How to Make an Old Computer Useful Again

Howard Fosdick

(C) 2018
Who am I?

* Independent Consultant (DBA, SA)
* Refurbishing for charity is a hobby
* Talked on this 12 years ago

OMG! What'd I do this time?
Why Refurb?

+ Charity

+ Fun

+ Environment
Agenda

I. Why Refurb?
II. How to – Hardware
III. How to – Software
Refurbish = Reuse

OR

Recycle = Destroy
What I Do

Individuals

Small Organizations

Recyclers

I fix it

Individuals or Small Groups

FreeGeek
People Trash Good Hardware... Because of Software

-- Windows slows down
-- People don't know to tune it
-- Perceive their system is obsolete
-- Like a disposable razor blade
-- Vendors like this

Friggin' computer!
...too slow...
It's outta here!

I'm still on Win 7. I better toss it!

10 2015
8.1 2013
8 2012
7 2009
Vista 2007
How Long Should a Computer Last?

> Depends on use
> Laptops vs Desktops

Consensus is 3 to 5 years

Treat it like a car --
+ Regular maintenance (tune ups)
+ Replace parts
+ Run age-appropriate software (Linux)

-> Any dual-core is still useful

Windows is excellent for many roles.
Refurbishing is not one of them.
Vendor Incentives

-- Would you rather sell to a customer every 3 years, or every 9 years?

-- Financial incentive to recycle... not refurbish

+ Incentives against pollution

Vendors prefer this:
Dirty Recycling
--- vs ---
Environmental Recycling

-- 80% is not Environmentally Recycled...
though companies tell you it is!

-- Scandal exposed by 60 Minutes, Time, others
II. How To – Hardware

-> I can make no assumptions about hardware or users
How to Refurbish

1. Clean it
   - Ground yourself
   - Compressed air

2. Identify hardware
   - Write it down

3. Verify hardware

4. Size & install software

5. Verify
# 2. Identify Hardware

<table>
<thead>
<tr>
<th>Query:</th>
<th>Line Command:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display all info about hardware</td>
<td>inxi -Fx or hwinfo --short or lshw</td>
</tr>
<tr>
<td>Display all CPU info</td>
<td>lscpu or lshw -C cpu</td>
</tr>
<tr>
<td>Display CPU features (eg, PAE, SSE2)</td>
<td>lshw -C cpu</td>
</tr>
<tr>
<td>Is CPU 32- or 64- bit?</td>
<td>lshw -C cpu</td>
</tr>
<tr>
<td>Display BIOS/UEFI info</td>
<td>dmidecode -t bios -q</td>
</tr>
<tr>
<td>Current memory size and configuration?</td>
<td>dmidecode -t memory</td>
</tr>
<tr>
<td>Maximum memory for this hardware?</td>
<td>dmidecode -t memory</td>
</tr>
<tr>
<td>Are memory slot available? (null answer means NO)</td>
<td>lshw -short -C memory</td>
</tr>
<tr>
<td>Show current memory use</td>
<td>free -m or top</td>
</tr>
<tr>
<td>Determine amount of video memory</td>
<td>lspci</td>
</tr>
<tr>
<td>Show kernel version, is it 64-bit, network host name</td>
<td>uname -v</td>
</tr>
<tr>
<td>List disk drives</td>
<td>lshw -short -C disk</td>
</tr>
<tr>
<td>List disks and partitions info</td>
<td>lsblk (simple) or fdisk -l (detailed)</td>
</tr>
<tr>
<td>List mounted filesystems, space used &amp; available</td>
<td>df -m</td>
</tr>
<tr>
<td>List partition ids (UUIDs)</td>
<td>blkid</td>
</tr>
<tr>
<td>List USB devices</td>
<td>lsusb</td>
</tr>
<tr>
<td>List PCI devices</td>
<td>lspci</td>
</tr>
</tbody>
</table>

--- **GUI Tools ---**

Bios/Uefi panels, I-Nex, hardinfo, lshw-gtk, kinfocenter
3. Verify Hardware

1. Memory
2. Disk
3. Mobo
4. Peripherals (DVD, USB ports, etc)

* Bios/Uefi diagnostics
* Hirens Boot CD, Ultimate Boot CD (UBCD)

> Minimize this step at your peril!
The Most Common Problems --

1. Dirt
2. Capacitor
3. Corroded USB ports
4. Sticky DVD
5. Disk
6. Hot laptop

“Quick Guide to Fixing Hardware”

www.osnews.com/story/26650/Quick_Guide_to_Fixing_Hardware
3. Verify Hardware -- Disks

* MTBF misleads, AFR better
* Backblaze.com stats
* Run all SMART tests
* GUIs -> gnome-disks, GSmartControl
* 0 bad sectors
* Thumb drive backup

SMART Data & Self-Tests

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Normalized</th>
<th>Threshold</th>
<th>Worst</th>
<th>Type</th>
<th>Updates</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Error Rate</td>
<td>0</td>
<td>200</td>
<td>51</td>
<td>200</td>
<td>Pre-Fail</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Spinup Time</td>
<td>5 seconds</td>
<td>193</td>
<td>21</td>
<td>188</td>
<td>Pre-Fail</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Start/Stop Count</td>
<td>400</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Reallocated Sector Count</td>
<td>0 sectors</td>
<td>200</td>
<td>140</td>
<td>200</td>
<td>Pre-Fail</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Seek Error Rate</td>
<td>0</td>
<td>200</td>
<td>51</td>
<td>200</td>
<td>Pre-Fail</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Power-On Hours</td>
<td>3 years, 3 months and 6 days</td>
<td>61</td>
<td>0</td>
<td>61</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Spinup Retry Count</td>
<td>0</td>
<td>100</td>
<td>51</td>
<td>100</td>
<td>Pre-Fail</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Calibration Retry Count</td>
<td>0</td>
<td>100</td>
<td>51</td>
<td>100</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Power Cycle Count</td>
<td>395</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Airflow Temperature</td>
<td>39°C/102°F</td>
<td>61</td>
<td>45</td>
<td>45</td>
<td>Old-Age</td>
<td>Online</td>
<td>Failed in the past</td>
</tr>
<tr>
<td>Temperature</td>
<td>39°C/102°F</td>
<td>111</td>
<td>0</td>
<td>95</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
<tr>
<td>Reallocation Count</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>200</td>
<td>Old-Age</td>
<td>Online</td>
<td>OK</td>
</tr>
</tbody>
</table>

gnome-disks: smartctl output
3. Verify Hardware – Laptop Temperature

* Clean it
* Check vents, fans

Then final stress test with –

* Package -> lm_sensors
* GUI -> Psensor or XSensors

Courtesy: MakeUseOf.com
3. Verify Hardware – Laptop Temperature

Psensor

X Sensors

Fan Overload
4. Sizing the Software –

Proxy for Your Computer's Power

1. Processor (# cores, speed)
2. Memory
3. Video Memory
4. Sizing the Software –
Which Era is your PC?

Look up your CPU at www.CpuBenchmark.net

Single Core Era
- XP (2000)
- Vista, 7 (2006)
- 2500

Dual Core Era
- Vista, 7 (2008)
- 2500

Multi Core Era
- 7, 8, 8.1, 10 (2012)
- Today

Memory Evolution

- **DDR**
  - 2000
  - Single Core

- **DDR2**
  - 2003
  - Dual Core

- **DDR3**
  - 2007
  - Multi Core
  - 2014

- **DDR4**
  - Today

Photo Credits:
- DDR3 By Kjerish - Own work, Wikipedia
- SO-DIMM3 by Kingston Technology
III. How to – Software

> Sizing software to the box is critical!
Keep Windows?

I securely erase then install Linux

1. Refurbish existing install

2. Reformat & reinstall
   - Only reformat guarantees no malware (except Lenovo)
   - Reinstall requires code and keys for:
     1. Windows
     2. Apps
     3. Drivers

3. Reformat & install new Windows version – verify 1st!

<table>
<thead>
<tr>
<th>Version</th>
<th>Support Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Xsupport ends 01/14/25</td>
</tr>
<tr>
<td>8.1</td>
<td>Xsupport ends 01/10/23</td>
</tr>
<tr>
<td>8</td>
<td>You <strong>must</strong> upgrade to 8.1</td>
</tr>
<tr>
<td>7 SP1</td>
<td>Xsupport ends 01/14/20</td>
</tr>
<tr>
<td>Vista</td>
<td><strong>Out of Support</strong></td>
</tr>
<tr>
<td>XP</td>
<td><strong>Out of Support</strong></td>
</tr>
</tbody>
</table>

Courtesy: Microsoft (TM)
How to Refurbish Windows

1. Eliminate malware
   www.pcworld.com/article/243818/security/how-to-remove-malware-from-your-windows-pc.html

2. Reclaim wasted disk space
   www.howtogeek.com/125923/7-ways-to-free-up-hard-disk-space-on-windows/

3. Uninstall unneeded programs
   http://support.microsoft.com/en-us/help/2601726

4. Prune the Start-up List
   www.howtogeek.com/74523/how-to-disable-startup-programs-in-windows/

5. Disable unneeded Services
   www.marksanborn.net/howto/turn-off-unnecessary-windows-services/

6. Encrypt your data

Takes a day or two!
# How to Securely Erase a Drive

<table>
<thead>
<tr>
<th>SSD</th>
<th>Wear Leveling:</th>
<th>If ATA Secure Erase Fails:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ ATA <em>Trim</em></td>
<td>+ DBAN / Nwipe @1 pass</td>
</tr>
<tr>
<td></td>
<td>+ ATA <em>Secure Erase</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ PC Disk Eraser</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ HDDErase</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Manufacturer's tools</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HD</th>
<th>Residual Magnetism:</th>
<th>Hard Remapped Sectors:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ DBAN / Nwipe</td>
<td>+ ATA <em>Secure Erase</em></td>
</tr>
<tr>
<td></td>
<td>+ DD or CAT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Encryption</td>
<td></td>
</tr>
</tbody>
</table>

**Tools:** ATA *Secure Erase* and *Trim* reside in disk firmware
UltimateBootCD.com & the disk manufacturer’s website

*Prior encryption of partition is the best method!*
Secure Erasure – Resources

1. “The Truth About How to Securely Erase SSDs”
   http://skrilnetz.net/the-truth-about-how-to-securely-erase-a-solid-state-drive-ssd/

2. “Reliably Erasing Data from Flash-based SSDs”

3. “How Long Do SSDs Really Last?”
   www.howtogeek.com/322856/how-long-do-solid-state-drives-really-last/

4. “Securely Erase a Hard Drive: DBAN May Not be Enough”

5. “Are We Completely Wiping that Hard Drive?”
   www.technibble.com/are-we-completely-wiping-that-hard-disk/

6. “Wiki Description: ATA Secure Erase”
   http://ata.wiki.kernel.org/index.php/ATA_Secure_Erase

Visit manufacturer's website!
Why Linux?

+ Supports hardware Windows no longer does
+ Distros specifically for old hardware
+ Malware-resistant (AV software slows performance)
+ Cost-free, doesn't slow w/ use
+ Installs with apps, thousands more for free download
+ No complicated licensing and activation
+ Doesn't bind to hardware (as Windows does via Registry)
+ Clone, copy, or move Linux & apps across partitions, disks, devices, and computers
+ Runs Windows programs
+ Linux Updates are reliable
+ Linux functions longer without rebooting
Which Linux?

- **Single Core Era**
  - XP 2000
  - Vista, 7 2006

- **Dual Core Era**
  - Vista, 7 2008
  - 2500

- **Multi Core Era**
  - 7, 8, 8.1, 10 2012

**Ultra-Light Distro**
- Puppy, antiX, TinyCore

**Lightweight Distro**
- Mint/Xfce, Xubuntu, Lubuntu

**Any Distro**
- Today

- 1000
- 2500
Which Distro?

> Depends on your needs!

Test with:

1. *Live OS* (eg, Unetbootin)

2. *Virtual Machines* – great for testing
   -- not for judging performance
Distro Criteria

+ User-friendly
+ Light apps
+ Big repository
+ Track record
+ Large user community & active forum
+ Stability -- LTS (not rolling releases)
+ Reliability not cutting edge features
+ Easy configuration (GUI not text files)
**Dual Core ➔ Lightweight Distros**

- **2 gig ram !**

+ Light DE (Xfce, LXDE, LXQt)
+ Simple menu interface  
  + no fancy GUI
+ Light Apps
+ Can do anything a current machine can:  
  + Surfing, social media, email, office, VOIP, Youtube, Ebay…

- It can’t do:
  -- VMs, emulators  
  -- High-end graphics, SOA games

-- Concurrency is lesser:
  -- Fast browser (Chromium, FF Quantum, Opera)  
  -- Block ads, trackers! (VPN may help)  
  -- Stop default run of flash, videos
– Trim app auto-start

--> 2 Firefox profiles (1 for speed, 1 for access)
+ Fulfills my criteria
+ Simple menu interface (no glitz)
Example – at Idle

EMachinesT5274
2008 / Vista

E2180 @ 2.0 ghz
1,087 passmark
3 G ram
256 M vram
Example – at Work

Running -->

+ FF (2 tabs open)
+ LOffice Impress
+ Hardware Info
+ Terminal
+ System Monitor
Want Virtual Machines?

Early Multi Core (2012 / Win 7)
Lenovo Thinkpad x220

i5-2520M 2x2 @ 2.5 ghz
3,584 passmark
12 G ram
Won’t Boot? Try this...

1. Boot messages (*splash, quiet*)
2. Kernel parms (*acpi=off or acpi=force, noapic, nomodeset, pci...*)
3. Update BIOS
4. Older kernel
5. Change Boot Loader
6. Change X Display Server

ACPI = Power Management (startup, shutdown, sleep states)

APIC = Interrupt Controller (IRQ sharing & remapping)

To change kernel parms, edit `/boot/grub/grub.conf`

At Grub menu --> **ESC**, then **E** for Edit, **F10** when done
Single-core → UltraLight Distros

-> 1 gig ram !
-> Add video card (AGP, PCI, or PCI-Express with VGA or DVI)

-> Verify your distro runs on OLD computers (not LIMITED ones)

-- Window Managers, not DE's (JWM, Fluxbox...)

+ Simple menu interface
  -- must change code to change it

+ Light apps (eg, GNOME Office not LibreOffice)

-- Web surfing is challenged by growing websites

-- Watch for outdated browsers

-- You must manage concurrency !
  -- Fast browser (Chromium, FF Quantum, Opera)
  -- Specialized browser (Dooble, Dillo...)
  -- Block ads, trackers! (VPN may help)
  -- Stop auto run of flash, videos
  -- Toggle JavaScript on/off
  -- Manage background processing
  -- Limit app auto-start list, open apps
Why are Webpages Slow?

**Average Web Page Weight**

Source: Yottaa.com

**Average Page Load Time**

With vs. Without Trackers

<table>
<thead>
<tr>
<th>No trackers blocked</th>
<th>19.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>All trackers blocked</td>
<td>8.6</td>
</tr>
</tbody>
</table>

More than 2x slower when no trackers blocked.

Average page load time (seconds) measured by Ghostery, of the top 500 US domains according to Alexa.

Source: Ghostery Study
Ultralight Example -> Retro Games Box

- Dedicated kids' computer
  - Pentium 4
    (3.2ghz, 2g, 40g, 256m vram)
  - antiX Full
  - WINE, Dosbox
- Strategy, logic, board, dice, card, educational games, puzzles, old action games

Linux, XP, 98/95, 3.1, DOS games
Everyone runs Puppy!

+ Older computers
+ Fast!
+ Big user community (lots of help)
+ Complete desktop
+ Ubuntu or Slackware Repository

Puppy was my choice for years...

Then PCs became more powerful.

- Expert install & configure
- Inflexible desktop
- Effort to get into Puppy World
+ Easier to get into than Puppy
+ Same benefits & shortcomings
+ Complete desktop
Free Book!

Tiny Core

- Different philosophy
- Build up from kernel
+ Great for learning
+ Great for dedicated box
-- Not a complete desktop
How to Run Windows Apps

1. Equivalent apps:
   http://alternativeto.net/
   http://wiki.linuxquestions.org/wiki/Linux_software_equivalent_to_Windows_software

2. VirtualBox

3. WINE
   + Look up app in WINE database
   + WINE is efficient (not an emulator)

   + WineTools
   + PlayOnLinux
Example – Word Compatibility

+ Created novel in html
+ Publisher requires either 1 doc or docx file –or-- 1 Pdf file

1. html
   open
   1 file / chapter

2. LibreOffice
   1 doc or docx file
   insert object from text file
   doc or docx files
   save as
   1 Master Document
   create

3. pdf files
   export
   pdftk
   1 pdf file
FreeGeekChicago.org

+ Donate PCs
+ Refurbish
+ Teach a class
## Recommended Refurbishers / Recyclers

- All operations in USA
- Meet all environmental & safety standards

<table>
<thead>
<tr>
<th>Refurbisher/Recycler</th>
<th>Website/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Geek</td>
<td>FreeGeekChicago.org on Diversey</td>
</tr>
<tr>
<td>SWANCC</td>
<td>SWANCC.org various locations</td>
</tr>
<tr>
<td>COM2</td>
<td>COM2recycling.com Carol Stream (Store in Lombard)</td>
</tr>
</tbody>
</table>
An Ode to Chopper
– In gratitude to a loyal Pentium D

I took you from the trash when no one wanted you, and nursed you back to health. You were thankful and said I need not work by stealth.

Before you said they didn't care about you, all they did was use you. But I cleaned you out, and never again did you pout.

You ran fast! (for an old machine) And did your work! (and I always kept you clean)

Chopper, Chopper, where did you go? Nothing left now, nothing left to know

You waved goodbye with a blinking yellow light and though it didn't seem right I knew you had to leave, as we all must, one sad April night.

Love,
Howard
IV. Questions ?
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* Photo of junked computers courtesy of eWaste Direct in Livermore, CA taken from their posting at Yelp at www.yelp.com/biz/ewaste-direct-livermore
* Clipart of man pondering from Clipart@Toonday at http://vecto.rs/design/vector-of-a-cartoon-man-pondering-coloring-page-outline-by-toonaday-22769
* Clipart of nice desktop computer by AJ from openclipart.org - http://openclipart.org/detail/17924/computer
* Crusher photo from Wikipedia credited as By Ana 2016 - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=51670248
* “Protect the Environment slide” -- Photo of shipping containers by Wikipedia (uncredited)
* People on junk pile from AP Photo posted at scmp.com
* Photo of the acid bath is from Basel Action Network at www.BAN.org posted by them on Wikipedia
* Junk ewaste photo by http://newhopecommodities.com/home/e-waste/
* Photo of landfill from Wikipedia, By Cezary p [GFDL (http://www.gnu.org/copyleft/fdl.html) or CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0)], from Wikimedia Commons
* Photo of dirty computer courtesy of www.acidcow.com
* Photo of bad capacitor from www.forum.lowyat.net
* Photo of memory slots and good capacitors from unixmen.com
* Cartoons courtesy of Clipartmansion.com, they took them from – topmost cartoon from tempo11.blogspot.com, bottom cartoon from thesmartech.com
* Photo of burning laptop courtesy of MakeUseOf at www.makeuseof.com/tag/macbook-air-overheating-5-things-can/
* Psensor output courtesy of unixmen.com, Xsensors screensnap
* Fan photo courtesy of Cooler Master
* Photo of DDR3 memory is from Wikipedia credited as by Kjerish - Own work, Wikipedia
* SO-DIMM memory from Kingston Technology website at www.Kingston.com
* “Keep Windows” logos are from various websites, all appear courtesy of Microsoft. The 1st is a registered TM of Microsoft. Thank you Microsoft for use of these.
* Illustration of hammering a laptop by Doug Griswold/Bay Area News Group, from Denver Post, 7/29/13
* Hitting disk with wrench by www.technibble.com/are-we-completely-wiping-that-hard-disk/
* Photo of the inside of a computer is from Wikipedia and credited as By Own work, GFDL 1.2, https://commons.wikimedia.org/w/index.php?curid=9088826
* Photos of e5274 and Lenovo x220 courtesy of Amazon (sales photos)
* Boot courtesy of Xatworld.com
* Line drawing of female boxers by Jun Li, posted at Youtube at www.youtube.com/watch?v=IQRZvSkBWWo
* Chart of webpage sizes courtesy of SpeedCurve.com, Chart of tracker overhead courtesy of Ghostery and their study “Tracking Tax” at Ghostery.com
* Chart of webpage composition courtesy of Yottaa.com
* Linux Mint logo from Wikipedia and credited as By Clement Lefebvre - The logo has been taken from an official website for the operating system, http://linuxmint-art.org/content/show.php/Official+logos+(white+background)?content=123381Cropped from File:123381-mint-logo-white-bg1.svg CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=10201366
* Linux mint w/Xfce sample screen from http://livescreenshot.netsons.org/linux-mint-16-xfce/
* Puppy Linux screen courtesy of Puppy Linux
* antiX logo taken from the antiX official website at antixlinux.com
* TinyCore linux logo is from Wikipedia and credited as By The original uploader was Nickispeaki at English Wikipedia -