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Malware Removal – Beyond Content and Context Scanning

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Malware Removal

- Why...
  - … is **Malware Removal** necessary?
  - … is comprehensive **Malware Removal** necessary?
  - … is **Malware Removal** a lot of work and a problem?

Why is Malware Removal necessary?

- Systems still get infected for different reasons
  - Users install an Anti-Malware software when it is too late …
  - Users update an Anti-Malware software when it is too late …
  - Anti-Malware vendors react when it is too late …
- These systems have to be cleaned

Why is Comprehensive Malware Removal Necessary?

- Comprehensive Malware Removal?
  - Malicious processes should be terminated and the related executables be removed
  - What about Run keys in the Registry?
  - What about settings changed by the malware?
  - What about other components, like image files or configuration files used by the malware?
- Why care?
  - Because the user cares
  - They are looking for a “really clean” system, since that’s what they pay for
  - Risk of reinfection when missing components or system changes
  - Another security product might “detect” the leftover components and leave the user in an uncertain state
  - Rogue Anti-Spyware products are producing false positives at the moment, they might happily switch to the leftover components

Why is Malware Removal a Lot of Work and a Problem?

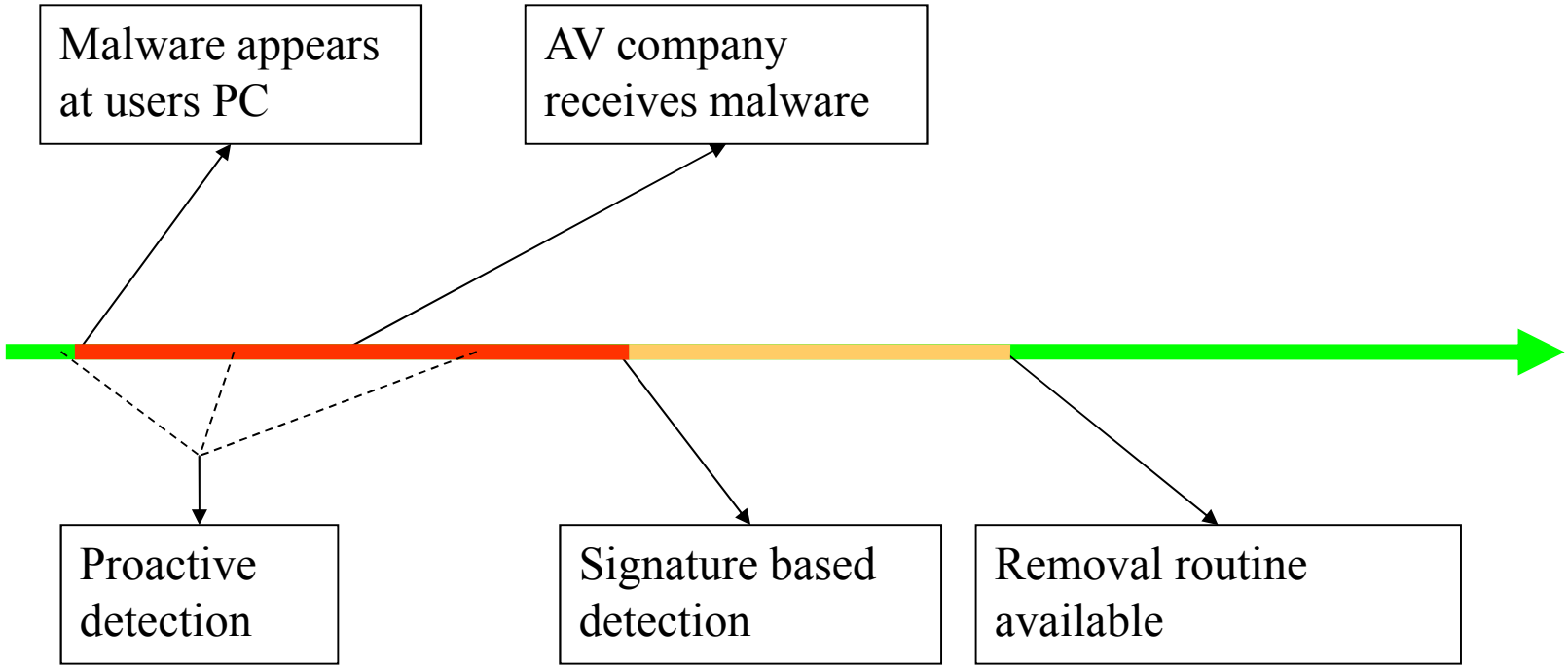
- To have proper removal routines in place, a lot of analysis work by the Anti-Malware vendor is required
  - Different behavior of malware on different systems
  - Behavior of malware may change over time (downloaded components)
  - Threats are way more complex today
- The increasing amount of malware is not going to make it better
- Bad removal routines indicate a bad analysis, which doesn't increase the trust of users in the software

Content and Context Scanning

- Content scanning uses signatures to identify malicious components
- Context scanning uses context rules to identify linked malicious components
- A combination of both is required to cope with today's complex threats
- Both approaches require an analysis
- Several issues have to be considered: random file names, rootkits, anti-removal techniques, shared components, pre-infection settings, changing behavior of malware
- Simple fixes and workarounds are available for most problems

Content and Context Scanning

- Response times



Malware Removal – Test Results

- Response Times and proactive detection

Vendor / Product	Average response time range, including proactive detections	Proactive detection (based on different tests)
Avira AntiVir	2 to 4 hours	20 to 50%
Alwil Avast	6 to 8 hours	5 to 35%
Grisoft AVG	6 to 8 hours	5 to 35%
BitDefender	2 to 4 hours	25 to 60%
F-Secure	less than 2 hours	20 to 50%
Kaspersky	less than 2 hours	20 to 50%
McAfee	14 to 16 hours	25 to 45%
Microsoft	38 to 40 hours	5 to 15%
Eset Nod32	4 to 6 hours	30 to 70%
Panda	4 to 6 hours	20 to 50%
Symantec Norton	6 to 8 hours	15 to 50%
Trend Micro	6 to 8 hours	15 to 45%

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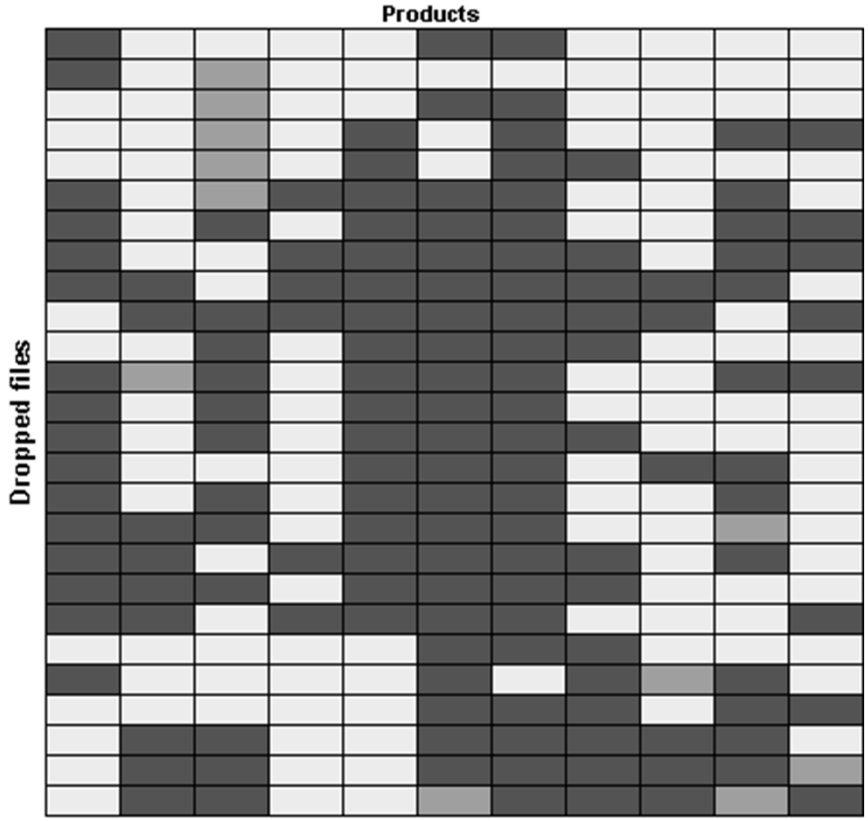
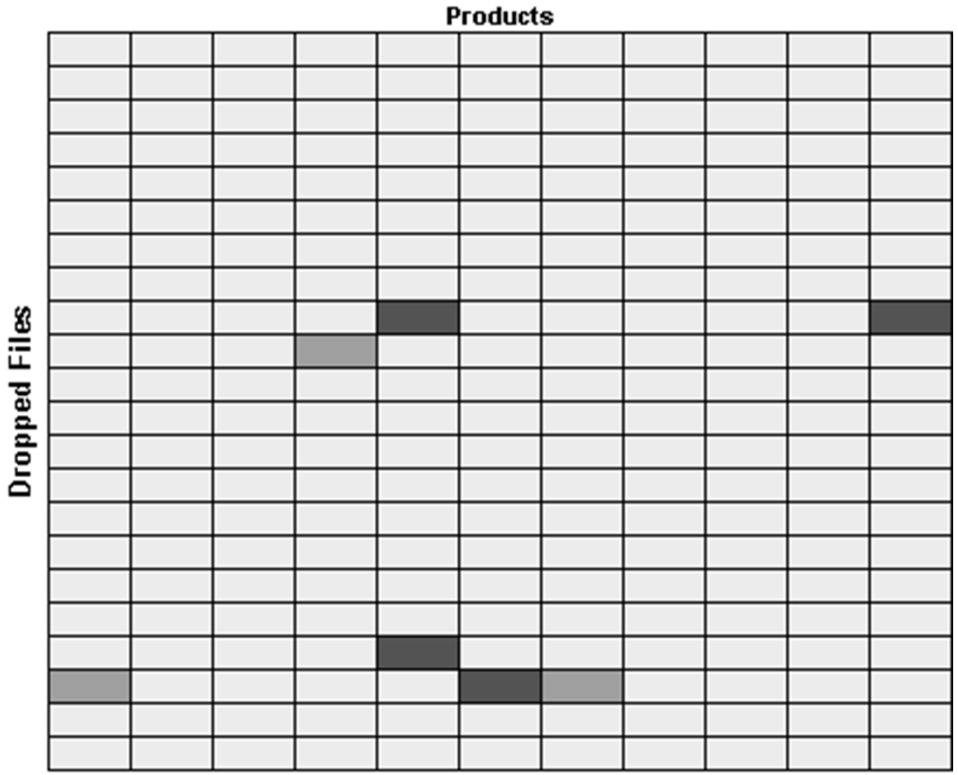
Malware Removal – Test Results

- Detection of dropped components
- Ad- and Spyware vs. WildList Malware





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Malware Removal – Test Results

- Removal Results

	Files created	**Registry keys created**
AdWare.Hotbar	183	789
	Files removed	**Registry keys removed**
Product A (AV)	16	0
Product B (AV)	25	0
Product C (AV)	26	43
Product D (AS)	182	778

Malware Removal – Conclusion

- Certain threats are handled very well (e.g. WildList malware)
- Other threat categories could need some more attention
- Proactive detection is far from 100%
- Response times still go up to several days
- It takes some time until removal routines are in place and no product is 100% perfect

Generic Malware Removal

- Overview
  - What is needed?
    - Reduce the response time where no sufficient disinfection routine is available
    - Disinfection without a dedicated analysis done by the vendors
  - Alternative times for an analysis
    - When the malware is first run on the users pc
    - When the malware is detected by the antivirus product

Generic Malware Removal

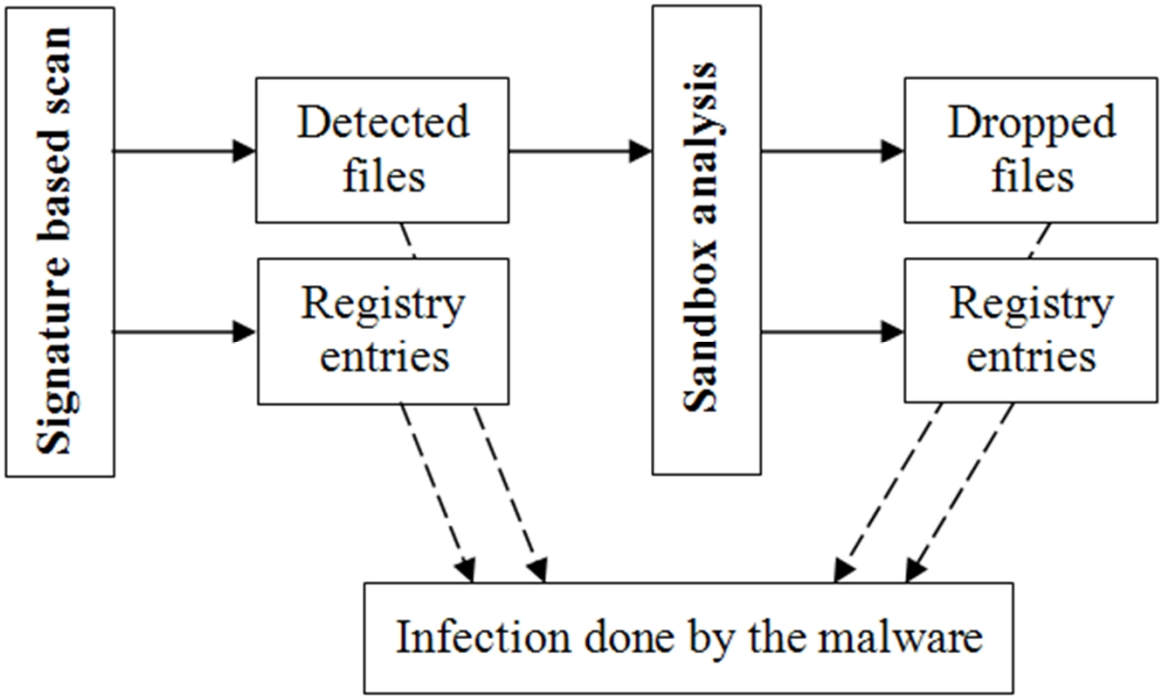
- Overview
  - How to analyze on detection time?
    - Run the malware again and monitor the changes it makes to the system
    - Run the malware without damaging the system
  - Sandbox-based disinfection
    - What is it?
    - How does it work?
    - How well does it work and what are the problems?

Generic Malware Removal

- Sandbox based Removal
  - The Idea
    - Emulate the malware and report all system changes
    - Perform a removal based on this report
  - What is a sandbox?
    - Virtual environment separated from the system
    - Executable files can be testdriven to analyse their behaviour

Generic Malware Removal

- Sandbox based Removal
  - Single-stage approach



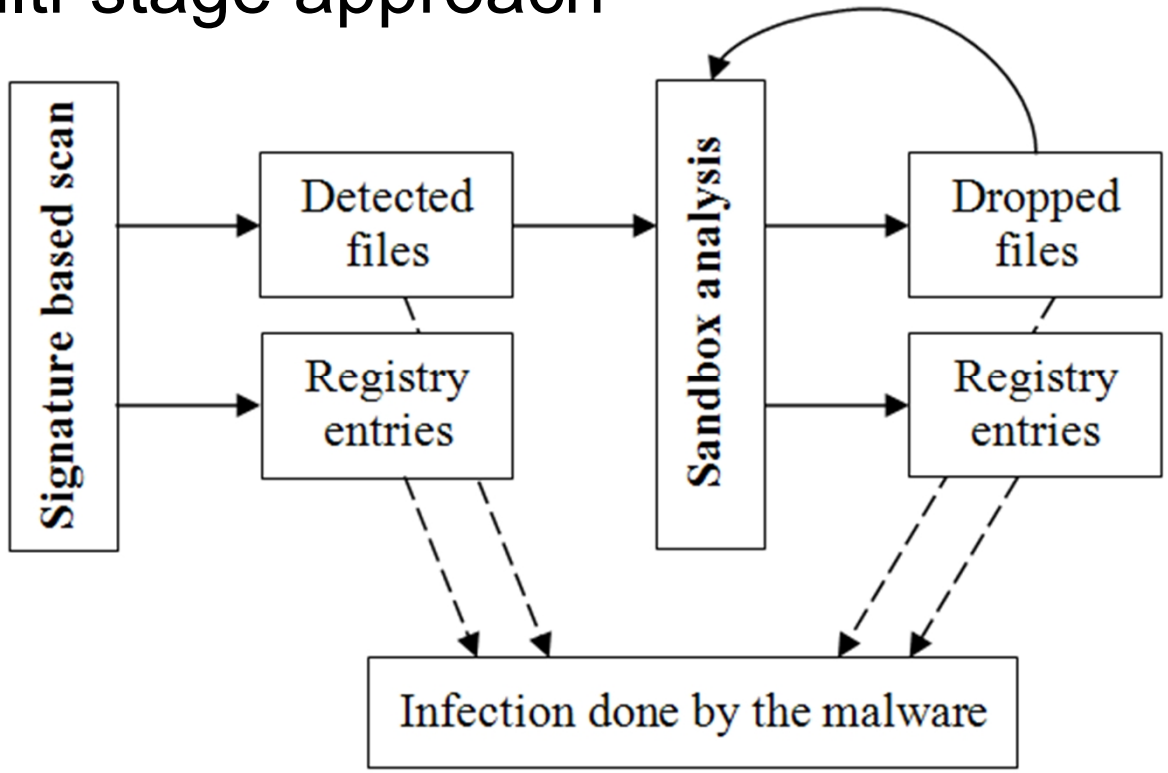
Generic Malware Removal

- Sandbox based Removal
  - Test results
    - Comparison of manual analysis with the sandbox analysis
    - Only few files and registry entries found
      - Example: Admedia
      - 24 of 48 files found
      - 6 of 178 Registry entries found

    ⇒ Single-stage approach not suitable for real malware

Generic Malware Removal

- Sandbox based Removal
  - Multi-stage approach



Generic Malware Removal

- Sandbox based Removal
  - Test results
    - More files and registry entries found
      - Example: Win32/Admedia
      - Increase from 24 to 32 of 48 files found
      - Increase from 6 to 10 of 178 Registry entries found
    - Multi-stage approach better but far from good

Generic Malware Removal

- Problems and solutions
  - Related to the sandbox (same for many malware samples)
    - The native API
    - Different behaviour in virtual environments
  - Related to the malware (can not be solved by improvements of the sandbox)
    - User interaction
    - Downloaded files from the internet during infection
    - Scheduled tasks, infection after reboot, etc.

Generic Malware Removal

- Problems and solutions
  - Related to the malware
    - Different behavior on an infected system
    - Random filenames
    - Pre-infection settings
  - Some worst case scenario
    - Inactive sample triggers the removal routine
    - The malware breaks out of the sandbox (exploiting some vulnerability) during emulation
    - Infection instead of disinfection

Further Concepts – Supervision

- Log the system changes done by a certain application
- As soon as it is known that this application is malicious, all the changes can easily be reverted
- Solves the problem of pre-infection settings or different behavior in sandbox and real pc
- There are other problems coming up:
  - Which applications should be supervised?
  - Which system changes are malicious and should be reverted?
  - Applications might evade the supervision

Further Concepts – Supervision

- Similar concepts are already used in current software:
  - Guards which monitor system areas and block all changes or ask the user whether to allow or block
  - Behavior based detection/prevention/blocking, which is a far better approach, because it takes the whole behavior and not only single actions into account and can, in the best case, decide by itself

Conclusion

	Content and Context Scanning (Manual Analysis)	Sandbox based approach	Supervision approach
Availability (Response time)	- (minutes to days)	+ (instantly)	+ (instantly)
Different behavior in sandboxes	+ (depends on the quality of the analysis)	- (obviously a problem)	+ (no problem)
Performance impact	+ (none)	+ (nearly none)	- (rather much)
Handling of pre-infection settings	- (resetting default values in the best case)	- (resetting default values in the best case)	+ (no problem)
Decision whether changes are malicious or not	+ (depends on the quality of the analysis)	- (hard to do)	- (hard to do)
Catch all (relevant) changes	+ (depends on the quality of the analysis)	- (problematic, as seen)	- (can be a problem)

Questions & Answers

- ???

- Note: Many testing papers can be found at: http://www.av-test.org → Publications → Papers