
sdmay18-09: Tool Support for Continuous Model-Based Verification of the Linux Kernel

Week 3 Report

September 23 - October 7

Team Members

Srinivas Dhanwada — *Team Lead*

Collin McIntyre — *Tool Integration Lead, Scribe*

Benjamin Weno — *Automation Lead*

Matthew Wall — *Web Lead*

Summary of Progress this Report

In this past period, we've successfully recreated the manual patching process on versions 3.18 and 4.08 of the Linux kernel. We've spent a large portion of our work for this period gaining an understanding of how the patches work and how to apply them, and are currently in the process of writing a program that will automatically apply the patch and build the kernel. We have also brainstormed several options for how to create the diff tool and have tried to write proof of concept programs to implement these designs. One of these programs works, but is slow and needs refinement before it can be applied to the kernel as a whole. We've analyzed our approach and have made note of potential improvements, but still need to implement them. We've also had some discussions about the creation of our website after the automatic verification process is complete. We've decided to redesign the website that the Knowledge Centric Software Lab uses which will allow us to incorporate additional features, such as searching for specific instances of locking mechanisms and previews of those instances.

Pending Issues

The patch we're applying to the kernel is designed to reroute each instance of one of the many kinds of locking mechanism to a single function to aid in the verification process. As new locking mechanisms are added and old ones are removed, we need to be able to automatically handle the change in applicable mechanisms. The patches for the versions we've tested are very similar since no major changes have been made to the kernel locking mechanisms, but we aren't yet sure how to determine when a new locking mechanism needs to be handled and when we can forgo handling of a mechanism that is no longer used. The diff tool will depend on the output of the verification tool, and the tool itself is primarily run through a user interface managed by the Atlas plugin for Eclipse. To our knowledge, Atlas doesn't support a command line interface. We need to find a way to receive that output and we're currently playing with the idea of creating our own Eclipse plugin that will manage our usage of Atlas, but aren't yet sure of the feasibility of this option.

Plans for Upcoming Reporting Period

All of the patches we've applied to the kernel up to this point have been provided for us. We plan to work through the process of writing and applying our own patches manually before working to automate the patching process. Automated patching process development will hopefully begin in a week or two. We also plan to revise and optimize our approach to creating the diff tool and hope to run it on a larger sample of instances of locking mechanisms within the upcoming period.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
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Srinivas Dhanwada	Srinivas has created the proof of concept programs for the diff tool and has worked with Ben and Collin to receive feedback on his approach and discuss alternatives to the process. He also manually applied a patch to version 3.18 of the kernel and verified that it worked as intended.	8.5	15
Collin McIntyre	Collin has applied a patch to version 4.08 of the kernel and verified that it worked as intended. He also brainstormed approaches for diff tool creation and automatic patch application with Srinivas and Ben. He also began maintenance on our Gitlab repository by uploading the verification results for kernel versions 3.17-3.19 and the patches for these versions.	8	15.5
Benjamin Weno	Ben brainstormed approaches for automated patch application and diff tool implementation with Srinivas and Collin. He also worked with Srinivas to set up our Gitlab repository with git-lfs to increase the efficiency of working in a repository that's currently about 8 gigabytes in size due to the verification results of three versions of the kernel.	4	11
Matthew Wall	Matt has given feedback on the processes we're planning to use for automated patch application and diff tool implementation. Matt has also generated a list of features that we'd like to incorporate into the website, and has also begun consideration of possible layouts/designs for the new website as a whole.	3	6.5