The Key-Value SSD as a First-Class Citizen in the Operating System

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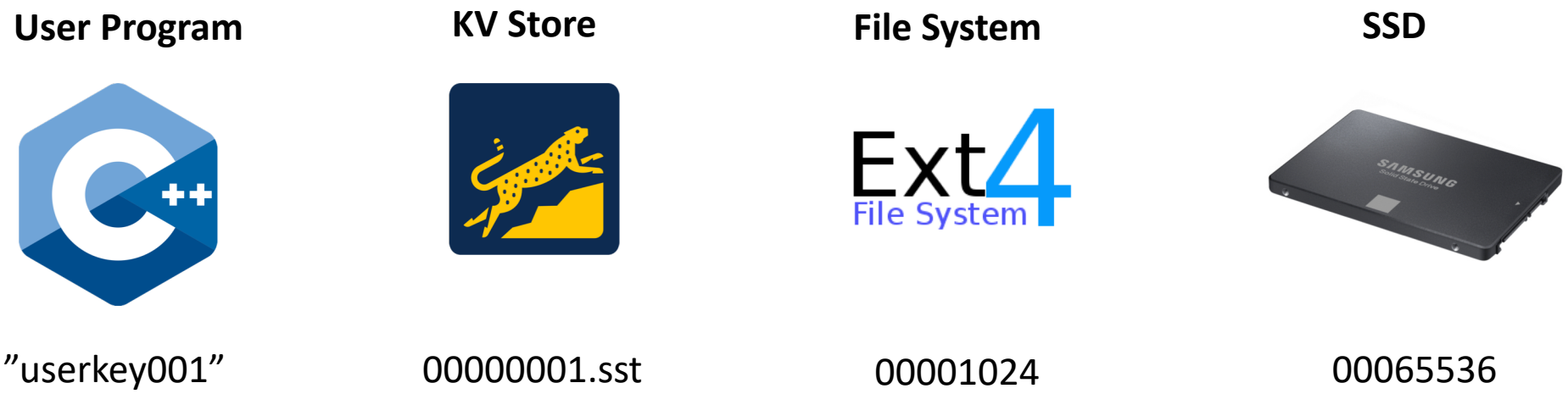
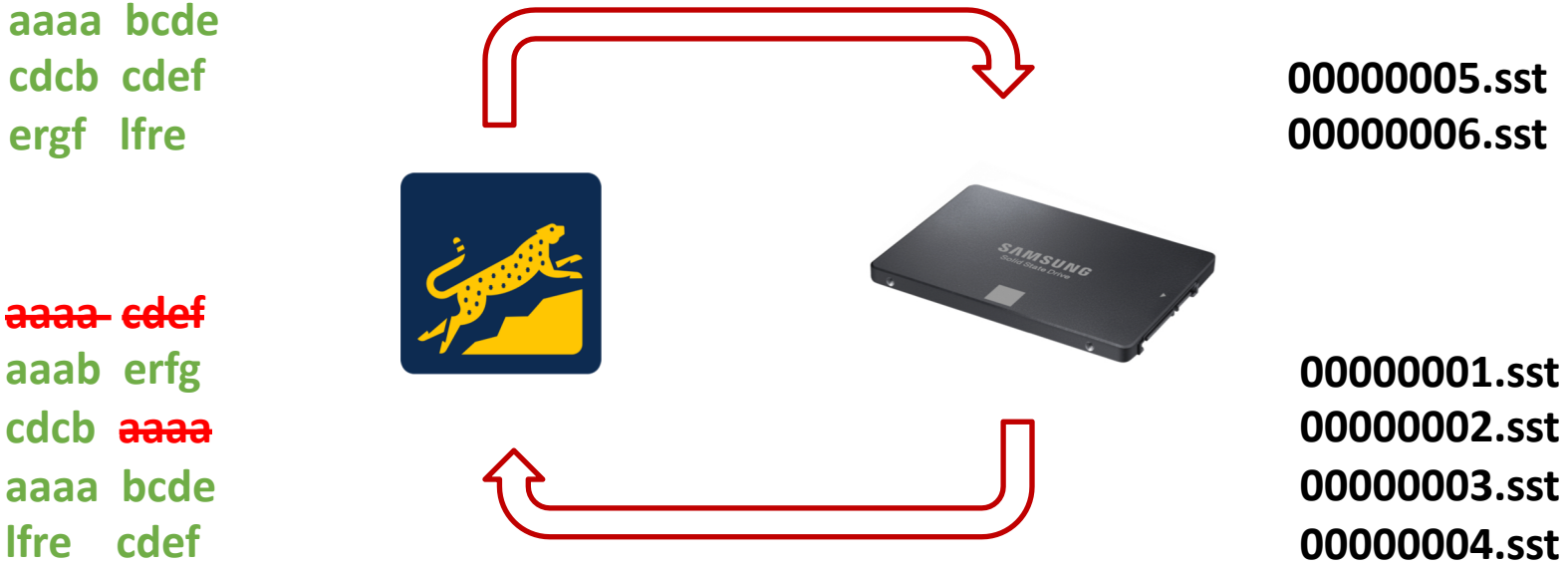
Key-Value SSDs vs Block SSDs

- Key-value stores running on block SSDs require several lookups from key to physical address



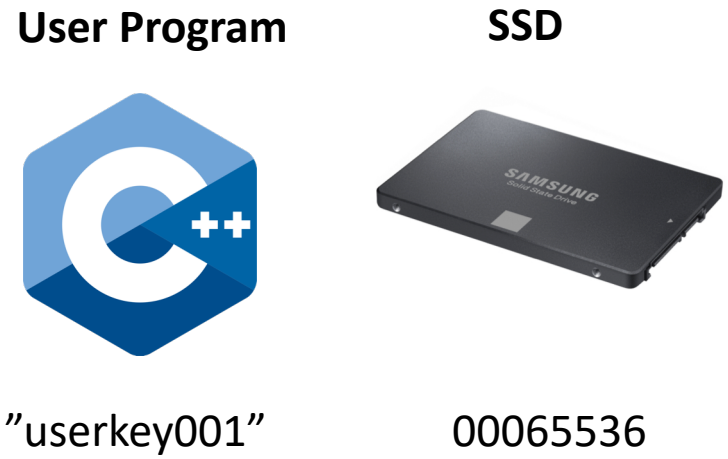
Key-Value SSDs vs Block SSDs

- Compaction is later required to remove stale data and reclaim logical space



Key-Value SSDs vs Block SSDs

- Key-value SSDs use *keys* to access files, not *LBAs*
- Data management operations are handled inside the device
- Less translation overheads, no compaction (or similar data management)

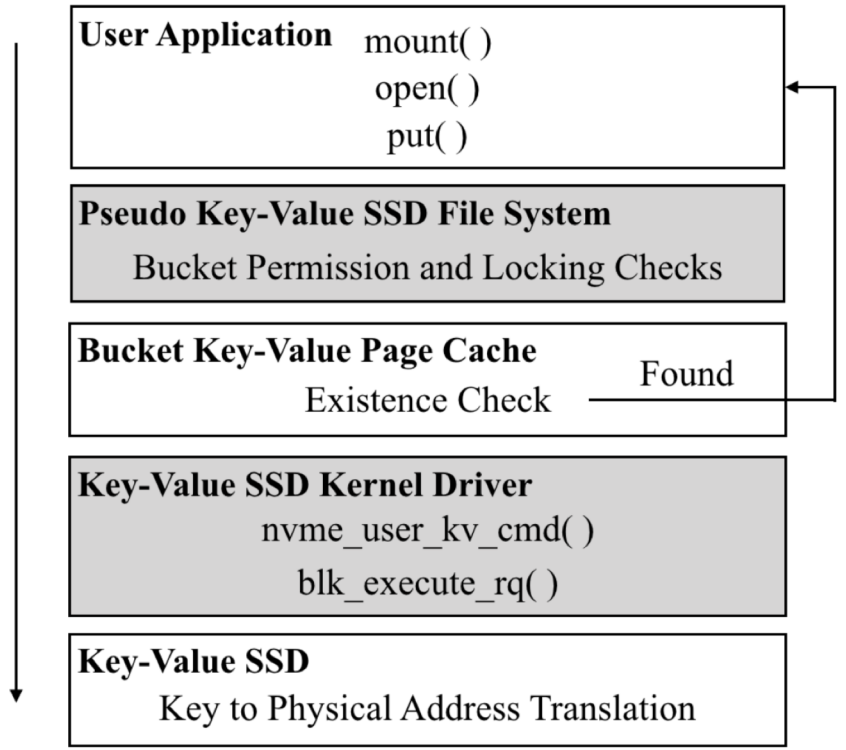


Missing KVSSD Support at the OS Level

- Key-value interface affords a leaner I/O stack
- However, bypasses important OS layers
  - Cannot safely use KVSSDs in cloud and multi-user environments
  - No OS level page caching
- Current system calls unsuitable for KVSSD I/O

Kernel Support for KVSSDs File System and Page Cache

- First proposal : a thin pseudo file system designed for KVSSDs
  - Provide a special file for each unique key space (bucket)
  - open() these files for bucket level permissions and locking
  - Key-value tailored data cache inside the file system
  - Call familiar functions on buckets (ls, cat)



Kernel Support for KVSSDs System Calls

- Second proposal : system calls for KVSSD I/O
  - Current Linux system calls unsuitable for key-value I/O
  - Perform I/O at the bucket level
  - put(), get(), delete(), batch(), iterate()
  - Larger value size support than allowed by device

```
int fd, ret, keylen = 8, vallen = 128;

void* key      = "ABCDEFGH";
void* putval   = (char*)malloc(vallen);
void* getval   = (char*)malloc(vallen);

fd = open("/mnt/kvssd/my_bucket", O_CREATE);

fill_buf(write_val);
ret = kv_put(fd, key, keylen, putval,
  vallen, NULL);
ret = kv_get(fd, key, keylen, getval,
  vallen, NULL);
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Thank You