

NASA KSC – Internship Final Report

The TSO Logic and G2 Software Product

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The TSO Logic and G2 Software Product Evaluation

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This internship assignment for spring 2014 was at John F. Kennedy Space Center (KSC), in NASA's Engineering and Technology (NE) group in support of the Control and Data Systems Division (NE-C) within the Systems Hardware Engineering Branch. (NE-C4). The primary focus was in system integration and benchmarking utilizing three separate computer software products. The first half of this 2014 internship is spent in assisting NE-C4's Electronics and Embedded Systems Engineer, Kelvin Ruiz and fellow intern Scott Ditto with the evaluation of a new piece of software, called G2. It's developed by the Gensym Corporation and introduced to the group as a tool used in monitoring launch environments. All fellow interns and employees of the G2 group have been working together in order to better understand the significance of the G2 application and how KSC can benefit from its capabilities. The second stage of this Spring project is to assist with an ongoing integration of a power monitoring tool, developed by a group of engineers from a Canadian based organization known as TSO Logic. Guided by NE-C4's Computer Engineer, Allan Villorin, NASA 2014 interns put forth great effort in helping to integrate TSO's software into the Spaceport Processing Systems Development Laboratory (SPSDL) for further testing and evaluating. The TSO Logic group claims that their software is designed for, "...monitoring and reducing energy consumption at in-house server farms and large data centers, ...allows data centers to control the power state of servers, without impacting availability or performance and without changes to infrastructure" and the focus of the assignment is to test this theory. TSO's Aaron Rallo / Founder and CEO, and Chris Tivel / CTO, both came to KSC to assist with the installation of their software in the SPSDL laboratory. TSO's software is installed onto 24 individual workstations running three different operating systems. The workstations were divided into three groups of 8 with each group having its own operating system. The first group is comprised of Ubuntu's Debian -based Linux the second group is windows 7 Professional and the third group ran Red Hat Enterprise Linux. The highlight of this portion of the assignment is to compose documentation expressing the overall impression of the software and its capabilities. The final stage of this 2014 Spring project was to assist Supervisory Ast, Technical Management Griffin, Laurie with a 3D modeling software used to create a virtual environment for different sectors of the NE Directorate.

I. Introduction

This internship assignment for spring 2014 was at John F. Kennedy Space Center (KSC), in NASA's Engineering and Technology (NE) group in support of the Control and Data Systems Division (NE-C) within the Systems Hardware Engineering Branch. (NE-C4) The primary focus was in system integration, data analyzing and product utilizing of three separate programs. The first piece of software was a graphical programming language, known as G2 developed by the Gensym Corporation. It was used as a potential means to model a fuel delivery system. The second program was a data analyst product developed by a group called TSO Logic. It was deployed into our lab environment as a potential means to a more cost effective method to server farms and laboratories. The third and final tool was a 3D modeling software called SketchUp. It was used to create a virtual model of one of our laboratory's environment.

II. Part 1: The G2 Experience

My internship assignment for spring 2014 was at John F. Kennedy Space Center (KSC), in NASA's Engineering and Technology (NE) group in support of the Control and Data Systems Division (NE-C) within the Systems Hardware Engineering Branch. (NE-C4) The primary focus was system integration, data analyzing, and

product utilization of three separate computer software products. The first product to study was a graphical programming language, known as G2. This software is developed by the Gensym Corporation and was proposed to our NE family by my mentor, Electronics and Embedded Systems Engineer, Kelvin Ruiz. G2 was introduced to us as a tool that could potentially be used at Kennedy Space Center as a more efficient method to model and eventually operate the fuel delivery system for the rocket in the SWORDS project. My assignment was to team with fellow intern Scott Dito, under the guidance of Mr. Ruiz, to better understand how KSC could better benefit from the software's capabilities.

I. Preparation

It was announced, about a month in advance, that engineers from Stennis Space Center (SSC) was scheduled to arrive on center to give a full demonstration on the G2 application. Mr. Ruiz quickly formed a group and I became part of a team constructed from a group of engineers from different parts of our NE family. Amongst us was Anthony E. Bharrat, (NE-A1), Gerald M. Stahl, (NE-C1), Jaime A. Toro Medina (NE-F6), Joanna L. Johnson, (NE-A1), Justin J. Youney, (NE-C1), Paul E. Paulick, (NE-A3), and Scott J. Dito, (NE-C4). Our overall objective was to get a more-than-novice understanding of the functionality of the software, and to be better prepared for the hands-on learning experience of the G2 engineers from Mississippi.

During this preparation, all members of our G2 Group were distributed textural and video materials needed to study the Gensym product. Our G2 group would meet every Friday at 11:00 a.m. in the SPSDL, to discuss the understanding of recent discoveries about the Gensym software. In addition to our scheduled meetings, G2 was also launched within the SPSDL laboratory onto four of our Windows workstations. It was by the way of VMware's Virtual Machines, that we were able to launch it across an additional four of the laboratory's Red-Hat, workstations.

II. Meet and Greet

It was in-between the dates of March 3-7 that the Spaceport Processing Systems Development Laboratory hosted veteran G2 application specialist from Stennis Space Center. During each of those days, in between the hours of 8a.m.-5p.m. our training consisted of a complete overview of the software and how it has been implemented so far in other NASA operations at SSC. Other detailed topics such as fault modeling and cryogenic-fluid environments were also covered. The veteran engineers gave us a G2 toolkit that had been developed over multiple years with pre-existing class libraries, which would help us to build our own customized application for Spaceport Processing Systems Development Laboratory. The Stennis group also shared ways in which the Gensym tool could create methods and procedures and design fault models and domain schematics. Overall, the key objective was to have the G2 application be used by KSC to design its own fuel delivery systems; based off of the experiences of the veteran G2 engineers from (SSC).

I. Part 2: The Vancouver Expedition

The second portion of my spring internship project was to assist with an ongoing integration of a data analyst tool, called TSO Metrics and Power Control. This tool is developed by a group of engineers from a Canadian based organization known as TSO Logic. Guided by NE-C4's Computer Engineer, Allan Villorin, the task was to team with fellow intern Aaron Garcia, to put forth great effort in helping to integrate TSO's software into the Spaceport Processing Systems Development Laboratory (SPSDL) for further testing and evaluating. The TSO Logic group claimed that their software was designed for, "...monitoring and reducing energy consumption at in-house server farms and large data centers, ...allows data centers to control the power state of servers, without impacting availability or performance and without changes to infrastructure." and the focus of my assignment was to test this theory.(TSO Logic, 2013)

II. The Long Distance Approach

Under the leadership of Allan Villorin, fellow intern Aaron Garcia and I were told in advance that the TSO Logic group would be sending representatives to KSC to assist with the installation of their software. It was our job to communicate with the Vancouver based organization and to learn as much as we could about the environment needed to successfully run TSO Metrics and Power Control application. We found it was best to create administrative accounts for the 24 workstations that were to be monitored. We also had to develop a spreadsheet that referenced the MAC and IP addresses on all the active computers. This information is critical in the integration of TSO Metric Control and had to be well documented prior to the arrival of the Vancouver representatives.

From our communications, we got the impression that the TSO Metrics and Power Control was a bi-functional piece of software. On the Metric side, it supposedly had the capability to monitor energy and power consumption of workstations and servers, while simultaneously projecting costs and savings estimates. The second half of the tool is the Control section, which supposedly gave the software the ability to power the machines on and off; by the way of network communications and control. It was our job to create a suitable environment and evaluate the software's capabilities. And after many emails and teleconferences we were finally able to meet all of their hardware and software recommendations.

III. The Logic Approach

In between the dates of February 3-7, TSO's Aaron Rallo / Founder and CEO, and Chris Tivel / CTO, both came to KSC to assist with the installation of their software in SPSDL. The goal of our mission was to install the TSO Metrics and Power Control application onto an individual workstation running Windows Server 2008, and used it to communicate with the remaining 23 workstations via network access. This method eliminated the need to have a client installed on each individual workstation, but did not come as easy as initially anticipated.

The TSO group was scheduled to be at KSC for 5 days and during the first 3 of those five days the installation proved to be somewhat difficult. We discovered that the TSO representatives were more familiar with the Windows operating systems than they were with Linux based systems and often times had to consult with their team back in Vancouver. This called for me and fellow intern Aaron Garcia to consistently assist the TSO team with the Red Hat and Ubuntu machines. We aided them with all our Linux knowledge while simultaneously keeping in sync with the progress of the remaining Windows workstations.

Prior to their arrival, TSO advised that in order for the Windows based units to communicate with the server it was best to take advantage of the management technology of the Windows Management Instrumentation (WMI), which has the ability to manage both local and remote computers. The three key features that we prioritized of WMI was its ability to start a process on a remote computer, schedule a process to run at specific times on specific days, and also its ability to reboot a computer remotely. (Microsoft, 2004) All of these features required additional settings in the bios of the workstations to be adjusted as well.

In order to for the Linux based units to communicate with the server we took advantage of the management technology of Simple Network Management Protocol (SNMP). It is widely used in local area networks (LAN), and has the ability to monitor network nodes from a management host. But this was not accomplished without some difficulty. During integration, we found that, just as in the case of the Windows workstations, these features required additional settings in the bios of the Red Hat and Ubuntu workstations to be adjusted as well; particularly the Red Hats. We found that in order for the application to communicate effectively with the Linux machines we had to activate the Wake on LAN feature; which is critical to Control portion of the TSO application. And after some modifications to /etc/sudoers file of the Linux boxes we were finally able to achieve our overall goal of collecting data for the Metrics portion of the application and the ability to remotely powering on and off for Control portion of the application.

III. The Tale of the Tape

After the departure of the TSO Logic team, we were left with the task of constantly monitoring and surveying the TSO Metrics and Power Control application. The highlight of this portion of the assignment was to compose documentation expressing the overall impression of the software and its capabilities. I was later asked to produce a product evaluation template based off the documentation used to evaluate the TSO Metrics and Power Control application. And after spending quite some time with software it was my job to meet in the Spaceport Processing Systems Development Laboratory, with fellow intern Aaron Garcia and present our give presentations of our findings to various members of our NASA family.

“On 3-14-14 I arrived in the SPSDL at LCC 2R11, along with fellow intern Aaron Garcia and System Hardware Engineering (NE-C4) Branch Chief Khoa Vo, AST, Ground Data Systems, Allan Villorin, and SUPV AST, TECH MGMT, NE-C4 John Porter and gave the first product evaluation of TSO Logic Power Management Tool.

On Monday, 3-17-14 we arrived in the SPSDL laboratory at LCC 2R11, along with System Hardware Engineering (NE-C4) Branch Chief Khoa Vo, AST, Ground Data Systems, Allan

NASA KSC – Internship Final Report

Villorin, Bryan S Banks {Trip} (IT-C3) , Mark A. Pugh (ADCC-PMO)[Abacus Technology] , CORY A. TAYLOR (KSC-TAA-4C) , and Ronald E. Schoen (TAA-4C) to give a second product evaluation of TSO Logic Power Management Tool.

On Monday 3/24/2014 I arrived in the SPSDL laboratory at LCC 2R11, fellow intern Aaron Garcia, AST, Ground Data Systems, Allan Villorin, and gave a product evaluation of, Linux and Windows based, TSO Logic Power Management Tool to Van Arsdalen, Robert G. (KSC-NE-C2)

On Friday 3/28/2014 I arrived in the SPSDL laboratory at LCC 2R11, with fellow intern Aaron Garcia, System Hardware Engineering (NE-C4) Branch Chief Khoa Vo,), Michael McDonough (NE-C4), AST, Ground Data Systems, Allan Villorin, and gave a product evaluation of, Linux and Windows based, TSO Logic Power Management Tool to Shaykhian, Linda H. (KSC-NEI)”

We periodically consult with an engineer from the TSO Logic team named Charles Dai, who was hands-on with the development of new features imposed into the application since its integration within the SPSDL; often times communicating through email and teleconferences to share information about the application’s state and behavior. Currently we are using Secure File Transfer Protocol (SFTP), a secure computing network protocol for accessing and managing files on remote file systems, to push data files back and forward to Mr. Dai. And despite the difficulties of the initial integration, the TSO application is proven itself to be stable and continues to be monitored and evaluated.

IV. Part 2: More Than a SketchUp

The third and final portion of my spring 2014 internship occurred when I consulted with Supervisory AST, Technical Management Laurie B. Griffin, (NEC2) in hopes of composing a 3-Dimensional model of the Spaceport Processing Systems Development Laboratory. Mrs. Griffin asked for me to get more familiar with a using a 3D modeling program Called SketchUp. It’s a 3D modeling program for applications such as architectural, interior design, and even has the capability to do civil and mechanical engineering design. (Trimble Navigation Limited, 2013) It was my job to obtain the dimensions of the SPSDL and make a virtual environment that could possibly be used as a display tool in presentations. So I consulted with Niev, Savrith A. NEC4 who assisted me in obtaining the proper information.

During that weekend I downloaded a free version of the software and spent about 20 hours getting to know my way around its environment. I found that my history with carpentry and art came of some use as I navigated way through the program. That following Monday, I felt as though I had a suitable model to present and contacted Ms. Griffin with screen shots of my end product. She expressed her approval and later on set up a teleconference with AST, Data Hardware Systems, Wyck C. Hebert, IT-C1. During the teleconference Mr. Hebert shared his background and experiences with similar programs and expressed his interest in the capability of SketchUp. So I forwarded him additional screenshots of my 3D model, converted into SketchUp’s default .skp file extension and the more universal .dae file extension. DAE is based on COLLADA, which is an XML-based schematic. (Havele, 2008)

Currently I’m continuing my studying of SketchUp’s capabilities and now have taken advantage of its ability to create animations within its environment. I briefly displayed this for Ms. Griffin and explained how the animations could also be saved in a .mov or .avi video format as well. I’m also in process of further developing my understanding of SketchUp’s ability to give objects geographical location and lighting features. (Chopra, 2010) I’ve also been delving into the market for other types of 3D modeling software. Overall, my division can prosper from this tool and tools like it. And I feel honored to have been on board to help advance us to the next level.

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