

History's Worst Software Bugs

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(<http://www.wired.com/software/coolapps/news/2005/11/69355?currentPage=all>)

Here, in chronological order, are a few of Wired News worst software bugs of all time ... so far.

1985-1987 -- Therac-25 medical accelerator. A radiation therapy device malfunctions and delivers lethal radiation doses at several medical facilities. Based upon a previous design, the Therac-25 was an "improved" therapy system that could deliver two different kinds of radiation: either a low-power electron beam (beta particles) or X-rays. The Therac-25's X-rays were generated by smashing high-power electrons into a metal target positioned between the electron gun and the patient. A second "improvement" was the replacement of the older Therac-20's electromechanical safety interlocks with software control, a decision made because software was perceived to be more reliable.

What engineers didn't know was that both the 20 and the 25 were built upon an operating system that had been kludged together by a programmer with no formal training. Because of a subtle bug called a "race condition," a quick-fingered typist could accidentally configure the Therac-25 so the electron beam would fire in high-power mode but with the metal X-ray target out of position. At least five patients die; others are seriously injured.

January 15, 1990 -- AT&T Network Outage. A bug in a new release of the software that controls AT&T's #4ESS long distance switches causes these mammoth computers to crash when they receive a specific message from one of their neighboring machines -- a message that the neighbors send out when they recover from a crash.

One day a switch in New York crashes and reboots, causing its neighboring switches to crash, then their neighbors' neighbors, and so on. Soon, 114 switches are crashing and rebooting every six seconds, leaving an estimated 60 thousand people without long distance service for nine hours. The fix: engineers load the previous software release.

1995/1996 -- The Ping of Death. A lack of sanity checks and error handling in the IP fragmentation reassembly code makes it possible to crash a wide variety of operating systems by sending a malformed "ping" packet from anywhere on the internet. Most obviously affected are computers running Windows, which lock up and display the so-called "blue screen of death" when they receive these packets. But the attack also affects many Macintosh and Unix systems as well.

June 4, 1996 -- Ariane 5 Flight 501. Working code for the Ariane 4 rocket is reused in the Ariane 5, but the Ariane 5's faster engines trigger a bug in an arithmetic routine inside the rocket's flight computer. The error is in the code that converts a 64-bit floating-point number to a 16-bit signed integer. The faster engines cause the 64-bit numbers to be larger in the Ariane 5 than in the Ariane 4, triggering an overflow condition that results in the flight computer crashing.

First Flight 501's backup computer crashes, followed 0.05 seconds later by a crash of the primary computer. As a result of these crashed computers, the rocket's primary processor overpowers the rocket's engines and causes the rocket to disintegrate 40 seconds after launch.

November 2000 -- National Cancer Institute, Panama City. In a series of accidents, therapy planning software created by Multidata Systems International, a U.S. firm, miscalculates the proper dosage of radiation for patients undergoing radiation therapy.

Multidata's software allows a radiation therapist to draw on a computer screen the placement of metal shields called "blocks" designed to protect healthy tissue from the radiation. But the software will only allow technicians to use four shielding blocks, and the Panamanian doctors wish to use five.

The doctors discover that they can trick the software by drawing all five blocks as a single large block with a hole in the middle. What the doctors don't realize is that the Multidata software gives different answers in this configuration depending on how the hole is drawn: draw it in one direction and the correct dose is calculated, draw in another direction and the software recommends twice the necessary exposure.

At least eight patients die, while another 20 receive overdoses likely to cause significant health problems. The physicians, who were legally required to double-check the computer's calculations by hand, are indicted for murder.

A couple more...

Microsoft Zune's New Year Crash

Incident Date: 12/31/2008 Ironic Factor: ****

(Associated Press) Happy New Year from Microsoft Corp.: Your Zune is dead.

Thousands of Microsoft's Zune media players -- the software company's answer to Apple Inc.'s iPod -- unexpectedly conked out Wednesday and showed users an error message, prompting references to 'Y2K for Zunes'. The problems appeared when people tried to start up their devices.

The software bug for the freeze was later isolated. It is a dumb programming bug that causes troubles only on the last day of a leap year.

Air-Traffic Control System in LA Airport

Incident Date: 9/14/2004 Ironic Factor: *****

(IEEE Spectrum) -- It was an air traffic controller's worst nightmare. Without warning, on Tuesday, 14 September, at about 5 p.m. Pacific daylight time, air traffic controllers lost voice contact with 400 airplanes they were tracking over the southwestern United States. Planes started to head toward one another, something that occurs routinely under careful control of the air traffic controllers, who keep airplanes safely apart. But now the controllers had no way to redirect the planes' courses.

The controllers lost contact with the planes when the main voice communications system shut down unexpectedly. To make matters worse, a backup system that was supposed to take over in such an event crashed within a minute after it was turned on. The outage disrupted about 800 flights across the country.

Inside the control system unit is a countdown timer that ticks off time in milliseconds. The VCSU uses the timer as a pulse to send out periodic queries to the VSCS. It starts out at the highest possible number that the system's server and its software can handle— 2^{32} . It's a number just over 4 billion milliseconds. When the counter reaches zero, the system runs out of ticks and can no longer time itself. So it shuts down.

Counting down from 2^{32} to zero in milliseconds takes just under 50 days. The FAA procedure of having a technician reboot the VSCS every 30 days resets the timer to 2^{32} almost three weeks before it runs out of digits.