# Binary Exploitation I — Summer 2019 Practical Course

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What is this?

## Exploiting buggy C programs on modern x86\_64 Linux systems.

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## Exploiting buggy C programs<sup>1</sup> on modern $x86_{64^2}$ Linux systems.

<sup>1</sup>Disclaimer: There might be a little C++ as well... <sup>2</sup>Disclaimer: There might be a little 32-bit x86 as well... What is this?

## Exploiting buggy C programs<sup>1</sup> on modern x86\_64<sup>2</sup> Linux<sup>3</sup> systems.

<sup>1</sup>Disclaimer: There might be a little C++ as well...

<sup>2</sup>Disclaimer: There might be a little 32-bit x86 as well...

<sup>3</sup>Just kidding — no Windows (yet). We kindly refer you to abx. ③

# You should...

### ...understand how computers work

- ...know the basics of the Intel x86 assembly language
- …have a reasonable grasp of the C programming language

...but most importantly:

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## …understand how computers work

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#### ...but most importantly:

...enjoy banging your head against tough challenges

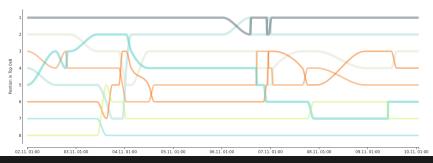
Phase I ( $\sim$  10 weeks):

► "Usual" practical course (weekly meetings and assignments)
Phase II (~ 4 weeks):

► Final project (vulnerable program, exploit and presentation)

| Team       |              | punco.       | punol      | pwm02        | pwn03       | punoA       | punos | punos | pomol | poun08       | pwm09        | pwn10 | pount | punt? | punt3 | punia        | pount5 | pwn16      | pountly      | ponts. | pwn19       | pwn20 | pwn21        | pwn22 | pwn23       | pun |
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| team208    |              | V            | Ø          | Z            | Z           | Z           | Ø     | V     | Ø     | Z            | Z            | Z     |       |       | V     | Ø            | Ø      | Ø          |              |        | Ø           | Ø     | V            | Ø     | V           | V   |
| # whoami   |              |              | Ø          | Z            | Ø           | Ø           | Ø     | Ø     | Ø     | Ø            | Ø            | Ø     |       |       | Ø     | Ø            | Ø      | Ø          |              |        | Ø           | Ø     | Ø            | Ø     |             | V   |
| team202    | V            | $\checkmark$ | Ø          | Z            | Ø           | Z           | Ø     | Ø     | Ø     | Ø            | Ø            | Z     |       |       | Ø     | Ø            | Ø      | Ø          | $\checkmark$ |        | Ø           | Ø     | $\checkmark$ | Ø     |             | V   |
| 0x400000   |              |              | Ø          | Z            | Ø           | Ø           | Ø     | V     | Ø     | Ø            | Ø            | Ø     | V     |       | V     | Ø            | Ø      | $\swarrow$ |              | Ø      | Ø           | Ø     | V            | Ø     | V           | ×   |
| Mantasr0x  |              | $\checkmark$ | $\swarrow$ | Ø            | Ø           | Ø           | Ø     | Ø     | Ø     | Ø            | Ø            | Ø     |       |       | Ø     | Ø            | Ø      | Ø          |              |        | Ø           | Ø     | Ø            | Ø     |             | ×   |
| team203    | V            | V            | Ø          | Z            | Ø           | Ø           | ×     | ×     | ×     | Ø            | Ø            | Ø     | V     | V     | V     | Ø            | Ø      | ×          | $\mathbf{X}$ | Ø      | Ø           | Ø     | ×            | V     | V           | ×   |
| team209    | $\boxtimes$  | ×            | ×          | $\mathbf{X}$ | $\boxtimes$ | $\boxtimes$ | ×     | ×     | ×     | $\mathbf{X}$ | $\mathbf{X}$ | ×     | ×     | ×     | ×     | $\mathbf{X}$ | ×      | ×          | ×            | ×      | $\boxtimes$ | ×     | ×            | ×     | $\boxtimes$ | ×   |
| team210    | $\mathbf{X}$ | ×            | ×          | ×            | ×           | ×           | ×     | ×     | ×     | ×            | ×            | ×     | ×     | ×     | ×     | ×            | ×      | ×          | ×            | ×      | ×           | ×     | ×            | ×     | ×           | ×   |

## 🔀 Graphs



## Process — Phase I

#### Teams of two

Every week: Introduction to a new topic

- Submission of solutions before the following week's meeting
- Private explanation of the solution during that meeting

## Final project

- Development of a vulnerable application
- Creation of an exploit (ab)using the vulnerability/ies
- Short paper (about 5 pages)
- Presentation (about 15 minutes)
- ► Hack the other teams' applications ☺
- Details follow when the time has come

# Contents

- Analysis and debugging tools
- ► Hijacking the control flow
- Shellcode
- Format string vulnerabilities
- Stack- and heap-based buffer overflows
- Exploiting heap management logic
- Bypassing protection mechanisms

# Don't say we didn't warn you

- Assume up to 30h of workload per week
- (But: You reach state-of-the-art uber 1337 h4x0r skillz knowledge about binary exploitation techniques on Linux systems)

Time and place

When? Tuesday, 14:00 Where? 01.05.013

# Registration

Solve our qualification challenge!

Available at:

## bxqual.sec.in.tum.de:55555

- Description https://www.sec.in.tum.de/i20/ teaching/ss2020/binary-exploitation
- Deadline: 2020-02-17 (23:59 pm)
- ► Details: See the course web page after the premeeting
- Registration using the matching system (formally required)
- ► 2<sup>4</sup> slots

- Contact me at jonischk@sec.in.tum.de
- ► PGP fingerprint:

▶ A903 76D1 65F3 25F9 8594 280A 2BA0 1592 EFAC B551

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# Questions?