# Kilobytes Megabytes Gigabytes Terabytes

The size of information in the computer is measured in kilobytes, megabytes, gigabytes, and terabytes. In this section, we'll look at common sizes you would see in real life, and work some arithmetic. Every person today should be able to think through problems with KB, MB and GB.

## Kilobyte or KB

- Kilobyte KB - about 1 thousand bytes
- As we know, 1 byte is one typed character
  - see below for why the phrase "about 1 thousand" is required here
- A small email text is about 2 KB
- A 5 page paper might be 100 KB
- Text is compact, requiring few bytes compared to images or sound or video
- Math: if you have N bytes, that's N/1000 KB
- e.g. 23,000 bytes is about 23 KB

One kilobyte (KB) is a collection of about 1000 bytes. A page of ordinary roman alphabetic text takes about 2 kilobytes to store (about one byte per letter). A typical short email would also take up just 1 or 2 kilobytes. Text is one of the most naturally compact types of data at about one byte required to store each letter. In non-roman alphabets, such as Mandarin, the storage takes up 2 or 4 bytes per "letter" which is still pretty compact compared to audio and images.

## Megabyte or MB

- Megabyte (MB) - about 1 million bytes
- aka about 1000 KB
- MP3 audio is about 1 megabyte per minute
- A high quality digital picture is about 2-5 megabytes
- Math: if you have N KB, that's N/1000 MB
- e.g. 45,400 KB is 45.4 MB

One megabyte is about 1 million bytes (or about 1000 kilobytes). An MP3 audio file of a few minutes or a 10 million pixel image from a digital camera would typically take up few megabytes. The rule of thumb for MP3 audio is that 1 minute of audio takes up about 1 megabyte. Audio and image and video data typically stored in "compressed" form, MP3 being an example. We'll talk about how compression works later. A data CD disk stores about 700 MB. The audio on a CD is not compressed, which is why it takes so much more space than the MP3. The series of bits are represented as spiral path of tiny pits in the silver material in the disk. Imagine that each pit is interpreted as a 0, and the lack of a pit is a 1 as the spiral sequence is read. Fun fact: the whole spiral on a CD is over 5km long.

## Gigabyte or GB

- Gigabyte GB = about a billion bytes
- aka about 1000 MB
- GB is a common unit for modern hardware
- e.g. 4000 MB = 4 GB
- An ordinary computer might have:
  -4 GB or RAM
  -256 GB of persistent storage
- A DVD disk has a capacity 4.7GB (single layer)
- -Figure 2 GB per hour of video (varies greatly)
- A flash drive might hold 32 GB
- A small hard drive might hold 750 GB
- Math: if you have N MB, that's N/1000 GB

One gigabyte (GB) is about 1 billion bytes, or 1 thousand megabytes. A computer might have 4 GB of RAM. A flash memory card used in a camera might store 16 GB. A DVD movie is roughly 4-8 GB.

## Terabyte or TB

One terabyte (TB) is about 1000 gigabytes, or roughly 1 trillion bytes. You can buy 4 TB hard drives today, so we are beginning the time when this term comes in to common use. Gigabyte used to be an exotic term too, until Moore's law made it common.

## Gigahertz - Speed, not Bytes

One gigahertz is 1 billion cycles per second (a megahertz is a million cycles per second). Gigahertz is a measure of speed, very roughly the rate that at a CPU can do its simplest operation per second. Gigahertz does not precisely tell you how quickly a CPU gets work done, but it is roughly correlated. Higher gigahertz CPUs also tend to be more expensive to produce and they use more power (and as a result give off more heat) .. a challenge for putting fast CPUs in small devices like phones. The ARM company is famous for producing chips that are very productive with minimal power and heat. Almost all cell phones currently use ARM CPUs.