Moore's law

Transistor density would double every 2 years.

Why Moore's law stopped being true

The definition of Dynamic Power is:

$$P = \alpha * CFV^2$$

We want to increase the computing capacity while keep the dynamic power low.

1. α is the percent of time switching, Larger α means more computing operations per unit time, and that's exactly what we want. So, we cannot reduce α.

2. C is capacitance (related to size). Due to the limit of material technology, we cannot reduce the size of transistors significantly.

3. F is the clock frequency. Increase clock frequency also increase the power consumption.

4. V is voltage swing. We want to reduce V since in the formula it is in square form. However, voltage cannot be too low due to some limits.

5. Increasing transistors lead to increasing power consumption which leads to higher temperature that may melt down the chip eventually.

6. Smaller transistors require lower voltage. However, the voltage cannot go too low. It has to stay above the threshold voltage. Also, noise problems may occur when the voltage is too low. Noise problems make it difficult to distinguish a high voltage from low voltage.

7. Leakage power is becoming a problem now, since the size of transistor today is bigger and the leakage power cannot be ignored anymore.