Moore's Law

Moore's Law refers to Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. Moore's Law states that we can expect the speed and capability of our computers to increase every couple of years, and we will pay less for them. Another tenet of Moore's Law asserts that this growth is exponential.

Moore's Law's Impending End

Experts agree that computers should reach the physical limits of Moore's Law at some point in the 2020s[1]

The high temperatures of transistors eventually would make it impossible to create smaller circuits. This is because cooling down the transistors takes more energy than the amount of energy that already passes through the transistors.[2]

In a 2007 interview, Moore himself admitted that "...the fact that materials are made of atoms is the fundamental limitation and it's not that far away...We're pushing up against some fairly fundamental limits so one of these days we're going to have to stop making things smaller."[3]

Power/Temperature Problem

- Transistors consume power when they switch
- Increasing transistor density leads to increased power consumption
- High power leads to high temperature
- Air cooling (fans) cannot remove as much heat

Dennard Scaling - Dynamic Power

Dennard Scaling is that voltage swing should scale with the transistor size. So as the transistors get smaller and you get more density, you would also like to scale down the voltage at the same time. Using the Dynamic Power formula we can see that Voltage Scaling reduces power consumption.

Voltage Scaling Problem

- Voltage can't go to low because must stay above threshold voltage and have noise problems.
- Doesn't consider leakage power

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1) https://www.technologyreview.com/2020/02/24/905789/were-not-prepared-for-the-end-of-moores-law/

2) https://spectrum.ieee.org/view-from-the-valley/semiconductors/design/power-problems-might-drive-chip-specialization

3) https://www.youtube.com/watch?v=MH6jUSjpr-Q