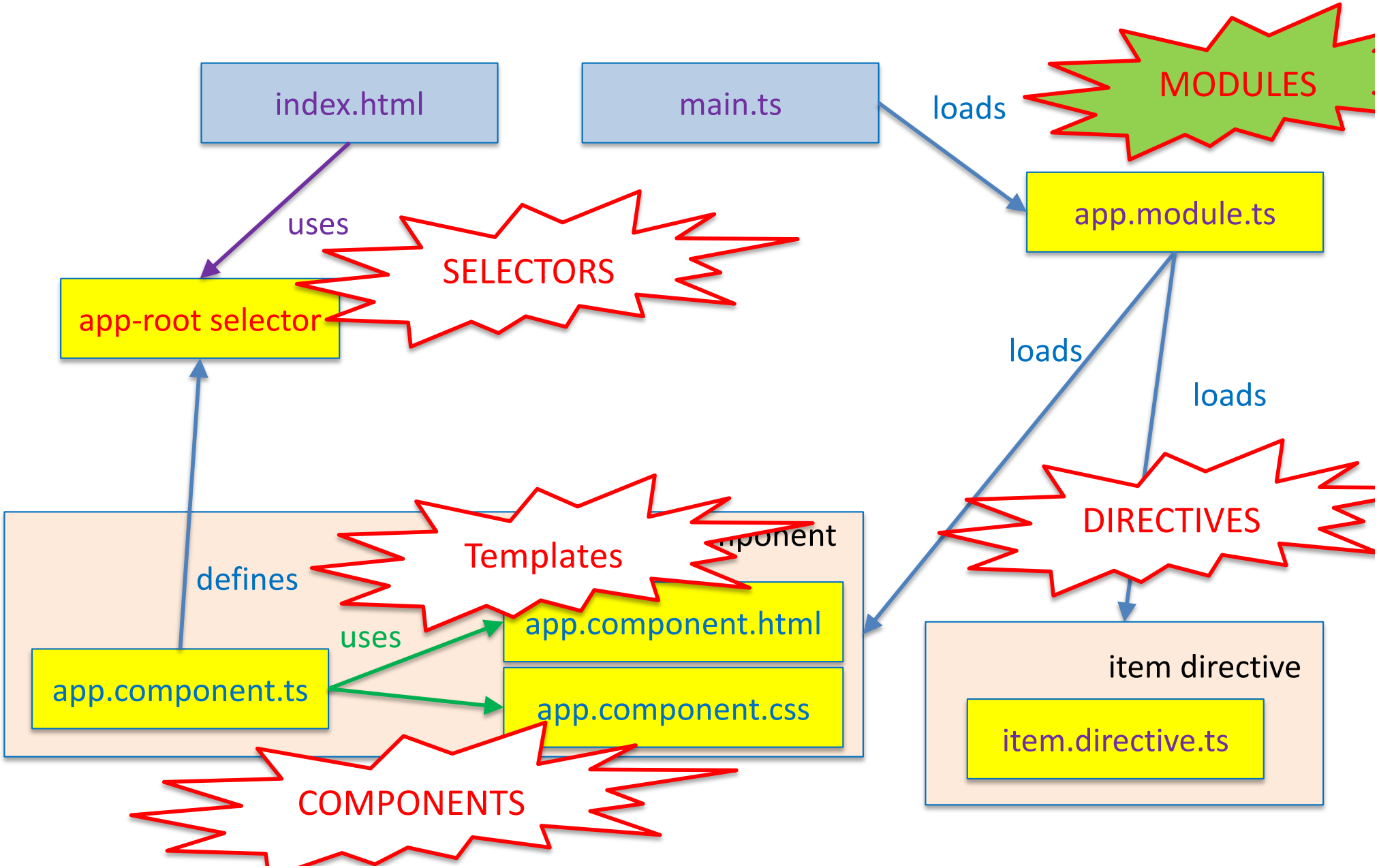
Q

So far we have seen only a pair template+component.

How do I compose a full app?

Putting the pieces together



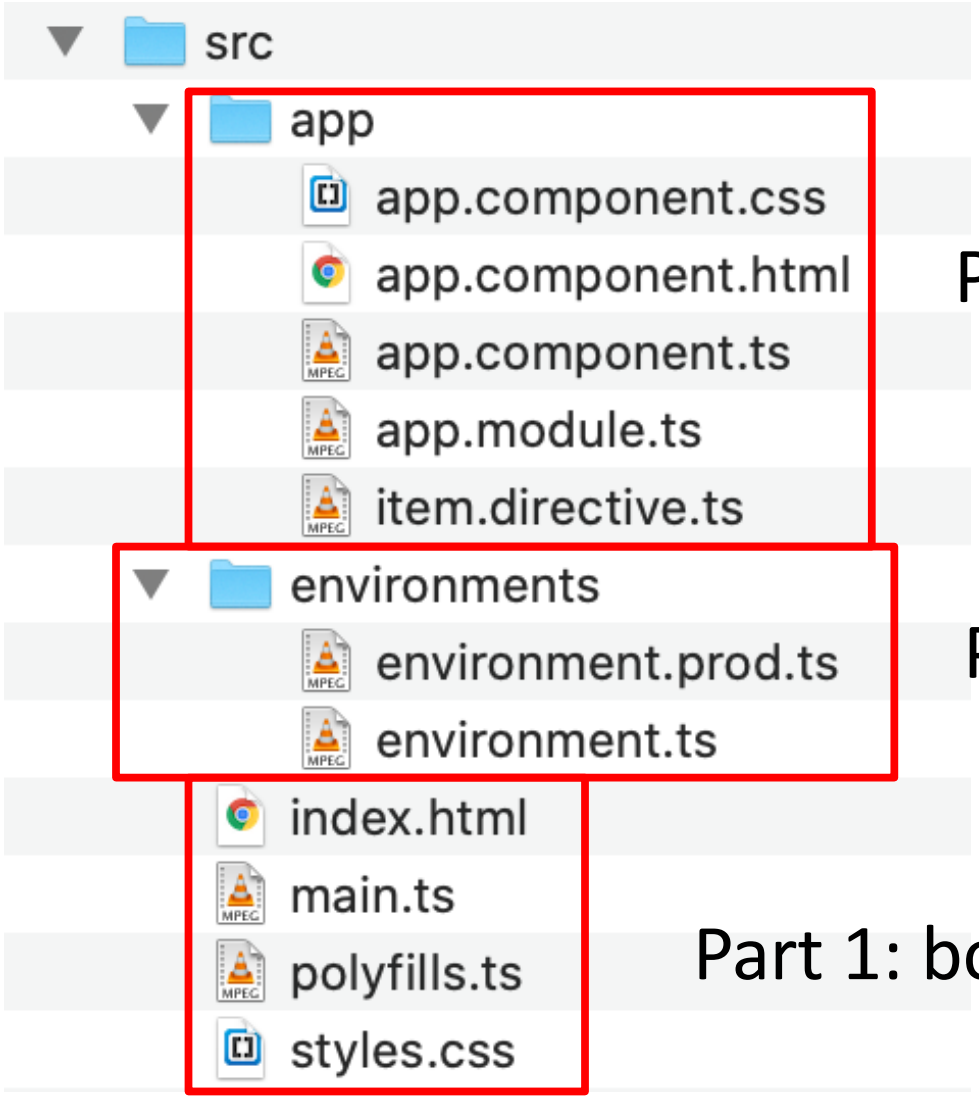
Modules: NgModule

The Angular Modules (or NgModules) are Angular ways of group together functional units: related components (but also directives, pipes and services, etc).

Every Component must belong to an Angular Module and cannot be part of more than one module. A component is registered in a Module by declaring it in the Module's metadata.

Every Angular app has a *root module*, conventionally named AppModule, which provides the bootstrap mechanism that launches the application.

Let's expand src



Part 3: the app

Part 2: deployment properties

Part 1: boot Section

Modules: NgModule

An app typically contains many functional modules.

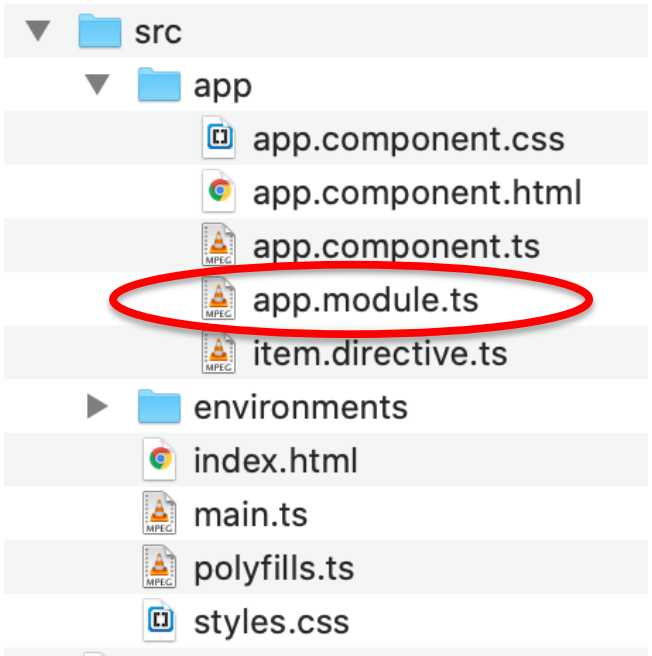
NgModules can import and export functionality from/to other NgModules.

Organizing code into distinct functional modules helps in managing development of complex applications, and in designing for reusability.

lazy-loading loads modules on demand—to minimize the amount of code that needs to be loaded at startup.

app.module.ts

```
import { BrowserModule } from '@angular/platform-browser';
import { NgModule } from '@angular/core';
import { FormsModule } from '@angular/forms';
import { HttpClientModule } from '@angular/common/http';
import { AppComponent } from './app.component';
import { ItemDirective } from './item.directive';
// @NgModule decorator with its metadata
@NgModule({
  declarations: [
    AppComponent,
    ItemDirective
  ],
  imports: [
    BrowserModule,
    FormsModule,
    HttpClientModule
  ],
  providers: [],
  bootstrap: [AppComponent]
})
export class AppModule { }
```



Adding a component to a module: ng g – ng generate

To create a new module:

`ng g module newModule`

Assuming you already have a module:

`cd newModule` to change directory into the newModule folder

`ng g component newComponent` to create a component as a child of the module.

or

`ng g component myModule/new-component`

(specifying the path to the module you want to insert the component into)

For a full example, see

https://www.tektutorialshub.com/angular/angular-adding-child-component/

Q

What are parent and child components?

Child components

In general, Angular applications will contain many components.
The the root component usually to just host these child components.

These child components, in turn, can host the more child components creating a Tree-like structure called Component Tree.

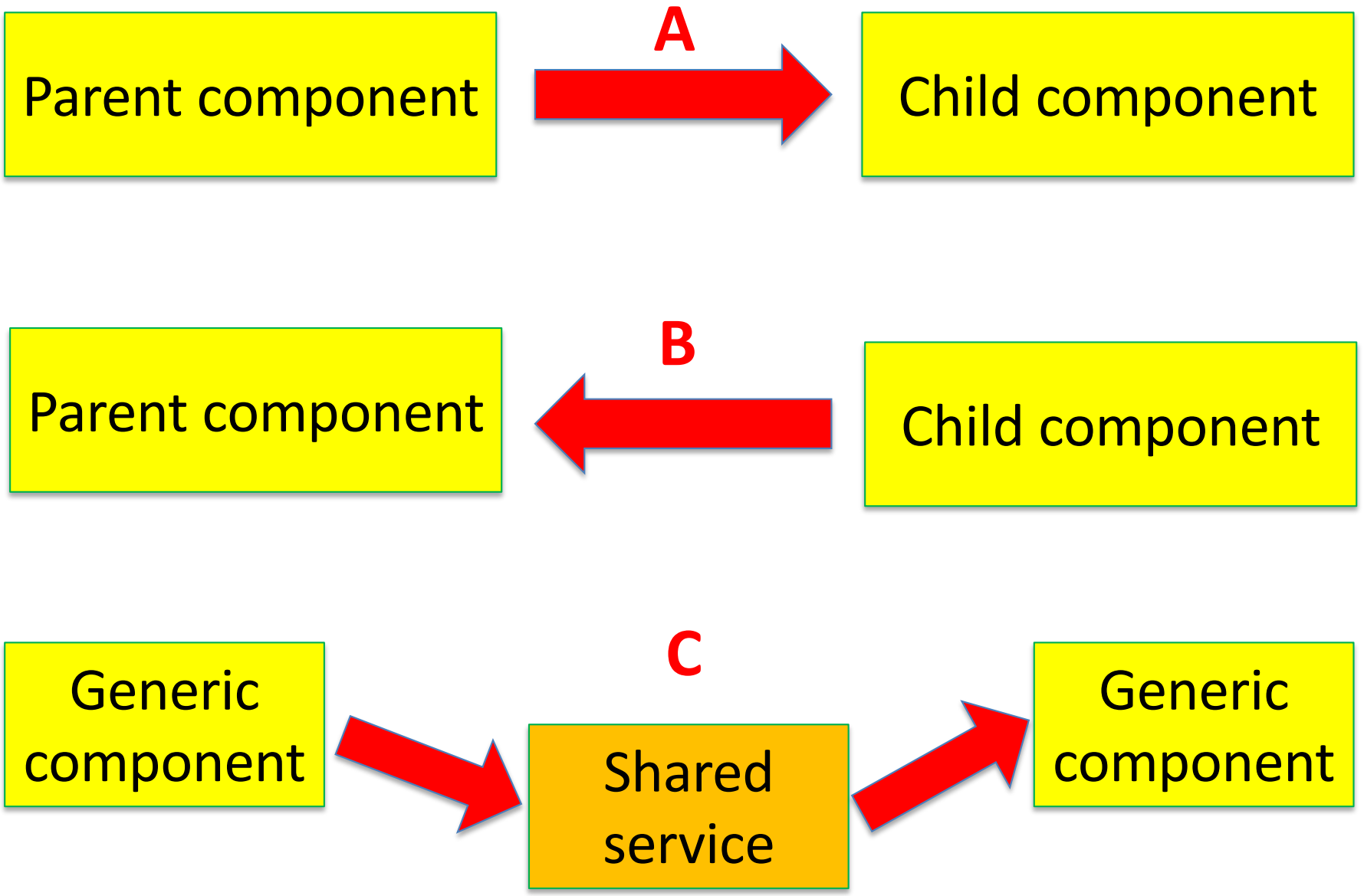
The relation between Parent component and Child component is NOT an IS-A, but a CONTAINMENT (HAS-A)

For an example, see
https://www.tektutorialshub.com/angular/angular-adding-child-component/

Q

How can components communicate?

3 scenarios:


Parent component
A
Child component
Parent component
B
Child component
Generic component
C
Shared service
Generic component

A - Pass data to a child component - 1

In the Child Component:

1. Import the @Input module from @angular/Core Library
2. Mark those property, which you need data from parent as input property using @Input decorator.

```
import { Component, Input  } from '@angular/core';

@Component({
    selector: 'child-component',
    template: `<h2>Child Component</h2>
               current count is {{ count }}
    `
})
export class ChildComponent {
    @Input() count: number;
}
```

in-line template

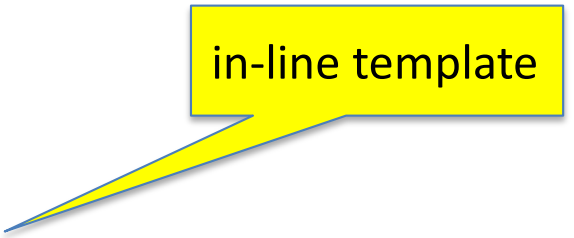
A -Pass data to a child component - 2

In the Parent Component:

1. Bind to Child Property

```
import { Component}
       from '@angular/core';

@Component({
  selector: 'app-root',
  template: `
        <h1>Welcome to {{title}}!</h1>
        <button (click)="increment()">Increment</button>
        <button (click)="decrement()">decrement</button>
        <child-component [count]=Counter></child-component>
` , styleUrls: ['./app.component.css']
})
export class AppComponent {
  title = 'Component Interaction';
  Counter = 5;
  increment() { this.Counter++; }
  decrement() { this.Counter--; }
}
```



B - Pass data to a parent component - 1

There are three ways to let parent get info from child

1. Parent Listens to Child Event
2. Parent uses Local Variable to access the child
3. Parent uses a @ViewChild to get reference to the child component

For options 1 and 3, see:
https://www.tektutorialshub.com/angular/angular-pass-data-to-parent-component/

B - Pass data to a parent component - 2

Child:

```
import { Component} from '@angular/core';
@Component({
    selector: 'child-component',
    template: `<h2>Child Component</h2>
               current count is {{ count }}
    `})
export class ChildComponent {
    count = 0;
    increment() {this.count++;}
    decrement() {this.count--;}
}
```

in-line template

B - Pass data to a parent component - 3

Parent:

```
import { Component} from '@angular/core';
@Component({
  selector: 'app-root',
  template: `
    <h1>{{title}}!</h1>
    <p> current count is {{child.count}} </p>
    <button (click)="child.increment()">Increment</button>
    <button (click)="child.decrement()">decrement</button>
    <child-component #child></child-component>` ,
  styleUrls: ['./app.component.css']
})
export class AppComponent {
  title = 'Parent interacts with child via local variable';
}
```

C - Using components vs services from other modules

The most common way to get a hold of shared services is through Angular dependency injection rather than through the module system (importing a module will result in a new service instance, which is not a typical usage).

Q

Can we generate events ?

What is reactive programming ?

Reactive programming

Reactive programming is programming with asynchronous data streams.

A stream is a sequence of ongoing events ordered in time. It can emit three different things: a value (of some type), an error, or a "completed" signal.

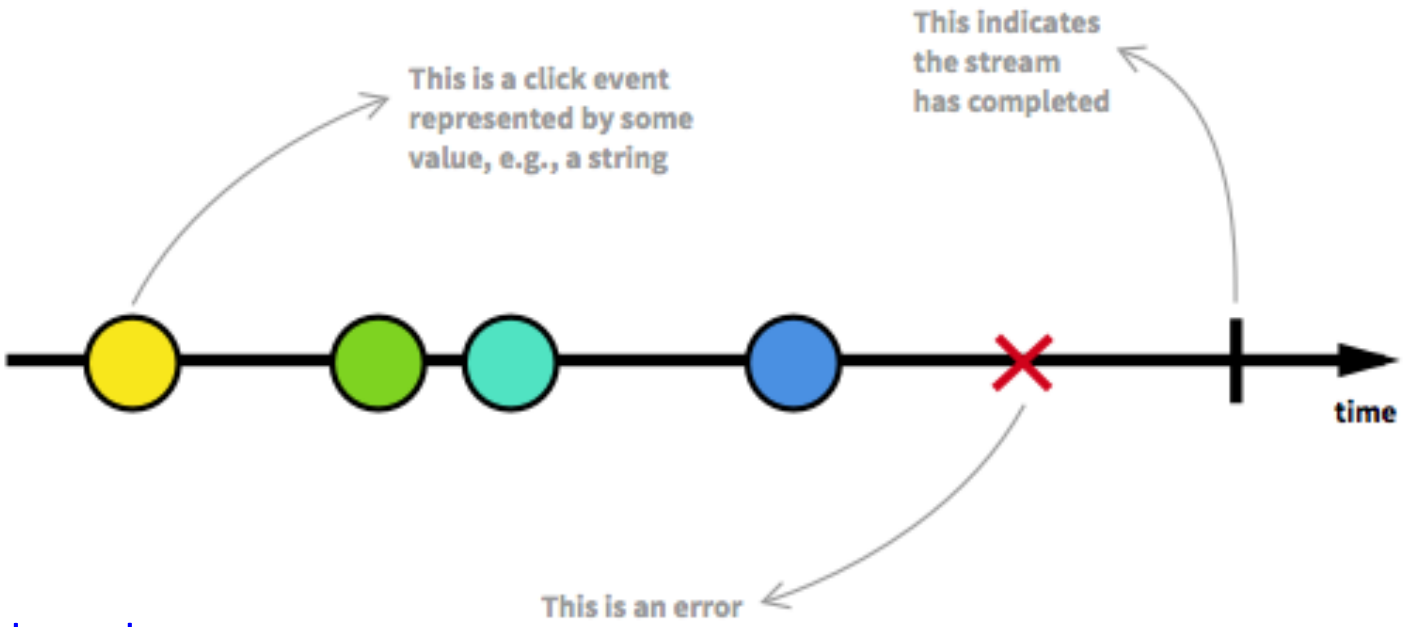


image by [andrestaltz]

Reactive programming

We capture these emitted events asynchronously, by defining functions that will execute :

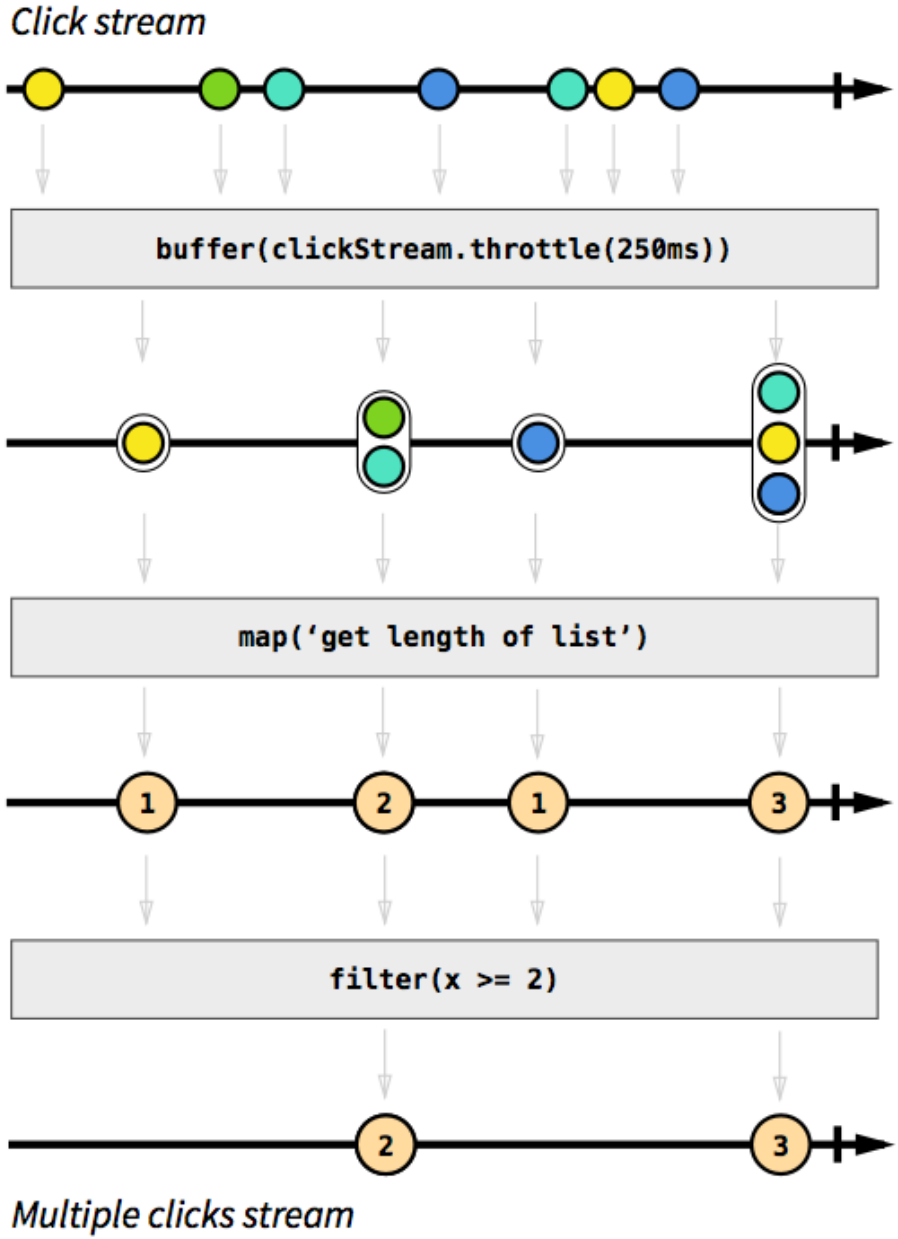
- when a value is emitted,
- when an error is emitted,
- when 'completed' is emitted.

According to the Observer Design Pattern:

- The stream "observable" being observed.
- The "listening" to the stream is called subscribing.
- The functions we are defining are "observers".

Reactive programming

In a reactive programming environment, you are generally given a toolbox of functions to combine, create and filter any of those streams.



RxJS

RxJS is a library for composing asynchronous and event-based programs by using observable sequences.
It provides:

- one core type, the Observable,
- satellite types (Observer, Schedulers, Subjects)
- operators (map, filter, reduce, every, etc) to allow handling asynchronous events as collections.

see https://rxjs-dev.firebaseapp.com/guide/overview

RxJS - operators

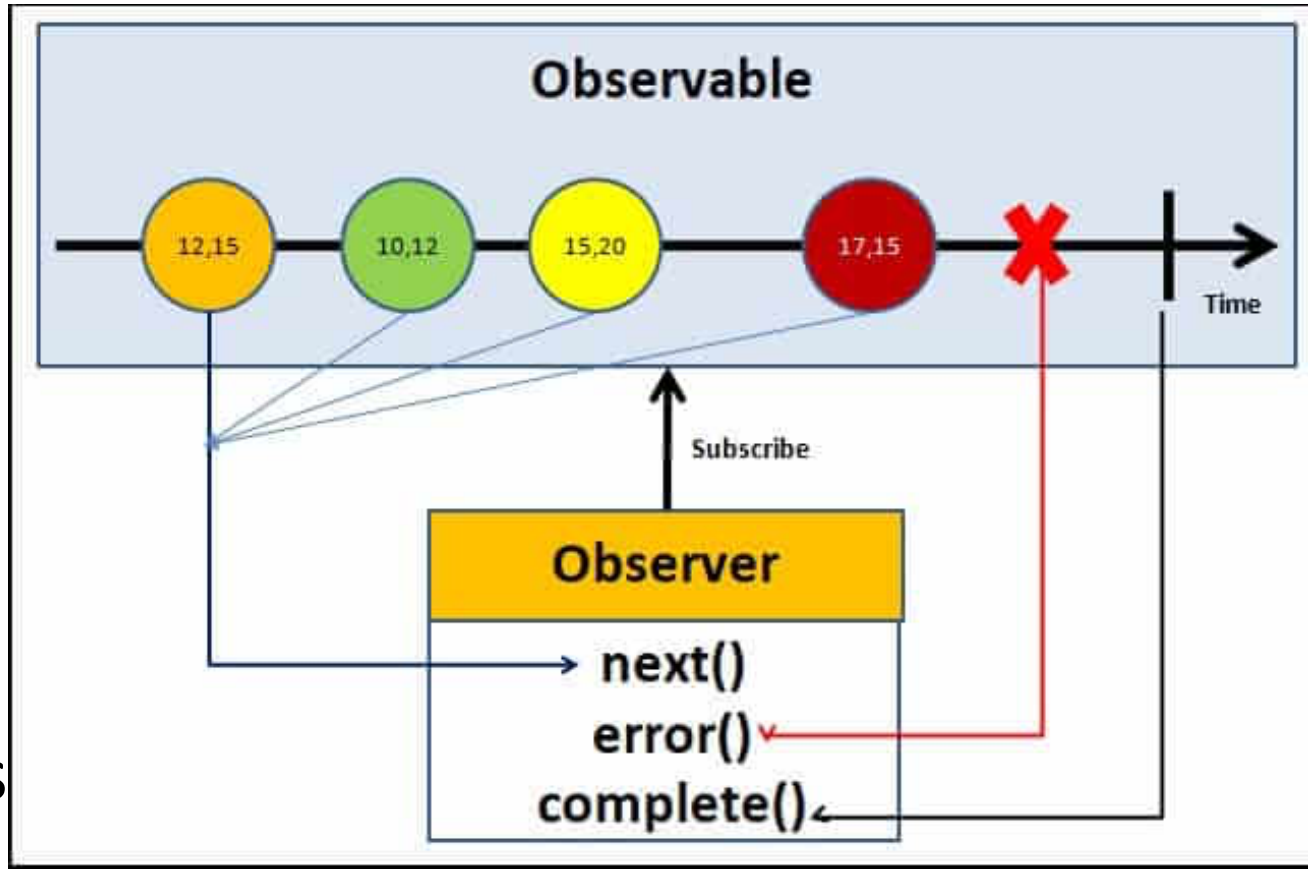
AREA	OPERATORS
Creation	`from`, `fromEvent`, `of`
Combination	`combineLatest`, `concat`, `merge`, `startWith` , `withLatestFrom`, `zip`
Filtering	`debounceTime`, `distinctUntilChanged`, `filter`, `take`, `takeUntil`
Transformation	`bufferTime`, `concatMap`, `map`, `mergeMap`, `scan`, `switchMap`
Utility	`tap`
Multicasting	`share`

see https://angular.io/guide/rx-library#operators

RxJS

The observable:

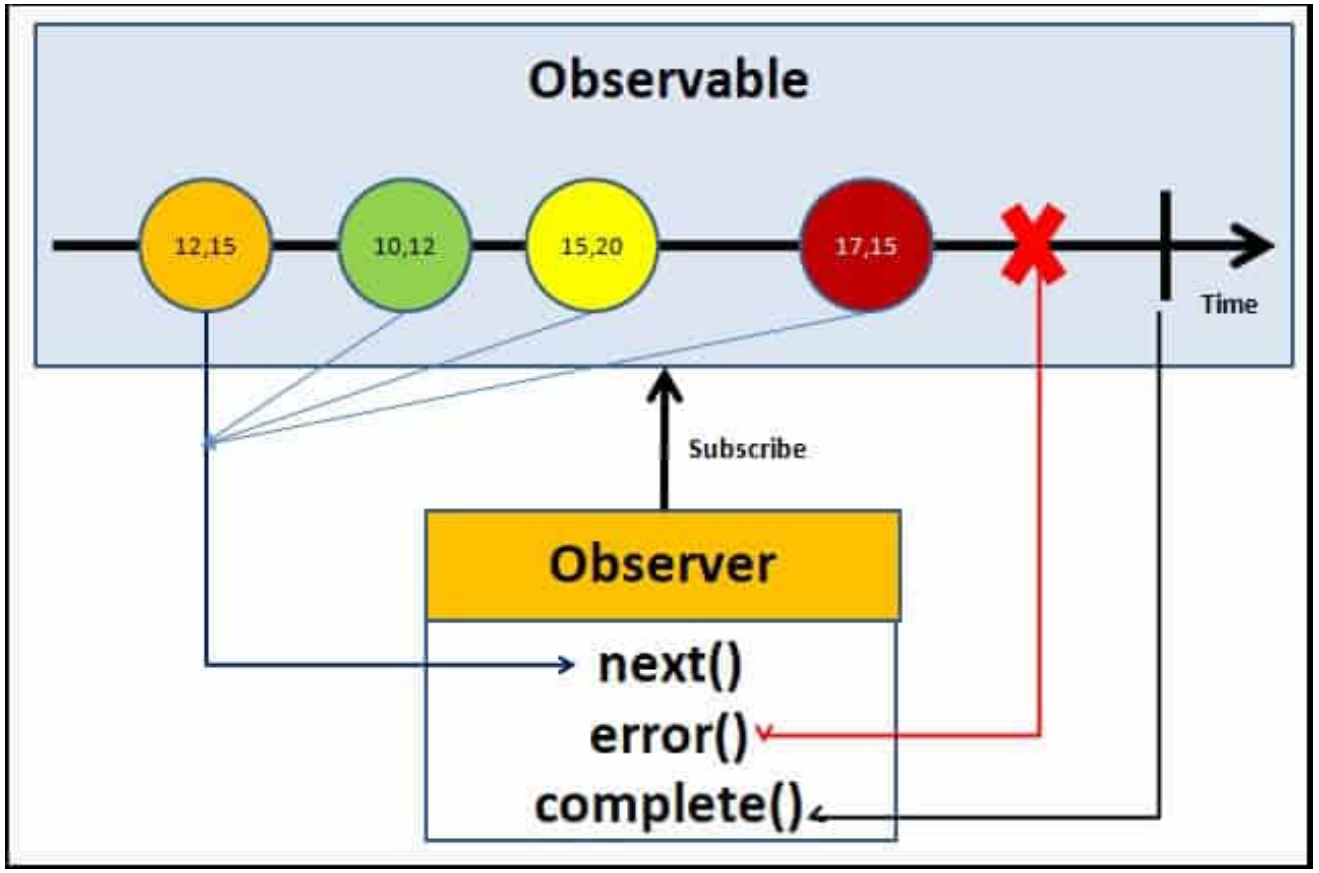
- invokes the next() callback whenever a value arrives in the stream. It passes the value as the argument to the next callback.



- If the error occurs, then the error() callback is invoked.
- It invokes the complete() callback when the stream completes.

RxJS

Observers subscribe to Observables.



Observer registers three callbacks with the observable at the time of subscribing:

- next(),
- error()
- complete()

All three callbacks are optional.

The observer receives the data from the observer via the next() callback

They also receive the errors and completion events via the error() & complete() callbacks

Example – app.component.ts

```
import { Component, OnInit } from '@angular/core';
import { Observable } from 'rxjs';
@Component({
  selector: 'app-root',
  templateUrl: './app.component.html',
  styleUrls: ['./app.component.css']
})
export class AppComponent implements OnInit {
  title = 'Angular Observable using RxJs - Getting
Started';
  obs = new Observable((observer) => {
    console.log("Observable starts")
    setTimeout(() => { observer.next("1") }, 1000);
    setTimeout(() => { observer.next("2") }, 2000);
    setTimeout(() => { observer.next("3") }, 3000);
    setTimeout(() => { observer.error("error emitted")
}, 3500);
    //this code is never called
    setTimeout(() => { observer.next("5") }, 5000);  })
```

Example – app.component.ts

```
  data=[];

  ngOnInit() {

    this.obs.subscribe(
      val => { console.log(val) },
      error => { console.log("error")},
      () => {console.log("Completed")}
    )
  }
}
```

For a full example see
https://www.tektutorialshub.com/angular/angular-observable-tutorial-using-rxjs/

Observable typing

In the end, an **Observable** is a (dynamic, asynchronous collection of "things": like Java collections it can be typed.

So an **Observable** is, by default, an ensemble of anything:

```
Observable<Any>
```

but it could be restricted

```
Observable<SomeType>
```

Most often **`SomeType`** is an interface

Observable typing

Although the Angular framework does not enforce a naming convention for observables, you will often see observables named with a trailing “$” sign.

example:

```
export class StopwatchComponent {
  stopwatchValue: number;
  stopwatchValue$: Observable<number>;
  start() {
    this.stopwatchValue$.subscribe(
        num => this.stopwatchValue = num
    );
  }
}
```

Emitting events and custom events

Components can also raise events with EventEmitter.
Using EventEmitter you can create a property and raise it using the EventEmitter.emit(payload).

The Parent component can listen to these events using the event binding and read the payload using
the $event argument.

A full, well elaborated example of custom events is here:
https://www.concretepage.com/angular-2/angular-2-custom-event-binding-eventemitter-example

Q

How can a component communicate with the web server?

HTTPClient Observable

- This particular type of Observables are single-value streams: If the HTTP request is successful, these observables will emit only one value and then complete

- These observables will emit an error if the HTTP request fails

Get syntax

```
get(url: string,
      options: {
          headers?: HttpHeaders | { [header: string]:
               string | string[]; };
          params?: HttpParams | { [param: string]:
               string | string[]; };
          observe?: "body|events|response|";
          responseType: "arraybuffer|json|blob|text";
          reportProgress?: boolean;
          withCredentials?: boolean;}
     ): Observable<>
```

Options

- **responseType**: Json is the default .The other allowed options are **arraybuffer, blob, and text**.
- **params** Allows to add URL or Get parameters
- **headers** allows you to add HTTP headers to the outgoing requests.
- **withCredentials** (boolean) When true HttpClient.get will request data with credentials (cookies)
- **observe**: by defaulr HttpClient.get returns the **body** of the response. If you may need to read the entire response (including headers and status codes) . you can set the observe property to **response**.

Post syntax

```
post(url: string,
     body: any,
     options: {
        headers?: HttpHeaders | { [header: string]:
            string | string[]; };
        observe?: "body|events|response|";
        params?: HttpParams | { [param: string]:
            string | string[]; };
        reportProgress?: boolean;
        responseType: "arraybuffer|json|blob|text";
        withCredentials?: boolean;
     }
): Observable<>
```

NOTE: similar syntax for the other HTTP commands

Get example – blind type

get-request-component.ts

```
import { Component, OnInit } from "@angular/core";
import { HttpClient } from '@angular/common/http';

@Component({
    selector: 'get-request',
    templateUrl: 'get-request.component.html' })
export class GetRequestComponent implements OnInit {
totalAngularPackages;

constructor(private http: HttpClient) { }

ngOnInit() {
    this.http.get<any>('https://api.npms.io/v2/search?q=scope:
        angular').subscribe(data => {
        this.totalAngularPackages = data.total;
    })
}
}
```

Get example

get-request-component.html

```
<div class="card text-center m-3">
<h5 class="card-header">Simple GET Request with response type
&lt;any&gt;</h5>
<div class="card-body">
Total @angular packages: {{totalAngularPackages}}
</div>
</div>
```

examples adapted from
https://stackblitz.com/edit/angular-http-get-examples?file=app%2Fcomponents%2Fget-request-typed.component.html

Get example with typing

get-request-typed-component.ts

```
interface SearchResults {
total: number;
results: Array<object>;
}
```

```
import { Component, OnInit } from "@angular/core";
import { HttpClient } from '@angular/common/http';

@Component({
    selector: 'get-request-typed',
    templateUrl: 'get-request-typed.component.html' })
export class GetRequestTypedComponent implements OnInit {
totalAngularPackages;

constructor(private http: HttpClient) { }

ngOnInit() {
    this.http.get<SearchResults>('https://api.npms.io/v2/searc
h?q=scope:    angular').subscribe(data => {
        this.totalAngularPackages = data.total;
    })
}}
```

Get example

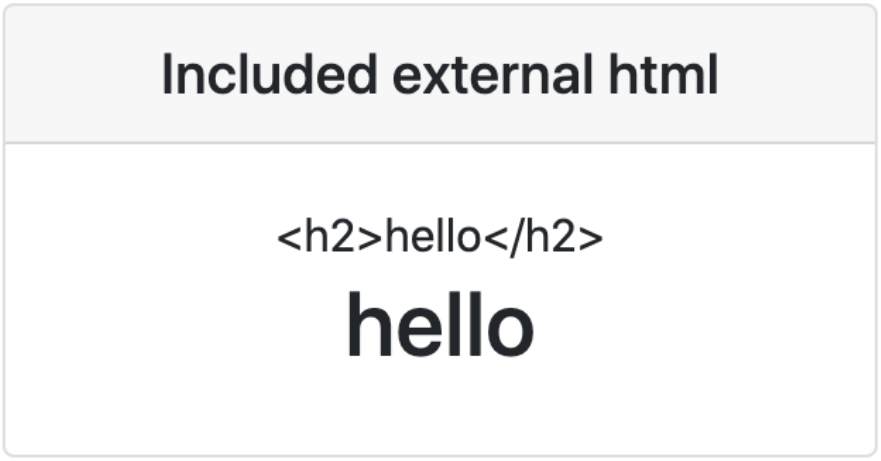
get-request-typed-component.html

```
<div class="card text-center m-3">
<h5 class="card-header">Simple GET Request with strongly
typed response </h5>
<div class="card-body">
Total @angular packages: {{totalAngularPackages}}
</div>
</div>
```

Including html fragments

```
<div class="card text-center m-3">
<h5 class="card-header">Included external html</h5>
<div class="card-body">
   {{htmlString}}
    <div [innerHTML]="htmlString"></div>
</div>
</div>
```

```
export class GetRequestComponent implements OnInit {
   htmlString: string;
    ngOnInit() {
       this.htmlString="<h2>hello</h2>";
     }
}
```



Including html fragments from web

```
export class GetRequestComponent implements OnInit {
  htmlString : string;
  ngOnInit() {
    const headers = new HttpHeaders({
      Accept: "text/html",
      Origin: "https://latemar.science.unitn.it"
    });
    const request = this.http.get<string>
    ('https://latemar.science.unitn.it/demo/fragment.html', {
      headers: headers,
      responseType: 'text' as 'json'
    }).subscribe(res => this.htmlString = res);
  }}
```

Cross Origin error

```
ERROR
▼HttpErrorResponse {headers: {…}, status: 0,
statusText: "Unknown Error",
url: "https://latemar.science.unitn.it
/demo/fragment.html"…}
▶error: ProgressEvent
▶headers: HttpHeaders
 message: "Http failure response for
https://latemar.science.unitn.it
/demo/fragment.html: 0 Unknown Error"
 name: "HttpErrorResponse"
 ok: false
 status: 0
 statusText: "Unknown Error"
 url: "https://latemar.science.unitn.it
/demo/fragment.html"
 __proto__: HttpErrorResponse
```

Including html fragments from web

```
export class GetRequestComponent implements OnInit {
  htmlString : string;
  ngOnInit() {
    const headers = new HttpHeaders({
      Accept: "text/html",
      Origin: "https://latemar.science.unitn.it"
    });
    const request = this.http.get<string>
    ('https://cors-
anywhere.herokuapp.com/https://latemar.science.unitn.it/demo/f
ragment.html', {
      headers: headers,
      responseType: 'text' as 'json'
    }).subscribe(res => this.htmlString = res);
  }}
```

see https://stackblitz.com/edit/angular-http-get-with-include-uwhl6

Cross origin

This API enables cross-origin requests to anywhere:
https://cors-anywhere.herokuapp.com/

Usage example:

```
https://cors-
anywhere.herokuapp.com/https://latemar.science.unitn.it/demo/
fragment.html
```

Note: cookies are stripped!

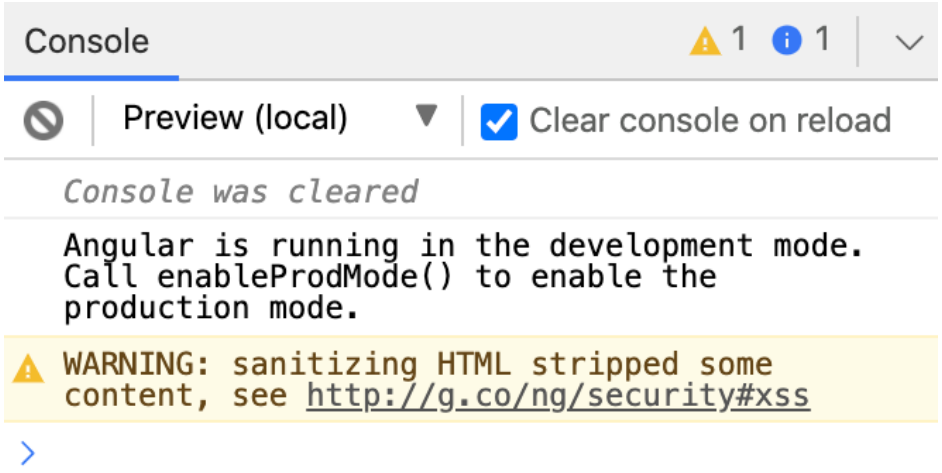
Sanitization

Sanitization is the inspection of an untrusted value, turning it into a value that's safe to insert into the DOM.

Angular sanitizes untrusted values for HTML, styles, and URLs; sanitizing resource URLs isn't possible because they contain arbitrary code.

In development mode, Angular prints a console warning when it has to change a value during sanitization.

see
https://angular.io/guide/security#sanitization-and-security-contexts



Get example

see https://stackblitz.com/edit/angular-http-get-examples?file=app%2Fcomponents%2Fget-request-error-handling.component.html

play with a json datasource, like

https://data.parliament.scot/api/members
https://data.parliament.scot/api/members/1848

https://data.parliament.scot/#/api-list