**Chapter 8 memory and data storage**

1. **Primary memory (e.g. RAM, ROM)**
2. **RAM means random access memory.**

It is volatile memory (the contents of the memory are lost when the power to the RAM is turned off)

It is used to store data, files or part of the operating system that are currently in use

It can be written to or read from and the contents of the memory can be changed.

RAM is much faster to write to or read from than other types of memory, but its main drawback is its volatility

Two types of RAM

1. Dynamic RAM (DRAM) 动态随机存储器

* They are less expensive to manufacture than SRAM
* They consume less power than SRAM
* They have a higher storage capacity than SRAM

1. Static RAM (SRAM) 静态随机存储器

* It is faster than DRAM (access time for SRAM is 25 nanoseconds and for DRAM is 60 nanoseconds)

1. **ROM means read only memory.**

ROM holds data that are non-volatile. Once data have been written into a ROM chip, they cannot be changed. The ROM often holds the instructions for starting up the computer

1. **The compare between primary storage and secondary storage**

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| --- | --- |
| Primary storage | Secondary storage |
| Directly accessible by the processor as it is internal to the computer | Not directly accessible to the processor |
| Temporarily stores data | Permanently stores data |
| Can be read from and written to primary storage almost instantly | Slower to read data from and write data to, as it needs to be transferred into RAM first |
| Normally a few gigabytes in capacity | Can be up to a terabyte or more in capacity |
| Fixed within the computer | Some devices are removable |

1. **secondary memory**
2. **Magnetic storage (磁性存储)**
3. **Hard disk drive (HDD)**

* Data is stored in a digital format on the magnetic surfaces of the disks.
* Latency 延时 is defined as the time it takes for a specific block of data on a data track to rotate around to the read-write head. User will notice that ‘please wait’or ‘not responding’

1. **Removable hard disk**
2. **magnetic tape**
3. **solid state storage**
4. **Solid State Drives (SSDs)**

* SSDs remove latency issue, they have no moving parts and all data is retrieved at the same rate.
* Solid state storage device store data by controlling the movement of electrons within NAND chips. It is non-volatile rewritable memory.

**The benefits of using SSD**

* They are considerably lighter(which make them suitable for laptops)
* They have a lower power consumption(which make them suitable for laptops)
* They run much cooler than HDDs(which make them suitable for laptops)
* They are more reliable (no moving part to go wrong)
* Data access is faster than HDD

**The drawback of SSD**

* Questionable longevity of the technology, most solid state storage devices are rated at only 20 GB write operations per day over a three-year period

**(ii) USB flash memory**

* They are very small, lightweight devices which make them as a method for transferring files between computers

1. **Digital storage cards**

* Each memory card is made up of NAND chips, and as with all solid-state memories, there are no moving parts.

1. **Optical storage (光学存储)**
2. **CD（compact disc）**It can store 700 MB of data
3. **DVD（digital versatile disc）**It can store 4.7 GB of data

**Why DVD has lager capacity than CD?**

* DVD use the dual-layering which increase the storage capacity.
* DVD ‘s ‘pit’ size and track width are smaller, this means more data can be stored on the DVD surface
* DVD use lasers with a wavelength of 650 nanometres 纳米; CD use lasers with a wavelength of 780 nanometres, the shorter the wavelength of the laser light, the greater the storage capacity of the medium.

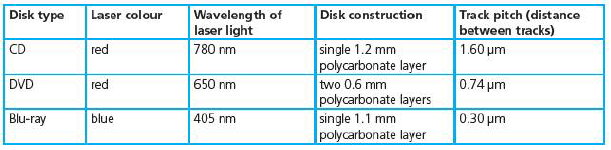
1. **DVD-RAM**

* It uses a number of concentric tracks which can allow read and write operations at the same time to take place
* They allow numerous read and write operations and have great longevity which make them ideal for archiving

1. **Blu-ray disks**

* A blue laser (rather than red laser) is used to carry out read and write operations
* Blu-ray uses a single 1.1 mm thick polycarbonate, DVD uses a sandwich of two 0.6 mm thick disks
* Blu-ray disks come with a secure encryption system which helps to prevent piracy and copyright issue.

1. **The difference between CD,DVD and blu-ray**

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