SERVICE ORIENTED SOFTWARE DEVELOPMENT

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Learning outcomes

1. Analyze and design service-oriented software systems
2. Develop applications using Microservices architecture
3. Deploy and operate systems with CI/CD pipelines

Textbooks

- **Required Textbooks**
  - [1]. Thomas Erl, “Analysis and Design for Services and Microservices”, 2th edition, Mark Taub, 2017
  - [2] Chris Richardson, “Microservices patterns With Examples in Java”, 2019
  - [3] Mitra R & Nadareishvili I, “*Microservices: Up and Running”, 2020*
- **Optional Textbooks**
  - [1] Sam Newman. Building Microservices, 2nd Edition. 2021.
  - [2]. M. Papazoglou. Web Services and SOA: Principles and Technology, 2nd Edition. 2012
  - [3]. Robert Daigneau. Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTful Web Services. 2011.

Grading Policy

Grading method	Percentage	Group/Individual
- Attendance	10 %	Individual
- Exams	20%	Individual
- Project (Group report)	40%	Group
- Project (Individual defense)	30%	Individual

Q & A

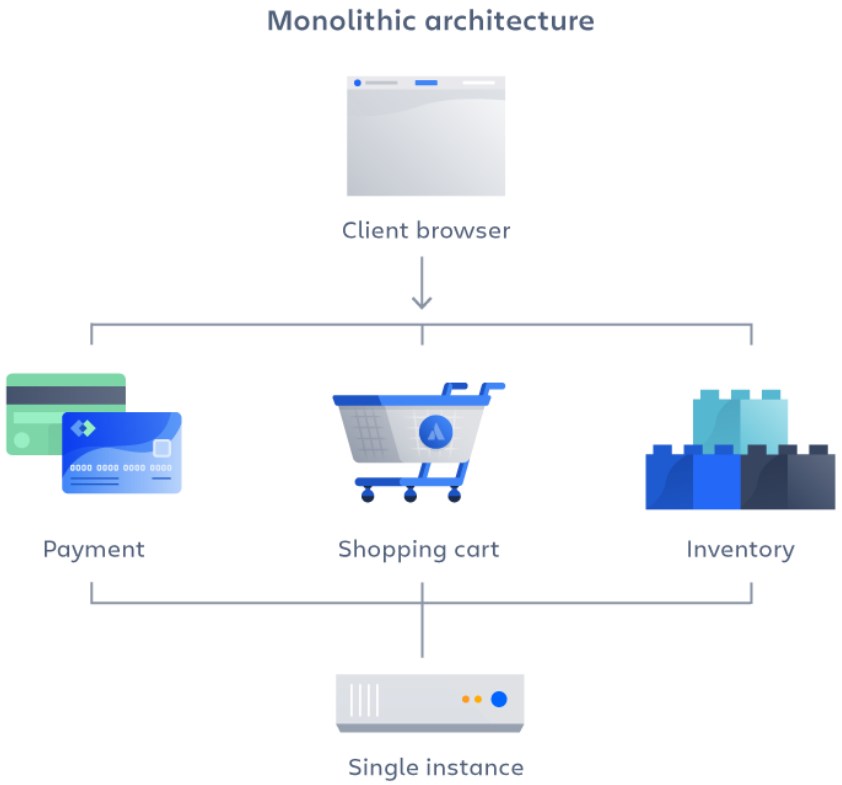
The History of Microservices

- Microservices, a popular architectural approach in software development, has its roots in the late 1990s and early 2000s.
- The Precursor: Service-Oriented Architecture (Late 1990s - Early 2000s)
- The Forerunner: Enterprise Java Beans (1997)
- The Shift from SOAP(1999) to REST(2005): 2008-2010
- The Birth of Microservices (2011-2012)
- The Present and Future: The Advantages of Microservices

Discussion

Monolithic | Vs | Microservices

Monolithic Architecture



A monolithic architecture is a traditional model of a software program

- **Built as a unified unit that is self-contained**
- **One code base that couples all of the business**
- **Allows everything in the monolith to be released at once.**

Advantages/Disadvantages of a monolithic architecture

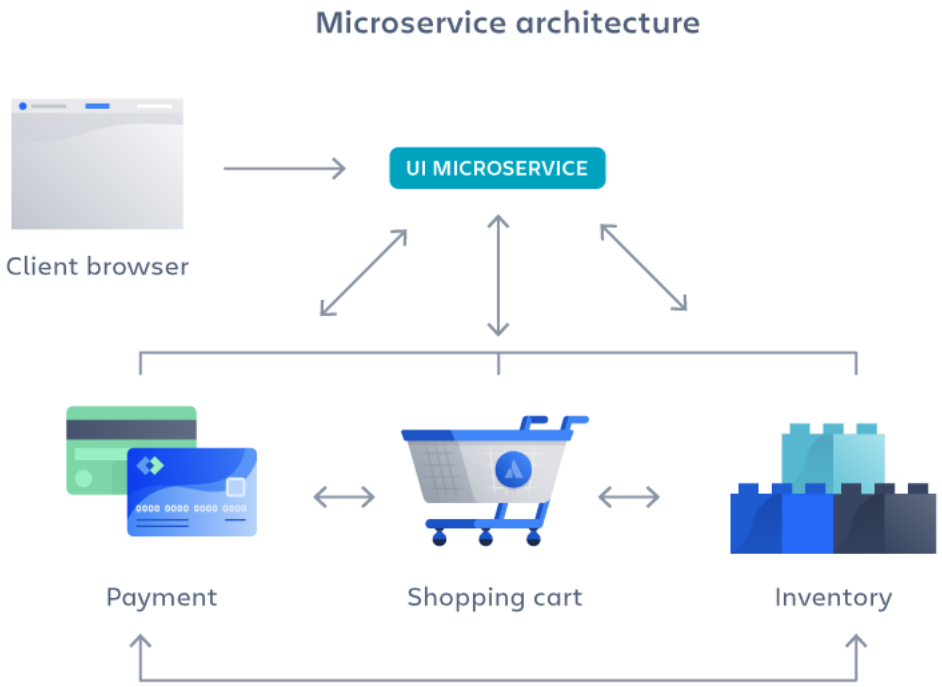
Advantages

- Easy deployment
- Development
- Performance
- Simplified testing
- Easy debugging

Disadvantages

- Slower development speed
- Scalability
- Reliability
- Barrier to technology adoption
- Lack of flexibility
- Deployment cost

Microservices architecture



A microservices architecture (microservices) an architectural that relies on a series of independently deployable services

- **These services have their own business logic, database with a specific goal**
- **These services have their own lifecycle (dev, test, deploy, scale, maintenance)**
- **Adopting microservices often goes hand in hand with DevOps, since they are the basis for continuous delivery (CD)**

SOA vs Microservice

Table 1.1 Comparing SOA with microservices

	SOA	Microservices
Inter-service communication	Smart pipes, such as Enterprise Service Bus, using heavyweight protocols, such as SOAP and the other WS* standards.	Dumb pipes, such as a message broker, or direct service-to-service communication, using lightweight protocols such as REST or gRPC
Data	Global data model and shared databases	Data model and database per service
Typical service	Larger monolithic application	Smaller service

Advantages/Disadvantages of a microservice architecture

Advantages

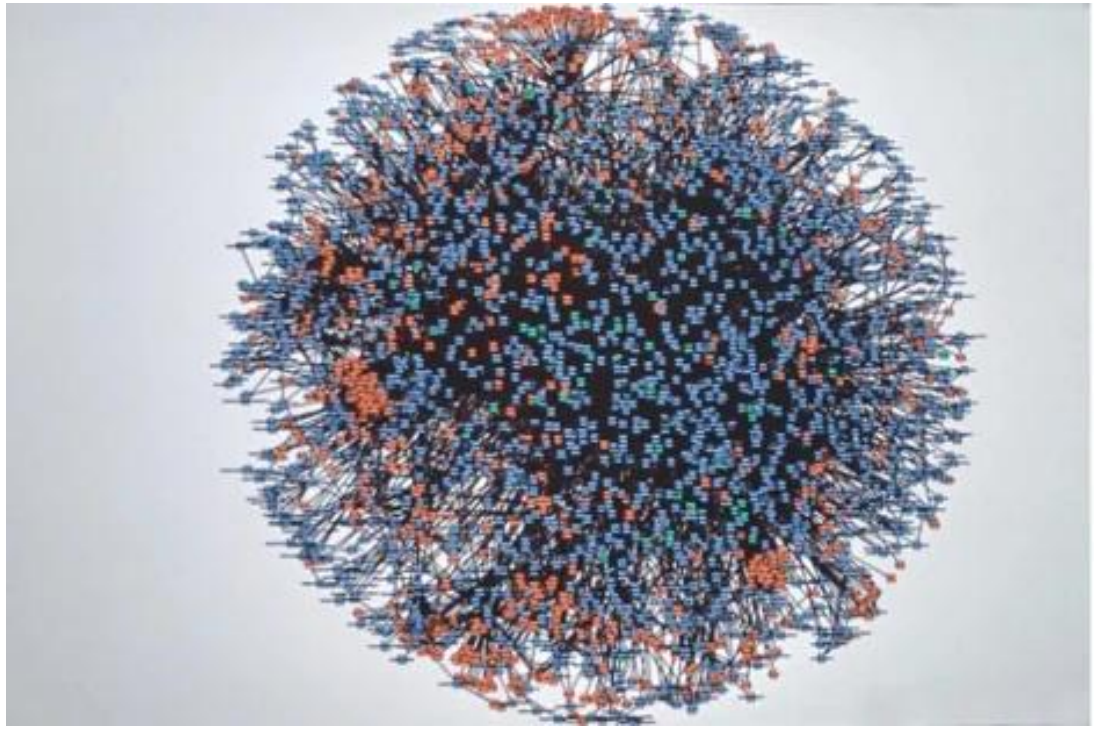
- Agility
- Flexible scaling
- Continuous deployment
- Highly maintainable and testable
- Independently deployable
- Technology flexibility
- High reliability
- Happier teams

Disadvantages

- Development sprawl
- Exponential infrastructure costs
- Added organizational overhead
- Debugging challenges
- Lack of standardization
- Lack of clear ownership

Case study (0)

- **Amazon**
  - In the early 2000s, Amazon's retail website behaved like a single monolithic application
  - In 2001, development delays, coding challenges, and service interdependencies inhibited Amazon's ability to meet the scaling requirements of its rapidly growing customer base
- **Amazon's "service-oriented architecture" was largely the beginning of what we now call microservices**



This is a 2008 graphic of Amazon's microservices infrastructure, aka the Death Star.

Case study (1)

Netflix's Case Study

- **Problem:** In 2009, faced growing pains as its monolithic architecture and scaling problem
- **Solution:** Migrated to a cloud-based microservices architecture (2010 – 2011)
- **Now:** Over a thousand microservices, with engineers deploying code multiple times each day, showcasing a true DevOps spirit.

Atlassian's Case Study

- **Problem:** Scaling challenges with Jira and Confluence.
- **Solution:** Transform from a monolithic system to a multi-tenant, stateless cloud application powered by microservices
- **Now**
  - In January 2016, about 15 total microservices.
  - Now more than 1300, moved 100K customers to the cloud
  - Autonomous teams and a better DevOps culture.

Case study (2)

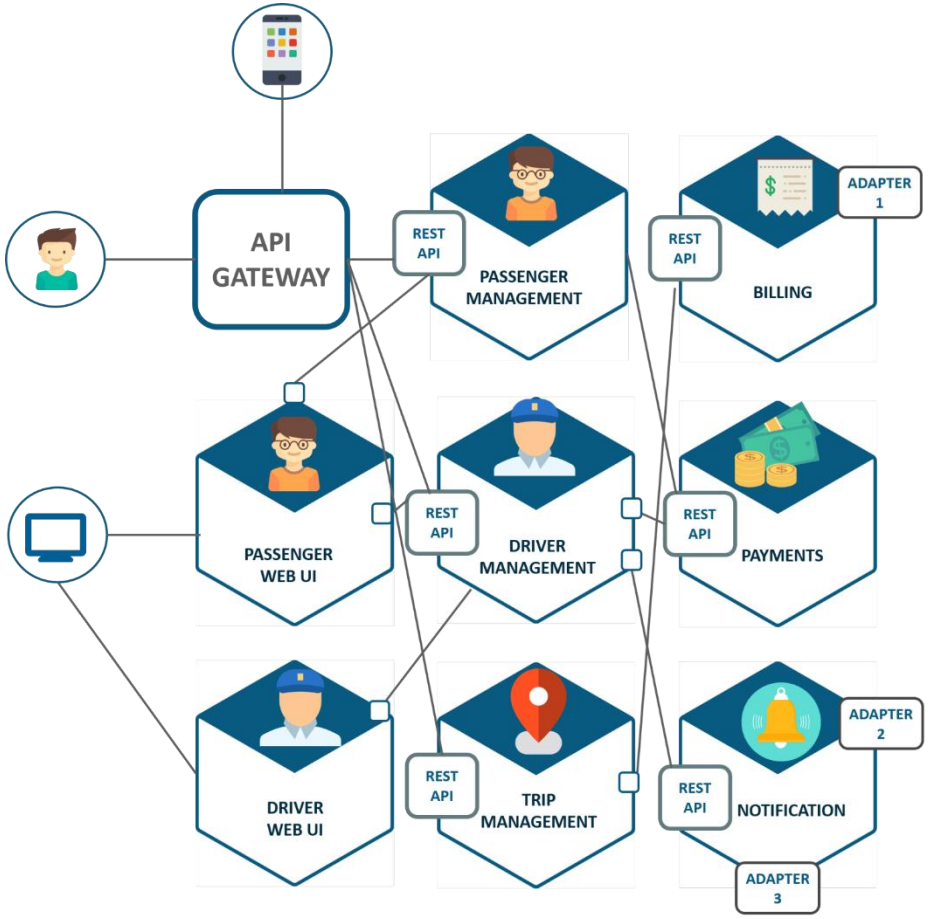
Carpooling / Ridesharing

- **Lyft Case Study**
- **Uber Case Study**

→ **Problem:** fast-growing organization/User and Monolithic scaling problem

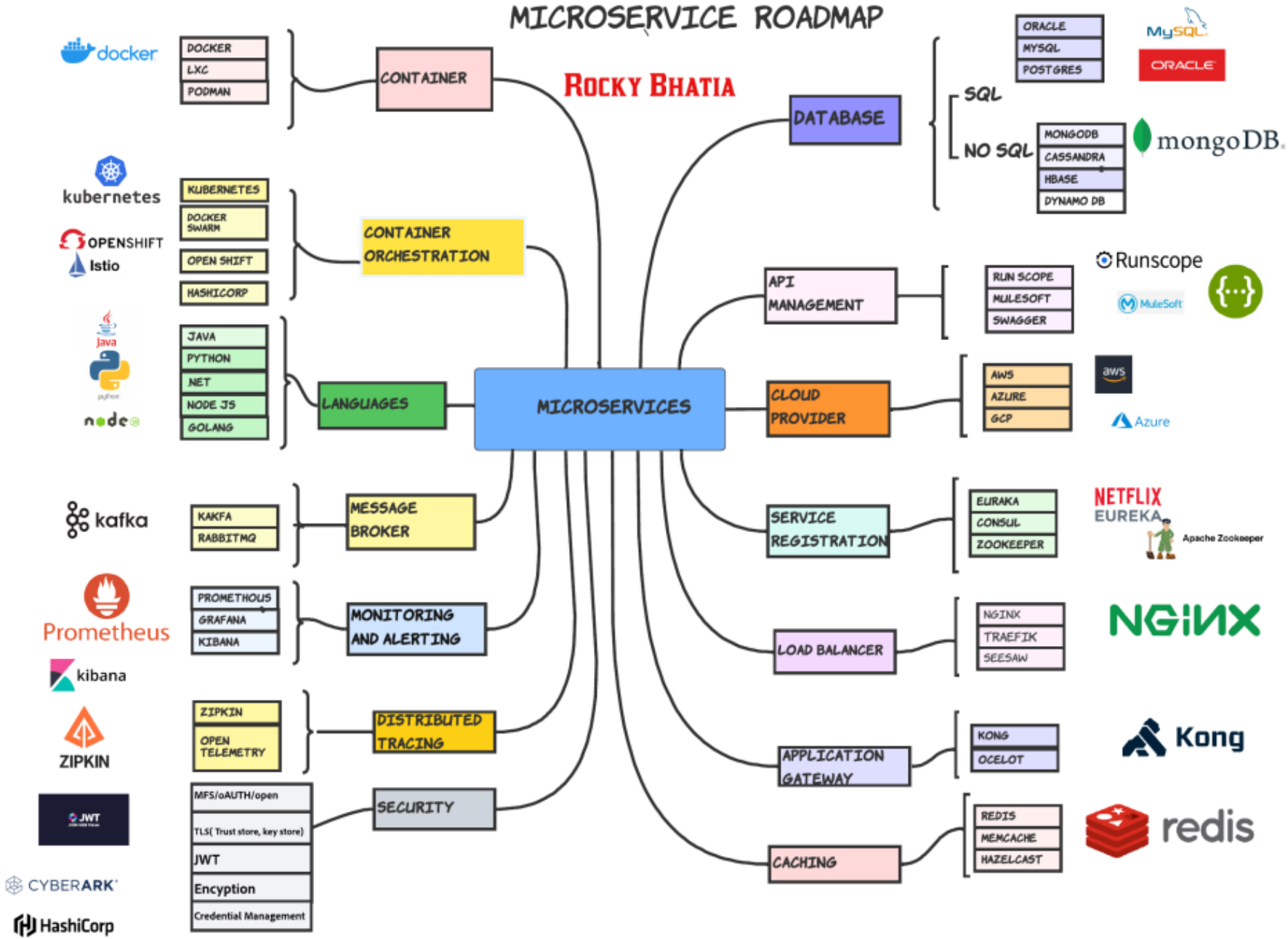
eCommerce platform

- **Etsy Case Study**
- **Problem:** Performance issues (reduce processing time to 1000-ms time-to-glass)
- **Now**: Etsy's new structure went live in 2016



Case study (3)

- **Spotify Case Study:** Spotify is a global music company that serves more than 170 million users
- **Problem**:
  - 1) Maintaining data centers did not meet objective.
  - 2) Free up developers from the jobs of provisioning resources and maintaining them
  - 3) Spotify wanted to derive advantages from Google Cloud's latest innovations (BigQuery- data warehouse, Pub/Sub - messaging, DataFlow – streaming data).
- **Solution**: Spotify formulated the migration plan in 2015 and they split the job into two parts, services and data.
  - Services migration: (2015 – 2017)
  - Data Migration: Spotify now runs its data on BigQuery while running close to 10 million queries per month.



Tham khảo: https://www.linkedin.com/pulse/one-post-refer-microservices-road-map-rocky-bhatia

DevOps Roadmap

Q & A

Reference

1. https://www.atlassian.com/microservices/microservices-architecture/microservices-vs-monolith
2. https://www.linkedin.com/pulse/history-microservices-from-thought-experiment-industry-muaath-bin-ali
3. https://www.linkedin.com/pulse/microservices-architecture-case-study-from-various-suryawanshi
4. https://www.linkedin.com/pulse/monolithic-vs-microservices-architecture-case-study-netflix-asif
5. https://blog.dreamfactory.com/microservices-examples