

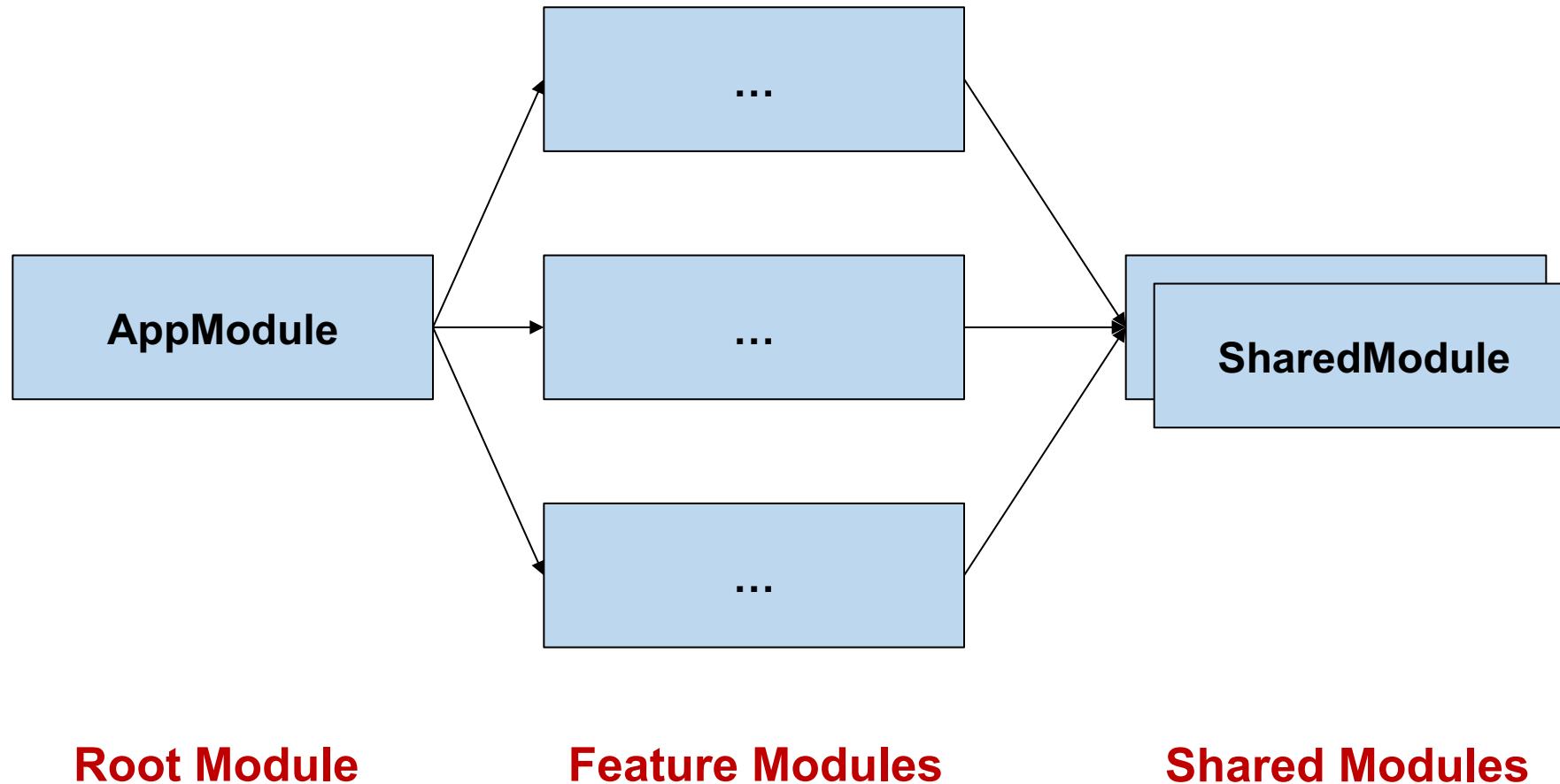


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Architecture for Angular Enterprise Applications

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 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

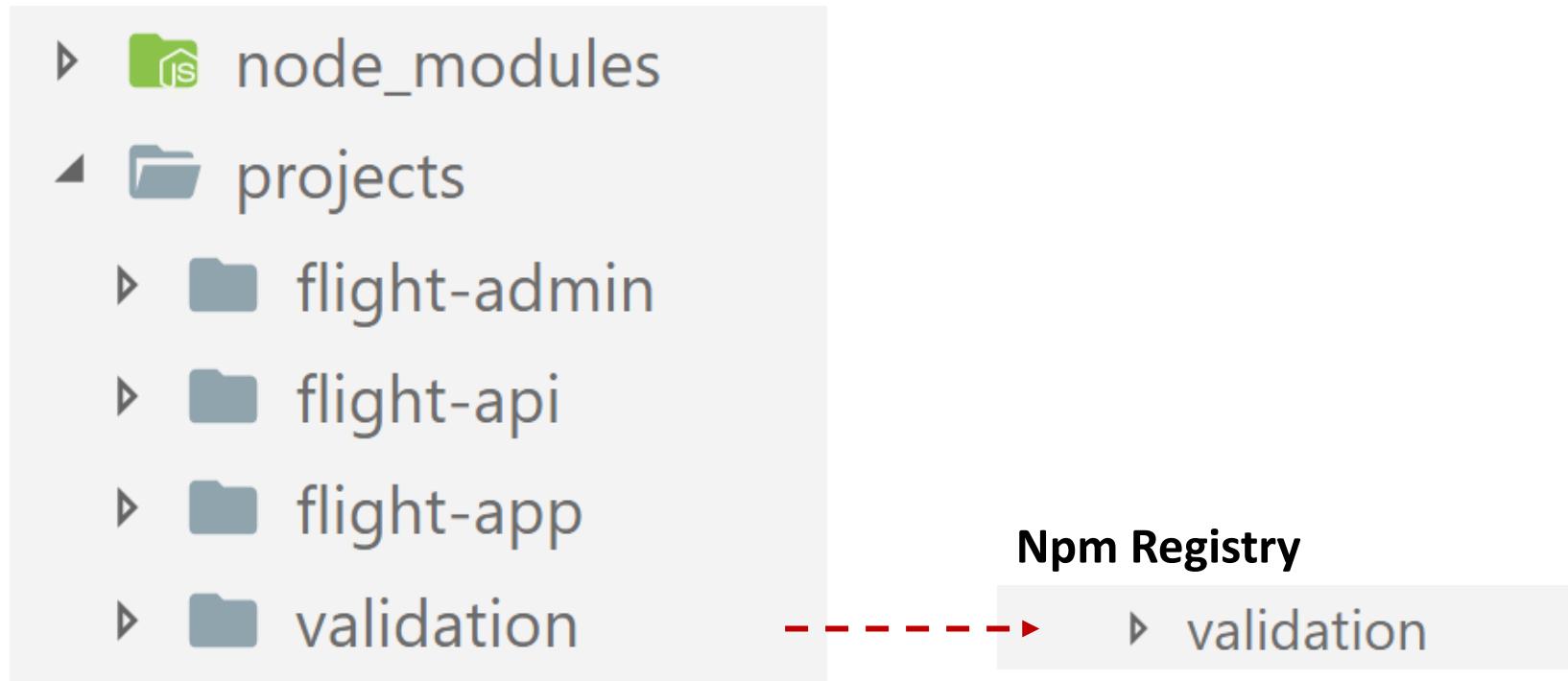
Project Monorepo

- Like Workspaces/Solutions in different IDEs

Company-wide Monorepo

- E. g. used at Google or Facebook

Moving back and forth



Tooling & Generator

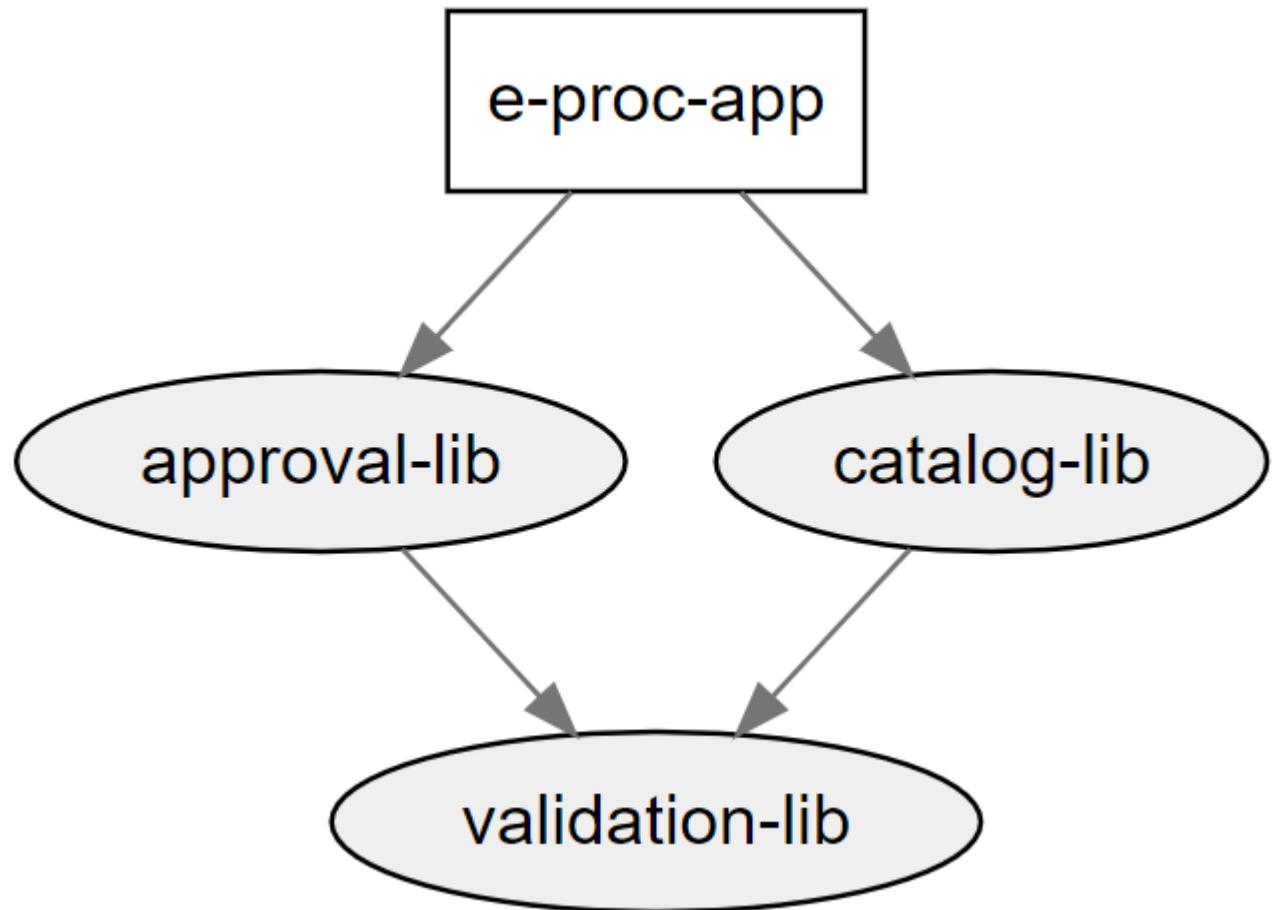
<https://nrwl.io/nx>



Nrwl Extensions for Angular

An open source toolkit for enterprise Angular applications.

Visualize Module Structure



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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 init nx-workspace 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**

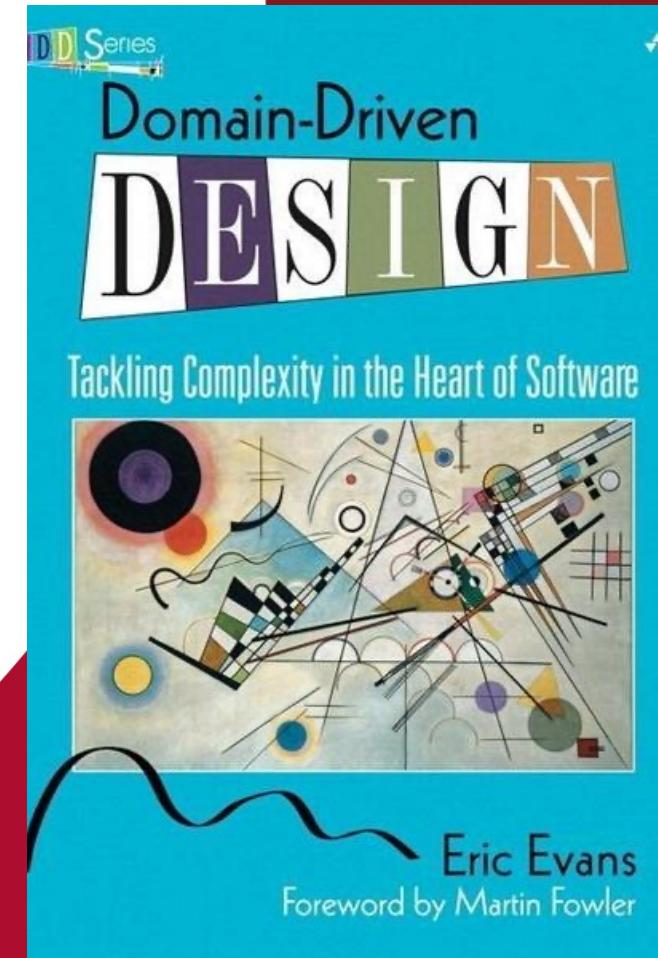
Tackling Complexity in the Heart of Software



Eric Evans
Foreword by Martin Fowler

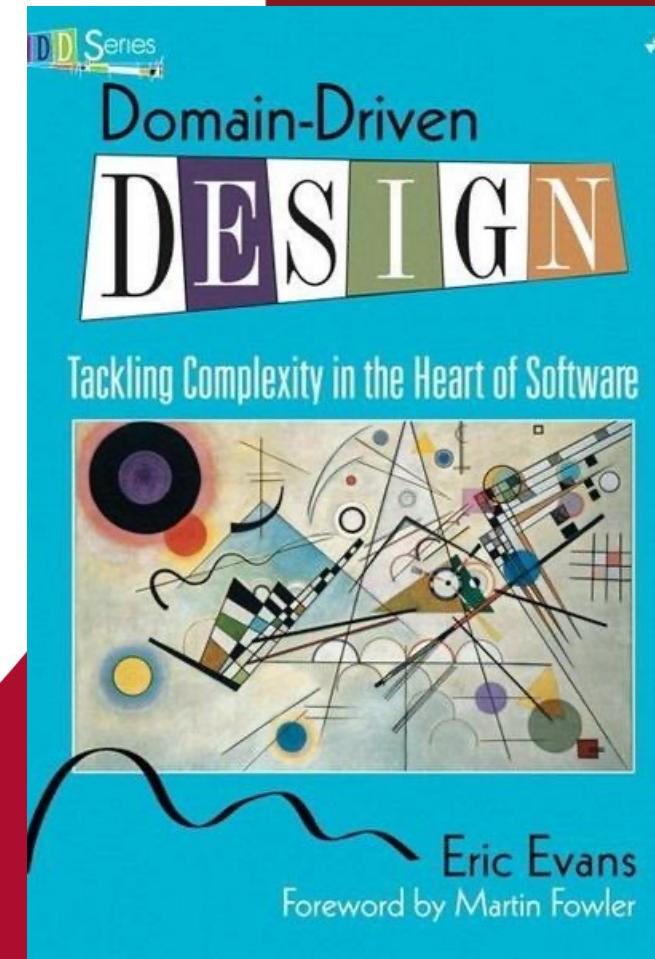
Methodology for
bridging the gap b/w
requirements and
architecture/ design

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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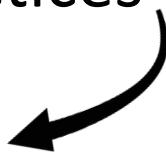
Domain Driven Design

Decomposing a System



Strategic Design

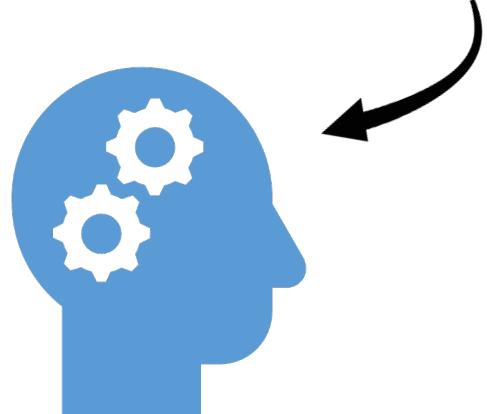
Design Patterns
& Practices



Tactical Design

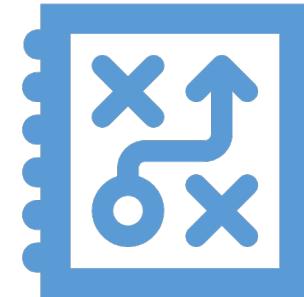
Domain Driven Design

Decomposing a System



Strategic Design

Design Patterns
& Practices



Tactical Design

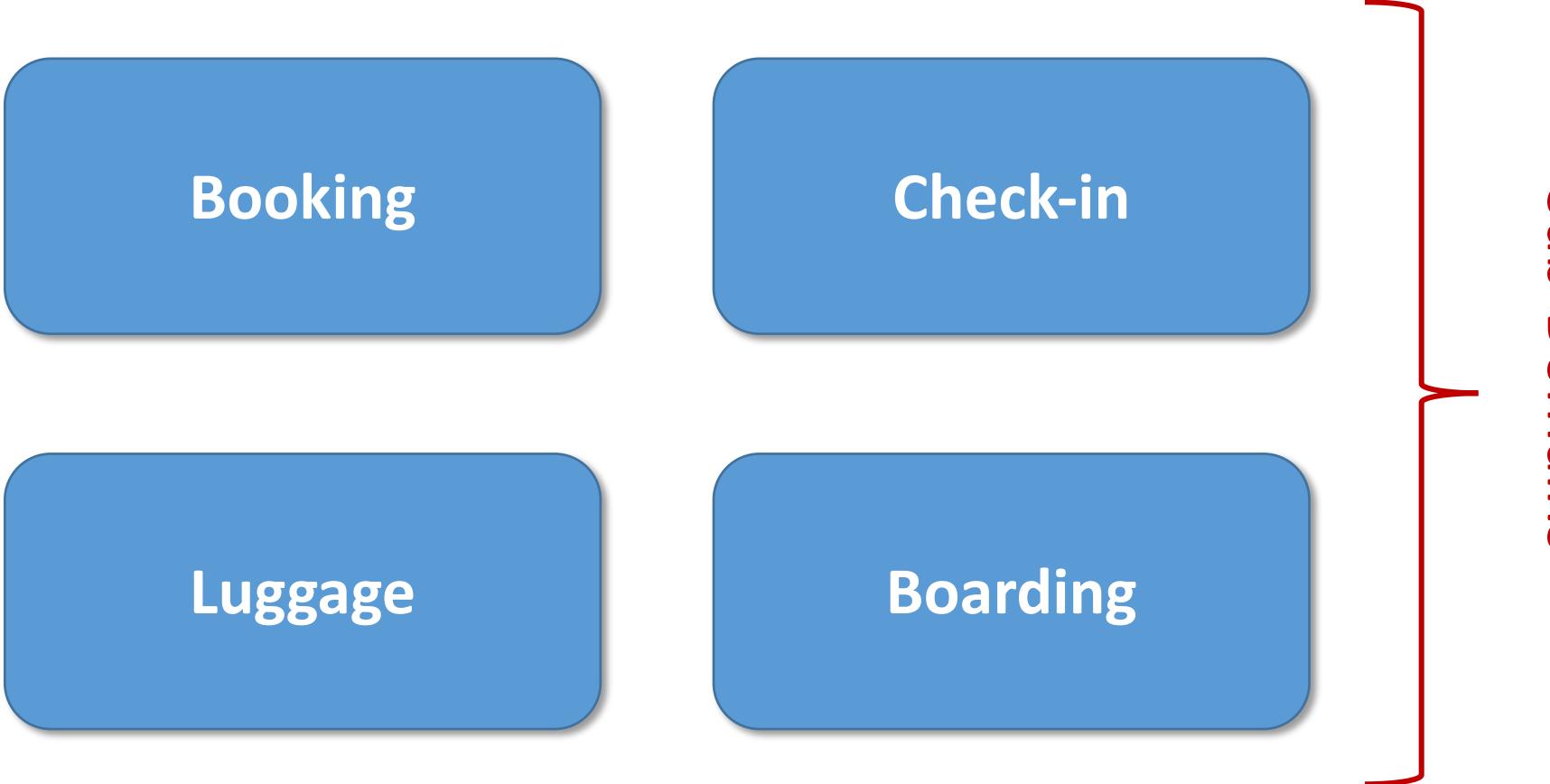


This is what Strategic DDD prevents

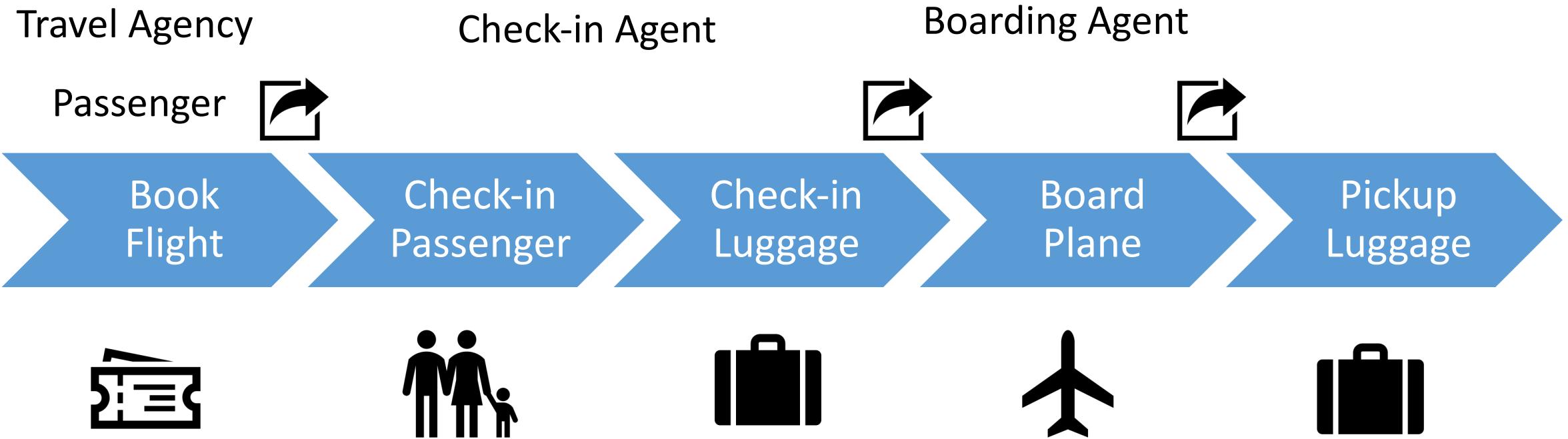
Example

Flight System

Example

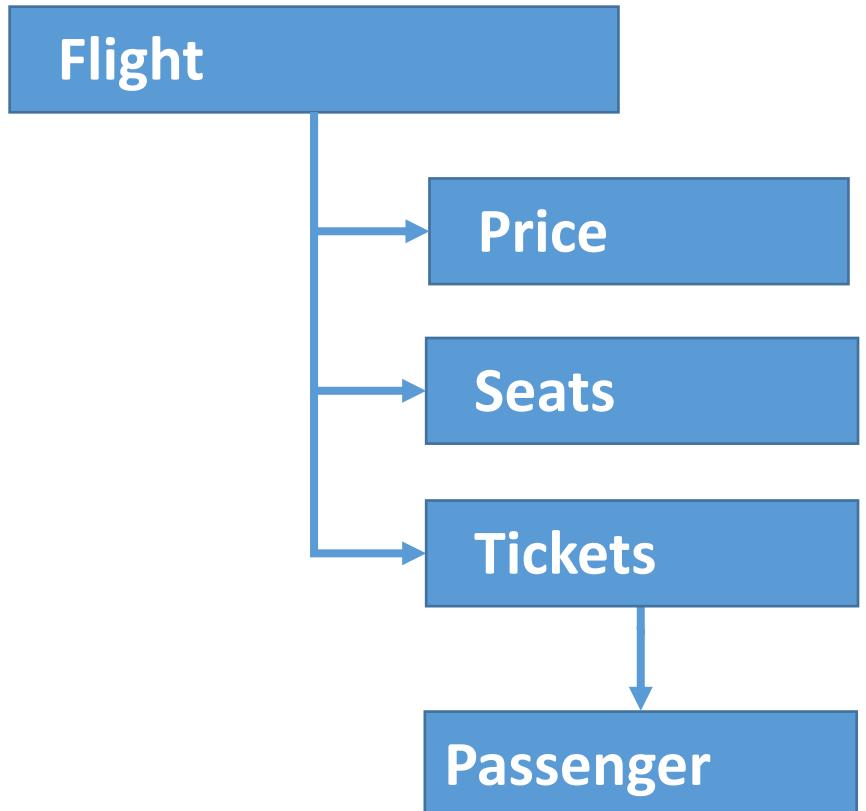


Finding Sub-Domains



Booking

Boarding



Bounded Context

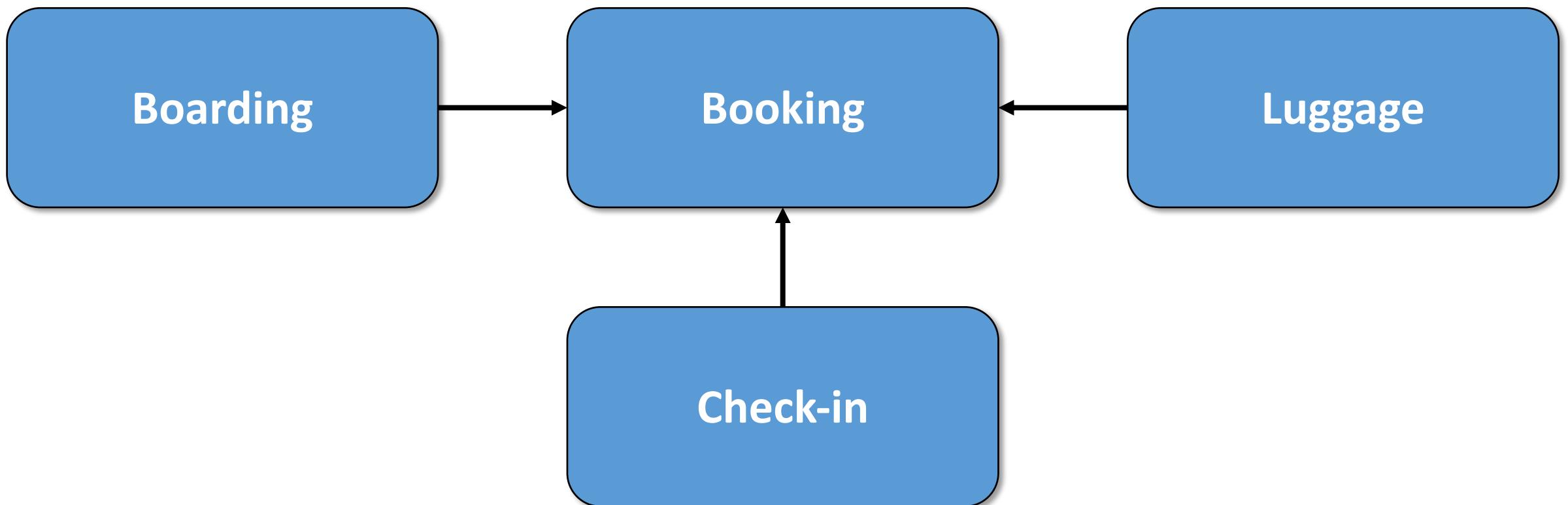


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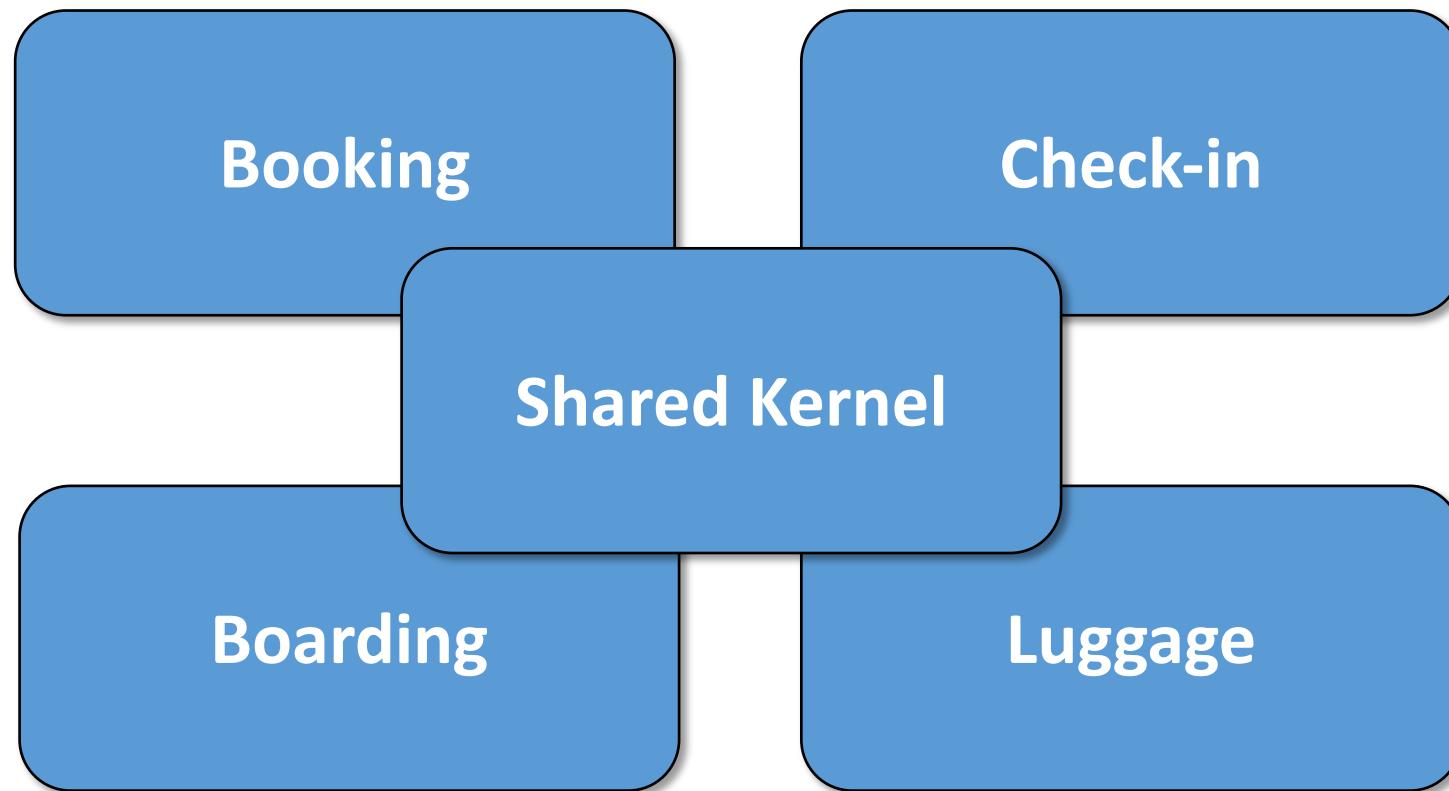
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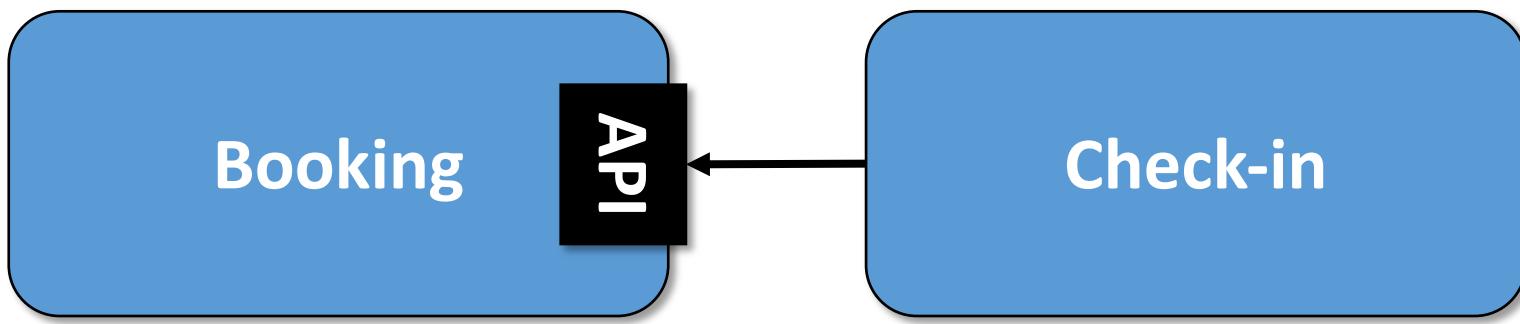
Context Map



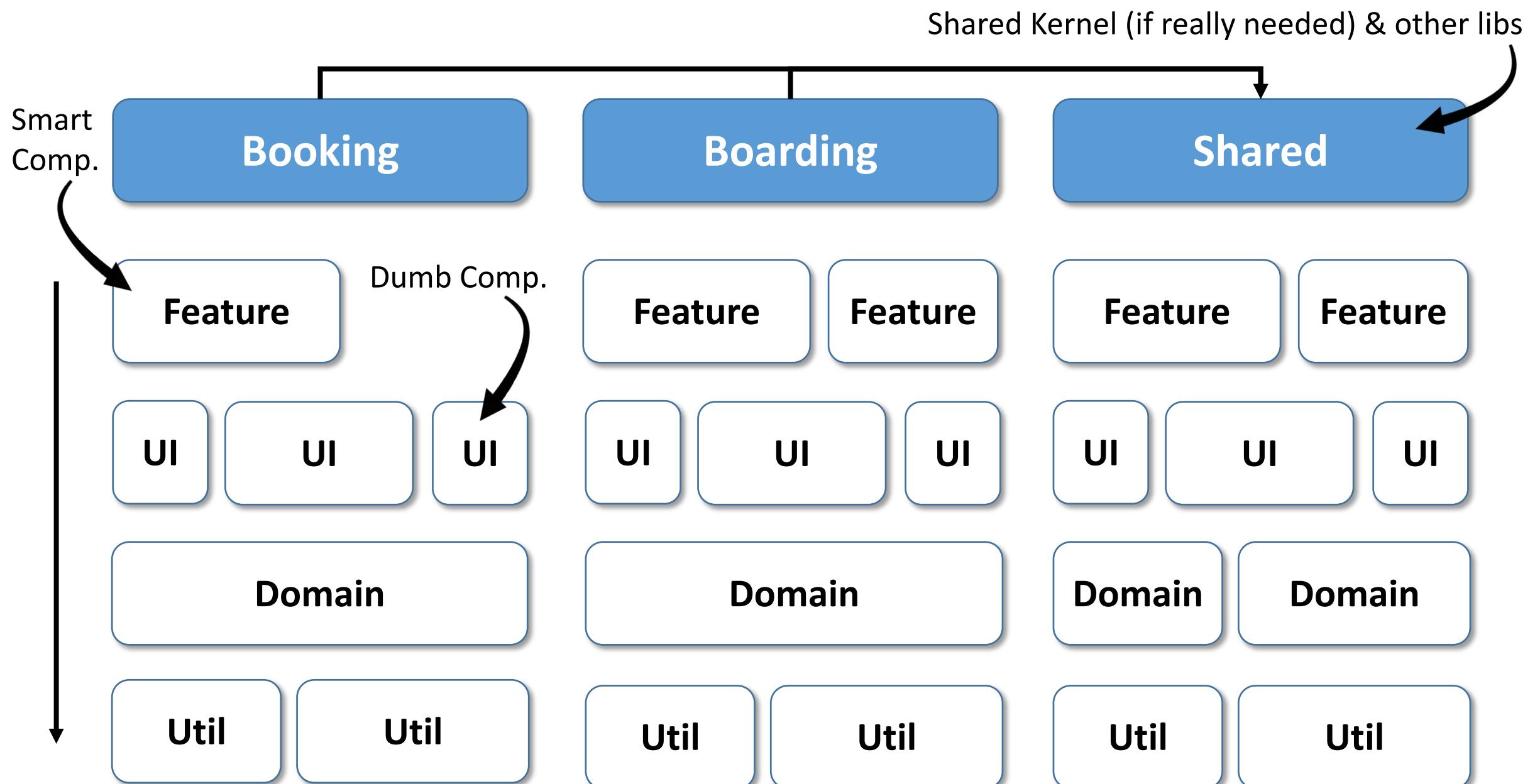
Context Map

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

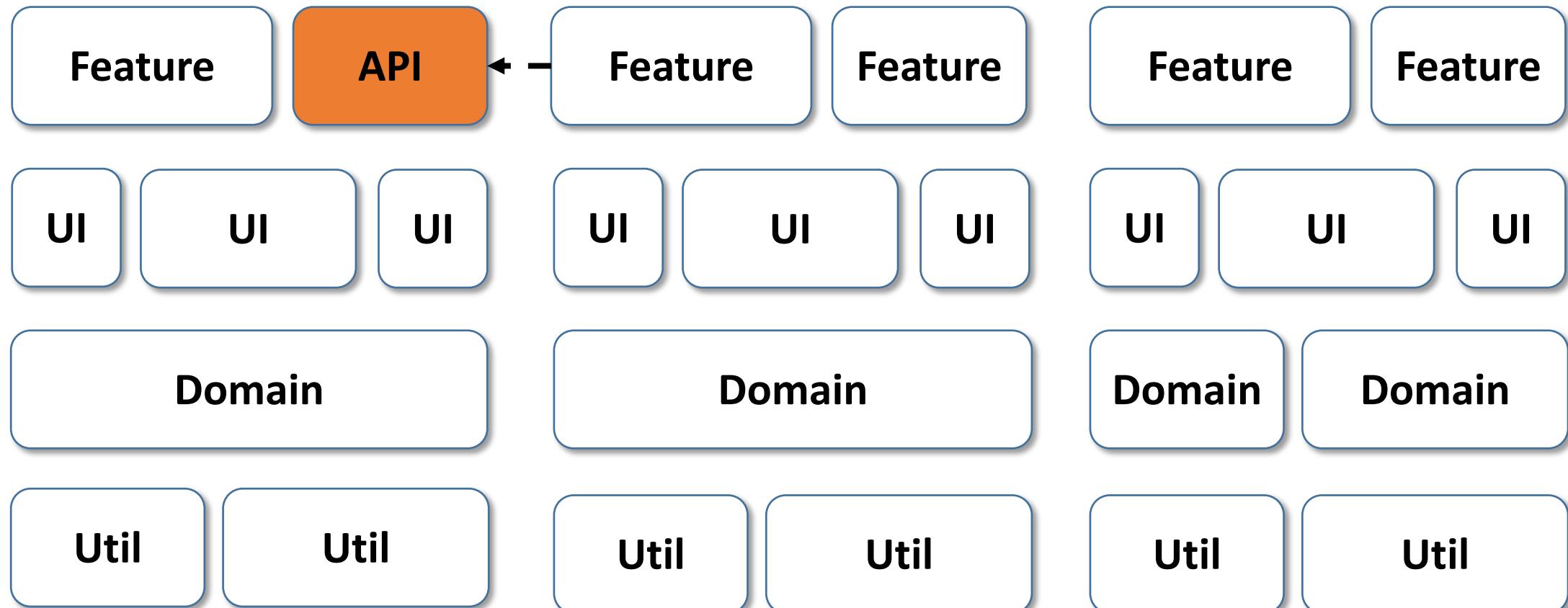
Domain-Driven DESIGN

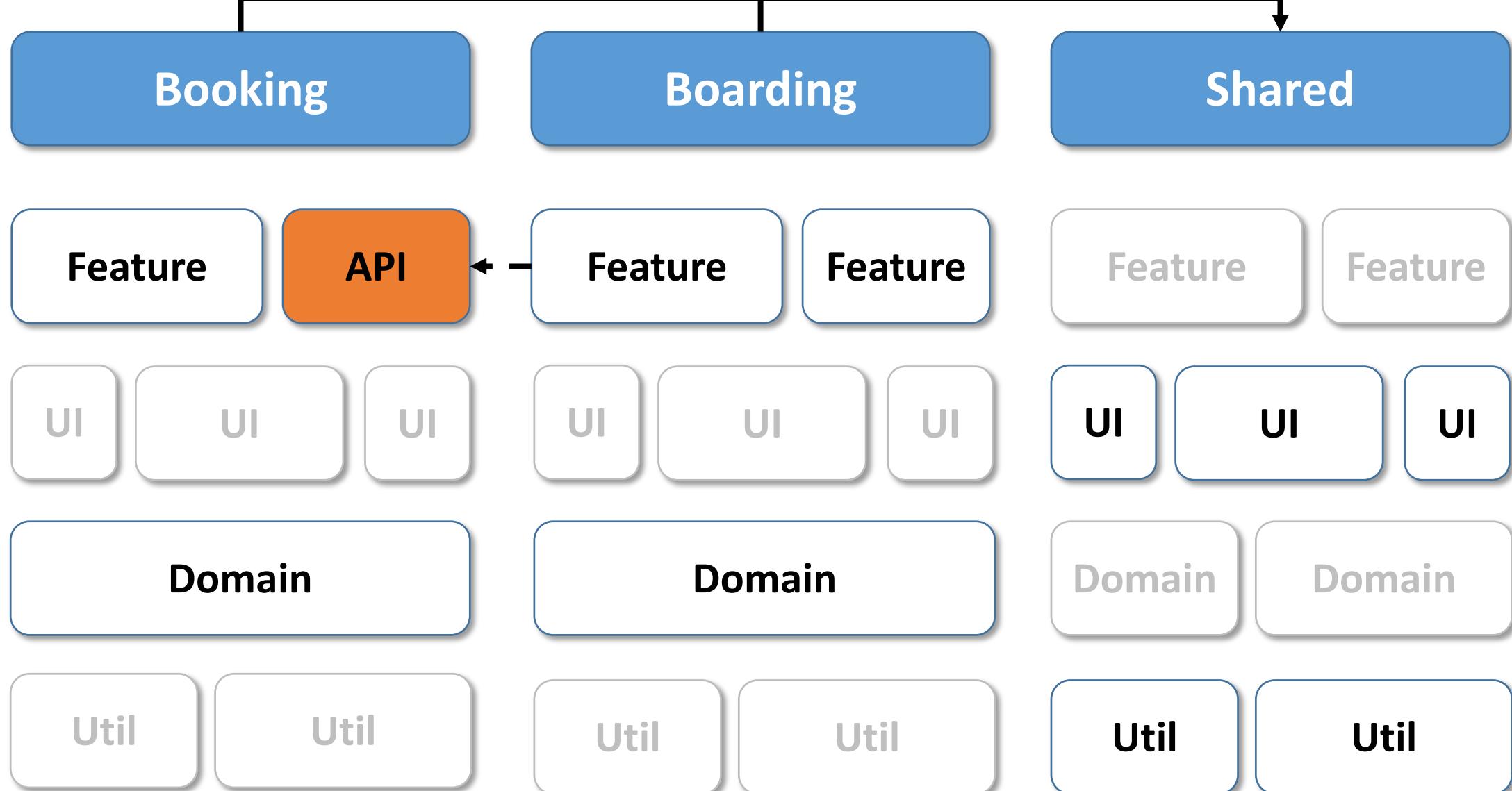
Tackling Complexity in the Heart of Software



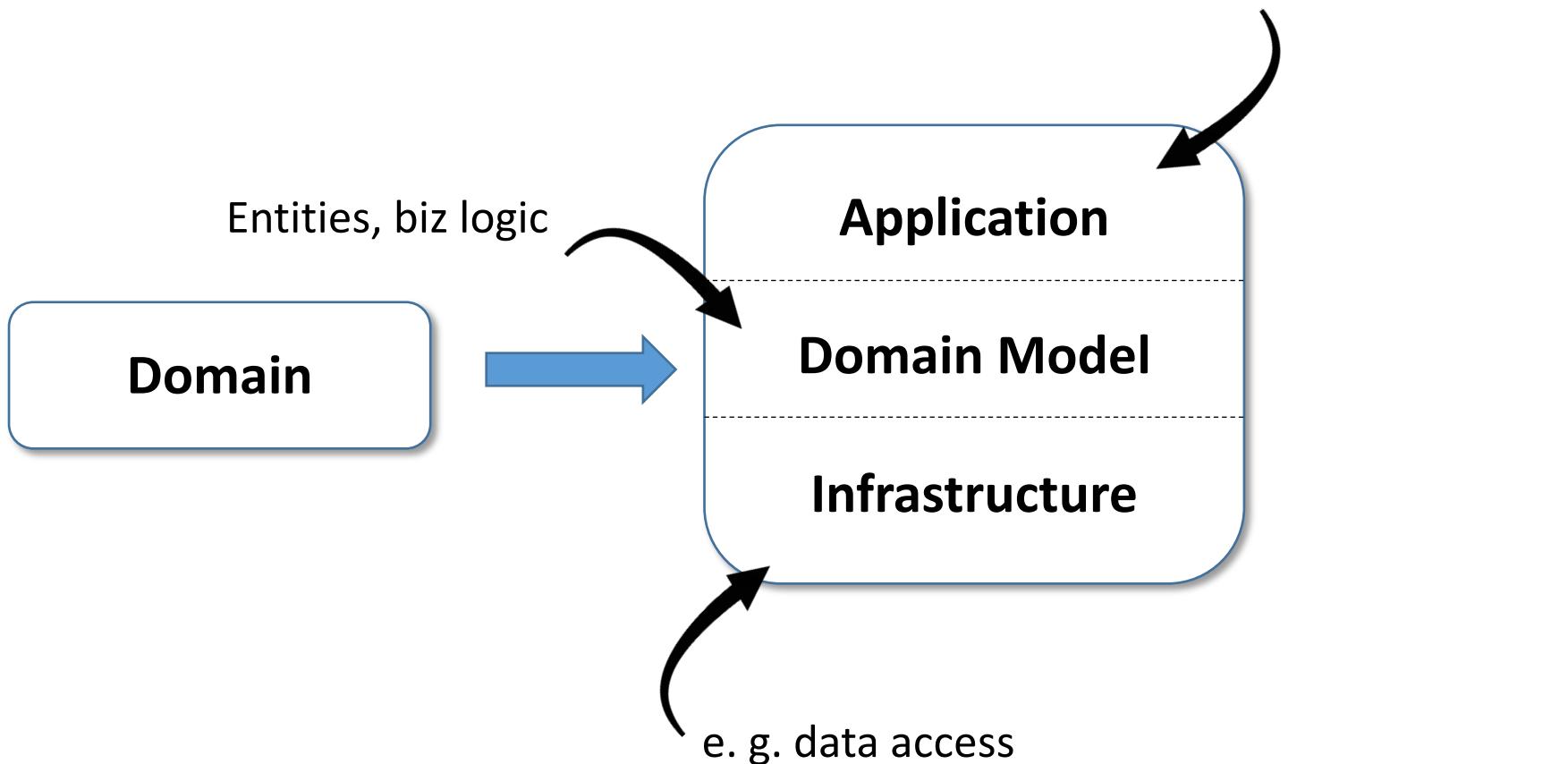
Eric Evans
Foreword by Martin Fowler

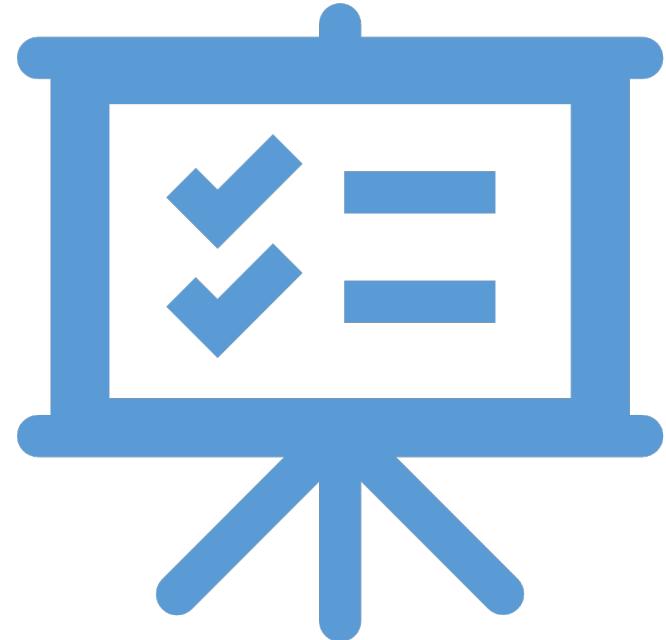
Lots of approaches
for cross-domain
communication and
more ...





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

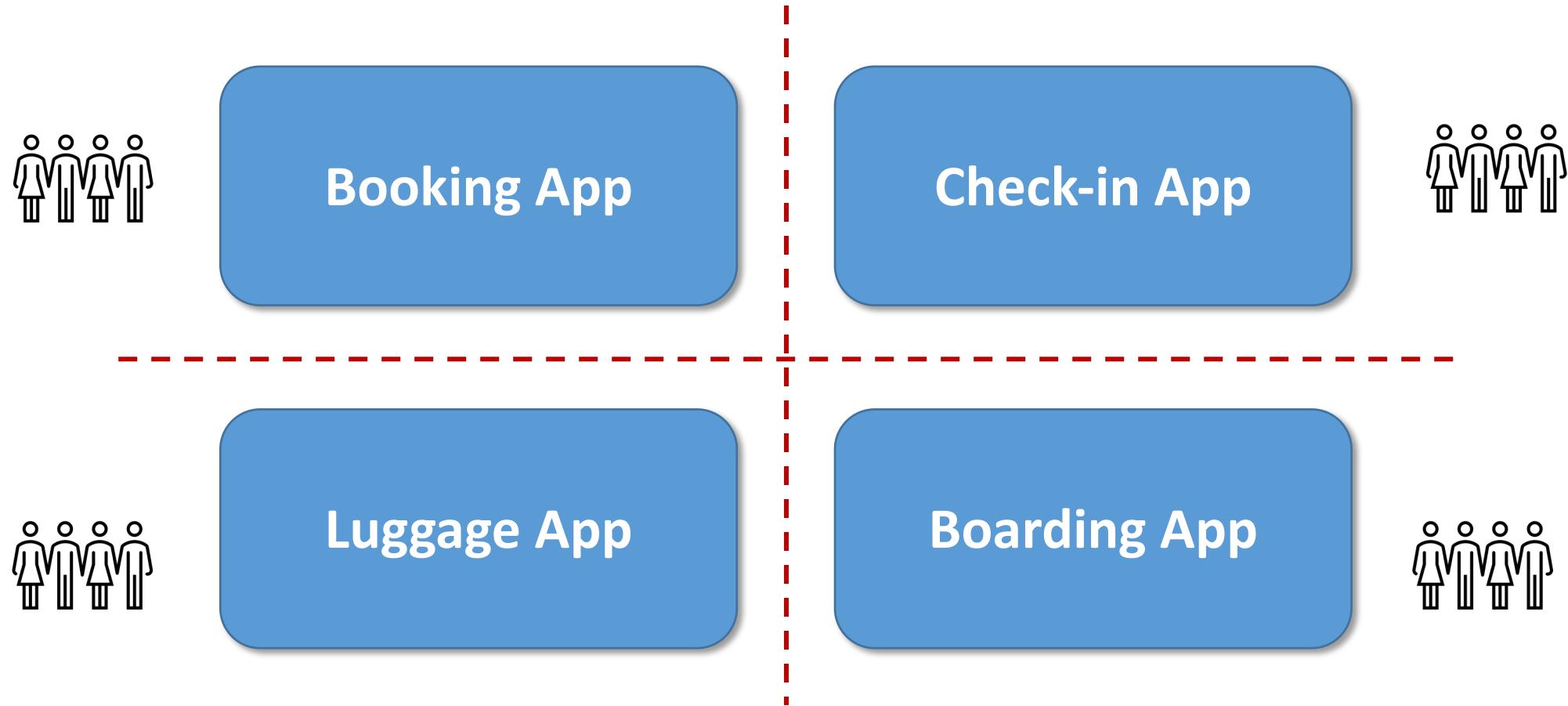
Nx DDD



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

...

...

...

...

...

...

...

...

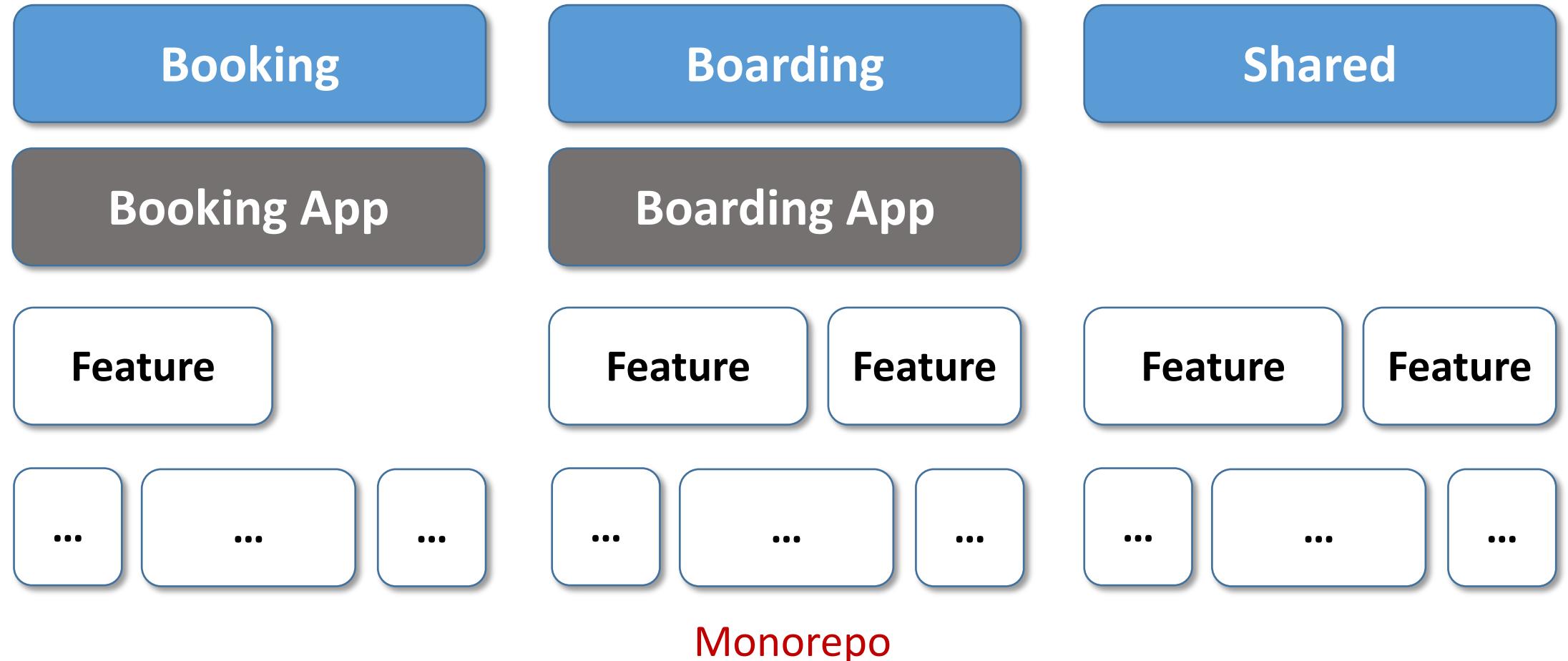
...



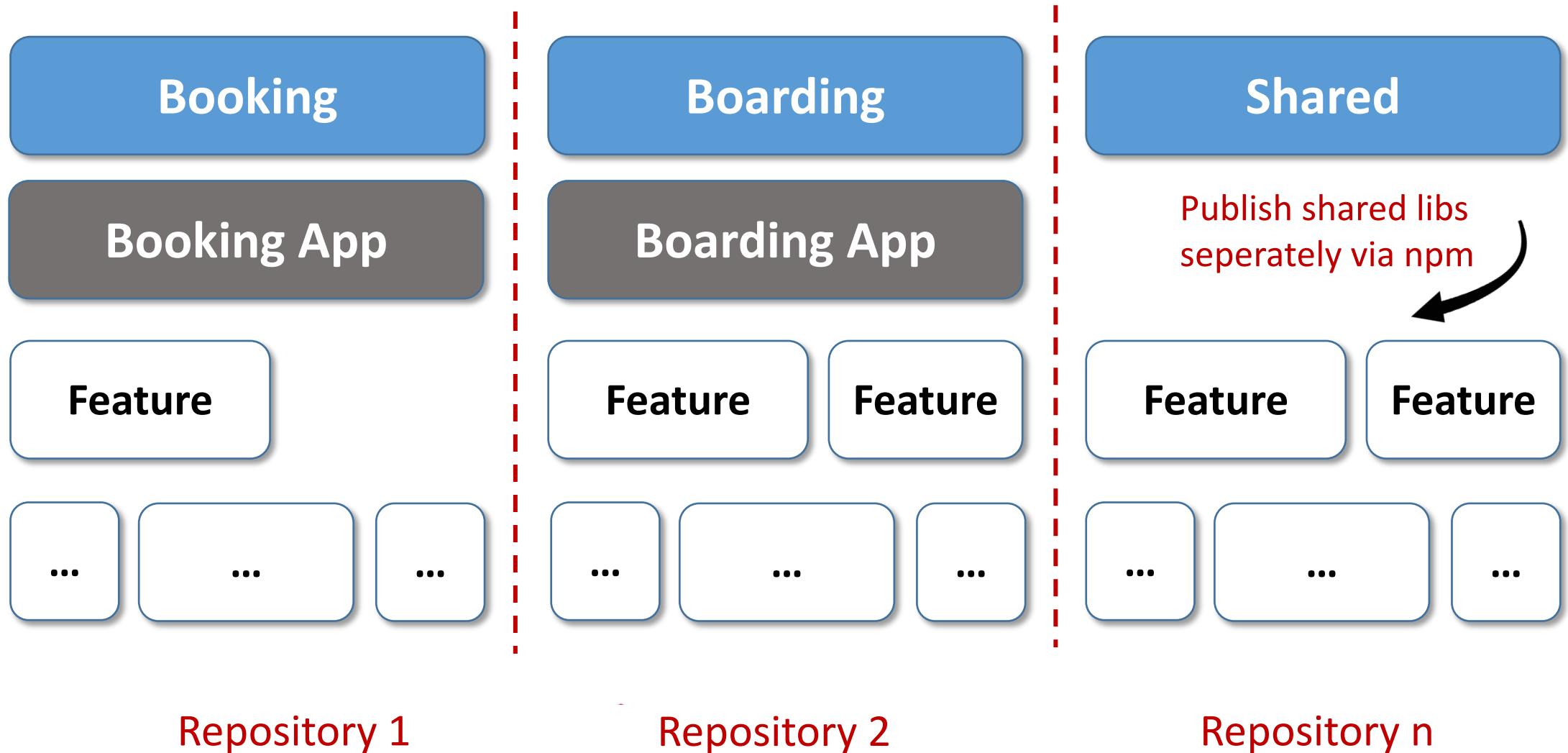
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Option 1: One App per Domain



Option 2: One Monorepo per Domain



Benefits

Autonomous Teams

Separate Development

Separate Deployment

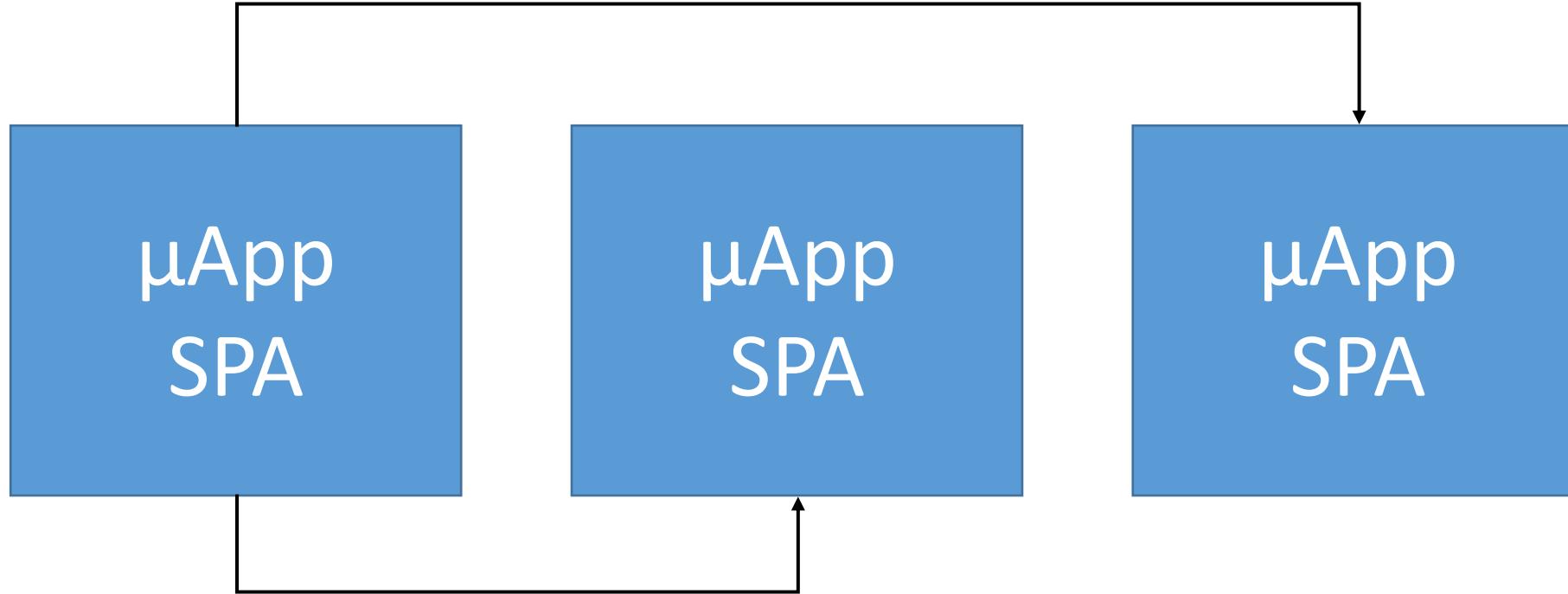
Own architecture decisions

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

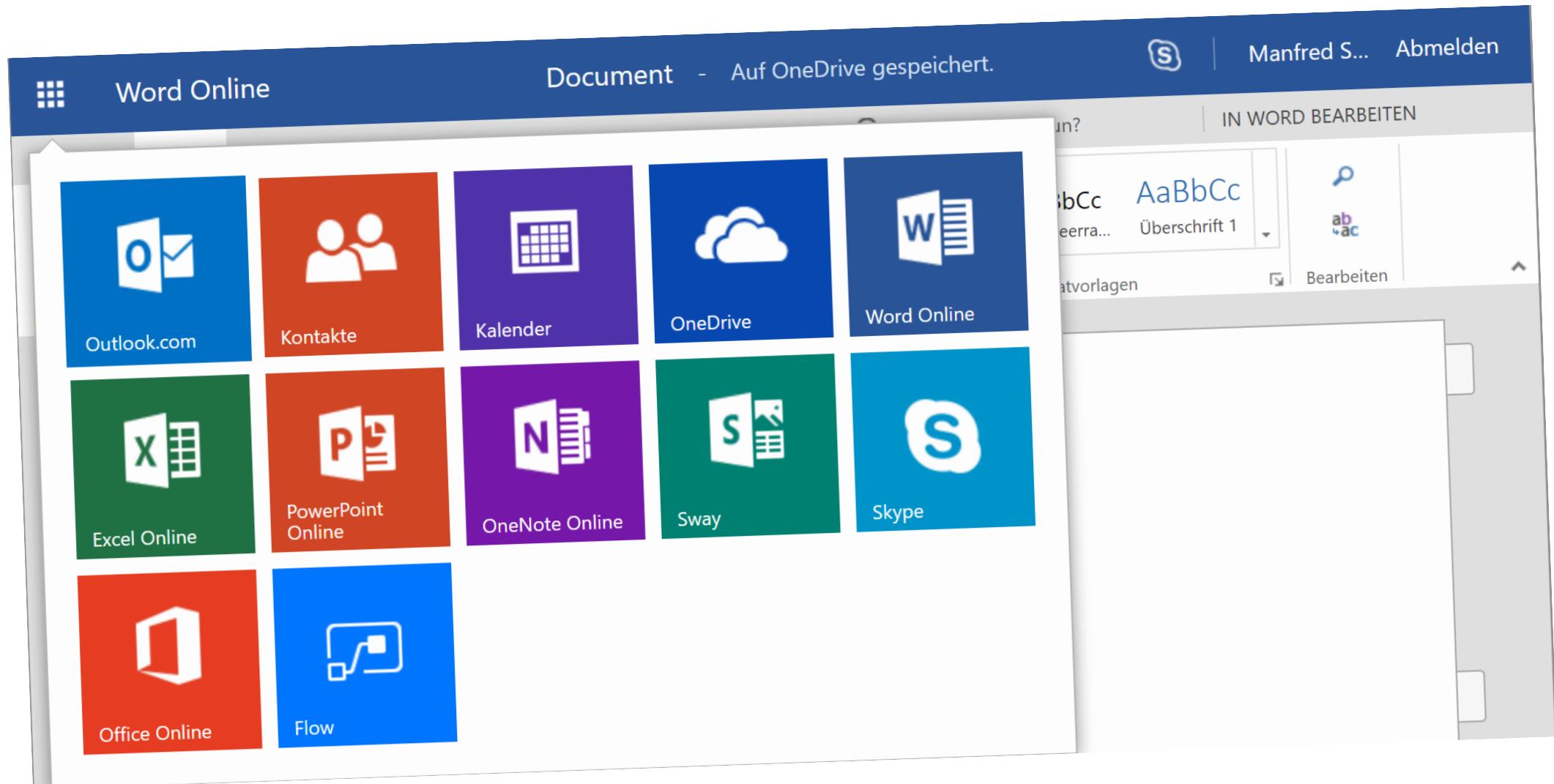
Calibri (Textkörper) 16 AaBbCc Standard AaBbCc Kein Leerra... Überschrift 1

Schriftart Absatz Formatvorlagen Bearbeiten

Hello World!

The screenshot shows the Microsoft Word Online interface. The ribbon at the top includes tabs for DATEI, START (selected), EINFÜGEN, SEITENLAYOUT, ÜBERPRÜFEN, and ANSICHT. A search bar says "Was möchten Sie tun?" and a link "IN WORD BEARBEITEN" is visible. The "START" tab has sections for "Schriftart" (Font) and "Absatz" (Paragraph). The "Formatvorlagen" section shows "Standard" selected. The main content area displays the text "Hello World!". On the left, there are standard file navigation icons like back and forward, and links for "Einfügen" and "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>
```

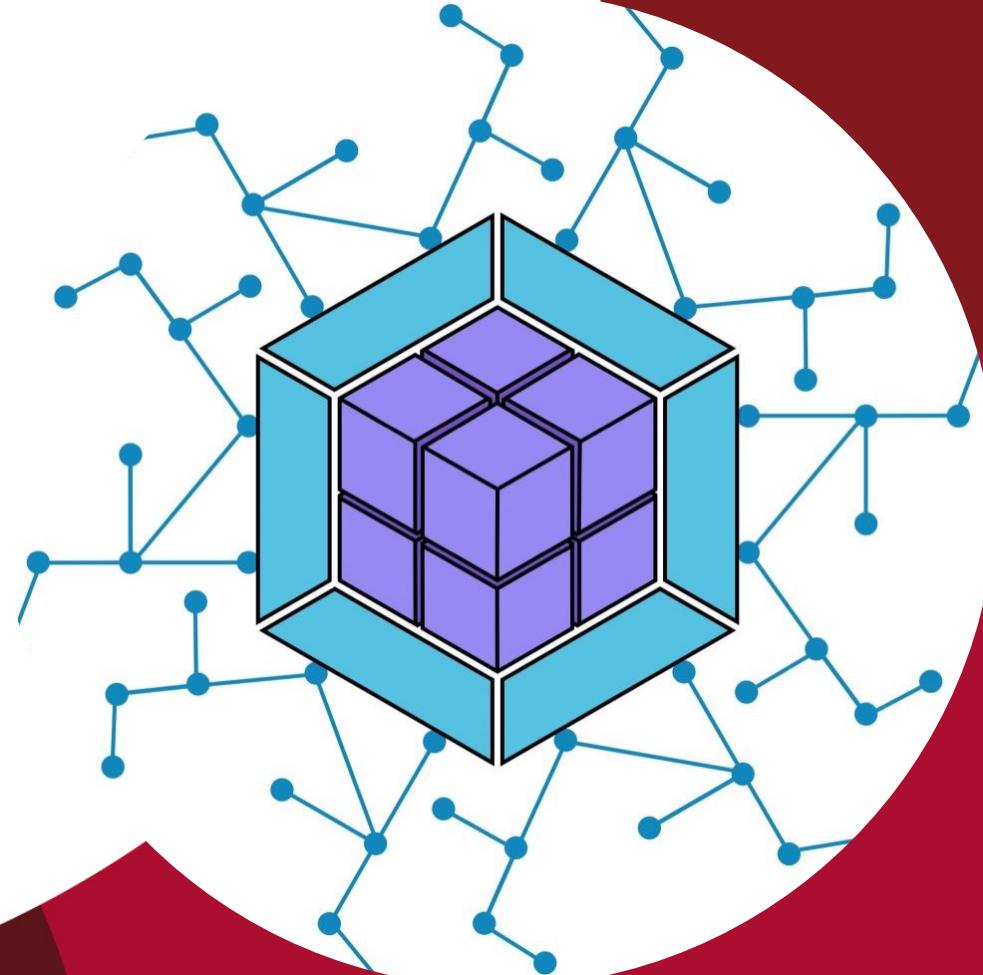
```
<micro-app></micro-app>
```

Loading Separately Compiled SPAs

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

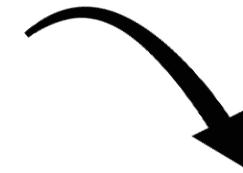
const clientA = document.createElement('client-a');
clientA['visible'] = true;
document.body.appendChild(clientA);
```

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

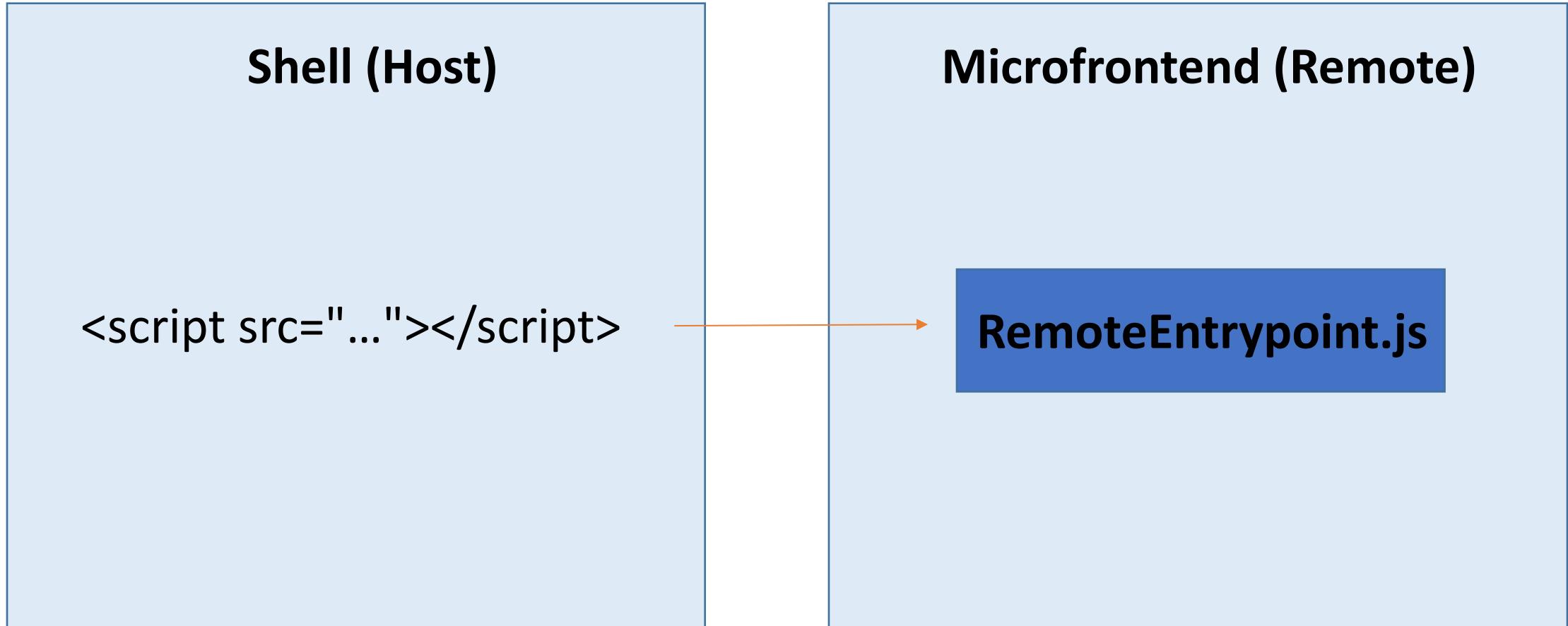
Shell (Host)

```
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?



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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 

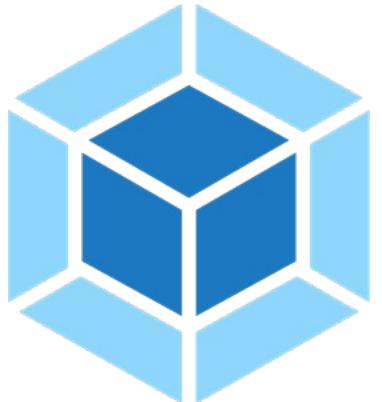
Relaxing Version Requirements

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

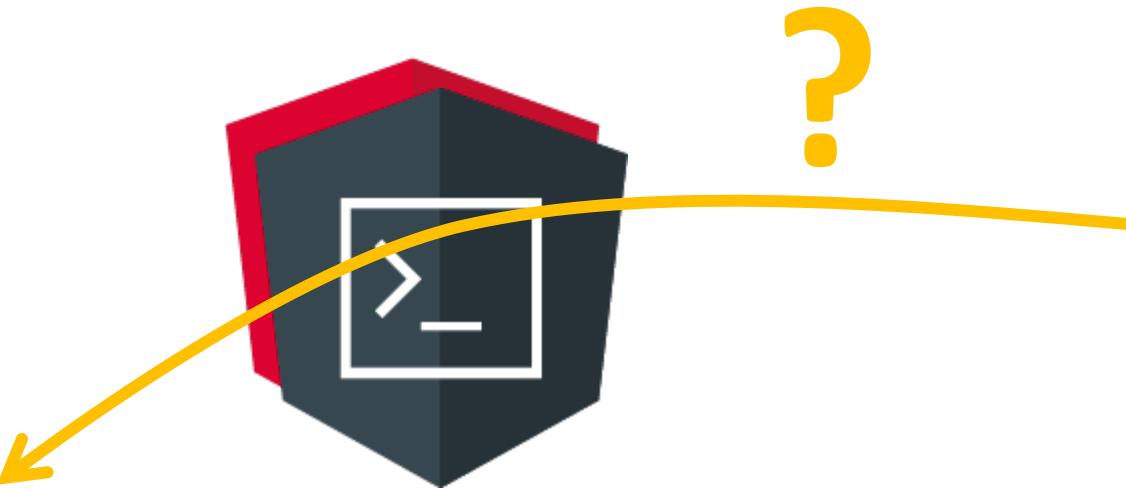
Federated Angular: Angular, CLI, & Module Federation



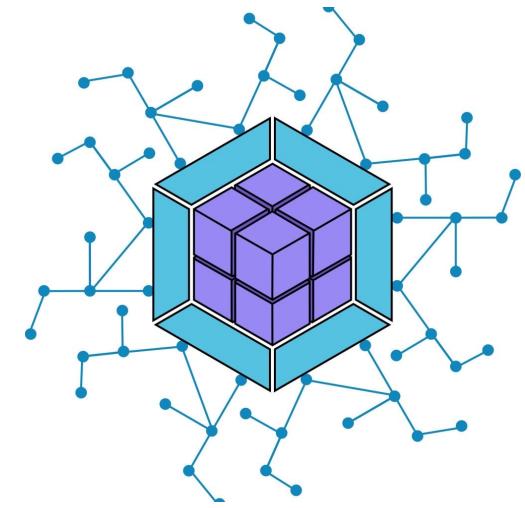
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webpack

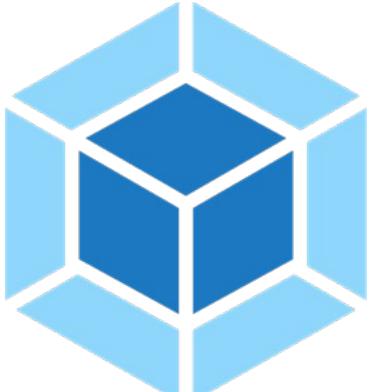


Angular CLI



Module Federation
Configuration

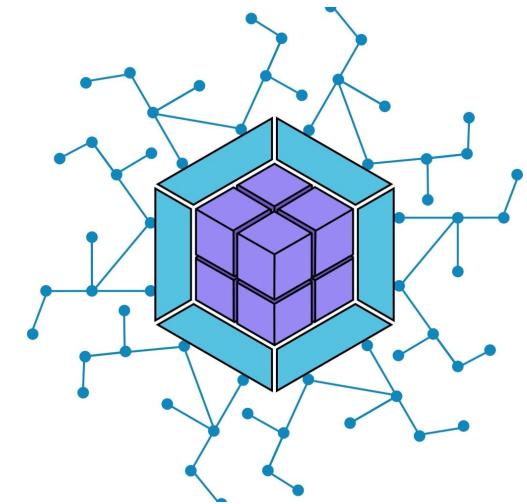
Custom Builder



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.

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



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');
```

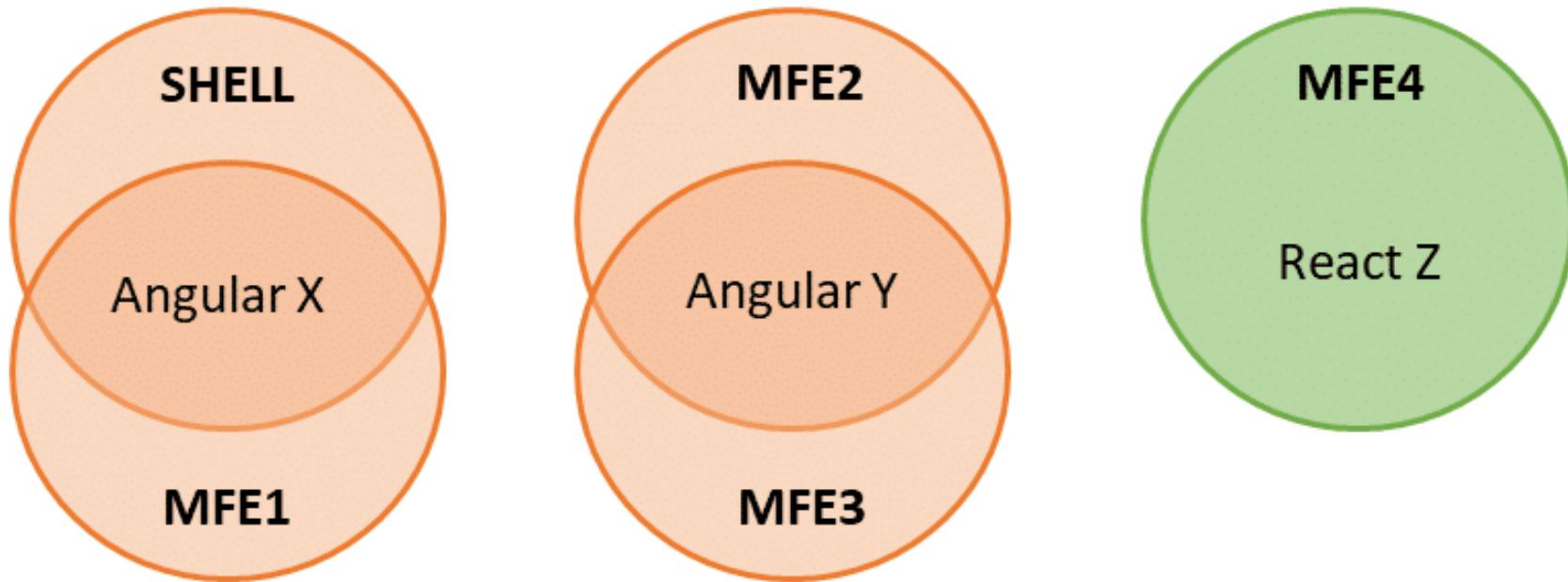
Routing to Another SPA?

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

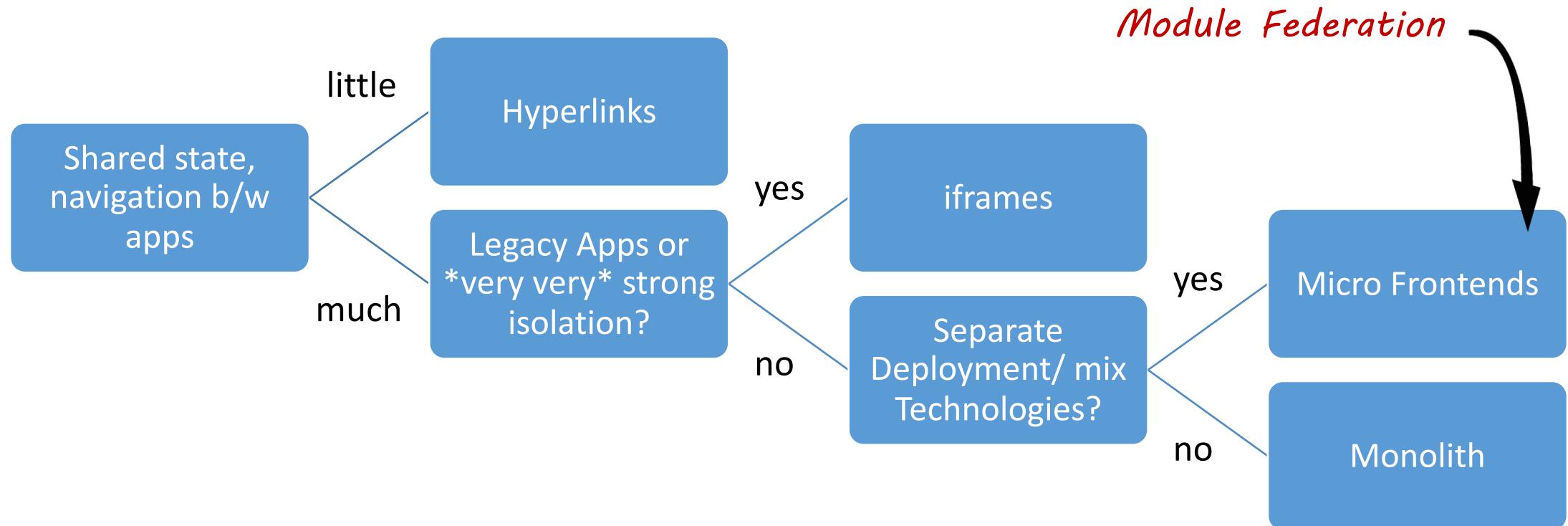
 Explore BETA

 1 Dependency

The background of the image is a dark, atmospheric room. The walls are covered in a repeating pattern of dark, ornate, floral or damask motifs. In the center of the room, there is a row of eight doors, all of which are closed except for the first one on the left. The doors are a light grey color and have simple silver door handles. 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? 😊