

# Why does a 1TB hard drive only have 931GB of actual capacity?

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There are several reasons why the ad size is not the same as the actual capacity, let's find out.

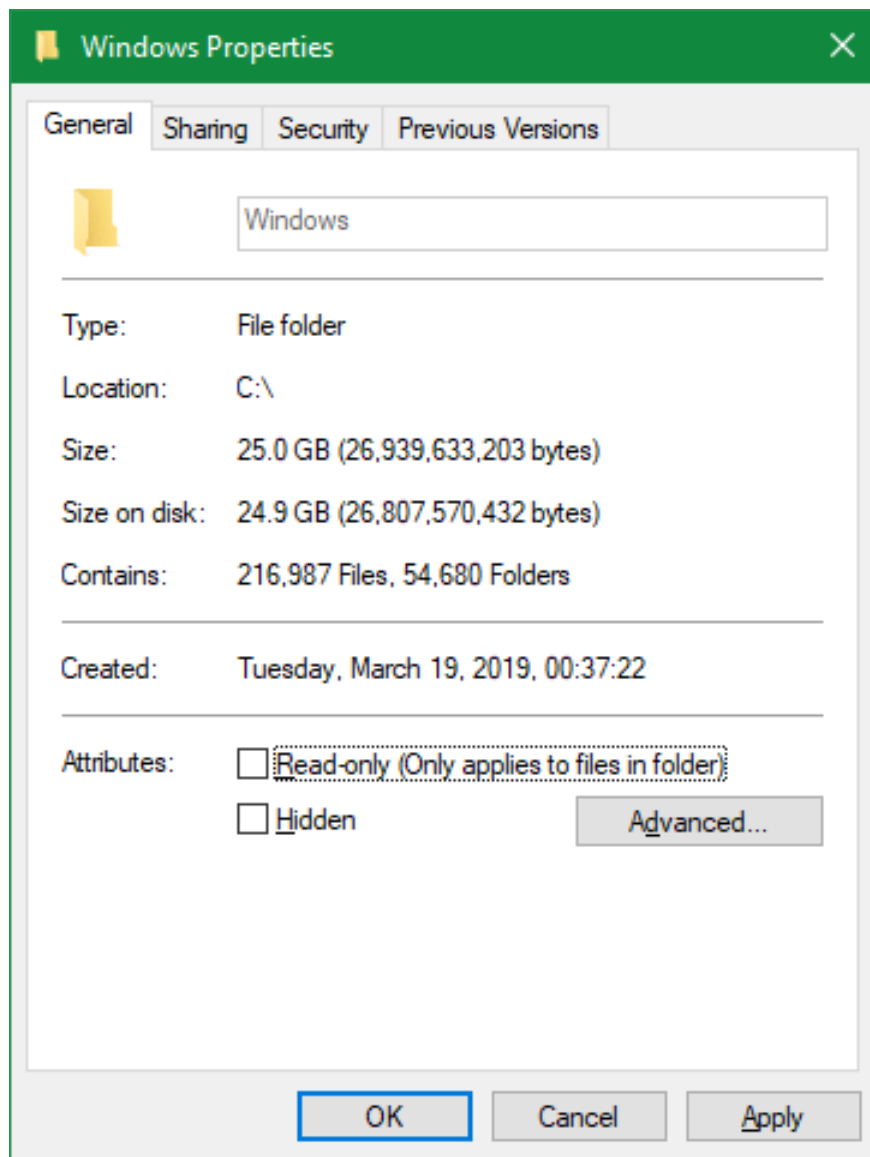
1. How to check the capacity of the computer hard drive
2. How much is the C drive capacity in the computer to be reasonable?
3. 4 best disk space analysis tool on Windows 10

## Pre-installed operating system and application

The most basic reason is that you cannot use all the hard drive capacity because it already has some data when you buy it. Removable hard drives like flash drives or SD cards rarely have data, but this is the main reason with pre-installed phones and computers.

When buying a computer, the operating system (like Windows or macOS) takes up a lot of space. These protected operating system files are needed for the system to run as intended.

For example, on a system, the C: Windows folder has 25GB, accounting for about 1/10 of the entire hard drive space.



However, not only does the operating system file take up that space, but it also includes additional applications that you want or don't want. It includes everything from Windows 10 bloatware to useful integrated macOS apps like GarageBand.

Although technically they are not part of the operating system but come with it and thus occupy space. You can remove these applications to regain storage space.

1. Tricks to remove default apps on Windows 10

## How the computer calculates the storage capacity

While pre-installed apps are a space hopper, the biggest reason why you don't get all the storage you have is because your measurement calculator is different from humans.

### Binary number

Computers use standard value prefixes, including kilos for thousands, mega for millions, giga for billions, tera for trillions, etc.

### 1. The basic steps of decoding binary numbers

Humans, including hard drive manufacturers, use the decimal system, compute numbers with base 10. Therefore, when say 500 gigabytes, that means 500 trillion bytes.

However, computers using binary system 2, all numbers are only 1 and 0. If not known, the following is a list of numbers 1 to 10 written in binary:

first  
ten  
11  
100  
101  
110  
111  
1000  
1001  
1010

As you can see, in binary,  $2^1$  represents the decimal value 1,  $2^2$  equals 2,  $2^3$  equals 4,  $2^4$  equals 8, etc. Each position of the new digit in binary increases the value of that number to a power of two.  $2^{10}$  equals 1,024.

## Measure binary and decimal

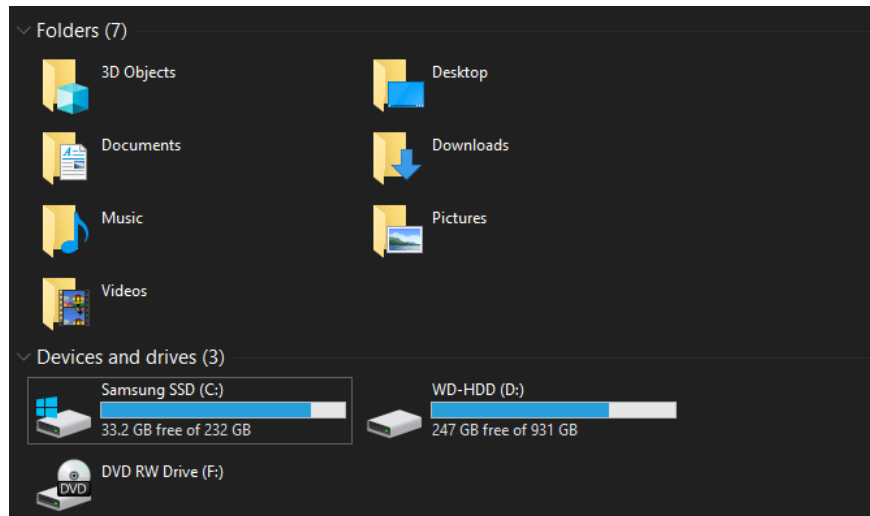
We now know that computers use 1,024 instead of 1,000 to identify these common prefixes. For computers, a kilobyte is 1,024 bytes, not 1,000 bytes as people think. Incrementally, we have 1 megabyte of 1,024 kilobytes and 1 gigabyte of 1,024 megabytes.

So how does this affect buying an external 250GB SSD? This hard drive contains 250,000,000,000 bytes, but the computer does not display that way.

We can divide by 1024 three times (one to convert bytes into kilobytes, again to convert kilobytes to megabytes and the last to convert megabytes to gigabytes) to see how much is actually:

$$250,000,000,000 / (1,024 * 1,024 * 1,024) = 232,830,643,653 \text{ bytes or } 232.83\text{GB}$$

Take a 250GB hard drive in Windows for a maximum capacity of 232 GB, exactly as calculated above. The difference is 18GB.



The larger the hard drive, the greater the difference between the measured capacity and the actual capacity. For example, a 1TB (1,000GB) hard drive has 931GB of space on the computer.

## Gigabyte and Gibibyte

You may wonder why there is a difference. Why are hard drive manufacturers not providing the correct storage capacity on the device? Yes, technically they do this.

The exact giga is determined to be 1,000 and the gibi is 1,024. The International Electrotechnical Commission has announced a standard for measuring binary data to address this confusion.

While a kilobyte (KB) equals 1,000 bytes, 1 kibibyte (KiB) equals 1,024 bytes. The same goes for mebibyte (MiB), gibibyte (GiB), tebibyte (TiB), etc.

For some reason, Windows uses the GB prefix incorrectly when it is actually measured in gibibyte. Operating systems like macOS accurately measure 1GB to 1 billion bytes. Therefore, the same 250GB hard drive is connected to a Mac it will display a total of 250GB of storage.

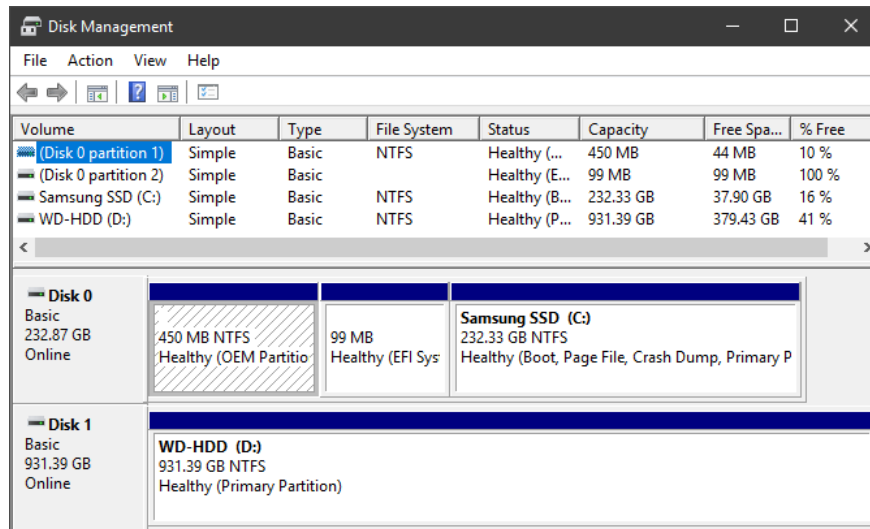
## Additional disk partitions

In addition to the above, another potential cause of reducing the total amount of space the drive has is additional partitions.

You can separate hard drives into different logical parts, called partitions. Hard drive partition allows installing two different operating systems on one hard drive.

When buying an existing computer, the manufacturer usually includes a recovery partition on the disk, containing data that allows resetting the system in the event of a serious problem. Like other files, they take up space on the hard drive. But because the recovery partition is usually hidden, you don't know it exists.

To view the partition on a hard drive in Windows, type **disk management** in the Start menu and click **Create and format hard disk partitions**. You will see each hard drive on the system and partitions are taking up space on it. If you see a Restore, Recovery, or similar label, it's a recovery partition.



In most cases, you can delete this partition and reclaim storage space. However, it is best to leave it alone to make it easy to restore the system, and this small increase in value is not worth the effort to restore the system manually.

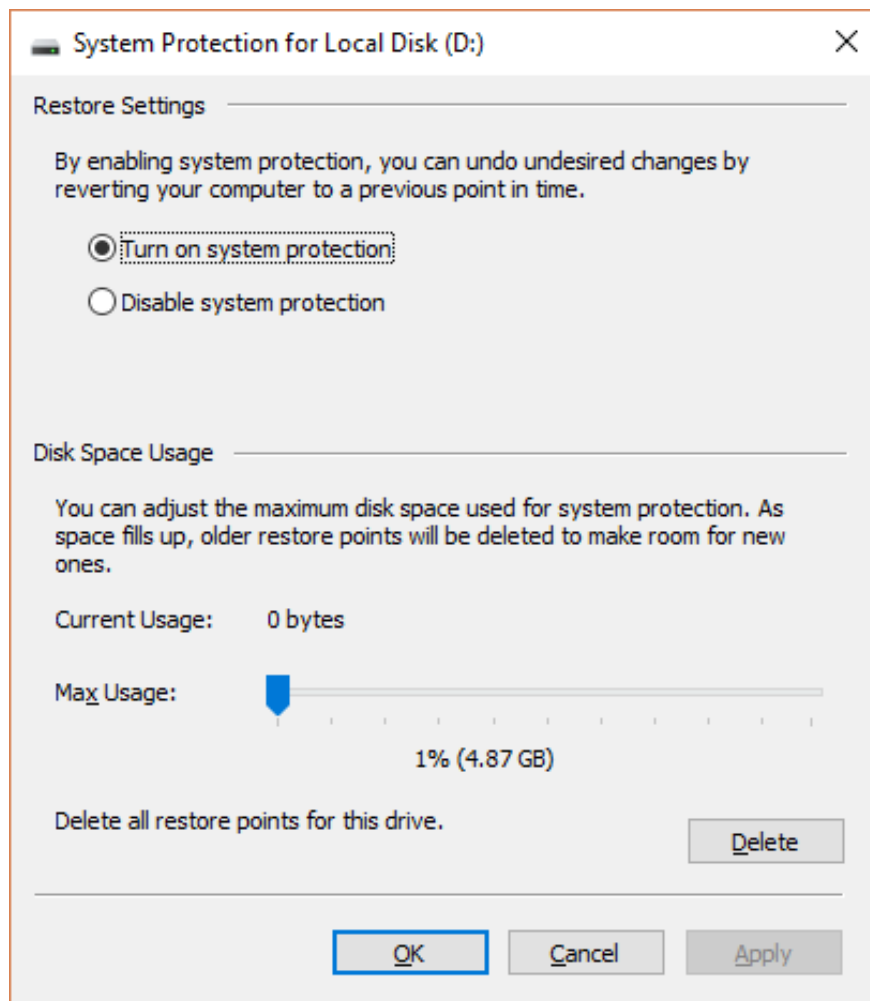
## Hidden features also take up space

Finally, most operating systems contain features that take up disk space but do not exist as actual files. For example, the Windows Shadow Copy service is used to enable both Previous Versions and System Restore.

System Restore allows you to return to an earlier time if the system is not working properly, while Previous Versions keeps a copy of your personal files so that you can undo the changes. Of course, both of these functions need space to work.

To view and change the amount of feature based on the Shadow Copy service used, press Win + Pause to quickly open the **System Control Panel** . From here, click on **System protection** on the left. In the resulting window, select the hard drive from the list and select **Configure** .

You will see a new dialog box that disables complete system protection. Below, you will see **Current Usage** and can adjust the maximum capacity Windows uses. About 10% is a reasonable number.



These factors are the cause of the noticeable difference between actual storage space and advertising. Although there are some other small factors such as special blocks in an SSD, these are the main reasons. Knowing this can ensure that you always have the necessary storage space on your new device.

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