What Is Moore's Law?

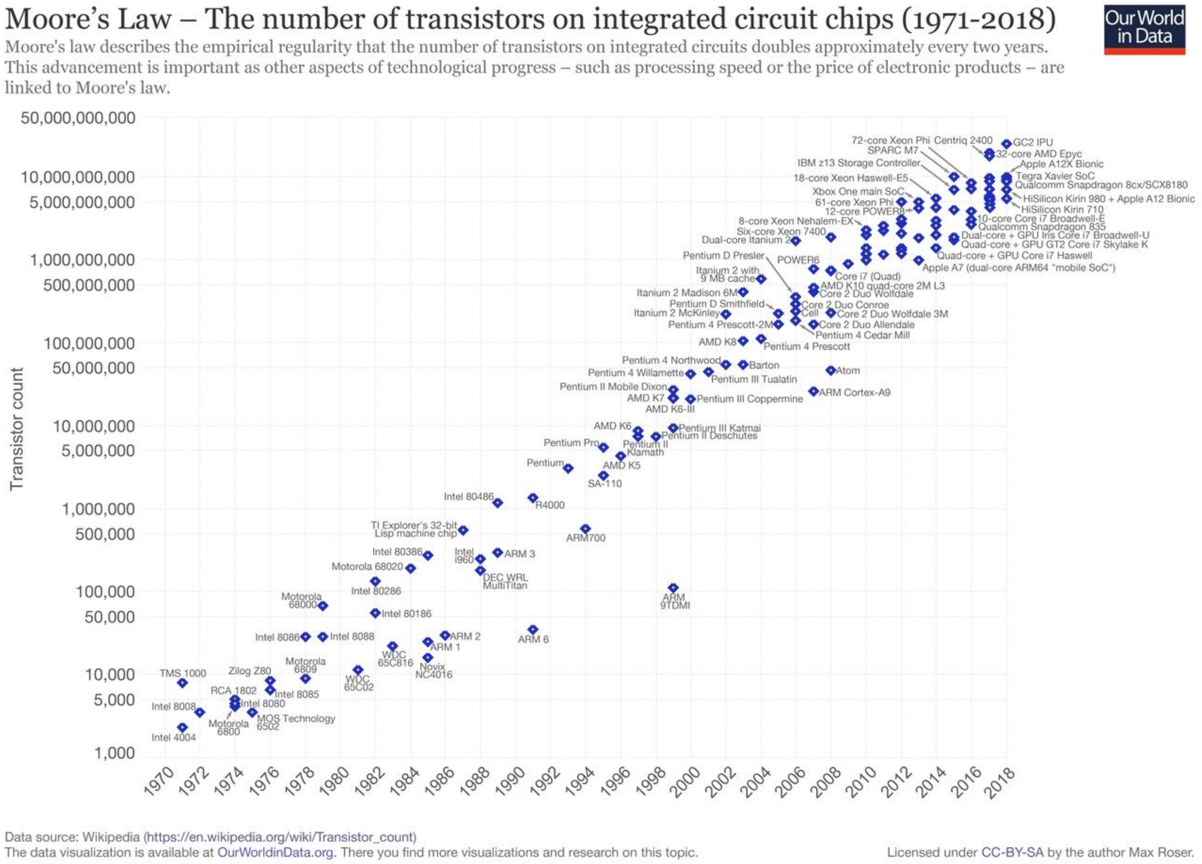
Moore's Law refers to Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. Moore's Law states that we can expect the speed and capability of our computers to increase every couple of years, and we will pay less for them. Another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

Understanding Moore's Law

In 1965, Gordon E. Moore—co-founder of Intel (NASDAQ: INTC)—postulated that the number of transistors that can be packed into a given unit of space will double about every two years. Today, however, the doubling of installed transistors on silicon chips occurs closer to every 18 months instead of every two years.

Background

Gordon Moore did not call his observation "Moore's Law," nor did he set out to create a "law." Moore made that statement based on noticing emerging trends in chip manufacturing at Intel. Eventually, Moore's insight became a prediction, which in turn became the golden rule known as Moore's Law.



Physical limitations that have prevented Moore's law from continuing to be true

Experts agree that computers should reach the physical limits of Moore's Law at some point in the 2020s. 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. In a 2005 interview, Moore himself admitted that his law "can't continue forever. It is the nature of exponential functions," he said, "they eventually hit a wall.". Moore's law applies to computer processing power (doubling every year), it is currently doing so at every 18 months (it is slowing down). There are physical limitations of pitch fineness of the tracks (currently 7nm) as you approach the atomic level, the finer they become, increases the likelihood of a fault and the entire processor is rejected. The higher the transistor density allows more computational power the limitation being the heat which this generator. This tends to be at a rate with an acceptable level of faulty processors - this is the practical limitation of the rate of reduction (as techniques improve they are adopted). You can always add more cores (but this increases the rejection rate), you could stack up, - this is tricky and the heat that is created would need to be drawn away - but a micro heat pipe is not impossible. All these things add cost. The point being there is always a means to double computational power, the chip manufacture wish to do so economically with the best utilisation of silicon wafers (expensive), they can no longer do so at the same cost and have not been able to for some time. Since transistors consume power when they switch, an increasing transistor density leads to an increase in the power consumption of microchips. Higher power consumption, in turn, leads to increasing temperatures, which make it necessary to cool a microchip to prevent it from melting. In recent years, however, traditional cooling systems like air cooling couldn't keep up with the rise in temperatures. This has brought Moore's Law to a halt, so that other ways of increasing computing speed such as multi-core processing are necessary now. In theory, the voltage required by a transistor should go down as transistor size decreases (as postulated by Dennard Scaling), which should limit the power consumption of a transistor. However, in practice the voltage can't go infinitely low because the voltage that powers a transistor has to be distinguishable from background noise and stay above a certain threshold for a transistor to switch reliably. At smaller scales, power leakage poses a problem as well because it leads to increasing power consumption and rising temperatures. These are the main physical reason that Moore's Law has stopped being true.