

A Storage Vision #3

Your life on a silver platter

Thomas M. Coughlin

President

Coughlin Associates

www.tomcoughlin.com

How much information?

In 2003 the Haas School of Business at Berkeley completed a landmark report called “How Much Information” that made an estimate of the total information in the world. One of their conclusions was that print, film, magnetic, and optical storage media produced about 5 exabytes of new information in 2002. Ninety-two percent of the new information was stored on magnetic media, mostly in hard disks (see **Figure 1**).

Extrapolating from the trends for new information in the Berkeley study I estimate that about 10 exabytes (1 followed by 18-zeros) of new information will be created in 2006 and within 10 years the amount of new information generated annually will approach 100 exabytes. This is an estimate of the total new information created, the accumulated information that is stored will be much larger since multiple copies of content are likely to exist and because much of the new content is likely to be stored and accumulated for latter use. It should be noted that in 2006 while the new information generated totals about 10 exabytes the total disk storage shipped will exceed 40 exabytes (over 4X greater). Within 10 years time almost all information will be digital and the total information capacity could approach 1,000 exabytes (1 followed by 21-zeros) or a zetabyte, particularly if personal content begins to out-strip commercial content production as I consider likely.

Where will all this data go? How can we make sure that the cultural legacies represented by all these bytes are passed on to following generations? What vision of digital storage gives us a way to capture, organize and maintain this vast pool of human experience? A key piece of this puzzle is represented by hard disk drives. Over the 50 years of their history hard disk drives have represented a cost effective way to storage large amounts of information while providing relatively rapid random access to that data. Although some storage technologies recover data faster no technology other than magnetic recording has been able to store such large capacities at such low cost. With the continuing development of hard disk storage with areal density growth rates exceeding 40% annually it is likely that the cost advantage of hard disk drives over other storage technologies will continue for the foreseeable future. That is why hard disk drives represent the major repository for much of the world’s accumulated information and together with magnetic tape creates most of the large data repositories and archives.

Figure 1. Hard Disk Drive (courtesy of Seagate Technology)



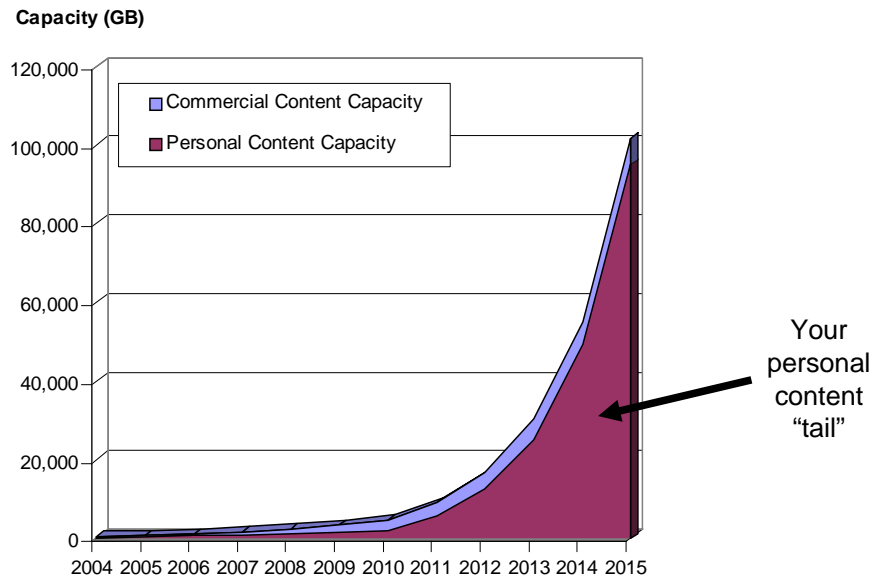
Storage tiers and the last repository of content

A concept long used in enterprise storage is the storage hierarchy. This refers to the different roles that various storage devices play for a given application. The elements in a storage hierarchy can be arranged to create a storage tier where different types of storage device are used at various times during the life of a piece of information. Usually storage tiers store information in storage devices depending upon their age and/or usage characteristics. New and often accessed information is stored on higher performance storage devices which tend to cost more per amount of storage capacity than lower cost and lower performance storage devices. As the data ages or is accessed less frequently it moves to lower performance and lower cost storage.

In the professional content creation space high resolution content such as 4K+ films can result in total content capacities of 1.6 petabytes per film (1 followed by 15-zeros). HD-DVD and Blu Ray Disc content releases result in file sizes of at least 25 gigabytes. But the costs of making and sharing content are decreasing, tapping the creativity of a great many people (note the popularity of content sharing networks such as YouTube). By 2010 a 5 terabyte (1 followed by 12-zeros) accumulated capacity home will be common. By the next decade people may take the capturing and sharing of their personal experiences to a new level with the advent of “life logs” where people record their lives as they happen. Much of the initial storage will be done with mobile devices using flash memory or for higher resolution content capture, hard disk drives, as the storage media. However the captured content will eventually be transferred to local storage networks using hard disk drives to preserve and manage the content.

With the advent of life logs personal content could easily exceed commercial content in a tech savvy home (see **Figure 2**). By my estimates accumulated content in a home could be several hundred terabytes by 2015 with the vast majority of this content being personally generated content.

Figure 2. Possible growth of home commercial and personal content by 2015
(© 2006, Coughlin Associates.)



As personal storage archives grow we expect the demand for digital storage to protect, store and share this content will blossom. While most homes today do not include digital external direct attached storage for backing up or accessing accumulated storage or backing up or sharing files over network attached storage this should change considerably over the next few years as the volume of personal content mushrooms. This will drive development of direct attached storage devices such as shown in **Figure 3** (a direct attached external-SATA or e-SATA drive capable of 3 Gigabit per second transfer rates, a blinding speed that may eventually make IEEE 1394 and even USB interfaces obsolete) and network attached storage devices such as shown in **Figure 4**.

Finding your life

Sheer quantities of data are one thing but equally important will be the organization and indexing of content so it can be accessed easily. In the creation of commercial entertainment content metadata (data about the data) is created by professionals to help in the management and reconstruction of content during the editing process and to find material in archives after the project is completed. Large content storage in the home will require similar capabilities to generate metadata on the content. However in the home this data about the data must be generated automatically and should be able to access data via visual, auditory and textual clues. This will require a new level of storage management software to support and manage the home storage hierarchy.

Figure 3. External SATA (e-SATA) Direct Attached Storage Device (courtesy of Seagate Technology)



Figure 4. Network attached storage or NAS device for the home market (Maxtor Shared Storage courtesy of Seagate Technology)



Digital storage in the home will use many devices from the digital storage hierarchy but the final repository of that storage will most often be hard disk drive based external storage systems (either direct attached or DAS or else networked storage systems or NAS). These devices will need to become more intelligent in order to help users find and preserve the vast capacity of personal digital content stored there. There may even

develop a remote storage market to provide disaster recovery for home files in case of destruction of the home and home storage.

The final repository of much of the worlds' and even our personal content will be hard disk drives no matter what the initial storage devices for capturing that content. These versatile devices are where our most precious memories and records are preserved for the future. It is the versatile combination of performance, low cost and copious capacity that puts hard disk drives in their unique role of final repository of much of the worlds' information.

The annual storage visions conference

Come join us January 6 & 7, 2007 at the Flamingo Hotel in Las Vegas, Nevada for the 6th annual Storage Visions Conference. Hear our sponsors such as Seagate Technology explore and describe new opportunities for digital storage and personal and entertainment content creation, distribution and reception. Meet and network with the creators of the future and explore all the ways that digital storage will enrich our human experience!