Tracking Cyber Attackers II

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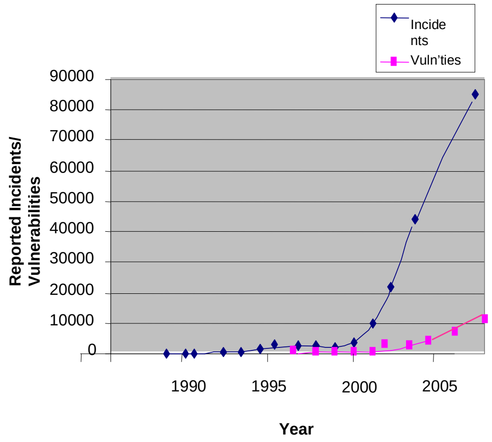
Outline

- Internet Security Trends
- Need to Track Cyber Attackers
- Methodology and Requirements
- Forensic Tools
- Hiding files
- Trojan Defense

Internet Security Trends

- Rising rate of cyber attacks
- Increasing sophistication of attacks
- Increasing permeability of firewalls
- Increasing vulnerability of browsers



Adopted from *www.cert.org*

Need to Track Cyber Attackers

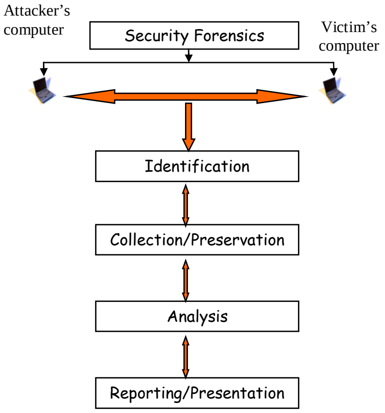
- National security
  - Potential for breaking into computer networks controlling sensitive processes
- Economic
  - Cyber attackers steal valuable information and intellectual property
- Legal
  - Corporations need to be prepared for possible litigation, e.g., for
    - Allegations of discrimination
    - Intellectual property claims
- Law enforcement
  - Agencies must be capable of tracking down law breakers

Methodology for Tracking Cyber Attackers

- *Security (or IT) Forensic* techniques are used to track cyber attackers.
- *Security Forensics*:

  The process of
  - Identifying,
  - Collecting and preserving,
  - Analyzing, and
  - Reporting and presenting

  digital evidence in a legally acceptable manner



Attacker's computer

Security Forensics

Victim's computer

Identification

Collection/Preservation

Analysis

Reporting/Presentation

IT Requirements for Security Forensics

- The following capabilities are needed:
  - Collecting relevant information from systems
  - Being able to positively identify users who log on to systems
  - Proving ownership and authenticity of evidence found on a system

Forensic Data Collection in Client Computers

- Most operating systems provide significant logging capabilities.
  - Windows systems (2000/NT/XP) store log files in the directory %systemroot%\system32\config\
  - In UNIX, information about running processes is usually stored in *var/log/syslog*
- Protecting logs
  - Attackers could delete or modify logs
  - Logs should be protected

Network-based Evidence

- Network monitoring can be performed to collect evidence:
  - Event monitoring: collecting network events, such as IDS alerts, network health monitoring alerts
  - Trap-and-trace monitoring: transaction data such as protocol flags
  - Full-content monitoring: collecting raw packets
- Network-based evidence can be found at endpoints and intermediate systems, such as
  - Authentication servers
  - Router logs
  - Firewall logs
  - Event logs from IDSs
  - Caller ID systems

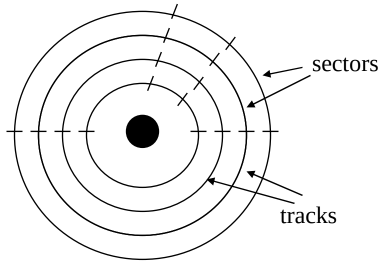
Forensic Tools

- Many forensic tools and applications exist, e.g., for
  - Hard disk duplication
  - Text and file searching
  - Internet history analysis
  - Data hiding/revealing
  - Network forensics
  - Analysis of email files
- Some popular tools:
  - *EnCase* for drive forensics
  - *E-Trust* for industrial espionage cases
  - *Forensic Toolkit* (FTK)
  - *ProDiscover*
- Hardware and software-based key loggers can collect key strokes for specified periods of time.

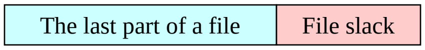
Hidden Evidence

- Evidentiary data is not often readily observable.
- Evidence could be in
  - Deleted files
  - Encrypted files
  - Files in parts of the hard drive that are not readily exposed:
    - In System directory
    - ATA "Protected Area"
    - In file slacks
  - Files hidden in other files

A Disk Platter



Last sector of a cluster



Hiding Files in other Files

- Files can be hidden in other files
- Steganography: storing hidden messages in such a way that no one other than the intended recipient knows of the existence of the message.

Original Image

+

Hidden message

```
101101011010101010
100101000101101101
101010100101011010
101011110000101010
100101110101101011
010100101001000010
011101010011110110
111101110111010001
```

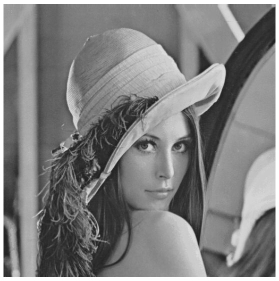
=

Final image

Example: The LSB Algorithm

- In a digital black and white image, where each pixel is represented by 8 bits to represent its gray value, use the least significant bit (LSB) of each 8-bit word for the hidden message.
- The method can be extended to LSB plus additional bits.

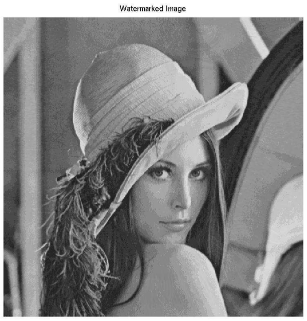
Original



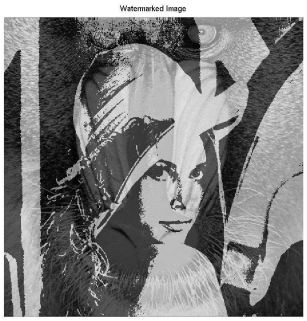
1 LSB

LSB Plus Additional Bits

4 LSBs



7 LSBs



S-Tools

- *S-Tools* is a freeware steganographic tool which can embed a message (audio file, image or text file) into an image of GIF or BMP format or audio in *wav* format.
- It is available from http://www.spychecker.com.

What is Trojan Defense?

- The Trojan Defense:

  The suspect claims "I didn't do it; someone else did."
  - The suspect claims that his/her computer was broken into and files (images, malware) planted in it; thus not responsible for what the computer did.
- The Trojan defense presents two problems:
  - The possibility of acquitting the guilty
  - The possibility of convicting the innocent.
- It presents the forensic investigators with a major challenge: to prove or disprove that the accused person is responsible for the evidence found on the computer.

Trojans and Back-doors

- *Trojan* (or *Trojan horse*): a malicious program that is disguised as legitimate software
- The malicious program could, e.g.,
  - download tools that could be used for intrusion
  - upload sensitive data from the victim's computer
- Characteristics:
  - A Trojan can be attached to otherwise useful software, or it can be stand-alone.
  - The payload of a Trojan can be any type of malware, e.g., spyware, adware, back-door.
- *back-door:* a method of bypassing normal authentication which is hidden to casual inspection

Trojan Making - Wrappers

- Many Trojans are created by Trojan-making kits, referred to as *wrappers*.
  - GUI-based or command-line driven *wrappers* are available, e.g., EliteWrap (*www.packetstormsecurity.org/trojans/*)
- Trojan could be distributed to a mass audience, to targeted groups, or to individuals.
- Typical distribution mechanisms:
  - Attachment to e-mail
  - File sharing and removable media
  - Direct implant via hacking

Trojan Making - Packers

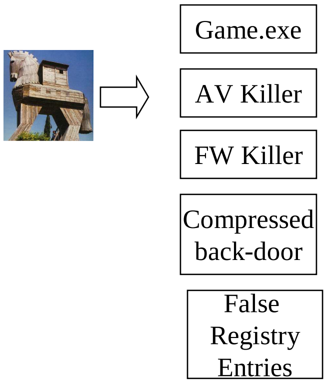
- The terms "packer" and "compressor" refer to utilities which compress a file, thus changing its binary structure.
  - Example: *www.programmerstools.org*
- Back-doors are usually detectable by Antivirus tools via their signatures.
- Even compressed back-doors would in most cases still be detectable.
- However, the attacker may use a compression algorithms not detectable by Antivirus tools.

Antivirus and Personal Firewall Killers

- Malicious tools exist that shut down or disable the Antivirus (AV) application or the Personal Firewall (FW) software on the victim's computer.
  - Example: kiLLer (*www.illmob.org)*
- A victim may inadvertently execute malware which deploys an AV/FW killer.
  - Then, forensic investigators often cannot see any events or logs alerting them to this incident.

A Trojan Scenario

- The victim downloads a game from a P2P network.
- The game is a Trojan designed to deliver
  - An AV killer and a FW killer in the payload
  - A routine to implant false registry keys into the victim's system
  - A back-door to allow access to the victim's machine.
- The AV is first disabled so that when the back-door is decompressed, an AV response is not triggered.
- The FW Killer disables the personal FW software, allowing free traffic flow in and out of the victim's system.
- The back-door installs itself allowing the attacker remote access to the victim's machine.
- At the same time, the back-door notifies its "owner" of its presence via an outbound open port.
- The registry keys could
  - Ensure stealth start-up of rogue processes
  - Add falsified histories relating to Internet surfing activity



Back-door/Trojans Forensics

- Back-door/Trojan kits have three components:
  - *Server:* the back-door itself, often wrapped up into the overall Trojan
  - *Client:* to control the back-door from a remote location
  - *Creator Tool:* to control the behavior of the back-door
- Existence of only the *server* part on a computer could be used as Trojan Defense.
- But the presence of *client* and/or *creator* should raise questions about the Trojan Defense.
- Corroborating evidence could be found in FW or proxy server logs.

Conclusions

- Internet security attacks are on the rise
- Methods are needed to track cyber attackers
- Logs play an essential role in security forensics
- Effective tools are needed
- Experience counts!