

Microservices Workshop





Somkiat Puisungnoen

Search

Somkiat | Home

Update Info 1 View Activity Log 10+ ...

Timeline About Friends 3,138 Photos More

When did you work at Opendream? X

... 22 Pending Items

Post Photo/Video Live Video Life Event

What's on your mind?

Public Post

Intro

Software Craftsmanship

Software Practitioner at สยามชานาญกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Somkiat Puisungnoen 15 mins · Bangkok · ...

Java and Bigdata

 Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

3

Microservices



“ Don’t use Microservice ”

Start with your **problems** ?



Design

Develop
Test

Deploy

Observability

Continuous Integration/Delivery



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 + Testing

Recap Microservice

Properties of Microservice

Microservice 1.0 - 4.0 (4.5)

How to develop Microservice ?

How to test Microservice ?

12-factors app

Observable services



Module 3 : Deploy

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





Performance

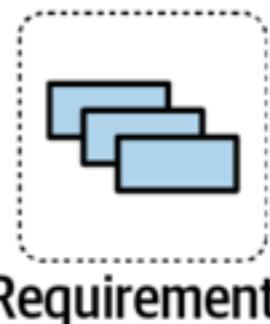


Scalability



Security

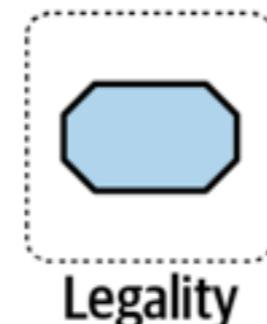
Software Architecture



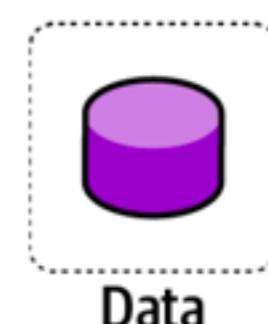
Requirements



Auditability

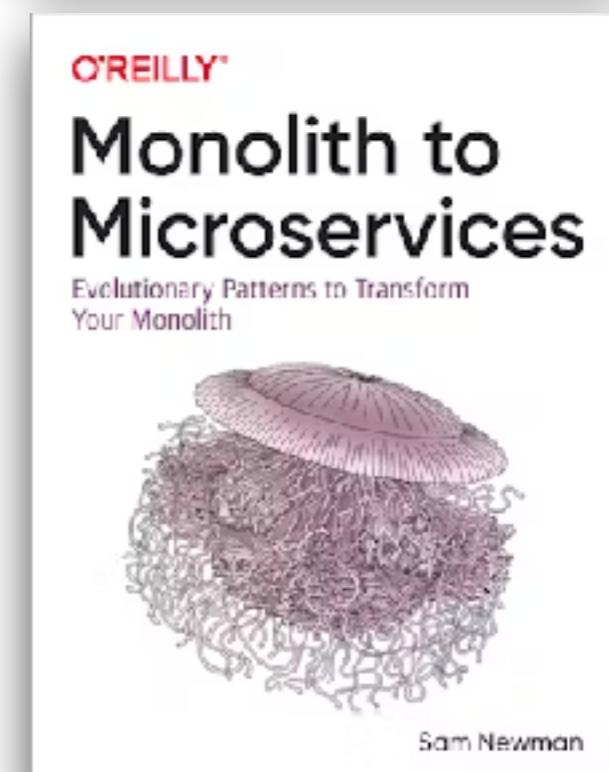
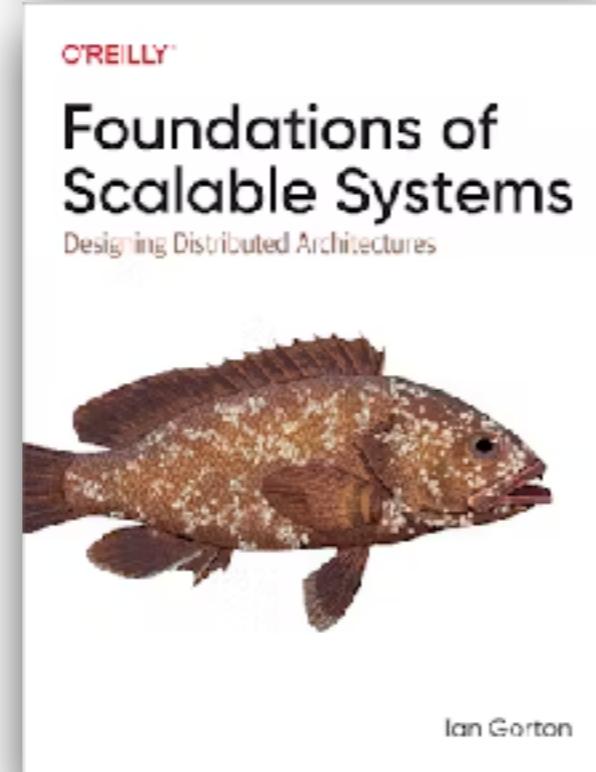
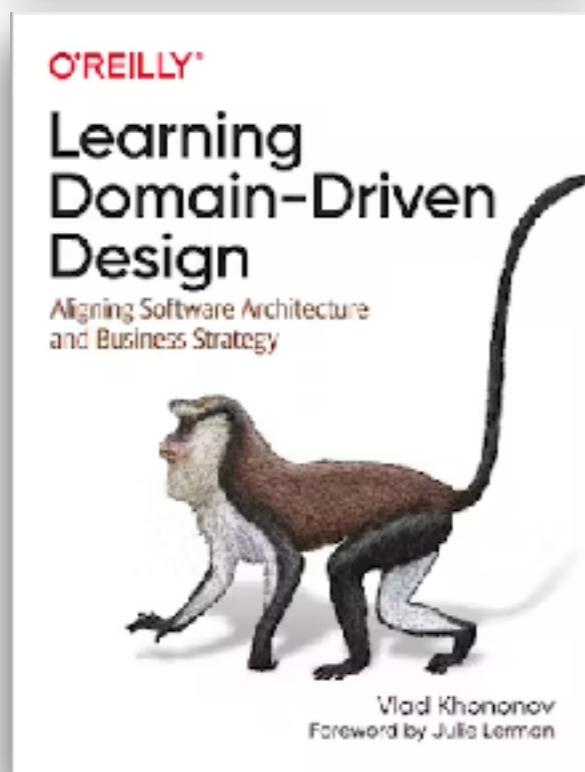
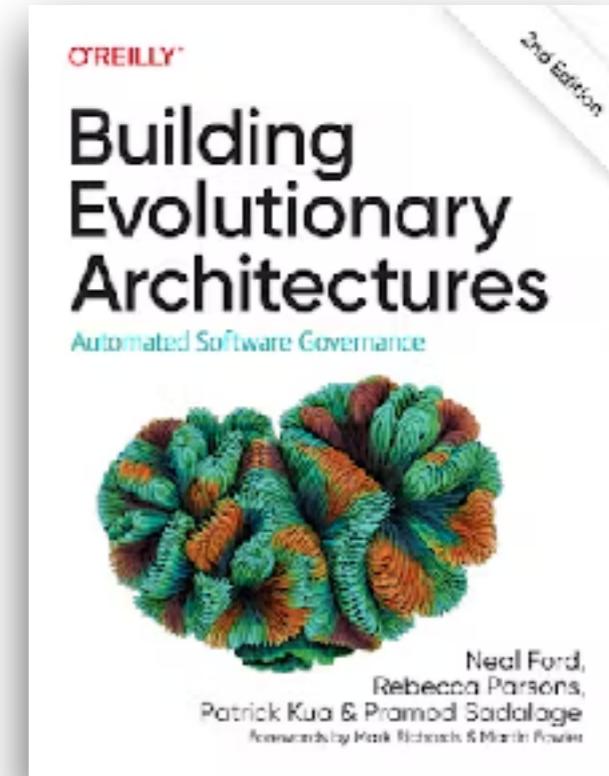
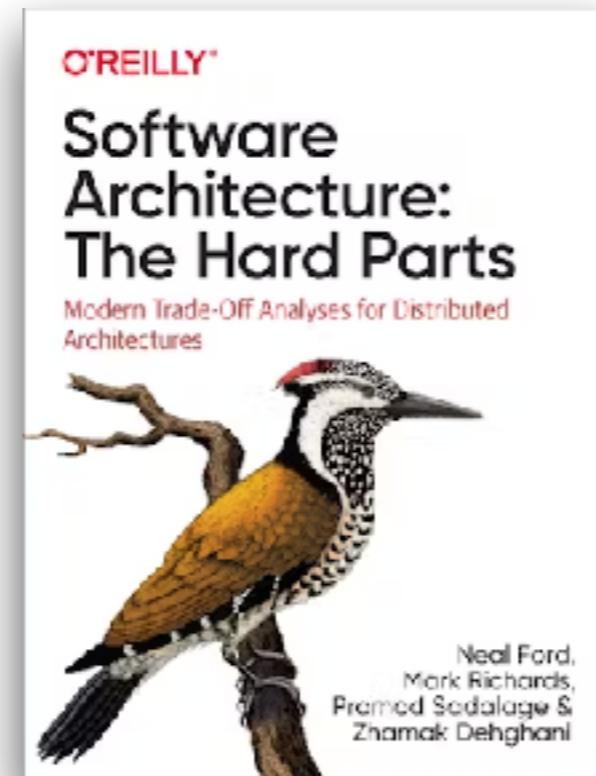
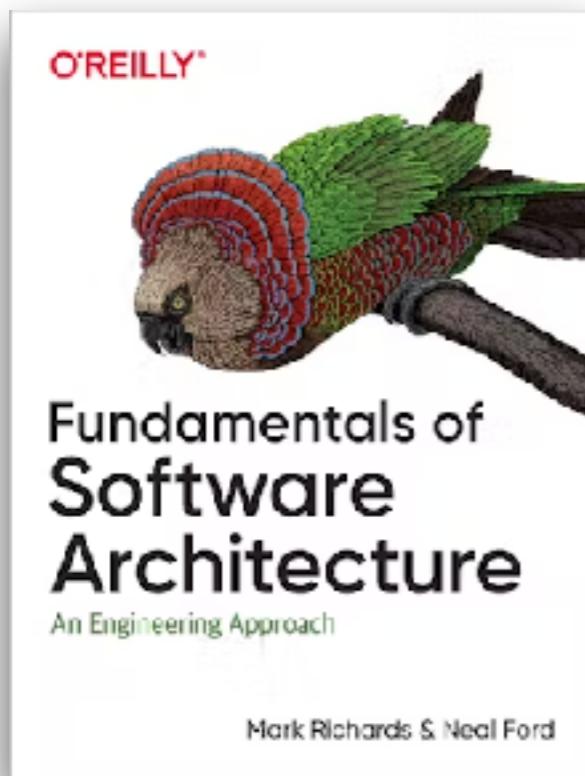


Legality



Data





<https://www.amazon.com/Fundamentals-Software-Architecture-Comprehensive-Characteristics/dp/1492043451>



Microservices

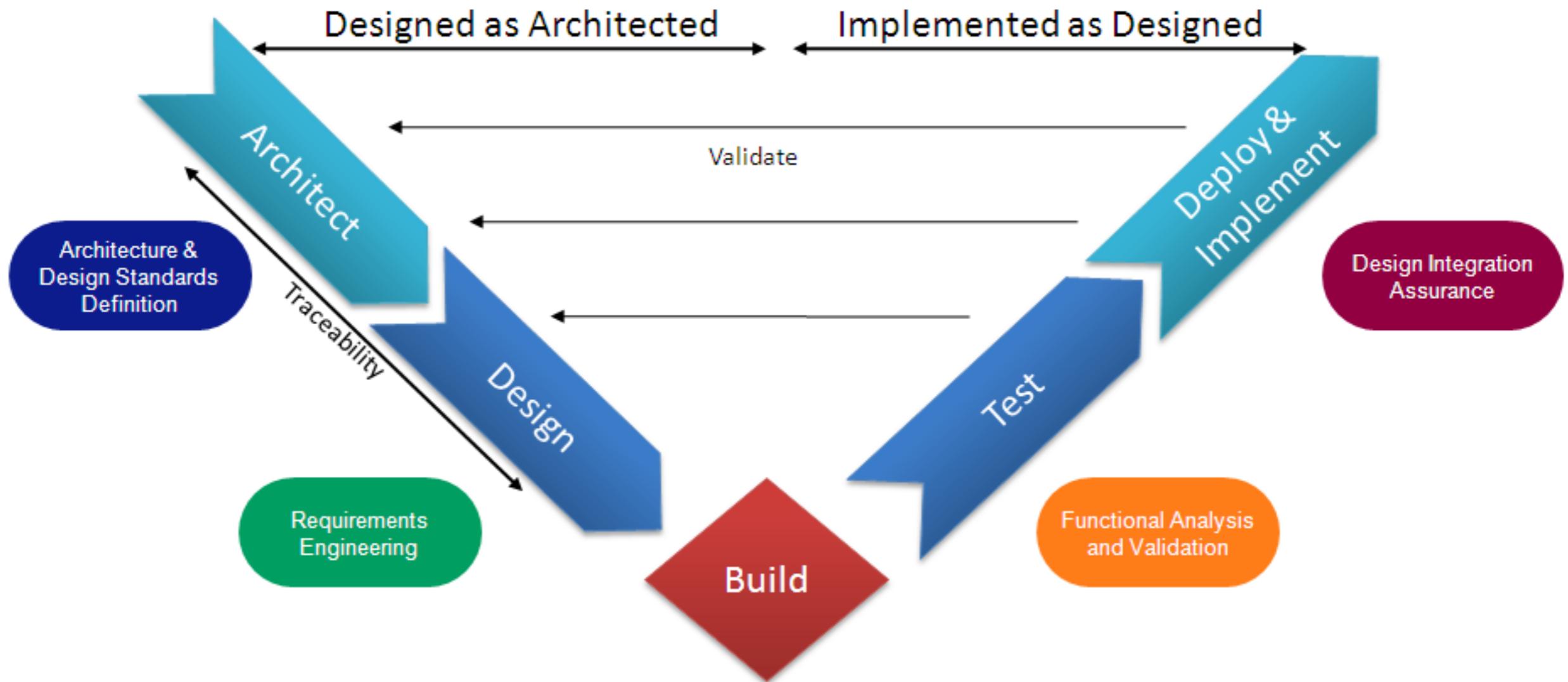
© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

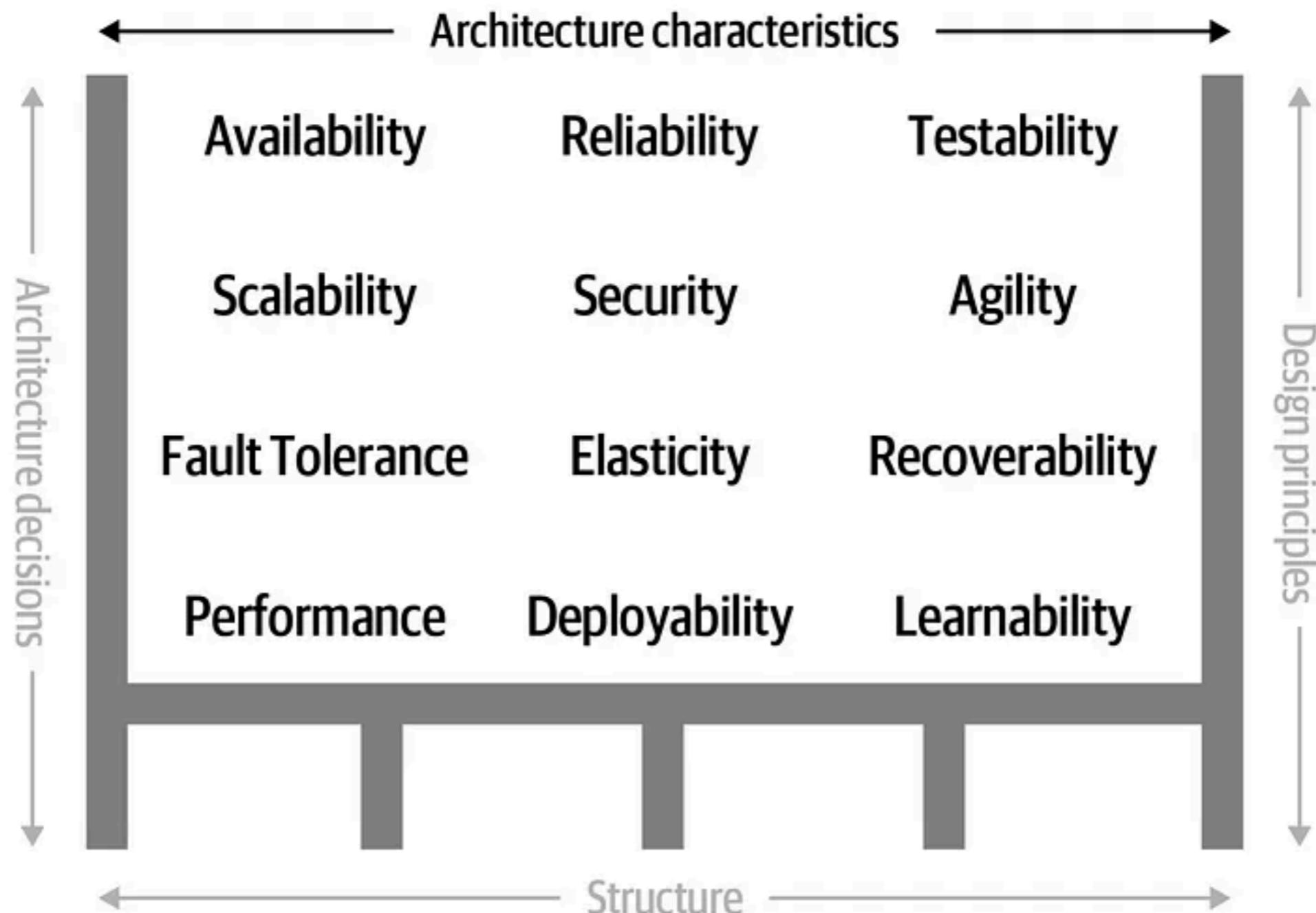


Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

Traditional Process



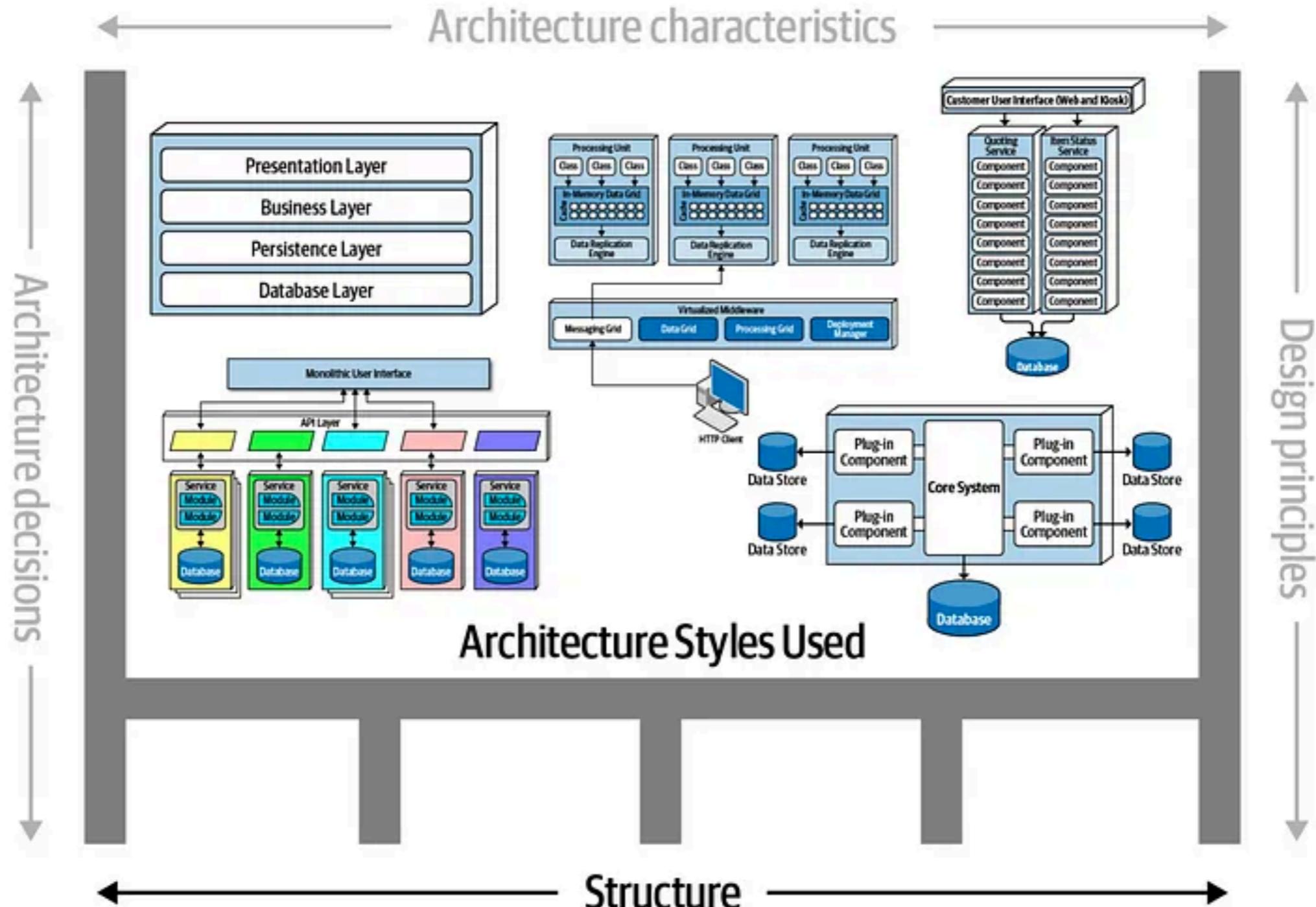


<https://www.amazon.com/Fundamentals-Software-Architecture-Comprehensive-Characteristics/dp/1492043451>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

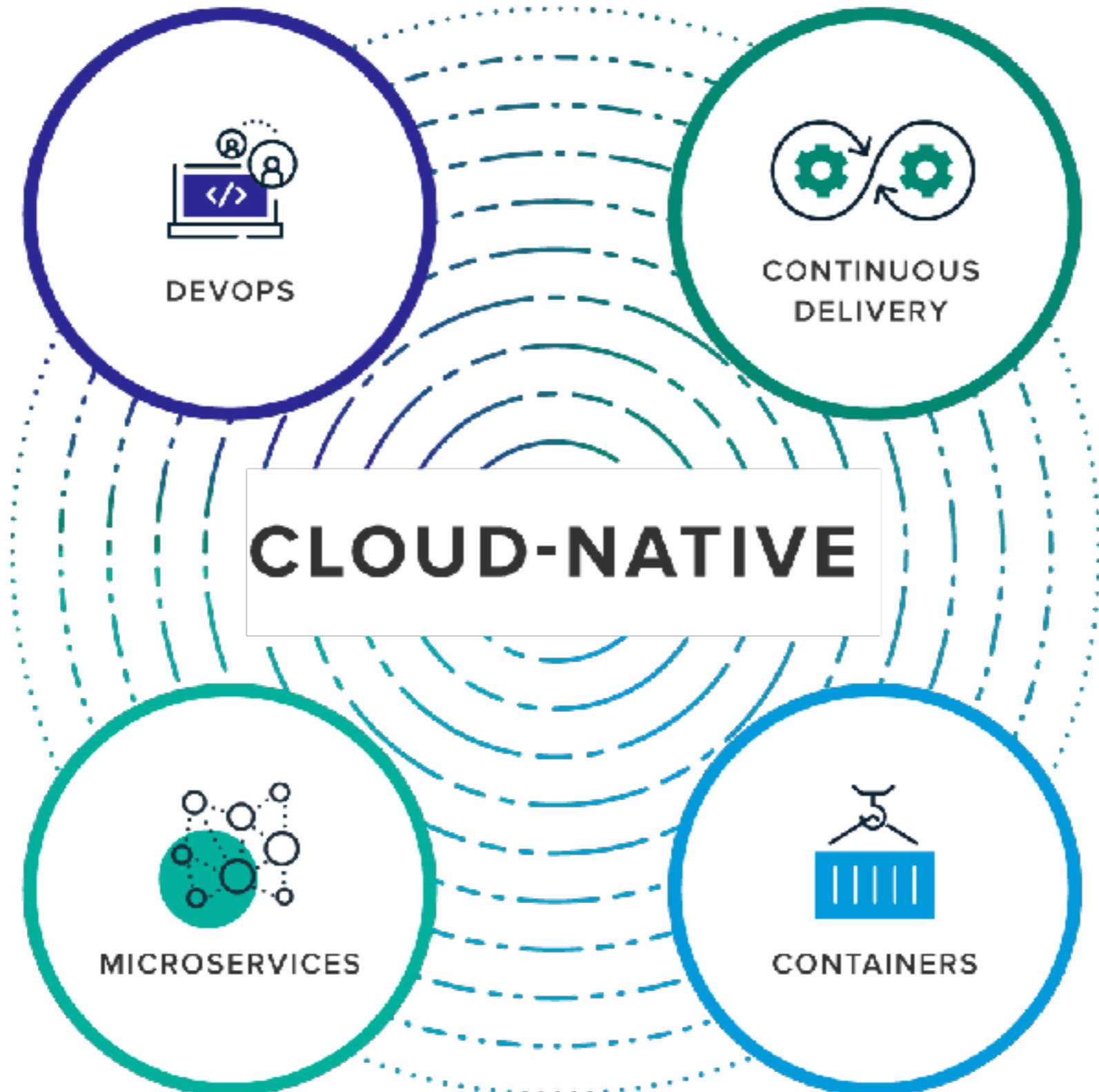


Module 1 : Design



Software design is an exercise in human relationships





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



Cloud Native ?

Build efficiency

Scalability

Portability

On-premise and On-cloud

Loosely
Coupled

Resilience

Manageable

Observable

<https://www.somkiat.cc/cloud-native-go-part-1/>

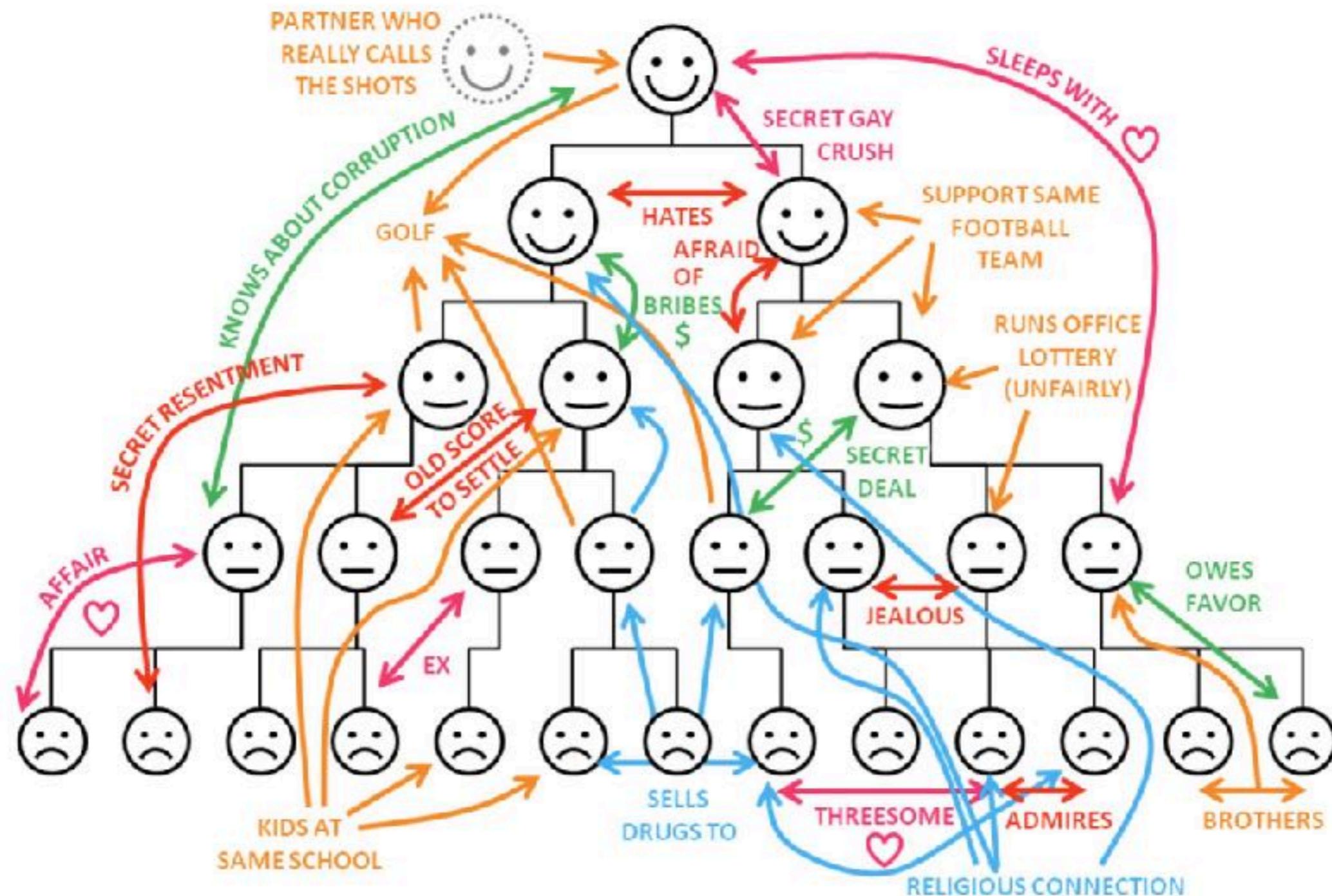


**Any organization that designs a system
will produce a design whose structure
is a copy of the organization's
communication structure.**

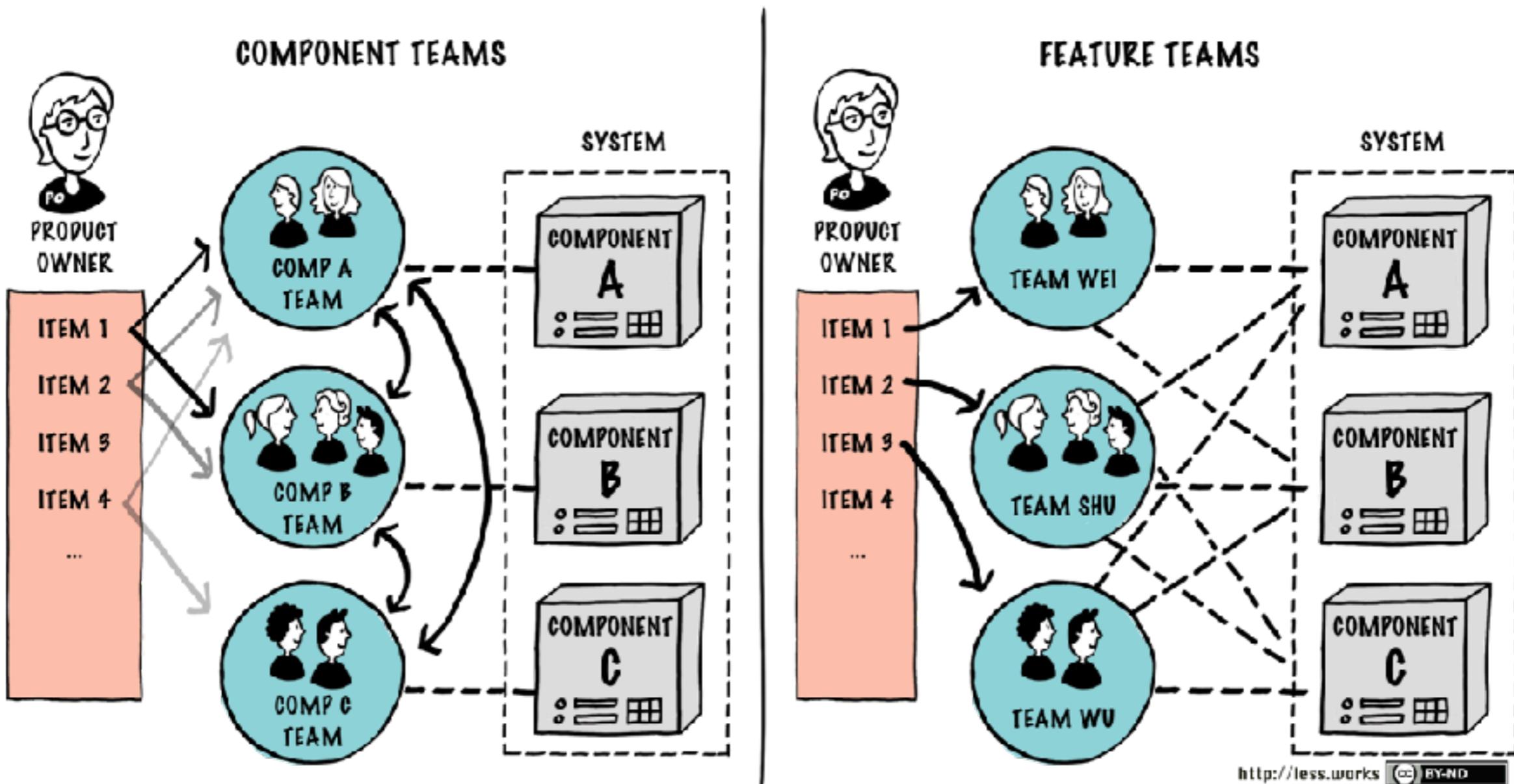
-- Melvin Conway



Organization Structure



Component vs Feature teams



<https://less.works/less/structure/feature-teams>



Evolution of Architecture



WANT TO KNOW THE BEST SOFTWARE ARCHITECTURE?



Pangaea
300M years ago

LOOK AT THE EVOLUTION OF THE EARTH.



nowadays

Daniel Storl {turnoff.us}



3 Pillars of Evolution Architecture

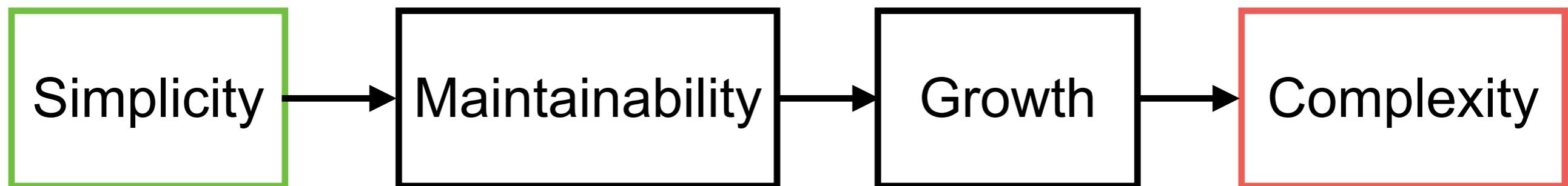
Solution
Structure

Infrastructure

Deployment
strategy



Steps of Evolutions



Let's Start with solution and structure

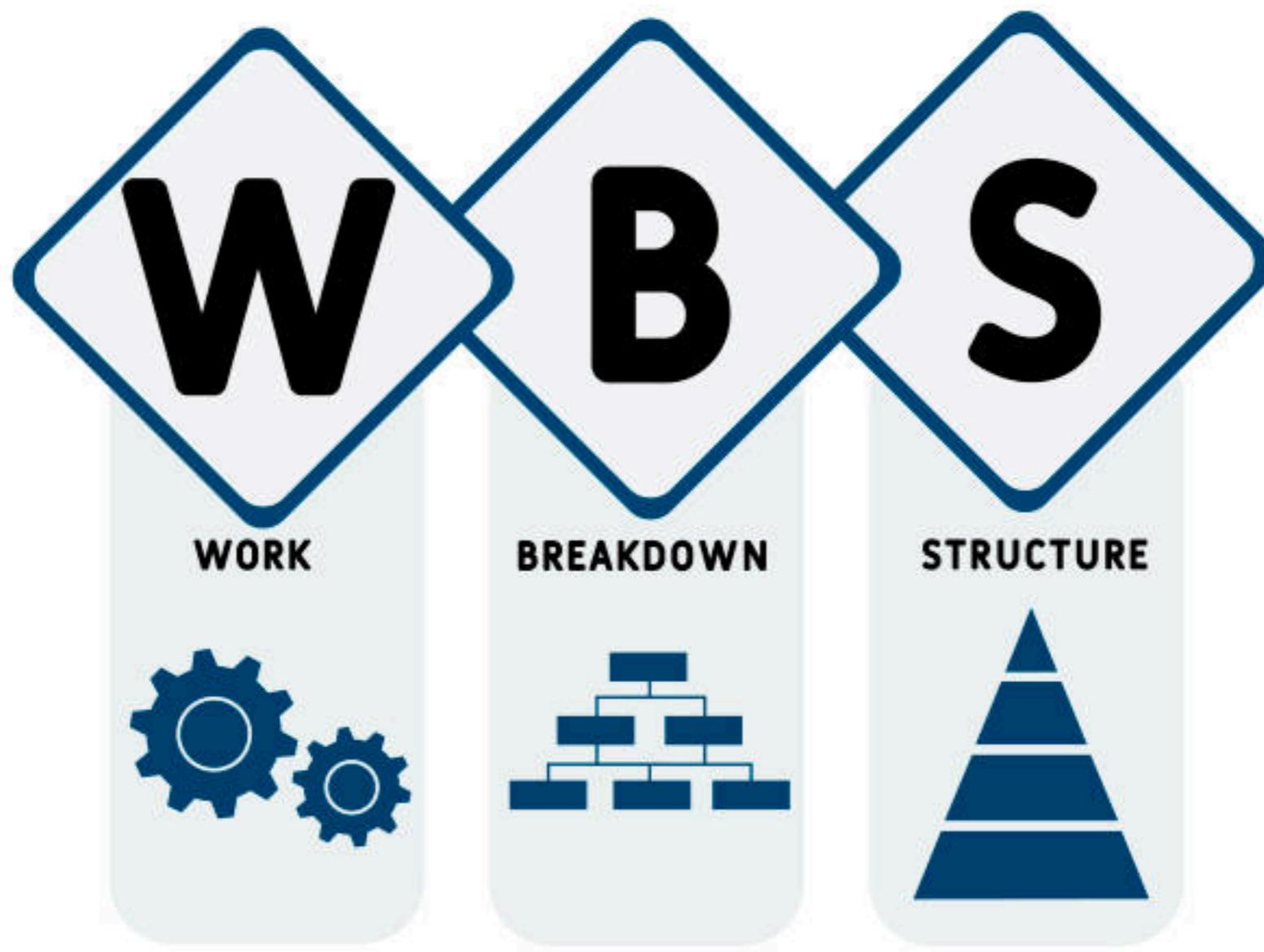


Monolith

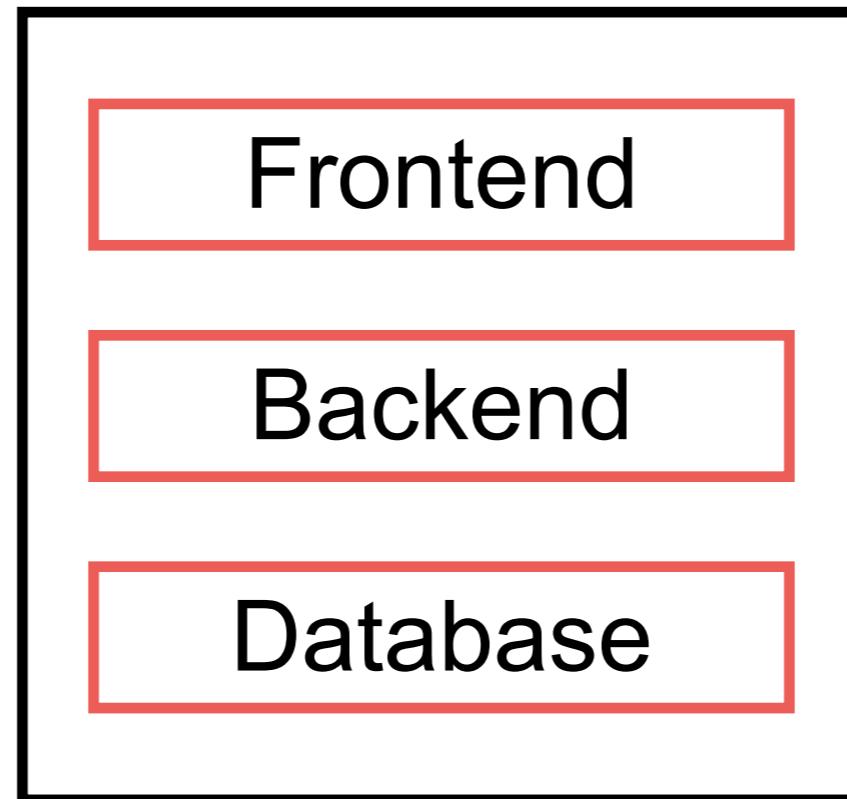
App



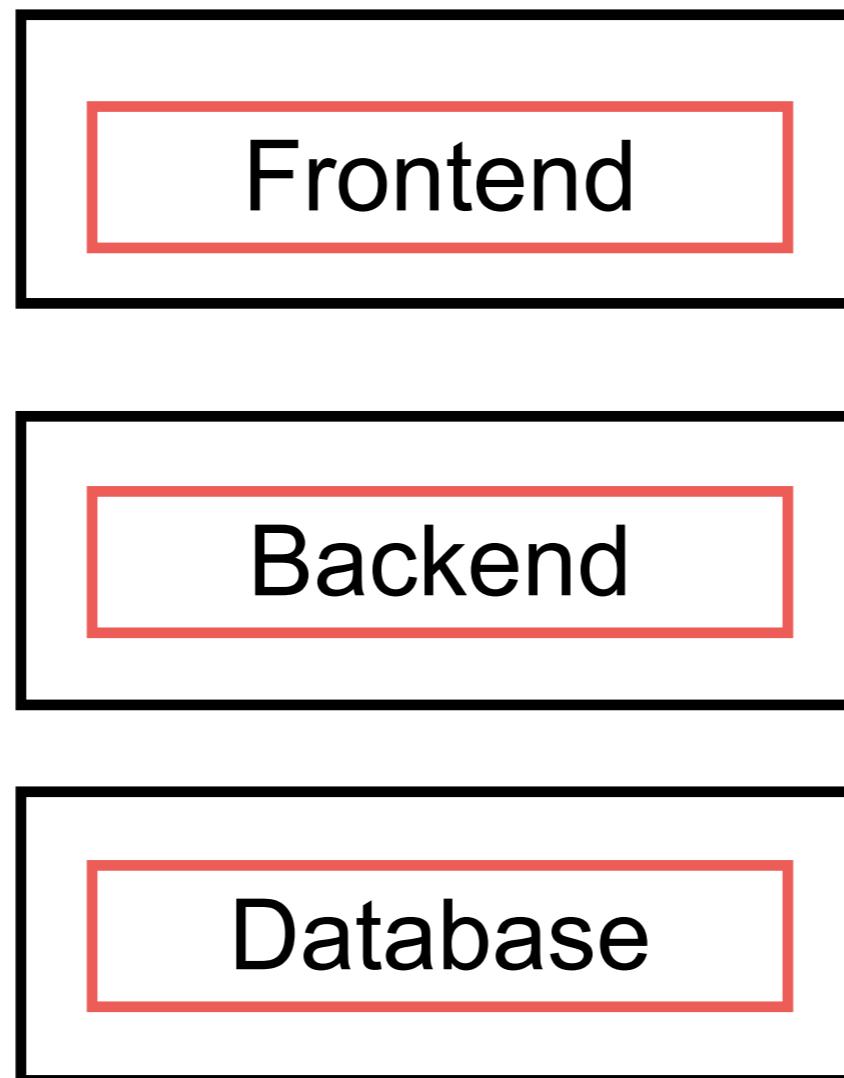
Work Breakdown Structure



Layers (inter-process)



Tiers (out-of-process)



More features ...

Frontend

Backend

Database



More features ...

Frontend

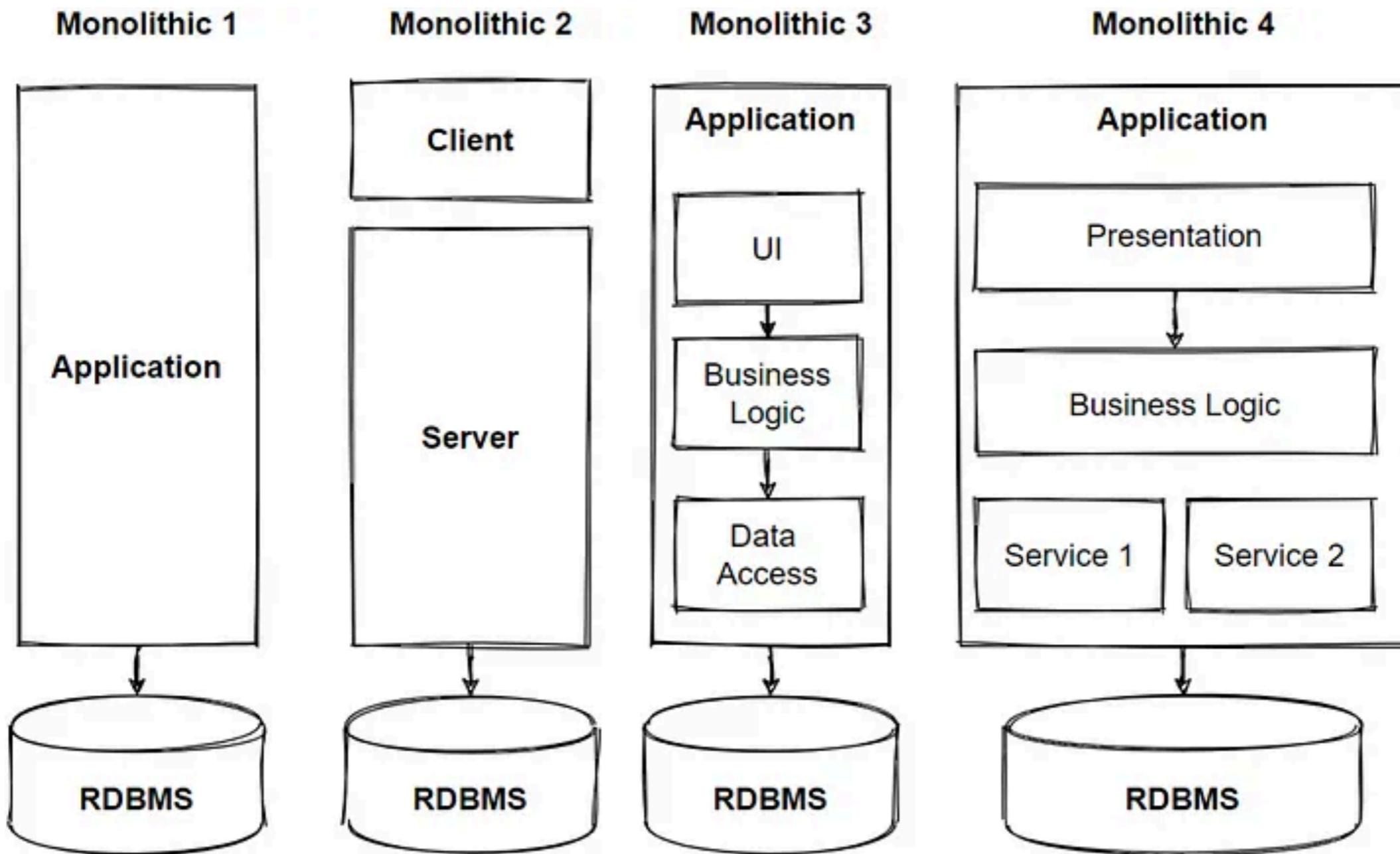


In spaghetti code, the relations between the pieces of code are so tangled that it is nearly impossible to add or change something without unpredictably breaking something somewhere else.

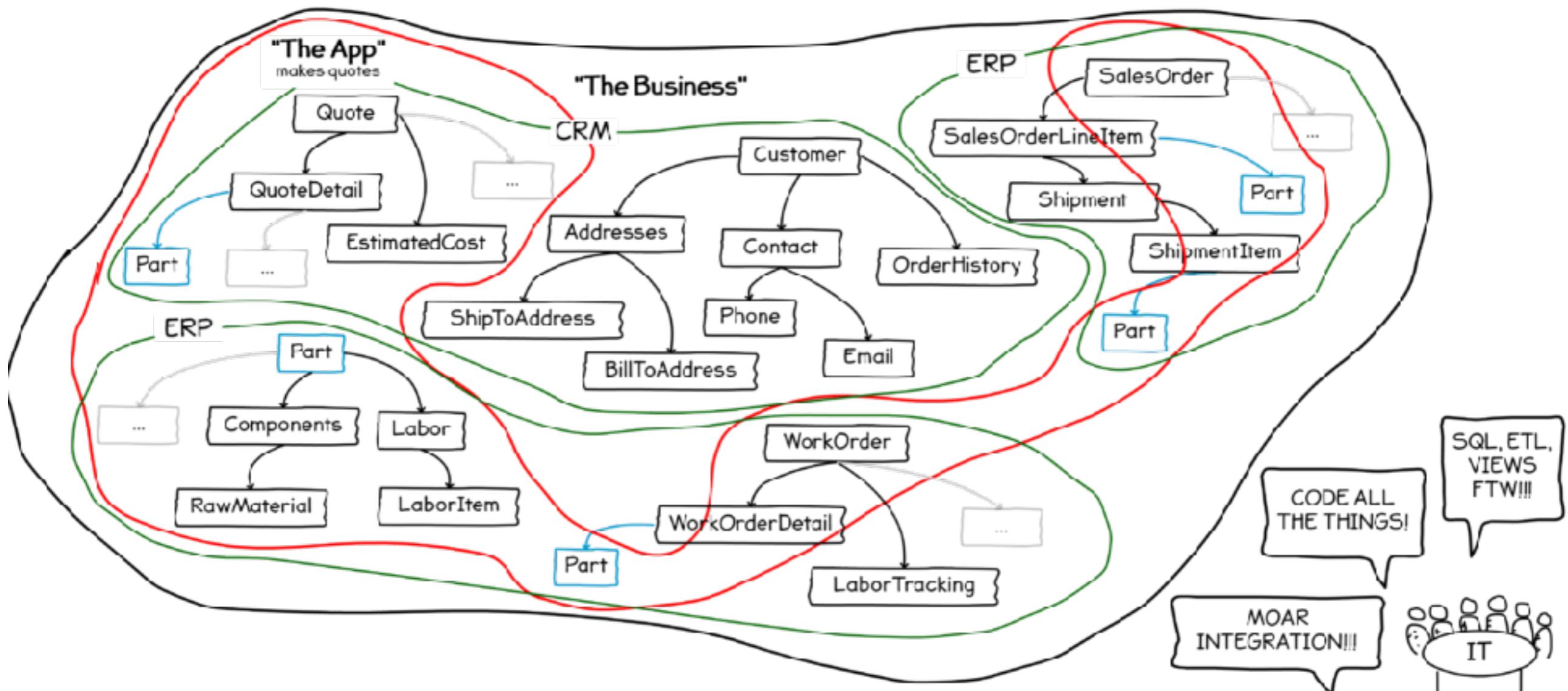
Database

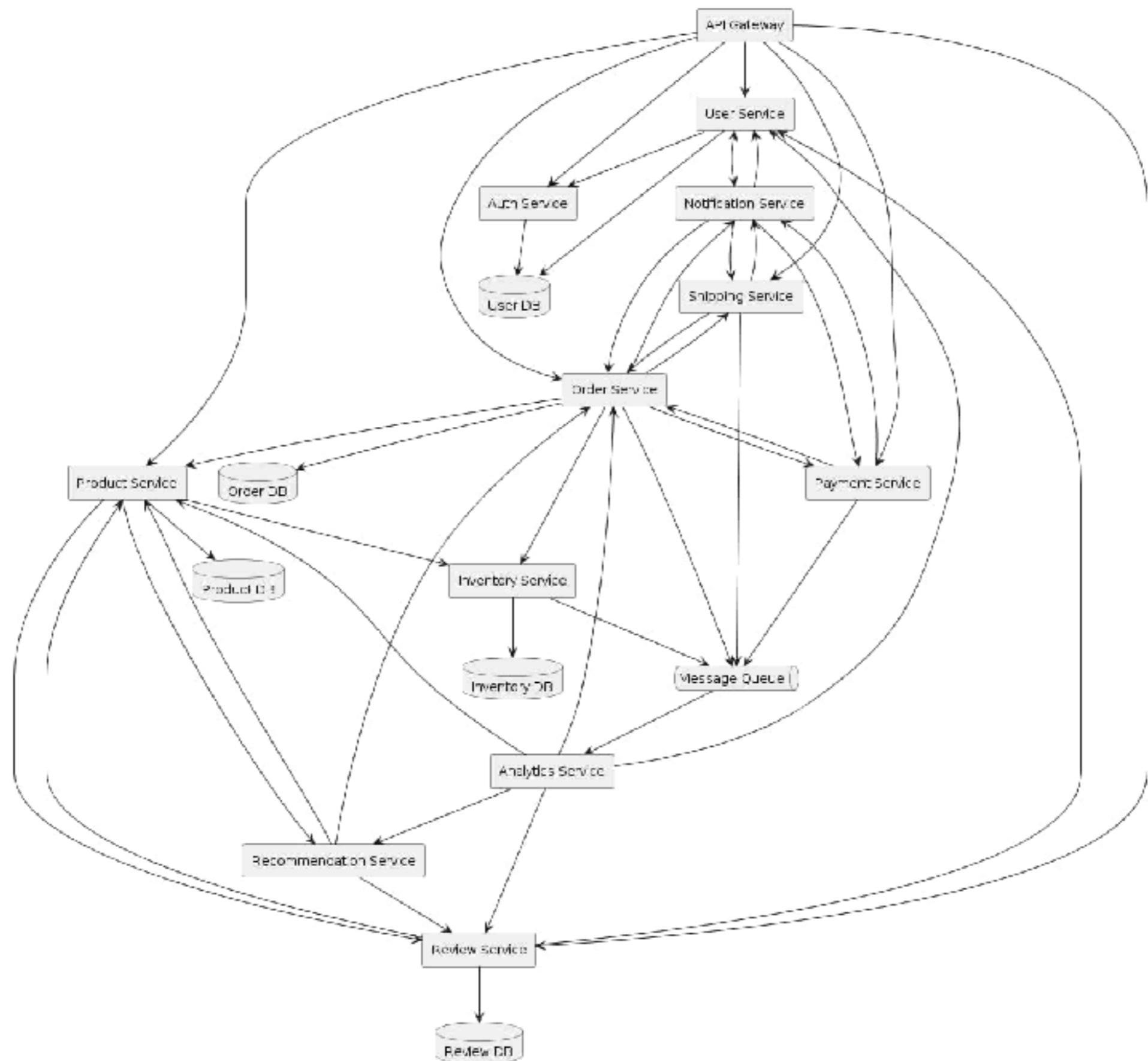


Evolution of Monolith ...



Monolith Hell



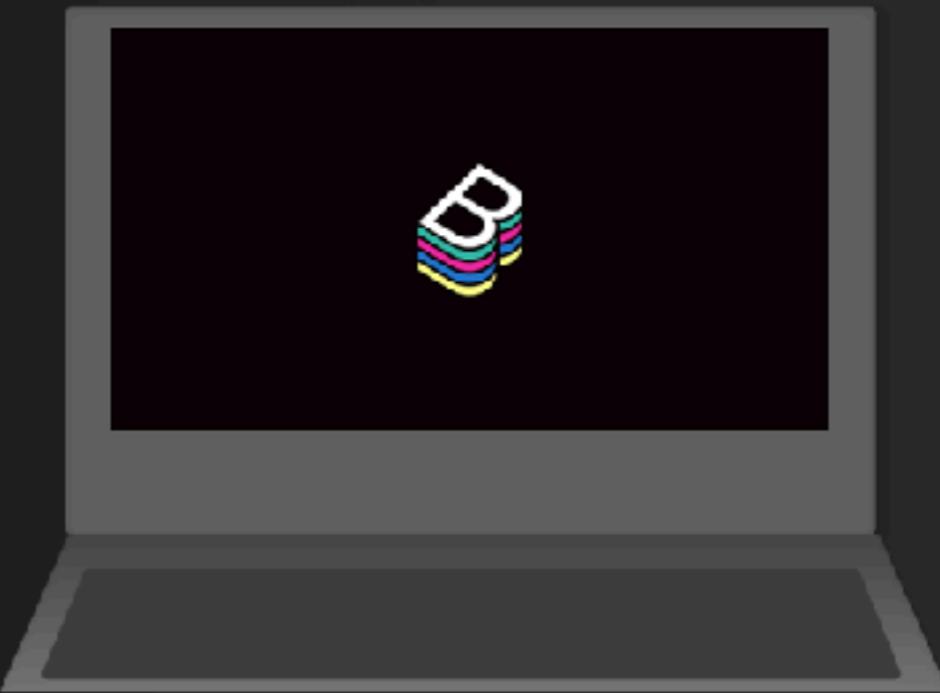


Service Catalog

[GitHub](#)[Docs](#)[Plugins](#)[Blog](#)[Releases](#)[Demos](#)[Community](#) Search X K

An open source framework for building developer portals

Powered by a centralized software catalog, Backstage restores order to your infrastructure and enables your product teams to ship high-quality code quickly — without compromising autonomy.

[GITHUB](#)[OFFICE HOURS](#)

New Adopters

<https://backstage.io/>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

Example of Service Catalog

The screenshot shows the Backstage Catalog interface. The left sidebar contains navigation links: Home, Catalog, APIs, Docs, Create..., Explore, Tech Radar, Cost Insights, and GraphQL. The main area is titled "Backstage Catalog" and displays a table of "All components (16)". The table columns are: NAME, SYSTEM, OWNER, TYPE, LIFECYCLE, DESCRIPTION, TAGS, and ACTIONS. The components listed are:

NAME	SYSTEM	OWNER	TYPE	LIFECYCLE	DESCRIPTION	TAGS	ACTIONS
artist-lookup	artist-engagement-portal	team-a	service	experimental	Artist Lookup	java data	<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
backstage		cnf	library	experimental	Backstage is a...		<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
backstage-demo		backstage/maintainers	website	experimental	An example...		<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
dice-roller		guest	service	production	It rolls dice	go	<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
petstore		Team C	service	experimental	[The Petstore]...		<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
playback-order	audio-playback	Guest User	service	production	Playback Order	java playback	<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
playback-sdk	audio-playback	Team C	library	experimental	Audio and vid...		<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>
podcast-api	podcast	Team B	service	experimental	Podcast API	java	<input checked="" type="checkbox"/> <input type="button" value="edit"/> <input type="star"/>

<https://demo.backstage.io/>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

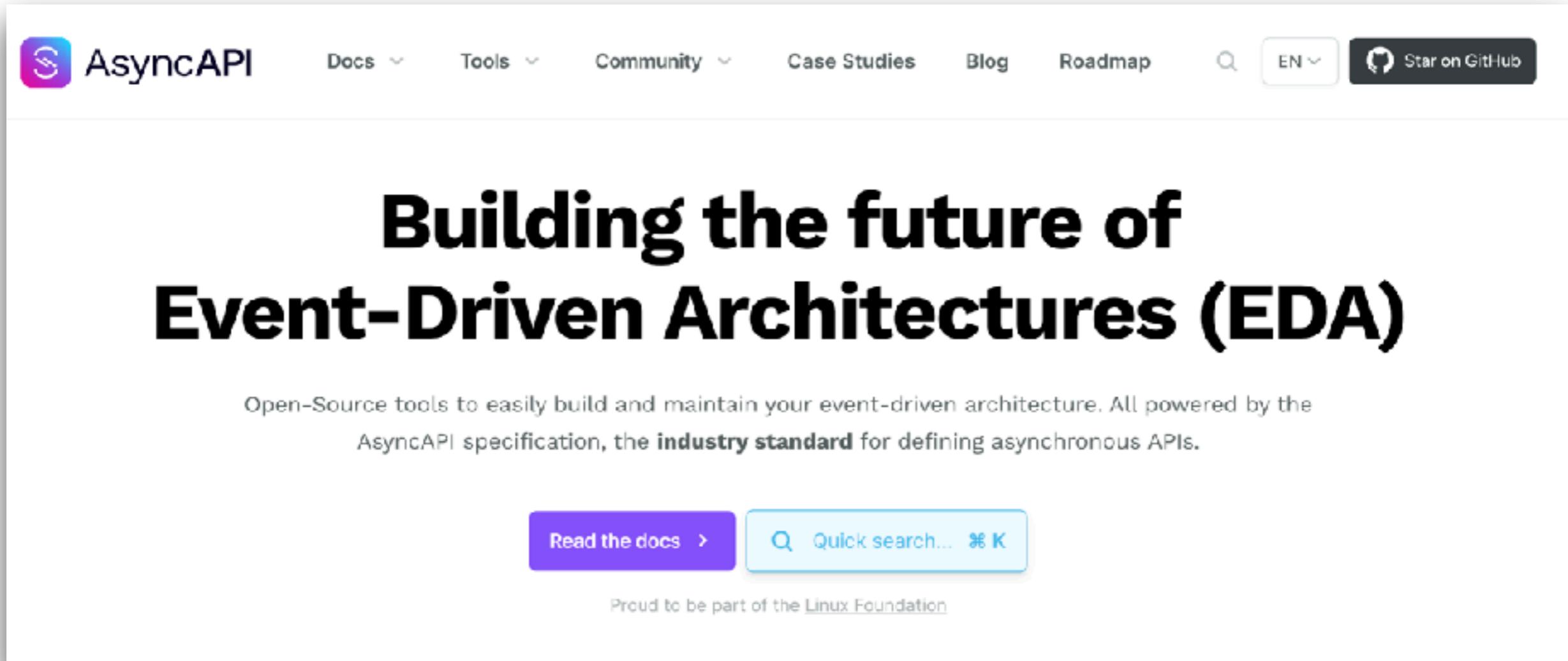
OpenAPI

The screenshot shows the homepage of the Swagger website. At the top, there is a navigation bar with the Swagger logo (a green circle with white curly braces), the text "Swagger. supported by SMARTBEAR", and menu items "Learn", "Tools", and "Resources". To the right of the menu are a search icon, a "Sign In" button, and a "Try Free" button. Below the navigation bar, there is a large green banner with the text "API Development for Everyone". Underneath the banner, a call-to-action text reads: "Simplify your API development with our open-source and professional tools, built to help you and your team efficiently design and document APIs at scale." There are two blue buttons: "Find your tool" and "Read the docs →". Below these buttons, there is a section titled "TRUSTED BY" featuring logos for Microsoft, NATIONAL GEOGRAPHIC, and ZUORA. On the right side of the page, there is a sidebar titled "API Resources" showing a list of HTTP methods and their corresponding endpoints: GET /resources, POST /resources, GET /resources/{id}, PUT /resources/{id}, PATCH /resources/{id}, DELETE /resources/{id}, OPTIONS /resources/{id}, and HEAD /resources/{id}. The URL in the sidebar is "https://api.swagger.io".

<https://swagger.io/>



AsyncAPI



The screenshot shows the AsyncAPI website homepage. At the top, there is a navigation bar with links for Docs, Tools, Community, Case Studies, Blog, and Roadmap. There is also a search icon, a language selector set to EN, and a GitHub star button. The main title "Building the future of Event-Driven Architectures (EDA)" is prominently displayed in large, bold, black font. Below the title, a subtitle explains the purpose: "Open-Source tools to easily build and maintain your event-driven architecture. All powered by the AsyncAPI specification, the **industry standard** for defining asynchronous APIs." Two buttons are visible: a purple "Read the docs" button and a light blue "Quick search..." button. A small note at the bottom states "Proud to be part of the [Linux Foundation](#)".

**Building the future of
Event-Driven Architectures (EDA)**

Open-Source tools to easily build and maintain your event-driven architecture. All powered by the AsyncAPI specification, the **industry standard** for defining asynchronous APIs.

[Read the docs](#) [Quick search... 36 K](#)

Proud to be part of the [Linux Foundation](#)

<https://www.asyncapi.com/en>



EventCatalog

Documentation tool for Event-Driven Architectures

EventCatalog is an Open Source project that helps you document your [events](#), [services](#) and [domains](#). Over [11,000](#) catalogs created.

Powered by markdown, components and plugins.

[Start Documenting →](#) [View Demo](#)

The screenshot shows the EventCatalog interface with the following details:

- Event Details:** AddedItemToCart, version: 0.0.3, summary: Holds information about the customer who creates when they add an item to the cart.
- Producers:** Basket
- Consumers:** Data
- Owners:** dboyn
- Mermaid Diagram:** A sequence diagram showing the flow from `ShoppingCart` to `AddItemToCart` to `CustomerBasket`.
- Details:** This event can be triggered multiple times per customer. Everytime the customer interacts with their shopping cart and removes an item the event will be triggered.
- Event Schema:** A JSON schema for the event payload.

<https://www.eventcatalog.dev/>



Microservices

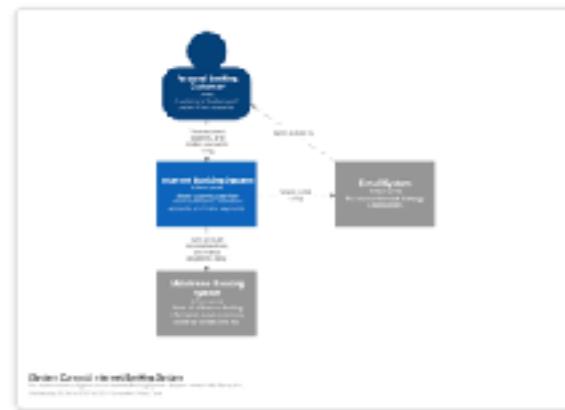
© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

Overall architecture of system ?

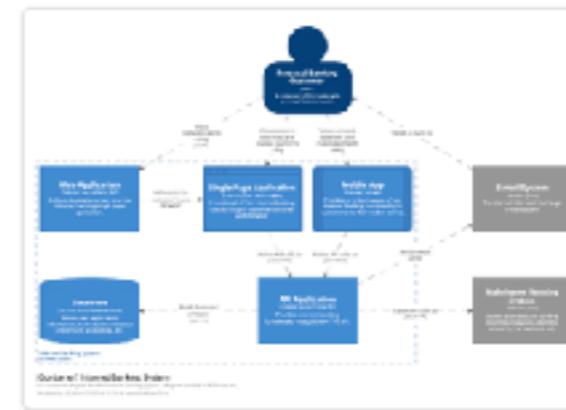


C4 Model

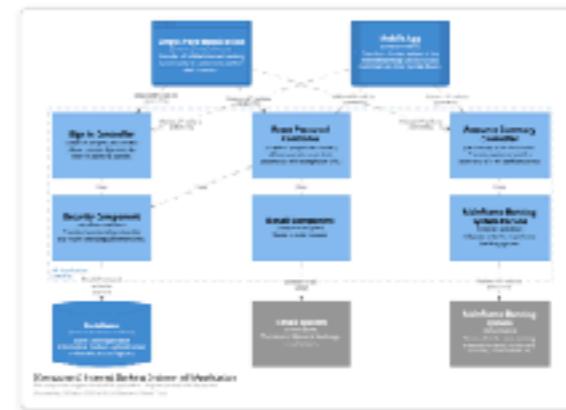
Visualizing software architecture



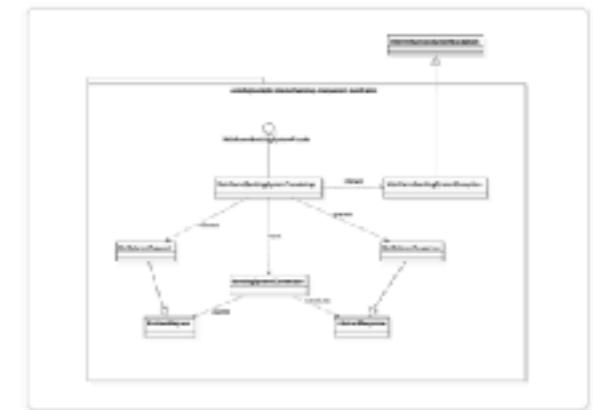
Level 1: A System Context diagram provides a starting point, showing how the software system in scope fits into the world around it.



Level 2: A Container diagram zooms into the software system in scope, showing the high-level technical building blocks.



Level 3: A Component diagram zooms into an individual container, showing the components inside it.



Level 4: A code (e.g. UML class) diagram can be used to zoom into an individual component, showing how that component is implemented.

<https://c4model.com/>



Monolith problems ?

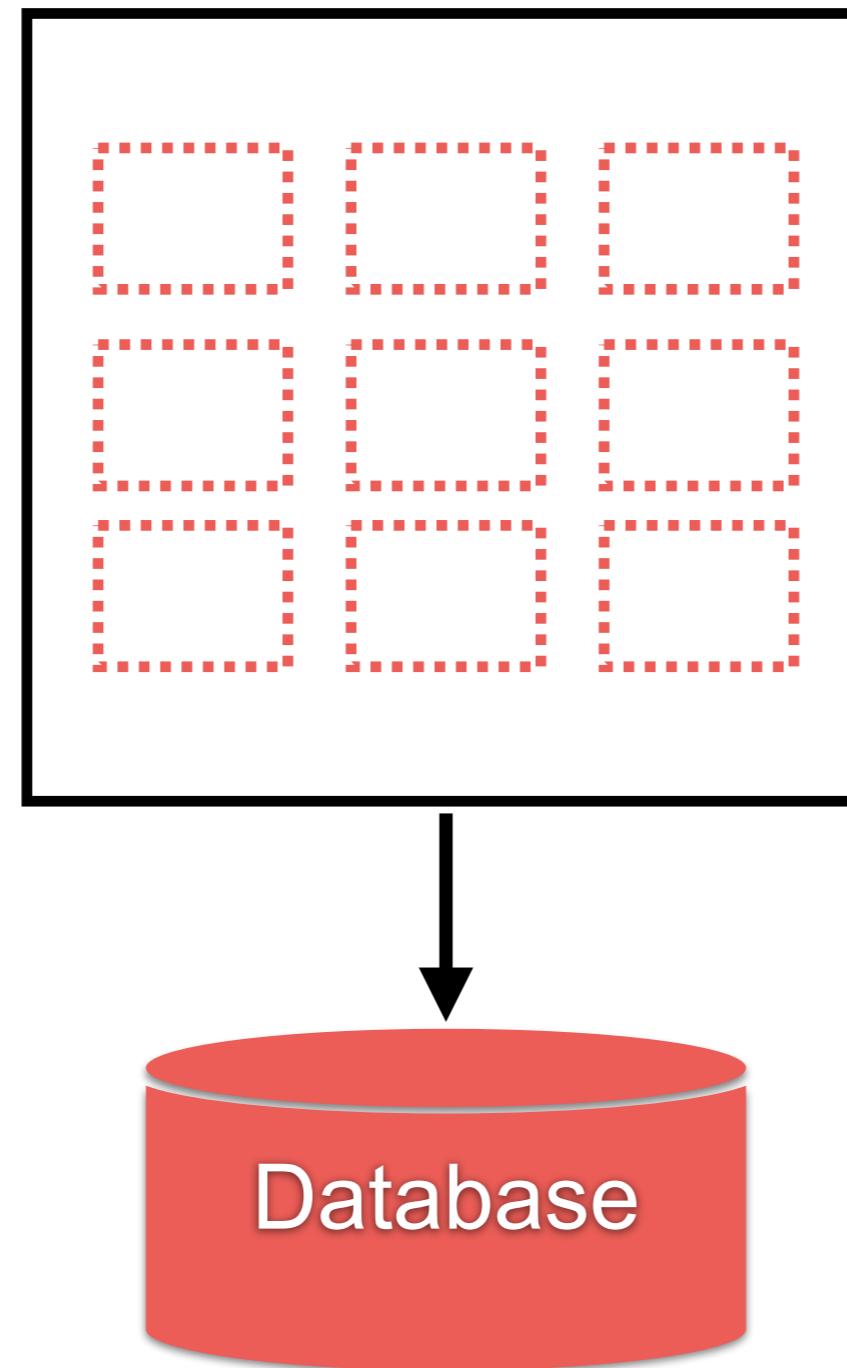
Build
Test
Deploy
Troubleshooting
Scale out (horizontal)

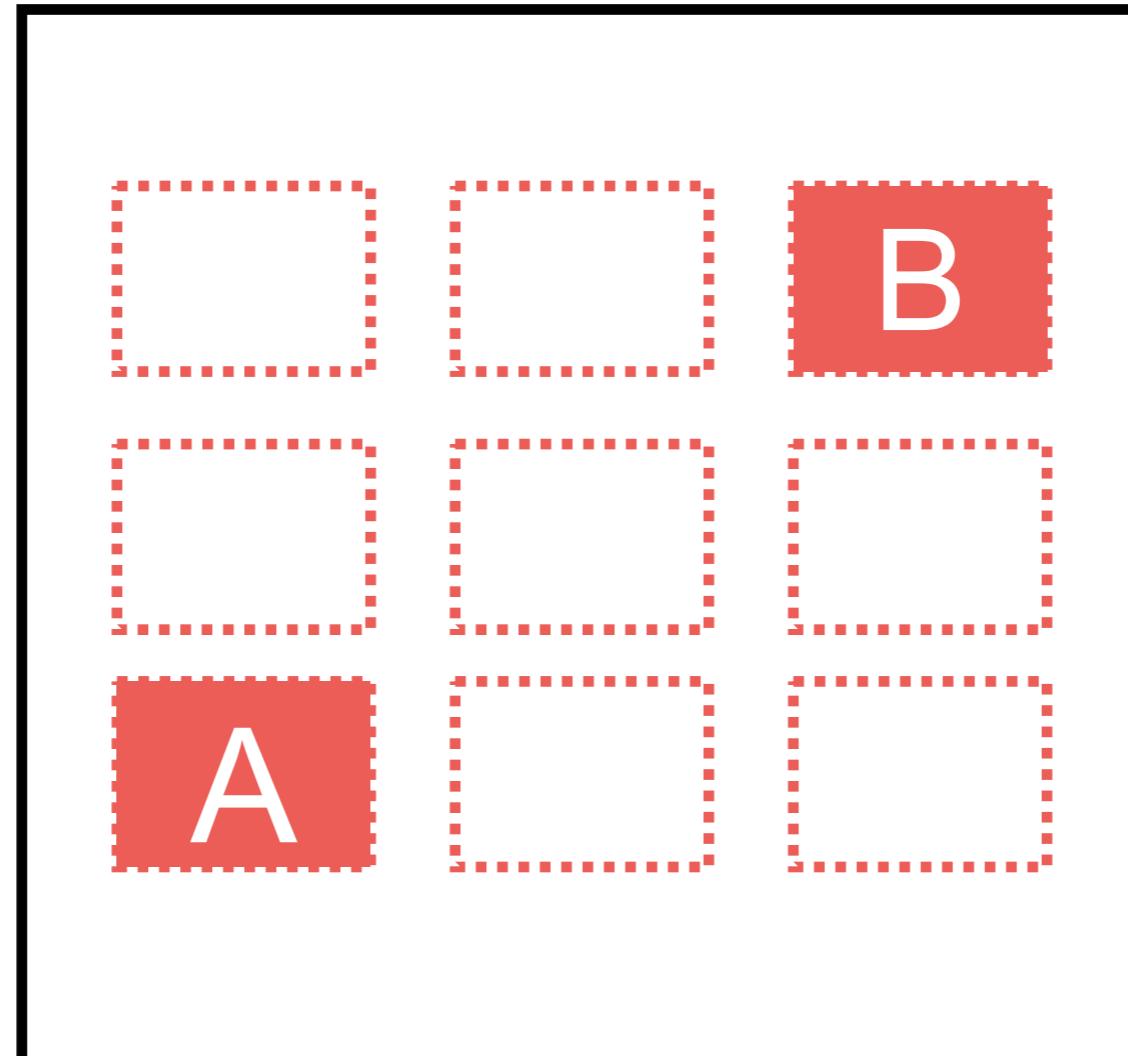


How to scale system ?



Service with Modular





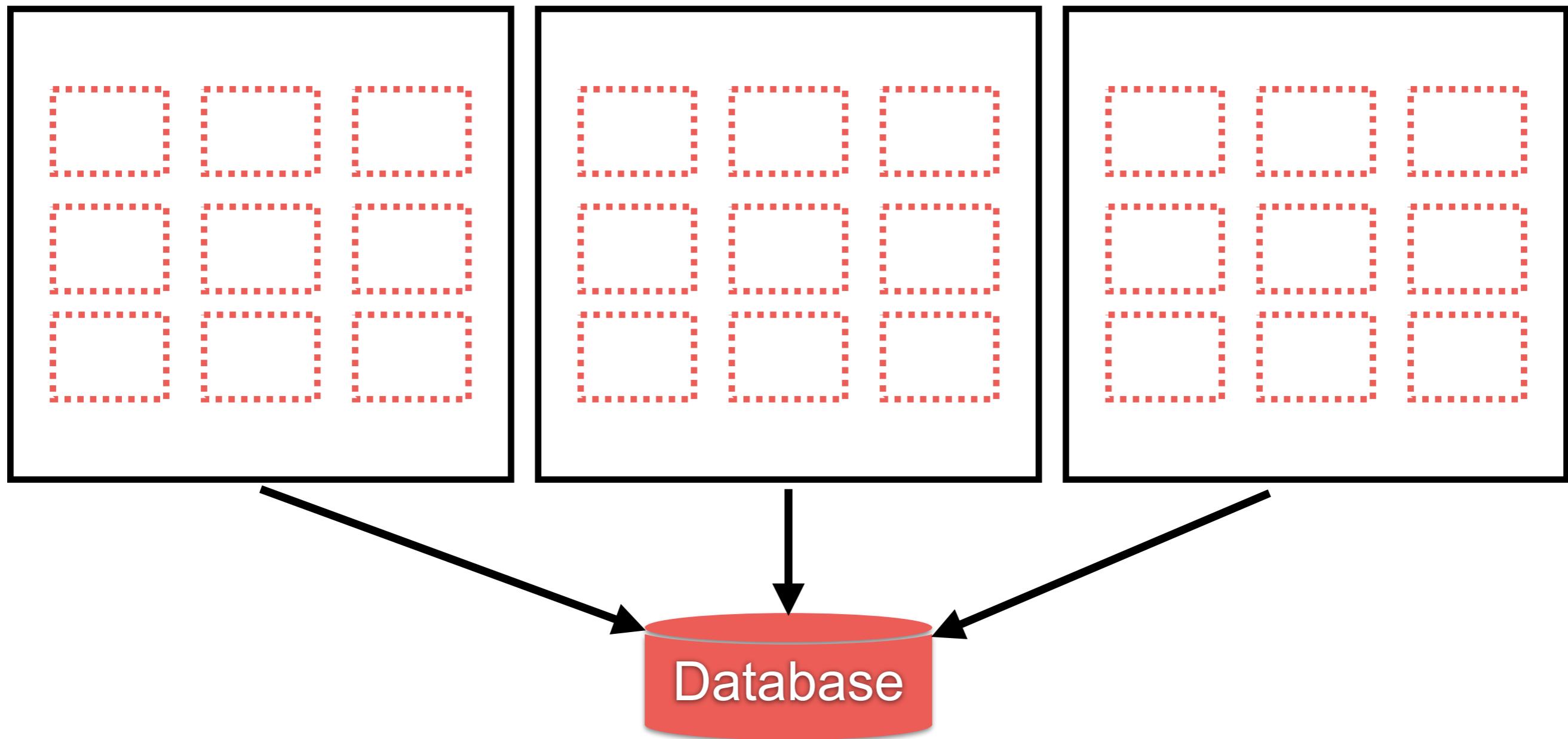
How to scale ?



Scale Up (Vertical)



Scale Out (Horizontal)



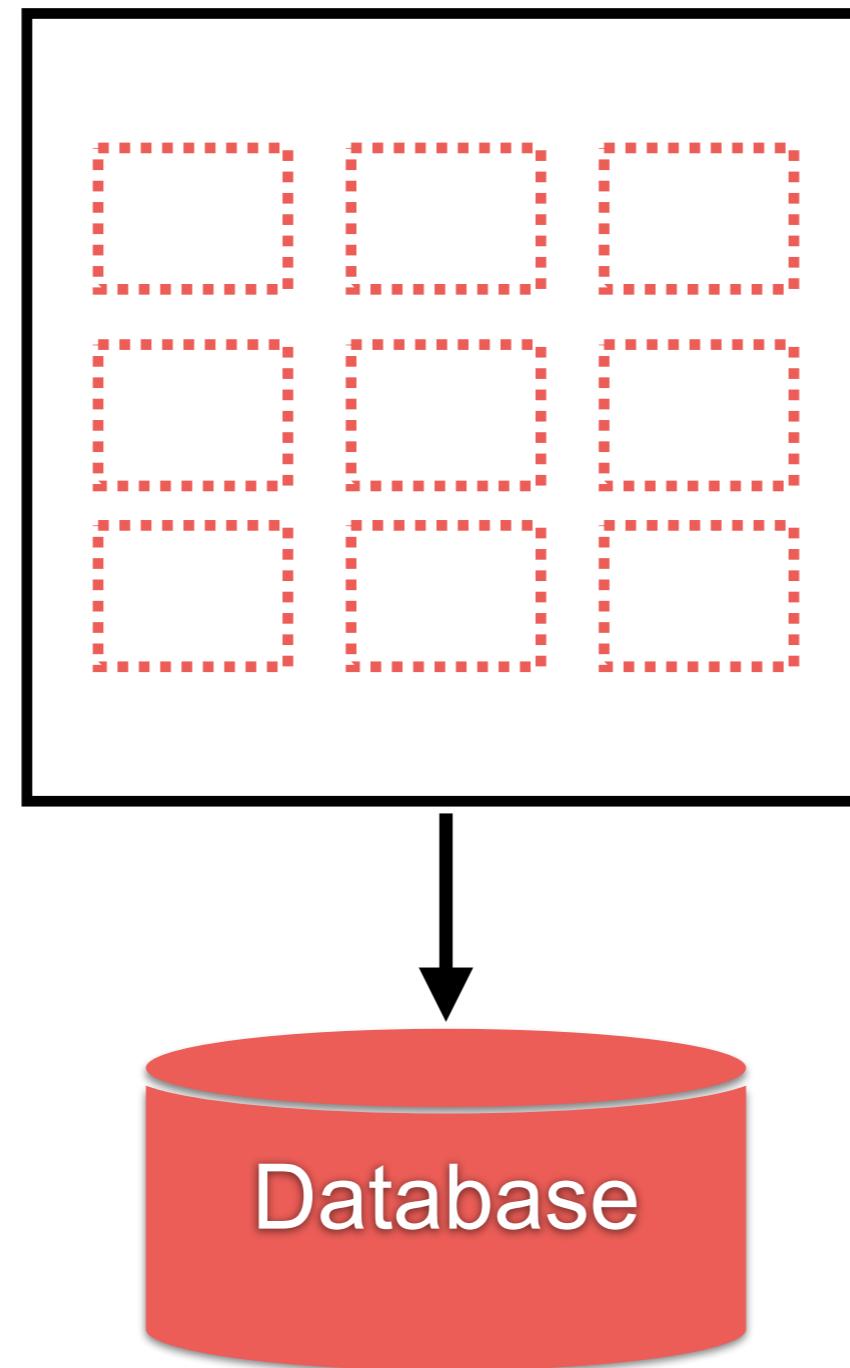
What happens when we need more servers ?



What if we don't use all modules equally ?



Database ?



How can we update individual models/database ?



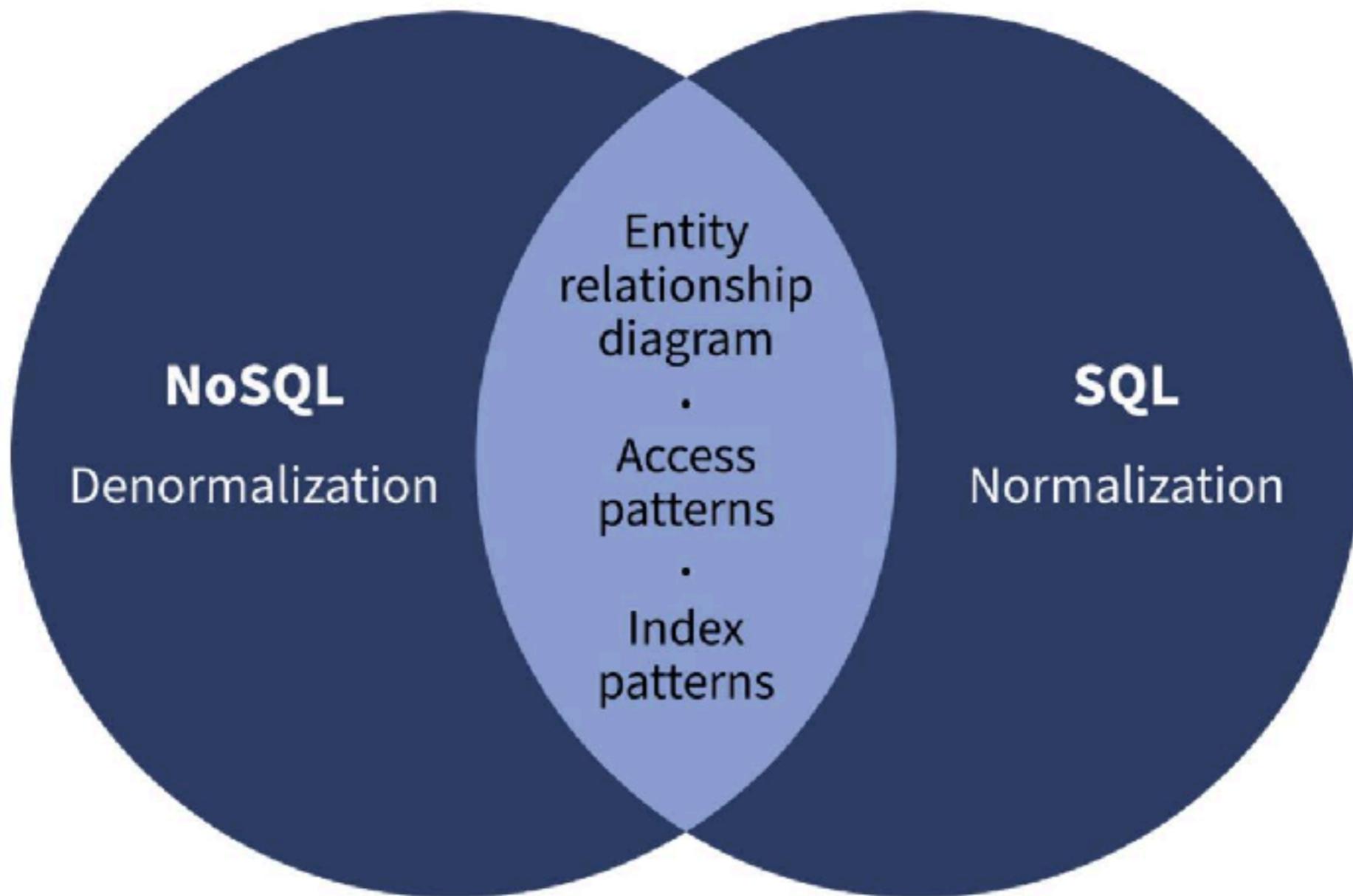
Scale up or Scale out ?



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



Database ?



Database Models

424 systems in ranking, March 2025

Rank			DBMS	Database Model	Score		
Mar 2025	Feb 2025	Mar 2024			Mar 2025	Feb 2025	Mar 2024
1.	1.	1.	Oracle	Relational, Multi-model 	1253.08	-1.74	+32.02
2.	2.	2.	MySQL	Relational, Multi-model 	988.13	-11.86	-113.37
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model 	788.14	+1.27	-57.67
4.	4.	4.	PostgreSQL 	Relational, Multi-model 	663.42	+3.81	+28.52
5.	5.	5.	MongoDB 	Document, Multi-model 	396.42	-0.21	-28.11
6.	↑7.	↑9.	Snowflake	Relational	161.78	+6.20	+36.40
7.	↓6.	↓6.	Redis	Key-value, Multi-model 	155.36	-2.55	-1.64
8.	8.	↓7.	Elasticsearch	Multi-model 	131.38	-3.25	-3.41
9.	9.	↓8.	IBM Db2	Relational, Multi-model 	126.57	+1.14	-1.18
10.	10.	10.	SQLite	Relational	113.08	-0.74	-5.08
11.	11.	↑12.	Apache Cassandra	Wide column, Multi-model 	106.65	+4.07	+2.07
12.	12.	↓11.	Microsoft Access	Relational	96.72	+0.18	-11.21
13.	13.	↑17.	Databricks	Multi-model 	96.01	+5.97	+21.67
14.	14.	↓13.	MariaDB	Relational, Multi-model 	94.23	+4.72	-0.80
15.	15.	↓14.	Splunk	Search engine	78.87	-1.68	-10.80

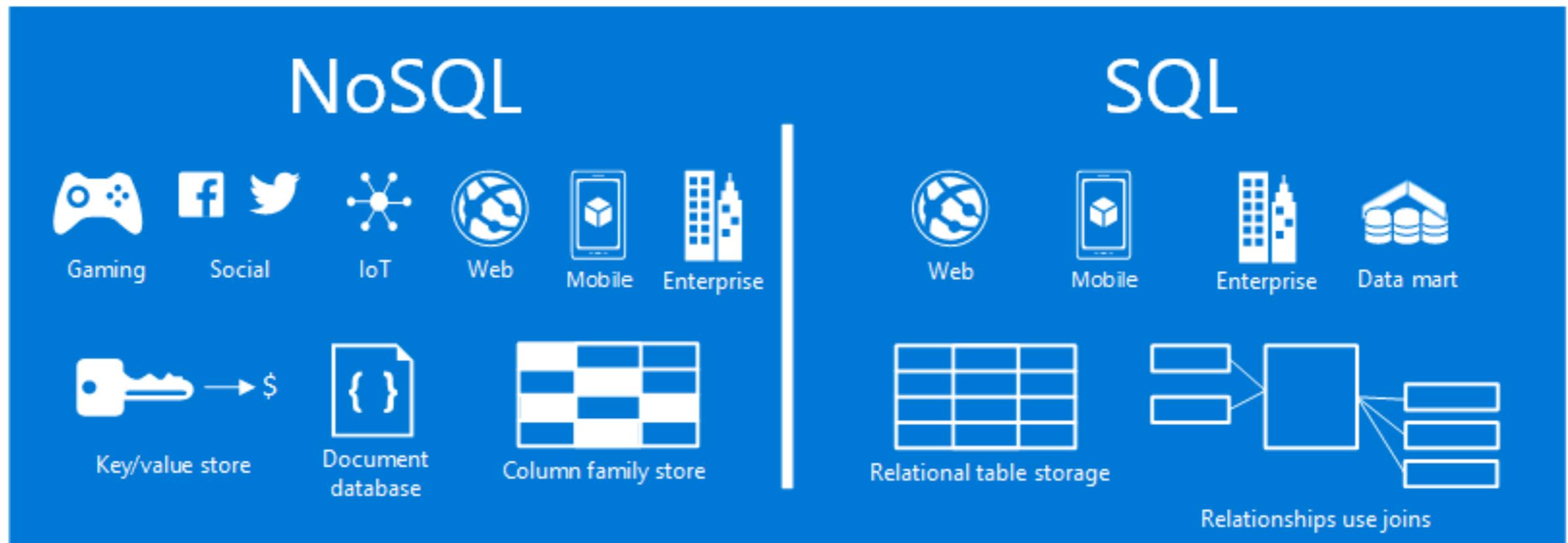
<https://db-engines.com/en/ranking>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

Database Models



Database design

Design for read

Design for write

Pre-join tables or pre-aggregate data

Manage data size

Sharding

Caching data



We need to improve

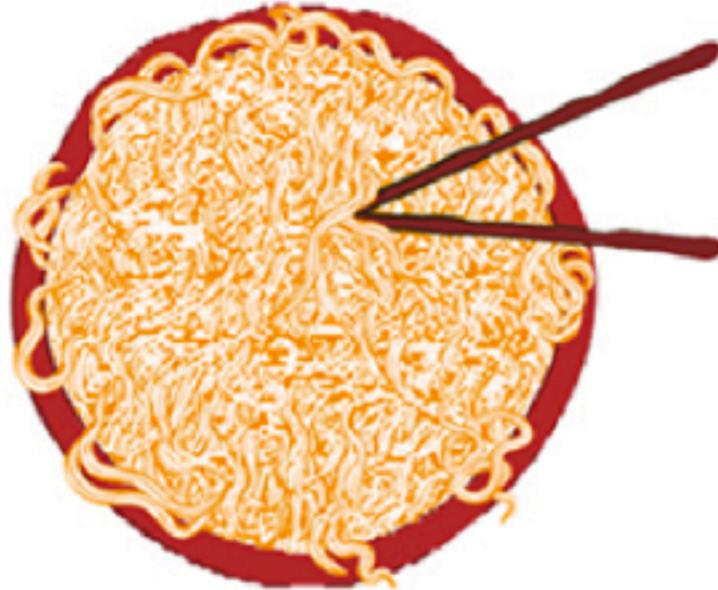
We need to get better



SOA

1990s and earlier

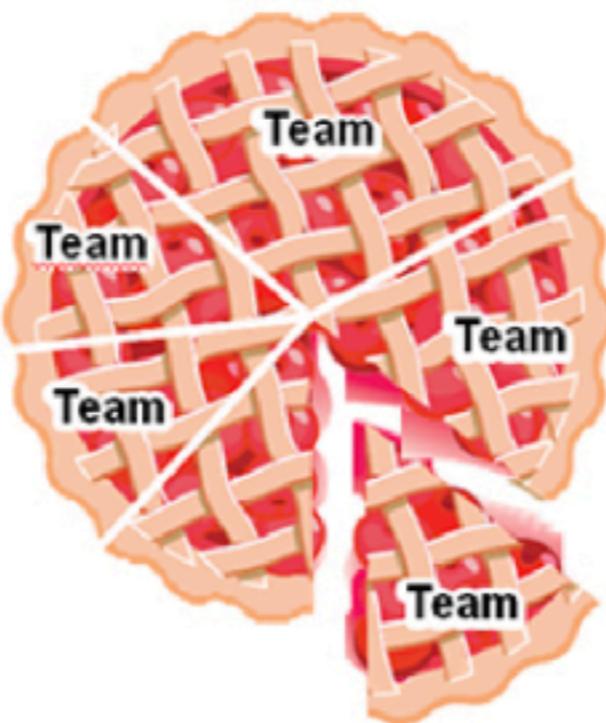
Pre-SOA (monolithic)
Tight coupling



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



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

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

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

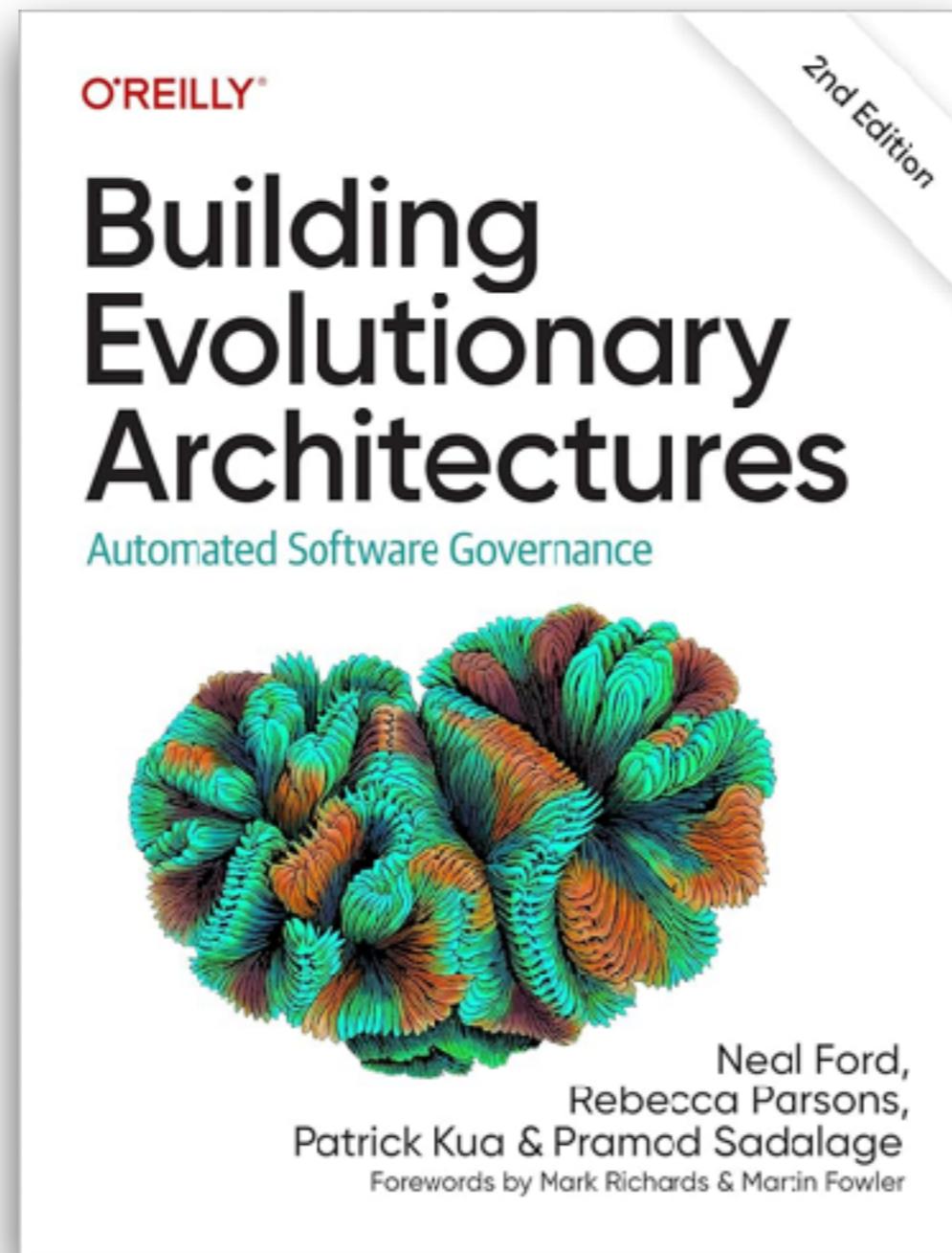
Evolutionary refinement over pursuit of initial perfection



Evolution design and continuous improvement



Building Evolutionary Architecture



<https://www.amazon.com/Building-Evolutionary-Architectures-Automated-Governance/dp/1492097543>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

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

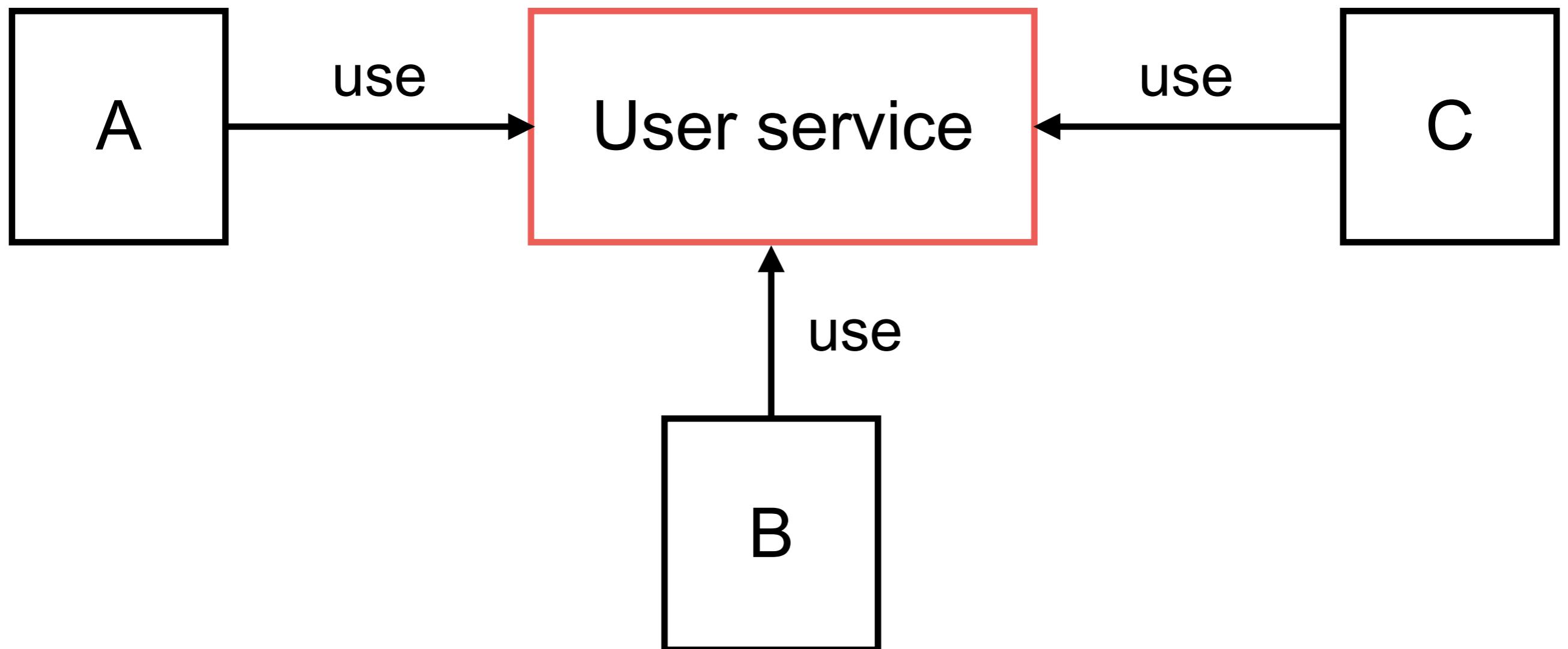
Flexibility over optimization

Evolutionary refinement over pursuit of initial perfection

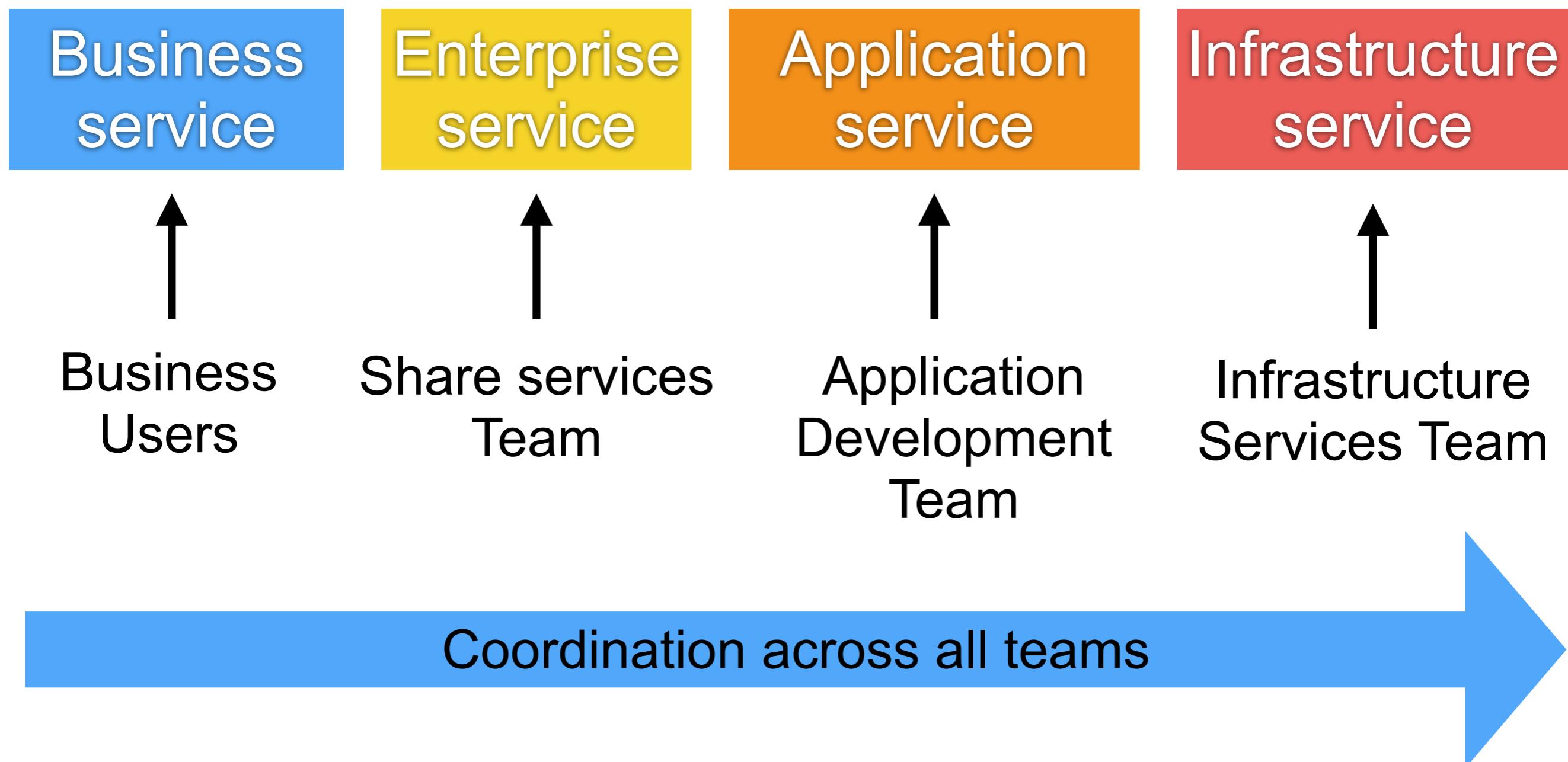
<http://www.soa-manifesto.org/>



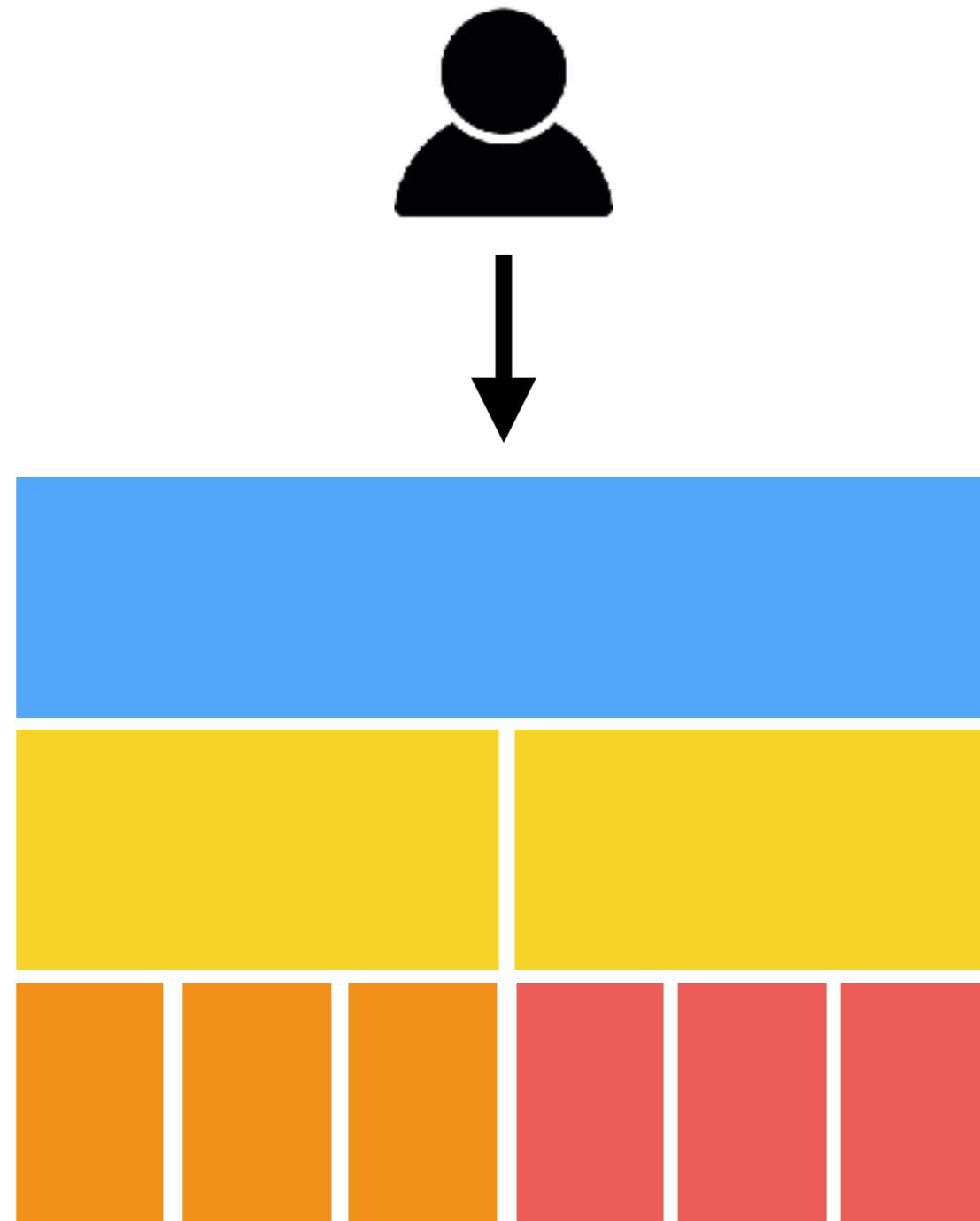
Shared service ?



Service-Oriented Architecture



Service-Oriented Architecture



We need to improve

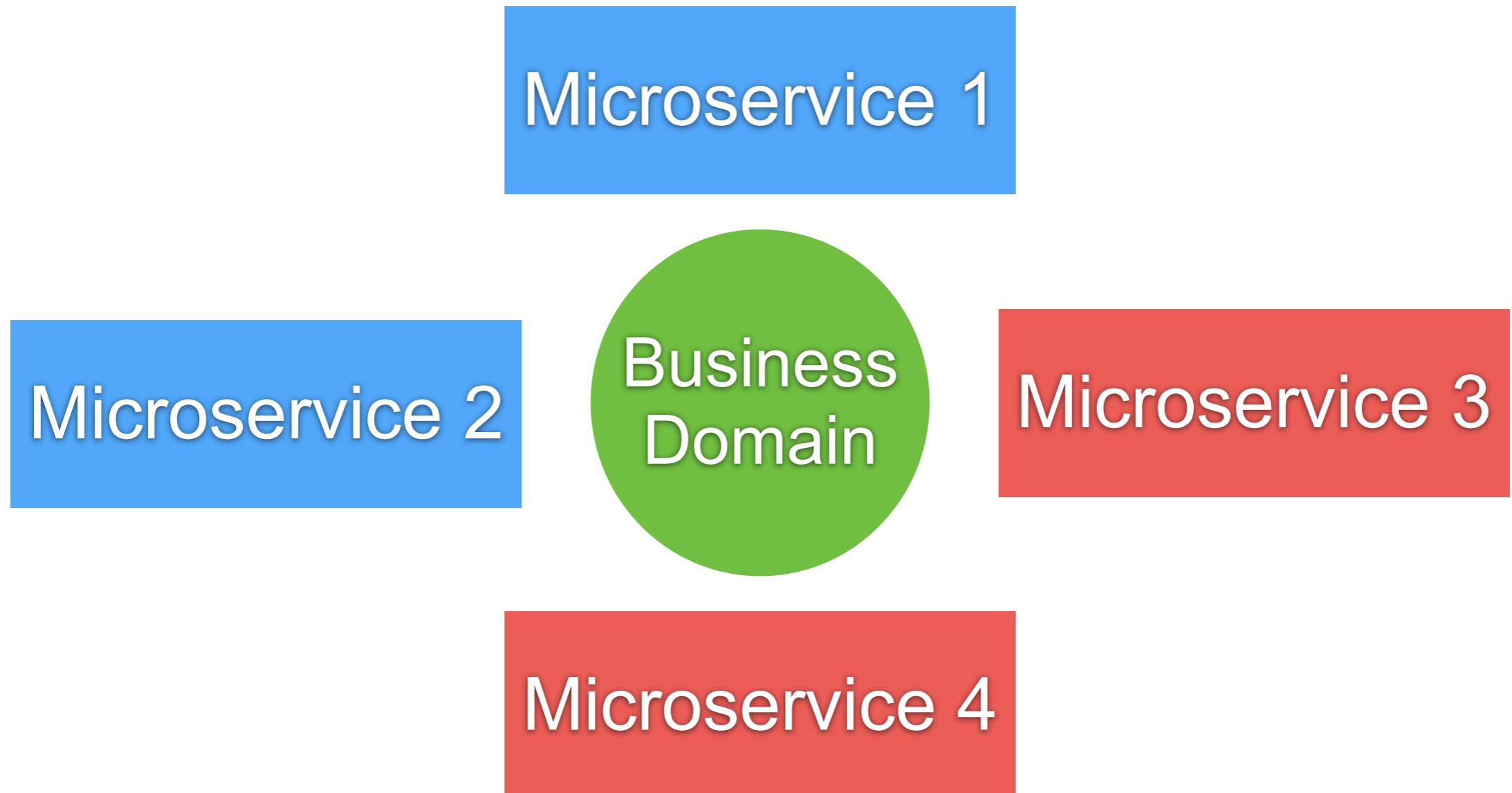
We need to get better



Microservice



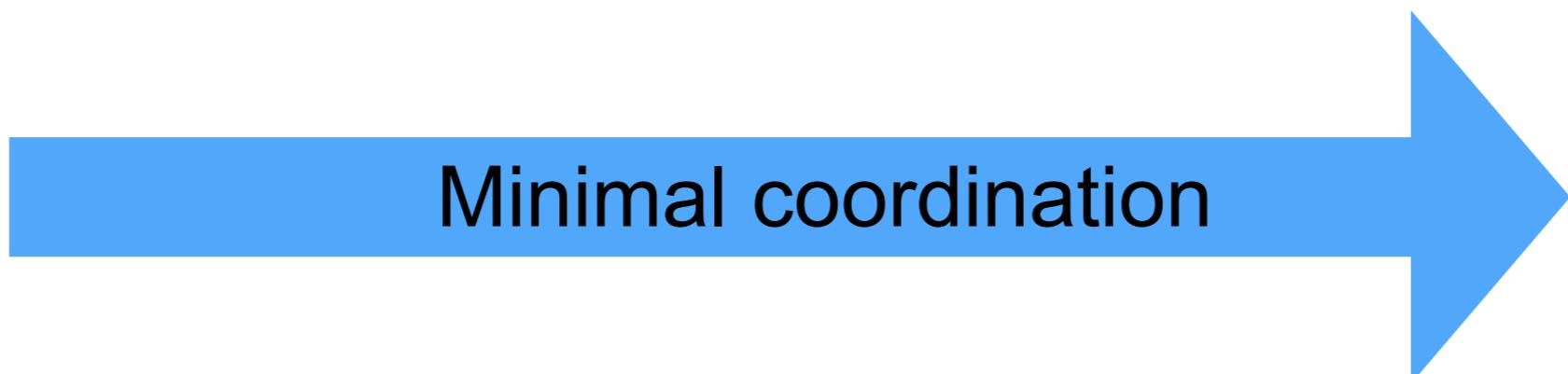
Microservice



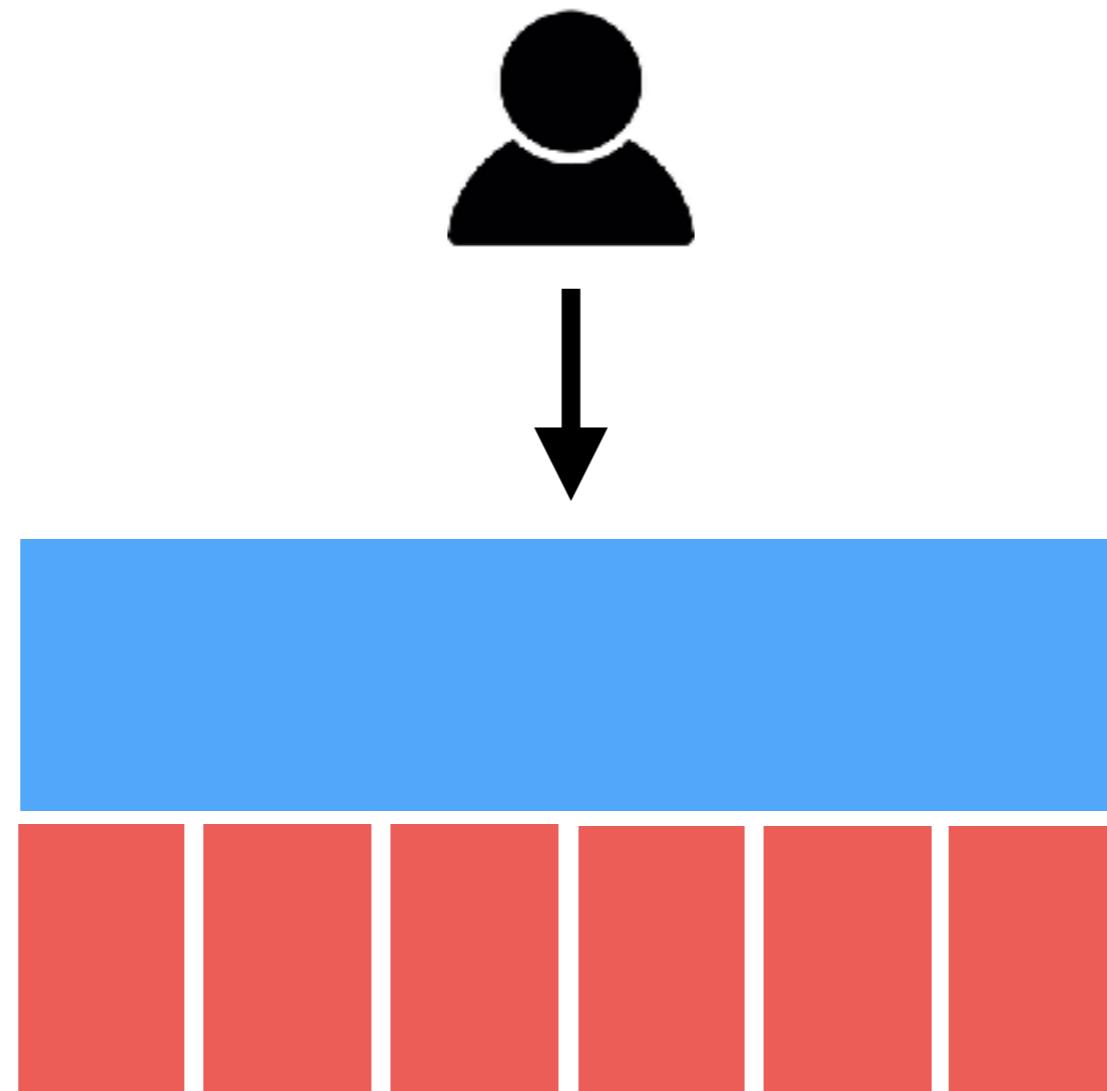
Microservice

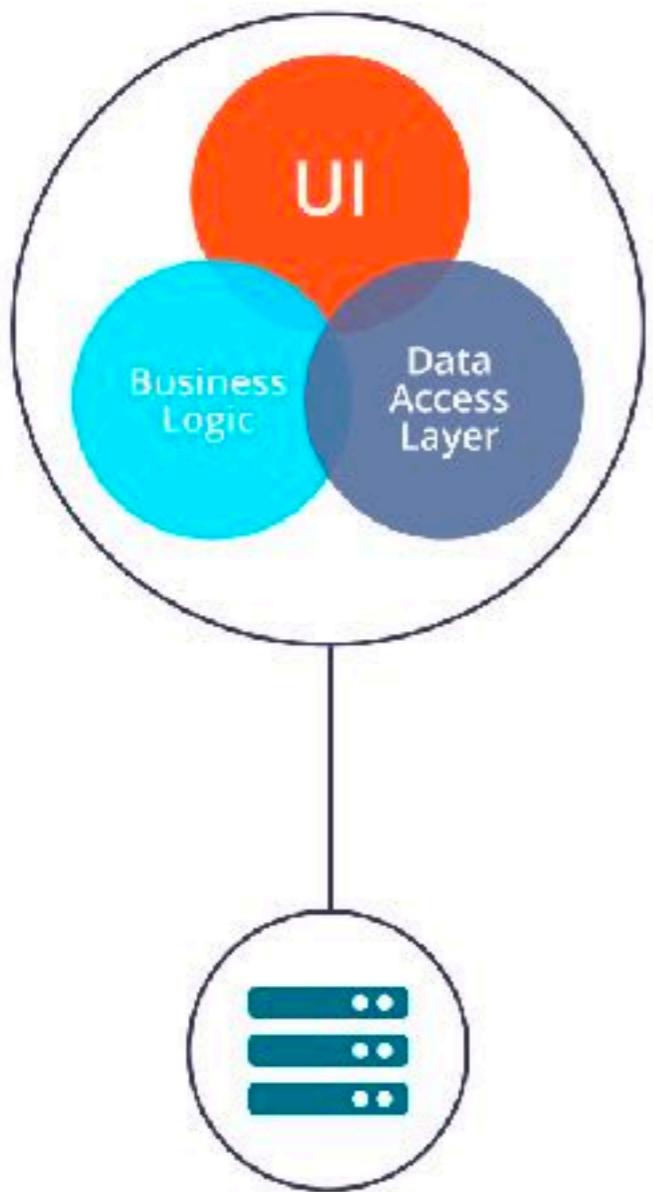


Application Development Team

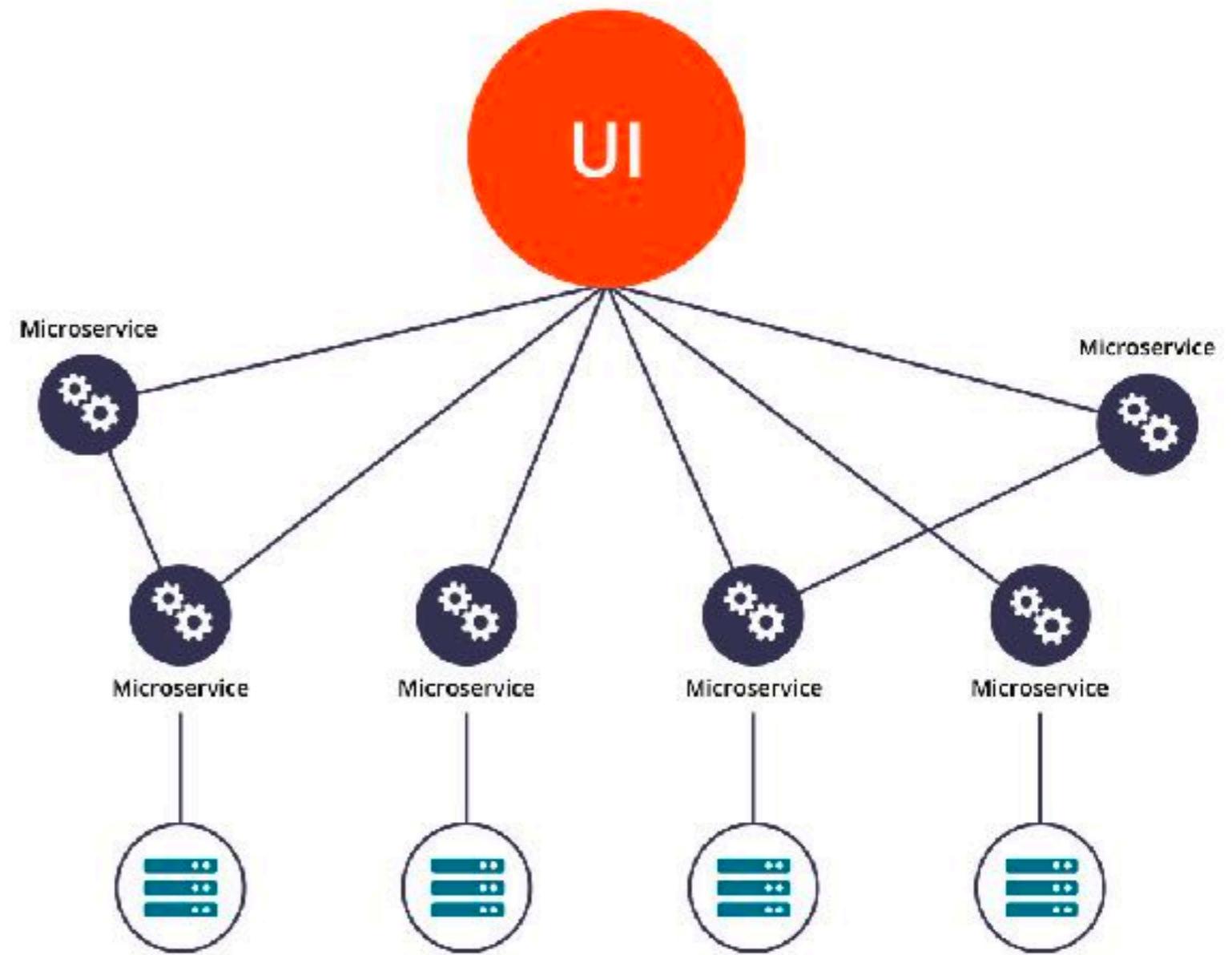


Microservice





Monolithic Architecture



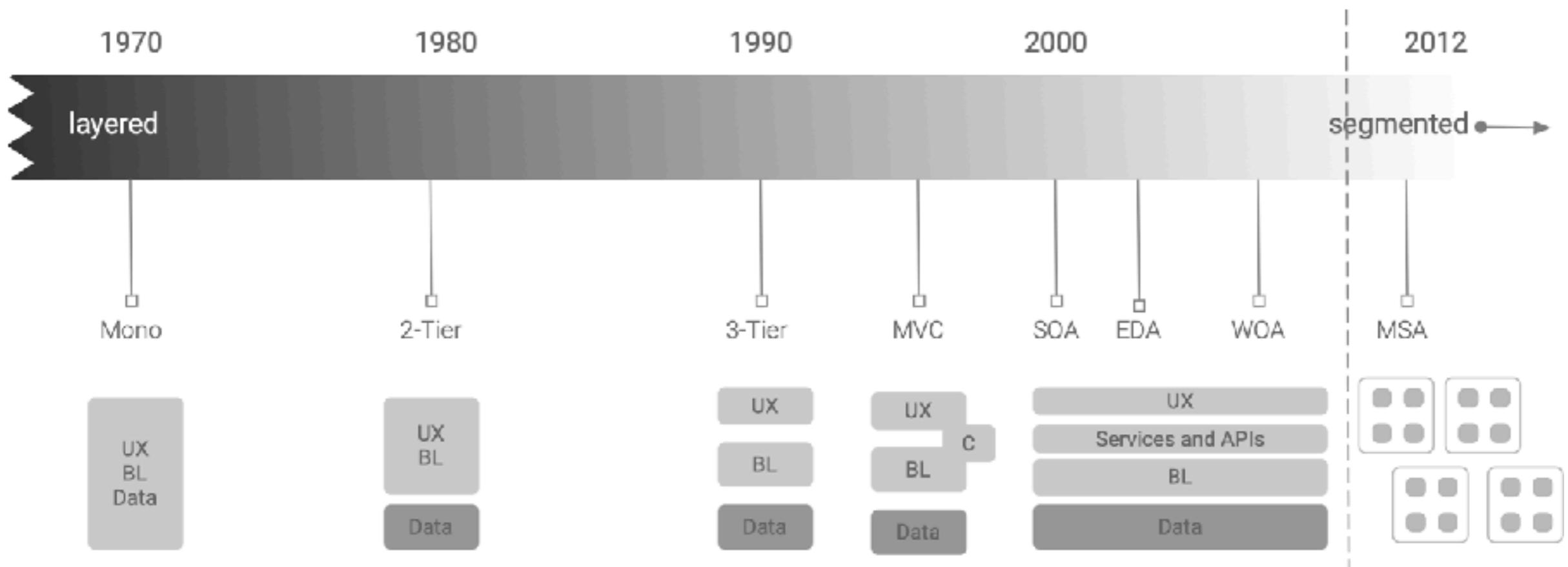
Microservice Architecture



Summary



Evolution of Architecture

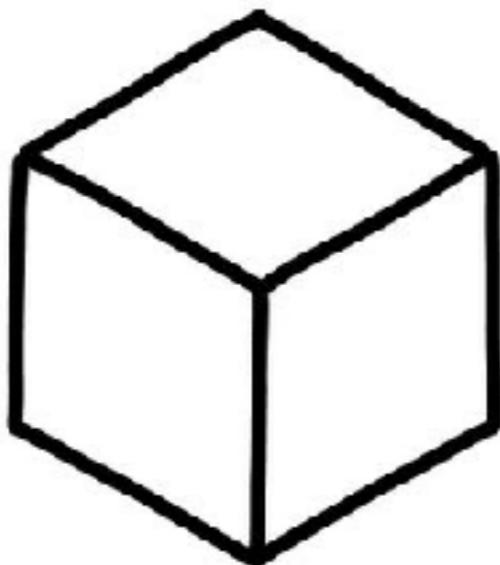


<https://github.com/wso2/reference-architecture/blob/master/reference-architecture-layered-segmented.md>



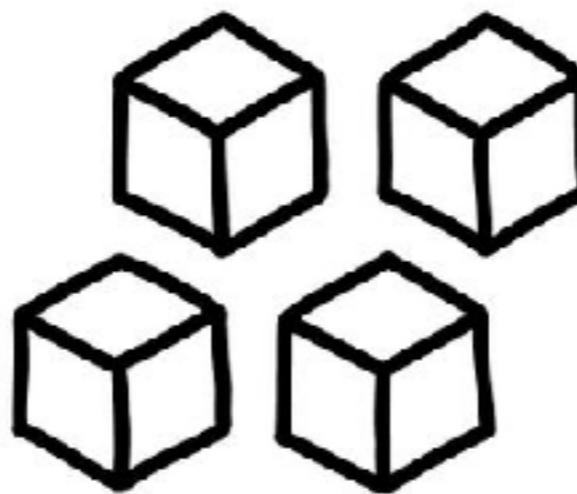
GRANULARITY OF SYSTEMS

Monolithic



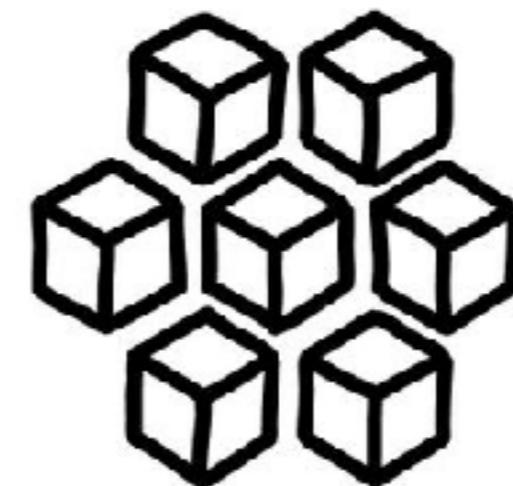
Single unit

SOA



Coarse-grained

Microservices



Fine-grained

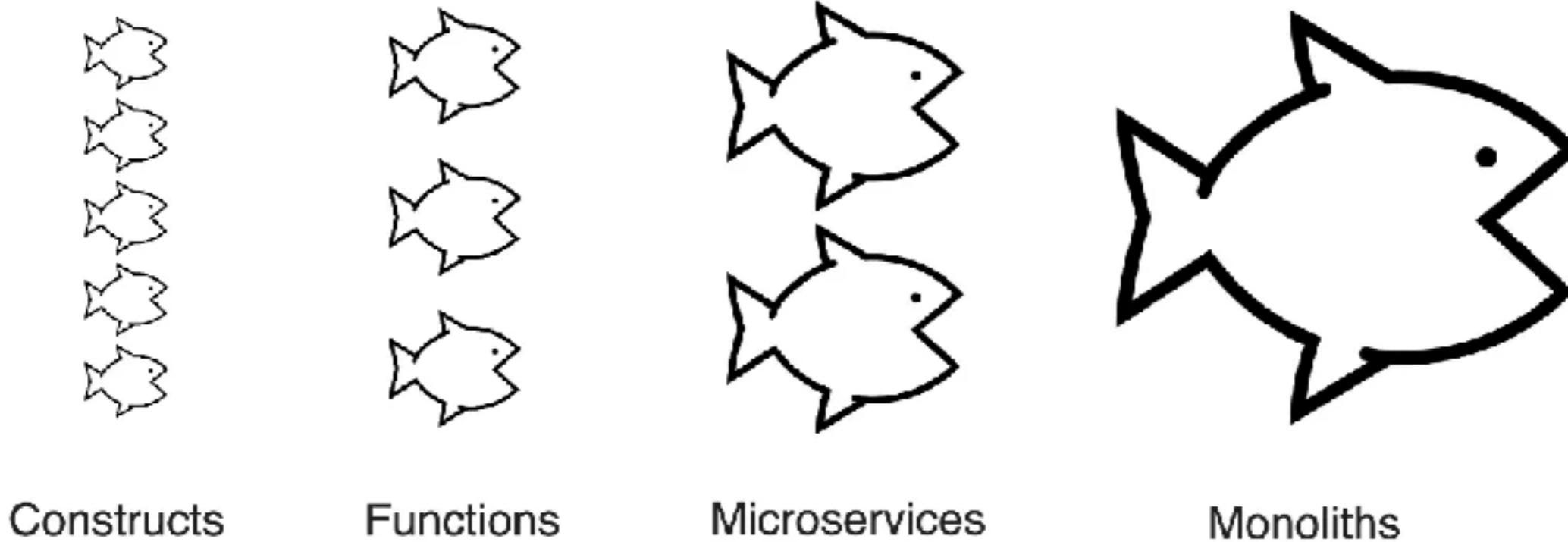
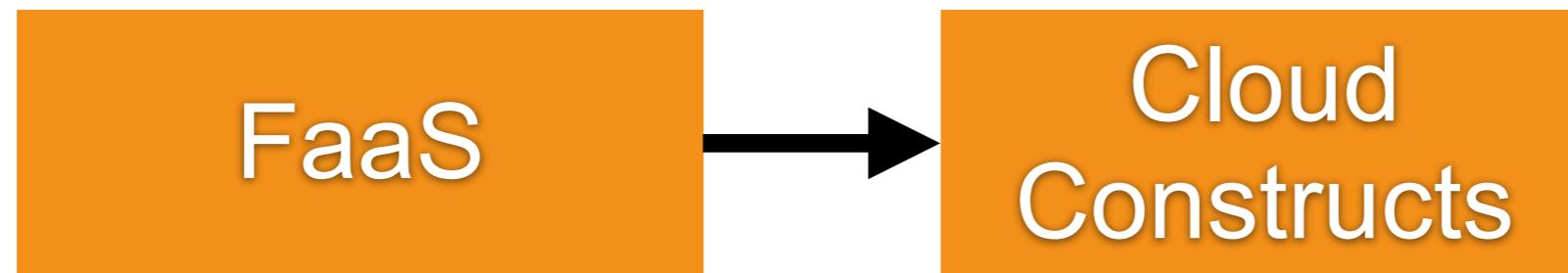
<https://architecturenotes.co/p/granularity-of-systems>



Next !!!



Next !!!



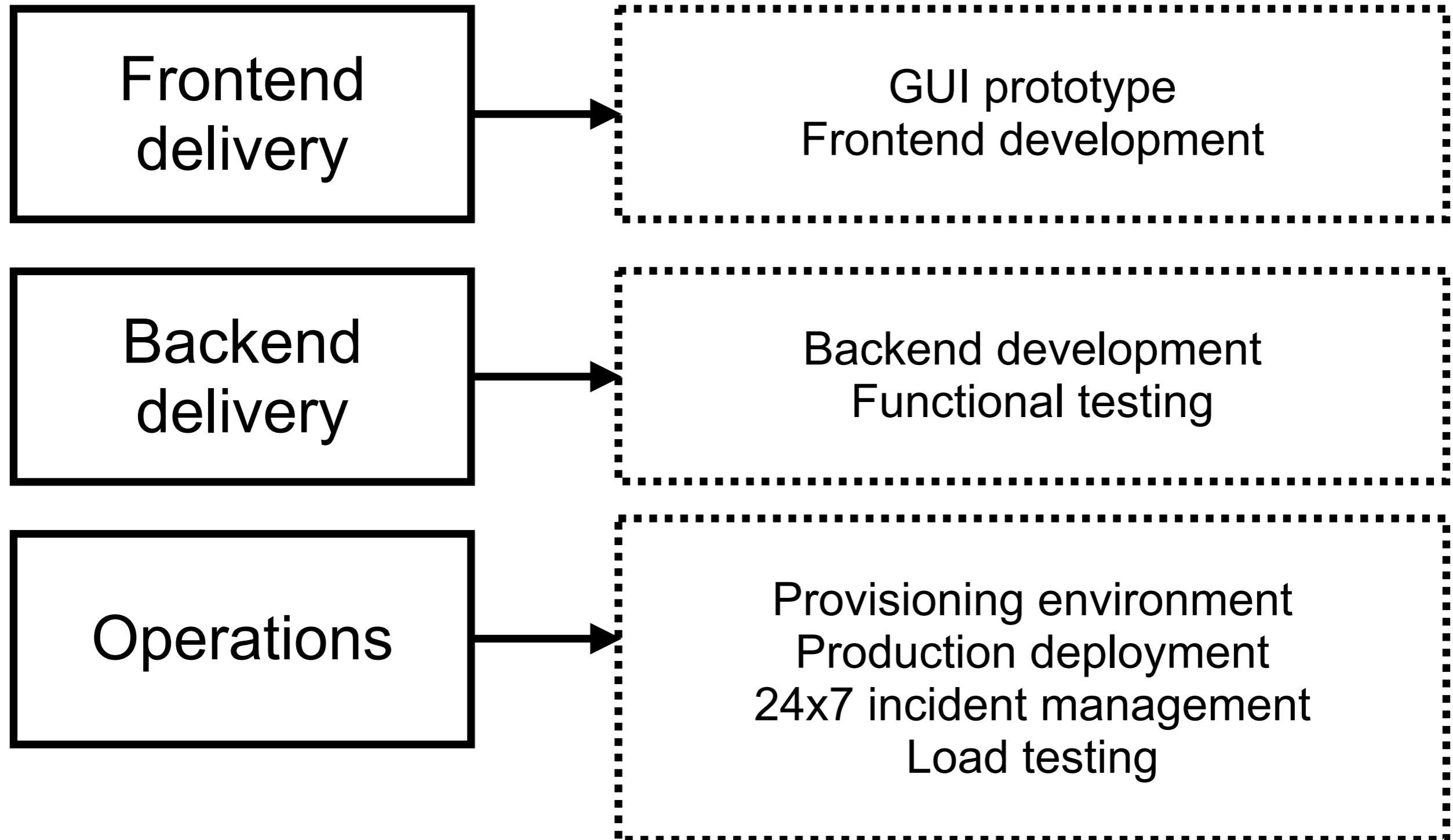
<https://www.infoq.com/articles/cloud-computing-post-serverless-trends/>



Delivery Problems



Delivery Responsibilities



Delivery Improvement ?



Better ?

Delivery Team

Frontend
delivery

Backend
delivery

Operations

GUI prototype
Frontend development
Backend development

Functional testing
Provisioning environment
Incident management (office hours)

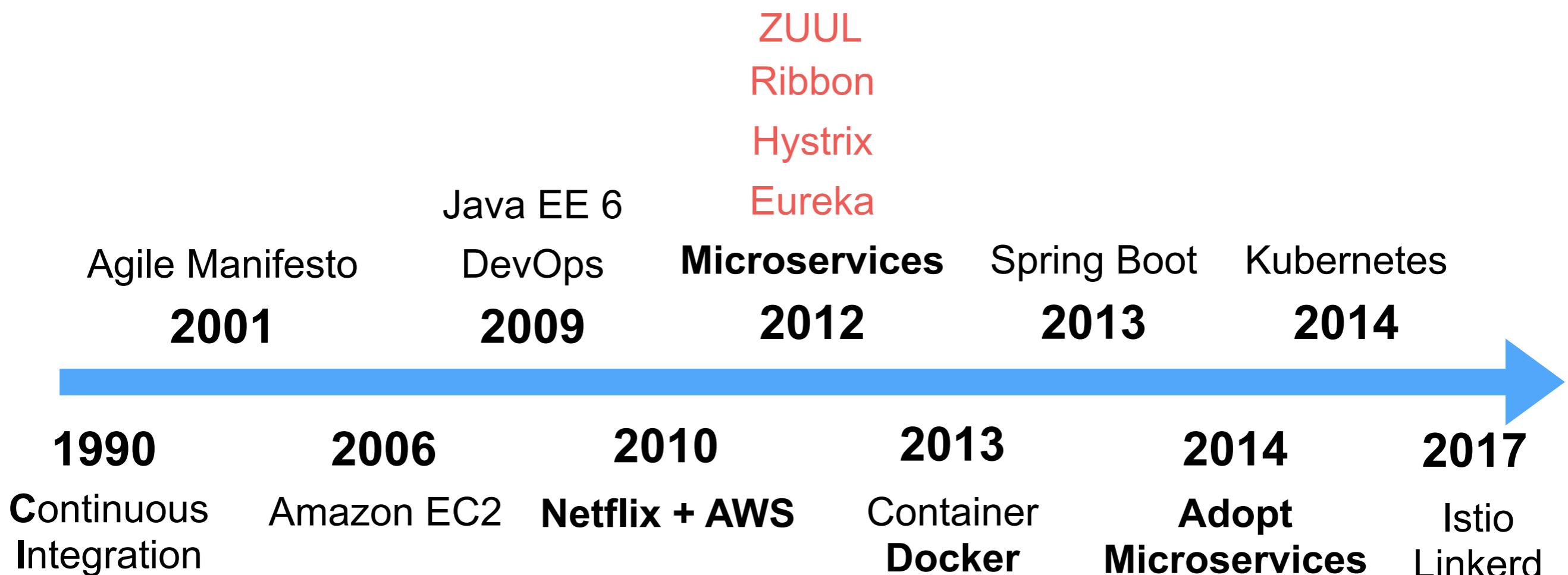
Incident management (off-office hours)
Load testing
Production deployment
Self-service platform



Microservice's History



History



Microservice

Small, Do one thing (Single Responsibility)

Modular

Easy to understand

Easy to develop

Easy to deploy

Easy to maintain

Scale independently



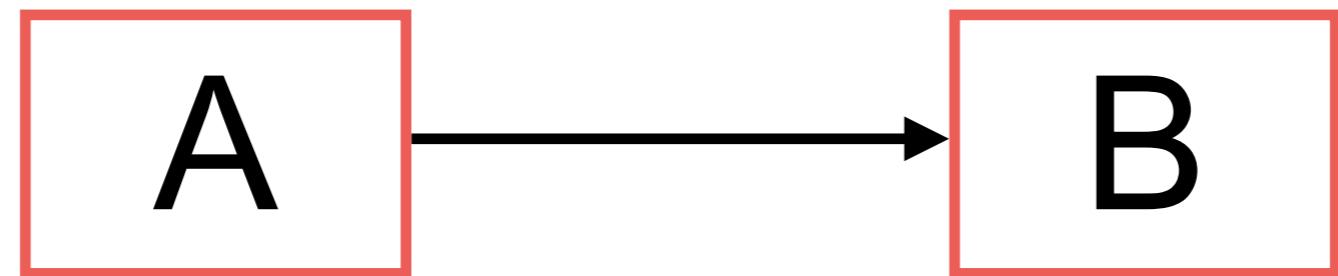
Goals

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



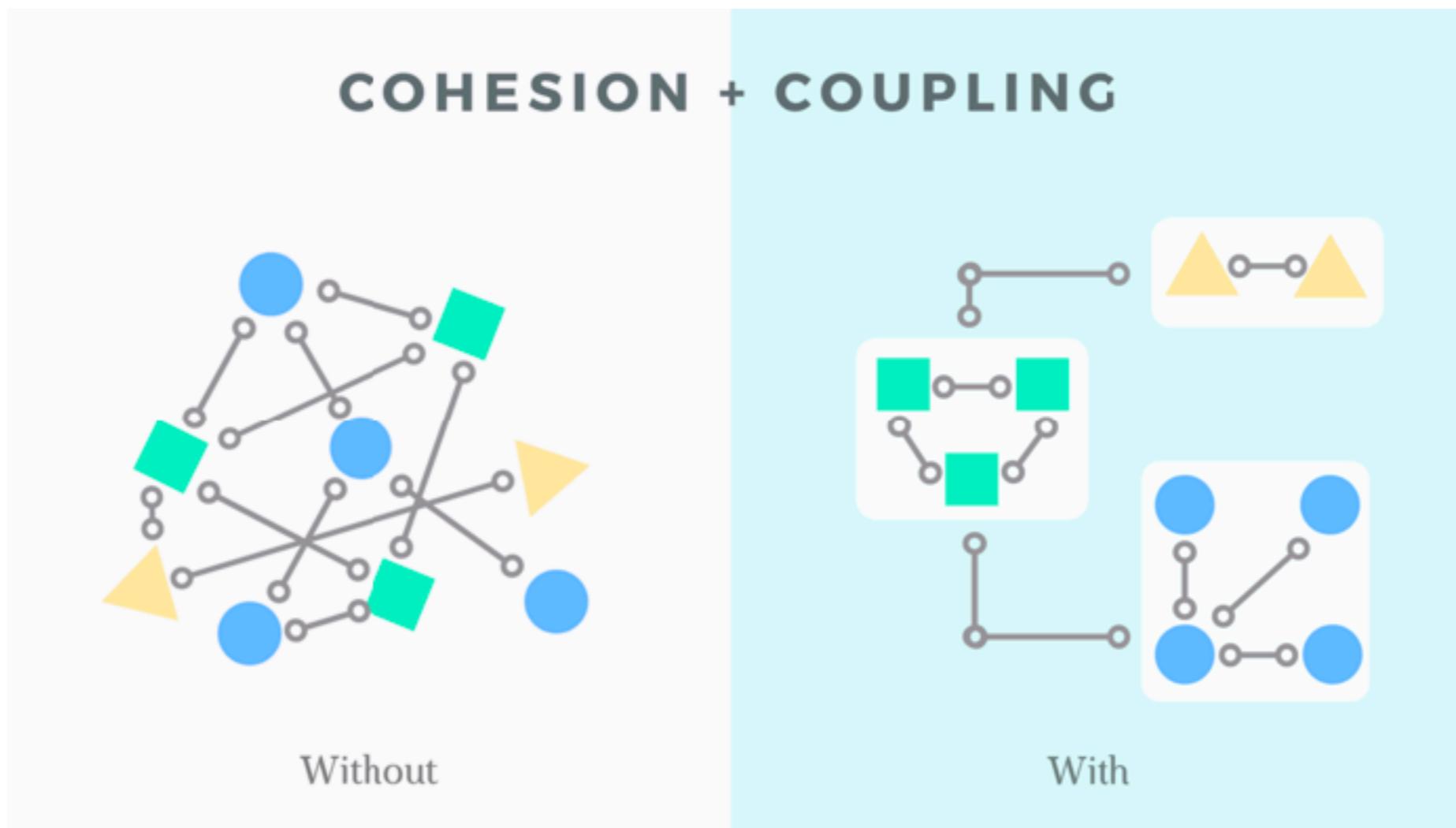
Independent

Replicable Updatable Scalable Deployable

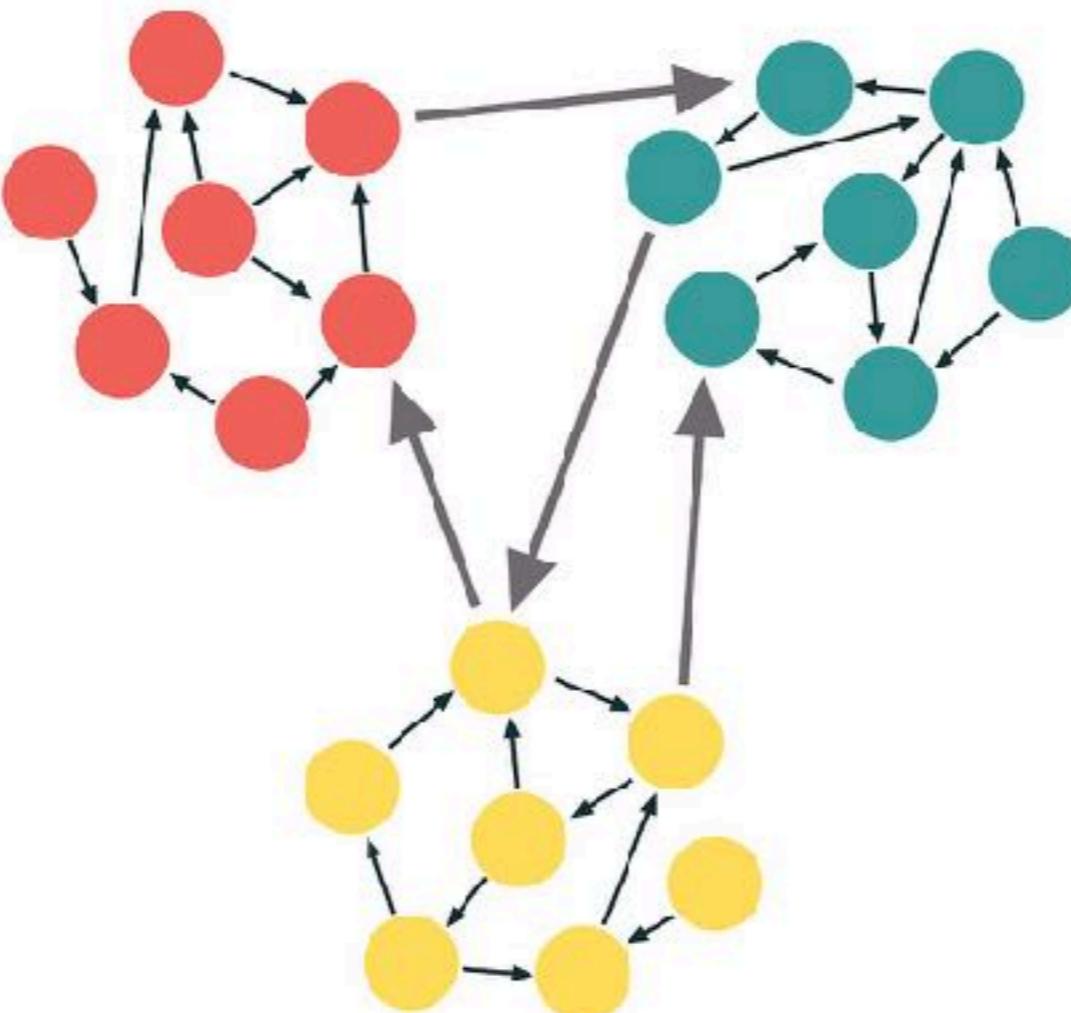


Better Architecture

Loose coupling
High cohesion



Coupling (Idea)



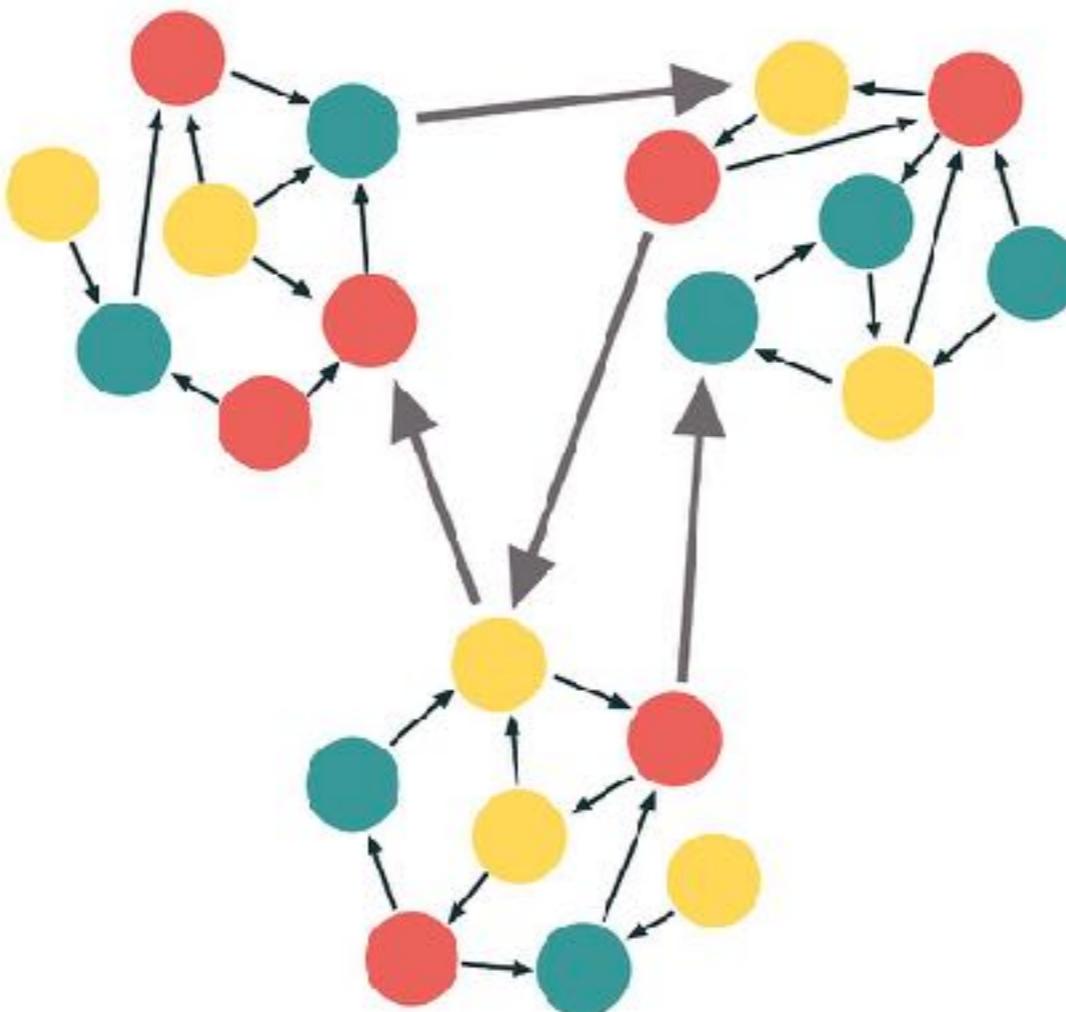
<https://enterprisecraftsmanship.com/posts/cohesion-coupling-difference/>



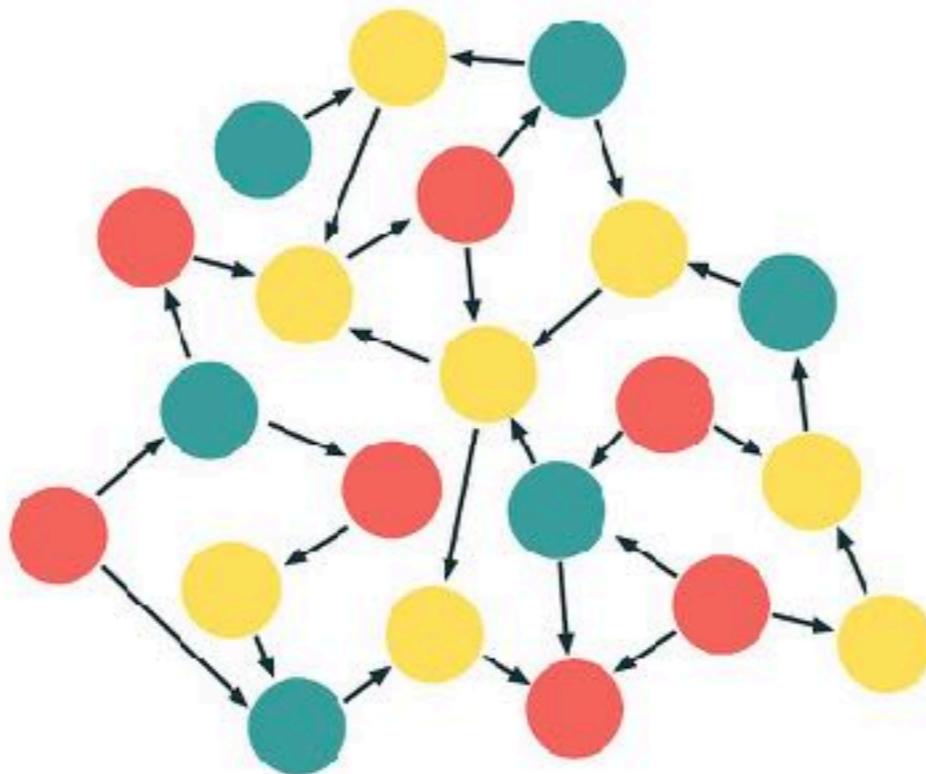
Microservices

© 2020 - 2025 Siam Chamnkit Company Limited. All rights reserved.

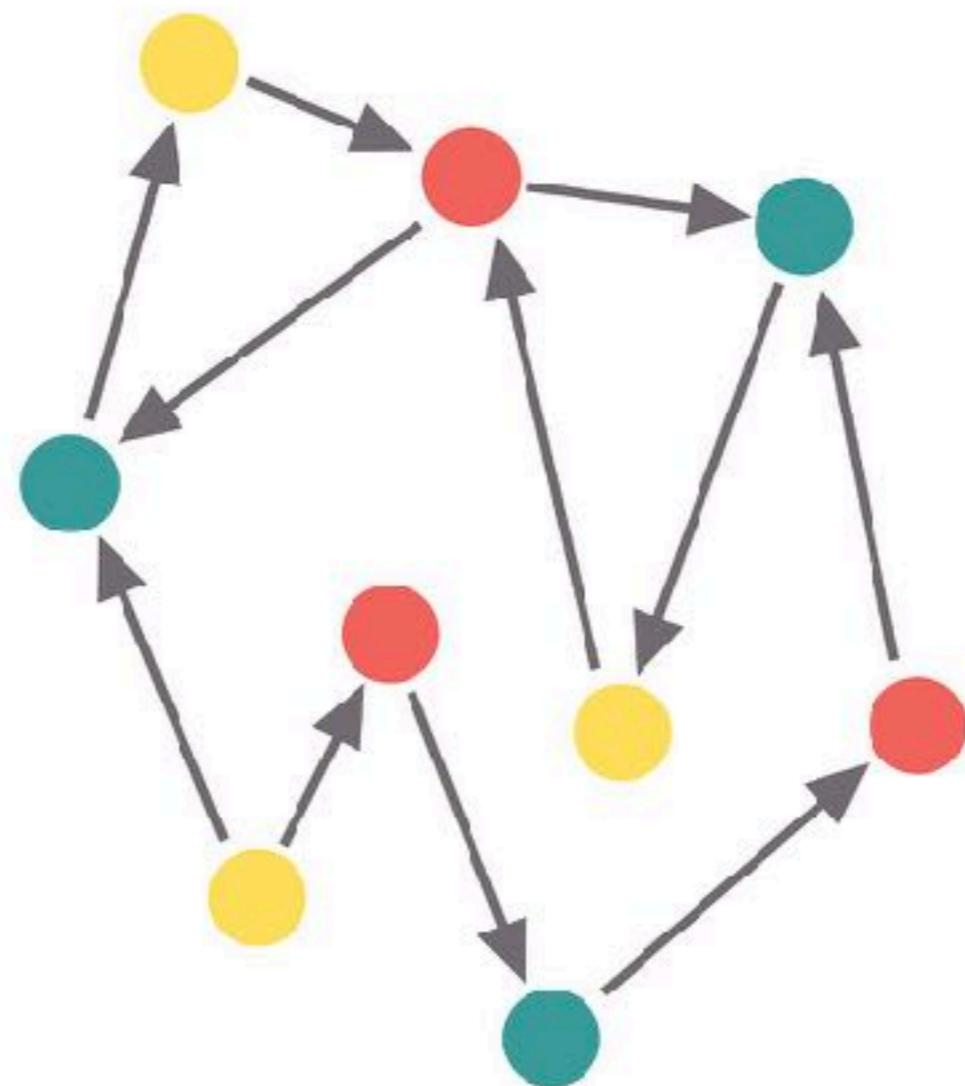
Coupling (Poorly boundary)



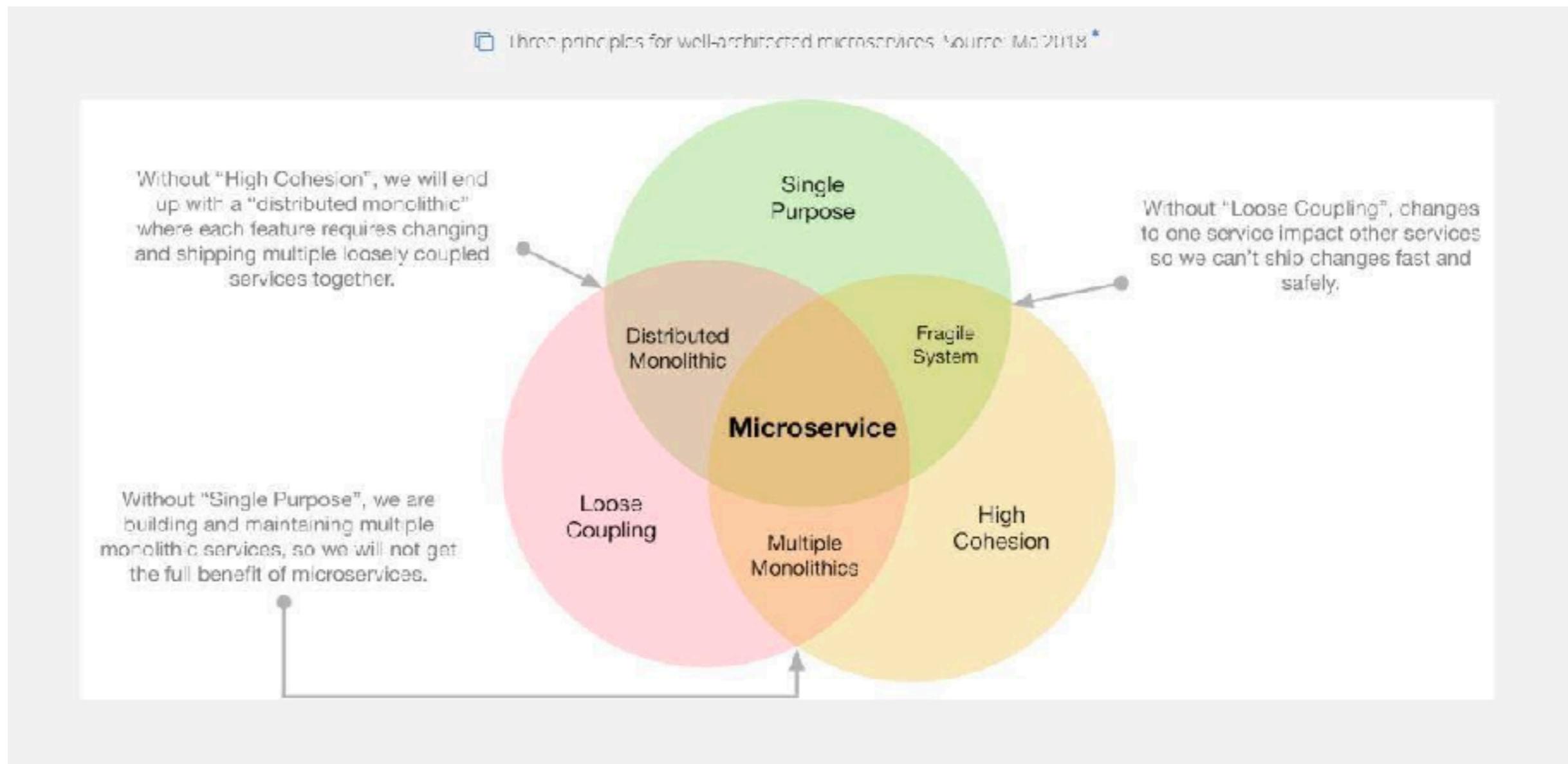
Coupling (God)



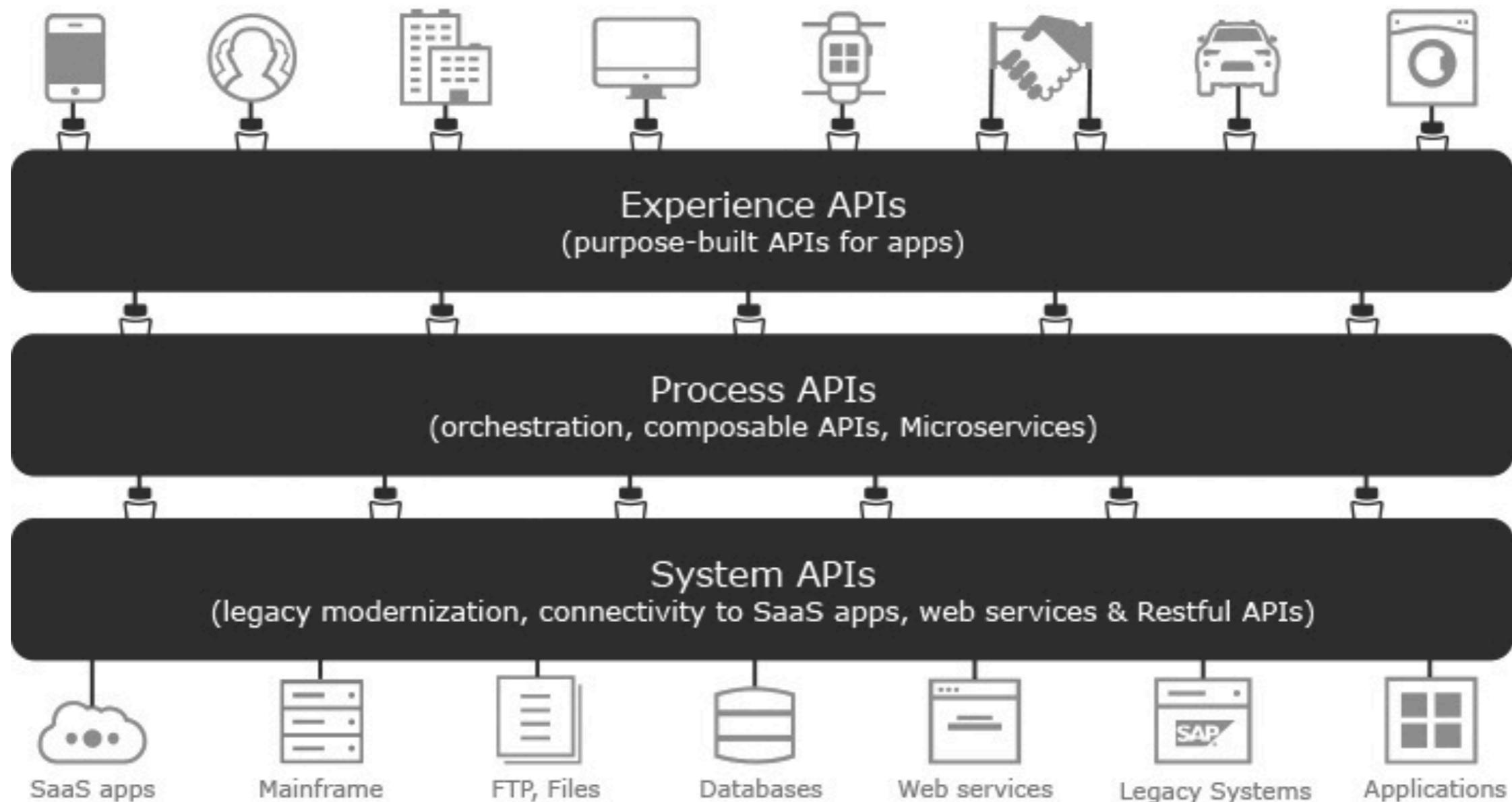
Coupling (Destructive decouple)



Better Architecture



Real World Architecture

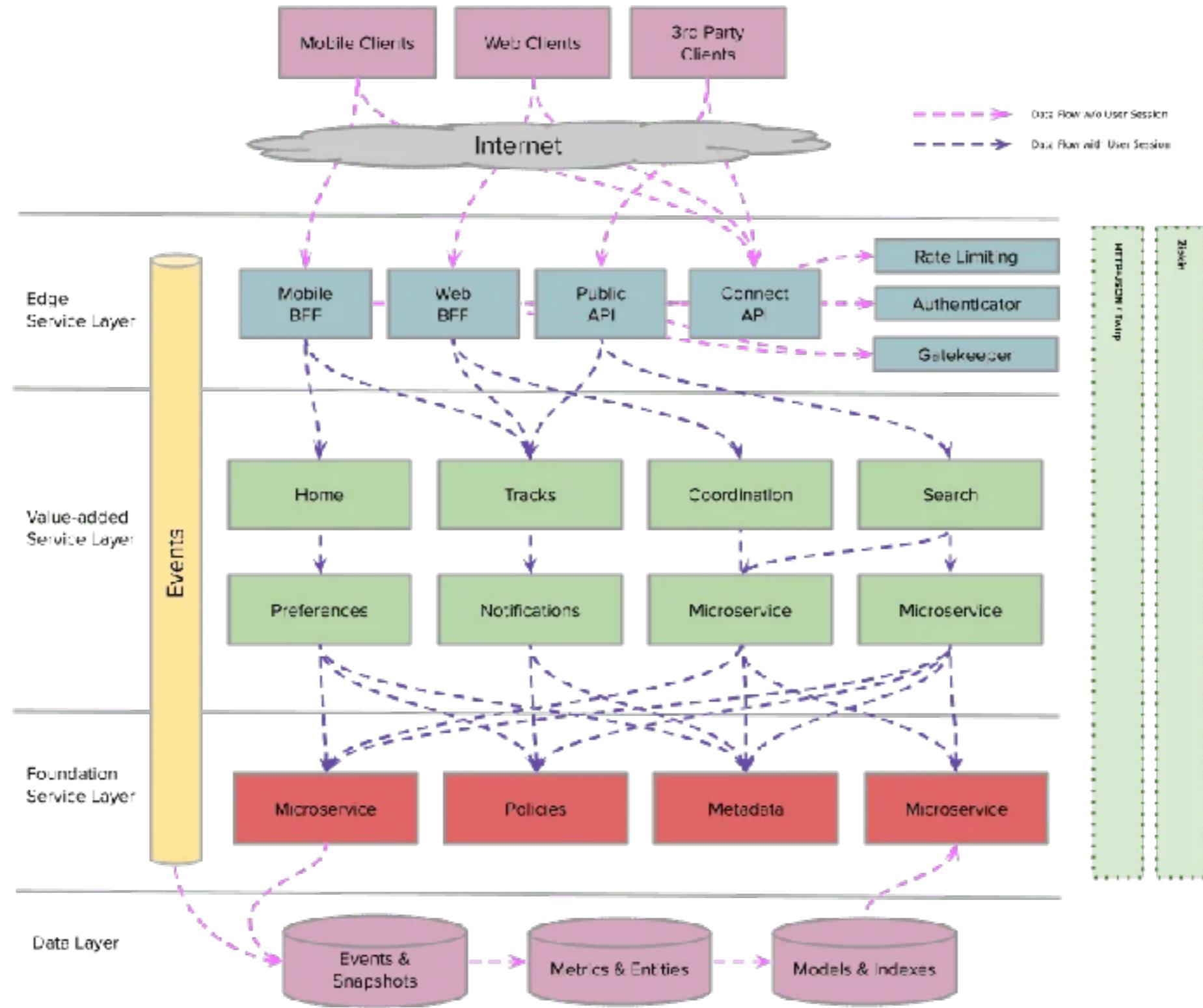


<https://blogs.mulesoft.com/dev-guides/how-to-tutorials/api-templates-reusable-system-process-apis/>



Microservices

© 2020 - 2025 Siam Chamnkit Company Limited. All rights reserved.



<https://www.infoq.com/news/2021/10/ddd-vas-gateway-soundcloud/>

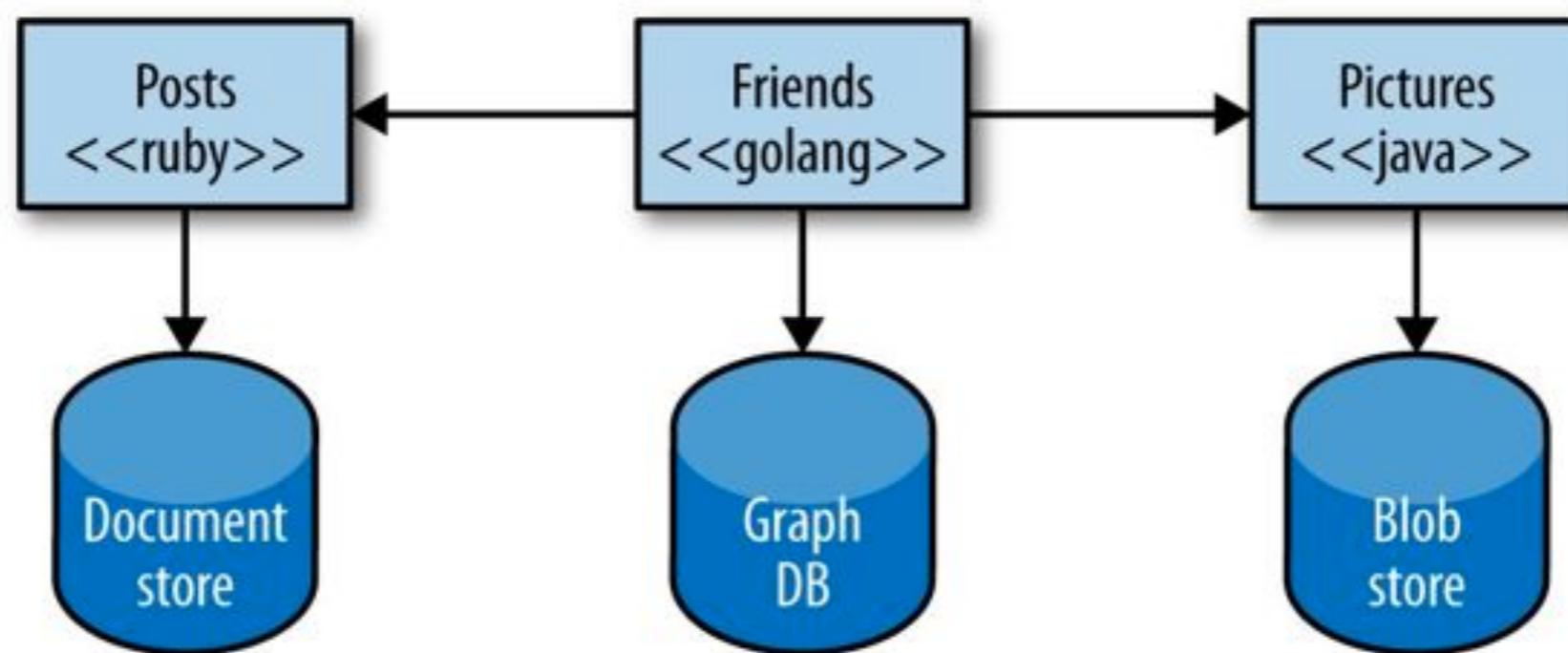


Key Benefits

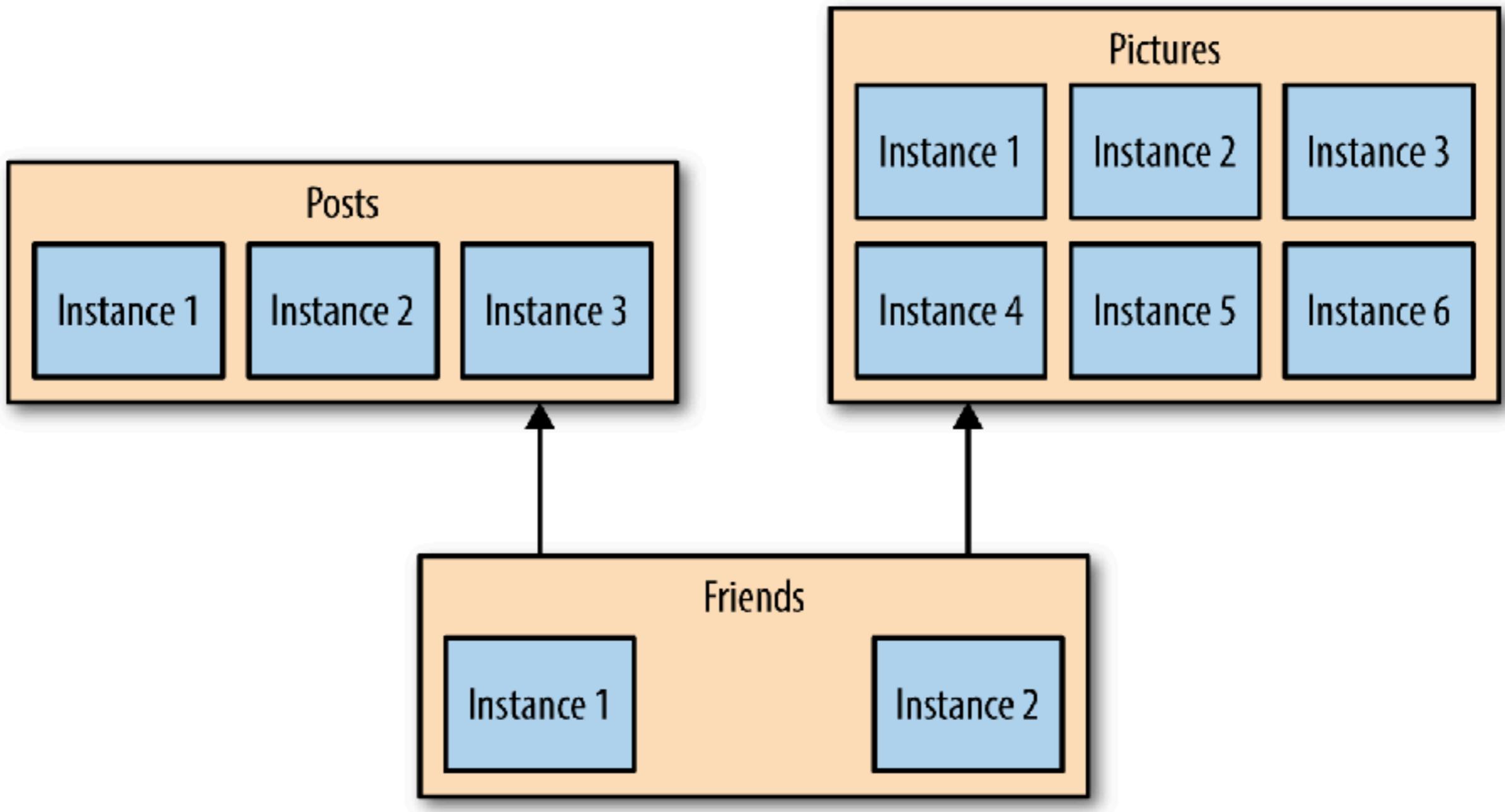


1. Technology heterogeneous

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

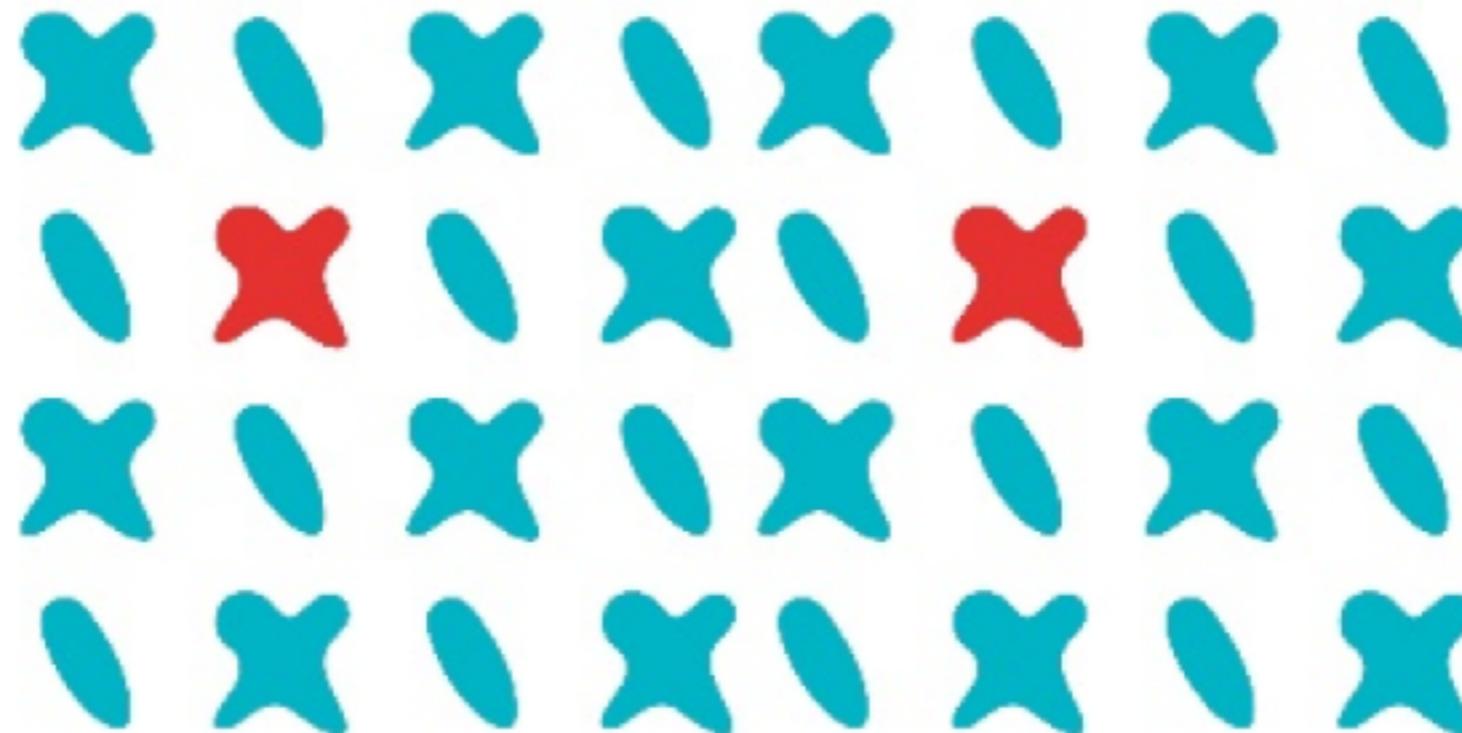


2. Scaling

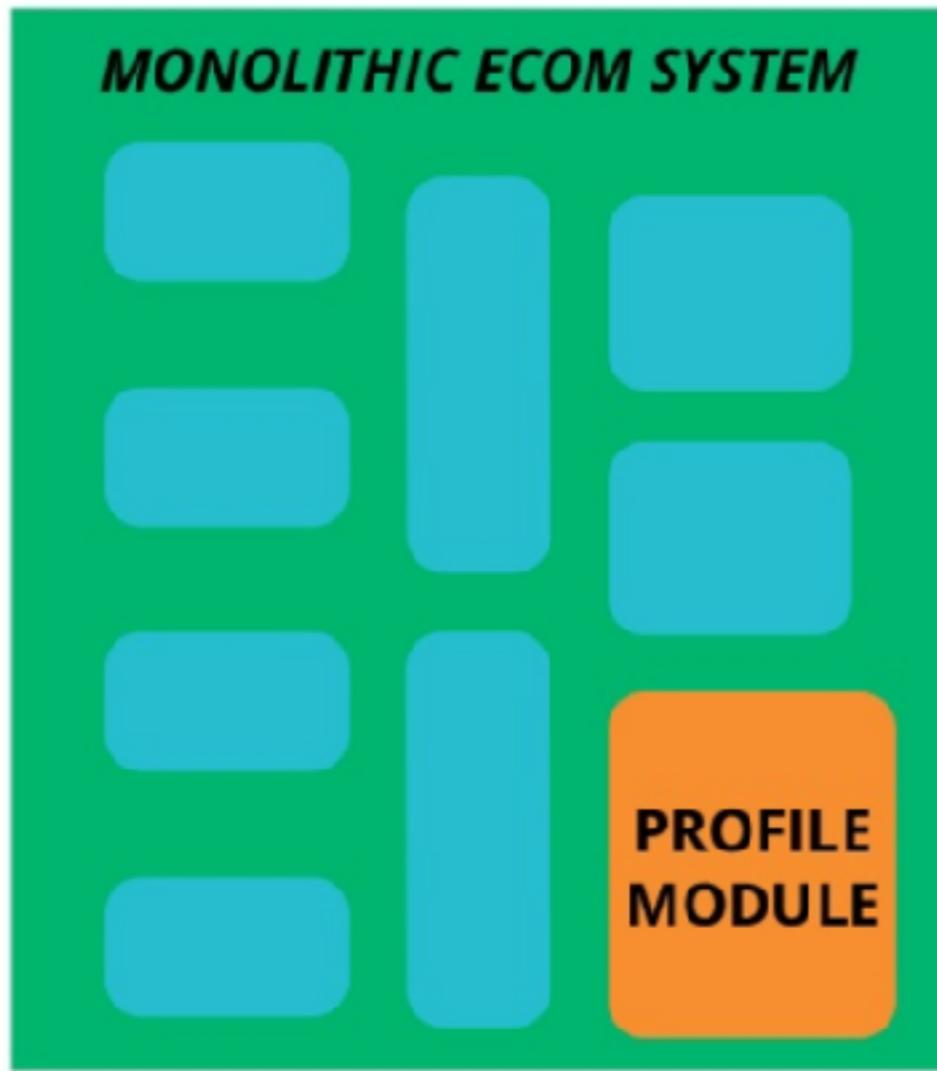


3. Ease of deployment

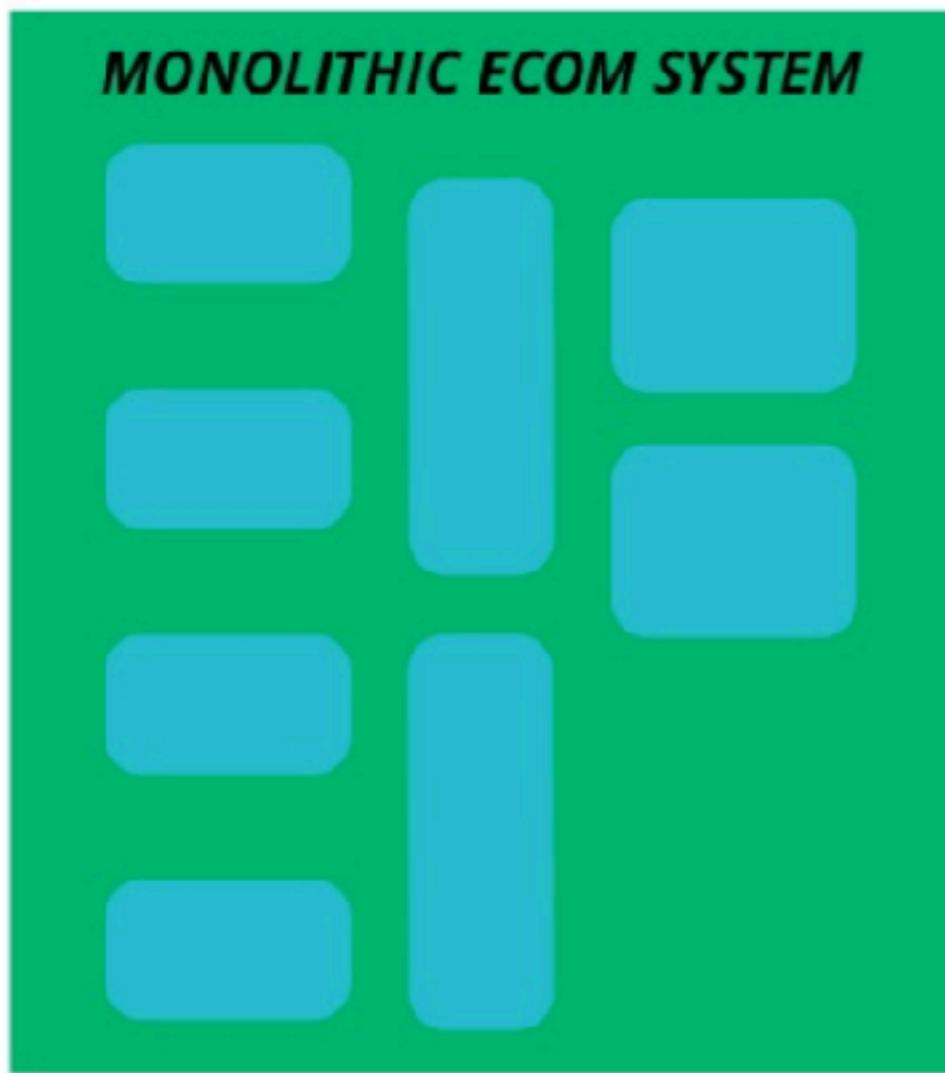
Deploys are faster, independent and problems can be isolated more easily



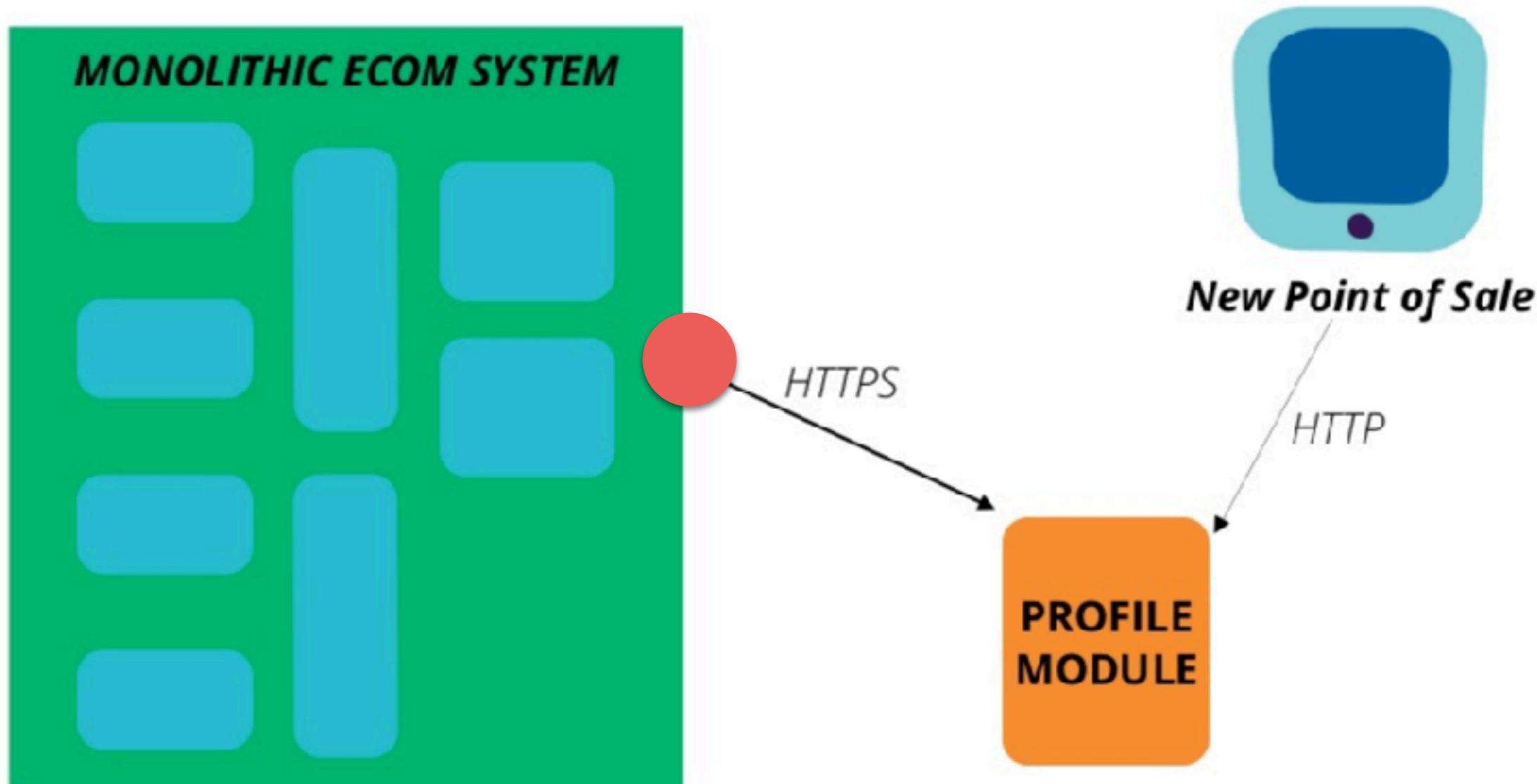
4. Composability and replaceability



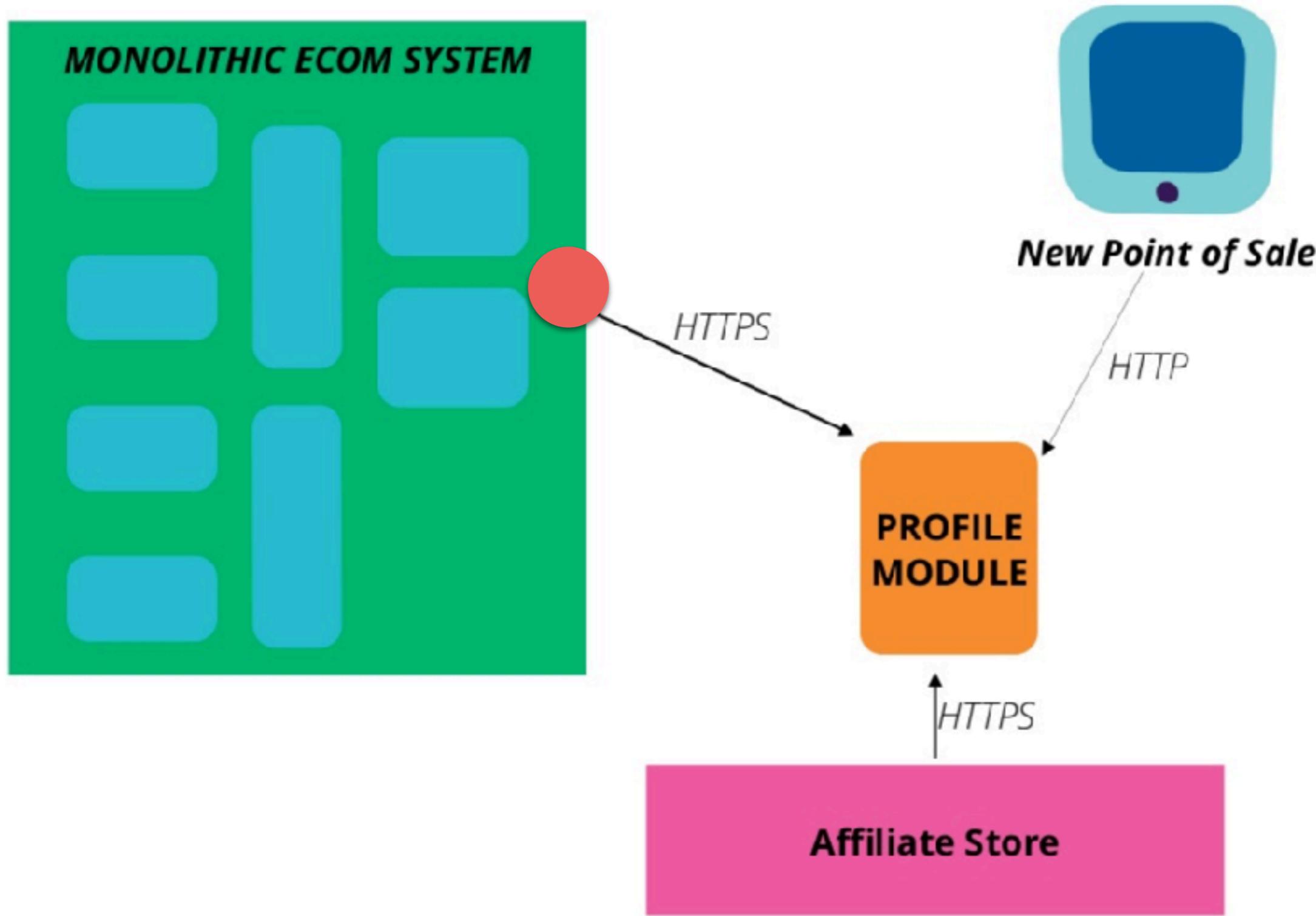
4. Composability and replaceability



4. Composability and replaceability



4. Composability and replaceability



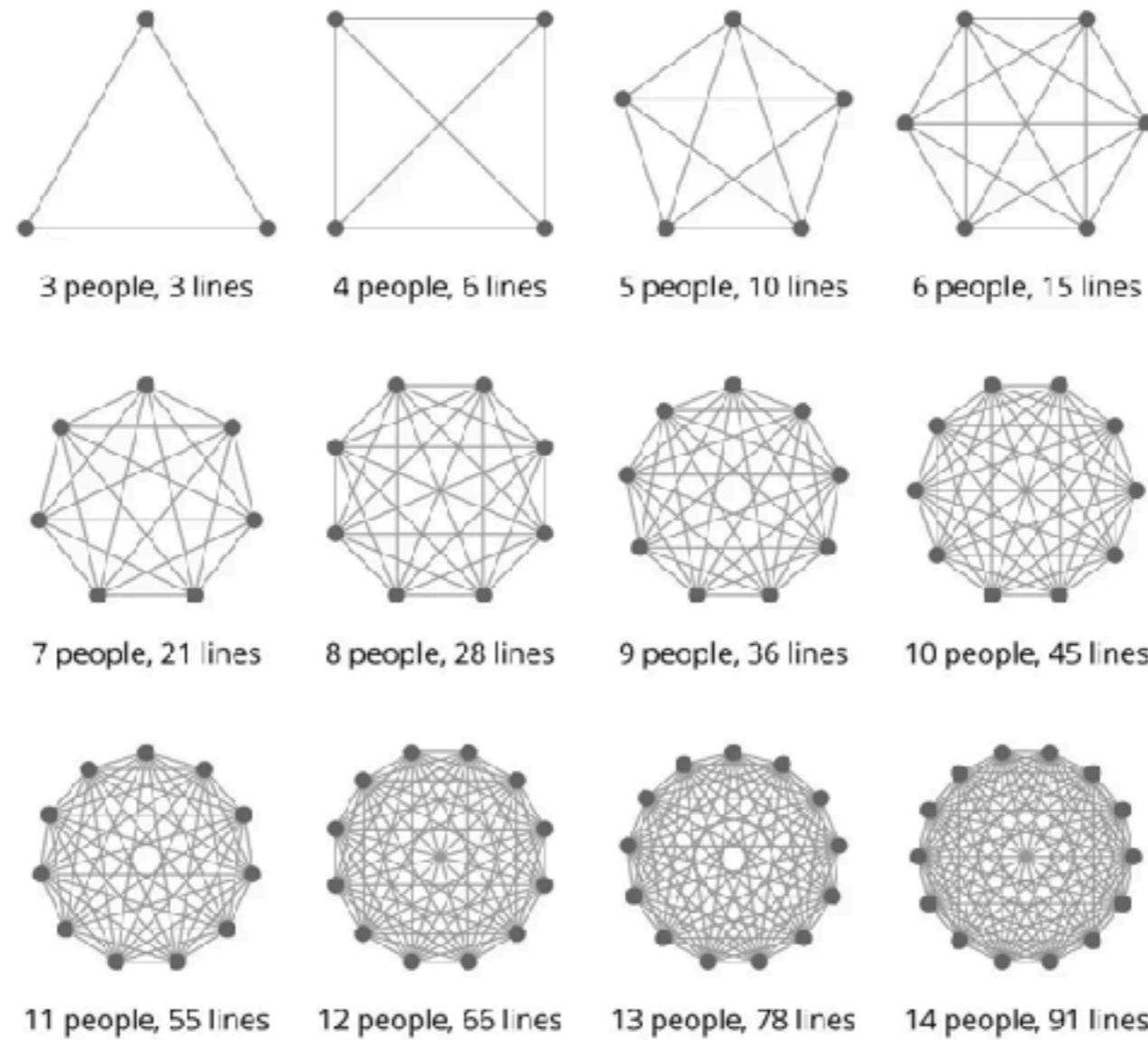
5. Organization alignment

Small teams and smaller codebases



Small team !!

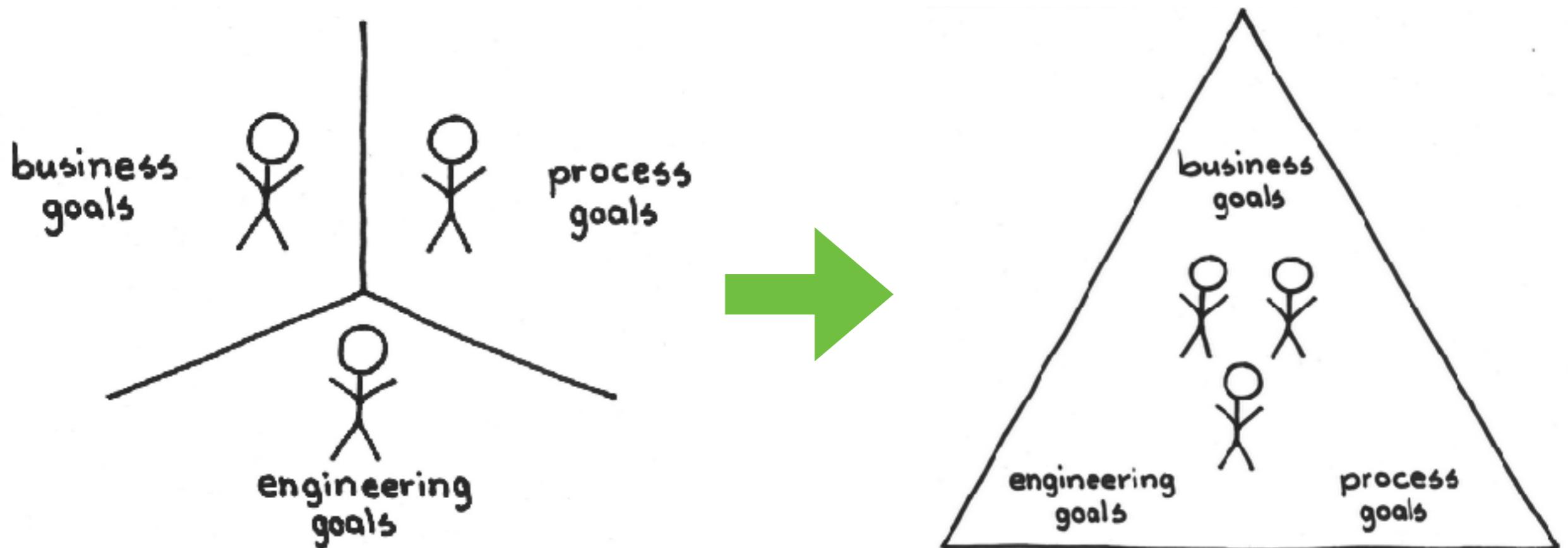
Line of communication and team size



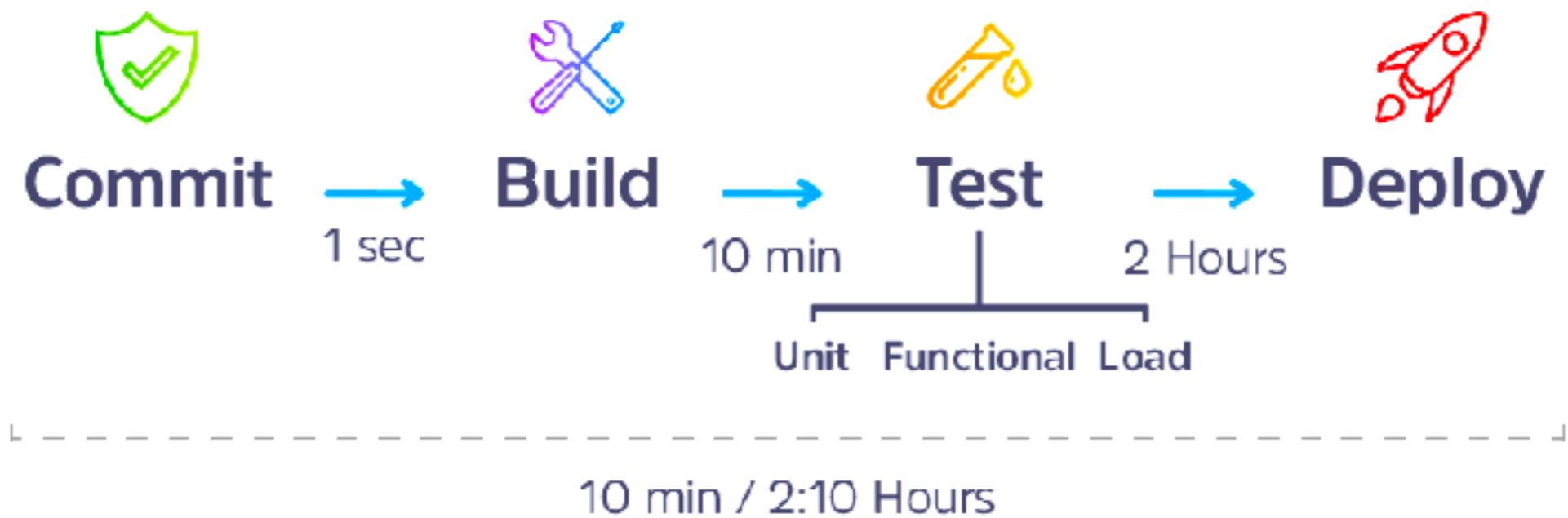
<https://www.leadingagile.com/2018/02/lines-of-communication-team-size-applying-brooks-law>



Autonomous team



Autonomous team



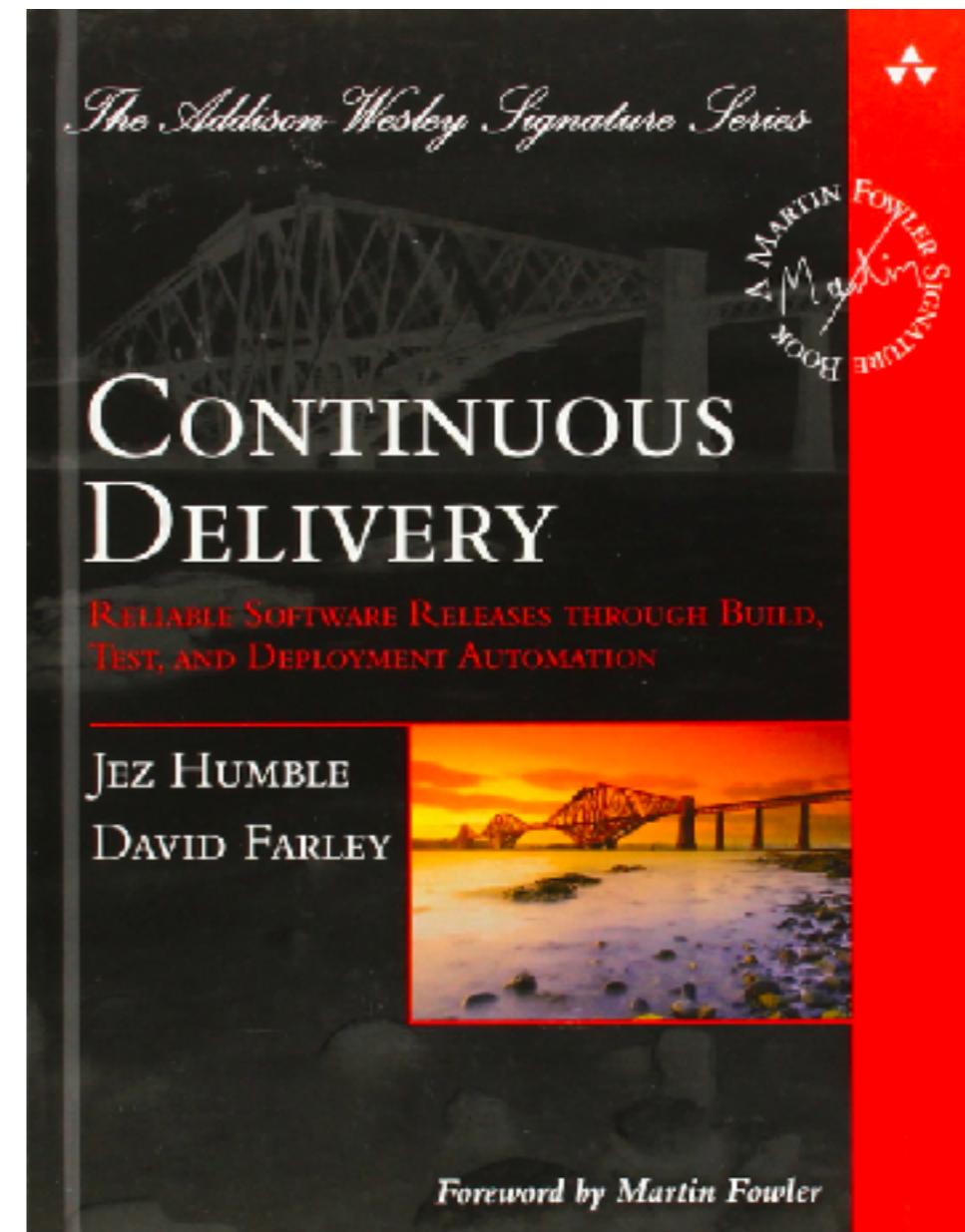
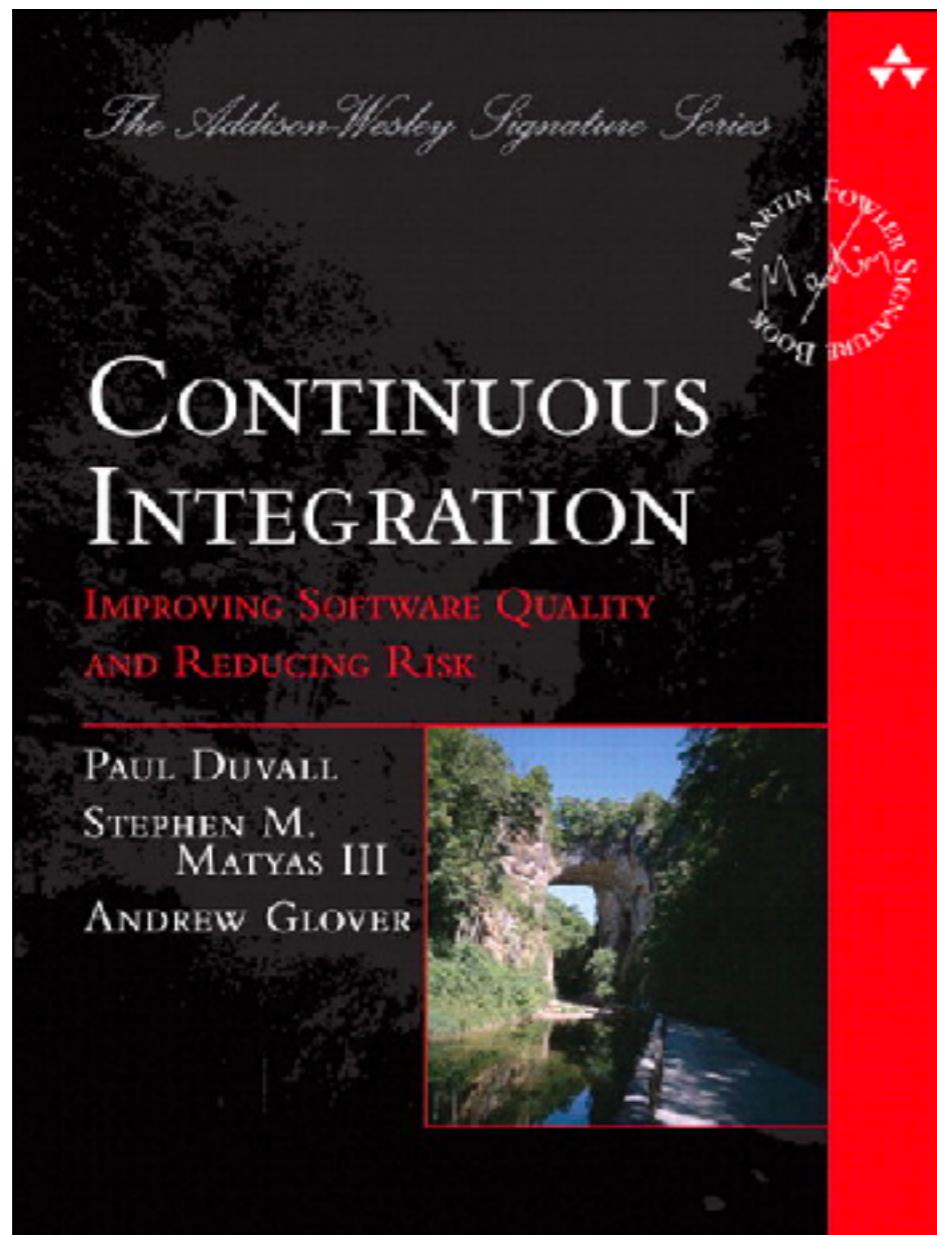
6. Enable Continuous Delivery

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

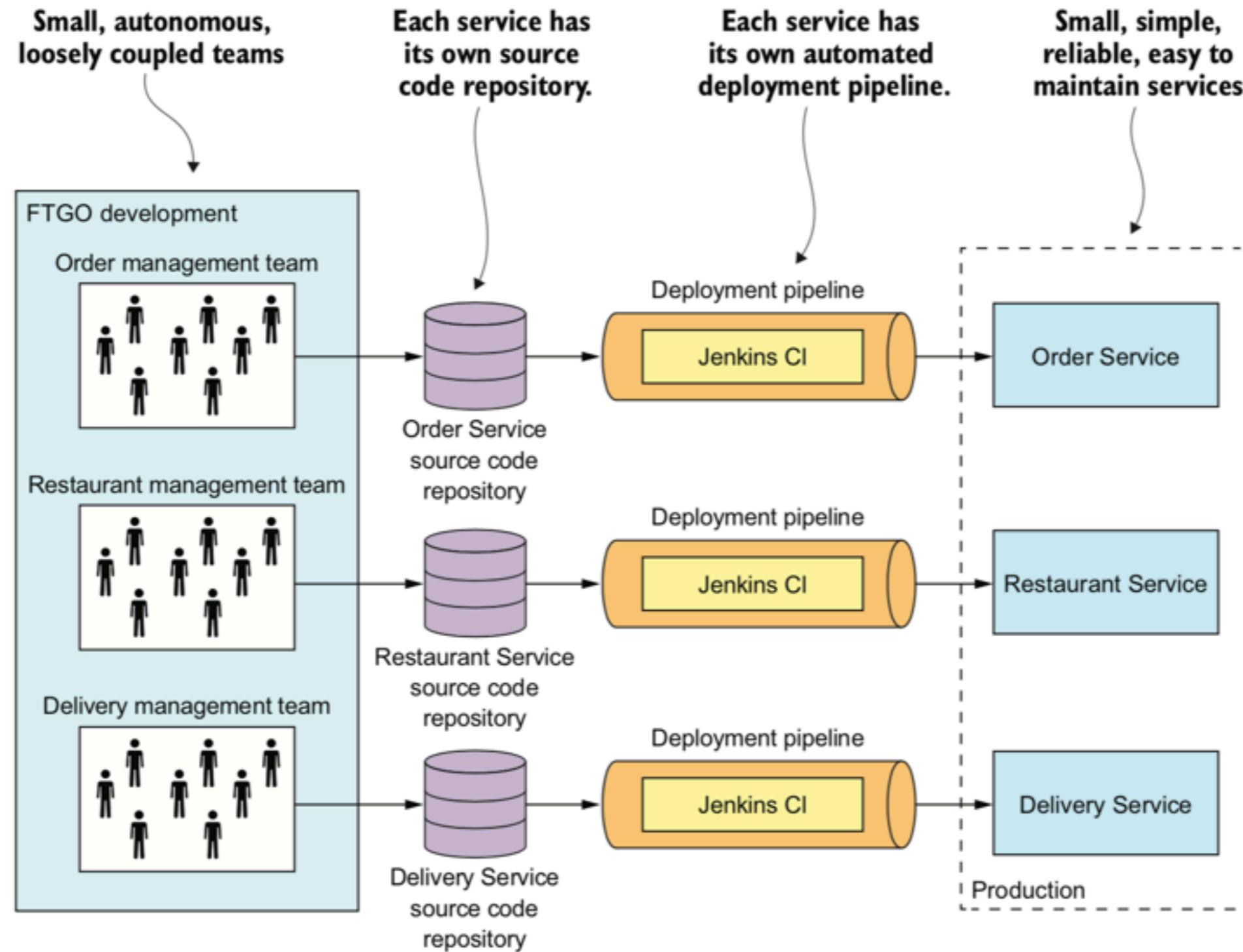
Reduce time to market

Enable **business** to provide reliable service

Employee satisfaction is higher



Continuous Delivery for service



Drawbacks of Microservice

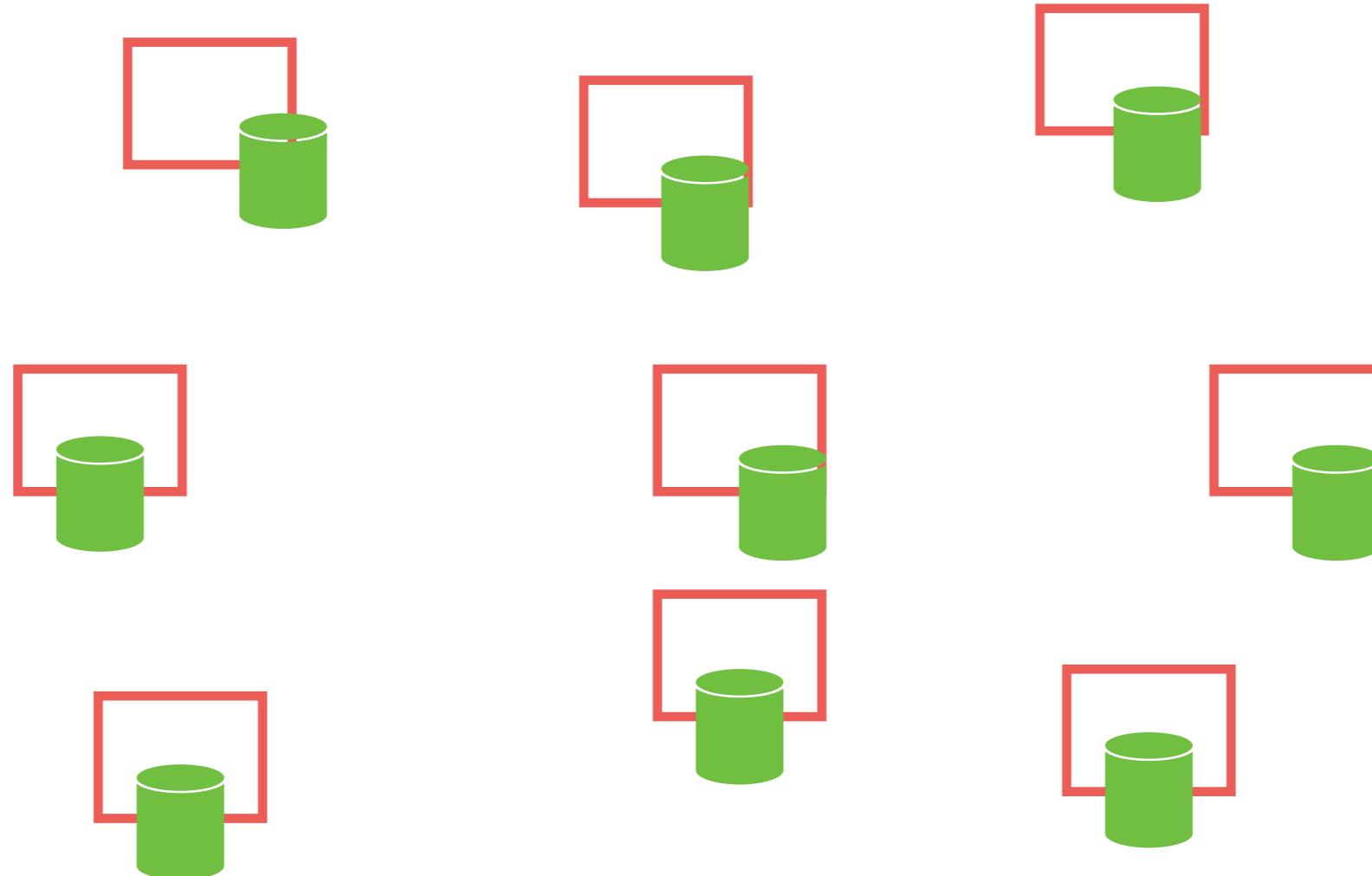


Drawbacks of Microservice

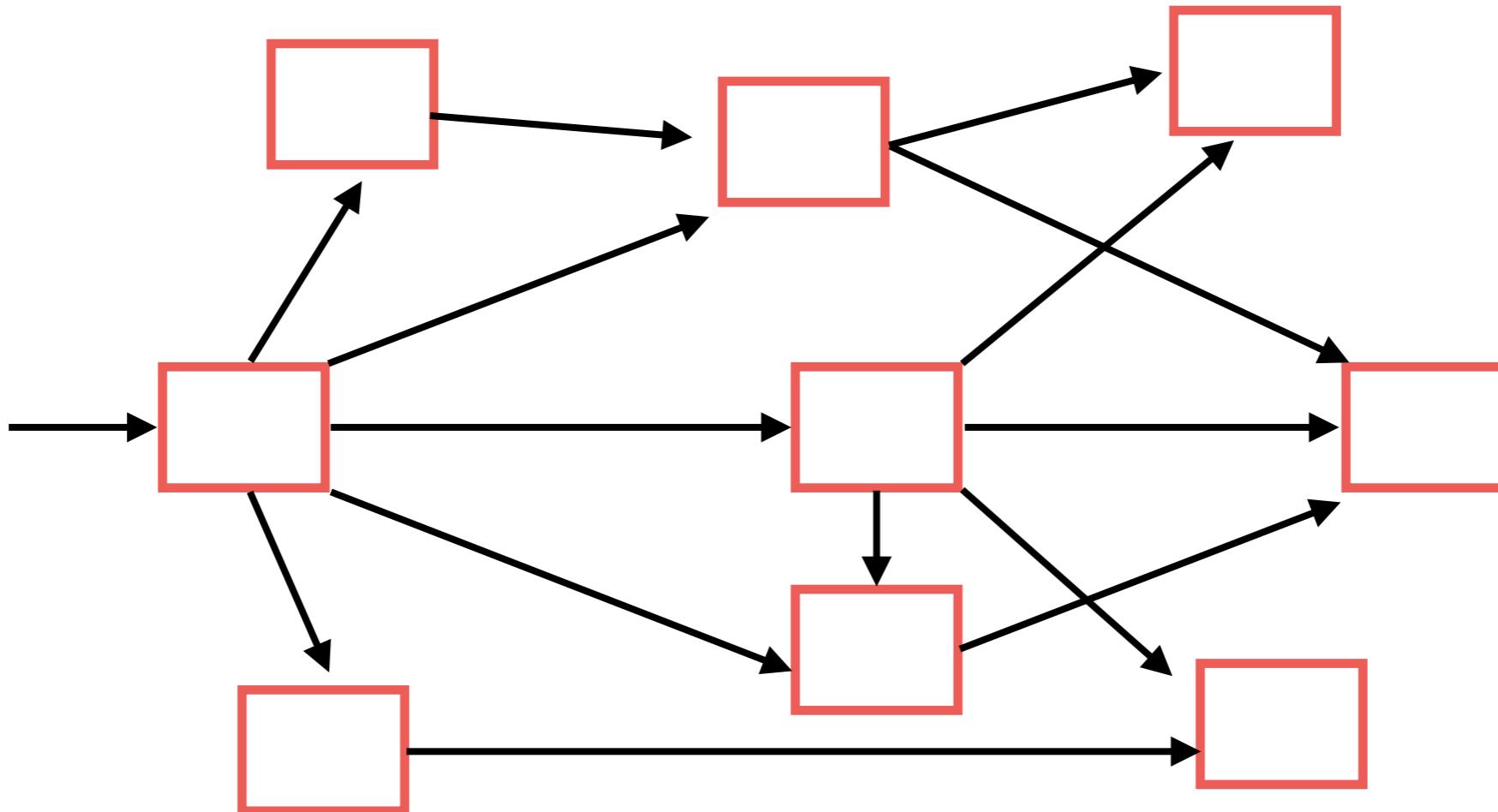
Find the right set of services
Distributed systems are complex
How to develop, testing and deploy ?



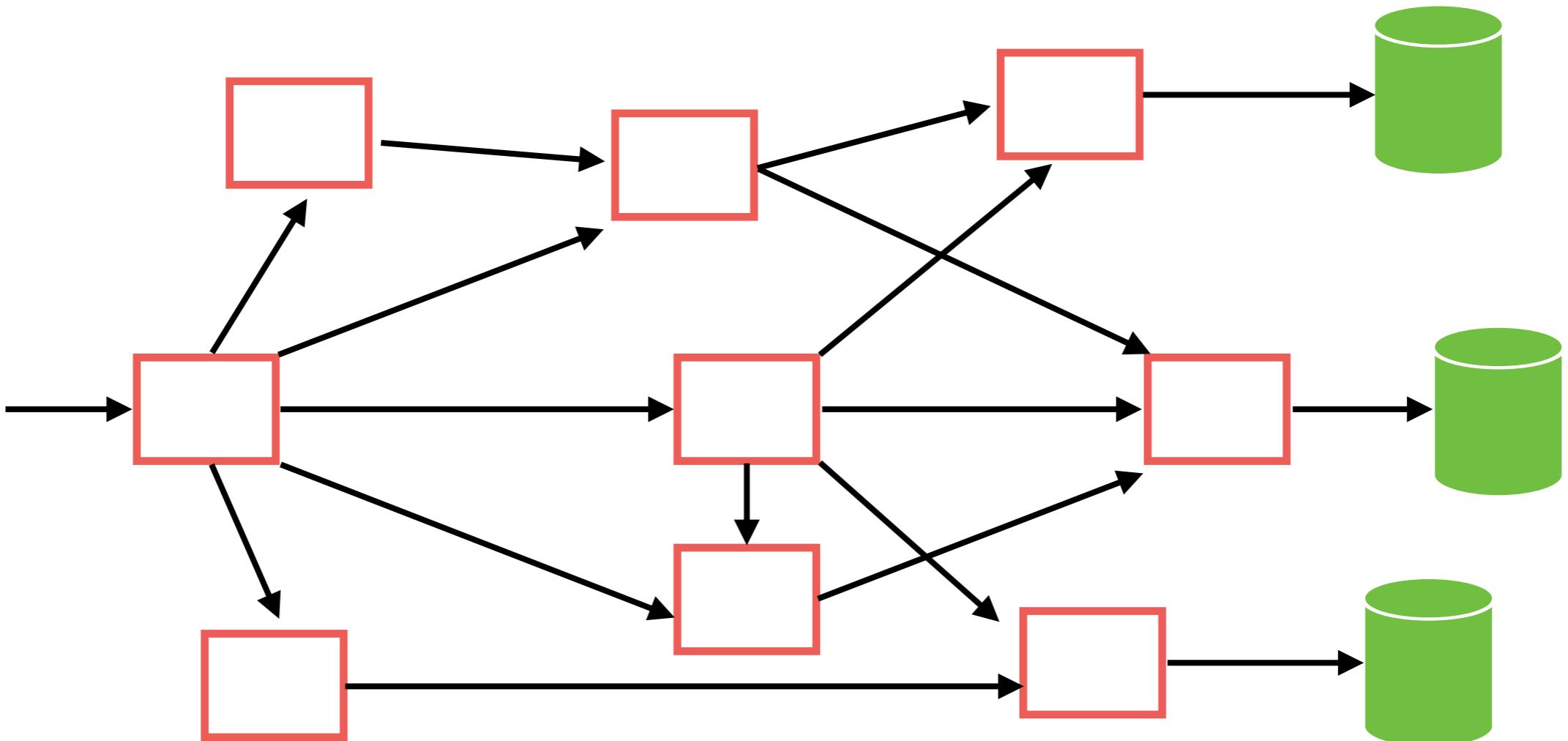
Microservice (Loosely coupled)



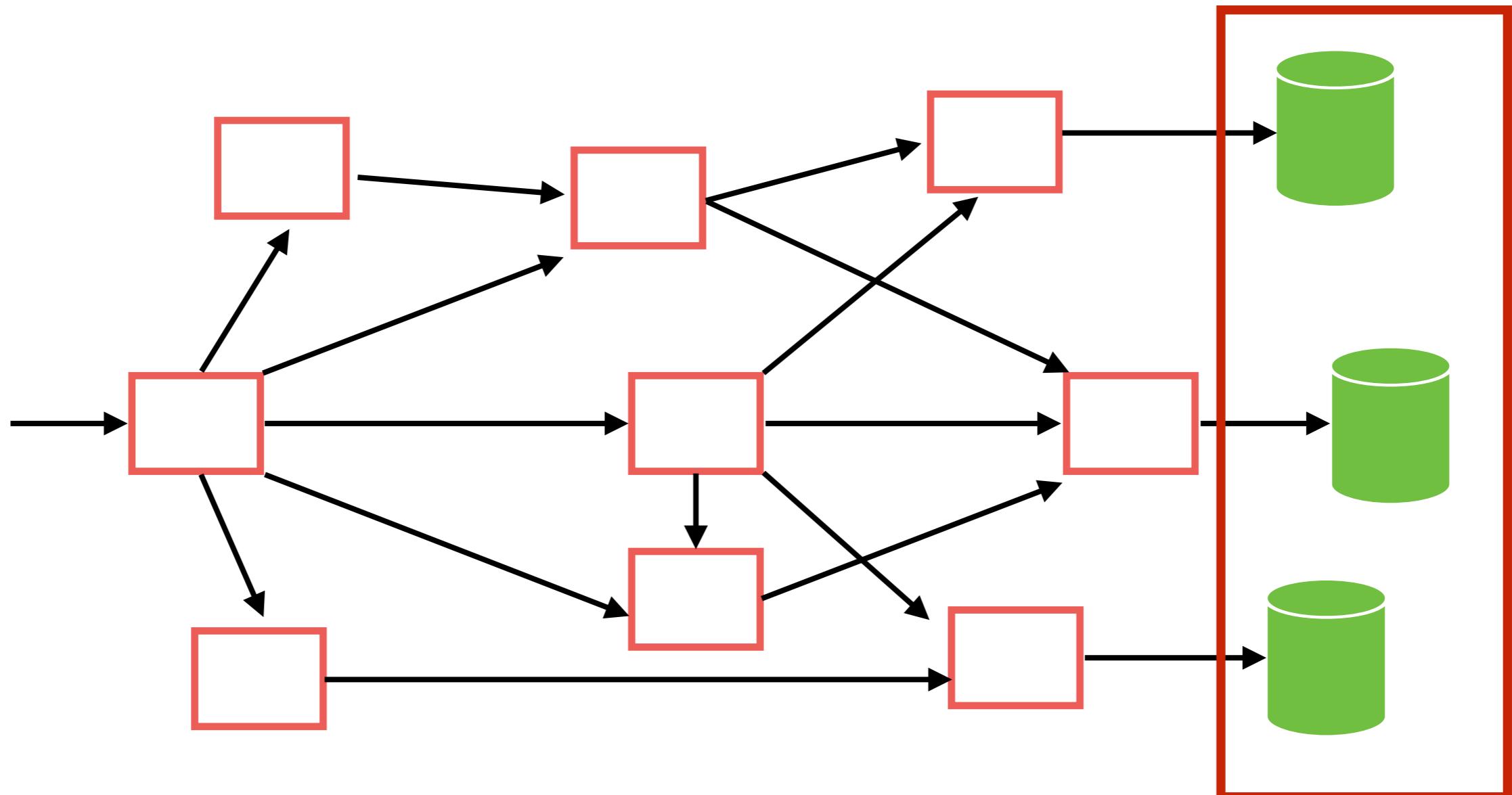
Microservice (Tightly coupled)



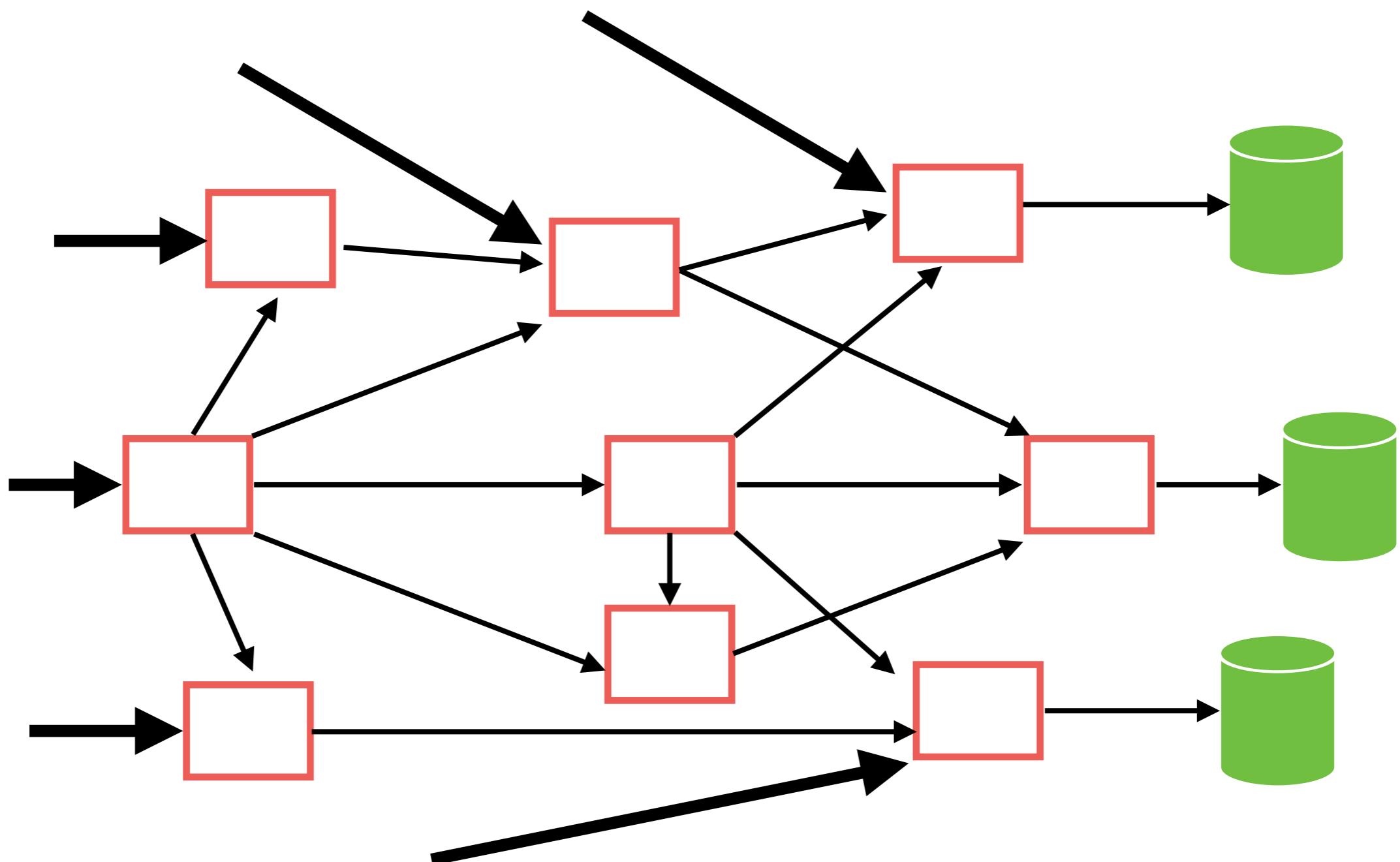
Own data



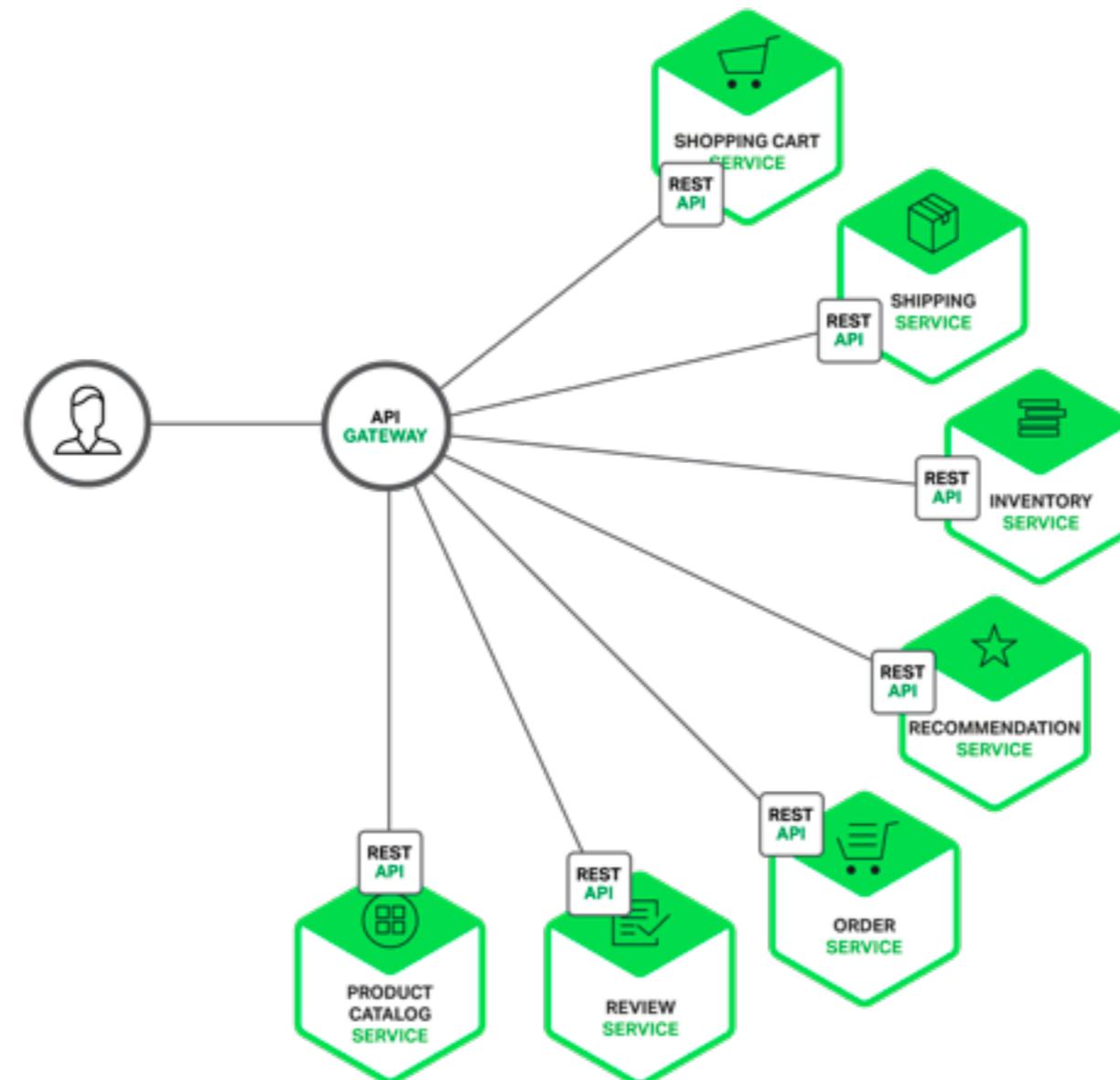
Data consistency !!



Multiple entry points



Working with API gateway



<https://www.nginx.com>



Features 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

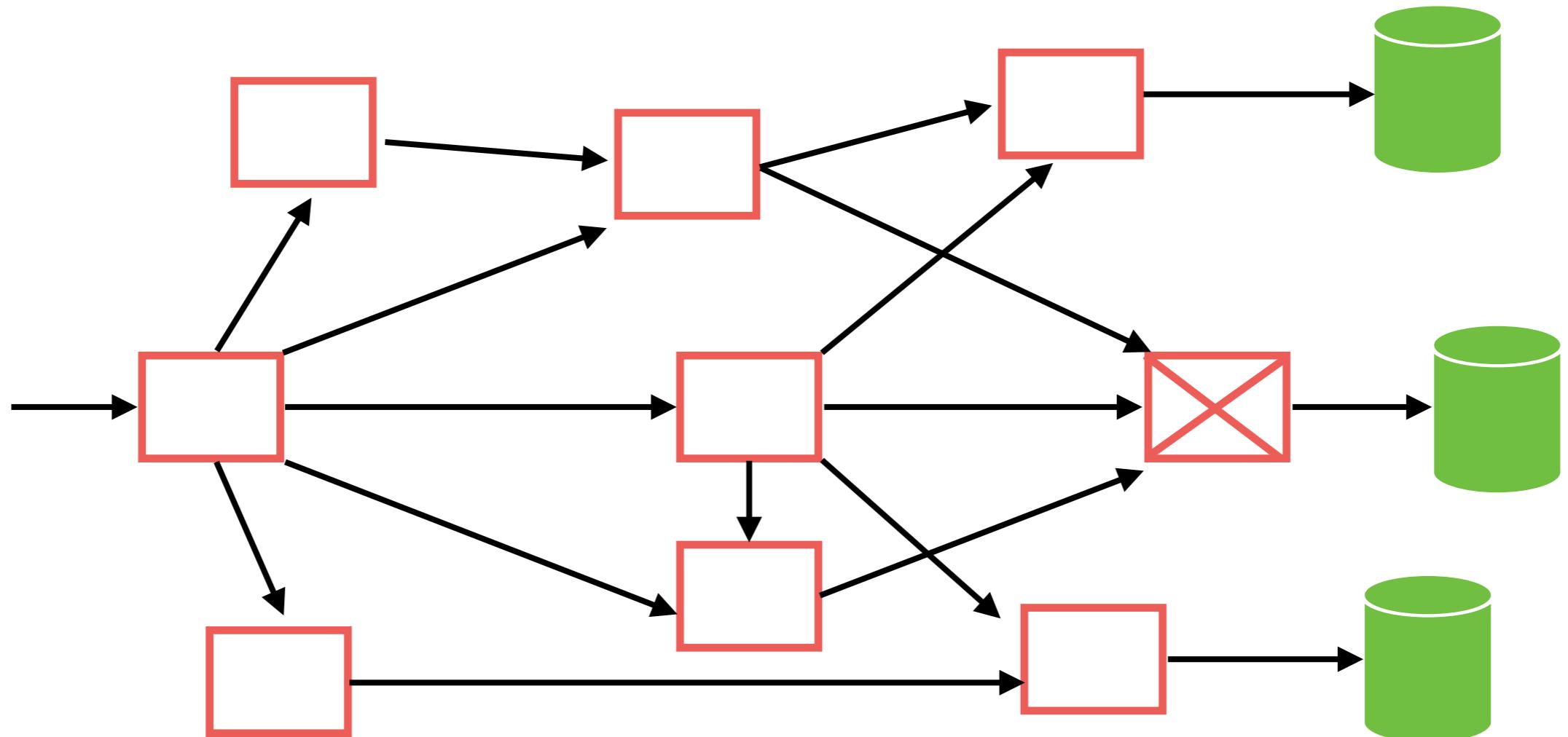


Drawbacks

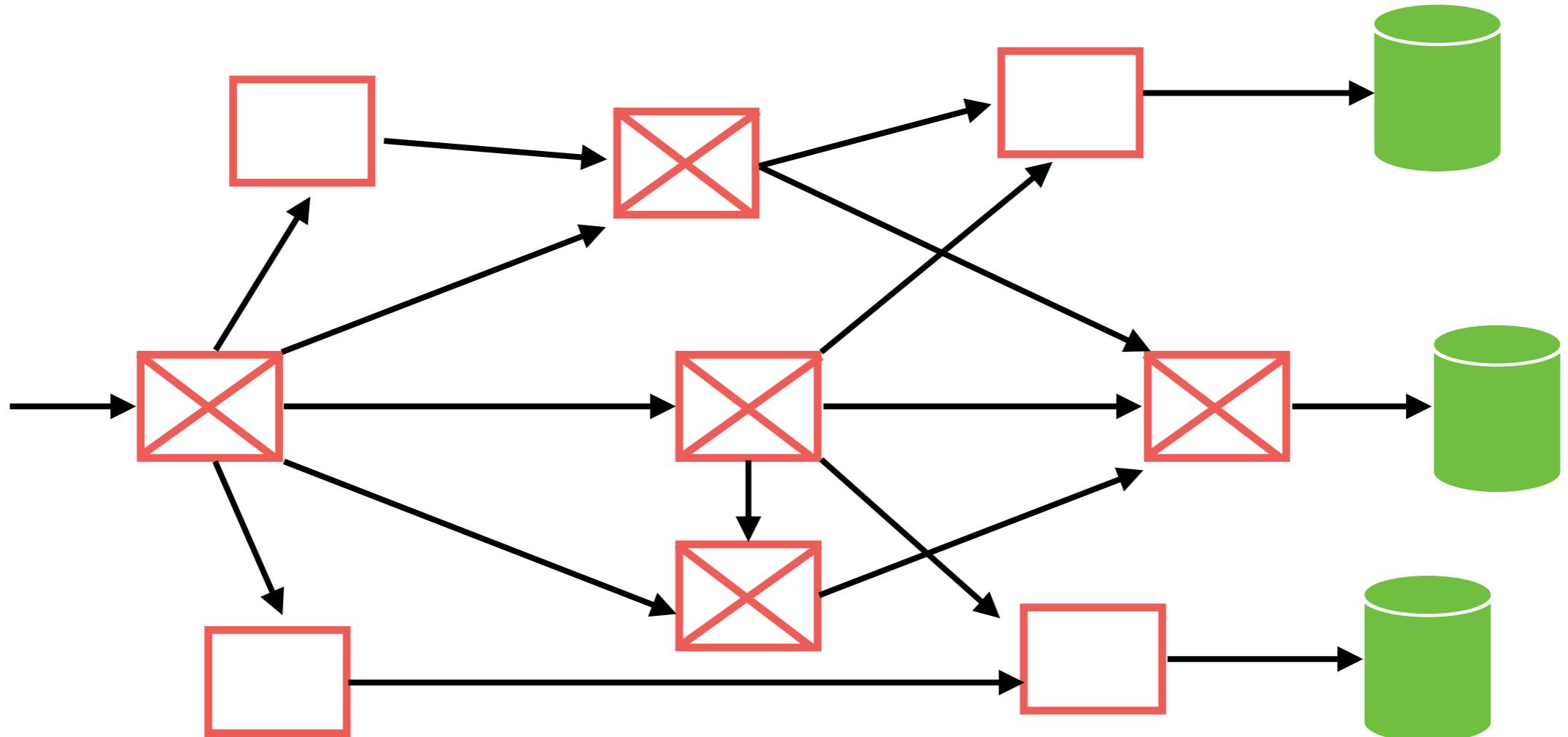
Development/Performance bottleneck
Single point of failure
Waiting for update data in gateway



Failure !!



Cascading Failure !!



Solutions for Resilience ?

Timeout

Retry

Rate Limit

Queue messaging

Circuit breaker

Bulkhead

Auto-scale

<https://learn.microsoft.com/en-us/azure/well-architected/resiliency/reliability-patterns>



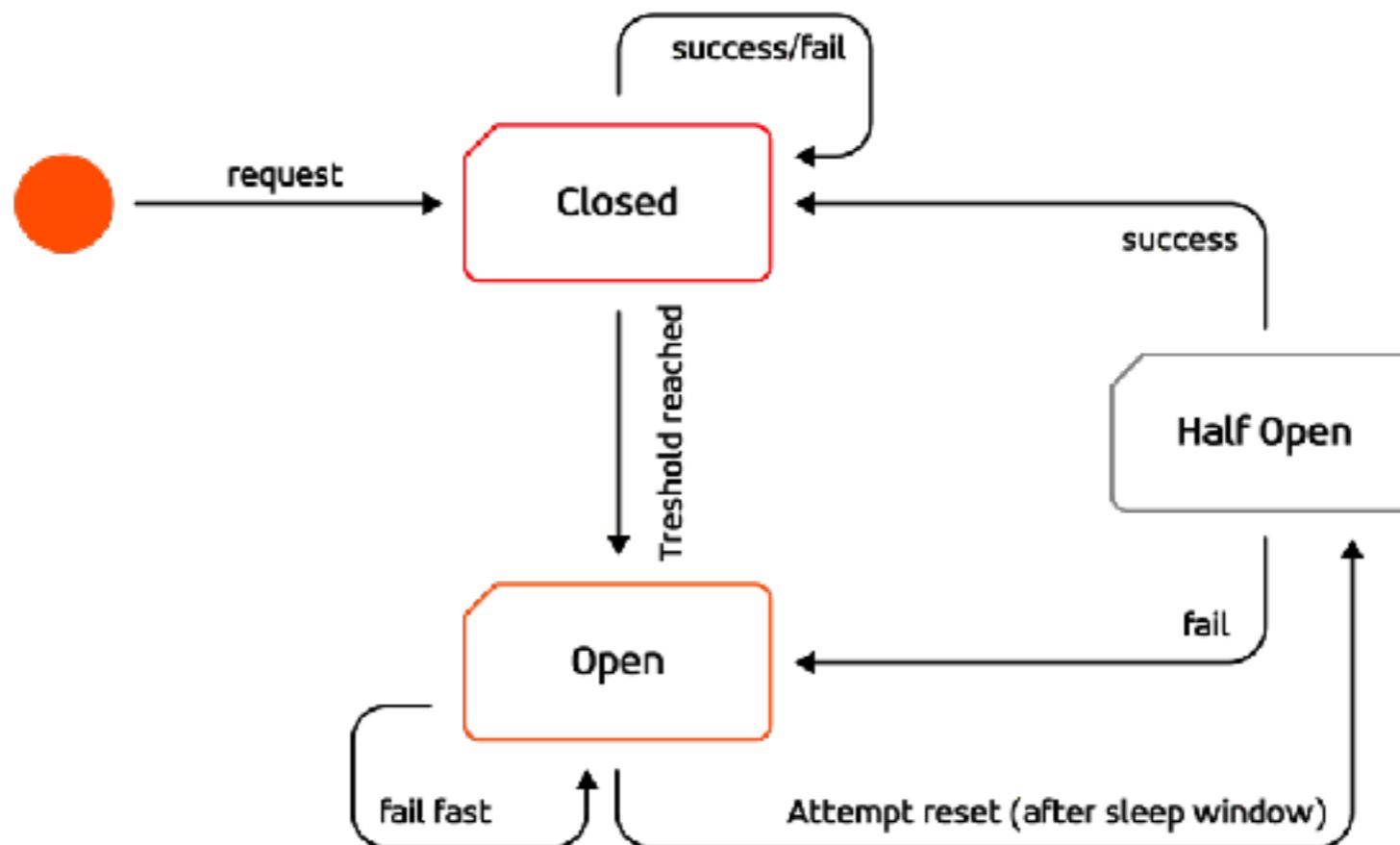
Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

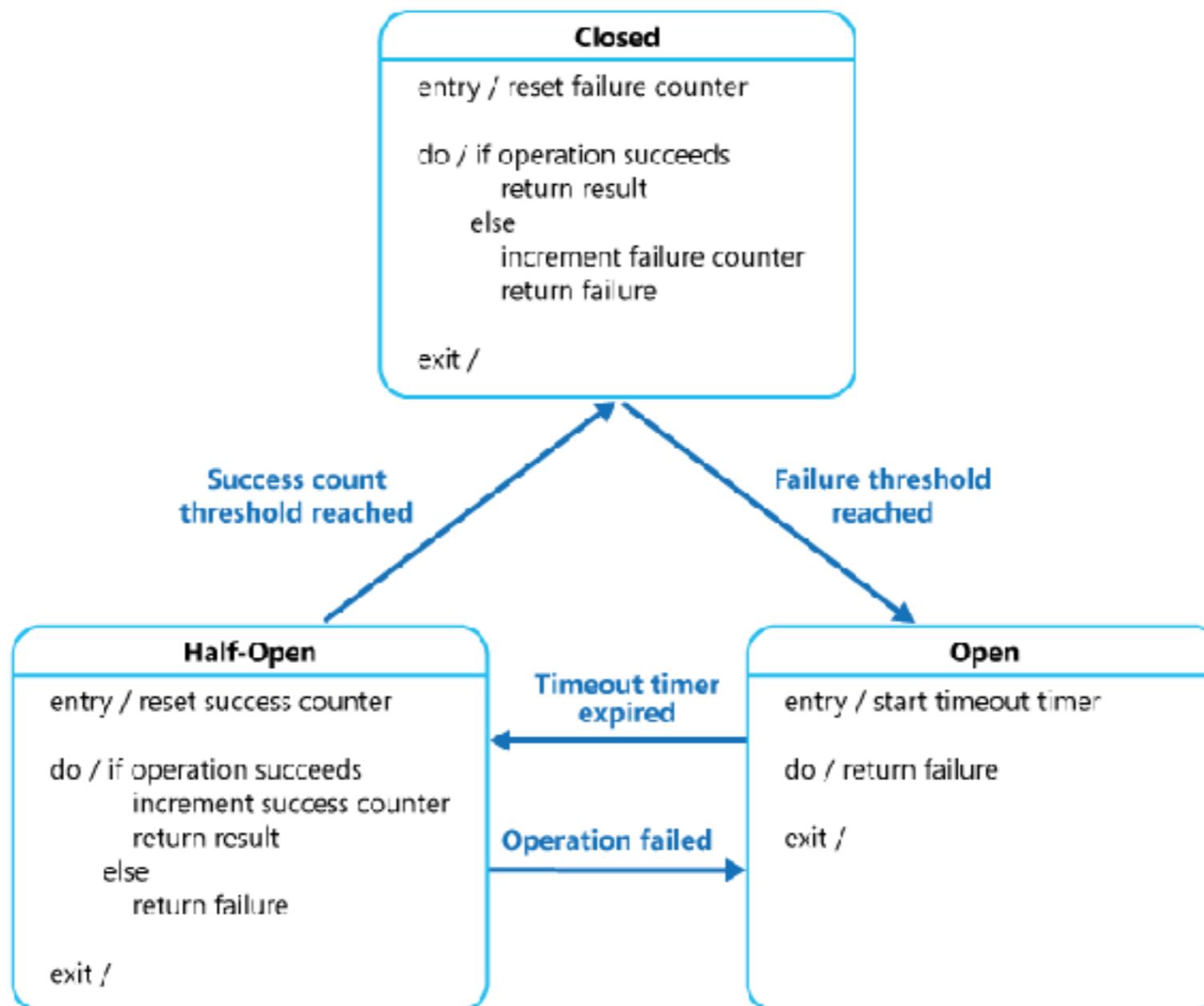
Circuit Breaker pattern

Track the number of success and failure

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



Circuit Breaker pattern

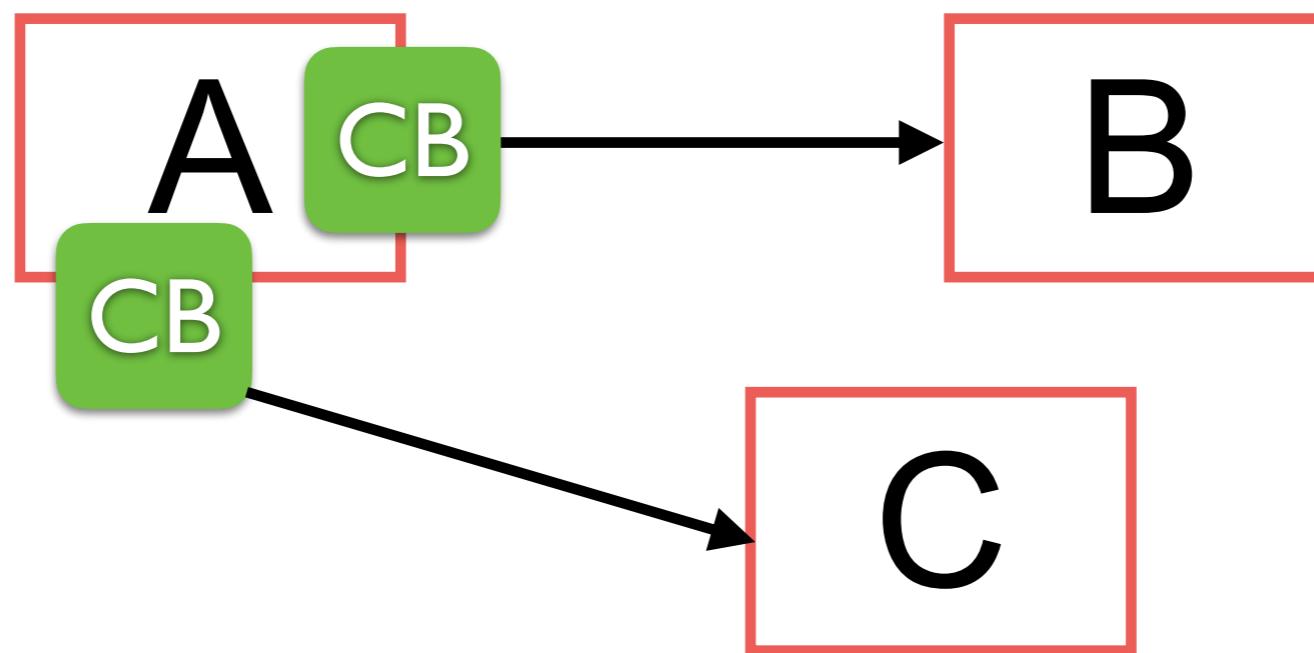
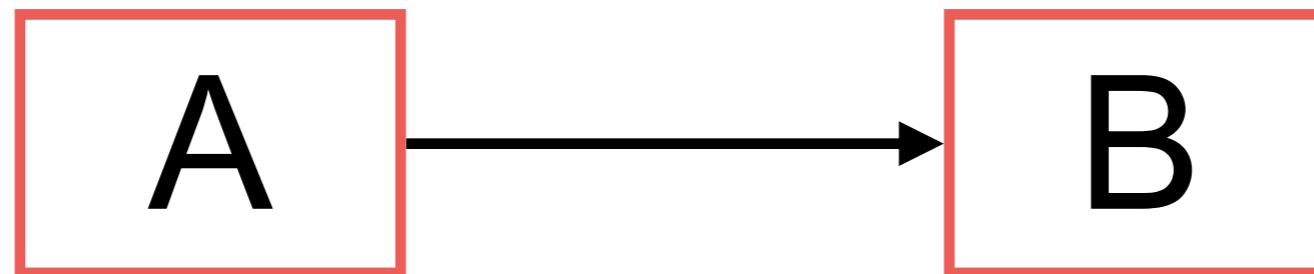


<https://learn.microsoft.com/en-us/azure/architecture/patterns/circuit-breaker>

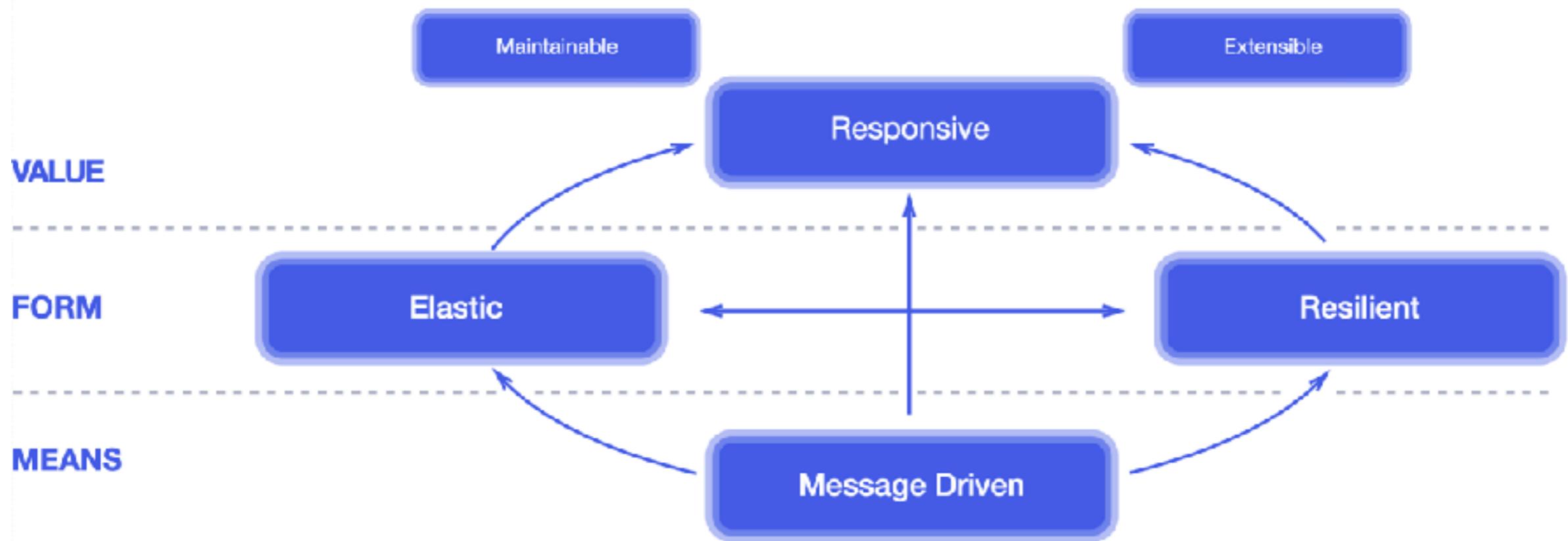


Circuit Breaker pattern

How to handling partial failure ?



Reactive Architecture



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



Service Principles



Service Principles

Creation

Interface

Testing

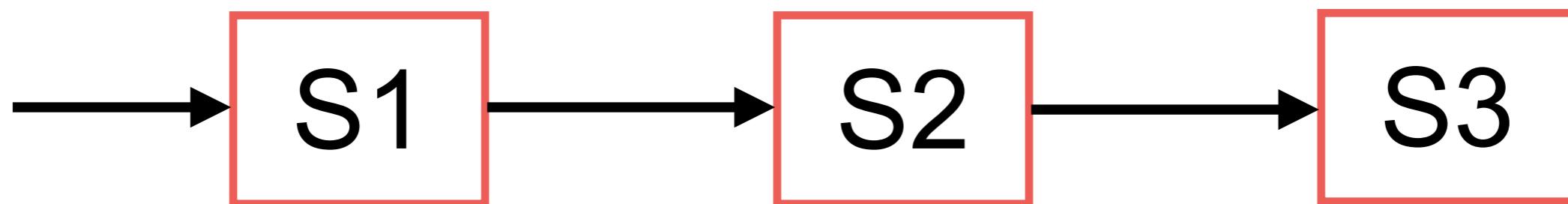
Operation

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



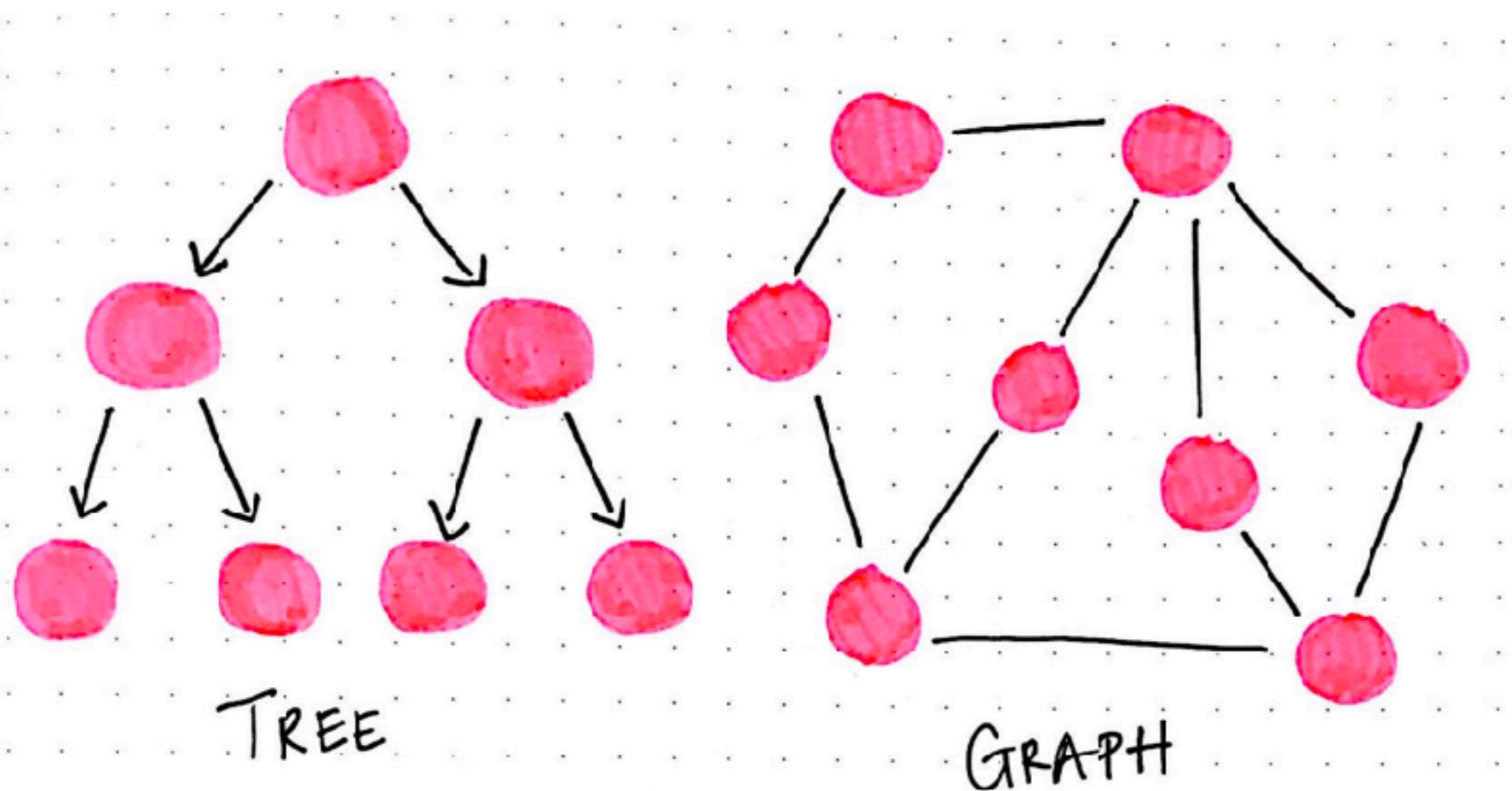
Drawbacks of Microservice

Deploy feature that required multiple service ?



Service Principles

Minimize the depth of the service call-graph



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

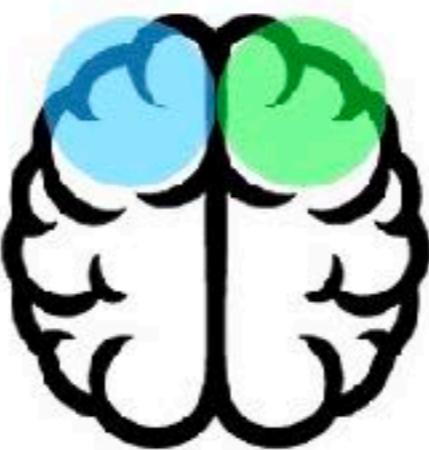


Service Principles

Minimize the number of services owned by your team

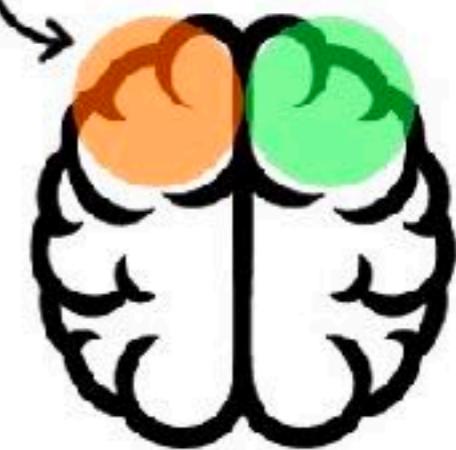


SINGLE TASK



TWO TASKS

THE 3RD TASK IS REPLACING
ONE OF THE 3 TASKS



THREE TASKS

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



Service Interfaces

APIs => HTTP, Messaging
Backward compatibility
Versioning
Design standard

JSON Schema

Kafka Schema
Registry



Testing strategies for Services

Unit testing

Integration testing

Component testing

Contract testing

End-to-End testing

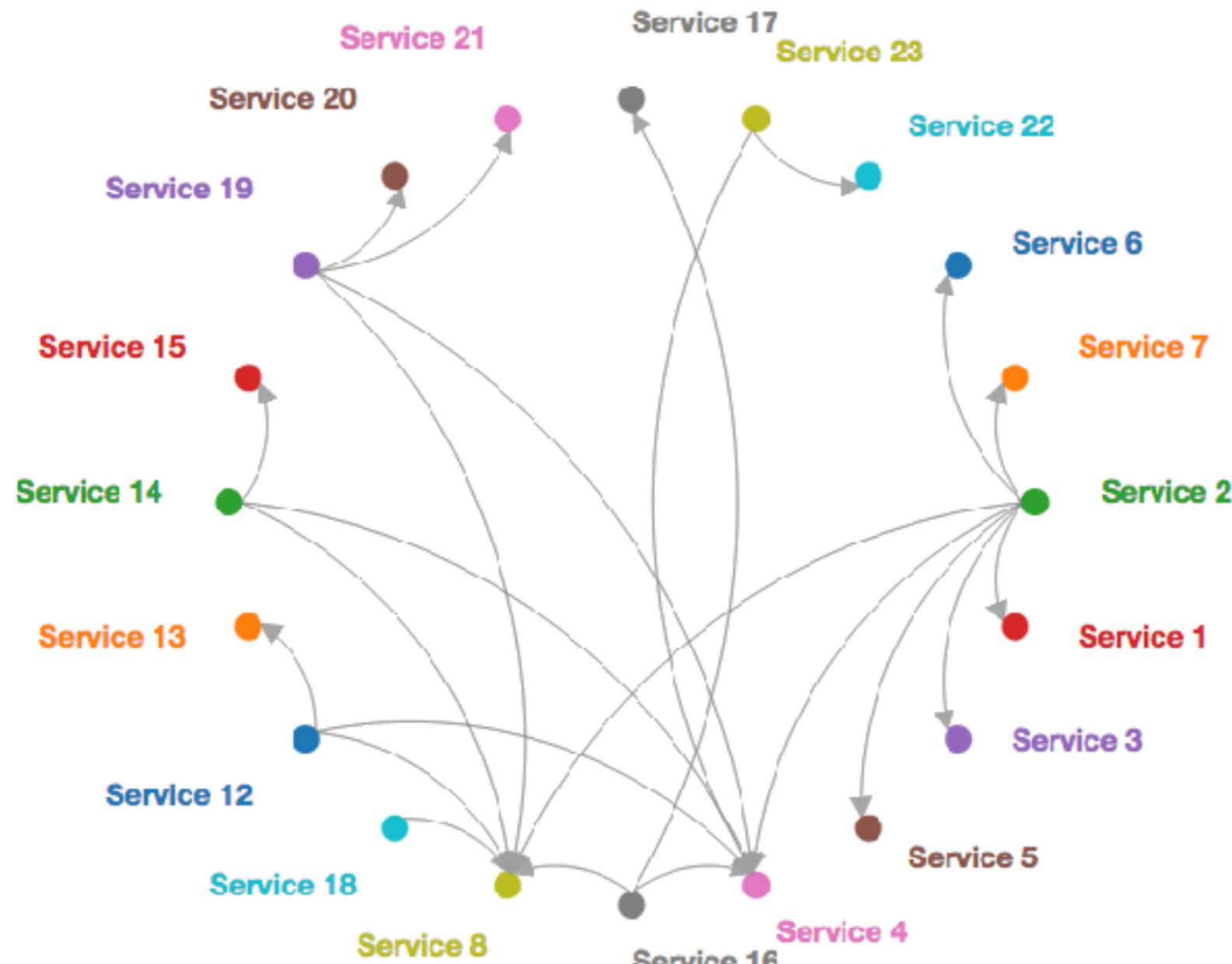
Chaos testing

Performance
testing

Security
testing



Testing strategies for Services



https://docs.pact.io/pact_broker



Operation for Services

How to deploy ?
Observable services
Plan for failures !!



Microservice architecture patterns

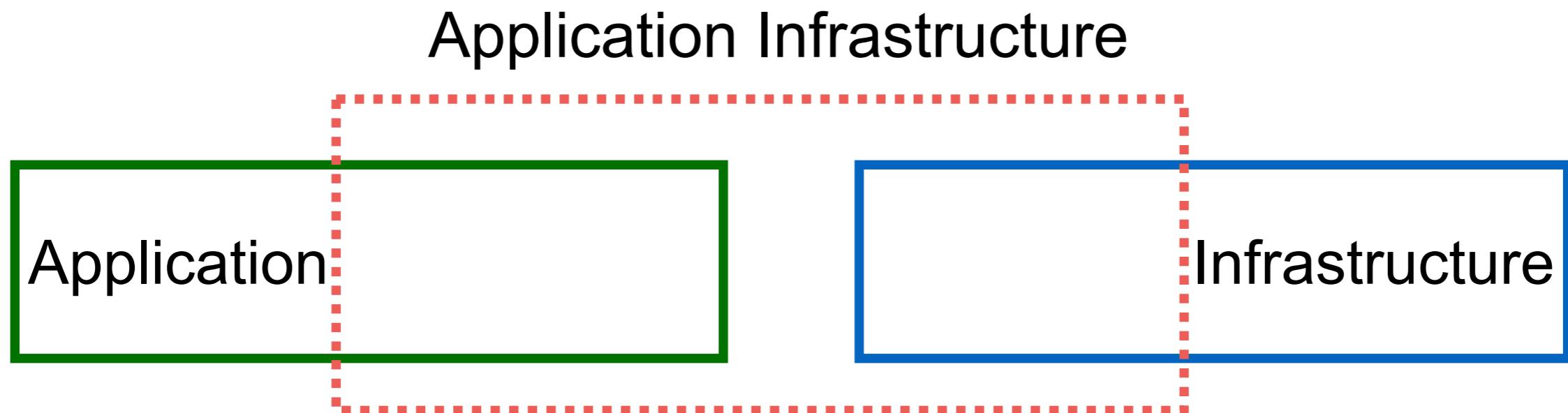


3 Layers of service patterns

Application patterns

Application infrastructure pattern

Infrastructure pattern



<https://microservices.io/>



Decompose application into small services !!



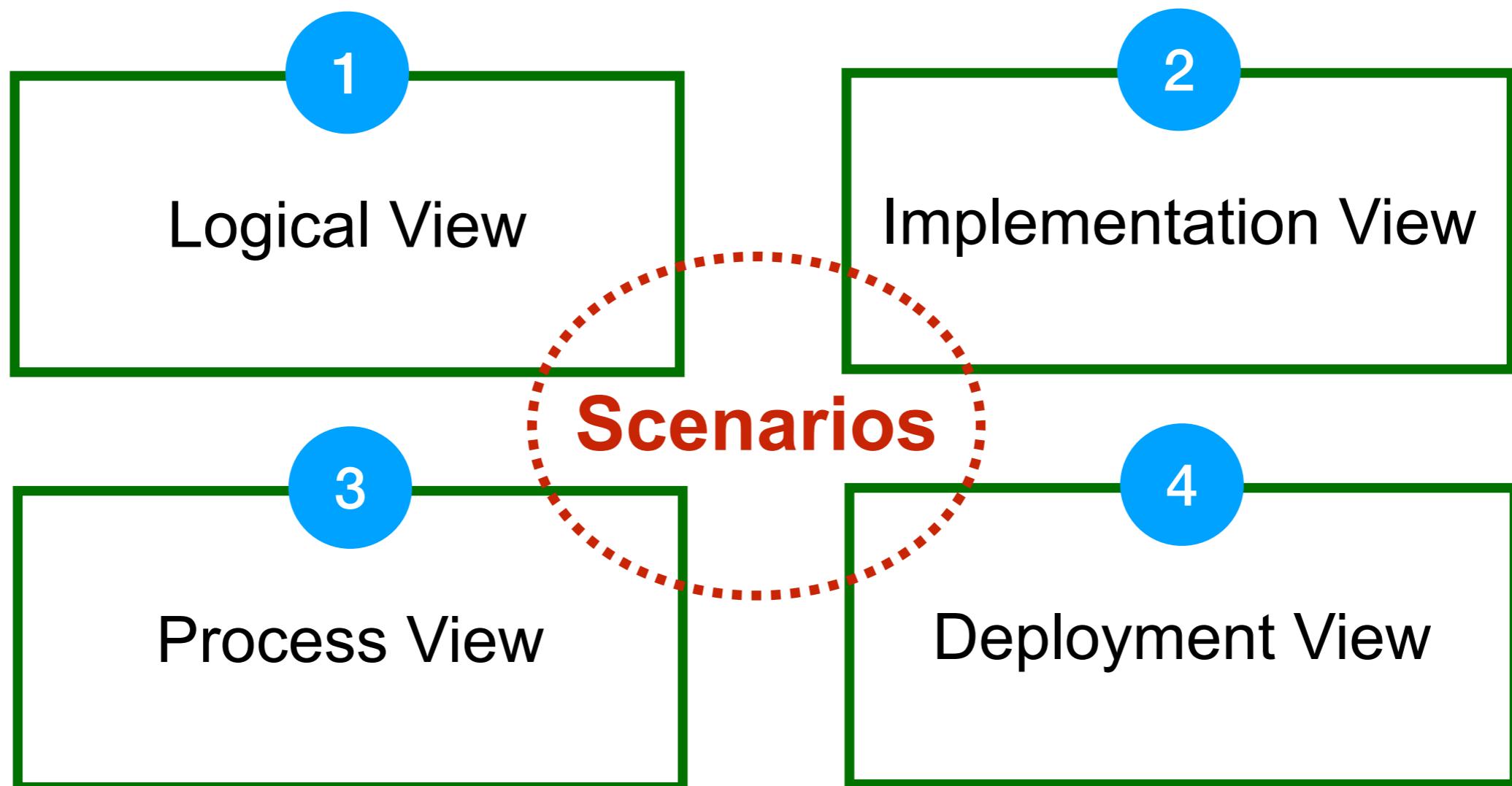
Premature splitting is the root of
all evil.



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



Decompose application into services

By business capability ?

By subdomain/technical ?

By team ?



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

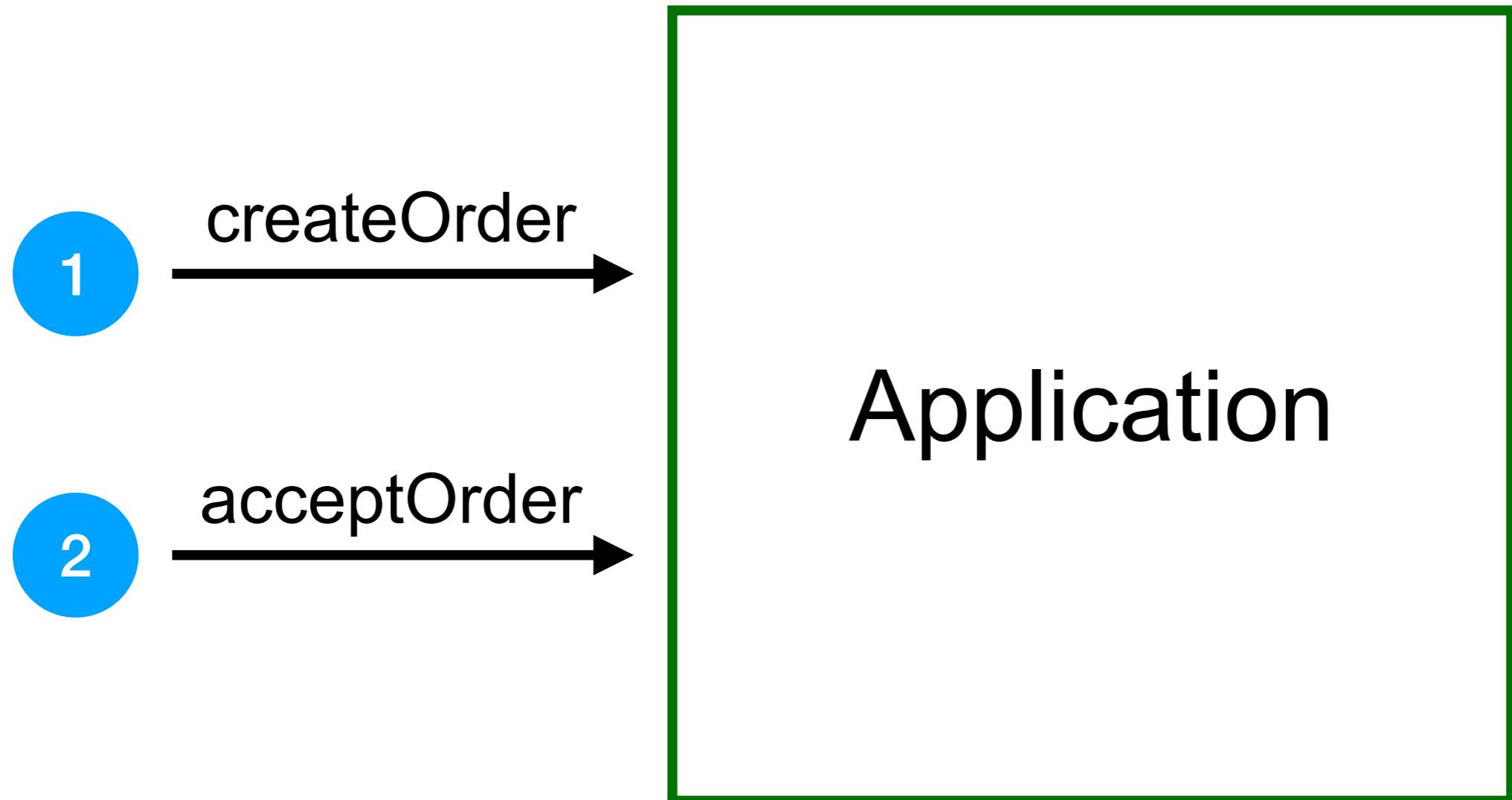
ลูกค้าต้องการสั่งซื้้อาหาร

2

ร้านอาหารรับคำสั่งซื้อ



1. Identify system operations



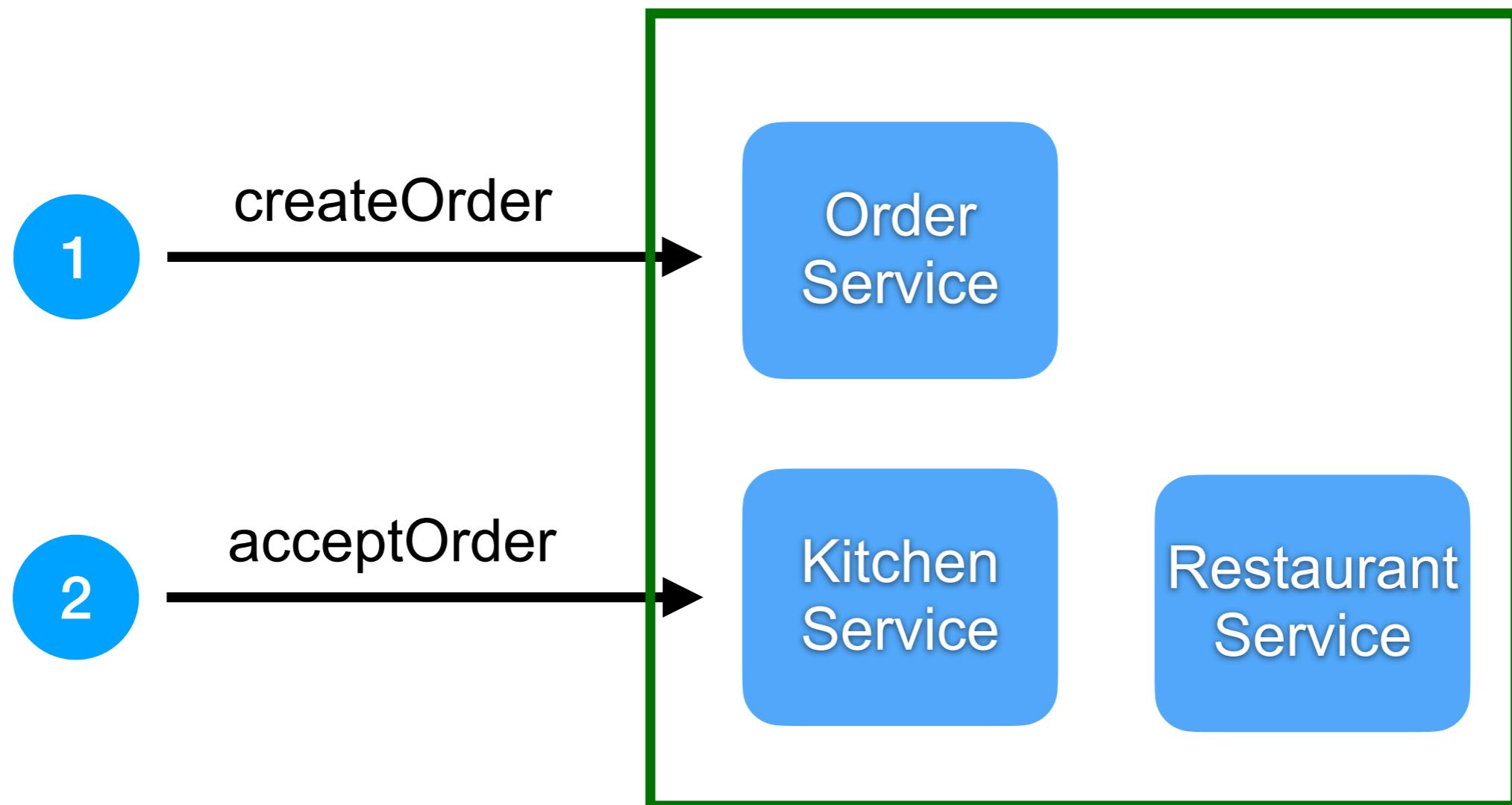
2. Identify services

Try to decomposition into services

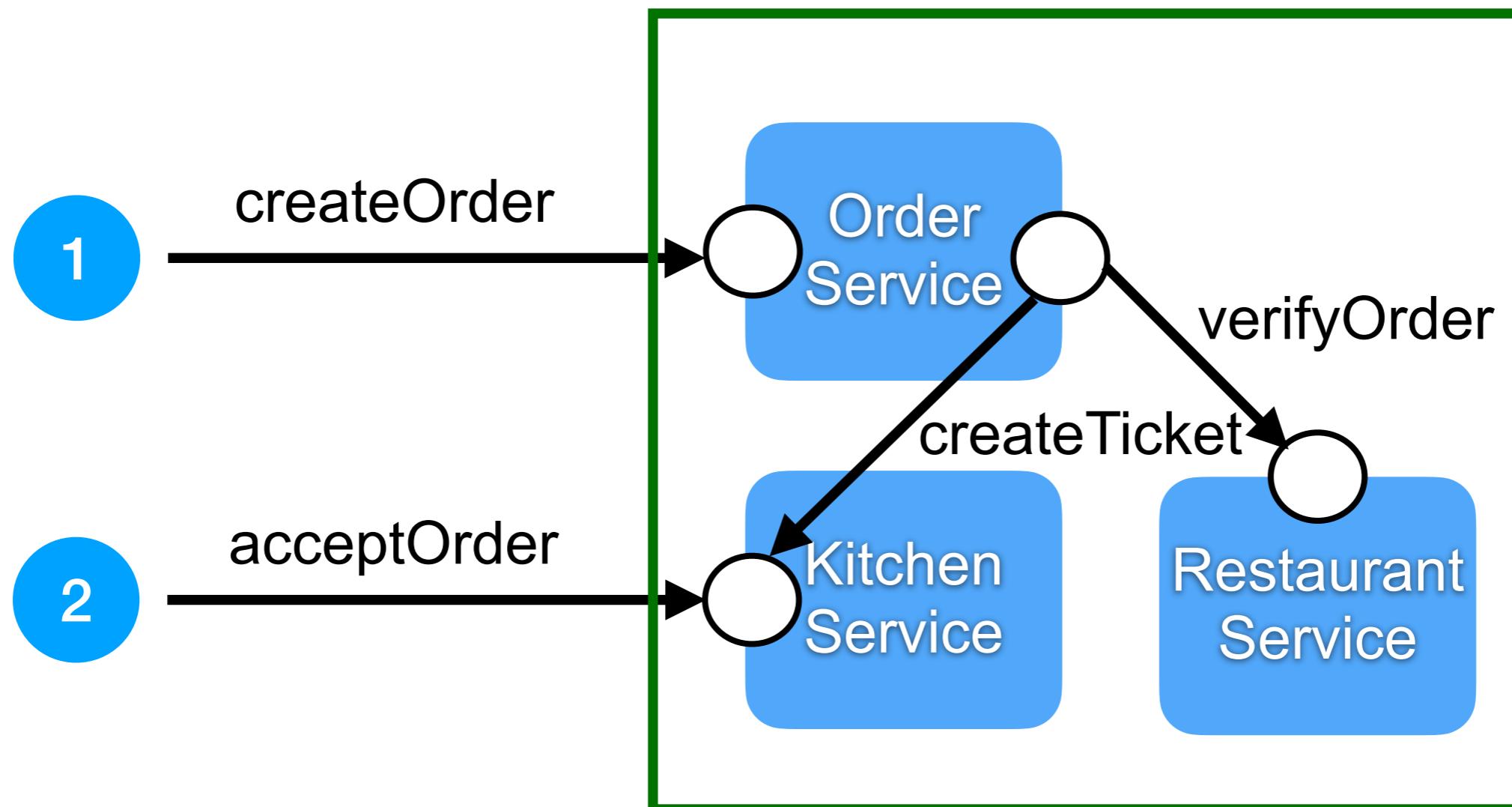
Business > Technical concept
What > How



2. Identify services



3. Define service APIs and collaborations



Problems when decompose services ?

Network latency

Reliability of communication

Maintain data consistency

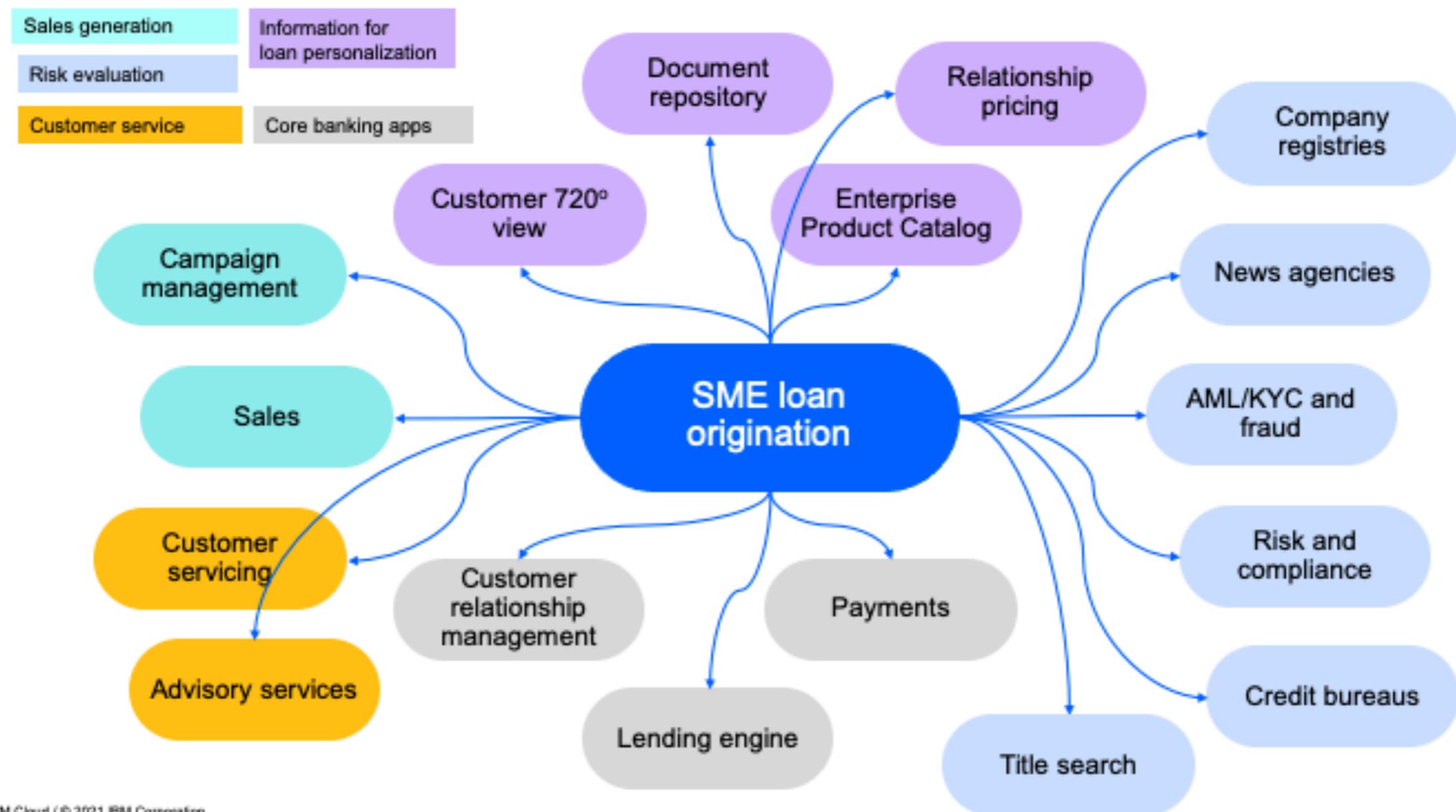
God services !!

Microlith !!



Example of System Context

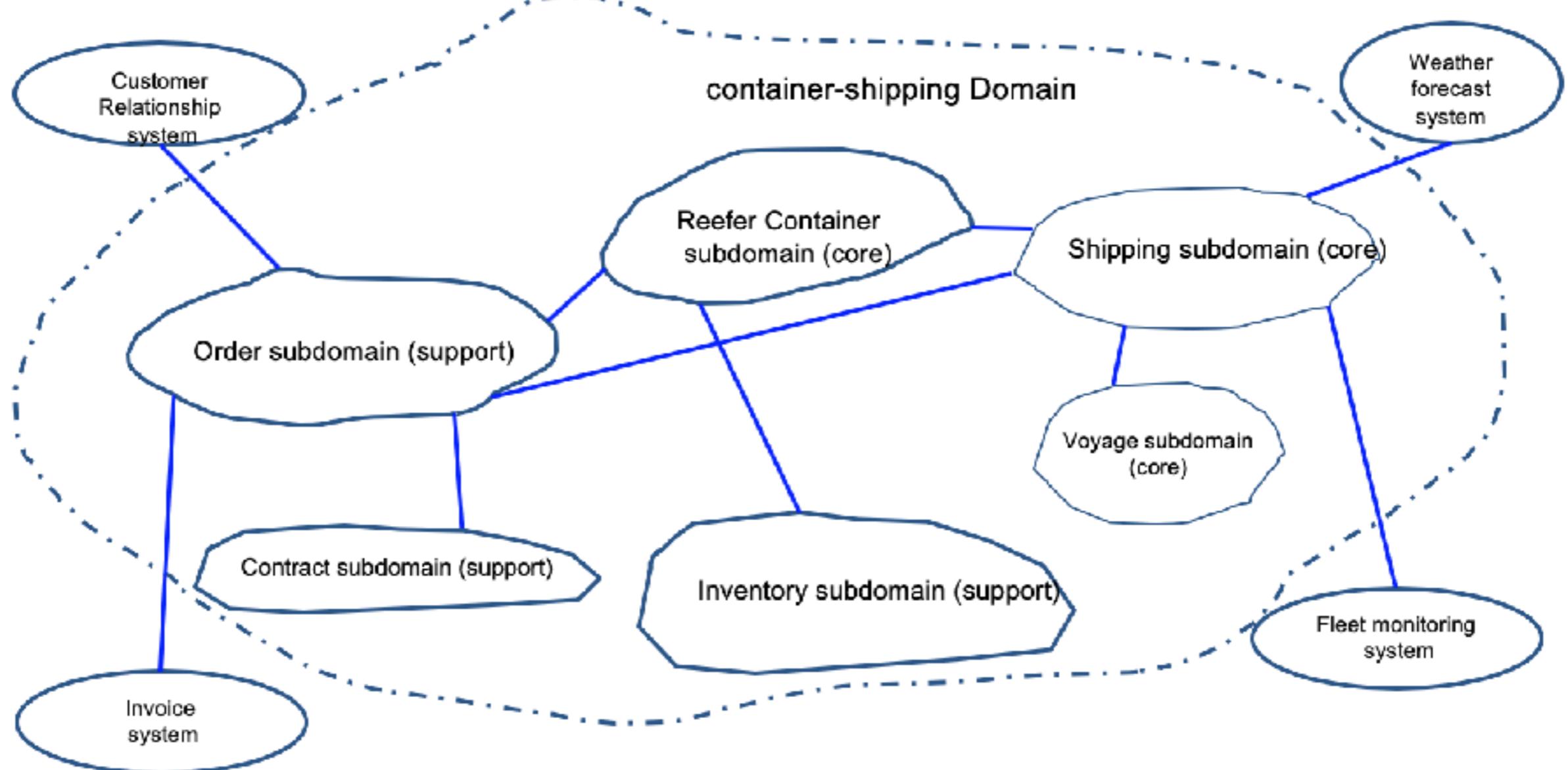
System context



IBM Cloud / © 2021 IBM Corporation



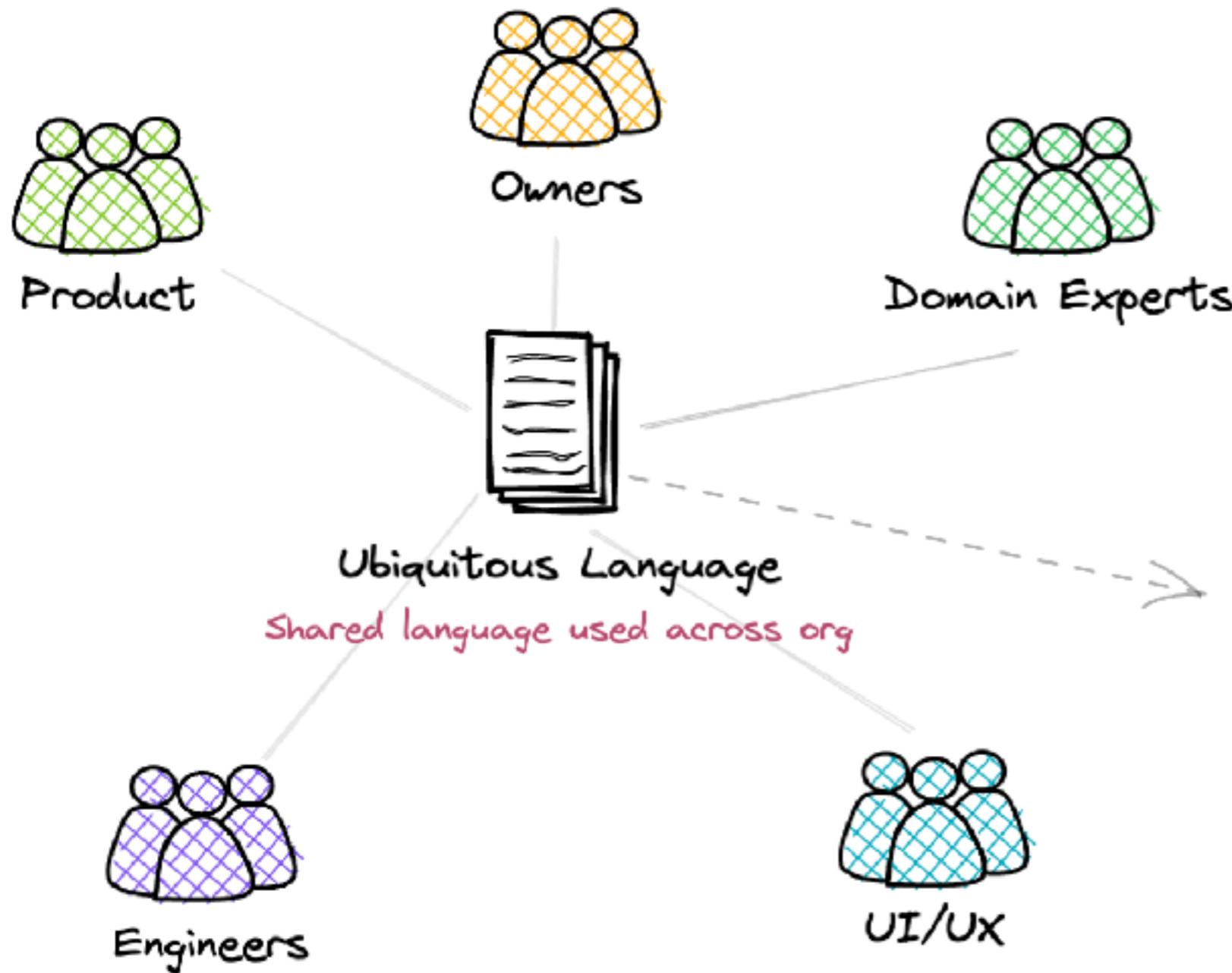
Assess domains and sub-domains



Define the ubiquitous language



Define the ubiquitous language



What is Ubiquitous Language

1. Language of the business
2. Reduces domain translations
3. Improve communication
4. Single Language
5. Terms easy to understand
6. Precise and consistent
7. Eliminate the need for assumptions
8. Single meaning for each term
9. Part of DDD
10. Use when describing business domain

@boyney123

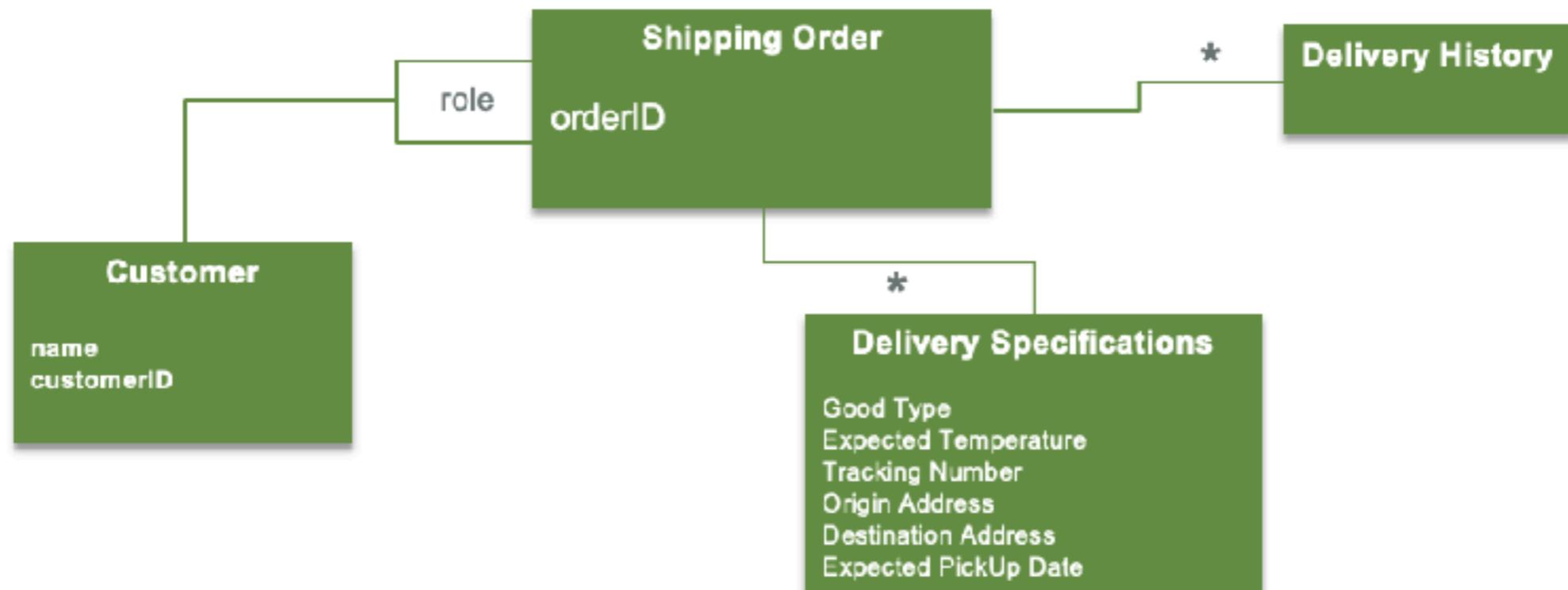
<https://serverlessland.com/event-driven-architecture/visuals/ubiquitous-language>



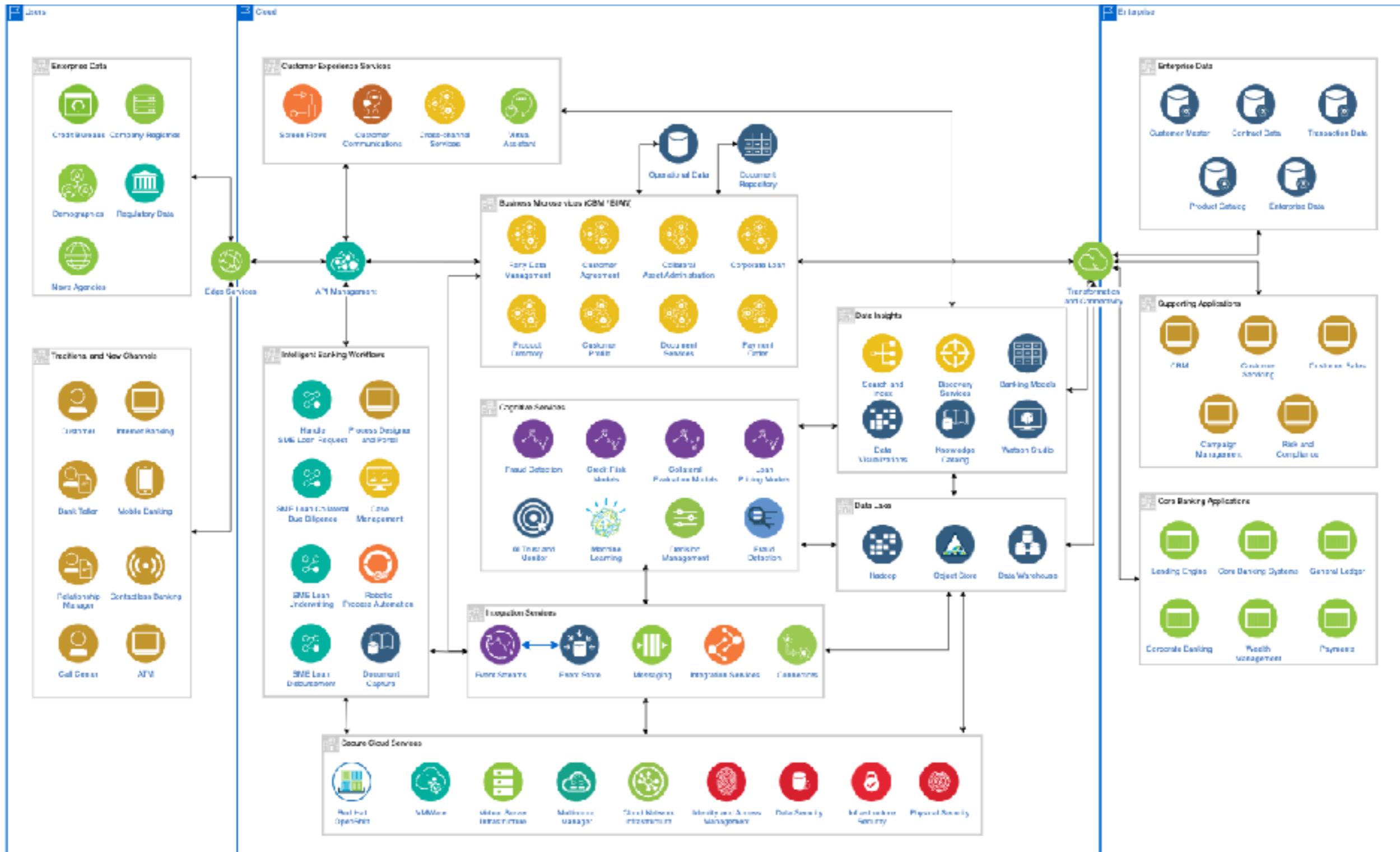
Microservices

© 2020 - 2025 Siam Chamnkit Company Limited. All rights reserved.

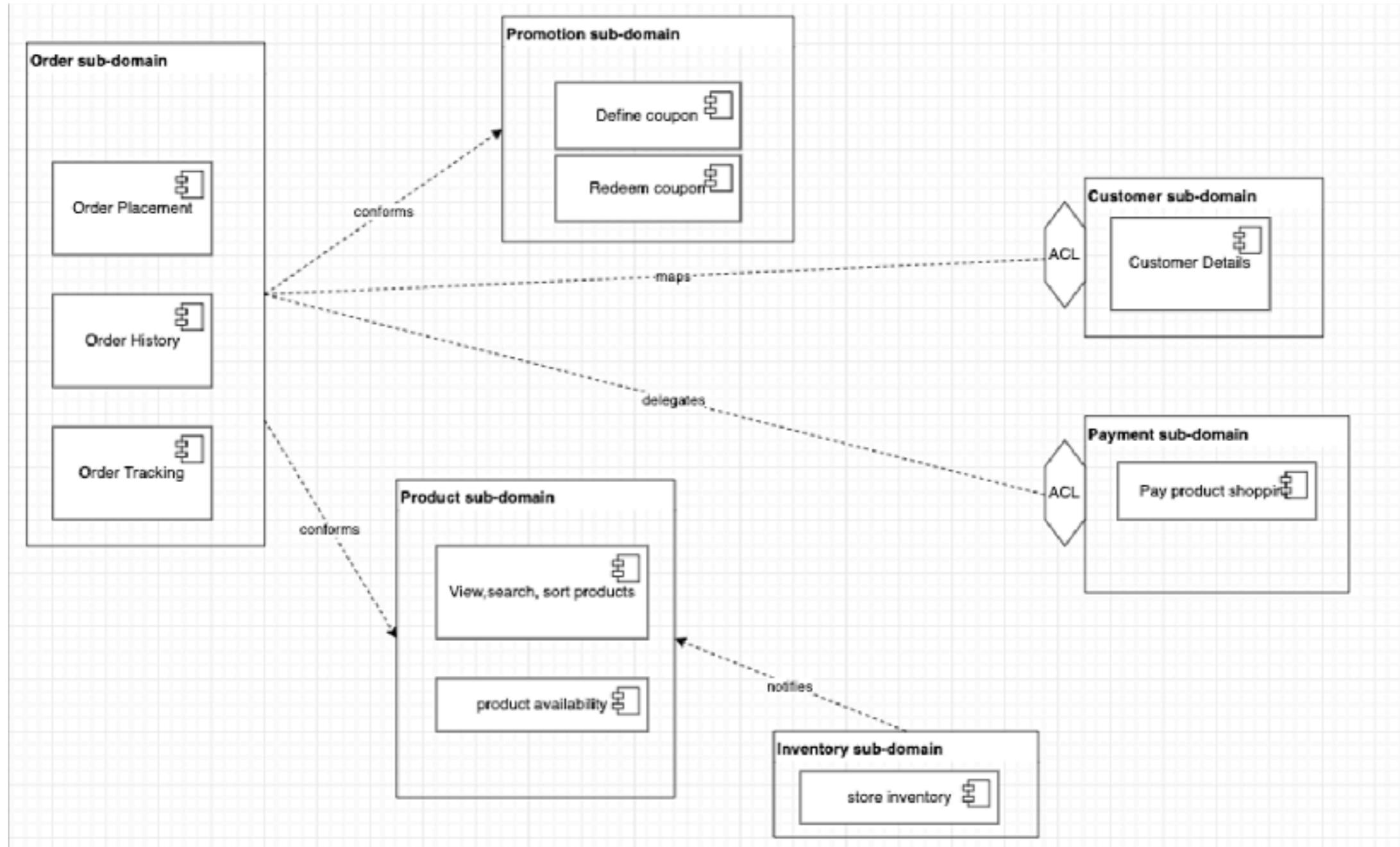
Structure of data



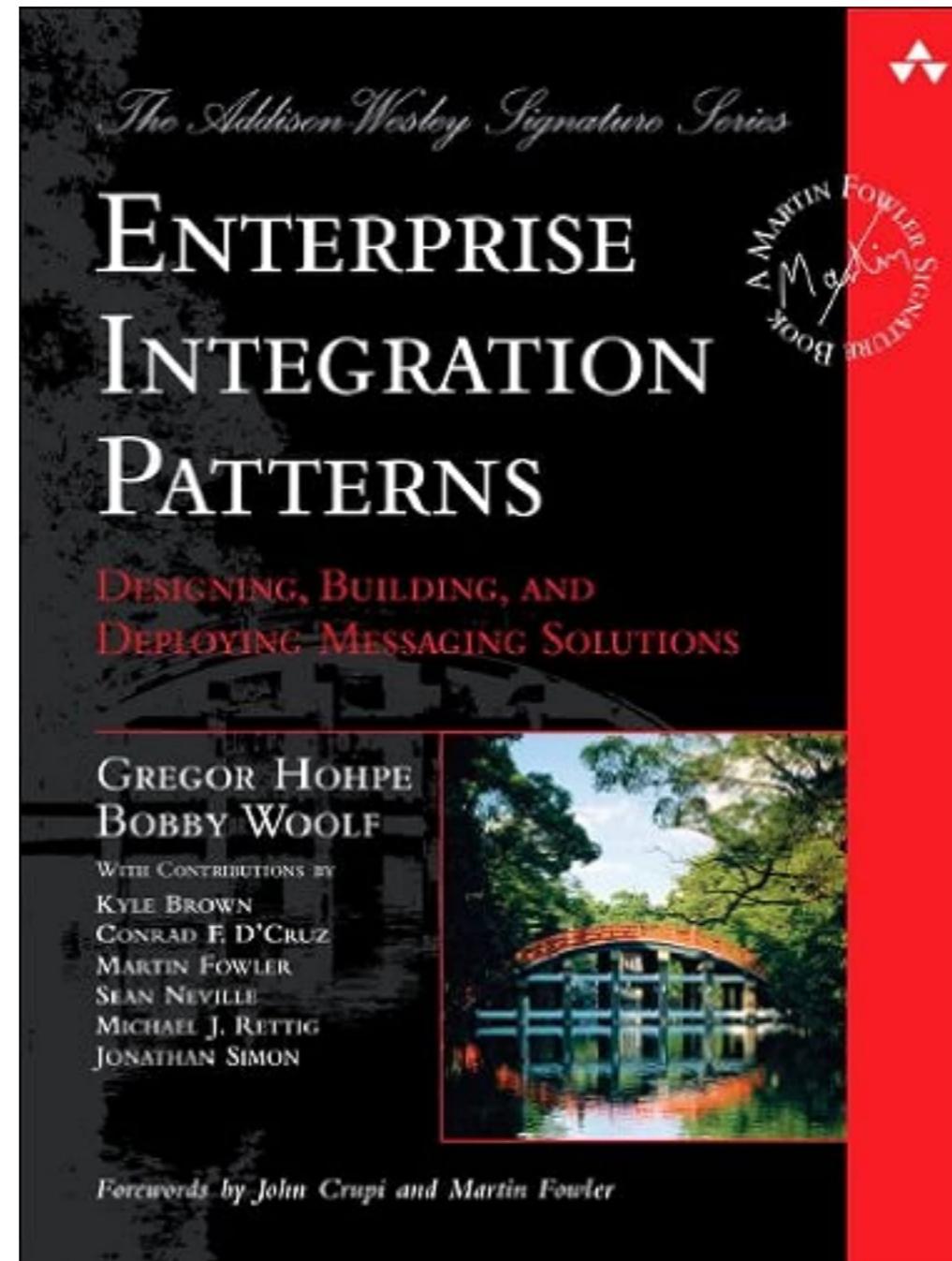
Grouping services



Communication types ?



Enterprise Integration Patterns



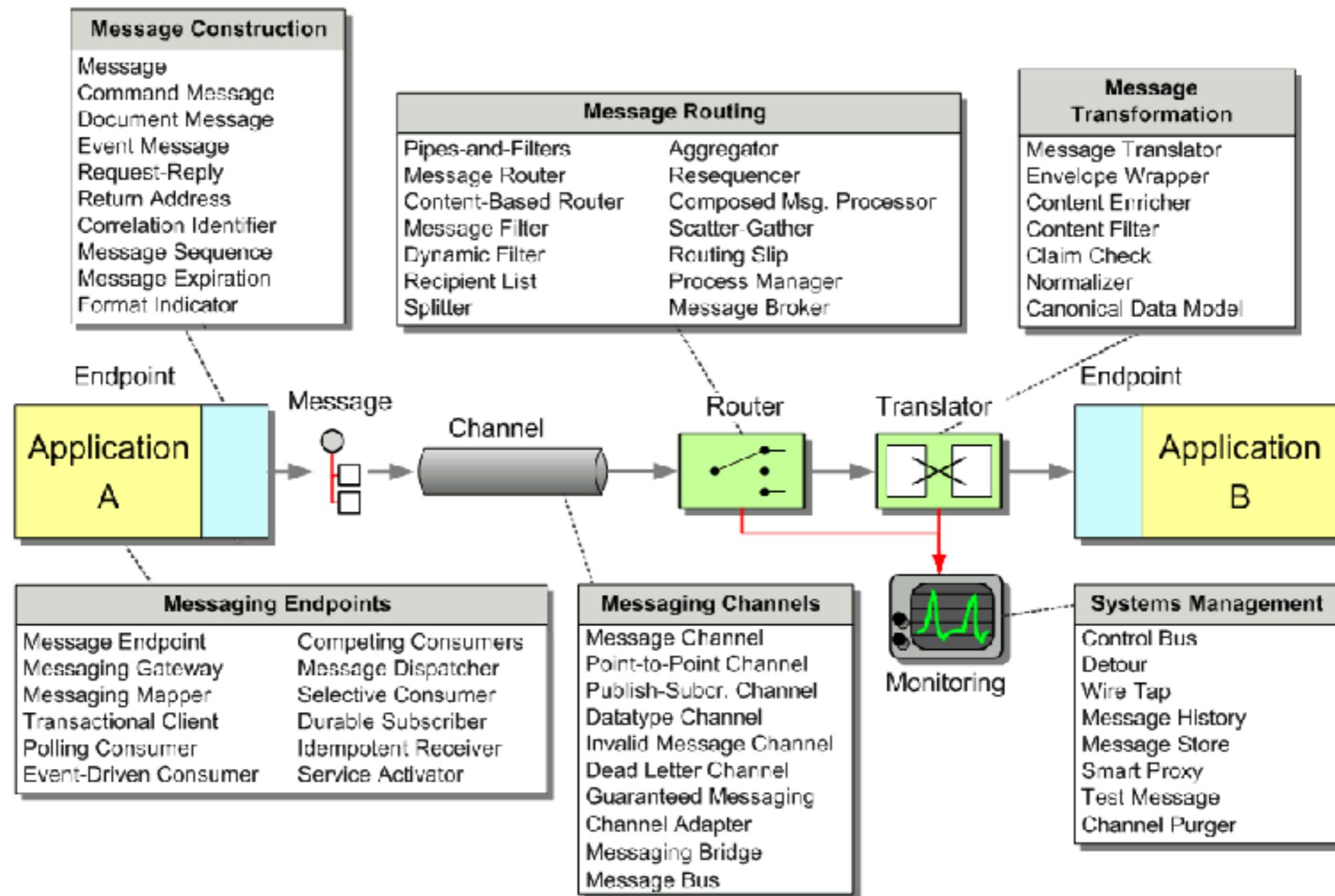
<https://www.amazon.com/Enterprise-Integration-Patterns-Designing-Deploying/dp/0321200683>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

Integration Pattern Language



<https://www.enterpriseintegrationpatterns.com/patterns/messaging/>



Microservices

© 2020 - 2025 Siam Chamnkit Company Limited. All rights reserved.

Communication between services



Interaction Styles

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



Synchronous Communication

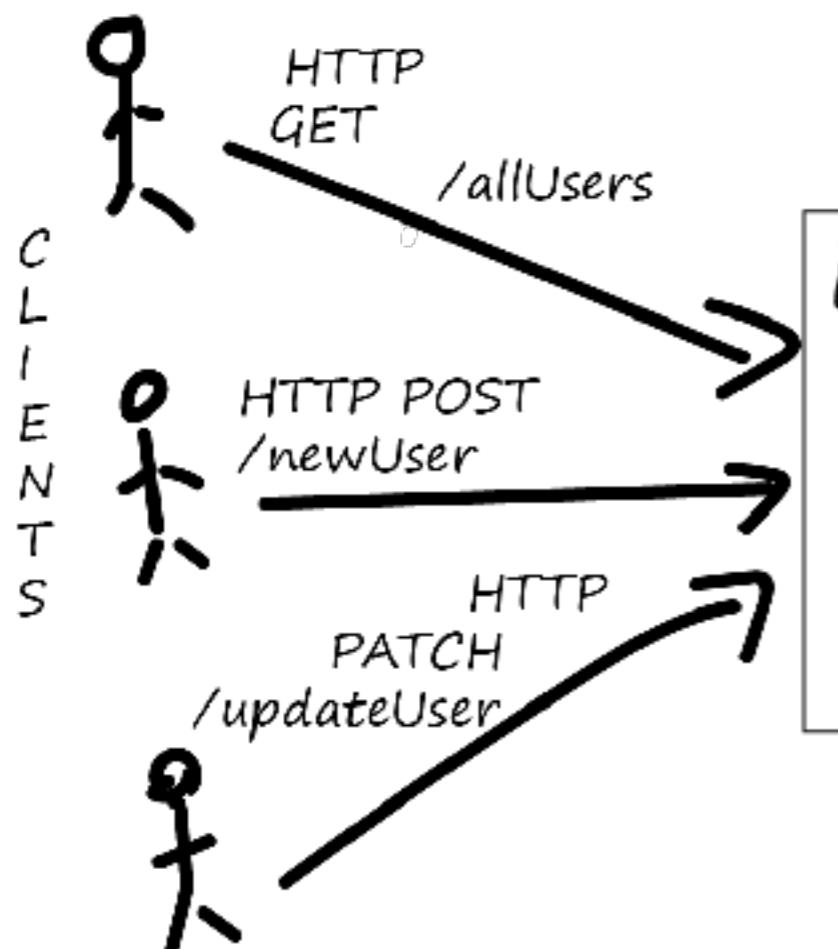
REST
gRPC

Handling failure with Circuit breaker
Service discovery



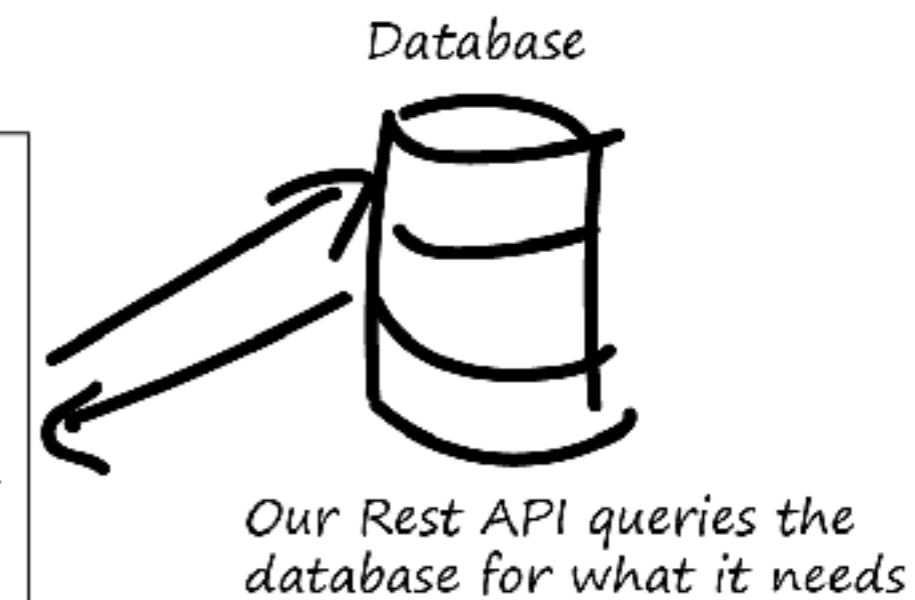
REpresentational State Transfer

Rest API Basics



Our Clients, send HTTP Requests and wait for responses

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



API Documentation



API Development for Everyone

Simplify your API development with our open-source and professional tools, built to help you and your team efficiently design and document APIs at scale.

[Find your tool](#)[Read the docs →](#)

TRUSTED BY



Servers	https://api.swagger.io
API Resources	
GET	/resource
POST	/resource
PUT	/resource
PATCH	/resource
DELETE	/resource
OPTIONS	/resource
HEAD	/resource

<https://swagger.io/>

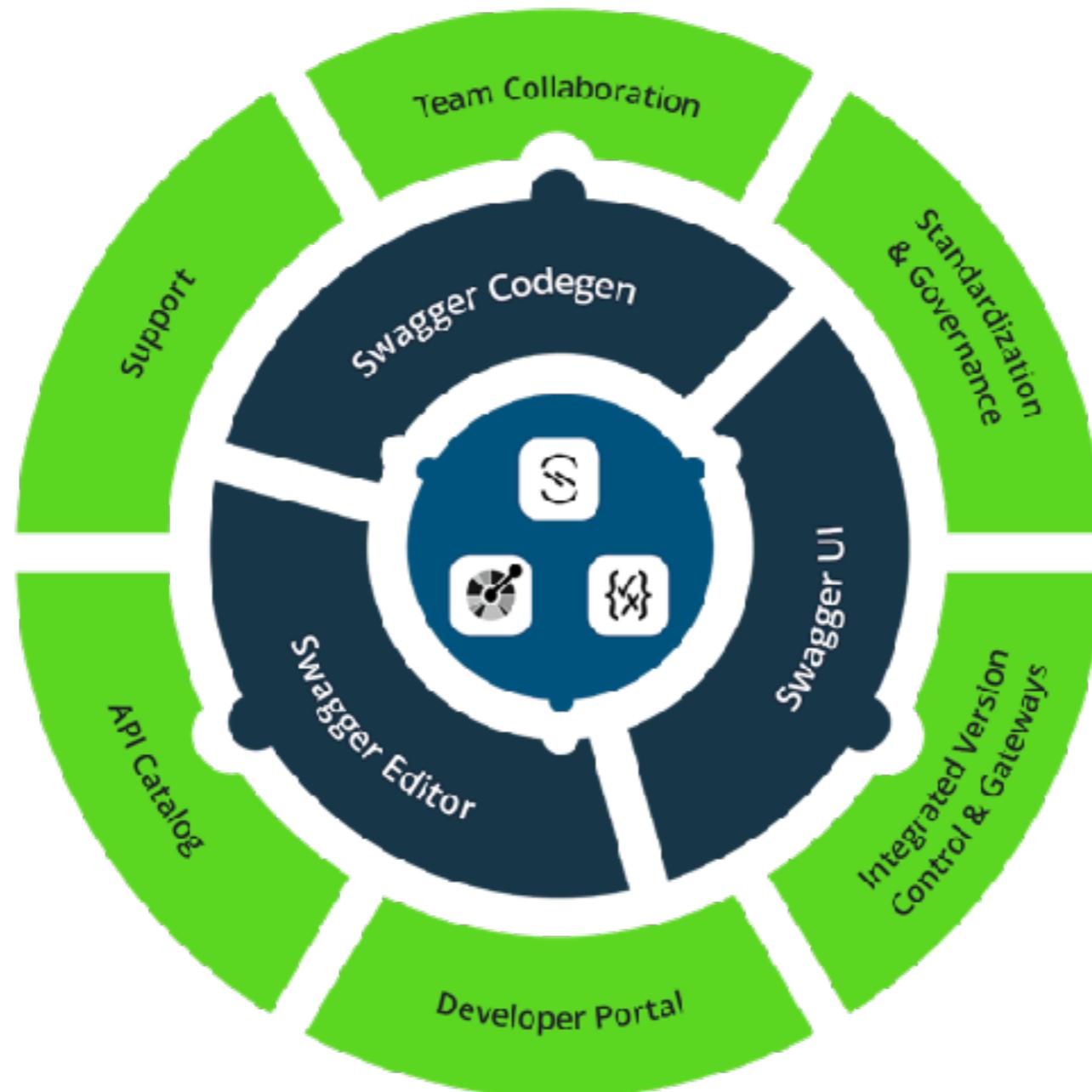


Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

173

Swagger/OpenAPI



<https://swagger.io/>



Microservices

© 2020 - 2025 Siam Chamnkit Company Limited. All rights reserved.

Swagger/OpenAPI

The screenshot shows the Swagger Editor interface. On the left, the OpenAPI 3.0 specification for the Petstore API is displayed in a code editor. The specification includes details like the title "Swagger Petstore - OpenAPI 3.0", a detailed description of the Pet Store Server, and links to GitHub repositories. On the right, the API documentation is shown under the "pet" category, which is described as "Everything about your Pets". It lists several operations:

- PUT /pet**: Update an existing pet.
- POST /pet**: Add a new pet to the store.
- GET /pet/findByStatus**: Finds Pets by status.
- GET /pet/findByTags**: Finds Pets by tags.
- GET /pet/{petId}**: Find pet by ID.
- POST /pet/{petId}**: Updates a pet in the store with form data.
- DELETE /pet/{petId}**: Deletes a pet.
- POST /pet/{petId}/uploadImage**: uploads an image.

Below the "pet" section is the "store" section, described as "Access to Petstore orders". It contains one operation:

- GET /store/inventory**: Returns pet inventories by status.

At the top right of the interface, there is a green button that says "Try our new Editor".

```
openapi: 3.0.3
info:
  title: Swagger Petstore - OpenAPI 3.0
  description: |
    This is a sample Pet Store Server based on the OpenAPI 3.0 specification. You can find out more about Swagger at [https://swagger.io](https://swagger.io). In the third iteration of the pet store, we've switched to the design first approach! You can now help us improve the API whether it's by making changes to the definition itself or to the code. That way, with time, we can improve the API in general, and expose some of the new features in OAS3.
  ...
  If you're looking for the Swagger 2.0/OAS 2.0 version of Petstore, then click [here](https://editor.swagger.io?url=https://petstore.swagger.io/v2/swagger.yaml). Alternatively, you can load via the 'Edit > Load Petstore OAS 2.0' menu option!
  ...
  Some useful links:
  - [The Pet Store repository](https://github.com/swagger-api/swagger-petstore)
  - [The source API definition for the Pet Store](https://github.com/swagger-api/swagger-petstore/blob/master/src/main/resources/openapi.yaml)
  termsOfService: http://swagger.io/terms/
  contact:
    email: apiteam@swagger.io
  license:
    name: Apache 2.0
    url: http://www.apache.org/licenses/LICENSE-2.0.html
  version: 1.0.11
  externalDocs:
    description: Find out more about Swagger
    url: http://swagger.io
  servers:
```

<https://swagger.io/>



How to design your API ?

Design first

Code first



gRPC



A high performance, open source universal RPC framework

[Learn more](#)

Get started!

Go

C++

Java

Python

...

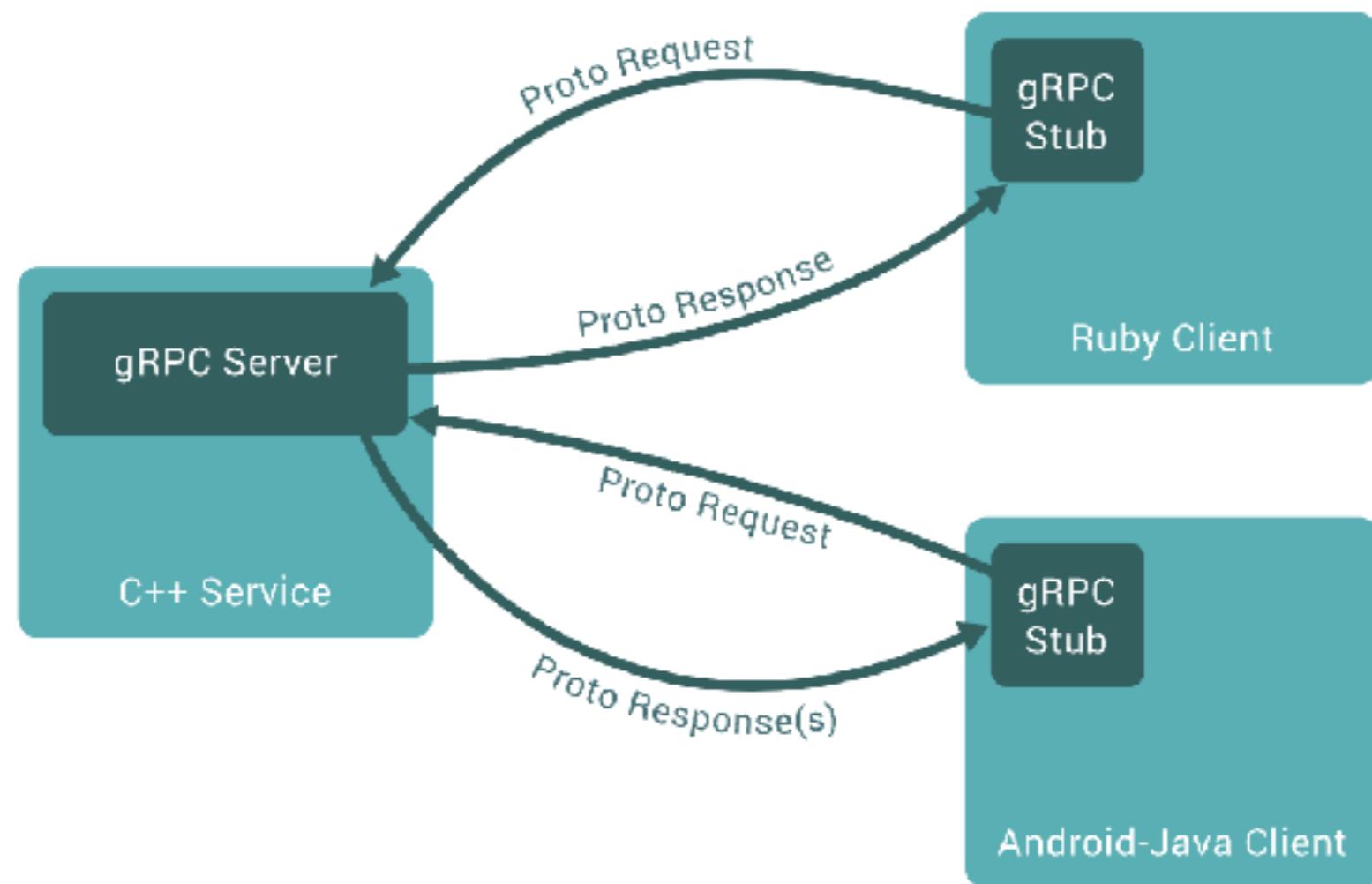
<https://grpc.io/>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

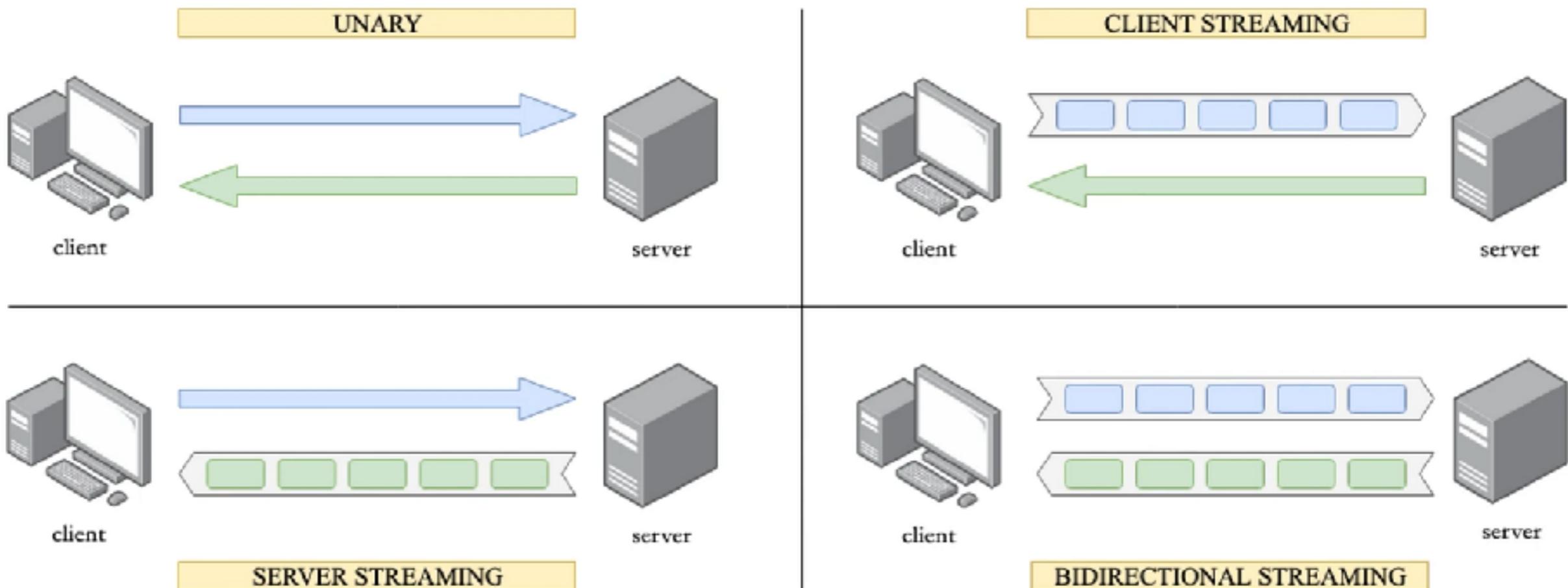
gRPC



<https://grpc.io/>



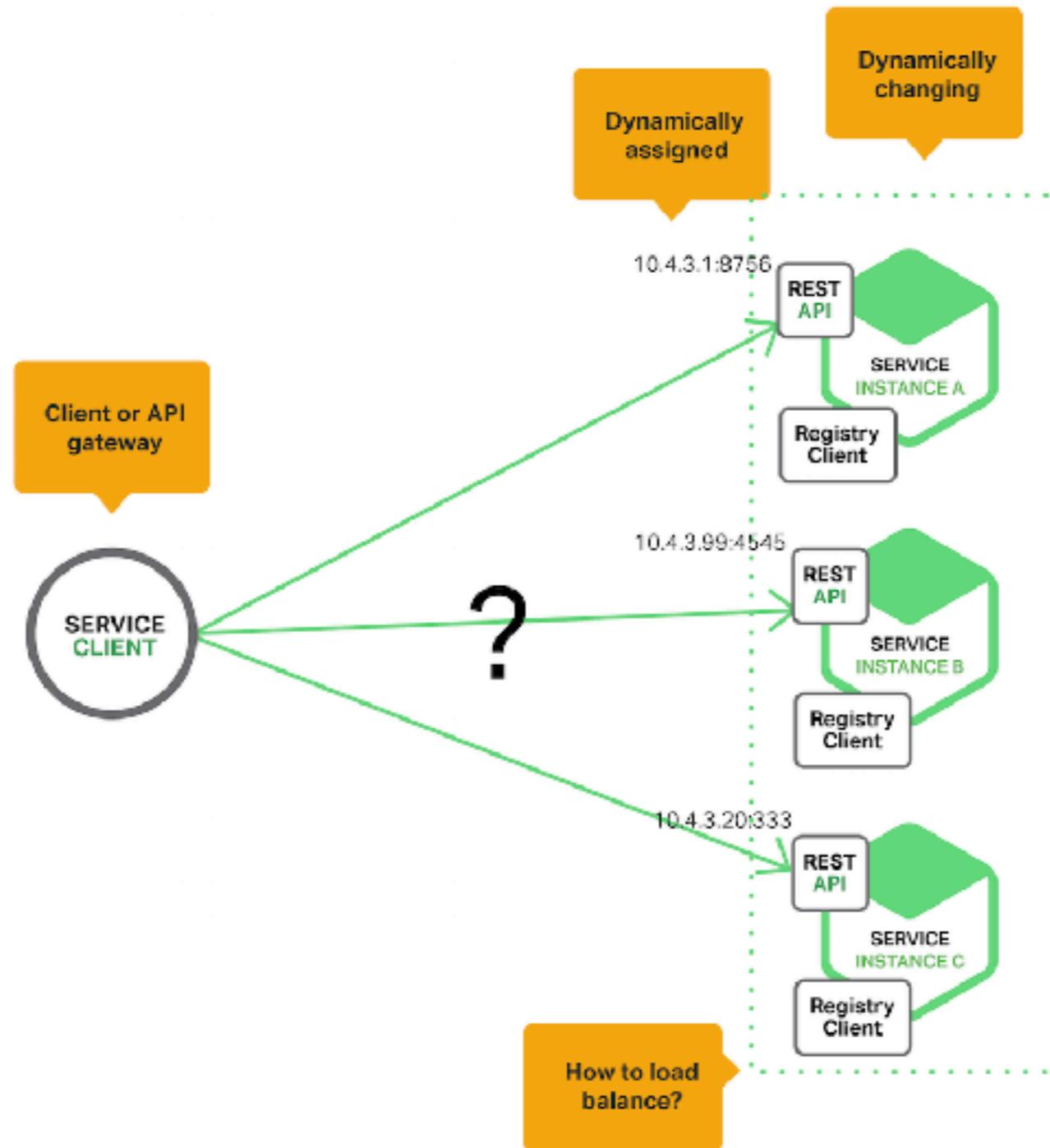
gRPC



<https://grpc.io/>



Service Discovery ?



<https://www.nginx.com/blog/service-discovery-in-a-microservices-architecture/>

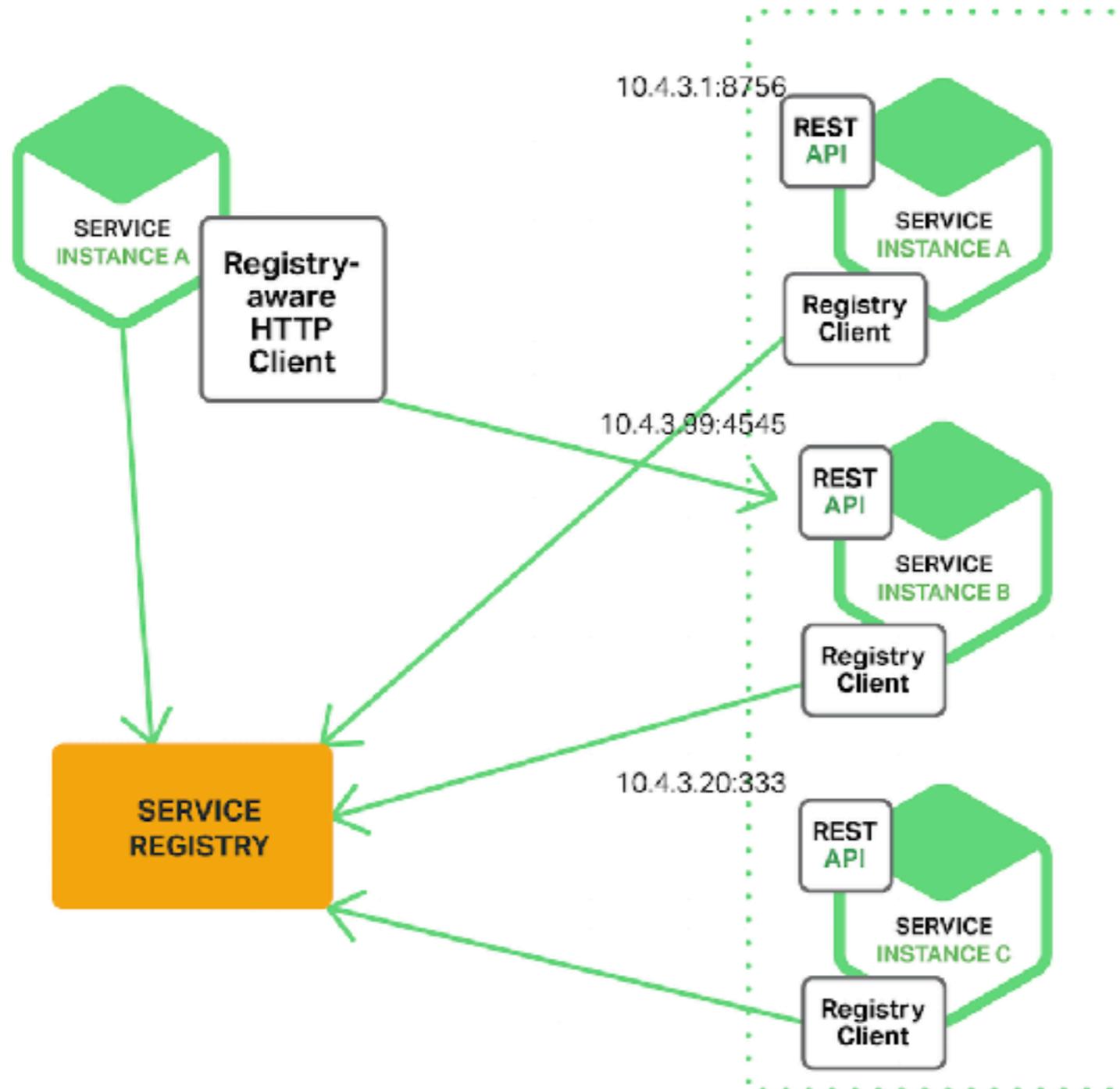


Service Discovery ?

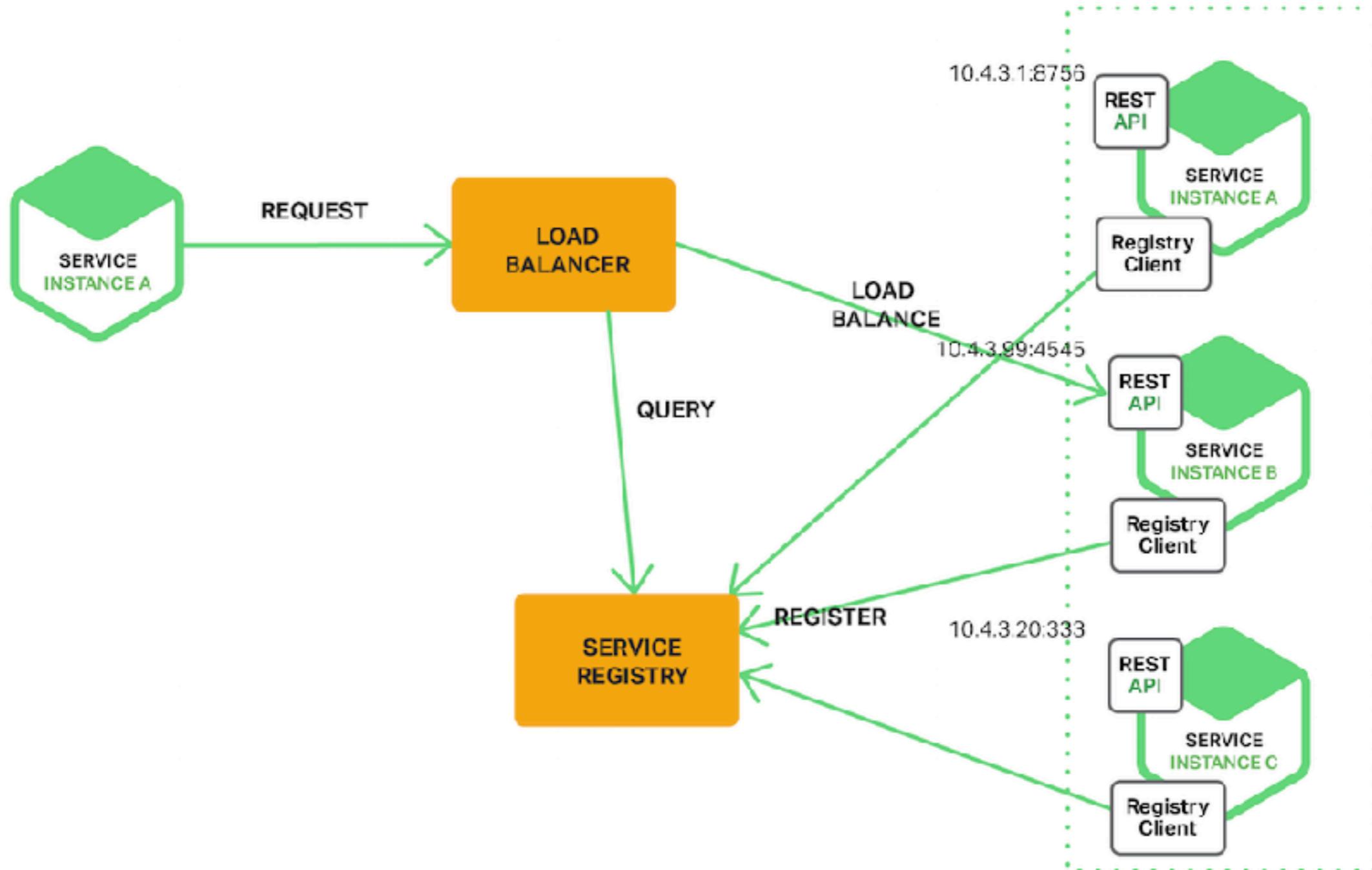
Client-side
Server-side



Client-side Discovery



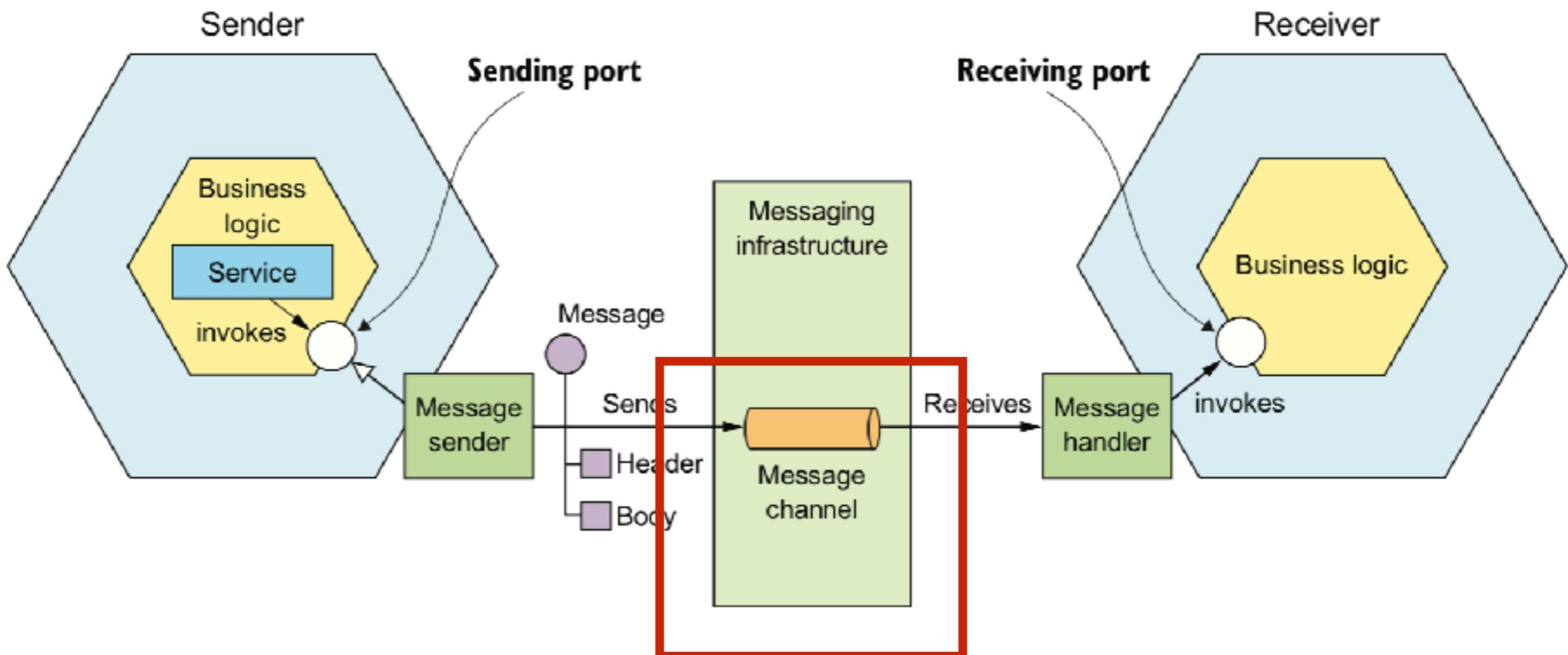
Server-side Discovery



Asynchronous communication

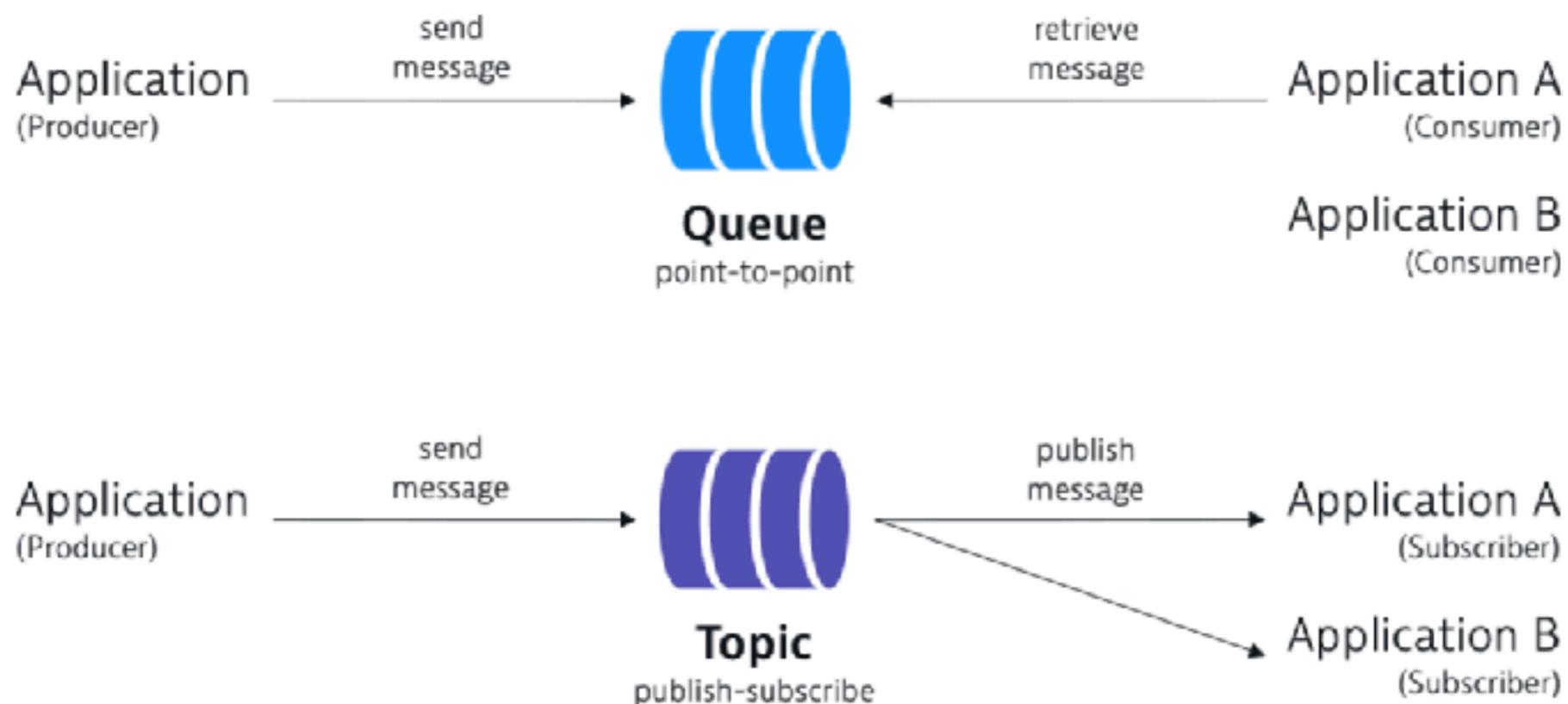


Asynchronous messaging pattern



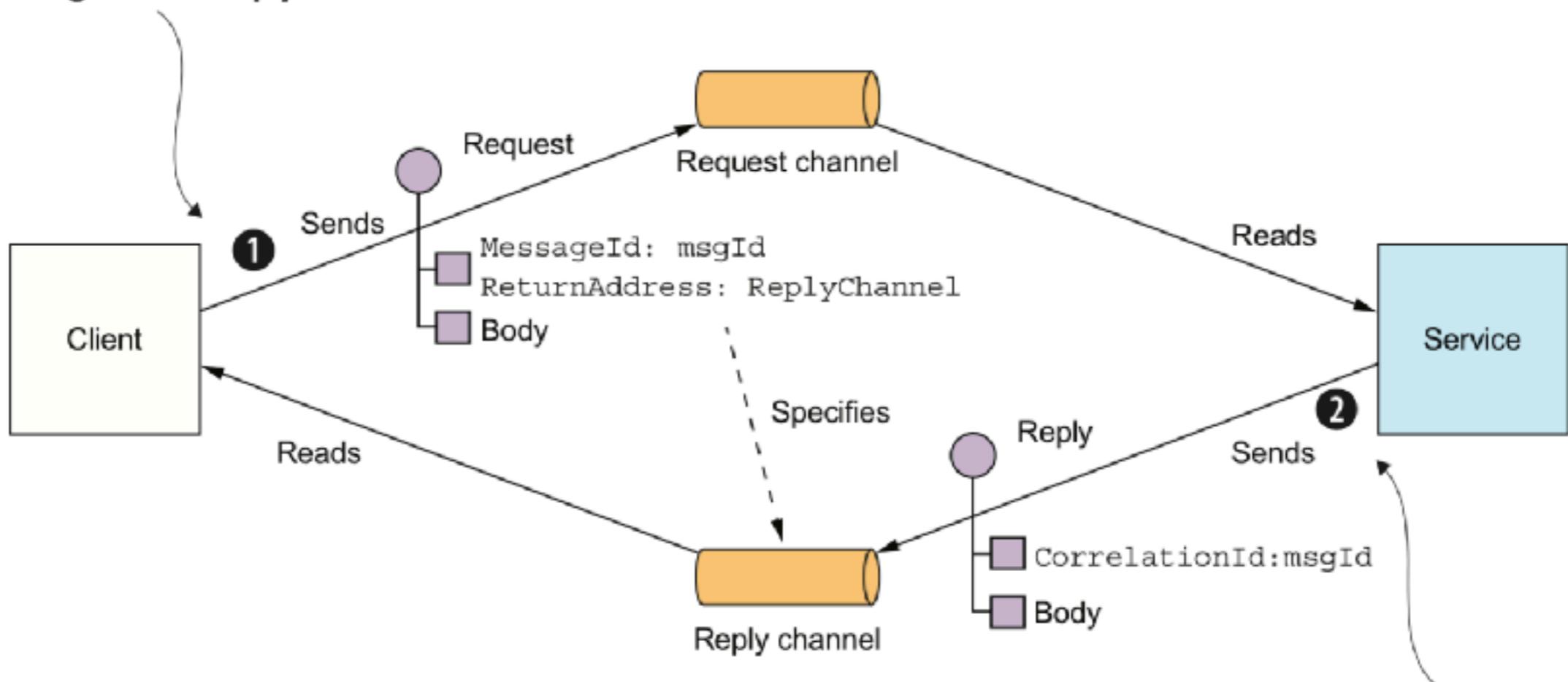
Messaging channels

Publish-subscribe Point-to-point



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.



Message brokers



Benefits

Loose-coupling
Message buffer
Flexible communication



Drawbacks

Performance bottleneck
Single point of failure
Operational complexity
Testing
Monitoring

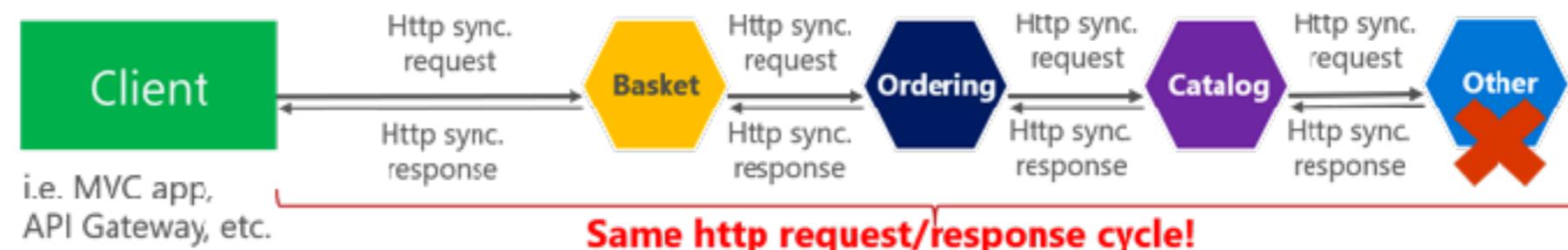


Communication !!

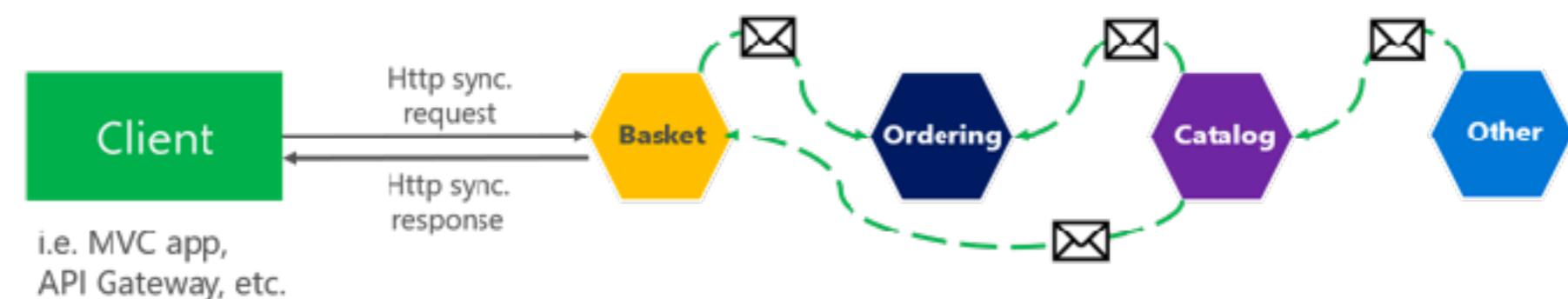
Synchronous vs. async communication across microservices

Anti-pattern

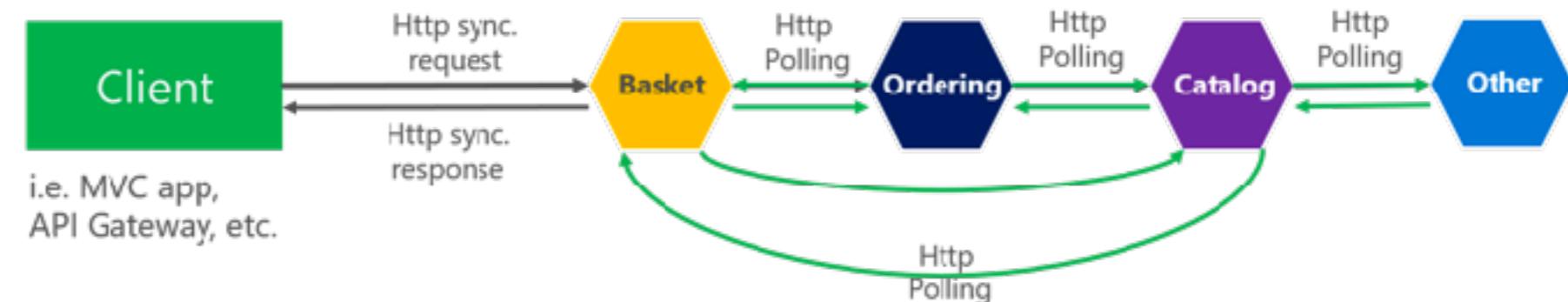
Synchronous
all req./resp. cycle



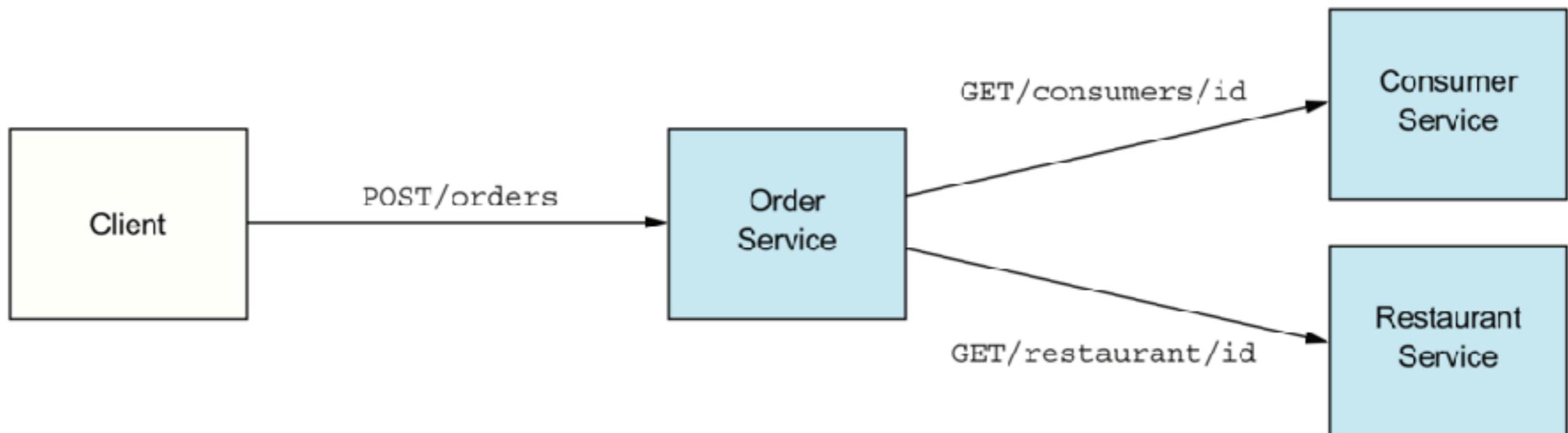
Asynchronous
Comm. across
internal microservices
(EventBus: i.e. **AMQP**)



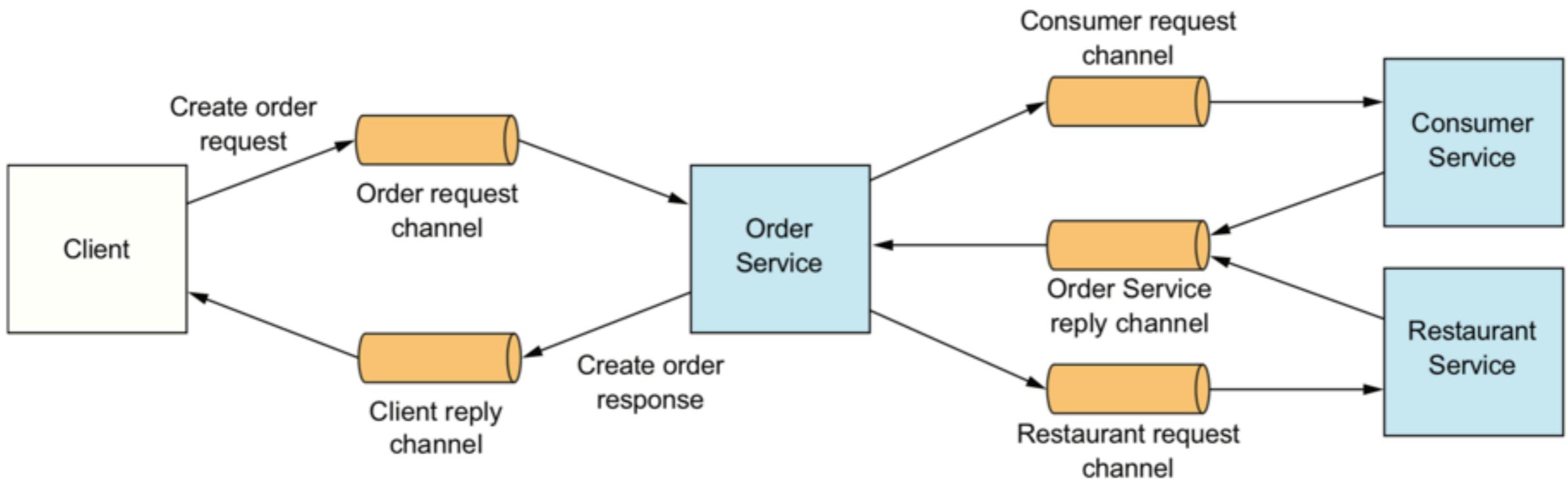
"Asynchronous"
Comm. across
internal microservices
(Polling: **Http**)



Synchronous reduce availability



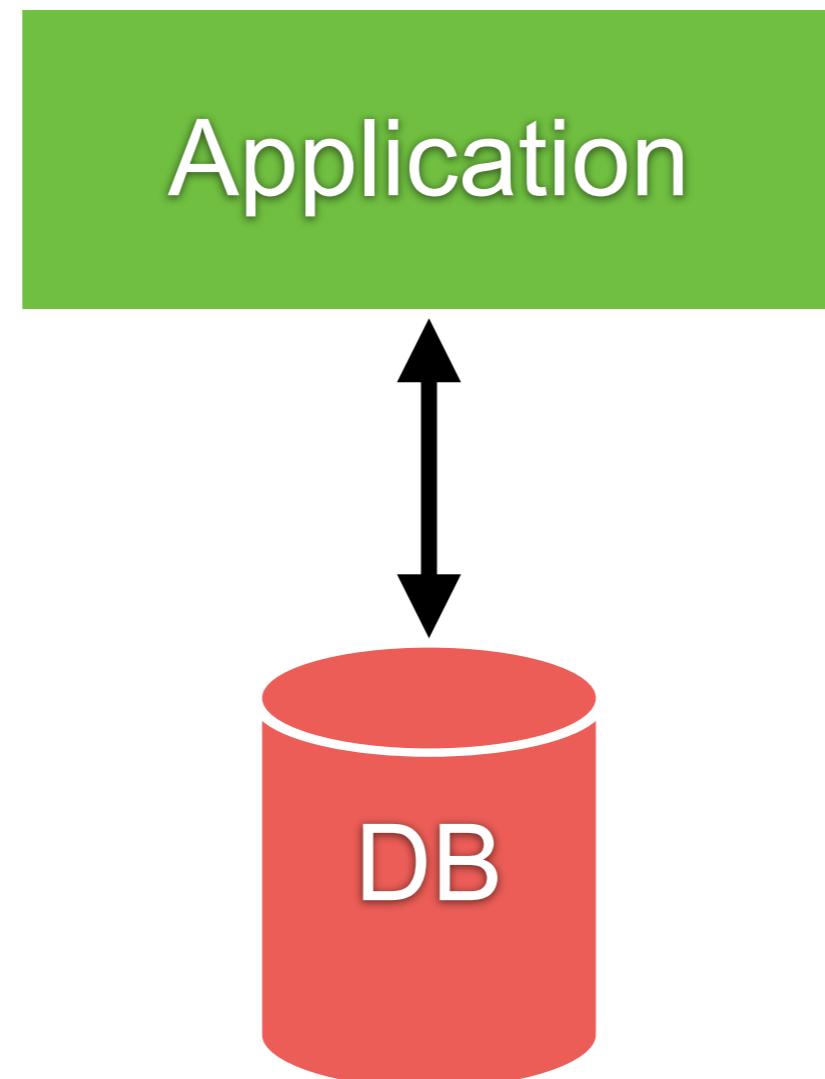
Replace with asynchronous



Manage Data Consistency

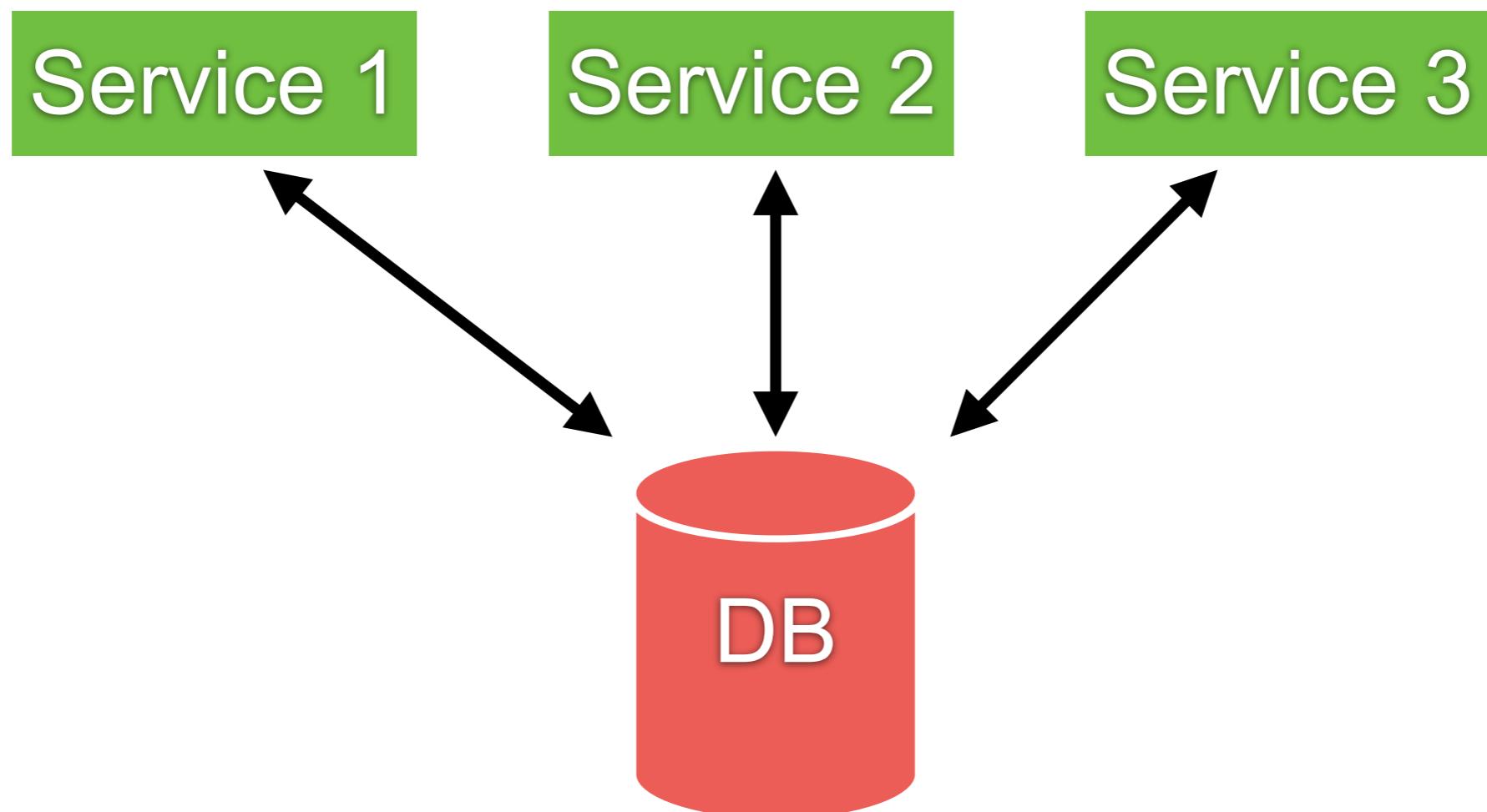


Monolithic



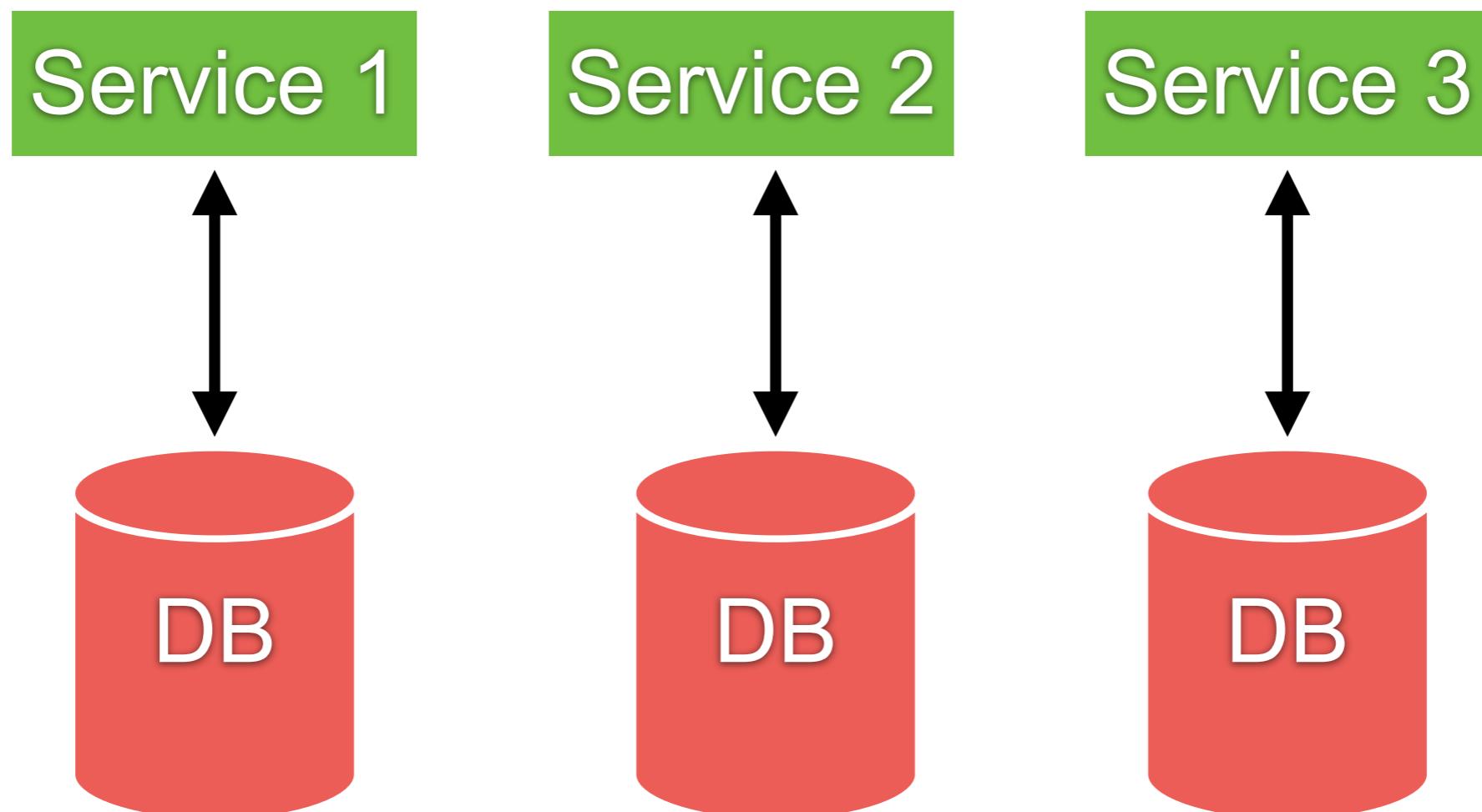
Microservices

Shared database

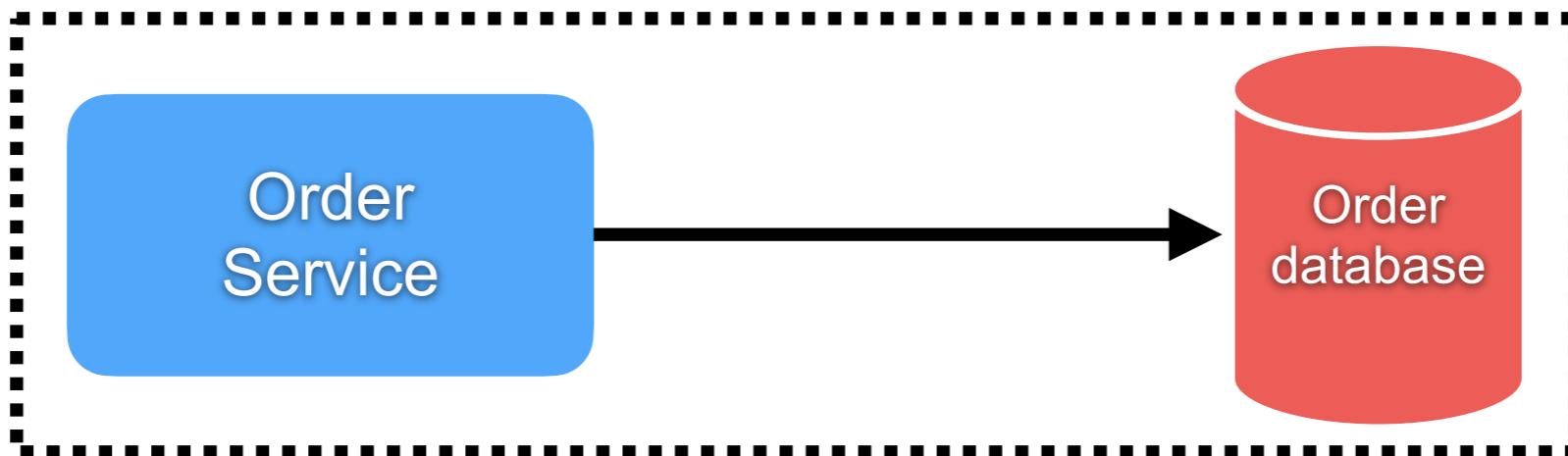


Microservices

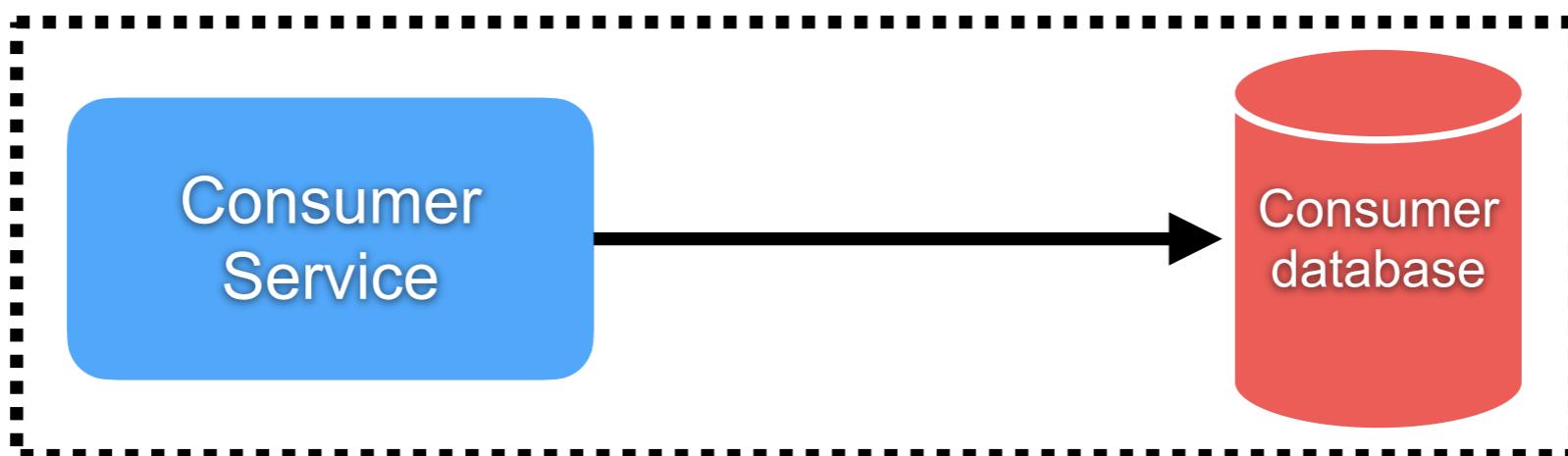
Database per service



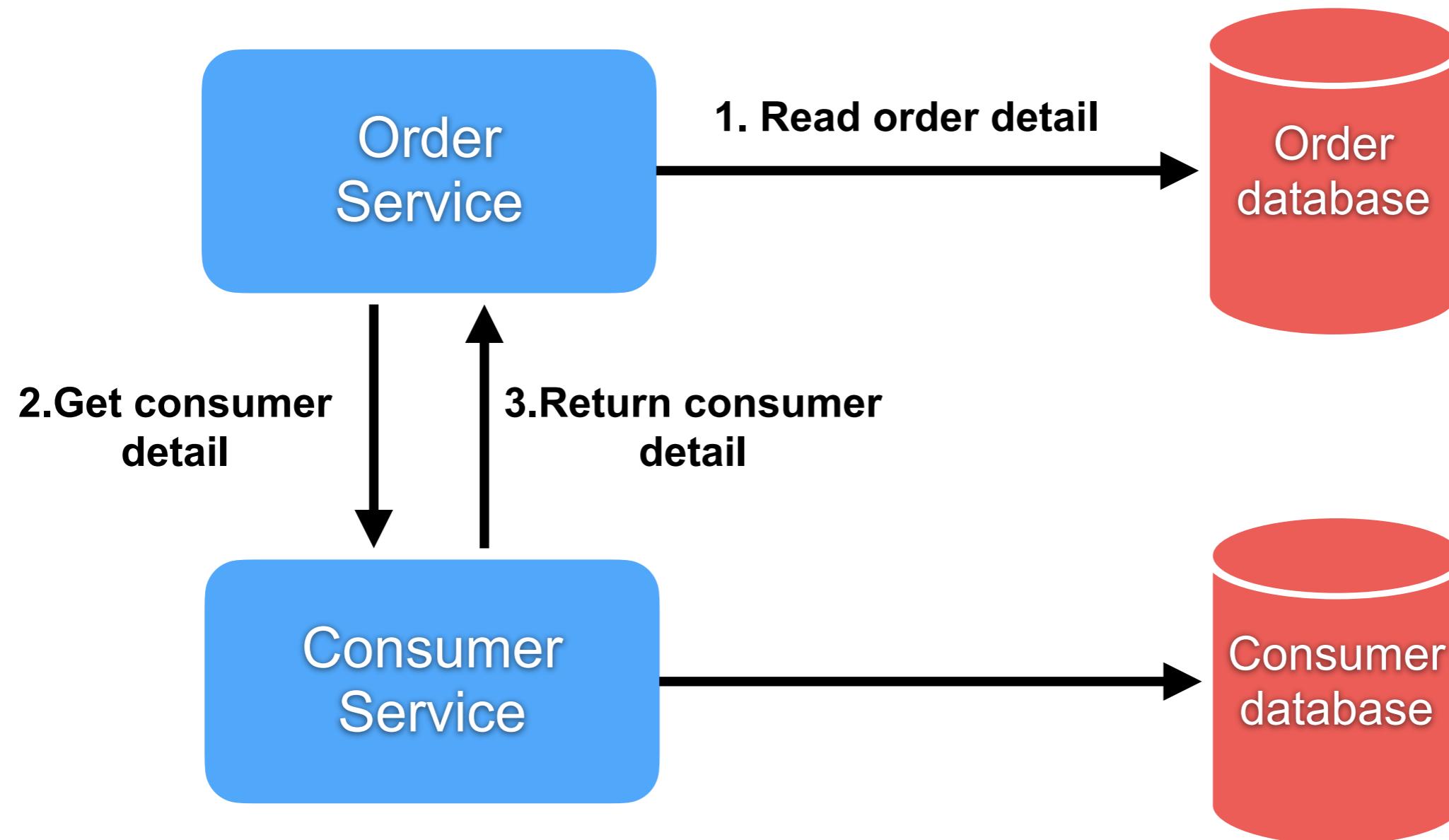
Database per service



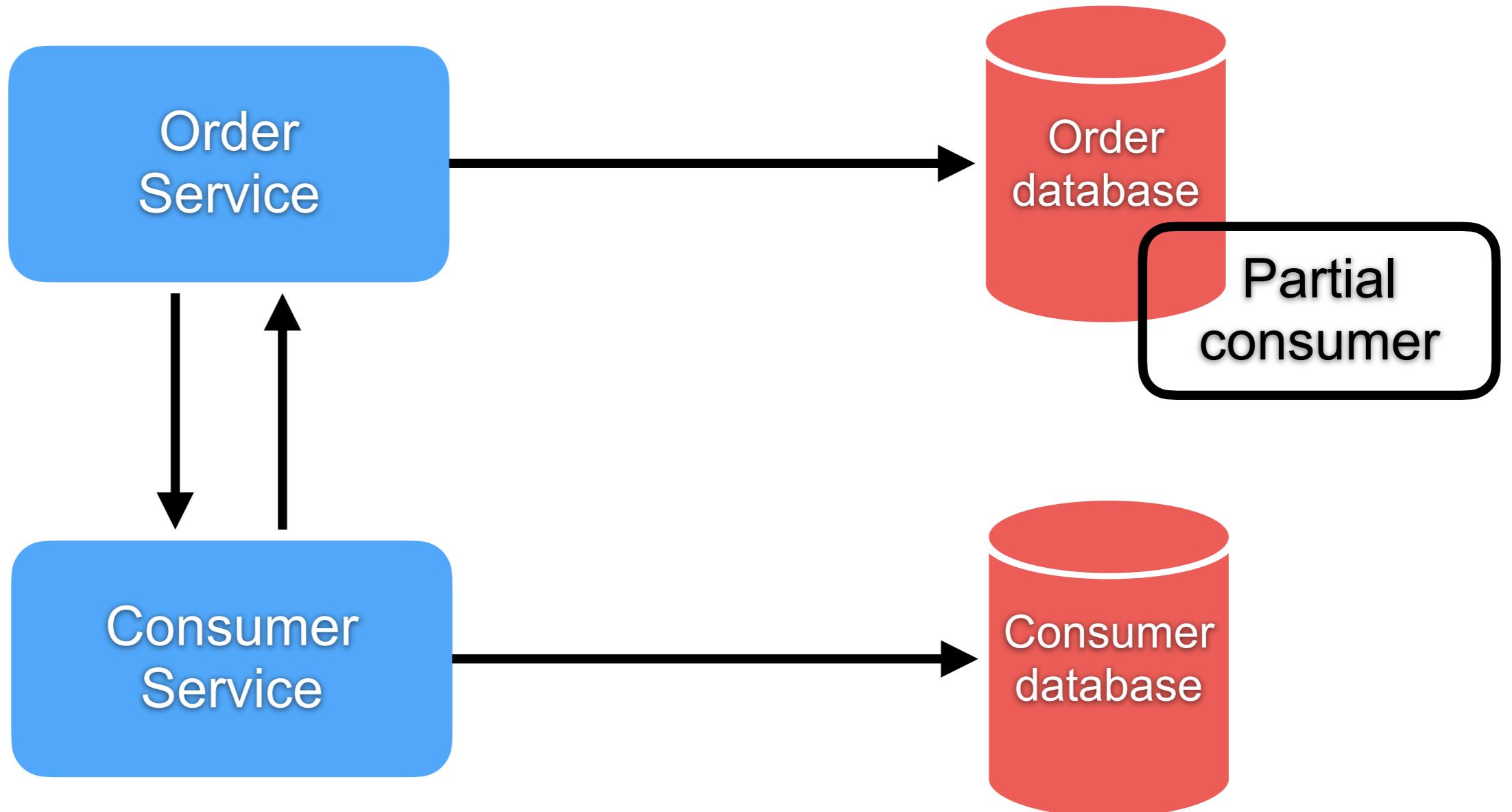
Strong Boundary



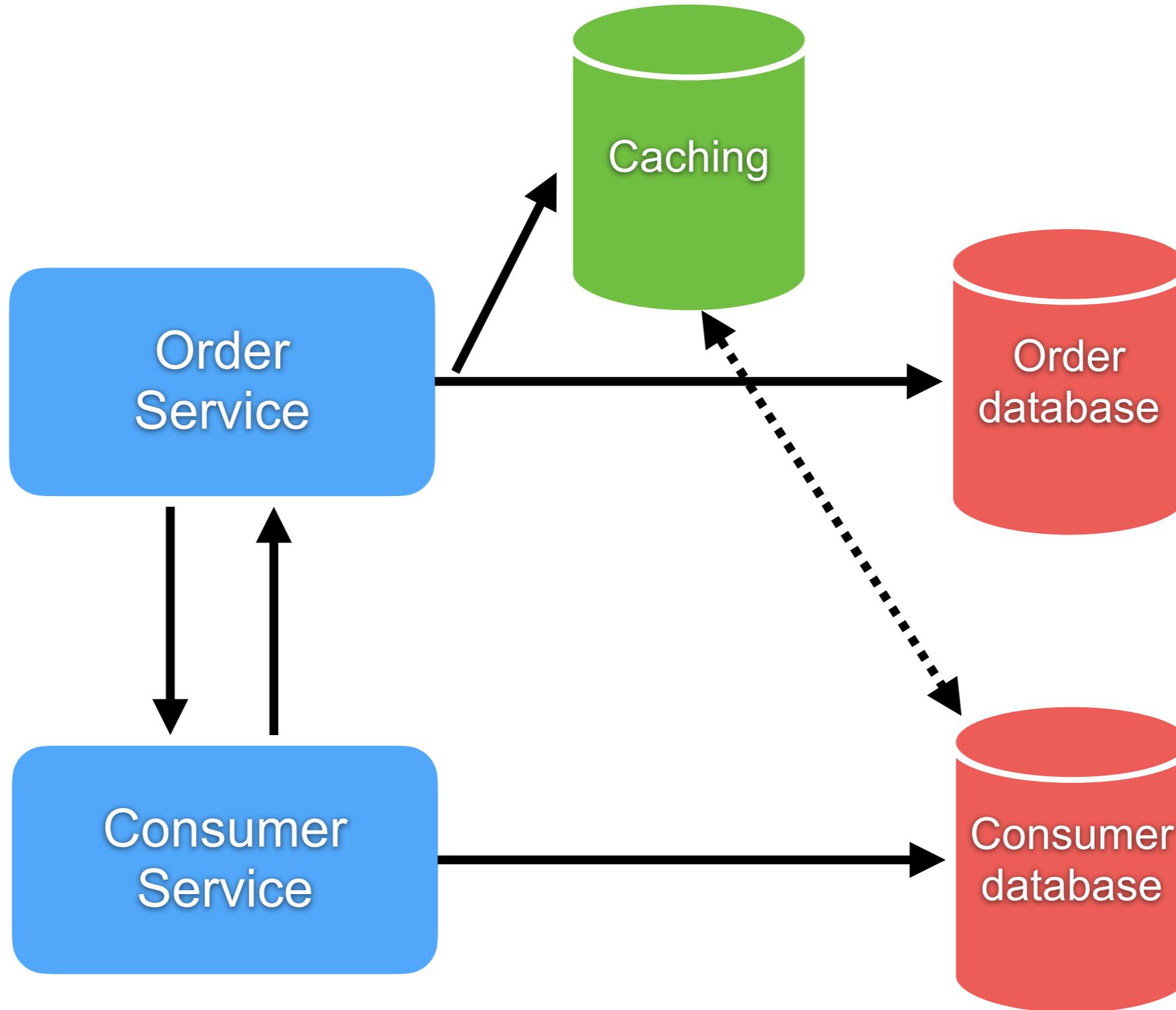
Loose coupling = encapsulation data



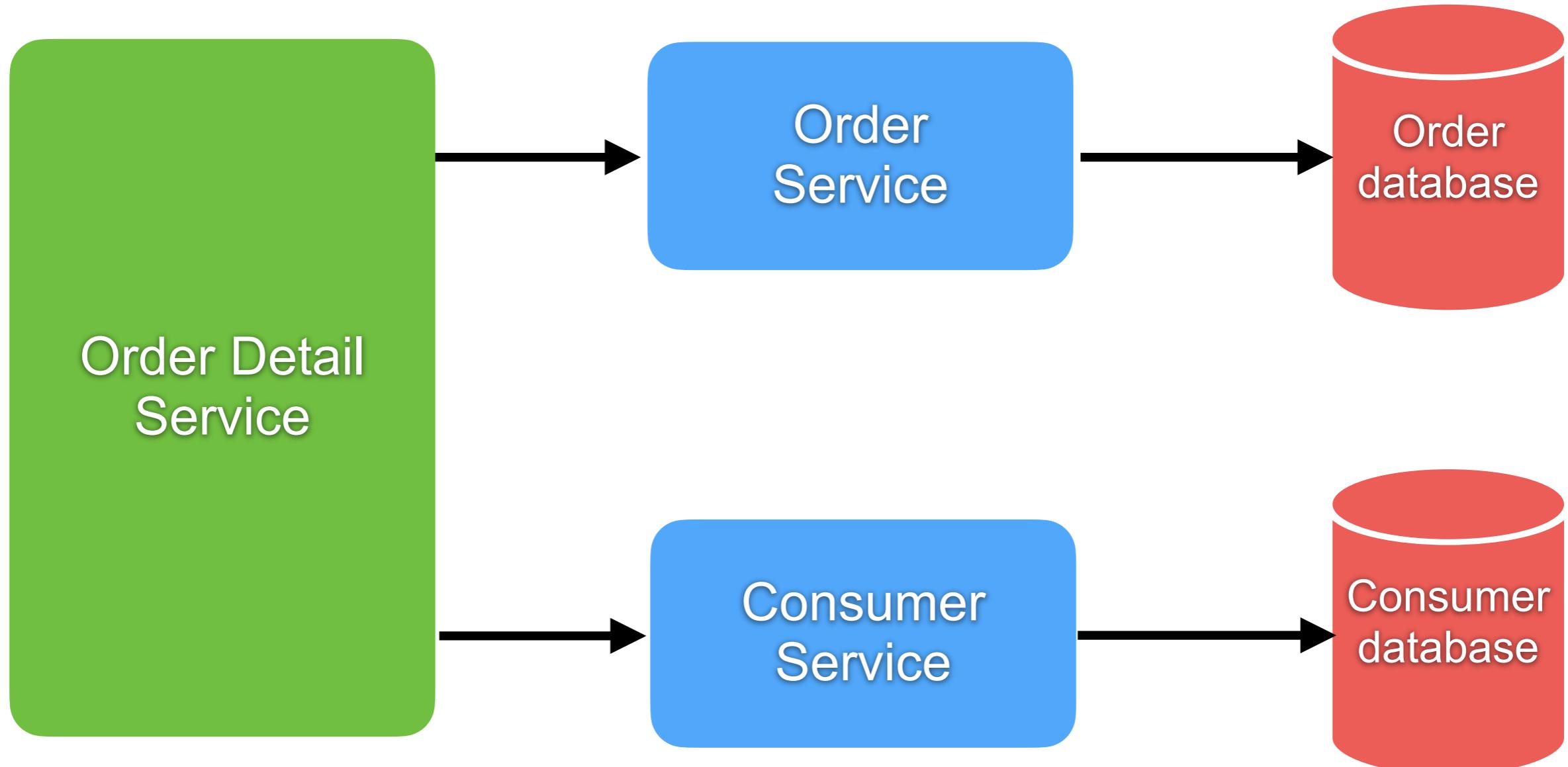
Store partial data



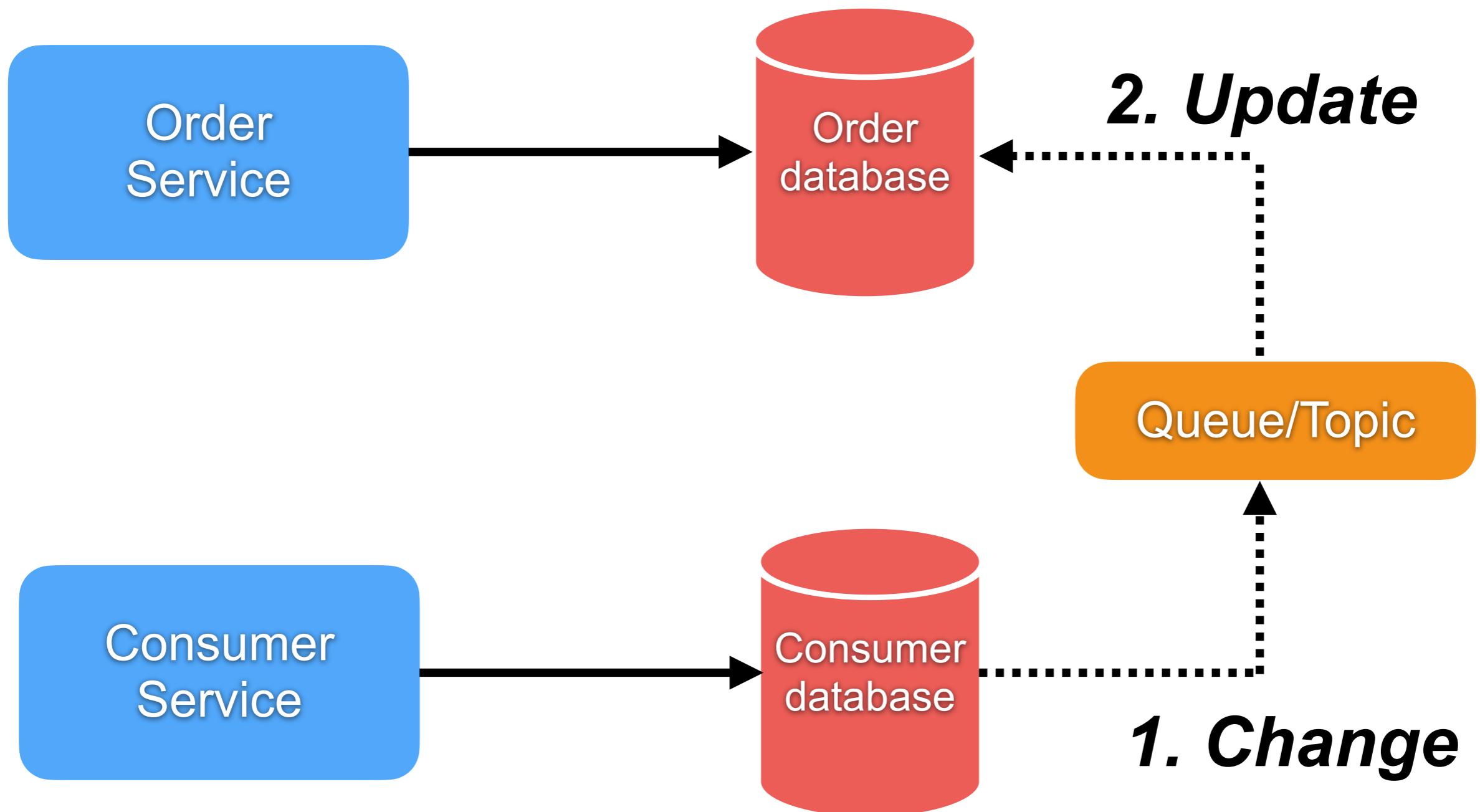
Caching data



Order detail orchestration service



Use messaging to shared data



Database per service

High complexity

Query data across multiple databases

Challenge “How to join data ?”

Maintain database consistency

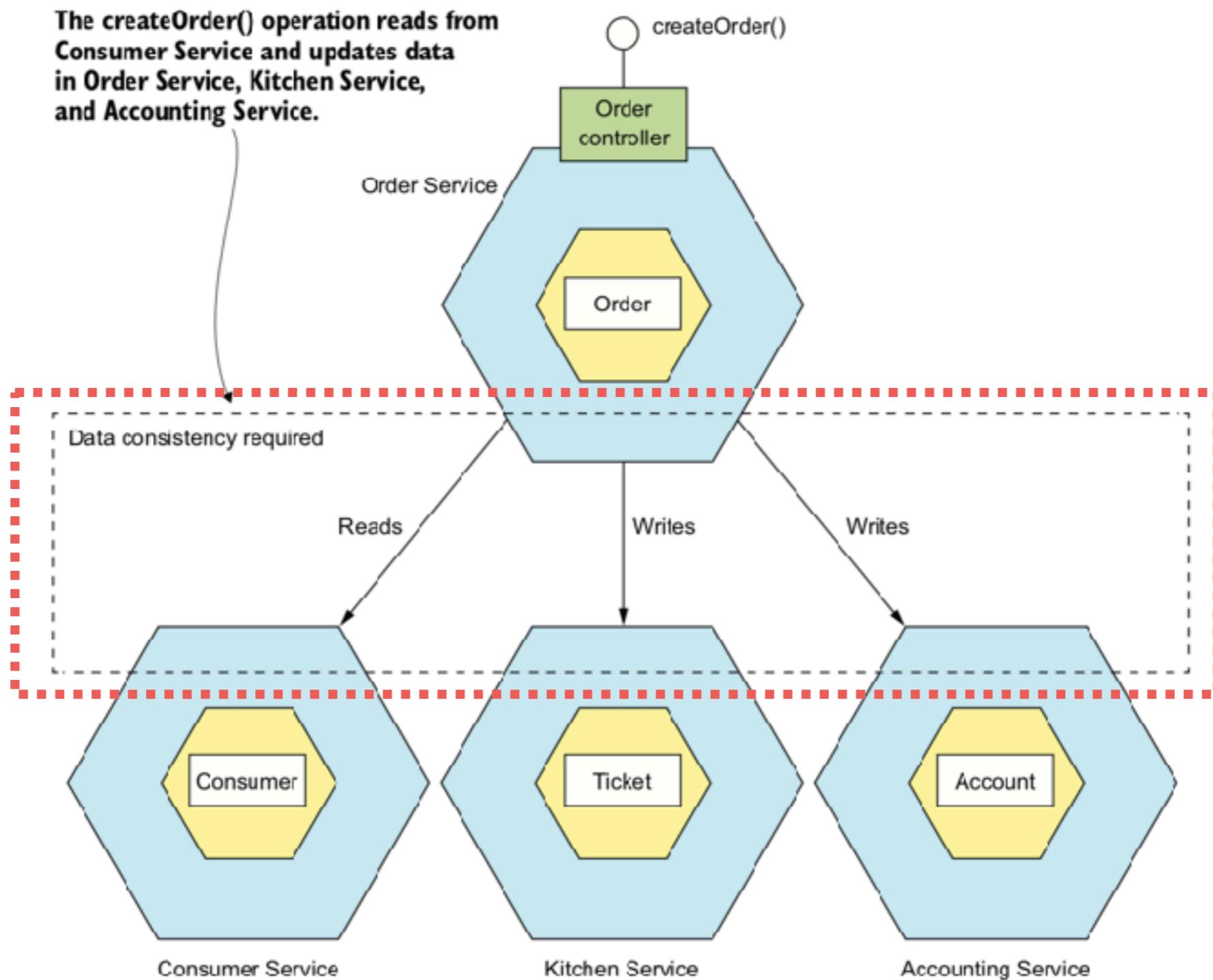


Manage transaction ?

Manage data consistency ?



Distributed process failure !!



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



A - Atomicity

All or Nothing Transactions

C - Consistency

Guarantees Committed Transaction State

I - Isolation

Transactions are Independent

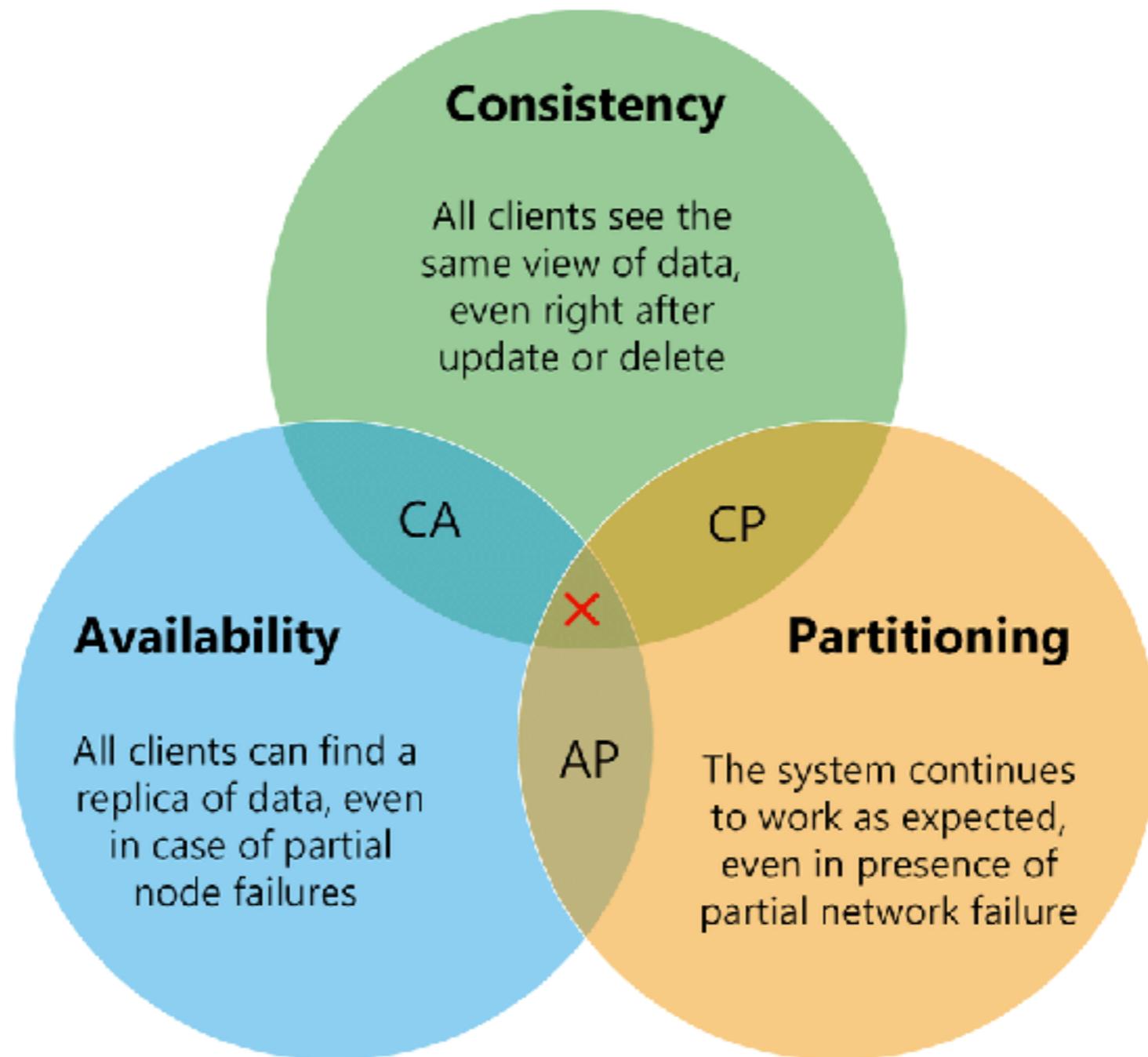
D – Durability

Committed Data is Never Lost

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



CAP Theorem



BASE

Basic Available
Soft state
Eventually consistent



ACID vs BASE

ACID	BASE
Scale up (vertical)	Scale out (horizontal)
Strong consistency	Weak/Eventual consistency
Isolation	Last write win, availability first
Transaction	Application transaction
Fix schema	Flexible schema
Expensive joins and relations	Free



Distributed transaction

Common approach is Two-phase commit(2PC)

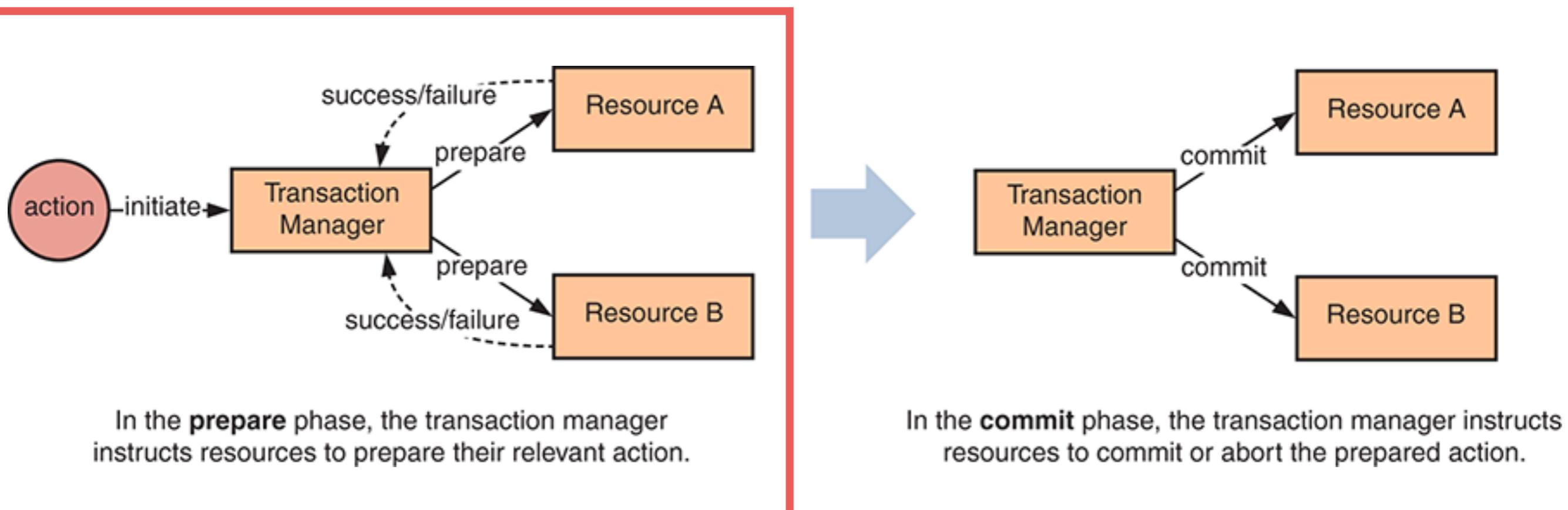
Use transaction manager to split operations across multiple resources in 2 phases

1. *Prepare*
2. *Commit*



Two-phase commit

Phase 1: prepare

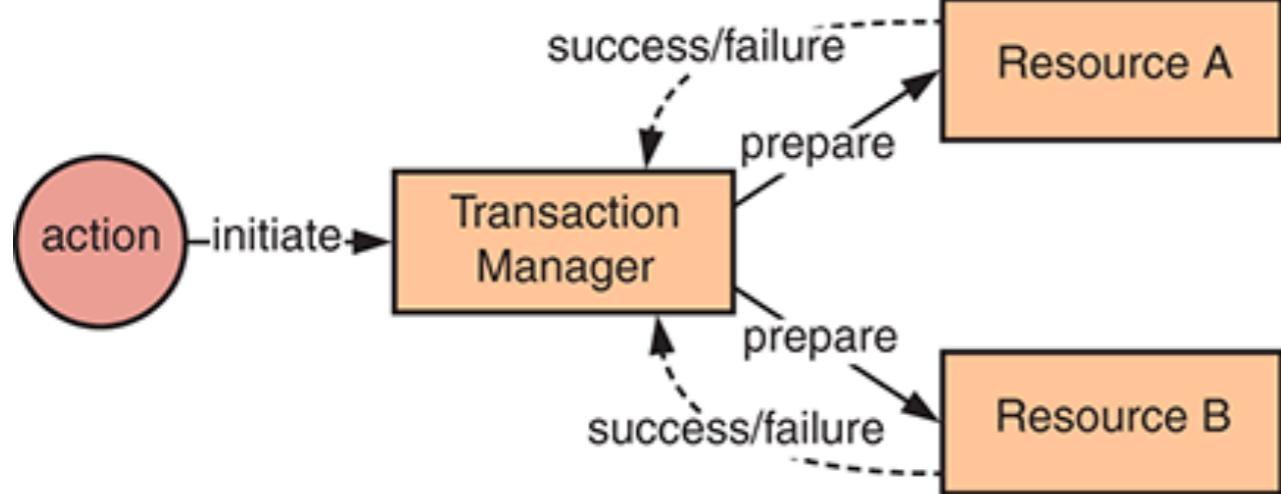


https://en.wikipedia.org/wiki/Two-phase_commit_protocol

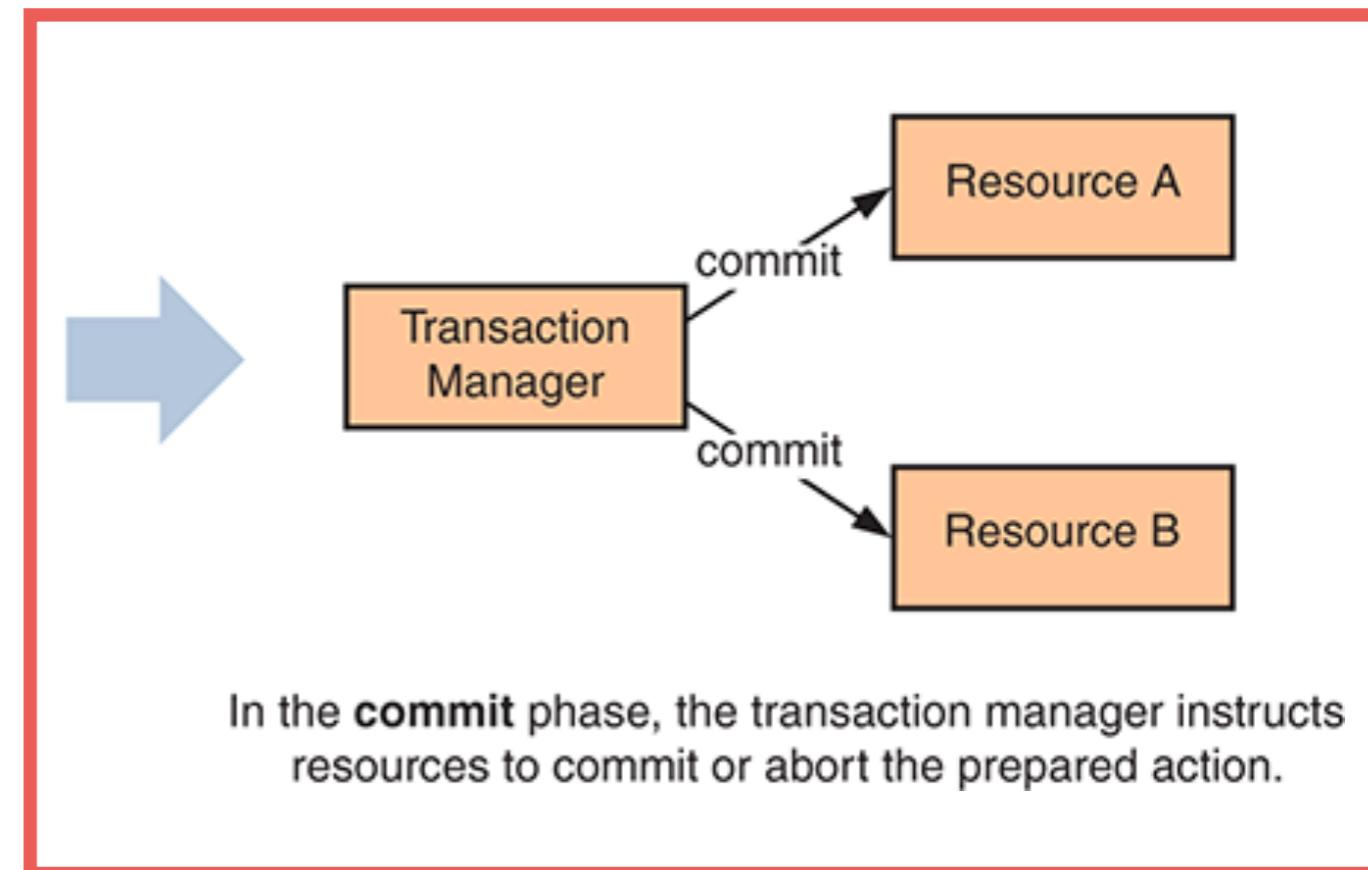


Two-phase commit

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

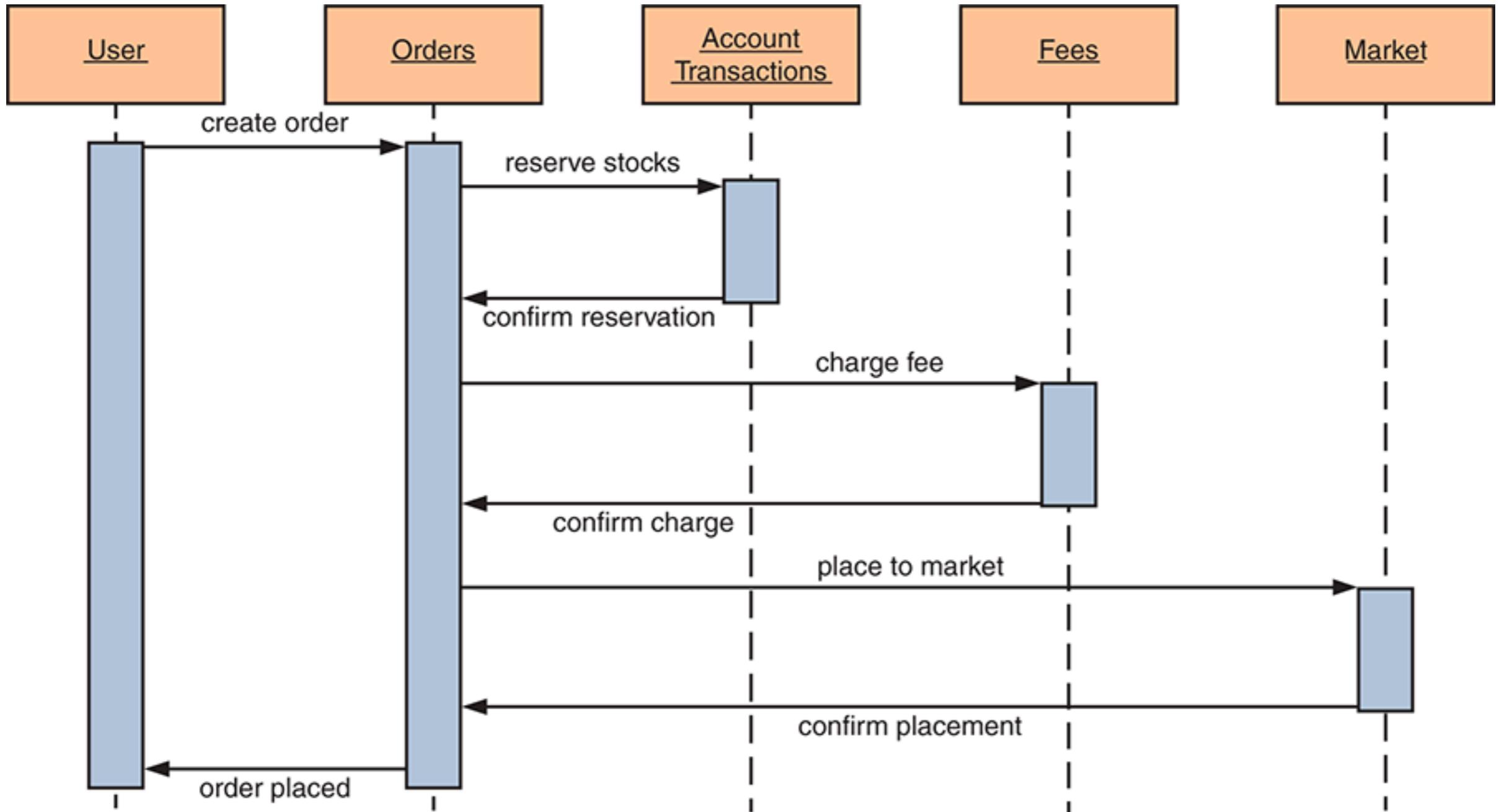


We need ...

Don't need distributed transaction
Reduce complexity of code
Reliable



Synchronous process

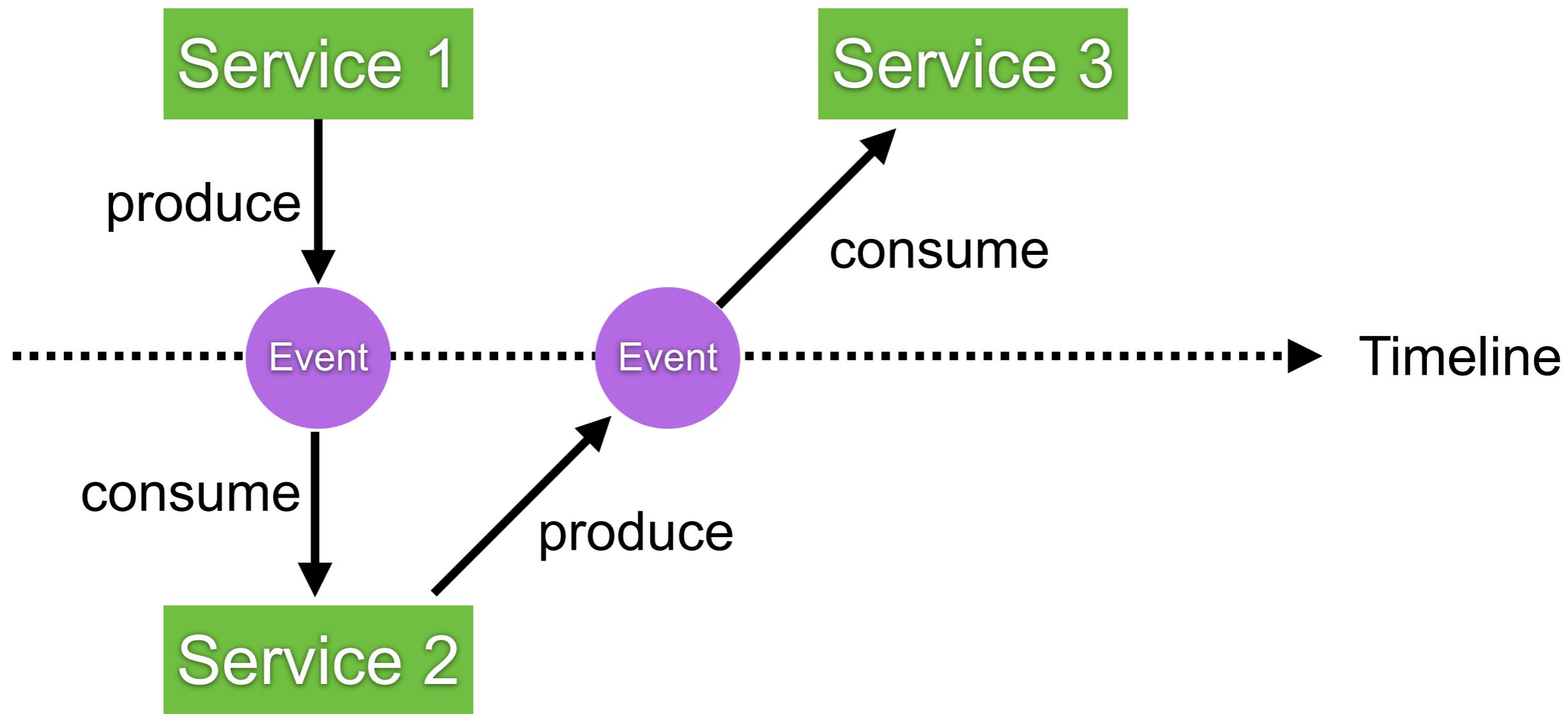


Event-Driven communication



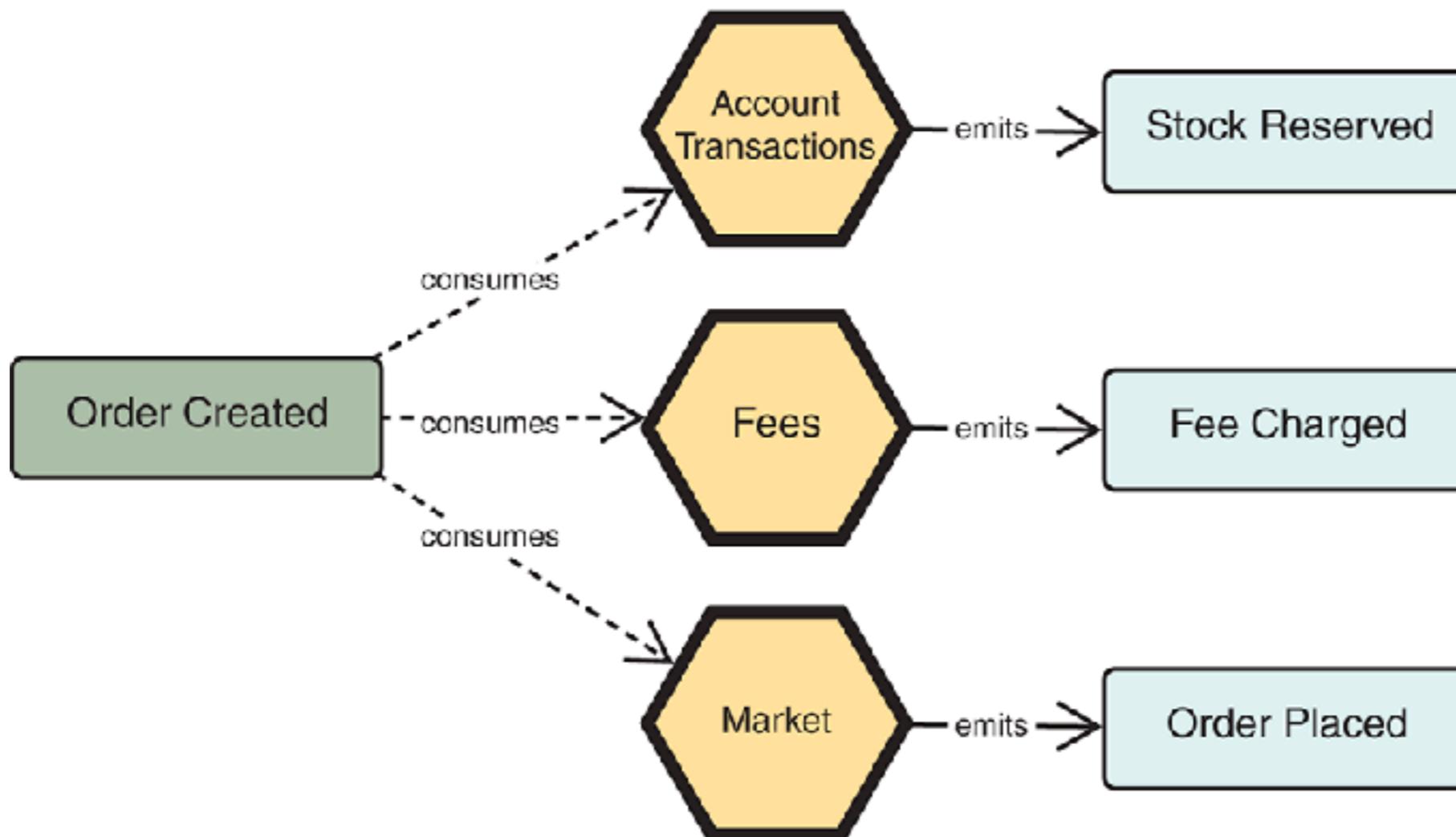
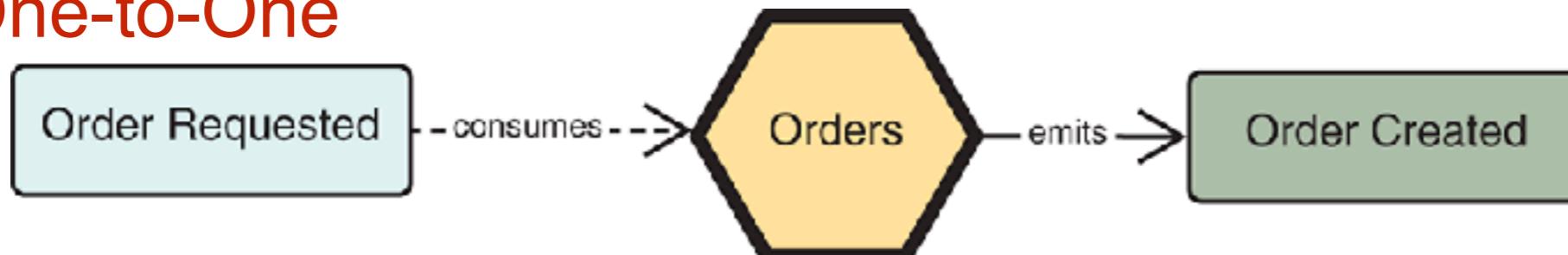
Choreography pattern

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

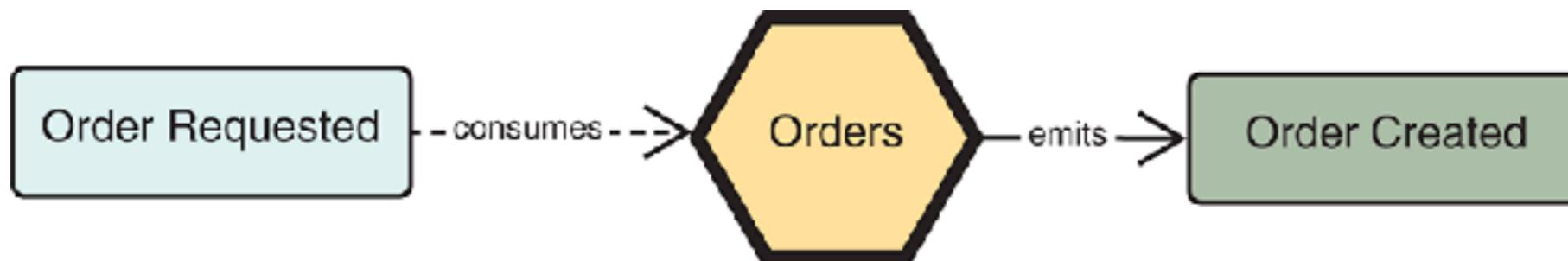


Service consume and emit event

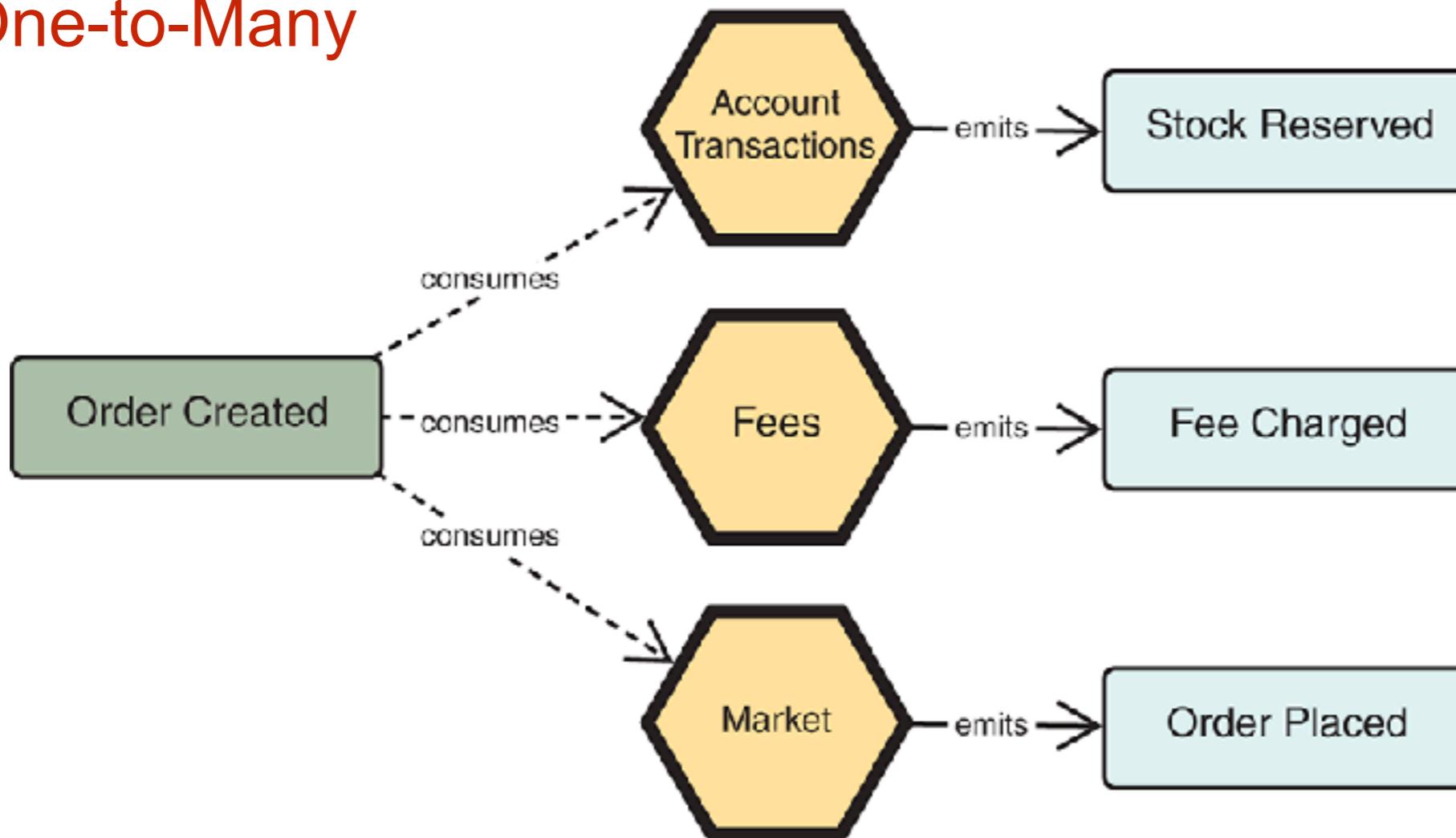
One-to-One



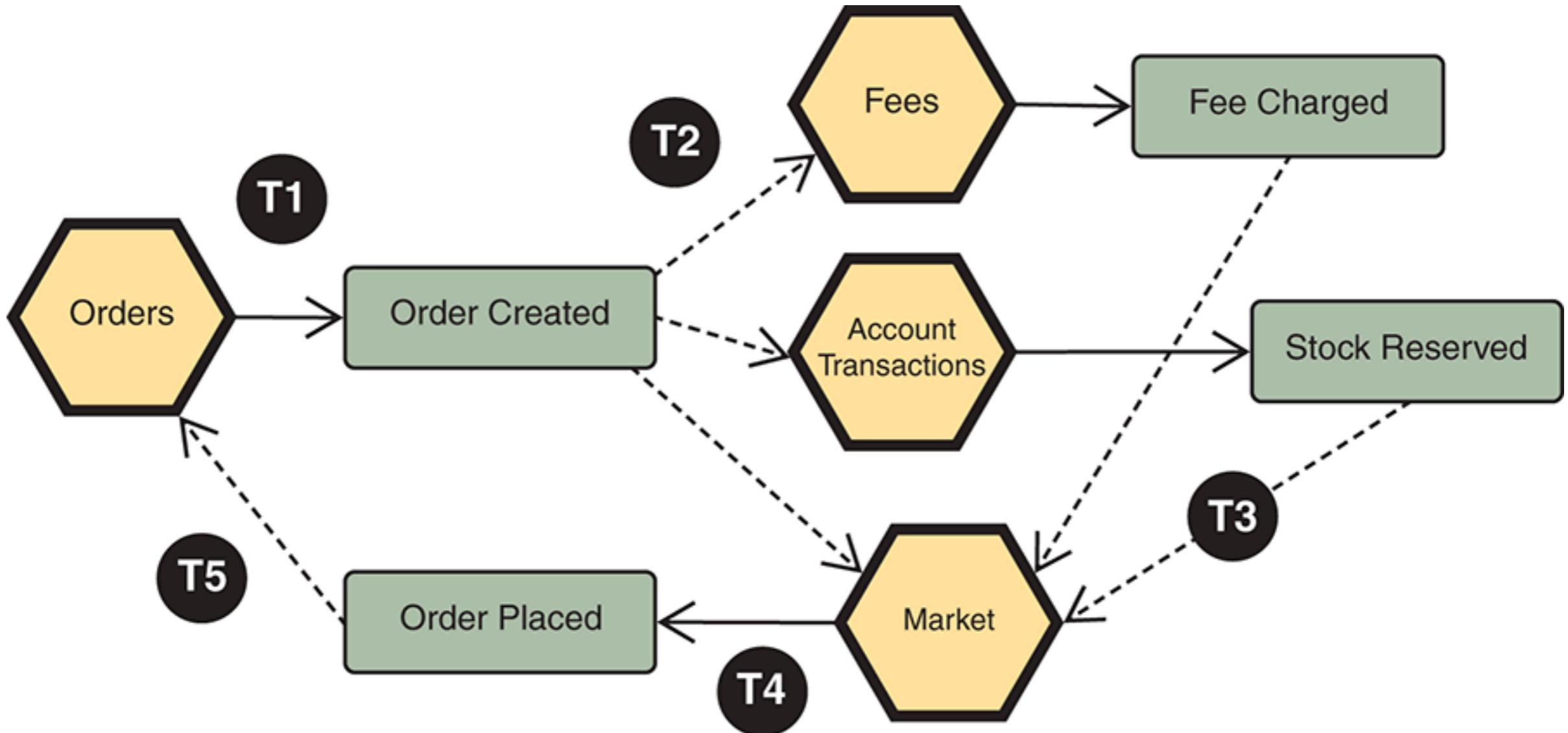
Service consume and emit event



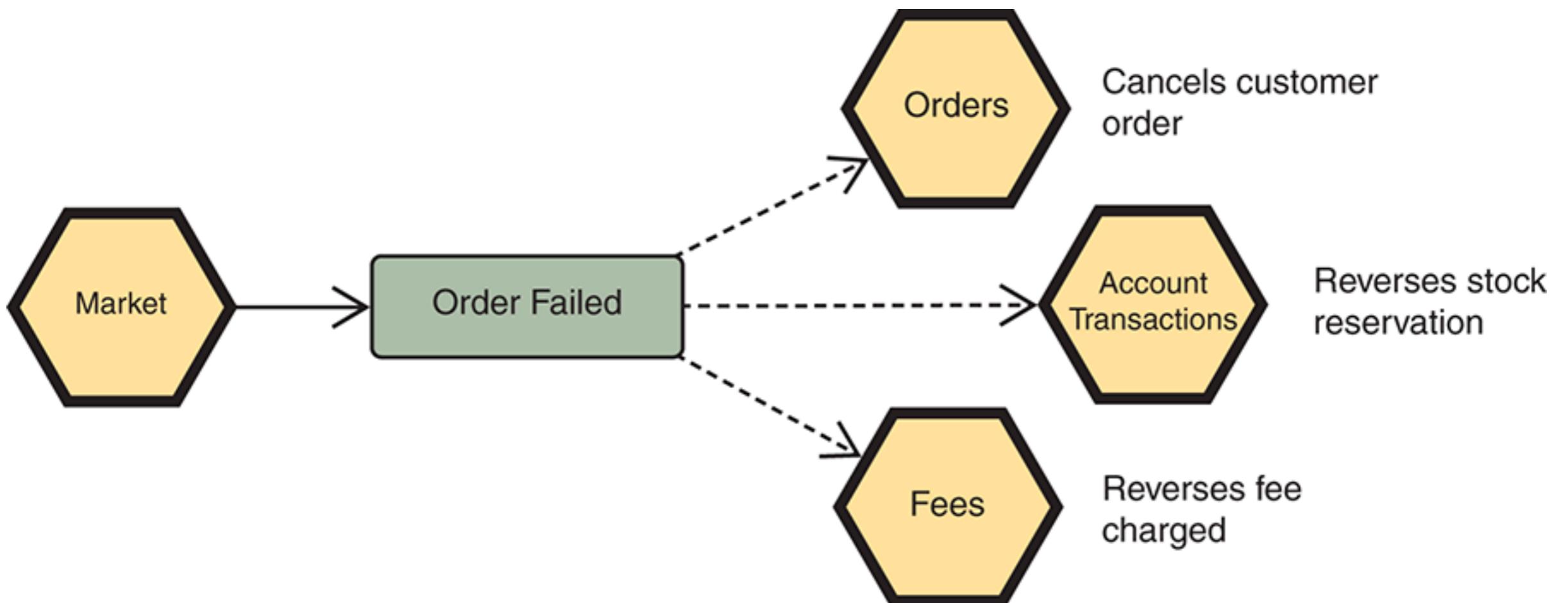
One-to-Many



Example (Success)

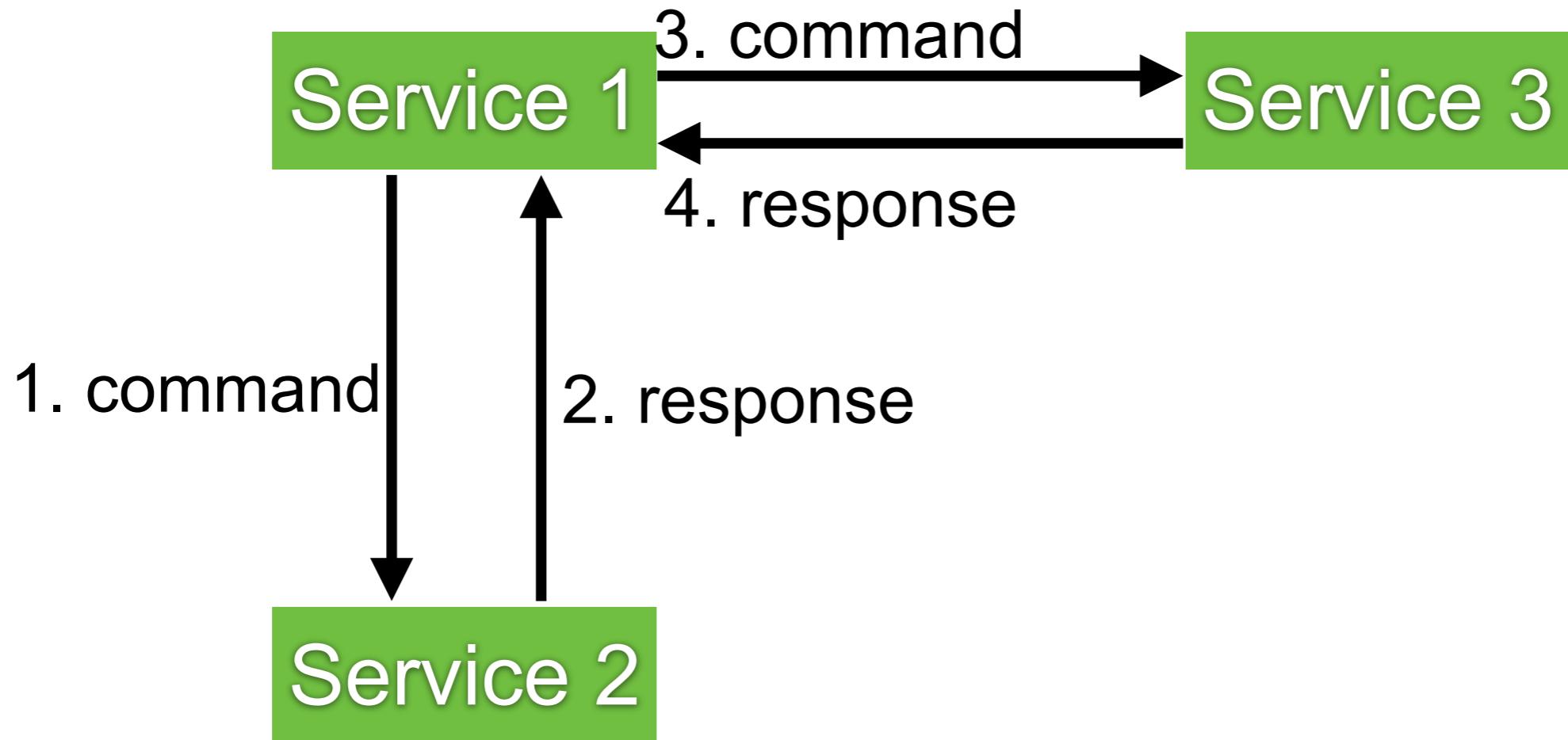


Example (Fail)

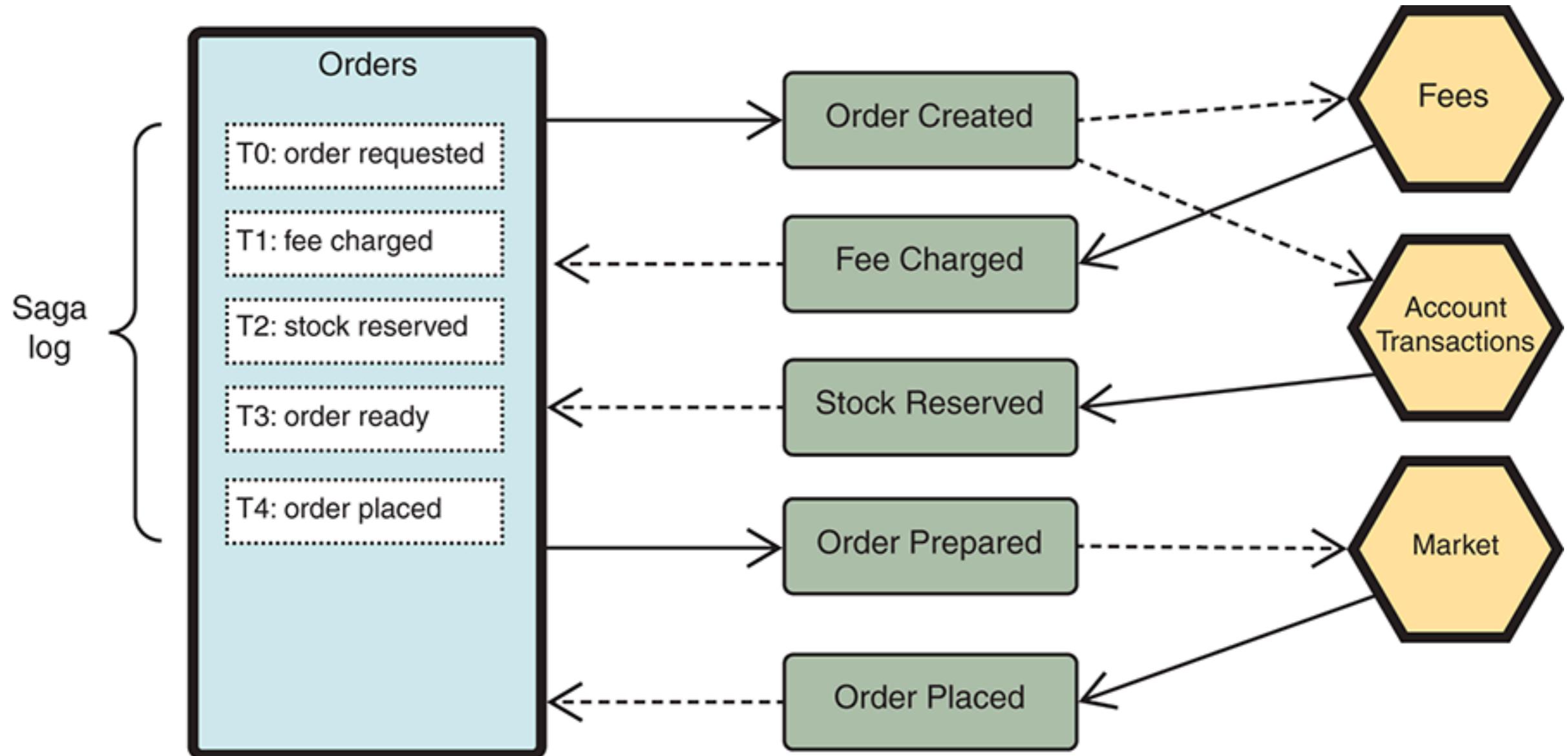


Orchestrate pattern

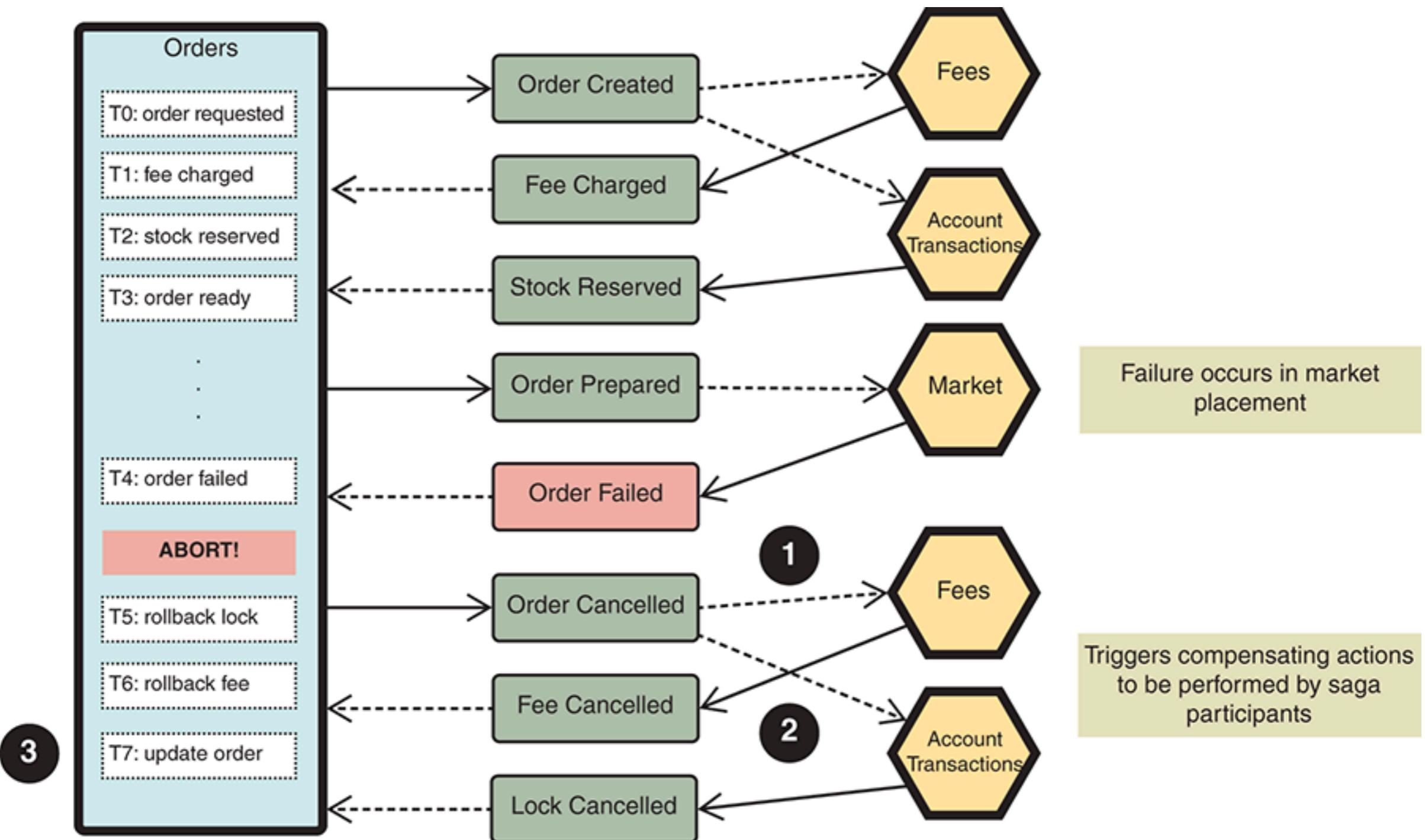
Sequence of Tx and emit **event** or **message** that trigger the next process in Tx



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

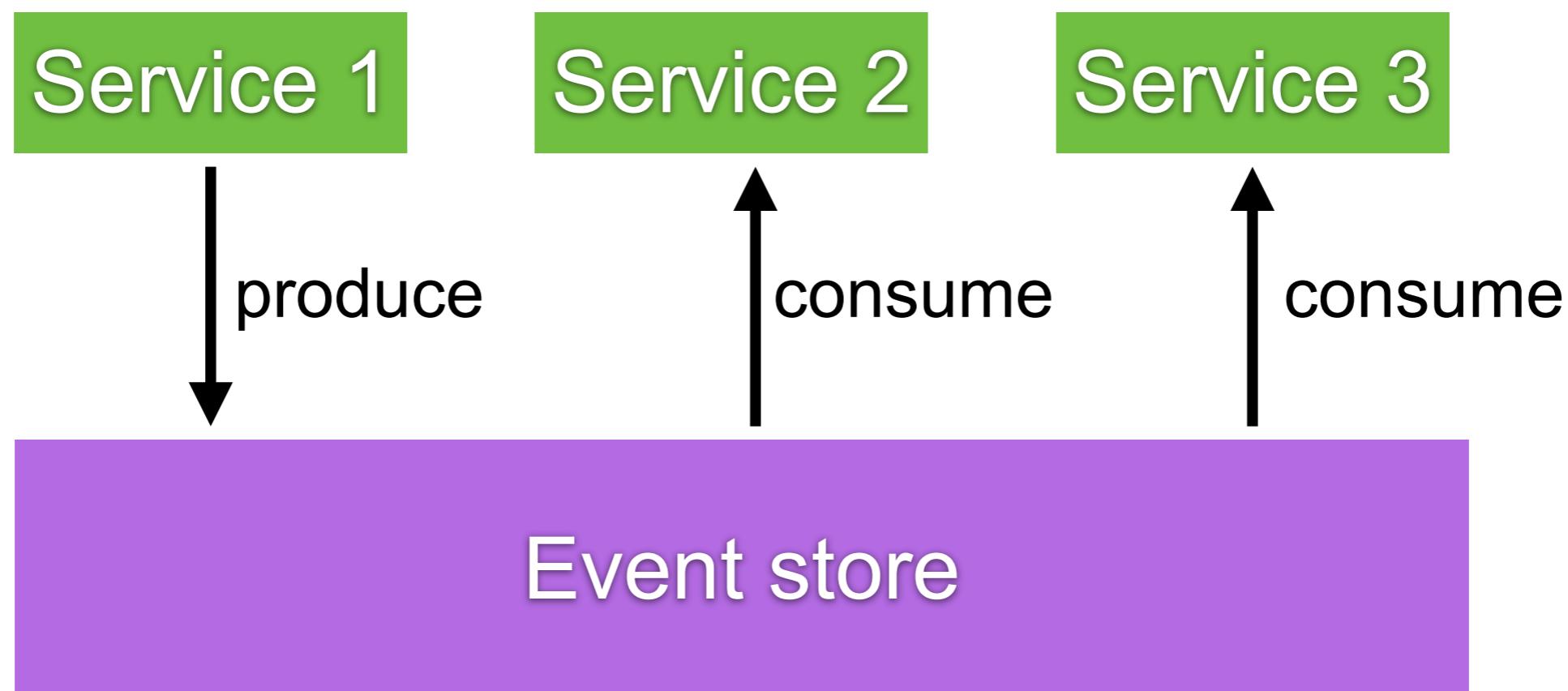


Sequence of event is keep in **Event store**



Event store

Keep events in order
Broadcast new event

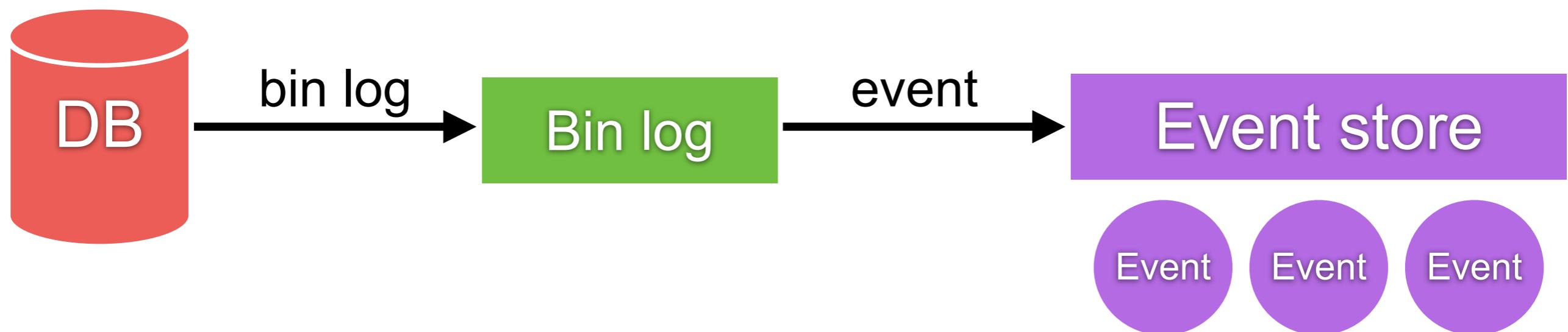


**With Event sourcing, we can
decouple services (query and
command)**



Event sourcing with database

Working with database



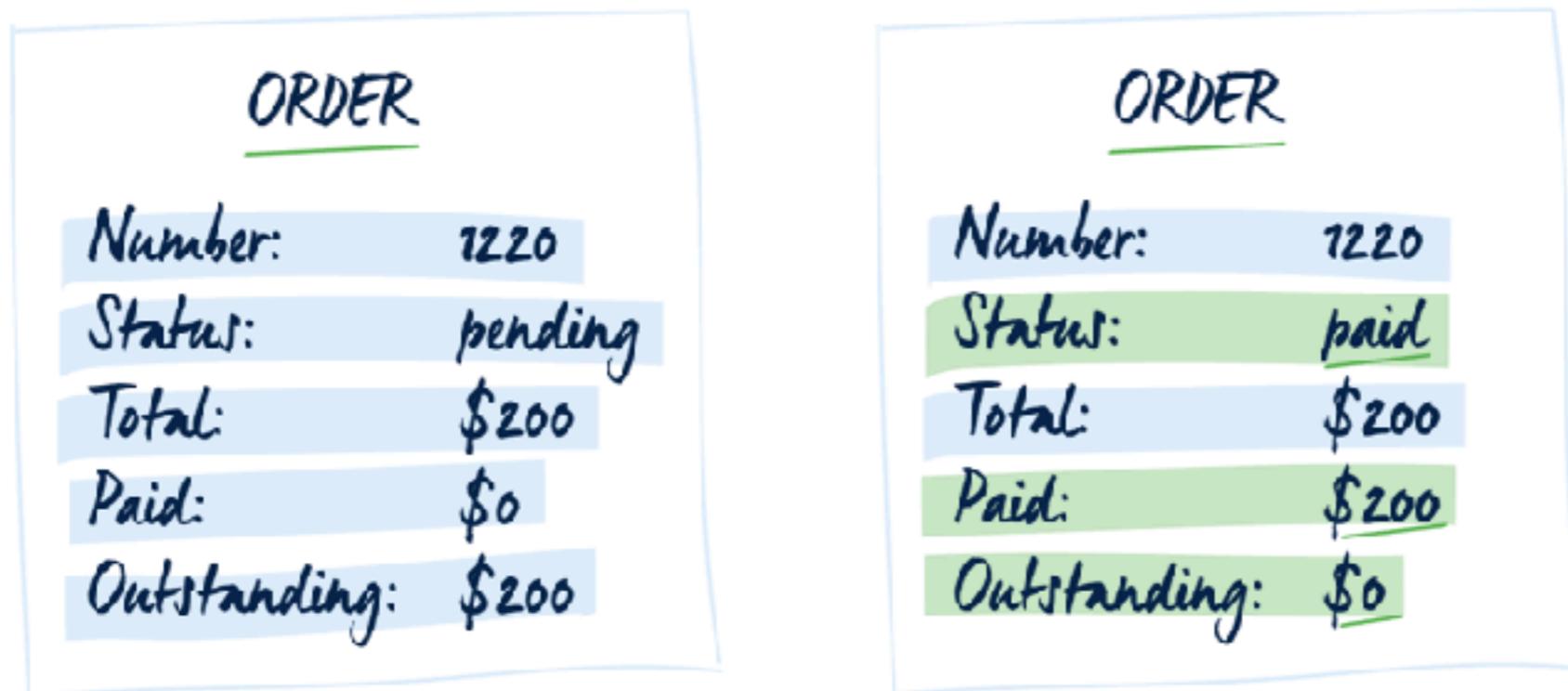
Binlog or Binary log event is information about data modification made to database



Example of Events



Order payment



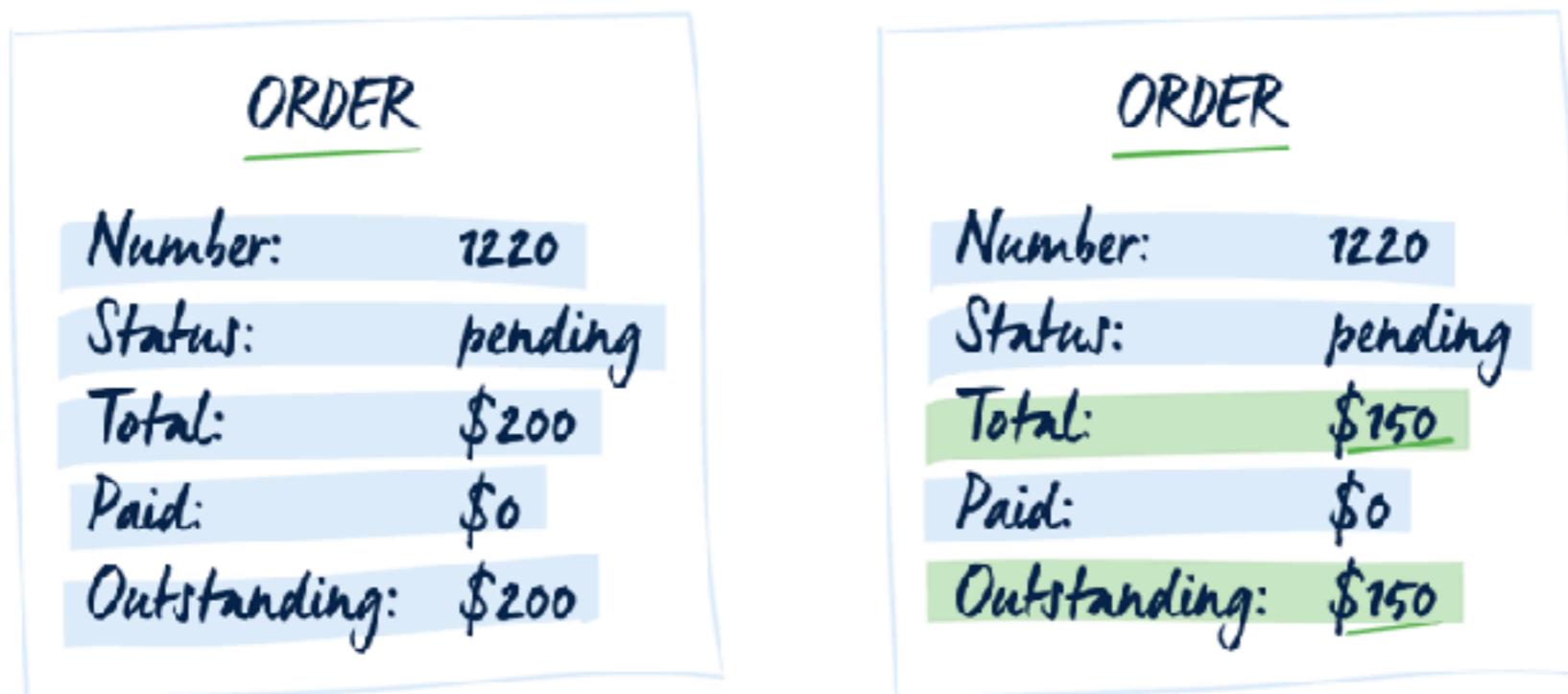
Order Payment Received

Order number: 1220
Payment amount: 200
Currency: USD

<https://www.eventstore.com/event-sourcing>



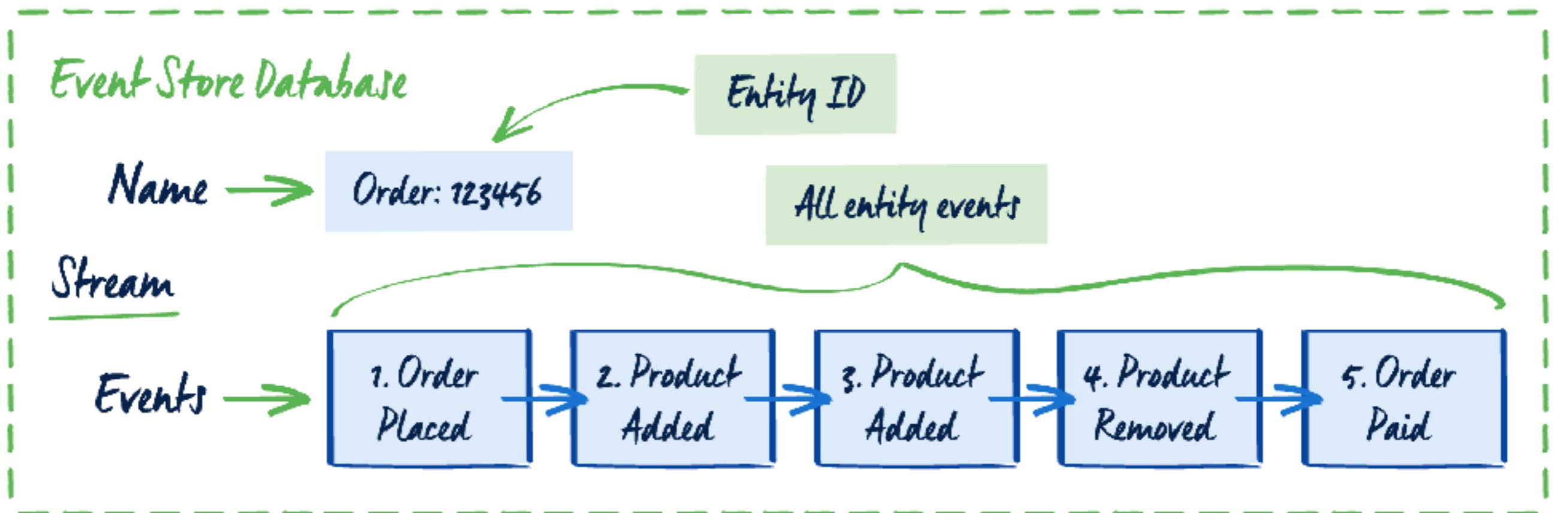
Apply discount



<https://www.eventstore.com/event-sourcing>



Event sourcing



<https://www.eventstore.com/event-sourcing>



How to implement queries data ?



Query data from multiple services

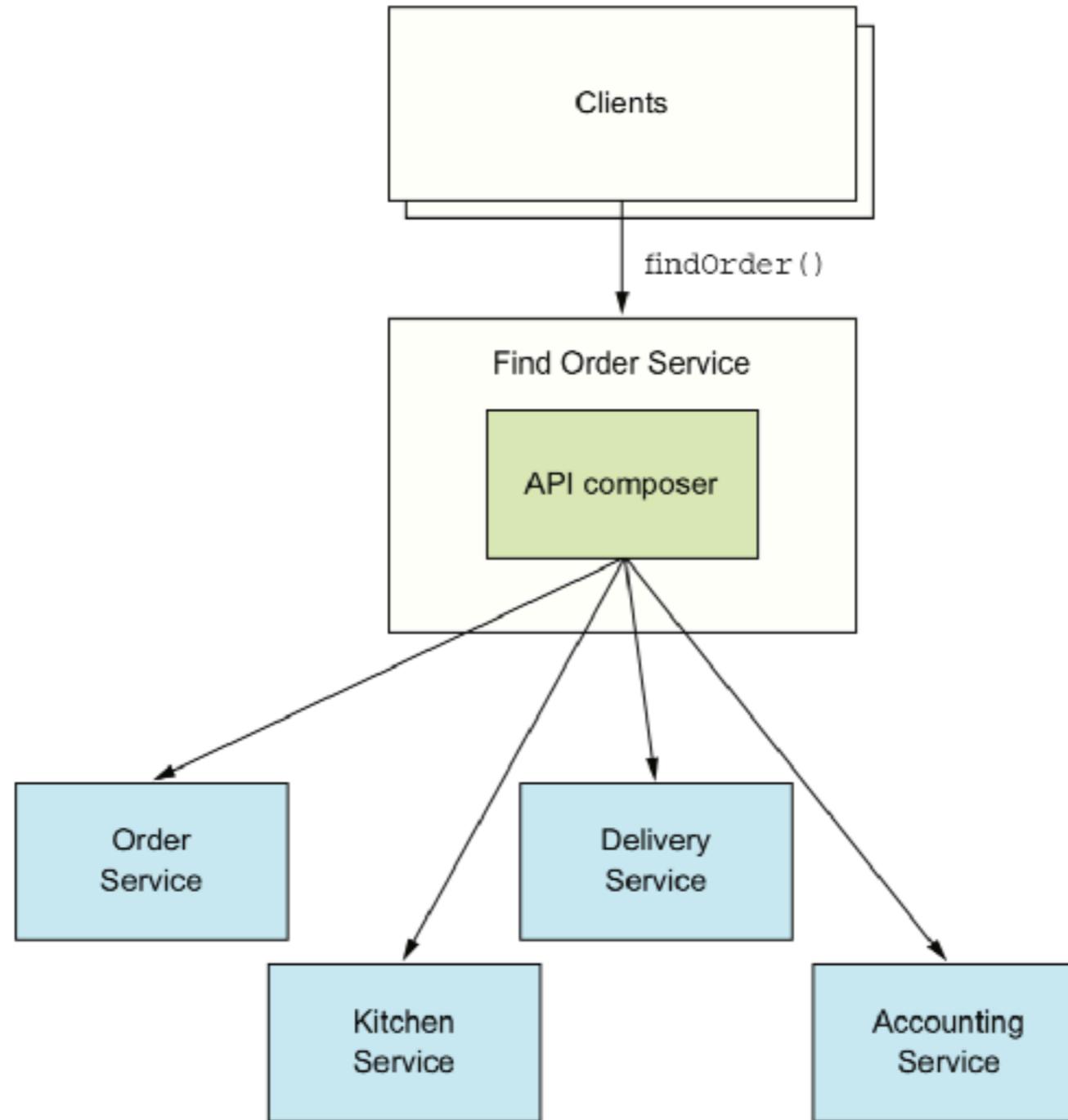
API composition

Cold data from services

CQRS (Command Query Responsibility Segregation)



API composition pattern



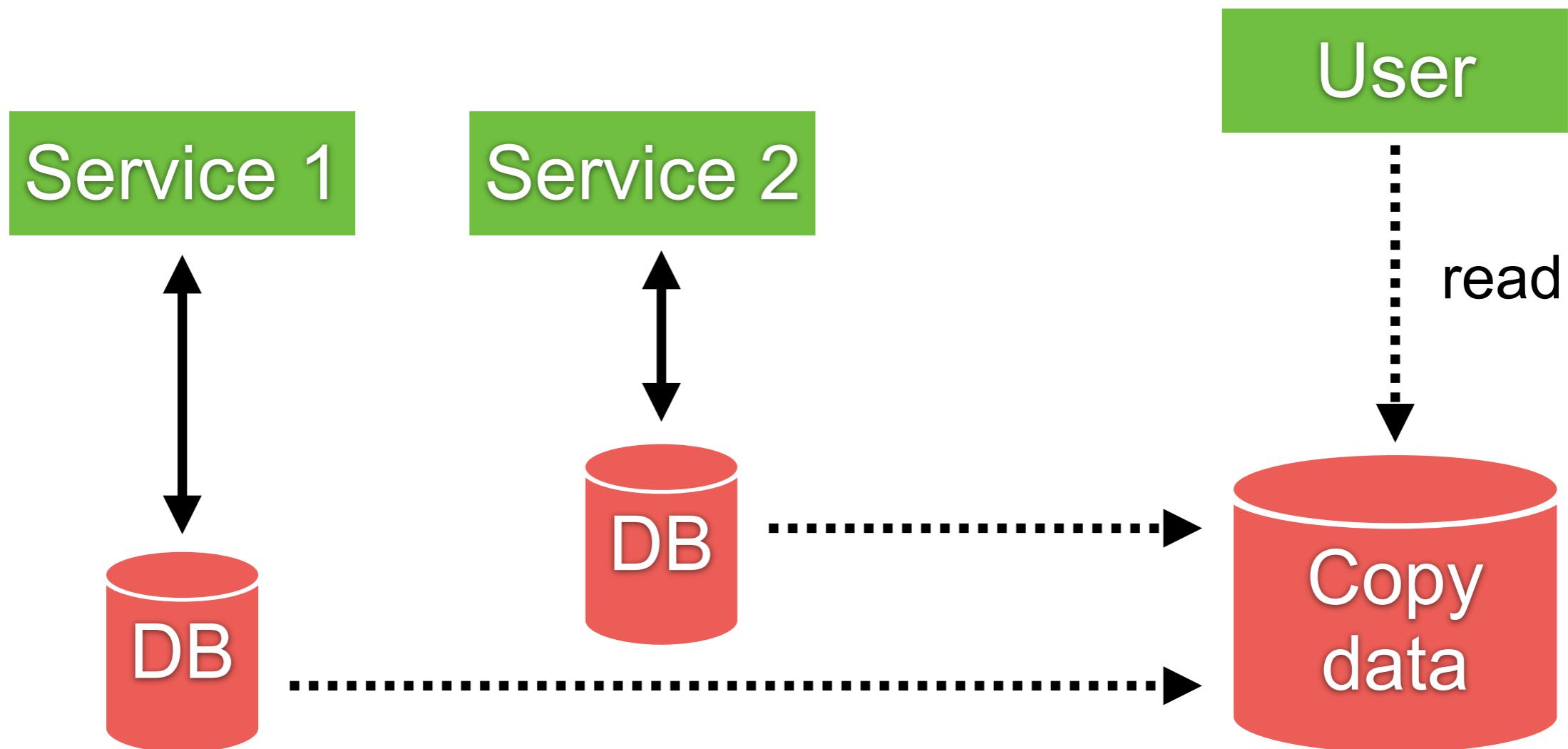
Drawbacks

Increase overhead
Lack of transactional data consistency
Reduce availability



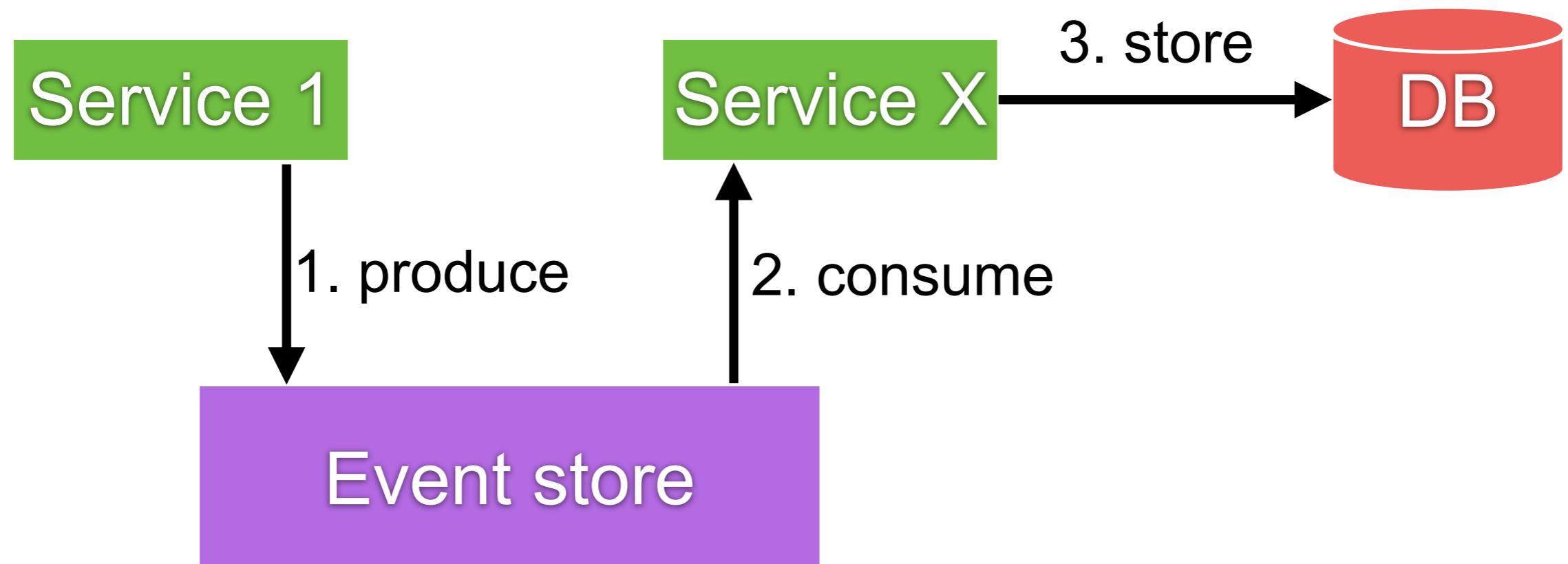
Storing copy data

Copy or caching data to other database



Working with Event-based

Publish event to store copy data

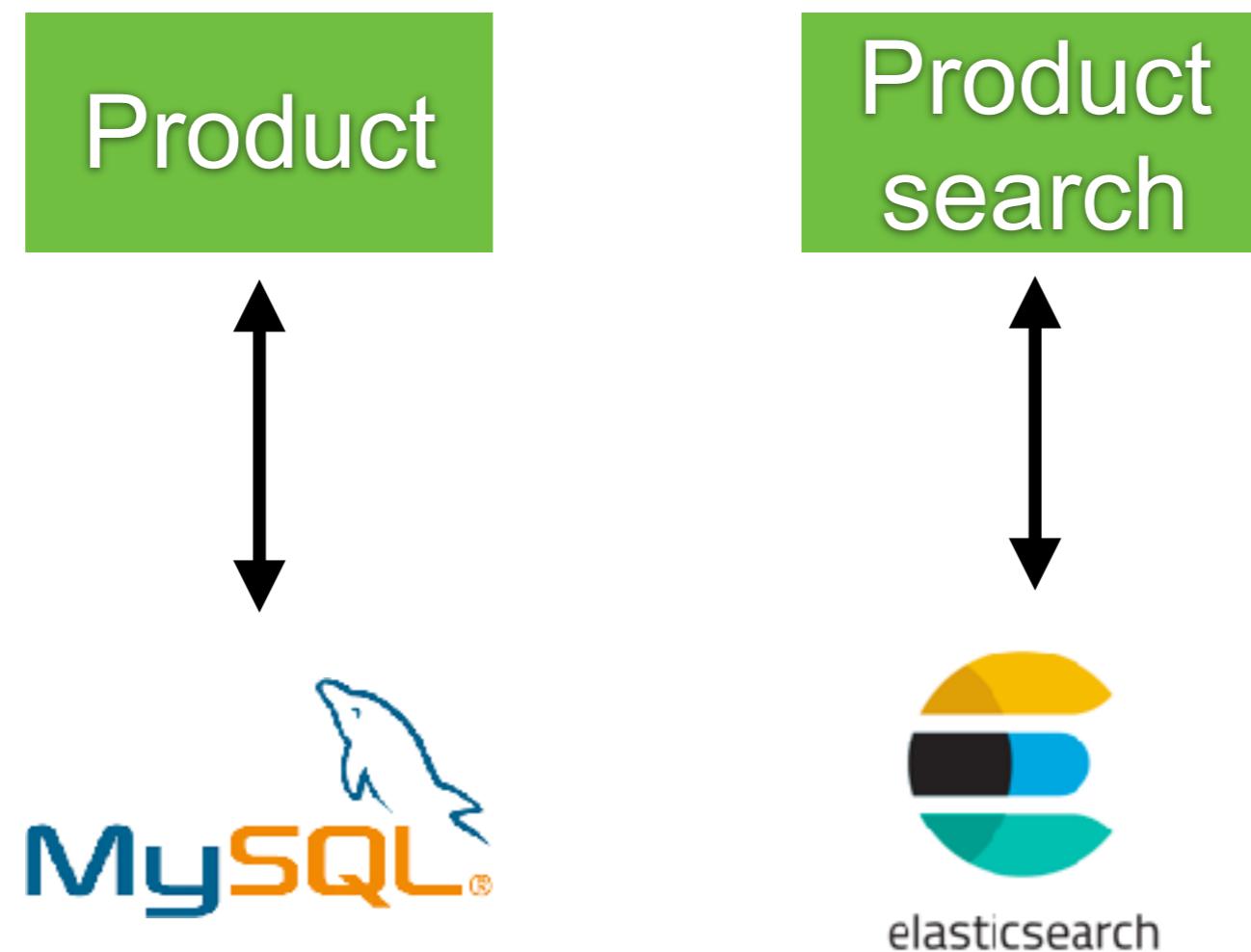


Separate query and command



Separate data for read and write

For example MySQL to write, Elasticsearch to search

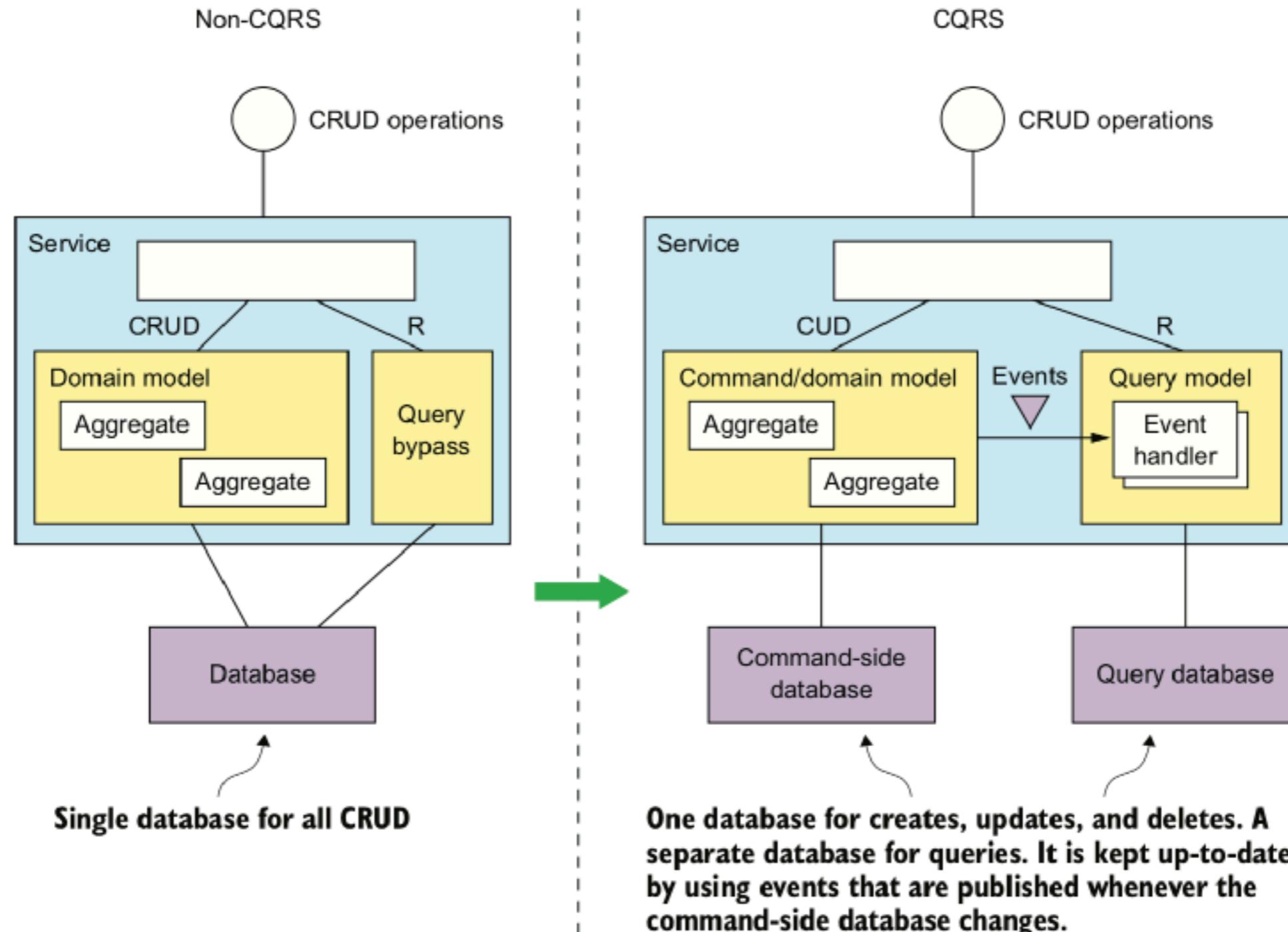


CQRS

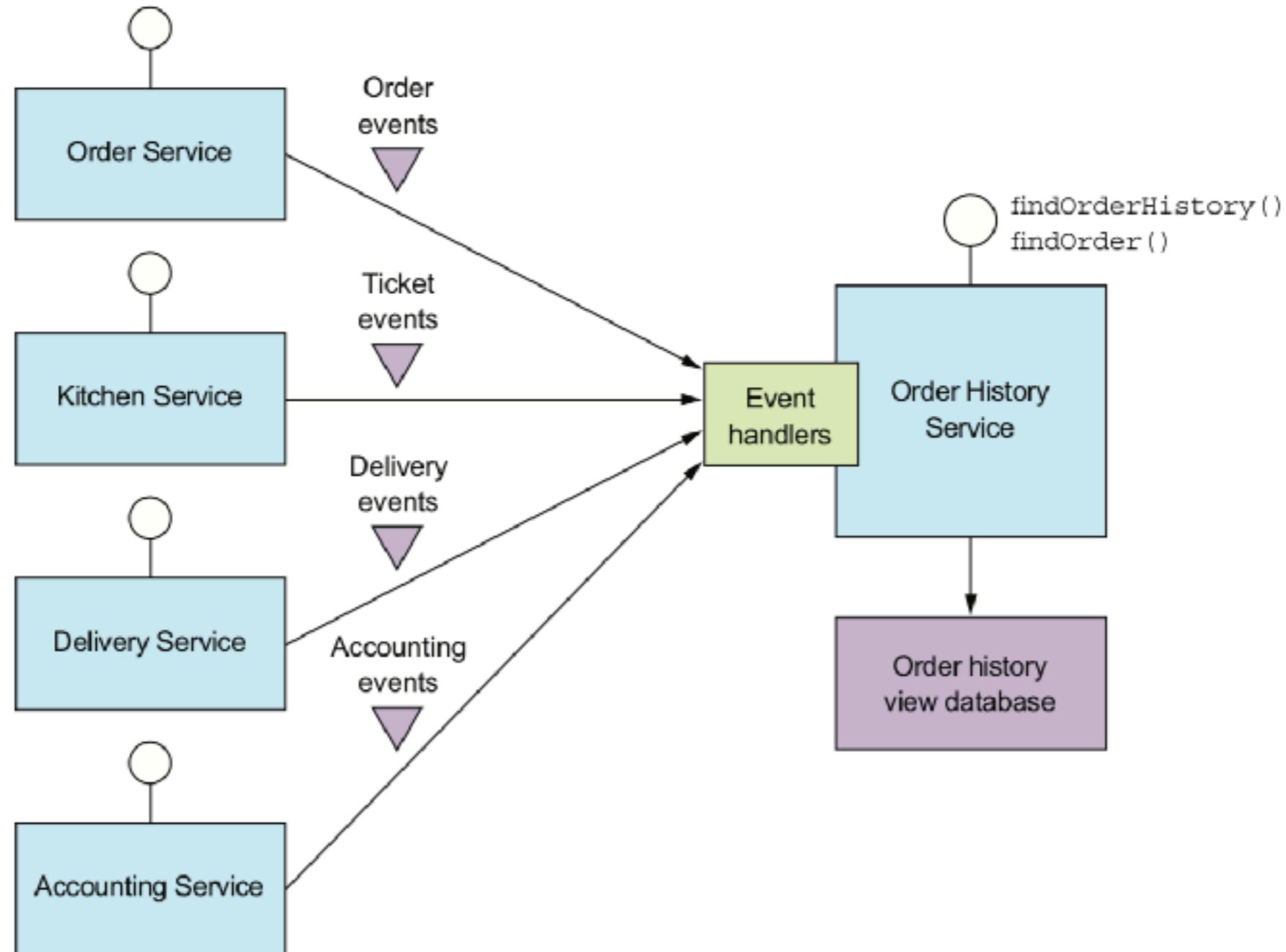
Command Query Responsibility Segregation



CQRS = Separate command from query



CQRS = Query-side service



Benefits

Improve separation of concern
Efficiency query



Drawbacks

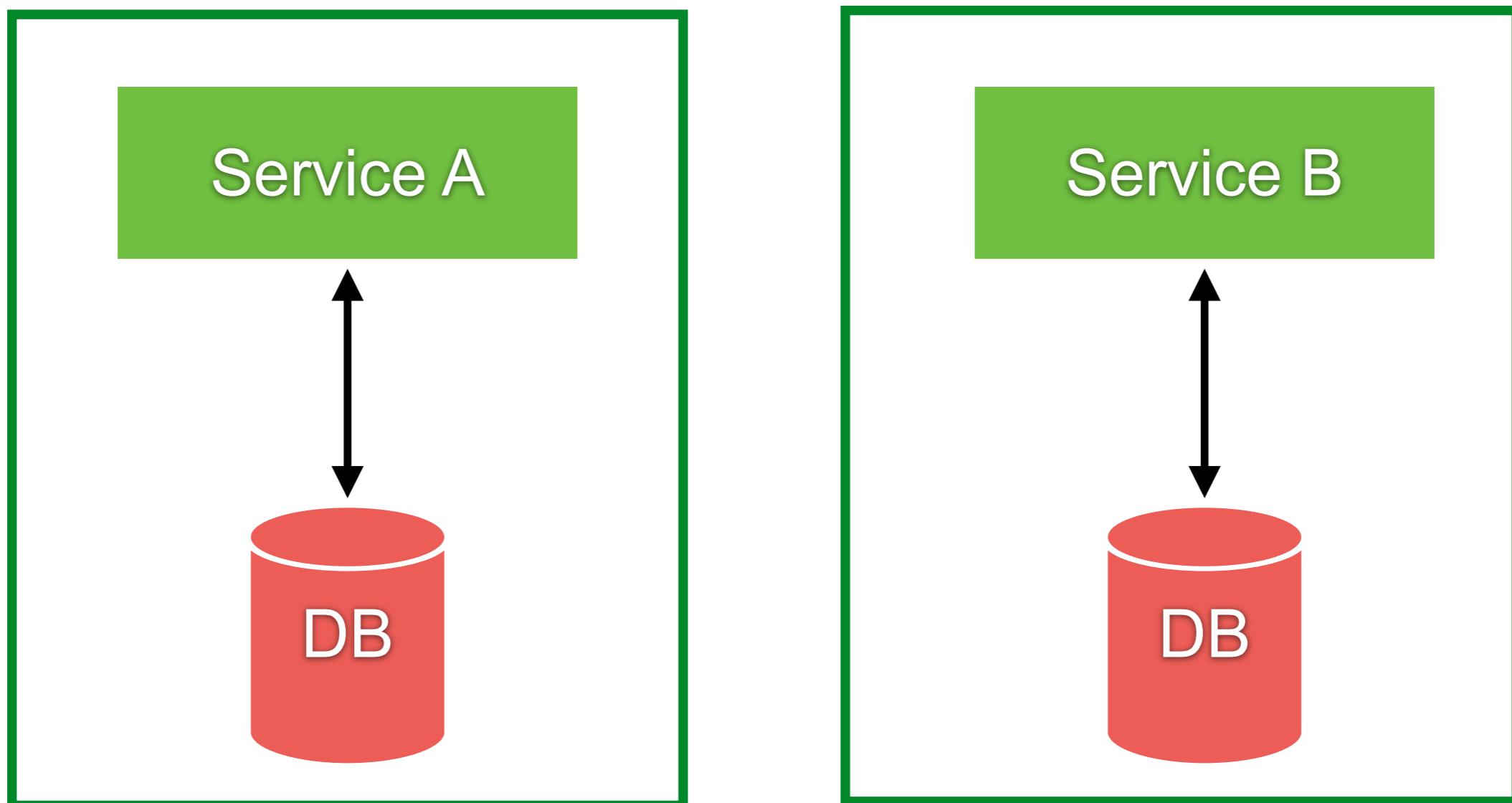
More complex

Lag between **command** and **query** side

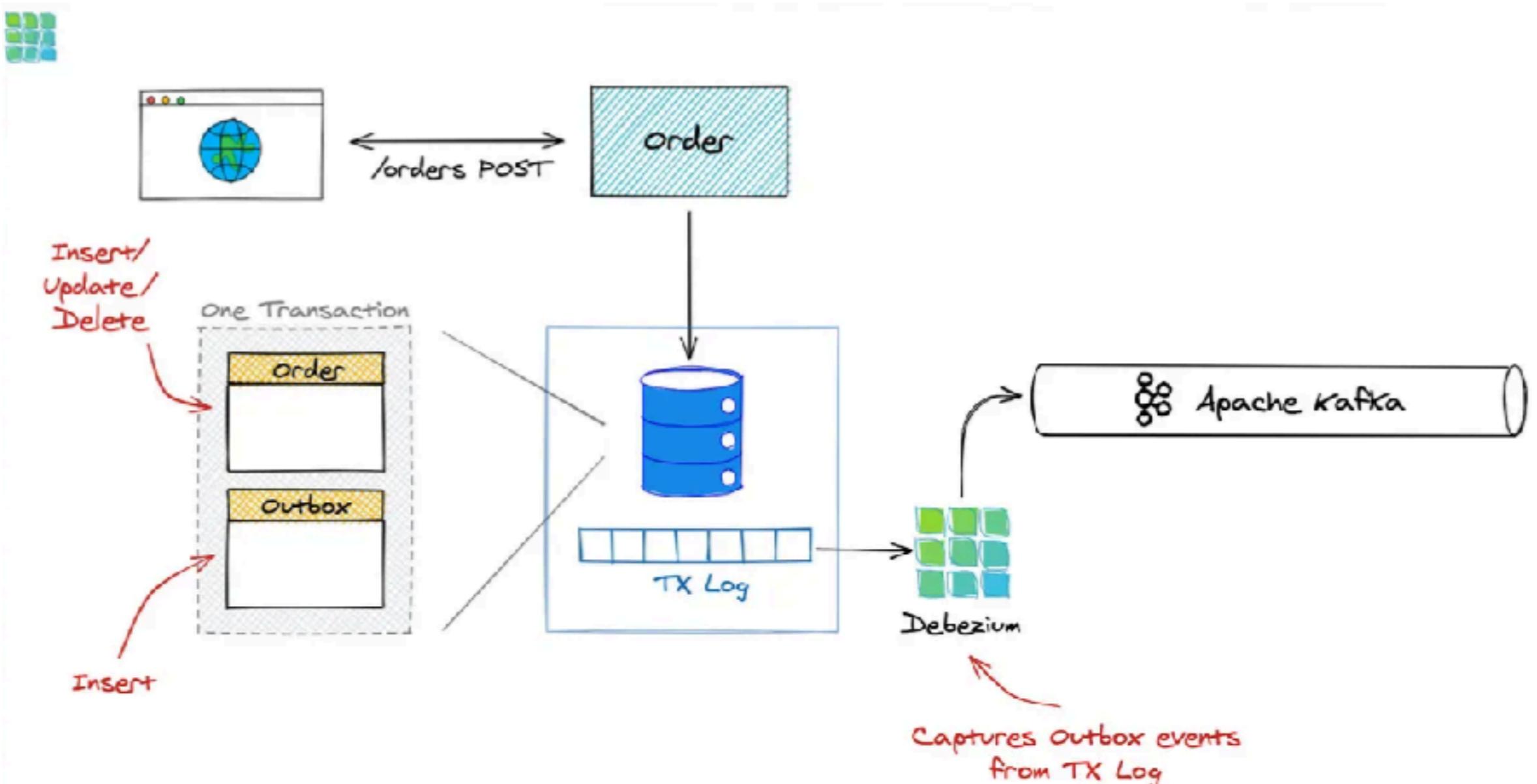


Outbox pattern

Decouple services using Pub/Sub
to exchange data between services



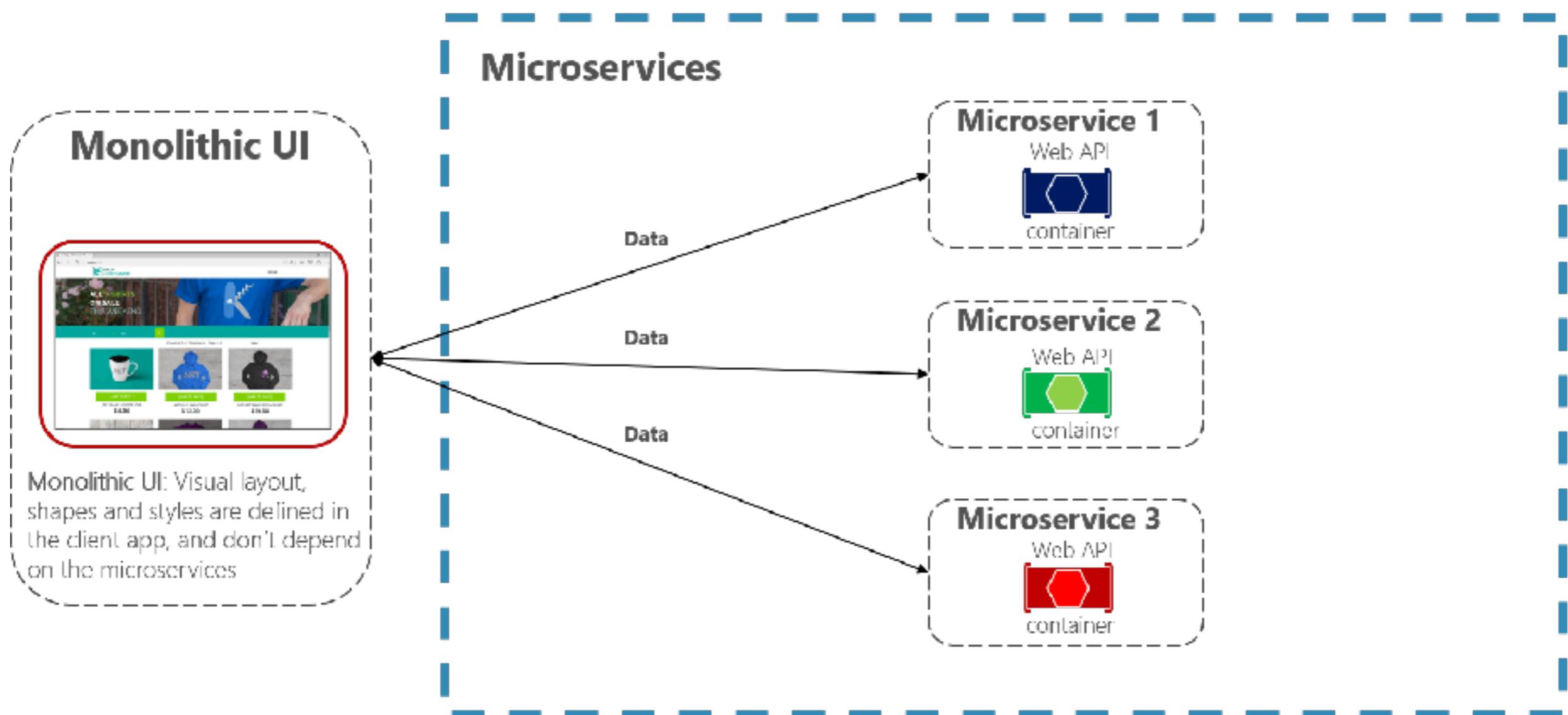
Example of Outbox pattern



Integrate services with User Interface



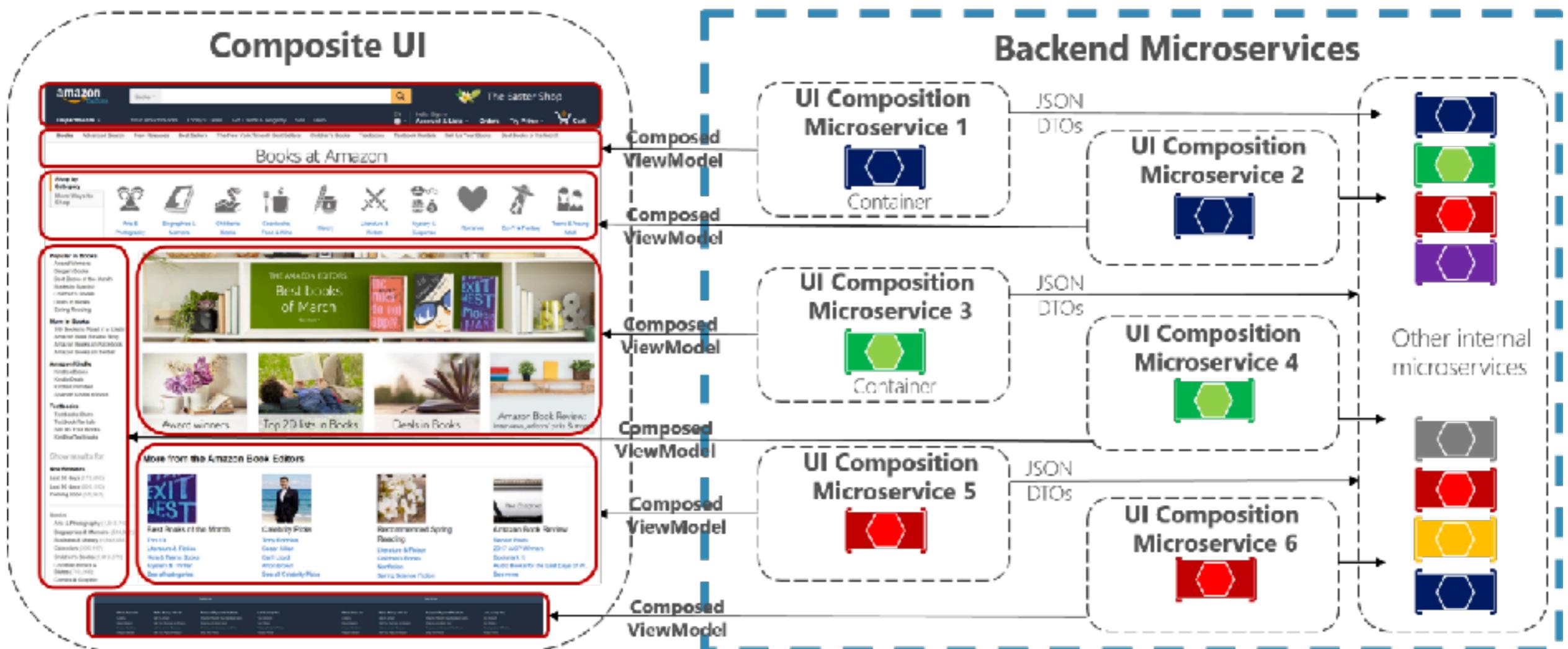
Monolithic UI consuming microservices



<https://docs.microsoft.com>



Composite UI generated by microservices



<https://docs.microsoft.com>



Monolith frontend

The Monolith

Frontend

Backend

Database

The Shop Team



Front & Back

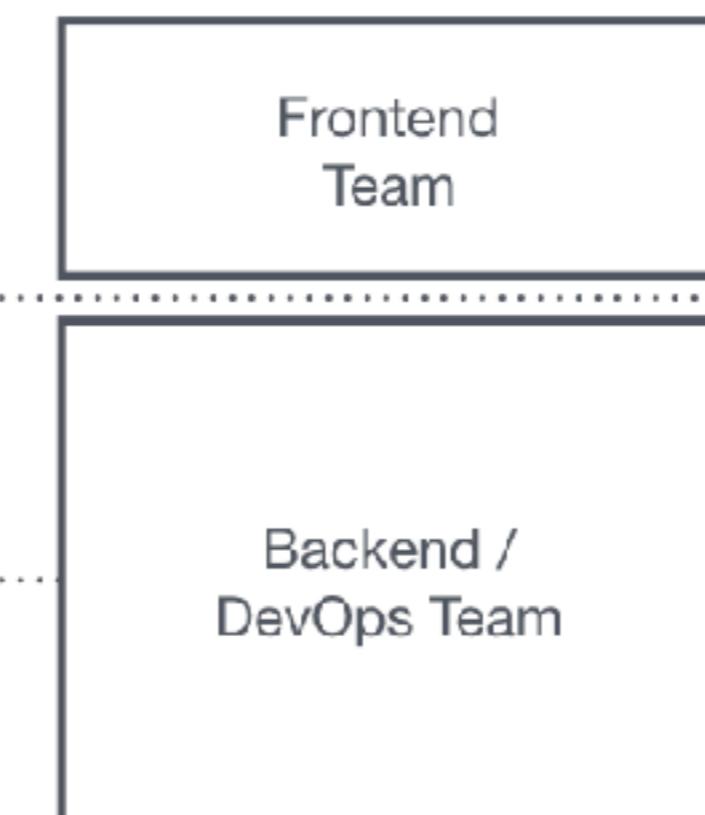
Frontend

Database

Backend

Frontend Team

Backend / DevOps Team



Microservices

Frontend

Database

Backend

Frontend Team

Aggregation Layer (e.g. BFF, GraphQL, ...)

Product Service

Reco Service

Basket Service

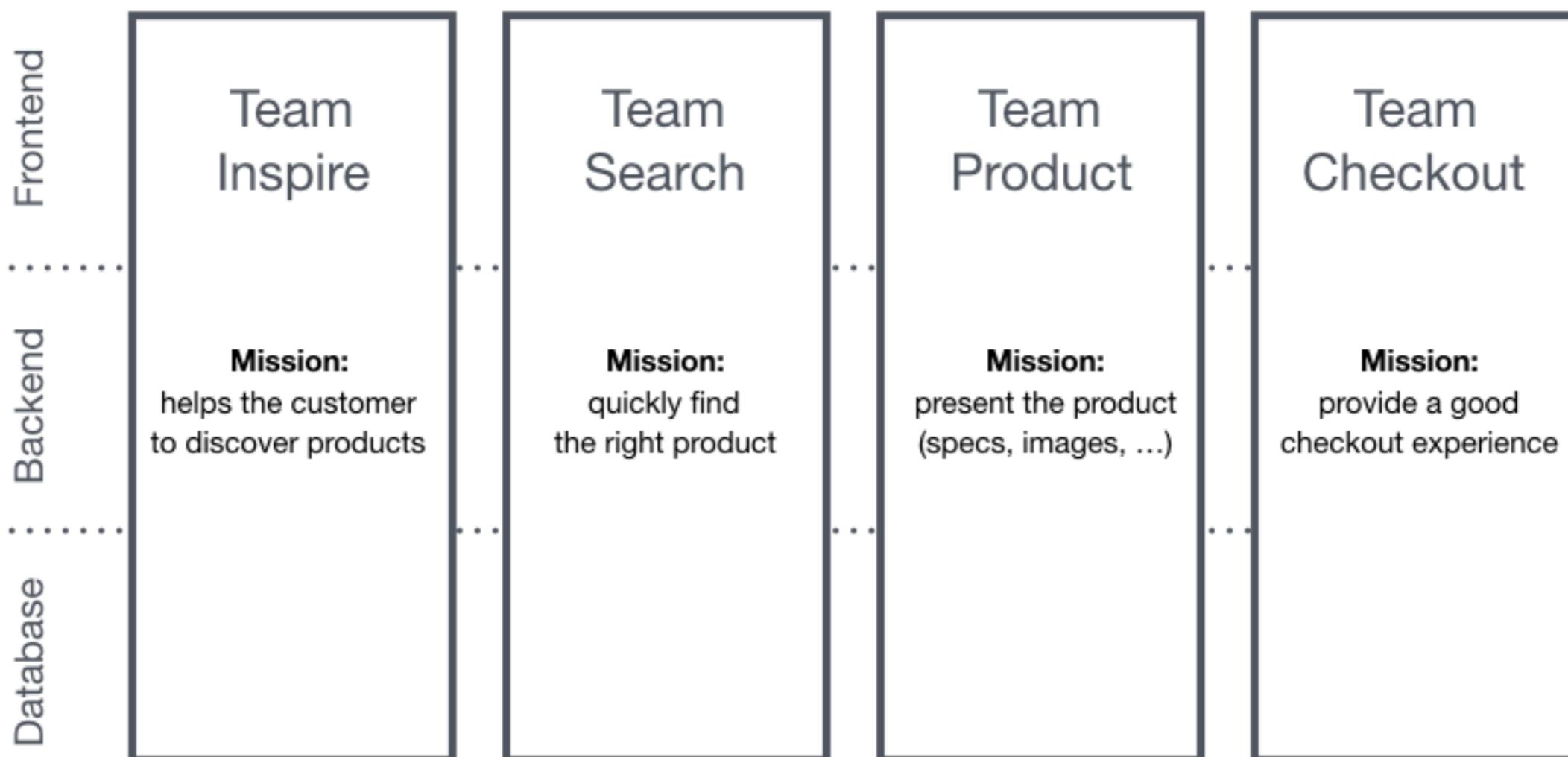
Payment Service

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



Micro frontend

End-to-End Teams with Micro Frontends



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



Observability of services

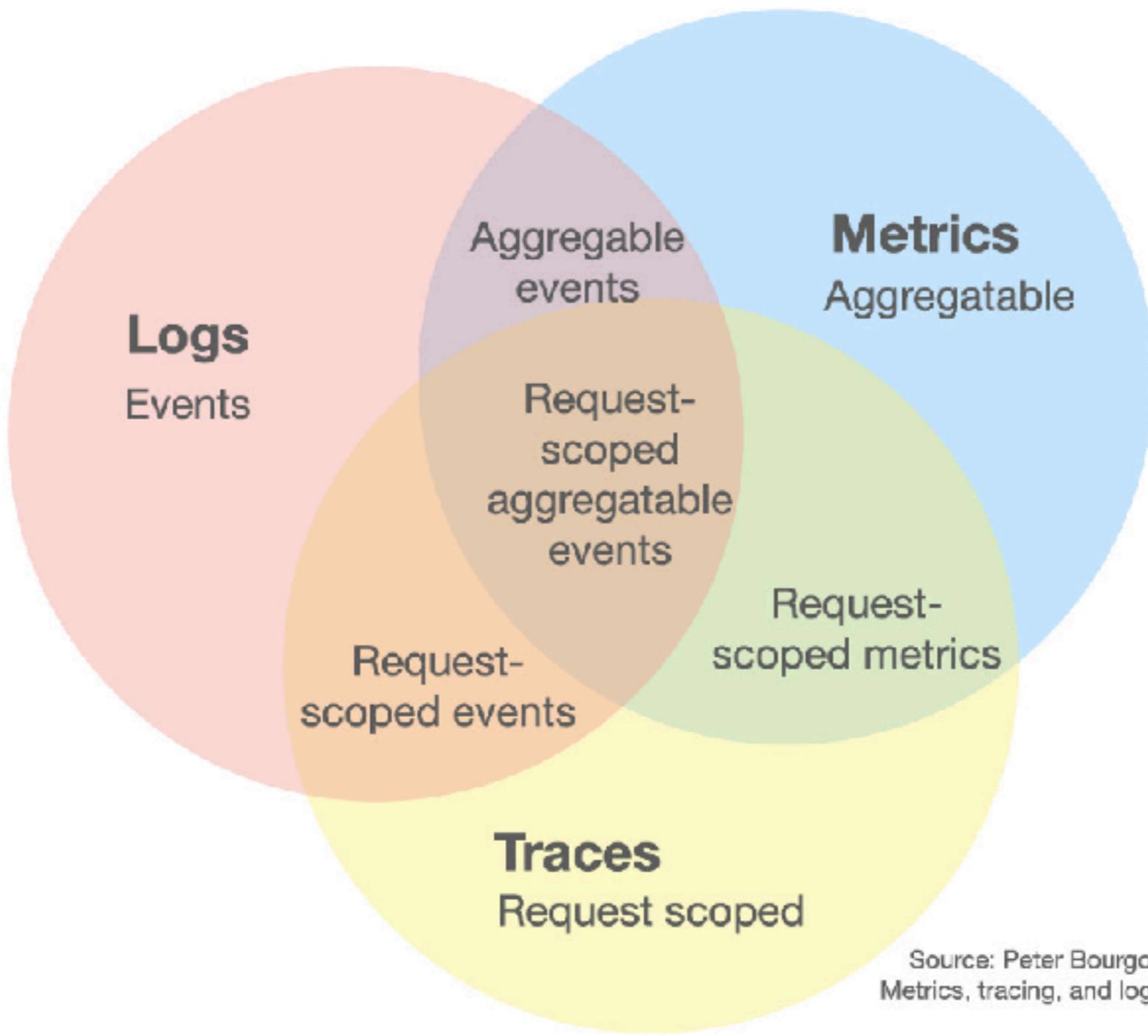


Observability of services

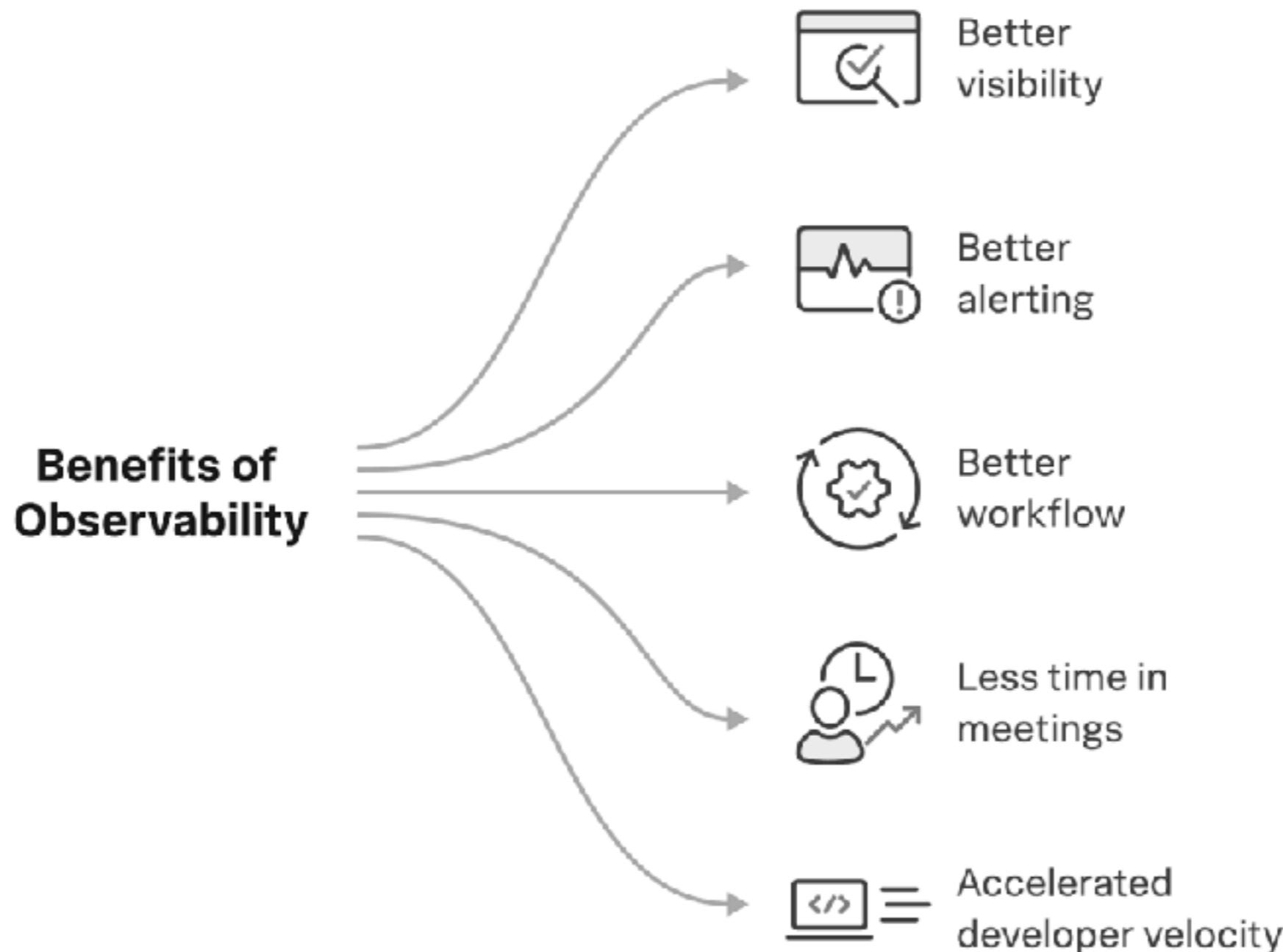
Application metrics
Distributed tracing
Log aggregation
Alert system
Exception tracking



Observability of services



Observability of services



Application metrics

Metrics represent logs numerically over intervals of time

Request rate

Error rate

Health

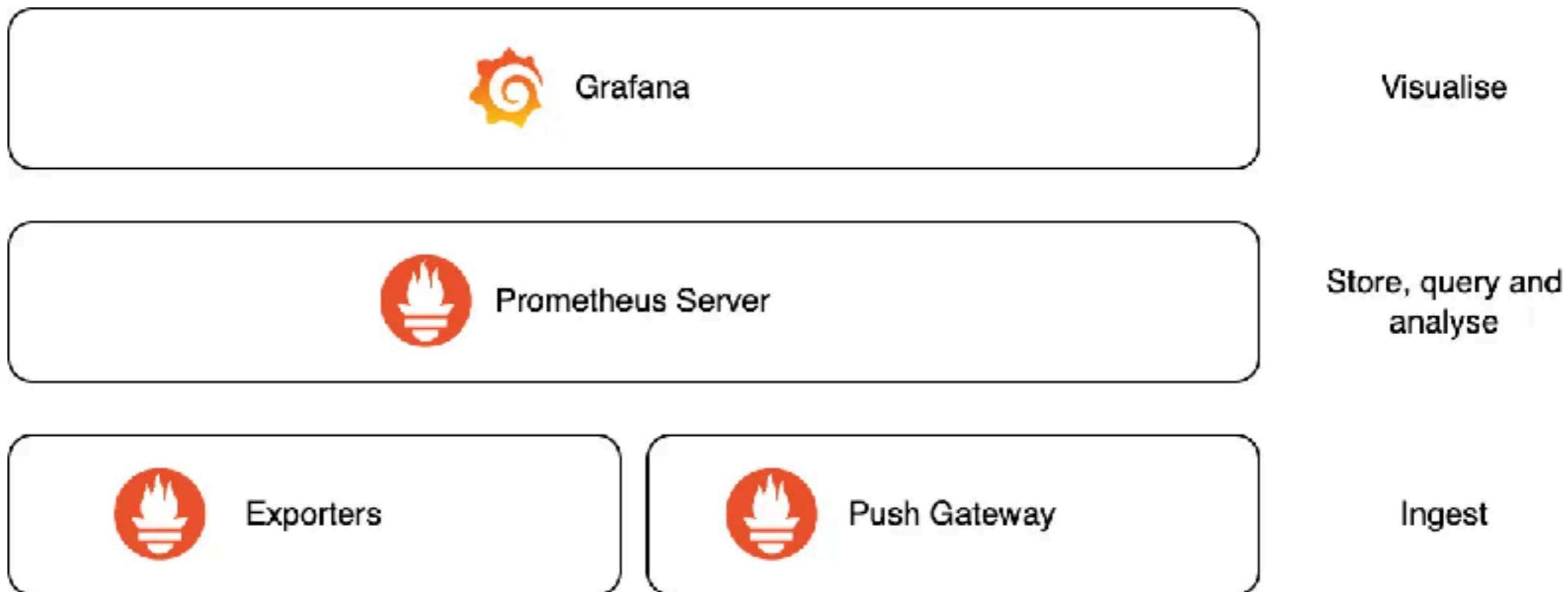
Latency

Utilization

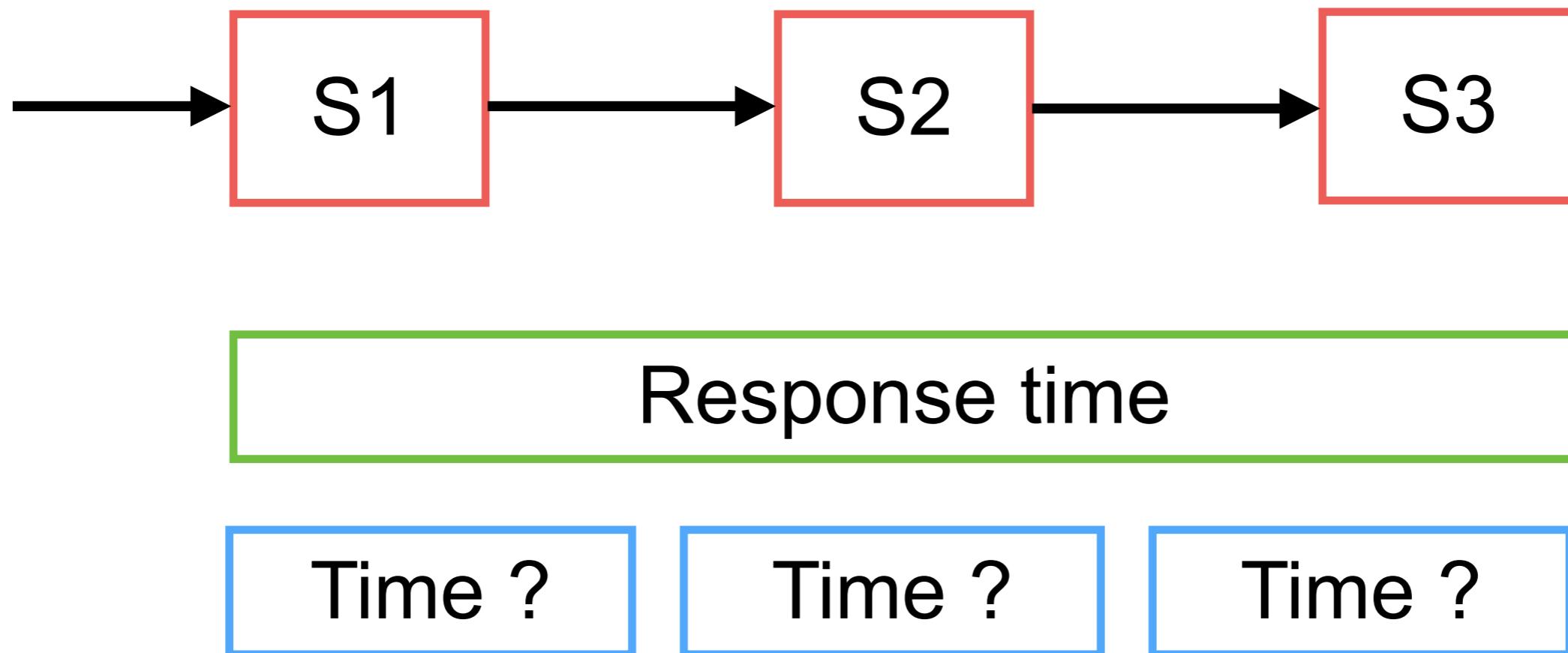
Availability



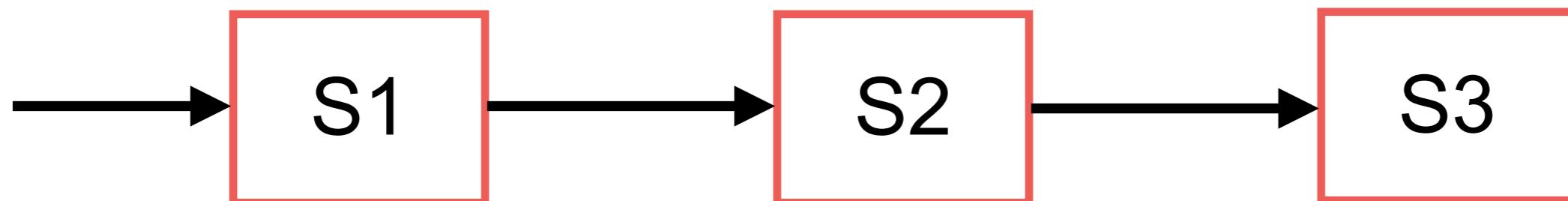
Application metrics



Distributed tracing



Correlation IDs



Response time **id=111**

Time ?

id=222

Time ?

id=333

Time ?

id=444

parent_id=111 **parent_id=111** **parent_id=111**





OpenTelemetry

High-quality, ubiquitous, and portable telemetry to enable effective observability

[Learn more](#)[Try the demo](#)

Get started based on your role

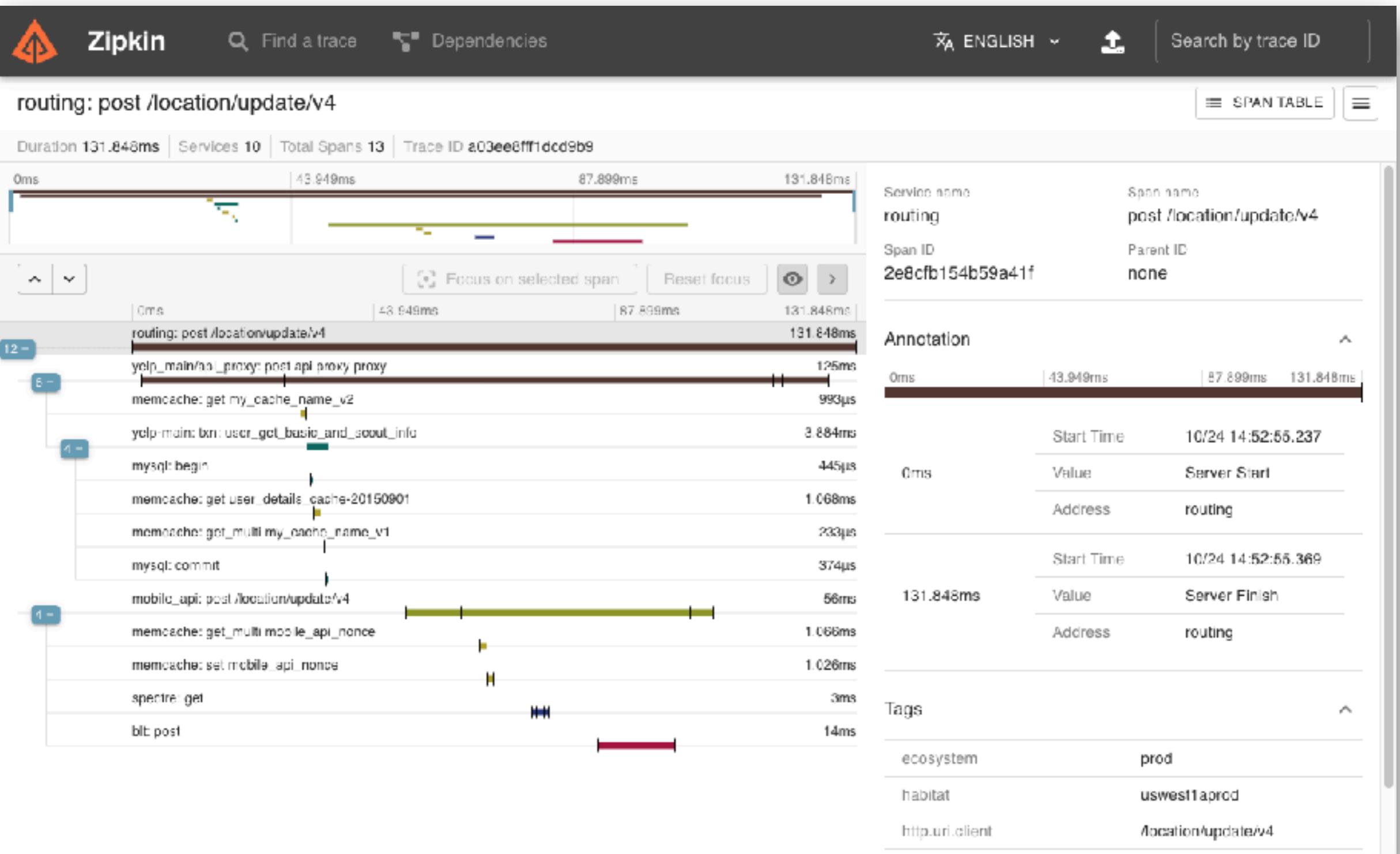
[Dev](#)[Ops](#)

<https://opentelemetry.io/>



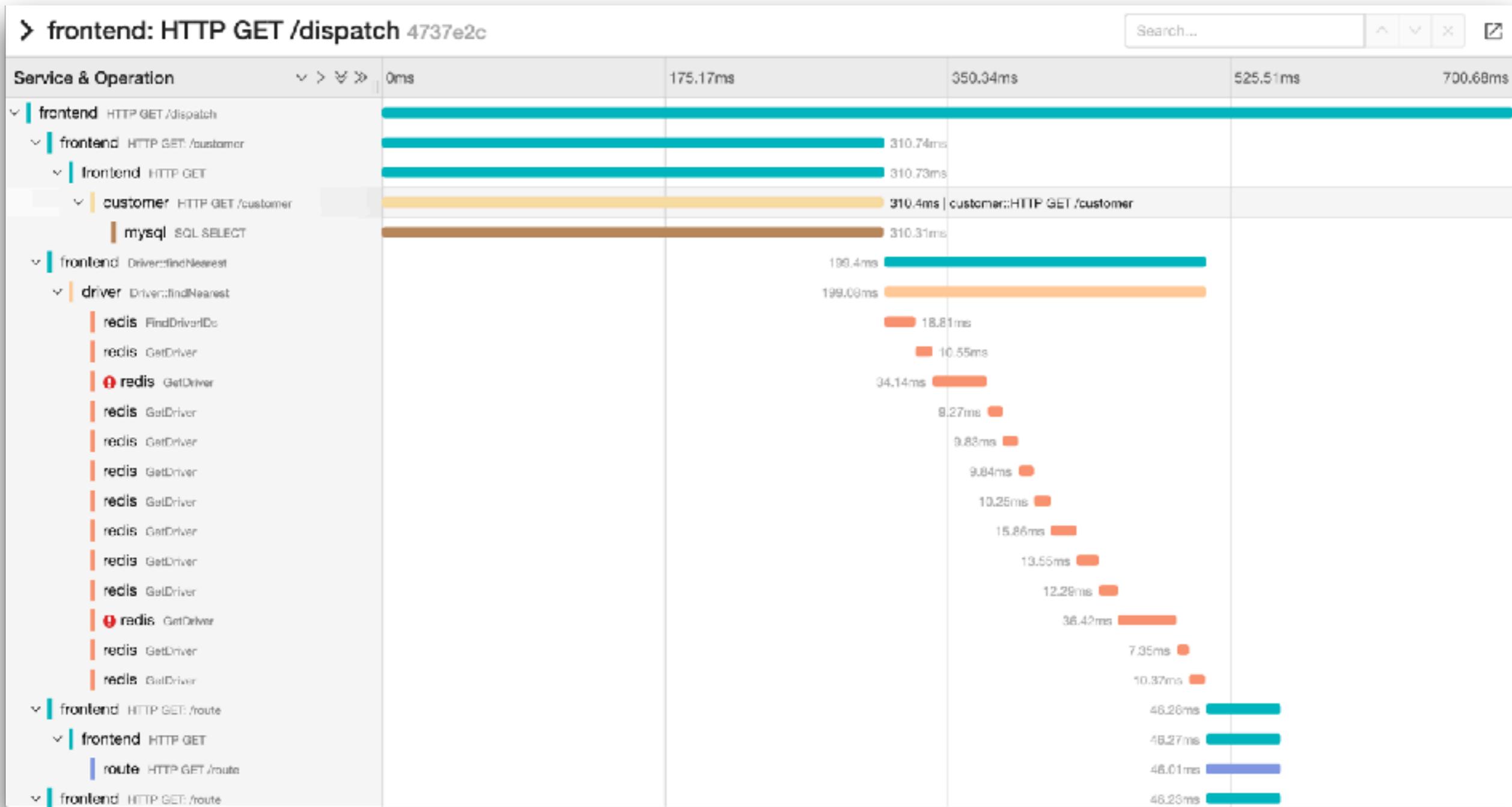
Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.



<https://zipkin.io/>





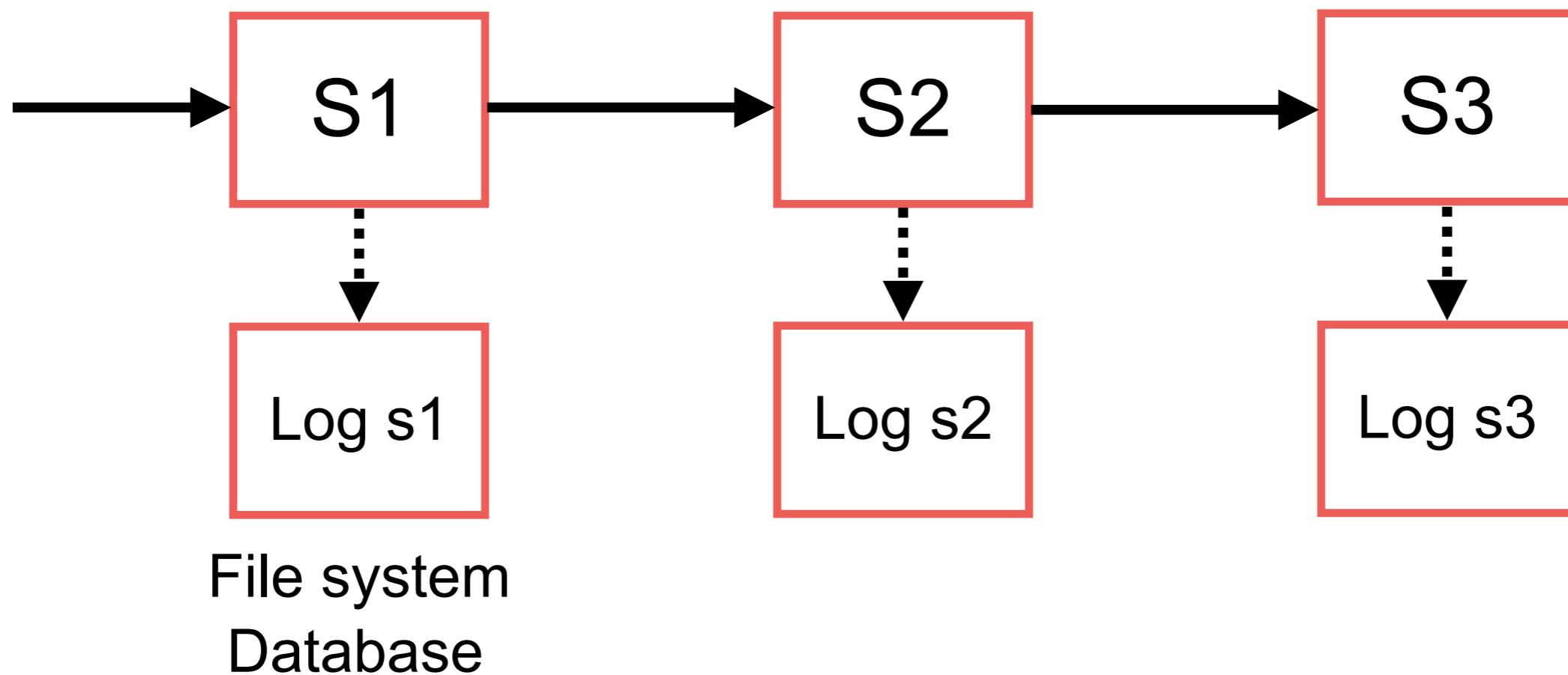
<https://www.jaegertracing.io/>



Microservices

© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

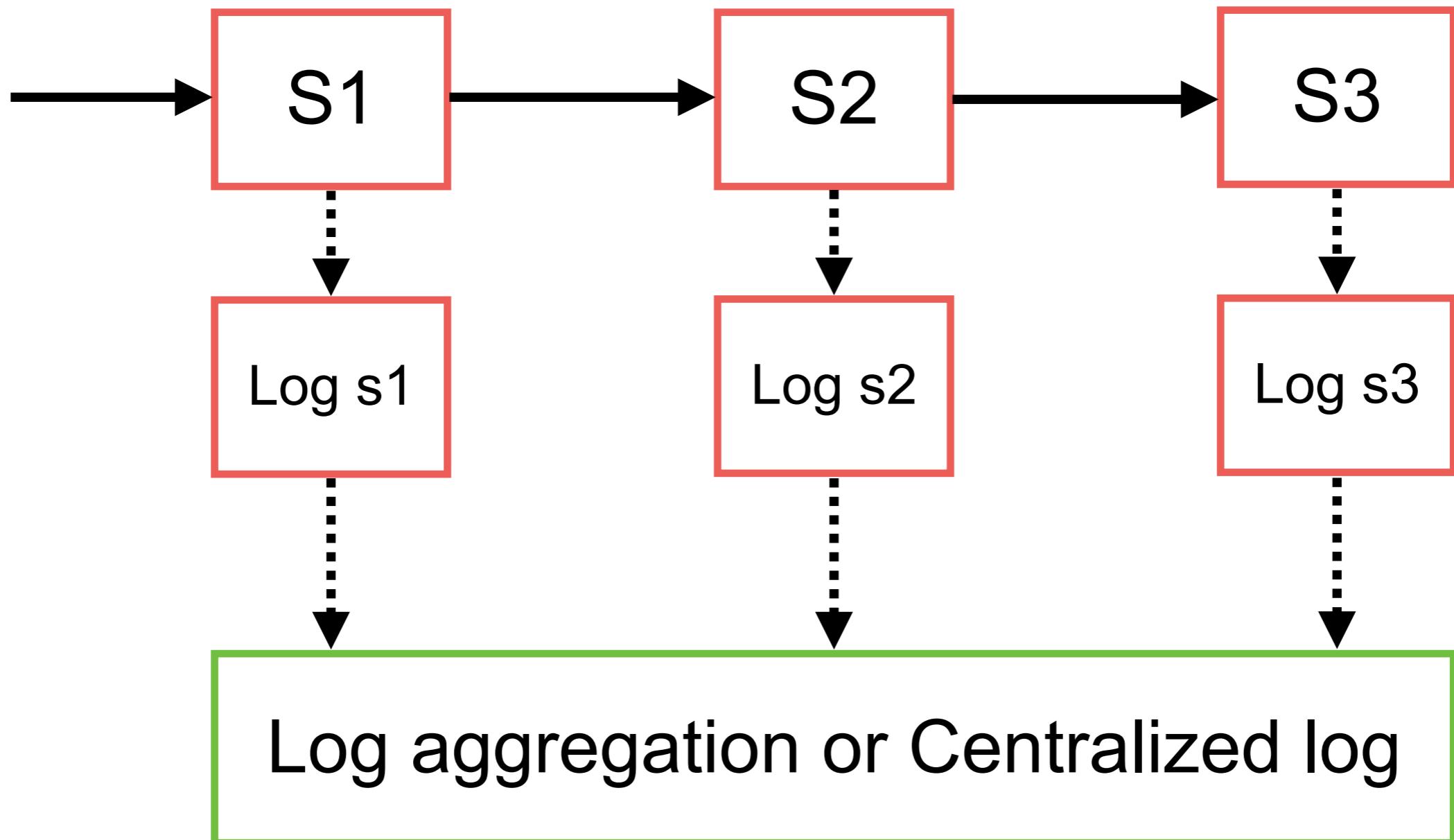
Log aggregation



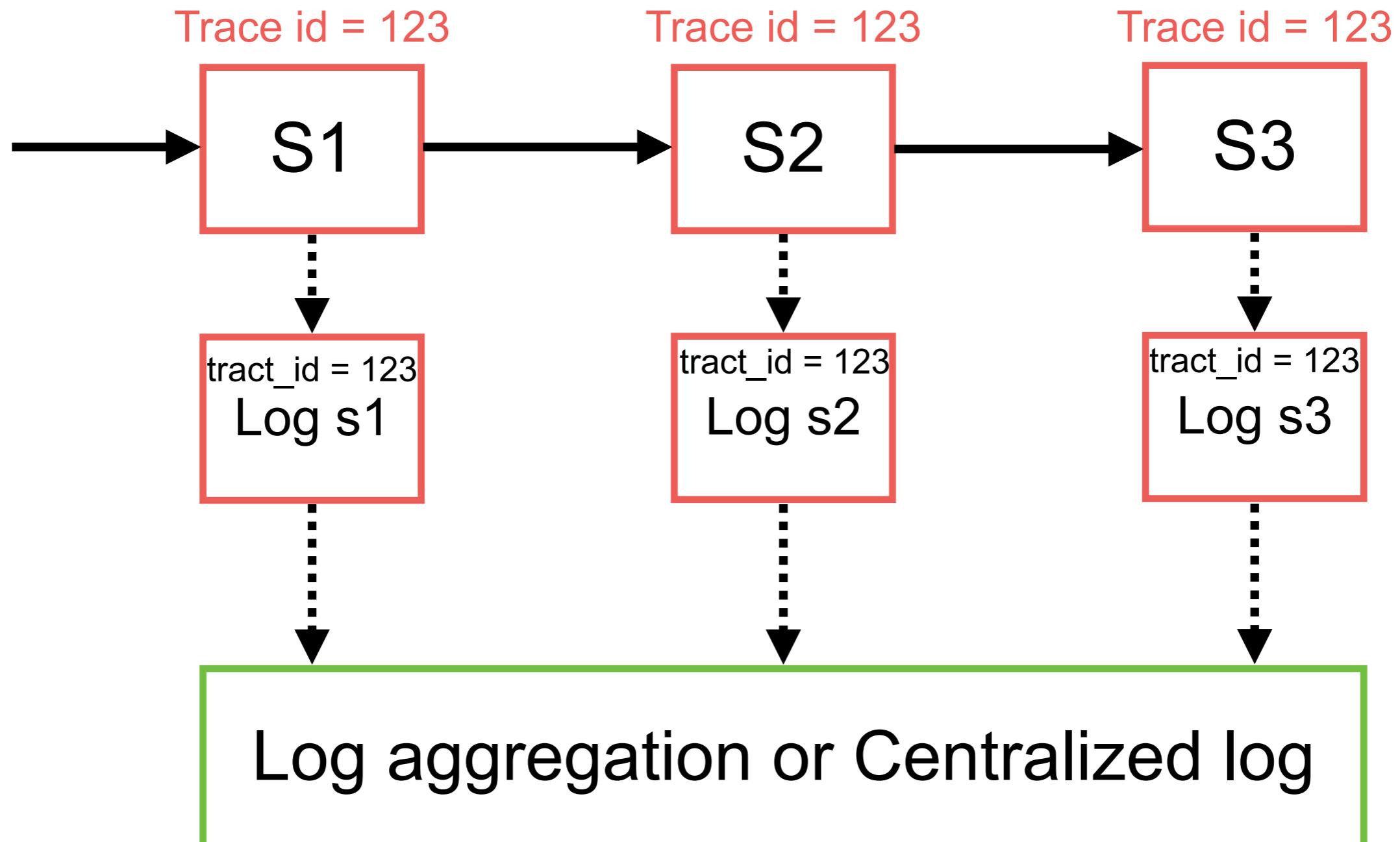
How to find errors from log ?



Log aggregation



Log aggregation + Correlation IDs



Consistent Structure Logs

Property	Description	Example
Timestamp	Date and time of the log	2023-07-01
Log level	DEBUG, INFO, ERROR	
Trace Id or Correlation Id	Unique identifier that refer to other logs from all services	
Event/Action Name	Identify to event or action of log	Authentication fail
Service ID/ Name	Identify to service	
Request path	Path for the request	/api/products

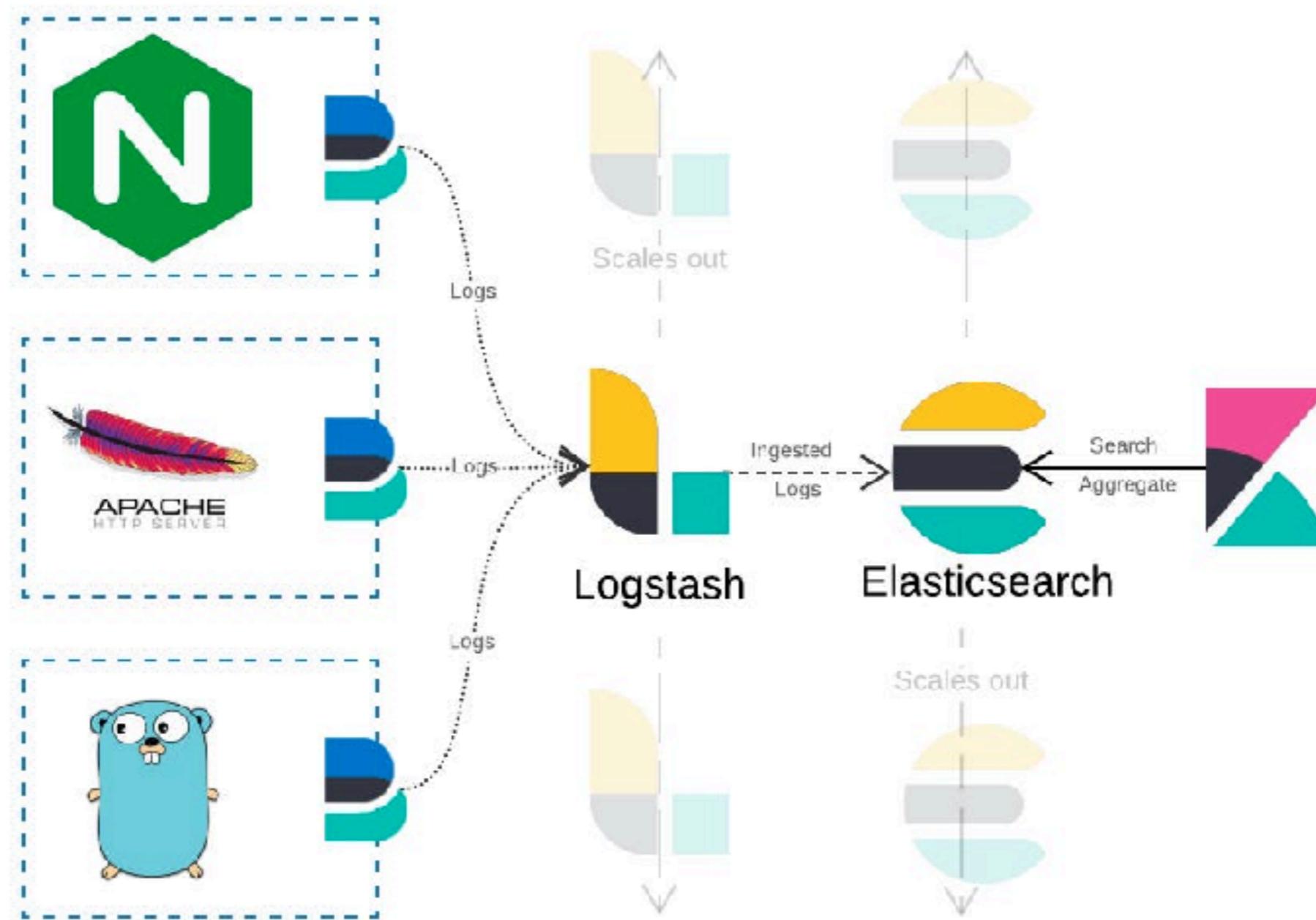


Don't keep !!

```
com.framework.FrameworkException: Error in web request
  at com.framework.ApplicationStarter.lambda$start$0(ApplicationStarter.java:15)
  at spark.RouteImpl$1.handle(RouteImpl.java:72)
  at spark.http.matching.Routes.execute(Routes.java:61)
  at spark.http.matching.MatcherFilter.doFilter(MatcherFilter.java:134)
  at spark.embeddedserver.jetty.JettyHandler.doHandle(JettyHandler.java:50)
  at org.eclipse.jetty.server.session.SessionHandler.doScope(SessionHandler.java:1568)
  at org.eclipse.jetty.server.handler.ScopedHandler.handle(ScopedHandler.java:144)
  at org.eclipse.jetty.server.handler.HandlerWrapper.handle(HandlerWrapper.java:132)
  at org.eclipse.jetty.server.Server.handle(Server.java:503)
  at org.eclipse.jetty.server.HttpChannel.handle(HttpChannel.java:364)
  at org.eclipse.jetty.server.HttpConnection.onFillable(HttpConnection.java:260)
  at org.eclipse.jetty.io.AbstractConnection$ReadCallback.succeeded(AbstractConnection.java:305)
  at org.eclipse.jetty.io.FillInterest.fillable(FillInterest.java:103)
  at org.eclipse.jetty.io.ChannelEndPoint$2.run(ChannelEndPoint.java:118)
  at org.eclipse.jetty.util.thread.QueuedThreadPool.runJob(QueuedThreadPool.java:765)
  at org.eclipse.jetty.util.thread.QueuedThreadPool$2.run(QueuedThreadPool.java:683)
  at java.base/java.lang.Thread.run(Thread.java:834)
Caused by: com.project.module.MyProjectFooBarException: The number of FooBars cannot be zero
  at com.project.module.MyProject.anotherMethod(MyProject.java:20)
  at com.project.module.MyProject.someMethod(MyProject.java:12)
  at com.framework.ApplicationStarter.lambda$start$0(ApplicationStarter.java:13)
  ... 16 more
Caused by: java.lang.ArithmaticException: The denominator must not be zero
  at org.apache.commons.lang3.math.Fraction.getFraction(Fraction.java:143)
  at com.project.module.MyProject.anotherMethod(MyProject.java:18)
  ... 18 more
```



ELK stack



More ...



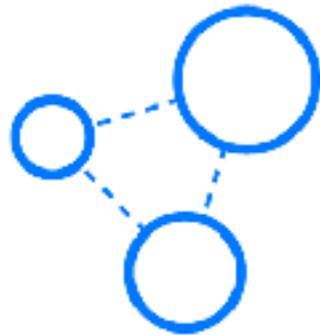
How to develop ?
How to test ?
How to deploy ?



Summary



Beyond Microservice Process and Organization



Flexible organizational structure

With clear roles and accountabilities



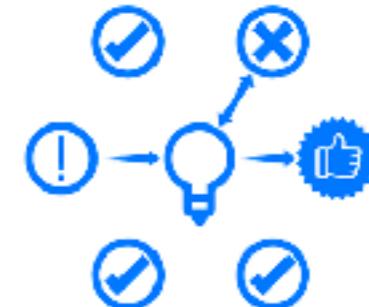
Efficient meeting formats

Geared toward action and eliminating over-analysis



More autonomy to teams and individuals

Individuals solve issues directly without bureaucracy



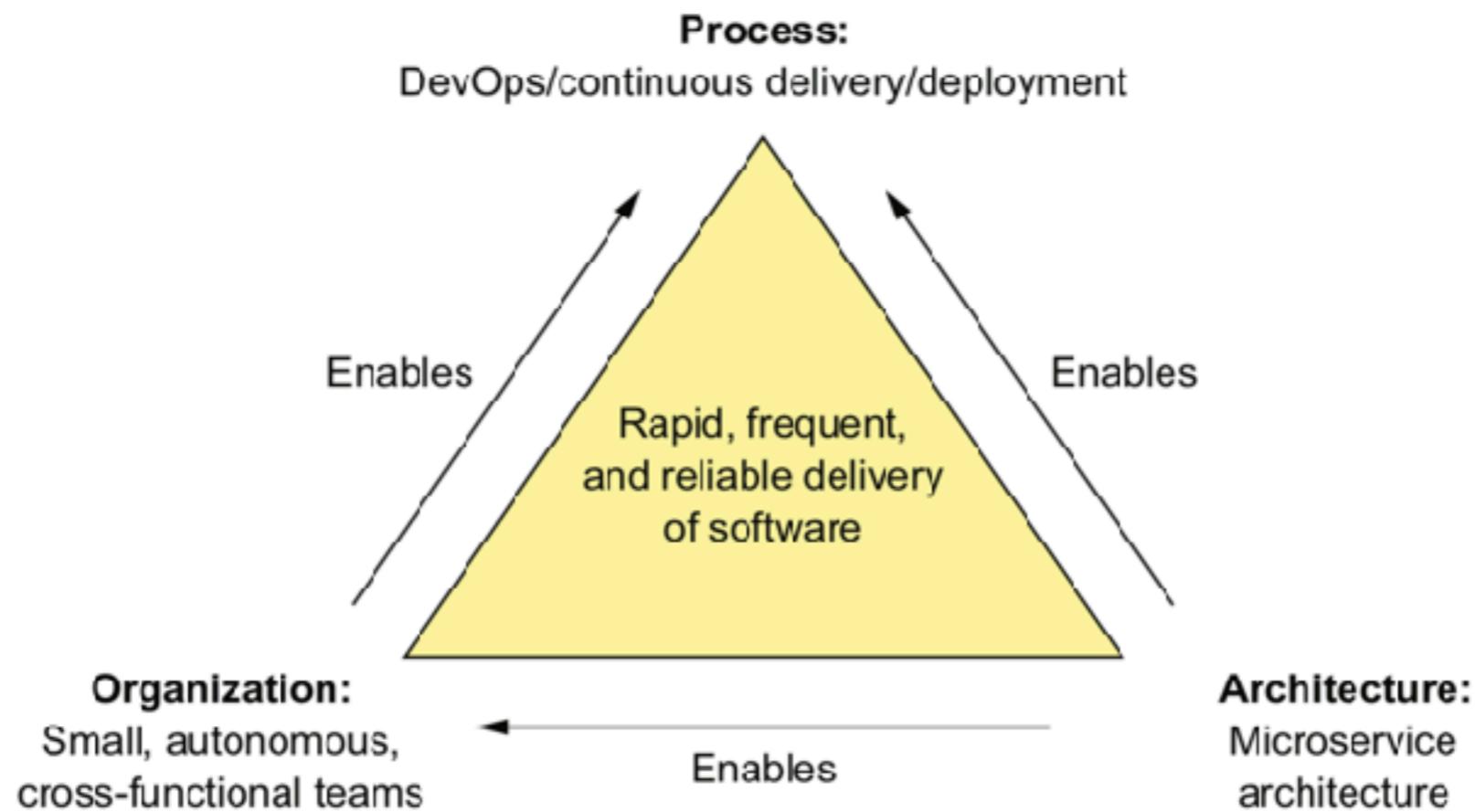
Unique decision-making process

To continuously evolve the organization's structure.

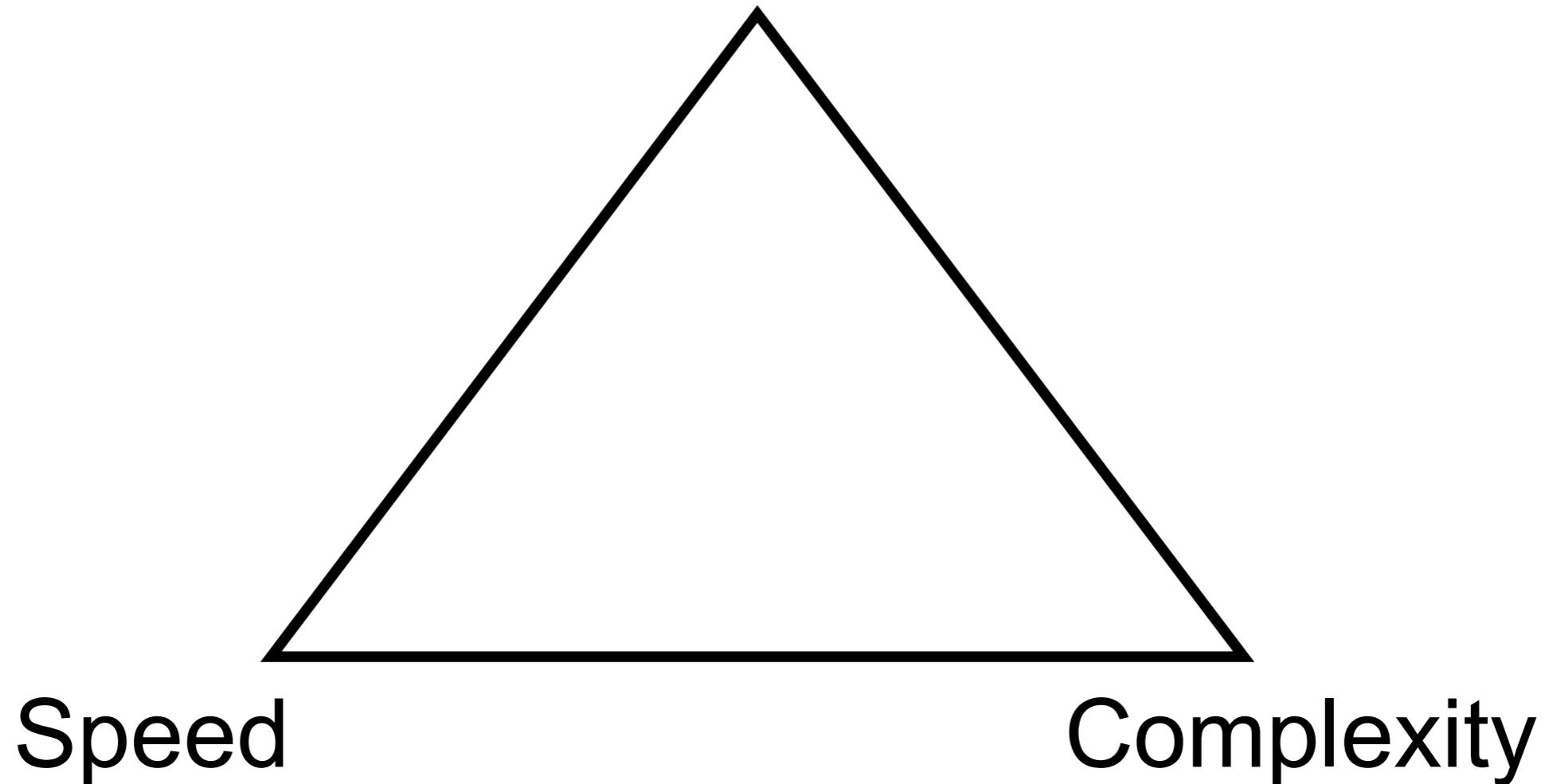


Success project needs ...

Organization process
Development process
Delivery process



Customer value



Don't forget about the human side when adopt Microservice



Let's start with good monolith



Module 1

Module 2

Module 3

Module 4

Module 5

Module 6



Find your problems



Module 1

Module 2

Module 3

Module 4

Module 5

Module 6



Module 1

Module 2

Module 3

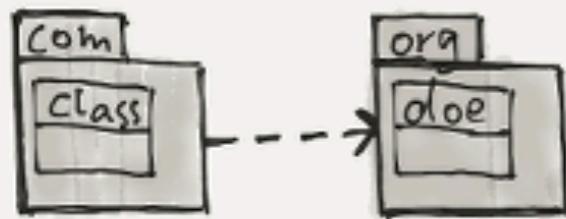
Module 5

Module 6

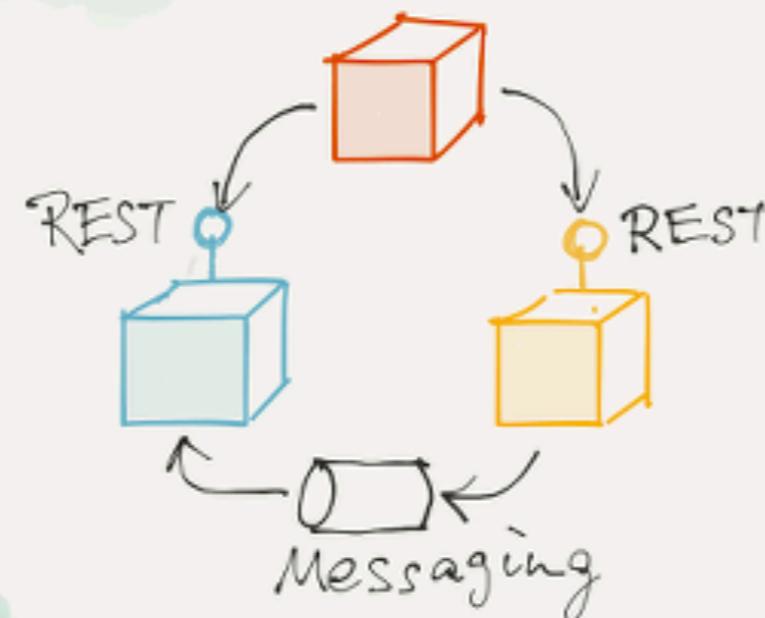
Module 4



Architecture



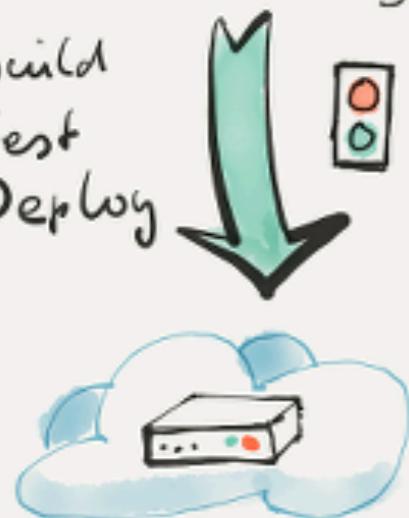
Microservices



Deployment

Continuous Delivery

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



Infrastructure

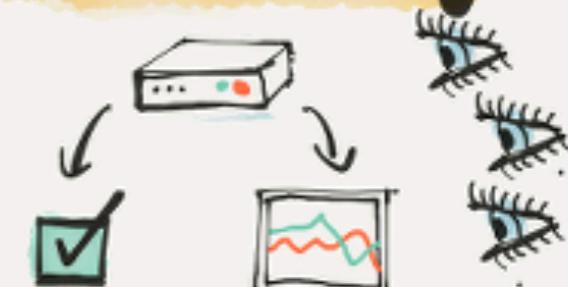


People & Teams



Communication
Collaboration

Monitoring



Features & Technology



Microservice prerequisites

Rapid provisioning
Basic monitoring
Rapid Application Deployment
DevOps culture



Let's start your journey !!

