Concurrency in Go – week 1 – peer-graded assignment (Bas Dijkstra)

Moore's Law (it's not really a law, more of an observation or a prediction) states that processor density doubles roughly every two years. Increased density means that transistors are getting smaller, they switch faster and, as a result, computation speed of processors increases.

However, Moore's law has come to an end (in fact, it has not been true for a number of years already). There are several reasons that explain why:

- Transistors consume power when they switch. When transistor density increases, so does power consumption. Since many devices nowadays run on batteries, there's a limit to the power consumption that a device can accommodate before it's useless.

- High power consumption also leads to high temperature, which in turn (if not cooled properly) leads to chip damage. This is a phenomenon called the 'power wall': there's an upper limit to the number of transistors you can safely put together in a small area before temperature becomes enough of a problem and air cooling cannot sufficiently remove heat.

- Dennard scaling is the observation that the voltage used in a transistor should scale with transistor size (smaller transistor means smaller voltage). This ensures that power consumption and temperature generation stays low, too. However, this voltage can't come down forever, for two reasons:

    - The voltage swing (the difference between a 'low' and a 'high' or a 0 and a 1) must remain above the threshold voltage, which is the voltage needed by a transistor to switch on.
    - When voltage decreases, noise problems increase, meaning a transistor has more difficulties deciding whether a signal is a 0 or a 1.
    - Transistors have a certain amount of leakage power (power leaking from one transistor to the next). When transistors become smaller, insulators become thinner, and leakage increases.