

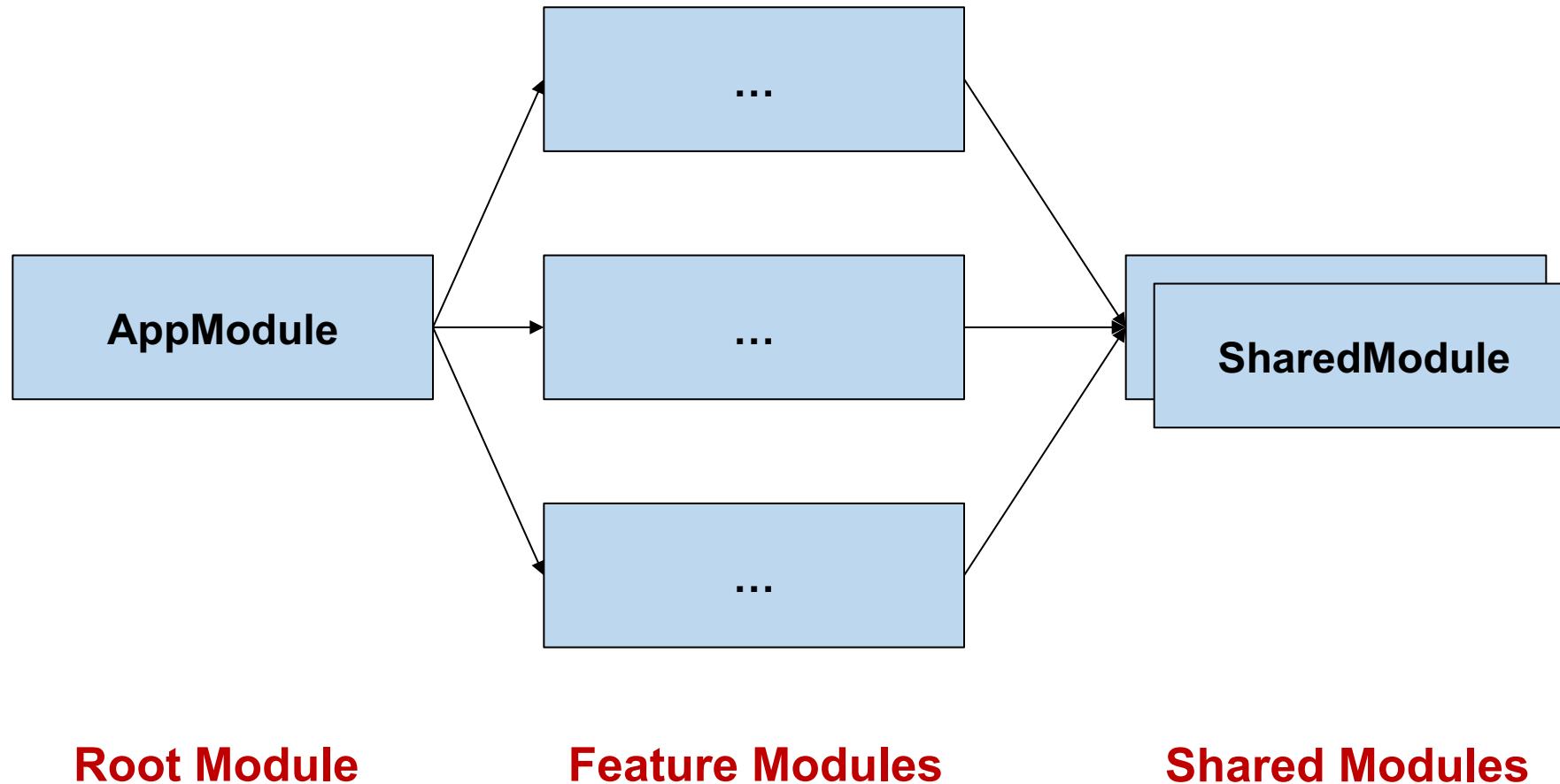


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# Architecture for Angular Enterprise Applications

Alex Thalhammer

# Typical Module Structure



# Outline

- Nx Monorepos
- Strategic Design and DDD
- Micro Frontends
- Module Federation

A wide-angle photograph of Uluru (Ayers Rock) in Australia. The massive, rounded monolith is bathed in a deep orange-red glow from the setting sun, which illuminates its layered, textured surface. In the foreground, a field of tall, golden-yellow grasses and low-lying desert shrubs stretches across the frame. The sky above is a clear, pale blue with a few wispy white clouds.

Monorepos

# Monorepo Structure

```
▶ 📁 node_modules
◀ 📂 projects
  ▶ 📂 flight-admin
  ▶ 📂 flight-api
  ▶ 📂 flight-app
  ▶ 📂 validation
  🔍 .gitignore
  ⚡ angular.json
  📜 package-lock.json
  📜 package.json
```

# Advantages

Everyone uses the latest versions

No version conflicts

No burden with distributing libs

Creating new libs: Adding folder

Experience: Successfully used at Google, Facebook, ...

# Two Flavors

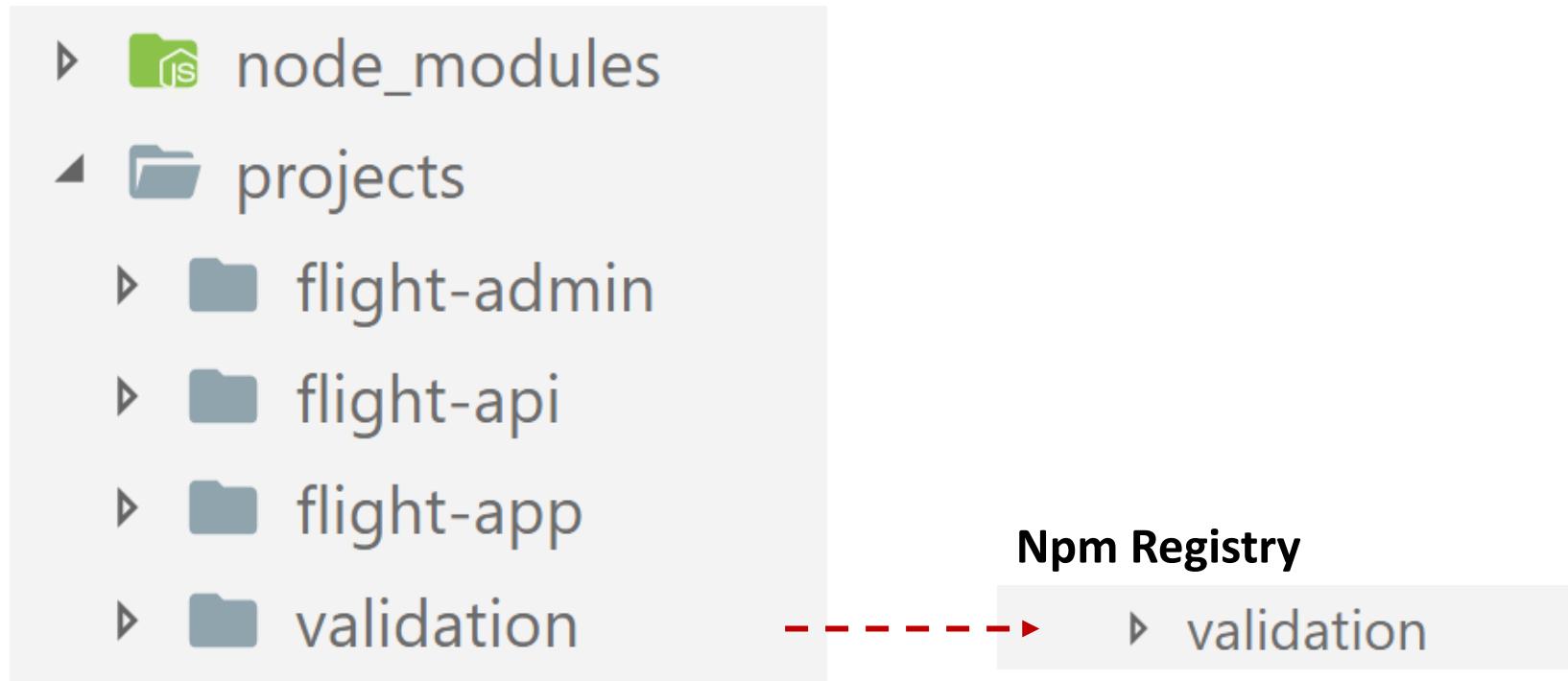
## Project Monorepo

- Like Workspaces/Solutions in different IDEs

## Company-wide Monorepo

- E. g. used at Google or Facebook

# Moving back and forth



# Tooling & Generator

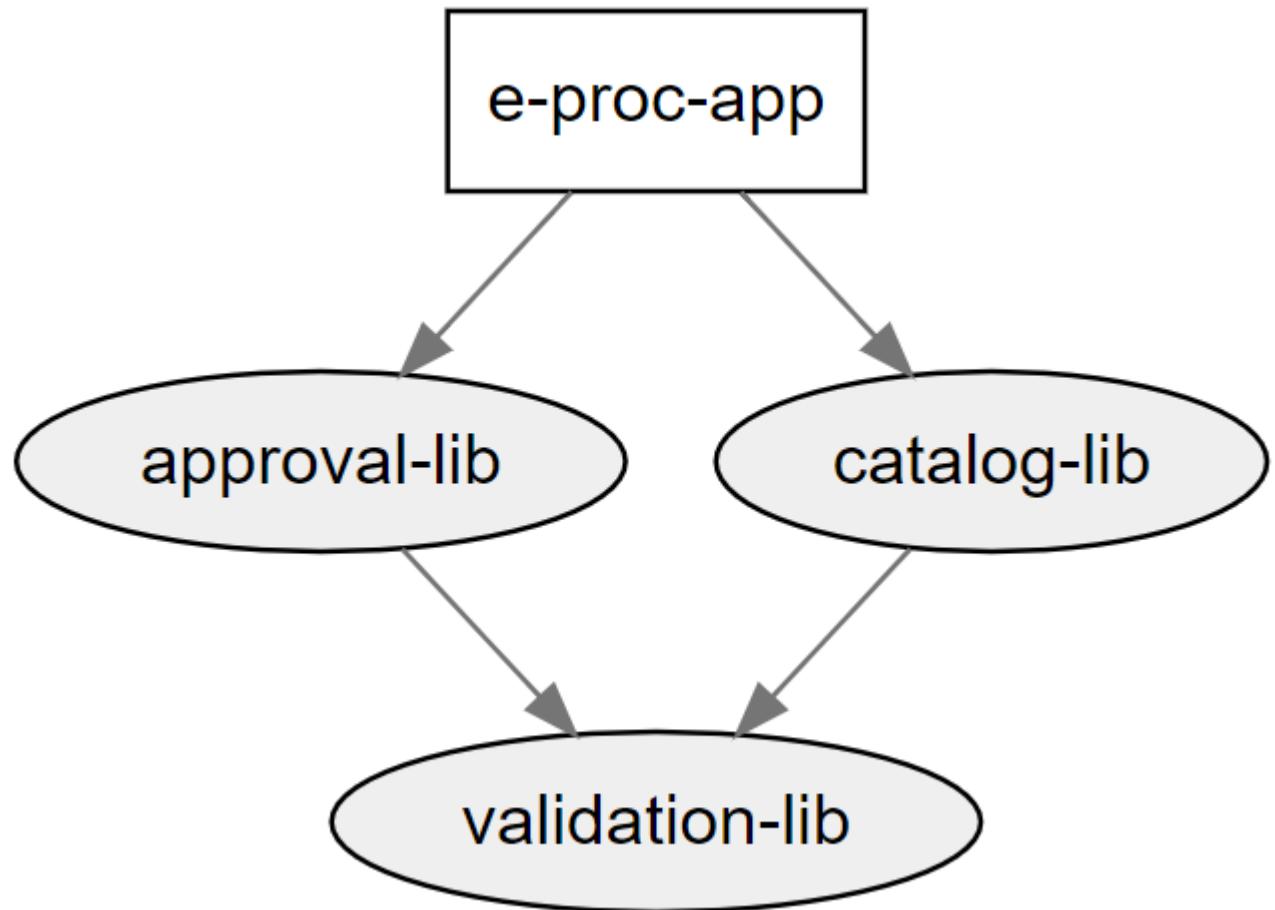
<https://nrwl.io/nx>



## Nrwl Extensions for Angular

An open source toolkit for enterprise Angular applications.

# Visualize Module Structure



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# Features of Nx

- Visualize module structure and dependencies
- Additional schematics / generators (nx g app/lib/... also for NgRx)
- Access restrictions: which apps/libs can access which libs (via ESLint)
- Build cache: Just recompile changed apps/libs (no cloud needed!)
- Out-of-the-box support for
  - NgRx
  - Jest, Cypress & Storybook

# Creating a Workspace

```
npm install -g @angular/cli
```

```
ng new workspace
```

```
cd workspace
```

```
ng generate app my-app
```

```
ng generate lib my-lib
```

```
ng serve --project my-app
```

```
ng build --project my-app
```

# Creating a Workspace

```
npm install -g @angular/cli  
npm install -g nx
```

**npx create-nx-workspace**

```
cd workspace
```

```
nx generate app my-app  
nx generate lib my-lib --buildable
```

```
nx serve --project my-app  
nx build --project my-app
```

# DEMO

# Lab

*Libraries and Monorepo*



DDD

in a nutshell

# Domain-Driven **DESIGN**

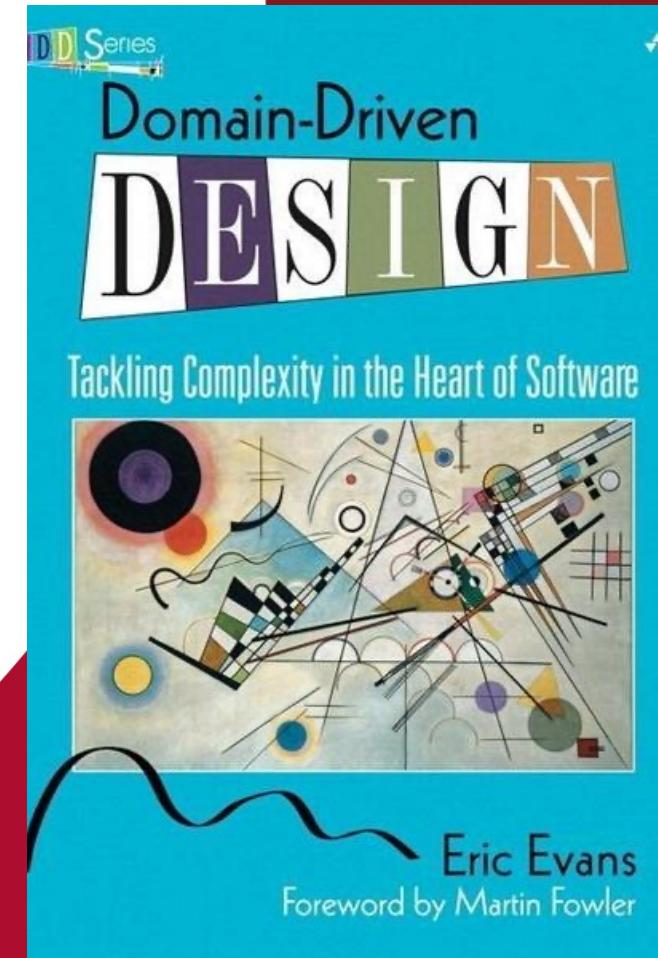
Tackling Complexity in the Heart of Software



Eric Evans  
Foreword by Martin Fowler

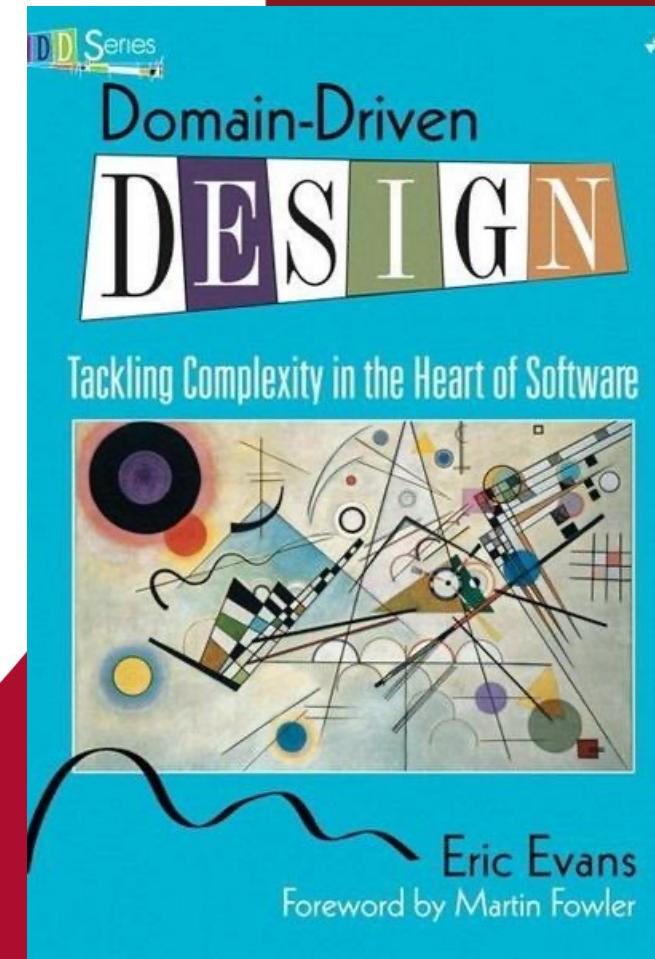
Methodology for  
bridging the gap b/w  
requirements and  
architecture/ design

# How to create sustainable frontend architectures with ideas from DDD?



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# How to create **sustainable** frontend architectures with **ideas from DDD?**



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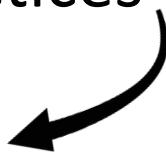
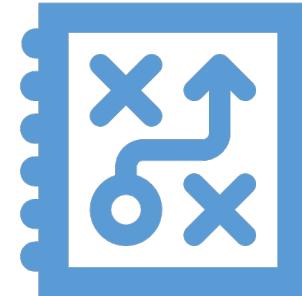
# Domain Driven Design

Decomposing a System



Strategic Design

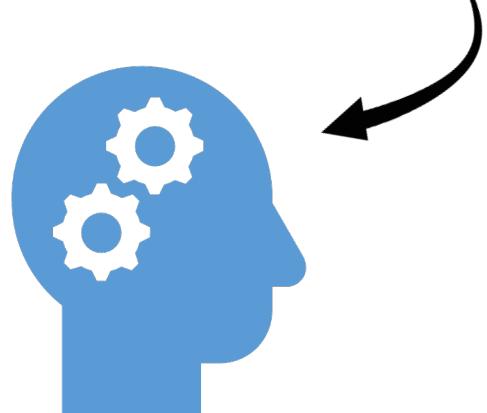
Design Patterns  
& Practices



Tactical Design

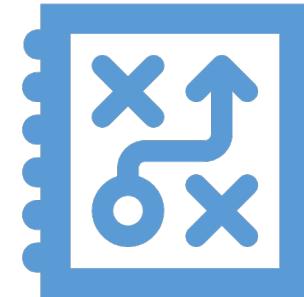
# Domain Driven Design

Decomposing a System



## Strategic Design

Design Patterns  
& Practices



## Tactical Design

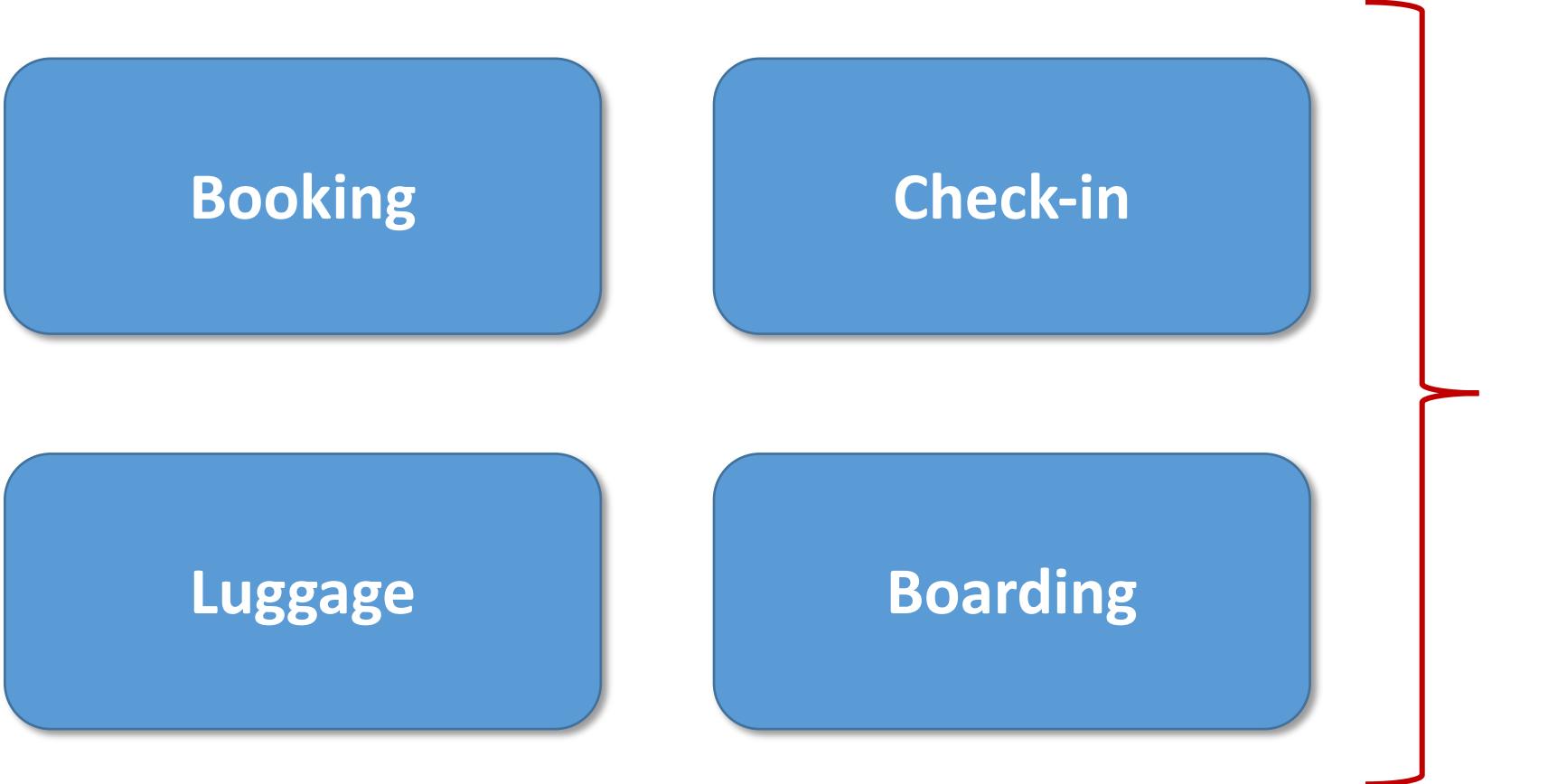


This is what Strategic DDD prevents

# Example

Flight System

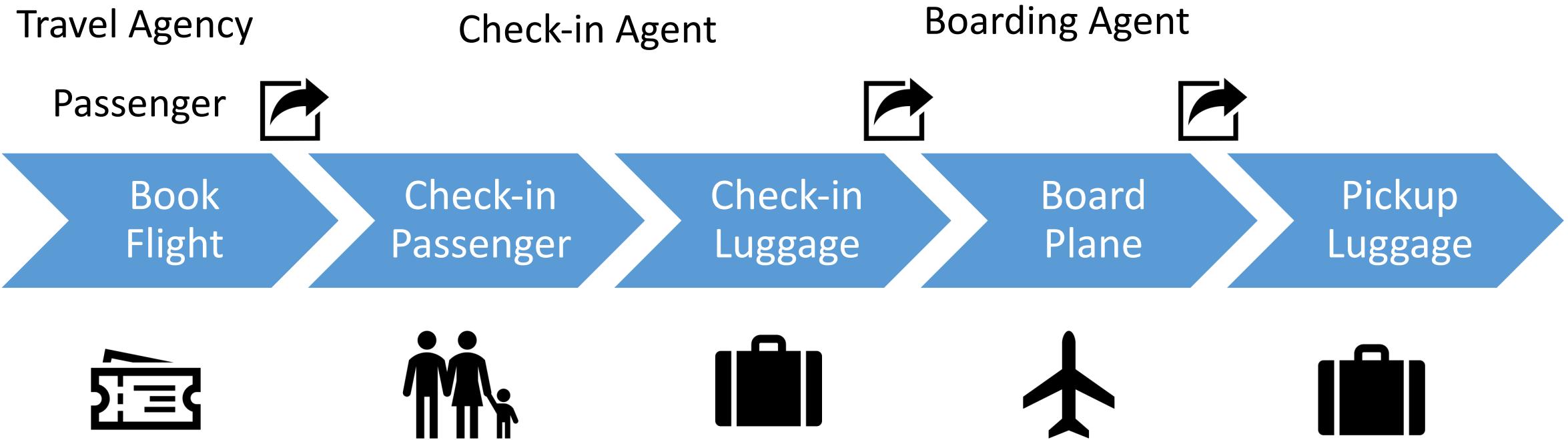
# Example



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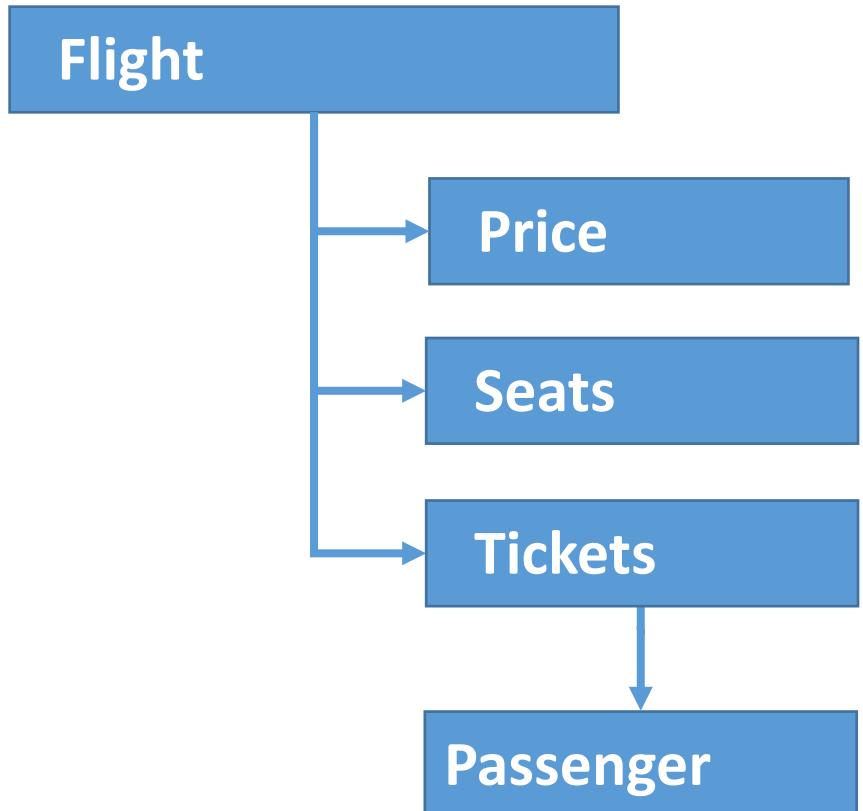


# Finding Sub-Domains



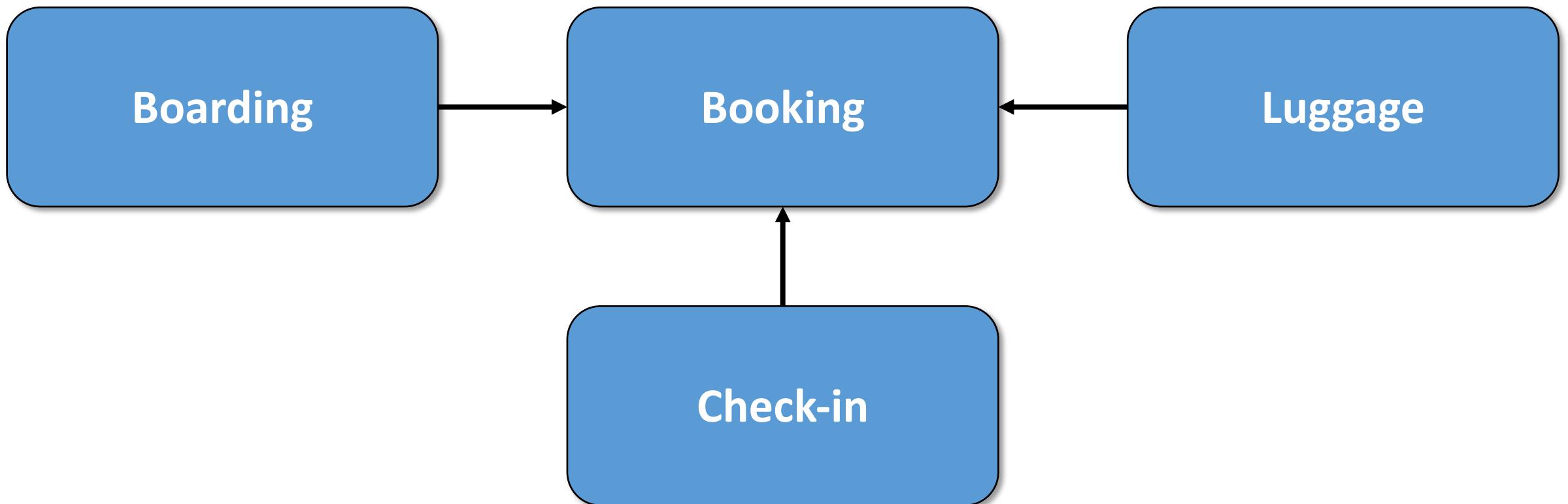
## Booking

## Boarding



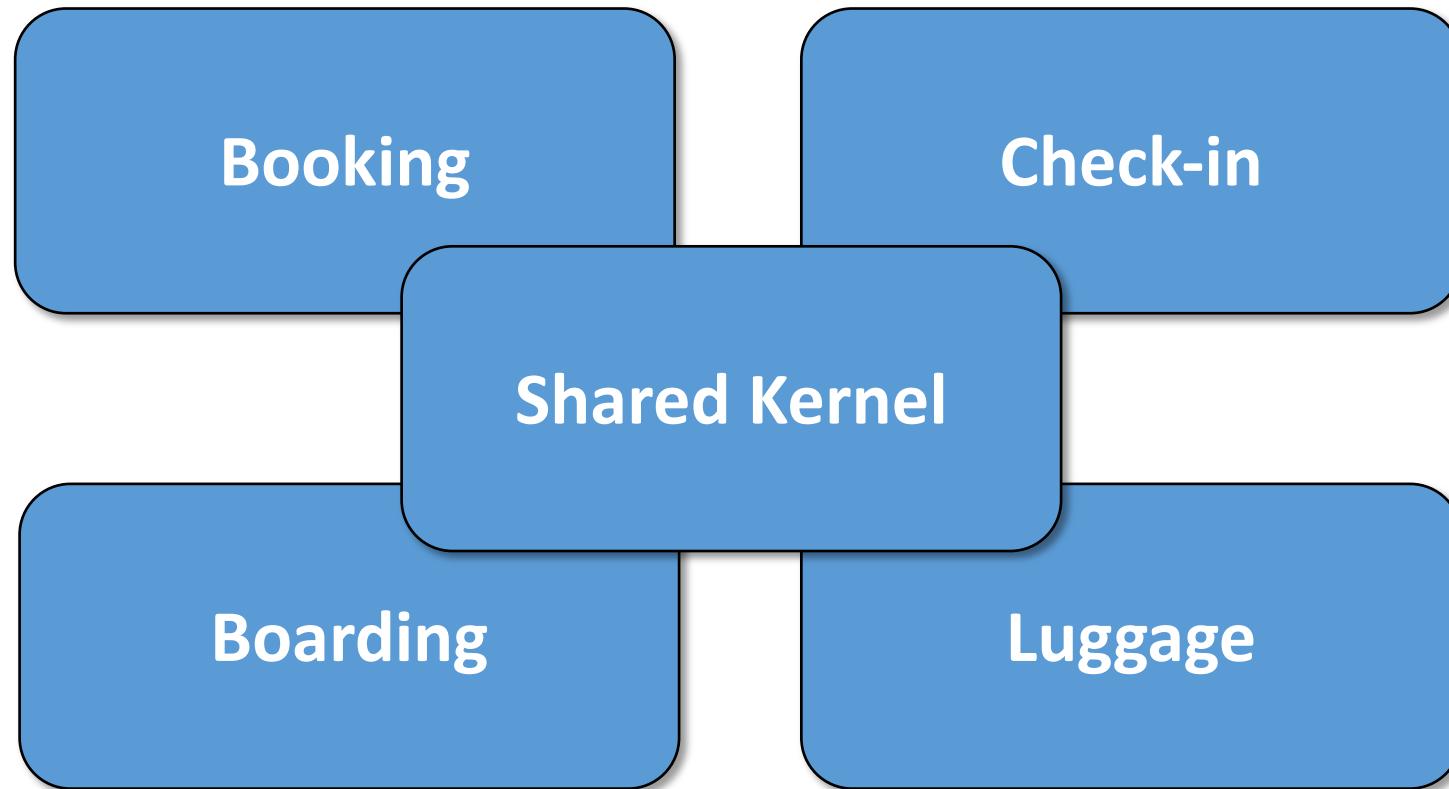
Bounded Context

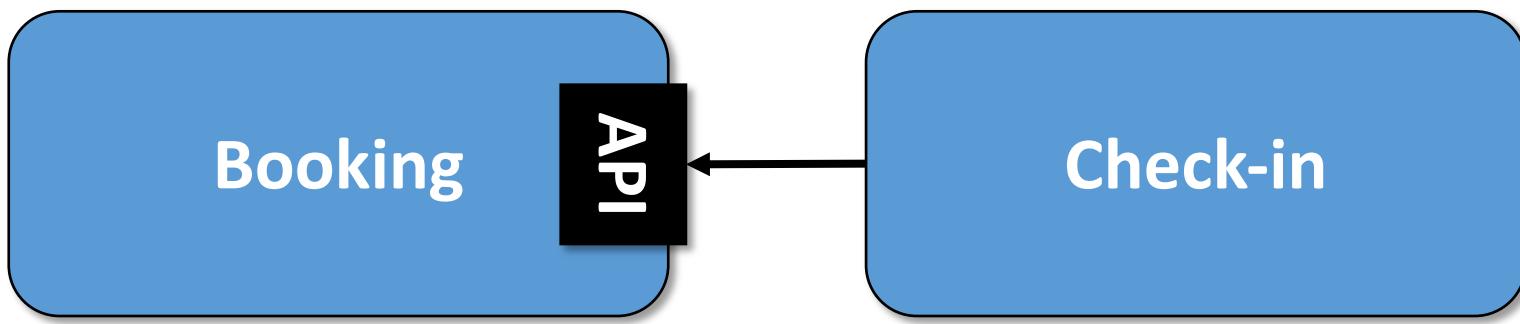
# Context Map



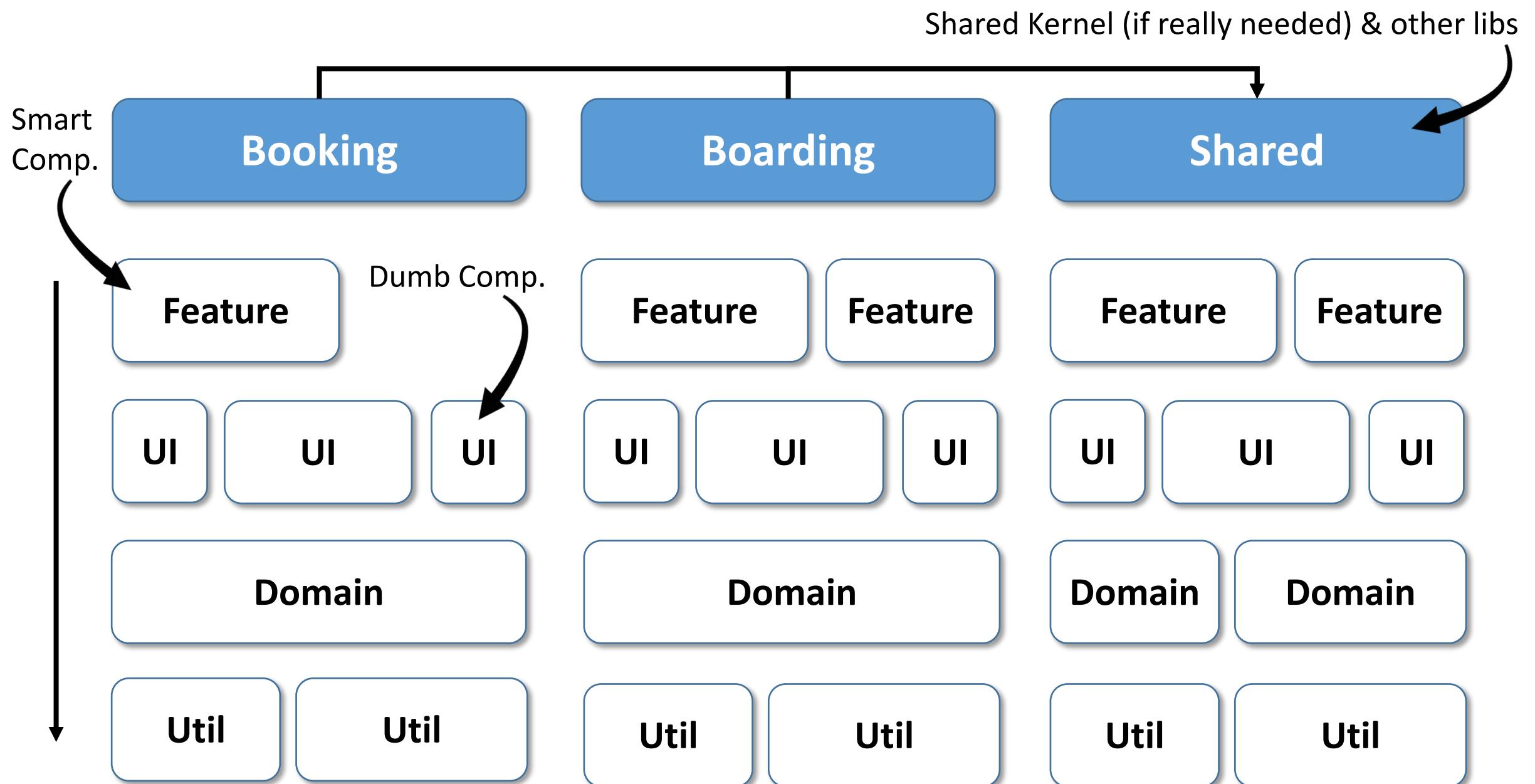
# Context Map

Responsibilities?  
Breaking Changes?





Open-/Host-Service



# Smart vs. Dumb Components

## Smart / Controller

- 1 per feature / use case / route
- Business logic
- Container

## Dumb / Presentational

- Independent of Use Case
- Reusable
- Leave

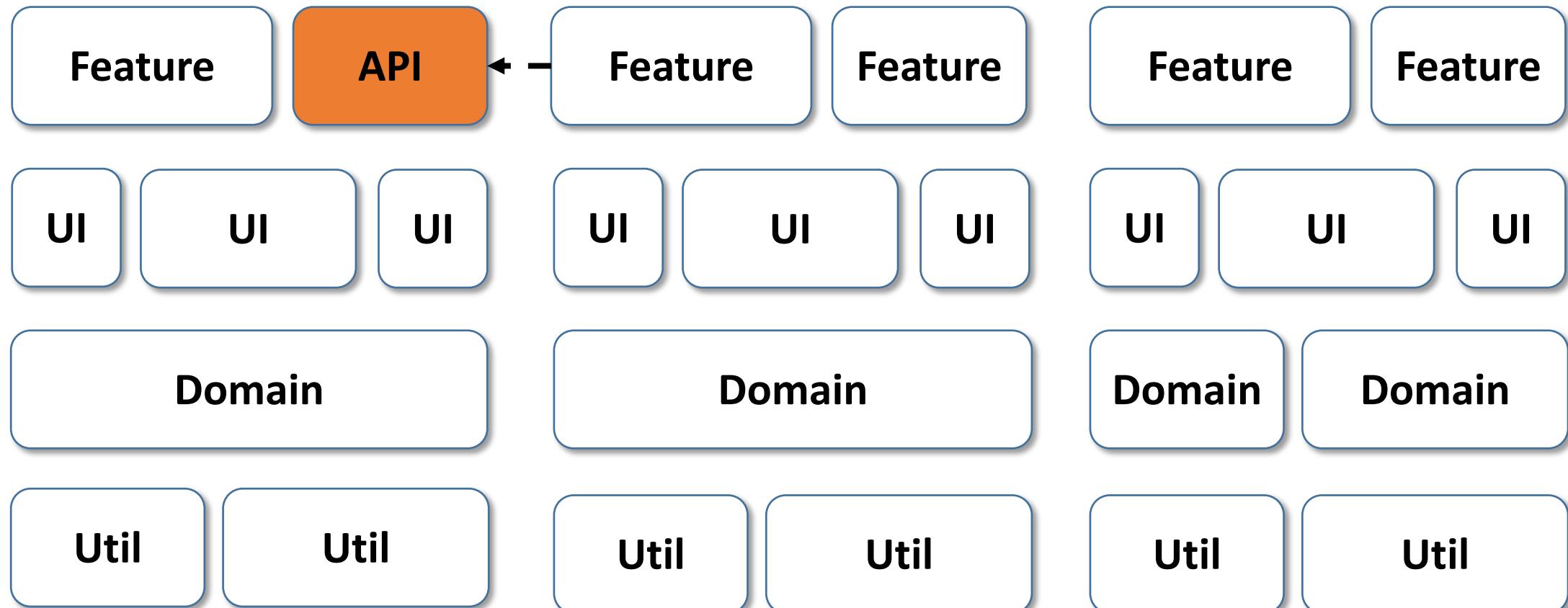
# Domain-Driven DESIGN

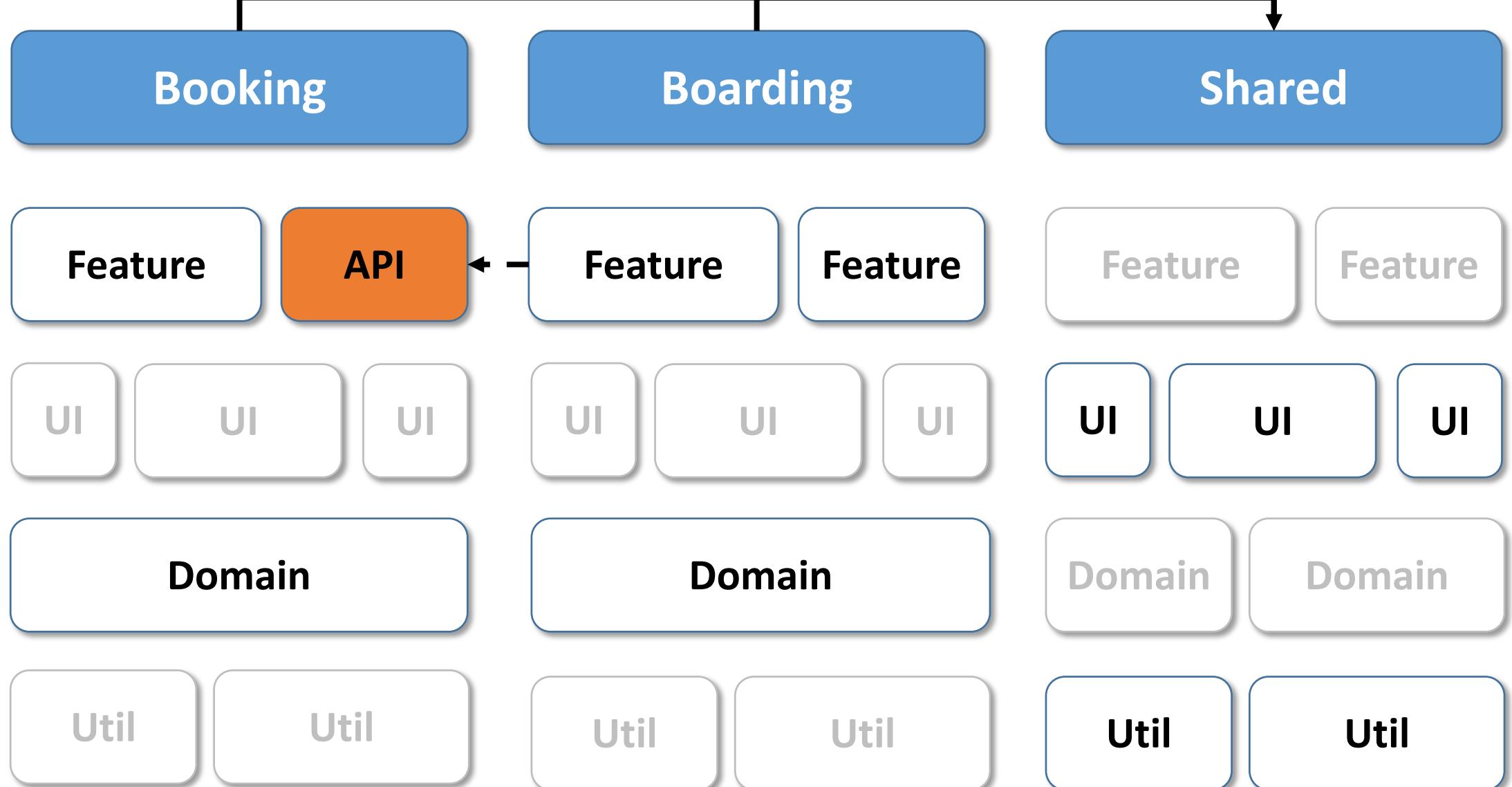
Tackling Complexity in the Heart of Software



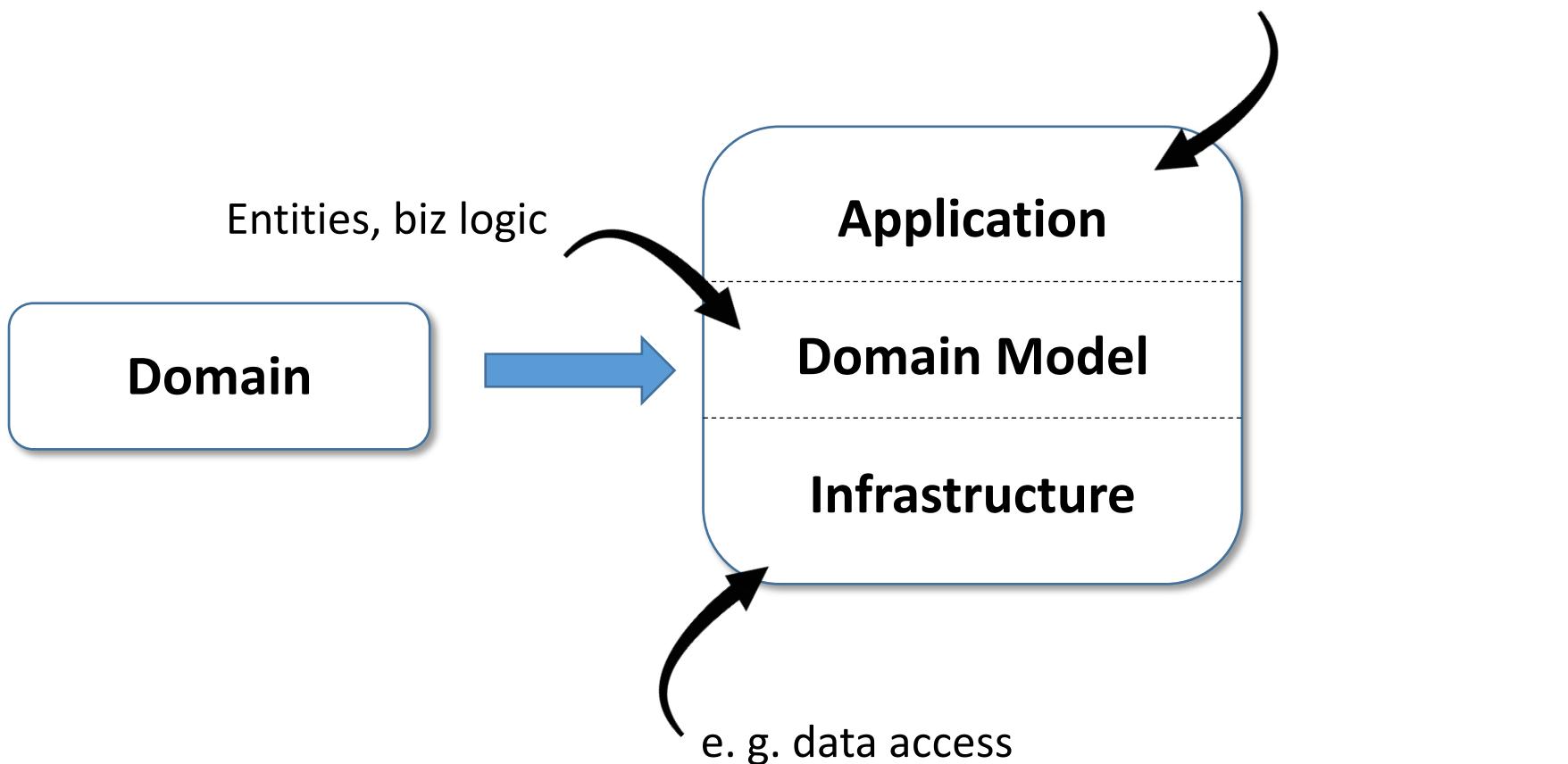
Eric Evans  
Foreword by Martin Fowler

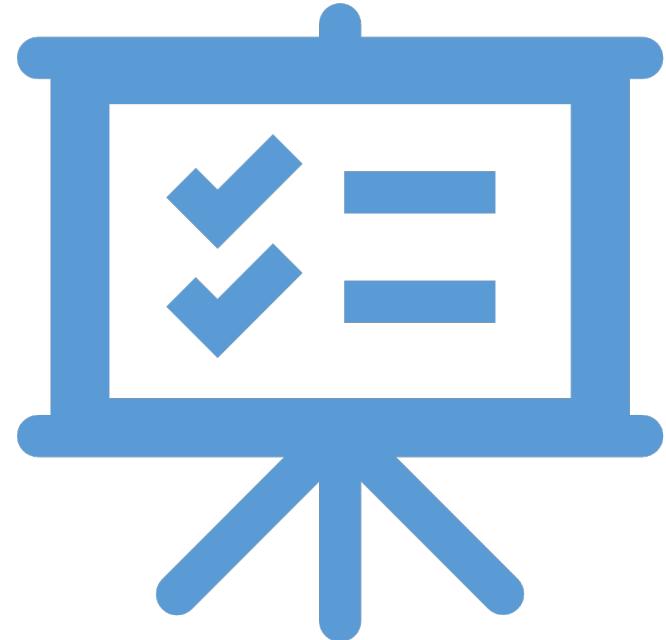
Lots of approaches  
for cross-domain  
communication and  
more ...





# Isolate your domain!





## Finegrained Libraries

- Unit of recompilation
- Unit of retesting
- Access restrictions
- Information Hiding
- Easy: Just `ng g lib ...`
- Future replacement for NgModules?



## Alternatives to layering

- e. g. Hexagonal Architecture, Clean Architecture
- Anyway: We need to **restrict access** b/w libraries



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# Categories for Libraries with Nx - I

From the [free e-book about Monorepo Patterns](#)

- **feature:** Implements use case controller (smart) components
- **ui:** Provides use case agnostic, thus reusable (dumb) presentational components
- **data-access:** Contains REST (or GraphQL) services that function as client-side delegate layers to server tier APIs
- **util:** Provides common utilities/services/helper functions

# Categories for Libraries with Nx - II

NX access restrictions between libs

E.g. a “util” lib is not able to depend on a “feature” lib (or even an app)

# Categories for Libraries with DDD

In addition, we're also using the following categories:

- **shell**: For an application that contains multiple domains, a shell provides the entry point for a domain
- **api**: Provides functionalities exposed for other domains
- **domain**: Domain logic like calculating additional expanses

# Nx type:tags for Libraries incl. DDD

e2e

app / shell

feature / api

ui

data-access

domain(-logic)

util

# Nx type:tags for Libraries incl. DDD (reduced)

e2e

app / shell

feature / api

ui

domain

# Lab

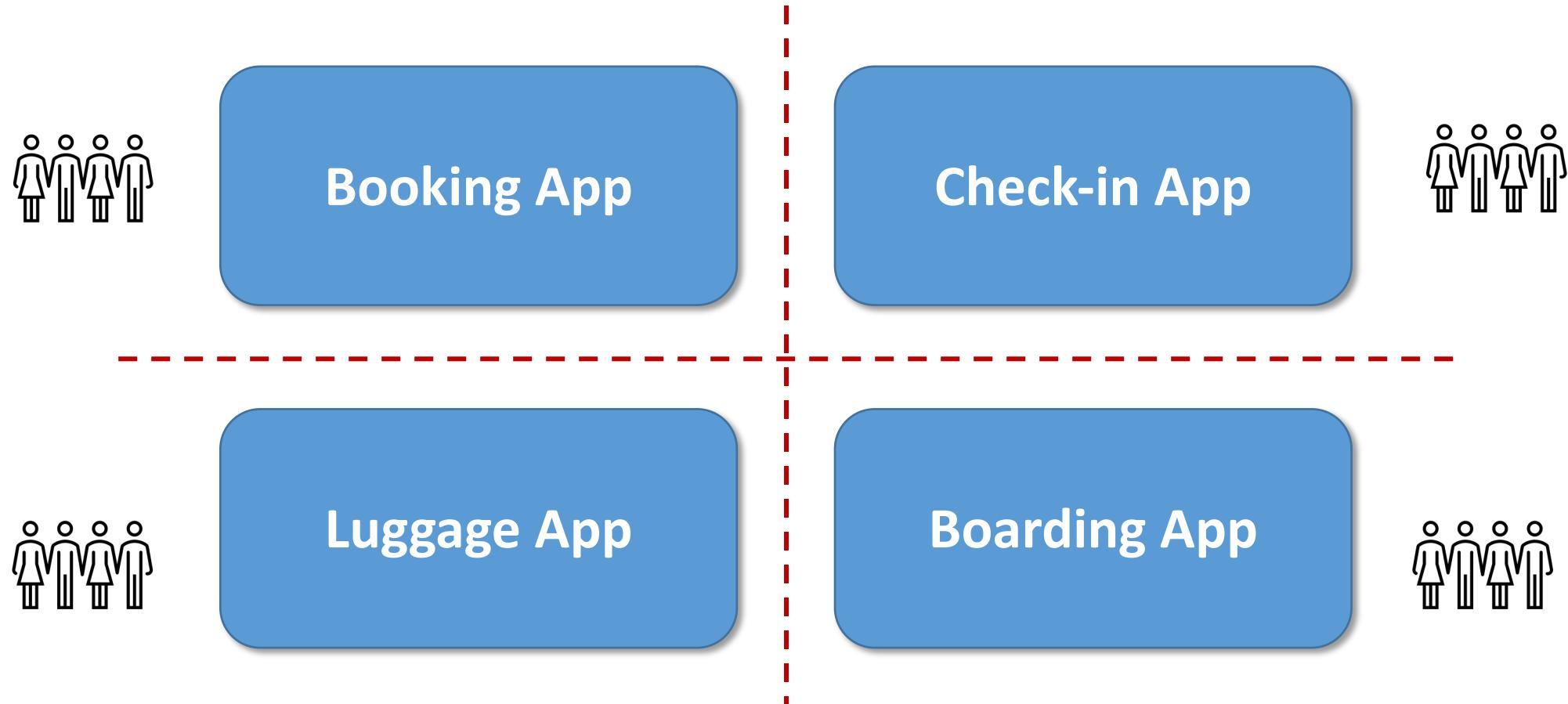
Nx DDD



# Micro Frontends?

Short outlook

# Microfrontends



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Microfrontends  
are first and foremost  
about **scaling teams!**



# Deployment Monolith

Booking

Boarding

Shared

Flight App

Feature

Feature

Feature

Feature

Feature

...

...

...

...

...

...

...

...

...



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# Microfrontends

Booking

Boarding

Shared

Booking App

Boarding App

Feature

Feature

Feature

Feature

Feature

...

...

...

...

...

...

...

...

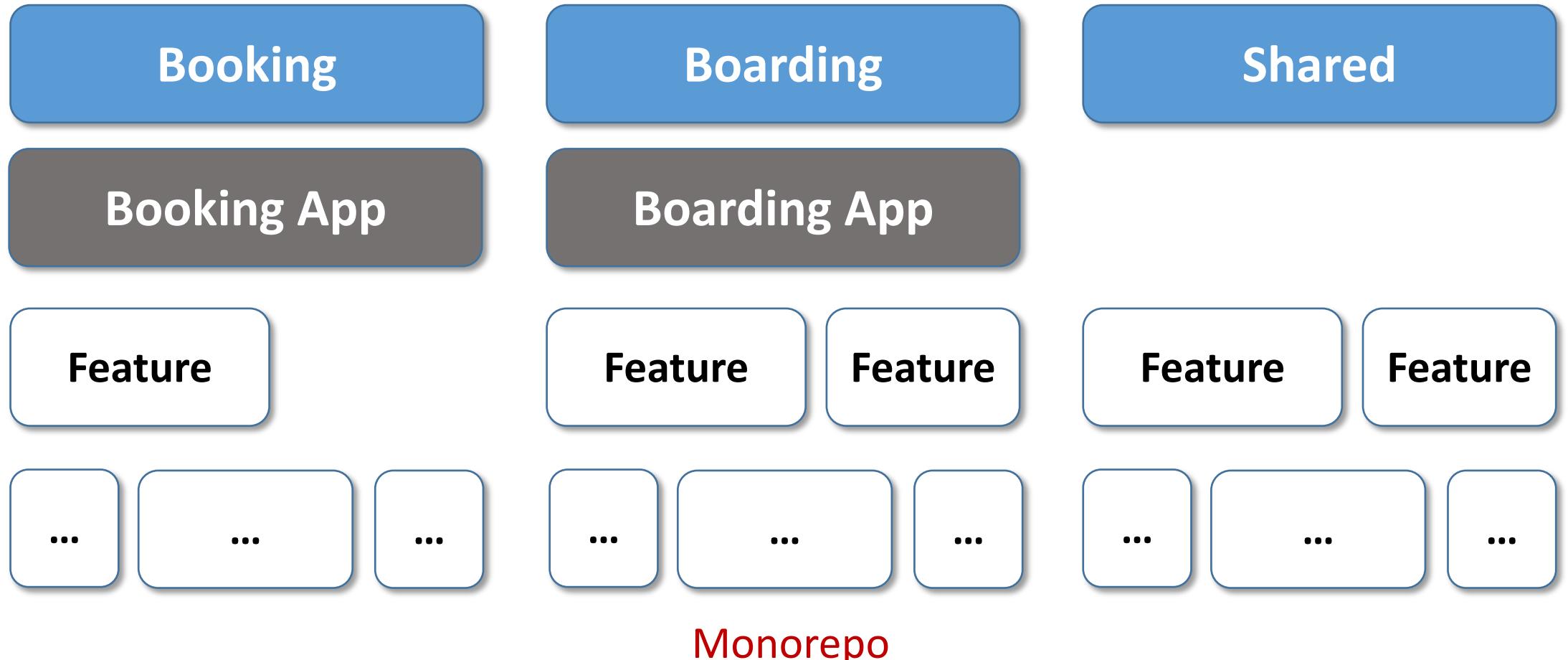
...



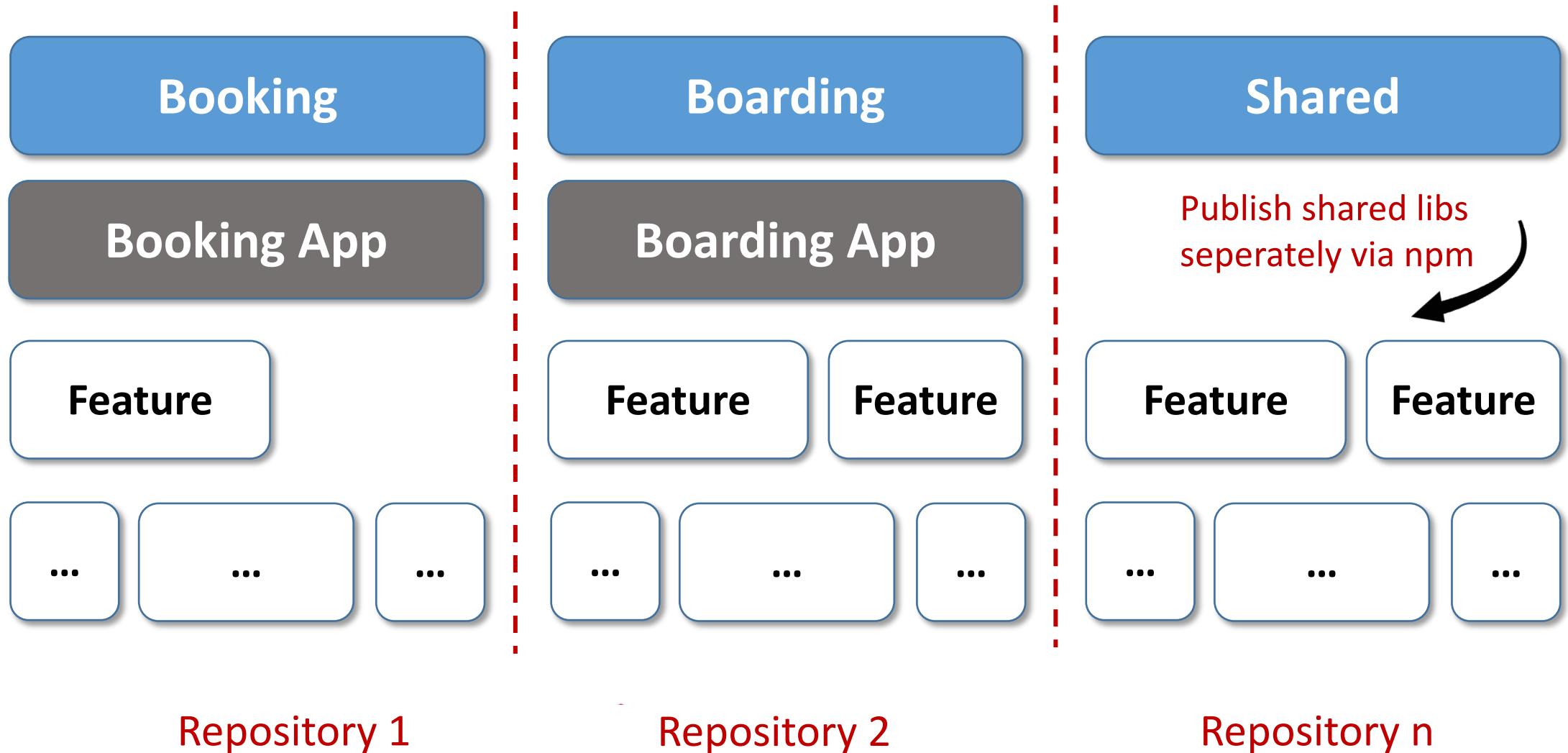
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# Option 1: One App per Domain



# Option 2: One Monorepo per Domain



# Benefits

Autonomous Teams

Separate Development

Separate Deployment

Own architecture decisions

Own technology decisions



Integration via  
Hyperlinks

---

# UI Composition w/ Hyperlinks



Word Online

Document - Auf OneDrive gespeichert.

Manfred S... Abmelden

DATEI START EINFÜGEN SEITENLAYOUT ÜBERPRÜFEN ANSICHT Was möchten Sie tun? IN WORD BEARBEITEN

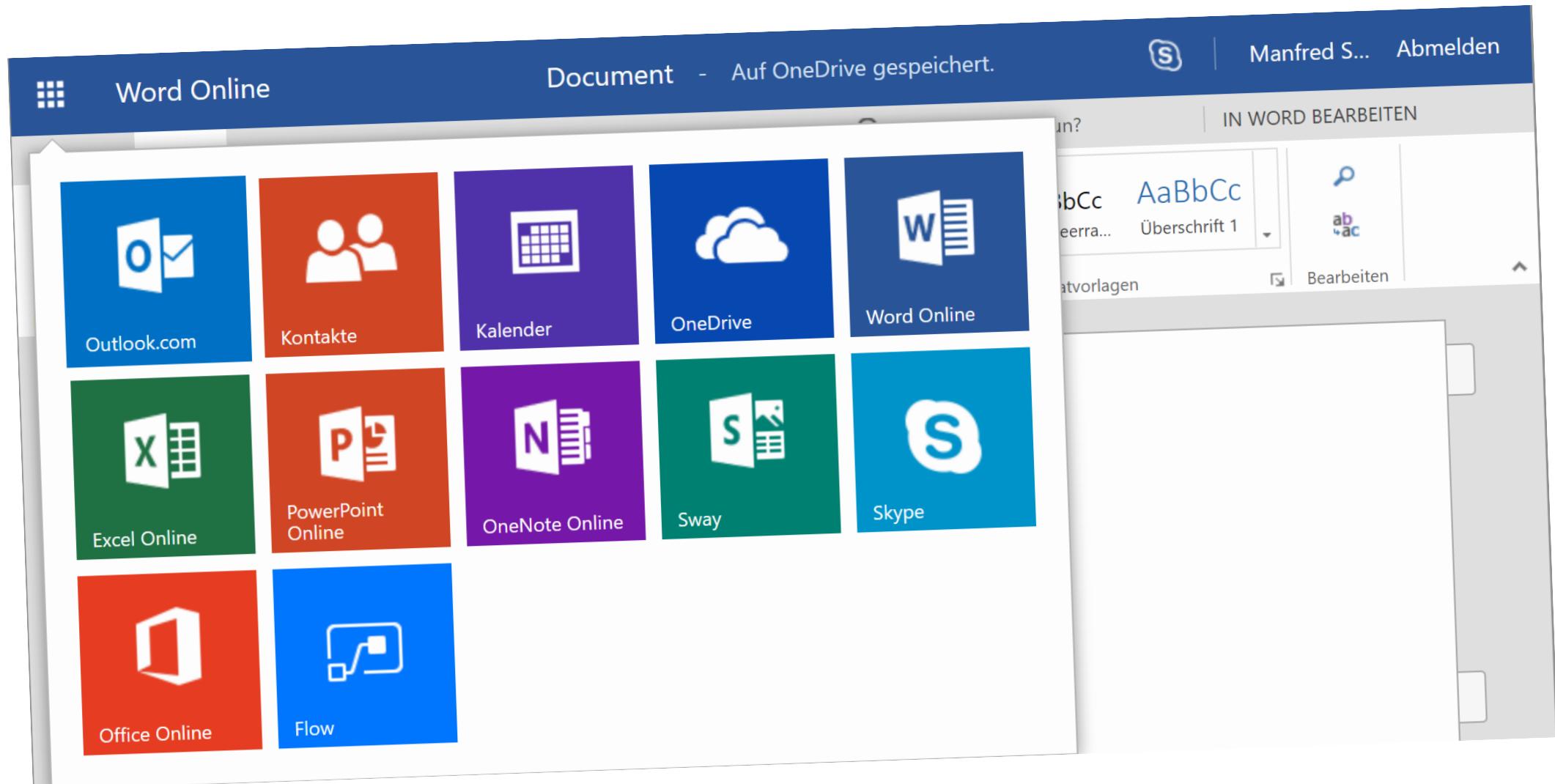
Rückgängig Einfügen Zwischenablage

Calibri (Textkörper) 16 AaBbCc Standard AaBbCc Kein Leerra... Überschrift 1

Schriftart Absatz Formatvorlagen Bearbeiten

Hello World!

This screenshot shows the Microsoft Word Online interface. The top navigation bar includes 'Word Online', the document title 'Document - Auf OneDrive gespeichert.', user information 'Manfred S... Abmelden', and a search bar 'Was möchten Sie tun?'. Below the ribbon, there are sections for 'IN WORD BEARBEITEN' and 'Formatvorlagen'. The main content area displays the text 'Hello World!'. On the left, there are standard Word ribbon icons for file operations like 'Rückgängig' and 'Einfügen', and for clipboard management like 'Zwischenablage'.



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A large, light-colored conical shell, resembling a giant snail shell, sits on a sandy beach. The shell has a textured, spiral pattern and a pointed apex. In the background, the ocean with white-capped waves meets a clear blue sky.

Integration via  
Shell

---

# Providing a (SPA based) Shell (aka Host)

Shell / Host

μApp

μApp

μApp

# Lazy Loading?

- This is more than lazy loading
- This is about loading part **NOT KNOWN** at runtime

# Providing a (SPA based) Shell

- iframes
- Bootstrapping several SPAs
  - + Lazy Loading



# Loading MicroApps

```
<script src="micro-app.bundle.js"></script>
```

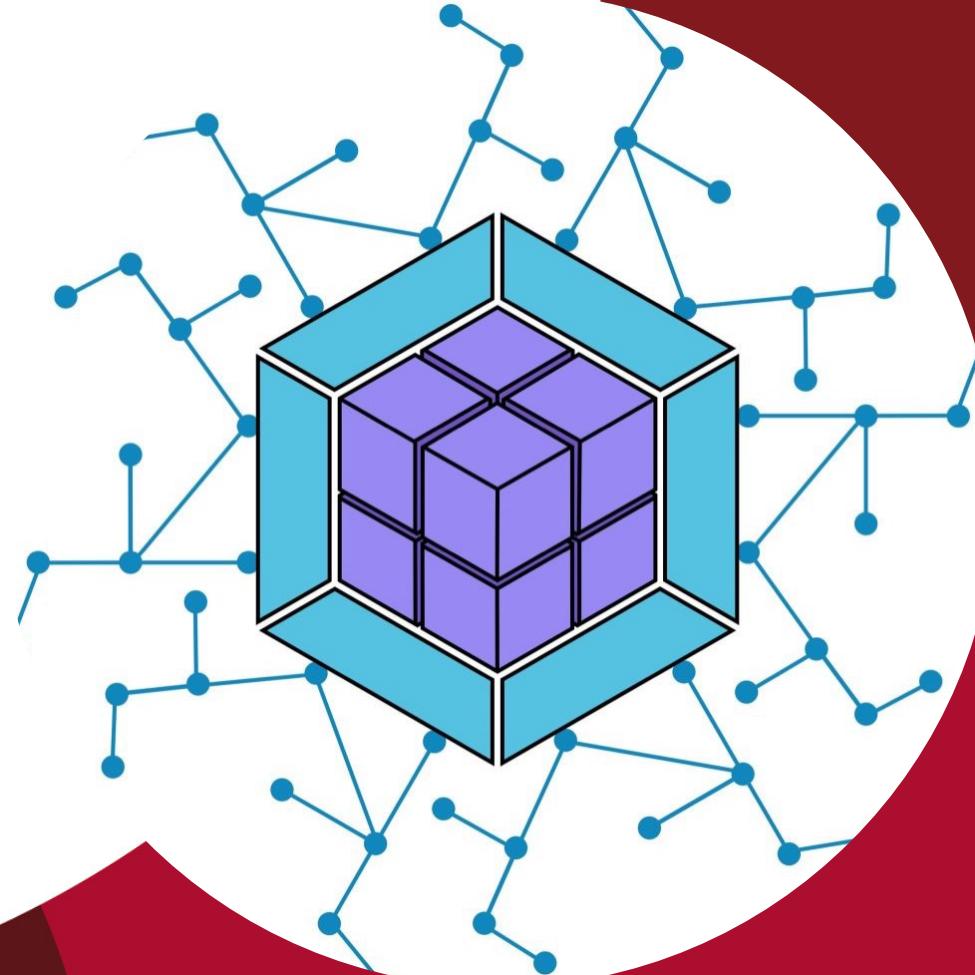
```
<micro-app></micro-app>
```

# Loading Separately Compiled SPAs

```
const script = document.createElement('script');
script.src = 'assets/main.bundle.js';
document.body.appendChild(script);

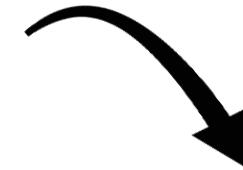
const clientA = document.createElement('client-a');
clientA['visible'] = true;
document.body.appendChild(clientA);
```

# Webpack 5 Module Federation



# Idea

Does not work with  
webpack/ Angular CLI



```
const Component = import('http://other-app/xyz')
```

Even lazy parts must be  
known at compile time!



# Webpack 5 Module Federation

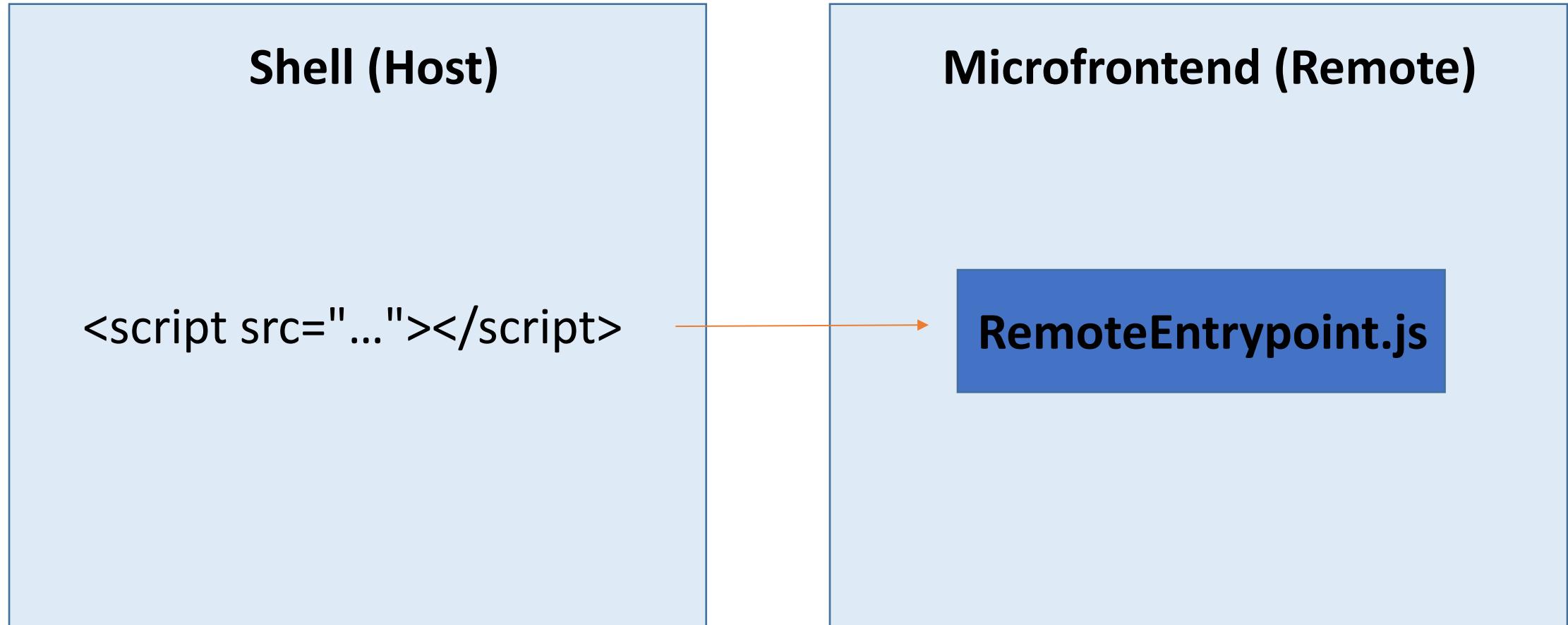
## Shell (Host)

```
import('mfe1/Cmp')  
  
// MapsUrls in  
// webpack config  
remotes: {  
  mfe1: "mfe1"  
}
```

## Microfrontend (Remote)

```
// Expose files in  
// webpack config  
exposes: {  
  Cmp: './my.cmp.ts'  
}
```

# How to Get the Microfrontend's URL?



# How to Share Libs?

## Shell (Host)

```
shared: [  
  "@angular/core", "..."  
]
```

## Microfrontend (Remote)

```
shared: [  
  "@angular/core", "..."  
]
```



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# Dealing with Version Mismatches



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# Default Behavior

Selecting the highest compatible version

10.0 

10.1 

# Default Behavior

Conflict: No highest compatible version

11.0 ✓

10.1 ✓

# Example

- Shell: my-lib: ^10.0
- MFE1: my-lib: ^10.1
- MFE2: my-lib: ^9.0
- MFE3: my-lib: ^9.1

## Result:

- Shell and MFE1 share ^10.1
- MFE2 and MFE3 share ^9.1

# Configuring Singletons

```
shared: {  
  "my-lib": {  
    singleton: true  
  }  
}
```

11.0 

10.1 

# Configuring Singletons

```
shared: {  
  "my-lib": {  
    singleton: true,  
    strictVersion: true // Error instead of warning!  
  }  
}
```

11.0  10.1 

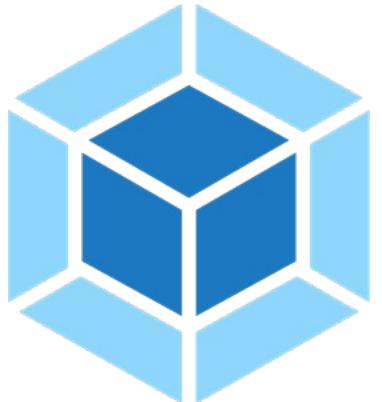
# Relaxing Version Requirements

```
shared: {  
  "my-lib": {  
    requiredVersion: ">=1.0.1 <11.1.1"  
  }  
}
```

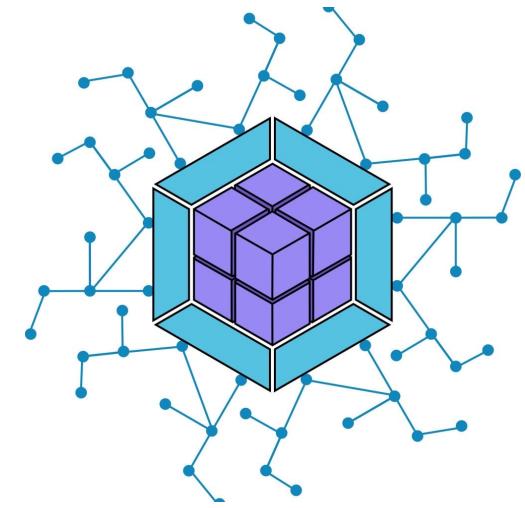
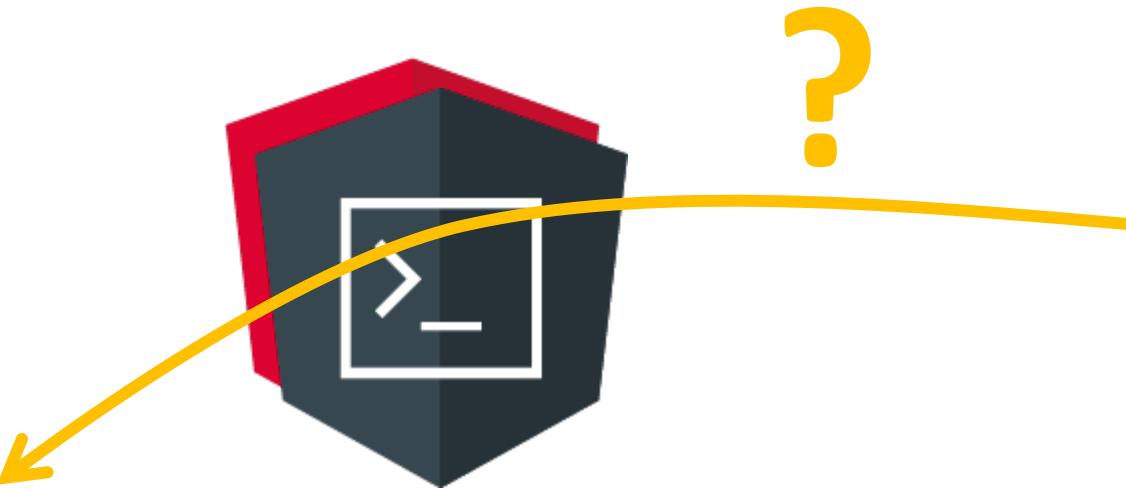
# Federated Angular: Angular, CLI, & Module Federation



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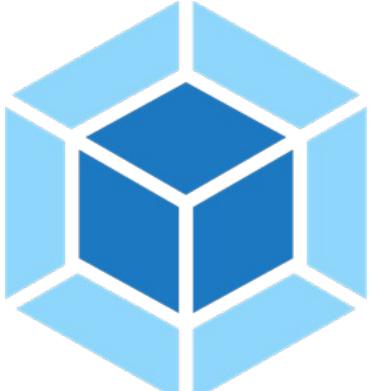


webpack



Module Federation  
Configuration

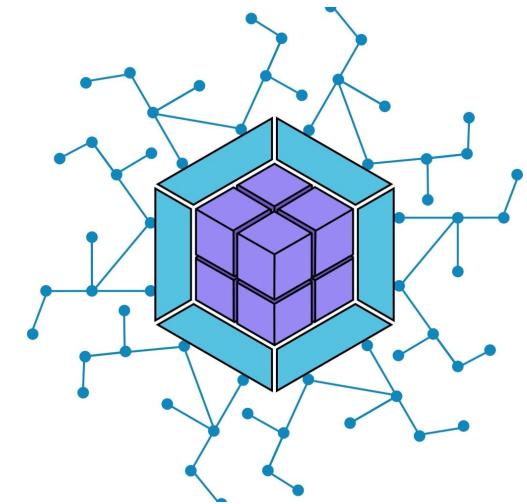
# Custom Builder



webpack



Angular CLI



Module Federation  
Configuration

# @angular-architects/module-federation

1.0.2 • Public • Published 18 hours ago

 Readme

 Explore BETA

 3 Dependencies

## Features 🔥

- Generates the skeleton for a Module Federation config.
- Installs a custom builder to enable Module Federation.
- Assigning a new port to serve (`ng serve`) several projects at once.

# Usage

- 1) `ng add @angular-architects/module-federation`
- 2) Use schematic to create configuration
- 3) Adjust generated configuration
- 4) `ng serve`

# Module Federation Demo

# Lab

Module Federation

# Multi Framework/ Version Solutions



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# Abstracting Differences b/w SPA Frameworks

Wrap them into Web Components



# Loading Web Components via Module Federation



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# Module Federation

```
await import('other-app/web-cmp');
```

# Module Federation

```
const rootElm = document.createElement('web-cmp')
document.body.appendChild(rootElm);
```

```
await import('other-app/web-cmp');
```

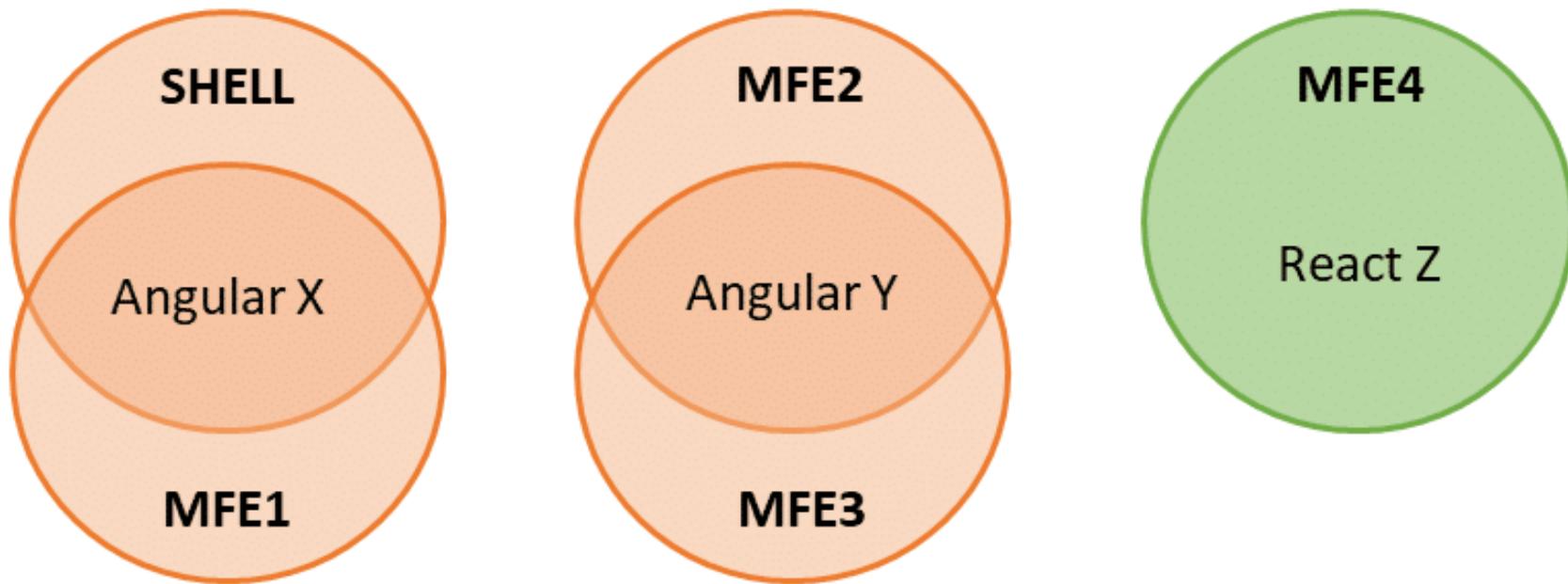
# Routing to Another SPA?

## WrapperComponent

```
const rootElm = document.createElement('web-cmp')
document.body.appendChild(rootElm);

await import('other-app/web-cmp');
```

# Result



# DEMO

<https://red-ocean-0fe4c4610.azurestaticapps.net>

# Challanges

- Bundle Size
- Multiple Routers
- Bootstrapping Several Angular Instances
  - Share Platform-Object when same version is reused
  - Share ngZone

# Challanges & Solutions

@angular-architects/module-federation-tools 

12.5.3 • Public • Published 21 days ago

 Readme

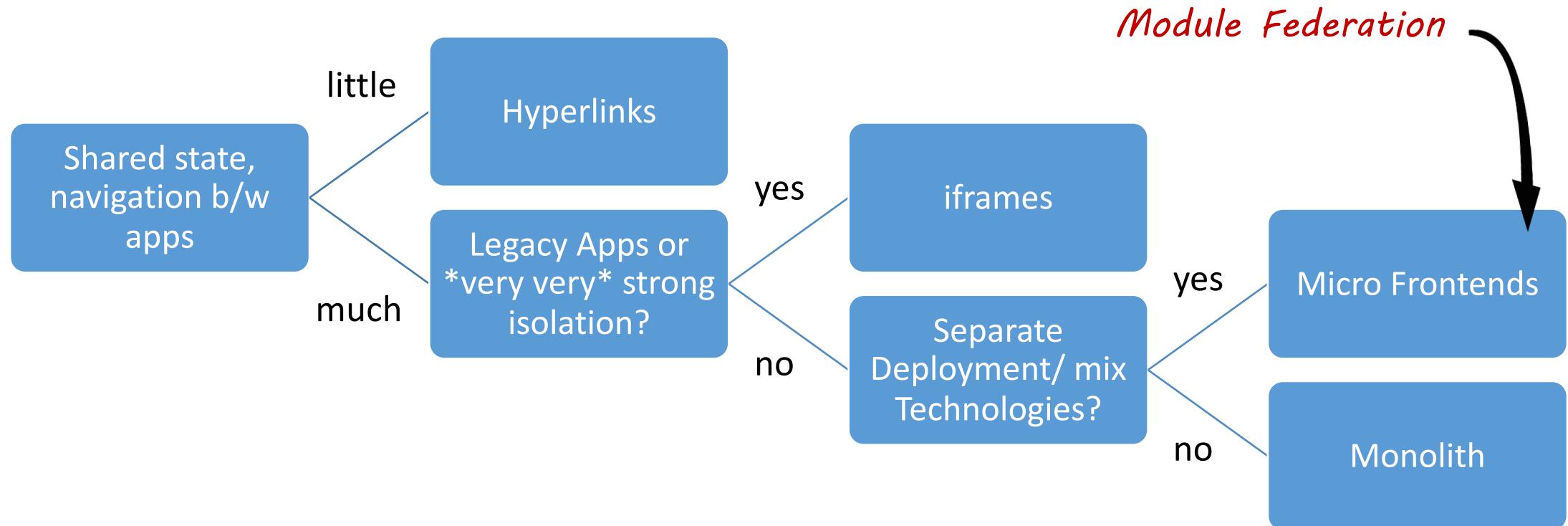
 Explore BETA

 1 Dependency

The background of the image shows a dark room with a wall covered in a repeating, ornate damask pattern in shades of grey and black. There are several doors of different styles and colors (white, light grey, dark grey) standing in a row. The floor is made of dark wood planks.

# Choosing a Solution

# Some General Advice



# Summary

Libs: Subdividing big solution into tiny parts

Monorepo: No burden with distributing libs

Strategic Design: Cut system into loosely coupled domains

Nx: Access restrictions, visualization, incremental compilation/ testing, etc.

Microfrontends: Autarkic Teams, separate deployment, has challenges

Like this topic?

Read Manfred's book in this repo 😊

# That's it for architecture

- Any questions left over? 😊