

UNIVERSITÉ  
DE GENÈVE

# MEMORY: SIZE COMARISON INDIVIDUAL READING



# MEMORY: SIZE COMPARISON

Type double (8 B)



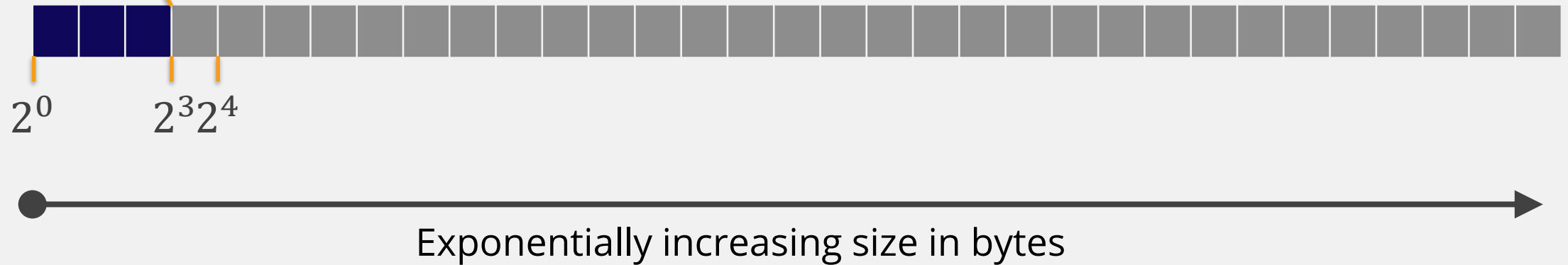
It is useful to keep in mind the relative size of objects presented in this course.

Let's start with a 64-bit variable, like a double-precision float.

We represent it in blue, using three cells, because its size is  $8 = 2^3$  bytes.

# MEMORY: SIZE COMPARISON

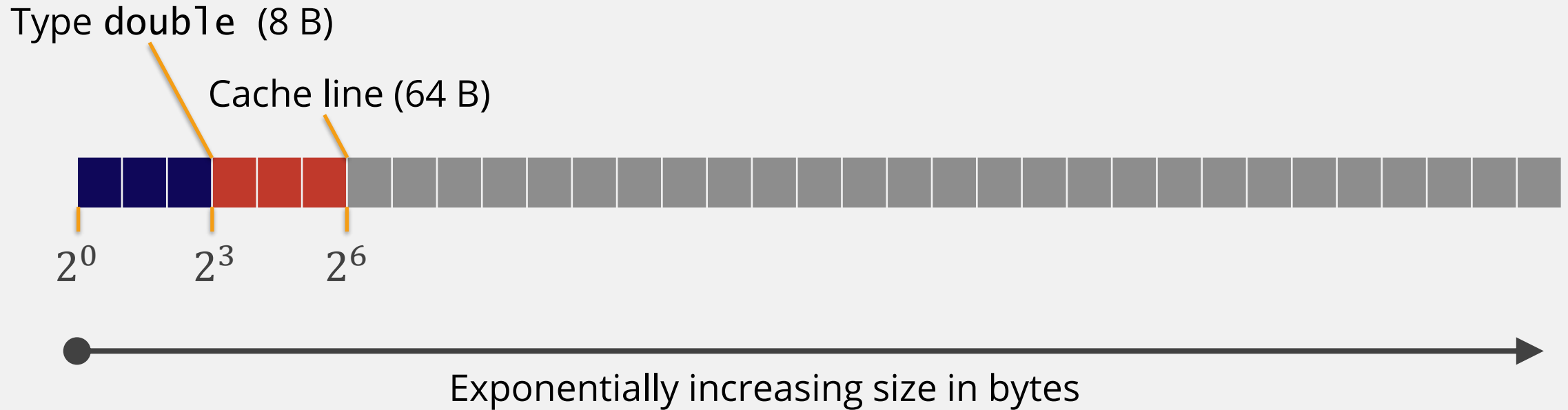
Type double (8 B)



From left to right, size expands exponentially.

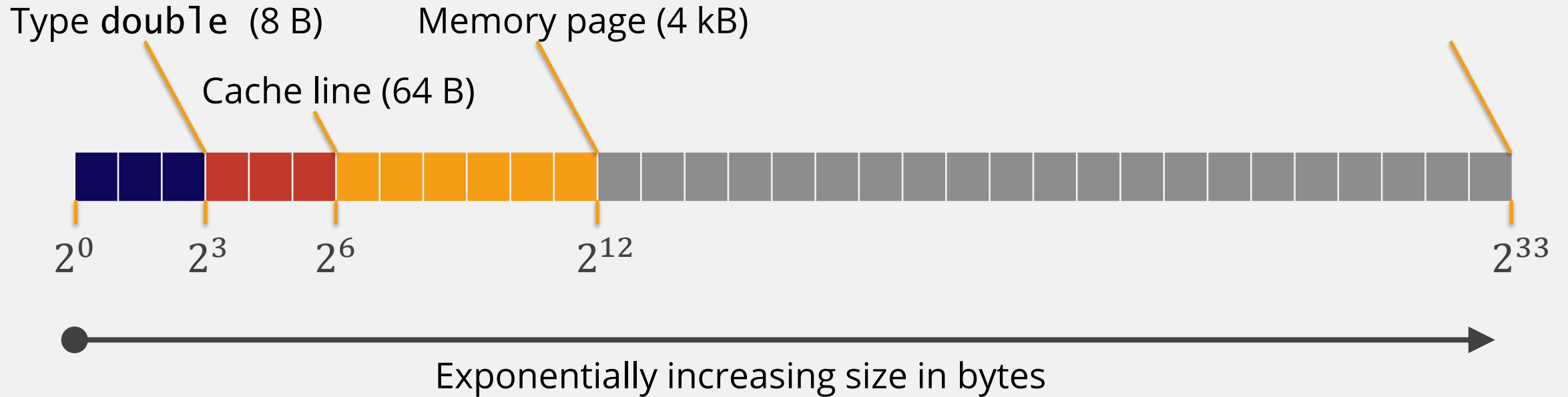
If we add one cell, the size grows from  $2^3 = 8$  bytes to  $2^4 = 16$  bytes.

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Our next milestone is a cache line, with a typical size of  $2^6 = 64$  bytes.  
A cache line can store 8 doubles, or 16 floats.

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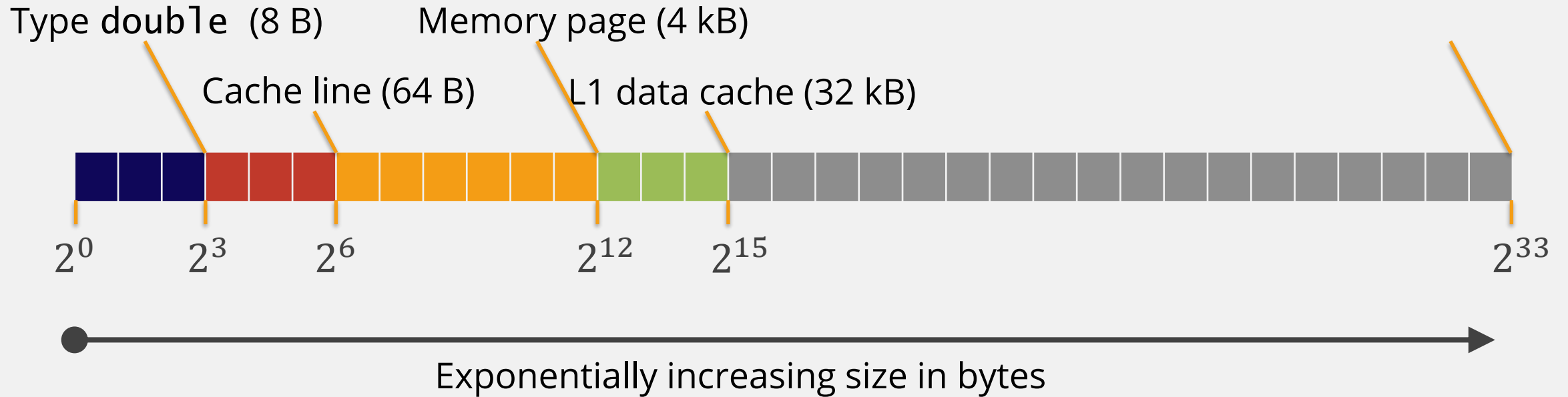


Virtual memory works with memory pages.

One memory page hold  $2^{12}$  bytes = 4 kB.

A memory page holds 64 cache lines, or 512 double-precision floats.

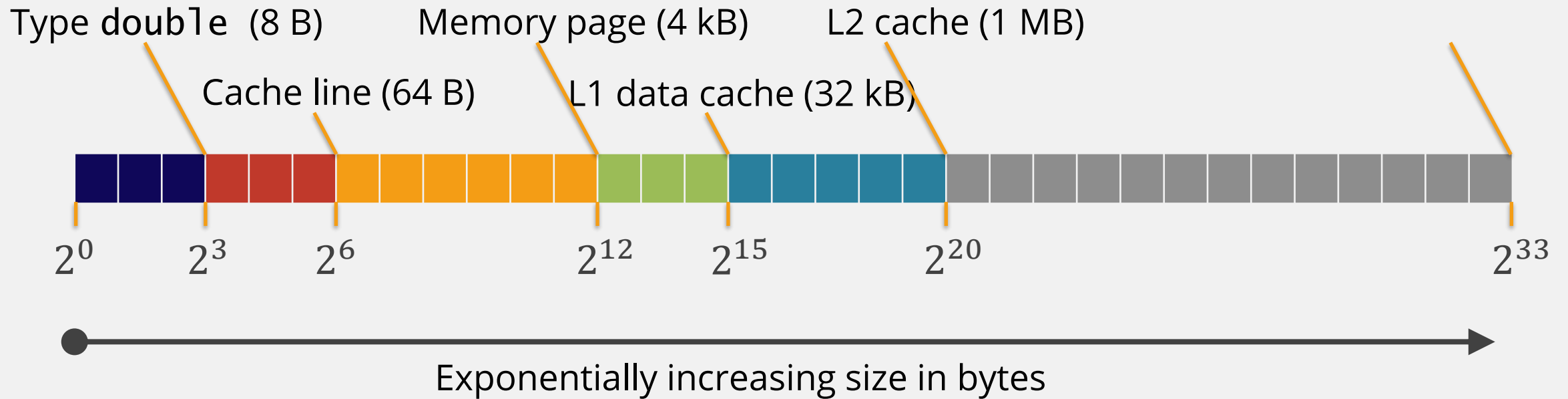
# MEMORY: SIZE COMPARISON



L1 data cache can have a size of approximately  $2^{15}$  bytes = 32 kB.

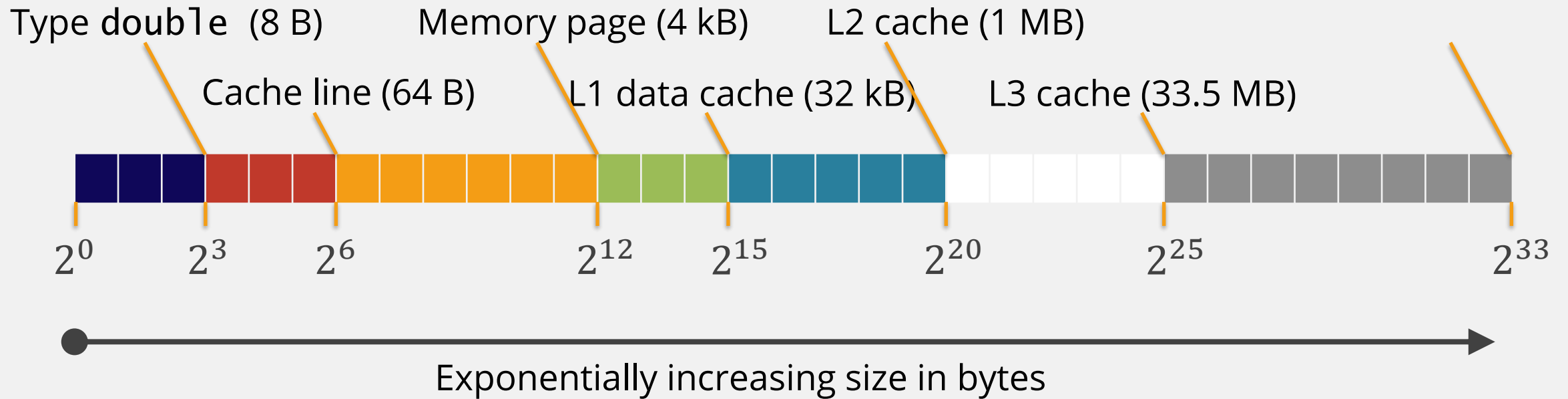
With this size, you can fit 8 memory pages into the L1 data cache.

# MEMORY: SIZE COMPARISON



L2 cache is usually much larger, for example  $2^{20}$  bytes = 1 MB.  
This makes it 32 times larger than the L1 data cache.

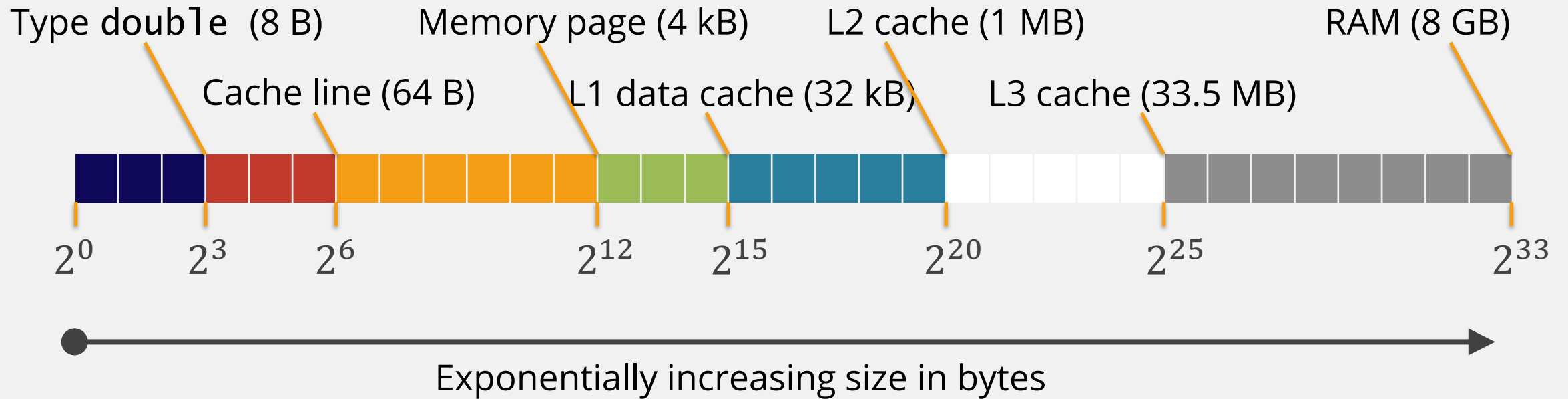
# MEMORY: SIZE COMPARISON



L3 cache can be again 32 times larger:  $2^{25}$  bytes = 33.5 MB.



# MEMORY: SIZE COMPARISON



The main memory is substantially larger.

In this example, the system has  $2^{33}$  bytes = 8 GB of RAM.

That's 256 times the size of L3 cache.