A+ Guide to Hardware: Managing, Maintaining, and Troubleshooting, 5e

Chapter 9
PC Maintenance and Troubleshooting Strategies
Objectives

• Learn about operational procedures to keep you, other people, the equipment, and the environment safe
• Learn how to develop a preventive maintenance plan and what to include in it
• Learn how to approach and solve a PC problem
Operational Procedures When Supporting Personal Computers

• Topics covered
  – Physical dangers that support personal face when maintaining computers
  – Sources of damage to the computer and equipment
    • Prevention
  – Used equipment disposal
  – Safely moving computers
  – Software copyright law
Stay Safe and Keep Others Safe

• Electrical equipment damaged physically, exposed to water, moisture, or electrical shorts
  – Unplug immediately

• Other dangers
  – Chemical burns
  – Cables that can cause people to trip
  – Heavy equipment that can hurt a technician’s back
  – Sharp edges in and around case
Stay Safe and Keep Others Safe (cont’d.)

• Proper use of cleaning pads and solutions
  – Most contain flammable and poisonous materials
  • Keep away from skin and eyes

Figure 9-1 Cleaning solutions and pads. Courtesy: Course Technology/Cengage Learning
Stay Safe and Keep Others Safe (cont’d.)

• Proper use of cleaning pads and solutions (cont’d.)
  – Accidental exposure procedures
    • View Material Safety Data Sheet (MSDS)
    • Know company reporting policies

Figure 9-2 Each chemical you use should have available a material safety data sheet. Courtesy: Course Technology/Cengage Learning
Stay Safe and Keep Others Safe (cont’d.)

• Managing cables
  – Trip hazard
    • Loose cables or cords in a traffic area where people can trip over them
  – Use cable or cord cover
    • Nail or screw to floor
Stay Safe and Keep Others Safe (cont’d.)

• Lifting heavy objects
  – Put on a cart
  – Guidelines
    • Balance the load when lifting
    • Stand close to the object with feet apart
    • Keep back straight, bend knees, and grip the load
    • Lift with legs, arms, and shoulders
    • Keep load close to body and avoid twisting
    • Put the object down by keeping back straight and lowering object by bending knees
  – Ask for help if necessary
Physically Protect Your Equipment

• Guidelines
  – Do not move or jar computer when on
  – Do not smoke around the computer
  – Do not leave PC turned off for weeks or months
  – Do not block air vents on the case or monitor

Figure 9-3 For optimum airflow, don’t leave empty expansion slots and bays uncovered. Courtesy: Course Technology/Cengage Learning
Physically Protect Your Equipment (cont’d.)

• Guidelines (cont’d.)
  – Use keyboard covers in dirty environments
  – Avoid high humidity around hard drives
  – Use BIOS setup to disable ability to write to the hard dive boot sector
  – Keep private data under lock and key
  – Protect storage media from direct sunlight, heat, and extreme cold
  – Keep magnets away from the computer
  – Protect electrical equipment from power surges
  – Do not unpack and turn on a cold computer
How to Dispose Of Used Equipment

- PC technician responsibility
  - Proper disposal of used equipment and consumables

<table>
<thead>
<tr>
<th>Part</th>
<th>How to Dispose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline batteries, including AAA, AA, A, C, D, and 9-volt</td>
<td>Dispose of these batteries in the regular trash. First check to see if there are recycling facilities in your area.</td>
</tr>
<tr>
<td>Button batteries used in digital cameras and other small equipment; battery packs used in notebooks</td>
<td>These batteries can contain silver oxide, mercury, lithium, or cadmium and are considered hazardous waste. Dispose of them by returning them to the original dealer or by taking them to a recycling center. To recycle, pack them separately from other items. If you don’t have a recycling center nearby, contact your county for local regulations for disposal.</td>
</tr>
<tr>
<td>Laser printer toner cartridges</td>
<td>Return these to the manufacturer or dealer to be recycled.</td>
</tr>
<tr>
<td>Ink-jet printer cartridges Computer cases, power supplies, and other computer parts Monitors Chemical solvents and containers</td>
<td>Check with local county or environmental officials for laws and regulations in your area for proper disposal of these items. The county might have a recycling center that will receive them. Discharge a monitor before disposing of it. See the MSDS documents for chemicals to know how to dispose of them.</td>
</tr>
<tr>
<td>Storage media such as hard drives, CDs, DVDs, and BDs</td>
<td>Do physical damage to the device so it is not possible for sensitive data to be stolen. Then the device can be put in the trash. To meet legal requirements to destroy data, consider using a data-destruction service.</td>
</tr>
</tbody>
</table>

A+ Guide to Hardware  Table 9-1 Computer parts and how to dispose of them
How to Dispose Of Used Equipment (cont’d.)

• Monitors and power supplies
  – Discharge
    • Let sit unplugged for 60 minutes
    • Use a high-voltage probe

• Protect private data on hard drives
  – Physically damage a hard drive with nail and hammer
  – Break CDs and DVDs in half
  – Consider a secure data-destruction service
    • Thoroughly check out references and guarantees of legal compliance
How to Move Computer Equipment

• Risks involved with shipping a computer
  – Damage from rough handling
  – Exposure to water, heat, or cold
  – May be misplaced, lost, stolen

• Preparing a computer for shipping
  – Back up all important data
  – Coil all external cords and secure them
  – Pack the computer, monitor, and devices in original shipping cartons or similar boxes
    • Use adequate packing material
  – Purchase insurance on the shipment
Protecting Software Copyrights

• License
  – Right to use software (gained in purchase)

• Copyright
  – Right to copy software
  – May be transferred from one entity to another

• Legal responsibility
  – Protect the software copyright
Protecting Software Copyrights (cont’d.)

• Federal copyright act of 1976
  – Designed to protect software copyrights
  – Requires software copies to be legal
    • Allows for one backup copy of software to be made
  – Software piracy (copyright infringement)
    • Making unauthorized copies of software
  – Violation of the law
    • Making software copy and selling it or giving it away
  – Site license
    • Provides right to use multiple copies of software
Figure 9-4 Agree to the EULA before the installation continues
Courtesy: Course Technology/Cengage Learning
Protecting Software Copyrights (cont’d.)

- Industry associations
  - Software Information Industry Assoc (SIIA)
    - Educates the public and enforces copyright laws
  - Business Software Alliance (BSA)
    - Manages BSA Anti-Piracy Hotline: 1-888-NOPIRACY
  - Hard-disk loading: installing pirated software on disk
  - Signs of hard-disk loading
    - No end-user license included
    - No mail-in product registration card
    - Documentation and original disks are missing
    - Documentation is photocopied or labels are handwritten
Protecting Software Copyrights (cont’d.)

• What are your responsibilities under the law?
  – Software Rental Amendment Act (1990)
    • Prevents illegal renting, leasing, lending, and sharing
    • Copyright holder may extend written permission
  – Criminal penalties for software piracy (1992)
    • Imprisonment for up to five years and/or fines
    • Applies to illegal copying/distribution of 10 or more units
  – Responsibilities
    • Use and purchase only legitimate software
    • Comply with all terms of license (includes site license)
    • Use open source software if on a budget
Personal Computer Preventive Maintenance

• Prevent computer problems from occurring in the first place

• PC technicians responsibilities
  – Make and implement a preventive maintenance plan
  – Create a disaster recovery plan

• Preventive maintenance goals
  – Reduce likelihood of events causing PC failures
    • Lessen the damage if they do occur
Set Up a Method of Documentation

- Create a new computer record book
  - Record changes in setup data, problems experienced, and maintenance performed
  - Keep it up to date
  - Store it with hardware and software documentation
Create a Preventive Maintenance Plan

• Evolves from a history or pattern of malfunctions within an organization

Table 9-2 Guidelines for developing a PC preventive maintenance plan

<table>
<thead>
<tr>
<th>Component</th>
<th>Maintenance</th>
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<tbody>
<tr>
<td>Computer</td>
<td>Physically inspect the computer by doing the following:</td>
</tr>
<tr>
<td></td>
<td>Make sure the computer is in a proper environment. Problems to look for are listed earlier in the chapter.</td>
</tr>
<tr>
<td></td>
<td>Check that air vents on the computer case or monitor are not blocked by papers, books, drapes, or other obstructions.</td>
</tr>
<tr>
<td></td>
<td>Make sure the inside of the computer case is free from dust. Use an antistatic vacuum, blower, or can of compressed air to blow the dust out of the case and clean vents, power supply, and fans.</td>
</tr>
<tr>
<td></td>
<td>Verify that chips and expansion cards are firmly seated.</td>
</tr>
<tr>
<td></td>
<td>Check cables and cords for wear and tear. Look for trip hazards and correct them if necessary.</td>
</tr>
<tr>
<td>Keyboard</td>
<td>Clean the keyboard. Unplug the keyboard and then blow or vacuum it out. To dislodge debris, turn the keyboard upside down and bump it. Use cleaning wipes to clean the surface.</td>
</tr>
<tr>
<td>Mouse</td>
<td>Clean the mouse. To clean a wheel mouse, remove the cover of the mouse ball from the bottom of the mouse. The cover usually comes off</td>
</tr>
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<tr>
<td></td>
<td>with a simple press and shift or turn motion. Clean the rollers with a cotton swab dipped in a very small amount of liquid soap. The sticky side of duct tape works well to clean the mouse ball.</td>
</tr>
<tr>
<td>Monitor</td>
<td>▶ Clean the screen with a lint-free cloth. You can also use special monitor wipes that are safe for CRT and LCD monitors.</td>
</tr>
</tbody>
</table>
| Printers             | ▶ Using compressed air or a vacuum, clean out the dust and bits of paper. Small pieces of paper can be removed with tweezers, preferably insulated ones.  
▶ Clean the paper path with a soft, lint-free cloth.  
▶ Don’t re-ink ribbons or use recharged toner cartridges.  
▶ If the printer uses an ozone filter, replace it as recommended by the manufacturer.  
▶ Replace other components as recommended by the manufacturer.  
You can purchase maintenance kits from the printer manufacturer, which include a scheduled maintenance plan for the printer.  
How to perform these scheduled maintenances is covered in Chapter 22. |
| UPS or surge protector| ▶ Verify the system is protected against electrical surges by using a UPS or surge protector.  
▶ Run a weak battery test on the UPS.  
▶ Run a diagnostic test on the UPS as appropriate. |
| Backup of data        | ▶ If the computer is used to hold important data, verify data is being backed up on a regular basis and backup media is being kept in an offsite location. How to schedule backups is covered in Chapter 13. |
| Hard drive            | ▶ Rearrange noncontiguous parts of files (called defragmenting the drive), delete unneeded files, and check the drive for errors. How to do all this is covered in Chapter 13. |
| Clean up the start routine | ▶ To keep Windows from starting slowly, reduce Windows startup programs to a minimum (covered in Chapters 13 and 14).  
▶ Delete temporary files and check the hard drive for errors (covered in Chapter 13). |
| Drivers and firmware updates | ▶ Update firmware or device drivers only if the device is giving problems (covered in Chapter 5). |
| Security              | ▶ Verify Windows has all updates and patches installed and that Windows is set to automatically download and install updates (covered in Chapter 12).  
▶ Verify that antivirus software is installed, running, and updated (covered in Chapter 20).  
▶ Verify that a personal firewall is configured and running on the computer (covered in Chapter 19). |
| Software              | ▶ If directed by your employer, check that only authorized software is present. |
| Written records       | ▶ Keep a record of all software, including version numbers and the OS installed on the PC.  
▶ Keep a record of all hardware components installed, including hardware settings.  
▶ Record when and what preventive maintenance is performed.  
▶ Record any repairs done to the PC. |

Table 9-2 Guidelines for developing a PC preventive maintenance plan (continued)
How to Troubleshoot a PC Problem

• Approach the problem first as an investigator and discoverer
  – Do not compound the problem
  – Ask questions until problem source understood
  – Positive attitude

• Use a systematic method to solve a problem
  – Interspersed with 15 rules

• Rule 1: Approach the problem systematically
How to Troubleshoot a PC Problem (cont’d.)

• Systematic method steps
  – Interview the user and back up data before changes are made
  – Examine the system, analyze the problem, make an initial determination
  – Test theory
  – After problem source determined:
    • Plan what to do to fix the problem and then fix it
  – Verify problem is fixed and system works
    • Take preventive measures to make sure problem does not happen again
  – Document activities, outcomes, and knowledge learned
Figure 9-5 General approach to problem solving. Courtesy: Course Technology/Cengage Learning.
Step 1: Interview the User and Back Up Data

• Beginning of troubleshooting situation
  – Interview user
    • Can you please describe the problem, including error messages, failures, and what you see or hear?
    • What changes have recently been made to the system?
    • Is there important data on the system that is not backed up?
    • Can you show me how to reproduce the problem?
  – Ask more penetrating questions to obtain all information to help solve the problem
Step 1: Interview the User and Back Up Data (cont’d.)

- Rule 2: Establish your priorities
- Rule 3: Beware of user error
- Rule 4: Keep your cool and don’t rush
  - Back up any important data
    - Risks with the data must be the user’s decision
    - Have user verify all important data safely backed up
Step 2: Examine the System and Make Your Best Guess

• Rule 5: Make no assumptions
• Rule 6: Try the simple things first
• Steps to form a best guess (best theory) and test it
  – Reproduce the problem and observe what the user described
  – Decide if the problem is hardware or software related
  – Make a best guess of problem source
    • Search resources for ideas and tips if necessary
Figure 9-6 Search manufacturer Web sites for help with a hardware or software product. Courtesy: Course Technology/Cengage Learning
Step 3: Test Your Theory

• Examples where Steps 3, 4, and 5 go very fast
  – Video does not work
    • Suspect loose cables or monitor not turned on
    • Check video cable connection and discover it’s loose
    • Screw video cable to the connection
  – Corrupted spreadsheets
    • Watch user save a file
    • Discover user is saving files in a wrong format
    • Step the user through saving the file correctly
    • Verify others can open the file
    • Explain to the user which format to use
Step 3: Test Your Theory (cont’d.)

• Examples of Step 3 which include testing an incorrect guess
  – CD drive won’t read a CD, suspect CD scratched
    • Disc looks fine upon inspection
    • Next guess: CD drive not recognized by Windows
    • Device Manager reporting drive errors
    • Next guess: corrupt drivers
  – System refuses to boot and gives hard drive not found message
    • Internal cable connections solid
    • Next guess: power supply not supplying power to the drive
Step 3: Test Your Theory (cont’d.)

• Examples of Step 3 with a correct guess, move on toward Step 4 to plan a solution
  – Corrupted Word files
    • Eliminate several simple causes
    • Guess bad hard drive
    • Event Viewer shows write errors to the drive
    • Bad drive theory confirmed
    • Will need to replace drive
Step 3: Test Your Theory (cont’d.)

• Examples of Step 3 with a correct guess, move on toward Step 4 to plan a solution (cont’d.)
  – Video does not work
    • Check cables, power, and monitor settings
    • Exchange video cable with known good one
    • Guess a bad monitor: move monitor to a working PC and it still does not work
    • Try a good monitor on the first PC: works fine
    • Bad monitor confirmed
    • Plan to purchase new monitor
Step 3: Test Your Theory (cont’d.)

• As testing of guesses proceeds, keep in mind the following rules:
  – Rule 7: Trade known good for suspected bad
  – Rule 8: Trade suspected bad for known good
  – Rule 9: Divide and conquer
  – Rule 10: Become a researcher
  – Rule 11: Write things down
  – Rule 12: Don’t assume the worst
  – Rule 13: Reboot and start over
Step 4: Plan Your Solution and Then Fix the Problem

- Some solutions are expensive and time consuming
- Carefully consider what will be done and the order
- When planning and implementing a solution, keep in mind the following rules:
  - Rule 14: Use the least invasive solution first
  - Rule 15: Know your starting point
Step 4: Plan Your Solution and Then Fix the Problem (cont’d.)

- Steps to plan a solution and fix the problem:
  - Consider different solutions
    - Select the least invasive one
  - If hardware needs replacing:
    - Select a replacement part compatible with the system
  - Before installing a new part
    - Determine what works and does not work
    - Provides starting point
  - Install the new part
Step 5: Verify the Fix and Take Preventive Action

• Checks:
  – Try reaching the Internet, use the printer, and burning a CD
  – Have user check everything and verify the job was completed satisfactorily
    • If a problem is found return to Step 2
  – After verification consider how problem could have been prevented
    • Instruct the user to do what is appropriate to prevent future problems
Step 6: Document What Happened

• Good documentation helps the technician:
  – Take knowledge learned into next troubleshooting situation
  – Train others
  – Develop effective preventive maintenance plans
  – Satisfy any audits or customer or employer queries about your work
Figure 9-8 Service call report form
Courtesy: Course Technology/Cengage Learning
Summary

• Operational procedures in the PC support role
  – Know physical dangers when maintaining computers
  – Know damage sources to computers and equipment
  – Know how to dispose of used equipment properly
  – Know how to move computers safely
  – Understand and abide by software copyright law

• Preventive maintenance goals
  – Reduce likelihood of events causing PC failures
    • Lessen damage if they do occur

• PC trouble shooting involves six steps and 15 rules