonomous team



Autonomous team



Autonomous team



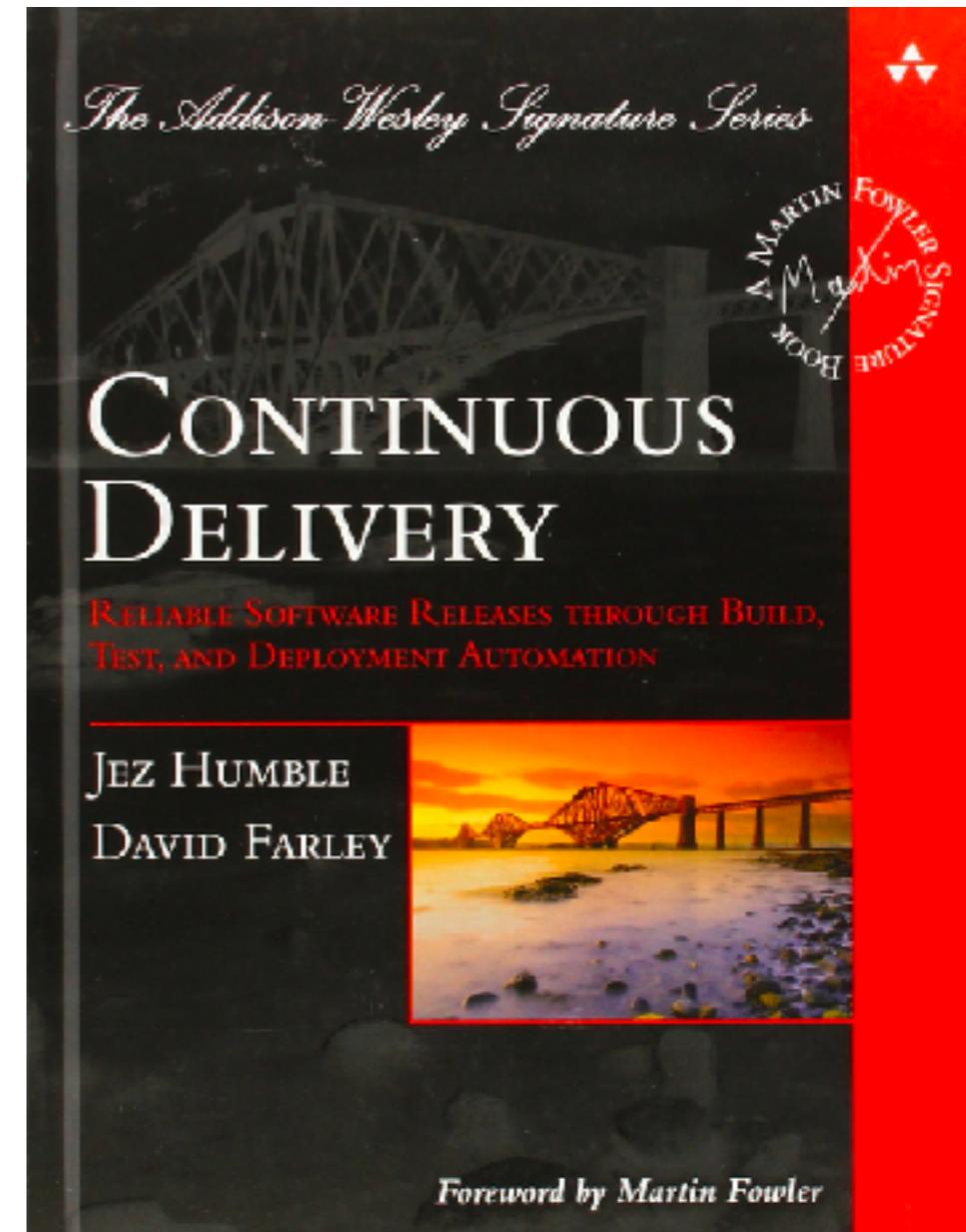
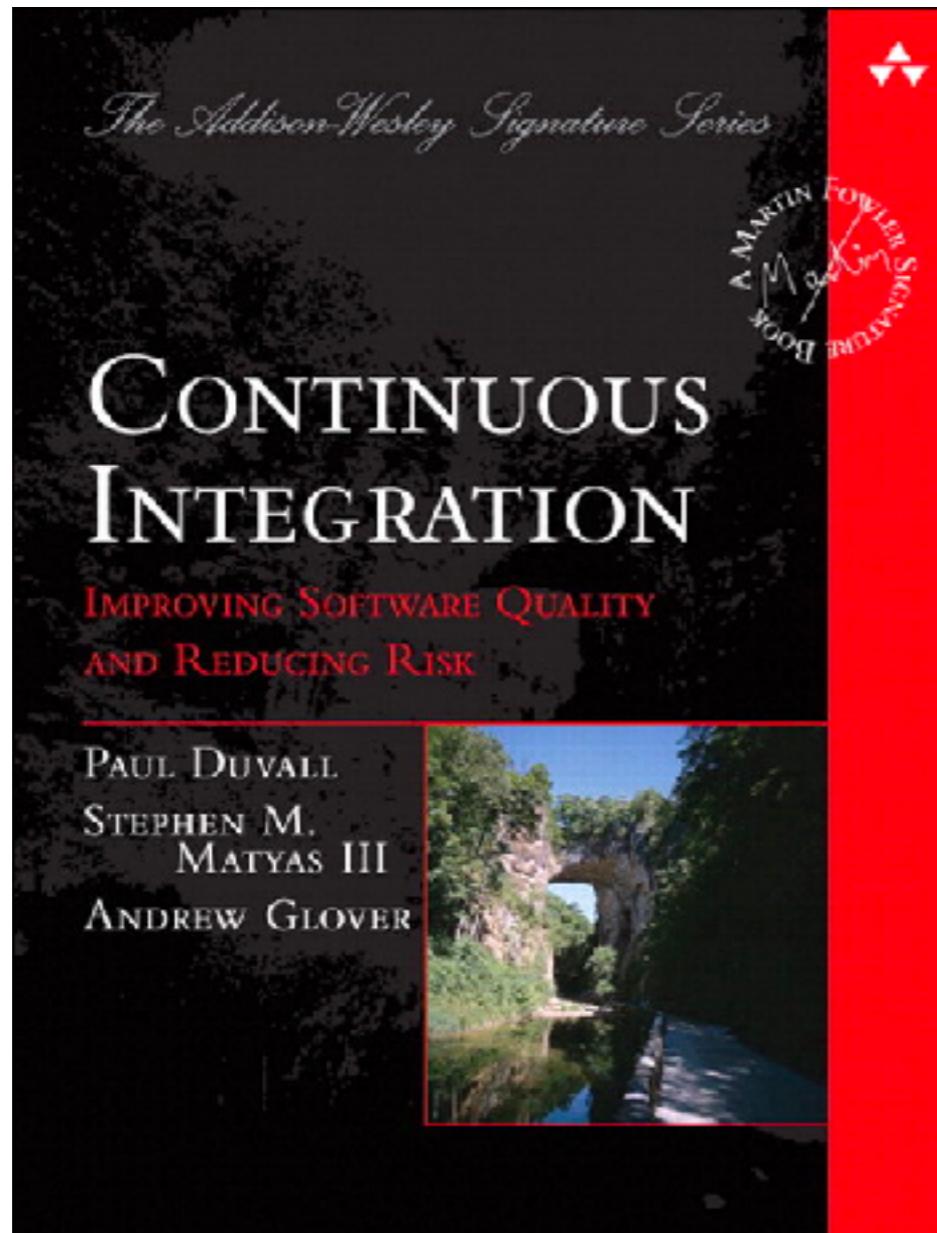
6. Enable Continuous Delivery

A part of DevOps

Set of practices for the **rapid, frequent and reliable delivery** software



Continuous Delivery/Deployment



Continuous Delivery/Deployment

Testability
Deployability

Autonomous team and loose coupling



Benefits of Continuous Delivery

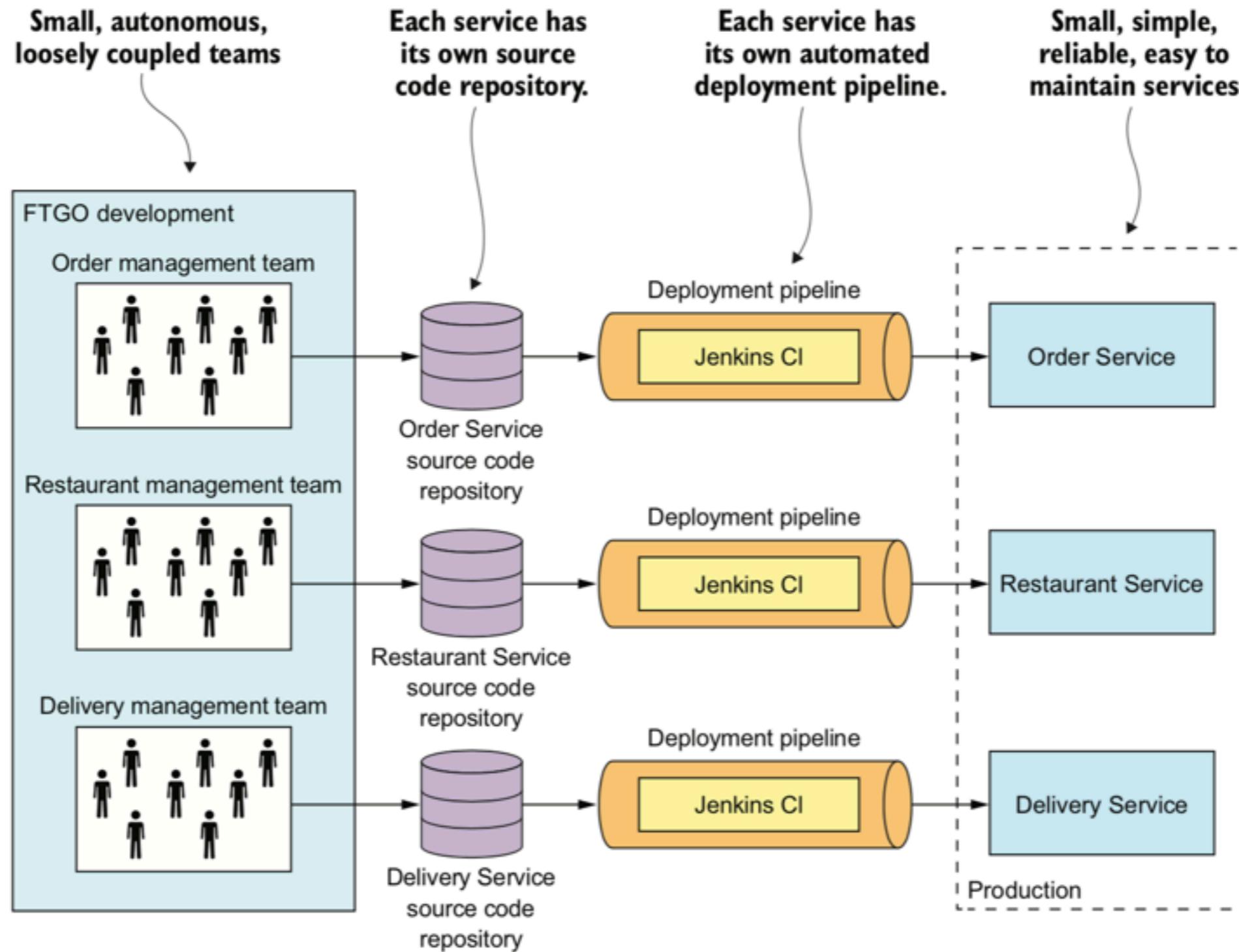
Reduce time to market

Enable **business** to provide reliable service

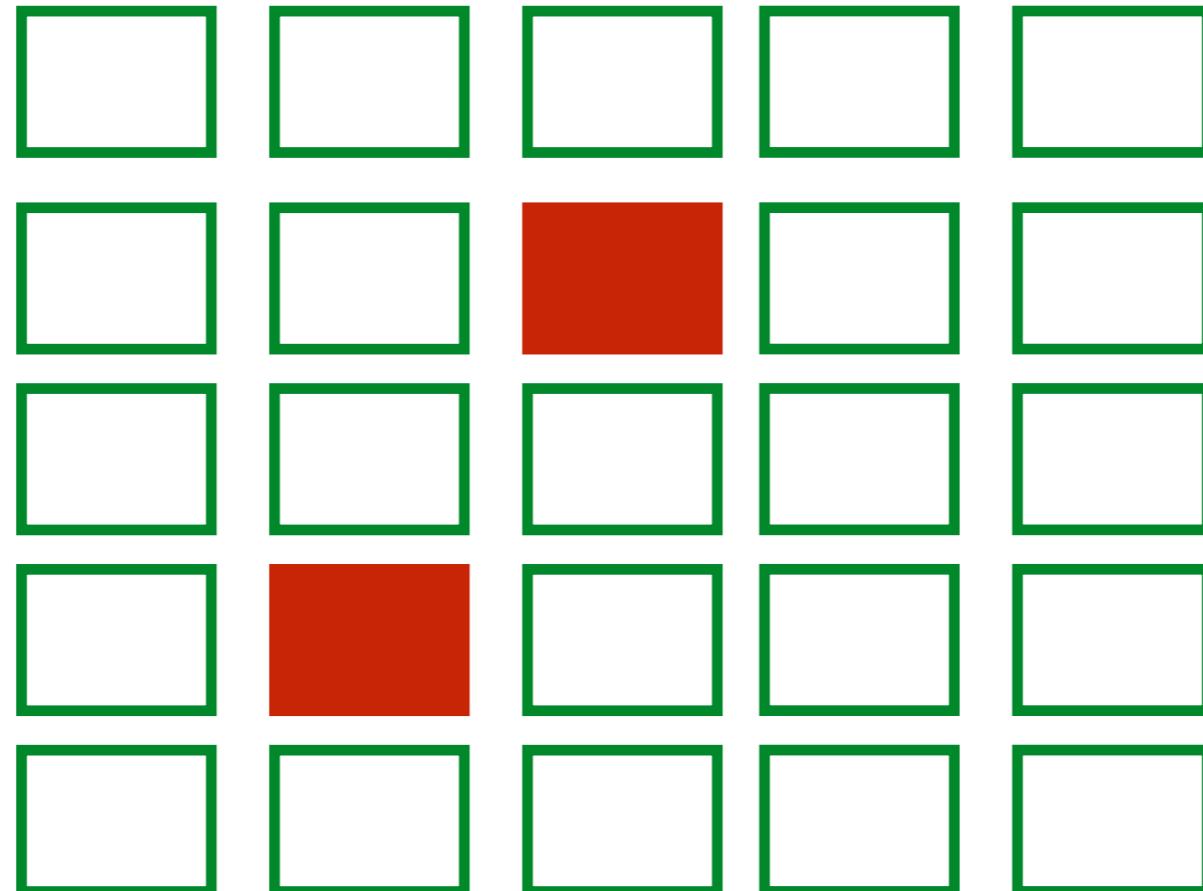
Employee satisfaction is higher



Continuous Delivery for service



7. Better Fault isolation



Drawbacks of Microservice



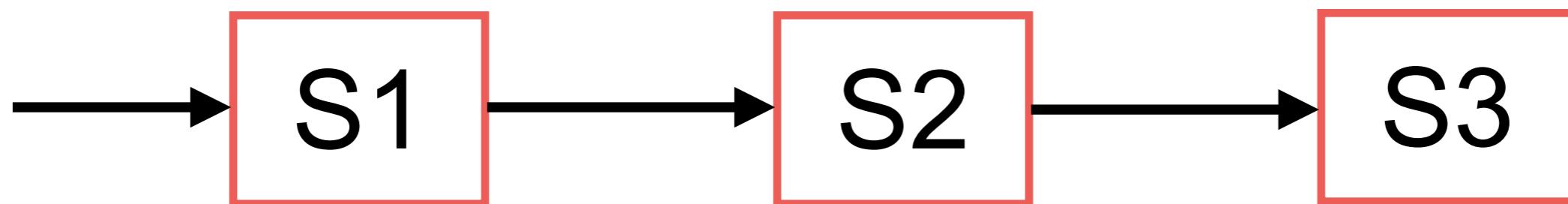
Drawbacks of Microservice

Find the right set of services
Distributed systems are complex
How to develop, testing and deploy ?



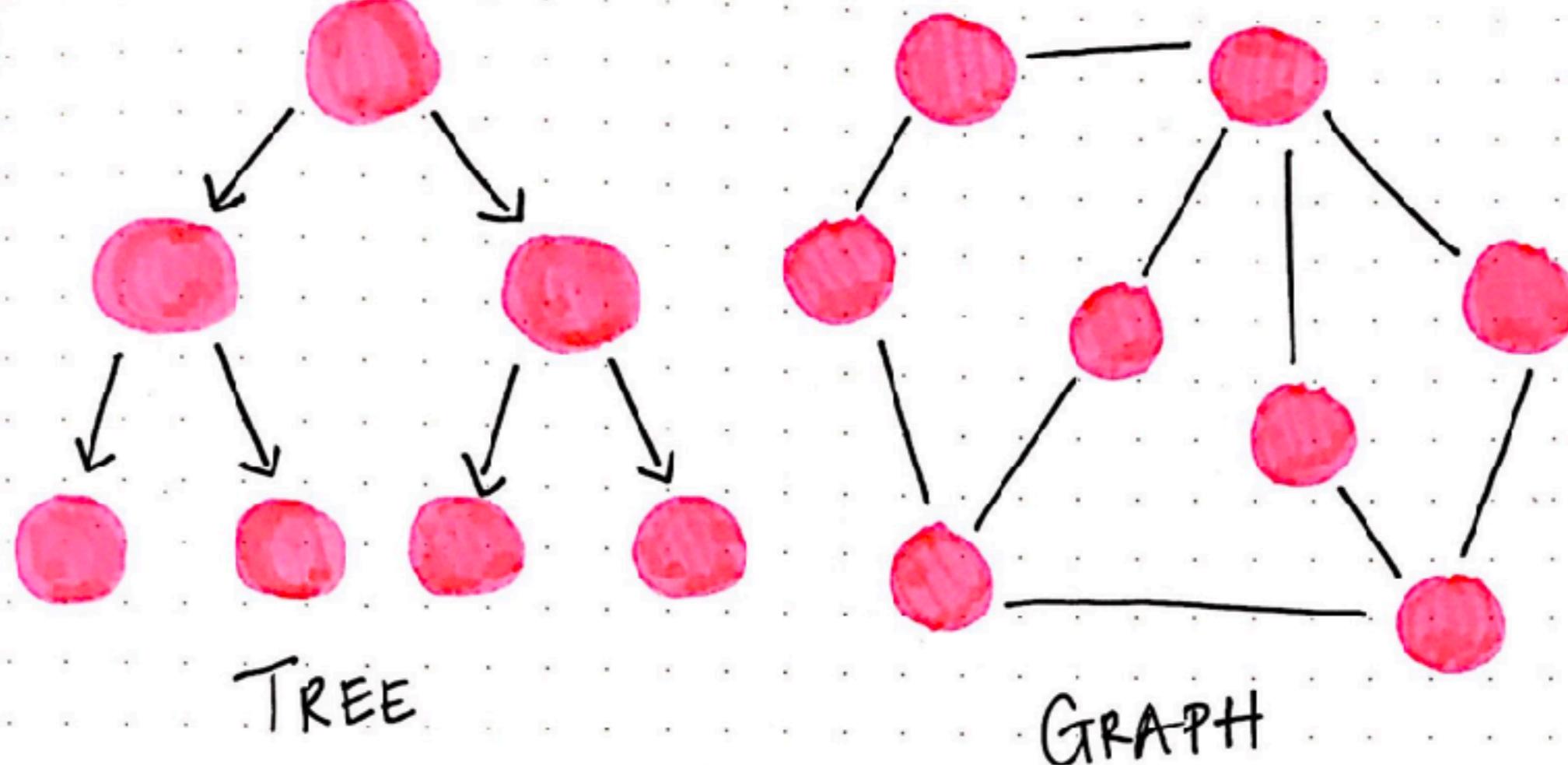
Drawbacks of Microservice

Deploy feature that required multiple service ?



Service Principles

Minimize the depth of the service call-graph



<https://github.com/Yelp/service-principles>



Service Principles

Minimize the number of services owned by your team

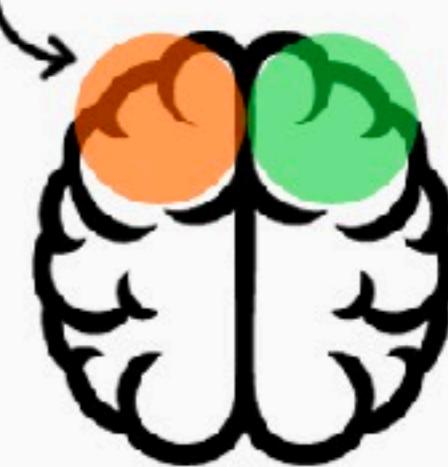


SINGLE TASK



TWO TASKS

THE 3RD TASK IS REPLACING
ONE OF THE 3 TASKS



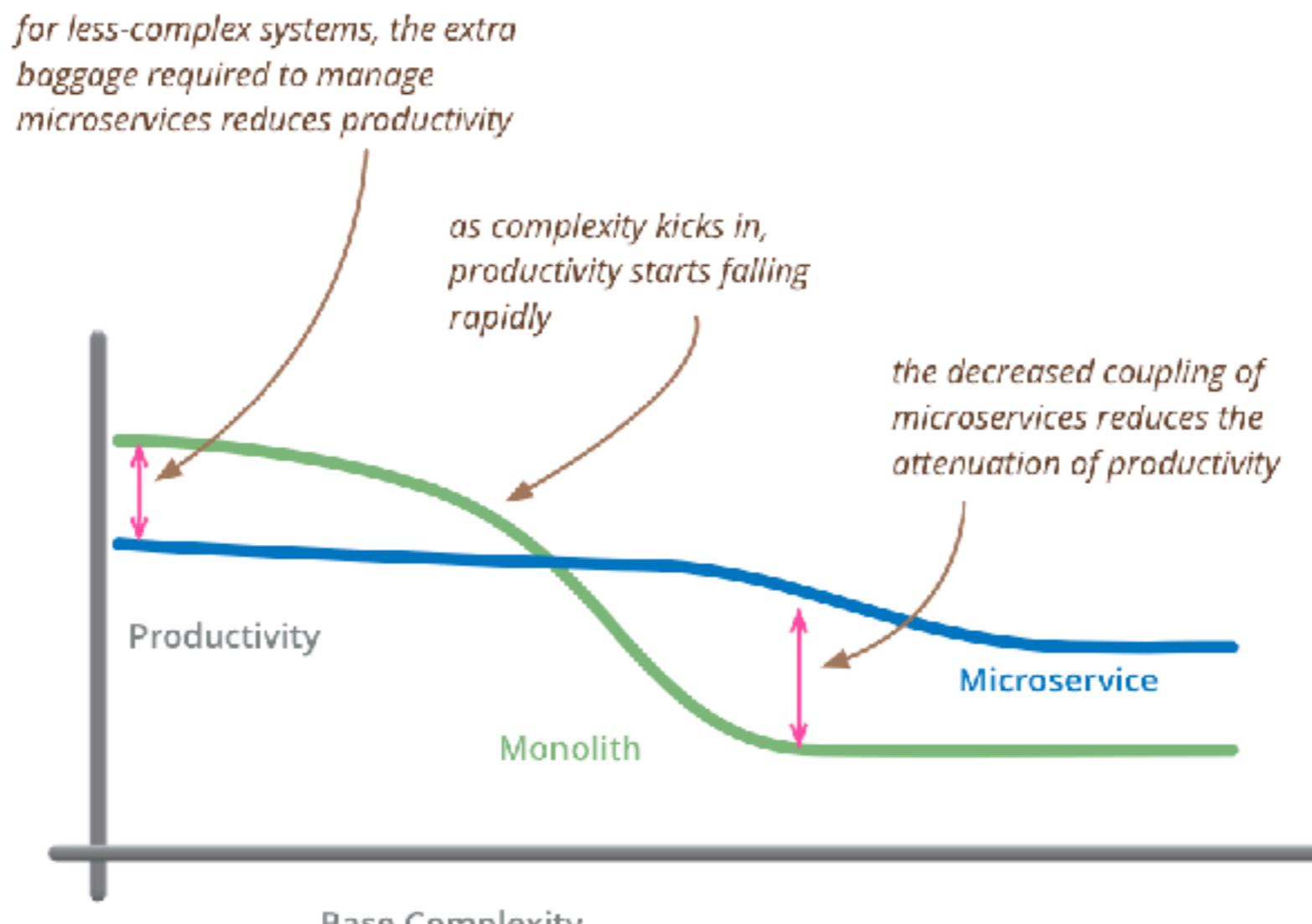
THREE TASKS

<https://github.com/Yelp/service-principles>



Drawbacks of Microservice

Decide to use when adopt is difficult !!



but remember the skill of the team will outweigh any monolith/microservice choice



Microservice architecture patterns

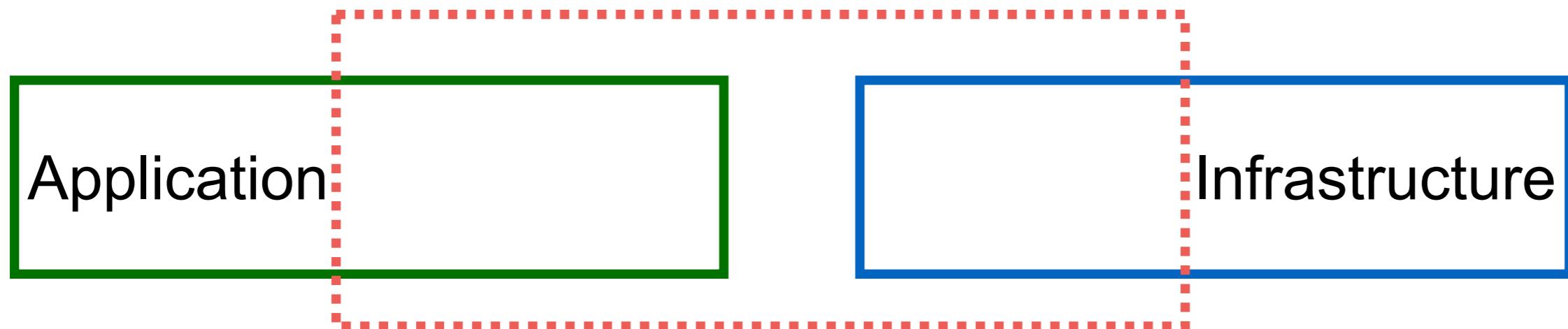


3 Layers of service patterns

Application patterns

Application infrastructure pattern

Infrastructure pattern



<https://microservices.io/>



Decompose application into services



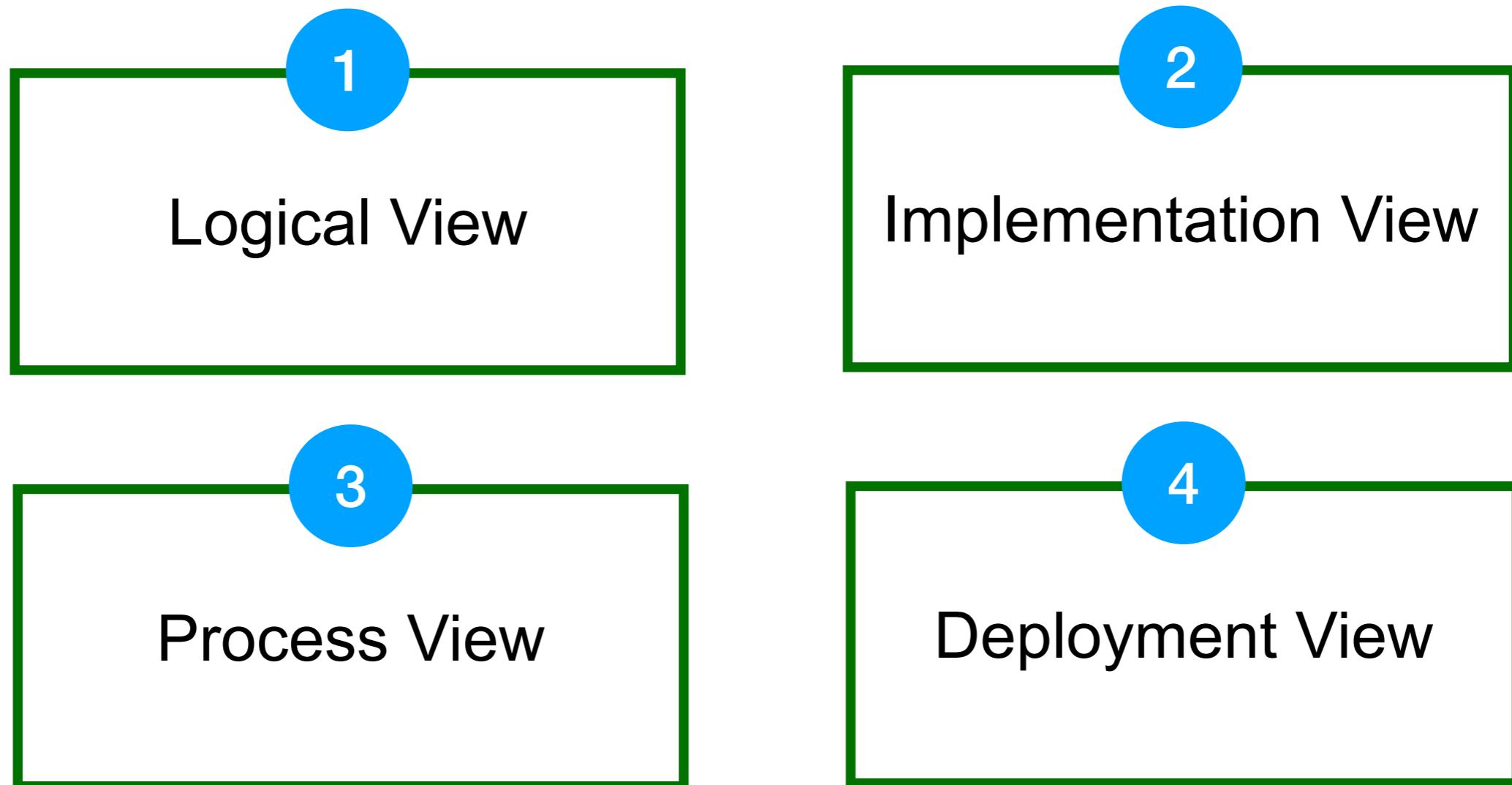
Premature splitting is the root of
all evil.



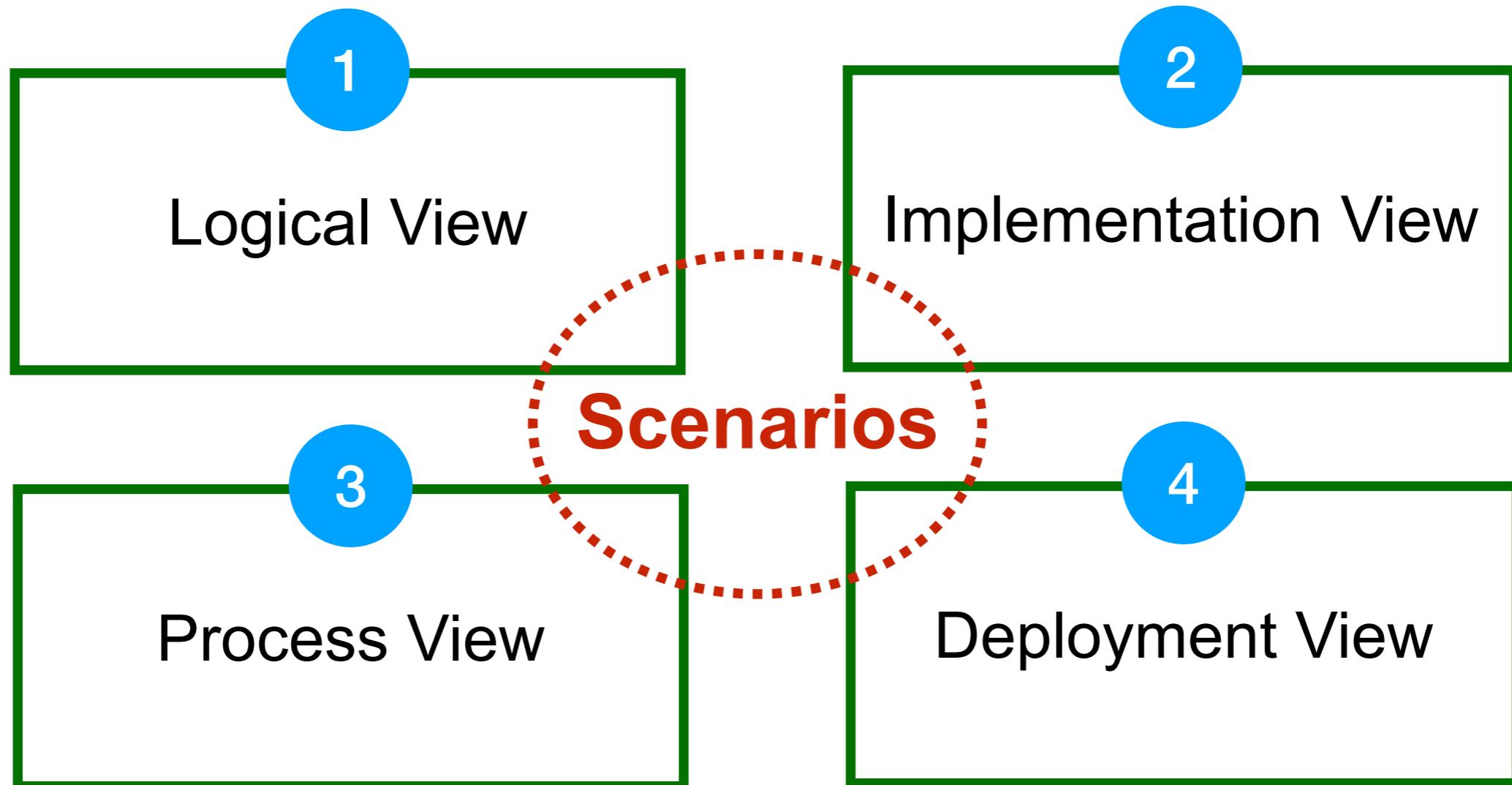
Every time you make the decision
to split out a new microservice,
there's a **risk** of ending up with a
bloated app.



4 View model of Software Architecture



4 View model of Software Architecture



Decompose application into services

By business capability ?
By subdomain/technical ?



Step to define services

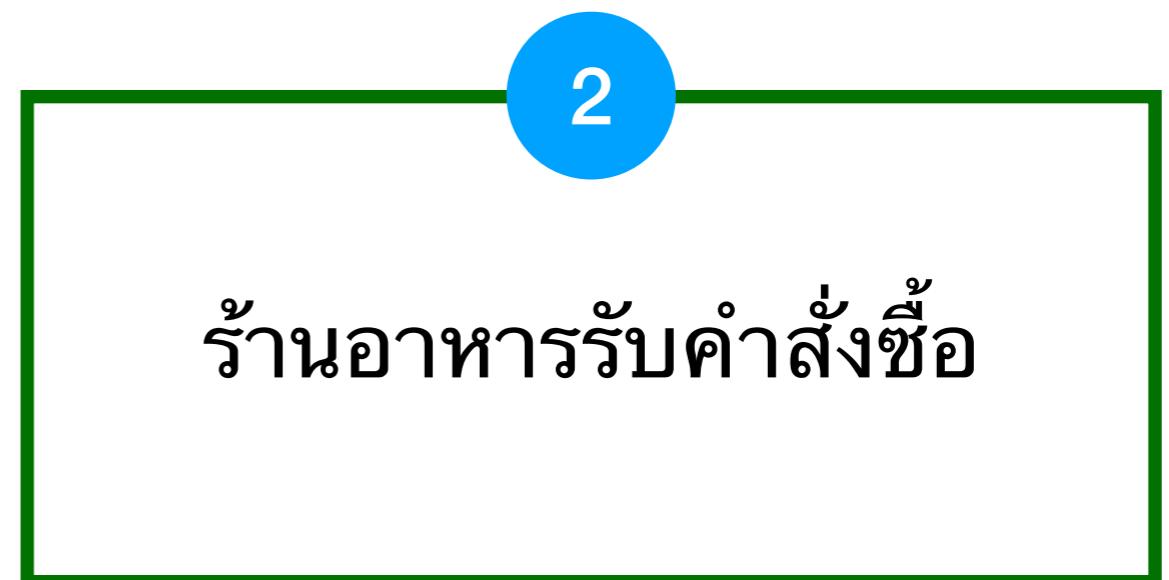
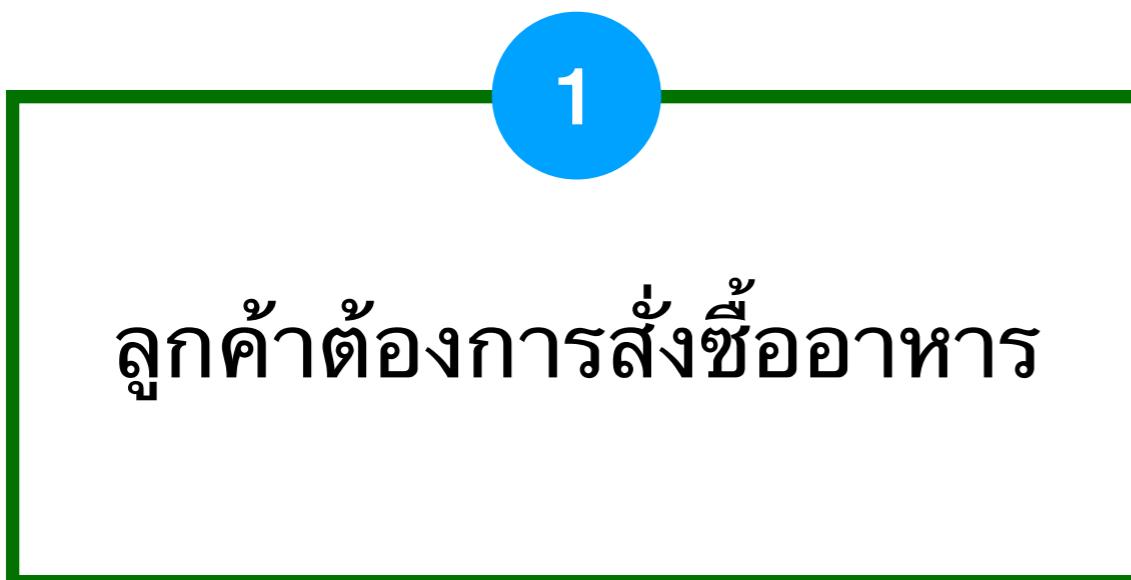
1. Identify system operations
2. Identify services
3. Define service APIs and collaboration



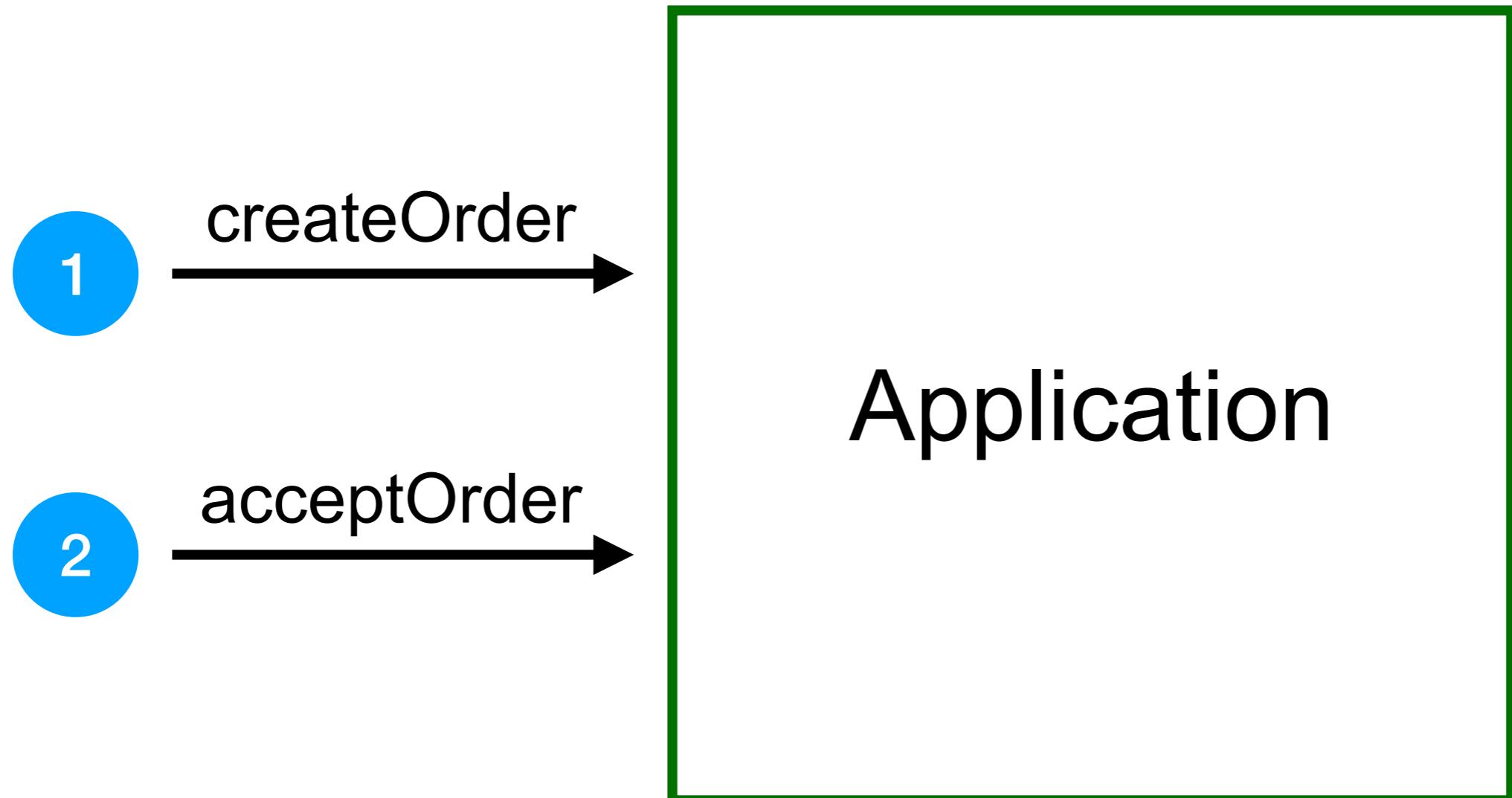
1. Identify system operations

Start with functional requirements

User story



1. Identify system operations



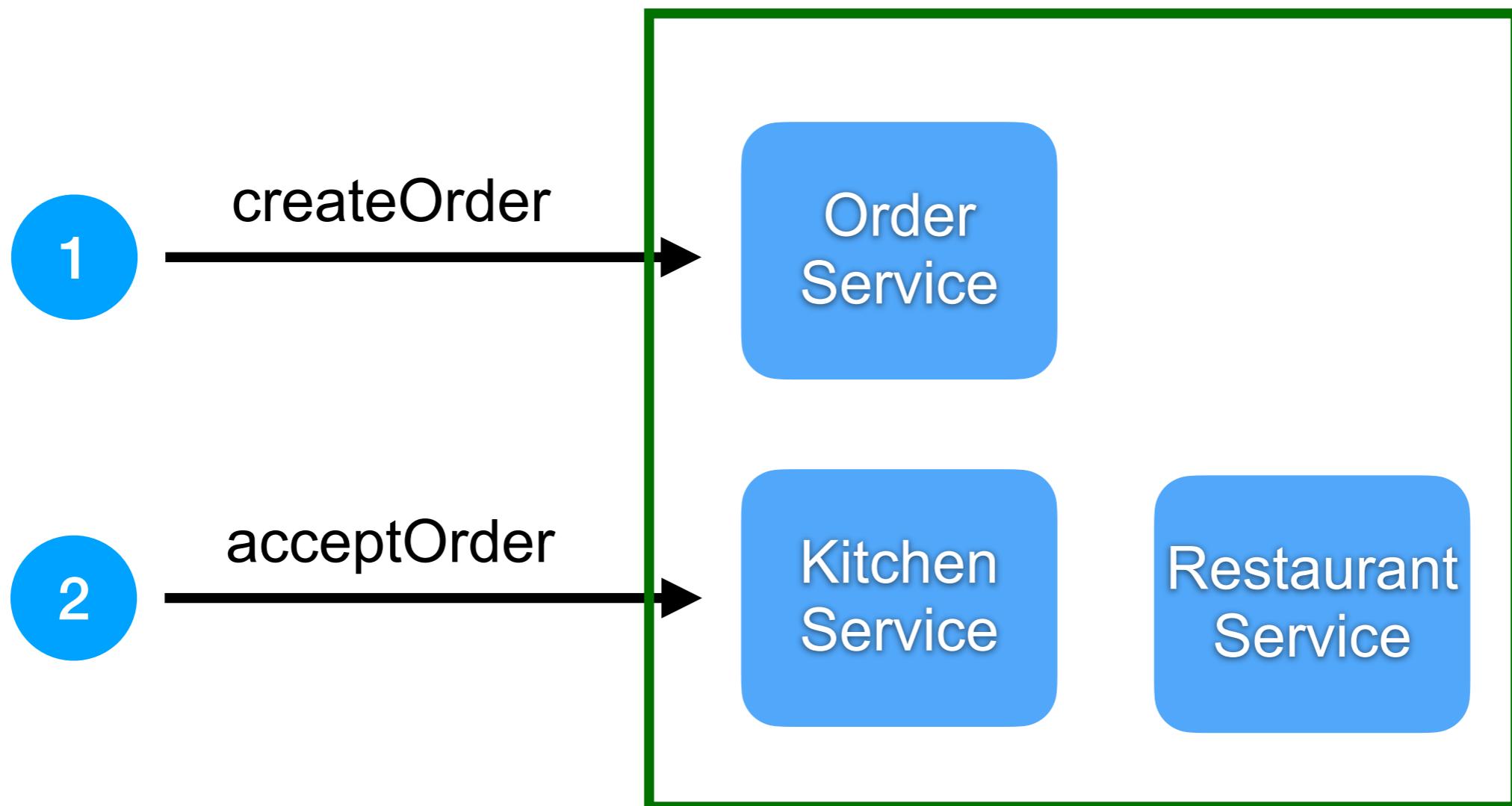
2. Identify services

Try to decomposition into services

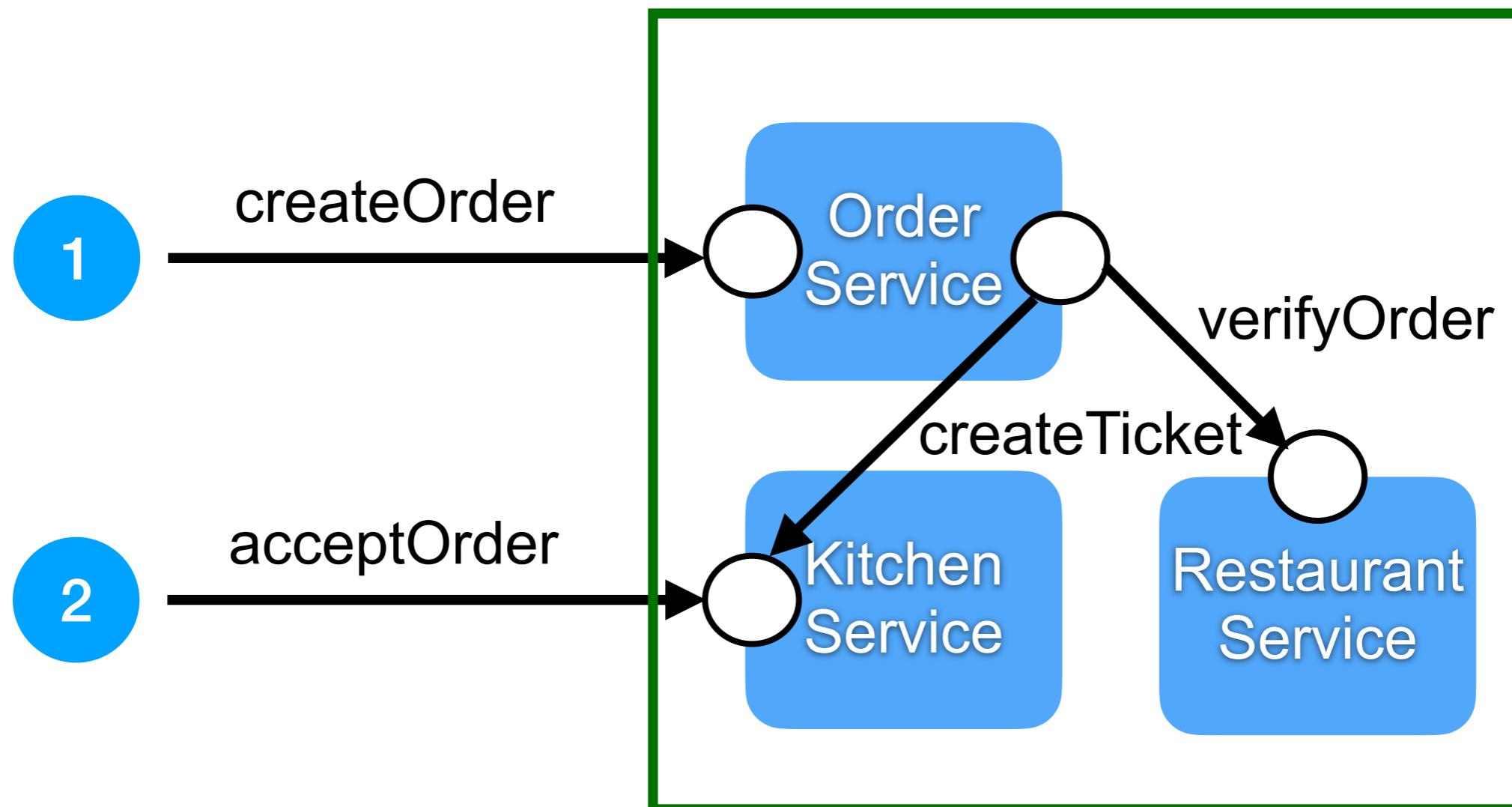
Business > Technical concept
What > How



2. Identify services



3. Define service APIs and collaborations



Problems when decompose services ?

Network latency

Reliability of communication (sync)

Maintain data consistency

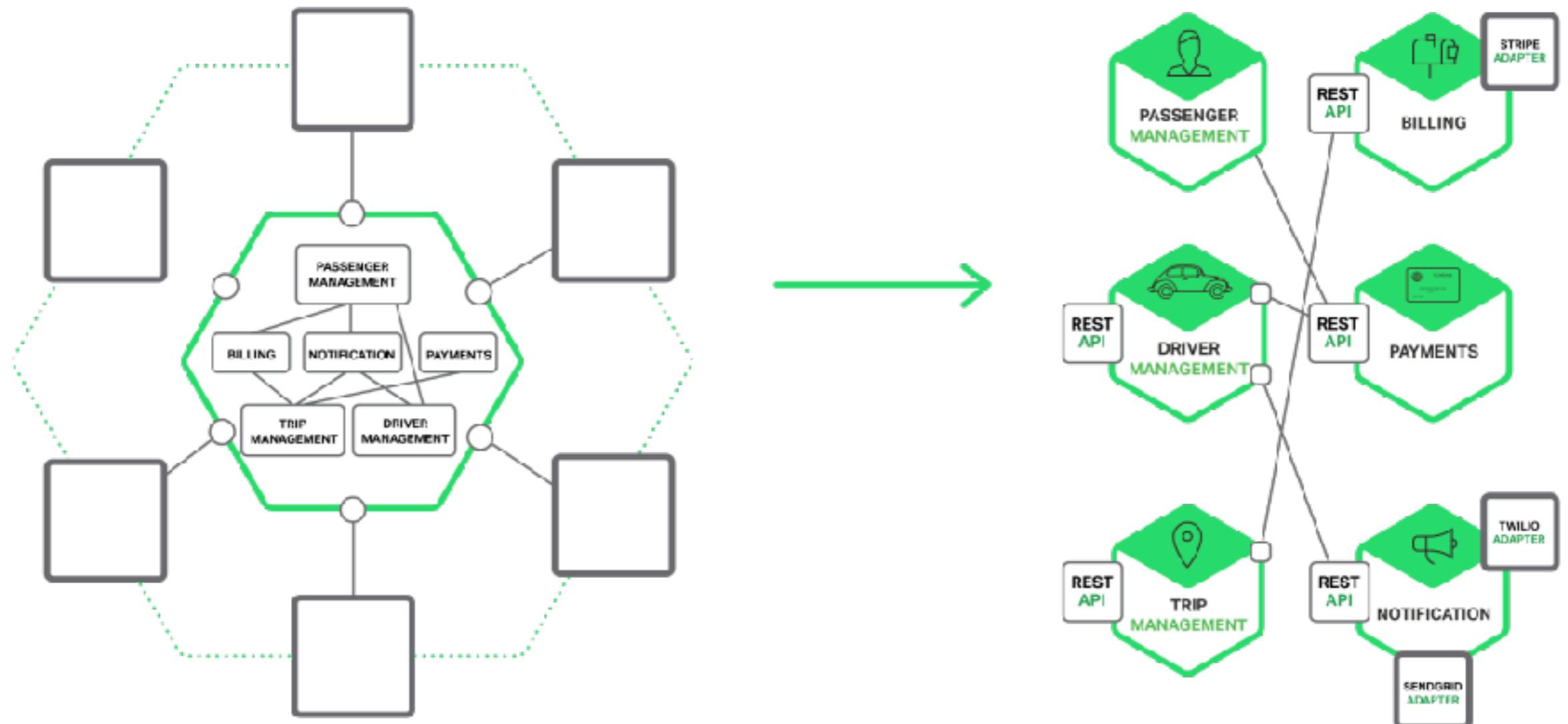
God classes



Communication between services



Inter Process Communication (IPC)



<https://www.nginx.com>



Interaction Styles

	One-to-one	One-to-many
Synchronous	Request/response	-
Asynchronous	Async request/response	Publish/subscribe
	Notification	Publish/async response



Synchronous communication



Synchronous Communication

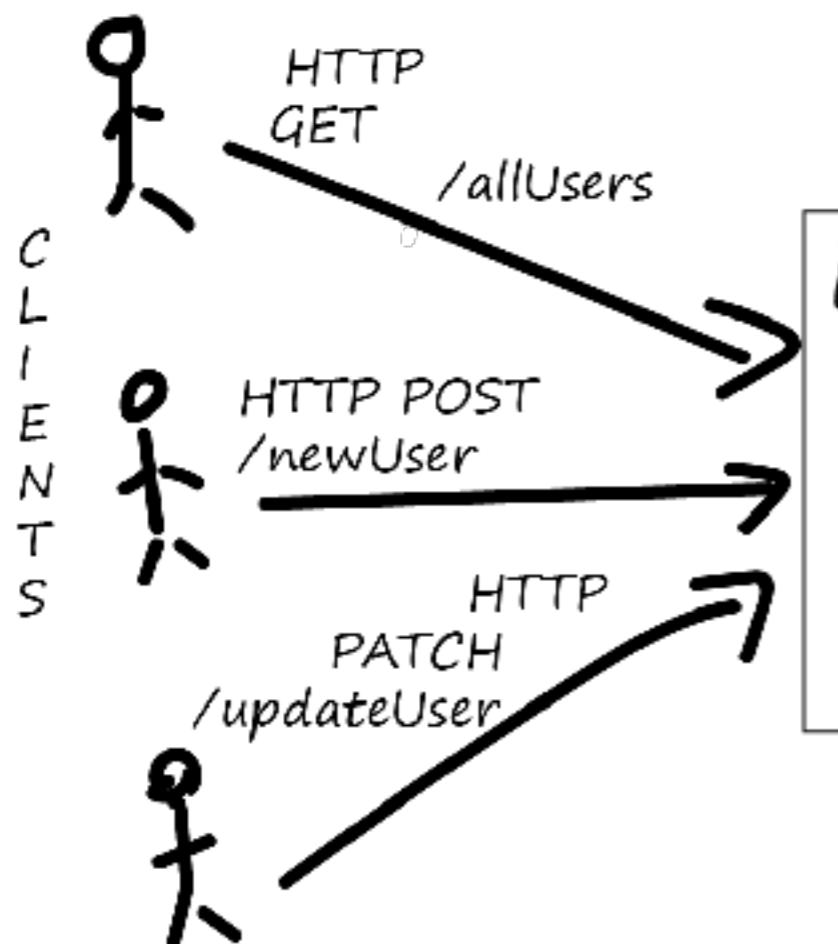
REST
gRPC

Handling failure with Circuit breaker
Service discovery



REpresentational State Transfer

Rest API Basics

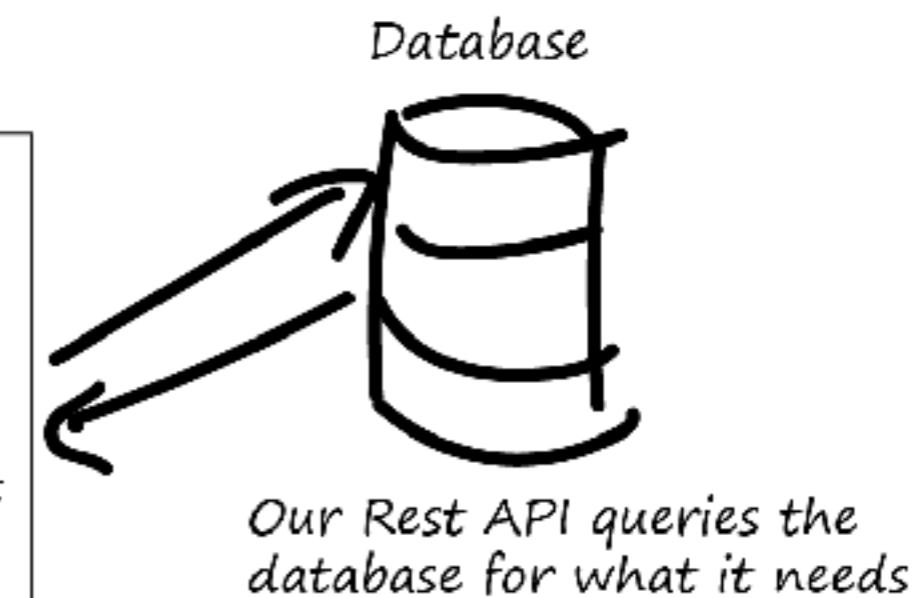


Our Clients, send HTTP Requests and wait for responses

Rest API

Receives HTTP requests from Clients and does whatever request needs. i.e create users

Typical HTTP Verbs:
GET → Read from Database
PUT → Update/Replace row in Database
PATCH → Update/Modify row in Database
POST → Create a new record in the database
DELETE → Delete from the database



Response: When the Rest API has what it needs, it sends back a response to the clients. This would typically be in JSON or XML format.



REST :: mapping with HTTP verbs

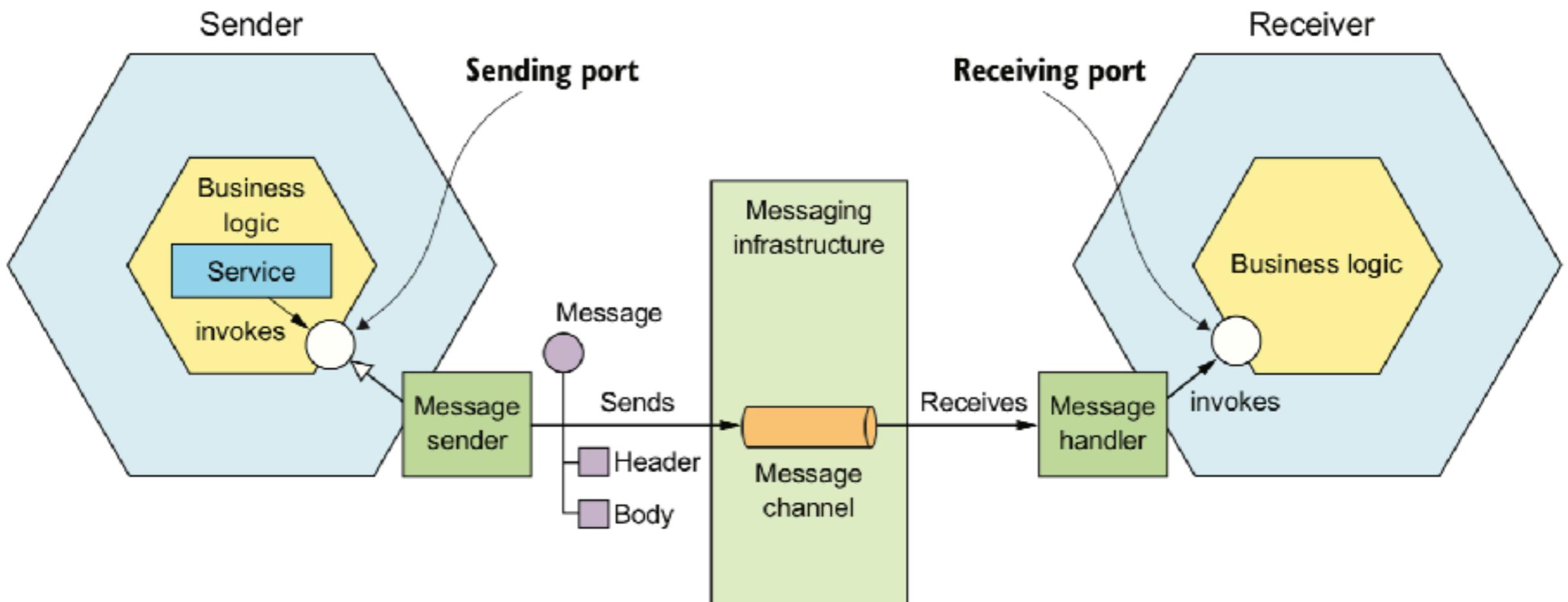
Activity	HTTP Method
Retrieve data	GET
Create new data	POST
Update data	PUT
Delete data	DELETE



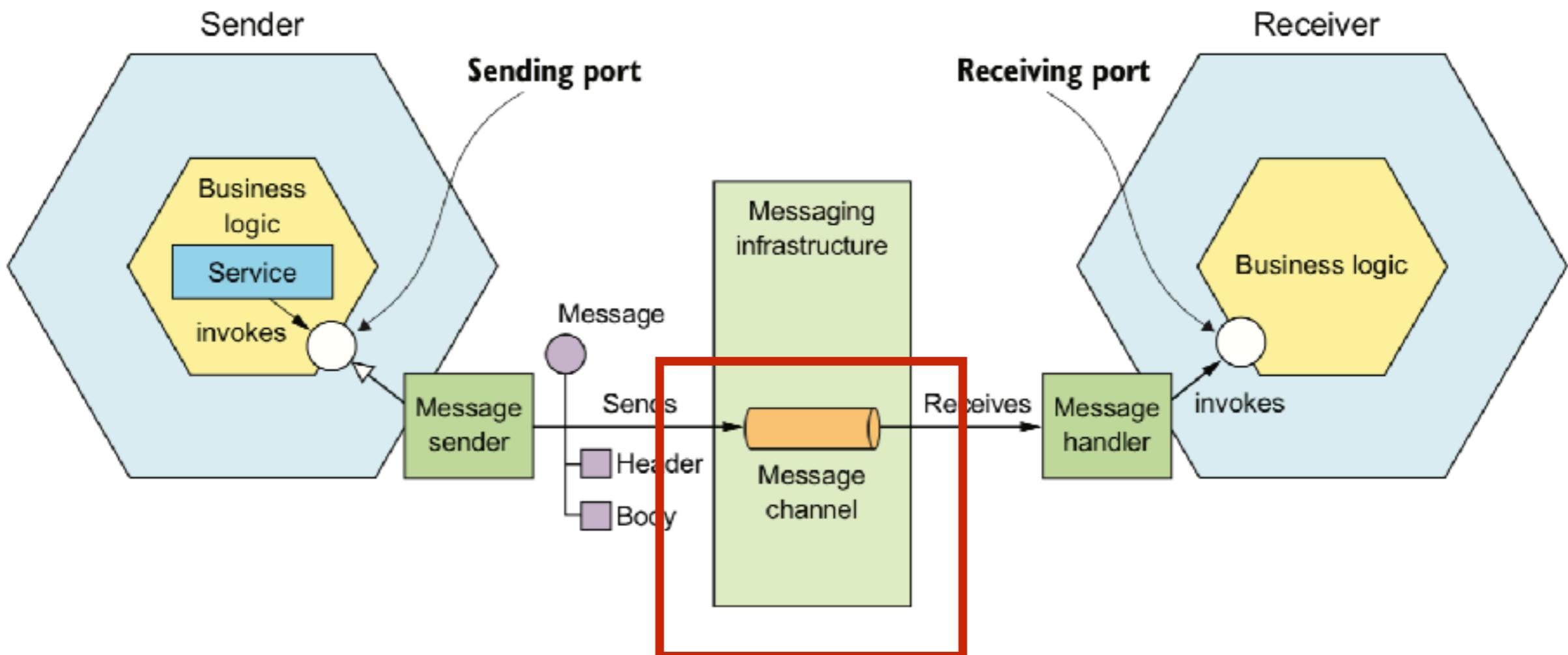
Asynchronous communication



Asynchronous Communication

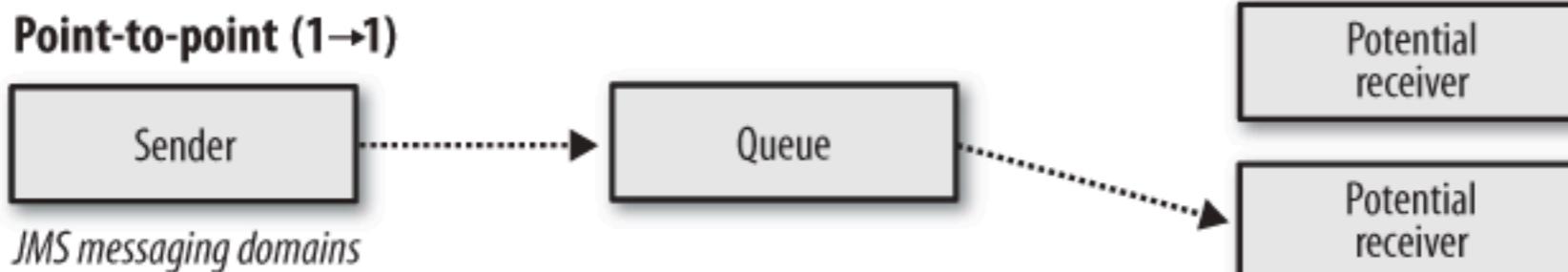
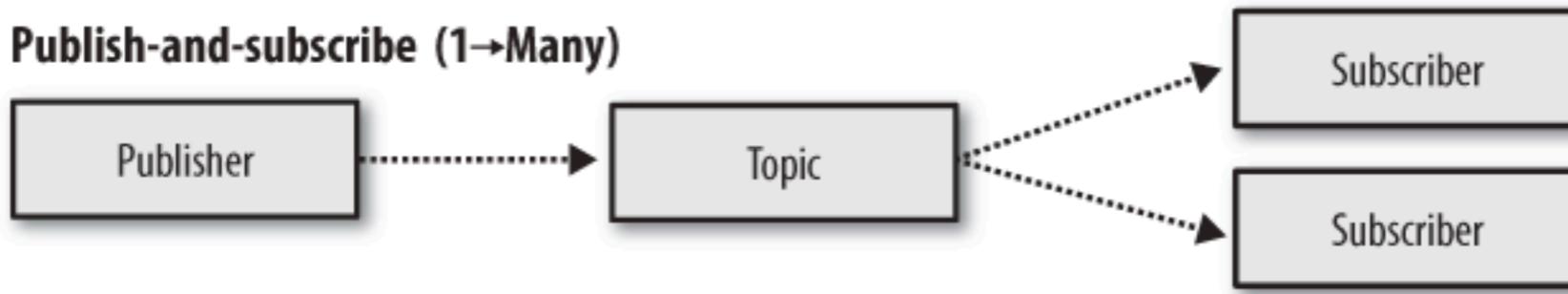


Asynchronous messaging pattern



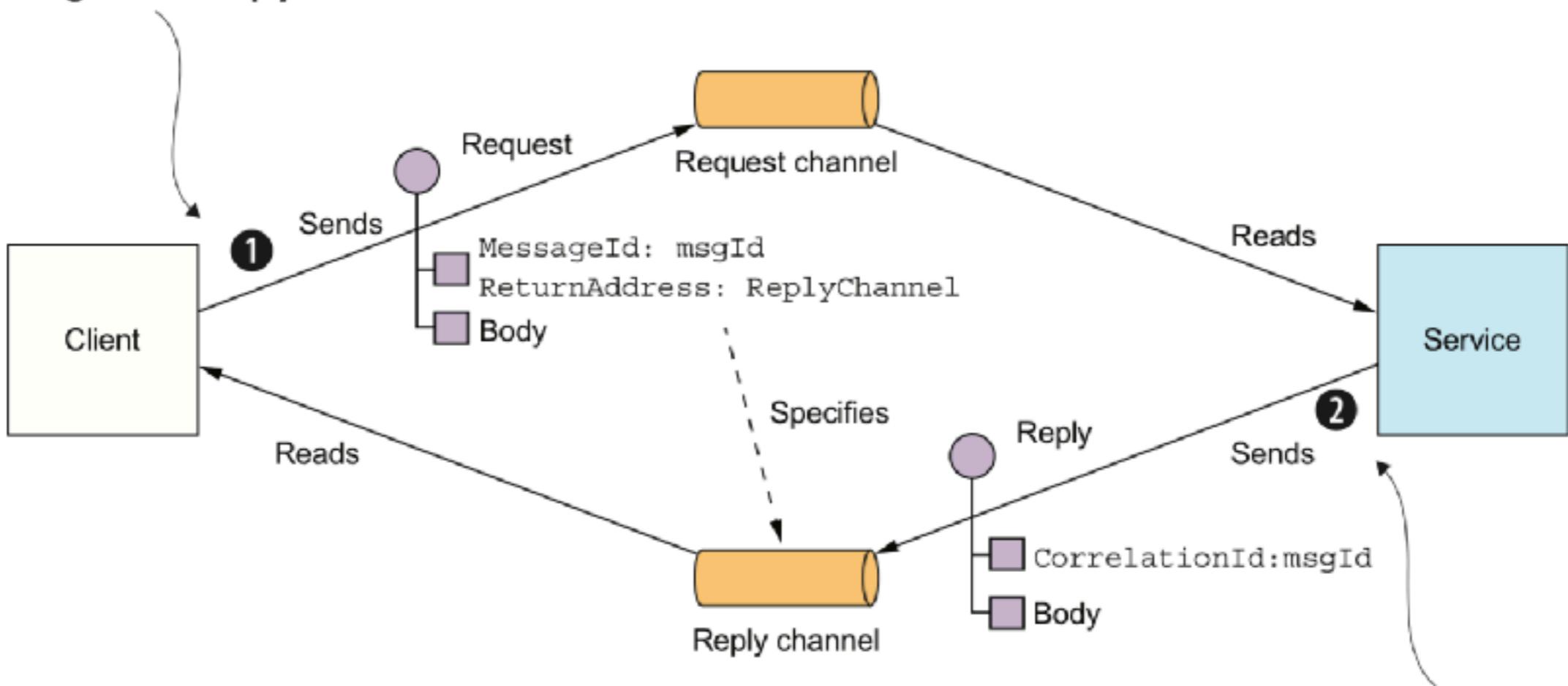
Messaging channels

Point-to-point Publish-subscribe



Async request/response (1)

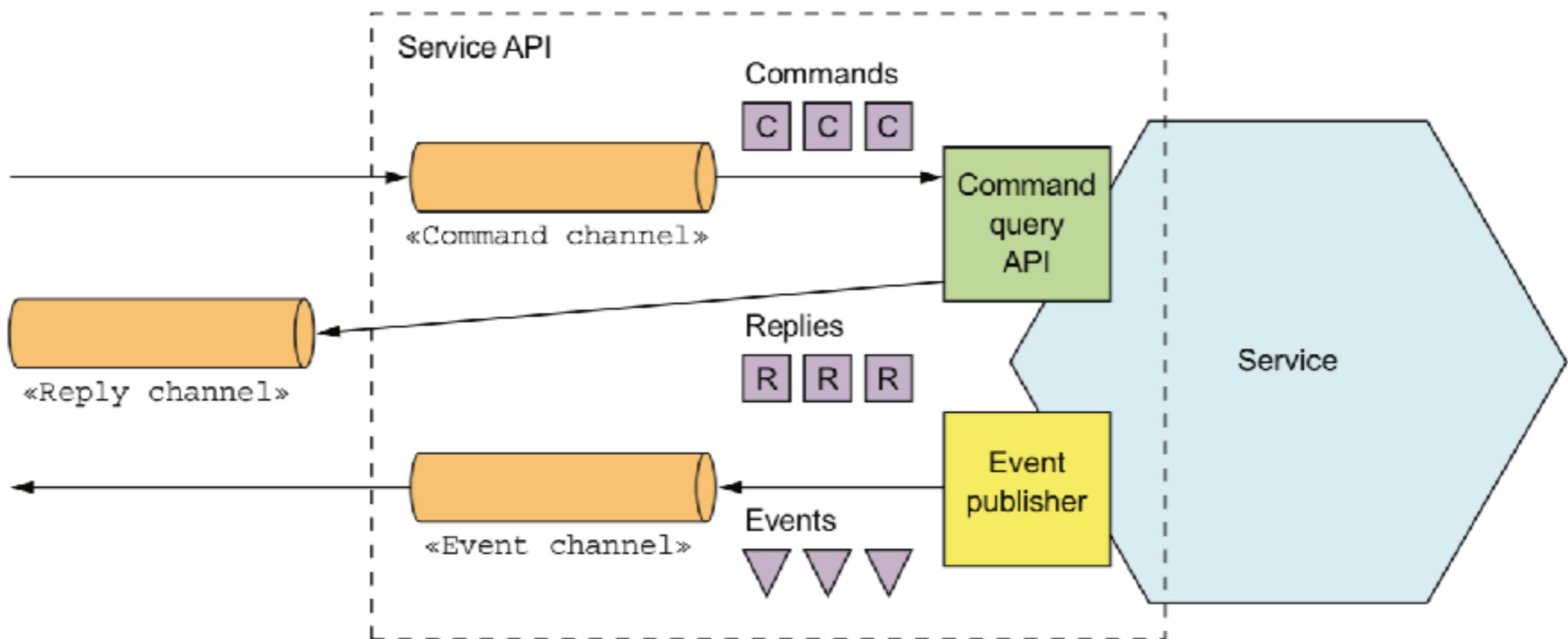
Client sends message containing msgId and a reply channel.



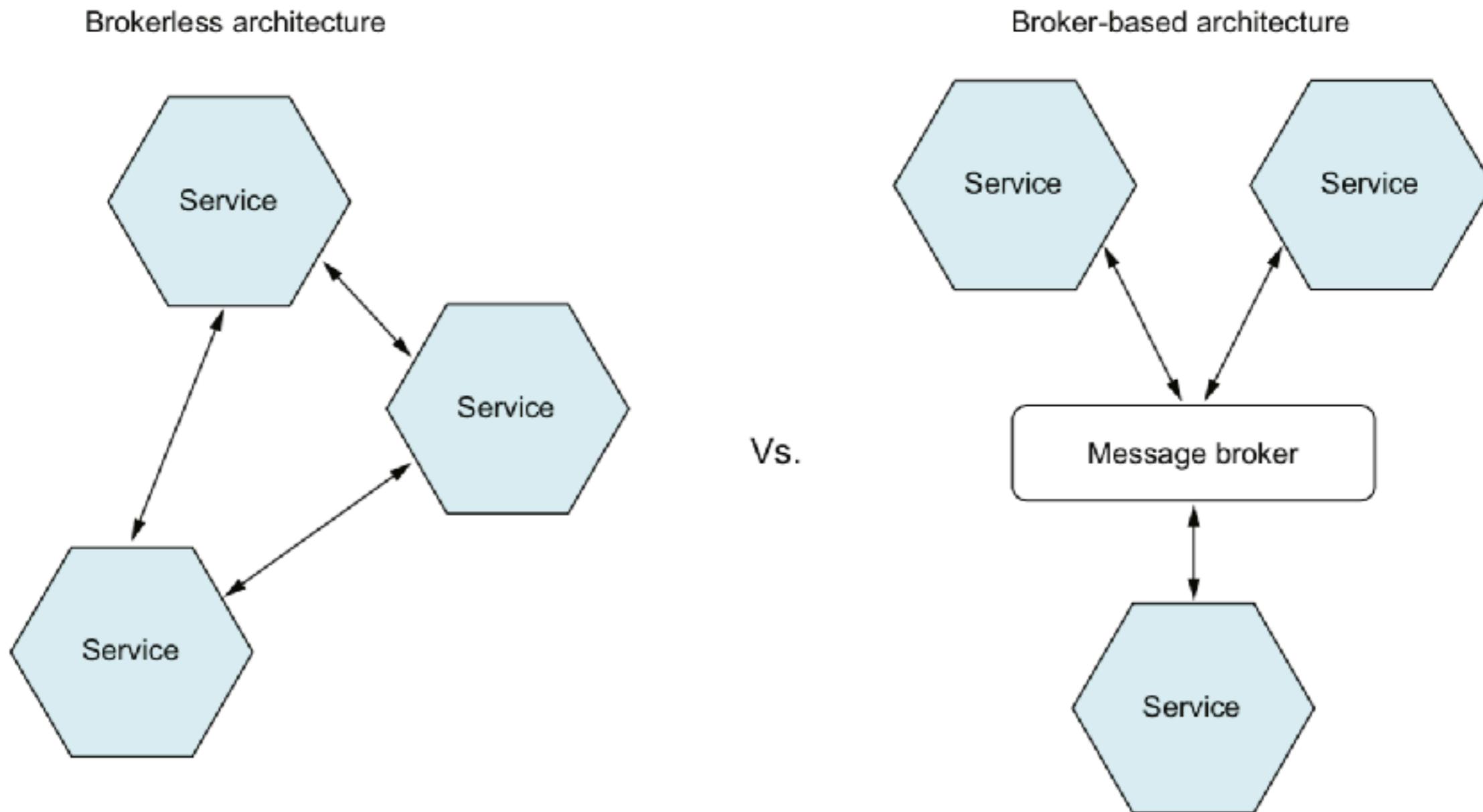
Service sends reply to the specified reply channel. The reply contains a correlationId, which is the request's msgId.



Async request/response (2)



Messaging-based use message broker



Message brokers



Benefits

Loose-coupling
Message buffer
Flexible communication



Drawbacks

Performance bottleneck
Single point of failure
Operational complexity

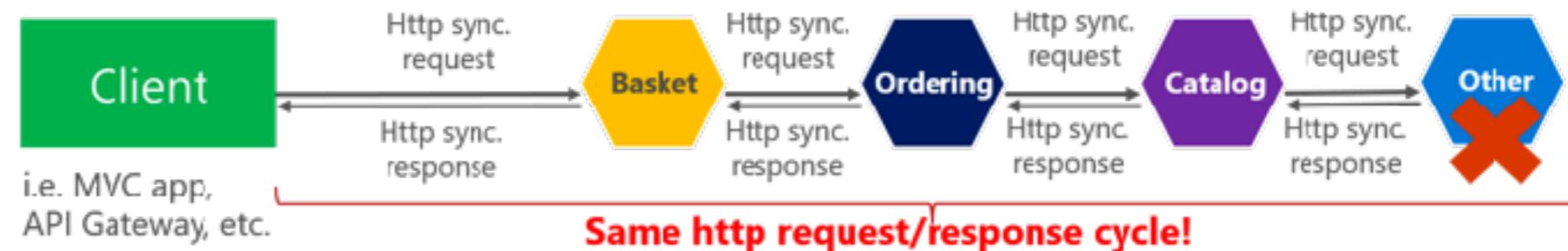


Communication !!

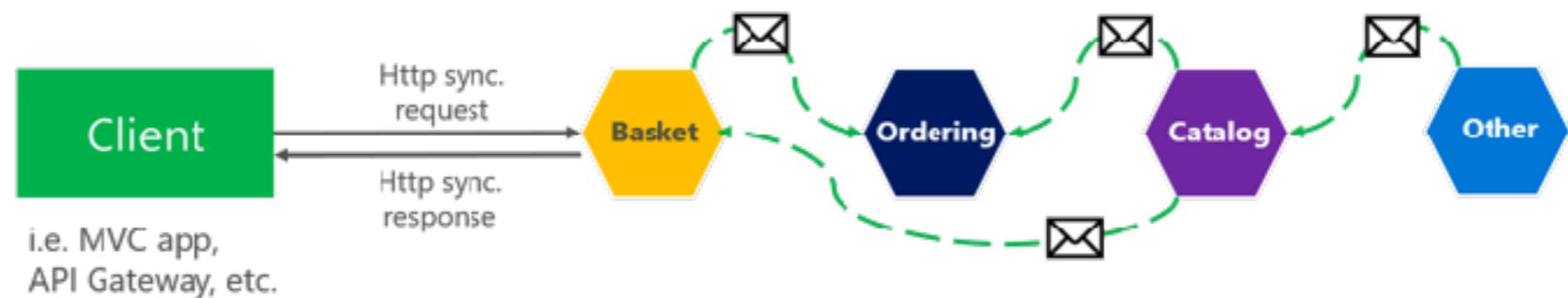
Synchronous vs. async communication across microservices

Anti-pattern

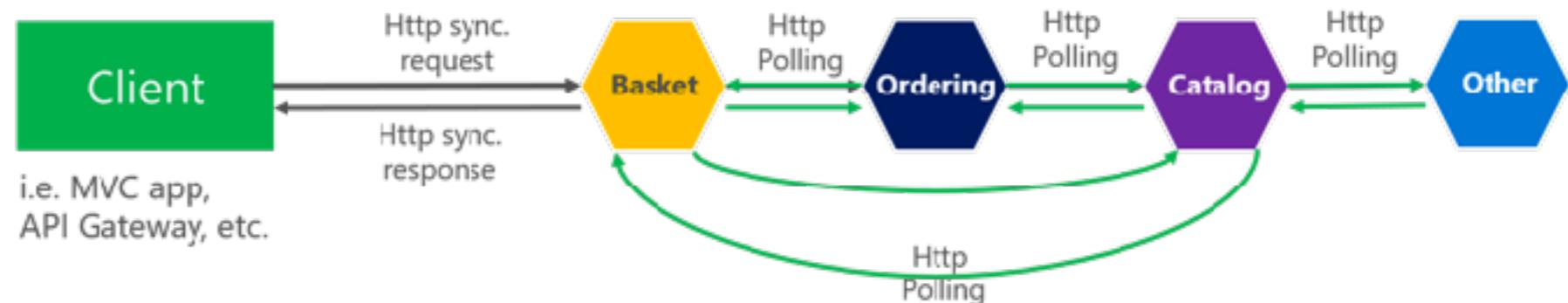
Synchronous
all req./resp. cycle



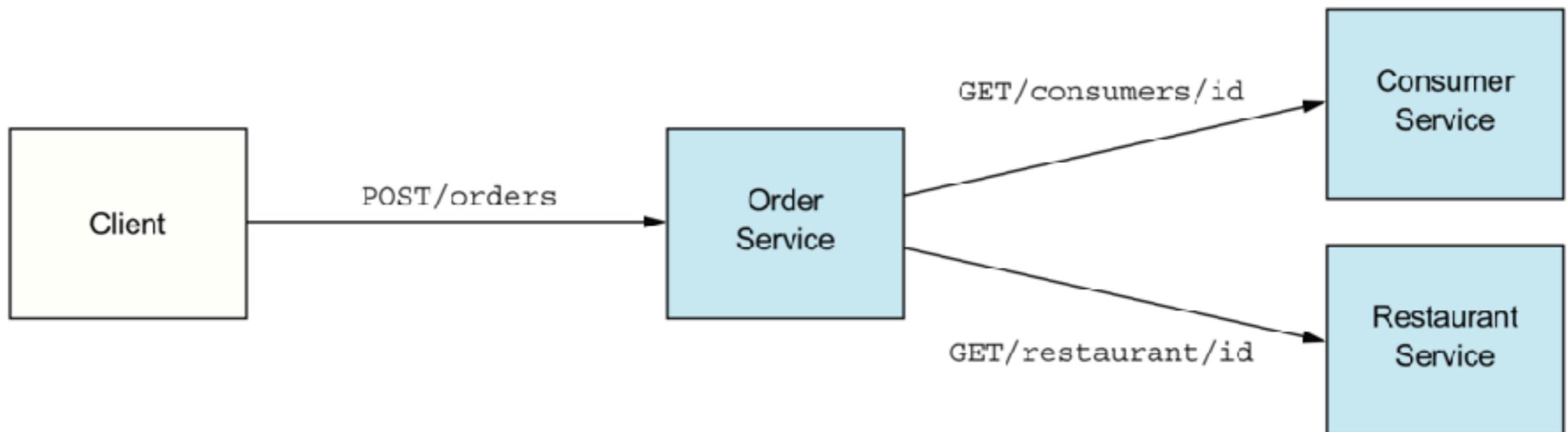
Asynchronous
Comm. across
internal microservices
(EventBus: i.e. **AMQP**)



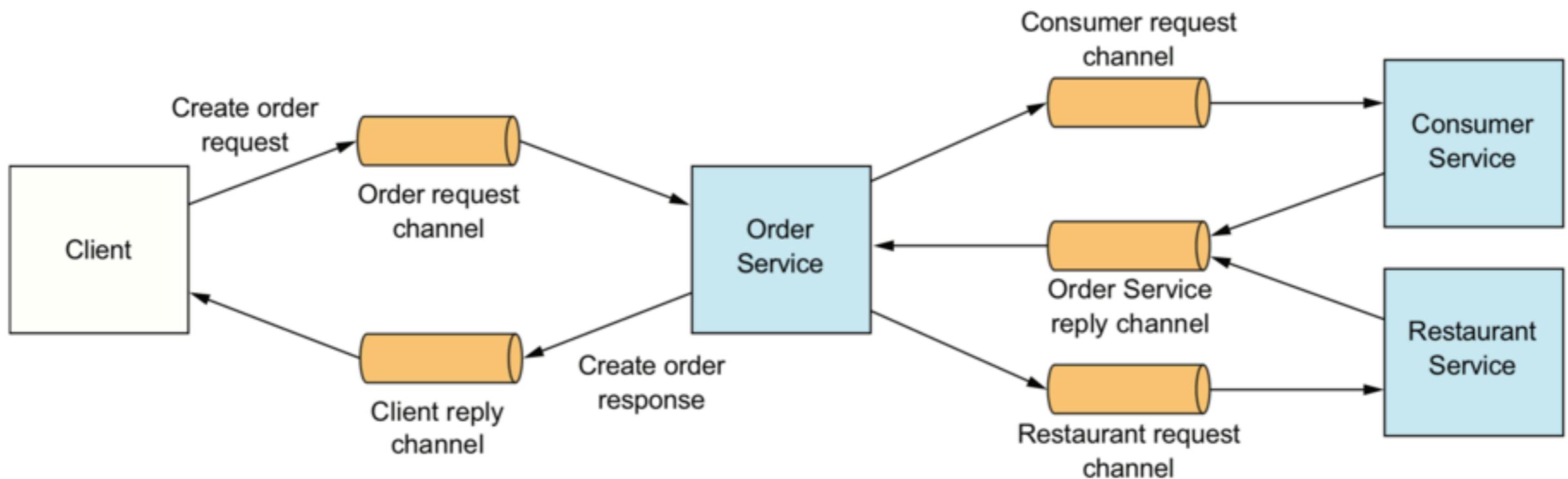
"Asynchronous"
Comm. across
internal microservices
(Polling: **Http**)



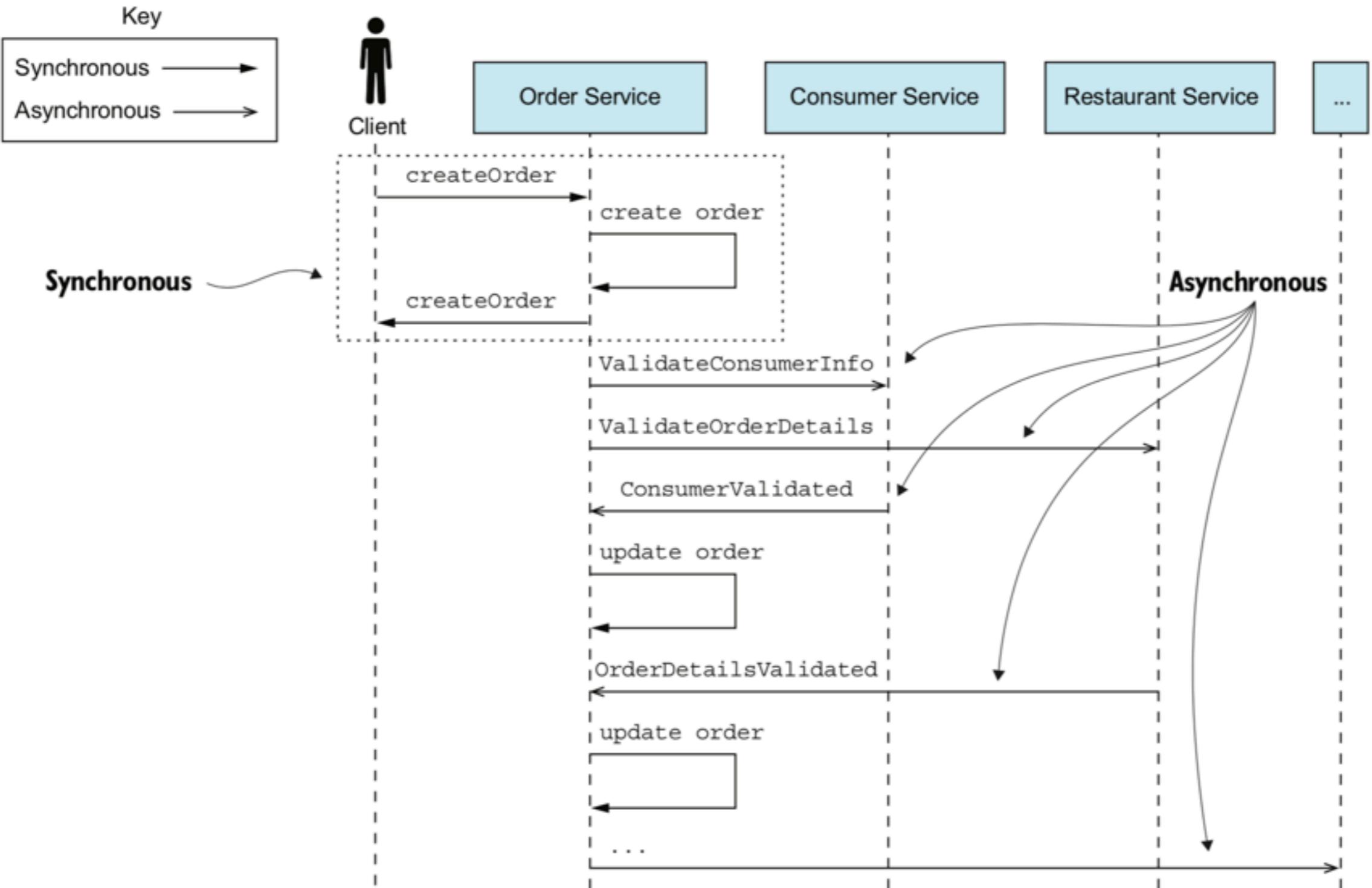
Synchronous reduce availability



Replace with asynchronous (1)



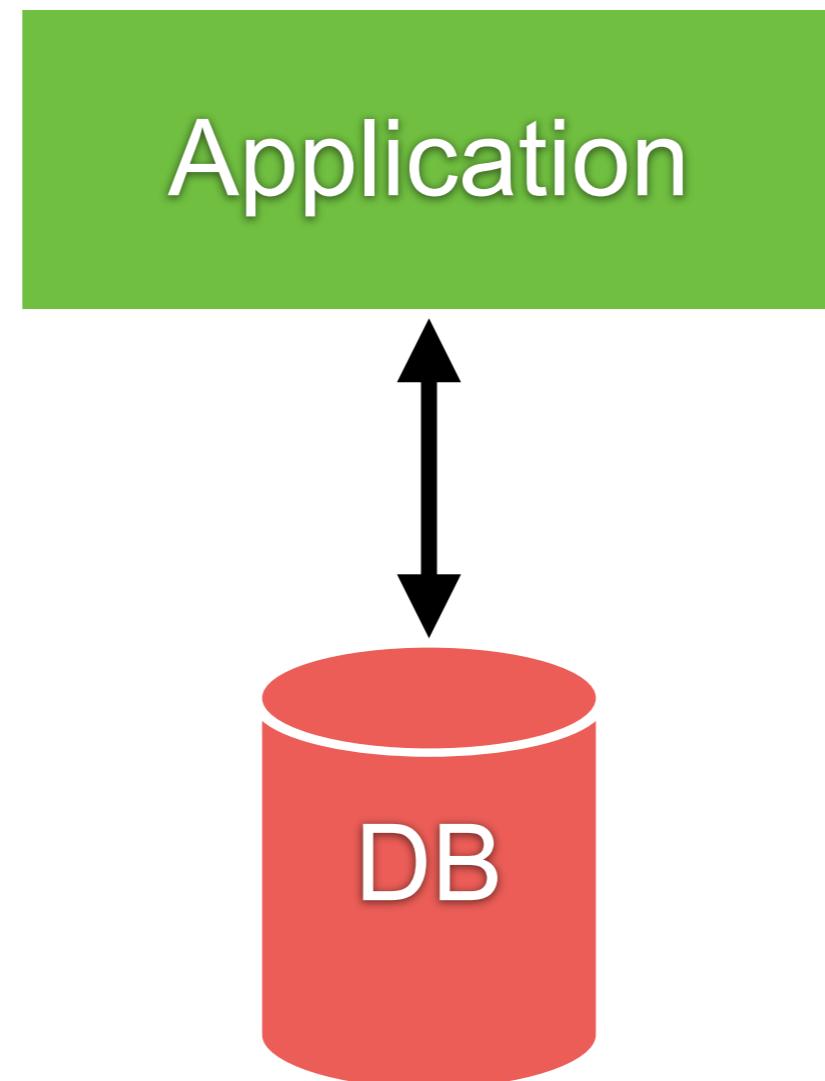
Replace with asynchronous (2)



Manage data consistency

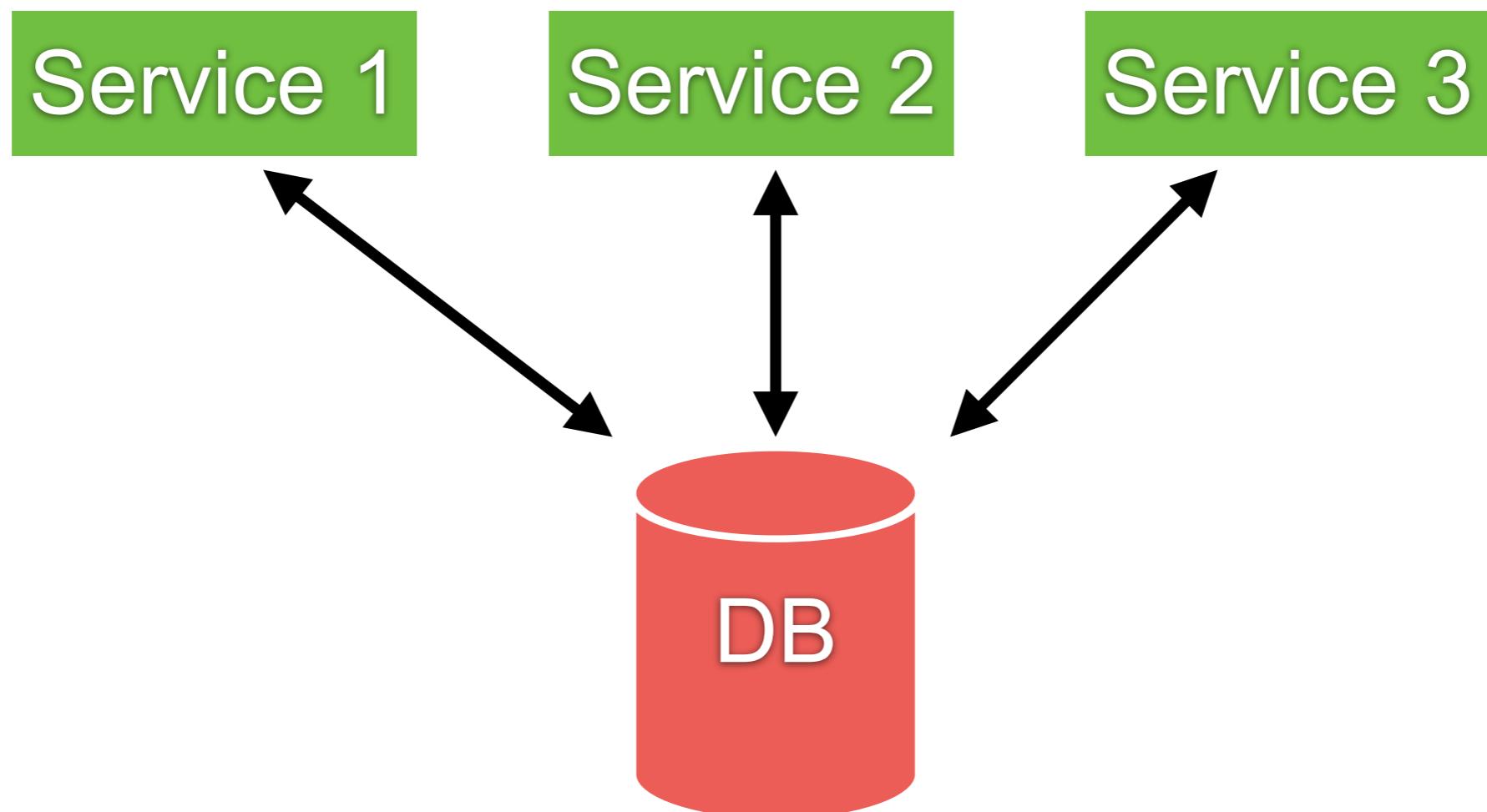


Monolithic



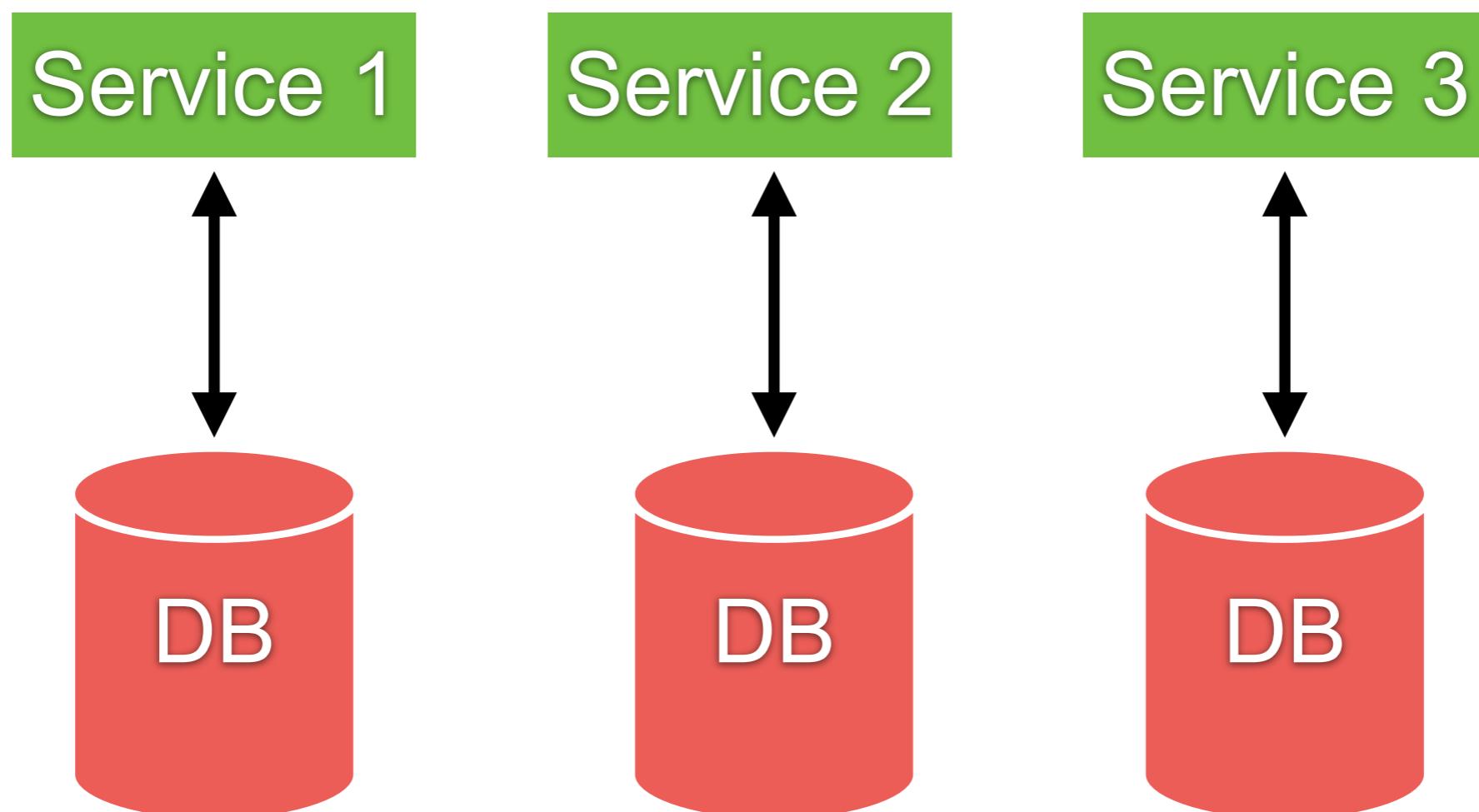
Microservices

Shared database

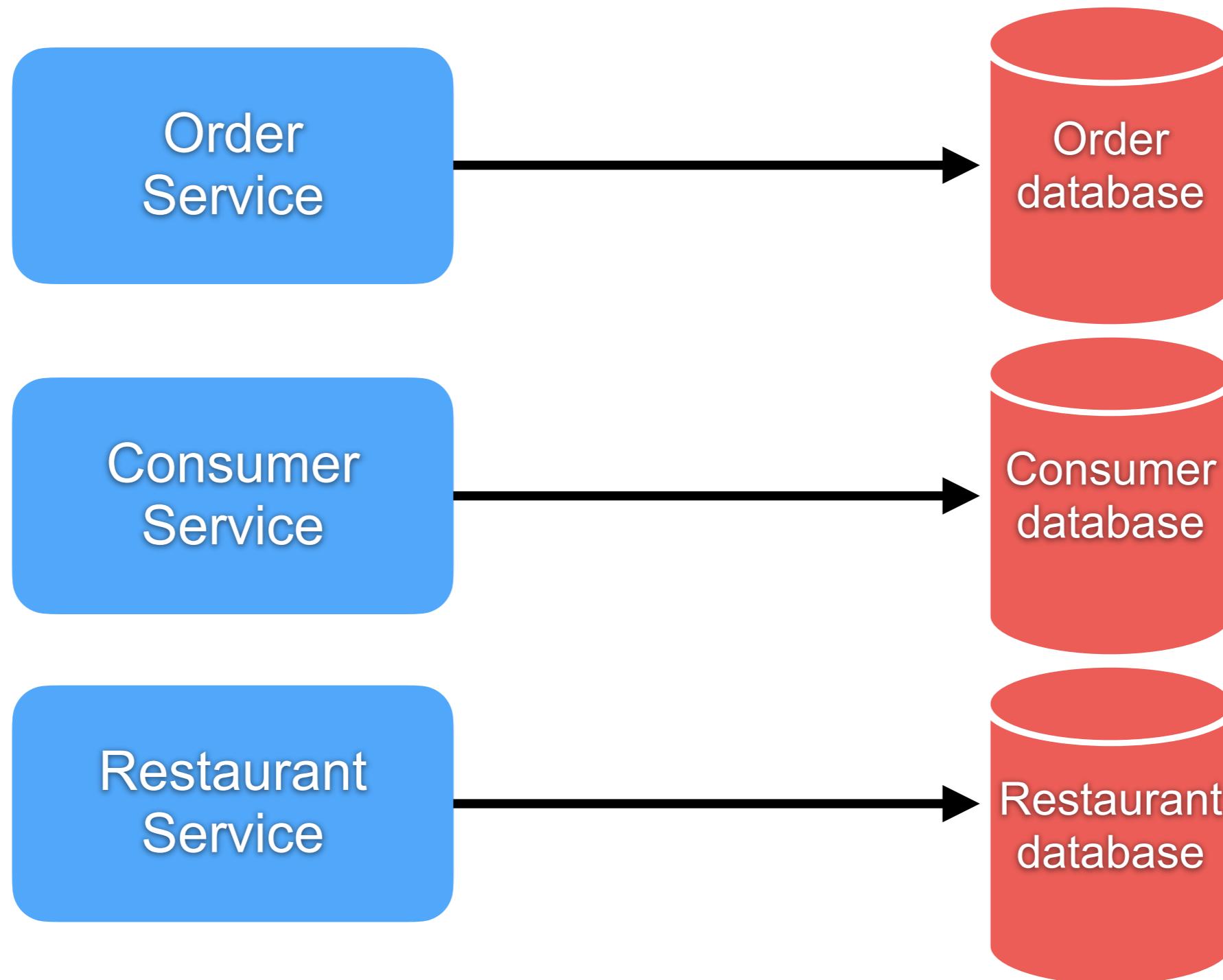


Microservices

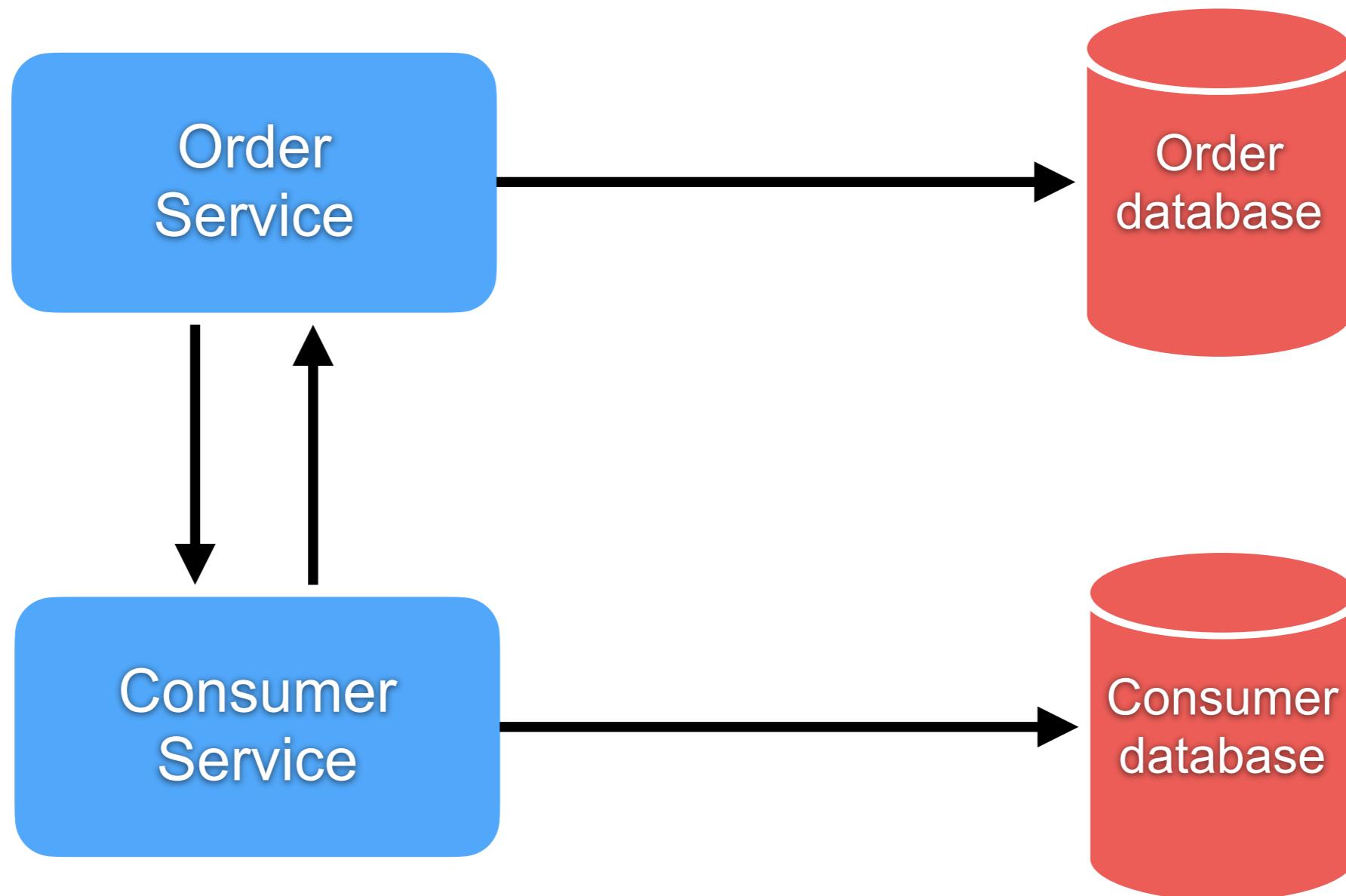
Database per service

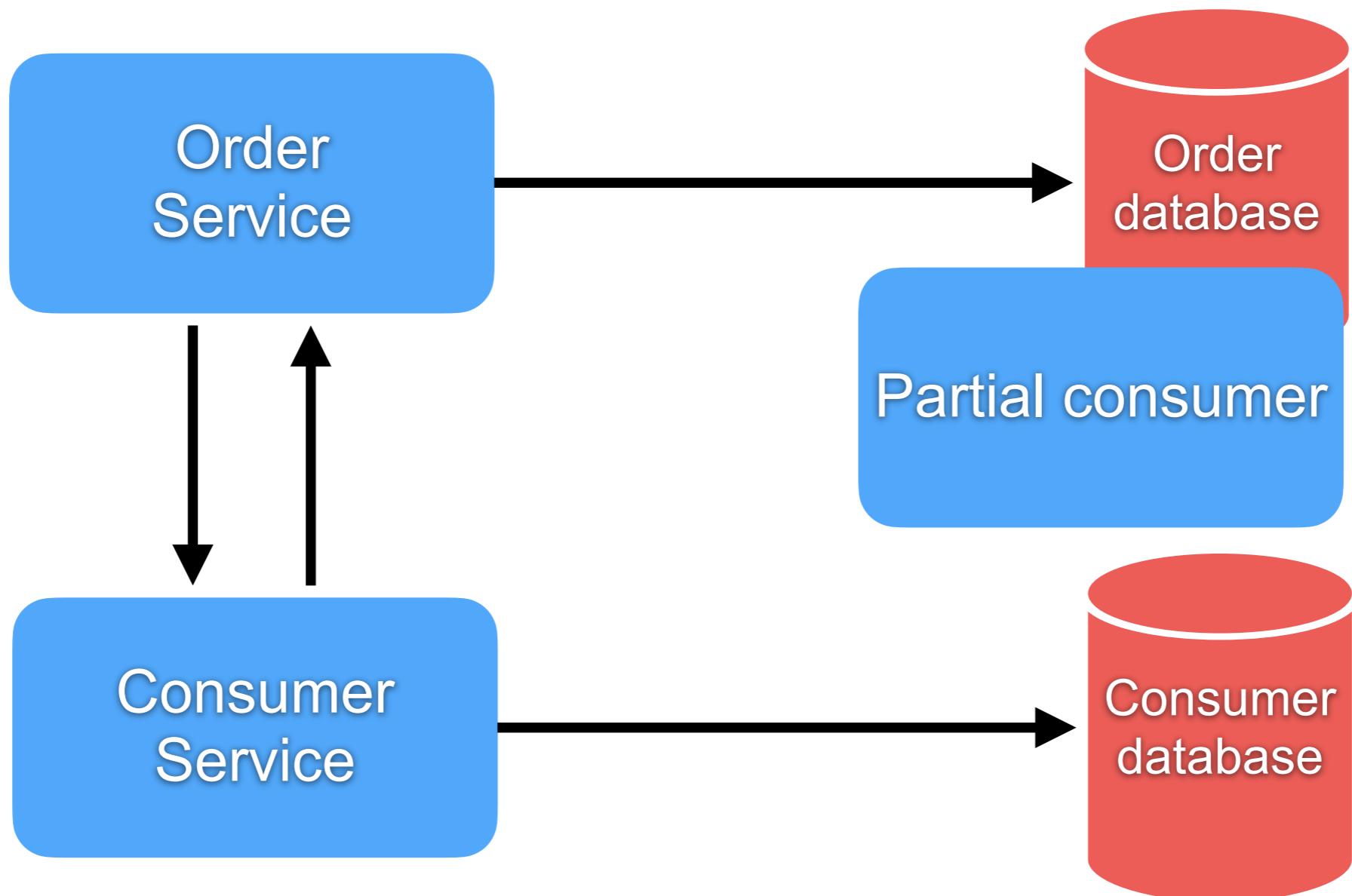


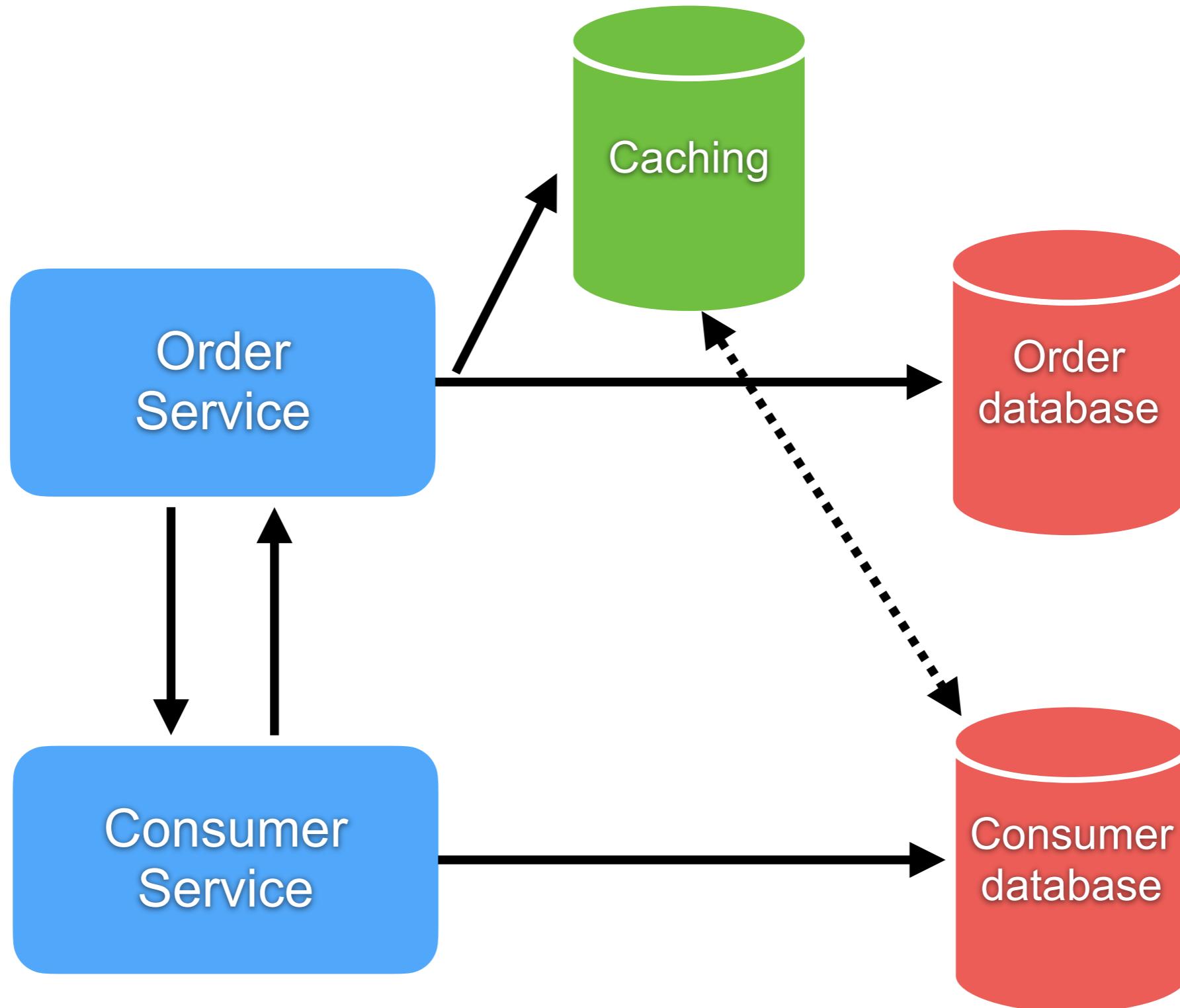
Database per service



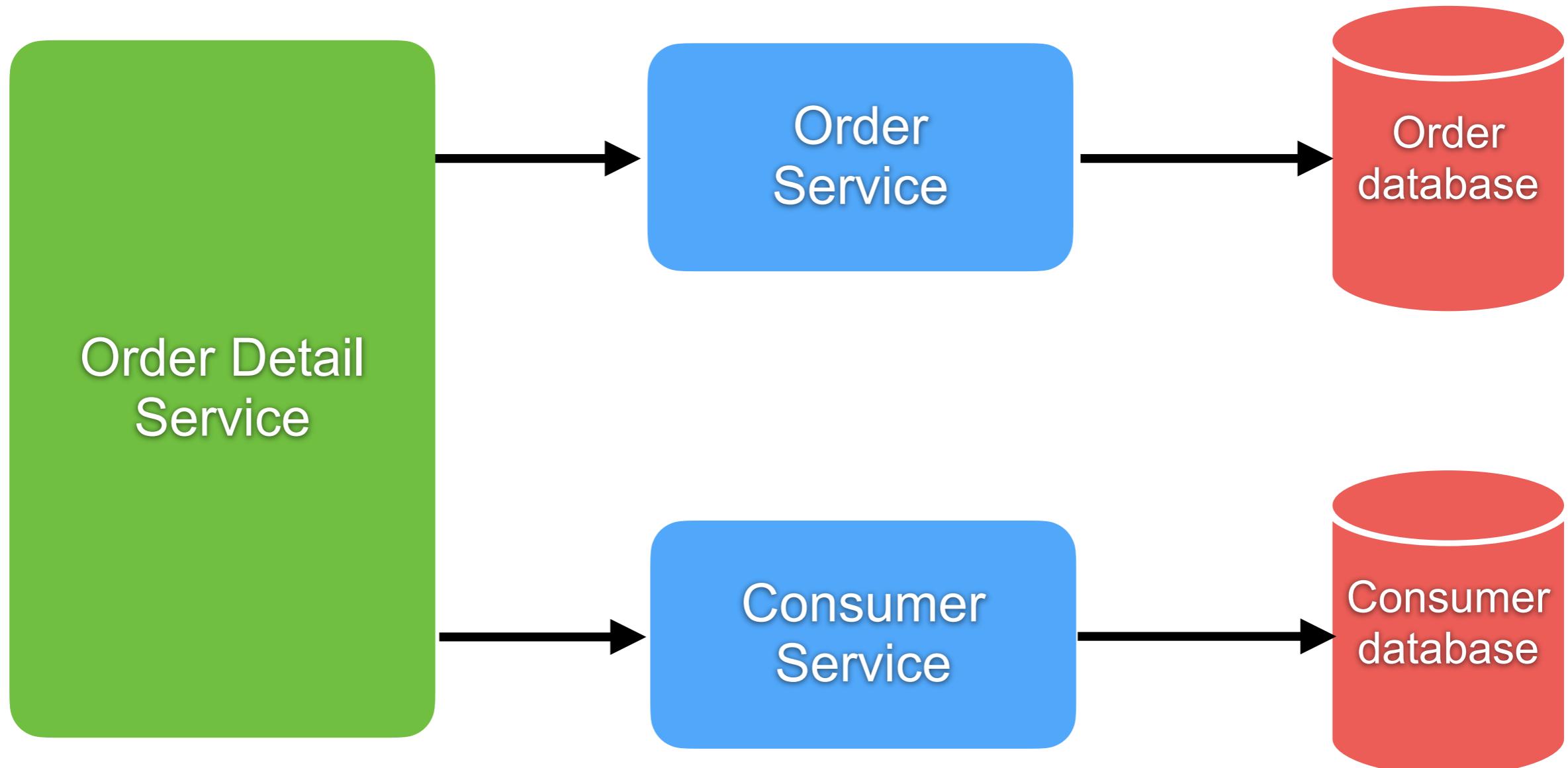
Loose coupling = encapsulation data



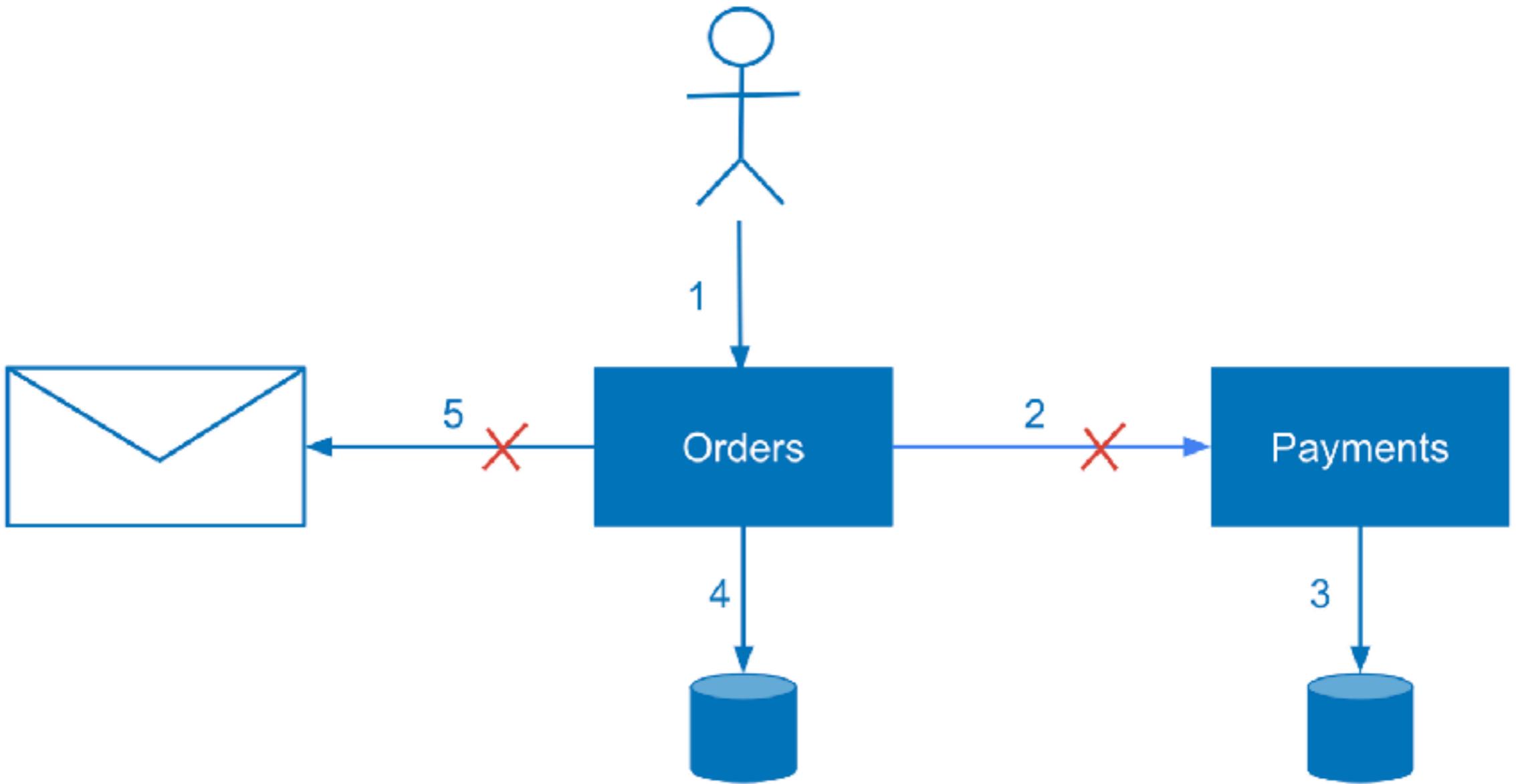




Order detail orchestration service

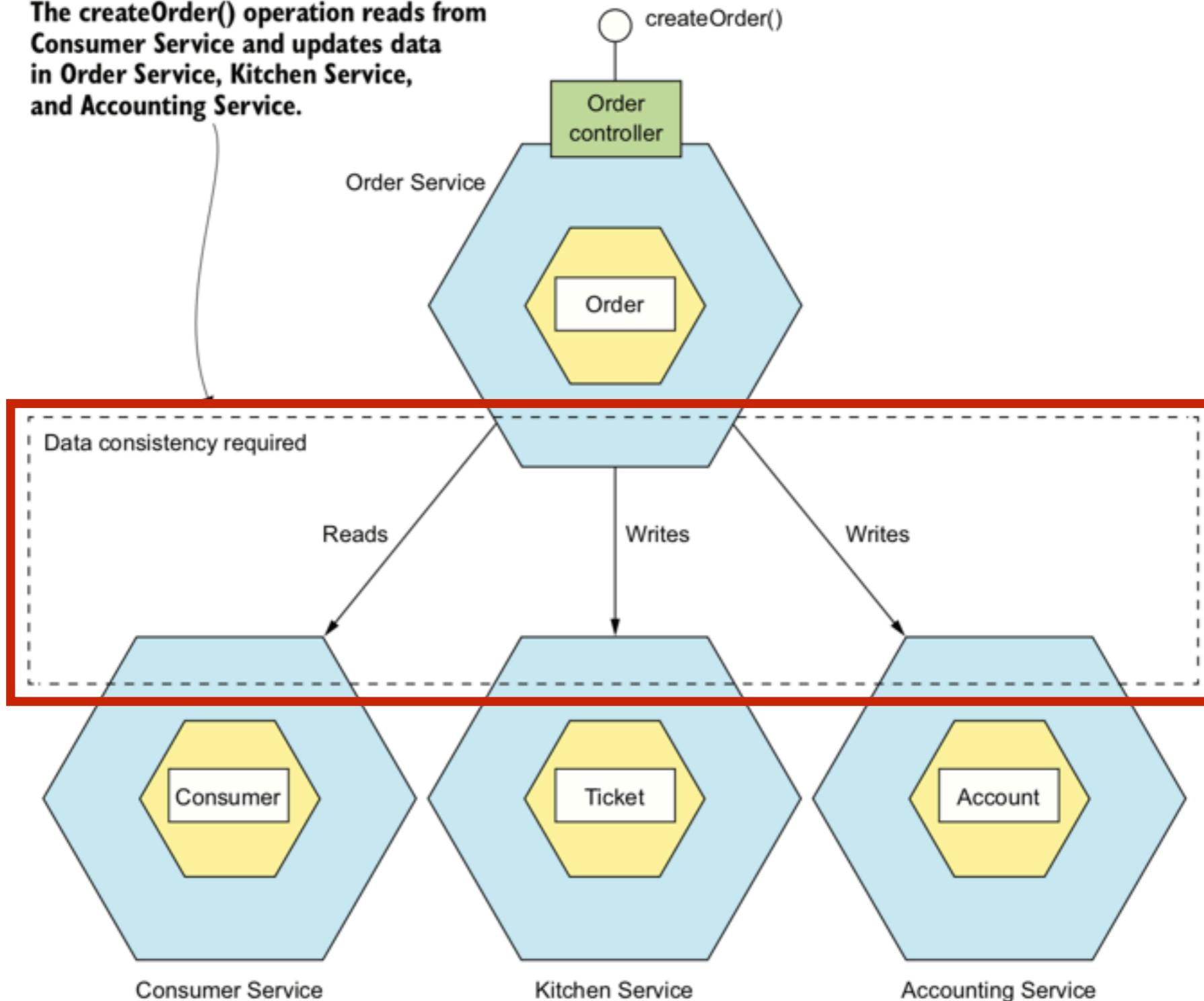


Distributed process failure !!



Problem ?

The **createOrder()** operation reads from Consumer Service and updates data in Order Service, Kitchen Service, and Accounting Service.



Can't use **ACID** transaction !!



A - Atomicity

All or Nothing Transactions

C - Consistency

Guarantees Committed Transaction State

I - Isolation

Transactions are Independent

D – Durability

Committed Data is Never Lost

(c) <http://blog.sqlauthority.com>

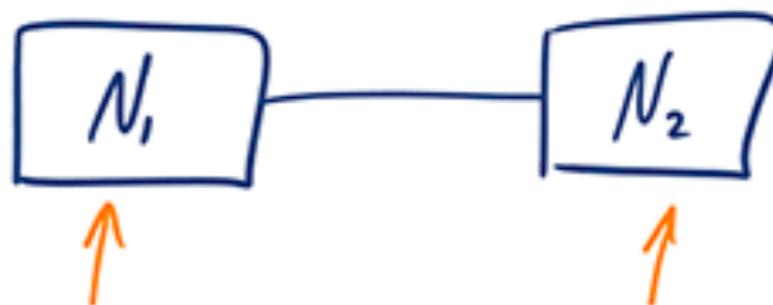


CAP Theorem

Consistency



Availability



Partition Tolerance



<http://robertgreiner.com/2014/08/cap-theorem-revisited/>



Database per service

High complexity

Query data across multiple databases

Challenge “How to join data ?”

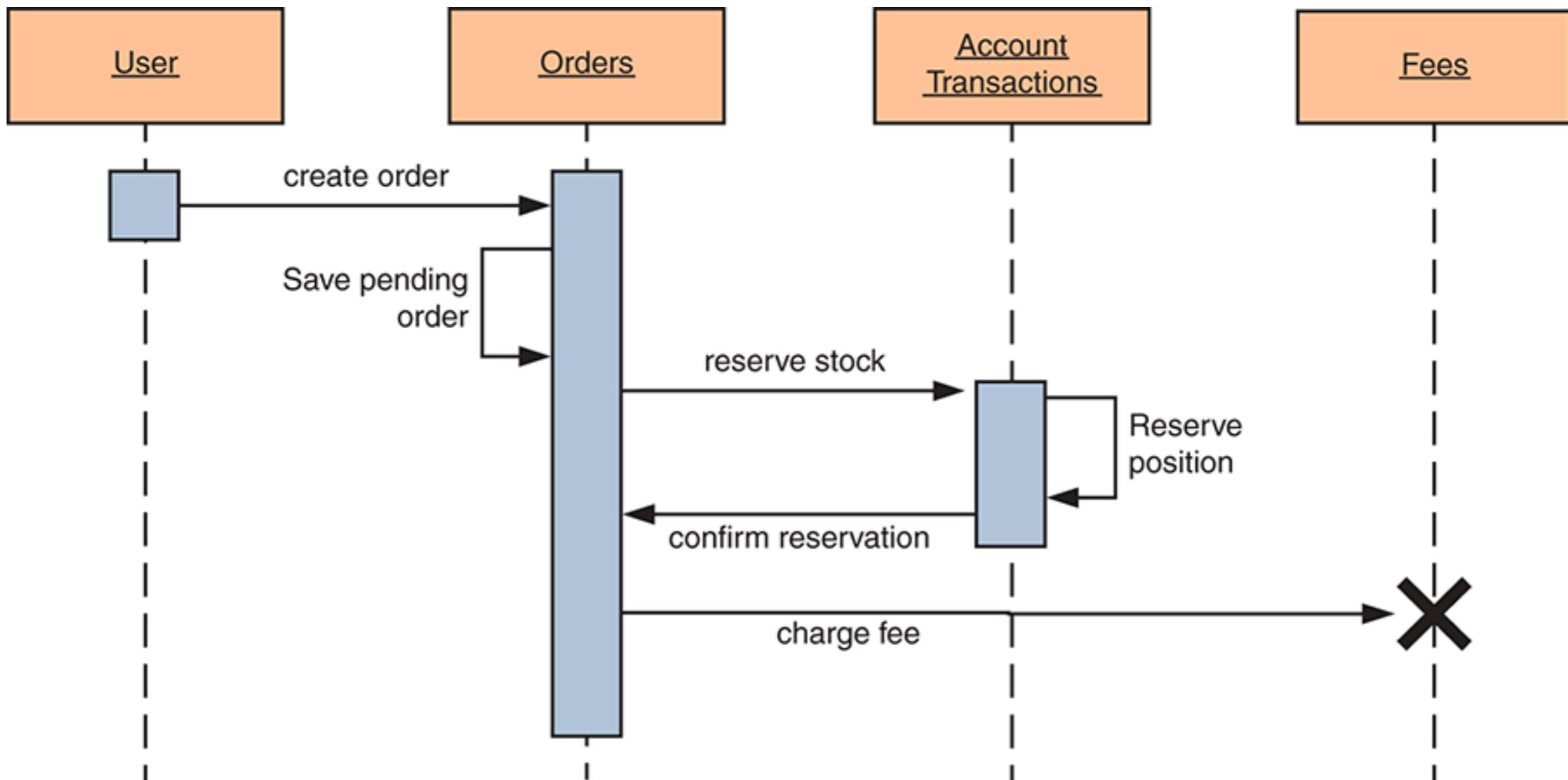
Maintain database consistency



How to maintain data consistency across services ?



Problem



Distributed transaction

Common approach is Two-phase commit(2PC)

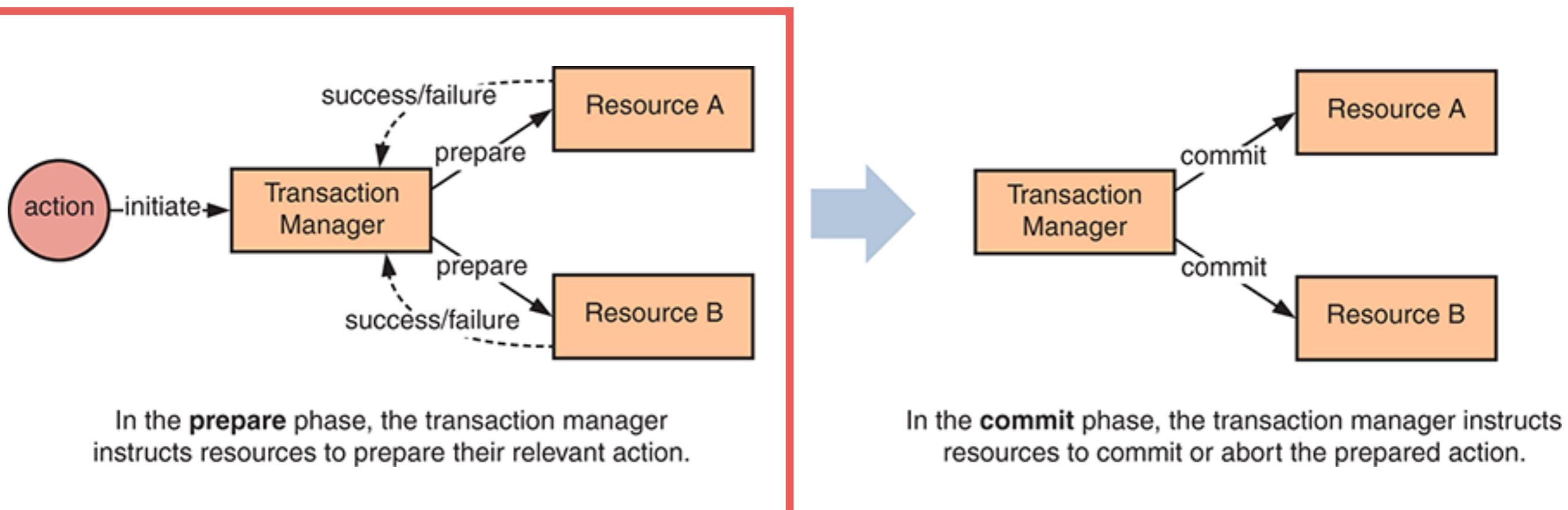
Use transaction manager to split operations across multiple resources in 2 phases

1. *Prepare*
2. *Commit*



Two-phase commit

Phase 1: prepare

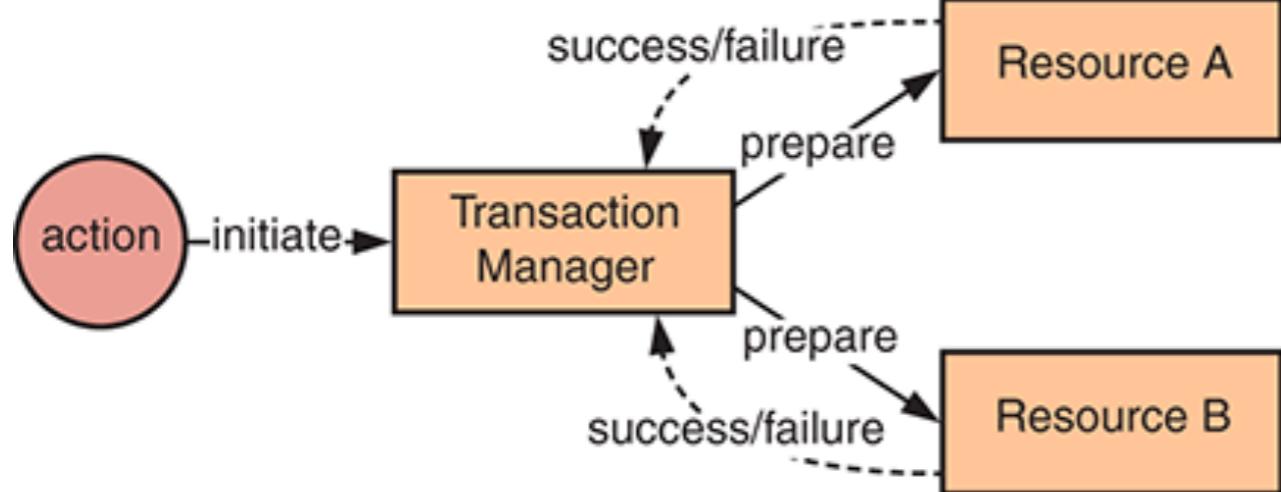


https://en.wikipedia.org/wiki/Two-phase_commit_protocol

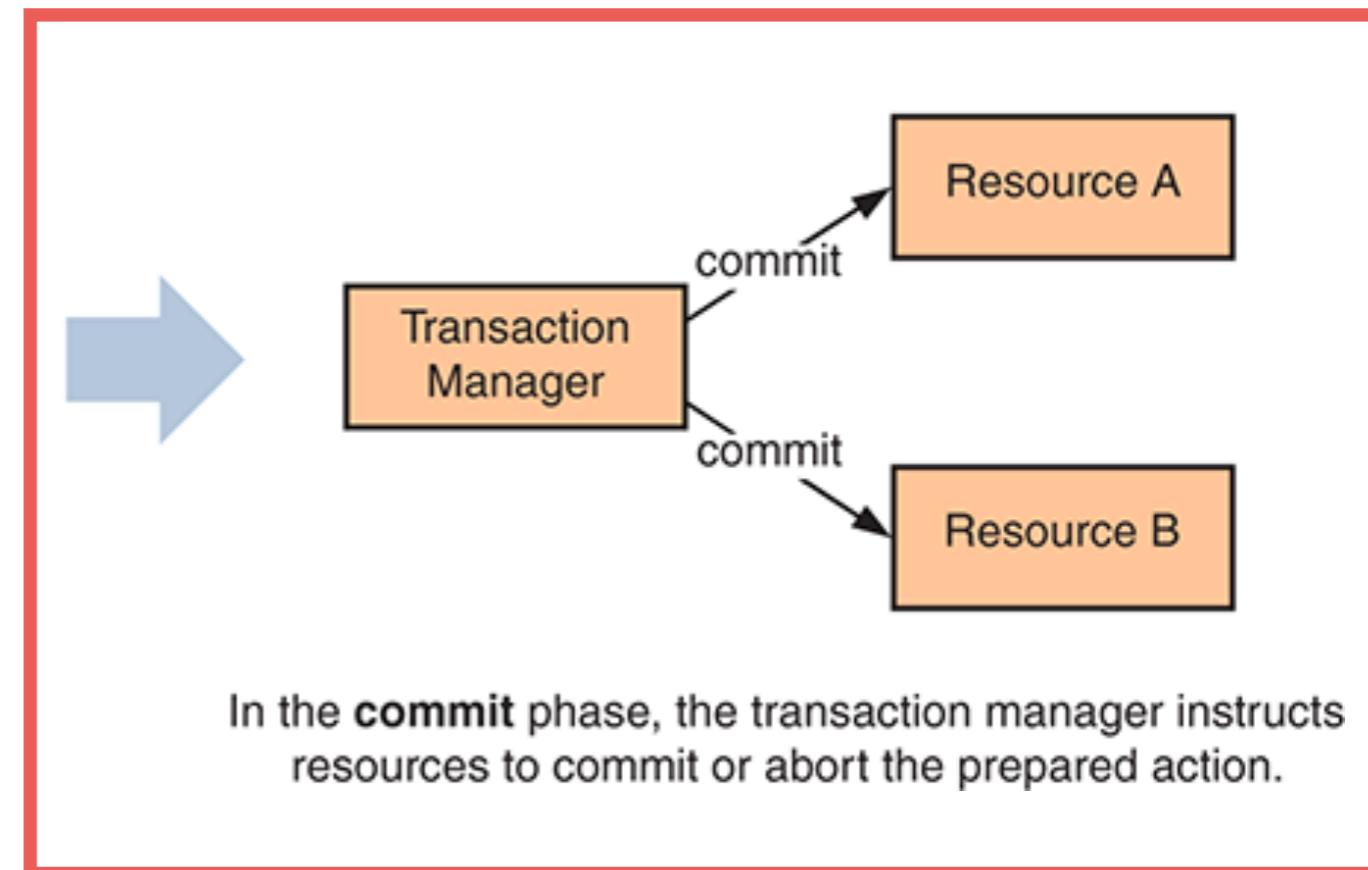


Two-phase commit

Phase 2: commit



In the **prepare** phase, the transaction manager instructs resources to prepare their relevant action.



In the **commit** phase, the transaction manager instructs resources to commit or abort the prepared action.

https://en.wikipedia.org/wiki/Two-phase_commit_protocol



**Distributed transaction places
a lock on resources under
transaction to ensure isolation**



Inappropriate for long-running operations



Increase risk of contention and deadlock

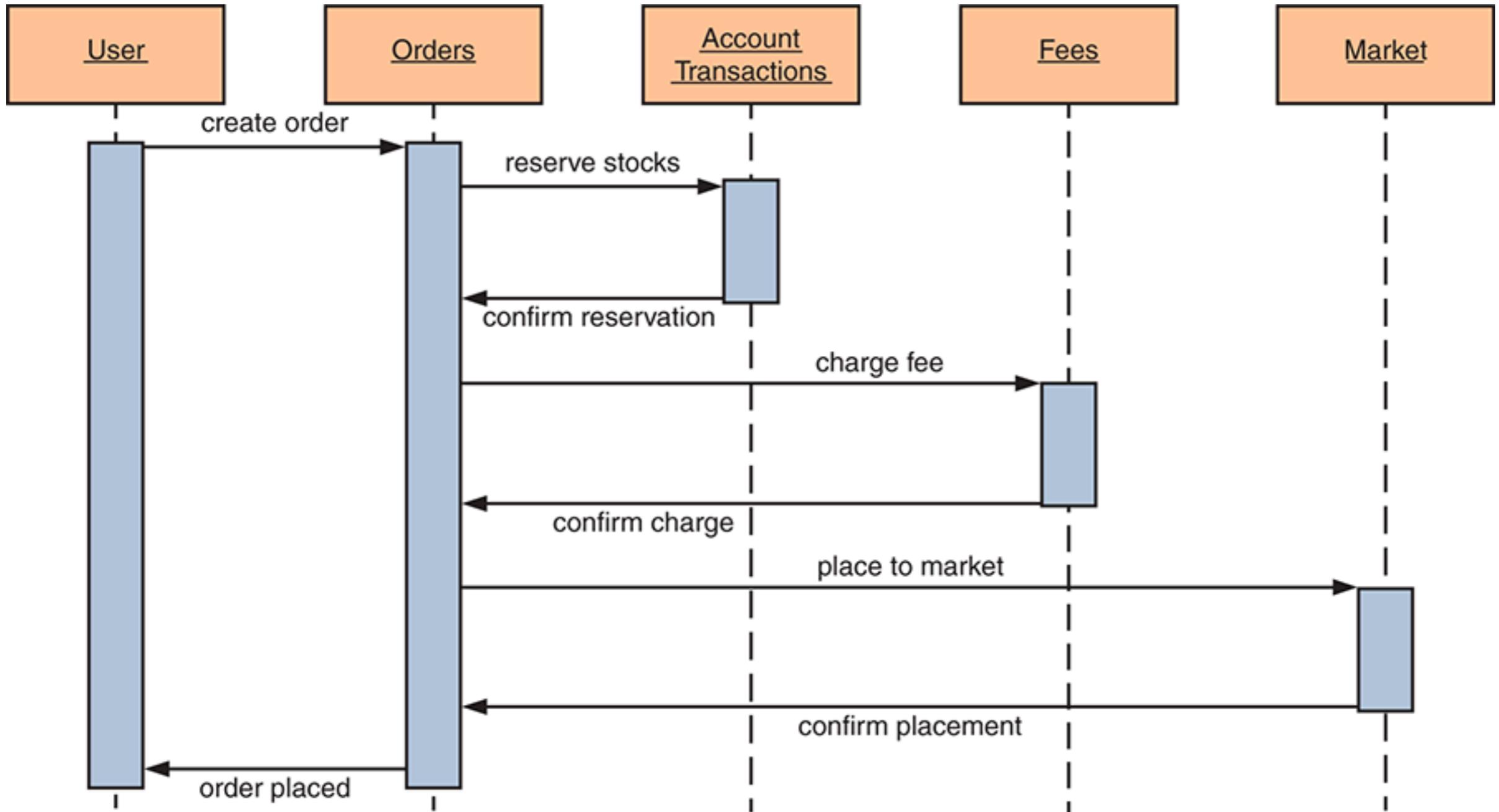


We need ...

Don't need distributed transaction
Reduce complexity of code
Reliable



Synchronous process

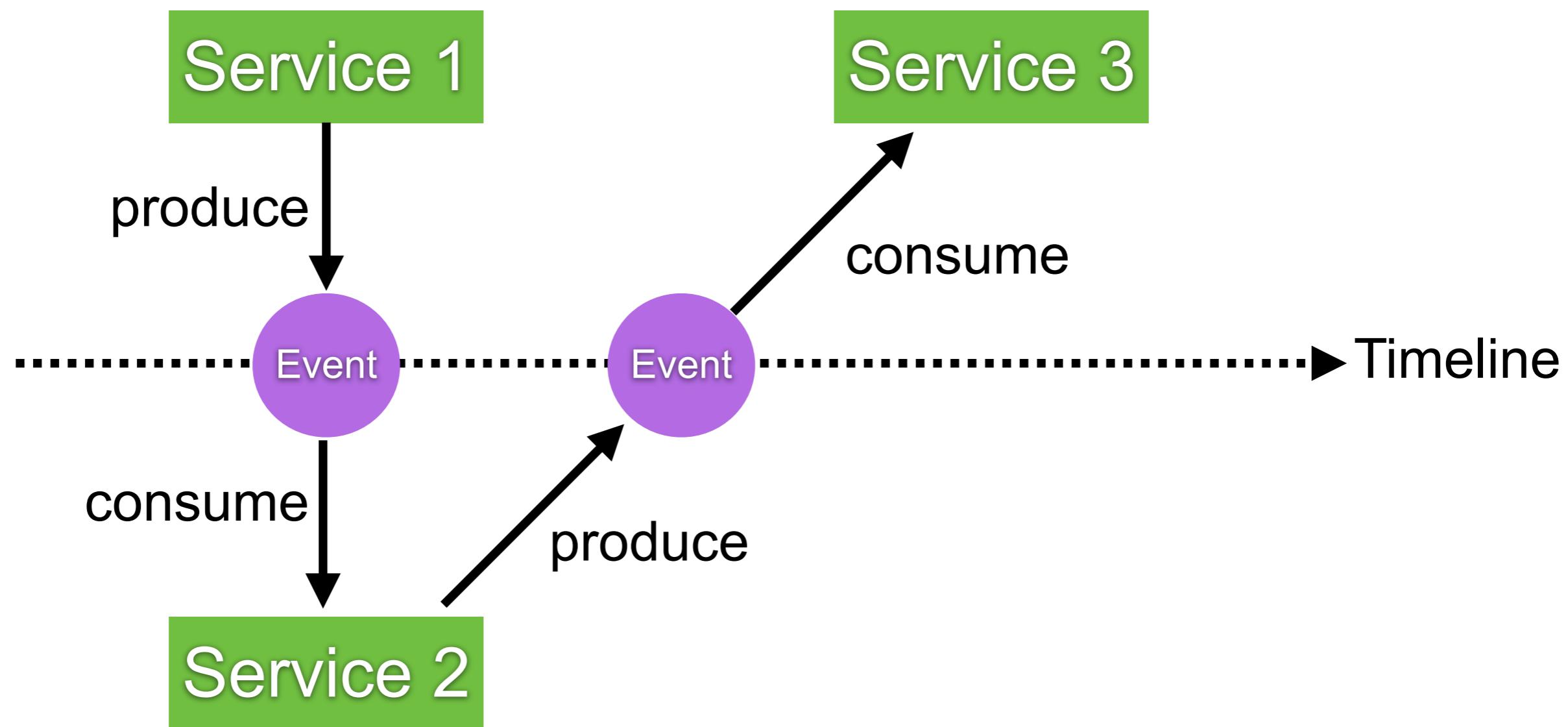


Event-based communication



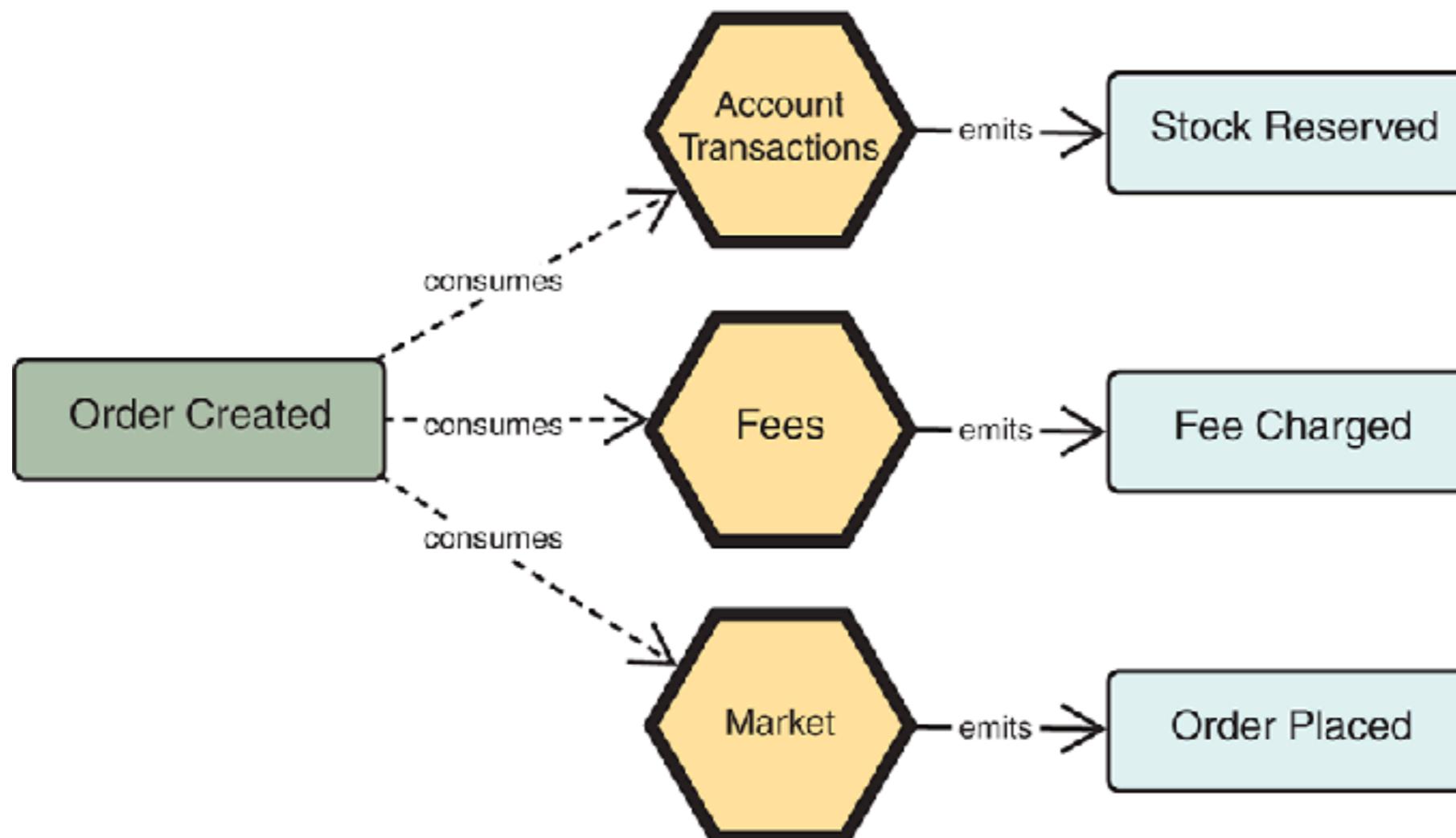
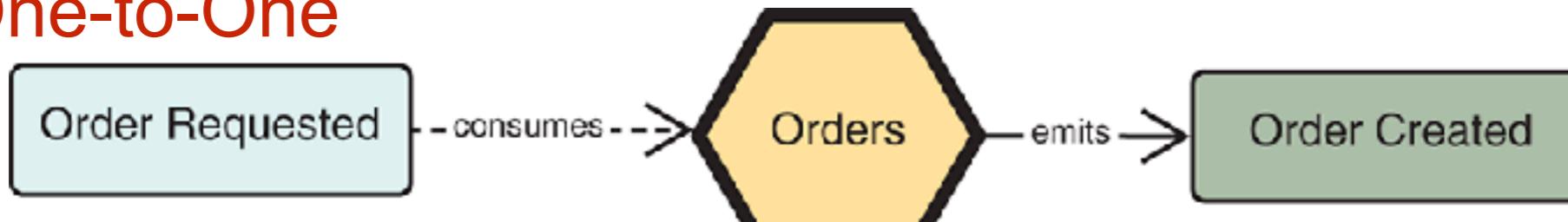
Choreography pattern

Sequence of Tx and emit **event** or **message** that trigger the next process in Tx

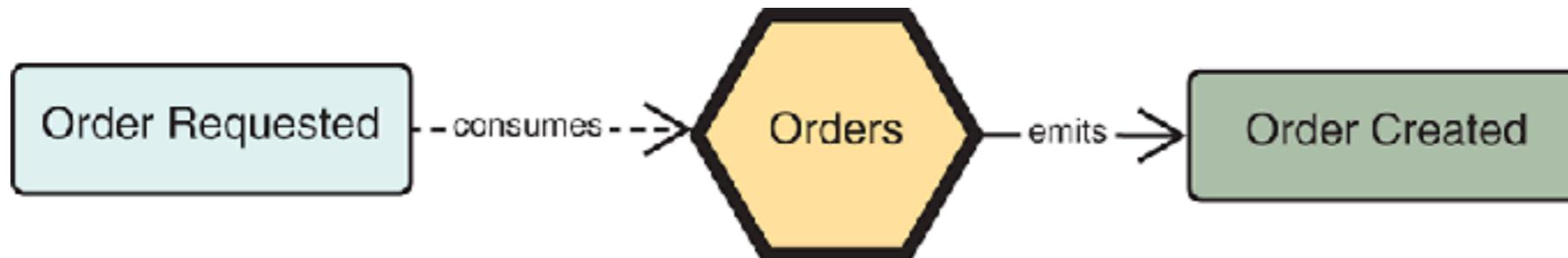


Service consume and emit event

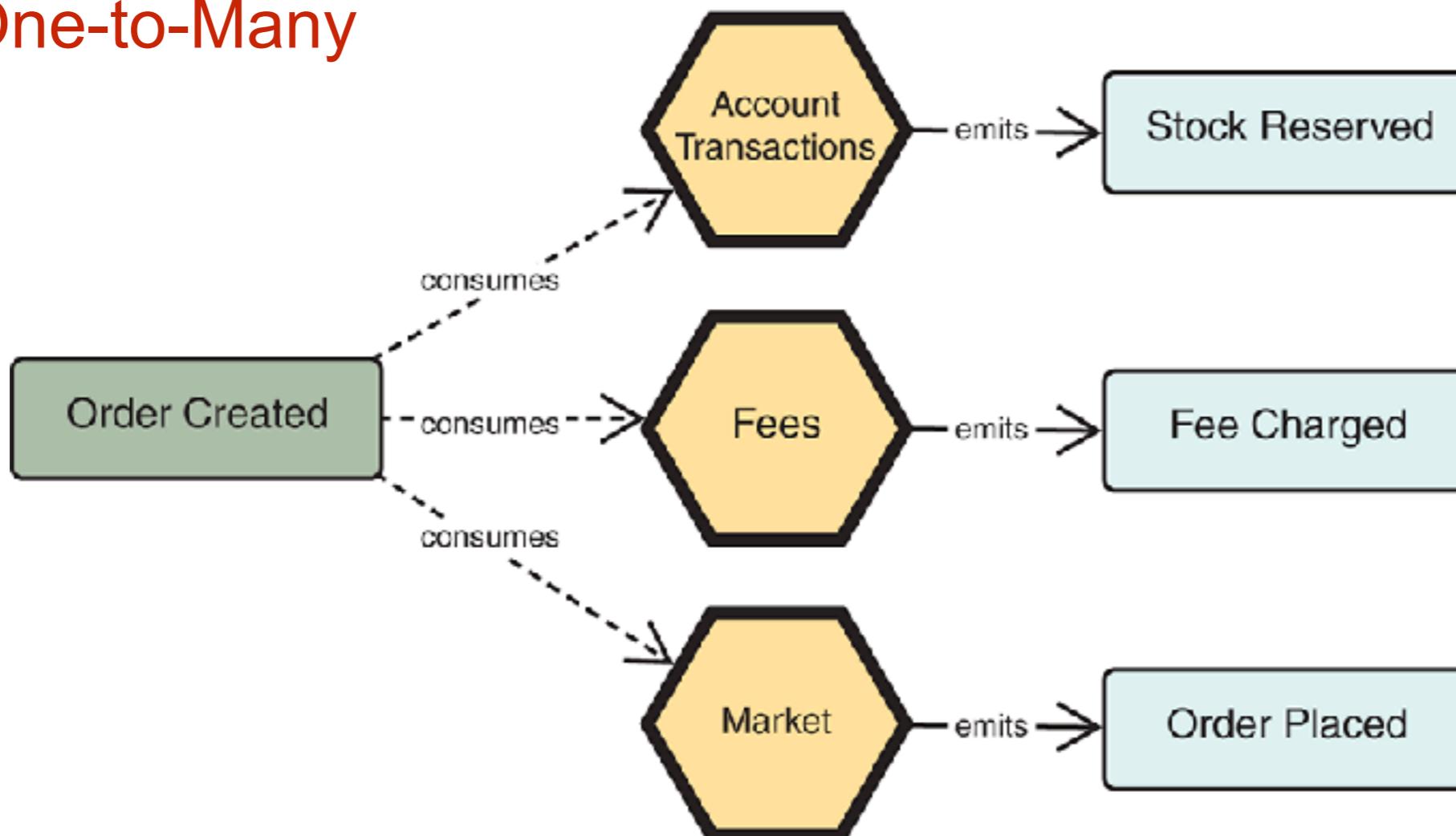
One-to-One



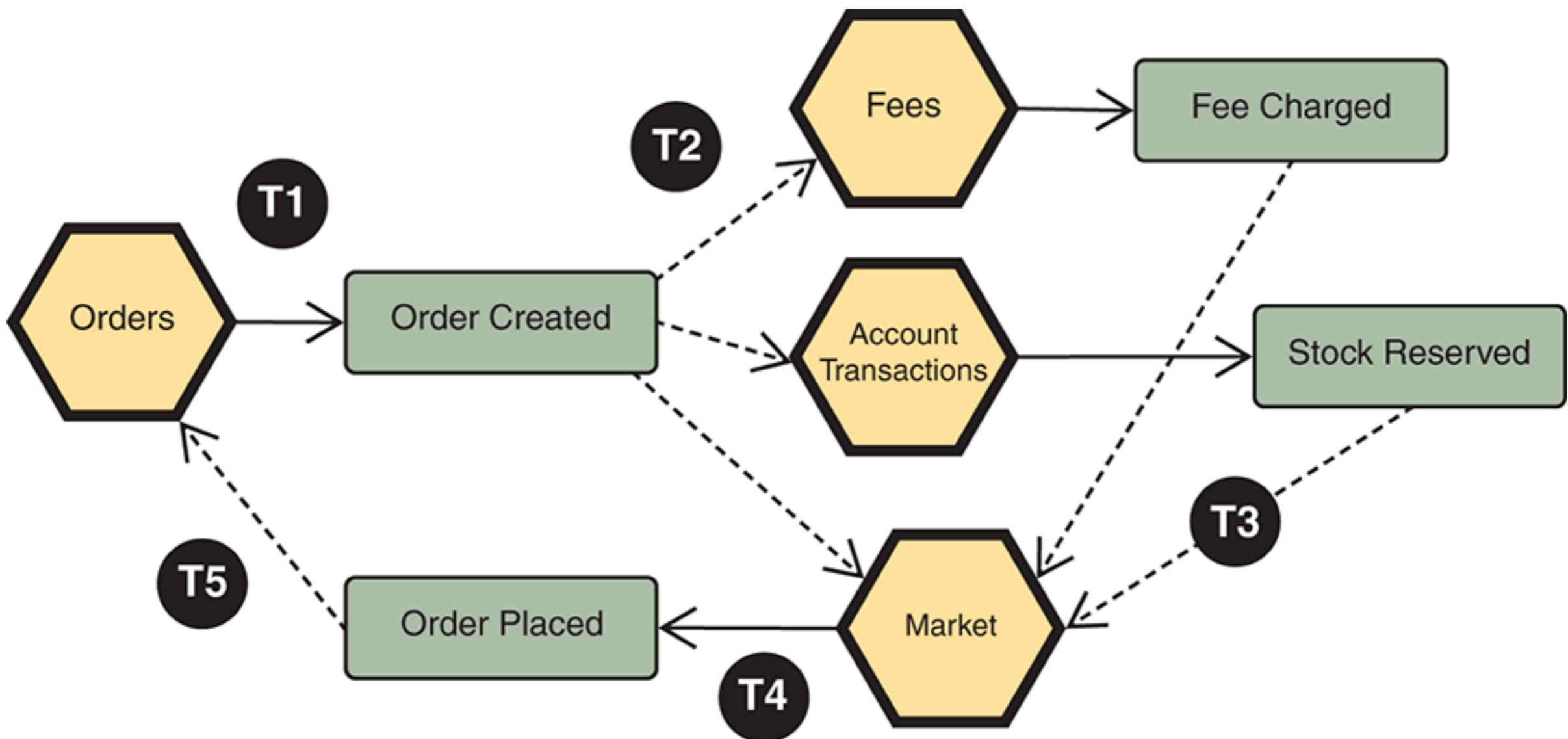
Service consume and emit event



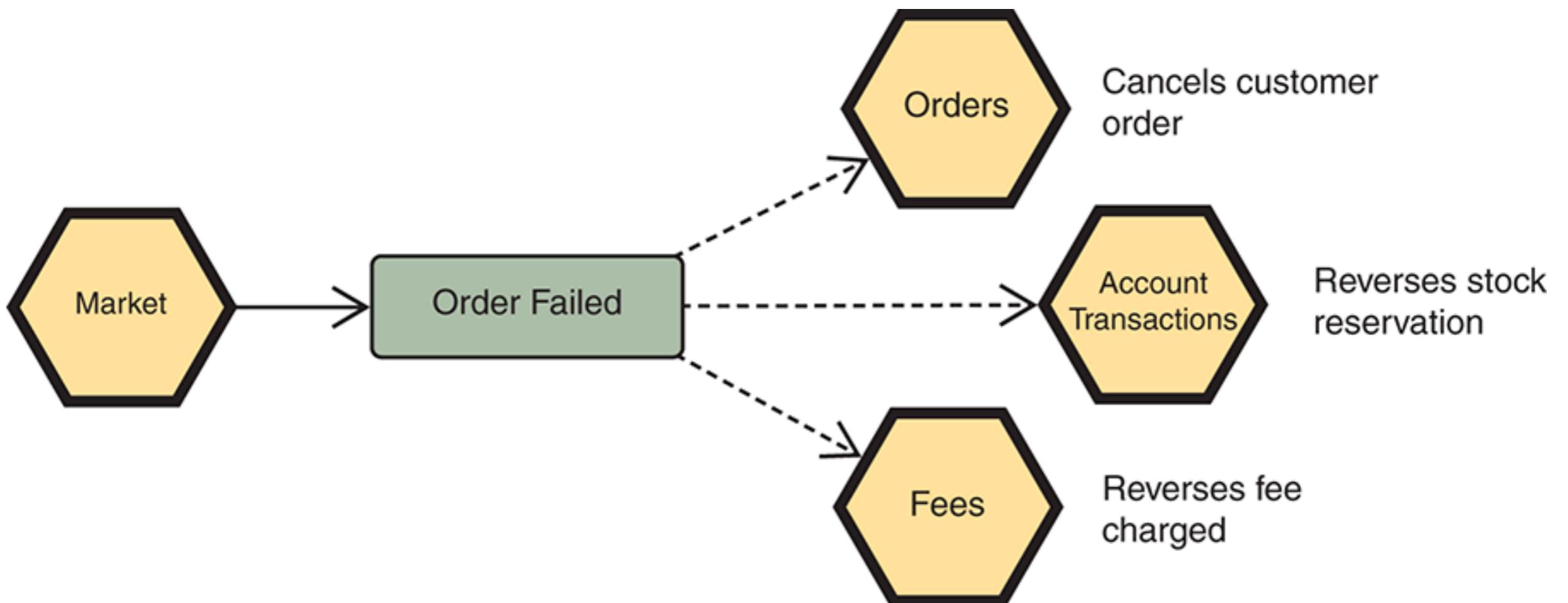
One-to-Many



Example (Success)

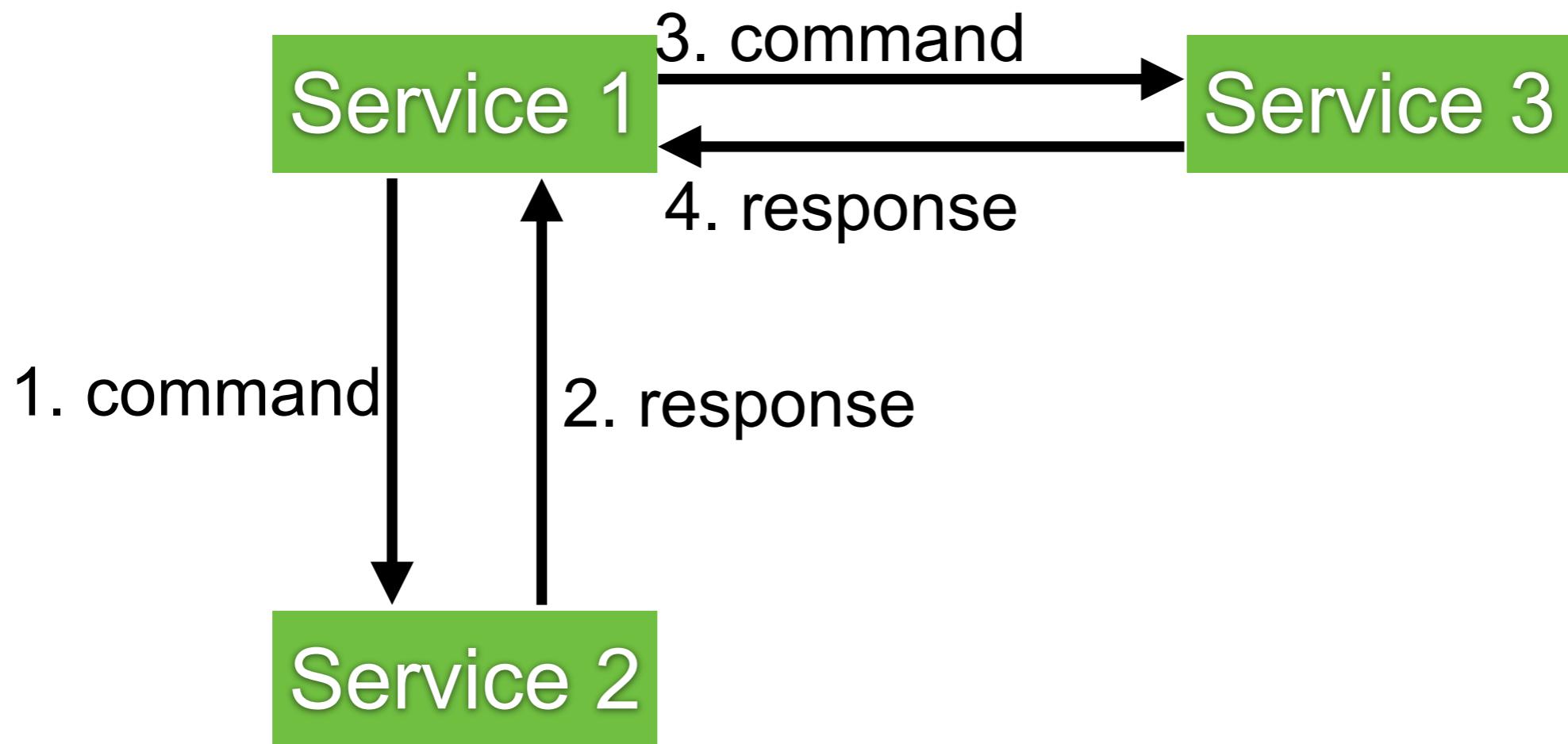


Example (Fail)

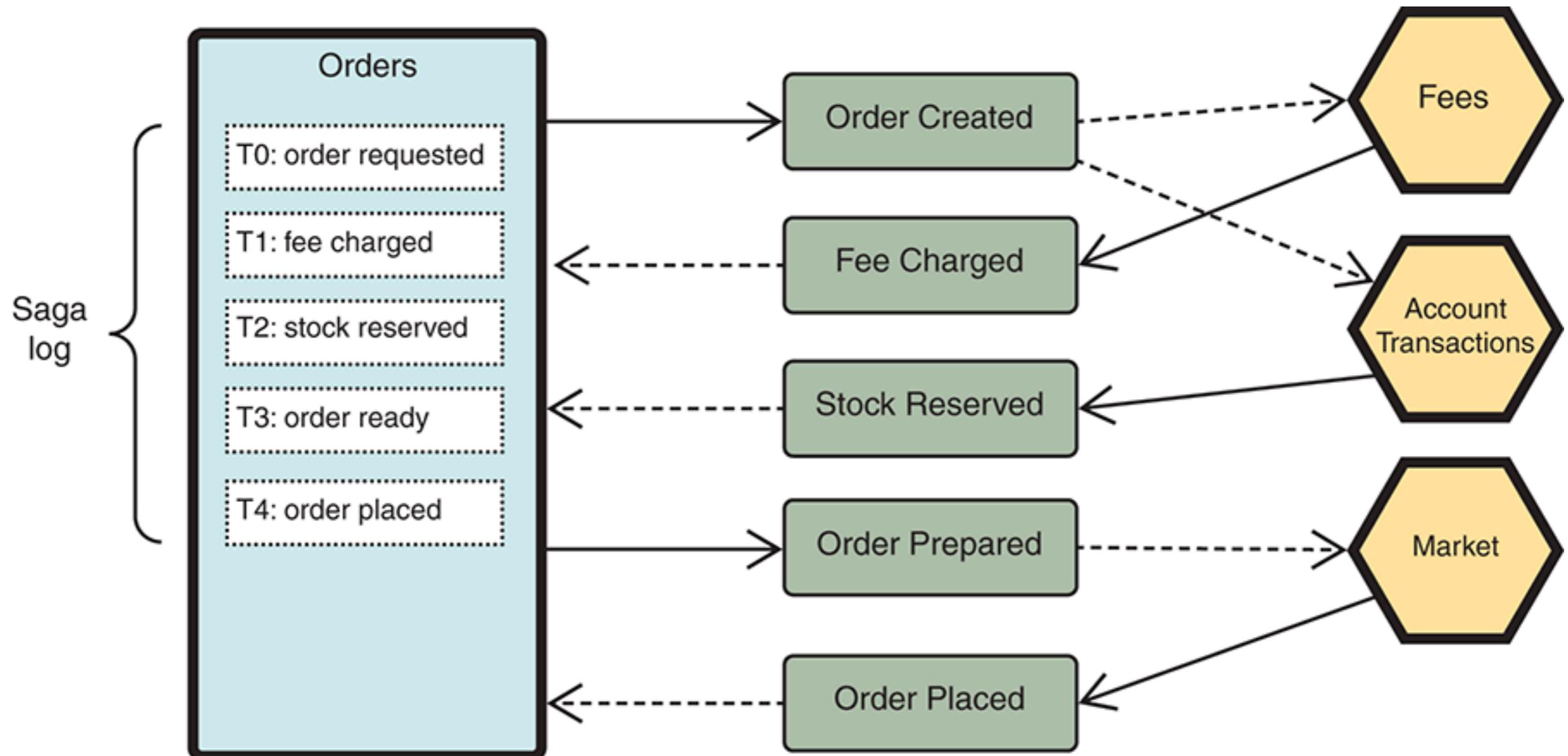


Orchestrate pattern

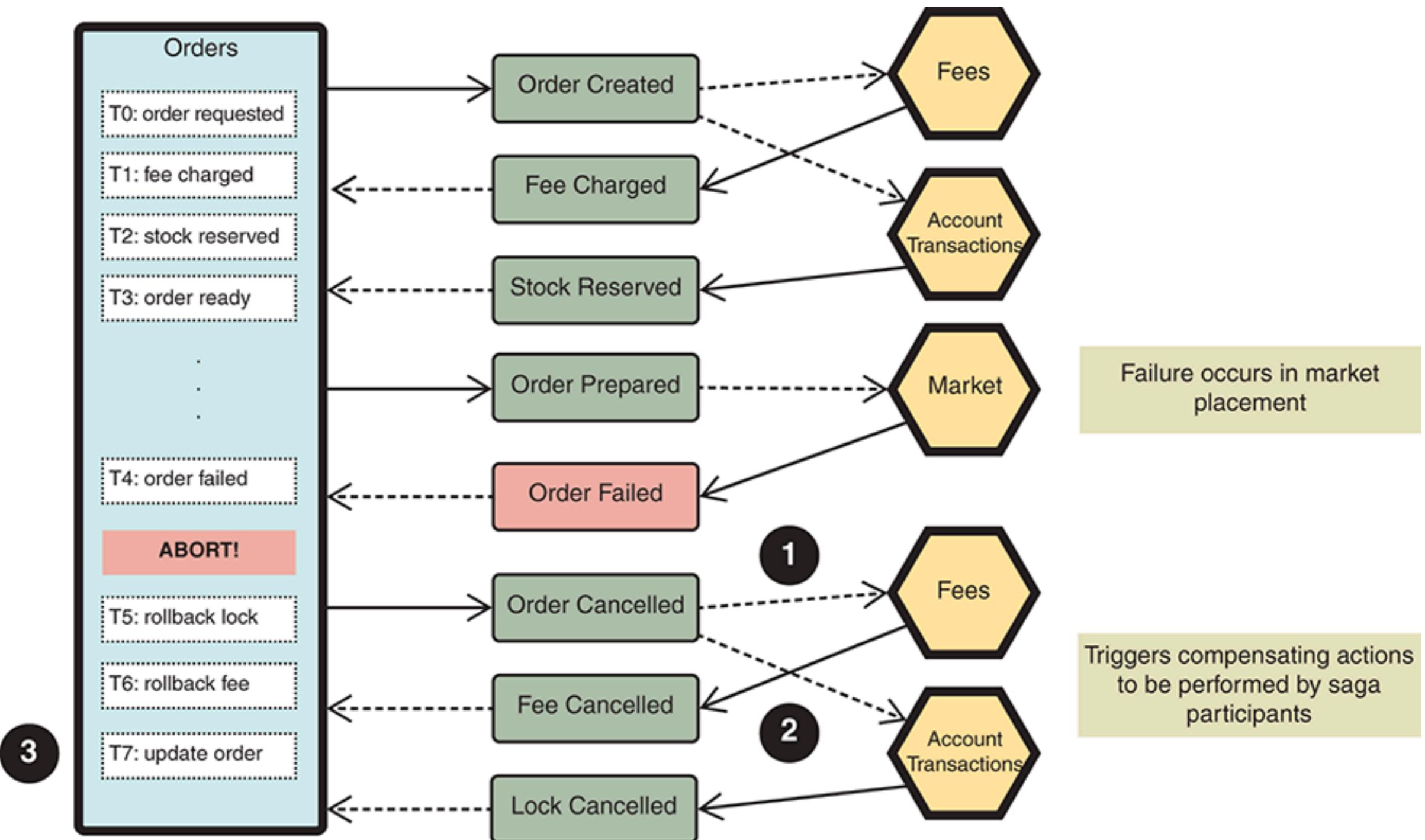
Sequence of Tx and emit **event or message** that trigger the next process in Tx



Example (Success)



Example (Fail)



Consistency patterns

Name	Strategy
Compensating action	Perform action that undo prior action(s)
Retry	Retry until success or timeout
Ignore	Do nothing in the event of errors
Restart	Reset to the original state and start again
Tentative operation	Perform a tentative operation and confirm (or cancel) later



“Saga”



Message vs Event

Message is addressed to someone

Event is something that happen and someone can react to that



Event sourcing

Maintain source of truth of business
Immutable sequence of events

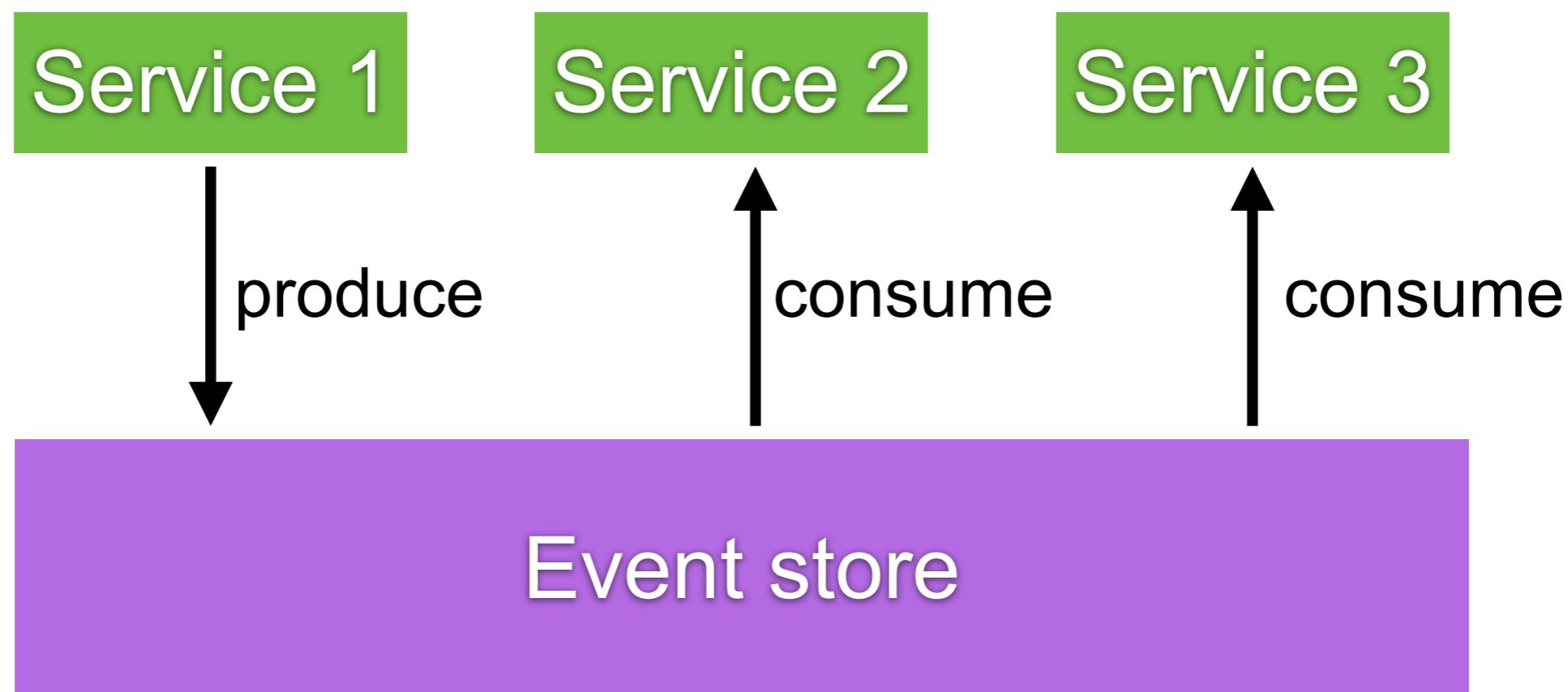


Sequence of event is keep in **Event store**



Event store

Keep events in order
Broadcast new event

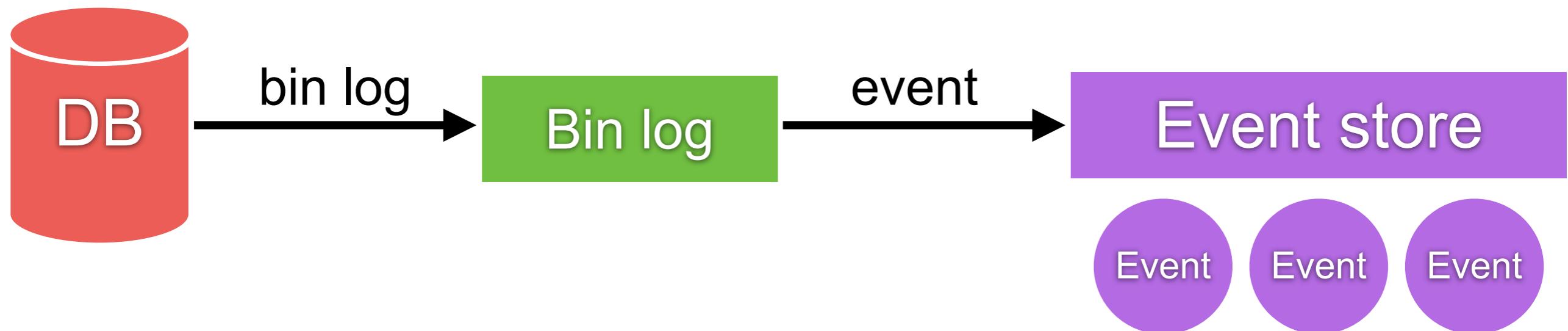


**With Event sourcing, we can
decouple services (query and
command)**



Event sourcing with database

Working with database



Binlog or Binary log event is information about data modification made to database



Event sourcing

Duplication data (denormalize database)
Complexity (separate query and command)
Difficult to maintain



Event sourcing can't solve all problems



Start with **understand** your purpose



Start with understand your
problem to resolve



How to implement queries ?



Query data from multiple services

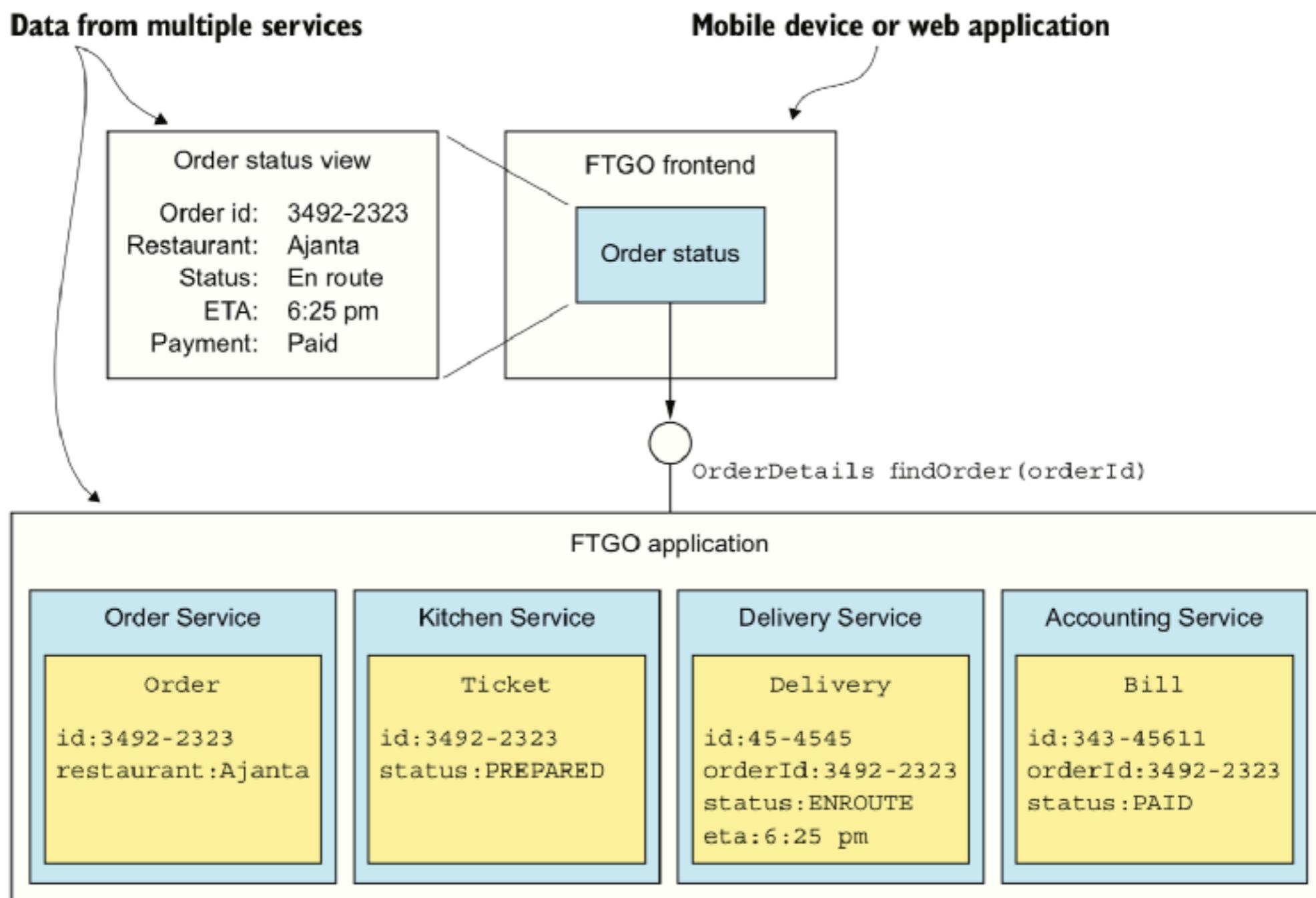
API composition

Cold data from services

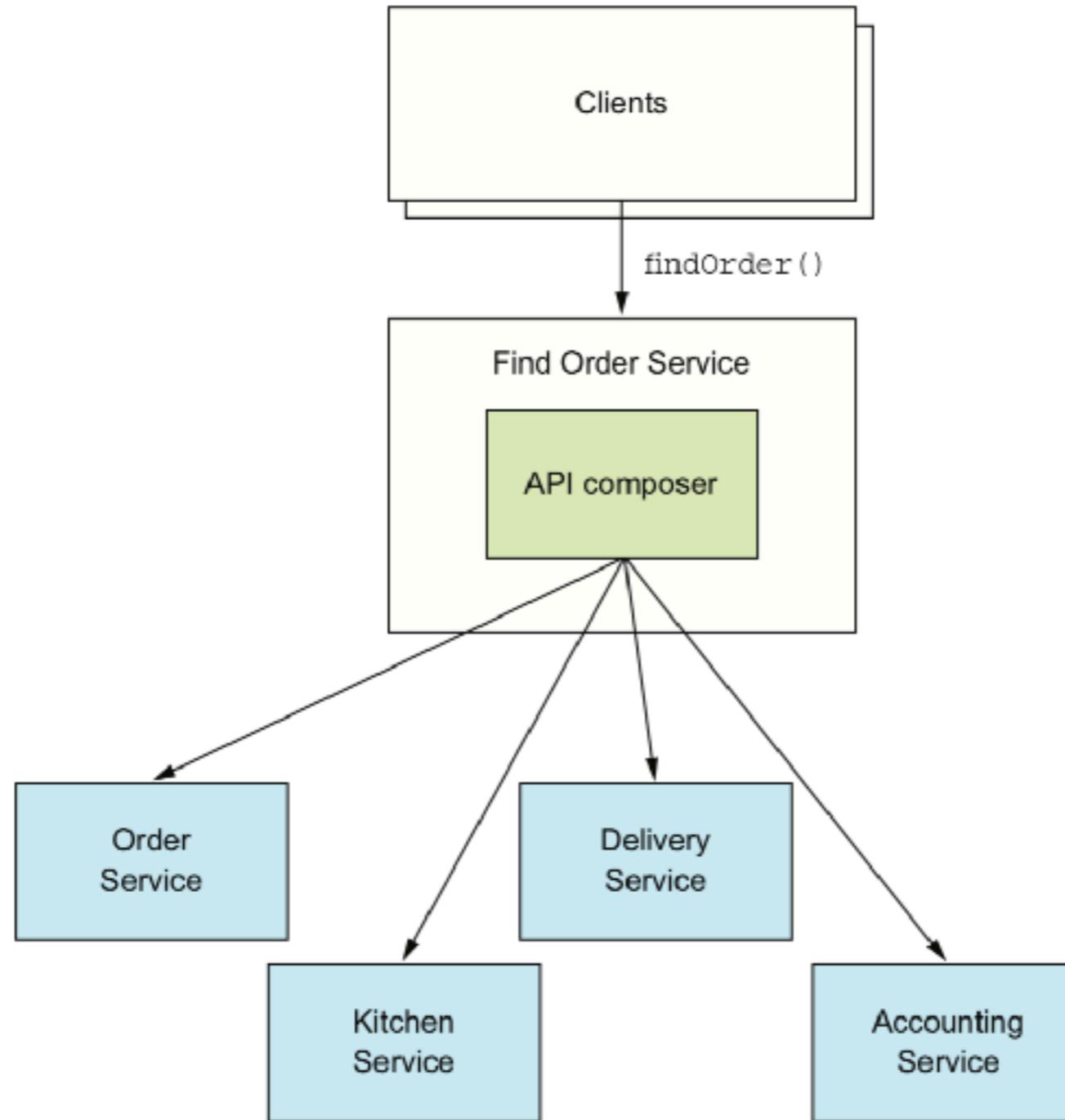
CQRS (Command Query Responsibility Segregation)



Problem ?



API composition pattern



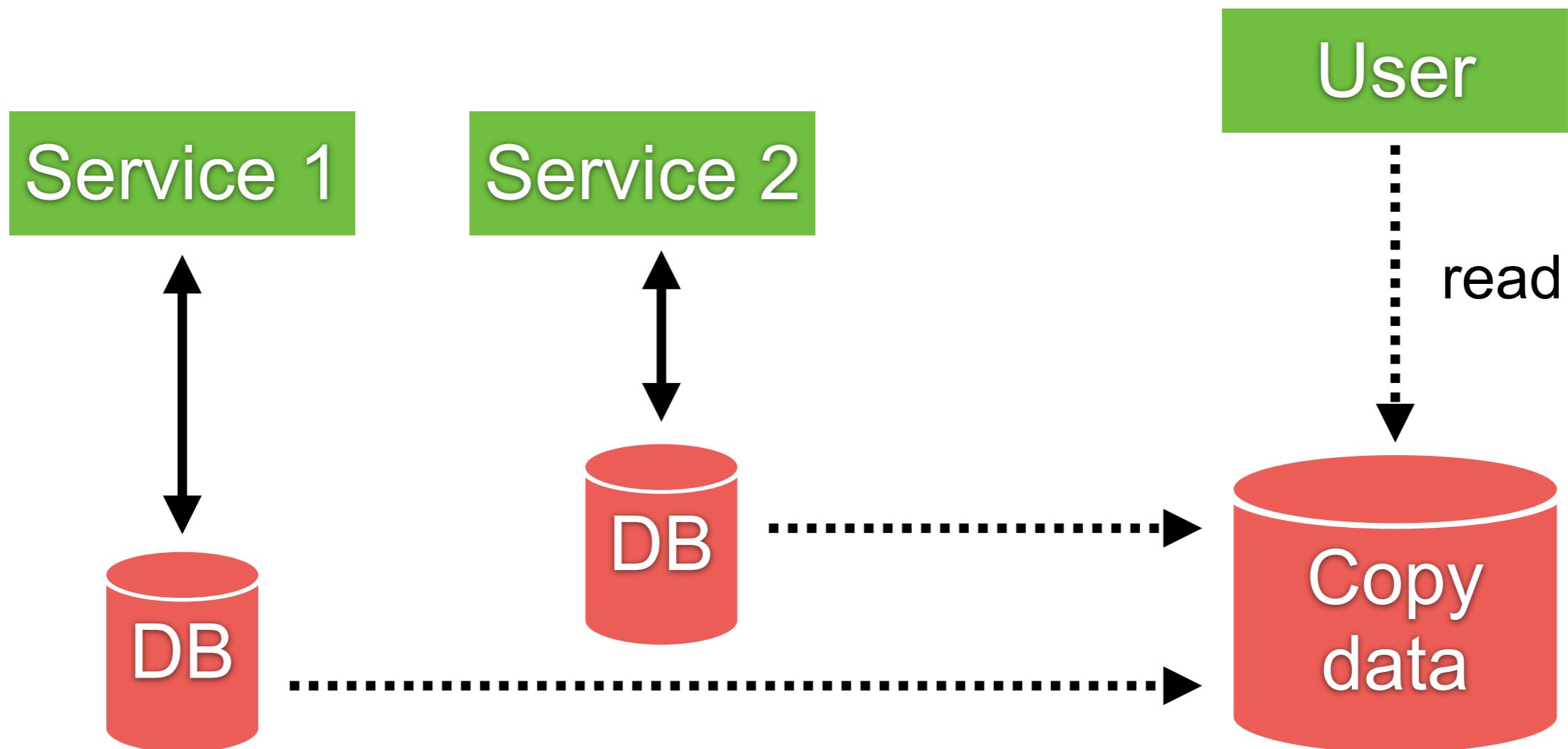
Drawbacks

Increase overhead
Lack of transactional data consistency
Reduce availability



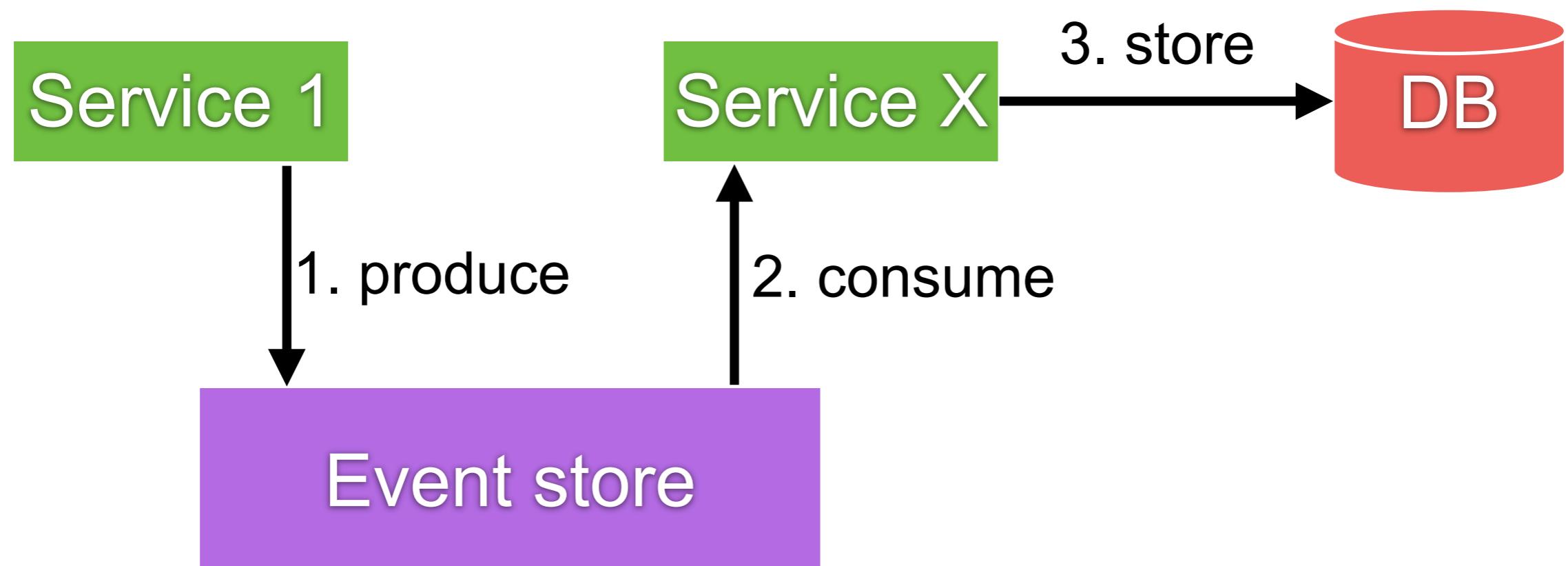
Storing copy data

Copy or caching data to other database



Working with Event-based

Publish event to store copy data

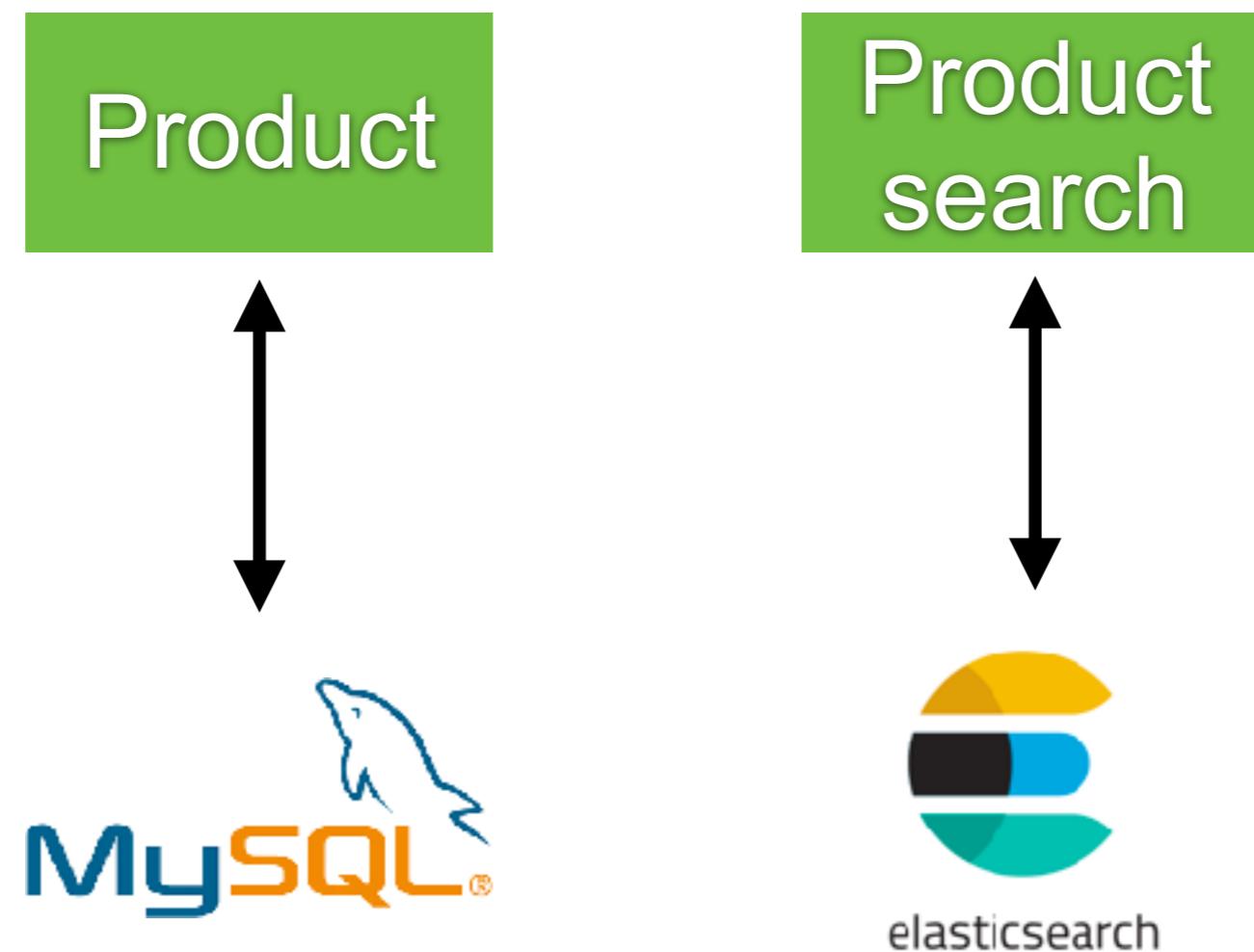


Separate query and command



Separate data for read and write

For example MySQL to write, Elasticsearch to search

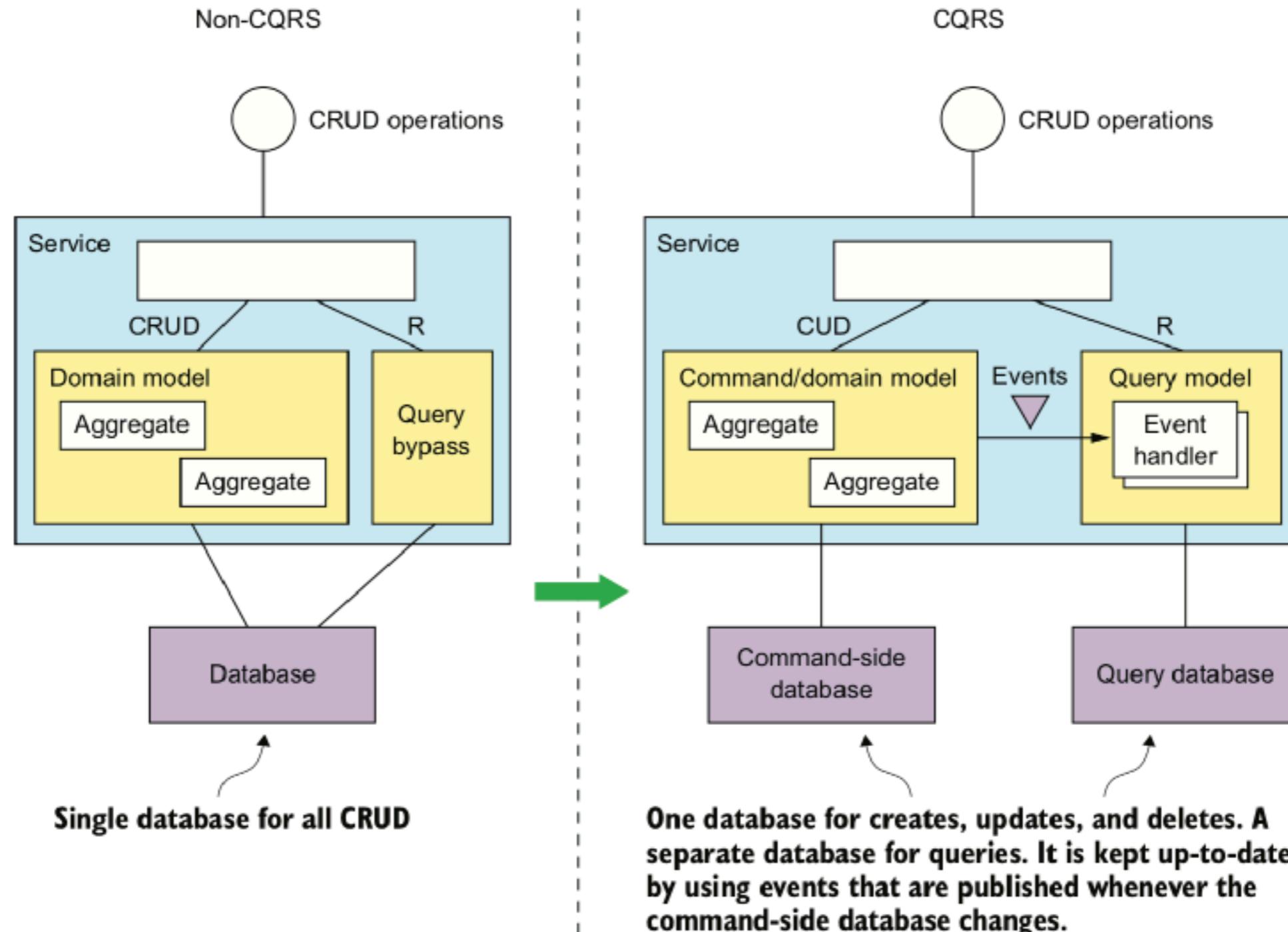


CQRS

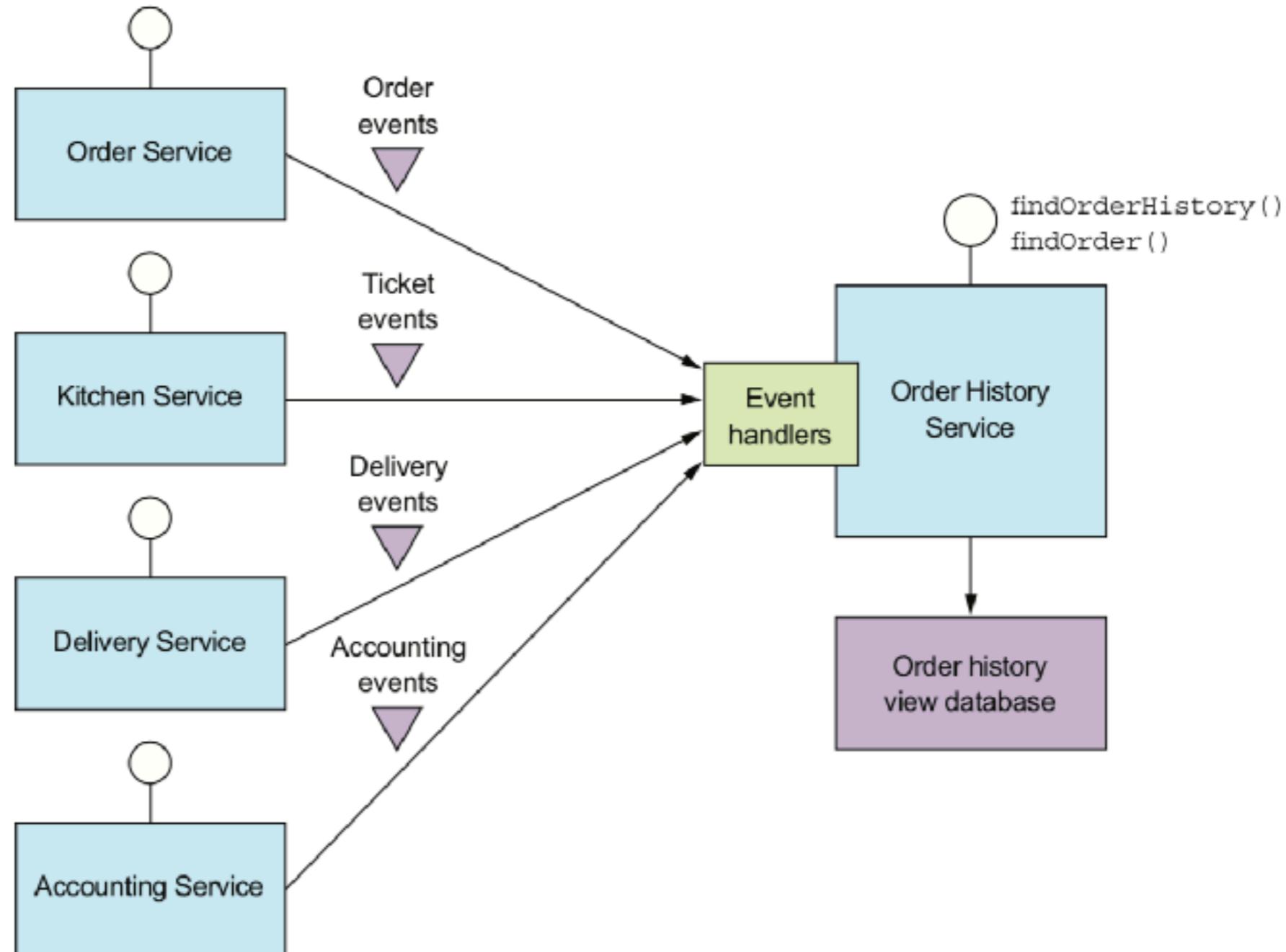
Command Query Responsibility Segregation



CQRS = Separate command from query



CQRS = Query-side service



Benefits

Improve separation of concern
Efficiency query



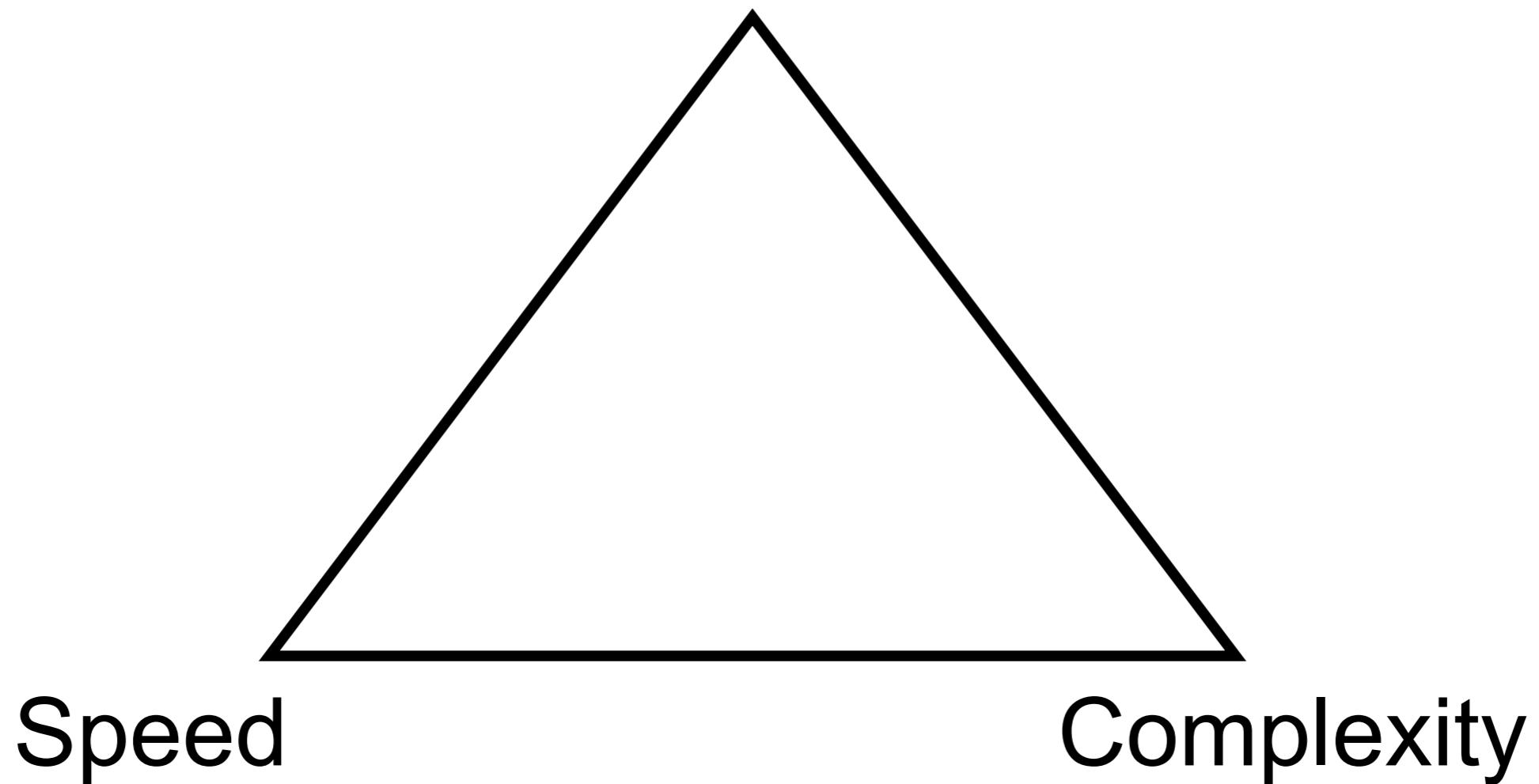
Drawbacks

More complex

Lag between command and query side



Customer value

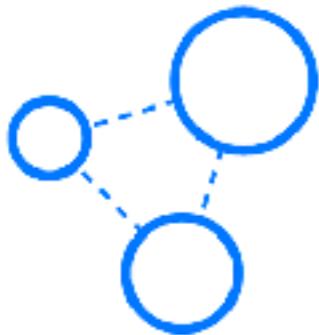


More ...



Beyond Microservice

Process and Organization



Flexible organizational structure

With clear roles and accountabilities



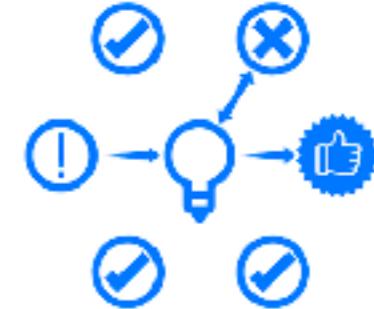
Efficient meeting formats

Geared toward action and eliminating over-analysis



More autonomy to teams and individuals

Individuals solve issues directly without bureaucracy



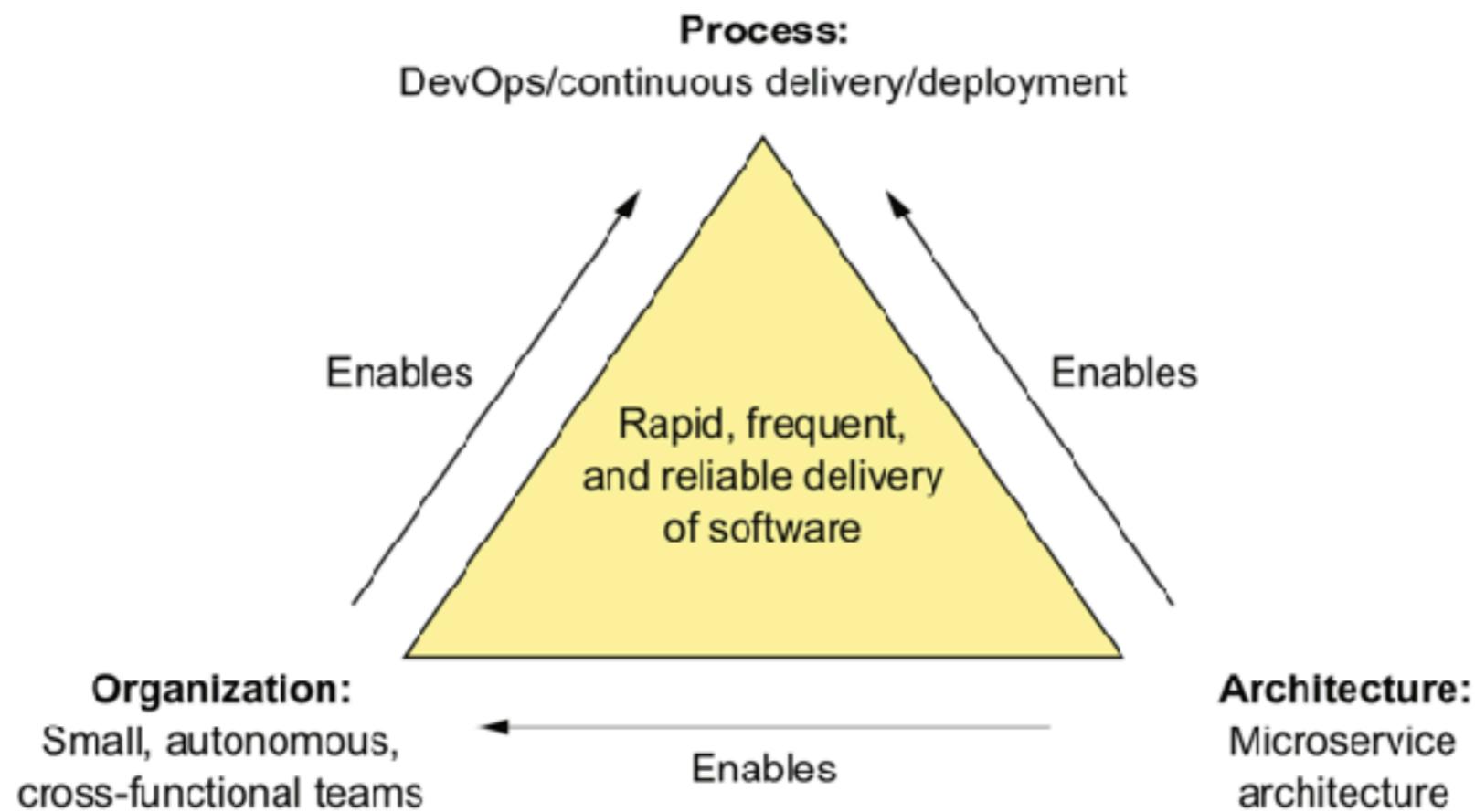
Unique decision-making process

To continuously evolve the organization's structure.



Success project needs ...

Organization process
Development process
Delivery process



Don't forget about the **human** side when adopt Microservice



“organizations which design systems ... are constrained to produce designs which are copies of the communication structures of these organizations”

- *Melvin Conwey, 1968* -



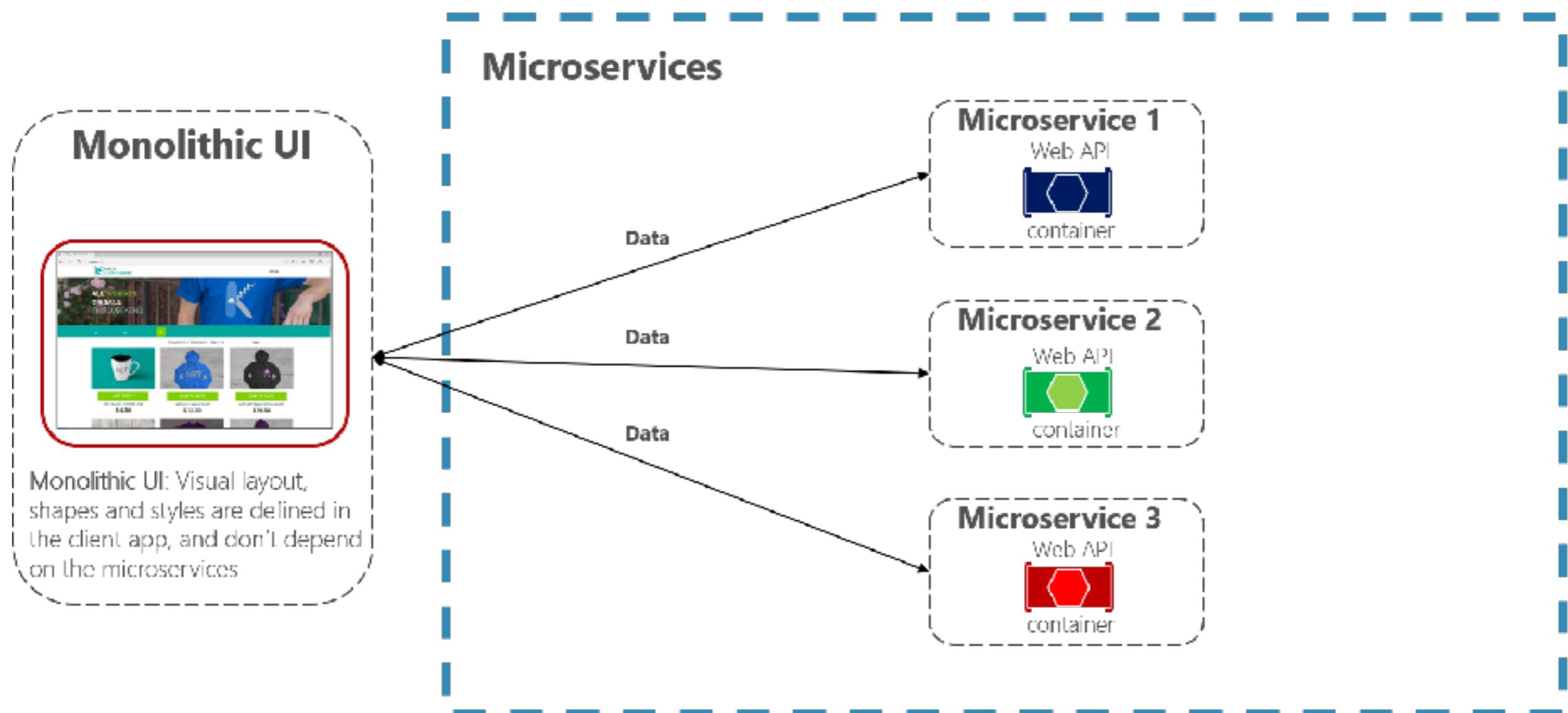
More ...



Integrate services with User Interface



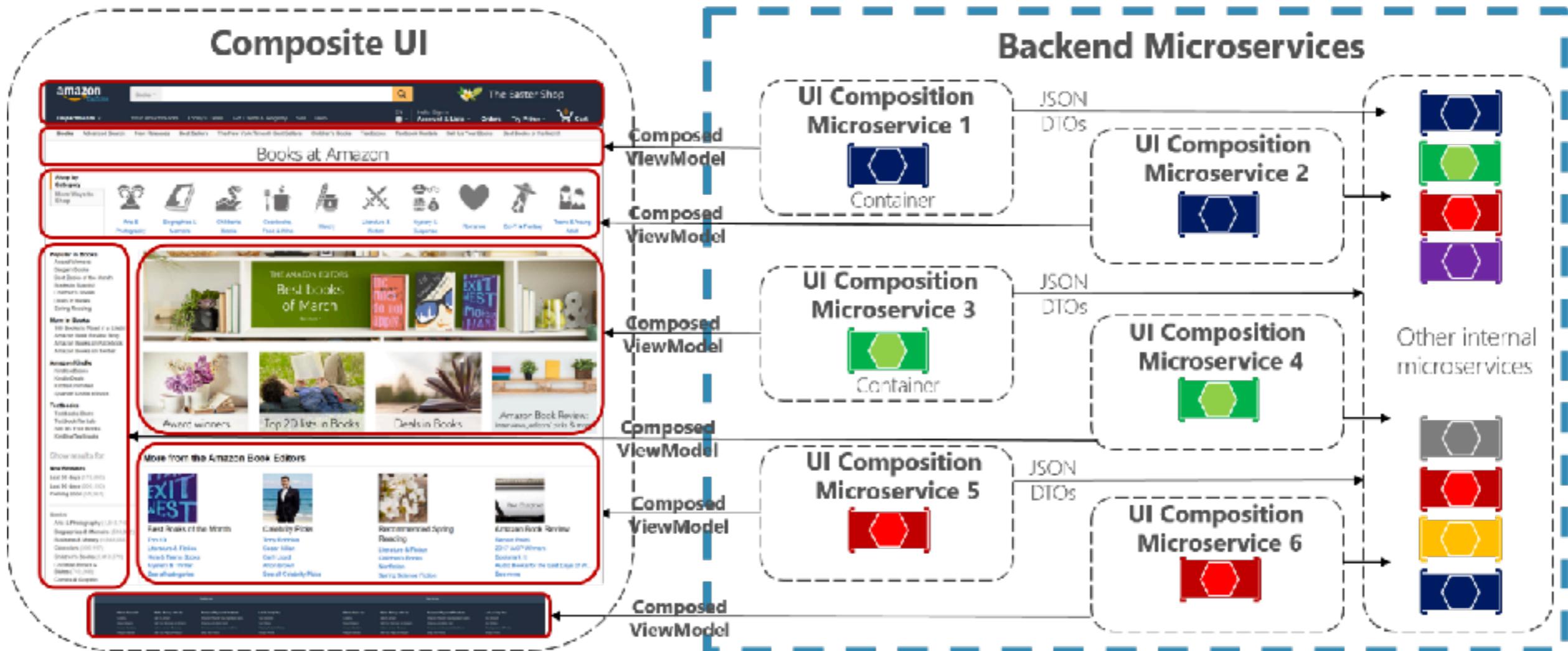
Monolithic UI consuming microservices



<https://docs.microsoft.com>



Composite UI generated by microservices



<https://docs.microsoft.com>

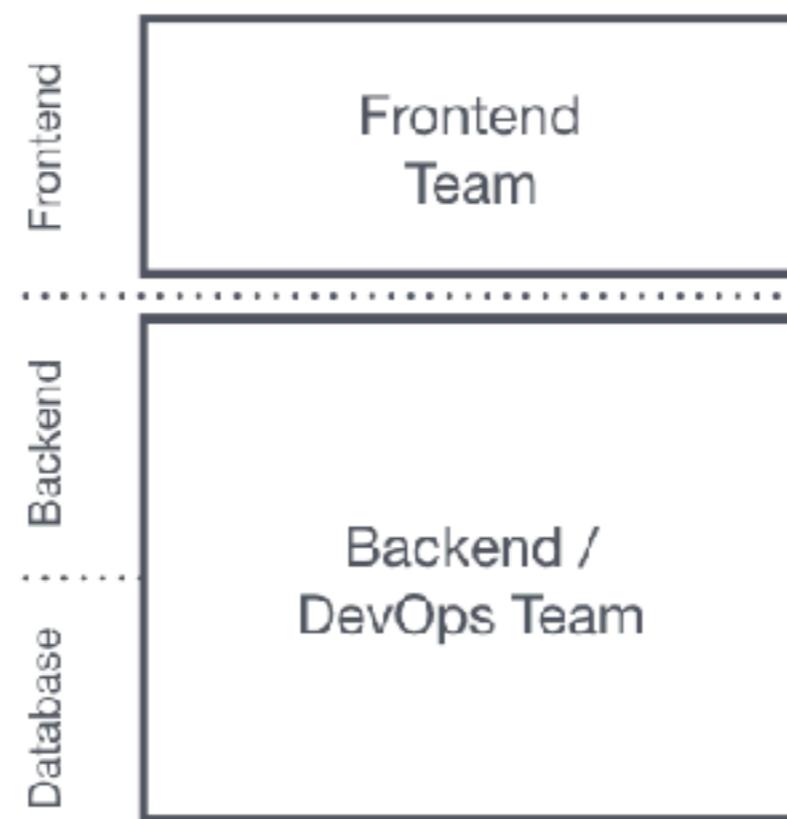


Monolith frontend

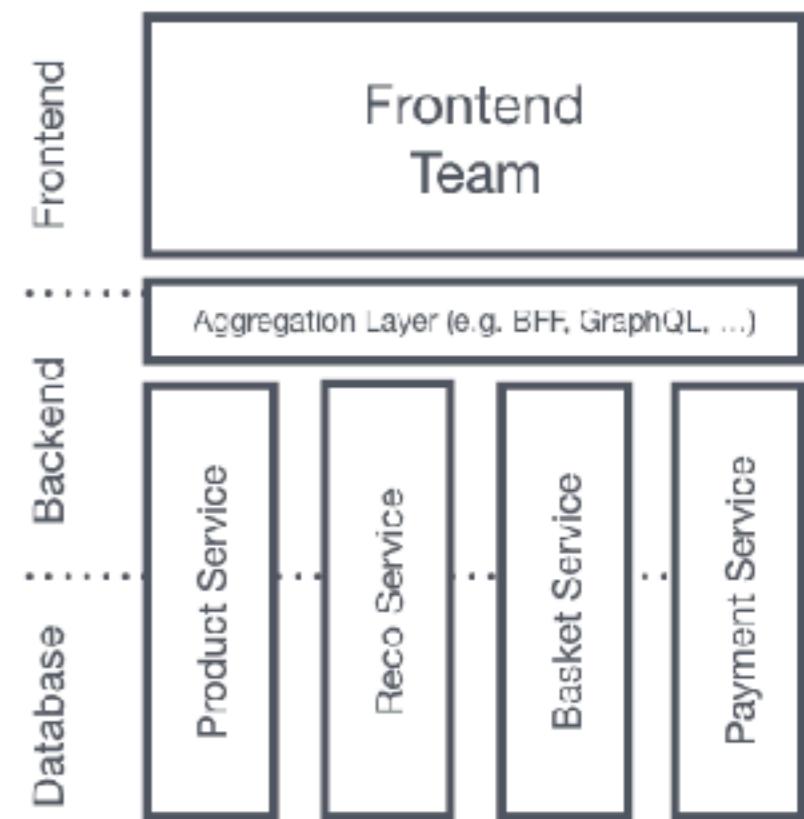
The Monolith



Front & Back



Microservices

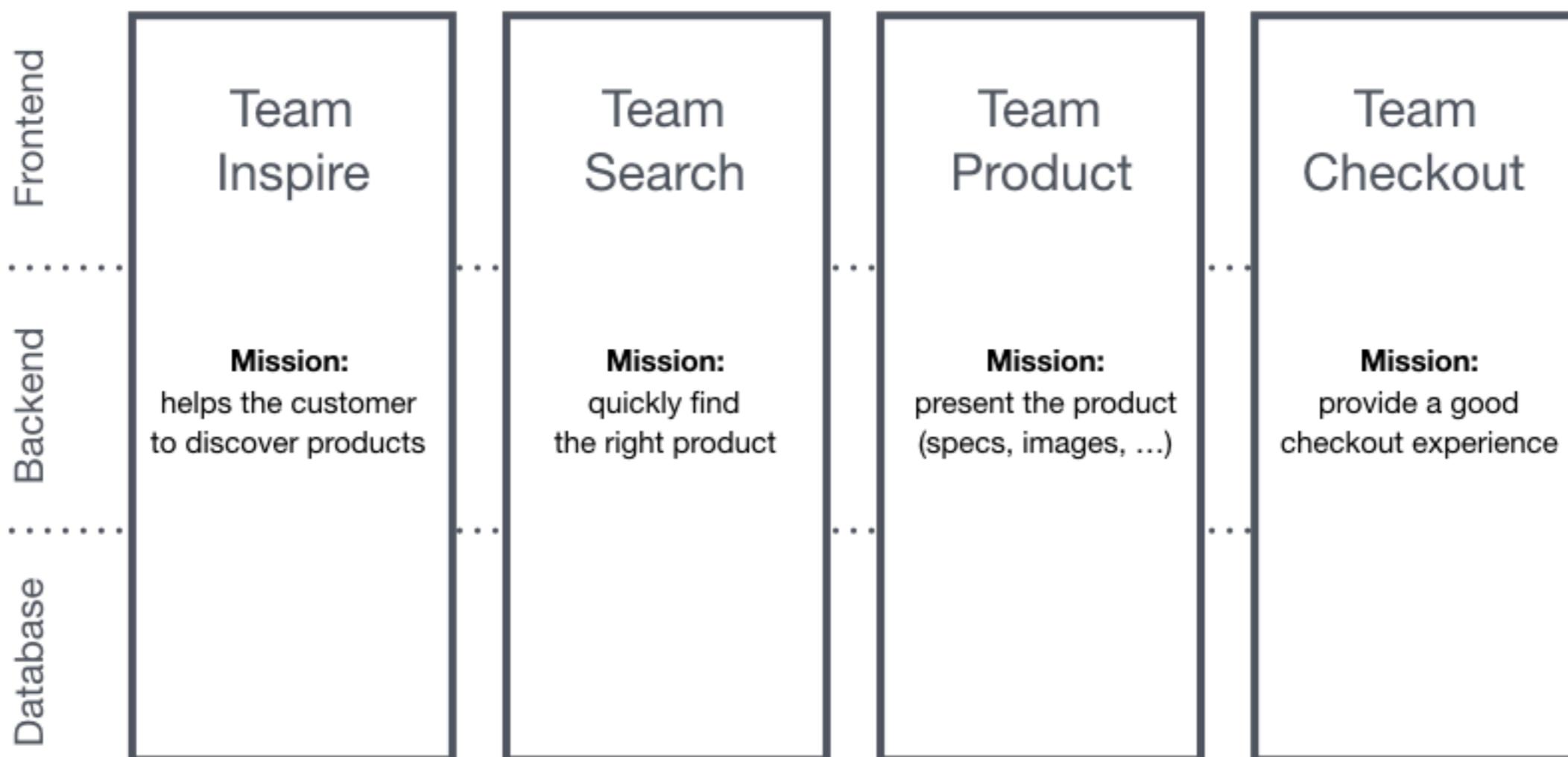


<https://micro-frontends.org/>



Micro frontend

End-to-End Teams with Micro Frontends



<https://micro-frontends.org/>



Summary



Let's start with good monolith



Module 1

Module 2

Module 3

Module 4

Module 5

Module 6



Find your problem



Module 1

Module 2

Module 3

Module 4

Module 5

Module 6



Module 1

Module 2

Module 3

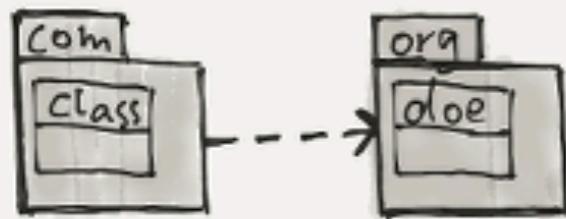
Module 5

Module 6

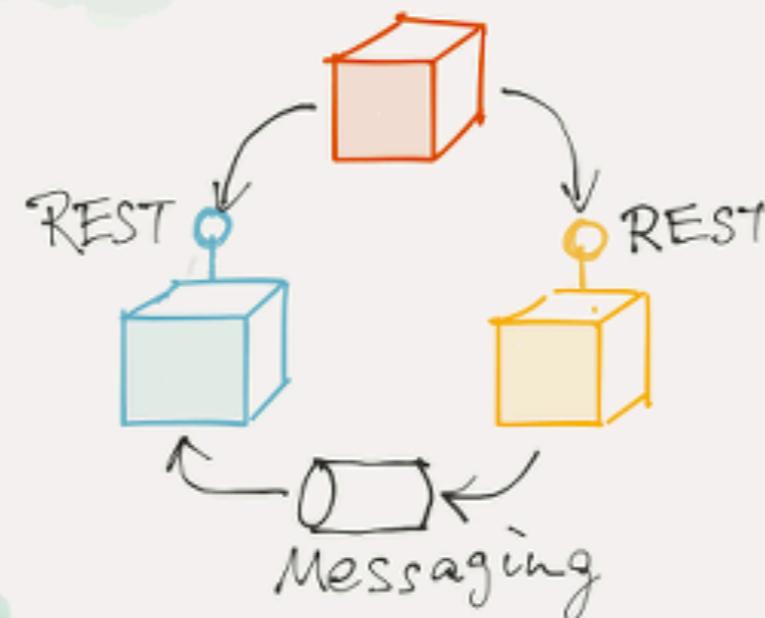
Module 4



Architecture



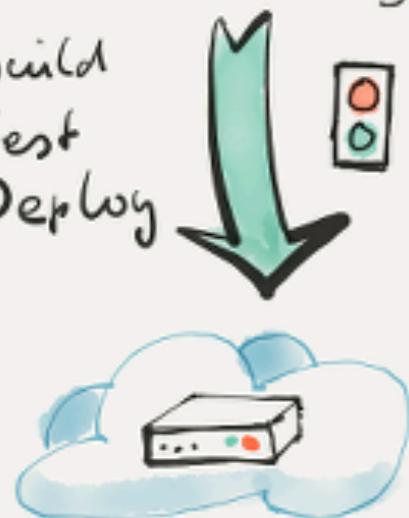
Microservices



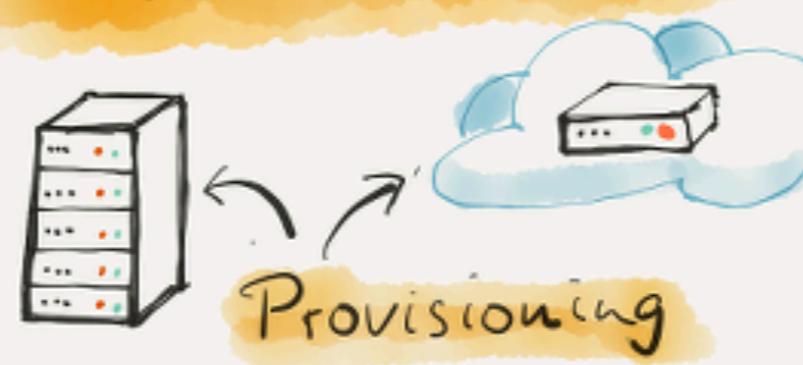
Deployment

Continuous Delivery

`{ var i=1; }`
Build
Test
Deploy



Infrastructure

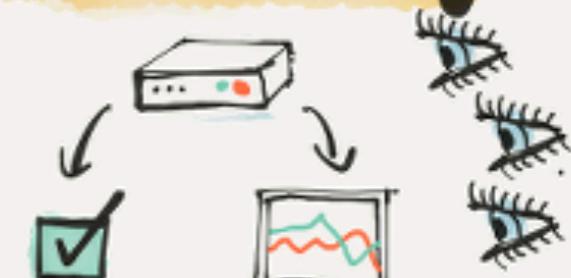


People & Teams



Communication
Collaboration

Monitoring

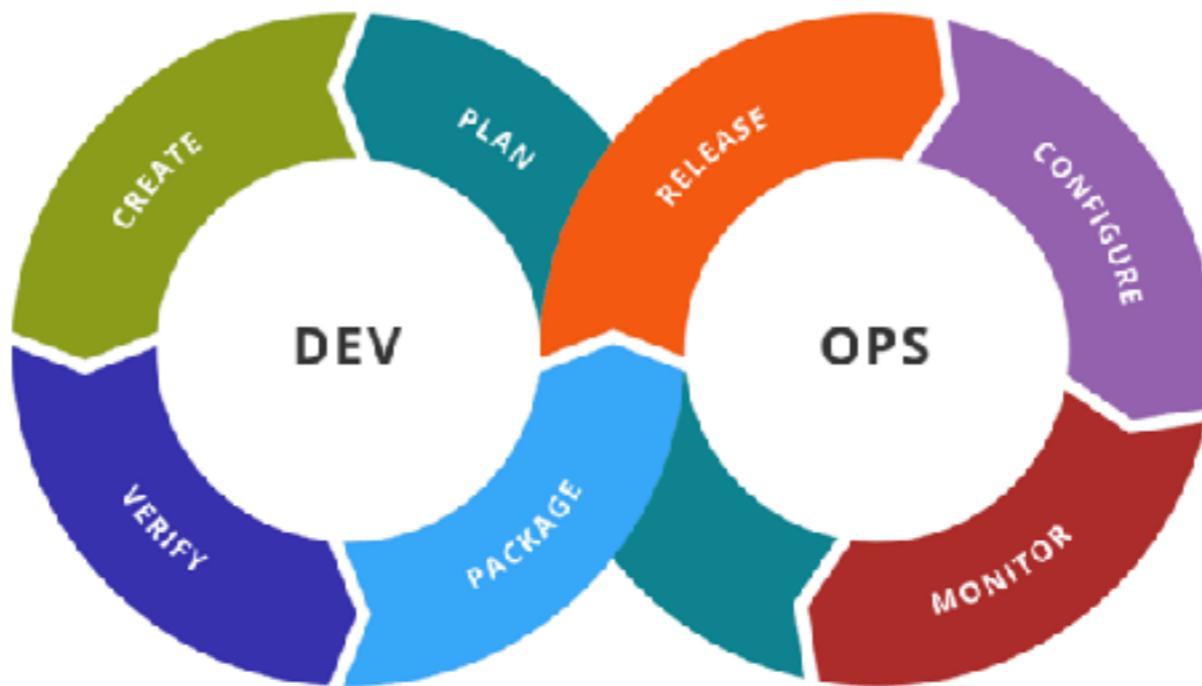


Features & Technology



Microservice prerequisites

Rapid provisioning
Basic monitoring
Rapid Application Deployment
DevOps culture



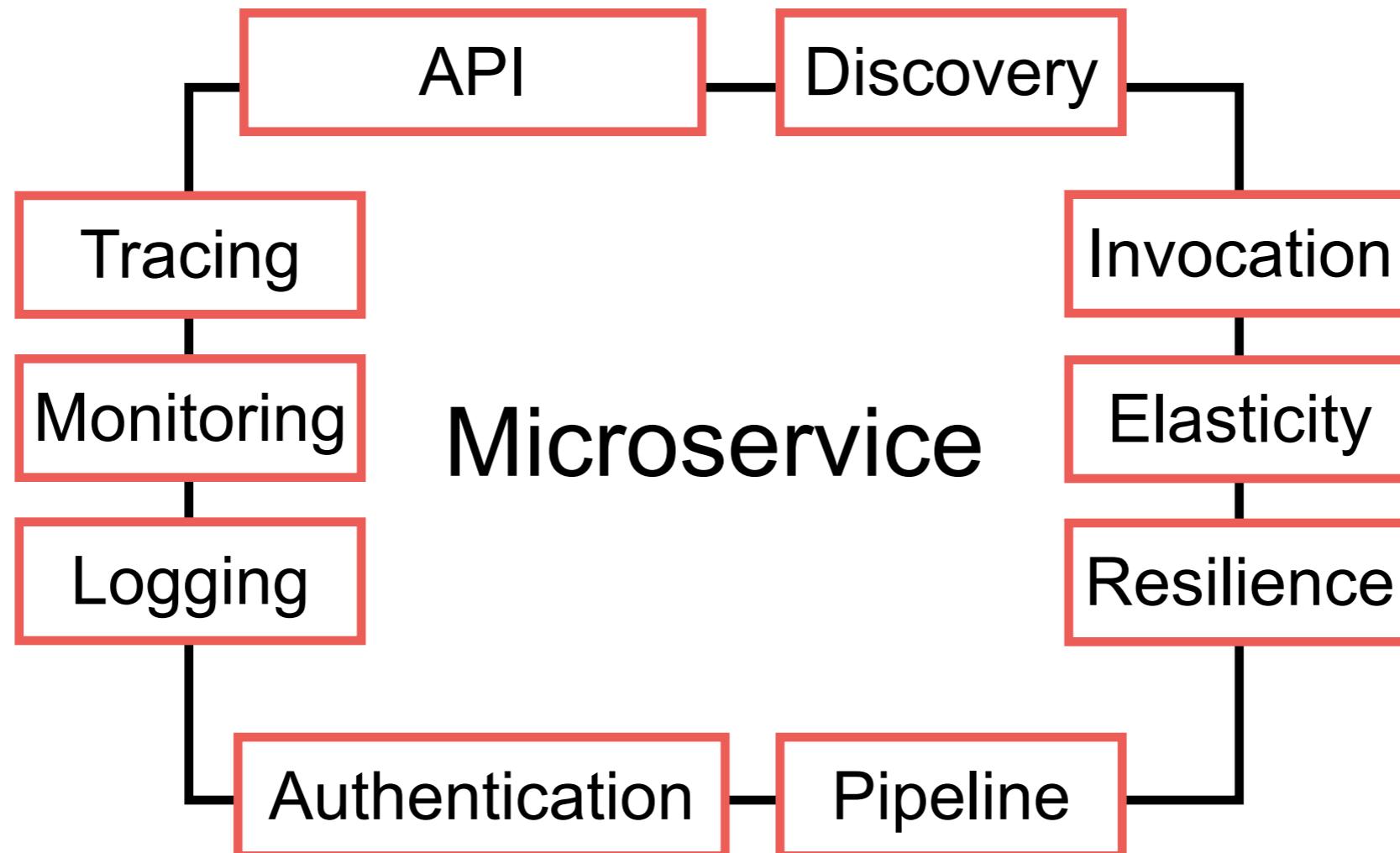
Design Workshop



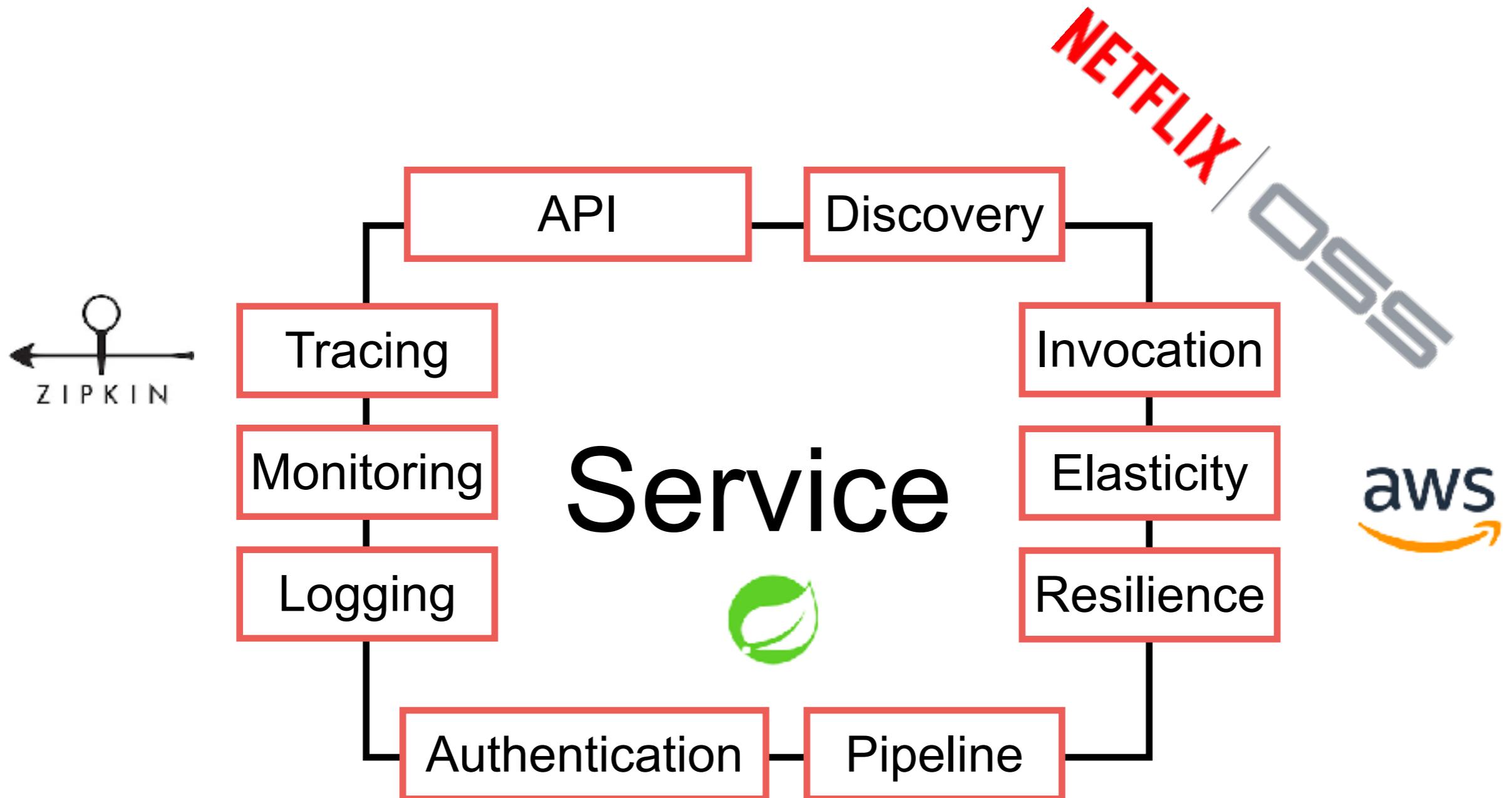
Module 2 : Develop



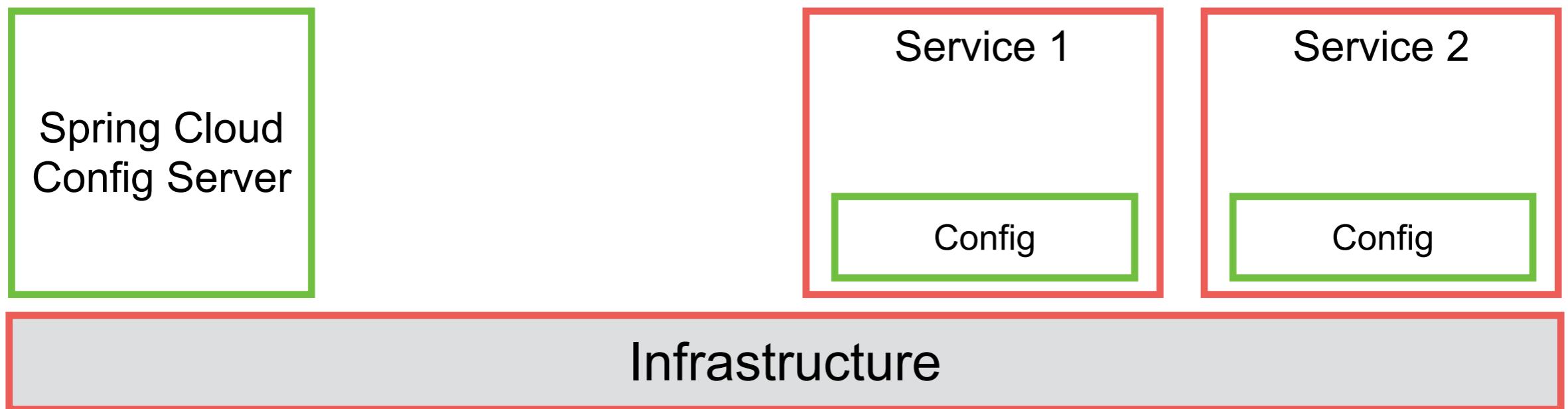
Properties of Microservice



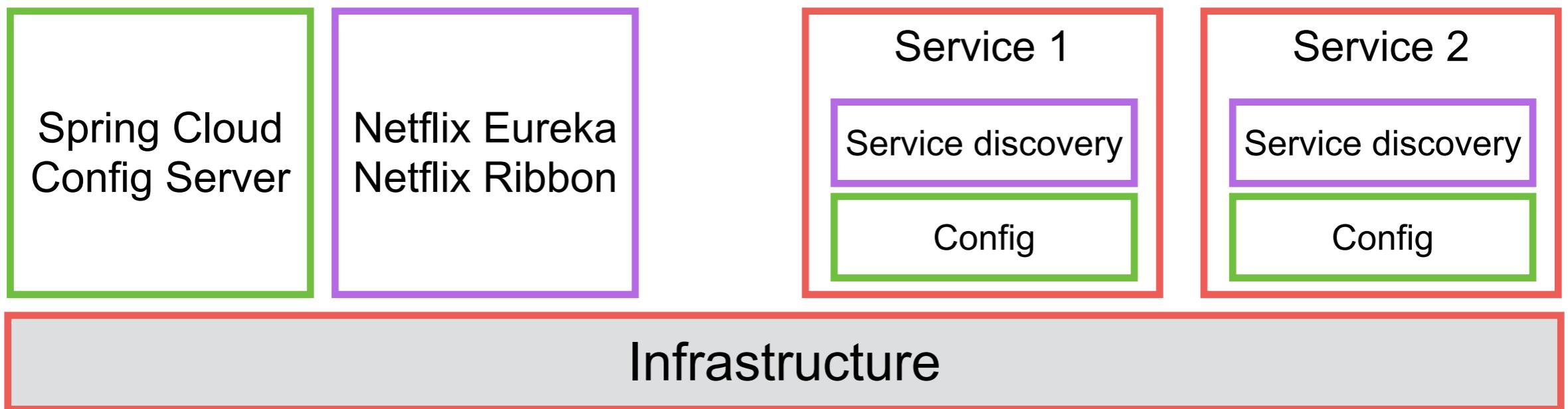
Microservice 1.0



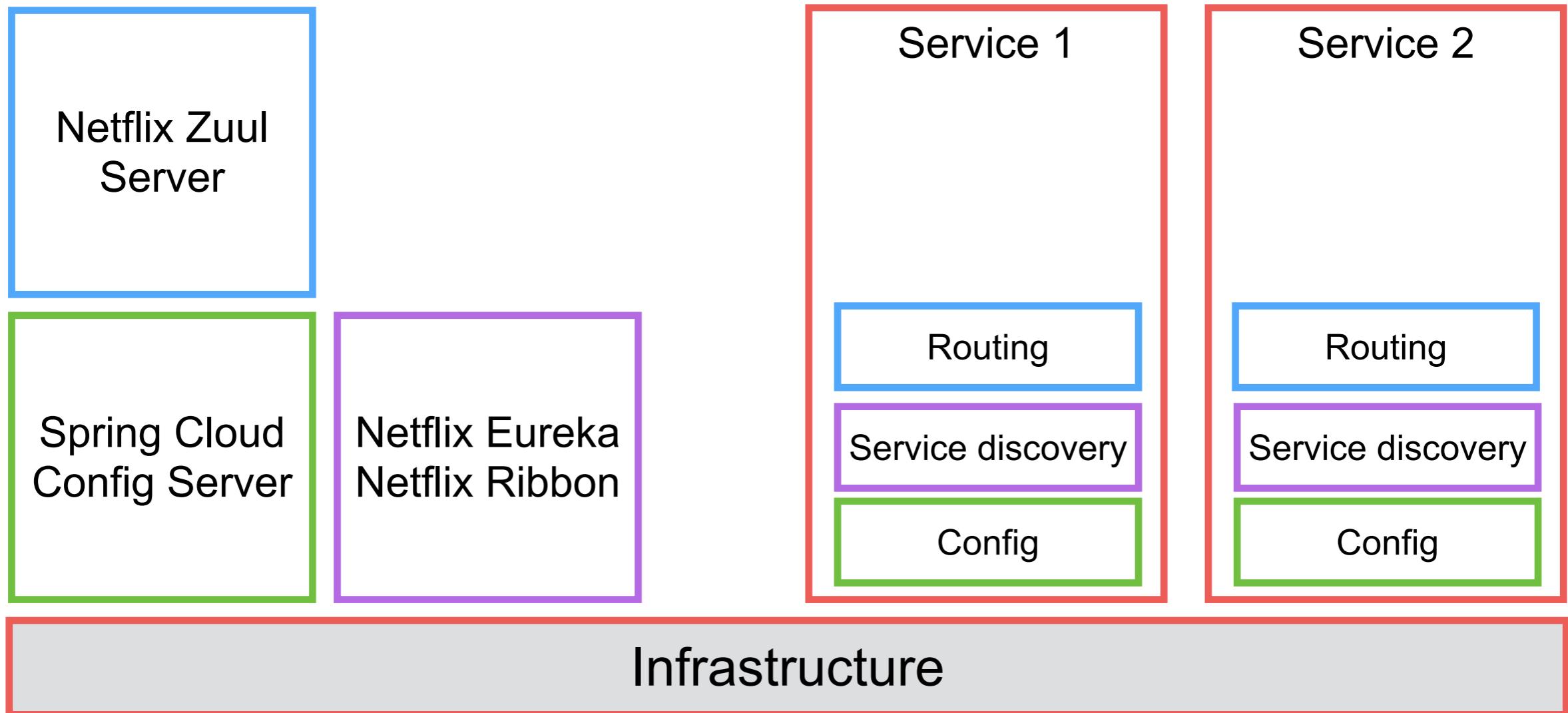
Configuration



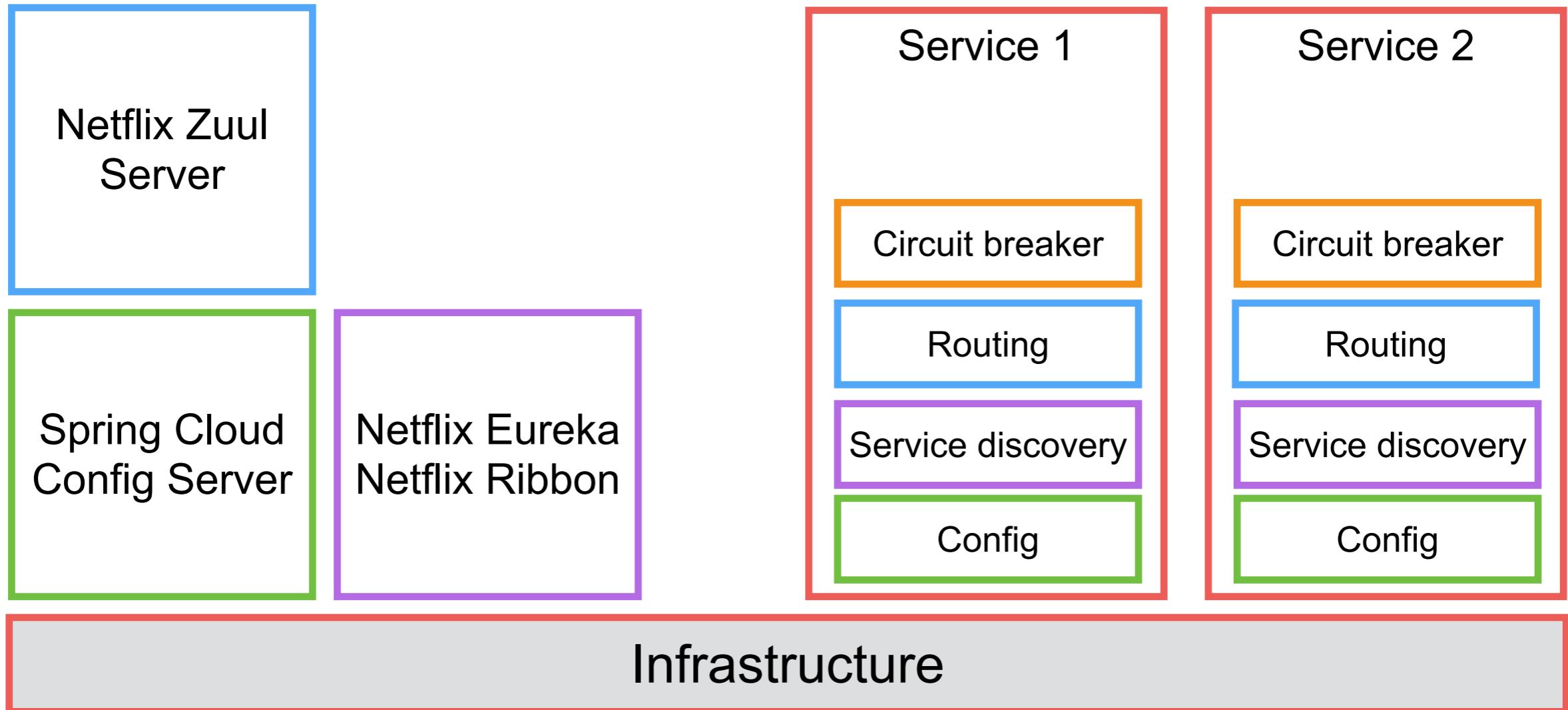
Service Discovery



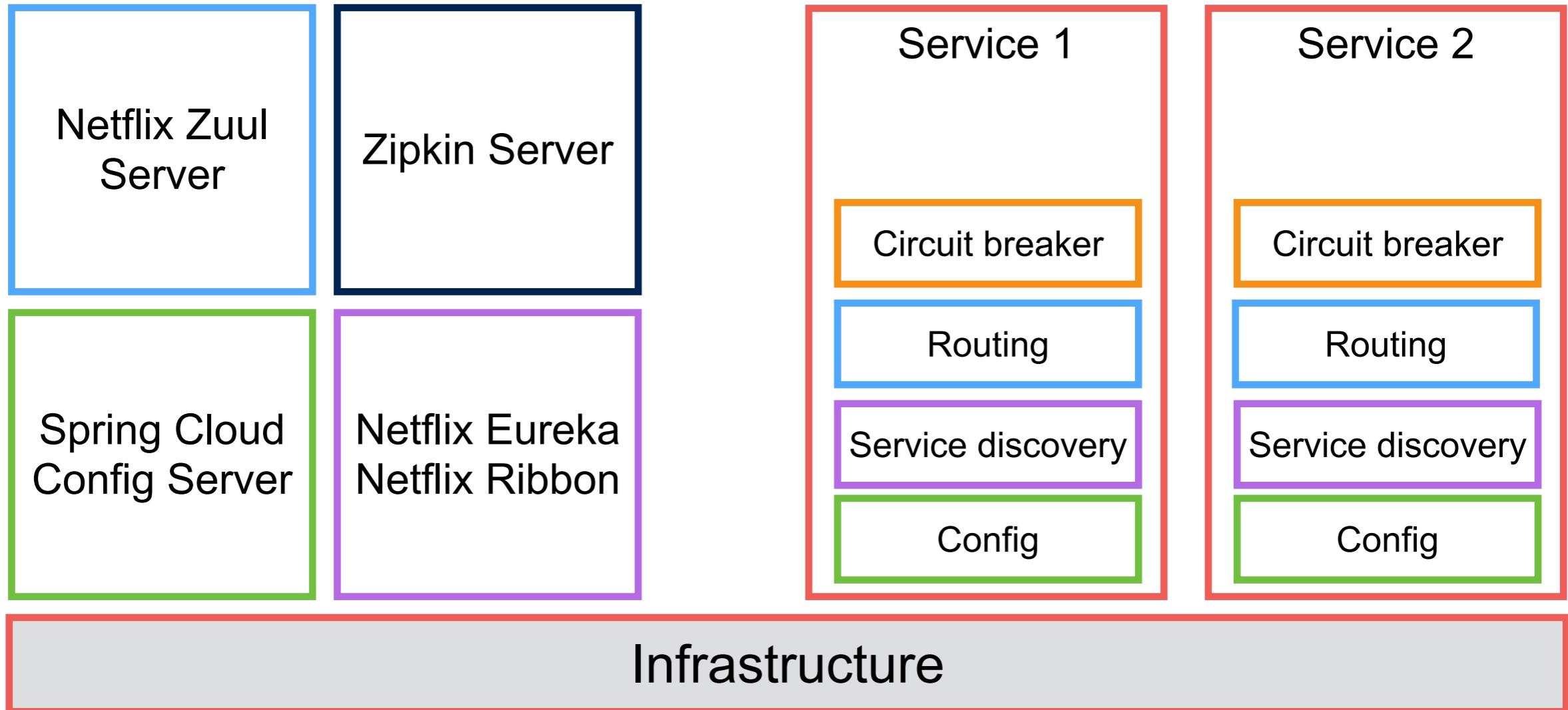
Dynamic Routing



Fault Tolerance



Tracing and Visibility



Microservice 1.0

JVM only
Add libraries to your code/service

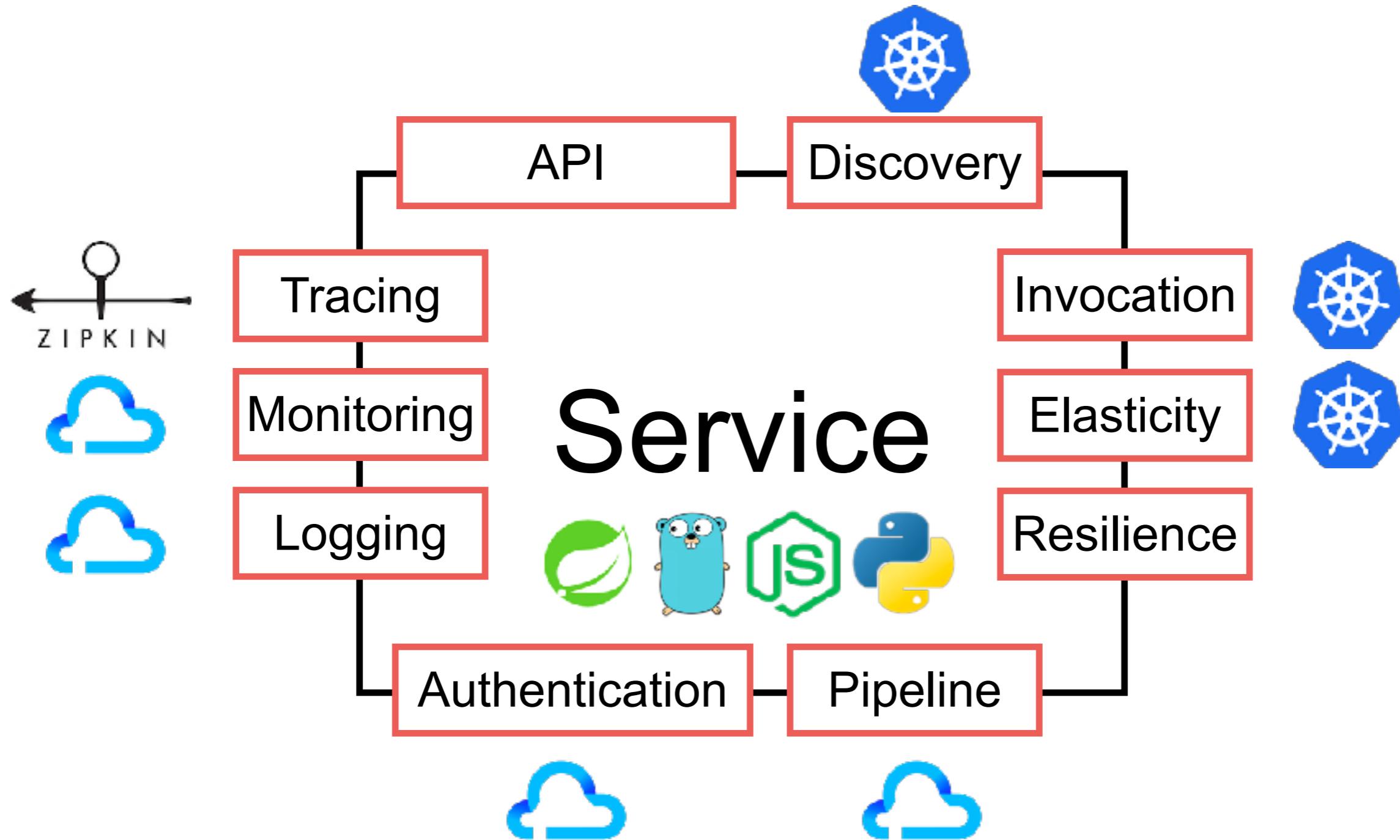


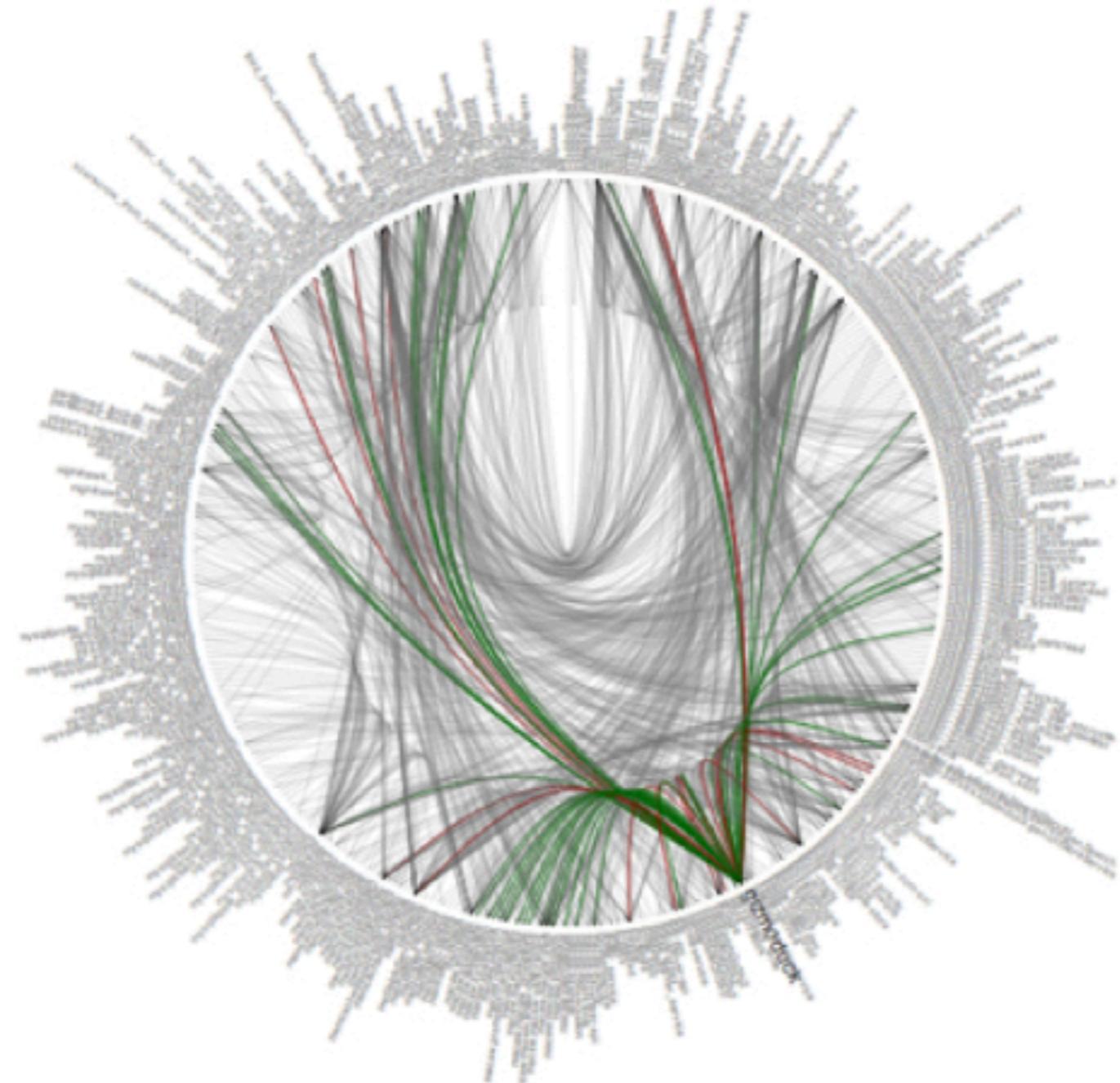


kubernetes



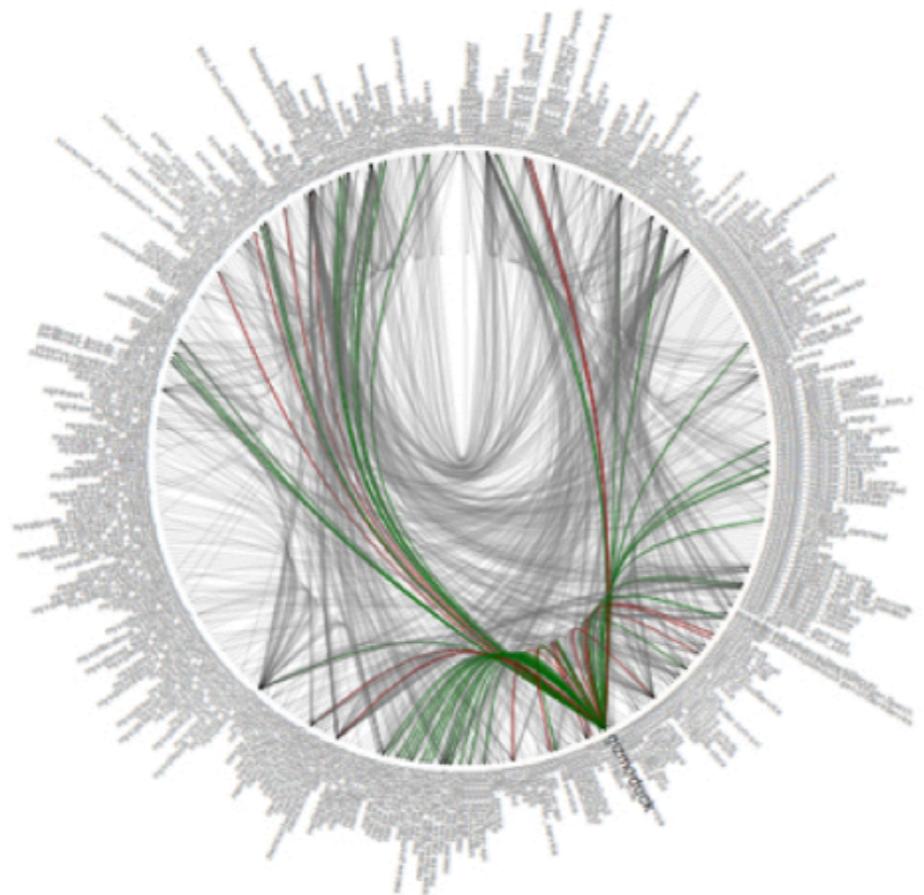
Microservice 2.0





Service Mesh

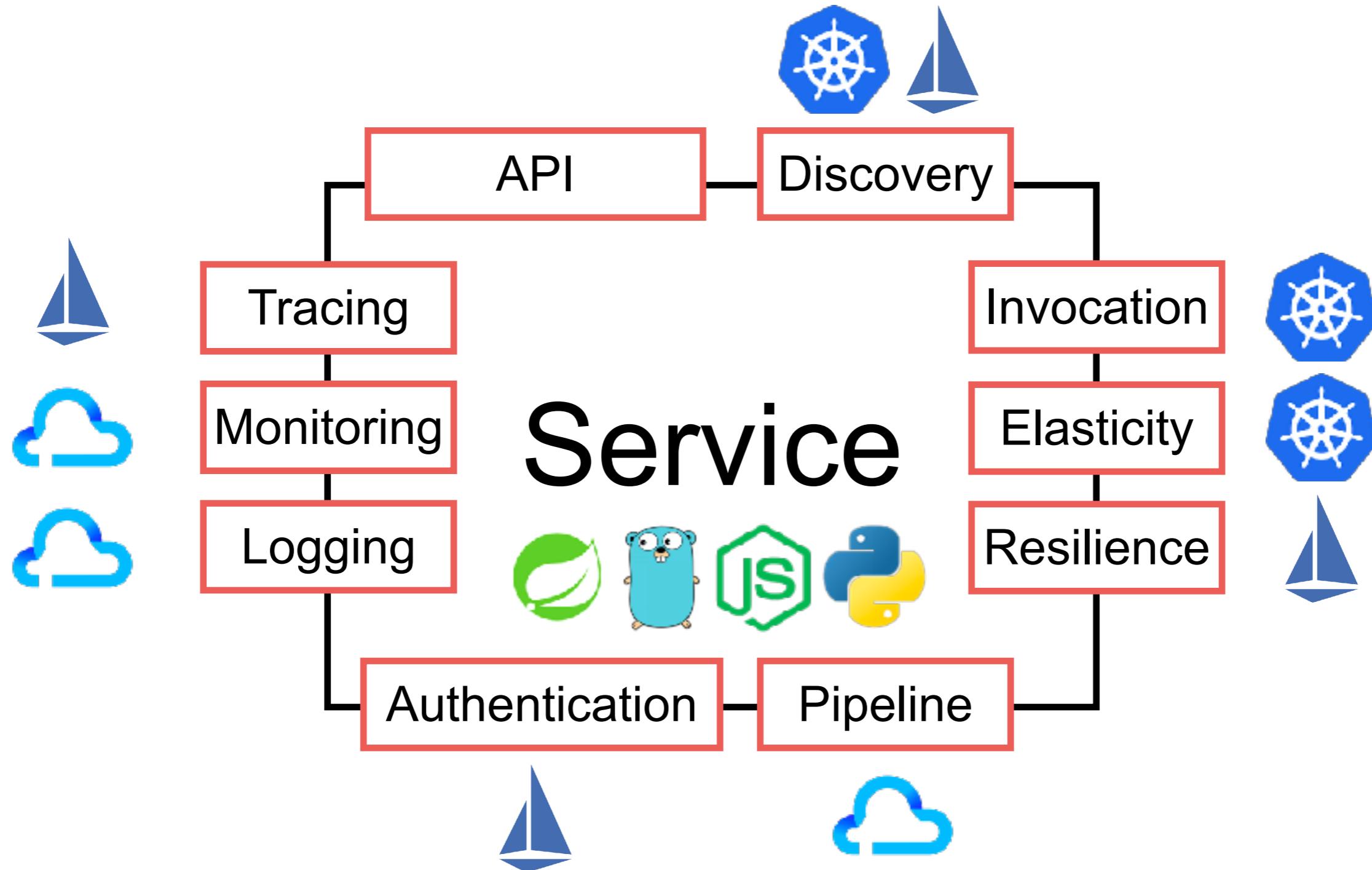




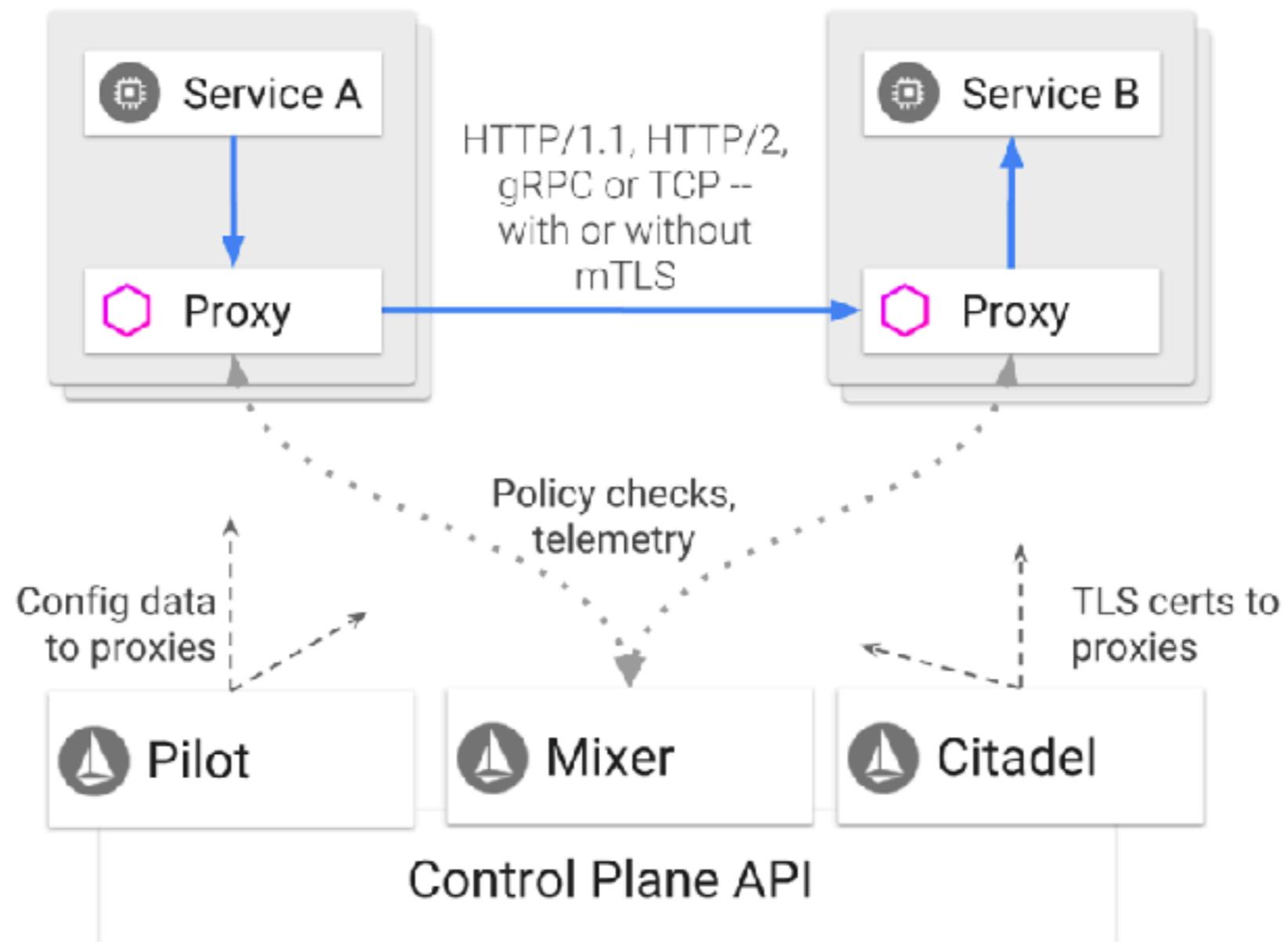
Service Mesh with Istio



Microservice 3.0



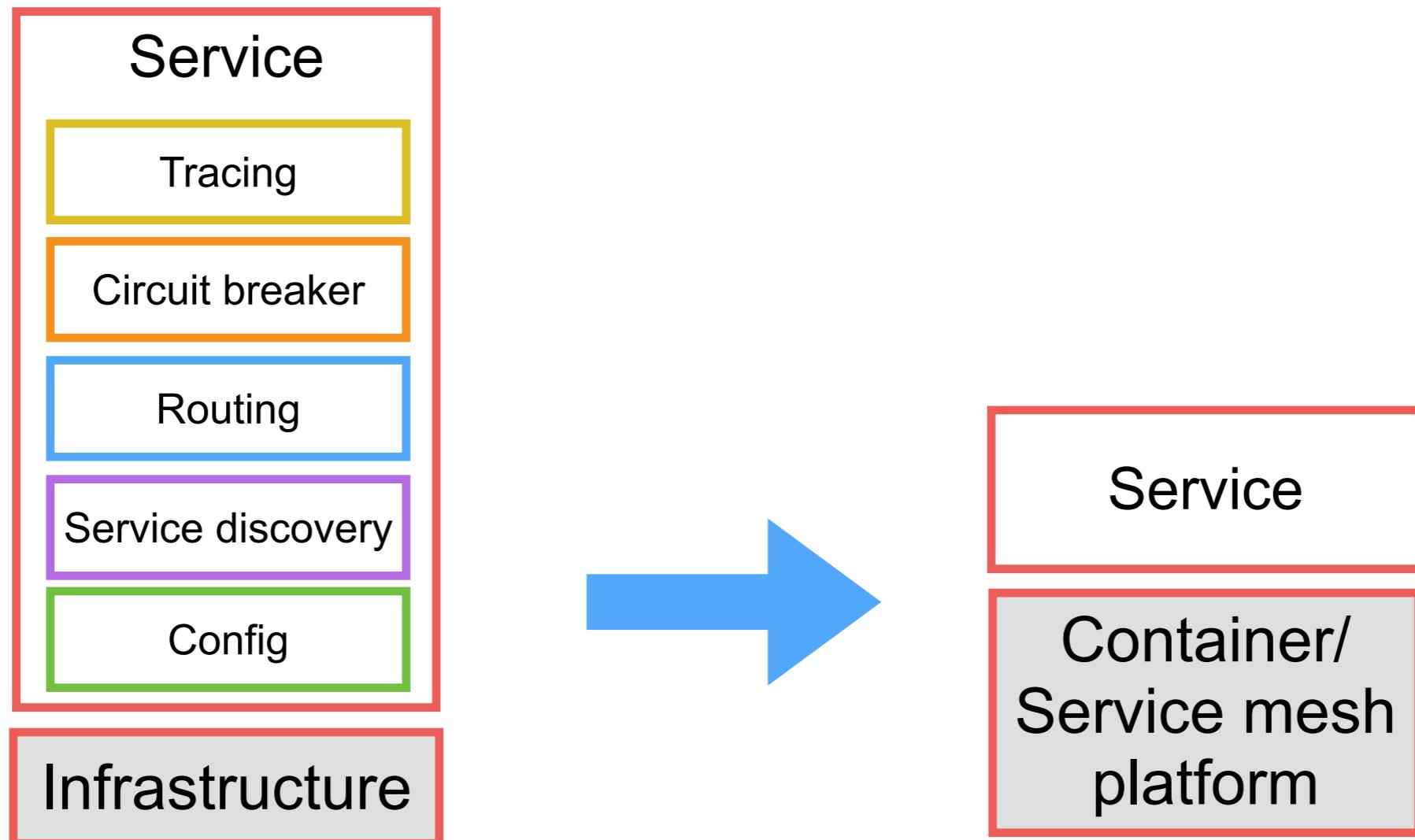
Istio



<https://istio.io/docs/concepts/what-is-istio/>



Microservice Evolution



Function-as-a-Service (FaaS)



Microservice 4.0 == FaaS



OPEN FAAS



APACHE
OpenWhisk™



Workshop

Microservice 1.5



Twelve-Factor App



Twelve-Factor App

<https://12factor.net/>

Initial to build app for Heroku

Principles to cloud and container native app



1. Codebase

Codebase must be tracked in version control
and will have many deploy



2. Dependencies

Dependencies are explicitly declared and isolated

Use dependency management tools to shared
libraries



3. Configuration

Store configuration in the environment

Add configuration in environment variables or
config files



4. Backing services

Treat backing services as an attached resource

Should easy to deploy and change



5. Build, Release, Run

Always have a build and deploy strategy

Build strategies for repeated builds, versioning of running system and rollback



6. Processes

Execute the application as a stateless process



7. Port Binding

Expose services via port bindings



8. Concurrency

Scale out with the process model



9. Disposability

Quick application startup and shutdown times
Graceful shutdown



10. Dev/prod parity

Application is treated the same way in dev, staging and production

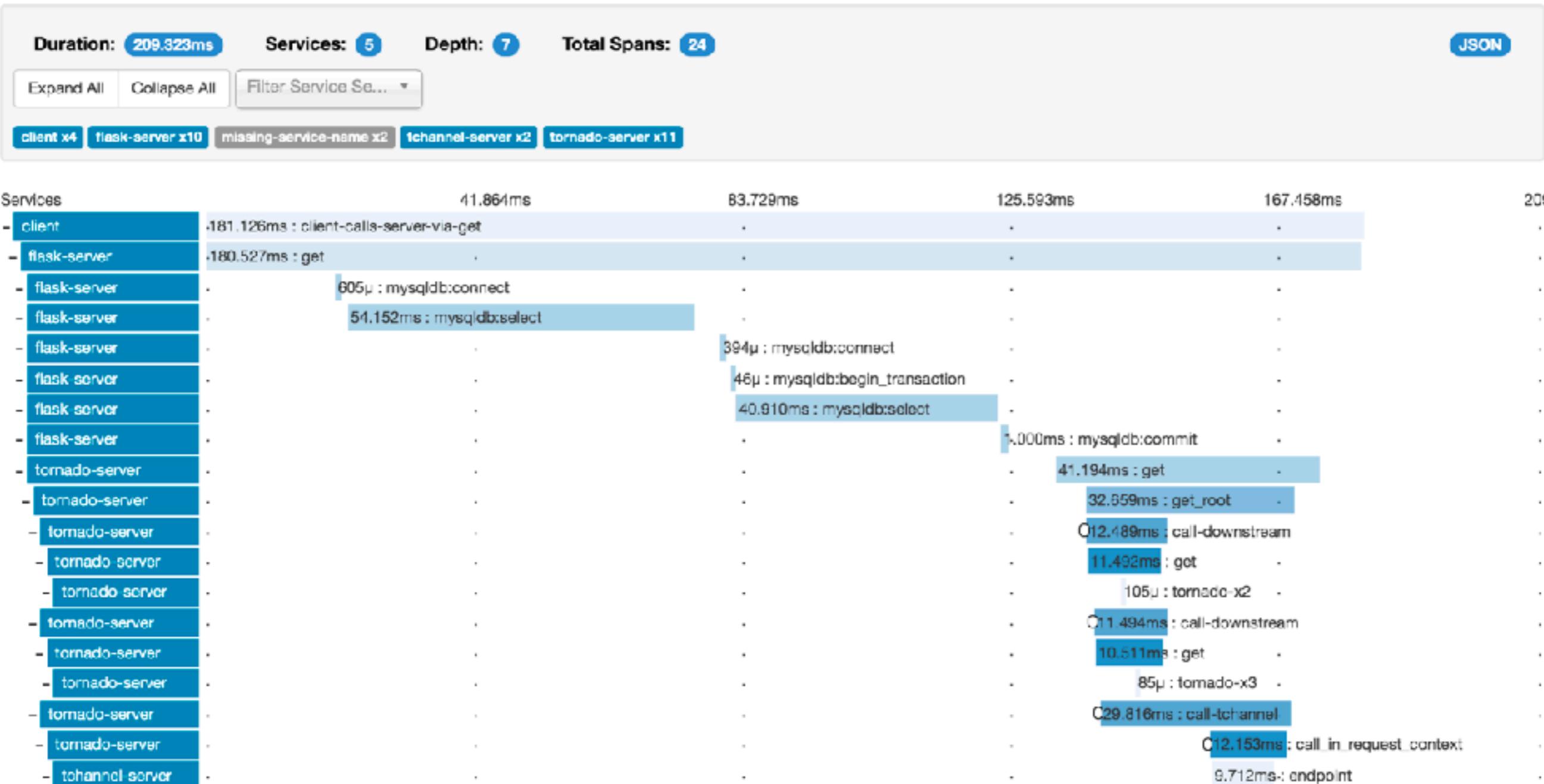


11. Log management

Treated as an event stream



Logging/Tracing



<https://zipkin.io/>



12. Admin tasks

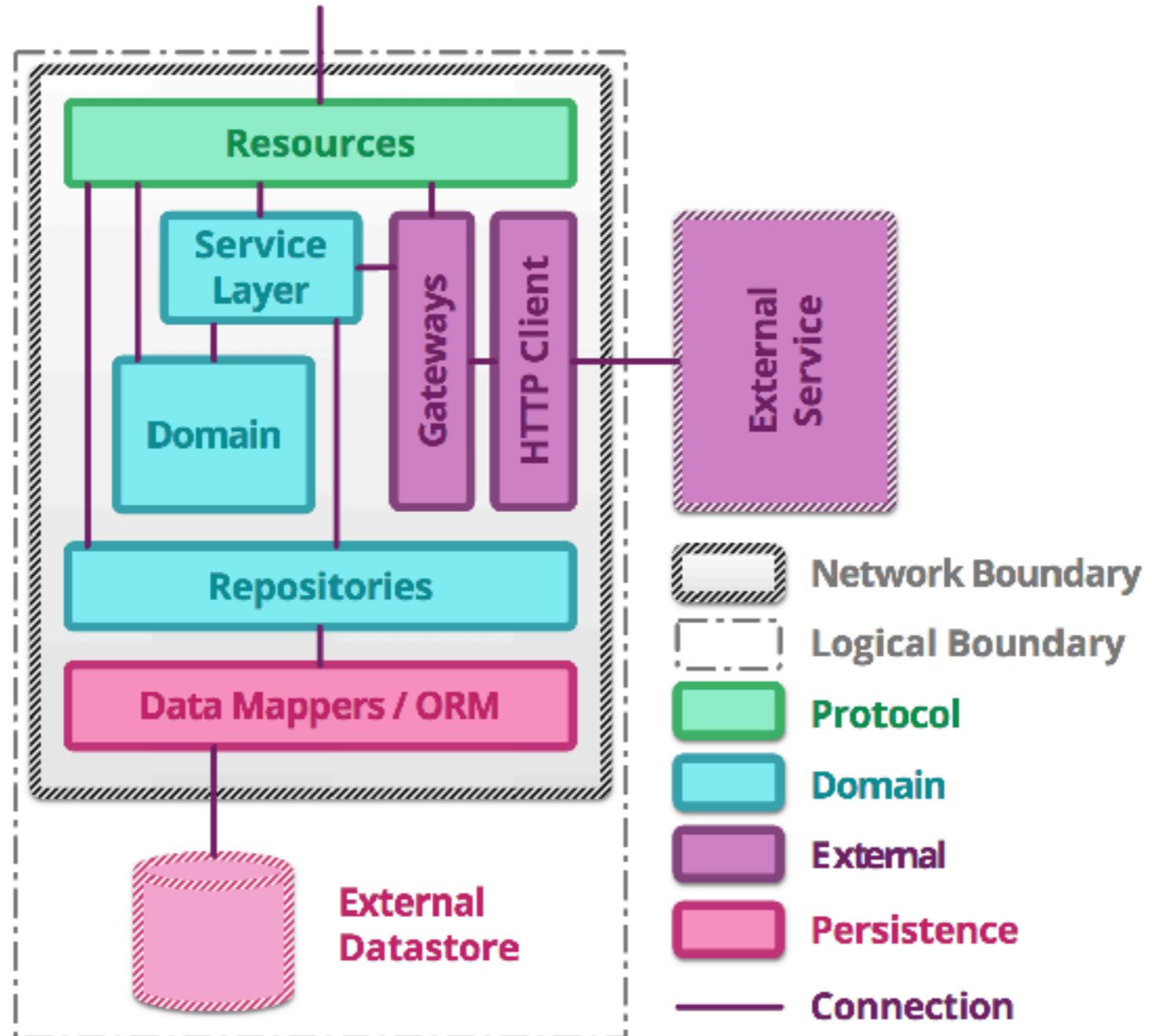
Treated the same way like the rest of the application



Microservice Testing



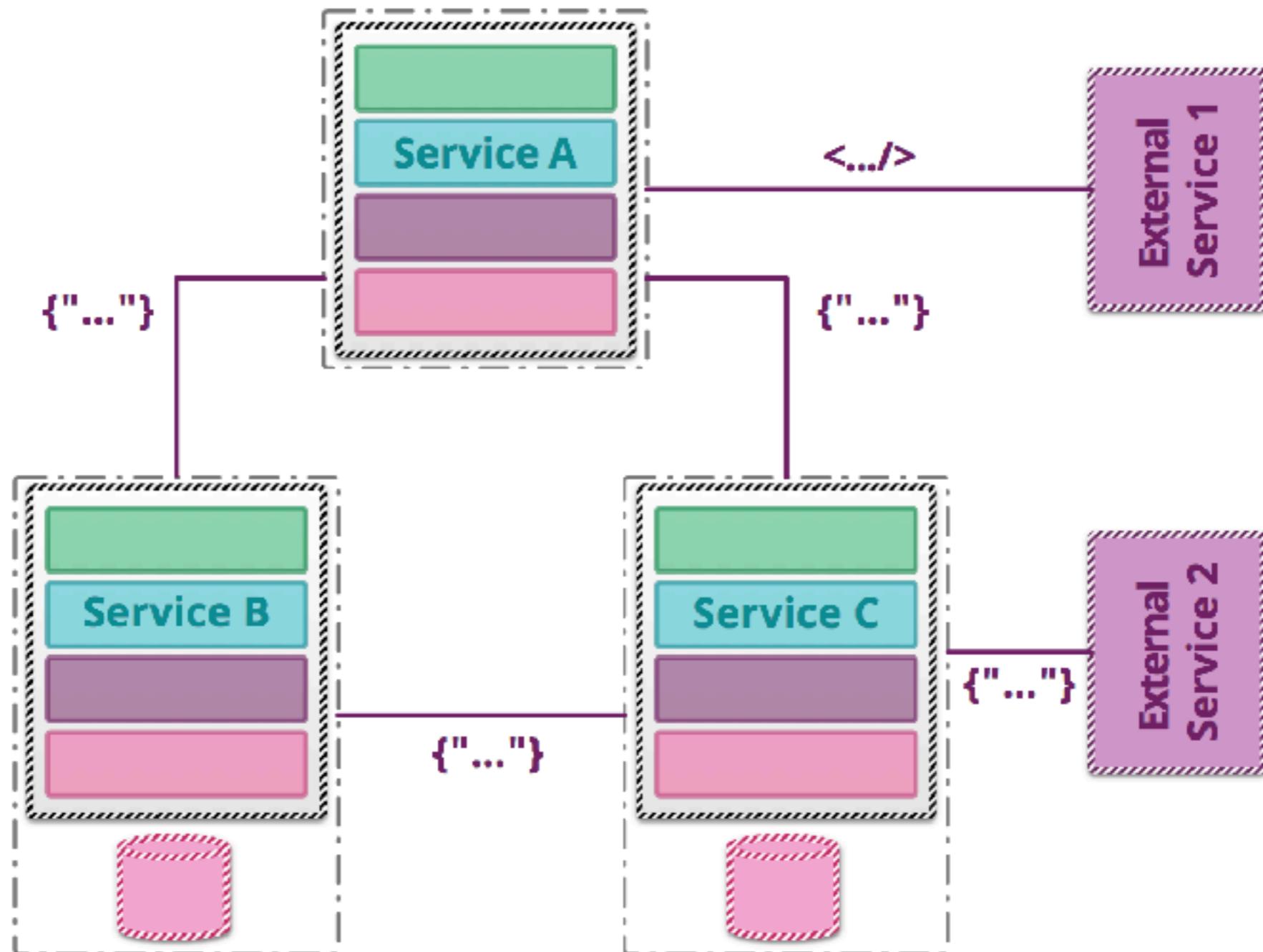
Service structure



<https://martinfowler.com/articles/microservice-testing>



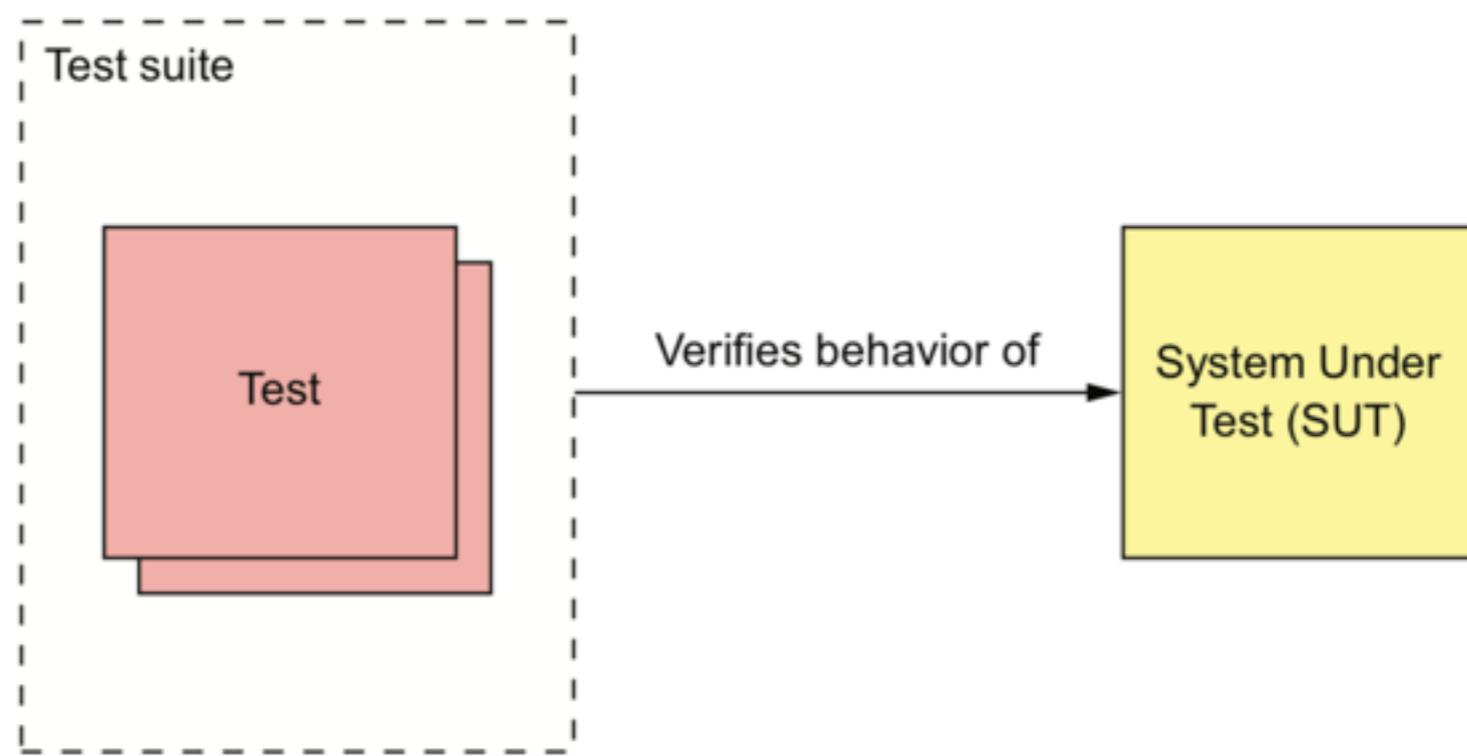
Multiple services



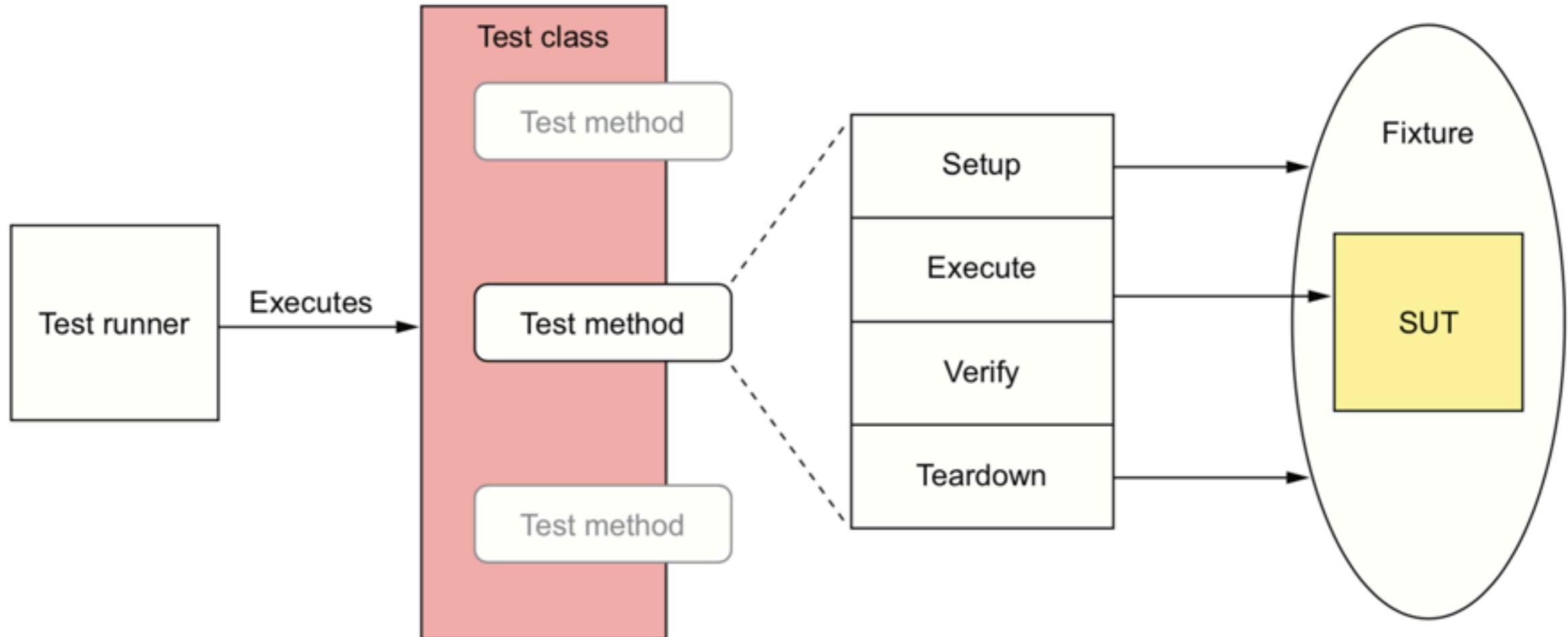
<https://martinfowler.com/articles/microservice-testing>



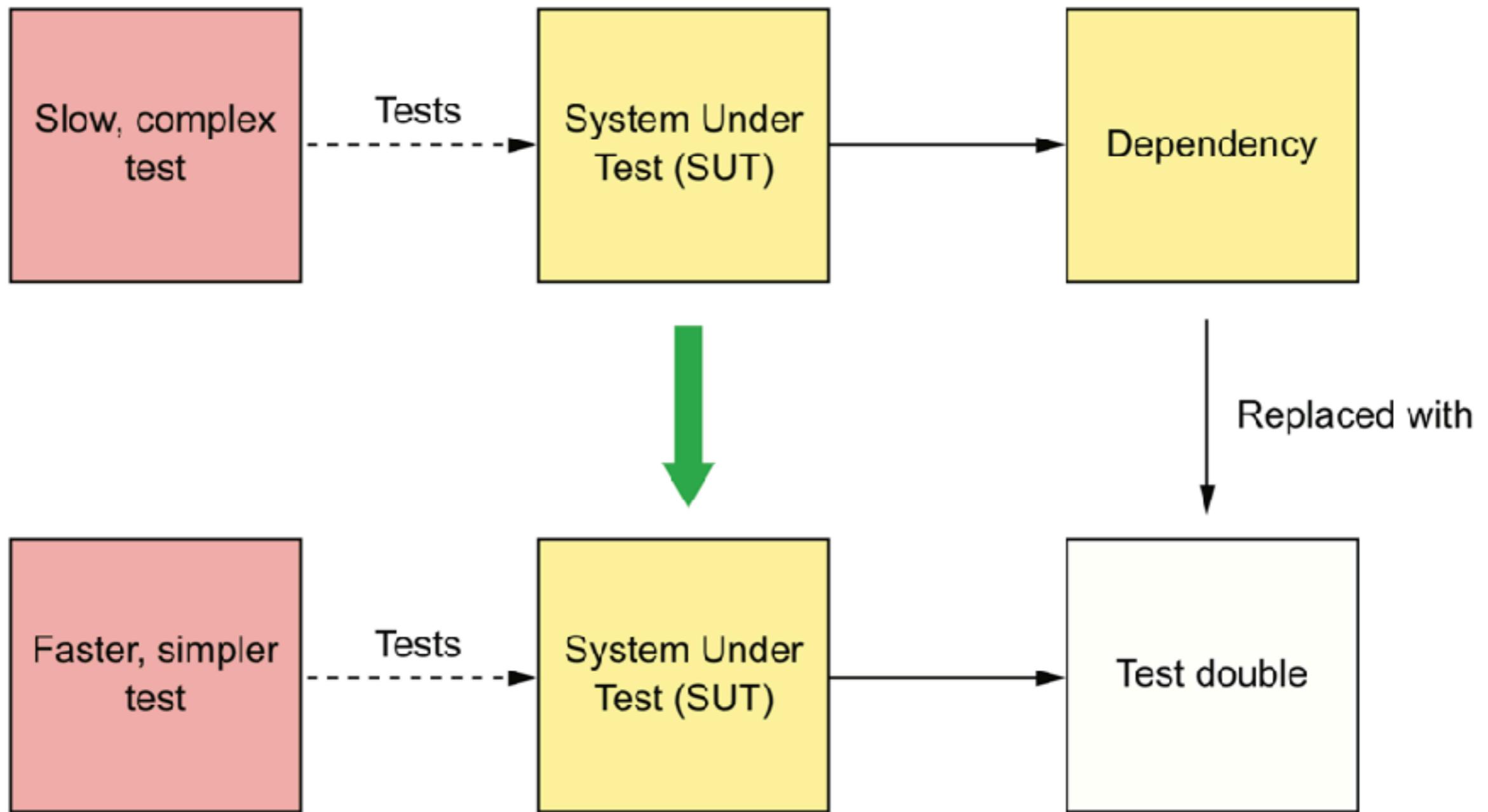
Testing

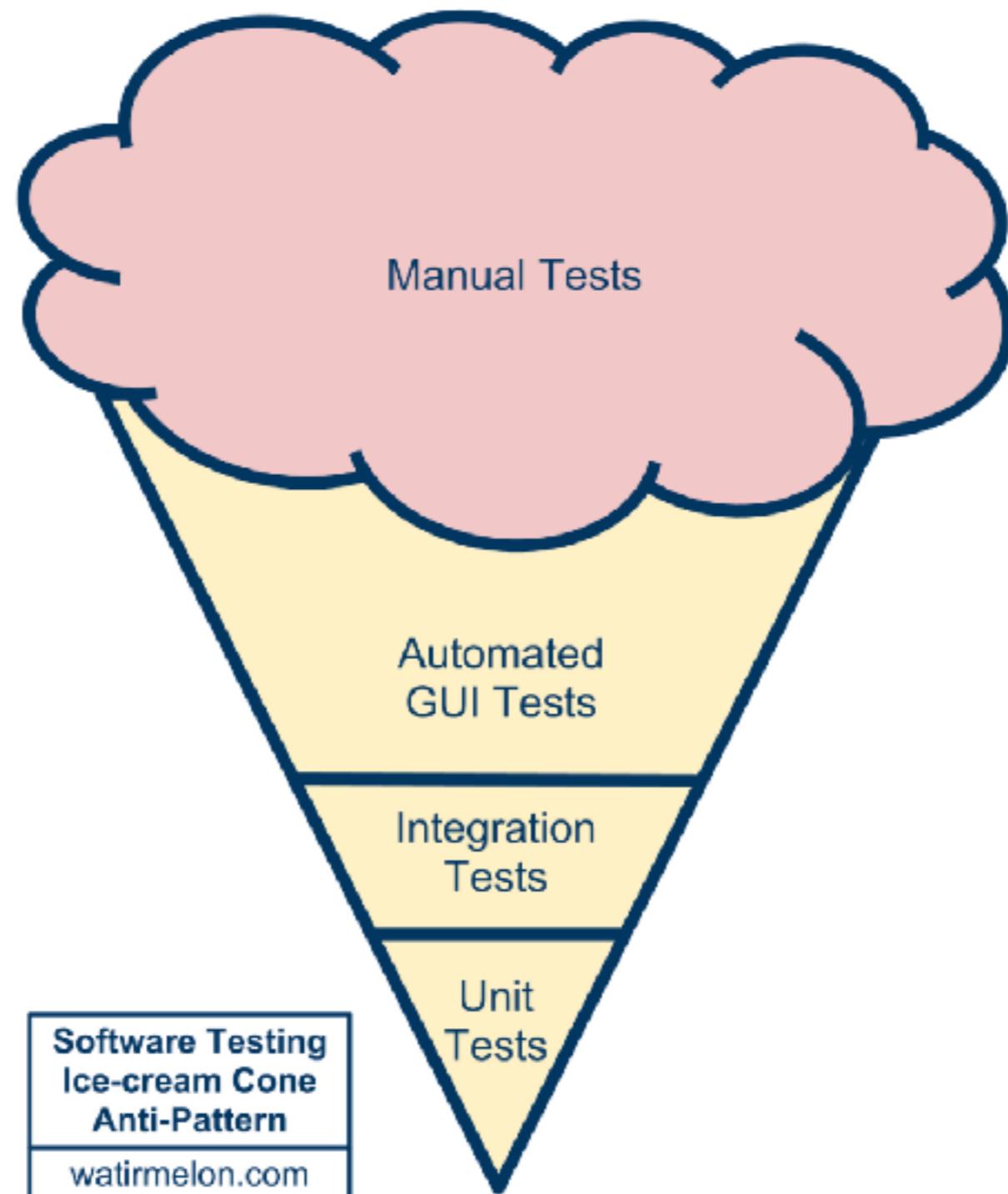


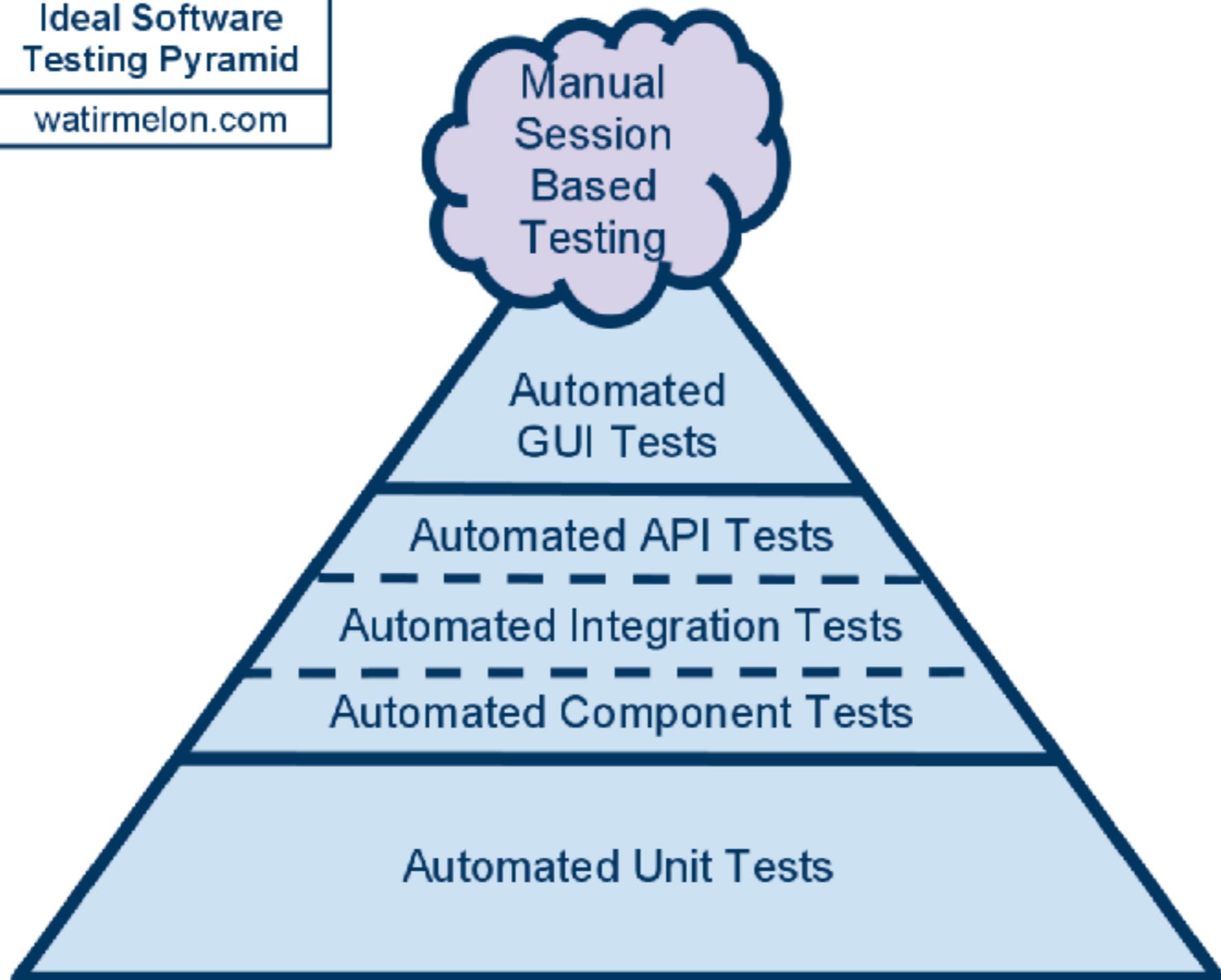
Structure of Automated tests

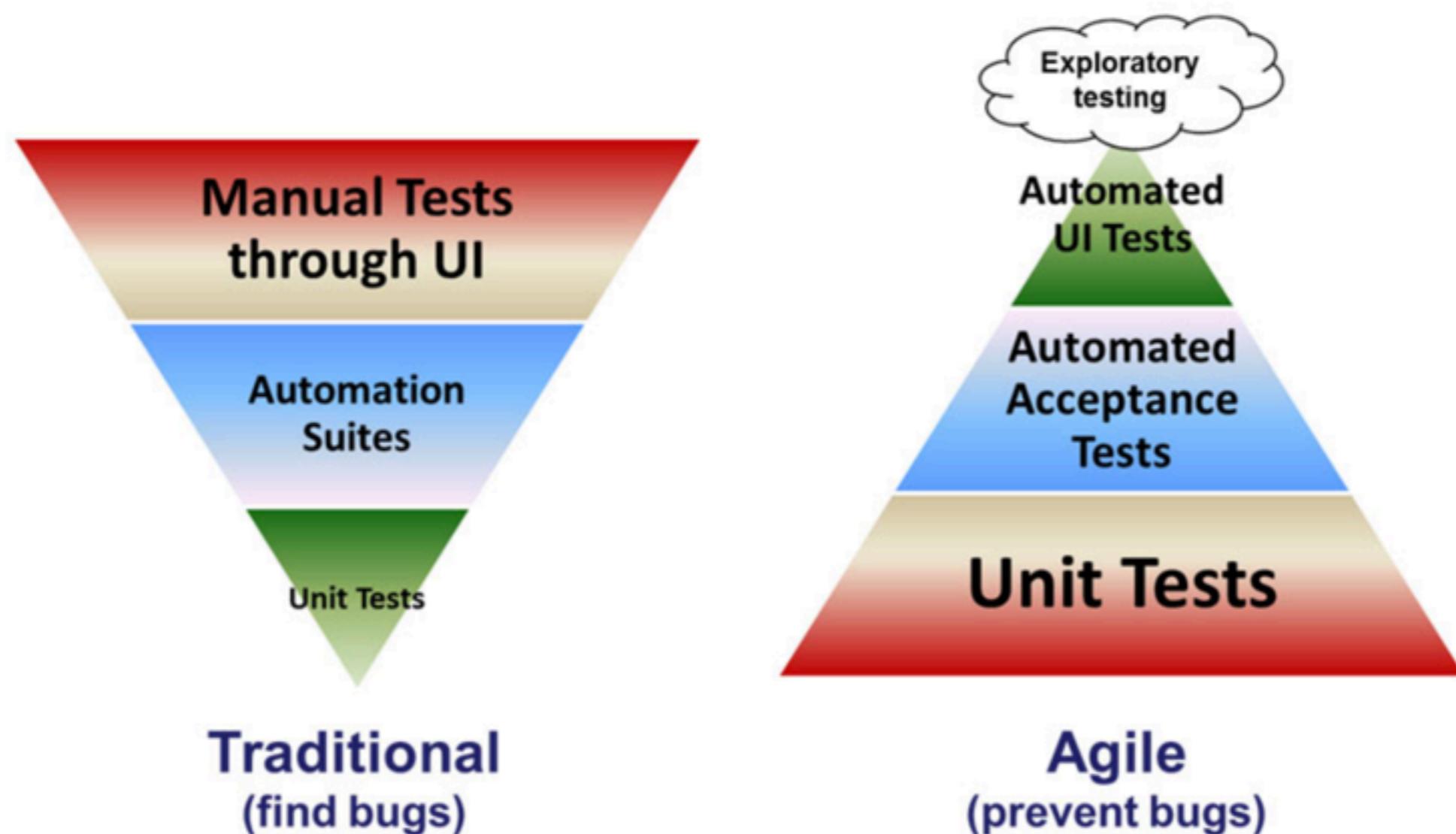


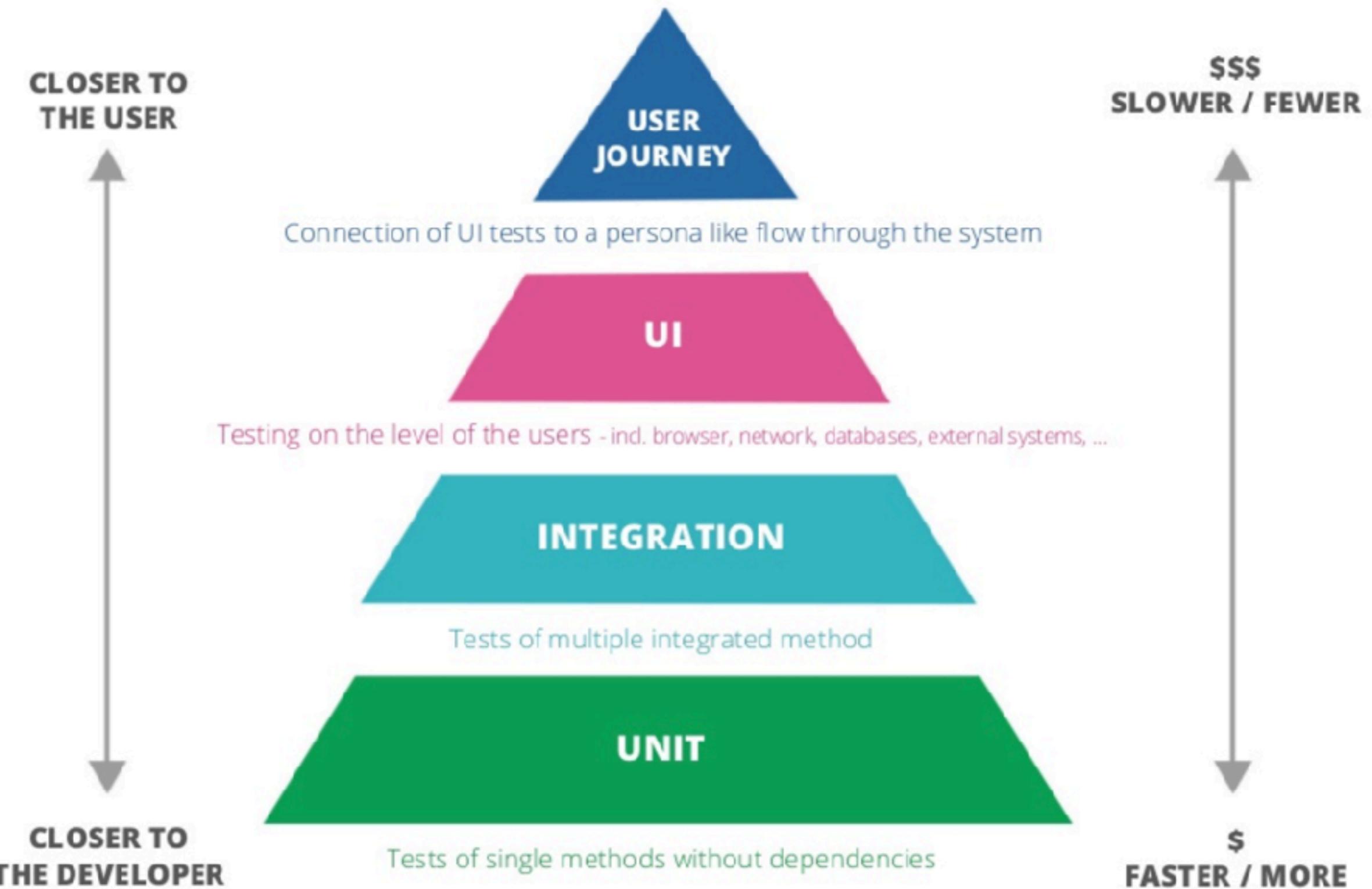
Working with Test double



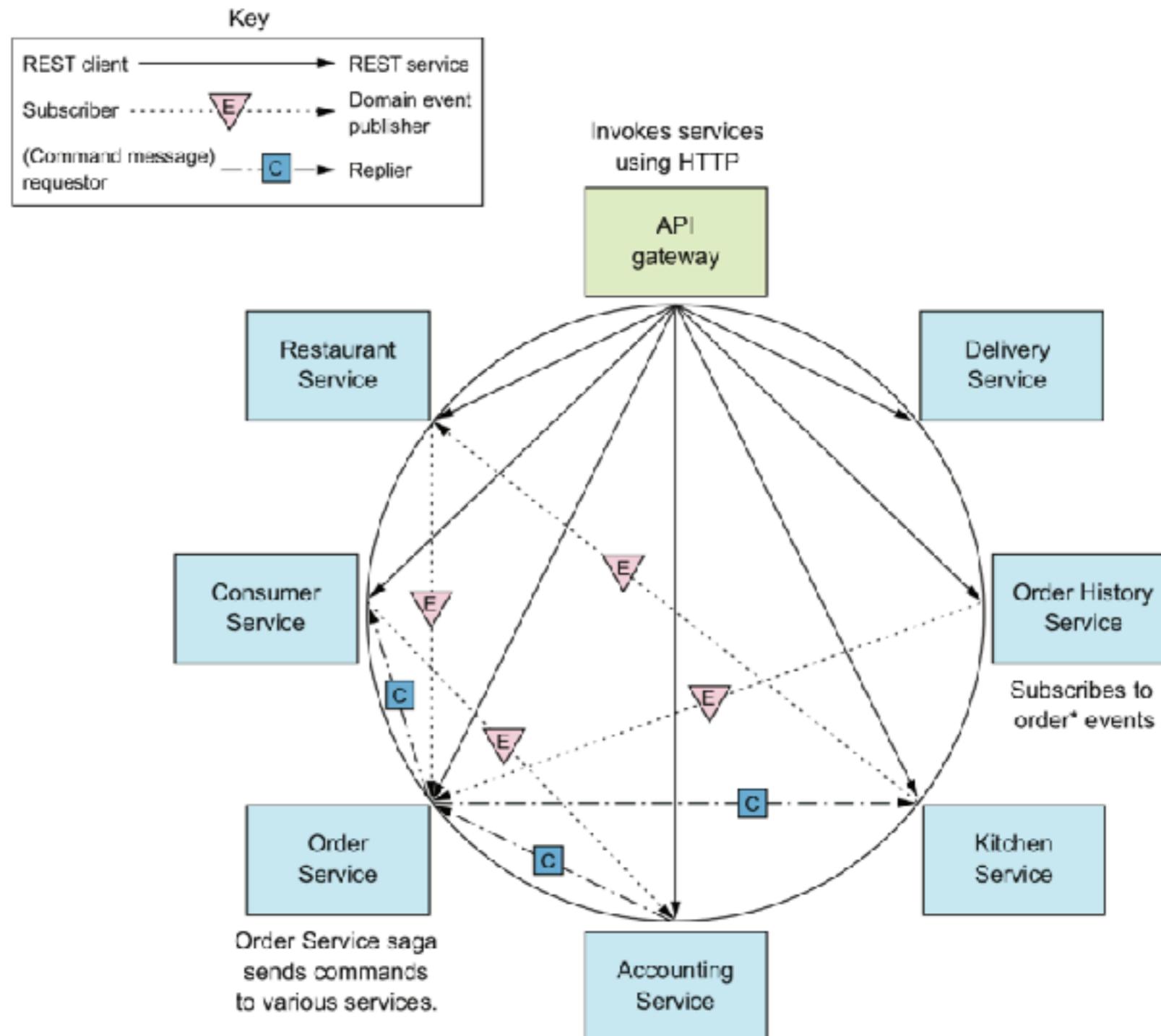






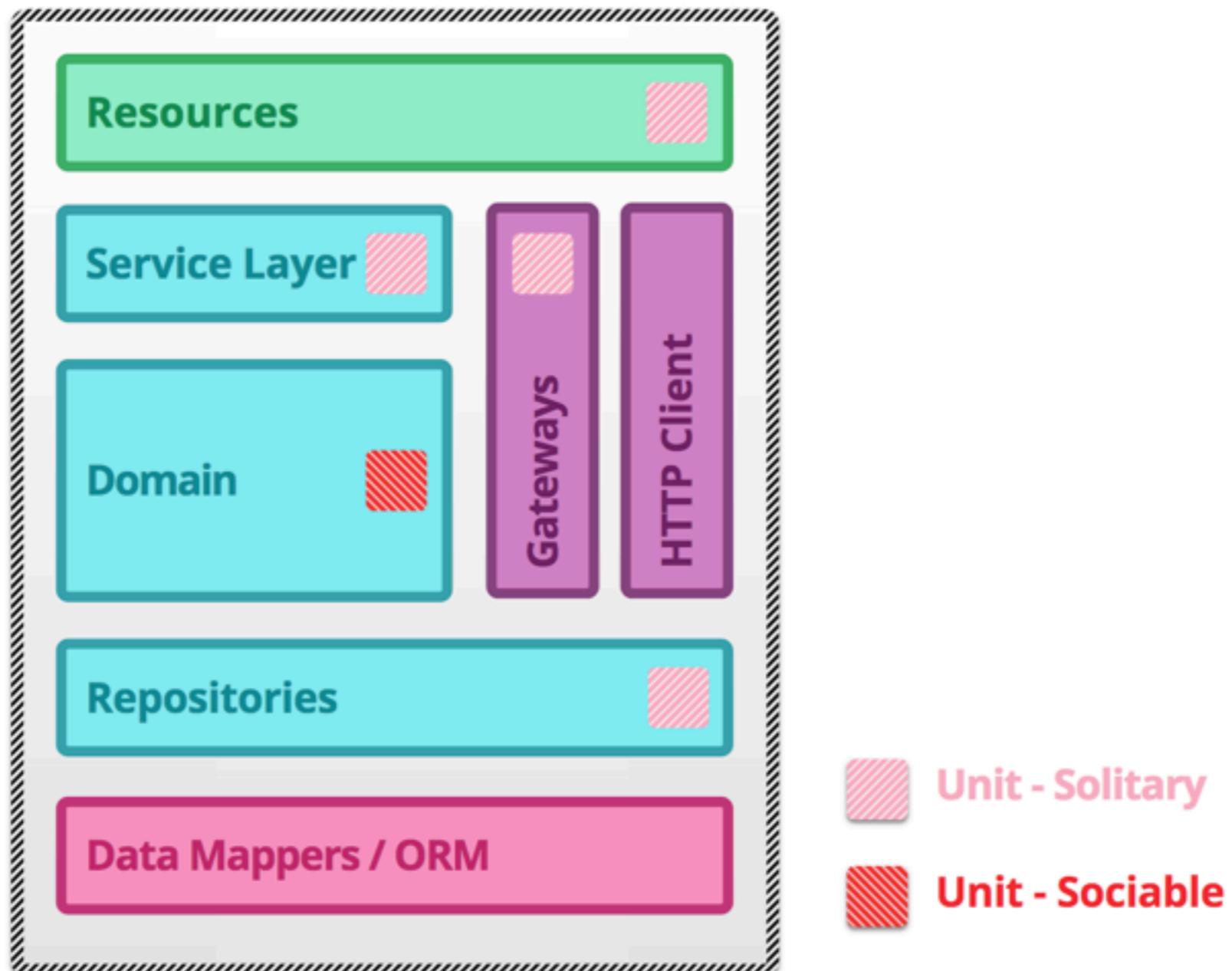


Testing Microservices ?

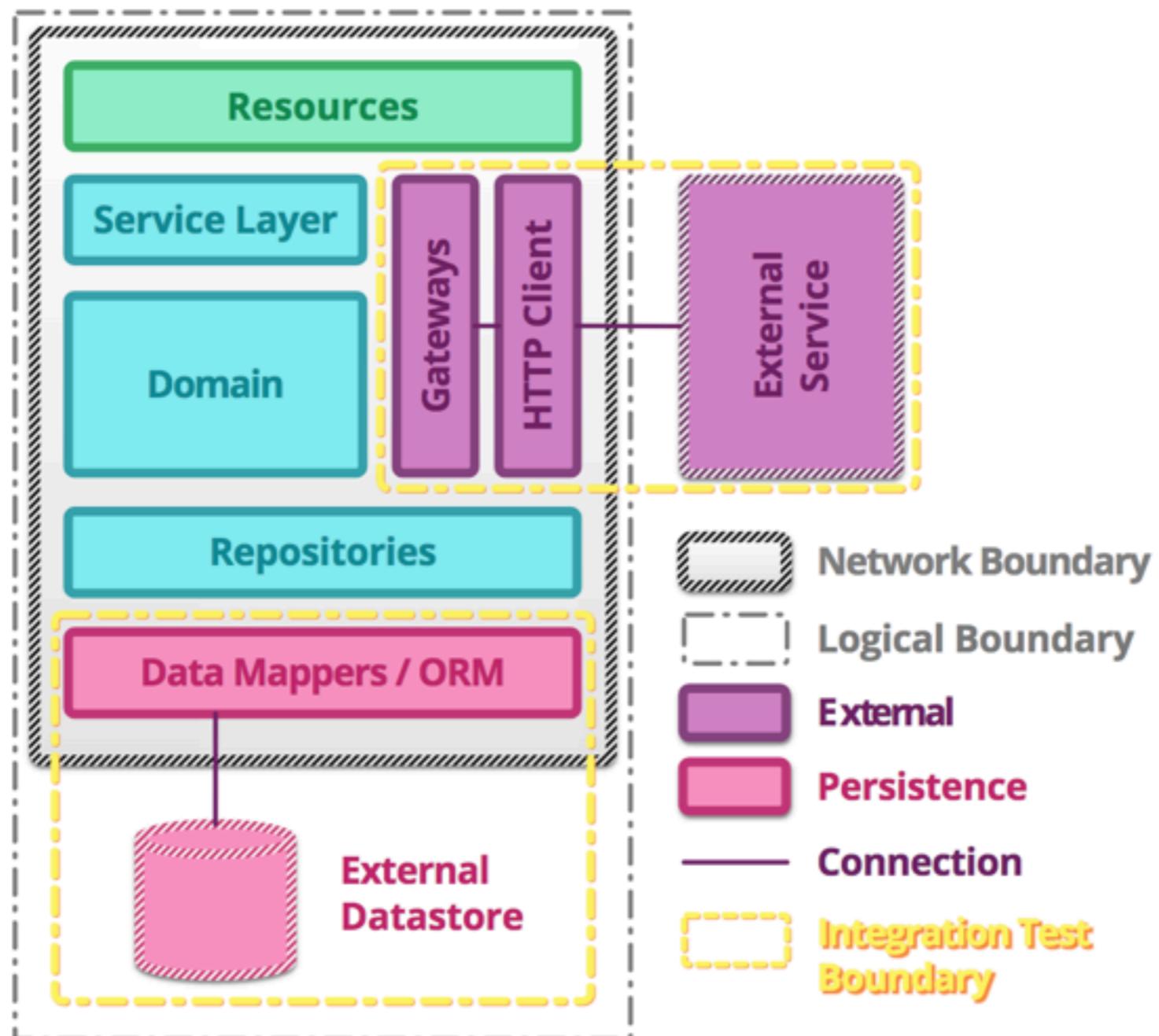




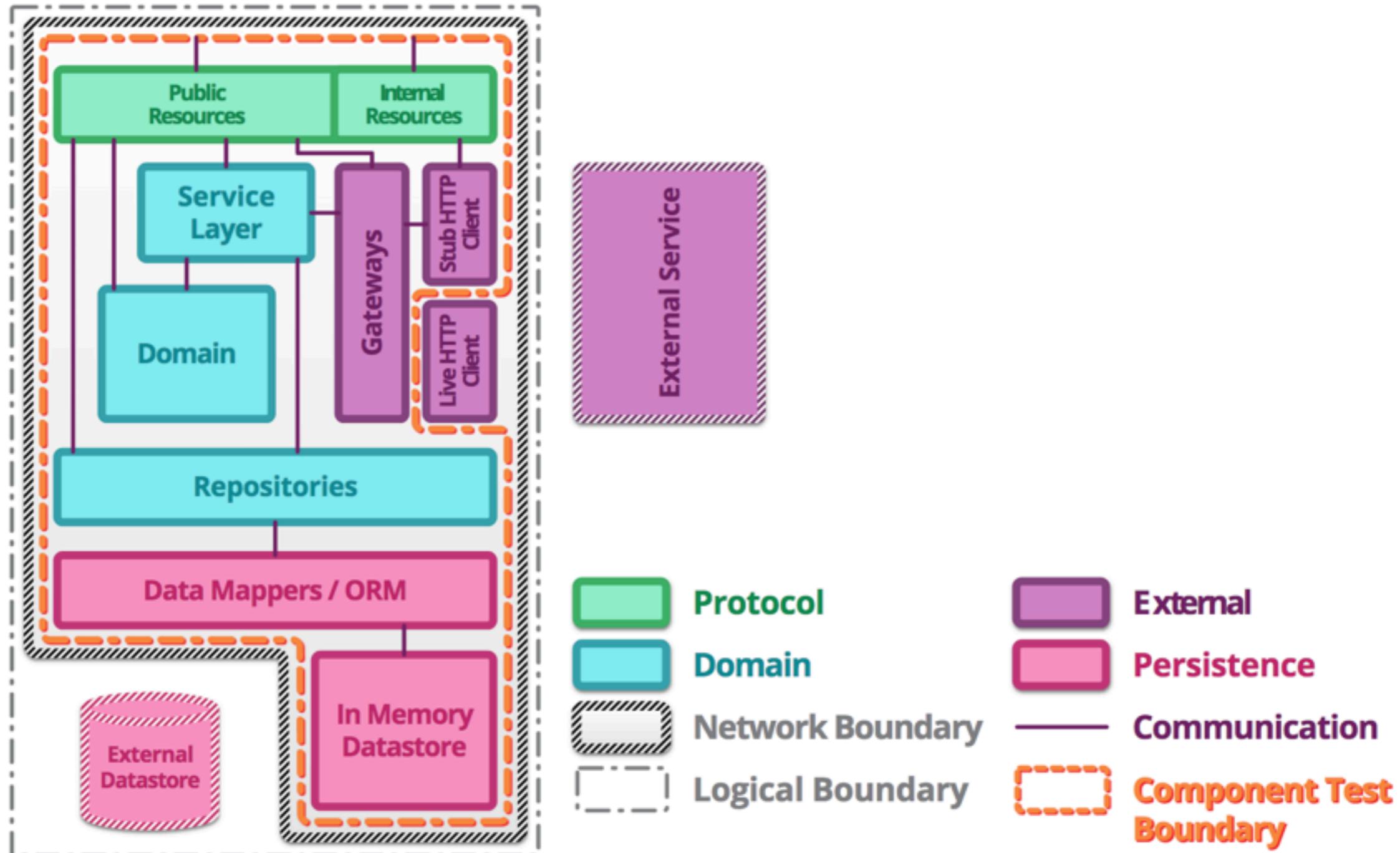
Unit testing



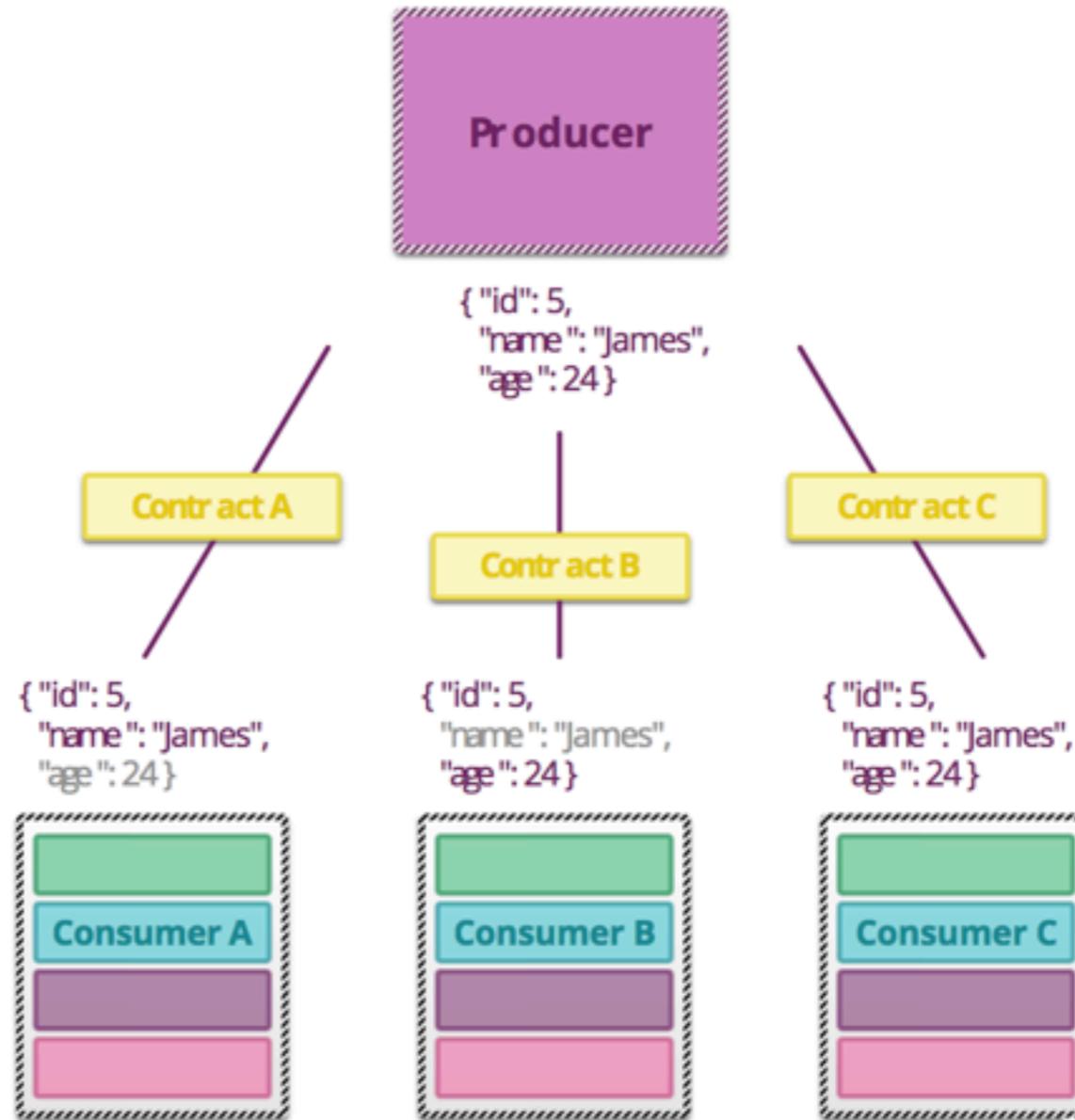
Integration testing



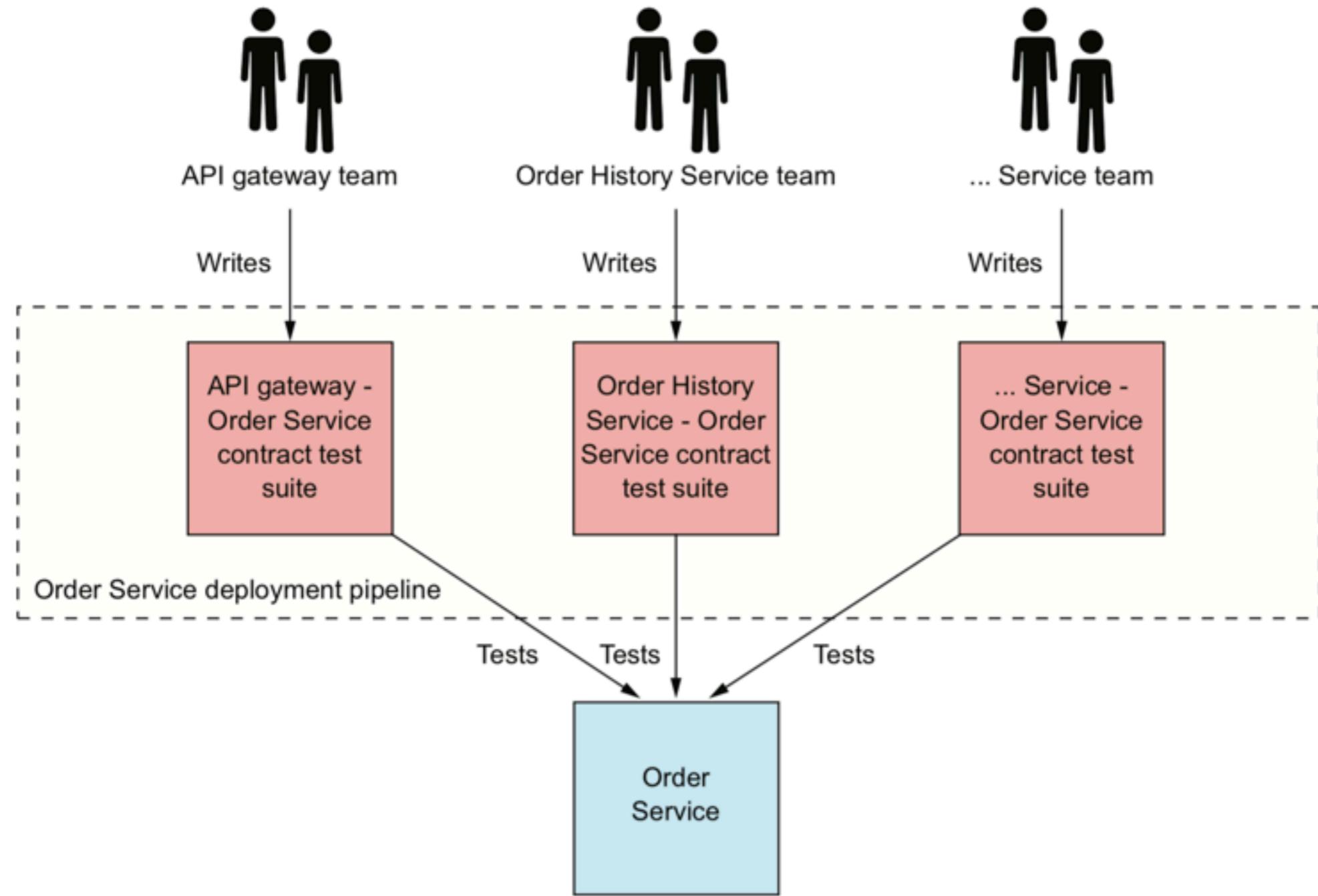
Component testing



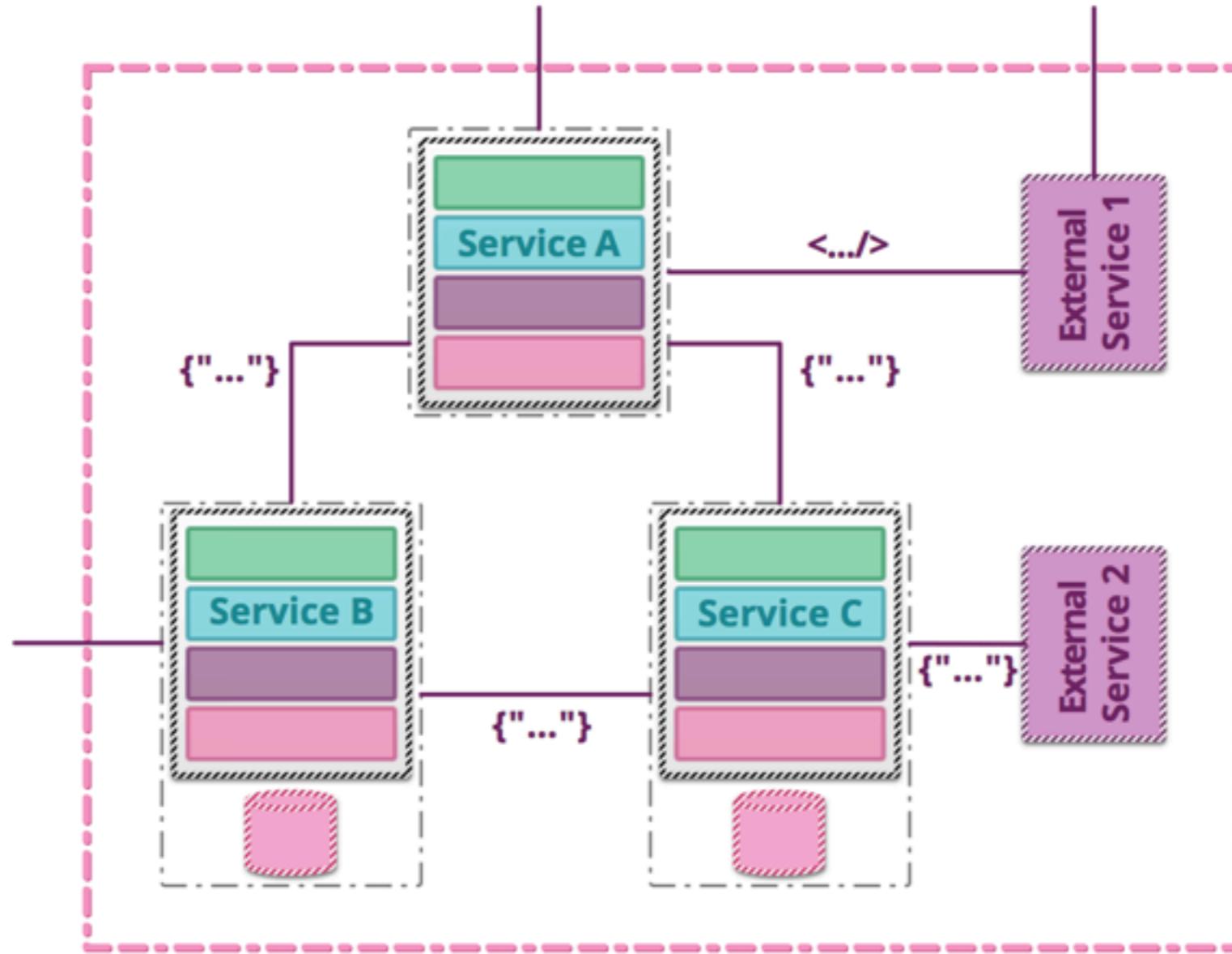
Contract testing



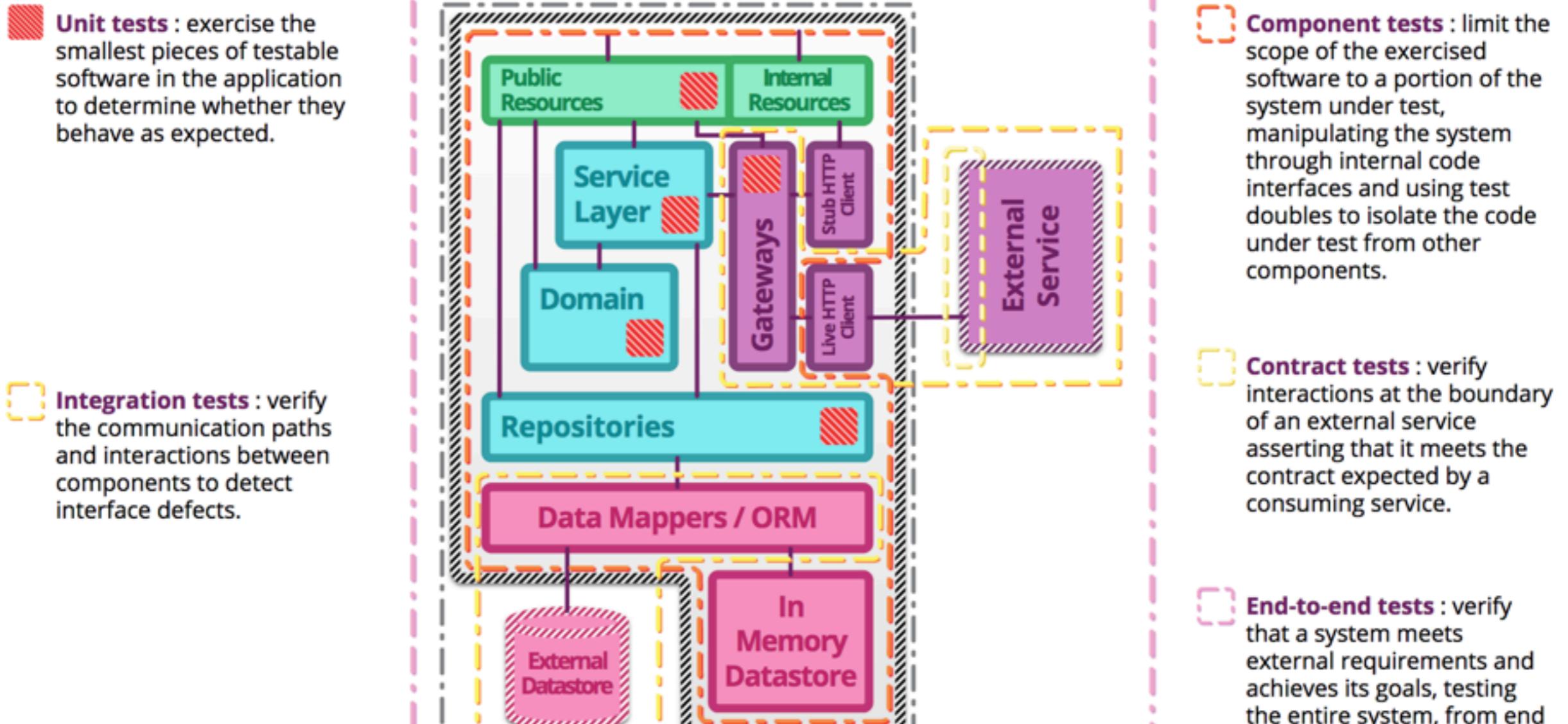
Consumer Contract testing



End-to-End testing



Summary



Unit tests : exercise the smallest pieces of testable software in the application to determine whether they behave as expected.

Integration tests : verify the communication paths and interactions between components to detect interface defects.

Component tests : limit the scope of the exercised software to a portion of the system under test, manipulating the system through internal code interfaces and using test doubles to isolate the code under test from other components.

Contract tests : verify interactions at the boundary of an external service asserting that it meets the contract expected by a consuming service.

End-to-end tests : verify that a system meets external requirements and achieves its goals, testing the entire system, from end to end.



What is your testing strategy ?



Performance testing ?

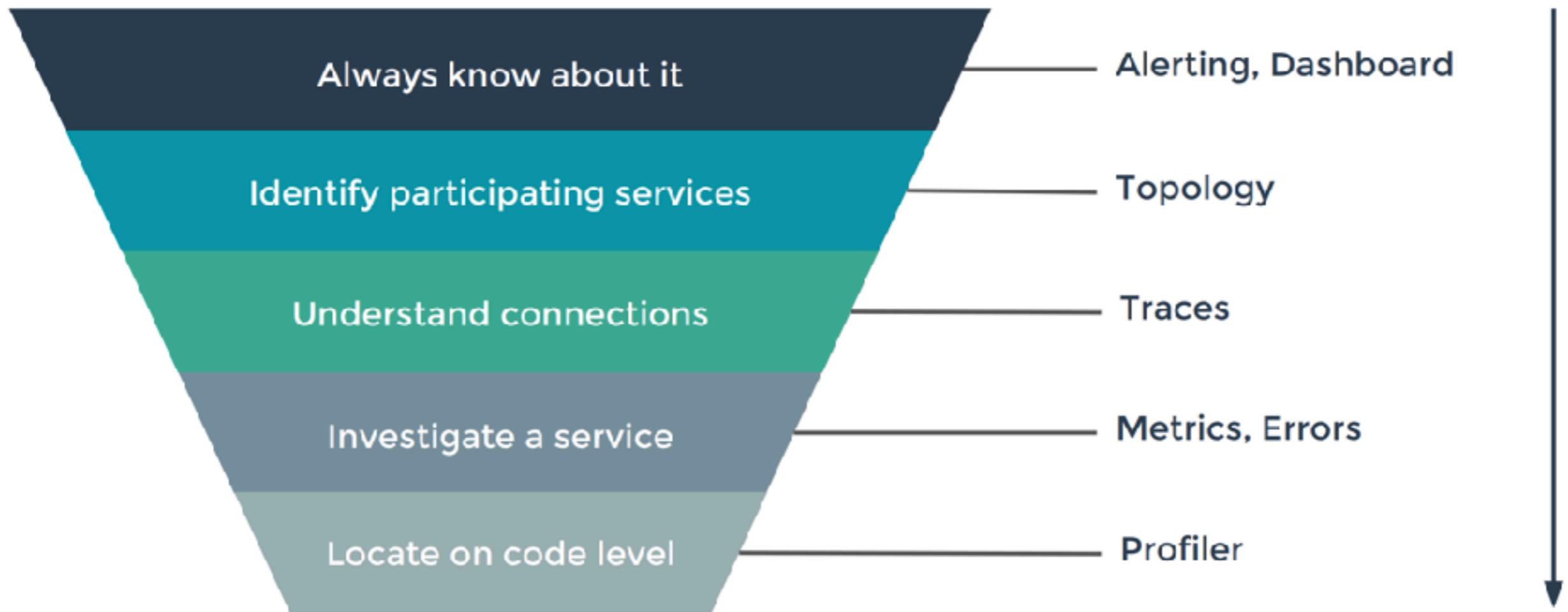
Security testing ?



How to find an issue ?



How to find an issue ?



Develop production-ready services



Important quality attributes

Security
Configurability
Observability



Secure services



Develop secure services

Authentication

Authorization

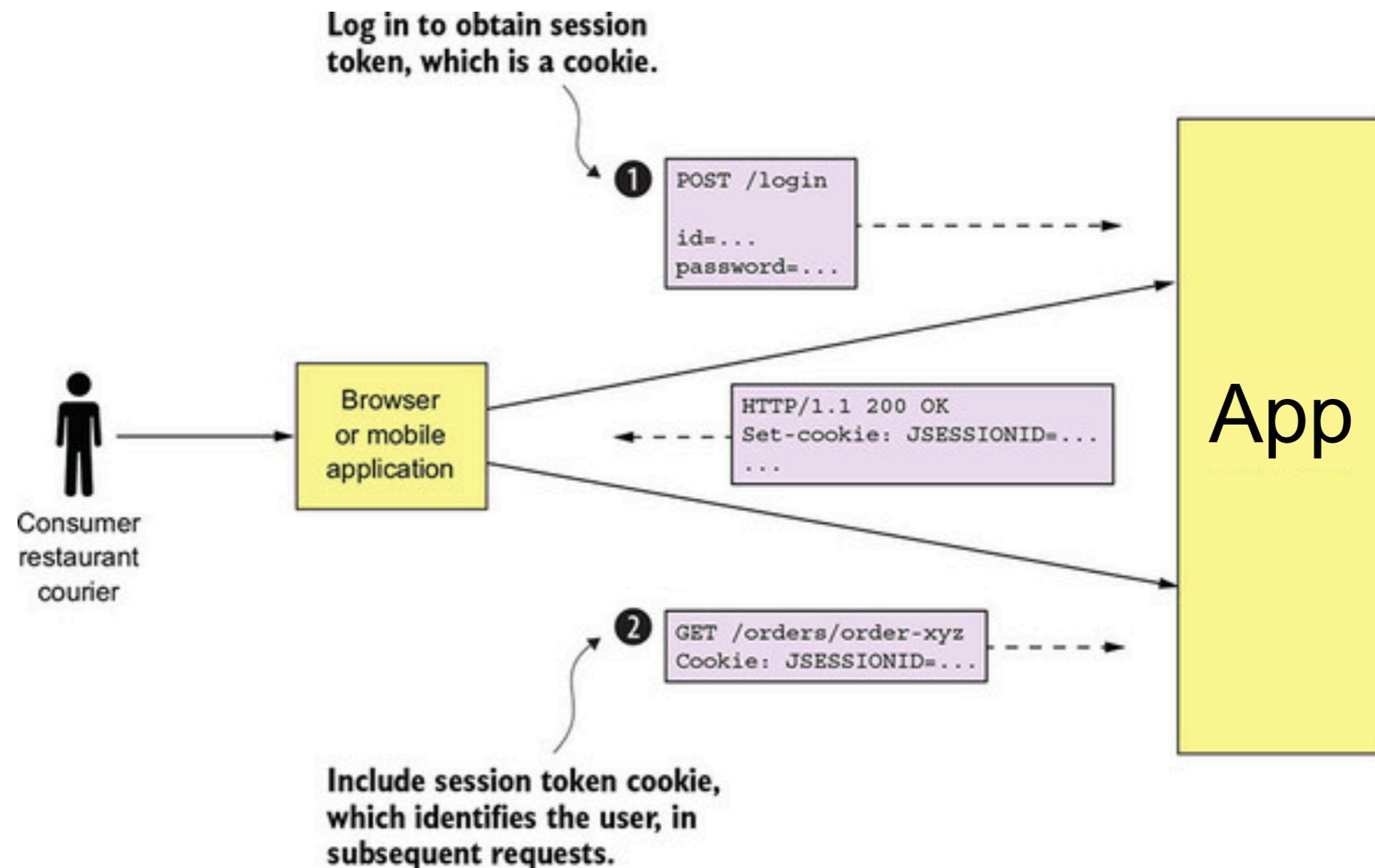
Auditing

Secure interprocess communication



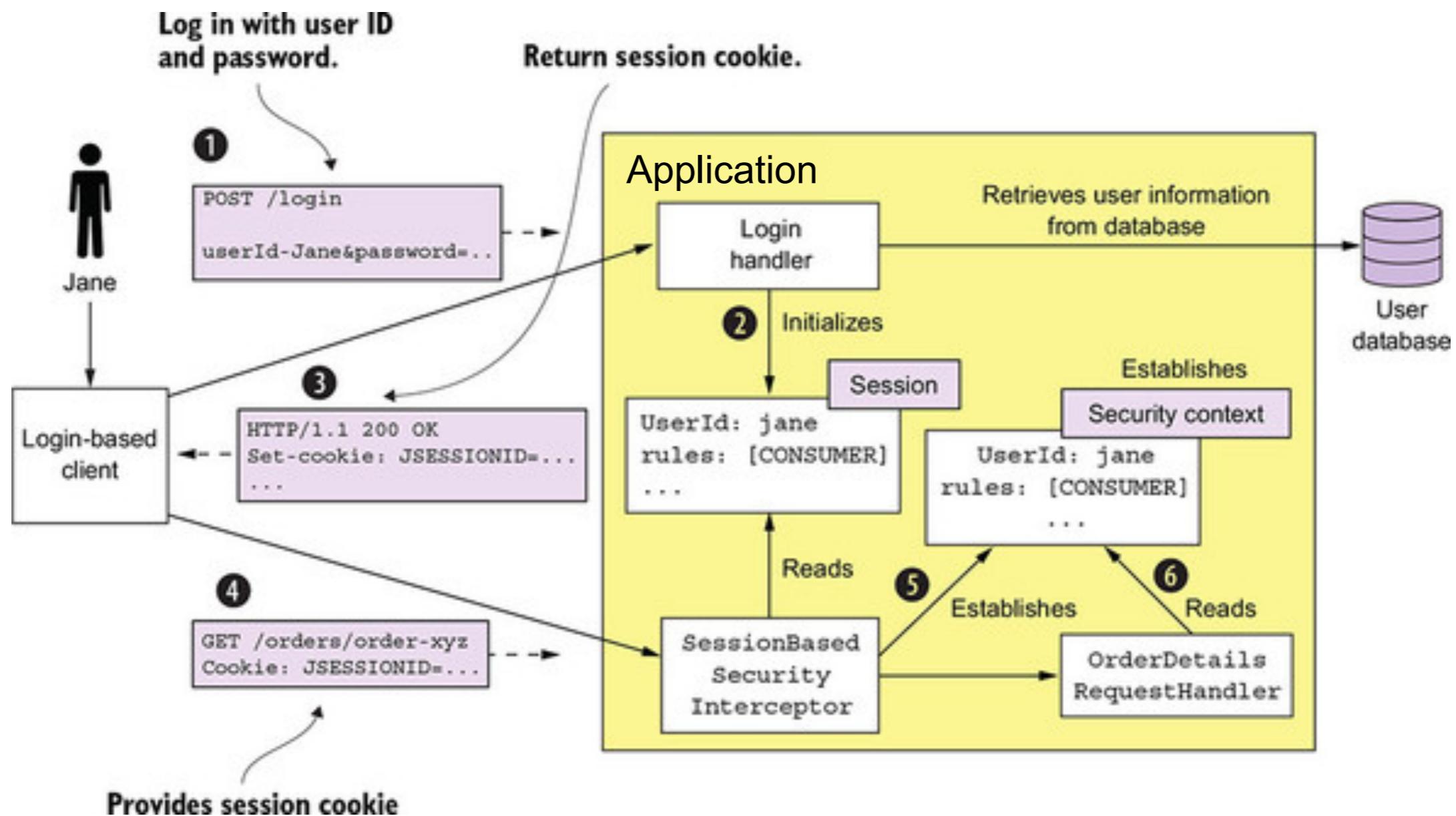
Security in traditional application

Keep security information in browser's cookie



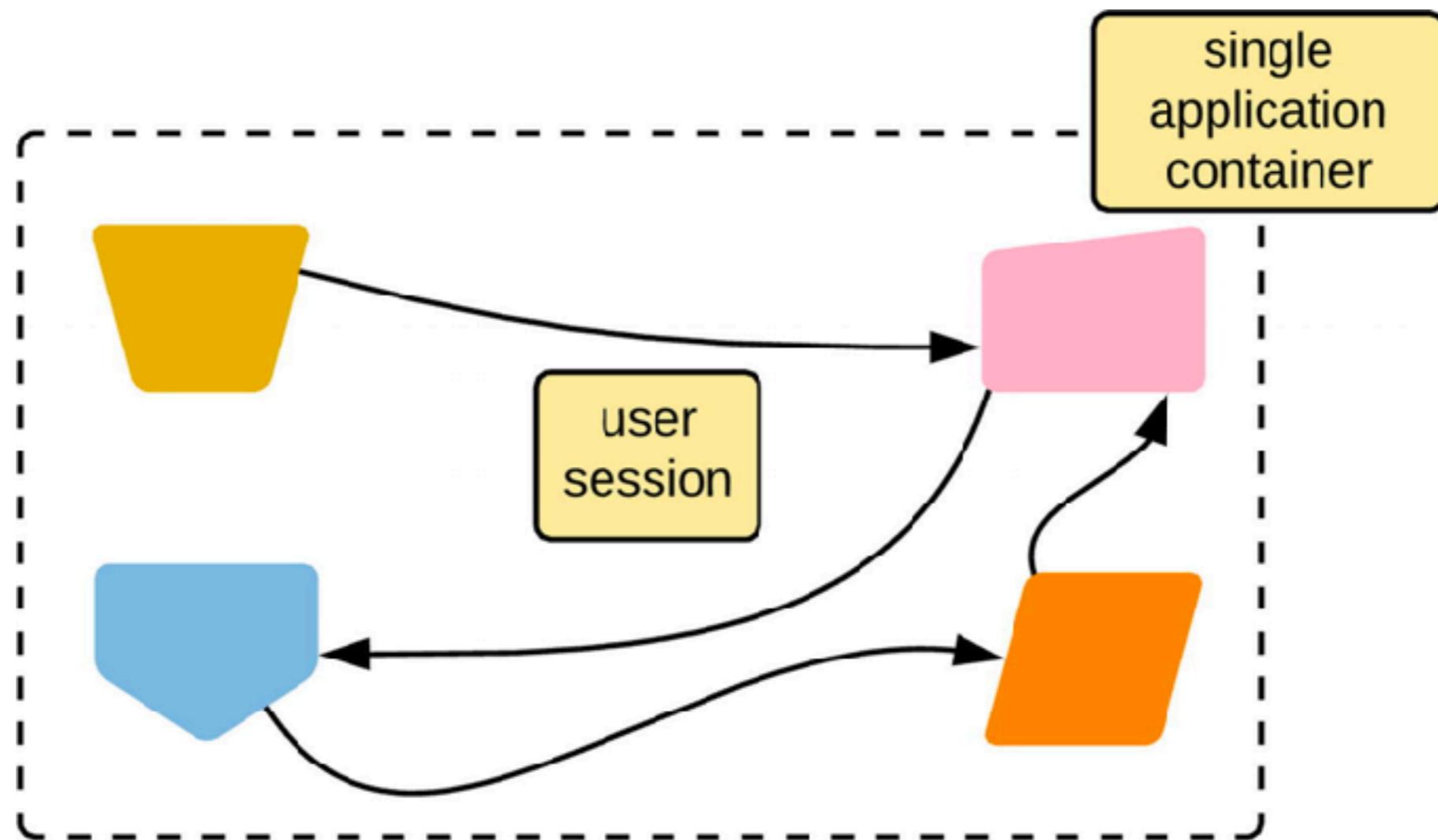
Security in traditional application

Implement security process in application



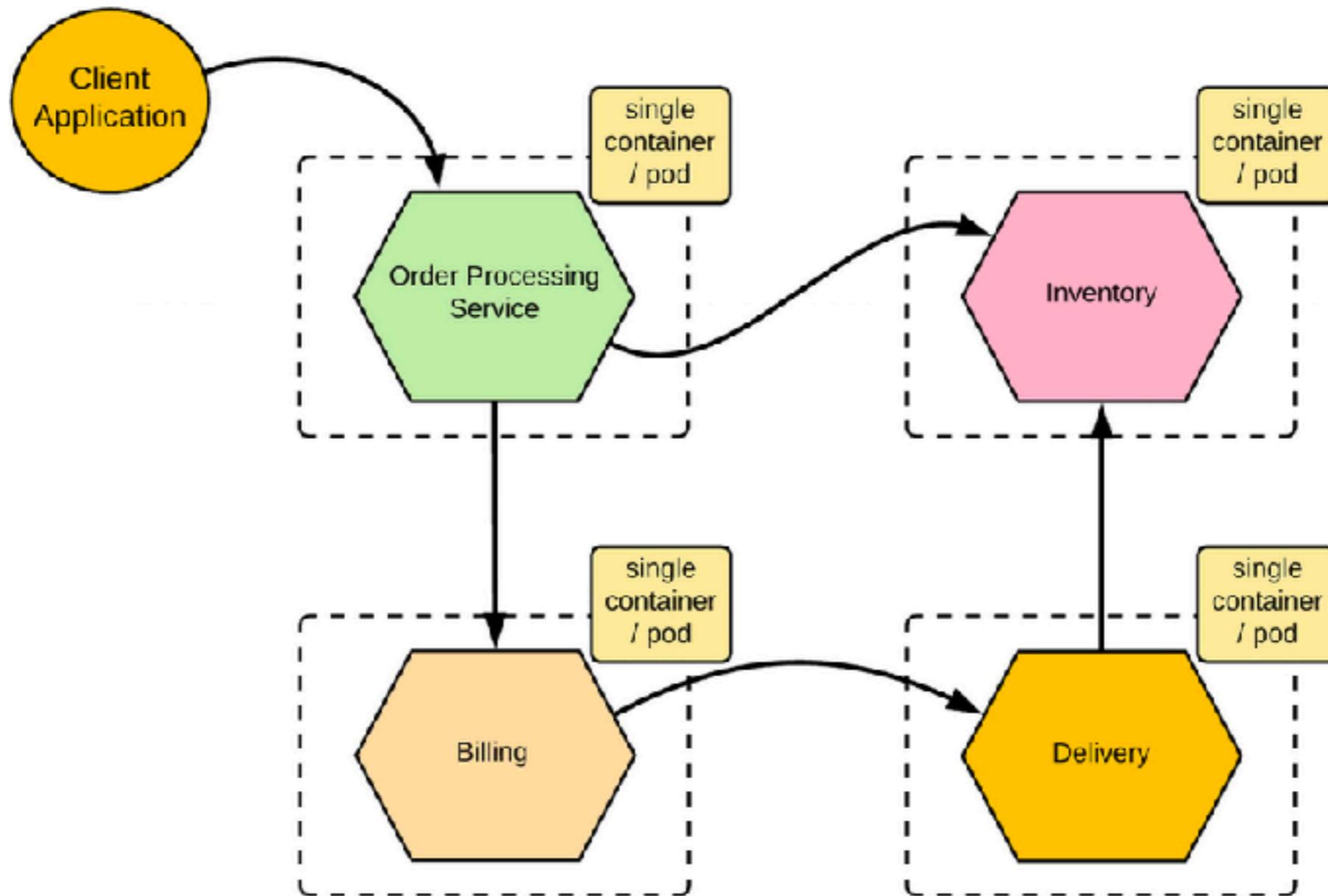
Security in traditional application

Sharing a user session in application



Security in multiple services ?

Interaction between multiple services



Secure service-to-service communication

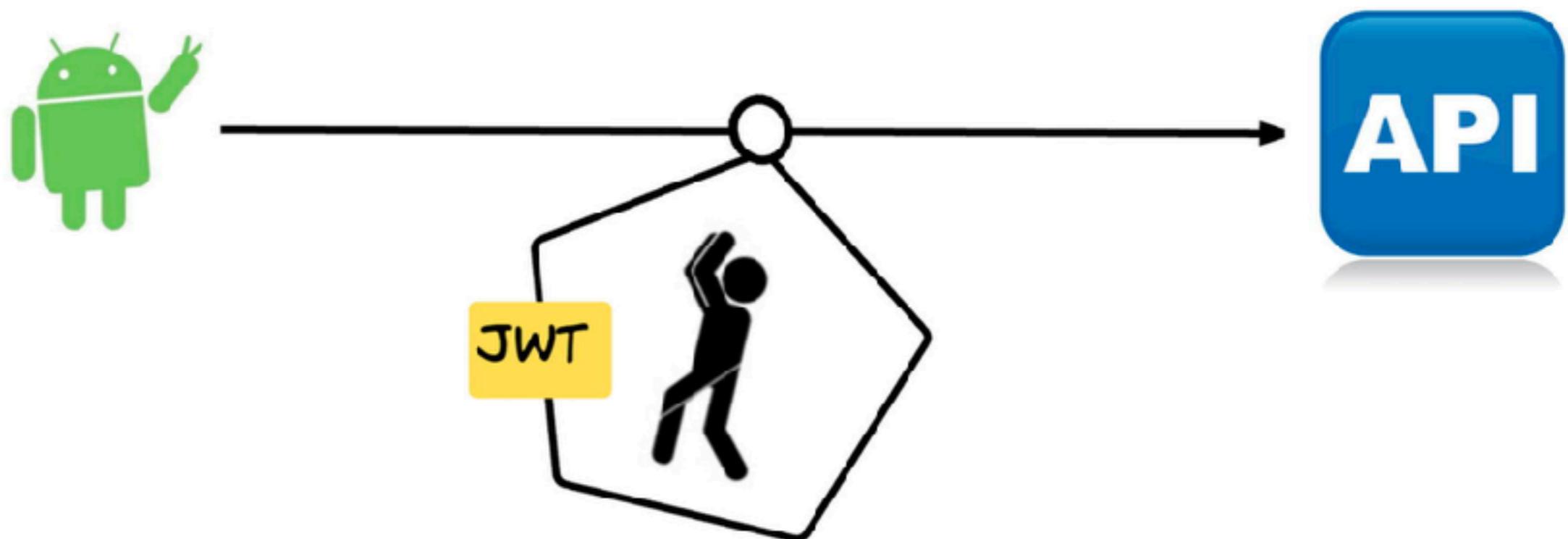
JSON Web Token (JWT)

Transport Layer Security (TLS) mutual authentication

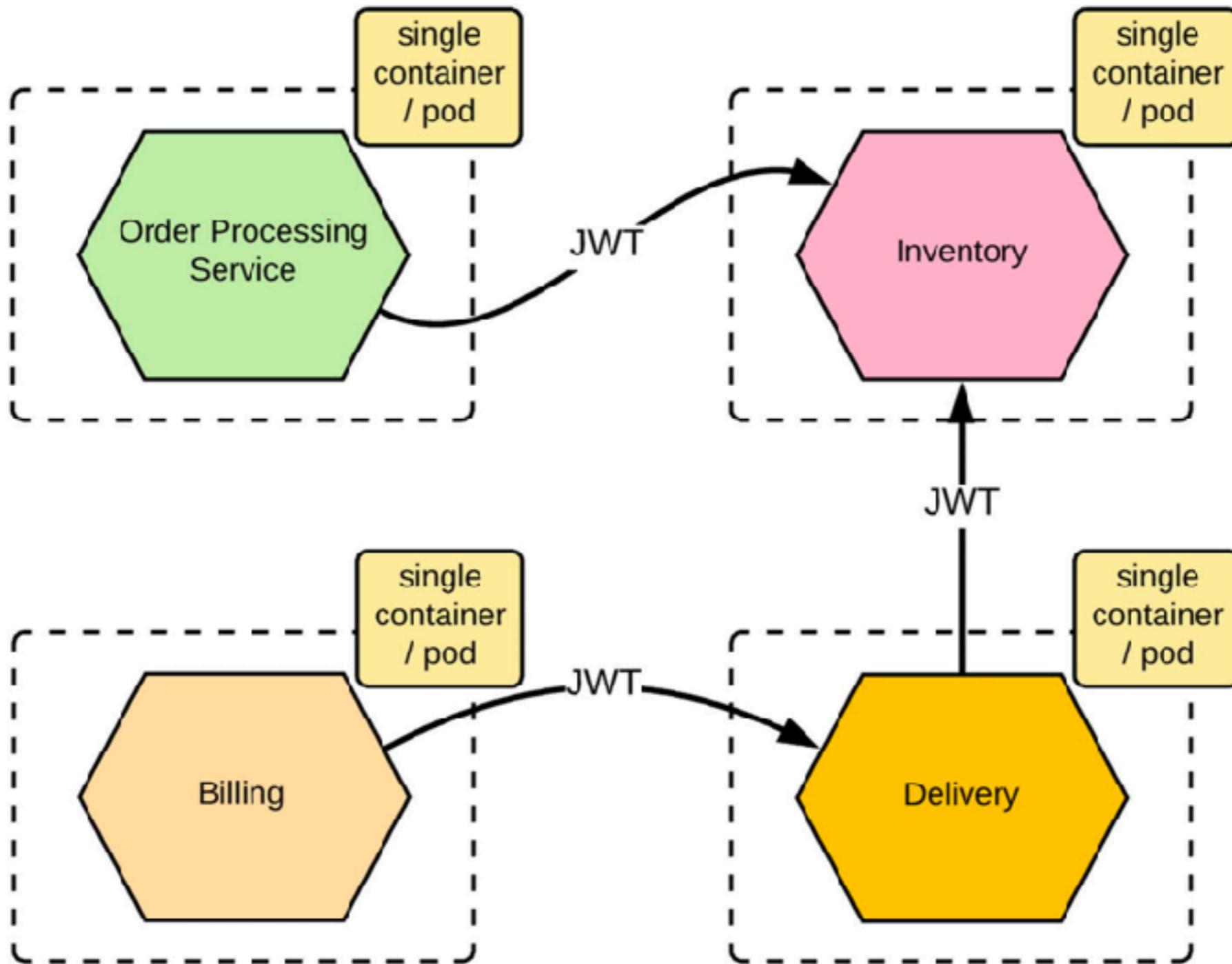


JSON Web Token (JWT)

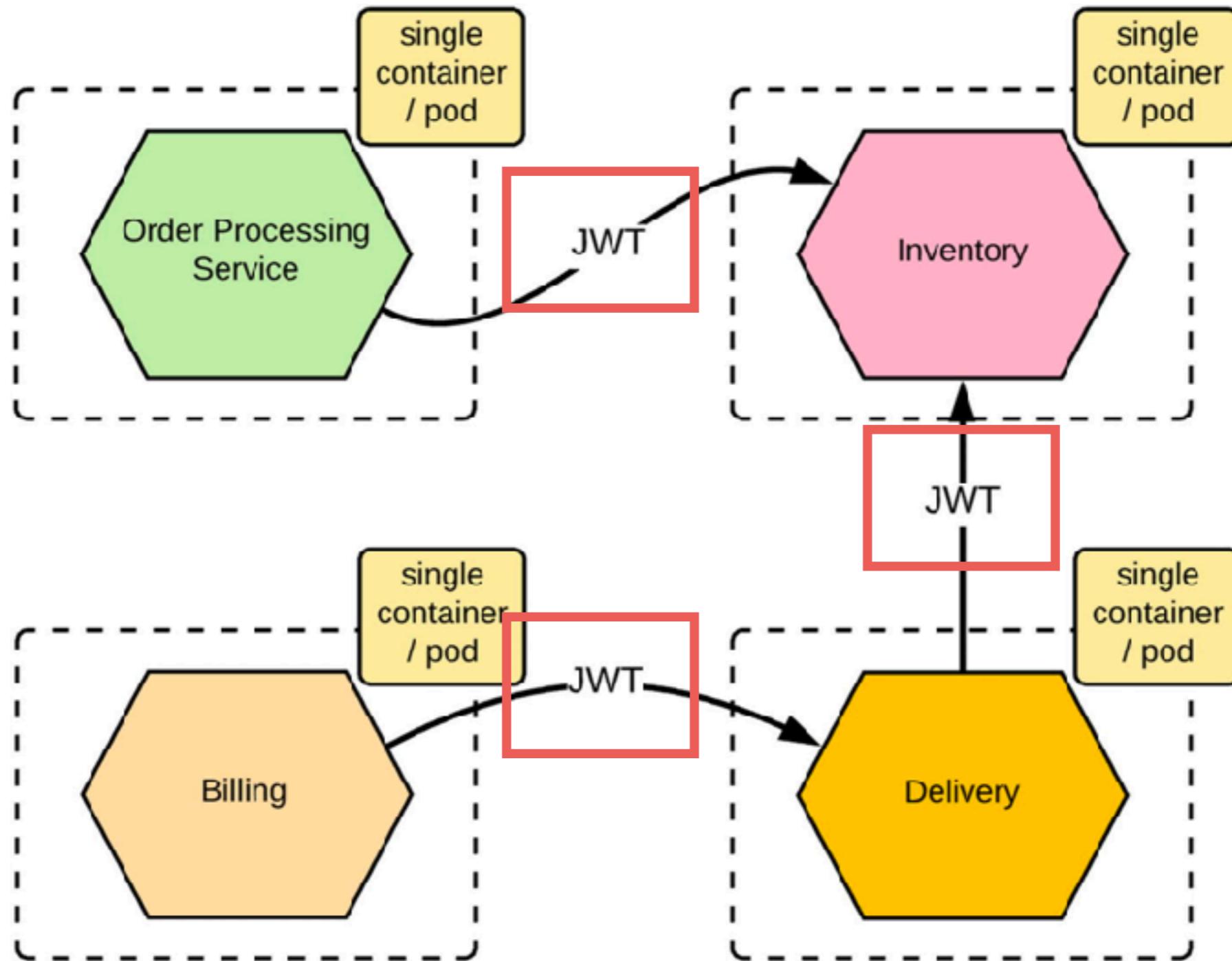
Define a container to transport data between interested parties



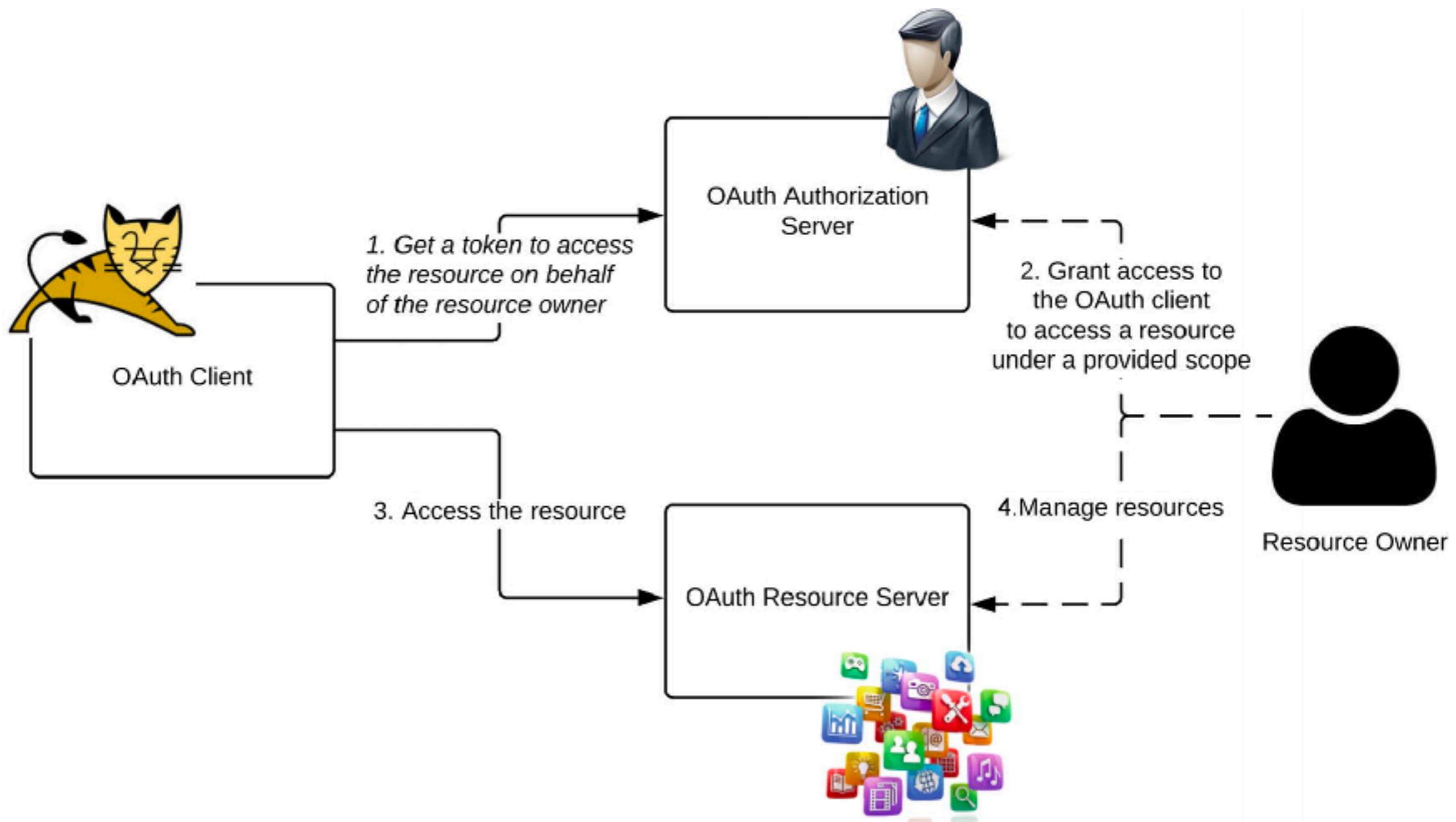
Passing user context as JWT



Problem ?

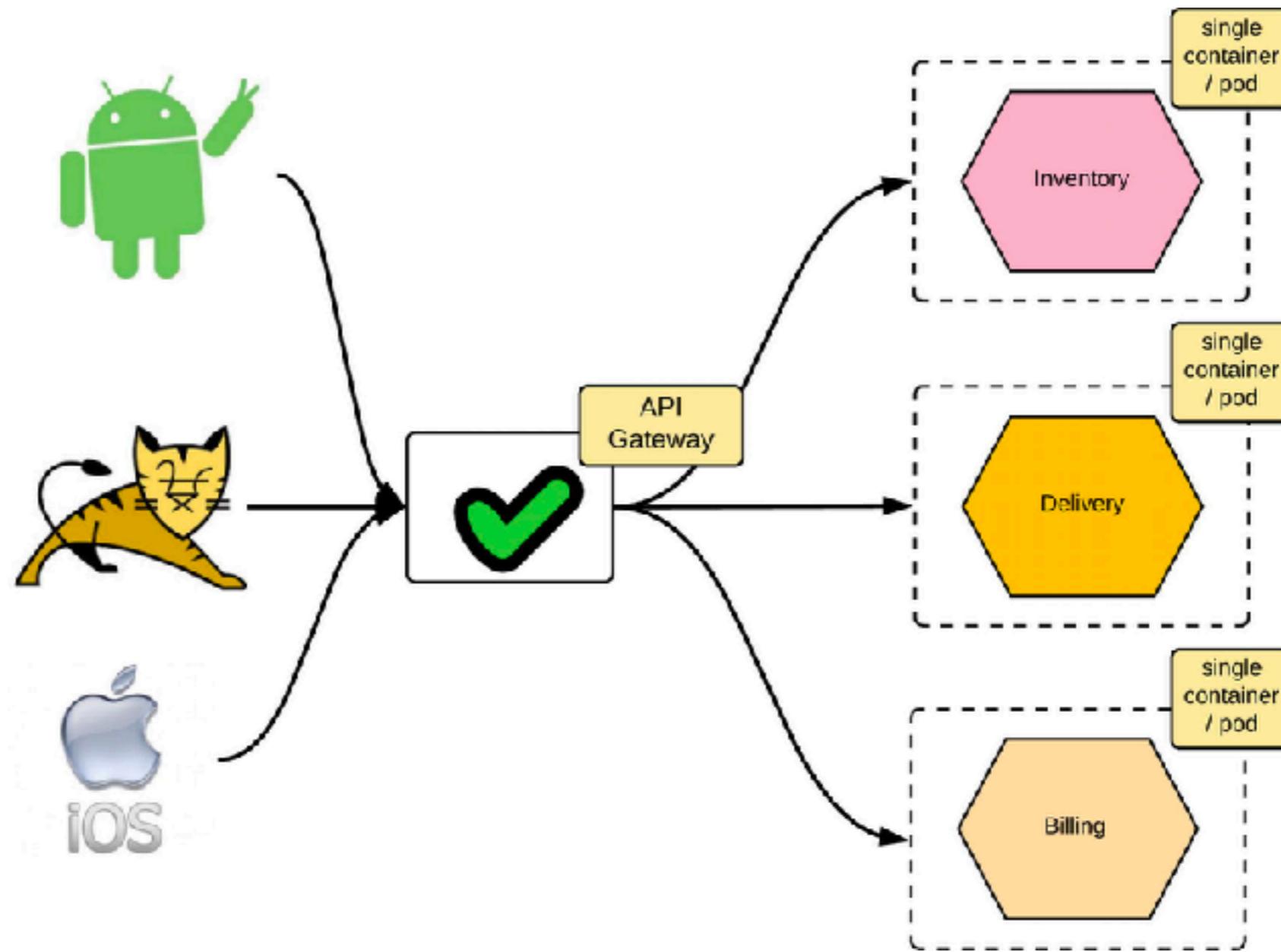


OAuth 2.0



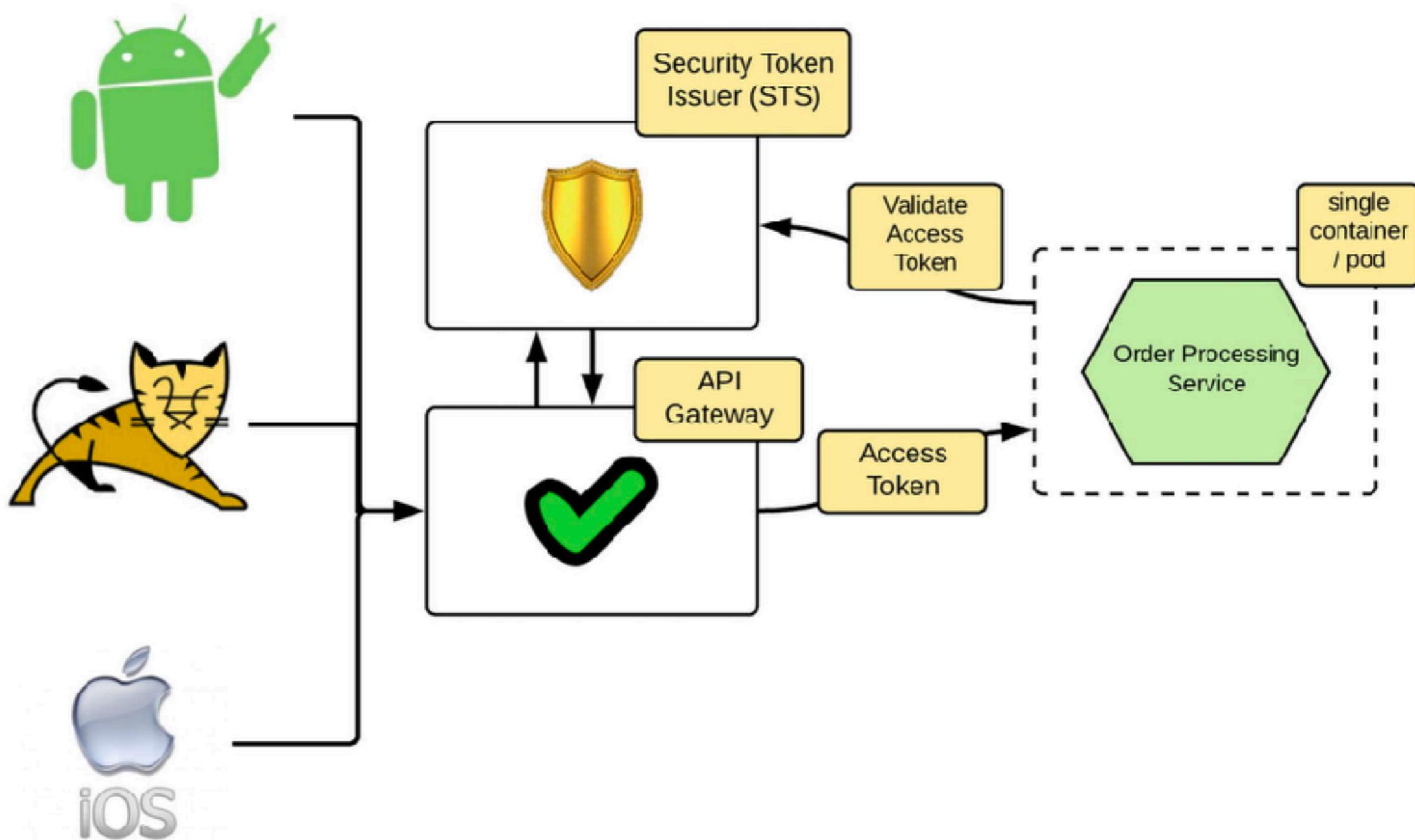
Centralize pattern

Using API gateway pattern

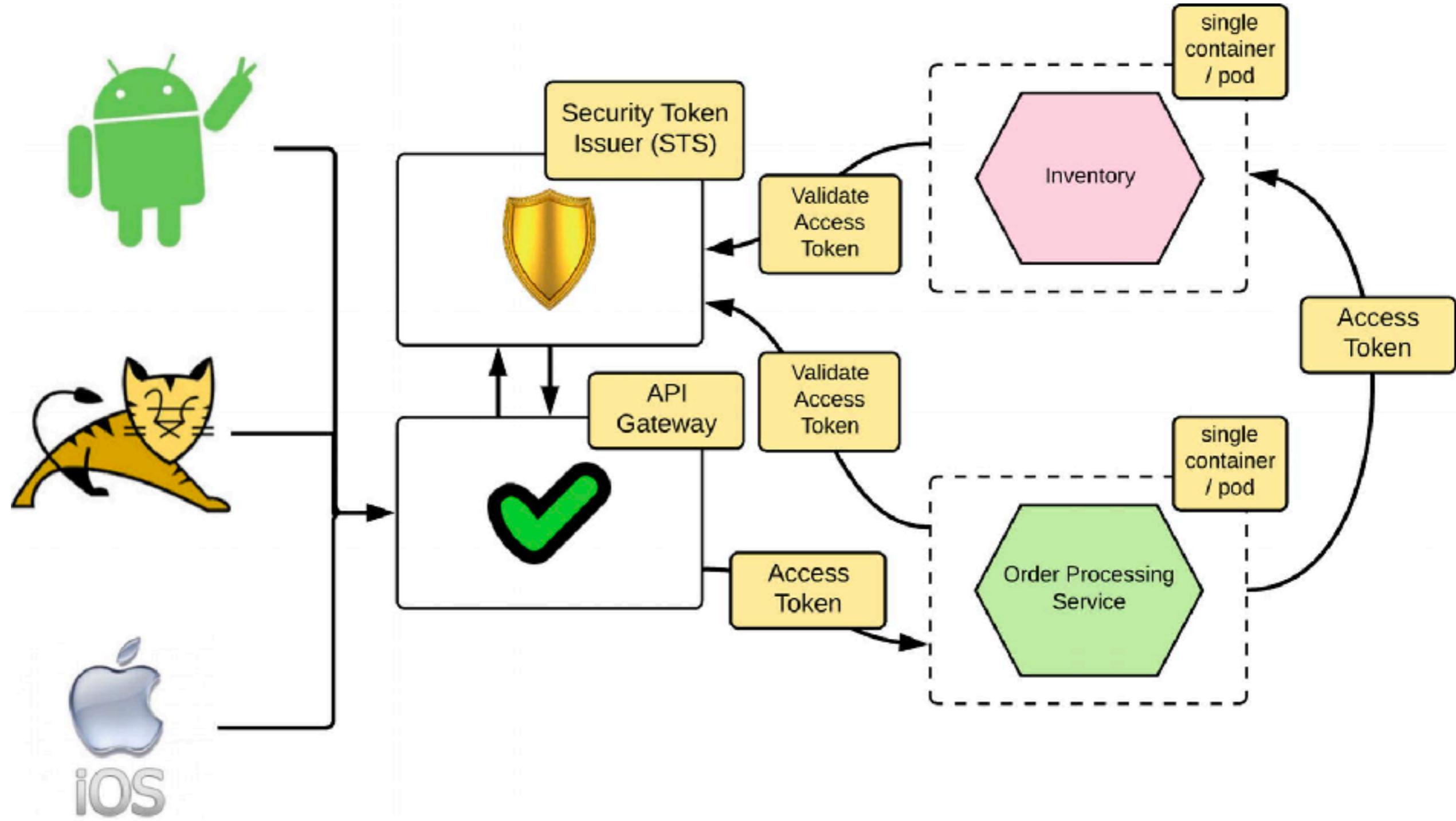


Centralize pattern

Using API gateway pattern

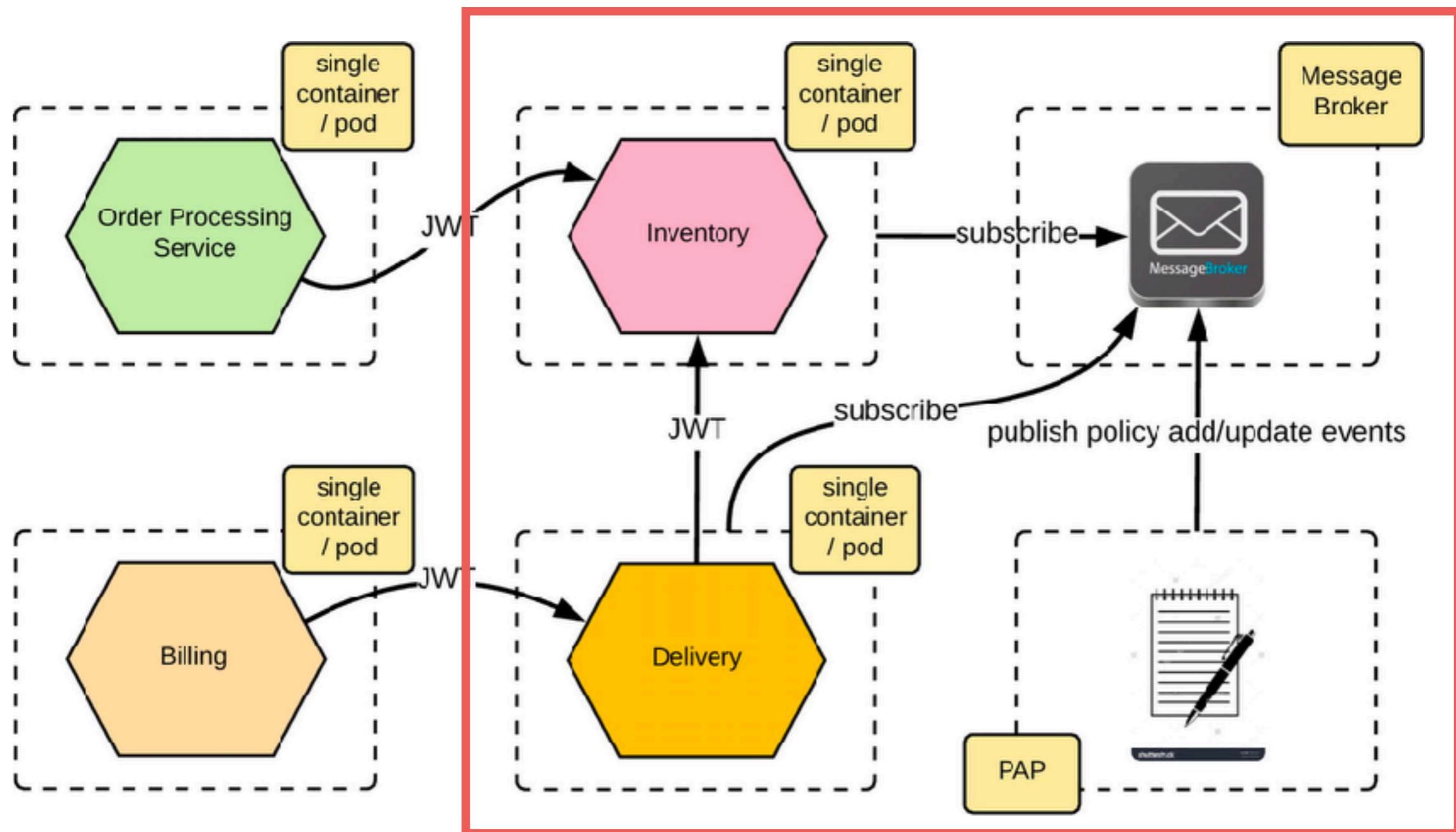


API gateway with OAuth 2.0



Access control of services

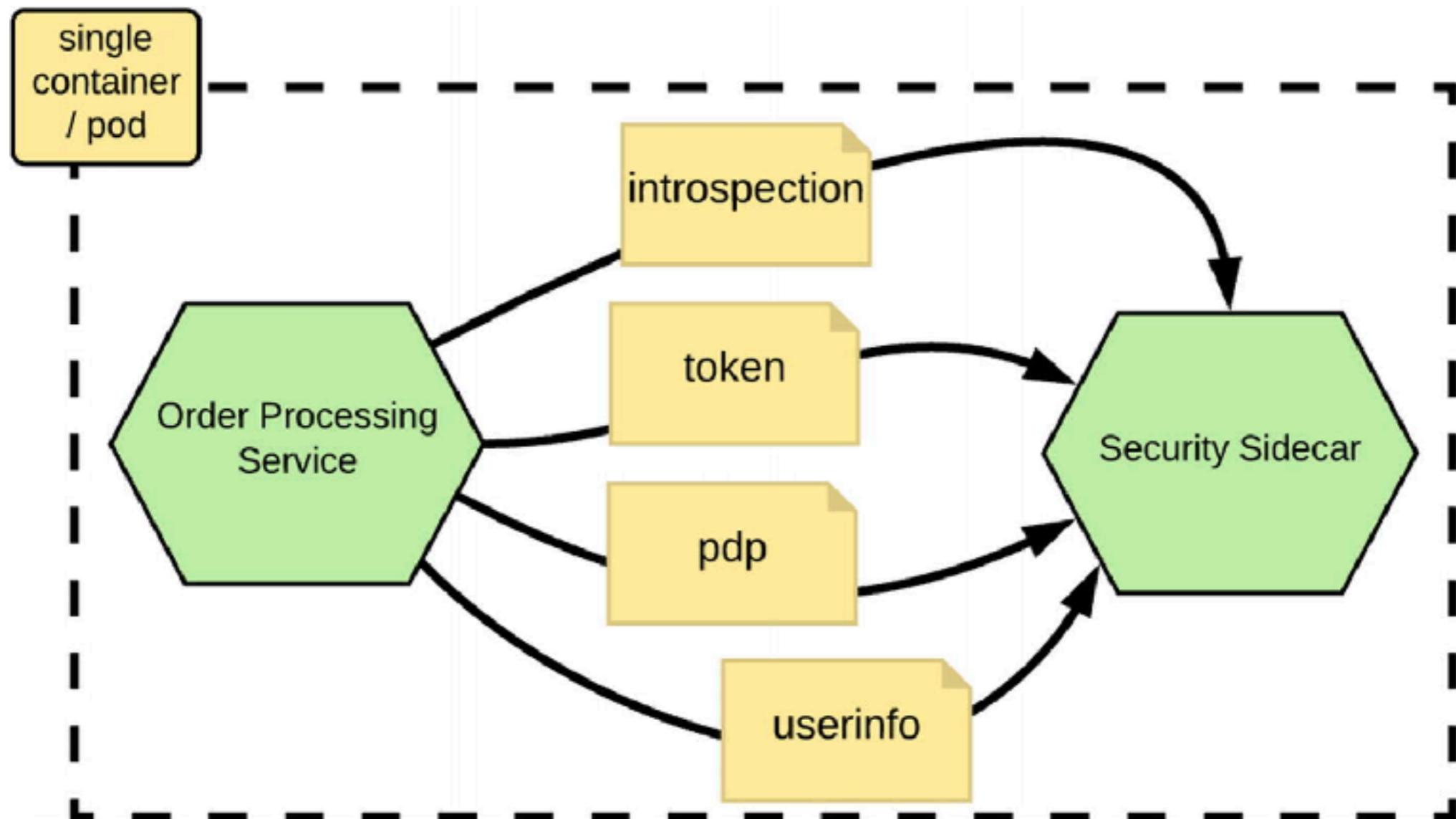
Policy Administration Point



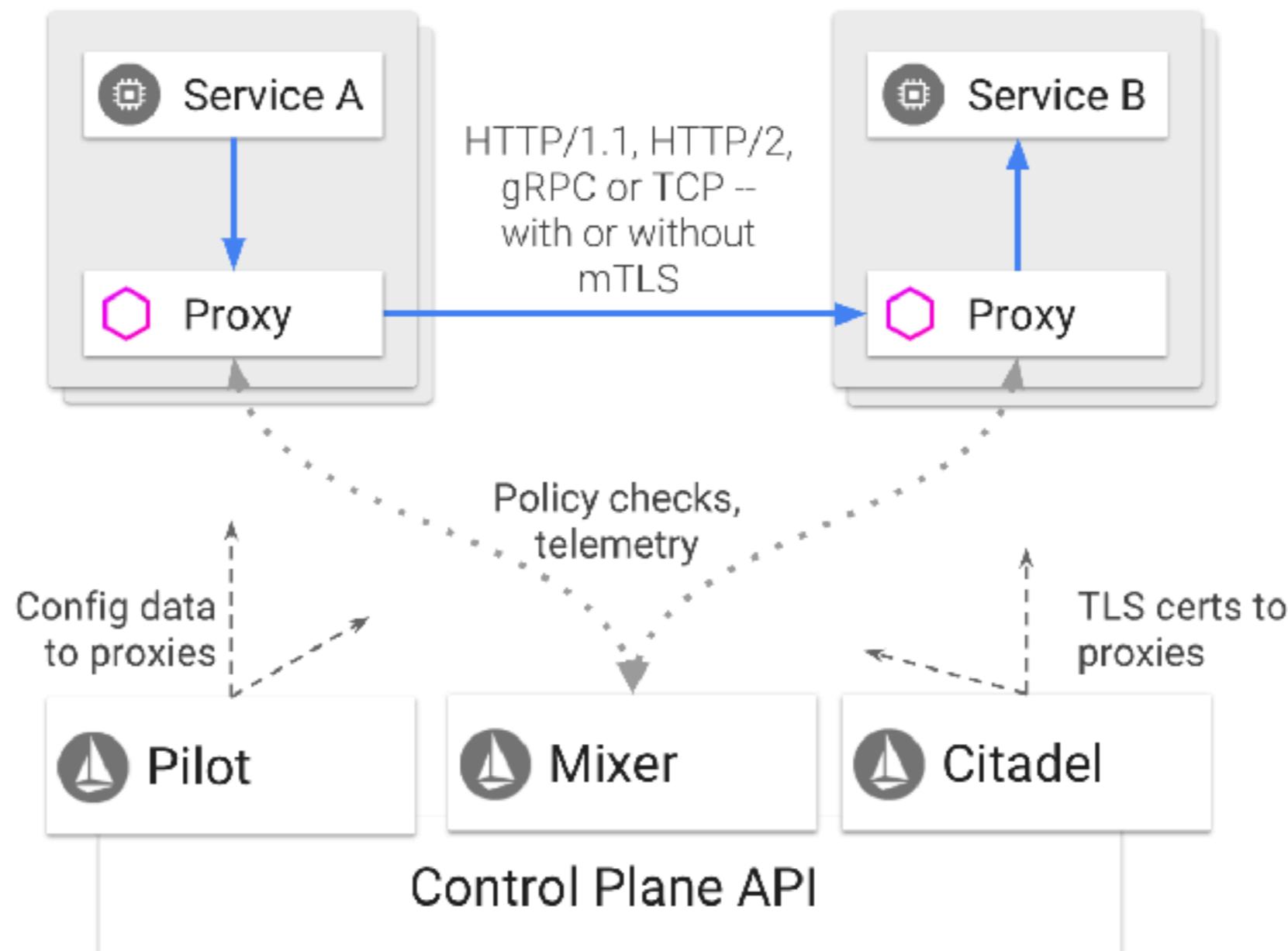
Working sidecar



Security sidecar



Security sidecar



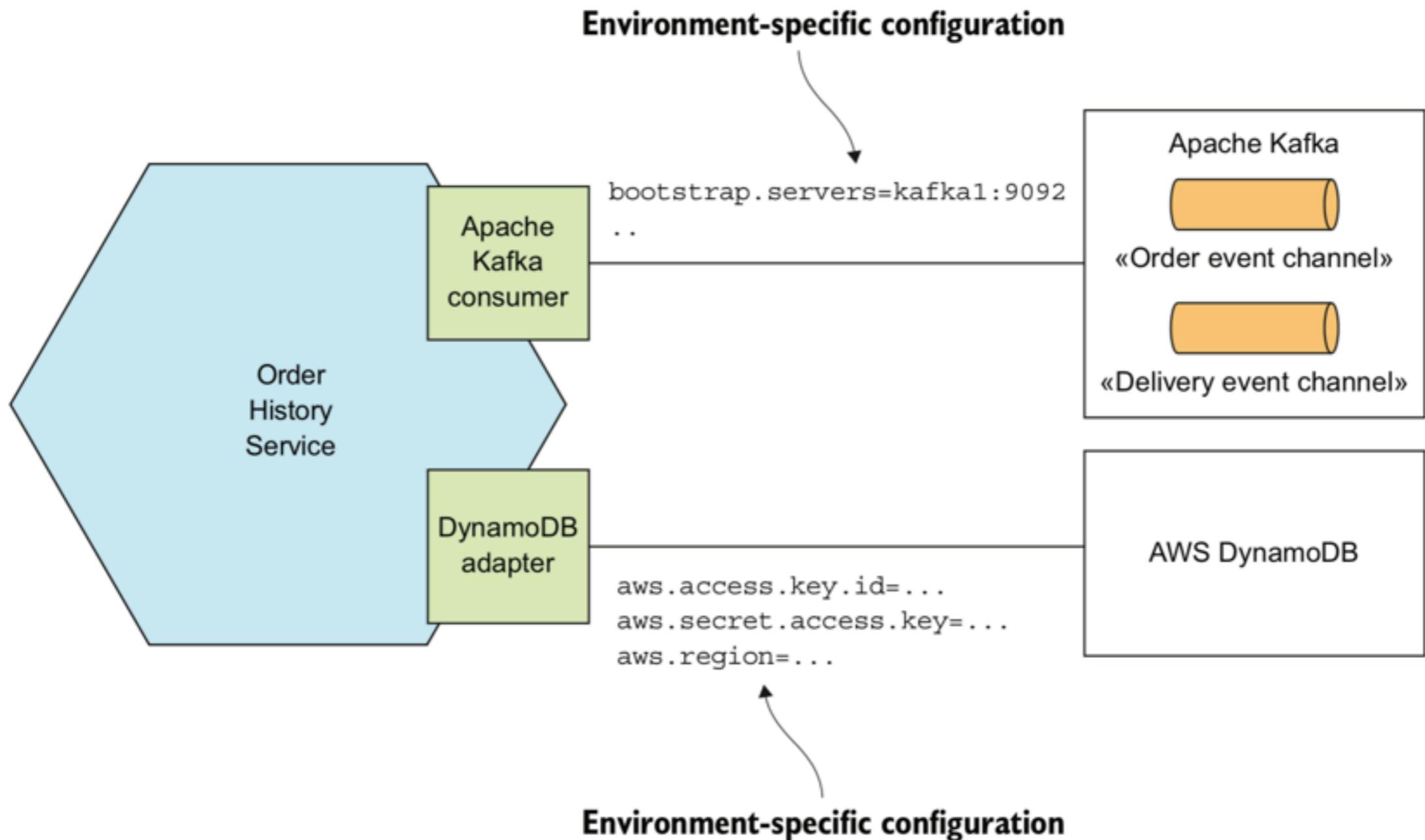
<https://istio.io/docs/concepts/what-is-istio/>



Configurable services



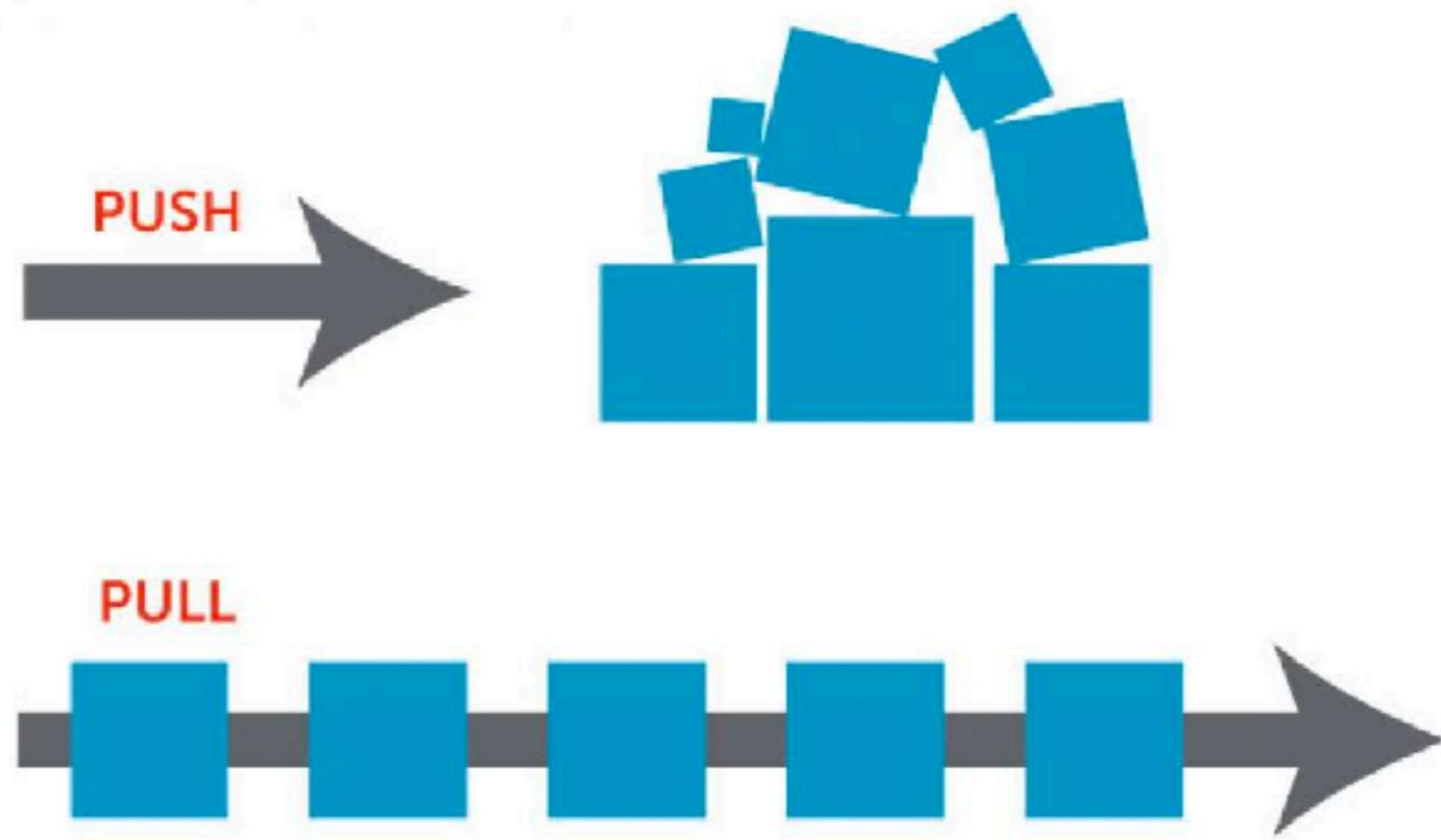
Design configurable services



External configuration models

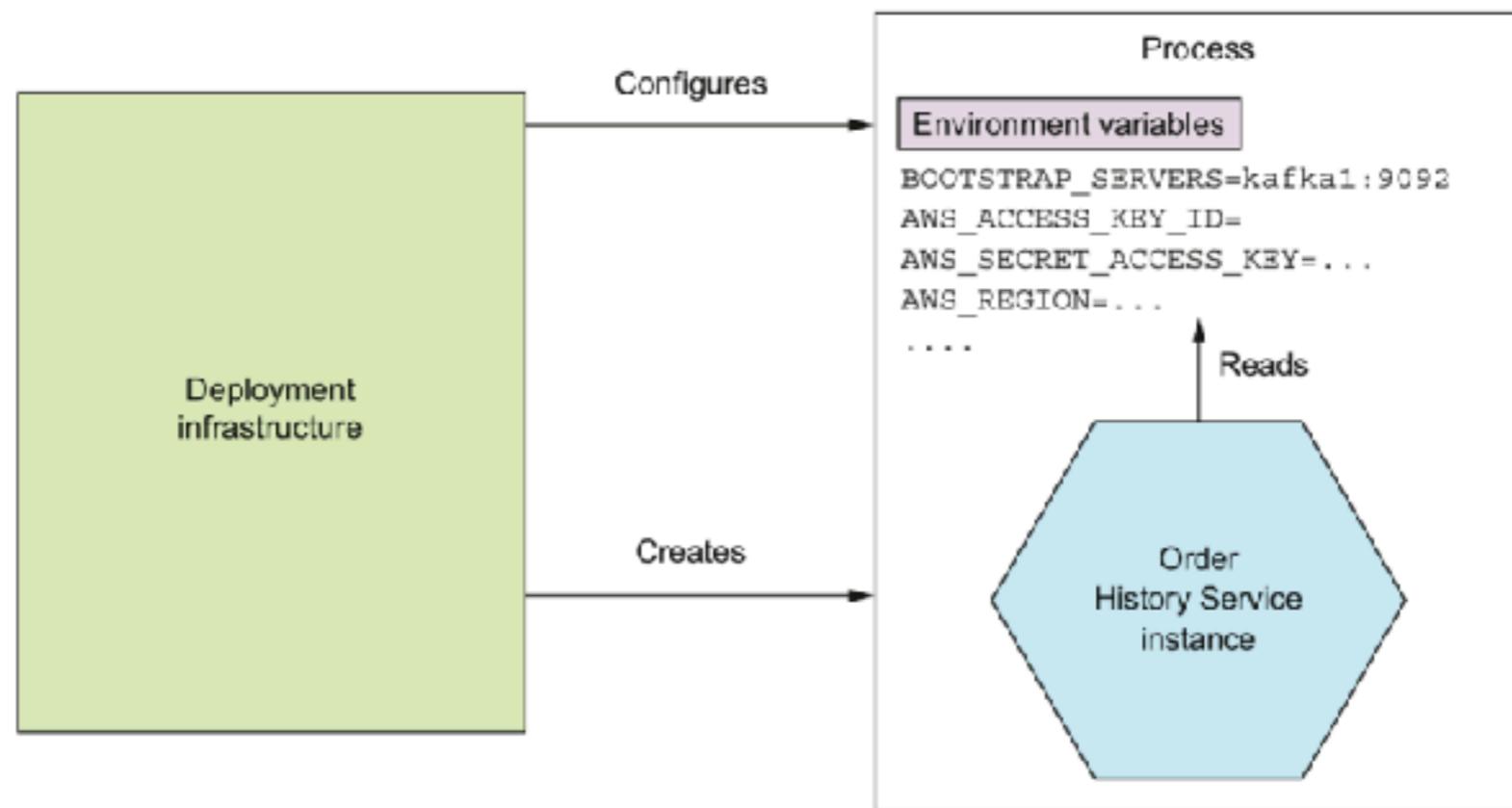
Push model

Pull model



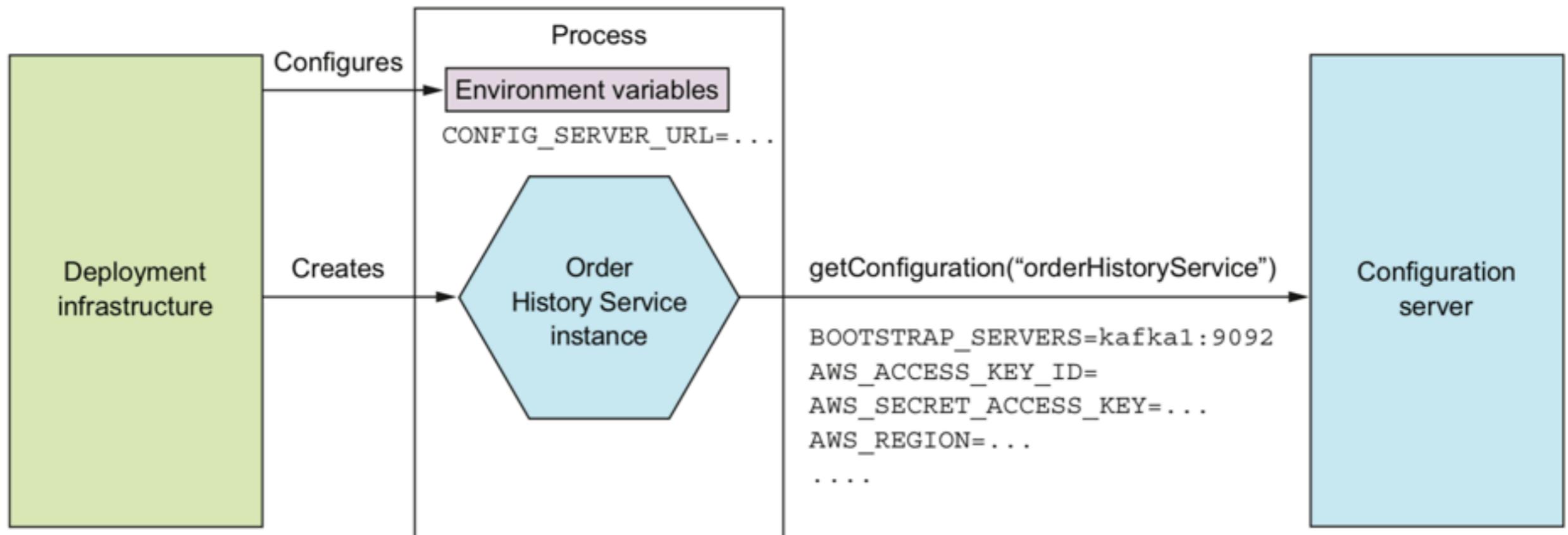
Push model

Pass the configuration to service
OS environment variables
Configuration files



Pull model

Service read configuration from configuration server



Benefits of configuration server

Centralized configuration

Transparent decryption of sensitive data

Dynamic reconfiguration



Drawbacks of configuration server

Need setup and maintain !!

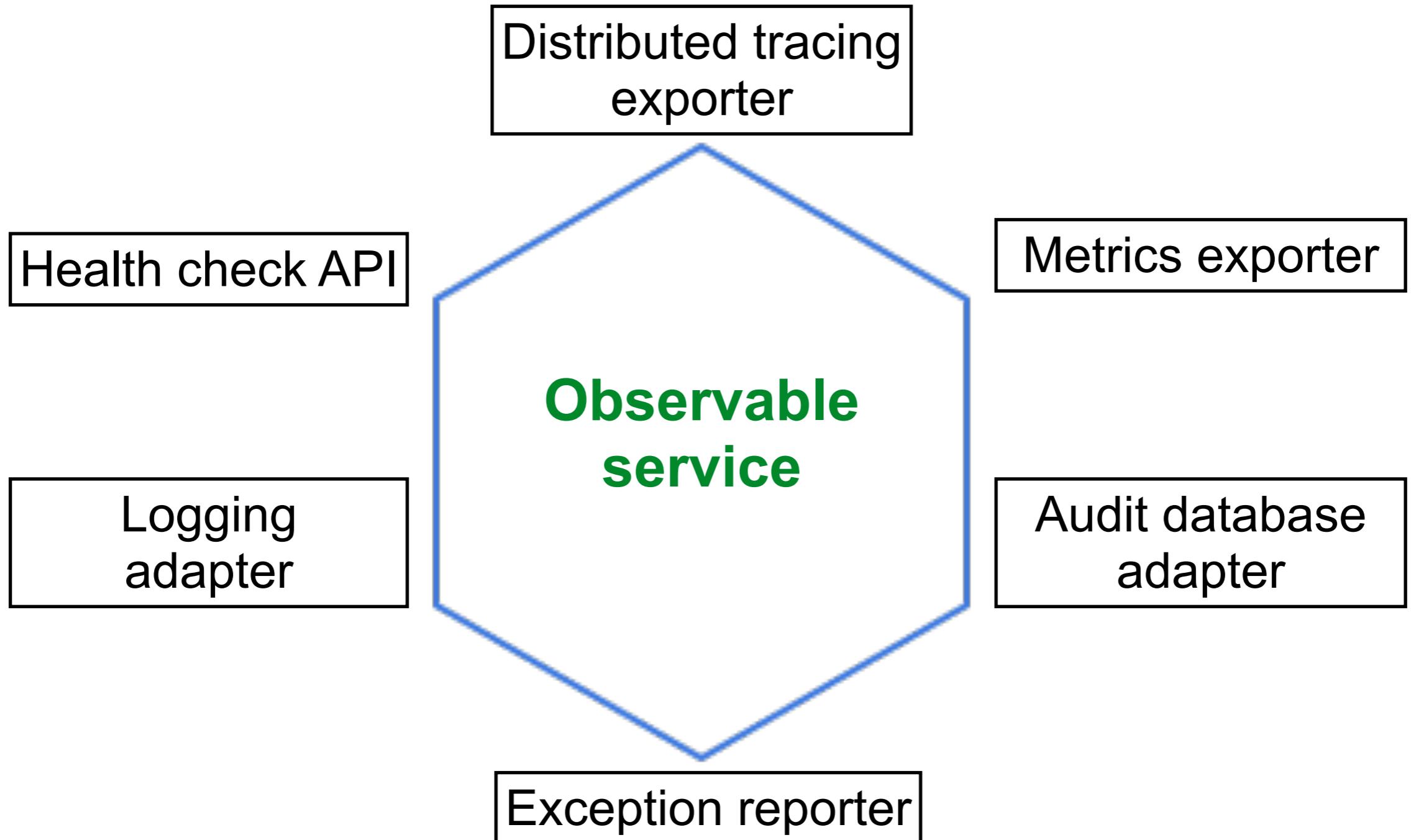


Design observable services

- Health check API
- Log aggregation
- Distributed tracing
- Exception tracking
- Application metrics
- Audit logging

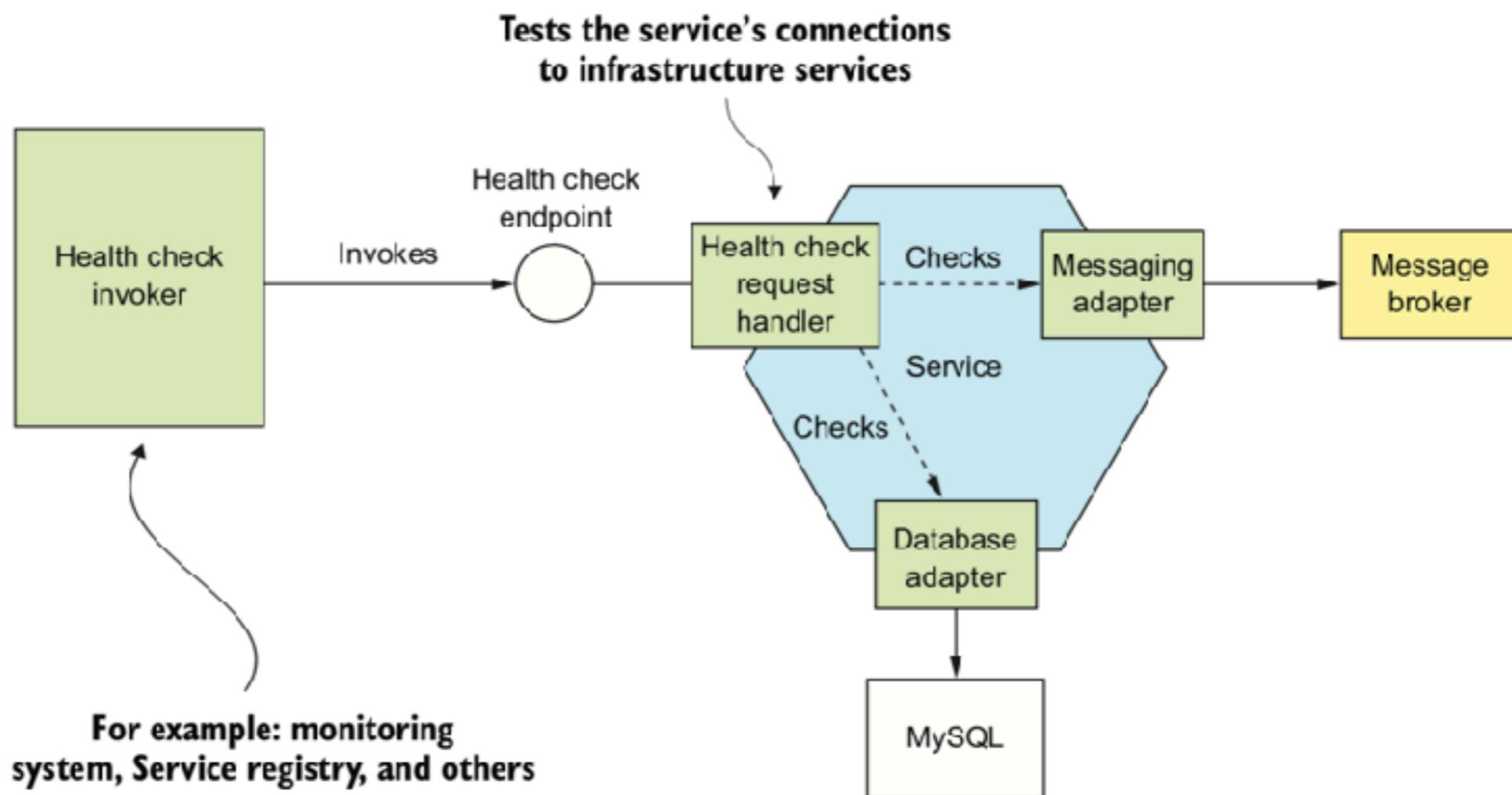


Observable services



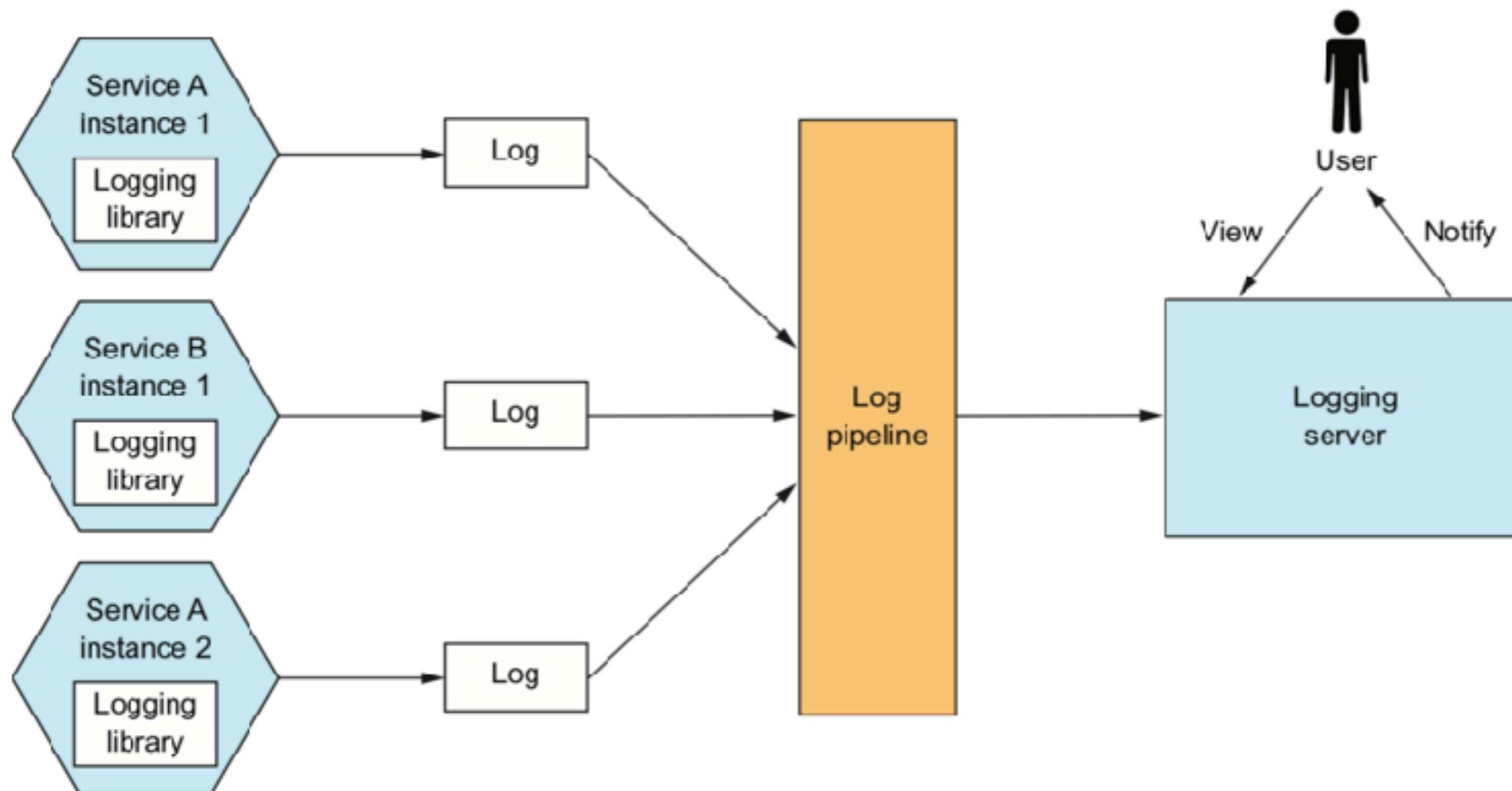
Health check API

Expose an endpoint that return the health of service



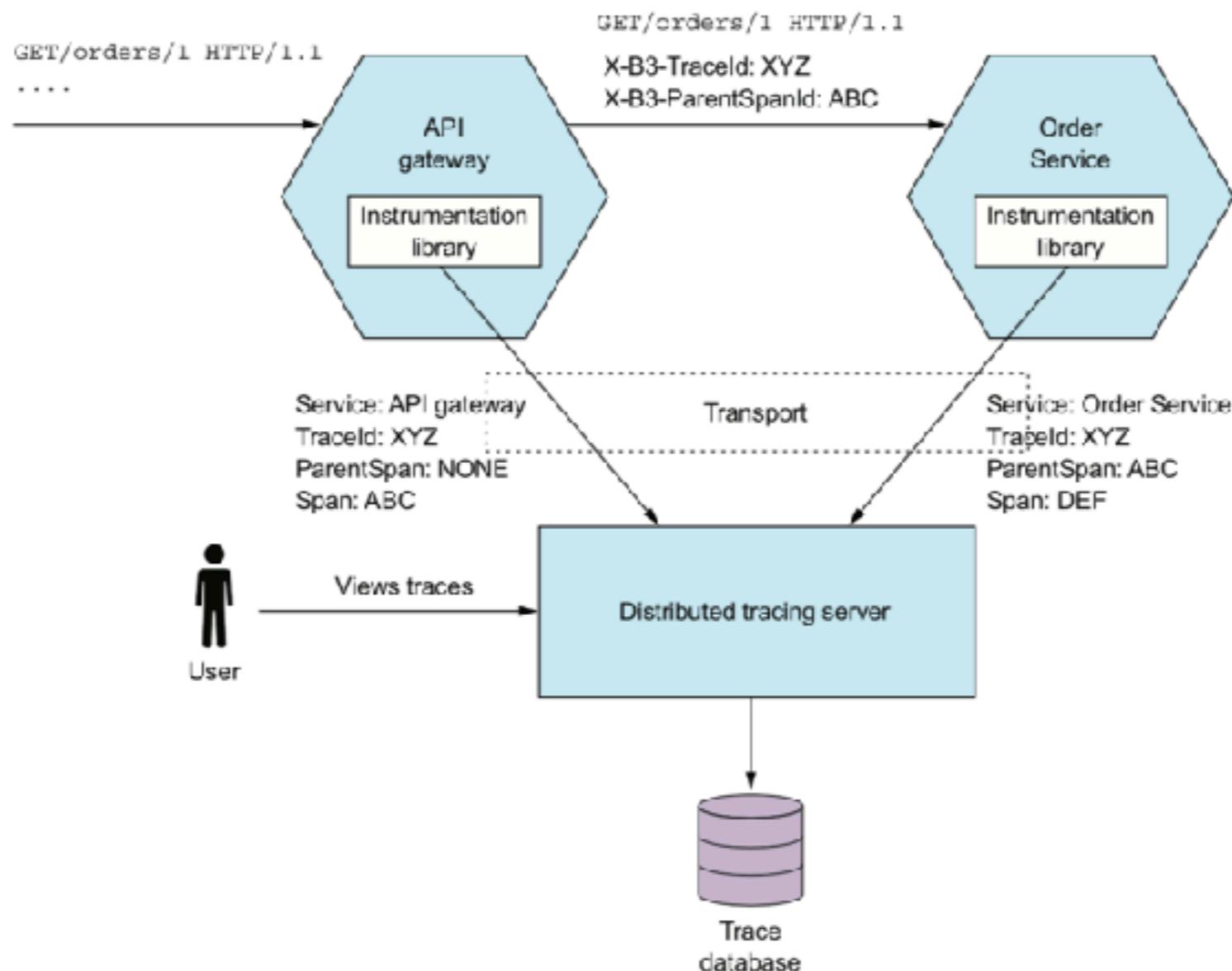
Log aggregation

Log service activity and write logs into a centralized logging server. (searching, alerting)

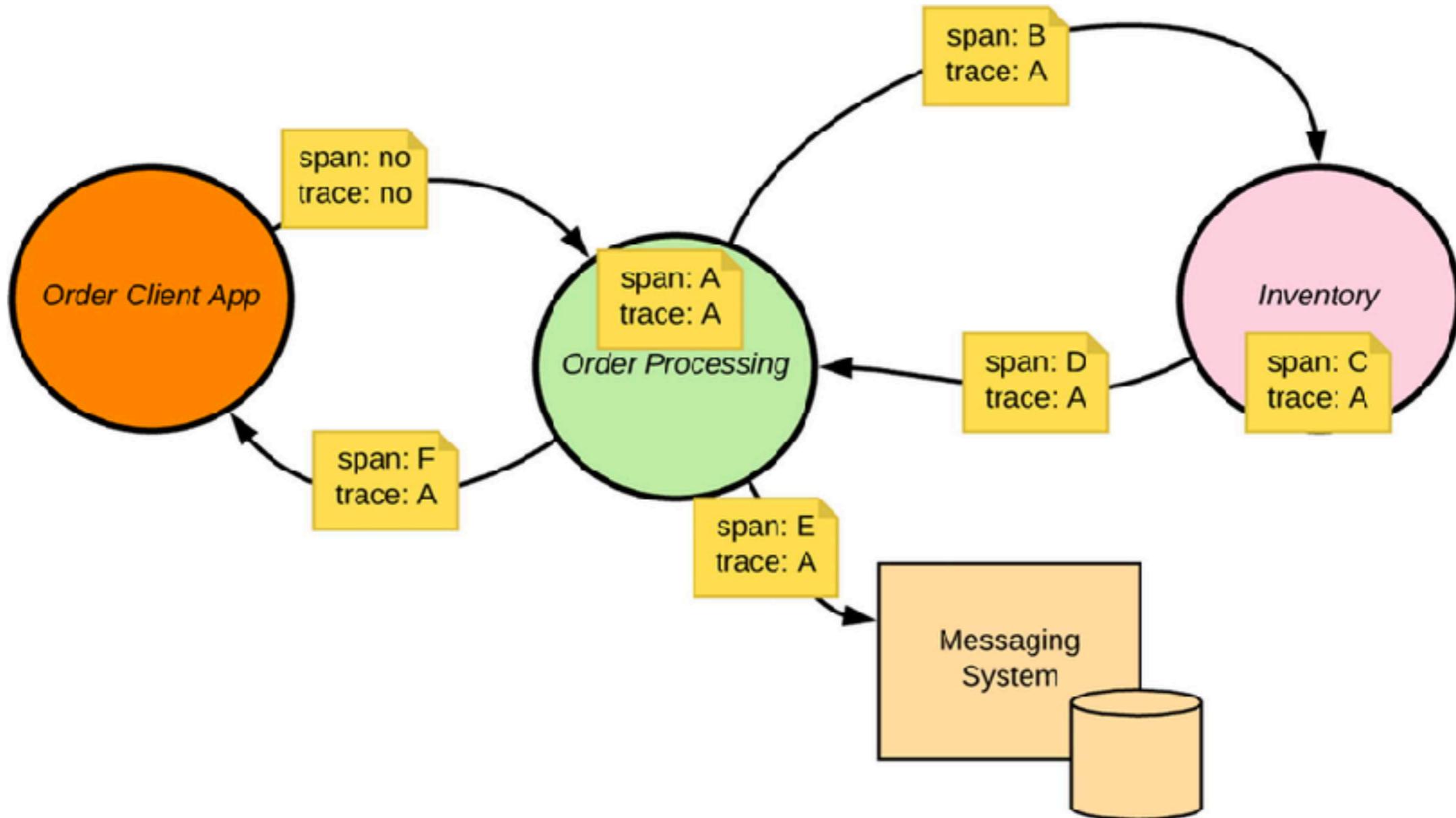


Distributed tracing

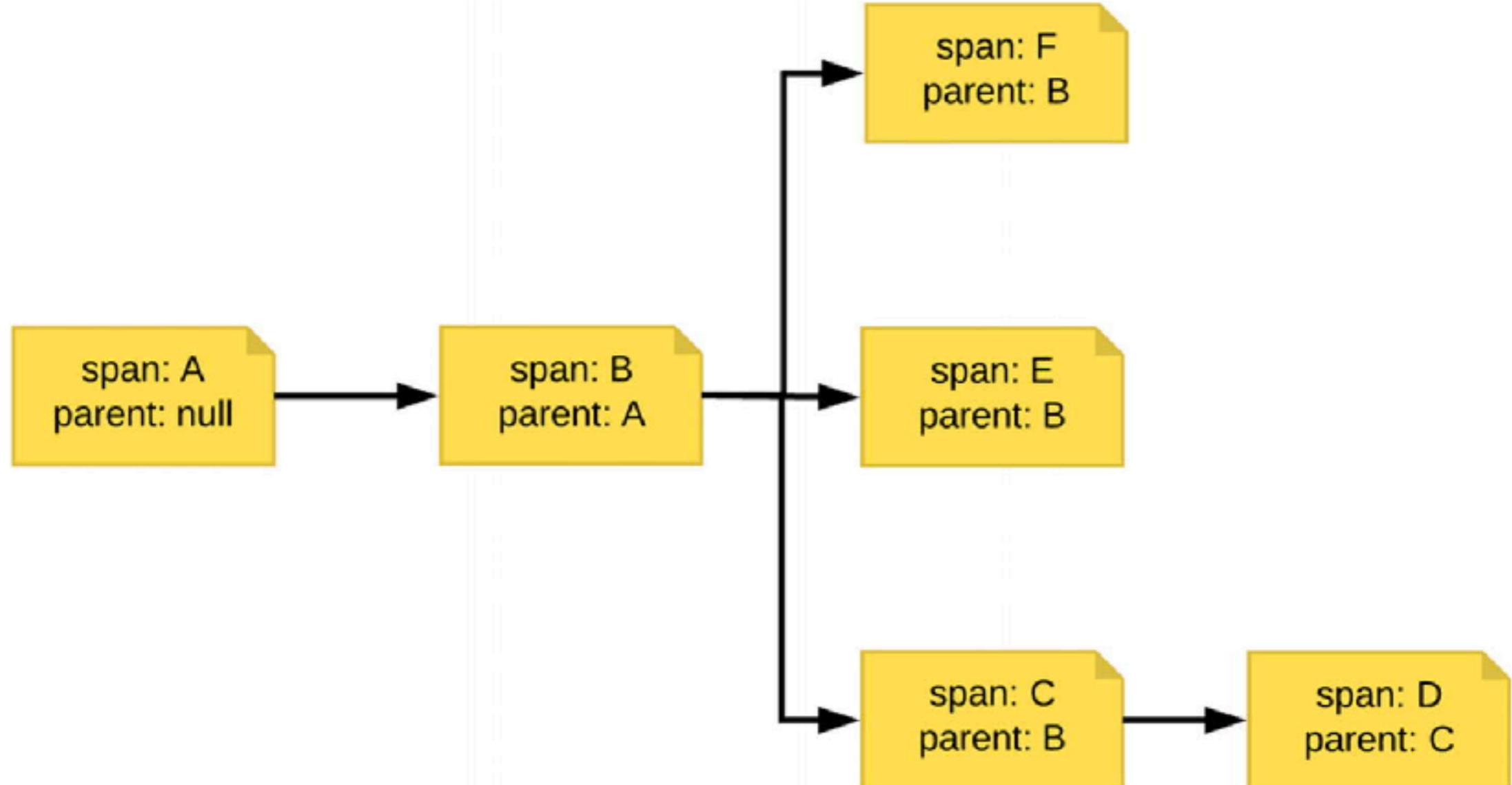
Assign each external request a unique ID and trace requests as flow between services



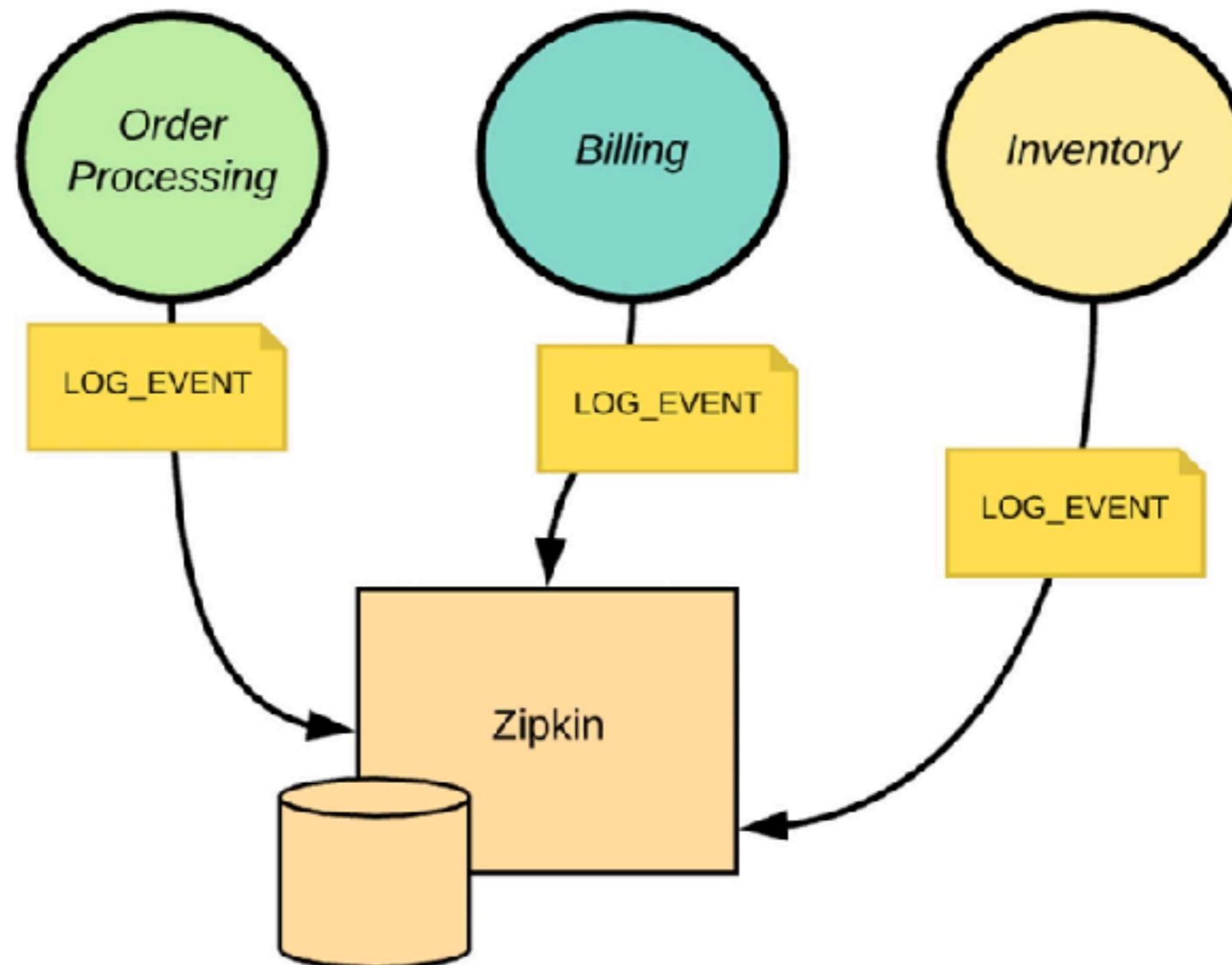
Distributed tracing



Distributed tracing



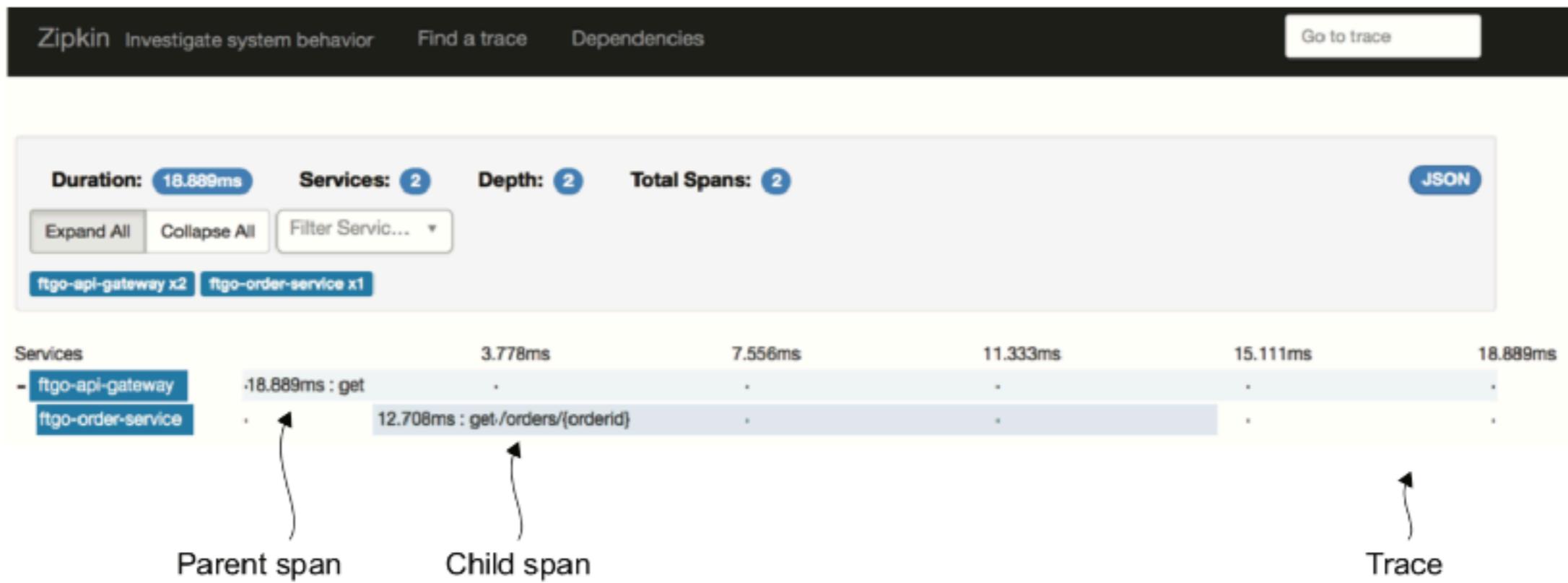
Distributed tracing with Zipkin



<https://zipkin.io/>



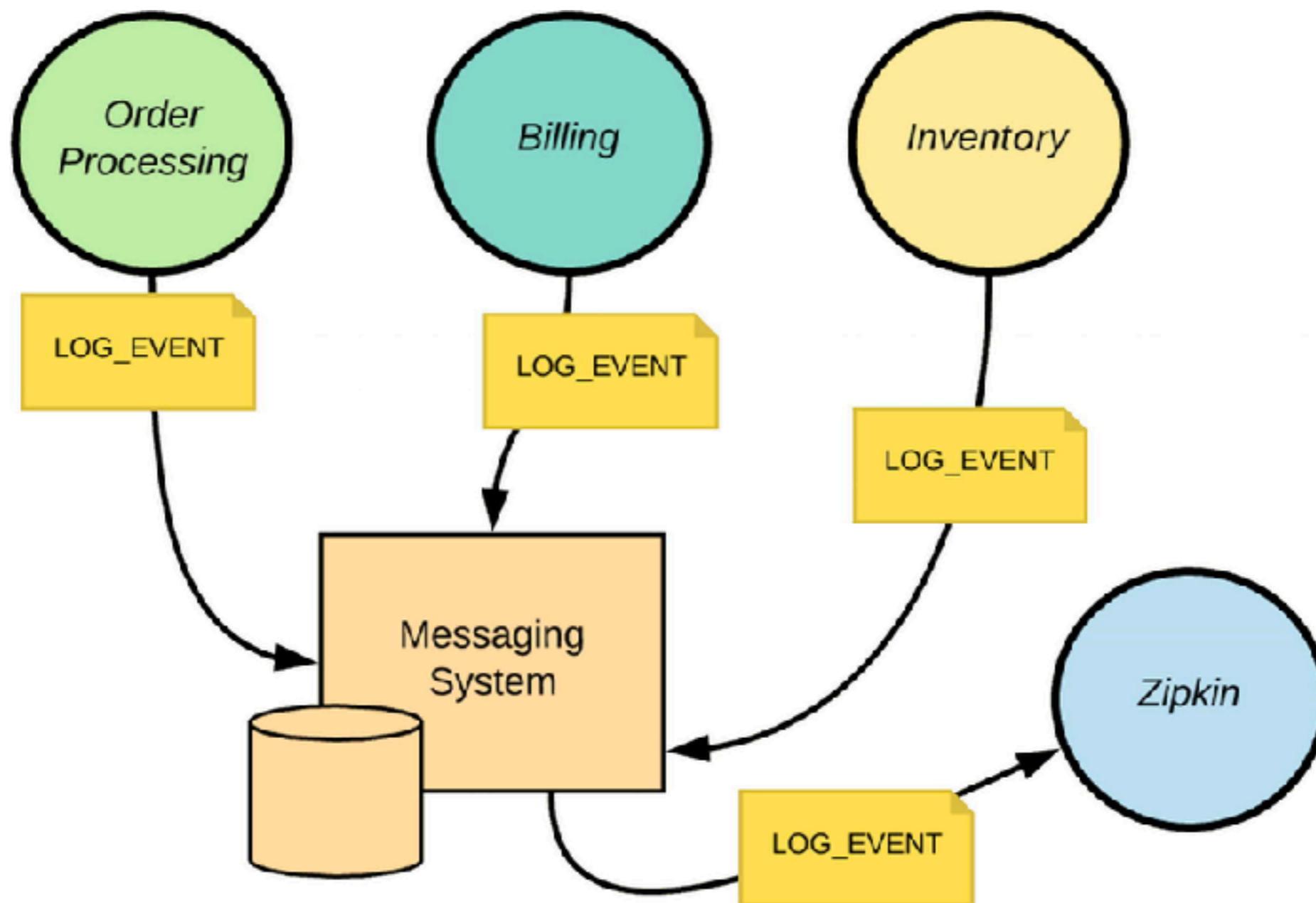
Distributed tracing with Zipkin



<https://zipkin.io/>

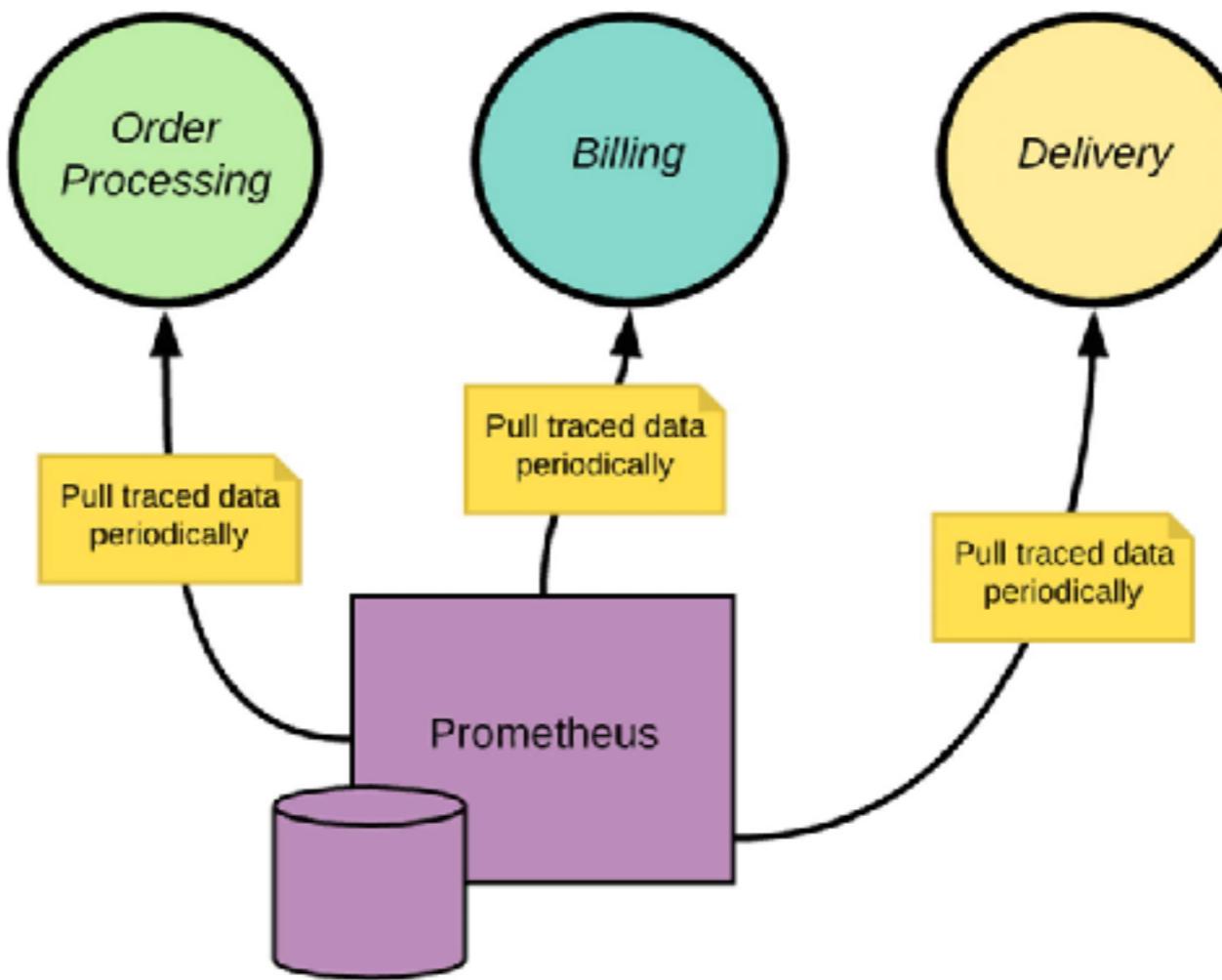


Distributed tracing with Zipkin



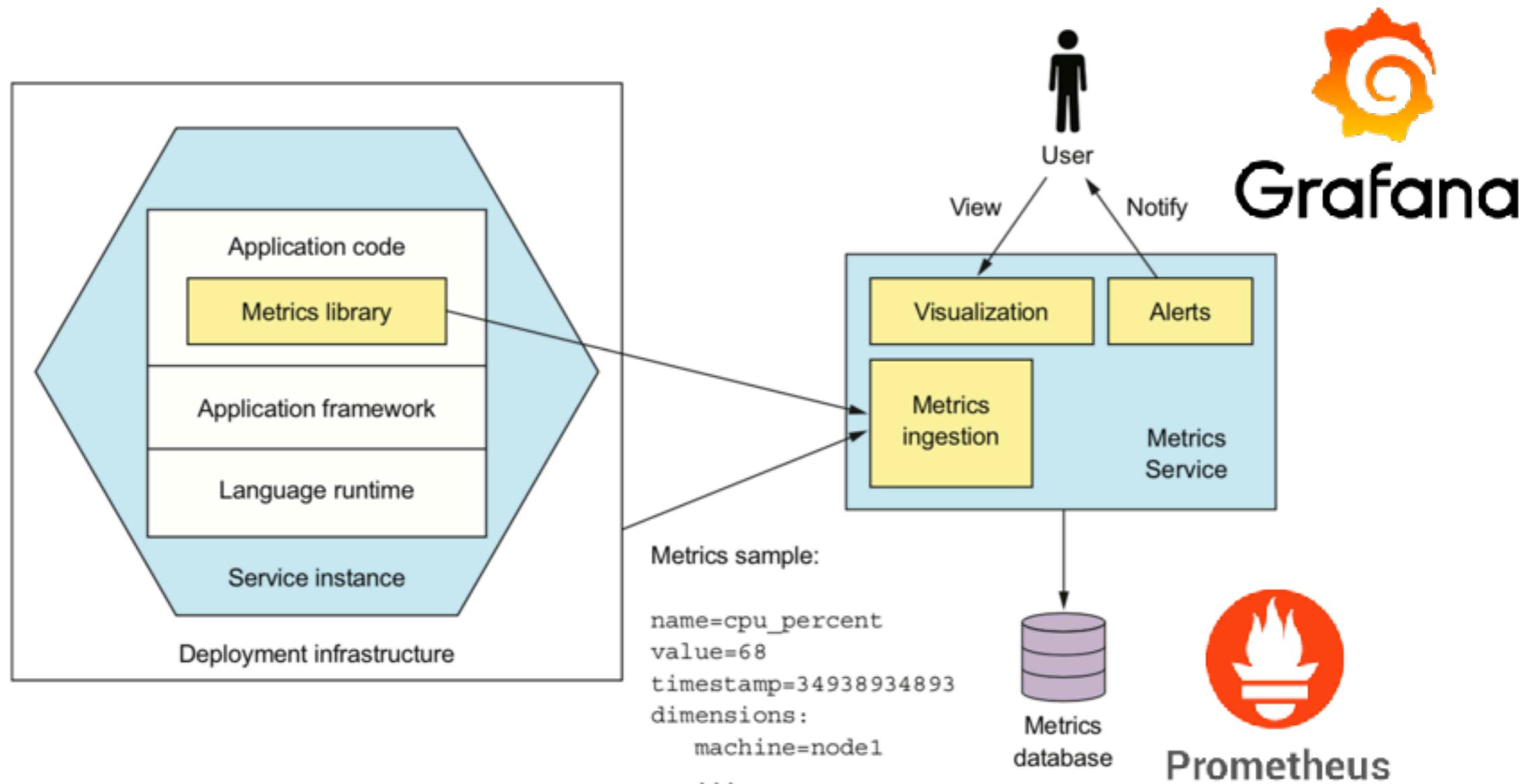
Application metrics

Services maintain metrics and expose to metric server (counters, gauges)



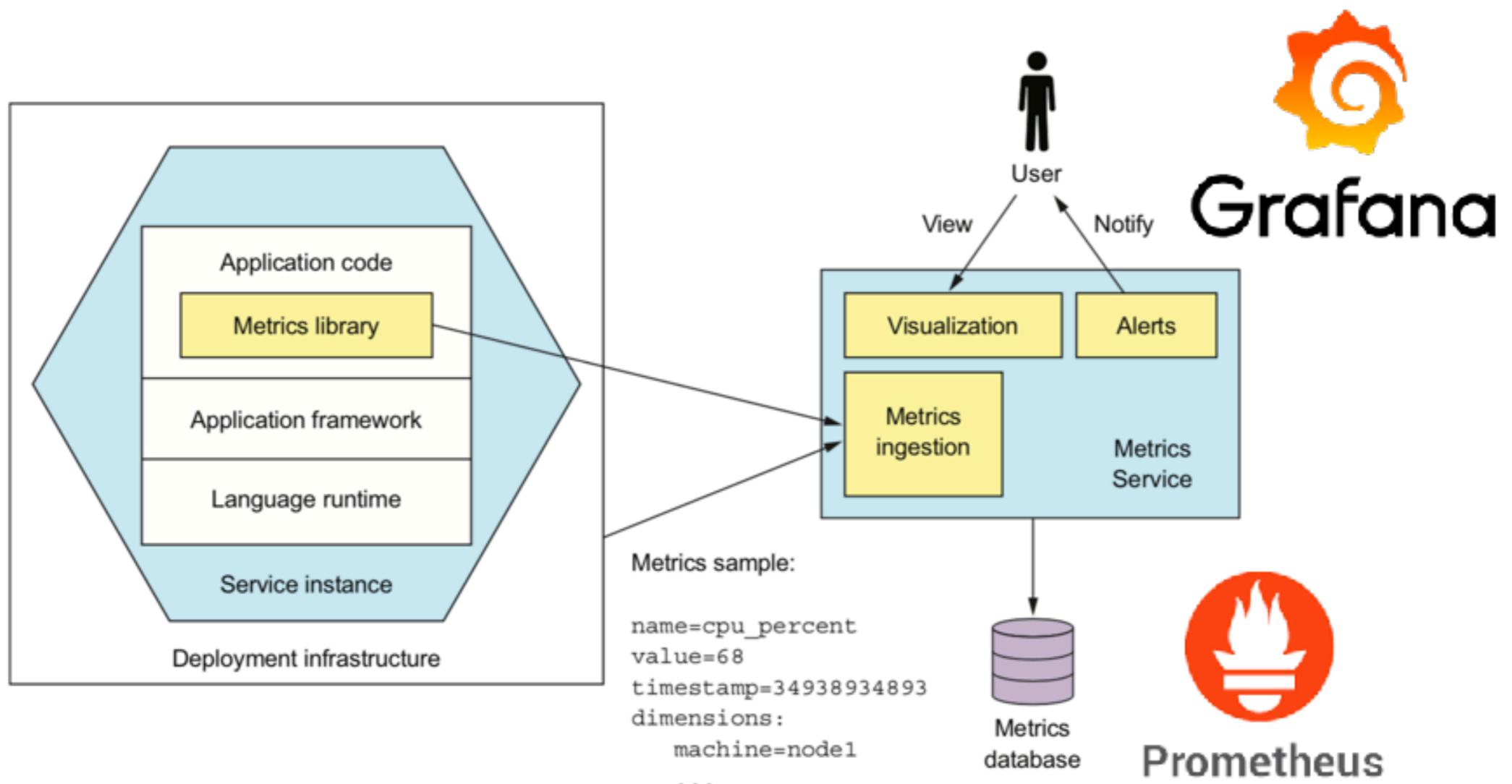
Application metrics

Services maintain metrics and expose to metric server (counters, gauges)



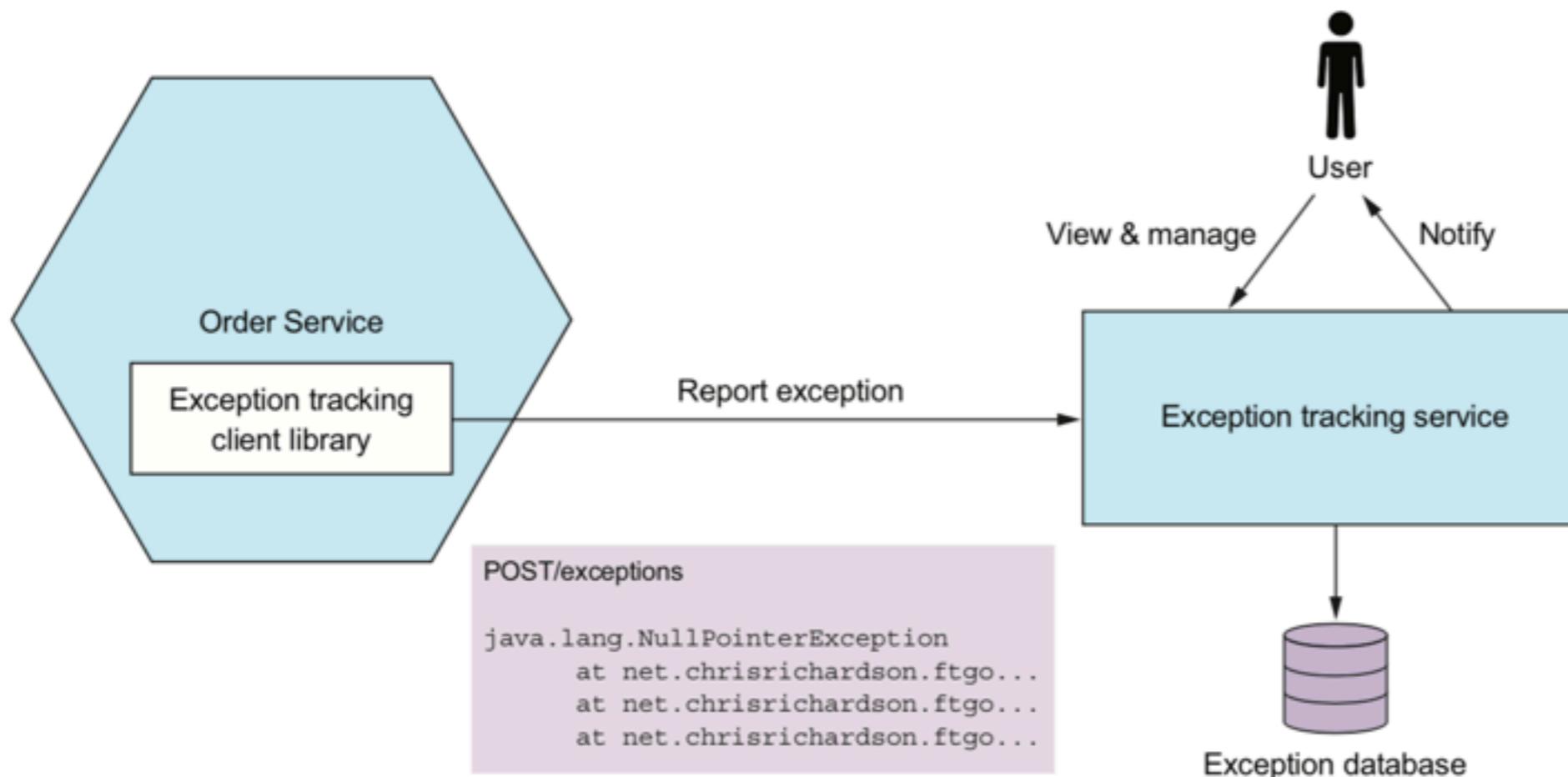
Application metrics

Metrics database => Prometheus
Visualization, Alert => Grafana



Exception tracking

Report exceptions to exception tracking service
Help to identify the root cause



Exception tracking services



Audit logging

Log of user actions

Help customer support

Ensure compliance

Detect suspicious behaviour



How to implement the audit logging ?

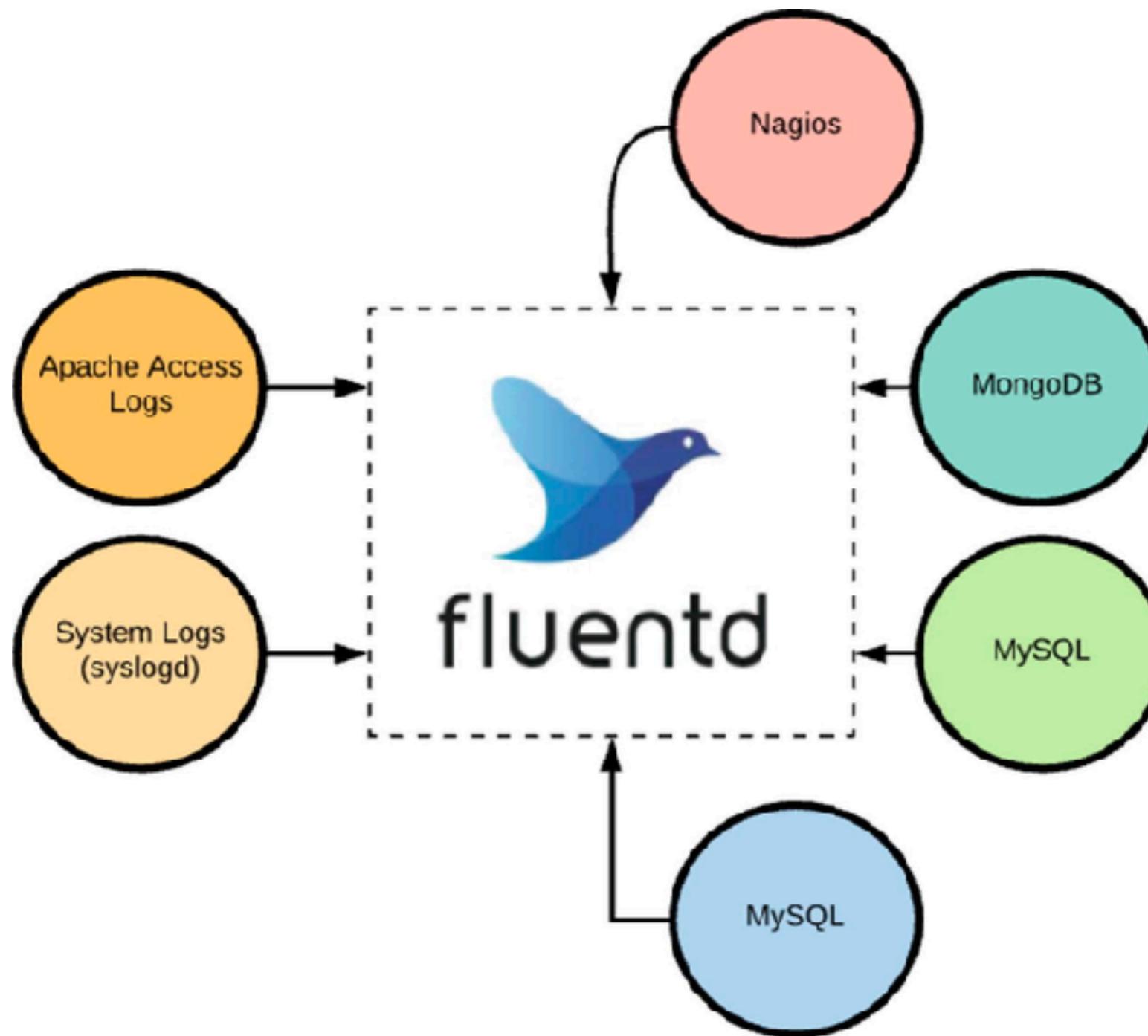
Add logging code in business logic

Use AOP (Aspect-Oriented Programming)

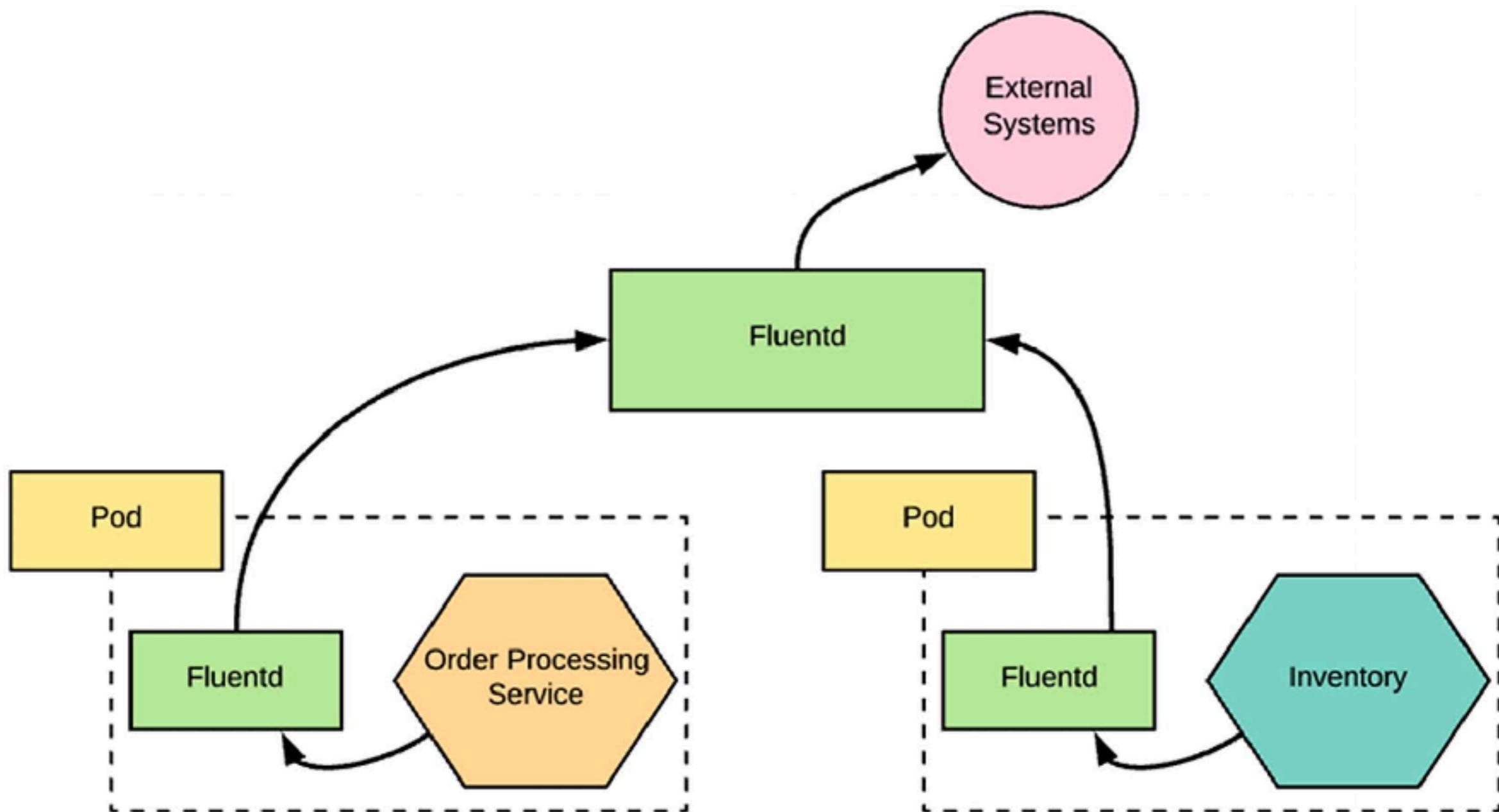
Use event sourcing



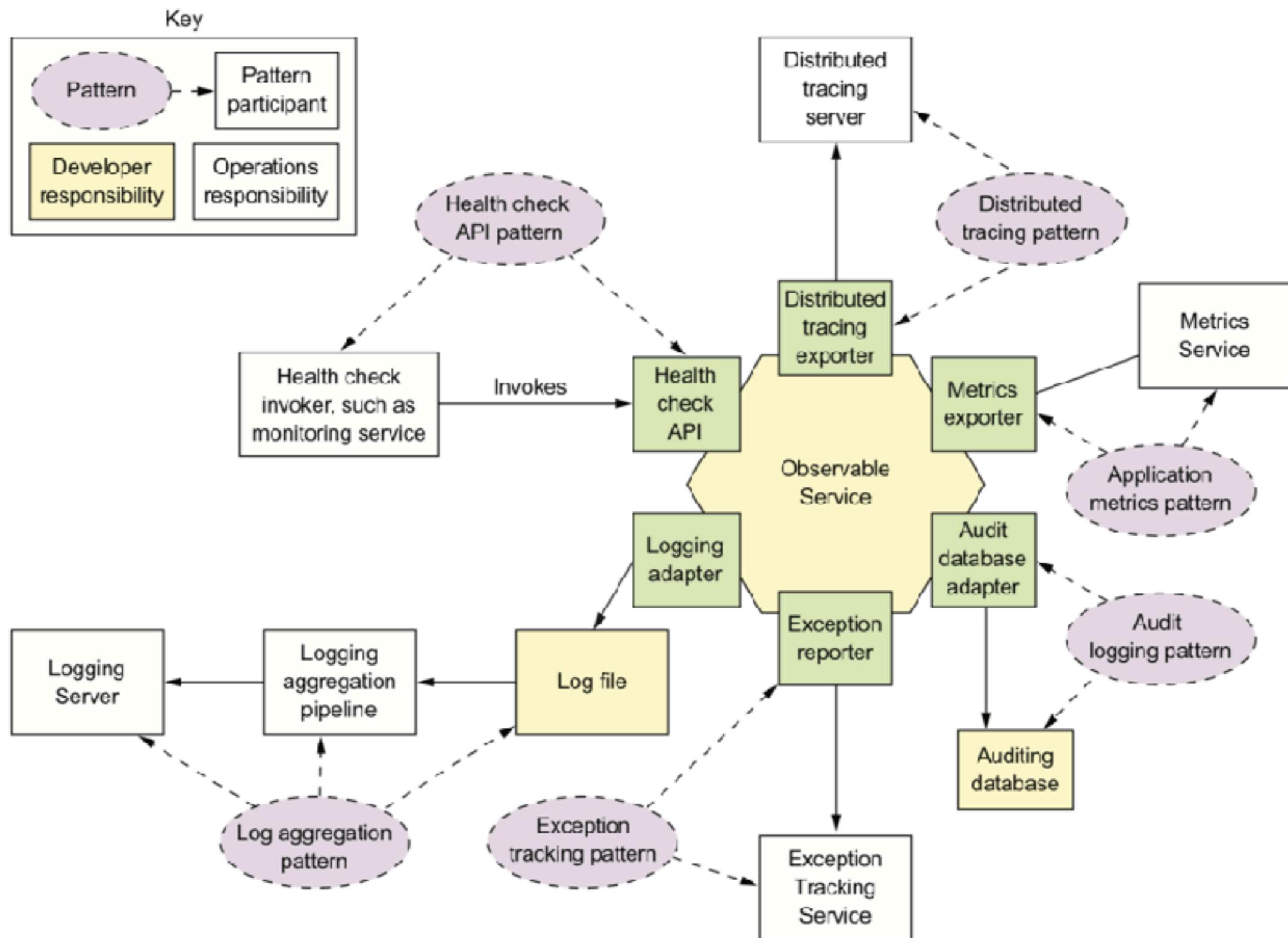
Centralize logging



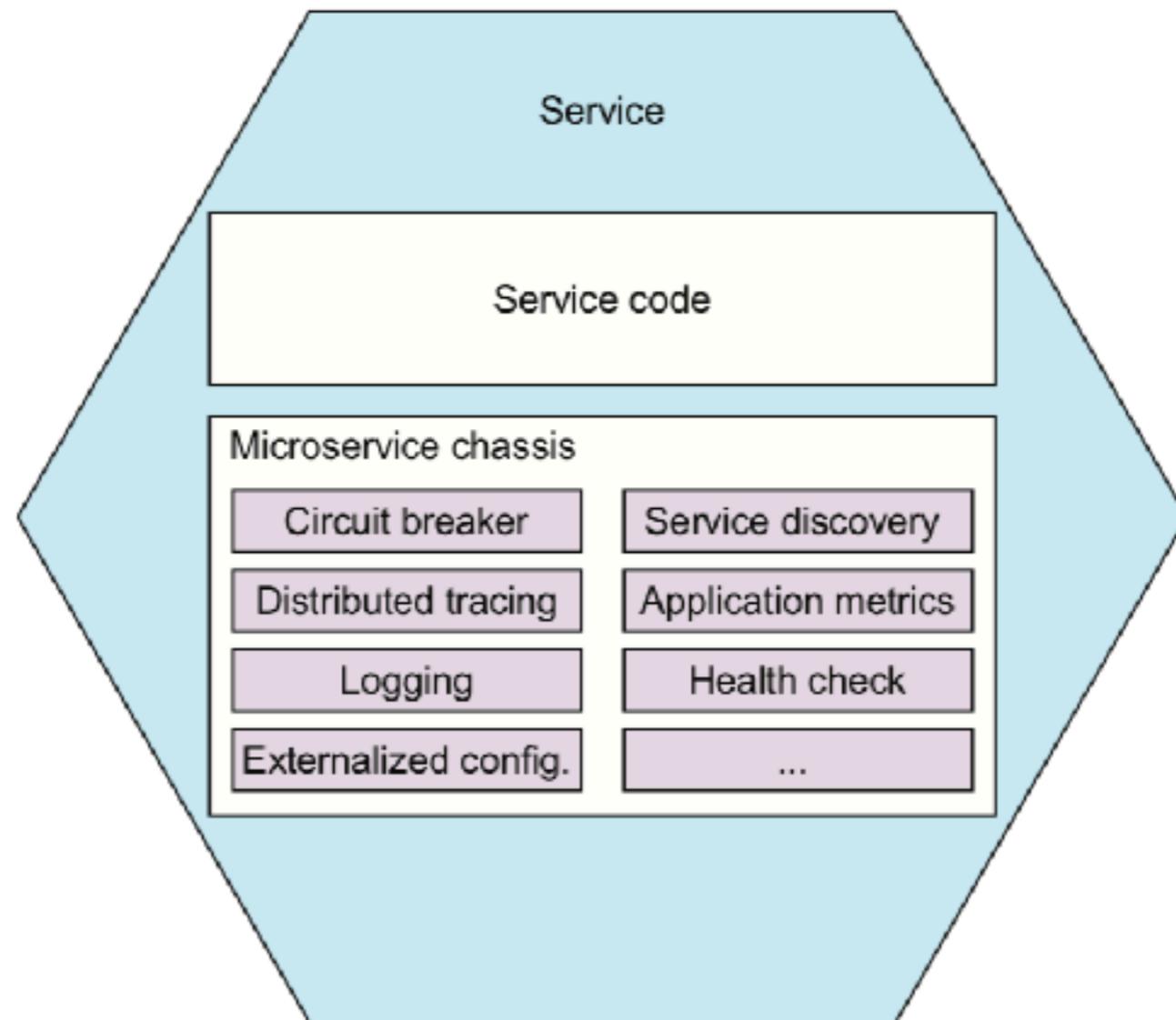
Centralize logging



Observable services



Microservice framework

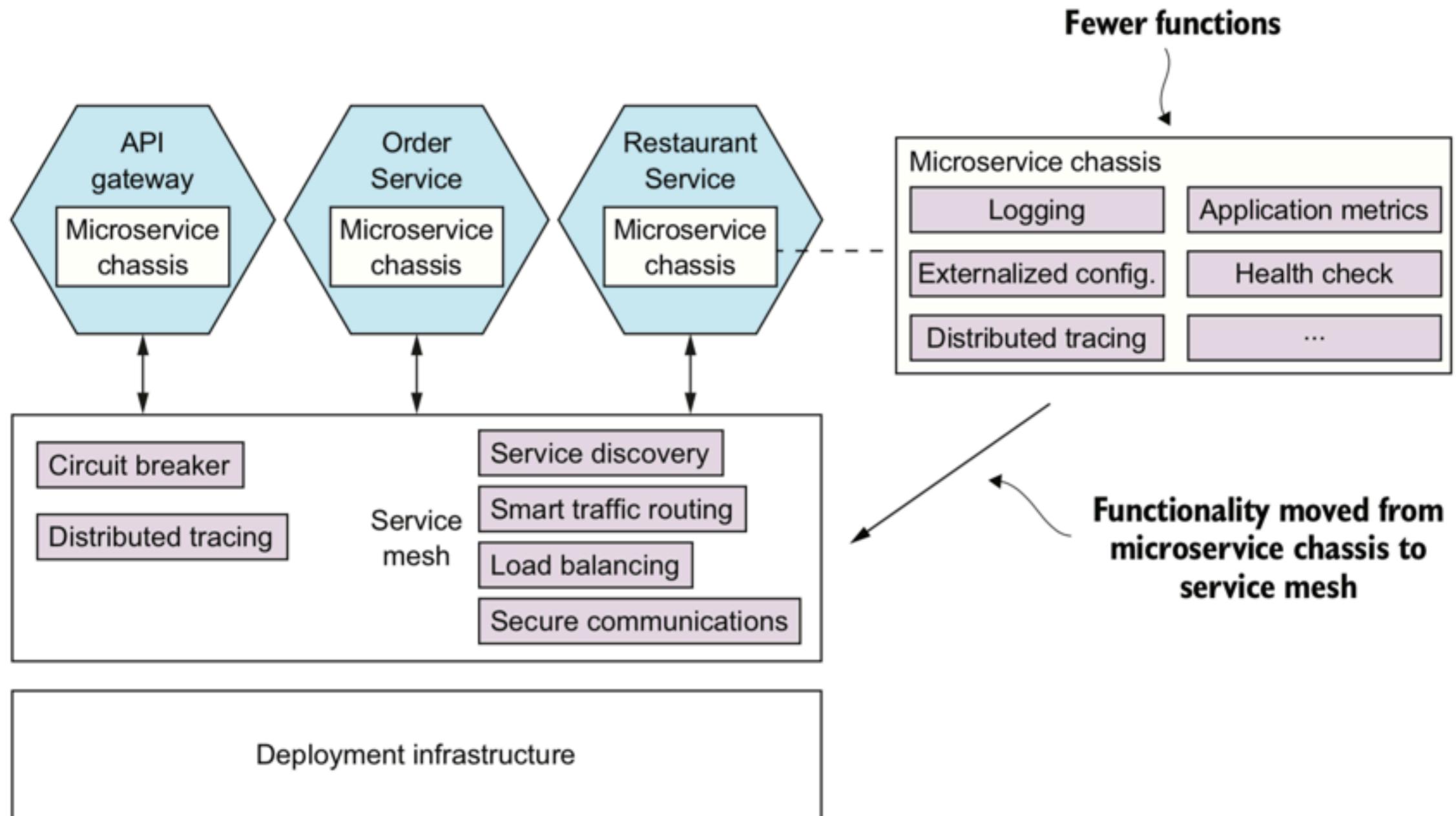


Microservice framework

Programming language	Framework
Java	Spring boot Spring cloud
Golang	Go-kit Micro



Service Mesh



Service Mesh



Istio

Connect, secure, control, and observe services.



CONDUIT



linkerd



Module 3 : Deploy

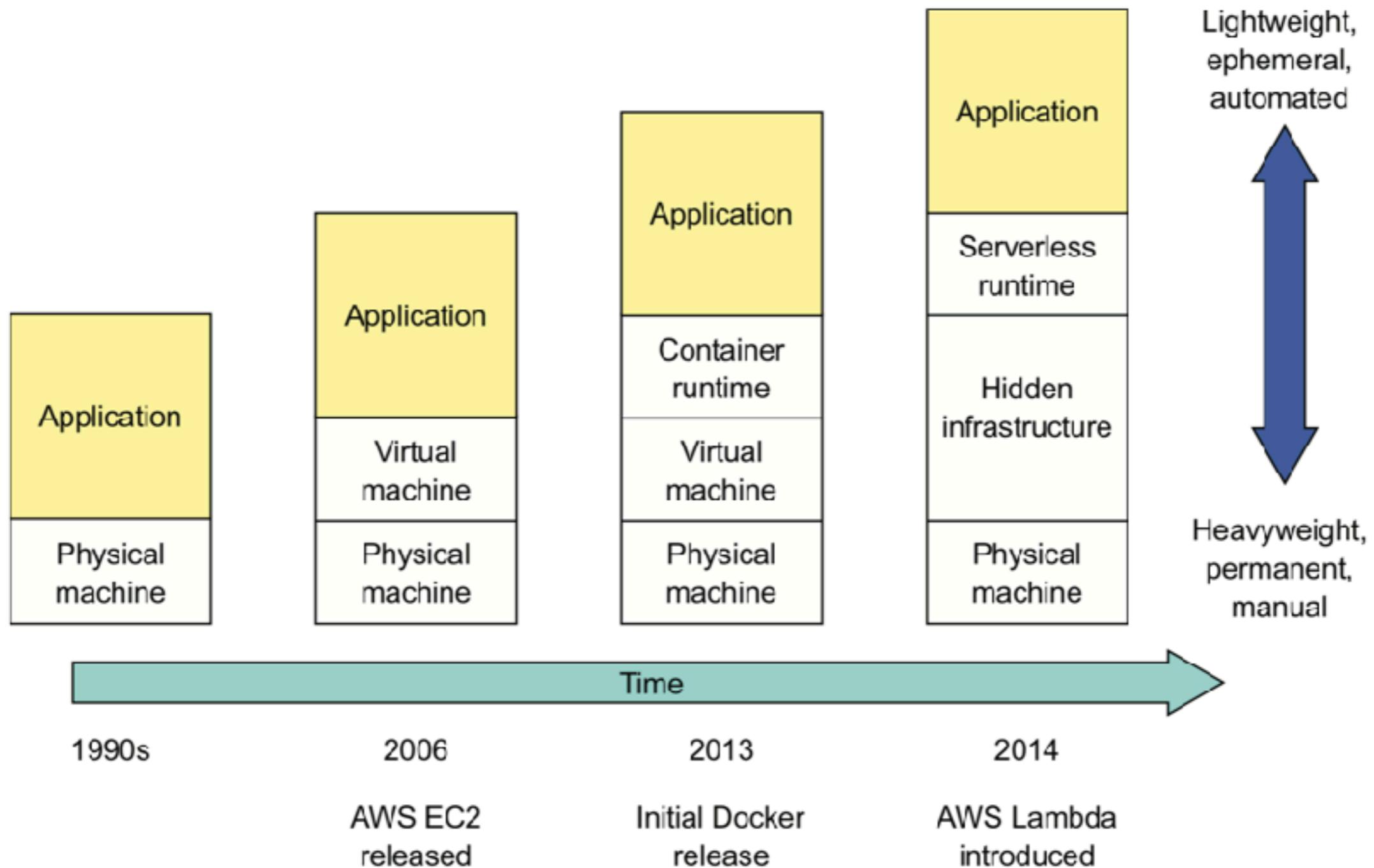




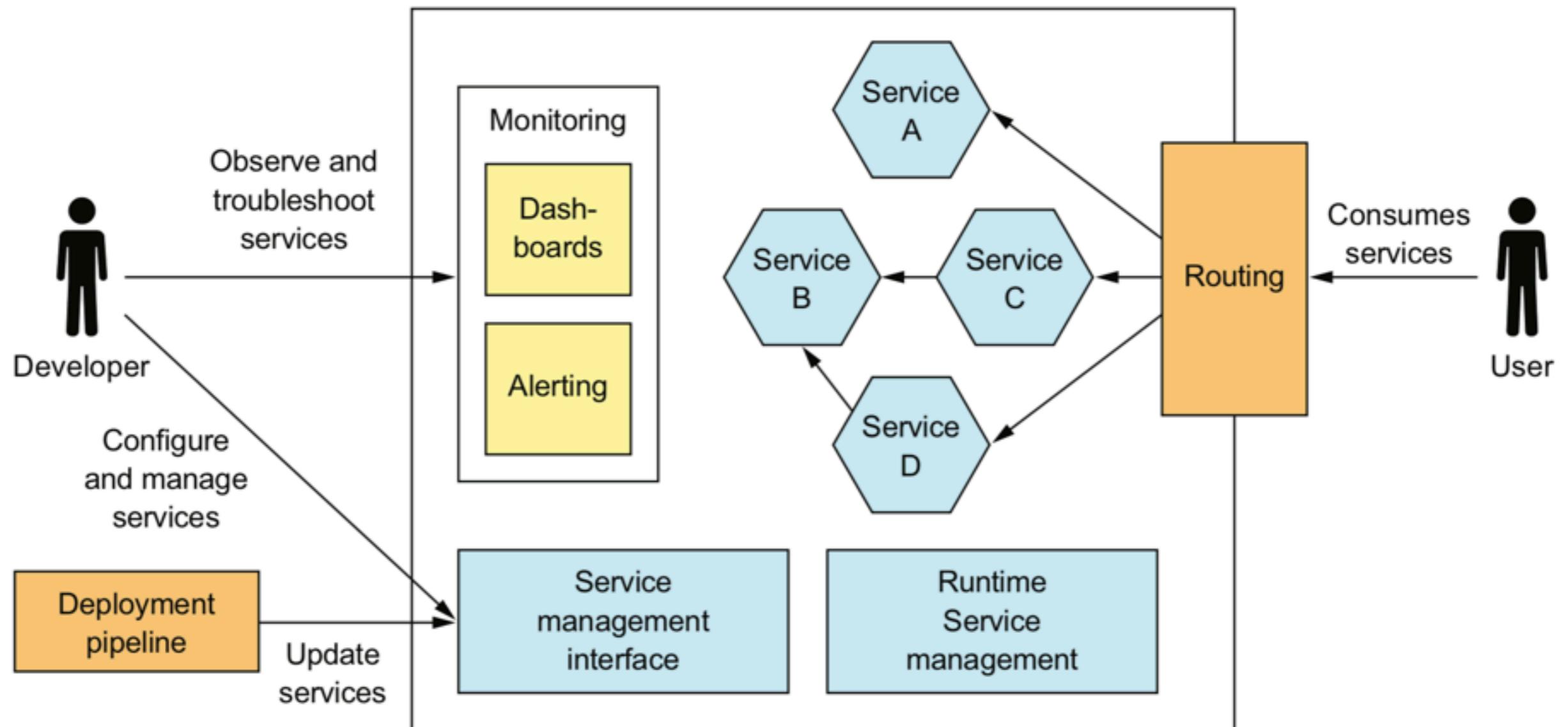
@redbadgerteam



Infrastructure



View of production environment



Deploy Microservices

Language-specific packaging

Virtual Machine (VM)

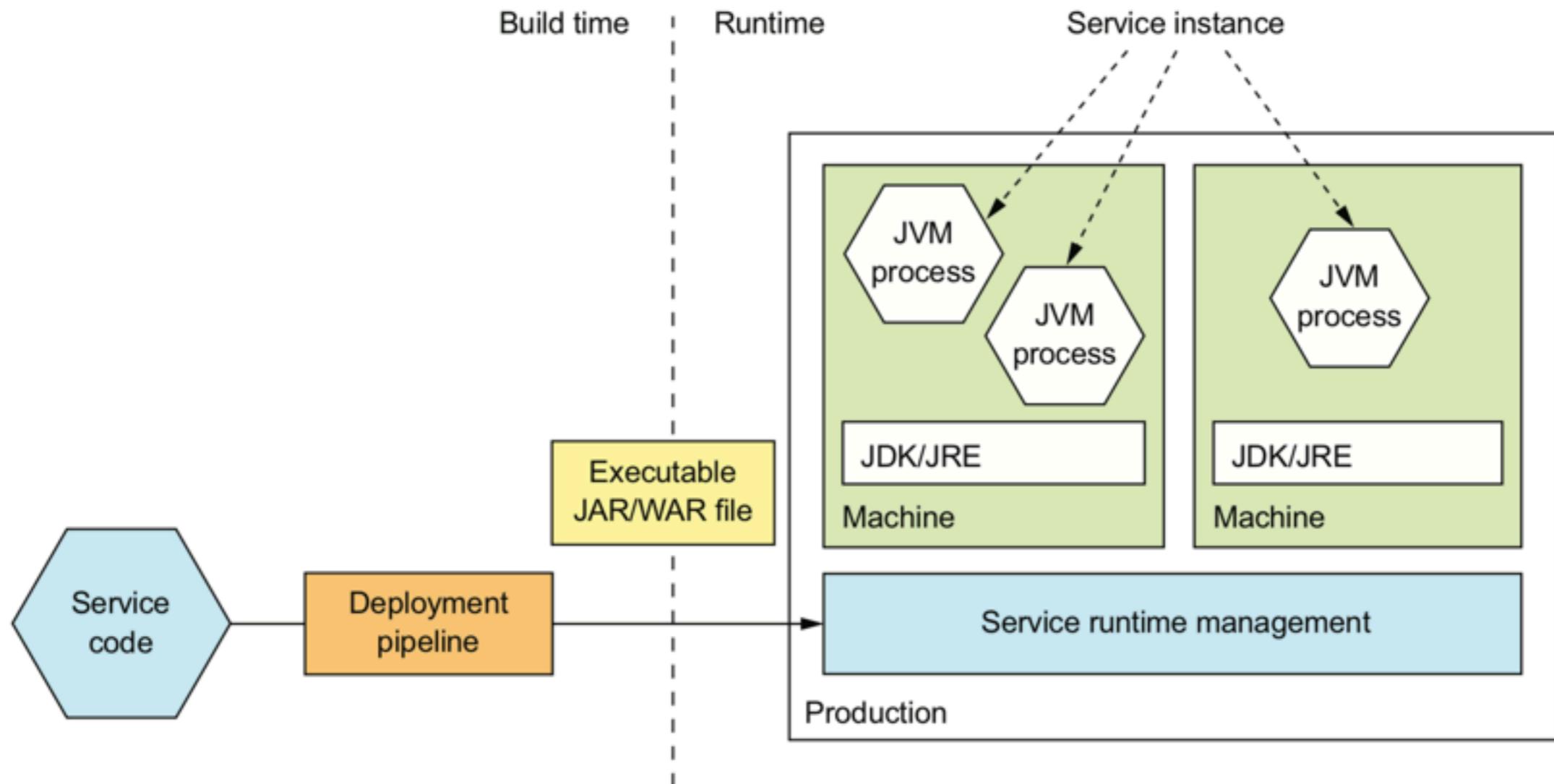
Container

Kubernetes

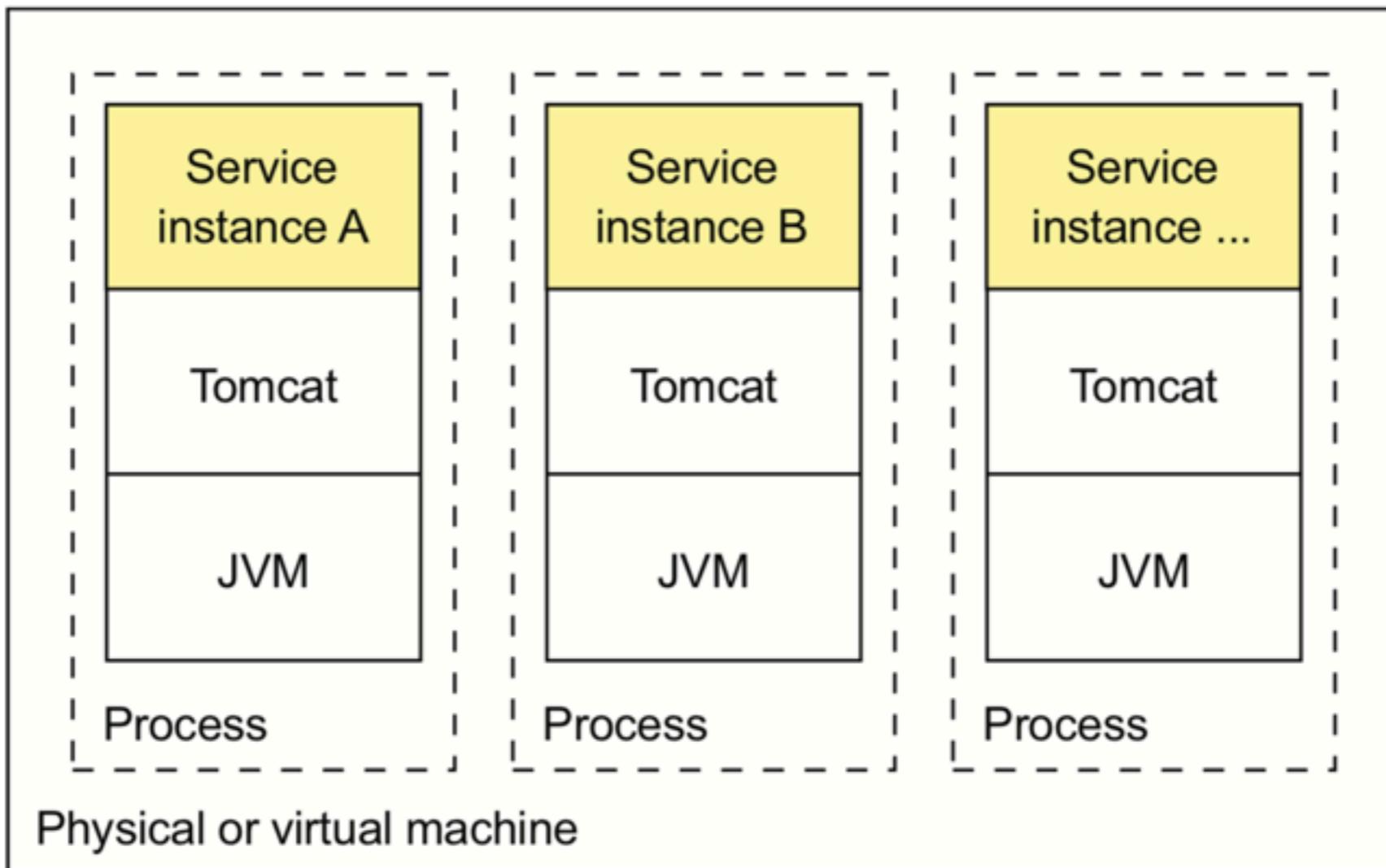
Serverless/FaaS



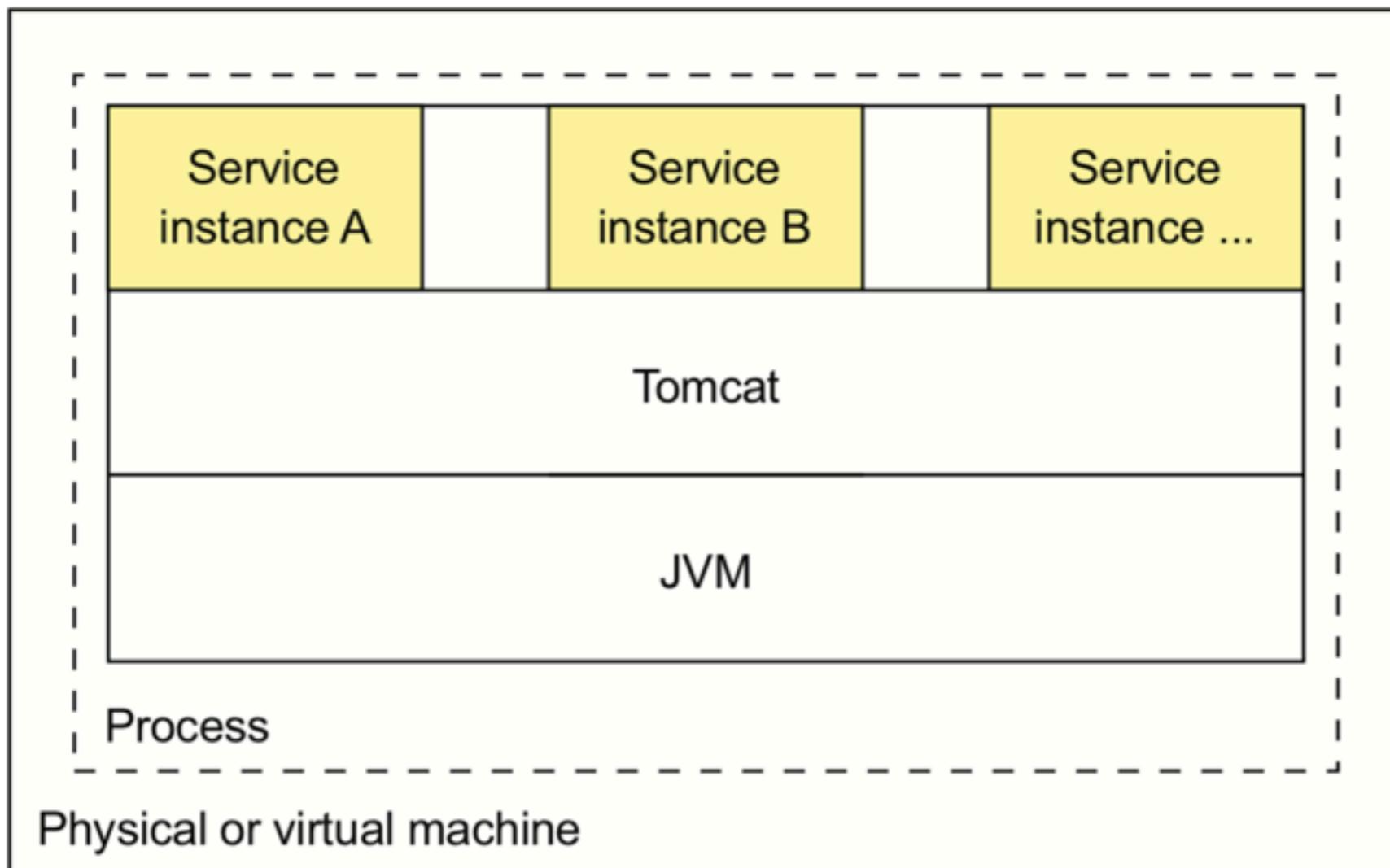
1. Language-specific packaging



Multiple services on same machine



Multiple services on same process



Benefits

Fast deployment

Efficient resource utilization

Service instances's resources are constrained



Drawbacks

Lack of encapsulation of technology stack

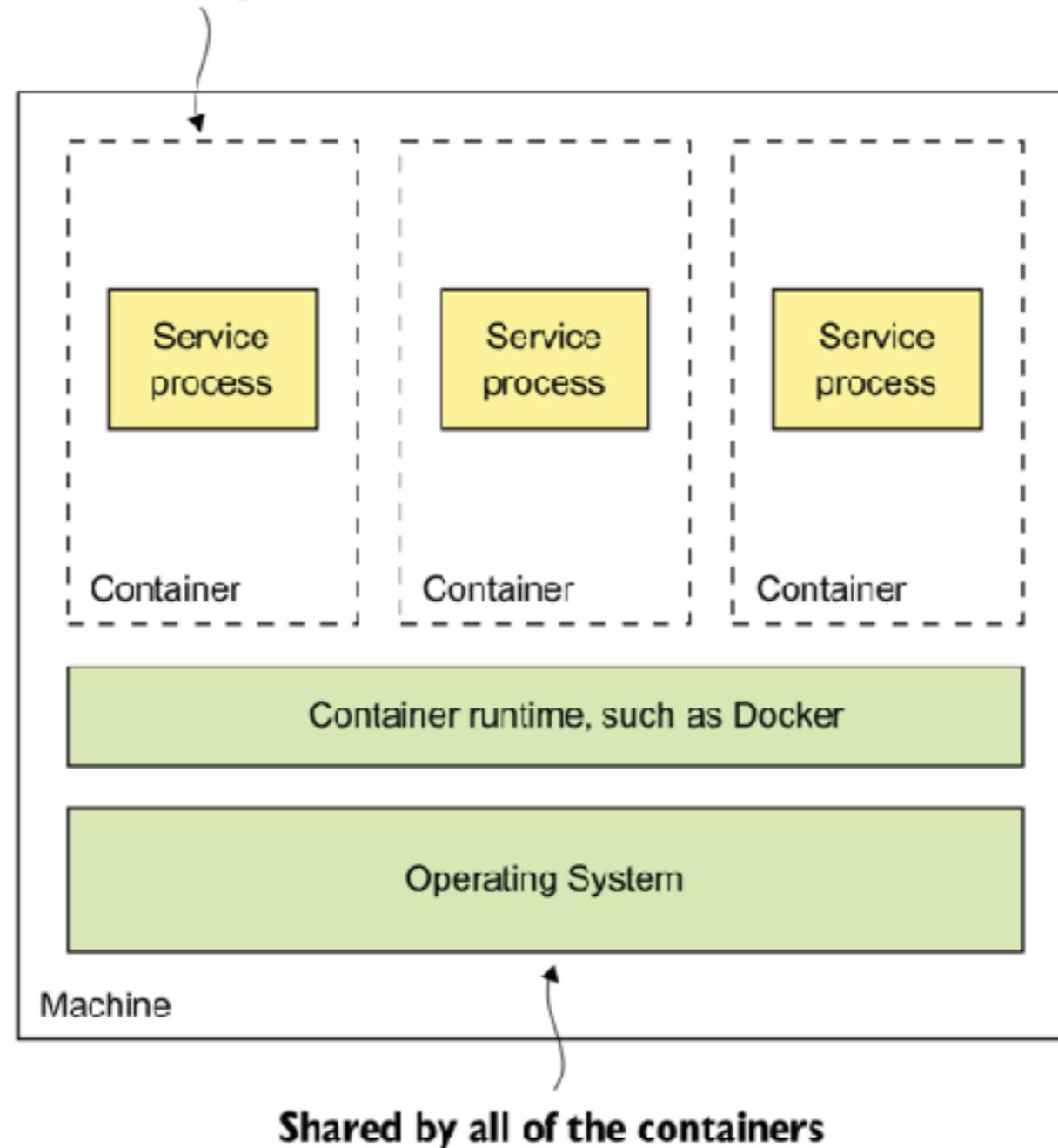
No ability to constrain resources of service

Lack of isolation

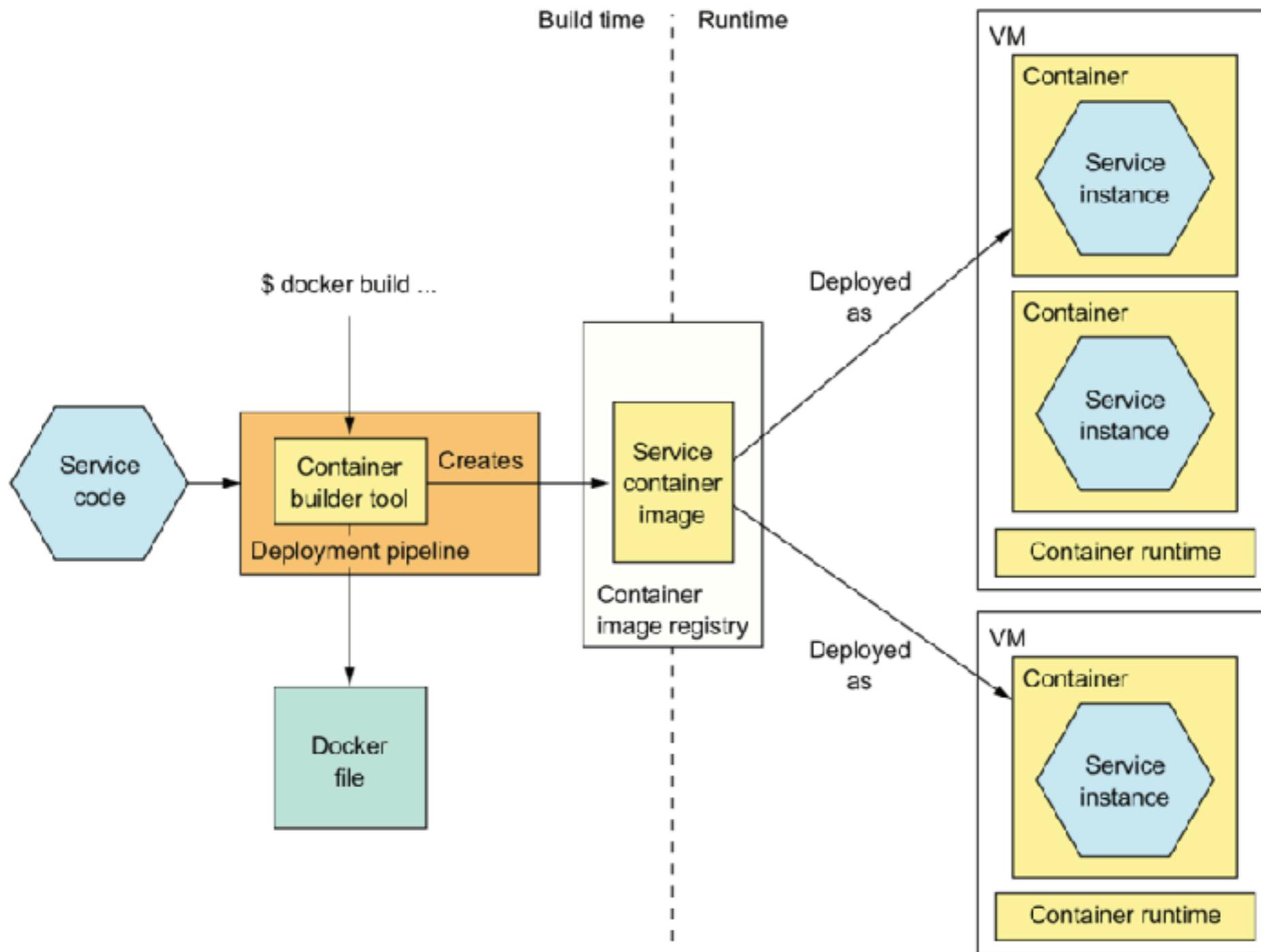


2. Working with container

**Each container is a sandbox
that isolates the processes.**



Deployment with container



Deploy services with Docker

Build a docker image

Push docker image to a registry

Run docker container

Working with docker-compose



Benefits

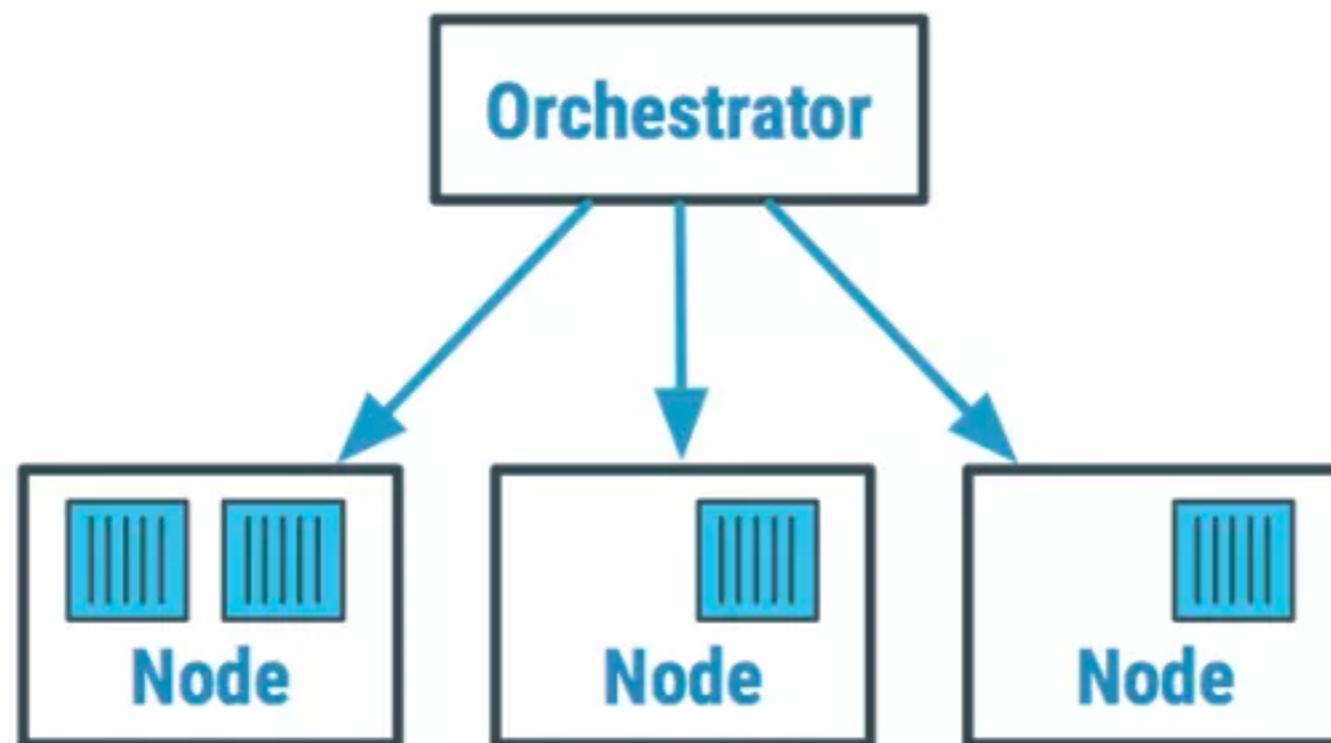
Encapsulate technology stack

Service instances are isolated

Service instances's resources are constrained



Container Orchestration ?



Orchestration tools

Configuration Management



CI/CD orchestration



Container orchestration



Cloud-specific orchestration



PaaS orchestration



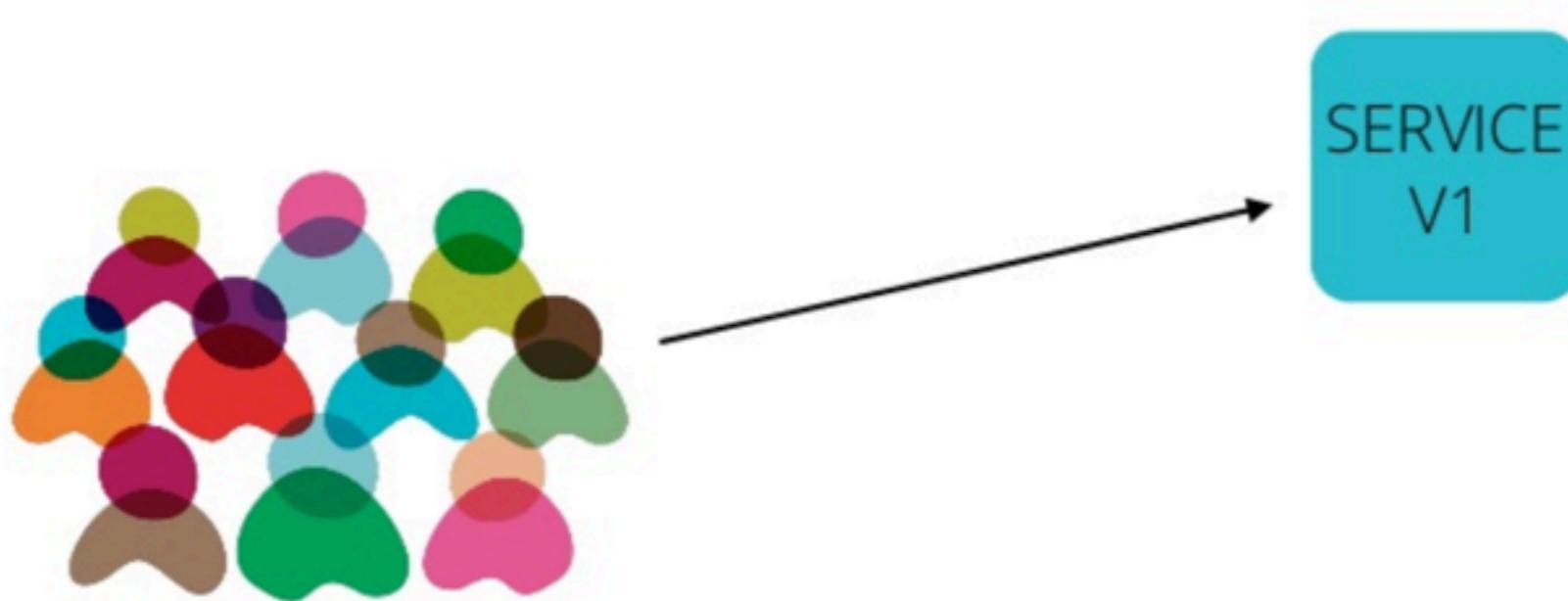
Deployment strategies



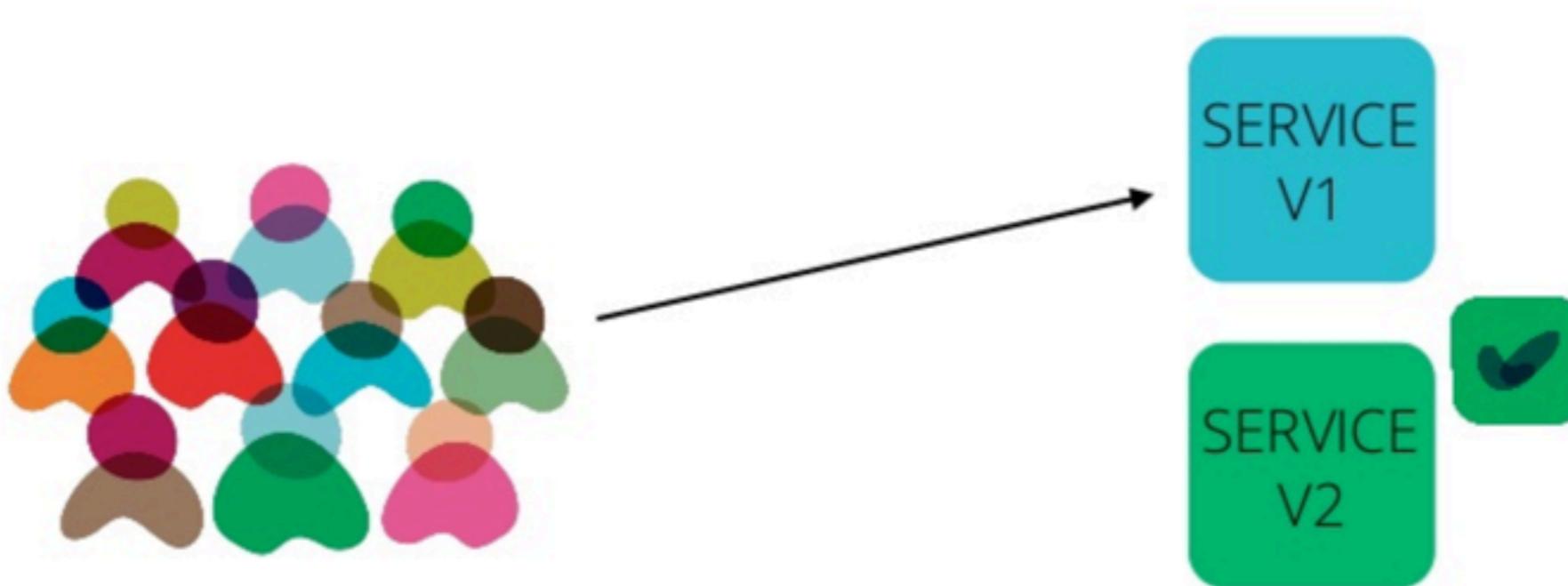
Blue Green Deployment



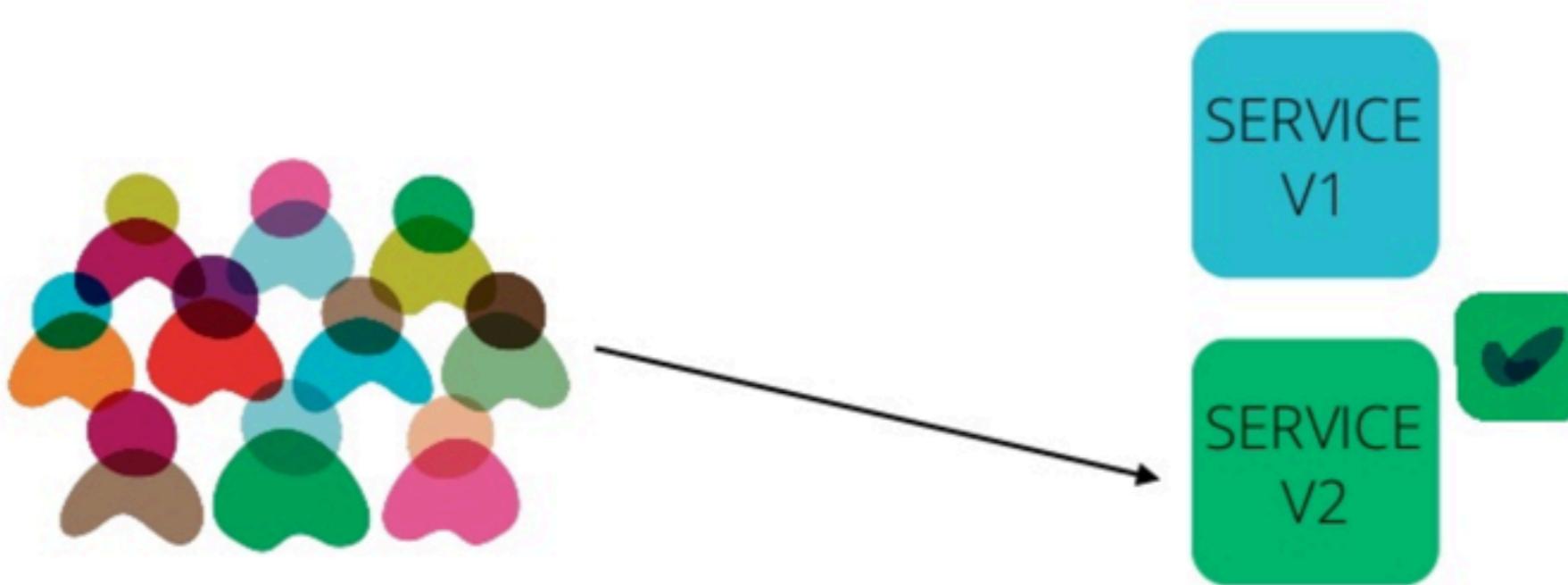
Blue Green Deployment



Blue Green Deployment



Blue Green Deployment



Canary Release



Canary Release



Canary Release



Canary Release

