COMP2511

🎨 9.2 - Introduction to Microservices (Bonus)

In this lecture

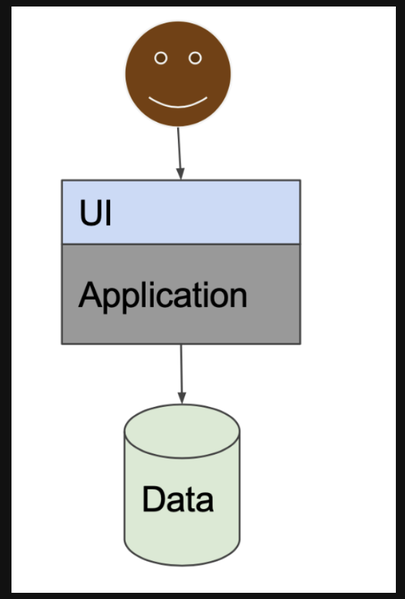
- Service-Oriented Architecture
- Monolith vs Microservices
- Microservice Ecosystem and technologies
- Trade-offs of a Microservice Approach

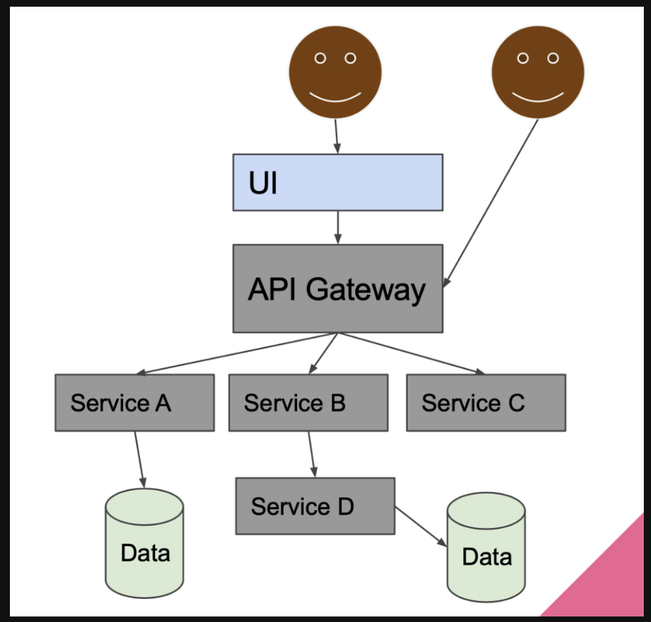
Service-Oriented Computing

- The era of cloud computing - a move from software as **products** to software as **services**
- **Infrastructure as a Service** - physical / virtual machines to run code on is provided as a service
- **Platform as a Service** - hardware and operating system are provided and accessed remotely by developers
- **Software as a Service** - hardware, operating system and software are outsourced and accessed remotely and used by users
- Platform layers and **platformisation** in PaaS

Monolith vs Microservices

- **Monolith**: a single large application that contains the entire software solution
  - One service to rule them all
- **Microservices**: A series of small-scale services that communicate with one another
  - Each service does *one task well*
- Where have we seen this before?

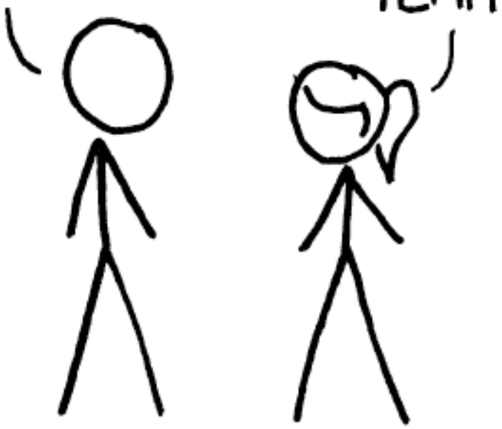




HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

SITUATION:
THERE ARE
14 COMPETING
STANDARDS.

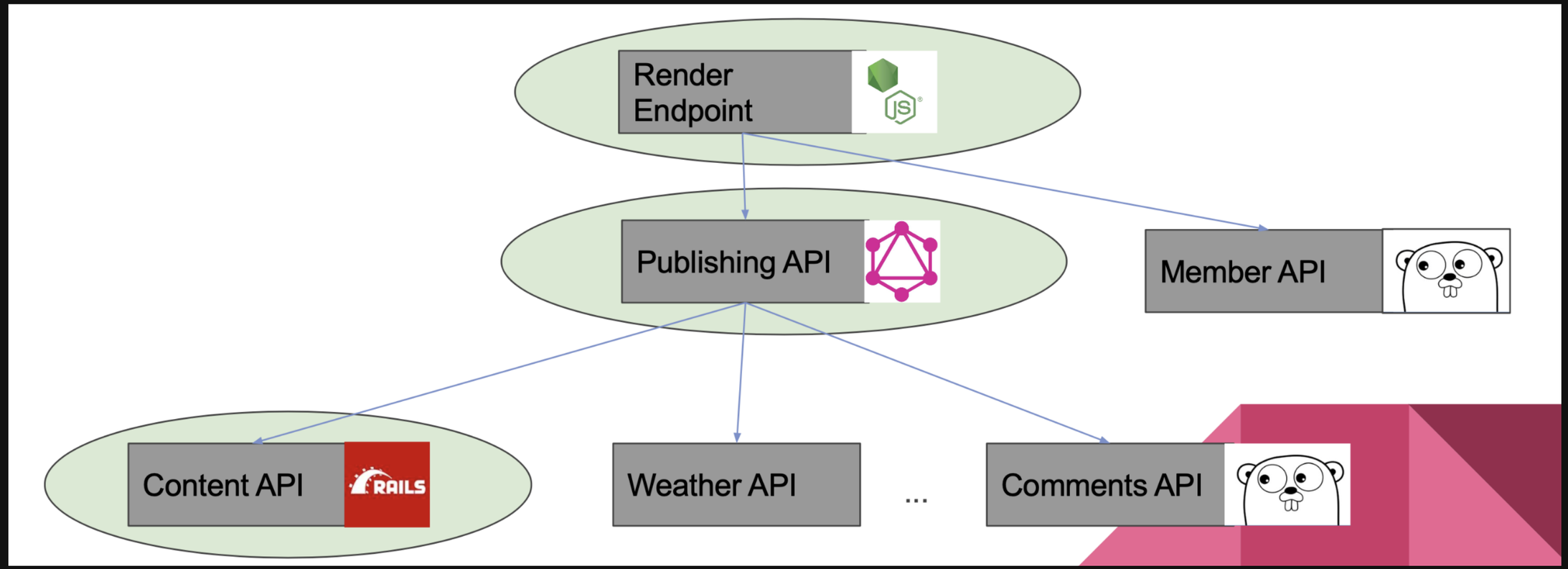
14?! RIDICULOUS!
WE NEED TO DEVELOP
ONE UNIVERSAL STANDARD
THAT COVERS EVERYONE'S
USE CASES.



SOON:

SITUATION:
THERE ARE
15 COMPETING
STANDARDS.

Microservices Example



Microservice Ecosystem: Data Interchange

- Services need to be able to communicate to one another over a **common interface**
- Synchronous interchange technologies
  - REST
  - gRPC - uses Protobuf, good for Service to Service communication
  - GraphQL - a query languages allowing for dynamic querying of data - good for public-facing APIs
- Asynchronous interchange technologies
  - Apache Kafka
  - Amazon SQS / SNS
- **Eventual consistency** - propagation of state so that Services have same logical state model

Microservice Ecosystem: Deployment

- Amazon & AWS - IaaS
  - Applications - Elastic Beanstalk
  - Compute - EC2
  - Compute - Lambdas - Serverless Deployment
  - Storage - S3
  - Database - DynamoDB / RDS
- **Containerisation** - Docker images
- **Observability** - tools to help you understand what's happening inside a deployed application
- **Feature Flags** - switchboards to toggle and incrementally release new parts of code
- ... and much, much more

Trade-offs: Microservice Benefits

- Freedom for service-specific programming languages / technology stacks
- Less responsibility, less coupling
- Easier to test
- Faster build and release cycles
- Lower risk per-microservice
- Not a single point of failure
- Easier to scale individual services

Trade-offs: Microservice Costs

- Either everything breaks, or the glue breaks - how much time and money is actually saved?
- Dealing with distributed systems
  - Reliance on network connections
  - Communication latency
  - Consistency between services running in parallel
- Overhead, complexity and risk in orchestrating services in an end-to-end use case
- More complex deployment
- Security - now need to authenticate for every service, not just one
- Debugging is more difficult as control flows over different services (distributed tracing)

Summary

- All Software Architecture is making trade-offs
- Monoliths grow too large, complex and risky and too difficult to scale
- Microservices present an alternative, which have their own challenges