Why Moore's Law has stopped being True

Moore's law states that the transistor density on a microchip doubles every two years. It has now stopped being true for the following reasons:

Increased transistor density leads to higher dynamic power consumption. This is modelled via the following dynamic power equation:

$$P = \alpha CFV^2$$

Where:

P = Power
α = Percentage of time transistor is switching
C = Capacitance
F = Clock frequency
V = Voltage swing

An increased dynamic power leads to higher temperatures. If a chip reaches a high enough temperature, it would melt, rendering the chip useless. There is a limit to how well we can cool a microchip using traditional air cooling, and hence a limit to the operating temperature for microchips.

Furthermore, due to limitations with Denard scaling, a microchip needs a voltage swing above a threshold voltage, and be large enough to counteract noise found within the signal. Since power is proportional to the voltage swing squared, and we need to maintain a minimum voltage for operating a microchip, this limits our ability to reduce power consumption, and hence temperature.

There is also the issue of leakage power which occurs when shrinking microchip size due to a thinner insulation layer. This will further increase overall power, and hence temperature.

In order to gain performance, CPU manufacturers have pivoted to producing multi core CPUs which further reduces pressure to increase microchip density and continue Moore's law.