WD 2.1.7.x 190 Solution of T2 Editor

Most of Western Digital's 800xx and above series hard drives use SMR technology, a technology that was created to dramatically increase platter capacity at the expense of hard drive performance and customer experience. The application of the technology we should have dealt with long ago, is Seagate began to gradually promote the LM series a few years ago. Although the technology has been relatively mature, but the damage to the hard drive is also great, the security of customer data also caused a great test.

Nominally, SMR means perpendicular magnetic recording technology, because there is a stacked structure in the distribution of the underlying tracks, so it is also called stacked tile disk.

How does this technique work?

First, we need to know that the magnetic tracks are distributed in a circle from the inside out, with sectors distributed on top. The smallest unit of data reading and writing by the magnetic head is sector, not byte. The allocation of bytes is not linear, but in blocks that make up a sector, which means that 512 bytes are specified to make up a sector, and thus the sector has a width if you look at it on a microscopic level. This also means that the magnetic track also has a width.

However, when the head reads and writes, not tightly along the width of a sector reads and writes, the actual read and write area of the head is across multiple tracks. Considering that adjacent tracks are overlapping areas, this produces great inconvenience when writing only one sector of data, and the data covering the adjacent tracks must be pre-read, then write the data of the target track, and finally write back the pre-read data.

In order to facilitate the management of LBA, Western Digital adopts the "band" approach to read and write capacity management, that is, each band

actually spans more than ten tracks, and the tracks inside each band cover a number of sectors, so that each time the data is written, a large amount of data can be written at once without the need to pre-reading and then writing back the data for a single track each time.

Since the reading and writing operations of the actual scenario are quite complex, WD configured the oversized module 190 in the firmware structure, whose entries point to the LBA segment of the data area, i.e., each entry represents a certain volume of user area data. In order to facilitate fast reading and writing, its entry data is modified in real time with the reading and writing operation of the hard disk, which also leads to the management of the LBA, the original way of translator defects considered is no longer sufficient, the need to increase the second level of LBA data entries.

The LBA entries here actually point to the "band", and since each sector of the track originally has its own address, following the linear management of the PBA, the address of the LBA will change in real time after considering the 190 LBA entries.

This alone still does not meet the actual capacity management needs, for example, some areas are not yet used, and the 190 is managing the actual data areas stored by the user, that is, the real data exists before the band is recorded by the 190, and the unused areas are still managed according to the first-level translator. This management is reflected in the distribution of entries in the 190 as each entry must be logically addressed consecutively, and if it is reduced to the PBA approach, there are many unused areas between sectors and sectors.

In this way, the drive first undergoes a first-level translator process to form a de-defective LBA. At the same time unused areas can be addressed using the first-level compiler, while the second-level compiler is only for data areas, for which it is necessary to continue to do a LBA addressing to form a contiguous new LBA. Here we simply write a formula as follows.

Formula a user area LBA = f (PBA, first-level translator of defective entries)

Formula b user area LBA = f (formula a, second-level translator of data entry)

The data recorded as 190 entries must use formula b, while the unused area still uses formula a. Since the unused area is filled with 00, once the 190 entries generate errors, such as computer-side formatting of a partition which causes the data to show 00, so that 190 does not modify in time to take effect, the real data area cannot be unfolded and is shown as data in the unused area, i.e., the data area is 00.

The 190 entry problems known up to now include a variety of scenarios: missing entries such as bad sectors, interleaved adjacent entries, incorrect entry data, gaps in entries, and empty entries. In the software processing, it is impossible to recover the real data of the entry, but only to do something about the continuity of the address of the entry.

The reason for this is also very simple: there is a 190 entry before there is a corresponding LBA, because the corresponding LBA and the 190 entry cannot be predicted in advance, the entry data cannot be recovered so far from our understanding. Therefore, the extent of data recovery depends on the integrity of the original 190 entries, resulting in the following outcomes:

① Data cannot be recovered

② A large amount of data is missing and discontinuous.

③ Individual partitions or data segments are missing.

④ Some files have file records but the data is empty

⑤ Complete data recovery

To facilitate the operation, the software has added the function button "Rebuild 190". The entries shown in the interface generally do not need to edit. The result of the reconstruction is the final result may be presented.

Because the software uses the way of writing to RAM to use 190 entries data,

the address of different hard drives may vary, and 190 data and other unknown faults have not yet been resolved, therefore, after writing 190 to RAM, some will have other 190 data problems leading to power reset when reading user sectors. Some are caused by the software imperfections of the RAM writing method leading to memory errors, and the hard drive automatically powers off and on.

The current means of resolution is rather limited. It can be tested in the DE factory mode using the PBA mode to see if it works.

In addition, in the process of using the function, you may need to use the translator regeneration function. This command will affect the 190's data, so please be sure not to try the function when the original data is present.

The above is the latest version of MRT on 190 failure and software features detailed explanation. More hard disk support needs further research and support. Please look forward to it.

Thank you for your support and see you next time!