Summary of Stack Smashing Attack

1. Find a buffer overflow vulnerability in the program (e.g., strcpy from users' input without checking boundaries)
2. Inject shellcode into a known memory address
3. Exploit the buffer overflow vulnerability to overwrite EIP with the shellcode address. Normally this step can be combined with step 2 using one input.
4. Return from the vulnerable function.
5. Start to execute the shellcode.

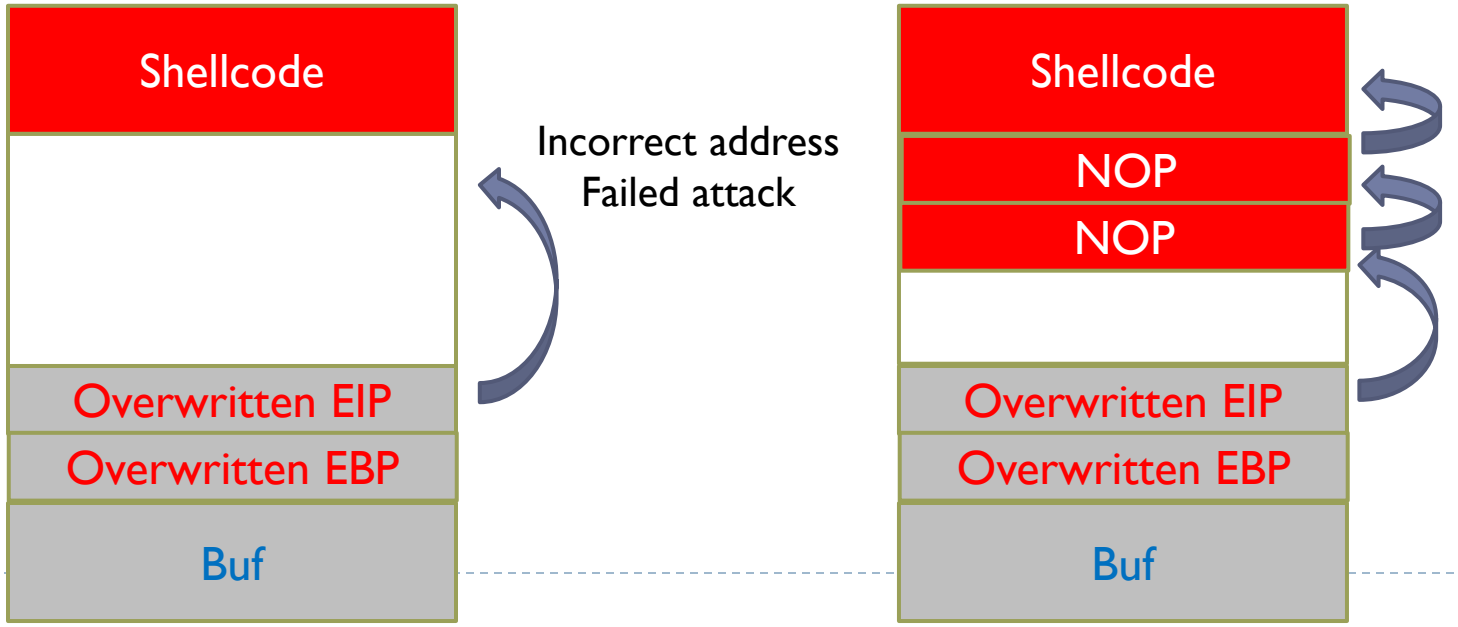
Shellcode Address is Unknown

Need to guess the address of shellcode.

- Incorrect address can cause system crash: unmapped address, protected kernel code, data segmentation

Improve the chance: Insert many NOP instructions before shellcode

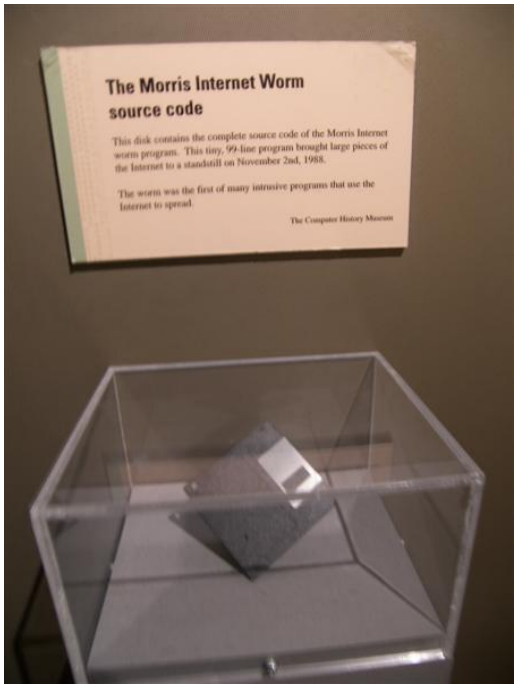
- NOP (No-Operation): does nothing but advancing to the next instruction.



Morris Worm: the First Buffer Overflow Vulnerability

History

- Released at 8:30pm, 2 November 1988 by Robert Tappan Morris, a graduate student at Cornell University
- Launched from the computer system of MIT, trying to confuse the public that this is written by MIT students, not Cornell.
- Buffer overflow in sendmail, fingerd network protocol, rsh/rexec, etc.



loppy disk containing the source code for the Morris Worm, at the Computer History Museum

Impact

- ~6,000 UNIX machines infected (10% of computers in Internet)
- Cost: $100,000 - $10,000,000

Robert Tappan Morris

What happens after Morris Worm

- Tried and convicted of violation of 1986 Computer Fraud and Abuse Act. This is the first felony conviction of this law.
- Sentenced to three years' probation, 400 hours of community service, and a fine of $10,050 (equivalent to $22,000 in 2023).
- Had to quit PhD at Cornell. Completed PhD in 1999 at Harvard.
- Cofounded Y Combinator in 2005
- Became a tenured professor at MIT in 2006. Elected to the National Academy of Engineering in 2019.

Robert Tappan Morris, Entrepreneur, professor at MIT

Following Morris Worm