



# Standards for improving SSD performance and endurance

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## What is being standardized?

- An interface to provide better collaboration between SSD and storage systems
  - Background operation control
    - Advanced garbage collection
  - Stream operation
    - Stores data with similar lifetime in associated physical locations
- Object Storage
  - IP Based Drive management
  - Key Value Storage API



# Advanced Background Operation (ABO) Control

- Why ABO control?
  - IO performance is degrade when ABO occurs at the same time as IO
  - Avoids overlap of IO and ABO
- What does ABO provide?
  - Notification when ABO is imminent
  - Mechanism for host to specify the time to spend on ABO
- Provides predictable and consistent performance



## Write Streams

- Allows host to associate each write operation with a stream
- Device places all data associated with a stream in physically associated locations
- All data associated with a stream is expected to be invalidated at the same time (e.g., trimmed, unmapped)
- Why stream operation?
  - When different lifetime data is intermixed
    - Garbage Collection overhead increases
    - Write Amplification Factor increases
- Improves system performance
- Improves device endurance



## NVMe standardization

- Directives Technical Proposal
  - Extensible feature to provide host directives to device
  - Identify Directive
  - Event Notification



# NVMe Standardization (ABO)

- ABO directive
  - Device Returns characteristics for ABO
    - Minimum percentage resources available
    - Current percentage resources available
    - Maximum percentage resources possible
    - Current status of ABO
  - ABO imminent notification



## NVMe Stanandardization (ABO) (Continued)

- Host informs device of time to perform ABO
  - Maximum time to perform ABO
  - Target percentage of resources
  - Notification threshold





# NVMe Standardization (Streams)

- Device reports properties
  - NVM Subsystem
    - Maximum streams
  - Namespace
    - Optimal Stream Write Size
    - Stream Granularity
    - Allocated Stream Resources
    - Stream Status



## NVMe Standardization (Streams) (Continued)

- Implicit assignment of identifier
- Release of identifier
  - Implicit
  - Explicit
- Identifier in the write command associates write with that stream



## NVMe Standardization (Status)

- Technical proposal close to complete
- Member review in September



## SCSI Standardization

- ABO and Streams standardization completed May 2015
- Streams does not support implicit identifier assignment and release
- Will be updated to match the NVMe model
- Additional standardization of rebuild assist for SSDs
  - Complete by November



# SATA Standardization

- ABO standardization completed April 2016
- Stream standardization taking place in SATA-IO
  - Following NVMe standard
  - Expect completion later this year



## Object Drive

- Development in SNIA
- Starting with IP Based Storage Management
- Future directions
  - Key Value API



Thank You