



# Performance Trade-Offs of Flash-based Client Storage Solutions

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# Implications of Ultrabook™ to Data Storage

- UltraBook™ encourages low-profile and caseless designs beyond HDD form factors
  - 5mm HDDs
  - mSATA SSDs
  - Next Generation Form Factor SSDs
- “Thin and Light” competes with large storage capacities
- Modern computing demands high performance and low power consumption, but not at an open-ended price!



# Storage Solutions Evolve... and Proliferate!



## Hard Disk Drive

- Inexpensive, high capacity data storage
- Proven technology
- Higher power consumption
- Shock/vibe tolerant



## Hybrid HDD

- NAND cache improves:
  - Power consumption
  - Performance
  - Better Shock/vibe tolerance
- Low cost, high performance, single drive solution



## Solid State Drive

- Highest performance
- High capacity available
- Lowest power consumption
- Best shock tolerance
- Caseless solutions = lowest profiles
- Silent computing



## Dual Drive

- Combine mSATA/NGFF SSD w/ HDD
- Improve performance and maximize capacity
- Lowers power consumption
- Configuration flexibility
- Ease of integration

# How to Choose?

	750GB Hybrid HDD	500GB HDD + 32GB SSD	128GB SSD
Time to boot (s)	19.0 s	17.5 s	10.0 s
Windows Movie Maker (MB/s)	112.7 MB/s	113.3 MB/s	194.7 MB/s
PCMark Vantage Score	15,834	16,930	42,849
Average Power (MobileMark 2007)	620 mW	700 mW	150 mW
Weight (g)	92 g	100 g	8 g
Complexity	Hybrid Info Drivers, single socket	Caching S/W, dual socket	No S/W, single socket

*All data taken with production UltraBook™ from leading manufacturer*

- Applications Engineering, NAND Solutions Group  
SSD Product Marketing, Micron Technology, Boise, ID
- Facilitates new product integration and qualifications  
for notebook and desktop applications
- Data storage experience in HDD and solid state  
industries in Manufacturing, New Product and Process  
Development, Quality/Reliability and Applications.
- Jon earned his BS degree in Electrical and Computer  
Engineering from the University of Colorado at  
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