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FUJIFILM: Development of tape technology and challenges to overcome

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Fujifilm is the world's leading manufacturer of magnetic tapes (LTO, 3592 and T10000). More than 80% of the storage capacity delivered on tapes comes from Fujifilm's manufacturing and assembly plants in Odawara (Japan) and Bedford (USA). Fujifilm is working in partnership with IBM on the development of the next tape generations: a roadmap is established, describing the tape formats that will be used until the 2030s. The Scientific environment, HPC users, the genomic research, the satellite imagery or the biotechnology are among the industry segments that provide the most information to IBM and Fujifilm regarding the development criteria for future tape formats.

From a purely industrial point of view, the news in tape technology is to see how manufacturers can develop higher capacity and higher performance levels than previous generations, without hitting the recording stability, nor the data integrity. For example, we can mention the stakes related to storage capacity: in 2011, higher-capacity users could use 3592JC tapes (4TB of data per cartridge) and small and medium-sized businesses used to purchase LTO5 tapes (1.5 TB capacity). By the end of 2018, IBM will launch the 3592JE tapes, which will offer capacities of 20TB per tape cartridge. However, to make tapes of higher data capacity, it is necessary to be able to use smaller particles on tape. The problem is that the magnetic output of a particle depends, theoretically, on its size. A particle that is too small, with a magnetic resonance that is too low, would prevent the read/write process, or, simply, generate data loss. We call SNR (Signal-to-Noise Ration), the measurement of the perception by the head of the drive, of the signals emitted by the particles that are coated on the tapes. Only a high SNR level can allow a stable recording. Preserving or even improving the level of SNR in tape technology is one of the key requirements for the development of higher capacity tapes.

Another fundamental risk lies in the fact that an increase in the capacity of a tape involves the use of smaller writing tracks. Reducing track width reduces the overall magnetic field and, consequently, hurts the SNR. Finally, an increased write speed, corollary to a greater storage capacity, is logically the third reduction factor of the SNR, and therefore of data loss. The development of new tape generations goes hand in hand with the development of new technologies that are designed to improve the quality of perception of the signals emitted between the tape and the drive's head. On top of Fujifilm's progress in tape manufacturing we can also evoke the technological innovations that result from IBM's R&D:

- The use of a larger number of write channels, which drastically increases both write and read speeds. 16 channel heads on LTO6 drives allow 160MB/s transfer rate, while 32 channel heads can increase the write speed up to 500MB/s.
- A Larger number of channel heads combined with thinner tracks pushed IBM to produce new heads that would be thinner and more performant at the same time. However, the new performances required in tape technology rendered the technologies used until now obsolete. Hybrid heads or "dual heads" are those that are traditionally used in tape technology. These heads combine two different functions: the writing process, which works by magnetic field injection to the tape (as a toothpaste) and the read process that captures magnetic signals via sensors. By launching its new generation of Terzetto heads, IBM has created the principle of ''specialized head". From now on each head will have a unique function, which considerably increases its properties. The concrete result of the launch of these heads is an unprecedented improvement in the field of data integrity, and the SNR.
- The TMR head: the improvement of the system's performance increases the transfer of the current within the head, which generates a phenomenon of warming. Major warming disturbs the magnetic field: the new TMR heads, thanks to a greater resistance can multiply the capacity of the head to capture signals by 4.

These three new features are part of the improvements we will discuss with users during the Hepix exhibition. We will also discuss other major issues such as the development deadlines for tape technologies offering beyond 50TB, how to increase the write speed of new storage systems, or how best to stabilize the transition of the tape within the drive, despite higher unwinding speeds than in the past.
Finally, we will introduce the new Strontium Ferrite technology, a tape coating method using particles, which, with the same size as Barium Ferrite particles, offer a superior magnetic output. This technology will enable the manufacture of tapes of more than 100TB capacity. It is likely that this technology will be the one most commonly used in the 2020s.

Desired length

20 minutes (if possible 12 extra minutes)

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