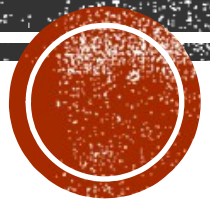
DELETED FILE PERSISTENCE ON DIGITAL MEDIA



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and several others...

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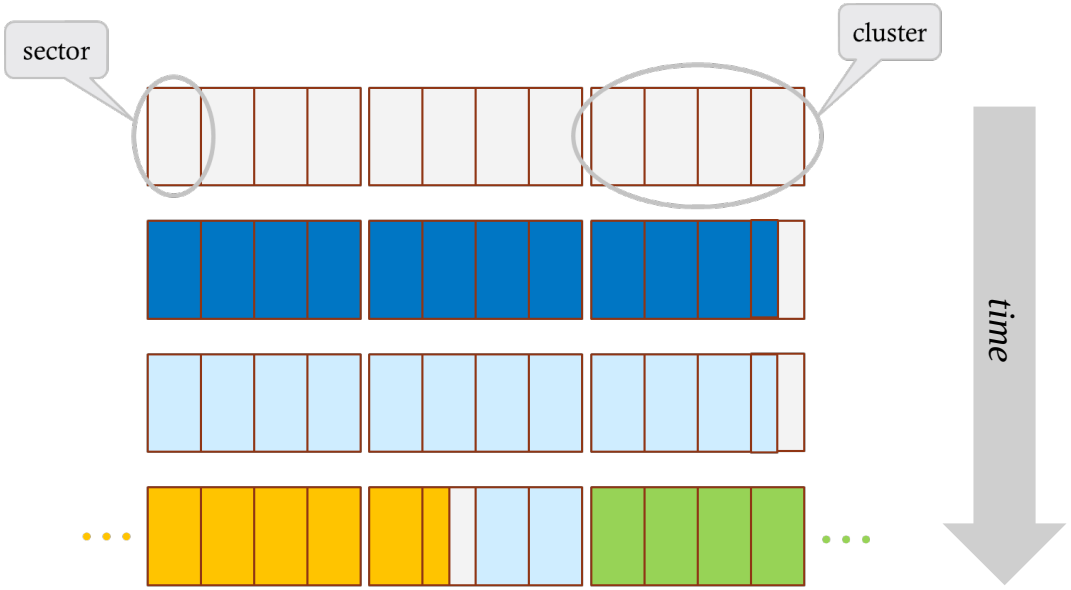
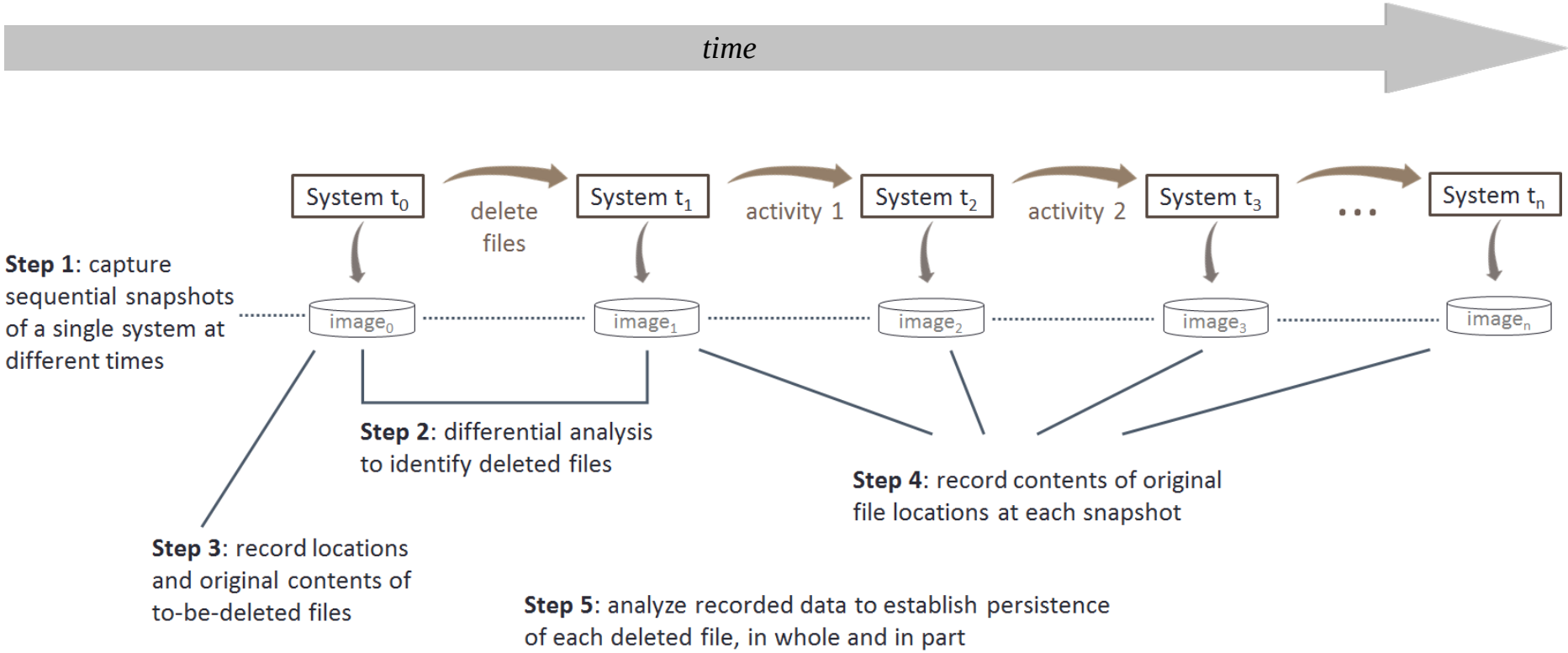
DFRWS 2017

WHAT ARE THE FACTORS THAT AFFECT DIGITAL FILE PERSISTENCE (DECAY)?



- Can a predictive model be constructed?
- Could it be used for triage decisions? to interpret recovered residual fragments? privacy?

WE DEVELOPED TOOLS AND TECHNIQUES TO STUDY THIS QUESTION



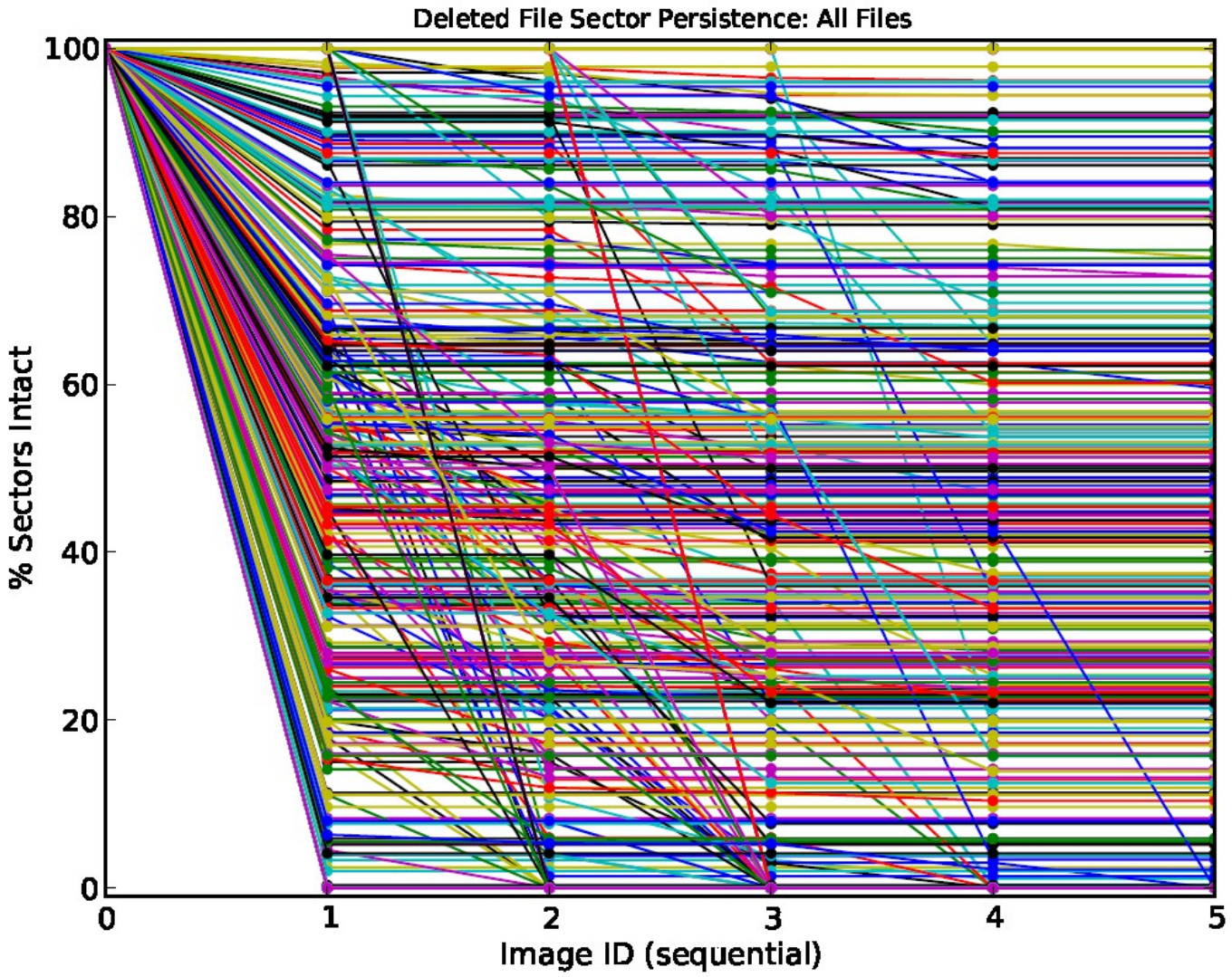
Jones, J. H., & Khan, T. M. (2017, January). A method and implementation for the empirical study of deleted file persistence in digital devices and media. In Computing and Communication Workshop and Conference (CCWC), 2017 IEEE 7th Annual (pp. 1-7). IEEE.

M57 ADVANCED KEYLOGGER

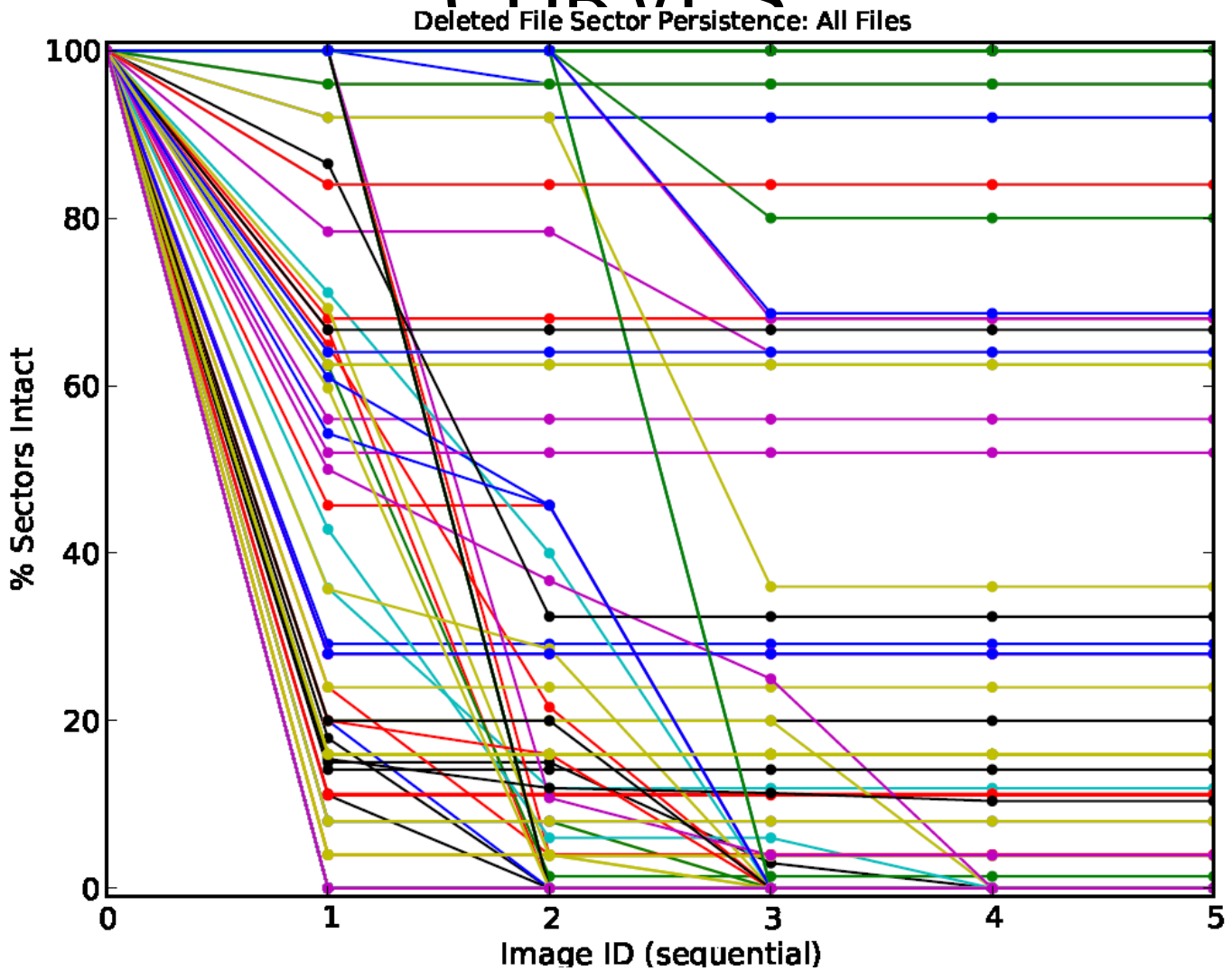
- 17 snapshots over 25 days (11/16 - 12/11)
- Advanced Keylogger installed on machine Pat 12/02 - 12/03
- Uninstalled and files deleted 12/04 - 12/07
  - 1314 files (662,307 sectors) deleted between these images
  - 691 of these files (13,173 sectors) are Advanced Keylogger logs
- Continued use 12/07 - 12/11

Garfinkel, Farrell, Roussev and Dinolt, Bringing Science to Digital Forensics with Standardized Forensic Corpora, DFRWS 2009, Montreal, Canada

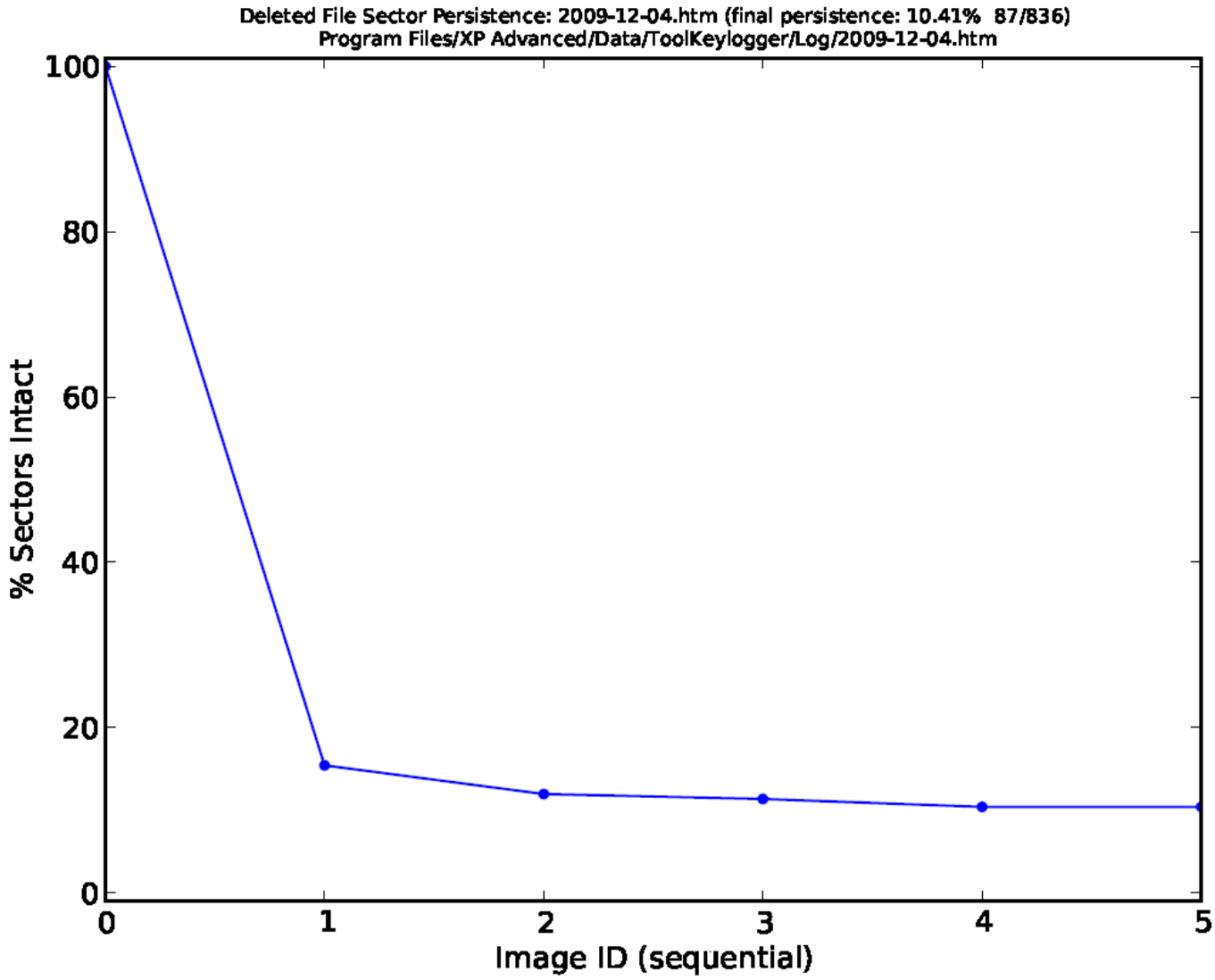
M57 ADVANCED KEYLOGGER: DECAY CURVES



M57 ADVANCED KEYLOGGER: DECAY CURVES



M57 ADVANCED KEYLOGGER: DECAY CURVES



RESULTS: AUDIO FILES

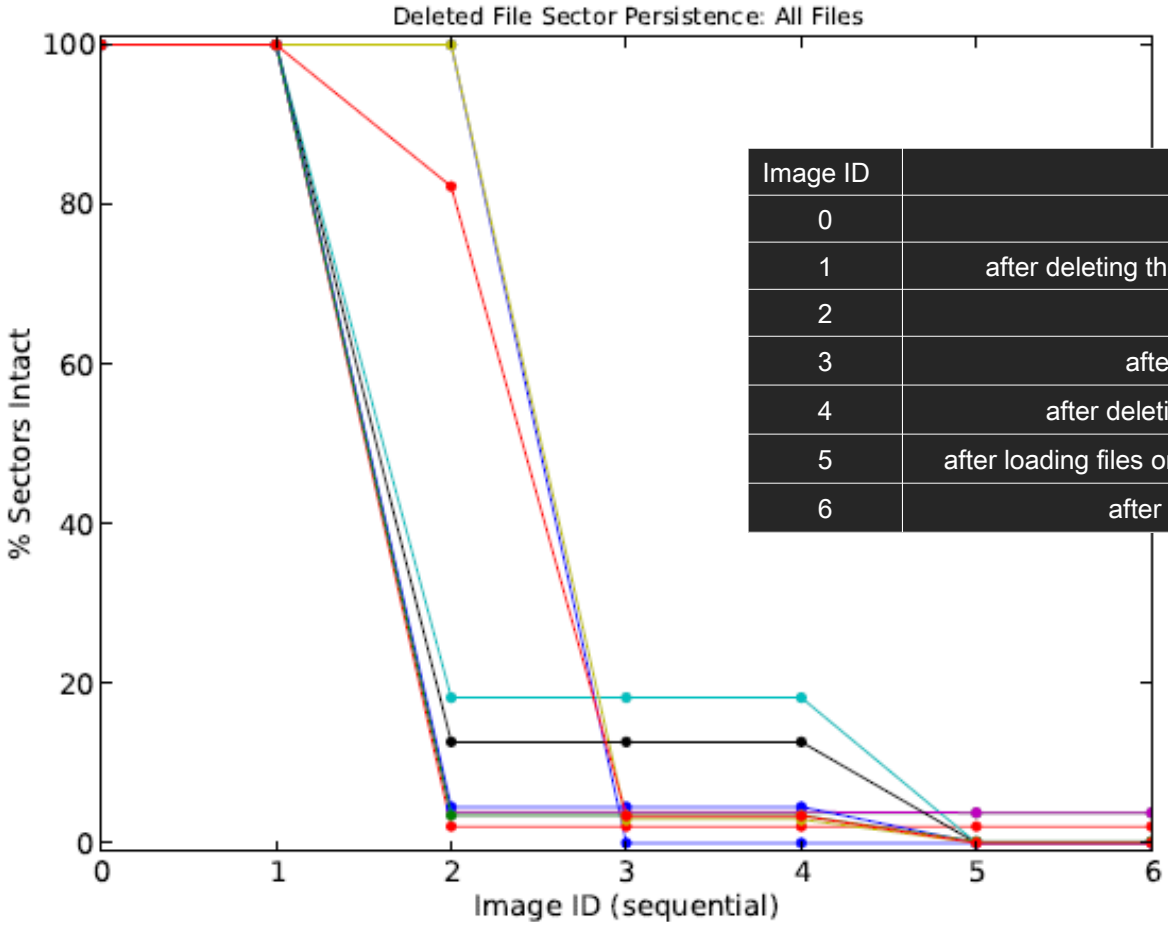
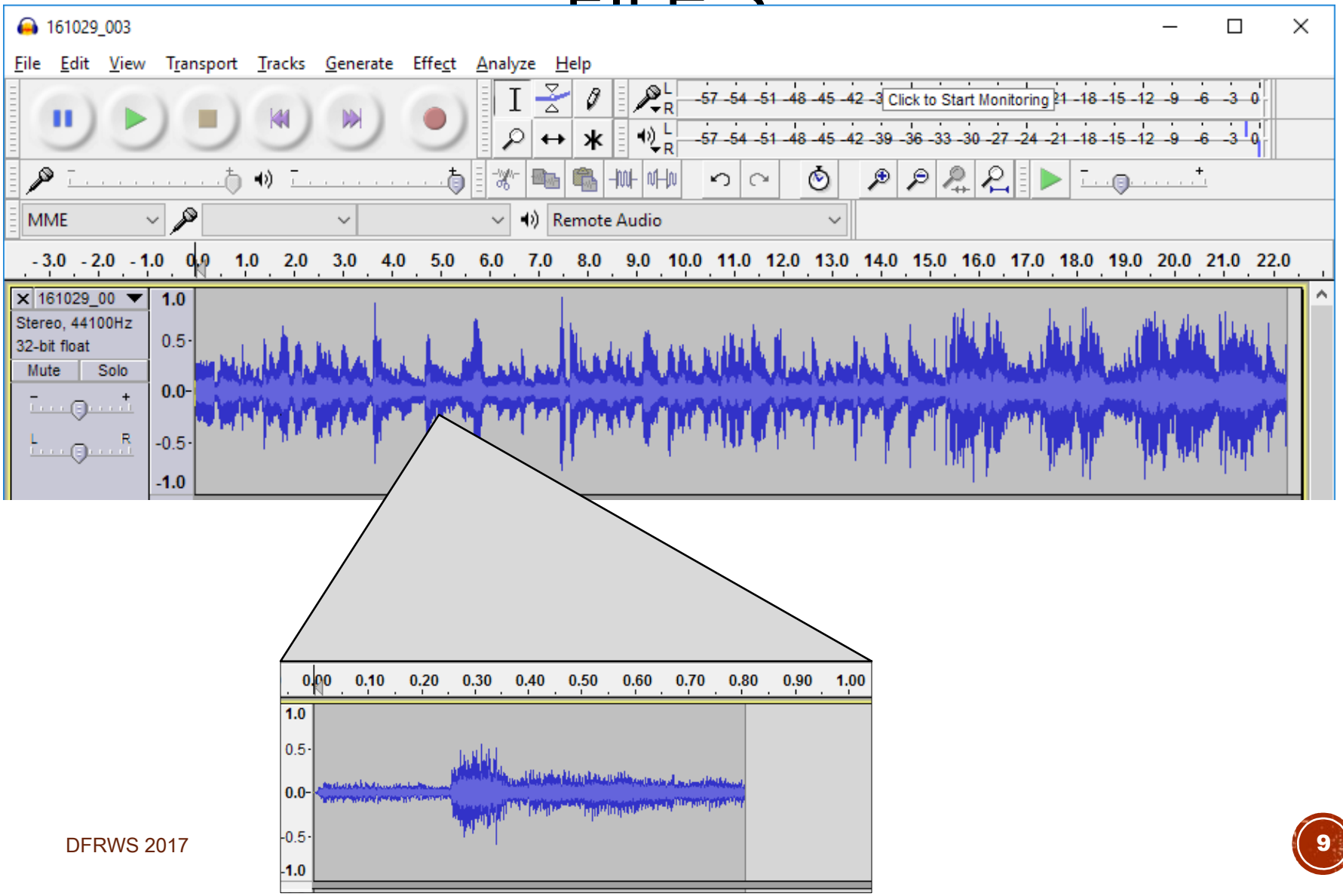


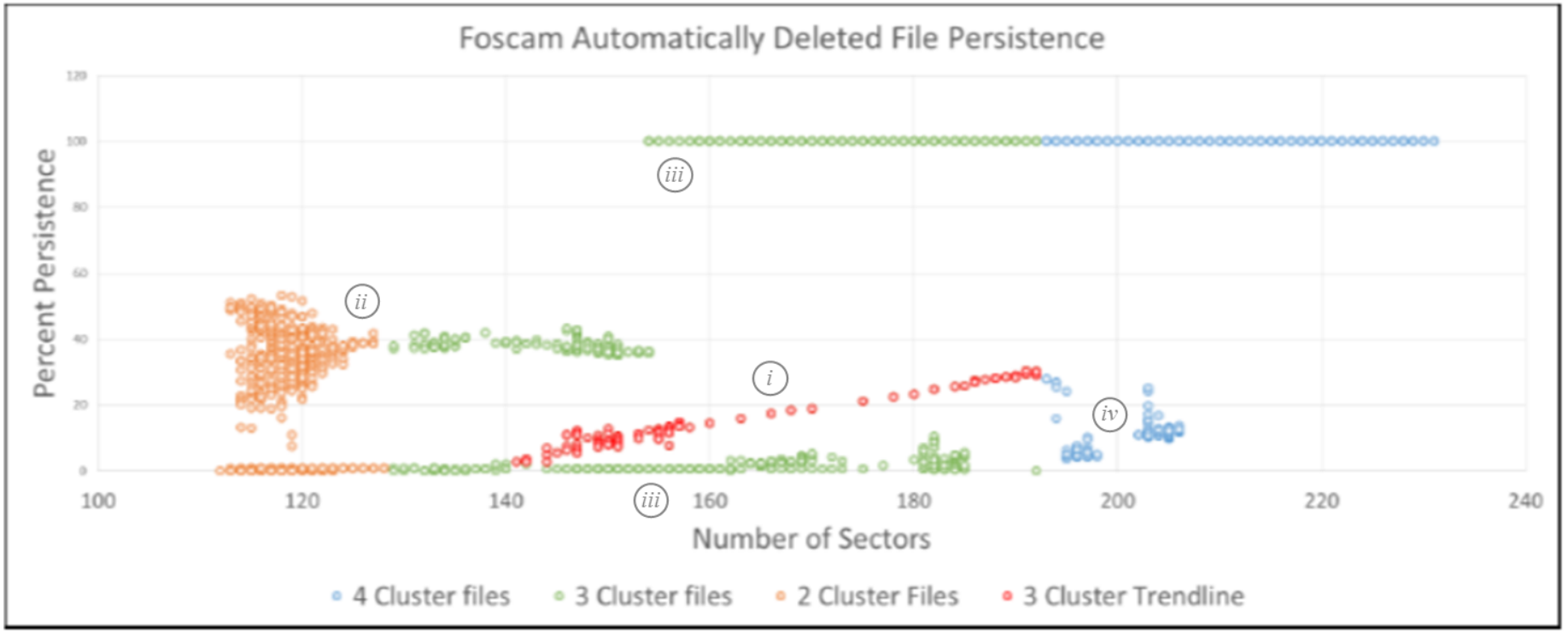
Image ID	Activity
0	after creating 10 audio files
1	after deleting those 10 files manually (via USB connection to PC)
2	after creating nine new audio files
3	after creating seven additional audio files
4	after deleting the newly created (all) files on the device
5	after loading files on the device manually (3GB; to near device capacity)
6	after (quick) reformatting the device storage

Jones, James. "Deleted Audio File Decay on a Digital Voice Recorder." Audio Engineering Society Conference: 2017 AES International Conference on Audio Forensics. Audio Engineering Society, 2017.

RECOVERED AUDIO FRAGMENTS FROM FILE 3

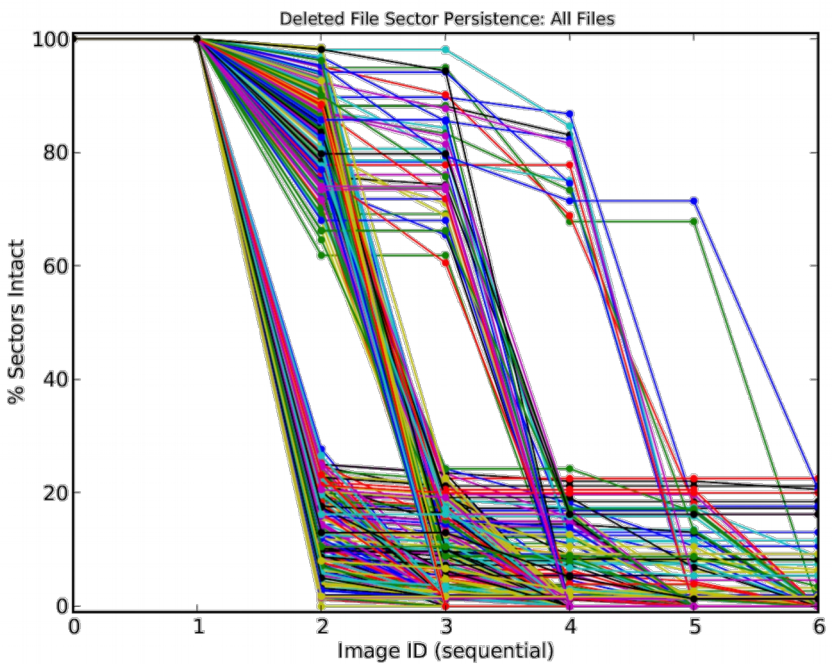


RESULTS: CAMERAS AND SDCARDS

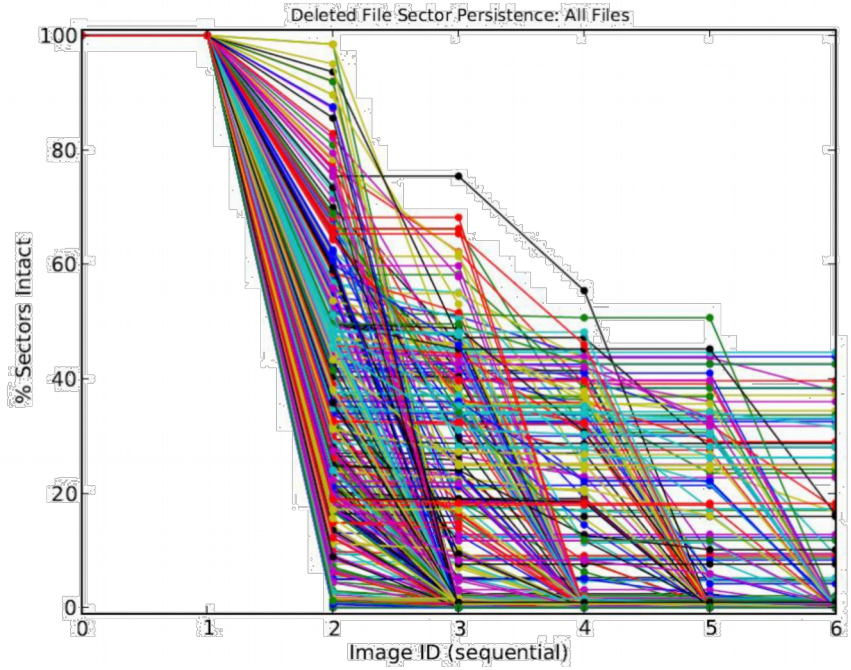


Jones, James H. Jr; Srivastava, Anurag; Mosier, Josh; Anderson, Connor; and Buenafe, Seth, "Understanding Deleted File Decay on Removable Media using Differential Analysis" (2017). Annual ADFSL Conference on Digital Forensics, Security and Law. 13.

SD CARDS: CLUSTER SIZE

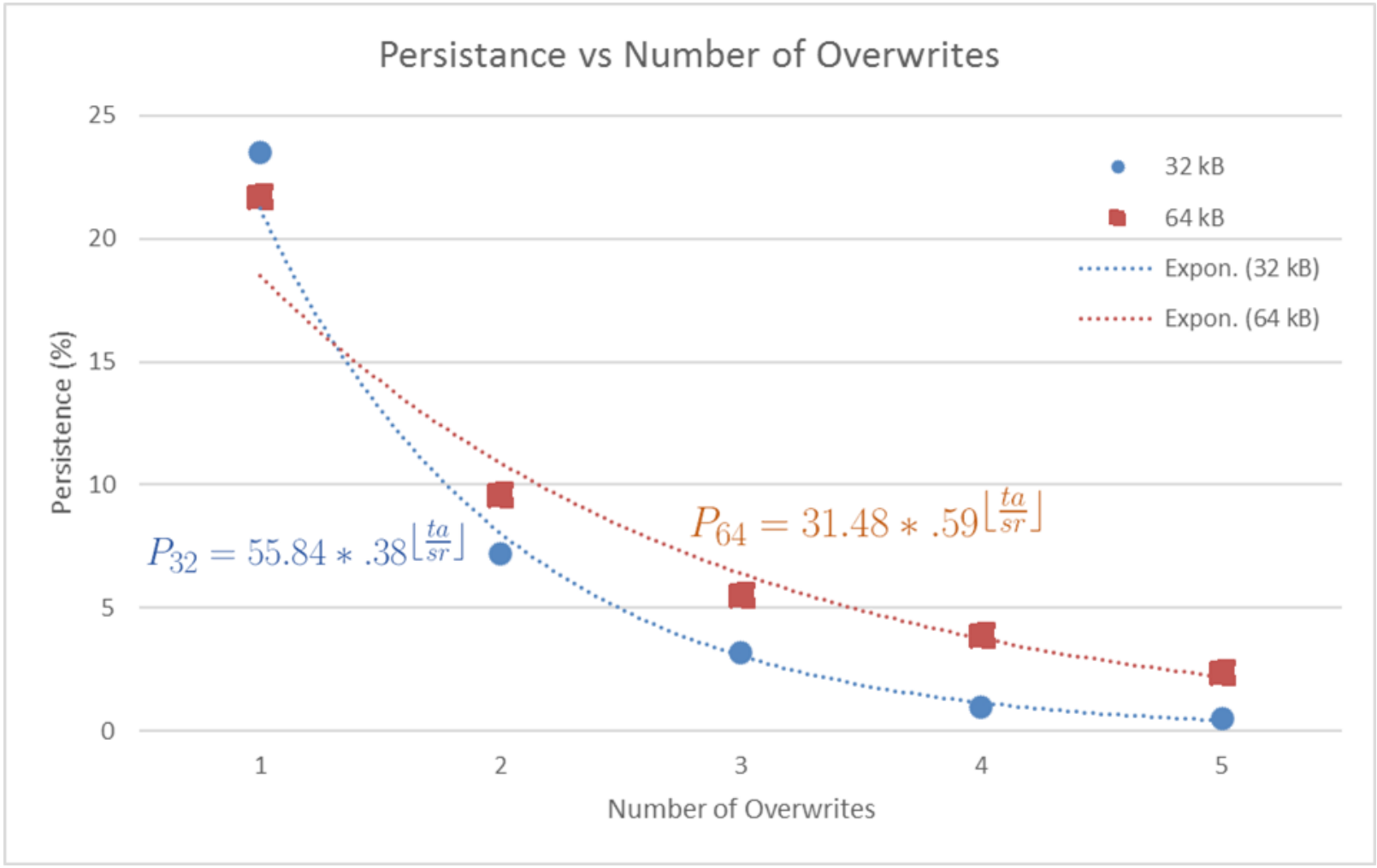


32 kB clusters

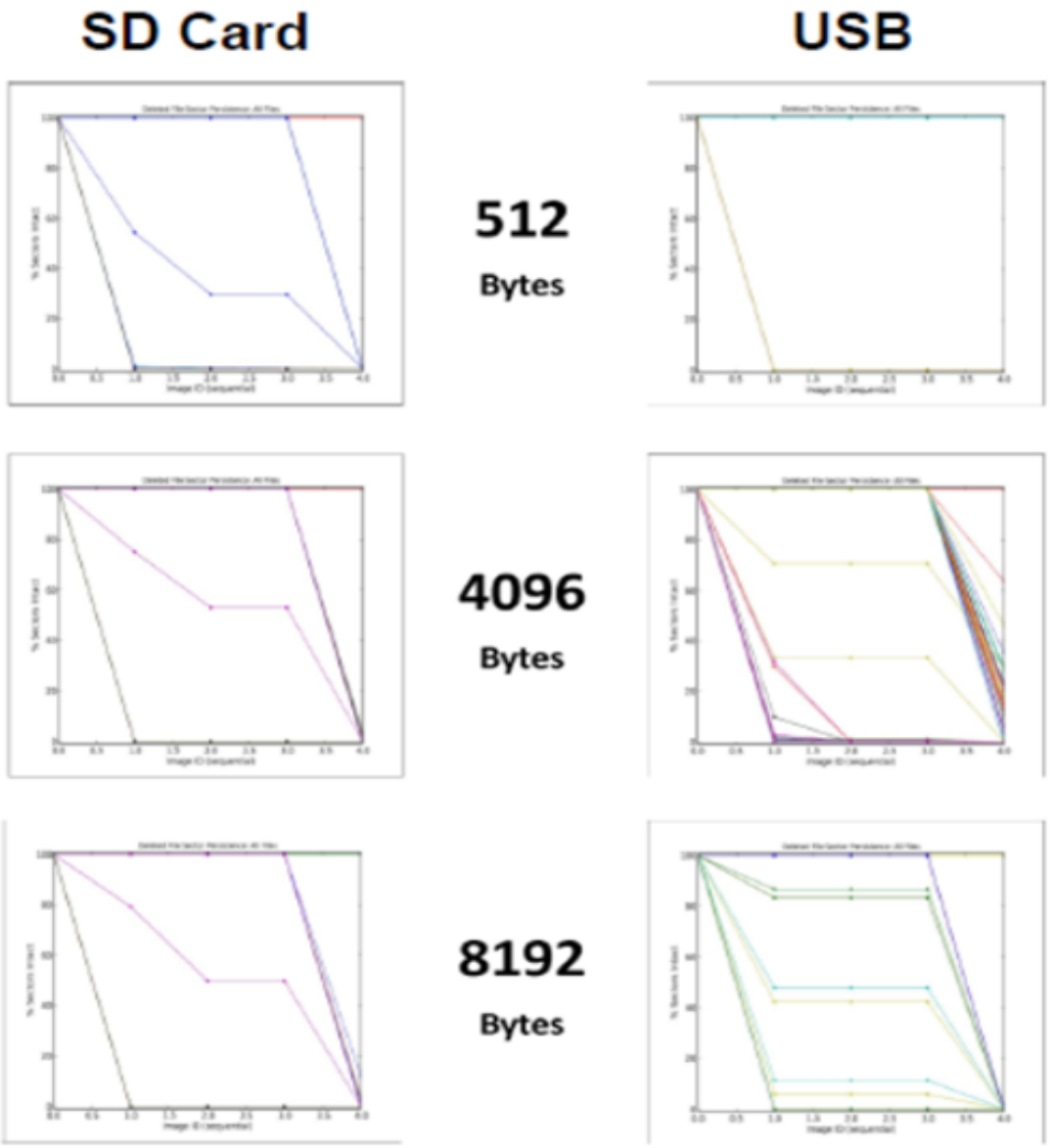


64 kB clusters

SD CARDS: CLUSTER SIZE (CONTINUED)



SD CARDS AND USB STICKS



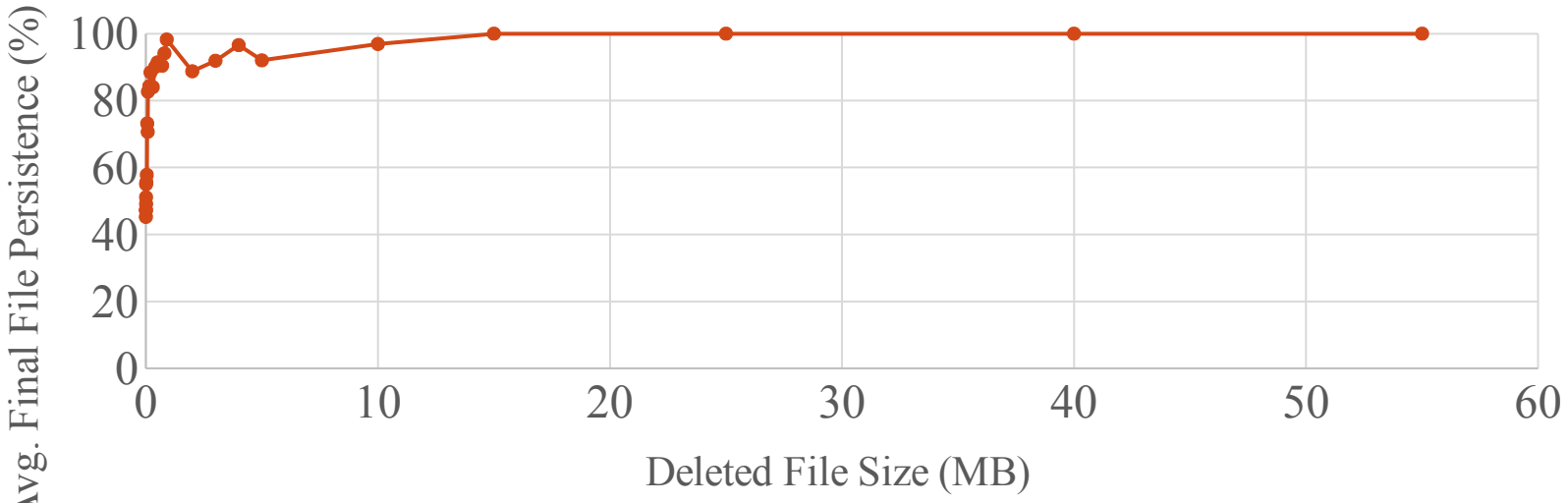
RESULTS: MAGNETIC HARD DISKS

- 12 Disks (3 disk frag levels x 4 disk free levels)
- 9 User Activities, Repeated 3 Times
- 12 x 9 x 3 = 324 experimental runs
- Dataset Includes:
  - Disk Free Bytes
  - Disk Fragmentation
  - User Activity
  - File Characteristics:
    - Source, Path, Image Offset, Extension, Size, Fragmentation
  - Final File Persistence

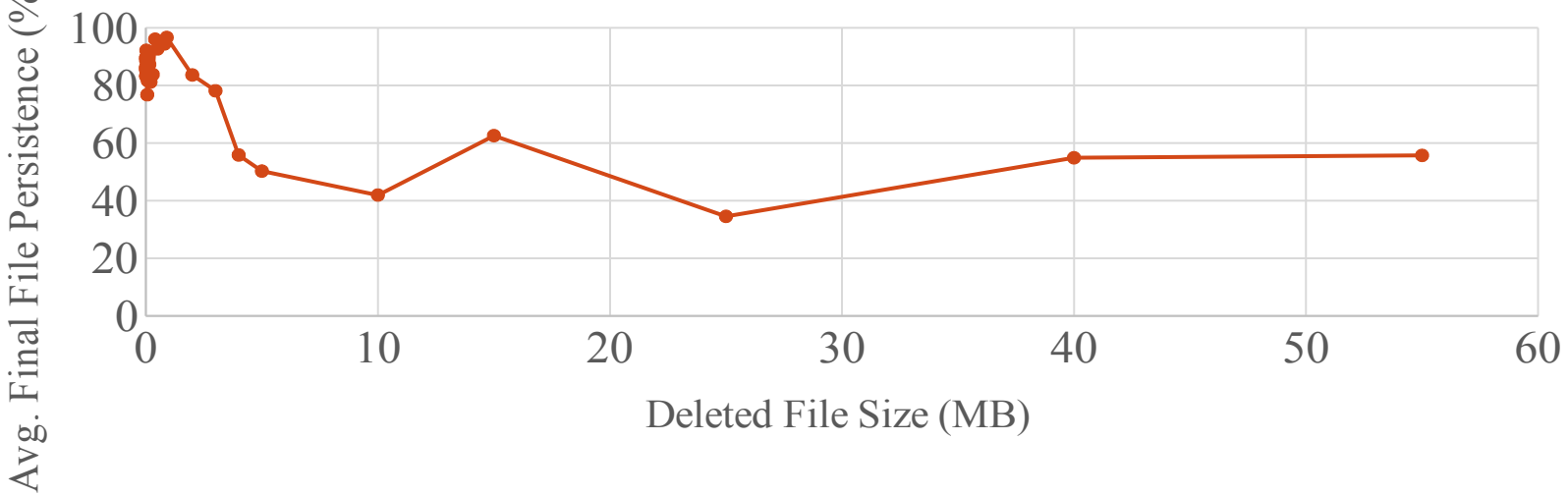
Experimental runs: 324
Tracked deleted files: 1917
Dataset records: 621,108

USER ACTIVITY

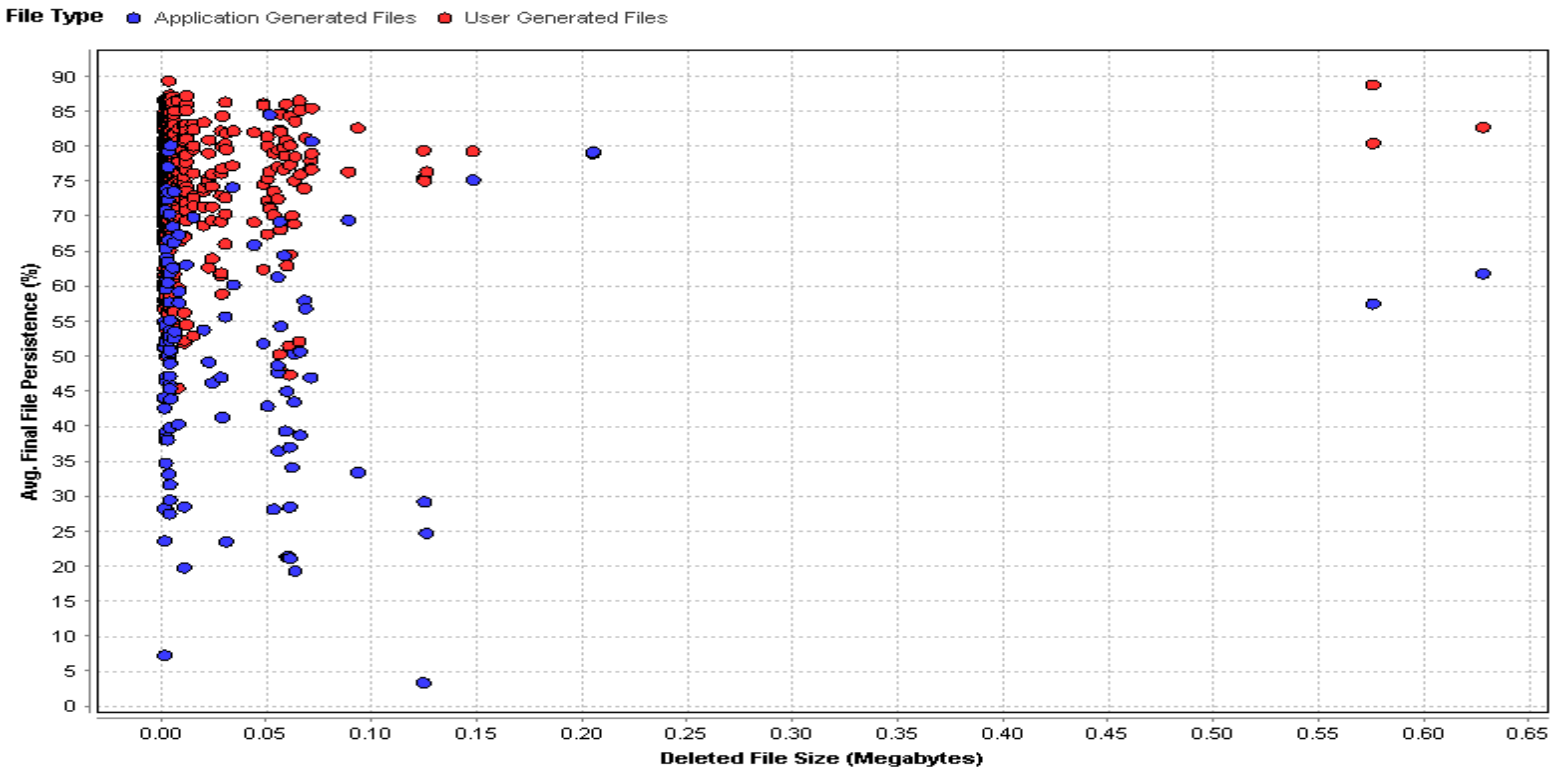
web



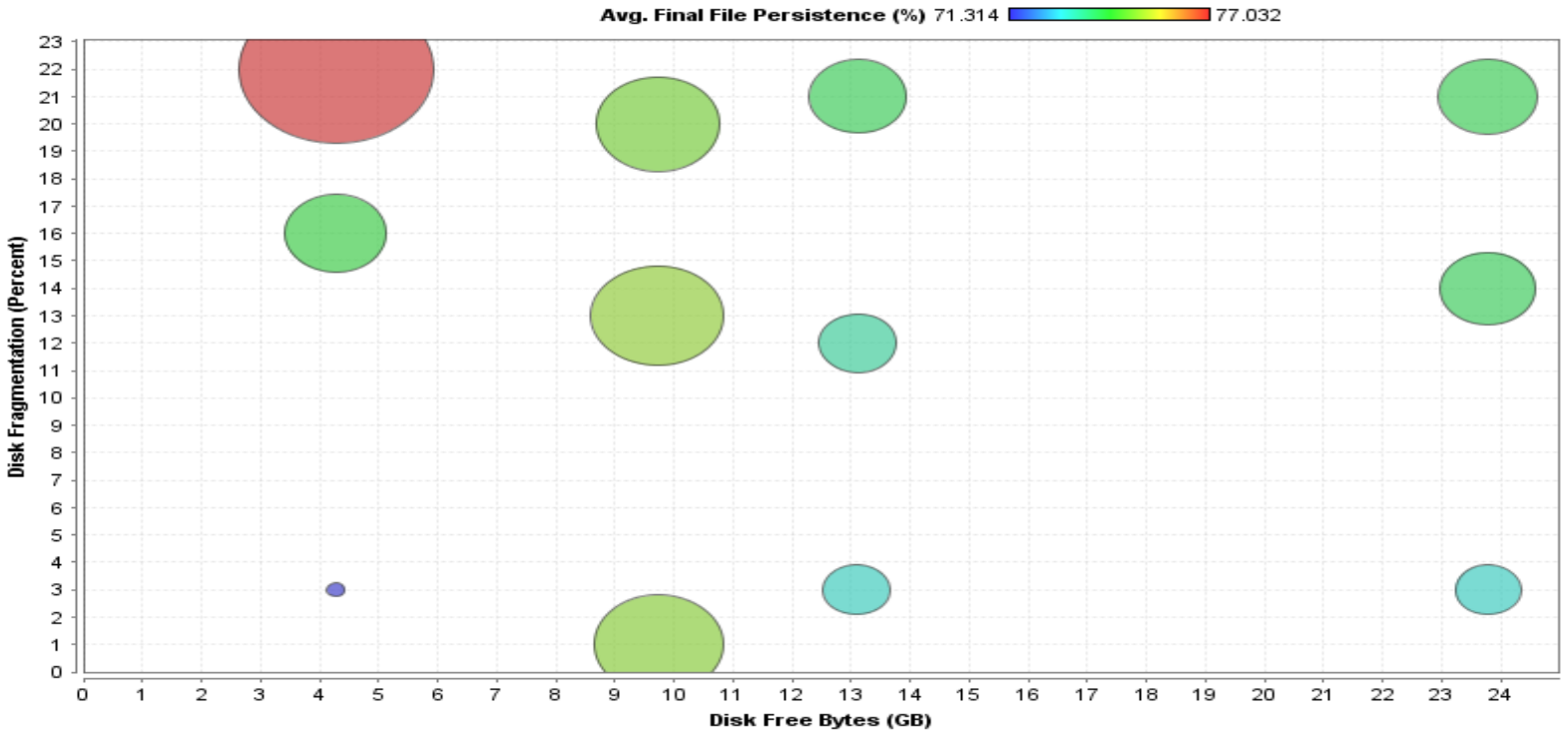
3GB



FILE SOURCE ("WHO" WROTE IT)



DISK FRAGMENTATION AND FREE DISK SPACE



LIMITATIONS AND FUTURE WORK

- Content is copied and moved, but we only track the initial logical location
- Deleted file decay is complicated; depends (at least) on:
  - OS, filesystem, hardware, user and system activity, format, disk usage and fragmentation, file characteristics, ... need to do more work
- Time matters: can we use a model to date the file deletion?
- Other devices, media, and applications:
  - SSDs, mobile, malware, ICS, ...

QUESTIONS?

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(w) http://cfrs.gmu.edu/
Github: jjonesu/DeletedFilePersistence

BACKUP

M57 ADVANCED KEYLOGGER