

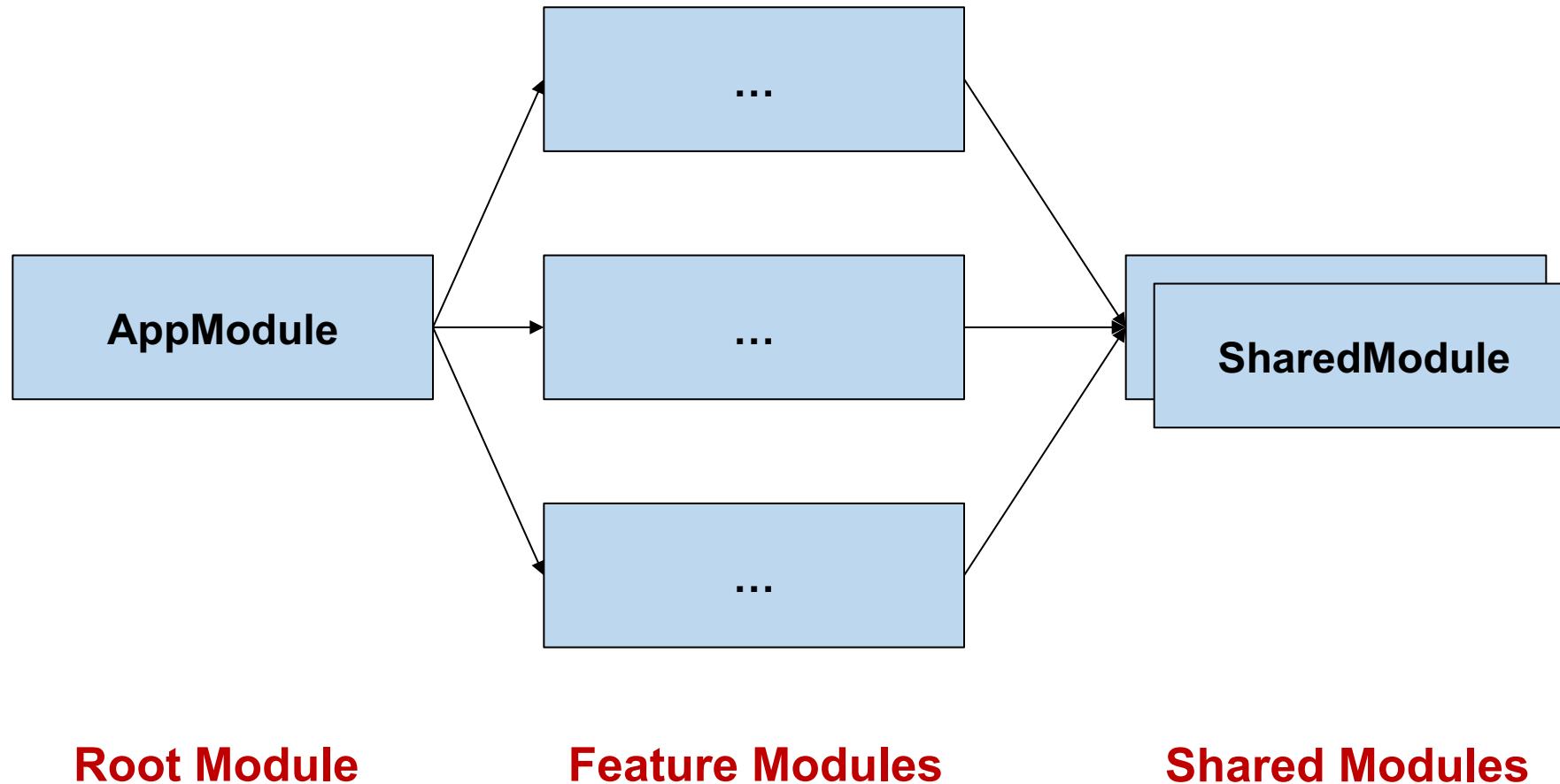


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# Angular Architektur-Workshop: NX Monorepo, Strategic Design, Micro Frontends & Module Federation

[ANGULARarchitects.io](https://ANGULARarchitects.io)

# 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

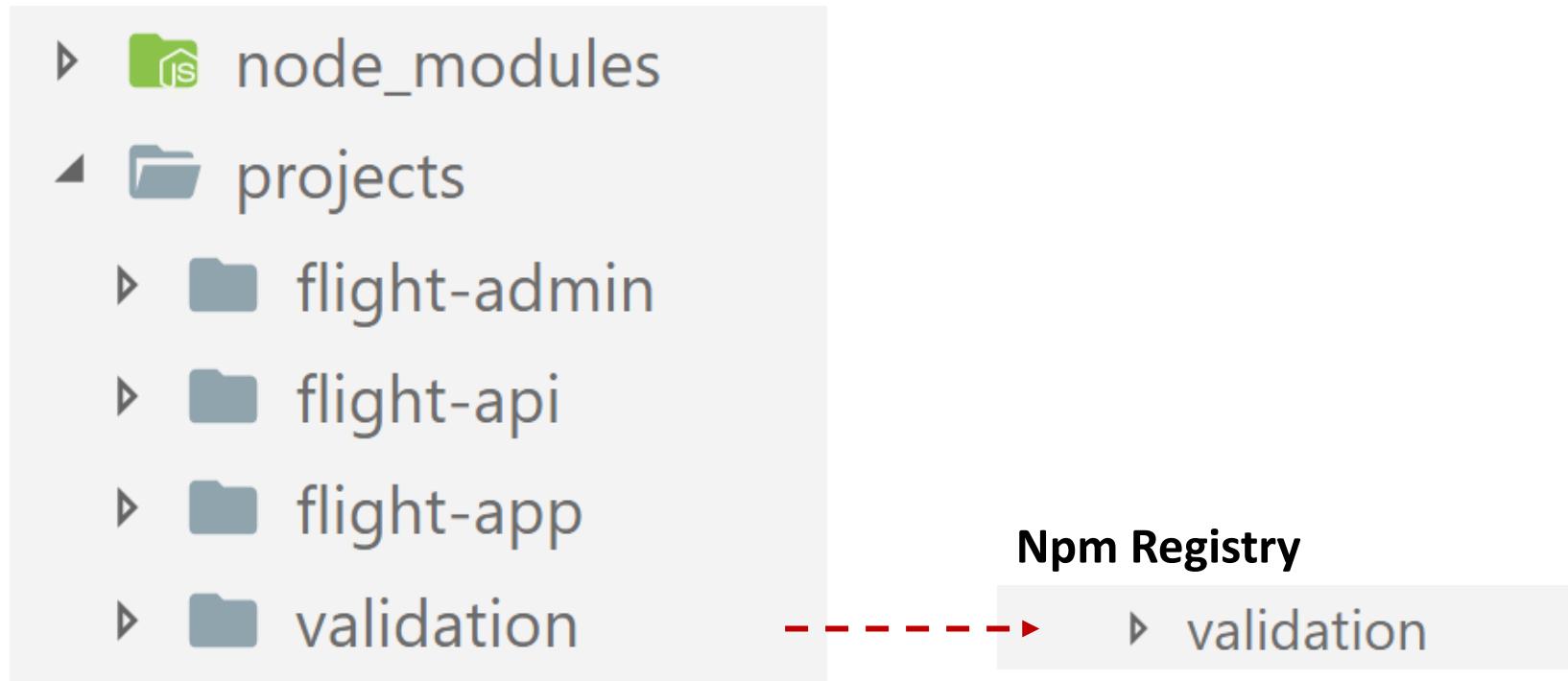
## Project Monorepo

- Like Workspaces/Solutions in different IDEs

## Company-wide Monorepo

- E. g. used at Google or Facebook

# Moving back and forth



# Tooling & Generator

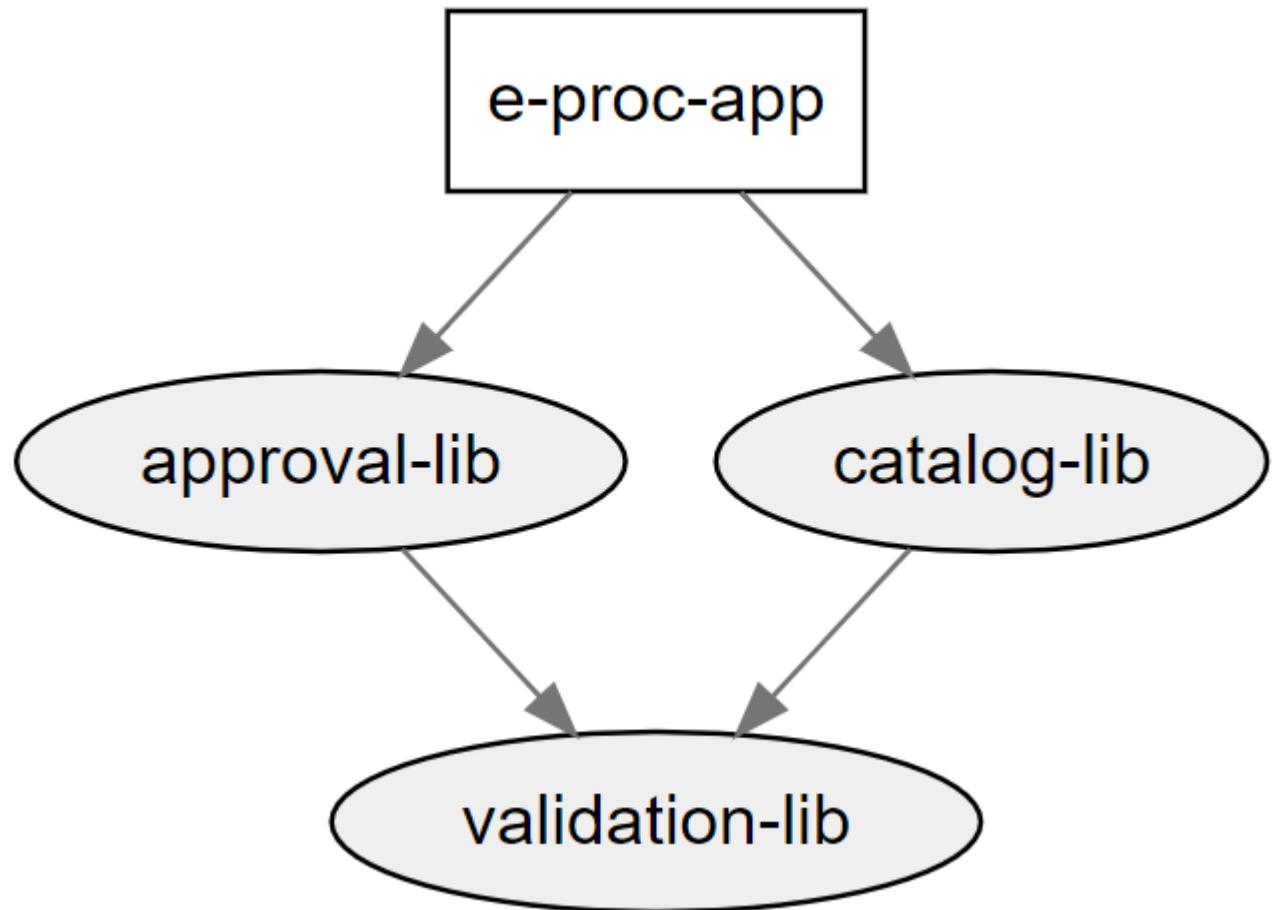
<https://nrwl.io/nx>



## Nrwl Extensions for Angular

An open source toolkit for enterprise Angular applications.

# Visualize Module Structure



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# 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

# Building Blocks in Plugins

## Executors

- Build-related Tasks
- nx build, nx test, ...
- nx run

## Generators

- Generate Code
- nx generate

# 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

*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

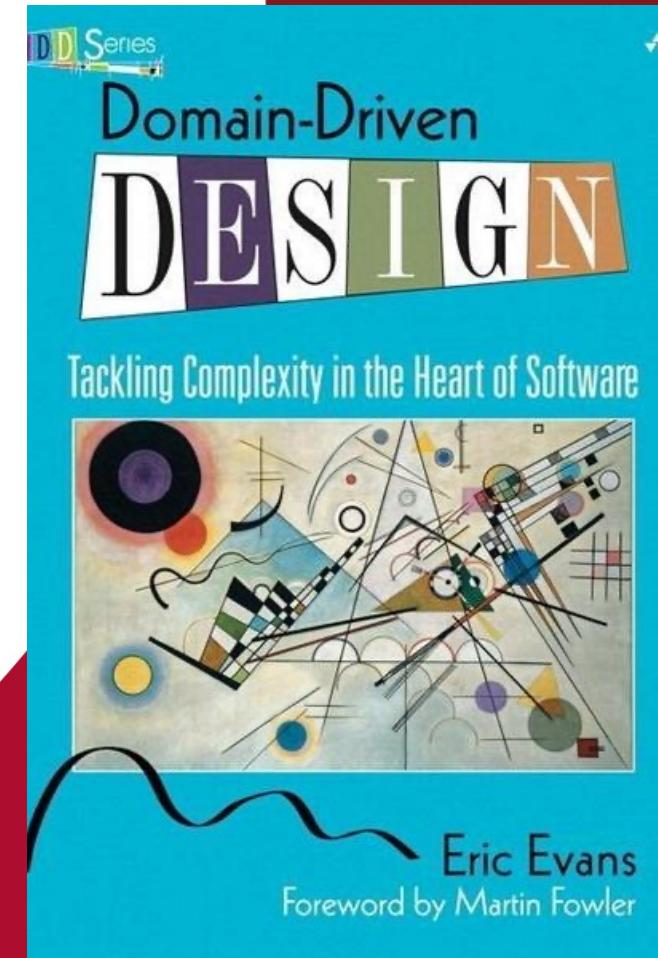


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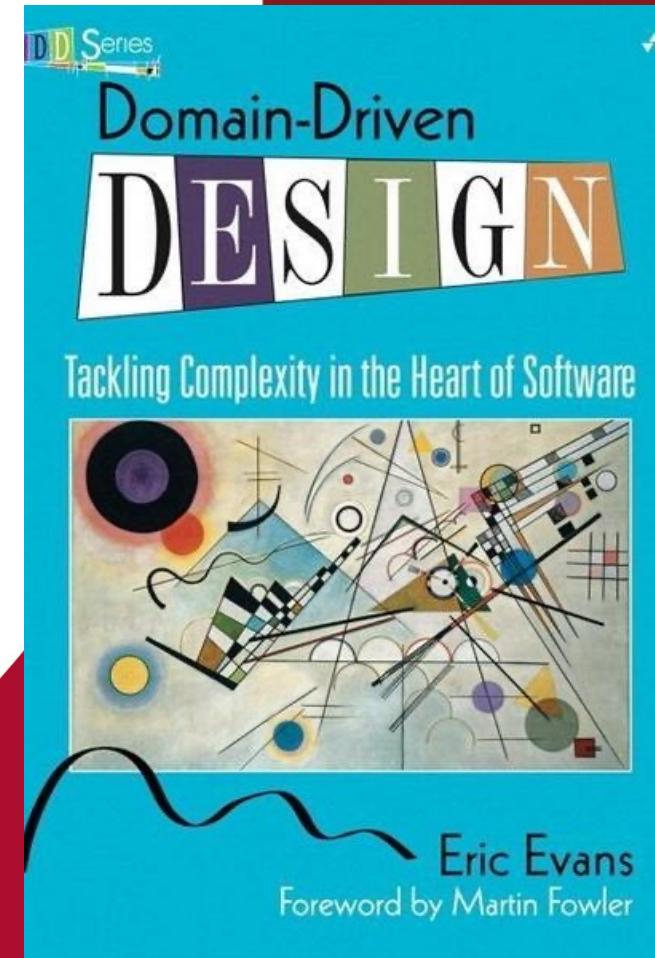
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# How to create sustainable frontend architectures with ideas from DDD?



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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

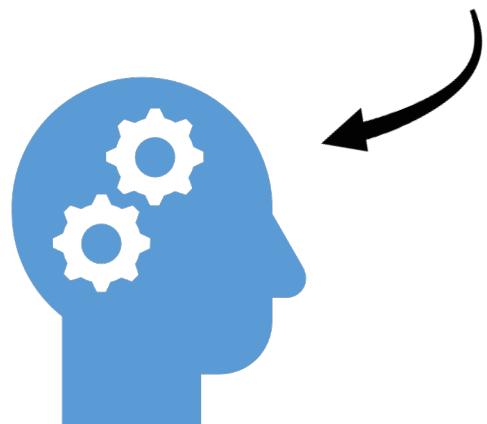
Design Patterns  
& Practices



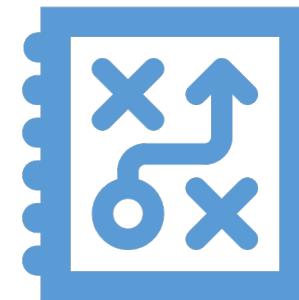
Tactical Design

# Domain Driven Design

Decomposing a System

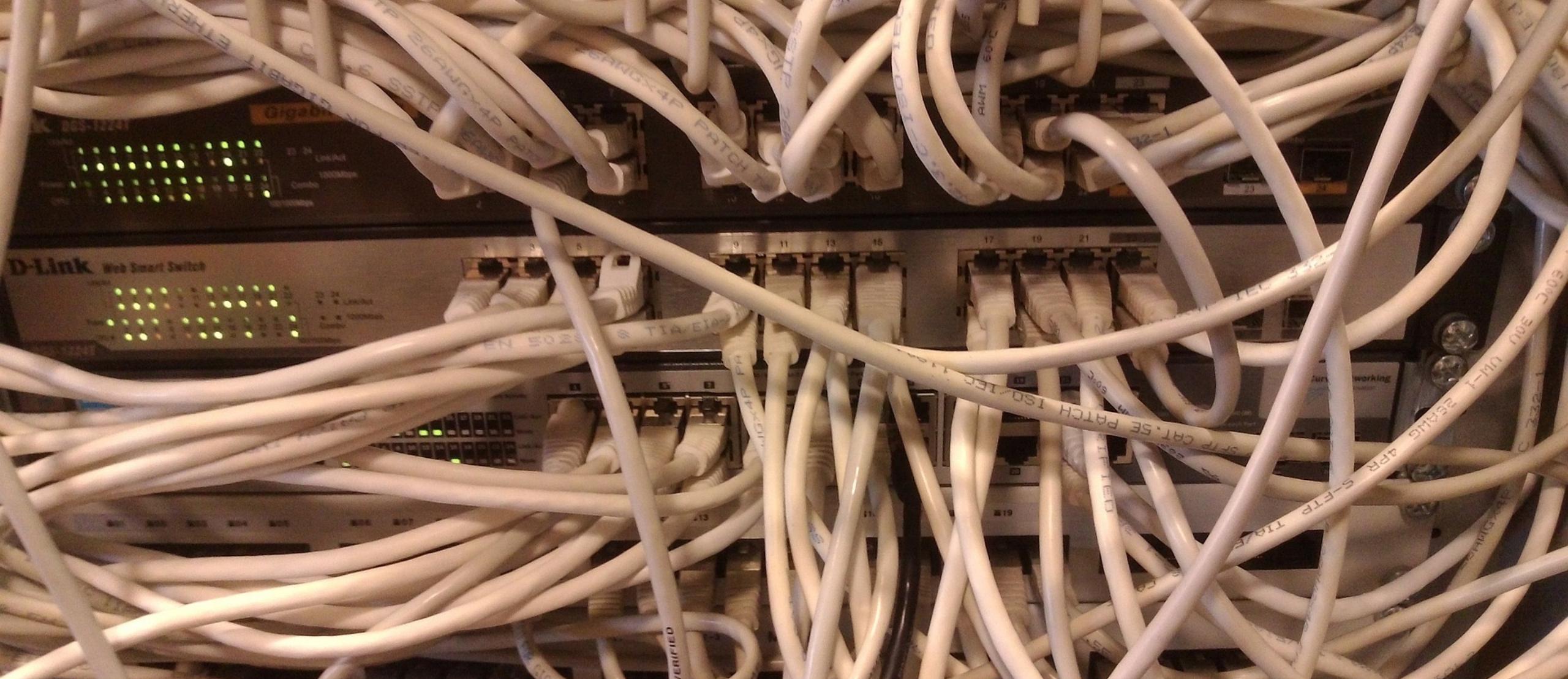


Design Patterns  
& Practices



## Strategic Design

## Tactical Design

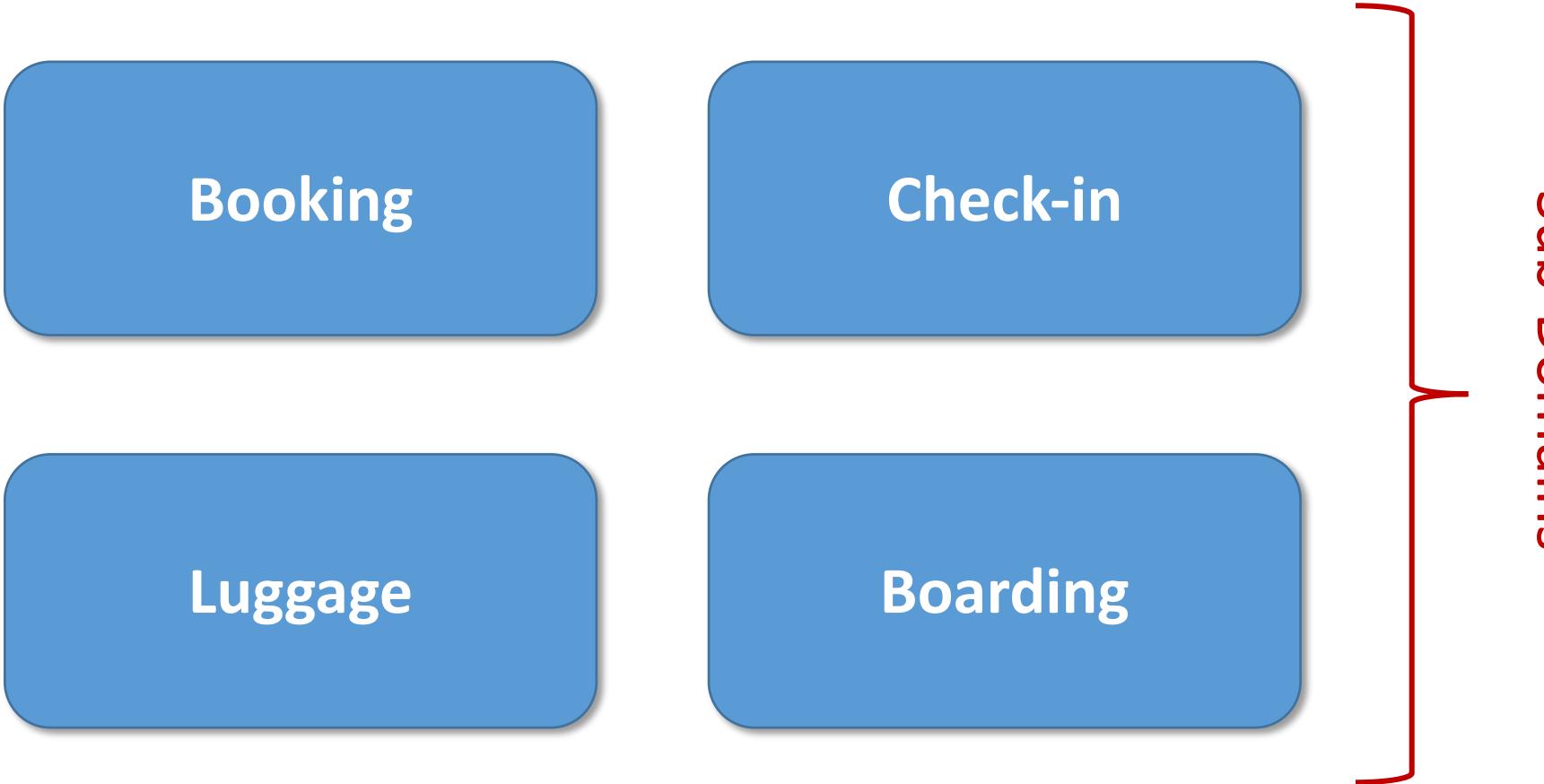


This is what Strategic DDD prevents

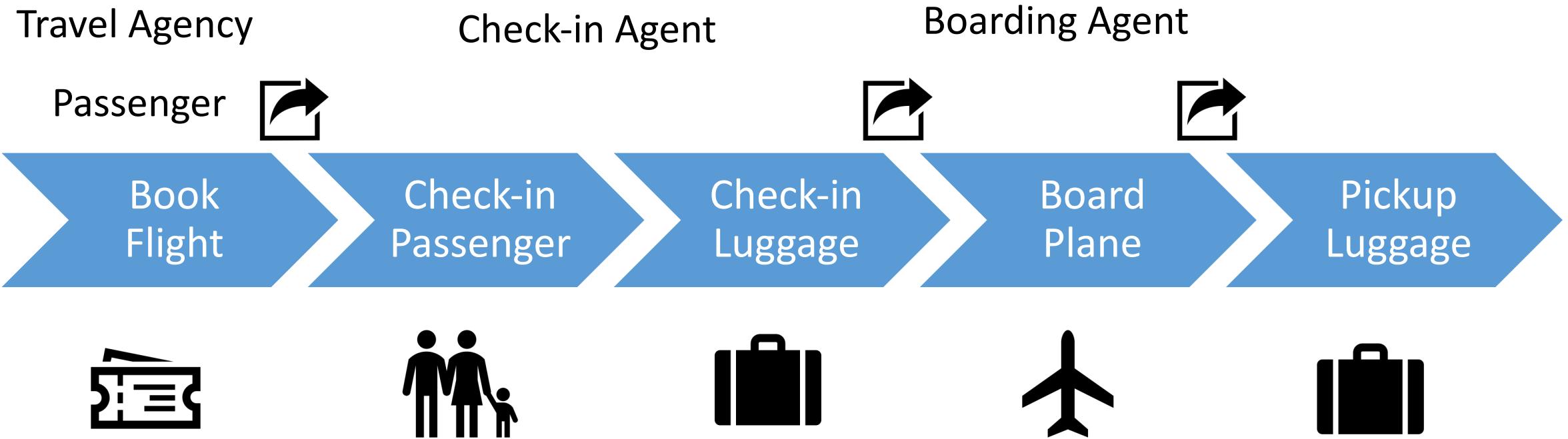
# Example

Flight System

# Example

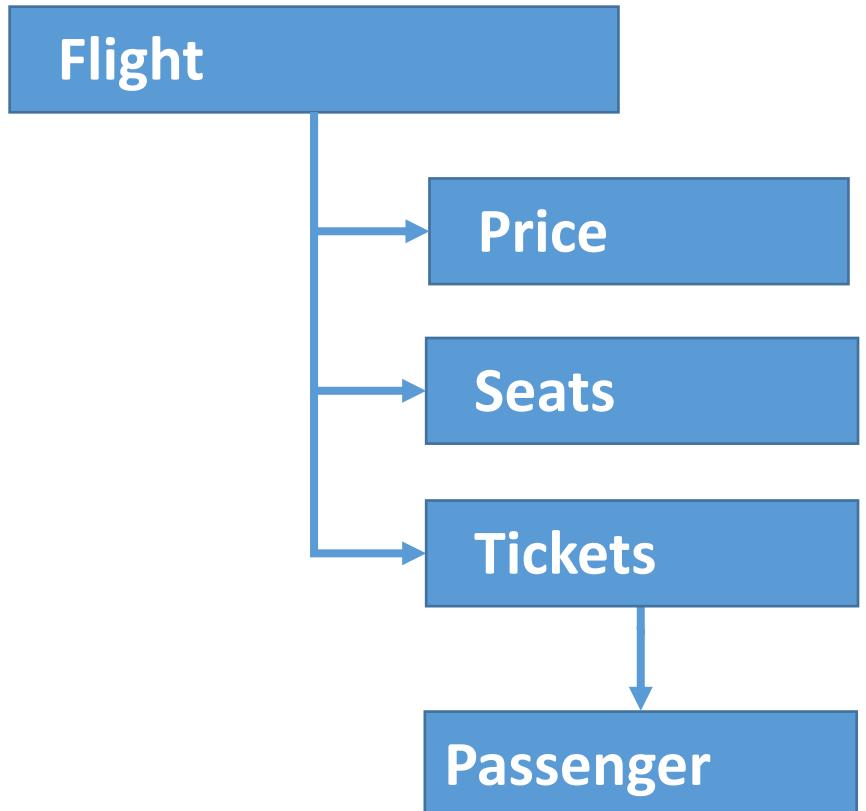


# Finding Sub-Domains



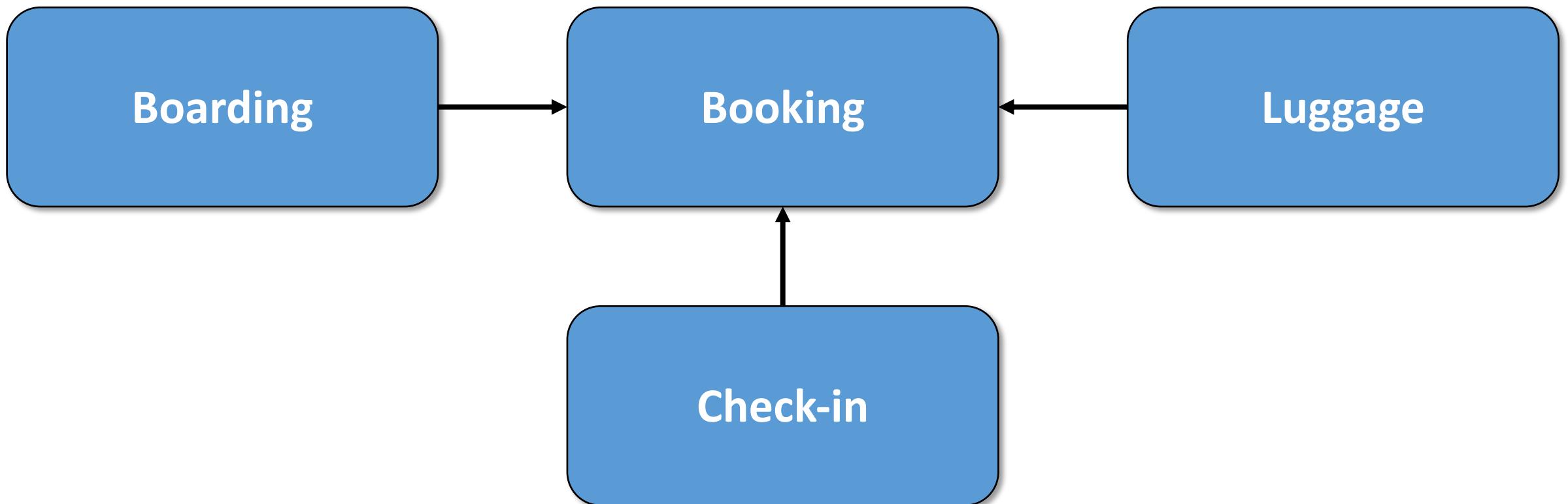
## Booking

## Boarding



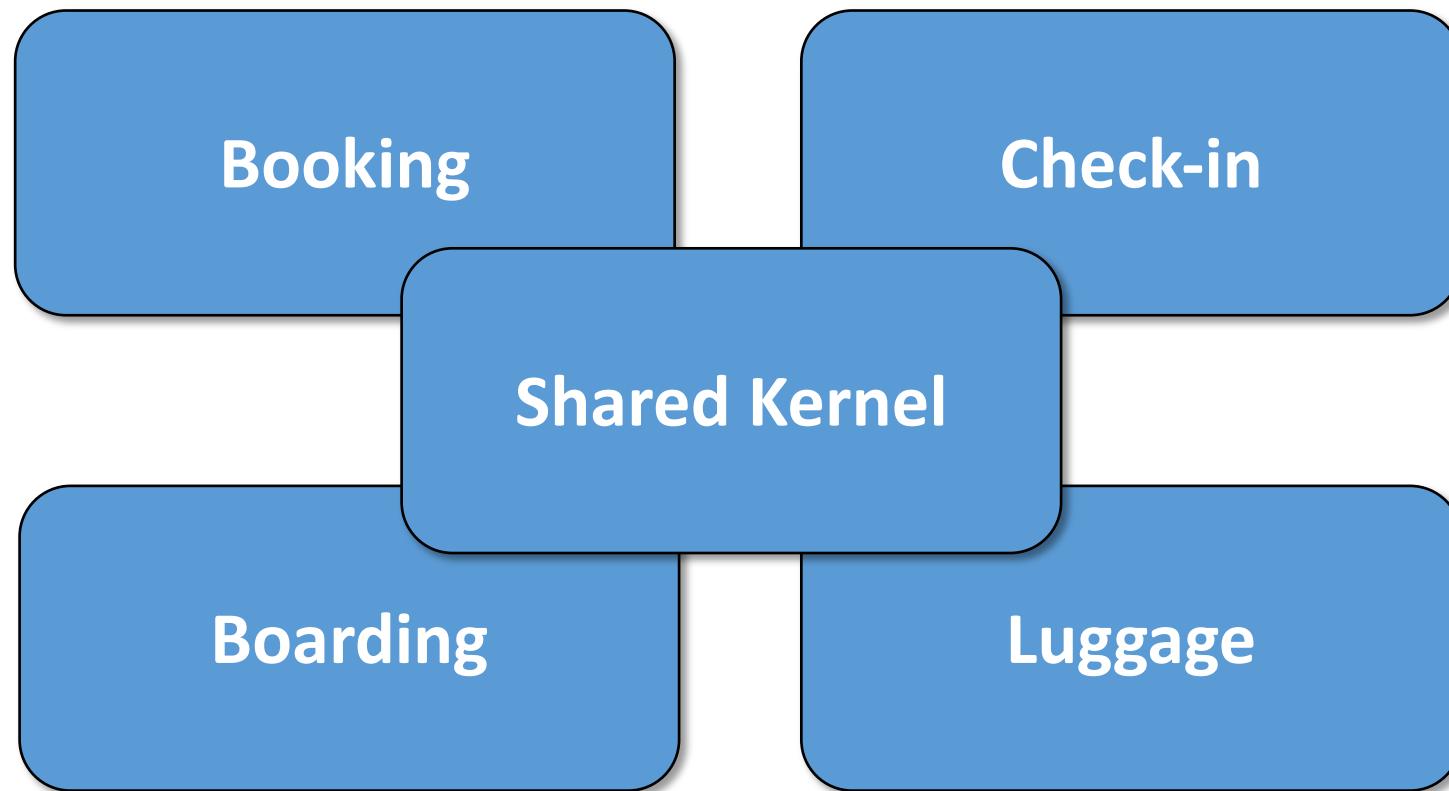
Bounded Context

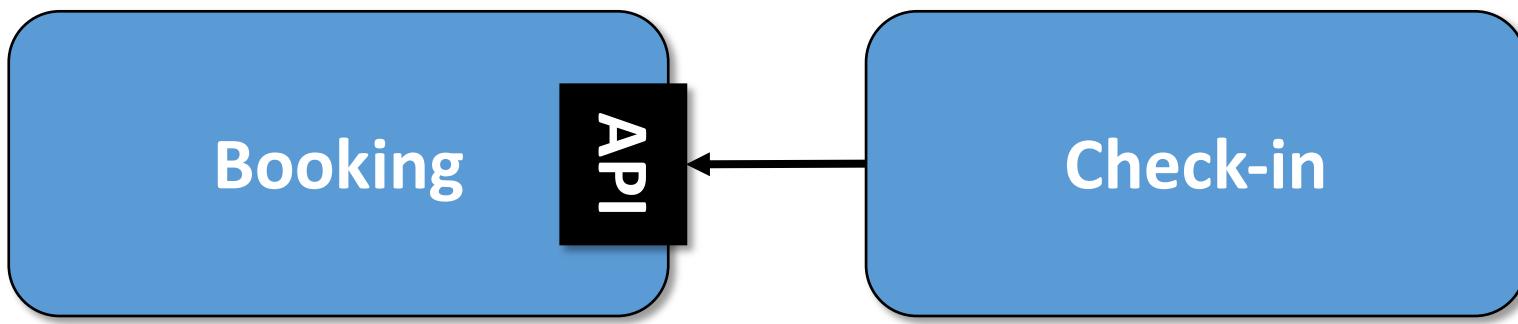
# Context Map



# Context Map

Responsibilities?  
Breaking Changes?





Open-/Host-Service

# Domain-Driven DESIGN

Tackling Complexity in the Heart of Software



Eric Evans  
Foreword by Martin Fowler

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

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**

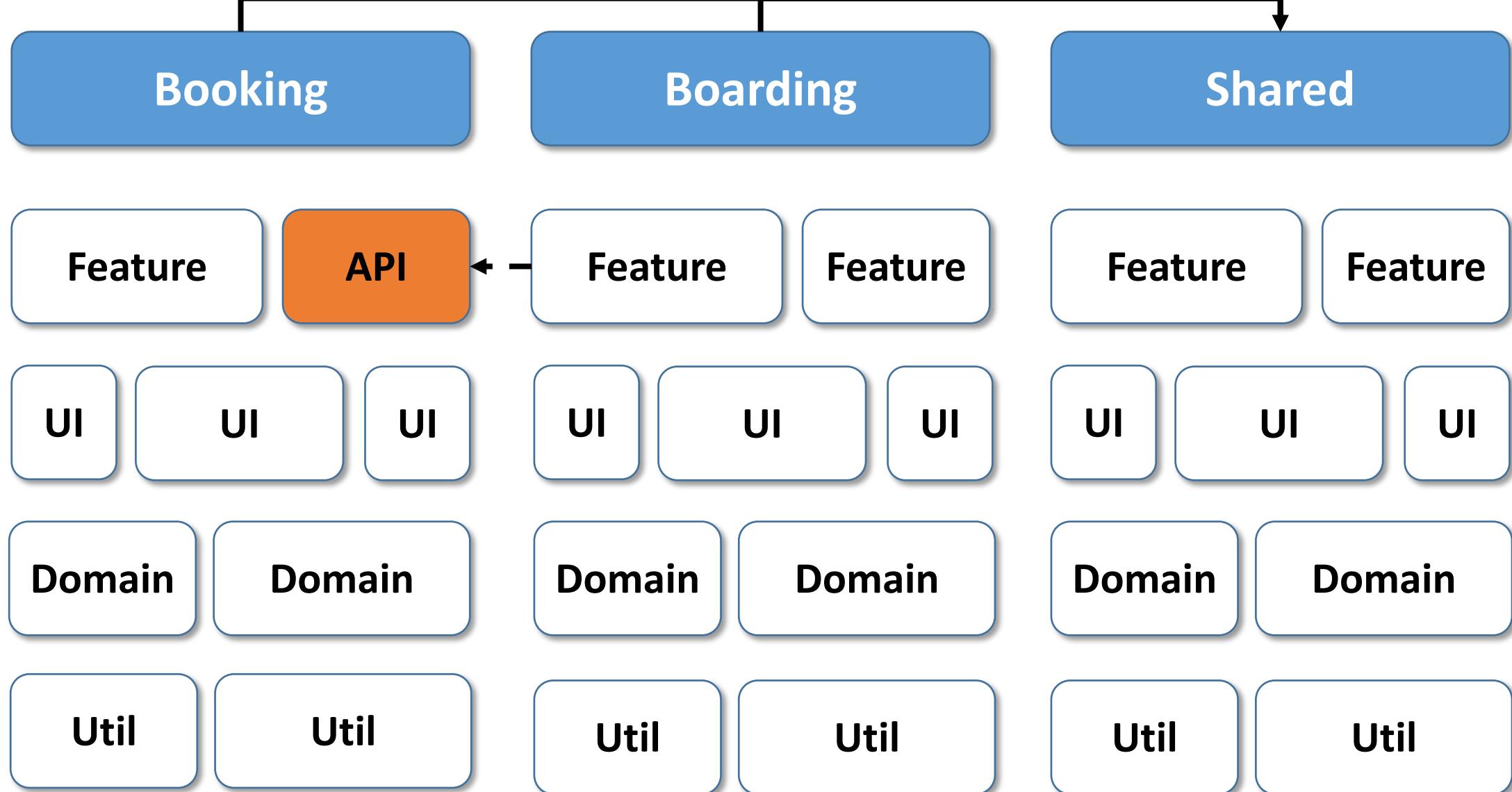
**Util**

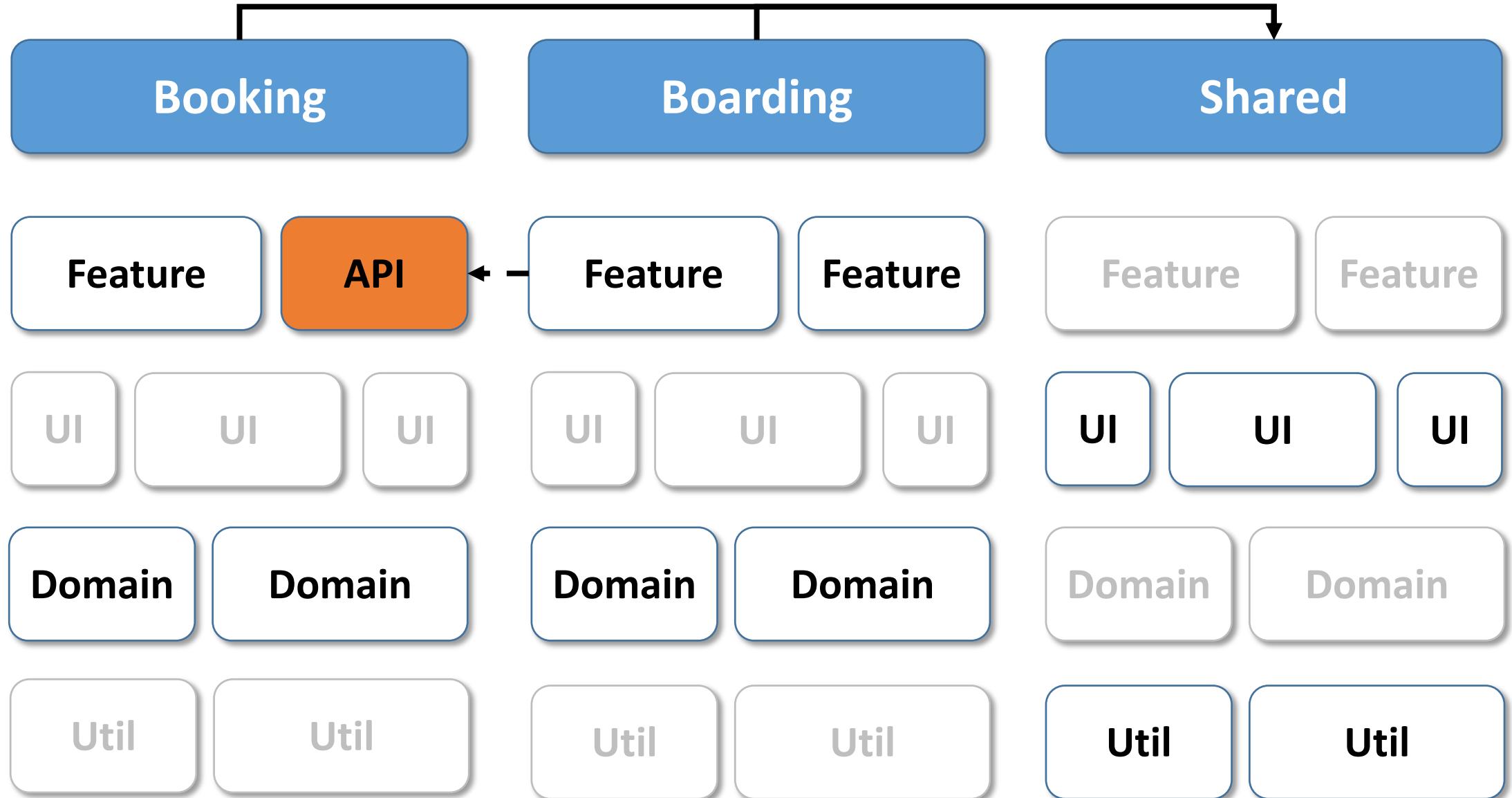
**Util**

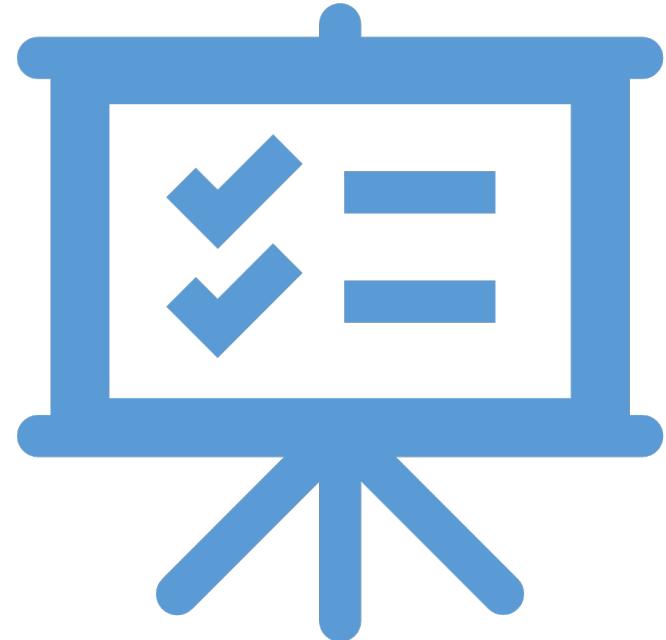


@ManfredSteyer

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







## 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 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

# Lab

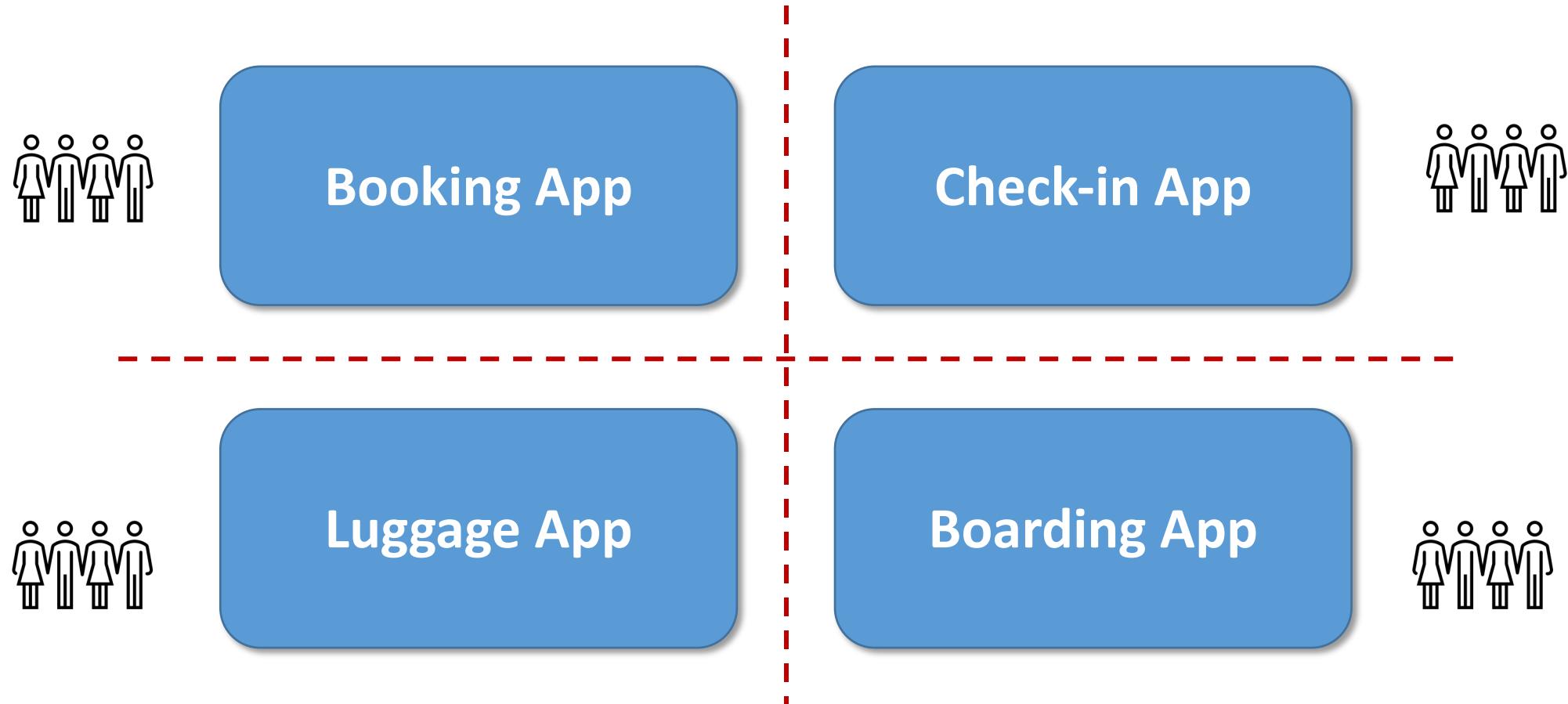
Nx DDD



# Micro Frontends?

Short outlook

# Microfrontends



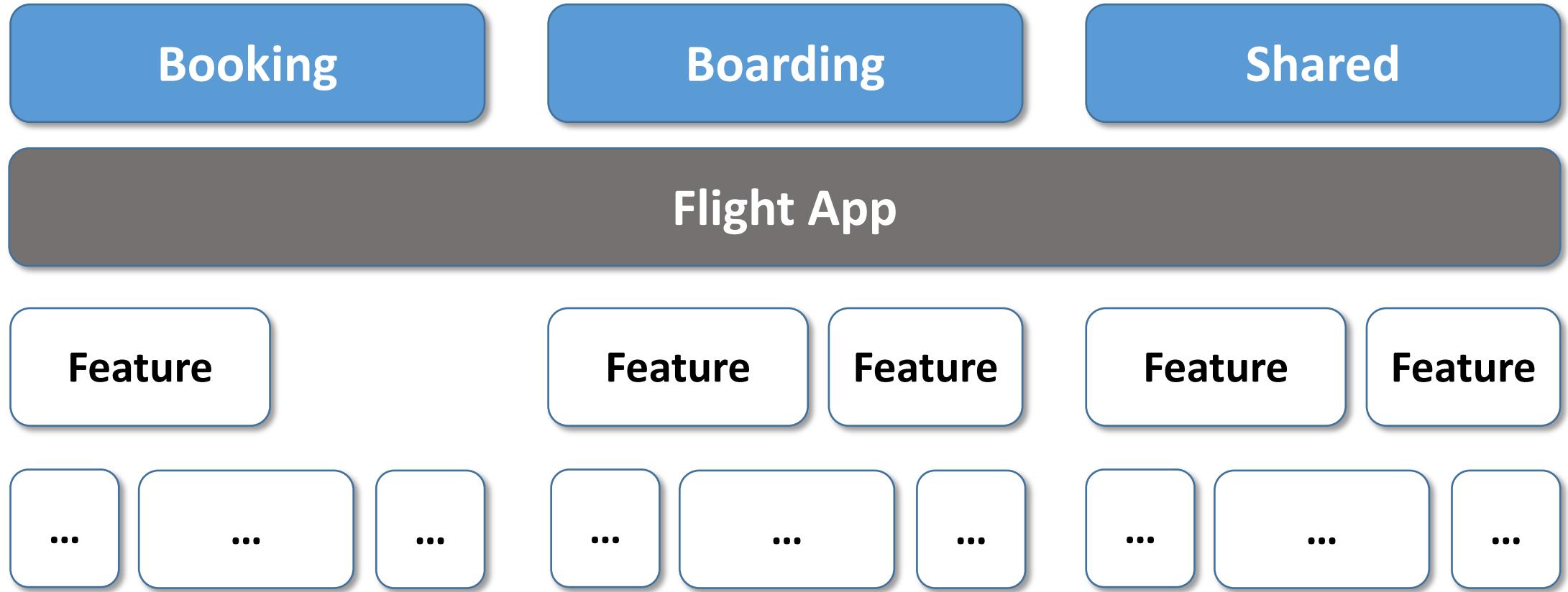
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Microfrontends  
are first and foremost  
about **scaling teams!**



# Deployment Monolith



# Microfrontends

Booking

Boarding

Shared

Booking App

Boarding App

Feature

Feature

Feature

Feature

Feature

...

...

...

...

...

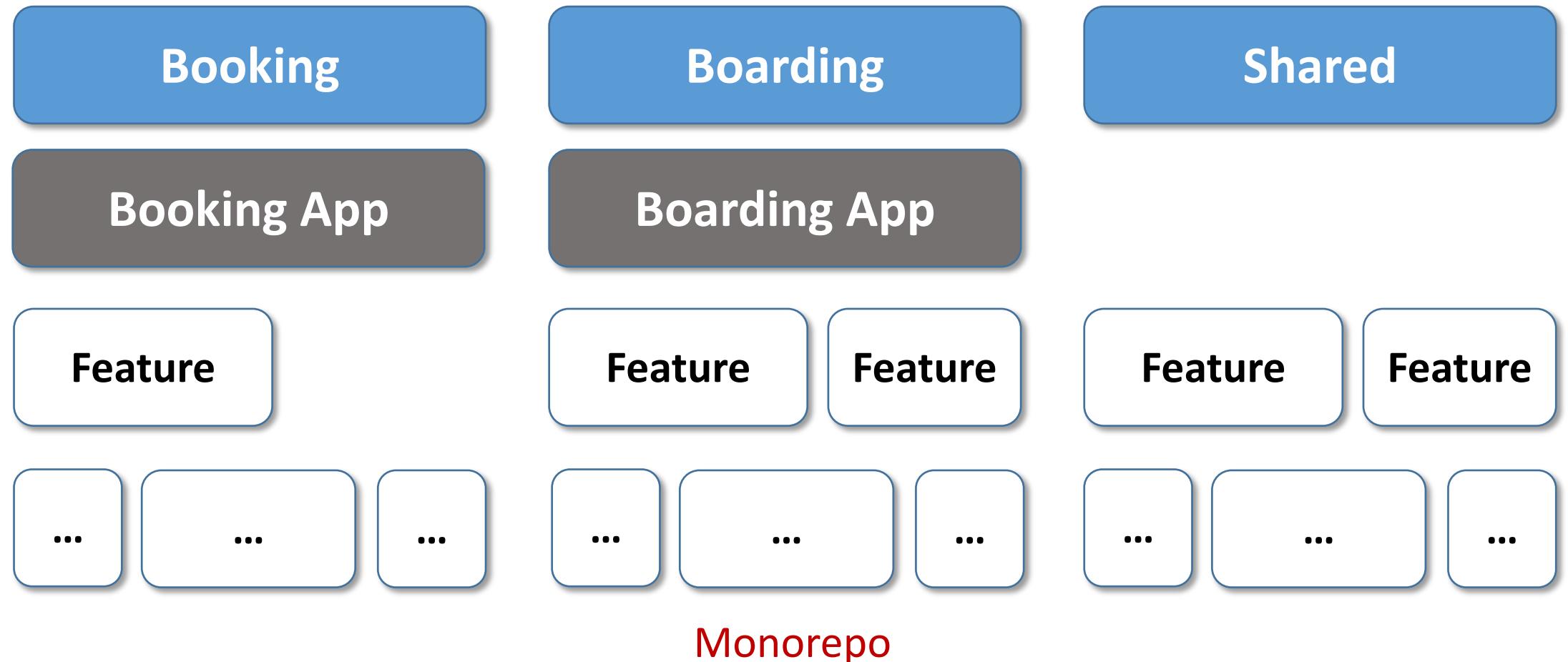
...

...

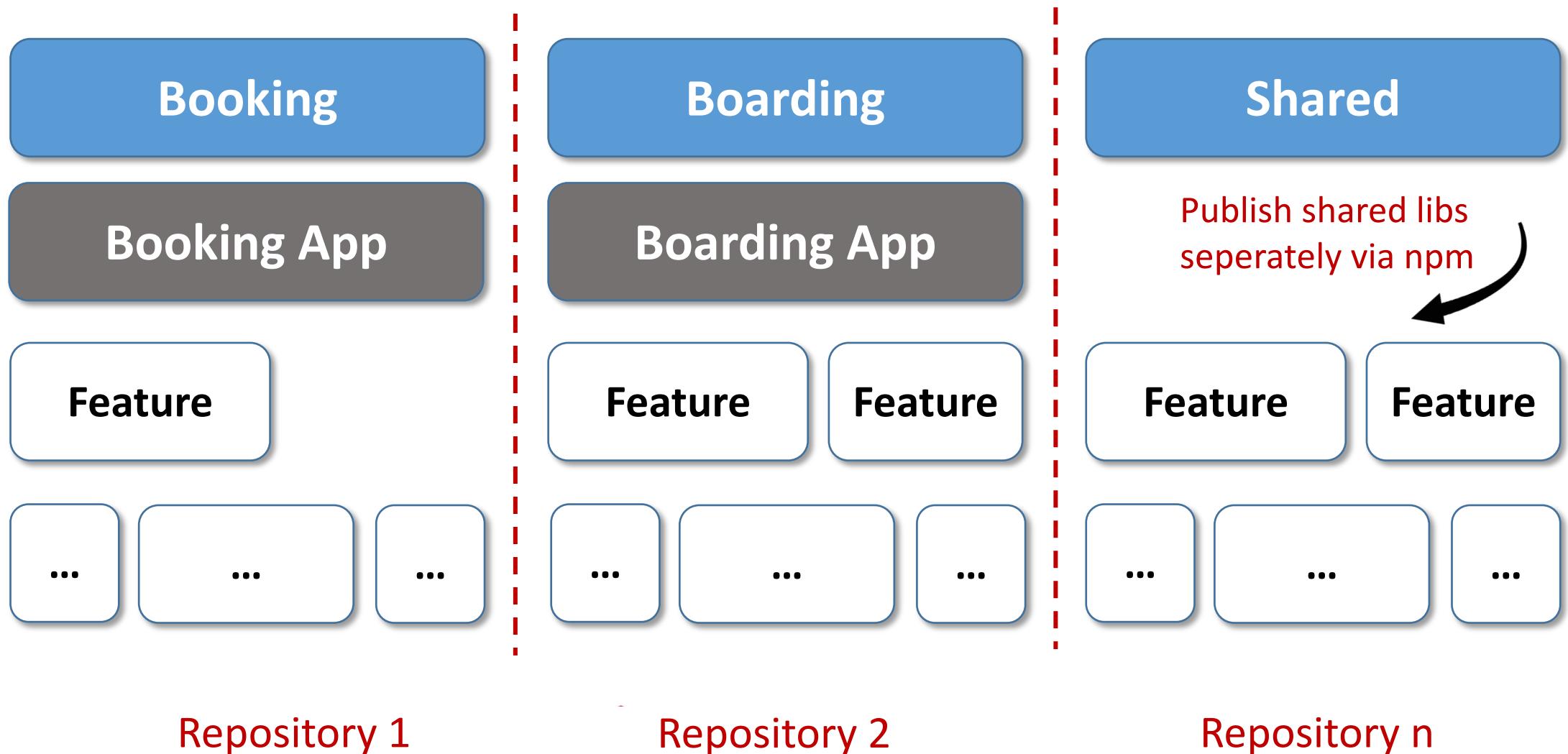
...

...

# Option 1: One App per Domain



# Option 2: One Monorepo per Domain



# Benefits

Autonomous Teams

Separate Development

Separate Deployment

Own architecture decisions

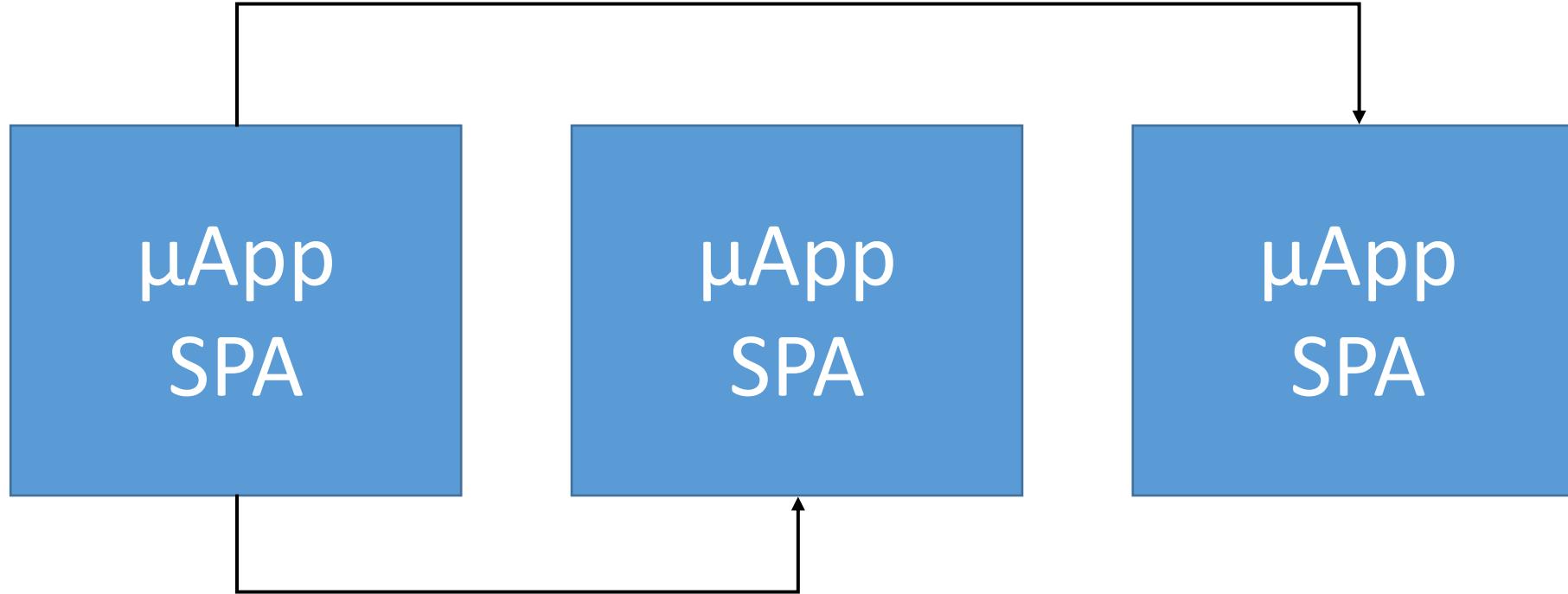
Own technology decisions



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!

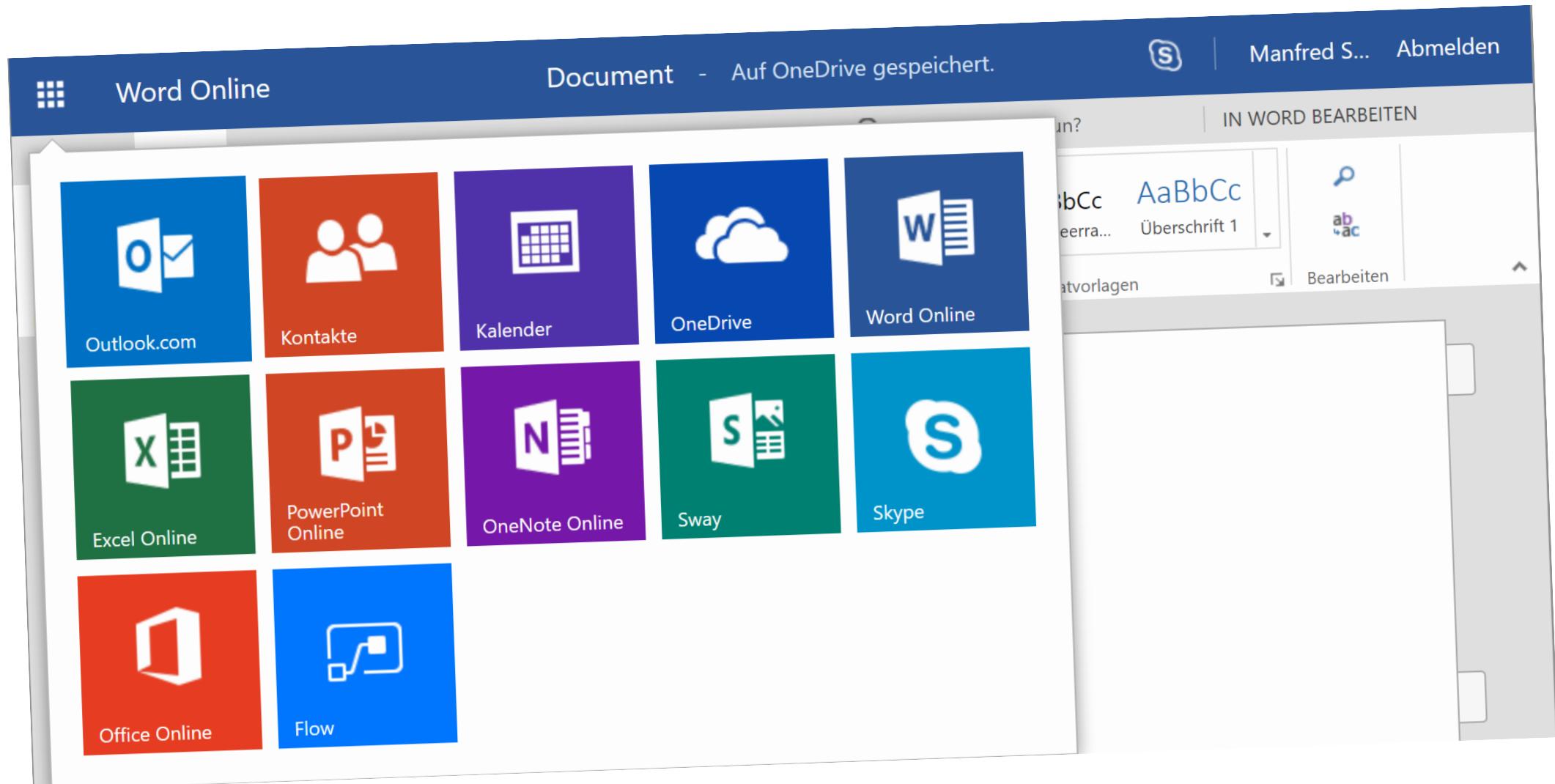
The screenshot shows the Microsoft Word Online interface. The ribbon at the top has tabs: DATEI, START (selected), EINFÜGEN, SEITENLAYOUT, ÜBERPRÜFEN, and ANSICHT. A search bar says "Was möchten Sie tun?" and a button says "IN WORD BEARBEITEN". The left sidebar has "Rückgängig", "Einfügen", and "Zwischenablage". The ribbon icons include a grid for DATEI, a folder 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 displays 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

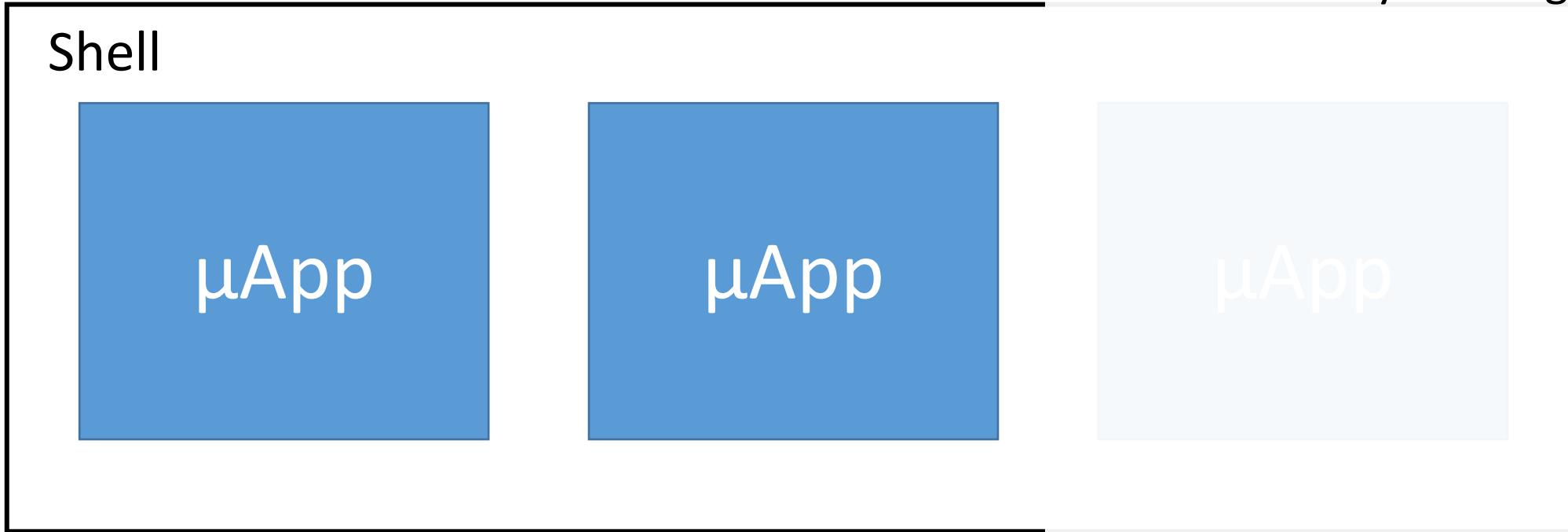
μApp

# 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>
```

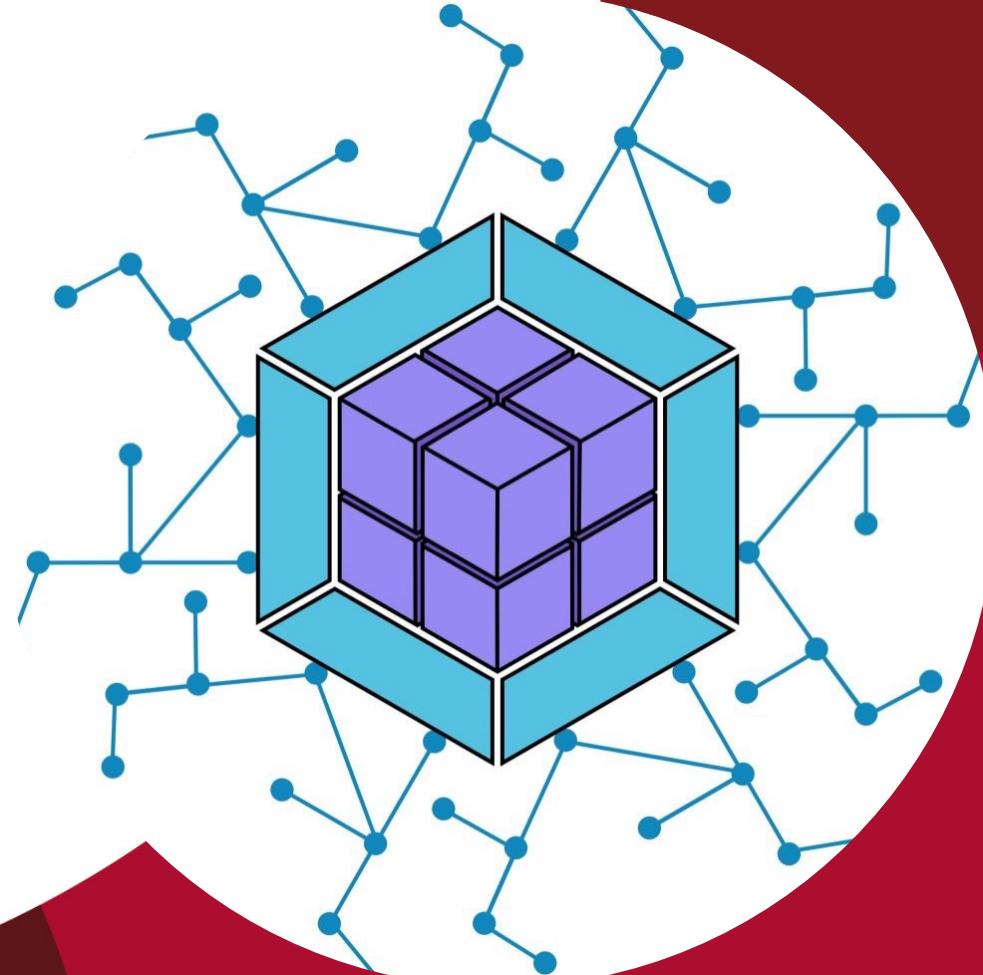
```
<micro-app></micro-app>
```

# Loading Separately Compiled SPAs

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

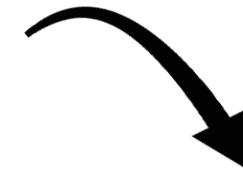
const clientA = document.createElement('client-a');
clientA['visible'] = true;
document.body.appendChild(clientA);
```

# 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'  
}
```

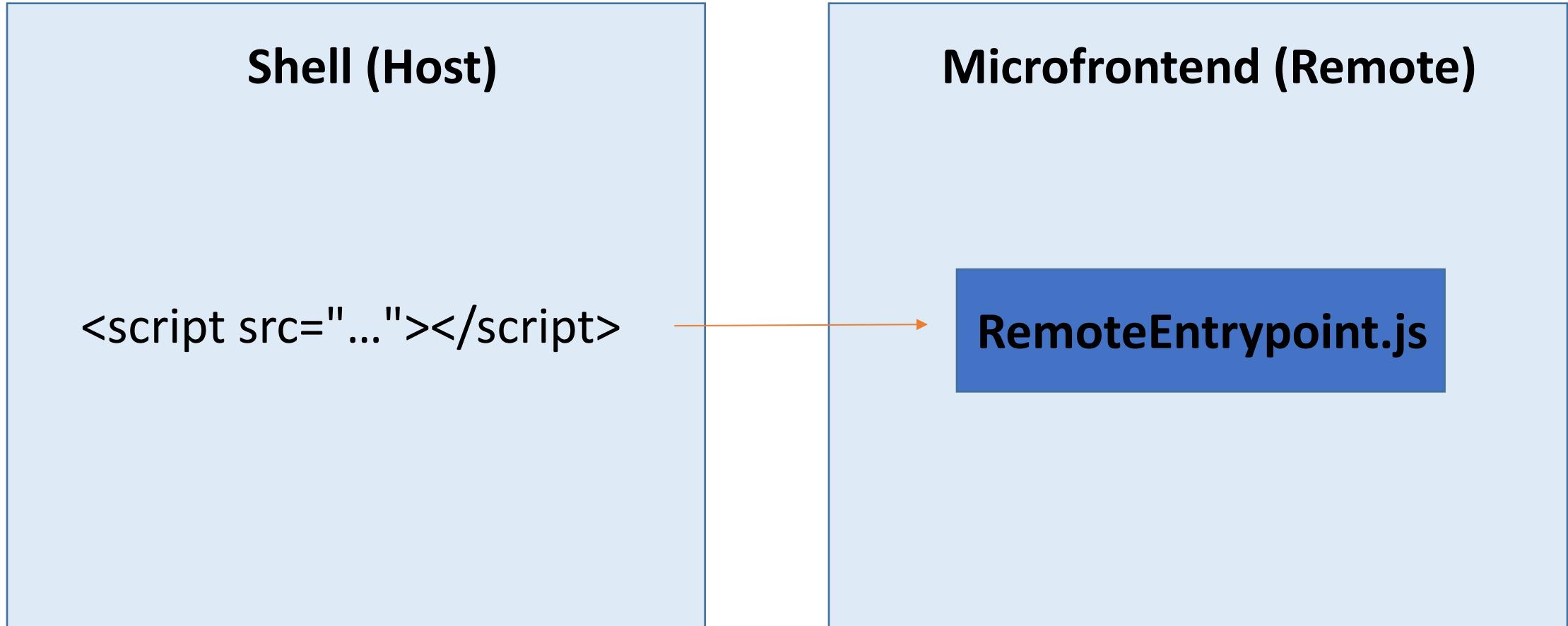


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ARCHITECT

# 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 

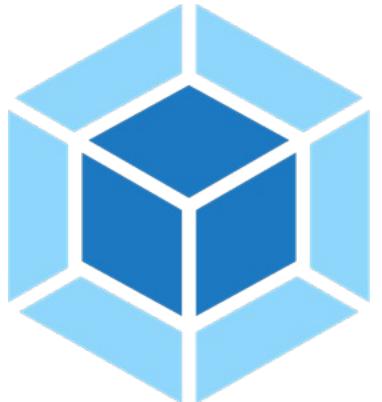
# Relaxing Version Requirements

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

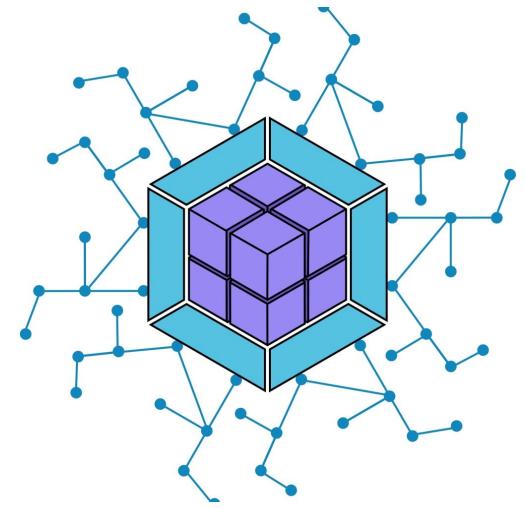
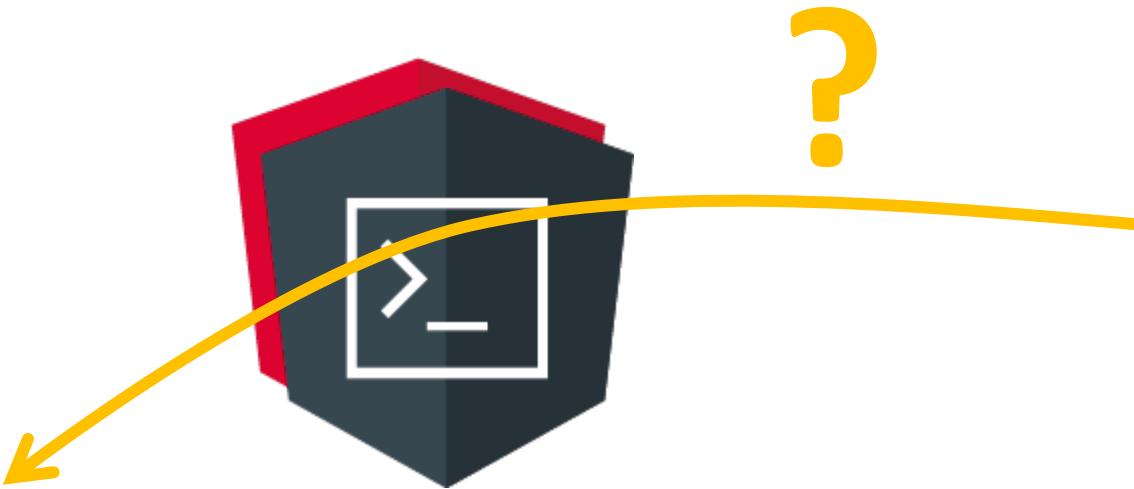
# Federated Angular: Angular, CLI, & Module Federation



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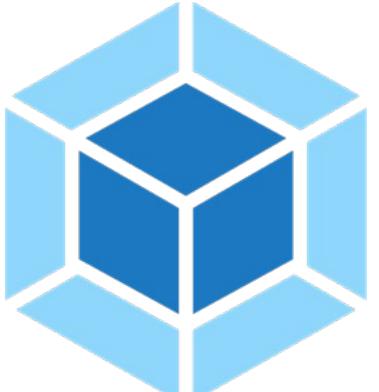


webpack



Module Federation  
Configuration

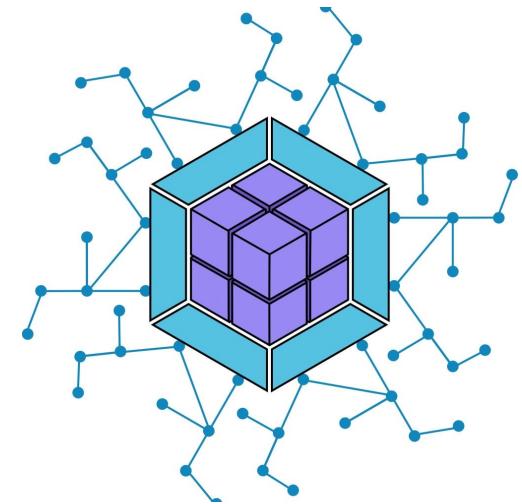
# Custom Builder



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) Adjust generated configuration
- 3) ng serve

# Module Federation Demo

# Lab

Module Federation

# Multi Framework/ Version Solutions



# Abstracting Differences b/w SPA Frameworks

Wrap them into Web Components



# Loading Web Components via Module Federation



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# Module Federation

```
const Component = await import('other-app/cmp');
```

# Module Federation

```
const main = await import('other-app/main');
```

```
main.bootstrap();
```

# Module Federation

```
const rootElm = document.createElement('app-root')
document.body.appendChild(rootElm);
```

```
const main = await import('other-app/main');
```

```
main.bootstrap();
```

# Module Federation

```
const rootElm = document.createElement('app-root')
document.body.appendChild(rootElm);

await import('other-app/main'); // Self-Bootstrapping
```

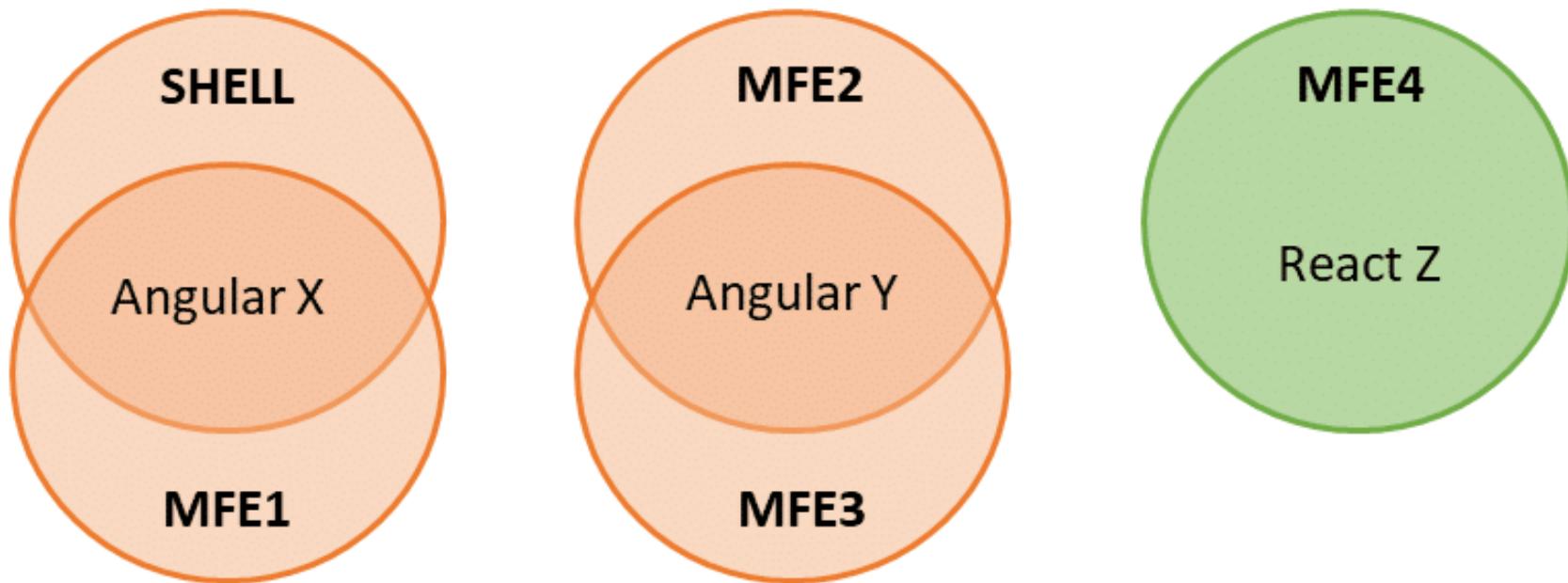
# Routing to Another SPA?

## WrapperComponent

```
const rootElm = document.createElement('app-root')
document.body.appendChild(rootElm);

await import('other-app/main');
```

# Result



# 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

# 4 Steps to Your Frankenstein

@angular-architects/module-federation-tools 



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# Step #1: Expose MFE via Web Components

```
ng add @angular/elements
```

# Step #1: Expose MFE via Web Components

```
@NgModule({
  imports: [BrowserModule],
  declarations: [AppComponent],
  bootstrap: []
})
export class AppModule { }
```

# Step #1: Expose MFE via Web Components

```
@NgModule({
  imports: [BrowserModule],
  declarations: [AppComponent],
  bootstrap: []
})
export class AppModule {

  constructor(private injector: Injector) { }

}
```

# Step #1: Expose MFE via Web Components

```
@NgModule({
  imports: [BrowserModule],
  declarations: [AppComponent],
  bootstrap: []
})
export class AppModule {

  constructor(private injector: Injector) { }

  ngDoBootstrap() {
    const DateElement = createCustomElement(
      AppComponent, { injector: this.injector });

    customElements.define('angular3-element', DateElement);
  }
}
```

# Step #1: Expose MFE via Web Components

Result: Browser renders component w/o framework support

```
<my-app></my-app>
```

# Step #2: Expose MFE/Web Component via Module Federation

```
// webpack.config.js in Micro Frontend

plugins: [
  new ModuleFederationPlugin({
    name: "angular3",
    filename: "remoteEntry.js",
    exposes: {
      './web-components': './src/bootstrap.ts',
    },
    shared: [
      "@angular/core", "@angular/common",
      "@angular/router", "rxjs"
    ]
  })
],
```

# Step #3: Use Bootstrap Helper in MFE

```
// Bootstrapping in both, Shell and Micro Frontends

bootstrap(AppModule, {
  production: environment.production,
  appType: 'microfrontend';
});
```

# Step #3: Use Bootstrap Helper in Shell

```
// Bootstrapping in both, Shell and Micro Frontends

bootstrap(AppModule, {
  production: environment.production,
  appType: 'shell';
});
```

# Step #4: Make Shell to Route to MFE

```
// Routing Config in Shell

{
  matcher: startsWith('angular3'),
  component: WebComponentWrapper,
  data: {
    type: 'script',
    remoteEntry: 'https://[...]/remoteEntry.js',
    remoteName: 'react',
    exposedModule: './web-components',
    elementName: 'angular3-element'
  } as WebComponentWrapperOptions
},
```

# Step #4: Make Shell to Route to MFE

```
// Path Matcher in both, Shell and Micro Frontends

{
  //path: 'react',
  matcher: startsWith('angular3'),
  component: WebComponentWrapper,
  data: {
    type: 'script',
    remoteEntry: 'https://[...]/remoteEntry.js',
    remoteName: 'react',
    exposedModule: './web-components',
    elementName: 'angular3-element'
  } as WebComponentWrapperOptions
},
```

# Routing

/client-a/this/that

/client-b/this/that

/client-c/this/that

:

# Routing

/client-a/this/that

/client-b/this/that

/client-c/this/that

:

# Communication

client-a/this/that?customerId=17

client-b/this/that?customerId=17

client-c/this/that?customerId=17

# For (a lot) more on Microfrontends

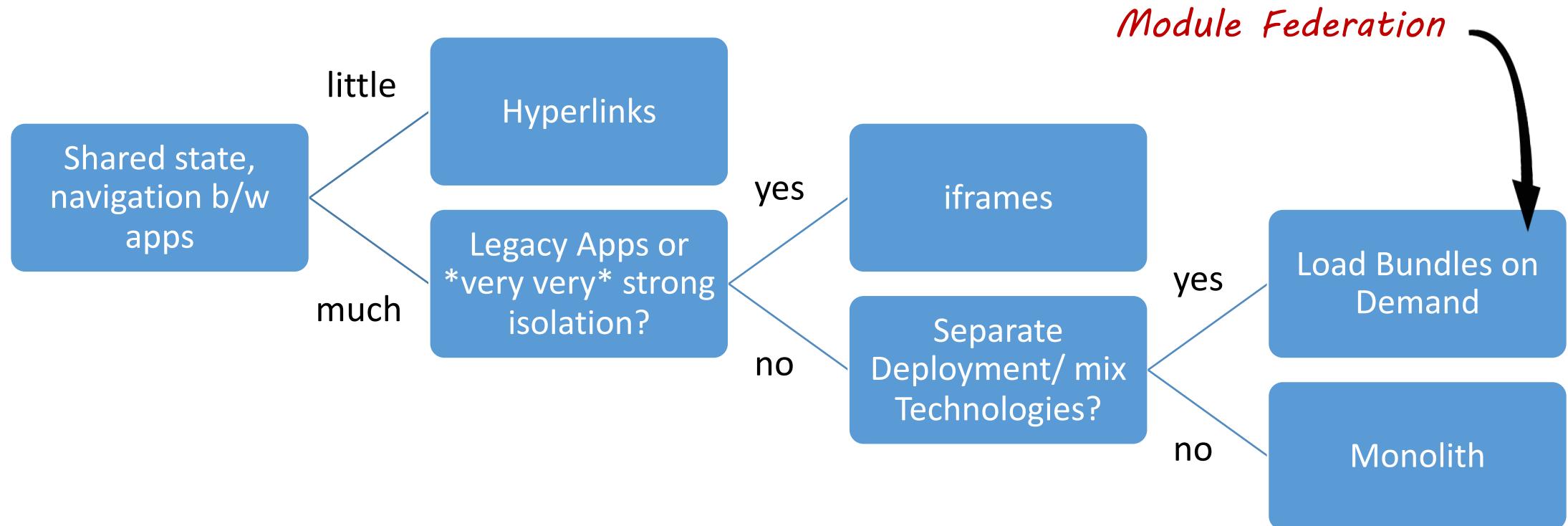
Check out our blog at

<https://www.angulararchitects.io/aktuelles/the-microfrontend-revolution-module-federation-in-webpack-5/>

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 laminate material. The doors are set into a wall that has a subtle texture and depth. The floor is made of dark, polished wooden planks that lead towards the center of the room.

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 your repo

# That's it for architecture

- Any questions left over? 😊