Disk Level Virus Detection

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The Project

- Group members:
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- **Goal:** a better way to catch viruses
  - Using virus behavior
  - Using the disk processor

How Norton AV works

- String scanning
  - Compare files against a database of known viruses
- All files stored as bits on a disk
  - MOVE.W D4 D5 ↔ 0011101000000100
- Signatures are strings of bits
  - 01101010011101000000100100110

Do virus scanners work?

- **Norton Anti-Virus detection rates**
  - WildList viruses: 100%
  - Zoo threads: 97%
  - Heuristic detection:
    - 1-month-old signatures: 22%
    - 2-month-old signatures: 8%
  - Outbreak response time: 10-12 hrs

** From AV-test.org, an independent testing agency. Published in PC Mag.*

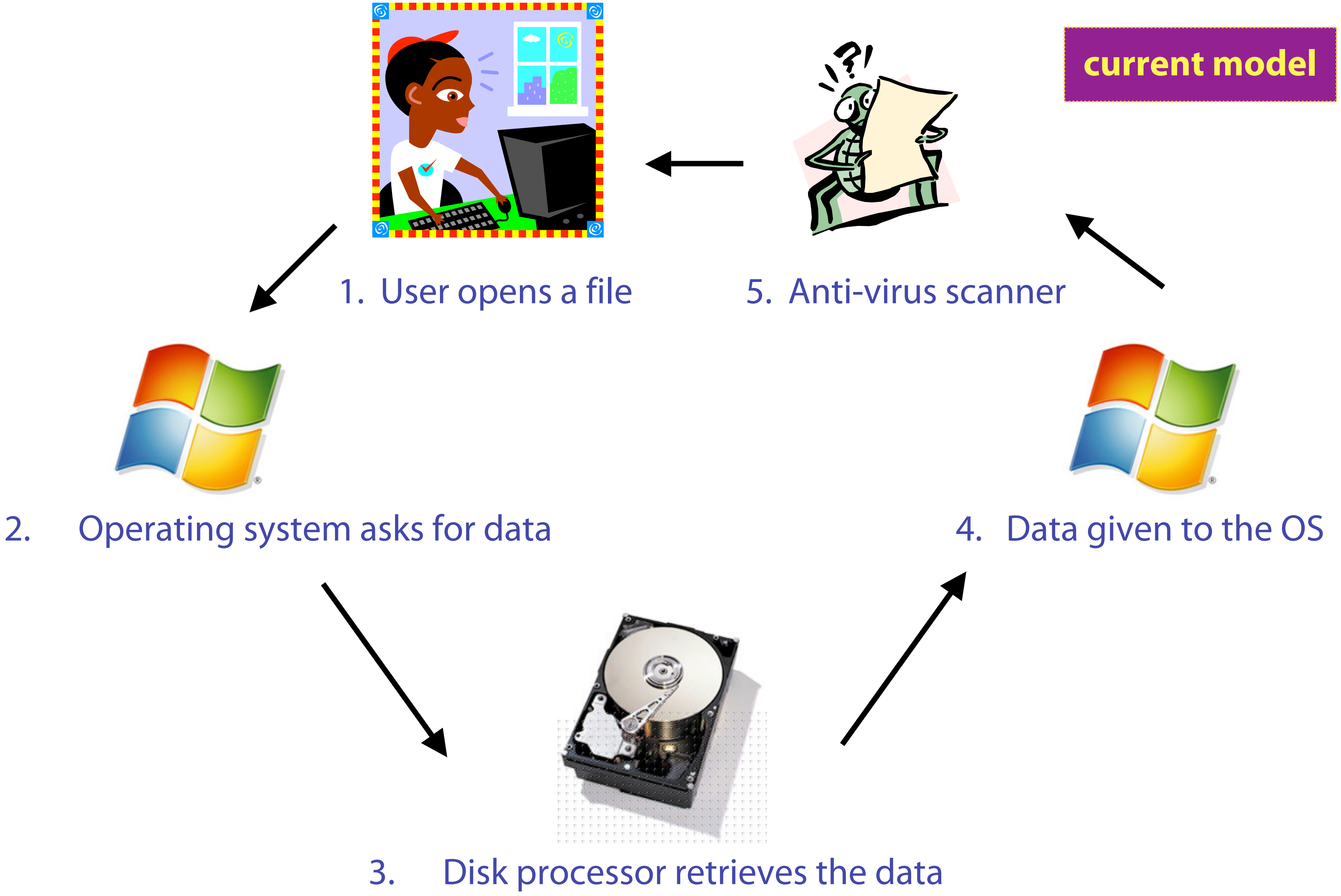
How viruses don’t get caught

- “Morphing” viruses
  - Change their own code between generations
  - For example:
    - x = x+1; ↔ a = x;
a = a + 1;
x = a;
  - Now it won’t match the signature!
    - …00110011000001000111011000100…
    - …00100001011001001000011000010…

Our solution

- Behavior-based detection
  - Static vs. dynamic approach
  - Harder to change actions than code
- Watch behavior using disk processor
  - Viruses access files
  - Disk processor sees all reads/writes

current model



1. User opens a file

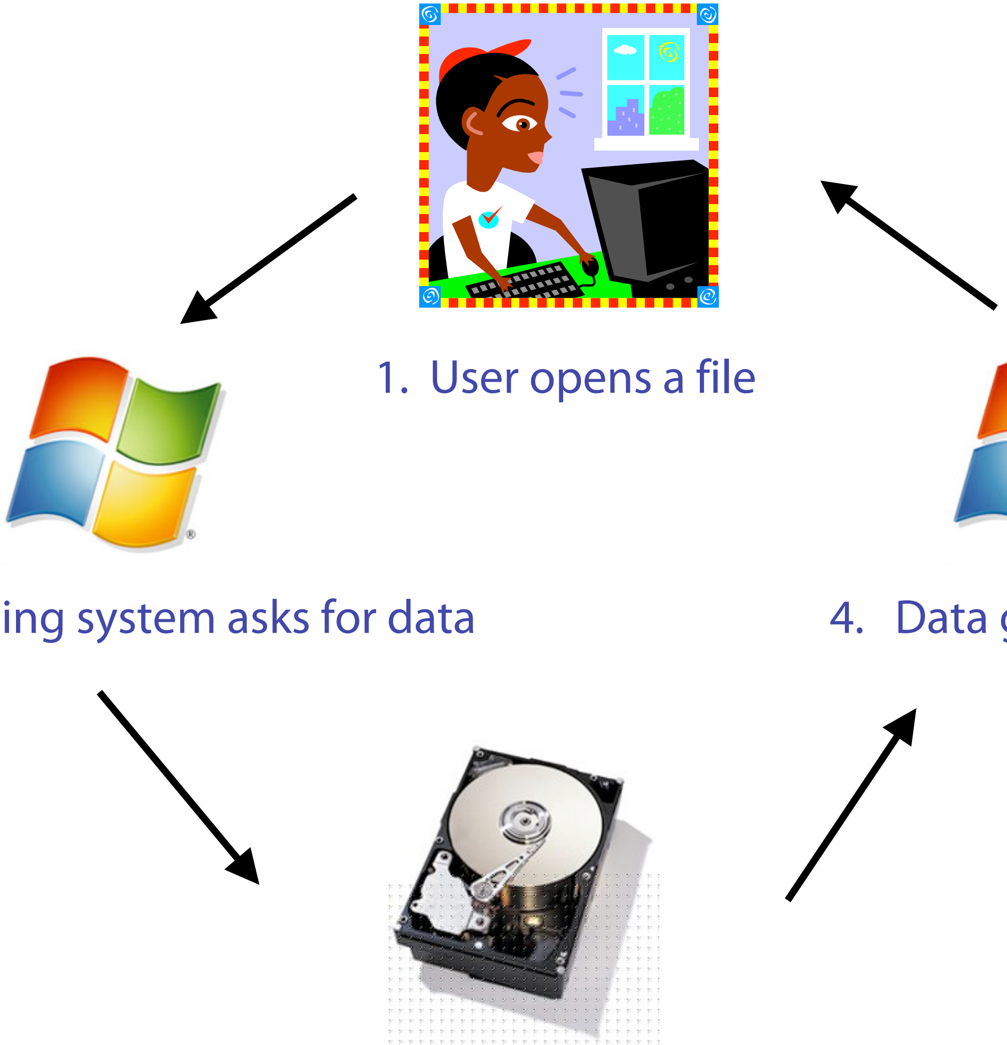
2. Operating system asks for data

3. Disk processor retrieves the data

4. Data given to the OS

5. Anti-virus scanner

our model



1. User opens a file

2. Operating system asks for data

3. Disk processor retrieves the data

3.5 Disk processor watches for viruses

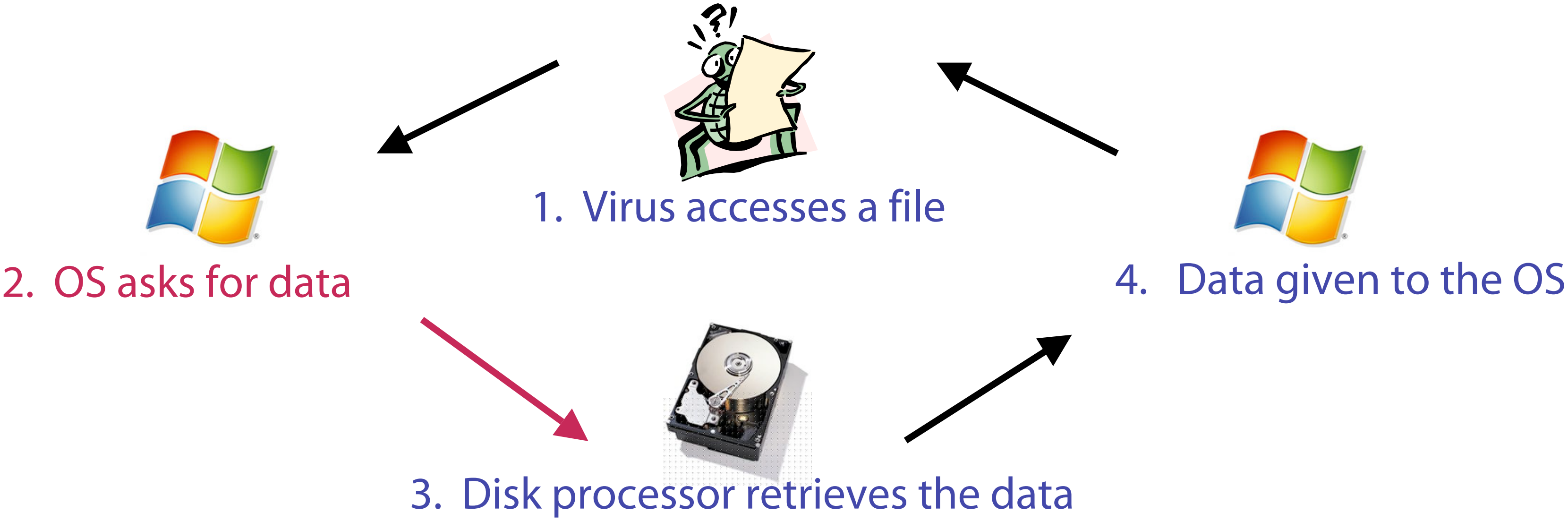
4. Data given to the OS

My research

- **Goal:** show that idea is feasible
  - Create “low-level” behavioral signatures
  - Difficult-to-detect viruses
- Experimental overview
  - Run the viruses
  - Record their behavior
  - Look for patterns

Experimental model

- Future disk processors
  - File names, opens, closes, offsets
- Current disk processors
  - Reads, writes, block numbers



1. Virus accesses a file
2. OS asks for data
3. Disk processor retrieves the data
4. Data given to the OS

Disk requests -> signatures

```
READ     1636.1672        14:27:20:984       <NO NAME>
    block=      530 ## 5Ëª˝˜Éƒ    «E_RtlCreateActivationContextSXS:
    %s…
WRITE    1636.1672        14:27:20:984       EFISHNC.EXE
    block=       15 ## <@KERNEL32.dllUSER32.dllExitProcessWriteProce…
```

- Can see behavior from these requests!
  - Use “goat” files to make it clearer
  - Run lots of traces
  - Patterns emerge

What makes a virus a virus?

- Self-replicating program
- Adds its own code to the host’s programs
- Destroys data
- Annoys the user

- **Can we tell this apart from user behavior?**

Two types of signatures

- General behavior signatures
  - Viruses like executables
  - Change header information
- Virus-specific signatures
  - Characteristic virus behavior
  - Meant for a single or small number of viruses

Testing & refining signatures

- False positives
  - Detecting a user application as a virus
  - This is really bad
- False negatives
  - Not detecting a virus
  - This is bad too

My current work

- Looking for patterns in virus string databases
- There are many similar viruses
  - Can we take advantage of this?
  - *aaa* and *aaaaaa*

Questions?

- Disk level virus detection
  - Behavioral signatures composed of disk requests
  - Based on intrinsic virus properties
  - General and specific signatures
- My thesis
  - Finding patterns in virus signatures