Explained: why a reboot is the go-to computer fix

September 14 2016, by Rob Miles

Credit: George Hodan/Public Domain

It's the most common answer to our computing woes: when your PC or mobile is playing up, try turning it off and on again. Or, alternatively, rebooting.

To understand the concept of a "reboot", it's helpful to first understand what a boot means as far as computers are concerned. The word comes

from the expression "pull yourself up by your own bootstraps", which I've never fully understood, but apparently means "improve yourself by your own efforts".

In a computer, the only program physically built into the computer hardware is a tiny one, called the "bootloader". When the computer starts up, this program gets control and loads, or "boots" another, much larger, program which serves as the "operating system" for the computer. We know these systems by such names as Unix, Mac OS, Android and Windows 10.

The operating system does for your computer what your parents did for you during the first five years of your life. It organises the allocation of resources, fetches things and puts them away – and controls what the programs can and can't do. However, sometimes the operating system can get itself into a bit of a state – like your mum or dad did when the doorbell rang just as the washing machine sprang a leak and your pet rabbit escaped.

A clean slate

If we give the computer too many tasks to run – or a set of physical events occur in a sequence that the software writers weren't expecting – then tasks can get "stuck" in memory. Computer scientists talk about a "deadly embrace" that occurs when task A is waiting for task B to do something, and task B is waiting for task A to do something, causing them both to get stuck.

In addition, as tasks run, they fetch and use resources such as computer memory and, over time, the arrangement of these resources will become fragmented and harder to manage, just like it is difficult to find things in an untidy bedroom (which is probably why your parents made such a fuss about it). A reboot may also be a temporary fix for problems caused

by hardware that is becoming unreliable, particularly if things start to go wrong when components get hot.

Modern operating systems are very adept at spotting and removing stuck processes and also work very hard to keep things tidy, but sometimes a computer can reach a state where the best thing to do is start again from scratch. A reboot removes every task and then restarts with a clean slate.

As a computer scientist I'm always looking for the easiest way to solve a problem and rebooting a computer is a good thing to try first, before looking for more complicated reasons why a system is running poorly.

Fix-all?

There are two flavours of reboot, which are often called "warm" and "cold". You do a "cold" reboot by actually turning the computer off and on again. A "warm" reboot, meanwhile, just reloads the operating system. Sometimes a warm reboot will fix your problems, but if some of your hardware has got itself into a state where it is not responding to any signals from the outside world, you might need to reach for the power switch.

One thing reboots cannot fix, however, is malicious software such as viruses. These horrid bits of program usually insert themselves into the boot process so that they get control next time the computer starts up. The only way to get rid of these pesky intruders is to scan your system, find them, and remove them.

In my experience the need for reboots is decreasing over time. These days I find that the main reason why I have to reboot my machine is to install updates. This is because it is very hard for an operating system to update parts of itself while it is running – rather like trying to repair an aircraft in flight.

Some systems are never rebooted. Things like air traffic control systems and the programs that run our nuclear reactors are left running continuously. These systems have the advantage that they only run one particular program and their operating system can be built around this code. However, for general purpose machines like the ones on our desks and in our pockets, the need for reboots will remain for a while. For me, it's just a necessary consequence of having such a powerful and flexible device at my fingertips.

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