Practical 6: Password Cracking and Attacks

Objectives: By the end of this practical exercise, students should be able to:

- ~~Setup and use virtual machines.~~
- ~~Know the usage of integrity check program such as FCIV.~~
- Store passwords in Safe Document.
- Install password cracking program.
- Use rainbow tables to crack hashed passwords.
- Understand the importance of strong passwords.

Instructions: Write your answers in the spaces provided.

Please also down the Practical 6 from BrightSpace. Practical 6 is using Windows XP, and you may want to explore it.

Important : Disable Windows defender

A. Windows Certutil

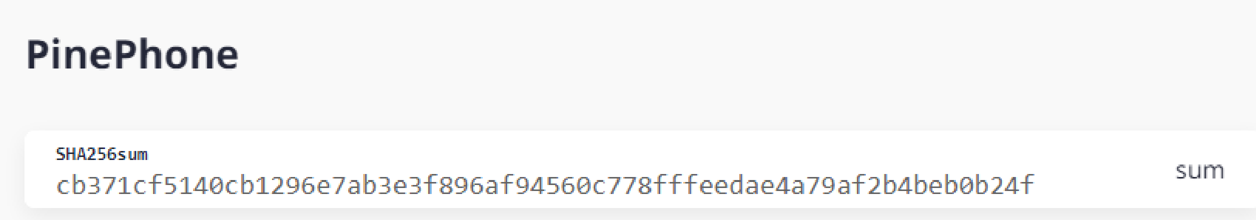
Using certutil to hash files.

https://www.mcbsys.com/blog/2017/03/use-certutil-to-get-file-hash/

1. Download PinePhone; https://www.kali.org/get-kali/#kali-mobile

   You may download any files you like provided there is CRC checksum for the file; Hashing.

2. **Take Noted of the file checksum; SHA256sum -- cb371cf5140cb1296e7ab3e3f896af94560c778fffeedae4a79af2b4beb0b24f**

3. 

   PinePhone

   SHA256sum

   cb371cf5140cb1296e7ab3e3f896af94560c778fffeedae4a79af2b4beb0b24f

4. Go to your folder where PinePhone is downloaded.

5. C:\Users\admin\Downloads>certutil -hashfile nethunterpro-2023.2-pinephone-phosh.img.tar.xz sha256

6. Note down the hash value produced by the "certutil" command line tool.

```
C:\Users\admin\Downloads>certutil -hashfile nethunterpro-2023.4-pinephone-phosh.img.tar.xz sha256
SHA256 hash of nethunterpro-2023.4-pinephone-phosh.img.tar.xz:
8004ce925753d8e502af631dcd8d93d16dbedc60e87eb910b3a4d1e8c520840c
CertUtil: -hashfile command completed successfully.
```

____

7. Now, compare it with the integrity check value on Question A2

8. What is your observation?

____

The file has been tampered with and it's a different hash

____

9. What is your conclusion?

I learned how to check if the file has been tampered with, and how it works

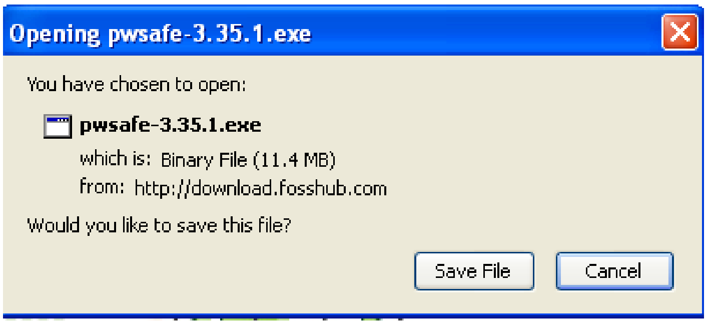
https://www.okta.com/identity-101/hashing-algorithms/

MD5: 72b003ba1a806c3f94026568ad5c5933
SHA-256: f6bf870a2a5bb6d26ddbeda8e903f3867f729785a36f89bfae896776777d50af

B. Store Passwords in Safe Document

Note: Because of the difficulty in remembering strong passwords, you can store all password list in a single "strong" encrypted document.

1. Google **pwsafe,** download and install.
   The version you see below may be different from yours.



Opening pwsafe-3.35.1.exe

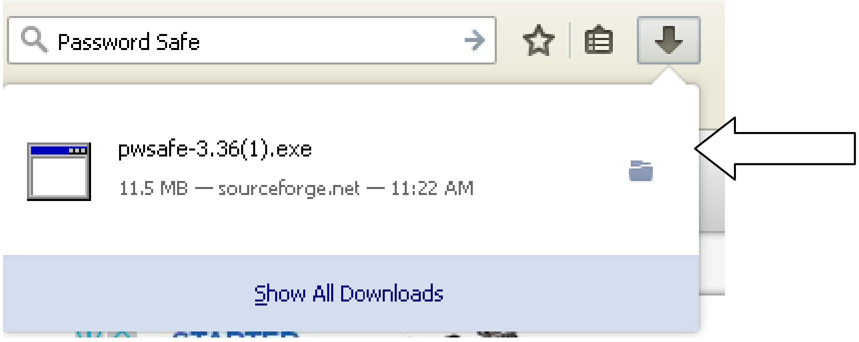
You have chosen to open:

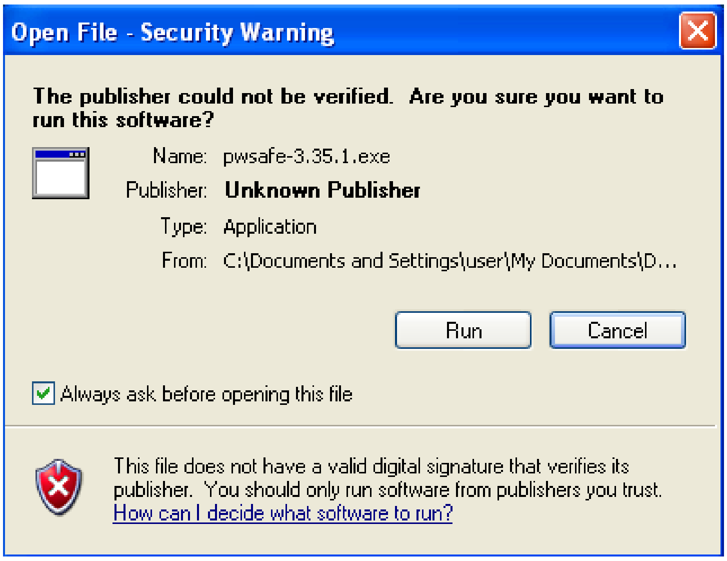
pwsafe-3.35.1.exe

which is: Binary File (11.4 MB)
from: http://download.fosshub.com

Would you like to save this file?

When the file is downloaded, click on the downloaded file to install it.





The publisher could not be verified. Are you sure you want to run this software?

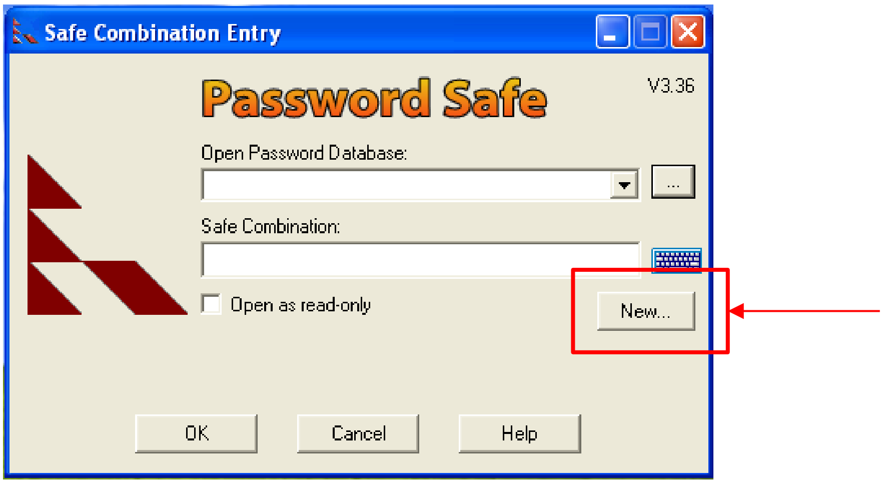
Name: pwsafe-3.35.1.exe
Publisher: Unknown Publisher
Type: Application
From: C:\Documents and Settings\user\My Documents\D...

☑ Always ask before opening this file

This file does not have a valid digital signature that verifies its publisher. You should only run software from publishers you trust. How can I decide what software to run?

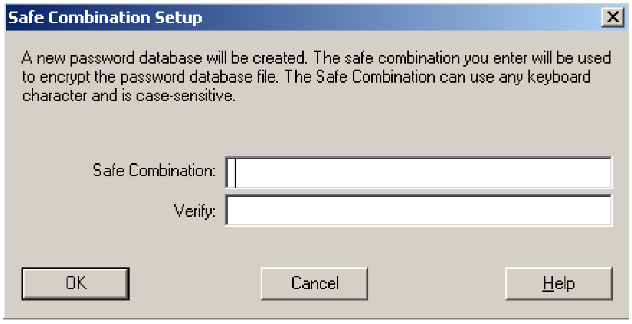
Click on “Run” button and follow the instructions to install this program on your computer with default settings.

Double-click the Password Safe desktop icon to start Password Safe.



Click **Create new database**. Save it using a filename of your choice.

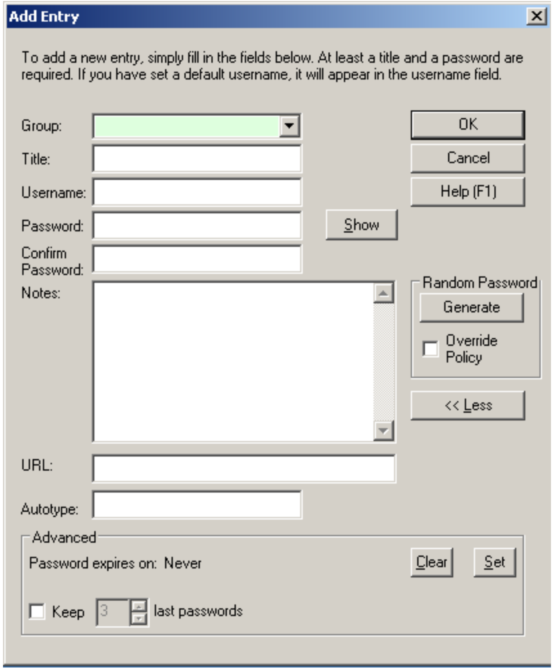
Enter a strong password for **Safe Combination**. The password must have upper and lowercase letters and at least one digit or character of punctuation. Re-entering of password is under **Verify**. Click **OK**.



A new password database will be created. The safe combination you enter will be used to encrypt the password database file. The Safe Combination can use any keyboard character and is case-sensitive.

Now you can add your passwords to the database. Click **Edit** and **Add Entry**. Fill in the blanks for title, username and password for accounts that you use regularly. **Group** and **Notes** are optional entries. Note that the password may appear in clear text when you enter it. Click **OK.**

Try to create an entry for your personal email, bank accounts, etc.



To add a new entry, simply fill in the fields below. At least a title and a password are required. If you have set a default username, it will appear in the username field.

Password expires on: Never

Note: As you may have downloaded a later version of Password Safe, the user interface may not look exactly like the one shown here.

Click **File** and then click **Exit**.

Start **Password Safe** again. Enter your safe combination.

Double-click the entry you have created. Your password is now added to the Windows Clipboard. You can paste the password into the **Password** line whenever you access the account to which it corresponds. The password will be cleared from the Clipboard when Password Safe is closed.

You may try to paste the password into the password field of your account (for e.g. your personal email account, bank account etc.).

Close the Password Safe.

Part III

A. Use Rainbow Tables for Cracking Hashed Password

Although brute force and dictionary attacks were once the primary tools to crack an encrypted password, today rainbow tables are more frequently used. In this exercise, you will download and install Ophcrack, an open-source password cracker program that uses rainbow tables.

https://en.wikipedia.org/wiki/Rainbow_table

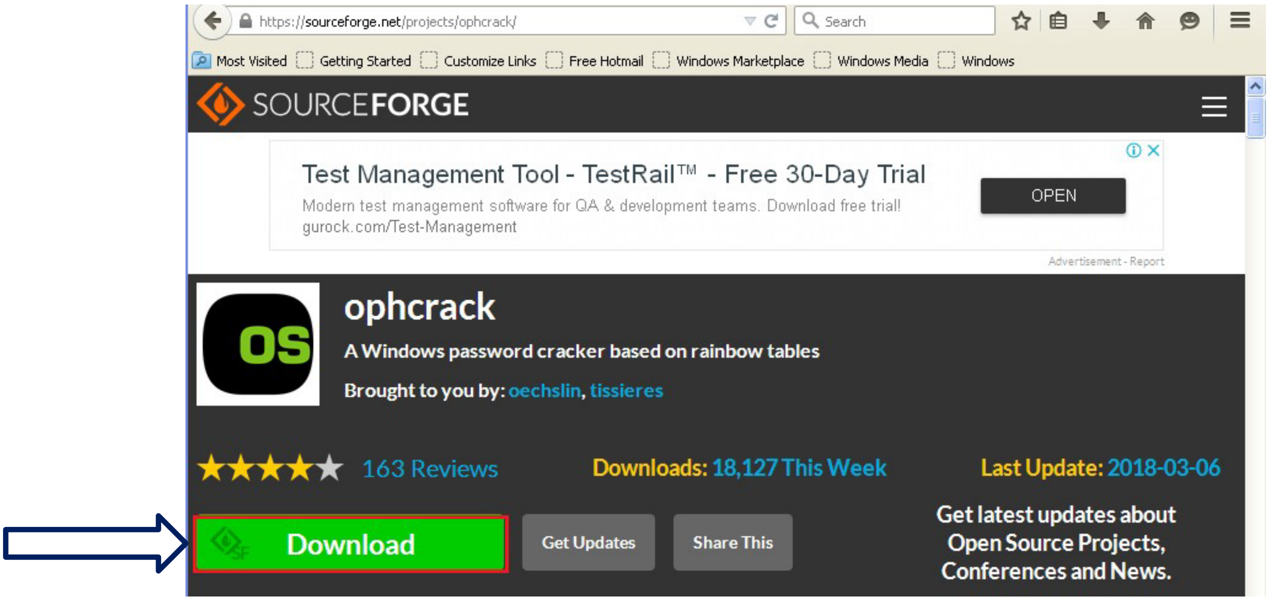
A rainbow table is a precomputed table for caching the outputs of a cryptographic hash function, usually for cracking password hashes. Passwords are typically stored not in plain text form, but as hash values. If such a database of hashed passwords falls into the hands of an attacker, they can use a precomputed rainbow table to recover the plaintext passwords.

Note: **This program should never be used to attempt to crack the password of a valid account.**

1. Open your FireFox web browser and enter the URL **http://sourceforge.net/projects/ophcrack/**

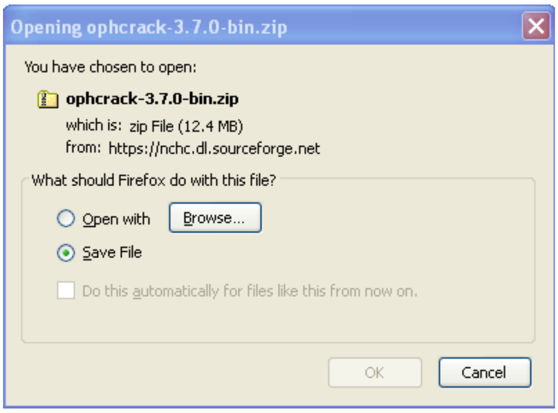
Note: The location of content on the Internet such as this program may change without warning. If you are no longer able to access the program through the above URL, then use a search engine like Google (www.google.com) and search for "Ophcrack".

***** You may need to turn off your anti-virus software running this on your host machine. You should not face any problems downloading/executing Ophcrack, perform the steps in virtualised environment *****


https://sourceforge.net/projects/ophcrack/
Search
Most Visited
Getting Started
Customize Links
Free Hotmail
Windows Marketplace
Windows Media
Windows
SOURCEFORGE
Test Management Tool - TestRail™ - Free 30-Day Trial
Modern test management software for QA & development teams. Download free trial!
gurock.com/Test-Management
OPEN
Advertisement - Report
ophcrack
A Windows password cracker based on rainbow tables
Brought to you by: oechslin, tissieres
163 Reviews
Downloads: 18,127 This Week
Last Update: 2018-03-06
Download
Get Updates
Share This
Get latest updates about Open Source Projects, Conferences and News.

2. Click to download the Ophcrack password crack program and save the compressed file

ophcrack-3.7.0-bin.zip in the Documents download area.



Opening ophcrack-3.7.0-bin.zip

You have chosen to open:

ophcrack-3.7.0-bin.zip

which is: zip File (12.4 MB)
from: https://nchc.dl.sourceforge.net

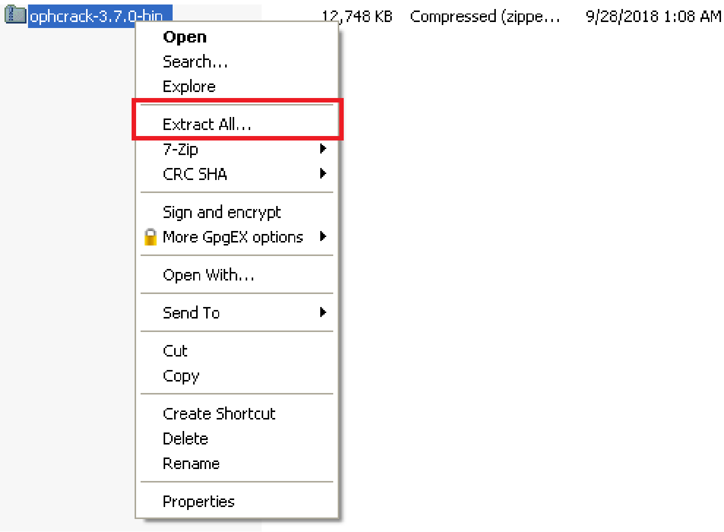
What should Firefox do with this file?

○ Open with

● Save File

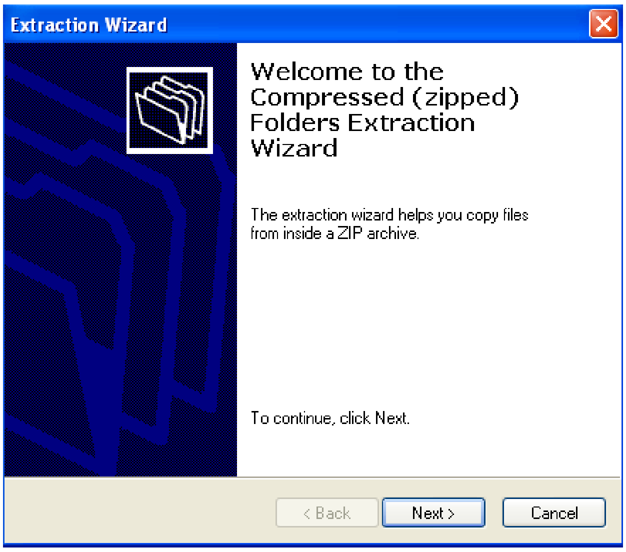
□ Do this automatically for files like this from now on.

3. When the file is downloaded, unzip the file by right clicking and select extract all to extract all the files.



ophcrack-3.7.0-bin 12,748 KB Compressed (zippe... 9/28/2018 1:08 AM

4. Click next to extract the files.



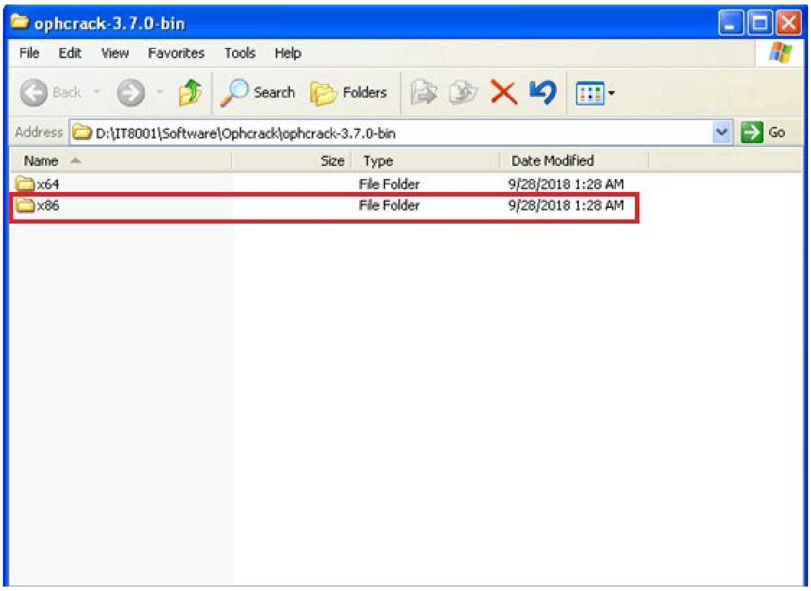
Extraction Wizard

Welcome to the Compressed (zipped) Folders Extraction Wizard

The extraction wizard helps you copy files from inside a ZIP archive.

To continue, click Next.

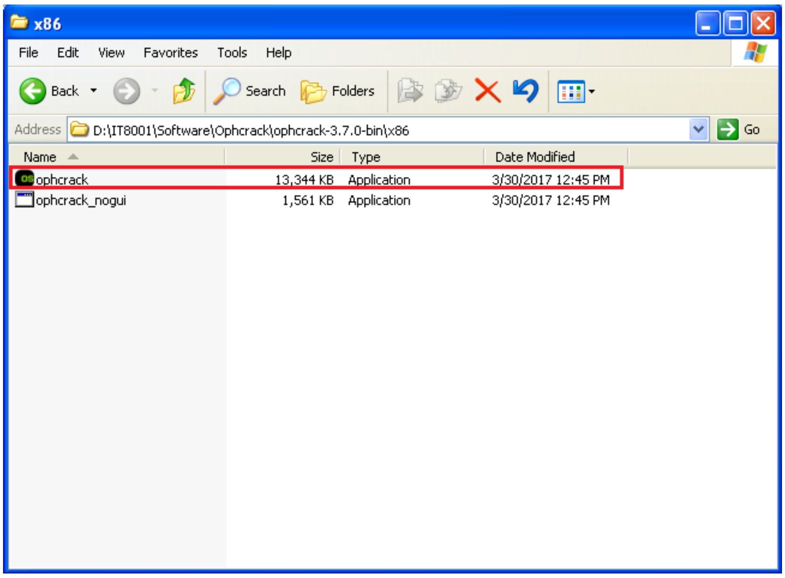
5. Two binaries would be extracted in two folders – x64 and x86. Click on the x86 folder to open it. (The x64 folder is for Ophcrack in a 64-bit environment)



D:\IT8001\Software\Ophcrack\ophcrack-3.7.0-bin

Name	Size	Type	Date Modified
x64		File Folder	9/28/2018 1:28 AM
x86		File Folder	9/28/2018 1:28 AM

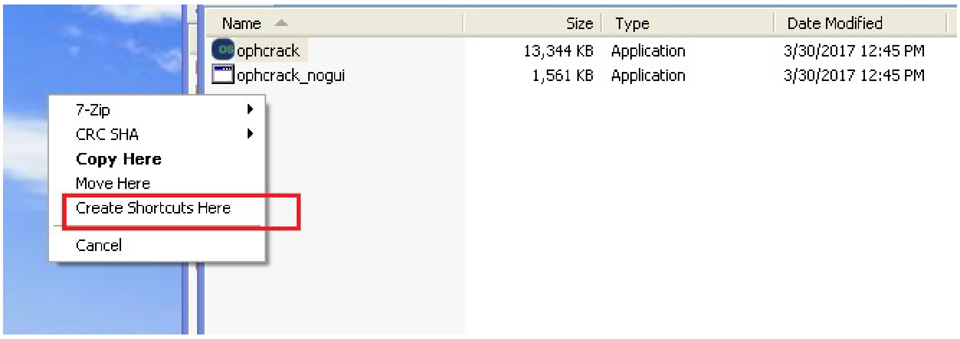
5. Right click on the ophcrack application and drag it to the desktop.



D:\IT8001\Software\Ophcrack\ophcrack-3.7.0-bin\x86

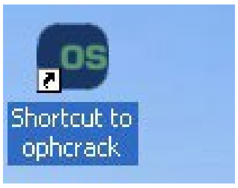
Name	Size	Type	Date Modified
ophcrack	13,344 KB	Application	3/30/2017 12:45 PM
ophcrack_nogui	1,561 KB	Application	3/30/2017 12:45 PM

6. Select Create Shortcuts here to create a link. This will facilitate opening the program.

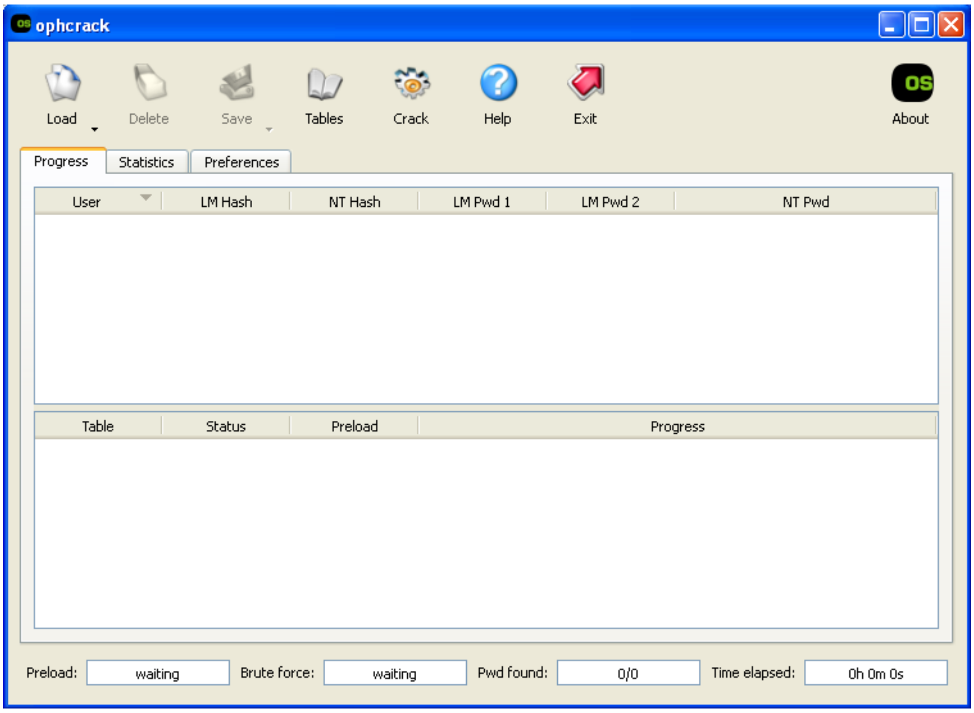


Name	Size	Type	Date Modified
ophcrack	13,344 KB	Application	3/30/2017 12:45 PM
ophcrack_nogui	1,561 KB	Application	3/30/2017 12:45 PM

4. You should have an icon shutcut to Ophcrack on the desktop.



5. Click on the ophcrack icon to start the program.



Preload: waiting Brute force: waiting Pwd found: 0/0 Time elapsed: 0h 0m 0s

You will be able to select different rainbow tables that you want to use. Please note that the rainbow tables are very big and may take you more than one hour to download, depending on your connection speed. We will select two rainbow tables which would be used later.

6. Go to https://sourceforge.net/projects/ophcrack/files/tables/ → Rainbow Tables to download two zipped files for the following rainbow tables:

- tables_xp_free_small
- tables_vista_free

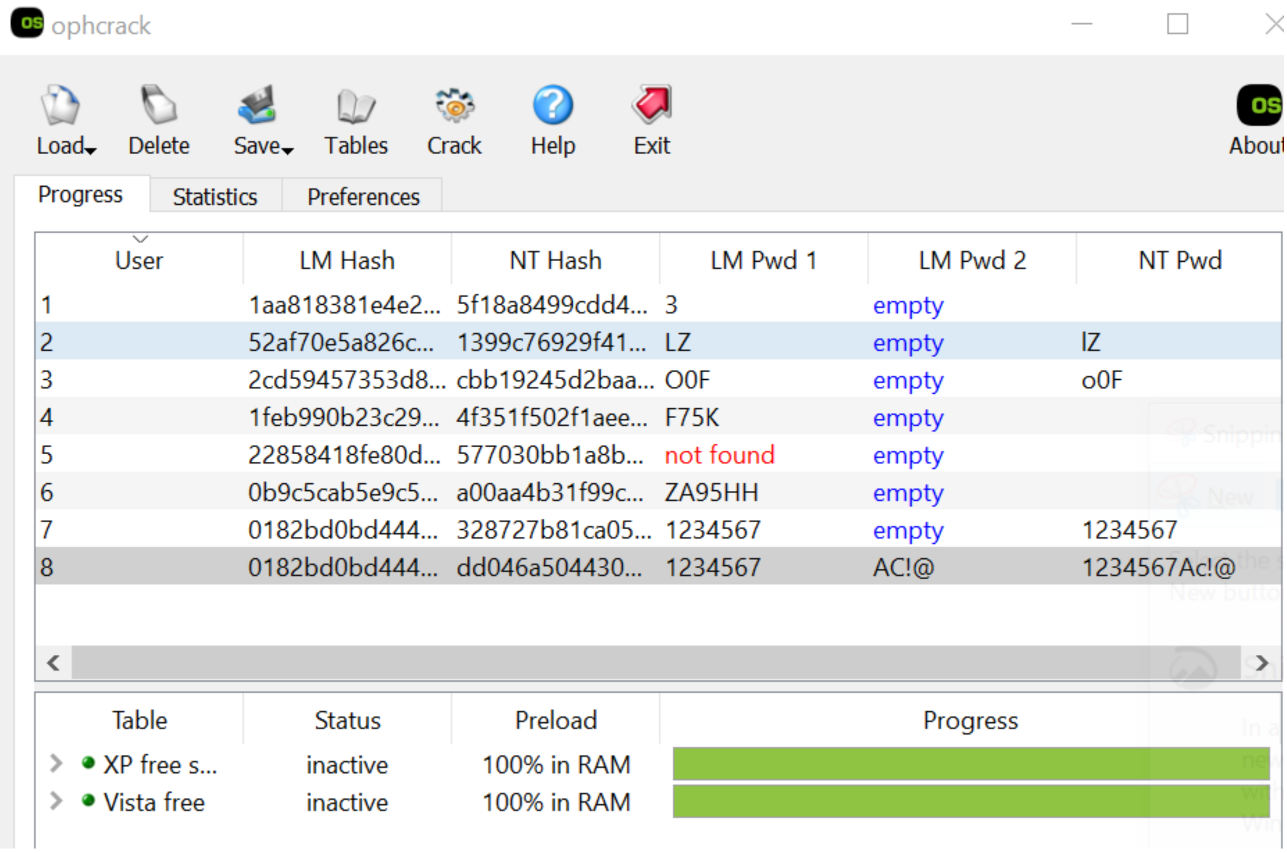
Copy the two zipped files containing the above tables to your Windows XP VM, and unzipped them to two respective folders.

7. Try to crack these eight passwords listed below. Copy one entire line at a time to the clipboard and submit it to **Ophcrack**.

```
1:1009:1aa818381e4e281baad3b435b51404ee:5f18a8499cdd4f43d89424ad39ce9af7:::
2:1010:52af70e5a826c9c1aad3b435b51404ee:1399c76929f41a9e7557e02c3993748c:::
```

```
3:1011:2cd59457353d8649aad3b435b51404ee:cbb19245d2baa671749236af72493285:::
4:1012:1feb990b23c293a2aad3b435b51404ee:4f351f502f1aee79a331bbcb40c9500f:::
5:1013:22858418fe80dbecaad3b435b51404ee:577030bb1a8b6c42c8eaa1eac5137447:::
6:1014:0b9c5cab5e9c5de1aad3b435b51404ee:a00aa4b31f99caa9260484fefbaceadb:::
7:1015:0182bd0bd4444bf8aad3b435b51404ee:328727b81ca05805a68ef26acb252039:::
8:1016:0182bd0bd4444bf8a0859a0c248642f8:dd046a504430737c964078609b30f301:::
```

Write down each answer in the spaces provided.



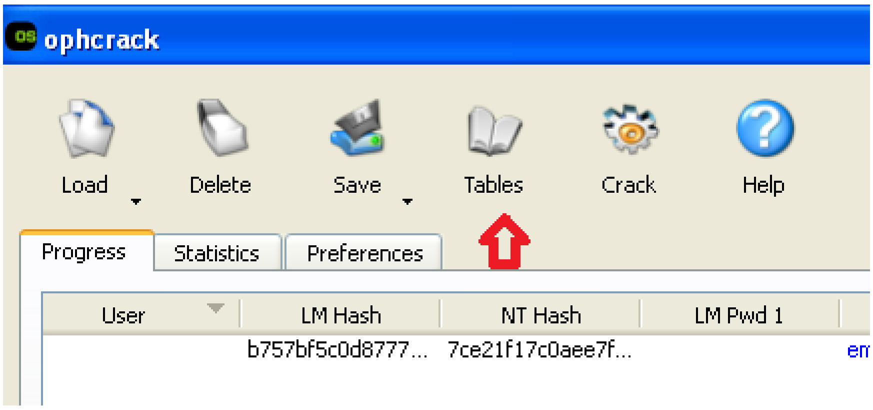
User	LM Hash	NT Hash	LM Pwd 1	LM Pwd 2	NT Pwd
1	1aa818381e4e2...	5f18a8499cdd4...	3	empty	
2	52af70e5a826c...	1399c76929f41...	LZ	empty	lZ
3	2cd59457353d8...	cbb19245d2baa...	O0F	empty	o0F
4	1feb990b23c29...	4f351f502f1aee...	F75K	empty	
5	22858418fe80d...	577030bb1a8b...	not found	empty	
6	0b9c5cab5e9c5...	a00aa4b31f99c...	ZA95HH	empty	
7	0182bd0bd444...	328727b81ca05...	1234567	empty	1234567
8	0182bd0bd444...	dd046a504430...	1234567	AC!@	1234567Ac!@

Table	Status	Preload	Progress
XP free s...	inactive	100% in RAM	🟩
Vista free	inactive	100% in RAM	🟩

LM - The LM hash is used for storing passwords. It is disabled in W7 and above. However, LM is enabled in memory if the password is less than 15 characters. That's why all recommendations for admin accounts are 15+ chars. LM is old, based on MD4 and easy to crack. The reason is that Windows domains require speed, but that also makes for shit security.
NT - The NT hash calculates the hash based on the entire password the user entered. The LM hash splits the password into two 7-character chunks, padding as necessary.
NTLM - The NTLM hash is used for local authentication on hosts in the domain. It is a combination of the LM and NT hash as seen above.
NetNTLMv1/2 - Hash for authentication on the network (SMB). Sometimes called NTLMv2, but don't get confused; it is not the same as an NTLM hash.

8. So far you are just using the **brute force** method to crack the passwords. You will not be able to crack all the eight listed passwords with the brute force method. You need to make use of rainbow tables to crack strong passwords.

Select **Tables**.



User	LM Hash	NT Hash	LM Pwd 1
	b757bf5c0d8777...	7ce21f17c0aee7f...	

Select the table to load and install (e.g. XP Free Small table), and click on "Install" button.

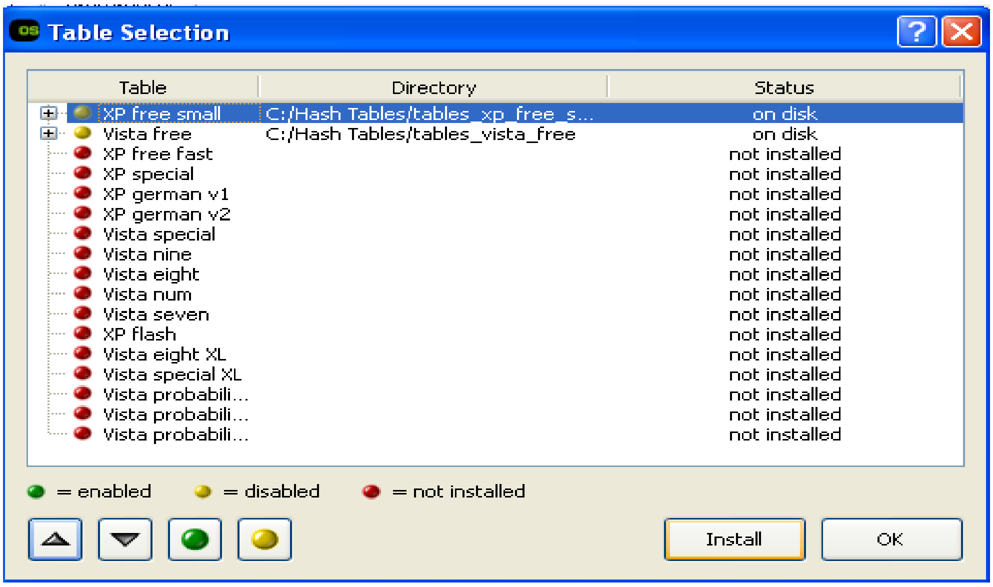


Table	Directory	Status
🟡 XP free small	C:/Hash Tables/tables_xp_free_s...	on disk
🟡 Vista free	C:/Hash Tables/tables_vista_free	on disk
🔴 XP free fast		not installed
🔴 XP special		not installed
🔴 XP german v1		not installed
🔴 XP german v2		not installed
🔴 Vista special		not installed
🔴 Vista nine		not installed
🔴 Vista eight		not installed
🔴 Vista num		not installed
🔴 Vista seven		not installed
🔴 XP flash		not installed
🔴 Vista eight XL		not installed
🔴 Vista special XL		not installed
🔴 Vista probabili...		not installed
🔴 Vista probabili...		not installed
🔴 Vista probabili...		not installed

🟢 = enabled 🟡 = disabled 🔴 = not installed

Then browse to the folder where the table is located. Click on 🟢 to enable the table, or 🟡 to disable the table. When you are done with loading an installing the tables click **OK**.

9. Crack the eight passwords again, this time using the rainbow tables.

10. Based on what you have seen, is there a pattern to what type of passwords are more secure?

Some passwords wont be cracked as the password is not inside the password list

11. Close all windows when finished.

Part IV

A. Windows Password Cracking

Ophcrack is an open source Windows password cracker that uses rainbow tables. It may not work with anti-virus software which flag it as a Trojan.

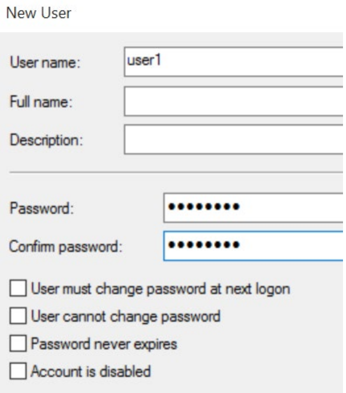
Password cracking can be resource-intensive. If you are able to, you may want to increase the virtual memory of your Win10 VM to 4GB.

Note: **This program should never be used to attempt to crack the password of a valid account.**

In Win10 VM:

First create a few users with passwords to crack.

1. In the bottom left corner, right-click on the Windows icon, and choose “Computer Management”.
2. In the left pane, expand “Local Users and Groups”.
3. Right-click on Users and choose New User.
4. Create a new user with Username “user1” and a simple password “password”. Uncheck the box “User must change password at next login”.
5. Click Create.



New User

User name: user1

Full name:

Description:

Password: ••••••••

Confirm password: ••••••••

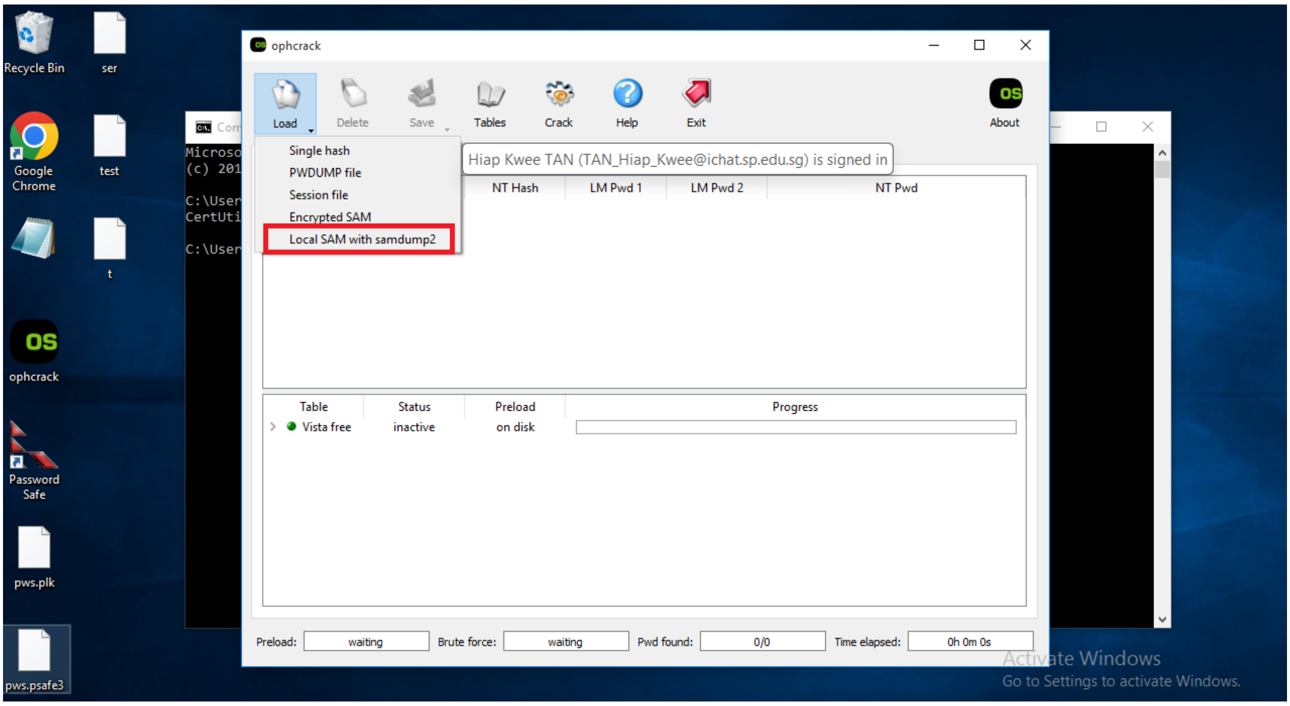
☐ User must change password at next logon

☐ User cannot change password

☐ Password never expires

☐ Account is disabled

6. Create another user with User name “user2” and simple password “bubble”. (or you can select another password value)
7. Create another user with User name “user3” and not-so-simple password “bluebubble”. (or you can select another password value)
8. Open the file, Ophcrack as Administrator; Right click the file, and “Run as administrator”.
9.



Hiap Kwee TAN (TAN_Hiap_Kwee@ichat.sp.edu.sg) is signed in

NT Hash	LM Pwd 1	LM Pwd 2	NT Pwd

Table	Status	Preload	Progress
Vista free	inactive	on disk	

Preload: waiting Brute force: waiting Pwd found: 0/0 Time elapsed: 0h 0m 0s

10. Under Load menu, click on “Load SAM with samdump2”.

It will dump your current SAM file.

If step 10 fails, proceed to the below steps, a to e Only.

a. Create a new folder, and copy Mimikatz.exe, mimidrv.sys and mimilib.sys to it.

b. Right click, mimikatz.exe, and “Run as Administrator”.

c. Type the command in RED.

d. Copy the NTLM hash of the username you one to crack to Ophcrack; for this case, I am cracking admin password.

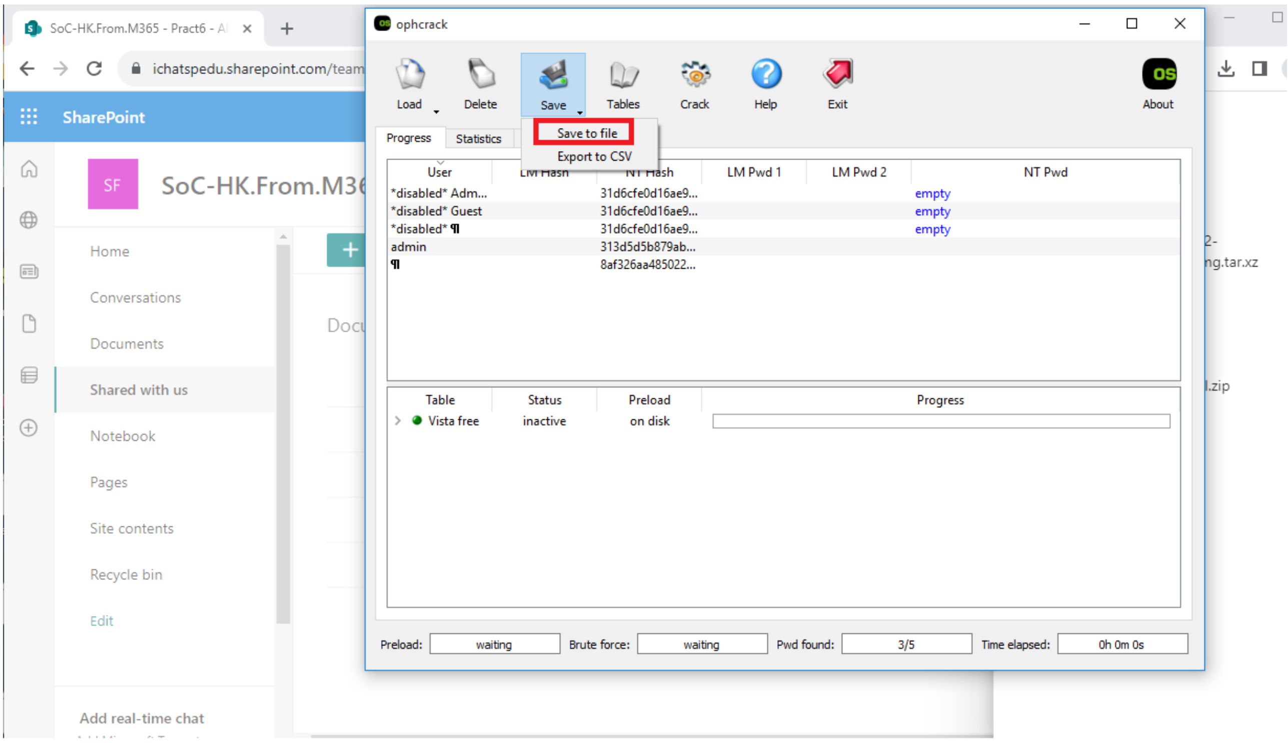
e. Then proceed to crack the password using Ophcrack.

```
mimikatz # privilege::debug
Privilege '20' OK

mimikatz # sekurlsa::logonpasswords full

Authentication Id : 0 ; 614370 (00000000:00095fe2)
Session           : Interactive from 1
User Name         : admin
Domain            : DESKTOP-A6FC7NP
Logon Server      : DESKTOP-A6FC7NP
Logon Time        : 1/7/2024 6:20:56 PM
SID               : S-1-5-21-4200824037-223962120-302892357-1001
        msv :
         [00000003] Primary
         * Username : admin
         * Domain   : DESKTOP-A6FC7NP
         * NTLM     : 313d5d5b879ab0b9b3bbb2bb4ec9c697
         * SHA1     : 2c51df2937a28743c55d2cf90c69b8e8c03d3f0e
         [00010000] CredentialKeys
         * NTLM     : 313d5d5b879ab0b9b3bbb2bb4ec9c697
```

END



User	LM Hash	NT Hash	LM Pwd 1	LM Pwd 2	NT Pwd
disabled Adm...		31d6cfe0d16ae9...			empty
disabled Guest		31d6cfe0d16ae9...			empty
disabled ¶		31d6cfe0d16ae9...			empty
admin		313d5d5b879ab...			
¶		8af326aa485022...			

Table	Status	Preload	Progress
Vista free	inactive	on disk	

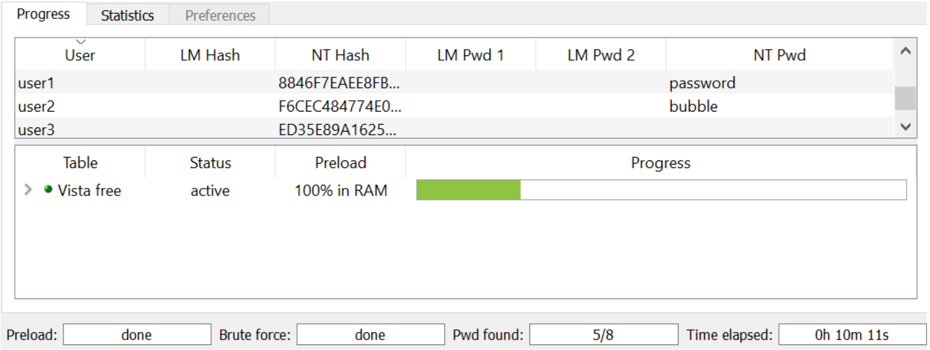
Preload: waiting Brute force: waiting Pwd found: 3/5 Time elapsed: 0h 0m 0s

Under Save menu, click “Save to file”. Name the file;ntt.txt, and upload the file to your Kali VM. You can use scp or any tools you have learnt in term 1.

11. Click Crack to start the password cracking. It may take a while to crack even the simple passwords.

12. You do not have to wait for all the passwords to be cracked, you can click Stop and exit Ophcrack.

With bigger rainbow tables, there is a higher chance that the passwords (if they are not complex) can be cracked.



User	LM Hash	NT Hash	LM Pwd 1	LM Pwd 2	NT Pwd
user1		8846F7EAEE8FB...			password
user2		F6CEC484774E0...			bubble
user3		ED35E89A1625...			

Table	Status	Preload	Progress
Vista free	active	100% in RAM	

Preload: done Brute force: done Pwd found: 5/8 Time elapsed: 0h 10m 11s

B. Using John the Ripper password cracker

In Kali VM:

1. Create a user with the simple password “service”.

```
sudo useradd –m user1
sudo passwd user1
```

2. In a terminal, run John the Ripper to crack the passwords in the current Linux shadow file.

   ```
   sudo john /etc/shadow
   ```

   You may get a message that there are no password hashes that John the Ripper can crack.

3. Run the following command to use John the Ripper with the `crypt` format to crack the hashed passwords; sudo john --list=formats | grep crypt

   ```
   sudo john --format=crypt /etc/shadow
   ```

4. The passwords that are cracked will be displayed.
5. A directory called `.john` is created in the /root directory. The passwords that are cracked successfully are listed in a file `john.pot` in this directory. View the cracked passwords.

   ```
   sudo cat /root/.john/john.pot
   ```

6. To view the cracked passwords again using John the Ripper command

   ```
   sudo john –-show /etc/shadow
   ```

7. View the contents of the password list available in the john the ripper directory. This password list is tried when John the Ripper is used without any options. How many words are there in the default password.list?

   ```
   less /usr/share/john/password.lst
   wc –l /usr/share/john/password.lst
   ```

8. View the other word lists available in Kali. How many words are there in these word lists?

   ```
   sudo find / -name *wordlist*
   ```

   Some wordlists can be found in the directory /usr/share/wordlists.

9. Create two more users, this time with the passwords “backstreet” and “blueflowers”. These passwords are not in the default password.lst.

10. Run John the Ripper to crack the passwords in the Linux shadow file. When it can’t find the password in the password.lst, it will start to try all possible character combinations as passwords (brute force)

    ```
    sudo john --format=crypt /etc/shadow
    ```

11. While John the Ripper is running, you can usually press Enter to see the status.

12. If you do not wish to wait for John the Ripper to crack the password, use Control-C to stop.

13. We will now run John the Ripper with another password list called “rockyou.txt”. It is currently located in /usr/share/wordlists in compressed mode, so we will uncompress it.

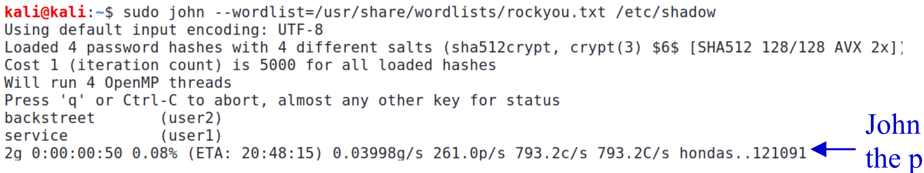
    ```
    sudo gunzip /usr/share/wordlists/rockyou.txt.gz
    ```

14. Try running John the Ripper with the password list rockyou.txt. Enter the command in a single line.

    ```
    sudo john --wordlist=/usr/share/wordlists/rockyou.txt --
    format=crypt /etc/shadow
    ```

https://www.cyberciti.biz/faq/understanding-etcshadow-file/

15. While John the Ripper is running, you can usually press Enter or other keys to see the status.



```
kali@kali:~$ sudo john --wordlist=/usr/share/wordlists/rockyou.txt /etc/shadow
Using default input encoding: UTF-8
Loaded 4 password hashes with 4 different salts (sha512crypt, crypt(3) $6$ [SHA512 128/128 AVX 2x])
Cost 1 (iteration count) is 5000 for all loaded hashes
Will run 4 OpenMP threads
Press 'q' or Ctrl-C to abort, almost any other key for status
backstreet       (user2)
service          (user1)
2g 0:00:00:50 0.08% (ETA: 20:48:15) 0.03998g/s 261.0p/s 793.2c/s 793.2C/s hondas..121091
```

John the Ripper is trying the passwords in this range from the wordlist

16. If pressing the keys does not show the status, a workaround is to use the kill command to send a USR1 signal to the John the Ripper process.

    First, in another terminal, run the ps command to find the Process ID of the John the Ripper process.

    ```
    sudo ps -ef | grep john
    ```

    Then use the kill command to send a USR1 signal to the John the Ripper process.

    `sudo kill -s USR1 ProcessID` (replace *ProcessID* with ProcessID of john)

    View the status in the terminal running John the Ripper.

John the Ripper can also crack Windows passwords.

```
└─$ sudo john --format=nt ntt.txt
```

C. Using Hydra to crack network passwords

In web-server2 VM:

1. Create a new user with the simple password “peanut”.

```
useradd -m student01
passwd student01
```

In Kali VM:

2. Type “man hydra” to view the manual page for Hydra.
3. Run Hydra to crack the user student01’s SSH password on web-server2 VM with a password list. (check that the SSH service is still running)

Change to your web-server2 IP

Change to the user whose password you want to crack

```
hydra 192.168.10.100 ssh -l student01
   -P /usr/share/wordlists/rockyou.txt  -V -t 10
```

4. Hydra will try the values contained in the password list, ten at a time.

In web-server2 VM:

5. Such online password attacks can be easily detected. View the logfile `/var/log/secure`. You will see the many password attempts being logged.

Hydra can also be used to crack Web login forms.

Besides Hydra, Ncrack and Medusa can also be used to crack network passwords.

D. Using fcrackzip to crack password protected zip files

In Kali VM:

1. Download the "fcrackzip.zip" file from the earlier links under "Files-for-Topic9". You can also download from http://http.kali.org or install using the "apt-get install" command.
2. Extract the fcrackzip.zip.
3. Run the following command to install fcrackzip.

```
sudo dpkg -i fcrackzip_1.0-10_amd64.deb
```

4. Download the sample password-protected "files.zip" from Brightspace or the earlier links under "Files-for-Topic9".
5. Try to unzip the file. A password is required to extract its contents.

```
unzip files.zip
```

6. In a terminal, type "man fcrackzip" to view the manual page for the fcrackzip command.
7. Run the following command to try fcrackzip with the dictionary list "rockyou.txt"

```
fcrackzip --dictionary -p /usr/share/wordlists/rockyou.txt files.zip
```

8. Fcrackzip will find a list of possible passwords. Try out the possible passwords and see which of them can extract the contents of "files.zip".

9. Run fcrackzip with the -u option to try out all the possible passwords and see which of them can extract the contents of "files.zip".

```
fcrackzip --dictionary -p /usr/share/wordlists/rockyou.txt -u files.zip
```

------------------ End of Practical 6 --------------