Data storage and next-generation non-volatile memory technology

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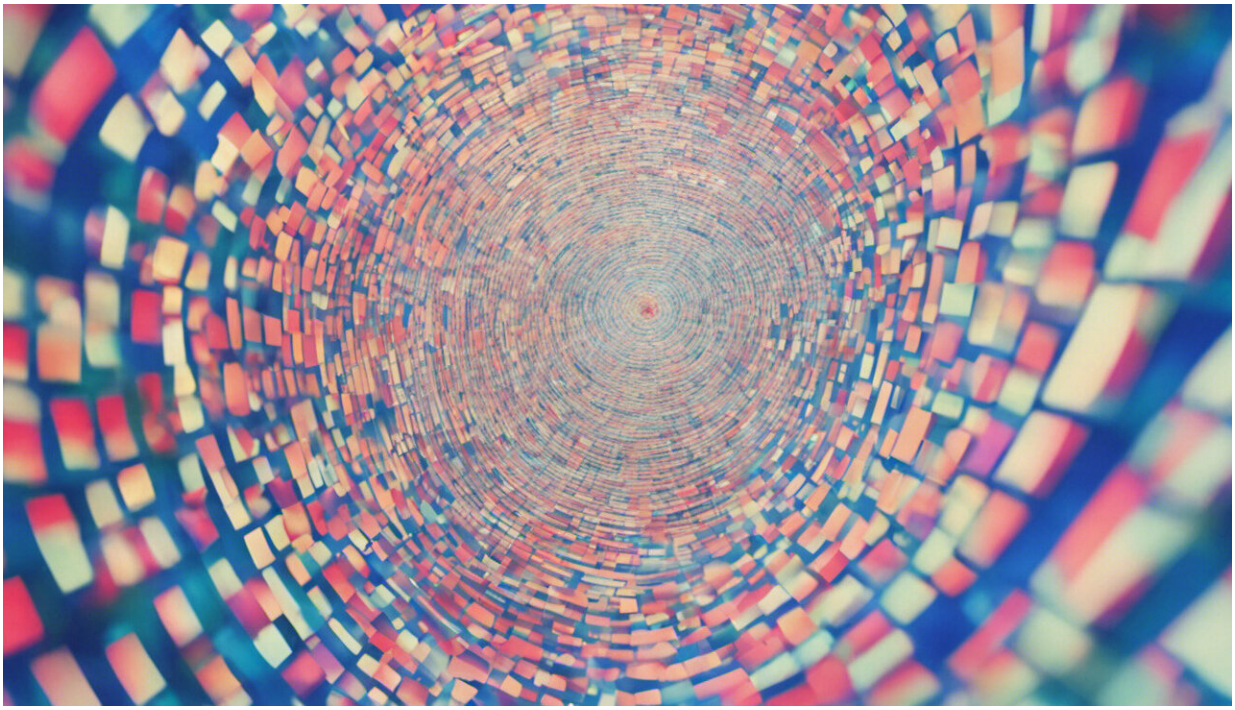

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(Phys.org)—Internet, computing and networking technologies are now integral to many people's lives, generating ever-increasing amounts of digital information. Data storage experts estimate that by 2020, 35 zettabytes—35 x 10^{21} bytes—of digital information will require storage that is safe, reliable and above all, quickly accessible. "Storage is the

most likely issue to inhibit the capability and performance of a computing system," explains Yong Khai Leong at the A*STAR Data Storage Institute. "Current hard disk drives consume significant energy and release a lot of heat."

Most of the processing work in a computer is performed by random-access memory (RAM), which can access any part of its memory very quickly. However, this comes at a cost—information in RAM is not stored when the computer is off—so storage devices using non-volatile memory (NVM), such as ROM and flash memory associated with magnetic hard disks, are used for long-term storage.

Yong and co-workers reviewed existing data center storage systems, and suggested ways to incorporate next-generation NVM, which can do the job of RAM as well as providing storage, into future data centers. They focused on the importance of scalable, affordable storage systems, and the need for devices that can quickly read files and metadata. Examples of metadata include the keywords stored alongside every webpage for the benefit of internet search engines.

Data centers already use alternatives to hard disks such as solid-state drives (SSDs) that use less power than magnetic hard disks. However, SSDs are expensive and still slower than RAM. "We propose a new storage architecture incorporating next-generation NVM technology in a hybrid form with magnetic disk drive technology," explains Yong. "This NVM has a longer life span than SSDs, and is quicker at reading metadata."

A conventional magnetic disk drive in hybrid with next-generation NVM can spin less quickly because the task of reading data is sent through the NVM first. As a result, less energy is consumed. Also, while the NVM is searching through files, the disk drive is free to carry out maintenance tasks such as file backups, reducing the potential for data loss.

Yong notes that future systems will need intelligent algorithms—software that knows which data tasks to prioritize in the NVM at different times according to user demand.

A*STAR is leading the global search for data storage solutions, with a three-year research program in place. "We are taking a holistic approach in investigating the optimal ways to integrate these new emerging memory technologies into current systems and data centers," Yong says.

More information: Yong, K. L., Aung, K. M. M. & Alexopoulos, P. S. Storage system architecture for data centers of the future. *International Journal of Advancements in Computing Technology* 4, 184–192 (2012). www.aicit.org/IJACT/global/pap … ml?jname=IJACT&q=866

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