FORENSICS @ NIST #NISTForensics

NSRL Next Generation – Diskprinting

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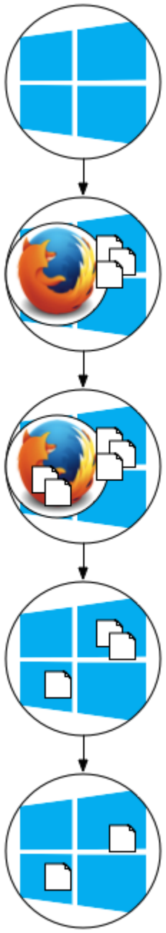
Disclaimer

- This talk mentions several software products.
- No mentions are or should be construed as endorsements of that software.
- In this research, they are test subjects.

Diskprints show when artifacts appear.



- Baseline
- Installation
- Running
- Uninstallation
- Rebooting

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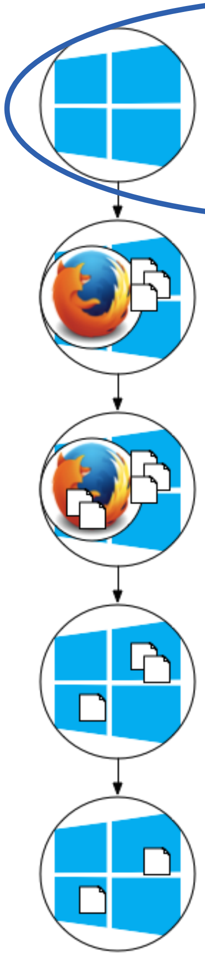

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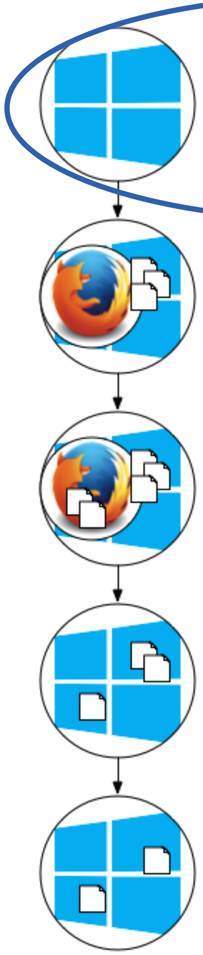

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*Registry entries: **460,000***

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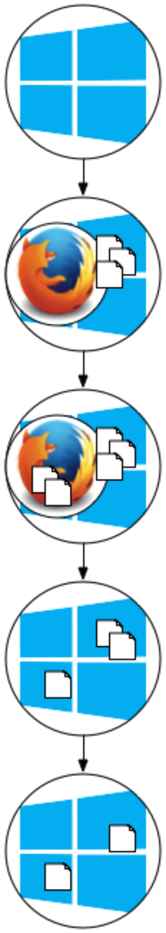

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Registry entries: ***460,000***

+ 10 – 10,000

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• Baseline	*Registry entries:* ***460,000***
• Installation	*+* ***10 – 10,000***
• Running	*+* ***more***
• Uninstallation	
• Rebooting	

Diskprints show when artifacts appear.

• Baseline	*Registry entries:* ***460,000***
• Installation	*+* ***10 – 10,000***
• Running	*+* ***more***
• Uninstallation	*+* ***less*** *&* ***more***
• Rebooting	

We need to understand artifact origins.

- Files, Registry cells – mostly unknown origins.
  - Most created by software.
  - Some recognized from malware signatures.
  - Most just *in the way of finding relevant data*.

Diskprints help recognize *artifacts* and *behaviors*.

- Whole virtual machine states are available.
- We compute changes between states, making:
  - Catalogues of system behavior
  - Known-file lists
  - Software signatures

Diskprint data are being made from *forensic differencing*.

- New NSRL data sets based on diskprint sequences.
  - Using forensic differential analysis [Garfinkel *et al.*, DFRWS 2012]
  - Extension: *Forensic sequence analysis*

Outline: Data set production

- File system analysis language
- Diskprint lineage analysis workflow
- Results (with URL)
- Research on software signatures
- Conclusions

File system analysis language

Digital Forensics XML

File system analysis with DFXML

- Digital Forensics XML describes storage system metadata.
  - – Currently hosted by NIST.
    - Originally by Garfinkel [SADFE, 2009; DI, 2012].
  - – Document language (with XML schema).
  - – Python bindings available.
  - – In use by forensic researchers, digital archivists.

DFXML describes storage, and changes.

- Simple annotations for files.
  - New, removed, modified.

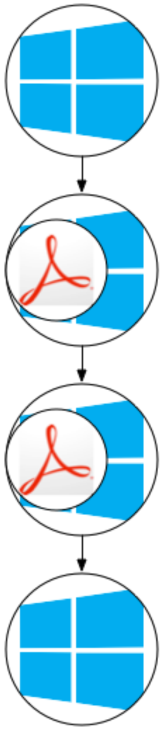
- New analytics on *reduced data*.
  - *E.g.* timeline of changes, instead of whole system.

The structure of diskprint data

Lineage graph

The diskprint lineage graph

A machine’s state is related to its ancestors.



The diskprint lineage graph

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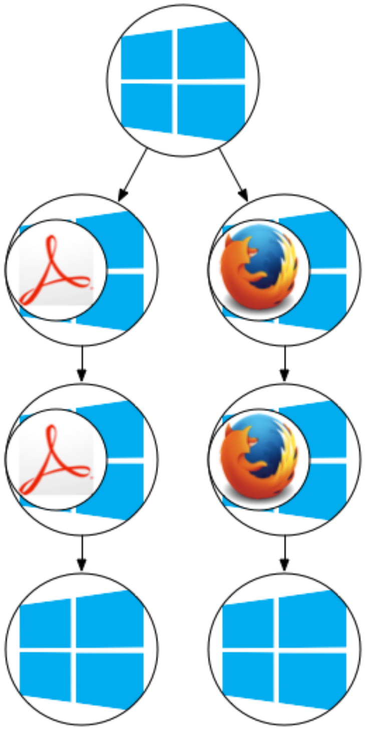

The history can fork.

The tree is rooted at the baseline OS.

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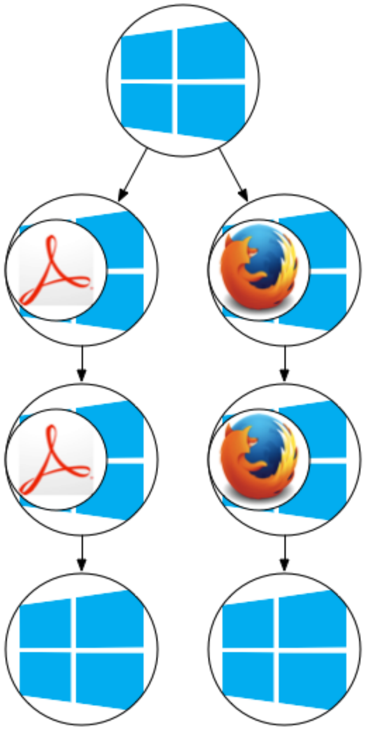

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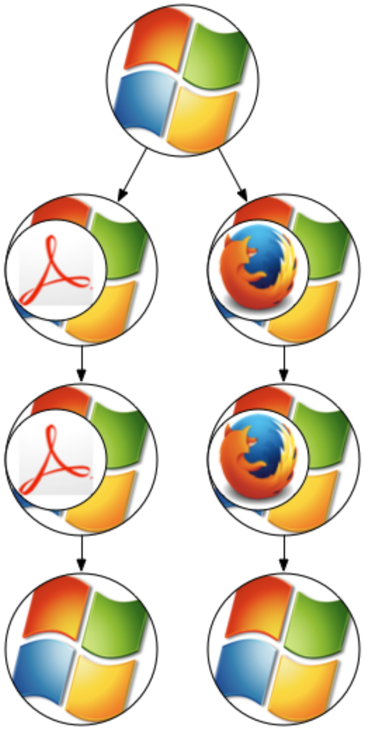

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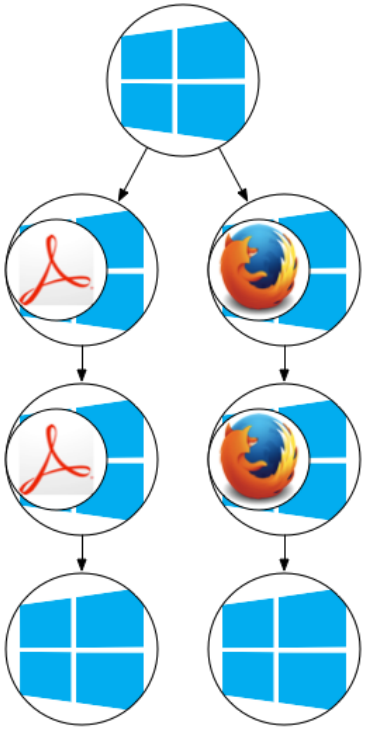

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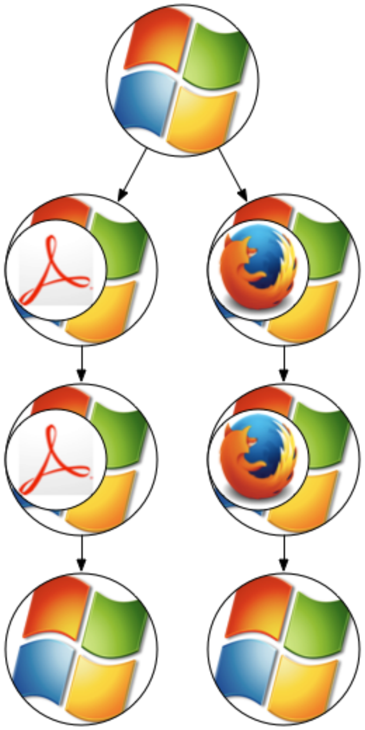
The *lineage graph* is all of the trees.

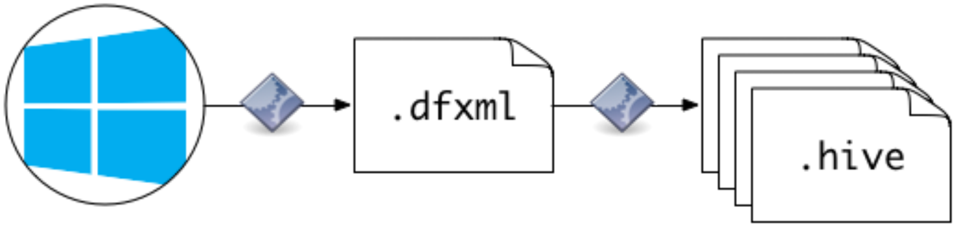


The diskprint analysis workflow

Lineage-based differencing

The diskprint analysis workflow

Some results can be derived from a single snapshot.



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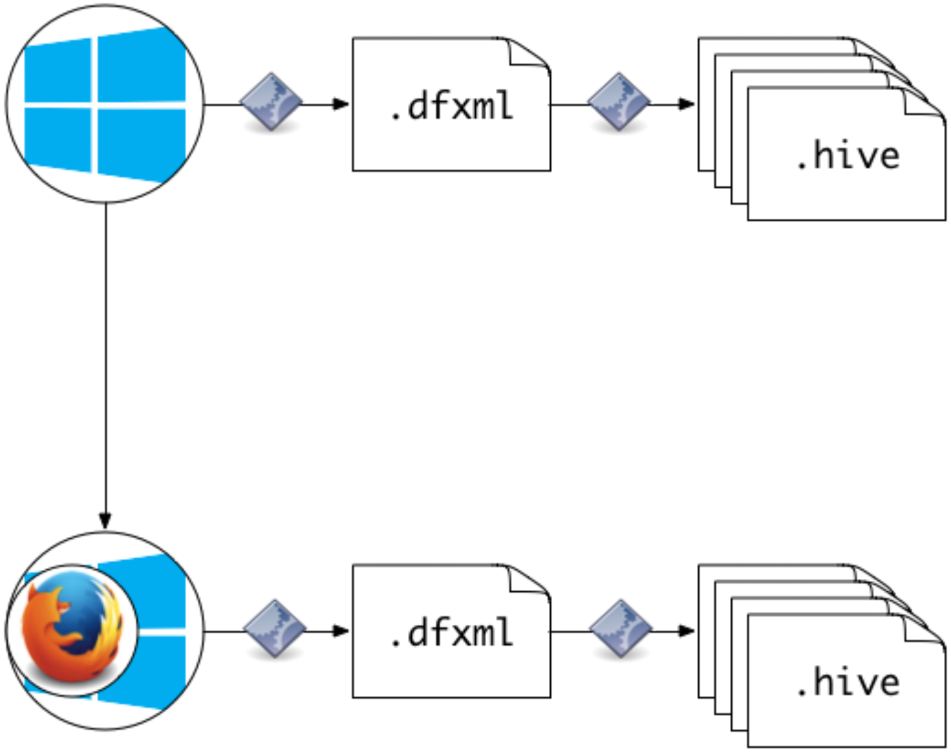
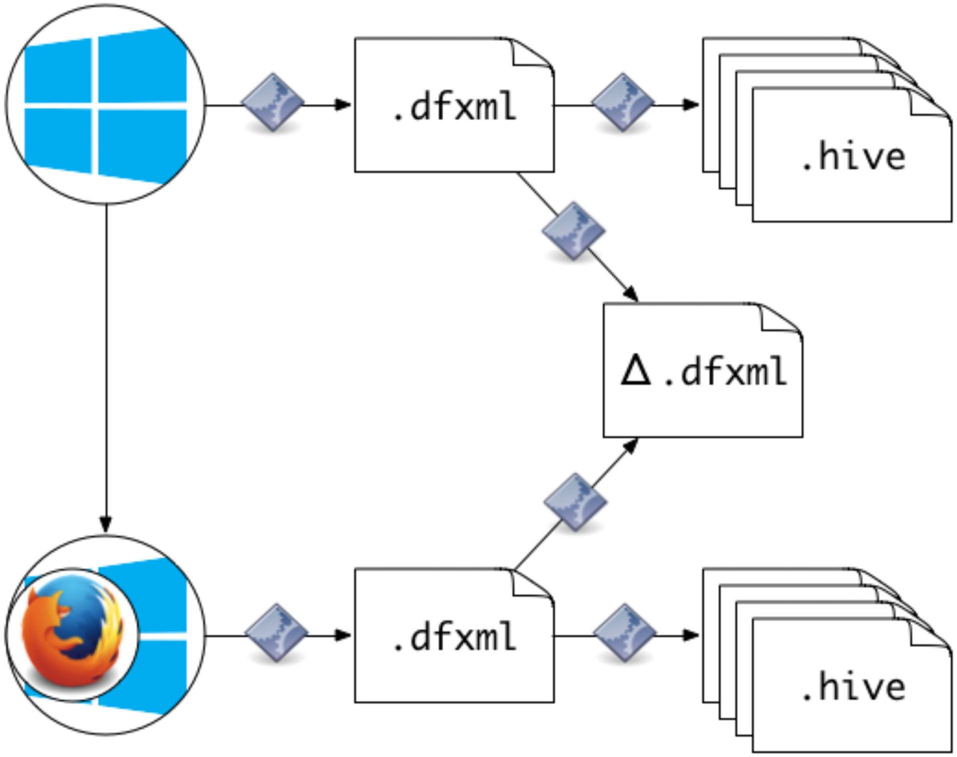


The diskprint analysis workflow

Some results come from two snapshots.



Results

New-content data sets

Now available:
File system difference data

- File system changes available in:
  - – Differential DFXML
  - – NSRL RDS format (CSV)
  - – CybOX

- Sector hashes of new and modified files

- http://www.nsrl.nist.gov/dskprt/sequence.html

Research

Registry-based software signatures

Developing software signatures

- What artifacts are distinct to an application?
  - Or, have sufficient affinity?

- Can the Windows Registry show the software history of a computer?
  - A boon to triage.

Methodology: "Document" search

1. Observe the sets of Registry artifacts created by a snapshot.

2. Assemble those sets into "Fingerprint documents"

3. Query with a Registry.

Signature challenges

- Some indistinct artifacts confuse signatures.
  - Need “Background noise” identification.
- (See me at poster session for more.)

Summary

Data in use,

research on horizon.

Community

- Forensic standards
  - MITRE
- Archival applications of Digital Forensics
  - BitCurator
- Academia
  - George Mason University
  - San Jose State University
  - University of California, Santa Cruz

Conclusion

- Diskprints are a record of system states.
- The workflow extracts artifacts and behaviors.
- Artifact attribution tells a computer's software story.