# Threat Testing for the Good of the Internet

How hacking anti-virus and other security products makes everyone safer

SE Labs

# # whoami: Simon Edwards

- **SE Labs founder/ CEO**
- AMTSO Chairman

## SE Labs

- London-based security testing lab
- Experienced team
- Works with:
  - Global 500 enterprises
  - **Security service/ product vendors**
  - Security teams (e.g. BT)
  - Analysts

# What we test

- Endpoint security software (detection/ protection/ response)
- Network appliances (security)
- Combined solutions (endpoint and appliance)
- Cloud security services (vs. on-prem)

# Why do we test?

- Too much snake oil
- Bad enough before ‘next-gen’
- “AV is dead, AI will save the world!”
- **This stuff costs LOAD$!**

# Intelligence-based testing

- Realism
  - NO VIRUS TOTAL TESTING!
  - Real-life attacks and close copying of techniques
  - Full attack chain
  - **Breach, not just compromise**
- Validation
  - Don’t believe the security products
  - **Forensic ‘incident response’ approach**
- Ethics
  - Reproducible (product improvement)
  - **Transparent (low-level data sharing, clear methodologies)**

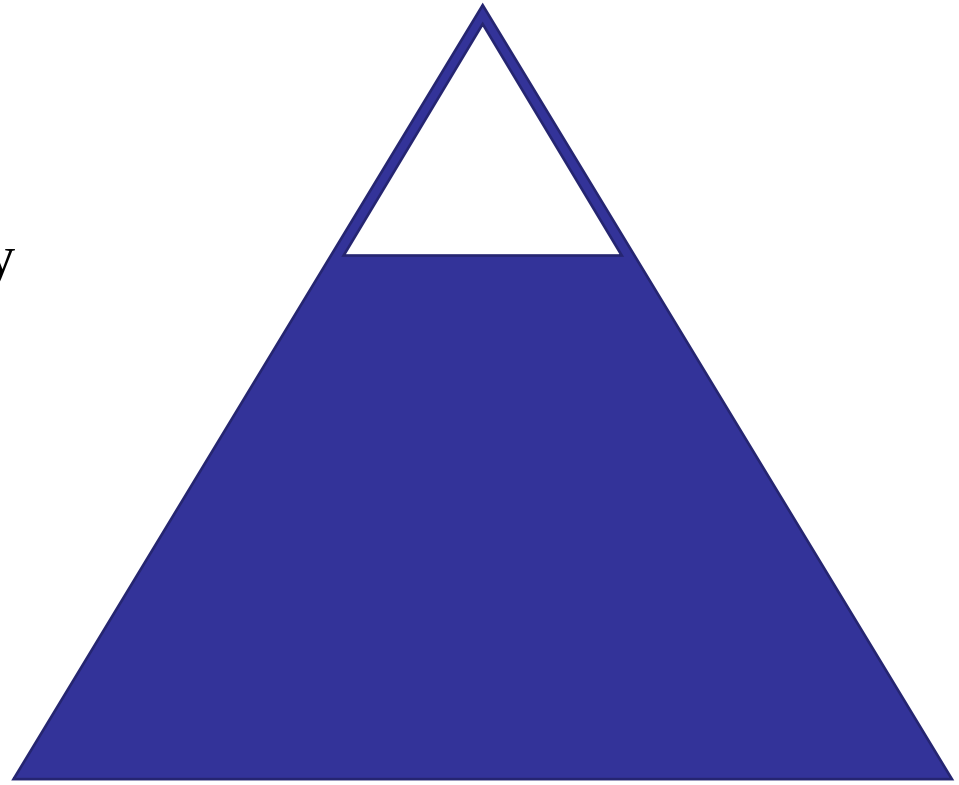
# Different strokes for different folks

- Not all products work the same way
- Not all products do the same thing (or claim to – some next-gen)
- Testing needs to pay heed to these differences
- Millions of malware samples vs. series of well-known targeted attacks
- How products react to real attacks provides **valuable information for improvement**

# Real threats for better tests

- Locate prevalent threats
- Don’t take feeds from vendors
- Expose products realistically
  - Social engineering (web, email)
  - Automatic attacks (web-based exploits) < a specialty
  - Targeted attacks

- What about APTs?
  - Threat intelligence exists
  - **It’s ‘just hacking’**
  - FireEye’s pyramid of relevance



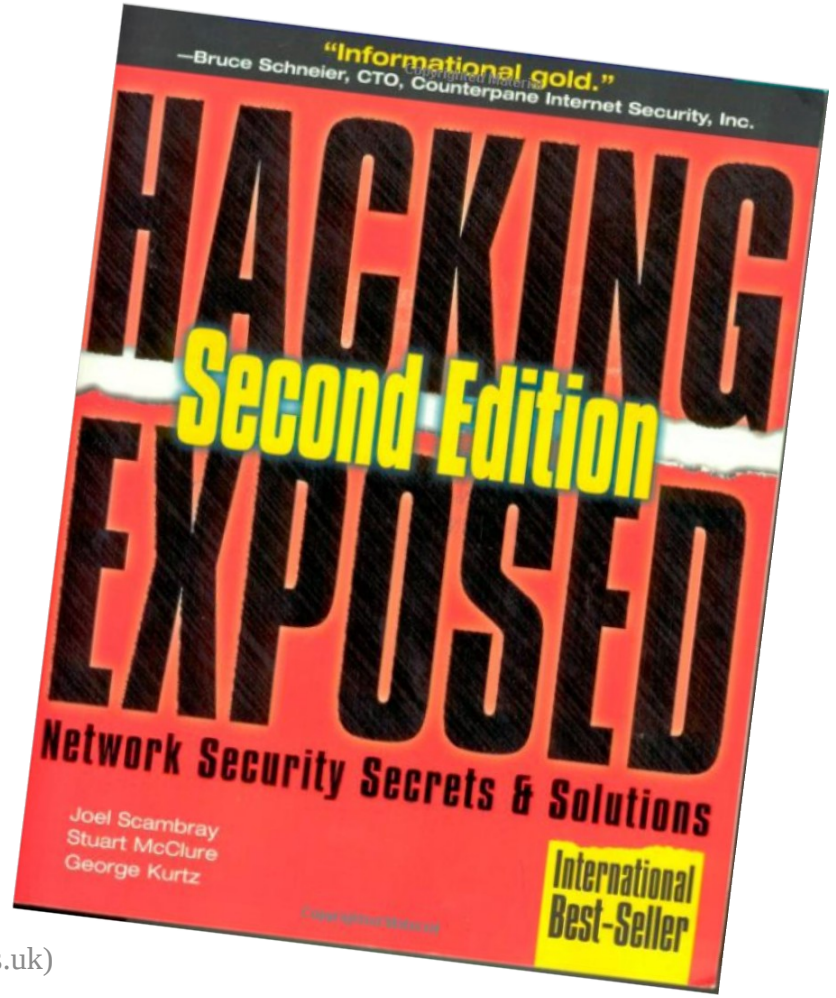
# Can we behave like an ‘APT’?

- Nation states/ criminals are **not equally well-resourced**
  - The Unbearable Lightness of APTing ( https://www.virusbulletin.com/uploads/pdf/conference_slides/2015/Balmas-etal-VB2015.pdf) compares tactics used by US and middle-east actors
  - Mossad vs. Hamas
- Nation states have **incentives not to use zero days**
  - Scalable
  - Extra hard to attribute
  - Disposable ‘burner’ technology
- Nation state **targets often lack defences** (activists and their friends/ families)
- Breach Level Index 2016 **– 1% state sponsored**
- Verizon **– 0.4%** Cyber Espionage

# Hacking Exposed vs. Hacking Team

- Hacking Exposed 2nd Edition – pub. **2000**
- Hacking Team – compromised **2015**
- Data leak published **2015**
- Phineas Phisher's 'methodology' pub. **2016**

- Compare and contrast his/her methods and those outlined in a 16 year-old manual. (Hint: virtually **identical**)



# Zero to Neo

Zero resources

Skilled

Unlimited resources

Basic

Advanced

# Breach = process, not infection

- Products will miss the infection stage sometimes
- Products may not notice post-infection activities – but they might!
- A breach is a **combination of attack stages**
- Many tests stop after the malware is introduced
- A thorough test will make no assumptions about a product's capabilities
  - Test like a real attacker and see what happens
  - Take no short-cuts (e.g. introduce malware realistically, such as via email)
  - Use realistic configurations (seek advice)

# Testing challenges with evasive malware

- **Rootkits hide** (O RLY?!)
- Mainly about validation of installation and removal…
- How can you tell if anti-malware blocked/ removed a rootkit?
- How can you validate that the rootkit installation succeeded (when pre-infecting systems?)
- What if you want to test specialised anti-rootkit tools?
- What kind of evidence will satisfy challengers of the results?
- Have the seen the size of a modern memory dump?

# Expensive memory dumping

WindowsSCOPE CaptureGUARD Physical Memory Acquisition Hardware – PCIe Add-on


**$9,599** ea. (March 2019)

http://www.windowsscope.com/product/captureguard-physical-memory-acquisition-hardware-pcie-add-on/

# Free memory dumping

- **DumpIt**
  (Was by MoonSols, now Comae Technologies)
  - Direct download: http://www.moonsols.com/wp-content/plugins/download-monitor/download.php?id=7
  - 'Legit' download: https://comae.typeform.com/to/XIvMa7 (annoying survey > email link to download)

- Mdd
  (Apparently from ManTech, but good luck finding the link on the corporate site…)
  - Download: https://sourceforge.net/projects/mdd/

- Why >1? Sometimes one will crash on infected systems.

# Analysis: Malware infection (not rootkit)

From a recent SE Labs test, in which the result of ‘compromised’ was disputed by the vendor…

- File system changes:
  - + C:\Users\x\AppData\Local\Temp**server.exe**
- Registry changes:
  - + HKLM\SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion**Run**\x: ""C:\Users\x\AppData\Local\Temp**server.exe**" ..“
  - + HKLM\SYSTEM\CurrentControlSet\services\SharedAccess\Parameters\FirewallPolicy**FirewallRules**\x: "v2.10|Action=**Allow**|Active=TRUE|**Dir=In**|Protocol=17|Profile=Public|App=C:\Users\x\AppData\Local\Temp**server.exe**|Name=server.exe|

# Summary: ‘Regular’ infection

```
si@SEL:~/$ volatility -f dump.raw --profile=Win7SP1x64 pslist

Name                 PID  PPID   Thds     Hnds   Sess  Wow64 Start
-------------------- ---- ------ -------- ------ ----- ------ ----------
System               4    0      112      504    ------ 0      2017-01-18 10:04:15
smss.exe             288  4      2        33     ------ 0      2017-01-18 10:04:15
svchost.exe          716  540    12       369    0      0      2017-01-18 10:04:20
Agent.exe            780  540    42       978    0      0      2017-01-18 10:04:21
taskhost.exe         1500 540    11       197    1      0      2017-01-18 10:05:45
dwm.exe              1544 796    6        126    1      0      2017-01-18 10:05:45
explorer.exe         1552 1536   35       820    1      0      2017-01-18 10:05:45
AgentUI.exe          2256 1552   17       379    1      0      2017-01-18 10:05:47
server.exe           2688 2152   11       218    1      1      2017-01-18 10:05:48
Dumpit.exe           3372 1552   6        53     1      1      2017-01-18 10:07:06
```

Memory analysis for visual proof

# Direct Kernel Object Mode (DKOM)

- Common technique: unlink a process' entry from the doubly-linked list
- Malicious process won't appear in the process list (pslist)
- Run psscan and compare outputs
- Entries in psscan output that are **missing** from pslist are suspect

- Bit onerous, though…

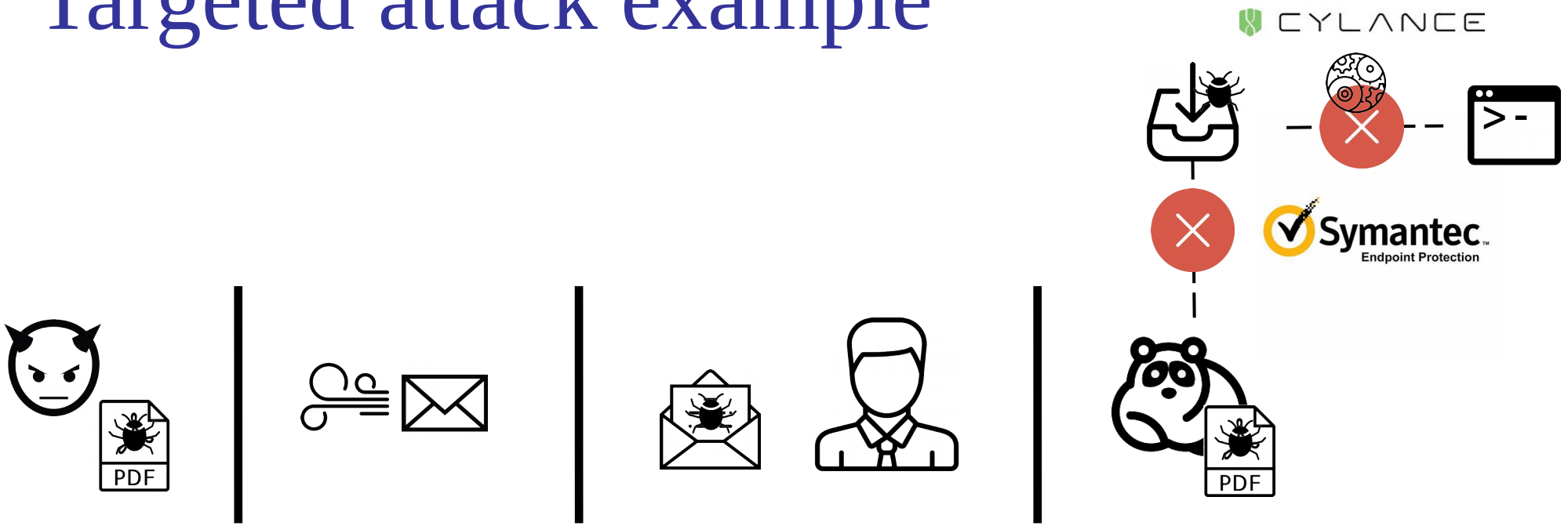
# psxview FTW!

| Name | pslist | psscan | thrdproc | pspcid | csrss | session | deskthrd |
|---|---|---|---|---|---|---|---|
| svchost.exe | True | True | True | True | True | True | True |
| 1_doc_RCData_61 | False | True | True | True | True | True | True |
| explorer.exe | True | True | True | True | True | True | True |
| winlogon.exe | True | True | True | True | True | True | True |
| svchost.exe | True | True | True | True | True | True | True |
| msiexec.exe | False | True | False | False | False | False | False |
| rundll32.exe | False | True | False | False | False | False | False |

# Important tips

- Use these techniques in all tests, not just anti-rootkit tests
- Hygiene is important. Clean your MBR between test cases.
- Have more than one memory dumping tool to hand.
- Analyse offline.
- For a reasonable test, have a lot of storage for memory dumps.
- Share output of analysis, not full memory dumps (KBs vs. GBs).

# Targeted attack example



# Demo

- Fully-updated Windows 10 PC, Windows Defender, UAC enabled
- Four year-old PDF exploit
- Default Metasploit installation (and no other tools)
- Minimal social engineering
- Full 0wnership in < 7 minutes
- What does anti-malware see?
- What does ‘next-gen’ see?
- EXAMPLE THREAT WAS NOT CHERRY PICKED FOR DRAMA!

# Anti-virus vs. next-gen detection

# Next-generation detection

- Private test result
  - No detection/ protection from well-known ‘next-gen’ products (infection)
  - No protection from surprising number of established anti-malware products
  - Good protection from some established anti-malware products
  - Detection from some ‘next-gen’ products (post-exploit actions)

# Reasons to run full breach testing

- Testing can indicate:
  - How useful are established and new security solutions?
  - Where are the **strengths and limits** of their capabilities?
  - Do they do what they claim?
  - Do they have **other benefits**?
- The above information can help businesses consider:
  - Are they good **value for money**?
  - How much **training** will staff need to use them effectively?
  - How much **overlap** is there with currently deployed measures?

# Questions?

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