An Analysis of the Significance of Spring Boot in The Market

Conference Paper · July 2022

DOI: 10.1109/ICICT54344.2022.9850910

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***Abstract*—This paper intends to collect various research papers, chapters, and articles based on the Java Spring boot Framework. Several documents and articles are reviewed to gain their insights and collectively report based on those papers. A detailed study towards the spring boot framework is reviewed based on the recent articles, demystify the various applications and possibilities of working process under different caters is analyzed. Ranging from Enterprise Java applications to building restful Web services that are highly scalable, can be done and carried out with ease using spring boot. Some of the articles revised the different styles of architecture used via spring boot to build scalable and efficient applications. These articles and papers discuss designing other scalable systems for performing various actions like Hour man information management system, Backend for public complaint systems, etc. This survey shows the importance of Spring boot as the best choice for building a backend for applications required to be scalable and Multithreaded. This Java framework provides many extra benefits when processing huge amounts of data compared to other Node JS, a single-threaded one.**

Keywords — Spring Boot, Spring Framework, JAVA, Enterprise level coding

I. Introduction

Spring boot is one of the spring module frameworks which provides Rapid Application Development (RAD) functionality built on top of the popular Java Spring Framework to provide quick and fast access to information in doing a project. Setting up the RAD is quite easy to configure and run web-based and enterprise developments using Java. The most significant thing about this framework is that we can just run the application as it requires very minimal spring configuration, making developing standalone spring-based applications a lot easier. Embedded Servers and the Spring Framework modules are used by Spring Boot for its operational purpose. Also, in spring, it is not required to configure XML.

It follows the software design paradigm of convention over configuration. In simple words, the efforts of the developer are minimalized. Starting a spring boot project has been made so easy that we can directly use Spring Initializer. Generally, spring provides features such as dependency injection, powerful database transaction management, and simplified integration with other Java frameworks such as JPA/Hibernate ORM, Struts, and so forth. The development of the application takes less time and costs less. The dependencies in a project add Spring Boot annotations to configure the application automatically. For instance, the MySQL database is on the class path, and we haven't yet configured the database connection, but spring boot sets up an in-memory database for us.

II. Related Works

In suggested [1] developed a web application towards public complaint service using spring boot-microservices architecture. These microservices architecture are used to split the functionality based on the corporate process. These services are interconnected to each other, resulting in a complete business process in a single application.

Introduced in [2], a person-hour managing information system using spring boot framework. This system is used to process, analyze, and identify the person-hour workflow problems over industrial and assembly-based service companies. An in-depth analysis is done based on why spring boot is selected for this research purpose.

Discussed how the internet technology applications can be used under government sectors through spring boot supported technologies [3]. It also outlines how these applications can be more effective in problem-solving complex management processes with low-efficiency work execution. This paper proposes a customized spring boot framework to adopt the concept of micro-services architecture and other integrated Mybatis, Redis technologies used within the spring framework.

According to [4], using the spring boot platform, you can keep up to date with the latest economic and policy news and information in the Belt and Road regions. A complex problem of hard data processing was solved for the "Belt and Road" complex data. As a background framework, the proposed system uses Spring, Spring Boot, and Mybatis.

Object-oriented programming and software engineering techniques are applied to describe the civil aircraft structural strength materials performance database systems [5]. As a starting point, the management scope and input data standards for the material library are defined; Material information for metals, composites, and layup is classified and managed based on its use.

A simple demonstration in [6] using Java Message Service (JMS) helps us understand how the clients work and are configured under the spring boot framework. Also, JMS is considered part of message-oriented middleware for sending messages between two or more clients at a particular time interval T.

Furthermore, the author of [7] has discussed the workings of Advanced Messaging Queuing Protocol (AMQP), an agnostic messaging protocol. This AMQP is often used in the financial sector and other financial applications. In time, the extension of VMware/Pivotal has acquired its working process by embedding it with the Erlang programming language. Thus, the programming language of RabbitMQ was born with unique functionality.

Nowadays, Cloud Computing is one of the most in-demand and significant concepts in the Information Technology (IT) industry [8]. Apps and architectures based on "Cloud-Native" concepts are gaining popularity because they allow developers to more easily follow patterns that provide speed, scalability, and security. An alternative mechanism is used similar to the existing technique, i.e., the Maven command, which allows the creation of standalone applications [9]. Using a container for external applications, we can create WARs from web applications.

Spring Boot provides an Actuator module that gives various non-functional requirements to our application ready to go into production. The authors of [10] have done a detailed study about the usage of the Spring Actuator module and give a gist of how to use the features provided to monitor Spring Boot applications. In general, after deployment, developers check the logs to ensure correctness and check for bugs. CRUDyLeaf, a DSL (Domain-Specific Language), extends the DSL programming languages used to develop and design in such a way to based on the problem that occurred in addressing domain with n number of alternative solutions [11]. Also, for CRUD entity operations, the spring boot framework uses an external API known as “REST” for generating CRUDyLeaf entries in the database.

Web applications hold a significant and key role among applications powering these businesses [12]. There is a need to build robust servers and applications to support a rapidly increasing user base. In this paper, we discuss how we can make reactive systems using Spring Boot and Spring Webflux.

III. Technological Developments

The technological development towards the spring boot is focused on five stages of development.

A. Research Initiative Differences

Recent research initiatives using spring boots are listed. Many other technologies and methodologies are bound with spring boots to observe the benefits to develop an efficient system.

- ✓ Web Service integration through AI (Artificial Intelligence to use predication algorithms on various applications [13].
- ✓ Oak Ridge National Laboratory's ARM Data Center (ADC) uses Spring Boot to create a REST-based SOA-based API that bridges the front-end user interface with the back-end database. Users of the ARM platform can now submit reports by either using the user forum or by using the REST service API, which collects the same data quality information about ARM data as stated in [14].
- ✓ Using Microservices and Spring Boot, we develop a backend application for public complaint systems were proposed in [1]. A web browser can be used to access the cloud-based application. It can also be added more microservices without affecting others, which is an advantage of this architecture.
- ✓ Model and View separation on an application through many technologies for a warehouse management system is proposed [15]. The design towards front-end uses Angular JS and bootstrap. In contrast, the back-end utilizes Java with spring boot to form the business logic and data processing.

B. Feature Comparison

The feature comparison of the spring boot towards the existing mechanism is explained as follows,

- ✓ Spring Boot reduces the cluttering in our project. Unlike other frameworks for building RESTful Web services, Spring Boot stands apart because of its unique features.
- ✓ Spring Security which adds a protective layer that is more secure than typical JSON Web Token (JWT) used in Node JS etc.,
- ✓ Having a Java framework, Spring boot has the advantage of being multithreaded. So, for building backends that are required to support a huge amount of data significant in today’s era, Spring Boot can easily stand apart from other frameworks.

C. Technology Differences

The technology differences used in spring boot and outcomes are discussed as follows,

- ✓ Spring Boot is based on the Spring framework and uses Java language.
- ✓ It varies with other frameworks like NodeJS, Django, Php etc. But when it comes to light weighted and more scalable solutions, NodeJs can be a better fit.
- ✓ Using Java which is a multithreaded language, Spring Boot has an extra edge here over NodeJS.

D. Merits and demerits over the genre of application

- ✓ Spring Boot can handle huge amounts of data, can be used especially in the Big Data industry.
- ✓ When it comes to being lightweight and more robust, Spring Boot has many dependencies that make it a heavy application.
- ✓ A lot of configuration has to be done for all the dependencies and is not so simple compared to NodeJs etc.
- ✓ Spring boot is very simple for building RestFul Web services and APIs, making it simpler for the developer to complete the job.
- ✓ Demerits include a lack of control and flexibility in projects.
- ✓ Also, we can find bloated JAR's, i.e., many unused dependencies, which sometimes makes them unsuitable for large-scale projects.

E. Highlights of Spring Boot

- ✓ AutoConfiguration - You can automatically configure specific classes if it detects their presence in the class path. For example, Spring Boot automatically creates an in-memory database for you and a ready-to-use JDBC Template when you add the JDBC Template to your class path and include the H2.jar. To use the JDBC Template in a DAO layer, you do not need to write the above code.
- ✓ Starter POMs - By identifying and adding common dependencies to the project, the starter POMs remove the pain. The minimum number of dependencies that need to be incorporated in order to build a simple Spring MVC-based REST application and run it in an embedded container is seven. All of these can be found by adding spring-boot-starter-web dependency in your pom.xml using Spring Boot starter packages or starter dependencies.
- ✓ Spring Boot CLI - In order to create Spring-based web applications using Groovy programming, you can use the Spring Boot CLI, a command-line interface provided by the Spring Boot framework. Spring Boot and Groovy go well together. Java developers benefit from Groovy's simplicity, while Spring developers benefit from the simplicity of Spring Boot.
- ✓ Actuator - Using the actuator, you can see what's going on in a running Spring Boot application. The application provides a lot of metrics and insight about how applications are running in production. For example, using an actuator lets you determine the ex By using an actuator, you can determine the exact beans and configuration used in an application context, make decisions based on auto-configuration, see what environment variables, system properties, and command-line arguments are available to an application, and many other things. Spring Actuator addresses the problem of not knowing what is inside your application with all its auto-configuration goodness.
- ✓ Spring Boot Initializer - Spring Boot's initializer solves the problem of project structure with another feature called Spring Initializer. Maven or Gradle can be generated from the website using Java, Kotlin, Groovy, or Spring Boot. Project Metadata is all that needs to be provided, such as name, group, artifact, etc. Additionally, a variety of starter dependencies can be selected, such as web, JPA, and security.

F. Tools

Some of the tools supporting the spring boot are explained and listed as follows,

- ✓ Gradle - An IDE to support software development under multiple languages. It focuses on the product, testing and publishing.
- ✓ Maven – A tool handles projects written using C#, Ruby, Scala and so on.
- ✓ IntelliJ – A commercial development tool written in JAVA language. It provides coding assistance, built-in tool integration, plugin ecosystem, 28+ language supports.
- ✓ JMeter – A testing software added as a plugin to spring boot to measure various services' performance.
- ✓ Mockito - Test-driven development and behavior-driven development can both be conducted with double test objects created in the framework.
- ✓ Live Reload – A browser extension used to support CLI application and server programs through APIs.

G. Companies that support the technology

- ✓ Netflix
- ✓ Google
- ✓ PayPal
- ✓ Discover Financial Services
- ✓ United Health group
- ✓ Wells Fargo
- ✓ Intuit
- ✓ Target

H. Workflow of Spring Boot

Figure 1 illustrates the architecture of the sample application as it consists of each component and microservice, as described below. The connections between each service represent the communication points as to how the protocols are defined and used for computation purposes.

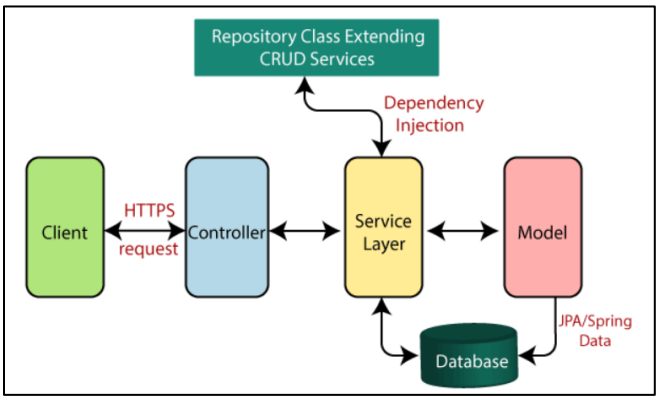

Figure 1 Working Architecture of Spring Boot

The validator class, the view class, and the utility class are now available. Using all the Spring-like modules, such as Spring MVC, Spring Data, etc., Spring Boot uses them all. There is only one difference between Spring Boot and Spring MVC: Spring Boot does not require DAO and DAOImpl classes. CRUD operations are performed on a data access layer. HTTP requests are made by the client (PUT or GET). Controllers map requests and handle them. Requests are sent to them and are handled by them. If required, it then invokes the service logic. The business logic is performed in the service layer. The model classes map data to JPA and perform logic on it. The user is returned a JSP page if there are no errors.

L. Market Value

Market demand for Spring Boots has remained strong. There is always something new coming out of the Spring community and they have created an ecosystem that has gone global. This framework dominates the market today. Figure 2 depicts the overall graphical representation of spring boot usage under various frameworks over the past decades.

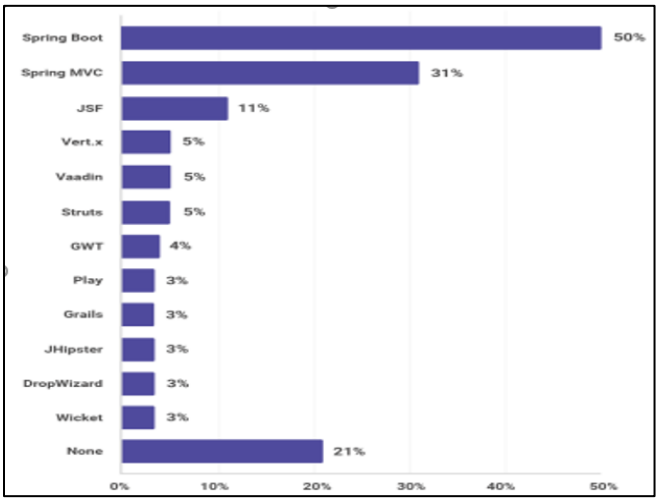

Figure 2 Spring Boot Graph Process

IV. Conclusion

Spring boot is one of the most used and popular frameworks worldwide to develop ready to use enterprise-level applications in Java. It can be used to formulate Restful Webservices and API more simply and reduce the developer's efforts by avoiding all the boilerplate code. It is very useful and appropriate, especially for a huge amount of data and processing. While other competitors like NodeJS are faster, it's still ineffective due to its security features, especially in the banking sector. As per analysis, 24% of the market was affected directly by spring boot and 41 % indirectly by spring supported services. It is better to understand the demand and supply of the IT industry to diversify our research focus.

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