Computers of Hope | Tools, Parts and General Guidelines

# Introduction

This purpose of this document is to highlight the recommended tools and procedure/precautions to be employed during the Computers of Hope Repair event occurring on the 22nd of February. As with any project, using the proper tools for the job gives the best possible results, and often makes the job less strenuous and allows the job to be completed in a more timely fashion. This is especially important, as there will only be a limited time for participants to finish repairing the computer systems on the day (event is scheduled to run from 9:00 AM to 3:00 PM, allowing participants time for lunch of an hour gives them 5 hours of working time). This document is also important in that it describes tools and practices of an International Standard, helping to prepare the participants to perform at a level comparable to others on the global stage.

# Corporeal (Hardware) Tools

Obviously, this refers to the actual physical tools involved in disassembly and reassembly of the computer systems. The most important tool that can be used in this segment is your hands. Jokes aside, your hands have to reach into tight spaces, manipulate most of the other tools that you will use, etc. If you’ve ever worked with Legos, especially Bionicle or Technic kits, then you would likely already have the appropriate hand strength and dexterity to work on computers. The following is a list of other tools that would be used (not all are necessary):

1. Screwdrivers: This is quite an extensive category, because there are so many types of screws used in computers (and electronics in general). For Desktop Computers, most screws used in a standard build are cut for a Phillips Head screwdriver, namely a #0 or a #1 Driver, with the #1 being used more often. A Flat-Head Screwdriver may also prove useful in certain scenarios, so it’s a good idea to also have a pair of 1/8” and 3/16” drivers. Laptops generally use the smaller screws that the #0 should handle, but there may be even smaller ones in use that a precision screwdriver kit would stock. You will find that for both desktops and laptops, you sometimes encounter screws that have a peculiar head shaped like a six pointed star. This type of screw is known as a Torx. Computers that use Torx generally employ a T15 or T10. Other types of screws used on proprietary computer such as a MacBook may include Tri-Wing or Pentalobe, sometimes Tri-Point screws are used as well. The last type of screw that one may encounter in these systems would be a hex socket screw, otherwise known as an Allen screw, which the so-named Allen Key/ Allen Wrench is used on; these are often in a wide variety of sizes. NOTE: while it is tempting to use a magnetic screwdriver head for the convenience of holding screws, for PC use, one should never use a magnetic screwdriver head.
2. Socket Drivers: also known as nut drivers, these are similar to screwdrivers but fit around the head of the screw-type object in question. For computers, these are often used to secure motherboard stand-offs, and a 3/16” socket is the correct tool for the job.
3. Leatherman Pliers (Multi-tool): Many of the varying tools listed in this section are included on a Leatherman Pliers, which is always useful to have. A Leatherman (or similar multi-tool) combines a Swiss Army Knife and a pair of combination pliers.
4. Needle-nose Pliers: These pliers have a very long nose (front grip section). A nose size of 4-5” is preferable, as this gives extended reach, as would be needed in circumstances where this type of plier becomes more useful.
5. Tweezers: a pair of metal tweezers that are not too stiff are excellent for use in this case.
6. Parts Retriever: This is a syringe-shaped object, that when pressed down, pushes out three metal prongs. This can be used for holding screws, especially in tight spots, and retrieving parts in general.
7. Flashlight: either a handheld flashlight or a head-mounted unit will work, with things such as lumens output and weight/size determined as preferred by yourself.
8. Thermal Paste Removal Solution: While methylated spirits/rubbing alcohol/isopropyl alcohol (>90% preferred) works passably, the best thermal paste remover continues to be Arcticlean 1&2. Paper Towels or the following cloth can be used in conjunction.
9. Lint-Free Microfiber Cloth: A cloth such as this would be used to carefully wipe certain components such as fans free of dust.
10. ½” or Smaller Soft Paintbrush: used to brush dust off of components in general, suitable for use on almost all parts.
11. Antistatic Wristband and Antistatic Mat: Whilst mostly ignored by the local I.T. community, anti-static wristbands protect valuable components from being reduced to scrap from the simple phenomenon of static electricity. These fit around your wrist, and either have an alligator clip, or attach to an antistatic mat, which also have an alligator clip. The alligator clips (which are clipped to a large piece of metal that assumedly has a connection to the earth) can be removed usually, revealing a bare piece of metal which can be plugged into the ground connection of a wall socket.
12. Electrical Tape: Never know when this could come in handy.
13. Paperclip: This is one of those does it all type tools. Have at least one medium sized paperclip on you.
14. Compressed Air Can: Used to blow off dust from components.

Note that a computer repair toolkit from the likes of Belkin often carries all the essential parts that one would need, even the 10 piece toolkit. For more specialty drivers, consider something like the iFixit Pro Tech Toolkit.

What do you really need for this event though? The only absolutely essential tool is a demagnetized PH#1 screwdriver, but a precision screwdriver kit and a PH#0 are also good to bring. Pick and choose which of the tools you already own, and purchase those that you don’t as long as you can. Such a purchase is not only useful for this event, but also for any future project which you might undertake.

# Parts

Whilst one may assume to see a variety of things such as RAM listed here, this list includes much more commonplace things that are often missing in computer systems of this kind. These items are provided on the day, but descriptions are present here for some useful pre-reading.

* Screws. Oftentimes, computers that need to be repaired are missing screws, mostly due to the errors of poor technicians. Whilst laptops and other proprietary computer devices may use a variety of screws, the standards for computer screws (desktop) are as follows:
  + #6-32 course thread screw. Often found in hex variant, this is used to mount your hard drive, motherboard, GPU, PSU and even the side panel, and thus is the most common screw in a computer. The thumbscrew variant is a higher quality option for mounting your side panel and GPU.
  + Fan Screw. This screw cuts into the fan (threads itself) to achieve retention. Characterized by a flat or button head. If a fan or radiator comes with a particular set of screws then those should be used, otherwise generic “Fan Screws” work fine.
  + M3 Hex. Also M3 round, this is a fine thread screw that mounts only the optical drive and SSDs. These are often mistaken for the #6-32 screws which have more space between each thread in the screw.
* Thermal Paste. While this may not necessarily be missing, it may be either very old, or you may need to remove the cooler from a particular item. Thermal Pastes, and other thermal compounds such as thermal grease and thermal pads, have a specific purpose, which is to ensure that there is no air in-between the cold-plate of the cooler on a chip and the chip itself (both CPUs and GPUs). While the cold-plate and the chip surface are precision milled, there may be fine defects in the surface which are invisible to the human eye. Thermal paste is a highly heat-conductive substance used to fill these gaps.  
  Buying Generic thermal paste, while it can save some money, is not generally a good idea, since much higher quality pastes do not cost that much more, and can substantiate more than 10 degrees of cooling difference. The best pastes are Cooler Master MakerGel Nano, Arctic MX-4, Arctic MX-2, Arctic Silver 5, Noctua NT-H1 and Gelid GC Extreme. For laptop usage, IC Diamond can be considered as well. Thermal Paste should be only lightly applied, and more instructions will be given on-site.
* Adapters and Cables. The most common types to need are SATA cables, IDE Ribbon Cables and Jumpers, Molex to SATA adapters, etc.

# Software Tools

A wide variety of software should be brought into bear by participants. This software should be stored on a USB Flash Drive, or on a DVD-R/RW if specifically indicated, most of the software can be provided to you on the day of the event. If available, acquire both 32-bit (x86) and 64-bit (x64) versions of the software, and preferably non-install/ portable variants. All software listed is free to use unless duly noted in the respective entry.

## Specification Software

Used to identify the particular hardware components of a system, as well as specific data about them including information such as clock speed, voltages, etc., these tools are as follows:

* CPU-Z: available in a no-install package from [www.cpuid.com](http://www.cpuid.com) . Used to report information on CPU model, instruction sets, clock speed, voltages, multiplier, memory SPD, memory clock speeds and memory voltages.
* GPU-Z: also available in a no-install package from [www.techpowerup.com](http://www.techpowerup.com) . Used to report on GPU clock speed, temperature, fan speed (if present), voltage, power consumption, and model.
* HWMonitor: again, available in a no-install package from [www.cpuid.com](http://www.cpuid.com) . Used to report a variety of system voltages, temperatures over time, and battery health if used on a laptop.
* Process Explorer: not strictly a tool used to provide specifications, this software offers what is basically the windows task manager on steroids. It offers a very competent resource monitor component, which surpasses the vanilla windows resource monitor for the purposes listed here.
* WinDirStat: short for Windows Directory Statistics, this tool is a comprehensive view of the files stored on the storage drives of a windows-based PC.

## Cleanup Tools

As the name implies, these tools are used to delete unnecessary and unwanted files off a computer system, thus freeing up system resources considerably.

* CCleaner: available from [www.piriform.com](http://www.piriform.com) , this is the quintessential system junk remover. Originally called Crap Cleaner, this tool allows the user to delete browser cache, unused files, leftover files from installations, temp files, application junk files, etc. It also allows the user to ‘clean’ the registry, though this is not recommended. It is also recommended to uninstall applications through CCleaner, as it removes leftover files by default.
* Eraser: when a file is deleted (i.e. cleared from the recycle bin, or shift-deleted), only the links to the file in the Windows File System are deleted. The actual data still exists on the hard drive. For security reasons (and to speed up future operations on slower disks) the free tool known as Eraser can be used to permanently delete the file, thus actually freeing up space, and permanently getting rid of confidential information. Several types of overwrite passes can be done, corresponding to certain patterns of random 1s and 0s as developed by the US Department of Defence or other organizations, or the complete overwrite model comprising of 35 passes of overwrites as developed by Guttmann (note that this model takes an extremely long time to complete).
* Recuva: available from [www.piriform.com](http://www.piriform.com) , using the same logic as described above by the Eraser entry, one can restore the deleted files through use of Recuva. What is critical to restoring these ‘deleted’ files is the fact that since Windows has declared the location where the files were stored empty space, it will overwrite that location once any new data is loaded onto the hard drive. The files may still be recoverable, but the longer you leave it, the longer it takes.
* Defraggler or Puran Defrag: disk defragmentation software that far surpasses the vanilla windows tools. Never attempt to defragment an SSD, as it is a true random access storage medium that does has a limited number of write operations allowed, therefore defragmentation lowers its lifespan.

## Malware Control Tools

Often computers that come into repair will be rampant with a variety of malware. Using the proper tools to purge the system of malware should not only increase system performance, but also prevent the user’s attached storage devices from becoming infected.

* Antivirus/ Internet Security Suite: for free purposes, Avast is a decent option, though there are a few better options. If paid security is what you want, high end-suites such as Norton Internet Security, Kaspersky Internet Security, ESET Smart Security and Bitdefender provide the all-round best protection. Avast will be suitable to bring to this event.
* MalwareBytes Anti-Malware: an all-round malware prevention and protection solution. The free option is excellent, and what is required for this event. Not only good for viruses and adware, this will also remove PUPs (Potentially Unwanted Programs) from a computer system.
* Rkill: available from <http://www.bleepingcomputer.com/download/rkill/> , used to stop common malware processes and check for registry changes made by malware. This should be run prior to starting an Antivirus or MalwareBytes Security Scan
* TDSSKiller: available from <http://www.bleepingcomputer.com/download/tdsskiller/> , this tool from Kaspersky Labs is used to remove certain types of very persistent rootkits from your computer.
* ComboFix: also available from [www.bleepingcomputer.com/download/combofix](http://www.bleepingcomputer.com/download/combofix) , this tool could be considered to be the last line of defense against malware. Boot a computer into safe mode, run Rkill and then run this. If this fails, clean install of a new OS is likely your only option.

## Operating System

Here’s where it gets more complex. We don’t expect anyone to be packing an OS with them (if you want to, that would be good). We will provide that in the event that one is required.

* Windows 7 32-bit and 64-bit ISO.
* Linux Mint 17.3 MATE edition 32-bit and 64-bit.
* Bodhi Linux 32-bit and 64-bit.

## Benchmarking Tools

Undoubtedly the most fun software to run on a computer with the exception of games, benchmarks allow you to test and compare a computer system to others on an equal footing. By running a standardized test, or series thereof, benchmarks report how powerful your system is. They often produce a weighted score that you can directly compare to other computers that run the test.0