Why does the timestamp of a file increase by up to 2 seconds when I copy it to a USB thumb drive?

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We saw some time ago that the FAT file system records timestamps in local time to only two-second resolution. This means that copying a file to a FAT-formatted device (typically a floppy drive or a USB thumb drive) can increase the timestamp by up two seconds. And even after the file is copied, the timestamp is not stable. The timestamp changes depending on the time zone employed by the computer that accesses the drive. In particular, if you are in a part of the world which changes clocks during the summer, then the timestamp on the file moves by an hour every spring and then moves in the opposite direction every autumn. (Because you change time zones twice a year.)

Okay, but why does the timestamp always *increase* to the nearest two-second interval? Why not round to the *nearest* two-second interval? That way, the timestamp change is at most one second.

Because rounding to the nearest interval means that the file might go backward in time, and that creates its own problems. (Causality can be such a drag.)

For example, suppose you regularly back up files from your NTFS-formatted C: drive to your USB thumb drive mounted as drive F: by typing

```
xcopy /D C:\Files\* F:\Files\*
```

If the timestamps rounded to the nearest two-second interval, then half the files on average will have a timestamp on the USB thumb drive older than the files on the C: drive. This means that if you perform the command a second time, approximately half of the files will be copied *again*. To the user, it looks like the `xcopy` command *never finishes the job*, because each time you tell it “Perform an incremental backup” it always finds something to copy. It never says, “All files up to date, you can go home now.”

To avoid this infinite loop, the convention is always to round *up*, so that the copy of a file is never older than the original.

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