

ITAS 167 Lab 6

File Systems & Hard Disk read/write speed tests

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Project Overview

These lab activities provide hands-on experience for students to familiarize themselves with various file system and maintenance tasks on both Windows 10 and Linux operating systems. Activities range from creating and navigating folders in Windows, fixing corrupted Master Boot Records, compressing files, to navigating the Linux file system through both shell prompts and the GNOME Files GUI tool, and checking and comparing the speed for disk and memory on different machines. The labs emphasize the importance of understanding fundamental file system operations and offer multiple methods to achieve common tasks.

Responsibilities

These activities (Part C) were completed as an individual project, following the collaborative efforts in Part A and Part B.

Activity 1 – Exploring the File System in Windows

The objective of this activity was to familiarize myself with the Windows file system using File Explorer.

- Boot and log into my Windows 10 computer.
- Right-click on 'Start', select 'File Explorer'.
- In the left pane, expand 'This PC' if needed and click 'Local Disk (C:)' to access the hard drive content.
- Navigate to the 'Windows' folder by double-clicking it.
- Change the folder and file view by selecting the 'View' tab, then 'Details' in the 'Layout' section. I can experiment with other view settings.
- Ensure 'File name extensions' and 'Hidden items' checkboxes are selected. This will display hidden files and their extensions.
- On the 'View' tab, click 'Options' then 'Change folder and search options'.
- Under 'Files and Folders', deselect 'Hide protected operating system files' and confirm. This reveals hidden system files, which might be useful for troubleshooting.
- Close 'File Explorer'.

Activity 2 – Creating Folders in Windows

The objective of this activity was to learn how to create and navigate folders in Windows.

Steps:

- Boot up your Windows 10 computer and access File Explorer (Right-click on Start).
- In the left panel, expand 'This PC' and right-click on 'Local Disk (C:)', inspecting the properties. Observe the NTFS file system and explore other tabs.
- Navigate to Users > rajsi.
- Create a new folder named with my initials and "folder" (rsfolder).

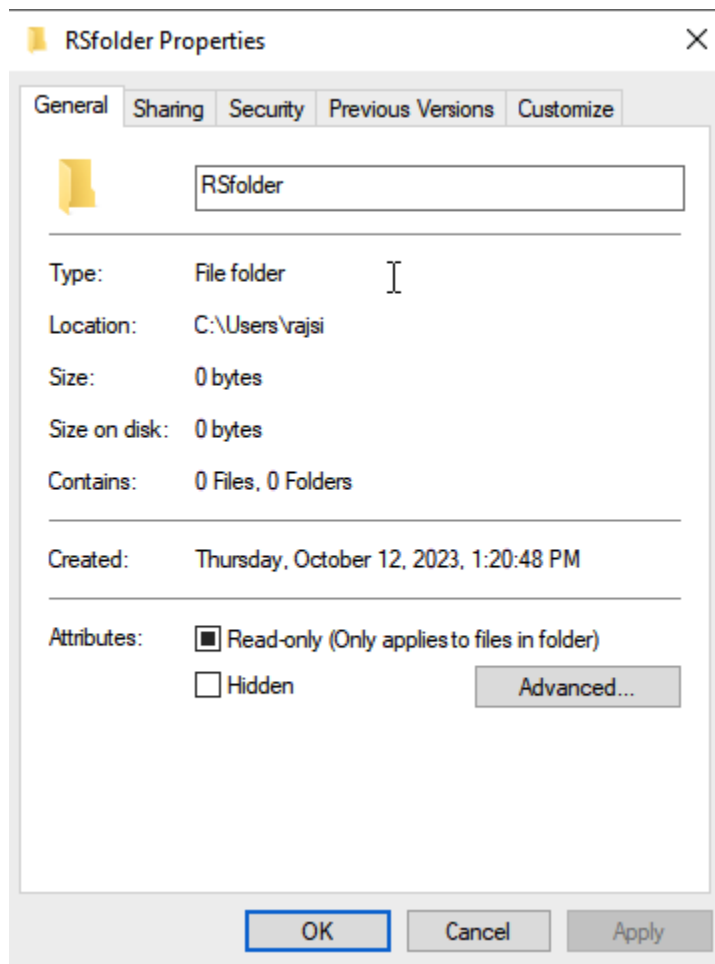


Figure 1 - Various properties available for configuration on a Windows folder.

- Review the properties and attributes of the folder you've created.
- Experiment with different folder creation methods:
- Use the Folder icon in the Quick Access toolbar.

- Right-click in the right pane > New > Folder.
- Keyboard shortcut: Ctrl+Shift+N.
- Access Windows PowerShell (Right-click on Start). Note: PowerShell is now the default command-line program, replacing the command prompt.
- Navigate the directory using the dir command to view folders. Create a new folder named 'MyDocs' using mkdir MyDocs. Navigate inside using cd mydocs.

```
PS C:\Users\rajsi> dir

Directory: C:\Users\rajsi

Mode                LastWriteTime         Length Name
----                -
d-r--             9/20/2023   8:27 PM           3D Objects
d-----          9/22/2023  11:19 PM    AReallongFolderName
d-r--             9/20/2023   8:27 PM           Contacts
d-----          9/20/2023   8:30 PM           Documents
d-r--             9/20/2023   8:27 PM           Downloads
d-r--             9/20/2023   8:27 PM           Favorites
d-r--             9/20/2023   8:27 PM           Links
d-r--             9/20/2023   8:27 PM           Music
d-----         10/12/2023  11:20 PM           MyDocs
dar--l           10/12/2023  12:48 PM           OneDrive
d-----         10/12/2023   7:13 PM           RSfolder
d-r--             9/20/2023   8:27 PM           Saved Games
d-r--             9/20/2023   8:29 PM           Searches
d-----          9/20/2023   8:46 PM           Testdocs
d-r--             9/21/2023   3:20 PM           Videos
```

Figure 2 - Display of newly created folders in the 'C:\Users\rajsi' directory.

- Understand directory shortcuts: "." represents the current folder and ".." signifies the parent folder.
- Move to the root directory with cd \. Conclude by closing the command prompt.
- Shutdown the computer.

Activity 3 – Fixing a Corrupted MBR in Windows

The objective of this activity was to learn to fix a corrupted MBR in Windows.

Below is the windows Recovery Menu Access Guide:

→ **Power Off Mode:**

Hold Windows Key + Power Button, release both.

→ **Windows Logon:**

Click Power icon, hold SHIFT + click Restart.

→ **Windows Desktop:**

- Go: Start > Power, hold SHIFT + click Restart.
- Go: Start > Settings > Update & Security > Recovery > Advanced startup > Restart now.
- Command prompt: Enter Shutdown /r /o.

→ **Post Windows Setup:**

Proceed until you see 'Repair your computer'. Press R for Windows Recovery Menu.

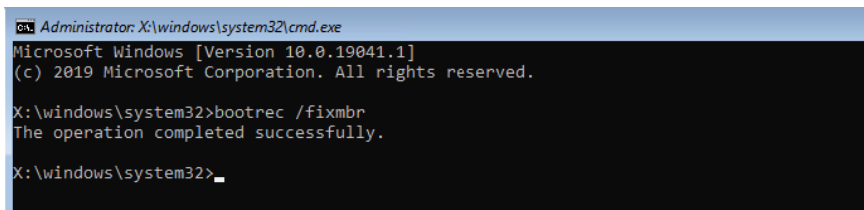
Choose: Troubleshoot > Advanced options > Command Prompt for Recovery Console.

→ **Recovery Console Commands:**

To fix Master Boot Record (MBR): bootrec /fixmbr.

Help for bootrec: Type bootrec /?.

After commands, type exit and click Continue to boot Windows.



```
Administrator: X:\windows\system32\cmd.exe
Microsoft Windows [Version 10.0.19041.1]
(c) 2019 Microsoft Corporation. All rights reserved.

X:\windows\system32>bootrec /fixmbr
The operation completed successfully.

X:\windows\system32>
```

Figure 3 - A Command Prompt window showing a successful 'bootrec /fixmbr' operation.

Activity 4 – Compressing Files in Windows

The objective of this activity was to understand and implement file compression in Windows 10 using the native features of the operating system.

Procedure:

- **Setup:** Using File Explorer, navigated to C:\Users\rajsi\RSFolder.
- **Folder Creation:** Created 'SubFolder' inside this directory.
- **Compression:** Accessed 'SubFolder' properties and clicked 'Advanced'. Selected "Compress contents to save disk space".

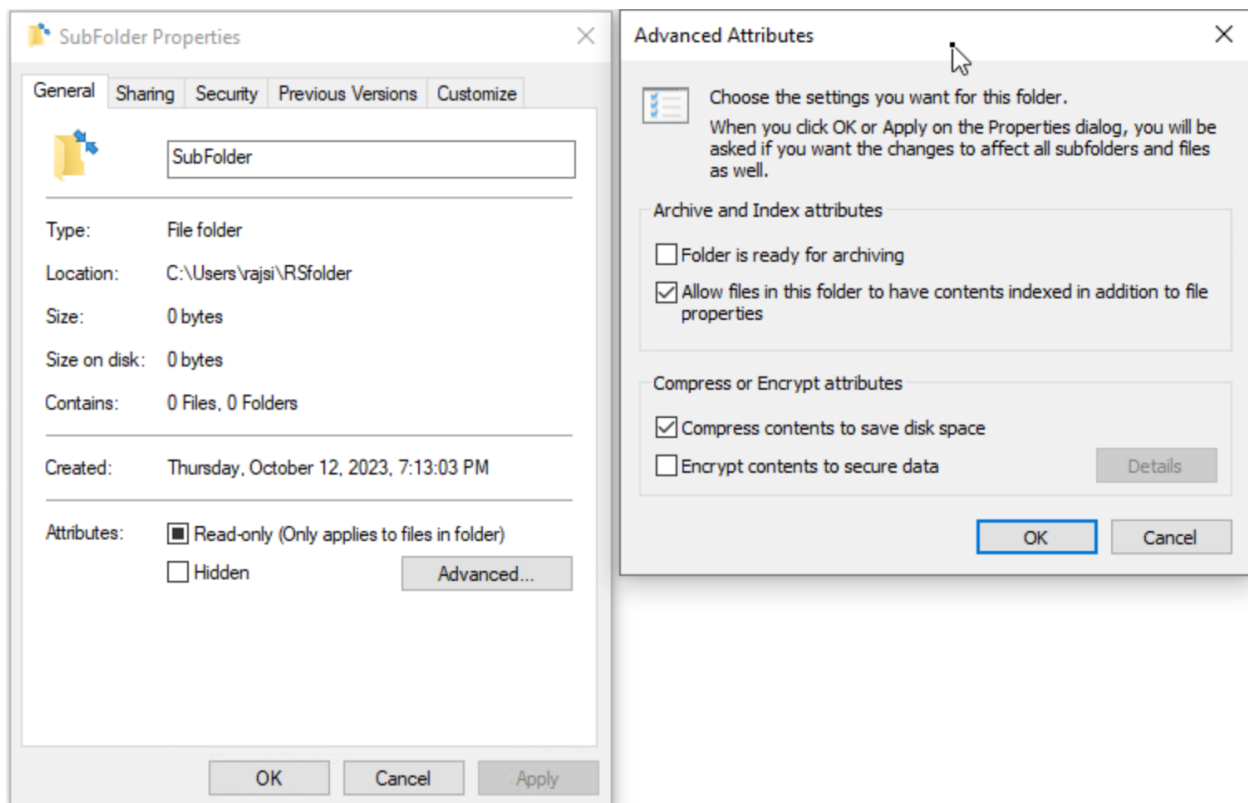


Figure 4a - Advanced Attributes dialog box highlighting folder compression options.

- **Observations:** 'SubFolder' icon now shows two blue compression arrows. A new text document created within it inherits this compressed status, indicated by similar blue arrows.

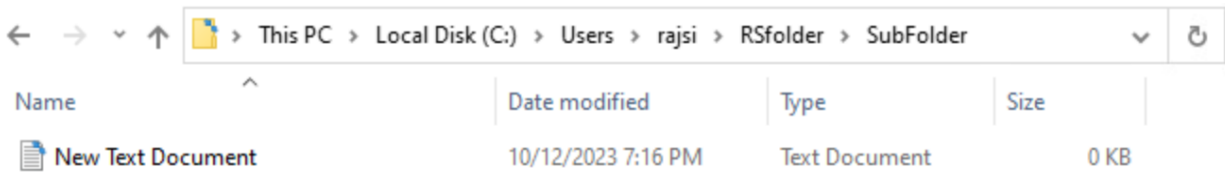


Figure 4b - A new compressed text document inside compressed directory "SubFolder".

- **Conclusion:** Successfully compressed files in Windows 10; contents in a compressed folder are also automatically compressed on disk but are uncompressed when accessed.

Activity 5 – Navigating the Linux File System from the Shell Prompt

The objective of this activity was to explore the Linux file system from a shell prompt.

Procedure:

- **Initialization:** Started my Fedora Linux VM and opened a terminal window.
- **Home Directory:** Typed `ls -a` and press enter. This displayed all contents of my home directory, even hidden files.

```
[rajsingh@fedora ~]$ ls -a
.          .bash_logout  .cache  Documents  .mozilla  Public
..         .bash_profile .config Downloads  Music     Templates
.bash_history .bashrc      Desktop .local     Pictures  Videos
```

- **Access Root:** At the shell prompt, represented by "~", typed `cd /` and pressed enter. Noted the prompt change.
- **Navigation:** To return to my home directory, I could either type `cd` and press enter or type `cd ~` and press enter.
- **View User Directories:** Typed `cd /home` followed by `ls` to view home folders. This is akin to the 'C:\users' directory in Windows.

```
[rajsingh@fedora /]$ cd /home
[rajsingh@fedora home]$
```

- **My Home Folder:** Navigate to my specific user folder by typing `cd username`, replacing 'username' with my account name "rajsingh".

```
[rajsingh@fedora home]$ cd rajsingh
[rajsingh@fedora ~]$
```

→ **Creating Folders:** Typed `mkdir Folder1` to create a new directory. To access it, typed `cd Folder1`.

Note: Linux differentiates between 'Folder1' and 'folder1'.

→ **Checking Contents:** Within 'Folder1', typing `ls` will show no content. However, hidden folders "." and ".." can be viewed using `ls -a`.

```
[rajsingh@fedora ~]$ mkdir Folder1
[rajsingh@fedora ~]$ cd Folder1/
[rajsingh@fedora Folder1]$ ls -a
```

→ **Creating a File:** Used `touch newfile1` to create a file. To view its details, typed `ls -l`.

```
[rajsingh@fedora Folder1]$ touch newfile1
[rajsingh@fedora Folder1]$ ls -l
total 0
-rw-r--r--. 1 rajsingh rajsingh 0 Oct 12 19:37 newfile1
```

→ **Completion:** Closed the terminal when done.

Activity 6 – Using the GUI to Explore the Linux File System

The objective of this activity was to Navigate the Linux file system using the GNOME Files tool in Linux to navigate folders and manage files.

- I logged in to my Linux system.
- I accessed the Files tool by selecting "Activities" and then clicking on the "Files" icon.
- I started in the default home directory where I located the "Folder1" I had previously made.
- Inside "Folder1", I found the file I had created using the touch command.
- For a system overview, I clicked on "Other Locations", then on "Computer" in the right pane, and accessed the home directory.
- I entered my specific user folder. I right-clicked on "Folder1" and chose "Compress".
- Linux created a .zip of the folder in my home directory. I confirmed its creation by spotting the "Folder1.zip" file.
- I then exited the Files tool and either logged off or shut down my computer.

Activity 8 – Disk Partitions and Read/Write Performance

The objective of this activity was to create primary and extended partitions and analyze disk speed.. I did this by taking the steps below:

- **Inspecting Windows 10 VM Disk Configuration:**
 - I used the disk management tool within my Windows 10 VM to observe my current disk layout.

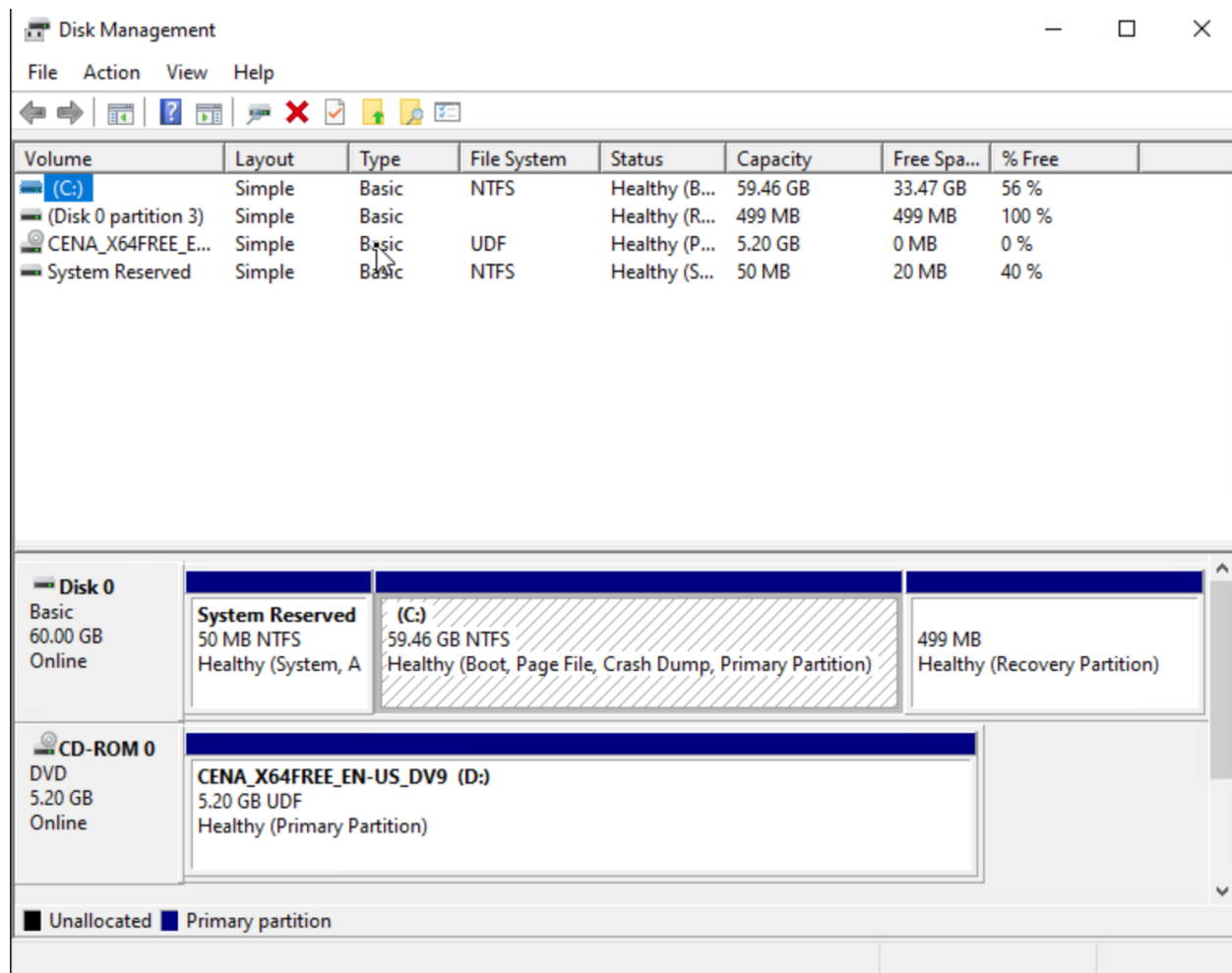


Figure 8a - Disk Management window displaying various partitions and their statuses.

→ Creating a New Virtual Disk:

- I created a new 60 GB virtual hard disk for my Windows 10 guest within VMware Workstation.
- I initialized it as a basic disk using the MBR.
- I began partitioning the disk, creating partitions of 10000 MB in size.
- I assigned drive letters starting from G to K.
- I created the first three partitions using the "create simple volume" option.
- The fourth partition appeared as an extended partition.
- I used the remaining space to create my K: drive.

→ Analyzing Disk Configuration:

- On my host Mac, I ran the chkdsk command to find the NTFS allocation unit size of my main partition.

```
C:\Windows\system32>winsat disk -read -ran -ransize 4096 -drive c:
Windows System Assessment Tool
> Running: Feature Enumeration ''
> Run Time 00:00:00.00
> Running: Storage Assessment '-read -ran -ransize 4096 -drive c:'
> Run Time 00:00:06.48
> Dshow Video Encode Time          0.00000 s
> Dshow Video Decode Time          0.00000 s
> Media Foundation Decode Time     0.00000 s
> Disk Random 4.0 Read              7.22 MB/s
> Total Run Time 00:00:07.08
```

Figure 8b - Disk random read performance on drive C: showcases a speed of 7.22 MB/s.

```
C:\Windows\system32>winsat disk -write -ran -ransize 4096 -drive c:
Windows System Assessment Tool
> Running: Feature Enumeration ''
> Run Time 00:00:00.00
> Running: Storage Assessment '-write -ran -ransize 4096 -drive c:'
> Run Time 00:00:00.47
> Dshow Video Encode Time          0.00000 s
> Dshow Video Decode Time          0.00000 s
> Media Foundation Decode Time     0.00000 s
> Disk Random 4.0 Write            17.86 MB/s
> Total Run Time 00:00:00.55
```

Figure 8c - Disk random write performance for drive C: reflects a speed of 17.86 MB/s.

- Using the winsat command on my Windows VM, I gauged the random read speed and write speed:
VM Read Speed: 7.22MB/s
VM Write Speed: 17.86MB/s
- On my host Mac, I used the **BlackMagic tool** from the Mac App Store to determine the read and write speed:

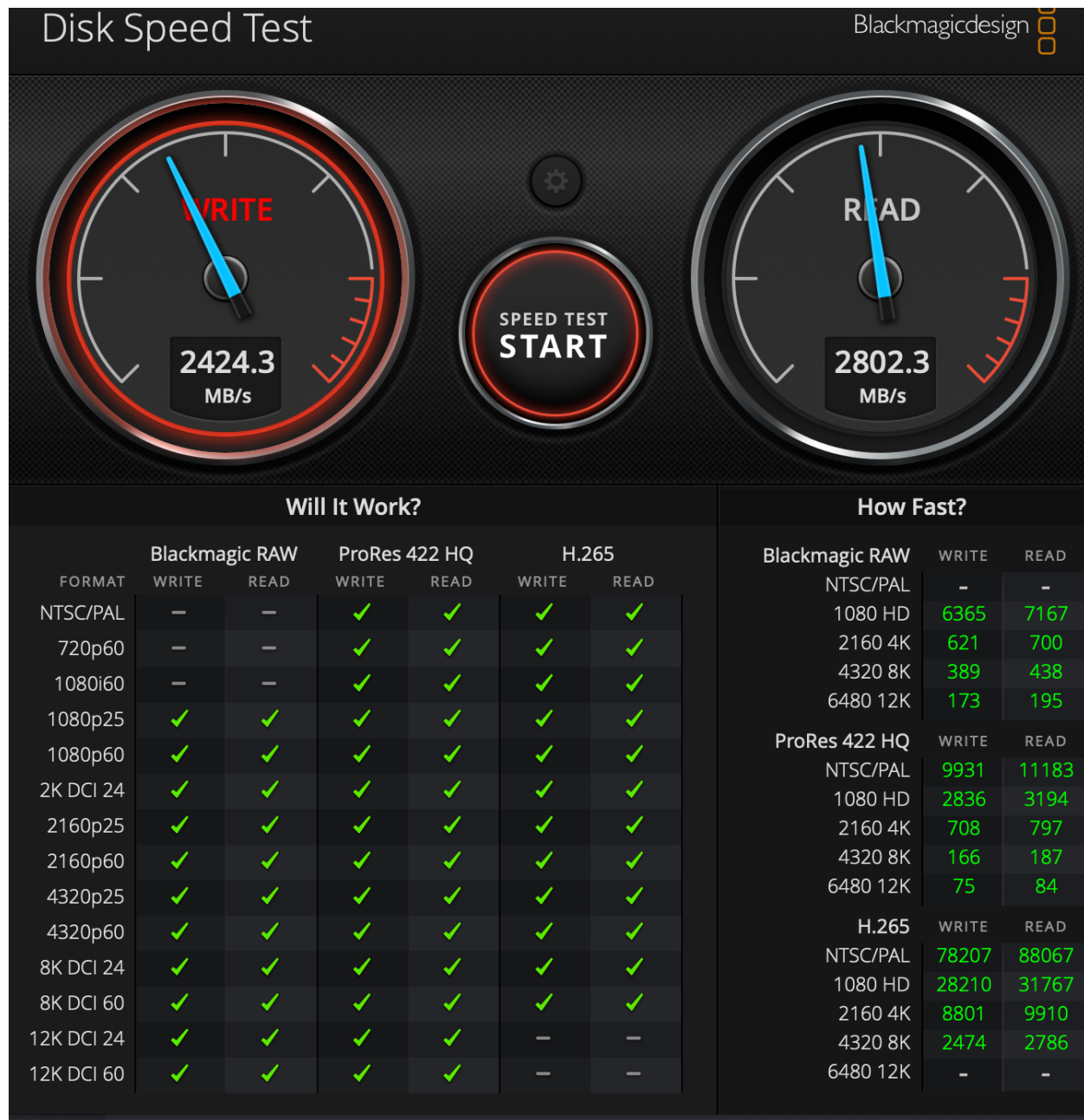


Figure 8d - Blackmagic Speed Test: Write/Read Speeds on MacOS

- **Host Computer Read Speed: 2802.3MB/s**
- **Host Computer Write Speed: 2424.3MB/s**

- **Host vs. VM: Host speeds are significantly higher than the VM (Reasons):**

Virtualization: Direct hardware access on the host provides better optimization compared to the VM's indirect access.

Resource Allocation: VMs get only a subset of total system resources, potentially limiting performance.

→ **Additional Memory Testing:**

- On my Windows VM, I employed the **winsat mem** command to assess memory performance:

```
C:\Windows\system32>winsat mem
Windows System Assessment Tool
> Running: Feature Enumeration ''
> Run Time 00:00:00.00
> Running: System memory performance assessment ''
> Run Time 00:00:02.50
> Memory Performance 10832.18 MB/s
> Dshow Video Encode Time 0.00000 s
> Dshow Video Decode Time 0.00000 s
> Media Foundation Decode Time 0.00000 s
> Total Run Time 00:00:03.19
```

Figure 8e - Windows Memory Performance Assessment: 10832.18 MB/s Read Speed.

VM Memory Performance: 10832.18 MB/s

- For my host Mac system, I turned to the memtester CLI tool for memory performance evaluation:

Host Memory Performance: 2457 MB/s

- The memtester tool also provided a detailed breakdown of various memory performance metrics, such as Stuck Address, Random Value, Bit Flip, and more. Each metric was tested, and all resulted in a successful "ok" status.

- **VM memory performance is higher than the host (Reasons):**

Memory Allocation: Dedicated RAM for VMs might offer optimized memory access.

System Overheads: VMs could achieve better performance with fewer background tasks compared to hosts.