Hard drives continue to be a reliable and cost-effective solution for meeting the world's growing data demands.

Hard Drives Remain Indispensable in Data Centers

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In recent years, there have been predictions of the hard drive's demise. Yet, this storage medium remains indispensable in the data centers of enterprises and cloud providers. And, for the foreseeable future, this is unlikely to change.

While hard drives may have disappeared from most consumer devices -and with that, from the view of end users - they remain highly prevalent in data centers. More than that, they bear the brunt of data storage demands, as no other storage medium can provide the direct access and necessary capacity for AI, video streaming, and other data-intensive applications as economically as hard drives. After all, SSDs are still about five to eight times more expensive per unit of capacity. Even if their price were to match HDDs, it would take many decades and insurmountable investments to scale production capacity to a level where SSDs could possibly replace hard drives. This is due to the complex and costly production of flash memory in cleanrooms.

Therefore, not only does the majority of installed storage capacity in data centers consist of hard drives, but newly added capacity is also predominantly based on this classic storage medium. In the year 2024 alone,

56 million enterprise HDDs were shipped globally, with a total capacity of 959 Exabytes - that's 959 million Terabytes and more than four times the capacity of enterprise SSDs shipped in the same period (59 million units with a total of 226 Exabytes).

The reason the hard drive is still so in demand almost 70 years after its debut is due primarily to its consistent capacity growth - by 2 terabytes per year - while maintaining stable costs. Initially, innovations like helium-filled drives and thinner disks enabled higher capacities. Today, new recording technologies such as Microwave-Assisted Magnetic Recording (MAMR) and Heat-Assisted Magnetic Recording (HAMR) are driving this progress. These technologies utilise microwaves and laser diodes respectively, which means less magnetic energy is required and the write head can be smaller. Smaller write heads mean denser data storage and, consequently, higher capacities. Experts predict that drives with up to 50 terabytes per unit will be possible in the coming years.

Additionally, despite their moving parts, hard drives are remarkably durable and efficient. The failure rate of enterprise HDDs is typically around 0.35%, which translates to just seven failed drives per year in a data center with 2,000 hard drives in operation. Large data center operators and cloud providers often achieve even better reliability rates. Power consumption for hard drives is also relatively consistent, regardless of capacity or workload, as most energy is used to spin the spindle - typically around 7 to 8 W. For high-capacity drives, this makes HDDs very energy-efficient, consuming only 0.3 to 0.5 W per terabyte, which is comparable to SSDs of the same capacity.

The comparatively low performance is often cited against hard drives, but this case only holds true when considering a single drive. In modern storage architectures, dozens of hard drives work together in arrays, enabling parallel read and write operations. In this way, storage systems can easily achieve throughput rates of 15 GB/s and over 15,000 IOPS.

Ultimately, hard drives offer everything data center operators and cloud providers value: high capacities at low acquisition and operating costs, high reliability, and sufficient performance for most applications. Where performance falls short, a few SSDs can easily be added into the mix, but the majority of data still resides on disks.

Hard drives may not be the star of the data center - they've been around too long for that. Instead, they are the quiet, indispensable workhorses that reliably operate in the background. Without them, it's fair to say, our digital world would no longer function.

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