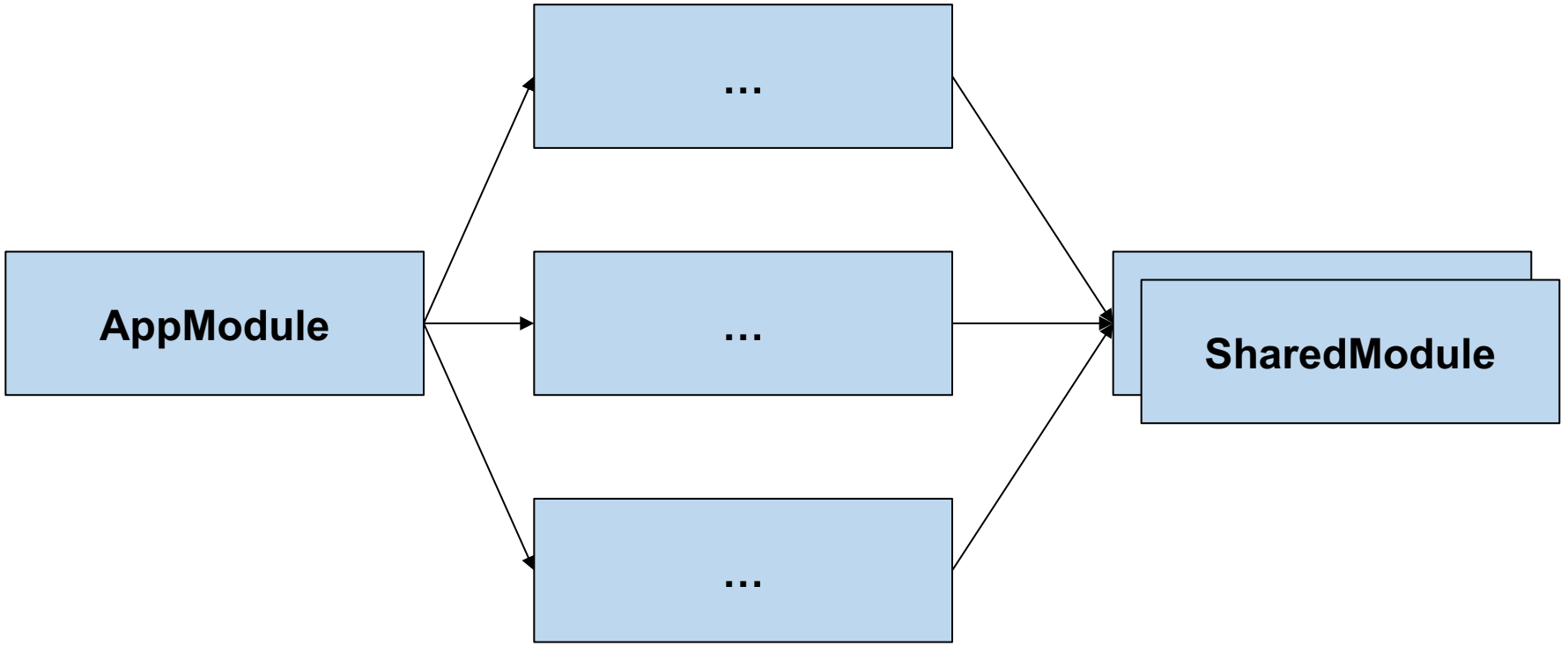
ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

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

ANGULARarchitects.io

Typical Module Structure



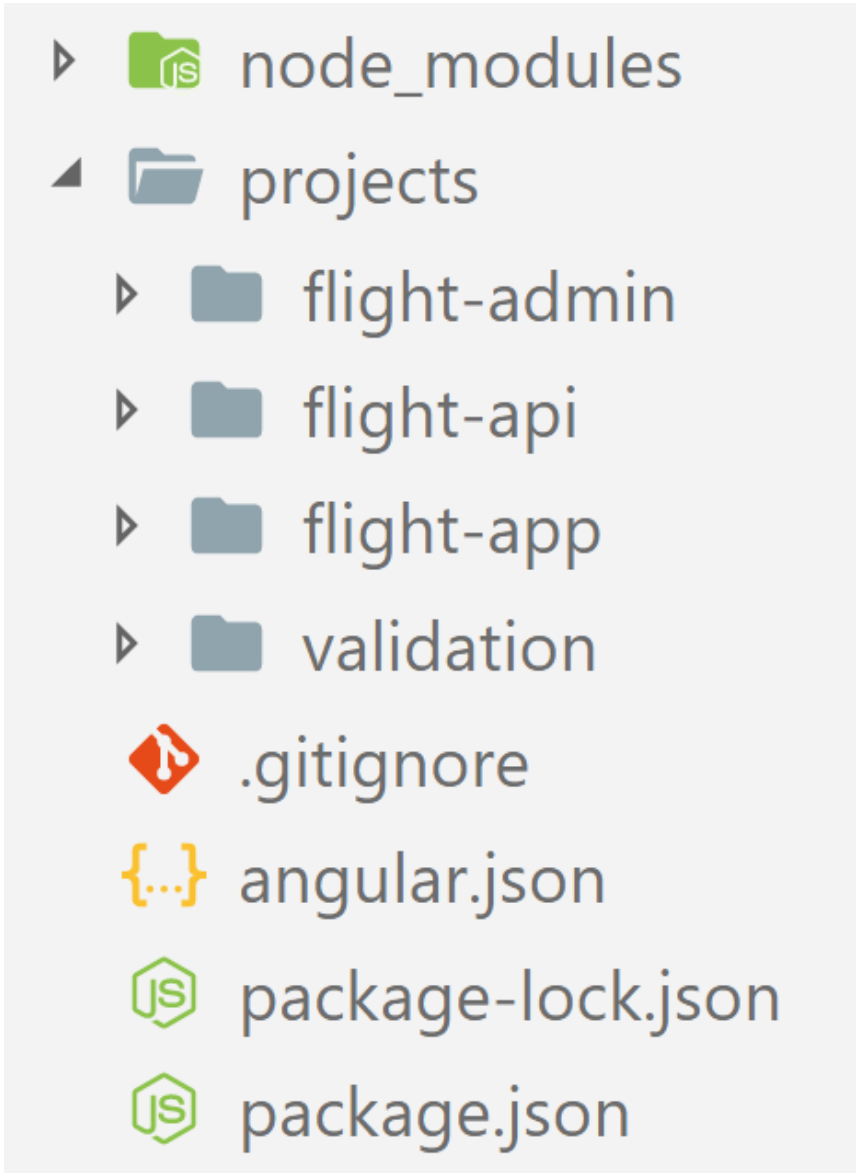
Root Module **Feature Modules** **Shared Modules**

Outline

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


Monorepos

Monorepo Structure



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

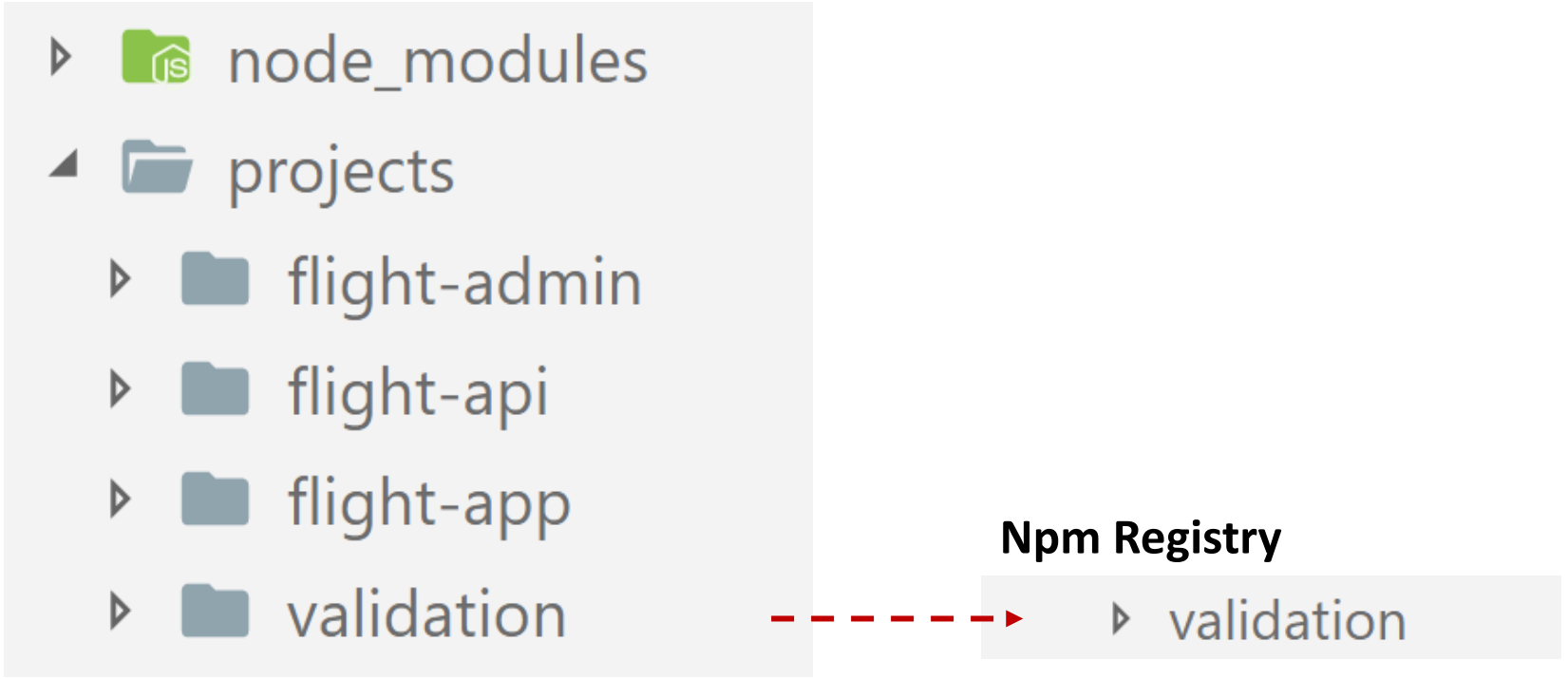
Project Monorepo

- Like Workspaces/Solutions in different IDEs

Company-wide Monorepo

- E. g. used at Google or Facebook

Moving back and forth



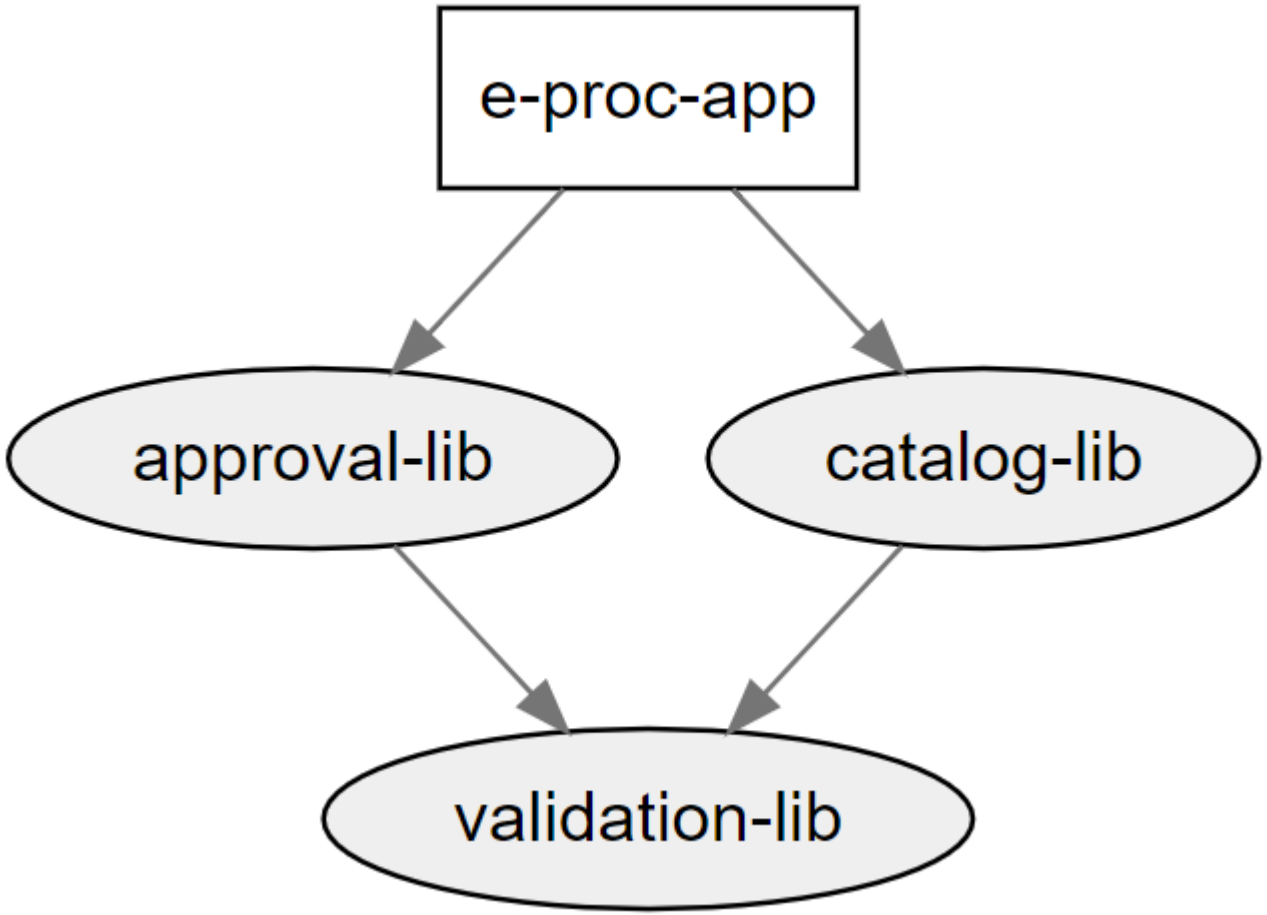
Tooling & Generator

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

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

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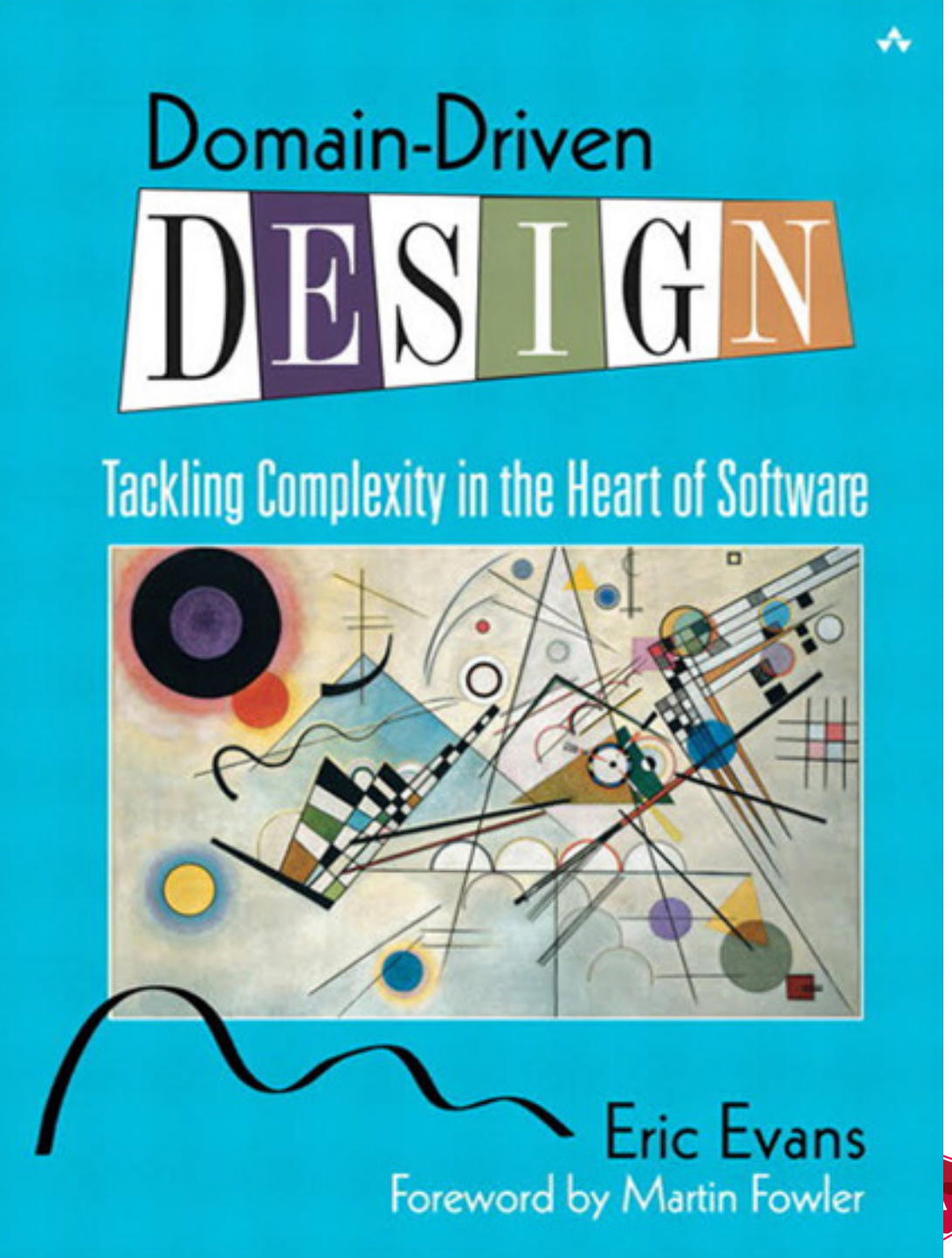
ARCHITECT

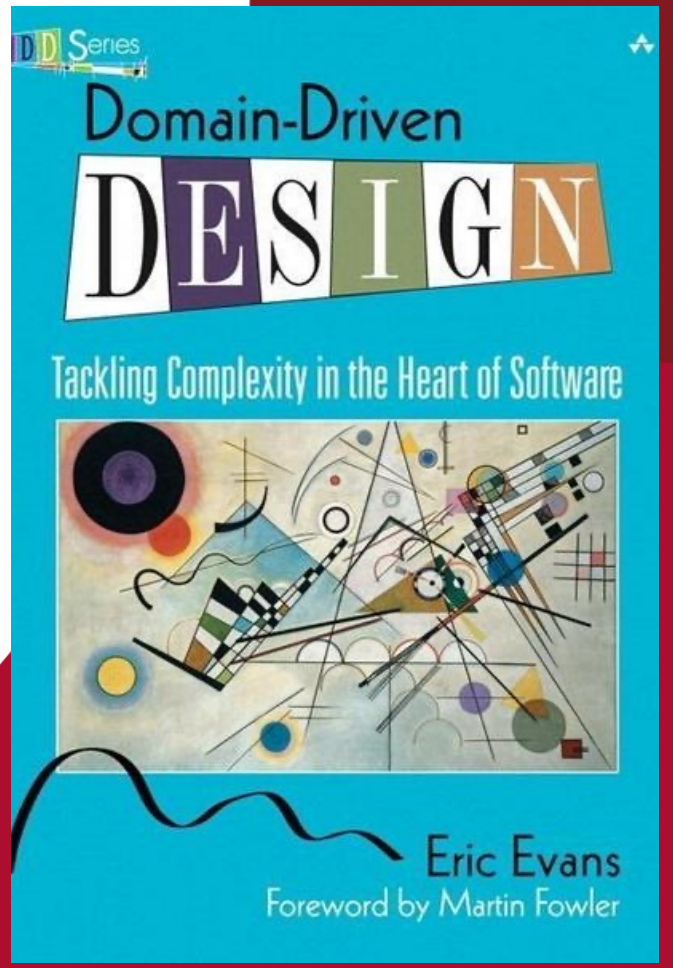
DDD

in a nutshell



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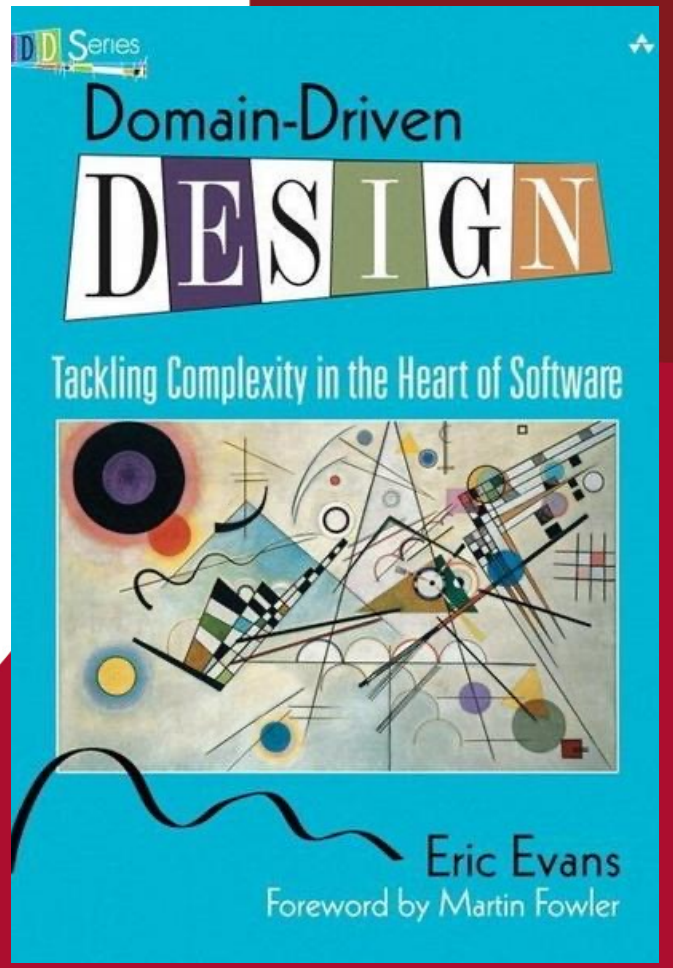
How to create **sustainable** frontend architectures with **ideas from DDD**?



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Domain Driven Design

Decomposing a System

Design Patterns
& Practices

Strategic Design

Tactical Design

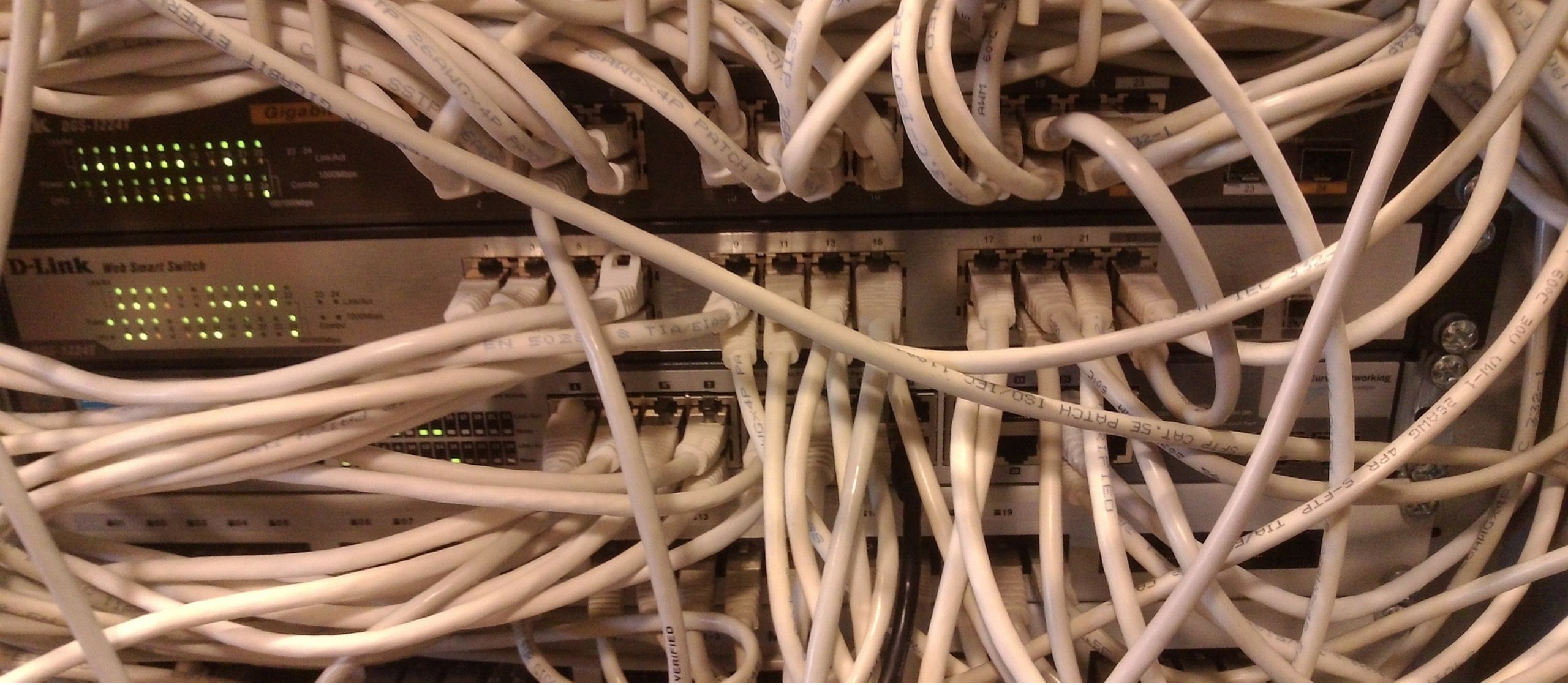
Domain Driven Design

Decomposing a System

Design Patterns
& Practices

Strategic Design

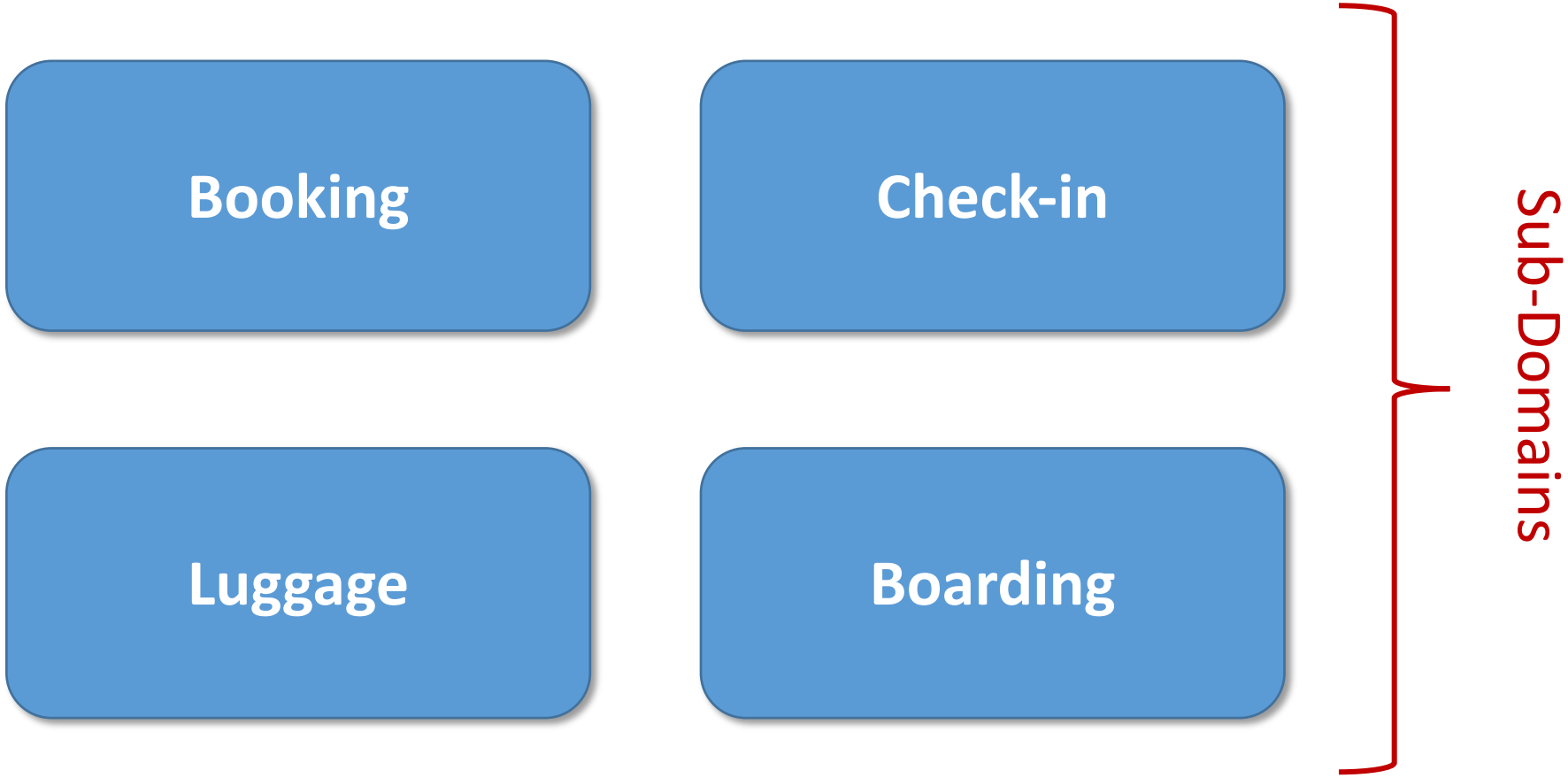
Tactical Design



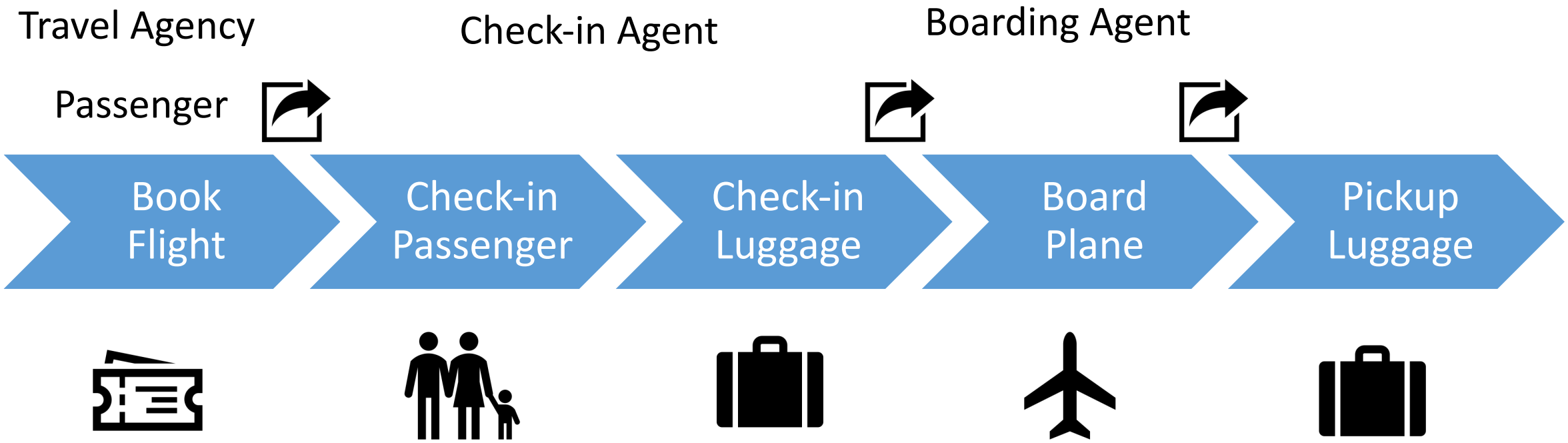
This is what Strategic DDD prevents

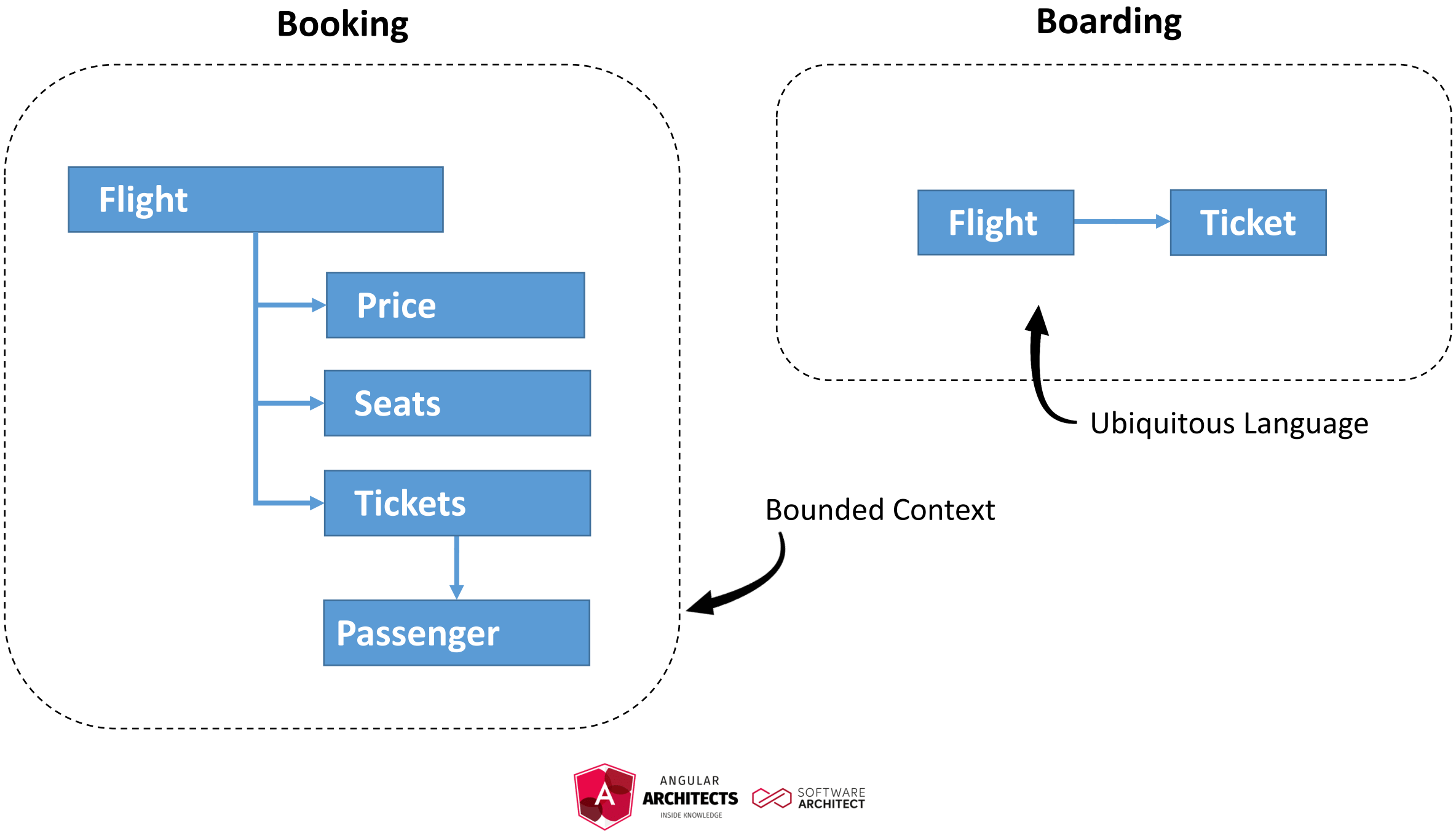
Example

Example

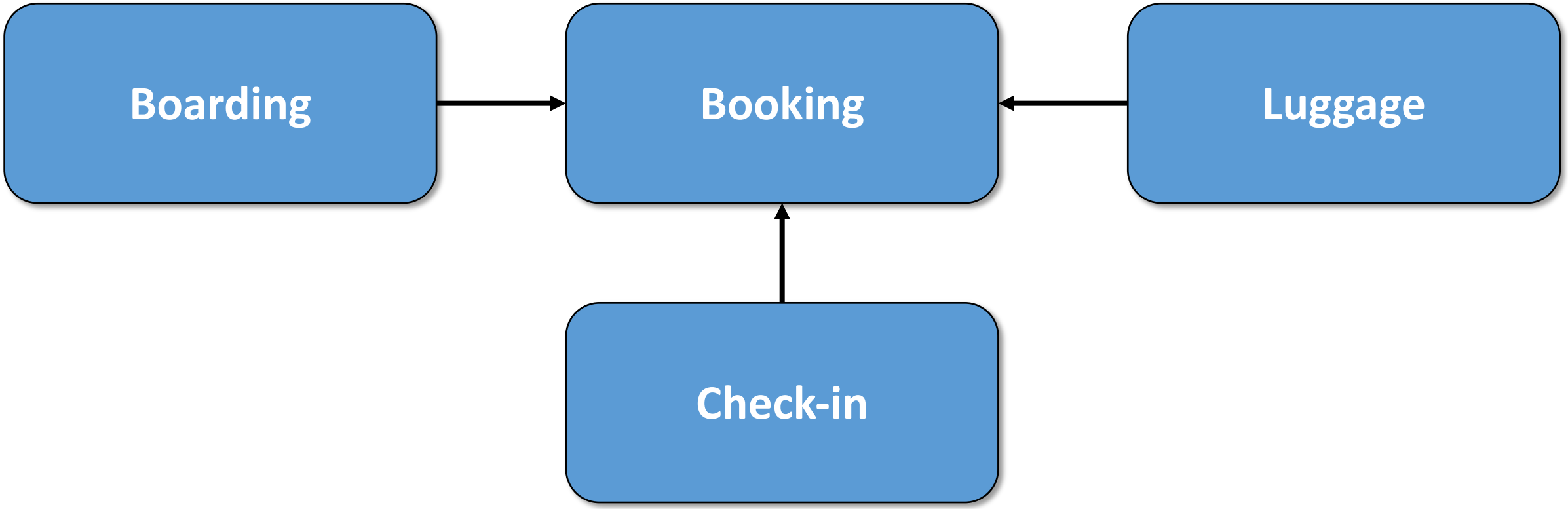


Finding Sub-Domains




Booking
Flight
Price
Seats
Tickets
Passenger
Boarding
Flight
Ticket
Ubiquitous Language
Bounded Context

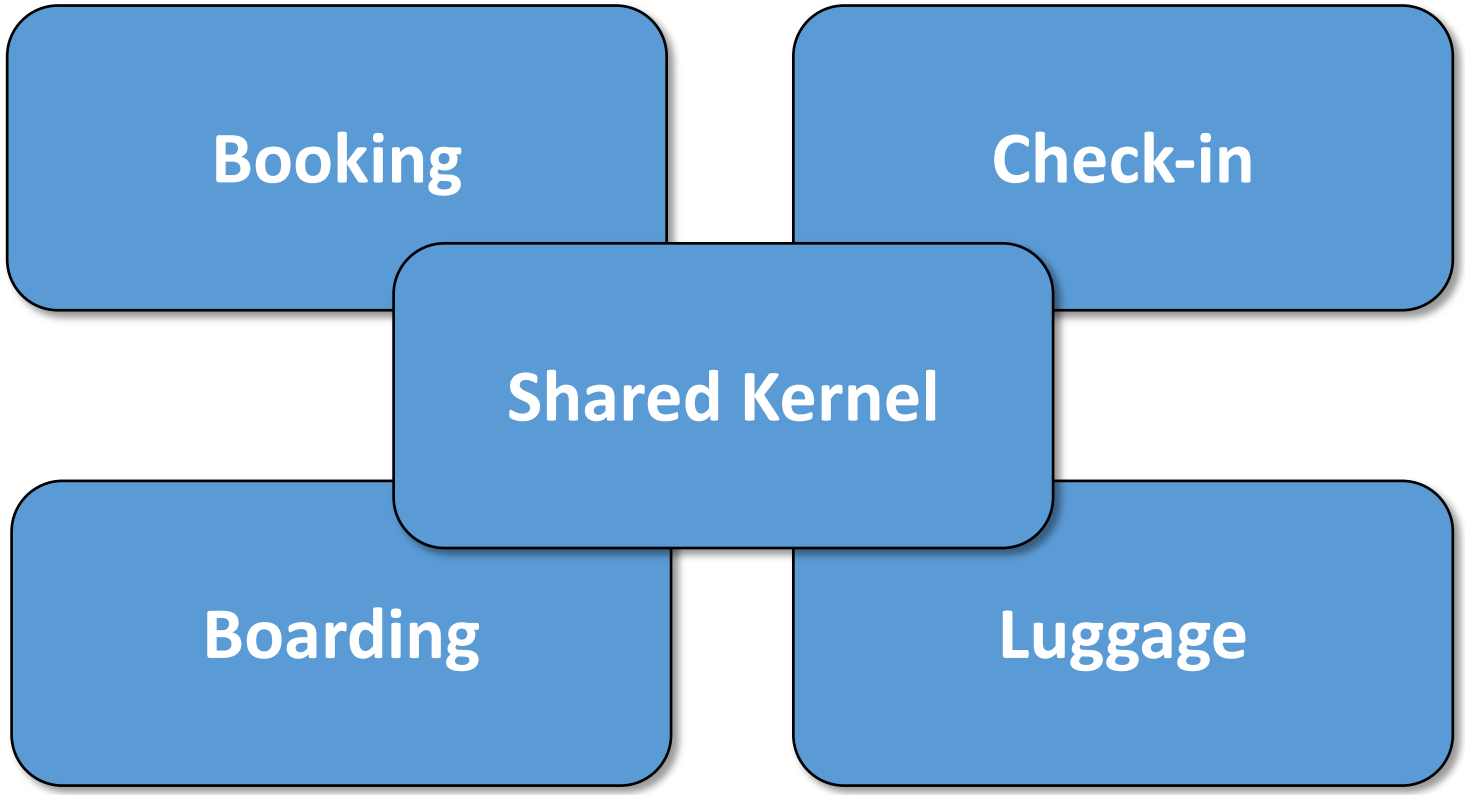
Context Map

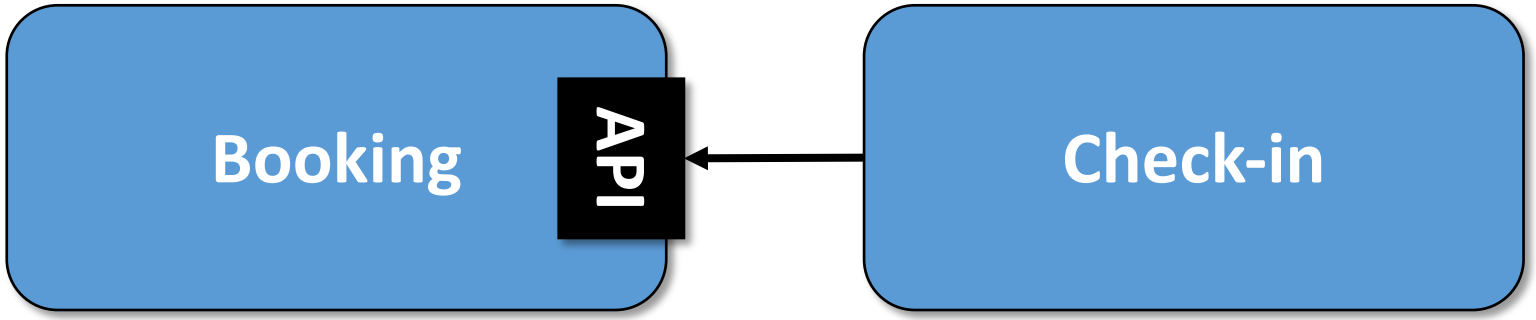


Context Map

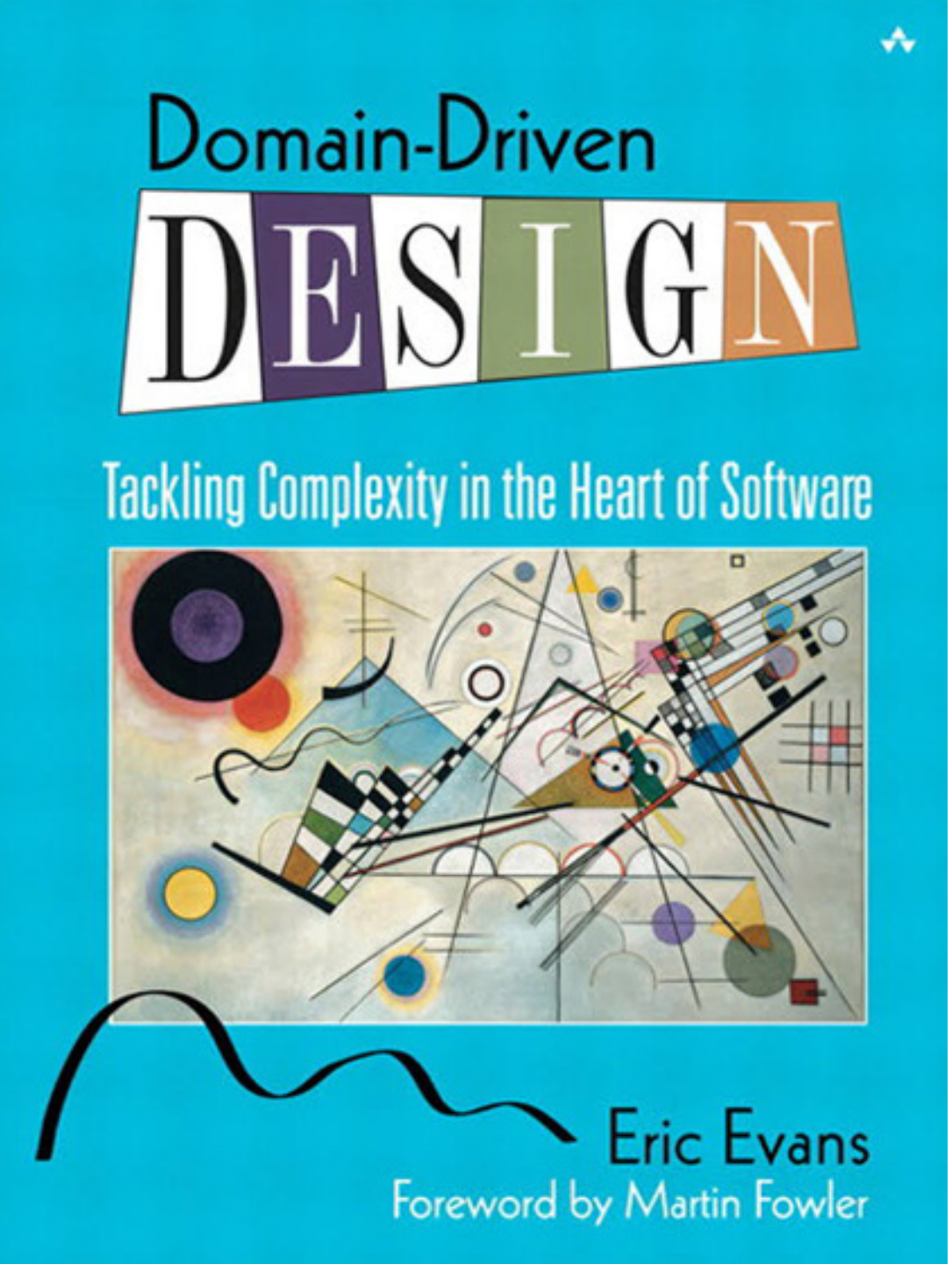
Responsibilities?

Breaking Changes?

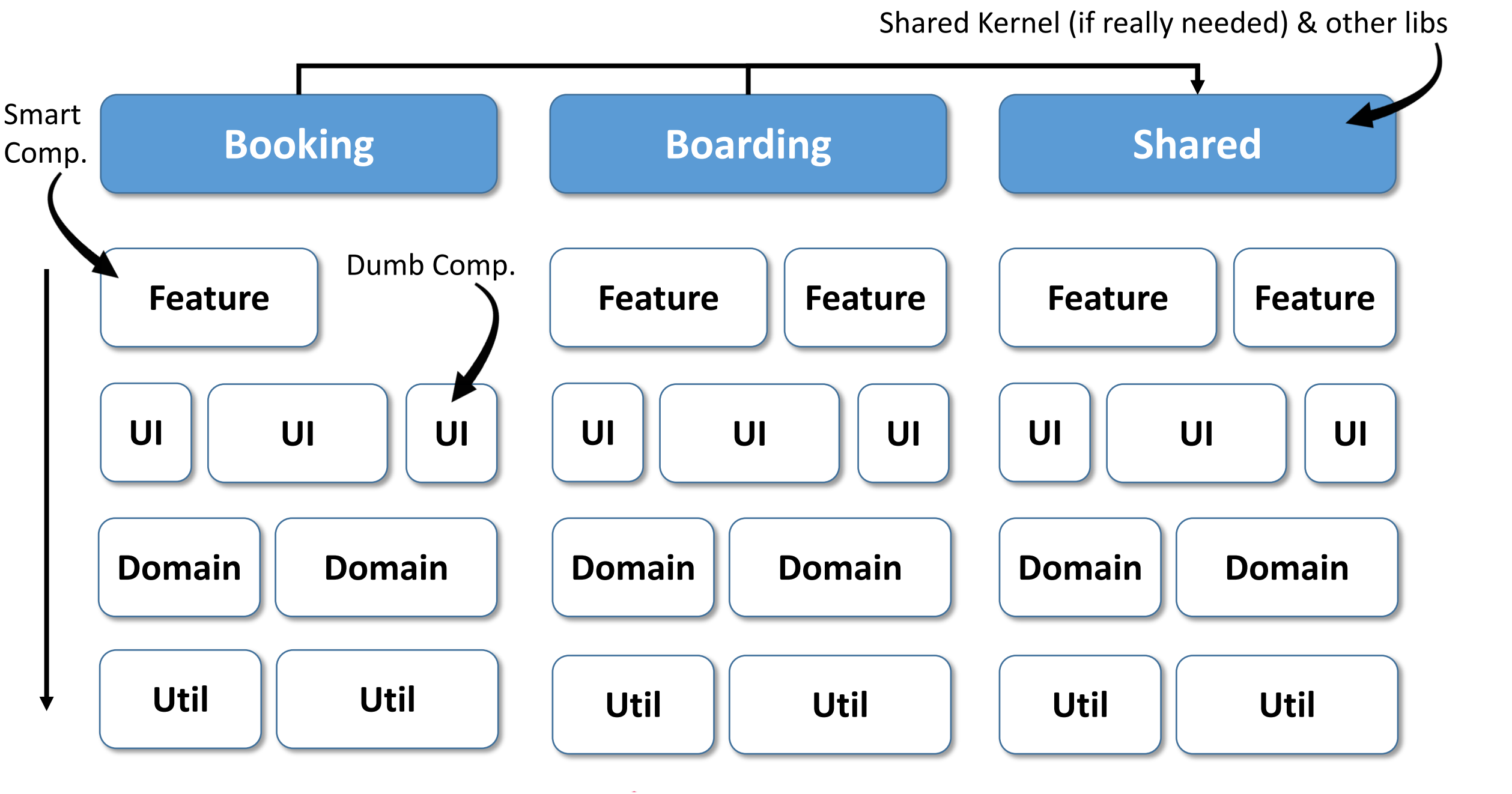




Open-/Host-Service



Lots of approaches for cross-domain communication and more …


Shared Kernel (if really needed) & other libs
Smart Comp.
Booking
Boarding
Shared
Dumb Comp.
Feature
Feature
Feature
Feature
Feature
UI
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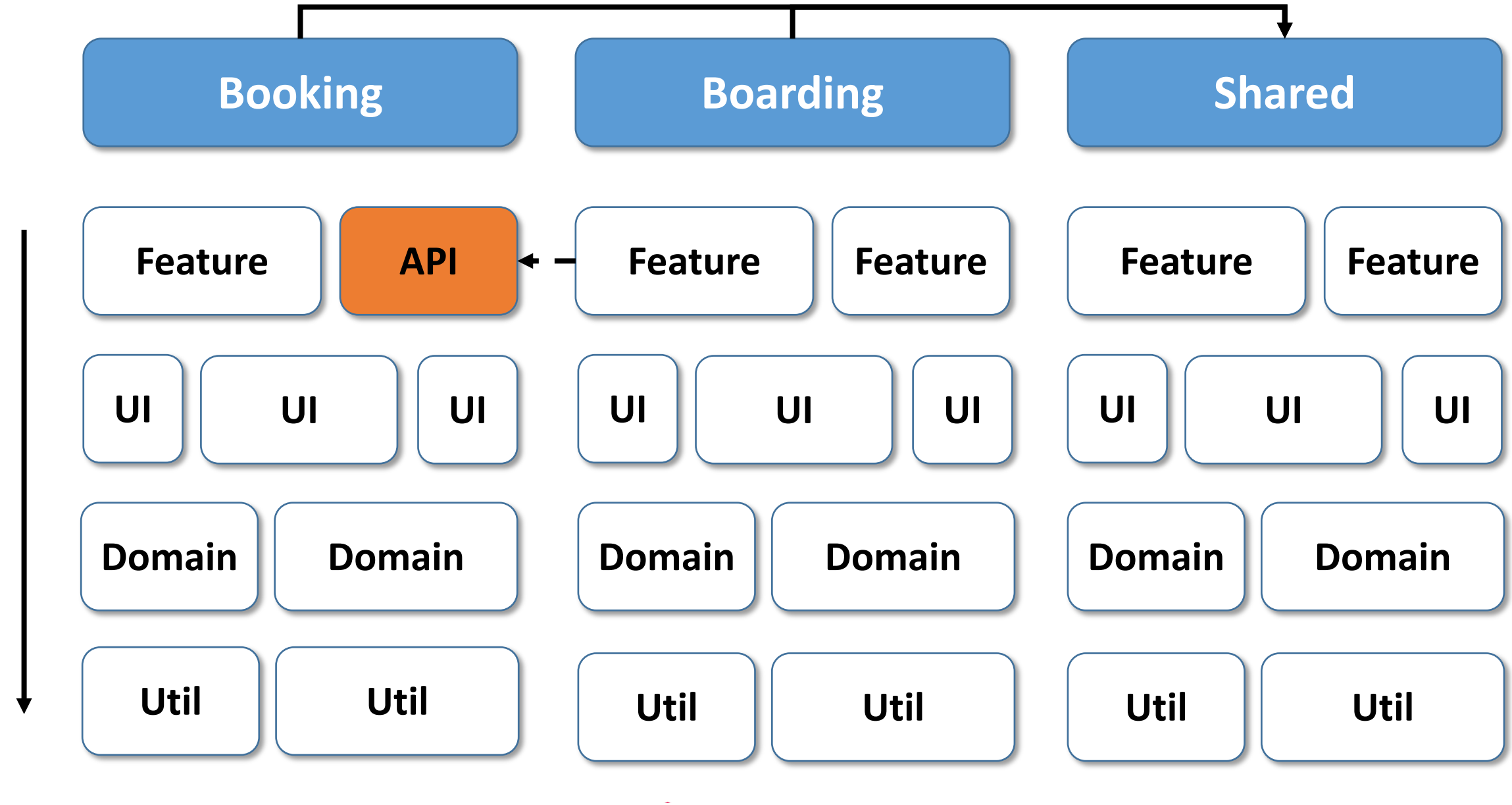
Booking
Boarding
Shared
Feature
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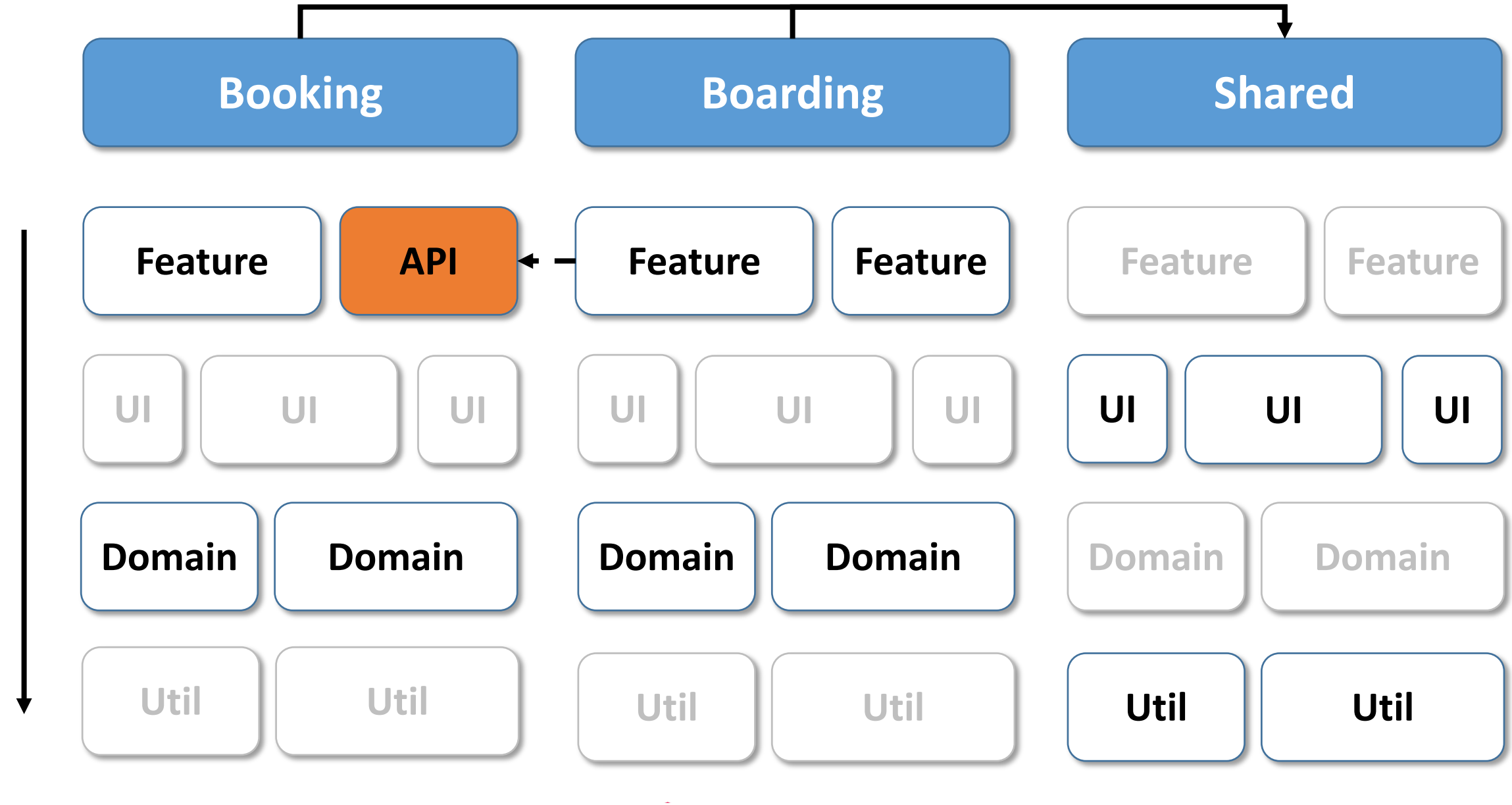
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Util

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

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Nx DDD

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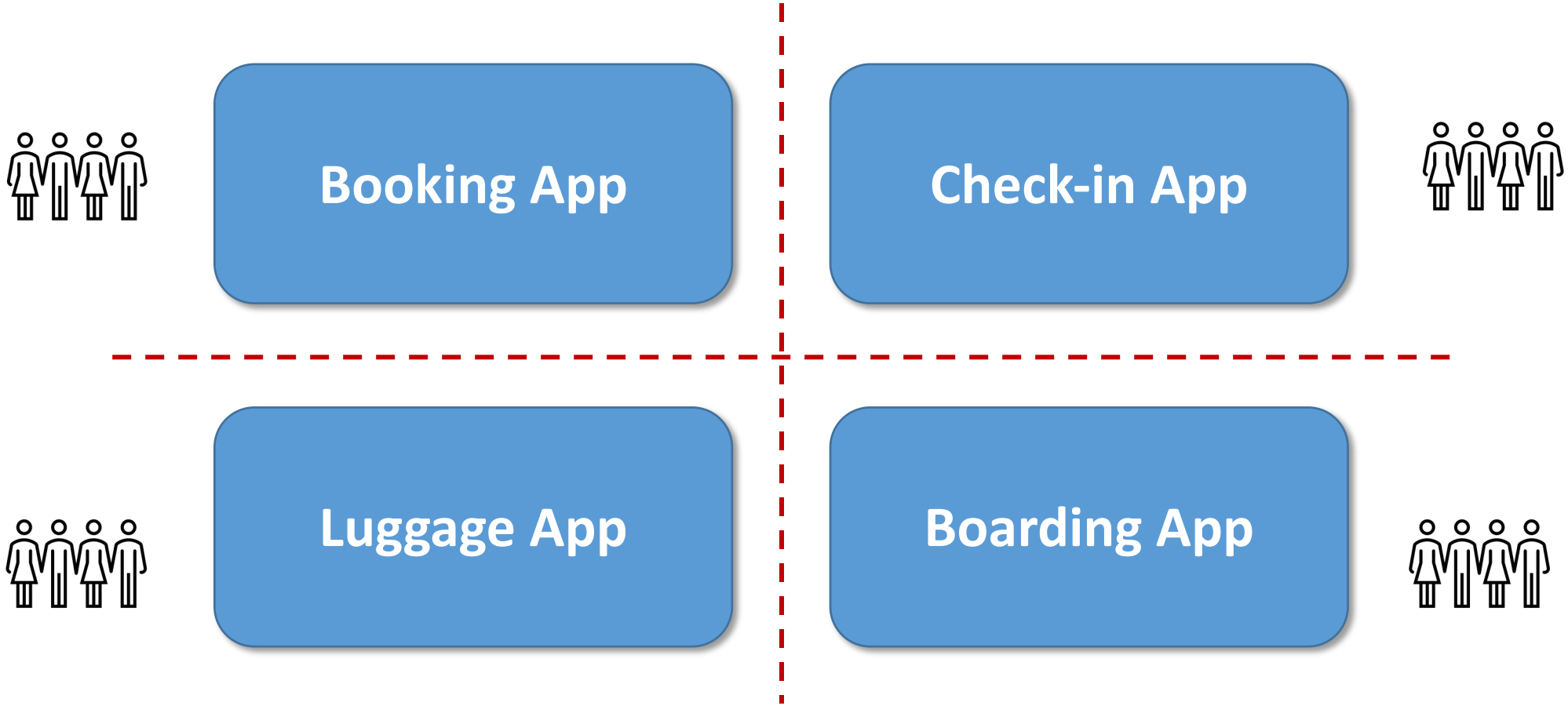
SOFTWARE ARCHITECT

Micro Frontends?

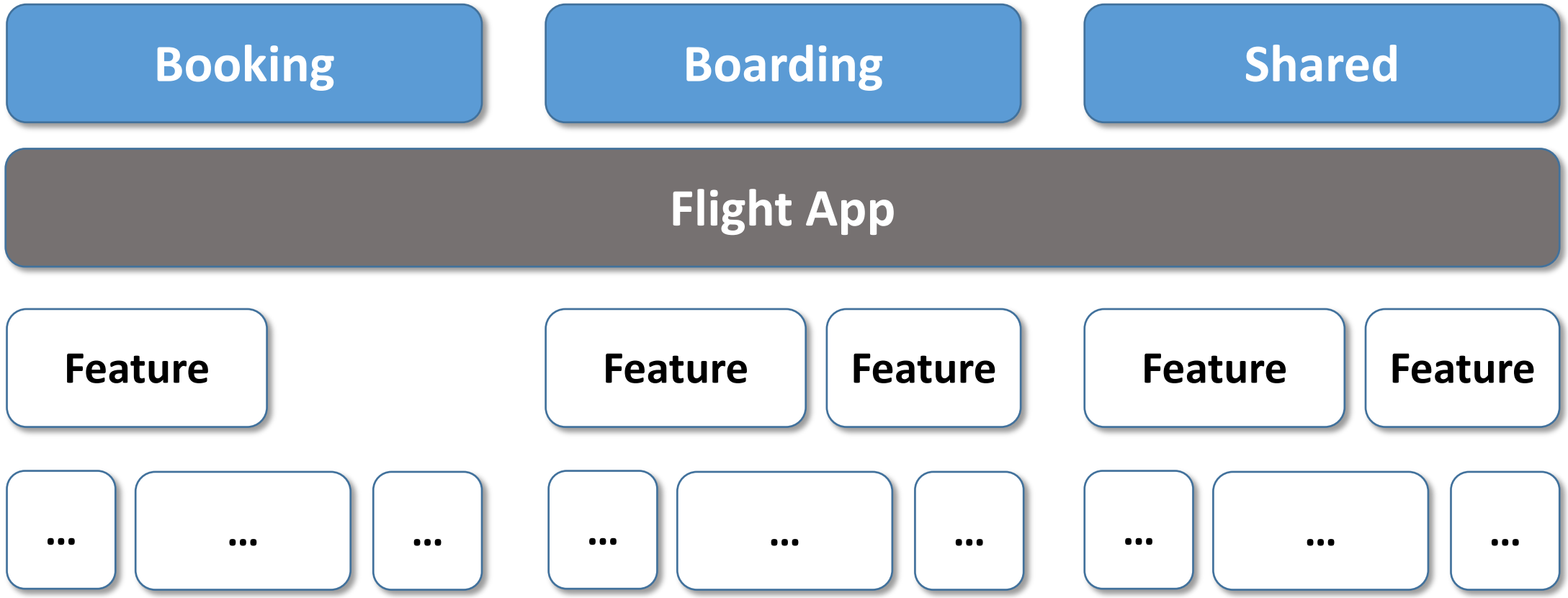
Short outlook

Microfrontends

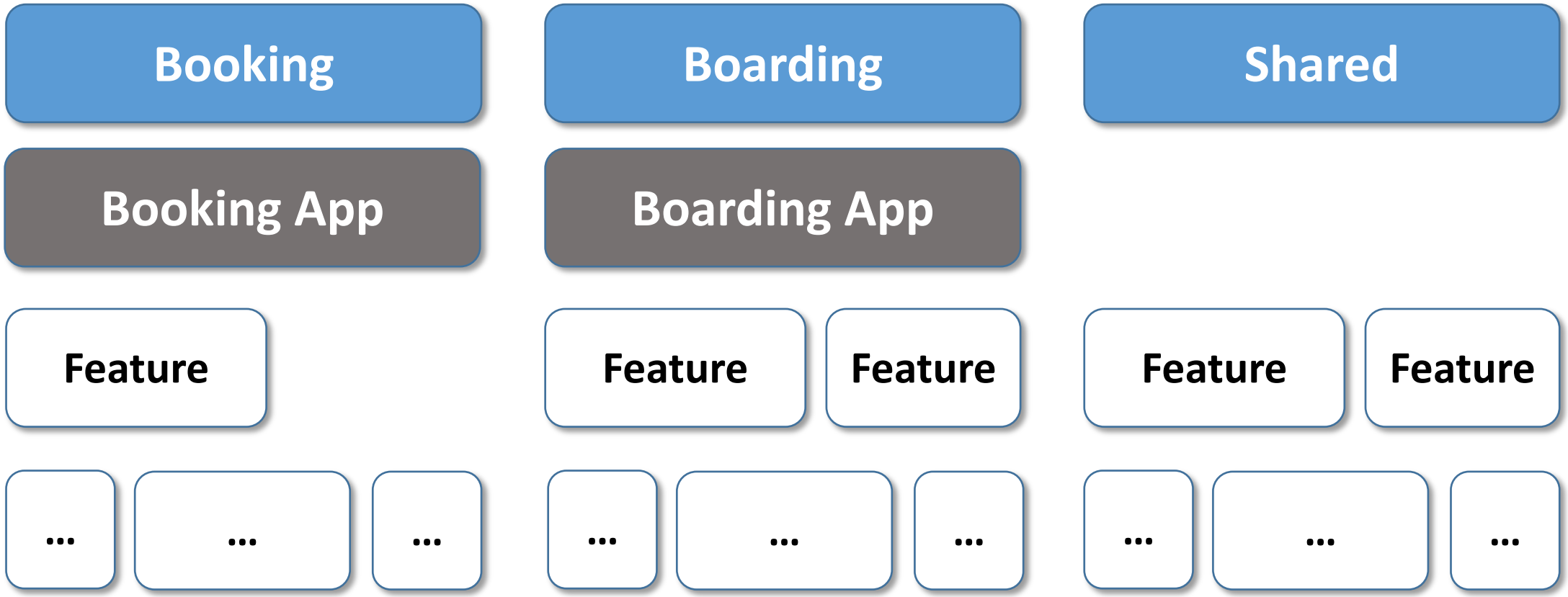


Microfrontends
are first and foremost
about **scaling teams!**

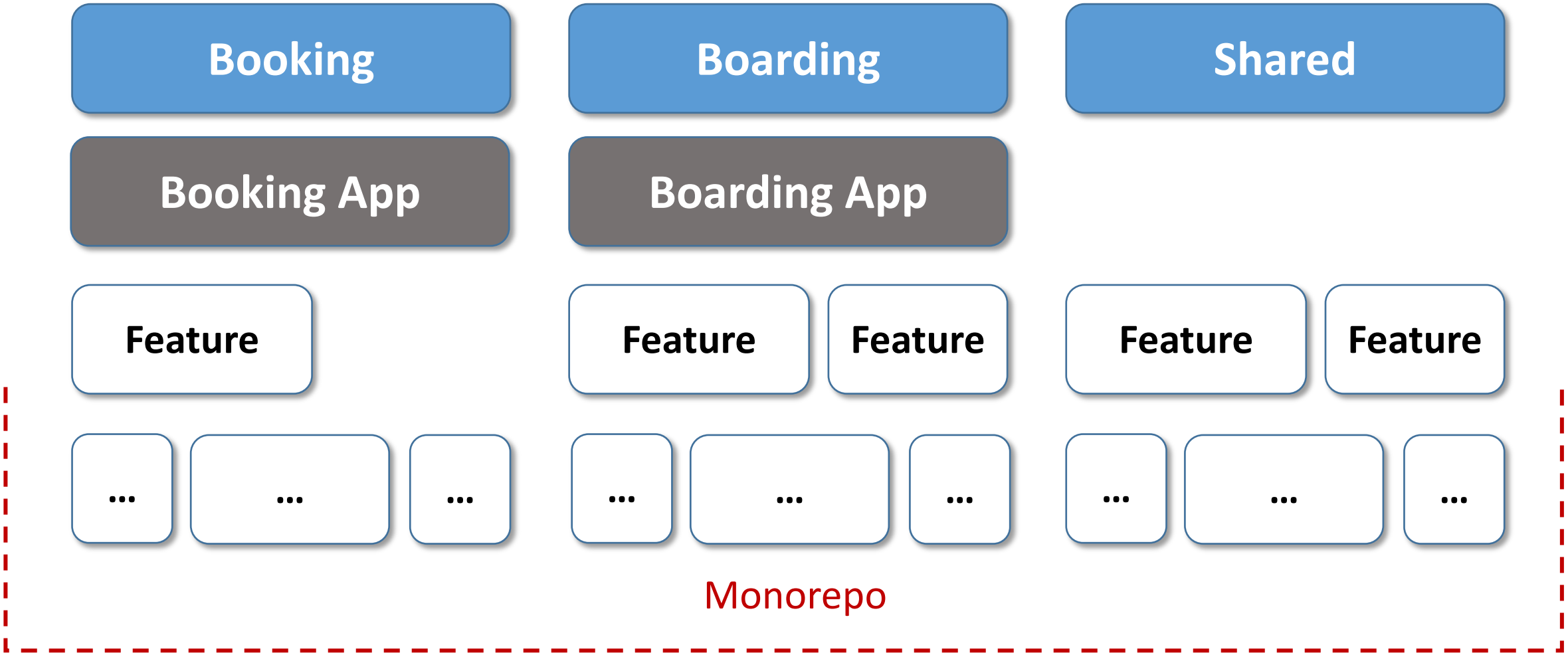
Deployment Monolith



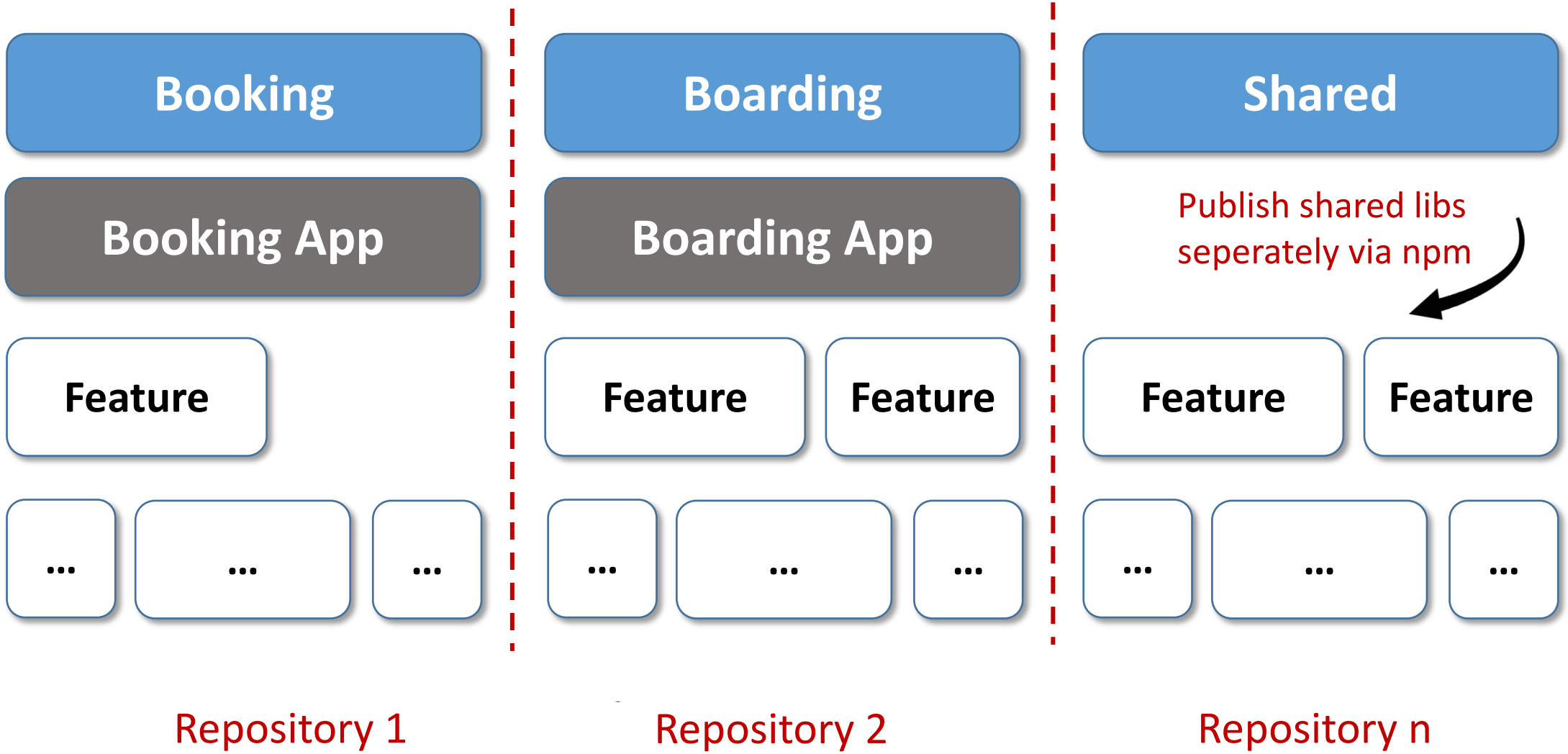
Microfrontends



Option 1: One App per Domain



Option 2: One Monorepo per Domain

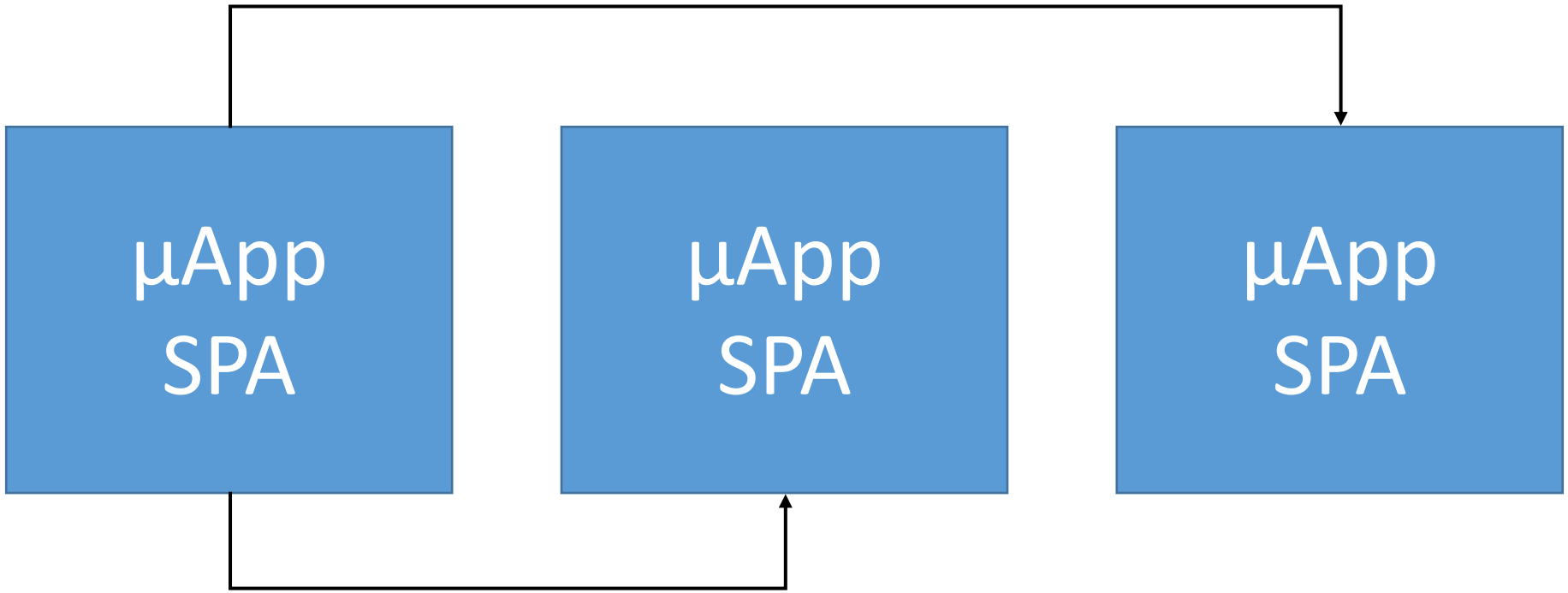


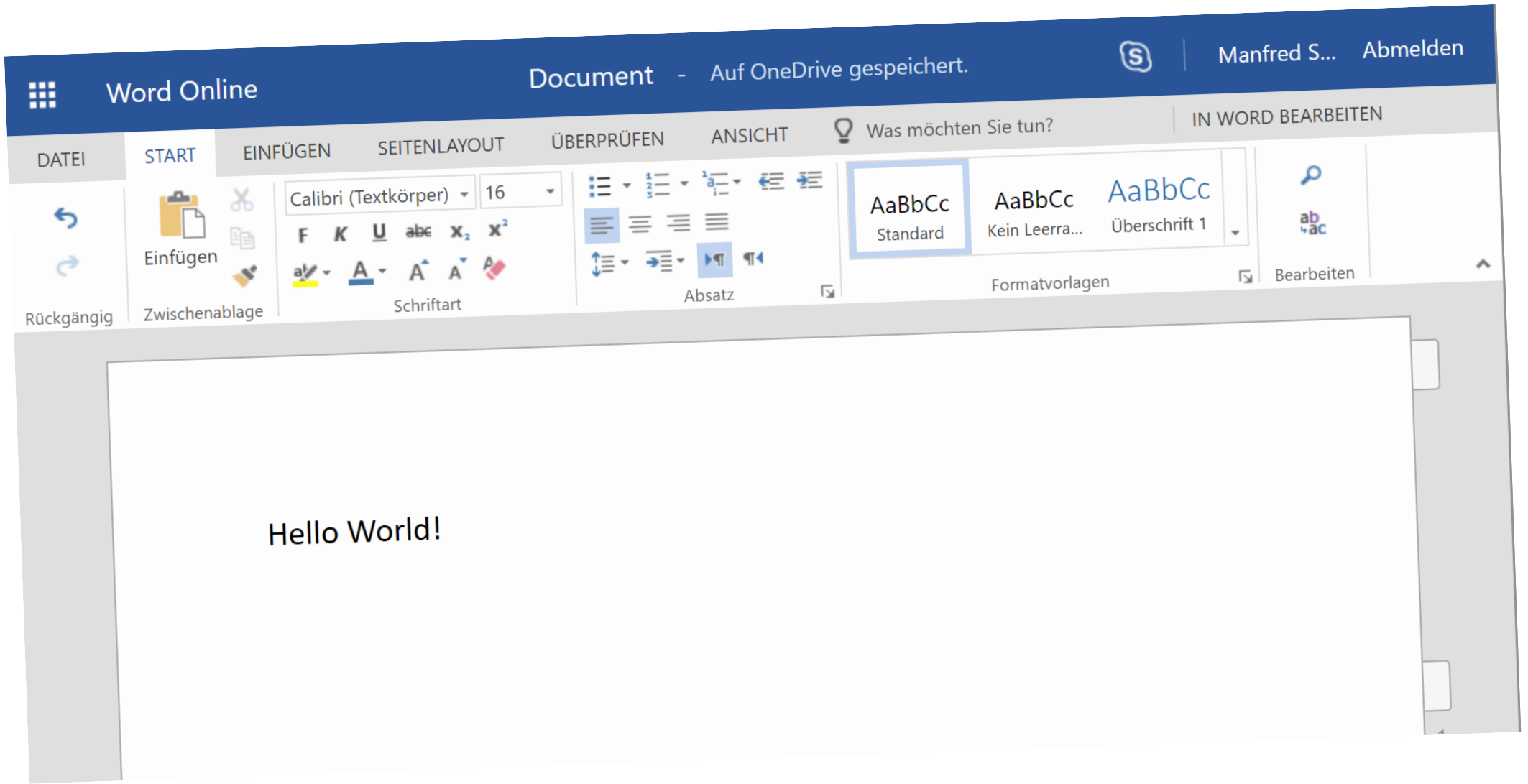
Benefits

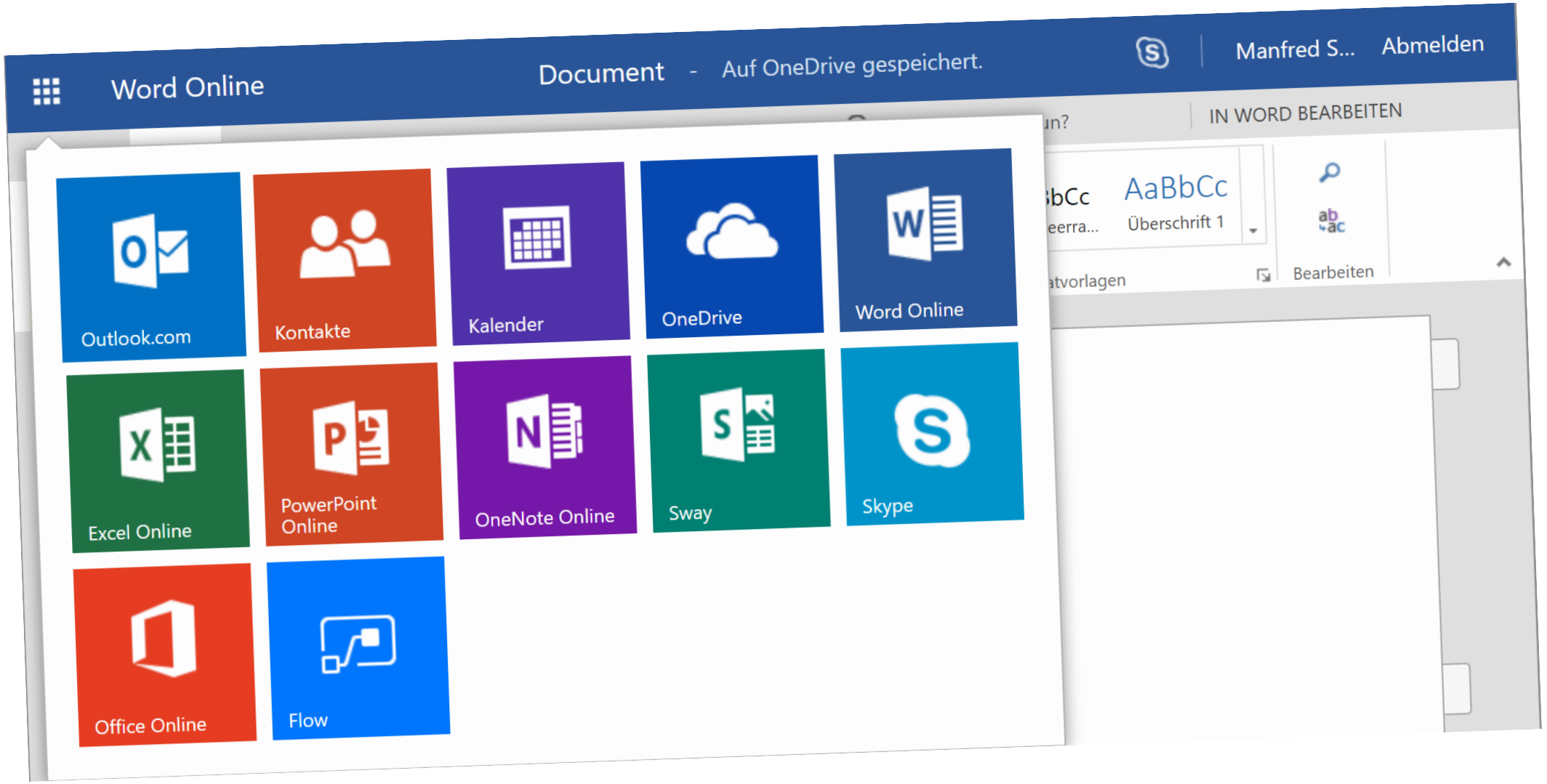
- **Autonomous Teams**
- Separate Development
- Separate Deployment
- Own architecture decisions
- Own technology descisions

Integration via Hyperlinks

UI Composition w/ Hyperlinks








Integration via
Shell

Providing a (SPA based) Shell (aka Host)

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

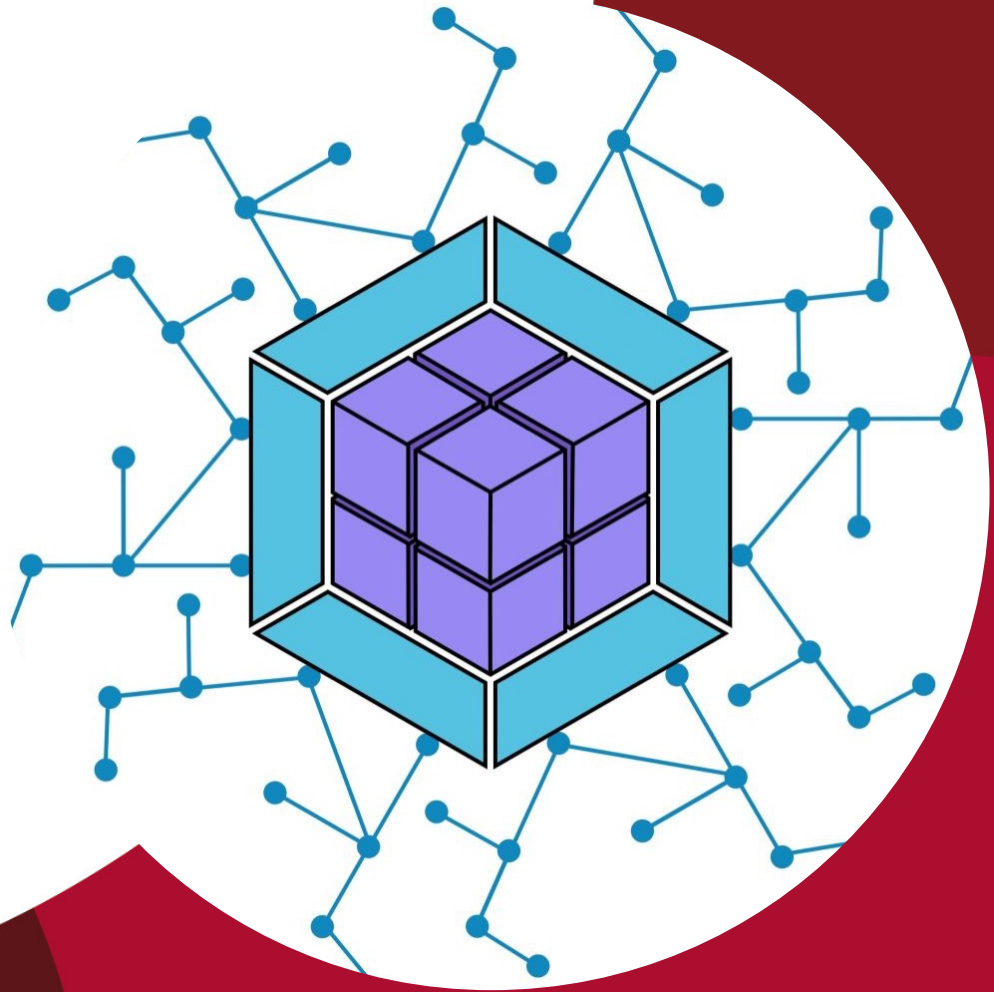
Loading MicroApps

```
<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



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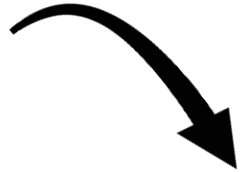
Idea

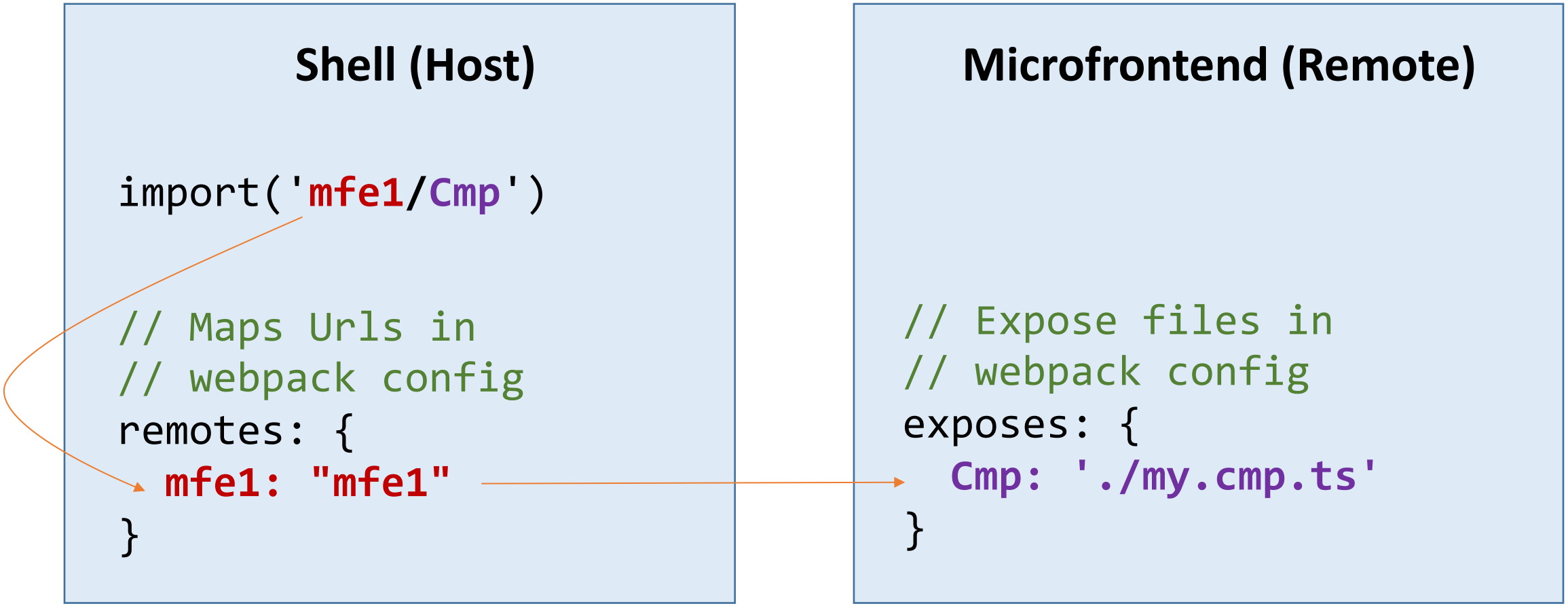
Does not work with
webpack/ Angular CLI



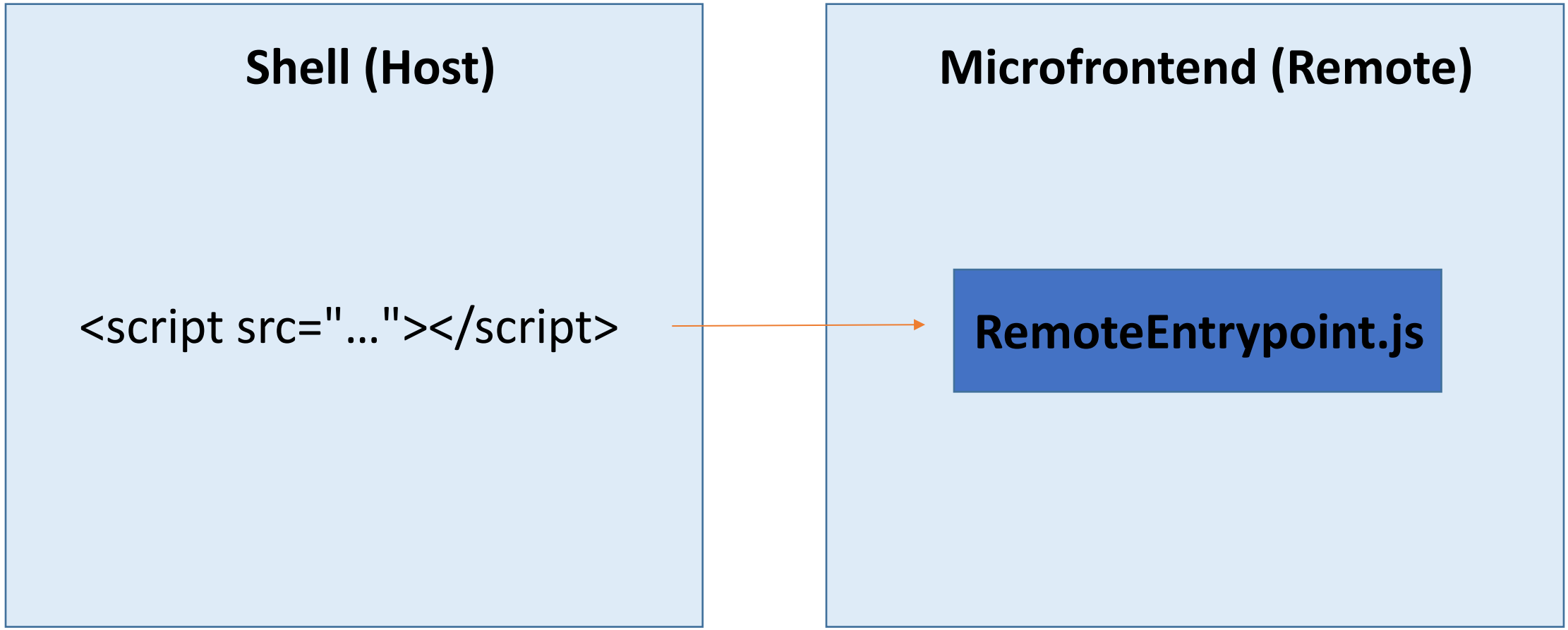
```
const Component = import('http://other-app/xyz')
```

Even lazy parts must be
known at compile time!

Webpack 5 Module Federation



How to Get the Microfrontend's URL?



How to Share Libs?

Shell (Host)

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

Microfrontend (Remote)

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

Dealing with Version Mismatches

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Default Behavior

Selecting the highest compatible version

Default Behavior

Conflict: No highest compatible version

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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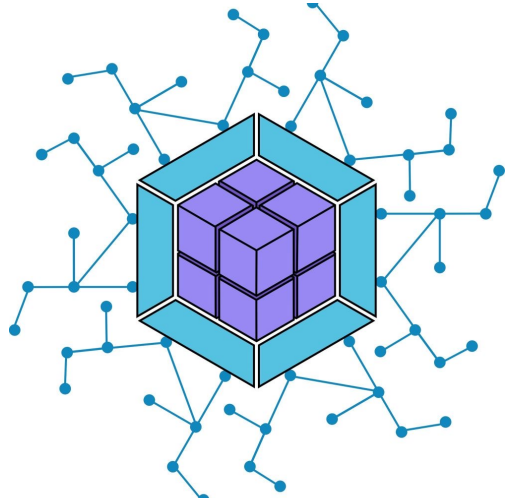
Angular CLI

?

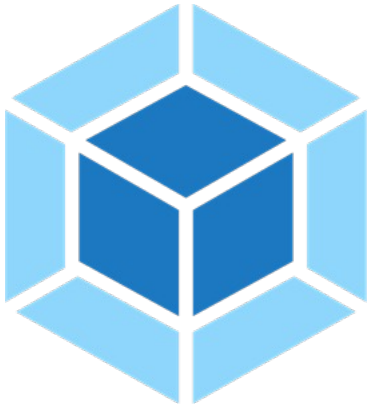
webpack



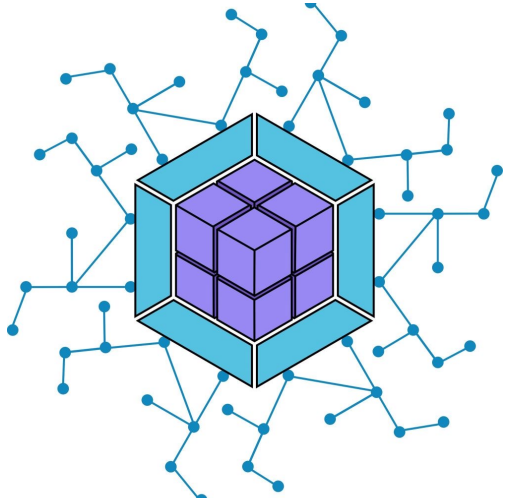
Module Federation
Configuration

Custom Builder

Angular CLI



webpack



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

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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

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
```

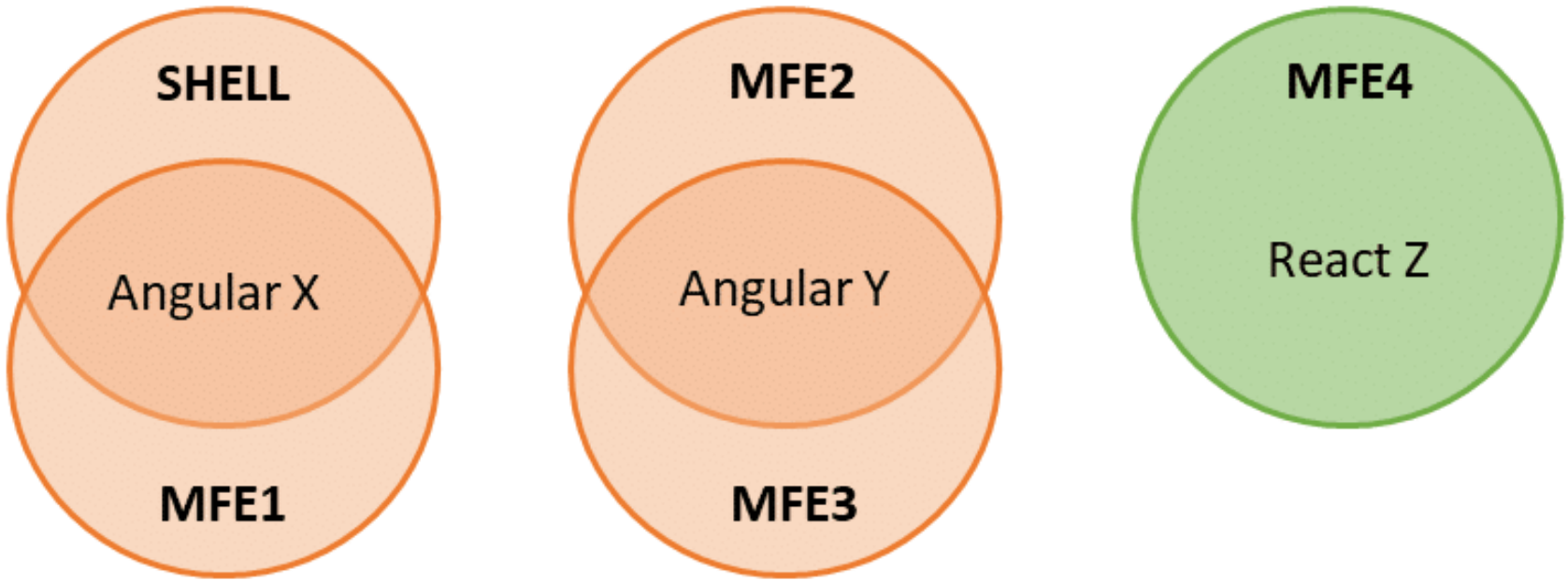
Routing to Another SPA?

WrapperComponent

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

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

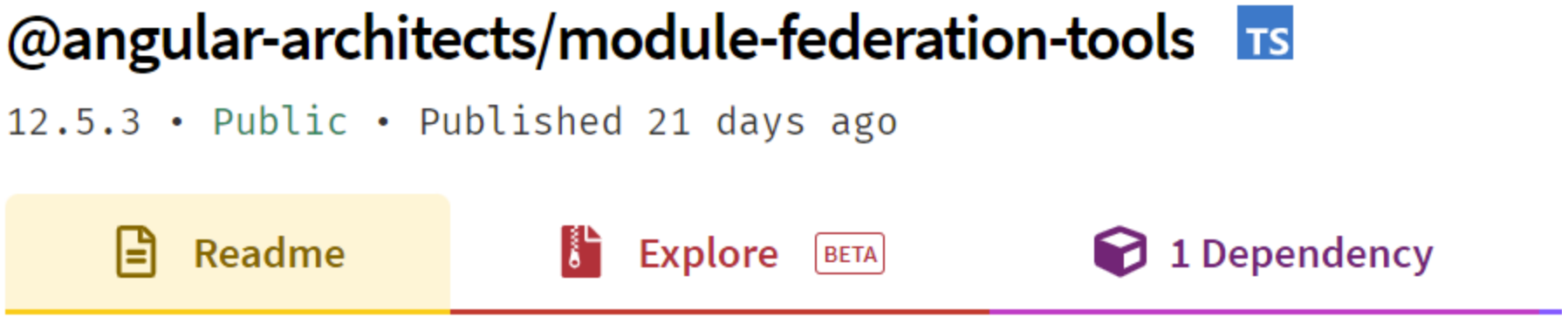
Result



Challanges

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

Challanges & Solutions



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

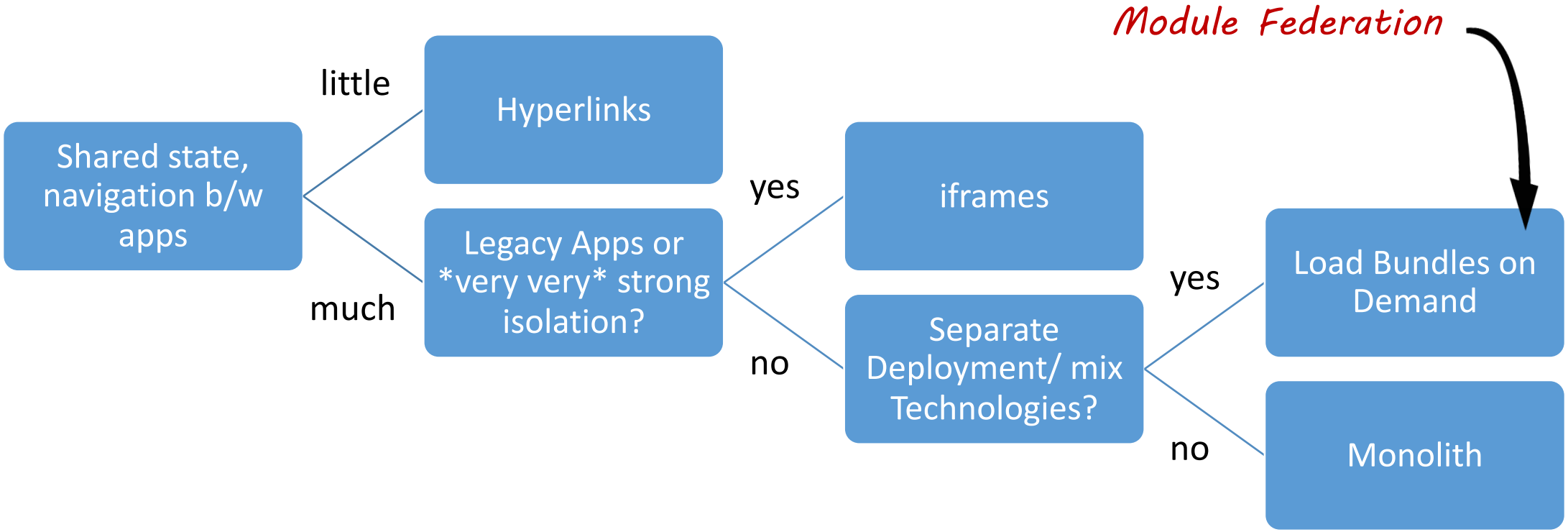
For (a lot) more on Microfrontends

Check out our blog at

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


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? ☺