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## 1. What is Angular Framework?

Angular is a **TypeScript-based open-source** front-end platform that makes it easy to build applications with in web/mobile/desktop. The major features of this framework such as declarative templates, dependency injection, end to end tooling, and many more other features are used to ease the development.

## 2. What is the difference between AngularJS and Angular?

Angular is a completely revived component-based framework in which an application is a tree of individual components.

Some of the major difference in tabular form

AngularJS	Angular
It is based on MVC architecture	This is based on Service/Controller
This uses JavaScript to build the application	Introduced the typescript to write the application
Based on controllers concept	This is a component based UI approach
Not a mobile friendly framework	Developed considering mobile platform
Difficulty in SEO friendly application development	Ease to create SEO friendly applications

## 3. What is TypeScript?

TypeScript is a typed superset of JavaScript created by Microsoft that adds optional types, classes, async/await, and many other features, and compiles to plain JavaScript. Angular built entirely in TypeScript and used as a primary language. You can install it globally as

```
npm install -g typescript
```

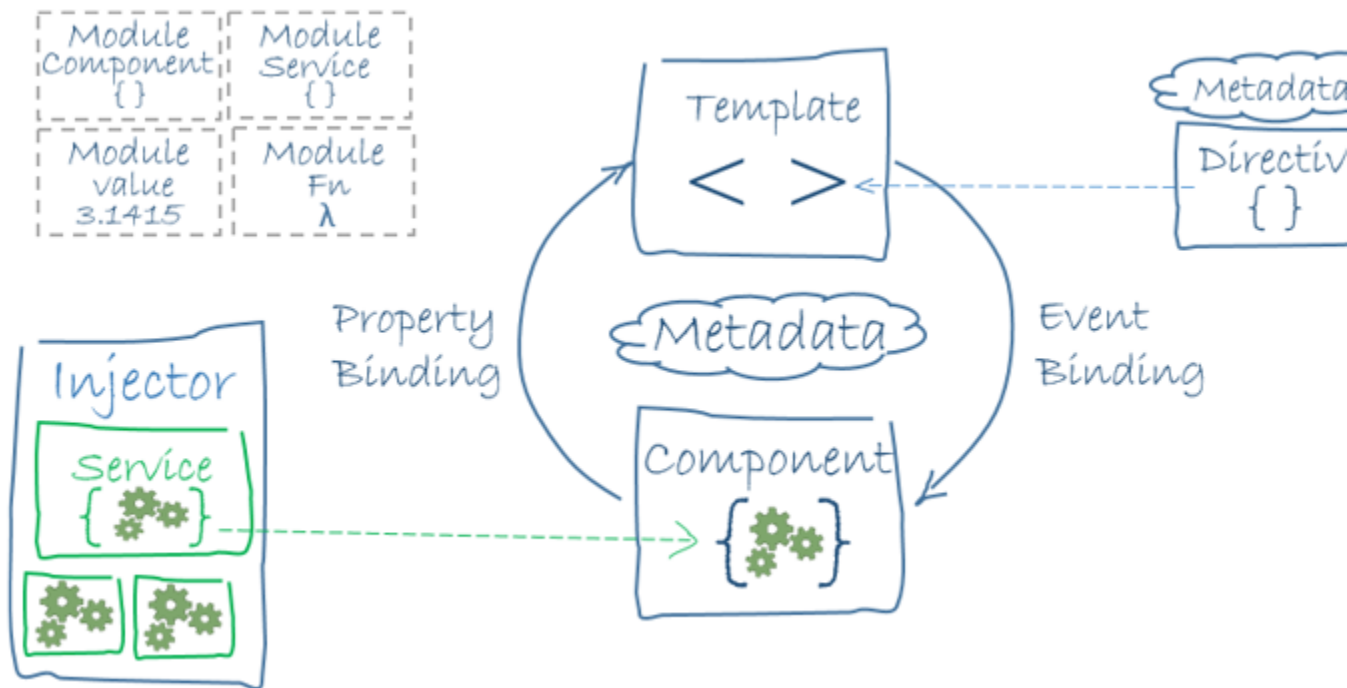
Let's see a simple example of TypeScript usage,

```
function greeter(person: string) {  
    return "Hello, " + person;  
}  
  
let user = "Sudheer";  
  
document.body.innerHTML = greeter(user);
```

The greeter method allows only string type as argument.

## 4. Write a pictorial diagram of Angular architecture?

The main building blocks of an Angular application is shown in the below diagram



## 5. What are the key components of Angular?

Angular has the below key components,

- i. **Component:** These are the basic building blocks of angular application to control HTML views.
- ii. **Modules:** An angular module is set of angular basic building blocks like component, directives, services etc. An application is divided into logical pieces and each piece of code is called as "module" which perform a single task.
- iii. **Templates:** This represent the views of an Angular application.
- iv. **Services:** It is used to create components which can be shared across the entire application.
- v. **Metadata:** This can be used to add more data to an Angular class.

## 6. What are directives?

Directives add behaviour to an existing DOM element or an existing component instance.

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

@Directive({ selector: '[myHighlight]' })
export class HighlightDirective {
  constructor(el: ElementRef) {
    el.nativeElement.style.backgroundColor = 'yellow';
  }
}
```

Now this directive extends HTML element behavior with a yellow background as below

```
<p myHighlight>Highlight me!</p>
```

## 7. What are components?

Components are the most basic UI building block of an Angular app which formed a tree of Angular components. These components are subset of directives. Unlike directives, components always have a

template and only one component can be instantiated per an element in a template. Let's see a simple example of Angular component

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

@Component ({
  selector: 'my-app',
  template: `<div>
    <h1>{{title}}</h1>
    <div>Learn Angular6 with examples</div>
  </div> `,
})

export class AppComponent {
  title: string = 'Welcome to Angular world';
}
```

## 8. What are the differences between Component and Directive?

In a short note, A component(@component) is a directive-with-a-template.

Some of the major differences are mentioned in a tabular form

Component	Directive
To register a component we use @Component meta-data annotation	To register directives we use @Directive meta-data annotation
Components are typically used to create UI widgets	Directive is used to add behavior to an existing DOM element
Component is used to break up the application into smaller components	Directive is use to design re-usable components
Only one component can be present per DOM element	Many directives can be used per DOM element
@View decorator or templateUrl/template are mandatory	Directive doesn't use View

## 9. What is a template?

A template is a HTML view where you can display data by binding controls to properties of an Angular component. You can store your component's template in one of two places. You can define it inline using the template property, or you can define the template in a separate HTML file and link to it in the component metadata using the @Component decorator's templateUrl property. **Using inline template with template syntax,**

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

@Component ({
  selector: 'my-app',
  template: `
    <div>
      <h1>{{title}}</h1>
      <div>Learn Angular</div>
    </div>
  `
})
```

```

    })
  }
  export class AppComponent {
    title: string = 'Hello World';
  }
}

```

### Using separate template file such as app.component.html

```

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

@Component ({
  selector: 'my-app',
  templateUrl: 'app/app.component.html'
})

export class AppComponent {
  title: string = 'Hello World';
}

```

## 10. What is a module?

Modules are logical boundaries in your application and the application is divided into separate modules to separate the functionality of your application. Lets take an example of **app.module.ts** root module declared with **@NgModule** decorator as below,

```

import { NgModule }      from '@angular/core';
import { BrowserModule } from '@angular/platform-browser';
import { AppComponent }  from './app.component';

@NgModule ({
  imports:      [ BrowserModule ],
  declarations: [ AppComponent ],
  bootstrap:   [ AppComponent ]
})
export class AppModule { }

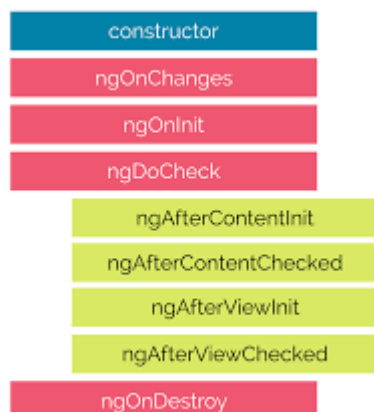
```

The NgModule decorator has three options

- i. The imports option is used to import other dependent modules. The BrowserModule is required by default for any web based angular application
- ii. The declarations option is used to define components in the respective module
- iii. The bootstrap option tells Angular which Component to bootstrap in the application

## 11. What are lifecycle hooks available?

Angular application goes through an entire set of processes or has a lifecycle right from its initiation to the end of the application. The representation of lifecycle in pictorial representation as follows,



The description of each lifecycle method is as below,

- i. **ngOnChanges:** When the value of a data bound property changes, then this method is called.
- ii. **ngOnInit:** This is called whenever the initialization of the directive/component after Angular first displays the data-bound properties happens.
- iii. **ngDoCheck:** This is for the detection and to act on changes that Angular can't or won't detect on its own.
- iv. **ngAfterContentInit:** This is called in response after Angular projects external content into the component's view.
- v. **ngAfterContentChecked:** This is called in response after Angular checks the content projected into the component.
- vi. **ngAfterViewInit:** This is called in response after Angular initializes the component's views and child views.
- vii. **ngAfterViewChecked:** This is called in response after Angular checks the component's views and child views.
- viii. **ngOnDestroy:** This is the cleanup phase just before Angular destroys the directive/component.

## 12. What is a data binding?

Data binding is a core concept in Angular and allows to define communication between a component and the DOM, making it very easy to define interactive applications without worrying about pushing and pulling data. There are four forms of data binding(divided as 3 categories) which differ in the way the data is flowing.

- i. **From the Component to the DOM: Interpolation:** `{{ value }}`: Adds the value of a property from the component

```
<li>Name: {{ user.name }}</li>
<li>Address: {{ user.address }}</li>
```

**Property binding:** `[property]="value"`: The value is passed from the component to the specified property or simple HTML attribute

```
<input type="email" [value]="user.email">
```

- i. **From the DOM to the Component: Event binding: (event)="function"**: When a specific DOM event happens (eg.: click, change, keyup), call the specified method in the component

```
<button (click)="logout()"></button>
```

- i. **Two-way binding: Two-way data binding:** `[(ngModel)]="value"`: Two-way data binding allows to have the data flow both ways. For example, in the below code snippet, both the email DOM input and component email property are in sync

```
<input type="email" [(ngModel)]="user.email">
```

## 2. What is metadata?

Metadata is used to decorate a class so that it can configure the expected behavior of the class. The metadata is represented by decorators

- i. **Class decorators**, e.g. `@Component` and `@NgModule`

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

```
@Component({
  selector: 'my-component',
  template: '<div>Class decorator</div>',
})
```

```

    })
    export class MyComponent {
      constructor() {
        console.log('Hey I am a component!');
      }
    }
  }

  @NgModule({
    imports: [],
    declarations: [],
  })
  export class MyModule {
    constructor() {
      console.log('Hey I am a module!');
    }
  }
}

```

- i. **Property decorators** Used for properties inside classes, e.g. @Input and @Output

```

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

@Component({
  selector: 'my-component',
  template: '<div>Property decorator</div>'
})

export class MyComponent {
  @Input()
  title: string;
}

```

- i. **Method decorators** Used for methods inside classes, e.g. @HostListener

```

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

@Component({
  selector: 'my-component',
  template: '<div>Method decorator</div>'
})
export class MyComponent {
  @HostListener('click', ['$event'])
  onHostClick(event: Event) {
    // clicked, `event` available
  }
}

```

- i. **Parameter decorators** Used for parameters inside class constructors, e.g. @Inject

```

import { Component, Inject } from '@angular/core';
import { MyService } from './my-service';

@Component({
  selector: 'my-component',
  template: '<div>Parameter decorator</div>'
})
export class MyComponent {
  constructor(@Inject(MyService) myService) {
    console.log(myService); // MyService
  }
}

```

## 2. What is angular CLI?

Angular CLI(**Command Line Interface**) is a command line interface to scaffold and build angular apps using nodejs style (commonJs) modules. You need to install using below npm command,

```
npm install @angular/cli@latest
```

Below are the list of few commands, which will come handy while creating angular projects

- i. **Creating New Project:** ng new
- ii. **Generating Components, Directives & Services:** ng generate/g The different types of commands would be,
  - ng generate class my-new-class: add a class to your application
  - ng generate component my-new-component: add a component to your application
  - ng generate directive my-new-directive: add a directive to your application
  - ng generate enum my-new-enum: add an enum to your application
  - ng generate module my-new-module: add a module to your application
  - ng generate pipe my-new-pipe: add a pipe to your application
  - ng generate service my-new-service: add a service to your application
- iii. **Running the Project:** ng serve

## 2. What is the difference between constructor and ngOnInit?

TypeScript classes has a default method called constructor which is normally used for the initialization purpose. Whereas ngOnInit method is specific to Angular, especially used to define Angular bindings. Even though constructor getting called first, it is preferred to move all of your Angular bindings to ngOnInit method. In order to use ngOnInit, you need to implement OnInit interface as below,

```
export class App implements OnInit{
  constructor(){
    //called first time before the ngOnInit()
  }

  ngOnInit(){
    //called after the constructor and called after the first ngOnChanges()
  }
}
```

## 3. What is a service?

A service is used when a common functionality needs to be provided to various modules. Services allow for greater separation of concerns for your application and better modularity by allowing you to extract common functionality out of components. Let's create a repoService which can be used across components,

```
import { Injectable } from '@angular/core';
import { Http } from '@angular/http';

@Injectable() // The Injectable decorator is required for dependency injection to work
export class RepoService{
  constructor(private http: Http){
  }

  fetchAll(){
    return this.http.get('https://api.github.com/repositories').map(res => res.json());
  }
}
```

The above service uses Http service as a dependency.

## 4. What is dependency injection in Angular?

Dependency injection (DI), is an important application design pattern in which a class asks for dependencies from external sources rather than creating them itself. Angular comes with its own dependency injection framework for resolving dependencies( services or objects that a class needs to perform its function).So you can have your services depend on other services throughout your application.

## 5. How is Dependency Hierarchy formed?

## 6. What is the purpose of async pipe?

The AsyncPipe subscribes to an observable or promise and returns the latest value it has emitted. When a new value is emitted, the pipe marks the component to be checked for changes. Let's take a time observable which continuously updates the view for every 2 seconds with the current time.

```
@Component({
  selector: 'async-observable-pipe',
  template: `<div><code>observable|async</code>:
    Time: {{ time | async }}</div>`
})
export class AsyncObservablePipeComponent {
  time = new Observable(observer =>
    setInterval(() => observer.next(new Date().toString()), 2000)
  );
}
```

## 7. What is the option to choose between inline and external template file?

You can store your component's template in one of two places. You can define it inline using the **template** property, or you can define the template in a separate HTML file and link to it in the component metadata using the **@Component** decorator's **templateUrl** property. The choice between inline and separate HTML is a matter of taste, circumstances, and organization policy. But normally we use inline template for small portion of code and external template file for bigger views. By default, the Angular CLI generates components with a template file. But you can override that with the below command,

```
ng generate component hero -it
```

## 8. What is the purpose of ngFor directive?

We use Angular ngFor directive in the template to display each item in the list. For example, here we iterate over list of users,

```
<li *ngFor="let user of users">
  {{ user }}
</li>
```

The user variable in the ngFor double-quoted instruction is a **template input variable**

## 9. What is the purpose of ngIf directive?

Sometimes an app needs to display a view or a portion of a view only under specific circumstances. The Angular ngIf directive inserts or removes an element based on a truthy/falsy condition. Let's take an example to display a message if the user age is more than 18,

```
<p *ngIf="user.age > 18">You are not eligible for student pass!</p>
```

**Note:** Angular isn't showing and hiding the message. It is adding and removing the paragraph element from the DOM. That improves performance, especially in the larger projects with many data bindings.

## 10. What happens if you use script tag inside template?

Angular recognizes the value as unsafe and automatically sanitizes it, which removes the **<script>** tag but keeps safe content such as the text content of the **<script>** tag. This way it eliminates the risk of script injection attacks. If you still use it then it will be ignored and a warning appears in the browser console. Let's take an example of innerHtml property binding which causes XSS vulnerability,

```
export class InnerHtmlBindingComponent {
  // For example, a user/attacker-controlled value from a URL.
  htmlSnippet = 'Template <script>alert("0wned")</script> <b>Syntax</b>';
}
```



## 11. What is interpolation?

Interpolation is a special syntax that Angular converts into property binding. It's a convenient alternative to property binding. It is represented by double curly braces({{}}). The text between the braces is often the name of a component property. Angular replaces that name with the string value of the corresponding component property. Let's take an example,

```
<h3>
  {{title}}
  
</h3>
```

In the example above, Angular evaluates the title and url properties and fills in the blanks, first displaying a bold application title and then a URL.

## 12. What are template expressions?

A template expression produces a value similar to any Javascript expression. Angular executes the expression and assigns it to a property of a binding target; the target might be an HTML element, a component, or a directive. In the property binding, a template expression appears in quotes to the right of the = symbol as in [property]="expression". In interpolation syntax, the template expression is surrounded by double curly braces. For example, in the below interpolation, the template expression is {{username}},

```
<h3>{{username}}, welcome to Angular</h3>
```

The below javascript expressions are prohibited in template expression

- i. assignments (=, +=, -=, ...)
- ii. new
- iii. chaining expressions with ; or ,
- iv. increment and decrement operators (++ and --)

## What are template statements?

A template statement responds to an event raised by a binding target such as an element, component, or directive. The template statements appear in quotes to the right of the = symbol like (event)="statement". Let's take an example of button click event's statement

```
<button (click)="editProfile()">Edit Profile</button>
```

In the above expression, editProfile is a template statement. The below JavaScript syntax expressions are not allowed.

- i. new
- ii. increment and decrement operators, ++ and --
- iii. operator assignment, such as += and -=
- iv. the bitwise operators | and &
- v. the template expression operators

## How do you categorize data binding types?

Binding types can be grouped into three categories distinguished by the direction of data flow. They are listed as below,

- i. From the source-to-view
- ii. From view-to-source
- iii. View-to-source-to-view

The possible binding syntax can be tabularized as below,

Data direction	Syntax	Type
From the source-to-view(One-way)	1. {{expression}} 2. [target]="expression" 3. bind-target="expression"	Interpolation, Property, Attribute, Class, Style
From view-to-source(One-way)	1. (target)="statement" 2. on-target="statement"	Event
View-to-source-to-view(Two-way)	1. [(target)]="expression" 2. bindon-target="expression"	Two-way

## What are pipes?

A pipe takes in data as input and transforms it to a desired output. For example, let us take a pipe to transform a component's birthday property into a human-friendly date using **date** pipe.

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

@Component({
  selector: 'app-birthday',
  template: `<p>Birthday is {{ birthday | date }}</p>`
})
export class BirthdayComponent {
  birthday = new Date(1987, 6, 18); // June 18, 1987
}
```

## What is a parameterized pipe?

A pipe can accept any number of optional parameters to fine-tune its output. The parameterized pipe can be created by declaring the pipe name with a colon ( : ) and then the parameter value. If the pipe accepts multiple parameters, separate the values with colons. Let's take a birthday example with a particular format(dd/mm/yyyy):

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

@Component({
  selector: 'app-birthday',
  template: `<p>Birthday is {{ birthday | date | 'dd/mm/yyyy' }}</p>` // 18/06/1987
})
export class BirthdayComponent {
  birthday = new Date(1987, 6, 18);
}
```

**Note:** The parameter value can be any valid template expression, such as a string literal or a component property.

## How do you chain pipes?

You can chain pipes together in potentially useful combinations as per the needs. Let's take a birthday property which uses date pipe(along with parameter) and uppercase pipes as below

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

@Component({
  selector: 'app-birthday',
  template: `<p>Birthday is {{ birthday | date:'fullDate' | uppercase}} </p>` // THURSDAY, JUNE
18, 1987
})
export class BirthdayComponent {
  birthday = new Date(1987, 6, 18);
}
```

## What is a custom pipe?

Apart from built-in pipes, you can write your own custom pipe with the below key characteristics,

- i. A pipe is a class decorated with pipe metadata **@Pipe** decorator, which you import from the core Angular library. For example,

```
@Pipe({name: 'myCustomPipe'})
```

- iii. The pipe class implements the **PipeTransform** interface's transform method that accepts an input value followed by optional parameters and returns the transformed value. The structure of pipeTransform would be as below,

```
interface PipeTransform {
  transform(value: any, ...args: any[]): any
}
```

- iii. The **@Pipe** decorator allows you to define the pipe name that you'll use within template expressions. It must be a valid JavaScript identifier.

```
template: `{{someInputValue | myCustomPipe: someOtherValue}}`
```

## 2. Give an example of custom pipe?

You can create custom reusable pipes for the transformation of existing value. For example, let us create a custom pipe for finding file size based on an extension,

```
import { Pipe, PipeTransform } from '@angular/core';

@Pipe({name: 'customFileSizePipe'})
export class FileSizePipe implements PipeTransform {
  transform(size: number, extension: string = 'MB'): string {
    return (size / (1024 * 1024)).toFixed(2) + extension;
  }
}
```

Now you can use the above pipe in template expression as below,

```
template: `
  <h2>Find the size of a file</h2>
  <p>Size: {{288966 | customFileSizePipe: 'GB'}}</p>
`
```

## 3. What is the difference between pure and impure pipe?

A pure pipe is only called when Angular detects a change in the value or the parameters passed to a pipe. For example, any changes to a primitive input value (String, Number, Boolean, Symbol) or a changed object reference (Date, Array, Function, Object). An impure pipe is called for every change detection cycle no matter whether the value or parameters changes. i.e, An impure pipe is called often, as often as every keystroke or mouse-move.

## 4. What is a bootstrapping module?

Every application has at least one Angular module, the root module that you bootstrap to launch the application is called as bootstrapping module. It is commonly known as AppModule. The default structure of AppModule generated by AngularCLI would be as follows,

```
/* JavaScript imports */
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';

/* the AppModule class with the @NgModule decorator */
@NgModule({
  declarations: [
    AppComponent
  ],
  imports: [
    BrowserModule,
    FormsModule,
    HttpClientModule
  ],
  providers: [],
  bootstrap: [AppComponent]
})
export class AppModule { }
```

## 5. What are observables?

Observables are declarative which provide support for passing messages between publishers and subscribers in your application. They are mainly used for event handling, asynchronous programming, and handling multiple values. In this case, you define a function for publishing values, but it is not executed until a consumer subscribes to it. The subscribed consumer then receives notifications until the function completes, or until they unsubscribe.

## 6. What is HttpClient and its benefits?

Most of the Front-end applications communicate with backend services over HTTP protocol using either XMLHttpRequest interface or the fetch() API. Angular provides a simplified client HTTP API known as **HttpClient** which is based on top of XMLHttpRequest interface. This client is available from @angular/common/http package. You can import in your root module as below,

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

The major advantages of HttpClient can be listed as below,

- i. Contains testability features
- ii. Provides typed request and response objects
- iii. Intercept request and response
- iv. Supports Observable APIs
- v. Supports streamlined error handling

## Explain on how to use HttpClient with an example?

Below are the steps need to be followed for the usage of HttpClient.

- i. Import HttpClient into root module:

```
import { HttpClientModule } from '@angular/common/http';
@NgModule({
  imports: [
    BrowserModule,
```

```

    // import HttpClientModule after BrowserModule.
    HttpClientModule,
  ],
  .....
})
export class AppModule {}

```

- iii. Inject the HttpClient into the application: Let's create a userProfileService(userprofile.service.ts) as an example. It also defines get method of HttpClient

```

import { Injectable } from '@angular/core';
import { HttpClient } from '@angular/common/http';

const userProfileUrl: string = 'assets/data/profile.json';

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

getUserProfile() {
  return this.http.get(this.userProfileUrl);
}

```

- iii. Create a component for subscribing service: Let's create a component called UserProfileComponent(userprofile.component.ts) which inject UserProfileService and invokes the service method,

```

fetchUserProfile() {
  this.userProfileService.getUserProfile()
    .subscribe((data: User) => this.user = {
      id: data['userId'],
      name: data['firstName'],
      city: data['city']
    });
}

```

Since the above service method returns an Observable which needs to be subscribed in the component.

## 2. How can you read full response?

The response body doesn't may not return full response data because sometimes servers also return special headers or status code which which are important for the application workflow. Inorder to get full response, you should use observe option from HttpClient,

```

getUserResponse(): Observable<HttpResponse<User>> {
  return this.http.get<User>(
    this.userUrl, { observe: 'response' });
}

```

Now HttpClient.get() method returns an Observable of typed HttpResponse rather than just the JSON data.

## 3. How do you perform Error handling?

If the request fails on the server or failed to reach the server due to network issues then HttpClient will return an error object instead of a successful response. In this case, you need to handle in the component by passing error object as a second callback to subscribe() method. Let's see how it can be handled in the component with an example,

```

fetchUser() {
  this.userService.getProfile()
    .subscribe(
      (data: User) => this.userProfile = { ...data }, // success path
      error => this.error = error // error path
    );
}

```

It is always a good idea to give the user some meaningful feedback instead of displaying the raw error object returned from HttpClient.

## 4. What is RxJS?

RxJS is a library for composing asynchronous and callback-based code in a functional, reactive style using Observables. Many APIs such as HttpClient produce and consume RxJS Observables and also uses operators for processing observables. For example, you can import observables and operators for using HttpClient as below,

```
import { Observable, throwError } from 'rxjs';
import { catchError, retry } from 'rxjs/operators';
```

## 5. What is subscribing?

An Observable instance begins publishing values only when someone subscribes to it. So you need to subscribe by calling the **subscribe()** method of the instance, passing an observer object to receive the notifications. Let's take an example of creating and subscribing to a simple observable, with an observer that logs the received message to the console.

```
Creates an observable sequence of 5 integers, starting from 1
const source = range(1, 5);

// Create observer object
const myObserver = {
  next: x => console.log('Observer got a next value: ' + x),
  error: err => console.error('Observer got an error: ' + err),
  complete: () => console.log('Observer got a complete notification'),
};

// Execute with the observer object and Prints out each item
myObservable.subscribe(myObserver);
// => Observer got a next value: 1
// => Observer got a next value: 2
// => Observer got a next value: 3
// => Observer got a next value: 4
// => Observer got a next value: 5
// => Observer got a complete notification
```

## 6. What is an observable?

An Observable is a unique Object similar to a Promise that can help manage async code. Observables are not part of the JavaScript language so we need to rely on a popular Observable library called RxJS. The observables are created using new keyword. Let see the simple example of observable,

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

const observable = new Observable(observer => {
  setTimeout(() => {
    observer.next('Hello from a Observable!');
  }, 2000);
});
```

## 7. What is an observer?

Observer is an interface for a consumer of push-based notifications delivered by an Observable. It has below structure,

```
interface Observer<T> {
  closed?: boolean;
  next: (value: T) => void;
  error: (err: any) => void;
  complete: () => void;
}
```

A handler that implements the Observer interface for receiving observable notifications will be passed as a parameter for observable as below,

```
myObservable.subscribe(myObserver);
```

**Note:** If you don't supply a handler for a notification type, the observer ignores notifications of that type.

## 8. What is the difference between promise and observable?

Below are the list of differences between promise and observable,

Observable	Promise
Declarative: Computation does not start until subscription so that they can be run whenever you need the result	Execute immediately on creation
Provide multiple values over time	Provide only one
Subscribe method is used for error handling which makes centralized and predictable error handling	Push errors to the child promises
Provides chaining and subscription to handle complex applications	Uses only .then() clause

## 45. What is multicasting?

Multi-casting is the practice of broadcasting to a list of multiple subscribers in a single execution. Let's demonstrate the multi-casting feature,

```
var source = Rx.Observable.from([1, 2, 3]);
var subject = new Rx.Subject();
var multicasted = source.multicast(subject);

// These are, under the hood, `subject.subscribe({...})`:
multicasted.subscribe({
  next: (v) => console.log('observerA: ' + v)
});
multicasted.subscribe({
  next: (v) => console.log('observerB: ' + v)
});

// This is, under the hood, `s
```

## 46. How do you perform error handling in observables?

You can handle errors by specifying an **error callback** on the observer instead of relying on try/catch which are ineffective in asynchronous environment. For example, you can define error callback as below,

```
myObservable.subscribe({
  next(num) { console.log('Next num: ' + num)},
  error(err) { console.log('Received an error: ' + err)}
});
```

## 47. What is the short hand notation for subscribe method?

The subscribe() method can accept callback function definitions in line, for next, error, and complete handlers is known as short hand notation or Subscribe method with positional arguments. For example, you can define subscribe method as below,

```
myObservable.subscribe(
  x => console.log('Observer got a next value: ' + x),
  err => console.error('Observer got an error: ' + err),
```

```
() => console.log('Observer got a complete notification')
);
```

## 48. What are the utility functions provided by RxJS?

The RxJS library also provides below utility functions for creating and working with observables.

- i. Converting existing code for async operations into observables
- ii. Iterating through the values in a stream
- iii. Mapping values to different types
- iv. Filtering streams
- v. Composing multiple streams

## 49. What are observable creation functions?

RxJS provides creation functions for the process of creating observables from things such as promises, events, timers and Ajax requests. Let us explain each of them with an example,

- i. Create an observable from a promise

```
import { from } from 'rxjs'; // from function
const data = from(fetch('/api/endpoint')); //Created from Promise
data.subscribe({
  next(response) { console.log(response); },
  error(err) { console.error('Error: ' + err); },
  complete() { console.log('Completed'); }
});
```

- i. Create an observable that creates an AJAX request

```
import { ajax } from 'rxjs/ajax'; // ajax function
const apiData = ajax('/api/data'); // Created from AJAX request
// Subscribe to create the request
apiData.subscribe(res => console.log(res.status, res.response));
```

- i. Create an observable from a counter

```
import { interval } from 'rxjs'; // interval function
const secondsCounter = interval(1000); // Created from Counter value
secondsCounter.subscribe(n =>
  console.log(`Counter value: ${n}`));
```

- i. Create an observable from an event

```
import { fromEvent } from 'rxjs';
const el = document.getElementById('custom-element');
const mouseMoves = fromEvent(el, 'mousemove');
const subscription = mouseMoves.subscribe((e: MouseEvent) => {
  console.log(`Coordinates of mouse pointer: ${e.clientX} * ${e.clientY}`);
});
```

## 46. What will happen if you do not supply handler for observer?

Normally an observer object can define any combination of next, error and complete notification type handlers. If you don't supply a handler for a notification type, the observer just ignores notifications of that type.

## 47. What are angular elements?



Angular elements are Angular components packaged as **custom elements**(a web standard for defining new HTML elements in a framework-agnostic way). Angular Elements hosts an Angular component, providing a bridge between the data and logic defined in the component and standard DOM APIs, thus, providing a way to use Angular components in non-Angular environments.

#### 48. What is the browser support of Angular Elements?

Since Angular elements are packaged as custom elements the browser support of angular elements is same as custom elements support. This feature is currently supported natively in a number of browsers and pending for other browsers.

Browser	Angular Element Support
Chrome	Natively supported
Opera	Natively supported
Safari	Natively supported
Firefox	Natively supported from 63 version onwards. You need to enable <code>dom.webcomponents.enabled</code> and <code>dom.webcomponents.customelements.enabled</code> in older browsers
Edge	Currently it is in progress

#### 49. What are custom elements?

Custom elements (or Web Components) are a Web Platform feature which extends HTML by allowing you to define a tag whose content is created and controlled by JavaScript code. The browser maintains a `CustomElementRegistry` of defined custom elements, which maps an instantiable JavaScript class to an HTML tag. Currently this feature is supported by Chrome, Firefox, Opera, and Safari, and available in other browsers through polyfills.

#### 50. Do I need to bootstrap custom elements?

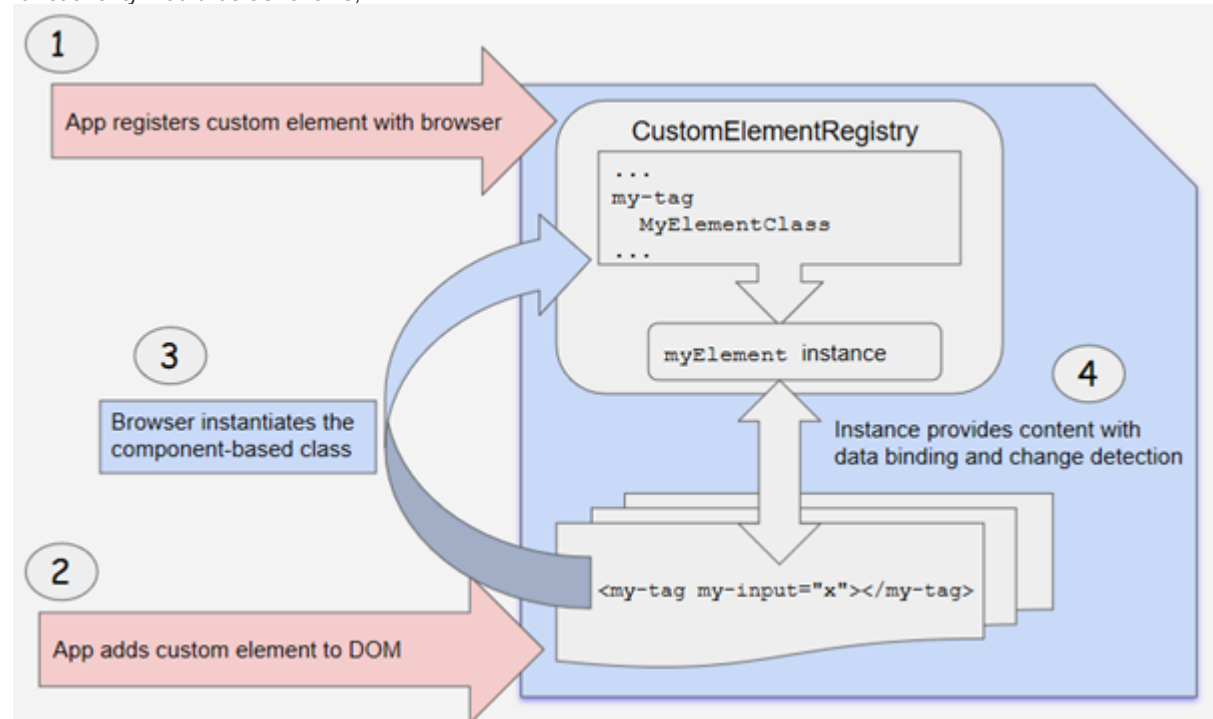
No, custom elements bootstrap (or start) automatically when they are added to the DOM, and are automatically destroyed when removed from the DOM. Once a custom element is added to the DOM for any page, it looks and behaves like any other HTML element, and does not require any special knowledge of Angular.

#### 51. Explain how custom elements works internally?

Below are the steps in an order about custom elements functionality,

- i. **App registers custom element with browser:** Use the `createCustomElement()` function to convert a component into a class that can be registered with the browser as a custom element.
- ii. **App adds custom element to DOM:** Add custom element just like a built-in HTML element directly into the DOM.
- iii. **Browser instantiate component based class:** Browser creates an instance of the registered class and adds it to the DOM.
- iv. **Instance provides content with data binding and change detection:** The content with in template is rendered using the component and DOM data. The flow chart of the custom elements

functionality would be as follows,

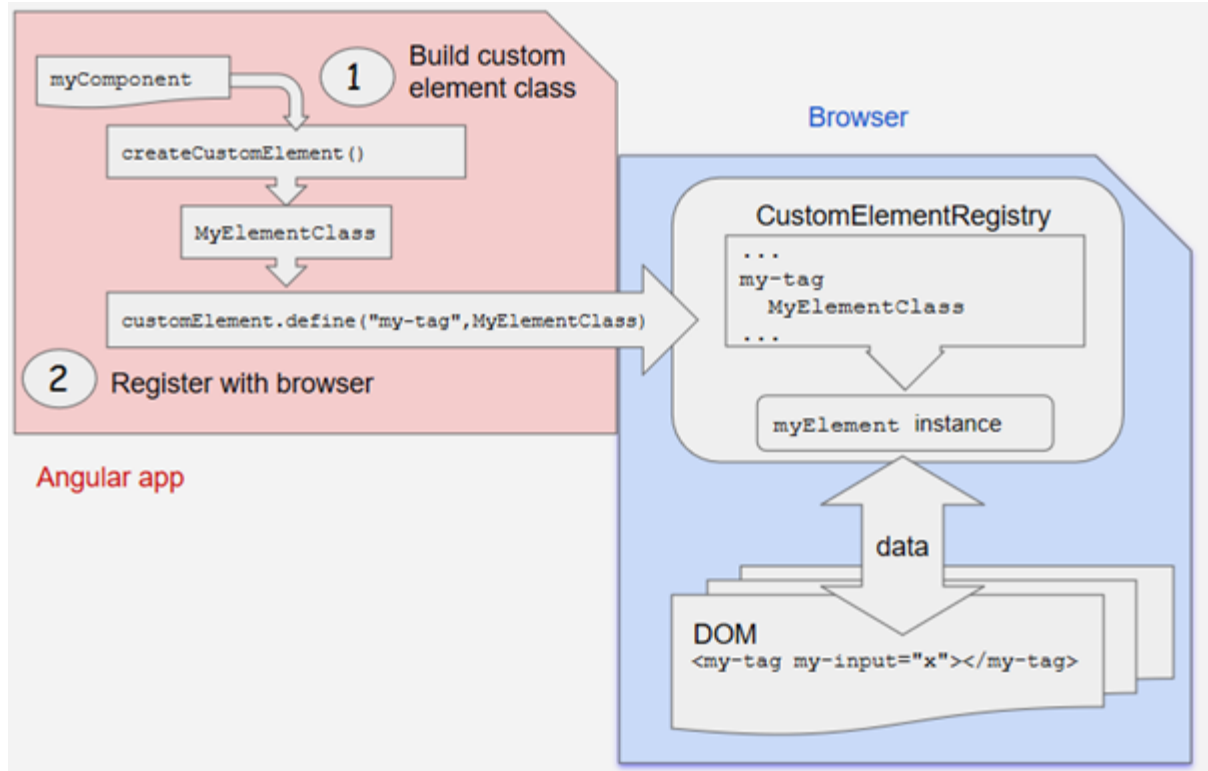


## How to transfer components to custom elements?

Transforming components to custom elements involves **two** major steps,

- Build custom element class:** Angular provides the `createCustomElement()` function for converting an Angular component (along with its dependencies) to a custom element. The conversion process implements `NgElementConstructor` interface, and creates a constructor class which is used to produce a self-bootstrapping instance of Angular component.
- Register element class with browser:** It uses `customElements.define()` JS function, to register the configured constructor and its associated custom-element tag with the browser's `CustomElementRegistry`. When the browser encounters the tag for the registered element, it uses the constructor to create a custom-element instance. The detailed structure would be as

follows,



## What are the mapping rules between Angular component and custom element?

The Component properties and logic maps directly into HTML attributes and the browser's event system. Let us describe them in two steps,

- The `createCustomElement()` API parses the component input properties with corresponding attributes for the custom element. For example, component `@Input('myInputProp')` converted as custom element attribute `my-input-prop`.
- The Component outputs are dispatched as HTML Custom Events, with the name of the custom event matching the output name. For example, component `@Output() valueChanged = new EventEmitter()` converted as custom element with dispatch event as "valueChanged".

## How do you define typings for custom elements?

You can use the `NgElement` and `WithProperties` types exported from `@angular/elements`. Let's see how it can be applied by comparing with Angular component, The simple container with input property would be as below,

```
@Component(...)
class MyContainer {
  @Input() message: string;
}
```

After applying types typescript validates input value and their types,

```
const container = document.createElement('my-container') as NgElement & WithProperties<{message:
string}>;
container.message = 'Welcome to Angular elements!';
container.message = true; // <-- ERROR: TypeScript knows this should be a string.
container.greet = 'News'; // <-- ERROR: TypeScript knows there is no `greet` property on `container`.
```

## What are dynamic components?

Dynamic components are the components in which components location in the application is not defined at build time.i.e, They are not used in any angular template. But the component is instantiated and placed in the application at runtime.

## What are the various kinds of directives?

There are mainly three kinds of directives.

- i. **Components** — These are directives with a template.
- ii. **Structural directives** — These directives change the DOM layout by adding and removing DOM elements.
- iii. **Attribute directives** — These directives change the appearance or behavior of an element, component, or another directive.

## How do you create directives using CLI?

You can use CLI command `ng generate directive` to create the directive class file. It creates the source file(`src/app/components/directivename.directive.ts`), the respective test file(`.spec.ts`) and declare the directive class file in root module.

## Give an example for attribute directives?

Let's take simple highlighter behavior as a example directive for DOM element. You can create and apply the attribute directive using below steps,

- i. Create HighlightDirective class with the file name `src/app/highlight.directive.ts`. In this file, we need to import **Directive** from core library to apply the metadata and **ElementRef** in the directive's constructor to inject a reference to the host DOM element ,

```
import { Directive, ElementRef } from '@angular/core';

@Directive({
  selector: '[appHighlight]'
})
export class HighlightDirective {
  constructor(el: ElementRef) {
    el.nativeElement.style.backgroundColor = 'red';
  }
}
```

- i. Apply the attribute directive as an attribute to the host element(for example,

)

```
<p appHighlight>Highlight me!</p>
```

- i. Run the application to see the highlight behavior on paragraph element

```
ng serve
```

***General Questions:***

- What did you learn about Angular yesterday/this week?
- What are some of the reasons you would choose to use Angular in your project?
- What did you like about working with Angular?
- How do you keep your Angular code more readable and maintainable?
- What does testable code mean to you in context of Angular?
- What does reusable code mean to you in context of Angular?

***Animations Questions:***

- How do you define transition between two states in Angular?
- How do you define a wildcard state?

***Architecture Questions:***

- What is a good use case for ngrx/store?
- What is a good use case for ngrx/entity?
- Can you talk about a bug related to a race condition, how to solve it and how to test it?
- What is the difference between a smart/container component and dumb/presentational component? What is a good use case example? What are the advantages?

***API Questions:***

- What does this code do:

```
@HostBinding('class.valid') isValid;
<div *ngIf='someObservableData | async as data; else loading'>{{data}}</div>

<ng-template #loading>
  Loading Data...
</ng-template>
```

- Why would you use renderer methods instead of using native element methods?
- How would you control size of an element on resize of the window in a component?
- What would be a good use for NgZone service?
- What are the bootstrap options for NgZone? Why would you use them? (Angular 5+)
- How would you protect a component being activated through the router?
- How would you insert an embedded view from a prepared TemplateRef?
- What is the difference between @ViewChild() and @ContentChild()

### **Template Syntax Questions:**

- How can you add an active class to a selected element in a list component?
- What is a template variable. How would you use it?
- What is the difference of using a property binding verses a function binding on a template?
- What happens if you subscribe to a data source multiple times with async pipe?
- What is the difference between ng-content, ng-container and ng-template?
- When you create a data-binding in Angular, are you working with attributes or properties? What is the difference anyway?
- When can you omit the brackets in template binding?

### **Component Questions:**

- What is the minimum definition of a component?
- What is the difference between a component and a directive?
- How do components communicate with each other?
- How do you create two way data binding in Angular?
- How would you create a component to display error messages throughout your application?
- What does a lean component mean to you?

### **Component Interaction & State Management Questions:**

- How would you pass data from a parent component to a child component?
- How would you pass data from a child component to a parent component?
- Which components will be notified when an event is emitted?
- Tell me about the different ways how you would get data to your components from a service and talk about why would you use one way vs the other?
- How would you use cached data?

### **Forms Questions:**

- When do you use template driven vs model driven forms? Why?
- How do you submit a form?
- What's the difference between `NgForm`, `FormGroup`, and `FormControl`? How do they work together?
- What's the advantage of using `FormBuilder`?
- How do you add form validation to a form built with `FormBuilder`?
- What's the difference between `dirty`, `touched`, and `pristine` on a form element?
- How can you access validation errors in the template to display error messages?
- What is async validation and how is it done?
- What is the correct form control class name which is set to true when value is modified?

#### ***NgModules Questions:***

- What is the purpose of `NgModule`?
- How do you decide to create a new `NgModule`?
- What are the attributes that you can define in an `NgModule` annotation?
- What is the difference between a module's `forRoot()` and `forChild()` methods and why do you need it?
- What is `providedIn` property used for in an `NgModule`?
- What would you have in a shared module?
- What would you not put shared module?
- What module would you put a singleton service whose instance will be shared throughout the application (e.g. `ExceptionService` and `LoggerService`)?
- What is the purpose of exports in a `NgModule`?
- What is the difference between exports and declarations in `NgModule`?
- Why is it bad if `SharedModule` provides a service to a lazy loaded module?

#### ***Services Questions:***

- What is the use case of services?
- How are the services injected to your application?
- How do you unit test a service with a dependency?
- Why is it a bad idea to create a new service in a component like the one below?

```
let service = new DataService();
```

#### ***Structural Directives Questions:***

- What is a structural directive?
- How do you identify a structural directive in html?
- When creating your own structural directives, how would you decide on hiding or removing an element? What would be the advantages or disadvantages of choosing one method rather than the other?

#### ***Style Guide Questions:***

- What are some of the Angular Style Guide suggestions you follow on your code? Why?
- Is it important to have a style guide? Why/not?

#### ***Styling Questions:***



- How would you select a custom component to style it.
- What pseudo-class selector targets styles in the element that hosts the component?
- How would you select all the child components' elements?
- How would you select a css class in any ancestor of the component host element, all the way up to the document root?
- What selector force a style down through the child component tree into all the child component views?
- What does :host-context() pseudo-class selector targets?
- What does the following css do?

```
:host-context(.theme-light) h2 {
  background-color: red;
}
```

### ***Lifecycle Hooks Questions:***

- What is the possible order of lifecycle hooks.
- When will ngOnInit be called?
- How would you make use of ngOnInit()?
- What would you consider a thing you should be careful doing on ngOnInit()?
- What is the difference between ngOnInit() and constructor() of a component?
- What is a good use case for ngOnChanges()?

### ***Observables RxJS Questions:***

- What is the difference between an observable and a promise?
- What is the difference between an observable and a subject?
- What are some of the angular apis that are using observables?
- How would you cache an observable data?
- How would you implement a multiple api calls that needs to happen in order using rxjs?
- What is the difference between switchMap, concatMap and mergeMap?
- How would you make sure an api call that needs to be called only once but with multiple conditions.  
Example: if you need to get some data in multiple routes but, once you get it, you can reuse it in the routes that needs it, therefor no need to make another call to your backend apis.
- How would you implement a [brush behavior](#) using rxjs?
- How would you implement a color picker with rxjs?
- If you need to respond to two different Observable/Subject with one callback function, how would you do it?(ex: if you need to change the url through route parameters and with prev/next buttons).
- What is the difference between scan() VS reduce() ?

### ***Performance Questions:***

- What are some of the things that you pay attention to, to make sure your angular application is performant?
- What tools would you use to find a performance issue in your code?
- What tools have you used to improve the performance of your application?
- What are some ways you may improve your website's scrolling performance?
- Explain the difference between layout, painting and compositing.
- Have you seen Jeff Cross's NgCruise talk on performance?

### ***Pipes Questions:***

- What is a pure pipe?
- What is an async pipe?
- What kind of data can be used with async pipe?
- How do you create a custom pipe?
- How does async pipe prevents memory leaks?
- What is the difference between pure and impure pipes?

### ***Router Questions:***

- What is the difference between RouterModule.forRoot() vs RouterModule.forChild()? Why is it important?
- How does loadChildren property work?
- Do you need a Routing Module? Why/not?
- When does a lazy loaded module is loaded?
- Below link doesn't work. Why? How do I fix it?

```
<div routerLink='product.id'></div>
```

- Can you explain the difference between ActivatedRoute and RouterState?
- How do you debug router?
- Why do we need route guards?
- What is a RouterOutlet?

### ***Security Questions:***

### ***Testing Questions:***

- What are some of the different tests types you can write?
- How do you mock a service to inject in an integration test?
- How do you mock a module in an integration test?
- How do you test a component that has a dependency to an async service?
- What is the difference between 'async()' and 'fakeAsync()'?

### ***TypeScript Questions:***

- Why do you need type definitions?
- How would you define a custom type?
- What is the difference between an Interface and a Class?
- First line below gives compile error, second line doesn't. Why?

```
someService.someMethod(x);  
someService['someMethod'](x);
```

- What are Discriminated union types?
- How do you define Object of Objects type in typescript?
- How can you capture the 'type' the user provides (e.g. number), so that we can use that information later.

### JavaScript Questions:

- Explain the difference between var, let and const key words.
- Could you make sure a const value is garbage collected?
- Explain Object.assign and possible use cases.
- Explain Object.freeze and possible use cases.
- Explain the code below. How many times the createVal function is called?

```
function createVal(){
  return Math.random();
};

function fun( val = createVal()){
  // Do something with val...
}

fun();
fun(5);
```

- What is the spread operator doing in this function call? Seriously!

```
doStuff(...args);
```

- What is destructuring assignment?
- Explain why the below stand-alone syntax is not valid?

```
{a, b} = {a: 1, b: 2}
```

### Coding Questions:

- What would these components render?

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

@Directive({selector: 'pane'})
export class Pane {
  @Input() id: string;
}

@Component({
  selector: 'tab',
  template: `
    <div>panes: {{serializedPanes}}</div>
  `
})
export class Tab {
  @ContentChildren(Pane) panes: QueryList<Pane>;
  get serializedPanes(): string { return this.panes ? this.panes.map(p => p.id).join(', ') : ''; }
}

@Component({
  selector: 'example-app',
  template: `
    <tab>
      <pane id="1"></pane>
      <pane id="2"></pane>
      <pane id="3" *ngIf="shouldShow"></pane>
    </tab>
    <button (click)="show()">Show 3</button>
  `
})
export class ContentChildrenComp {
```

```
shouldShow = false;  
show() { this.shouldShow = true; }  
}
```

- What's a cool project that you've recently worked on?
- What are some things you like about the developer tools you use?
- Who inspires you in the angular community?
- Do you have any pet projects? What kind?
- How did you design the architecture of your project?
- What's your favorite feature of Angular?
- If you could decide on a new feature for angular, what would it be?