

A Study on CPU Clock Frequency Optimization in Kernel

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KEYWORDS

Power consumption; Android; CPU clock frequency; Governor

1 INTRODUCTION

The Android operating system has become one of the most popular platforms on mobile devices, with a market share of 76.7% in Oct. 2019 [1]. One of the most important smartphone issues is large power consumption [2]. The principal power-consuming elements is the CPU and a CPU governor controls its consumption.

2 IMPROVEMENT OF THE ONDEMAND CPU GOVERNOR

We propose to modify the policies of *ondemand*, which is the default CPU scaling governor of Linux kernel in the Android operating system. The proposed method decreases the CPU clock frequency more aggressively when it decides to decrease the frequency from the maximum level. Conversely, it increases it frequency less aggressively when it decides to increase the frequency to a frequency below the maximum. The pseudo codes of the original and modified implementations are as follows.

Pseudo code of the original implementation:

```
cpu_work->frequency = table[index].frequency;
```

Pseudo code of the modified implementation:

```
if( cpu_work->frequency == max_freq ){  
    cpu_work->frequency = table[index/m].frequency;  
} else if( table[index].frequency != max_freq ){  
    cpu_work->frequency = table[index/n].frequency;  
} else{  
    cpu_work->frequency = table[index].frequency;  
}
```

3 EVALUATION

We evaluate the modified governor using the top application in the Google Play Store sales ranking as of October 15, 2016—a game application. Figure 1 shows the processing time and power consumption. The proposed method decreased the power consumption by 7.28% with only 0.68% processing time increase. The proposed method achieved better power consumption and processing time compared to the *powersave* governor.

4 CONCLUSION

In this paper, we proposed a method for optimizing the CPU clock frequency of *ondemand* governor. We then evaluated the governor in the Android operating system and showed that our modified method reduced the power consumption with a very small increase in processing time.

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REFERENCES

- [1] Mobile Operating System Market Share Worldwide | StatCounter Global Stats, <https://gs.statcounter.com/os-market-share/mobile/worldwide> [Accessed: 15-Nov-2019]
- [2] Shun Kurihara, Shoki Fukuda, Saneyasu Yamaguchi, Ayano Koyanagi, Masato Oguchi, Ayumu Kubota, Akihiro Nakarai, "A study on identifying battery-draining Android applications in screen-off state," *2015 IEEE 4th Global Conference on Consumer Electronics (GCCE)*, Osaka, 2015, pp. 603-604. doi: 10.1109/GCCE.2015.7398682

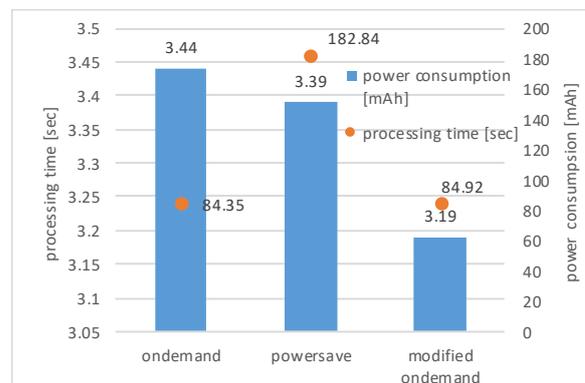


Figure 1. Performance and power consumption