

Chapter 4: Preventive Maintenance and Troubleshooting



IT Essentials v7.0



Chapter 4 - Sections & Objectives

- 4.1 Preventive Maintenance
 - Explain why preventive maintenance must be performed on personal computers.
 - Describe PC preventive maintenance.
- 4.2 Troubleshooting Process
 - Troubleshoot problems with PC and Peripheral devices
 - Describe each step of the troubleshooting process.
 - Identify common problems and solutions for PCs.
 - Troubleshoot computer components and peripherals using the six-step troubleshooting process.



4.1 PREVENTIVE MAINTENANCE



PC Preventive Maintenance Overview

- **Benefits of Preventive Maintenance**
 - Reduces potential hardware and software problems, computer downtime and repair costs by:
 - Improving data protection
 - Extending the life of the components
 - Improving equipment stability
- **Preventive Maintenance Tasks**
 - Hardware tasks include:
 - remove dust from fans, power supply, internal components and peripherals, clean the mouse, keyboard, and display, check for and secure any loose cables.
 - Software tasks include:
 - review and install appropriate OS, security and driver updates, regularly update virus definition files, regularly scan for virus and spyware, remove unwanted programs, regularly scan hard drive for errors.





Benefits to Preventive Maintenance

- Preventive maintenance plans are developed based on at least two factors:
 - **Computer location or environment** - Dusty environments, such as construction sites, requires more attention than an office environment.
 - **Computer use** - High-traffic networks, such as a school network, might require additional scanning and removal of malicious software and unwanted files.



Preventive Maintenance Tasks

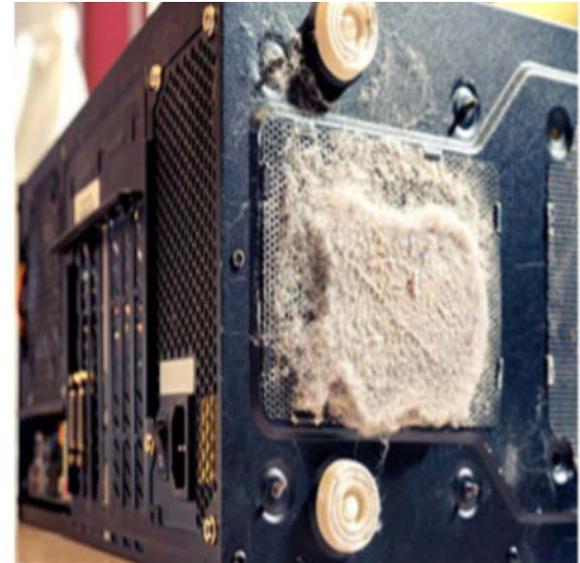
- Hardware Maintenance

- Check the condition of cables, components, and peripherals.
- Repair or replace any components that show signs of excess wear.
- Removing dust from inside the computer and fans should be part of every preventive maintenance plan.
- Keep components clean to reduce the likelihood of overheating.
 - Hold compressed air can upright while spraying
 - Don't spray directly into fans, they can be damaged



Preventive Maintenance - Dust

- Use a cloth or a duster to clean the outside of the computer case. If using a cleaning product, put a small amount onto a cleaning cloth and then wipe the outside of the case.
- Dust on the outside of a computer can travel through cooling fans to the inside.
- Accumulated dust prevents the flow of air and reduces the cooling of components.
- Hot computer components are more likely to break down.
- Remove dust from the inside of a computer using a combination of compressed air, a low-air-flow ESD vacuum cleaner, and a small lint-free cloth.





Preventive Maintenance – Internal Components

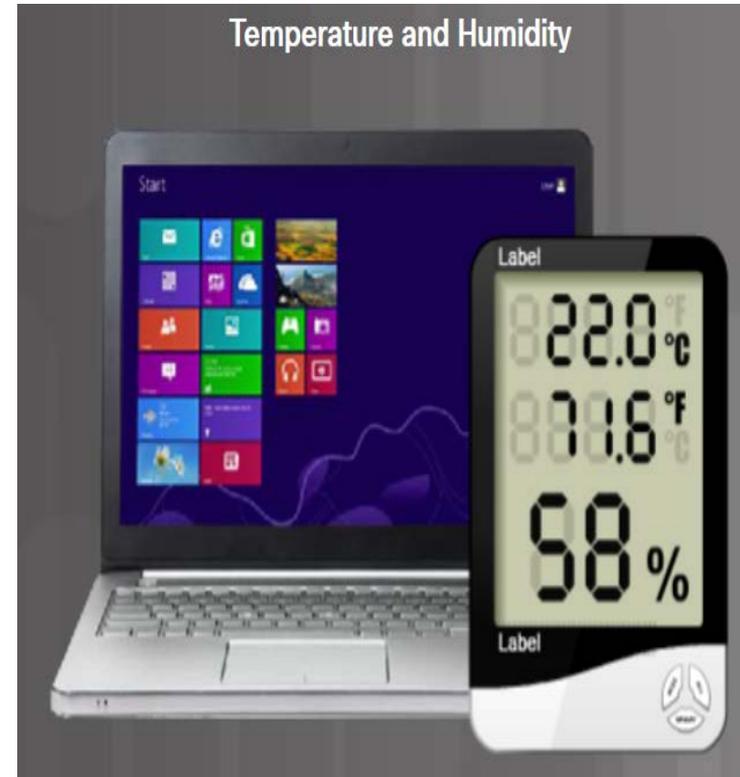
- A basic checklist of components to inspect for dust and damage includes:
 - CPU heat sink and fan assembly
 - RAM modules
 - Storage devices
 - Adapter cards
 - Cables
 - Power devices
 - Keyboard and mouse





Preventive Maintenance – Environmental Concerns

- An optimal operating environment for a computer is clean, free of potential contaminants, and within the temperature and humidity range specified by the manufacturer.





Preventive Maintenance – Software

- Verify that installed software is current.
 - Follow the policies of the organization when installing security updates, operating system, and program updates.
- Create a software maintenance schedule to:
 - Review and install the appropriate security, software, and driver updates.
 - Update the virus definition files and scan for viruses and spyware.
 - Remove unwanted or unused programs.
 - Scan hard drives for errors and defragment hard drives.



PC Preventive Maintenance Overview

- Clean the Case and Internal Components
 - Dust or dirt can accumulate inside the computer.
 - Accumulated dirt and dust block airflow inside the case.
 - Use a low-air-flow ESD vacuum cleaner
 - Make sure to keep the following internal components clean: Heat sink and fan assembly, RAM, adapter cards, motherboard, fans, power supply and internal drives.
- Inspect Internal Components
 - Examine the computer on a regular schedule.
 - The main components to inspect are: CPU heat sink and fan assembly, RAM, storage devices, adapter cards, screws, cables, power devices, keyboard and mouse.
- A direct spray of compressed air can damage a fan.





PC Preventive Maintenance Overview

- Environmental Concerns
 - Computers should not be operated in harsh environmental conditions.
 - Due to their mobile nature, laptops are subject to various environmental conditions.
- Guidelines to help ensure optimal computer operating performance include:
 - Do not obstruct vents or airflow to the internal components.
 - Keep the room temperature between 45 to 90 degrees Fahrenheit (7 to 32 degrees Celsius).
 - Keep the humidity level between 10 and 80 percent.





4.2 TROUBLESHOOTING PROCESS



Introduction to Troubleshooting

- Troubleshooting requires an organized and logical approach to problems with computers and other components.
- Eliminates variables and identifies causes of problems in a systematic order.
- Troubleshooting is a skill refined over time.
- **Before you begin troubleshooting problems, always follow the necessary precautions to protect data on a computer.**
 - **Backup Internet favorites and user created documents.**





The Troubleshooting Process

Step	Troubleshooting Process
1	Identify the Problem
2	Establish a Theory of Probable Cause
3	Test the Theory to Determine Cause
4	Establish a Plan of Action to Resolve the Problem and Implement the Solution
5	Verify Full System Functionality and, if Applicable, Implement Preventive Measures
6	Document Findings, Actions, and Outcomes

- Follow an organized and logical procedure.
- Eliminate variables one at a time.
- Troubleshooting is a skill that is refined over time.
- The first and last steps involve effectively communicating with the customer.



Data Protection

- Before troubleshooting problems, **always** follow the necessary precautions to protect data on a computer.
- User Data, like documents and favorites, should be backed up to a removable drive before starting any diagnostics or repairs.
- If unsure that a backup has been done, do not attempt any troubleshooting activities until the following are verified:
 - Date of the last backup
 - Contents of the backup
 - Data integrity of the backup
 - Availability of all backup media for data restore
- If no backup can be created, ask customer to sign a release form.





Liability Release Form

- A Liability Release form should be signed by the customer before beginning work and should include:
 - a description of the work to be performed.
 - permission to work on the computer without a current backup available.
 - a release from liability if data is lost or corrupted.



Troubleshooting Process Steps

Step 1 - Identify the problem

- During the troubleshooting process, gather as much information from the customer as possible, but always be respectful.
- This information will be used to aid in solving the problem.
- Use the following strategy during this step:
 - Start by using open-ended questions to obtain general information.
 - Continue using closed-ended (yes/no) questions to get relevant information.
 - Document the responses in the work order and in the repair journal.
 - Verify the customer's description by gathering data from the computer using applications such as:
 - Event Viewer
 - Device Manager
 - Beep Codes
 - BIOS or UEFI Information
 - Diagnostic Tools
 - Event Viewer
 - Device Manager
 - Task Manager

Step 1: Identify the Problem.	
Customer Information	<ul style="list-style-type: none"> • Company Name • Contact Name • Address • Phone Number
Computer Configuration	<ul style="list-style-type: none"> • Manufacturer and Model • Operating System • Network Environment • Connection Type
Problem Description	<ul style="list-style-type: none"> • Open-ended Questions • Closed-ended Questions
Error Messages	
Beep Sequences	
LEDs	
POST	



Troubleshooting Process Steps

Step 2 - Establish a theory of probable cause

- Create a list of the most common reasons why the error would occur. The computer manual and the computer's repair history log can help establish a plan of action.
- List the easiest or most obvious causes at the top and more complex causes at the bottom.
- Research the symptoms.
 - The computer manual
 - The computer repair history log.
 - Internet search.

Step 2. Establish a Theory of Probable Cause.

- Device is powered off.
- Power switch for an outlet is turned off.
- Surge protector is turned off.
- Loose external cable connections.
- Non-bootable disk in designated boot drive.
- Incorrect boot order in BIOS setup.



Troubleshooting Process Steps

Step 3 – Test the Theory to Determine cause

- Determine the exact cause by testing the theories of probable cause one at a time, starting with the easiest and most obvious first.
- After identifying an exact cause of the problem, determine the steps to resolve the problem.
- If the exact cause of the problem has not been determined after all theories have been tested, establish a new theory of probable causes and test it.
- Document each test tried that did not correct the problem.

Step 3. Test the Theory to Determine the Cause.

Common steps to determine cause

- Ensure the device is powered on.
- Ensure the power switch for an outlet is turned on.
- Ensure the surge protector is turned on.
- Ensure external cable connections are secure.
- Ensure that the designated boot drive is bootable.
- Verify the boot order in BIOS setup.



Troubleshooting Process Steps

Step 4 – Establish a Plan of Action to Resolve the Problem and Implement the solution

- After the exact cause of the problem is determined, establish a plan of action to resolve the problem and implement the solution.
- Sometimes quick procedures can determine the exact cause of the problem or even correct the problem.
- If a quick procedure does not correct the problem, further research is needed to establish the exact cause.
- Divide larger problems into smaller problems that can be analyzed and solved individually.

Step 4: Establish a Plan of Action to Resolve the Problem and Implement the Solution.

If no solution is achieved in the previous step, further research is needed to implement the solution.

- Helpdesk repair logs
- Other technicians
- Manufacturer FAQ websites
- Technical websites
- News groups
- Computer manuals
- Device manuals
- Online forums
- Internet search



Troubleshooting Process Steps

Step 5 – Verify Full System Functionality and, If Applicable, Implement Preventive Measures

- The troubleshooting process is not over until full system functionality is confirmed.
- Have the customer tryout the fixes you implemented.
- Ensure that you have not created another problem while repairing the computer.
- If the system is working properly, implement preventive measures if needed.

Step 5: Verify Full System Functionality and if Applicable Implement Preventive Measures.

- Reboot the computer.
- Ensure multiple applications work properly.
- Verify network and Internet connections.
- Print a document from one application.
- Ensure all attached devices work properly.
- Ensure no error messages are received.



Troubleshooting Process Steps

Step 6 – Document Findings, Actions, and Outcomes

- Discuss the solution with the customer, both verbally and in writing.
- Have the customer confirm that the problem has been solved.
- Document the entire process for future reference.
- Document the details and frequency of each maintenance task.
- Document the process:
 - Problem description
 - Steps to resolve the problem
 - Components used in the repair

Step 6: Document Findings, Actions, and Outcomes

- Discuss the solution implemented with the customer.
- Have the customer verify that the problem has been solved.
- Provide the customer with all paperwork.
- Document the steps taken to solve the problem in the work order and in the technician's journal.
- Document any components used in the repair.
- Document the amount of time spent to resolve the problem.



PC Common Problems and Solutions

- Computer problems can be attributed to hardware, software, networks, or some combination of the three. These are some common hardware problems:
 - **Storage Device** - Storage device problems are often related to loose, or incorrect cable connections, incorrect drive and media formats, and incorrect jumper and BIOS settings.
 - **Motherboard and Internal Components** - These problems are often caused by incorrect or loose cables, failed components, incorrect drivers, and corrupted updates.
 - **Power Supply** - Power problems are often caused by a faulty power supply, loose connections, and inadequate wattage.
 - **CPU and Memory** - Processor and memory problems are often caused by faulty installations, incorrect BIOS settings, inadequate cooling and ventilation, and compatibility issues.
 - **Displays** – Display problems are often caused by incorrect settings, loose connections, and incorrect or corrupted drivers.



Common Problems and Solutions for Storage Devices

- Optical drive discs can be removed by inserting a pin or paper clip into the small hole on the front of the drive.
- Loose cables can cause front LEDs from working.

The computer does not recognize a storage device	
Probable Causes	Possible Solutions
The power cable is loose.	Secure the power cable.
The data cable is loose.	Secure the data cable.
The jumpers are set incorrectly.	Reset the jumpers.
A storage device failed	Replace the storage device.
The storage device setting in BIOS are incorrect.	Reset the storage device settings in BIOS.



Common Problems and Solutions for Motherboards and Internal Components

- Temperature can affect motherboards, CPUs, and hard drive.
- Can cause the PC to lock up.
- Loose screws, plugging in cables while the computer is on, and unseated cards can cause the motherboard to short-circuit.
- Longer boot time and incorrect system time can be caused by the CMOS battery.

The clock on the computer is no longer keeping the correct time or the BIOS settings are changing when the computer is rebooted

Probable Causes	Possible Solutions
The CMOS battery may be loose.	Secure the battery.
The CMOS battery may be drained.	Replace the battery.



Common Problems and Solutions for Power Supplies

- Smell of burning electronics.
- Unexpected shutdown.

The computer will not turn on	
Probable Causes	Possible Solutions
The computer is not plugged in to the AC outlet.	Plug the computer into a known good AC outlet.
The AC outlet is faulty.	Plug the computer into a known good AC outlet.
The power cord is faulty.	Use a known good power cord.
The power supply switch is not turned on.	Turn on the power supply switch.
The power supply switch is set to the incorrect voltage.	Set the power supply switch to the correct voltage setting.
The power button is not connected correctly to the front panel connector.	Correctly orient the power button to the front case panel connector and reconnect.
The power supply has failed.	Install a known good power supply.



Common Problems and Solutions for CPUs and Memory

- Adding RAM can improve performance problems.
- Be sure RAM is installed correctly and firmly seated.
- Overheating can cause the computer to lockup or shutdown unexpectedly.
- Improperly seated RAM can cause the PC to not boot.

The computer will not boot or it locks up

Probable Causes	Possible Solutions
The CPU has overheated.	Reinstall the CPU. <ul style="list-style-type: none">• Replace the CPU fan.• Add fan(s) to the case.
The CPU fan is failing.	Replace the CPU fan.
The CPU has failed.	Replace the CPU.



Common Problems and Solutions for Displays

- Video problems can be caused by setting in the BIOS.

Display has power but no image on the screen

Probable Causes	Possible Solutions
Video cable is loose or damaged.	Reconnect or replace video cable.
The computer is not sending a video signal to the external display.	Use the Fn key along with the multi-purpose key to toggle to the external display.



Common Problems and Solutions for Software

- Antivirus software is out of date or expired. Update or renew, then run a full virus scan.
- Event Viewer may show information about errors caused by the system, the user, or the software.



Personal Reference Tools

- Personal reference tools include troubleshooting guides, manufacturer manuals, quick reference guides, and repair journals. In addition to an invoice, a technician keeps a journal of upgrades and repairs:
 - **Notes** - Make notes as you go through the troubleshooting and repair process. Refer to these notes to avoid repeating steps and to determine what needs to be done next.
 - **Journal** - Include descriptions of the problem, possible solutions that have been tried to correct the problem, and the steps taken to repair the problem. Note any configuration changes made to the equipment and any replacement parts used in the repair. Your journal, along with your notes, can be valuable when you encounter similar situations in the future.
 - **History of repairs** - Make a detailed list of problems and repairs, including the date, replacement parts, and customer information. The history allows a technician to determine what work has been performed on a specific computer in the past.



Internet Reference Tools

- The Internet is an excellent source of information about specific hardware problems and possible solutions:
 - Internet search engines
 - News groups
 - Manufacturer FAQs
 - Online computer manuals
 - Online forums and chat
 - Technical websites



4.3 CHAPTER SUMMARY



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 - Explain why preventive maintenance must be performed on personal computers.
 - Describe PC preventive maintenance.
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New Terms and Commands

- Closed-Ended Questions
- Open-Ended Questions

