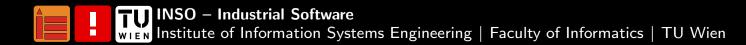


Advanced Security for Systems Engineering – VO 01: Advanced Attacks on Applications 1

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Capture-the-Flag Team defragmented.brains



- Take part in many international hacking competitions
- Diverse bunch, different skills and skill levels
- Join our mailinglist:
 ctf-join@inso.tuwien.ac.
 at
- Next CTF: Hack.lu (Fluxfinger/Bochum) 28.-30.10.



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Memory Corruption Bugs: Basics



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After decades of research, problem still prevalent.

- Morris Worm (11/2/1988) exploited a buffer overrun in fingerd
- 33 years, and thousands of research papers later: memory corruptions bugs still relevant
- 2015: More than 1 billion devices affected by Stagefright vulnerability
- 2017: WanaCry ransomware infects 200.000 computers within a day via EternalBlue (SMB heap exploit, stockpiled by the NSA, leaked by The Shadow Brokers)
- Hard to exploit due to mitigation techniques nowadays
- Exploits traded for serious money on the black market

Memory Corruption Bugs: Vulnerability Categories

- Stack overflow
- Heap overflow
- Double free
- Use after free
- Buffer underrun
- Format string vulnerability
- Integer overflow
- Signed/unsigned conversion error
- Type confusion error
- NULL pointer dereference

Memory Corruption Bugs: Main Culprits

Computer and OS Architecture

Memory space contains control flow information as well as user data

- Function return address stored on stack
- Heap management info interleaved with user data
- Function pointers: exception handler pointer, virtual function table, etc.

Type-unsafe Programming Languages

C or C++ allow arbitrary writes in process' memory space

- Programmer responsible for validating user input
- Some programming errors difficult to catch

Memory Corruption Bugs: Results of successful exploits

Denial of Service

Induce process crash, prevent clients from accessing service

Information Disclosure

- Leaking private information (e.g., passwords, private keys)
- Often 1st step in circumventing mitigation techniques (e.g., leaking process space address information)

Control Flow Hijacking

 Maliciously alter the process' behaviour: "Arbitrary Code Execution"



Memory Corruption Bugs: Control Flow Hijacking

- 1. Modify control flow data / metadata with user input
 - Function return address
 - Function pointer
 - Virtual method table
 - Heap metadata
 - Global Offset Table (GOT) or Import Address Table (IAT)
- 2. Redirect Control Flow
 - to injected (machine) code
 - or to existing code in the process' memory space

esse Literature / Links

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Thank you!

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