
Define Moore's law and explain why it has now stopped being true. Be sure to describe all of the physical limitations that have prevented Moore's law from continuing to be true.

Definition: Moore's law, (not actually a physical law rather an observation) predicted that transistor density would double every two years.

It stopped being true because as the transistors got smaller, they ran into the power wall problem.
As you increase the density of transistors, the power consumption increases, which leads to high temperature.

Consumption of power occurs during switching between on and off state, this power consumption is called **DYNAMIC POWER** and can be described by the following formula:

$P = \alpha CFV^2$

-**alpha** being the percentage of time the transistors are switching. ($0<\alpha<1$)
(as the user and designer of the transistor, we want alpha to be as high as possible since it leads to faster computation)

-**C capacitance**, goes down as the size of the transistors go down so this will contribute to lower dynamic power naturally.

-**F is the clock frequency**, we want it to be as high as possible, this will lead to higher power consumption as well

-**V is the voltage swing**, the threshold that determines the signal as being 0 or 1.
naturally we would want it to lower as we shrink transistor size (Dennard Scaling),
but due to two reasons issues on:
1- **threshold voltage ;** we can't go lower than the minimum voltage required for turning on a transistor (related to the chemical composition of the transistor)

2- **noise ;** as we go lower in voltage, the signal will tend to be more susceptible to environment noises.

Therefore we can't decrease voltage swing as we want so that the overall power will be less.

And we still have not considered leakage power, which is the escape of heat as we use thinner and thinner insulators, so going lower in size will have another bad effect.
