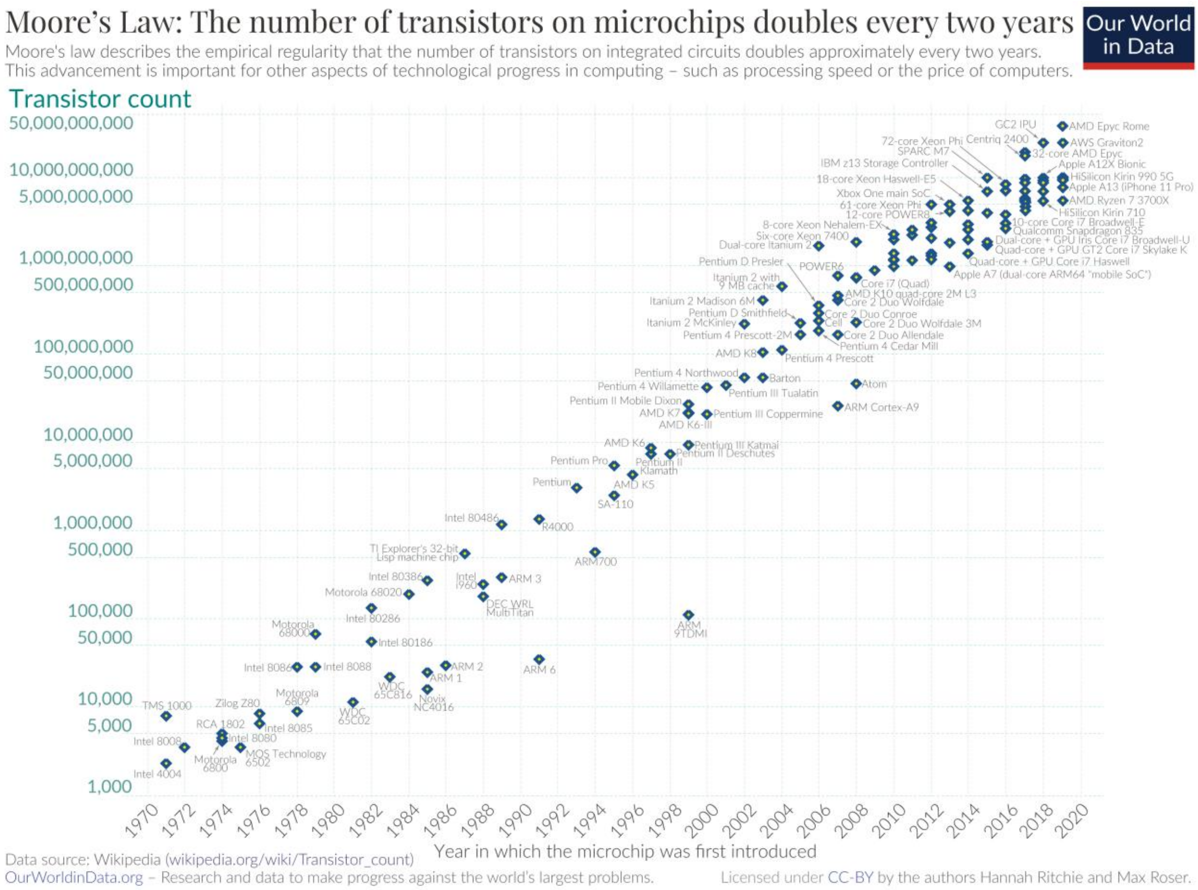
Moore’s Law

Define Moore’s Law

Moore’s Law states the principle that the speed and capability of computers can be expected to double every two years, as a result of increases in the number of transistors a microchip can contain. 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.



Why Moore’s Law coming to an end?

Moore’s Law is coming to an end simply because engineers are unable to develop chips with smaller (and more numerous) transistors.

Over the last few years, the growth of the number of transistors on each integrated circuit is declining, falling much lower than what Moore’s Law predicts.

But the shrinking can’t go on forever, and we’re already starting to see three interrelated variables (size, heat, and power) threatening to stop Moore’s Law’s advance. When you make processors smaller, the more tightly packed electrons will heat up a chip—so much so that unless today’s most powerful chips are cooled down, they will melt inside their encapsulated. To keep the fastest computers cool, most PCs need fans, and most corporate super computers have elaborate and expensive air conditioning and venting systems to prevent a meltdown.

The end of putting more transistors on a single chip doesn’t mean the end of innovation in computers or mobile devices.

The great challenges impacting Moore's law:

1. Temperature increases as power increases. The high temperatures of transistors eventually would make it impossible to create smaller circuits.
2. Power increases as transistor density increases. The increasing speed and density of elements on chips have led to problems of power consumption and dissipation. computers are projected to reach their limits because transistors will be unable to operate within smaller circuits at increasingly higher temperatures. This is due to the fact that cooling the transistors will require more energy than the energy that passes through the transistor itself.
3. Voltage scaling reduces (dynamic) power consumption.
4. Voltage scaling is limited due to noise or threshold voltage. Voltage can’t go too low. Must stay above threshold voltage. Noise problems occur.
5. Voltage scaling cannot prevent leakage power loss. Billions of transistors leaking can seriously threaten the integrity of the whole chip, so the processor must reduce the amount of voltage it takes in or throttle the number of transistors in use to prevent overheating, limiting the processing power of the chip.

There are three major factors contributing to the slowing rate of growth in processor power, and they’re all related.

1. First, you have electrical leakage. For decades, as transistors got smaller, they became more energy efficient.
2. Now, however, they have gotten so small, as small as 10 nanometres, that the channel that carries the electrical current through the transistor cannot always contain it.
3. This generates heat which can wear out the transistors more quickly, making them even more susceptible to leakage. Heat isn't just limited to one transistor though.
4. Billions of transistors leaking can seriously threaten the integrity of the whole chip, so the processor must reduce the amount of voltage it takes in or throttle the number of transistors in use to prevent overheating, limiting the processing power of the chip.
5. Finally, there is the third strike against Moore's law: economics.
6. When the number of transistors doubles, so does the amount of heat they can generate. The cost of cooling large server rooms is getting more and more untenable for many businesses who are the biggest purchasers of the most advanced processing chips.

As businesses try to extend the life and performance of their current equipment to save money, chipmakers responsible for fulfilling Moore's Law bring in less revenue to devote to R&D—which itself is becoming more expensive.

Without that extra revenue, it becomes much harder to overcome all of the physical impediments to shrinking the transistors even further.

Computer chips need new developmental architectures implemented into them in order to be as efficient if more transistors are to be utilized.

While the creation of more powerful computers is regarded as the most important aspect of a computer system, energy efficiency and device lifetime is just as important, requiring more effective utilization of large numbers of transistors, especially when it comes to large cloud data centres which power large portions of online web applications.