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Using FDP to Optimize Video Recording Performance for External Storage

[Confidential]

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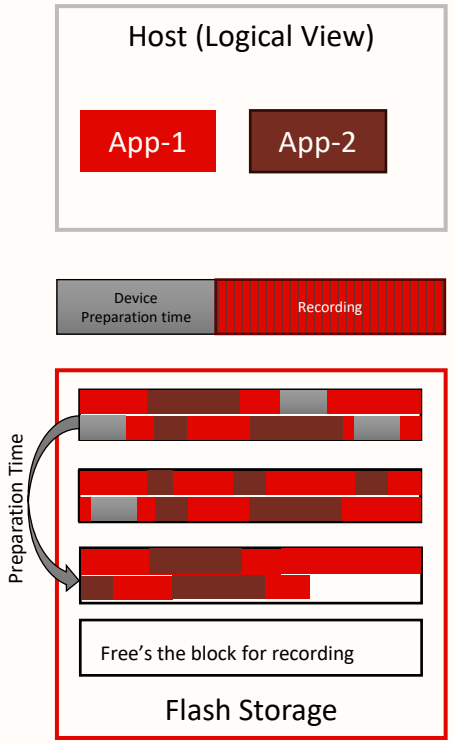
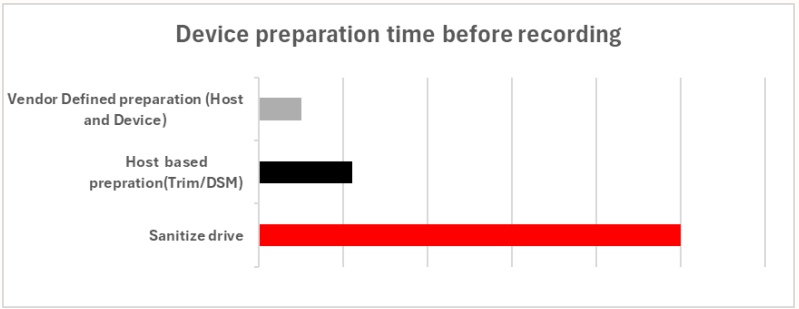
Background : Present approach of guaranteeing recording performance

- Device preparation approach
  - Multiple preparation approach followed by host and device
  - Both Host and device initiate periodic preparation based on the device’s state
  - Device perform garbage collection and other background tasks to prepare for write operations.
- Device preparation impact
  - Reduces host available bandwidth
  - Leads to unpredictable performance across different time windows
  - Performance degradation is more pronounced under multi-application workloads
- **Can the device preparation time be reduced to zero?**

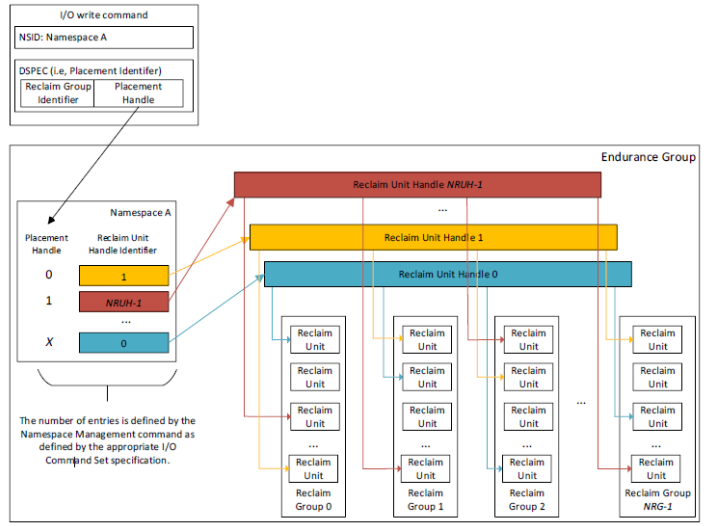


Video Guaranteed Speed



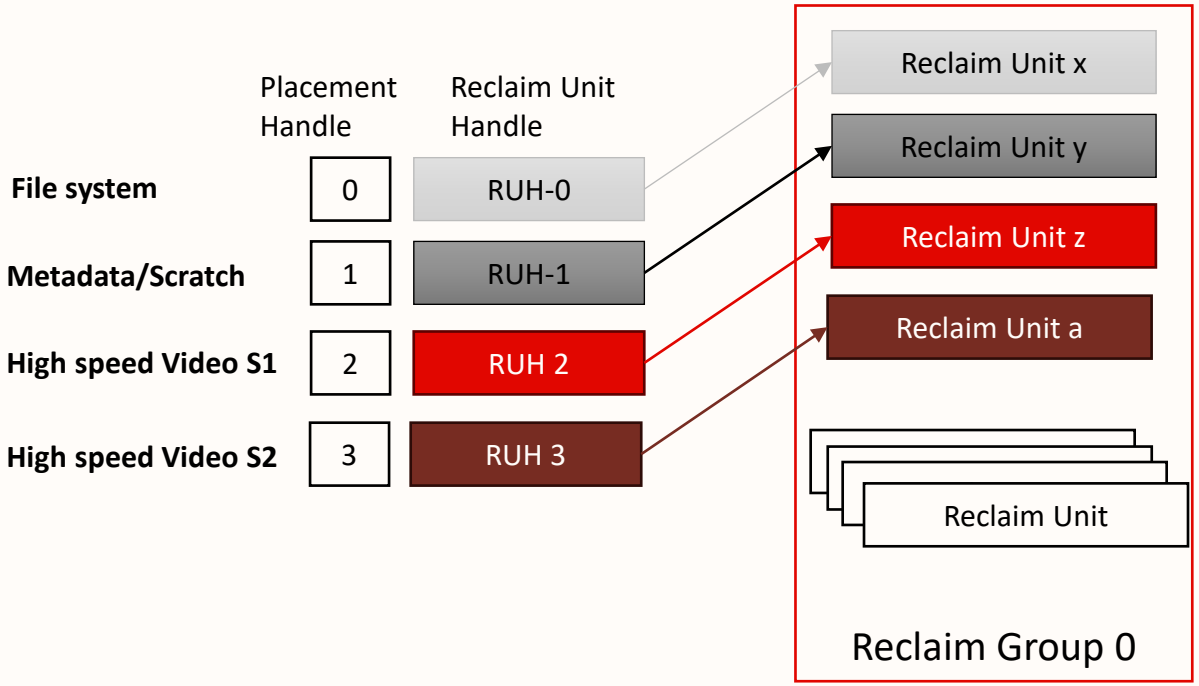
Ideal approach for guaranteed performance with zero preparation time

- Device should avoid performing garbage collection during write operation
- Host awareness of the state of device for write operations
- NVMe Flexible Data Placement (FDP) feature
  - Enables Host to provide placement hints for device during write
  - Improves data placement in storage device
  - Allows Host to understand the data placement in the device
- Can FDP be effectively leveraged to optimize video recording performance?



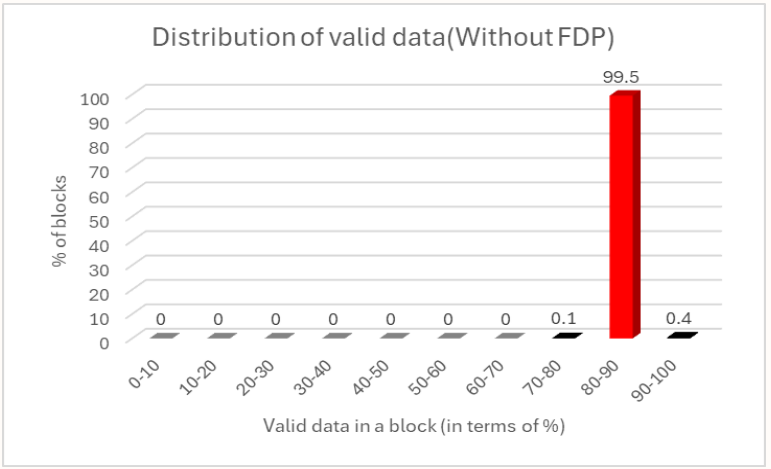
Video recording : Example use case when FDP enabled

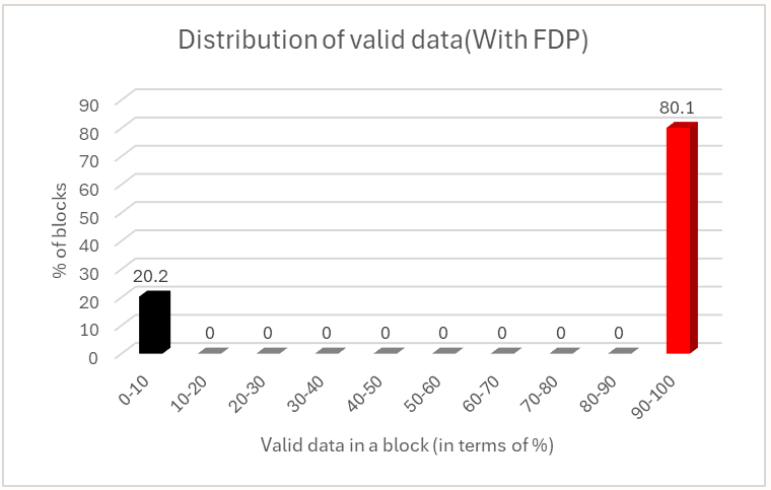
- Recording Pattern of data when FDP enabled
  - File system data : Random LBAs with command width (1-8 sectors)
  - Metadata (FDP) : Data temporarily stored and used as separated LBA’s to accumulate and organize information. Dedicated reclaim unit should not be mixed with other data
  - Multiple concurrent video recording stream : sequential large command length
  - Video stream (FDP) : Require strict performance guarantee dedicated reclaim unit for each stream



Analysis of the existing video recording patterns

- Analysis summary (key Metrics)
  - Valid data distribution graph
    - Without FDP : High percentage of blocks with 80 to 90 % valid data
    - With FDP : Either blocks with 100% valid data or 0%valid data
  - With FDP routing : 20% of the block contains 0% of valid data which drastically reduces the background operations





Conclusion

Direct Benefits

- **Simple straight forward approach** for the host drivers to map application write data to the device Reclaim units
- Device supporting **FDP allow hosts to fine tune the recording algorithm** based on the application specific needs
- Little **increase in Device resources** to handle FDP features , but with **significant performance gains**
- Device support of FDP enables **higher sustained storage bandwidth** and **guaranteed performance**

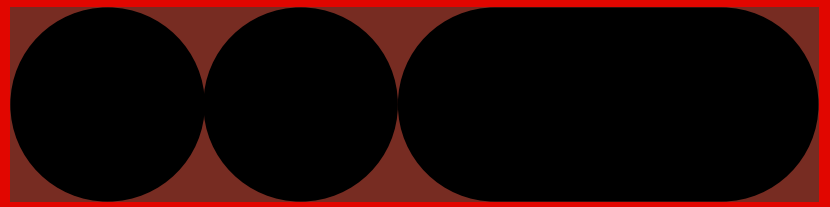
Indirect benefits

- **Reduced power** consumption (Avoids unnecessary background operations)
- Predictable device response time , helps host **better pipelining of the storage request**

Questions ?

- ……

Thank you all for your time



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