

Angular 2 Tutorial: Create a CRUD App with Angular CLI

By [Jurgen Van de Moere](https://www.sitepoint.com/author/jvandemoere/), [Todd Motto](https://www.sitepoint.com/author/tmotto/)



This article is by guest authors **Todd Motto** and **Jurgen Van de Moere**. SitePoint guest posts aim to bring you engaging content from prominent writers and speakers of the JavaScript community.

2016.12.20: This article has been revised in response to reader feedback, and to take account of the current release version of Angular 2.

2017.02.17: As of February 9, 2017, the `ng deploy` command has been removed from the core of Angular CLI. Read more [here](https://github.com/angular/angular-cli/blob/master/CHANGELOG.md#100-beta31-2017-02-09) (<https://github.com/angular/angular-cli/blob/master/CHANGELOG.md#100-beta31-2017-02-09>).

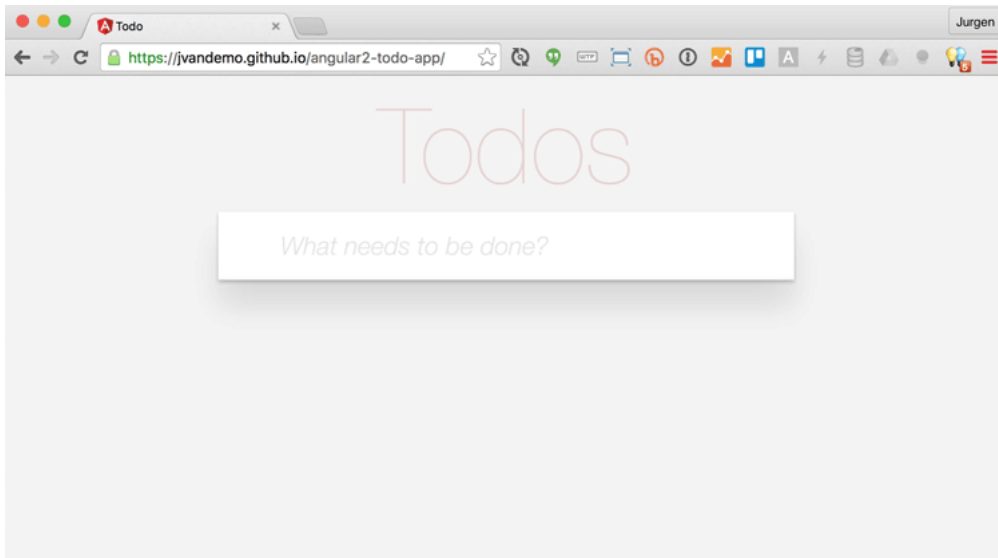
This is the first article in a 4-part series on how to write a Todo application in Angular 2:

P.S. For expert-led online Angular training courses you can't go past Ultimate Angular by Todd Motto. Try his courses [here](https://ultimateangular.com/) (<https://ultimateangular.com/>), and use the code SITEPOINT to get 25% off and to help support SitePoint.

For another app development example, using Ember, check out our video tutorial: [Get Started Building Ember Apps](https://www.sitepoint.com/premium/screencasts/using-ember-cli-to-get-started-building-ember-apps) (<https://www.sitepoint.com/premium/screencasts/using-ember-cli-to-get-started-building-ember-apps>).

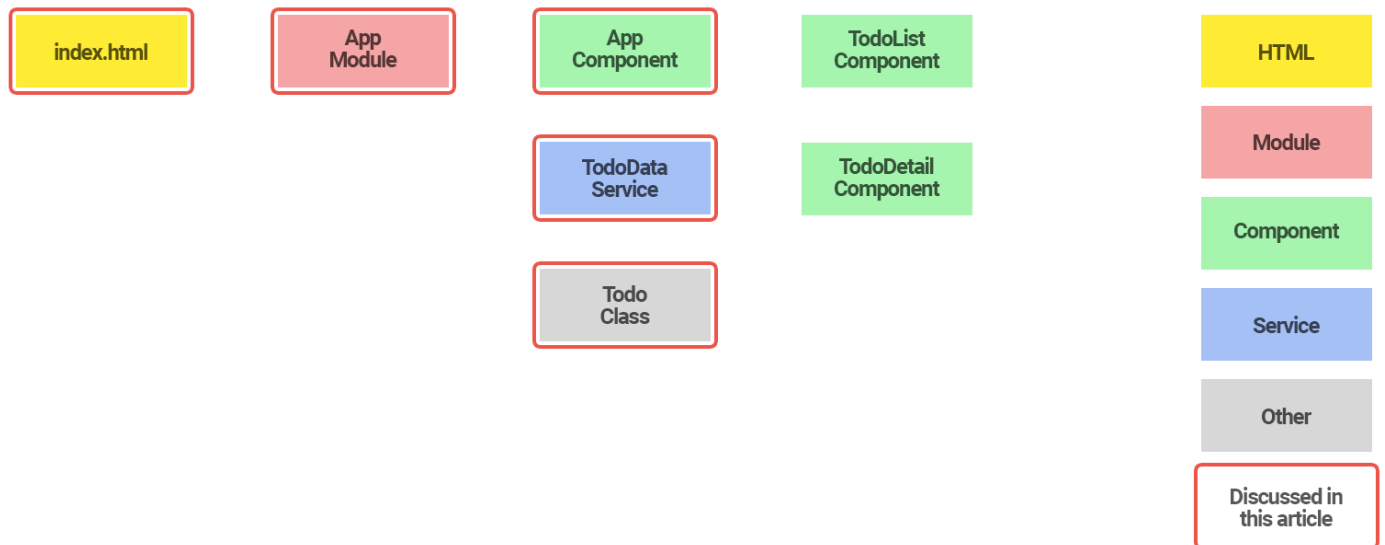
- 1 [Part 0— The Ultimate Angular CLI Reference Guide](https://www.sitepoint.com/ultimate-angular-cli-reference/) (<https://www.sitepoint.com/ultimate-angular-cli-reference/>)
- 2 **Part 1— Getting our first version of the Todo application up and running**
- 3 [Part 2— Creating separate components to display a list of todo's and a single todo](https://www.sitepoint.com/understanding-component-architecture-angular/) (<https://www.sitepoint.com/understanding-component-architecture-angular/>)
- 4 [Part 3— Update the Todo service to communicate with a REST API](https://www.sitepoint.com/angular-rxjs-create-api-service-rest-backend/) (<https://www.sitepoint.com/angular-rxjs-create-api-service-rest-backend/>)
- 5 Part 4— Use Component Router to route to different components

In each article we'll refine the underlying architecture of the application and we make sure we have a working version of the application that looks like this:



By the end of this series, our application architecture will look like this:

Application Architecture



More from this author

[Angular and RxJS: Create an API Service to Talk to a REST Backend \(https://www.sitepoint.com/angular-rxjs-create-api-service-rest-backend/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor\)](https://www.sitepoint.com/angular-rxjs-create-api-service-rest-backend/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor)

[The Ultimate Angular CLI Reference Guide \(https://www.sitepoint.com/ultimate-angular-cli-reference/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor\)](https://www.sitepoint.com/ultimate-angular-cli-reference/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor)

[Understanding Component Architecture: Refactoring an Angular App \(https://www.sitepoint.com/understanding-component-architecture-angular/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor\)](https://www.sitepoint.com/understanding-component-architecture-angular/?utm_source=sitepoint&utm_medium=relatedinline&utm_term=&utm_campaign=relatedauthor)

The items that are marked with a red border are discussed in this article, while items that are not marked with a red border will be discussed in follow-up articles within this series.

In this first part, you will learn how to:

- initialize your Todo application using Angular CLI
- create a **Todo** class to represent individual todo's
- create a **TodoDataService** service to create, update and remove todo's
- use the **AppComponent** component to display the user interface

deploy your application to GitHub pages

So let's get started!

Rather than a successor of AngularJS 1.x, Angular 2 can be considered an entirely new framework built on lessons from AngularJS 1.x. Hence the name change where Angular is used to denote Angular 2 and AngularJS refers to AngularJS 1.x. In this article we will use Angular and Angular 2 interchangeably but they both refer to Angular 2.

Initialize Your Todo Application Using Angular CLI

One of the easiest ways to start a new Angular 2 application is to use Angular's [command-line interface \(https://github.com/angular/angular-cli\)](https://github.com/angular/angular-cli) (CLI).

To install Angular CLI, run:

```
$ npm install -g angular-cli
```

which will install the **ng** command globally on your system.

To verify whether your installation completed successfully, you can run:

```
$ ng version
```

which should display the version you have installed:

```
angular-cli: 1.0.0-beta.21
node: 6.1.0
os: darwin x64
```

Now that you have Angular CLI installed, you can use it to generate your Todo application:

```
$ ng new todo-app
```

This creates a new directory with all files you need to get started:

```
todo-app
├── README.md
├── angular-cli.json
├── e2e
│   ├── app.e2e-spec.ts
│   ├── app.po.ts
│   └── tsconfig.json
├── karma.conf.js
├── package.json
├── protractor.conf.js
├── src
│   ├── app
│   │   ├── app.component.css
│   │   ├── app.component.html
│   │   ├── app.component.spec.ts
│   │   ├── app.component.ts
│   │   ├── app.module.ts
│   │   └── index.ts
│   ├── assets
│   ├── environments
│   │   ├── environment.prod.ts
│   │   └── environment.ts
│   ├── favicon.ico
│   ├── index.html
│   ├── main.ts
│   ├── polyfills.ts
│   ├── styles.css
│   ├── test.ts
│   ├── tsconfig.json
│   └── typings.d.ts
└── tslint.json
```

If you are not familiar with the Angular CLI yet, make sure you check out [The Ultimate Angular CLI Reference \(https://www.sitepoint.com/ultimate-angular-cli-reference/\)](https://www.sitepoint.com/ultimate-angular-cli-reference/).

You can now navigate to the new directory:

```
$ cd todo-app
```

and start the Angular CLI development server:

```
$ ng serve
```

which will start a local development server that you can navigate to in your browser on **http://localhost:4200/**.

The Angular CLI development server includes LiveReload support, so your browser automatically reloads the application when a source file changes.

How convenient is that!

Creating the Todo Class

Because Angular CLI generates TypeScript (<http://www.typescriptlang.org/>) files, we can use a class to represent Todo items.

So let's use Angular CLI to generate a **Todo** class for us:

```
$ ng generate class Todo --spec
```

which will create:

```
src/app/todo.spec.ts
src/app/todo.ts
```

Let's open up **src/app/todo.ts**:

```
export class Todo {
}
```

and add the logic we need:

```
export class Todo {
  id: number;
  title: string = '';
  complete: boolean = false;

  constructor(values: Object = {}) {
    Object.assign(this, values);
  }
}
```

In this Todo class definition, we specify that each **Todo** instance will have three properties:

- id**: number, unique ID of the todo item
- title**: string, title of the todo item
- complete**: boolean, whether or not the todo item is complete

We also provide constructor logic that lets us specify property values during instantiation so we can easily create new Todo instances like this:

```
let todo = new Todo({
  title: 'Read SitePoint article',
  complete: false
});
```

While we are at it, let's add a unit test to make sure our constructor logic works as expected.

When generating the **Todo** class, we used the **--spec** option. This told Angular CLI to also generate **src/app/todo.spec.ts** for us with a basic unit test:

```
import {Todo} from './todo';

describe('Todo', () => {
  it('should create an instance', () => {
    expect(new Todo()).toBeTruthy();
  });
});
```

Let's add an additional unit test to make sure the constructor logic works as expected:

```
import { Todo } from './todo';

describe('Todo', () => {
  it('should create an instance', () => {
    expect(new Todo()).toBeTruthy();
  });

  it('should accept values in the constructor', () => {
    let todo = new Todo({
      title: 'hello',
      complete: true
    });
    expect(todo.title).toEqual('hello');
    expect(todo.complete).toEqual(true);
  });
});
```

To verify whether our code works as expected, we can now run:

```
$ ng test
```

to execute the [Karma \(https://karma-runner.github.io\)](https://karma-runner.github.io) test runner and run all our unit tests. This should output:

```
[karma]: No captured browser, open http://localhost:9876/
[karma]: Karma v1.2.0 server started at http://localhost:9876/
[launcher]: Launching browser Chrome with unlimited concurrency
[launcher]: Starting browser Chrome
[Chrome 54.0.2840 (Mac OS X 10.12.0)]: Connected on socket /#ALCo3r1JmW2bvt_fAAAA with id 84083656
Chrome 54.0.2840 (Mac OS X 10.12.0): Executed 5 of 5 SUCCESS (0.159 secs / 0.154 secs)
```

If your unit tests are failing, you can compare your code to the [working code on GitHub \(https://github.com/sitepoint-editors/angular-todo-app/tree/part-1\)](https://github.com/sitepoint-editors/angular-todo-app/tree/part-1).

Now that we have a working `Todo` class to represent an individual todo, let's create a `TodoDataService` service to manage all todos.

Creating the TodoDataService Service

The `TodoDataService` will be responsible for managing our Todo items.

In another part of this series you will learn how to communicate with a REST API, but for now we will store all data in memory.

Let's use Angular CLI again to generate the service for us:

```
$ ng generate service TodoData
```

which outputs:

```
installing service
create src/app/todo-data.service.spec.ts
create src/app/todo-data.service.ts
WARNING Service is generated but not provided, it must be provided to be used
```

When generating a service, Angular CLI also generates a unit test by default so we don't have to explicitly use the `--spec` option.

Angular CLI has generated the following code for our `TodoDataService` in `src/app/todo-data.service.ts`:

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

@Injectable()
export class TodoDataService {

  constructor() { }

}
```

and a corresponding unit test in `src/app/todo-data.service.spec.ts`:

```
/* tslint:disable:no-unused-variable */
import { TestBed, async, inject } from '@angular/core/testing';
import { TodoDataService } from './todo-data.service';

describe('TodoDataService', () => {
  beforeEach(() => {
    TestBed.configureTestingModule({
      providers: [TodoDataService]
    });
  });

  it('should ...', inject([TodoDataService], (service: TodoDataService) => {
    expect(service).toBeTruthy();
  }));
});
```

Let's open up `src/app/todo-data.service.ts` and add our todo management logic to the `TodoDataService`:

```

import { Injectable } from '@angular/core';
import { Todo } from './todo';

@Injectable()
export class TodoDataService {

  // Placeholder for last id so we can simulate
  // automatic incrementing of id's
  lastId: number = 0;

  // Placeholder for todo's
  todos: Todo[] = [];

  constructor() {
  }

  // Simulate POST /todos
  addTodo(todo: Todo): TodoDataService {
    if (!todo.id) {
      todo.id = ++this.lastId;
    }
    this.todos.push(todo);
    return this;
  }

  // Simulate DELETE /todos/:id
  deleteTodoById(id: number): TodoDataService {
    this.todos = this.todos
      .filter(todo => todo.id !== id);
    return this;
  }

  // Simulate PUT /todos/:id
  updateTodoById(id: number, values: Object = {}): Todo {
    let todo = this.getTodoById(id);
    if (!todo) {
      return null;
    }
    Object.assign(todo, values);
    return todo;
  }

  // Simulate GET /todos
  getAllTodos(): Todo[] {
    return this.todos;
  }

  // Simulate GET /todos/:id
  getTodoById(id: number): Todo {
    return this.todos
      .filter(todo => todo.id === id)
      .pop();
  }

  // Toggle todo complete
  toggleTodoComplete(todo: Todo){
    let updatedTodo = this.updateTodoById(todo.id, {
      complete: !todo.complete
    });
    return updatedTodo;
  }
}

```

The actual implementation details of the methods are not essential for the purpose of this article. **The main takeaway is that we centralize the business logic in a service.**

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To make sure the business logic in our `TodoDataService` service works as expected, we also add some additional unit tests in `src/app/todo-data.service.spec.ts`:


```

import { TestBed, async, inject } from '@angular/core/testing';
import { Todo } from './todo';
import { TodoDataService } from './todo-data.service';

describe('TodoDataService', () => {
  beforeEach(() => {
    TestBed.configureTestingModule({
      providers: [TodoDataService]
    });
  });

  it('should ...', inject([TodoDataService], (service: TodoDataService) => {
    expect(service).toBeTruthy();
  }));

  describe('#getAllTodos()', () => {

    it('should return an empty array by default', inject([TodoDataService], (service: TodoDataService) => {
      expect(service.getAllTodos()).toEqual([]);
    }));

    it('should return all todos', inject([TodoDataService], (service: TodoDataService) => {
      let todo1 = new Todo({title: 'Hello 1', complete: false});
      let todo2 = new Todo({title: 'Hello 2', complete: true});
      service.addTodo(todo1);
      service.addTodo(todo2);
      expect(service.getAllTodos()).toEqual([todo1, todo2]);
    }));

  });

  describe('#save(todo)', () => {

    it('should automatically assign an incrementing id', inject([TodoDataService], (service: TodoDataService) => {
      let todo1 = new Todo({title: 'Hello 1', complete: false});
      let todo2 = new Todo({title: 'Hello 2', complete: true});
      service.addTodo(todo1);
      service.addTodo(todo2);
      expect(service.getTodoById(1)).toEqual(todo1);
      expect(service.getTodoById(2)).toEqual(todo2);
    }));

  });

  describe('#deleteTodoById(id)', () => {

    it('should remove todo with the corresponding id', inject([TodoDataService], (service: TodoDataService) => {
      let todo1 = new Todo({title: 'Hello 1', complete: false});
      let todo2 = new Todo({title: 'Hello 2', complete: true});
      service.addTodo(todo1);
      service.addTodo(todo2);
      expect(service.getAllTodos()).toEqual([todo1, todo2]);
      service.deleteTodoById(1);
      expect(service.getAllTodos()).toEqual([todo2]);
      service.deleteTodoById(2);
      expect(service.getAllTodos()).toEqual([]);
    }));

    it('should not removing anything if todo with corresponding id is not found', inject([TodoDataService], (service:
TodoDataService) => {
      let todo1 = new Todo({title: 'Hello 1', complete: false});
      let todo2 = new Todo({title: 'Hello 2', complete: true});
      service.addTodo(todo1);
      service.addTodo(todo2);
      expect(service.getAllTodos()).toEqual([todo1, todo2]);
      service.deleteTodoById(3);
      expect(service.getAllTodos()).toEqual([todo1, todo2]);
    }));

  });

}

```

```

    })
  });

describe('#updateTodoById(id, values)', () => {

  it('should return todo with the corresponding id and updated data', inject([TodoDataService], (service: TodoDataService) => {
    let todo = new Todo({title: 'Hello 1', complete: false});
    service.addTodo(todo);
    let updatedTodo = service.updateTodoById(1, {
      title: 'new title'
    });
    expect(updatedTodo.title).toEqual('new title');
  }));

  it('should return null if todo is not found', inject([TodoDataService], (service: TodoDataService) => {
    let todo = new Todo({title: 'Hello 1', complete: false});
    service.addTodo(todo);
    let updatedTodo = service.updateTodoById(2, {
      title: 'new title'
    });
    expect(updatedTodo).toEqual(null);
  }));

});

describe('#toggleTodoComplete(todo)', () => {

  it('should return the updated todo with inverse complete status', inject([TodoDataService], (service: TodoDataService) => {
    let todo = new Todo({title: 'Hello 1', complete: false});
    service.addTodo(todo);
    let updatedTodo = service.toggleTodoComplete(todo);
    expect(updatedTodo.complete).toEqual(true);
    service.toggleTodoComplete(todo);
    expect(updatedTodo.complete).toEqual(false);
  }));

});

});

```

Karma comes pre-configured with [Jasmine \(https://github.com/jasmine/jasmine\)](https://github.com/jasmine/jasmine). You can read the [Jasmine documentation \(http://jasmine.github.io/2.4/introduction.html\)](http://jasmine.github.io/2.4/introduction.html) to learn more about the Jasmine syntax.

Let's zoom in on some of the parts in the unit tests above:

```

beforeEach(() => {
  TestBed.configureTestingModule({
    providers: [TodoDataService]
  });
});

```

First of all what is **TestBed**?

TestBed is a utility provided by **@angular/core/testing** to configure and create an Angular testing module in which we want to run our unit tests.

We use the **TestBed.configureTestingModule()** method to configure and create a new Angular testing module. We can configure the testing module to our liking by passing in a configuration object. This configuration object can have most of the properties of a [normal Angular module \(https://angular.io/docs/ts/latest/guide/ngmodule.html\)](https://angular.io/docs/ts/latest/guide/ngmodule.html).

In this case we use the **providers** property to configure the testing module to use the real **TodoDataService** when running the tests.

In part 3 of this series we will let the **TodoDataService** communicate with a real REST API and we will see how we can inject a mock service in our test module to prevent the tests from communicating with the real API.

Next, we use the **inject** function provided by **@angular/core/testing** to inject the correct service from the **TestBed** injector in our test function:

```
it('should return all todos', inject([TodoDataService], (service: TodoDataService) => {
  let todo1 = new Todo({title: 'Hello 1', complete: false});
  let todo2 = new Todo({title: 'Hello 2', complete: true});
  service.addTo(todo1);
  service.addTo(todo2);
  expect(service.getAllTodos()).toEqual([todo1, todo2]);
}));
```

The first argument to the `inject` function is an array of Angular dependency injection tokens. The second argument is the test function whose parameters are the dependencies that correspond to the dependency injection tokens from the array.

Here we tell the `TestBed` injector to inject the `TodoDataService` by specifying it in the array in the first argument. As a result we can access the `TodoDataService` as `service` in our test function because `service` is the name of the first parameter of our test function.

If you want to learn more about testing in Angular, be sure to check out the [official Angular testing guide \(https://angular.io/docs/ts/latest/guide/testing.html\)](https://angular.io/docs/ts/latest/guide/testing.html).

To verify whether our service works as expected, we run our unit tests again:

```
$ ng test
[karma]: No captured browser, open http://localhost:9876/
[karma]: Karma v1.2.0 server started at http://localhost:9876/
[launcher]: Launching browser Chrome with unlimited concurrency
[launcher]: Starting browser Chrome
[Chrome 54.0.2840 (Mac OS X 10.12.0)]: Connected on socket /#fi6bwZk8IjYr1DZ-AAAA with id 11525081
Chrome 54.0.2840 (Mac OS X 10.12.0): Executed 14 of 14 SUCCESS (0.273 secs / 0.264 secs)
```

Perfect— all unit tests ran successfully!

Now that we have a working `TodoDataService` service, it's time to implement the actual user interface.

In Angular 2, parts of the user interface are represented by **components**.

Editing the AppComponent Component

When we initialized the Todo application, Angular CLI automatically generated a main `AppComponent` component for us:

```
src/app/app.component.css
src/app/app.component.html
src/app/app.component.spec.ts
src/app/app.component.ts
```

The template and styles can also be specified inline, inside the script file. Angular CLI creates separate files by default, so that's what we'll use in this article.

Let's open up `src/app/app.component.html`:

```
<h1>
  {{title}}
</h1>
```

and replace its content with:

```

<section class="todoapp">
  <header class="header">
    <h1>Todos</h1>
    <input class="new-todo" placeholder="What needs to be done?" autofocus="" [(ngModel)]="newTodo.title"
(keyup.enter)="addTodo()">
  </header>
  <section class="main" *ngIf="todos.length > 0">
    <ul class="todo-list">
      <li *ngFor="let todo of todos" [class.completed]="todo.complete">
        <div class="view">
          <input class="toggle" type="checkbox" (click)="toggleTodoComplete(todo)" [checked]="todo.complete">
          <label>{{todo.title}}</label>
          <button class="destroy" (click)="removeTodo(todo)"></button>
        </div>
      </li>
    </ul>
  </section>
  <footer class="footer" *ngIf="todos.length > 0">
    <span class="todo-count"><strong>{{todos.length}}</strong> {{todos.length == 1 ? 'item' : 'items'}} left</span>
  </footer>
</section>

```

Here is a super-short primer on Angular's template syntax in case you haven't seen it yet:

[property]="expression" : set property of an element to the value of **expression**
(event)="statement" : execute statement when **event** occurred
[(property)]="expression" : create two-way binding with **expression**
[class.special]="expression" : add **special** CSS class to element when the value of **expression** is truthy
[style.color]="expression" : set **color** CSS property to the value of **expression**

If you're not familiar with Angular's template syntax, you should definitely read [the official template syntax documentation \(https://angular.io/docs/ts/latest/guide/template-syntax.html\)](https://angular.io/docs/ts/latest/guide/template-syntax.html).

Let's see what that means for our view. At the top there is an input to create a new todo:

```

<input class="new-todo" placeholder="What needs to be done?" autofocus="" [(ngModel)]="newTodo.title"
(keyup.enter)="addTodo()">
  [(ngModel)]="newTodo.title" : adds a two-way binding between the input value and newTodo.title
  (keyup.enter)="addTodo()" : tells Angular to execute addTodo() when the enter key was pressed while typing in the input element

```

Don't worry about where **newTodo** or **addTodo()** come from yet, we will get there shortly. Just try to understand the semantics of the view for now.

Next there is a section to display existing todo's:

```

<section class="main" *ngIf="todos.length > 0">
  *ngIf="todos.length > 0" : only show the section element and all its children when there is at least one todo

```

Within that section, we ask Angular to generate an **li** element for each todo:

```

<li *ngFor="let todo of todos" [class.completed]="todo.complete">
  *ngFor="let todo of todos" : loop over all todo's and assign current todo to a variable called todo for each iteration
  [class.completed]="todo.complete" : apply CSS class completed to li element when todo.complete is truthy

```

and finally we display todo details for each individual todo:

```

<div class="view">
  <input class="toggle" type="checkbox" (click)="toggleTodoComplete(todo)" [checked]="todo.complete">
  <label>{{todo.title}}</label>
  <button class="destroy" (click)="removeTodo(todo)"></button>
</div>
  (click)="toggleTodoComplete(todo)" : execute toggleTodoComplete(todo) when the checkbox is clicked
  [checked]="todo.complete" : assign the value of todo.complete to the property checked of the element
  (click)="removeTodo(todo)" : execute removeTodo(todo) when the destroy button is clicked

```

OK, let's breathe. That was quite a bit of syntax we went through.



If you want to learn every detail about Angular's template syntax, make sure you read the [official template documentation \(https://angular.io/docs/ts/latest/guide/template-syntax.html\)](https://angular.io/docs/ts/latest/guide/template-syntax.html).

You may wonder how expressions like `addTodo()` and `newTodo.title` can be evaluated. We haven't defined them yet, so how does Angular know what we mean?

That's exactly where the **expression context** comes in. An expression context is a context in which expressions are evaluated. The expression context of a component is the component instance. And the component instance is an instance of the component class.

The component class of our `AppComponent` is defined in `src/app/app.component.ts`.

Angular CLI already created some boilerplate code for us:

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

@Component({
  selector: 'app-root',
  templateUrl: './app.component.html',
  styleUrls: ['./app.component.css']
})
export class AppComponent {
  title = 'app works!';
}
```

so we can immediately start adding our custom logic.

We will need the `TodoDataService` service in our `AppComponent` logic, so let's start by injecting the service in our component.

First we import `TodoDataService` and specify it in the `providers` array of the `Component` decorator:

```
// Import class so we can register it as dependency injection token
import {TodoDataService} from './todo-data.service';

@Component({
  // ...
  providers: [TodoDataService]
})
export class AppComponent {
  // ...
}
```

The `AppComponent`'s dependency injector will now recognize the `TodoDataService` class as a dependency injection token and return a single instance of `TodoDataService` when we ask for it.

Angular's dependency injection system accepts a variety of dependency injection recipes. The syntax above is a shorthand notation for the *Class provider* recipe that provides dependencies using the singleton pattern. Check out [Angular's dependency injection documentation \(https://angular.io/docs/ts/latest/guide/dependency-injection.html\)](https://angular.io/docs/ts/latest/guide/dependency-injection.html) for more details.

Now that the component's dependency injector knows what it needs to provide, we ask it to inject the `TodoDataService` instance in our component by specifying the dependency in the `AppComponent` constructor:

```

// Import class so we can use it as dependency injection token in the constructor
import { TodoDataService } from './todo-data.service';

@Component({
  // ...
})
export class AppComponent {

  // Ask Angular DI system to inject the dependency
  // associated with the dependency injection token `TodoDataService`
  // and assign it to a property called `todoDataService`
  constructor(private todoDataService: TodoDataService) {

  }

  // Service is now available as this.todoDataService
  toggleTodoComplete(todo) {
    this.todoDataService.toggleTodoComplete(todo);
  }
}

```

The use of **public** or **private** on arguments in the constructor is a shorthand notation that allows us to automatically create properties with that name, so:

```

class AppComponent {

  constructor(private todoDataService: TodoDataService) {

  }
}

```

is a shorthand notation for:

```

class AppComponent {

  private todoDataService: TodoDataService;

  constructor(todoDataService: TodoDataService) {
    this.todoDataService = todoDataService;
  }
}

```

We can now implement all view logic by adding properties and methods to our **AppComponent** class:

```

import {Component} from '@angular/core';
import {Todo} from './todo';
import {TodoDataService} from './todo-data.service';

@Component({
  selector: 'app-root',
  templateUrl: './app.component.html',
  styleUrls: ['./app.component.css'],
  providers: [TodoDataService]
})
export class AppComponent {

  newTodo: Todo = new Todo();

  constructor(private todoDataService: TodoDataService) {

  }

  addTodo() {
    this.todoDataService.addTodo(this.newTodo);
    this.newTodo = new Todo();
  }

  toggleTodoComplete(todo) {
    this.todoDataService.toggleTodoComplete(todo);
  }

  removeTodo(todo) {
    this.todoDataService.deleteTodoById(todo.id);
  }

  get todos() {
    return this.todoDataService.getAllTodos();
  }
}

```

We first define a **newTodo** property and assign a **new Todo()** when the component class is instantiated. This is the same **Todo** instance specified in the two-way binding expression of **[(ngModel)]** in our view:

```

<input class="new-todo" placeholder="What needs to be done?" autofocus="" [(ngModel)]="newTodo.title"
(keyup.enter)="addTodo()">

```

Whenever the input value changes in the view, the value in the component instance is updated. And whenever the value in the component instance changes, the value in the input element in the view is updated.

Next, we implement all methods we used in our view:

```

addTodo() {
  this.todoDataService.addTodo(this.newTodo);
  this.newTodo = new Todo();
}

toggleTodoComplete(todo) {
  this.todoDataService.toggleTodoComplete(todo);
}

removeTodo(todo) {
  this.todoDataService.deleteTodoById(todo.id);
}

get todos() {
  return this.todoDataService.getAllTodos();
}

```

Their implementation is very short and should be self-explanatory as we delegate all business logic to the **todoDataService**.

Delegating business logic to a service is a good programming practice as it allows us to centrally manage and test it.

Before we try the result in our browser, let's run our unit tests again:

```
$ ng test
05 12 2016 01:16:44.714:WARN [karma]: No captured browser, open http://localhost:9876/
05 12 2016 01:16:44.722:INFO [karma]: Karma v1.2.0 server started at http://localhost:9876/
05 12 2016 01:16:44.722:INFO [launcher]: Launching browser Chrome with unlimited concurrency
05 12 2016 01:16:44.725:INFO [launcher]: Starting browser Chrome
05 12 2016 01:16:45.373:INFO [Chrome 54.0.2840 (Mac OS X 10.12.0)]: Connected on socket /#Wcdc0x0IPj-cKul8AAAA with id 19440217
Chrome 54.0.2840 (Mac OS X 10.12.0) AppComponent should create the app FAILED
    Can't bind to 'ngModel' since it isn't a known property of 'input'. ("<
      <h1>Todos</h1>
      <input class="new-todo" placeholder="What needs to be done?" autofocus="" [ERROR ->][ngModel)]="newTodo.title"
(keyup.enter)="addTodo()">
    </header>
    <section class="main" *ngIf="tod"> AppComponent@3:78
  Error: Template parse errors:
    at TemplateParser.parse (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/template_parser/template_parser.js:97:0 <- src/test.ts:11121:19)
    at RuntimeCompiler._compileTemplate (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/runtime_compiler.js:255:0 <- src/test.ts:25503:51)
    at webpack:///Users/jvandemo/Projects/jvandemo/todo-app/~/@angular/compiler/src/runtime_compiler.js:175:47 <-
src/test.ts:25423:62
    at Set.forEach (native)
    at RuntimeCompiler._compileComponents (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/runtime_compiler.js:175:0 <- src/test.ts:25423:19)
    at createResult (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/runtime_compiler.js:86:0 <- src/test.ts:25334:19)
    at RuntimeCompiler._compileModuleAndAllComponents (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/runtime_compiler.js:90:0 <- src/test.ts:25338:88)
    at RuntimeCompiler.compileModuleAndAllComponentsSync (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/src/runtime_compiler.js:62:0 <- src/test.ts:25310:21)
    at TestingCompilerImpl.compileModuleAndAllComponentsSync (webpack:///Users/jvandemo/Projects/jvandemo/todo-
app/~/@angular/compiler/bundles/compiler-testing.umd.js:482:0 <- src/test.ts:37522:35)
    at TestBed._initIfNeeded (webpack:///Users/jvandemo/Projects/jvandemo/todo-app/~/@angular/core/bundles/core-
testing.umd.js:758:0 <- src/test.ts:7065:40)
    ...
Chrome 54.0.2840 (Mac OS X 10.12.0): Executed 14 of 14 (3 FAILED) (0.316 secs / 0.245 secs)
Three tests are failing with the following error: Can't bind to 'ngModel' since it isn't a known property of 'input'..
```

Let's open up `src/app/app.component.spec.ts`:


```

/* tslint:disable:no-unused-variable */
import { TestBed, async } from '@angular/core/testing';
import { AppComponent } from './app.component';

describe('AppComponent', () => {
  beforeEach(() => {
    TestBed.configureTestingModule({
      declarations: [
        AppComponent
      ],
    });
  });

  it('should create the app', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app).toBeTruthy();
  }));

  it(`should have as title 'app works!'`, async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app.title).toEqual('app works!');
  }));

  it('should render title in a h1 tag', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    fixture.detectChanges();
    let compiled = fixture.debugElement.nativeElement;
    expect(compiled.querySelector('h1').textContent).toContain('app works!');
  }));
});

```

The reason Angular complains about not knowing `ngModel`, is because the `FormsModule` is not loaded when the `AppComponent` is instantiated by Karma using the `TestBed.createComponent()` method.

To learn more about `TestBed`, make sure to check out the [Official Angular documentation on testing \(https://angular.io/docs/ts/latest/guide/testing.html\)](https://angular.io/docs/ts/latest/guide/testing.html).

To make sure Angular also loads the `FormsModule` when Karma instantiates the `AppComponent` using `TestBed.createComponent()`, we must specify `FormsModule` in the `imports` property of the Testbed configuration object:

```

/* tslint:disable:no-unused-variable */

import { TestBed, async } from '@angular/core/testing';
import { AppComponent } from './app.component';
import { FormsModule } from '@angular/forms';

describe('AppComponent', () => {
  beforeEach(() => {
    TestBed.configureTestingModule({
      imports: [
        FormsModule
      ],
      declarations: [
        AppComponent
      ],
    });
  });

  it('should create the app', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app).toBeTruthy();
  }));

  it(`should have as title 'app works!'`, async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app.title).toEqual('app works!');
  }));

  it('should render title in a h1 tag', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    fixture.detectChanges();
    let compiled = fixture.debugElement.nativeElement;
    expect(compiled.querySelector('h1').textContent).toContain('app works!');
  }));
});

```

We now have 2 failing tests:

```

Chrome 54.0.2840 (Mac OS X 10.12.0) AppComponent should have as title 'app works!' FAILED
  Expected undefined to equal 'app works!'.
    at webpack:///Users/jvandemo/Projects/jvandemo/todo-app/src/app/app.component.spec.ts:28:22 <- src/test.ts:46473:27
    at ZoneDelegate.invoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/zone.js:232:0 <-
src/test.ts:50121:26)
    at AsyncTestZoneSpec.onInvoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/async-
test.js:49:0 <- src/test.ts:34133:39)
    at ProxyZoneSpec.onInvoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/proxy.js:76:0 <-
src/test.ts:34825:39)
Chrome 54.0.2840 (Mac OS X 10.12.0) AppComponent should render title in a h1 tag FAILED
  Expected 'Todos' to contain 'app works!'.
    at webpack:///Users/jvandemo/Projects/jvandemo/todo-app/src/app/app.component.spec.ts:35:53 <- src/test.ts:46479:58
    at ZoneDelegate.invoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/zone.js:232:0 <-
src/test.ts:50121:26)
    at AsyncTestZoneSpec.onInvoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/async-
test.js:49:0 <- src/test.ts:34133:39)
    at ProxyZoneSpec.onInvoke (webpack:///Users/jvandemo/Projects/jvandemo/todo-app~/zone.js/dist/proxy.js:76:0 <-
src/test.ts:34825:39)
Chrome 54.0.2840 (Mac OS X 10.12.0): Executed 14 of 14 (2 FAILED) (4.968 secs / 4.354 secs)

```

Karma warns us that the component instance does not have a property `title` that equals `app works!` and that there is no `h1` element that contains `app works!`.

That is correct because we changed the component logic and template. So let's update the unit tests accordingly:

```

/* tslint:disable:no-unused-variable */

import { TestBed, async } from '@angular/core/testing';
import { AppComponent } from './app.component';
import { FormsModule } from '@angular/forms';
import { Todo } from './todo';

describe('AppComponent', () => {
  beforeEach(() => {
    TestBed.configureTestingModule({
      imports: [
        FormsModule
      ],
      declarations: [
        AppComponent
      ],
    });
  });

  it('should create the app', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app).toBeTruthy();
  }));

  it(`should have a newTodo todo`, async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    let app = fixture.debugElement.componentInstance;
    expect(app.newTodo instanceof Todo).toBeTruthy();
  }));

  it('should display "Todos" in h1 tag', async(() => {
    let fixture = TestBed.createComponent(AppComponent);
    fixture.detectChanges();
    let compiled = fixture.debugElement.nativeElement;
    expect(compiled.querySelector('h1').textContent).toContain('Todos');
  }));
});

```

We first add a unit test to make sure the `newTodo` property is instantiated correctly:

```

it(`should have a newTodo todo`, async(() => {
  let fixture = TestBed.createComponent(AppComponent);
  let app = fixture.debugElement.componentInstance;
  expect(app.newTodo instanceof Todo).toBeTruthy();
}));

```

and then we add a unit test to make sure the `h1` element contains the expected string:

```

it('should display "Todos" in h1 tag', async(() => {
  let fixture = TestBed.createComponent(AppComponent);
  fixture.detectChanges();
  let compiled = fixture.debugElement.nativeElement;
  expect(compiled.querySelector('h1').textContent).toContain('Todos');
}));

```

Now our tests are running successfully:

```

$ ng test
WARN [karma]: No captured browser, open http://localhost:9876/
INFO [karma]: Karma v1.2.0 server started at http://localhost:9876/
INFO [launcher]: Launching browser Chrome with unlimited concurrency
INFO [launcher]: Starting browser Chrome
INFO [Chrome 55.0.2883 (Mac OS X 10.12.0)]: Connected on socket /#S1TIAhPPqLOV0Z3NAAAA with id 73327097
Chrome 54.0.2840 (Mac OS X 10.12.0): Executed 14 of 14 SUCCESS (0.411 secs / 0.402 secs)

```

If you want to learn more about testing, be sure to check out [the chapter on Testing in the Official Angular documentation \(https://angular.io/docs/ts/latest/guide/testing.html\)](https://angular.io/docs/ts/latest/guide/testing.html).

Feel free to [play around with the live demo \(https://sitepoint-editors.github.io/todo-app/\)](https://sitepoint-editors.github.io/todo-app/) to see what the result looks like.

Before we wrap up this article, let's have a look at one last really cool feature of Angular CLI.

Deploying to GitHub Pages

Angular CLI makes it super simple to deploy our application to GitHub Pages with a single command like this:

```
$ ng github-pages:deploy --message 'deploy(dist): deploy on GitHub pages'
```

The `github-pages:deploy` command tells Angular CLI to build a static version of our Angular application and push it to the `gh-pages` branch of our GitHub repository:

```
$ ng github-pages:deploy --message 'deploy(dist): deploy on GitHub pages'
```

Built project successfully. Stored in "dist/".

Deployed! Visit <https://sitepoint-editors.github.io/todo-app/>

GitHub pages might take a few minutes to show the deployed site.

Our application is now available at <https://sitepoint-editors.github.io/todo-app/> (<https://sitepoint-editors.github.io/todo-app/>).

How awesome is that!

Summary

Angular 2 is a beast, no doubt. A very powerful beast!

In this first article, we learned:

- how to kickstart a new Angular application using Angular CLI
- how to implement business logic in an Angular service and how to test our business logic with unit tests
- how to use a component to interact with the user and how to delegate logic to a service using dependency injection
- the basics of Angular template syntax, briefly touching on how Angular dependency injection works
- finally, we learned how to quickly deploy our application to GitHub Pages

There is a lot more to learn about Angular 2. In the next part of this series, we will have a look at how we can create separate components to display a list of todos and individual todo details.

So stay tuned for more about this wonderful world of Angular 2.

Have you built anything with Angular 2 yet? Are you planning to upgrade your Angular 1.x applications? Please get in touch via the comments and let us know what you think!

Ready for a another app development tutorial. Watch our screencast [Get Started Building Ember Apps](https://www.sitepoint.com/premium/screencasts/using-ember-cli-to-get-started-building-ember-apps) (<https://www.sitepoint.com/premium/screencasts/using-ember-cli-to-get-started-building-ember-apps>) to continue your learning.

This article was peer reviewed by [Vildan Softic](https://www.sitepoint.com/author/vildansoftic) (<https://www.sitepoint.com/author/vildansoftic>). Thanks to all of SitePoint's peer reviewers for making SitePoint content the best it can be!

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Meet the author

Jurgen Van de Moere (<https://www.sitepoint.com/author/jvandemoere/>) [🐦 \(https://twitter.com/jvandemo\)](https://twitter.com/jvandemo) [g+](https://plus.google.com/u/0/+JurgenVandeMoere) (<https://plus.google.com/u/0/+JurgenVandeMoere>) [in](https://www.linkedin.com/in/jvandemo) (<https://www.linkedin.com/in/jvandemo>) [🔗](https://github.com/jvandemo) (<https://github.com/jvandemo>)

Front-end Architect at The Force - specializing in JavaScript and AngularJS. Developer Expert at Google. Gymnast. Dad. Family man. Creator of Angular Express.



Meet the author

Todd Motto (<https://www.sitepoint.com/author/tmotto/>) [Twitter](https://twitter.com/toddmotto) (<https://github.com/toddmotto>)

Developer Advocate @Telerik. Founder of Voux. JavaScript, Angular, React, conference speaker. Developer Expert at Google, open source lover.

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ccpony

28 Jun 2016
THANK YOU! Excellent presentation.

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ccpony

28 Jun 2016
Well, after problems running ng serve and ng test, I've stopped testing Angular-cli. Is this product REALLY in beta - - because it's performing like a pre-alpha.

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jvandemo → ccpony

29 Jun 2016
@ccpony:disqus - What problem are you seeing? Any specific error? Thanks!

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bennypowers

29 Jun 2016
Great tutorial. I had a funny issue when applying some of the concepts I learned here to a half-started project. I had previously created a component called "QuoteComponent" When I did `ng g class quote` it caused karma tests to fail (TypeError: quote_1:Quote is not a constructor). I solved the problem by renaming QuoteComponent to SingleQuoteComponent (in all my files) and removing references to the old barrels in system-config.ts.

Reply · Share ·

jvandemo → bennypowers

9 Jul 2016
@bennypowers:disqus - Was it caused by the fact that you already had an existing class with the name `QuoteComponent`? Thanks!

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bennypowers → jvandemo

9 Jul 2016
It seems like it. A lot of the angular 2 tutorials out in the wild feature hand-spun components/services/classes with similar names (e.g. ticket.class.ts, ticket.service.ts, ticket.component.ts) but when it comes to ng-cli, it's best to keep to unique names

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jvandemo → bennypowers

10 Jul 2016
Great to know, thank you for sharing @bennypowers:disqus!

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bennypowers

29 Jun 2016
Why didn't you create a SingleToDo component to render each todo item?

Reply · Share ·



jvandemo → bennypowers

29 Jun 2016
@bennypowers:disqus - Hi Benny, you can totally do that. We kept things as short as possible for the sake of article length (as it was already lengthy enough) but in a larger application that would definitely be the recommended approach. #thumbsUp

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Julius Koronci

1 Jul 2016
certainly better that the entire angular 2 tutorial(heroes tour or whatever) they have :)

(/)
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Todd Motto → Julius Koronci



Thanks!
7 Jul 2016

Reply · Share ·  

jksg → Julius Koronci

For sure a good, compact tutorial. But not for beginners. Too many steps skipped (see comments) and boilerplate generators are in general no good advice for novices to become familiar with a new technology. Generators simply "generate" too much automatically. Newbies won't understand what it is doing magically.

But for everyone who worked with the official tutorial this is a good next step to become more productive. Indeed, I personally think the official tutorial is not that bad. It offers plenty of ways to extend it; much more as a simple TODO app allows.

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