

Integration and Testing of LCS Software

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Kennedy Space Center is in the midst of developing a command and control system for the launch of the next generation manned space vehicle. The Space Launch System (SLS) will launch using the new Spaceport Command and Control System (SCCS). As a member of the Software Integration and Test (SWIT) Team, command scripts, and bash scripts were written to assist in integration and testing of the Launch Control System (LCS), which is a component of SCCS. The short term and midterm tasks are for the most part completed. The long term tasks if time permits will require a presentation and demonstration.

Nomenclature

<i>ACL</i>	=	Application Control Language
<i>AD1</i>	=	Application Development Set 1
<i>CUI</i>	=	Compact Unique Identifier
<i>DDE</i>	=	Desktop Development Environment
<i>DMON</i>	=	Data Monitor
<i>FR1</i>	=	Firing Room 1
<i>FR3</i>	=	Firing Room 3
<i>FIN</i>	=	Firing Room 1 Non-redundant
<i>FIR</i>	=	Firing Room 1 Redundant
<i>GSDO</i>	=	Ground Systems Design and Operations
<i>KSC</i>	=	Kennedy Space Center
<i>KGCS</i>	=	Kennedy Ground Control Subsystem
<i>LCC</i>	=	Launch Control Center
<i>LCS</i>	=	Launch Control System
<i>LDA</i>	=	LCS Development Set A
<i>MCO</i>	=	Master Console Operator
<i>NIFS</i>	=	NASA Internships, Fellowships, Scholarships
<i>PLC</i>	=	Programmable Logic Controllers
<i>PWS</i>	=	Portal Workstation
<i>SCCS</i>	=	Spaceport Command and Control System
<i>SLS</i>	=	Space Launch System
<i>SWIT</i>	=	Software Integration and Test

I. Introduction

My internship here at KSC provided me with great experience into the world of launching rockets. Coming from the world of rocket testing on static engine stands, the world of launching rockets provided me a view of rockets in action. Currently NASA is developing the SLS for space travel beyond low earth orbit. The SCCS is comprised of two components and is one of four Subsystems that make up the command and control portion of the GSDO Program that will be used to launch the SLS. The two components are LCS, and KGCS. Specifically, I am working on the LCS portion of SCCS. I am part of the SWIT team in FR1 / FR3 at the LCC assisting in LCS software integration and testing, FR1 is for operations, and FR3 is for development. . The LCC has four firing rooms. FR1 contains sets F1R, and F1N. The F1R set is a redundant set for hazardous operations. F1N is a non-redundant set for non-hazardous operations. FR3 contains the LDA, and AD1 sets. LDA set in FR3 is for LCS development. AD1 set in FR3 is for application development. I usually develop my scripts on the F1N or F1R set. During the semester I assisted the MCO's in automating some of their tasks. A list of tasks was assigned to me to work on over the semester. The tasks were divided into short term, mid-term and long term tasks. The short term tasks included updating PLC nomenclature, writing command scripts for performance testing, and

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updating ping test scripts. My mid-term tasks were writing bash scripts for init term, DDE shutdown scripts, security test case. My long term tasks were researched tools on automated testing for Java / JViews, and automating DDE's. All the tasks are detailed below.

II. Short Term Tasks

My first short term tasks were to develop command scripts. Command scripts allow a user to give commands much like scripting in Linux for the LCS environment. Command scripts are run in the LCS environment via the dash board. In the dashboard, you would select LCS, and then Command Scripeter. The command scripeter is similar to CPRO except that multiple commands can be sent in a script file. The first command script was to update the nomenclature for the new set of PLC's. The update of the PLC nomenclature took less an hour to update. The nomenclature for the PLCs is different between Build 14-1 and Build 15-1. Build 15-1 gives you the ability to ADA/IDA a chassis with multiple PLCs. The commands scripts were for enabling data acquisitions, and disabling data acquisition for the new PLC's.

I also modified existing command scripts and created new command scripts for testing the standard traffic model, performance 2850, and performance 35000 on Build 14-1. The standard traffic model included setting, enabling, and disabling a set of 350 performance CUI's. The performance 35000 model included setting, enabling, and disabling a set of 35000 performance CUI's. For the 2850 performance model, a set of 2850 performance CUI's were set, enabled, and disabled. The performance CUI's test the performance of networks, CPU utilization, and memory. Command scripts help set up tests consistently, and saves time because manual setup is not necessary. To set up the test manually will take approximately one hour. However with automated command scripts, the setup takes place in minutes. The command script for the traffic model and performance model took me approximately two afternoons to write.

The next scripts I wrote were bash scripts. Bash stands for Bourne Again Shell. The shell is the layer of programming that understands and executes the commands a user enters. In some systems, the shell is called a command interpreter. The first two bash scripts I modified were ping test scripts. The modification was to cluster of PWS's ranging from A to I in FIR and FIN set for the various networks on the set. The last script for the short term was to develop CUI lists of at most 100. These CUI lists are xml lists of CUI's. The CUI lists are used for DMON and plotview and will save users time and effort in the future.

III. Mid-Term Tasks

The three mid-term tasks I had were to write a DDE shutdown script, init-terms scripts for Build 15-1, and Security Test Case for Build 15-1's new security tools.

A DDE is a small LCS set for one user. To ensure that the DDE termination is consistent, the plan is to create a DDE shutdown script. My task was to determine the instance of the DDE, and reboot the Linux sim, and stop and unload the windows sim. The next step was to reboot the Linux sim, and reboot the DDE system server, and kill three processes on the display server. I have an idea for what to write for the bash script. However, I have ran into a permissions issue with the system administrators allow the general user to reboot the machine. Currently rebooting the machine is a system administrator function.

In the init-term script for Build 15-1, my task was to build the script to account for separate partitions, whereas on Build 14-1 all the gateway and app servers were on one partition. The first question I asked in the script was how many times the user wanted to run the script. The next step was to init all the gateway servers, check for process, and determine if the processes are running. If running add to good column, and if not running add to bad column. Also for each iteration, I count all the bads for each process in addition to the grand total bad, and grand total good. After the process information is collected, the gateway servers are termed. I have written the init term bash script. The script needs to be run to see how the script works. I have not had an opportunity to run the script yet. Init means to initialize. Term means to terminate. Below is a summary of the results.

```

SUMMARY: GOODS: 0 BADS: 13
SAC: 1 CSC: 1 DAD: 1 KGCS: 1
SAC: 1 CSC: 1 DAD: 1 KGCS: 1
SAC: 1 CSC: 1 DAD: 1 KGCS: 1
SAC: 1 CSC: 1 DAD: 1 KGCS: 1
SAC: 1 CSC: 1 DAD: 1 MPCV: 1
SAC: 1 CSC: 1 DAD: 1 MPCV: 1
SAC: 1 CSC: 1 DAD: 1 SLS: 1
SAC: 1 CSC: 1 DAD: 1 SLS: 1
SAC: 1 CSC: 1 DAD: 1
SAC: 1 CSC: 1 DAD: 1 ASMAIN: 1
SAC: 1 CSC: 1 DAD: 1 ASMAIN: 1
SAC: 1 CSC: 1 DAD: 1 ASMAIN: 1
SAC: 1 CSC: 1 DAD: 1 ASMAIN: 1
[ ]$
Mon Nov 10 18:22:03 UTC 2014 TCID SIM

```

The last task was to build a script for Build 15-1 to test if all the script tools were running and check the versions of the security tools. The first step was to echo the version of each of the security tools. Next, I check specific processes for each security tool to see if they were running or not. If not running output not running. If running output running. I have written the bash script for testing the Build 15-1 security tools. However, I have not been able to run the script due the tools not being currently installed in the FIR set.

IV. Long Term Tasks

The two long term tasks were automated test tools research, and automated DDE testing. First step in the process was to research open source shareware on screen automation for testing guis. Some of the open source shareware I research were SikuliX. Other alternatives I researched were Eggplant, and T-Plan. The last step in the process is to include one of the tools selected above from the evaluation to include in automated DDE testing. I have conducted preliminary research on the automated testing tools. The information is gathered in a trade study paper which I submitted to my technical point of contact. Once he reviews the paper, I will be provide further direction on whether to make a presentation on the tools, or to demo the tools.

V. Miscellaneous

For the first three weeks, we received extensive training. For the first three weeks we trained learning and using various systems here. Some of the systems we trained on were Clearquest, AccRev, and WindChill. Clearquest is used to keep track of software issues. Windchill is used for accessing various documents. AccRev is the code repository. In addition we also trained in making remote displays, and learning how to use and program in ACL. We also received an extensive overview of LCS in terms of local and remote systems.

I also attended many enrichment activities sponsored by the Education office or our directorate. The activities included a wildlife refuge tour, a SWAT team / K-9 demo, a Thanksgiving potluck, visit to a tiger sanctuary, and tour of various chemistry labs.

During the events sponsored by the Education office we also practiced our public speaking skills by giving brown bag presentations on our projects assigned to us for the semester.

I also participated in intern sponsored events. Events included attending a showing of the movie Interstellar, a beach get together, and a social event at a restaurant called Grills.

VI. Conclusion

During this semester I worked on a variety of tasks. My tasks included using command script to manipulate the LCS environment. Other tasks were writing scripts in Bash for cleaning up DDE's to ping tests for machines on the set. Lastly, I had a task to evaluate commercial of the shelf software for automated gui testing. Working on the scripts gave me an overview of the LCS system. Working in the firing room gave me experience into the protocol for firing room procedure during daily operations. If I had to come back, I would definitely come back and learn more about the LCS system. The firing room is a great place to work. The firing room is where the action is at.

I also attended various team building events sponsored by the Educational office, the directorate, and interns. The events ranged from wildlife refuge tour to a viewing of movies. The enrichment experience gave me a chance to see things I would have never had a chance to see otherwise.

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