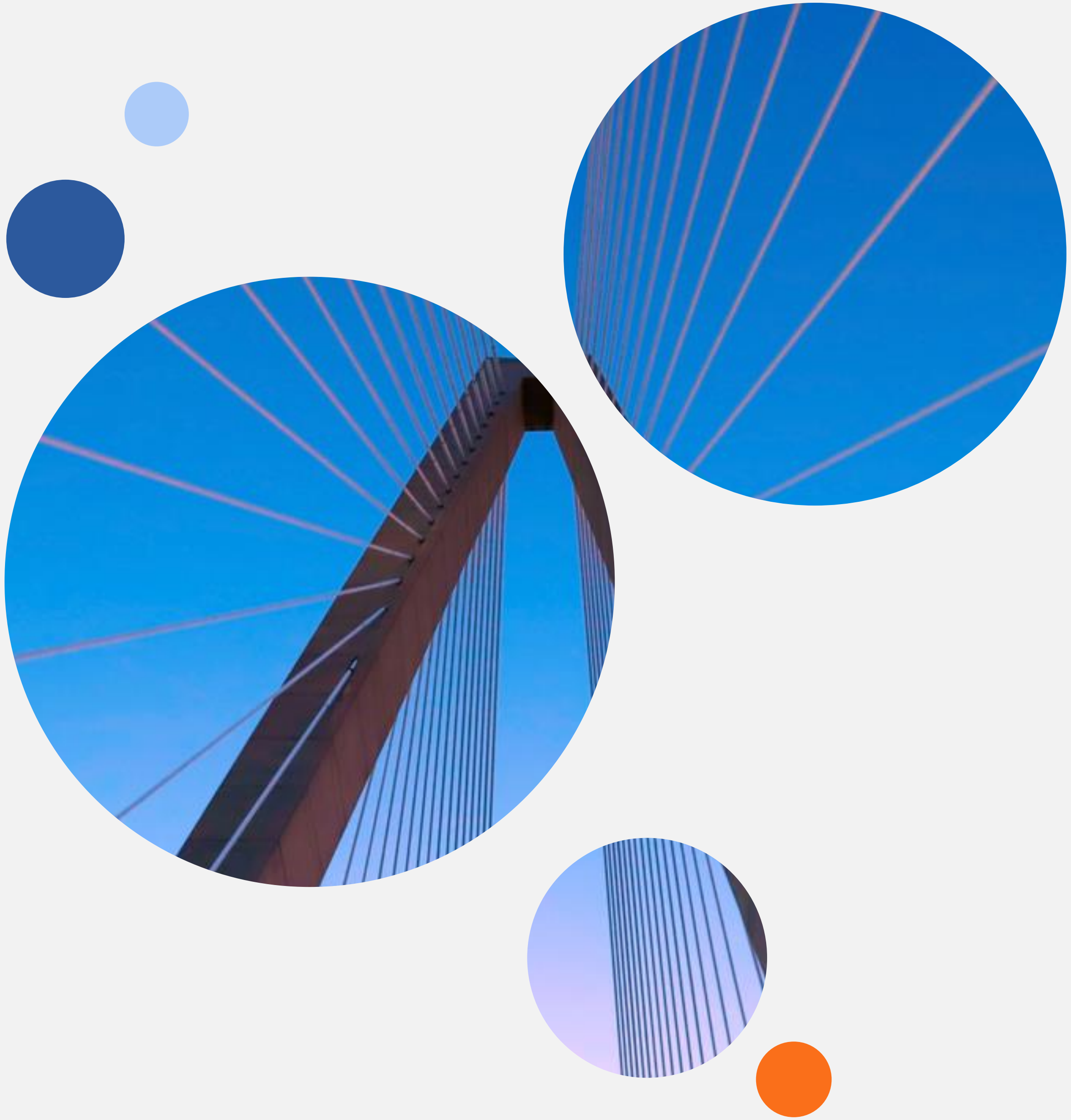
Microservices Architecture

By
Ahmed Abouzeid

Agenda

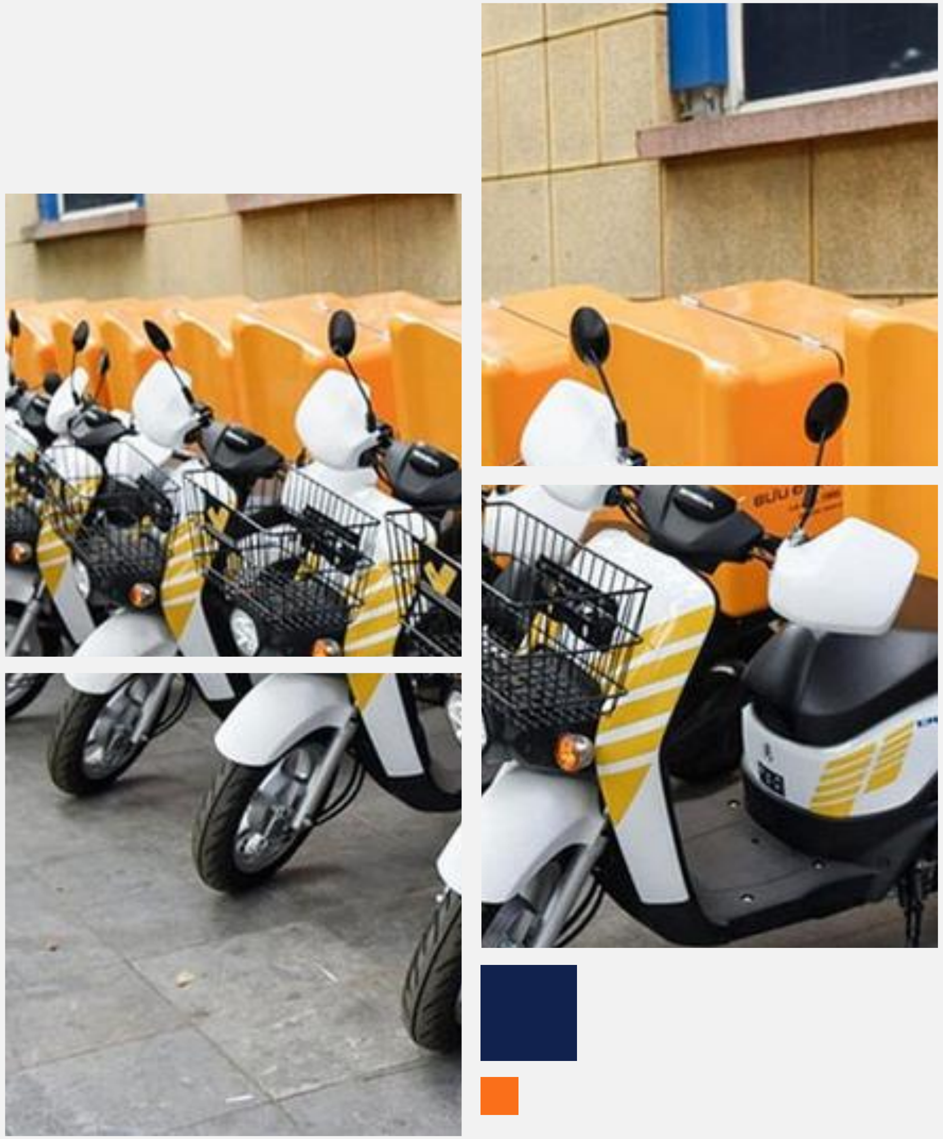
- Business Case
- Tackling the business case
- What is Microservices architecture?
- Benefits and Challenges
- Domain Modeling for Microservices
- Compute options
- Interservice communication
- API Gateway
- Data Management



Business Case

Delivery Service

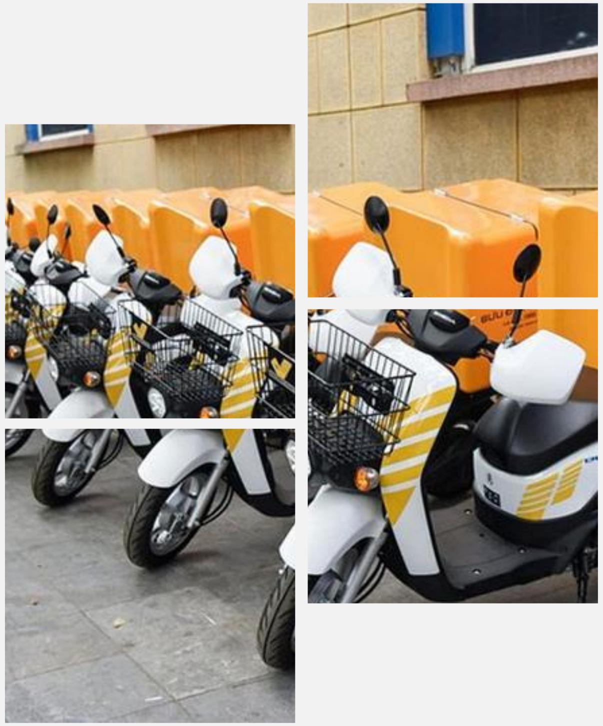
- The company manages a fleet of vehicles
- Businesses register with the service, and users can request a vehicle to pick up goods for delivery
- When a customer schedules a pickup, a backend system assigns a vehicle and notifies the user with an estimated delivery time
- The customer can track the location of the vehicle, with a continuously updated ETA

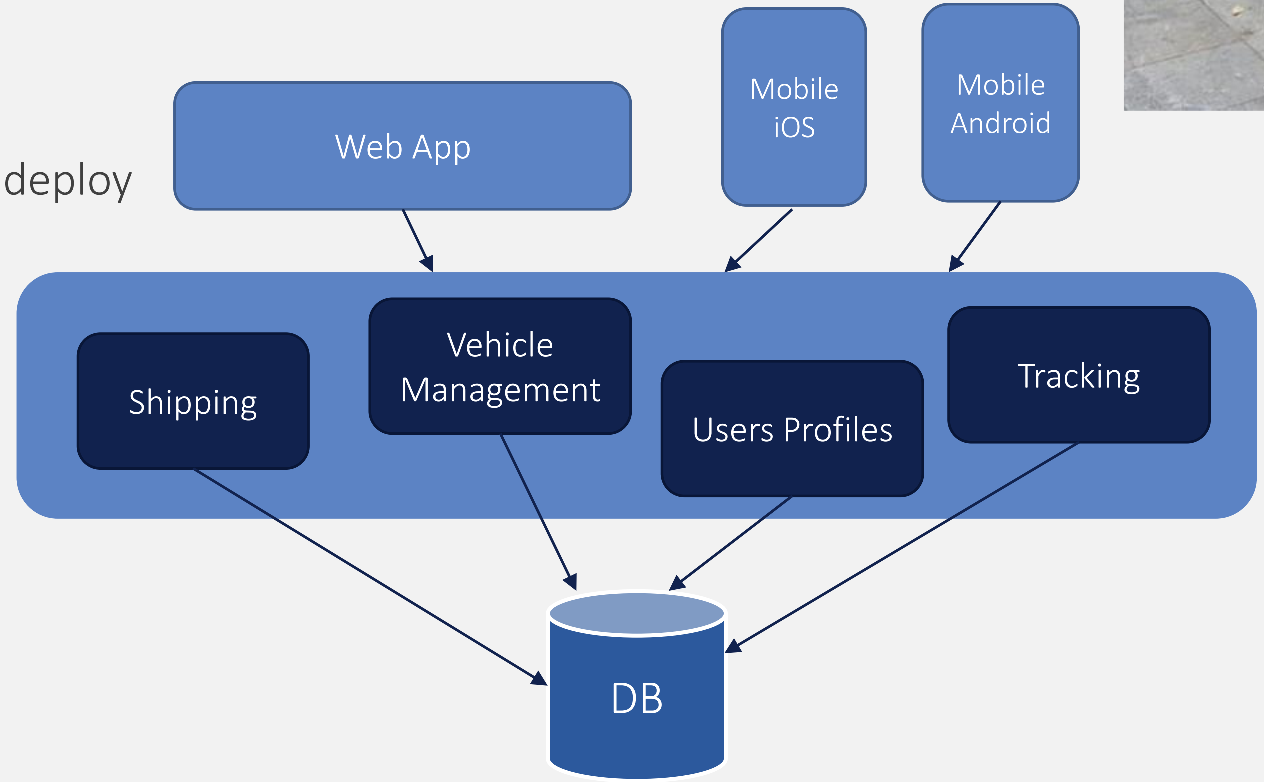


Tackling the business case

Monolithic Architecture

- The traditional unified model for the design of a software program.
- Multiple components are combined into one large application.
- Motivations:
  - Well Known
  - Easy to understand
  - Easy to develop, test and deploy



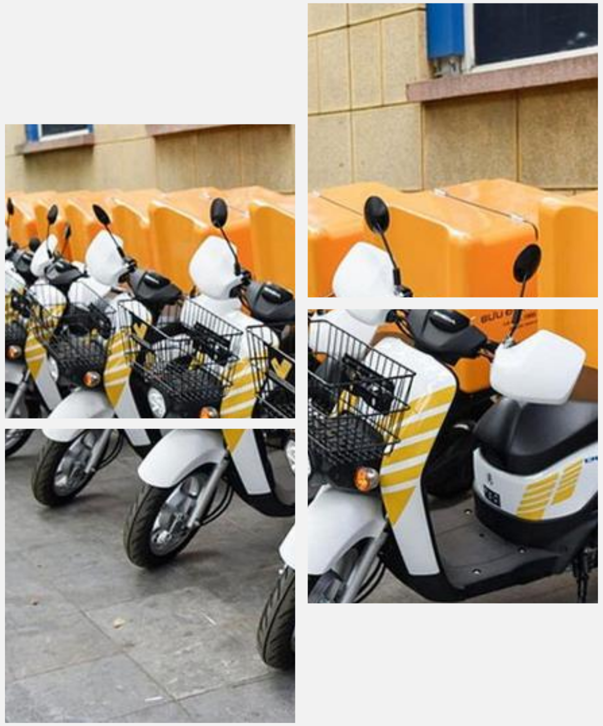


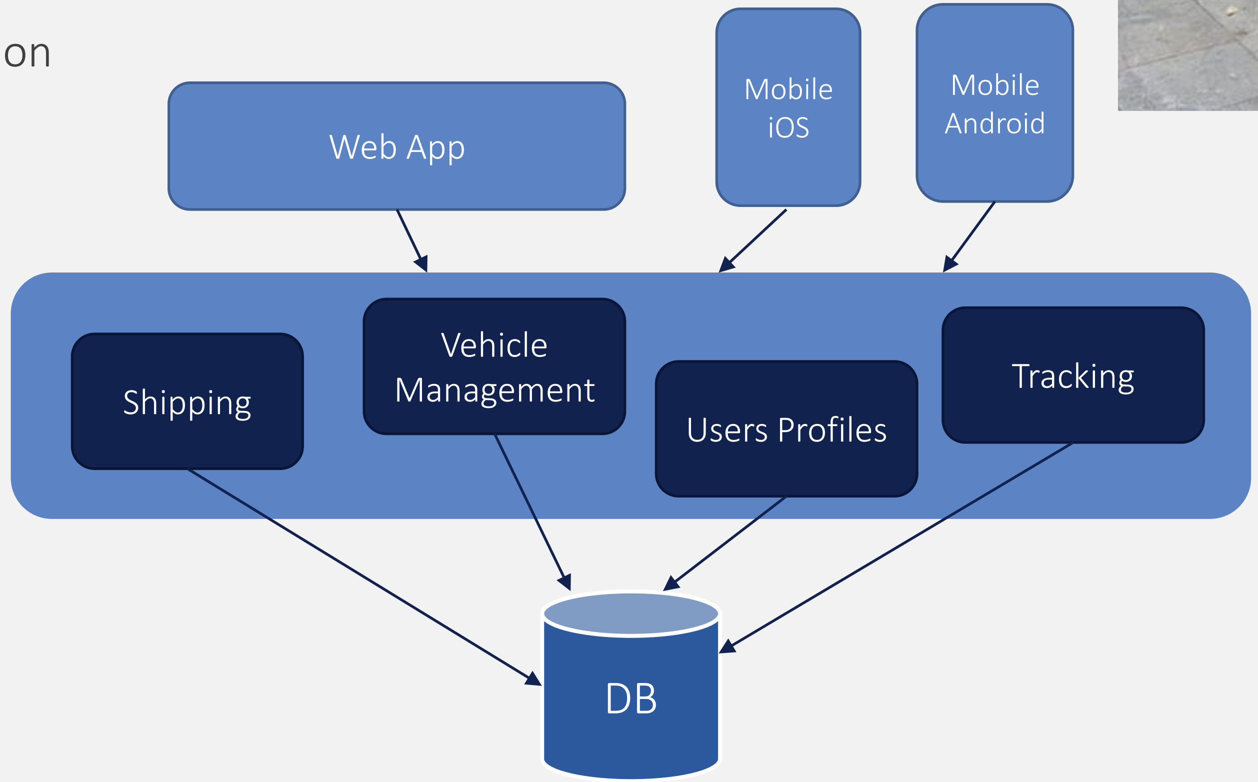
Tackling the business case

Monolithic Architecture

Downsides

- Hard to maintain the modularity
- Bigger == more complex
- Scale out the whole application
- Fault tolerance
- Update to new technology
- Multiple teams





What is Microservices architecture?

- Microservices are small, independent, and loosely coupled
- Each service is a separate codebase, which can be managed by a small development team
- Services can be deployed independently
- Services are responsible for persisting their own data or external state
- Services communicate with each other by using well-defined APIs
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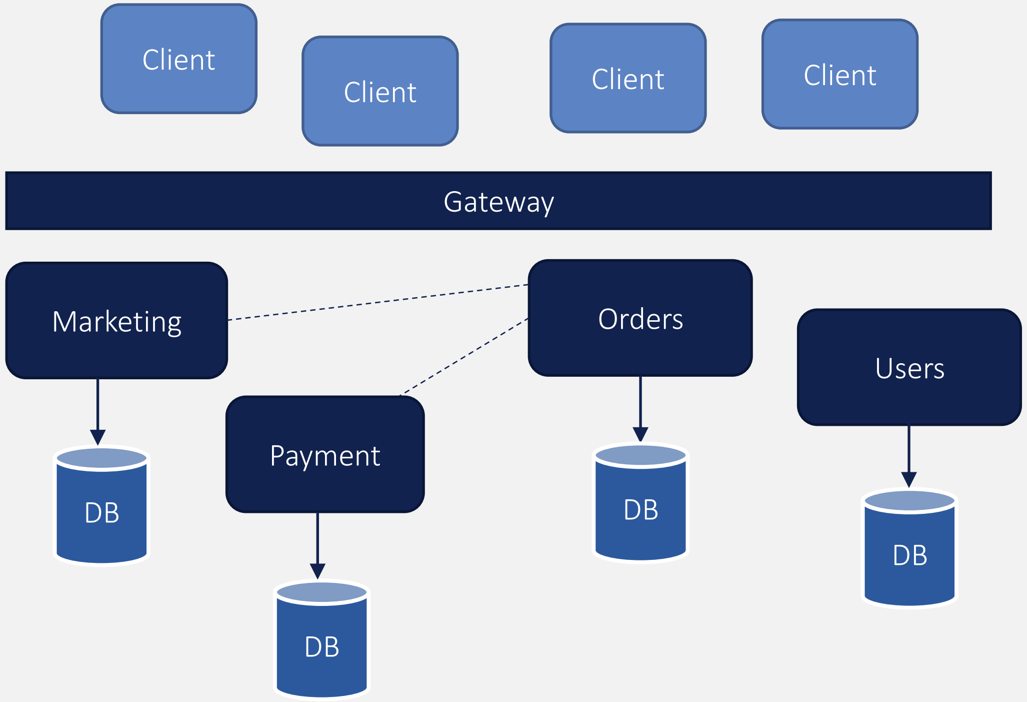
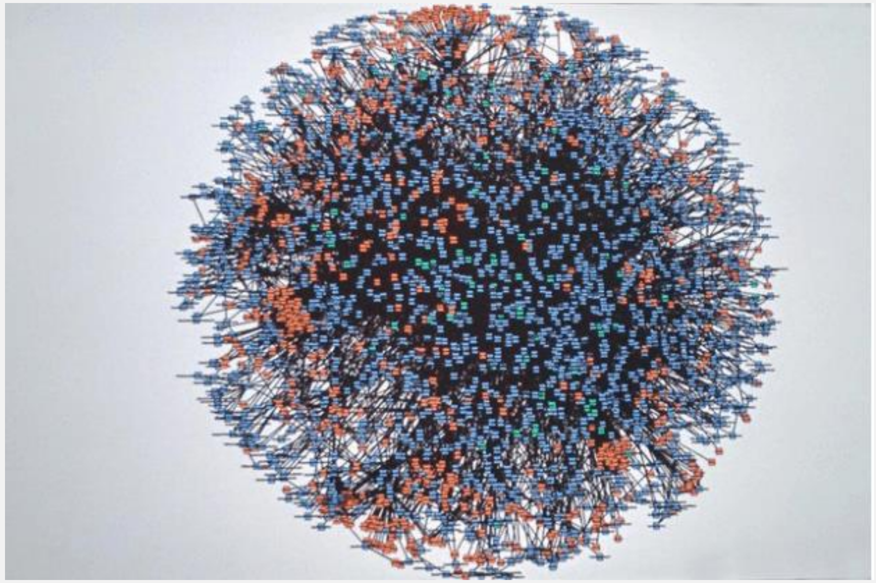


Microservices Examples

- Amazon



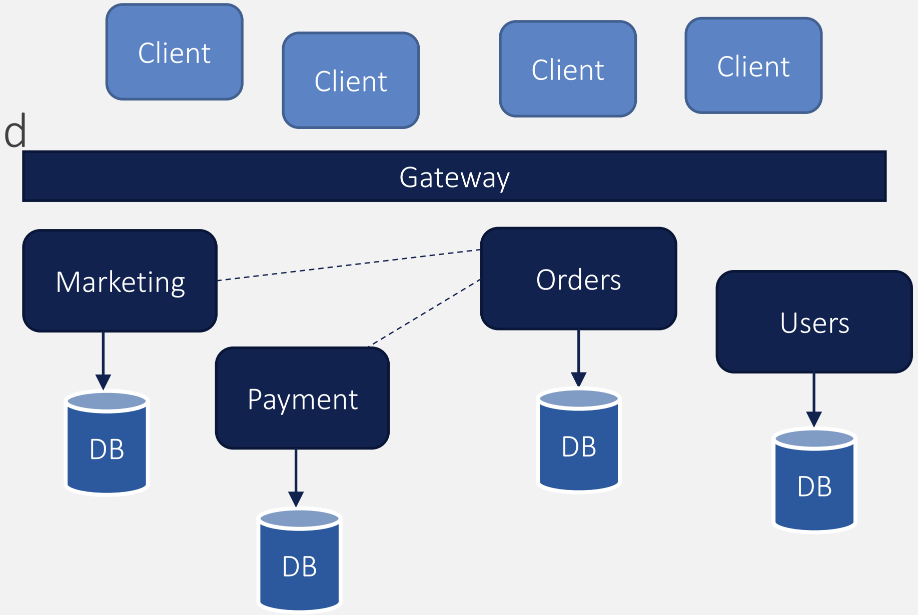
This is a 2008 graphic of Amazon’s microservices infrastructure

- **Netflix**: 110 million subscribers, 1 billion hours of video each week, 5 million new subscribers per quarter. Uses over 700 loosely coupled microservices
- **Uber**: 1300 microservices

Benefits and Challenges

Benefits

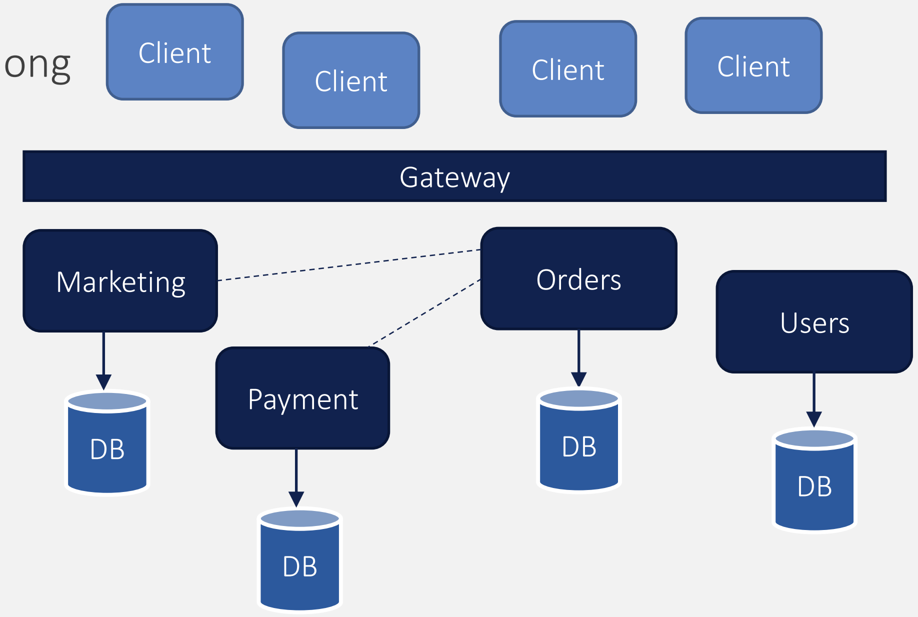
- **Small, focused teams**: A microservice should be small enough that a single feature team can build, test, and deploy it.
- **Agility**: easier to manage bug fixes and feature releases.
- **Small code base**
- **Mix of technologies**
- **Fault isolation:** as long as any upstream microservices are designed to handle faults correctly
- **Scalability:** scale out subsystems that require more resources, without scaling out the entire application
- **Data isolation:** easier to perform schema updates



Benefits and Challenges

Challenges

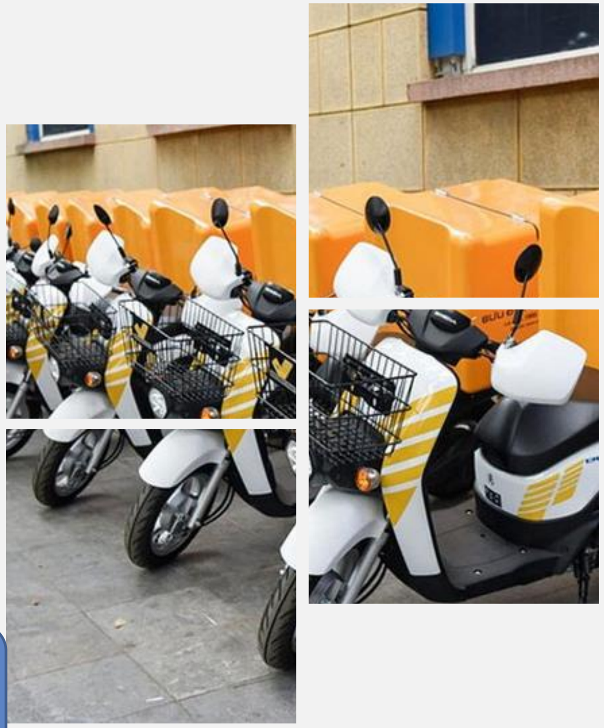
- **Complexity**: Each service is simpler, but the entire system as a whole is more complex.
- **Development and testing**: rely on other dependent services requires a different approach, refactoring across services, integration tests
- **Lack of governance:** many different languages and frameworks. It may be useful to put some project-wide standards
- **Network congestion and latency:** chain of service dependencies gets too long (service A calls B, which calls C...), avoid overly chatty APIs
- **Data integrity:** data consistency can be a challenge
- **Management:** requires a mature DevOps culture
  Correlated logging across services
- **Versioning:** Updates to a service must not break services
- **Skill set**

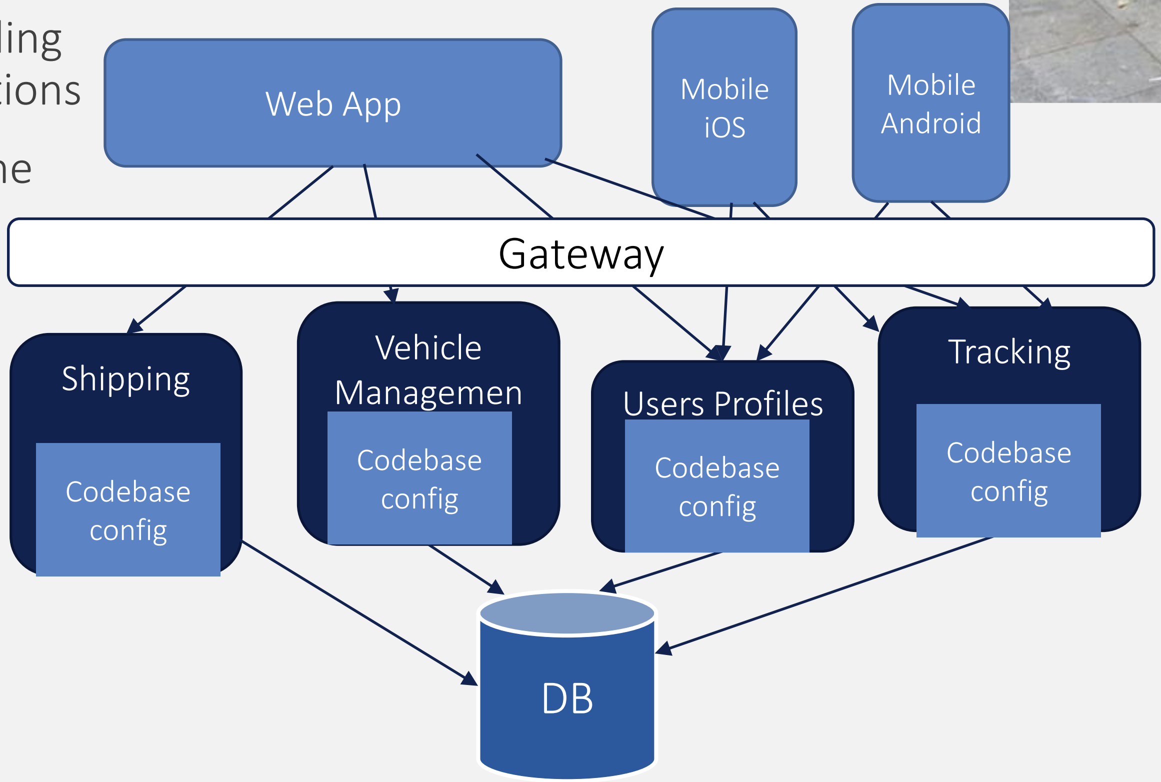


Tackling the business case (cont.)

Distributed Monolithic Architecture

- Independent services
- Shared database
- Must be deployed and released at once
- Bundled into single package including codebase , libraries and configurations
- Introduce API Gateway to overcome clients' maintenance



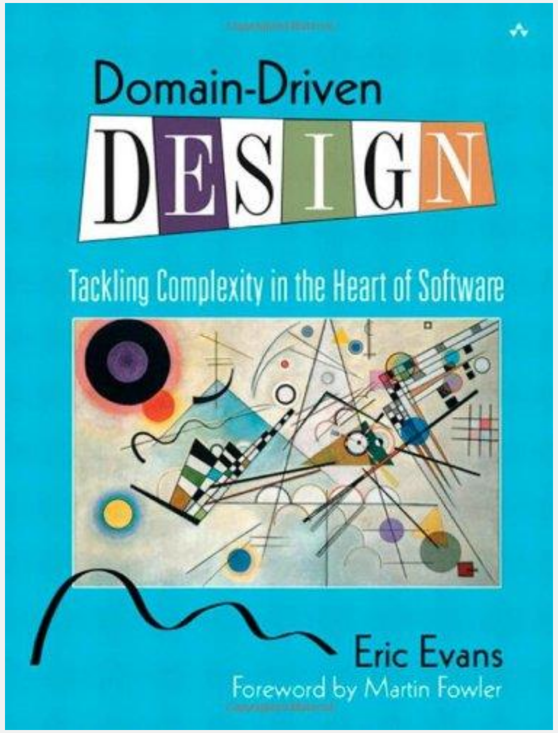


Domain Modeling for Microservices

Software Complexity Types

- Technical complexity
- Amount of data
- Performance
- Business logic complexity → DDD

Domain Driven Design can handle complex business logic complexity in such away that it would be possible to extend, maintained and keep it simple

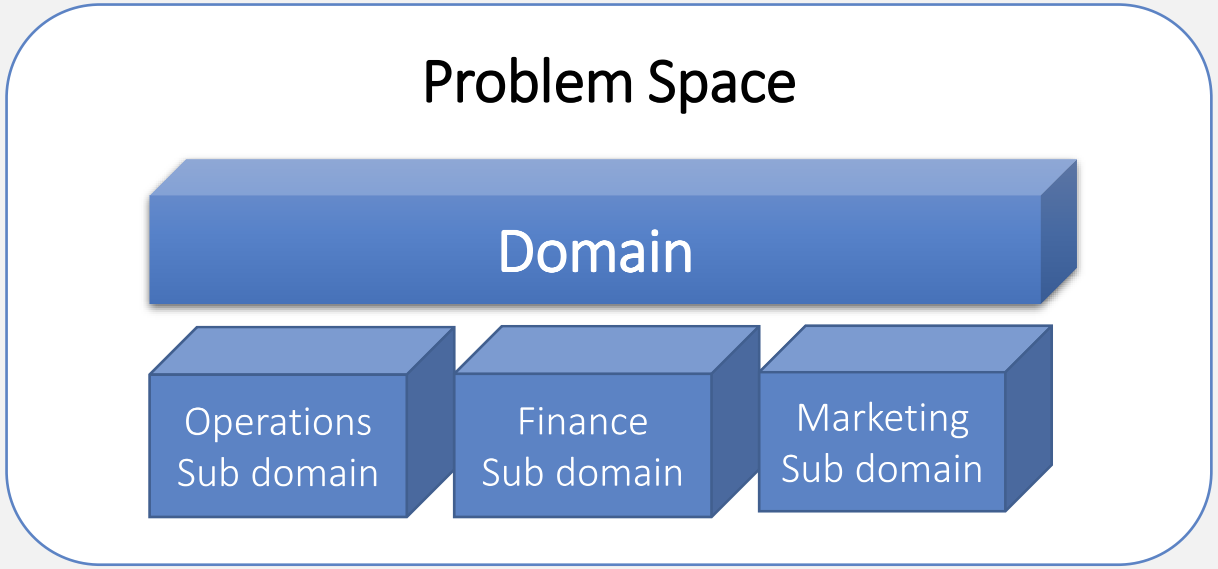

Domain-Driven
DESIGN
Tackling Complexity in the Heart of Software
Eric Evans
Foreword by Martin Fowler

Domain Modeling for Microservices

Domain

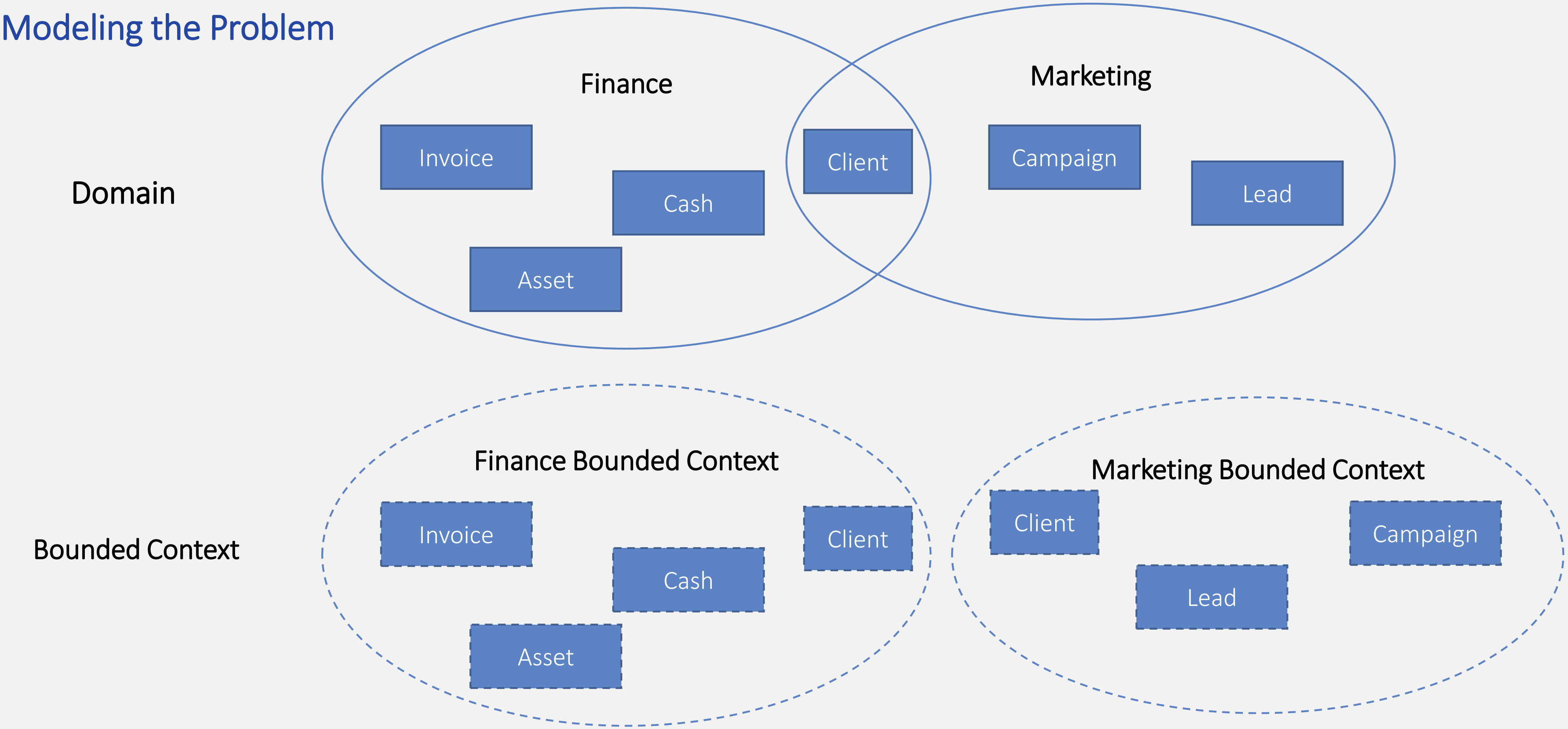
Field of study that defines a set of common requirements, terminology, and functionality for any software program

Ubiquitous Language



Domain Modeling for Microservices

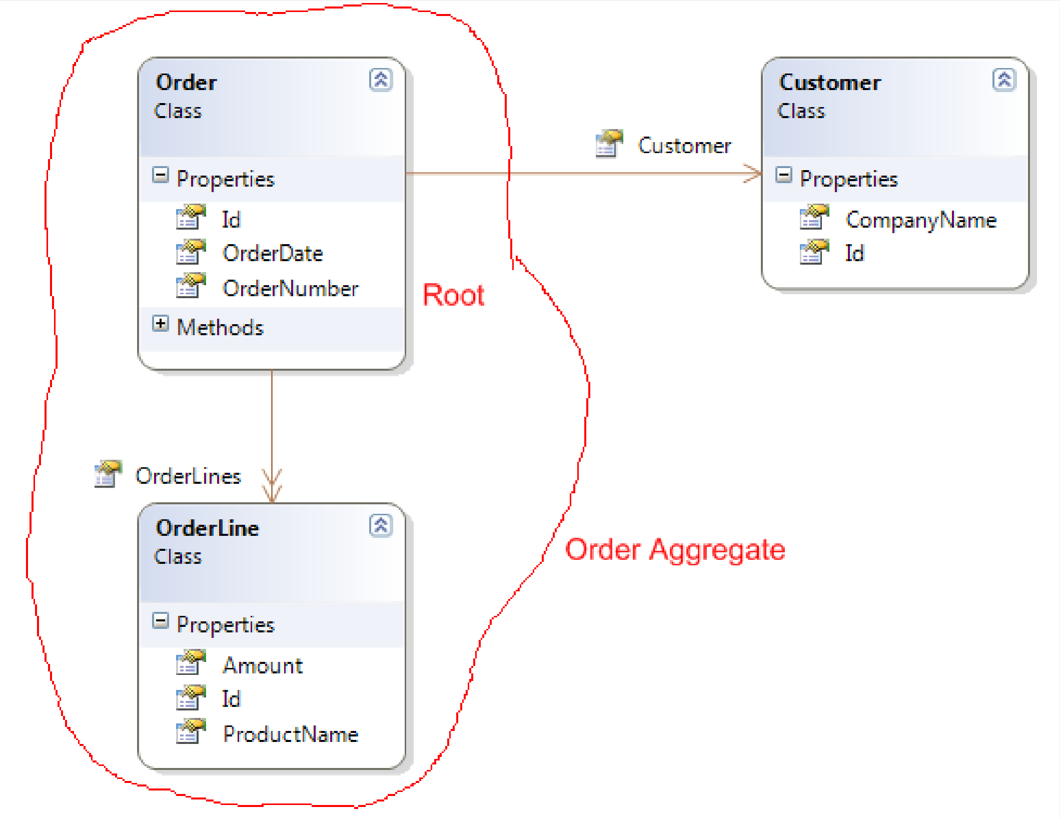
Modeling the Problem



Domain Modeling for Microservices

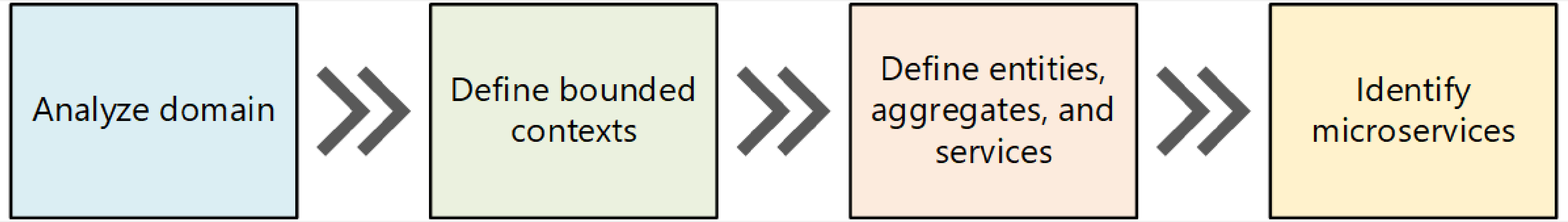
Aggregate

A DDD aggregate is a cluster of domain objects that can be treated as a single unit



Domain Modeling for Microservices

Domain-driven design (DDD) provides a framework that can get you most of the way to a set of well-designed microservices

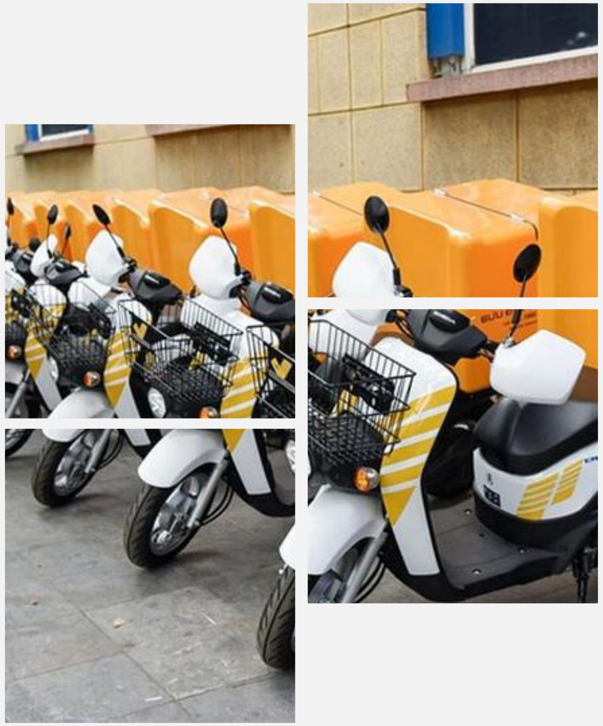


Analyze domain

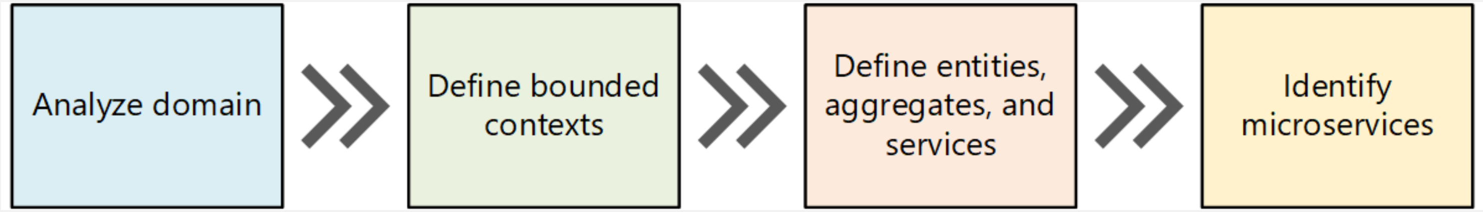
Define bounded contexts

Define entities, aggregates, and services

Identify microservices



Domain Modeling for Microservices



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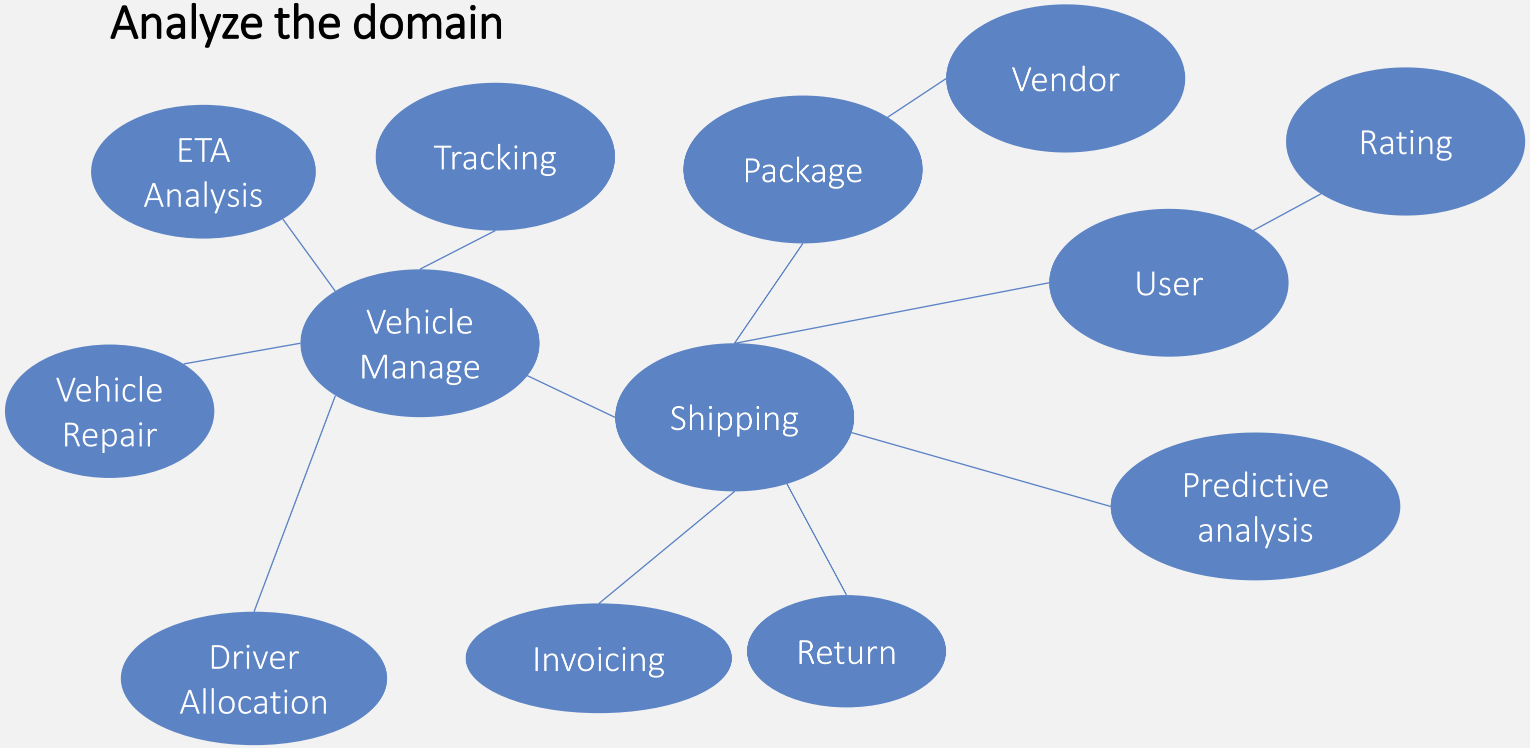


ETA Analysis

Tracking

Package

Vendor

Rating

User

Vehicle Manage

Vehicle Repair

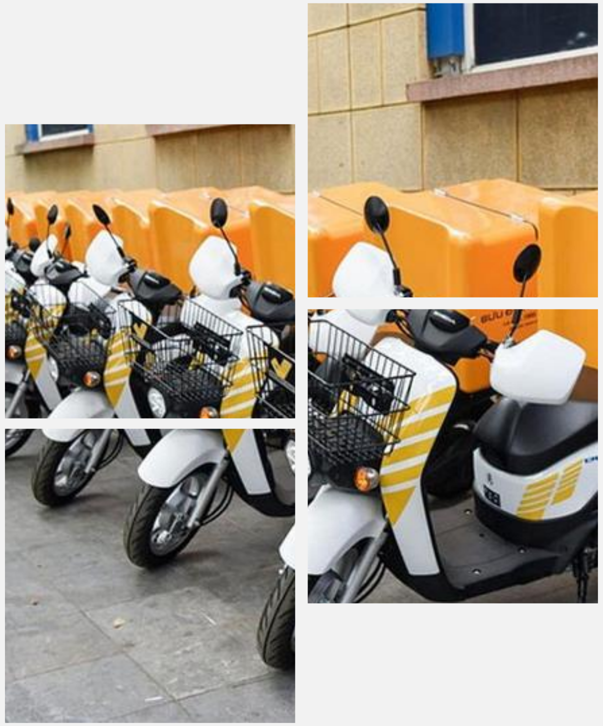
Shipping

Predictive analysis

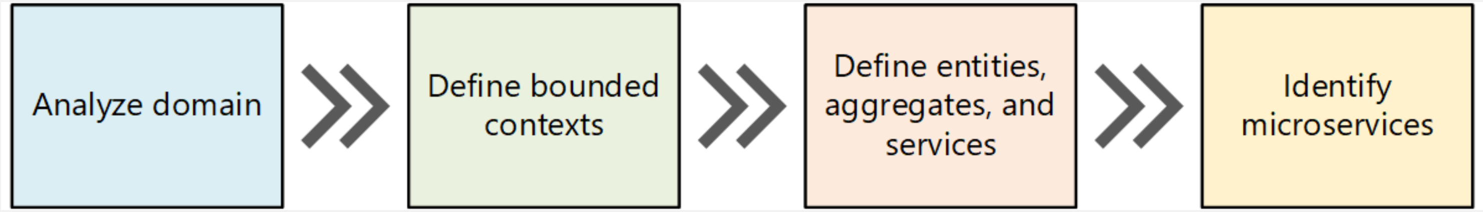
Driver Allocation

Invoicing

Return



Domain Modeling for Microservices



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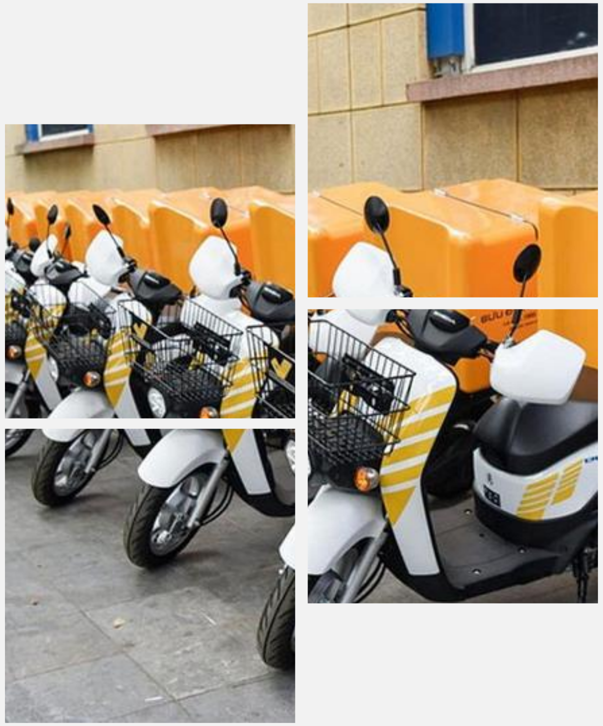

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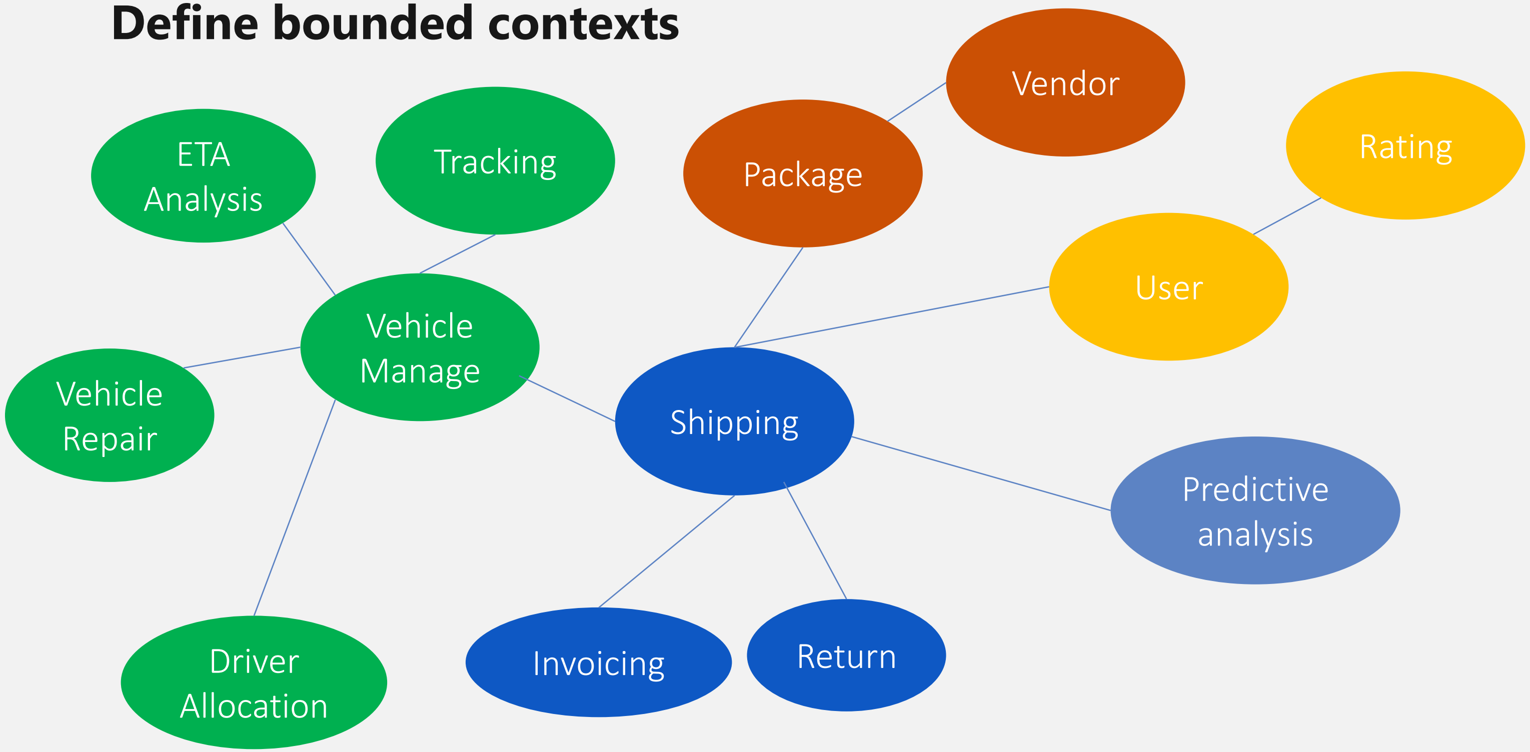

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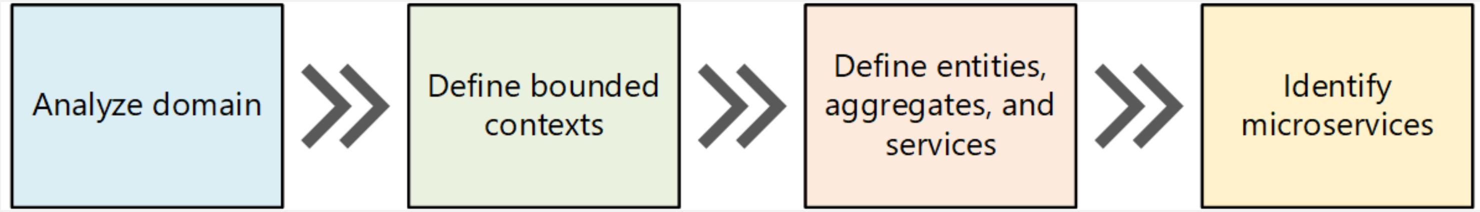

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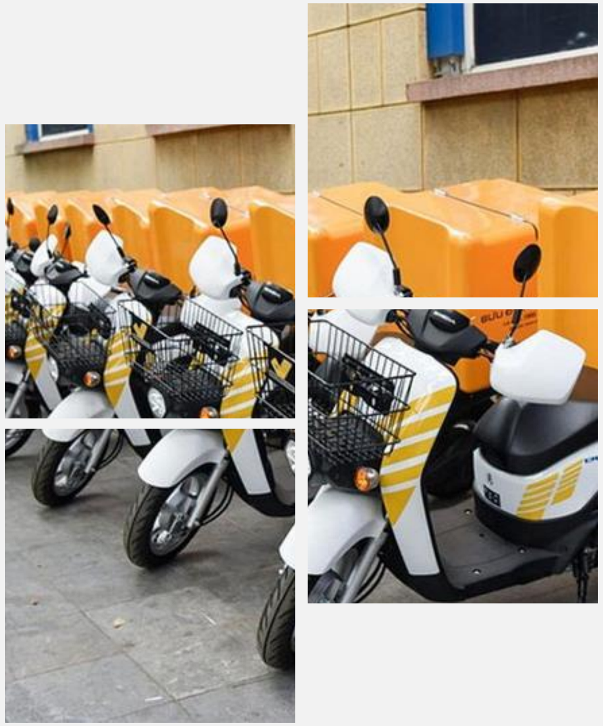
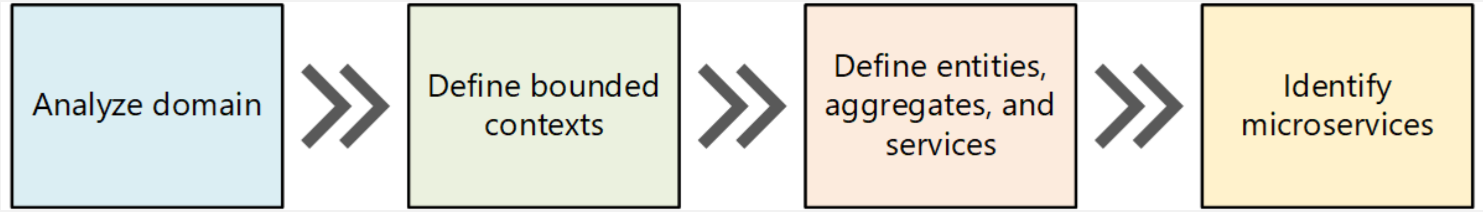


Define entities, aggregates, and services

- A customer can request a vehicle to pick up goods.
- The sender generates a tag (i.e. barcode) to put on the package.
- Pick up and deliver a package from the source location to the destination location
- The customer is notified when the delivery is completed.
- The sender can request delivery confirmation from the customer, in the form of a signature or finger print.

Shipping

Domain Modeling for Microservices



Analyze domain

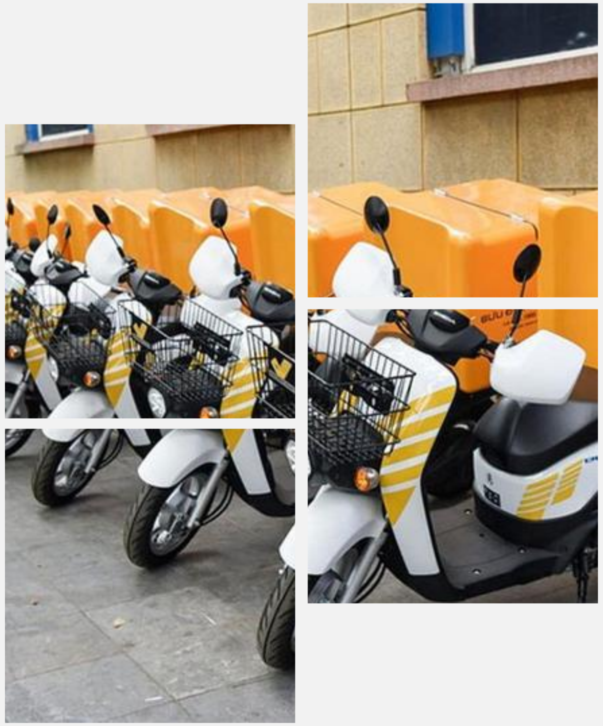
Define bounded contexts

Define entities, aggregates, and services

Identify microservices

Define entities, aggregates, and services

- **Entities**:
  - Delivery
  - Package
  - Vehicle
  - Account
  - Confirmation
  - Notification
  - Tag
- **Aggregates**: Delivery, Package, Vehicle, and Account



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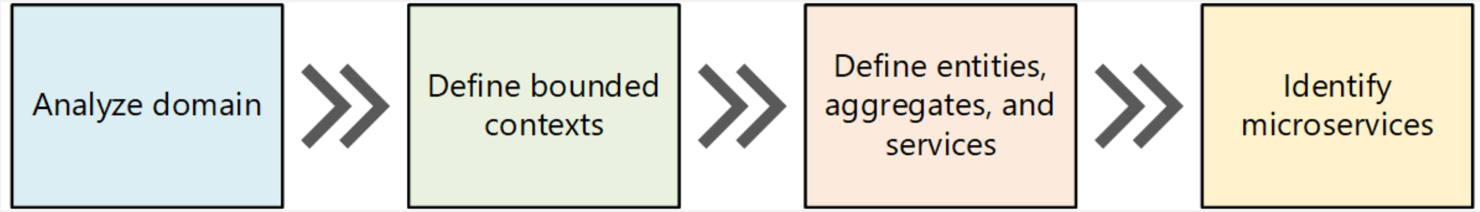

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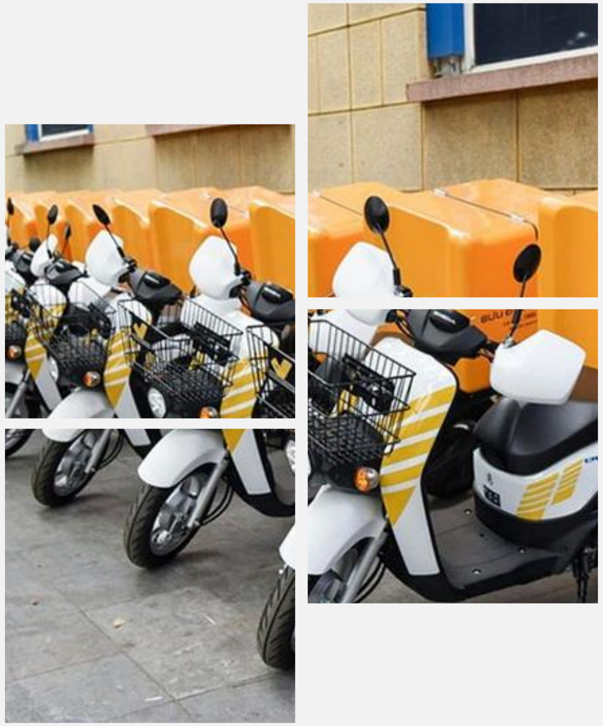
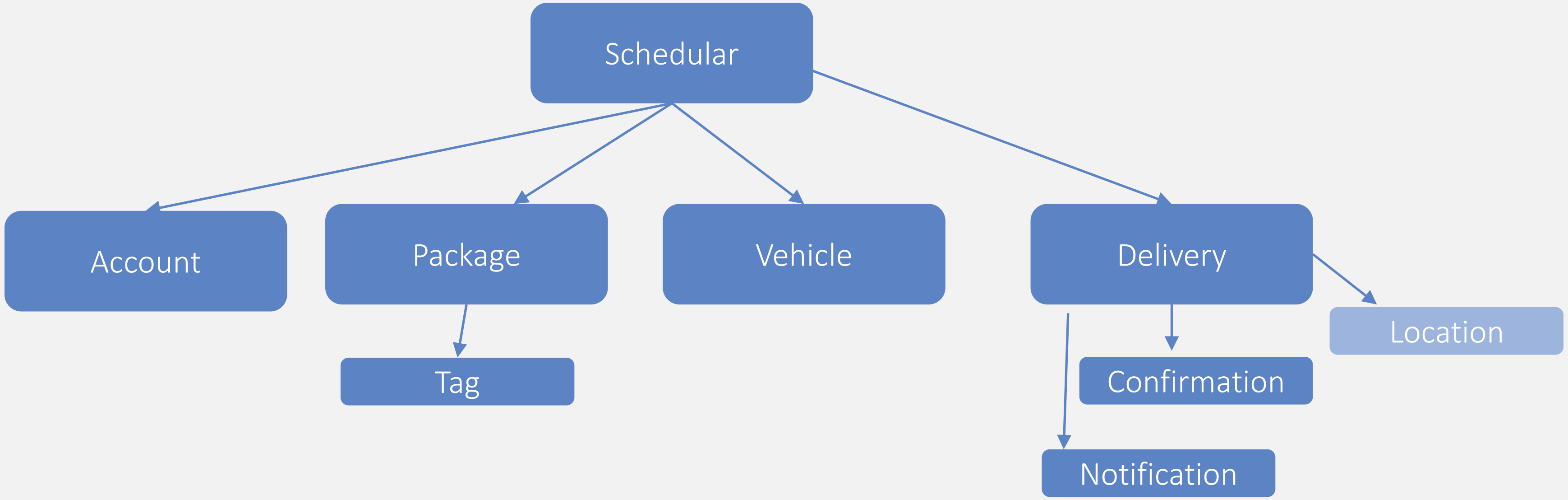


Define entities, aggregates, and services

- **Domain Service**: Schedular



Schedular

Account

Package

Vehicle

Delivery

Tag

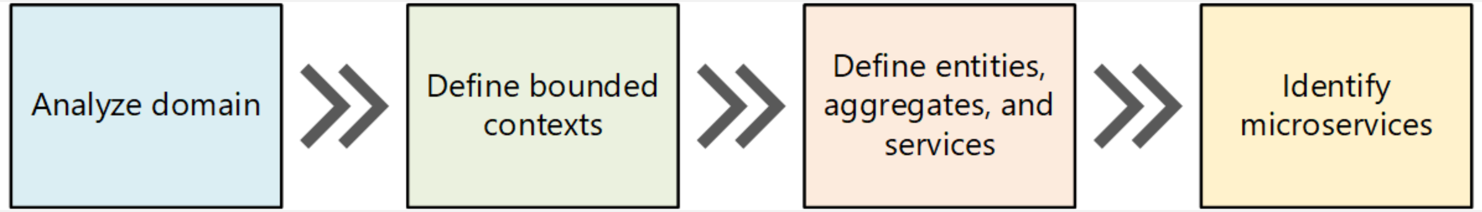
Location

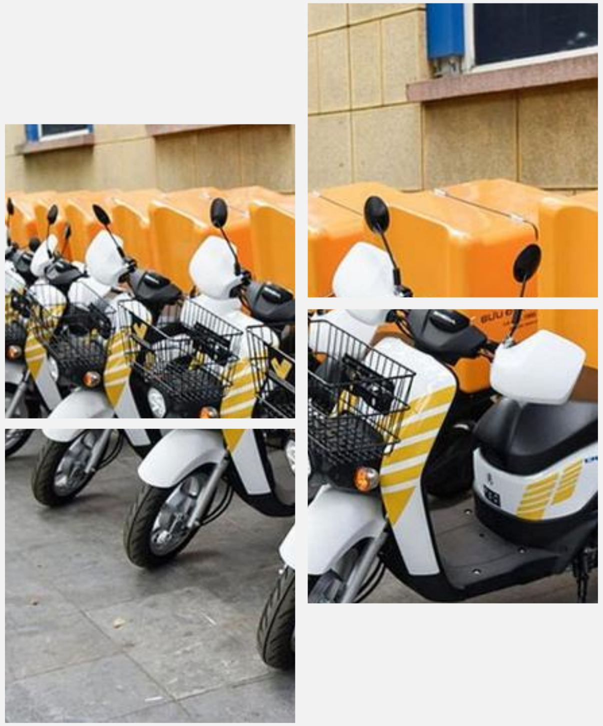
Confirmation

Notification

Shipping

Domain Modeling for Microservices

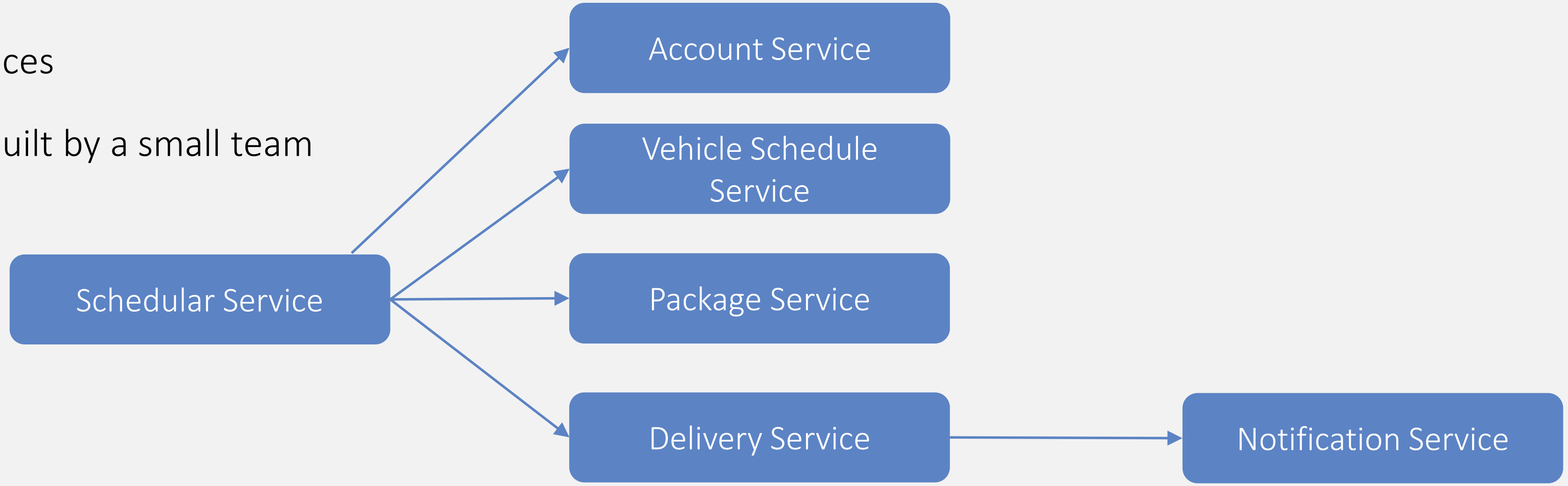




Identify microservices

"not too big and not too small"

- Each service has a single responsibility.
- No chatty calls between services
- Small enough that it can be built by a small team


Account Service
Vehicle Schedule Service
Schedular Service
Package Service
Delivery Service
Notification Service