



Storage Squeeze Play

HDDs Losing Ground to SSD and Tape



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Introduction

The traditional storage market is shifting as applications are more effectively exploiting the tiered storage hierarchy to better align availability requirements, service levels, and data protection mandates with the optimal infrastructure cost. Clearly HDDs remain and for the foreseeable future will continue to be the work-horse of the storage hierarchy. They are steadily losing market share for response time critical, high performance applications to the growing deployment of SSD technology while losing many lower activity, archival and resilience applications to significantly improved modern tape technology. The pressure is on the HDD industry and is illustrated by worldwide [HDD shipments](#) (data from Statista), which peaked with 651,300 million in 2010 and dropped 35% to 403,710 million in 2017. HDD shipments are predicted to fall to 341,950 million in 2020. Data which in prior years was often stored on HDDs without much thought to storage optimization is now taking up residence elsewhere. As storage pools get larger, the need to optimize storage by getting the right data in the right place also gets larger.

What's Behind the Shift?

SSDs mean high performance. SSDs have successfully addressed much of the high-performance storage market that was basically the exclusive domain of HDDs. Within the next 12-18 months, [solid-state flash arrays](#) currently using 2D NAND are projected to improve in performance by a factor of 10x and double in density and cost-effectiveness as 3D NAND and [3D XPoint](#) technology begins to emerge. This technological progression will significantly change the dynamics of the performance centric storage market. Compared to HDDs, SSDs have higher data-transfer rates, faster access times, better reliability, much lower latency with lower energy consumption. For most users, the [consistent](#) and high speed at which SSDs can read and write data and meet service levels is the key attraction. Because SSDs have no moving parts, they can operate at speeds far above those of a typical HDD. Fragmentation is not an issue for SSDs. Files can be written anywhere with little impact on R/W times, resulting in read times far faster than any HDD.

HDDs can handle every data type and have carried the most of load for the storage industry for years, however future challenges for HDDs are mounting. HDDs are increasing in capacity but *not* in performance as the IOPS (I/Os per Second) for HDDs have basically leveled off. The potential for more concurrently active data sets or files increases as HDD capacity grows and the increased contention for the single actuator arm causes erratic response time delays. Excessive RAID rebuild times are a growing concern and it can now take several days to rebuild a failed HDD in a RAID array degrading performance during the lengthy rebuild period. As HDD capacities continue to increase, total time required for the RAID rebuilding process will become prohibitive for many IT organizations and higher capacity HDDs could force a replacement for traditional RAID architecture implementations. HDD areal density is currently progressing at ~16% annually, about half the rate of tape technology. HDD capacity is often increased by adding more platters as the available surface recording are is squeezed as areal density increases. HDDs have a much higher TCO and use considerably more energy than tape or SSD.

For tape, significant technology improvements over the past 10 years have resulted in a tape renaissance. These changes enable tape to provide the lowest acquisition cost and TCO, the highest capacity, fastest data transfer rates, lowest energy consumption and most reliable storage medium available. Tape reliability has surpassed that of HDDs by three orders of magnitude. Over the last 10 years, [LTO tape](#) has increased capacity 1,400%, performance 200%, and reliability 9,900% while modern tape media life now exceeds 30 years. Tape data rates are now nearly 2x faster than HDDs and are projected to be 5x faster by 2025. [New features like](#) the Active Archive, RAIT and RAO add significant performance and access time improvements beyond traditional tape. Using tape for cloud archives, rather than HDDs, greatly reduces cloud TCO and creates a “green cloud”. The steady innovation, compelling value proposition and new architectural developments demonstrate tape technology is not sitting still and the renaissance is expected to continue indefinitely.

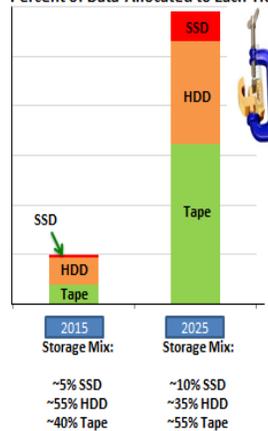
Summary

A fundamental shift in the storage landscape is well underway as high-performance data moves from HDDs onto flash SSD while lower activity, resiliency and archive data migrate from HDD to modern tape. For the foreseeable future, HDDs will remain the home for many primary storage, mission-critical data along with the highest availability applications, but HDD shipment growth rates have declined nearly 35% since its highpoint in 2013 and projections indicate no signs of ending. As SSDs and tape continue to show rapid improvements and re-balance the traditional tiered storage hierarchy, HDDs will continue to feel more pressure. The storage squeeze play is underway, and HDDs are caught in the middle.

Storage Squeeze Play – HDD Caught in Middle

SSD and Tape *Squeezing* HDD Market

Percent of Data Allocated to Each Tier



HDD Challenges are Mounting

- Why are HDD Shipments Down 35% Since 2010?
- Further HDD Performance Gains Minimal
- Tape Data Rates Faster Than HDD (~2x)
- HDD Re-build Times Excessive (n * days)
- HDD Capacity Gains Facing Limits
- HDD Adding Platters to Increase Capacity
- HDD TCO Higher Than Tape (4-15x)
- HDD Data at Rest Main Target for Hackers
- Tape Reliability Has Surpassed HDD
- Tape Areal Density Growing Faster Than HDD
- Tape is Much Greener Than HDD
- Tape Media Life Now 30 Years or More

Old way: **Keep adding more disk**
 New way: **Optimize flash, disk and tape**

Source: Horizon, IDC