

# React

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A JavaScript library for building user interfaces

# What is React?

React is a JavaScript library used to build the user interface for web applications

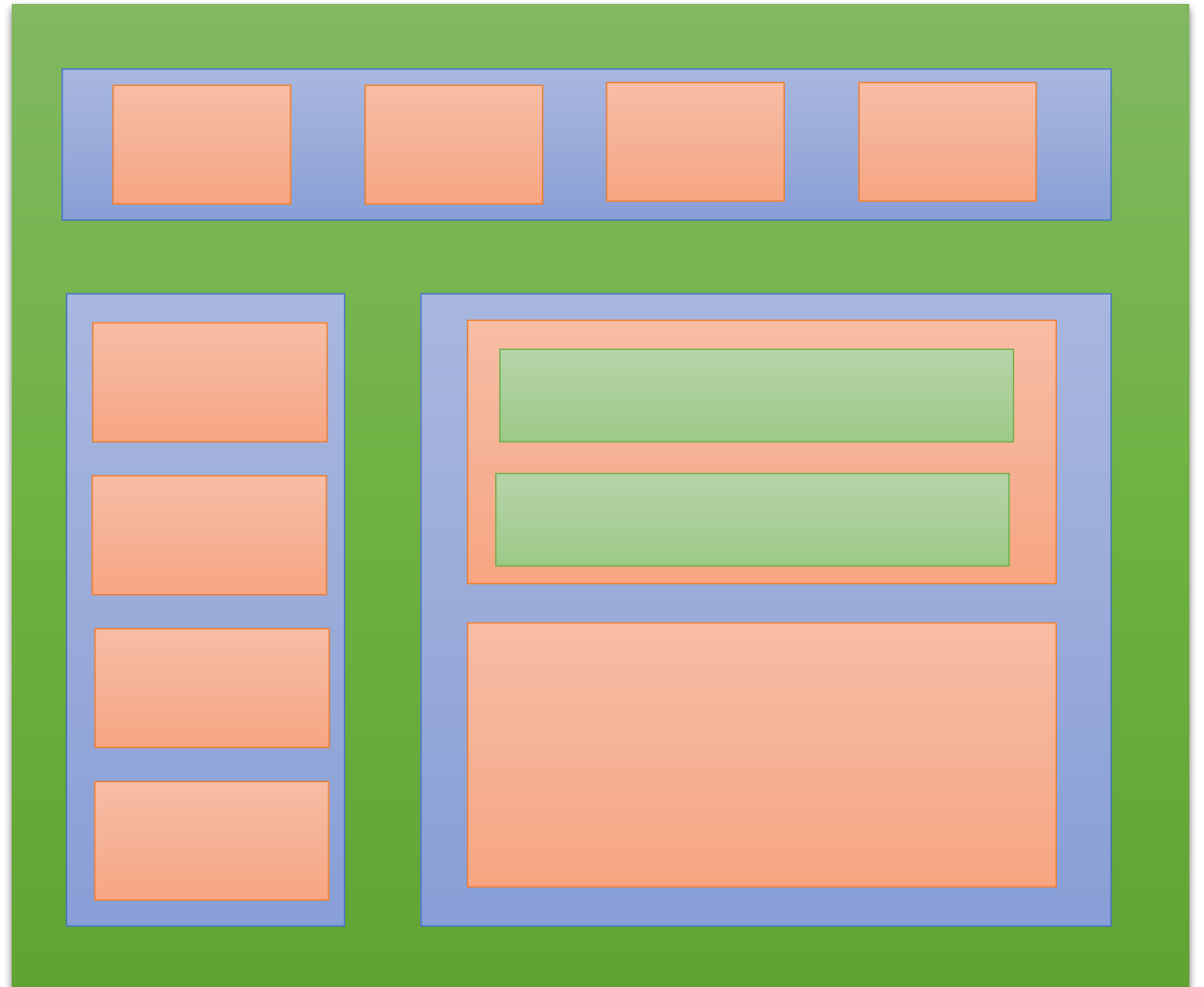
React was developed and maintained by the folks at Facebook

An open source project with an active developer community.

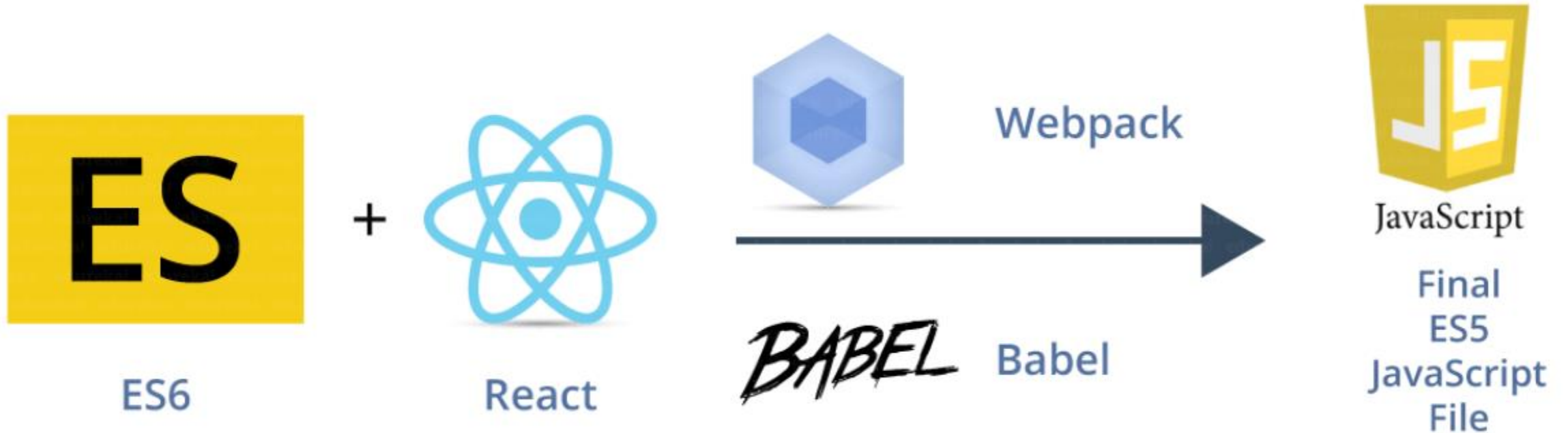
Write less and do more!!

# More About React App

In a React application, you should **break down** your site, page or feature **into smaller pieces** of components. It means that your site will be built by the combination of different components. These components are also built on the top of other components and so on.



# Key Terminologies



# Key Terminologies

JSX (JavaScript Extension)	JSX Allows us to include 'HTML' in the same file along with 'JavaScript' (HTML+JS=JSX). Each component in React generates some HTML which is rendered by the DOM
ES6 (ES2015)	The sixth version of JavaScript is standardized by ECMA International in 2015. Hence the language is referred to as ECMAScript.
ES5(ES2009)	The fifth JavaScript version and is widely accepted by all modern browsers,
Webpack	A module bundler which generates a build file joining all the dependencies
Babel	This is the tool used to convert ES6 to ES5. This is done because not all web browsers can render React (ES6+JSX) directly.

# Why React?

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Easy to understand for developers with the knowledge of XML/HTML

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UI state becomes difficult to handle with Vanilla JavaScript

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High Performant Apps

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Huge Ecosystem

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Active community

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Easy to test

# React Internals

Understanding React internally

# React Internals - Virtual DOM

Virtual DOM is in memory lightweight representation of actual DOM.

For every DOM object, there is a corresponding Virtual DOM object.

Pure JS intermediate representation.

React never reads from real DOM, only writes to it.

Manipulating the DOM is slow. Manipulating the virtual DOM is much faster, because nothing gets drawn onscreen.



# Virtual DOM Update Process

The virtual DOM gets compared to previous vs current virtual DOM



React figures out what object has changed.



The changed objects, and the changed objects only, get updated on the real DOM.



Changes on the real DOM cause the screen to change.

# Virtual DOM in Nutshell

To track down model changes and apply them on the DOM (*rendering*) we have to be aware of two important things:

When data has changed?

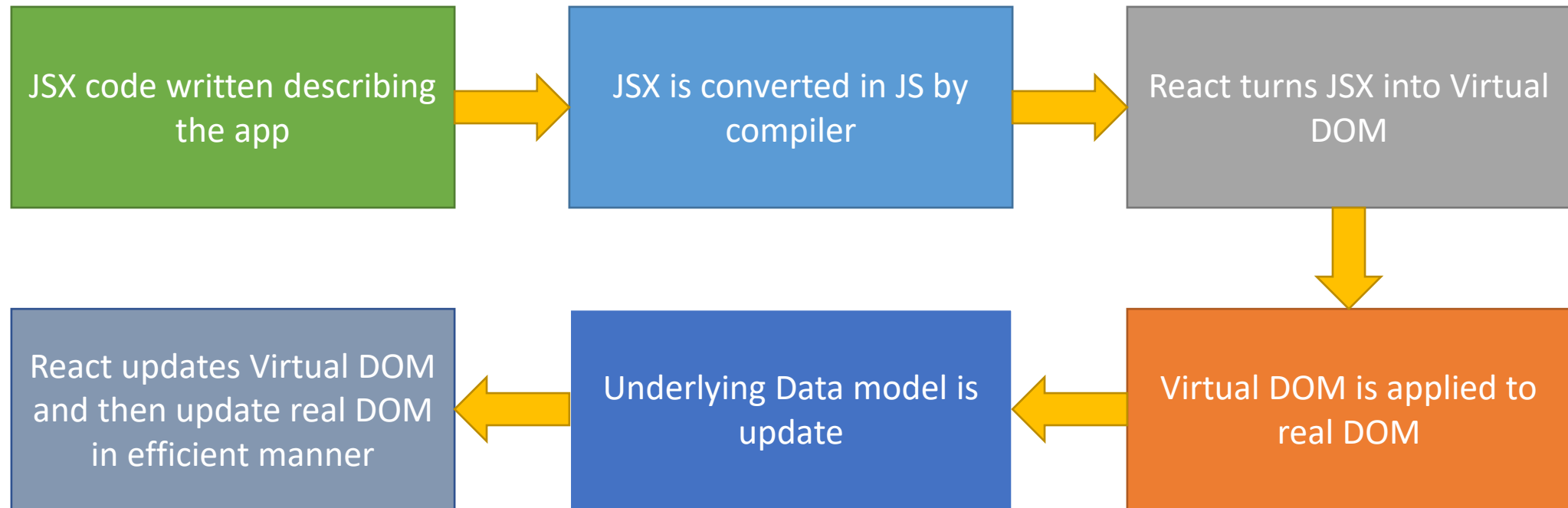
For the change detection, React uses an observer model instead of dirty checking (*continuous model checking for changes*). That's why it doesn't have to calculate what is changed, it knows immediately.

Which DOM element(s) to be updated?

For the **DOM changing challenge**, React builds the tree representation of the DOM in the memory and calculates which DOM element should change.

React tries to keep as **much DOM elements untouched as possible**. Given the less DOM manipulation can be calculated faster based on the object representation, the costs of the DOM changes are reduced nicely

# How React renders the View?



# Components

Components let you split the UI into independent, reusable pieces, and think about each piece in isolation.

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React components are the core building blocks of a React application that represent how a particular element would be visualized on the User Interface.

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Combining tens to thousands of components together makes up your application.

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A component must be designed in a way that makes it reusable across any page or even projects.

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A component may be responsible for performing a single task

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A typical React app is a component tree having one root component ("App") and then a potentially infinite amount of nested child components.

# Create-react-app : The React CLI Tool

CRA involves configuring a combination of things such as webpack, babel, and react.

## To install CRA

- `npm install -g create-react-app`

## To create an App

- `create-react-app <app-name>`

## CRA Commands

- `npm run start`
- `npm run build`
- `npm run eject`

# Component Types

## Functional Component

All function component is created using a JavaScript function.

Function component can be a named function or using an arrow function

Function components are also referred as Stateless components.

## Class Based Component

Class components as its name suggests are created using the ES6 class syntax.

Every class that extends the `React.Component` class is obligated to implement the `render()` method.

The `render()` method returns a React element

# JSX : A Syntax Extension To JavaScript

JSX is a Markup language used in order to create React elements.

JSX produces React “elements”.

You can put any valid JavaScript expression inside the curly braces in JSX, but not the reserved keywords eg class, for etc.

After compilation, JSX expressions become regular JavaScript function calls and evaluate to JavaScript objects.

You can put any valid JavaScript expression inside the curly braces in JSX.

# Unidirectional (One way) Data Flow

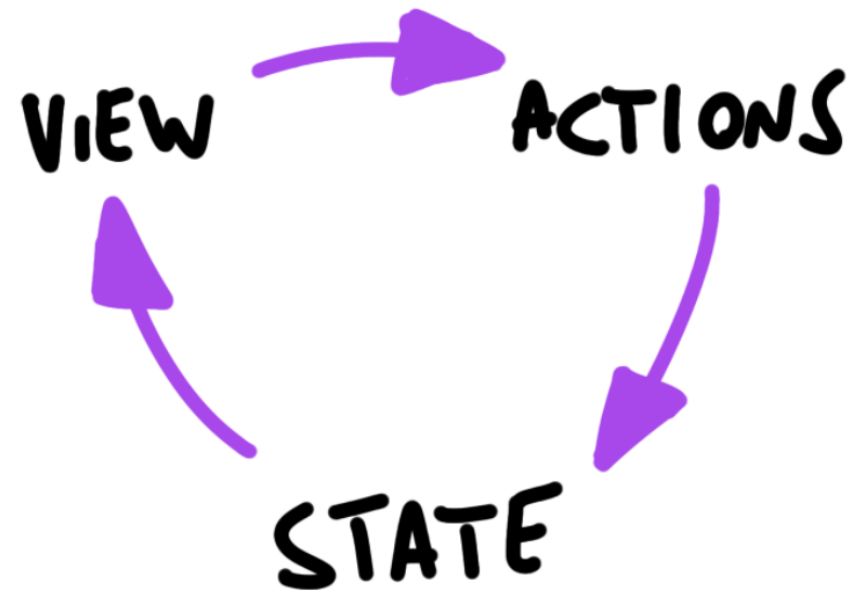
Unidirectional data flow means that data has one, and only one, way to be transferred to other parts of the application.

State is passed to the view and to child components

Actions are triggered by the view

Actions can update the state

The state change is passed to the view and to child components





# More About One way Data Flow

A state is always owned by one Component. Any data that's affected by this state can only affect Components below it: its children.

Changing state on a Component will never affect its parent, or its siblings, or any other Component in the application: just its children.

The state is often moved up in the Component tree, so that it can be shared between components that need to access it.

# Props

A React component is a reusable component which can be used over and over again in the UI, but not always we are going to render the same component with same data. Sometimes we have to change the data or content inside a component. That's why *props* are introduced in React.

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Props allow you to pass data from a parent component to a child component

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Only changes in props and/or state trigger React to re-render your components and potentially update the DOM in the browser.

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Props are considered as “immutable”

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Props are supplied as attribute to components

# State

A state in React Component is its own local state, the state cannot be accessed and modified outside the component and can only be used inside the component

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React components can be made dynamic by adding state to it.

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State is used when component needs to change independently of its parent.

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Changes to state also trigger an UI update.

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React component's state can be updated using `setState()`

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*Best practice* : top level components are stateful which keep all interaction logic, manage UI state, and pass the state down to hierarchy to stateless components using props.

# Components

Reusable Piece of Code

# Functional Components

**React Function Components** are the equivalent of React Class Components but expressed as functions instead of classes.

The only constraint for a functional component is to accept *props* as an argument and return valid JSX.

In the past, it wasn't possible to use state or side-effects in Function Components – that's why they were called **Functional Stateless Components** – but that's not the case anymore with *React Hooks* which rebranded them to **Function Components**.

React Hooks were also introduced to bring side-effects to Function Components. We cover commonly used hooks later.

# Class Based Component

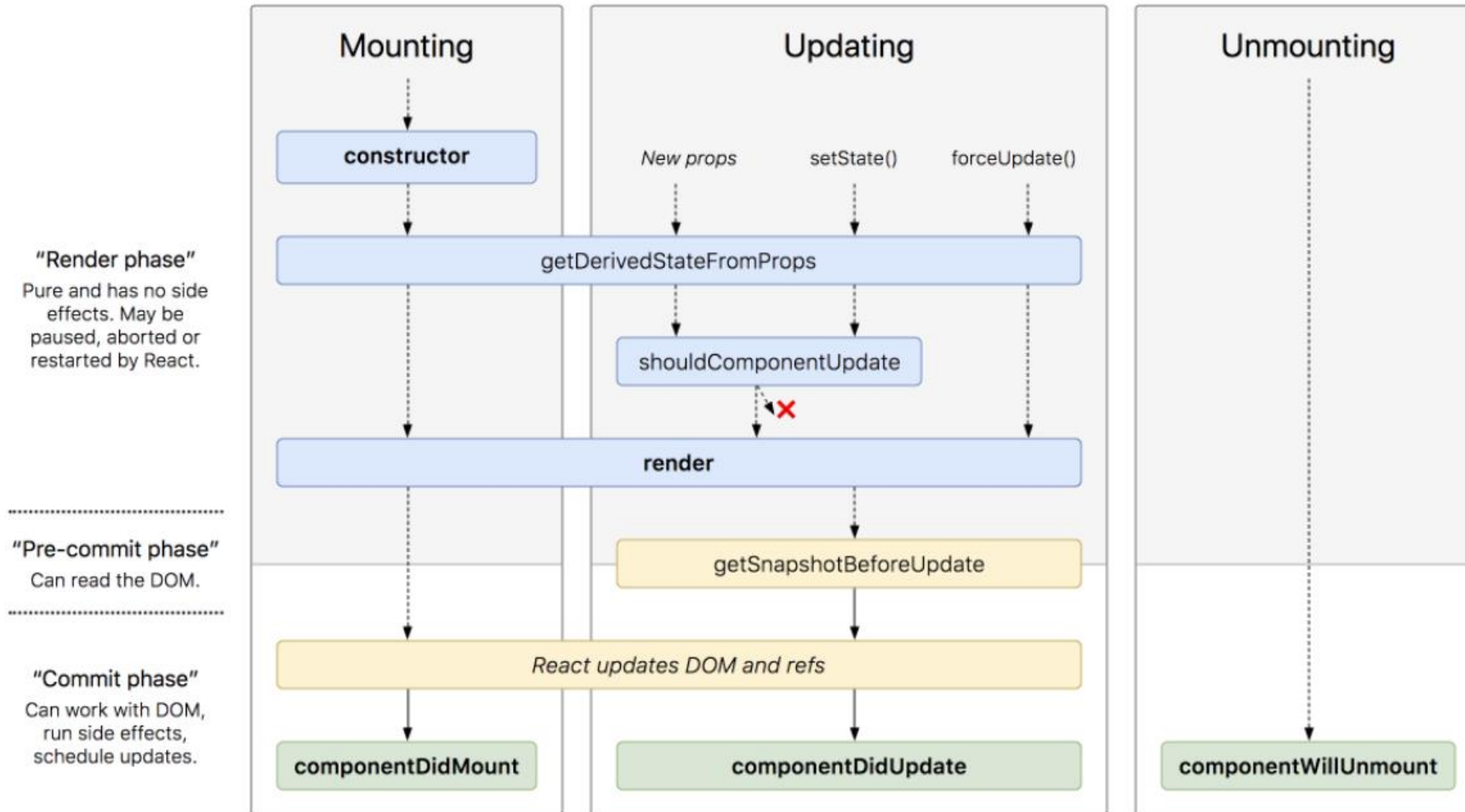
**React Class Components** were introduced with JavaScript ES6, because JS classes were made available to the language.

All the internal React Component logic comes from the `extends React.Component` via object-oriented inheritance

React class components offer several lifecycle methods for the mounting, updating, and un-mounting of the component.

By using `this.state`, `this.setState()`, and lifecycle methods, state management and side-effects can be used side by side in a React class component

# Component Life Cycle Methods



# Component Life Cycle Methods

Lifecycle methods are various methods which are invoked at different phases of the lifecycle of a component.

## Mounting

- Mounting refers to the loading of components on the DOM.
- This phase contains a set of methods which get invoked when the component is getting initialized, and loaded on to the DOM.

## Updating

- This phase starts when the react component has taken birth on the browser and grows by receiving new updates.
- The component can be updated in two ways, sending new props from parents or updating the current state.

## Unmounting

- In this phase, the component is not needed and the component will get unmounted from the DOM.



# Mounting Phase Methods

## constructor

This is the first method that gets called whenever a component is created. The constructor is called only once in the whole lifecycle of a component. It's used to set up the initial values of variables and component state.

## render

This is the required method in a React component, as this method prepares the element that gets mounted on to the browser DOM.

## componentDidMount

This is the hook method which is invoked immediately after the component **did** mount on the browser DOM.

# Updating Phase Methods

`shouldComponentUpdate`

This method tells React that when the component is being updated, it should re-render or skip rendering altogether.

`render`

And then the component gets rendered

`componentDidUpdate`

executed when the newly updated component has been updated in the DOM.

# Unmounting Phase Method

`componentWillUnmount`

This method is the last method in the lifecycle. This is executed just before the component gets removed from the DOM

# Why Functional Components ?

Functional components make your code easier to read and understand

functional components are easier to test. No hidden state / props.

Avoid unnecessary overhead such as lifecycle events.

Functional components depend only on the props they are given to produce an output which makes debugging easier.

Functional components can reduce coupling

# Add Keys : Rendering List Of Items

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Each child in an array or iteration must be uniquely identified by assigning unique key with the help of “key” prop.

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The key should always be supplied directly to the components in an array, not to the container element.

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Identity and state of each component must be maintained across render passes.

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The key is not really about performance, its more about identity (which in turns

# Forms

Accepting User Inputs

# Working with Forms

Form elements naturally keep some internal state.

An input form element whose value is controlled by React in this way is called a “controlled component”.

With a controlled component, the input’s value is always driven by the React state.

A controlled component takes its current value through props and notifies the changes through callbacks like an onChange event.

## Create Account

Email:

Password:

Country:

☐ I accept the terms of service

Submit

# Accessing User Input Using Refs

There are mainly two types of form input in React.

- Controlled : Element state managed by React Component
- Uncontrolled : Element state managed by DOM itself

HTML elements maintain their own state that will be updated when the input value changes.

For Uncontrolled elements, there is no need to write an event handler for every state update. You can use a *ref* to access the input field value of the form from the DOM



# Hooks

Making Functional Components Powerful

# Hooks

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Hooks are a new addition in React 16.8. e.g. `useState`, `useEffect`, `useContext`, `useReducer` and many more.

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They let you use state and other React features without writing a class component.

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Don't call Hooks inside loops, conditions, or nested functions. Only call Hooks at the top level.

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Only call Hooks from React functional components

# Hook : useState()

```
const [state, setState] = useState(initialState);
```

Returns a stateful value, and a function to update it.

During the initial render, the returned state is the same as the value passed as the first argument (initialState).

The setState function is used to update the state. It accepts a new state value and re-render the component

If the new state is computed using the previous state, you can pass a function to setState. The function will receive the previous value, and return an updated value.

# Hook : useEffect()

```
useEffect(didUpdate);
```

Accepts a function that contains imperative, possibly effectful code.

All side-effects can run eg. Mutations, subscriptions, timers, logging, and other possible side effects.

By default, effects run after every completed render, but you can choose to fire them only when certain values have changed.

useEffect may return a clean-up function.

# Hook : useContext()

```
const value = useContext(MyContext);
```

Accepts a context object (the value returned from `React.createContext`) and returns the current context value for that context.

The current context value is determined by the `value` prop of the nearest `<MyContext.Provider>` above the calling component in the tree.

The argument to `useContext` must be the context object itself.

# Hook : useReducer()

```
const [state, dispatch] = useReducer(reducer,  
                                     initialArg, init);
```

Accepts a reducer of type (state, action) => newState, and returns the current state paired with a dispatch method.

useReducer is usually preferable to useState when you have complex state logic that involves multiple sub-values or when the next state depends on the previous one

# Hook : useMemo()

```
const memoizedValue = useMemo(() =>  
  computeExpensiveValue(a, b), [a, b]);
```

Pass a “create” function and an array of dependencies.

The function passed to useMemo runs during rendering.

useMemo will only recompute the memoized value when one of the dependencies has changed.

If no array is provided, a new value will be computed on every render.

# Hook : useCallback()

```
const memoizedCallback = useCallback(cb);
```

Returns a memoized callback.

Pass an inline callback and an array of dependencies. `useCallback` will return a memoized version of the callback that only changes if one of the dependencies has changed.

This is useful when passing callbacks to optimized child components that rely on reference equality to prevent unnecessary renders

`useCallback(fn, deps)` is equivalent to `useMemo(() => fn, deps)`.



# Routing & Navigation

Creating Single Page Apps

# Routing in React

```
npm install react-router-dom
```

React Router is a standard library for routing in React

It enables the navigation among views of various components in a React Application.

React Router allows changing the browser URL and keeps the UI in sync with the URL.

# Main Components of React Router

## BrowserRouter

BrowserRouter is a router implementation that uses the HTML5 history API to keep your UI in sync with the URL.

## Route

Route is the conditionally shown component that renders some UI when its path matches the current URL.

## Link

Link component is used to create links to different routes and implement navigation around the application. It works like HTML anchor tag.

## Switch

Renders the first child `<Route>` or `<Redirect>` that matches the location.

# Redux

Predictable State Management Container

# Should I Use Redux ?

You have reasonable amounts of data changing over time

You need a single source of truth for your state

You find that keeping all your state in a top level component is no longer sufficient

# Redux : Overview

```
npm install redux react-redux
```

Redux is a predictable state container for JavaScript apps.

It helps you write applications that behave consistently, run in different environments (client, server, and native), and are easy to test.

It provides a great developer experience, such as live code editing combined with a time traveling debugger.

# Three Principles of Redux

## Single source of truth

The state of your whole application is stored in an object tree within a single store.

## State is read only

The only way to change the state is to emit an action , an object describing what happened.

## Changes are made with pure functions

To specify how the state tree is transformed by actions, you write pure reducers

# Actions

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Actions are payloads of information that send data from your application to your store

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They are the only source of information for the store.

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You send them to the store using `store.dispatch()`

```
{  
  type : "ADD_TODO",  
  payload : "Hello Reducx"  
}
```



# Reducer

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The reducer is a pure function that takes the previous state and an action , and returns the next state.

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Reducers specify how the application's state changes in response to actions sent to the store.

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Actions only describe what happened, but don't describe how the application's state changes.

```
(prevState, action) => newState
```

# Don'ts for Reducers

Things you should never do inside a reducer:

- Mutate its arguments.
- Perform side effects like API calls and routing transitions.
- Call non pure functions, e.g. `Date.now( )` or `Math.random( )`

# Store

The Store is the single object.

Holds application state.

Allows access to state.

Allows state to be updated via dispatching action

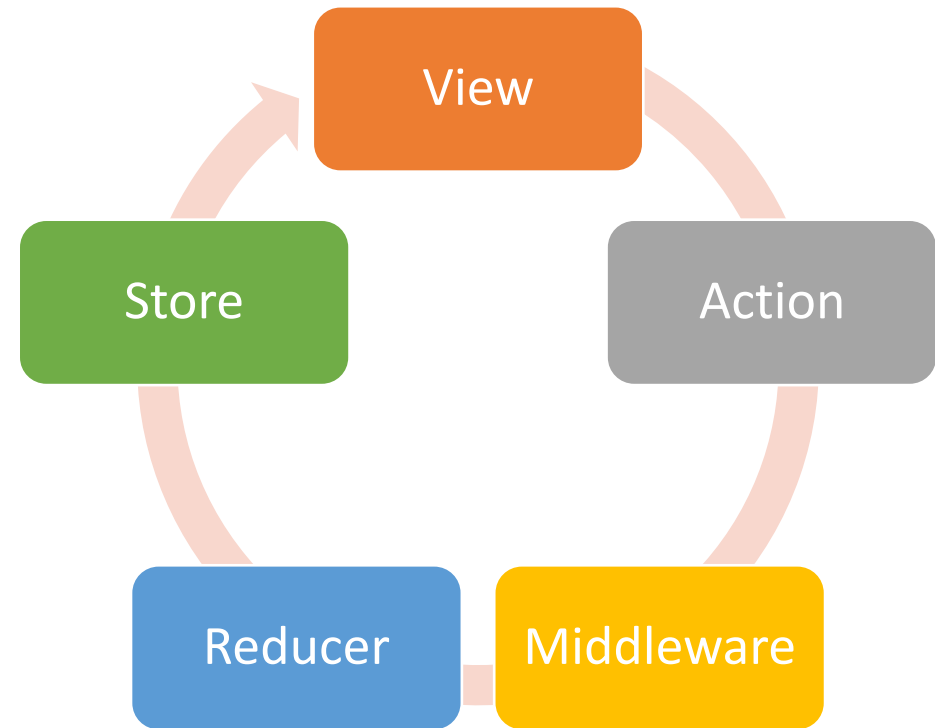
Registers listeners via `subscribe(listener)`.

# Data Flow in Redux

Redux architecture revolves around a strict unidirectional data flow.

The data lifecycle in any Redux app follows these 4 steps:

- Your view will dispatch the Action
- The Redux store calls the reducer function.
- The root reducer may combine the output of multiple reducers into a single state tree.
- The Redux store saves the complete state tree returned by the root reducer.



# Micro-frontend

Let's split it up

# What are Micro-frontends?

Divide a  
monolithic App  
into multiple,  
smaller apps

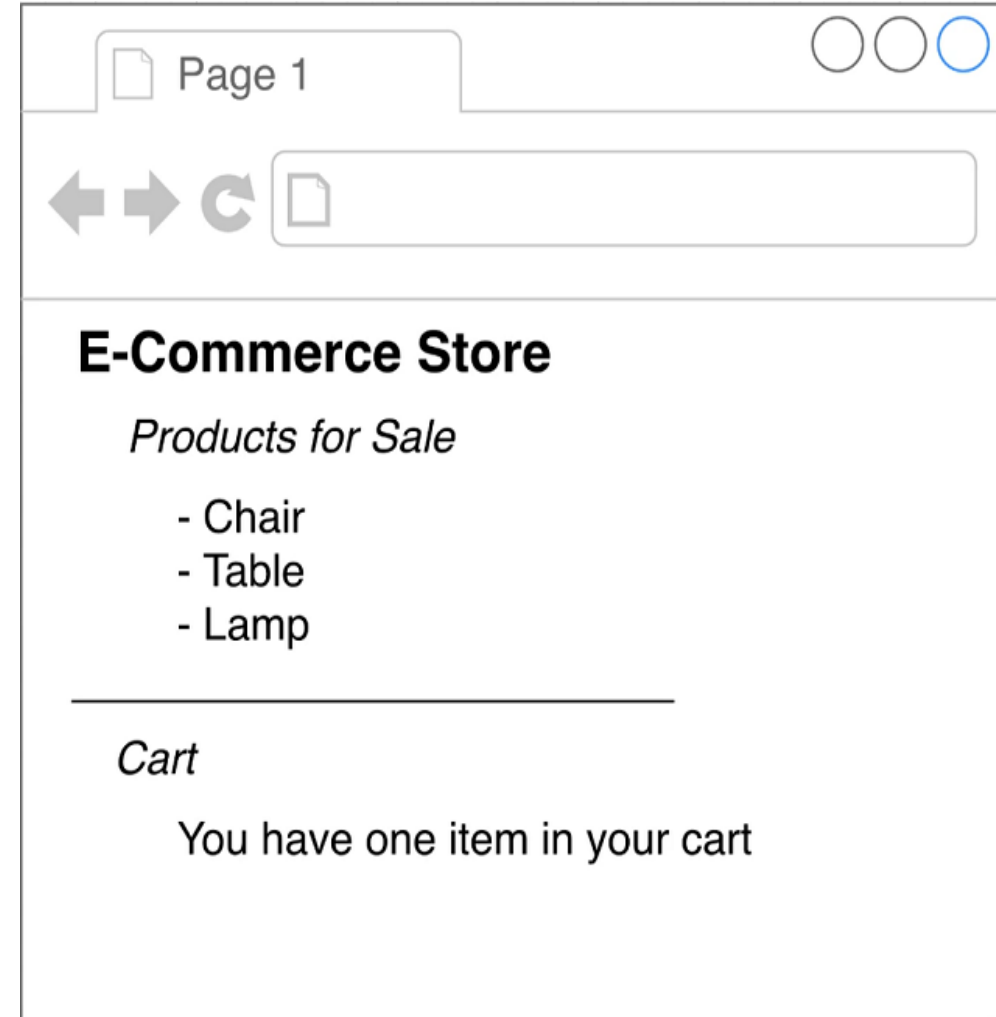
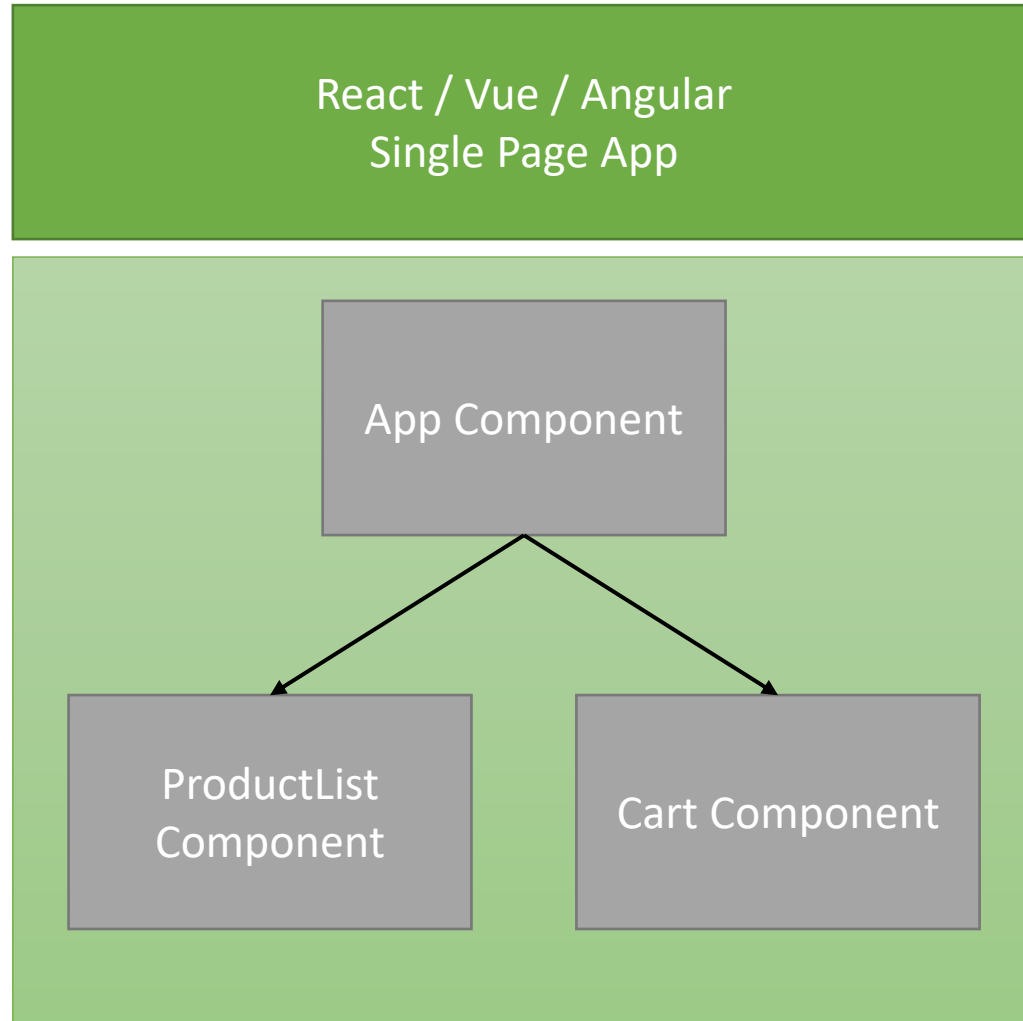
Each smaller app is  
responsible for a  
distinct feature of  
the whole App

# Why Micro-frontends?

Multiple  
engineering team  
can work in  
isolation

Each smaller app is  
easier to  
understand and  
make changes to.

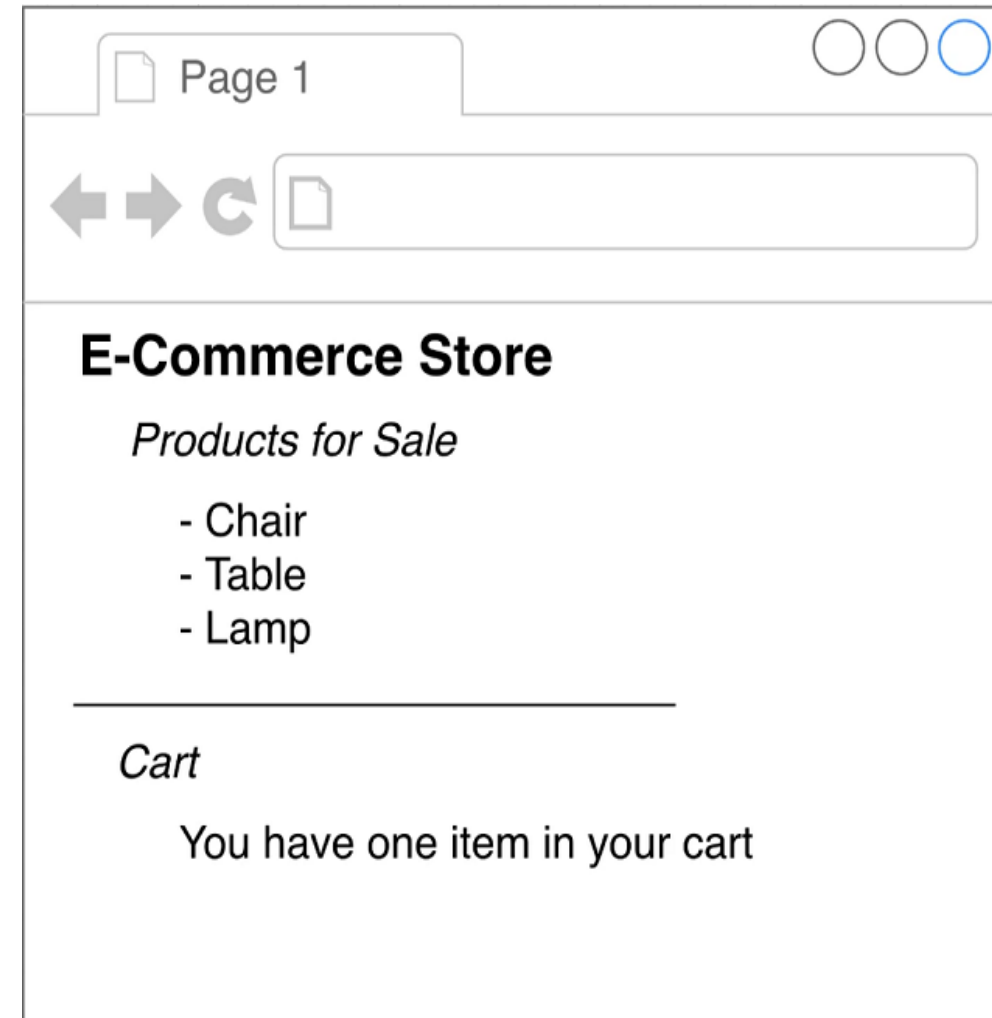
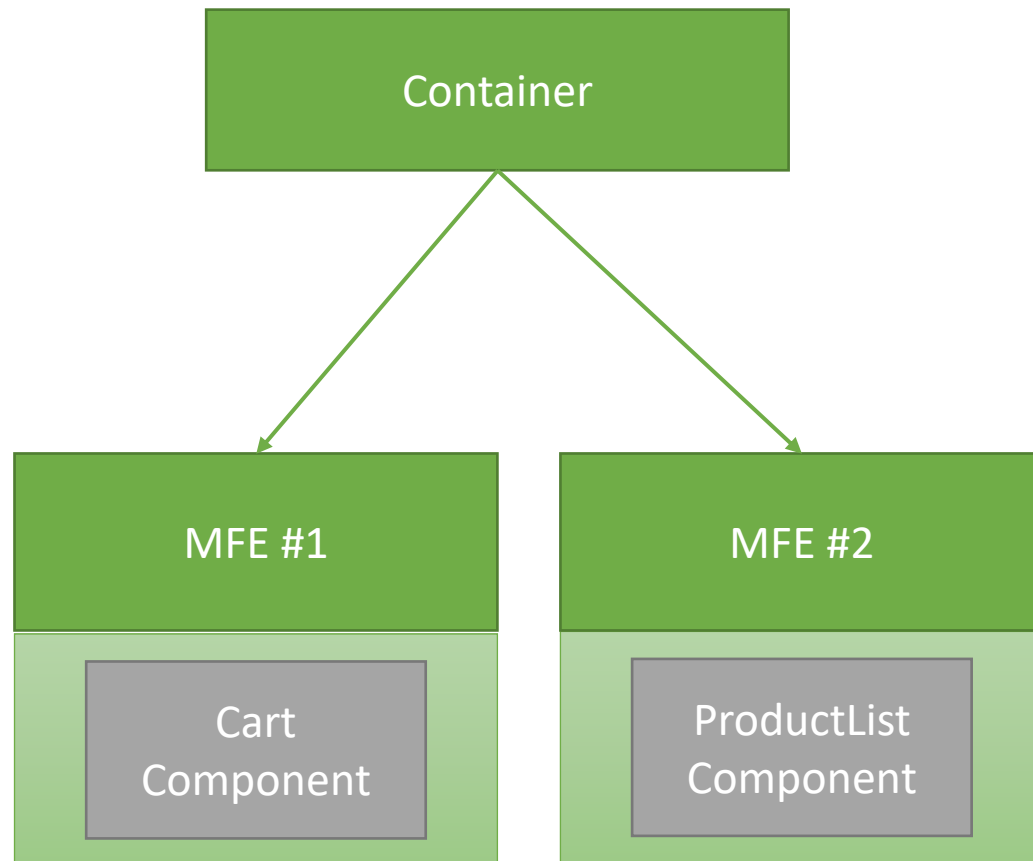
# Monolithic App





# Micro-frontend App

Decides when and where to show each Micro-frontend



# Integration

How and when does the container get access to the source code in MFE #1 & MFE #2

There is no single perfect solution for integration

There are many solutions, each have pros and cons

Look at what your requirements are, then pick a solution

# Major Integration Type

## Build Time Integration

Before container gets loaded in the browser, it get access to MFE source code

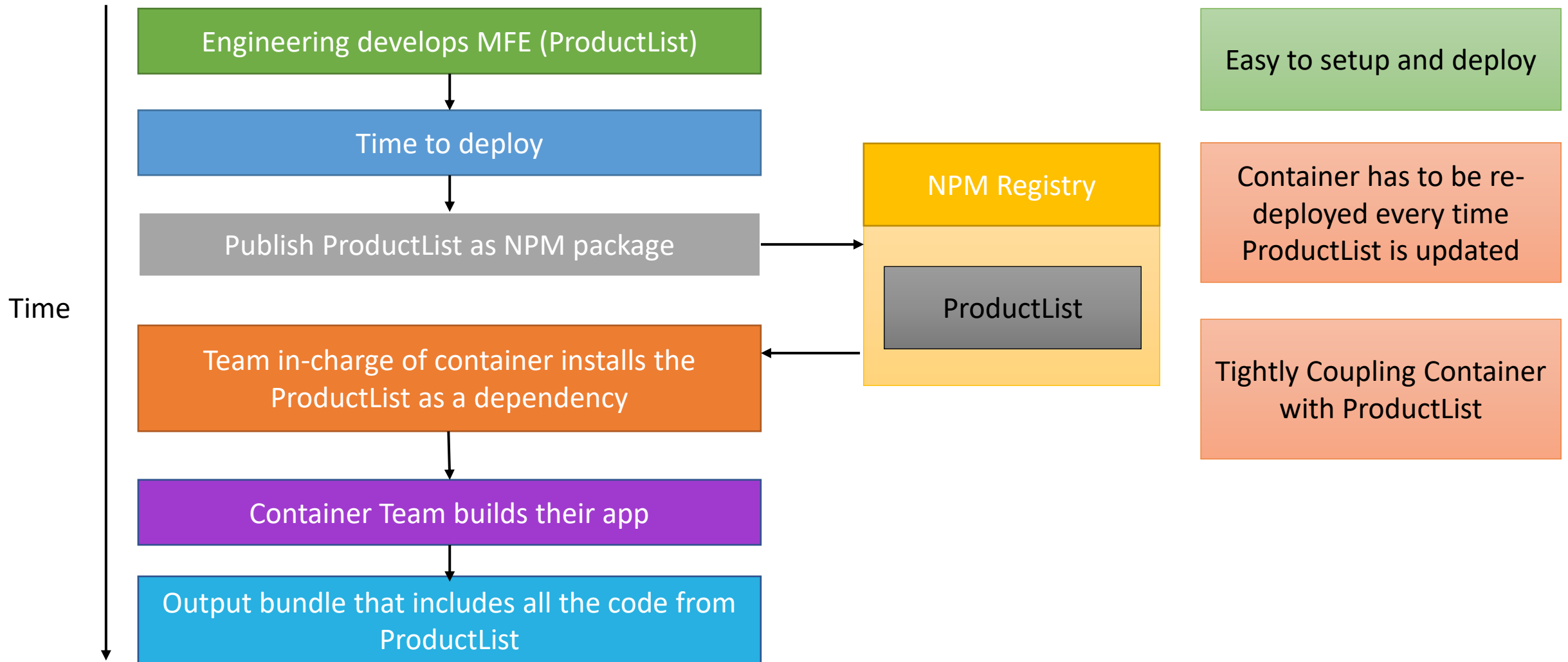
## Run Time Integration

After container gets loaded in the browser, it get access to MFE source code

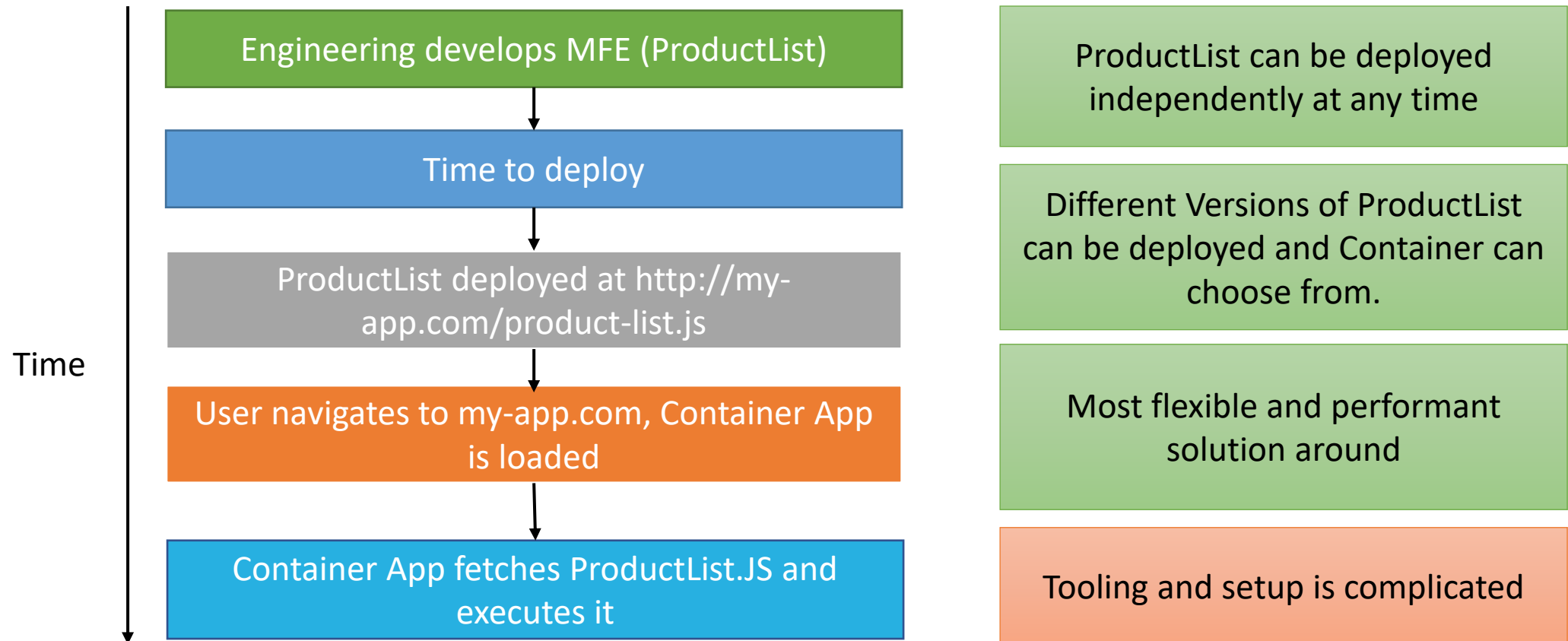
## Server Integration

While sending JS to load the container, a server decides on whether or not to include MFE source code

# Build Time Integration



# Run Time Integration

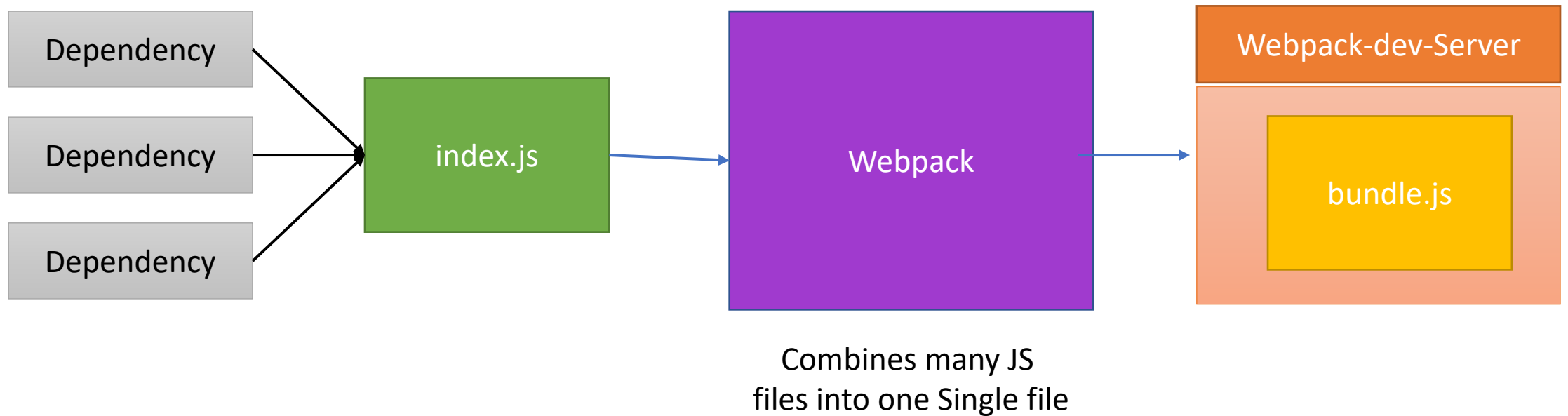


# Version Update

Working versions can be installed by running the following commands:

```
npm install webpack@5.68.0 webpack-cli@4.9.2 webpack-dev-server@4.7.4  
faker@5.1.0 html-webpack-plugin@5.5.0
```

# Webpack Introduction



# Implementing Module Federation

Designate one App as the Host container and one app as the remote

In the remote, decide, which file you want to available to other projects

Setup module federation plugin to expose these files

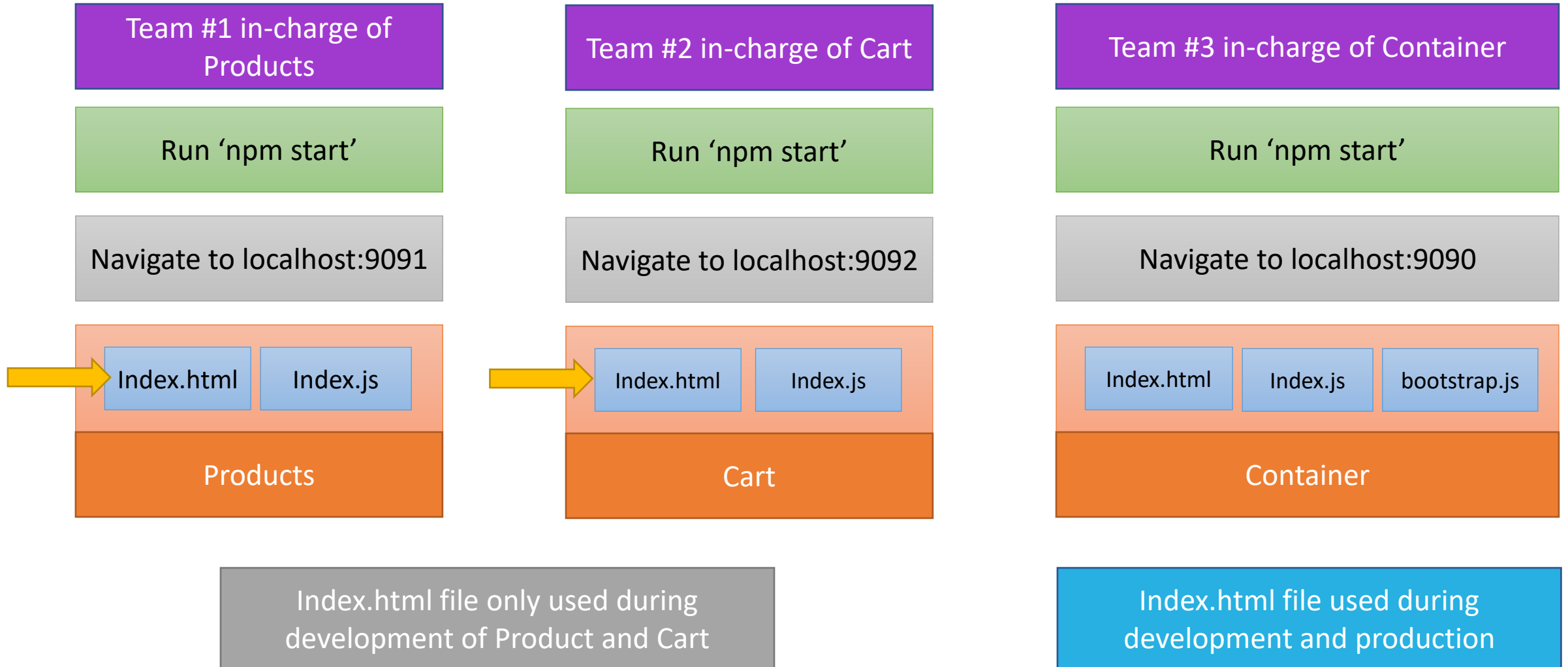
In the host, decide which file you want to get from the remote

Setup Module Federation to to fetch those files

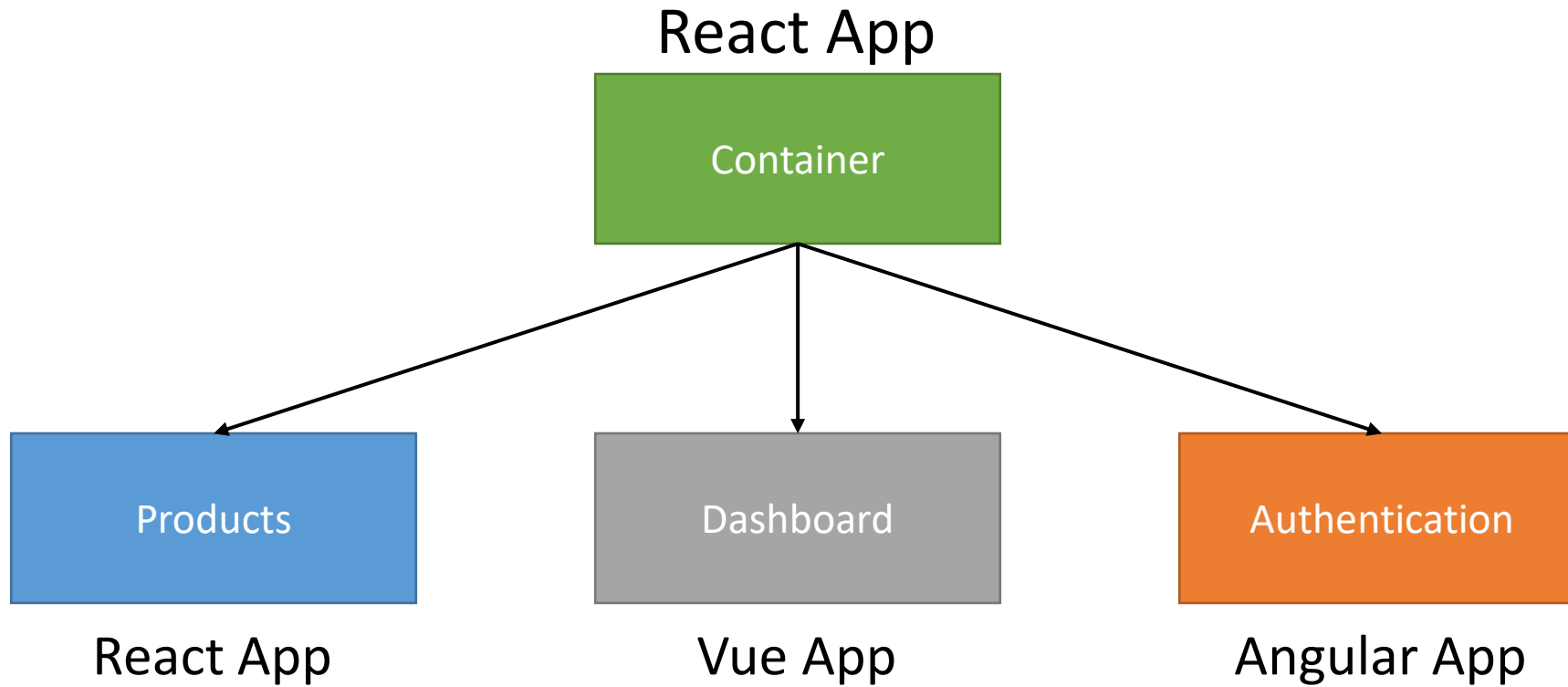
In the host, import whatever file s you need from the remote



# Sub-app Execution Context



# Linking Multiple Apps Together



# Requirements To Choose Correct MF Architecture

## Requirement #1

- Zero coupling between child projects
- No import of functions/objects/classes etc
- No shared state
- Shared libraries through MF is OK

## Requirement #2

- Non-Zero coupling between Container and child projects
- Container should not assume that child is using a particular project
- Any necessary communication will done via callbacks / simple Events

# Requirements To Choose Correct MF Architecture

## Requirement #3

- Version Control (monorepos or separate) should not have any impact on overall project

## Requirement #4

- CSS from one project should not affect others

## Requirement #5

- Container should be able to decide to always use the latest version of micro-frontend or specify a specific version

# Thank You

Now you have required foundation to go ahead on you exciting and lucrative journey.

ALL THE BEST