

Fjord: Informed Storage Management for Smartphones

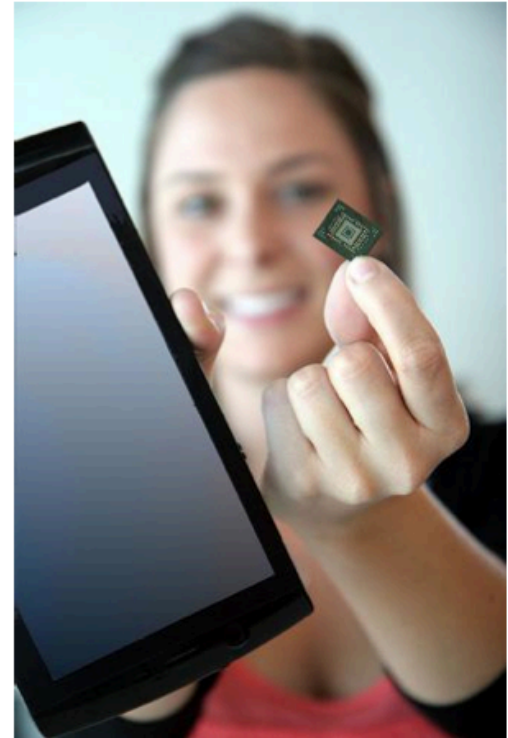
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^{+IBM} Almaden Research, [◇] Georgia Institute of Technology

Smartphone Storage at Massive Data Storage Conference?

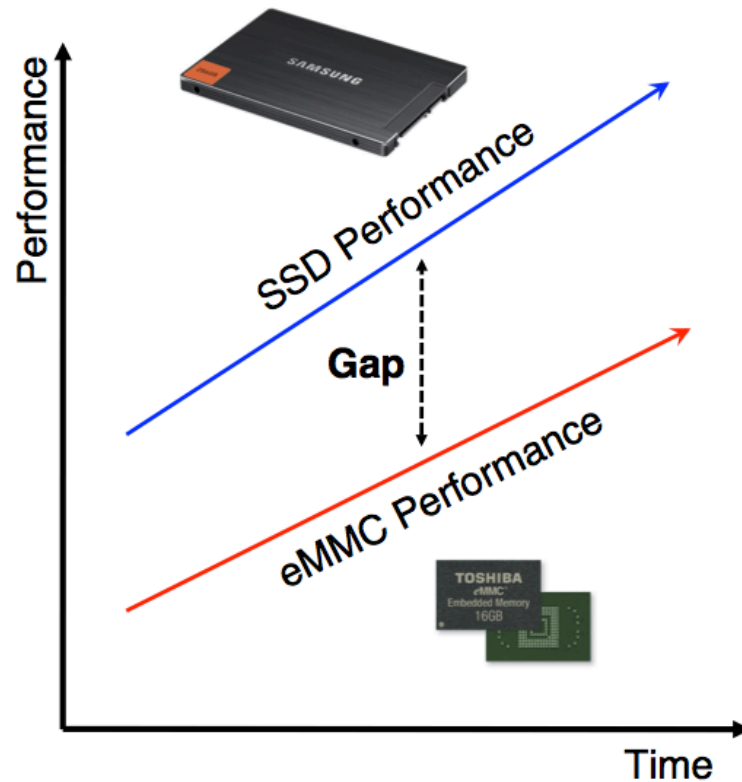
- Smartphones are also massive!
 - There are 1 billion active smartphone users worldwide (Q3,2012-Strategy Analytics)
 - More smartphones were shipped than feature phones in (Q1,2013-IDC report)
- Mobile devices are important
 - Smartphone sales overtook the combined sales of PC and Laptop in 2011 (Canalys)
 - About 80% of Apple revenue comes from iPhone, iPad and iPod (Q1, 2013 – Apple)

Why storage matters in smartphones?



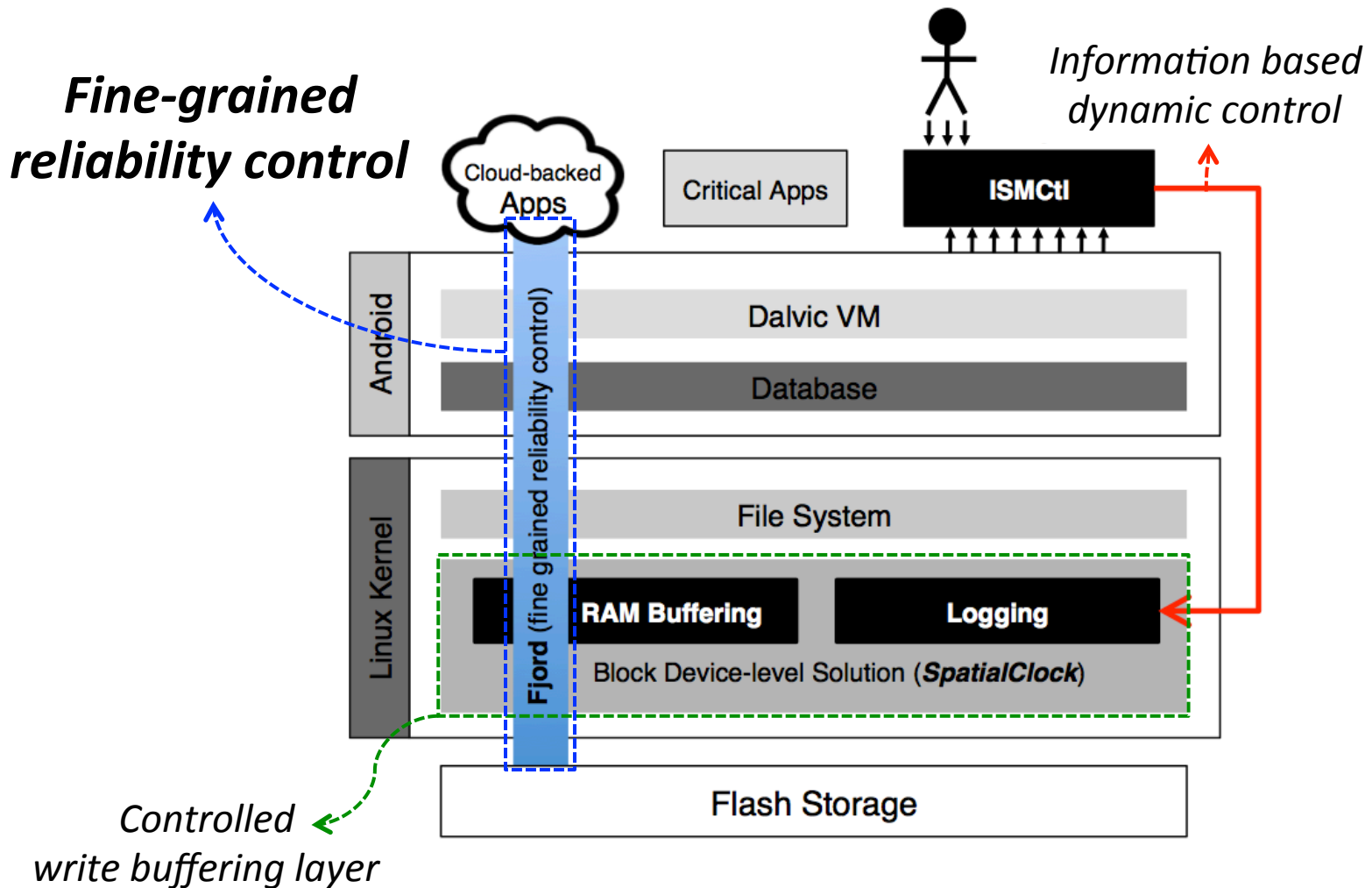
- Smartphones have limitations: size, power consumption, cost
- Smartphone storage is different to HDDs and also to regular sized SSDs

A gap-filler is needed



- Laptops and Tablets will have similar workloads, but their storage devices remain different.

How to improve storage performance of smartphones?

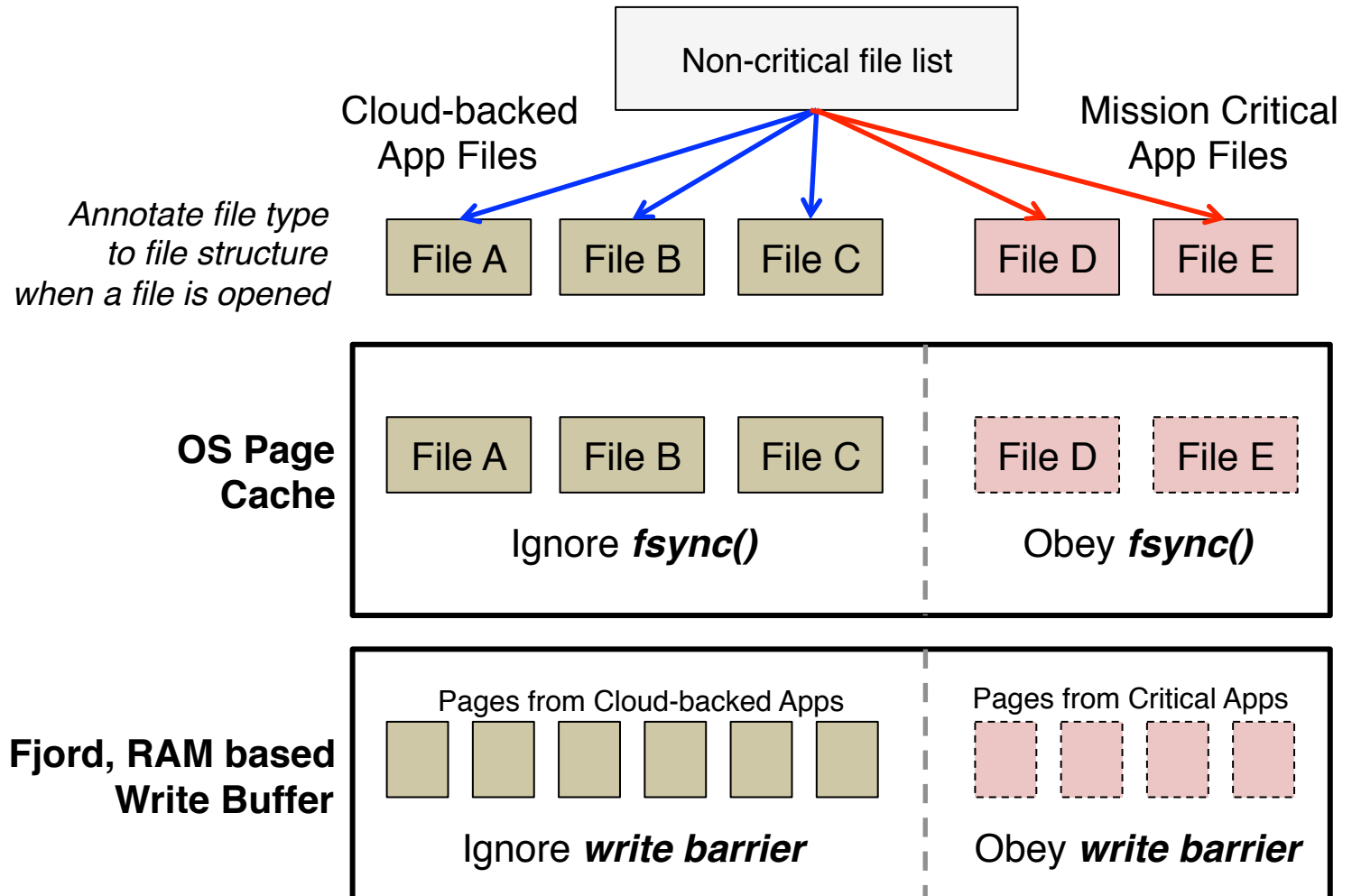


Fine-grained reliability control

- Smartphones require high reliability
 - Communication functionality is critically important
 - Smartphones are used in unstable environments
 - Smartphones are hard to fix
 - Thus, the slower but safer design choices normally win over faster but risky ones
- Smartphones are terminal devices for cloud contents
 - Local smartphone storage is used as a cache for the cloud data
 - Loss of the cached content is not catastrophic
 - E.g., Facebook, Web Browser, Twitter, Google Maps, etc.

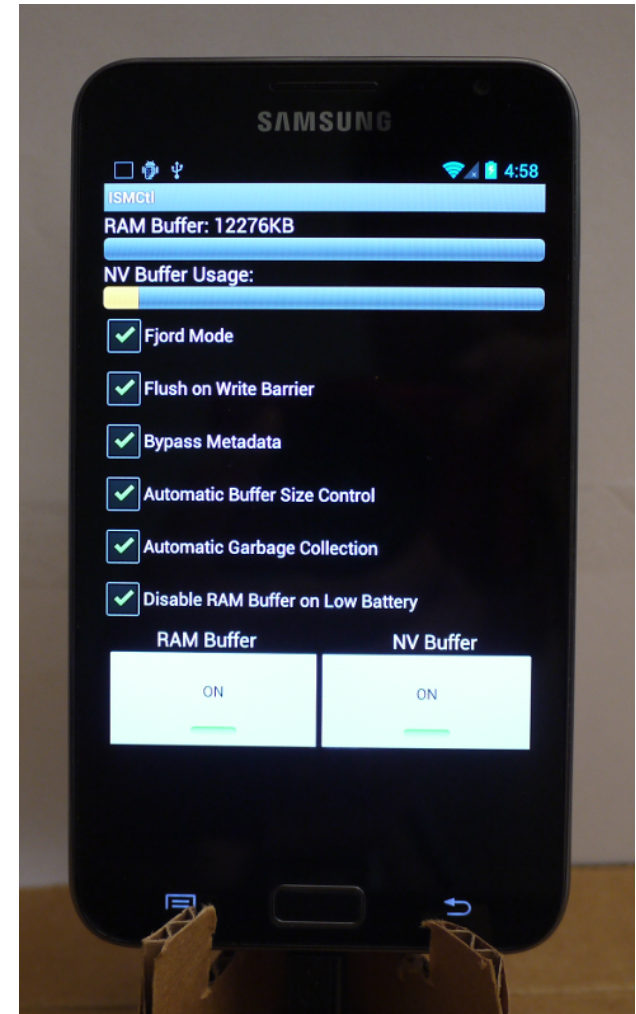
Can we selectively relax the reliability of cloud-backed Apps without hurting the reliability of mission critical Apps?

File-level Reliability Control



Evaluation

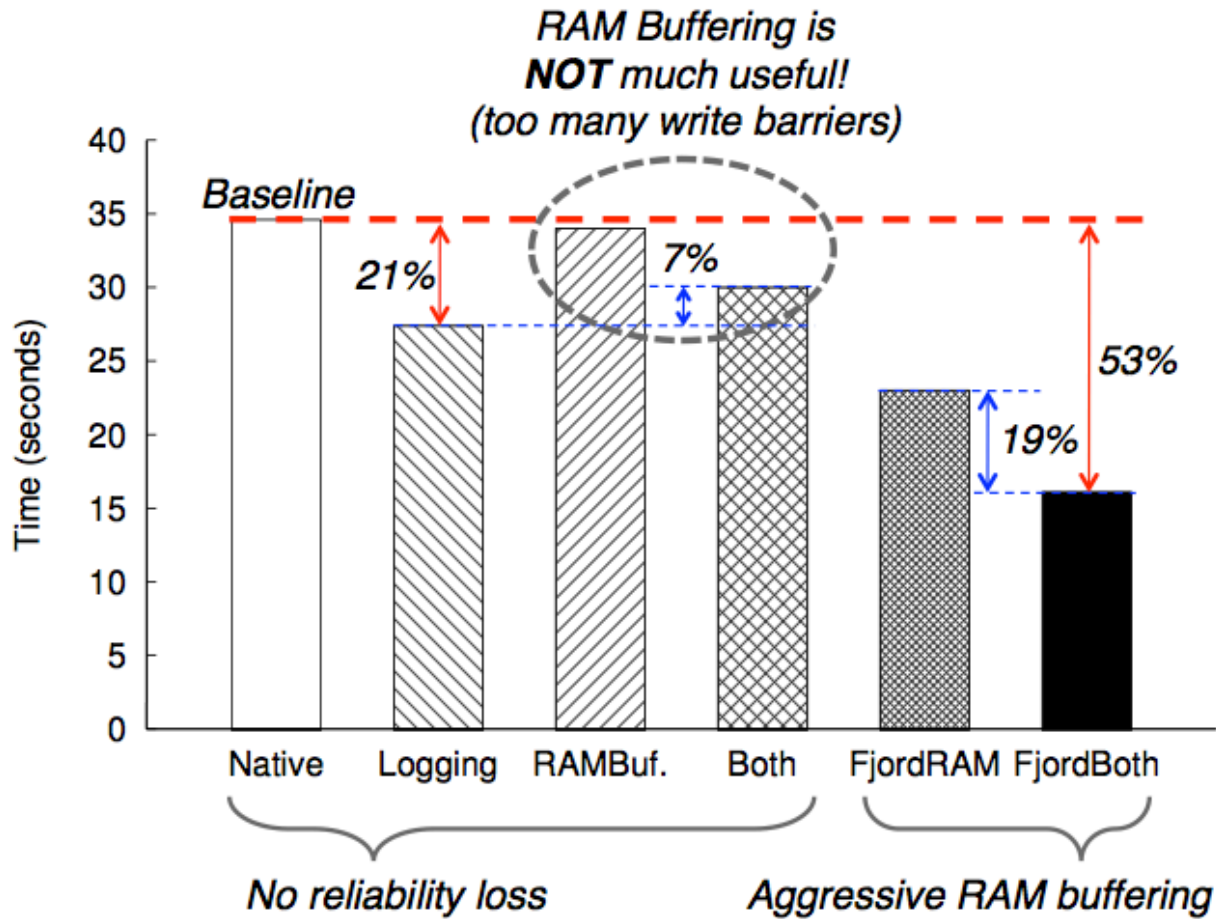
- Hardware
 - Android phones
 - Galaxy Note, Nexus One
 - Two storage devices
 - eMMC, class 10 microSD card
- Software
 - Android 4.0.4 for Galaxy Note
 - Android 2.3.7 for Nexus One
- Test cases
 - Email Application
 - SQLite Benchmark



Demo Videos

- Email on Galaxy Note:
 - Download emails after initial account setting
 - <http://youtu.be/Zz8S2D0gnMw>
- WebBench on Nexus One:
 - Visit 20 popular web sites continuously
 - <http://youtu.be/9dzznZjHpfs>

Email on Galaxy Note with SDHC



Conclusion

- Smartphones are important today, and storage matters in smartphones
- Smartphone storage solution
 - Controlled write buffering layer
 - Fine-grained reliability control
 - *Information based dynamic control*
- Significant performance improvements are demonstrated
- The ideas have potentials ***beyond smartphones***

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