Moore’s law refers to Moore’s observation that the number of transistors on a microchip doubles every 2 years, all while costs steadily declined. These packet transistors are used to do computation so when the transistor density exponentially increases, the transistors are getting smaller which leads to an exponential increase in speed (they can go high to low faster).

However, transistors are so small today they’re beginning to reach their fundamental physical limits in regard to their size, resulting in the end of Moore’s law. A key limitation for chip designers is that Moore’s law depends on transistors shrinking, and eventually will interfere with the laws of physics. Specifically, electron tunnelling prevents the length of a gate from being smaller than 5 nm. Consequentially Dennard observed as transistors shrank, so did necessary voltage and current; power is proportional to the area of the transistor (voltage scaling reduces dynamic power consumption.) However, Dennard (scaling) ignored the leakage current and threshold voltage which establish a baseline of power per transistor. Voltage scaling therefore cannot prevent power los and is limited due to threshold voltage.

Another limitation for chip designers is the increase in temperature as power increases. The high temperatures of transitions eventually would make it impossible to create smaller circuits. This is due to cooling down the transistors takes more energy than the amount of energy that already passes through the transistors. The more transistors there are on a chip, the more heat is produced and the greater chance of a malfunction.