Micro Frontends

A new migration process for monolithic web applications (FR2BCO04)

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Introduction

Currently, the CERN accelerators controls domain relies on more than **30 monolithic web applications**

- **Diverse** technology stacks
  (VueJS, AngularJS, Angular)
- Obsolete or **unsupported** technologies
  (e.g. AngularJS EoL was on January 2022 & Vue 2 is on December 2023)
- **Frozen** development due to extensive migrations plans
- **Challenging recruitment** of newcomers

Can we transform the process to deliver solutions without long development cycles and repeated migrations?

Architecture

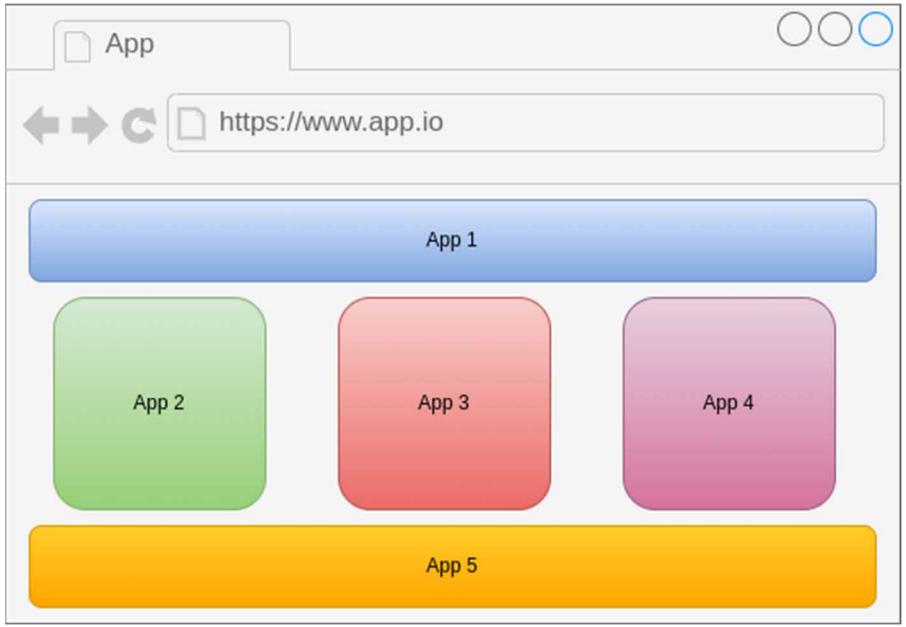
A new architecture known as **Micro Frontends** was introduced to tackle the aforementioned issues

- **Independent**, applications that can be **composed** into a greater one
- **Incremental** upgrade and **eradication** of legacy solutions
- **Simpler** applications with **smaller** codebases
- **Autonomous** teams with different methodologies/technologies

We evaluated 2 different micro frontend architectures in existing applications

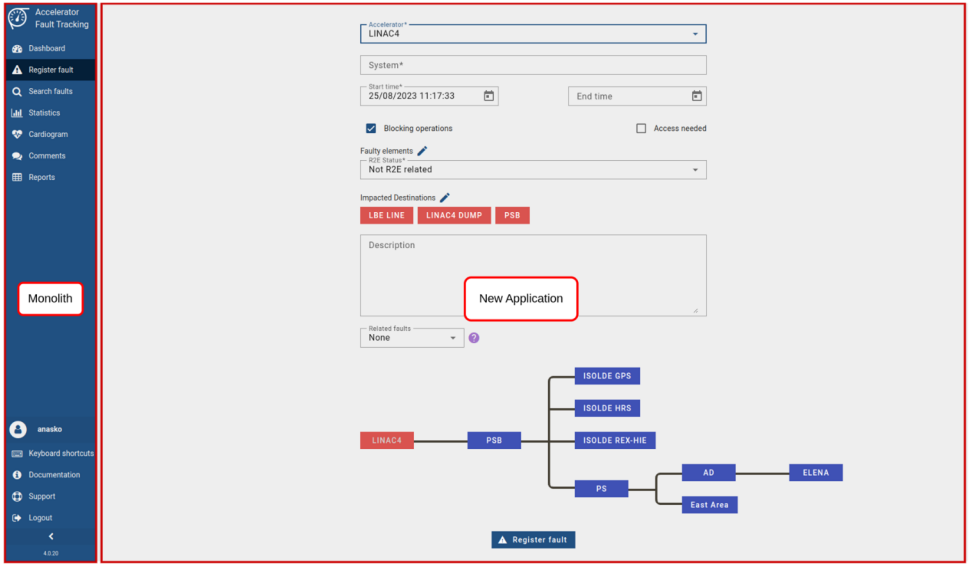
Micro frontend Architecture 1 - Single Page Application

- **Encapsulation** of specific functionality and **reusability**
- Impose **isolation** to prevent unintended conflicts with other components
- **Interoperability** allowing **integration** of multiple libraries and frameworks



Example - Single Page Application

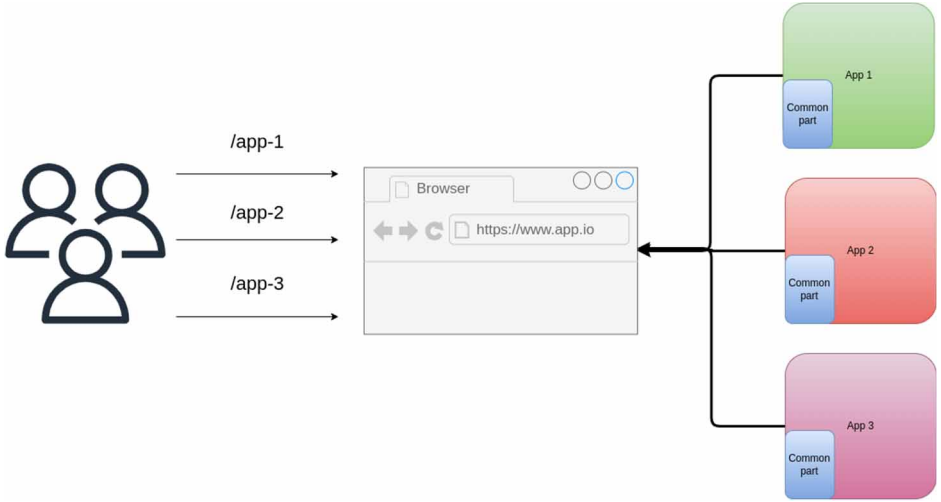
- Your micro frontends are **within** a Single Page Application
- Integration & **communication** between the different applications
- **Urgent** development of small features



Micro frontend SPA-based upgrade of CERN's Accelerator Fault Tracking (AFT) system

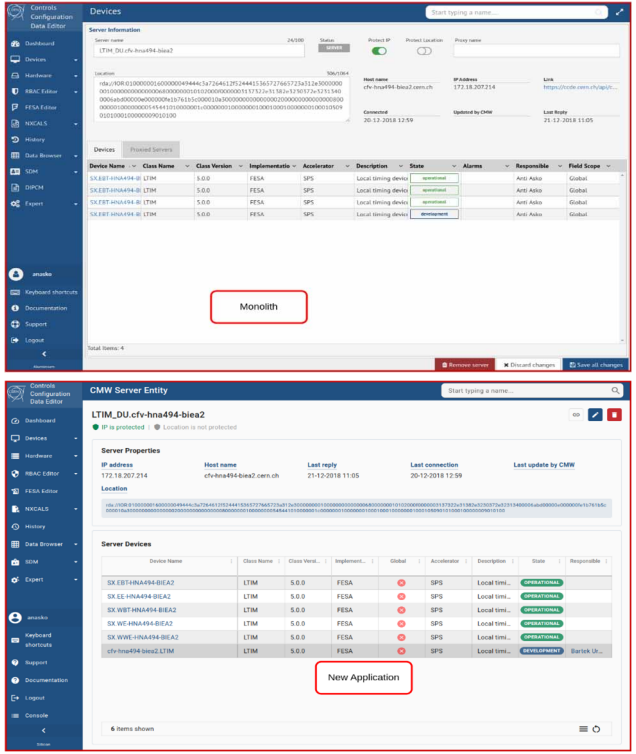
Micro frontend Architecture 2 - Different URIs

- **Independent** and **isolated** development of each application
- Provides **granular** deployment
- **Scalability** with **dynamic** loading of each application
- **Sharing** of common functionalities across applications



Example - Different URIs

- Modules can live as **standalone** applications
- **Separation** of different applications and teams
- **Independent** deployment and potential lifecycle



Micro frontend URI-based upgrade of CERN's Controls Configuration Data Editor

Challenges - Size

Application size nearly **doubled** due to the multiple frameworks under the same application

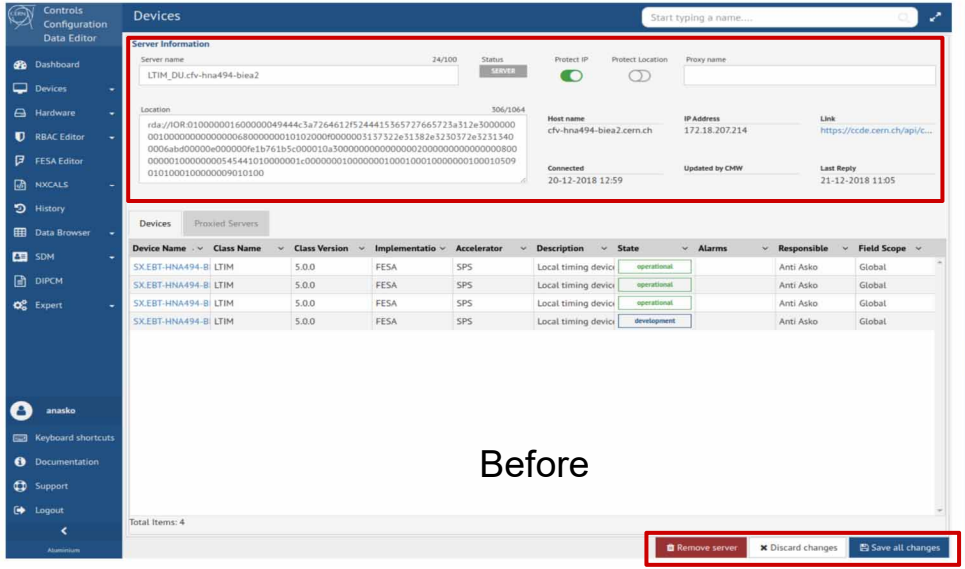
- **Caching** of the static content on the client's side
  After first load, display of the micro frontends is instant

- **Compression** of the static content during transmission
  Faster loading times depending on the network bandwidth (5.2 MB -> 1.3 MB)
  24 seconds -> 1.5 seconds

Improvements are visible on both Monolith and Micro frontends

Challenges - Look & Feel

- Aim to **minimize** the differences as much as possible
- Provide **enhancements** in the usability and ergonomics



Micro frontend URI-based upgrade of CERN's Controls Configuration Data Editor

Challenges - State management

Communication between the applications becomes more challenging due to unawareness of each other

- Create rules early and use **standard** solutions
  Use standard HTML events (onclick, oninput etc.)

- **Minimise** communication as much as possible
  Hyperlinks communication

State management is a complicated matter and there is no perfect solution

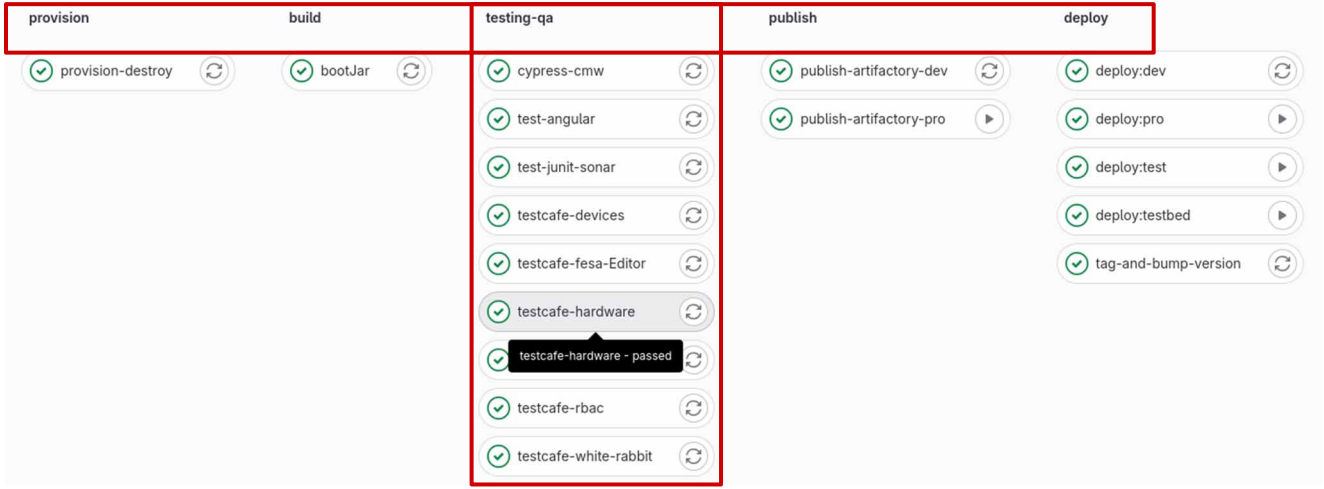
Challenges - Development & Testing

- **Standardizing** testing processes throughout the full stack

  80% unit/component testing and 20% integration/e2e testing

- CI/CD throughout the whole development **lifecycle**

  Complete automation of the process, minimizing human interaction



Conclusions

After evaluating both approaches for the past year, we concluded that the **URI-based solution** is more appropriate for our needs

Lessons learned:

- Establish a **standardized** set of **tools/frameworks** and **processes**
- Some code **duplication** is **inevitable** between the old and new applications
- A well-defined application **scope** should be **defined** early on
- Aim for a **lightweight** solutions if possible with the bulk of the **business logic** in the **backend**

Micro frontends help to embrace
inevitable changes in the web development ecosystem

Technology stack

Frontend:

- Angular a **mature**, **feature-rich** framework
- Angular Material a **powerful UI** component library

Backend:

- Spring boot **ecosystem** a Java based, **enterprise** framework
- Gradle an advance **build automation tool**