Hacking like in the movies

Insomni'hack 2015 CTF

writeups

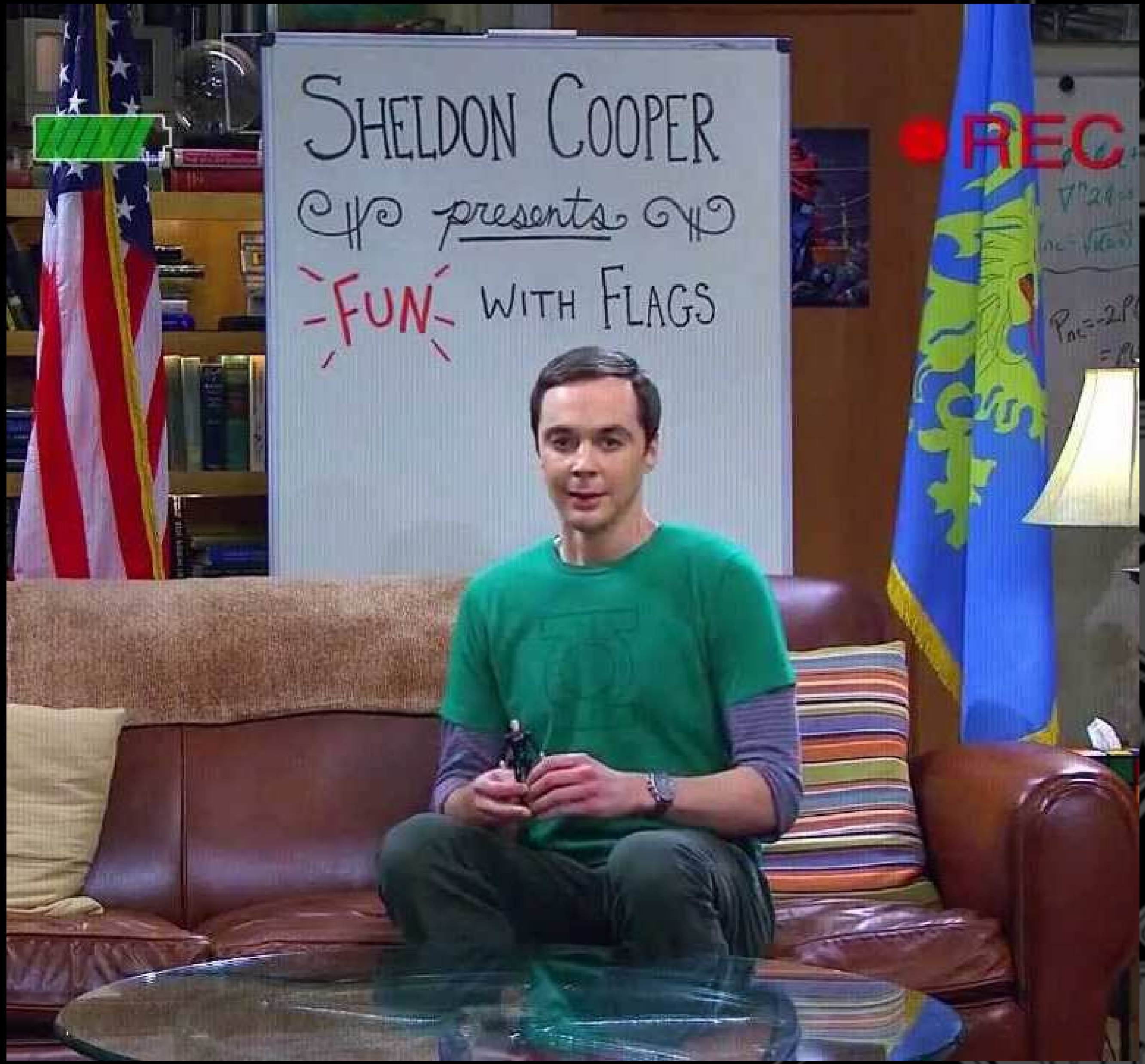
INSOMNI'HACK

Intro|Insomni’hack ?

- Organized by SCRT
- First edition in 2008
- Security talks since 2011
- Official CTF teaser since 2014
- Next edition :
  - Teaser January 16
  - CTF March 18 2016

Intro | CTF ?

- Capture The Flag
- Security challenges
- Time limited
- Jeopardy or attack/defense
- https://ctftime.org/



Intro | CTFs are good for you

- Pros
  - Get out of your comfort zone
  - Learn new tricks
  - Fun experience
- Cons
  - Time consuming

Intro | Insomni’hack 2015 teaser

- Theme: Mocking Hollywood hacking
- Online for 36h
- ~370 teams
- 5 challenges
- Pwnable, reversing and web

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Intro | Insomni’hack 2015 CTF

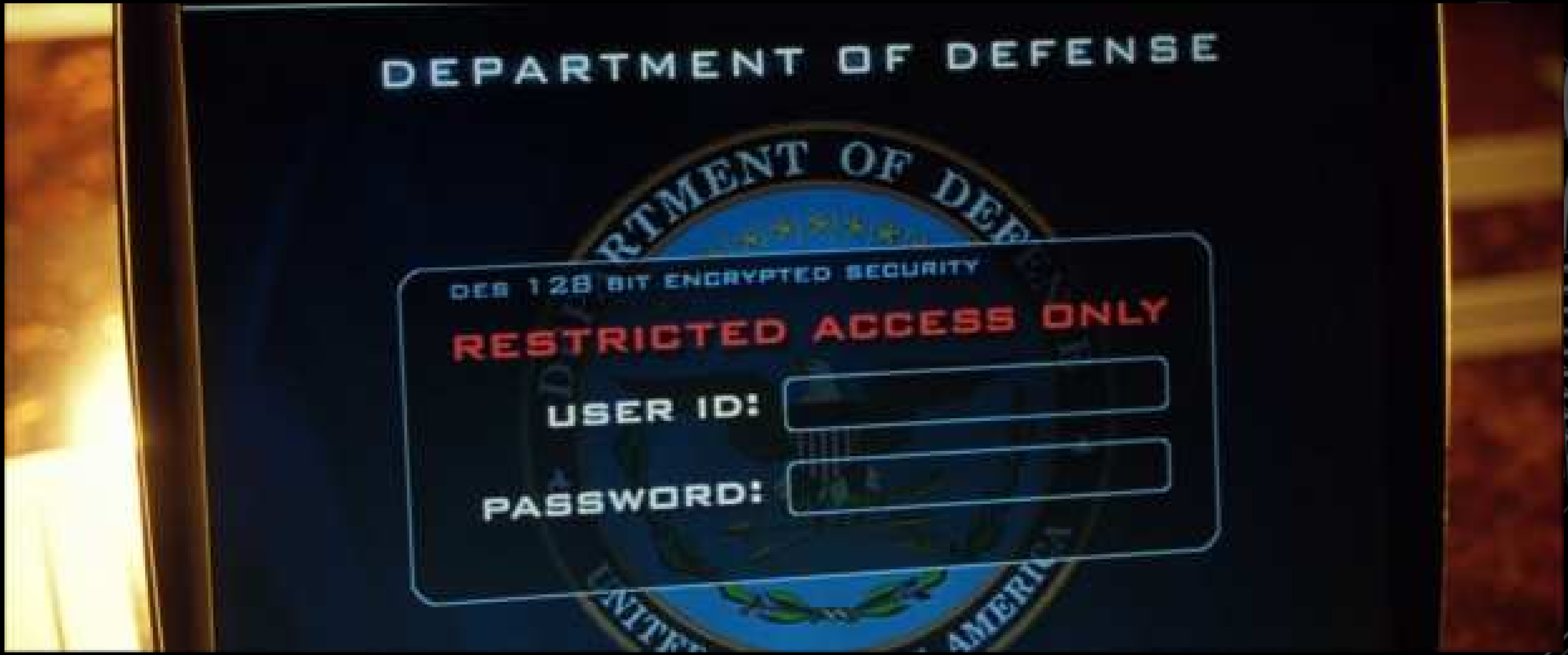
- ~350 participants (56 teams)
- Won by Dragon Sector
- Several international teams present
- 28 challenges
- Pwnable, shellcoding, reversing, web, network, forensics, hardware and mobile

Intro | Mocking Hollywood hacking

- Hollywood is terrible @hacking
- Like… really.
- Except for a very few select movies
- 3d malwares, IPv5, manual password bruteforcing, progress bars, image zooming, etc.

Intro | Mocking Hollywood hacking

Intro | Mocking Hollywood hacking



DEPARTMENT OF DEFENSE

DES 128 BIT ENCRYPTED SECURITY

RESTRICTED ACCESS ONLY

USER ID:

PASSWORD:

Intro | Mocking Hollywood hacking

Tools

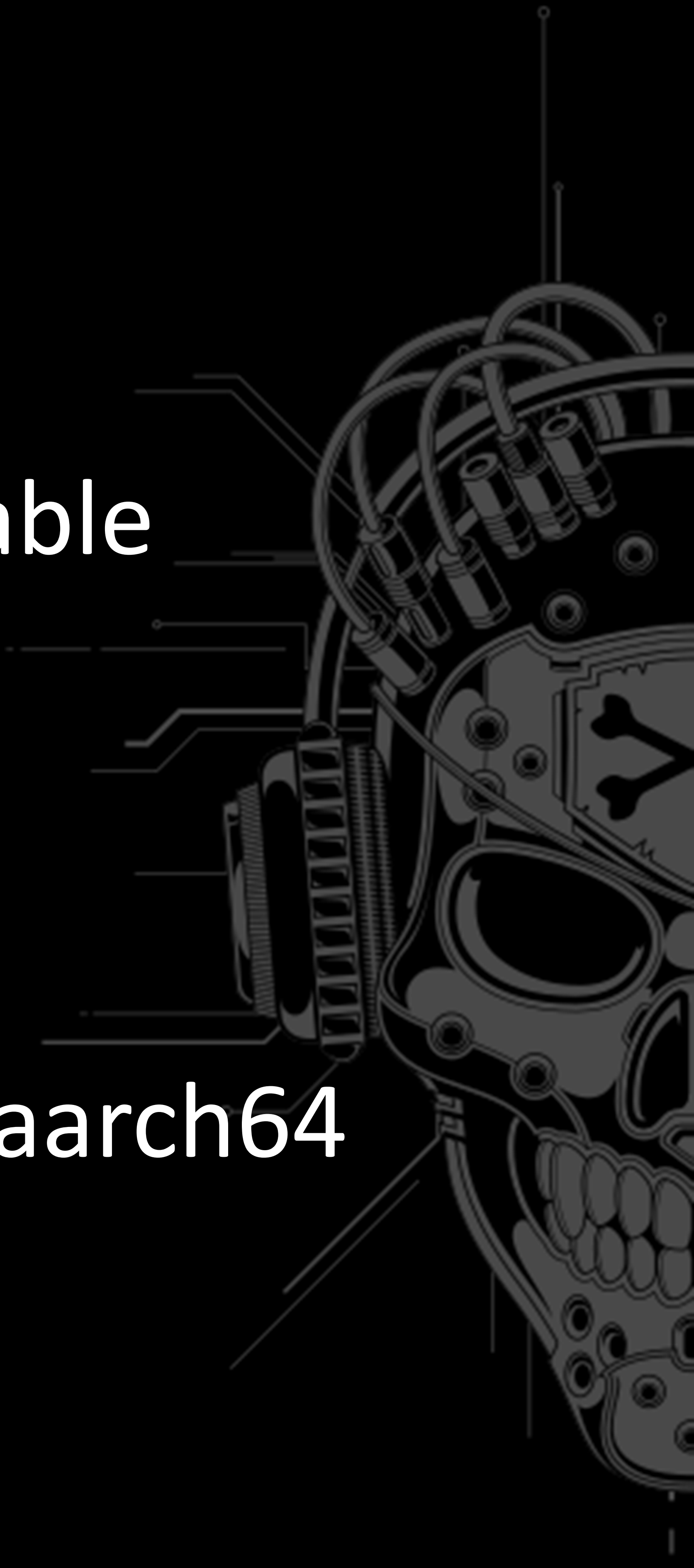
Web,reverse,exploit,forensic

Tools | web

- Burpsuite / Webscarab
- LiveHTTPHeaders / Firebug / Tamper Data / Hackbar
- Python requests
- curl

Tools | reverse

- IDA Pro
  - Expensive but the most powerful available
  - Supports many architectures
  - Hex-Rays decompiler
- Hopper
  - Cheap but supports x86, x64, arm and aarch64
  - Decompiler for x86, x64 and arm



Tools | reverse

- Snowman
  - IDA pro decompiler plugin
  - Also a standalone version
  - ARM, x86 and x64
- Radare : r2
  - Open source disassembler with console or web interface

Tools | reverse

You're planning to do this ctf only with r2 ?

Tools | reverse/exploit

- gdb & peda
  - The Linux pwner’s toolbag
  - searchmem
  - telescope
  - pretty print of changed regs
  - branching indications

Tools|exploit

- checksec.sh

```
RELRO           STACK CANARY      NX            PIE
Partial RELRO   Canary found      NX enabled    No PIE
```

- rp++
  - One of the best gadget finders for x86 / x64
  - Supports Linux, Windows, FreeBSD and Mac OSX
- ROPgadget Tool

Tools | forensics

- Volatility
  - Powerful for process reconstruction (net connections, process image, etc.)
  - Easy to use
- Wireshark
  - Network analysis swiss army knife

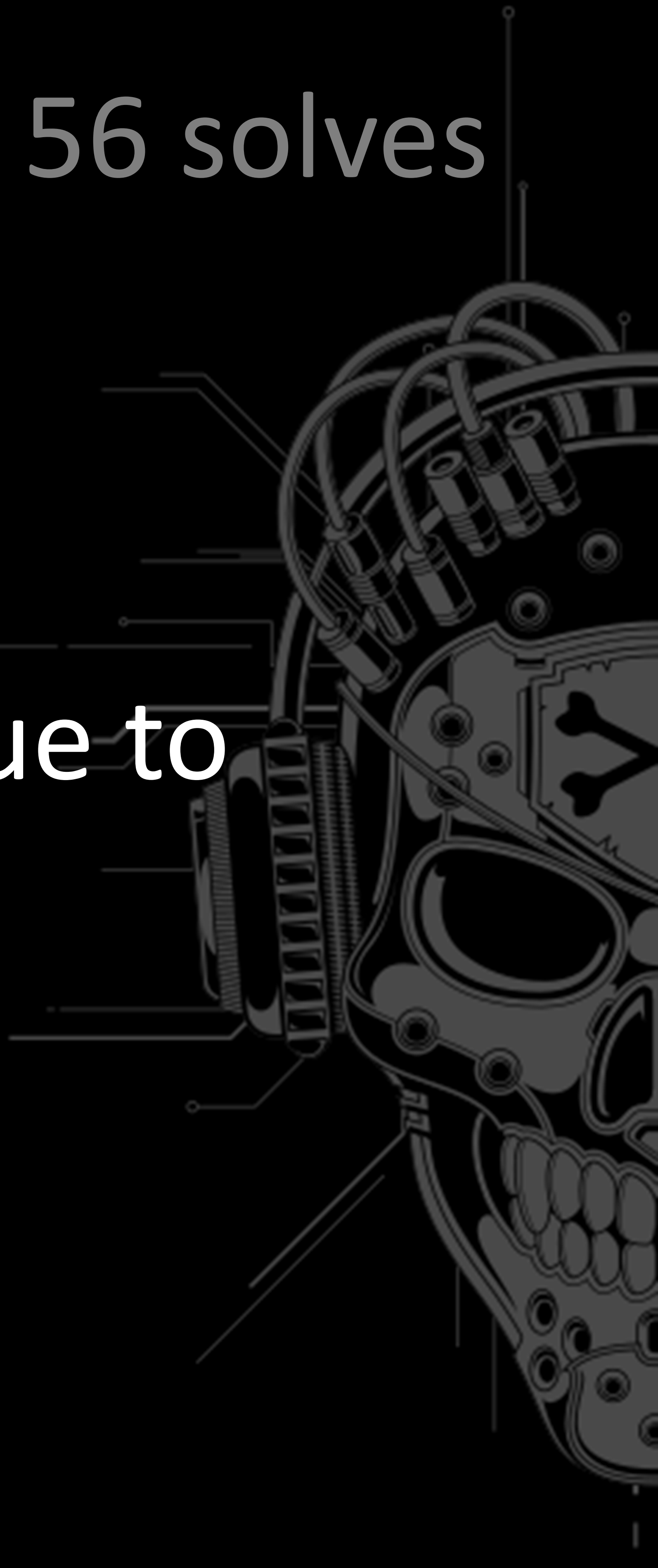
The challenges

Web, hardware, reversing, network, exploits, shellcoding, forensics, mobile

Web|n00bs gonna win!

56 solves

- Easy challenge that anyone can solve
- What is the best hacking movie
- Read the HTML source, edit form value to submit hidden field value Matrix
- Obvious bad choices : «Swordfish», «Hackers», etc.



Web | Smell of the lamp

32 solves

- Hint: edited with vim
- Get the source from `index.php~`
- SQL Injections everywhere
- Query results not printed
- Error-based SQL Injection

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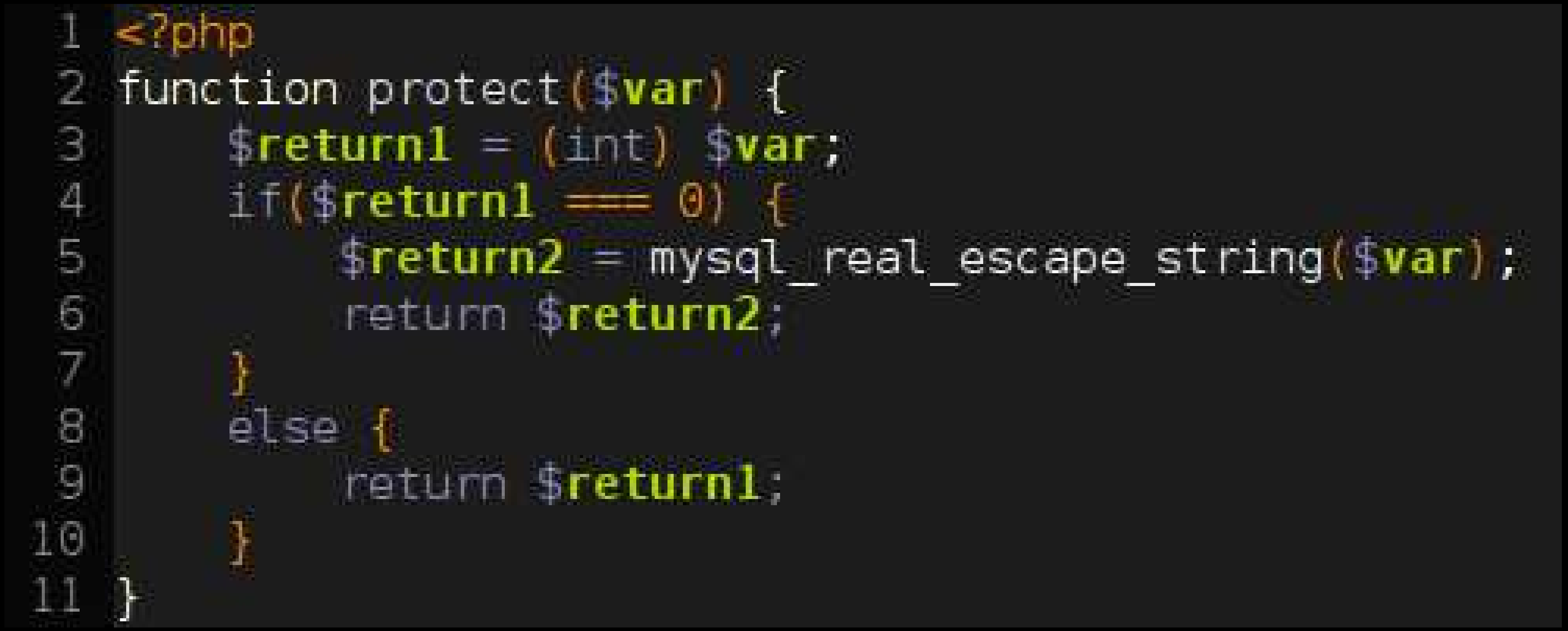
Web|Hacker News

30 solves

- SQL Injection in an integer field

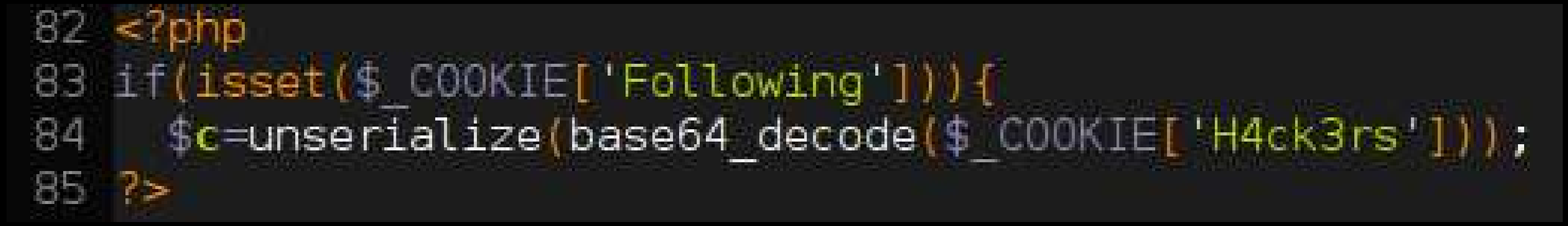


```php
<?php
function protect($var) {
    $return1 = (int) $var;
    if($return1 === 0) {
        $return2 = mysql_real_escape_string($var);
        return $return2;
    }
    else {
        return $return1;
    }
}
```

Web|Serial Hackers

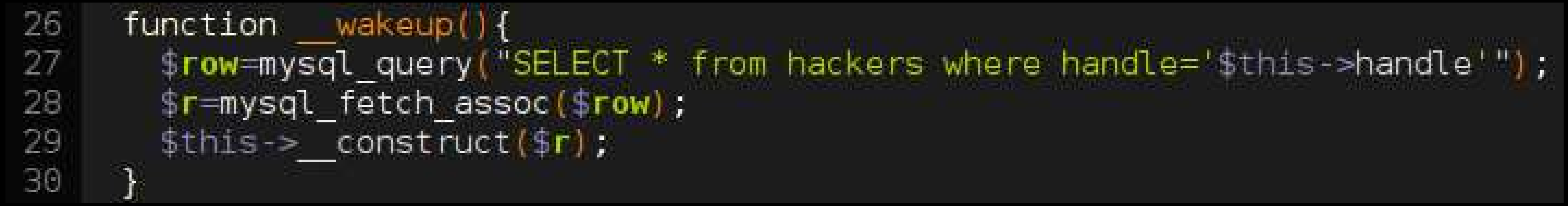
19 solves

- Unsafe unserialize



```php
<?php
if(isset($_COOKIE['Following'])){
  $c=unserialize(base64_decode($_COOKIE['H4ck3rs']));
?>
```

- Modify handle attribute ⇨ SQL Injection



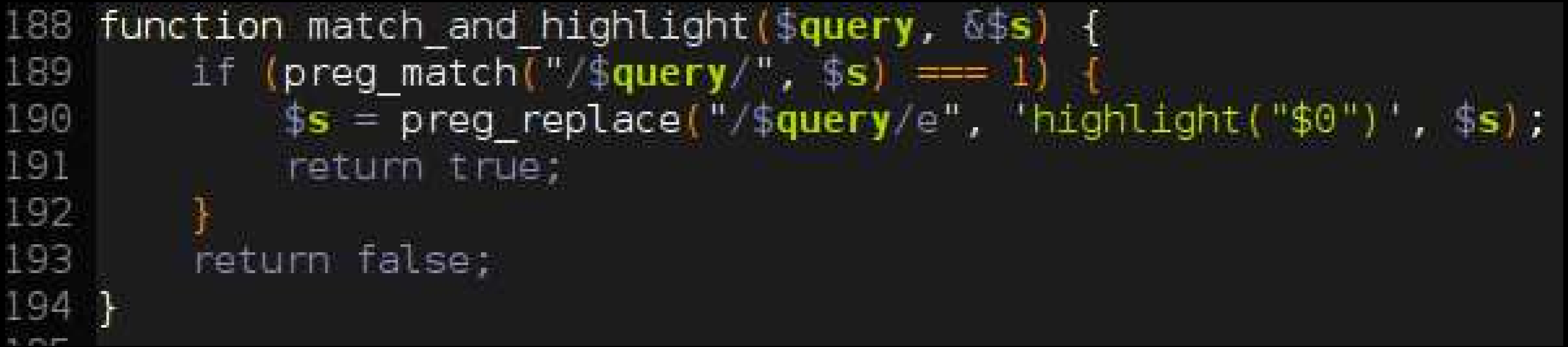
```php
  function __wakeup(){
    $row=mysql_query("SELECT * from hackers where handle='$this->handle'");
    $r=mysql_fetch_assoc($row);
    $this->__construct($r);
  }
```

- Find and dump secret table

Web | Smelly lamp got makeup

4 solves

- Forum about hacking movies
- Vuln in comments / search



```php
function match_and_highlight($query, &$s) {
    if (preg_match("/$query/", $s) === 1) {
        $s = preg_replace("/$query/e", 'highlight("$0")', $s);
        return true;
    }
    return false;
}
```

- `$query = '\$\{system\(\$_REQUEST\[code\]\)\}';`
- `$s = '${system($_REQUEST[code])}';`

Web|Hacker Idol

2 solves

- Neo4j graph database
- Traversal REST endpoint
- SSJI in `return_filter`
- sandboxed context
- Create direct relations to actors get the flag
  - Bypass the huge agency commission!

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Web | Jack the clicker

1 solve

- Clickjacking!
- PhantomJS bot visits the link and clicks at random locations
- Include the application in an iframe, put the target button under the cursor with Javascript

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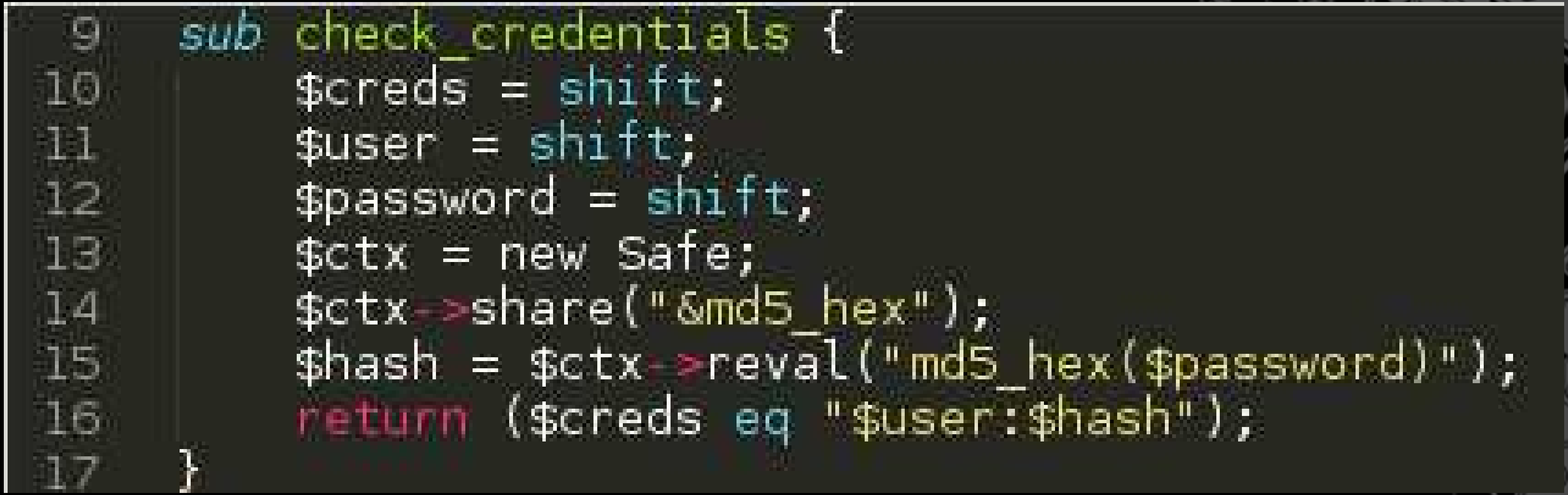
Web|Hack like it’s 1999!

0 solve

- PERL… Need to login to server
- LFI to get file source
- reval in `download.pl`
- No imports allowed



```perl
sub check_credentials {
        $creds = shift;
        $user = shift;
        $password = shift;
        $ctx = new Safe;
        $ctx->share("&md5_hex");
        $hash = $ctx->reval("md5_hex($password)");
        return ($creds eq "$user:$hash");
}
```

Web|Hack like it’s 1999!

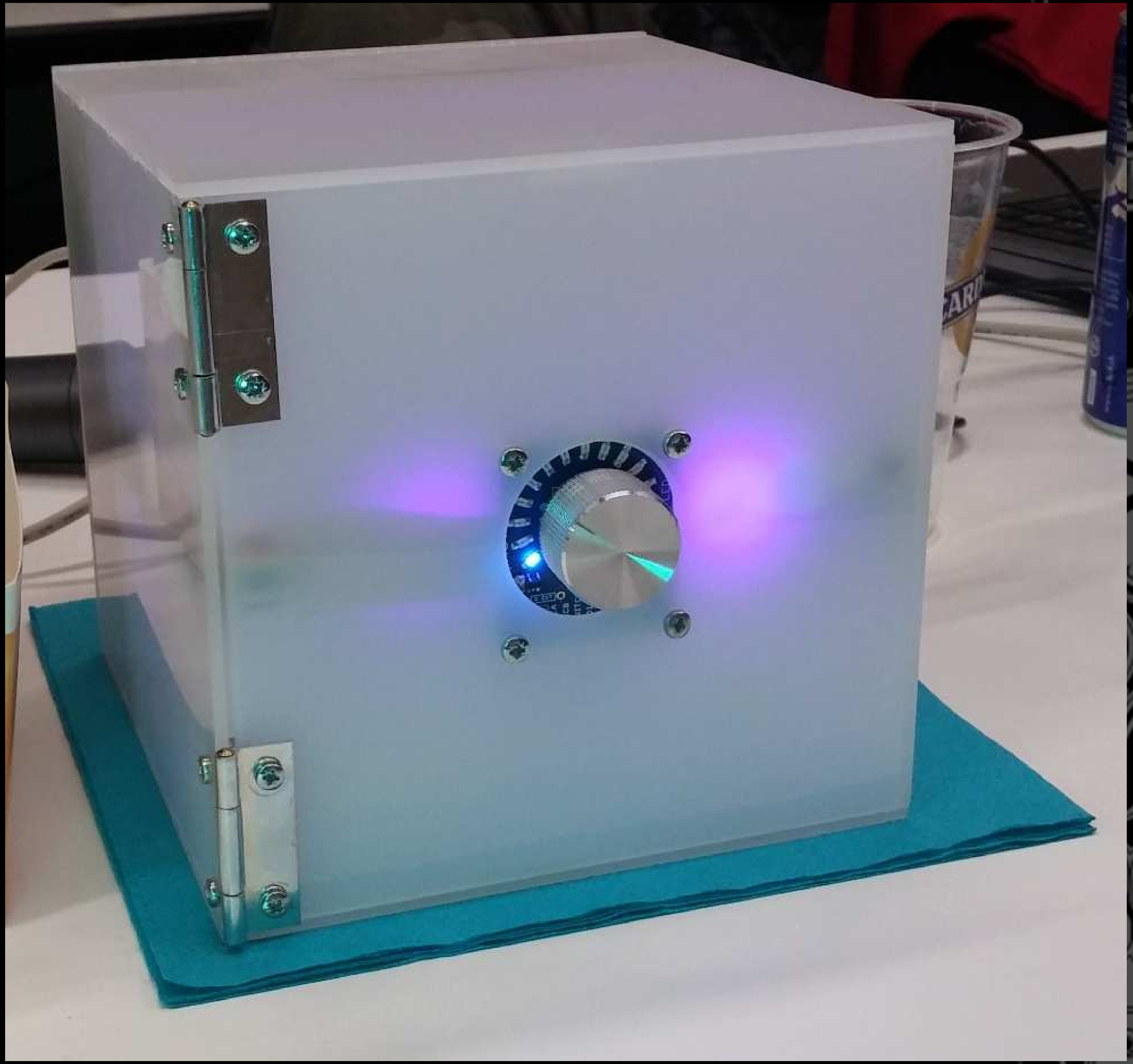
0 solve

- $_ contains hash and username
- Can close the parenthesis in order to run arbitrary perl code
- Leak the username and hash char by char using loop function to "sleep"
- use tricks of `reval("md5_hex($password), hex_value")` so it actually returns `hex_value`

Hardware | 1-2-3-4

3 solves

- What’s inside the box ?
- AVR (arduino) binary
- Reverse the logic
- Find the combination



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PARENTAL

ADVISORY

EXPLICIT CONTENT

Reversing | Swordfish

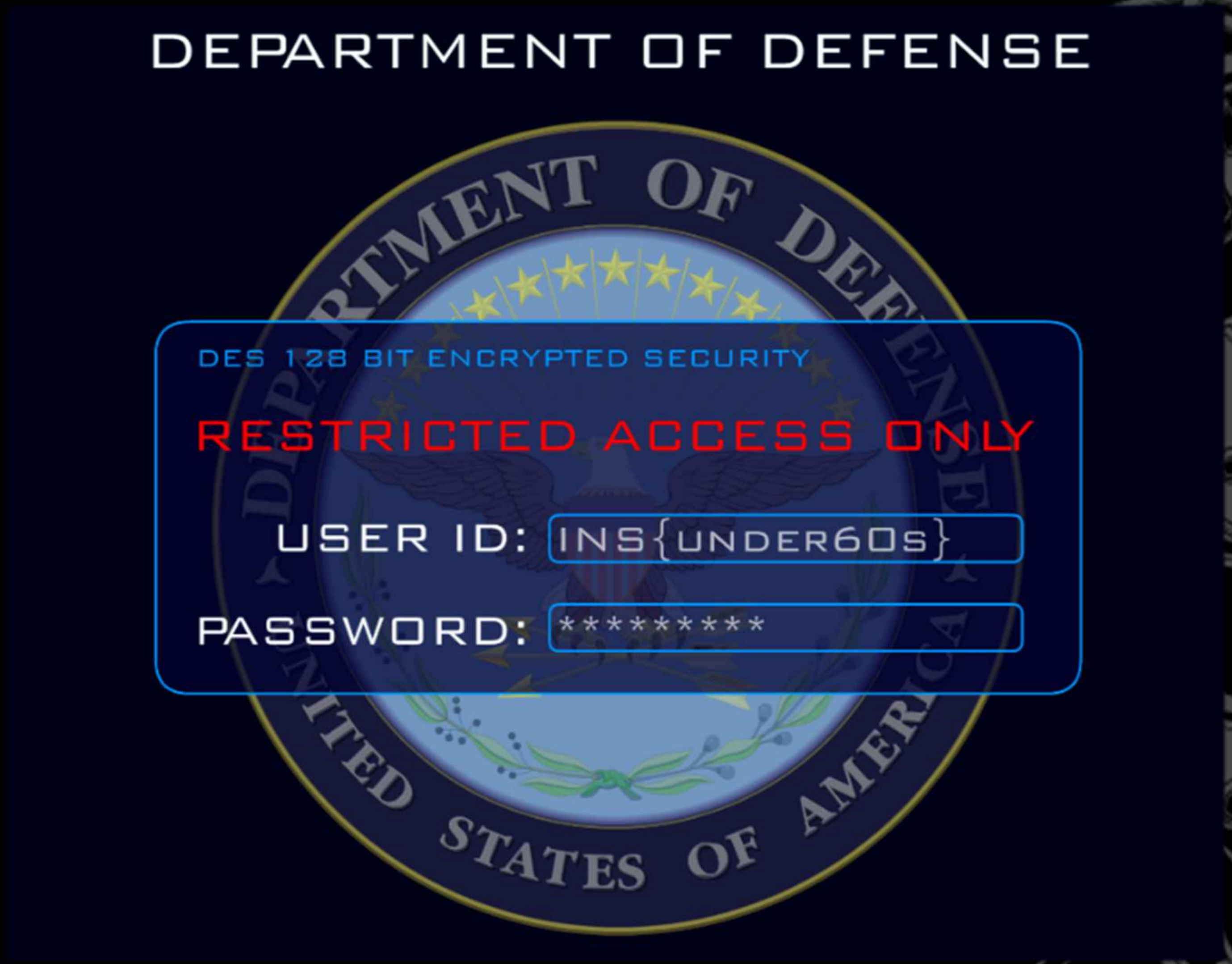
43 solves

https://www.youtube.com/watch?v=zfy5dFhw3ik

Reversing | Swordfish

43 solves

- Flash with hardcoded password
- Decompile with JPEXS (or other)



DEPARTMENT OF DEFENSE

DES 128 BIT ENCRYPTED SECURITY

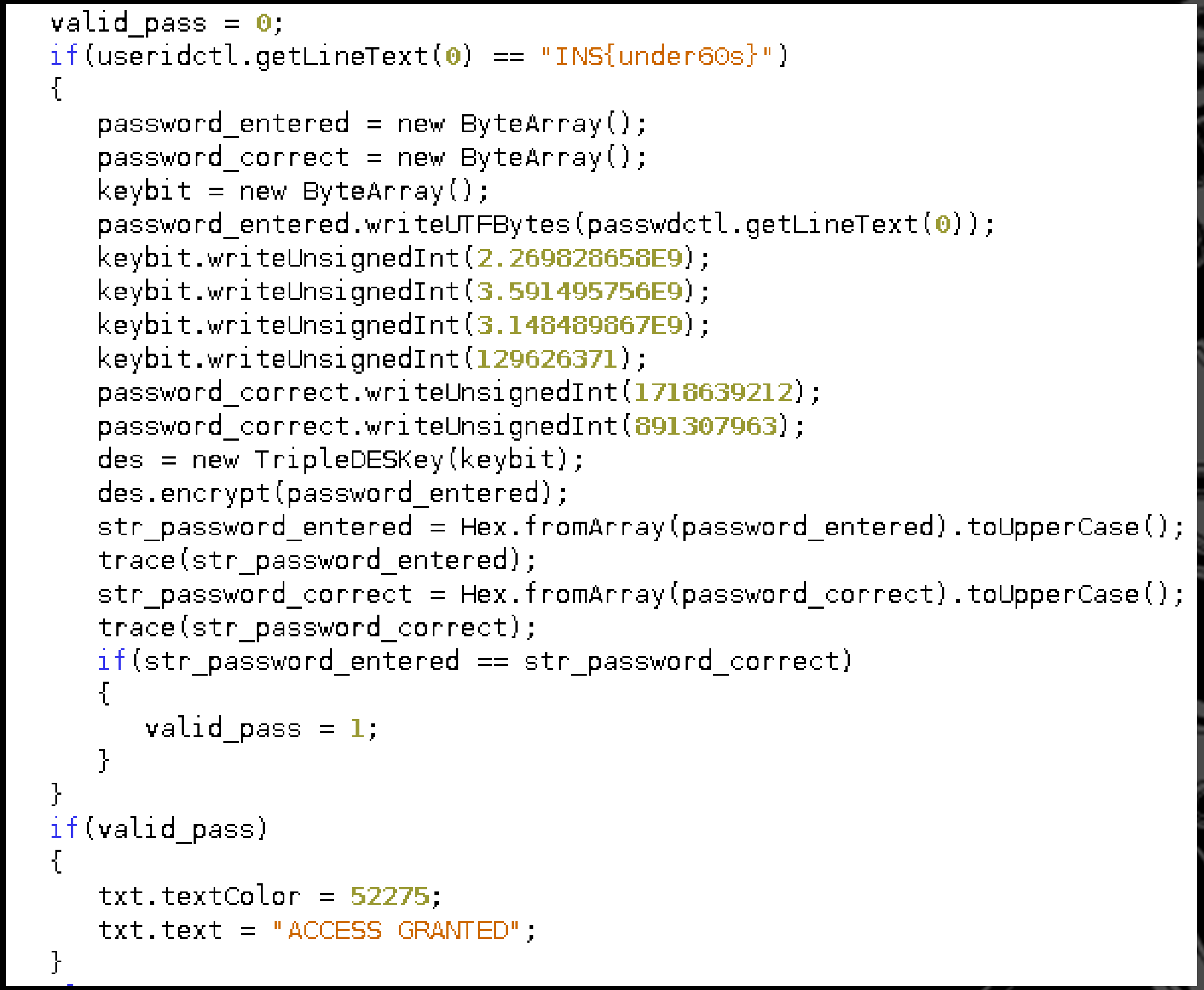
RESTRICTED ACCESS ONLY

USER ID: INS{UNDER60s}

PASSWORD: *********

Reversing | Swordfish password 12 solves

- Password stored in DES 128
- Hardcoded key
- Patch bytecode to invert the DES mode
- Patch bytecode to change the argument
- Launch Flash in debug mode
- Read the log

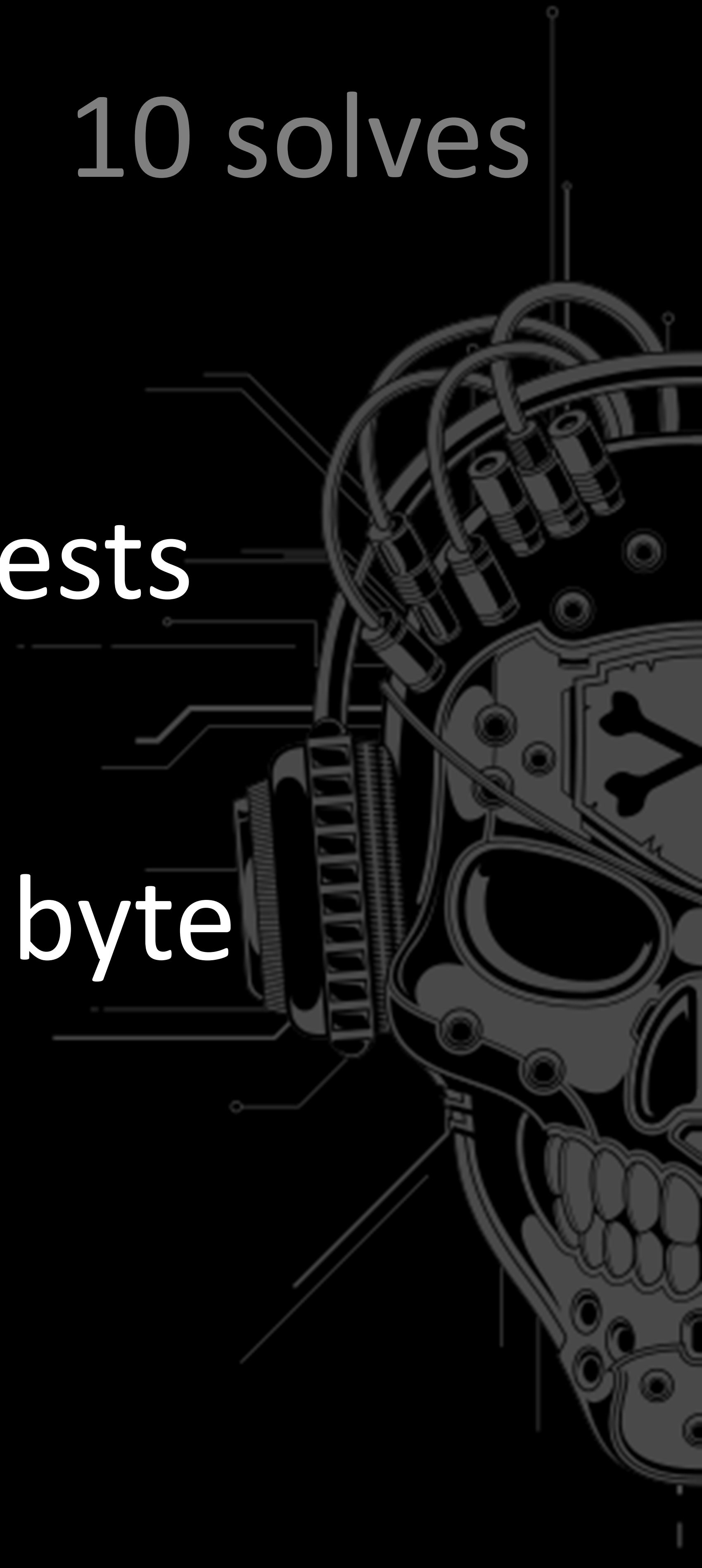


```
valid_pass = 0;
if(useridctl.getLineText(0) == "INS{under60s}")
{
   password_entered = new ByteArray();
   password_correct = new ByteArray();
   keybit = new ByteArray();
   password_entered.writeUTFBytes(passwdctl.getLineText(0));
   keybit.writeUnsignedInt(2.269828658E9);
   keybit.writeUnsignedInt(3.591495756E9);
   keybit.writeUnsignedInt(3.148489867E9);
   keybit.writeUnsignedInt(129626371);
   password_correct.writeUnsignedInt(1718639212);
   password_correct.writeUnsignedInt(891307963);
   des = new TripleDESKey(keybit);
   des.encrypt(password_entered);
   str_password_entered = Hex.fromArray(password_entered).toUpperCase();
   trace(str_password_entered);
   str_password_correct = Hex.fromArray(password_correct).toUpperCase();
   trace(str_password_correct);
   if(str_password_entered == str_password_correct)
   {
      valid_pass = 1;
   }
}
if(valid_pass)
{
   txt.textColor = 52275;
   txt.text = "ACCESS GRANTED";
}
```

Network | TimeToLeak

10 solves

- Pcap with ICMP traffic
- Host selectively replies to echo requests
- TTL "port knocking"
- Use raw sockets, guess the flag byte byte



Network|Hollywood network

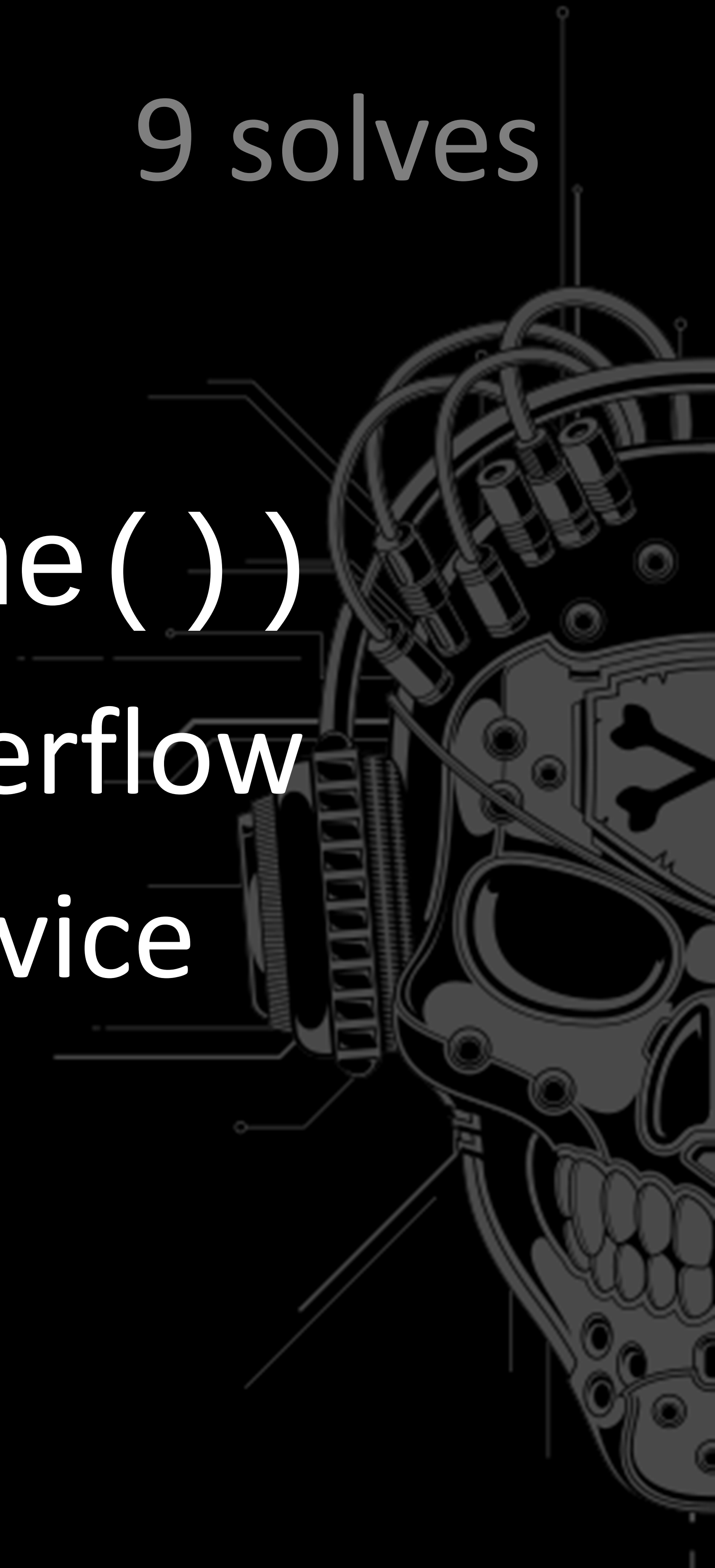
0 solve

- Connect to a fake z/OS IBM server
- FLAG command sends flag
- Running on IPv5, ex: `312.5.125.833`
- Sniff with Wireshark and notice ARPv5 packets
- Craft reply ARPv5 packet using raw sockets
- Server will send IPv5 packet with the flag in cleartext

Exploit | mastermind

9 solves

- Mastermind game
- Combination based on `srand(time())`
- Win in one attempt to be able to overflow
- Trick is to connect 2 times to the service
- Fail in one of the sessions to get the combination



Exploit | smtpwn

5 solves

- SSH challenge. Creates an unreadable temporary mail file with a random token, some constants, the flag, and your input
- `ulimit` tricks
  - limit number of open fds ⇨ file descriptor exhaustion ⇨ cannot open `/dev/urandom`
  - limit file size ⇨ use the checksum to guess the flag byte by byte

Exploit|Sql inject flow

2 solves

- Forking service using MySQL to store data
- Stack: [buffer][pointer]…
- sscanf off-by-one
- Stack: [AAAAAAAAAAAAAAAAAAAAA][\x00pointer]…
- Function pointer gets fixed
- Stack: [AAAAAAAAAAAAAAAAAAAAA][pointer]…
- Buffer is inserted in MySQL: leak!

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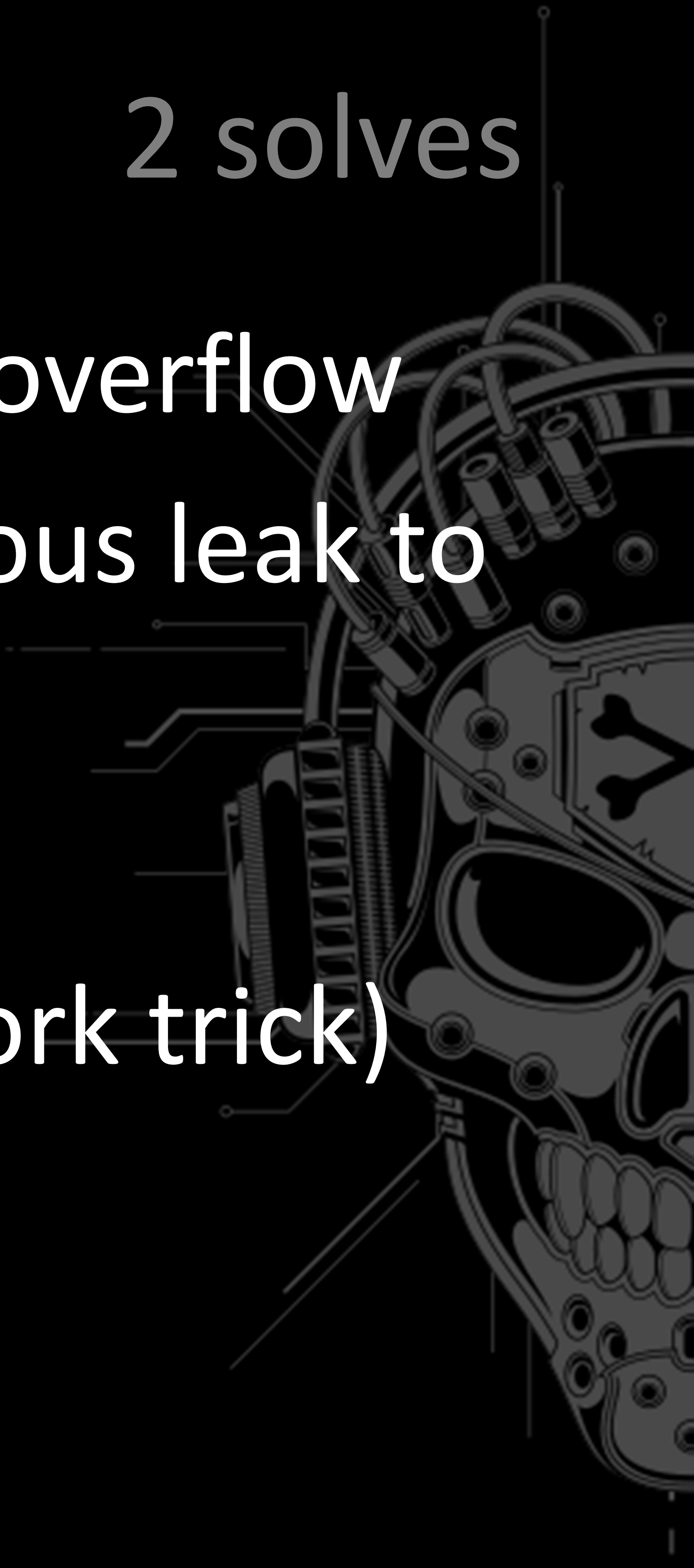
Exploit | Sql inject flow

2 solves

- SQL Injection, output leads to a buffer overflow
- Build a ropchain in SQL using the previous leak to bypass PIE

- Alternative: brute ASLR byte by byte (fork trick)



Exploit | The Firm(ware)

0 solve

- Small MIPS firmware to reverse
- Obvious overflow in the HTTP `lang` parameter
- Jump directly to a nopsled + shellcode like old times (No ASLR, No NX)

Exploit | Jurassic Sparc

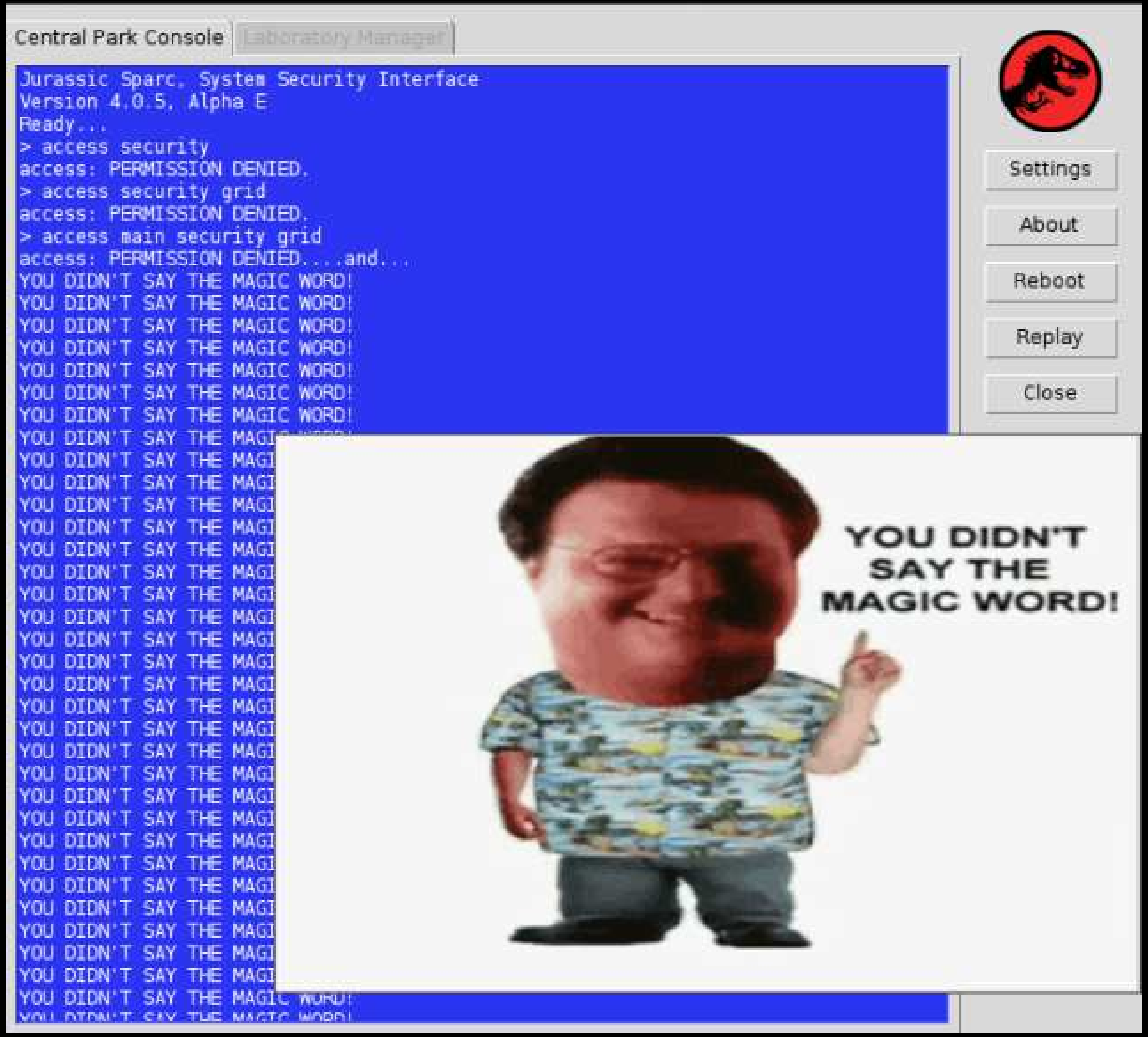
0 solve

- Sparc64 service, custom protocol
- Provided python client
- Credentials + magic word = flag

- 8 byte stack buffer overflow in the reboot feature
- Overwrite file descriptors ⇨ leak database during backup operation
- `strcmp` of a raw hash ⇨ easy collision

Exploit | Jurassic Sparc

0 solve



```
Jurassic Sparc, System Security Interface
Version 4.0.5, Alpha E
Ready...
> access security
access: PERMISSION DENIED.
> access security grid
access: PERMISSION DENIED.
> access main security grid
access: PERMISSION DENIED....and...
YOU DIDN'T SAY THE MAGIC WORD!
YOU DIDN'T SAY THE MAGIC WORD!
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YOU DIDN'T SAY THE MAGI
YOU DIDN'T SAY THE MAGIC WORD!
YOU DIDN'T SAY THE MAGIC WORD!
```

Exploit|SH1TTY

0 solve

- TTY keylogger, kernel module
- Special feature to log only passwords
- Linux kernel stack buffer overflow

- More details tomorrow!

Shellcoding | blue pill

8 solves

- `read(0, buf, 4); jmp buf;`
- 4 bytes shellcode, chrooted
- Return Oriented Shellcoding
  - Stager, « enlarge your shellcode »

Shellcoding | tldr

6 solves

- Chroot and sandboxed environment (seccomp-bpf)
- Blocked syscalls include open and read
- RTFM!

-
  ```
  int openat(int dirfd, const char *pathname, int flags);
  """If pathname is relative and dirfd is the special
  value AT_FDCWD, then pathname is interpreted relative to
  the current working directory of the calling process."""
  ```
-
  ```
  ssize_t sendfile(int out_fd, int in_fd, off_t *offset,
  size_t count);
  ```

Forensic|ZoomIn

43 solves

- Use exif tools to extract a thumbnail
- Thumbnail in the thumbnail
- We need to zoom deeper

YO DAWG, I HEARD U LIKE THUMBNAILS
SO I PUT A THUMBNAIL IN YO THUMBNAIL, SO U CAN ZOOM WHILE U ZOOM
imgflip.com

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Forensic|Lost In Memories

26 solves

- Memory dump of an infected Windows machine communicating with a C&C.
- Use your favorite forensic tool to find the C&C address (requires creds) and get the flag:
    - volatility
    - … or strings|grep ☺

Forensic | Elysium ropchain analysis 1 solve

- Provided: PCAP + binary + libc
- Exploitation of the teaser « Elysium » task
- Mix exploit/forensics

- Exploit leaks `/proc/self/maps`
- First ropchain is a stager and pivots to stage 2

Forensic | Elysium ropchain analysis 1 solve

- Stage 2:
  - `memfrob()` to decrypt structure and filename (/flag)
  - Read flag and `cbc_crypt()` it in DES
  - `cbc_decrypt()` stage 3 ropchain

Forensic | Elysium ropchain analysis 1 solve

- Stage 3:
  - Sends the encrypted flag hidden in the TTL (byte by byte)

Conclusions | Hack the planet!

- 8 hours is short, one must pwn fast
- CTFs don't teach PowerPoint ☹
  - But are great to keep your other skills sharp!

- Challenge sources on https://github.com/Insomnihack/Insomnihack-2015

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Conclusions|Questions/Contact

- Questions ?

- Twitter:
  - @0xGrimmlin
  - @__awe