Digital Memory

The amount of information that humans produce and want to store is increasing exponentially. It is estimated that the total digital information on Earth is of the order of zettabytes (thousands of billions of billions of bytes). The amount of digital information that people want to archive --- by which we mean store safely, recoverably, for long periods of time with only rare access and with minimal ongoing maintenance requirements --- is also growing. However, at present essentially no long-term archiving of digital information is taking place. This is because all current digital storage media --- for example, CDs, DVDs, hard disk drives, magnetic tapes etc. --- require a constant cycle of refreshing both the storage medium and the 'reading' and 'writing' hardware. This in turn is because there is no technology that is trusted to survive more than a few years. The media themselves decay and may become unreadable; even if the media remain secure, the hardware for reading them will not. There are therefore continuing costs in media, hardware and active archive maintenance.

Recent genome science-inspired advances in the technologies for reading and writing DNA led us to look at the possibility of using DNA as a digital archive medium. DNA has a 3-billion year proven pedigree as a stable information carrier, with individual 10,000-year-old DNA molecules routinely recovered from historical samples. Safe DNA storage conditions are easily maintained at low cost, and the ability to read DNA fragments will surely survive for as long as there are technologically-advanced humans inquisitive about the working of living organisms' genomes. In our proof-of-principle experiment, we showed how existing DNA technologies could be used to store and recover approximately 750kb of digital information in a manner that could be extrapolated to global data scales, incorporating modern methods such as error correcting codes for data integrity. This talk will describe our and others' work in "DNA-storage" and will speculate on the future of DNA as a digital storage medium.

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