Observables & Reactive Programming

Agenda

- REST Calls: Observables vs. Promises
- Observable & Observer
- Introduction to Reactive Extentions
- Using Observables
- Using Operators
- Subscribing to DOM Events

Promises vs Observables

Promises vs Observables

Promise

- One Time Result
- Not Cancable
- Executed throught method ie. http.get(...)
- Processed using .then()
- Need reference to original function for retry

Observable

- One Time Result or Stream
- Cancable
- Executed throught subscription
- Processed using [.map() and] .subscribe()
- Build in Support for retry (retry, retryWhen)
-

Promises vs Observables - Code

Service implementation

```
@Injectable()
export class VouchersService {
constructor(private http: HttpClient) { }

getVouchers() : Promise<any> {
  return this.http.get('/api/vouchers').toPromise();
}

getVouchersObs() : Observable<Voucher[]> {
   return this.http.get<Voucher[]>('/api/vouchers');
}
```

Service consumption

```
export class VouchersComponent implements OnInit {
vouchers: Voucher[];
constructor(private router: Router, private vs: VouchersService) { }
  ngOnInit() {

  //promise
 this.vs.getVouchers().then(data => this.vouchers = data)

  //observable
  this.vs.getVouchersObs()
    .subscribe((responseData)=>{
      this.vouchers = responseData;
})
}
```

Observables & Observer

What is an Observable

- *Observable can be:*
  - *A one-time response (of http operations)*
  - *A Sequence of items (using WebSockets, or Streams)*
  - *Events, triggered by Code or User input*
  - *…*
- *Alternative to using:*
  - *Callbacks or*
  - *Promises*

```
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getVouchers() : Observable<Voucher[]> {
   return this.http.get<Voucher[]>('/api/vouchers');
}
```

```
export class VouchersComponent implements OnInit {
vouchers: Voucher[];
constructor(private router: Router, private vs: VouchersService) { }
  ngOnInit() {
    this.vs.getVouchers()
    .subscribe((responseData)=>{this.vouchers = responseData;})
}
```

What is an Observer

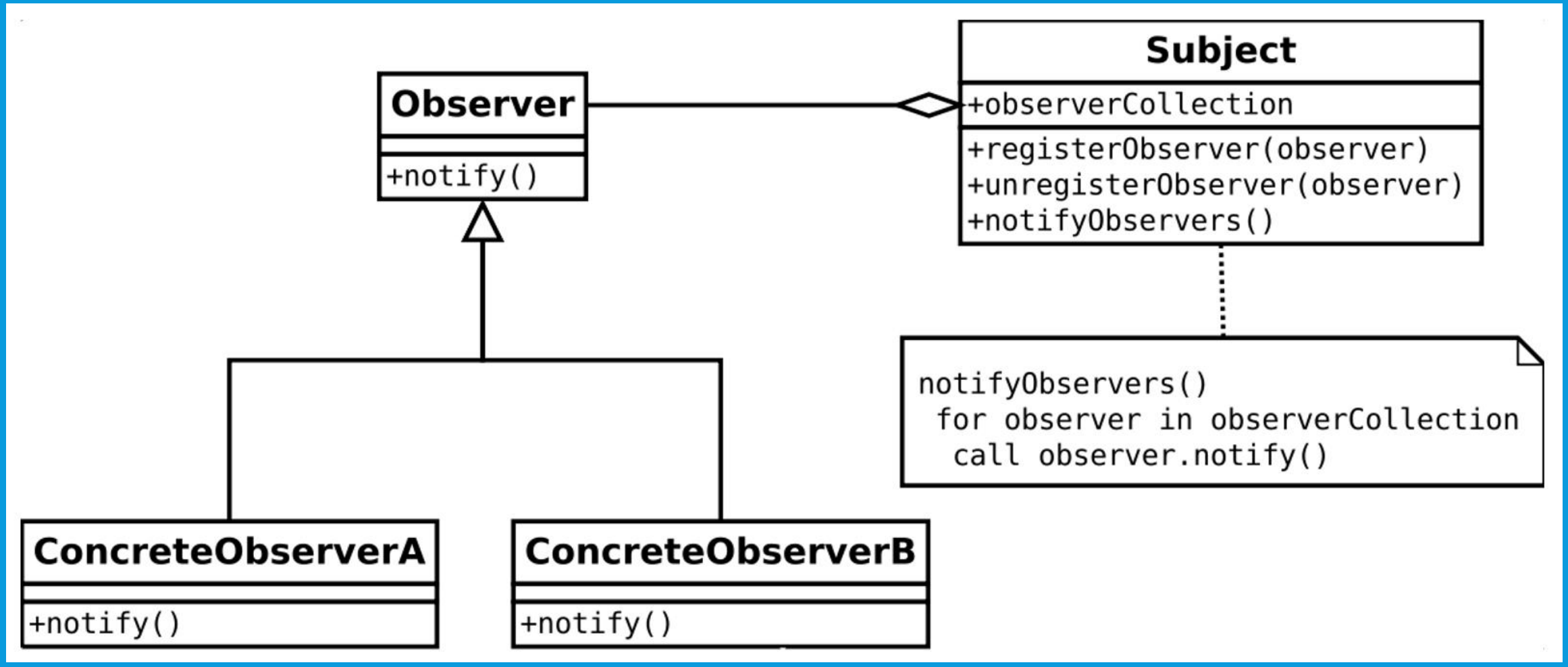
- Observer subscribes to an Observable (… observes Observable)
- Reacts to whatever item or sequence of items the Observable emits:
  - Handle Data: next()
  - Handle Error: error()
  - Handle Completion: complete()
- Might use Operators to deal with Observables – ie Filter

```
myObservable.subscribe(myOnNext, myError, myComplete);
```

Subject

- Is simply an Observer and Observable at the same time
- You can push new values as well as subscribe to it
- Many Subject implementations:
  - Subject
  - Behavior Subject
  - ...

Observable Pattern - Big Picture



Introduction to Reactive Extentions

What are Reactive Extentions?

- API for async programming with observables

  Streams

- Availbale for JavaScript, .NET, Swift, Java, …
- An implementation of the Observable Pattern
- Reactive Programming provides a collection of operators to manipulate response (Observables)
- Most common used operator is Map – transform response into a subset (… matching the Data Model)
- Operator documented @ http://reactivex.io/documentation/operators.html

Getting Started

- RxJS is used internally by Angular -> No need to install anything
- Just import Objects and Operators you want to use
- For production make sure you just import what you need to reduce download size

```
import { Observable } from 'rxjs/Rx';
```

```
import 'rxjs/add/operator/map';
import 'rxjs/add/operator/toPromise';
```

Using Observables

Creating Observables

- Observables can be created using
  - Observable.from()
  - Observable.create()
  - Observable.fromPromise()
  - Observable.fromEvent()

```
this.nbrObs = Observable.from([1, 5, 10, 18, 22]);
```

```
this.mediaSingleton = Observable.create((observer: Observer<MediaItem>) => {
  observer.next(<MediaItem>{title: `${label} ${moment().format("h:mm:ss a")}`});
});
```

Using BehaviorSubject

- BehaviorSubject is a type of subject.
- The unique features of BehaviorSubject are:
  - Upon subscription it returns the last value of the subject.
  - A regular observable only triggers when it receives an onnext
  - At any point you can retrieve the last value of the subject in a non-observable code using the getValue() method.

```
let bs: BehaviorSubject<MediaItem[]> = new BehaviorSubject<MediaItem[]>(this.buildMedia(initialCount));
return bs.asObservable();
```

Using Operators

Operators

- Operatorsallow us to deal with / manipulae Observables
- Operators can be chained
- Can be grouped into Operators that:
  - Create Observables (Create, From, …)
  - Transform Observables (Map, GroupBy, …)
  - Filter Observables (Filter, Take, Distinct, …)
  - Combine (And / Then / When, …)
  - Error Handling & Utitlity (Catch, Retry, Subscribe, …)
- Documented @ http://reactivex.io/documentation/operators.html

.map()

- Transform the items emitted by an Observable by applying a function to each item
- Often used when working with Http to extract Data from Response

```
getVouchersHttp(){
 this.http.get('http://localhost:5000/api/vouchers')
 .map(response => response.json()).subscribe((data)=>{
 this.result = data;
 })
}
```

.filter()

- Emit only those items from an Observable that pass a predicate test

```
getVouchersFilter(){
 this.http.get('http://localhost:5000/api/vouchers')
 .map(response => response.json())
 .filter(data => data.json().deleted == false)
 .subscribe((data)=>{
  this.result = data;
 })
}
```

Subscribing to DOM Events

Subscribing to DOM Events

- The Observable Pattern can also be used to subscribe to DOM Events like
  - Mouse Events
  - Button Events
  - Change of URL, QueryParams
  - ...
  - Full list of DOM events:
    - https://www.w3schools.com/jsref/dom_obj_event.asp

Using Mouse Events

- Subscriptions to Mouse Events are created using:
  - Observable.fromEvent()

```
useMouse(){

  let mouse = Observable.fromEvent(document, "mousemove");

  mouse
    .map((evt: MouseEvent )=>{ return { X : evt.clientX, Y: evt.clientY }})
    .subscribe(data=>console.log("Mouse Moved @: ", data))
}

unsubscribeMouseEvt(){
   this.mouseSubs.unsubscribe();
   console.log("unsubscribed from Mouse Event")
}
```

Using Button Evens

- Subscriptions to Button Events are created using:
  - Observable.fromEvent()
- Alternative to Callback Pattern

```
let buttonClick = Observable.fromEvent(document.getElementById("mybutton"), "click");
this.buttonClickSubs = buttonClick.subscribe(evt=>console.log("Button Clicked"))
```