Moore's Law

Oscar de Felice[a]

[a]*LaJavaness, 19 rue Martel, 75010 Paris*

MOORE'S LAW
Moore's law is the observation that the number of transistors in a dense integrated circuit doubles about every two years. This law – which is more an observation and projection of a historical trend – is named after George Moore, the co-founder of Fairchild Semiconductor and CEO and co-founder of Intel, who in 1965 posited a doubling every year in the number of components per integrated circuit, and projected this rate of growth would continue for at least another decade. As said, rather than a law of physics, it is an empirical relationship linked to gains from experience in production.

KEYWORDS
Moore's law; Transistors; Integrated Circuit; Computer

INTRODUCTION

Moore's law is the observation that the number of transistors in a dense integrated circuit doubles about every two years. This law – which is more an observation and projection of a historical trend – is named after George Moore, the co-founder of Fairchild Semiconductor and CEO and co-founder of Intel, who in 1965 posited a doubling every year in the number of components per integrated circuit, and projected this rate of growth would continue for at least another decade. In 1975, looking forward to the next decade, he revised the forecast to doubling every two years. As said, rather than a law of physics, it is an empirical relationship linked to gains from experience in production.

LIMITS

Although the rate held steady from 1975 until around 2012, the rate was faster during the first decade. In general, it is not logically sound to extrapolate from the historical growth rate into the indefinite future. For instance, the 2010 update to the *International Technology Roadmap for Semiconductors* predicted that growth would slow around 2013, and in 2015 the same Gordon Moore foresaw that the rate of progress would reach saturation:

I see Moore's law dying here in the next decade or so.

Reason of the end of Moore's law

One can list the several reasons at the root of the end of Moore's law:

1. As transistors increase, power demand increases, which increases heat.
2. Smaller transistors switch faster, increasing power demand.
3. Exponential increase in density would lead to exponential increase in speed
4. Transistor's need a minimum voltage to switch, and voltage reduction has lower limits due to noise.
5. Dynamic power consumption is reduced by voltage scaling.
6. Voltage scaling does not prevent power leakage.

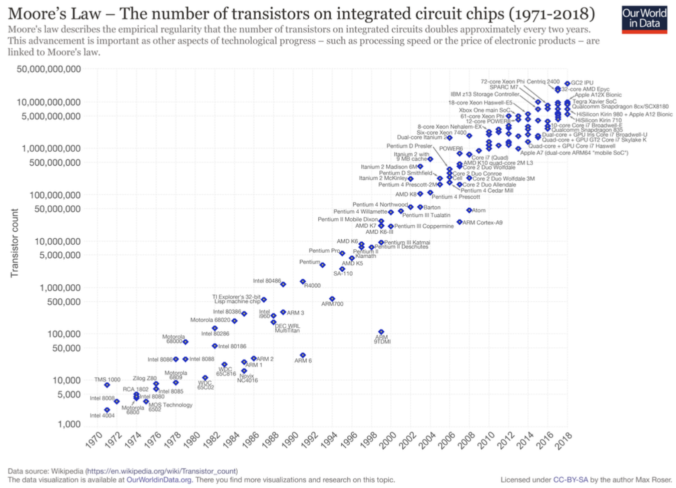

Figure 1. A semi-log plot of transistor counts for microprocessors against dates of introduction, nearly doubling every two years.

CONCLUSIONS

As said in the beginning, Moore’s law is not a physical law. It was just an extrapolation of a trend, only true in a very specific moment of time. A good programmer should not base the good performances of its software only on hardware capacity.