Moore's law is an empirical relationship which states that transistor density - the number of transistors per unit volume on an integrated circuit - doubles every 2 years. It has been shown to be true over the period of 1975 to 2012. However, over recent years the rate has been slowing down.

In order to increase transistor density, the physical size of transistors has been reducing. Decreasing the physical size has consequences other than increasing the number that you can fit on a board, one of which is the power consumption. This is given below:

P = alpha * C * F *V^2

Where:
P = power
alpha = % of time switching
C = capacitance
F = clock frequency
V = voltage swing

Dennard Scaling states that as the size of a transistor reduces its power consumption also decreases. The capacitance reduces with size as well as the necessary voltage swing to switch the transistor's state. If the clock frequency and the percentage of time switching does not change then a large power reduction is achieved. This fact has allowed Moore's law to hold true for 40 years.

Dennard Scaling has reached its limit, however. There is a minimum threshold voltage that must be maintained regardless of size. Additionally the signal to noise ratio is ever increasing causing interference problems and leakage power means power consumption cannot continue to be reduced.

The problem this raises is that as the transistor density increases the power consumption is increasing. This increases heat production which must be removed to prevent damage to the circuit board. Heat removal has been acheived by using fans and liquid cooling systems but these have their limits too.

This has led to the use of multiple cores and the idea of parallel computing.