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SSD vs. HDD vs. SSHD

It's not who **will** win, it's who **should** win.

John E Moon

Sr. Director, Emerging Systems

Seagate Technology



Meet the contenders.



Hard Disc Drive

- Lowest \$/GB
- Long history
- Highly experienced producers.



Solid State Drive

- No moving parts.
- High performance.
- Lightweight and thin.



Solid State Hybrid

- Best balance Cost/capacity/performance.
- Strengths of both.
- Redundancy.

Who should win?



Hard Disc Drive



Solid State Drive



Solid State Hybrid



Who should win?
The Consumer!

What does the consumer want?



The Best SSDs

- When high performance is number one. Cost and capacity are distant seconds.



The Best SSHDs

- When you need SSD-performance & HDD capacity at a reasonable price



The Best HDDs

- When you need the maximum storage capacity at the lowest cost

Where can we improve on working together?



No need to reinvent the wheel!



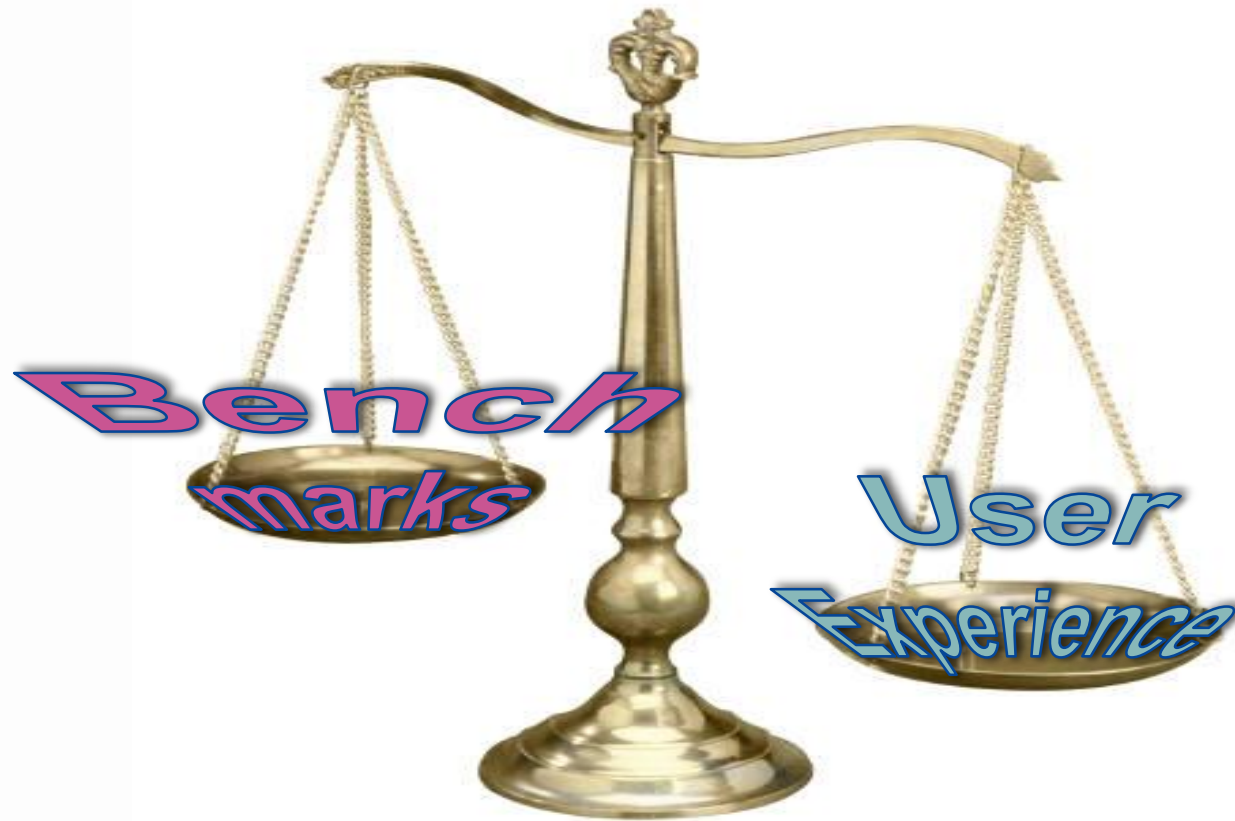
No need to reinvent the wheel!



SSDs and SSHs can leverage from HDD history:

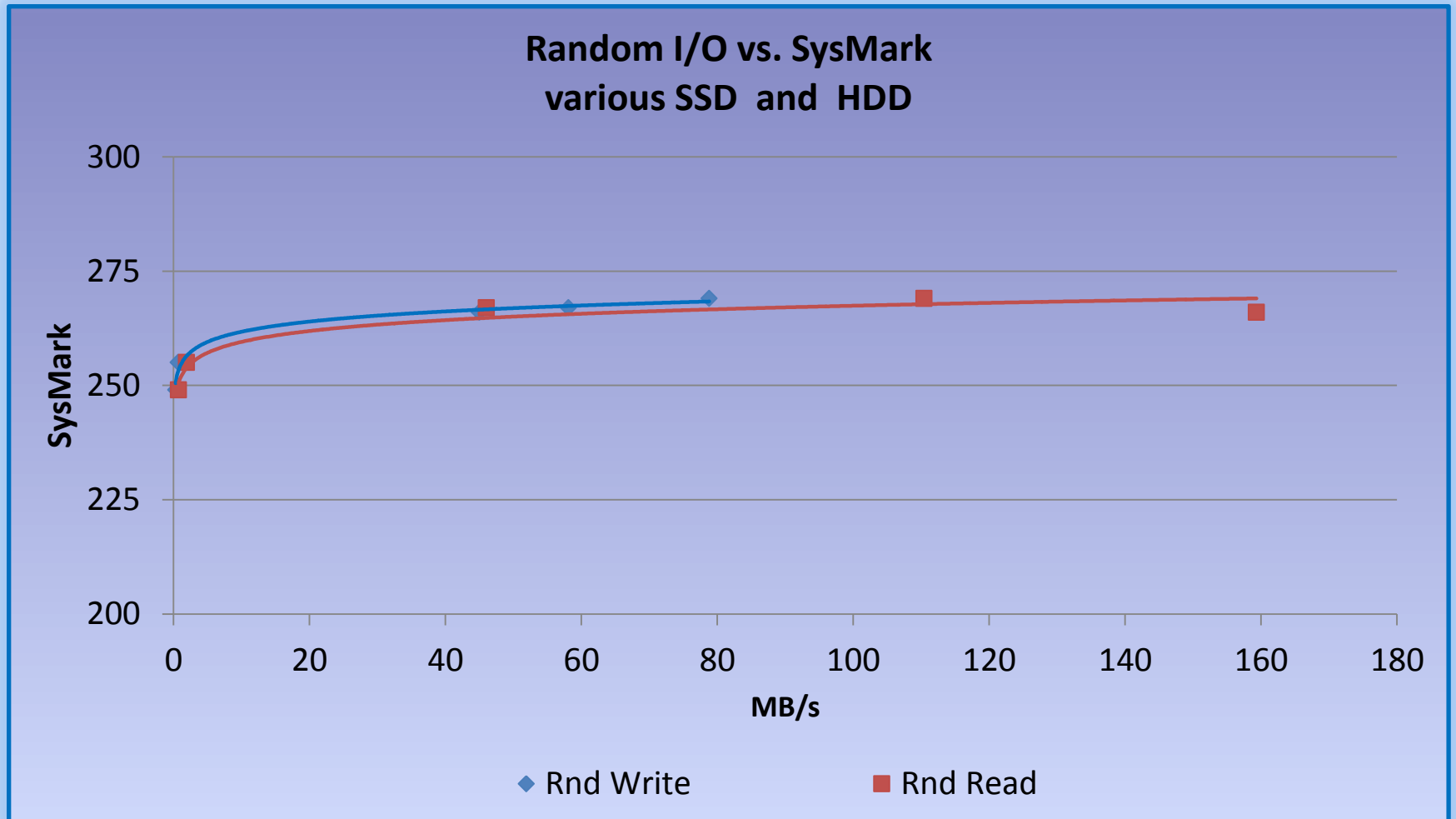
- 1970: Error Correction Codes
- 1985: DRAM buffers.
- 1986: Read Retries
- 1992: Auto-reallocation of bad sectors.
- 1995: S.M.A.R.T
- 2000: Background Activities; Offline scan, data refresh.
- 2009: LDPC

Let's demonstrate the truth!



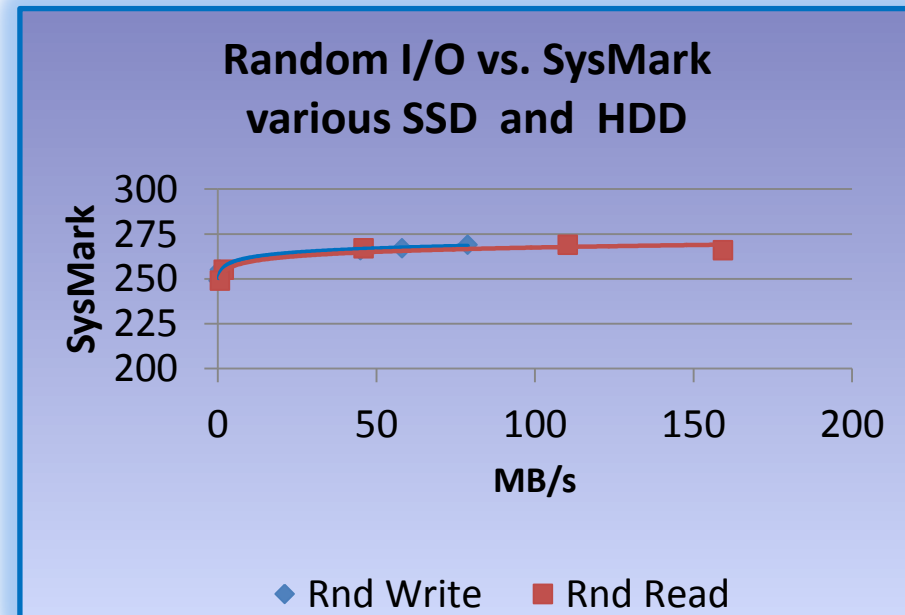
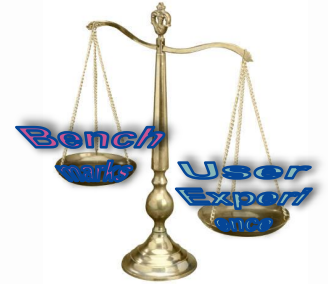


Let's demonstrate the truth!



Let's demonstrate the truth!

- Must translate to end user experience.
 - Need more data.
 - Initial state?
- Easy to use, but understandable.
- System independent or not?
- Repeatable results.



Your friend can be my friend!



Your friend can be my friend!

Who?

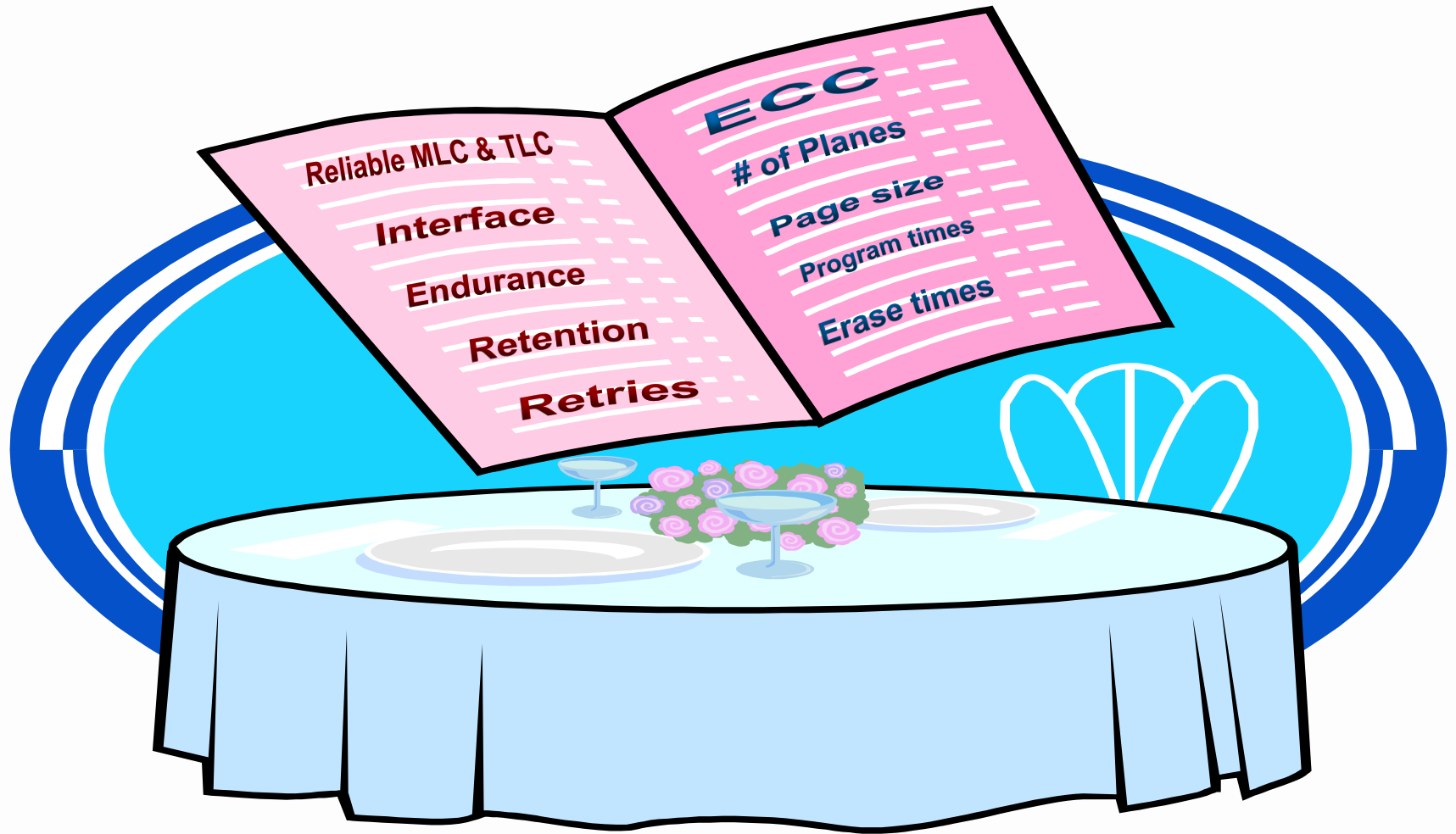
- SSD; HDD; SSH; O/S; System; BIOS; Driver

What?

- TRIM
- RPM detect
- Defrag
- Hints for ordering writes
- System prefetching.
- Hibernate, Sleep, Resume
- File aware information



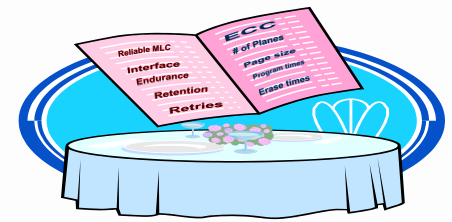
Can we share the same menu!



Can we share the same menu!

The more common the NAND Flash, the more productive for everyone.

- Reliable MLC & TLC;
 - Cost reduction.
 - Endurance and retention for all applications.
- Common Interface;
 - Capable of high transfer rates.
 - Not costly to implement.
 - Small pin count.
- Common Error Handling.
 - ECC
 - Retries
 - Signal processing
- Speed capabilities
 - Page sizes
 - # of Planes
 - Program and Erase Times



Some good starts!



Storage Performance Council



But more is needed for the consumer to win.



“If you want to be incrementally better: Be competitive.

If you want to be exponentially better: Be cooperative.”

Source Unknown

Thank you for listening!

Q & A

John E. Moon
Sr. Director, Emerging Systems
Seagate Technology
John.Moon@Seagate.com

