Key Value Storage Standardization Progress

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What is Key Value Storage?

- Storing an object (value) associated with a key
- A New paradigm that is different than block storage
- Different than Object Storage
How is Key Value different than Object Storage

- **Object storage**
  - A solution or platform
    - A cluster of storage in general, Global namespace, Extensive higher layer features: global namespace, resiliency, etc.
  - A device (e.g., Kinetic)
    - No storage native interface (e.g., object(REST) interface)
  - Searchable based on the value in the object
  - Performs operations based on the object key and object(value)

- **Key Value Storage**
  - A device
  - Native key and value interface (e.g., store(), retrieve(), delete(), etc. with key and value instead of LBA)
  - Searches and other operations on the value are done outside of the storage element
Why Key Value Storage

- Solid State Storage maps from an address to a physical location already
- This is a different mapping but what SSS already does
- This removes the triple mapping that occurs in current systems
  - Mapping from key to filesystem
    - Done in the host
  - Mapping from filesystem to Logical Block Address
    - Done in the host
  - Mapping from Logical Block Address to Physical address
    - Done in the storage device
Where is Key Value Storage being standardized

- SNIA
  - Key Value Storage API
- NVMe
  - Key Value Command set
SNIA KVS API

- Current revision 0.16 has been released for public review
  - [http://www.snia.org/publicreview](http://www.snia.org/publicreview)
- What is included
  - Keyspace management
  - Store
  - Retrieve
  - Exist
  - List
  - Delete
  - Group operations
Keyspace management

- Multiple Keyspaces coexist on a single key Value device
- Each Keyspace has its own characteristics
  - Capacity
  - Key ordering
  - Device characteristics are global
Store

- Specifies
  - Keyspace
  - Key
  - Value
- Options
  - Compression
  - Overwrite
  - Update only
Retrieve

- Specifies
  - Keyspace
  - Key
- Options
  - Decompress
  - Delete after retrieve
List

- Returns a list of keys
- Has a starting point
- Has a size of what is to be returned
  - Based on the key size determines number of keys to return
Exist

- Returns success if value exists
- May be performed on a list of values
Group operations

- Allows operations to be performed on a group of keys specified by
  - A set of bits within the key
  - A mask of those bits

- Supported operations
  - List
  - Delete
SNIA KV API Status

- Being developed in the Object Drive TWG
- Meeting weekly
- Currently revision 0.16 available for public review
- Aiming for release as a specification end of this year
NVMe Command Set

- In architectural development
- A new command set
- Operates over
  - PCIe
  - NVMe-oF
Architecture overview

- A single controller supports either
  - Block Commands
  - Keyvalue Commands
  - NOT both

- A NVM Subsystem may have
  - A Block Command controller; and
  - A Keyvalue Controller

- New specification that references
  - NVMe Base specification
  - NVMe-oF specification
  - NVMe-PCIe Specification
Keyspace

- Comparable to Namespace
- Allows separate spaces on a controller to use the same keys without overlap
- Allows partitioning of the controller resources
Store Command

- Keys up to 16 bytes are carried in the command
- Keys greater than 16 bytes are passed as part of the DATAPTR
  - May be SGL or PRP
- Value is pointed to by DATAPTR
  - May be SGL or PRP
Retrieve Command

- Keys up to 16 bytes are carried in the command
- Keys greater than 16 bytes are passed as part of the DATAPTR
  - May be SGL or PRP
- Value is returned to location pointed to by DATAPTR
  - May be SGL or PRP
List Command

- Returns a list of keys within the keyspace
- Starts at the key specified by the command
- Keys up to 16 bytes are carried in the command
- Keys greater than 16 bytes are passed as part of the DATAPTR
  - May be SGL or PRP
Exist Command

- Returns success if key exists in the keyspace
- Keys up to 16 bytes are carried in the command
- Keys greater than 16 bytes are passed as part of the DATAPTR
  - May be SGL or PRP
NVMe KV Status

- Provisionally approved by NVMe Board
- Developing architecture
- Weekly subgroup meetings
- Pushing for member review around end of 2018
Thank You
Subhead

- Example 1
- Example 2

Subhead