

Ten Bugs that Shook the World

Big Money, Secrets, Death, and Health Care



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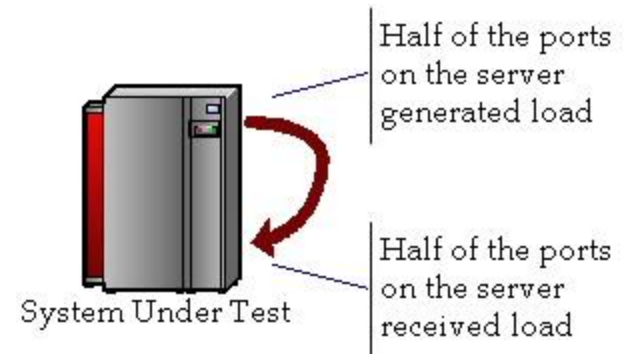
Ten Bugs that Shook the World

- ❖ Okay, so I ripped off the title for this slide deck
- ❖ Maybe software and hardware bugs aren't as significant as the Russian communist revolution
- ❖ These bugs do have serious impacts, though
 - ❖ Personal injury and death
 - ❖ Big financial losses
 - ❖ National security implications
- ❖ While hundreds of examples exist, let's look at some of the worst
- ❖ In this webinar, we examine ten world-shaking bugs...



10. Performance Bug Kills a Project

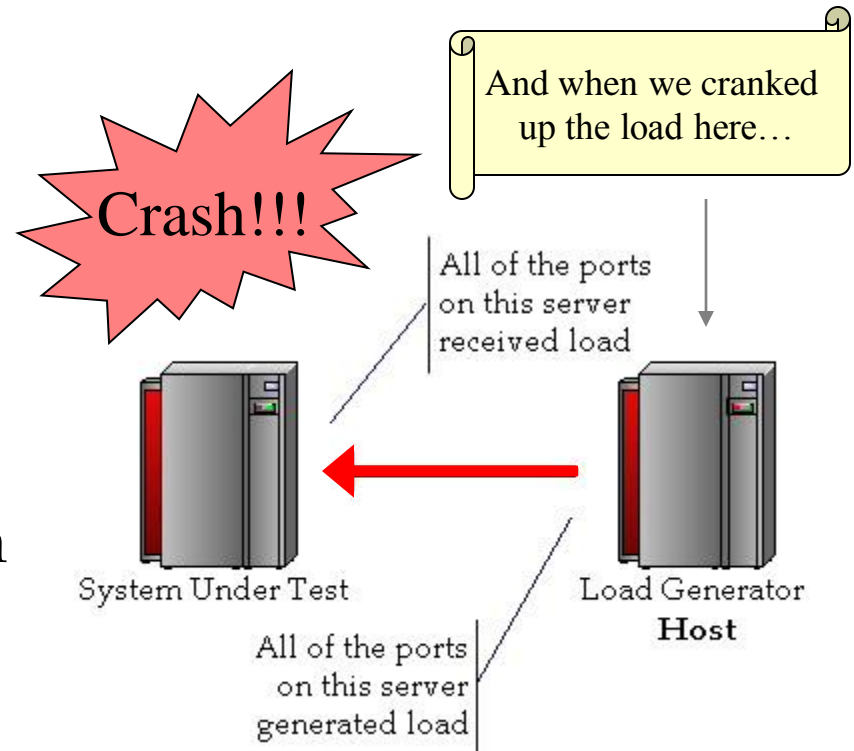
- ❖ For an interactive voice response server, the developers tested subsystem performance by generating load using half of the telephony cards
- ❖ The system load imposed by the load generators was below that of the telephony subsystems under test
- ❖ Warnings from test professionals about the meaninglessness of such tests were ignored
- ❖ The tests “passed”, until...





When We Really Tested It

- ⊕ We built a load generator that ran on an identical but separate host
- ⊕ We loaded all telephony ports
- ⊕ The tests failed, revealing project-threatening design problems
- ⊕ The problems were not resolvable, and the project failed, costing millions of dollars





9. Bad Database Design Kills a Project

- ✦ A bank's insurance division had grown through mergers
- ✦ They had dozens of applications managing customers' policies
- ✦ They tried to create a single application to manage all the policies
- ✦ Unfortunately, the two people who designed the underlying database had no skills or experience with relational database design for large-scale applications
- ✦ Three years into the planned seven-year project, the scalability issues with the database design came to light
- ✦ The underlying database design bugs would have been revealed by design reviews...had such reviews occurred
- ✦ The project failed, at a cost of tens of millions of dollars and even larger opportunity costs



8. *TJ Maxx Credit Card Breach*

- ❖ Weak encryption of wireless routers and failure to delete data lead to a leak of 47,000,000 customer records
- ❖ Largest leak of personal information so far, but Target may end up unseating this record
- ❖ The hackers used the information to fraudulently purchase over \$1,000,000 in merchandise
- ❖ The pilfered credit card information was also found for sale on the Internet
- ❖ Security testing had revealed the problem
- ❖ The company did not fix the defect, because the PCI Data Security Standard in force at that time did not require a fix for compliance



7. *Ford Expedition*

- ⊕ This doesn't really qualify, but it's a point of personal privilege
- ⊕ My family's Ford Expedition developed a spontaneous ignition system failure
- ⊕ The engine would stop randomly, sometimes at highway speed
- ⊕ Ford was unable to fix the problem through software updates
- ⊕ Eventually, they had to replace the vehicle with a new one when my wife threatened to sue under Texas's Lemon Law
- ⊕ Irreproducible failures can be the worst kind of bugs



6. Flash Crash

- ⊕ Automated trading systems (high frequency traders) caused spontaneous and illogical stock market crash in 2010...followed by a quick recovery
 - ⊕ Second largest point swing
 - ⊕ Biggest one day point drop
- ⊕ These programs look to exploit small differences in bid and ask prices
- ⊕ In about 15 seconds, these programs made almost 30,000 transactions, about half of the total market trading volume
- ⊕ This caused a “death spiral” on prices which was only broken when automated trade-stopping limits were hit
- ⊕ Similar problems in Knight Capital’s systems cost about \$450 million
- ⊕ According to Forbes in 2013, the underlying defects are not fixed, though automated detection mechanisms are improved





5. *Boeing 787 Dreamliner Li-Ion Battery*

- ✦ After a delay-plagued development cycle, Boeing started delivering its new 787 Dreamliners in 2012
- ✦ The modern design and materials were supposed to save airlines millions in annual fuel costs
- ✦ However, lithium-ion batteries caught fire or failed dangerously, leading to the grounding of all delivered 787s
- ✦ Airlines that had purchased them lost millions during the ground
- ✦ NTSB's conclusion: "The testing was not as conservative as it could have been."





4. *Apple Battery Recall*

- ✦ In the largest consumer-electronics recall in history, Apple and Dell recalled Sony lithium-ion laptop batteries due to fire hazards
- ✦ Dell properly load tested their recall server, and was able to process 4.1 million battery replacements in an orderly fashion
- ✦ Apple did not adequately test their servers
- ✦ Consumers suffered long delays while trying to replace 1.8 million dangerous batteries
- ✦ Sony ended up losing over \$100,000,000 on the problem





3. *Airbus Pitot Tube/ Autopilot Failure*

- ✦ Air France flight 447 from Rio to Paris disappeared without a trace one night in 2009
- ✦ The plane stalled (lost lift) at altitude
 - ✦ Fell 38,000 feet in five minutes
 - ✦ Impacted ocean at 120 miles per hour
 - ✦ All 228 passengers and crew died
- ✦ The reason: a \$3,500 Thales pitot tube froze, sending bad data to the autopilot, which turned off...in the middle of a thunderstorm
- ✦ According to French investigators “only a highly-trained military pilot” could have recovered once the stall occurred
- ✦ Tragically, this was a **known** bug, and Airbus was already in the process of replacing the pitot tubes





2. *Snowden and Manning Leaks*

- ⊕ These might be controversial as “bugs”
- ⊕ However, consider: both Snowden and Manning were able to gain access **individually** to huge quantities of classified information
- ⊕ In properly functioning security configurations, what they did would not be possible (e.g., can a single person launch a nuclear missile)
- ⊕ Conversations with military security personnel indicate that penetration testing may be underutilized by the US military and intelligence
- ⊕ Patriots or traitors, call them what you will, but clearly these leaks have had a profound impact



1. *Healthcare.gov*

- ⊕ The administration's launch of healthcare.gov has gone very poorly
 - ⊕ Massive performance problems
 - ⊕ Security problems with personal data
 - ⊕ Integration problems with insurance company systems
- ⊕ Political decisions left requirements vague until less than a year remained to build and test the site
- ⊕ Leaks reveal that contractors knew that inadequate testing had been done
- ⊕ With health care making up one-sixth of the US economy, the financial impact of these problems could be profound if not fixed soon



Conclusions

- ❖ Software and hardware bugs are a regular fact of life
- ❖ Often they are just annoying, but some are expensive, dangerous, or politically explosive
- ❖ We've seen ten examples here, each with significant impact
- ❖ As computers become more ubiquitous in human existence, the potential impact of bugs will only increase



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