Data Recovery from SSD
Lab Techniques and Challenges

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DriveSavers Data Recovery

HDD vs SSD Data Recovery

Hard Disk Drives

- Electro-mechanical failures
- Component issues, media damage, firmware corruption
- 25+ years of engineering solutions in the lab

Solid State Drives

- Electro-logical failures, typically very binary
- Firmware or controller corruption
- NAND media issues
- Encryption, compression, many layers of logic
- 5 years of engineering and lots of ongoing R&D

SSD Data Recovery Methodology

Multi-level Processes & Tool Development

- Extensive R&D in the lab is required
- 4 tiered approach to maximize recoverability
- Each level of deeper analysis requires more complex logic and tools
- This approach has shown yields of 80% and greater recoverability in high volume SSDs today

Engineering Alliances w SSD OEMs Important

- IP and tech challenges drive need for cooperation
- Diagnostic data may be encrypted
- DR feedback to their Engineering teams aids future development
- OEMs want their SSDs to be recoverable!

SSD Data Recovery – Level 1

Issue: SSD is semi-functional but not operating as expected

- Displays correct capacity in disk management but fails to mount or respond to commands

Method: Access to LBA (logical block address) Layer via Data Interface & Controller

- Goal is to extract critical data via intact file system

Data Recovery Tools:

- OEM toolbox software may help to diagnose or to update firmware
- Conventional, commercial data recovery tools can be used by user to attempt recovery

SSD Data Recovery – Level 2

Issue: SSD shows incorrect capacity or 0MB
- Does not respond to any bus commands aka "bricked"

Method: LBA Access via Special Firmware or Software
- Goal is "un-brick" firmware and see SSD data bus

Data Recovery Tools:
- Custom solution co-developed w DR lab & OEM
- Special access to device is sometimes required due to protected IP
- Temporary more error tolerant firmware is applied
- Goal is to revive device long enough to extract data

SSD Data Recovery – Level 3

Issue: SSD does not appear on bus or unknown
- L1 and L2 methods fail to produce results

Method: Disk Image Extraction
- Goal is "Best effort" LBA image extraction and reconstruction utilizing controller & encryption logic

Data Recovery Tools:
- More complex software development required
- Extract all bands of decrypted user and metadata
- This *may* provide TRIMmed data that has not yet been garbage collected
- Partial image only can be result
- Extensive coding required for post-processing, filtering and "stitching" of image

Issue: SSD does not appear on bus or unknown
•L1-L3 methods fail to produce results. Last chance.

Method: NAND Raw Image Extraction
•Goal is base level extraction of all NAND contents
•Used only on non-encrypted SSDs (*)

Data Recovery Tools:
•Custom software must "see" through all logic layers and extract raw data from NAND flash
•Includes all over-provisioned, ECC, metadata, and redundant blocks
•Potentially valuable for forensic data recovery
•Requires extensive post-processing, coding, filtering and "stitching" to recover any user data

In Conclusion

- SSD OEMs are designing more "recoverability" into future platforms.
- The data recovery commercial tool industry is developing solutions but they are behind the curve.
- Opal security spec and encryption in general will continue to create additional challenges in recovery.
- There is no "magic wand" or "silver bullet" solution to SSD data recovery!
- The good news…high data recovery rates can be obtained from SSD with a multi-tiered approach to process and tool development.

Thank You!

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