

Web Application Stack

by

Ronnie Rocha

Submitted to the Department of Mathematics & Computer Science

School of SUNY Purchase

in partial fulfillment of the requirements

for the degree of Bachelor of Arts

Purchase College

State University of New York

December 2021

Sponsor: Lee Tusman

Second Reader: Knarik Tunyan

Contents

[[Title]]	1
Abstract	3
Introduction	4
1. Frontend	5
1.1 HTML	5
1.2 CSS	5
1.3 JavaScript	6
2. Backend	7
2.1 Apache Web Server	7
2.2 Tomcat Servlet	8
2.3 MySQL Database	9
3. Conclusion	9
4. References	10

A web application is made up of many pieces working together to create the overall design and function. These pieces are referred to as the web application stack when referencing to them as a whole. My research found that there are many different stacks that can be used depending on the end result that's needed. To put into practice this research, I created a electronic register application. For my mockup application I used many different pieces to make up both the frontend and backend of the application. The frontend included HTML, CSS and JavaScript. While the backend consisted of Apache tomcat server and MySQL database. This research was important for learning of real-world applications of these stacks. In this thesis I explore the web application stack, define its individual parts, and put them into practice to create a mockup electronic register application. This application would be used to make sales transactions and save them within a database for record keeping.

My senior research consists of researching how web applications are made and what they consist of. A Web application itself is just an application program that is stored on a server and accessed over the internet through a browser. Since its stored on a server, a web application doesn't need to be downloaded to be accessed by a user. Using a web browser such as Mozilla Firefox, Google Chrome and many others, a user can access the web application and interact with it. Web applications have many benefits to them, one being that it allows for multiple users to have access to the same version of an application at the same time. Also, it can usually be accessed by users through multiple platforms such as desktops, laptops and mobile devices like phones and tablets. Some commonly used web applications are cloud service apps, e-commerce apps for shopping and even media steaming apps like Netflix for example. Web applications for the most part are made up of a Web application stack, which is just a combination of technologies working together to create a software project.

The Web application stack will consist of many different pieces but can be split into two main parts, those being the Frontend and Backend. The Frontend is the part of the application that you as the user will see and interact with. The frontend is also known as the client side for that reason. The client side of the web application is usually built using a combination of HTML, CSS, and JavaScript. Working along with the frontend, is also the backend of the web application. The backend performs behind the scenes and isn't in sight of the user. The backend takes on the task of driving the application and implementing its logic. It will consist of a server, server application and a database. The server application runs on the server and waits for requests from the user, then either retrieves information or sends information to the database. If it

retrieves information, then it also sends the response back to the user with the information. In conjunction both the frontend and backend are important to making a complete web application.

The frontend consists of HTML, CSS, and JavaScript. All three have their own functions and together create the interface of the web application. HTML stands for HyperText Markup Language and is the most basic building block of the web. It describes the structure of the web page and is the standard markup language used for creating web pages. HTML consists of an array of different elements, which will tell the browser how to display the content to the user. These elements are defined by a starting tag, some content, and an end tag. Some examples of tags are `<html>`, `<head>`, `<title>`, `<body>`, `<h1>`, and `<p>` which are shown in Figure 1. The

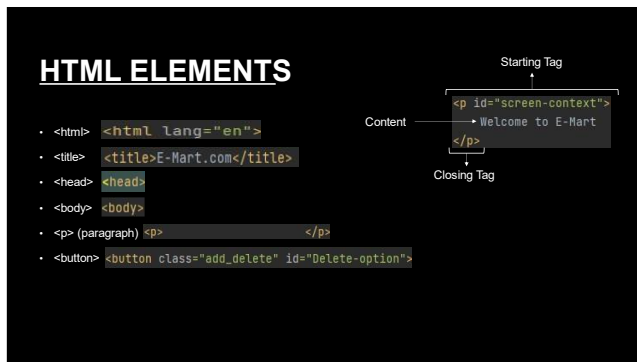


Figure 1

HTML element will consist of everything from the starting tag to the ending tag. All the elements define a certain aspect and combined create the structure of the web page. A web browser will read the HTML document and use it to display it properly.

The tags themselves aren't on the web page but are used to determine how exactly the document will be displayed to the user. The document will be displayed using the browser's default style, which will be styled according to the tags used. The browser will apply this basic styling to make sure the HTML is readable even if no explicit styling is given. This is where CSS comes into play and gives some styling to the HTML. CSS stands for Cascading Style Sheet and with it, it's possible to create pleasant and good-looking web pages. CSS is a rule-based language, so an individual can define rules specifying a collection of styles that should be applied to either specific or groups of elements. The styling can be anything from color, font, arrangement of

elements, animation and much more. The rule opens with a selector, which selects the HTML

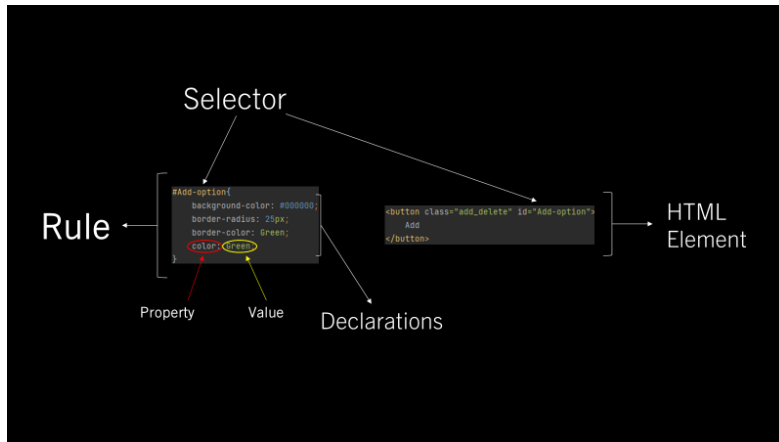


Figure 2

element that the styling will apply

to. Inside these rules, a single or more declarations can be made.

These declarations will take the form of property and value pairs.

Every one of these pairs will

specify a property of an element

that is being selected and the value that is being given to that property. Each CSS property will have values that are allowable depending on the property that is being specified. For example,

the color property will require a value of a specific color. In combination HTML and CSS are

languages that create structure and styling for the web page, but JavaScript gives the web page

interactive elements that the user can engage with. JavaScript is a text-based programming

language that can be used on both the client-side and server-side. It improves the user's

experience on the web page by changing a static page into a dynamic interactive page. JavaScript

will allow the user to interact with the web page, doing things like playing audio/video, zooming

in and out of a map, or even

checking to make sure all required

fields in a form are filled before it

being submitted. Examples of

sound being played on a button

click and generated maps can be

seen in Figure 3. There are

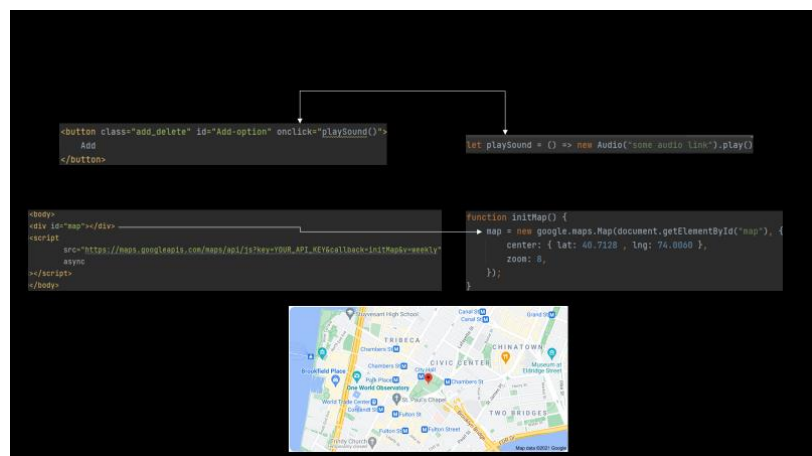


Figure 3

practically no limitations to the things that can be done using JavaScript. These three languages together create the client-side of the web application and is the visual/interactive segment of the web application.

The backend consists of a server, server application and a database. One of the most commonly used web servers is the Apache web server. Its not physical server but a software that runs on a HTTP server. Its job consists of establishing a connection between the server and the user's browser. When a user wants to visit a web page, their browser sends a HTTP request to the server and the Apache web server responds with the web page or file. The user's browser will request for a specific file or resource and the web servers' job is to read this request, grab this file or resource, and serve them as web pages so that the user can analyze them. All the communication between the browser and web server occurs using HTTP. HTTP or HyperText Transfer Protocol, is the protocols provided to the hosts and clients. These protocols are instructions on how to access the files, transfer them, and display them properly. The web server will serve these files in the users web browser as HTML files.

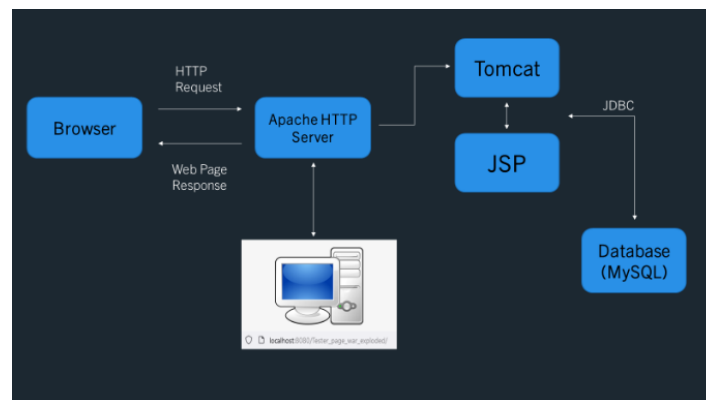


Figure 4

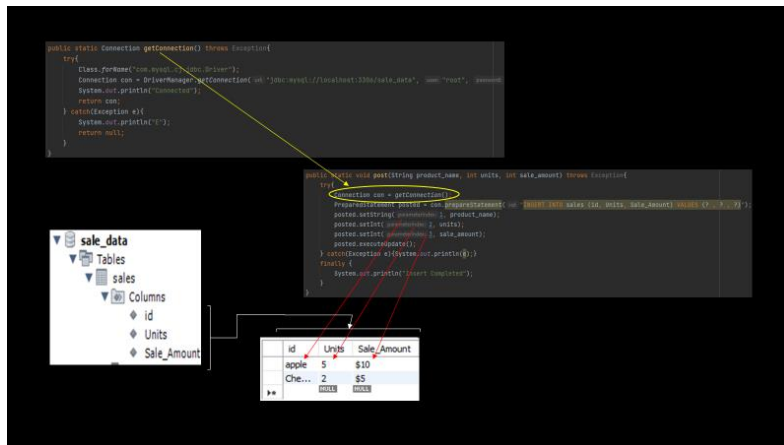
If some amount of processing is required, then the Apache web server will send the request to the Tomcat server application. This is all considering that a three-tier architecture is

being used. The three-tier architecture in web development consists of the web server, application server, and the database server. Each tier runs on its own infrastructure, so each piece can be worked on separately by different teams for efficiency in time during development. Another benefit of this three-tier architecture is that one tier can be updated without impacting the other two tiers, this is because each can be running on different operating systems and have their own dedicated servers. In comparison to a two-tier architecture, the three-tier will be able to do more complex logic as where the two-tier would be restricted to more simple actions like entering and receiving data.

Tomcat is a servlet, which handles the logic and defines how requests and responses should be handled. It will use Java Based logic to take in requests, potentially contact the database for information, and then use that information to send back a response to the web server and back to the user. A servlet is the program that runs on the web server or application server. It's used to handle requests that are acquired from the web server. It will process these requests, construct a response using its logic, and send the response back to the web server. Servlets are capable of taking on complex requests that are acquired from the web server. Using Java servlets allows a way to create dynamic web pages. It has the ability to take advantage of Java class libraries to communicate with other software, including our database. JDBC, or Java Database Connectivity, is used by the java program to access database management systems, which in this case was used to connect to MySQL.

MySQL is a database system used on the web that uses the standard SQL language. SQL stands for Structured Query Language. It's a standardized programming language that's used to manage relational databases. MySQL is used for a wide range of purposes, mainly being a web

database. It's used to store anything from a simple record of information to a whole inventory of



available products of an online store. In Figure 5, an example of some java code is shown that will access the database and insert into it what is needed. For the mockup application, this database is used to keep records of what product is

sold, the number of units sold and the sales amount of the transaction. Each column is a certain aspect of the transaction's information, while the row is the whole transactions information per specific transaction. When Tomcat needs to, it sends a query to the database asking for certain information from it and the database responds with the information. These actions can be adding to the database, receiving transaction information, or deleting a transaction completely.

Based on the research, while a web application is a singular thing, it is composed of many pieces. Each doing their own job, whether it be describing the interface details, or running logic on the backend. For my mockup application the web stack chosen was a good fit and gave all the tools necessary to create an electronic register. This research was important on giving insight to what goes into web application development and its process of creation. While the combination of technologies that went into the stack chosen worked for this project, more research into other technologies would be needed to put together a different stack to better fit a different web application concept. Web application stacks similar to the one studied, drive many of our modern-day applications. They allow users to access, interact, and have a personalized experience within the web application.

References

TechTarget Contributor August 2019, TechTarget

<<https://searchsoftwarequality.techtarget.com/definition/Web-application-Web-app>>

Daria Bulatovych, Yalantis

<<https://yalantis.com/blog/tech-stack-for-web-app-development/>>

HTML Introduction, w3schools

https://www.w3schools.com/html/html_intro.asp

What is CSS? October 2021, Mozilla

<https://developer.mozilla.org/en-US/docs/Learn/CSS/First_steps/What_is_CSS>

What is JavaScript used for? August 26, 2021, Hack Reactor

<<https://www.hackreactor.com/blog/what-is-javascript-used-for>>

Richard B. Dec 08, 2021, Hostinger

<https://www.hostinger.com/tutorials/what-is-apache#What_Is_a_Web_Server>

Matthew Tyson Dec 19, 2019, InfoWorld

<<https://www.infoworld.com/article/3510460/what-is-apache-tomcat-the-original-java-servlet-container.html>>

Cameron McKenzie Oct 24, 2019, TheServerSide

<<https://www.theserverside.com/video/Tomcat-vs-Apache-HTTP-Server-Whats-the-difference>>

Alexander Roznovsky, Light-IT

<<https://light-it.net/blog/choosing-a-technology-stack-for-web-application-development/>>

GeeksforGeeks Sept 6, 2021, GeeksforGeeks

<<https://www.geeksforgeeks.org/introduction-java-servlets/>>

PHP MySQL Database, w3schools

<https://www.w3schools.com/php/php_mysql_intro.asp>

HTML: HyperText Markup Language, Mozilla

<<https://developer.mozilla.org/en-US/docs/Web/HTML>>