

# SOLID Principles. RxJS. Services

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**#angular**

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# **Change Detection Strategy**

- Angular performs change detection on all components (from top to bottom) every time something changes
- Change detection is very performant, but as an app gets more complex and the amount of components grows, change detection will have to perform more and more work

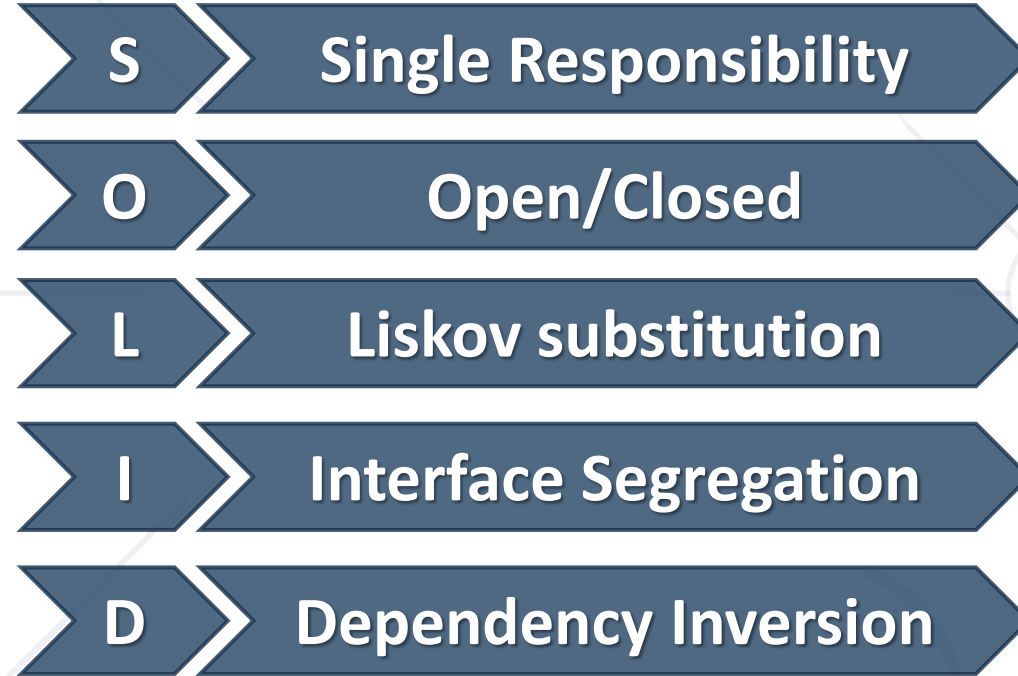


- The strategy that the default change detector uses to detect changes

```
enum ChangeDetectionStrategy {  
    OnPush: 0,  
    Default: 1  
}
```

- When set, takes effect the next time change detection is triggered

- **OnPush: 0** - CheckOne strategy
  - Automatic change detection is deactivated until reactivated by setting the strategy to Default
  - This strategy applies to all child directives and cannot be overridden
- **Default: 1** - CheckAlways strategy
  - Use the default CheckAlways strategy
  - Change detection is automatic until explicitly deactivated



# SOLID Principles



# Single Responsibility Principle



- A **responsibility** can be defined as a **reason to change**
- Every class should have **only one** responsibility
  - The responsibility should be entirely **encapsulated** by the class
- This principle leads to
  - **Stronger cohesion** and **looser coupling**
  - Better **readability**
  - **Lower** complexity

# Open-Closed Principle



- Software entities like **classes**, **modules** and **functions** should be **open** for **extension**, but **closed** for **modification**
- **Open** for extension
  - Adding new behavior **doesn't require** changes over existing source code
- **Closed** for modification
  - Changing the source code is **not allowed**

# Liskov Substitution Principle

- Derived types must be completely **substitutable** for their base types
- Derived classes
  - Only **extend** functionalities of the base class
  - Must **not** remove **base** class **behavior**



# Interface Segregation Principle

- Classes that implement **interfaces**, should **not** be **forced** to implement **methods** they **do not use**
- "**Fat**" interfaces need to be divided into "**role**" interfaces (**small** and more **specific**)
- It is **better** to have many **smaller** interfaces, than fewer, **fatter** ones



# Dependency Inversion Principle

- High-level modules should not depend on low-level modules. Both should depend on abstractions
- Abstractions should not depend on details. Details should depend on abstractions




# Dependency Inversion Principle

- The design principle does not just change the direction of the dependency
- Splits the dependency between the high-level and low-level
  - The high-level module depends on the abstraction
  - The low-level depends on the same abstraction



# Dependency Injection

- 
- Dependency is another **object** that your class **needs**
    - Examples (**Framework, Database, File System, Providers**)
  - Classes that **dependent** on each other are called **coupled**
  - Dependencies are **bad** because they **decrease** reuse

```
public class Customer {  
    customerService = new CustomerService('Service');  
}
```

Customer class is dependent  
on **concrete service**

- Dependency Injection is a popular **design pattern**
- Inversion of Control (**IoC**)
  - Dependencies are **pushed** in the class from the **outside**
  - The class does **not** instantiate its dependencies

```
public class Customer {  
    private customerService;  
    constructor(cService: CustomerService) {  
        this.customerService = cService;  
    }  
}
```

The service comes from **outside**



- Using the **new** keyword
- Using **static** methods/properties

```
public class Laptop {  
    public battery: Battery;  
    public videoCard: VideoCard;  
  
    constructor() {  
        this.battery = new Battery('Acer battery');  
        this.videoCard = new VideoCard('Nvidia 960 GTX');  
    }  
}
```

The class is **brittle**,  
**inflexible** and **hard** to test

# How to Fix?

- Add the dependencies **through** the **constructor**

```
constructor(  
    public videoCard: VideoCard,  
    public battery: Battery)
```

- Create whatever **model** you like

```
let firstLaptop = new Laptop(  
    new VideoCard('Nvidia 940m'),  
    new Battery('Acer Battery'));
```

```
let secondLaptop = new Laptop(  
    new VideoCard('Radeon 280x'),  
    new Battery('Toshiba Battery'));
```

- A class should **receive** its dependencies from **external** sources rather than **creating** them **itself**
- **Decouple** dependencies through **constructor injection**
- Your **code** should be **easier** to test
- Additional information

<https://angular.io/guide/dependency-injection-overview>



# Services

Constructor Injection, Providers, Injectable

# Why We Need Services ?

- Components **shouldn't** fetch or save **data** directly
- They should focus on **presenting data** and delegate data access to a service
- Services are a great way to
  - Share information among classes that **don't know** about each other
  - Avoid **code duplication**



- Services in Angular are just normal **TypeScript classes** that handle data manipulation

```
export class BooksService {  
  booksData: Book[];  
  
  addBook(b: Book) {  
    this.booksData.push(b);  
  }  
}
```

- Services are injected into components via **constructor injection**
- Before that they should be **provided** from inside the **decorator**

```
@Component({  
  providers: [ BooksService ]  
})  
export class BookListComponent {  
  constructor(  
    private booksService: BooksService  
  ) { }  
}
```

The **same instance** will be provided  
for **child components**

- In order to inject **one** service **into another** use the **@Injectable** decorator

```
@Injectable()  
export class BooksService {  
  booksData: Book[];  
  
  constructor (  
    private loggingService: LoggingService  
  ) { }  
}
```

```
@Injectable({  
  providedIn: 'root'  
})
```

Provided in 'app.module.ts'





# **RxJS and Observables**

Intro to FRP

- Functional Programming is used a lot in JavaScript
  - Easier **array** manipulation using (**map**, **filter**, **reduce**, etc.)
- Front-end programming is **asynchronous**
- Using a **stream** to handle **asynchronous** operations

0, 1, 2, 3, 4

A stream of numeric values

- In Angular we **handle** streams using **Observables**
  - **Create** Streams
  - **Subscribe** to Streams
  - **React** to new values
  - **Combine** streams to build new ones

```
[ 0, 1, 2, 3, 4 ]
```

Handle a **stream** as an **array**

- FRP is a **paradigm** for software development
  - Entire **programs** can be built **uniquely** around the notion of **streams**
  - Create, combine and subscribe to streams
- The core **goal** of FRP
  - Build programs in a **declarative** way
  - Lack of application **state** variables



# Introducing RxJS

- Stands for **R**eactive **E**xtensions for **J**ava**S**cript

- Install Library

```
npm install rxjs
```

- Use with CommonJS

```
const { range } = require('rxjs')  
const { map, filter } = require('rxjs/operators')
```

- Use with import/export

```
import { range } from 'rxjs'  
import { map, filter } from 'rxjs/operators'
```

# Observables Side Effect (Hot vs Cold)

- Using the **tap** operator

```
const obs = range(1, 10)
  .pipe(
    tap(i => console.log(`Hello: ${i}`))
  );
```

- Observables are either **hot** or **cold**

- **Cold observables** are observables where the data producer is created by the observable itself

**of, from, range, interval** and **timer**

- **Hot observables** have their data producer outside the observable itself

**fromEvent**

- Observables are **not shared** by **default**
  - Creating a **subscriber** sets up a whole **new** separate processing **chain**

```
obs.subscribe(i => console.log(`first sub ${i}`));  
obs.subscribe(i => console.log(`second sub ${i}`));
```

- **Two** things to **keep** in mind:
  - Is the observable **hot** or **cold**?
  - Is the observable **shared** or **not**?

- The **map** operator

```
const obs = range(1, 10).pipe(map(i => i ** 2));
```

- The **filter** operator

```
const obs = range(1, 10).pipe(filter(i => i % 2 === 0));
```

- The **reduce** operator

```
const obs = range(1, 10).pipe(  
  reduce((prevVal, val) => prevVal + val, 0)  
))
```



- RxJS and FRP are powerful concepts
- Multiple choice to **structure** an **Angular** app
  - Go **full** reactive (extensive use of RxJS)
  - Via **parts** (Forms or Http)
- More on observables here: [Click](#)
- More RxJS operators here: [Click](#)



# HTTP Client

Fetching Data from a Remote API

# The HTTP Client Module

- Before using the **HttpClient** to **fetch** data, import the **HttpClientModule** in "app.module.ts"

```
import { HttpClientModule } from '@angular/common/http'
```

- Add the module in **imports** array

```
@NgModule({  
  declarations: [ // App Components ],  
  imports: [  
    BrowserModule,  
    HttpClientModule  
  ],  
})
```

From now on **HttpClient** can be  
**injected** in Services

# Using the HTTP Client in Services

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

Inject the **HttpClient** and use it as a **service**

```
  getAllPosts() : Observable<Post[]> {
    const url = 'https://jsonplaceholder.typicode.com/posts';

    return this.http.get<Post[]>(url);
  }
}
```

The **Client** works with **generic** types

# Subscribe to the Observable

- **Inject** a service and **subscribe** to observables

```
export class PostsComponent implements OnInit {  
  posts: Posts[];  
  constructor(  
    private postsService : PostsService  
  ) { }  
  
  ngOnInit(): void {  
    this.postsService.getAllPosts()  
      .subscribe(data => {  
        this.posts = data;  
      });  
  }  
}
```

Always **subscribe** to observables

# Type Checking the Response

- It is recommended to **cast** the response

```
getAllPosts() : Observable<Post[]> {  
  const url = 'https://jsonplaceholder.typicode.com/posts';  
  
  return this.http.get<Post[]>(url);  
}
```

Should be an **interface**

```
interface Post {  
  userId: number;  
  id: number;  
  title: string;  
  body: string;  
}
```

- To handle **errors**, add an error **handler** to **subscribe** call

```
ngOnInit(): void {  
  this.postsService.getAllPosts()  
    .subscribe(  
    data => { // Attach data to prop },  
    err => {  
      console.log(` ${JSON.stringify(err)} `)  
    }  
  )  
}
```

- DI is a popular **design** pattern
- **Using** services in **Angular** is recommended

```
@Component({  
  providers: [ UserService ]  
})
```

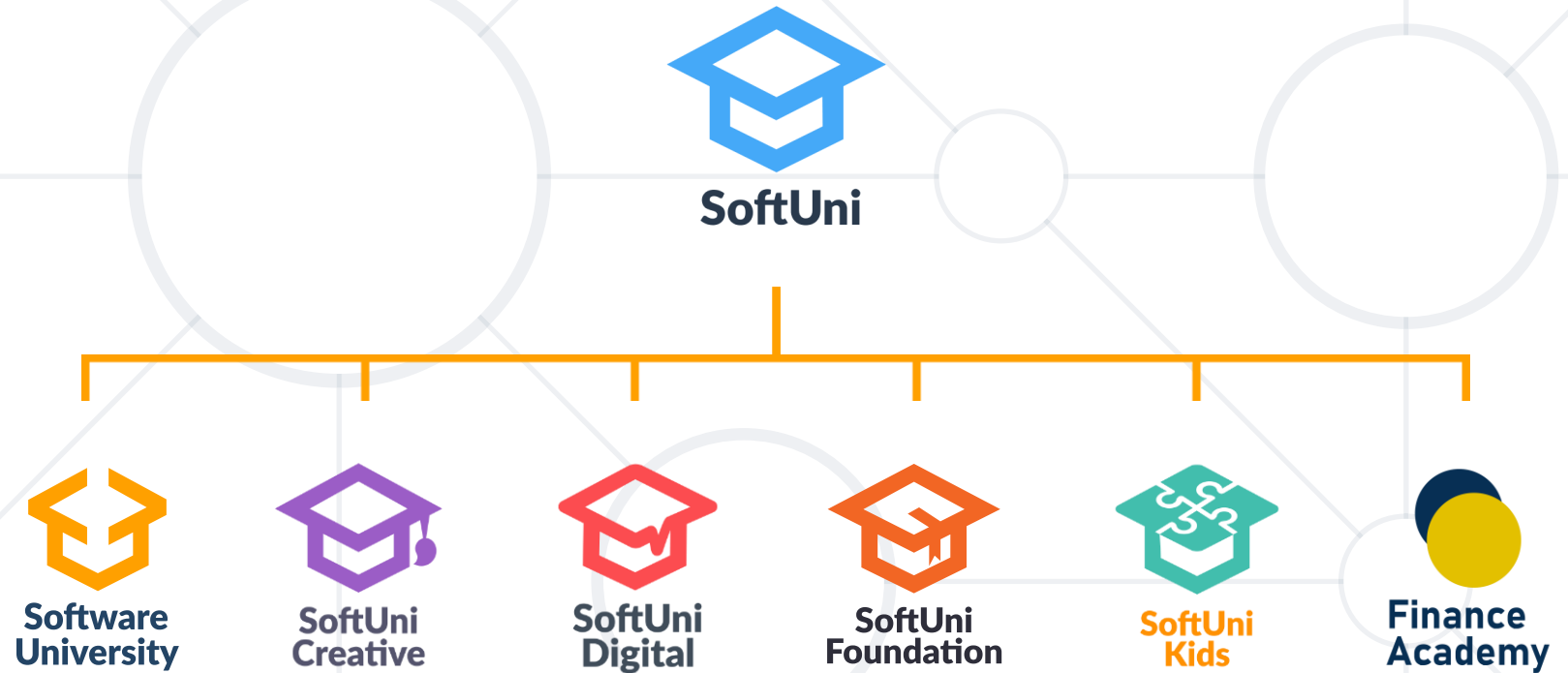
- RxJS and FRP are **powerful** concepts
- Use the **HttpClient** to **fetch** data from an **API**

```
this.http.get(url).retry().pipe().subscribe()
```





# Questions?



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