SANDY BAY PARK RESIDENTS ASSOCIATION (SBPRA)

COMPUTER BASICS 2

Data Storage and Usage

How computers work!
An explanation of the units of digital information.

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Computer Basics – Data Storage and Usage

We covered the fundamentals of the binary numbering system used in digital devices in Computer Basics 1

How is the binary number system used in practice? What terms are used to describe the information units that indicate files sizes, the storage capacity of a mobile phone, the data consumption allowance you subscribe to every month or the SD Memory Card in your camera?

What is a Byte?

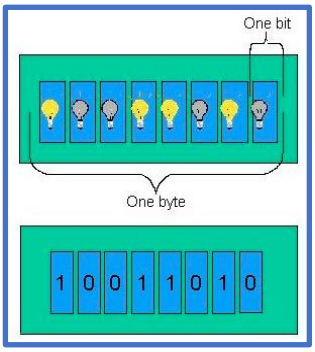
We use units of measurement to make sense of our everyday lives:

- A day is 24 hours long, or 1,440 minutes, or 86,4000 seconds,
- We weigh ourselves in stones and pounds,
- Liquids are measured in millilitres and litres,
- Distances are measured in miles.

Another unit of measurement that affects our daily life is **the byte**. Bytes are used to express:

- How many photos you can store on your mobile phone,
- When it's time to clean out your computer's hard drive,
- The size of the Random Access Memory (RAM) on your laptop.

They are the smallest unit of measurement for quantities of data. From Computer Basics 1 we all know that a byte consists of an eight bit binary number.



In the diagram this is represented by a series of light bulbs, either on or off, each one representing one bit. The binary

number is depicted in the lower half of the diagram, 1 = bulb on, 0 = bulb off. The byte forms the basis for binary communication between computers. A single bit describes one of two states: '0' or '1'.
If you combine several bits, the number of states that can be written also increases. With one byte, i.e., 8 bits, 256 (2^8) states are possible. Nevertheless, a byte is just large enough to represent a **single character**. You can see that complex digital processes and representations require a huge number of bytes.

Megabyte, kilobyte, and gigabyte – What's the difference?

To keep a better overview, bytes are therefore grouped into different size units. According to the decimal system, a megabyte stands for **1 million bytes**. 1 MB is a lot easier to write than 1,000,000 bytes.
So, what's larger – a MB or a GB? And what is the difference between KB and MB? There are always confusions when it comes to digital storage units.
The correct classification of kilobytes, megabytes, and gigabytes makes it easier to deal with files and storage devices.
According to the decimal system, 1 megabyte = 1,000 kilobytes and 1,000 megabytes correspond to one gigabyte. 1 MB is therefore significantly larger than 1 KB and significantly smaller than 1 GB. However, because the prefixes kilo, mega, and giga are based on the **decimal system** and computers use the **binary system**, this conversion is not accurate.
The International Electrotechnical Commission (IEC) found a solution to this problem. It introduced new prefixes that weren't based on the power of ten but on the power of two which are used by computers. These prefixes are based on

their decimal counterparts but are assigned the syllable ‘bi’. Megabyte thus becomes **mebibyte**, gigabyte becomes gigibyte, etc.
As a result, instead of the conversion number 1,000 (10^3), the technically correct **1,024** (2^{10}) is used. Nevertheless, the binary prefixes have not caught on yet. Instead, the old decimal prefixes are still widely used, but with the more precise conversion of 1,024.
The table shows which data capacities are currently in use.

Storage unit	Conversion	Value in byte
Byte (B)	= 8 Bit	1
Kilobyte (KB)	= 1,024 Byte	$1{,}024^1$
Megabyte (MB)	= 1,024 KB	$1{,}024^2$
Gigabyte (GB)	= 1,024 MB	$1{,}024^3$
Terabyte (TB)	= 1,024 GB	$1{,}024^4$
Petabyte (PB)	= 1,024 TB	$1{,}024^5$
Exabyte (EB)	= 1,024 PB	$1{,}024^6$
Zettabyte (ZB)	= 1,024 EB	$1{,}024^7$
Yottabyte (YB)	= 1,024 ZB	$1{,}024^8$
Brontobyte (BB)	= 1,024 YB	$1{,}024^9$

So, what does all this mean in the real world?

The information in the on Page 3 can seem quite abstract. To give you a better idea of what the megabyte storage unit means in everyday use of digital media, here are a few examples:

- Approx. 1MB = 500 pages of text in a Word document,
- Approx. 5MB = 1 picture taken by a 12 megapixel camera,
- Approx. 30MB = 1 minute of a YouTube video in HD quality,
- Approx. 500MB = Contents on a standard CD-ROM,
- Approx. 5,000MB = DVD quality film.

We are all aware of streaming TV and Films through the internet, for example using Netflix, Prime Video and Disney

amongst many others.

According to Netflix, you use 1 GB of data per hour when you stream a standard definition (SD) video. High definition (HD) videos, on the other hand, use 3 GB per hour. And 4K Ultra HD streams use up to 7 GB per hour of video. This means you'll use around 2 GB to stream a two-hour SD movie, 6 GB to stream the HD version or 14 GB

for the 4K stream. A half-hour TV show would be 500 MB for the SD version, 1.5 GB for the HD version or 3.5 GB for 4K. Downloading a Netflix video to watch later uses a similar amount of data. How much data do other media companies use?

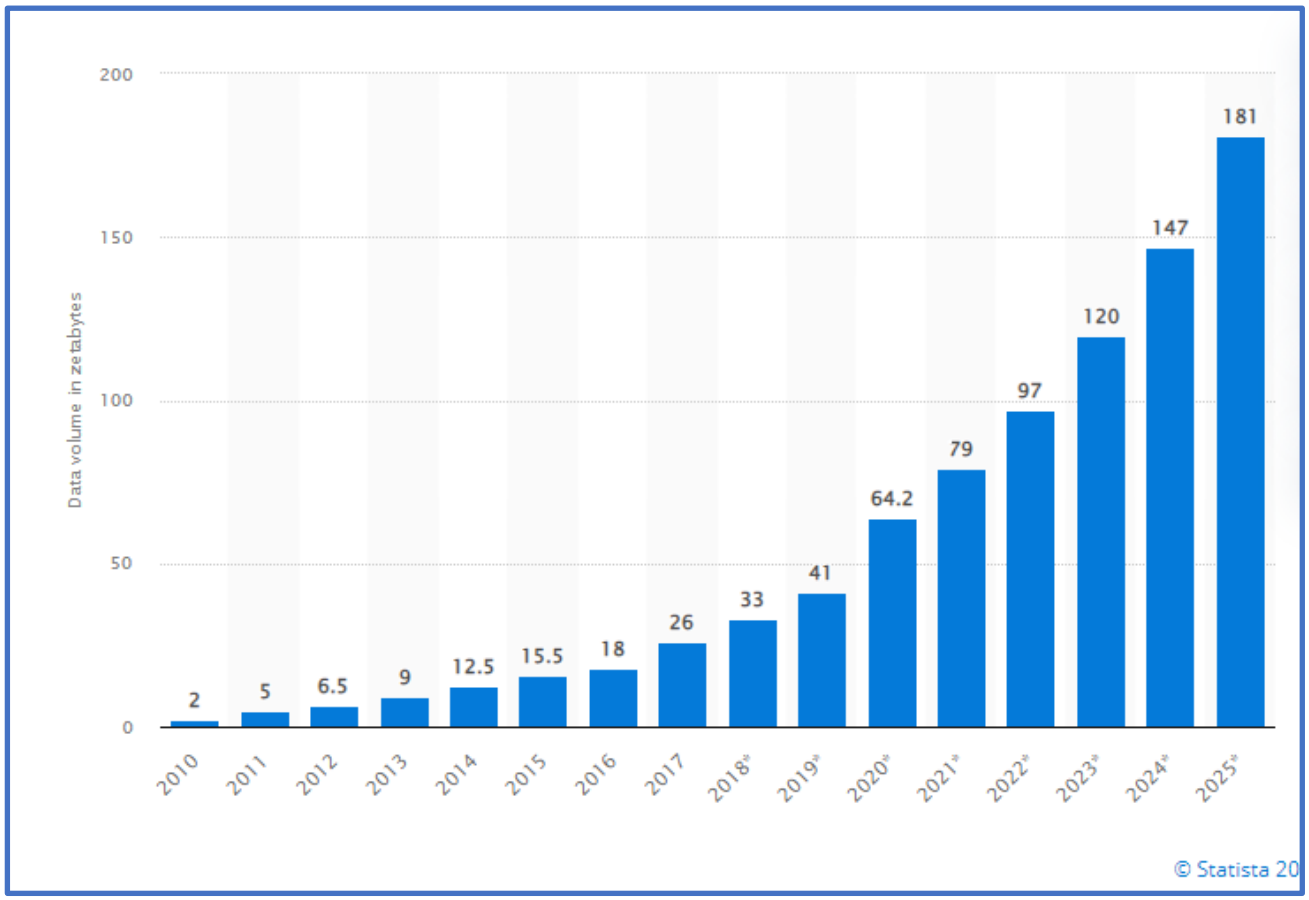
Spotify	40-150MB Per Hour	Depends on audio quality
Facebook	1.5MB per minute	Equals 90 MB per hour
Instagram	1MB	To scroll through 40 photos in your feed
Instagram	2-4 MB	To upload photos to your feed
Instagram	8MB	To post Instagram Stories
Google Maps	0.67MB	Every 10 miles
Google Maps	0.73MB	For 20 minutes of navigation
YouTube	3GB per hour	At 1080p video quality

The Zettabyte = a really big number!

1ZB = 1,000,000,000,000,000,000,000 (10^{21}) Bytes!!

The digital universe is forecast to grow rapidly. Over the next five years up to 2025, global data creation is projected to grow to more than 180 zettabytes. In 2020, the amount of data created and replicated reached a new high.

The growth was higher than previously expected caused by the increased demand due to the COVID-19 pandemic, as more people worked and learned from home and used home entertainment options more often. See graph below.



Only a small percentage of newly created data is kept though, as just two percent of the data produced and consumed in 2020 was saved and retained into 2021. In line with the strong growth of the data volume, the installed

global storage capacity is forecast to increase, growing at a compound annual growth rate of 19.2 percent over the forecast period from 2020 to 2025.

Approximately 70% of the world's digital content is generated by individuals thanks to the popularity of social networking, online video, mobile phones, and digital photography.

In 2010, more than 12 years ago, the size of the digital universe required 75 billion iPads to store and was roughly the equivalent of a century of constant tweeting by everyone on Earth.

How long before the world is covered by data centres?