Sector size and MFT FILE Record size

May 4, 2012 in Forensic Analysis

This is a quick post to clarify a very common misconception about sizes of a sector and a single MFT FILE record on NTFS file system.

The most common values associated with these 2 parameters are:

- 512 bytes – for a sector
- 1024 bytes – for a single MFT FILE record

It turns out that new large drives are often seen by OS as having a sector size that is larger than 512 bytes and as a result, the MFT FILE record size is often also larger. This is not a big issue and many forensic tools handle it properly, but seeing many people explicite calling out these 'hard wired' values, I thought I will make an attempt to clarify it a bit.

A side effect of this is that $MFT size may quickly grow to many GiBs.

I do not work with hardcore file carving on daily basis, so I am pretty sure that someone who does could (and I hope will) offer a more in-depth explanation of what's going on under the hood (e.g. whether the 4096 is a virtual sector made out of 8 'old-school' physical sectors that are 512 bytes, etc.).

On a practical level, one can confirm the size of the sector and cluster as well as MFT FILE record size using e.g. fsutil tool in Windows.

For a drive with a 512-bytes long sector, you may get a result like this:

```
fsutil fsinfo ntfsinfo c:

[...]

Bytes Per Sector  :               512  <- sector size
Bytes Per Cluster :               4096 <- cluster size = 8 sectors
Bytes Per FileRecord Segment    : 1024 <- MFT FILE Record size = 2 sectors

[...]
```

For a drive with 4096 bytes long sectors, the fsutil can give the following result:

```
fsutil fsinfo ntfsinfo g:

[...]

Bytes Per Sector  :               4096 <- sector size
```

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Bytes Per Cluster :               4096 <- cluster size = 1 sector
Bytes Per FileRecord Segment    : 4096 <- MFT FILE Record size
                                        = 1 sector = 1 cluster


[...]
```

The values for a logical volume can be read from BPB (BIOS Parameter Block) – a decent explanation on encoding used to preserve the value of FILE record size can be found here.

This is an example of a FILE record on such a large drive:

```
000000000 46 49 4C 45 30 00 09 00 27 25 00 02 00 00 00 00 FILE0...'%......
000000010 01 00 01 00 48 00 01 00 68 01 00 00 00 10 00 00 ....H...h.......
000000020 00 00 00 00 00 00 00 00 04 00 00 00 01 00 00 00 ................
000000030 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
000000040 00 00 00 00 00 00 00 00 10 00 00 00 60 00 00 00 ............`...
000000050 00 00 18 00 00 00 00 00 48 00 00 00 18 00 00 00 ........H.......
000000060 B9 78 C5 A0 47 51 CB 01 B9 78 C5 A0 47 51 CB 01 .x..GQ...x..GQ..
000000070 B9 78 C5 A0 47 51 CB 01 B9 78 C5 A0 47 51 CB 01 .x..GQ...x..GQ..
000000080 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
000000090 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 ................
0000000A0 00 00 00 00 00 00 00 00 30 00 00 00 70 00 00 00 ........0...p...
0000000B0 00 00 18 00 00 00 02 00 52 00 00 00 18 00 01 00 ........R.......
0000000C0 05 00 00 00 00 00 05 00 B9 78 C5 A0 47 51 CB 01 .........x..GQ..
0000000D0 B9 78 C5 A0 47 51 CB 01 B9 78 C5 A0 47 51 CB 01 .x..GQ...x..GQ..
0000000E0 B9 78 C5 A0 47 51 CB 01 00 40 00 00 00 00 00 00 .x..GQ...@......
0000000F0 00 40 00 00 00 00 00 00 06 00 00 00 00 00 00 00 .@..............
000000100 08 03 24 00 4D 00 46 00 54 00 4D 00 69 00 72 00 ..$.M.F.T.M.i.r.
000000110 72 00 00 00 00 00 00 00 80 00 00 00 48 00 00 00 r...........H...
000000120 01 00 40 00 00 00 01 00 00 00 00 00 00 00 00 00 ..@.............
000000130 03 00 00 00 00 00 00 00 40 00 00 00 00 00 00 00 ........@.......
000000140 00 40 00 00 00 00 00 00 00 40 00 00 00 00 00 00 .@.......@......
000000150 00 40 00 00 00 00 00 00 11 04 02 00 00 00 00 00 .@..............
000000160 FF FF FF FF 00 00 00 00 20 00 00 00 20 02 00 00 ........ ... ...
000000170 01 02 00 00 00 00 00 05 20 00 00 00 20 02 00 00 ........ ... ...
000000180 80 00 00 00 48 00 00 00 01 00 40 00 00 00 01 00 ....H.....@.....
000000190 00 00 00 00 00 00 00 00 03 00 00 00 00 00 00 00 ................
0000001A0 40 00 00 00 00 00 00 00 00 00 40 00 00 00 00 00 @........@......
0000001B0 00 40 00 00 00 00 00 00 00 00 40 00 00 00 00 00 .@.......@......
0000001C0 11 04 02 00 00 00 00 00 FF FF FF FF 00 00 00 00 ................
0000001D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
0000001E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
0000001F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 00 ................
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000000300 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
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