Video: Study of Storage Impact on Smartphone Application Delay

David T. Nguyen
College of William and Mary
McGlothlin-Street Hall 126
Williamsburg
VA 23185, USA
dnguyen@cs.wm.edu

Gang Zhou
College of William and Mary
McGlothlin-Street Hall 126
Williamsburg
VA 23185, USA
gzhou@cs.wm.edu

Guoliang Xing
Michigan State University
3115 Engineering Building
East Lansing
MI 48824-1226, USA
glxing@cse.msu.edu

ABSTRACT

The smartphone has become an important part of our daily lives. However, the user experience is still far from being optimal. In particular, despite the rapid hardware upgrades, current smartphones often suffer various unpredictable delays during operation, e.g., when launching an application, leading to poor user experience. This video features our study of storage impact on smartphone application delay. We conduct the first large-scale measurement study on the I/O delay of Android using the data collected from our application running on 1009 devices within 130 days. We observe that Android devices spend up to 58% of their CPU active time waiting for storage I/Os to complete. This negatively affects the smartphone's overall application performance, and results in slow response time. Further investigation, among others, reveals that reads experience up to a 626% slowdown in the presence of concurrent writes. The obtained knowledge is used to design and implement a system called SmartIO that reduces the application delay by prioritizing reads over writes, and grouping them based on assigned priorities. SmartIO is implemented on the Android platform and evaluated extensively on several groups of popular applications. The results from the 20 researched applications demonstrate that SmartIO reduces launch delays by up to 37.8%, and run-time delays by up to 29.6%.

Categories and Subject Descriptors

C.4 [**Performance of Systems**]: Design studies; C.5.3 [**Computer System Implementation**]: Microcomputers-Portable devices.

General Terms

Experimentation, Design, Measurement

Keywords

Smartphone Application Delay; I/O Optimizations; Flash Storage; Application Launch

1. RESOURCES

The video is available on the homepage of the first author [4], and the project overview is presented in [5, 6]. Interested readers may download our StoreBench storage benchmark application used in the large-scale study from Google Play [2]. StoreBench requires a rooted device with Android 3.0 or higher, and installed BusyBox [1] on the device. The dataset of the large-scale storage performance study will be made available at [3].

2. ACKNOWLEDGEMENTS

3. REFERENCES

[1] Busybox. **http://goo.gl/CF6vJ**, 2014.
[2] Storebench download. **http://goo.gl/ava9eV**, 2014.
[3] Storebench web. **http://StoreBench.com**, 2014.
[4] D. T. Nguyen. Homepage.
    http://www.cs.wm.edu/~dnguyen.
[5] D. T. Nguyen. Smartphone application delay optimizations. In *Proceedings of the 12th International Conference on Mobile Systems, Applications, and Services*, MobiSys '14, New York, NY, USA, 2014. ACM.
[6] D. T. Nguyen, G. Zhou, and G. Xing. Poster: Towards reducing smartphone application delay through read/write isolation. In *Proceedings of the 12th International Conference on Mobile Systems, Applications, and Services*, MobiSys '14, New York, NY, USA, 2014. ACM.