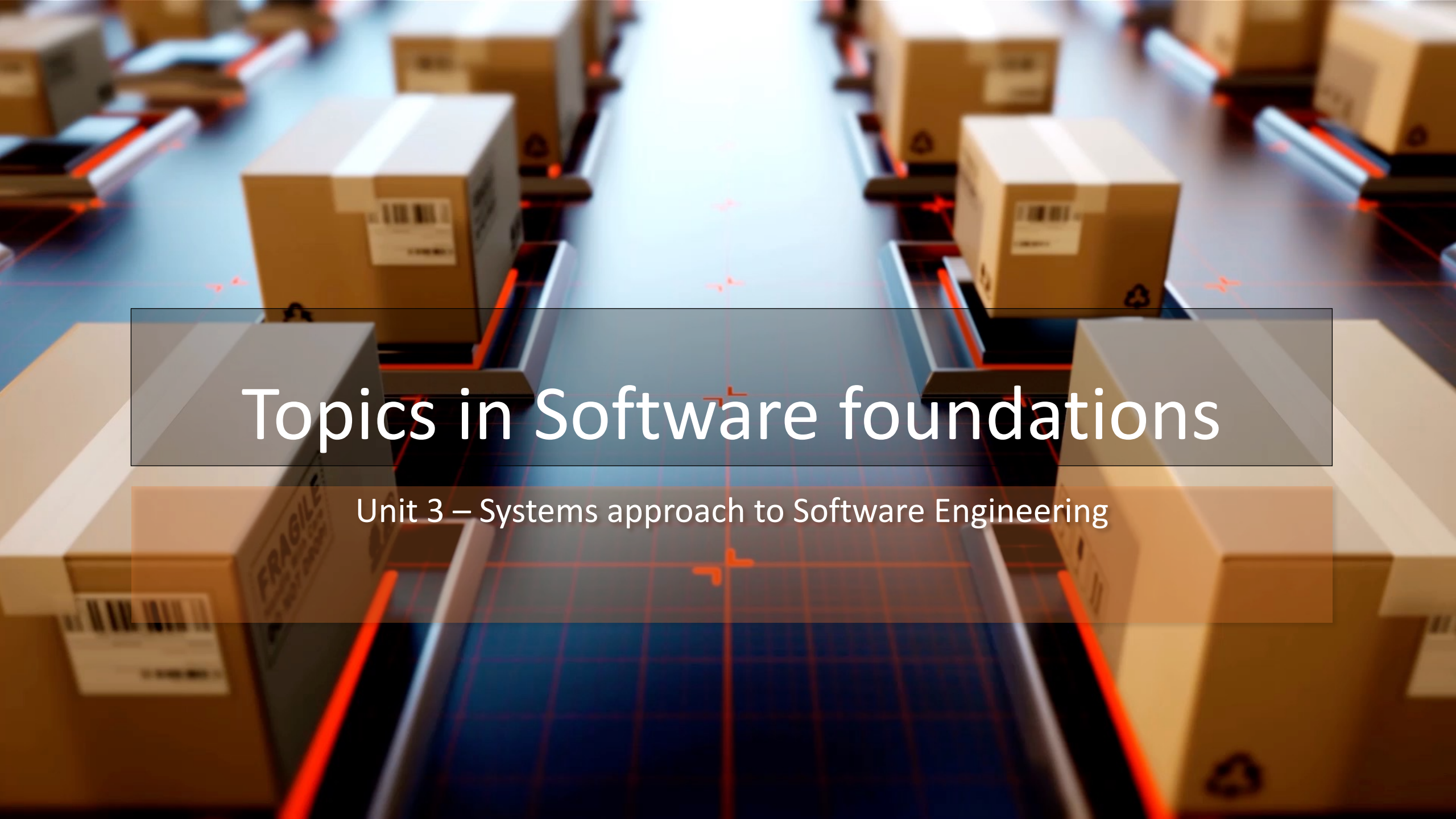


Topics in Software foundations

Unit 3 – Systems approach to Software Engineering

Topics we cover

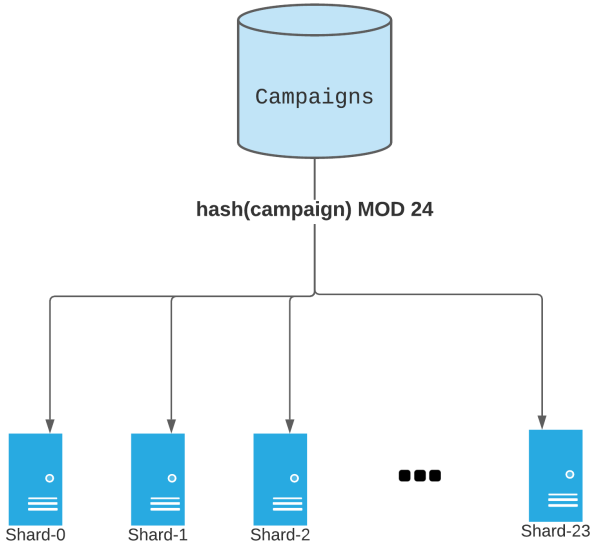
- Introduction to systems modeling
- Modeling System of Systems (SoS)
- Modeling communications
- Modeling UI systems
- Modeling data access
- Formalizing TS as a modeling language

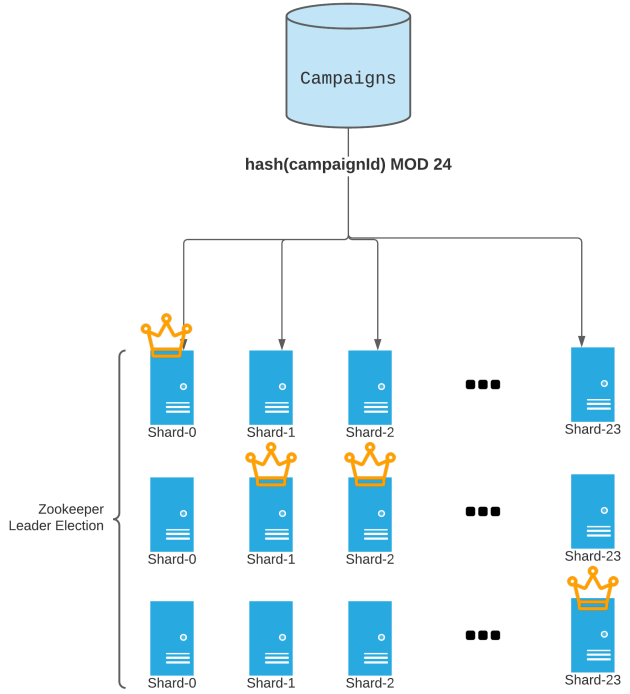
Classwork: Ad Pacing at Twitter

The categorization (Architecture, Model, Design) is a judgement call, important thing is to understand the differences in multiple descriptions of systems (and be able to choose the right one for the given situation)

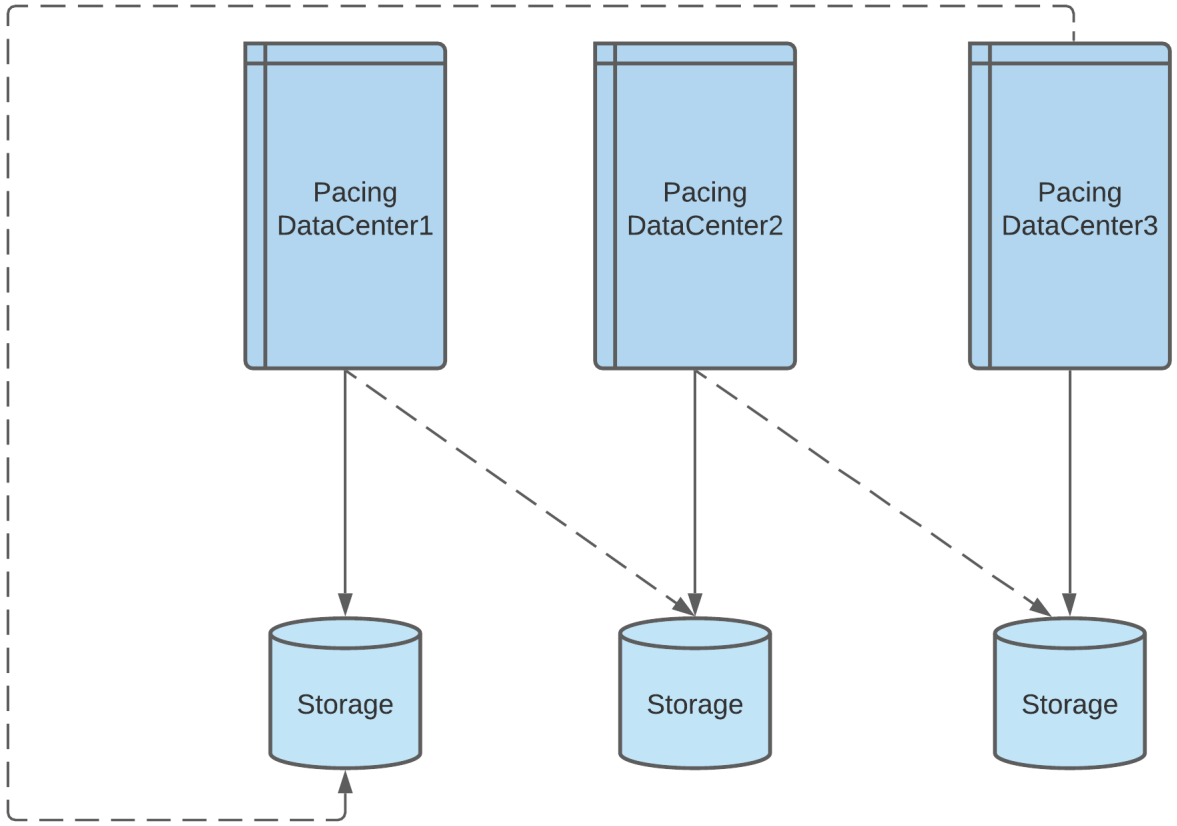
https://blog.twitter.com/engineering/en_us/topics/infrastructure/2021/how-we-built-twitter-s-highly-reliable-ads-pacing-service

Design for scale → Architect for Reliability

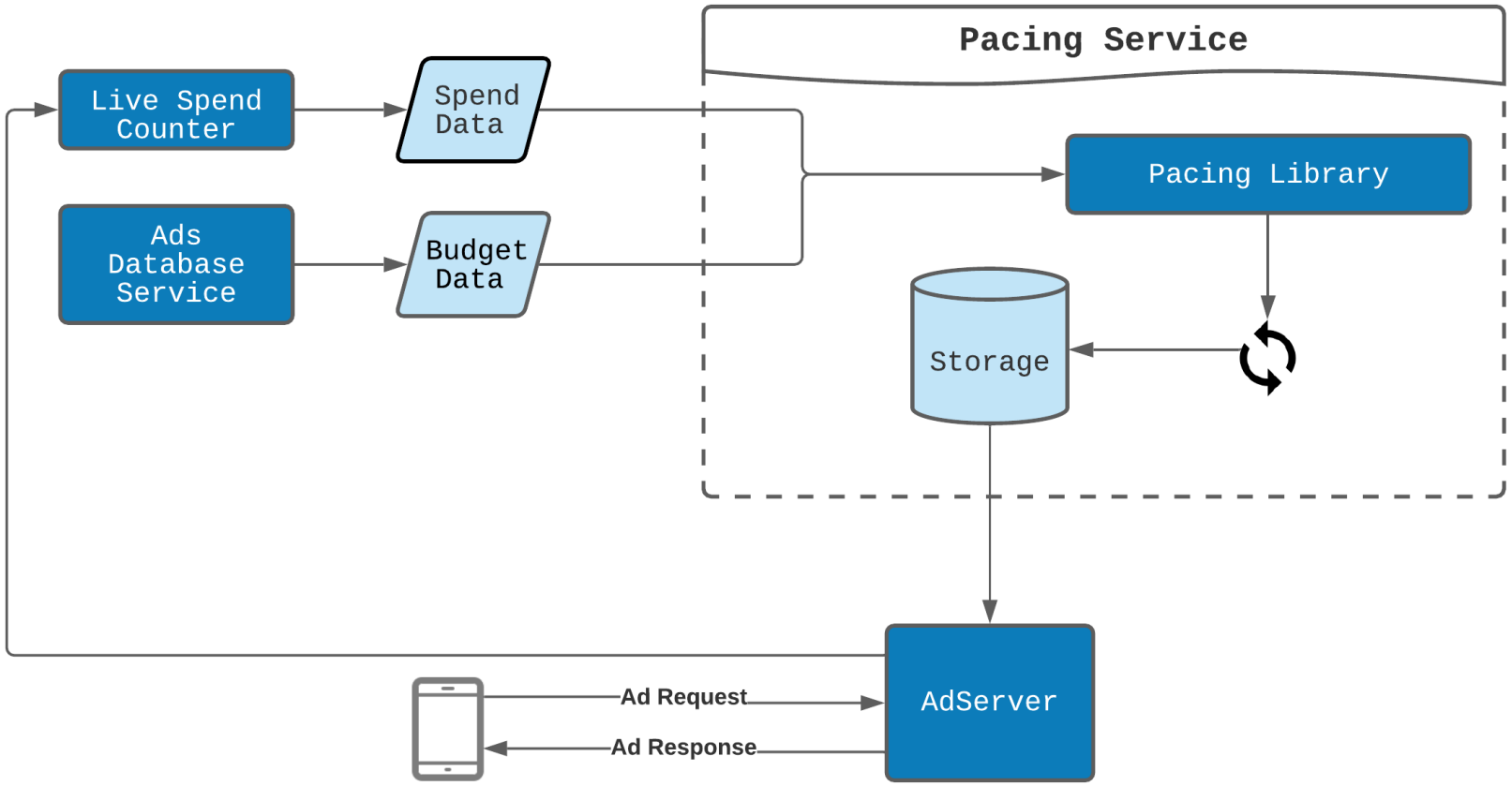




Design for handling DC failure: Allow cross-DC writing



Model the service behavior

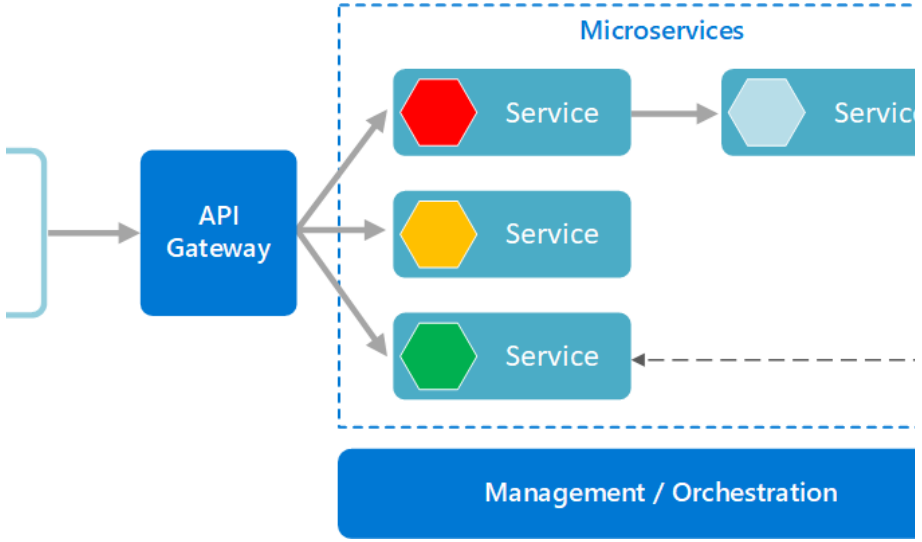


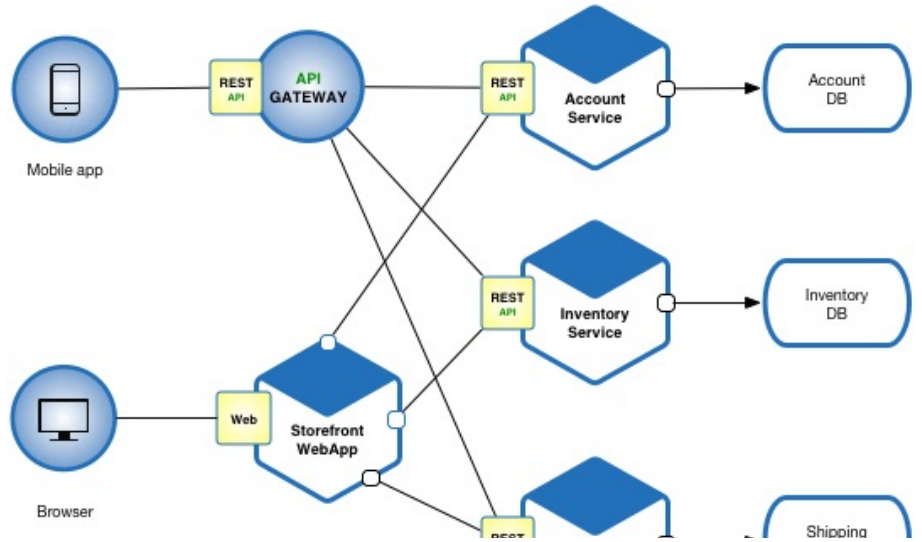
Model

A theoretical representation of a system (or of a part of it) at the desired level of abstraction so that it can be be understood, analyzed or simulated

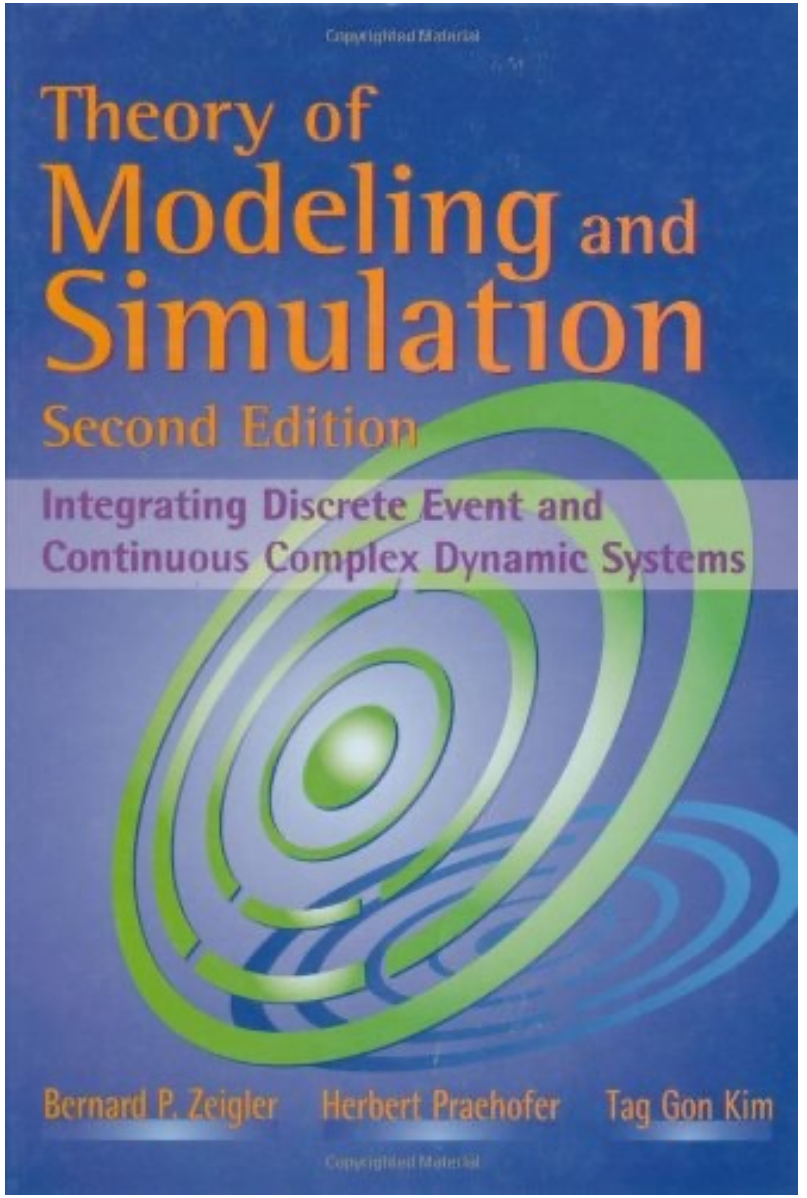
Systems modeling is a different way to see and analyze software systems

Application software are system of systems (SoS)





If you want to learn more about systems modeling



Modeling System of Systems (SoS)

Unit 3 – TiSF S'23

Session 3 (2023-03-30)

Characteristics of modern application software

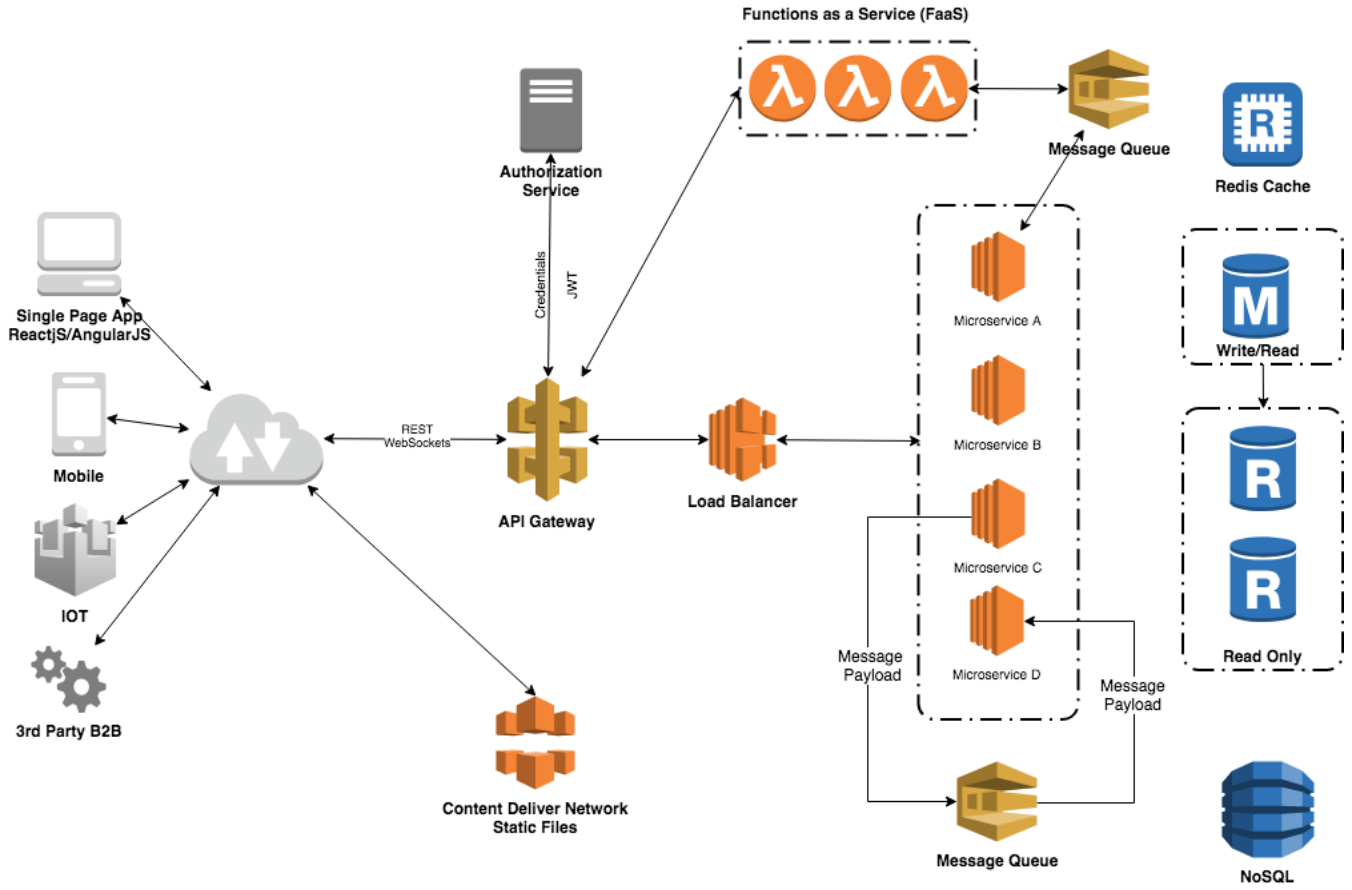
Distributed architecture - Performance, availability, reliability, and other non-functional requirements at scale is a key concern

Composed of microservices and external services running on public cloud

Data intensive – multiple domains of data used by multiple services for their business logic

Rich UI/UX across multiple form factors - multi-layered architecture

Typical Web Application architecture



Source: [erwindev]

Is there a typical web application?

B2C applications

- Facebook
- Netflix
- Twitter
- Instagram
- WhatsApp

B2B Applications

- Salesforce
- Magento
- SAP
- Slack
- Office 365

A web application should be understood through models

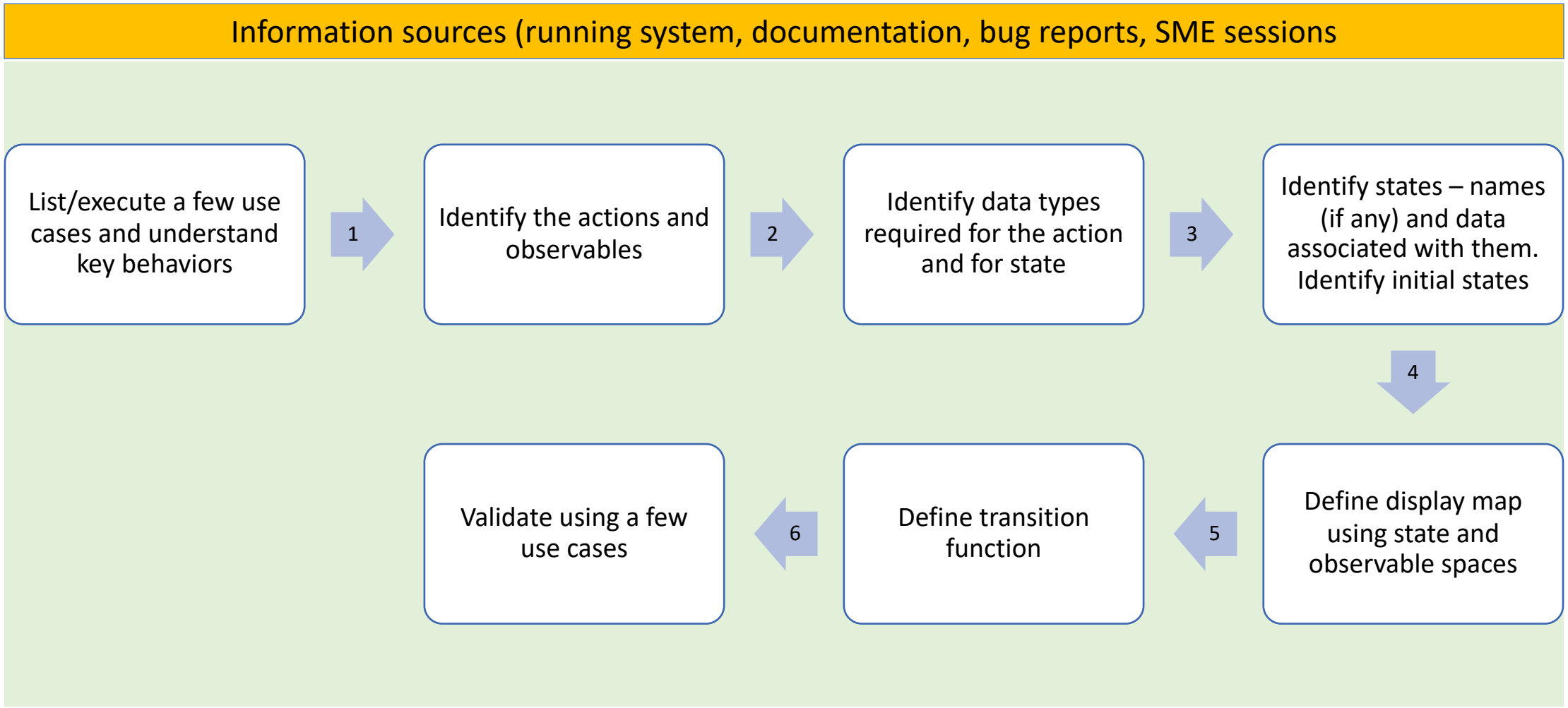
Behavioral, structural and interaction models can capture the overall behavior of the web application

Architecture is a model with a specific set of goals around performance characteristics

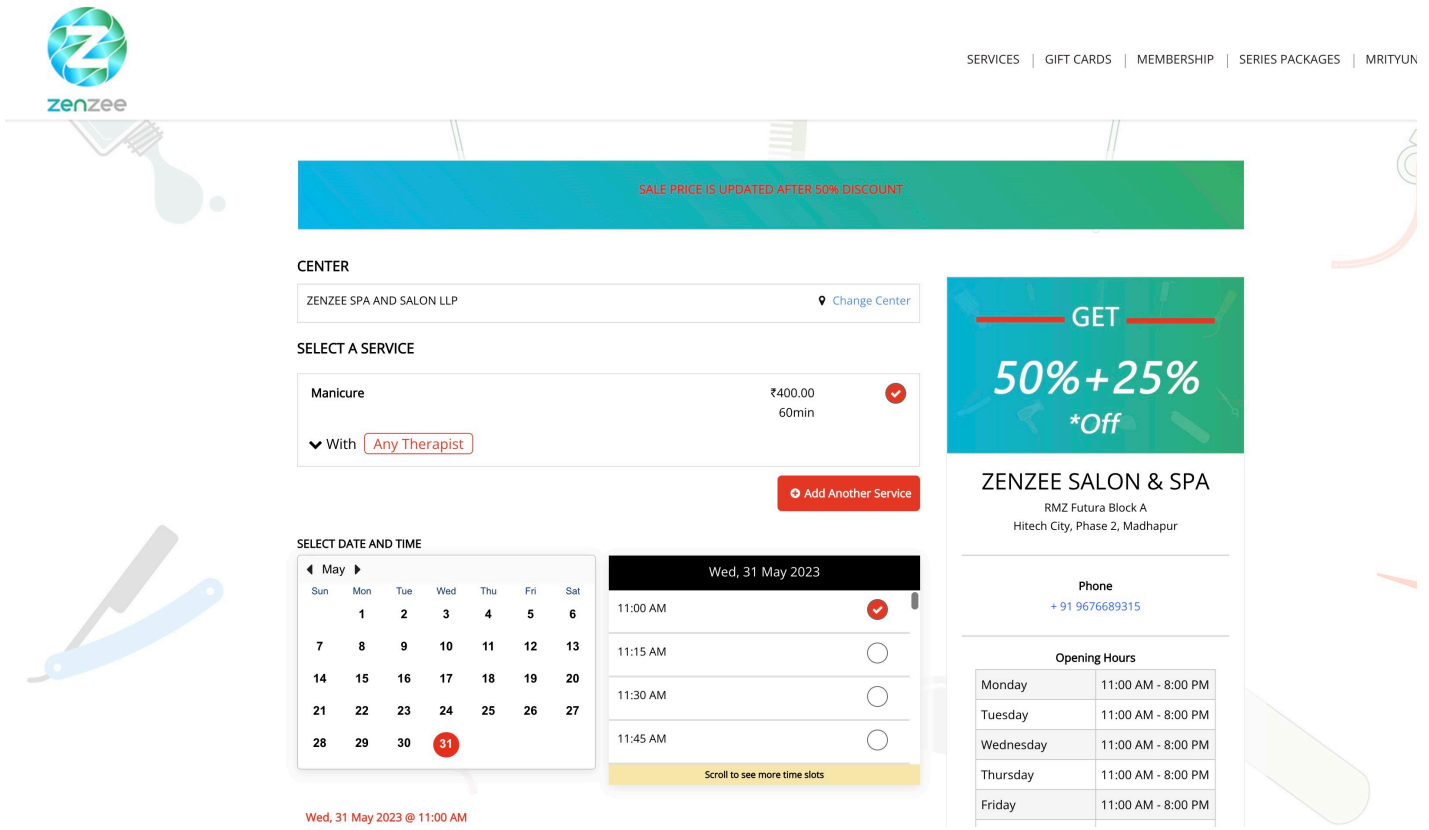
The model is built iteratively. It is refined as information is available through different sources

Modeling is a top-down exercise, code comprehension comes later and helps in creating a detailed version of the model

Modeling a system is an iterative process

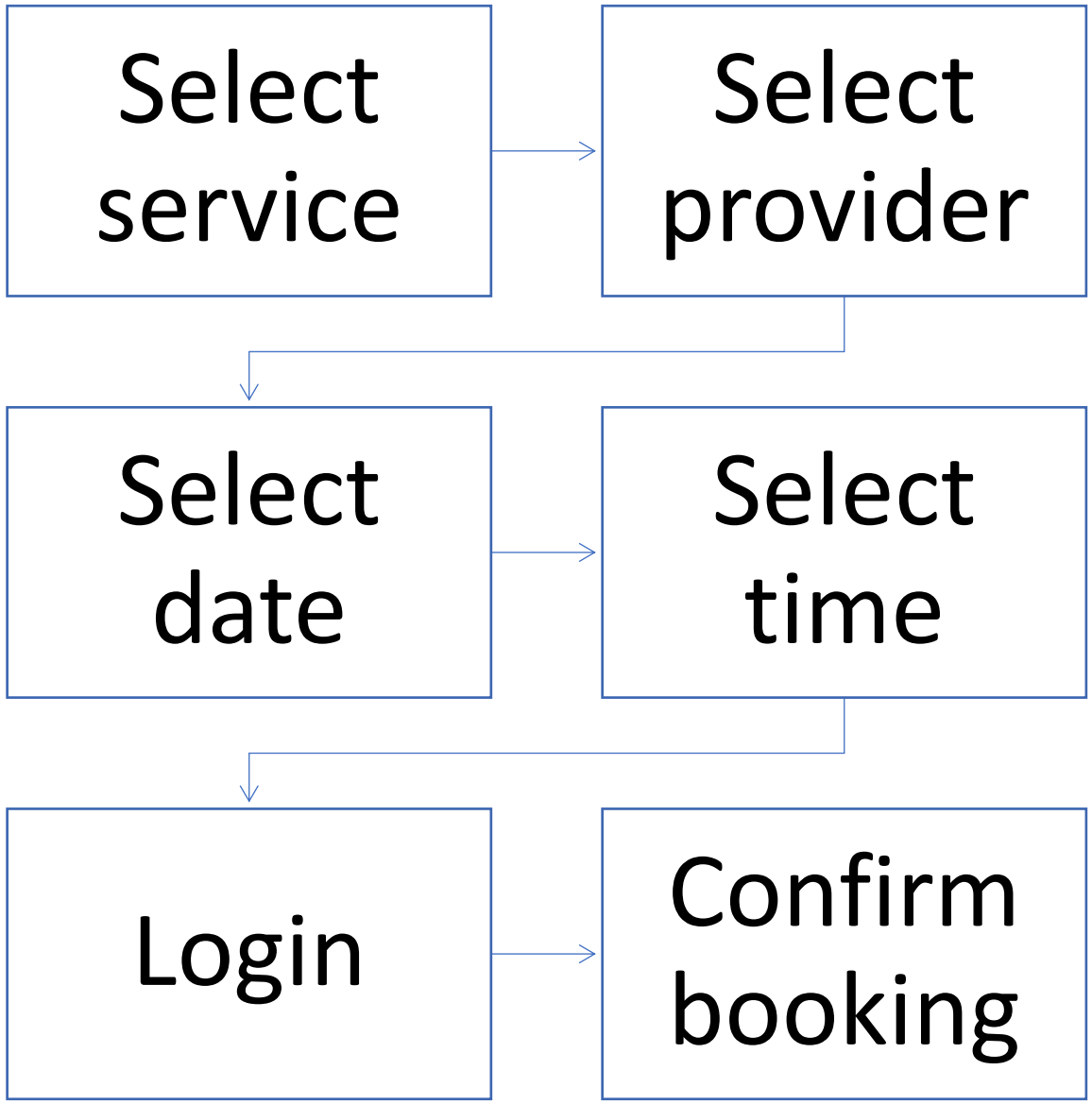


Let’s try modeling an online appointment booking system



https://zenotispasalon.zenoti.com/webstoreNew/services

Booking Flow



Board work

This is a system of systems (SoS)

What are the component systems you can think of?

What are the interconnections?

Some of the subsystems it interacts with

Inventory management subsystem

Resource management system

Calendar subsystems

Resource calendar

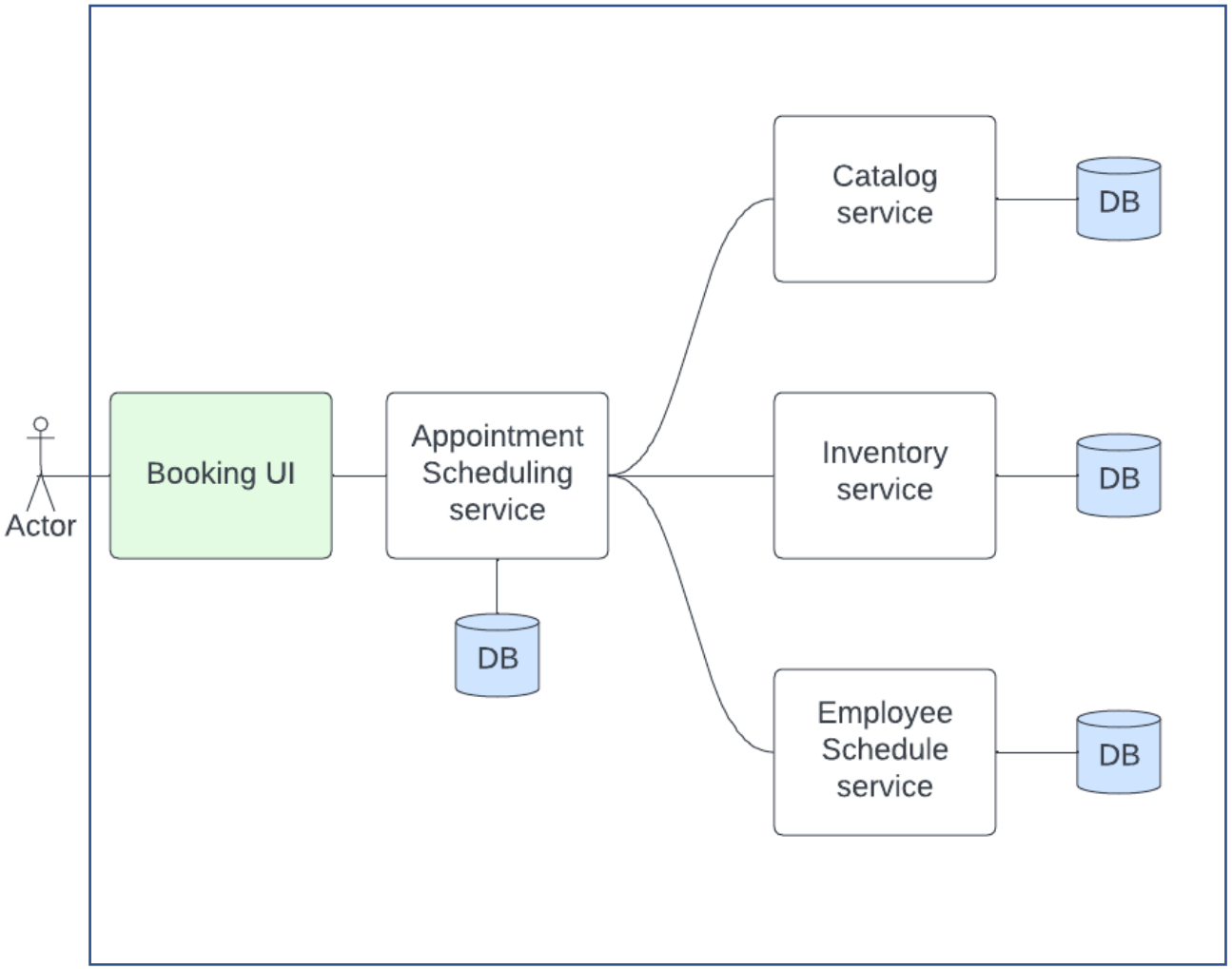
Employee calendar

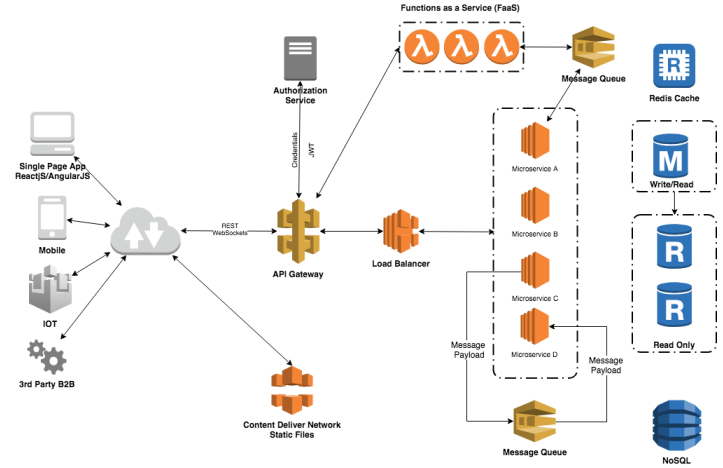
Scheduling system (for employees)

Service catalog system

Pricing System

Appointment booking SoS





We write behavioral model of the SoS – this captures the requirements, the behavior the actor expects to see

We then break into component systems, each with its own transition system model, and interconnections between systems

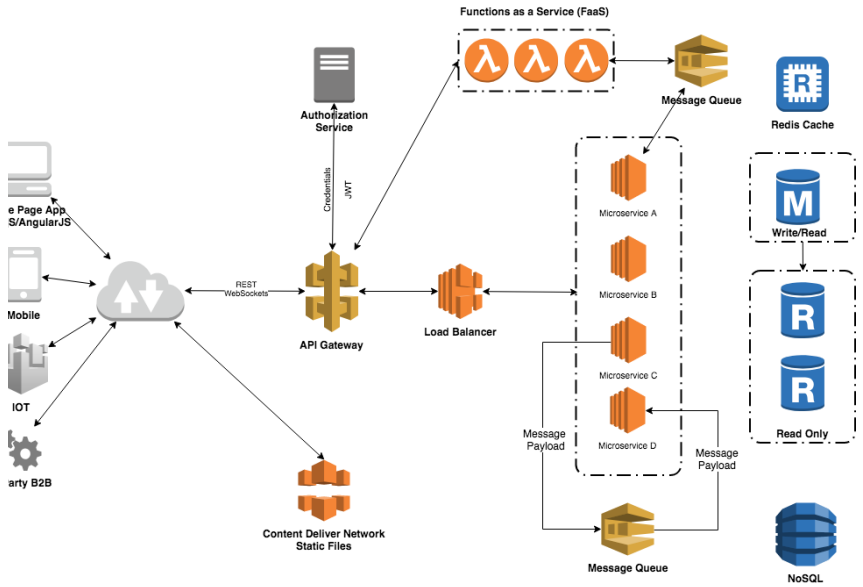
Board work

Recurring themes in large systems modeling

How do we identify/divine component systems?
What is the model of an interconnect? Is it like electrical wiring, where data flows? Or is it something smarter?
How should we model communication? Should message M from system A to system B mean Y of A is M, and U of B is M? What about synchronous vs. asynchronous messages?
UI system interacts with human actors, other systems interact with each other, does it make sense to model UI systems in a different way?
Every system owns its data, and needs data from other sources (systems), how do we model them?

Key themes we will tackle in this course

- Component services and interconnections
- Communication/messaging
- Separation between Front-end and back-end
- Modeling data access



Questions?