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Patrick Ferate

CS411W

Janet Brunelle

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1 INTRODUCTION

The Strome Entrepreneurial Center at Old Dominion University was created to educate students on entrepreneurship as a career and cultivate students as up-and-coming business leaders (Strome Entrepreneurial Center, n.d.). The center has venture advisers and community partners to help students go through the entrepreneurial process. There are workshops, seminars, and other networking events hosted regularly.

One of the key aspects of the Center 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 Center'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 multiple people to approve accounts.

When a student visits the Center, 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 Strome Entrepreneurial Center. There are a number of things that staff members at the Center would like an easier way to connect future entrepreneurs with possible collaborators. They also want a more direct way to send updates and notifications to users registered in their system.

2 STROME INFUSION PRODUCT DESCRIPTION

2.1 Key Product Features and Capabilities

Strome InFusion is an application that users will access over the Internet, through one or more of the access portals. The first being the InFusion website, or web application, which will be the main interface for users. The web application will utilize responsive web design; this will provide 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. Once a user joins InFusion, it will be easier for the Entrepreneurial Center staff 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 a 2-step process. 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.

Once a user registers with Strome InFusion, they will be able connect with venture mentors, possible collaborators, and relevant community partners. They will also be able to get notified of events being hosted at the Strome Entrepreneurial Center, as well as scheduling 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. They will also be able to access the Strome InFusion Job/Message Board, which will be a place for entrepreneurs and users looking to be collaborators can connect with each other.

2.2 Major Components

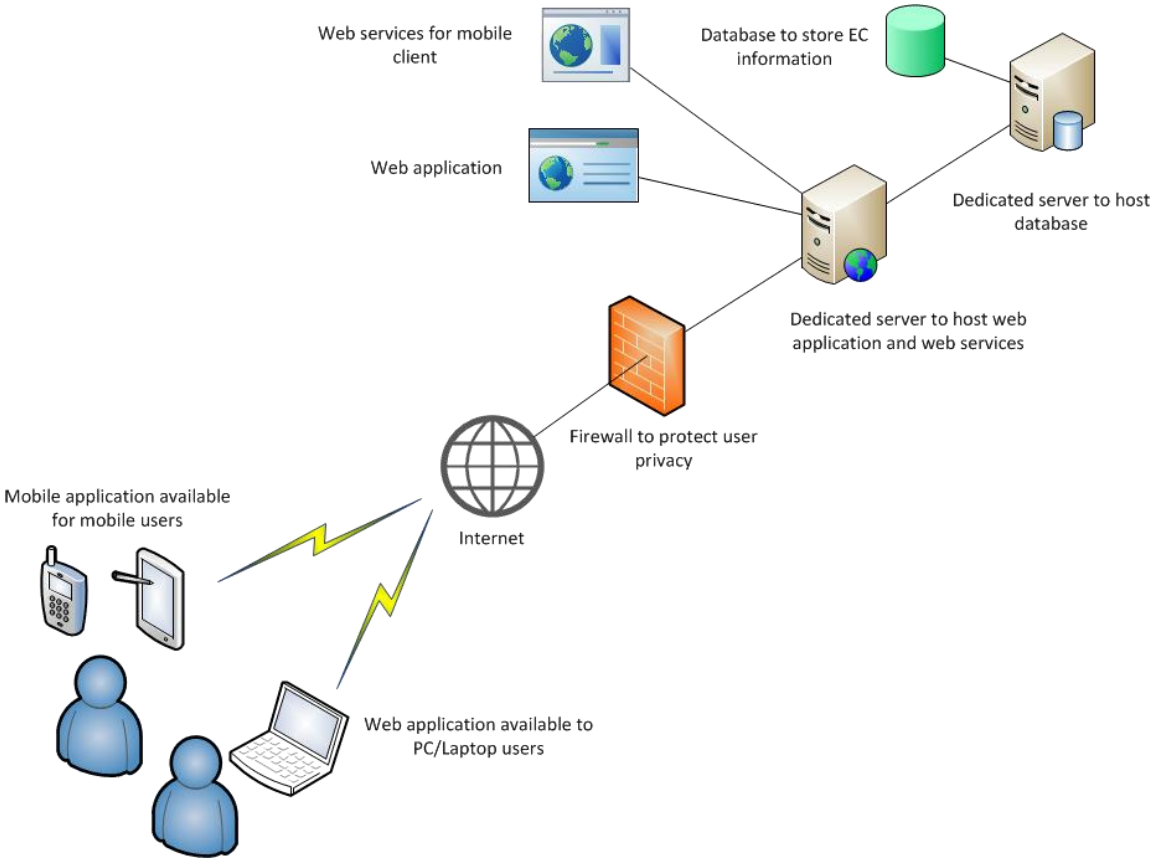

Figure 1. Major functional component diagram

Strome InFusion is a web based application made up of many components working together. At the base of our technology stack is the operating system running the services. Most modern operating systems can run the software needed by InFusion, so we are not forced into 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 just about computer and scale up easily it the need arises (PCWorld 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 ten thousand concurrent connections, which it does by using an asynchronous, events-driven architecture. Nginx is less resource intensive, compared to Apache, and is able to easily scale on commodity hardware (Digital Ocean 2015). When compared to Apache, Nginx is about 4.2 times faster at transferring data (The Organic Agency 2013). This may vary, depending on the specific set up, so it would be beneficial to run a benchmark comparison to see what would give us the best results. Based on the initial data, we will be using Nginx for the web server.

We want visitors to have a positive user experience; one way of doing that is providing a responsive interface. We will be doing that by using the AngularJS web 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, in parallel, and be displayed when they are ready. This is done by making multiple requests to the API server, which in turn, process and provide information to AngularJS. With the presentation being done client-side, compared to server-side, the amount of data being transmitted and page load times decrease significantly (Thousand Eyes 2013).

When looking for a back-end to run InFusion, it was important find something that was fast, light-weight (in terms of resource usage), and had a powerful database interface. There are

many web frameworks that meet those needs, written in various programming languages. We decided to use Flask, which is a micro web framework written in Python. It makes writing fast RESTful APIs simple, which will be access frequently by the client application. In order to have code written in Python run on a web server, we will need to use a Web Server Gateway Interface (WSGI). For InFusion, we 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 a very important job. There are 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 us 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 a more open license; so for these reasons, we 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.

3 IDENTIFICATION OF CASE STUDY

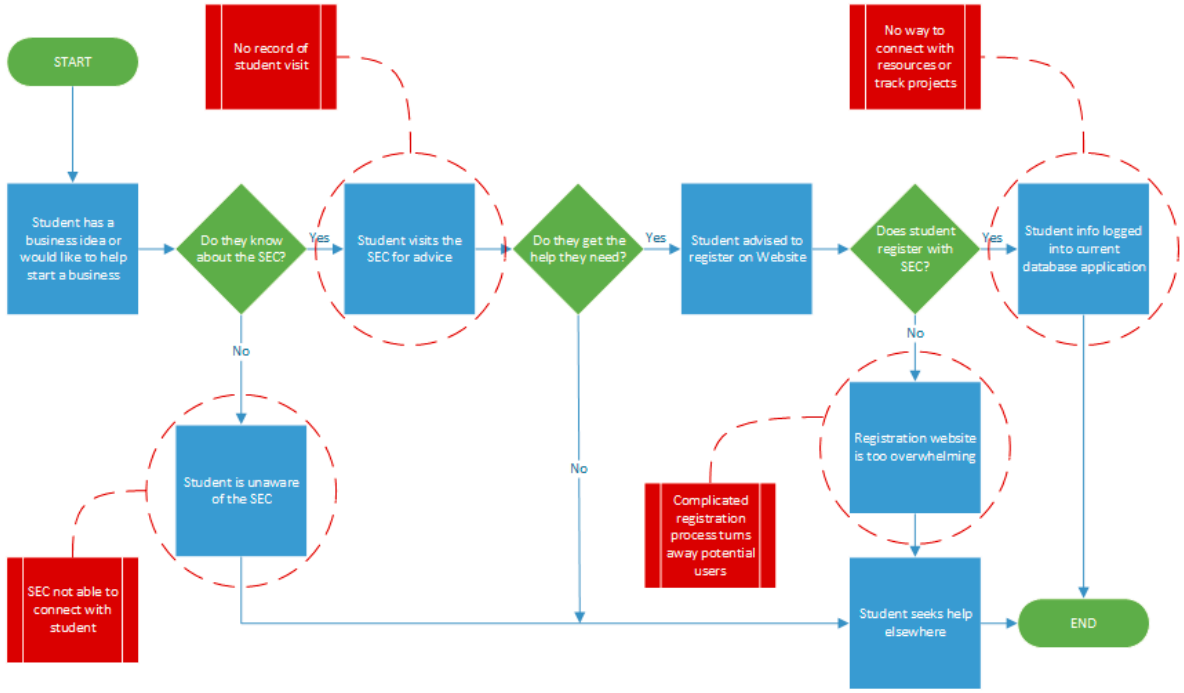

Figure 2. Current process a student may take to register at Strome Entrepreneurial Center

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

Members of the local community will also be able to register for an account and once approved by a staff member, be able to become an adviser or post on the InFusion job board.

These users are seen as external members within InFusion, but can also be venture mentors or provide another service to the Entrepreneurial Center.

4 STROME INFUSION PRODUCT PROTOTYPE DESCRIPTION

4.1 Prototype Architecture

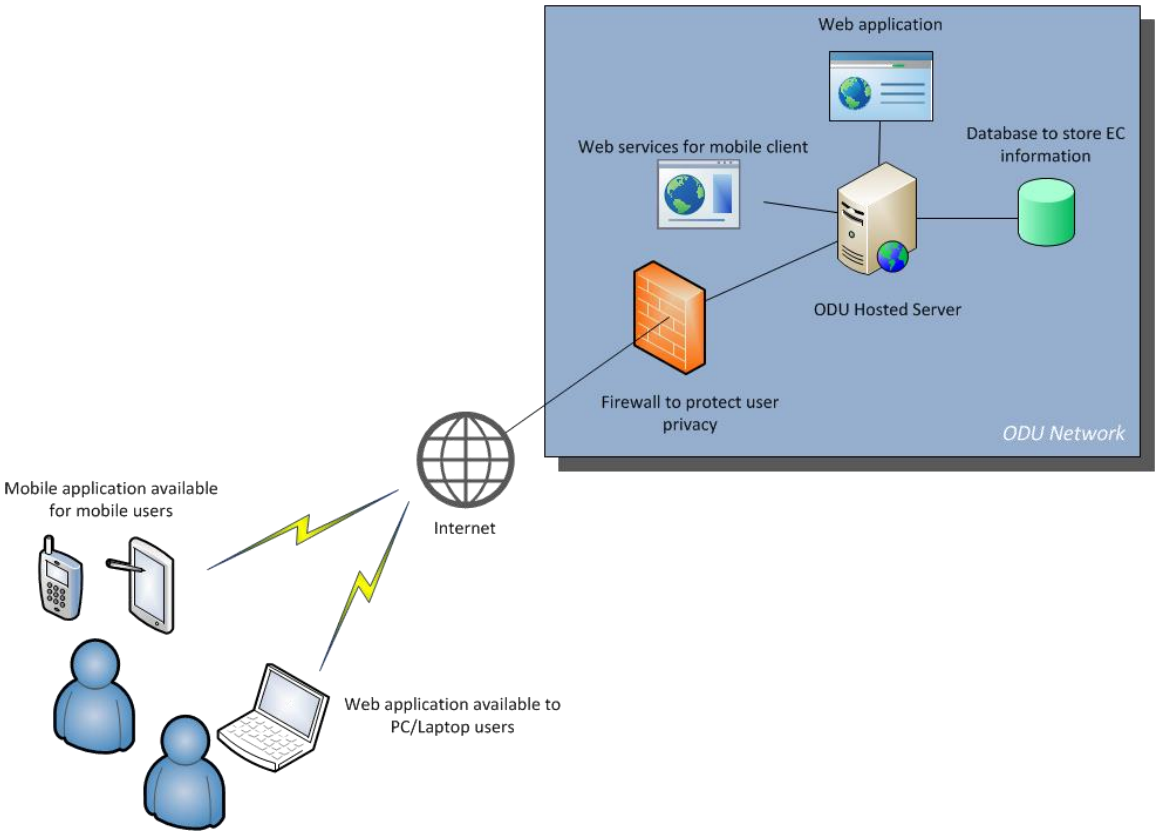

Figure 3. Phase 1 prototype major functional component diagram

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

The components that we chose are very easily scaled up, both horizontally and vertically, with very little work. Complimentary to that, the same components are very easily scaled down. For this reason, the major components of Strome InFusion remain the same for the prototype.

4.2 Prototype Features and Capabilities

Feature	Real World Product	Prototype
Authentication	Integration with 3rd 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

The capability for integration of multiple 3rd party authentication technologies will be accounted for, 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 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, we can put in plans and algorithms to scale up, but we will not have the resources to fully test the scaling capabilities. It is also unknown what type of scaling or how it will be done in the future; there are a lot of variables to account for.

We are also limited on resources for testing on various mobile platforms. The software that we will be using should be able to deploy on multiple platforms, but we won't be able to fully test them. To deploy on Apple devices, we would also need access an Intel-based computer with at least Mac OS X Lion (10.7.4+) and Xcode 4.5 (Cordova, n.d.). We don't have access to a computer meeting those requirements and do not have a developer license, so we won't be able to build an application for Apple devices.

Another challenge that will need to be overcome is handling the limited time for development of the prototype. There are a lot of features that need to be developed and tested, so if there are many unforeseen problems, the schedule may be affected. We will overcome this by

using an Agile workflow, as well as testing early and often, so that any issues are discovered and resolved before the problem is too large.

5 APPENDIX

5.1 Glossary

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: An open-source web application framework developed to address many of the challenges encountered in developing single-page applications.

Apache Cordova: A set of device APIs that allow a mobile application developer to access native device functions from JavaScript.

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

Application Programming Interface (API): A set of routines, protocols, and tools for building software applications.

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

Flask: A micro web application framework written in Python and based on the Werkzeug toolkit and Jinja2 template engine.

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

InFusion: An alternative name for Strome InFusion.

Javascript: A high level, dynamic, untyped, and interpreted programming language.

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

MySQL: An open-source relational database management system.

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

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

ODU: Old Dominion University

PostgreSQL: An object-relational database management system with an emphasis on extensibility and on standards-compliance.

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 API: Web service APIs that adhere to the REST architectural constraints

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

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

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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