# Applications instead of Libraries

## Micro Frontends with Module Federation

# Mario Fernandez

## Wayfair

# 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

# A Humble Beginning

# What Are We Building?

# Partner Home @ Wayfair

wayfair PARTNER HOME

- Reporting
- Tickets
- Orders
- Stocking Orders
- CastleGate
- Inventory
- Products
- Premium Shelf
- Finance
- Developer
- Account Management
- Catalog
- Download Center
- Help & Support

# Your Wayfair Dashboard

Help

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)

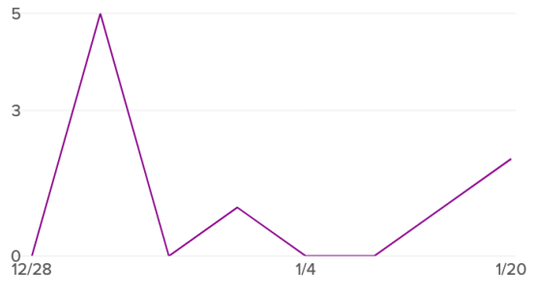
View Sales Dashboard

### Revenue

$99.31


### Units Sold

5




## 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

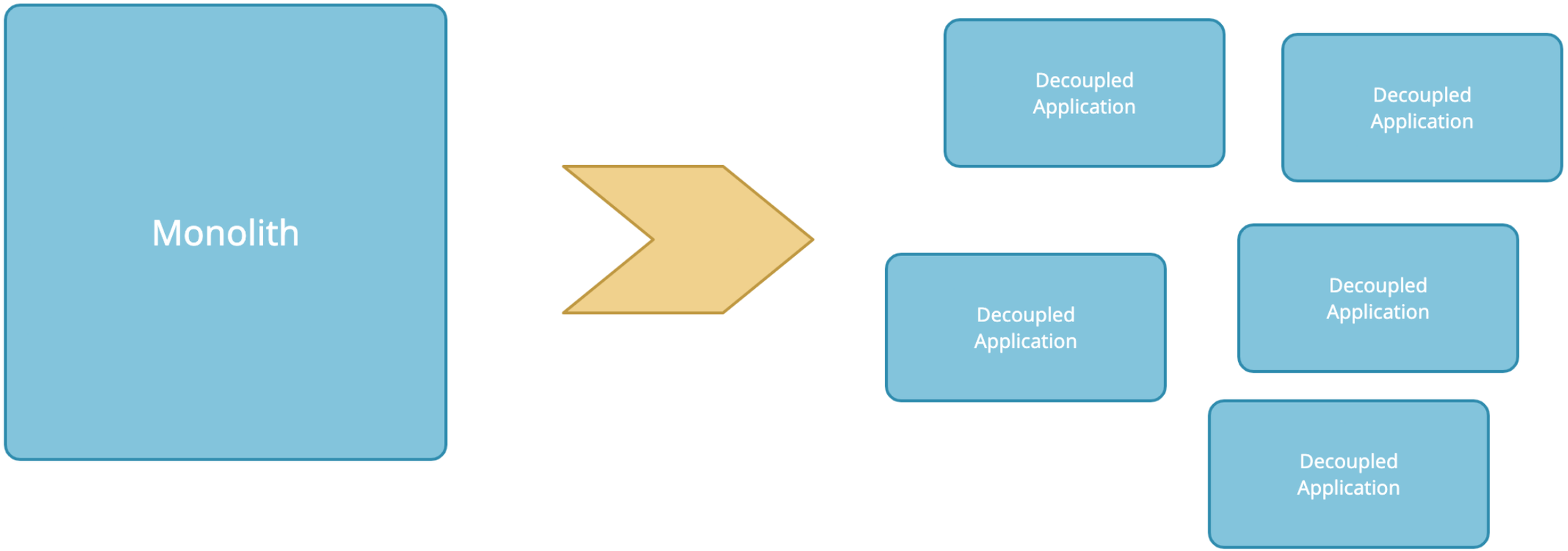
### Accelerant Hub

Accelerant Hub Home
Sponsored Products
Brand Page Management

# Rough numbers

## ~100 flows

## ~30 experience teams

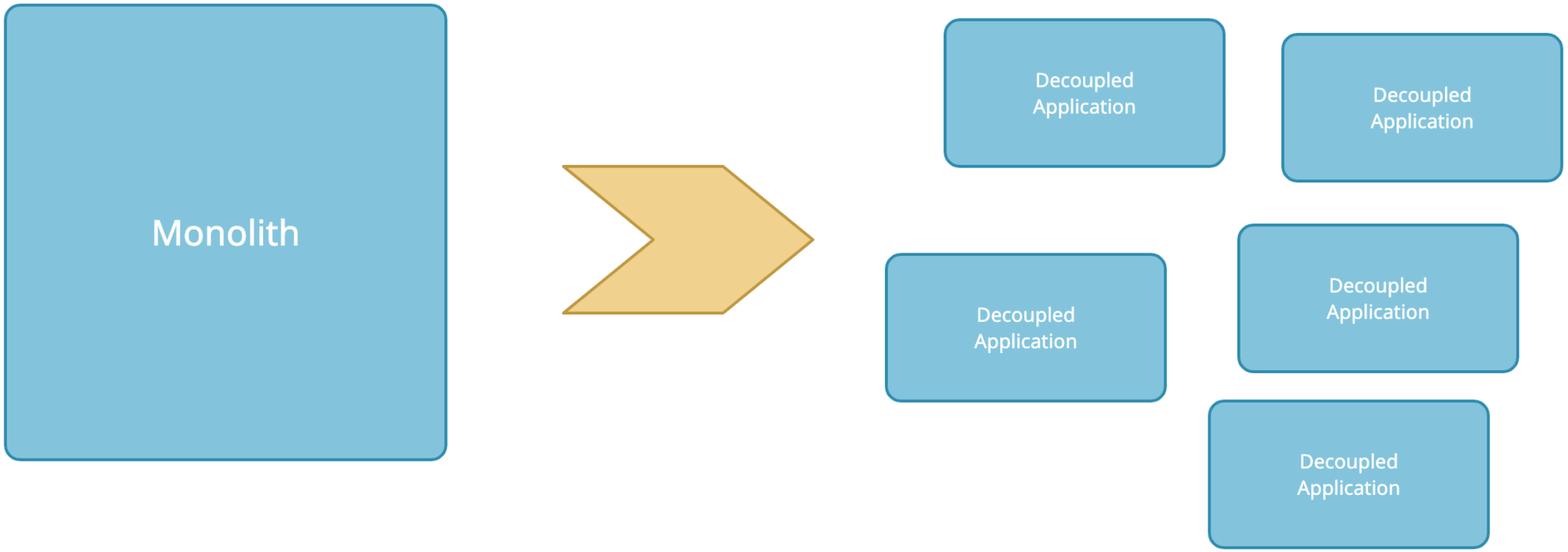

Monolith
Decoupled Application
Decoupled Application
Decoupled Application
Decoupled Application
Decoupled Application


React

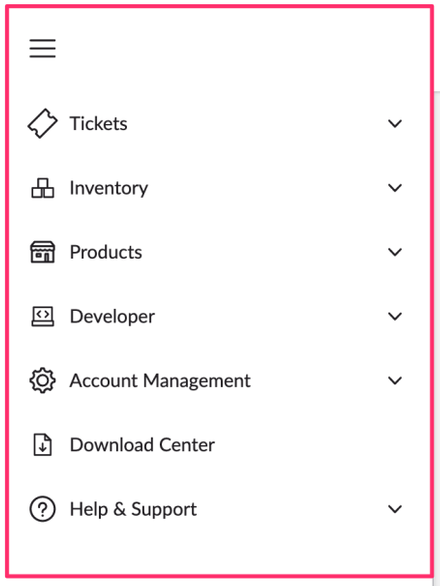
# Facing a Challenge

# Let's start with a question

# How to distribute front end applications?


Monolith
Decoupled Application
Decoupled Application
Decoupled Application
Decoupled Application
Decoupled Application

# What about shared concerns?




wayfair PARTNER HOME

Powell

# Your Wayfair Dashboard

Help

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.

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

## Today's Tasks

50 Order Alert(s)

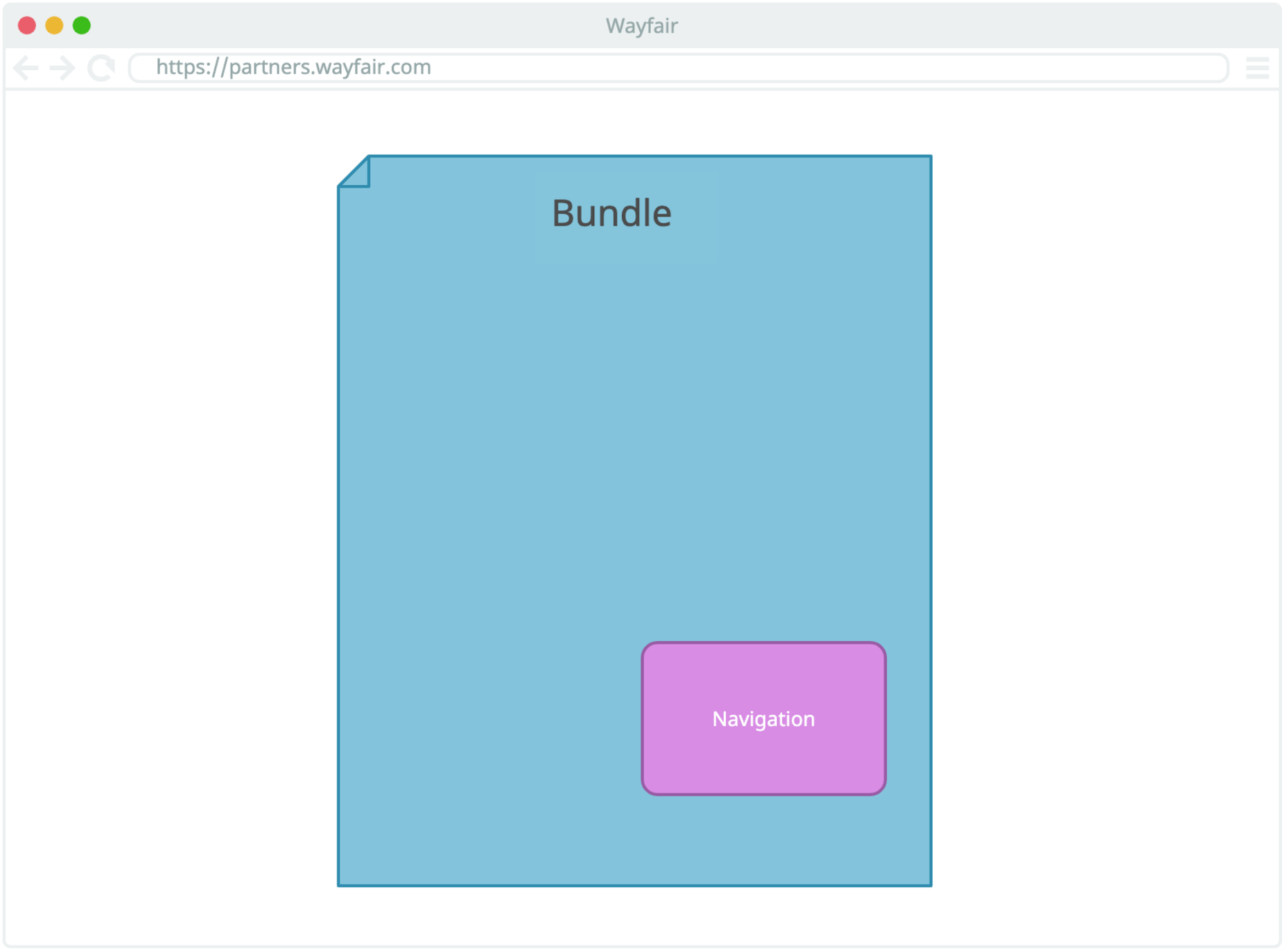
**86** to Ship Today

**36** to Ship Next Business Day

465 Ticket(s)

# Attempt 1️⃣

## Using an npm package


Wayfair
https://partners.wayfair.com
Bundle
Navigation

# You can guess it didn't work for us

# Challenges

# Challenges

## Propagating updates

# Challenges

## Propagating updates

## Consistency

# Challenges

## Propagating updates

## Consistency

## Operability

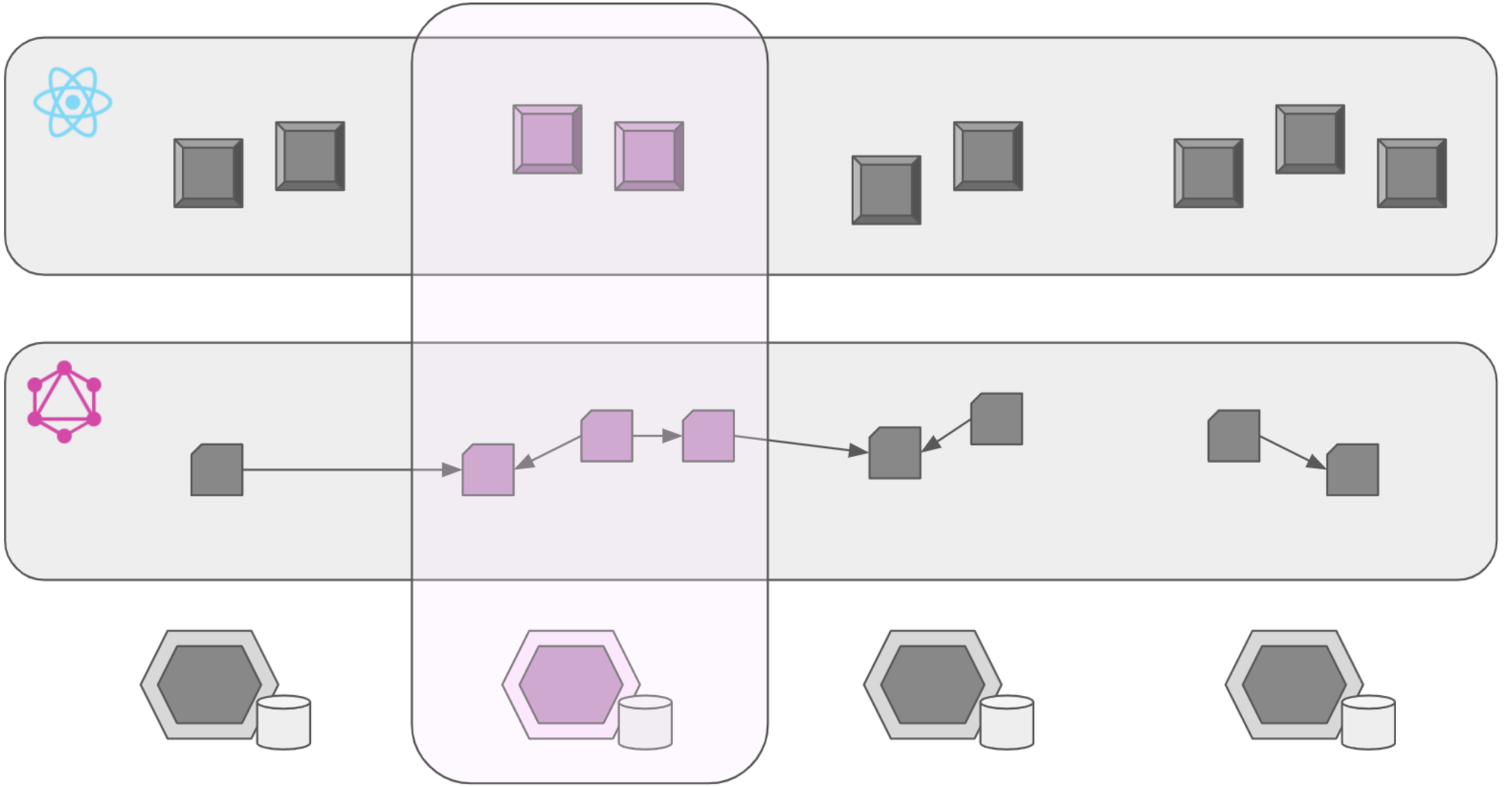
# Attempt 2️⃣

## Applications instead of libraries

# A different paradigm

## Independently deployed applications

## Integrated as a cohesive whole



# Plenty of ways to implement micro frontends

The one right way to do microfrontends - two opinions

youtube.com/watch?v=Wly6KseqABE

# Let's talk about our implementation

# What is module federation?

# Load modules remotely at runtime

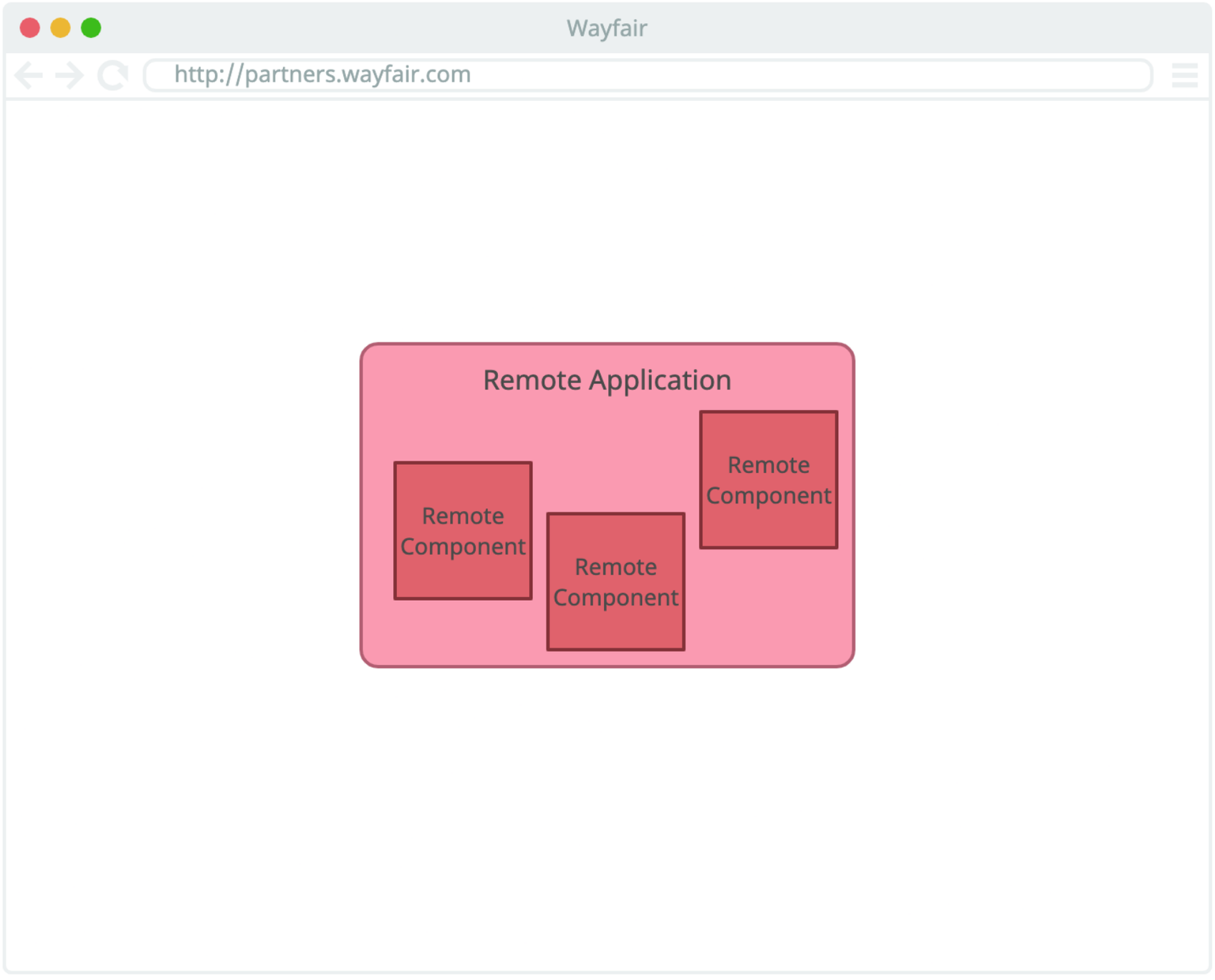
# New in Webpack 5

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

# Why is that relevant?

# Low friction integration between independent applications

# Making an Application Remote


Wayfair
http://partners.wayfair.com
Remote Application
Remote Component
Remote Component
Remote Component

```
new ModuleFederationPlugin({
  name: 'remote',
  filename: 'remoteEntry.js',
  exposes: {
    './Welcome': './src/Welcome',
  },
  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,
      },
    },
  ],
})
```

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        import: '@applications-instead-of-libraries/shared-library',
        requiredVersion: require('../shared-library/package.json').version,
      },
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        singleton: true,
      },
    },
  ],
})
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  shared: [
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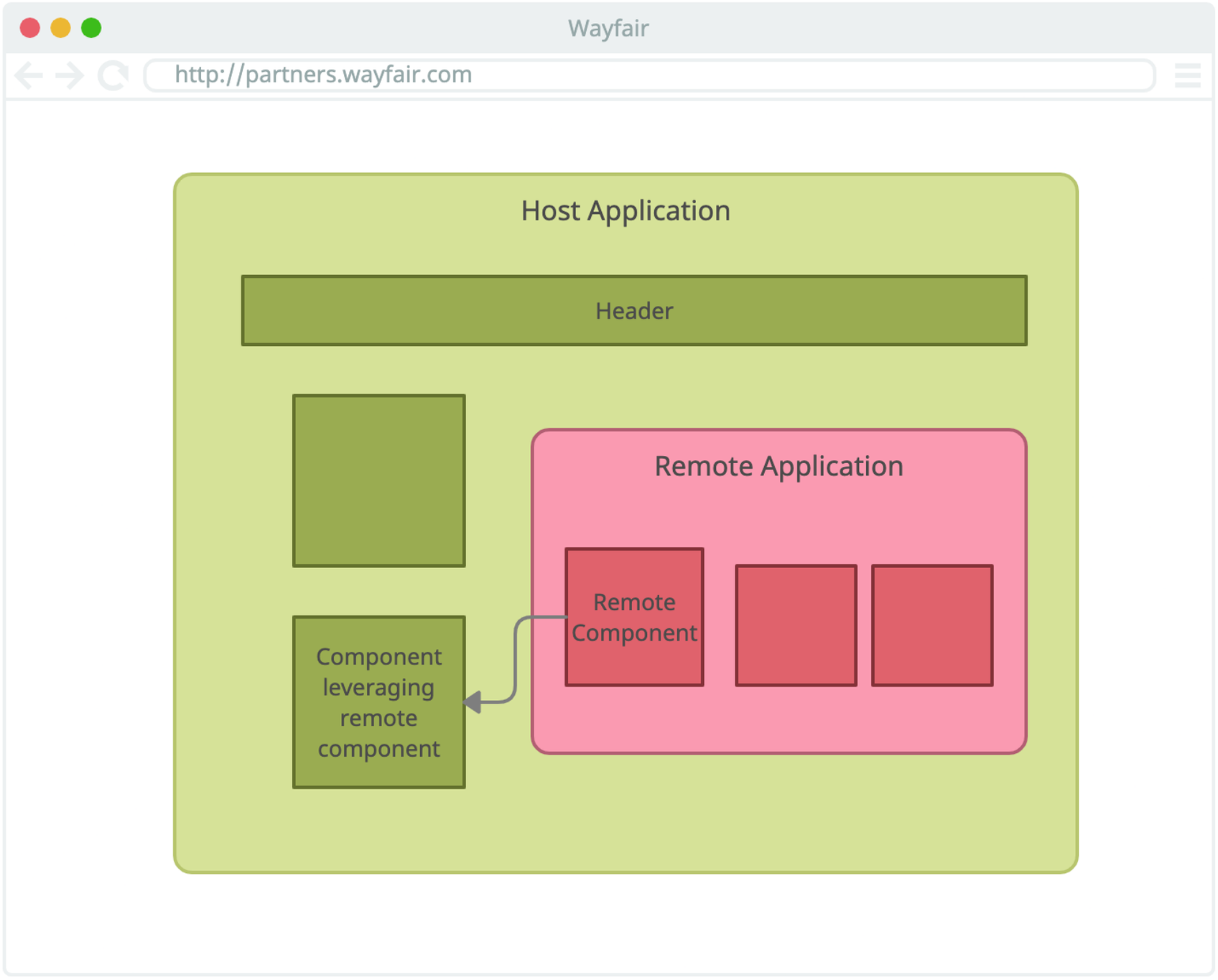
        import: '@applications-instead-of-libraries/shared-library',
        requiredVersion: require('../shared-library/package.json').version,
      },
      '@material-ui/core': {
        requiredVersion: deps['@material-ui/core'],
        singleton: true,
      },
    },
  ],
})
```

# That's it? 🤔

# Consuming a Remote Application


Wayfair
http://partners.wayfair.com
Host Application
Header
Remote Application
Remote Component
Component leveraging remote component

```
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,
      },
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        requiredVersion: deps['@material-ui/core'],
        singleton: true,
      },
    },
  ],
})
```

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new ModuleFederationPlugin({
  name: 'host',
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  shared: [
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        requiredVersion: require('../shared-library/package.json').version,
      },
      '@material-ui/core': {
        requiredVersion: deps['@material-ui/core'],
        singleton: true,
      },
    },
  ],
})
```

```
export default class LazyModule extends React.Component {
  constructor(props) {
    super(props)
    this.state = { error: null }
  }

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

```
export default class LazyModule extends React.Component {
  constructor(props) {
    super(props)
    this.state = { error: null }
  }

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

# A problem

## Dynamic loading

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

# More flexible loading

```
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

```
{
  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,
      },
    },
  ],
}
```

```
{
  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,
      },
    },
  ],
}
```

# You don't want to download React multiple times

# You don't want strong coupling, either

# 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 }
```

```
1  const Context = createContext('')
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11         </CardContent>
12       </Card>
13     </Context.Provider>
14   )
15 }
```

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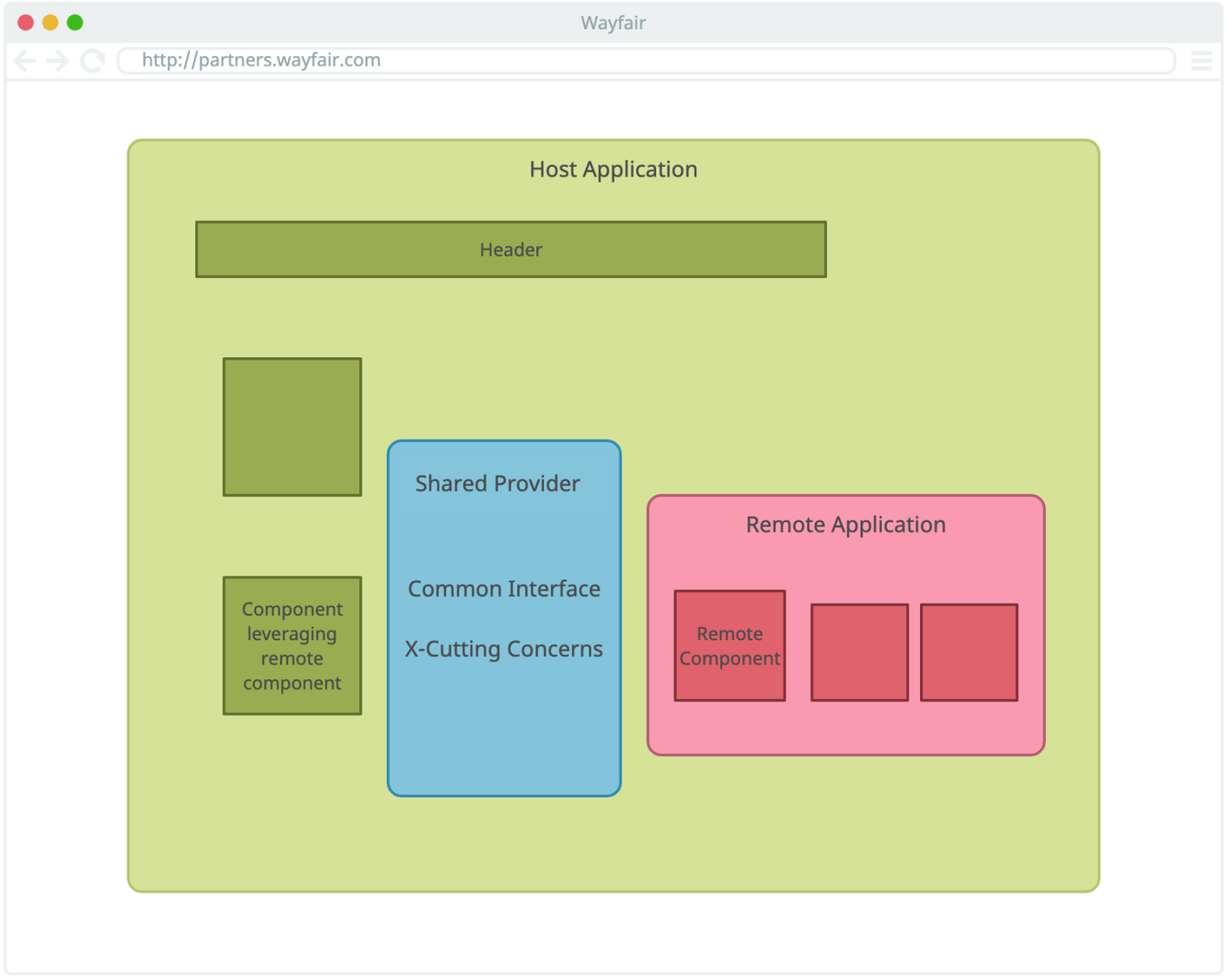
8          <CardHeader title="WelcomeFrame"></CardHeader>
9          <CardContent>
10           <Welcome />
11         </CardContent>
12       </Card>
13     </Context.Provider>
14   )
15 }
```

# Interactions between host and remote applications

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

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


Wayfair
http://partners.wayfair.com
Host Application
Header
Component leveraging remote component
Shared Provider
Common Interface
X-Cutting Concerns
Remote Application
Remote Component

# X-Cutting concerns

## Logging

## Monitoring

## i18n

# 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

```
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)

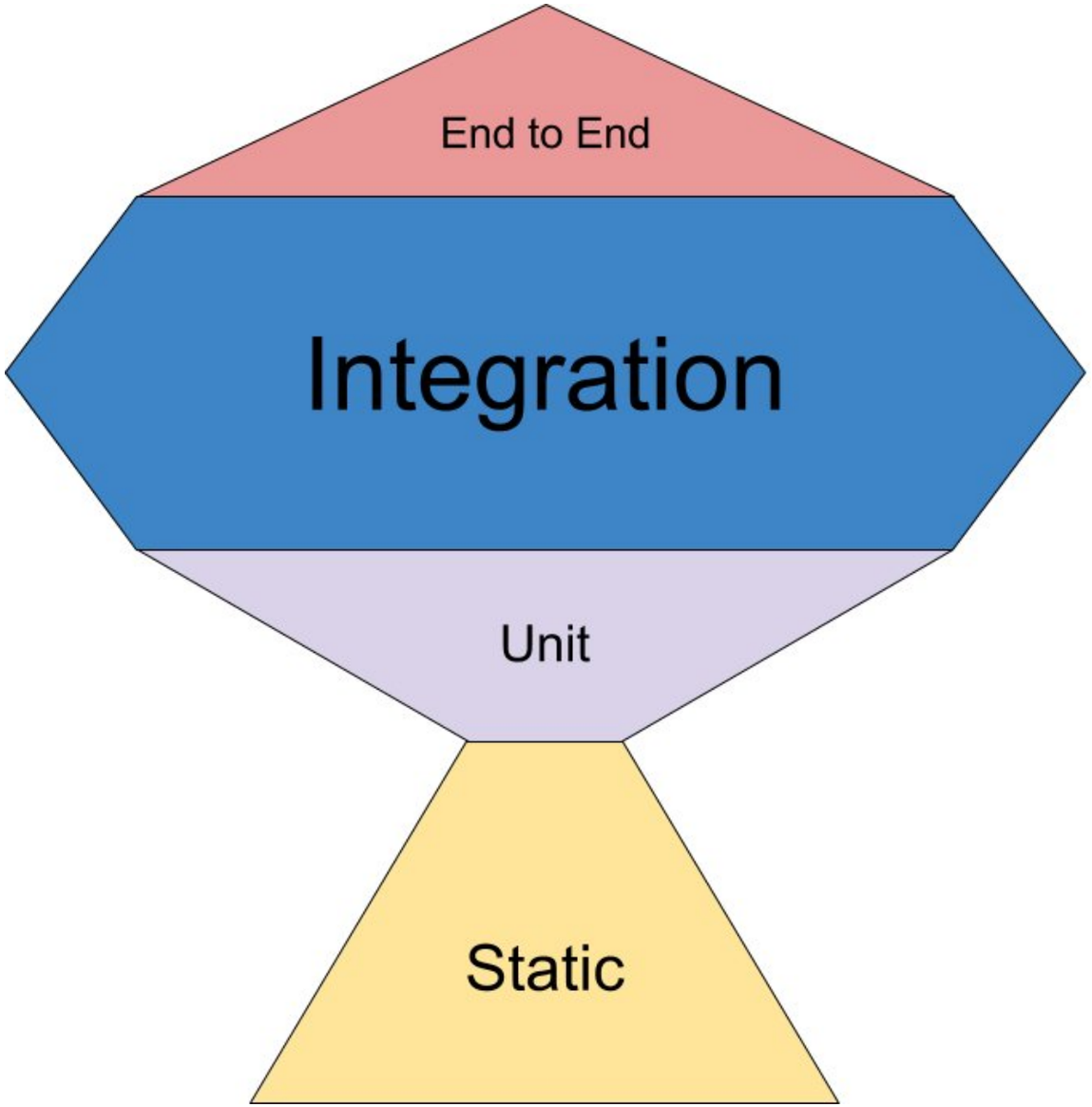
    if (this.props.logger) {
      this.props.logger.error({
        message: 'LazyModule failed while loading remote module',
        data: errorInfo,
      })
    }
  }
}
```

```
export default class LazyModule extends React.Component {
  render() {
    if (this.state.error !== null) {
      const errorFallback = this.props.error

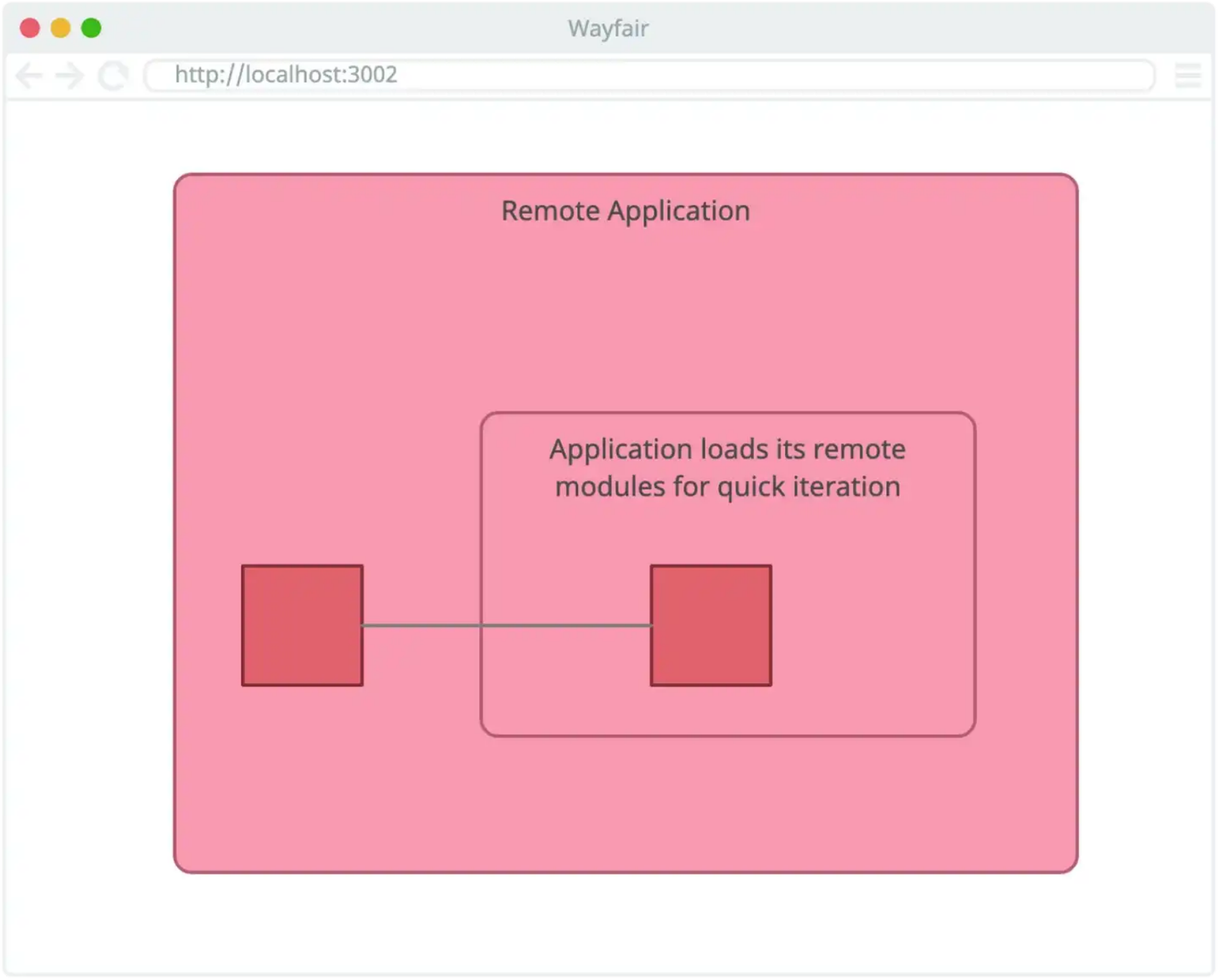
      if (React.isValidElement(errorFallback)) {
        return errorFallback
      } else if (typeof errorFallback === 'function') {
        return errorFallback({ error: this.state.error })
      } else {
        return null
      }
    }

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

# Testing


End to End
Integration
Unit
Static

# Testing remote components


Wayfair
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

# A micro frontend is a live application

# A MICRO FRONTEND IS A LIVE APPLICATION

Synthetics > Partner Home - Navigation Available

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

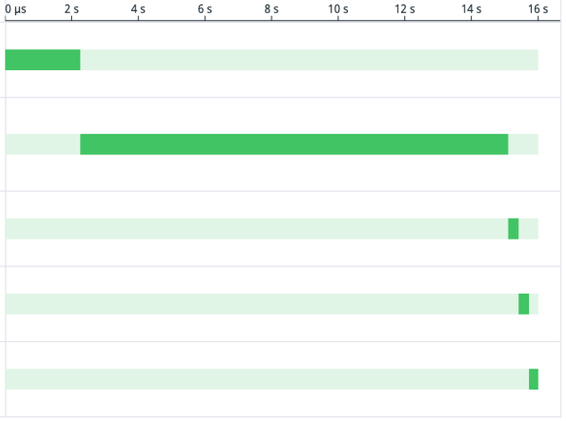
# Partner Home - Navigation Available

## 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 ✔ |  | Navigate to start URL<br>https://partners.wayfair.com/v/login/index<br>Started at about:blank | 18 Resources<br>15 Traces | 2 s |
| 1 ✔ |  | Subtest Partner Home - Login<br>Started at https://partners.wayfa[...]3fbc04df2a7f731378d56d4 in main test tab<br>Expand 10 steps | 2 Resources | 11.5 s |
| 2 ✔ |  | ✔ Navigation Panel present<br>Started at https://partners.wayfa[...]upplier_dashboard/index | | 265 ms |
| 3 ✔ |  | ✔= User displayed<br>Should not be empty<br>Started at https://partners.wayfa[...]upplier_dashboard/index | | 277 ms |
| 4 ✔ |  | ✔ "Help & Support" is present<br>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?

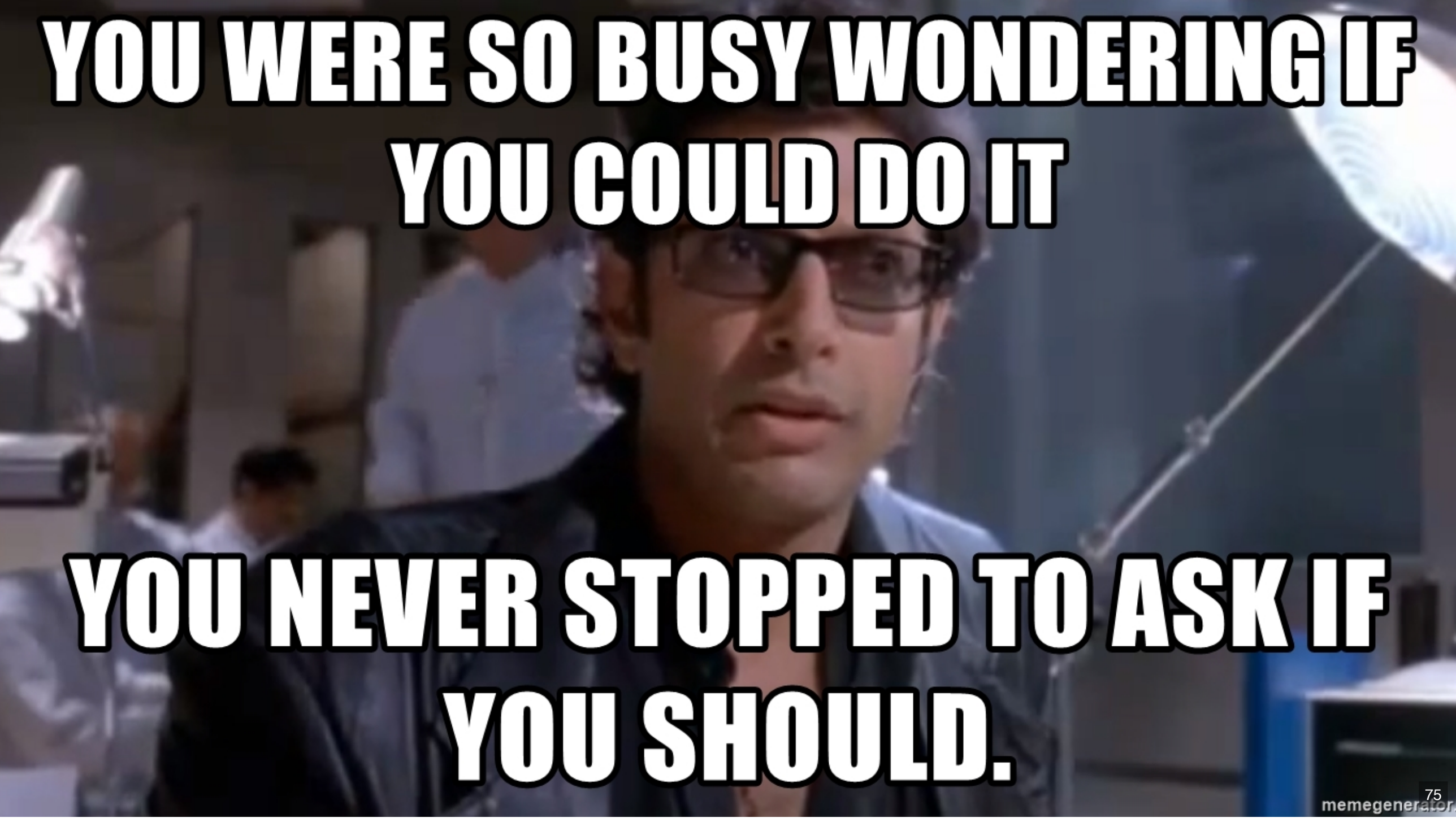
```
const RemoteContainerProvider = ({
  environment,
  origins,
  children,
}: RemoteContainerProviderProps) => {
  const remoteContainerRegistry = useRemoteContainerRegistry({
    environment,
    origins,
  });

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

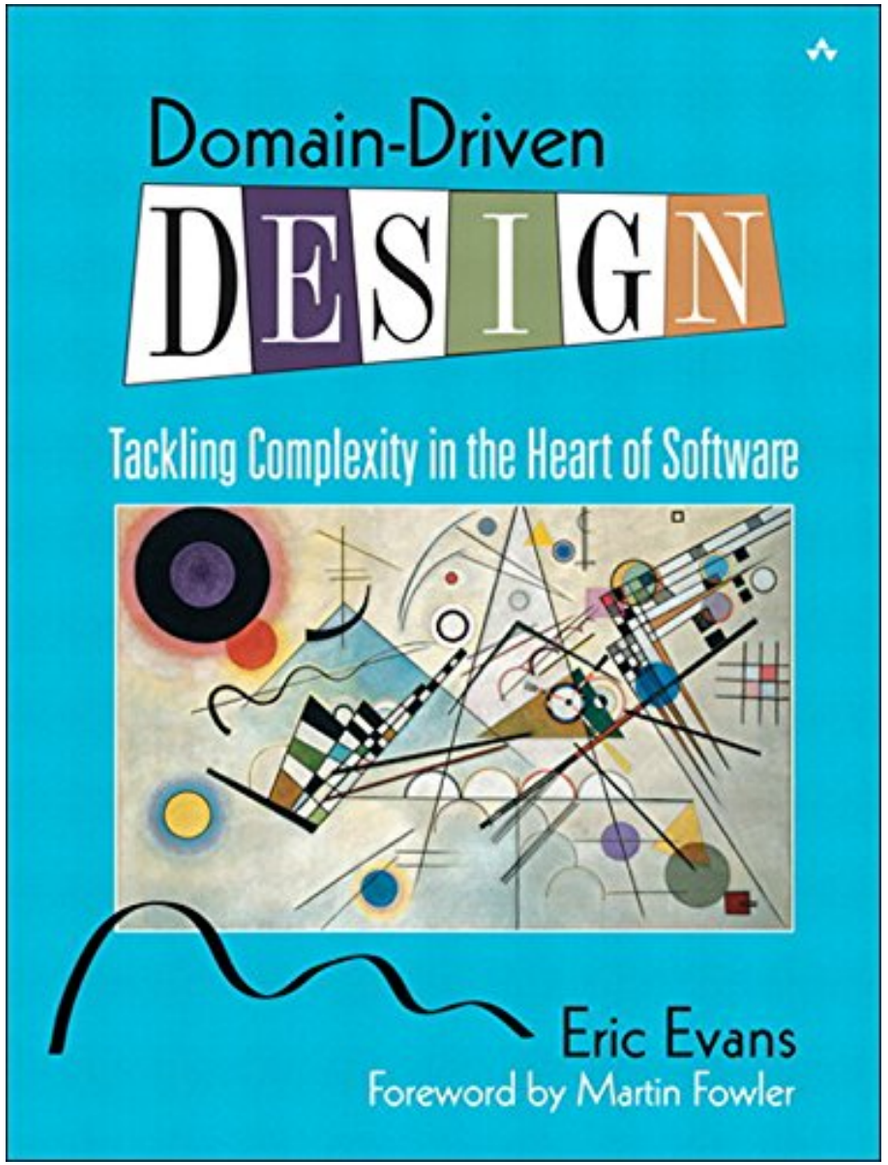
# Encouraging Adoption

# Should we build our new application as a micro frontend?

# It depends!


YOU WERE SO BUSY WONDERING IF YOU COULD DO IT
YOU NEVER STOPPED TO ASK IF YOU SHOULD.
memegenerator

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


Domain-Driven
DESIGN
Tackling Complexity in the Heart of Software
Eric Evans
Foreword by Martin Fowler

# 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