

# Microservices Architecture

*Software Architecture*

Richard Thomas

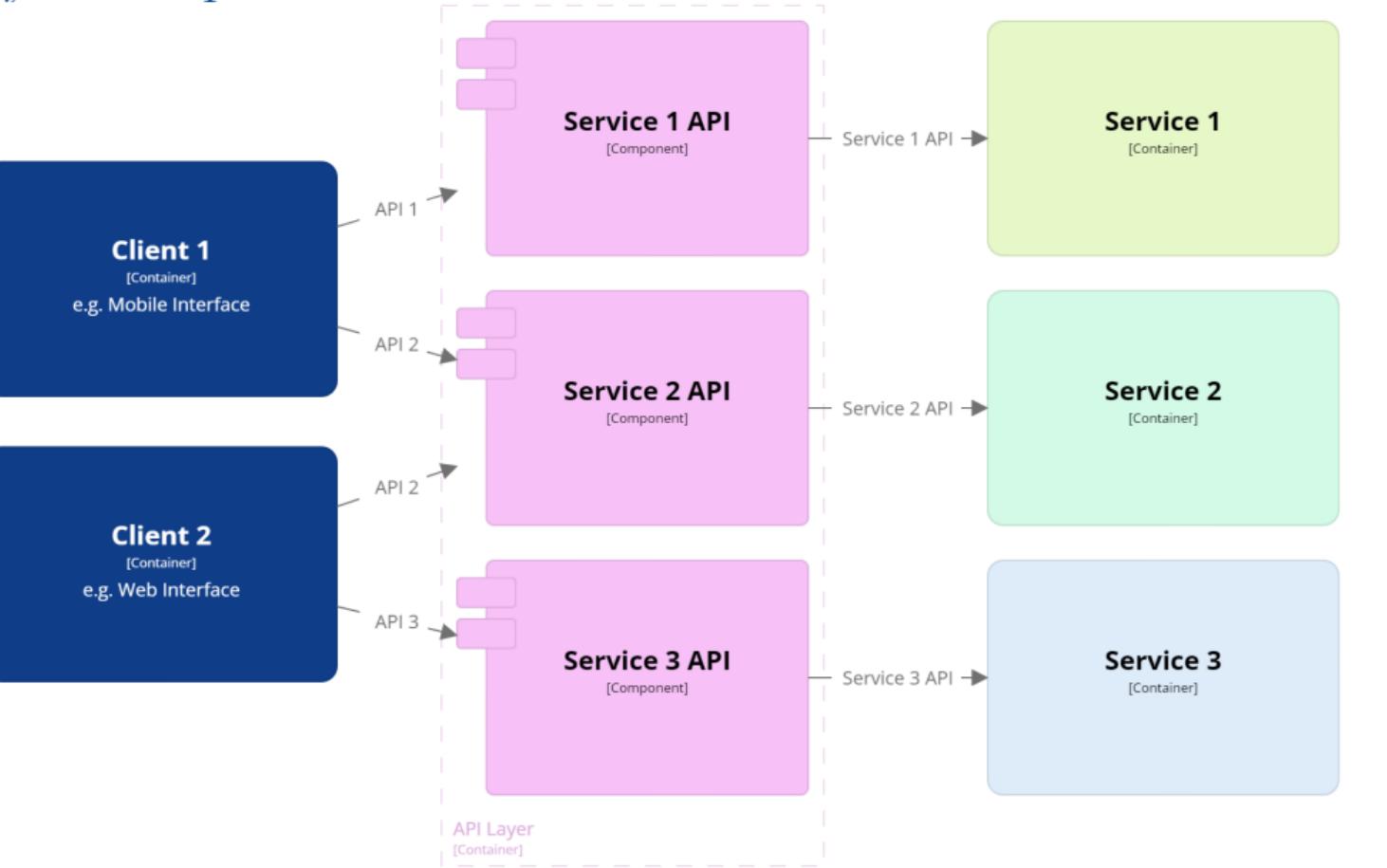
April 14, 2025

# Microservices General Topology



- Multiple clients demonstrates common scenario of multiple interfaces to system (e.g. mobile, web).
- Client UIs may be monolithic to provide a rich interface.

# API Layer Components



- Each client may use a different combination of services.
- API layer provides reverse proxy or gateway services, see Service-Based Architecture notes & slides.
- Typically Service APIs in this layer have a one-to-one relationship with Services and are designed by the Service teams.
- Routing behaviour may not be required.

## Service 1 Components



Services 2 & 3 are essentially the same.

## Client with Monolithic UI



- Purist Microservices architecture – each service development team builds their service's UI(s).
- Typically needs some coordinating activity in the UI.
- Can still have multiple UIs (e.g. web, mobile, ...).

### *DDD Influence*

Services are *bounded contexts*.

Bounded contexts are not necessarily *services*.

### *Definition 0.* Bounded Context

Logical boundary of a domain where particular terms and rules apply consistently.



### *Definition 0.* Service Cohesion Principle

Services are cohesive business processes.

They are a bounded context.

## Large Bounded Contexts

A bounded context may be too large to be a single service.

Split it into services that are *independent* sub-processes.

*Definition 0.* Service Independence Principle

Services should not depend on the implementation of other services.

*Corollary 0.* Low Coupling

There should be minimal coupling between services.

*Corollary 0.* No Reuse

Avoid dependencies between services.  
Do not reuse components between services.

## Bounded Domains Implications

- Duplication
  - Entities specialised for domain
    - Requires mapping of entity data between domains

## Bounded Domains Implications

- Duplication
  - Entities specialised for domain
    - Requires mapping of entity data between domains
  - Should everything be duplicated?

## Bounded Domains Implications

- Duplication
  - Entities specialised for domain
    - Requires mapping of entity data between domains
  - Should everything be duplicated?
    - What about common services (e.g. logging, ...)?

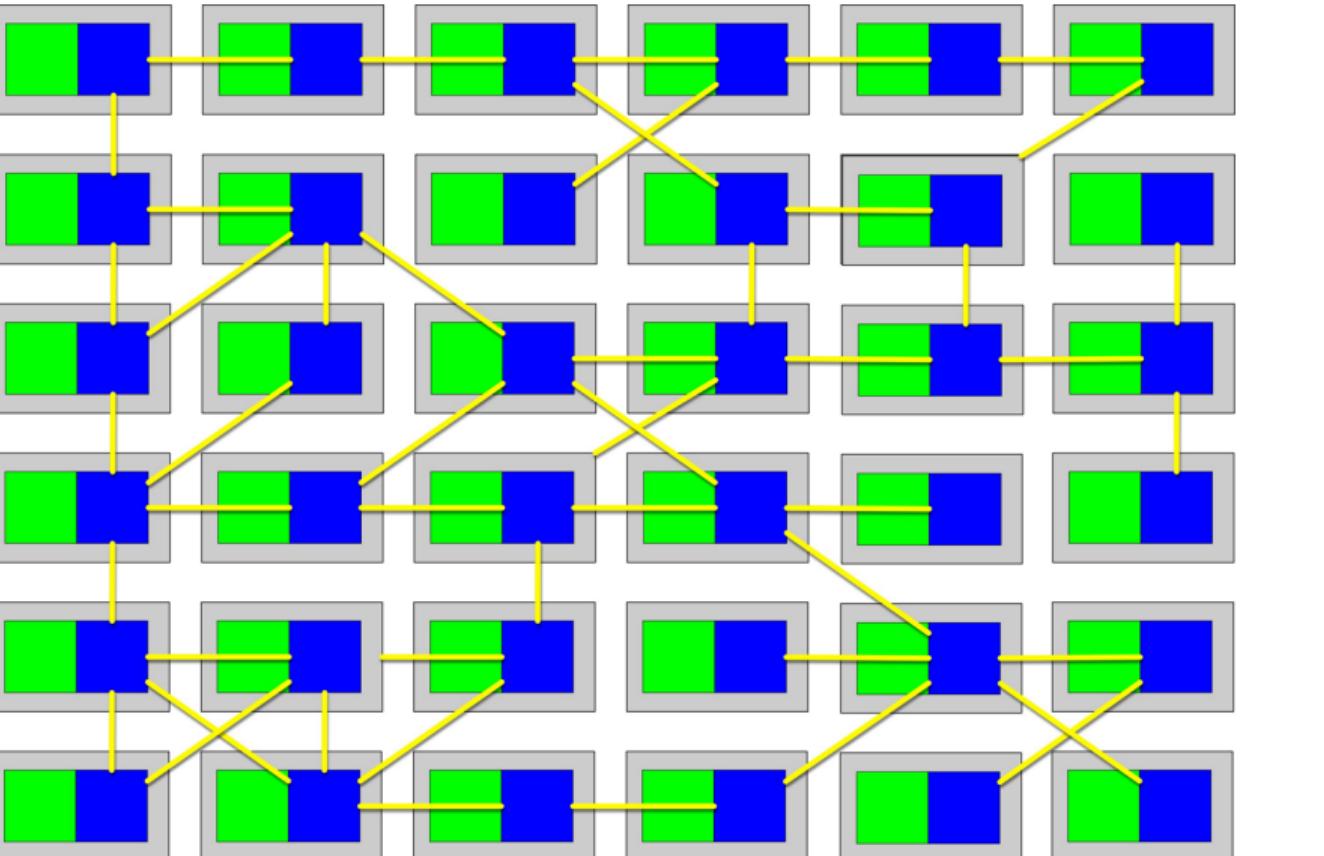
## Bounded Domains Implications

- Duplication
  - Entities specialised for domain
    - Requires mapping of entity data between domains
  - Should everything be duplicated?
    - What about common services (e.g. logging, ...)?
- Heterogeneity
  - Services can use different implementation technologies

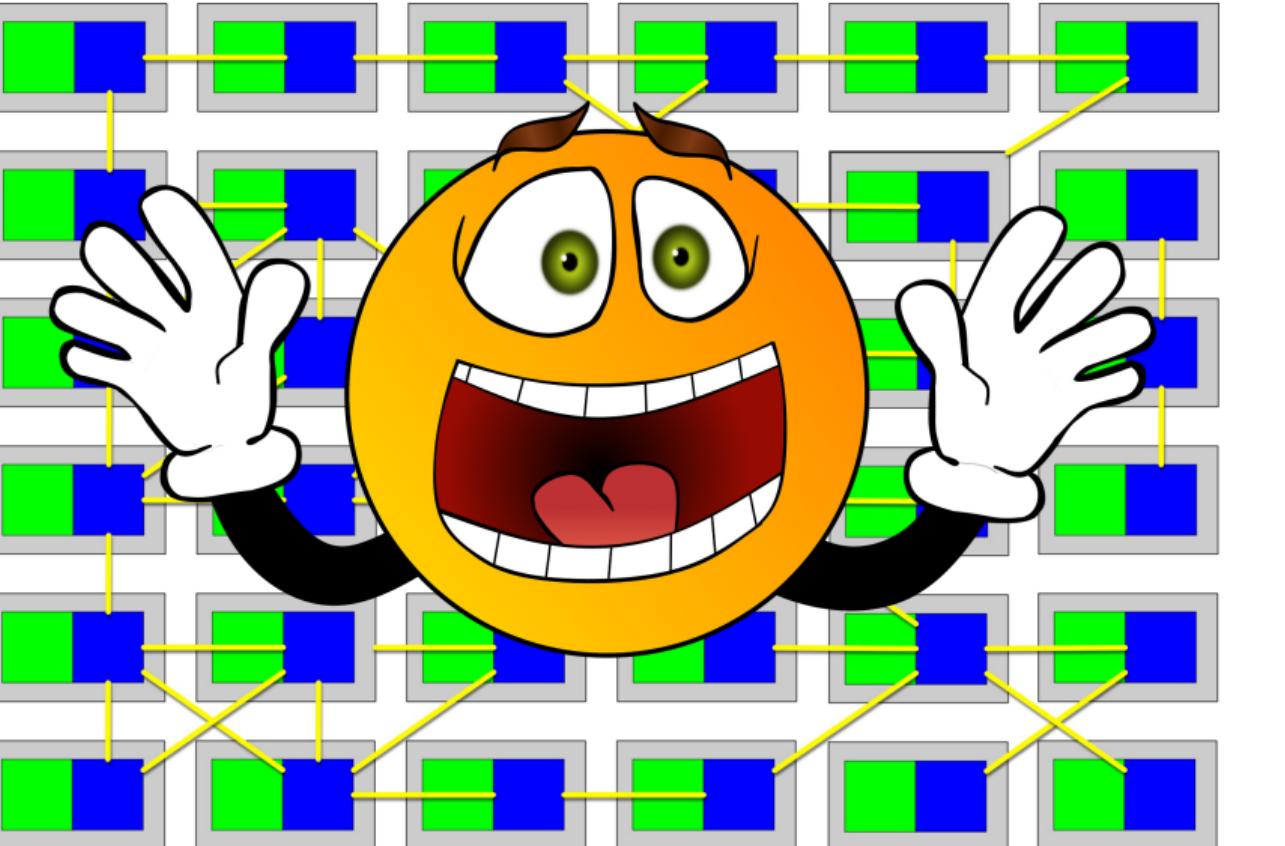
# Service Plane



## Service Mesh



## Service Mesh

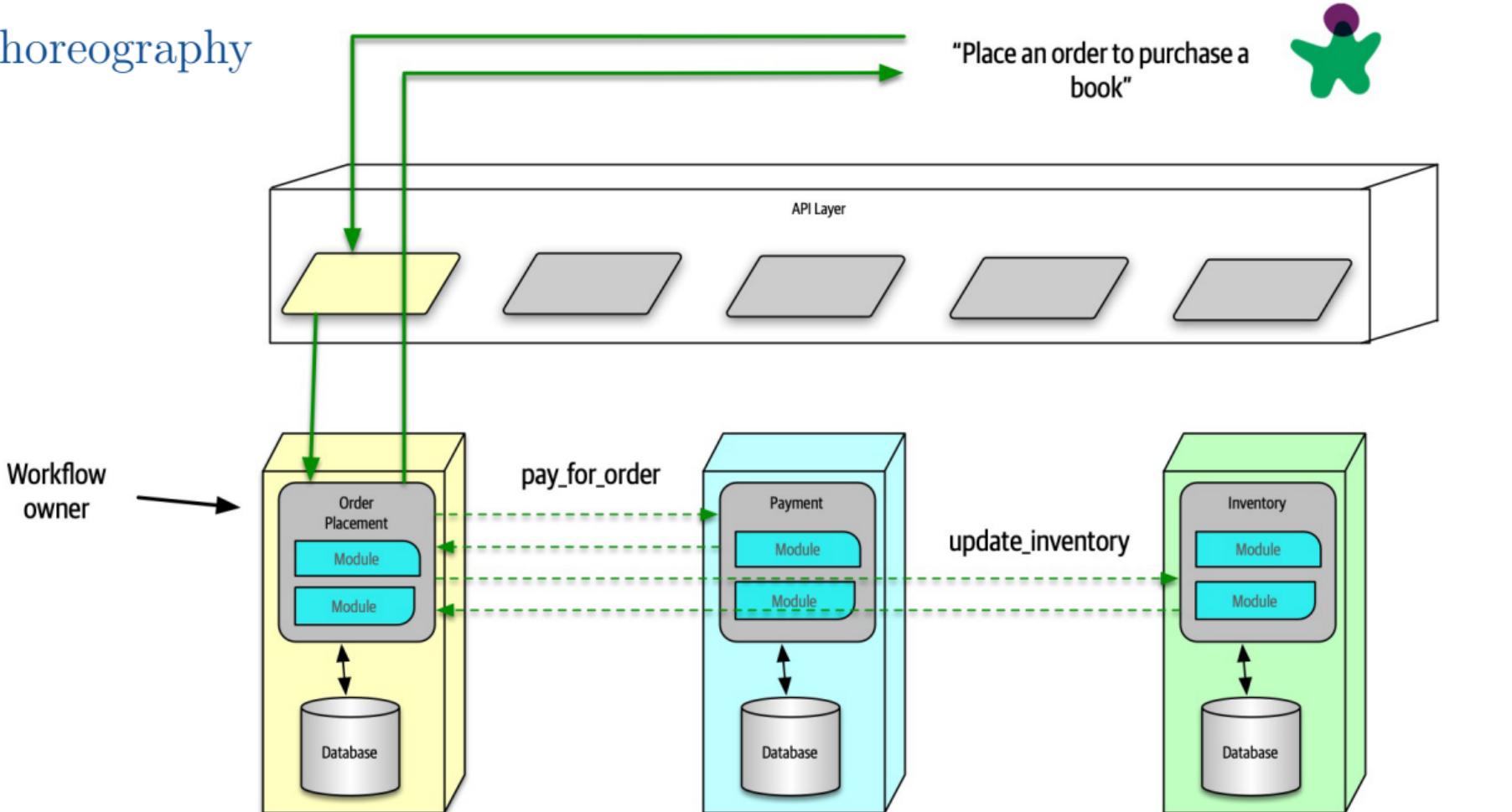


## *Choreography & Orchestration*

Choreography Similar to event-driven *broker*

Orchestration Similar to event-driven *mediator*

## Choreography





# Purchase Product Dynamic Diagram



# Orchestration



*Question*

How bad is the coupling with choreography or  
orchestration?

*Question*

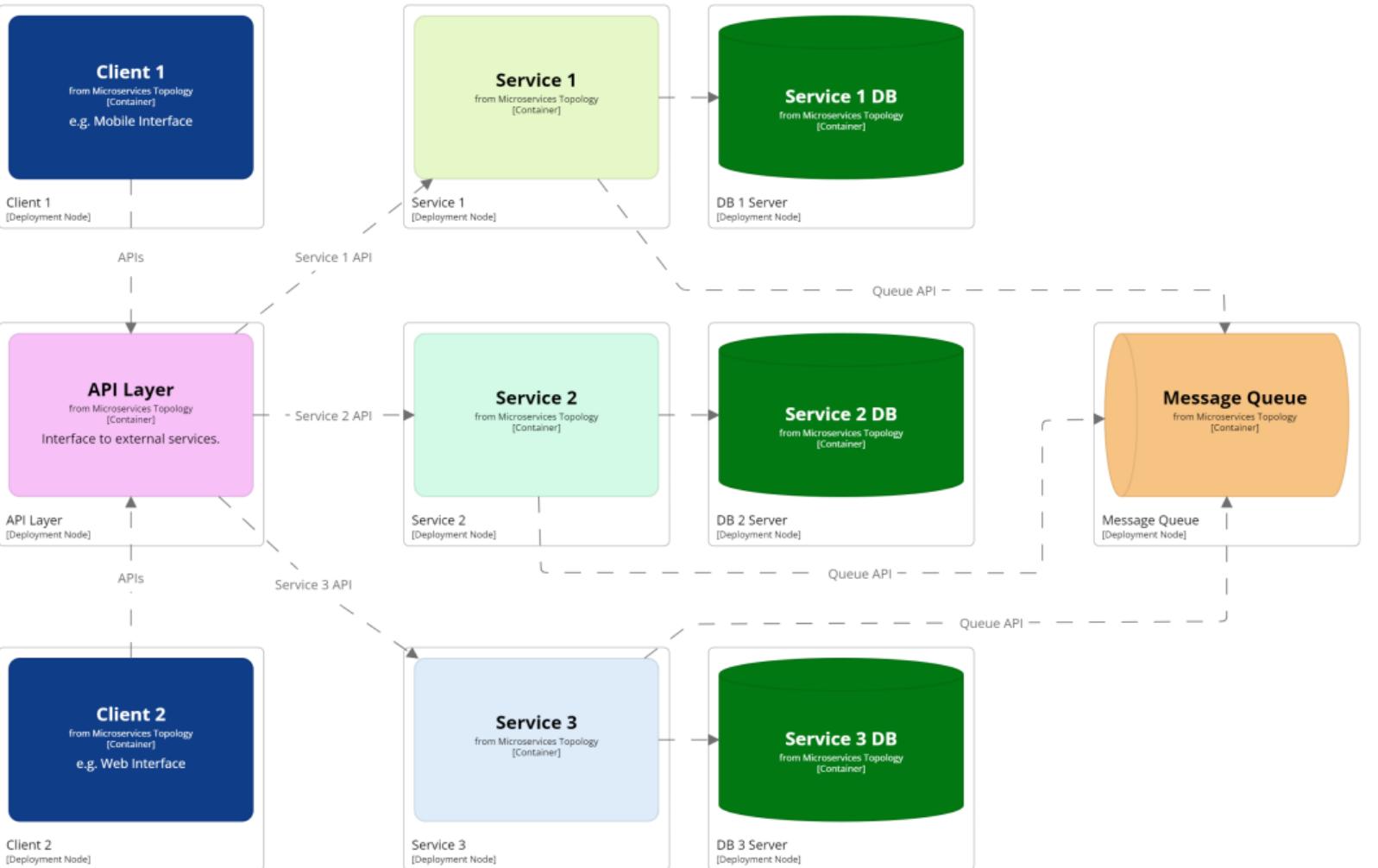
How bad is the coupling with choreography or orchestration?

*Answer*

For a large system, *very bad*.

In 2017, Uber had over 1400 services ... consider how bad coupling would be with either approach.

# Microservices with Event Queue



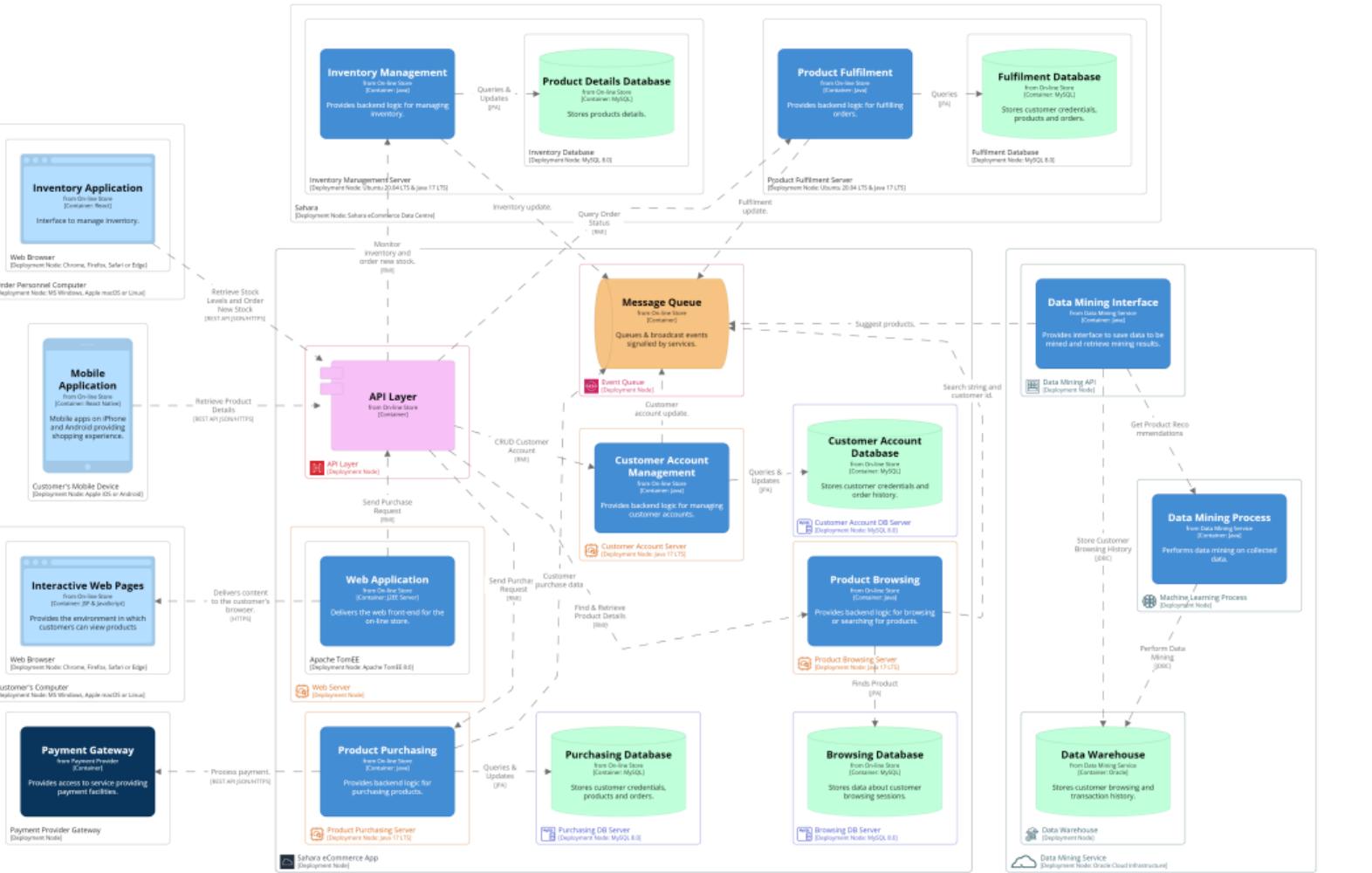
- Use the tried and true Observer pattern, with the event-driven architecture pattern.
- Services publish events indicating what they have been done.
- Services listen for events to decide how to coordinate their part of the system behaviour.

## Service 1 Components with Event Queue



Services 2 & 3 are essentially the same.

Sahara using an Event Queue



- Sahara eCommerce system as a simple microservices architecture, using event-driven messaging between services.
  - Services publish events indicating what they have been done.
  - Also an example of a multi-tenanted system built across in-house servers, AWS and OCI.

*Question*

Are *browsing* and *purchasing* separate contexts?

*Question*

Are *browsing* and *purchasing* separate contexts?

*Answer*

- Are they a single business process or different processes?
- Do they share much or little data?

- Probably different business processes, but possibly the same context.
- If separate services, browse needs to send an event for every change to the shopping cart, and purchase needs to listen for these.
- Possibly merge into one service, as one context.

*Question*

- What about *inventory management* and *browse*?
- How do they maintain a consistent product database?

## Pros & Cons

Modularity



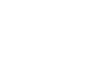
Extensibility



Reliability



Interoperability



Scalability



Security



Deployability



Testability



Simplicity

