Standardization for a Key-Value Interface underway at NVM Express and SNIA

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What is Key Value

• A mechanism to store user data associated with a key
• Key may be any length (byte granularity)
• Value may be any length (byte granularity)
Differences between KV and Block interface

• **Block**
  • User data is in multiples of block length
  • Logical block address is a number from 0 to max LBA

• **KV**
  • Variable length user data
  • Key is a variable length identifier
Differences between Object and KV interface

- **KV**
  - Tool to facilitate object storage
  - Keys may not be ordered
  - Not searchable based on contents of value

- **Object**
  - Keys are ordered
  - More functionality to search objects
    - Does value contain “X”
  - Support logging or other mechanisms to maintain database integrity
Key Value SSD layers

- **Application(s)**
- **KV API**
  - e.g. SNIA KV API
- **SNIA KV Library**
  - e.g. C Library, Java, etc.
  - Written by vendors, open source, etc.
- **KV Protocol Host Interface**
  - e.g. NVMe KV commands
- **KV Wire Protocol**
- **KV Protocol Device Interface**
- **KV Device**
  - e.g. KV SSD
SNIA KV API Status

• Version 1.0 has been approved and is publically available
  • https://www.snia.org/tech_activities/standards/curr_standards/kvsapi
• Allows library calls independent of the underlying transport
  • NVME
  • SCSI
  • SATA
What does the API define?

- **Structure**
  - Key Space
  - Key Group
  - Key Value Pair
  - Device info
  - Key Space info

- **Access**
  - Store
  - Retrieve
  - Delete
  - Delete Group
  - Exist
  - List
  - Iterator
Iterator Function

• enables a device to prepare a Key Group of keys for iteration by matching a given bit pattern
• Allows listing/deleting keys/values within the iterator group
NVMe KV work

• Working on a Key Value command standard
• Relies on other work in NVMe to provide supporting structure for NVMe KV
  • Namespace Types/ Multiple Command sets
• Expect to release later this year
Features of KV Command set

• Currently Key limited to 16 bytes
• Comparable commands to the API definitions in SNIA
  • Store
  • Retrieve
  • Delete
  • List
  • Exist
Future work on NVMe KV

- Extended key length
- Append
- Retrieve (Index)
- Sorted Keys
Software/Driver Support

• Samsung has open source code available
  • Currently proprietary
  • SNIA API available in next 2 months
  • Samsung KV API, Kernel driver
    • Public github:
      – [https://github.com/OpenMPDK/KVSSD](https://github.com/OpenMPDK/KVSSD)
    • Kv userspace driver:
      – [https://github.com/OpenMPDK/uNVMe](https://github.com/OpenMPDK/uNVMe)
• KV Ceph: Ceph object storage designed for Samsung Key-Value SSD
  • [https://github.com/OpenMPDK/KVCeph](https://github.com/OpenMPDK/KVCeph)
Thank You