Digital Forensics – UiO

About Me

I am:

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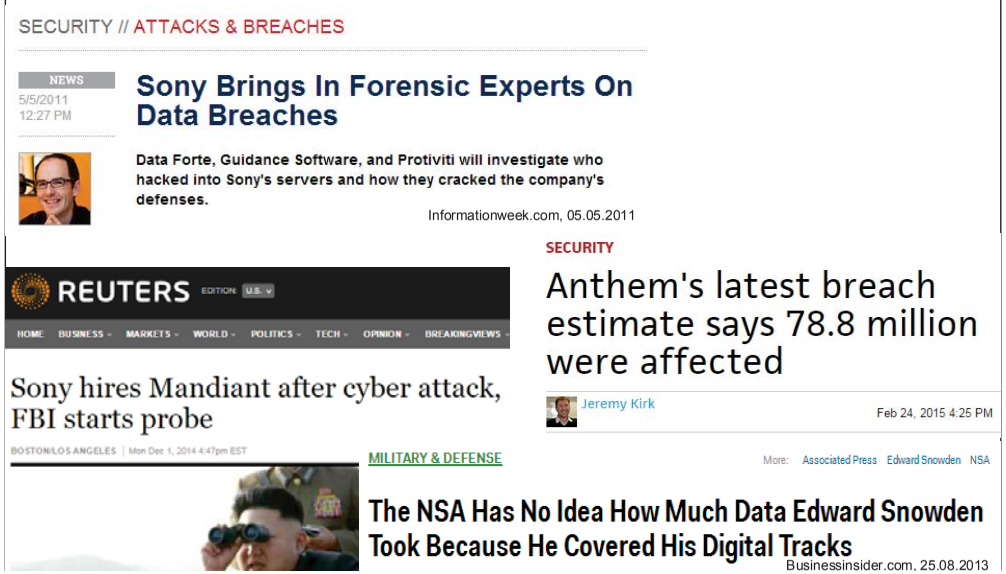
I work as:

- Information Security Consultant
  - Security Audits
  - Digital Forensics / Incident Response
  - Education

Outline

- Incident Management
- Digital Forensics
- Finding Evidence

Digital Forensics in Incident Management



Incident Response

Incident Management

- Incident Response Policy
- Incident Response Team

Incident Response Policy

- Responsibility
  - Who makes the decisions?
- Asset Priority
  - Which systems can be taken offline?
  - Which systems can absolutely not be taken offline?
- Outside Experts and Agencies
  - "Who you gonna call"?
  - At what point is Law Enforcement involved?

Incident Response Policy

- As an employee, if I discover an incident, what do I do?
- The policy must include information on
  - Chain of escalation
  - How to prevent further damage
  - How to preserve evidence until the Response Team can take over

Incident Response Team

- Permanent
- Virtual
- Hybrid

Red team – Blue team

- Derived from military wargames
- A simulated attack using security specialists
- The Incident Response Team defends the system from the attack

Incident Response Procedures

- Triage
- Investigation
- Containment
- Analysis
- Tracking
- Recovery

Triage

- Weed out false positives
- Categorize the event
  - Type of incident
  - Source of incident
  - Growth of incident
  - Damage potential of incident

Investigation and Containment

- Collect data
- Mitigate the damage

Analysis and Tracking

- What is the root cause of the incident?
  - Who
  - How
  - When
  - Why
- Do we need to involve Law Enforcement?

Follow-up (Postmortem)

- Fix the problem
- Can we improve the Incident Response Policy?
- Disclosure

Digital Forensics

Digital Forensics in Court

- The BTK Killer
  - Metadata in Word file led to arrest after 30 years
- Krenar Lusha
  - Search of laptop led to discovery of bomb-making equipment
- Matt Baker
  - Suicide of wife ruled murder after incriminating google searches is discovered 4 years later
- Sharon Lopatka
  - Emails on her computer led to her killer
- Corcoran Group
  - Evidence that data had been deleted led to conviction

Digital Forensics

- Known by many names
  - Computer forensics
  - Network Forensics
  - Electronic Data Discovery
  - Cyberforensics
  - Forensic Computing

What is Digital Evidence?

- Any digital data that contains reliable information that supports or refutes a hypothesis about an incident

The Forensic Investigation Process

- Identification
- Preservation
- Collection
- Examination
- Analysis
- Presentation

At the Crime Scene

- Document the crime scene
  - Document who has access
  - Document any contamination
- Photograph everything
  - Especially the screen
- Locate the media
  - Follow cables
  - Search for WiFi
- If the computer is running, dump the RAM

The Digital Forensic Toolkit

- Screwdrivers
- Evidence bags
- Labels
- Forensic software
- Write Blocker
- Camera
- Notebook with numbered pages
- Storage – Large HDDs

Basic Scientific Principles

1. Best evidence
2. Minimal Intrusion
3. Minimal Force
4. Minimal Interruption
5. Transparency
6. Chain of Custody
7. Primacy of the Mission
8. Impartiality
9. Documentation

Where is the Evidence?

- Network analysis
- Media analysis
- Software analysis
- Hardware analysis

When Dealing with Evidence

- R-OCITE
  - Return

  Or seize
  - Original
  - Clone
  - Image
  - Targeted copy
  - Extensive copy

Is the Evidence admissable?

- How was it gathered?
- How was it treated?
- Who handled it?
- How reliable is it?
- Is the Chain of Custody complete?

Evidence categories

- Conclusive Evidence
  - This is fact
- Best Evidence
  - This is it
- Secondary Evidence
  - This how it looks
- Direct Evidence
  - This is what I saw

Evidence categories

- Corroborative Evidence
  - That happened, because of this
- Circumstantial Evidence
  - That could have happened, because of this
- Opinion Evidence
  - I'm an expert, this is what happened
- Hearsay Evidence
  - I heard this about that

Digital Evidence

- Digital evidence is considered hearsay
- Unless an expert vouches for it

Finding Evidence

- Many ways to hide evidence
- Many ways to find evidence

Hidden files

- Setting the “hidden” flag on the file
- Placing illicit materials in folders named “Tax Stuff” or “Guest Lectures”

Locating hidden files

- We ignore the “hidden” flag by default
- Forensic software can be set to show the whole drive as a “flat” drive, ignoring all folders

Changing File Extensions

- When opening the file, the system returns an error message
- “Oh, I guess it is corrupted. Too bad.”

Discovering changed File Extensions

- Some forensic software will point out files with mismatched extensions
- File signatures tells us what kind of file it is
  - Also called “Magic Numbers”

File signatures

- A hexadecimal code in the file

Examples:

25 50 44 46	= %PDF	= PDF
49 44 33	= ID3	= MP3
FF D8 FF	= ÿØÿà	= JPEG
42 4D	= BM	= BMP
4D 5A	= MZ	= EXE, COM, DLL

Example signature: JPEG

Offset	0	1	2	3	4	5	6	7	8	
00000000	FF	D8	FF	E1	15	FE	45	78	69	ÿØÿá þExi
00000009	66	00	00	49	49	2A	00	08	00	f II*
00000018	00	00	09	00	0F	01	02	00	06	
00000027	00	00	00	7A	00	00	00	10	01	z
00000036	02	00	14	00	00	00	80	00	00	▮
00000045	00	12	01	03	00	01	00	00	00	
00000054	01	00	00	00	1A	01	05	00	01	
00000063	00	00	00	94	00	00	00	1B	01	▮
00000072	05	00	01	00	00	00	9C	00	00	▮
00000081	00	28	01	03	00	01	00	00	00	(

Obscure filenames

- Hide files by giving them innocent sounding names
- “Blueprints_iPhone7.jpeg” becomes “Florida vacation 001.jpeg”

Filenames not always necessary

- We use hashing algorithms to quickly look for known files, and either note or ignore them
  - Hash lists recognize known illicit files
  - Other lists recognize known good files
  - We can create our own

Encrypted Files

- Strong encryption algorithms almost impossible to break
- “Sorry, I’ve forgotten my 50 character long password.”

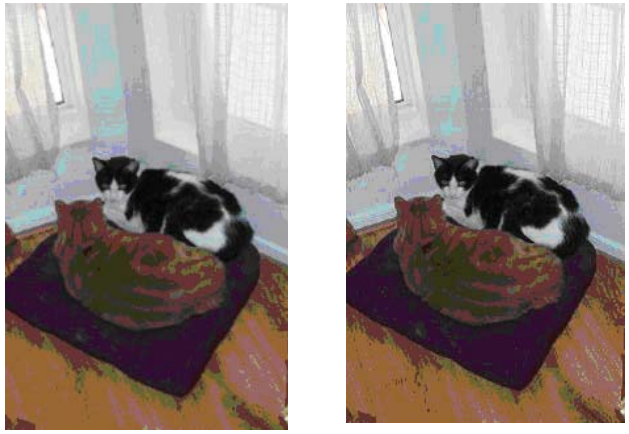
“Breaking” Encryption

- Recovering key from RAM
- Brute force
- Exploiting weaknesses in the software or the algorithm used (Cryptanalysis)
- Some countries have laws that compel the suspect to give up keys
- Less ethical methods
  - Rubber-hose cryptanalysis
  - Black-bag cryptanalysis

Steganography

- Hiding a file inside another file
- Hiding “Nuclear Launch Codes.txt” inside “Adorable Cat.jpeg”

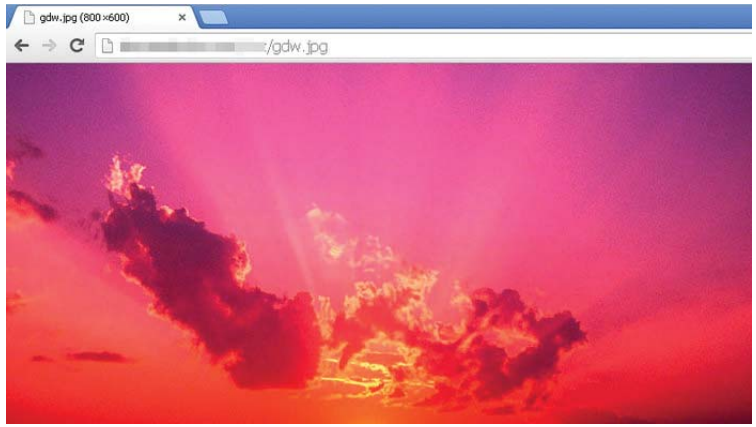
Steganography example



Inside one of these files the text “This is a test. This is only a test.” is hidden.

symantec.com, 02.11.2010

Steganography example



The ZeusVM malware uses image files to hide configuration files

digi.no, 19.02.2014

Discovering Steganography

- Hard to determine, unless you are looking for it
- Steganography software on the suspects computer is a strong indicator

Deleting Files

- Deleting the files from the computer before law enforcement claims it
- “You can’t prove anything, there is nothing there.”

How does the System delete Files?

- Deleting a file does not actually remove it
- In Windows, the file is renamed
  - CorporateSecrets.txt
  - ~orporateSecrets.txt
- This tells the system that the space is available

How to reclaim it?

- Simplest way: Renaming!
  - ~orporateSecrets.txt
  - CorporateSecrets.txt
- The system no longer considers the space available

What if the space has been overwritten?

- Pieces of data can be recovered from the “file slack” between files

AAAA	BBBB	CCCC	DDDD	1111	2222	3333	4444
~AAA	BBBB	CCCC	DDDD	1111	2222	3333	4444
XXXX	YYYY	ZZZZ	DDDD	1111	2222	3333	4444

Metadata

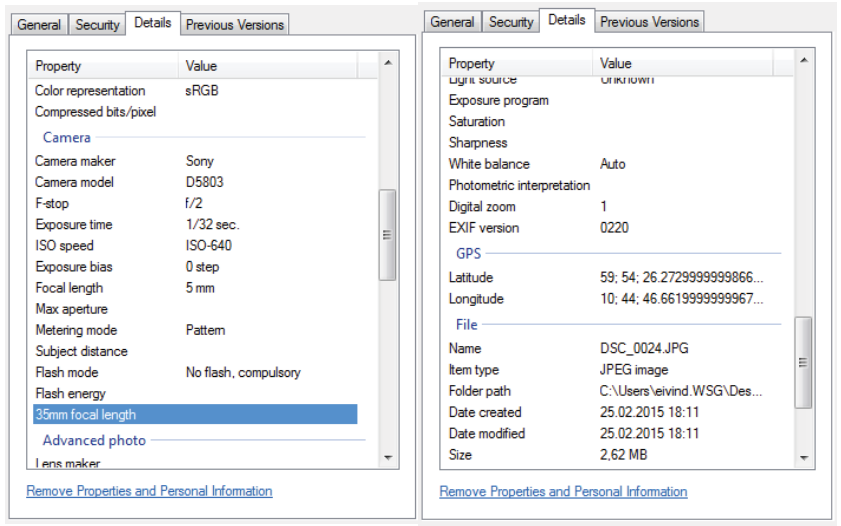
- What if we only have a file?

Using Metadata

- Data about the file
  - When was the file last used?
  - When was the file created?
  - Who opened it?
  - Where was it created?
- Can prove who had access to the file

Metadata Example

Metadata Example



Metadata Example