Advanced Angular using ReactiveX and Redux

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Hi, I'm…

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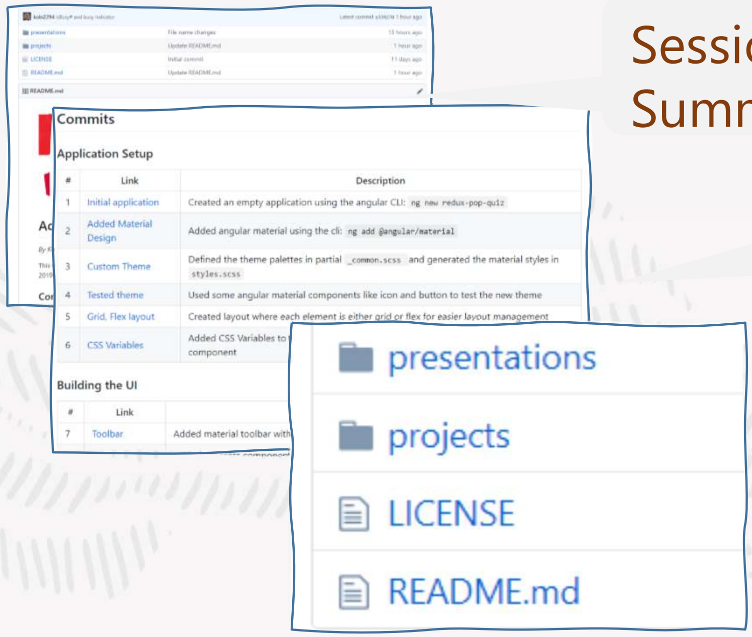
We have a GitHub Repository!

Kobi2294/OracleWeek2022



presentations	File name changes	13 hours ago
projects	Update README.md	1 hour ago
LICENSE	Initial commit	11 days ago
README.md	Update README.md	1 hour ago

README.md

Commits

Application Setup

#	Link	Description
1	Initial application	Created an empty application using the angular CLI: `ng new redux-pop-quiz`
2	Added Material Design	Added angular material using the cli: `ng add @angular/material`
3	Custom Theme	Defined the theme palettes in partial `_common.scss` and generated the material styles in `styles.scss`
4	Tested theme	Used some angular material components like icon and button to test the new theme
5	Grid, Flex layout	Created layout where each element is either grid or flex for easier layout management
6	CSS Variables	Added CSS Variables to component

Building the UI

#	Link	
7	Toolbar	Added material toolbar with

- presentations
- projects
- LICENSE
- README.md

Session Summary

Project Code with Commits Summary

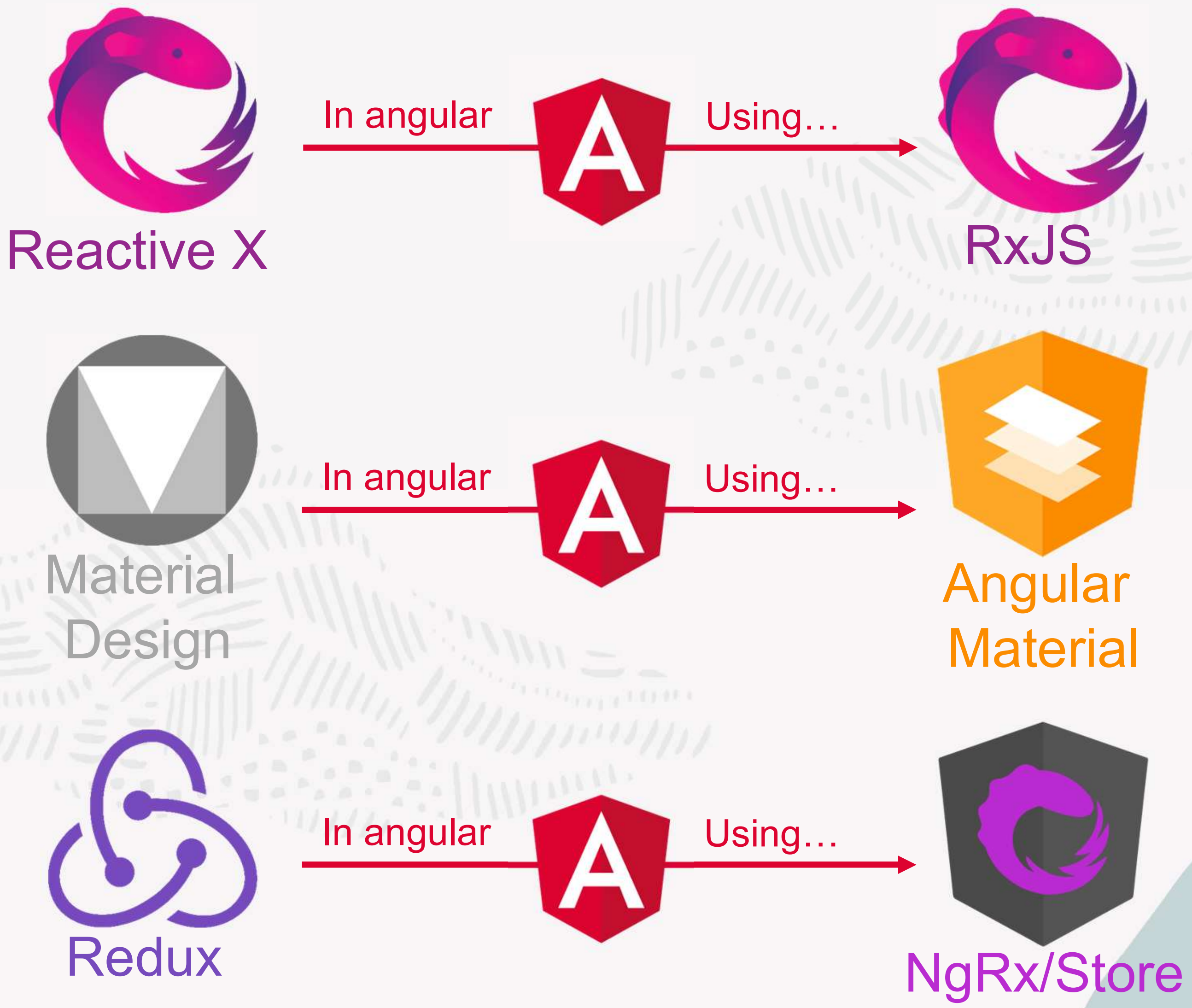
- This presentation
- Useful Links

2022 Cloud שבוע אורקל

ORACLE Cloud

JOHN BRYCE תלמדו הייטק. זה עובד! a matrix company

Our Agenda:



Reactive X

Rx - Motivation

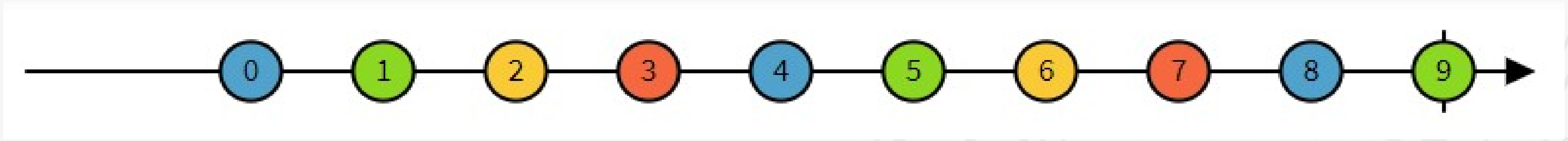
- Mostly useful when using single point of data with multiple consumers
- The traditional solution to this is using method invocation to pull data
- There are several problems with this approach:
  - Redundancy - Multiple method invocation to “calculate” the same data
  - Synchronization – When should each consumer ask for data
- Reactive X moves the initiative to the producer. Instead of being asked for data, it pushes it to the consumer.
- The producer Acts, the consumer Re-acts.
- **Hence Reactive…**

Some Buzzwords

- Observer Pattern
- Iterator Pattern
- Asynchronous Development

Streams

A Stream is a sequence of events describing the state of a single data over



- Streams may end successfully
- Streams may end in failure
- Streams may never end…

Observers

`Next(value: T)`	called to notify the observer of the new value of the data
`Complete()`	called to indicate that the stream is over – so the value will no longer change
`Error(err: any)`	called to indicate that there is something wrong with the stream – and that there will be no more events, but for a bad reason

- Of course, Observer<T> is an interface to be implemented so your object may be called about a stream.

Observable<T>

`Subscribe(observer: Observer<T>)`	Subscribe another observer

An `Observable<T>` is an object that allows multiple Observers<T> to subscribe.

What does “Subscribe” return?

Warm and Cold Observables

- An Observable is lazy
- It does not really start unless you subscribe.
- In fact – the only logic you can provide into an observable is on the subscribe callback

A “Warm” Observable produces the same events regardless of subscriptions

A “Cold” Observable is one that relies on subscribers to start producing events

DEMO

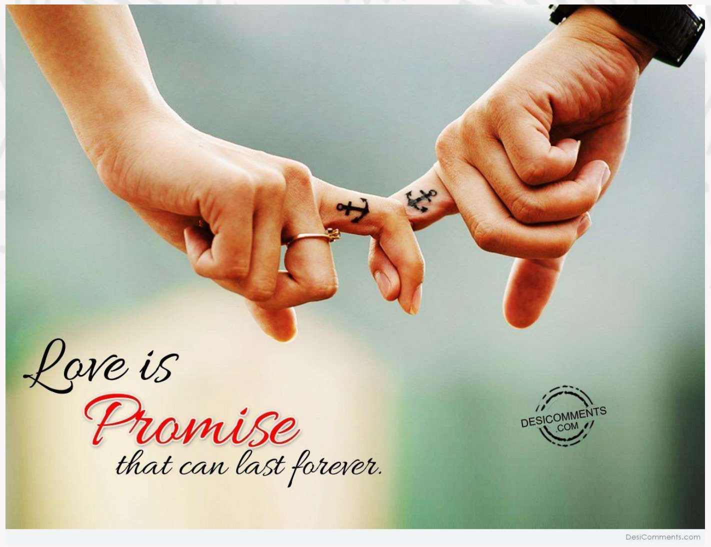
Observables

Demo Conclusions:

- An observable is defined by the logic it runs when an observer subscribes.
- That logic is passed to it in the constructor.
- This is the **only way to access observers** and raise events.
- Cold Observables will only execute when they are subscribed to.
- And they will re-execute every time they are subscribed again.

Is it like promises?

- Well yes and no.
- A promise is like an observable that only throws one next, and always throws complete right after the single next.
- In a way – ~~love~~ (rxjs) is a promise that lasts forever 😊
- Oh and promises are not lazy… they run code as soon as the promise is created even if it is never listened to. (“then”-ed to)



Promises are like hot observables that return a single result and completion together.

Observables may send different events to each observer

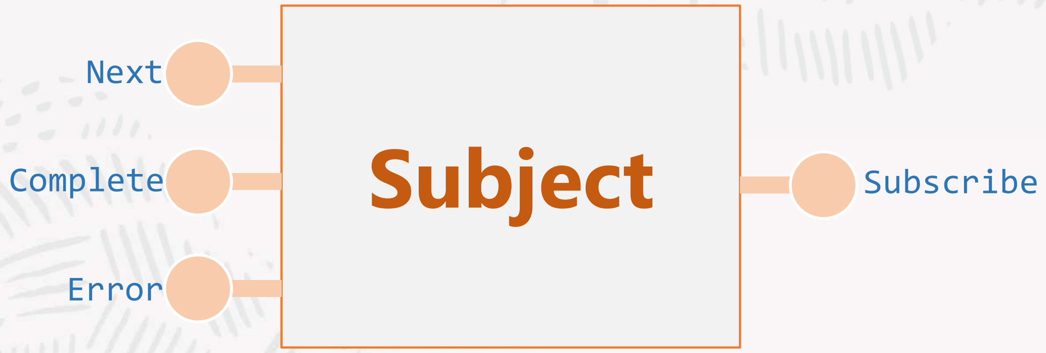
Accessing an observer is possible only in the constructor

A constructed observable is “read only”. You can subscribe to it, but you can not emit events

Subjects

A Subject is an observable that allows you to emit events.

It is both an Observable and an Observer at the same time



- When you call “next”, “complete” or “error”, it sends the event to all subscribed observers
- In a way, it is like a writeable observable
- Is it a “cold” or “hot” observable?

Behavior Subject

- `BehaviorSubject<T> extends Subject<T>`
- When subscribed to, it emits the latest event to the subscriber
- Ideal for storing variable state
- Requires an initial value on constructor (why?)
- Has a `Value` property you can use to get the value of the latest event.
- Hot or Cold?
  - Its not cold, because it shares the events between all observer
  - Its not purely “hot” because it does produce one dedicated event to each observer
  - So, it is considered “warm” ☺

DEMO

Subjects

Unsubscribe !

- Consider a specific scenario
  - Single service
  - Component subscribes to service
  - Component gets destroyed and re-created many times
- Service observable now points to component (in the callback)
- It accumulates callbacks
- Memory leaks
- Probably even more problematic: performance leaks
- Possibly also – problematic responses to changes

Do we always need to unsubscribe?

- Some services do not require unsubscribe:
  ```
  http
  activatedRoute
  ```

- How is it possible?

- When an observable “completes” it unsubscribes all its observers.
- So, you only need to unsubscribe observables that out-live the observer.

Async Pipe

- A new method of development where you bind directly to the observables in the component.
- It Subscribes and Unsubscribes for you – which avoids memory leaks
- Also works with promises

DEMO

async pipe & operators

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Material Design

with

`@angular/material`

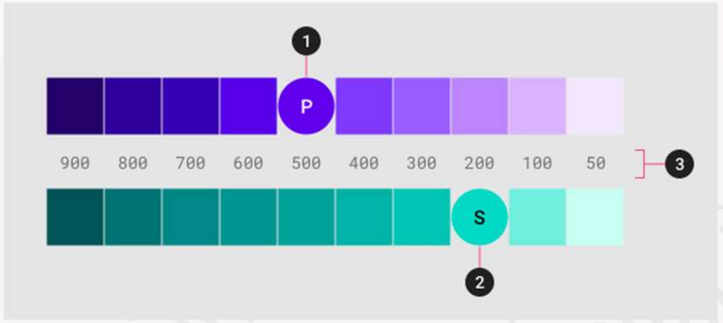
Material Design + Angular = Angular Material

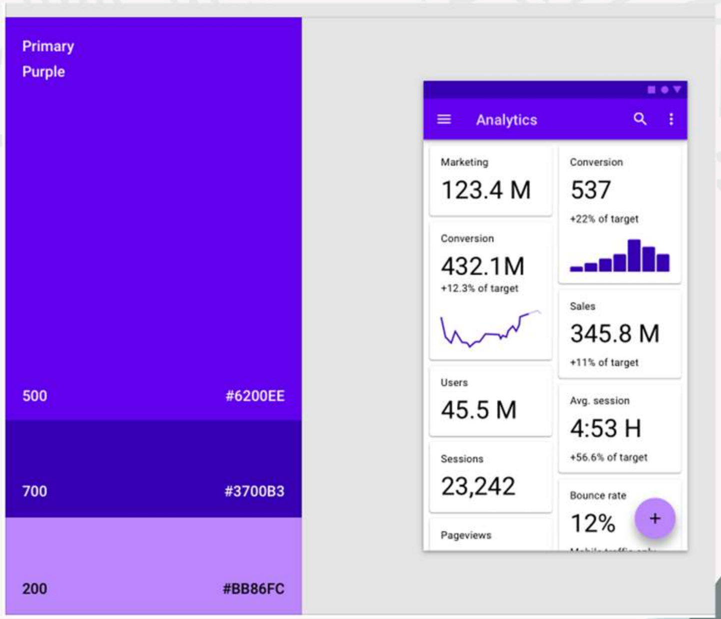
Material Design

- A set of well-defined design guidelines
- Developed by Google on 2014
- Summarized in a detail web site: https://material.io/design/
- Defines:
  - Color system (themes and palettes)
  - Icons
  - Fonts
  - Standard Margins, shadows, and corner radiuses
  - Animations
  - A set of component designs

The Color System

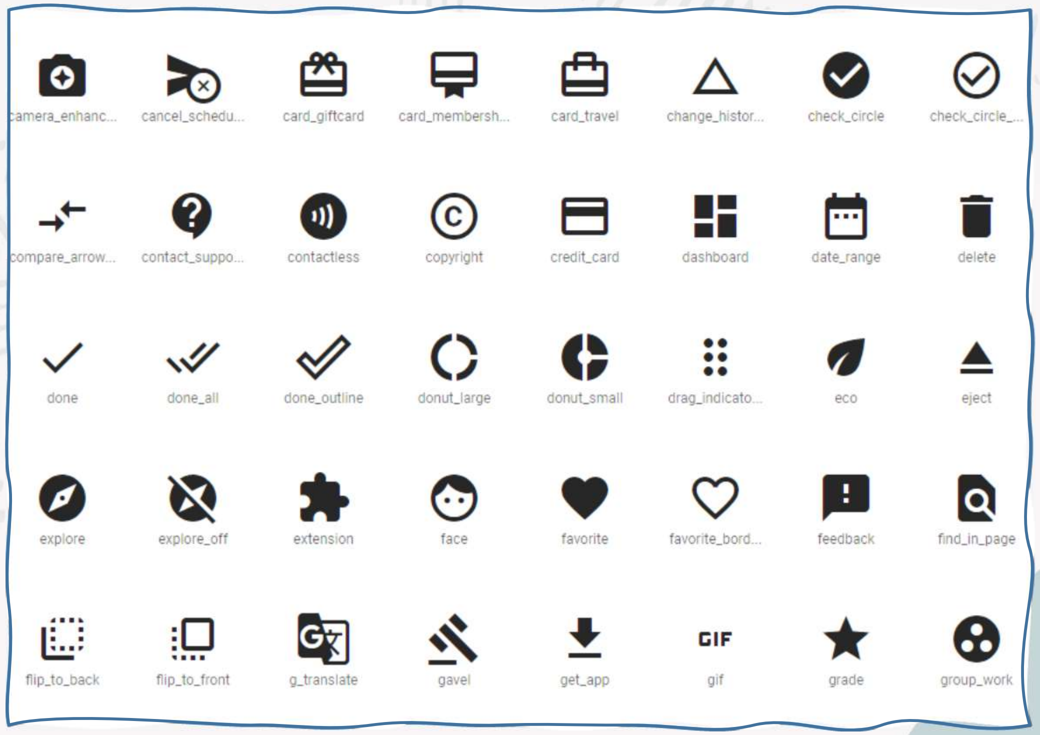
- Themes are defined using:
  - A primary color palette
  - A Secondary (accent) color palette
  - Dark / Light
- The 3 parameters yield a set of reusable colors:





Icons

- Material Design defines how icons are to be created
- It also comes with a (large) set of predefined icons

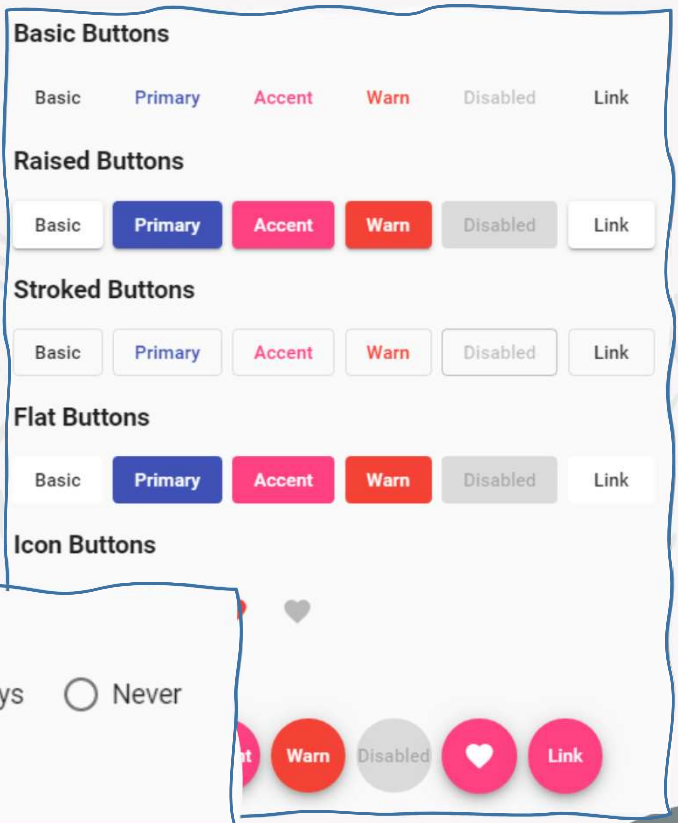


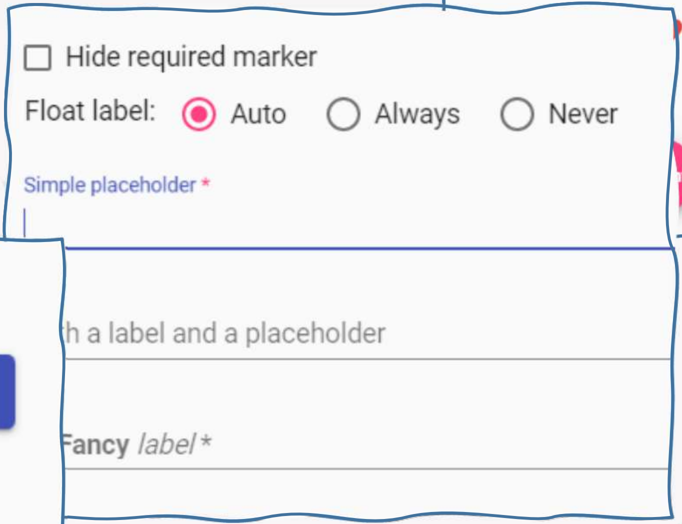
Angular Material

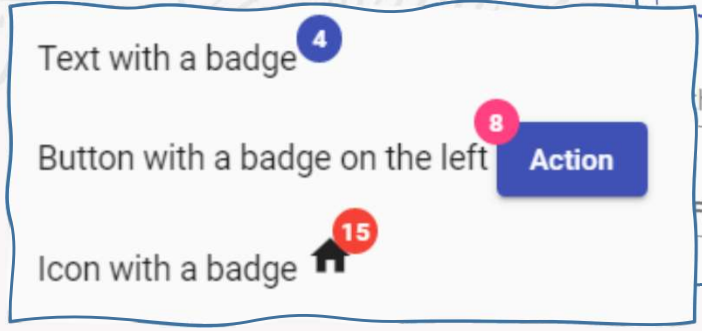
- An implementation of Material Design as Angular Components.
- Uses Scss to define themes and standard classes.
- Uses another package called “CDK” to develop the components
- We are also able to use the same package to extend the components library

Angular Material

- Includes a large set of the “Material Design” Components including:
  - Form Controls
  - Cards and other layout components
  - Buttons and Indicators
  - Supports popups and dialogs







DEMO

Building UI

Redux

with

@ngrx/store

+ + =

Redux RxJS Angular NgRX

Our Goal

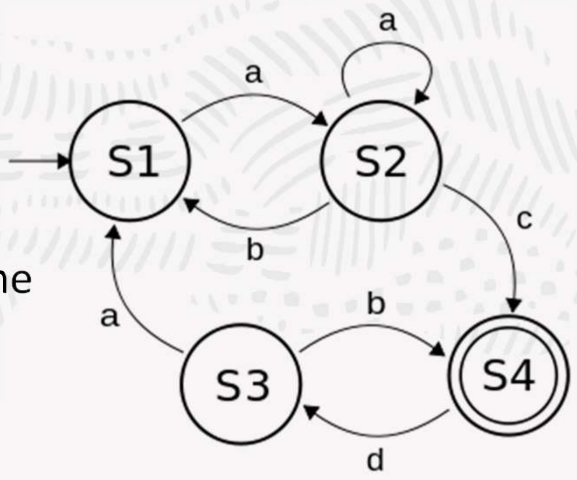
- Understand Redux
- Understand how to combine Redux with Angular
- Understand how combining the two can improve performance

Our Objective

- Following our Redux lesson, our objective:
  - Create a Popup Quiz app
  - Entire app with chage detection strategy OnPush

What is a State

- In college at automation course we learned about Finite-state machines (FSA)
- FSA is a mathematical model of computation
- FSA can be in one state out of a group of final states at any given time
- FSA can transition to a new state based on certain change in input

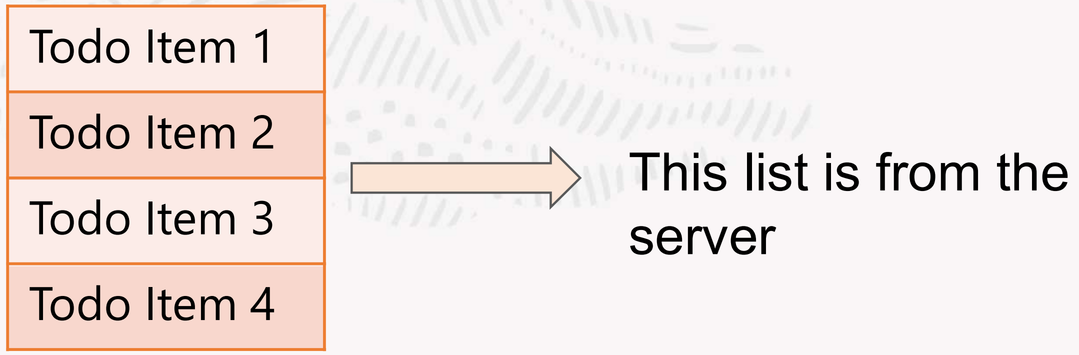


Can we look at our frontend application as an FSA?

What can be the cause of a transition in state in a frontend web app?

(Hypothetcal) Todo App State

- In our todo app we have a component that displays the list of todo items
- At the beginning, the list is empty and we query the server for the list of items
- After the server return our response we display the list of tasks
- The todo list component looks like this:



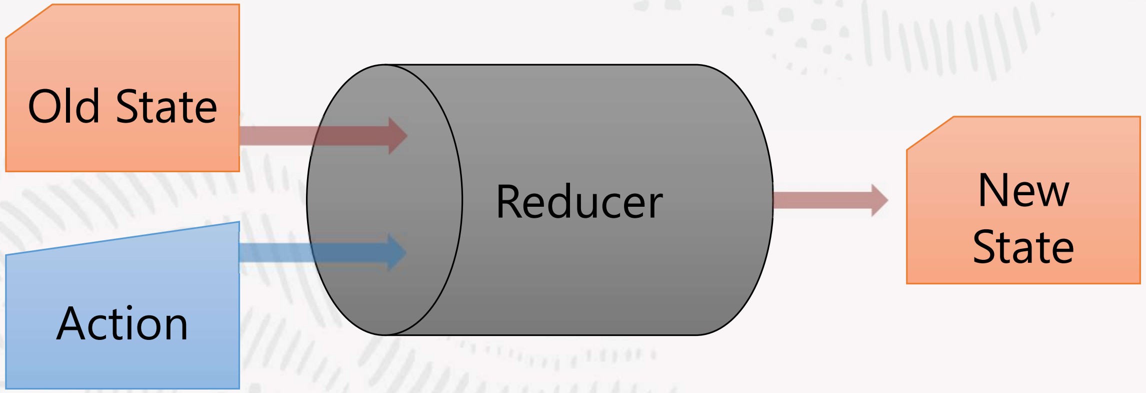
What is Redux

- Predictable state container for JS apps
- Using redux we have a single object holding the state of our app which is called **store**
- The state in the store can be an Object, Array, Primitive but it's highly recommended that it will be **immutable**
- The only way to change the state is by calling a method on the store called **dispatch**
    - **store.dispatch(action)**
- An action is a simple object describing **what happened**
- The store decides how the state will change using a pure function called **reducer**
- The reducer answers the questions **How does the state change?**
    - **(state, action) => state**

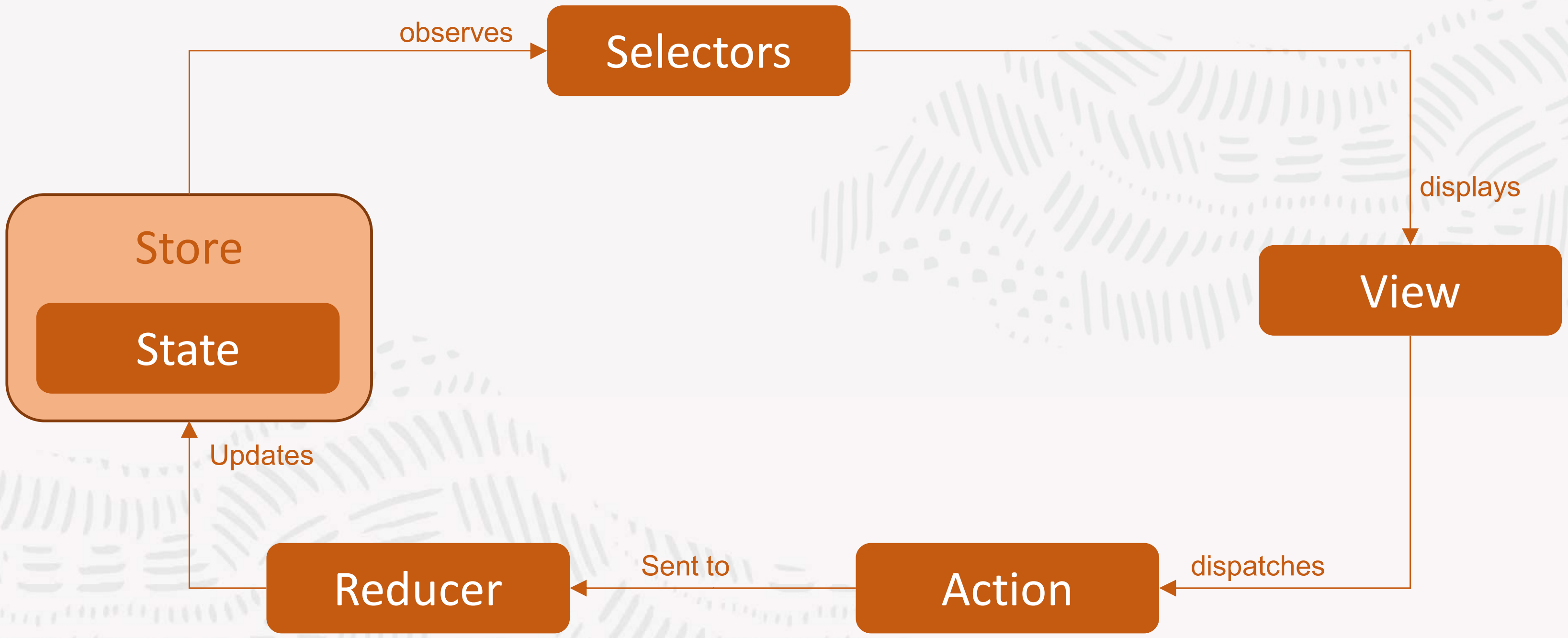
Redux Core

Redux core concepts are:

- Actions
- Reducers
- Store



The Redux "circle of life"



Actions and Action creators

- **Action** is a simple JS Object
- The action needs to hold the following information
  - identifier of the action (string)
  - data associated with the action
  - example: `{type: ‘SET_LOADING’, payload: true }`
- Action creator is a pure function which returns an action
- The latest NgRx provides action creators

```
function setIsLoading(isLoading) {
  return {type: ‘SET_LOADING’, payload: isLoading};
}
```

Which action creators do you think our Todo app requires?

Reducers

- Reducers are functions that apply action to create a new state
- Reducers are **pure** functions
- Reducers get the current state and action as arguments
- The reducer need to decide based on the action and the current state what the next state will be
- The state has to be **immutable.**
- When our state grows if we use only a single reducer the reducer will be huge so it is better to split the state to sections and also split the reducers
- Redux has a function called **combineReducers** to help us split the app and make each reducer in charge of certain section of the state

combineReducers

- When our state grows so will our single reducer
- We want to split the state to logical sections
- Let’s say our quiz application will need to hold information about the current user
- We will create another reducer that will handle the user info and combine those reducers with the `combineReducers` function.
- The latest NgRx has an alternative which is easier for lazy loaded feature modules

Store

- there is a single store in redux application
- the store holds the state of our app
- to create the store we use `createStore`
  - `createStore(reducers, initialState)`
- we need to pass to the `createStore` the combined reducers and optional initial state
- Let’s create our store

Redux dev tools

- one of the strong features of redux is the ease of testing and ease of development
- you have a state and the app should behave according to the state
- for development purpose it’s better if we can easily examine the current state and all the actions that got us to this state
- there is an easy to use browser extension:
  - https://github.com/zalmoxisus/redux-devtools-extension
- to install the devtool extension:

```
ng add @ngrx/store-devtools
```

Combining with Angular

- Now that we know what Redux is, lets try and combine Angular and redux together using **@ngrx/store**

What is @ngrx/store

- state management for Angular applications inspired by redux
- we select items from the state and get them as observables
- we then use async pipe to display them in the components
- async pipe will cause a re-render even if the component is in change strategy on push
- install with ng add:

```
ng add @ngrx/store
```

Store as a Module

- Similar to how we placed routing in separate modules, we will do the same with our state
- Each module which needs to add items to our state will have that logic in a store module
  - **app-store** - will contain store module for the root module
  - **user-store -** will contain store module for the feature module called user
- Inside each module we can split the reducers based on logical sections

Actions

- Let’s start by implementing our actions
- We will use the `createAction` function.
- We will define the action payload using the `props` function.
- We will also use typescript grouping to group them under a single alias

Selectors

- Selectors are used to create pre-built reusable queries
- We will use the `createFeatureSelector` function to create a selector that queries the entire “slice” or “feature” of the store.
- We will use the `createSelector` function to create a selector that queries a specific piece of data from the store.
- We will also use typescript grouping to group them under a single alias

Reducer

- We will define an interface that describes the section of the state that the reducer is in charge of
- We will define our initial state
- Create our reducer as a pure function with using the “on” function.
- The pure function will use the types defined in the action file

Store Module

- We will call `StoreModule.forRoot` to create our store
- It will get the reducer map we created before
- For lazy loaded module their state will be lazy loaded as well and we will call the function `StoreModule.forFeature`
- We will add our store module to the app module
- We can now inject the store to our services and components

Components

- Inject the store to the components
- We can use the `store.dispatch` method to invoke actions.
- We can use the `store.select` method to use selectors and create observables.
- We will use the async pipe to display that observable

Summary

- With redux we can manage the state of our app
- The only way to change the state is by calling `store.dispatch(action)`
- Reducers will decide how the state changes
- As a best practice, we will use selectors to access the data using observables.
- Combining Angular and redux is a powerful tool which gives us
  - More testable app
  - Better performance
  - Easier management of the data of our app

DEMO

Logic and Data using NgRx Store

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