Getting the Most Out of Performance Specs:

Top Ten Points for Embedded Designers

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Forward statement

- Paper written during the Football (Soccer) World Cup
- Performance in sports, but also for Flash memory storage systems
Anyhow, what is Football?

• The importance of semantic

• Same situation to define and report performance for a NAND Flash storage.
#10. Sprinting vs distance running

- FOB* vs steady-state Flash storage performance
  - No standard benchmark
  - Check performance after drive written 2 or 3 times
  - Trade-off performance vs. endurance (ask us)

* FOB: Fresh-Out-of-the-Box
#9. Performance through the match

- Workload is key
- Steady state dependency on workload
- Use-Case Tracker tool available to characterize your workload (ask us)
Overprovisioning (OP) as a possibility

- lower WAF* / longer lifetime
- Better random performance
- TBW** with different OP?
- Lifetime Estimation Tool (ask us)

* WAF: Write Amplification Factor
** TBW: Total Bytes Written
#7. Resting periods

- Static vs. Dynamic data
- Different FTL* configurations
  - Lower WAF and increased Lifetime
  - Effect on reliability
- Consider Dynamic Data Refresh (patented)
  & Read Disturb Management (ask us)

* FTL: Flash Translation Layer
#6. Your health first!

- Health monitoring throughout lifetime
  - Diagnostics
  - Reports
  - Warnings
  - Maintenance schedule
- hySMART® diagnostic tool (ask us)
#5. Placed or counter attacks

- Sequential or Random performance
  - Use-case importance
  - Page Base Mapping vs. Block Base Mapping
  - PBM vs. BBM performance comparison (ask us)
  - hyMap®
    > 10x IOPS increase, lower WAF, longer lifetime
#4. Approved performance boosters

- Many options depending on use case
  - Early Acknowledgment
  - SLC/pSLC/MLC/TLC/pMLC modes
  - Read Disturb Management, etc…
  - Latency and start-up time (Instant-up)
- Controller vendor relationship is key (talk to us)
#3. Short cuts for performance

- MLC and TLC Flash memories can be used in pseudo modes (pSLC or pMLC)
  - Enhanced performance
  - Reliability at the cost of drive capacity
  - Is it right for you?
- Option for industrial application ($$/Gb)
#2. Prevent heart failure!

- Reliability trade-off against performance
  - Sudden Power Fail robustness

- Intensive test
- Guaranteed Robustness (ask us)
#1. Setup your objectives

• Your requirements

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<th>Performance</th>
<th>Reliability</th>
<th>Price</th>
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• System bottlenecks? TCO?

• Industrial controller might be right for you…
Conclusion

• Beware of advertised performances
• Define your use case & requirements
• Consider the TCO
• Check industrial controllers

• Ask the tough questions!
Objectives met:
Assembly of many (player) options, strong management → winning combination

Same as:
Revisit Hyperstone’s FMS 2018 presentation at: