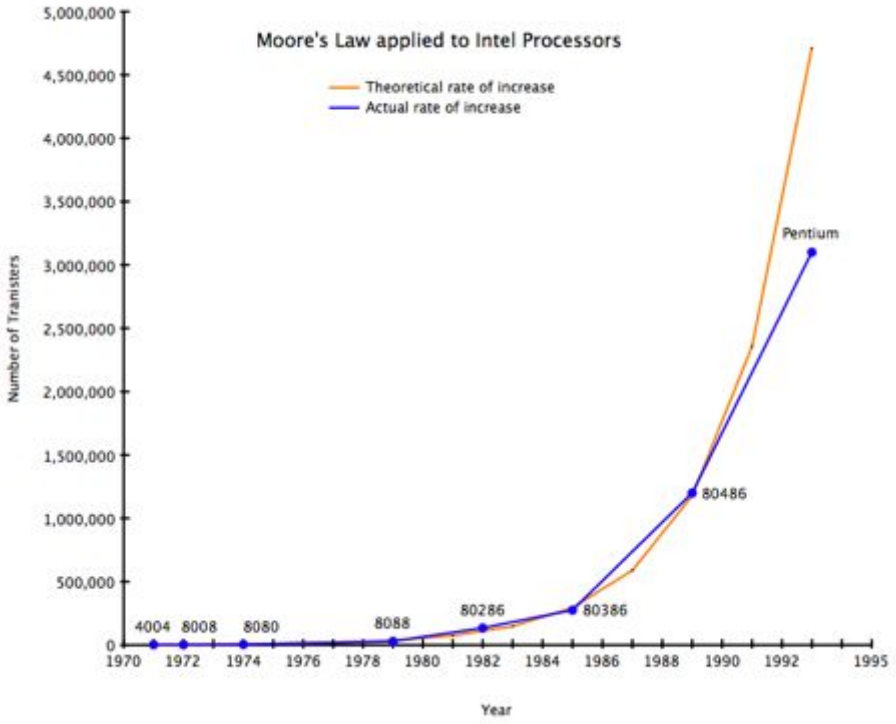
Moore’s law isn’t true now

That law says that each 2 years the density of the transistors is a chip increase in a double proportion.



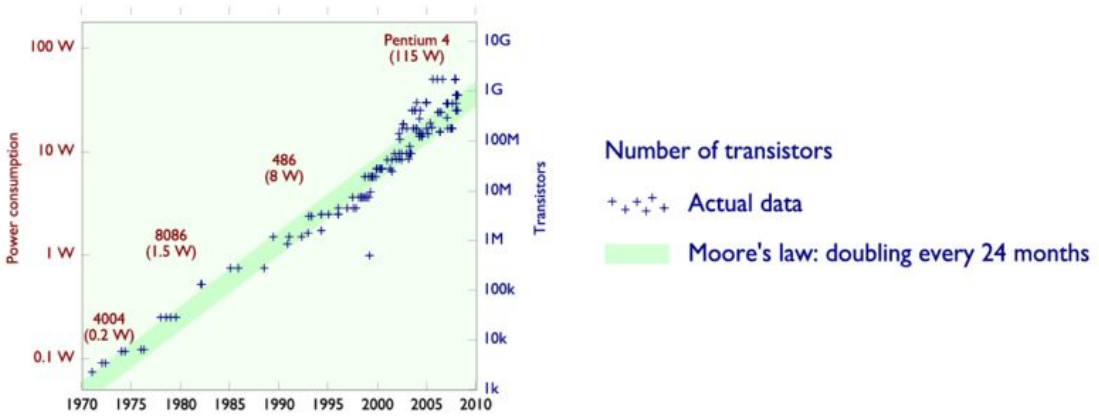
Moore’s law from Wikipedia

But nowadays that’s not anymore true.

The question is, why? The answer isn’t a single phrase it has a lot of reasons, some of them are:

Power consumption

The power consumption is related with the amount of transistors in a chip, well it is directly proportional to the amount, it means: *if you increase the amount of transistors you will consume more power.* And that’s a problem because if you have a super power CPU in your laptop the battery should support the power consumption. And that’s a physical limitation, because we want speed but we don’t want to have a device that only support 30 mins to be alive.

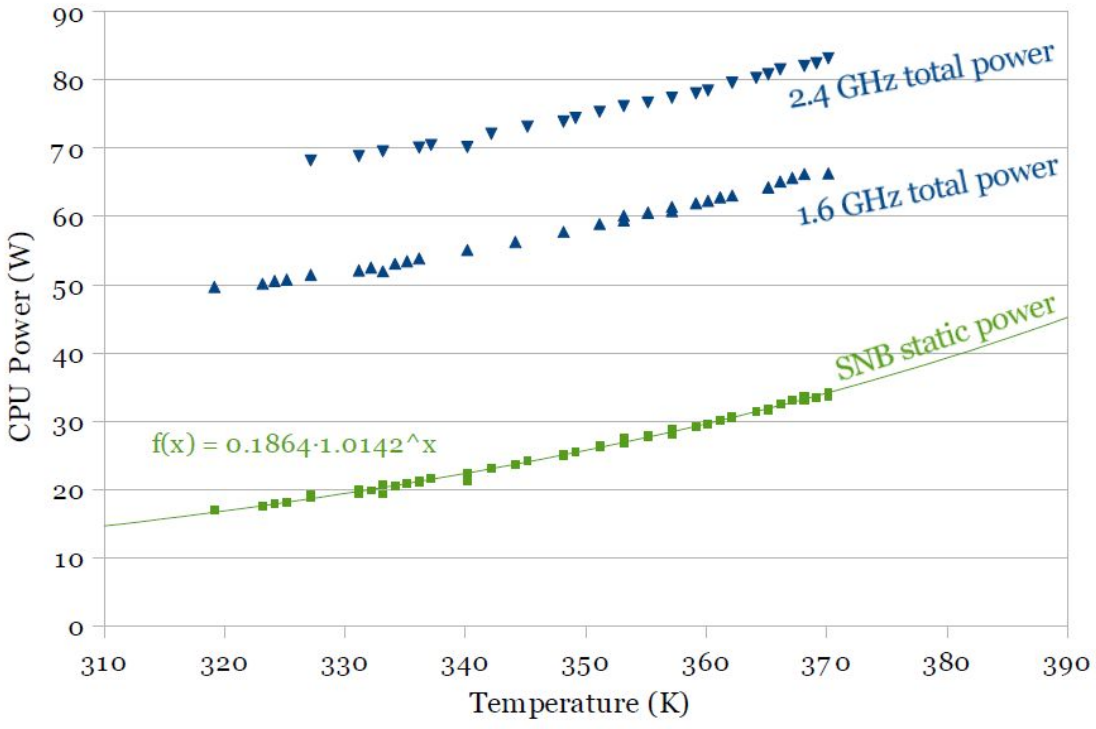


https://researchgate.com (image from)

Heat

As you can image, the electricity is movement (electrons moving through a conductor) and the movement makes heat. That's another physically limitation. ***If we increase the amount of transistors, so we increase the power consumption then we increase the temperature.***

We don't want to have a fast computer that can cook an egg, right? And yes that's something to take care. Now we have coolers in the computers that move with air the heat in the CPUs but in some situations it isn't enough, so that's why there is coolers based on nitrogen or water systems.



http://blog.stuffedcow.net (image from)

Voltage limits

There is an equation that relates power with voltage, frequency and capacitance. It's like this:

$$P = \alpha * C * F * V^2$$

You can see that if we reduce the voltage we can reduce very fast the *power consumption* right?

But we can do it so easy because each transistors has a threshold voltage and if we provide a voltage less than that threshold we can confuse a 0 with a 1 or a 1 with a 0 because the noise that naturally real systems have and that will cause catastrophes, and also there will be power leaks, so that's why some standard amount of voltage used in general are 1.8v, 5v or 12v it depends on the machine.

In conclusion we can't only increase the amount of transistors in a chip, we have physical limitations that avoid that, but maybe with quantum physics in a near future we will know new capabilities that now we don't know.