Microsoft

Modernizing Applications with Containers and Orchestrators

Microsoft Services

Microsoft

Module 4 - Microservices and Containers

Microsoft Services

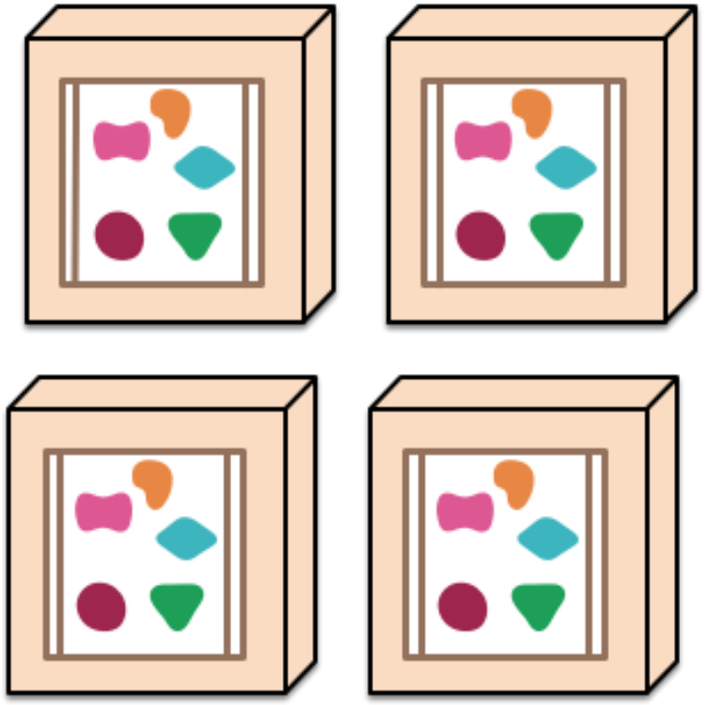
Objectives

- What are Microservices?
- Microservices Patterns
- Microservices Real World Case Studies
- Microsoft Platform and Microservices
- Containers & Microservices
- Demo

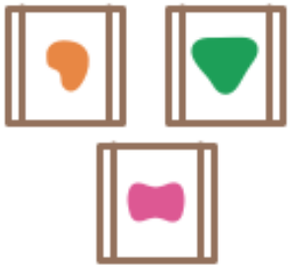
Microservices Architecture

A monolithic application puts all its functionality into a single process...

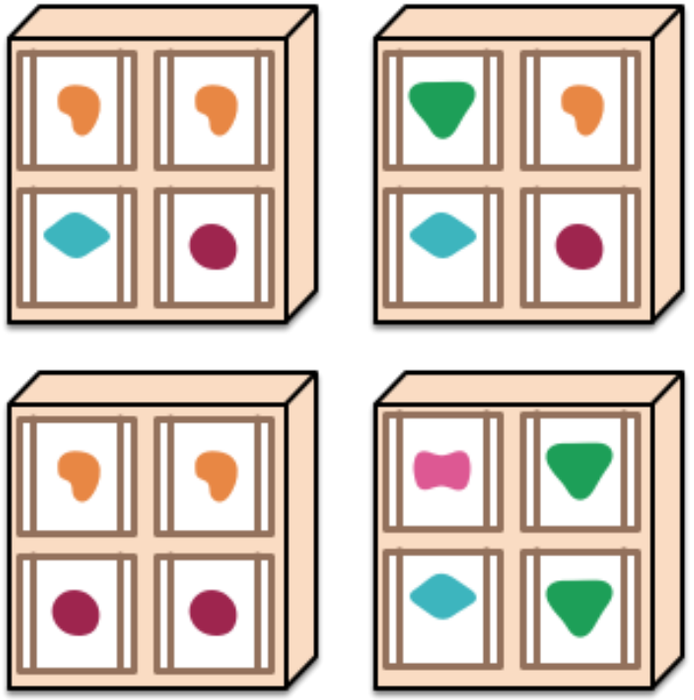
... and scales by replicating the monolith on multiple servers



A microservices architecture puts each element of functionality into a separate service...

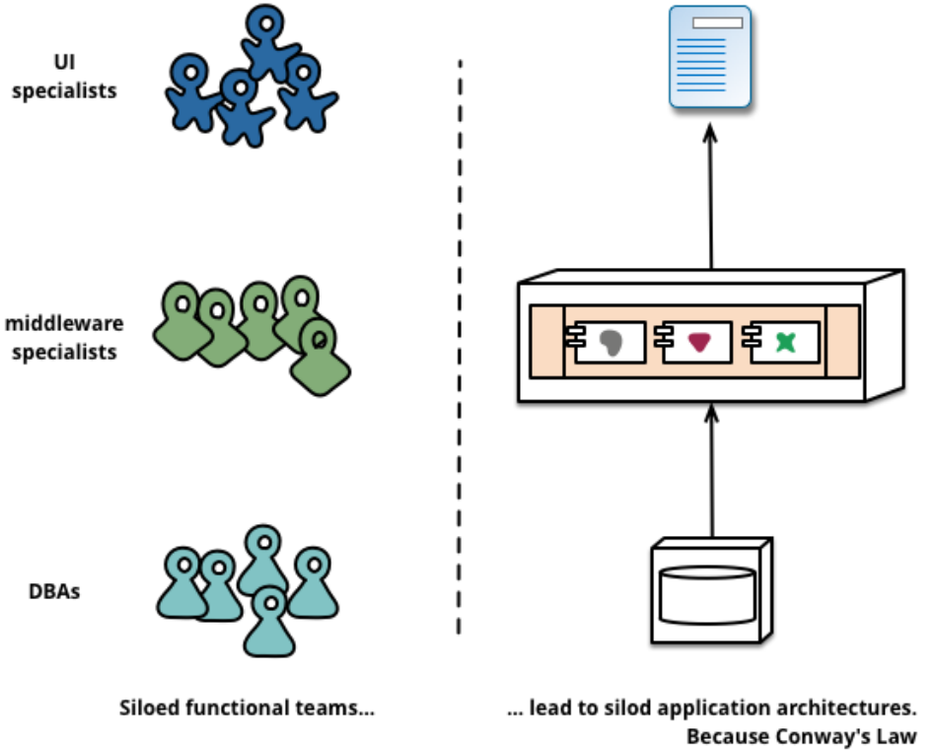


... and scales by distributing these services across servers, replicating as needed.

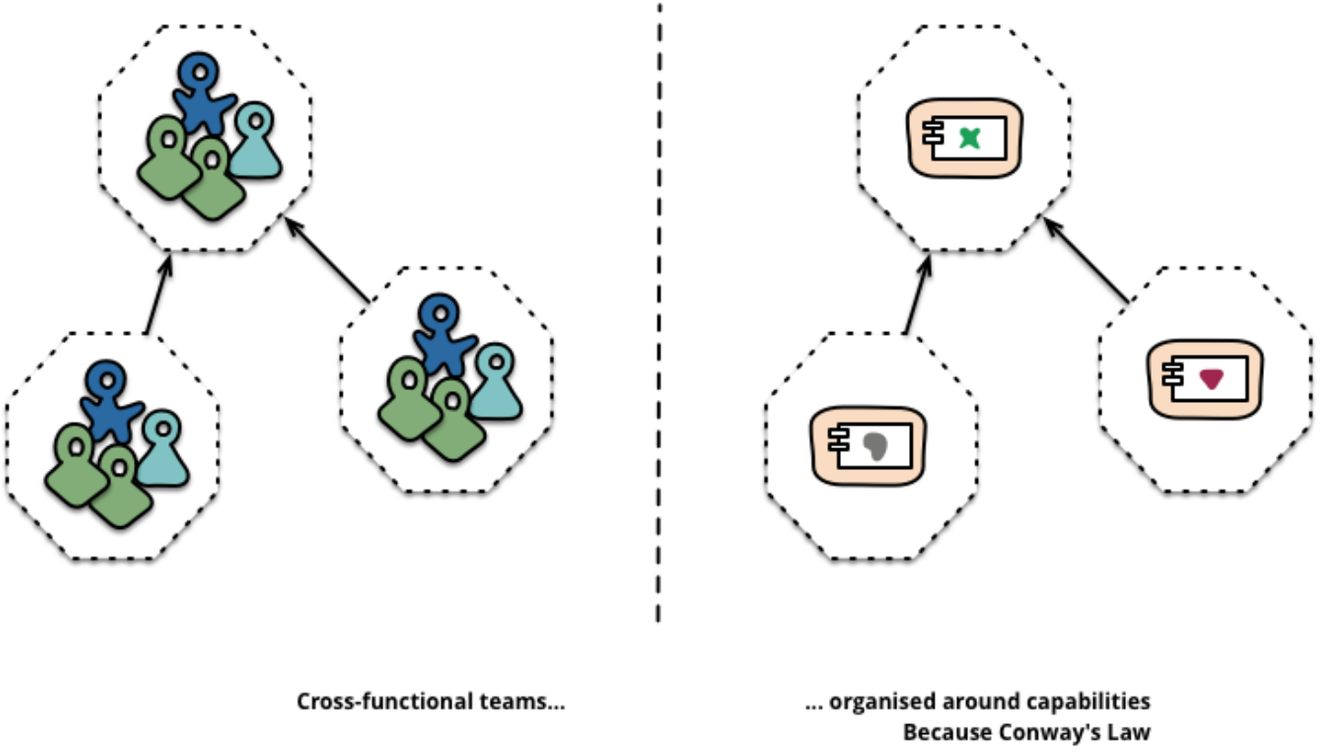


Microservices Architecture (Cont.)

"Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure." -- Melvyn Conway, 1967



Monolithic



Microservices

SOA and Microservices

SOA

- Services are interfaces of a large monolith
- Orchestration is often required and tend to contain business logic
- Spans across the enterprise

Microservices

- Services are individually developed and deployed
- Does not require integration technology
- Logic resides in microservices
- Can be limited to an individual project

Microservices Design Patterns

API Gateway

Challenges this pattern solves:

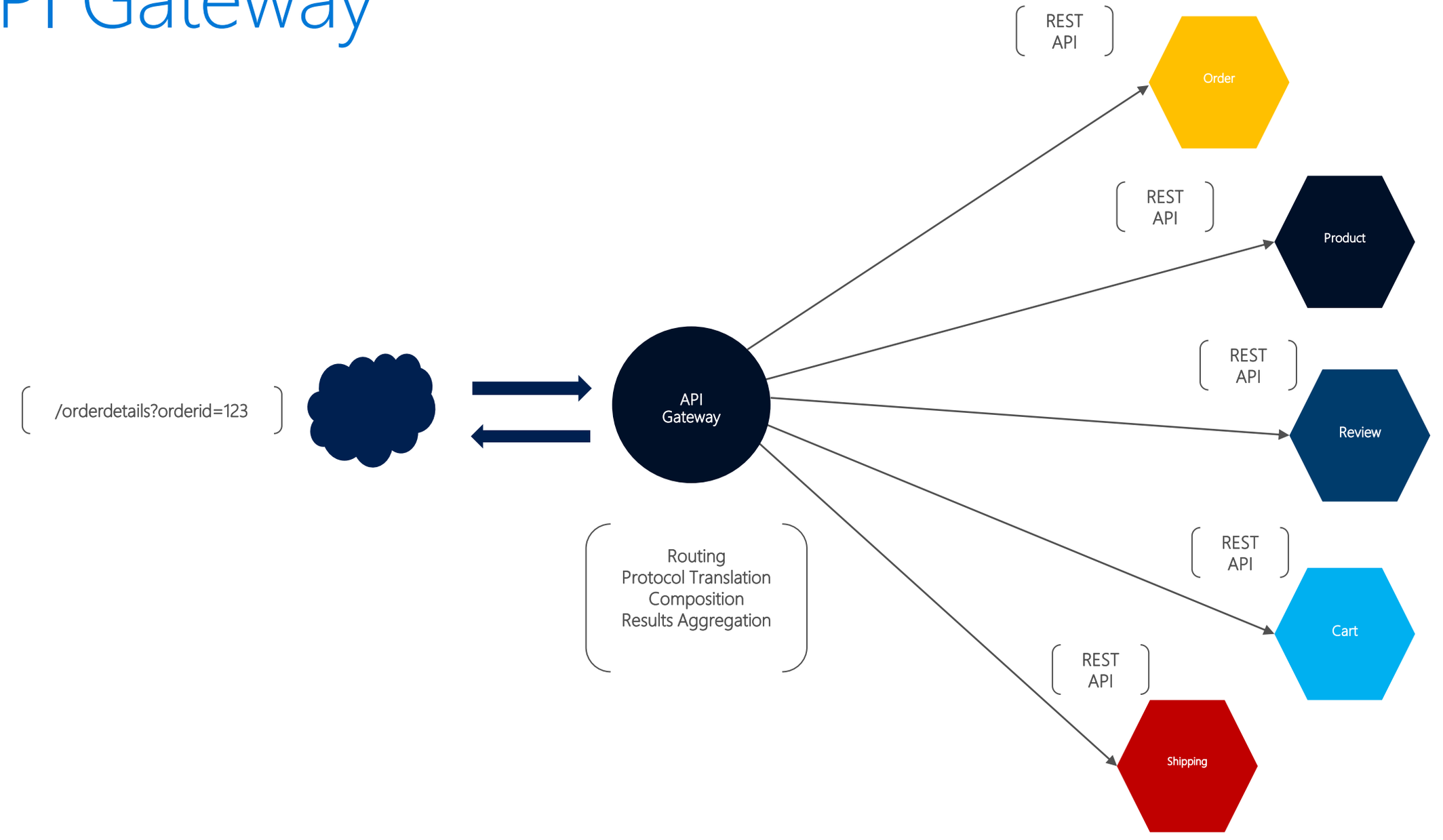
- Granularity of services is often more fine grained than what clients would need
- Different type of clients need different data
- Protocol used by services differ greatly. E.g. AMQP, WebSocket etc.
- Partitioning of services should be hidden from the clients

API Gateway

Solution:

- API Gateway acts as an entry point for all access to Microservices by encapsulating the internal system design and provides:
  - API that is tailored for each client
  - Security features such as authentication, token cache etc.
  - Protocol transition
  - Load balancing

API Gateway


/orderdetails?orderid=123
API
Gateway
Routing
Protocol Translation
Composition
Results Aggregation
REST
API
Order
REST
API
Product
REST
API
Review
REST
API
Cart
REST
API
Shipping

Service Discovery

Challenges this pattern solves:

- Services address change dynamically due to auto scaling
- Discovering services is inherently more challenging as more services are added

Solution

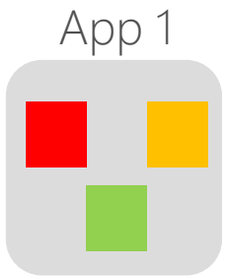
Discover services dynamically using service registry (database of available services) that will locate the instance of service to call

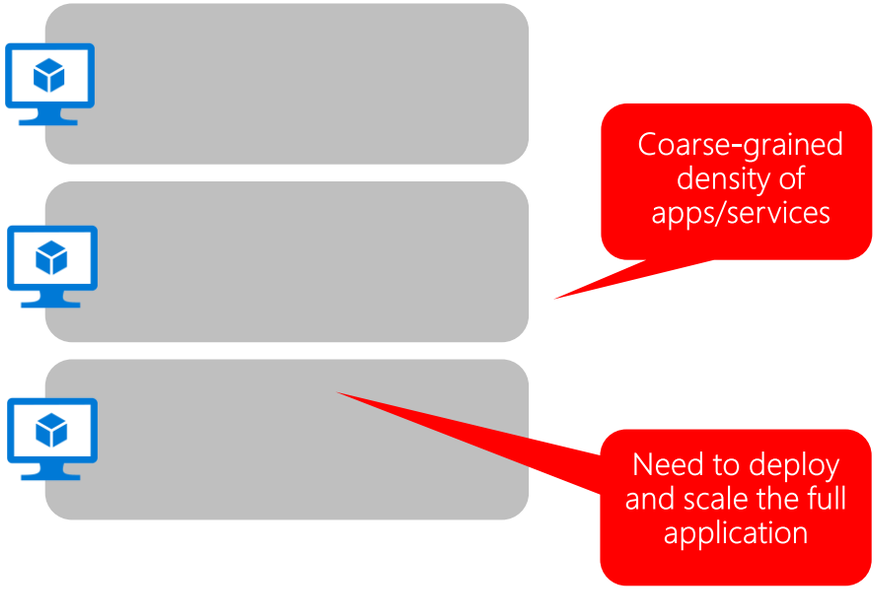
- Client Side Discovery
- Server Side Discovery

Microservices Design Patterns in Practice

Traditional application approach

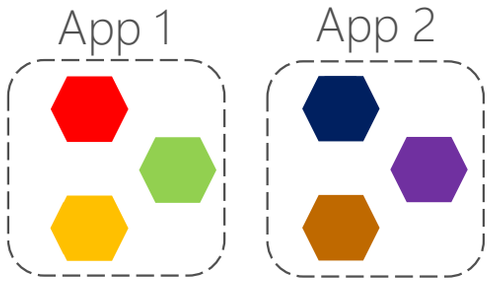
- A traditional application has most of its functionality within a few processes that are componentized with layers and libraries.
- Scales by cloning the app on multiple servers/VMs

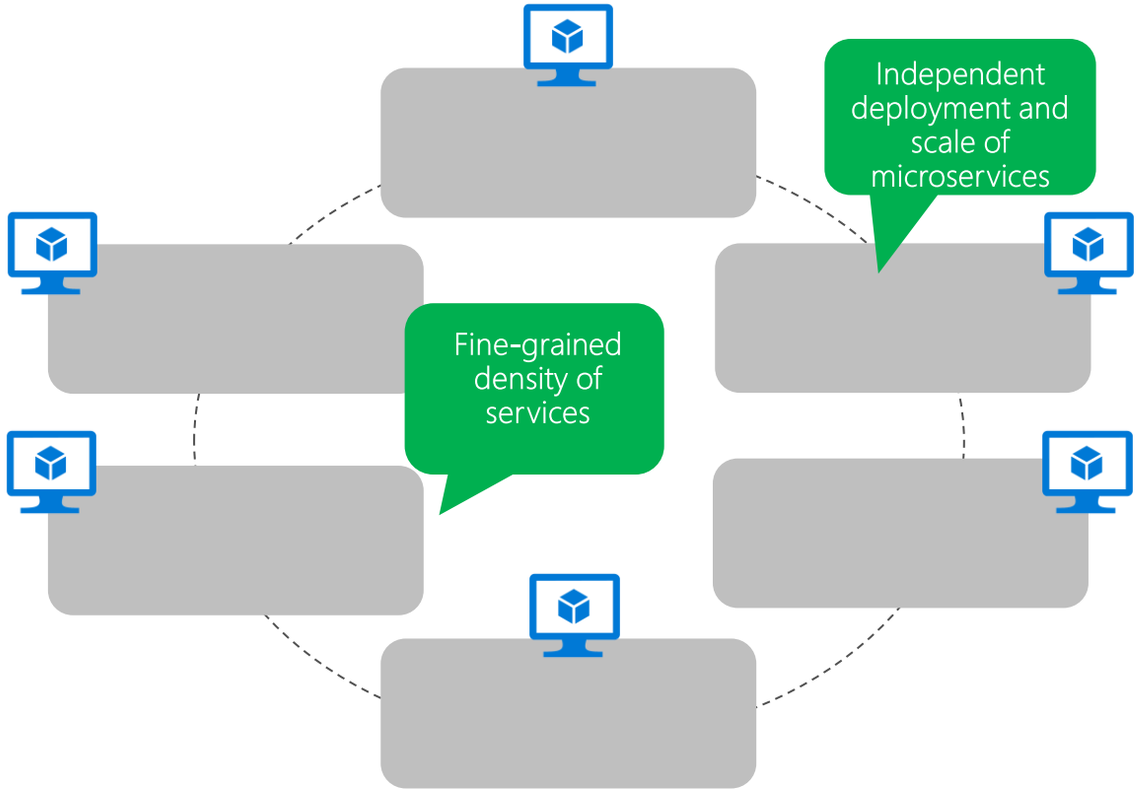




Microservices application approach

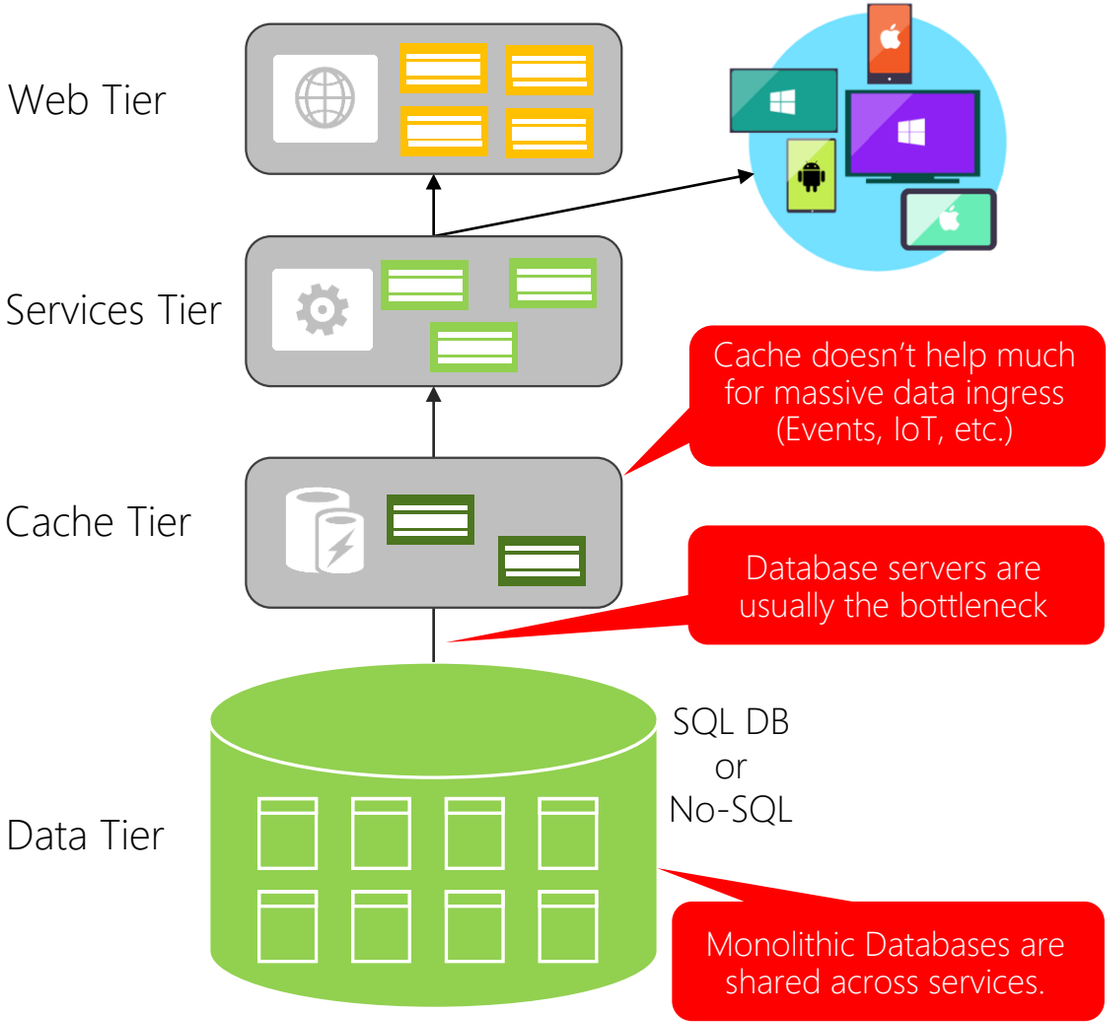
- A microservice application segregates functionality into separate smaller services.
- Scales out by **deploying each service independently** with multiple instances across servers/VMs





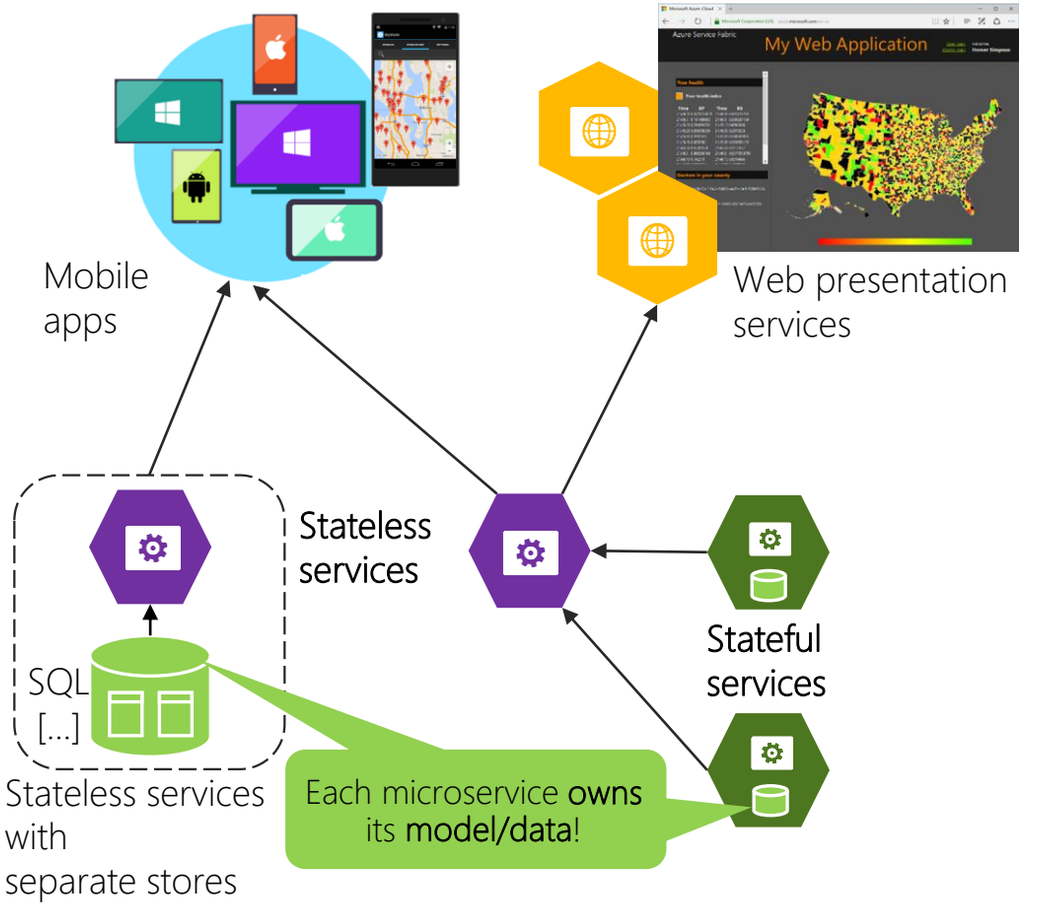
Data in Traditional approach

- Single monolithic database
- Tiers of specific technologies

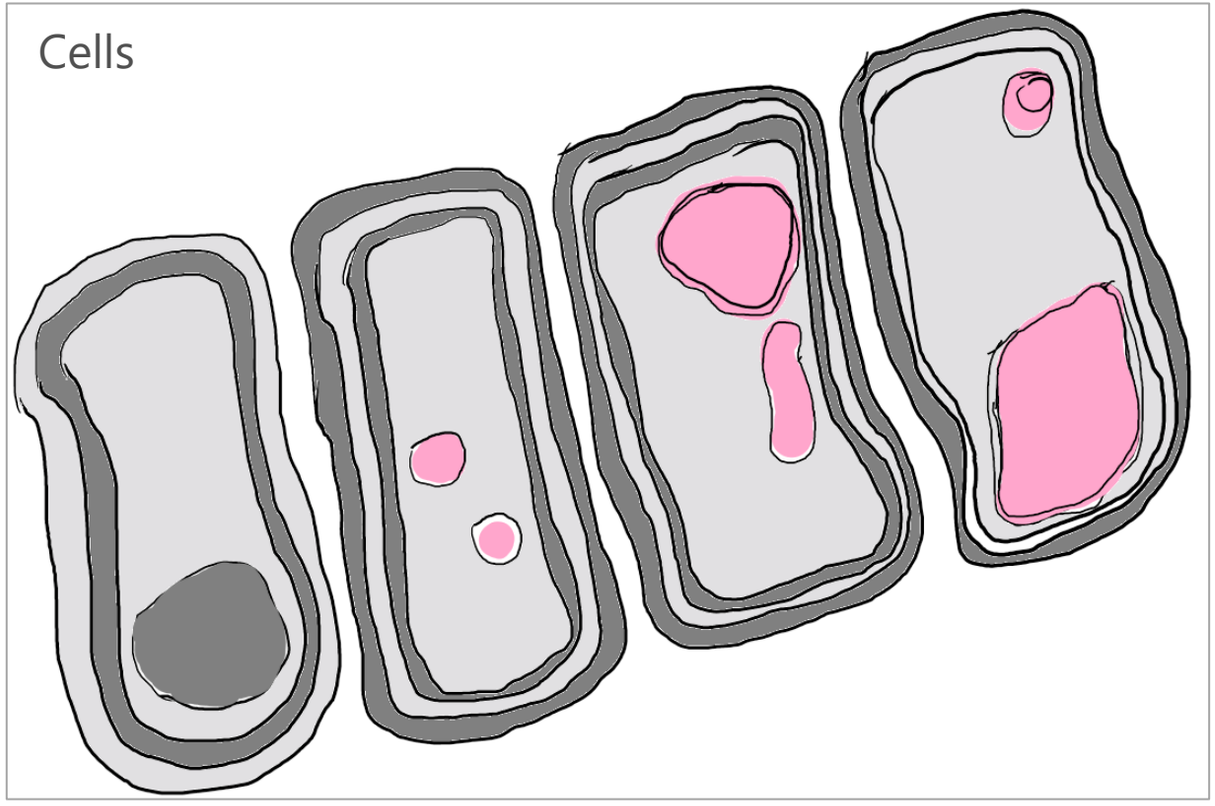


Data in Microservices approach

- Graph of interconnected microservices
- State typically scoped to the microservice
- Remote Storage for cold data



The Bounded Context Pattern



Independent
Autonomous
Loosely coupled composition

"Cells can exist because their membranes define what is in and out and determine what can pass"
[Eric Evans]

Bounded Contexts and Microservices

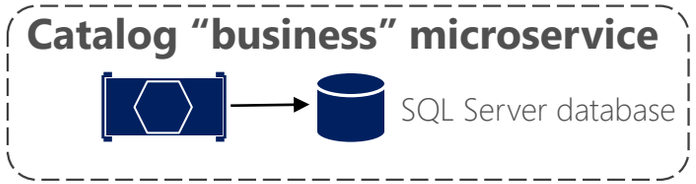
Bounded Context == “Business Microservice” boundary

Each Bounded Context has:

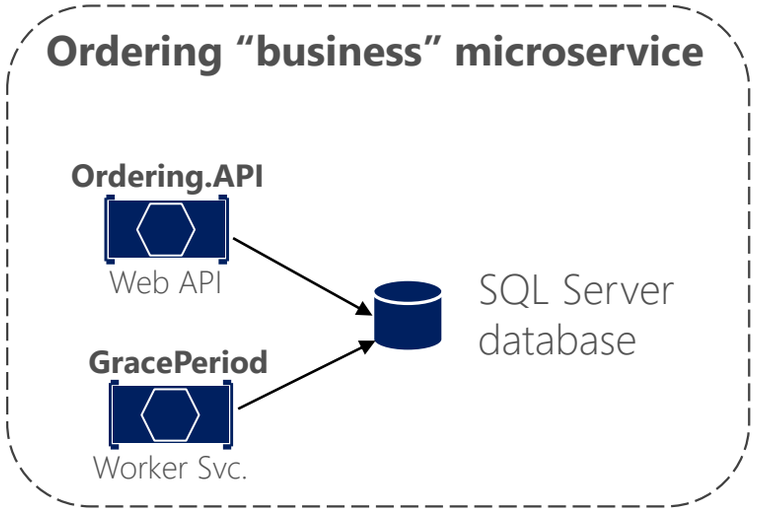
- Its own Domain Model → i.e. Database
- Its own context, invariants, rules, code!
- IT IS AUTONOMOUS!

Business/Logical Microservices (Bounded Contexts)

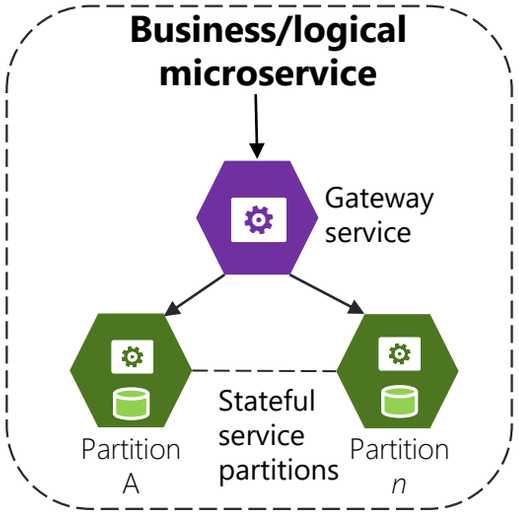
Example 1



Example 2



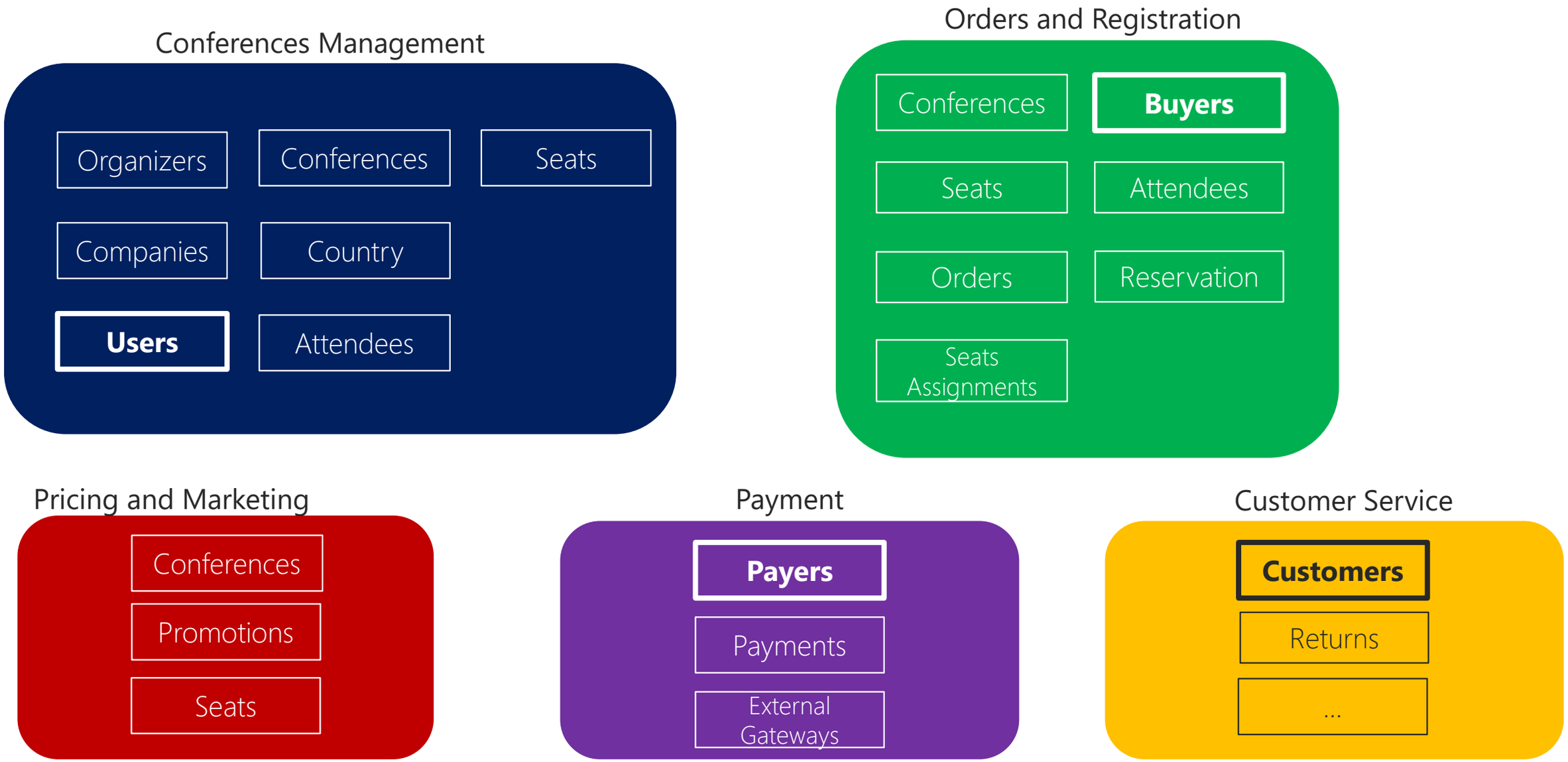
Example 3



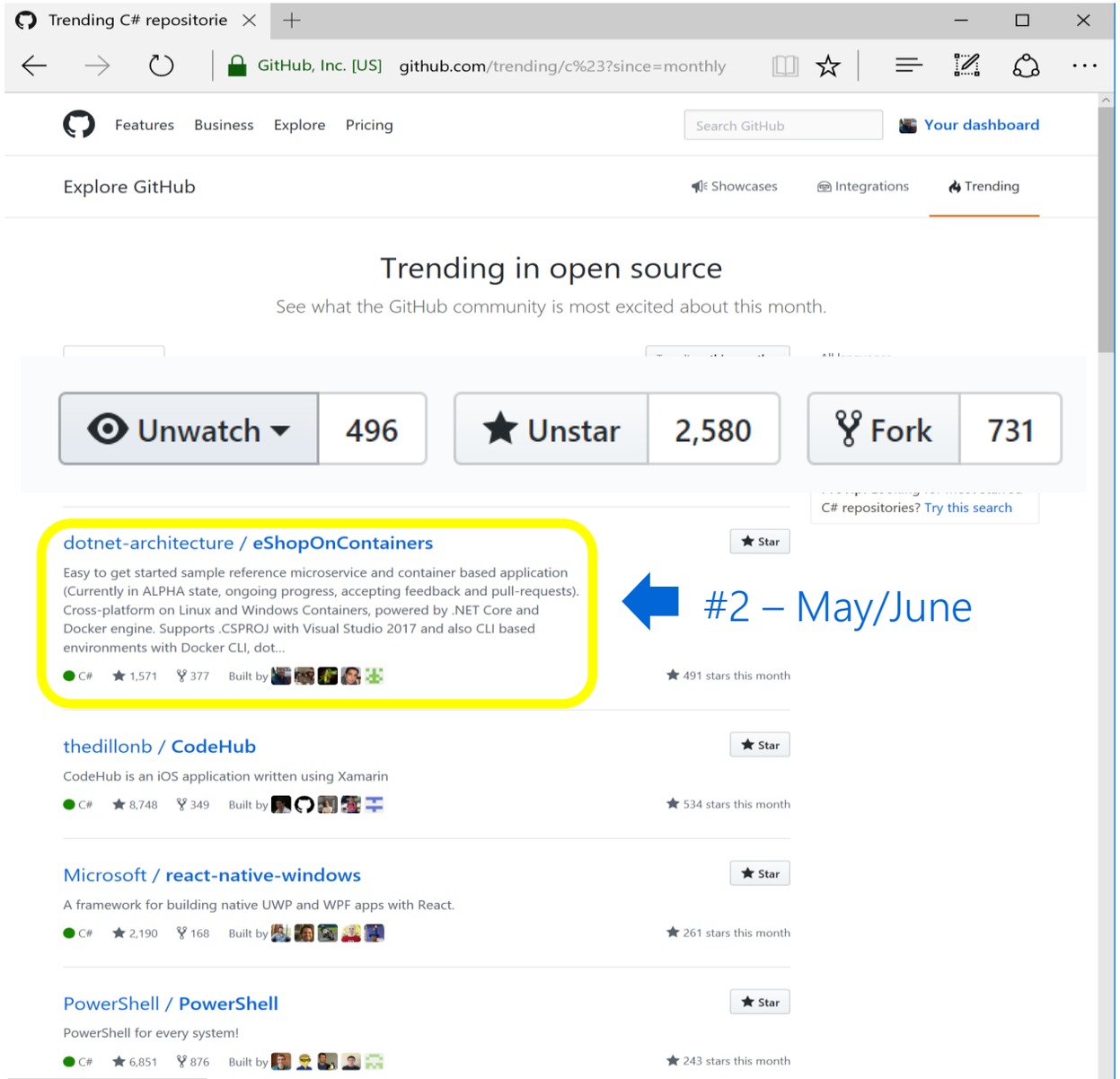
(Using Azure Service Fabric Stateful Reliable Services)

- The Logical Architecture can be different from the Physical/Deployment Architecture
- A Bounded Context can be implemented by 1 or more services (i.e. ASP.NET Web API)

Identifying a Domain Model per Microservice/BoundedContext

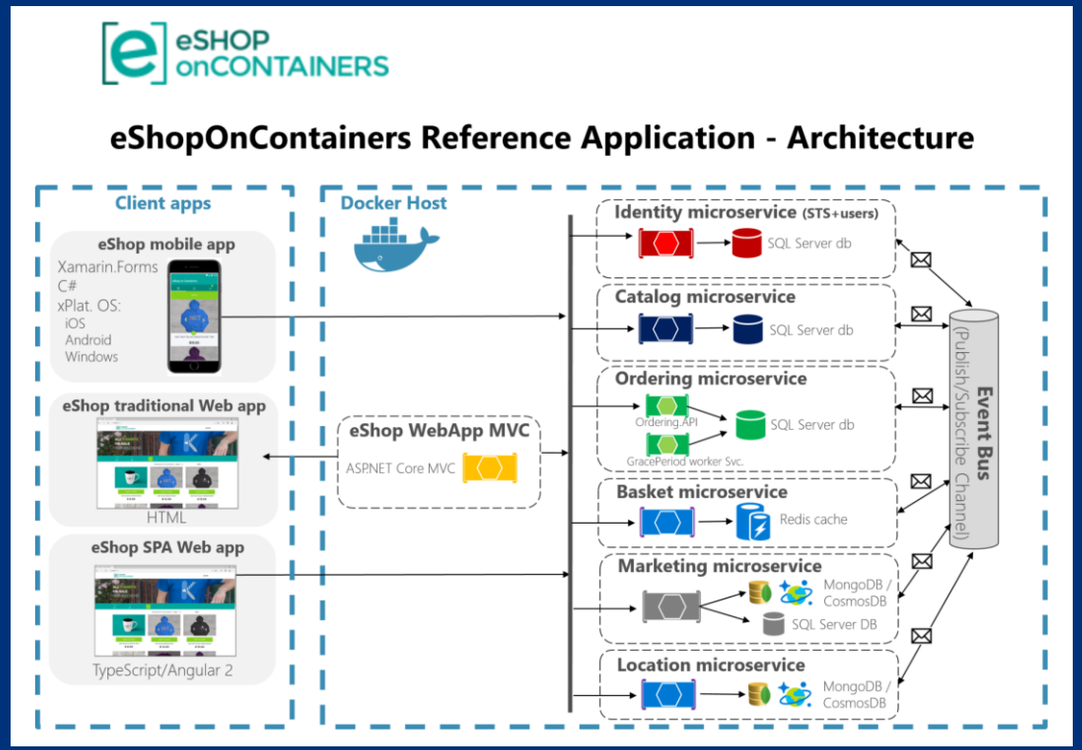


.Net Microservice And Container Guidance

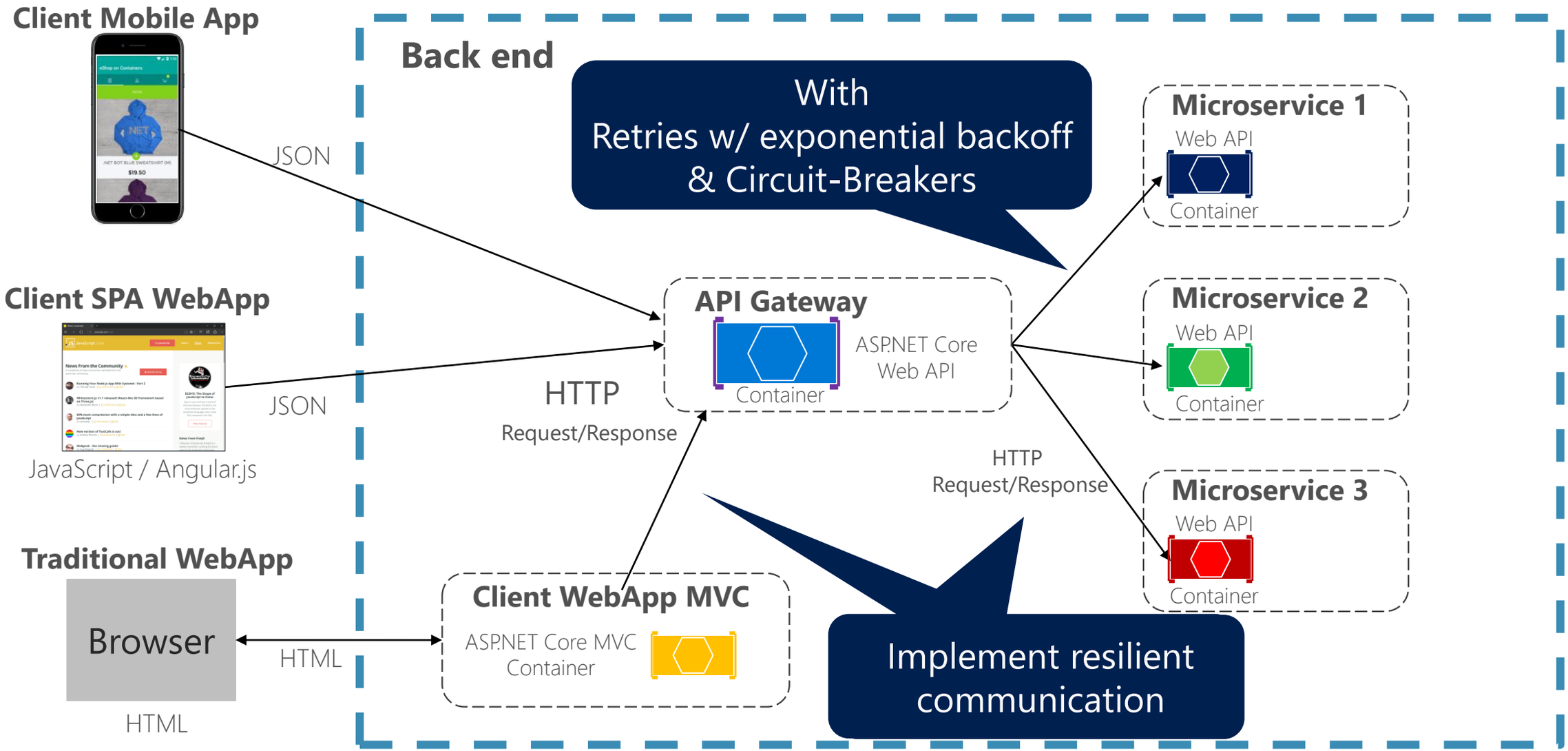


Reference application

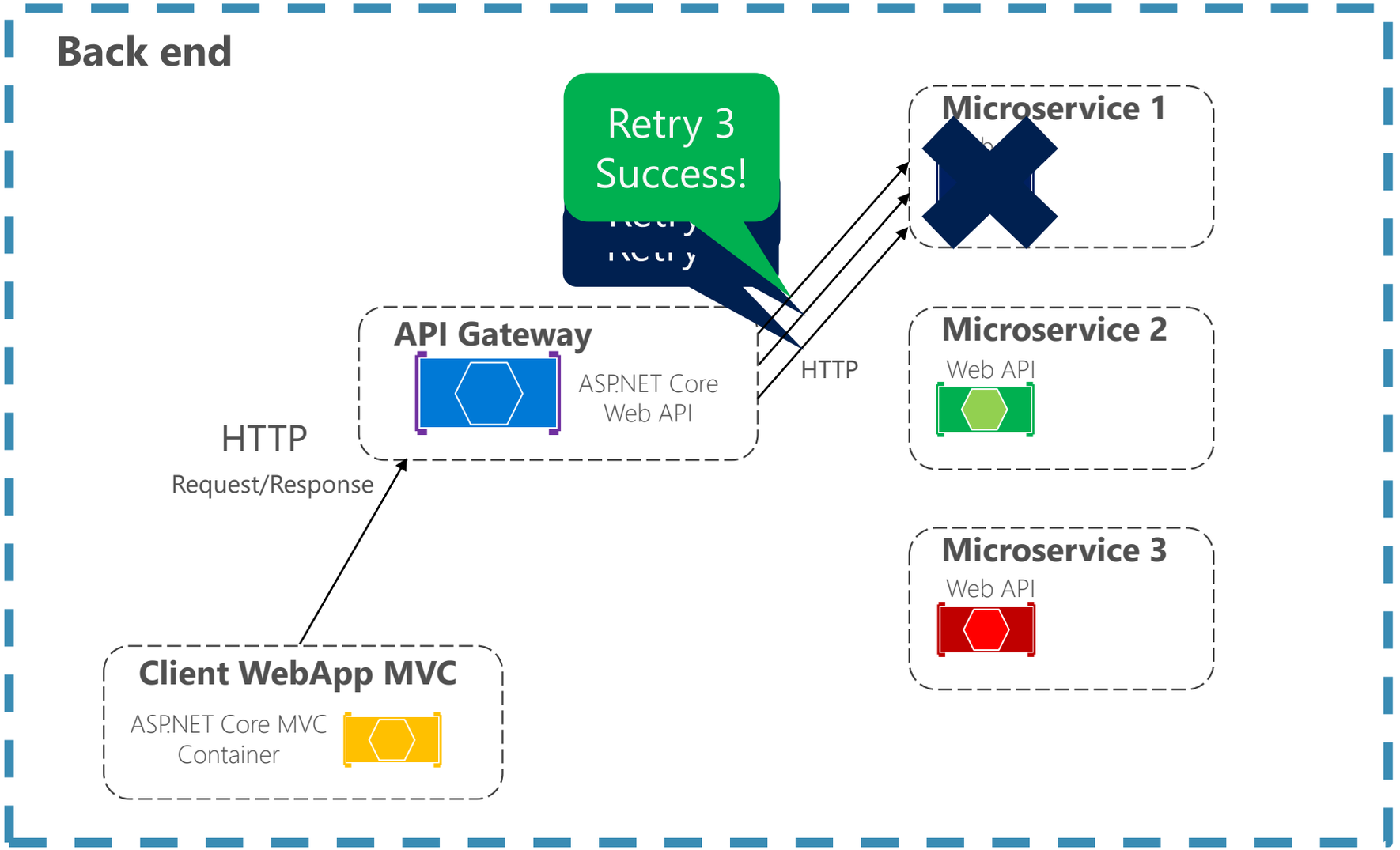
aka.ms/MicroservicesArchitecture



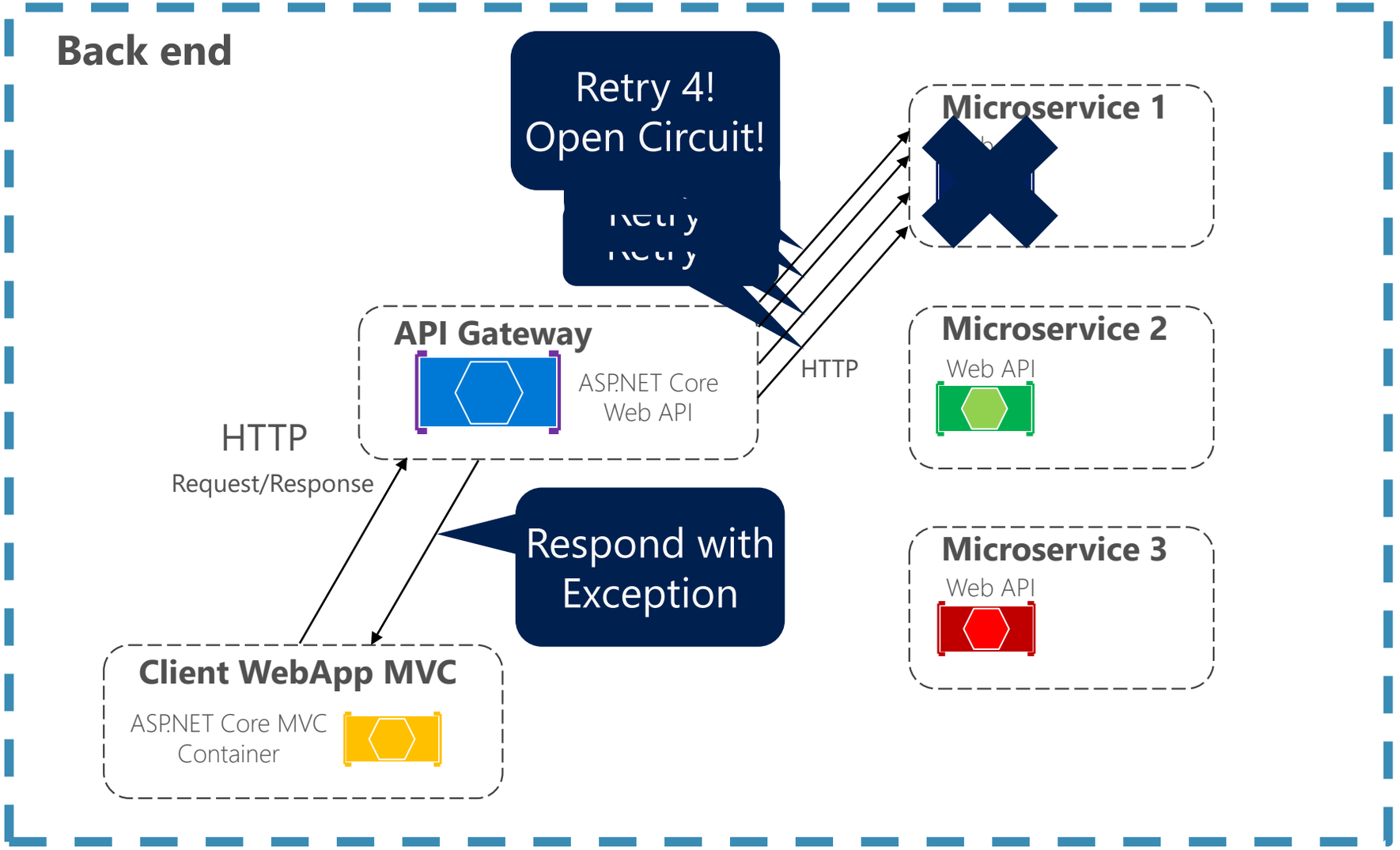
Building **Resilient** Cloud Applications



Retries with Exponential Backoff

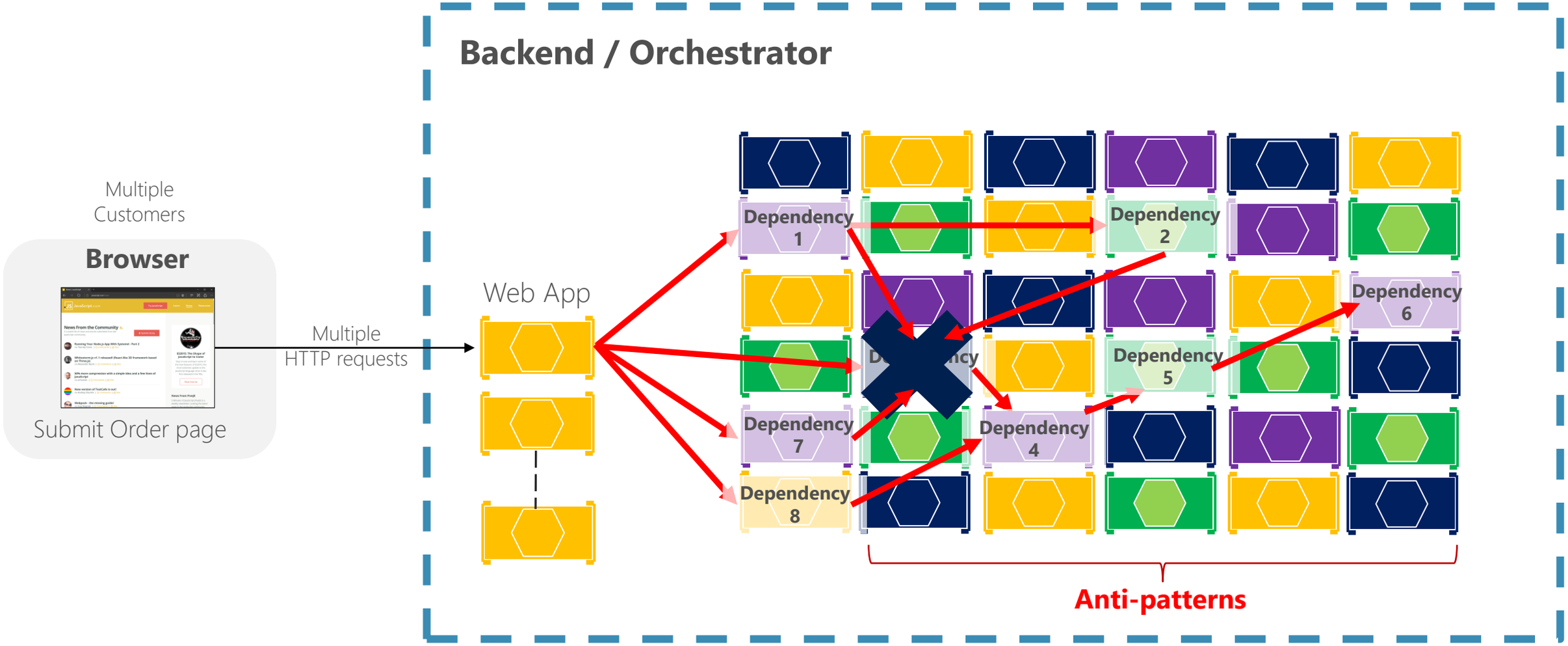


Retries with Exponential Backoff + Circuit Breaker



Risk of Partial Failure Amplified by Microservices

HTTP request/response communication



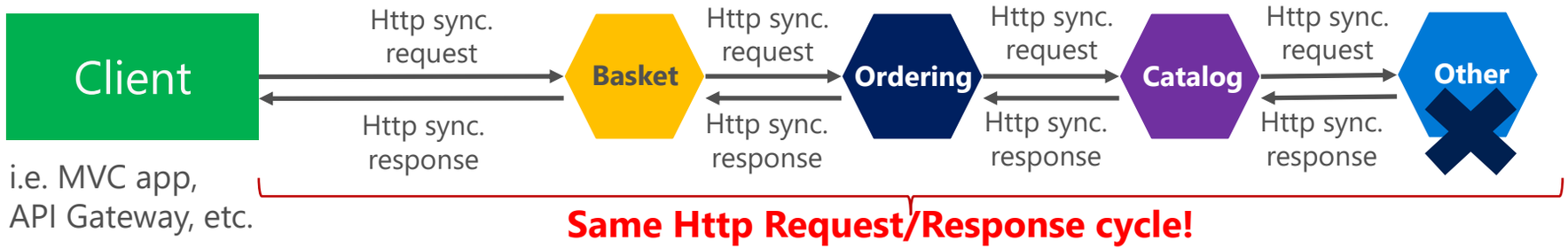
How To Minimize Exponential Failures In Microservices

- Circuit-Breakers
- Avoid long Http call chains within the same request/response cycle

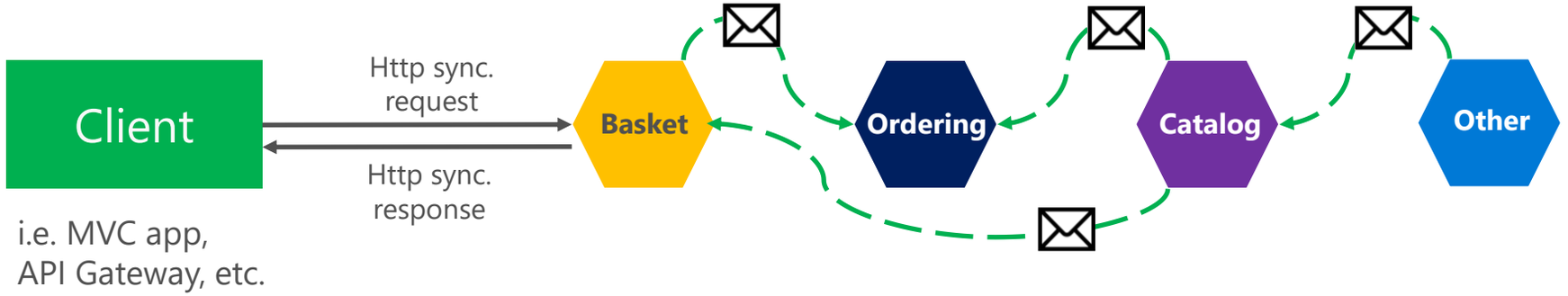
Synchronous vs. Async communication across Microservices

Anti-pattern

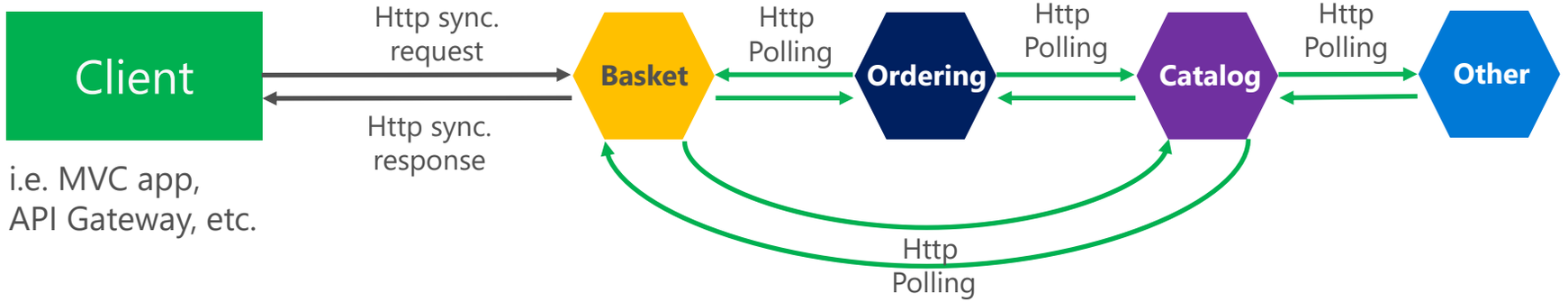
Synchronous
all req./resp. cycle



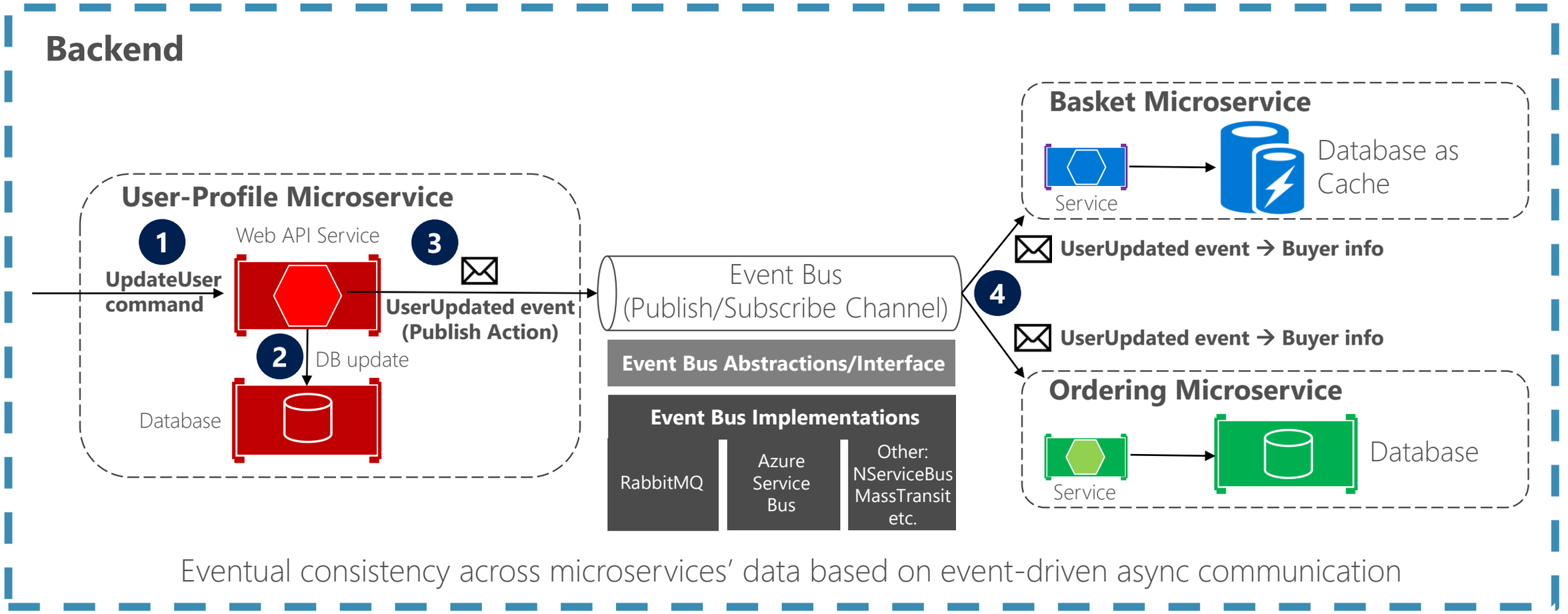
Asynchronous
Comm. across internal microservices
(EventBus: i.e. **AMPQ**)



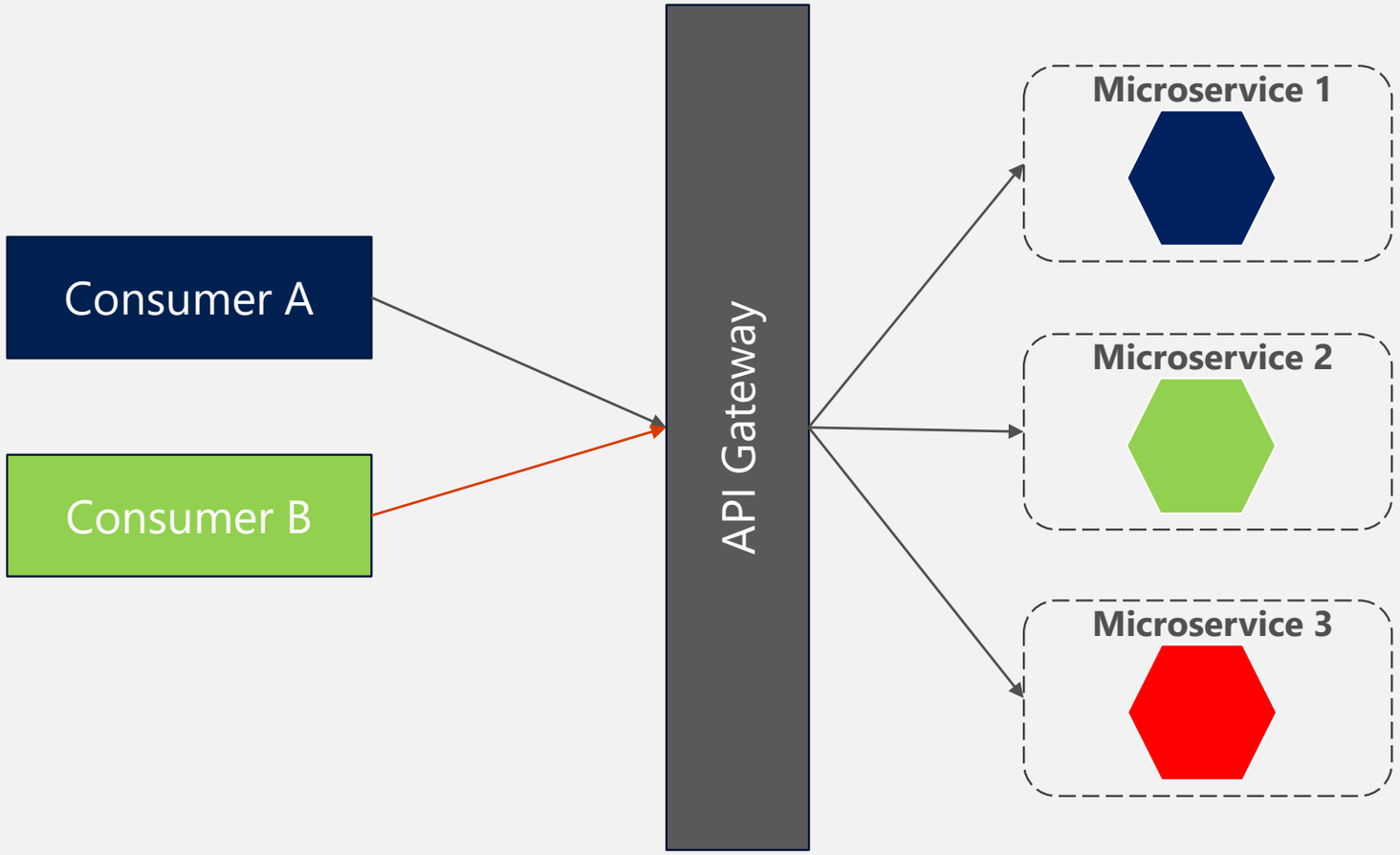
"Asynchronous"
Comm. across internal microservices
(Polling: **Http**)



Asynchronous Event-Driven communication with an Event Bus



API Gateway



Calls aggregation

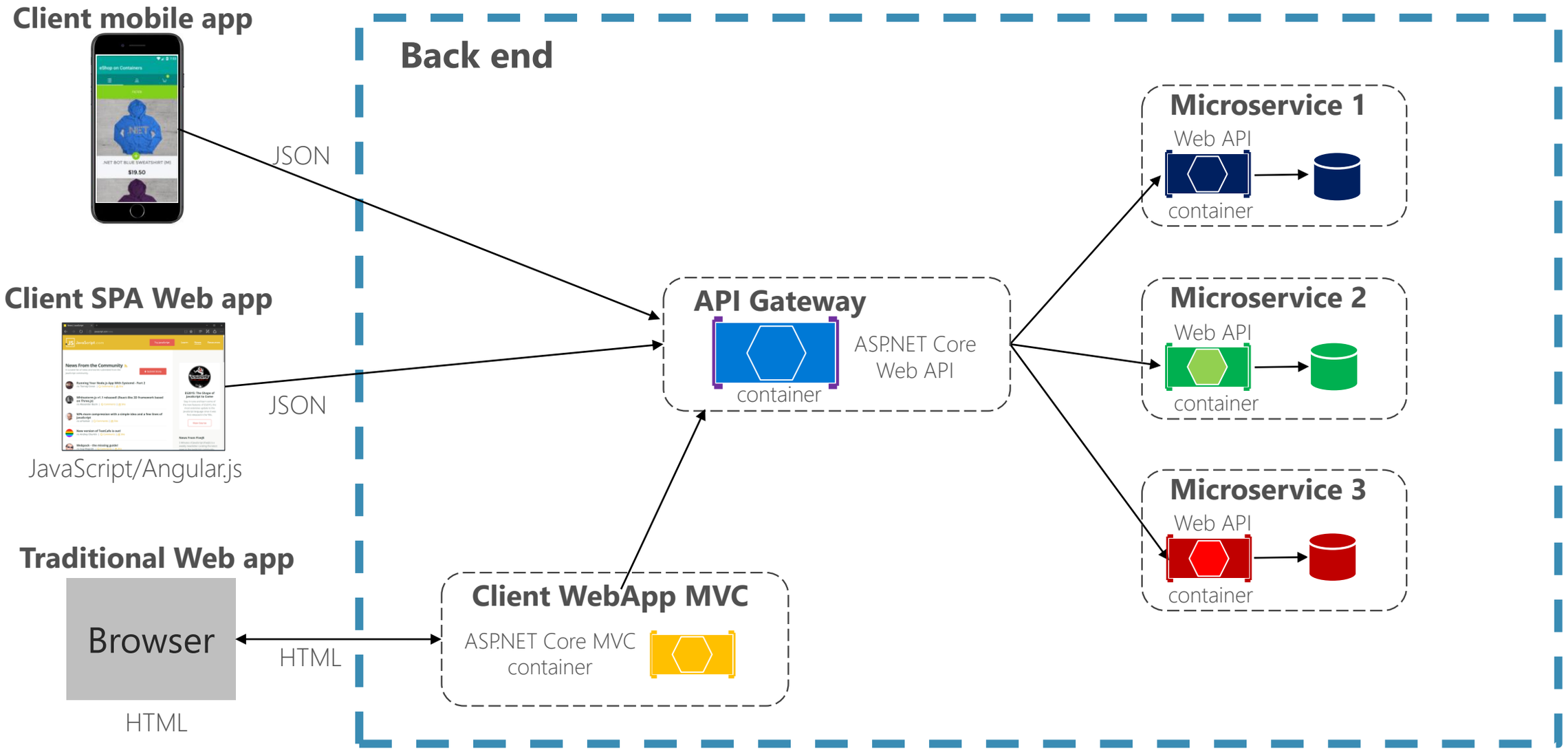
Who is consuming our services?

Who was consuming what?

What rate?

What time?

Using a **custom** API Gateway Service



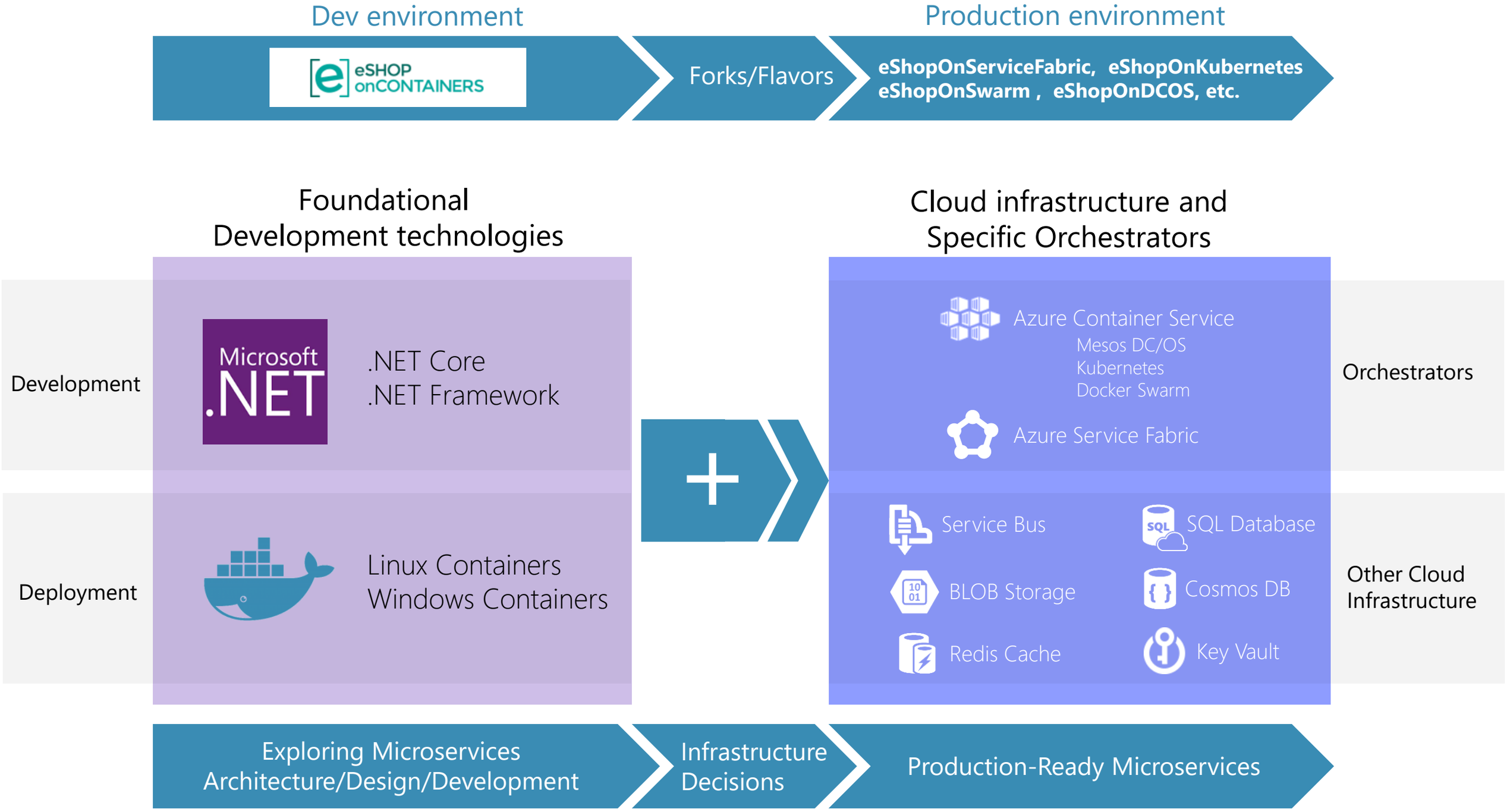
API Gateway “as a service/product”

AZURE API MANAGEMENT

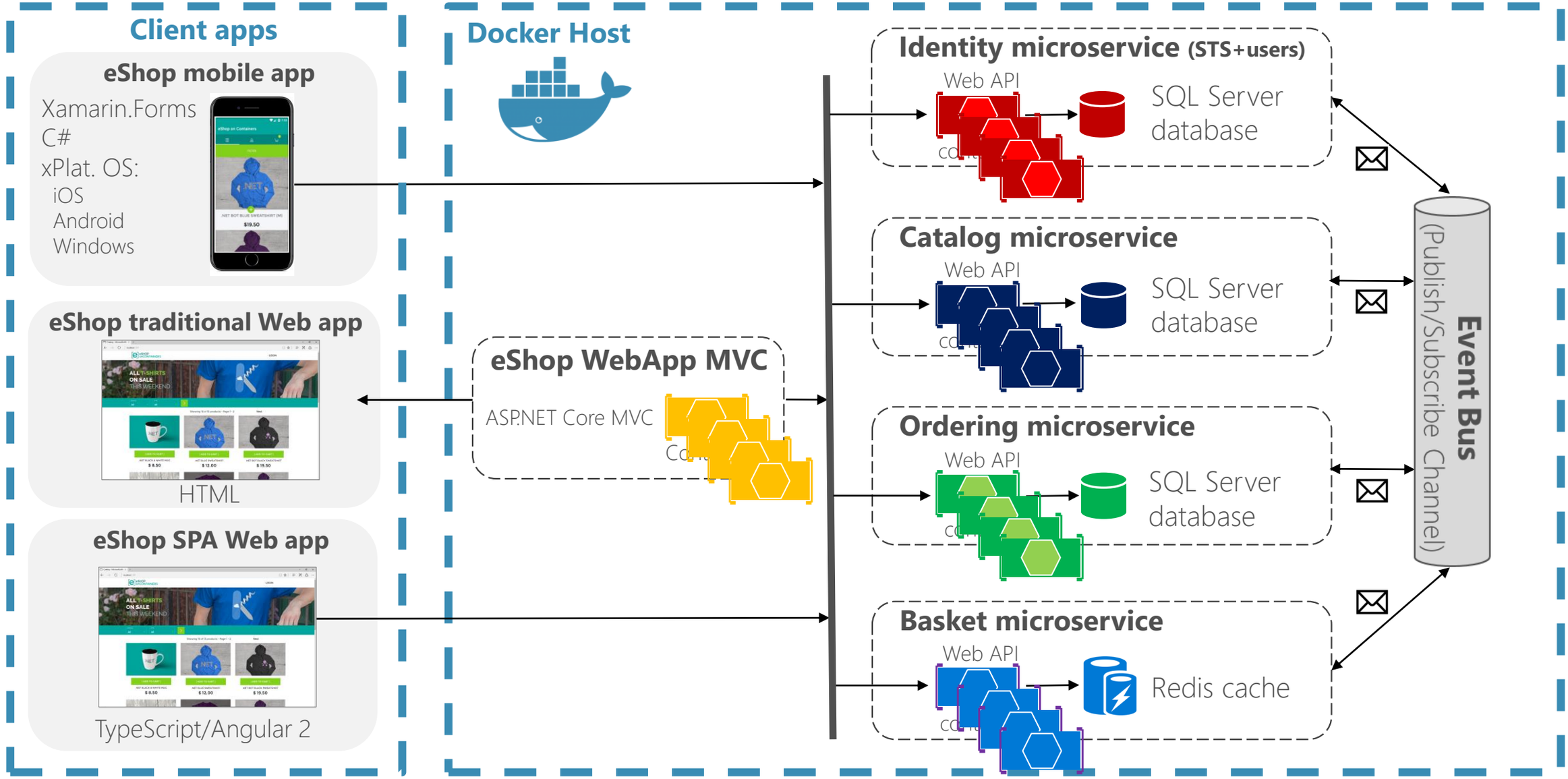
Third parties

KONG

apigee


Dev environment
eSHOP onCONTAINERS
Forks/Flavors
Production environment
eShopOnServiceFabric, eShopOnKubernetes
eShopOnSwarm , eShopOnDCOS, etc.
Foundational
Development technologies
Cloud infrastructure and
Specific Orchestrators
Development
Microsoft .NET
.NET Core
.NET Framework
Azure Container Service
Mesos DC/OS
Kubernetes
Docker Swarm
Azure Service Fabric
Orchestrators
Deployment
Linux Containers
Windows Containers
Service Bus
SQL Database
BLOB Storage
Cosmos DB
Redis Cache
Key Vault
Other Cloud
Infrastructure
Exploring Microservices
Architecture/Design/Development
Infrastructure
Decisions
Production-Ready Microservices

Scaling out eShopOncontainers



Demonstration: *Building Microservices with Containers*

eShopOnContainers