All I/O is Random I/O

Flash Memory Summit 2013

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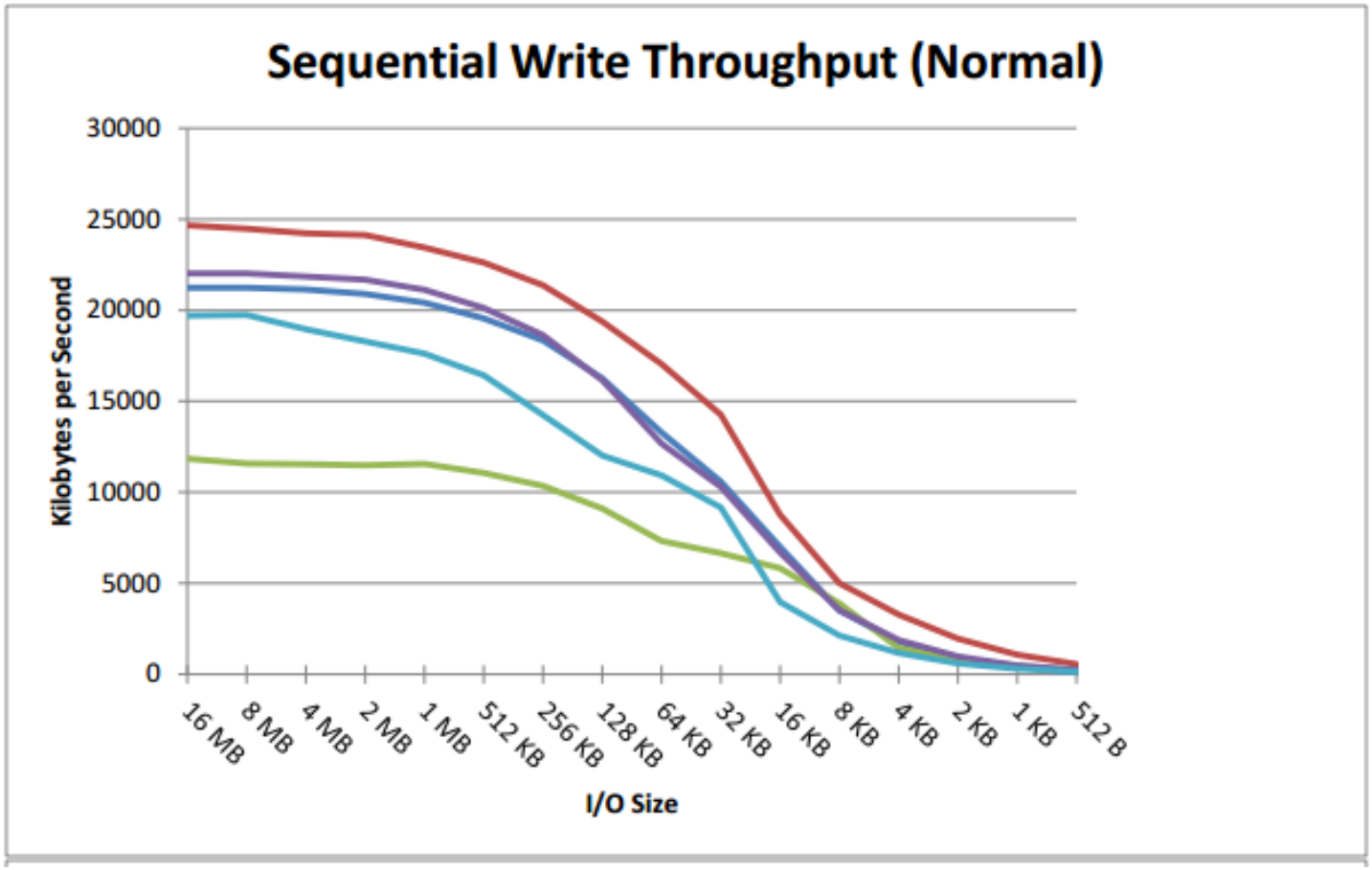
Talking Points

- Performance diffs – sequential/random
  - Contribution of Database on Android
- Benchmarks (measuring RAM)
- Write Amplification
- Correcting with Software
- Other expectations (ACID, lifetime)

Sequential I/O looks great



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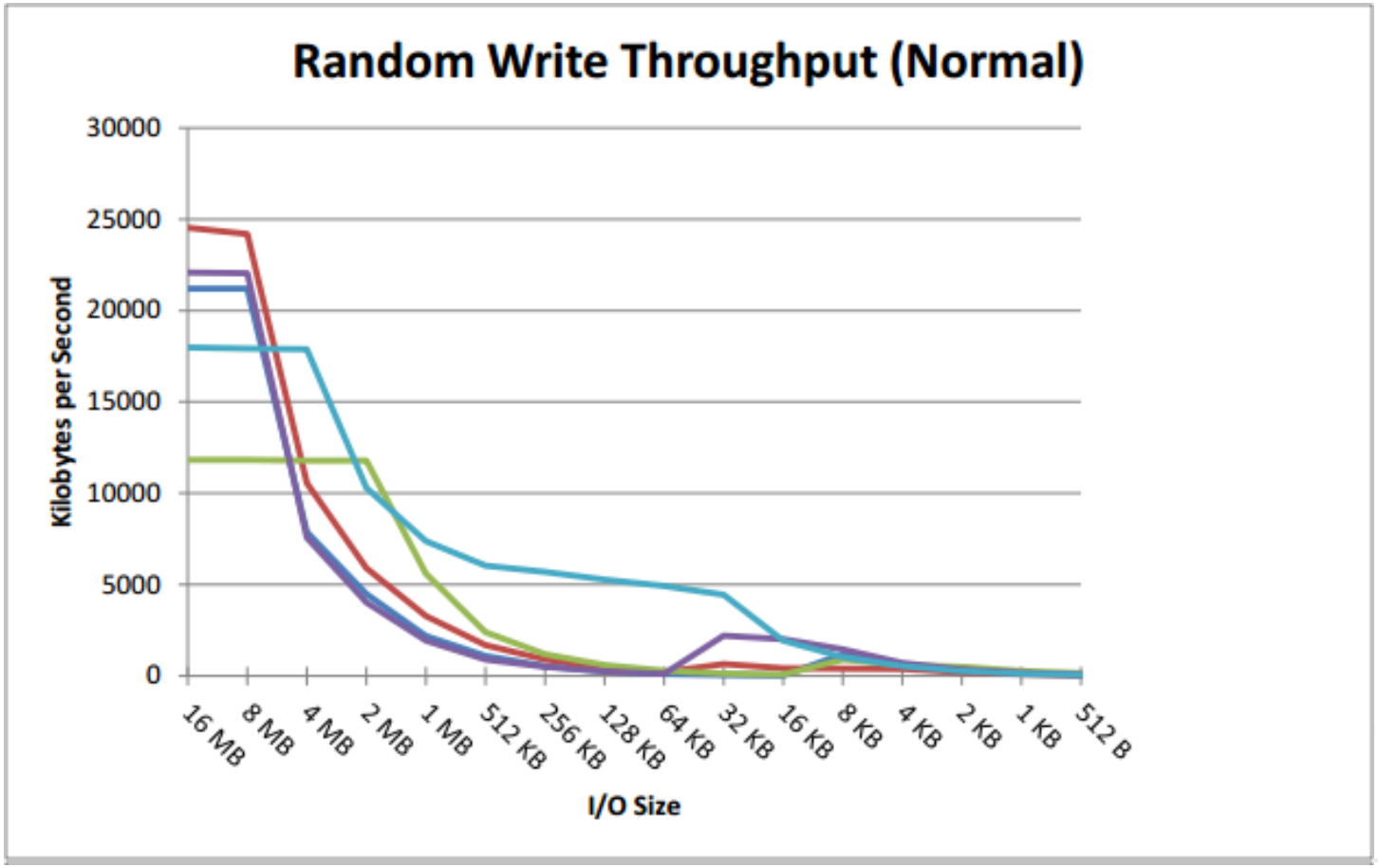
Random I/O not as good



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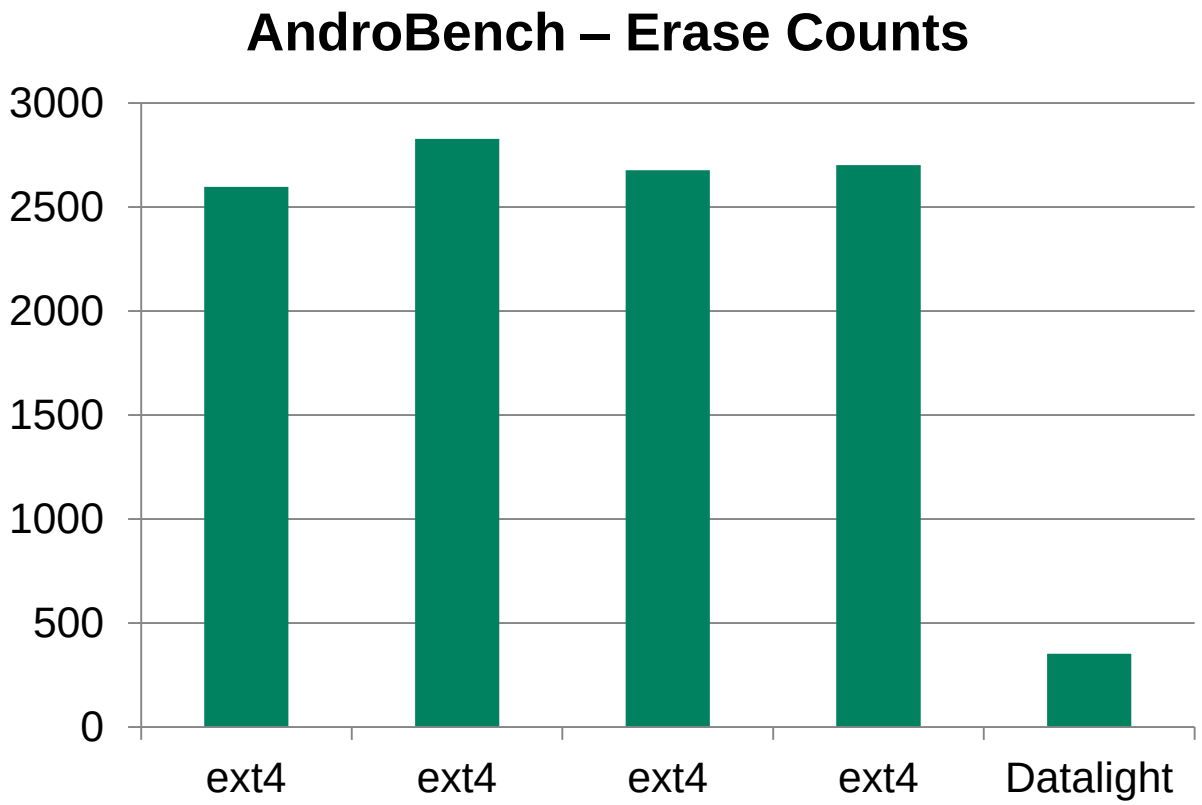
Android and SQLite



Each erase represents 2k of data written

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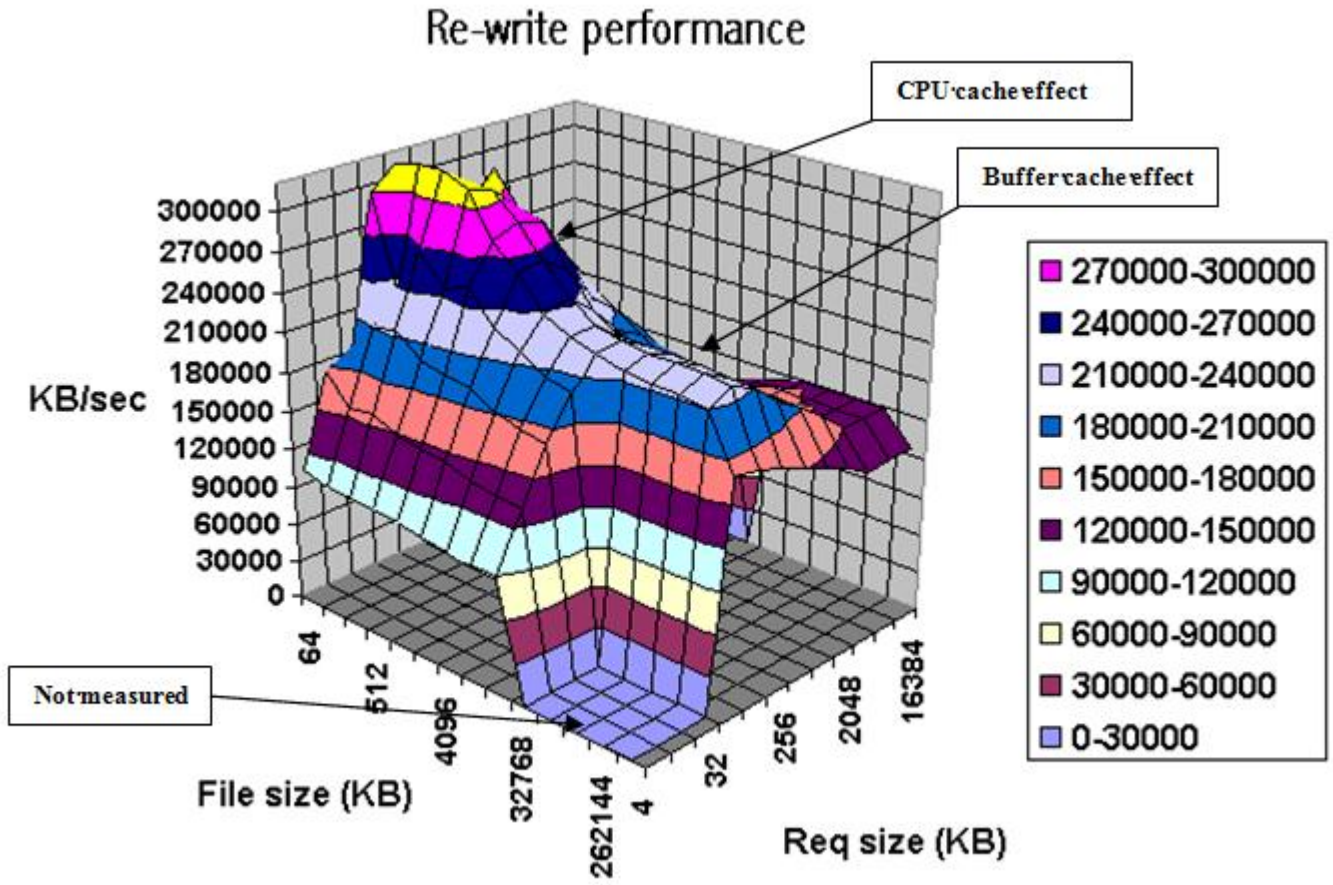
Measuring Cache and Buffers



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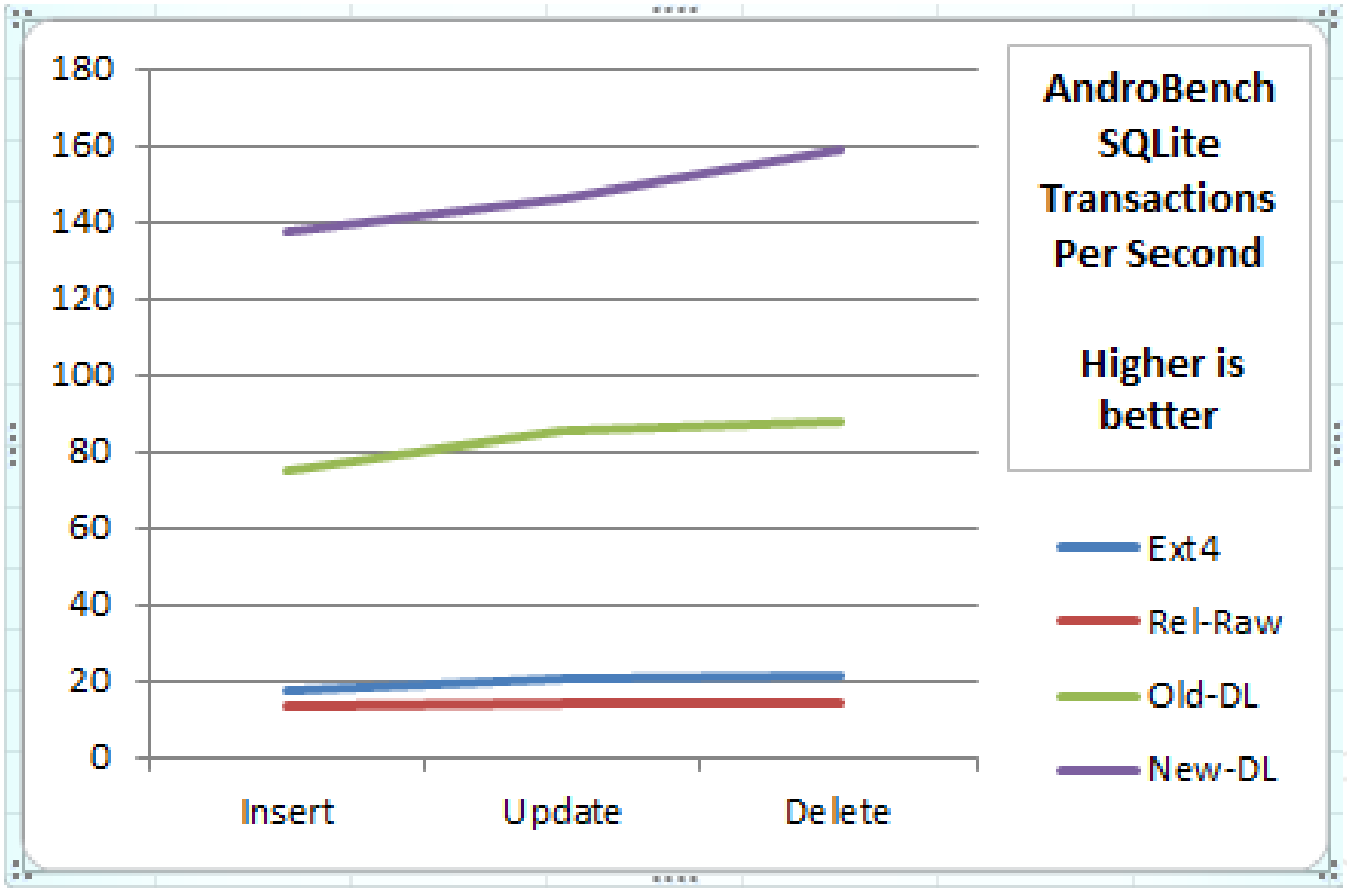
AndroBench



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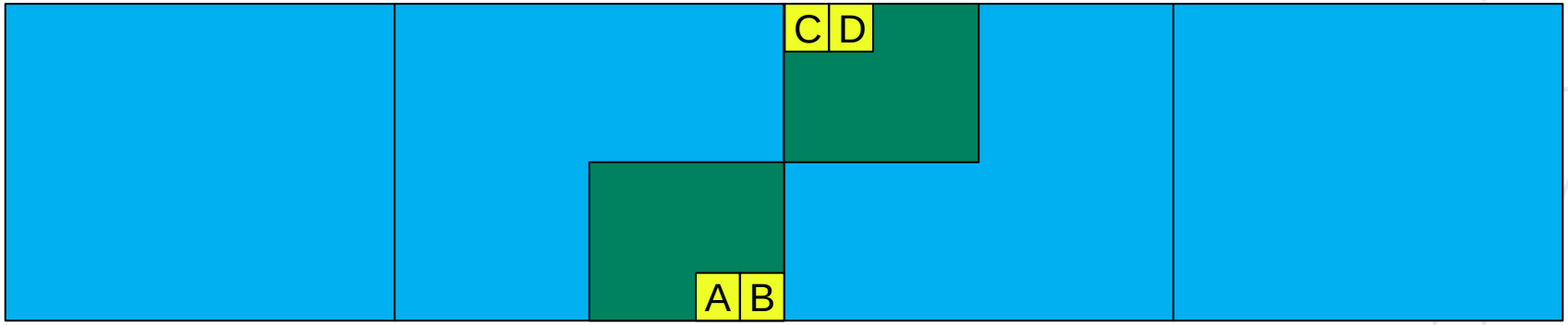
Write Amplification



- 4k file, minimum 512 byte write size
- Flash system Metadata
- File system Metadata & Directory Info

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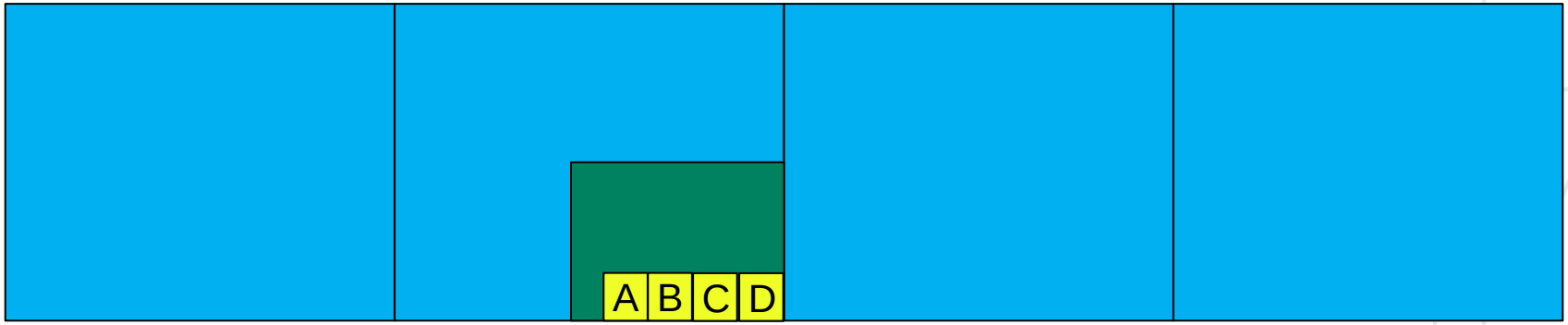
Correcting with Software



- Align writes to match Flash media
- Write sequentially where possible
- Collect writes into Atomic groups
  - Best match to underlying firmware

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Flash Media Lifetime

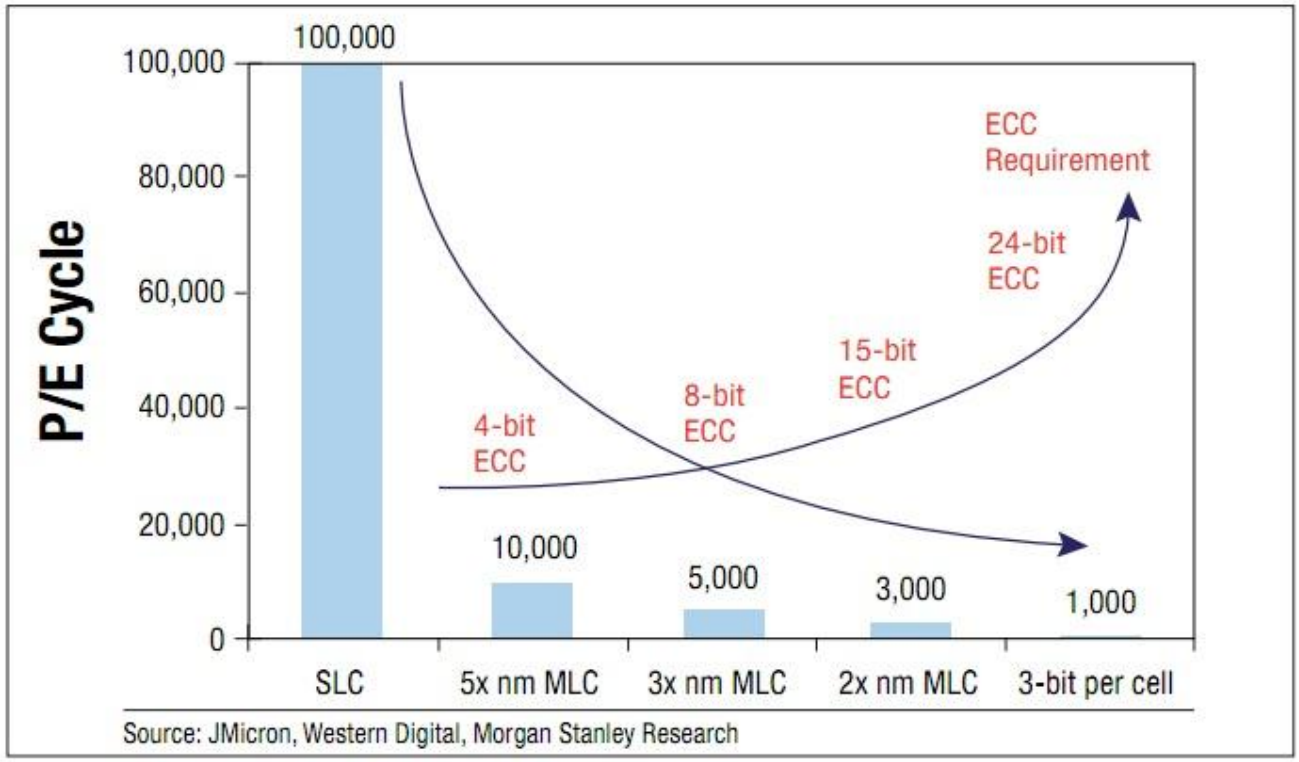

Figure 1 | A life cycle and ECC comparison of NAND flash by process node shows how an increase in correction capability is not enough to maintain endurance of the memory cell.

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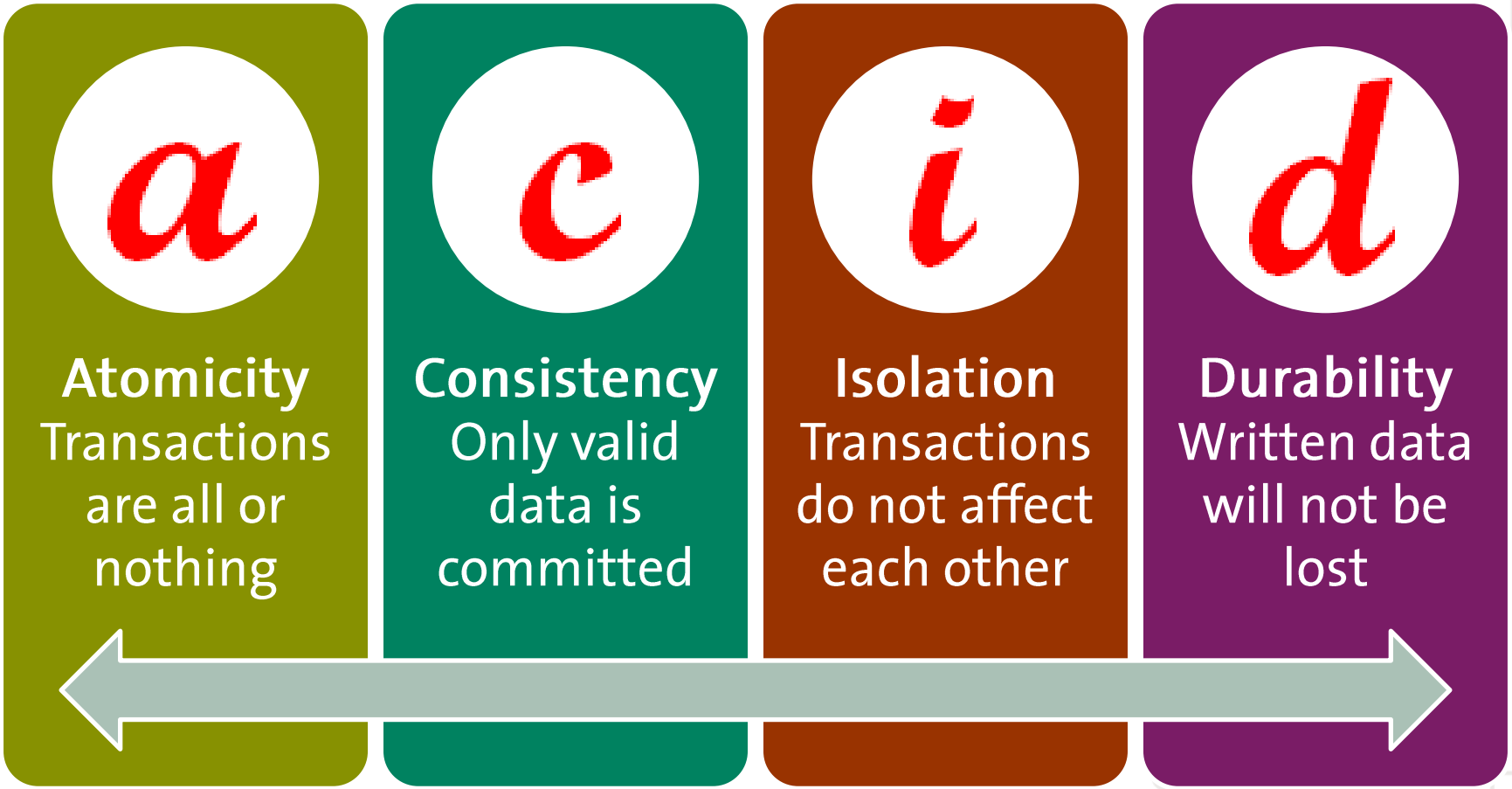

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Summary

- Performance Benchmarks need to account for RAM and Use Case
  - Ideally on the embedded target
- Software can improve access to the media and reduce overhead & Write Amplification
- Added benefits to Flash Media Lifetime and Reliability