Professional Internship Report

Summer 2014

Junnutula Meghanath Reddy

Software Engineering Intern

Contents

1 Acknowledgments

- **Dr. Frank Shipman**
  Professor at Texas A&M University-College Station
  He had the kindness to allow me to go on this internship and gain professional knowledge about various software practices and technologies.

- **Marjorie Farmer**
  Discipline Manager, Wireline Technology Software, Halliburton
  I thank her for the Internship opportunity and consideration which allowed me to explore my abilities thereby learning about the current trends and practices in software industry.

- **Horacio Zea**
  Software Development Lead, Wireline Technology Software, Halliburton
  He was an excellent teacher and mentor who had patience to deal with a novice and explain every detail about the project. I thank him for all the guidance and help through which I was able to realize my dream of becoming a professional software developer.

- **Wireline and Perforating Technology Software Team**
  Halliburton
  I would like to thank all the members of the Wireline Software Team for their review and careful analysis of my project which helped me better design the project and improve my abilities as a Software Engineer.

2 Abstract

This document provides a detailed report of my internship experience at Halliburton Energy Services in Houston. During the summer, I was a Software Engineering Intern working for the Wireline and Perforating Technology Software product service line. My main goal was to develop a software application following all the stages of the software development life cycle through agile-Scrum methodologies. This application was a necessity in order to relieve the field engineers from making tedious calculations and also offer the immense technical software features that the traditional excel sheet could not offer.

Thus, I have created my impact by successfully completing the internship and thereby developing a working and tested Pinning Sheet application. Also, I have learnt C#, a language which was used for the back-end logic and Windows Presentation Foundation, a Microsoft technology that has been used in collaboration with C# to develop the front-end of the application. The Model View ViewModel architecture has been adapted for the project to loosely couple the view and model thereby initiating a simultaneous working environment between the developers and designers.

This internship has taught me the various practices of software engineering in the real world, professional development in scrum methodology and helped me surface the technical abilities within me. I had a chance to put forth all concepts and knowledge acquired at school to good professional practice. Finally, I worked on a new tool called Isolator++ which is used to unit test the C++ legacy code. This improved the current Application Programming Interface and eliminated any dependencies. The main objective behind using this tool is to mock all the required components rather than using the original members as it would endanger the code to various vulnerabilities. I provided a report of my research about Isolator++ and the challenges faced during its implementation as it was considerably a new technology. Thus, I have successfully completed my objectives and motives underlined during the start of this internship program.

3 Introduction

3.1 About Halliburton

Halliburton is one of the world's largest providers of products and services to the energy industry. The company serves the upstream oil and gas industry throughout the life-cycle of the reservoir – from locating hydrocarbons and managing geological data, to drilling and formation evaluation, well construction and completion, and optimizing production through the life of the field.

In my view, Halliburton is a huge tree. The clients sow seeds of faith and provide data required, which Halliburton processes with its hugely diverse and branched organization to deliver the fruits (solutions or strategies) to the client.

Today, Halliburton offers the world's broadest array of products, services and integrated solutions for oil and gas exploration, development and production.

3.2 Internship

Firstly, I really appreciate Halliburton organizing team events throughout the internship, which helped interns from different parts of North America spend

time with each other and get to know more about their work and life. This particularly helped me break the ice with most of the interns as I am one among those people who would prefer to know more about my colleagues before I start working with them. Hence I found the group tasks and outings extremely helpful.

During the course of the project, my supervisor and mentor scheduled review sessions and involved us in team meetings which helped me get a better taste of the professional environment and helped me feel involved and served as important checkpoints for gauging my progress. These meetings were also instrumental in understanding the expectations of my team and vice-versa, which is an efficient tool in managing expectations and ensuring there's efficient two way communication. My supervisors Horacio Zea, Software Developer Lead and Fabian Rojas, Senior Software Engineer have constantly checked with me to make sure I had sufficient resources at my disposal to achieve the objectives of the project. I thank them, my mentors and colleagues for helping me make the most of this internship.

3.3 Team

A Halliburton employee's lifestyle is way more exciting than I imagined it to be with a perfect balance between work and play, which according to me is an ideal lifestyle and something I'd like to embrace for a long time.

3.4 Project Ambit

The on-field employees at Halliburton used a Microsoft excel sheet to calculate the number of pins required to detonate and trigger other processes. All the calculations were manually performed for accuracy as minor error within the Pinning Sheet would create havoc and turn hazardous. Hence, the Wireline and Perforating team wanted to automate this process and ensure all the calculations were thoroughly tested before the work kicks-off on the field, and the easiest way they would eliminate all dependencies and maintain a clean sheet is through a standalone application. The goal of my internship was to design and develop such an application which would provide consistency among clients and automatic the whole process.

3.5 Limitations

The main limit was the last of my stay: 14 weeks. It defined the deadline of the project. I thank my mentor, Horacio Zea and manager, Marjorie Farmer for having all the necessary resources at my disposal to realize my objective in the given time frame.

4 Methodology

4.1 C# language

Although, I had never dealt with the language before I was able to learn with the guidance of my mentor, Horacio Zea.

1. It should use the object-oriented programming methodology.
2. It should use the object-oriented programming methodology.
3. It should contain built-in support for using computer networks.
4. It should be designed to execute code from remote sources securely.
5. It should be easy to use by selecting what were considered the good parts of other object oriented languages.

4.2 Windows Presentation Foundation

Windows Presentation Foundation (or WPF) is a graphical subsystem for rendering user interfaces in Windows-based applications by Microsoft. WPF employs XAML, an XML-based language, to define and link various interface elements. WPF applications can also be deployed as standalone desktop programs, or hosted as an embedded object in a website. All the elements can then be linked and manipulated based on various events, user interactions, and data bindings. Hence, we decided that this technology would stand out best for our Pinning Sheet application.

4.3 MVVM Design Pattern

The Model View ViewModel (MVVM) is an architectural pattern used in software engineering that originated from Microsoft. MVVM facilitates a clear separation of the development of the graphical user interface from the development of the business logic or back end logic known as the model. MVVM facilitates the designer, who works to develop the beauty or the view and the developer, who improves the functionality can simultaneously without any hindrance and obstacles.

4.4 Software Used

- **Microsoft Visual Studio 2010**
  The most appreciated IDE (Integrated Development Environment) of the majority of the C# developers: it's powerful, flexible, reliable and free. Also the community is very large and provides a lot of useful plug-ins.
- **Resharper**
  ReSharper is a renowned productivity tool that makes Microsoft Visual Studio a much better IDE. ReSharper implements code inspections, automated code refactoring, blazing fast navigation, and coding assistance.

5 Software Development Life Cycle

5.1 Feasibility Analysis

Firstly, we included an analysis of project requirements in terms of input data and desired output, processing required to transform input into output, cost-benefit analysis, and schedule of the project. The feasibility analysis also includes the technical feasibility of a project in terms of available software tools,

hardware, and skilled software professionals. At the end of this phase, a feasibility report for the entire project is created.

5.2 Requirements

In this stage, several meetings were conducted with the clientele in order to thoroughly understand, gather, validate the specifications and requirements of the projects. This helped to plan each and every activity, where we wanted to discover things that belong to the project. Once the general requirements were gathered from the client, we made an analysis of the scope of the development and gauged the various technical difficulties that could be involved.

5.3 Design

After the requirements have been thoroughly understood, we started to design the structure of the project. This involved understanding certain design patterns and realizing their feasibility with the project. Finally, we decided to adapt the Model View ViewModel architecture which loosely couples the Graphical user interface and the Model driving the back end logic. This pattern also uniquely helps in segregating the work of the designer and developer to exist and work in tandem which otherwise could create dependencies and fallacies in development. Initially, the mathematical model of the Pinning Sheet was designed, Unit Tested and carefully analyzed to ensure all the formulas were correctly represented.

5.4 Development

The actual code was developed according to the design stage iteratively through each sprint. The code has been developed through C# using Windows Presentation Foundation which incorporates the use of XAML for the graphical user interface. The development was carried out in Microsoft Visual Studio 2010 and Team Foundation Server for the system integration. Our main goal, as stated in the Agile-Scrum methodology was to develop testable-working software at the end of each sprint.

The project consisted of daily stand up meetings which involved looking at the burn down charts and realizing our progress for the current sprint. Also, each member provided their feedback and current status which immensely helped in improving the project at every step.

Data Serialization, saving the current state and retrieving the previous states were some of the features developed through this stage. The capability of multiple units was a special add-on as requested by the client.

5.5 Agile-Scrum Methodology

Scrum is an iterative and incremental agile software development framework for managing product development. A key principle of Scrum is its recognition that during a project the customers can change their minds about what they want and need (often called "requirements churn"), and that unpredicted challenges cannot be easily addressed in a traditional predictive or planned manner. As such, Scrum adopts an empirical approach—accepting that the problem cannot

be fully understood or defined, focusing instead on maximizing the team's ability to deliver quickly and respond to emerging requirements.

5.5.1 Product Owner

The Product Owner represented the stakeholders and is the voice of the clients. This role was performed by Don Crawford III and his inputs were valuable at every stage of the project.

5.5.2 Scrum Master

Nadine Bonamy-Project Manager and Horacio Zea-Software Development Team Lead, our Scrum masters were accountable for removing impediments to the ability of the team to deliver the product goals.

5.5.3 Development Team

I and my mentor, Horacio Zea, Software Development Team Lead formed the core members of the development team for this project along with the guidance of Fabian Rojas, Senior Software Engineer.

5.6 Testing

Detection of errors and certain bugs, if any were included in this phase. Firstly, the code was Unit Tested using Microsoft Unit Testing framework. All the individual models were tested and their correctness was assured. Next, integration testing was carried out to ensure the compatibility of each individual model with the whole system. The code was tested and mapped against the design state to verify all the development was carried as designed and planned.

5.7 Deployment

The project is currently under deployment which includes securing export compliance as it would be released in different countries outside North America. The application has been licensed to eliminate any duplicity and would go through the Halliburton's regular licensing policies.

6 Conclusion

This internship at Halliburton was my first experience in an international firm and my first professional experience abroad. It brought me everything that a graduate student engineer may hope. I worked closely to software developers, scrum team, field engineers and managers. This allowed me to improve my team work skills, but also my capacities to communicate and to collaborate with experienced people.

Amongst other tasks, I was totally responsible for the development of the software throughout the cycle. Hence, I was extremely detail oriented and particular at every issue. I had to collect data from several departments of the company, including the Wireline and Perforating technical engineers, and to

look beyond the technical aspects of my work. Getting aware of the organization of the company, the allocation of the work, and the time and budget binds improved my working habits as an engineer. I observed that the preliminary work I carried out (collecting data, ripening the specifications and the architecture of the software, and planning the development) avoided lots of technical issues during the development. It spared me time to focus on other points, such as the communication with my mentor and my colleagues. An efficient communication is, I believe, a secret of a successful project, especially when the time is the main limiting factor.

From a technical point of view, I had the chance to improve my skills in objects oriented programming, in imitation, in communication synchronization and in the design of user interfaces. A very interesting facet of my internship was that I had to integrate my work to an existing environment. I had to be very demanding regarding my work, the reduction of my code and of my specifications. On a more personal point of view, this internship has been an exceptionally rewarding Experience as it allowed me to discover new working culture and improve my technical abilities. The very friendly nature of the employees at Halliburton considerably facilitated my integration and instilled the interest to work in the future at Halliburton. Eventually, the goal of my internship has been attained.

I am satisfied for the work accomplished and impact made at Halliburton. I am sure that this internship constitutes an important step in the build of my professional career.