UNIT 2

System Recovery and Advanced Maintenance

Student Learning Outcomes

By the end of this chapter, you will be able to:

- Define post-troubleshooting maintenance and explain its role in preventing recurring system issues.
- Use Task Manager, Resource Monitor, Resource Monitor and to monitor CPU, memory, and disk usage, and terminate unresponsive applications by reviewing system logs .
- Start Windows in Safe Mode and explain when this mode is useful.
- Create and use a restore point to return the system to a previous working state.
- Distinguish between System Restore and System Reset, and identify when to use each.
- Explain the purpose of bootable recovery media and when it is required.
- Create a bootable USB using Rufus or built-in Windows tools, choosing the correct partition style (GPT or MBR).
- Identify the differences between GPT and MBR and check a disk's partition style.
- Explain the role of BIOS and UEFI in system startup.
- Describe the Power-On Self-Test (POST) process and its importance.
- Access BIOS/UEFI settings to change boot order or reset defaults.
- Recover deleted files using built-in tools as well as third-party recovery tools such as Tenorshare.
- Perform Disk Cleanup to remove temporary and unnecessary files.
- Apply software updates (patch management) to improve security and stability.
- Run virus scans using Windows Defender and enable real-time protection.
- Create a maintenance calendar to schedule regular updates, cleanups, and scans.
- Maintain repair and update logs using a standard template.
- Explain the importance of keeping accurate system maintenance records.

Introduction

In this unit, we will explain how to maintain and recover a computer system after troubleshooting. You will learn to monitor system health using tools like Task Manager, Resource Monitor, and Event Viewer, and explore recovery options such as Safe Mode, System Restore, and bootable drives.

The unit also introduces the role of Basic Input/Output System (BIOS) and Unified Extensible Firmware Interface (UEFI) in system startup, simple data recovery techniques, and important preventive maintenance tasks like disk cleanup, updates, and virus scans. By the end of this chapter, you will understand how to keep system logs and maintenance records to run a computer system smoothly and handle common recovery tasks effectively.

2.1 Introduction to Post-Troubleshooting

Troubleshooting steps, including restarting the system, checking physical connections, and addressing simple issues related to software or hardware and to fix common computer problems, The next step is to learn what actions to take once the issue is resolved. This process is called *post-troubleshooting* maintenance. It includes additional steps that help the computer continue to work properly and avoid the same problems in the future. This chapter explains how to maintain a computer system and keep it stable, secure, efficient and reliable.

Importance of Continuous Maintenance

Solving a computer problem is only the first step. The system still needs regular care to continue working properly. Without maintenance, the same issue can happen again, or new problems may appear. Regular maintenance keeps the system stable and prevents future problems. It ensures better performance, longer life, and fewer disruptions in computer usage.

Example: If the computer becomes slow due to full storage, deleting a few files may improve its speed for a short time. However, if unnecessary files are not removed regularly or the system is not updated, the same issue may occur again.

Impact of Poor Maintenance

If a computer is not maintained regularly, it may face several problems that affect its performance and reliability. The following issues commonly occur due to a lack of proper maintenance:

Below are some common problems that result from a lack of regular maintenance:

- **Slow Performance:** Temporary files, unused programs, and background processes can build up over time. If these are not managed, the computer may become slow and unresponsive.
- **System Failures:** If important system updates are not installed, the computer may stop working properly. It can freeze, crash, or fail to start.
- **Security Risks:** When the system or apps are not updated, harmful software like viruses can enter the computer more easily.
- **Data Loss:** Without backups, important files can be lost during crashes or hardware failure.
- **Hardware Damage:** Dust and overheating can damage the hardware components if the system is not cleaned or properly ventilated.

Introduction to System Health Monitoring

For the smooth running of a system, it is important to check its performance regularly. This process is known as system health monitoring. Modern operating systems, such as Microsoft Windows, include built-in tools that help monitor system activity.

These tools allow you to:

- Check how much memory and processing power are being used
- Monitor background applications and services
- View system warnings and error messages
- Identify programs that may slow down the computer

Regular monitoring helps detect small issues before they become serious. By using these tools, users can take timely actions to improve performance and avoid future problems.

2.2 Using Built-in Diagnostic Tools

In addition to basic troubleshooting steps, modern operating systems provide built-in tools to help users monitor system performance in more detail. These tools give useful information about the computer's current state and help identify problems related to memory, storage, processing power, and system errors.

This section introduces three important diagnostic tools available in Microsoft Windows:

- Task Manager

- Resource Monitor
- Event Viewer

Each of these tools plays a different role in resolving system health and performance-related issues.

Task Manager

Task Manager is a built-in tool in Microsoft Windows that helps users to monitor the performance of their computers. It shows real-time information about how the system's processor (CPU), memory (RAM), and storage (disk) are being used. The Processes tab of the task manager shows all active programs and how much system resources they are using, while the *Performance* tab displays detailed graphs for CPU, memory, disk, and network usage.

How to Open Task Manager?

There are two simple ways to open Task Manager:

I. Press the **Ctrl + Shift + Esc** shortcut key from the keyboard
II. Or right-click on the taskbar and select Task Manager from the menu

What You Can Do with Task Manager?

Task Manager is helpful when your computer is slow, or an application stops responding. It allows you to:

- See how much processing power and memory are being used by each program.
- Select a program from the processes tab of task manager and click End Task to close it if it is not working properly (see **Figure 2.1**).
- View programs running silently in the background.

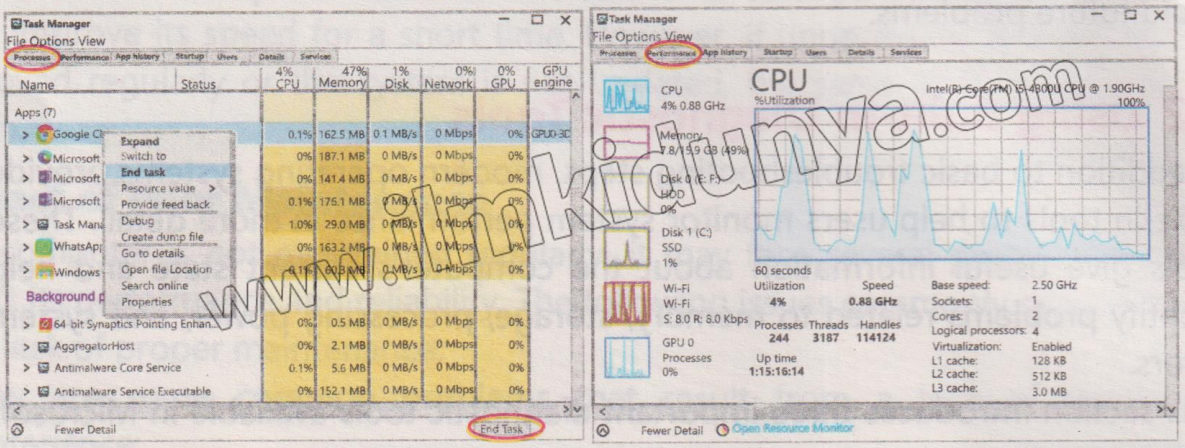

Figure 2.1: Task Manager Showing Active Processes and System Performance in Windows

- The performance tab of the task manager shows real-time graphs and data showing how your computer is performing (see **Figure 2.1**).

Resource Monitor

Resource Monitor is an advanced system tool in Microsoft Windows that gives a deeper view of how your computer's resources (memory, CPU, and disk) are being used, as shown in Figure 2.1 While Task Manager gives a quick overview, Resource Monitor provides more detailed information about which programs and background services are using system resources. It is especially helpful when the system is running slowly, overheating, or using a lot of memory without any clear reason.

How to Open Resource Monitor?

There are two common ways to open Resource Monitor:

- Open Task Manager, go to the Performance tab, and click on Open Resource Monitor at the bottom.
- Or press the shortcut key **Windows + R**, type the command ***resmon*** in the dialog box that appears, and press Enter (see **Figure 2.2**).

Key Features of Resource Monitor

Some key features of the resource monitor are listed below:

- **CPU Tab:** Shows which processes and services are using the processor.
- **Memory Tab:** Displays how much memory is used, free, or reserved.

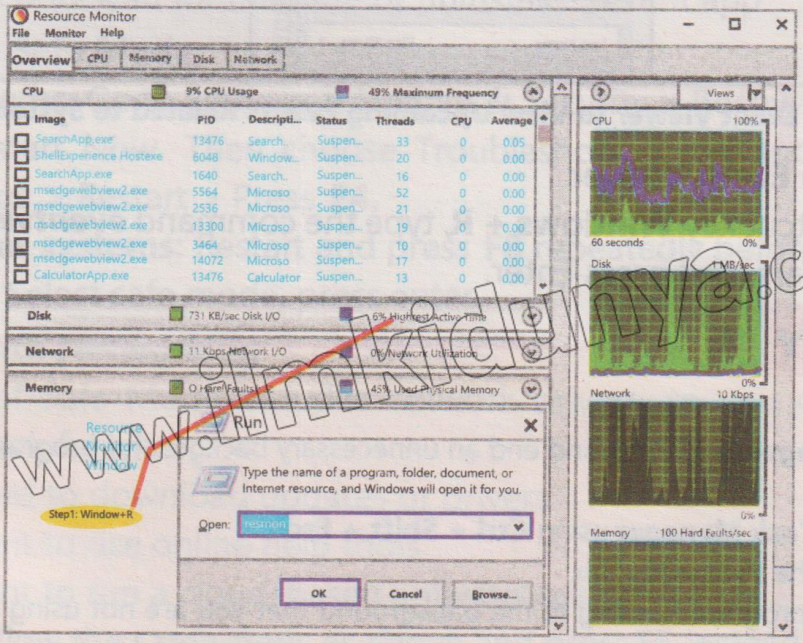

Figure 2.2: Resource Monitor to Monitor the Usage of System Resources

- **Disk Tab:** Monitors which programs are reading from or writing to the hard drive.

  Network Tab: Shows which applications are sending or receiving data over the internet or network.

Event Viewer

Event Viewer is also a built-in Windows tool that records detailed logs of system activities. It helps users check for errors, warnings, and important events related to software, hardware, and security, as shown in **Figure 2.3**.

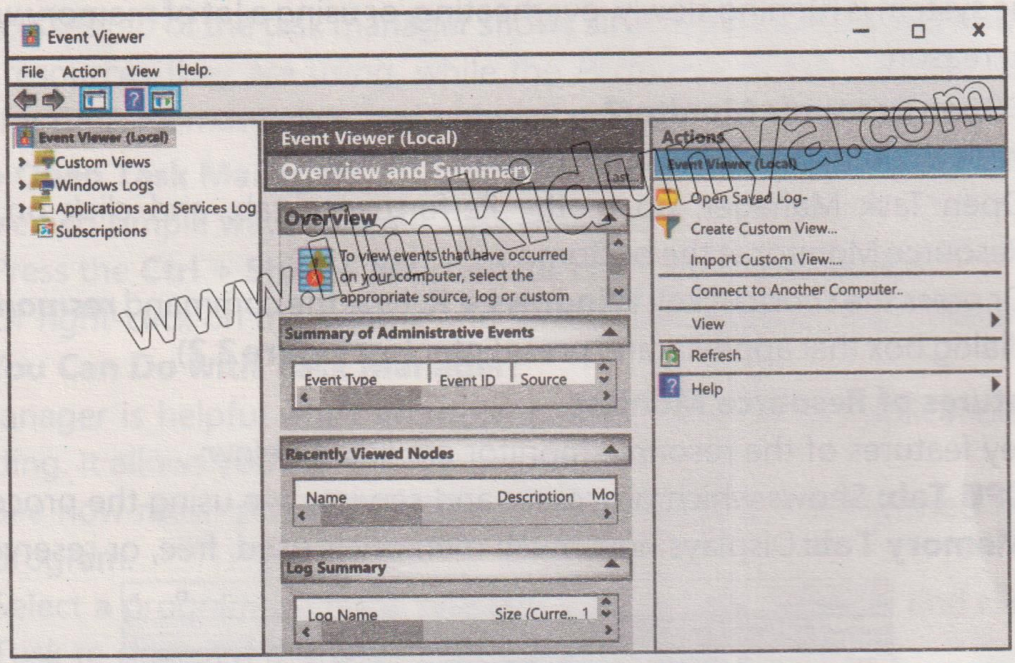

Figure 2.3: The Event Viewer to View Upcoming Events Related to System Maintenance

How to Open Event Viewer

Press the shortcut key **Windows + R**, type the command ***eventvwr*** in the dialog box that appears, and press Enter.

ACTIVITY

Objective:

Use **Task Manager** to identify and end an unnecessary background program.

Steps:

1. Open **Task Manager** using **Ctrl + Shift + Esc**.
2. Go to the **Processes** tab.
3. Find a program running in the background that you are not using (e.g., Music app, update service).

4. Select it and click **End Task** (only if you're sure it is safe to close).
5. Observe if your computer's speed improves.

Answer the questions:

Did ending the task improve system performance?

Why do you think that happened?

2.3 System Recovery Options

In some cases, basic troubleshooting is not enough to fix a problem. The computer may crash, become unresponsive, or fail to start. To handle such situations, operating systems like Microsoft Windows provide special tools known as system recovery options. These recovery options help restore the computer to a working state without losing important data in most cases. In this section, we learn about the three commonly used recovery tools.

Safe Mode

Safe Mode starts Windows with only the most fundamental drivers and services. It disables unnecessary background programs and startup software, making it easier to fix problems caused by faulty apps or settings.

When and How to Use

Safe Mode is useful when:

- The system keeps crashing or restarting
- A program or driver is causing the computer to freeze
- You need to scan for malware or uninstall a recent app

How to open Safe Mode:

On most systems: Go to Settings > Update & Security > Recovery > Advanced Startup > Restart Now. Then choose Troubleshoot > Advanced Options > Startup Settings > Restart > Press **F4.**

On some older systems: Restart and press **F8** repeatedly before the Windows logo appears. Select safe mode, press enter.

Safe Mode with Networking

This version of Safe Mode includes network drivers, so you can access the internet. It is helpful when:

- You need to download updates or drivers
- You want to use online help tools
- You want to run a cloud-based antivirus scan

To enter it, follow the same steps as above and press **F5** instead of **F4**.

SMART TIPS

While using Safe Mode, follow these precautions:
Do not change settings unless you understand their purpose.

- Avoid deleting system files; they may be important for Windows to work properly.
- Use only built-in or trusted tools to fix issues.
- Restart your computer normally after finishing the task.
- Ask for help from your teacher or IT expert if unsure.

Safe Mode is powerful, but it should be used carefully.

System Restore

System Restore allows you to take your computer back to an earlier state without deleting personal files. It works by using restore points, which are saved versions of your system created before major changes.

What are The Restore Points?

A restore point is like a saved snapshot of your system's settings and files. It helps you return your computer to an earlier, working condition if something goes wrong, such as after installing a faulty program or driver. Restore points are made automatically before system updates or driver installations, or manually by the user when it is needed.

Steps to Create a Restore Point

Follow these steps to create a restore point manually:

- Click the Start button and open the ***Control Panel***.
- Go to ***System and Security***, then click ***System***.
- On the left, click ***System Protection***.
- In the new window, under the System Protection tab, click the Create button.
- Type a name for your restore point (e.g., "Before installing printer driver") and click Create.
- Wait a few seconds for confirmation. Your restore point is now saved.

Steps to Use a Restore Point

If your computer is not working properly, follow these steps to go back to a previous state:

- Open the ***Control Panel***.
- Go to ***Recovery*** and click ***Open System Restore***.
- A window will appear showing available restore points.
- Select the most recent restore point when your system was working fine.

- Click **Next**, then Finish.
- Your system will restart and restore the selected settings.

Bootable Recovery Media

Sometimes, a computer may stop working completely and fail to start. In such cases, normal recovery options like Safe Mode and Restore Points may not work. So, in this case, we use bootable recovery media to recover the system.

Understanding Bootable Media and Its Uses

Bootable recovery media is a ***USB*** flash drive or ***DVD*** that contains important system files. It helps start the computer from an external device instead of the built-in storage. After starting the system, you can use built-in recovery tools such as:

- Startup Repair to fix problems that prevent Windows from loading
- System Restore to go back to a working state using a restore point
- Command Prompt for advanced troubleshooting
- System Reset or Reinstallation to reinstall the operating system if needed

When We Use Bootable Media

We use this media in such cases where the system:

- Safe Mode is not accessible
- You need to repair or reinstall the operating system.

How to Create and Use a Bootable USB

To create a bootable USB:

- Download the system image or installer from the official website of your operating system provider (e.g., Windows ISO, Linux ISO, or macOS installer).
- Download Rufus (a free USB tool) from its official site (https://rufus.ie/en/), for Windows only. For macOS, you can use its built-in tools like Terminal or Disk Utility.
- Plug in a USB drive (16 GB or more).
- Open Rufus, select the USB and the ISO file.

For Windows or Linux systems, choose GUID Partition Table (**GPT**) for modern PCs and Master Boot Record (**MBR**) for older systems. Then click Start to create the bootable USB.

DO YOU KNOW?

GPT and MBR are two different ways of organizing data on a storage drive (Hard drive or SSD).

- MBR is the older system. It supports up to **2 TB** of disk size and a maximum of **4** primary partitions.
- GPT is the modern standard. It supports disks larger than 2 TB, allows over **100** partitions, and is required for UEFI-based systems.

That's why new computers and operating systems now prefer GPT over MBR!

How to Check the Partition Style (MBR or GPT)

To check the Partition Style, you need to:

i. Press Win + X and select Disk Management.
ii. Find the drive where Windows is installed (usually Disk 0).
iii. Right-click on the disk label (e.g., Disk 0), then choose Properties.
iv. Go to the Volumes tab.

Look at Partition Style:
It will show either:

- GUID Partition Table (GPT)
- Master Boot Record (MBR)

SMART TIPS

If your computer uses GPT, but you create the USB in MBR format, it might not boot at all. The same happens if your system uses MBR and you use a GPT USB.

ACTIVITY

Objective:
Learn how to create a bootable recovery drive using built-in Windows tools.
Requirements:

- A Windows 10 or 11 PC
- An empty USB drive (at least **16** GB)

Steps:

I. Insert the USB into the computer.
II. Press the Windows key, type Recovery Drive, and open it.
III. Check "Backup system files to the recovery drive" and click Next.
IV. Select your USB drive and click Next (Do not click "Create" in class unless permitted).

Answer the question: What does Windows say this recovery drive will help you with?

2.4 BIOS/UEFI and Boot Process Awareness

When you press the power button on your computer, several hidden steps take place before the operating system (like Windows) appears on the screen. These early steps are controlled by special built-in software called ***firmware***. In this section, you will learn what firmware is, how the Basic Input/Output System (BIOS) and Unified Extensible Firmware Interface (UEFI) help start the computer, and how you can access basic startup settings if needed.

Role of BIOS / UEFI in Computer Startup

All computers have special software built into the motherboard called ***firmware***. It is not stored on the hard drive and does not get deleted when the computer is turned off. Firmware gives the computer basic instructions on how to start.

Two common types of firmware are:

- **BIOS** older firmware software shows a basic, text-only menu and works with the keyboard only.
- **UEFI** newer type of firmware software, supports a graphical menu that uses both mouse and keyboard, and larger hard drives.

Role of BIOS/UEFI in Starting the Computer:

- Checks if the hardware is working correctly (like RAM, keyboard, and hard drive).
- Finds the boot device (USB, hard disk, etc.) and starts the operating system.
- Allows users to change system settings like date, time, and boot order.

DO YOU KNOW? BIOS was first developed in the 1980s, while UEFI is now used in most modern computers because it is faster and more secure.

The POST Test

POST stands for Power-On Self-Test. It is the first thing the firmware does after the computer is turned on. POST checks the most important hardware to make sure everything is working properly. If all parts are fine, the computer continues to load the operating system. If something is wrong, it may beep or show an error message on the screen.

Example: If the RAM is missing, the computer will beep continuously.

Accessing BIOS and resetting to defaults

Sometimes you need to enter BIOS/UEFI to change settings or fix problems.

How to Open BIOS/UEFI Settings:

To open this setting, you need to shut down your computer.

i. Turn it on and immediately press a key like **Del**, **F2**, **F10**, or **Esc** (the correct key depends on the brand, like HP, DELL, and MSI).

ii. The BIOS or UEFI screen will appear.

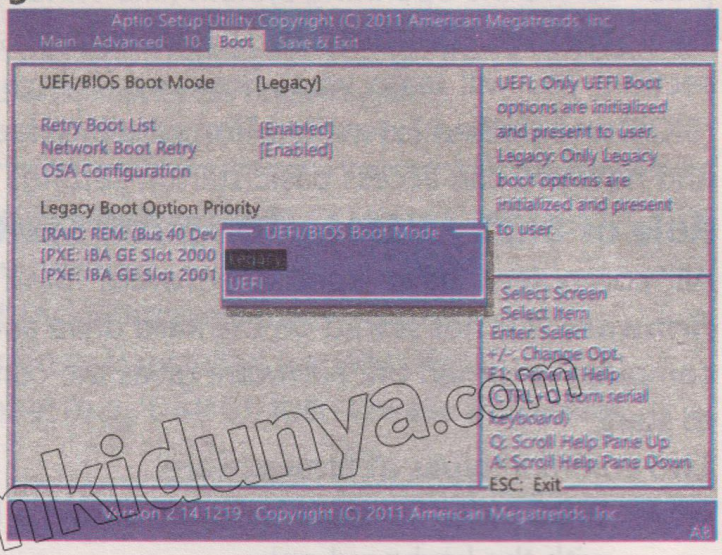

Figure 2.4: BIOS /UEFI

Resetting to Default Settings

If the wrong settings are saved, you can restore the system to its original state by selecting "Load Setup Defaults" or "Reset to Default" inside BIOS/UEFI settings.

Boot order and boot repair

Boot order means the sequence in which the computer looks for a device to load the operating system. For example, it may try the USB drive first, then the hard drive.

How to Change Boot Order:

- Enter BIOS/UEFI settings.
- Go to the Boot tab or menu.
- Move your desired device (e.g., USB) to the top of the list.
- Save changes and exit.

Sometimes the computer cannot start due to missing files or errors. This can be fixed by using Startup Repair from Windows recovery USB or DVD.

2.5 Data Recovery Techniques

Sometimes, we delete files by mistake or lose them due to system problems. In many cases, it is possible to recover lost files using built-in tools or with the help of special third-party software. This section explains basic methods for file recovery and how to avoid permanent data loss. There are two main ways to recover deleted files:

i. Using built-in tools.
ii. Using third-party software.

Built-in Tools

These tools are already part of the operating system, which is why we call them built-in tools. In this section, we will discuss some built-in tools that are available to recover deleted files.

Recycle Bin

When a file is deleted in Windows, it usually goes to the Recycle Bin. It stays there until the bin is empty. You can open the Recycle Bin, right-click the file, and select Restore to bring it back to its original location.

File History

File History is a backup feature in Windows. If it is turned on, the system keeps copies of your files at regular intervals. You can recover files from earlier versions, even if they have been deleted or changed. To turn it on, go to Settings > Update & Security > Backup, connect an external USB or Hard drive, and select "Add a drive". Once enabled, Windows will regularly back up your files like Documents, Pictures, and Desktop on that drive.

Previous Versions

This feature allows you to recover an earlier version of a file or folder. Right-click the file or folder, choose Properties, then go to the Previous Versions tab. If available, you can select and restore an older copy.

Third-party tools

Sometimes, deleted files are not found in the Recycle Bin or Previous Versions. In such cases, you can try using third-party recovery software. ***Tenorshare*** is a free and easy-to-use file recovery program demonstrated in **Figure 2.5**. It can scan your hard drive, USB, or memory card to find files that were recently deleted. You can then choose which files to recover.

How to use Tenorshare?

Steps to Use Tenorshare :

i. Open Tenorshare, select the location from which you want to recover a file, such as a specific drive or folder(see **Figure 2.5**).
ii. Choose the type of file to recover (e.g., pictures, documents).
iii. Click "Scan" to start searching for lost files.
iv. Select the files you want to recover and click "Recover" to restore them.

Recovery success depends on how recently the file was deleted and whether new data has overwritten it.

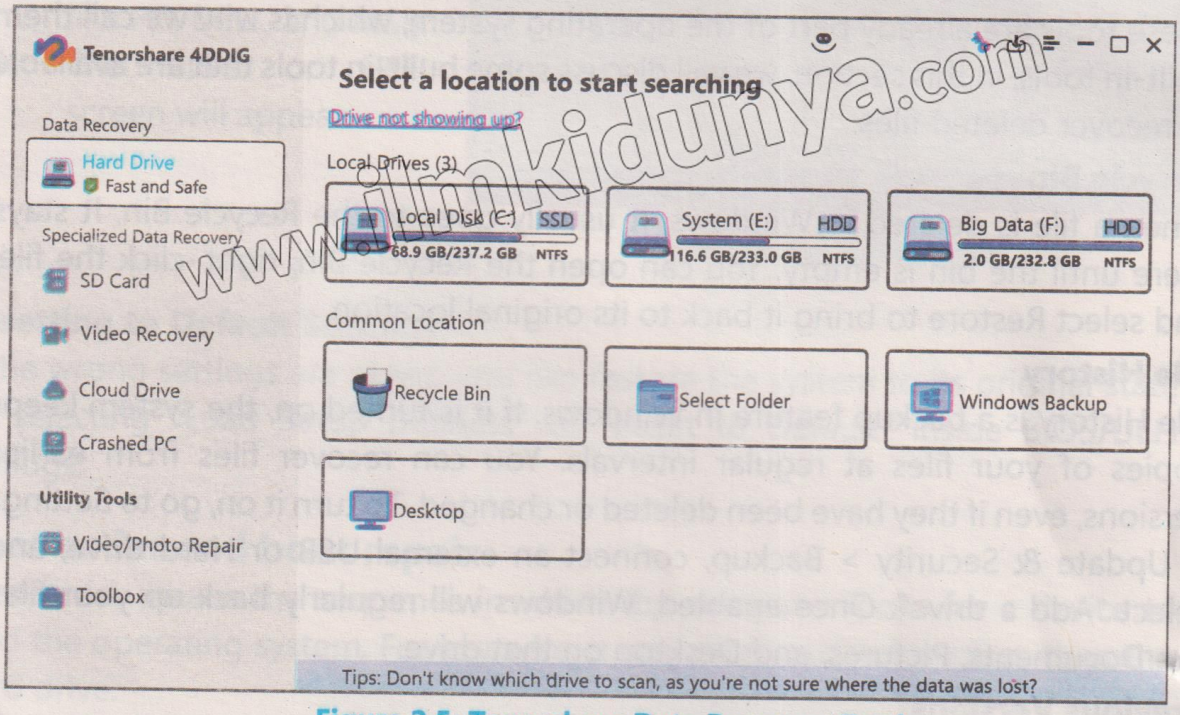

Figure 2.5: Tenorshare Data Recovery Tool

Limitations of recovery and best practices

While data recovery tools can be helpful, they have the following limitations.

- If a file is deleted a long time ago, it may no longer be recoverable.
- Recovery is not always possible if the hard drive is damaged or formatted.
- Files may be permanently lost if the Recycle Bin is emptied, and no backups were made.

SMART TIPS

1) Never install recovery software on the same drive where your lost file was stored. This may reduce the chance of successful recovery.
2) Always check the Recycle Bin first before trying advanced recovery tools. It is the easiest and safest way to restore deleted files.

ACTIVITY

Objective:
To help students understand how file recovery works by using Tenorshare on a test file.
Steps:

1) Create a text file named "TestFile.txt" on the Desktop.
2) Delete it and empty the Recycle Bin.
3) Open Tenorshare → Select All Files → Choose Desktop as location.
4) Click Scan → When the file appears, select and click Recover.
5) Save it to another folder (e.g., Documents).

Answer the questions:
Were you able to recover the file?
Why should you avoid saving new files to the same drive after deletion?

2.6 Best Practices for Preventive Maintenance

Just like we take care of our health or maintain our vehicles, computers also need regular attention to keep working properly. Preventive maintenance means doing simple tasks that help avoid bigger problems in the future. These tasks can improve your computer's speed, keep it secure, and help it last longer.

Disk Cleanup

After some time, the computer collects unnecessary files such as temporary internet files, system cache, Windows update files, and items in the Recycle Bin. These files take up space and may slow down system performance.
Disk Cleanup is a built-in Windows tool that helps remove such files safely.

Steps to Perform Disk Cleanup

I. Type Disk Cleanup in the Windows search bar and open the tool from the list. This opens a small window asking you to choose a drive to clean, as shown in **Figure 2.6**.
II. Select the drive you want to clean (usually C:) and click OK.
III. Check the boxes from the dialog box that appears after OK, as shown in **Figure 2.6**, for the types of files you want to delete.
IV. Click OK to remove the selected files.

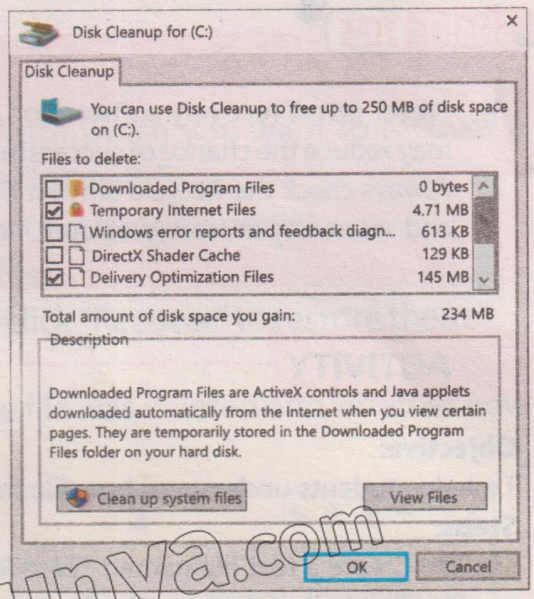

Figure 2.6: Disk Cleanup Menu

Patch management/ System Updation

Software updates, also known as patches, are released regularly by developers to fix bugs, add features, and improve security. Keeping your system updated helps to protect it from viruses and security threats.

There are two types of updates:

I. Operating system updates (for Windows, macOS, etc.)
II. Application updates (for programs like browsers, media players, etc.)

To check for updates in Windows:

- Open Settings > Update & Security.
- Click Check for updates.
- Install the updates if available.

Staying Protected with Windows Defender

Windows Defender is the built-in security tool in Windows that protects your computer from viruses, malware, and other threats. It offers two types of scans.

- Quick Scan to check common problem areas.
- Full Scan to check the entire system thoroughly.

Windows Defender also provides real-time protection, which means it keeps watching your system in the background and alerts you if anything suspicious happens.

Keeping a maintenance calendar

It's a good idea to set a regular schedule for basic maintenance tasks. A maintenance calendar helps you remember when to clean your system, scan for viruses, or check for updates. You can write it down or set reminders on your phone or computer.

2.7 System Documentation and Logs

Keeping proper records is an important part of a computer system's maintenance. When we document what we do, such as installing software, fixing issues, or performing updates, it becomes easier to manage and troubleshoot systems in the future. This section explains the basics of system documentation in a simple and practical way.

Summary

- Troubleshooting steps, including restarting the system, checking physical connections, and addressing simple issues related to software or hardware and to fix common computer problems.
- Modern operating systems, such as Microsoft Windows, include built-in tools that help monitor system activity.
- Task Manager is a built-in tool in Microsoft Windows that helps users to monitor the performance of their computers.
- Resource Monitor is an advanced system tool in Microsoft Windows that gives a deeper view of how your computer's resources (memory, CPU, and disk) are being used.
- Event Viewer is also a built-in Windows tool that records detailed logs of system activities. It helps users check for errors, warnings, and important events related to software, hardware, and security.
- System Restore allows you to take your computer back to an earlier state without deleting personal files.
- Bootable recovery media is a *USB* flash drive or *DVD* that contains important system files.
- POST stands for Power-On Self-Test. It is the first thing the firmware does after the computer is turned on.

- Boot order means the sequence in which the computer looks for a device to load the operating system.
- Software updates, also known as patches, are released regularly by developers to fix bugs, add features, and improve security.

EXERCISE

Multiple Choice Questions

1. **Task Manager is mainly used to**
   (a) Monitor running applications
   (b) Clean up disks
   (c) Scan for viruses
   (d) Manage files

2. **Safe Mode starts Windows with**
   (a) All drivers and services
   (b) Basic drivers only
   (c) Network services
   (d) Antivirus tools

3. **Bootable USB drives are used for**
   (a) Installing games
   (b) System repair and recovery
   (c) Watching videos
   (d) Sending emails

4. **In UEFI systems, a bootable USB must be created in**
   (a) NTFS format
   (b) MBR style
   (c) GPT style
   (d) ZIP format

5. **The Power-On Self-Test (POST) is performed**
   (a) During system shutdown
   (b) After login
   (c) At system startup
   (d) When installing software

6. **Tenorshare is a tool used to**
   (a) Play videos
   (b) Recover lost files
   (c) Create charts
   (d) Monitor CPU

7. **File History helps to**
   (a) Track website history
   (b) Save copies of personal files
   (c) Install apps
   (d) Scan for malware

8. **Windows Defender provides**

(a) File compression
(b) Virus protection
(c) Disk formatting
(d) Music playback

Short Questions

1. Write one key function of the Resource Monitor.
2. Define the use of Safe Mode in system recovery.
3. List the steps to create a bootable USB using Rufus.
4. What happens during the Power-On Self-Test (POST).
5. Why is the boot order setting important when using recovery tools from a USB drive?
6. List the two benefits of running regular disk cleanup.
7. How does Windows Defender help in maintaining system health?

Long Questions

1. Explain the roles of Task Manager and Event Viewer in system maintenance. Give one example for each tool where it can help solve a problem.
2. Your computer is not starting properly due to a system issue. Describe how System Restore or a bootable recovery USB can be used to fix the problem without deleting personal files.
3. Briefly explain any two preventive maintenance techniques that help to keep a computer running smoothly.
4. Explain how deleted files can be recovered using a third-party software. Also, discuss why recovery may not always be successful.
5. A classmate wants to clean up disk space after a large Windows update. Explain how to use Disk Cleanup, including the option to remove system files safely.

Answer Key for Multiple Choice Questions

1. **a)** - Monitor running applications
2. **b)** - Basic drivers only
3. **b)** - System repair and recovery
4. **c)** - GPT style
5. **c)** - At system startup
6. **b)** - Recover lost files
7. **b)** - Save copies of personal files
8. **b)** - Virus Protection