Cloud storage – Megas, Gigas and Teras

I think that I need cloud storage. I have photos, videos, music and documents on my computer that I can only retrieve from my computer. If my computer got struck by lightning or dropped from a 5-story building and I had not recently backed it up to an external drive, I would lose all of my files and would never be able to see them again. Those images, videos, songs and documents would be gone!

So I'm looking into storing my photos and documents online = Cloud storage.

I've found a whole lot of providers for storage online. They are all different in how much storage they offer, at what cost I can increase my storage, and what is allowed for free in my account. I feel lost. What does it all mean? How much space do I really need?

Below are 4 storage options that we've chosen to compare. There are lots more options out there.

- Flickr will give me 1 TB of space for my photos and videos for free. Seems like a lot, but its only photos and videos ...
- Dropbox gives the first 2 GB free, then costs $9.99 per month for 100 GB
- GoogleDrive gives the first 15 GB free, then charges $1.99 per month for 100 GB and $9.99 per month for 1 TB
- iCloud gives 5 GB of free storage with an iCloud account, then charges $20 per year for 10 GB, $40 per year for 20 GB, and $100 per year for 50 GB of storage. Anything purchased in an iTunes account does not count toward the storage limits.

*What do those units (**terabyte, megabyte, kilobyte**) mean?*

Maybe you've heard of base two. Here's the low down. Computers basically work by sending electronic signals that are as primitive as on and off. Circuits are wired with branches that are again on or off. We notate those on/off decisions with binary representations ... either 0 or 1.

A **bit** of information is either a yes or a no ... on or off ... 0 or 1. You really can't compute or demonstrate much with just one bit of information. So let's look at the next biggest unit of grouping on a computer.

A **nibble** is made of 4 bits. How many pieces of information could you compute with only a nibble of information. I arranged the digits 0 and 1 in all of the possible ways that I could order them and got 16 arrangements.

0000	0100	1000	1100
0001	0101	1001	1101
0010	0110	1010	1110
0011	0111	1011	1111

So, I guess I could represent 16 different pieces of information with a nibble.

1. Why do you suppose 2 choices for the first digit, 2 choices for the second digit, 2 choices for the third digit, and 2 choices for the fourth digit turned out to be 16 possible ways of writing the 4 digits? Please explain.

2. Just to check your methods, see if you can list all of the ways that 5 bits could be arranged. Does your short-cut method work for 5 digits? Be careful, I may not have included enough cells ... or I may have used too many cells.

00000	01000			
00001	01001			
00010	01010			
00011	01011			
00100	01100			
00101	01101			
00110	01110			
00111	01111			

3. Describe an easier or more efficient way to have figured this out.

Here's a chart of the size of each electronic memory unit.

Name of unit	Abbreviation	Contents	Bytes	Close to
1 bit	1 b (lower case)	1 symbol either 1 or 0		
1 Nibble		4 bits	½ byte	
1 Byte	1 B (upper case)	8 bits or 2 Nibbles or 2^3 bits	1 byte	
1 Kilobyte	1 KB	2^{10} bytes	1,024 bytes	1 thousand bytes
1 Megabyte	1 MB	$(2^{10})^2$ bytes	1,048,576 bytes	1 million bytes
1 Gigabyte	1 GB	$(2^{10})^3$ bytes	1,073,741,824 bytes	1 trillion bytes
1 Terabyte	1 TB	$(2^{10})^4$ bytes	1,099,511,627,776 bytes	1 quadrillion bytes
1 Petabyte	1 PB	$(2^{10})^5$ bytes	1,125,899,906,842,624 bytes	1 quintillion bytes
1 Exabyte	1 EB	$(2^{10})^6$ bytes	1,152,921,504,606,846,976	1 sextillion bytes
1 Zetabyte	1 ZB	$(2^{10})^7$ bytes	1,180,591,620,717,411,303,424 bytes	1 septillion bytes
More than is useful to know				

4. Without counting any list of numbers, figure out how many different ways you could write a **byte** of information.

So when someone sends a page of print electronically, they are really sending a series of 0's and 1's that represent each of the letters or symbols in the document. Each of those letters or symbols probably contains a byte of information. This could get huge.

ASCII text (American Standard Code for Information Interchange) is binary machine language. The letters, digits, common symbols, and some keystrokes all have binary symbols that are used to print, calculate, or render text. For instance, a capital "A" in ASCII is 100 0001. So it takes 7 bits to store a capital "A" in binary. 7 bits is pretty close to a byte. So, it is convenient to think that each character in English requires a byte for storage.

5. Calculate how many **bits** and **bytes** of memory just one average-length word might require.

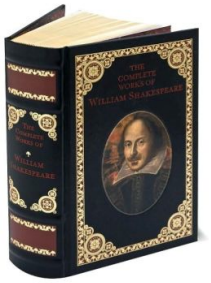
Maybe we had better consider a larger grouping of information clusters than just a bit or byte. The next biggest capacity is a kilobyte (KB). A kilobyte of information contains 1,024 (2^{10} bytes of information). One long paragraph of a typewritten page might contain 1 KB of binary (base 2) information.

6. Estimate how large the memory size of a book might require.

It might be useful here to use a larger unit of measure than a KB. A kilobyte squared is a Megabyte (MB).

7. If a KB = 2^{10} bytes then 2 raised to what power is a megabyte?

I found that the Complete Works of Shakespeare would require 10MB of storage. That tomb has about 1,300 pages of print.



8. Choose an average-sized book that you might read, calculate what fraction of the Complete Works of Shakespeare your book size is, and check your guessed answer to question 6.

So back to how much storage I need in the cloud …

Storing documents

I'm writing this activity in Word. When I look at the file list on my desktop, I can see that its size now is 412KB.

9. Does the size of this document seem consistent with the memory needed for a huge Shakespeare tomb? Please explain.

10. So if I upload my documents on Google Drive (which allows for 15 GB of free storage) for our written documents, about how many documents will I be able to store for free? Please show your figuring.

11. What do you estimate to be your document storage needs (or your family's needs)?

Storing photos

Photographs are even denser in file-storage-needs than printed information and require much more memory use. I find it interesting that printed text requires so much less memory than an image. One page of print in an average paperback book might require 2 KB of storage. A low-resolution photograph might require 100 KB of storage and a high-resolution photograph 2 MB of storage.

12. How many times more memory is required for a high-resolution photo than a low-resolution photo?

13. How many times greater is the need of a low-resolution photograph than a page of text from a paperback book?

14. Flickr will allow me 1 terabyte of storage space for my photos for free. About how many photos could I store for free at Flickr?

15. What do you estimate to be your photo storage needs (or your family's photo storage needs)?

Storing music

Movies and music are entirely different animals. One minute of audio might use 1 MB of space. So, one minute of sound might require the space of two sets of the Complete Works of Shakespeare. Doesn't seem fair.

16. About how long are the songs that you listen to on the radio? How much memory might one of those songs require? Show your work.

Luckily, I don't store music on my computer. I can just listen to an online service like Pandora. But I imagine that iPods or people's personal music collections require a huge amount of information since music is so dense with memory need.

17. What do you estimate are the storage needs for your music library (or your family's needs)?

Storing movies

But wait, it gets worse ... movies. I don't want to lose the movie that I made of my sister's wedding. The file size of the wedding movie is 22MB and it last 7.5 minutes.

But how big would a Youtube video be to download to my computer? Youtube movies are usually recorded at 300 Kb/second. (Notice that the "b" is not capitalized in Kb/second. This is **kilobits** per second.) So you might figure out how many seconds the movie that you want on your computer requires and just multiply that number times 300 Kb/second. Then if you divide by 8 (because there are 8 bits in a byte) you should get the number of KB of memory that are required for your download. Let's try that.

18. The "Three Ships to Locate" video was 2 minutes and 51 seconds long. About how much memory does Youtube have to use to store that movie for us to see? Show your work and try to use the most concise units to express your answer ... KB, MB, GB, or TB.

Just so you appreciate what you are using, high-definition (HD) video is recorded at about 2,000 Kb/second.

19. Calculate how much memory is required for a 10 minute, high-definition (HD) movie. How about a 2-hour HD movie?

20. Do you or your family have any videos that you want to back up to the cloud? What do you estimate are your storage requirements for video?

Back to the cloud dilemma …

21. Now that we have a better understanding of computer memory and the pricing from cloud providers, which cloud service do you recommend? Considering your storage needs for documents, photos, music and videos, which would you choose (or which combination of providers would you choose) for your needs, or your family's needs?

		iCloud	Dropbox	Google Drive	Flickr for photos and videos
Free storage		5GB	2GB	15GB	1TB
Upgrade pricing	10GB	$20/yr		$1.99/month	-
	20GB	$40/yr			-
	50GB	$100/yr			-
	100GB		$9.99/month		-
	1TB			$9.99/month	-

22. I can't help but notice what a great deal Flickr is for backing up photos and videos. I have a lot of photos and videos. How much per year would it cost me to store 1 TB of pictures and videos using iCloud?

Sources: http://searchstorage.techtarget.com/definition/How-many-bytes-for#anchor1
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