# OCCULT COMPUTING AND ANTI-FORENSICS

Adrian Crenshaw

# About Adrian

- I run Irongeek.com
- I have an interest in InfoSec education
- I don't know everything - I'm just a geek with time on my hands
- I'm an (Ir)regular on the InfoSec Daily Podcast: http://isdpodcast.com
- Co-Founder of Derbycon http://www.derbycon.com/

Twitter: @Irongeek_ADC

# Short Version

- Here is a longer talk I did on this subject: http://www.irongeek.com/i.php?page=videos/anti-forensics-occult-computing
- For those that want to leave early, here is the VERY short version:

1. Maintain physical control of your computer.
2. Use full hard drive encryption.
3. Keep things separate.

# Why Occult Computing?

- Occult comes from the Latin word occultus (clandestine, hidden, secret), referring to "knowledge of the hidden".
- Forensic: Relating to the use of science and technology in the investigation and establishment of facts or evidence in a court of law.
- Since hiding activities is what we are doing, Occult Computing seems like a good name.
- Since people are not necessarily hiding their activities from a court of law, the term anti-forensics may not always apply.
- Occult Computing sounds cooler than Anti-forensics ☺
  *Cthulhu fhtagn*



Thanks to Wikipedia and Wiktionary for wording of definitions

# What's this talk about?

Why:

- Not about just hiding your stash from the Fuzz…
- Law/policy enforcement may find it useful to know how folks hide their computer activities
- Users may want to know how to hide their activities from invasive law/policy enforcement
- Companies may want to know how to clear boxes before donating them

What:

- Mostly Windows, but most ideas are applicable to other operating systems
- Not going to cover malware analysis, nor network anti-forensics (at least not much)
- Mostly we will cover hiding tracks left on storage media

# Four categories

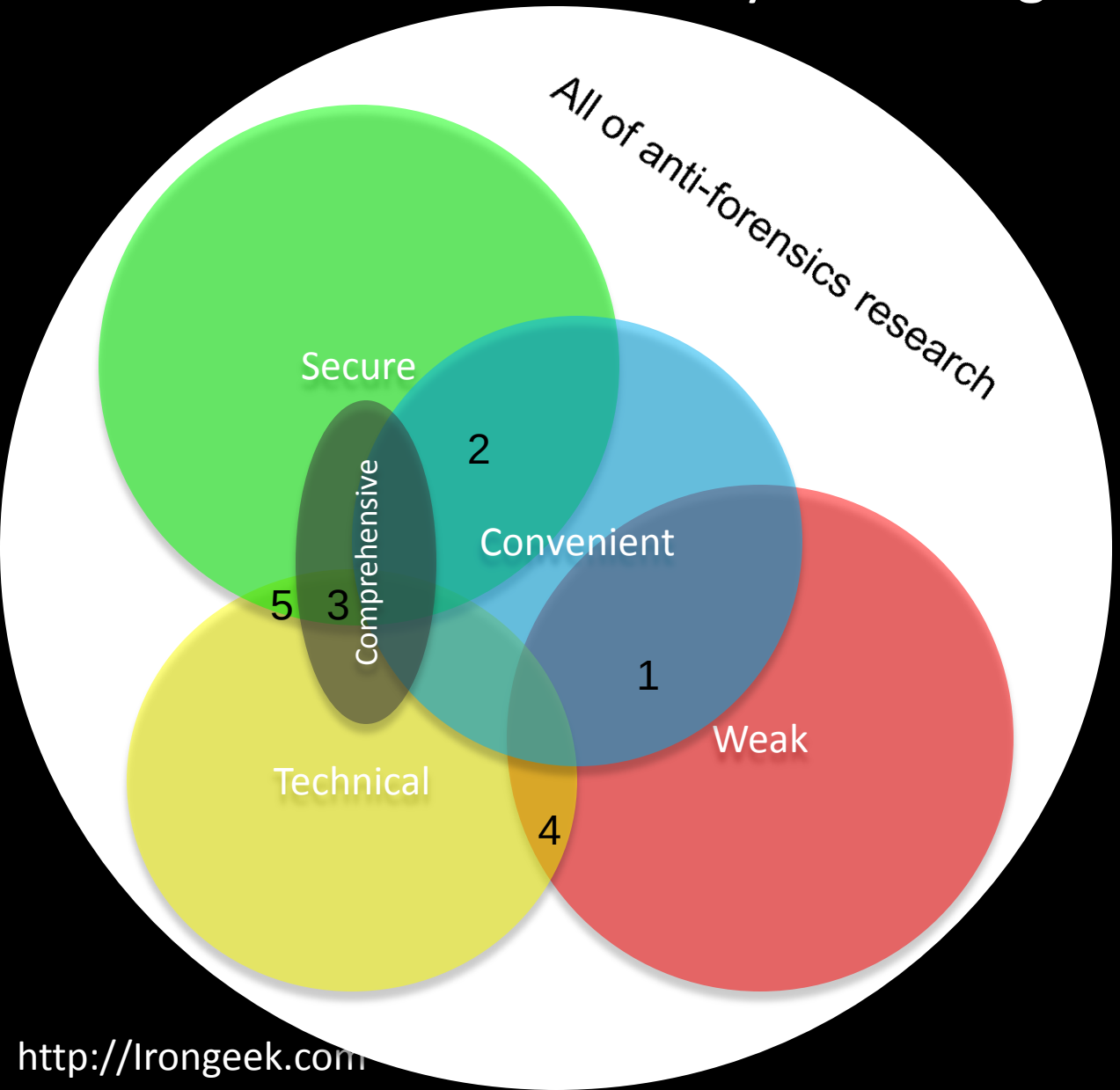
1. Don’t leave tracks in the first place
2. Selective file removal and encryption tools
3. Parlor Tricks
4. Nuke it from orbit, it's the only way to be sure

# Irongeek's first two rules of personal security/privacy

1. If it's not easy, folks won't do it.
2. If it's not secure there's no point in doing it.

# What anti-forensic techniques are likely to be seen?

- Bow down before my Venn diagram of doom!!!




1. Just deleting a file
2. Selective file wiping and encryption
3. Full drive wiping and encryption
4. Hidden partitions
5. Stego

# BACKGROUND INFO

Stuff that's useful to know

# Interesting legal stuff
# IANAL

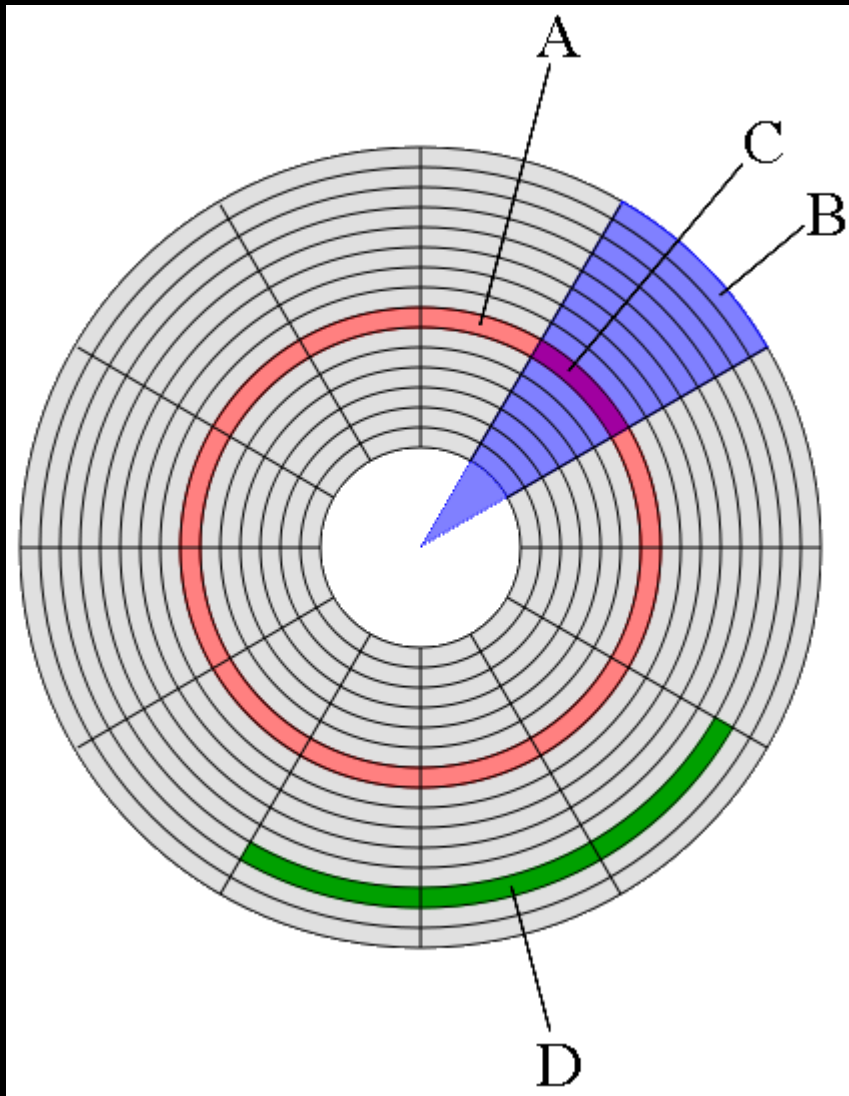
- Julie Amero
  http://en.wikipedia.org/wiki/State_of_Connecticut_v._Julie_Amero
  http://www.securityfocus.com/columnists/434/
- Sebastien Boucher
  http://en.wikipedia.org/wiki/United_States_v._Boucher
- The “Hacker Defense”
  http://www.forensicswiki.org/wiki/Legal_issues
  http://exforensis.blogspot.com/2008/07/troljan-horse-defense.html
- If the system is set to wipe data at regular intervals normally, that may be ok. Wiping data once an investigation is about to be underway will make things worse.
- Spoliation: Someone screwed up the evidence
- CSI effect
  http://en.wikipedia.org/wiki/CSI_effect
- Plausible Deniability Tool Kit (PDTK)
  http://www.nmrc.org/pub/pdtk/
  http://www.defcon.org/html/links/dc-archives/dc-14-archive.html#weasel

# Tech Stuff

- It’s hard to cover this in order.
- You need to understand some things before you understand others, but which you have to understand first is questionable.
- Windows jams data in all sorts of places, and there are tools to make this data fairly easy to recover.

# Disks, Tracks, Sectors

- A. Track
- B. Geometric Sector
- C. Track Sector
- D. Cluster



# Slack Space

- Yum…Leftovers!!!
- RAM slack (but name no longer really applies) and Residual slack

| Offset | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 04049E70 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 2FILE2FILE2FILE2 |
| 04049E80 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | FILE2FILE2FILE2F |
| 04049E90 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | ILE2FILE2FILE2FI |
| 04049EA0 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | LE2FILE2FILE2FIL |
| 04049EB0 | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | E2FILE2FILE2FILE |
| 04049EC0 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 2FILE2FILE2FILE2 |
| 04049ED0 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | FILE2FILE2FILE2F |
| 04049EE0 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | ILE2FILE2FILE2FI |
| 04049EF0 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | LE2FILE2FILE2FIL |
| 04049F00 | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | E2FILE2FILE2FILE |
| 04049F10 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 2FILE2FILE2FILE2 |
| 04049F20 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | FILE2FILE2FILE2F |
| 04049F30 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | ILE2FILE2FILE2FI |
| 04049F40 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 46 | 49 | 4C | LE2FILE2FILE2FIL |
| 04049F50 | 45 | 32 | 46 | 49 | 4C | 45 | 32 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | E2FILE2 |
| 04049F60 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049F70 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049F80 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049F90 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FA0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FB0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FC0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FD0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FE0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 04049FF0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 0404A000 | 65 | 31 | 66 | 69 | 6C | 65 | 31 | 66 | 69 | 6C | 65 | 31 | 66 | 69 | 6C | 65 | e1file1file1file |
| 0404A010 | 31 | 66 | 69 | 6C | 65 | 31 | 66 | 69 | 6C | 65 | 31 | 66 | 69 | 6C | 65 | 31 | 1file1file1file1 |

# Hash

One way functions:

Easy:

md5("I am a string") =
"1710528bf976601a5d203cbc289e1a76“

Hard:

String("1710528bf976601a5d203cbc289e1a76“) =

("I am a string")

Can be used to fingerprint files, or see if they have changed

# Host-Protected Areas and Disk Configuration Overlay

- Parts of the drive that can be set aside that normal OS and BIOS functions can't see
- Possible to hide data there, but it's a pain
- Taft (he's one bad mother….) http://www.vidstrom.net/stools/taft/
- More info http://www.forensicswiki.org/wiki/DCO_and_HPA

# Forensically interesting areas in the Windows file system

- Way too many to list, but lets check some out:

http://www.irongeek.com/i.php?page=security/windows-forensics-registry-and-file-system-spots

- Nirsoft has a lot of tools for grabbing data: http://www.nirsoft.net/

- Deft Linux http://www.deftlinux.net/

# DON'T LEAVE TRACKS IN THE FIRST PLACE

Pr0n mode and places data hides

# Privacy mode (aka porn mode) in browsers

Firefox (Private Browsing)

- Keyboard shortcut: Ctrl+Shift+P
- Command line: No command line, but can be set on start via Tools>Options>Privacy "Use custom setting"

IE (InPrivate)

- Keyboard shortcut: Ctrl+Shift+P
- Command line: -private

Chrome (Incognito mode)

- Keyboard shortcut: Ctrl+Shift+N
- Command line: --incognito

Opera (kiosk mode)

- Ok, not quite the same thing, but maybe someone will email me a solution

- Do some research online to see how good your browser's "porn mode" really is.

# Private portable browsers

- Portable Apps
  http://portableapps.com/apps/internet
- Tor Browser Bundle
  http://www.torproject.org/easy-download.html.en
  Firefox based, comes with Tor and Pidgin
- OperaTor
  http://archetwist.com/opera/operator
  Opera based, comes with Tor

- Keep in mind, Tor != Secure

# Other Darknets

- Darknets Talk: http://www.irongeek.com/i.php?page=videos/darknets-i2p-tor-phreaknic
- I2P http://www.i2p2.de/

# Boot media

Linux:

- Knoppix
  http://www.knoppix.net/
- Ubuntu
  http://www.ubuntu.com/
- Unetbootin
  http://unetbootin.sourceforge.net/

And so many more… Look up the noswap option

Windows:

- Bart PE
  http://www.nu2.nu/pebuilder/
- Ultimate Boot CD for Windows
  http://www.ubcd4win.com/
- WinBuilder
  http://winbuilder.net/

# SELECTIVE FILE REMOVAL AND ENCRYPTION

For those that don’t want to go all the way

# Links to automated selective wiping tools

- Clean After Me
  http://www.nirsoft.net/utils/clean_after_me.html

- CCleaner
  http://www.ccleaner.com/

- And many more….

# Tools for selective file wiping

- DD
  dd if=/dev/zero of=f:\Notes.docx bs=12940 count=1
  I like this Windows version:
  http://www.chrysocome.net/dd
- Sdelete
  http://technet.microsoft.com/en-us/sysinternals/bb897443.aspx
- Eraser
  http://eraser.heidi.ie/
- *nix guys, look into Shred
  http://en.wikipedia.org/wiki/Shred_%28Unix%29

# Just slack and unused space

- Eraser
- Cipher that comes with Windows as a command line EFS tool

  Run once:

  cipher /w:g:

  Schedule script:

  ```
  REM at 2:00 /every:m,t,w,th,f,s,su c:\defragandcipher.bat
  defrag c: /f
  defrag c: /f
  defrag c: /f
  cipher /w:c:\
  ```

# Selective File Encryption

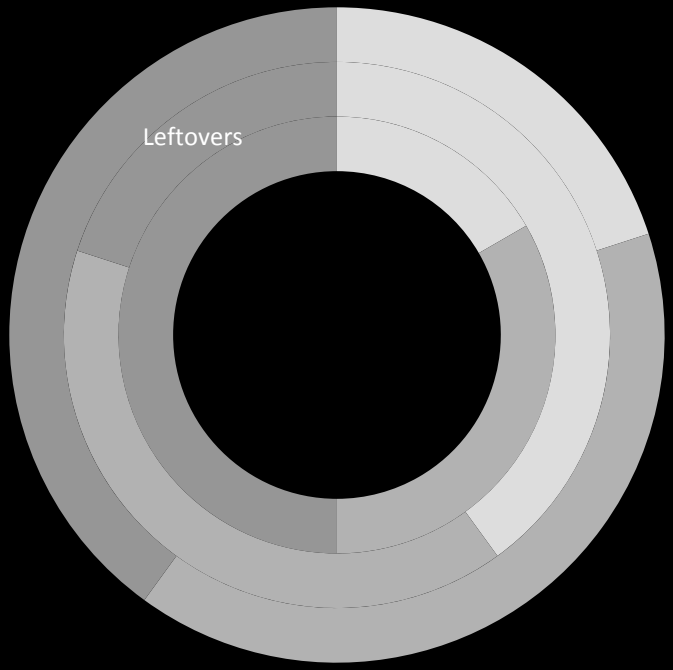
- EFS
  http://en.wikipedia.org/wiki/Encrypting_File_System
  - Hash insertion does not help (Pnordahl)
  - Can read file names
  - Best to use a SYSKEY password or boot key
- TrueCrypt
  http://www.truecrypt.org/
  http://sourceforge.net/projects/tcexplorer/
- FreeOTFE
  http://www.freeotfe.org/
- Good encryption does not compress much

# Reasons why relying on selective file wiping is not a good idea

- Windows jams data in all sorts of places, it's hard to get them all
- You got the main file, but what about the temp?
- Defrag, moving files and abandoned clusters
- USB device logs
- Page and hibernation files
- Data carving ☺

# Defrag issues

- You defrag a drive
- You wipe a file on that drive
- What about the remnants of the file from before the defrag?




# USB device log

- Ah, so the suspect has a camera/thumbdrive/iPod/etc
- USBDeview http://www.nirsoft.net/utils/usb_devices_view.html
- HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\USB
- HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\USBSTOR
- Search for “USBSTOR” in c:\windows\inf\setupapi.dev.log

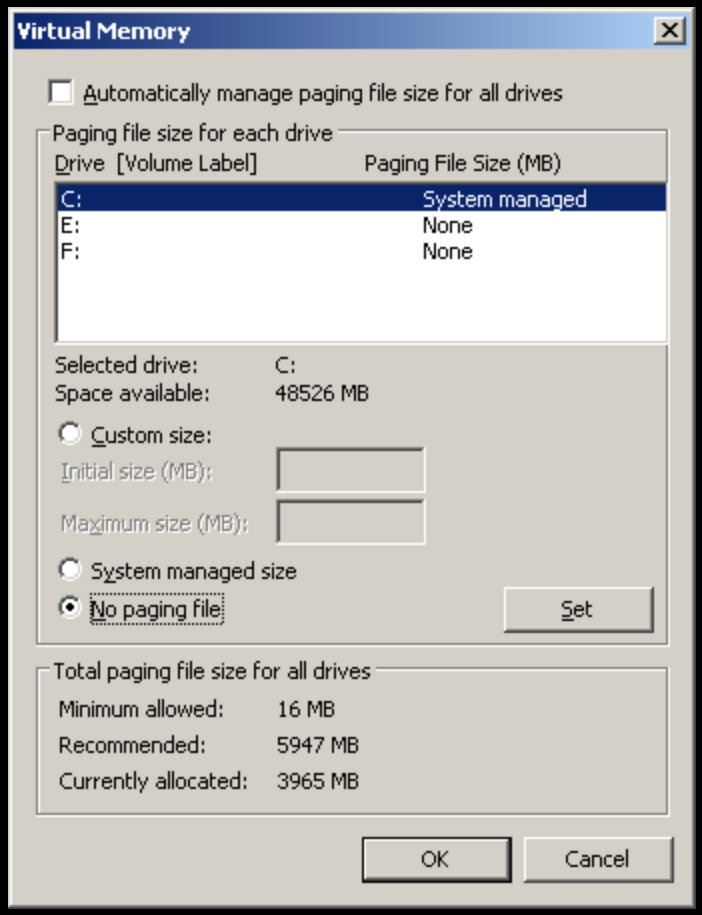
# Page file

- File used for swapping memory: pagefile.sys

- Linux folks, investigate swap space

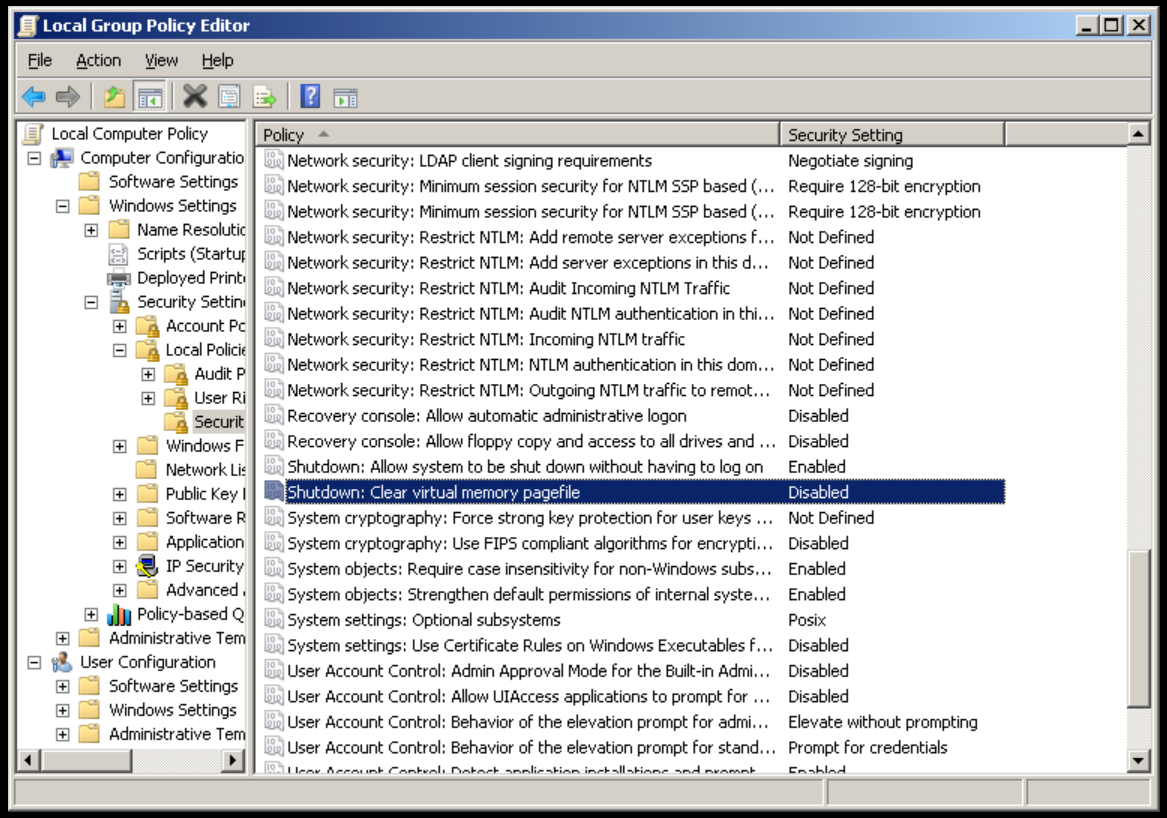
# Disable page file

- Disable:
  Control Panel->System and Security->System->Advanced System Settings->Performance->Advanced->Virtual Memory->Change




# Wipe page file

- Set HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager\Memory Management\ClearPageFileAtShutdown to 1

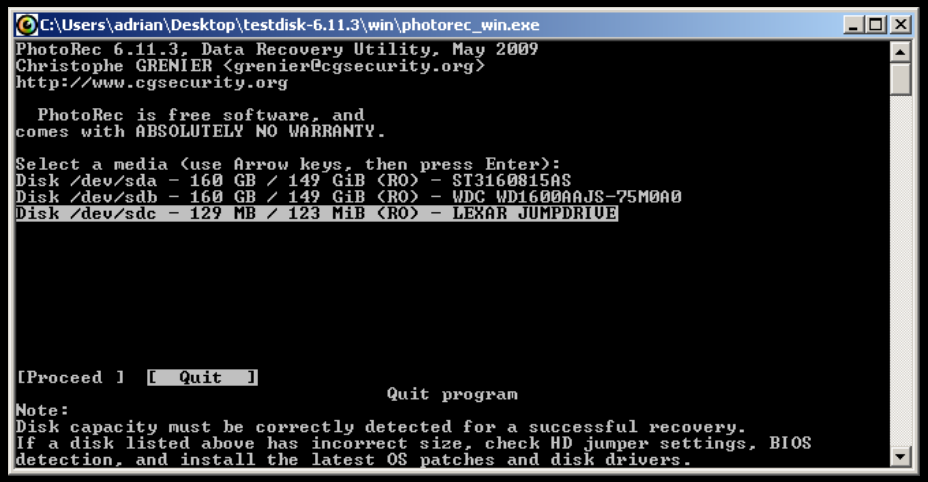



# Hibernation file

- File used for storing active memory when going into hibernation mode:
  hiberfil.sys
  Go into power settings to disable

# Data carving

- Go down the drive bit by bit looking for file headers




- DiskDigger
  http://dmitrybrant.com/diskdigger
- Photorec
  http://www.cgsecurity.org/wiki/PhotoRec
- Other file carving tools
  http://www.forensicswiki.org/wiki/Tools:Data_Recovery#Carving
- File system compression makes file carving far less reliable!

# So, what is writing where?

What needs to be wiped?  What is this tool doing?

- Process Monitor
  http://technet.microsoft.com/en-us/sysinternals/bb896645.aspx
- RegFromApp
  http://www.nirsoft.net/utils/reg_file_from_application.html
- ProcessActivityView
  http://www.nirsoft.net/utils/process_activity_view.html

# PARLOR TRICKS

Maybe useful sometimes, but mostly fluff

# Tool/Solution Kiddies

- Does the examiner understand the concepts, or just the tool?
- Think back to the Julie Amero case
- What is their case load like?


# Timestomp

- Making the chain of events hard to manage
  http://www.metasploit.com/research/projects/antiforensics/

  -m <date> M, set the "last written" time of the file
  -a <date> A, set the "last accessed" time of the file
  -c <date> C, set the "created" time of the file
  -e <date> E, set the "mft entry modified" time of the file
  -z <date> set all four attributes (MACE) of the file
  -v show the UTC (non-local time) MACE values for file
  -b sets the MACE timestamps so that EnCase shows blanks -r does the same recursively , Know as the Craig option

- For setting an arbitrary time recursively:

Command:

for /R c:\users\ %i in (*) do timestomp.exe %i -z "Monday 3/12/2099 10:00:00PM"

# AltDS

- Alternate data streams

type mypr0n.jpg disney.jpg:hide

mspaint disney.jpg:hide

- Hit or miss with file carving
- Practical Guide to Alternative Data Streams in NTFS
  http://www.irongeek.com/i.php?page=security/altds

# Shadow Copy

- Tim Tomes and Mark Baggett Lurking in the Shadows from Hack3rcon II http://www.irongeek.com/i.php?page=videos/hack3rcon2/tim-tomes-and-mark-baggett-lurking-in-the-shadows
- vssown.vbs
- Not sure how long a file will stick around

# Steganography

(Hiding stuff in stuff so people don't find your stuff)

- **With encryption, most times people know that some data is there, just not what it is.**
- **With Stego, they hopefully will not even know it's there.**
- **http://www.irongeek.com/i.php?page=videos/steganography-intro**

# Steganography
## (Tacked on)

- Since jpegs care about what is in the first part of a file, and zips care about what is at the end, you can try the following:

- copy /B image.jpg+putty.zip test.jpg

- Please note, not all jpeg viewers will accept the file.

# Steganography
## (Insertion)

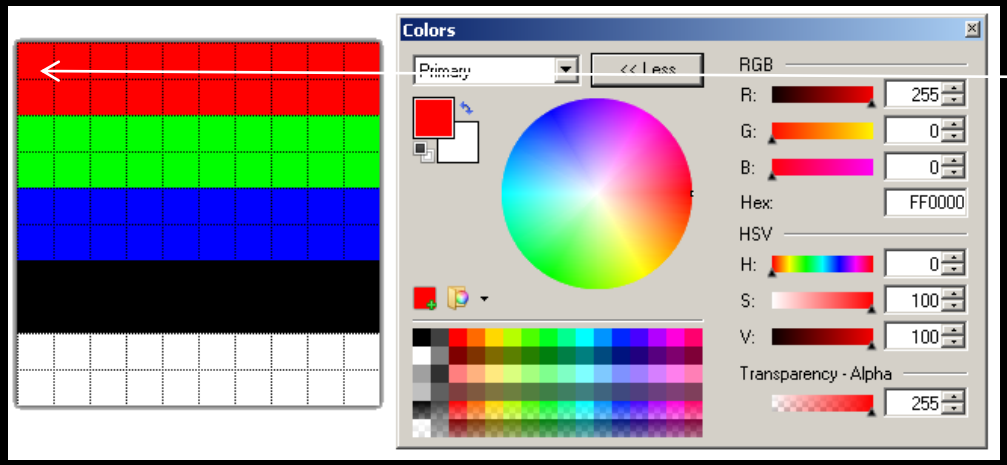
- Example: Putting a file inside of a DOCX, it's just a ZIP file with some XML, just add your inserted file name into [Content_Types].xml so the DOCX does not report as corrupted. Or use my code at:

  http://www.irongeek.com/i.php?page=security/ms-office-stego-code

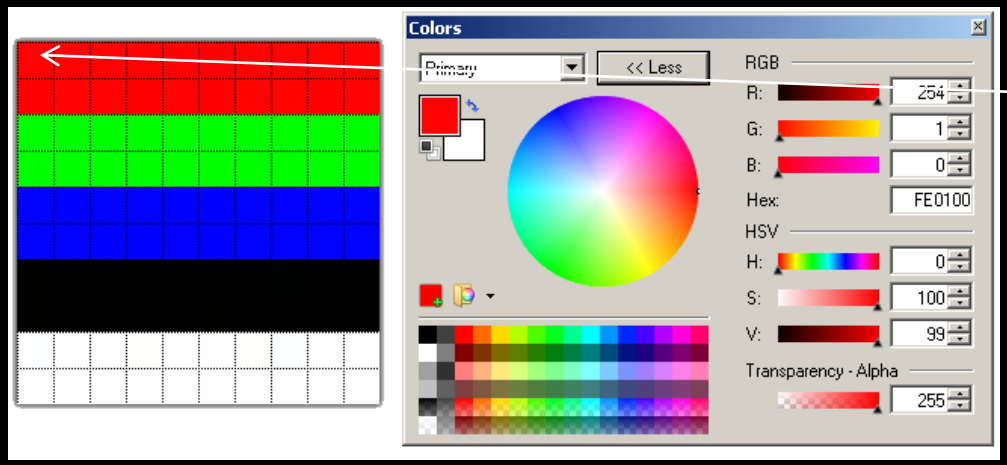
# Steganography

## (Additive)

- LSB (Least Significant Bit), for example making imperceptible changes to a format that can take loss and still be useful (audio, images, video).
- http://www.irongeek.com/i.php?page=security/unicode-and-lsb-stego-code




Original




Same file with “I should be able to hold 37 bytes!!!” encoded

# Lemonwipe
# (rude and crude)

Not recommended from a legal standpoint, but funny.

Repeat script to feed into DD:

```
@Echo Off
:TOP
type %1
Goto TOP
```

Command:

```
repeat.bat adrianbeer.jpg | dd of=\\.\f:
```

Create one big file:

```
@Echo Off
:TOP
type %1 >>%2\%1
if not %errorlevel%==0 goto :error
Goto TOP
:error
echo Exiting and deleting %2\%1
del %2\%1
exit /B -1
```

Command:

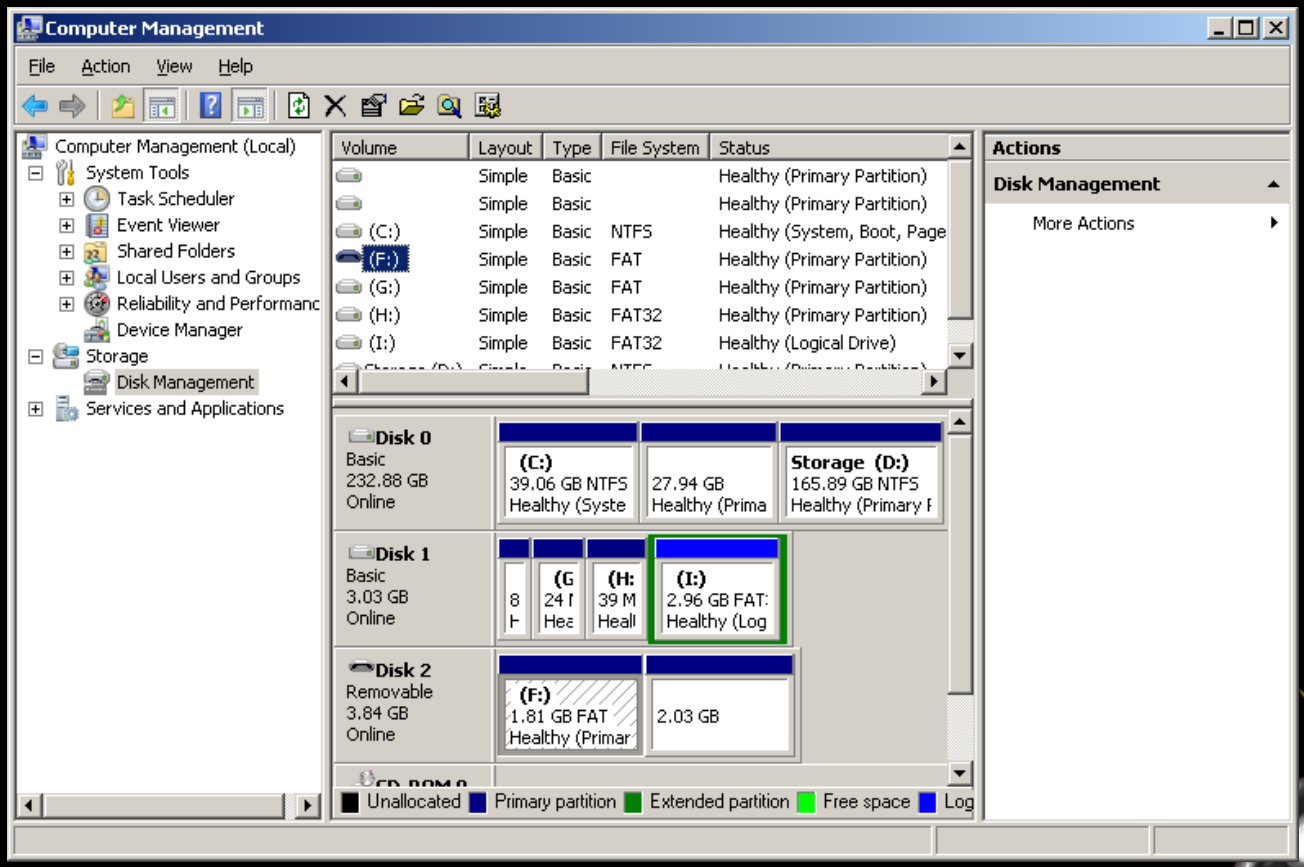
```
Smack.bat image.jpg f:
```

# Booby Trapped Device?

- Programmable HID USB Keyboard/Mouse Dongle PHUKD http://www.irongeek.com/i.php?page=security/programmable-hid-usb-keystroke-dongle

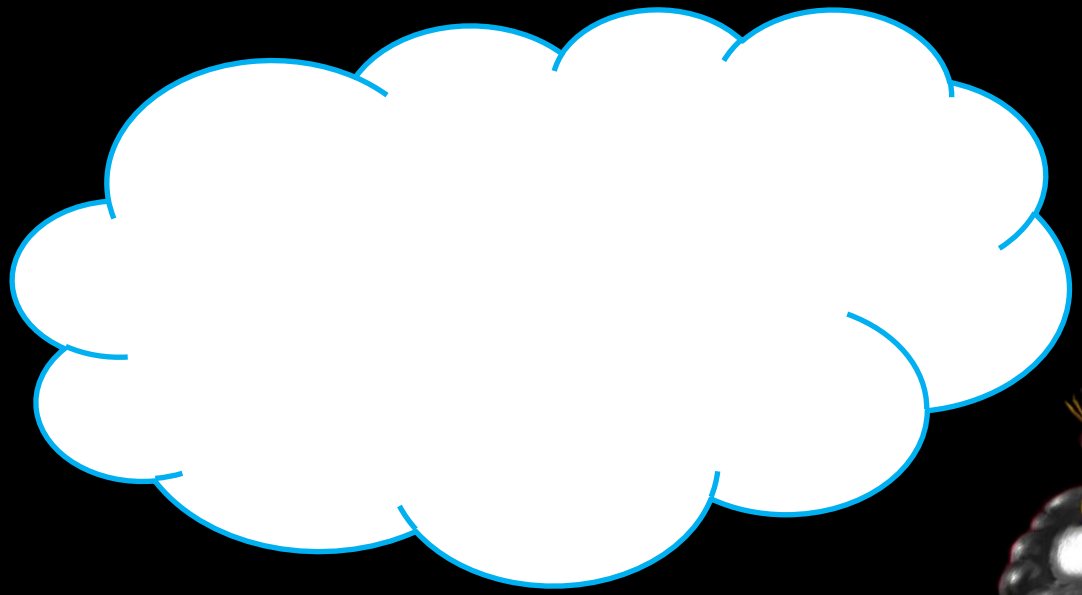
# Two partitions on a thumbdrive

- Two partitions on a thumb drive? Windows sees one.



# Cloud Computing?

- Use the browser's privacy mode, and SSL
- If it's not on the drive, they can't find it on the drive
- Less 4th amendment protection?
- Find a country that does not play nice with US law enforcement



# Attack the forensic software?

- XSS, not just for web forms anymore
  http://www.irongeek.com/i.php?page=security/xss-sql-and-command-inject-vectors

- Breaking Forensics Software: Weaknesses in Critical Evidence Collection (Encase and Sleuth Kit)
  ISEC Partners presentation at Defcon 15
  http://www.defcon.org/html/links/dc-archives/dc-15-archive.html#Palmer

- 42.zip = 4.5 PetaBytes
  http://www.unforgettable.dk/
  http://en.wikipedia.org/wiki/Zip_bomb

- Two comments on these attacks:
  1. If the examiner sees the data attacking him, they will know something is up.
  2. Do you really think it's a good idea to piss off the forensic examiner?

# Thermite

- http://hackaday.com/2008/09/16/how-to-thermite-based-hard-drive-anti-forensic-destruction/
- Uhm, just no.
- Destruction of evidence charges
- Fire hazard
- Just use full drive encryption
- While we are on that topic: http://www.youtube.com/watch?v=Bv5LHamqAsI

# NUKE IT FROM ORBIT

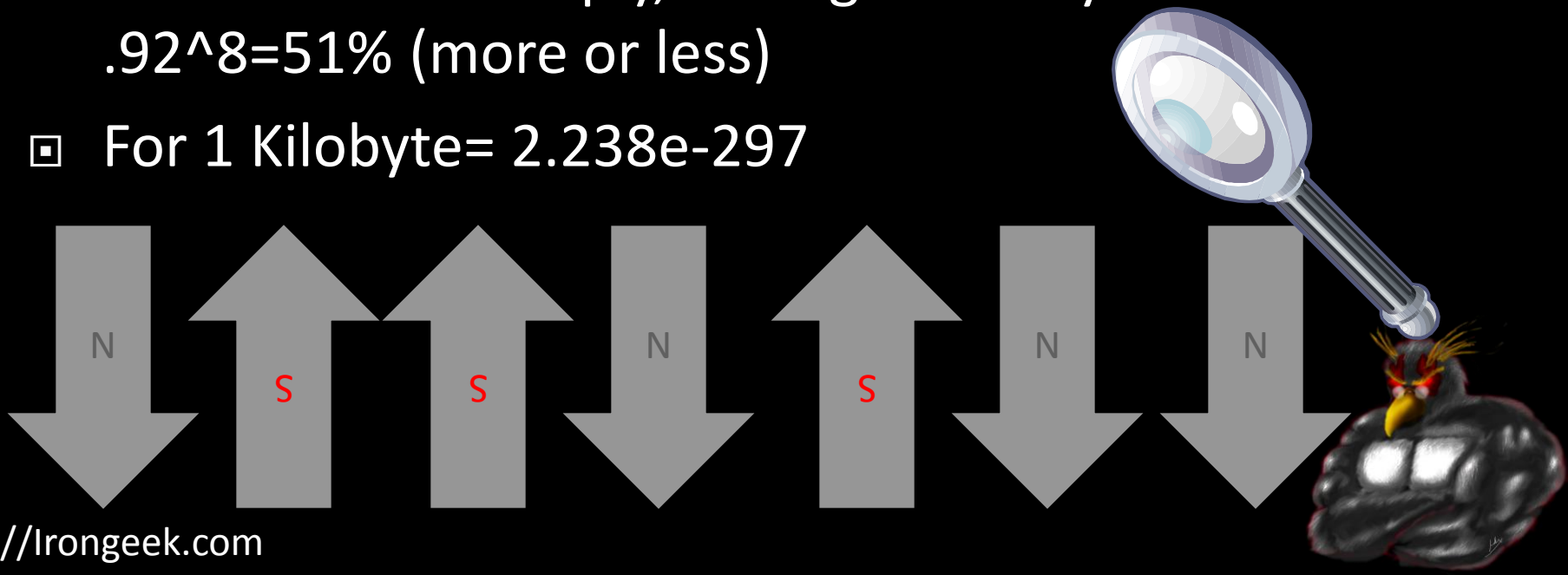
It’s the only way to be sure

# Wipe Tools

- DD
  dd if=/dev/zero of=\\.\f: --progress bs=1M
  dd if=/dev/zero of=\\.\Volume{de891b6a-8432-11de-86d4-005056c00008} bs=1M –progress
- DBAN
  http://www.dban.org/
- HDD Wipe Tool
  http://hddguru.com/content/en/software/2006.04.13-HDD-Wipe-Tool/

# One wipe?

- Magnetic Force Microscopy
  http://sansforensics.wordpress.com/2009/01/15/overwriting-hard-drive-data/
- On a pristine modern drive 92% chance to recover the correct previous bit , 56% on a used drive
- Probabilities multiply, so to get one byte: .92^8=51% (more or less)
- For 1 Kilobyte= 2.238e-297



# Enhanced Secure Erase

Not only is it faster, but it can wipe remapped blocks (bad sectors) from the G-LIST

- HDParm
  http://ata.wiki.kernel.org/index.php/ATA_Secure_Erase
- MHDD
  http://hddguru.com/content/en/software/2005.10.02-MHDD/
  http://hddguru.com/content/en/software/2006.02.10-Magic-Boot-Disk/
- HDDErase
  http://cmrr.ucsd.edu/people/Hughes/SecureErase.shtml

# Full System Drive Encryption

- BitLocker
  http://www.microsoft.com/windows/windows-vista/features/bitlocker.aspx
  - Built in to Windows Vista/7
  - AES CBC
  - Pain to setup in Vista
  - Look into Bitlocker To Go to secure your USB drive
  - To enable Bitlocker without TPM in Win 7, gpedit.msc > Computer Configuration > Administrative Templates > Windows Components > BitLocker Drive Encryption > Operating System Drives > Require Additional Authentication at Startup > Enable
  - Bitlocker Modes:
    TPM only
    TPM + PIN
    TPM + PIN + USB Key
    TPM + USB Key
    USB Key

- TrueCrypt
  http://www.truecrypt.org/
  - Open source
    (for review of a lot of eyes)
  - Read from other platforms
  - Works on XP
  - More cipher options
  - Uses XTS which is better than CBC, but ask a cryptographer why

- Also, look into hardware based options
  http://www.enovatech.net/

http://Irongeek.com

Thanks Doubleback for the Win 7 without TPM info

# How about running a VM form an encrypted volume?

- Easy to do
- I have some concern about data leaking into swap/ page file. This needs more testing.
- A few suggested tweaks:

  MemAllowAutoScaleDown = "FALSE"
  mainMem.useNamedFile = "FALSE“

- Use some of the page file wiping techniques mentioned before



Thanks to Nicholas for some input on this

# Other tools

- Deft Linux
  http://www.deftlinux.net/
- FTK Imager
  http://www.accessdata.com/downloads.html
- WinHex
  http://www.x-ways.net/winhex/

# How do I know someone had ran anti-forensics software on a computer?

- No 100% positive way
- Look for files names I mentioned in this presentation
- Leftovers from the tool, for example: HKCU\Software\Sysinternals\SDelete\EulaAccepted
- I need to work on some tools to do this sort of detection…
- Look at the drive for large sections of all zeros/random bytes, but this could be for other reasons (Vista & < after full format, Solid-state Drives)
- Hash search of know anti-forensics tools
  HashMyFiles
  http://www.nirsoft.net/utils/hash_my_files.html

# Change the hash of the file ☺

- If it's just the hash, change a few bytes, preferably in strings
- Compile from source if you have it
- Use a packer
  UPX
  http://upx.sourceforge.net/
  http://sourceforge.net/projects/upxer/files/
- Shikata Gai Nai from Metasploit
  http://www.metasploit.com

# Thanks

- Scott Moulton http://www.myharddrivedied.com/
- Tyler “Trip” Pitchford
- Folks at ISD and Pauldotcom podcasts

# Events

DERBYCON

Sept 27th-30th 2012

http://www.derbycon.com


Derbycon Art Credits to DigiP

Photo Credits to KC (devauto)

## Others

http://www.louisvilleinfosec.com
http://skydogcon.com
http://hack3rcon.org

http://outerz0ne.org
http://phreaknic.info
http://notacon.org

http://Irongeek.com

# QUESTIONS?

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