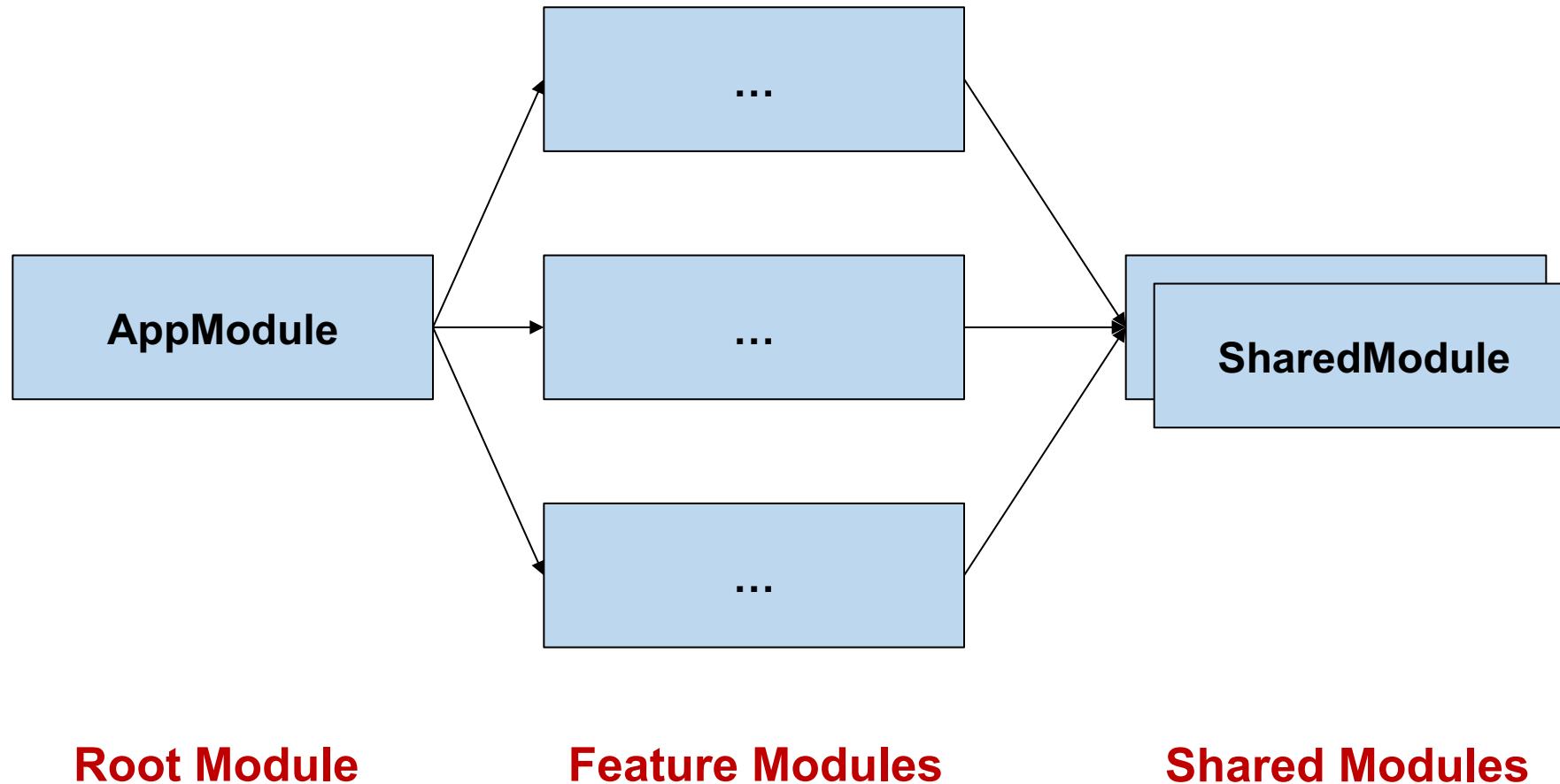




Architecture for Enterprise Applications

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 rock face. 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

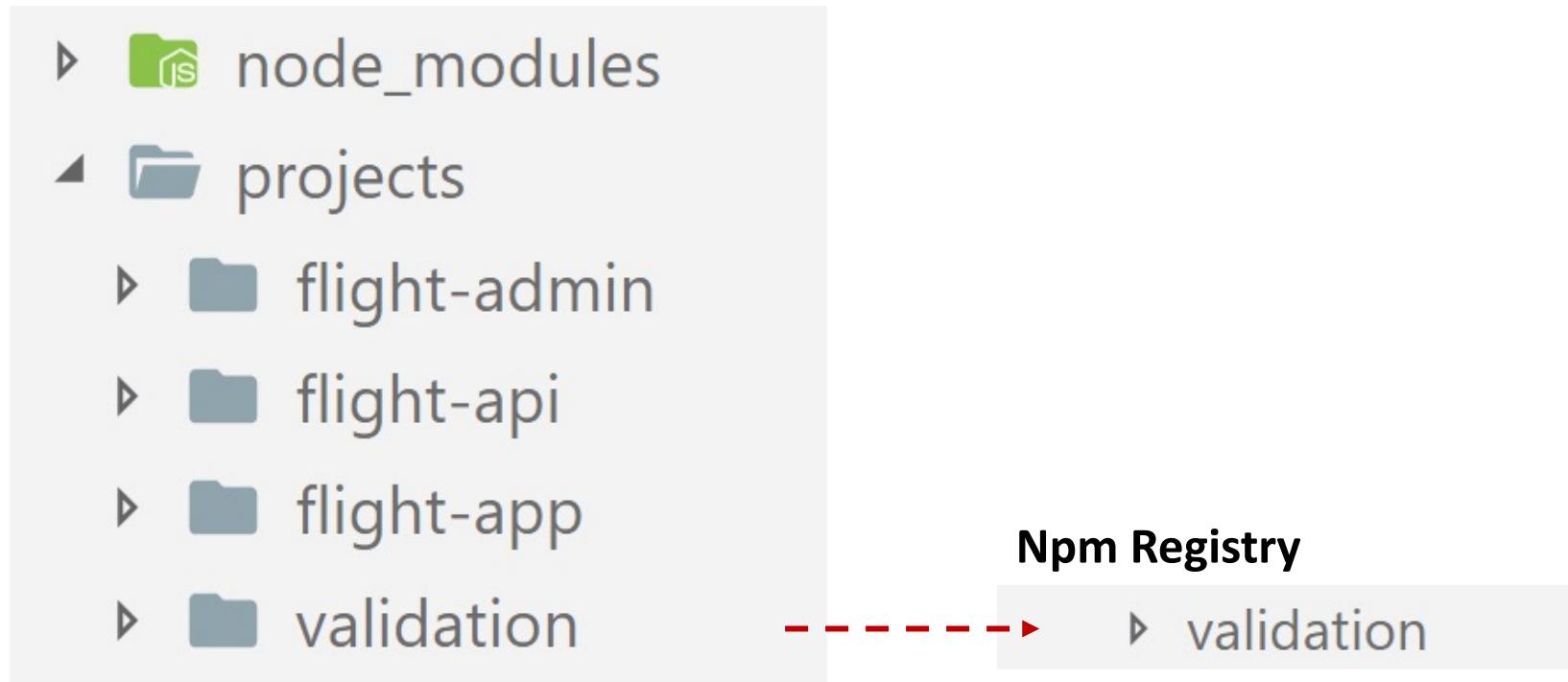
## Project Monorepo

- Like Workspaces/Solutions in different IDEs

## Company-wide Monorepo

- E. g. used at Google or Facebook

# Moving back and forth



# Tooling & Generator

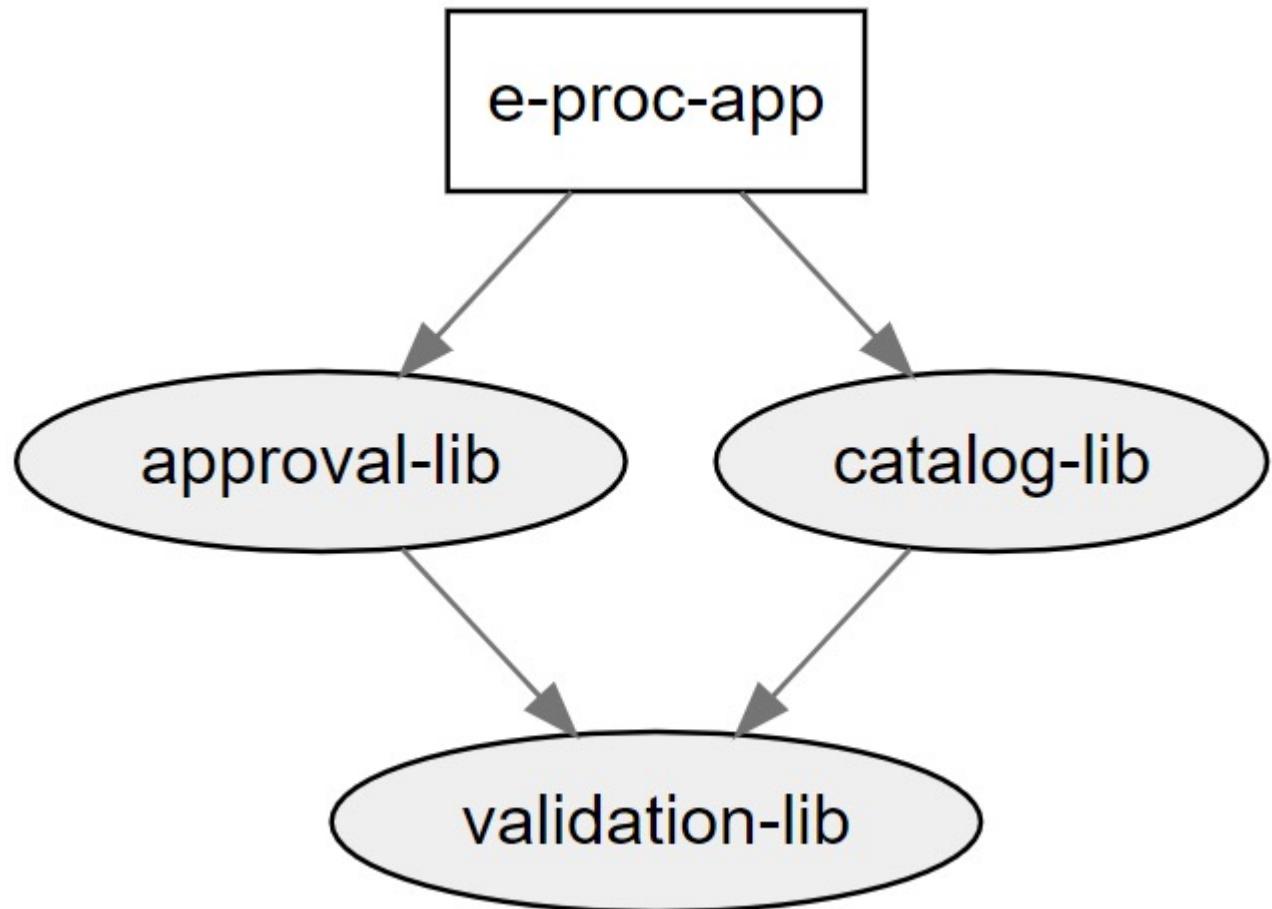
<https://nrwl.io/nx>



## Nrwl Extensions for Angular

An open source toolkit for enterprise Angular applications.

# Visualize Module Structure



# Further Features of Nx

- Define folders for libraries
- Restrict which apps/libs can access which other libs
- Just recompile changed apps
- Visualize module structure and dependencies
- Scaffold Boilerplate

# 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 init nx-workspace workspace
```

```
cd workspace
```

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

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

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

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

# Lab

Libs and Monorepo



DDD

in a nutshell

# Domain-Driven DESIGN

Tackling Complexity in the Heart of Software



Eric Evans

Foreword by Martin Fowler



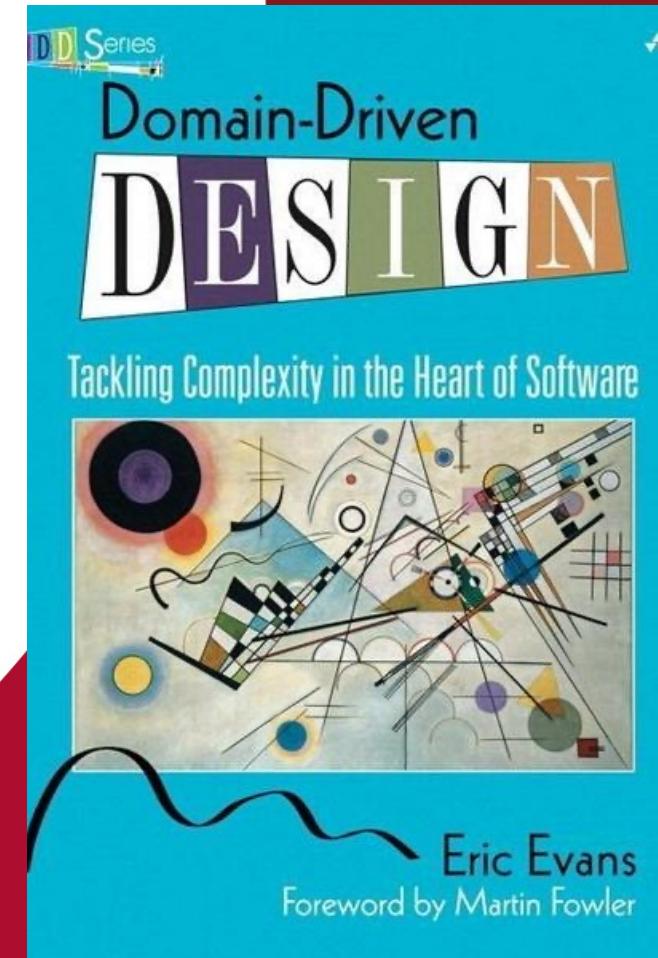
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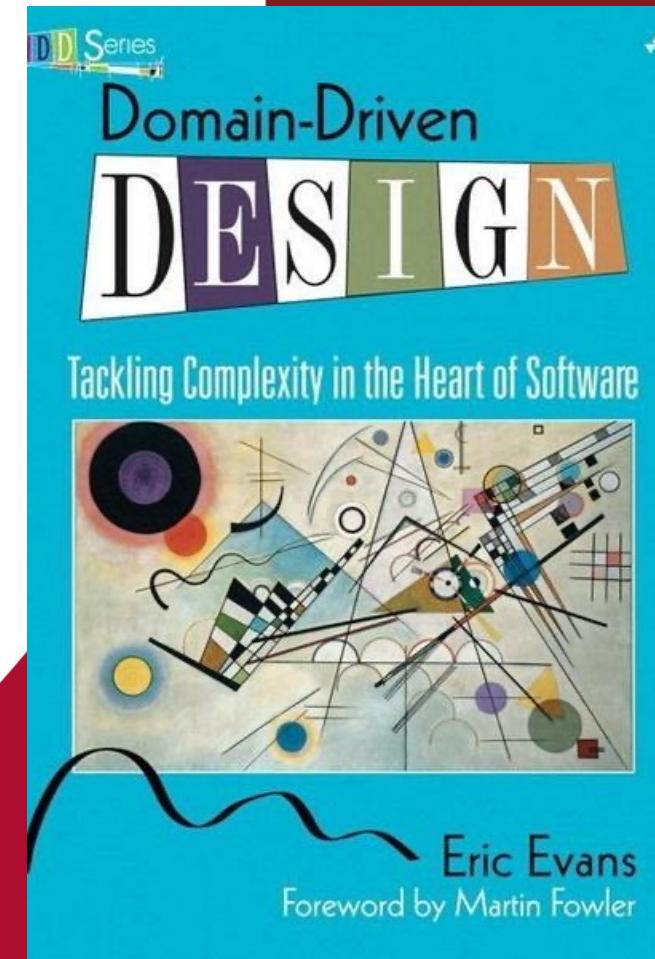
SOFTWARE  
ARCHITECT

# 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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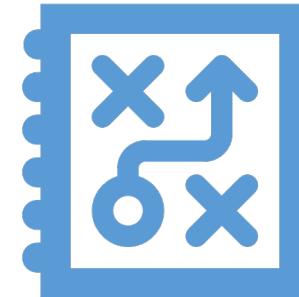
# Domain Driven Design

Decomposing a System



Strategic Design

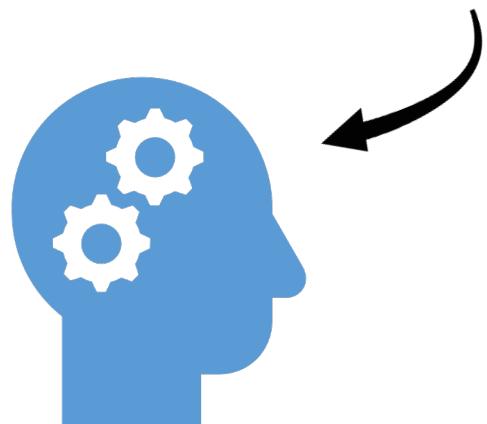
Design Patterns  
& Practices



Tactical Design

# Domain Driven Design

Decomposing a System



Design Patterns  
& Practices



## Strategic Design

## Tactical Design

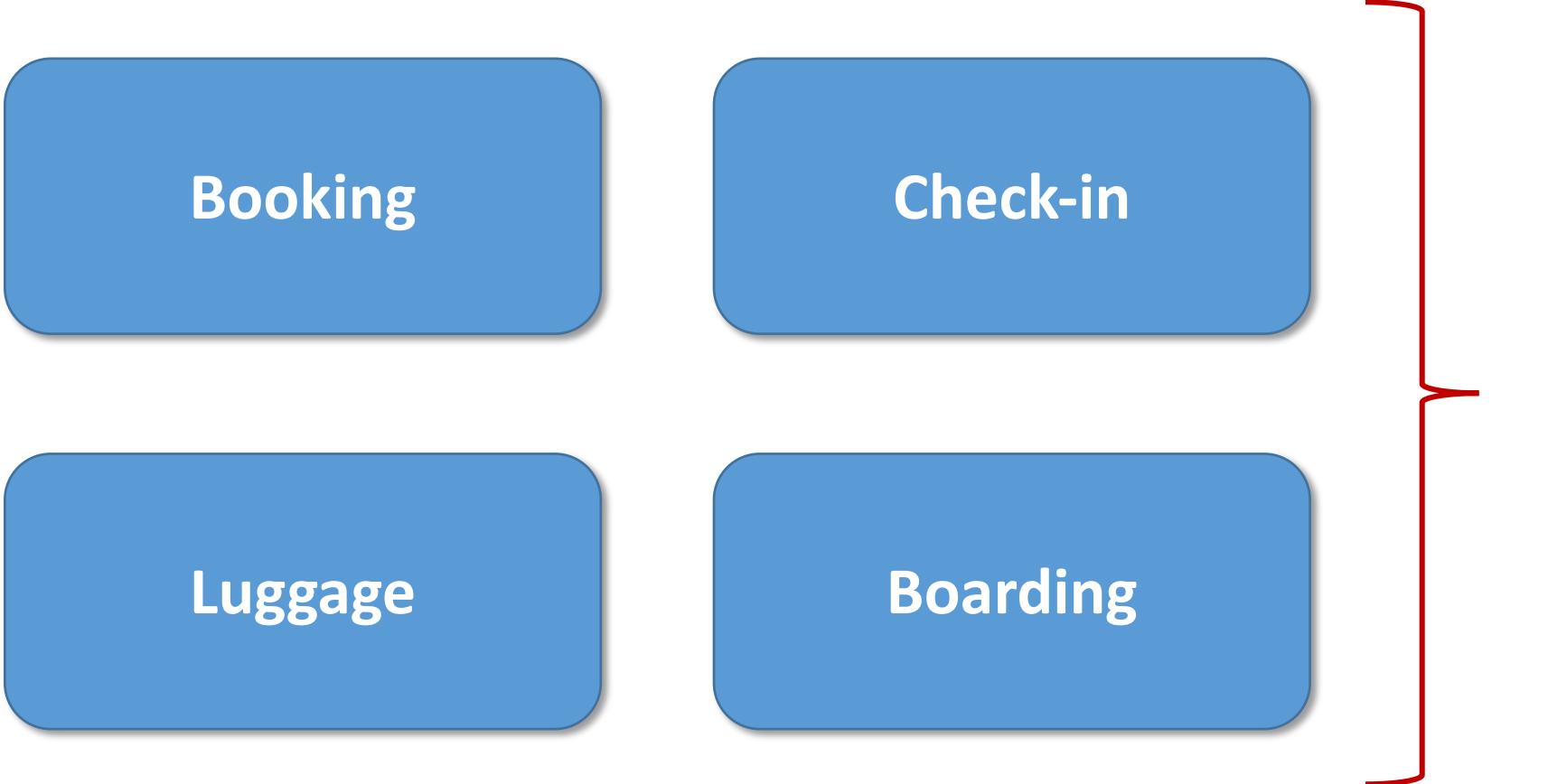


This is what Strategic DDD prevents

# Example

Flight System

# Example

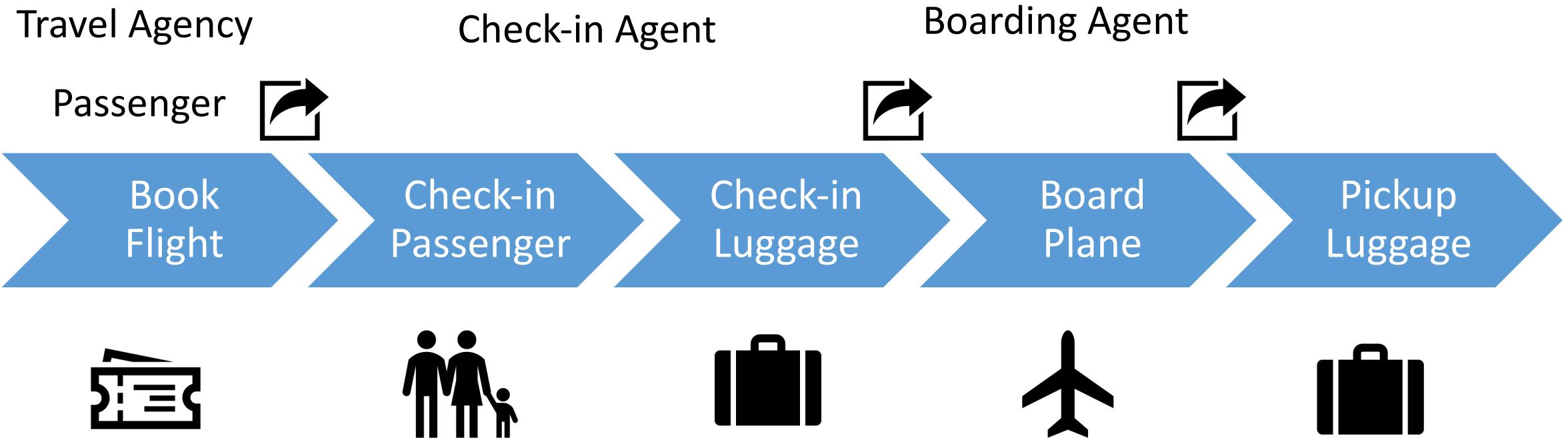


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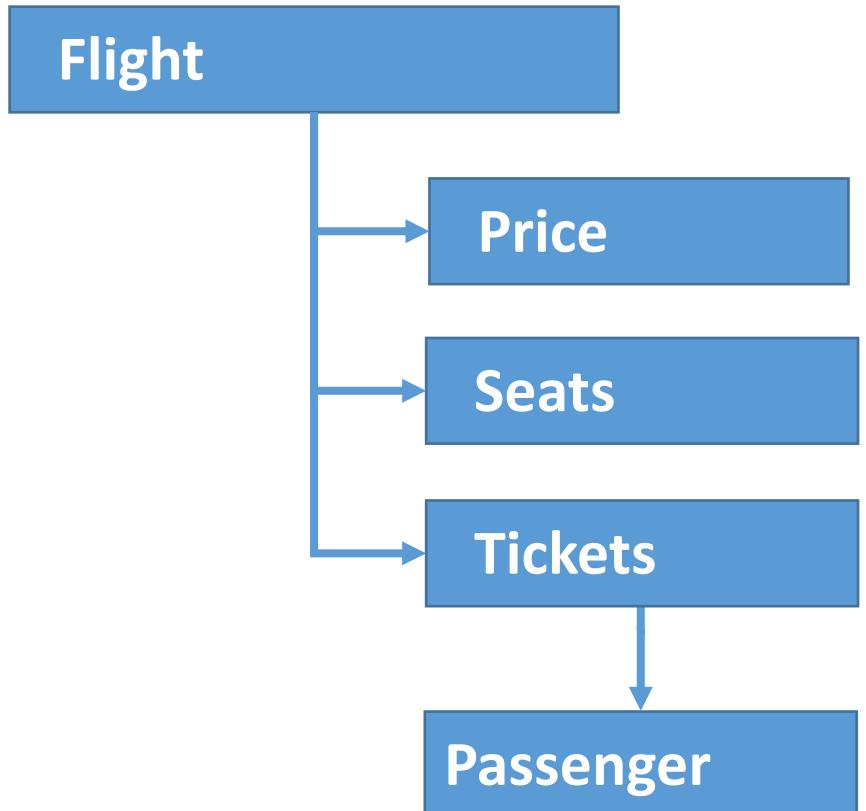
SOFTWARE  
ARCHITECT

# Finding Sub-Domains



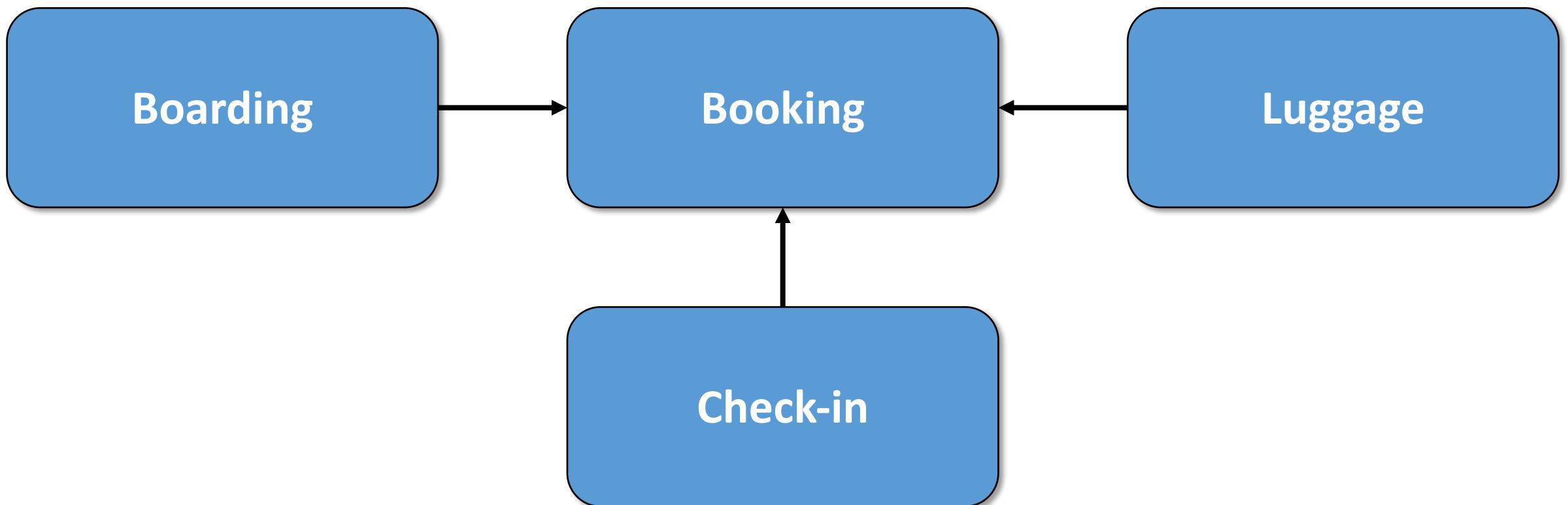
## Booking

## Boarding



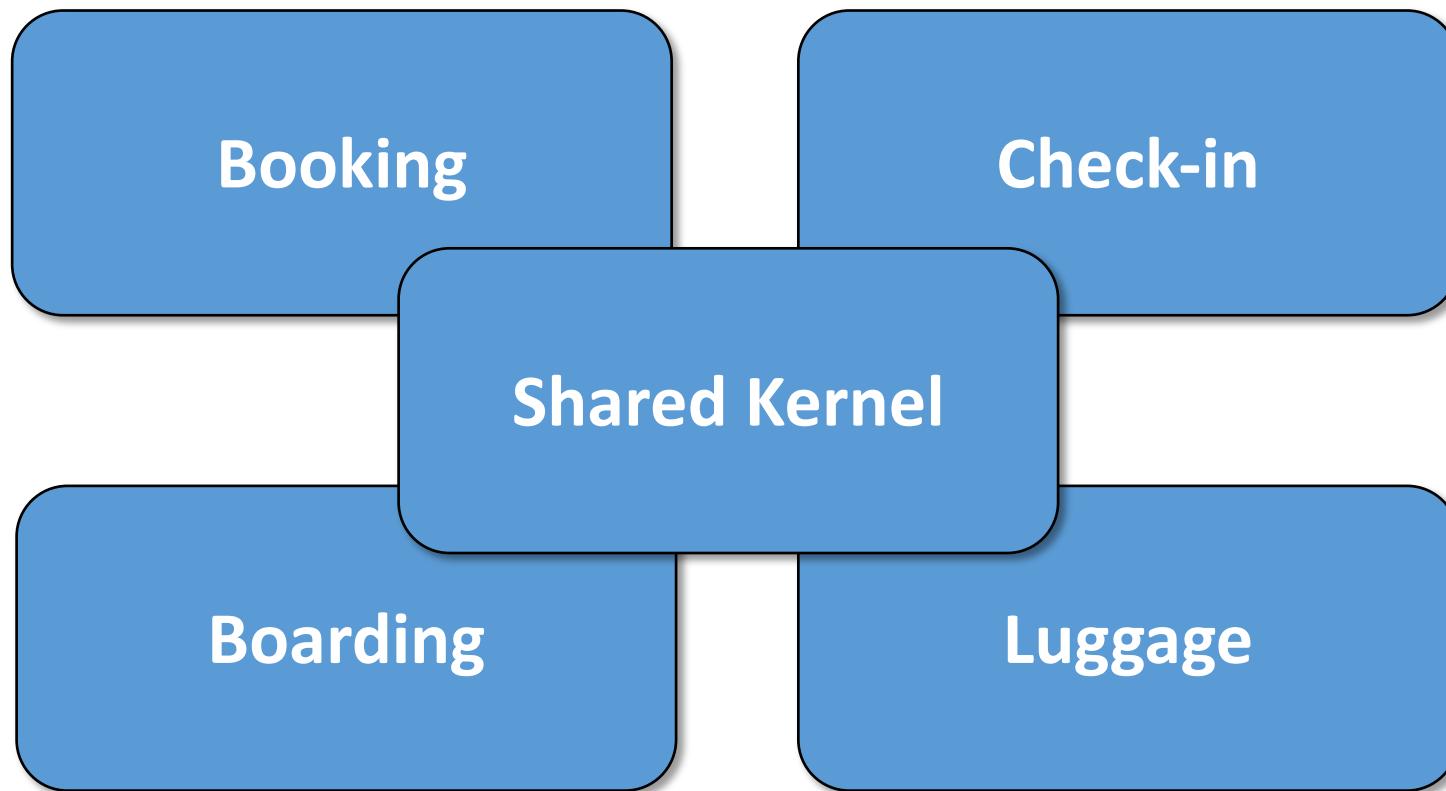
Bounded Context

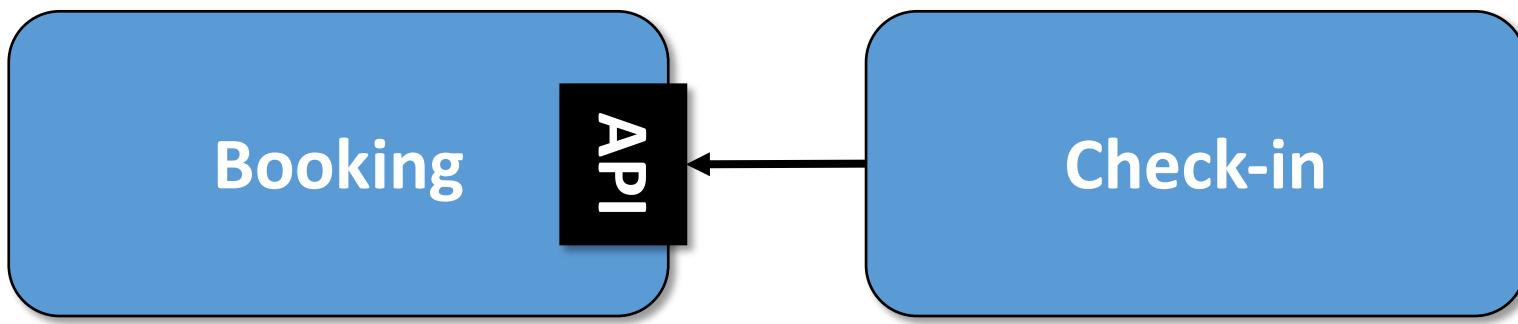
# Context Map



# Context Map

Responsibilities?  
Breaking Changes?





Open-/Host-Service

# Domain-Driven DESIGN

Tackling Complexity in the Heart of Software



Eric Evans

Foreword by Martin Fowler



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Shared Kernel (if really needed) & other libs

Smart  
Comp.

**Booking**

**Boarding**

**Shared**

**Feature**

**Feature**

**Feature**

**Feature**

**Feature**

**UI**

**UI**

**UI**

**UI**

**UI**

**UI**

**UI**

**UI**

**UI**

**Domain**

**Domain**

**Domain**

**Domain**

**Domain**

**Domain**

**Util**

**Util**

**Util**

**Util**

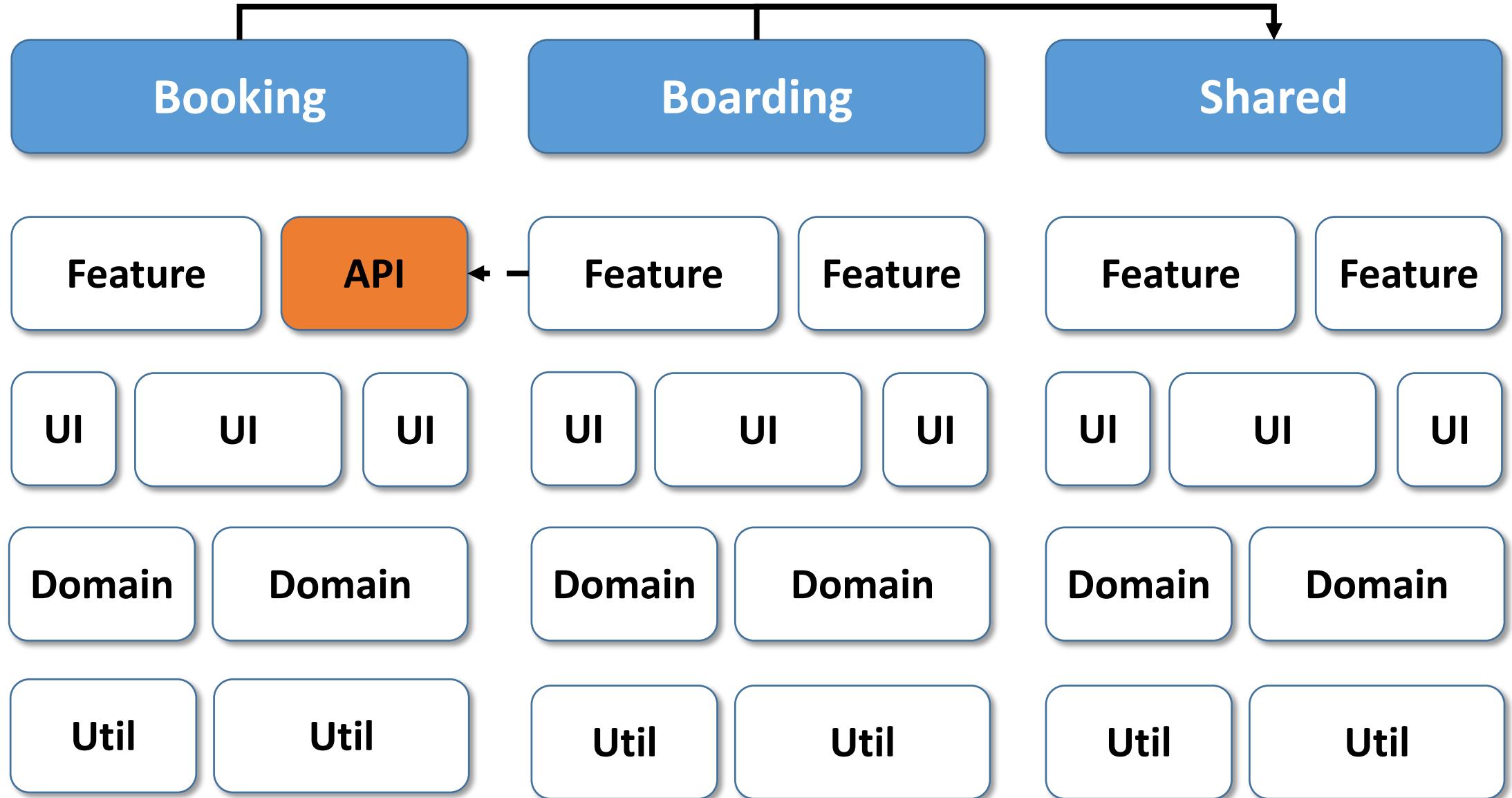
**Util**

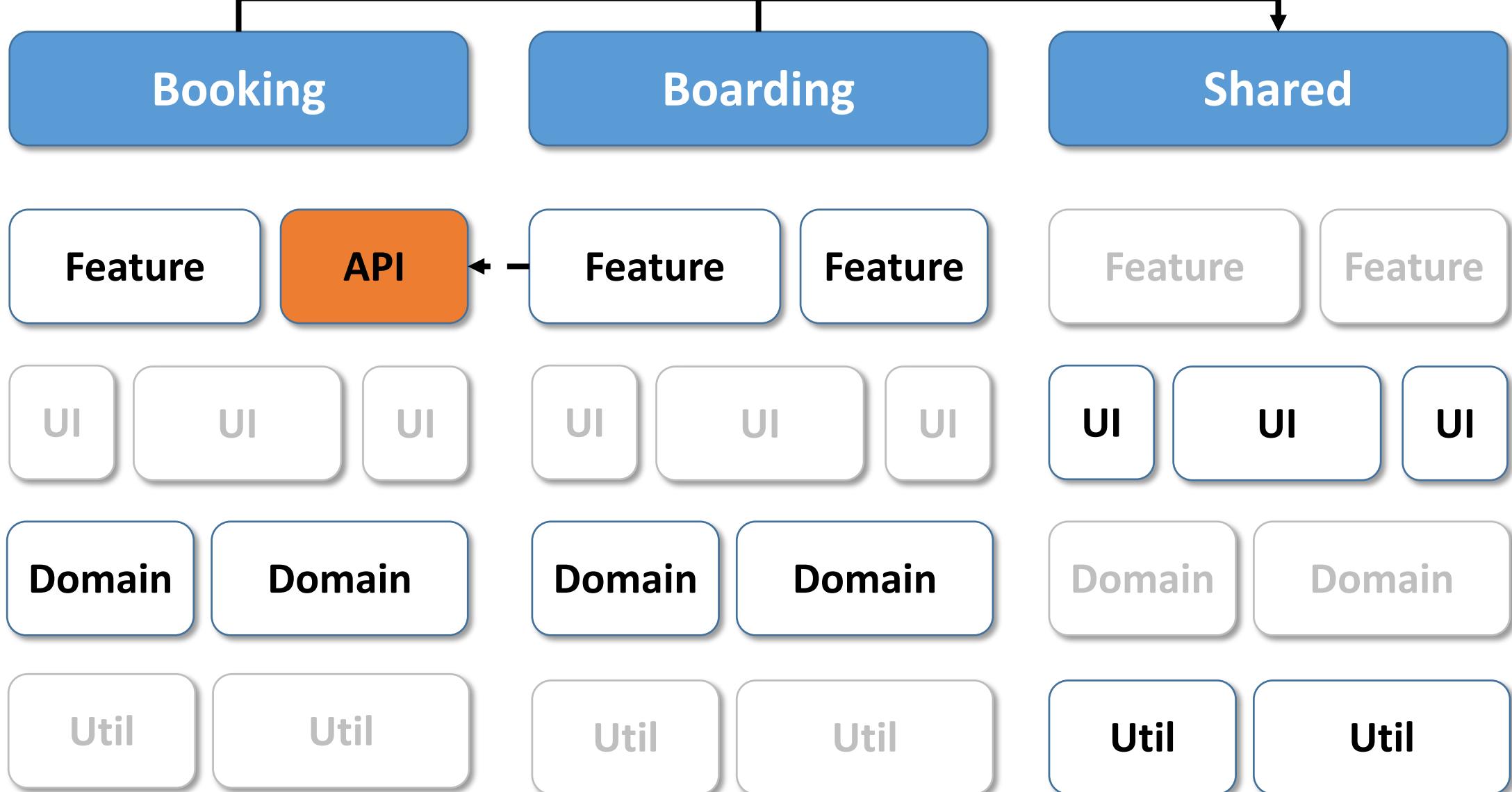
**Util**



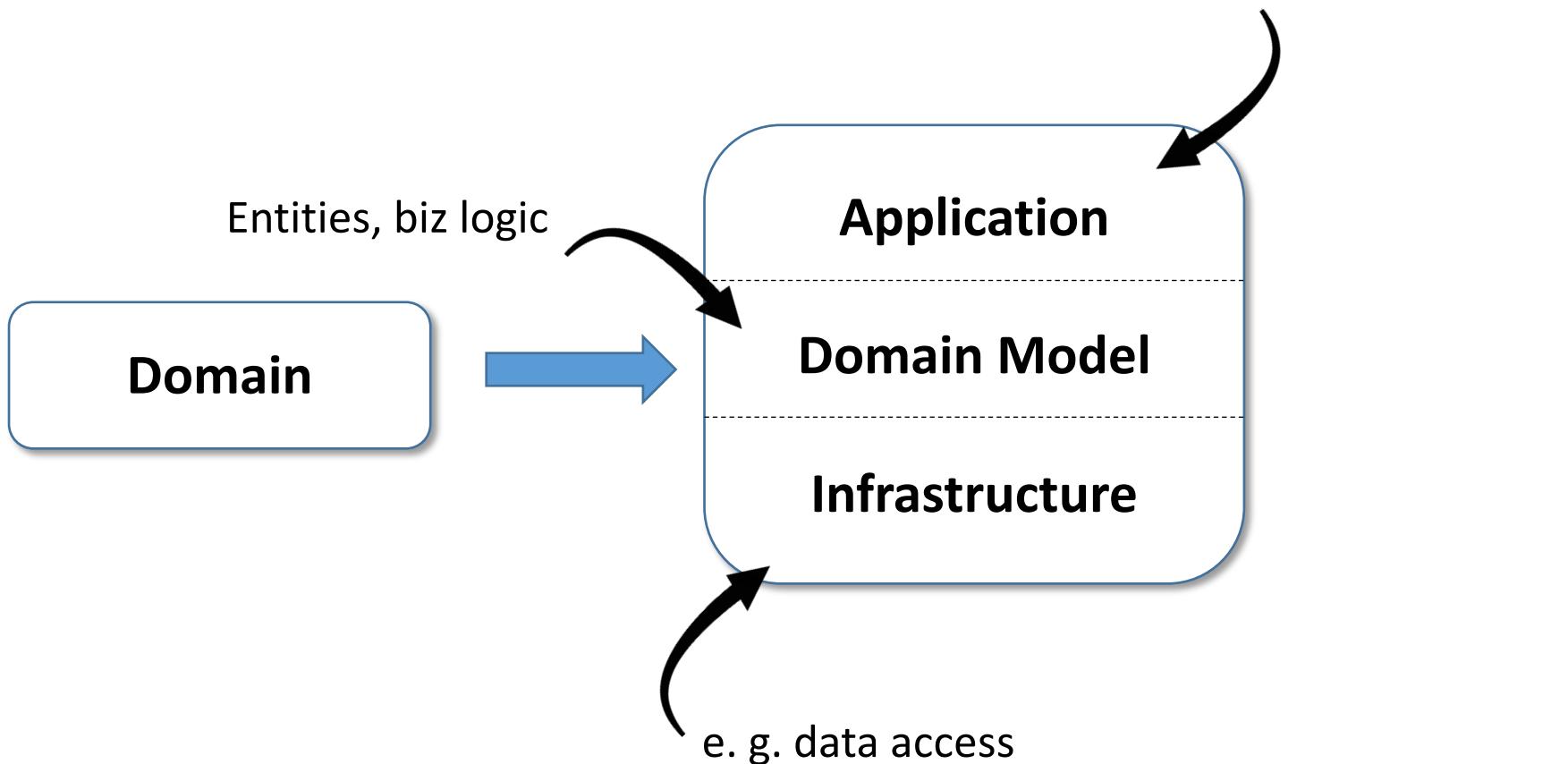
@ManfredSteyer

Enterprise Monorepo Patterns, Nrwl 2018: <https://tinyurl.com/y2jjxld7>





# Isolate your domain!





## Alternatives to layering

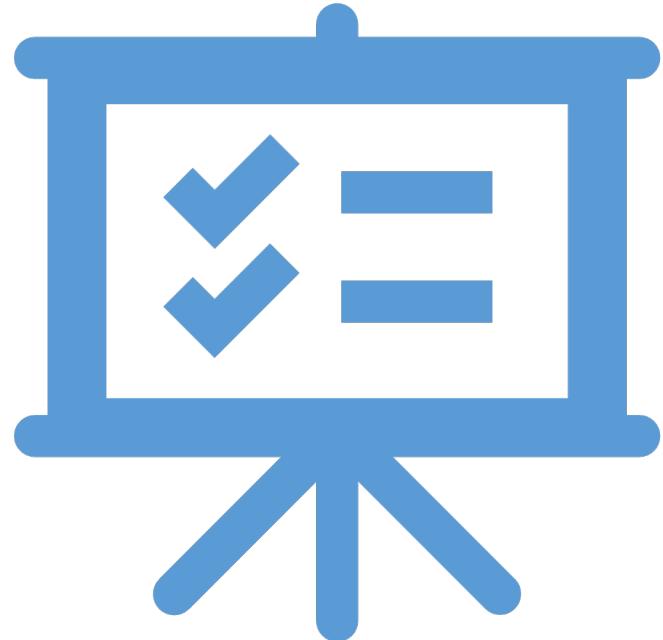
- e. g. Hexagonal Architecture, Clean Architecture
- Anyway: We need to **restrict access** b/w libraries



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## Finegrained Libraries

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

# Categories for Libraries with Nx - I

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

- **feature:** Implements a use case using smart components
- **data-access:** Implements data accesses, e.g. via HTTP or WebSockets
- **ui:** Provides use case agnostic, thus reusable (dumb) components
- **util:** Provides helper functions

# Categories for Libraries with Nx - II

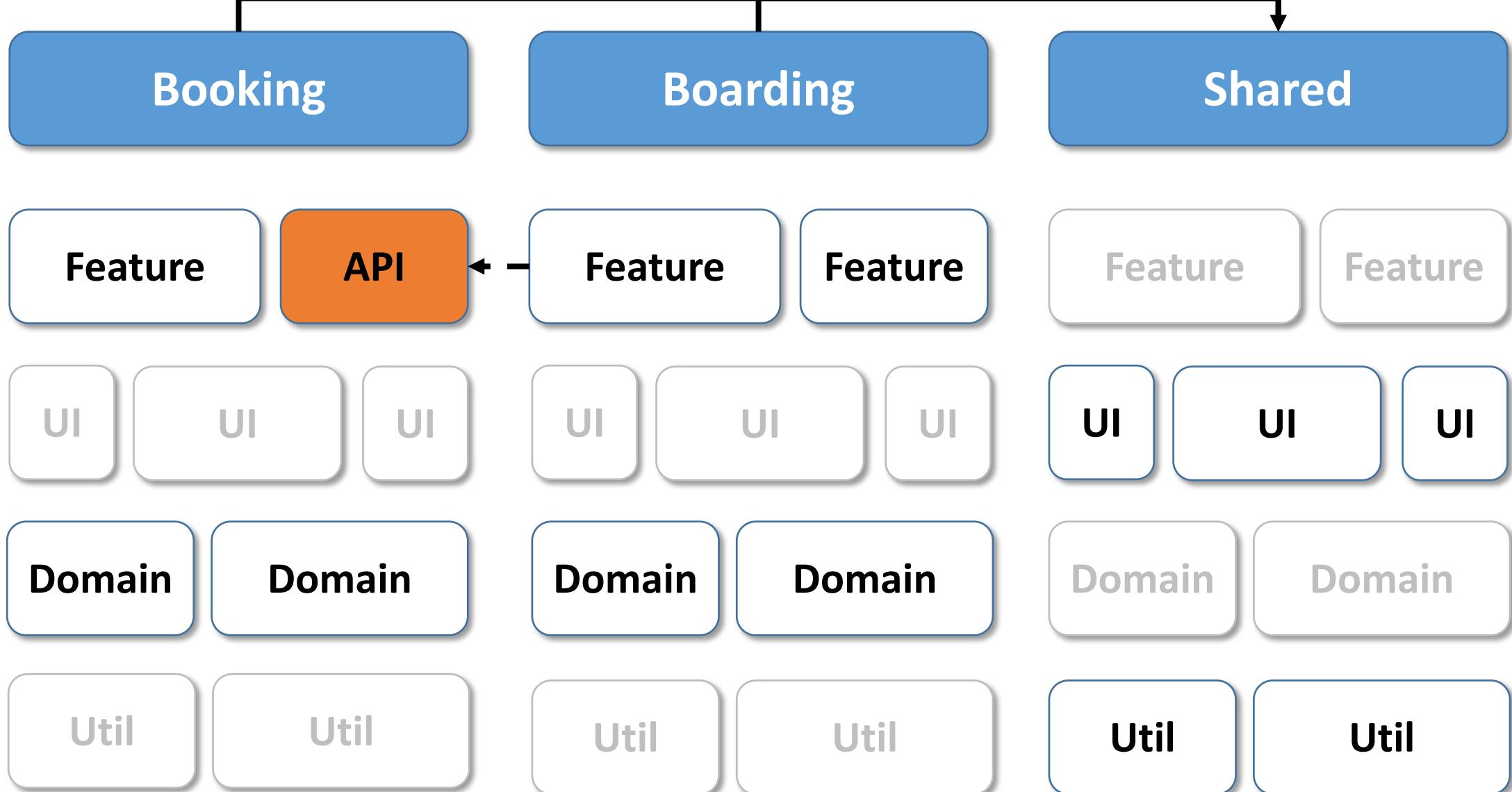
NX access restrictions between libs

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

# Categories for Libraries with Nx - III

In addition, I'm 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

e2e

app / shell

feature / api

ui

data-access

domain(-logic)

util

# Lab

NX Strategic Design

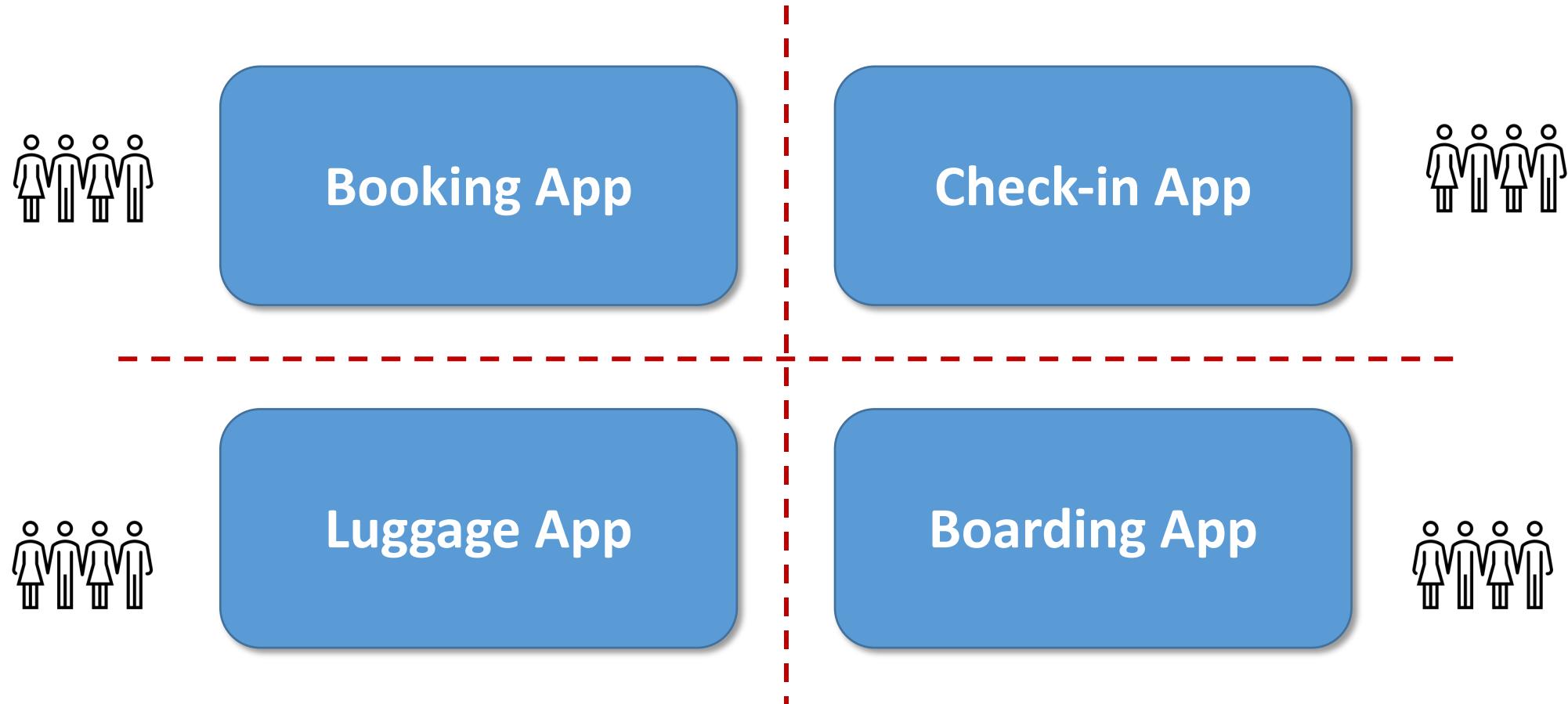


# Micro Frontends?

Short outlook



# Microfrontends



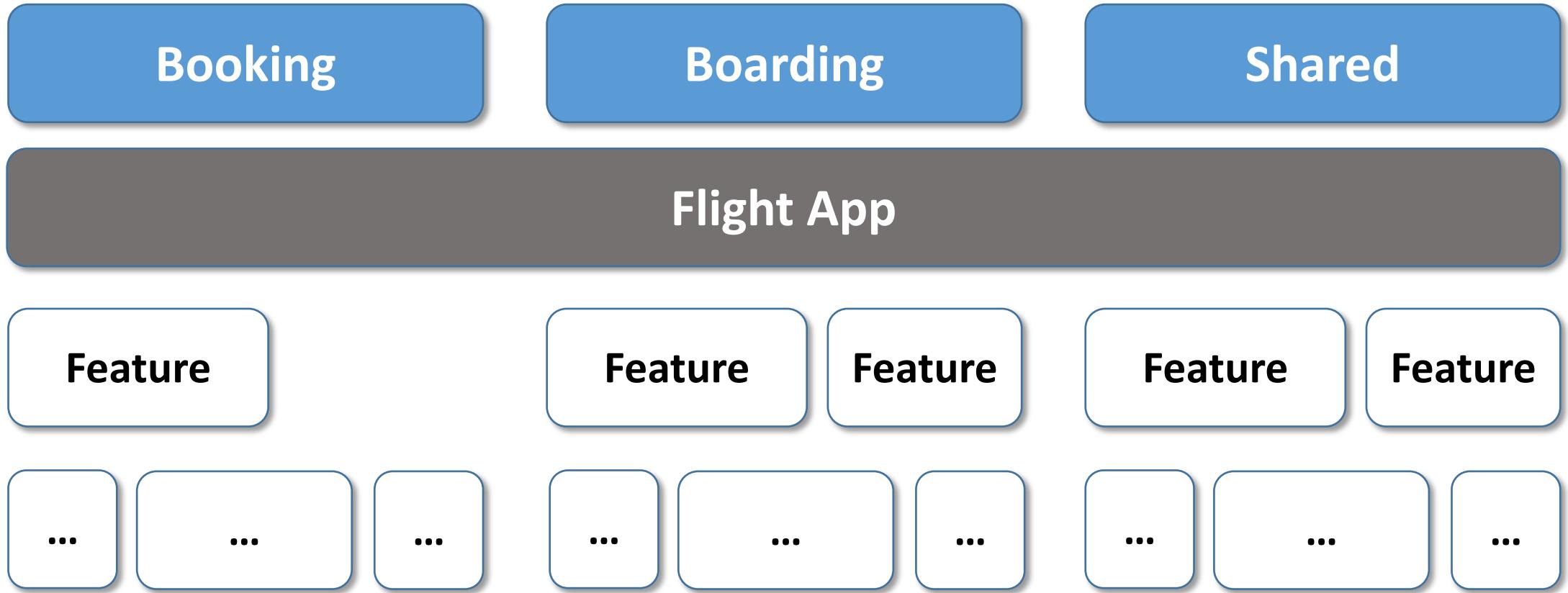
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Microfrontends  
are first and foremost  
about **scaling teams!**



# Deployment Monolith



# Microfrontends

Booking

Boarding

Shared

Booking App

Boarding App

Feature

Feature

Feature

Feature

Feature

...

...

...

...

...

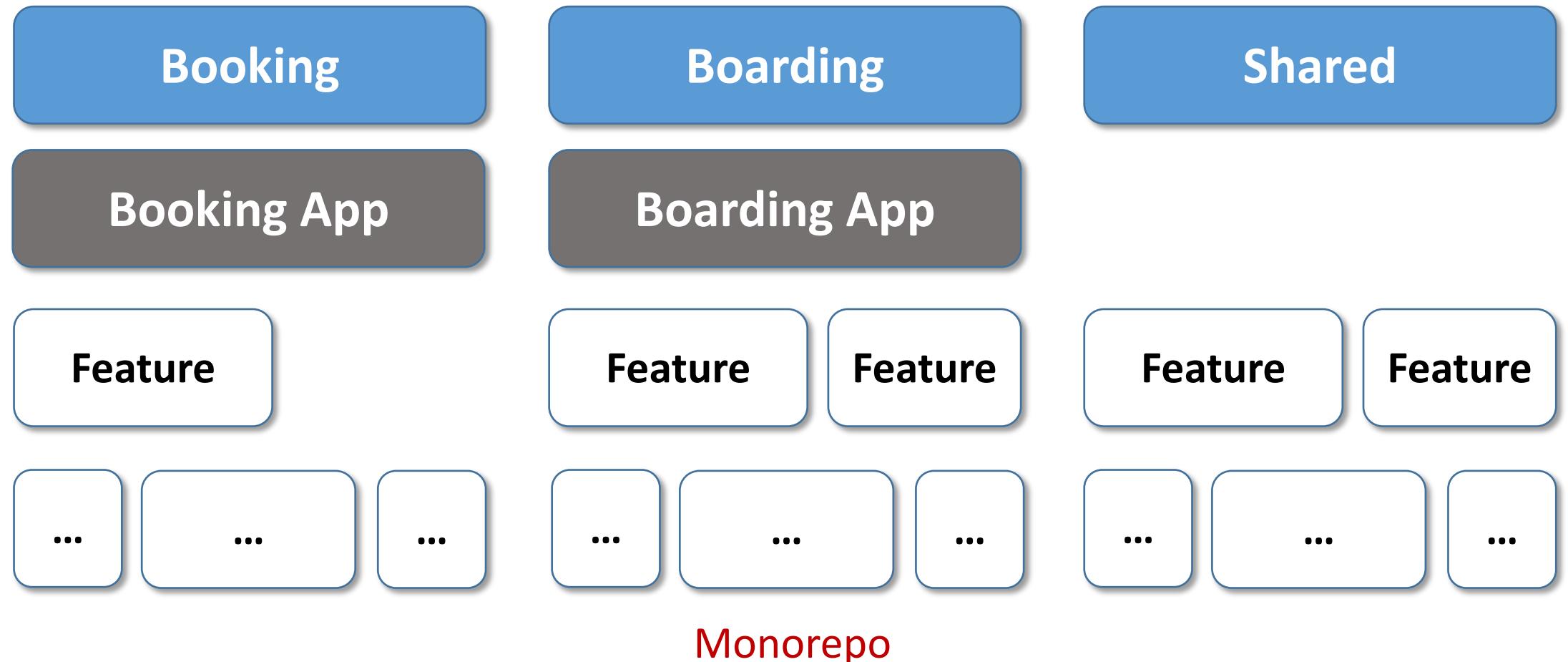
...

...

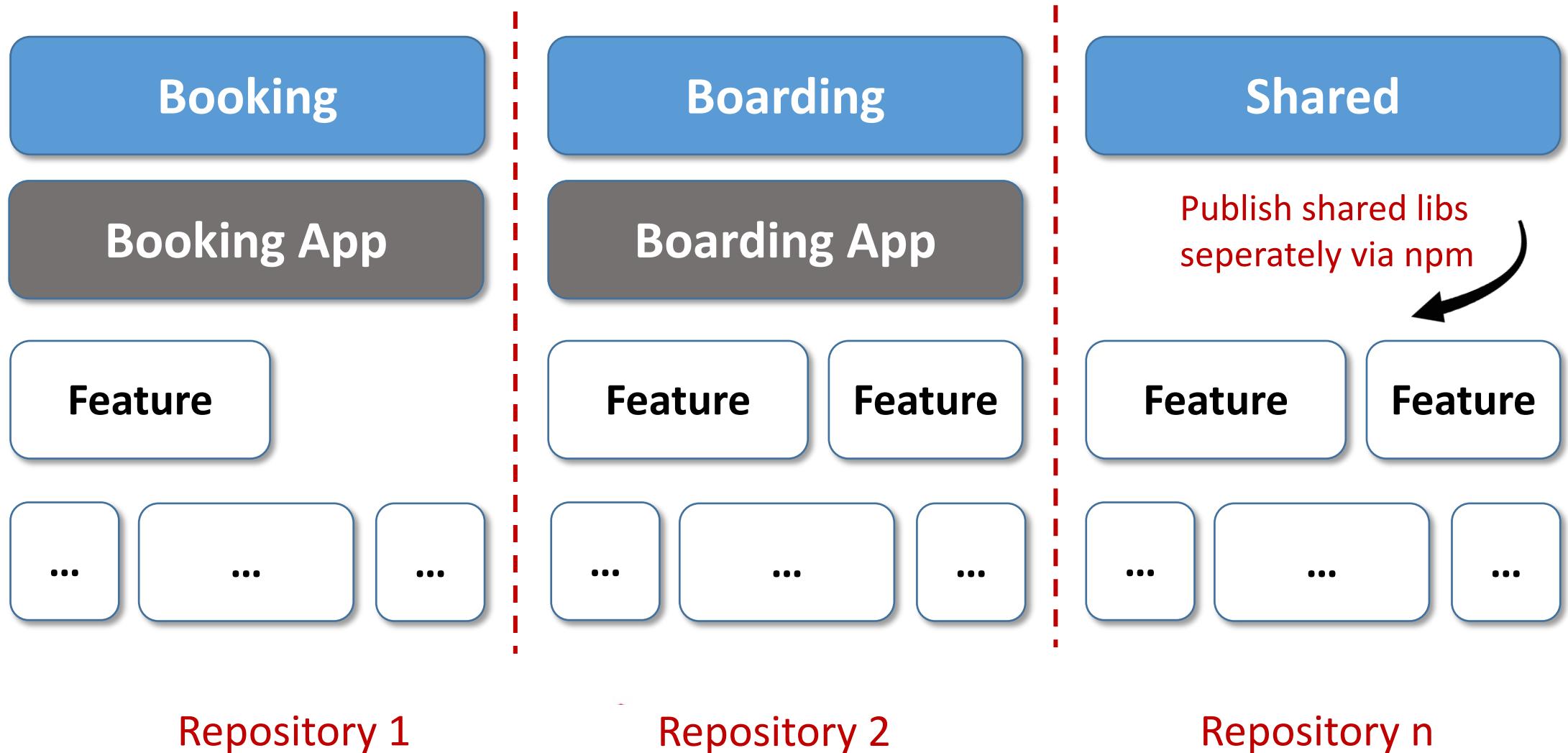
...

...

# Option 1: One App per Domain



# Option 2: One Monorepo per Domain



# Benefits

Autonomous Teams

Separate Development

Separate Deployment

Own architecture decisions

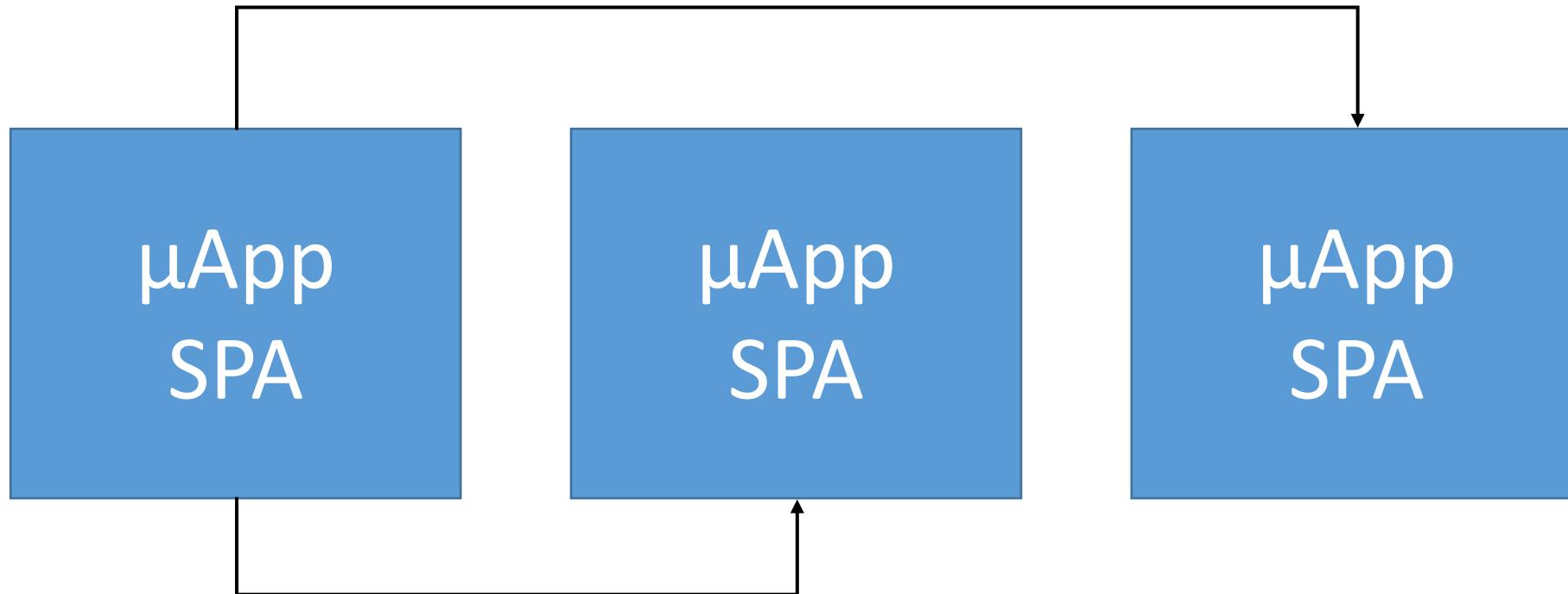
Own technology decisions



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!

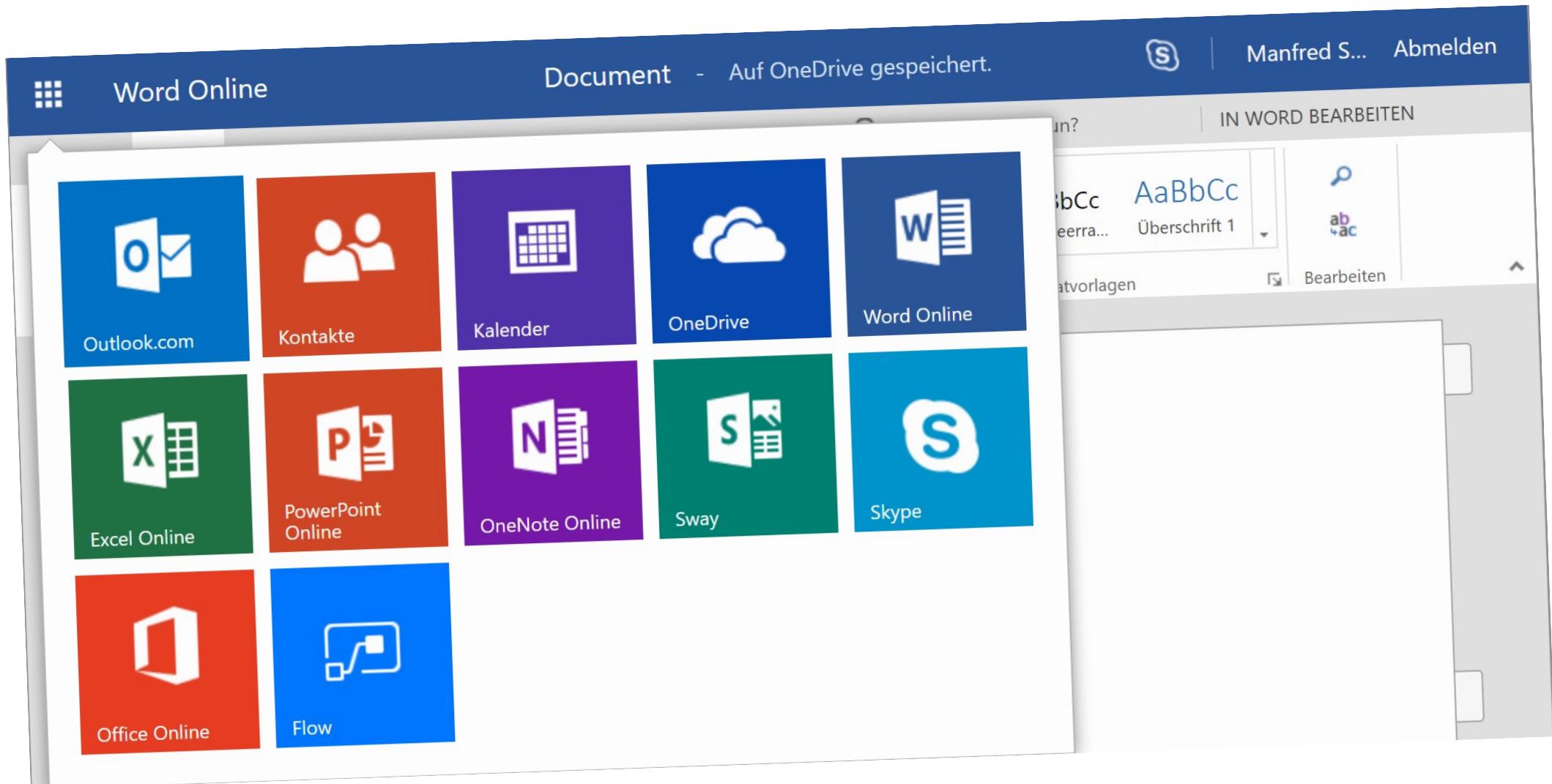
The screenshot shows the Microsoft Word Online interface. The ribbon at the top has tabs: DATEI, START (selected), EINFÜGEN, SEITENLAYOUT, ÜBERPRÜFEN, and ANSICHT. A search bar says "Was möchten Sie tun?" and a button says "IN WORD BEARBEITEN". The left sidebar has "Rückgängig", "Einfügen", and "Zwischenablage". The ribbon icons include a grid for DATEI, a file for EINFÜGEN, a clipboard for SEITENLAYOUT, a magnifying glass for ÜBERPRÜFEN, and a view icon for ANSICHT. The "START" tab has sections for Schriftart (Font) and Absatz (Paragraph). The font section shows "Calibri (Textkörper) 16" and a dropdown for "AaBbCc Standard". The paragraph section shows alignment and spacing options. The main content area contains the text "Hello World!".



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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

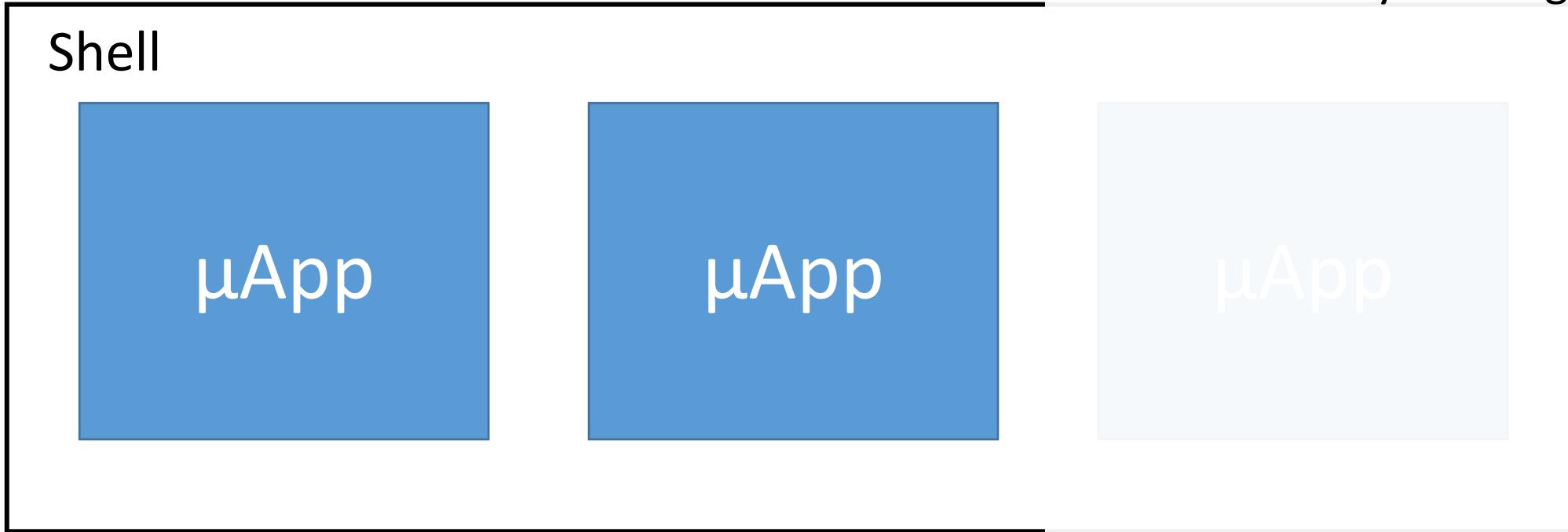
μApp

# 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>
```

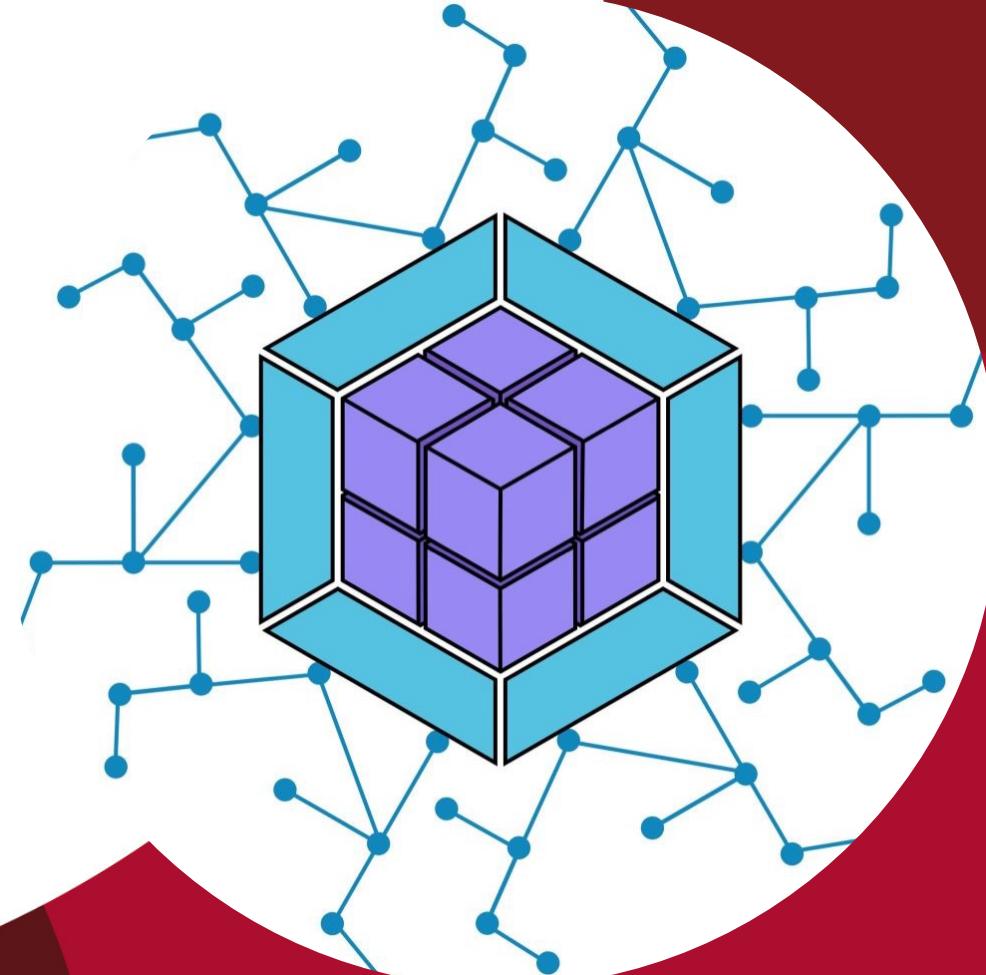
```
<micro-app></micro-app>
```

# Loading Separately Compiled SPAs

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

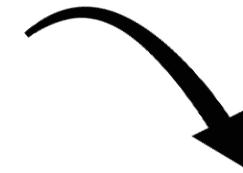
const clientA = document.createElement('client-a');
clientA['visible'] = true;
document.body.appendChild(clientA);
```

# 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'  
}
```

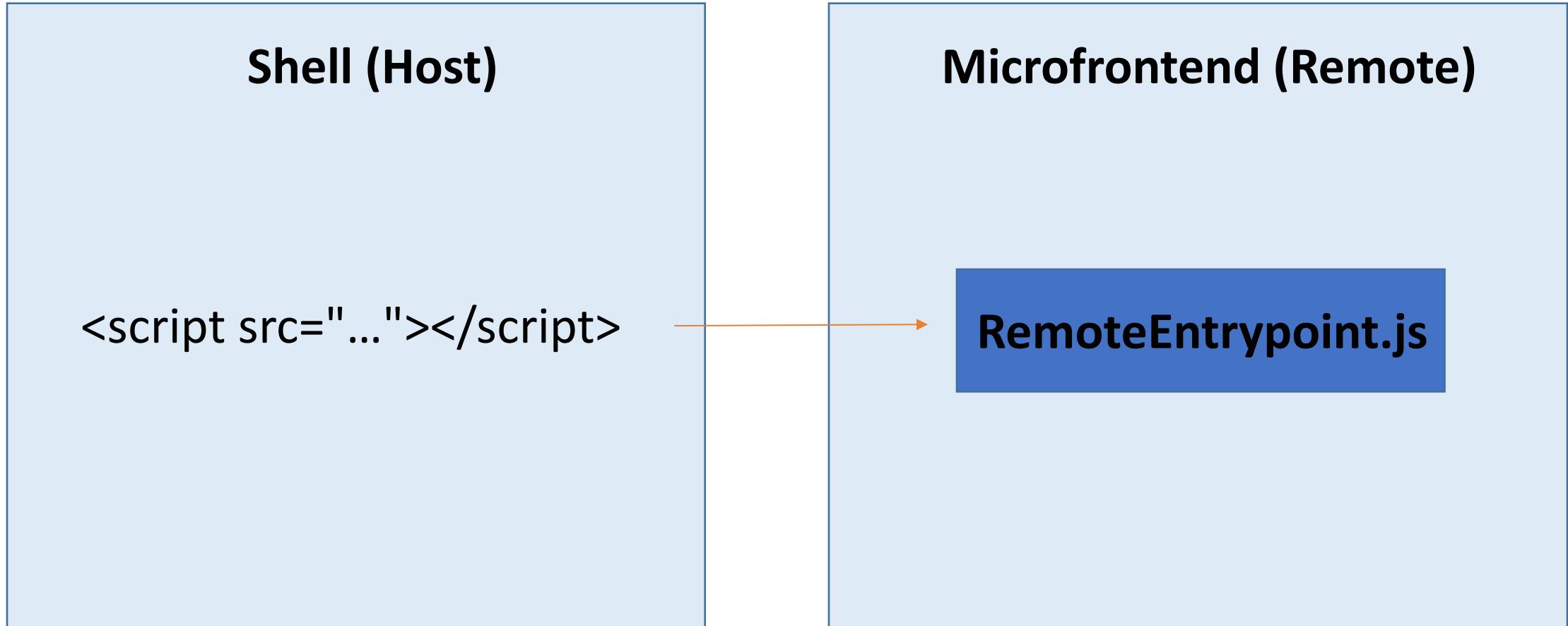


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# How to Get the Microfrontend's URL?



# 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 

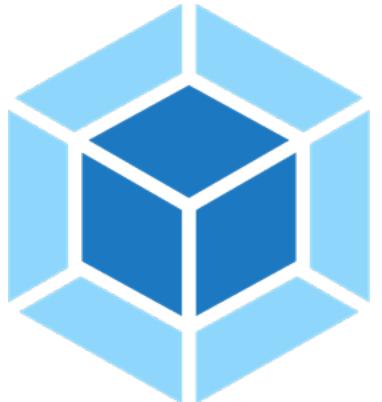
# Relaxing Version Requirements

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

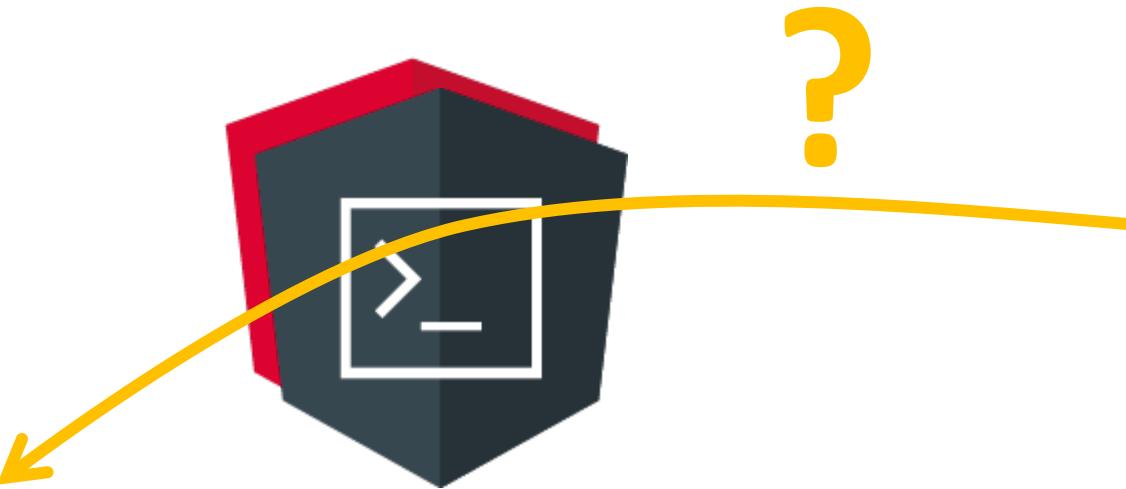
# Federated Angular: Angular, CLI, & Module Federation



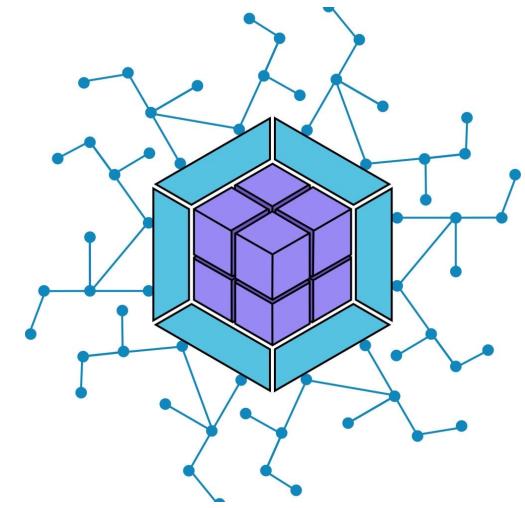
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webpack

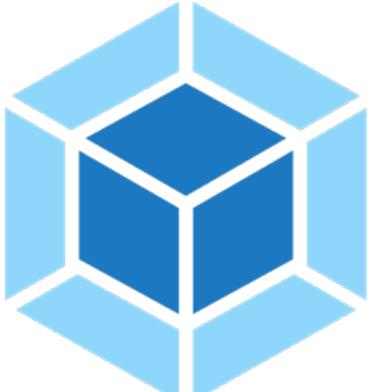


Angular CLI

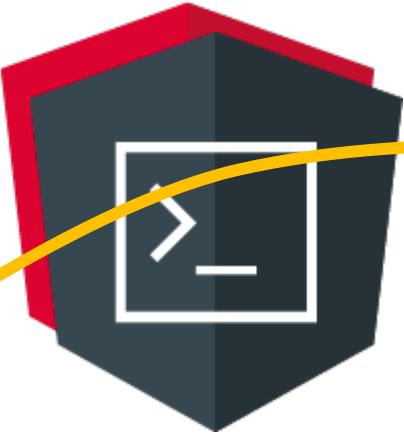


Module Federation  
Configuration

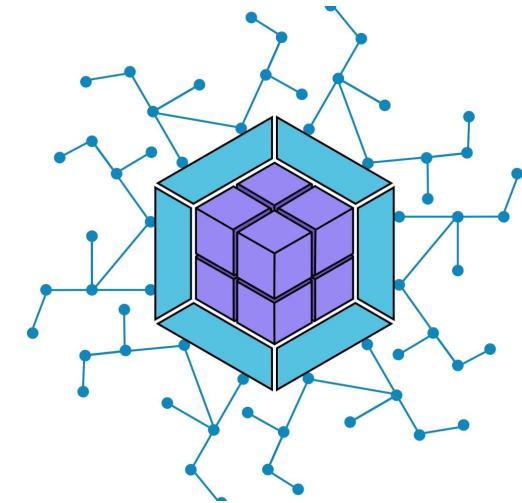
# Custom Builder



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.



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# Usage

- 1) ng add @angular-architects/module-federation
- 2) Adjust generated configuration
- 3) ng serve

# Module Federation Demo

# Lab

Module Federation

# Possible Roadmap



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# Well ...

Webpack 5: final

@angular-architects/module-federation: final

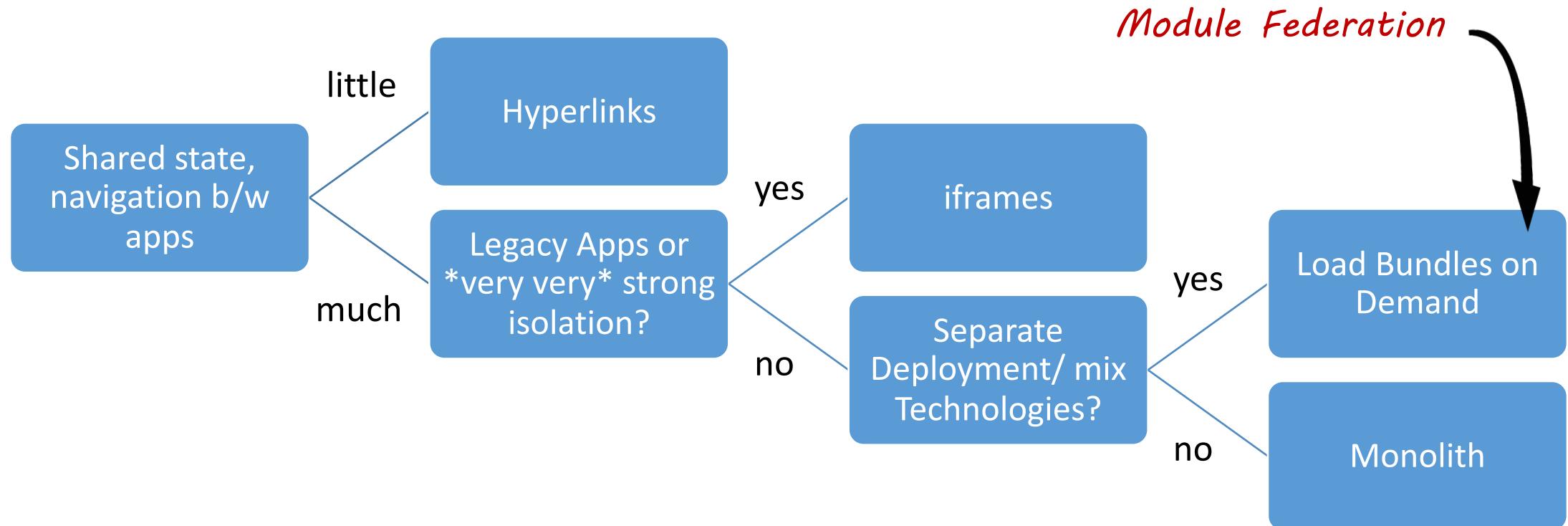
CLI 11: Experimental webpack 5 support (it works!)

CLI 12: Official webpack 5 support (just released!)

The background of the image is a dark, atmospheric room. The wall is covered in a repeating pattern of dark, ornate, floral or damask motifs. In the center of the frame, there is a row of several closed doors, all of which appear to be made of a light-colored wood or similar material. The doors are evenly spaced and extend from the foreground towards the background. The floor is made of dark, polished wooden planks that lead the eye towards the doors.

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 at

<https://www.angulararchitects.io/en/book/>

# That's it for architecture

- Any questions left over? 😊