

Angular: One of the Most Popular MVC Frameworks in JavaScript

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Abstract – Angular is one of the widely used MVC frameworks for modern single-page web application development which is designed to support dynamic views in the web applications. JavaScript frameworks are the backbone of single page web applications development and provide superpowers to plain HTML and JavaScript. Angular, release by the search engine Google and uses the MVC architecture with the onset up source JavaScript. Angular is highly enriched in prominent attribute for designing the client side applications with many features and properties. There numerous new mobile and web-based application frameworks have been released and adopted in both communities of software development industry and research. It allows you to decorate your HTML with special markup that synchronizes with your JavaScript leaving you to write your application logic instead of manually updating views. There are various other JavaScript frameworks like VueJS, BackboneJS and ReactJS frameworks competing together with the different versions of ‘Angular’ frameworks. To further assist Angular developers, this research proposes how the concept of model-driven development can be applied to Angular-based development. As the usage and demand of mobile applications increased, the need for cross-platform frameworks has significantly increased as well. This paper totally revolves around the Angular, like a tour to Angular with its important features and also gives the introduction to the versions of Angular.

Keywords – Angular; web applications; front- end; JavaScript frameworks.

I. INTRODUCTION

Software companies have the needs to deliver software products as fast as possible to stay competitive, and have to find the way to reduce time to market while producing quality software for customers. JavaScript is a fundamental piece of modern Web applications. The language is used nowadays to construct a variety of systems, including Web applications with sophisticated user interfaces. As a result, we are observing the birth of new technologies and tools (including JavaScript libraries and frameworks) to solve common problems faced in such applications. Specifically, a new family of JavaScript frameworks emerged, following the Model View-Controller (MVC) architecture pattern (or variations of it). As examples, we have Angular, Backbone.js, and Ember.js.

In this paper, we focus on the front-end that includes various dependencies affecting the service performance as well as the user satisfaction with the final software solution. Therefore, there is also a growing area of development in terms of new frameworks, platforms and IDE tools, availing different combinations of the basic and essential software development functionalities such as bundling, logging, compiling, packing, debugging and testing.

Angular is not a library rather Angular is a JavaScript framework that embraces extending HTML into a more expressive and readable format. It allows you to decorate your HTML with special markup that synchronizes with your JavaScript leaving you to write your application logic instead of manually updating views. Whether you're looking to augment existing JavaScript applications or harness the full power of the framework to create rich and interactive SPA's, Angular can help you write cleaner and more efficient code.

This isn't Google's first attempt at a JavaScript framework; they first developed their comprehensive Web Toolkit, which compiles Java down to JavaScript, and was used by the Google Wave team extensively. With the rise of HTML5, CSS3, and JavaScript, as both a front-end and back-end language, Google realized that the web was not meant to be written purely in Java. Angular can help you write cleaner and more efficient code. Its purpose is to help developing the web applications with model-view controller (MVC) capability in an effort to make development, maintaining and testing easier. After using minified files in your application, the size reduces to some KBs and load pages much faster. Angular is great for building highly active and interactive web applications. It is the most used JavaScript framework for developing Single Page Web Applications. Angular helps to create web applications which are based on HTML, CSS and JavaScript. You can create customized Document Object Model (DOM) elements using Angular. Back end

communication is taken care of, views and controllers play a critical part in making of the UI. Dependency injection is a big plus features, automatically loading new modules that you may require.

II. BACKGROUND

Angular is a popular JavaScript framework for creating front-end single page web applications. It is designed to support dynamic views which make browsing the page smooth like that in a native application. Important features are:

1. Data Binding

One way data binding not updates and synchronize the view and the model components. If any change occurs in one (view/model), the developers have to change the respective change in other also. It is not updated automatically. This is the problem is one way data binding, to overcome this problem, two way data binding comes.

2. Two way data binding:-

Data-binding in Angular is the automatic synchronization of data between the view and model components. The compilation step produces a live view. When the view change, the model reflects the change and when the model changes, the view also update the changes. It happens automatically and immediately and makes sure that the view and the model component is updated all the times.

Two way data binding is the most promising property which separates you from writing the lines of code with some minute alternation that include in many places. now, with the help of Data Binding developers are not take care for manually alternation the DOM elements to flash the changes in model.

3. REST Friendly

(Representation State Transfer) is an architectural schema for designing distributed system. It has a client server relationship; you can quickly talk to the server and get the data you need to interact with your web pages. it is not strictly to related to HTTP, but commonly associated with it.

4. MVC Based Pattern

This architecture separates the application into three layers: (1) view corresponds to the user interface shown on a browser, (2) model corresponds to the data shown to the users on views, and (3) controller corresponds to the logic to control the data shown on views. The view contains the visual layout and presentation (it is defined in HTML in Angular), the model contains the logic and the data (written in JavaScript in Angular) and controller connects the two (written in JavaScript in Angular). The controller needs to know about model and how to resolve the view and given or handled it to the model.

5. Form validation

Angular provides properties on forms that help to validate them. Angular offers client side form validation. Angular give various information about the form, monitors the state of the form and input fields applied to a form. If a user gives the incorrect input, the Angular notifies it that input is invalid for the form and gives instantly message for how to correct that invalid code. Server side validation is required for secure application.

6. Dependency Injection

Dependency Injection is the beauty of the Angular. The whole of angular is linked together with the dependency injection. It is a software design pattern which deals with the dependency with the components. Everyone wants to implement de-couple and less dependency components. we can design each and every component without depending on other components. In Angular "injectable factory Method "or "constructor function "using these function we can injected the dependencies. Components are injected with the "value" and "service" components as dependencies.

III. COMPARISON

In this section, we will give a review of the current emerging frameworks (AngularJS, React and Angular) for web and mobile development to shed light on each of them. Then we pave the way to a thorough comparison between the Angular framework and other frameworks showing the strengths and weaknesses of each. Afterwards, we discuss the key features of Angular over AngularJS.

React.js

ReactJs is an open source information center which is used for efficient rendering of large data sets. It was launched by facebook. Launched in 2013, React had a simple aim to divide the UI into a collection of components to simplify the development process of visual interfaces. React is used to build single page applications by implementing a new extraordinary feature, the virtual DOM. In the year of 2013, React was not only open-sourced but also adopted by approx 3 million front-end developers. After that, the coding problems have gradually resolved and React has gained a strong reputation in the year of 2014. Facebook and Instagram are the big companies using this framework.

In comparison with Angular, React needs more lines to do what Angular can handle in much fewer lines. React has a key feature which is the 'virtual DOM'. The virtual DOM is a light approach for updating DOM with new changes without affecting the performance. This is done by working with a light-weight copy of the original DOM then comparing with the re-rendered what should be changed optimally (using 'dirty checking' or 'observable'). Also, React does not need a browser to test as it does not interact with the real DOM.

On some attributes Angular is better and on others, React is better. React gives you freedom and simplicity, but lacks the declarative power of Angular. Angular is a much fuller featured framework than React, but that doesn't mean a lot when we don't see the need for most of the features that Angular provides. We have to write less code to do more in React, also React has better performance than Angular due to React's implementation of a virtual DOM. The support for Angular is much better, with a larger community, as React is just getting started.

Vue.js

Vue is also a JavaScript framework that was first released in February 2014 by an ex-Google-employee Evan You. Vue is the most rapidly growing JS framework, especially without the backing of any big company. The Vue inherits most of the good things from both React and Angular and hence some techies consider it an unofficial child of Angular and React.

In comparison with Angular, Vue.js is very lightweight and easy to learn framework that lets you create stunning applications your way. It is not as much famous as Angular (maintained by Google) among developers, but certainly creating major waves of change. You might not know, but Laravel community has also considered it as one of their preferred front-end frameworks. Angular is a much-evolved framework and has several tools right out of the box.

Both Angular and Vue.js are viable choices for web application development. They are also similar in nature when it comes to writing code. Vue.js is more lightweight, while Angular is more enterprise ready for developing complex applications. However, many enterprise users testify that Vue has its place in enterprise application development. Angular's main drawback is its size, startup time, and memory allocation capacity compared to Vue. However, Angular shines as the complexity of the application goes up. Angular is also great for SEO.

Ember.js

Ember.js is an open-source JavaScript application framework for creating single-page client-side web applications, which uses Model-View-Controller (MVC) pattern. The framework provides universal data binding together and URL-driven approach for structuring different applications with the focus on scalability. Ember was originated as SproutCore in 2007. In 2011 it was acquired by Facebook and renamed to Ember. It combines proven concepts from native frameworks like Apple's Cocoa with the lightweight sensibilities. In EmberJS, specific satter method is used on a model to update a value which in return is bound to UI while the page is rendered by handle bars. EmberJS depends upon widget based approach. It allows custom elements to be used in handle bar template. Ember's infrastructure enables custom application specific HTML tags. It has full-

fledged templating mechanism which drastically reduces the overall amount of code returns. It is performance focused so it has quick boot and inherent stability. It is compatible with many application ecosystem. It is well integrated of strong data layer with JAVA.

In comparison with Angular, Angular obviously has a popularity advantage over Ember. Fundamentally, Ember is extremely friendly to Rails programmers in terms of built tools including developer experience. Furthermore, if you absolutely consider about URLs plus SEO and still require to adopt one of these rich frameworks, Ember's built-in router would make it a little more SEO-friendly. As for Ember, we can say that it is smart JavaScript. It takes many decisions on its own so the time spent on researching and glowing together libraries is saved. It is not so popular so it takes time to gain knowledge. It is well suited for Future aspects projects.

AngularJS

AngularJS is an open-source, JavaScript-based, front-end web application framework for dynamic web app development. It utilizes HTML as a template language. By extending HTML attributes with directives and binding data to HTML with expressions, AngularJS creates an environment that is readable, extraordinarily expressive and quick to develop. This first version of the framework known as AngularJS was launched in the year 2009. It laid the foundation of the present-day front-end application development. Angular JS was one of the best single-page application development solution. Gradually, it wide adoption and become very popular.

In comparison with Angular, AngularJS is still useful or else everyone would have migrated to Angular by now. Each version of Angular has significant benefits, but there is much to gain in being up-to-date with the latest version. Angular is decidedly faster than AngularJS, has a mobile-driven approach, executes better with components, and enables smoother migration from earlier versions. If you are comfortable with one version of Angular, switching to another should be easy for you—and well worth the effort.

Backbone.js

Backbone.js is a framework that allows you to structure your JavaScript code in an MVC. Within the context of Backbone, the view kind of doubles up as a controller. It listens to DOM events and chucks them up to the models as appropriate. It also listens for changes to your models and collections and redraws the DOM appropriately.

It is easy, fast and lightweight framework so very easy to understand the documentation and codes. This explains how it will work. It is very easy to build your own framework in no time. The downside of Backbone is that it requires writing an extensive amount of code that is mostly for integrating components, which are ready-made in Knockout and Angular with a few attributes. This can be considered as a limitation from the development point of view. However, it can be considered as an advantage

where there will be no hidden configurations behind the scenes, therefore being more understandable and explicitly coded. The biggest drawback of Backbone is that, instead of providing structure, it provides some basic tools to create structure. So, somewhere you have to depend on developers to decide how to structure the application.

IV. VERSIONS

In this section, we will highlight about when angular came and how quickly it grew into a market. In every six months, Angular team is coming with the new version of angular, making it more powerful with new features. I must appreciate the angular team for their wonderful efforts. Angular is most discussed word in frontend development world. It has gained a lot of popularity in these years. Angular becomes a choice of a lot of frontend developers.

AngularJS - 2010

The first version of the framework known as AngularJS was launched in the year 2009. AngularJS is a JavaScript framework that is developed by Google. It is used to make single page application (SPA). AngularJS allow developers to develop web application faster. It uses a client side rendering—a technique in which rendering of the content is taken care by client (browser).

Features of AngularJS:

1. **Data binding**—automatic synchronization between model and view.
2. **Dependency Injection System**—a design pattern in which system supplies the dependent objects when it creates the object.
3. **Scope**—that takes care of controller and view.
4. **Services**—for sharing info among different parts of application.
5. **Directives**—It gives super power to HTML. For instance, ng-model, ng-app.
6. **Controllers**—heart of the application where logic resides.
7. **Template**—view that gives information using our controller and model.

AngularJS came with lots of features for developing a powerful web application but failed at some point like huge bundle size, performance issues, SEO problem, code maintainability issues but that does not mean that it is total failure. Data binding, Dependency Injection concepts are success of angular. Hence, we can say it's half failure and half success. The imperfection in AngularJS made angular team to rewrite the whole framework from scratch. Such big change in new version of any framework/library was never encountered in the market.

Angular 2 - 2016

Later version of AngularJS came into the market in 2016, then, it was no more known as AngularJS. It got a name 'Angular'. Angular 1.x version is known as AngularJS.

Later version after 2.x is known as Angular. But the thing to remember here is that it was not a typical update. Angular 2 is a complete rewrite of its counterpart. It uses the component based approach. The use of Angular 2 in developing HTML and JavaScript Web apps is prevalent.

Angular 2 came into market with drastic changes. The biggest change was introduction of Typescript. Typescript is superset of JavaScript with additional features like it follows OOPS concepts, strongly typed. Programmers that are coming from object oriented world finds it more familiar unlike JavaScript.

It is biggest cons that angularJS is poor in SEO. When you view the page source, you can see there is nothing(no HTML) which makes crawlers to think website useless i.e. without any info. It is very painful when your website wants google crawlers to index them and make them to reach on top in google search but could not achieve it. Angular team took care of it and introduced angular universal which takes care of SEO of your angular website. It uses server side rendering which in turn solves SEO problem.

Angular 4- March,2017

Angular 4 is typescript based open-source and front-end web app development framework. Angular 4 is the successor of Angular 2. It is not a complete rewrite, and both versions use the same patterns and concepts. It comes with some advanced features like smaller and faster apps, animation package, use of AS keyword and so on.

Angular 4 came with bug fixes and other new features and improvements. The biggest improvement that was done was in bundle size. They reduced bundle size by 60% which in turn made application lighter and hence application loading time decreased. The other thing that was done was in animation package. They pulled out animation feature in a separate package-@angular/animations.

Angular 5- November,2017

Angular 5 is more advanced and has more enhanced features than Angular 4. The best feature of Angular 5 is that it aids developers in removing unnecessary codes from their applications. Other improved features are a code-sharing feature, less time for assembling dynamic web applications, and so on. Moreover, it has DOM support, and its compiler helps with incremental compilation.

To enhance application performance more, they introduced build optimizer- It is a tool that was introduced to make small bundle size. It uses tree shaking technique to remove the dead code from application. Another feature that was introduced was state Transfer key (Transfer State Key which is part of the platform/browser package).

Another improvement that was done was in http client package. In this version, HTTP Client Module came with improvements like using this module, developers do not

have to parse the response using a map. Parsing step is not needed any more. Suppose if there is non-JSON type response, then you can specify that response using response Type in your HTTP request.

Angular 6- May, 2018

The improvements in this version are even better. Angular 6 has been written to prefer web parts that are a part of most cutting-edge browsers. With this, you can make an Angular web component and use it in various HTML pages later.

In this version, angular CLI got updated. New commands were introduced like ng update. To update your angular project dependencies to latest, you can use it. The other improvement that was done was in RxJS library called as RxJS6. Another change is—angular-cli.json is replaced with angular.json. This file defines the configuration of the project like styles, scripts, testing, build process and so on. In angular.json, more options for configuration are added like multiple projects configuration can be done.

The other improvements are—<ng-template> is now available instead of <template>. There is change in the way of making services available for use like in previous version, if we

want to make service available in entire application or in specific component- we have to provide it in provider array but in this version, in service file itself there is 'providedIn' metadata that is available for it. You can specify there the availability of services. By default, it makes service available at root level.

Another feature that is added is an 'angular element' package. This package allows developers to use your angular component in another environment (non-angular environment) like Vue.js. It's another interesting feature that makes you to use your angular component in other environment.

Angular 7- October, 2018

Google has released Angular version 7 in Oct 2018 with a lot of optimum features and significant changes like Angular Material, CLI prompts, Scrolling, Drag, and Virtual and Drop & Component Dev Kit (CDK). In Angular 7, the command-line interface (CLI) prompts have been updated to v7.0.2, When the user executes common commands like ng add @angular/material or ng new it will automatically prompt users commands like ng add @angular/material help you discover built-in features like routing or SCSS support.

The features that were added were CLI prompts, virtual scroll, drag and drop and again bundling size reduction. In CLI prompts, angular-cli asks you about options like when you make new application using ng new application-name. CLI asks you whether you want to add routing file or not and so on. There is also budget property

added in angular.json in which you can specify your maximum and minimum budget size value.

Angular 7 added a new compiler called the Angular Compatibility Compiler (ngcc). Just like the name suggests, the angular compiler offers an 8-phase rotating ahead-of-time compilation (AOT) and most of the angular applications noticed a massive reduction (95-99%) in bundle sizes. Angular 7 now supporting to TypeScript 3.1

Angular 8- May 28, 2019

Angular 8 has introduced with a bunch of workflow and performance improvements and a lot has changed in the framework under the hood in terms of tooling. Comparing Angular 6 vs Angular 7 vs Angular 8 Finally, Angular 8 released with ivy rendering which Angular team was along with updated angular core framework, Angular Material, and the Command Line Interface or CLI.

Major features included in Angular 8

1. AngularJS API Migration Improvements with \$location service.
2. Updated Typescript to 3.4.x
3. @angular/platform-webworker and @angular/platform-webworker-dynamic both the packages are deprecated.
4. @angular/http removed from the list of packages.
5. ng-build, ng-test, and ng-run are equipped to be extended by 3rd-party libraries and tool.
6. Angular router backward compatibility.
7. Dart-sass for Sass files.
8. The ViewChild and ContentChild decorators now must have a new option called static.

Angular 9- Feb 7, 2020

Angular 9 was released on the 7th of Feb 2020, with some exciting new features. Along with these existing features have also been modified. The highlight of this version is the default IVY compiler which forms the core structure of the entire framework.

Major updates in Angular 9

1. Selector-less directives were already supported in the old version but were missing in the Ivy preview in Angular 8. This has now been added to Angular 9.
2. The AOT builds will be noticeably faster ensuring a significant change in the compiler's performance.
3. With IVY we see an improvement in the build error. It gives less time for the builds to complete enabling all the error messages easier to read.
4. The Angular framework in the new version uses unique techniques and tools to debug its applications by themselves.
5. The deprecated versioned files option for service workers in the service worker asset group config has been removed.
6. The ViewEngine in this version translates the templates and components into regular HTML and JavaScript for the browser can interpret and display them.

V. CONCLUSION

In this paper, we have surveyed that Angular's innovative approach for extending HTML will make a lot of sense for people who are web developers in soul. With a large community and Google behind it, it is here to stay and grow, and it works well both for quick prototyping projects and large-scale production applications.

We have surveyed the latest technologies of web and mobile frameworks from Backbone, Vue and AngularJS to the recent releases of React and Angular. Through analyzing each of these frameworks based on the different key features of application platforms we were able to compare them thoroughly. Finally, there is no absolute winner or 'the best framework'. Each framework has its strengths and weaknesses, we have to learn different frameworks to see which is more suitable to the situation we are in and what functionality we seek. If the goal is creating a fast UI, structured project or a lightweight application needed for a quick prototype, then, the best option will be React, Angular and Knockout/Backbone, respectively. Needs to update with real data.

Still, we believe that Angular stands above other frameworks due to its efficiency, convenience, different features and cross-platform support. Although Angular can require significant time for learning (over other similar frameworks), it can be the best practice and the trending future of web and mobile applications to come. Angular is promising and a great choice to develop web applications. Angular features and the Angular services combine to result in feature rich and top notch web applications. Angular can be useful to built enterprise web applications. TypeScript has all the features needed to develop large-scale projects, as the Angular team claims. TypeScript is equipped with autocompletion, advanced refactoring, and navigation features. What's more, thanks to the architecture of this tool, you can easily reuse and maintain code.

Angular can also useful for develop apps with dynamic contents. Since the primary purpose of Angular was to create single-page web applications, it has a wide range of tools for SPA development. What's more, it's an ideal technology for websites where the content should change dynamically based on user behavior and preferences. Dependency injections ensure that in case one component is changed, other components related to it will be changed automatically.

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