

WES 237A Project Part 4 Guide

1. Overview

The goal of the project is to explore the use of dynamic voltage and frequency scaling on a mobile device to improve the battery lifetime. During the course of the project, each team will develop a kernel module that dynamically scales frequency to minimize the energy consumption, with minimum to no performance hit to the running applications. The design of your kernel module should be driven by the 'usage pattern' analysis which you will have performed throughout the course of the project.

2. Grading

Project Part 3 Deliverables	Weight
Progress Report	20%
Presentation	5%
Demo	10%
Report, Logs, Scripts and Code	65%

Additionally, up to 2% is given for the top-performing team with respect to energy delay product when running on our test cases during the demo.

3. Deliverables – Due 3/8 at 9:00 AM

1. Capture representative short and long term logs of usage on both phones. Submit one set of log files per phone. README should accompany the **dmesg** logs with the collected counters clearly identified .
2. Submit the source code of your kernel module for MSM8660 on TED.
3. A detailed description of the design of your policy. The policy should be general, but the explanation should be specific: e.g., it should cover any user/patterns/applications. Discuss what motivates your particular policy design, provide an overview of any related work you used and explain how your approach compares to it.
4. Add tables and/or figures with estimated energy savings and performance you obtain for the provided benchmarks and from your logs at the end of the report. Use the power vs. frequency data in the Appendix for 8660. Quantify the energy delay product (EDP) in your results (see equation below). Discuss key insights from this analysis.

$$EDP = energy * execution\ time$$

5. Perform a thorough analysis of the benefits and weaknesses of your policy. Compare to built-in policies in Android for both the benchmarks and your usage patterns. Use your data logs, graphs, and tables to estimate how well your DVFS policy would have done in terms of energy savings and EDP over long term. Report how you estimated the energy savings and EDP. Discuss any performance impact that your policy might have on *both* the benchmarks and usage patterns.

6. Submit the complete printed report of maximum 10 pages in 10pt font, single column with any additional figures/tables attached at the end in person on demo day. Add a title page with names of the team members on it (this page does NOT count toward your total 10pg allotment).
7. Prepare a max 4min slide presentation to provide an overview of what you have designed, why and what the main results are. Submit on TED. You will present this during the demo.
8. Be prepared to demo your work on the due date. Your submitted kernel module should be able to be compiled and executed on a test phone in an automated fashion. Any errors in this regard will compromise your grade
9. Bring your assigned phone to the demo date: **Friday, March 08, 2013**, at the start of class. Failure to do so will result in no grade assigned.

Report:

1. Log collection and analysis

- In your final report, you should identify *and quantify* your mobile phone usage, and explain how you developed a usage plan for the MDP, accounting for the limitations and features of the phone. You should be able to convince us that your usage pattern on the MDP sufficiently matches your own phone's usage pattern.
- Describe how you collected statistics, how you parsed the logs, and what you learned about energy consumption and EDP based on the logs.
- Compare and contrast the differences between usage patterns and benchmarks. Think about what is being executed in each scenario. How does this affect power management, and the sleep states for various components?
- ***You should use kernel output via dmesg for this part of the project. However, for long-running tasks, dmesg may cut off the earlier execution. If you opt to use dmesg, note that it is a limited circular buffer. You will need to develop a means of retaining logs for the whole session. Some options are:***
 - a. *Store kernel data in a file (this can be stored locally, and printed in the "cleanup_module"*
 - b. *Collect a deterministic subset of each benchmark (i.e. 30seconds of dmesg logging, starting 10s into a particular benchmark), which can be automated through the use of scripts*
 - c. *Collect and identify specific subsets of usage patterns in pieces (e.g. consolidating separate dmesg logs of each short-term activity). For an accurate comparison, this MUST be consistent*
 - d. *Pipe kernel messages to a standard output that collects past the circular buffer*

1. Design of your Governor as a Kernel Module

- ***Discuss*** what went well, and what didn't, *both* for short and long term usage, and in the benchmarks. You should also ***quantify*** how your approach improves over the current set of governors (e.g. show specific examples of utilization, energy, performance, EDP, where you foresee your governor behaving more or less efficiently).
- Describe how you arrived at your design – what were the tradeoffs made and why.

- Talk about how your governor affects the energy consumption in the rest of the system; quantify when possible using power data and logs.
- Discuss how you tested your governor – what corner cases did you use vs. what is the average case? How do you expect your governor to perform on other phones and for other users?

Appendix A: DVFS vs. Power table

Energy calculations for 8660 will be based on the power data similar to this (we will update this document by early next week).

Frequency (MHz)	Active Power (mW)	Idle Power (mW)
1188	625	179
1134	590	170
1080	554	161
1026	516	152
972	481	143
918	447	135
864	415	127
810	386	119
756	359	112
702	331	104
648	307	99
594	284	94
540	265	91
486	248	88
432	230	85
384	212	82

Appendix B: Presentation Details

These are the details we expect your presentation to cover:

1. Algorithm design and motivation
2. What perf counters were used, and why?
3. Highlights of results (for both daily usage and benchmarks)
4. Key insights of the phone behavior, algorithm, and results

Grading:

1. 3-minute presentation
2. 1-minute Q&A
3. How well does the presentation cover the points above?
4. *Timed* 3-minute presentation, with points taken off for going over (under 3 min is fine)
5. How well does each member answer the questions asked?
6. Grade per person, will impact participation grade.