Bits, Nibbles, and Bytes in

Memory!

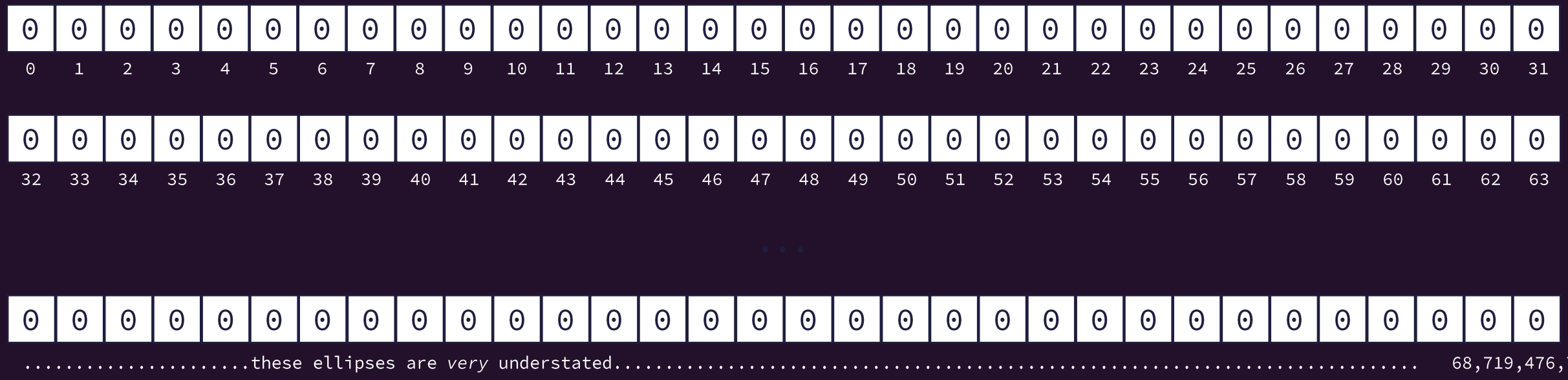
What does the symbol mean?

Data Abstraction

- How do you express **complex ideas** from **simple raw materials**?
  - The ***BIG IDEA*** is it comes down to how you ***combine*** *and* ***interpret*** them!

- Computers are state machines built from simple raw materials:
  - A **transistor** is an electronic switch with two states: **ON** and **OFF**
  - A **capacitor** stores electric energy of a **positive** or **negative** charge
  - These two building blocks can be paired to form a **DRAM memory cell**

Your computer's memory...



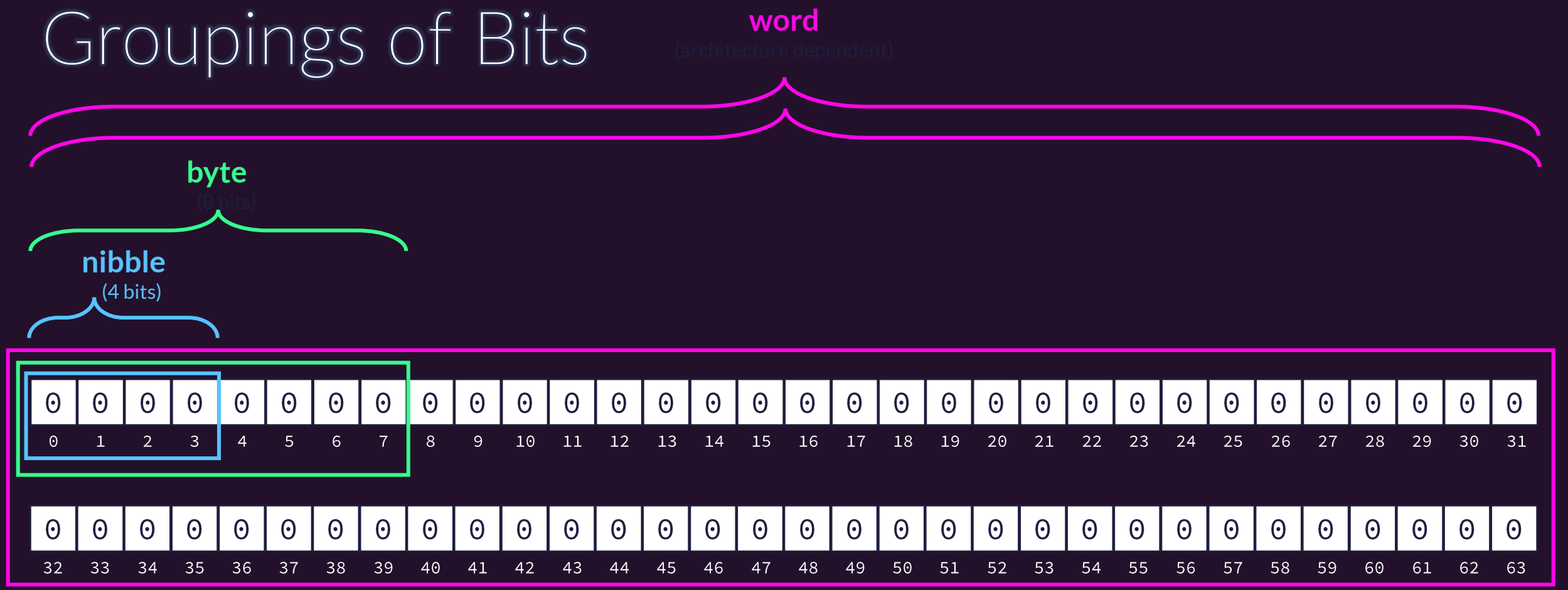
Your computer likely has over **68,719,476,736 DRAM memory cells**

Each stores **one bit** of information. A bit has two states: **1** or **0**.

The **programs** and **data** your computer processes are possible by combining and interpreting groups of bits as more meaningful units... data abstraction!

How bits are grouped together in a system is a human-made design decision.

Groupings of Bits



- A computer system's "*word* size" is architecture dependent. Your laptop's 64-bit processor uses 64-bit words. The deeper implications are covered in a course on Computer Organization. For our purposes it influences the size of certain variable types (importantly: pointers).
- In most computer systems a *byte* is the smallest addressable unit of memory and holds 8 bits.
- A nibble is half a byte. We'll teach fundamental representation concepts in terms of *nibbles*.

Historical aside… why the 8-bit byte?

"Brooks was particularly proud of the 8-bit byte, which permitted the use of uppercase and lowercase alphabets and expanded the role of computers in text processing."

- 1999 ACM Turing Award

https://amturing.acm.org/award_winners/brooks_1002187.cfm