Introduction to troubleshooting

Troubleshooting requires an organized and logical approach to problems with computers and other components. Sometimes issues arise during preventive maintenance. At other times, a customer may contact you with a problem. A logical approach to troubleshooting allows you to eliminate variables and identify causes of problems in a systematic order. Asking the right questions, testing the right hardware, and examining the right data helps you understand the problem and form a proposed solution to try.

Troubleshooting is a skill that you refine over time. Each time you solve a problem, you increase your troubleshooting skills by gaining more experience. You learn how and when to combine steps or skip steps to reach a solution quickly. The troubleshooting process is a guideline that is modified to fit your needs.

This section presents an approach to problem solving that you can apply to both hardware and software. You can also apply many of the steps to problem solving to other work-related areas.

NOTE: The term customer, as used in this course, is any user that requires technical computer assistance.

Before you begin troubleshooting problems, always follow the necessary precautions to protect data on a computer. Some repairs, such as replacing a hard drive or reinstalling an operating system, might put the data on the computer at risk. Make sure you do everything possible to prevent data loss while attempting repairs.

CAUTION: Always perform a backup before beginning any troubleshooting. You must protect data before beginning any work on a customer's computer. If your work results in data loss for the customer, you or your company could be held liable.

Data Backup

A data backup is a copy of the data on a computer hard drive that is saved to another storage device or to cloud storage. Cloud storage is online storage that is accessed via the Internet. In an organization, backups may be performed on a daily, weekly, or monthly basis.

If you are unsure that a backup has been done, do not attempt any troubleshooting activities until you check with the customer. Here is a list of items to verify with the customer about data backups:

- Date of the last backup

- Contents of the backup

- Data integrity of the backup

- Availability of all backup media for a data restore
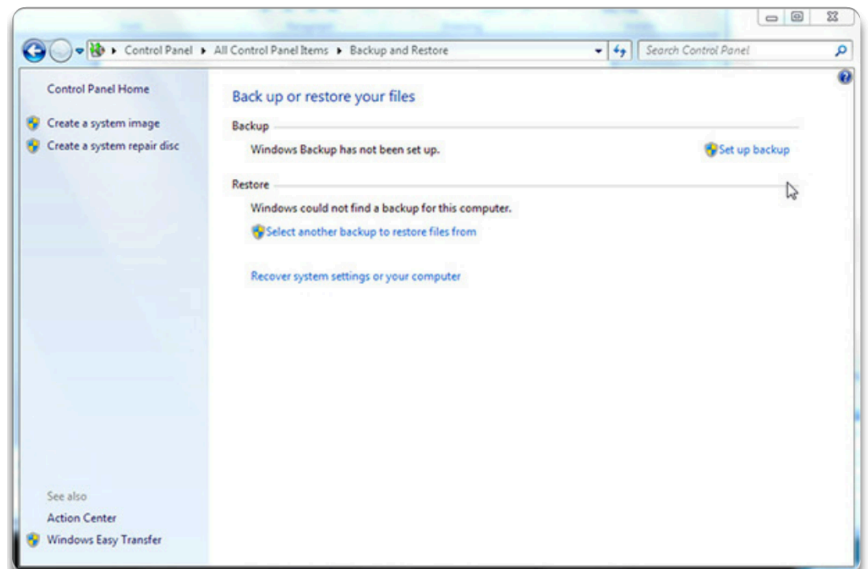
If the customer does not have a current backup and you are not able to create one, ask the customer to sign a liability release form. A liability release form contains at least the following information:

- Permission to work on the computer without a current backup available

- Release from liability if data is lost or corrupted

- Description of the work to be performed

Identify the problem

The first step in the troubleshooting process is to identify the problem. During this step, gather as much information as possible from the customer and then from the computer.

Conversation Etiquette

When you are talking to the customer, follow these guidelines:

- Ask direct questions to gather information.

- Do not use industry jargon.

- Do not talk down to the customer.

- Do not insult the customer.

- Do not accuse the customer of causing the problem.

By communicating effectively, you can elicit the most relevant information about the problem from the customer. The chart above lists some of the important information to gather from the customer.

Step 1. Identify the Problem	
Customer Information	• Company Name • Contact Name • Address • Phone Number
Computer Configuration	• Manufacturer and Model • Operating System • Network Environment • Connection Type
Problem Description	• Open-ended Questions • Closed-ended Questions
Error Messages	
Beep Sequences	
LEDs	
POST	

Open-Ended and Closed-Ended Questions

Open-ended questions allow customers to explain the details of the problem in their own words. Use open-ended questions to obtain general information.

Based on the information from the customer, you can proceed with closed-ended questions. Closed-ended questions generally require a yes or no answer. These questions are intended to get the most relevant information in the shortest time possible.

Documenting Responses

Document the information obtained from the customer in the work order and in the repair journal. Write down anything that you think might be important for you or another technician. The small details often lead to the solution of a difficult or complicated problem.

Beep Codes

Each BIOS manufacturer has a unique beep sequence, a combination of long and short beeps, for hardware failures. When troubleshooting, power on the computer and listen. As the system proceeds through the POST, most computers emit one beep to indicate that the system is booting properly. If there is an error, you might hear multiple beeps. Document the beep code sequence, and research the code to determine the specific hardware failure.

BIOS Information

If the computer boots and stops after the POST, investigate the BIOS settings to determine where to find the problem. A device might not be detected or configured properly. Refer to the motherboard documentation to make sure that the BIOS settings are accurate.

Event Viewer

When system, user, or software errors occur on a computer, the Event Viewer is updated with information about the errors. The Event Viewer application shown in the image records the following information about the problem:

- What problem occurred

- Date and time of the problem

- Severity of the problem

- Source of the problem

- Event ID number

- Which user was logged in when the problem occurred
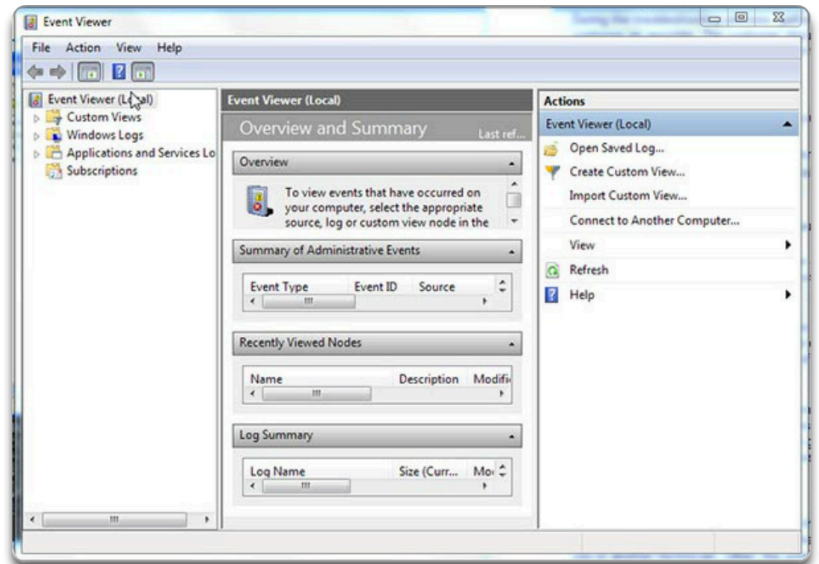
Although the Event Viewer lists details about the error, you might need to further research the solution.

Device Manager

The Device Manager shown in here displays all the devices that are configured on a computer. The operating system flags the devices that are not operating correctly with an error icon. A yellow circle with an exclamation point (!) indicates that the device is in a problem state. A red circle and an X means that the device is disabled. A yellow question mark (?) indicates that the the system does not know which driver to install for the hardware.
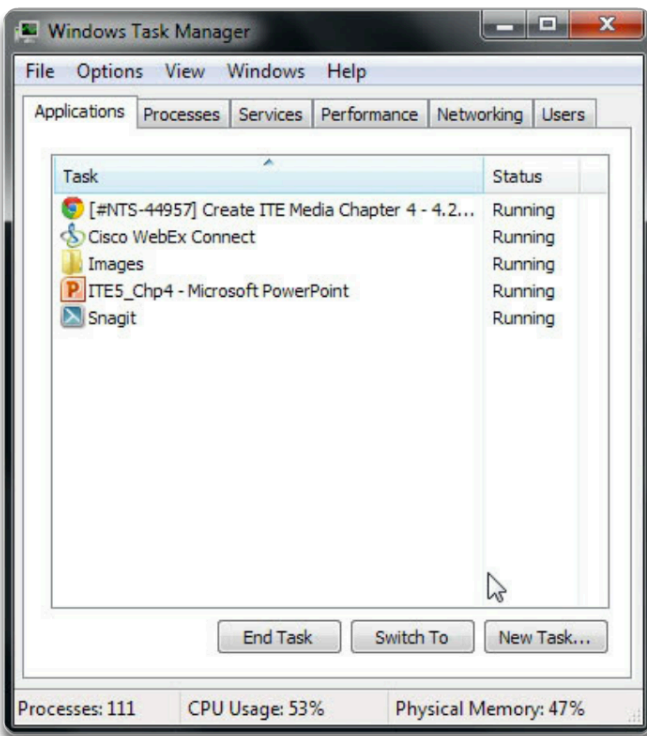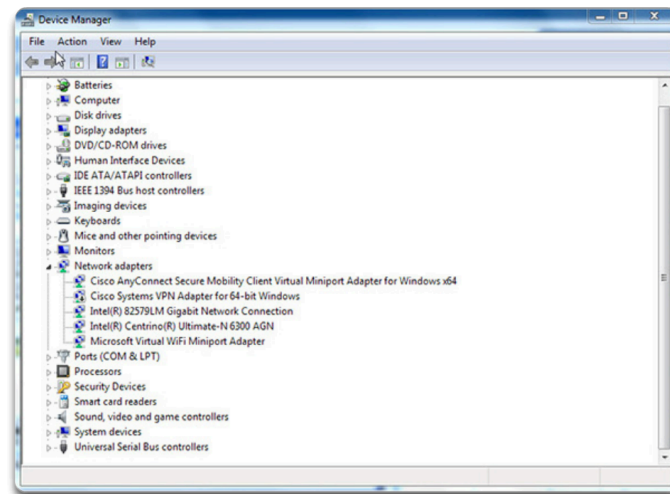
Task Manager

The Task Manager shown on the left displays the applications that are currently running. With the Task Manager, you can close applications that have stopped responding. You can also monitor the performance of the CPU and virtual memory, view all processes that are currently running, and view information about the network connections.

Diagnostic Tools

Conduct research to determine which software is available to help diagnose and solve problems. Many programs to help you troubleshoot hardware are available. Manufacturers of system hardware usually provide diagnostic tools of their own. For instance, a hard drive manufacturer might provide a tool to boot the computer and diagnose why the hard drive does not boot Windows.

Establish a theory of probable cause

The second step in the troubleshooting process is to establish a theory of probable cause. First, create a list of the most common reasons why the error would occur. Even though the customer may think that there is a major problem, start with the obvious issues before moving to more complex diagnoses. List the easiest or most obvious causes at the top. List the more complex causes at the bottom. The next steps of the troubleshooting process involve testing each possible cause.

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 floppy drive
- Incorrect boot order in BIOS setup

Test the theory to determine cause

You determine an exact cause by testing your theories of probable causes one at a time, starting with the quickest and easiest. This image identifies some common steps to determine the cause of the problem.

Step 3. Test the Theory to Determine 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 there are no disks in the floppy drive. • Verify the boot order in BIOS setup.

After identifying an exact cause of the problem, you then determine the steps to resolve the problem. As you become more experienced at troubleshooting computers, you will work through the steps in the process faster. For now, practice each step to better understand the troubleshooting process.

If you cannot determine the exact cause of the problem after testing all your theories, establish a new theory of probable causes and test it. If necessary, escalate the problem to a technician with more experience. Before you escalate, document each test that you tried, as shown in here.

Company Name: ___Cisco Systems, Inc.___
Contact: ___Office Manager___
Company Address: ___170 West Tasman Drive, San Jose, CA 95134___
Company Phone: ___408-526-4000___

Work Order

Generating a New Ticket

GENERATING A NEW TICKET

Category	HW	Closure Code		Status	RESOLVED
Type	Laptop	Escalated?	N	Pending	
Item	Laptop			Pending Until Date	

Business Impacting? ⚪ Yes ⚫ No

Summary | Won't Boot

Case ID | Cisco001 | Connection Type | Wireless network connection
Priority | Medium | Environment | Mobile

User Platform | Windows 7

Problem Description:
User complains that the laptop won't boot up.

No software was added recently. No operating system changes have been made.

No peripherals have been added.

Problem Solution:
Repairs attempted:

- Replaced AC adapter

- Resecured the battery

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Establish a plan of action to Resolve the problem and implement the solution

After you have determined the exact cause of the problem, establish a plan of action to resolve the problem and implement the solution. Sometimes quick procedures can correct the problem. If a quick procedure does correct the problem, verify full system functionality and, if applicable, implement preventive measures. If a quick procedure does not correct the problem, research the problem further and then return to Step 3 to establish a new theory of the probable cause.

After you have established a plan of action, you should research possible solutions. The figure lists possible research locations. Divide larger problems into smaller problems that can be analyzed and solved individually. Prioritize solutions starting with the easiest and fastest to implement. Create a list of possible solutions and implement them one at a time. If you implement a possible solution and it does not correct the problem, reverse the action you just took and then try another solution. Continue this process until you have found the appropriate solution.

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 FAQs • Technical Websites • News Groups • Computer Manuals • Device Manuals • Online Forums • Internet Search

Verify full functionality and, if applicable, implement preventive measures

After the repairs to the computer have been completed, continue the troubleshooting process by verifying full system functionality and implementing the preventive measures needed. Verifying full system functionality confirms that you have solved the original problem and ensures that you have not created another problem while repairing the computer. Whenever possible, have the customer verify the solution and system functionality.

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.

Document findings, action, and outcomes

After the repairs to the computer have been completed, finish the troubleshooting process with the customer. Communicate the problem and the solution to the customer verbally and in writing. The figure shows the steps to be taken when you have finished a repair.

Verify the solution with the customer. If the customer is available, demonstrate how the solution has corrected the computer problem. Have the customer test the solution and try to reproduce the problem. When the customer can verify that the problem

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.

has been resolved, you can complete the documentation for the repair in the work order and in your journal. Include the following information in the documentation:

- Description of the problem

- Steps to resolve the problem

- Components used in the repair

PC common problems and solutions

Computer problems can be attributed to hardware, software, networks, or some combination of the three. You will resolve some types of problems more often than others. Common hardware problems include the following:

- **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, as shown in the chart.

Common Problems and Solutions for Storage Devices

Identify the Problem	Probable Causes	Possible Solutions
The computer does not recognize a storage device.	• The power cable is loose. • The data cable is loose. • The jumpers are set incorrectly. • The storage device has failed. • The storage device settings in BIOS are incorrect.	• Secure the power cable. • Secure the data cable. • Reset the jumpers. • Replace the storage device. • Reset the storage device settings in BIOS.
The floppy disk drive will not read media or the drive light stays on constantly.	• The power cable or the data cable connection is loose. • Pin 1 on the data cable is not connected to Pin 1 on the drive. • The FDD settings in BIOS are incorrect. • The disc is bad or not formatted. • The disc is inserted upside down.	• Secure the power cable or the data cable to the drive and the motherboard. • Correctly connect the data cable. • Reset the FDD settings in BIOS. • Try another disc or format the disc. • Re-insert the disc correctly.
The computer fails to recognize an optical disc.	• The optical drive is faulty. • The disc is inserted upside down. • There is more than one disc inserted in the drive. • The disc is damaged. • The disc is the wrong format.	• Replace the optical drive. • Insert the disc correctly. • Ensure that there is only one disc inserted in the drive. • Replace the disc. • Use the correct type of disc.
The computer will not eject the optical disc.	• The optical drive is jammed. • The optical drive has been locked by software. • The optical drive is faulty.	• Insert a pin in the small hole next to the eject button on the drive to open the tray. • Reboot the computer. • Replace the optical drive.
The computer does not recognize a SCSI drive.	• The SCSI drive has an incorrect SCSI ID. • The SCSI termination is not set correctly. • The external SCSI drive was not powered on prior to booting the computer.	• Reconfigure the SCSI ID. • Ensure that the SCSI chain is terminated at the correct end points. • Turn on the drive before booting the computer.
The computer does not recognize a removable external drive.	• The removable external drive is faulty. • The removable external drive is not seated properly. • The external ports are disabled in the BIOS settings.	• Replace the removable external drive. • Remove and re-insert the drive. • Enable the ports in the BIOS settings.
A media reader cannot read a memory card that works properly in the camera.	• The media reader does not support the memory card type. • The media reader is not connected correctly. • The media reader is not configured properly in the BIOS settings. • The media reader is faulty.	• Use a different memory card type. • Ensure the media reader is connected correctly in the computer. • Reconfigure the media reader in the BIOS settings. • Install a known good media reader.

- **Motherboard and Internal Component** - These problems are often caused by incorrect or loose cables, failed components, incorrect drivers, and corrupted updates, as shown in the chart.

Common Problems and Solutions for Motherboards and Internal Components

Identify the Problem	Probable Causes	Possible Solutions
The clock on the computer is no longer keeping the correct time or the BIOS settings are changing when the computer is rebooted.	• The CMOS battery may be loose. • The CMOS battery may be failing.	• Secure the battery. • Replace the battery.
Retrieving or saving data from the USB flash drive is slow.	• The motherboard does not support USB 3.0. • The USB flash drive does not support USB 3.0. • The port is set to full speed in the BIOS setting.	• Update the motherboard or USB flash drive to support USB 3.0. • Set the port speed in the BIOS setting to high speed.
After updating the BIOS firmware, the computer will not start.	The BIOS firmware update did not install correctly.	Contact the motherboard manufacturer to obtain a new BIOS chip. (If the motherboard has two BIOS chips, the second BIOS chip can be used.)
The computer displays the incorrect CPU information when the computer boots.	• The motherboard has incorrect jumper settings. • The CPU settings are not correct in the advanced BIOS settings. • BIOS does not properly recognize the CPU.	• Set the appropriate CPU jumper settings on the motherboard. • Set the advanced BIOS settings correctly for the CPU. • Update the BIOS.
The hard drive LED on the front of the computer does not light.	• The hard drive LED cable is not connected or is loose. • The hard drive LED cable is incorrectly oriented to the front case panel connections.	• Reconnect hard drive LED cable to motherboard. • Correctly orient the hard drive LED cable to the front case panel connection and reconnect.
The built-in NIC has stopped working on a computer.	The NIC hardware has failed.	Add a new NIC to an open expansion slot.
The computer does not display any video after installing a new PCIe video card.	• BIOS settings are set to use the built-in video. • The cable is still connected to the built-in video. • The new video card is faulty.	• Disable the built-in video in the BIOS settings. • Connect the cable to the new video card. • Install a known good video card.
The new sound card does not work.	• The speakers are not connected to the correct jack. • The audio is muted. • The sound card is faulty. • BIOS settings are set to use the on-board sound device.	• Connect the speakers to the correct jack. • Unmute the audio. • Install a known good sound card. • Disable the on-board audio device in the BIOS settings.

- **Power Supply** - Power problems are often caused by a faulty power supply, loose connections, and inadequate wattage, as shown in the chart.

Common Problems and Solutions for Power Supplies

Identify the Problem	Probable Causes	Possible Solutions
The computer will not turn on.	• The computer is not plugged in to the AC outlet. • The AC outlet is faulty. • The power cord is faulty. • The power supply switch is not turned on. • The power supply switch is set to the incorrect voltage. • The power button is not connected correctly to the front panel connector. • The power supply has failed.	• Plug the computer into a known good AC outlet. • Use a known good power cord. • Turn on the power supply switch. • Set the power supply switch to the correct voltage setting. • Correctly orient the power button to the front case panel connector and reconnect. • Install a known good power supply.
The computer reboots, turns off unexpectedly; or there is smoke or the smell of burning electronics.	The power supply is starting to fail.	Replace the power supply.

- **CPU and Memory** - Processor and memory problems are often caused by faulty installations, incorrect BIOS settings, inadequate cooling and ventilation, and compatibility issues, as shown in Figure 4.

Common Problems and Solutions for CPUs and Memory

Identify the Problem	Probable Causes	Possible Solutions
The computer will not boot or it locks up.	• The CPU has overheated. • The CPU fan is failing. • The CPU has failed.	• Reinstall the CPU. • Replace the CPU fan. • Add fan(s) to the case. • Replace the CPU.
The CPU fan is making an unusual noise.	The CPU fan is failing.	Replace the CPU fan.
The computer reboots without warning, locks up, or displays error messages.	• The front-side bus is set too high. • The CPU multiplier is set too high. • The CPU voltage is set too high.	• Reset to the factory default settings for the motherboard. • Lower the front-side bus settings. • Lower the multiplier settings. • Lower the CPU voltage settings.
After upgrading from a single core CPU to a dual core CPU, the computer runs more slowly and only shows one CPU graph in the Task Manager.	The BIOS does not recognize the dual core CPU.	Update the BIOS firmware to support the dual core CPU.
A CPU will not install onto the motherboard.	The CPU is the incorrect type.	Replace the CPU with a CPU that matches the motherboard socket type.
The computer does not recognize the RAM that was added.	• The new RAM is faulty. • The incorrect type of RAM was installed. • The new RAM is loose in the memory slot.	• Replace the RAM. • Install the correct type of RAM. • Secure the RAM in the memory slot.
After upgrading Windows, the computer runs very slowly.	• The computer does not have enough RAM. • The video card does not have enough memory.	• Install additional RAM. • Install a video card that has more memory.
A computer with both DDR2 and DDR3 RAM installed only recognizes DDR3 RAM.	The motherboard does not support the installation of both DDR2 and DDR3 RAM.	Check the motherboard manual to see if the computer will support both types of RAM simultaneously.

Summary

This chapter discussed the concepts of preventive maintenance and the troubleshooting process.

- Regular preventive maintenance reduces hardware and software problems.

- Before beginning any repair, back up the data on a computer.

- The troubleshooting process is a guideline to help you solve computer problems in an efficient manner.

- Document everything that you try, even if it fails. The documentation that you create is a useful resource for you and other technicians.