Applications instead of Libraries

Micro Frontends with Module Federation

Mario Fernandez

Themes

Themes

Distributing front end applications

Themes

Distributing front end applications

Adopting module federation

Themes

Distributing front end applications

Adopting module federation

Making it production-ready

1️⃣ Distributing front end applications

Partner Home @ Wayfair

Reporting

Tickets

Orders

Stocking Orders

CastleGate

Inventory

Products

Premium Shelf

Finance

Developer

Account Management

Catalog

Download Center

Help & Support

Your Wayfair Dashboard

Announcements	Previous Announcements

No Announcements! See Previous Announcements for important news you may have missed

Search PO ❓

Enter PO Number

Search

🔔 Today's Tasks

2 Order Alert(s) ❯	13 to Ship Today ❯	**0** to Ship Next Business Day ❯

3733 Ticket(s) ❯

📊 Performance (Last 30 Days)

View Sales Dashboard

Revenue

$99.31

$100

$50

$0
12/28   1/4   1/20

Units Sold

5

5

3

0
12/28   1/4   1/20

Quick Links

Reporting

Sales Dashboard

Forecast

Order & Operations

Order Management

Warehouse Calendar

Product Management

Add New Products

Manage Pricing

Manage Product Details

Manage Product Images

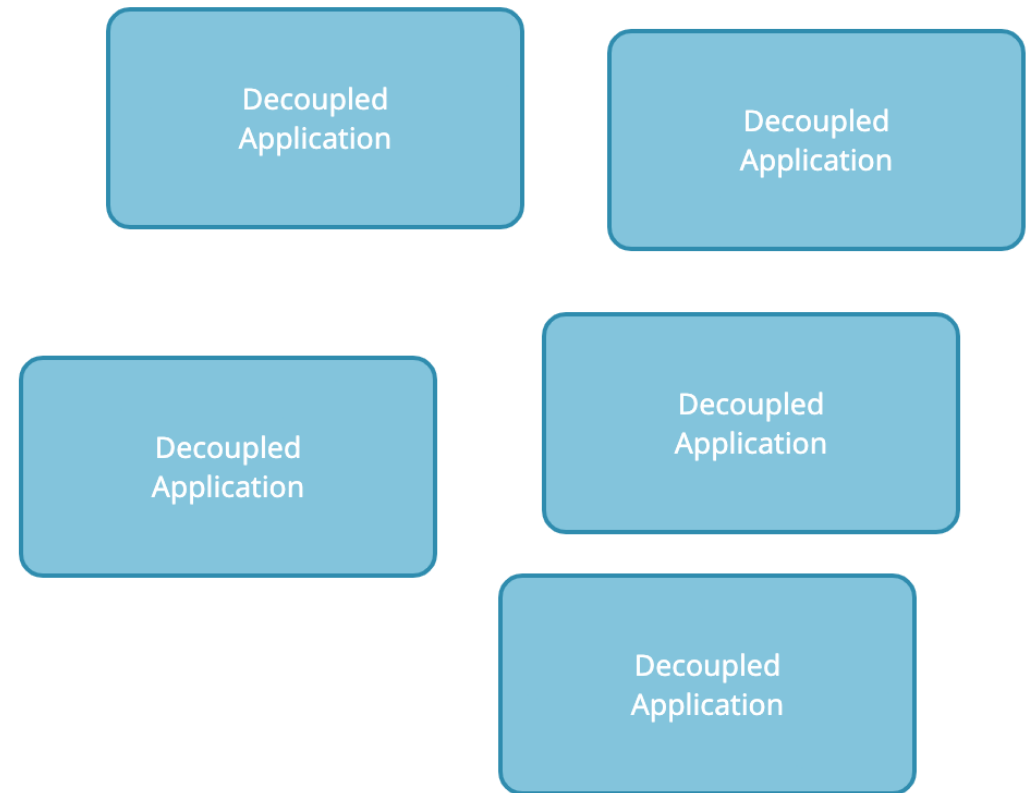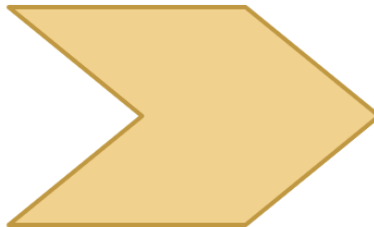Manage Shipping Dimensions

Manage Tried & True

Accelerant Hub

Accelerant Hub Home

Sponsored Products

Brand Page Management

Rough numbers

~100 flows

~30 experience teams

Monolith → Decoupled Application, Decoupled Application, Decoupled Application, Decoupled Application, Decoupled Application

Facing a Challenge

Distributing shared concerns

Your Wayfair Dashboard

❓ Help

Tickets ⌄
Inventory ⌄
Products ⌄
Developer ⌄
Account Management ⌄
Download Center
Help & Support ⌄

Announcements	Previous Announcements

12/10/2020

COVID-19 Guidance For Impacted Warehouses [North America]

If you are closing, extending a closure or reopening, **please update your Warehouse Closure Calendar,** open orders & submit our COVID-19 **impact** form. This will mitigate negative downstream effects on our mutual customers & you, our Supplier Partner.

Please reach out to your Performance and Relationship Managers with any questions.

06/25/2021

Current Order Management Tool Available Until September

The **current version of** Order Management will remain available until September, not July, as we take some extra time to polish the next version.

Until then, try out the new experience, including features we've added based on your feedback.

🔔 Today's Tasks

50 Order Alert(s) ›	**86** to Ship Today ›	**36** to Ship Next Business Day ›

465 Ticket(s) ›

Search PO ❓
Enter PO Number   [Search]

Quick Links

Product Management

Add New Products

Manage Pricing

Manage Product Details

Manage Product Images

Manage Shipping Dimensions

Manage Tried & True

Attempt 1️⃣
Using an npm package

Wayfair

https://partners.wayfair.com

Bundle

Navigation
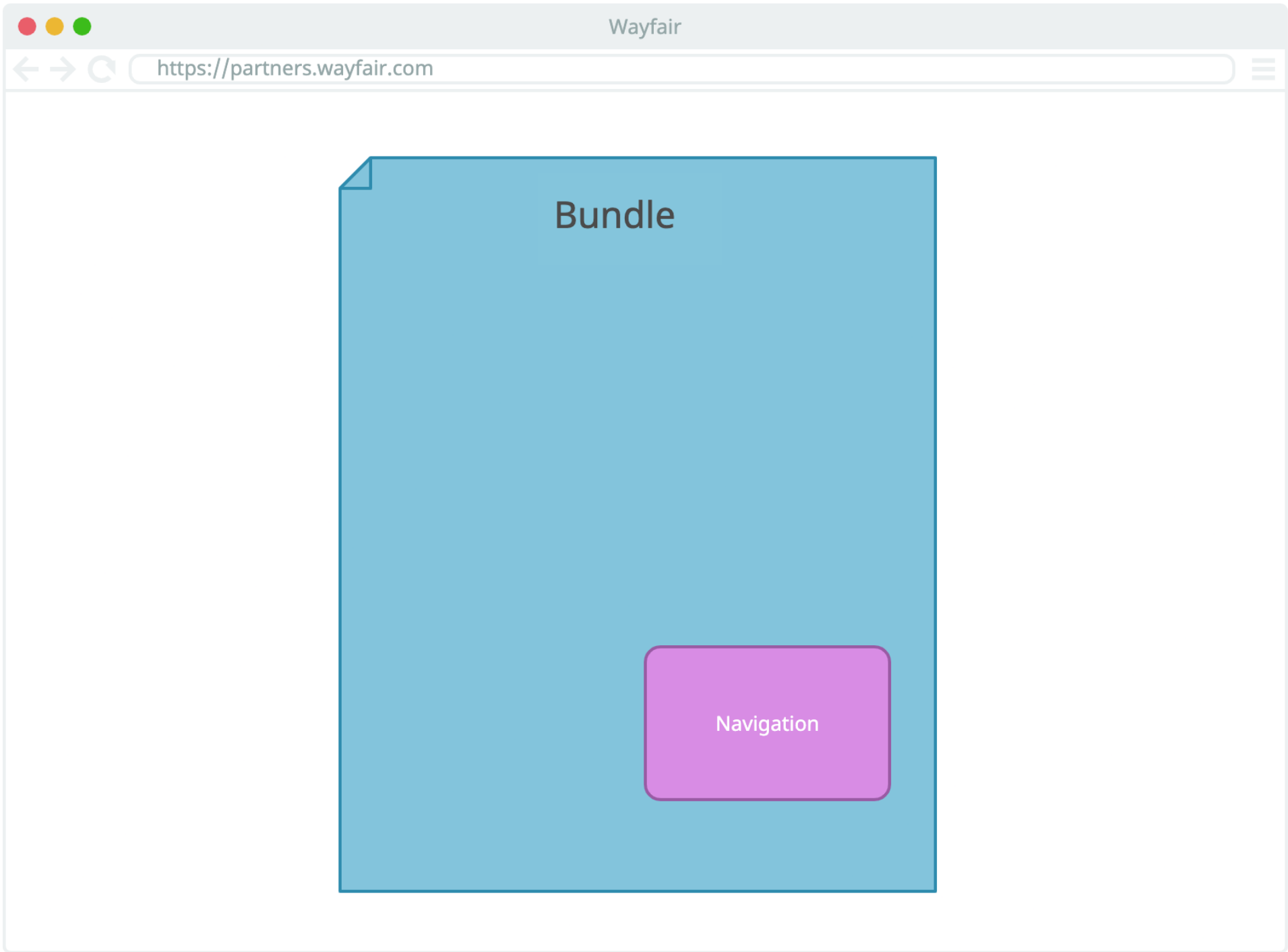
You can guess it didn't work

Challenges

Challenges

Propagating updates

Challenges

Propagating updates

Consistency

Challenges

Propagating updates

Consistency

Operability
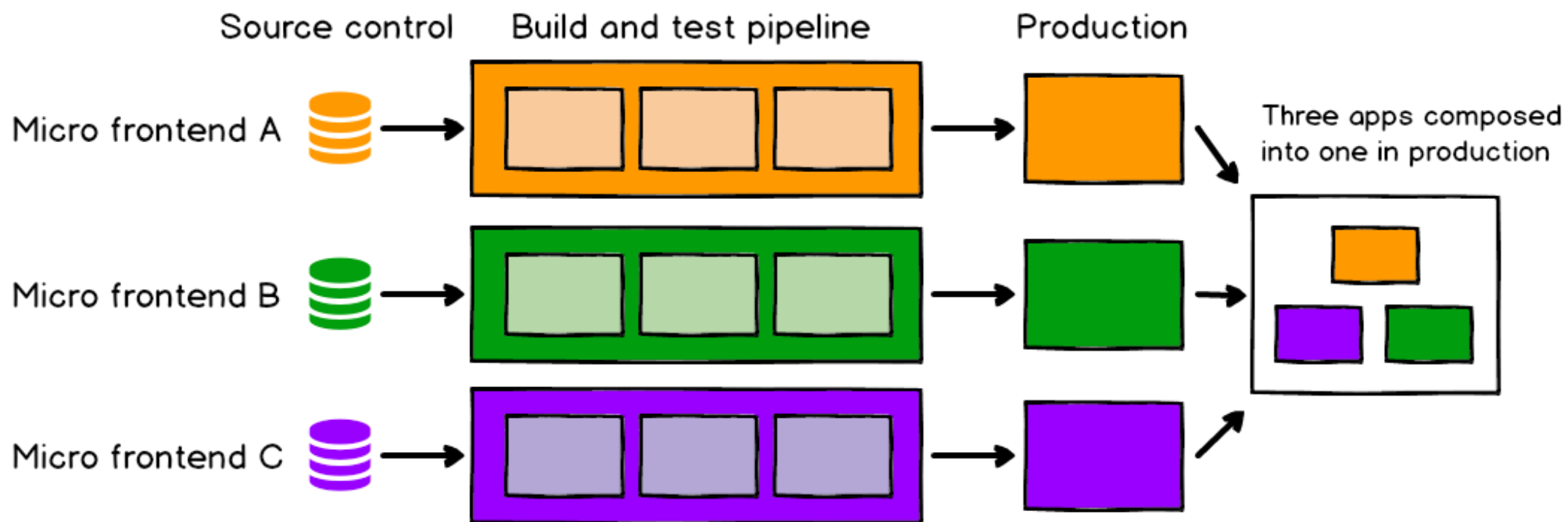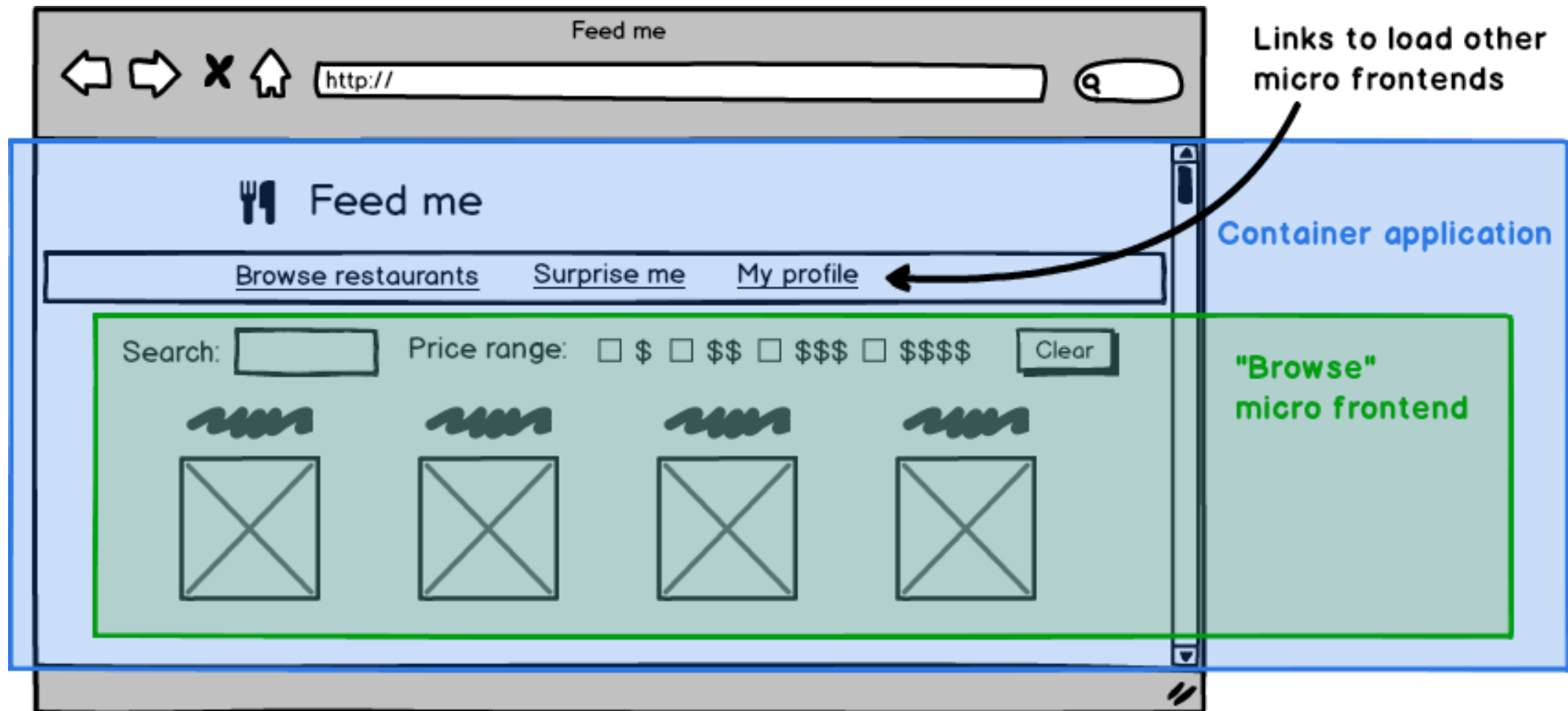
Attempt 2️⃣

Applications instead of libraries

Micro Frontends

An architectural style where independently deliverable frontend applications are composed into a greater whole

Source control   Build and test pipeline   Production

Micro frontend A

Micro frontend B

Micro frontend C

Three apps composed
into one in production

Feed me

http://

Feed me

Browse restaurants   Surprise me   My profile

Search: [   ]   Price range: ☐ $ ☐ $$ ☐ $$$ ☐ $$$$ [Clear]

Links to load other micro frontends

Container application

"Browse" micro frontend

Our Objectives

Our Objectives

Quicker path to production

Our Objectives

Quicker path to production

Preserve autonomy

Plenty of ways to implement micro frontends

The one right way to do microfrontends - two opinions
youtube.com/watch?v=WIy6KseqABE

Let's talk about *our* implementation

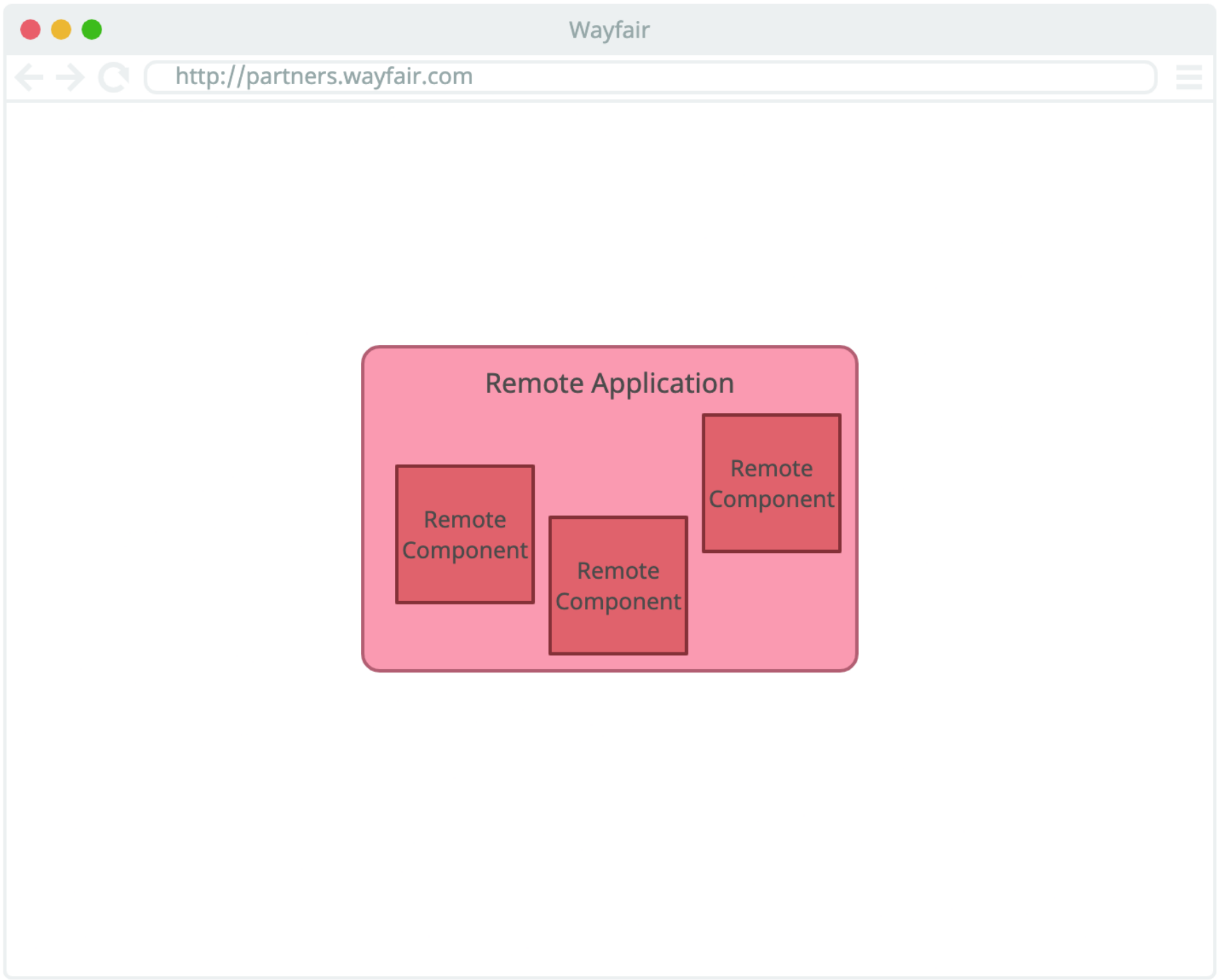2️⃣ **What is module federation?**

New feature in Webpack 5

webpack.js.org/concepts/module-federation/

Load modules remotely at *runtime*

Why is that relevant?

Low friction integration between independent applications

Making an Application Remote

```
1  new ModuleFederationPlugin({
2    name: 'remote',
3    filename: 'remoteEntry.js',
4    exposes: {
5      './Welcome': './src/Welcome',
6    },
7    shared: [
8      {
9        react: { requiredVersion: deps.react, singleton: true },
10       'react-dom': { requiredVersion: deps['react-dom'], singleton: true },
11       '@applications-instead-of-libraries/shared-library': {
12         import: '@applications-instead-of-libraries/shared-library',
13         requiredVersion: require('../shared-library/package.json').version,
14       },
15       '@material-ui/core': {
16         requiredVersion: deps['@material-ui/core'],
17         singleton: true,
18       },
19     },
20   ],
21 })
```
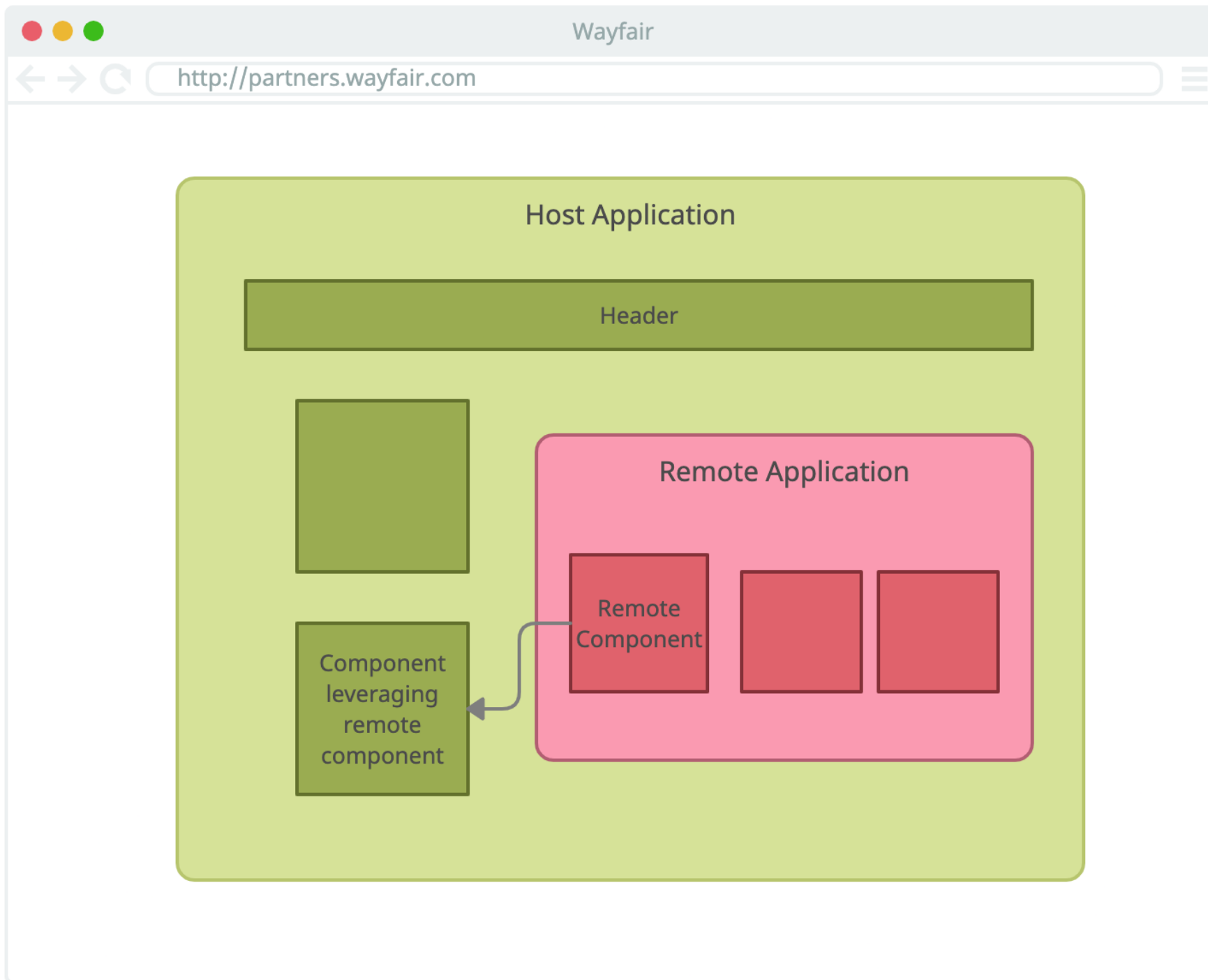
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1  new ModuleFederationPlugin({
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15      '@material-ui/core': {
16        requiredVersion: deps['@material-ui/core'],
17        singleton: true,
18      },
19    },
20  ],
21  })
```

That's it? 🤔

Consuming a Remote Application

Wayfair

http://partners.wayfair.com

Host Application

Header

Remote Application

Remote Component

Component leveraging remote component

```
1  new ModuleFederationPlugin({
2    name: 'host',
3    remotes: {
4      remote: 'remote@http://localhost:3002/remoteEntry.js',
5    },
6    shared: [
7      {
8        react: { requiredVersion: deps.react, singleton: true },
9        'react-dom': { requiredVersion: deps['react-dom'], singleton: true },
10       '@applications-instead-of-libraries/shared-library': {
11         import: '@applications-instead-of-libraries/shared-library',
12         requiredVersion: require('../shared-library/package.json').version,
13       },
14       '@material-ui/core': {
15         requiredVersion: deps['@material-ui/core'],
16         singleton: true,
17       },
18     },
19   ],
20 })
```

```javascript
new ModuleFederationPlugin({
  name: 'host',
  remotes: {
    remote: 'remote@http://localhost:3002/remoteEntry.js',
  },
  shared: [
    {
      react: { requiredVersion: deps.react, singleton: true },
      'react-dom': { requiredVersion: deps['react-dom'], singleton: true },
      '@applications-instead-of-libraries/shared-library': {
        import: '@applications-instead-of-libraries/shared-library',
        requiredVersion: require('../shared-library/package.json').version,
      },
      '@material-ui/core': {
        requiredVersion: deps['@material-ui/core'],
        singleton: true,
      },
    },
  ],
})
```

```
const OtherComponent = React.lazy(() => import('remote/OtherComponent'));
```

```
1  export default class LazyModule extends React.Component {
2    constructor(props) {
3      super(props)
4      this.state = { error: null }
5    }
6
7    render() {
8      return (
9        <React.Suspense fallback={this.props.delayed ?? null}>
10         <OtherComponent />
11       </React.Suspense>
12     )
13   }
14 }
```

```
const OtherComponent = React.lazy(() => import('remote/OtherComponent'));
```

```
1   export default class LazyModule extends React.Component {
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7     render() {
8       return (
9         <React.Suspense fallback={this.props.delayed ?? null}>
10          <OtherComponent />
11        </React.Suspense>
12       )
13     }
14   }
```

A problem

Dynamic loading

```
{
  remotes: {
    remote: 'remote@http://localhost:3002/remoteEntry.js',
  }
}
```

More flexible loading

```javascript
const RemoteComponent = ({component, error, delayed, environment, ...props}) => {
  const RemoteComponentLoader = useMemo(
    () => loadRemoteComponent({ component, environment }),
    [component, environment]
  )

  const RemoteObject = useMemo(
    () => React.lazy(RemoteComponentLoader),
    [RemoteComponentLoader]
  )

  return (
    <LazyModule error={error} delayed={delayed}>
      <RemoteObject {...props} />
    </LazyModule>
  )
}

export default RemoteComponent
```

Shared Dependencies

You don't want to download React multiple times

You don't want strong coupling, either

```
1  {
2    shared: [
3      {
4        react: { requiredVersion: deps.react, singleton: true },
5        'react-dom': { requiredVersion: deps['react-dom'], singleton: true },
6        '@applications-instead-of-libraries/shared-library': {
7          import: '@applications-instead-of-libraries/shared-library',
8          requiredVersion: require('../shared-library/package.json').version,
9        },
10        '@material-ui/core': {
11          requiredVersion: deps['@material-ui/core'],
12          singleton: true,
13        },
14      },
15    ],
16  }
```

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1  {
2    shared: [
3      {
4        react: { requiredVersion: deps.react, singleton: true },
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7          import: '@applications-instead-of-libraries/shared-library',
8          requiredVersion: require('../shared-library/package.json').version,
9        },
10       '@material-ui/core': {
11         requiredVersion: deps['@material-ui/core'],
12         singleton: true,
13       },
14     },
15   ],
16 }
```

Beyond Single Components

Keeping internal state private

```
1  const Context = createContext('')
2  export const useContext = () => React.useContext(Context)
3
4  const WelcomeFrame = () => {
5    return (
6      <Context.Provider value="[private]">
7        <Card variant="outlined">
8          <CardHeader title="WelcomeFrame"></CardHeader>
9          <CardContent>
10            <Welcome />
11          </CardContent>
12        </Card>
13      </Context.Provider>
14    )
15  }
```

```jsx
const Context = createContext('')
export const useContext = () => React.useContext(Context)

const WelcomeFrame = () => {
  return (
    <Context.Provider value="[private]">
      <Card variant="outlined">
        <CardHeader title="WelcomeFrame"></CardHeader>
        <CardContent>
          <Welcome />
        </CardContent>
      </Card>
    </Context.Provider>
  )
}
```

```
1  const Context = createContext('')
2  export const useContext = () => React.useContext(Context)
3
4  const WelcomeFrame = () => {
5    return (
6      <Context.Provider value="[private]">
7        <Card variant="outlined">
8          <CardHeader title="WelcomeFrame"></CardHeader>
9          <CardContent>
10           <Welcome />
11         </CardContent>
12       </Card>
13     </Context.Provider>
14   )
15 }
```

Interactions between host and remote applications

```
const HostApplication = () => {
  return (
    <LanguageProvider value="de-DE">
      <Box p={1}>
        <RemoteComponent
          component="WelcomeFrame"
          delayed={<>Loading...</>}
        />
      </Box>
    </LanguageProvider>
  )
}
```

```
 1  const HostApplication = () => {
 2    return (
 3      <LanguageProvider value="de-DE">
 4        <Box p={1}>
 5          <RemoteComponent
 6            component="WelcomeFrame"
 7            delayed={<>Loading...</>}
 8          />
 9        </Box>
10      </LanguageProvider>
11    )
12  }
```
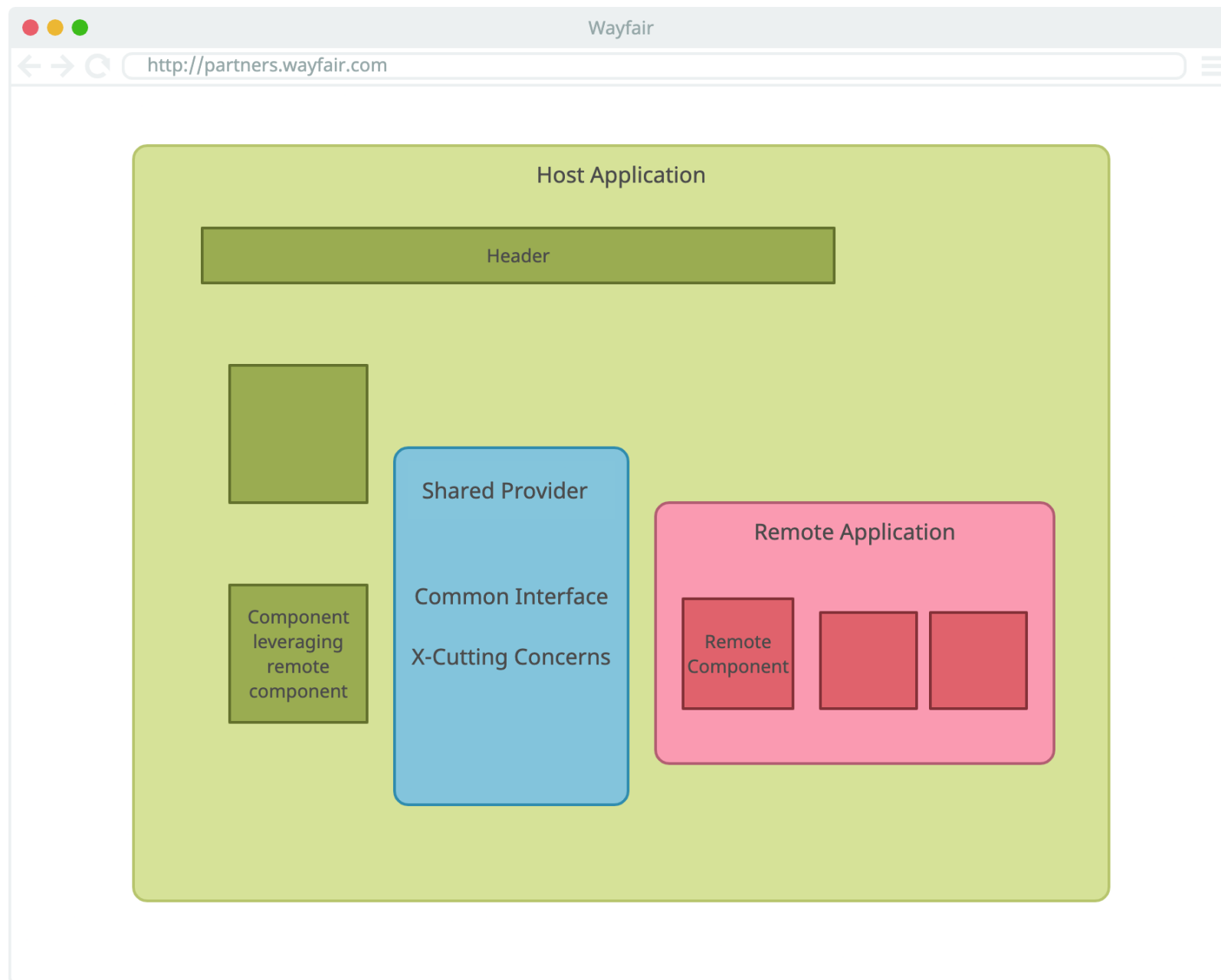
X-Cutting concerns

Logging

Monitoring

i18n

3️⃣ **Production Ready**

DevOps Borat
@DEVOPS_BORAT

To make error is human. To propagate error to all server in automatic way is #devops.

8:55 PM · Feb 26, 2011 · Mobile Web

Error Handling

```jsx
export default class LazyModule extends React.Component {
  static getDerivedStateFromError(error) {
    return { error }
  }

  constructor(props) {
    super(props)
    this.state = { error: null }
  }

  componentDidCatch(_error, errorInfo) {
    // eslint-disable-next-line no-console
    console.error('LazyModule failed while loading remote module', errorInfo)

    if (this.props.logger) {
      this.props.logger.error({
        message: 'LazyModule failed while loading remote module',
        data: errorInfo,
      })
    }
  }
}
```
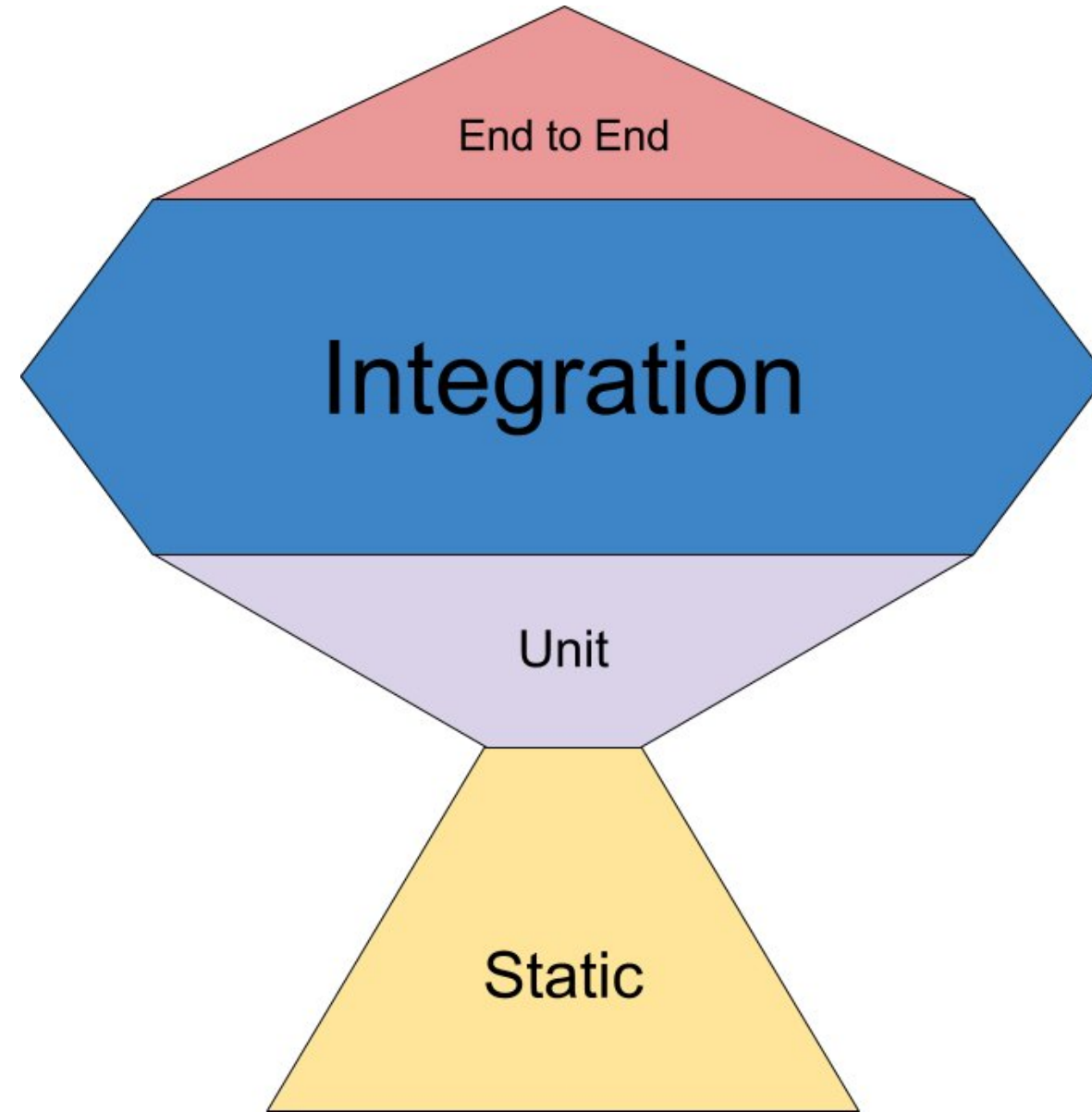
```jsx
export default class LazyModule extends React.Component {
  render() {
    if (this.state.error !== null) {
      const errorFallback = this.props.error

      if (React.isValidElement(errorFallback)) {
        return errorFallback
      } else if (typeof errorFallback === 'function') {
        return errorFallback({ error: this.state.error })
      } else {
        return null
      }
    }

    return (
      <React.Suspense fallback={this.props.delayed ?? null}>
        {this.props.children}
      </React.Suspense>
    )
  }
}
```
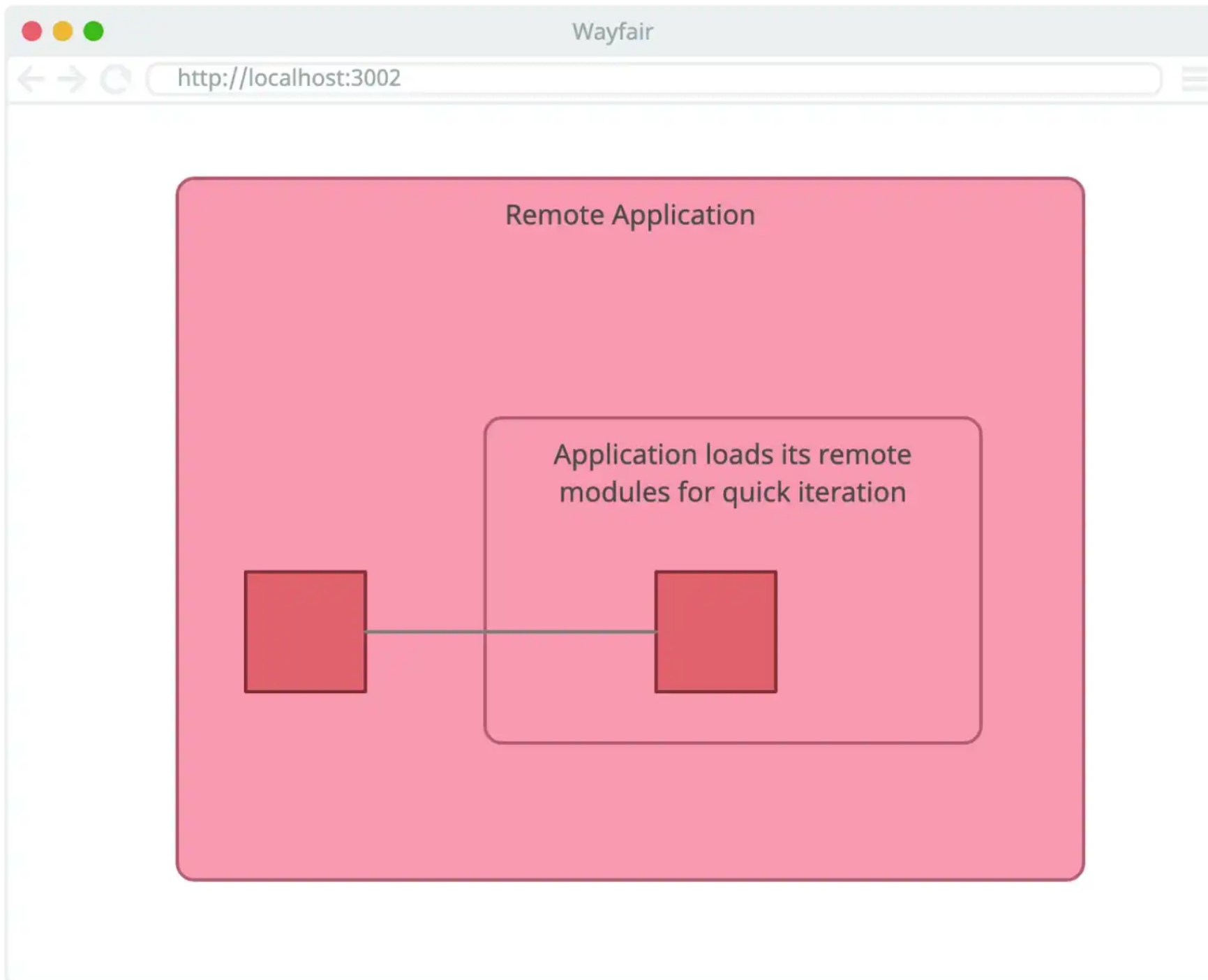
Testing

Testing remote components

http://localhost:3002

Remote Application

Application loads its remote modules for quick iteration

```
context('Integrated Application', () => {
  beforeEach(() => {})

  it('shows the integrated remote component', () => {
    cy.visit('http://localhost:3001')

    cy.contains('Host Application').should('exist')
    cy.contains('The selected locale is de-DE').should('exist')
  })
})
```

Contract Testing

matthias-kainer.de/blog/posts/contract-testing-in-the-frontend/

Monitoring

A MICRO FRONTEND IS A LIVE APPLICATION

OK Last ran 2 mins ago (Jan 25, 2022, 11:39 am)

Partner Home - Navigation Available

∨ Sample Runs

View sample | Successful Run | Failed Run |

STATUS	STARTING URL	STEPS	DURATION	LOCATION	DEVICE	BROWSER	TIME RAN	RUN TYPE
OK	https://partners.wayfair.com/v/login/index ⧉	5 / 5	15s	Frankfurt (AWS)	Laptop Large	firefox 95.0.2	1 min ago (Jan 25, 2022, 11:39 am)	Scheduled

	SCREENSHOT	ACTION		DURATION	0 μs 2 s 4 s 6 s 8 s 10 s 12 s 14 s 16 s
0 ✓		⧉ Navigate to start URL https://partners.wayfair.com/v/login/index Started at about:blank ⧉	🖼 18 Resources ≣ 15 Traces	2 s	
1 ✓		≣ Subtest Partner Home - Login ⧉ Started at https://partners.wayfa[...]3fbc04df2a7f731378d56d4 ⧉ in main test tab › Expand 10 steps	🖼 2 Resources	11.5 s	
2 ✓		✔ Navigation Panel present Started at https://partners.wayfa[...]upplier_dashboard/index ⧉		265 ms	
3 ✓		✓≡ User displayed Should not be empty Started at https://partners.wayfa[...]upplier_dashboard/index ⧉		277 ms	
4 ✓		✔ "Help & Support" is present Started at https://partners.wayfa[...]upplier_dashboard/index ⧉		259 ms	

∨ Test Runs

Events   **Test Runs**

| All | Ok | Alert |

Showing **the last 150** *test runs in the past 1 hour for selected locations* — *Limit reached, refine your query if needed*

Last updated less than a minute ago   ⟳ Refresh

STATUS	COMPLETED STEPS	DATE	DURATION	ERRORS	LOCATION	DEVICE	BROWSER	RUN TYPE
OK	5 / 5	**2 mins ago** Jan 25, 2022, 11:39 am	15s	0	Frankfurt (AWS)	Laptop Large	🦊 Firefox	Scheduled
OK	5 / 5	**2 mins ago** Jan 25, 2022, 11:39 am	15s	1	Frankfurt (AWS)	Laptop Large	◉ Edge	Scheduled
OK	5 / 5	**2 mins ago** Jan 25, 2022, 11:39 am	12s	1	Frankfurt (AWS)	Laptop Large	◉ Chrome	Scheduled
OK	5 / 5	**4 mins ago** Jan 25, 2022, 11:37 am	26s	1	N. California (AWS)	Laptop Large	◉ Edge	Scheduled

Scaling Usage

Remote Component

LazyModule

Webpack Configuration

Shared Provider

What if you have multiple remote applications?

```
const RemoteContainerProvider = ({
  environment,
  origins,
  children,
}: RemoteContainerProviderProps) => {
  const remoteContainerRegistry = useRemoteContainerRegistry({
    environment,
    origins,
  });

  return (
    <RemoteContainerContext.Provider value={remoteContainerRegistry}>
      {children}
    </RemoteContainerContext.Provider>
  );
};
```

Encouraging Adoption
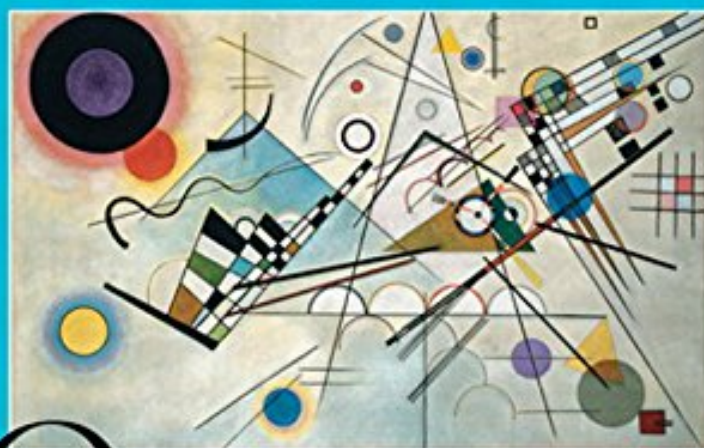
Should we build our new application as a micro frontend?

It depends!

Micro frontends are not about technology, they are about organizational structure

Finding meaningful boundaries is hard!

Lessons Learned

Clear advantages

Isolation

Quick path to production

There are challenges as well!

дэн
@dan_abramov

I don't understand micro-frontends.

5:48 AM · May 26, 2019 · Twitter Web App

medium.com/swlh/webpack-5-module-federation-a-game-changer-to-javascript-architecture-bcdd30e02669

aboutwayfair.com/careers/tech-blog/applications-instead-of-libraries-part-2

github.com/sirech/example-applications-instead-of-libraries