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Right Place, Write Architecture for SMR drives

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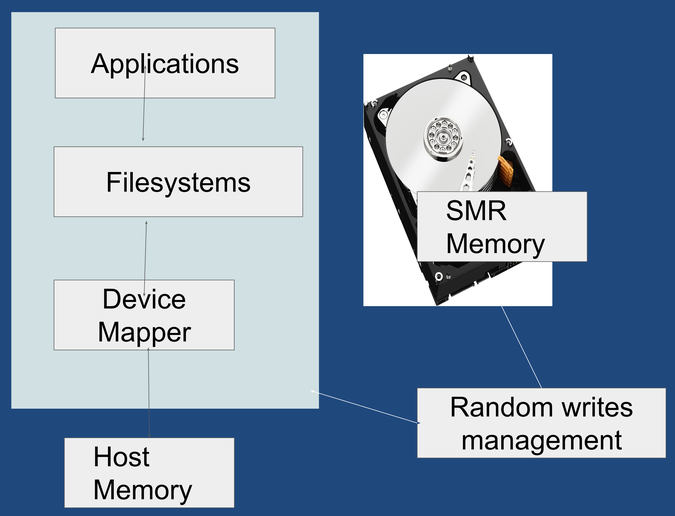
Problem:

- **Can we achieve similar performance as the Conventional Magnetic Recording (CMR) drives using Shingled Magnetic Recording Drives (SMR) Drives.**

Challenges:

- SMR Drives support only sequential writes.
- Random writes are either managed by an SMR translation layer on the device or by the Host OS.



Current Approach:

- Updated/Random writes are written to a non shingled disk portion (cache).
- Cache is emptied using a Read-Merge-Write operation.
- Sequential writes are written to the shingled portion.

Problem with current Approach:

- Cache emptying causes application I/O to stall; causes higher latency.
- Smaller cache exacerbates this problem.

Our Approach:

- **Employ log structured architecture in the host OS to manage the host Managed SMR drives.**
- **Develop a Linux kernel based device mapper that implements log structuring for experiments.**

	CMR	DM-SMR	HM-SMR
Cost	4 cents / GB	3 cents / GB	1.2 cents / GB
Random I/O	500 to 1000 IOPs	~150 IOPs	> 150 IOPs

Our contributions:

- A log structured device mapper.
- A literature survey of flash memory to investigate the reasons for the current STL architecture.
- A published cost and performance analysis of DM-SMR drives vs HM-SMR Drives.
- Discovering that HM-SMR are much superior to DM-SMR drives and the storage industry should stop producing them.

Parallel Work:

- Research if I/O priority assignment can improve the performance of log structured architure implemented on host managed NVMe SSDs and host managed SMR drives (Zoned Storage Devices) .