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Lab 1 – Strome InFusion Product Description

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## **1 INTRODUCTION**

Mark Strome graduated from Old Dominion University (ODU) in 1978 and went on to found a multimillion dollar California investment management firm (Council, 2014). He wanted to give back to his school for taking a chance on him during his admission process. Strome wants ODU to use his \$11 million donation to establish an entrepreneurial curriculum at the school and create a center to help students become entrepreneurs.

The Strome Entrepreneurial Center (SEC) at ODU educates students on entrepreneurship as a career and cultivates students as up-and-coming business leaders (Strome Entrepreneurial Center, n.d.). The center has venture advisors and community partners to help students go through the entrepreneurial process. Workshops, seminars, and other networking events hosted regularly.

One of the key aspects of the SEC is the potential for collaboration. In many cases, entrepreneurs need a team to see their aspirations become a reality. The Strome Entrepreneurial Center helps members identify their needs and find collaborators to meet those needs (Strome Entrepreneurial Center, n.d.).

Students must register through the SEC's online system before they are able to consult with staff at the center or community partners (Strome Entrepreneurial Center, n.d.). One of the problems that the Strome Entrepreneurial Center has is converting their visitors into registered members. Currently their registration process is very overwhelming, and requires that multiple people to approve accounts. When a student visits the SEC, there is no record of the visit. Staff members at the Center are unable to analyze any metrics to find out if they are helping all of the registered students.

Strome InFusion will solve these problems and provide a new online system for the SEC. There are a number of things that staff members at the SEC would like in a solution, such as an easier way to connect future entrepreneurs with possible collaborators and an easier way to send updates and notifications to users registered in their system.

## **2 STROME INFUSION PRODUCT DESCRIPTION**

Strome InFusion is a web-based product that will help entrepreneurial centers manage their members. InFusion has a simple registration process for users, which will help them find resources to help reach their goals in entrepreneurship. Entrepreneurs will be able to be matched up with other users that can provide a needed resource.

InFusion is composed of many parts working together. Figure 1 is a high level view of how an end-user will access InFusion and how the major components interact with each other.

### **2.1 Key Product Features and Capabilities**

Strome InFusion is an application that users can access over the Internet, through one or more of the access portals. The InFusion website, or web application, will be the main interface for users. The web application will utilize responsive web design, providing an optimal viewing experience for the user by adapting the page layout based on the size of the device the application is being viewed on.

The other program that will be used to access InFusion is a mobile application, which will be available on all major mobile platforms. With push notifications from the mobile application, users will be able to quickly receive any updates or messages from InFusion.

The registration form will be simple, to help increase the conversion rate of visitors to members, if that is the appropriate action. Once a user joins InFusion, the SEC staff will be able to keep in contact with them and make sure that their entrepreneurial needs are being met. Since

there are certain requirements that must be met in order to use the Entrepreneurial Center, the complete registration process will be 2-steps. After a user registers for an account, they will be guided to fill out their user profile. Concurrently, the staff members will be notified of the new user and take the appropriate action, either approving the user, requesting more information, or denying access; users that have an ODU email address will automatically approved.

When users register with Strome InFusion, they will be able connect with venture mentors, possible collaborators, and relevant community partners. Users will also be able to receive notifications of events being hosted at the Strome Entrepreneurial Center, as well as schedule meetings with mentors or other registered users.

Registered users are encouraged to fill out their user profile so that they can be easily matched up with future entrepreneurs looking for particular skillsets. Users will also be able to access the Strome InFusion Job/Message Board, which will be an online page for entrepreneurs and other users to connect with each other and help each other with their needs.

## **2.2 Major Components**

Strome InFusion is a web-based application made up of many components working together with each other. At the base of the InFusion technology stack is the operating system running the services. Most modern operating systems can run the software needed by InFusion, so we are not limited by a run-time environment. Linux will provide a stable and secure environment that can run all of software needed for InFusion. It is flexible enough to work on all major computer hardware and scale up easily if the need arises (Noyes, 2010).

The next major component in the technology stack is the web server. In the top one million busiest sites, Apache and Nginx host 47.18% and 23.36% of the sites, respectively (Netcraft, 2015). From a high-level point of view, both web servers are capable of running the

software for InFusion, as they are both powerful and flexible. Nginx was initially written to handle over 10,000 concurrent connections, which it does by using an asynchronous, events-driven architecture. Nginx is less resource intensive than Apache, and is able to easily scale on commodity hardware (Ellingwood, 2015). When compared to Apache, Nginx is about 4.2 times faster at transferring data (The Organic Agency, 2013). Speeds may vary, depending on the specific set up, so it would be beneficial to run a benchmark comparison to see what would give the best results. Based on the initial data, Nginx will be used for the web server.

Having a responsive interface is one way of providing a positive user experience. AngularJS will be used as the framework for the front-end of InFusion. With AngularJS, web pages do not need to be generated and transferred in their entirety; once the small, initial web page is loaded, remaining portions can continue to load in the background, and be displayed as they finish processing. Multiple API requests can be processed in parallel by the API server, so that requests that take a long time don't hinder other requests. With the presentation being processed client-side, instead of server-side, the amount of data being transmitted and page load times decrease significantly (Thousand Eyes, 2013).

Having a fast, light-weight (in terms of resource usage) back-end to run InFusion is very important. There are many web frameworks that meet those needs, written in various programming languages. Flask, a micro web framework written in Python, makes writing fast RESTful APIs simple. To have code written in Python run on a web server, a Web Server Gateway Interface (WSGI) is needed. InFusion will be using the uWSGI to interface with the web server, Nginx. SQLAlchemy will be used as a database interface.

Storing the data for Strome InFusion is an important job. Many factors that go into deciding on a database: performance, scalability, features, and cost. Both MySQL and

PostgreSQL provide what would be needed for InFusion. SQLAlchemy allows developers to write database agnostic code, which means that InFusion will be able to interface with many of the common databases on the market with little to no changes in the code base. Similar to the web servers, it would be beneficial to do benchmark comparisons to find the best solution. PostgreSQL has more features, is more standards-compliant, and has an open license; so for these reasons, InFusion will be using PostgreSQL.

In addition to accessing Strome InFusion from a web browser, users will also be able to use one of the mobile applications. We will be using Apache Cordova, which will allow Strome InFusion to easily be packaged into a mobile application and be compatible with many of the common mobile platforms. Through the mobile application, users will be able to access resources within Strome InFusion and receive push notifications of important messages.

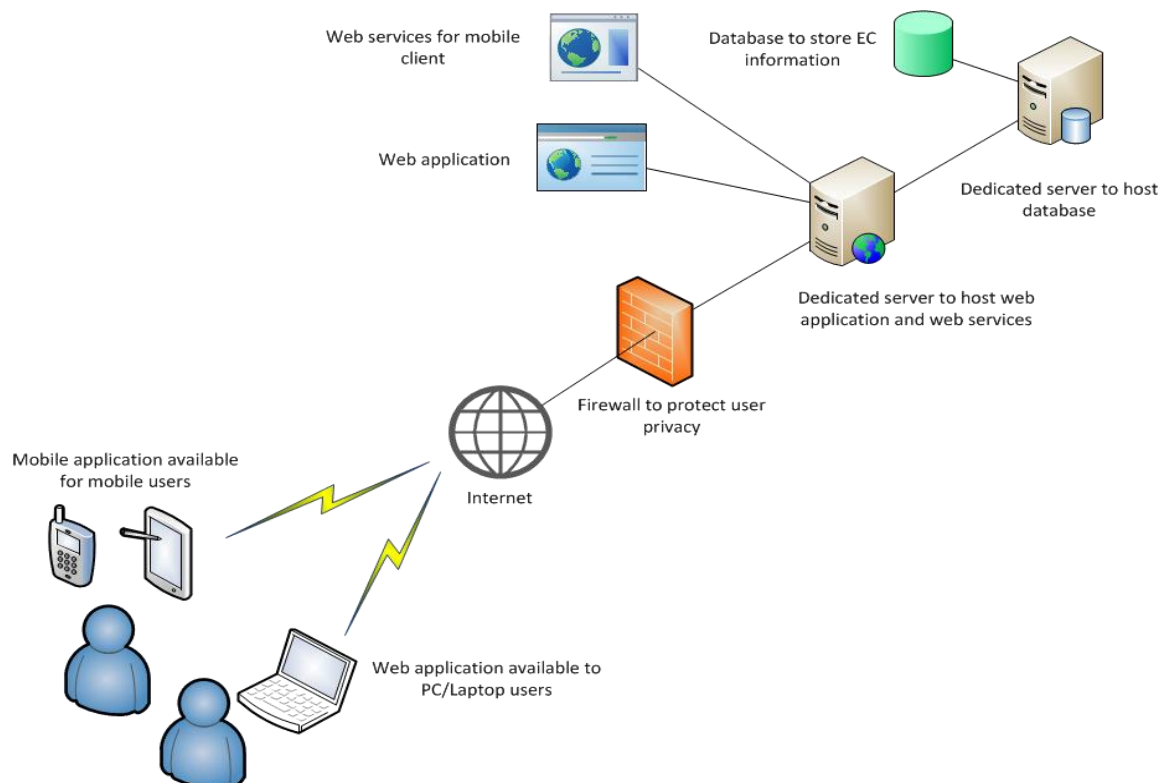


Figure 1. Major functional component diagram

### **3 IDENTIFICATION OF CASE STUDY**

Strome InFusion will have multiple types of users, including Strome Entrepreneurial staff members, potential entrepreneurs, venture advisors, and community partners. ODU students with a business idea can visit the Strome Entrepreneurial Center, meet with an advisor and get additional resources for their ventures. Those students will be able to register for a Strome InFusion account, leading to networking with other members, view entrepreneurial tips and information, and schedule meetings with a venture advisor. Strome InFusion will help match potential entrepreneurs with potential collaborators, as well as keep registered users up to date on events happening at the SEC.

Members of the local community will also be able to register for an account, and once approved by a staff member, will be able to become an advisor or post on the InFusion job board. These users are external members within InFusion, but can also be venture mentors or provide another service to the Entrepreneurial Center.

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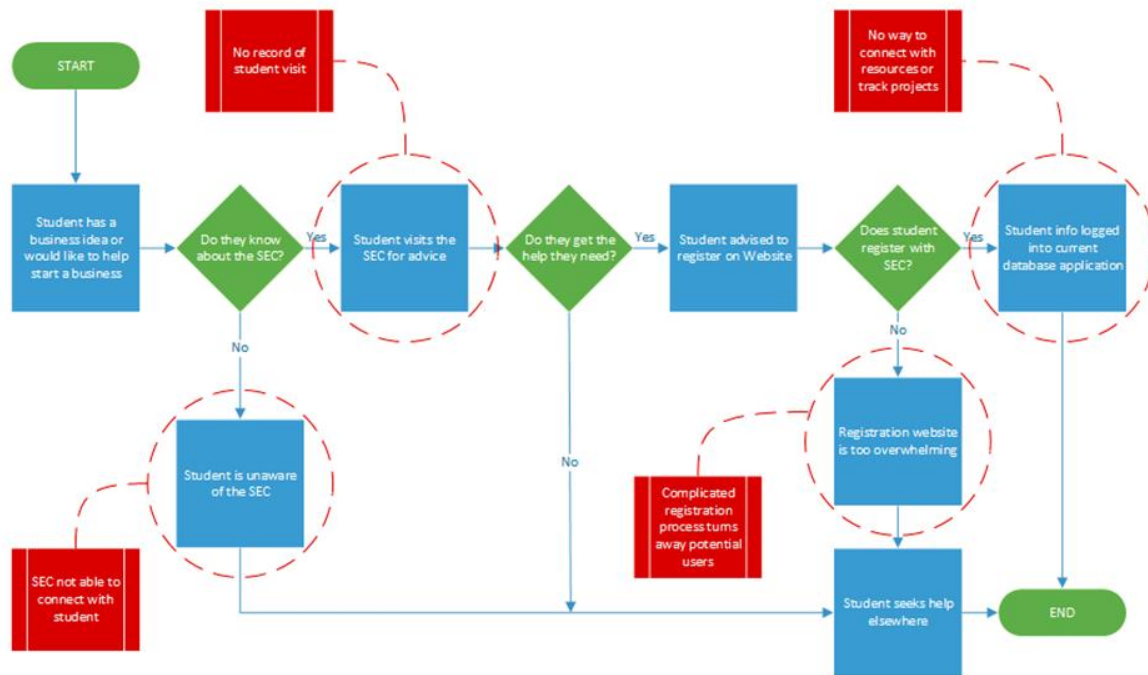


Figure 2. Current process a student may take to register at Strome Entrepreneurial Center

## 4 STROME INFUSION PRODUCT PROTOTYPE DESCRIPTION

The prototype of Strome InFusion demonstrates the major functionality of the full product of InFusion. The architecture of the prototype will be similar to the finished solution, but will not be at the same scale. The key components will work the same as the end product, but the differences are described in Table 1.

### 4.1 Prototype Architecture

Figure 3 visualizes the major functional components of Strome InFusion, as well as the interconnections between the end users and Strome InFusion. Instead of having separate, dedicated systems for the web and database servers, the processes will all be running on a virtual machine that is hosted by the Computer Science department at Old Dominion University.

The components of InFusion are easily scaled up, both horizontally and vertically, with minimal work. Complimentary to that, the same components are very easily scaled down,

meaning that they can run on low-end hardware. The major components of Strome InFusion remain the same for the prototype.

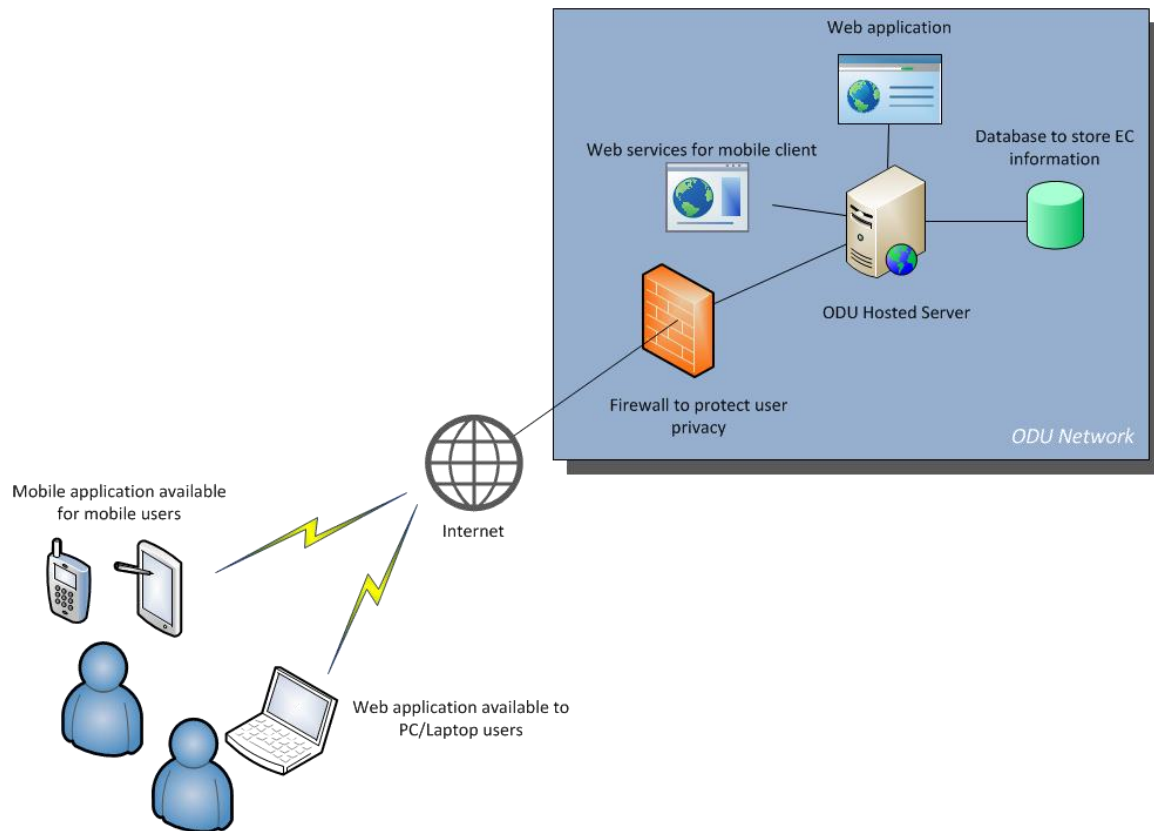


Figure 3. Phase 1 prototype major functional component diagram

## 4.2 Prototype Features and Capabilities

Strome InFusion has many features in the full product. The prototype will highlight many of those features, but will not have everything fully implemented. Table 1 compares the features in the full product and the prototype.

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Feature	Real World Product	Prototype
Authentication	Integration with third party schemes such as shibboleth	Custom authentication
Client Testing	Testing across a large variety of mobile and desktop web browsers	Mobile testing on only the devices that our team members own. Full support only for modern browsers
Customer Support	Telephone and email support for problems or questions using the application	Not simulated – Customer support is a common need for software applications.
Events	Ability to list events and add events to a calendar view for individuals and companies	Eliminated from prototype
External Resources	External investors and mentors who are willing to contribute to the success of the venture.	Test data provided by Director Grden and the Strome InFusion team
Internal Resources	Students who want to utilize their skills to work on a business venture.	Strome InFusion team members connecting as a venture to test functionality
Mobile Application	Mobile application will be available natively for all major mobile OS platforms	Will only be available natively for Android devices
SEC Staff	SEC staff and mentors who will provide guidance for the project.	Director Grden as well as Strome InFusion team members simulating Strome Entrepreneurial Center staff
Security	Audited to confirm the security of proprietary data	Not reviewed
Service	Support for scaling to multiple servers and other environments	Limited to the capabilities of a single virtual machine
Service Integrations	Integrate with existing software and services used by universities such as Microsoft Lync	Integrated with email
Students	Students at ODU who wish to collaborate on a business venture	Actual student and Strome InFusion team members using virtual machines using Strome InFusion team data along with special test functionality

Table 1. Feature comparison between full product and prototype

InFusion will be integrated with multiple 3<sup>rd</sup> party authentication technologies, but for the purposes of the prototype, authentication will be handled locally by InFusion. The testing team will include members of the development team, the director of the Strome Entrepreneurial

Center, and a set of SEC staff members. That team will act as various types of users to test all of the capabilities of the system and make sure that everything works as expected.

For the mobile application, the prototype will be developed for the Android operating system. The technology used for mobile development should allow for seamless distribution to other mobile platforms. Limited resources and funding restrict us to test with devices that the team members have access to, which happen to be Android devices.

### **4.3 Prototype Development Challenges**

As with any development project, there will be a number of challenges to overcome. One challenge is handling future scaling. During development, plans and algorithms to scale up will be put in place, but resources may not be available to fully test the scaling capabilities. There are many variables to account for when predicting future problems, and even more ways to solve them, so it may be difficult to know if horizontal or vertical scaling will be the best solution.

Testing on all mobile platforms will require a large amount of resources, so the Strome InFusion development team will only be able to test on resources that are available. Apache Cordova is able to deploy on multiple platforms, but the development team only has access to Android mobile devices. To deploy on Apple devices would require an Intel-based computer with at least Mac OS X Lion (10.7.4+) and Xcode 4.5 (Cordova, n.d.). The InFusion development team does not have access to a computer meeting those requirements and does not have a developer license, so building an application for Apple devices will not be possible.

Another challenge is handling the limited time for prototype development. There are many features that need to be developed and tested, so if there are many unforeseen problems, the schedule may be affected. This will be overcome by using an Agile workflow, as well as testing early and often, so that issues are discovered and resolved before the problem is too large.

## GLOSSARY

**ACID compliance:** Atomicity, consistency, isolation, and durability are the properties that guarantee that a database transaction is processed reliably.

**Agile (Software Development):** A group of software development methods in which solutions evolve through collaboration between self-organizing, cross-functional teams. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible response to change.

**AngularJS:** A structural framework for dynamic web applications, based off of JavaScript.

**Apache Cordova:** An open source project that provides a set of device APIs that allow a mobile application to utilize native device functions from JavaScript.

**Apache web server:** The world's most widely used web server software.

**API server:** A computer that provides API data over a network.

**Application Programming Interface (API):** An application programming interface is a set of routines, protocols, and tools for building software applications.

**Application server:** The middleware of a server centric architecture.

**Backend:** The server, the web application, and the database.

**Business Canvas:** A strategic management and lean startup template for developing new business models.

**Company:** Any business that is owned or operated outside of ODU.

**Company resource:** A resource an external company registers in Strome InFusion to assist with student ventures.

**Concurrency:** Allowing multiple processes to go at once.

**Cordova:** See Apache Cordova.

**CSS:** Cascading style sheets, gives form to the HTML page.

**Data integrity:** The accuracy and consistency of data stored in the database.

**Database:** A comprehensive collection of related data organized for convenient access.

**DOM:** The Document Object Model is a logical structured document applied to HTML, it represents separate and distinct browsers and interfaces to view and interact with the web application.

**Employer:** A person or company that hires at least one or more employees.

**Encryption:** Encoding information in a way that is not readable except by authorized entities.

**Entrepreneur:** A person who organizes and operates a business or businesses, taking on greater than normal financial risks in order to do so.

**Firewall:** Software that prevents hackers from gaining access to systems with sensitive data.

**Flask:** A python web application framework.

**Frontend:** The HTML, CSS, and JavaScript of a web page.

**GUI:** Graphical user interface, is an interface that allows the user to interact with the application.

**Horizontal Scaling:** Adding more nodes to a system, such as adding a new computer to a distributed software application.

**HTML:** Hypertext Markup Language, a standardized system for tagging text files to achieve font, color, graphic, and hyperlink effects.

**InFusion:** An alternative name for Strome InFusion.

**JavaScript:** An object-oriented computer programming language commonly used to create interactive effects within web browsers.

**JSON:** JavaScript Object Notation is a minimal, readable format of structured data.

**Linux:** A Unix-like and mostly POSIX-compliant computer operating system assembled under the model of free and open-source software development and distribution.

**Linux distributions:** Operating systems based off of the Linux kernel.

**Load balancing:** The distribution of processes across multiple available systems to improve performance.

**Mobile application:** An application developed to be operated and interacted within a mobile operating system.

**MVC:** Model View Controller is an architectural pattern for building applications.

**MySQL:** An open-source relational database management system.

**Native application:** An application that has access to system functionality (i.e. the camera on a cell phone).

**Nginx:** A web server with a strong focus on high concurrency, performance and low memory usage.

**ODU:** Acronym for Old Dominion University.

**Object-relational database:** Is a database that uses an object-oriented model: objects, classes, and inheritance are directly supported in the database schema and in the query language.

**Object-Relationship Mapper (ORM):** A programming technique for converting data between incompatible type systems in object-oriented programming languages.

**Open source:** Software where the source code is freely available.

**Operating system:** The software that supports a computer's basic functions (i.e. launching applications and handling peripherals).

**PostgreSQL:** An open sourced, object-relational database system.

**Push Notification:** The delivery of information from a software application to a computing device without a specific request from the client.

**Python:** A widely used general-purpose, high-level programming language.

**Representational State Transfer (REST):** Software architectural style of the World Wide Web.

**RESTful framework:** Representational state transfer is an architectural style framework for the development of web services.

**Reverse proxy server:** A server that can retrieve resources from one or more servers.

**SEC:** Acronym for Strome Entrepreneurial Center.

**SI:** Acronym for Strome Infusion.

**SDK:** Software Development Kit, a set of software development tools that allow the creation of applications for a certain piece of software.

**Server:** A computer system that manages access to a central resource or service.

**Small Business:** A business that has less than 500 employees.

**SQL:** Structured Query Language is used to communicate with relational databases.

**SQLAlchemy:** A Python SQL toolkit and Object Relational Mapper that gives application developers the full power and flexibility of SQL.

**Stakeholder:** A person who will be affected by the outcome of Strome Infusions development..

**Toolkit:** A set of software tools.

**Ubuntu:** An open source operating system based off of Linux.

**User experience:** The overall experience of a person using a product.

**User skill:** A skill a user registers in Strome InFusion to assist with ventures.

**uWSGI:** Deploys the application server and implements WSGI protocols.

**Venture:** A student run business enterprise with a dedicated profile within Strome InFusion.



**Vertical Scaling:** Adding resources to a single node in a system, typically involving the addition of CPUs or memory to a single computer.

**Virtual Machine or VM:** An operating system OS or application environment that is installed on software which imitates dedicated hardware.

**Web application:** Client-server software application in which the client or GUI runs in a web browser.

**Web application framework:** A framework for software that supports web applications, services, and resources.

**Web server:** Systems that deliver web pages.

**Web Server Gateway Interface (WSGI):** Specification for simple and universal interface between web servers and web applications for the Python programming language

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