“Hacking w praktyce”

made by ArduGeek

Kacper Ostrowski 2D TŁ

Cel prezentacji

- Przedstawienie:
  - Kilku praktycznych projektów
  - Zastosowania wiedzy w praktyce
  - Podatności w sieciach
  - Inżynierii wstecznej
  - Oraz innych praktycznych aspektów hackingu

Przed rozpoczęciem

- Jak dzielimy hackerów ?
  - Black hats – hackerzy którzy wykorzystajują swoją wiedze do nielegalnych działalności
  - White hats - hackerzy którzy wykorzystajują swoją wiedze do pogłębiania swoich umiejętności oraz do rozwiąaywania problemów, nie wykorzystują tego do żadej nielegalnej działaności
- Kto to jest hacker ?
  - (Ang.) A computer hacker is any skilled computer expert who uses their technical knowledge to overcome a problem.
  - (Pol.) Haker komputerowy to każdy wykwalifikowany ekspert komputerowy, który wykorzystuje swoją wiedzę techniczną do rozwiązania problemu.
  - Źródło: https://en.wikipedia.org/wiki/Hacker

Jak dzielimy Hacking ?

- Hardware hacking
  - Zmiana, modyfikowanie lub ulepszanie sprzętu oraz jego wewnętrznej logiki
- Software hacking
  - Zmiana, modifikowanie, ulepszanie lub inżynieria wsteczna oprogramowania
- Network hacking
  - Badanie, exploitacja, przechwytywanie lub wykrywanie podatności w sieciach

Przedstawione projekty

- License_key_crack (software hacking)
  - Złamanie klucza w prostej aplikacji, weryfikującej licencje
- Wave_files_hacking (software/hardware hacking)
  - Generowanie oraz modyfikowanie plików .wav
- JPG_capture (network hacking)
  - Wychwycenie danych w niezabezpieczonej sieci komputerowej
- Portable_lab (hardware/software hacking)
  - Wykorzystanie mikrokomputera raspberry pi zero W do stworzenia przenośnego routera z wbudowanym access pointem do trenowania umiejętności hackerskich

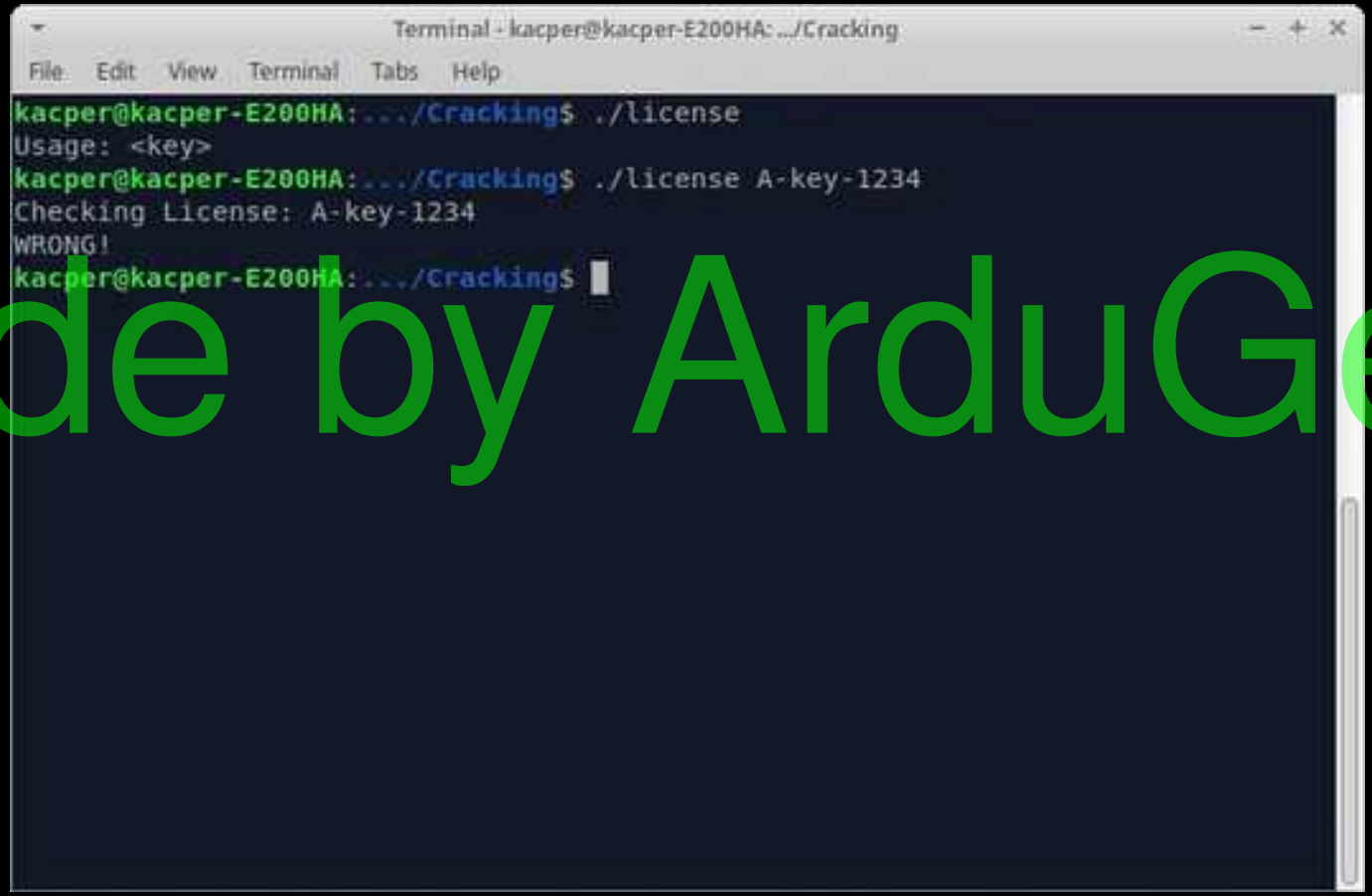
License_key_crack

made by ArduGeek

Środowisko oraz narzędzia

- Kompilator GCC
- Powłoka systemowa Xubuntu 18.04 LTS (bash)
- Debugger GDB

Złamanie prostej skompilowanej aplikacji wymagającej klucza do uruchomienia

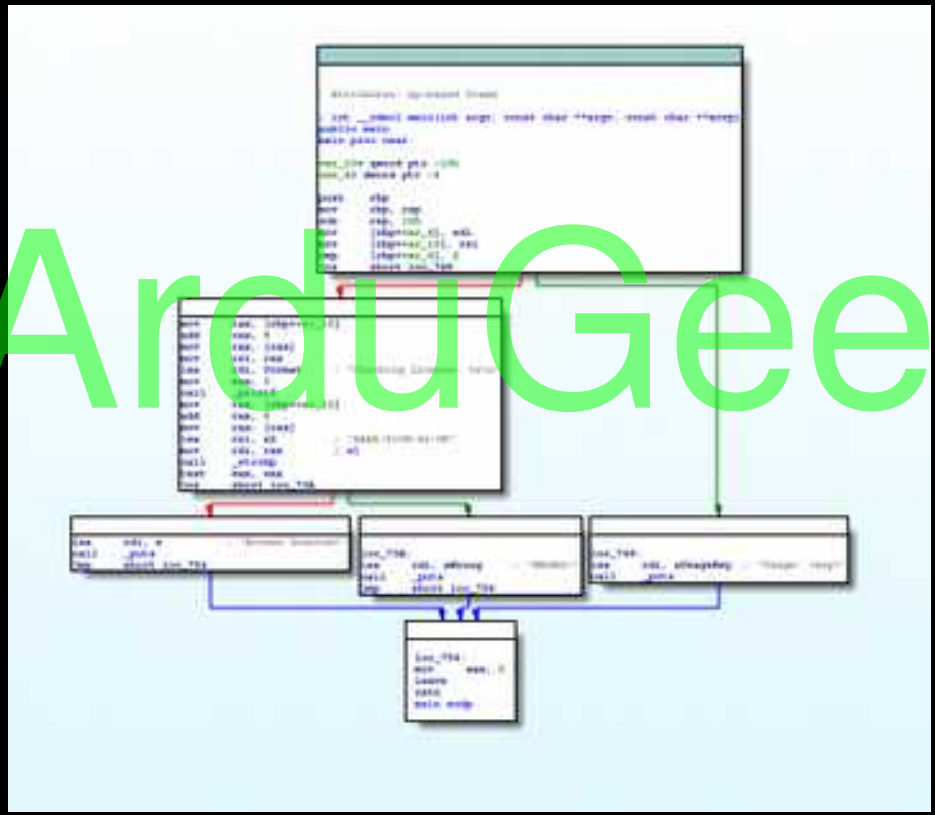


Kod aplikacji

```c
#include <string.h>
#include <stdio.h>

int main(int argc, char *argv[]) {
        if(argc==2) {
        printf("Checking License: %s\n", argv[1]);
        if(strcmp(argv[1], "AAAA-Z10N-42-OK")==0) {
            printf("Access Granted!\n");
        } else {
            printf("WRONG!\n");
        }
    } else {
        printf("Usage: <key>\n");
    }
    return 0;
}
```

Deasemblacja kodu aplikacji

```
Terminal - kacper@k
File  Edit  View  Terminal  Tabs  Help
(gdb) disassemble main
Dump of assembler code for function main:
   0x00000000000006da <+0>:     push   %rbp
   0x00000000000006db <+1>:     mov    %rsp,%rbp
   0x00000000000006de <+4>:     sub    $0x10,%rsp
   0x00000000000006e2 <+8>:     mov    %edi,-0x4(%rbp)
   0x00000000000006e5 <+11>:    mov    %rsi,-0x10(%rbp)
   0x00000000000006e9 <+15>:    cmpl   $0x2,-0x4(%rbp)
   0x00000000000006ed <+19>:    jne    0x748 <main+110>
   0x00000000000006ef <+21>:    mov    -0x10(%rbp),%rax
   0x00000000000006f3 <+25>:    add    $0x8,%rax
   0x00000000000006f7 <+29>:    mov    (%rax),%rax
   0x00000000000006fa <+32>:    mov    %rax,%rsi
   0x00000000000006fd <+35>:    lea    0xe0(%rip),%rdi        # 0x7e4
   0x0000000000000704 <+42>:    mov    $0x0,%eax
   0x0000000000000709 <+47>:    callq  0x5a0 <printf@plt>
   0x000000000000070e <+52>:    mov    -0x10(%rbp),%rax
   0x0000000000000712 <+56>:    add    $0x8,%rax
   0x0000000000000716 <+60>:    mov    (%rax),%rax
   0x0000000000000719 <+63>:    lea    0xda(%rip),%rsi        # 0x7fa
   0x0000000000000720 <+70>:    mov    %rax,%rdi
   0x0000000000000723 <+73>:    callq  0x5b0 <strcmp@plt>
   0x0000000000000728 <+78>:    test   %eax,%eax
   0x000000000000072a <+80>:    jne    0x73a <main+96>
---Type <return> to continue, or q <return> to quit---
   0x000000000000072c <+82>:    lea    0xd7(%rip),%rdi        # 0x80a
   0x0000000000000733 <+89>:    callq  0x590 <puts@plt>
   0x0000000000000738 <+94>:    jmp    0x754 <main+122>
   0x000000000000073a <+96>:    lea    0xd9(%rip),%rdi        # 0x81a
   0x0000000000000741 <+103>:   callq  0x590 <puts@plt>
   0x0000000000000746 <+108>:   jmp    0x754 <main+122>
   0x0000000000000748 <+110>:   lea    0xd2(%rip),%rdi        # 0x821
   0x000000000000074f <+117>:   callq  0x590 <puts@plt>
   0x0000000000000754 <+122>:   mov    $0x0,%eax
   0x0000000000000759 <+127>:   leaveq
   0x000000000000075a <+128>:   retq
End of assembler dump.
(gdb)
```



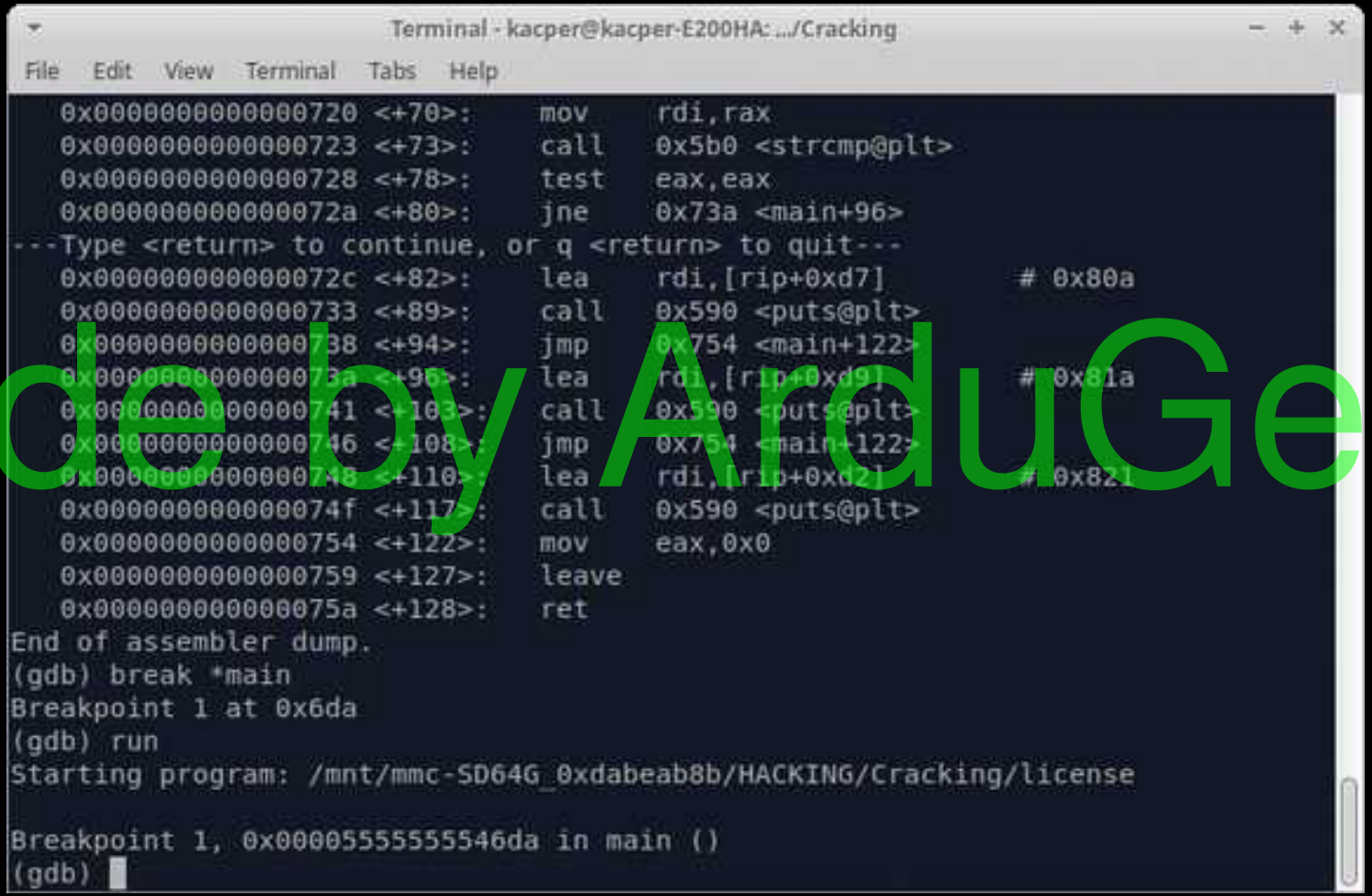
Analiza assemblera

```
(gdb) disassemble main
Dump of assembler code for function main:
   0x00000000000006da <+0>:     push   rbp
   0x00000000000006db <+1>:     mov    rbp,rsp
   0x00000000000006de <+4>:     sub    rsp,0x10
   0x00000000000006e2 <+8>:     mov    DWORD PTR [rbp-0x4],edi
   0x00000000000006e5 <+11>:    mov    QWORD PTR [rbp-0x10],rsi
   0x00000000000006e9 <+15>:    cmp    DWORD PTR [rbp-0x4],0x2
   0x00000000000006ed <+19>:    jne    0x748 <main+110>
   0x00000000000006ef <+21>:    mov    rax,QWORD PTR [rbp-0x10]
   0x00000000000006f3 <+25>:    add    rax,0x8
   0x00000000000006f7 <+29>:    mov    rax,QWORD PTR [rax]
   0x00000000000006fa <+32>:    mov    rsi,rax
   0x00000000000006fd <+35>:    lea    rdi,[rip+0xe0]        # 0x7e4
   0x0000000000000704 <+42>:    mov    eax,0x0
   0x0000000000000709 <+47>:    call   0x5a0 <printf@plt>
   0x000000000000070e <+52>:    mov    rax,QWORD PTR [rbp-0x10]
   0x0000000000000712 <+56>:    add    rax,0x8
   0x0000000000000716 <+60>:    mov    rax,QWORD PTR [rax]
   0x0000000000000719 <+63>:    lea    rsi,[rip+0xda]        # 0x7fa
   0x0000000000000720 <+70>:    mov    rdi,rax
   0x0000000000000723 <+73>:    call   0x5b0 <strcmp@plt>
   0x0000000000000728 <+78>:    test   eax,eax
   0x000000000000072a <+80>:    jne    0x73a <main+96>
---Type <return> to continue, or q <return> to quit---
   0x000000000000072c <+82>:    lea    rdi,[rip+0xd7]        # 0x80a
   0x0000000000000733 <+89>:    call   0x590 <puts@plt>
   0x0000000000000738 <+94>:    jmp    0x754 <main+122>
   0x000000000000073a <+96>:    lea    rdi,[rip+0xd9]        # 0x81a
   0x0000000000000741 <+103>:   call   0x590 <puts@plt>
   0x0000000000000746 <+108>:   jmp    0x754 <main+122>
   0x0000000000000748 <+110>:   lea    rdi,[rip+0xd2]        # 0x821
   0x000000000000074f <+117>:   call   0x590 <puts@plt>
   0x0000000000000754 <+122>:   mov    eax,0x0
   0x0000000000000759 <+127>:   leave
   0x000000000000075a <+128>:   ret
End of assembler dump.
(gdb)
```

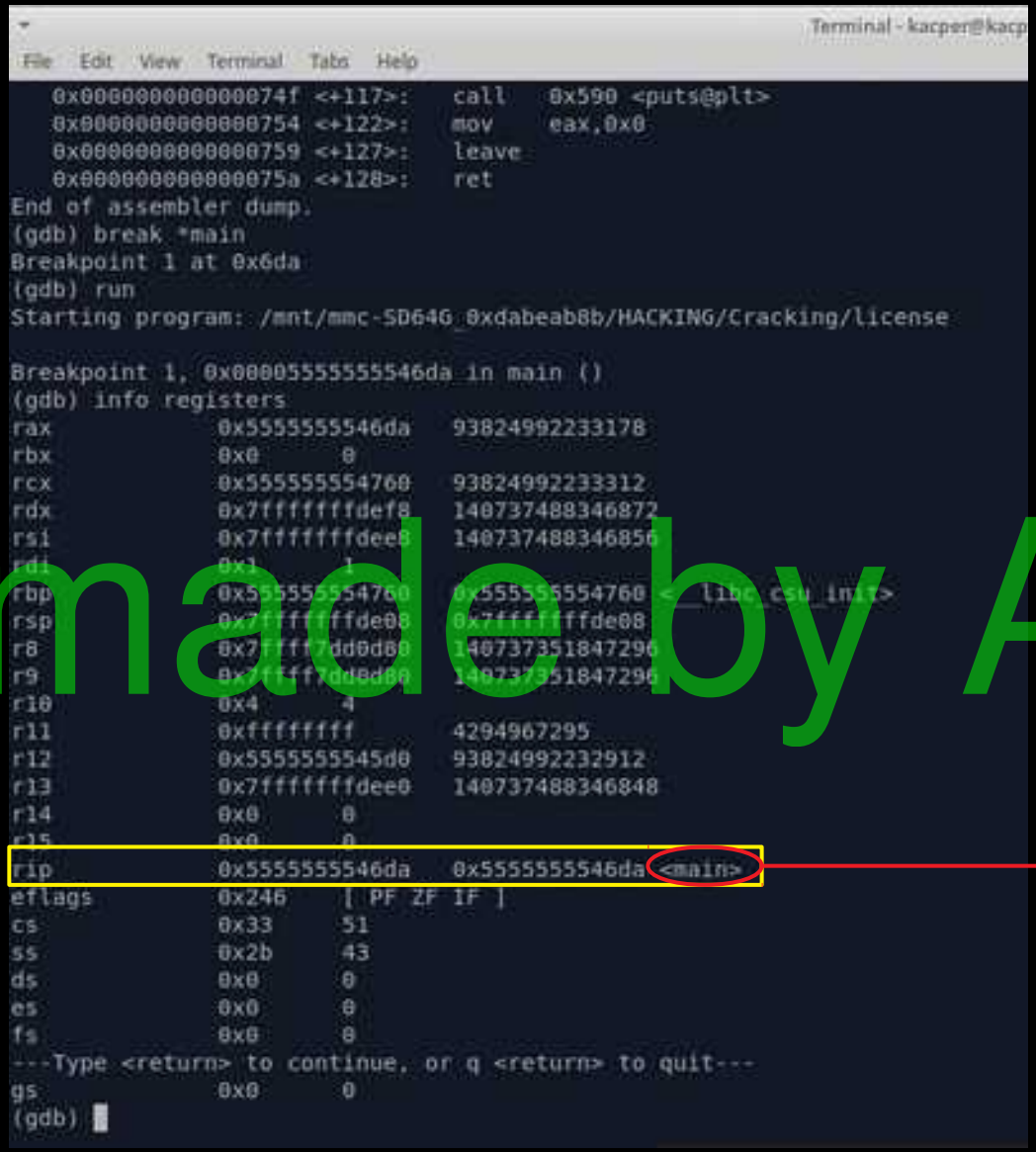
user@host:~$ man strcmp

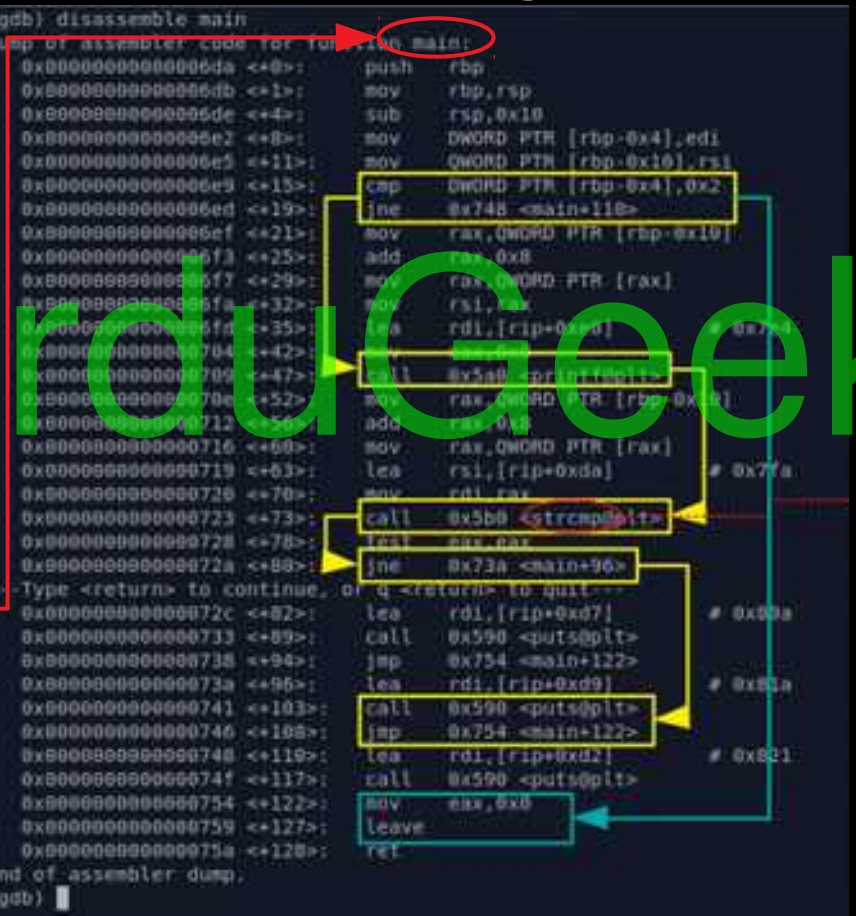
```
STRCMP(3)                  Linux Programmer's Manual                 STRCMP(3)

NAME
       strcmp, strncmp - compare two strings

SYNOPSIS
       #include <string.h>

       int strcmp(const char *s1, const char *s2);

       int strncmp(const char *s1, const char *s2, size_t n);

DESCRIPTION
       The  strcmp()  function compares the two strings s1 and s2.  It returns
       an integer less than, equal to, or greater than zero if  s1  is  found,
       respectively, to be less than, to match, or be greater than s2.

       The  strncmp()  function  is similar, except it compares only the first
       (at most) n bytes of s1 and s2.

RETURN VALUE
       The strcmp() and strncmp() functions return an integer less than, equal
       to, or greater than zero if s1 (or the first n bytes thereof) is found,
Manual page strcmp(3) line 1 (press h for help or q to quit)
```

Ustawienie breakpointu na początku funkcji main

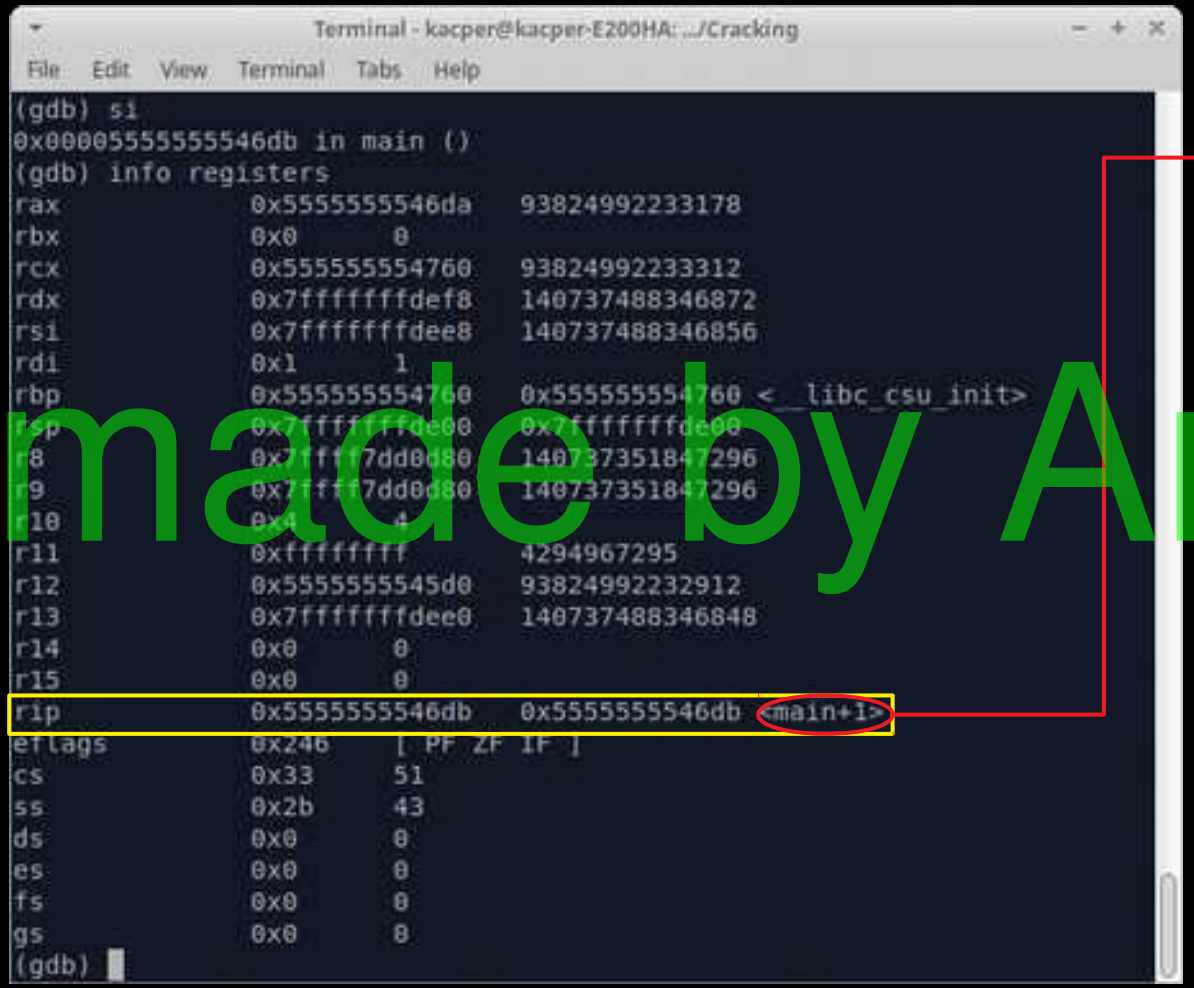


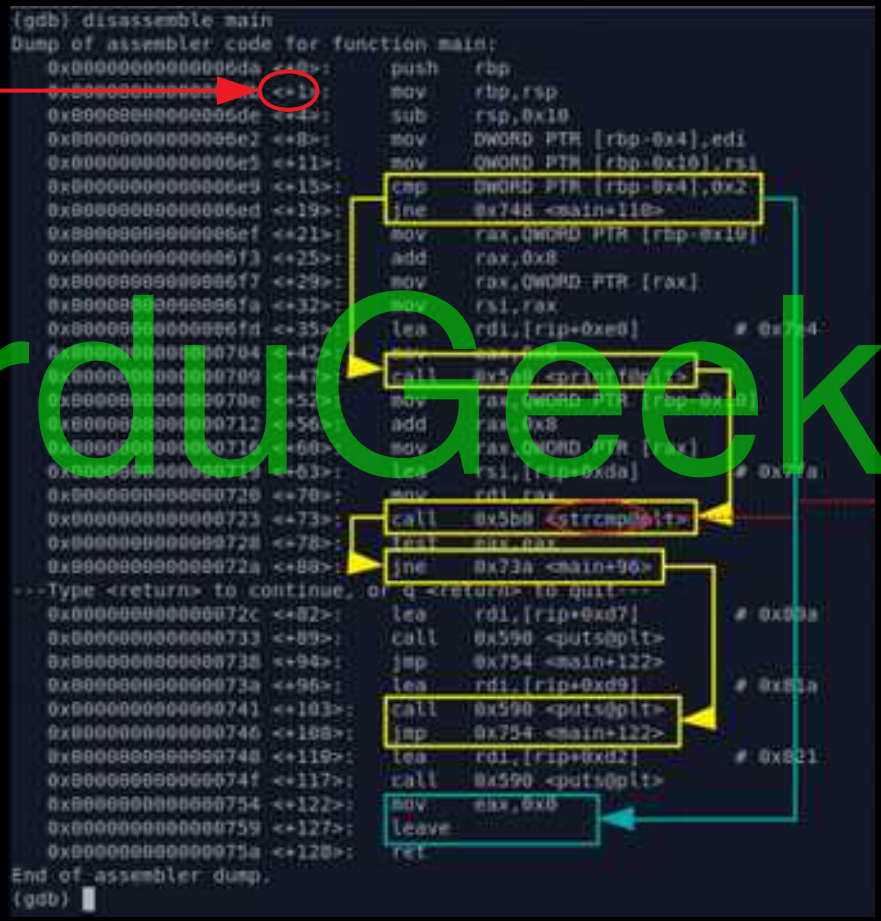
Sprawdzenie wartości rejestrów

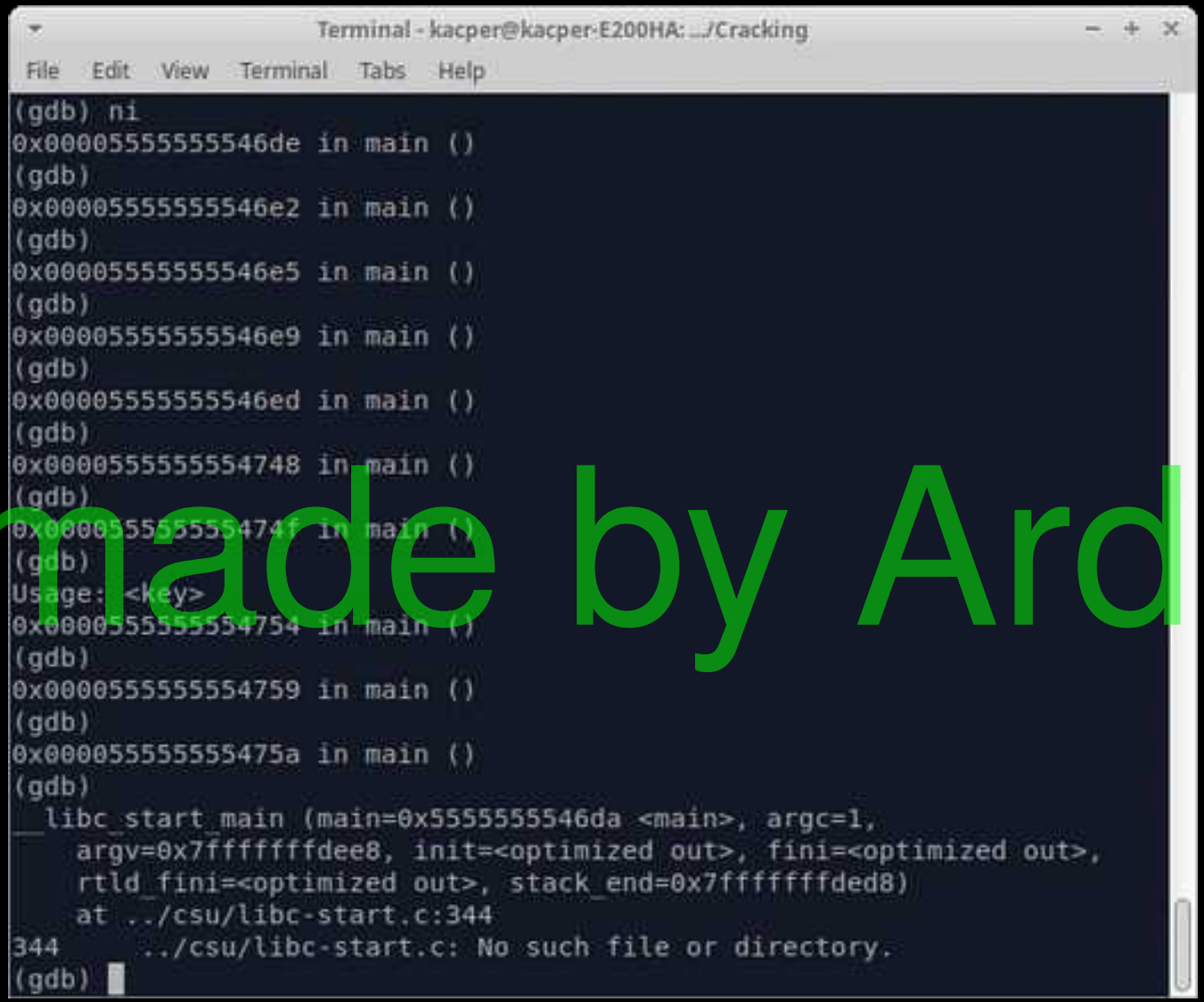




Kilka adresów dalej ...







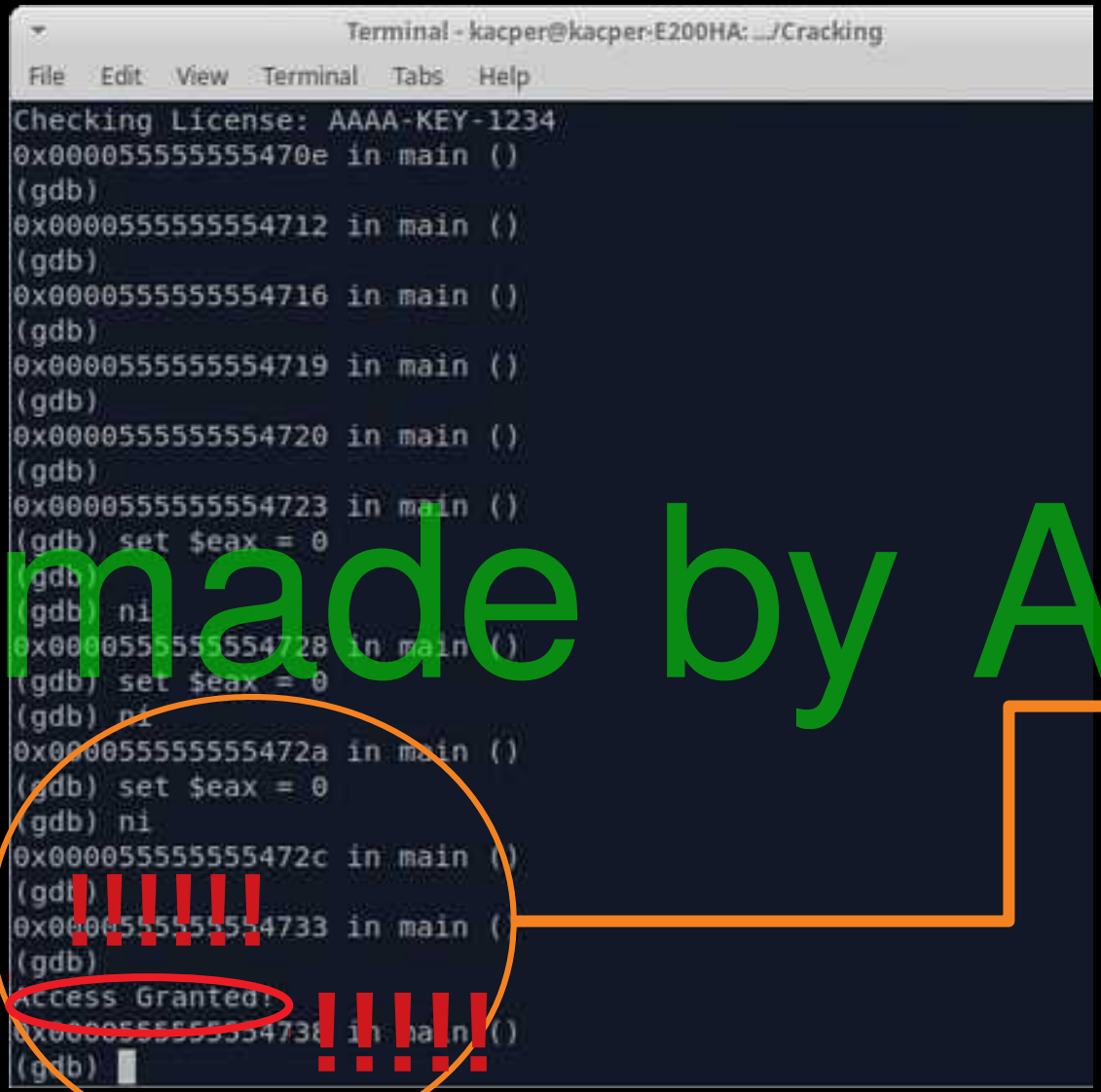
Przejście przez program bez podanego klucza

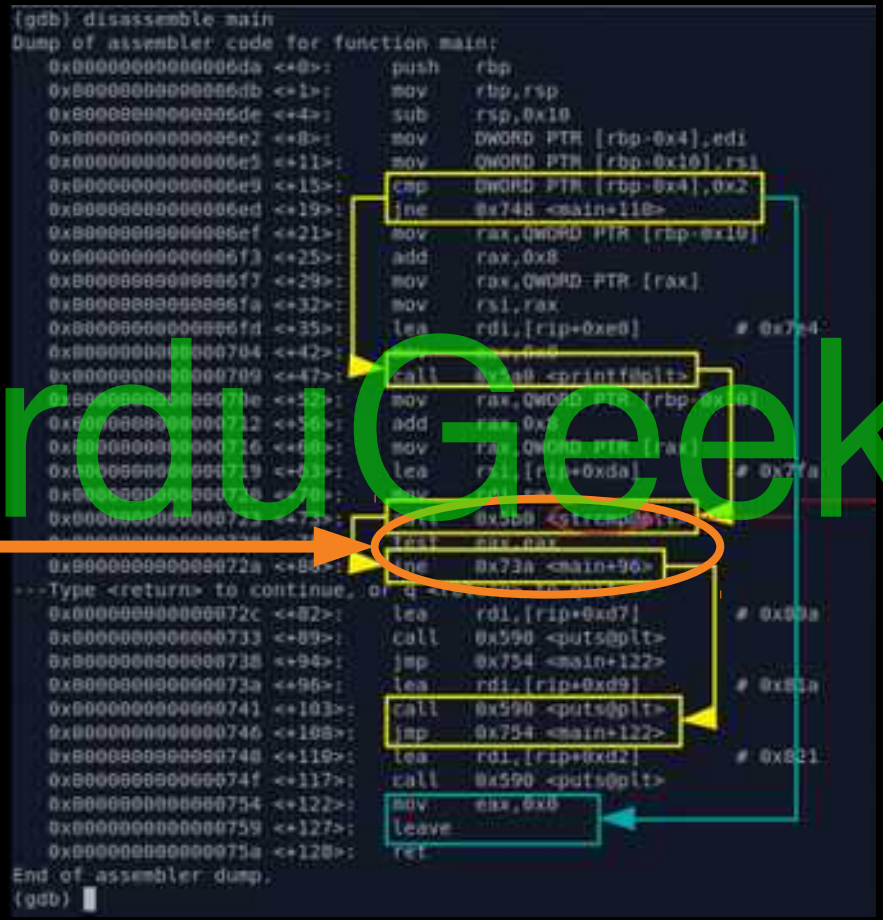
Przejście przez program z losowym kluczem

```
Terminal - kacper@kacper-E200HA: .../Cra
File  Edit  View  Terminal  Tabs  Help
344     ../csu/libc-start.c: No such file or directory.
(gdb) run AAAA-KEY-1234
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /mnt/mmc-SD64G_0xdabeab8b/HACKING/Cracking/license AAAA-KEY-1234

Breakpoint 1, 0x00005555555546da in main ()
(gdb) ni
0x00005555555546db in main ()
(gdb)
0x00005555555546de in main ()
(gdb)
0x00005555555546e2 in main ()
(gdb)
0x00005555555546e5 in main ()
(gdb)
0x00005555555546e9 in main ()
(gdb)
0x00005555555546ed in main ()
(gdb)
0x00005555555546ef in main ()
(gdb)
0x00005555555546f3 in main ()
(gdb)
0x00005555555546f7 in main ()
(gdb)
0x00005555555546fa in main ()
(gdb)
0x00005555555546fd in main ()
(gdb)
0x0000555555554704 in main ()
(gdb)
0x0000555555554709 in main ()
(gdb)
Checking License: AAAA-KEY-1234
0x000055555555470e in main ()
(gdb)
0x0000555555554712 in main ()
(gdb)
```

```
Terminal - kacper
File  Edit  View  Terminal  Tabs  Help
0x0000555555554709 in main ()
(gdb)
Checking License: AAAA-KEY-1234
0x000055555555470e in main ()
(gdb)
0x0000555555554712 in main ()
(gdb)
0x0000555555554716 in main ()
(gdb)
0x0000555555554719 in main ()
(gdb)
0x0000555555554720 in main ()
(gdb)
0x0000555555554723 in main ()
(gdb)
0x0000555555554728 in main ()
(gdb)
0x000055555555472a in main ()
(gdb)
0x000055555555473a in main ()
(gdb)
0x0000555555554741 in main ()
(gdb)
WRONG!
0x0000555555554746 in main ()
(gdb)
0x0000555555554754 in main ()
(gdb)
0x0000555555554759 in main ()
(gdb)
0x000055555555475a in main ()
(gdb)
__libc_start_main (main=0x5555555546da <main>, argc=2,
    argv=0x7fffffffdec8, init=<optimized out>, fini=<optimized out>,
    rtld_fini=<optimized out>, stack_end=0x7fffffffdeb8)
    at ../csu/libc-start.c:344
344     ../csu/libc-start.c: No such file or directory.
(gdb)
```

Złamanie klucza





```
Terminal - kacper@kac
File  Edit  View  Terminal  Tabs  Help
(gdb) disassemble main
Dump of assembler code for function main:
   0x00000000000006da <+0>:     push   rbp
   0x00000000000006db <+1>:     mov    rbp,rsp
   0x00000000000006de <+4>:     sub    rsp,0x10
   0x00000000000006e2 <+8>:     mov    DWORD PTR [rbp-0x4],edi
   0x00000000000006e5 <+11>:    mov    QWORD PTR [rbp-0x10],rsi
   0x00000000000006e9 <+15>:    cmp    DWORD PTR [rbp-0x4],0x2
   0x00000000000006ed <+19>:    jne    0x748 <main+110>
   0x00000000000006ef <+21>:    mov    rax,QWORD PTR [rbp-0x10]
   0x00000000000006f3 <+25>:    add    rax,0x8
   0x00000000000006f7 <+29>:    mov    rax,QWORD PTR [rax]
   0x00000000000006fa <+32>:    mov    rsi,rax
   0x00000000000006fd <+35>:    lea    rdi,[rip+0xe0]        # 0x7e4
   0x0000000000000704 <+42>:    mov    eax,0x0
   0x0000000000000709 <+47>:    call   0x5a0 <printf@plt>
   0x000000000000070e <+52>:    mov    rax,QWORD PTR [rbp-0x10]
   0x0000000000000712 <+56>:    add    rax,0x8
   0x0000000000000716 <+60>:    mov    rax,QWORD PTR [rax]
   0x0000000000000719 <+63>:    lea    rsi,[rip+0xda]        # 0x7fa
   0x0000000000000720 <+70>:    mov    rdi,rax
   0x0000000000000723 <+73>:    call   0x5b0 <__isoc99_sscanf@plt>
   0x0000000000000728 <+78>:    test   eax,eax
   0x000000000000072a <+80>:    jne    0x73a <main+96>
---Type <return> to continue, or q <return> to quit---
   0x000000000000072c <+82>:    lea    rdi,[rip+0xd7]        # 0x80a
   0x0000000000000733 <+89>:    call   0x590 <puts@plt>
   0x0000000000000738 <+94>:    jmp    0x754 <main+122>
   0x000000000000073a <+96>:    lea    rdi,[rip+0xd9]        # 0x81a
   0x0000000000000741 <+103>:   call   0x590 <puts@plt>
   0x0000000000000746 <+108>:   jmp    0x754 <main+122>
   0x0000000000000748 <+110>:   lea    rdi,[rip+0xd2]        # 0x821
   0x000000000000074f <+117>:   call   0x590 <puts@plt>
   0x0000000000000754 <+122>:   mov    eax,0x0
   0x0000000000000759 <+127>:   leave
   0x000000000000075a <+128>:   ret
End of assembler dump.
(gdb)
```

Co się tak naprawdę stało ?

Wave files hacking

made by ArduGeek

Środowisko oraz narzędzia

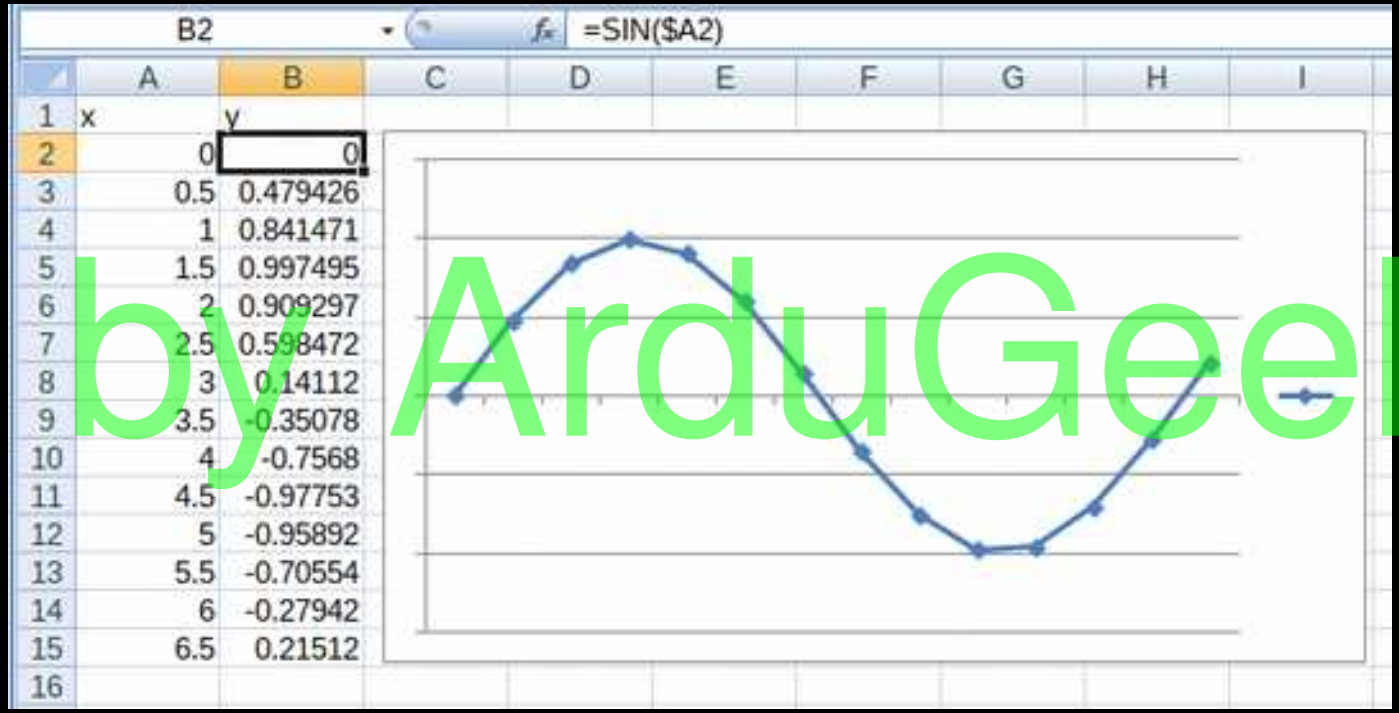
- System Xubuntu 18.04 LTS
- Interpreter Python 3.6

Dodatkowo:

- Arduino UNO
- Oscyloskop Cyfrowy
- Filtr dolnoprzepustowy RC

Parametry pliku .wav

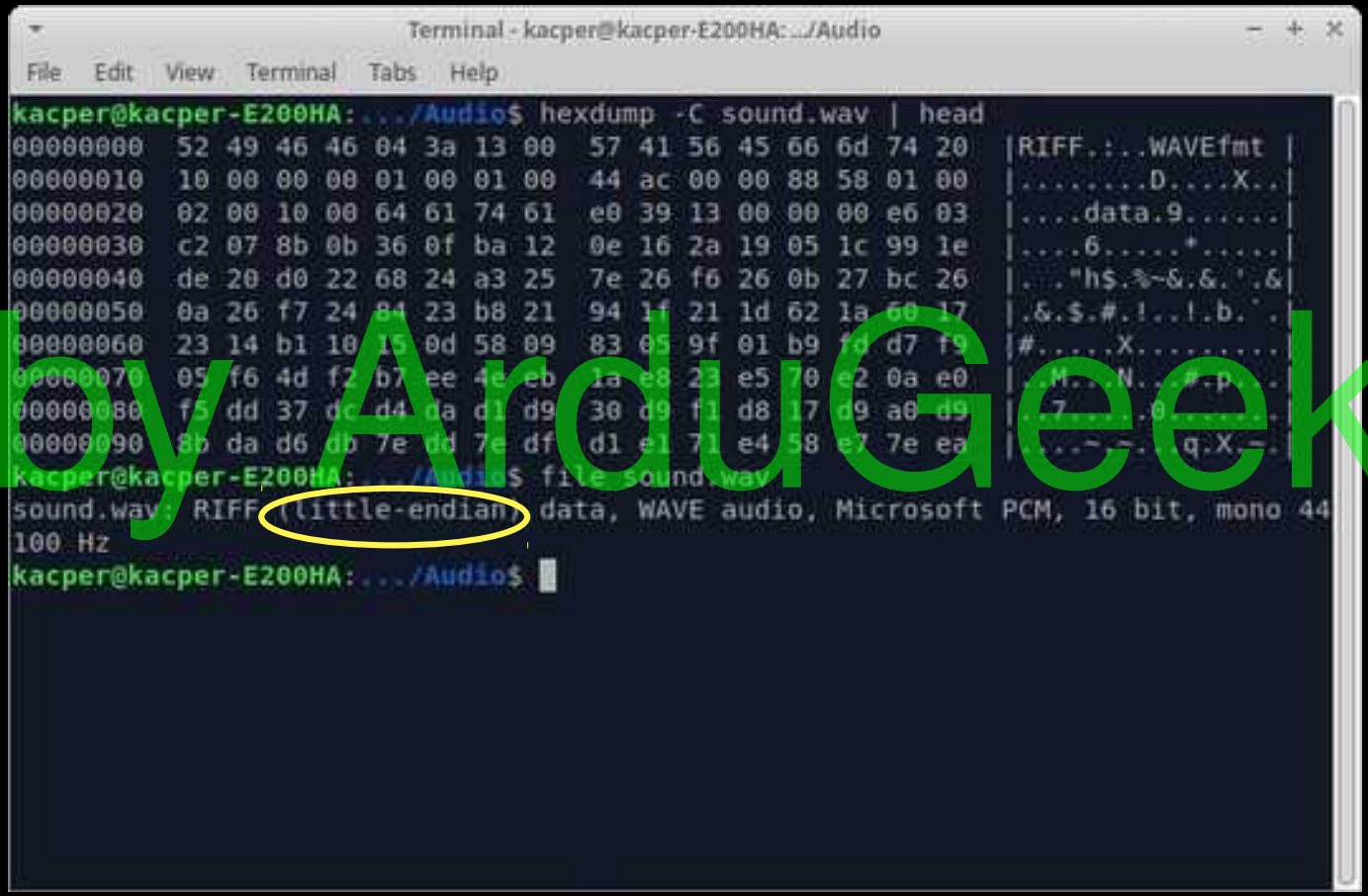
- Bit rate
- Bit depth



Parametry cd.

$13_D = 1011_{BLE}$

$13_D = 1101_{BBE}$



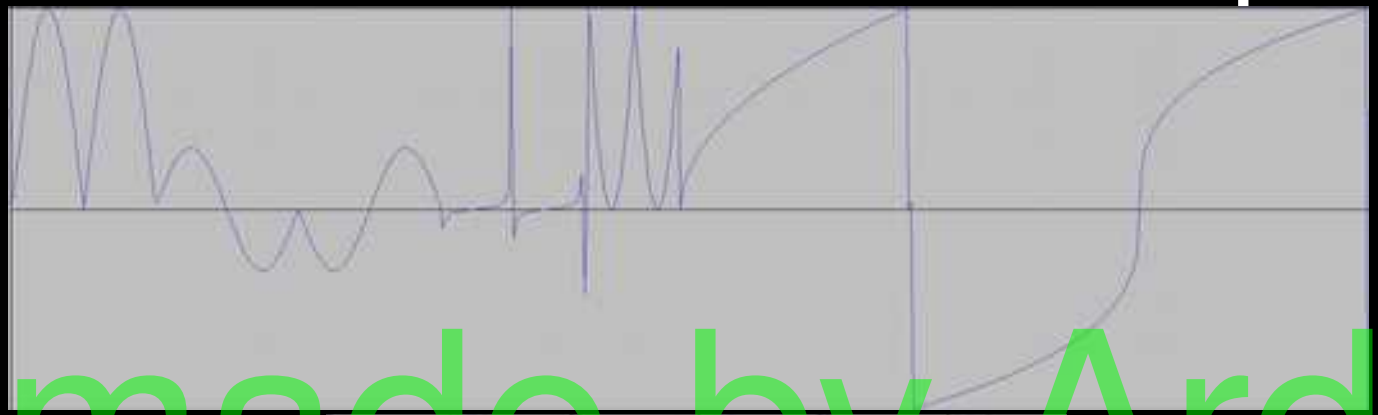
Jak wygenerować plik .wav

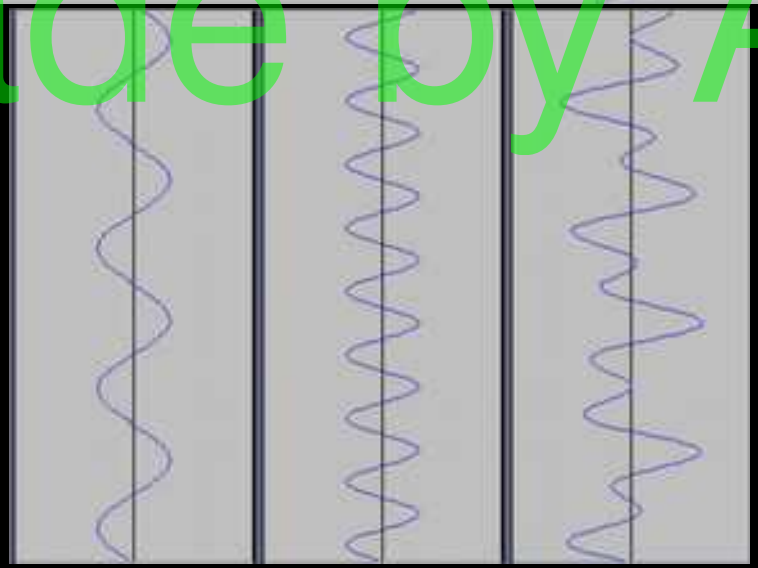
```python
import wave, struct, math, random, numpy
sampleRate = 44100.0
duration = 100.0
frequency = 440.0
obj = wave.open('sound.wav','w')
obj.setnchannels(1) # mono
obj.setsampwidth(2)
obj.setframerate(sampleRate)
audio = []
math_sine = []
values = numpy.arange(0, 6.28, 0.1)
for d in values:
    var1 = int(10000*numpy.sin(d))
    math_sine.append(var1)
for a in range(10000):
    for b in math_sine:
        audio.append(b)
for c in audio:
    data = struct.pack('<h', c)
    obj.writeframesraw( data )
obj.close()
```

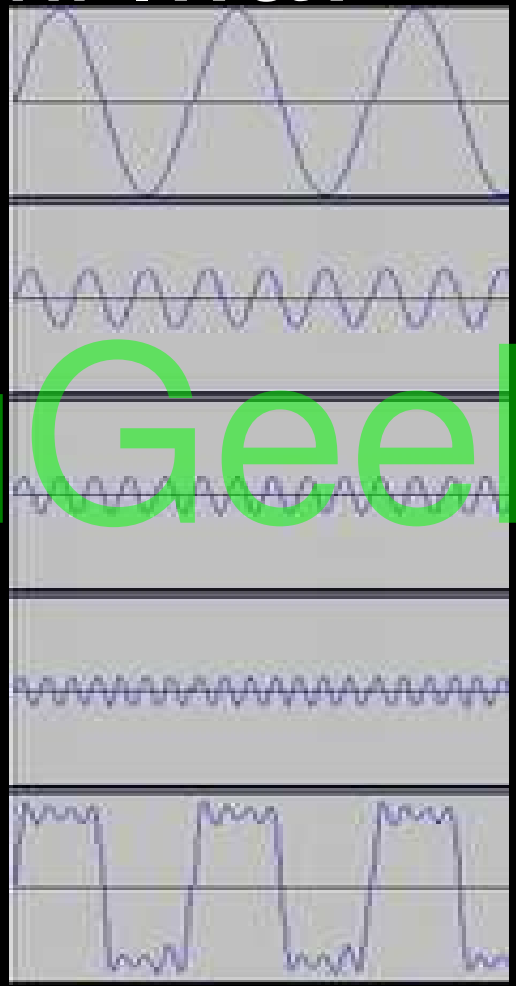
2^{16}=65536
65536/2 = 32768
Bit depth = (-32768, 32768)

0
998
1986
2955
3894
4794
5646
6442
7173
7833
8414
8912
9320
9635
9854
9974
9995
9916
9738
9463
9092
8632
8084
7457
6754
5984
5155
4273
3349
2392
1411
415
-583
-1577
-2555
-3507
-4425
-5298
-6118
-6877
-7568
-8182
-8715
-9161
-9516
-9775
-9936
-9999
-9961
-9824
-9589
-9258
-8834
-8322
-7727
-7055
-6312
-5506
-4646
-3738
-2794
-1821
-830

Inne ciekawostki z plikami .wav



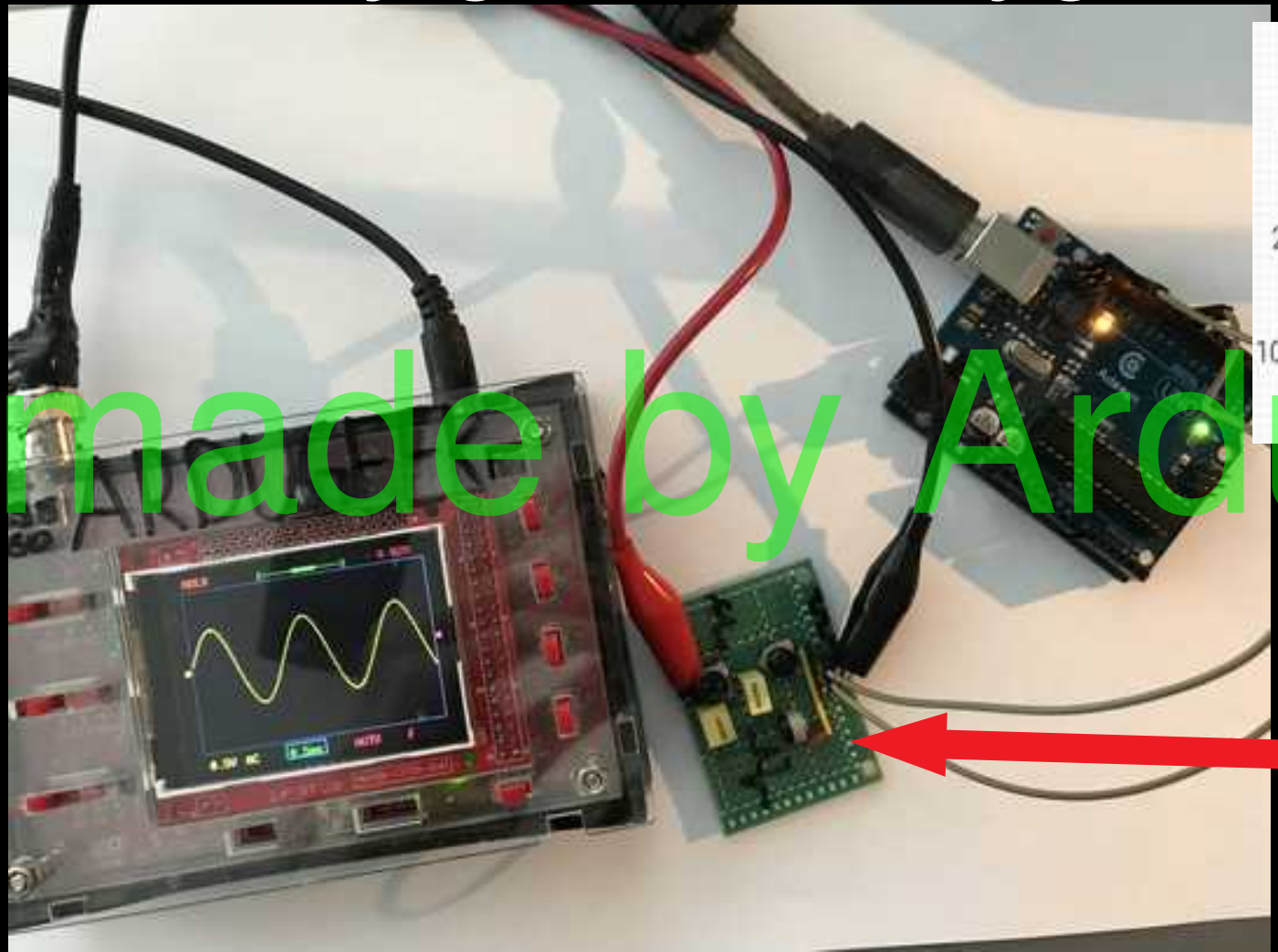


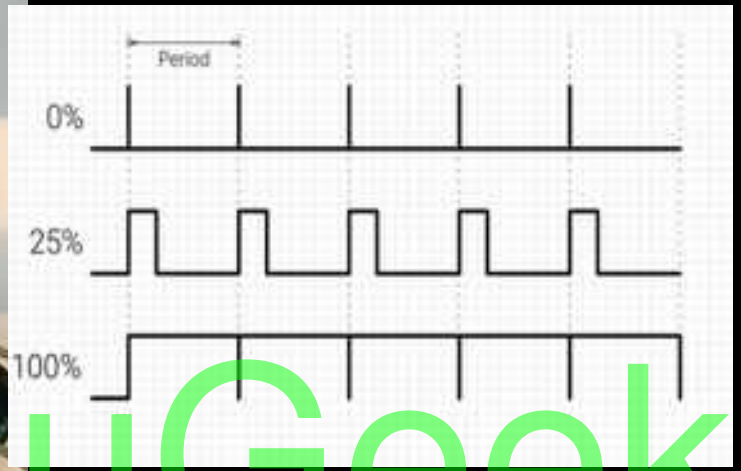


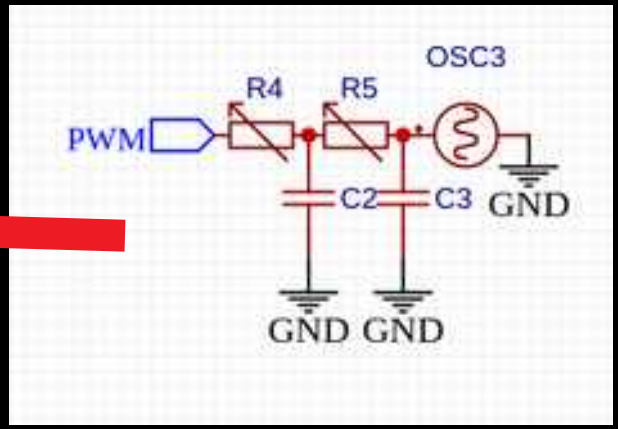
Do czego to może służyć

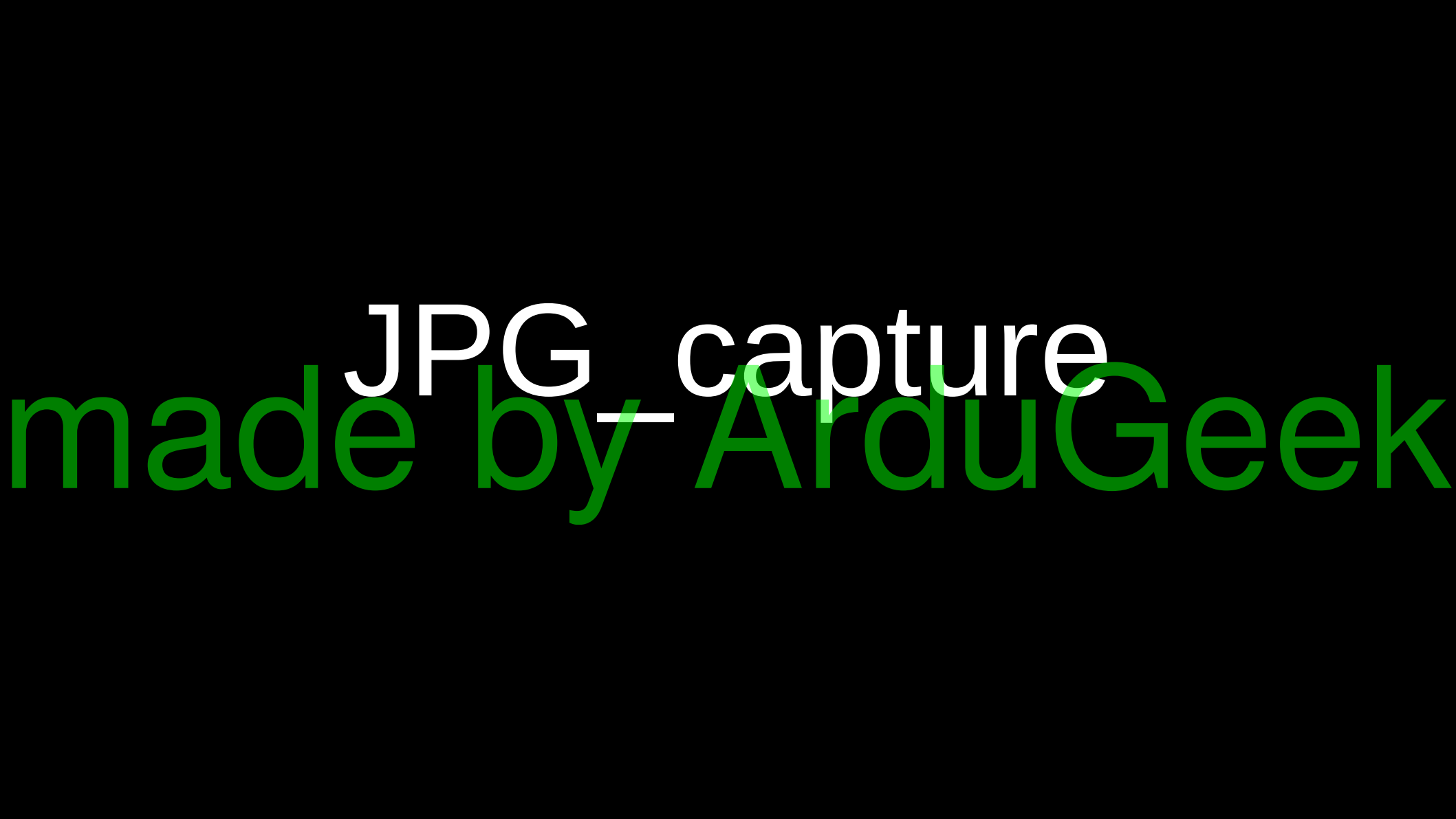
- Możemy tą metodą spreparować sygnał cyfrowy:
  - Przy pomocy wzmacniacza I anteny wemitować go zakłucając lub uzyskując porządaną łączność
  - Przy pomocy arduino odtwarzać ten sygnał z karty microSD i wprowadzić go do danego układu uzyskując porządany efekt

Prosty generator sygnałów z arduino





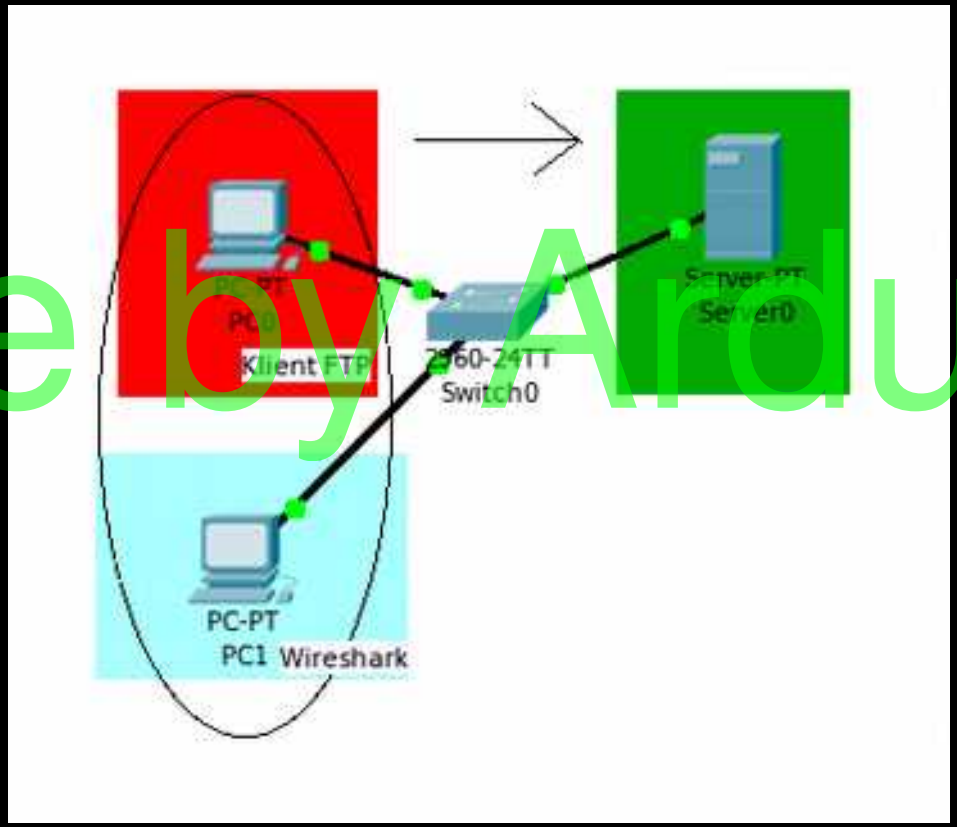



JPG_capture
made by ArduGeek

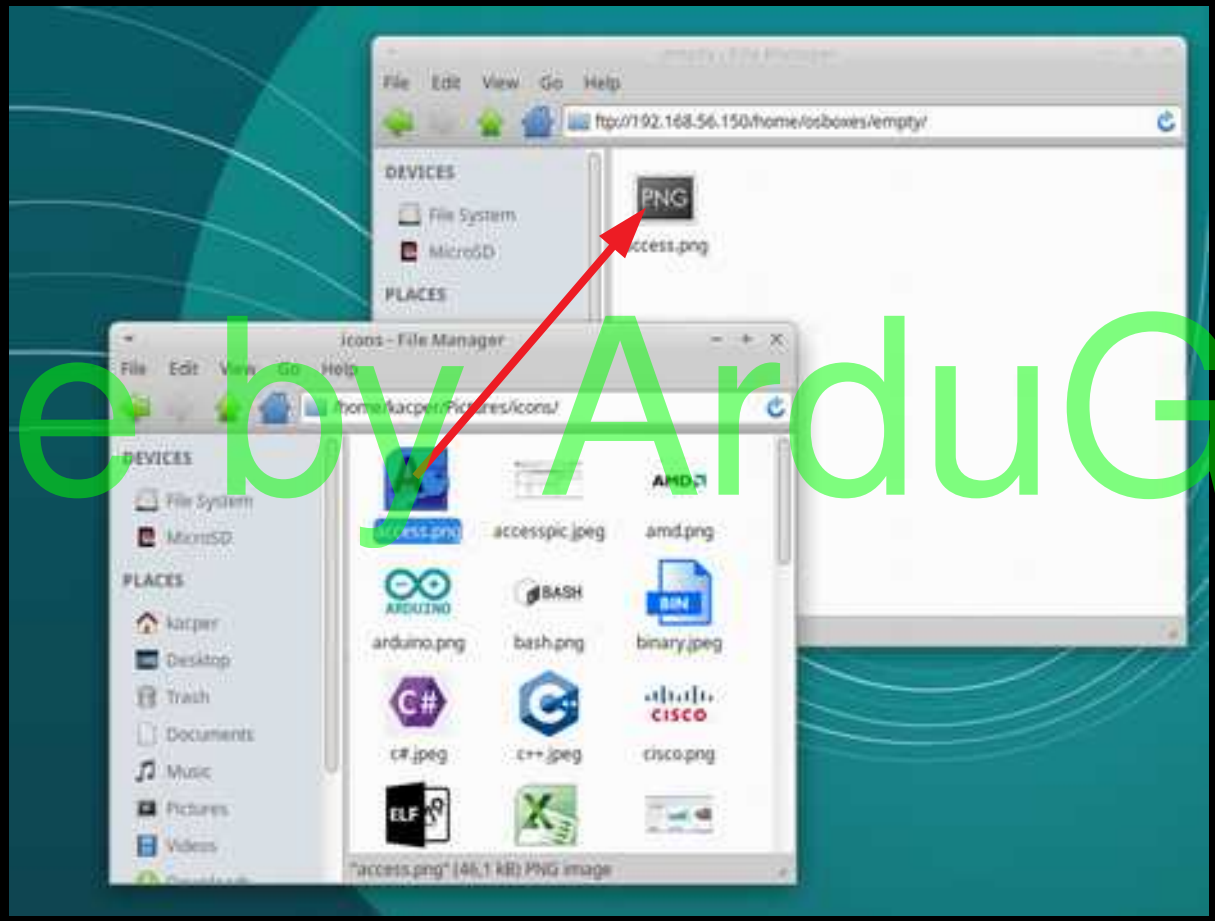
Środowisko oraz narzędzia

- Maszyna wirtualna Ubuntu Server 18.04 LTS z skonfigurowanym serwerem FTP, oraz statycznym adresem IP 192.168.56.150/24
- System Xubuntu 18.04. LTS
- Oprogramowanie wireshark
- Menedżer plików Thunar

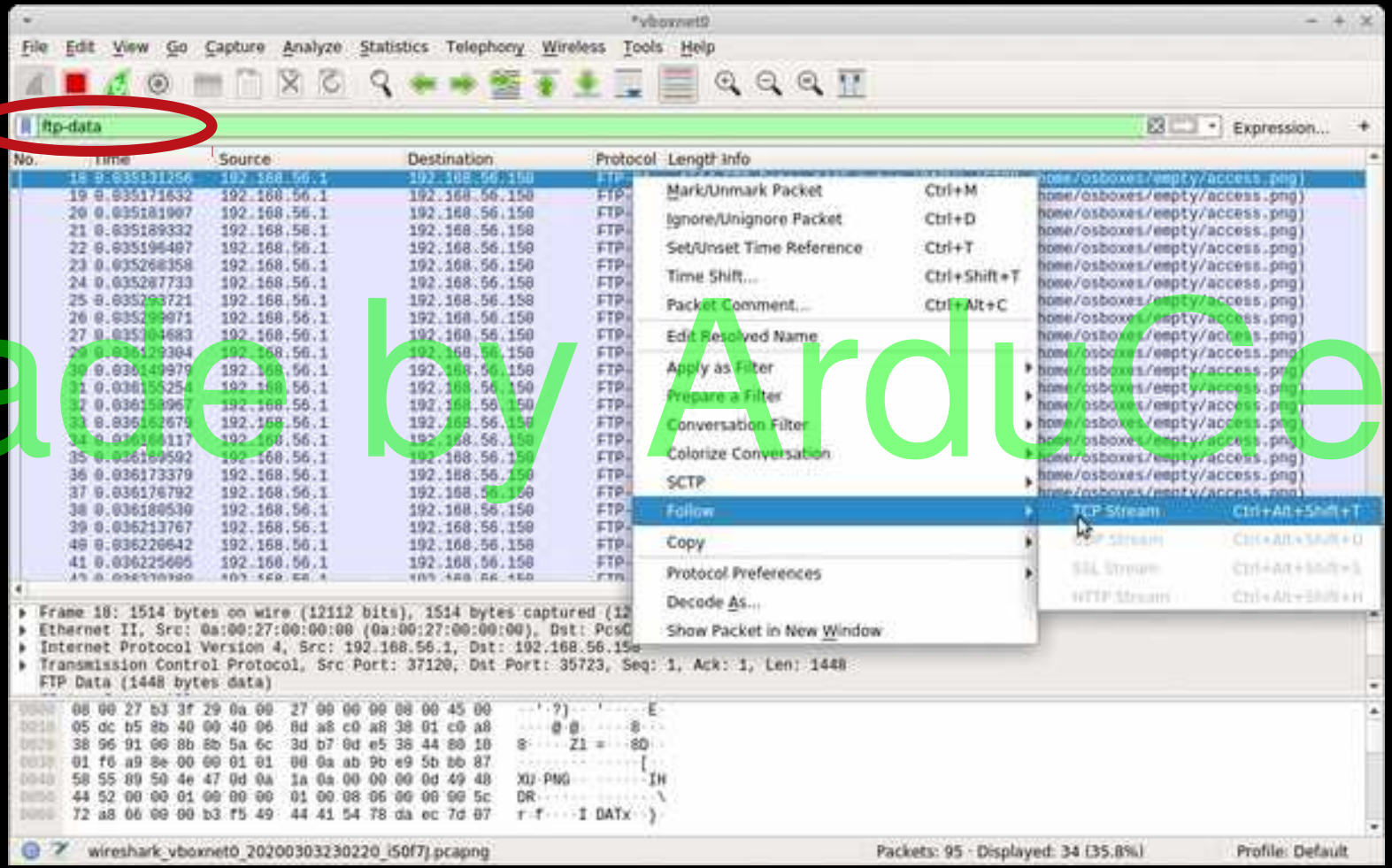
Przechwycenie pliku przesyłanego w źle/słabo skonfigurowanej sieci



PC0

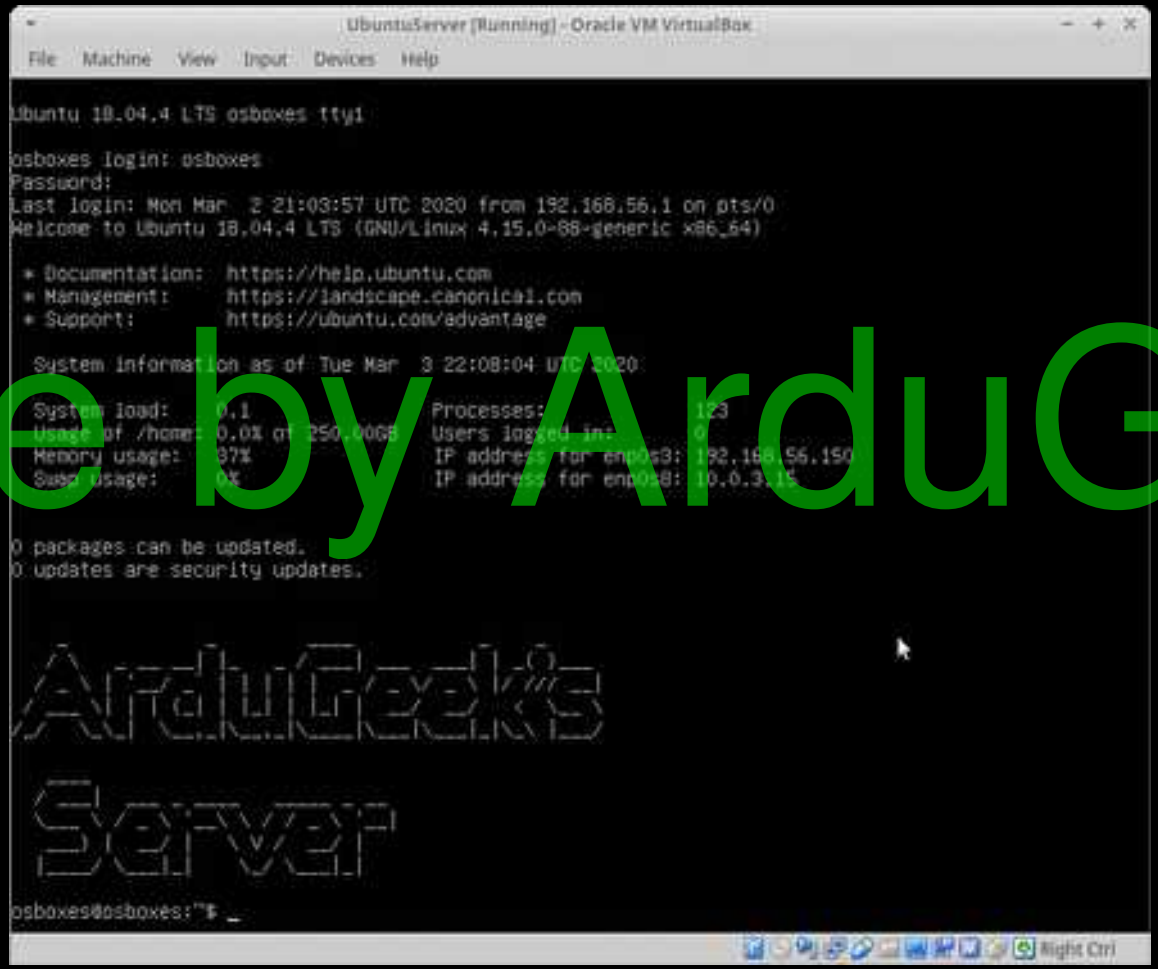


PC1



PC1 cd.

Server0



Wynik

- Przechwycone dane zapisane pod rozszerzeniem .jpg, będą widoczne jako

Portable lab

made by ArduGeek

Środowisko oraz narzędzia

- Karta microSD z raspbianem lite (odmiana Debian GNU/Linux)
- Mikrokomputer raspberry pi

Hardware

Jakie funkcje mogą być przydatne?

- Server ssh
- Server FTP
- Server http
- Server mysql
- Aplikacja phpMyAdmin

Podłączenie do raspberry pi

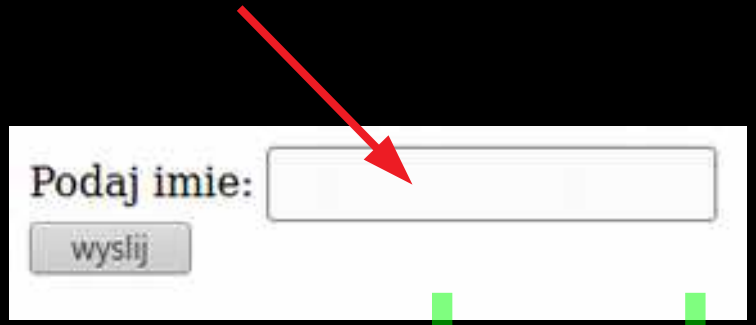
Skonfigurowane usługi

```
kacper@kacper-E200HA:~$ nmap 192.168.1.170

Starting Nmap 7.60 ( https://nmap.org ) at 2020-03-06 20:42 CET
Nmap scan report for 192.168.1.170
Host is up (0.0047s latency).
Not shown: 996 closed ports
PORT   STATE SERVICE
21/tcp open  ftp
22/tcp open  ssh
53/tcp open  domain
80/tcp open  http

Nmap done: 1 IP address (1 host up) scanned in 19.88 seconds
kacper@kacper-E200HA:~$
```

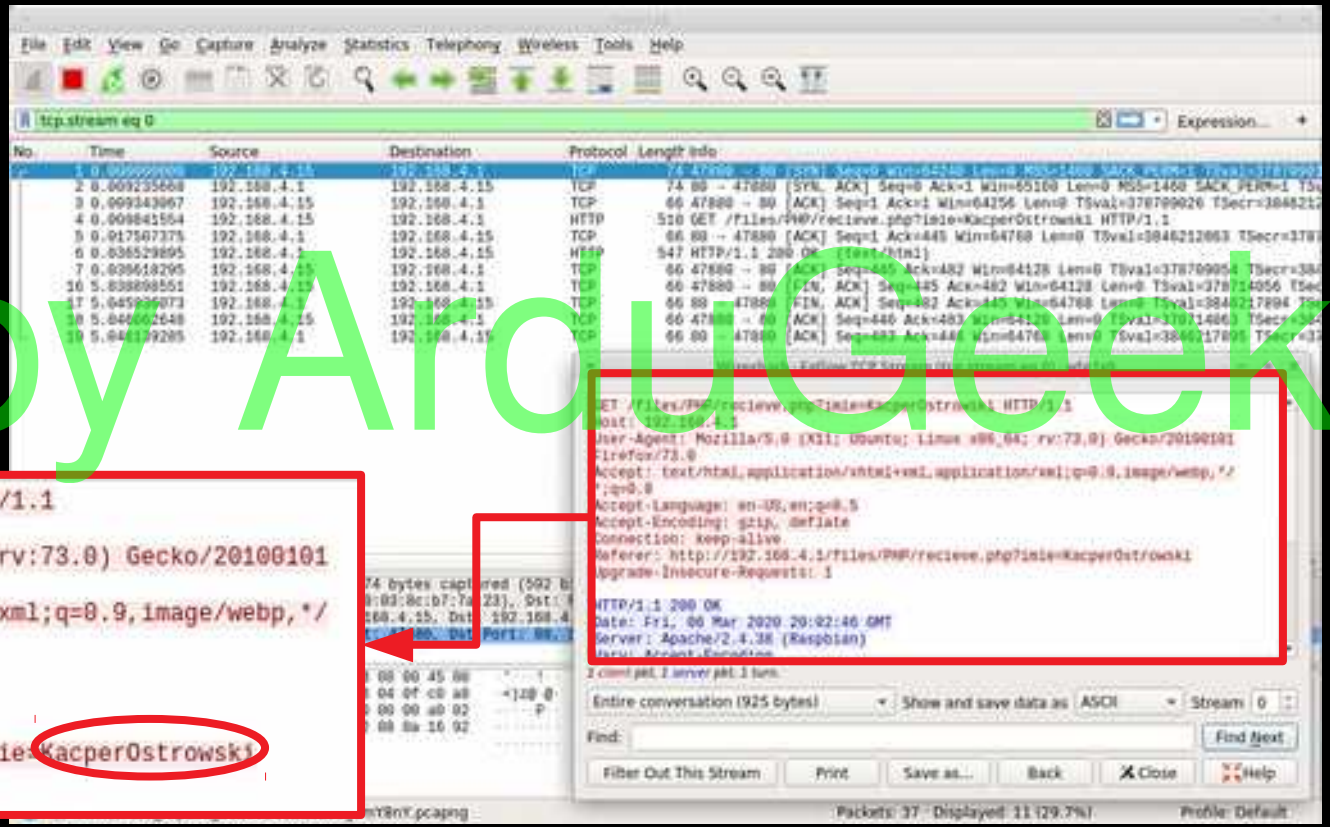
Do jakich testów może się przydać Portable_lab

- Testy aplikacji webowych
- Testy bazy danych
- Przechwytywanie danych przesyłanych w sieci stworzonej przez Portable_lab
- Ćwiczenie umiejętności programowania (aplikacji klienckich dla serwera)

Przechwycenie danych z nie zabezpieczonego formularza napisanego w jezyku PHP




```
GET /files/PHP/recieve.php?imie=KacperOstrowski HTTP/1.1
Host: 192.168.4.1
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:73.0) Gecko/20100101
Firefox/73.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/
*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Connection: keep-alive
Referer: http://192.168.4.1/files/PHP/recieve.php?imie=KacperOstrowski
Upgrade-Insecure-Requests: 1
```

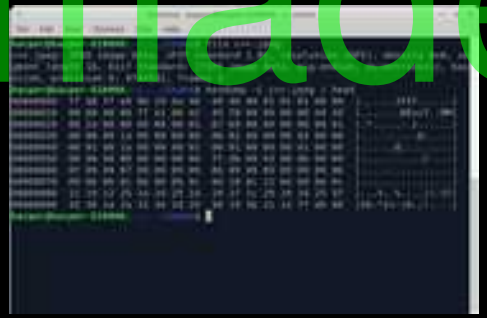


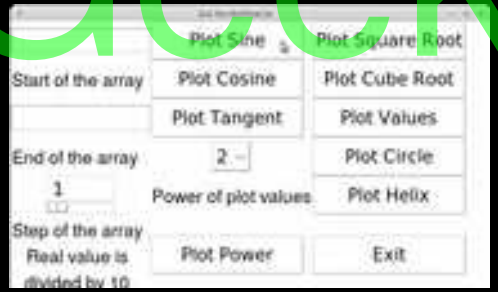
Prezentacja jest dostępna na stronie:

www.ardUgeek.pl

Pod zakładką Polish Site

Koło naukowe
Łączność bez Zakłóceń





Dziękuję za Uwagę

I zapraszam na moją stronę www.ardugeek.pl