Microfrontends Implementation Patterns

Thessaloniki 2025

About me

- Alexandros Tsichouridis
- Senior Software engineer
- Full Stack (Java, Spring, Angular, React ...)
- University of Macedonia, BSc & MSc
    - Clean code and design,
    - CS Education

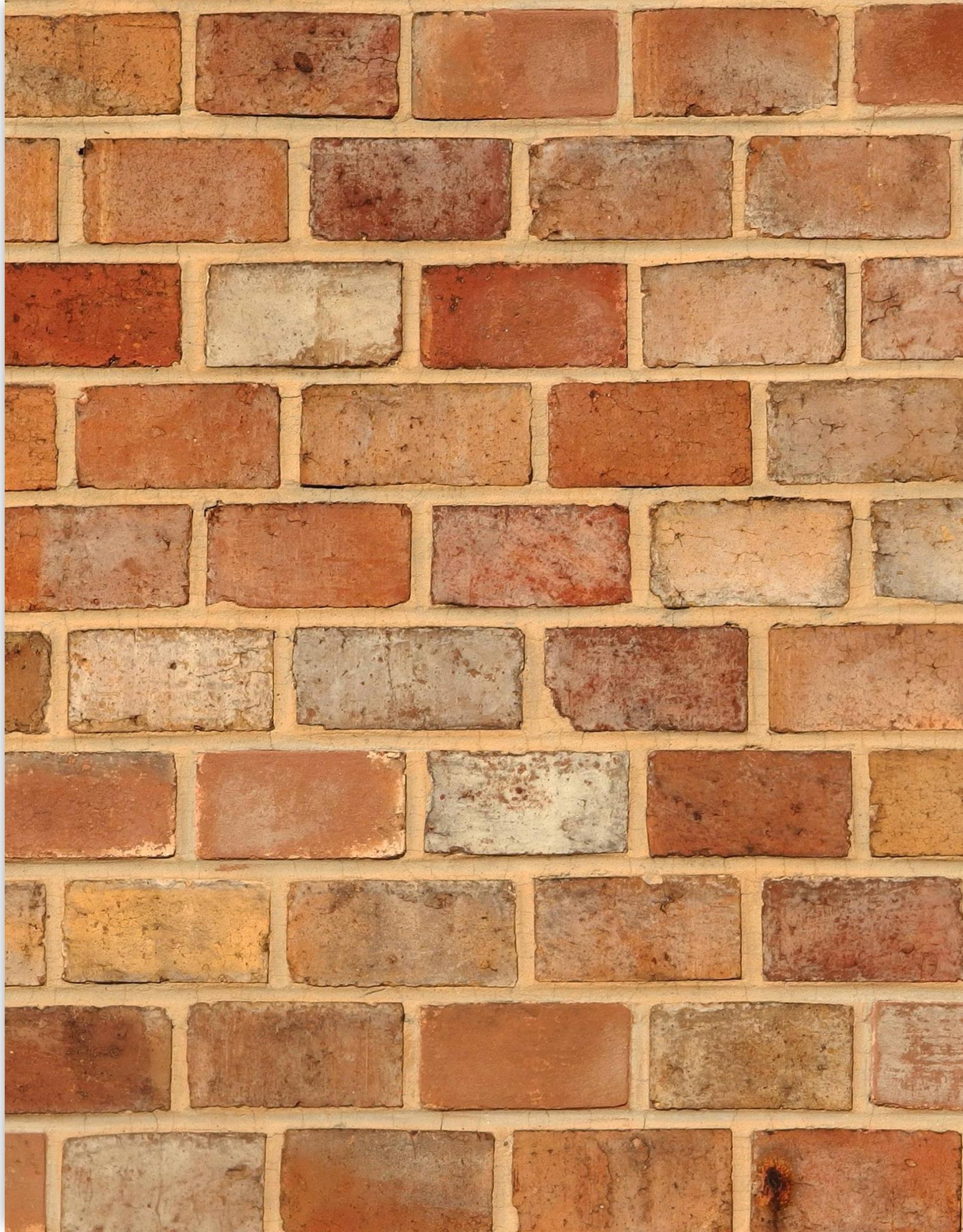
Agenda

01

Why Microftontends

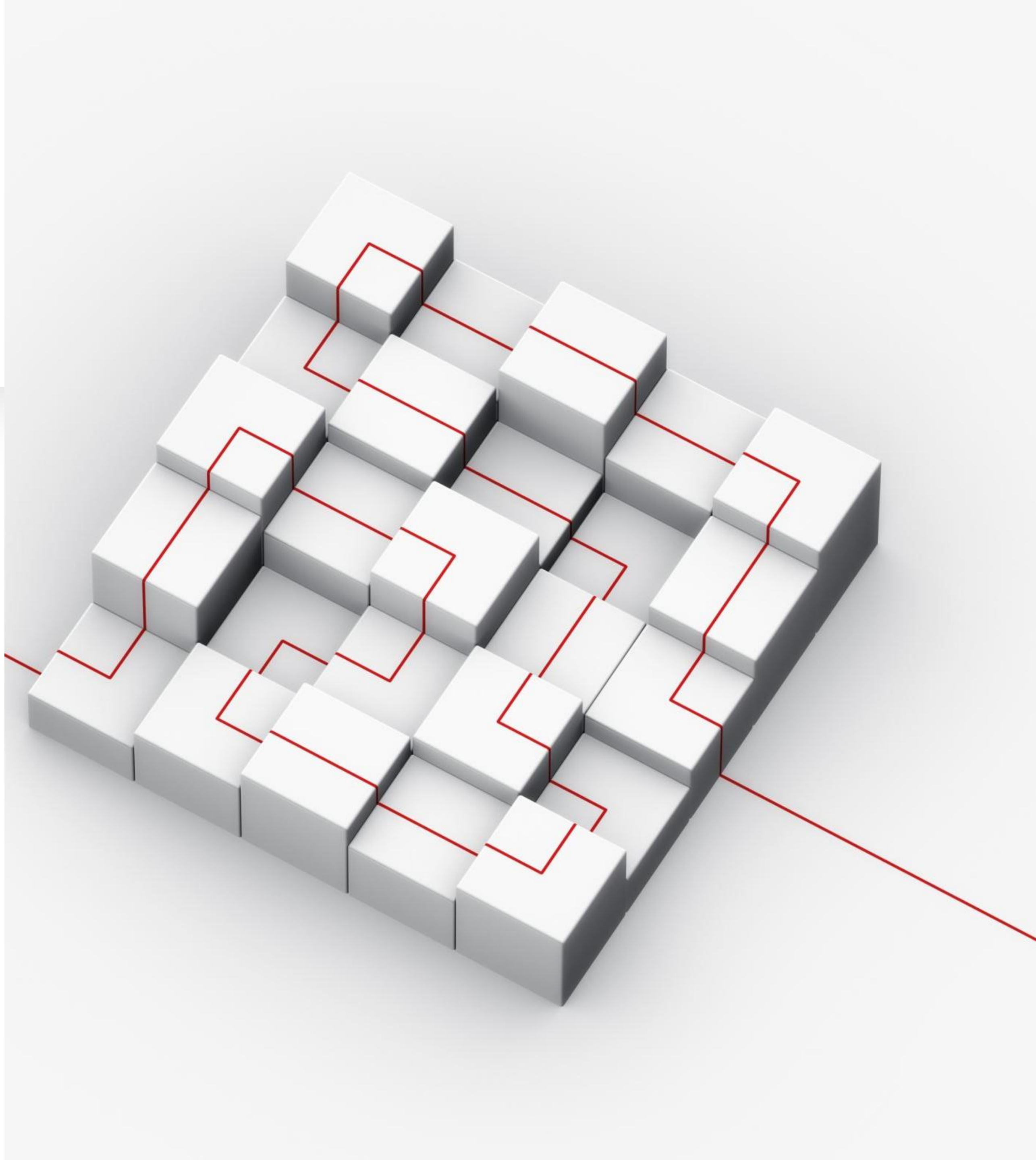
Typical Frontend application - Monolithic Approach challenges

- Very large codebase
- Multiple teams
- Time consuming deployment
- Tightly coupling
- Technology stack restriction



What are microfrontends ?

- Architectural approach for building modern web applications
- Splits a frontend app into smaller, semi-independent modules
- All modules are integrated to form a single user experience
- Inspired by microservices in backend development



Micro frontends - Benefits

- Smaller codebase and loose coupling
- Team independent
- Development flexibility
- Improved maintainability
- Independent deployments
- Technology diversity

Challenges

- Cross application communication
- Complex deployment
- Performance and latency
- Shared packages, library dependencies
- Versioning management
- Routing and application module mounting

02

Main Approaches

Architecture Approaches

- Build-time Integration
- Server-side Composition
- Runtime (Client-side) Integration
  - Edge-side includes

Build Time Integration

- Single bundle
- Monorepo or different artifacts
- Release Strategy

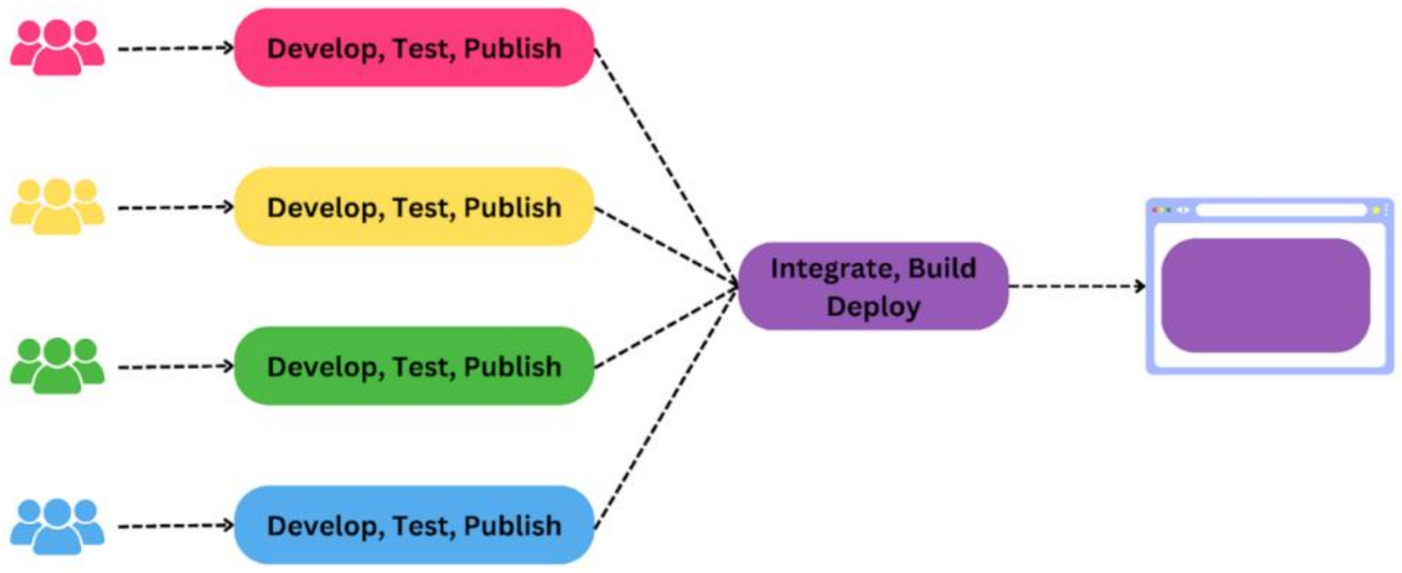


Diagram from https://www.syncfusion.com/blogs/post/micro-frontend-run-time-vs-build-time

Server-side Integration

- Mutliple bundles into one
- Server effort
- SEO

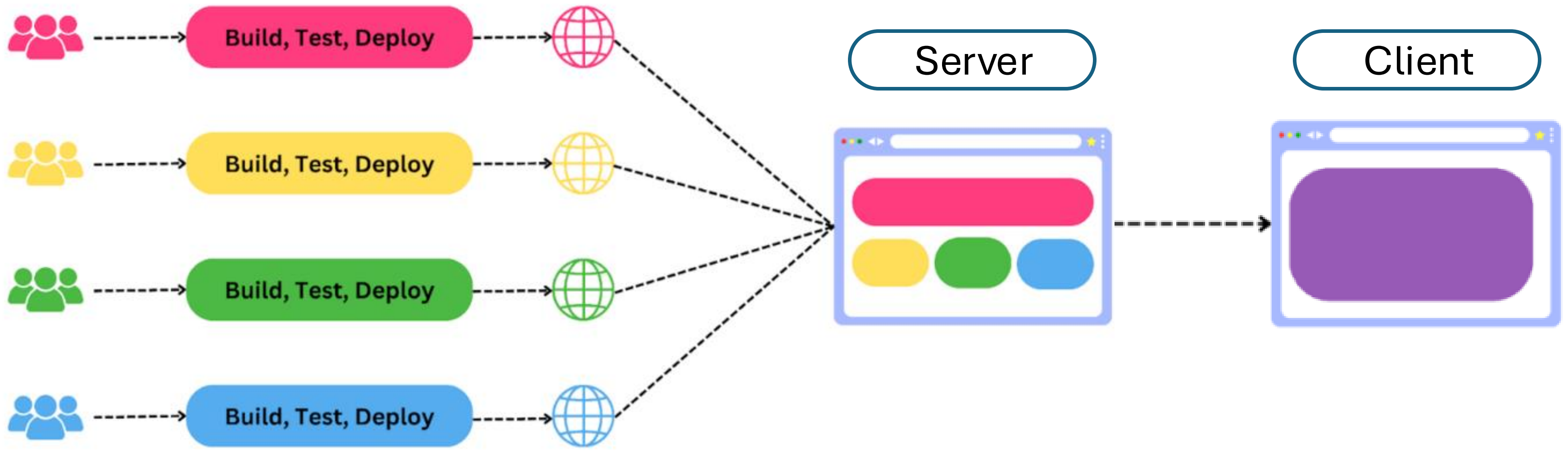
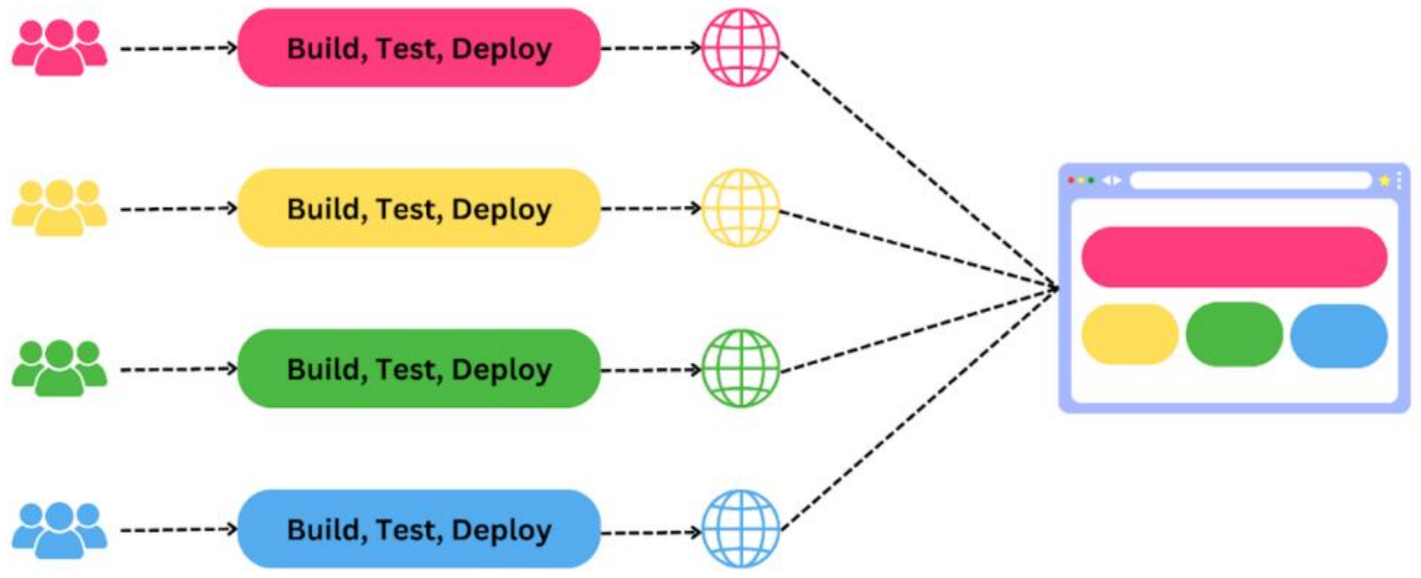


Diagram from https://www.syncfusion.com/blogs/post/micro-frontend-run-time-vs-build-time

Client-side Integration

- Independently deployed bundles
- Monorepo or Multirepo
- Edge side includes
- Client-side logic



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03

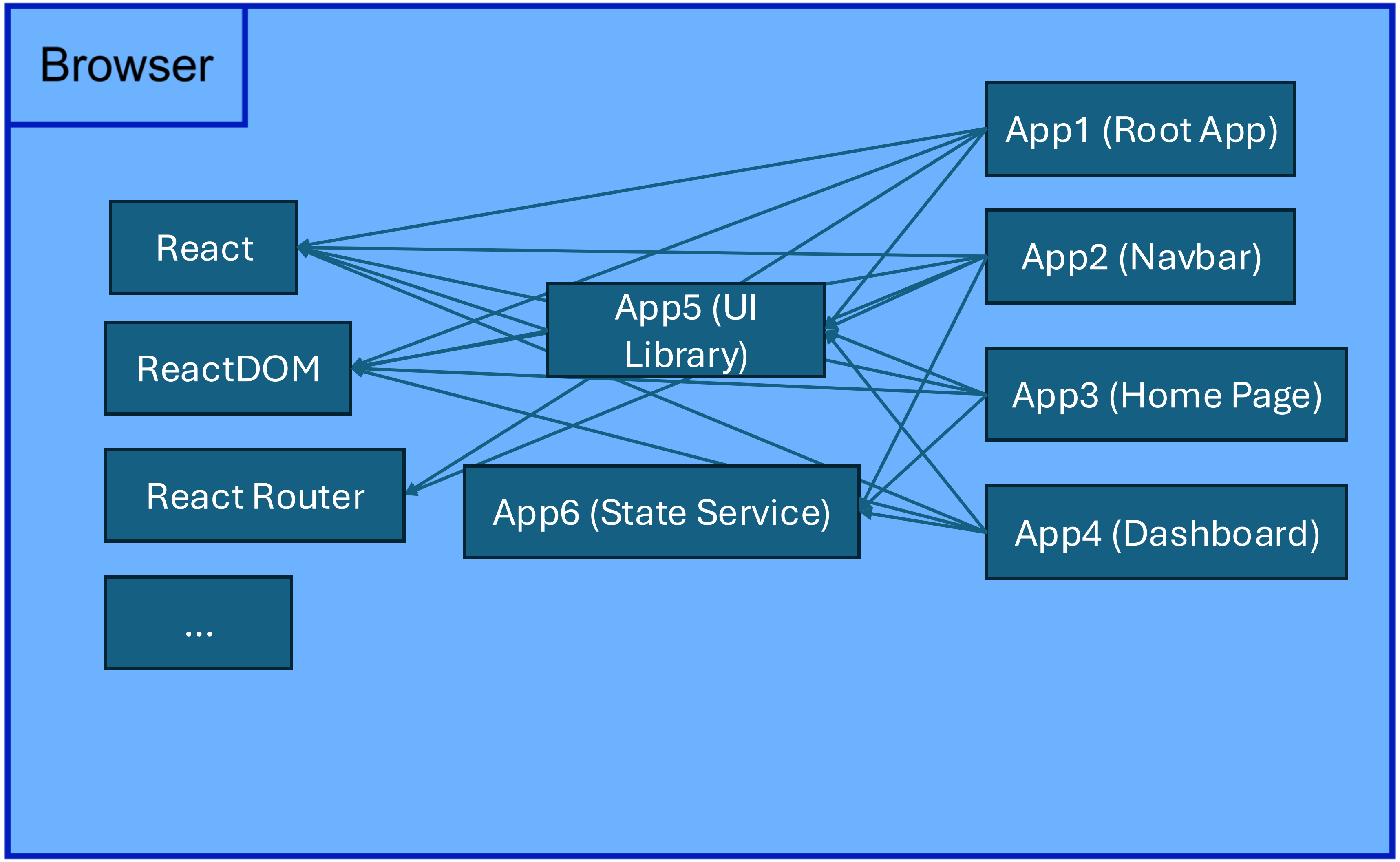
Microfrontends in Action

Micro frontends – Client-side integration in action!

- Webpack Module Federation
- Single-spa
- Web Components

How external / common dependencies work

- Packages are loaded once, used by many
- We have to define which dependencies are external or common
- When sharing dependencies, we can share their state too
- Some packages must be shared across applications to work properly (ReactDOM)
- Plugins do this automatically in many cases



Hands on!

Webpack Module Federation

- Industry Standard
- Included in Webpack 5
- Strong community
- Used by other tools
  - module-federation.io
  - NX

Example Scenario

- E-Commerce application (React)
- Different parts must be developed by different teams
- Consists of 5 parts
  - Navbar
  - Product
  - Product page
  - Checkout page
  - Order history

Single-Spa

- Framework agnostic
  - Angular, React, Vue, Vanilla JS, AngularJS and many others
- Supports legacy technologies before Webpack 5
- Leverages importmaps
- Single-SPA applications or Parcels

Single-Spa Example scenario

- Old Angular 9 company CRM app developed in 2020
- Modernized incrementally
- Different teams work using different technologies
- Modern frameworks
  - Angular 19
  - React 19
- Follow microfrontends approach using single-spa

Web Components

WEB COMPONENTS

- APIs for creating custom elements
- Follows Web Specifications
- Reusable elements / components
  - Design systems and component libraries
- React, Angular, Vue support creating web components
- Lit, Stencil
- Can be combined with Single-Spa or Module Federation or just SPAs

Microfrontend approaches comparison

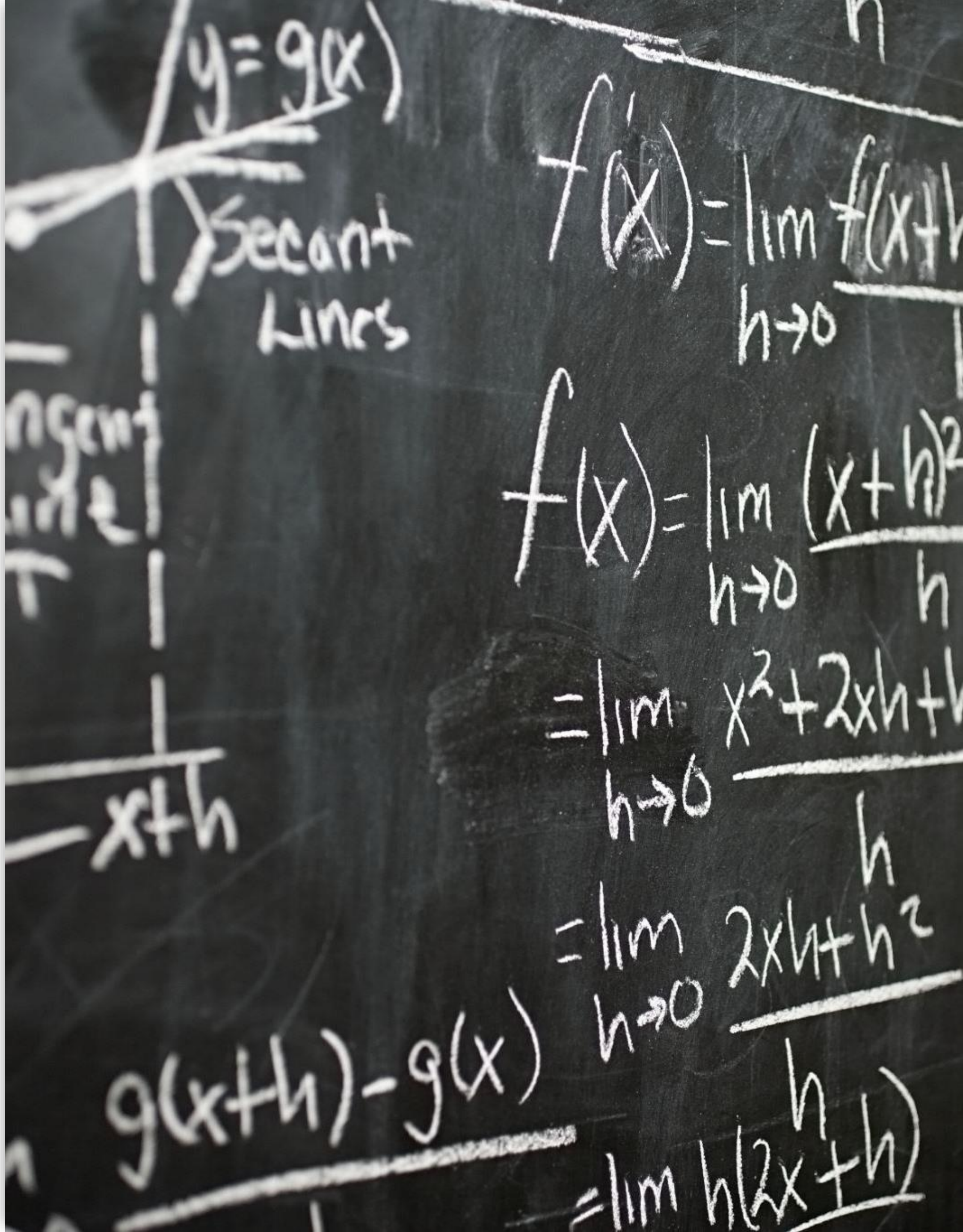
- Module Federation
  - Strong community
  - For webpack, avaible to other bundlers through community plugins
  - Good for same framework
- Single spa
  - Less active community
  - Framework Agnostic
  - Good support for Legacy systems
- Web Components
  - Specification for web applications, Browser native feature
  - Framework Agnostic

Beyond the Basics

- Dynamic module discovery
- Module metadata – manifest
- Assets management
- Styles mounting/unmounting and isolation
- Routing
- Version management – multiple package versioning
- Framework agnostic
- Legacy system modernization

Conclusion

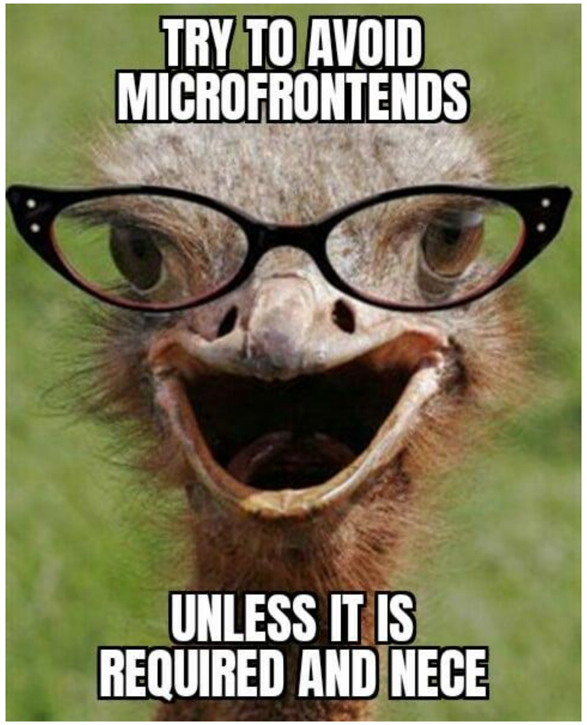
- Examine the actual needs and requirements
- Not ideal for small projects
    - Unnecessary complexity
- Steep learning curve



$ Try to avoid microfrontends, unless it is **required** and **necessary**

Got any fatherly advice for me?
try to avoid microfrontends son,
unless it is required and necessary

TRY TO AVOID MICROFRONTENDS
UNLESS IT IS REQUIRED AND NECESSARY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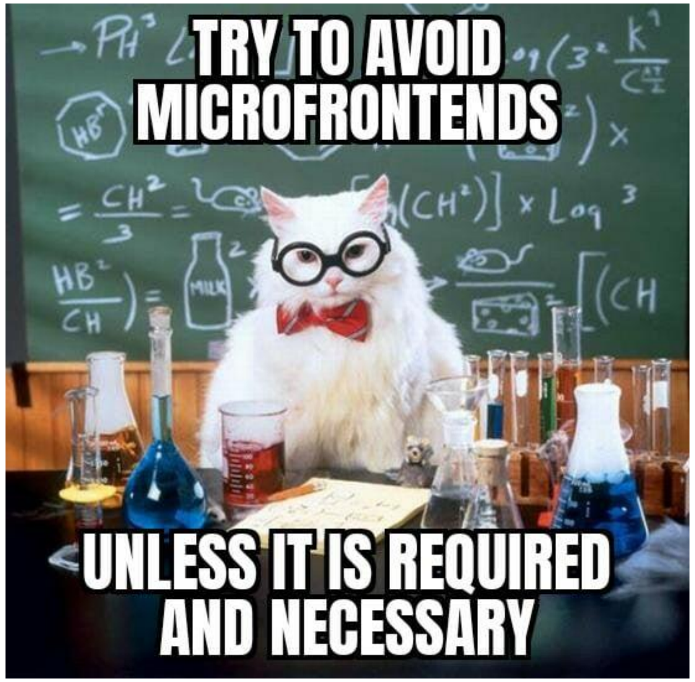
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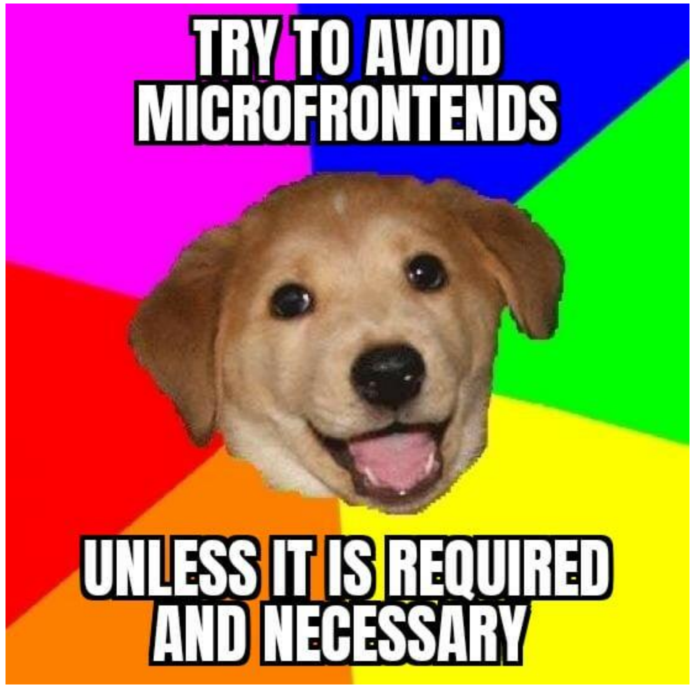
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THE END
THANK YOU FOR YOUR ATTENTION

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