ANGULAR

Outline

- What is Angular and why should you care!
- Single Page Application (SPA)
- Angular Architecture
- Angular features:
  - Components
  - Directives
  - Forms
  - Routing

What is ANGULAR ?

- Angular is an open source front-end web application framework for **efficiently** creating a Single Page Application (SPA)
  - SPA is a Web app that load a single HTML page and dynamically update that page as the user interacts with the app.
  - **Component based framework**
    - UI is composed of small reusable parts
    - A components encapsulates related UI elements and the behavior associated with them
  - Has built-in **client-side Template engine** that generates HTML views from an html template containing place holders that will be replaced by dynamic content
- Popular framework built by Google and has a large community behind it
    - **Google is paying developers to actively develop Angular**

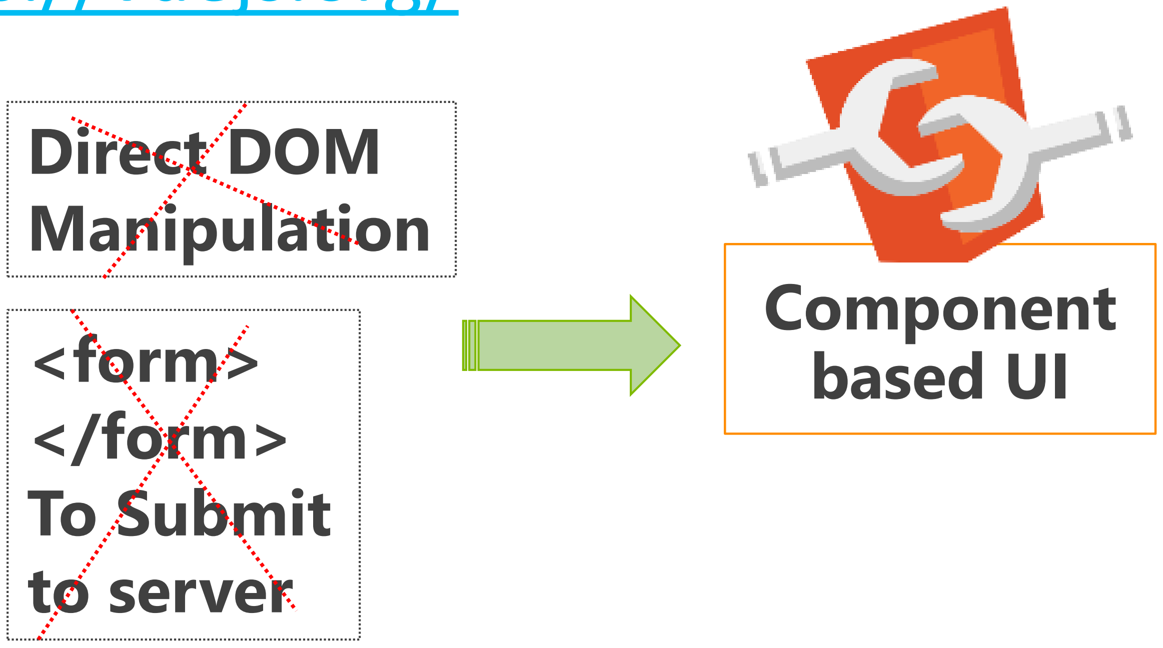
Angular Competitors

- React is a strong competitor!

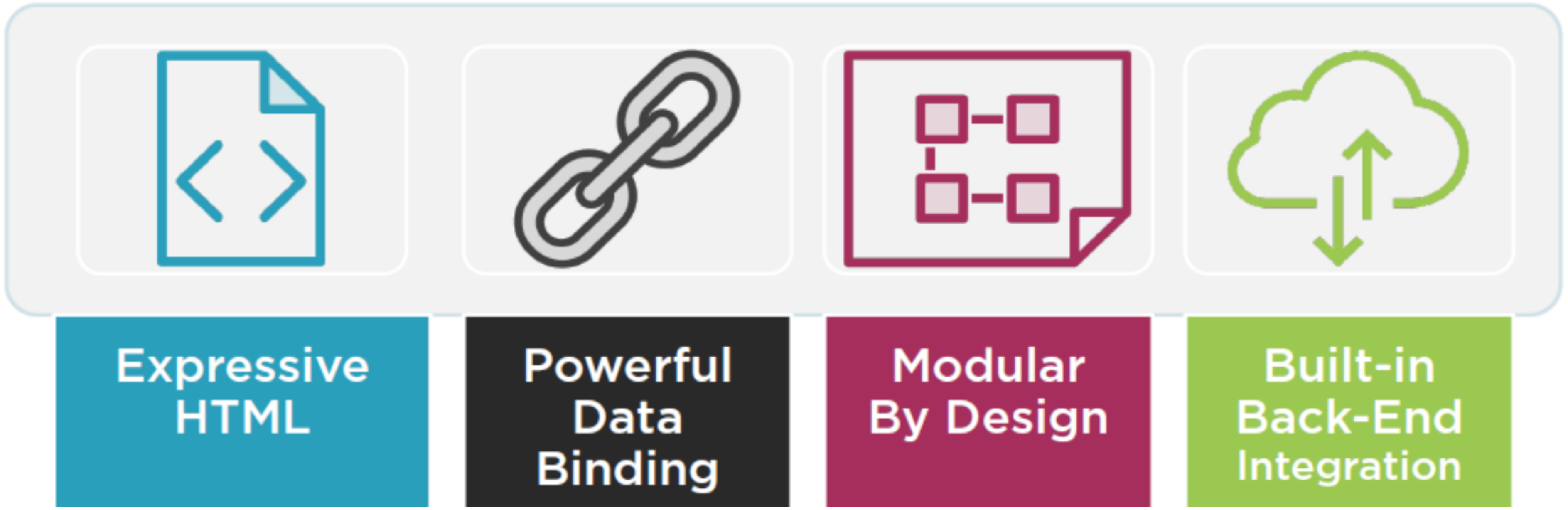
https://reactjs.org/

- Vue.js

https://vuejs.org/


~~Direct DOM Manipulation~~
~~<form> </form> To Submit to server~~
Component based UI

Why Angular?

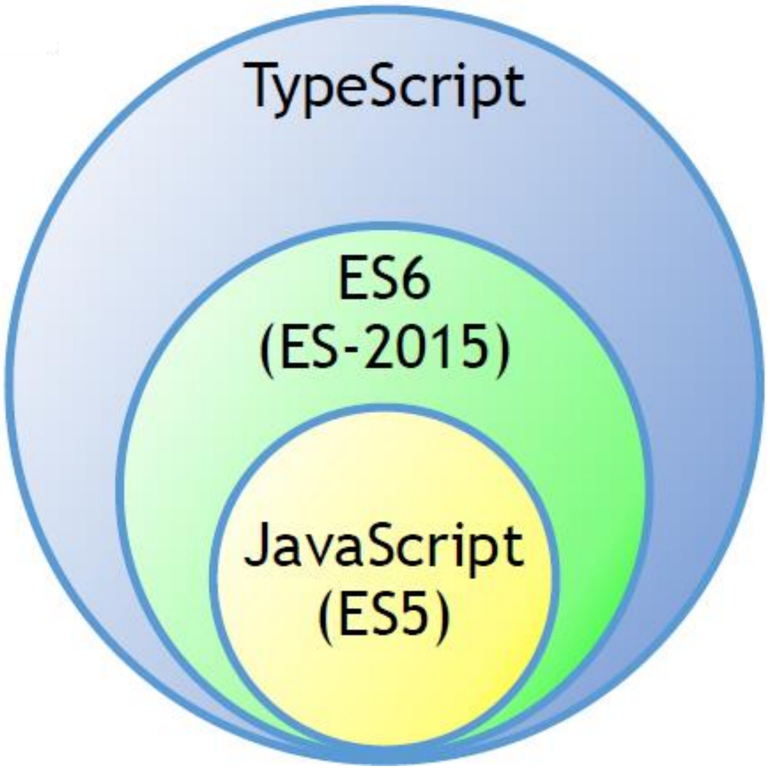

Expressive HTML
Powerful Data Binding
Modular By Design
Built-in Back-End Integration

TypeScript = JavaScript + Types

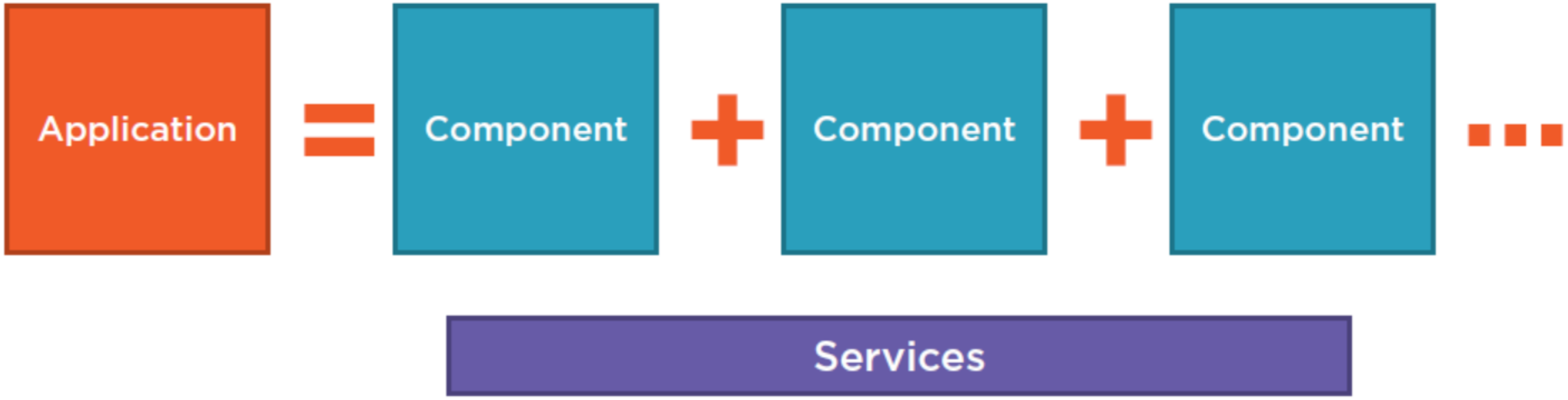
- type checking at dev time

string, number, boolean, any, Array<T>, interfaces

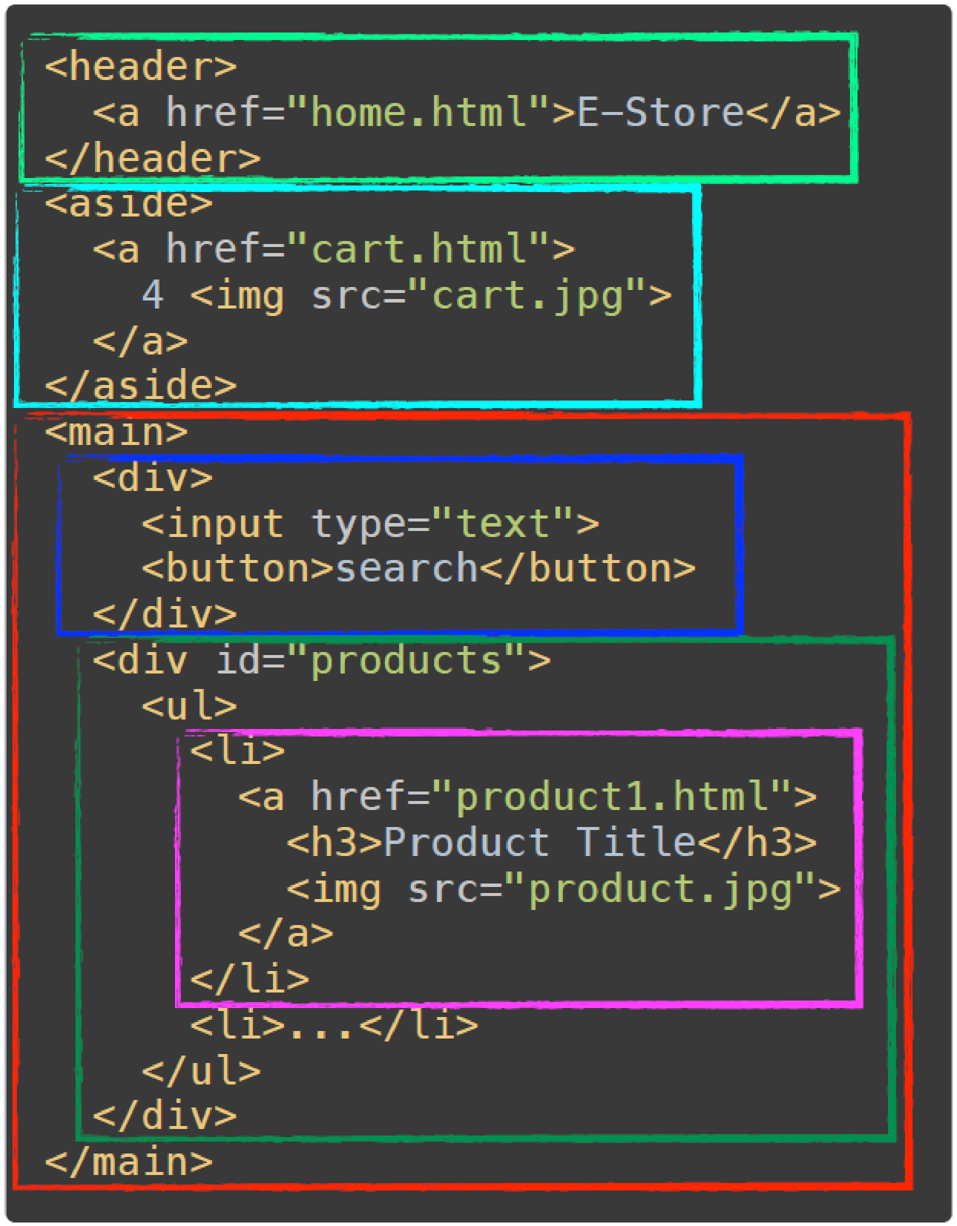
- code help - intellisense
- @decorators
- and more...



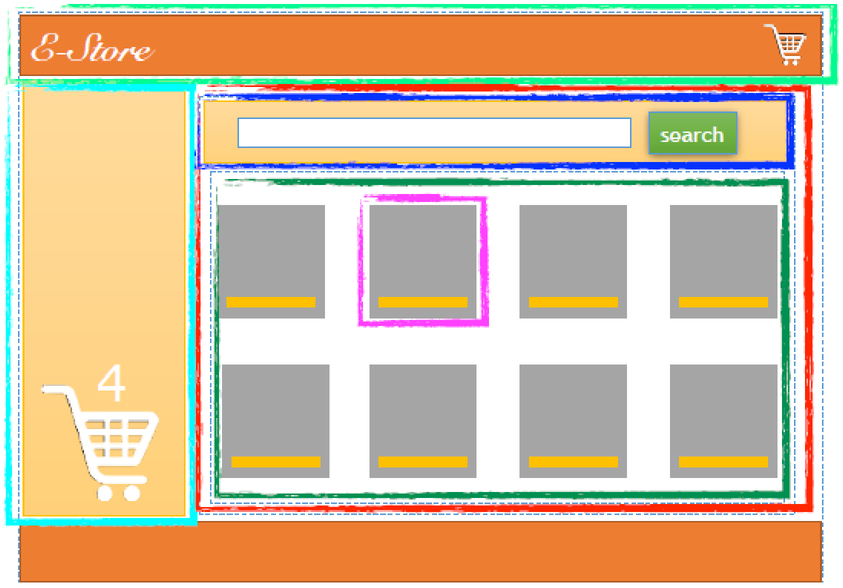
Anatomy of an Angular Application

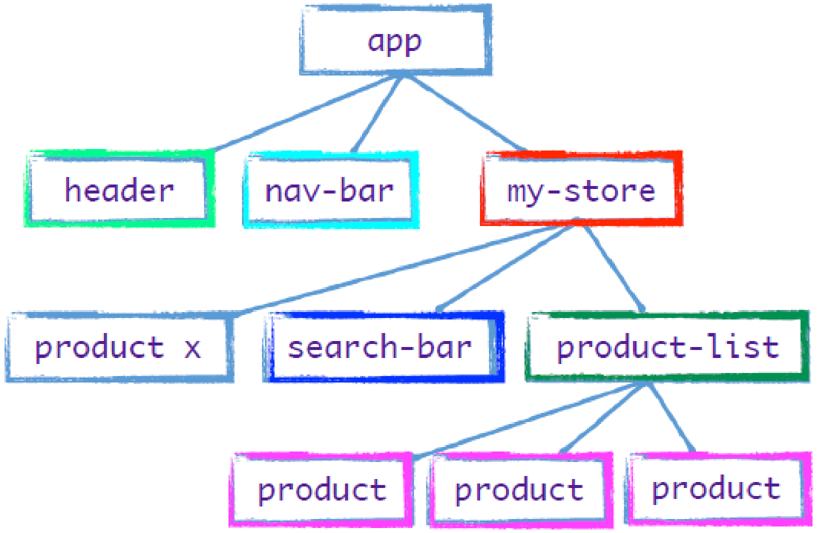


An app is a tree of components

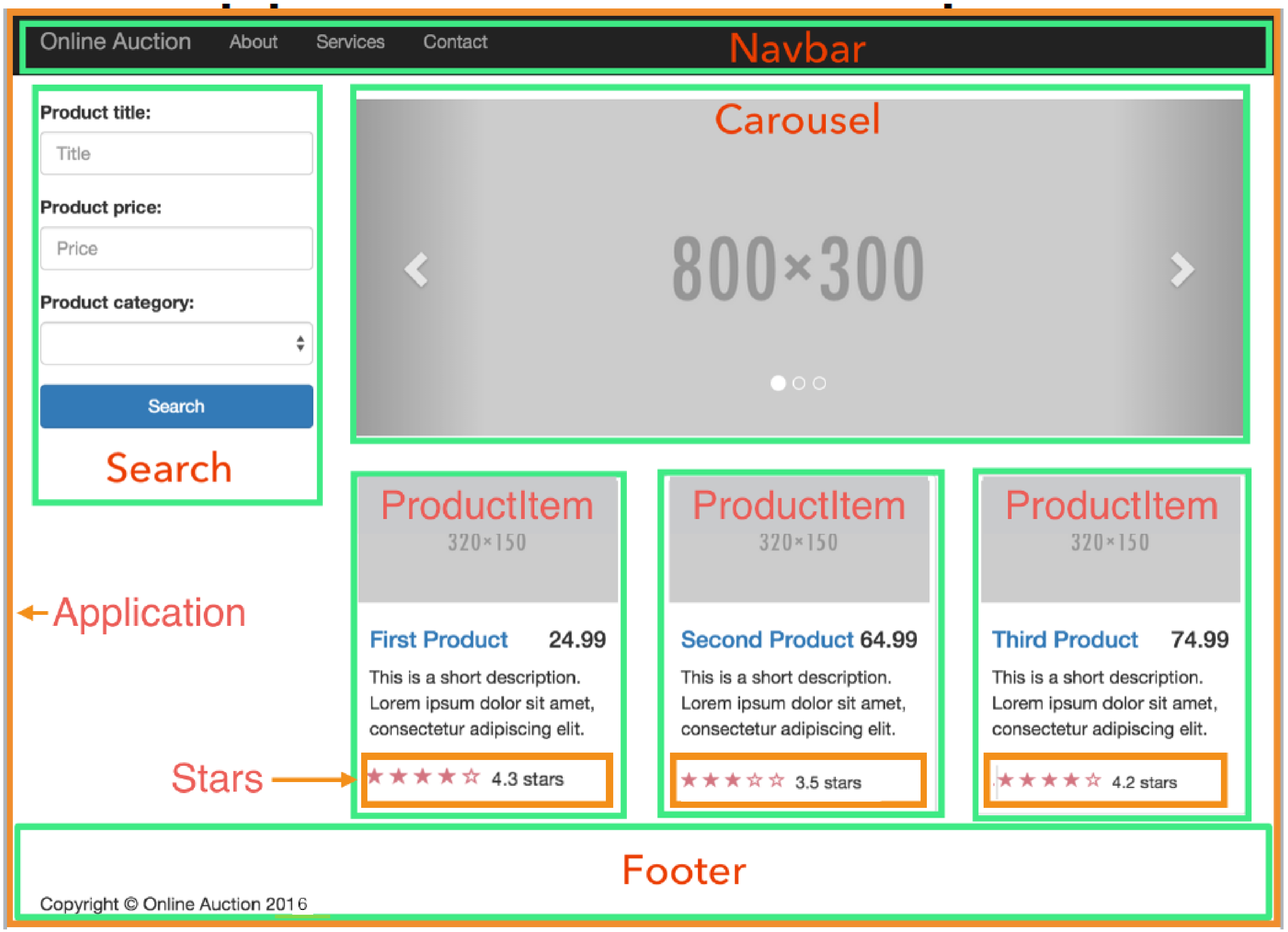


```
<header>
  <a href="home.html">E-Store</a>
</header>
<aside>
  <a href="cart.html">
    4 <img src="cart.jpg">
  </a>
</aside>
<main>
  <div>
    <input type="text">
    <button>search</button>
  </div>
  <div id="products">
    <ul>
      <li>
        <a href="product1.html">
          <h3>Product Title</h3>
          <img src="product.jpg">
        </a>
      </li>
      <li>...</li>
    </ul>
  </div>
</main>
```





An app is a tree of components



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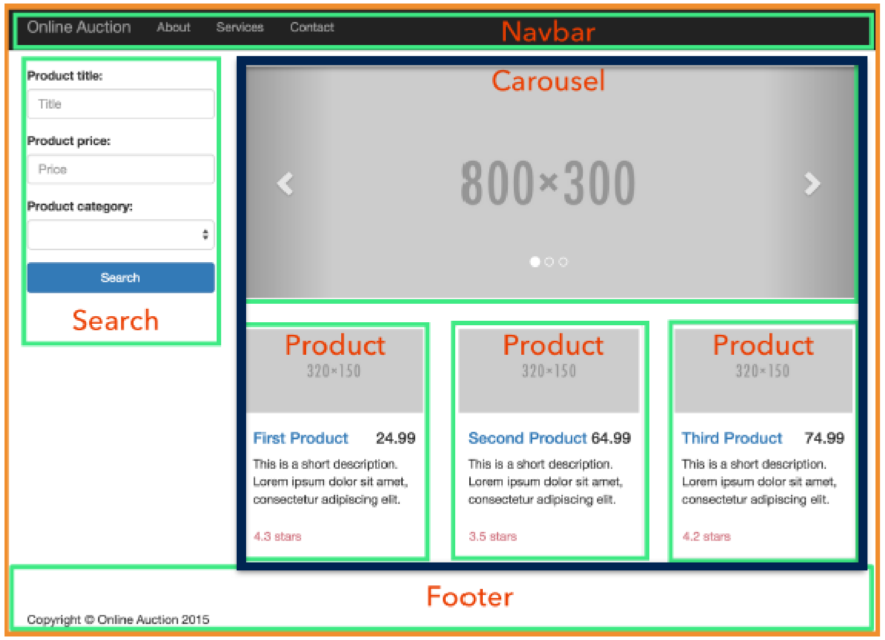
An app is a tree of components


Online Auction
About
Services
Contact
Navbar
Product title:
Title
Product price:
Price
Product category:
Search
Search
Carousel
800×300
Product
320×150
First Product 24.99
This is a short description. Lorem ipsum dolor sit amet, consectetur adipiscing elit.
4.3 stars
Product
320×150
Second Product 64.99
This is a short description. Lorem ipsum dolor sit amet, consectetur adipiscing elit.
3.5 stars
Product
320×150
Third Product 74.99
This is a short description. Lorem ipsum dolor sit amet, consectetur adipiscing elit.
4.2 stars
Footer
Copyright © Online Auction 2015

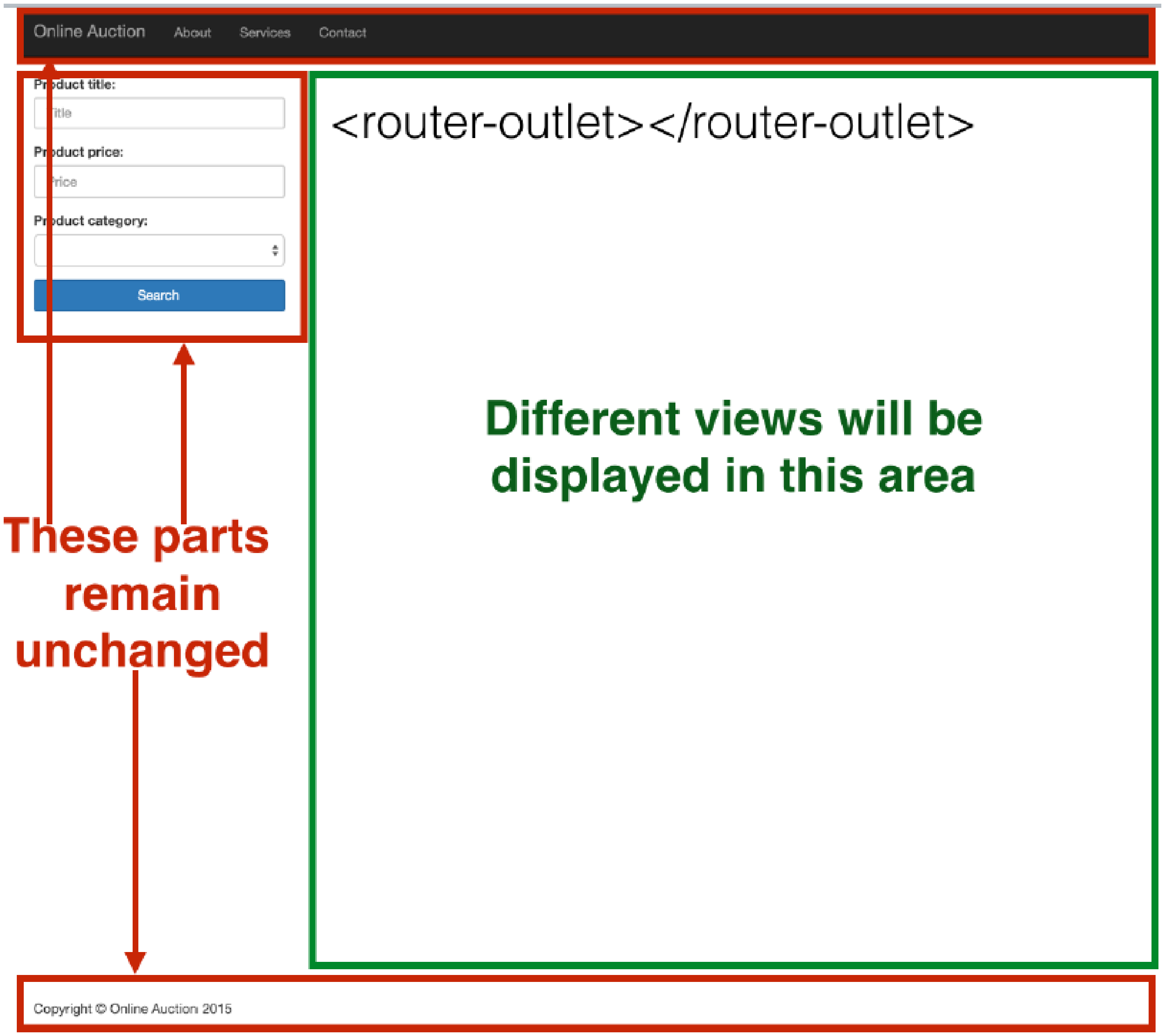
```html
<auction-navbar></auction-navbar>

<div class="container">
  <div class="row">
    <div class="col-md-3">
      <auction-search></auction-search>
    </div>

    <div class="col-md-9">
      <router-outlet></router-outlet>
    </div>
  </div>
</div>

<auction-footer></auction-footer>
```

```typescript
import {Component} from '@angular/core';
import {Product, ProductService} from '../services/product-service';

@Component({
  selector: 'app-root',
  templateUrl: 'application.html',
  styleUrls: ['application.css']
})
export class AppComponent {
  products: Array<Product> = [];

  constructor(private productService: ProductService) {
    this.products = this.productService.getProducts();
  }
}
```

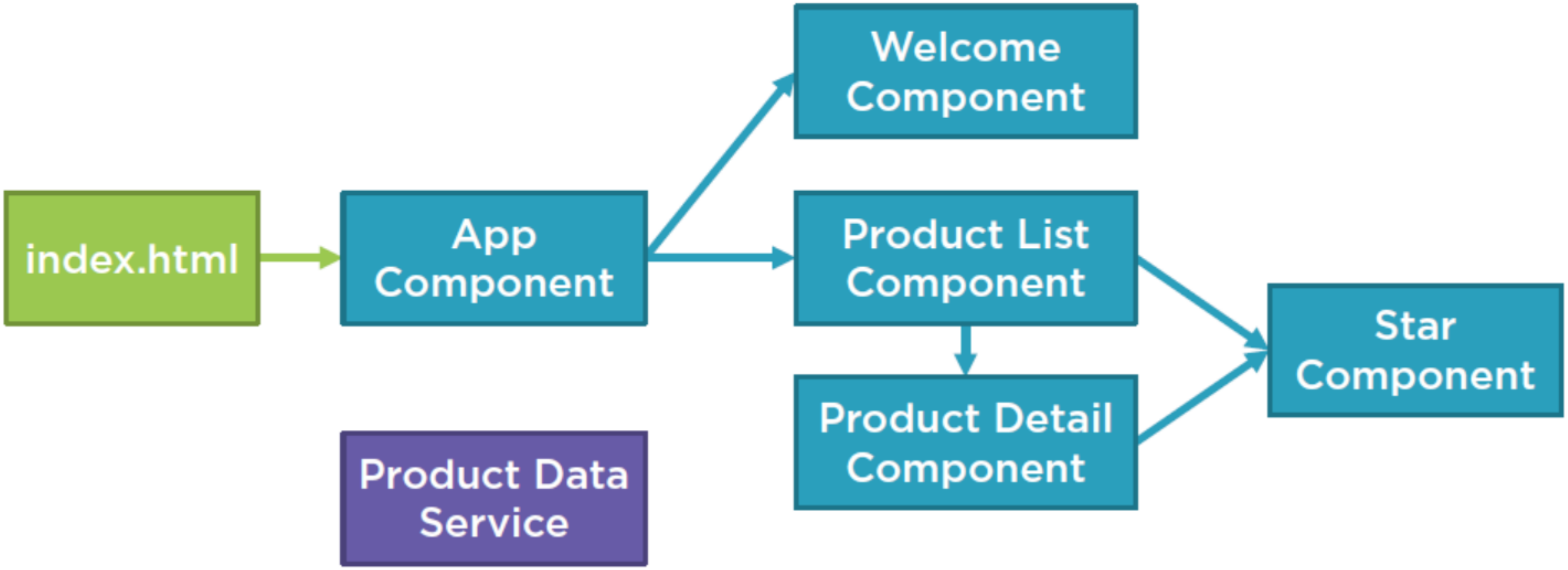
HTML, CSS

TypeScript

Single Page App


Online Auction
About
Services
Contact
Product title:
Title
Product price:
Price
Product category:
Search
<router-outlet></router-outlet>
Different views will be displayed in this area
These parts remain unchanged
Copyright © Online Auction 2015

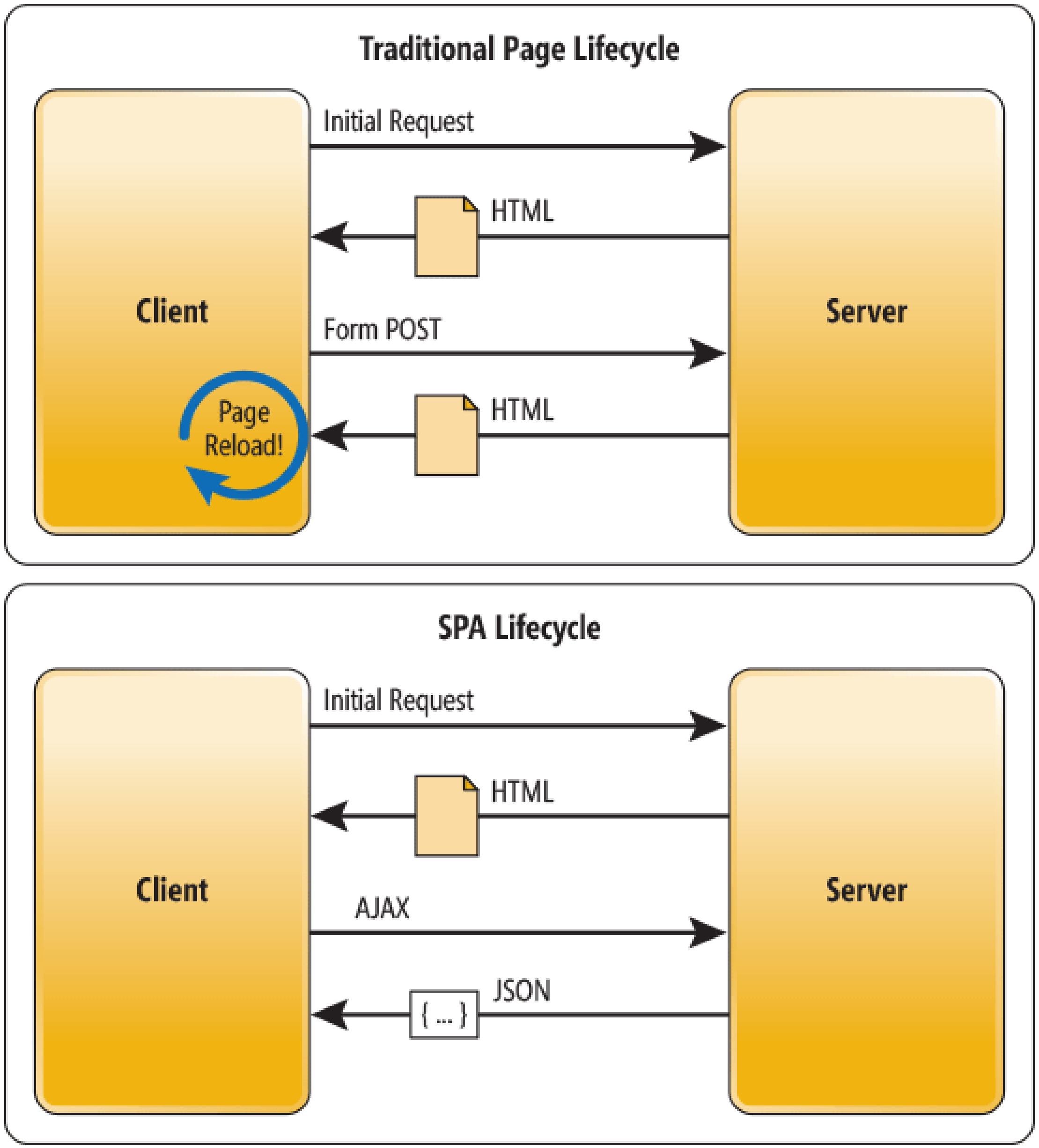
Sample Application Architecture



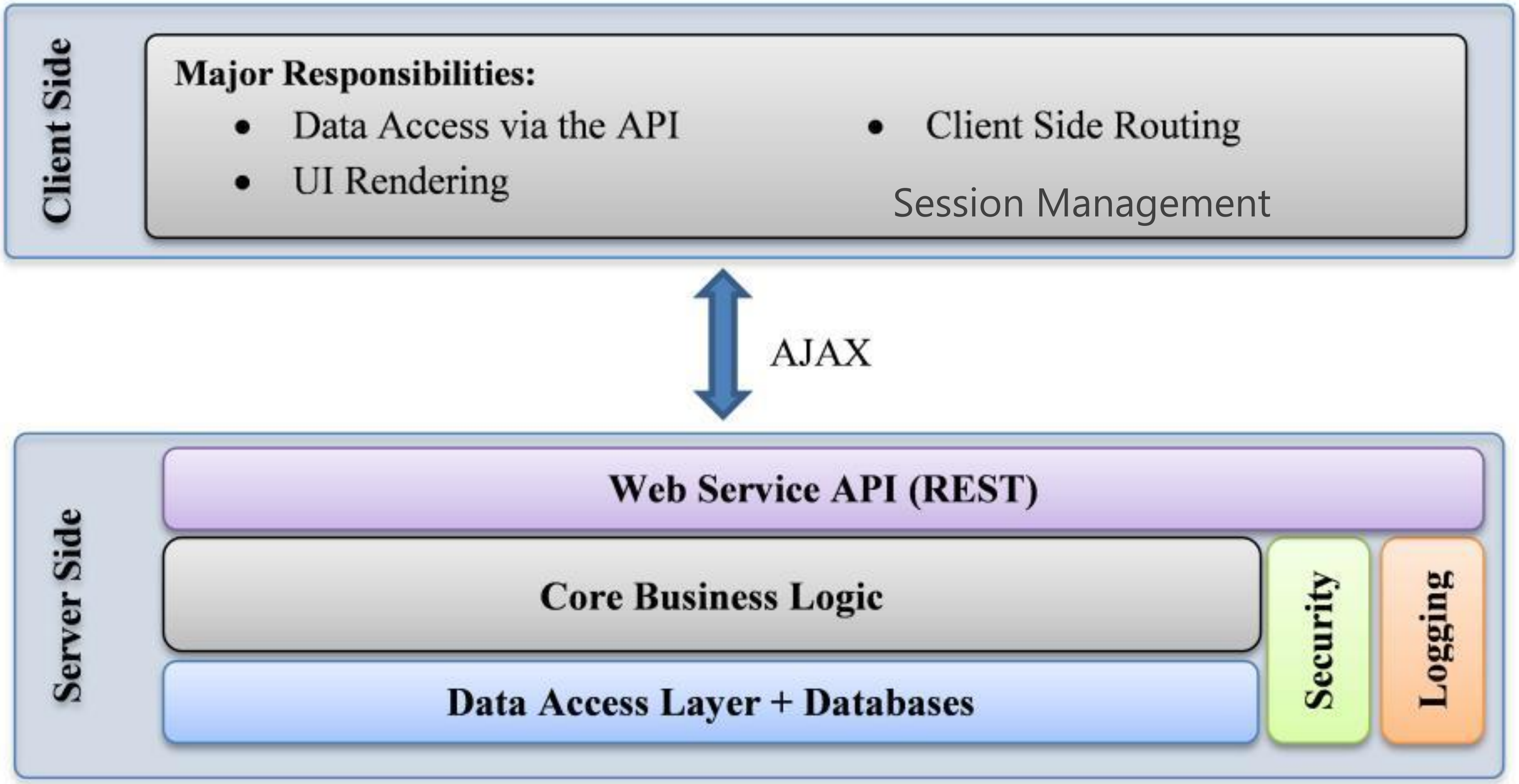
Single Page Application (SPA)

< Back

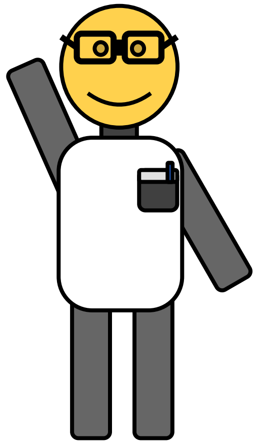
Traditional vs. SPA Lifecycle



Role of Client and Server in SPA



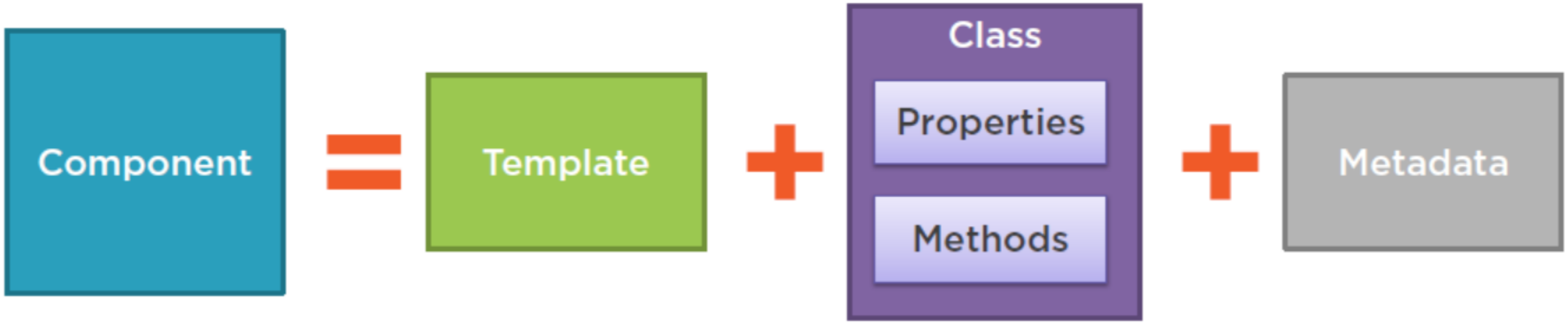
Benefits of a Single Page App



- **Better User experience**
- More interactive and responsive
- Less network activity and waiting
- Developer experience
  - Better (if you use a framework!)
  - No constant DOM refresh
- **State can be maintained on client + offline support**
  - Can use HTML5 JavaScript APIs to store state in the browser's localStorage

Angular App Architecture

Component

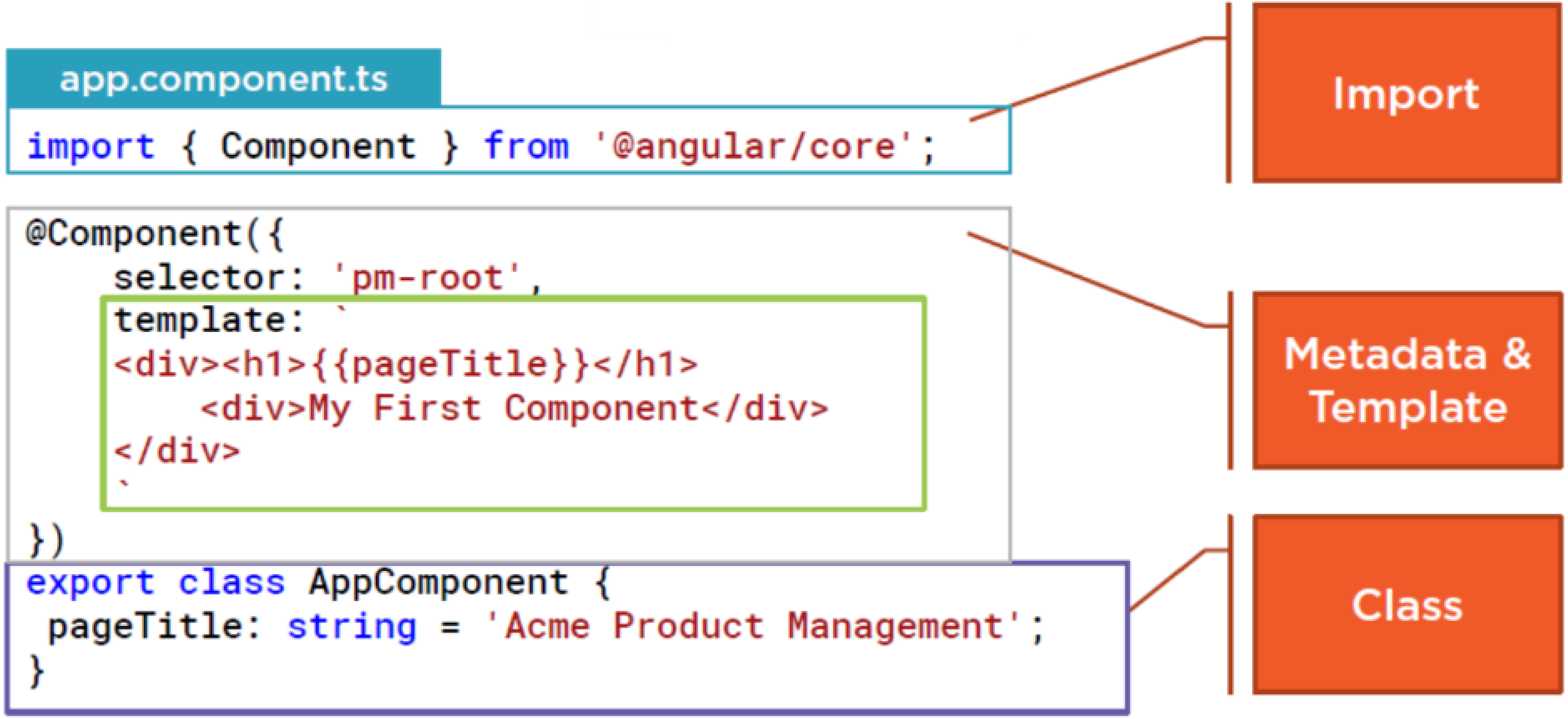


- View layout
- Created with HTML
- Includes binding and directives

- Code supporting the view
- Created with TypeScript
- Properties: data
- Methods: logic

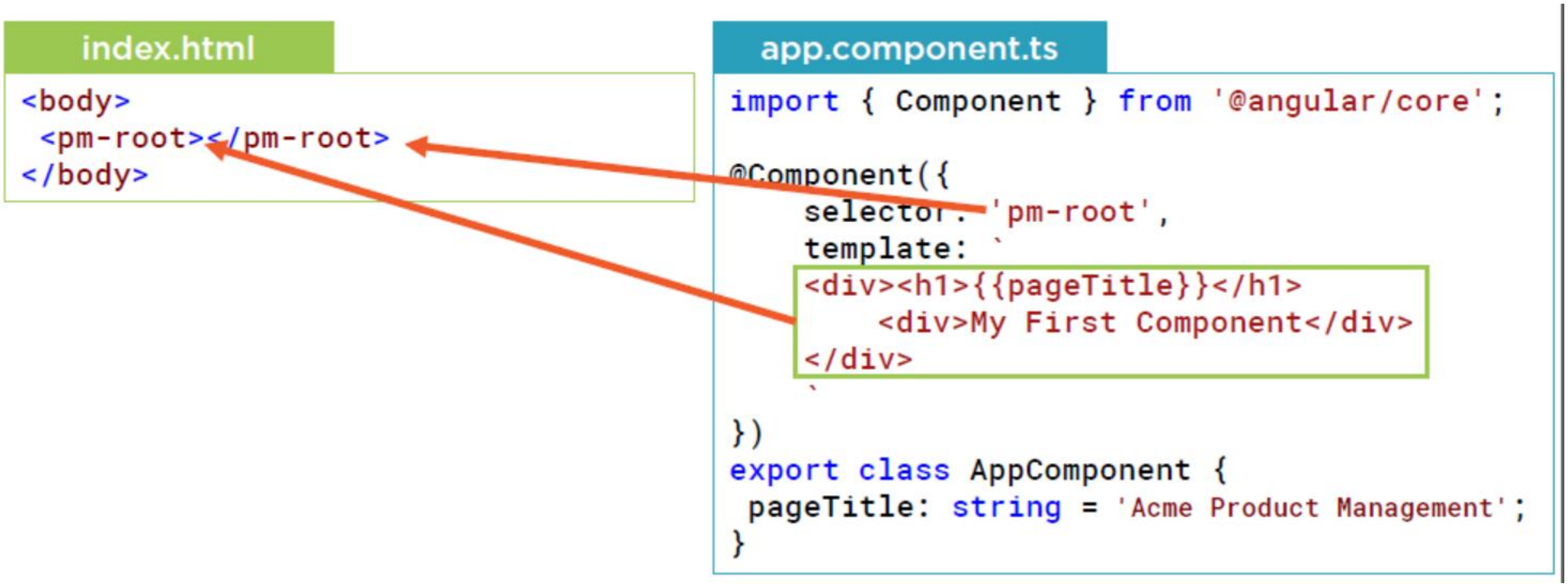
- Extra data for Angular
- Defined with a decorator

Component Example


app.component.ts

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

@Component({
     selector: 'pm-root',
     template: `
     <div><h1>{{pageTitle}}</h1>
         <div>My First Component</div>
     </div>
     `
})
export class AppComponent {
 pageTitle: string = 'Acme Product Management';
}
```

Loading a Component in the Shell Page



index.html

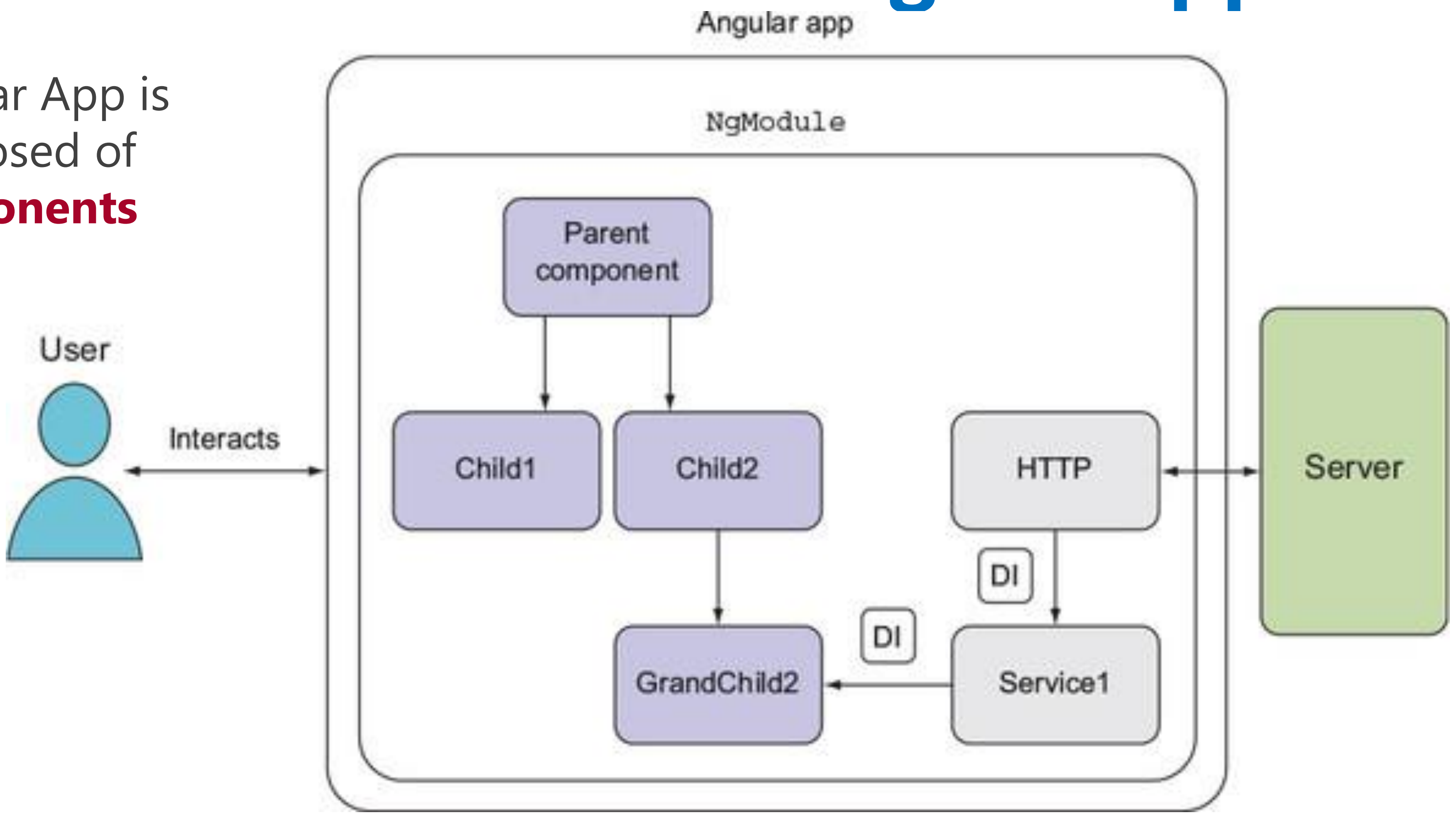
```
<body>
 <pm-root></pm-root>
</body>
```

app.component.ts

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

@Component({
     selector: 'pm-root',
     template: `
     <div><h1>{{pageTitle}}</h1>
         <div>My First Component</div>
     </div>
     `
})
export class AppComponent {
 pageTitle: string = 'Acme Product Management';
}
```

Architecture of an Angular app

Angular App is composed of **components**



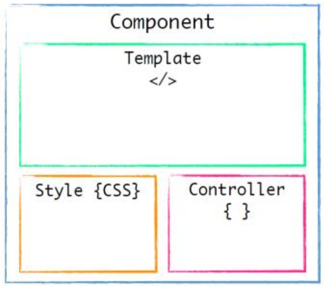
The figure shows a high-level diagram of a sample Angular application that consists of four components and two services; all of them are packaged inside a module. Angular's Dependency Injection (DI) module injects the Http service into Service1, which in turn is injected into the GrandChild2 component.

Source: '*Angular 2 Development with TypeScript*', Yakov Fain and Anton Moiseev, ISBN 9781617293122

Angular Architecture Highlights

- Angular App is composed of components.
    - A ***component*** has an HTML *template* and a class to ***provide data*** and ***handle events*** raised from the template.
    - Application logic in encapsulated in ***services*** that can be injected in components.
- A Component is a class (presentation logic) annotated with **@Component** annotation, it specifies:
    - a **selector** declaring the name of the custom tag to be used to load to component in HTML document
    - the **template** (=an HTML fragment with data binding expressions to render by the view) or **templateURL**

Component Example

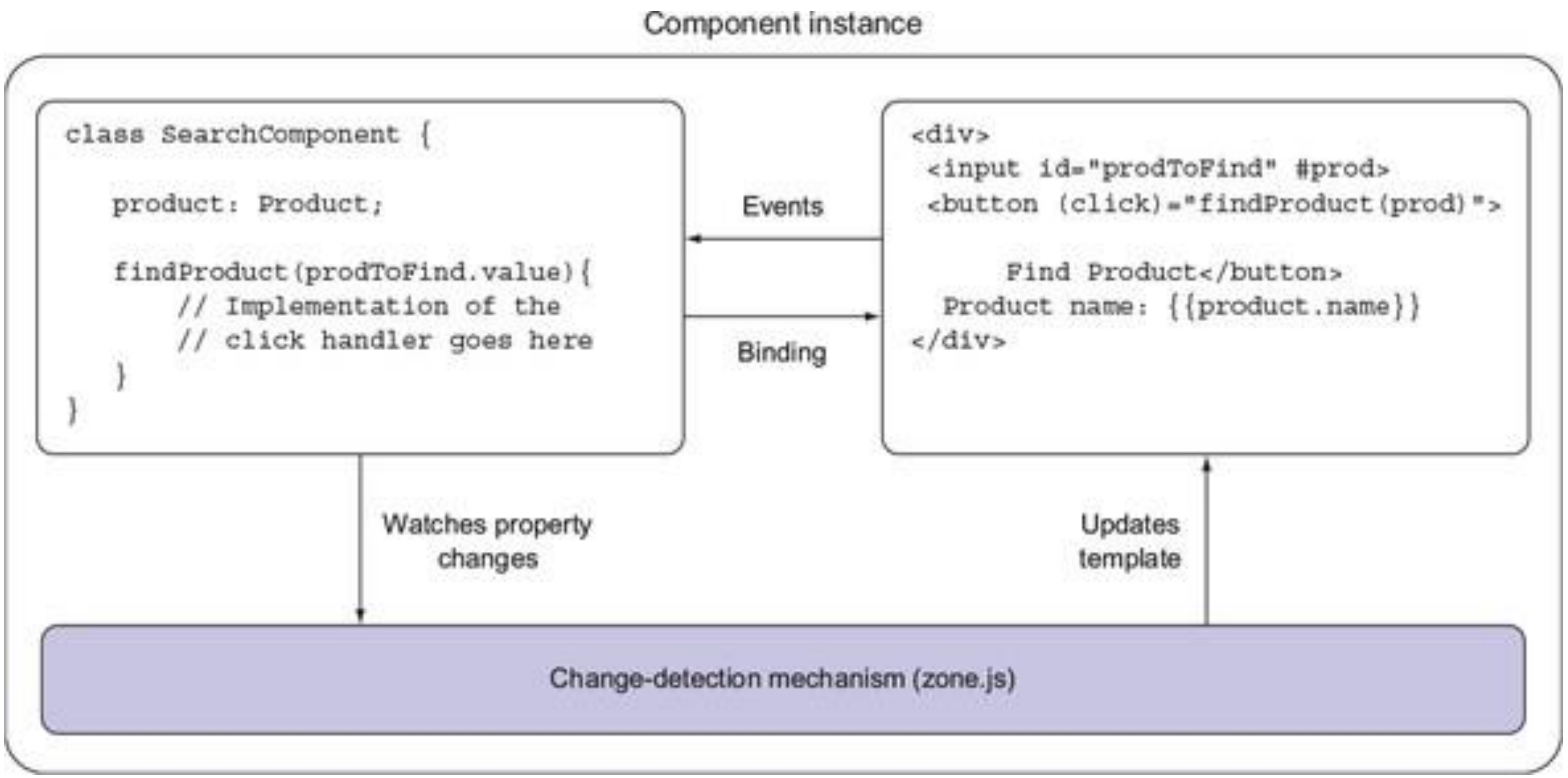


```
import { Component } from '@angular/core';

@Component({
  selector: 'app-hello',
  template: `
    <h1>{{ title }}</h1>`
})

export class HelloComponent {

 title = 'Hello World!';

}
```

Somewhere in your app

```
  <app-hello></app-hello>
```

Component internals

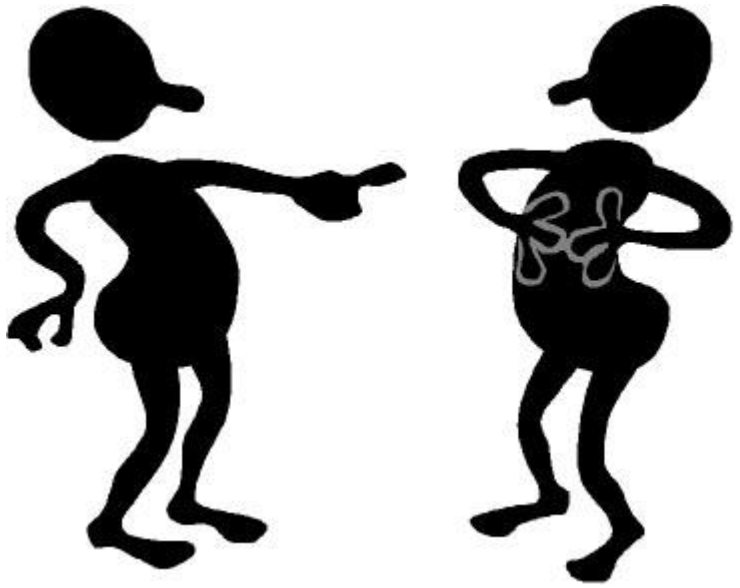


```
class SearchComponent {

   product: Product;

   findProduct(prodToFind.value){
       // Implementation of the
       // click handler goes here
   }
}
```

```
<div>
 <input id="prodToFind" #prod>
 <button (click)="findProduct(prod)">

      Find Product</button>
  Product name: {{product.name}}
</div>
```

Component is a unit encapsulating the presentation logic and the auto-generated change detector

Directives



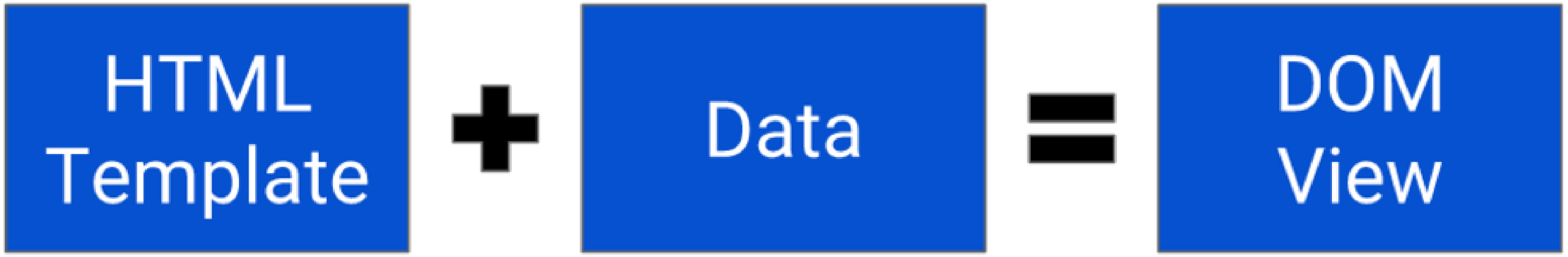
Back

Directives

- Directives are used to create **client-side HTML templates**
  - Adds additional markup to the view (e.g., dynamic content place holders)
  - A directive is just a function which executes when Angular ‘compiler’ encounters it in the DOM
  - Built-in directives start with ***ng** and they cover the core needs

HTML Template

- Template is:
  - Partial HTML file that contains only part of a web page
  - Contains HTML augmented with Angular Directives
  - Rendered in a "parent" view



Common Built-in Directives : ngFor

- **ngFor**: **repeater** directive. It marks <li> element (and its children) as the "repeater template"

```
<li *ngFor="#hero of heroes">
      {{ hero }}
</li>
```

- The **#hero** declares a local variable named hero

Common Built-in Directives : ngIf

- **ngIf**: conditional display of a portion of a view only if certain condition is true

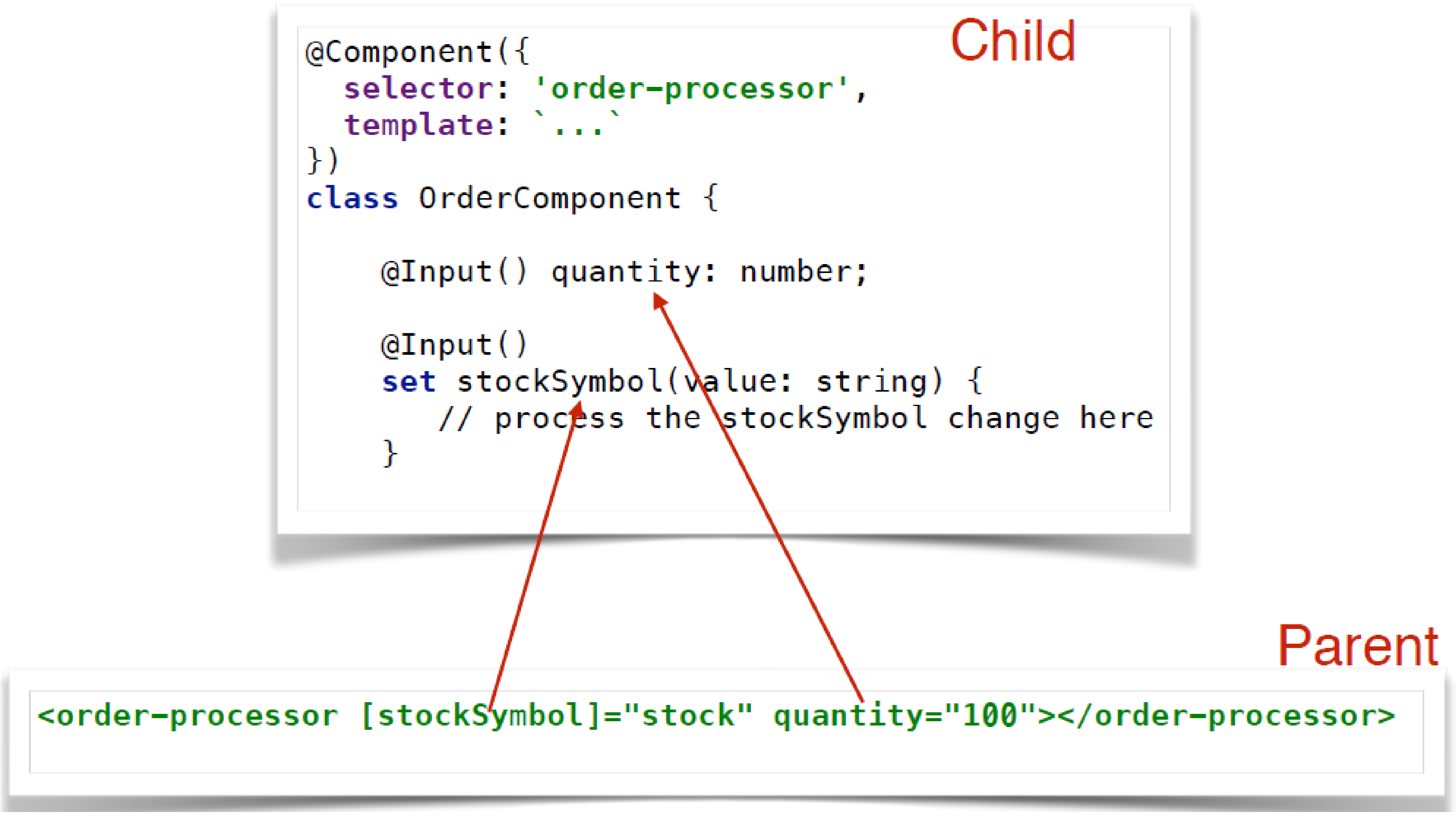
```
<p *ngIf="heroes.length > 3">There are many heroes!</p>
```

- This element will be displayed only if *heroes.length > 3*

Inter-component communications

Back

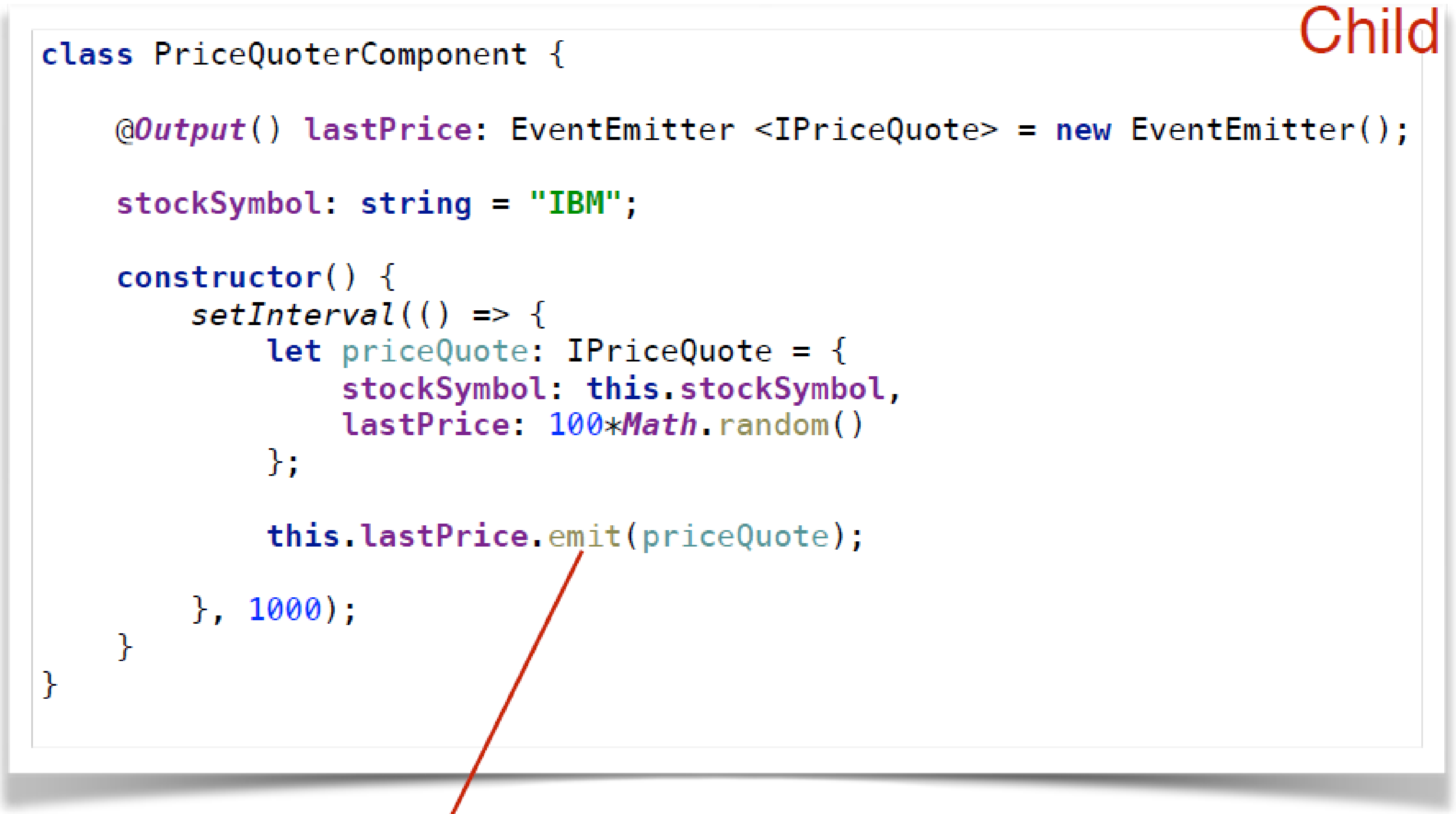
@Input properties



```
@Component({
  selector: 'order-processor',
  template: `...`
})
class OrderComponent {

    @Input() quantity: number;

    @Input()
    set stockSymbol(value: string) {
       // process the stockSymbol change here
    }
```

```
<order-processor [stockSymbol]="stock" quantity="100"></order-processor>
```

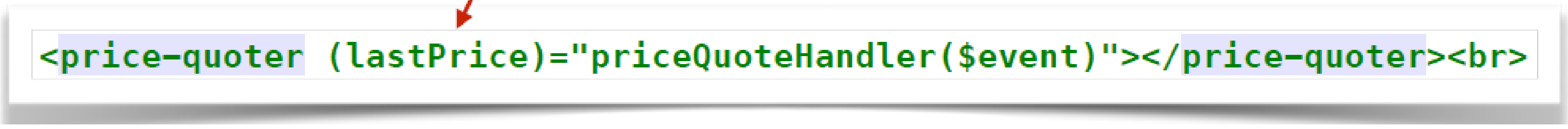
@Output properties



Child

```
class PriceQuoterComponent {

    @Output() lastPrice: EventEmitter <IPriceQuote> = new EventEmitter();

    stockSymbol: string = "IBM";

    constructor() {
        setInterval(() => {
            let priceQuote: IPriceQuote = {
                stockSymbol: this.stockSymbol,
                lastPrice: 100*Math.random()
            };

            this.lastPrice.emit(priceQuote);

        }, 1000);
    }
}
```

Parent

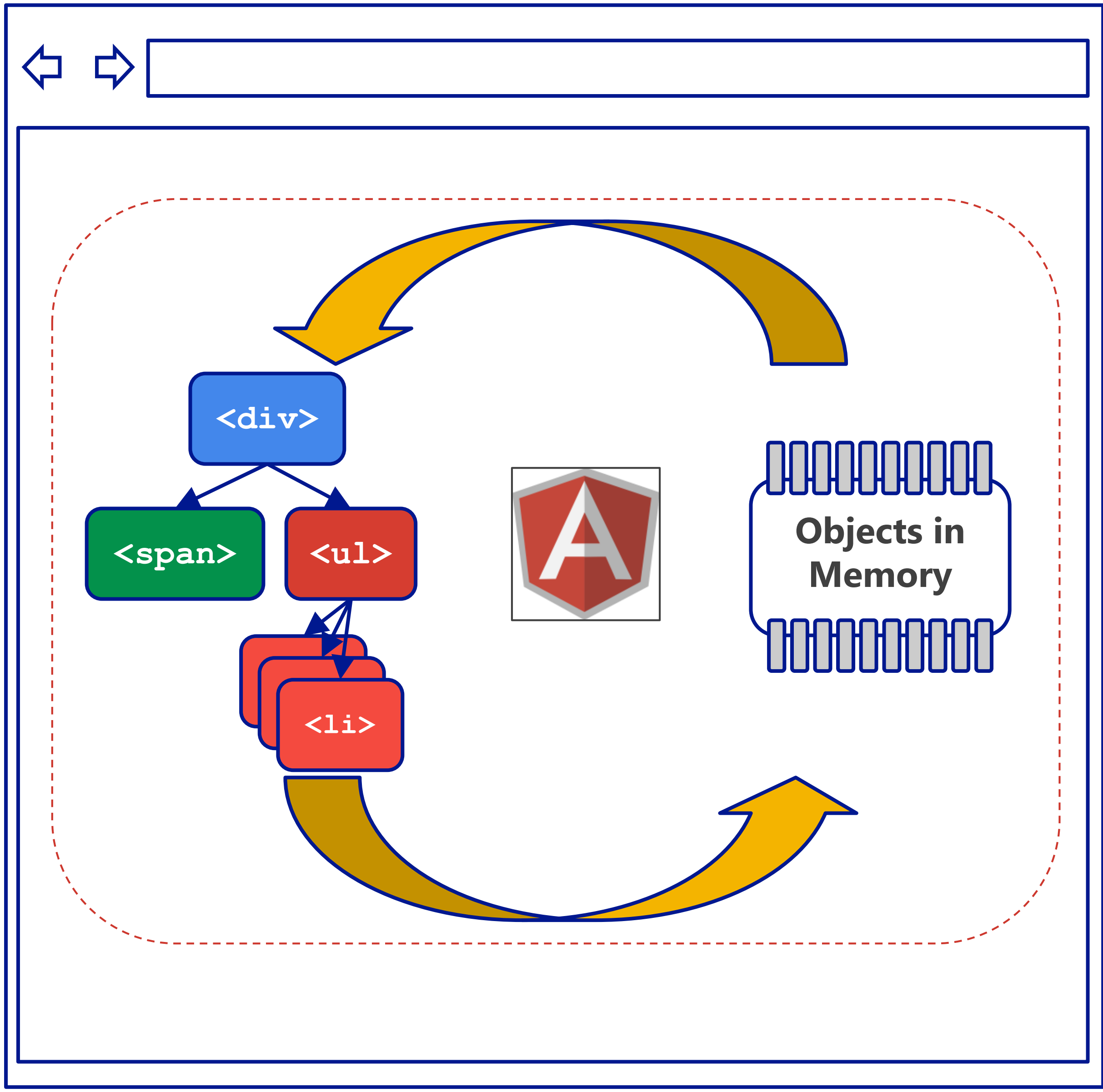


```
<price-quoter (lastPrice)="priceQuoteHandler($event)"></price-quoter><br>
```

Another Example

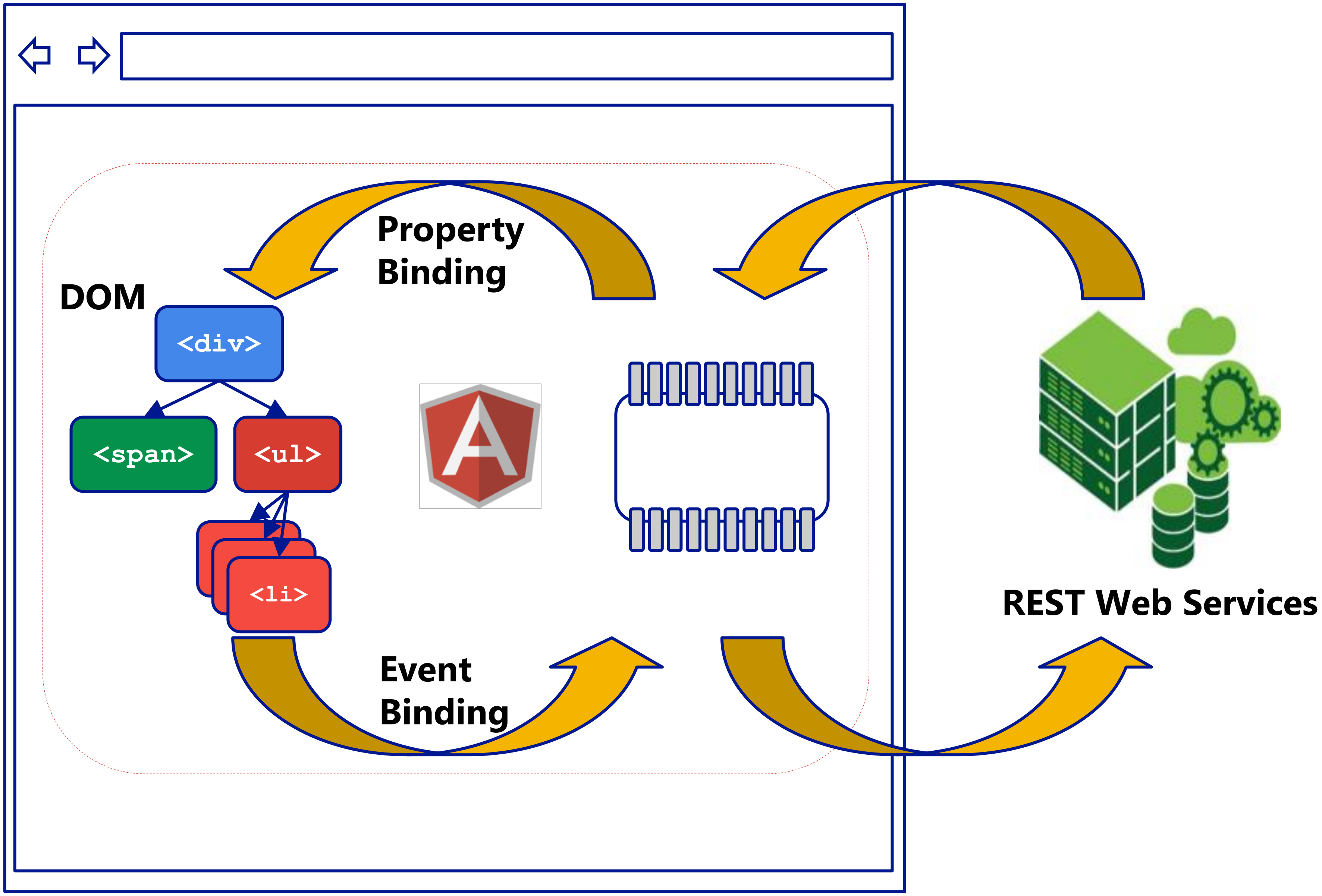
```
import { Component, EventEmitter } from '@angular/core';

@Component({
  selector: 'app-product-list',
  template: `
    <app-product *ngFor="let item of productList"
                 [product]="item">
    </app-product>`
 })

 export class ProductListComponent {

  @Input() productList:string = '';

  @Output() addToCart:EventEmitter<any> =
     new EventEmitter();

}
```

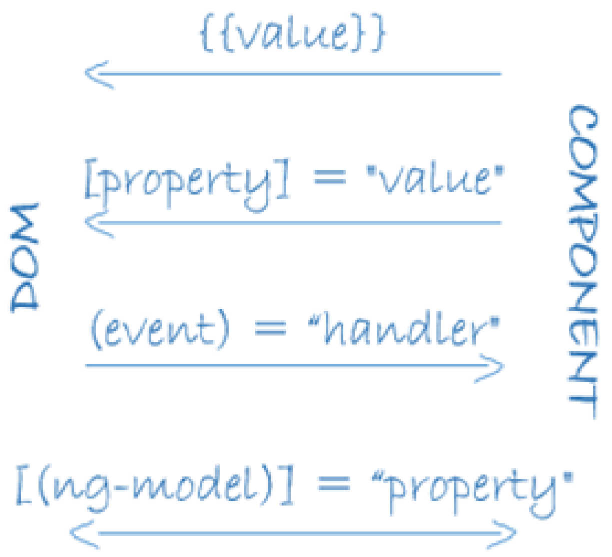
Binding



Back

Binding - big picture



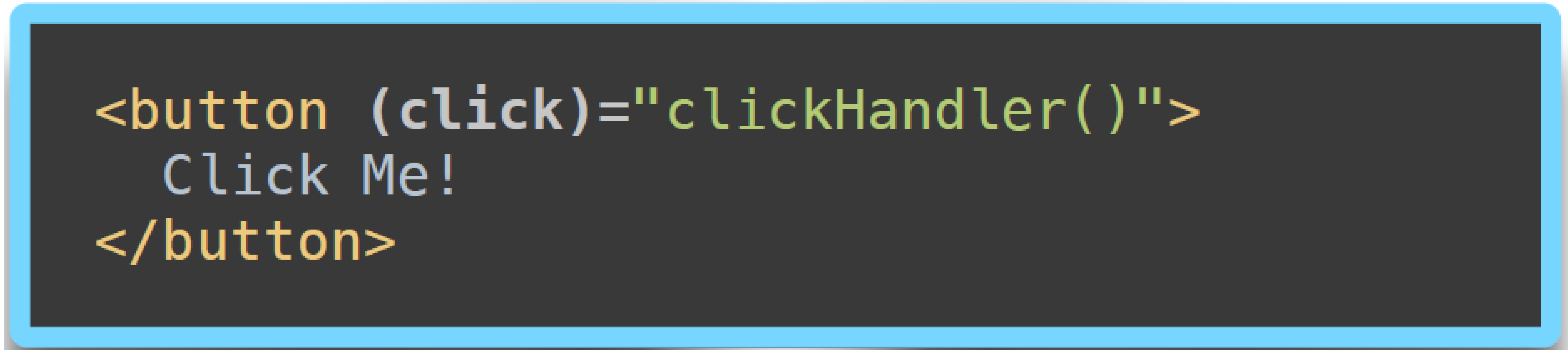


Things you can bind to

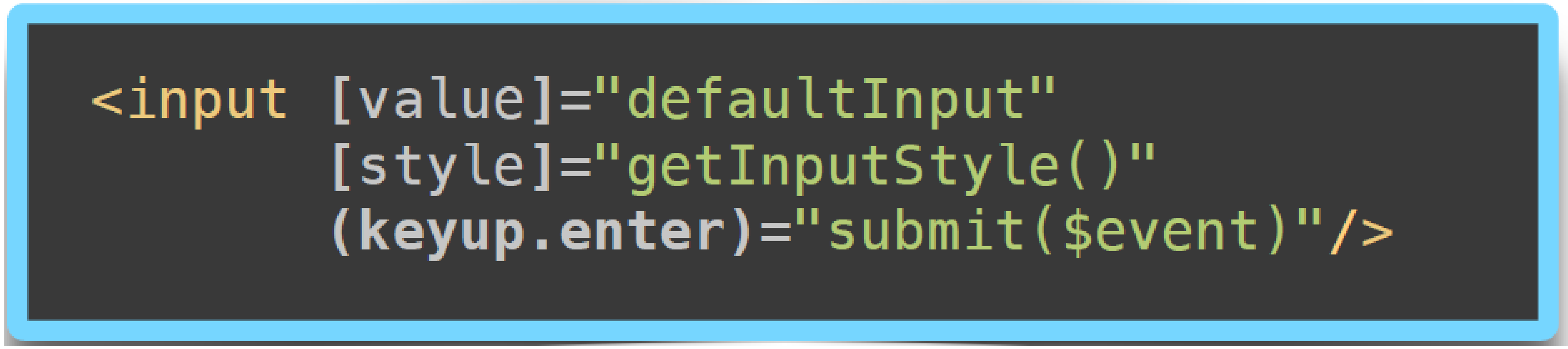
Binding	Example
Properties	<input **[value]**="firstName">
Events	<button **(click)**="buy($event)">
Two-way	<input **[(ngModel)]**="userName">

Data binding associates the Model with the View

Property & Event Binding

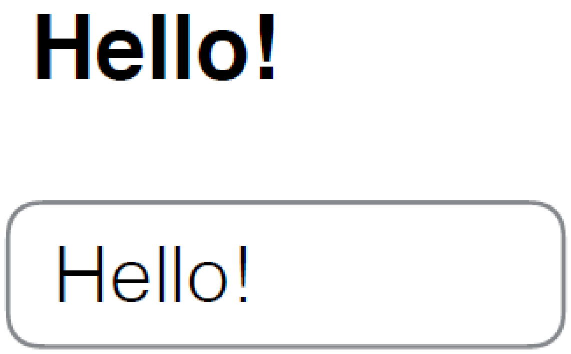


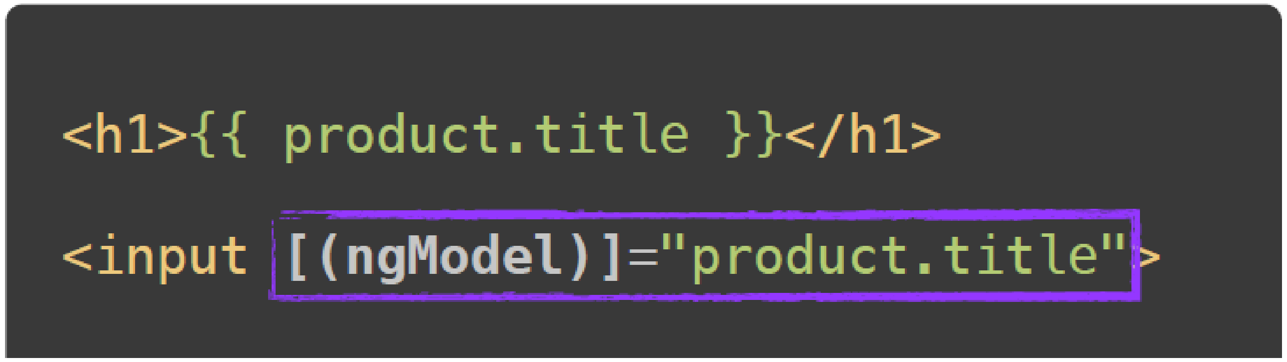
```
<button (click)="clickHandler()">
  Click Me!
</button>
```



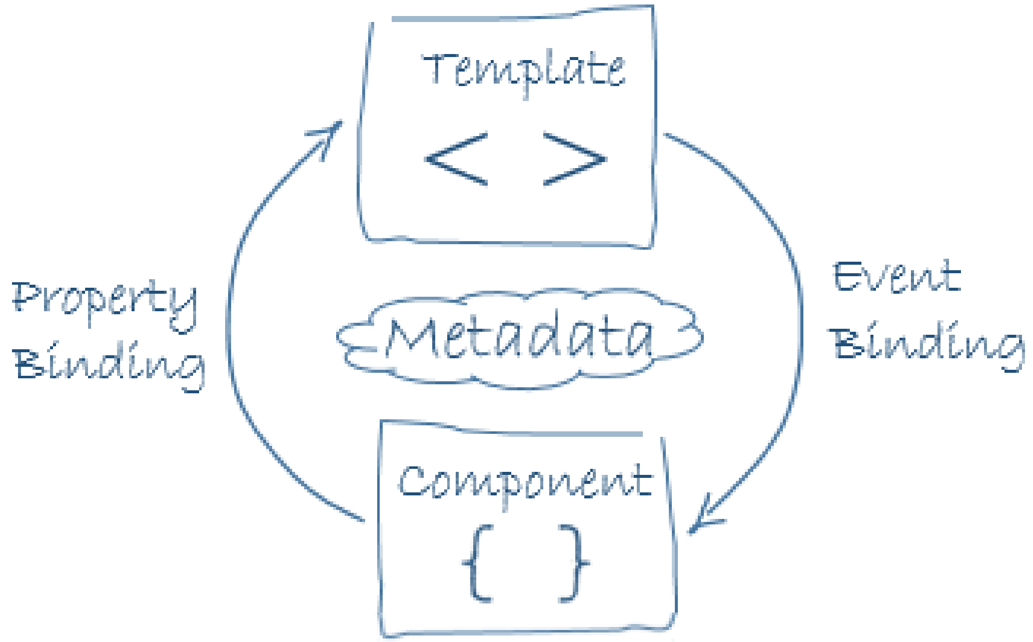
```
<input [value]="defaultInput"
       [style]="getInputStyle()"
       (keyup.enter)="submit($event)"/>
```

Inputs & Outputs - ngModel

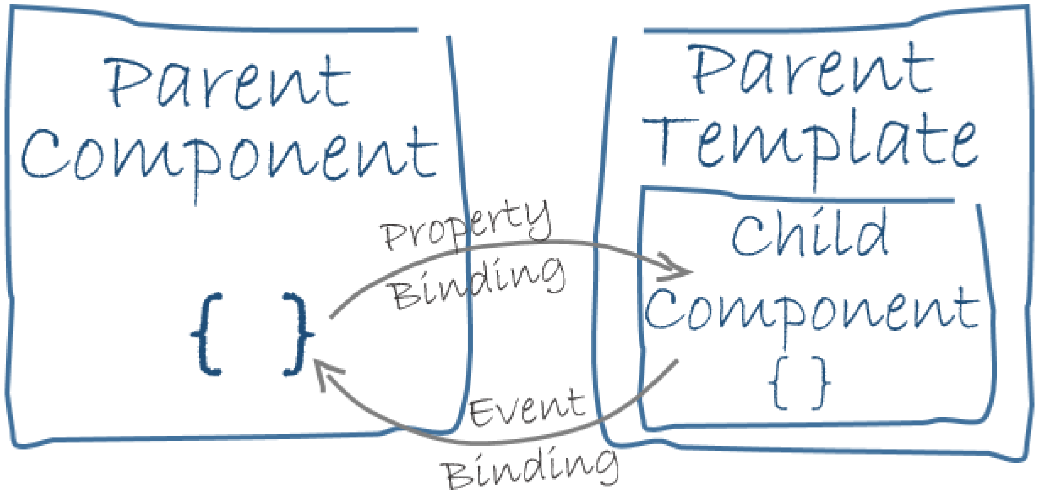




```
<h1>{{ product.title }}</h1>
<input [(ngModel)]="product.title">
```



Communication between a template and its component



Communication between parent and child components

Example

```
<button
        [disabled]="!inputIsValid"
        (click)="authenticate()">
    Login
</button>
```

Calls a function defined in the component class

```
<amazing-chart
        [series]="mySeries"
        (drag)="handleDrag()"/>
```

```
<div *ngFor="#guest of guestList">
  <guest-card [guest]="guest"></guest-card>
</div>
```

Angular Event Binding syntax

- **(eventName) = eventHandler**: respond to the click event by calling the component's onBtnClick method

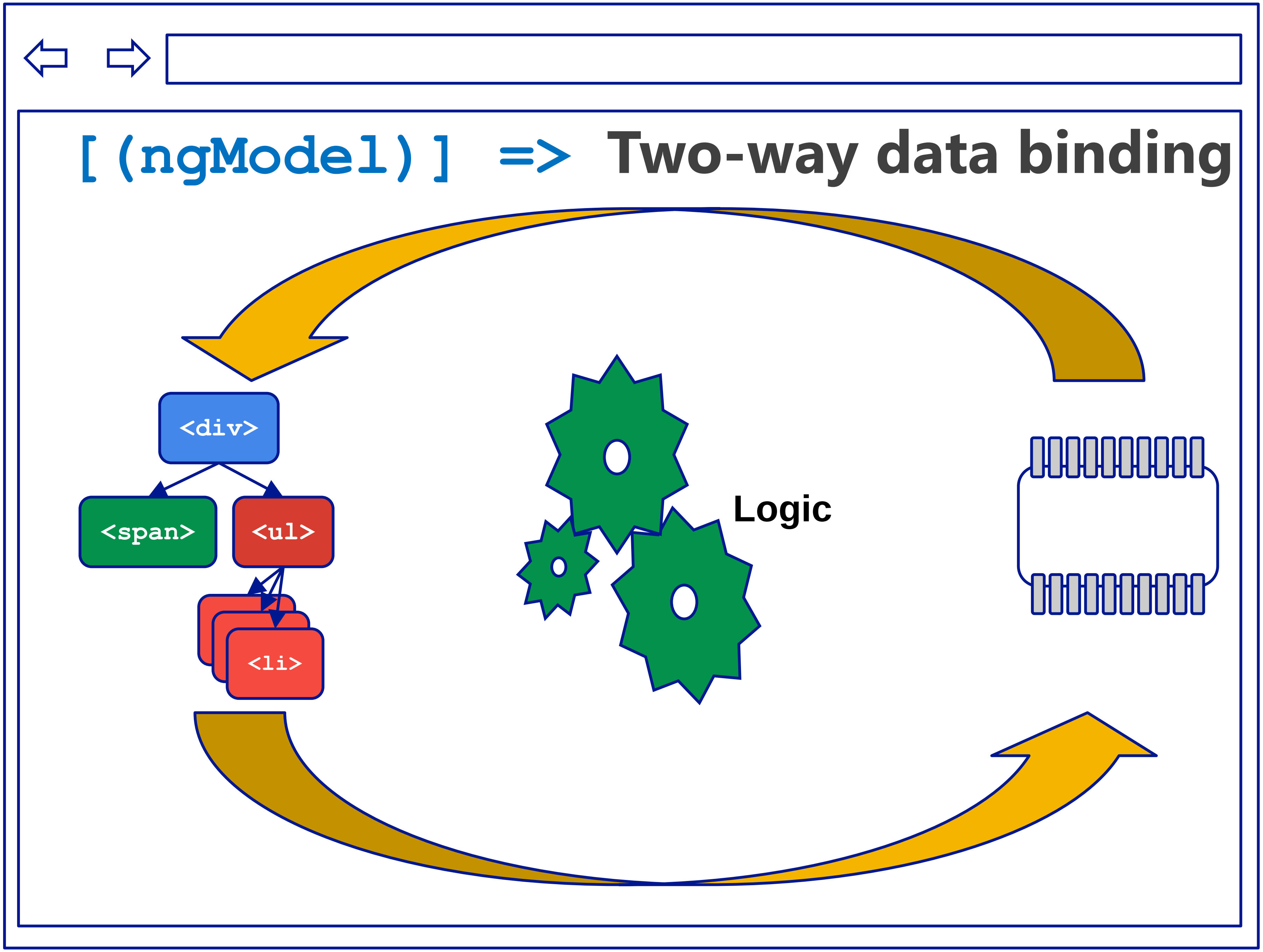
```
<button (click)="onBtnClick()">Click me!</button>
<input (keyup)="onKey($event)">
```

- $event is an optional standard DOM event object. It is value is determined by the source of the event.

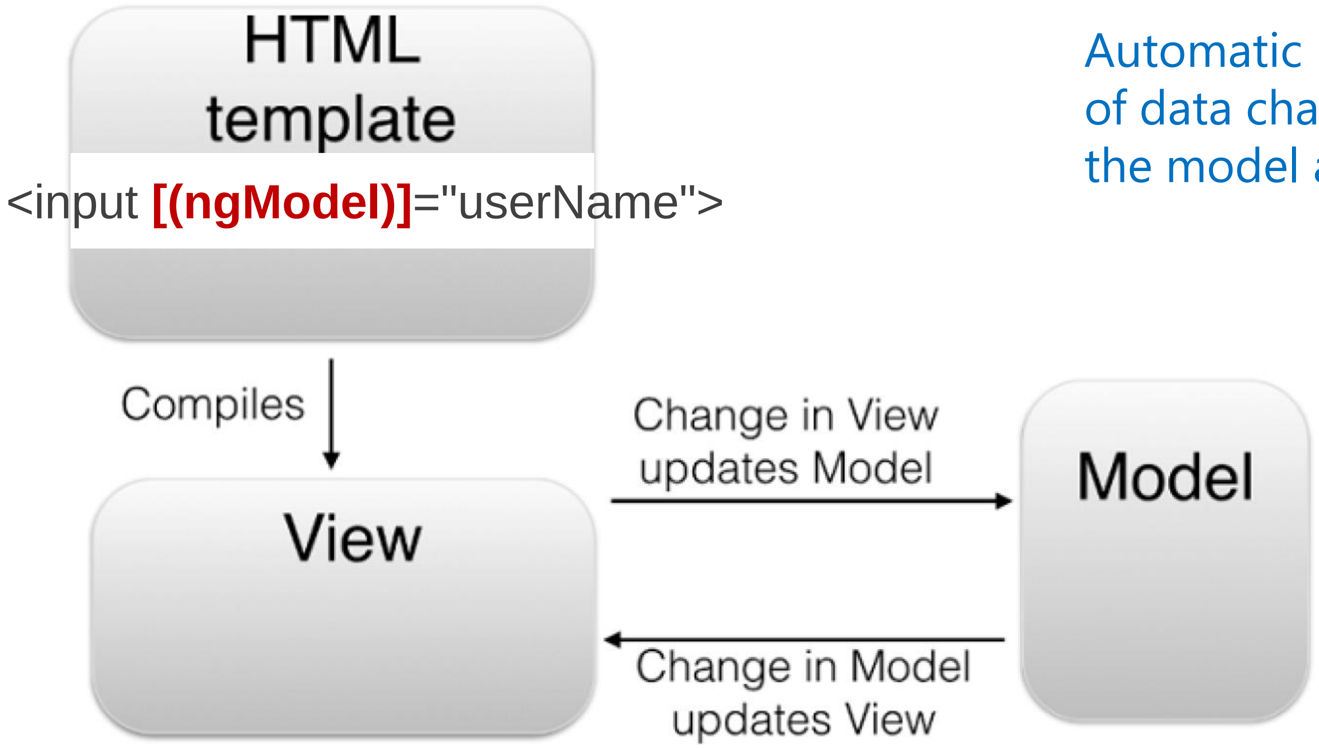
SearchComponent Example

```
@Component({
  selector: 'search-product',
  template:
     `<form>
        <div>
          <input id="prodToFind" #prod>
          <button (click)="findProduct(prod)">Find Product</button>
          Product name: {{product.name}}
        </div>
      </form>
    `
})
class SearchComponent {
   product: Product;

   findProduct(product){
    // Implementation of the click handler goes here
   }
}
```

[(ngModel)] => Two-way data binding



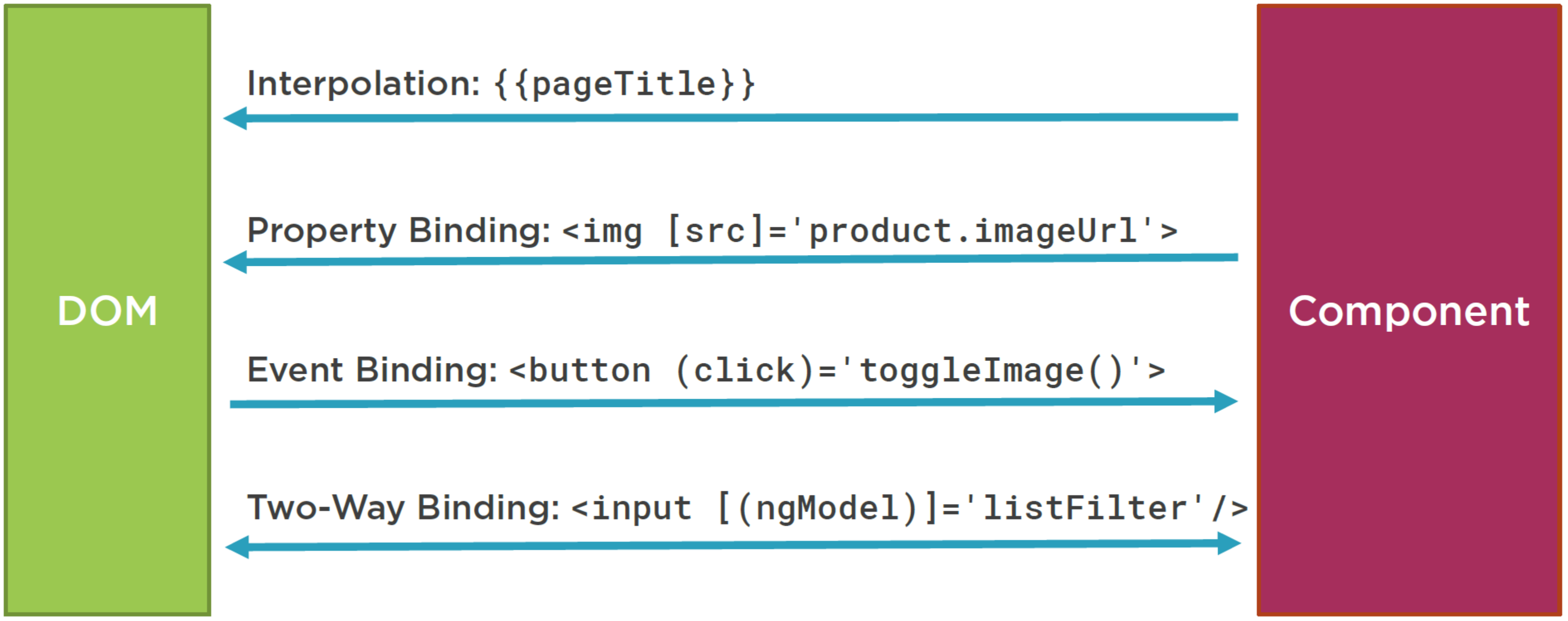
Two-way binding


HTML template
<input [(ngModel)]="userName">
Compiles
View
Change in View updates Model
Model
Change in Model updates View

Automatic propagation of data changes between the model and the view

ngModel will display the userName in a view and it will automatically update it in case it changes in the model. If the user modifies the userName on the view then the changes are propagated to the model. Such a **two-directional** updates mechanism is called two-way data binding

Data Binding Summary



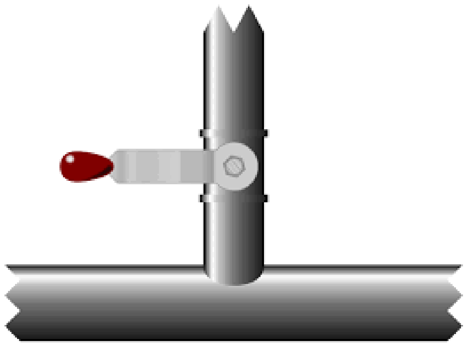
Interpolation: `{{pageTitle}}`

Property Binding: `<img [src]='product.imageUrl'>`

Event Binding: `<button (click)='toggleImage()'>`

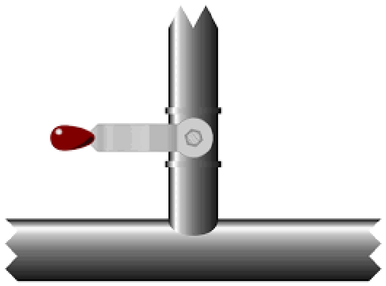
Two-Way Binding: `<input [(ngModel)]='listFilter'/>`

Pipes



Back

Pipes



- Pipes are declarative way to
  - Format / transform displayed data
  - Can create custom pipes to **filter** and **sort** data arrays
- Using pipes

```
{{ expression | pipe }}
```

- Built-in pipes
  - uppercase, lowercase
  - date
  - decimal
  - number, currency, percent
  - json , async

Example built-in pipe

```
<span>
  Today’s date is {{today | date}}
</span>
```

Today’s Date is May 1, 2017

```
<p>
   My birthday is {{ birthday | date:"dd/MM/yyyy" | uppercase }}
</p>
```

Custom pipe

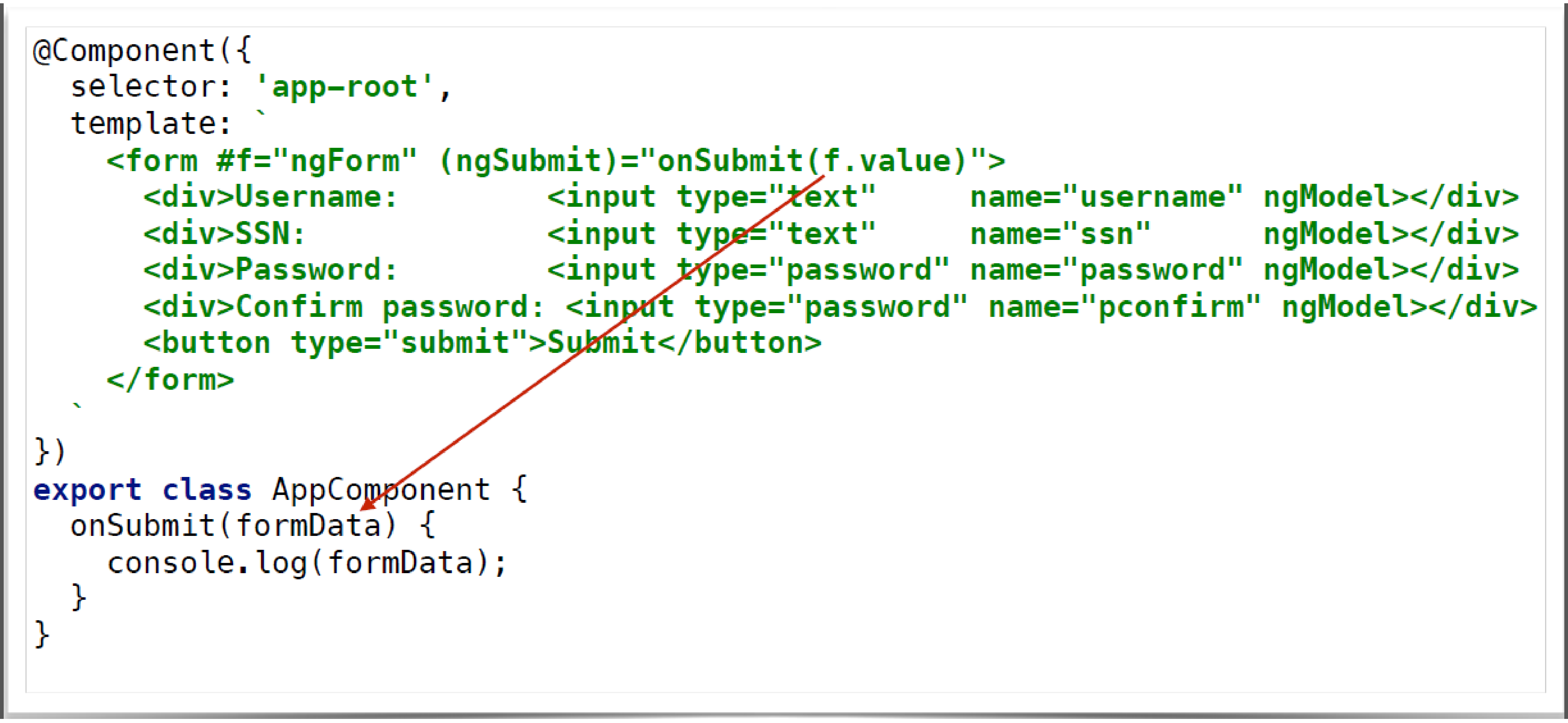
```
import { Pipe, PipeTransform } from '@angular/core';
@Pipe({ name: 'double'  })
class DoublePipe implements PipeTransform {
  transform(value, args) { return value * 2; }
}


@Component({
  template: '{{ 10 | double}}'
})
class CustomComponent {}
```

Forms

- Template-driven forms
- Reactive forms
- Form validation

< Back

A template-driven form



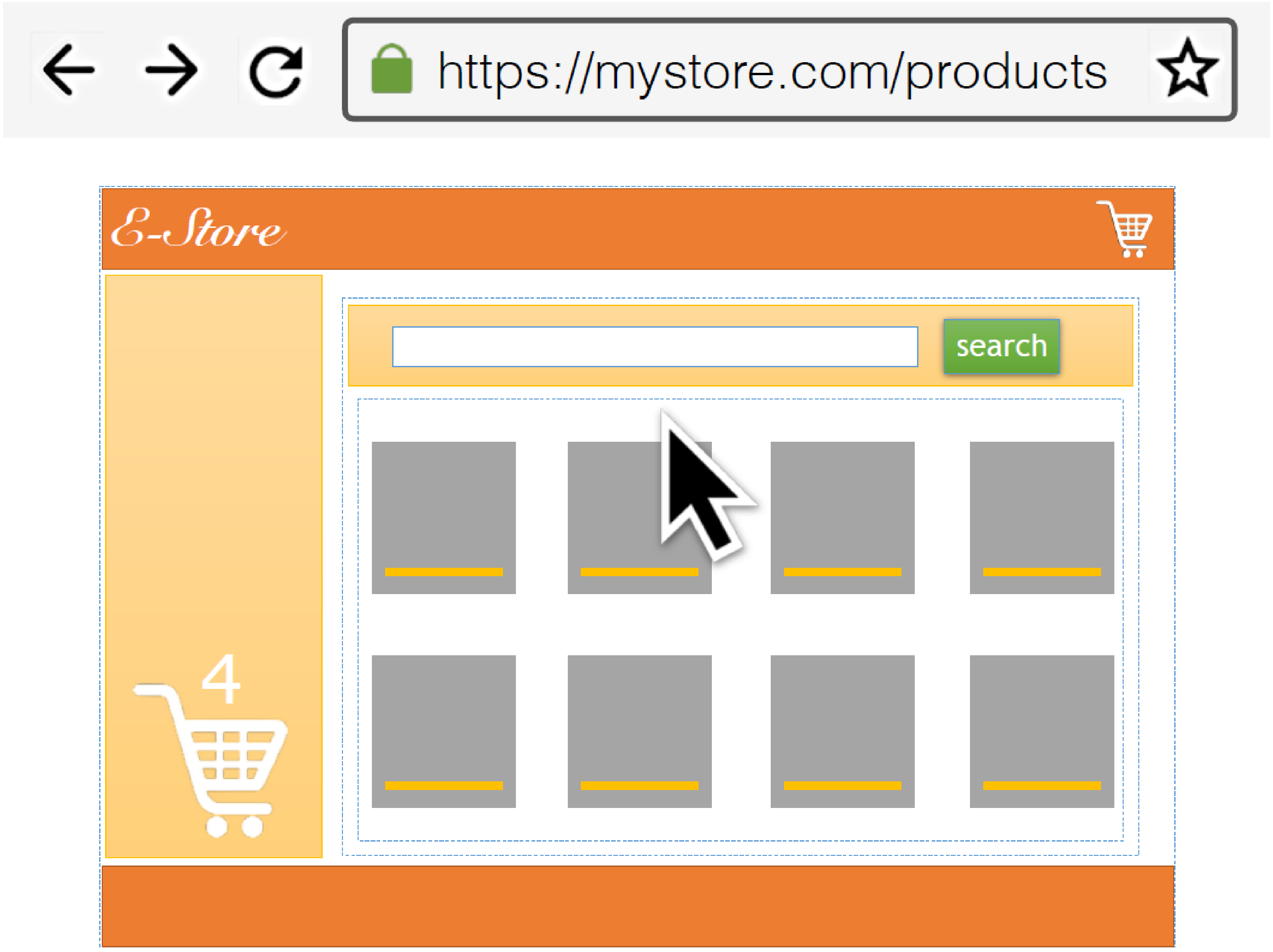
```
@Component({
  selector: 'app-root',
  template: `
    <form #f="ngForm" (ngSubmit)="onSubmit(f.value)">
      <div>Username:         <input type="text"     name="username" ngModel></div>
      <div>SSN:              <input type="text"     name="ssn"      ngModel></div>
      <div>Password:         <input type="password" name="password" ngModel></div>
      <div>Confirm password: <input type="password" name="pconfirm" ngModel></div>
      <button type="submit">Submit</button>
    </form>
  `
})
export class AppComponent {
  onSubmit(formData) {
    console.log(formData);
  }
}
```

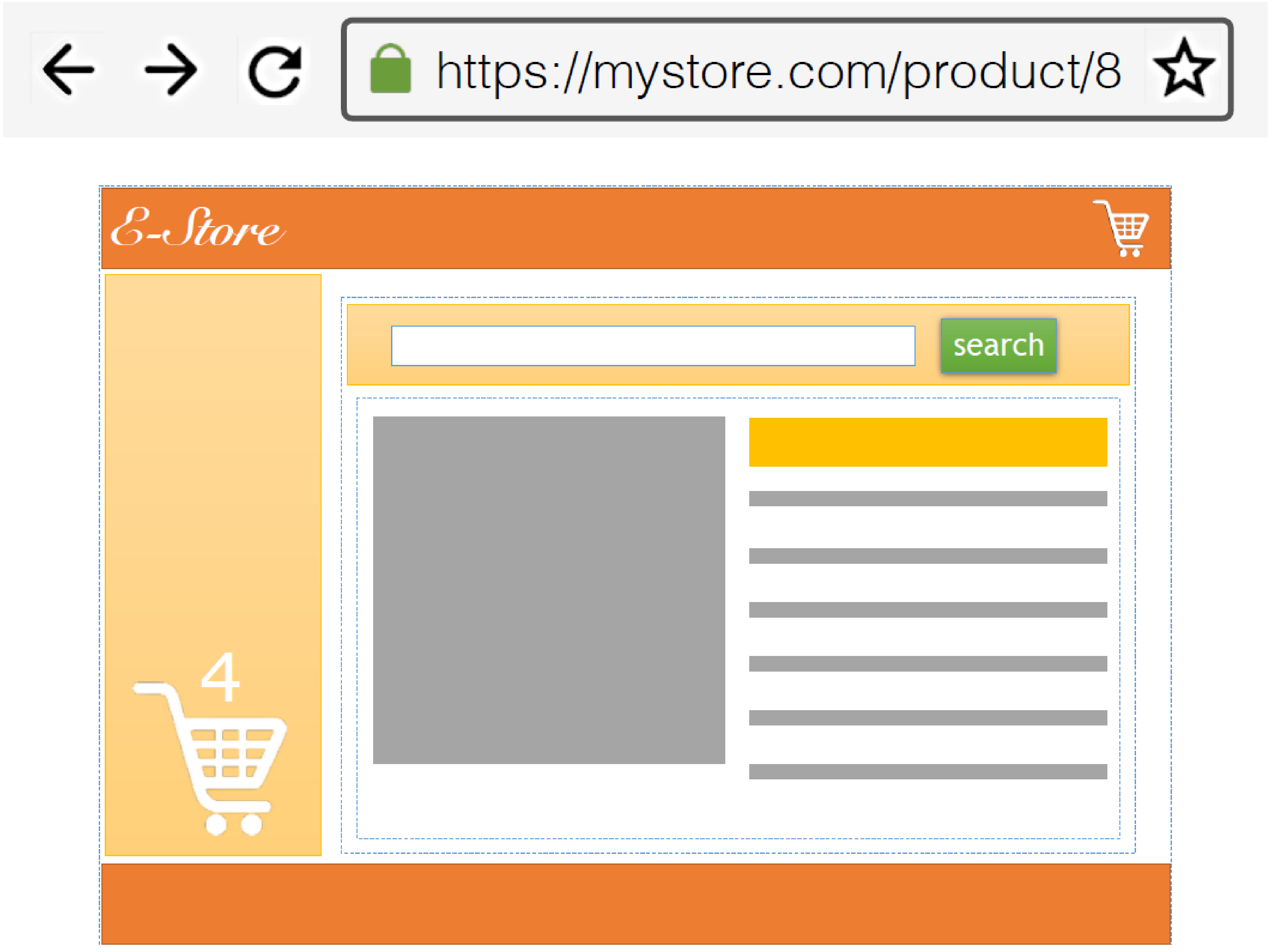
Form Validation

- Default validation
  - Required – makes property required
  - ngPattern – regex pattern
  - Form Properties – valid / invalid
  - CSS Classes – classes can be styled

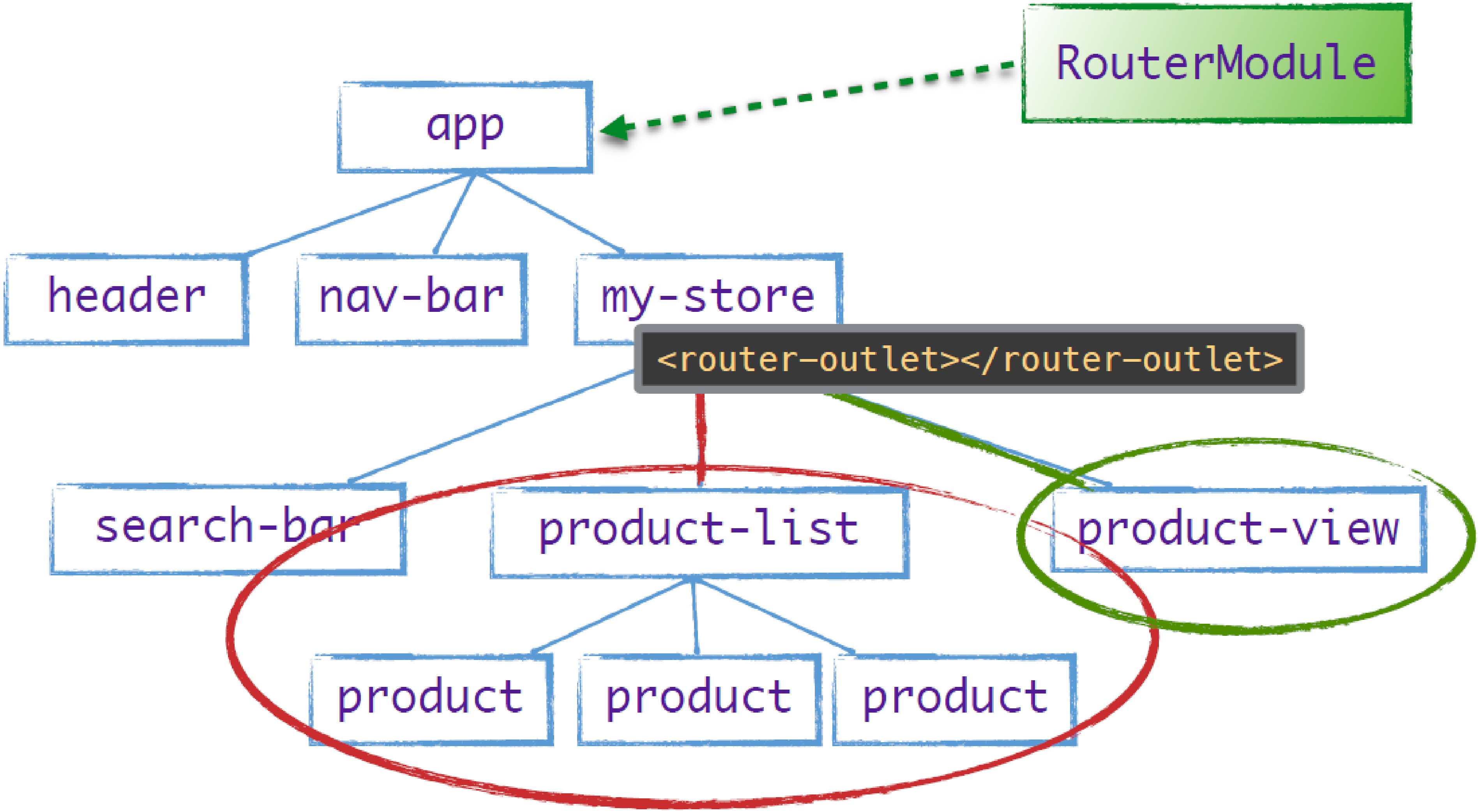
Routing and views

Back


https://mystore.com/products
E-Store
search
4


https://mystore.com/product/8
E-Store
search
4

Routing


RouterModule
app
header
nav-bar
my-store
<router-outlet></router-outlet>
search-bar
product-list
product-view
product
product
product

Routes

- Implement client-side navigation for SPA:
  - Configure routes, map them to the corresponding components in a declarative way.
- Defines the app navigation in **RouteModule**

  - On URL change => load a particular component

Angular Router

- **RouterOutlet** – a directive that serves as a placeholder within your Web page where the router should render the component
- **RouteModule (part of @NgModule)** – to map URLs to components to be rendered inside the *<router-outlet></router-outlet>* area
- **RouteParams** – a service for passing parameter to a component rendered by the router
- **RouterLink** – a directive to declare a link to a view and may contain optional parameters to be passed to the component

Router Programming Steps (1 of 2)

1. Configure the router on the root component level to map the URL fragments to the corresponding named components

- If some of the components expect to receive input values, you can use route **params**

- Needs

```
import { RouterModule } from '@angular/router';
```

```
RouterModule.forRoot([
  { path: '/', component: AppComponent },
  { path: '/hero/:id', component: HeroFormComponent }
])
```

Router Programming Steps (2 of 2)

2. Add **<router-outlet></router-outlet>** to the view to specify where the router will render the component

3. Add the HTML anchor tags with **[routerLink]** attribute, so when the user clicks on the link the router will render the corresponding component.

- Think of **[routerLink]** as href attribute of anchor tag

```
<a [routerLink]="['/']">Home</a>
<a [routerLink]="['/hero', {id: 1234}]">
Hero</a>
<router-outlet></router-outlet>
```

Route Parameters

- Route parameters start with ":"

```
RouterModule.forRoot([
    { path: '/product/:id', component: ProductDetailComponent  }
])
```

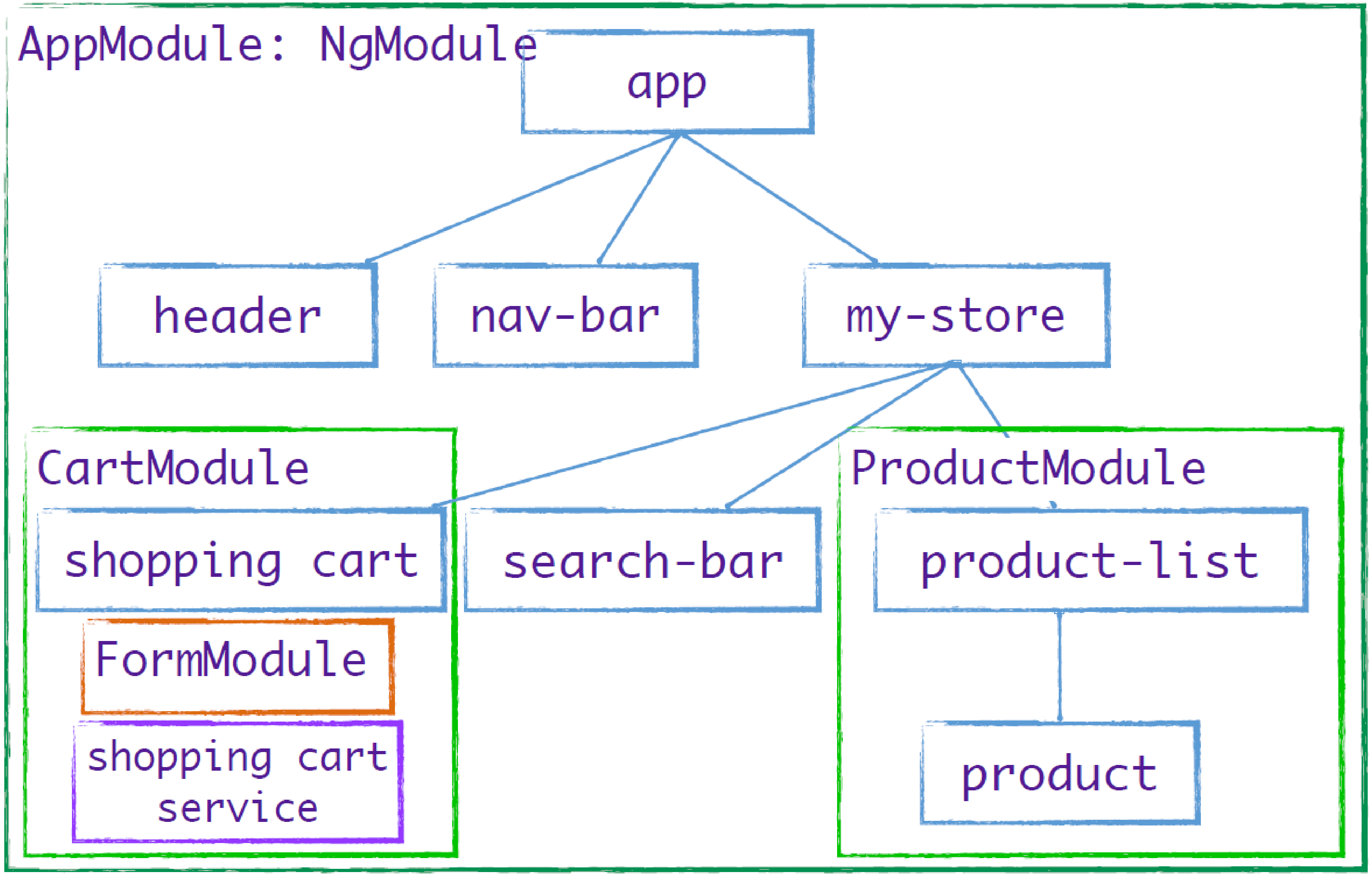
- You can use them later in ViewModel constructor

```
export class ProductDetailComponent {
    productID:string;

    constructor(params : RouteParams) {
        this.productID = params.get('id');
    }
}
```

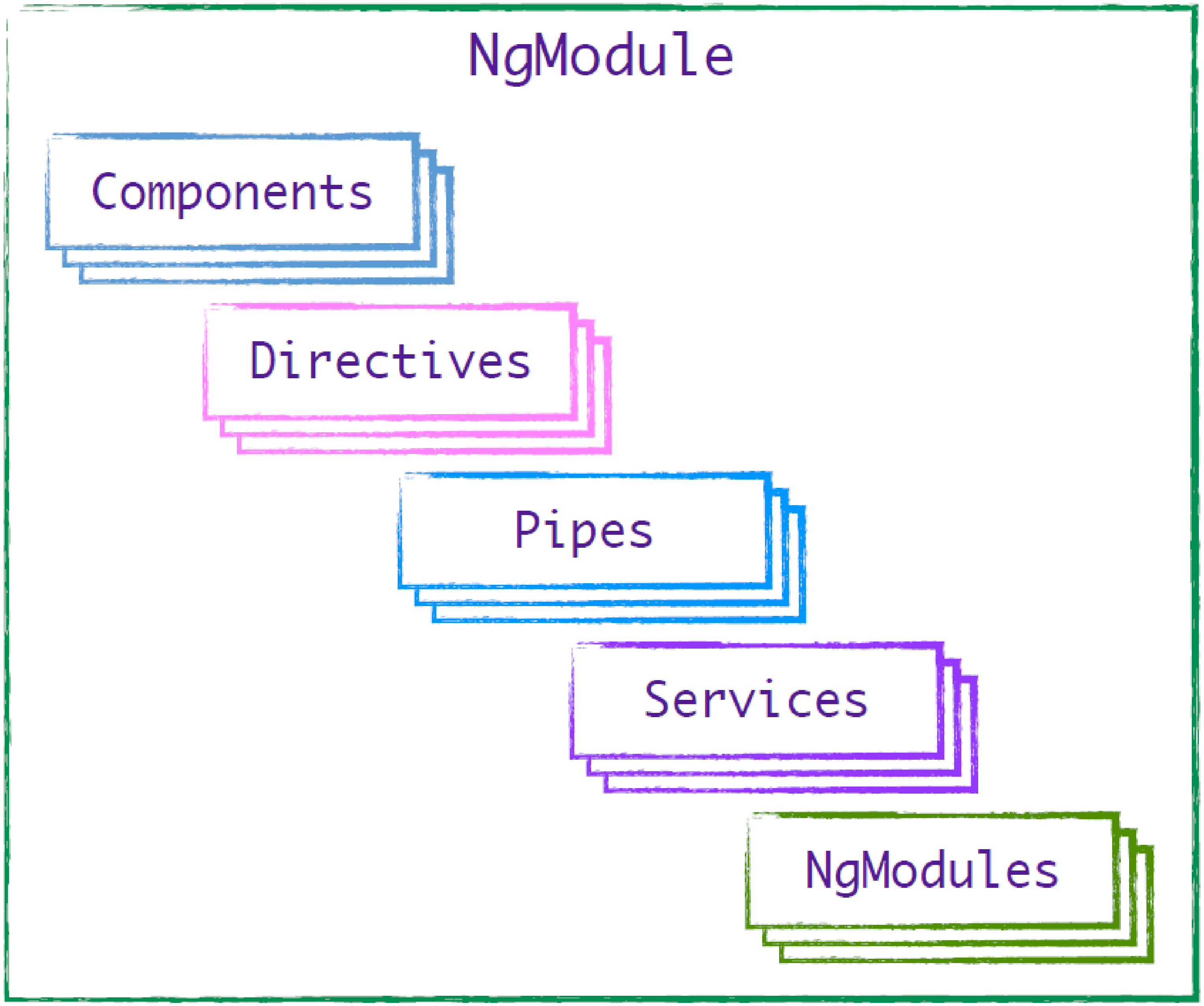
Angular Modules

Help organize an application into cohesive blocks of functionality

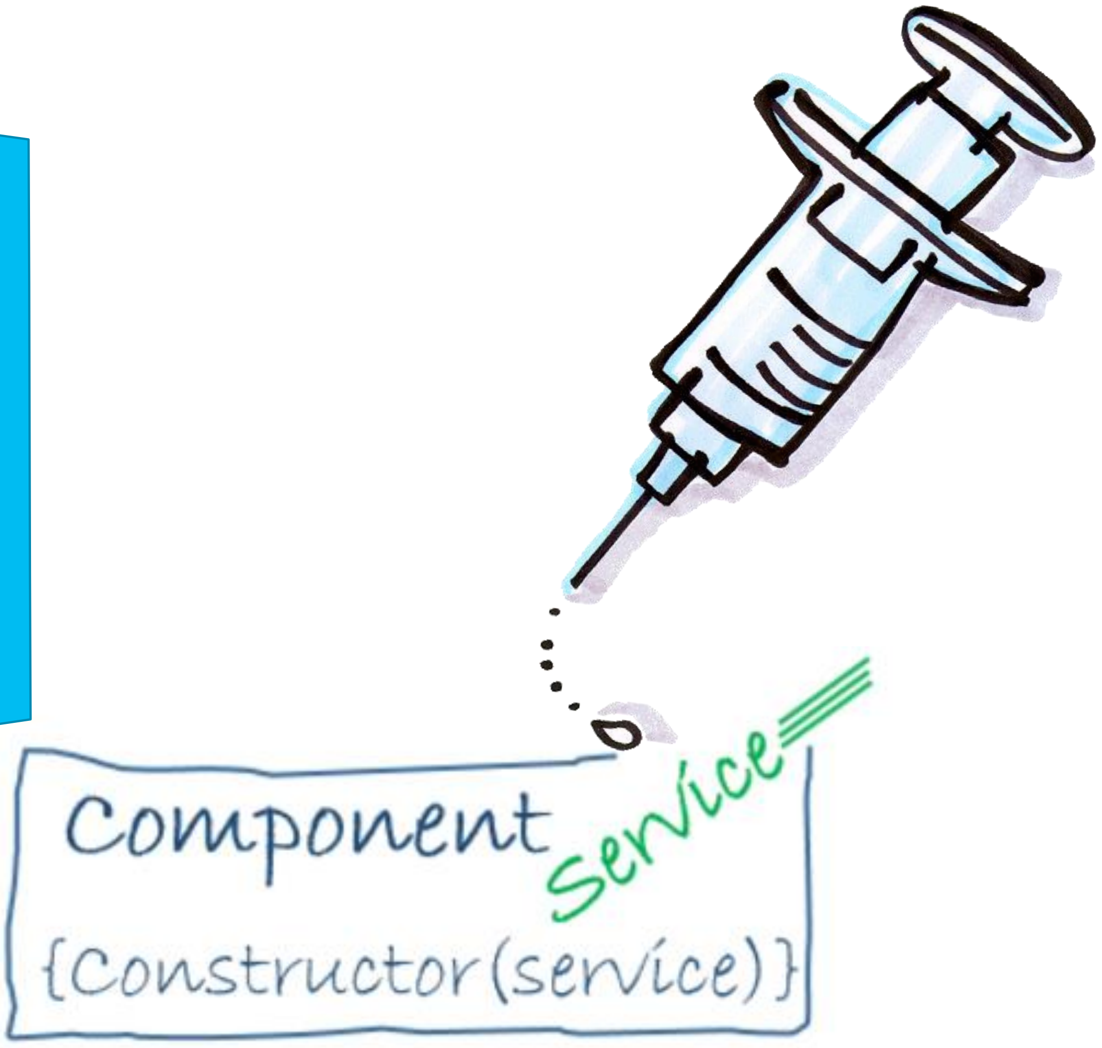
Component Tree



Angular Module



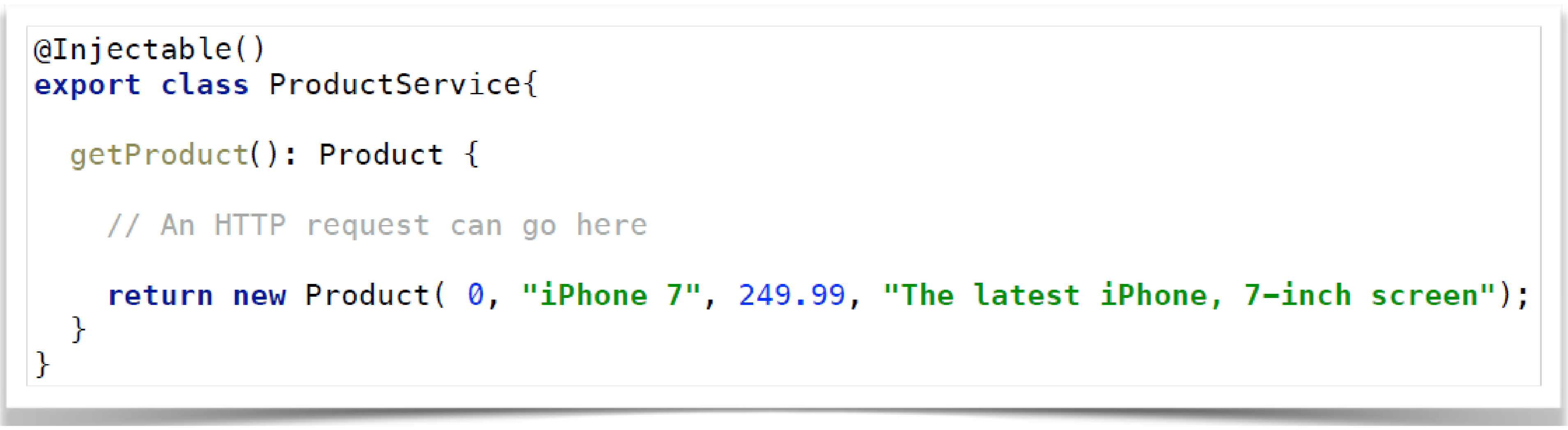
Dependency Injection



Back

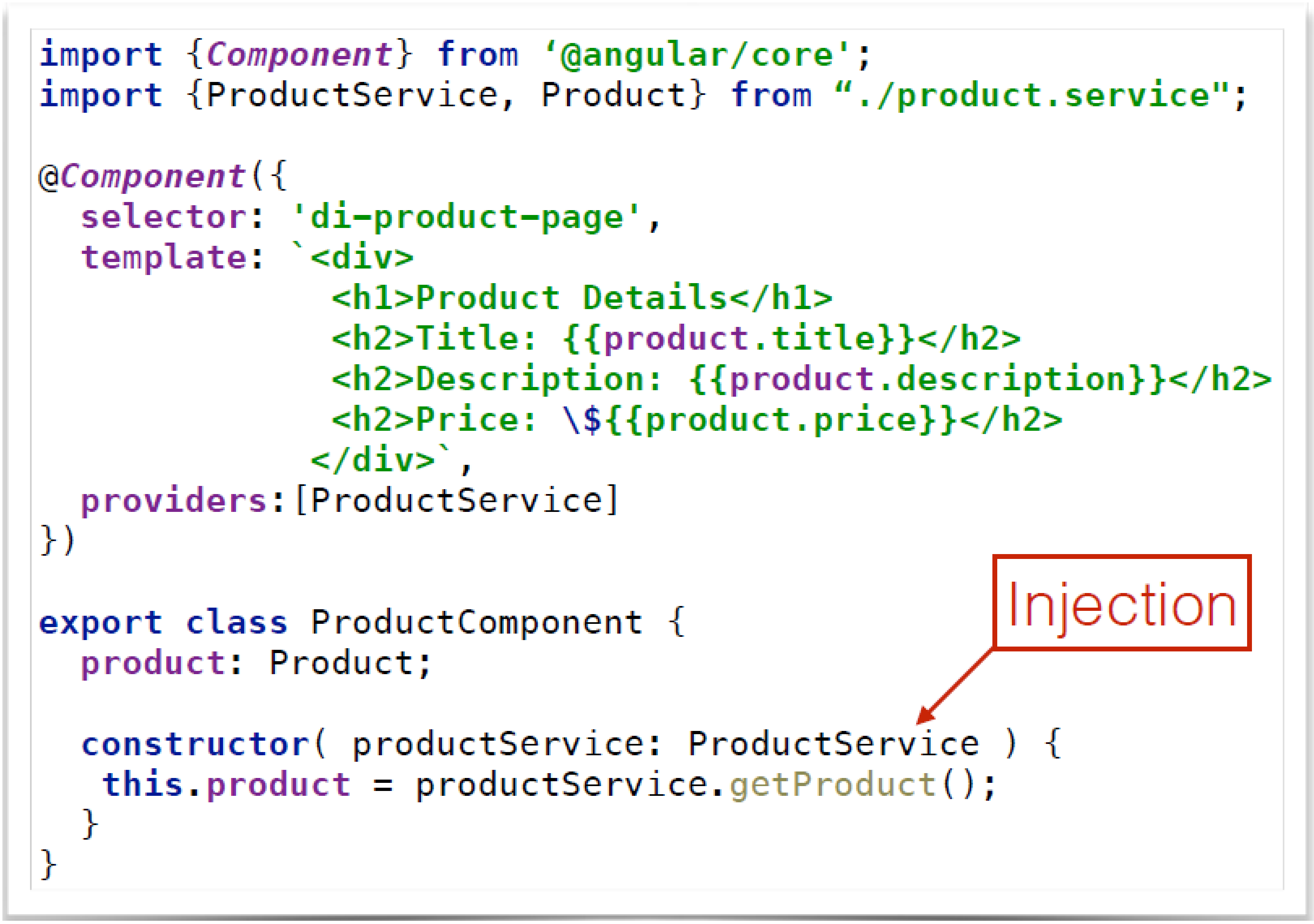
Dependency Injection

- An Angular Service is a JavaScript class than can be injected and made available to the entire application or to a particular component
- Angular injects **services** into components via constructors



```
@Injectable()
export class ProductService{

  getProduct(): Product {

    // An HTTP request can go here

    return new Product( 0, "iPhone 7", 249.99, "The latest iPhone, 7-inch screen");
  }
}
```

Injecting the ProductService



```
import {Component} from '@angular/core';
import {ProductService, Product} from "./product.service";

@Component({
  selector: 'di-product-page',
  template: `<div>
              <h1>Product Details</h1>
              <h2>Title: {{product.title}}</h2>
              <h2>Description: {{product.description}}</h2>
              <h2>Price: \${{product.price}}</h2>
             </div>`,
  providers:[ProductService]
})

export class ProductComponent {
  product: Product;

  constructor( productService: ProductService ) {
   this.product = productService.getProduct();
  }
}
```

Dependency Injection

- Dependency Injection is a design pattern that inverts the way of creating objects your code depends on

- Dependency Injection is a way to supply a instance of a class to a component

- Instead of explicitly creating object instances (e.g. with new) the framework will create and inject them into your code (i.e.,)
- Angular comes with a dependency injection module
- You can inject dependencies into the component only via its constructor

Dependency Injection

```
@Component({
  selector: 'search-product',
  viewProvider: [ProductService],
  template:[<div>...<div>]
})
class SearchComponent {
  products: Array<Product> = [];

  constructor(productService: ProductService) {
    this.products = this.productService.getProducts();
  }
}
```

- Inject the **ProductService** object into the **SearchComponent** by declaring it as a constructor argument
- Angular will instantiate the ProductService and provide its reference to the SearchComponent.

Reactive Programming With Observables

Observable Analogy

Observable is analogous to subscribing to a news paper

- When calling subscribe:
  - You give the address of your letter box (the observer)
  - You get a way to cancel the subscription in the future
  - Asynchronous nature! You're not blocked till the next newspaper arrives
- The observer is the letter box:
  - OnNext happens when the postman drops the newsletter in it
  - OnError happens when someone breaks your letter box or the postman drops dead
  - OnCompleted happens when the newspaper publisher goes bankrupt

Reactive Programming is based on Observables

- Reactive programming is a programming paradigm oriented around data flows and the **propagation of change**
- **A data stream that can be observed**
- What's an Observable?
    - Is a **function** like a Promise… but for many values
    - Like an array… but async
      = Asynchronous Data Streams
    - It allows processing Asynchronous Data Streams with **operators**

=> Results in Cleaner + maintainable

Both Promises and Observables are built to solve problems around async

(to avoid "callback hell" when doing DOM events handling, Animations, AJAX and WebSockets)

Promise vs. Observable

- Read-only view to a single future value
- Has success and error semantics via .then()
- Not lazy. By the time you have a promise, it’s on its way to being resolved.
- Immutable and uncancellable. Your promise will resolve or reject, and only once.

- “Streams” or sets of any number of things over any amount of time
- Has next, error, complete semantics
- Lazy. Observables will not generate values via an underlying producer until they’re **subscribed** to.
- Cancellable - Can be “**unsubscribed**” from. This means the underlying producer can be told to stop and even tear down

Observable: Like a Promise of Many Values

- **Promise:**

```
httpRequest.then(success, error);
```

- **Oberverable:**

```
socketMessages
  .subscribe(next, error, complete);
```

```
e.g:
socketMessages
  .subscribe(
    (msg) => console.log(msg),
    (err) => console.error(err),
    () => console.log(‘completed!’)
  );
```

Quick Recap

Observable - like an array, but async
= a set of <u>any</u> number of things over <u>any</u> amount of time
= Asynchronous Data Streams

- Values are pushed to the nextHandler
- The errorHandler is called if the producer experiences an error
- The completionHandler is called when the producer completes successfully
- Observables are lazy. It doesn't start producing data until **subscribe()** is called.
- **`subscribe()`** returns a subscription, on which a consumer can call **`unsubscribe()`** to cancel the subscription and tear down the producer

```
let sub = observable.subscribe(nextHandler, errorHandler,
completionHandler);
```

```
sub.unsubscribe();
```

Map/Filter/ConcatAll can be applied to observables similar to the way done of arrays

```
> [1, 2, 3].map(x => x + 1)
> [2, 3, 4]


> [1, 2, 3].filter(x => x > 1)
> [2, 3]


> [ [1], [2, 3], [], [4] ].concatAll()
> [1, 2, 3, 4]
> █
```

Observable Operators

- Operators are methods on Observable that allow you to compose new observables (e.g., map, filter, concat, merge, … etc.)
- See operators animation @ http://rxmarbles.com/

```
let taks = socketMessages
   .map(msg => msg.body)
   .filter(body => body === ‘tak!’);
taks.subscribe(msg => console.log(msg));
```

- //later – observables are cancellable

```
takSubscriber.unsubscribe();
```

Observables will be part of ES2016 Standard

github.com/zenparsing/es-observable

For Now Angular uses RxJS (Reactive Extensions for JS)

Angular Form Controls can be watched using Observables

Substribing to Textbox Value Changes

Template

```
<input
  type="text"
      #symbol
      [ngForm-control]="searchText"
      placeholder="ticker symbol">
```

Component

```
export class TypeAhead {
       searchText = new Control();
       constructor() {

    this.searchText.valueChanges
        .subscribe(...);
       }
}
```

```
this.searchText.valueChanges
     .debounceTime(200)
     .subscribe(...);
```

TickerSearcher usin Angular Http

```
class Searcher {
  constructor(private http: Http){}
  get(val:string):Observable<any[]> {
      return this.http
         .get(`/stocks?symbol=${val}`)
         .map(res => res.json());
    }
}
```

```
this.searchText.valueChanges
     .debounceTime(200)
  .switchMap(text => searcher.get(val))
     .subscribe(tickers => {
    this.tickers = tickers;
  });
```

```
<li *ngFor="#tick of tickers">
  {{ticker.symbol}}
</li>
```

```
this.tickers =
 this.searchText.valueChanges
     .debounceTime(200)
   .switchMap(text => searcher.get(val))
```

```
<li *ngFor="#tick of tickers | async">
  {{ticker.symbol}}
</li>
```

Classical Style Typeahead (Component - 26 LOC)

```
export class TypeAhead {
           searchText: string;
           searchTimeout: any;
           currentRequest: any;
           constructor() {}
           doSearch(text){
             var searchText = this.searchText;
             this.currentRequest = null;
             this.currentRequest = fetch(`server?symbol=${this.searchText}`)
             this.currentRequest
               .then(res => res.json())
               .then(tickers => {
                 if (this.searchText === searchText) {
                   this.tickers = tickers;
                 }
               });
           }

           searchChanged(){
             if(typeof this.searchTimeout !== 'number'){
               clearTimeout(this.searchTimeout);
               this.searchTimeout = null;
             }
             this.searchTimeout = setTimeout(() => {
               this.doSearch(this.searchText);
               this.searchTimeout = null;
             }, 500);
           }
         }
```

Reactive Style Typeahead (Component - 11 LOC)

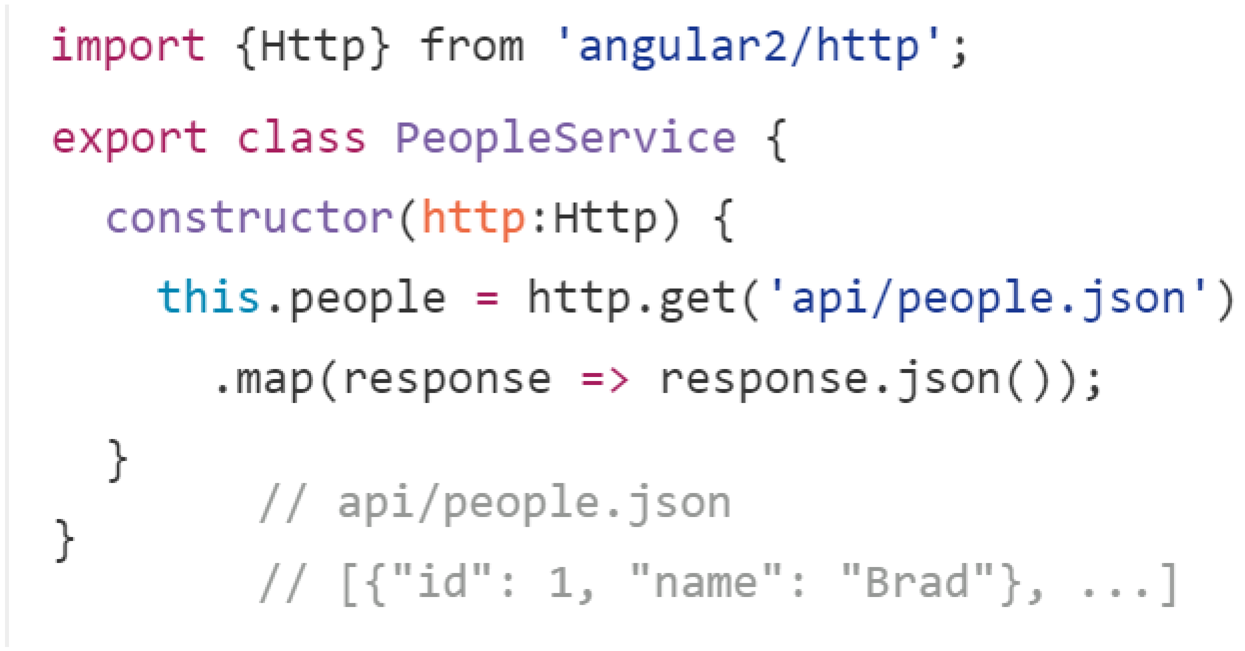
```
export class TypeAhead {
        ticker = new Control();
        tickers: Observable<any[]>;
        constructor(seacher:TickerSearcher) {
          this.tickers = this.searchText.valueChanges
            .debounceTime(200)
            .switchMap((val:string) =>
                   seacher.get(val));
        }
}
```

Ajax with angular/http

New Data Architecture using Reactive Programming and Observables

Back

Get Request Example



```
import {Http} from 'angular2/http';

export class PeopleService {

  constructor(http:Http) {

    this.people = http.get('api/people.json')

      .map(response => response.json());

  }
                 // api/people.json
}
                 // [{"id": 1, "name": "Brad"}, ...]
```

- http.get returns an Observable emitting Response objects
- ***.map*** *is used* to parse the result into a JSON object
- The result of ***map*** is also an ***Observable*** that emits a JSON object containing an Array of people.

Post Example

```
postData(){
   var headers = new Headers();
   headers.append('Content-Type', 'application/json');

   this.http.post('http://www.syntaxsuccess.com/poc-post/',
     JSON.stringify({firstName:'Joe',lastName:'Smith'}),
     {headers:headers})
      .map((res: Response) => res.json())
      .subscribe((res:Person) => this.postResponse = res);
}
```

Summary

Angular introduces many innovations:

- Component Router
- Dependency Injection (DI)
- Client-side templating
- Solid tooling thanks to Typescript + excellent testing support

Resources

- Cheat Sheet https://angular.io/cheatsheet
- Guide https://angular.io/docs/ts/latest/guide/
- Tour of Heroes tutorial

https://angular.io/docs/ts/latest/guide/learning-angular.html

- Angular 5 Education Resources

https://github.com/AngularClass/awesome-angular

- Angular 2 Development with TypeScript (free book via QU Library eResources)

https://www.safaribooksonline.com/library/view/angular-2-development/9781617293122/

https://www.ng-book.com/2/