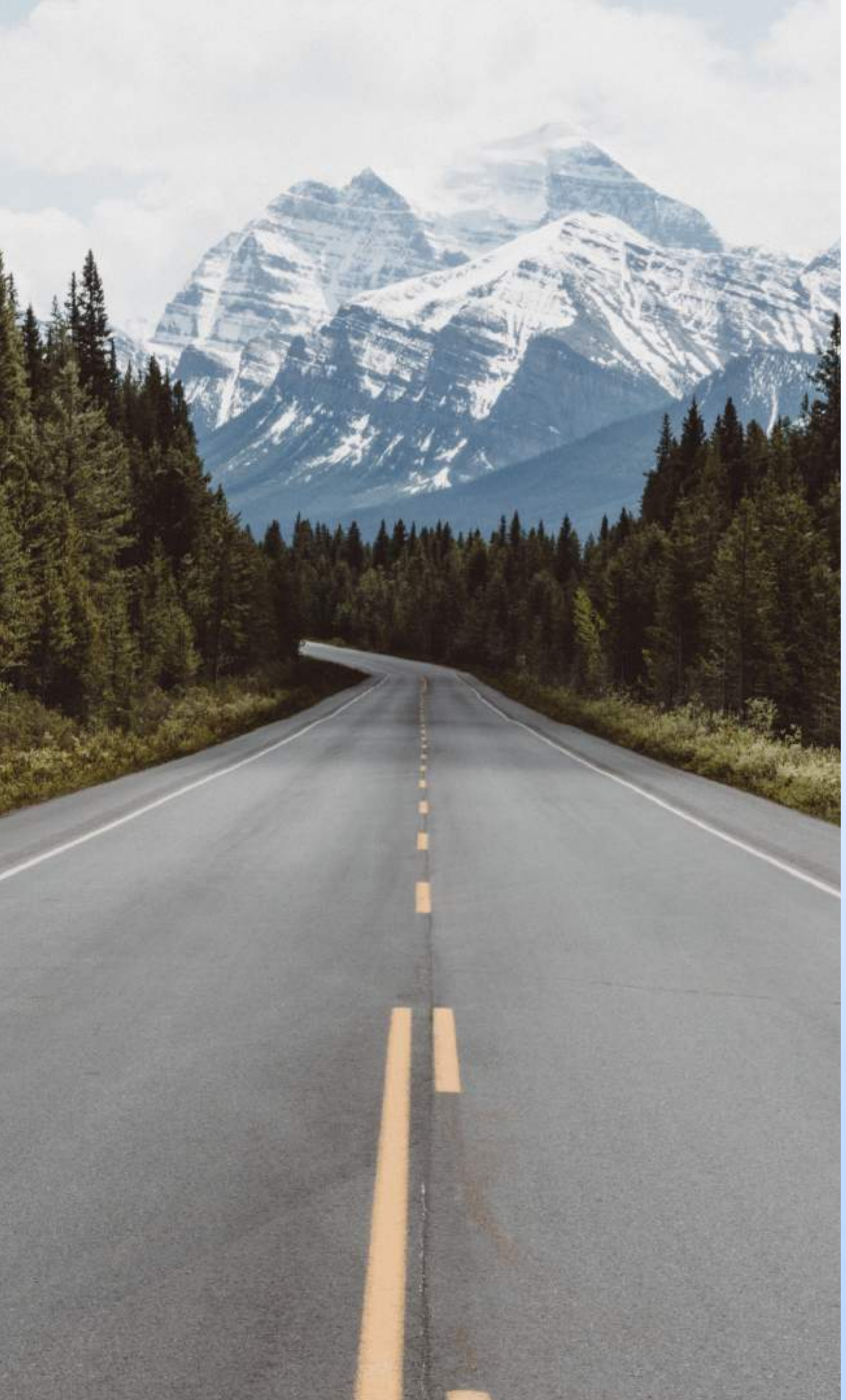
Angular & NgRx

- Slides here:
  - https://bit.ly/31ko0lr
- Starter project here:
  - http://stackblitz.com/github/apaytonmn/bananaapp
- Checkpoint repositories
- Chrome extension: Redux DevTools
  - Install if you want to participate with debug
- Questions?
  - Please hold questions so we can stay on track

Angular & NgRx

Aspen Payton
Research Applications Unit
Mayo Clinic



Journey to NgRx

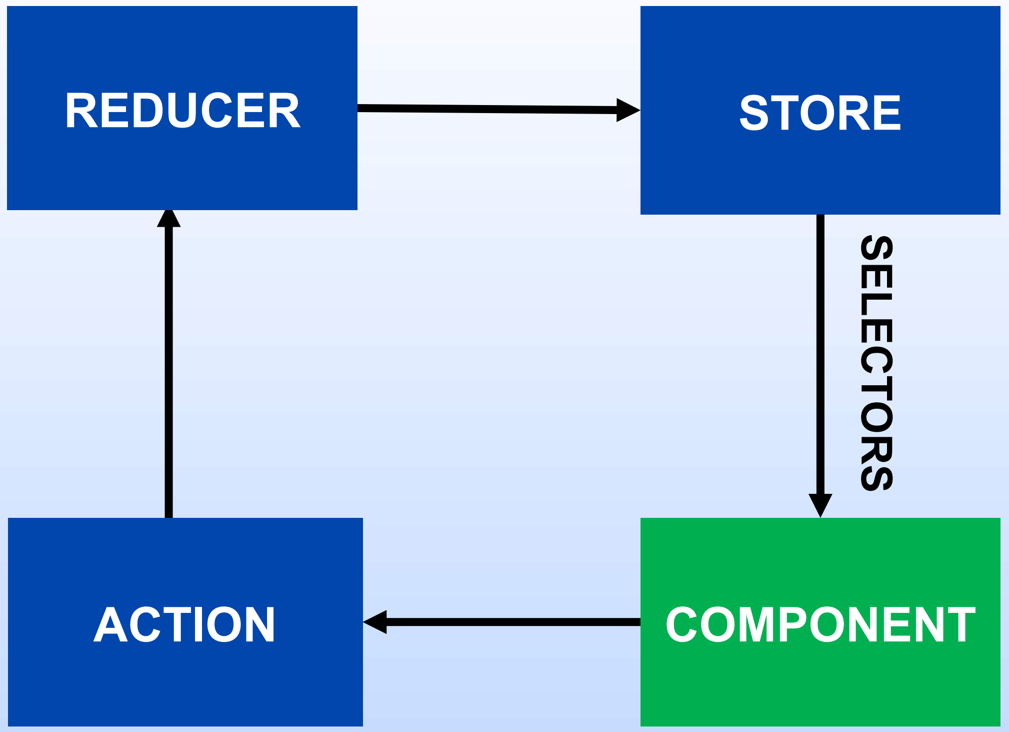
- What is NgRx?
- I had never heard of NgRx until Feb 2018
- Initial misunderstanding of intent
- The AH-HA moment!
- Education challenges
  - Options limited & often too basic
  - Real-world code examples often unrelatable

Why NgRx?

- Avoid spaghetti code!
- Consistent behavior
- All state stored in single object
- Great perks for testing
- Framework agnostic

- Maybe not for everyone

NgRx Basic Pattern

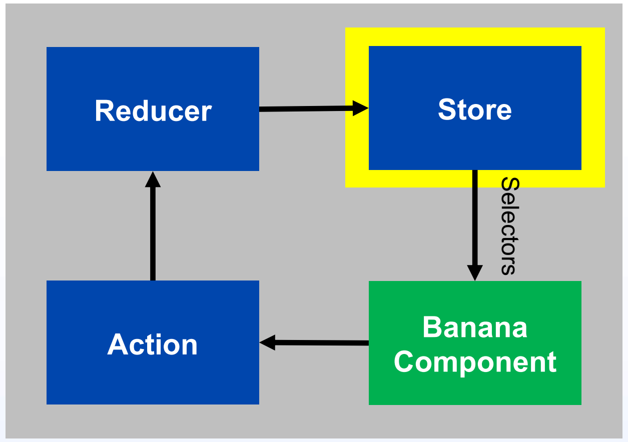


STARTING POINT

- Banana App!
  - https://bit.ly/2GV8XY9
  - http://stackblitz.com/github/apaytonmn/bananaapp
  - Fork the repository
  - Skeleton code structure
  - HTML already written
    - We will not touch the HTML in this workshop
  - Chrome extension: Redux DevTools

Banana State

- In banana directory
  - Create new state directory
  - In state directory, create new state file

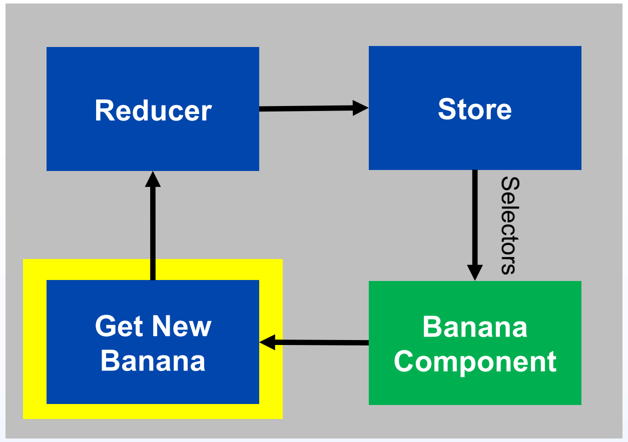


banana.state.ts

```
export interface State {
    isPeeled: boolean;
    bitesRemaining: number;
    color: string;
}

export const initialState: State = {} as State;
```

Action: Get New Banana

- In banana/state directory, create new actions file

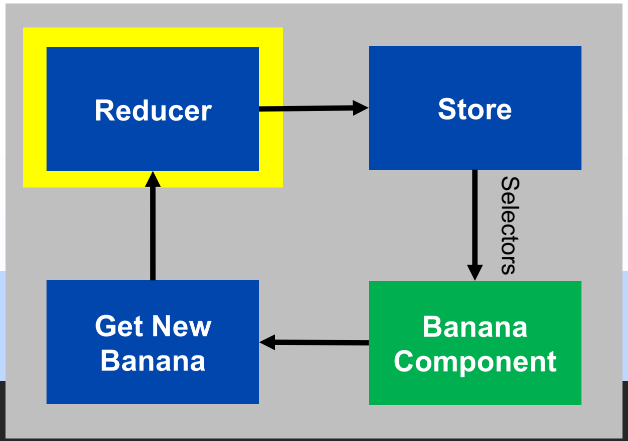


banana.actions.ts

```
import { Action } from '@ngrx/store';

export const GET_NEW_BANANA = 'Get New Banana';

export class GetNewBanana implements Action {
  readonly type: string = GET_NEW_BANANA;

  constructor(public payload: any) {
    console.log('ACTION ' + GET_NEW_BANANA);
  }
}

export type BananaAction = GetNewBanana;
```

Reducer: Get New Banana

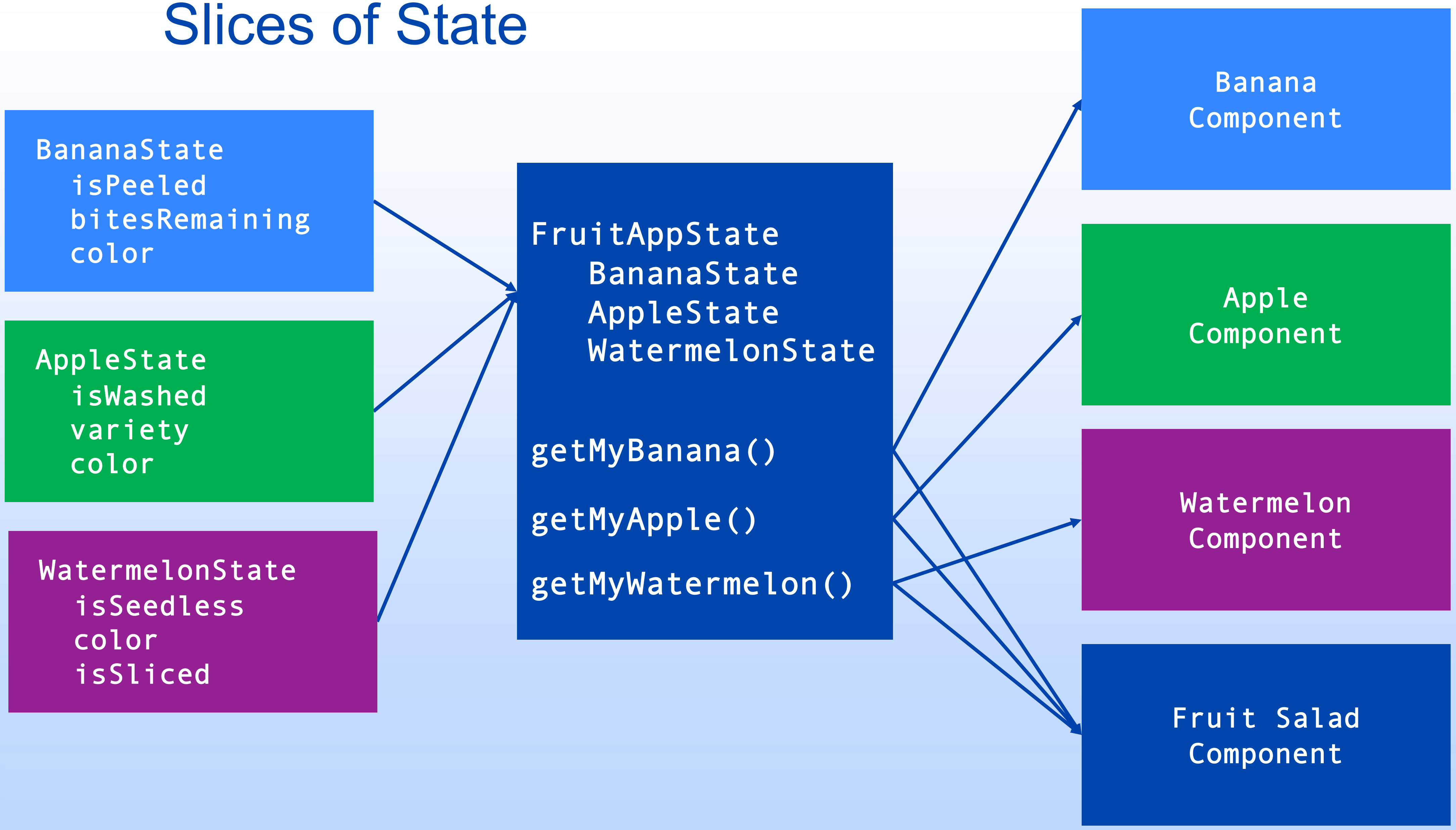
- In banana/state directory, create new reducer file



banana.reducer.ts

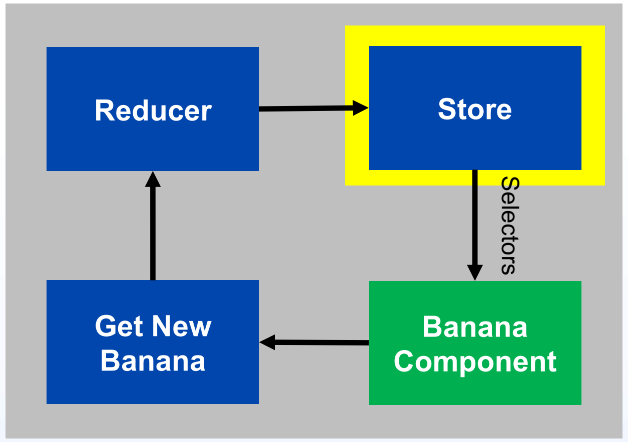
```
import { GET_NEW_BANANA } from './banana.actions';
import * as programActions from './banana.actions';

export function reducer(state: any, action: programActions.BananaAction): any {
  switch (action.type) {
    case GET_NEW_BANANA: {
      console.log('REDUCER ' + GET_NEW_BANANA);
      return {
        isPeeled: false,
        bitesRemaining: 9,
        color: 'yellow'
      };
    }
    default: {
      return {
        ...state
      };
    }
  }
}
```

Slices of State



Wire It Up!

- In banana/state directory, create new file for exports

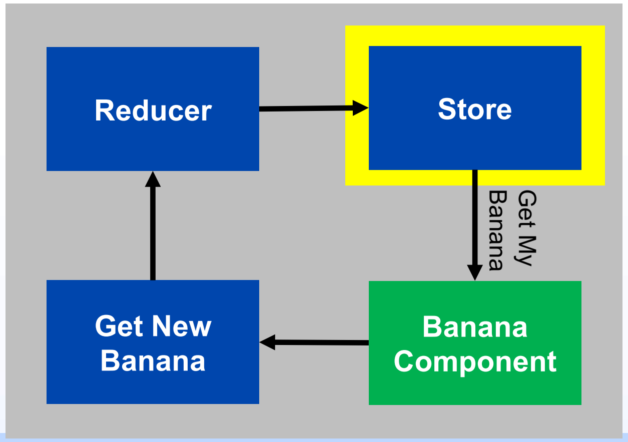


index.ts

```
export { reducer } from './banana.reducer';
export * from './banana.actions';
export { State, initialState } from './banana.state';
```

Wire It Up!

- At the app level create new file to define application level state

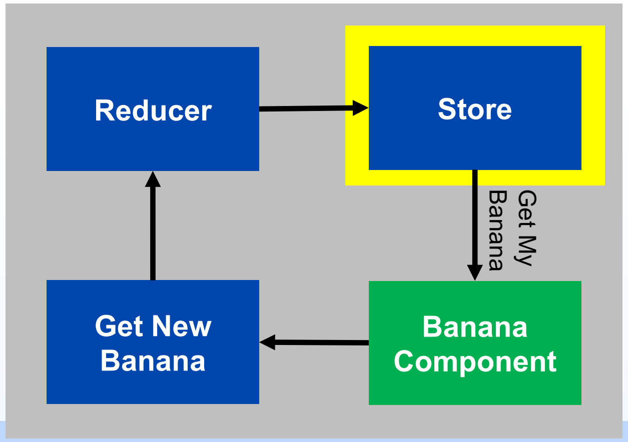


app.state.ts

```
import { ActionReducerMap } from '@ngrx/store';
import * as bananaStore from './banana/state';

export interface AppState {
  banana: bananaStore.State;
}

export const initialState: AppState = {
  banana: bananaStore.initialState
}

export const reducers: ActionReducerMap<AppState> = {
  banana: bananaStore.reducer
}

export const getMyBanana = (s: AppState) => s.banana;
```

Wire It Up!

- Update app module to bring in NgRx support



app.module.ts

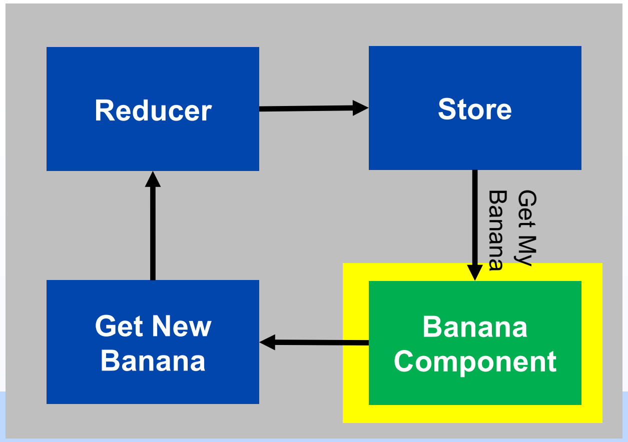
```
import { StoreModule } from '@ngrx/store';
import { StoreDevtoolsModule } from '@ngrx/store-devtools';
import { initialState, reducers } from './app.state';
```

```
StoreModule.forRoot(reducers, {initialState}),
StoreDevtoolsModule.instrument({
  maxAge: 25
})
```

For debug!
We will follow up on this later

Let’s Get a Banana!

- Bring all the work we just did into the component

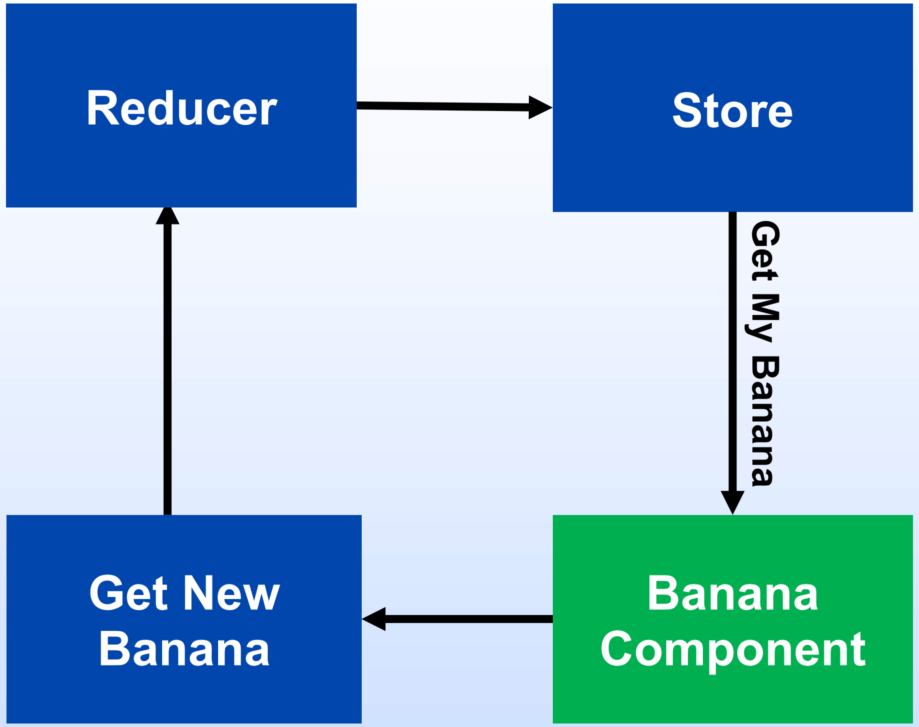


banana.component.ts

```
import { Store, select } from '@ngrx/store';
import { Observable } from 'rxjs';
import { AppState, getMyBanana } from '../app.state';
import { GetNewBanana } from './state';
```

```
banana$: Observable<any>;

constructor(private store: Store<AppState>) {}

ngOnInit() {
  this.newBanana();
  this.banana$ = this.store.pipe(select(getMyBanana));
}

newBanana() {
  this.store.dispatch(new GetNewBanana(null));
}
```

CHECKPOINT #1



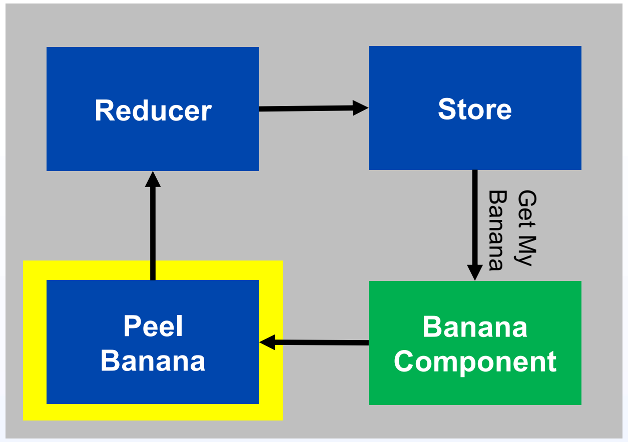
- https://bit.ly/2GV8XY9
- http://stackblitz.com/github/apaytonmn/bananaapp-checkpoint-one

More actions!

- That was a lot of work.
  Do I have to do all that work EVERY time I want to add a new action??
- NO!
  Now that we have the infrastructure in place, adding a new action is easy!

Action: Peel Banana

- Add the Peel Banana action to your actions file



banana.actions.ts

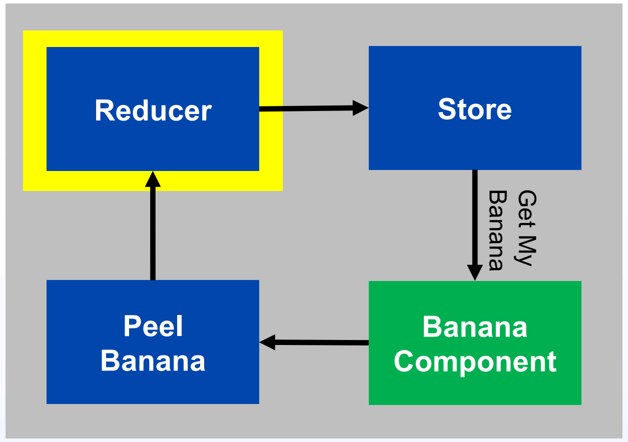
```
export const PEEL_BANANA = 'Peel Banana';
```

```
export class PeelBanana implements Action {
  readonly type: string = PEEL_BANANA;

  constructor(public payload: any) {
    console.log('ACTION ' + PEEL_BANANA);
  }
}
```

```
export type BananaAction = GetNewBanana | PeelBanana;
```

Reducer: Peel Banana

- Handle the Peel Banana action in your reducer



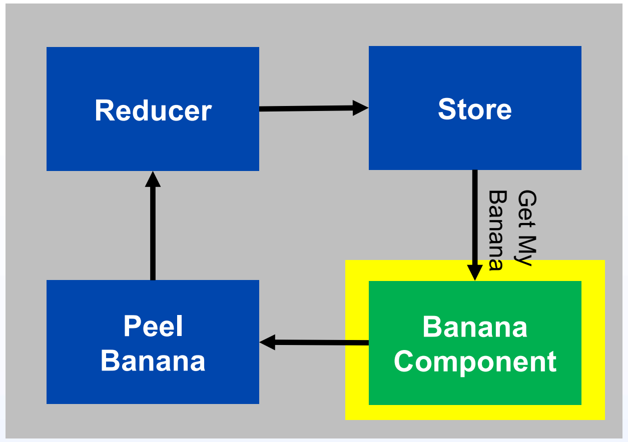
banana.reducer.ts

```
import { GET_NEW_BANANA, PEEL_BANANA } from './banana.actions';
```

```
case PEEL_BANANA: {
  console.log('REDUCER ' + PEEL_BANANA);
  return {
    ...state,
    isPeeled: true
  };
}
```

Component: Peel Banana

- Dispatch the Peel Banana action from your component



banana.component.ts

```
import { GetNewBanana, PeelBanana } from './state';
```

```
peelBanana() {
  this.store.dispatch(new PeelBanana(null));
}
```

CHECKPOINT #2

$$\begin{tikzcd}
\text{Reducer} \arrow[r] & \text{Store} \arrow[d, "\text{Get My Banana}"] \\
\text{Peel Banana} \arrow[u] & \text{Banana Component} \arrow[l]
\end{tikzcd}$$

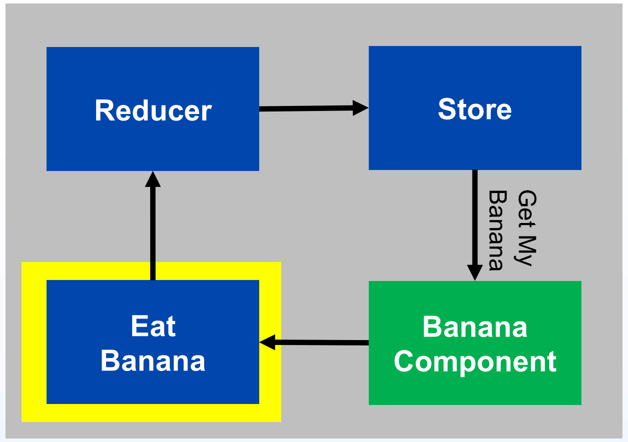
- https://bit.ly/2GV8XY9
- http://stackblitz.com/github/apaytonmn/bananaapp-checkpoint-two

Action with payload

- What if I need additional information to figure out how my state needs to change?
  - Ex. Retrieve info by record ID
- Action follows same pattern
  - Pass data as payload on dispatch
  - Handle payload in the reducer

Action: Eat Banana

- Add the Eat Banana action to your actions file



banana.actions.ts

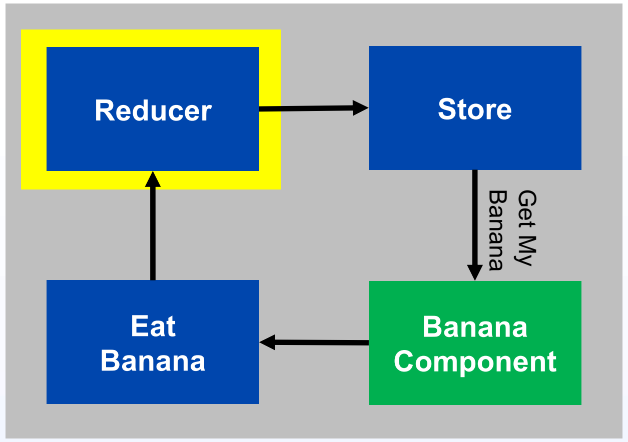
```
export const EAT_BANANA = 'Eat Banana';
```

```
export class EatBanana implements Action {
    readonly type: string = EAT_BANANA;

    constructor(public payload: number) {
        console.log('ACTION ' + EAT_BANANA);
    }
}
```

```
export type BananaAction = GetNewBanana | PeelBanana | EatBanana;
```

Reducer: Eat Banana

- Handle the Eat Banana action in your reducer



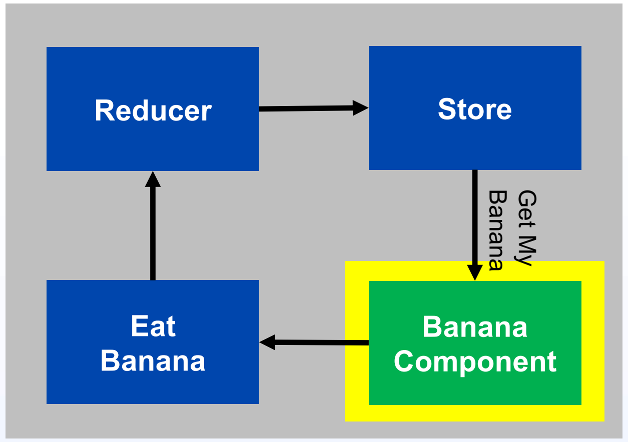
banana.reducer.ts

```
import { GET_NEW_BANANA, PEEL_BANANA, EAT_BANANA } from './banana.actions';
```

```
case EAT_BANANA: {
  console.log('REDUCER: Taking ' + action.payload + ' bites of the banana')
  return {
    ...state,
    bitesRemaining: (state.bitesRemaining - action.payload)
  };
}
```

Component: Eat Banana

- Dispatch the Eat Banana action from your component

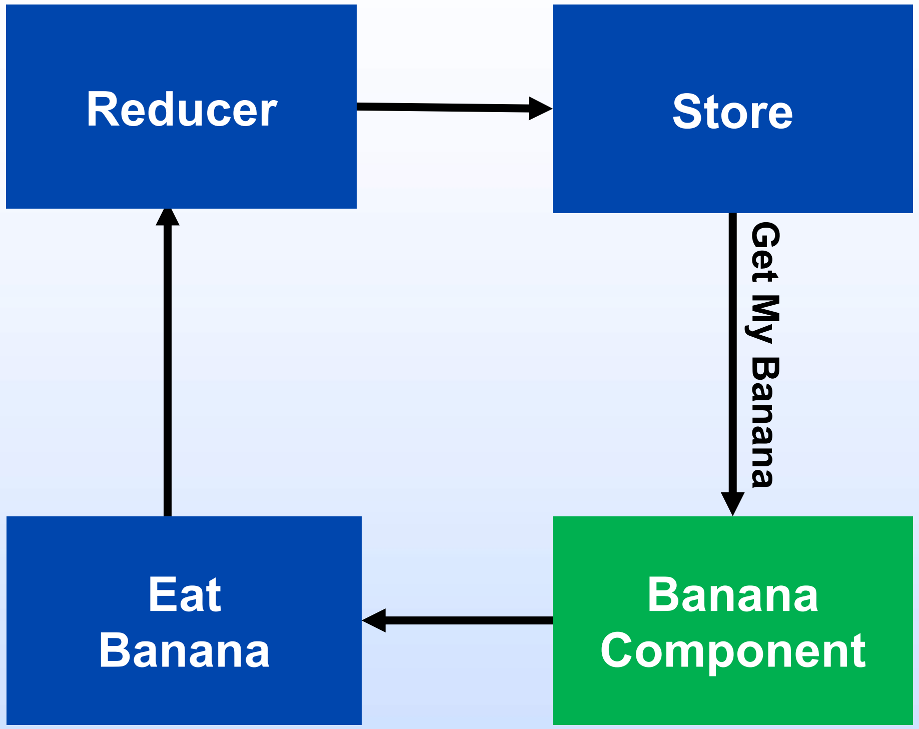


banana.component.ts

```
import { GetNewBanana, PeelBanana, EatBanana } from './state';
```

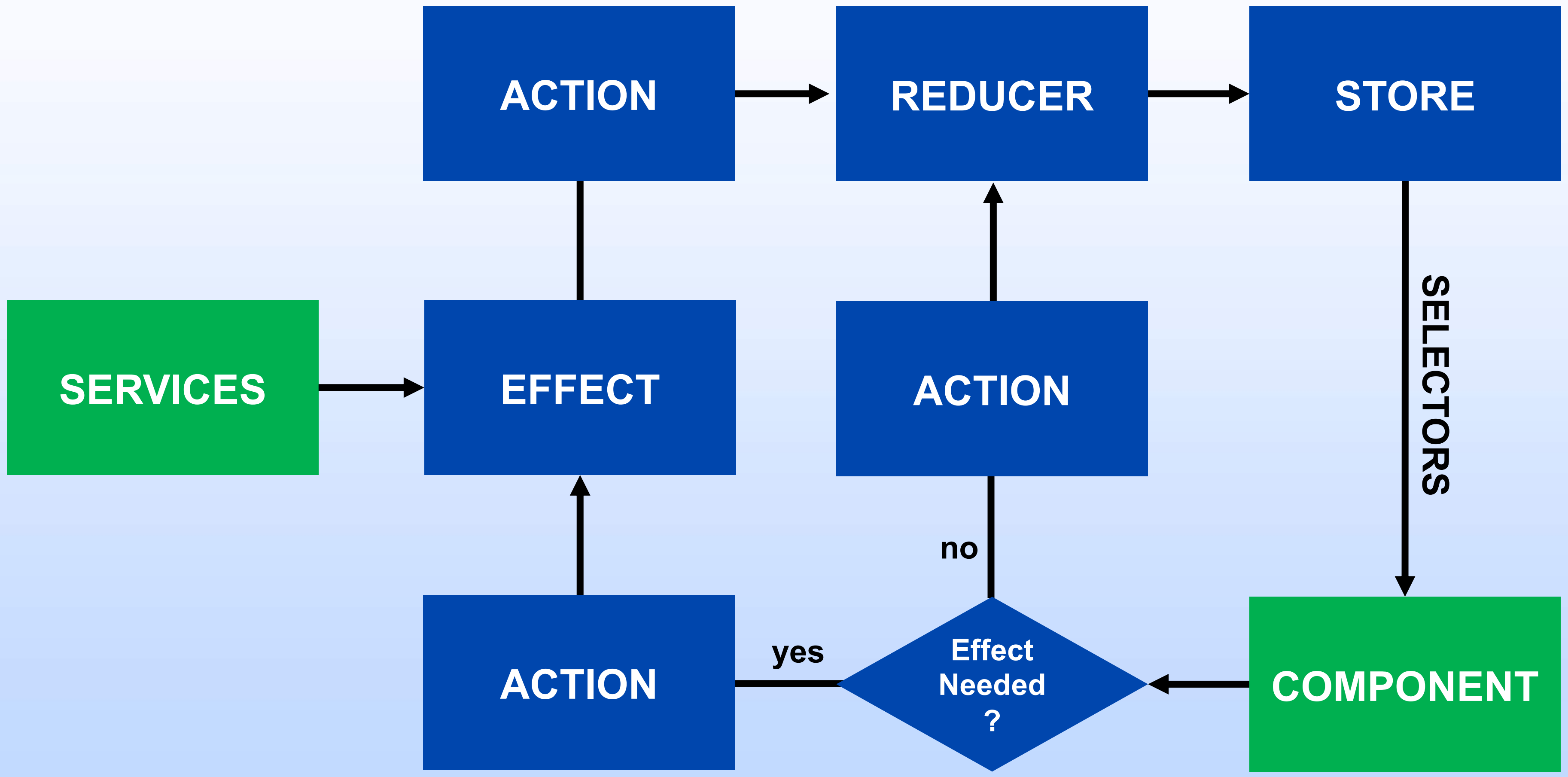
```
eatBanana() {
  this.store.dispatch(new EatBanana(3));
}
```

CHECKPOINT #3

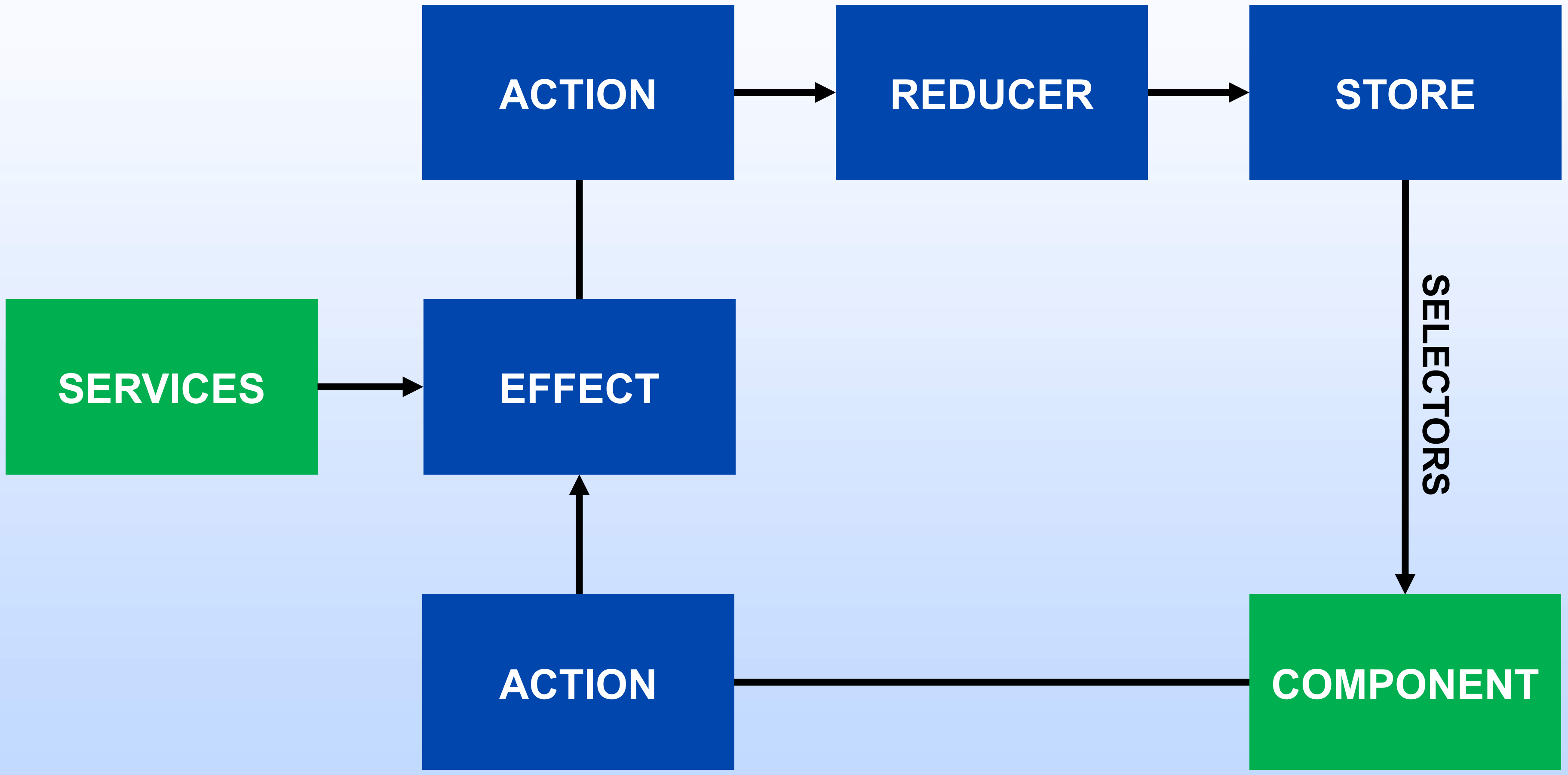


- https://bit.ly/2GV8XY9
- http://stackblitz.com/github/apaytonmn/bananaapp-checkpoint-three

ngRx Extended Pattern

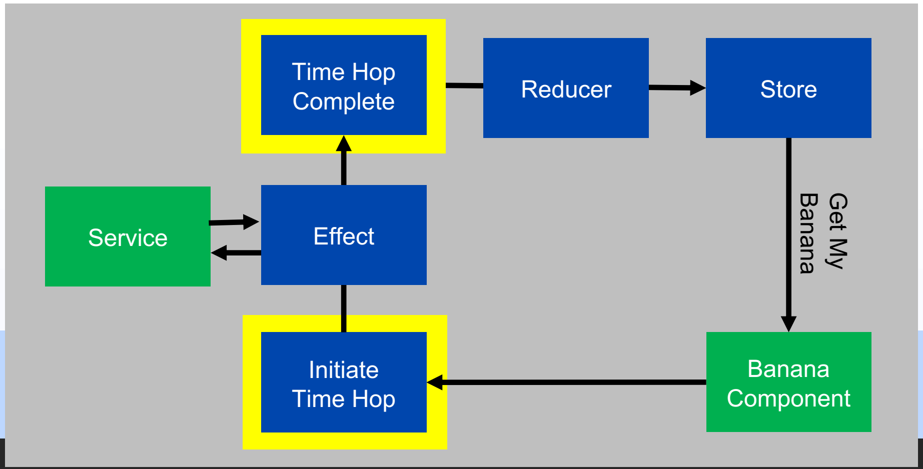


ngRx Extended Pattern



Actions: Initiate Time Hop & Time Hop Complete

- Add new actions to your actions file



banana.actions.ts

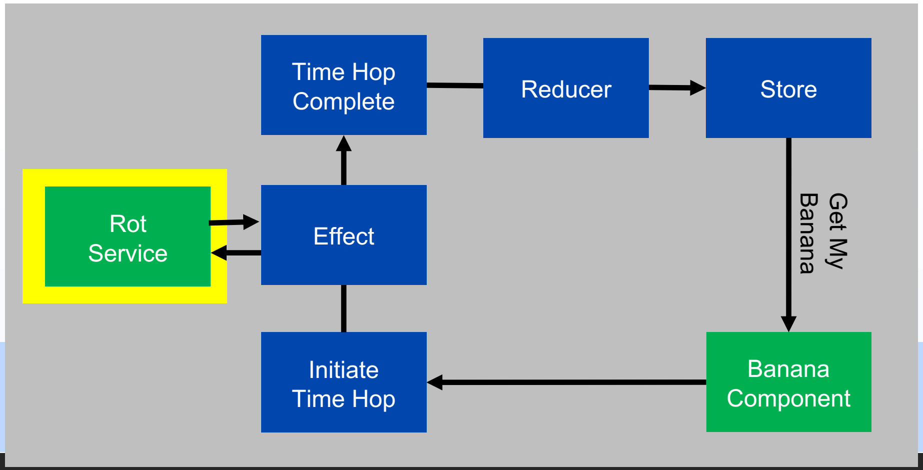
```
export const INITIATE_TIME_HOP = 'Initiate Time Hop';
export const TIME_HOP_COMPLETE = 'Time Hop Complete';
```

```
export class InitiateTimeHop implements Action {
  readonly type: string = INITIATE_TIME_HOP;

  constructor(public payload: any) {
    console.log('ACTION ' + INITIATE_TIME_HOP);
  }
}
export class TimeHopComplete implements Action {
  readonly type: string = TIME_HOP_COMPLETE;

  constructor(public payload: any) {
    console.log('ACTION ' + TIME_HOP_COMPLETE);
  }
}
```

```
export type BananaAction = GetNewBanana | PeelBanana | EatBanana | InitiateTimeHop | TimeHopComplete;
```

Service: Rot Service

- At app level, create new file for service

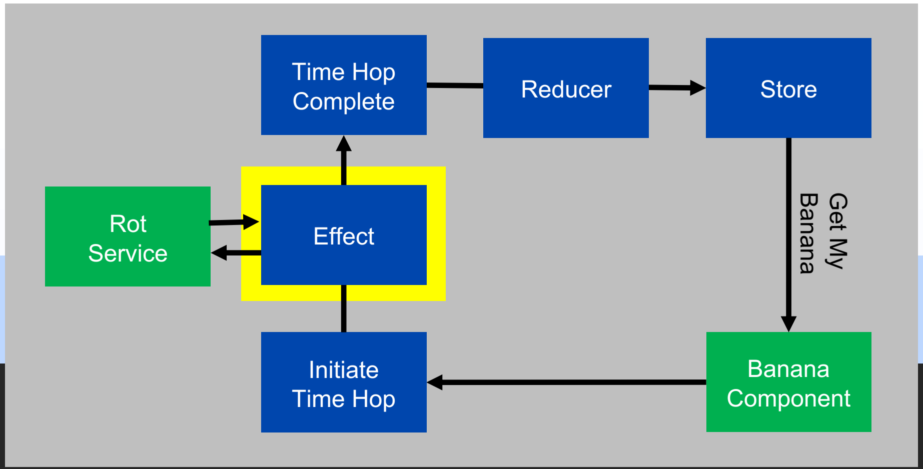


rot.service.ts

```
import { Injectable } from '@angular/core';
import { Observable } from 'rxjs/Observable';

@Injectable({providedIn: 'root'})
export class RotService {

  rotBanana(): Observable<any> {
    console.log('ROT BANANA');
    const milliseconds = 10000; // 10 seconds
    return Observable.create(observer => {
      setTimeout(() => {
        console.log('Done waiting');
        observer.next('brown');
        observer.complete();
      }, milliseconds);
    });
  }
}
```

Effects

- In banana/state directory, create effects file

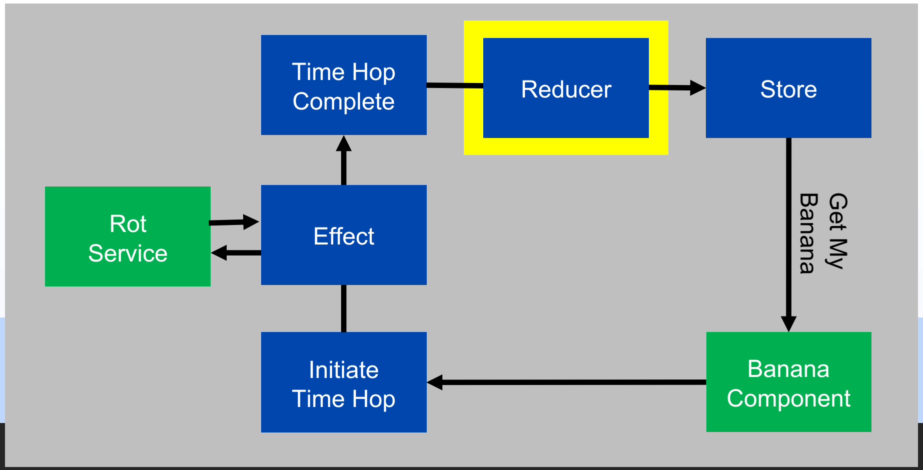


banana.effects.ts

```
import { Injectable } from '@angular/core';
import { Actions, Effect, ofType } from '@ngrx/effects';
import { switchMap, map } from 'rxjs/operators';
import { INITIATE_TIME_HOP, InitiateTimeHop, TimeHopComplete} from './banana.actions';
import { RotService } from '../../rot.service';

@Injectable()
export class BananaEffects {
  constructor(private actions$: Actions, private rot: RotService) { }

  @Effect()
  public initiateTimeHop$ = this.actions$.pipe(
    ofType(INITIATE_TIME_HOP),
    switchMap((action: InitiateTimeHop) =>
      this.rot.rotBanana().pipe(
        map(color => new TimeHopComplete(color))
      ),
    ),
  );
}
```

Reducer: Time Hop Complete

- Handle the Time Hop Complete action in your reducer



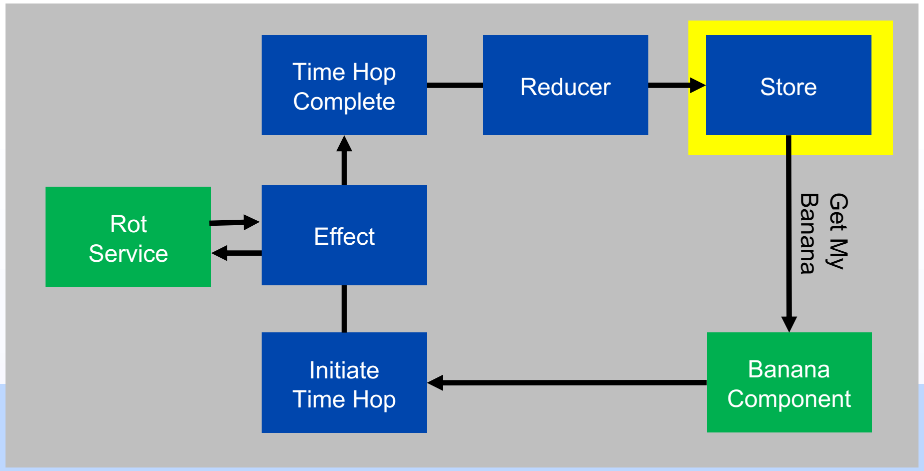
banana.reducer.ts

```
import { GET_NEW_BANANA, PEEL_BANANA, EAT_BANANA, TIME_HOP_COMPLETE } from './banana.actions';
```

```
  case TIME_HOP_COMPLETE: {
    console.log('REDUCER: Time hop complete')
    return {
      ...state,
      color: action.payload
    }
  }
```

Wire It Up!

- Tie the work we did in at the app level



index.ts

```
export { BananaEffects } from './banana.effects';
```

app.state.ts

```
export const effects: Array<any> = [
    bananaStore.BananaEffects
 ];
```

app.module.ts

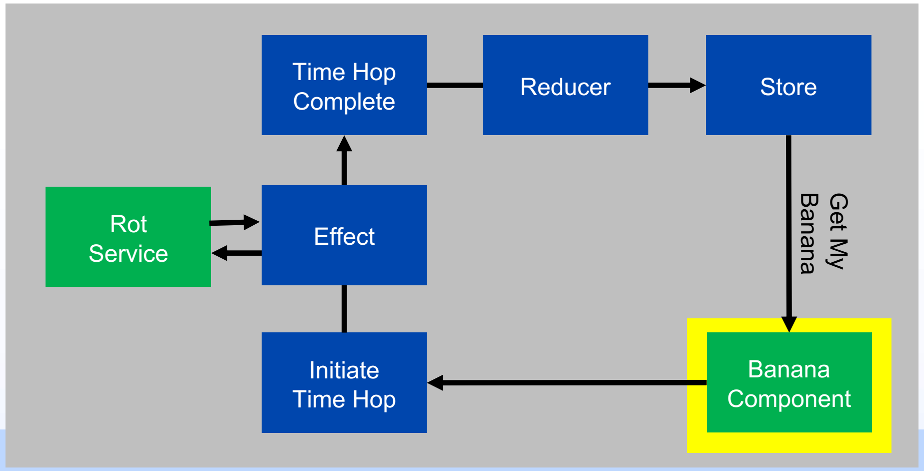
```
import { initialState, reducers, effects } from './app.state';
import { RotService } from './rot.service';
import { EffectsModule } from '@ngrx/effects';
```

```
EffectsModule.forRoot(effects),
```

In imports

Component: Initiate Time Hop

- Dispatch the Initiate Time Hop action from your component

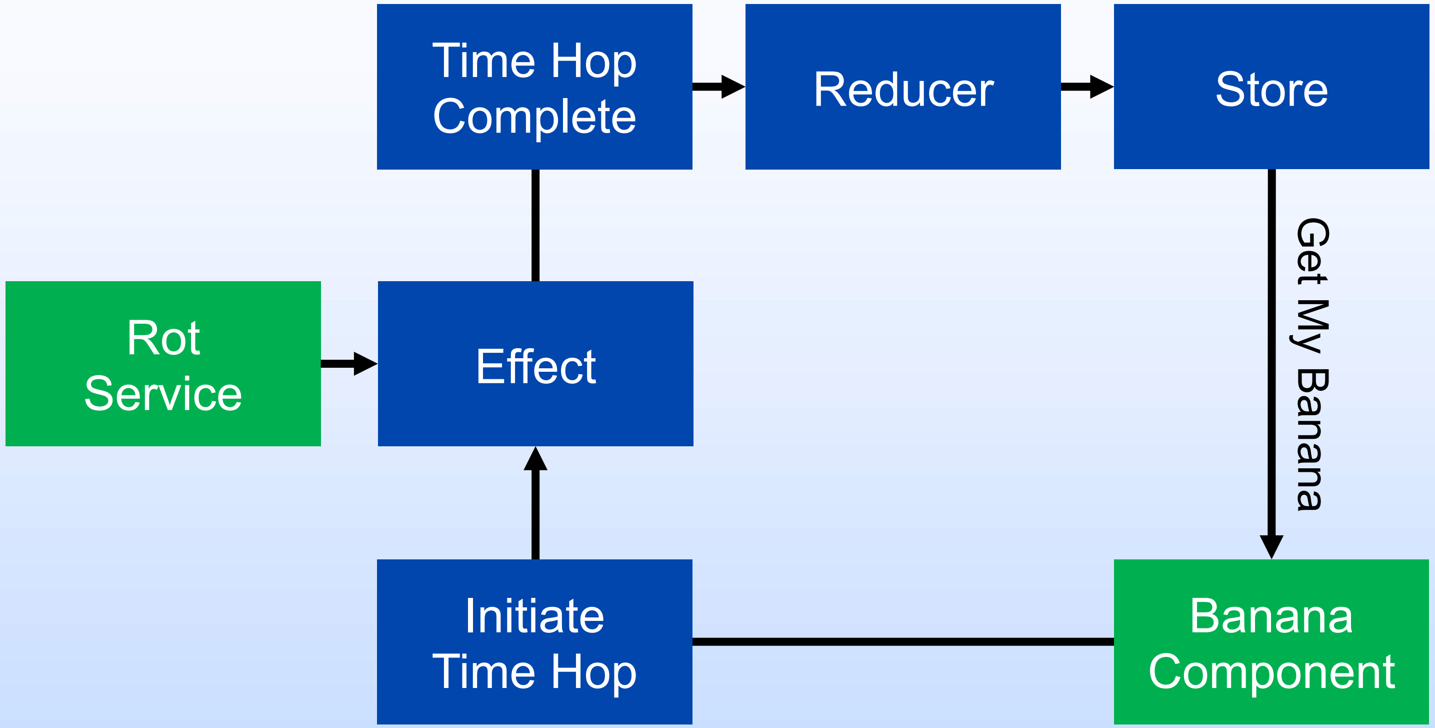


banana.component.ts

```
import { GetNewBanana, PeelBanana, EatBanana, InitiateTimeHop } from './state';
```

```
timeHop() {
  this.store.dispatch(new InitiateTimeHop(null));
}
```

FINAL CHECKPOINT

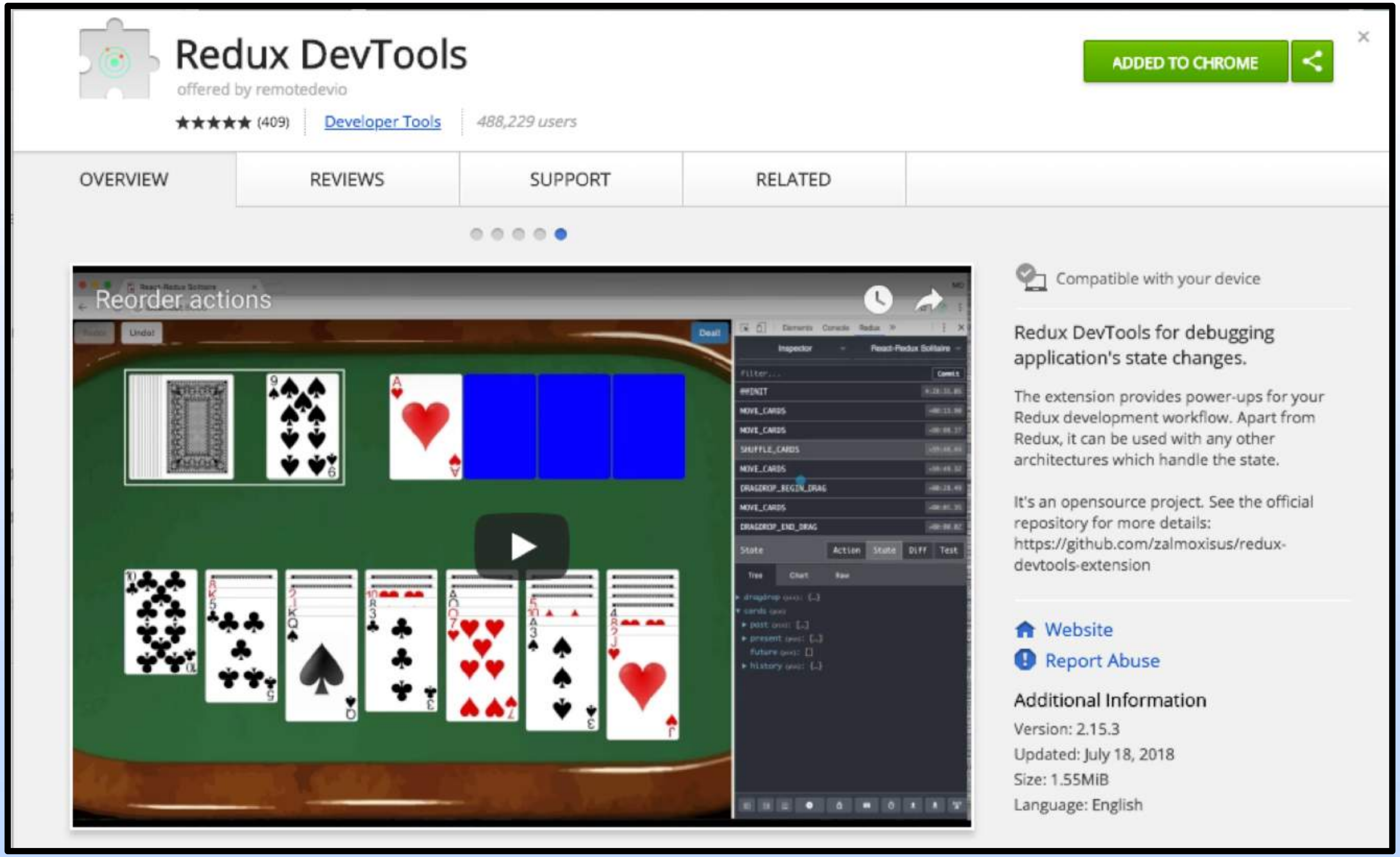


- http://stackblitz.com/github/apaytonmn/bananaapp-final

Debug with Redux DevTools

- HUGE benefit of NgRx
- Maintains history of actions
- Look “back in time” at state of application
- Easy to set up and use
- Feed state object for test

Debug with Redux DevTools



Redux DevTools

offered by remotedevio

★★★★★ (409) | Developer Tools | 488,229 users

Compatible with your device

Redux DevTools for debugging application's state changes.

The extension provides power-ups for your Redux development workflow. Apart from Redux, it can be used with any other architectures which handle the state.

It's an opensource project. See the official repository for more details: https://github.com/zalmoxisus/redux-devtools-extension

Website

Report Abuse

Additional Information

Version: 2.15.3

Updated: July 18, 2018

Size: 1.55MiB

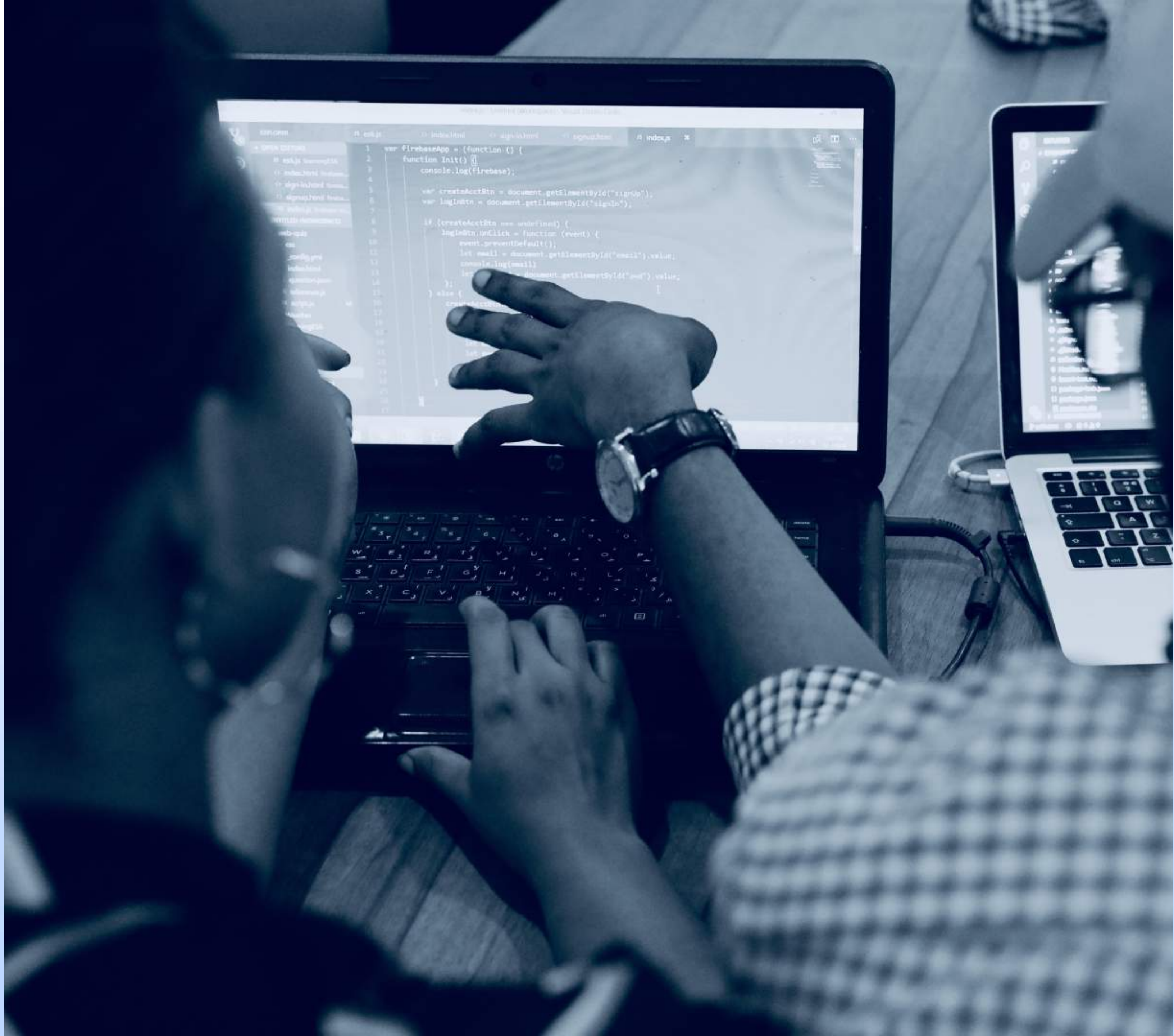
Language: English

Debug with Redux DevTools

app.module.ts

```
import { Store, StoreModule } from '@ngrx/store';
import { EffectsModule } from '@ngrx/effects';
import { StoreDevtoolsModule } from '@ngrx/store-devtools';

@NgModule({
  declarations: [
    AppComponent
  ],
  imports: [
    ...
    RouterModule.forRoot(appRoutes),
    StoreModule.forRoot(reducers, { initialState }),
    EffectsModule.forRoot(effects),
    StoreDevtoolsModule.instrument({
      maxAge: 25
    })
  ],
  providers: [ ],
  bootstrap: [
    AppComponent
  ]
})
```

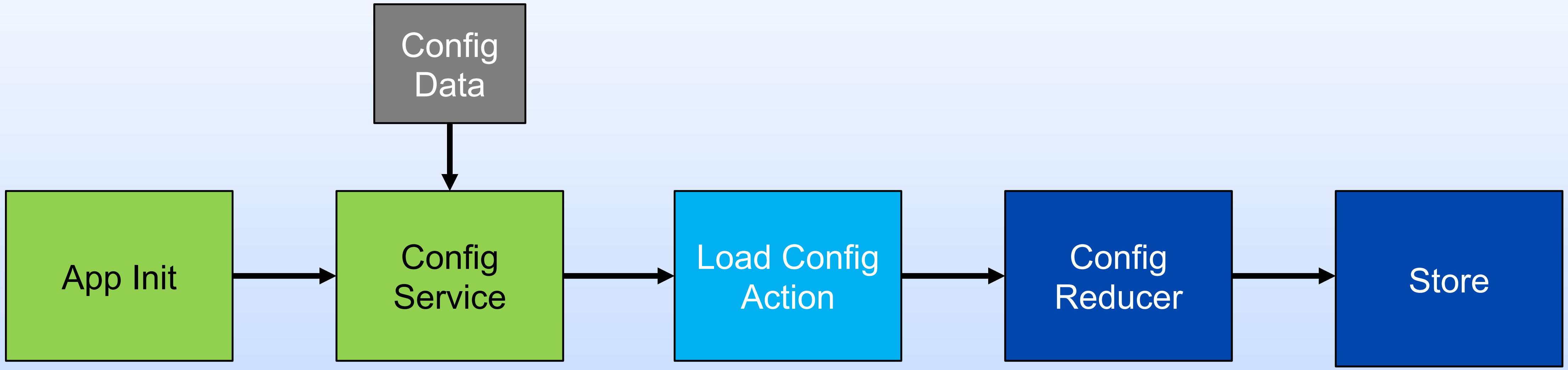
DEMO
Redux DevTools



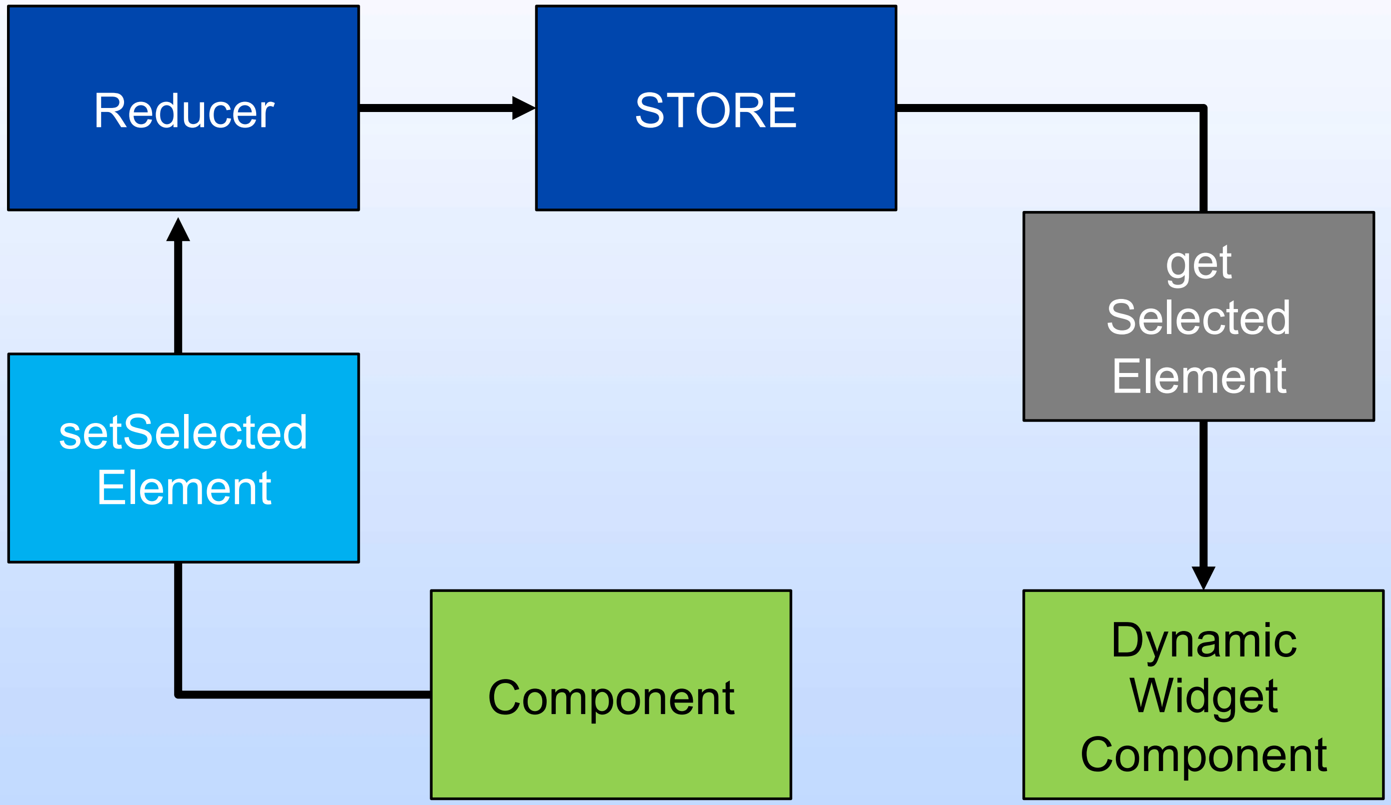
Extending NgRx complexity

- Introducing modules
- Config load at app initialization
- Integration with dynamic components

NgRx & App Initialization

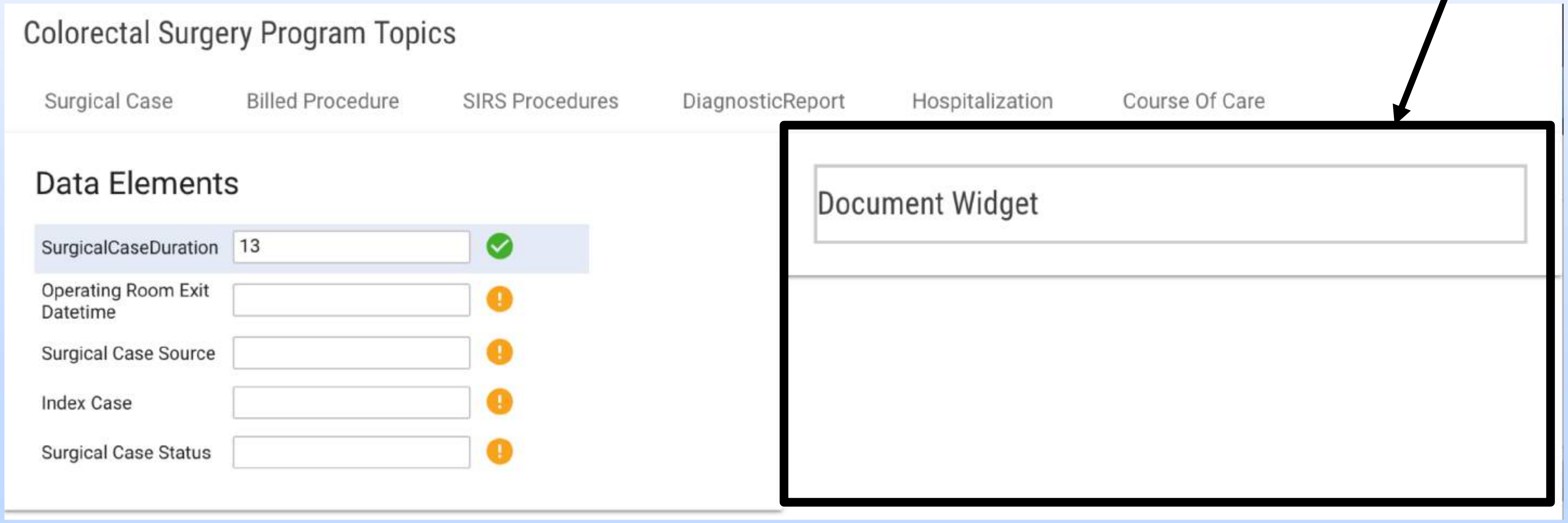


ngRx & Dynamic Components



ngRx & Dynamic Components

Define space in UI where components will be dynamically loaded



Colorectal Surgery Program Topics

Data Elements

SurgicalCaseDuration	13	✓
Operating Room Exit Datetime		!
Surgical Case Source		!
Index Case		!
Surgical Case Status		!

Document Widget

Resources

- Presentation Slides
  - https://bit.ly/2GV8XY9
- Explain Redux Like I'm Five
  - https://dev.to/hemanth/explain-redux-like-im-five
- NgRx: Patterns and Techniques
  - https://blog.nrwl.io/ngrx-patterns-and-techniques-f46126e2b1e5
- Mayo Clinic
  - www.mayo.edu

MAYO CLINIC

Midwest JS

Contact Me

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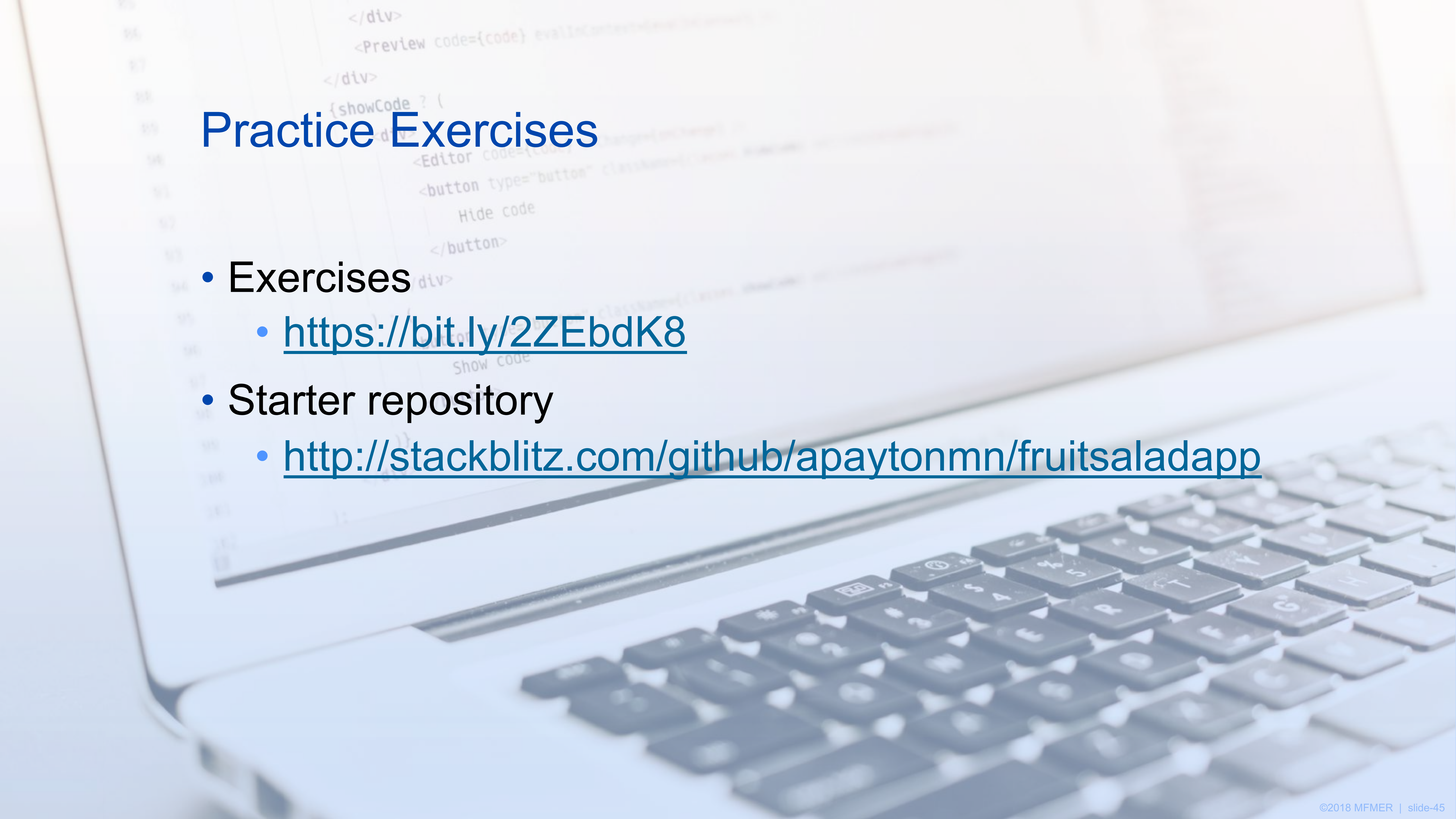
- **Twitter: @paytonmn**
- **Github: apaytonmn**



Practice Exercises

- Exercises
  - https://bit.ly/2ZEbdK8
- Starter repository
  - http://stackblitz.com/github/apaytonmn/fruitsaladapp