Computer Beginner’s Workshop Setup and Troubleshooting Procedures 15.8.20

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Firstly, effective computer and/or laptop troubleshooting requires a tidy, well-lit, spacious, dust-free and organised workbench, plus a tidy, patient, organised, and logical mind. A 'feel' for electronic components, and appropriate tool use, are also necessary, some parts are very fragile, some are easily damaged by EMF, all require optimum conditions for storage, assembly, and continued use. A good basic supply of 'known-goods' is important for component testing, plus appropriate tools, including voltmeter, USB socket tester and/or light, laser heat-sensor, propyl alcohol, PSU tester, 'magic' contact spray, mains test lights, mice, keyboard, monitor(s), converters, soft natural fibre brushes, air-blowing/compressing source, magnet rod, magnets from HDDs for tool attachment, etc. **Most importantly, be well-rested and relaxed, with a clear mind, before tackling computer troubleshooting.**

Note-taking, photos, online or other info sources, plus proper record-keeping, are also necessary. For the beginner, checklists and reminders will be especially useful. A felt pen will always be useful. Marking components or systems will avoid double handling, and, help with part storage and search, etc. Shelves with marked storage containers are a must. One good desk system, always online, will be useful for checking facts, specs, etc, via Google. An extra test system or 2 can be useful for parts and/or software testing. **Note also, that proficiency with computer assembly, disassembly, and troubleshooting, should precede such involvement with laptops, notebooks, etc.**

Test all variables sequentially, to be more precise, and, be ruthless with separating good parts from bad, tho proper recycle is recommended for faulty and unwanted parts. Without observing all of these listed basic requirements, troubleshooting efforts may well fail. **A professional will need to deal with less-than-adequate conditions if out on call,** but, ability to deal well with lesser conditions is made easier with properly learned work-habits, and an orderly mental approach. **Encourage all computer work to come to your own workshop,** if possible, where familiar tools and surroundings make all such work much easier.

Breaking down computers and laptops for recycle and/or spare parts requires a careful approach, just as with repair and assembly, and all other workshop conditions should be met, plus, components should be carefully handled, cleaned, tested, and properly stored, in anti static bags or carboard containers. **EMF is a problem that increases with lessening humidity,** also beware of synthetic materials, especially carpets, that can generate static. Use a bracelet, and/or exercise careful grounding, plus, rubber, wood or cardboard bench-covers, are important. Paper is also EMF-neutral, good for wrapping if anti-static bags are not available, never use ordinary plastic wrapping. **Note that WD-40 and similar liquids should not be used inside any case,** unless/except a discrete amount is used for loosening stubborn fasteners. Wipe off any remaining traces to prevent dust entrapment. Monitor screens are best cleaned with a **damp** sponge and dilute detergent, then dried with a paper tissue. Citronella is useful for labels and stubborn marks on cases, again, damp rather than wet application is advised, to avoid drips. **Propyl alcohol for DVD lenses and electric contact spray, for any contacts, are strongly recommended, however.**

Screws should always be saved, and small fittings, cables, etc, as well as representative sets of fans, largest and smallest are usually least common. **Make sure all good fans are oiled**, behind the label, with a drop or 2 of light oil, even if a small hole needs to be drilled for access, then seal with insulating tape. Brighter tape colours are recommended, and, can be well marked with a felt pen, unlike black tape. **This includes fans in PSUs,** especially cheaper brands. **Larger salvage objects saved will depend on space, current market demand, and workshop specialisation, use anti-static bags, or cardboard and paper.**

Best initial troubleshooting steps are just basic checking, systematic, orderly, sequential, ie, magic (contact) spray and unplug and replug, component isolation, plus JP1 reset and/or battery removal, to reset CMOS to default. **Always press Start after power and/or battery has been disconnected, to drain capacitors, before attempting any component replacement, and/or testing with known-goods.** If booting is problematical after initial steps, leave systems off overnight, before reboot, to totally drain any power, some RAM drains less quickly than others, and, errors held in live RAM confuse troubleshooting. **Alternatively, RAM substitution will achieve the same effect, if available. These initial troubleshooting steps should precede component swapping, and further disassembly.**

Visual signs re troubleshooting are important, so, apart from a quick blast of compressed air, if needed for excessive dust, cobwebs, **do not clean cases or parts until after first testing bootup**, as there may be useful hints as to the life and treatment of any given system that is being tested. When air cleaning is performed, mild compressed air is best, and be sure to do so outdoors and well away from workbench area, plus, for personal health reasons. **Do not breathe in the dust, this contains microparticles,** and, the origins of this dust, as well as particle size, could be hazardous to human health. **Keep all such dust and debris well away from the tech area.** Take photos of damage and/or contamination signs, for records, and to show interested parties.

Recommended, also, is that any system be positioned at least a meter from the floor, to lessen dust accumulation. Household pets are also a source of dust and debris, and should be kept away from booted systems and tech areas. **EMF attracts dust and debris, that is the electrical nature of booted PC, laptop, et al, systems. Best also to plug untested sytems directly to mains,** and not running them thru a UPS, in case of any PSU problems. (A fuse or breaker problem is easily dealt with, a damaged UPS less so.) UPSs should be used with any important systems, (there are 3 main types), next are power conditioners, and lastly, power surge monitors on plug boards are the minimm requirement to protect systems. Laptops have their own UPS, if a battery is present, and if still capable of storing charge. System capacitors can cope with very minor power fluctuations only, and damage can be catastrophic, or incremental, with repeated events. Consult Google.

RAM, motherboards, HDDs may have useful visible signs of problems, **a loupe or magnifying glass can be useful.** Look for dirty and/or discoloured contacts. Blown/swollen capacitors being another example. Replacement of capacitors is difficult with new high-temperature solder, motherboard damage is the usual result. RAM and peripheral card contacts should be cleaned with 'magic' contact spray, including the actual bottom underside strip, in case of contaminant bridging, using a cotton bud or similar, but, **leave no fibres afterward.**

Look for RAM specs using a hardware checker like Hardinfo, or similar, and make sure that the RAM total corresponds with the RAM sticks installed. If there are faults with RAM channels, this can then be discerned, factoring in any built-in motherboard RAM that may be present. Magic spray may fix the problem, if not, do so by methodical RAM channel substitution to isolate the malfunction. Also check actual RAM sticks themselves, as a matter of course.

Propyl alcohol on a cotton-bud is recommendeed to properly clean optical drive lenses, leave to dry before re-testing. Circuit strip contact points should also be cleaned with **'magic' electrical contact spray**, and, sockets given a small dose of bubbles, this applies to laptops, and to peripherals such as CD/DVDs, cameras, after disassembly. In fact, any appliance with a motherboard, sockets, and connectors, of whatever kind, will benefit from sort of this treatment, if patina formation is the only problem preventing proper function.

Climate will be a factor in troubleshooting, in fact, with moist climates, replugging everything, on whatever system or peripheral with a fault, especially with magic spray treatment, may well fix problems before other steps are taken. Magic spray used in initial assembly may forestall problems for a longer period, as well. Any dust of corrosion deposits that can cause current bridging, especially when moist, should be checked for, and cleaned/brushed with magic spray applied, this will also inhibit further corrosion deposits forming. **'Magic spray' aka electrical contact spray, really does earn that nickname..!**

CPUs are manufactured at high temps, with thermostatic regulation built in, and thus rarely give problems, unless physically mistreated, or, due to careless handling. Careful scrutiny of CPU sockets will show up any damage to tiny pins. These pins, in the past, were on the CPU, and now are transferred to the socket, nevertheless, care is still needed, **a damaged CPU socket usually means motherboard replacement.** Always carefully remove the CPU to check socket condition, most likely any suspected damage is caused by amateur tampering. **Reseat CPUs with magic spray**, **and then use fresh silver heat paste to reseat the heat sink, never 'convenient' heat pads, or cheaper paste products. A bare minimum is all that is required, see Intel's own thermal paste application instructions and pics online.**

Non-booting can mean a **JP1 reset or battery removal** to rule out BIOS tampering, and, beeps usually mean RAM faults, run such as **Memtest**, remember that RAM channels can also develop faults, test accordingly with known-good RAM. **For all beep codes, consult Google.** ***Sequentially remove/test all peripherals if necessary, including cards, and any drives***. Note that **Linux boot disks usually have SMART reading capabilities**, will display system info, and also, give the option to run **Memtest** at boot, given that video card and monitor are operational. **A Linux OS on an HDD/SSD will usually boot to any PC or laptop,** which makes system specs and performance checks much easier. Note that, as of 2019, anyway, **Win 10 installed, tho not validated,** will boot to different system SSD/HDDs, until validated to a particular system, useful fact for pre-validation testing. **That live Win DVD may never eventuate...?**

Locked BIOS and/or HDDs/SSDs are growing security-failure problems, discourage such password practices if possible, or, owners risk tossing out a motherboard and/or disk-drive when passports are lost. These problems can be rectified, but expensive expert help is required, unless you wish to specilise in such repairs. Also, as part of trouble-shooting, encourage regular back-up, **'if not backed up 3 x, then not backed up at all',** so, flash drive, storage partition, and offline drive, makes three, and then the Cloud makes a lucky fourth. There should always be a storage partition on an HDD/SSD as well as a boot partition, so that if the boot partition fails, data is still available, and the OS is more compactly confined, especially in the case of MS Win OSs. **Sympathy should not be wasted**

on those who will not back up, and that includes password loss, the warnings have been around for decades, OK!

HDD/SSD SMART is a useful indicator of HDD/SSD wear, even if not always precise, and, this is most relevant for computers that do not run continuously. HDD platter errors may be virtual, caused by power fluctuations, improper shut-down, etc, and these can be corrected with **HDAT2 or similar,** tho actual physical damage cannot be thus repaired, and such HDDs should never be used for other than testing purposes, with appropriate partitioning to isolate bad sectors. **Note that SSD failure can be catastrophic,** thus, SSDs are good for boot drives, but not currently advised for long-term data storage, **replace SSDs ASAP if SMART indicates any problems.**

SSDs may also show adverse SMART reports, even of imminent failure, if there are corrupted partitions, because SMART is reading such data states as actual faults with the SSD. **To be totally sure of the state of the SSD, given that the drive is recognised by the system, when either directly connected, or via USB, perform a quick wipe;** zeroes would suffice, to remove all partition info, and thus, leaving the SSD completely unallocated. **However, just removing partitions and basic reformatting may not be sufficient to correct disk data corruption and resulting SMART faults, within Linux or Windows.**

Zeroing will not cause as much wear as that of multiple wipes, while facilitating a true SMART read, and also readying the disk for re-partitioning and further service, if all is well, although perform such wipes only when absolutely necessary.

SMART reading in Linux systems can be performed by **Disks and GSMARTControl,** and in Windows, **CrystalDiskInfo** is very effective, also being preferrable for testing drives with Windows installed.

Darik's Boot and Nuke is useful for quick wipes, in general, plus, **Minitools,** or similar, on a booted Microsoft system.

As with any computer component, **think material stress**, especially with regard to heat, so keep systems at an optimal temp, eg, with the fans at times switching off, and, even cut or enlarge holes in system cases, (laptops), or add extra or larger fans to cases, for desktop systems. **CPUs, GPUs, SSD/HDDs, all benefit from cooler running, note.**

SMART-test at least weekly for drives over 3 years old, especially if secondhand, and note that **HDDs and SSDs drive, in general, will fail early, usually within 3 months, if faulty when new**, or, will thenceforth perform consistently when 'good', tho of course, only if treated well thereafter. 5-6 years effective lifespan is quite possible for a well-treated drive that is regularly in use. **SSDs are getting better**, both in transistor manufacture, and, in management software development; best used for boot drives tho, especially for their speed benefits. See Google in this regard, also re **SSD TRIM requirements.**

Troubleshooting inpections mean looking for damaged/dented cases, both for PCs and laptops et al, plus, dust, wear and tear marks, cracked screens, stains, spills, dirty fingerrmarks, dusty/dirty keyboards, smells, etc, and if booted, cluttered desktops and poorly responsive software. Note that faulty and/or over-full HDDs will also show these same symptoms, **the 80% Full Rule still applies for boot drives.** All this is typical of the adage that **when troubleshooting computer systems, one problem may be hiding behind another, especially when possible problem symptoms are similar.** There are all sorts of tips online re troubleshooting, incl. flow charts, forums, etc., tho usually, just a concise and lucid Google Search question will bring results. **Commonsense, and patience, will be the keys to successful online searches.**

Older systems are useful, and cost-effective, for learning, pulling multiple PCs and laptops apart will show recurring patterns of wear, and also, older systems that have been stored in indifferent conditions will display interesting and varying signs of deterioration. **Materials may break down with age, and corrosion WILL occur,** in fact, PCs and laptops are built to WORK, and this means moisture accumulation is mostly minimised if running regularly, even if not always continuously.

Moisture settling will lead to corrosion, shorting, heat accumulation, and, as air is seldom pure, dust particles may be soluble, and thus prove to be acid or alkaline. Airtight long-term storage is thus essential for any electronic parts or systems. As well, when passing from cold to warm surroundings, passive acclimatisation may take hours, condensation being the problem, especially for platter HDDs. An already running and warmed-up system should make the transition quickly, especially if passing thru an intermediate zone, resting say 30 minutes or so.

Note, in the case of older systems being cleaned and repaired, years of material stress due to thermal shock, plus general expansion and contraction, will mean that system components, especially the motherboard, will need to be handled carefully. The motherboard should not be flexed unduly, and also, be sure to just lightly wield a cleaning brush, blow out any dust from inside the case and heatsink, then try to boot, and, if successful, be content with that. Only replace the CPU heat paste if absolutely necessary, as extra flexing of the motherboard will be part of this process. **Contact spray and system replug are also advised**, though do so as carefully as possible.

Long-term storage of computers and laptops: Run the system for 30 mins or so, to drive off any residual moisture, preferably on a fine day, or in a warm room, then shrink-wrap, preferably, and **render the wrap as airtight as possible.** Laptops should have the battery removed, and be then stored in the same container, fully charged, separately wrapped to avoid knocks, accidental shorting, etc. Gel sachets enclosed would be an extra benefit. Similarly, warm a non-booting system, or parts, with a hair-dryer, in similar surroundings, before wrapping, as above.

Language, written or spoken, should be concise and to the point, as for any technical situation, special care is needed if there is any sort of personal language difficulty, or, expensive mishaps may result. **Record keeping should be concise, organised, and kept dated and sequential,** especially important when there is battery of systems to care for, so, routine maintenance, parts, and repairs, all should feature as part of the history of any given system, if at all important, even if secondhand. **A detailed Day Book will always be a useful reference. Never unquestioningly fix any sort of computer for friends, relatives, or idiots...and,** at least for idiots,only if done professionally, charging well for services rendered, and, for the others, well, make sure there is a fair quid pro quo agreed upon, that recompenses time, margin of skill, etc, however constituted. **This will avoid the all-to-common problem of such skilled work just being taken for granted. Keep a library of installed and bootable OSs to easily check system compatibilty,** this will save time, and simple cloning will transfer the optimum bootable OS to a given drive, given sufficient capacity. **Linux OSs to the rescue, again.**

Computer education is necessary when The Market does not want educated consumers...and this should emphasise that temperature dust, excess heat, liquids, vibration, shock, static, and power anomalies, all will take their toll on systems, either instantly or incrementally. **SMART is especially useful if G-sensor stats can be read,** important for life span of HDDs, tho **having an SSD does not mean that other details of system care can be overlooked, even if the shock hazard for platter HDDs is circumvented.**

General Computer Software Maintenance: MS Windows systems will always need extra cleaning and tweaking, and **Toolwiz, or similar, is recommended, Speedfan will show operating temps, and SMART. CrystalDisk Info** is also useful for detailed SMART. Carefully check program tweaks for best results. Turning off unneeded Win Services will also increase speed, consult Google, and proceed with care, and records. However, **Mac and Linux OSs are less likely to require such extensive cleaning and tweaking**, and, **Linux OSs installed on HDDs/SSDs can be plugged into any system for specs, testing stats,** performance, etc., as can **bootable Linux OS discs**. **Hiren's Boot CD** has many test programs that are worth investigating, even if just out of curiousity, and individual programs of interest for troubleshooting can be sourced separately.

There are other electronic consumer items that require service and repair, such as tablets, smartfones, etc, should you wish to specialise, and, in general, all the above principles of workshop mnagement, record-keeping and troubleshooting will still apply. Tiny parts and screws at assembly or dissassembly should be best dealt with over a patch of light-coloured and well-lit natural short-fibre carpet, or natural rubber mat, and, even by utilising a bench-apron such as watchmakers use, both help to prevent fretting over lost screws, and lost time. A magnetic rod is very useful for pickups, tho, **always best to prevent the problem of dropped parts in the first place.**

Flexibility with IT hardware maintenance and repair would be properly enhanced by a general qulaification in electronics, beyond just that of computer technician, note.

Three Golden Rules Of System Troubleshooting:

1) If there is more than one solution to a problem, utilise the lowest-tech first, and, one problem may hide behind another, but, act first on most recent changes.

2) Plus, if it is not broken, do not 'fix' it, and risk causing more problems..!

3) Also, perform consistent and orderly testing, one variable at a time, log your activities, and think calmly about what you are doing.

So, assuming that the system has been running properly hitherto, and is protected by a mains power surge monitor and/or UPS, and a Telecom surge monitor:

1) Replug everything, inside and outside the system, including mains and phone filters, if the Internet is being used, and Include motherboard switch/light connectors, and Startup switch. Use magic spray. Similarly, loose connections such as USB sockets or fan connectors that may be abraded by metal projections, can cause problems, so make sure these are properly located. Test any new leads or connectors, these can be faulty, even when mass-produced. Ensure that all USB or similar secondary motherboard connections are plugged correctly. Check that the PSU switch is on, then attempt Restart.

2) Ensure at restart that the CPU fan runs, (there may be a lag period), and, that drive lights show, plus, normal systems sounds ensue at Startup. HDDs should perceptibly vibrate, note, another useful test of both drive and system function. No signs of life usually means a PSU failure. Fast fans, no lights, no HDD vibration, usually mean a motherboard failure, factor in age as well. Note that CPUs rarely fail, unless really cooked, plus, modern CPUs have thermostatic regulation. Check by touch for any signs of overheating or unusual vibration anywhere in the system.

3) If not successful, and, using known-good substitutes, check all drives and controllers, plus RAM and channels, for full functionality, noting that intermittent faults may not show in pre-Boot warnings. Also use CD/DVD-ROM and/or floppy-based testing programs if the system does boot.

4) Perform a JP1 reset, or, at least perform an ESCD reset. Replace the CMOS battery, if necessary, and reset the time and date in BIOS, and the Boot Order. Check Start switches/Mb connections for proper function, jammed or faulty switches will inhibit booting. Also, check in BIOS/UEFI for Secure Boot inhibition, and make the appropriate adjustment if required.

5) Remove all plugged drives and plugged cards, as practicable, then re-add units individually with restarts. Adding or replacing parts to upgrade systems is best done after successfully migrating to a more modern case, to reduce the number of possibly fault-prone variables, including that of drivers..? Electrical contact spray on all physical connections...? Expansion cards should be situated either in their respective slots, or, in antistatic bags, do not place on or near any potential EMF source such as a monitor, PSU, or UPS during handling and/or system assembly.

6) Test the system with a bootable CD/DVD, and/or an HDD with Puppy Linux or Ubuntu O/Ss installed.

7) Ensure at restart that the CPU fan runs, and, that drive lights show, plus, normal systems sounds ensue at Startup. Check by touch, or heat sensor, for any signs of overheating or vibration. Note also that warming a system case interior with a hair-dryer may help with reluctant booting, in an emergency, when all else has been tried. This is itself a sign of impending motherboard failure, because material stress over time has caused some conductive filament to finally fail, with repeated shrinkage, at a cool or cold temperature.

8) Check for any hidden fuses in the system, eg, UPSs or PSUs can have fuses at their power switches, and, if blown fuses are found, check for reasons why they blew, or, just accept that age and constant use, causing material stress, can weaken a fuse. Replace with good quality equipment. Better also, to be overpowered than underpowered, re PSUs and laptop power blocks, to prevent overheating problems and avoidable material stress.

9) Leaving the computer off for 30 mins or so, (or even overnight), will effectively remove any residual circuit EMF, and, drain power from the RAM. A cup of coffee at this time will be good for you as well. A JP1 reset or battery removal at this stage will also be beneficial, if not already performed. Consider installing similar RAM, and same brand, if available, then retest. Reconfigure the BIOS after the next effective Startup.

10) One Special Fourth Golden Rule of Faultfinding is to periodically check all known-good components for their current integrity, then retest with these as installed system components once more, for more successful troubleshooting. Quis Custodiet Ipsos Custodes, OK!

The Last Resort for locating motherboard problems is to uninstall, and then check the case and baseboard for any loose screws or improperly located base contacts that may be causing shorts. Check the board itself, both sides, with a magnifying glass for any visible damage. Beyond step that lies known-good CPU testing. GPUs can be tested by connecting an external monitor, if screens do not function.

However, always consider that a major or minor system part fault can occur at any time, regardless of your current activities. **Computer system parts eventually fail, one way or the other, and, that is a fact of electronic life, especially complex machines, down to the smallest fuse, chip, capacitor, or diode.** If something has failed at the time of reassembly, and, this was not necessarily due to a handling mishap, you should then accept that failure was imminent anyway, especially with an older system. **Better now, than when processing valuable data later! Time then to upgrade for motherboard and CPU, at least, if not the system case and PSU. All part of customer education, as well.**

A final note about 'making do', notwithstanding the preceding system upgrade information:

For data rescue, **Linux Mint and Peppermint Linux** will both read **Windows files,** but, **plug required USB drives and check boot order, also for the CD/DVD, before booting. Clonezilla**, **Gparted,** and **Parted Magic**, will also copy or image your drives or partitions to an external drive, especially useful for laptop drive backup where there is usually only one HDD present. **EaseusDiskClone(f)** is another bootable alternative, and, being a dedicated cloning program, will use less resources, when and where this is important. **Boot-Repair-CD(f)** is as it says.

Linux Mint XFCE(f) loaded onto a spare HDD or sizeable flash drive makes a very handy O/S standby, just plug into any modern Wintel system, and boot. **You can use Firefox and Thunderbird for Web and email access, and there are many other downloadable programs to choose from. Physical system care is still the same, but, Housekeeping and Security are not as important as with Microsoft's OSs. (**Note, however, that Open Source custom boot discs, including O/S discs, may not boot when extra or incompatible graphics/video cards are present.) **Mint XFCE is thus a handy all-systems O/S standby when installed on a spare HDD.**
For those who do not need MS O/Ss for email and online research, consider installing **Puppy** on older laptops to prolong their useful life. The instructions for installing from Puppy's ISO CD are straightforward, and many programs such as for word-processing, email and web-browsing are included in the install, as is the case for **Mint. Puppy is quite effective as an O/S, yet the resource needs are modest, and, Puppy is seemingly untroubled by dual monitors.**

Note that these installed Open Source O/Ss may be useful for boot-testing a system, beyond just using a bootable CD. **Open Source/Linux testing programs** could also be included in either installation form for further system testing procedures. If you have spare small HDD/SSDs that are otherwise unused, just install these O/Ss from their downloadable ISOs. **Swappable HDDs with O/Ss that boot with any CPU are so adaptable..! Linux OSs boot as live DVDs, and can be fully installed on USB drives. For Win systems**, whole customised O/Ss can now be loaded onto USB external and large flash drives, given that the parent computer will boot to USB in BIOS, such as MiniPE, BartPE and Vista/Win7PE, which can also be loaded to a flash drive for emergency HDD data access.

So, these particular examples of **computing, system testing, and Internet minimalism** are hereby proffered to **provide an extra dimension to any upgrade decision** you may be contemplating, and as to **why** you are doing it. Also, to emphasise that there always needs to be **hardware backup**, including, as in this case, a **spare system for Internet access**, if this is important to you. Thus, if you still want to upgrade and migrate a present system, bear in mind that a suitable older, and smaller, system will still have very important backup uses, and**, if all you want to do is read papers, journals, and email online, then 'going large,' system-wise or software-wise, is definitely not necessary for sufficient quality Internet access.**

Even easier, given a handy computer-access plug-in opportunity, you can nowadays do this all of this, as well as in lieu of even laptop use, by using a portable flash drive loaded with those handy Linux OSs especially when 'on the road,' and travelling light! All you need is another system to plug into, be it at a private home, an Internet Café, or whatever.

Uninterruptible Power Supples, aka UPSs:

1) **Recommend using a good-quality surge monitor powerboard, and a UPS.** 'The three major types of UPS system configurations are online double conversion, **line-interactive** and **offline** (also called **standby** and **battery** backup). These UPS systems are defined by how power moves through the unit.' (See also: https://www.vertiv.com/en-emea/about/news-and-insights/articles/educational-articles/what-are-the-different-types-of-ups-systems/

2) A quality powerboard with surge monitoring capabilities will, in turn, protect the UPS, and, anything else plugged in it. Note that **laser printers** should not be on this particular board, as they **draw a lot of power when switched on,** and should be directly plugged to the mains, via a separate circuit/outlet if practicable, or, switch on before switching on the rest of your systems.

The importance of uninterruptible or standby power supplies for the smooth and trouble-free operation of computer systems, (and other sensitive electronic equipment), is paramount. Not only is data preserved from untimely deletion or corruption by power fluctuations and/or outages, but CPU and other transistors, and circuits, are also guarded against untimely death as a poor or inconstant electrical diet inevitably takes its toll.

Even if there is no actual hardware or software damage or shut-down with a power disturbance, **RAM** performance may still be inhibited, which also jeopardises interim data integrity, and, current program performance integrity, plus any updates, defrags, installing of programs, or flashing of BIOS. An **uninterruptible power supply draws directly** from a charged battery, and a **standby power supply**, (less expensive), simply **cuts in** to draw from a charged battery, when mains power supplies falter, fluctuate, or fail. **Line Boost** is the intermediate specification, and, is recommended as a good balance between effectiveness, and, budgetary constraints. **PSUs** do have some resilience against power fluctuations, but this is limited, and they do fail more often than any other PC hardware component.

If you care about your own digital investment, and the data contained within it, invest in a **UPS/SPS**, the standard versions of which are not expensive, **(usually they have lead-acid gel/AGM batteries, ie SLA or Sealed Lead-Acid Batteries, with low-maintenance lead-calcium plates)**, in return for what essential service they **will** provide; the first time your **UPS/SPS** 'cuts in' to maintain system function during a power disturbance, the investment is definitely realised**. Nofrillstech will not boot-up any computer without filtering power via a powerboard, and then utilising further power filtering via an ancillary UPS/SPS, to guard both systems and data. For battery details see *Car and Deep Cycle Battery FAQ/7.1,* et passim.**

Clean power outages may not harm the computer, although data may not be so lucky, but, mains power can surge, brownout, fluctuate, or cut out, while your electronic system needs **constant** voltage and cycles to operate smoothly, and, to ensure optimum health and useful life, **without material stress, especially heat-related.** The mains power is **AC**, (alternating/cycling current), this is converted to **DC,** (direct current) by the **UPS/SPS** to charge the battery, then inverted to **AC** again for use by the system **power supply unit**, **PSU**, which then converts the power again to **DC** in the respective voltages required by the motherboard and drives, etc.
The **economy SPS** is usually a **standby unit**, (as opposed to the more expensive **inline** type), whose electronics is fast enough to sense a power disturbance, and subsequently cuts in **between** Hertz cycles(!), to ensure that power flow to the system is continuous. The always-stable **direct current** that ultimately reaches your motherboard and peripherals in required voltages is required for smooth electronic function. **Note that 'power conditioners' are no real substitute for a matched UPS/SPS.**

An **in-line powerboard,** or power conditioner, sophisticated or otherwise, is still important to guard the overall function of inter-connected electrical computer devices, and must also have a **modern surge protector**, (not just a circuit breaker), to be fully effective, as well as phone line filter, regardless of what the **UPS/SPS** may also provide. **This ensures that the UPS/SPS is always preserved and protected, as well as all the other peripherals.** Your phone line should also have a plasma fuse outside the building, and you may need to consult your utility provider to obtain installation. Only a **plasma fuse** has any hope of containing a damaging surge down your phone line.

Your UPS specifications should also exceed expected loads, so do your sums. To test a UPS/SPS, connect a known-good PSU, then, test that with a standard PSU tester, as well as with momentary disconnection from the mains supply. **Irrespective of testing methods, there should be a draw, and no voltage fluctuation. If the results indicate less than optimum performance, or failure, then repair or replace the UPS. As always, faultfinding should be a systematic search, and, power problems that may involve a UPS are no exception. UPS/SPSs should also be set to the correct mains voltage, like PSUs.** Do not connect laser printers or other high initial power draw units to UPS/SPSs.

Remember always, that without a UPS/SPS, any software or hardware problems, **with no apparent explanation as to cause, are most probably due to power fluctuation, and then there is that consequent slow and cumulative CPU transistor death, if not actual catastrophic failure, as well as probable RAM damage. Smoother system operation is also immediately noticeable with UPS/SPS operation, and this includes monitors if the UPS/SPS is large enough to accommodate them on the circuit as well. Note that wattage should be read as 60% VA (Volts/Amps), as applicable.**

Once again, do not use electrical equipment, especially electronic, and/or phones and modems, during thunderstorms or other wild weather, if this can possible be avoided, so unplug from power and phone lines completely. Copper lines for power and phone use are subject to inductive accumulation of charge during electrical atmospheric disturbance; 160 km^2 is a minimum buffer zone, and there is no certainly safety in urban numbers, with extra copper cable present to aid inductive charge accumulation and transfer! Your own safety is also at stake!

Connection and installation of a **programmed UPS/SPS** is not difficult via either serial, or increasingly, **USB** ports; in general, just set up as per the instructions, though note that usually there is an 8-hour battery charging period before standard system usage begins. All that means is, do not plug in any potential loads during the initial charging period. **Nofrillstech** has found that it is worthwhile to check the **UPS/SPS** manufacturers' websites for updated software, which should contain necessary drivers as well as **GUI** programs.

Windows has an APC, and, a generic UPS/SPS program, plus, there is another **generic UPS/SPS program**, Winpower, which you could try, if you have difficulties with finding an original, and **not-quite-recent,** dedicated UPS/SPS program and its required drivers. **Be sure to download and read the Winpower Quick Start Guide** after you download the program, plus, after the downloaded program is unpacked, you can also find the **Setup Icon** in the **Program Folder** of the relevant O/S. You will need a relevant **UPS/SPS serial number** to open and run the **Winpower GUI** program, however.

One O/S Setup caution: **when installing or upgrading O/S software, always disconnect the UPS/SPS:system interface cable, if in use, as this may cause software conflicts. Reconnect/reinstall the UPS/SPS after the O/S installation or upgrade is complete.** If you want **regulated power shutdown**, this can, of course, be set up via the **GUI** program, but if preferred**, the UPS/SPS can be run just as effectively without reference to the software,** and can just sit and hum along and do its work **if you are always close by** to make a decision of normal shutdown, if an outage is sufficiently prolonged to warrant this. If you have a separate desk light on mains power, even if you cannot hear the UPS/SPS click-in, then you will be made aware of a power fluctuation incident when this occurs.

UPS/SPSs can be equally effective, and more budget-priced, if they support only system cases and external modems, and, even if the **GUI** program is not utilised, this will ensure **>30 minutes**, (depending on actual battery capacity, naturally, plus your correct sums), to either ride out a power problem, and/or time to quickly connect a monitor to the **UPS/SPS circuit** to achieve a normal shut-down if this is required. This time lag is especially useful if you are periodically away from your computer, and, **if** you **have** backed up before you left, then only a **Folder Scan** ensues at re-boot, **even if you do not get back in time** for a conventional shut-down. The main point being, whatever else happens, the system itself is saved, and all of your current, (backed-up!), data.

The **UPS/SPS** may also be required to support the system for sufficient time to cover the lag before a **supplemental power generating system** is enabled, this certainly would be a factor in maintaining digital integrity of **essential or medical services**, businesses, public service administration, and etc. While the supplemental generation is functioning, the **UPS/SPS** would again continue to operate as power filter and battery standby once more. **Nofrillstech has lost count of the times, over the years since Home SPS use began, in towns and cities as well as rural districts, when the installed SPS has literally saved the day, both for system and operator.** To hear that brisk, reassuring click even as the desk light falters, (and the monitor, if on the filtered mains circuit)**,** while the computer never misses a beat, **is such a relief, and believe it, OK!**

Defrag, cloning, or BIOS upgrade, are the times of maximum system vulnerability if mains power fluctuates, **as data lost then may never be able to be replaced**, even with O/S or other program repair, and/or there may be HDD or other 'collateral damage', with the inevitable full erase, partition, reformat, and complete reinstall, being needed to restore both functional and data integrity, whether any consequent physical repair is needed or not. **What is $150 or so, paid one-off for at least an SPS, if not a UPS, and $35 minimum every 3-4 years for battery replacement, if that sort of needless chore can be averted?**

Nofrillstech uses a Web interface computer system, plus work computer system when necessary, both being operated simultaneously on the same **UPS/SPS**. Each circuit is also power and phone double-filtered, including the **UPS/SPS** circuits. **Whilst normally running systems and modems only via the UPS/SPS power,** monitor plugs are marked for quick CRT transfer to the UPS/SPS circuit if ever required. **Most mains power problems are 95% transitory, and/or of less than 5 minutes** duration, but knowing you have extended shut-down time while temporarily absent from the computer is also of great comfort!

So, with this method, you can concurrently run two, or more, computer systems and modems on the one conventional home UPS/SPS of sufficient capacity, with peripherals for each on separate filtered power boards and phone line(s). Flat-screen monitors use less power than CRTs, so, running *them* from a UPS/SPS full time is reasonable, but, still do the sums required to ascertain the running wattage load versus the UPS/SPS wattage rating.

Note that VA = Watts x 1.6, or, Amps x Mains, all summed, when calculating UPS/SPS needs. **Note that computers have a safe Power/Loss Factor of** 60%. (See Troubleshooting, Maintaining and Repairing PCs, References**,** especially the accompanying standard **Runtime/Load Table.)** The Power Wattage Calculator **gives good results, though should an on-board video card be included? Also, note that not all full draws may be**

present, especially in hibernation, or, are all concurrent when in use. Working wattage values should thus be read as 2/3 of the total VA calculation. Note that, in regard to battery amp-hour ratings, conventional UPS/SPSs will usually protect 25% of their stored charge. Always test units, and their chargers, using known-good batteries, **as UPS/SPSs will not charge defunct batteries, only batteries within acceptable 'health' limits. An ad hoc UPS/SPS** could also be a solar battery, or similar, such as a suitable conventional lead-acid AGM/Gel/VRLA standby-battery with an appropriate inverter, although that does mean matching voltage type as well as suitable wattage capacity. As well, this basic standby battery could still be on a mains supply charger while you work when used with a matched inverter, this would also suit financial budgeting, and the battery is easily replaced as required. **Most importantly, during this ad hoc 'UPS/SPS' usage, an ultimately smooth flow of DC system power is assured where this is needed most, within the computer system**.

Note that a software interface program is really only necessary for always-on or unattended systems. Opinion seems to be divided re using a surge monitor on the mains plug, ahead of a plugged-in UPS, however, Nofrillstech had had no problems over 20 years, living with indifferent mains power, and, with frequent UPS cut-ins.

Your computer will also require this system of power transfer via a UPS/SPS, of whatever form, if independent and steady non-mains current is not available, such as from a mechanical generator, so testing is advised before operation if using a power supply that may not deliver optimal current for electronic well-being. **Laptops** have their own UPS/SPS, of course, but be very careful to match their mains supply carefully, (and phone lines), especially when travelling. **Utilising the conventional interface program, and either serial or USB connections,** is a matter of personal choice, but certainly advisable if a computer runs autonomously, or unattended, for any length of time, and this would apply especially for **businesses or utility monitoring. However**, what is important is **how much run time it will deliver when the main supply fails, noting that the unit will protect at least 25% of its charge prior to closing down.**

HWMonitor**,** SpeedFan**(f),** CPUCool**(s), or** Sensors View**($)**, (using MS OSs), **show PSU voltages in real time,** so, if you have an intermittent computer power supply problem that is not apparently attributable to mains supply or to the **UPS/SPS,** if present, then check these readings against system specifications; eg, voltages may appear as 1.54, 3.3, 5, and 12, or, similar readings that are both very close to prescribed standards, and most importantly, steady. **For Linux PC systems with lm_sensors installed, run 'sensors' command.**

Programs such as this are recommended to be installed in PCs, Macs, laptops, or any other computer system where such readings can be made, especially given that PSU failure is the most common major computer component malfunction. PSU voltage integrity can also be measured by a voltmeter while systems operate, if you have the skills required. ***An electronic PSU tester is strongly recommended.***

Be sure to test any unknown and previously used PSUs directly on the mains, with a load such as a test motherboard or system, or, an electronic PSU tester, **before plugging into a computer and UPS/SPS, as any internal short in the PSU will cause damage to the UPS/SPS, from blowing a fuse to something much worse, that may result in costly repairs. Burnt odour and fan irregularities, such stiffness or resistance when revolving, are also pre-test indicators that a PSU may be faulty, thus the unit should be disposed of, and replaced by a new one of good quality, before any further operations. If in doubt, buy new; PSUs are mass-produced units, and priced accordingly, including for better quality units.**
Look for on/off switch, separate fan grills, sturdy leads, and appreciable weight, that all indicate quality. Set PSU mains voltages correctly, 120 or 240 volts, and do ensure that replacement PSUs have correct voltages and connector wiring and plugs for the motherboard, most important for non-standard older systems, **eg, Dell and Compaq. Modern ATX power supplies may also have a missing lead for a voltage, (-5v for ISA), that is no longer required by modern motherboards.**

Of course, without installed batteries, laptops are susceptible to power fluctuations just as unprotected desktop PCs are, plus, both thus need overall surge protection anyway, and for their peripherals, as well as that all-important uninterrupted system power supply. **Remove battery packs if using AC mains power for extended periods.** RTFM re batteries, OK! (See **Upgrading and Repairing Laptops,** and, for **world travellers, Eaton Powerware posts world main grid voltages.)**

Finally, all of your computer and peripheral systems must be running on 3-core and properly-earthed power leads, whether you have power filters or not, and this is also for your own safety. Your computer-related systems should all be on the same dedicated circuit, and, not shared with any heavy loads, welders and laser printers, especially.

Plus, if necessary, get your dwelling circuits checked if you suspect poor earthing due to faulty or incorrect wiring. This can be done with a just circuit tester, but, you must know what you are doing, of course, electricity being what it is, so, all you do-it-yourselfers, preferably CONSULT about mains power circuit integrity, OK!

SSD/HDD Usage Crib Sheet:

SSDs have been around for a while now, the technology has been improved considerably, to the extent that they are considered to be just as long-lasting as HDDs. As always, remember the caveat emptor maxim, that you get what you paid for.

1) **SSDs are not suitable for undisturbed long-term storage,** as they have capacitors that need re-charging at regular intervals, 3 x per annum at least. Thus, **HDDs are still the best for long-term storage**, in ideal conditions, viz, temperate, minimum humidity, no harsh handling treatment, et al.

2) **SSDs are *fast*, thus, ideal for boot drives,** given that they have regular use as such. They are also read, and are serviced by, existing apps such as CrystalDiskInfo, GSmartcontrol, et al, plus, partitioned, wiped, etc., by other existing apps within any operating system software.

3) **SSDs are ideal for transfer of data between systems,** as they can withstand reasonable physical handling, **unlike HDDs, which should always be unmoving whilst in operation.** In fact, SSDs are also superior to ordinary *flash* drives in operation, viz, speed, accuracy, and useful lifespan, although they still should be connected/disconnected via OS protocols, note. Use a USB3 port, via a USB3 system socket, if practicable, for best performance.

4) **SSDs/HDDs are just as vulnerable, as all micro-electronics components are, to power fluctuations,** up or down, so, they should always operate whilst protected by a UPS, or, at least a power conditioner, either of which should be protecting any important computing system, anyway. Laptops have batteries as UPSs, but, **always-on laptops should have their batteries removed/disconnected, note.**

5) **SSDs are more likely to catastrophically fail than HDDs,** so, should have regular SMART checks as they as they age, which, indeed, should be the case with HDDs anyway, although the latter will give more **SMART** preliminary warnings before actual operational failure. **Excess heat will also affect both SSDs and HDDs, in the form of extra material stress, both expansion and contraction, with normal use.**

6) **However, entire working OS backup should be a routine procedure, regardless of using SSDs or HDDs,** for any computer system, as whole-drive clones, images, or, even just copies or clones of individual boot partitions. All of these options are available, for modern systems, regardless of OS type, or brand. **Files should have additional backup**, noting the mantra '**if not backed up 3 times, then not backed up at all'**, thus, no sympathy for those who would choose to ignore this universal standard of effective computing.

7) **SSDs are lighter, and thus more portable, than HDDs**, especially the newest E-types, which no longer have any surrounding enclosures when installed. Note also, that the socket configuration may not now be SATA, however, which means specific enclosures are needed for external use, and, also when matching their corresponding USB cable connections.

8) **SSDs are not defragged, unlike HDDs, instead, they are trimmed**, in that the SSD is scanned by the TRIM command, to enable the release of specific unused space for further data deployment. Modern OSs should do this automatically, and/or via a command line, so, consult respective OS manuals. **Defragging causes unnecessary wear on SSDs,** which are much faster in all respects, anyway, being entirely electronic, and, regardless of where data resides.

9) **Troubleshooting an SSD/HDD,** that will not boot, and/or, is not recognised by the system, is by the usual heuristic methods. Firstly, apply **Magic Spray,** (aka electrical contact spray), at the plug-in connection point with the system. If this does not work, **replace** the SSD/HDD, and see if the system then enables initial booting, to at least read the BIOS. **A MemTest 86 boot disc RAM check** at this point may be useful, as an initial system function check. After which, a **Linux OS on a test SSD/HDD** is very useful, to enable booting up properly, and thus, to check the entire system in operation. (Linux Mint is a reliable choice.) **If the system itself is proven OK, after these basic testing procedures, consider the SSD/HDD defunct, and then resort to your backup resources and protocols.**

10) …..

Some computer and Internet security notes, and also power security, using UPSs, et al:

1) **Recommend using a good-quality surge monitor powerboard, and a UPS.** 'The three major types of UPS system configurations are online double conversion, **line-interactive** and **offline** (also called **standby** and **battery** backup). These UPS systems are defined by how power moves through the unit.' (See also: https://www.vertiv.com/en-emea/about/news-and-insights/articles/educational-articles/what-are-the-different-types-of-ups-systems/

A quality powerboard with surge monitoring capabilities will, in turn, protect the UPS, and, anything else plugged in it. Note that **laser printers** should not be on this particular board, as they **draw a lot of power when switched on,** and should be directly plugged to the mains, via a separate circuit/outlet if practicable, or, switch on before switching on the rest of your systems.

2) **Re data security and The Cloud,** The Cloud also has its rackets, sadly, and cheap or no-charge sign-up soon changes....and you definitely get what you pay for. Google has 10 Gb free, which must be regularly accessed, to be 'live'. Cloud security will always be an issue online. Meanwhile, email repositories can also be useful, and/or, a personal website could suffice to store extra current files which you can retrieve as you want, ie, stored without links..? A separate working storage partition on you main system hard-drive is a must, also, as well as any other offline storage. Good quality portable HDDs, for main backup storage at home, cannot be bettered, especially if you have a lockable fireproof repository. Also, consider another backup set at a different location..?

If not backed up at least 3x, then not backed up at all, is the realistic motto these days.

3) **Use a separate Internet interface system,** (a reliable laptop would do), if online security is an issue, and keep your main processing system air-gapped, as much as possible, only go online for updates, when not otherwise in use, plus, usual virus-checker, et al, must be installed.

4) **Consider local wifi providers, rather than major telecom providers**. Eg, your landline number retained, and unlimited data for approx $80 pm..? Personal service, better security, and less outages..?

5) **For reliable system,** as always, buy from established, dedicated, computer businesses of good reputation. **Never trust a department store bargain, or online trading, unless you really know what you are doing...**

6) *Meanwhile, a further tip for your computer security,* ***recommend that your main Internet interface system has a Linux OS, very easy to use,*** *(eg, Mint, being very much like the XP era), can read/format to NTFS, re external drives, so, passing files for uploading from your main processing computer to your Linux interface system will pose no problems, and then upload to your website with Clonezilla. Takes about 15 mins to clone any Linux OS partition to a given HDD/SSD, using live Gparted, no problems there. Also, ClamAV is a useful Open Source antivirus, compatible with Mint, that can also read Microsoft data hard drives plugged as slaves, or, via USB..*

7) Finally, **If you just wish to help friends and family, or, advance to being an actual computer technician, and/or hands-on computer scientist, these following links will be useful, ranging from beginner to expert in scope.** ***Note that Sorin recommends aspiring computer technicians also undergo comprehensive micro-electronics training, to be fully effective and properly qualified.***

Useful references and links:

Sorin's Electronic School

Scott Mueller Troubleshoting *....see also books below.*

Carey Holzman

Louis Rossmann

Plus these printed references, *current versions:*

A+ Certification, M. Meyers, McGraw-Hill/Osborne, 2…, **ISBN 0072222743,** & Passport Version **ISBN 0072193638**

A+ Guide to Hardware, J. Andrews, Course Technology, 2…, **ISBN 9780619217624** (Buy if You Are Serious)

Build Your Own Computer 2, K. MacRae, Haynes 2005, ISBN **1844252280** (Buy If You Are Serious)

Essential Electronics for PC Technicians, J. Farber, Charles River Media 2004**, ISBN 1584503173**

How Computers Work, R. White, Que, 2…, ISBN **0789725495**

PC User's Bible, J. Ross & K. Murdock, Wiley 2007, ISBN **9780470088975**

Repairing and Upgrading Your PC, R & B Thompson, O'Reilly 2006, ISBN **059600866X** (**Buy If You Are Serious)**

Upgrading and Fixing a PC, S Yarnold, In Easy Steps 2…, **ISBN 1840783575**

Upgrading and Repairing PCs, S. Mueller, Que 2…, ISBN **0789729741 (Buy If You Are Serious, Computer Bible 1)**

Upgrading and Repairing Laptops, S. Mueller, Que 2…, ISBN **0789728001 (Buy If You Are Serious, Computer Bible 2)**

Wiki Books: How To Assemble A Desktop PC, Printable Version **