

MIT WORLD PEACE UNIVERSITY

Security Management and Cyber Laws
Third Year B. Tech, Semester 5

**TOOLS AND TECHNIQUES USED IN ETHICAL
HACKING**

SMCL GRADED TUTORIAL FOR UNIT 5
JOHN THE RIPPER

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November 28, 2023

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1 Aim

To study and use John the Ripper to crack passwords.

2 Objectives

1. To study the different features of John the Ripper.
2. To study the different ways to crack passwords.
3. To study the need of John the Ripper.

3 What is John the Ripper?

John the Ripper is a widely used open-source password cracking tool. It is designed to identify weak passwords by employing various password cracking techniques, including dictionary attacks, brute force attacks, and more. John the Ripper is highly flexible and supports multiple hash algorithms.

3.1 Features

John the Ripper offers the following key features:

- Support for various password hash algorithms such as DES, MD5, SHA-1, SHA-256, etc.
- Configurability for different attack modes and methods.
- Compatibility with different platforms, including Unix, Windows, and more.
- Multiple attack modes, including dictionary attacks, brute force attacks, and hybrid attacks.
- Availability of community-contributed patches and enhancements.

3.2 Ways to Crack Passwords

1. **Dictionary Attack:** Uses a wordlist to try potential passwords.
2. **Brute Force Attack:** Tries all possible combinations of characters systematically.
3. **Hybrid Attack:** Combines dictionary and brute force attacks for increased effectiveness.
4. **Rainbow Table Attack:** Uses precomputed tables of hashes for quick password lookup.
5. **Rule-based Attack:** Applies a set of rules to generate passwords.
6. **Mask Attack:** Uses a predefined mask to generate passwords.
7. **Permutation Attack:** Generates passwords using permutations of characters.
8. **Markov Attack:** Uses Markov chains for intelligent password guessing.
9. **PRINCE Attack:** Utilizes a PRINCE algorithm for password generation.

3.3 Need of John the Ripper

John the Ripper is crucial for:

- Assessing password security by identifying weak or easily guessable passwords.
- Conducting security audits to uncover vulnerabilities in password policies.
- Educating users about the importance of strong and secure passwords.
- Strengthening overall cybersecurity by proactively addressing password weaknesses.

3.4 Installation

To install John the Ripper on your system, follow these steps:

1. Download the latest version from the official website.
2. Extract the downloaded archive.
3. Navigate to the extracted directory.
4. Run the installation command appropriate for your platform.

4 Usage

We will now explore different methods to crack passwords using John the Ripper.

4.1 Dictionary Attack

4.1.1 JTR Command

```
john --wordlist=dictionary.txt hash_file
```

4.1.2 Pros

1. Fast and efficient for passwords based on dictionary words.
2. Utilizes a predefined list of potential passwords.
3. Suitable for users who might use common words as passwords.

4.1.3 Cons

1. Less effective against passwords with complex structures or variations.
2. Limited by the contents of the chosen wordlist.
3. Might not be successful against passwords with additional characters or patterns.

4.1.4 Steps

1. Replace hash_file with the actual name of your password hash file.
2. Ensure that dictionary.txt contains a comprehensive wordlist.
3. Run the provided JTR command in your terminal.

4.1.5 Screenshots

4.2 Brute Force Attack

4.2.1 JTR Command

```
john --incremental hash_file
```

4.2.2 Pros

1. Exhaustive and covers all possible combinations.
2. Guarantees success given enough time and resources.

4.2.3 Cons

1. Time-consuming, especially for complex passwords.
2. Resource-intensive, requires substantial computing power.

4.2.4 Steps

1. Replace hash_file with the actual name of your password hash file.
2. Execute the provided JTR command in your terminal.

4.2.5 Screenshots

4.3 Hybrid Attack

4.3.1 JTR Command

```
john --incremental --wordlist=dictionary.txt hash_file
```

4.3.2 Pros

1. Combines the thoroughness of brute force with the efficiency of a wordlist.
2. More time-effective than a pure brute force approach.

4.3.3 Cons

1. Success highly depends on the quality of the wordlist.
2. May not be as fast as dictionary attacks alone.

4.3.4 Steps

1. Replace hash_file with the actual name of your password hash file.
2. Provide a comprehensive wordlist in dictionary.txt.
3. Run the specified JTR command.

4.3.5 Screenshots

4.4 Rainbow Table Attack

4.4.1 JTR Command

```
john --format=raw-md5 --external=rainbow_table.rt hash_file
```

4.4.2 Pros

1. Rapid lookup for precomputed hashes.
2. Efficient for commonly used passwords.

4.4.3 Cons

1. Limited to precomputed tables.
2. Requires significant storage for extensive tables.

4.4.4 Steps

1. Replace `hash_file` with the actual name of your password hash file.
2. Use an appropriate precomputed rainbow table (`rainbow_table.rt`).
3. Execute the provided JTR command.

4.4.5 Screenshots

4.5 Rule-based Attack

4.5.1 JTR Command

```
john --wordlist=dictionary.txt --rules hash_file
```

4.5.2 Pros

1. Dynamically applies rules for password generation.
2. Efficient for complex password structures.

4.5.3 Cons

1. Success depends on the effectiveness of the rule set.
2. May require fine-tuning for optimal results.

4.5.4 Steps

1. Replace `hash_file` with the actual name of your password hash file.
2. Customize and provide rules for password generation.
3. Run the specified JTR command.

4.5.5 Screenshots

4.6 Mask Attack

4.6.1 JTR Command

```
john --mask=?l?d?u hash_file
```

4.6.2 Pros

1. Allows customization based on known patterns.
2. Useful for structured password cracking.

4.6.3 Cons

1. Resource-intensive for complex mask patterns.
2. Success depends on accurately defining the password structure.

4.6.4 Steps

1. Replace hash_file with the actual name of your password hash file.
2. Adjust the mask pattern (?l, ?d, ?u for lowercase, digit, uppercase) based on the expected password structure.
3. Execute the specified JTR command.

4.6.5 Screenshots

4.7 Permutation Attack

4.7.1 JTR Command

```
john --incremental=perm hash_file
```

4.7.2 Pros

1. Comprehensive by trying all permutations of characters.
2. Useful for cases where the password structure is not well-defined.

4.7.3 Cons

1. Highly resource-intensive and time-consuming.
2. Success depends on the length and complexity of the password.

4.7.4 Steps

1. Replace hash_file with the actual name of your password hash file.
2. Execute the specified JTR command.

4.7.5 Screenshots

```
Krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/word_cracking
krishnaraj@Krishnaraj-Arch ~ % main zip -e new_zip.zip secret.py
Enter password:
Verify password:
  adding: secret.py (deflated 61%)
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/word_cracking
krishnaraj@Krishnaraj-Arch ~ % main zip2john secret.zip
[1] 415287 segmentation fault (core dumped) zip2john secret.zip
x krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
password_cracking ~ % main zip2john new_zip.zip
ver 2.0 efh 5455 efh 7875 new_zip.zip/secret.py PKZIP Encr: 2b chk, TS_chk, cmplen=834, decmplen=2128, new_zip.zip/secret.py:$pkzip$1*x2*0x342*850*74251650*0*43*8*342*7425*b6f5*0ad778ba0f9e63776d68f893d75d9c796d5057e8f03fe8a413fe7184bf00330c4f4f2cd2689184e5cb3934ce49b3b6f946dbfd1f9baa59ca471decfb6aa8f44830b15cfcc1c0381c9a8c17731e3e35a1308a83c375f41b0806afc3cb9590698ca12397a7f07ae361977679a13d1e4c98bc429a795b6e46bfde839401707edf9c172ab99a954f43c834544384ed947db62745db49d26a543e8ed6b353f6e06f2710028307770cd859d51e2bfd26f47a29754e729da9d144ccdfb728aaaf0a77c33c4f8651aa0b7fff0c83acdbaa435065026b40d4e904627d1a252b642ba21e429cdc39426435c6f05c3e75677b7165f763006c44d38417cd01a398df7bbff01ae68f25b67b80062983f94978391ebaee2876303d749487e432b127913b222edc9188e74ad044a9ae5afb68d80968bb24794e3cdf72696cac4d97ca3d645326f18c84bdbc730e004d6dce8f2e3c2d410ca76dd466f9f1774d34e02ff4c064d18445104ce9dbbc01653e7154c8859b74d4ec8263c30ae99cf69701890b5bcb7f428e860bae8eaf49b3a76323093a96ddb7124fe5ce3d1ce330a0d420bb6e3c4dbddd0e507ca6ffa4ff02032570c7eb0383e91e814509e6e2a6228dfe4a784e07238cea9abd3946b6d522e5f4af21962ab3165e82cb866bd5f96264b43ac893298c757d8eb4fb737273b82d4dd3b44f8e30cd07e3a2c36ee44edb243a7059d97af92b7c83f45c58902760adfc9c88509e69fbf6a317419ac505c0e7a4921d6b8897217387b78d7961700fd98159c6825ff5f78b97c09878758b8160c16f:new_zip.zip::new_zip.zip
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
krishnaraj@Krishnaraj-Arch ~ % main zip2john new_zip.zip > hash.txt
ver 2.0 efh 5455 efh 7875 new_zip.zip/secret.py PKZIP Encr: 2b chk, TS_chk, cmplen=834, decmplen=2128,
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
password_cracking ~ % main john --format=zip new_zip.zip
Warning: invalid UTF-8 seen reading new_zip.zip
Using default input encoding: UTF-8
No password hashes loaded (see FAQ)
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
```

Figure 1: Making a Zip password

```
Session aborted
x krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
password_cracking ~ % main john hash.txt
Using default input encoding: UTF-8
Loaded 1 password hash (PKZIP [32/64])
Will run 8 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Warning: Only 7 candidates buffered for the current salt, minimum 8 needed for performance.
Warning: Only 4 candidates buffered for the current salt, minimum 8 needed for performance.
Warning: Only 7 candidates buffered for the current salt, minimum 8 needed for performance.
Warning: Only 4 candidates buffered for the current salt, minimum 8 needed for performance.
Almost done: Processing the remaining buffered candidate passwords, if any.
Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
123456          (new_zip.zip/secret.py)
1g 0:00:00:00 DONE 2/3 (2023-11-28 22:31) 20.00g/s 1086Kp/s 1086Kc/s 1086KC/s 123456..faithfaith
Use the "--show" option to display all of the cracked passwords reliably
Session completed
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security/password_cracking
```

Figure 2: Crackign a Zip password with JTR

```

krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Se
ord_cracking ~ % main zip -e new_zip.zip secret.py
Enter password:
Verify password:
updating: secret.py (deflated 61%)
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Se
ord_cracking ~ % main john hash.txt --wordlist=~/Downloads/rockyou.txt
Using default input encoding: UTF-8
Loaded 1 password hash (PKZIP [32/64])
No password hashes left to crack (see FAQ)

x krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Se
assword_cracking ~ % main zip2john new_zip.zip > hash.txt
ver 2.0 efh 5455 efh 7875 new_zip.zip/secret.py PKZIP Encr: 2b chk, TS_chk, cmplen=834, de
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Se
ord_cracking ~ % main john hash.txt --wordlist=~/Downloads/rockyou.txt
Using default input encoding: UTF-8
Loaded 1 password hash (PKZIP [32/64])
Will run 8 OpenMP threads
Press 'q' or Ctrl-C to abort, almost any other key for status
sunandmoon      (new_zip.zip/secret.py)
1g 0:00:00:00 DONE (2023-11-28 22:33) 100.0g/s 13107Kp/s 13107Kc/s 13107KC/s 022179..korn1
Use the "--show" option to display all of the cracked passwords reliably
Session completed

```

Figure 3: New Zip Password Cracked with Dictionary Attack

```

krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/Uni
assword_cracking ~ % main sudo useradd -r simpleguy
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/Uni
ord_cracking ~ % main sudo passwd simpleguy
New password:
Retype new password:
passwd: password updated successfully
krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/Uni
ord_cracking ~ % main sudo cp /etc/shadow .
krishnaraj@Krishnaraj-Arch ~ %

```

Figure 4: Making a new user with a simple password

```
assword_cracking ➤ ↵ main ➤ cat simple_guy_pass_hash
simpleguy:$y$j9T$yk7UMwPLGXWZG.FaZf32h/$MboSmomu5nY9/mcfYJH63ThxdD
krishnaraj@Krishnaraj-Arch ➤ /run/media/krishnaraj/Classes/Univers
ord_cracking ➤ ↵ main ➤ cat shadow
root:$6$Y2c8Vh9zdu9QIEVX$VWr0p2Xxj8KrkTG6SszaDN9zpzbX7TkyWKewtGfHa
krishnaraj:$6$Kmemx4ueZmlMy3R0$sDJrhwGNngHNu/LrUicP67wXAIG5mCwIyEi
mongodb:!*:19265:::::
mysql:!*:19265:::::
simpleguy:$y$j9T$yk7UMwPLGXWZG.FaZf32h/$MboSmomu5nY9/mcfYJH63ThxdD
```

Figure 5: Getting the shadow file.

```
krishnaraj@Krishnaraj-Arch ➤ /run/media/krishnaraj/Classes/University/Third Year/First Semester/
ord_cracking ➤ ↵ main ➤ john shadow
Warning: detected hash type "sha512crypt", but the string is also recognized as "sha512crypt-open
Use the "--format=sha512crypt-opencl" option to force loading these as that type instead
Using default input encoding: UTF-8
Loaded 2 password hashes with 2 different salts (sha512crypt, crypt(3) $6$ [SHA512 128/128 AVX 2x
Cost 1 (iteration count) is 5000 for all loaded hashes
Will run 8 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Warning: Only 2 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 6 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 8 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 7 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 11 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 7 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 5 candidates buffered for the current salt, minimum 16 needed for performance.
Almost done: Processing the remaining buffered candidate passwords, if any.
Warning: Only 9 candidates buffered for the current salt, minimum 16 needed for performance.
Warning: Only 2 candidates buffered for the current salt, minimum 16 needed for performance.
Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
0g 0:00:00:24 13.05% 2/3 (ETA: 22:08:04) 0g/s 933.0p/s 1731c/s 1731C/s noskcaj..toidi
Session aborted
```

Figure 6: Trying to crack the file with Jtr

```

krishnaraj@Krishnaraj-Arch ~ % cd /run/media/krishnaraj/Classes/University/Third Year/First Semester/Security_cracking
krishnaraj@Krishnaraj-Arch ~ % main
krishnaraj@Krishnaraj-Arch ~ % echo e10adc3949ba59abbe56e057f20f883e > hashes.txt
krishnaraj@Krishnaraj-Arch ~ % main
krishnaraj@Krishnaraj-Arch ~ % john hashes.txt --format=md5
Unknown ciphertext format name requested
krishnaraj@Krishnaraj-Arch ~ % john hashes.txt --format=raw-md5
Using default input encoding: UTF-8
Loaded 1 password hash (Raw-MD5 [MD5 128/128 AVX 4x3])
Warning: no OpenMP support for this hash type, consider --fork=8
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Almost done: Processing the remaining buffered candidate passwords, if any.
Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
123456      (?)
1g 0:00:00:00 DONE 2/3 (2023-11-28 22:29) 100.0g/s 19200p/s 19200c/s 19200C/s 123456..knight
Use the "--show --format=Raw-MD5" options to display all of the cracked passwords reliably
Session completed
krishnaraj@Krishnaraj-Arch ~ %

```

Figure 7: Cracking MD5 Hashes with JTR

5 Code

```

1 import hashlib
2
3
4 def hash_password(password):
5     # Hash the password using SHA-1
6     hashed_password = hashlib.sha1(password.encode()).hexdigest()
7     return hashed_password
8
9
10 # List of common passwords (for educational purposes only)
11 common_passwords = [
12     "password",
13     "123456",
14     "qwerty",
15     "letmein",
16     "admin",
17     "1234",
18     "welcome",
19     "tigger",
20     "sunshine",
21     "chocolate",
22     "password1",
23     "soccer",
24     "anthony",
25     "friends",
26     "butterfly",
27     "purple",
28     "shadow",
29     "melissa",
30     "eminem",
31     "matthew",
32     "robert",
33     "danielle",
34     "forever",
35     "family",

```

```
36 "jonathan",
37 "987654321",
38 "computer",
39 "whatever",
40 "dragon",
41 "vanessa",
42 "cookie",
43 "naruto",
44 "summer",
45 "sweety",
46 "spongebob",
47 "joseph",
48 "junior",
49 "softball",
50 "taylor",
51 "yellow",
52 "daniela",
53 "lauren",
54 "mickey",
55 "princesa",
56 "alexandra",
57 "alexis",
58 "estrella",
59 "miguel",
60 "william",
61 "thomas",
62 "beautiful",
63 "mylove",
64 "angela",
65 "poohbear",
66 "patrick",
67 "iloveme",
68 "sakura",
69 "adrian",
70 "alexander",
71 "destiny",
72 "christian",
73 "121212",
74 "sayang",
75 "america",
76 "dancer",
77 "monica",
78 "richard",
79 "112233",
80 "princess1",
81 "555555",
82 "diamond",
83 "carolina",
84 "steven",
85 "rangers",
86 "louise",
87 "orange",
88 "789456",
89 "999999",
90 "shorty",
91 "nathan",
92 "snoopy",
93 "gabriel",
94 "hunter",
```

```

95     "cherry",
96     "killer",
97     "sandra",
98     "alejandro",
99     "buster",
100    "george",
101    "brittany",
102    "alejandra",
103    "patricia",
104    "rachel",
105    "tequiero",
106    "7777777",
107    "cheese",
108    "159753",
109    "arsenal",
110    "dolphin",
111    "antonio",
112    "heather",
113    "ginger",
114 ]
115
116 # Create a text file to store hashed passwords
117 with open("hashed_passwords.txt", "w") as file:
118     for password in common_passwords:
119         # Hash each password and write it to the file
120         hashed_password = hash_password(password)
121         file.write(f"{password}: {hashed_password}\n")
122
123 print("Hashed passwords are stored in 'hashed_passwords.txt'")

```

Listing 1: Script to make hashes of passwords.

6 Platform

Operating System: Arch Linux x86-64

IDEs or Text Editors Used: Visual Studio Code

Compilers or Interpreters: Python 3.10.1

7 Conclusion

Thus, we have successfully installed and used John the Ripper to crack passwords, and also learnt about the need of John the Ripper.

References

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- [8] Mask Attack.
Website: <https://www.techopedia.com/definition/1779/dictionary-attack>
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