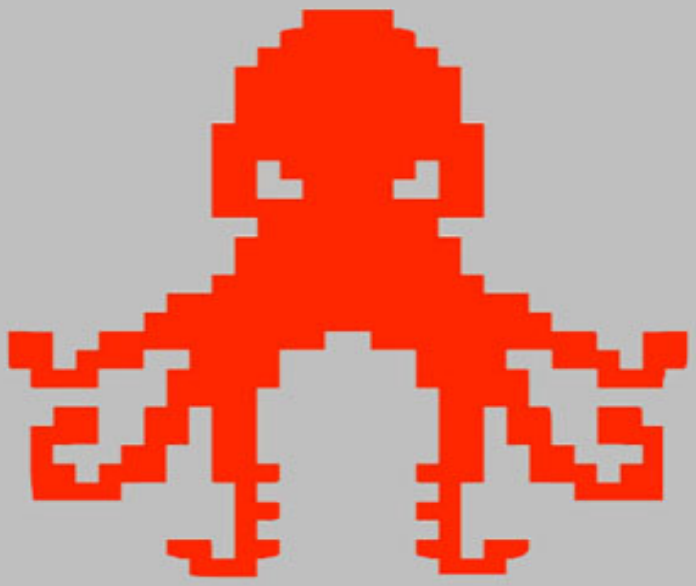
HASH CRACK

PASSWORD CRACKING MANUAL



v2.0

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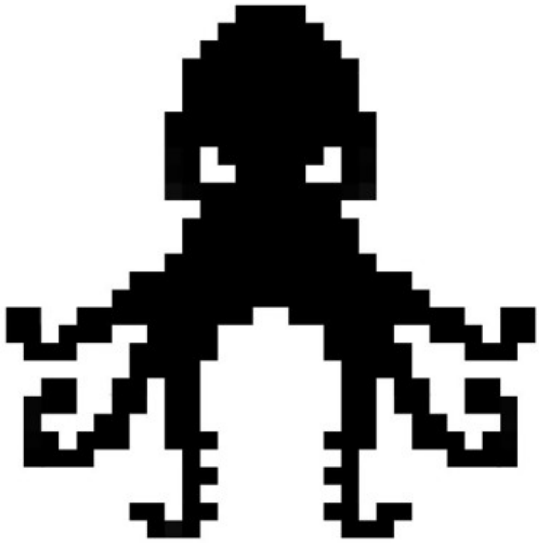

NETMUX

V2.0

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TABLE OF CONTENTS

-Hashcat Menu

-Hash Cracking Benchmarks

-Hash Cracking Speed

INTRO

This manual is meant to be a reference guide for cracking tool usage and supportive tools that assist network defenders and pentesters in password recovery (cracking). This manual will not be covering the installation of these tools, but will include references to their proper installation, and if all else fails, Google. Updates and additions to this manual are planned yearly as advancements in cracking evolve. Password recovery is a battle against math, time, cost, and human behavior; and much like any battle, the tactics are constantly evolving.

ACKNOWLEDGEMENTS

This community would not enjoy the success and diversity without the following community members and contributors:

Alexander ‘Solar Designer’ Peslvak, John The Ripper Team, & Community
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Royce ‘tychotithonus’ Williams
‘Waffle’

And many, many, many more contributors. If a name was excluded from the above list please reach out and the next version will give them their due credit.

Lastly, the tools, research, and resources covered in the book are the result of people's hard work. As such, I HIGHLY encourage all readers to DONATE to help assist in their efforts. A portion of the proceeds from this book will be distributed to the various researchers/projects.

Suggestions or comments, send your message to hashcrack@netmux.com

REQUIRED SOFTWARE

In order to follow many of the techniques in this manual, you will want to install the following software on your Windows or *NIX host. This book does not cover how to install said software and assumes you were able to follow the included links and extensive support websites.

HASHCAT v3.6 (or newer)
https://hashcat.net/hashcat/

JOHN THE RIPPER (v1.8.0 JUMBO)
http://www.openwall.com/john/

PACK V0.0.4 (Password Analysis and Cracking Toolkit)
http://thesprawl.org/projects/pack/

Hashcat-utils v1.7
https://hashcat.net/wiki/doku.php?id=hashcat_utils

Additionally you will need dictionaries/wordlists and highly recommend the below sources:

WEAKPASS DICTIONARY
https://weakpass.com/wordlist

CRACKSTATION DICTIONARY
https://crackstation.net/buy-crackstation-wordlist-password-cracking-dictionary.htm

SKULL SECURITY WORDLISTS
https://wiki.skullsecurity.org/index.php?title=Passwords

Throughout the manual, generic names have been given to the various inputs required in a cracking commands structure. Legend description is

below:

COMMAND STRUCTURE LEGEND
hashcat = Generic representation of the various Hashcat binary names
john = Generic representation of the John the Ripper binary names
#type = Hash type; which is an abbreviation in John or a number in Hashcat
hash.txt = File containing target hashes to be cracked
dict.txt = File containing dictionary/wordlist
rule.txt = File containing permutation rules to alter dict.txt input
passwords.txt = File containing cracked password results
outfile.txt = File containing results of some functions output

Lastly, as a good reference for testing various hash types to place into your "hash.txt" file, the below sites contain all the various hashing algorithms and example output tailored for each cracking tool:

HASHCAT HASH FORMAT EXAMPLES
https://hashcat.net/wiki/doku.php?id=example_hashes

JOHN THE RIPPER HASH FORMAT EXAMPLES
http://pentestmonkey.net/cheat-sheet/john-the-ripper-hash-formats
http://openwall.info/wiki/john/sample-hashes

CORE HASH CRACKING KNOWLEDGE

ENCODING vs HASHING vs ENCRYPTING
Encoding = transforms data into a publicly known scheme for usability
Hashing = one-way cryptographic function nearly impossible to reverse
Encrypting = mapping of input data and output data reversible with a key

CPU vs GPU
CPU = 2-72 cores mainly optimized for sequential serial processing
GPU = 1000's of cores with 1000's of threads for parallel processing

CRACKING TIME = KEYSPACE / HASHRATE
Keyspace: charset^length (?a?a?a?a = 95^4 = 81,450,625)
Hashrate: hashing function / hardware power (bcrypt / GTX1080 = 13094 H/s)
Cracking Time: 81,450,625 / 13094 H/s = 6,220 seconds
*Keyspace displayed and Hashrate vary by tool and hardware used

SALT = random data that's used as additional input to a one-way function
ITERATIONS = the number of times an algorithm is run over a given hash

HASH IDENTIFICATION: there isn't a foolproof method for identifying which hash function was used by simply looking at the hash, but there are reliable clues (i.e. 6 sha512crypt). The best method is to know from where the hash was extracted and identify the hash function for that software.

DICTIONARY/WORDLIST ATTACK = straight attack uses a precompiled list of words, phrases, and common/unique strings to attempt to match a password.

BRUTE-FORCE ATTACK = attempts every possible combination of a given character set, usually up to a certain length.

RULE ATTACK = generates permutations against a given wordlist by modifying, trimming, extending, expanding, combining, or skipping words.

MASK ATTACK = a form of targeted brute-force attack by using placeholders for characters in certain positions (i.e. ?a?a?a?l?d?d).

HYBRID ATTACK = combines a Dictionary and Mask Attack by taking input from the dictionary and adding mask placeholders (i.e. dict.txt ?d?d?d).

CRACKING RIG = from a basic laptop to a 64 GPU cluster, this is the hardware/ platform on which you perform your password hash attacks.

EXPECTED RESULTS
Know your cracking rig's capabilities by performing benchmark testing and don't assume you can achieve the same results posted by forum members without using the exact same dictionary, attack plan, or hardware setup. Cracking success largely depends on your ability to use resources efficiently and make calculated trade-offs based on the target hash.

DICTIONARY/WORDLIST vs BRUTE-FORCE vs ANALYSIS
Dictionaries and brute-force are not the end all be all to crack hashes. They are merely the beginning and end of an attack plan. True mastery is everything in the middle, where analysis of passwords, patterns, behaviors, and policies affords the ability to recover that last 20%. Experiment with your attacks and research and compile targeted wordlists with your new knowledge. Do not rely heavily on dictionaries because they can only help you with what is "known" and not the unknown.

CRACKING METHODOLOGY

Following is basic cracking methodology broken into steps, but the process is subject to change based on current/future target information uncovered during the cracking process.

1-EXTRACT HASHES
Pull hashes from target, identify hashing function, and properly format output for your tool of choice.

2-FORMAT HASHES
Format your hashes based on your tool's preferred method. See tool documentation for this guidance. Hashcat, for example, on each line takes <user>:<hash> OR just the plain <hash>.

3-EVALUATE HASH STRENGTH
Using the Appendix table "Hash Cracking Speed (Slow-Fast)" assess your target hash and it's cracking speed. If it's a slow hash, you will need to be more selective at what types of dictionaries and attacks you perform. If it's a fast hash, you can be more liberal with your attack strategy.

4-CALCULATE CRACKING RIG CAPABILITIES
With the information from evaluating the hash strength, baseline your cracking rig's capabilities. Perform benchmark testing using John The Ripper and/or Hashcat's built-in benchmark ability on your rig.
john --test
hashcat -b
Based on these results you will be able to better assess your attack options by knowing your rigs capabilities against a specific hash. This will be a more accurate result of a hash's cracking speed based on your rig. It will be useful to save these results for future reference.

5-FORMULATE PLAN

Based on known or unknown knowledge begin creating an attack plan. Included on the next page is a “Basic Cracking Playbook” to get you started.

6-ANALYZE PASSWORDS
After successfully cracking a sufficient amount of hashes analyze the results for any clues or patterns. This analysis may aid in your success on any remaining hashes.

7-CUSTOM ATTACKS
Based on you password analysis create custom attacks leveraging those known clues or patterns. Examples would be custom mask attacks or rules to fit target users’ behavior or preferences.

8-ADVANCED ATTACKS
Experiment with Princeprocessor, custom Markov-chains, maskprocessor, or custom dictionary attacks to shake out those remaining stubborn hashes. This is where your expertise and creativity really come into play.

9-REPEAT
Go back to STEP 4 and continue the process over again, tweaking dictionaries, mask, parameters, and methods. You’re in the grind at this point and need to rely on skill and luck.

BASIC CRACKING PLAYBOOK

This is only meant as a basic guide to processing hashes and each scenario will obviously be unique based on external circumstances. For this attack plan we will assume we know the password hashes are raw MD5 and assume we have already captured some plain text passwords of users. If we had no knowledge of plain text passwords we would most likely skip to DICTIONARY/WORDLIST attacks. Lastly, since MD5 is a "Fast" hash we can be more liberal with our attack plan.

1-CUSTOM WORDLIST

First compile your known plain text passwords into a custom wordlist file. Pass this to your tool of choice as a straight dictionary attack.

hashcat -a 0 -m 0 -w 4 hash.txt custom_list.txt

2-CUSTOM WORDLIST + RULES

Run your custom wordlist with permutation rules to crack slight variations.

hashcat -a 0 -m 0 -w 4 hash.txt custom_list.txt -r best64.rule --loopback

3 -DICTIONARY/WORDLIST

Perform a broad dictionary attack, looking for common passwords and leaked passwords in well known dictionaries/wordlists.

hashcat -a 0 -m 0 -w 4 hash.txt dict.txt

4-DICTIONARY/WORDLIST + RULES

Add rule permutations to the broad dictionary attack, looking for subtle changes to common words/phrases and leaked passwords.

hashcat -a 0 -m 0 -w 4 hash.txt dict.txt -r best64.rule --loopback

5-CUSTOM WORDLIST + RULES

Add any newly discovered passwords to your custom wordlist and run an attack again with permutation rules, looking any other subtle variations.

awk -F ":" '{print $2}' hashcat.potfile >> custom_list.txt
hashcat -a 0 -m 0 -w 4 hash.txt custom_list.txt -r dive.rule --loopback

6-MASK
Now we will use mask attacks included with Hashcat to search the keyspace for common password lengths and patterns, based on the RockYou dataset.

hashcat -a 3 -m 0 -w 4 hash.txt rockyou-1-60.hcmask

7-HYBRID DICTIONARY + MASK
Using a dictionary of your choice, conduct hybrid attacks looking for larger variations of common words or known passwords by appending/prepending masks to those candidates.

hashcat -a 6 -m 0 -w 4 hash.txt dict.txt rockyou-1-60.hcmask
hashcat -a 7 -m 0 -w 4 hash.txt rockyou-1-60.hcmask dict.txt

8-CUSTOM WORDLIST + RULES
Add any newly discovered passwords back to your custom wordlist and run an attack again with permutation rules looking any other subtle variations.

awk -F ":" '{print $2}' hashcat.potfile >> custom_list.txt
hashcat -a 0 -m 0 -w 4 hash.txt custom_list.txt -r dive.rule --loopback

9-COMBO
Using a dictionary of your choice, perform a combo attack by individually combining the dictionary's password candidates together to form new candidates.

hashcat -a 1 -m 0 -w 4 hash.txt dict.txt dict.txt

10-CUSTOM HYBRID ATTACK
Add any newly discovered passwords back to your custom wordlist and perform a hybrid attack against those new acquired passwords.

awk -F ":" '{print $2}' hashcat.potfile >> custom_list.txt
hashcat -a 6 -m 0 -w 4 hash. txt custom_list.txt rockyou-1-60.hcmask
hashcat -a 7 -m 0 -w 4 hash. txt rockyou-1-60.hcmask custom_list.txt

11-CUSTOM MASK ATTACK
By now the easier, weaker passwords may have fallen to cracking, but still some remain. Using PACK (on pg.51) create custom mask attacks based on your currently cracked passwords. Be sure to sort out masks that match the previous rockyou-1-60.hcmask list.

hashcat -a 3 -m 0 -w 4 hash.txt custom_masks.hcmask

12-BRUTE-FORCE
When all else fails begin a standard brute-force attack, being selective as to how large a keyspace your rig can adequately brute-force. Above 8 characters this is typically pointless due to hardware limitations and password entropy/ complexity.

hashcat -a 3 -m 0 -w 4 hash.txt -i ?a?a?a?a?a?a?a?a

CHEAT SHEETS

JOHN THE RIPPER CHEAT SHEET

ATTACK MODES

BRUTEFORCE ATTACK
john --format=#type hash. txt
DICTIONARY ATTACK
john --format=#type --wordlist=dict.txt hash.txt
MASK ATTACK
john --format=#type --mask=?l?l?l?l?l?l hash.txt -min-len=6
INCREMENTAL ATTACK
john --incremental hash.txt
DICTIONARY + RULES ATTACK
john --format=#type --wordlist=dict.txt --rules

RULES

--rules=Single
--rules=Wordlist
--rules=Extra
--rules=Jumbo
--rules=KoreLogic
--rules=All

INCREMENT

--incremental=Digits
--incremental=Lower
--incremental=Alpha
--incremental=Alnum

PARALLEL CPU or GPU

LIST OpenCL DEVICES
john --list=opencl-devices
LIST OpenCL FORMATS

john --list=formats --format=opencl
MULTI-GPU (example 3 GPU's)
john --format=<OpenCLformat> hash.txt --wordlist=dict.txt --rules --dev=<#> --fork=3
MULTI-CPU (example 8 cores)
john --wordlist=dict.txt hash.txt --rules --dev=<#> --fork=8

MISC

BENCHMARK TEST
john --test
SESSION NAME
john hash.txt --session=example_name
SESSION RESTORE
john --restore=example_name
SHOW CRACKED RESULTS
john hash.txt --pot=<john potfile> --show
WORDLIST GENERATION
john --wordlist=dict.txt --stdout --external:[filter name] > out.txt

BASIC ATTACK METHODOLOGY

1- DEFAULT ATTACK
john hash.txt
2- DICTIONARY + RULES ATTACK
john --wordlist=dict.txt --rules
3- MASK ATTACK
john --mask=?l?l?l?l?l?l hash.txt -min-len=6
4- BRUTEFORCE INCREMENTAL ATTACK
john --incremental hash.txt

HASH TYPES (SORTED ALPHABETICAL)

7z
7z-opencl
AFS
agilekeychain
agilekeychain-opencl
aix-smd5
aix-ssha1
aix-ssha256
aix-ssha512
asa-md5
bcrypt
bcrypt-opencl
bfegg
Bitcoin
blackberry-es10
Blockchain
blockchain-opencl
bsdicrypt
chap
Citrix_NS10
Clipperz
cloudkeychain
cq
CRC32
crypt
dahua
descrypt
descrypt-opencl
Django
django-scrypt
dmd5
dmg
dmg-opencl
dominosec
dragonfly3-32
dragonfly3-64
dragonfly4-32
dragonfly4-64
Drupal7
dummy
dynamic_n
eCryptfs
EFS
eigrp
EncFS
encfs-opencl
EPI
EPiServer
fde
FormSpring
Fortigate
gost
gpg
gpg-opencl
HAVAL-128-4
HAVAL-256-3
hdaa
HMAC-MD5
HMAC-SHA1
HMAC-SHA224
HMAC-SHA256
HMAC-SHA384
HMAC-SHA512
hMailServer
hsrp
IKE
ipb2
KeePass
keychain
keychain-opencl
keyring
keyring-opencl
keystore
known_hosts
krb4
krb5
krb5-18
krb5pa-md5
krb5pa-md5-opencl
krb5pa-sha1
krb5pa-sha1-opencl
kwallet
LastPass
LM
lotus5
lotus5-opencl
lotus85
LUKS
MD2
md4-gen
md5crypt
md5crypt-opencl
md5ns
mdc2
MediaWiki
MongoDB
Mozilla
mscash
mscash2
mscash2-opencl
MSCHAPv2
mschapv2-naive
mssql
mssql05
mssql12
mysql
mysql-sha1
mysql-sha1-opencl
mysqlna
net-md5
net-sha1
nethalflm
netlm
netlmv2
netntlm
netntlm-naive
netntlmv2
nk
nsldap
NT
nt-opencl
nt2
ntlmv2-opencl
o5logon
o5logon-opencl
ODF
ODF-AES-opencl
ODF-opencl
Office
office2007-opencl
office2010-opencl
office2013-opencl
oldoffice
oldoffice-opencl
OpenBSD-SoftRAID
openssl-enc
OpenVMS
oracle
oracle11
osc
Panama
PBKDF2-HMAC-SHA1
PBKDF2-HMAC-SHA256
PBKDF2-HMAC-SHA256-opencl
PBKDF2-HMAC-SHA512
pbkdf2-hmac-sha512-opencl
PDF
PFX
phpass
phpass-opencl
PHPS
pix-md5
PKZIP
po
postgres
PST
PuTTY
pwsafe
pwsafe-opencl
RACF
RAdmin
RAKP
RAKP-opencl
rar
rar-opencl
RAR5
RAR5-opencl
Raw-Blake2
Raw-Keccak
Raw-Keccak-256
Raw-MD4
Raw-MD4-opencl
Raw-MD5
Raw-MD5-opencl
Raw-MD5u
Raw-SHA
Raw-SHA1
Raw-SHA1-Linkedin
Raw-SHA1-ng
Raw-SHA1-opencl
Raw-SHA224
Raw-SHA256
Raw-SHA256-ng
Raw-SHA256-opencl
Raw-SHA384
Raw-SHA512
Raw-SHA512-ng
Raw-SHA512-opencl
ripemd-128
ripemd-160
rsvp
Salted-SHA1
sapb
sapg
scrypt
sha1-gen
sha1crypt
sha1crypt-opencl
sha256crypt
sha256crypt-opencl
sha512crypt
sha512crypt-opencl
Siemens-S7
SIP
skein-256
skein-512
skey
Snefru-128
Snefru-256
SSH
SSH-ng
ssha-opencl
SSHA512
STRIP
strip-opencl
SunMD5
sxc
sxc-opencl
Sybase-PROP
sybasease
tc_aes_xts
tc_ripemd160
tc_sha512
tc_whirlpool
tcp-md5
Tiger
tripcode
VNC
vtp
wbb3
whirlpool
whirlpool0
whirlpool1
WoWSRP
wpapsk
wpapsk-opencl
xsha
xsha512
XSHA512-opencl
ZIP
zip-opencl

HASHCAT CHEAT SHEET

ATTACK MODES

DICTIONARY ATTACK
hashcat -a 0 -m #type hash.txt dict.txt
DICTIONARY + RULES ATTACK
hashcat -a 0 -m #type hash.txt dict.txt -r rule.txt
COMBINATION ATTACK
hashcat -a 1 -m #type hash.txt dict1.txt dict2.txt
MASK ATTACK
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a?a
HYBRID DICTIONARY + MASK
hashcat -a 6 -m #type hash.txt dict.txt ?a?a?a?a
HYBRID MASK + DICTIONARY
hashcat -a 7 -m #type hash.txt ?a?a?a?a dict.txt

RULES

RULEFILE -r
hashcat -a 0 -m #type hash.txt dict.txt -r rule.txt
MANIPULATE LEFT -j
hashcat -a 1 -m #type hash.txt left_dict.txt right_dict.txt -j <option>
MANIPULATE RIGHT -k
hashcat -a 1 -m #type hash.txt left_dict.txt right_dict.txt -k <option>

INCREMENT

DEFAULT INCREMENT
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a --increment
INCREMENT MINIMUM LENGTH
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a --increment-min=4
INCREMENT MAX LENGTH
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a?a --increment-max=5

MISC

BENCHMARK TEST (HASH TYPE)
hashcat -b -m #type
SHOW EXAMPLE HASH
hashcat -m #type --example-hashes

DISABLE PASSWORD LENGTH LIMIT (Max Length 256)
hashcat -a 0 -m #type --length-limit-disable hash.txt dict.txt
SESSION NAME
hashcat -a 0 -m #type --session <uniq_name> hash.txt dict.txt
SESSION RESTORE
hashcat -a 0 -m #type --restore --session <uniq_name> hash.txt dict.txt
SHOW KEYSPACE
hashcat -a 0 -m #type --keyspace hash.txt dict.txt -r rule.txt
OUTPUT RESULTS FILE -o
hashcat -a 0 -m #type -o results.txt hash.txt dict.txt
CUSTOM CHARSET -1 -2 -3 -4
hashcat -a 3 -m #type hash.txt -1 ?l?u -2 ?l?d?s ?l?2?a?d?u?l
ADJUST PERFORMANCE -w
hashcat -a 0 -m #type -w <1-4> hash.txt dict.txt

BASIC ATTACK METHODOLOGY

1- DICTIONARY ATTACK
hashcat -a 0 -m #type hash.txt dict.txt
2- DICTIONARY + RULES
hashcat -a 0 -m #type hash.txt dict.txt -r rule.txt
3- HYBRID ATTACKS
hashcat -a 6 -m #type hash.txt dict.txt ?a?a?a?a
4- BRUTEFORCE
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a?a?a?a

HASH TYPES (SORTED ALPHABETICAL)

6 1Password, agilekeychain
6
0
0
8 1Password, cloudkeychain
2
0
0
1 3DES (PT = $salt, key = $pass)
4
1

00
01 7-Zip
11
60
00
63 AIX {smd5}
30
00
64 AIX {ssha256}
40
00
65 AIX {ssha512}
50
00
66 AIX {ssha1}
70
00
58 Android PIN
80
00
88 Android FDE < v4.3
80
00
12 Android FDE (Samsung DEK)
29
00
00

1600	Apache $apr1$
1225	ArubaOS
12001	Atlassian (PBKDF2-HMAC-SHA1)
113	AxCrypt
2000	AxCrypt in memory SHA1
3300	bcrypt $2*$, Blowfish(Unix)
2000	BLAKE2-512
6000	BSDiCrypt, Extended DES
12400	Bitcoin/Litecoin wallet.dat
11	

3
0
0
1 Blockchain, My Wallet
2
7
0
0
1 Blockchain, My Wallet, V2
5
2
0
0
1 ChaCha20
5
4
0
0
2 Cisco-ASA
4
1
0
5 Cisco-IOS 1
0
0
5 Cisco-IOS 4
7
0
0
9 Cisco-IOS 8
2
0
0
9 Cisco-IOS 9
3

0
0
2 Cisco-PIX
4
0
0
8 Citrix Netscaler
1
0
0
1 ColdFusion 10+
2
6
0
0
1 Cram MD5
0
2
0
0
1 CRC32
1
5
0
0
1 DES (PT = $salt, key = $pass)
4
0
0
0
1 descrypt, DES(Unix), Traditional DES
5
0
0
8 DNSSEC (NSEC3)
3

0
0
1 Django (SHA-1)
2
4
1 Django (PBKDF2-SHA256)
0
0
0
0
1 Domain Cached Credentials (DCC), MS Cache
1
0
0
2 Domain Cached Credentials 2 (DCC2), MS Cache 2
1
0
0
1 DPAPI masterkey file v1 and v2
5
3
0
0
7 Drupal7
9
0
0
1 eCryptfs
2
2
0
0
1 EPiServer 6.x < v4
4
1
1 EPiServer 6.x > v4

4 4 1 1	Ethereum Wallet, PBKDF2-HMAC-SHA256
5 6 0 0 1 5	Ethereum Wallet, PBKDF2-SCRYPT
7 0 0 1 5	FileZilla Server >= 0.9.55
0 0 0 7	Fortigate (FortiOS)
0 0 0 6 9	GOST R 34.11-94
0 0 1 1	GOST R 34.11-2012 (Streebog) 256-bit
7 0 0 1 1	GOST R 34.11-2012 (Streebog) 512-bit
8 0 0	

7200 GRUB 2

5000 HMAC-MD5 (key = $pass)

6000 HMAC-MD5 (key = $salt)

1500 HMAC-SHA1 (key = $pass)

1600 HMAC-SHA1 (key = $salt)

1450 HMAC-SHA256 (key = $pass)

1460 HMAC-SHA512 (key = $salt)

5100 Half MD5

5300 IKE-PSK MD5

0
0
5 IKE-PSK SHA1
4
0
0
2 IPB (Invison Power Board)
8
1
1
7 IPMI2 RAKP HMAC-SHA1
3
0
0
1 iTunes Backup < 10.0
4
7
0
0
1 iTunes Backup >= 10.0
4
8
0
0
4 iSCSI CHAP authentication, MD5(Chap)
8
0
0
1 JKS Java Key Store Private Keys (SHA1)
5
5
0
0
1 Joomla < 2.5.18
1
4 Joomla > 2.5.18

0
0
1 Juniper/NetBSD sha1crypt
5
1
0
0
2 Juniper Netscreen/SSG (ScreenOS)
2
5 Juniper IVE
0
1
1 Keepass 1 (AES/Twofish) and Keepass 2 (AES)
3
4
0
0
7 Kerberos 5 AS-REQ Pre-Auth etype 23
5
0
0
1 Kerberos 5 TGS-REP etype 23
3
1
0
0
6 Lastpass + Lastpass sniffed
8
0
0
3 LM
0
0
0
8 Lotus Notes/Domino 5
6

0
0
8 Lotus Notes/Domino 6
7
0
0
9 Lotus Notes/Domino 8
1
0
0
1 LUKS
4
6
0
0
9 MD4
0
0
0 MD5
1 md5($pass.$salt)
0
2 md5($salt.$pass)
0
3 md5(unicode($pass).$salt)
0
4 md5($salt.unicode($pass))
0
3 md5($salt.md5($pass))
7
1
0
3 md5($salt.$pass.$salt)
8
0
0
3 md5(md5($pass).md5($salt))

9
1
0
4 md5($salt.md5($salt.$pass))
0
1
0
4 md5($salt.md5($pass.$salt))
1
1
0
2 md5(md5($pass))
6
0
0
4 md5(sha1($pass))
4
0
0
4 md5(strtoupper(md5($pass)))
3
0
0
5 md5crypt 1, MD5(Unix)
0
0
9 MS Office 2007
4
0
0
9 MS Office 2010
5
0
0
9 MS Office 2013
6

0
0
9 MS Office <= 2003 $0
7
0
0
9 MS Office <= 2003 $0
7
1
0
9 MS Office <= 2003 $0
7
2
0
9 MS Office <= 2003 $3
8
0
0
9 MS Office <= 2003 $3
8
1
0
9 MS Office <= 2003 $3
8
2
0
1 MS-AzureSync PBKDF2-HMAC-SHA256
2
8
0
0
1 MSSQL(2000)
3
1
1 MSSQL(2005)
3

2
1 MSSQL(2012)
7
3
1
1 MSSQL(2014)
7
3
1
3 Mediawiki B type
7
1
1
2 MyBB
8
1
1
1 MySQL CRAM (SHA1)
1
2
0
0
2 MySQL323
0
0
3 MySQL4.1/MySQL5
0
0
1 NTLM
0
0
0
5 NetNTLMv1
5
0
0

5 NetNTLMv1 + ESS
5
0
0
5 NetNTLMv2
6
0
0
1 nsldap, SHA-1(Base64), Netscape LDAP SHA
0
1
1 nsldaps, SSHA-1(Base64), Netscape LDAP SSHA
1
1
1 OpenCart
3
9
0
0
2 osCommerce
1
1 OSX V10.4, OSX V10.5, OSX V10.6
2
2
1 OSX V10.7
7
2
2
7 OSX V10.8, OSX V10.9, OSX v10.10
1
0
0
1 Oracle S: Type (Oracle 11+)
1
2
3 Oracle H: Type (Oracle 7+)

1
0
0
1 Oracle T: Type (Oracle 12+)
2
3
0
0
1 PBKDF2-HMAC-MD5
1
9
0
0
1 PBKDF2-HMAC-SHA1
2
0
0
0
1 PBKDF2-HMAC-SHA256
0
9
0
0
1 PBKDF2-HMAC-SHA512
2
1
0
0
1 PDF 1.1 - 1.3 (Acrobat 2 - 4)
0
4
0
0
1 PDF 1.1 - 1.3 (Acrobat 2 - 4), collider #1
0
4

1
0
1 PDF 1.1 - 1.3 (Acrobat 2 - 4), collider #2
0
4
2
0
1 PDF 1.4 - 1.6 (Acrobat 5 - 8)
0
5
0
0
1 PDF 1.7 Level 3 (Acrobat 9)
0
6
0
0
1 PDF 1.7 Level 8 (Acrobat 10 - 11)
0
7
0
0
4 phpBB3
0
0
4 phpass
0
0
2 PHPS
6
1
2
5 Password Safe v3
2
0
0

9 0 0 0	Password Safe v2
1 3 3	PeopleSoft
1 3 5 0 0	PeopleSoft Token
9 9 9 9	Plaintext
1 2	PostgreSQL
1 1 1 0 0	PostgreSQL CRAM (MD5)
1 1 0 0 0	PrestaShop
4 5 2 2	PunBB
8 5	RACF

0
0
1 RAR3-hp
2
5
0
0
1 RAR5
3
0
0
0
9 Radmin2
9
0
0
7 Redmine
6
0
0
6 RipeMD160
0
0
0
7 SAP CODVN B (BCODE)
7
0
0
7 SAP CODVN F/G (PASSCODE)
8
0
0
1 SAP CODVN H (PWDSALTEDHASH) iSSHA-1
0
3

0
0
8 scrypt
9
0
0
1 SHA-224
3
0
0
1 SHA-256
4
0
0
1 SSHA-256(Base64), LDAP {SSHA256}
4
1
1
5 SHA-3(Keccak)
0
0
0
1 SHA-384
0
8
0
0
1 SHA-512
7
0
0
1 SHA1
0
0
1 SHA1(CX)
4

4
0
0
1 sha1($pass.$salt)
1
0
1 sha1($salt.$pass)
2
0
1 sha1(unicode($pass).$salt)
3
0
1 sha1($salt.unicode($pass))
4
0
4 sha1(sha1($pass))
5
0
0
4 sha1($salt.sha1($pass))
5
2
0
4 sha1(md5($pass))
7
0
0
4 sha1($salt.$pass.$salt)
9
0
0
1 sha256($pass.$salt)
4
1
0
1 sha256($salt.$pass)

4
2
0
1 sha256($salt.unicode($pass))
4
4
0
1 sha256(unicode($pass).$salt)
4
3
0
7 sha256crypt 5, SHA256(Unix)
4
0
0
1 sha512($pass.$salt)
7
1
0
1 sha512($salt.$pass)
7
2
0
1 sha512($salt.unicode($pass))
7
4
0
1 sha512(unicode($pass).$salt)
7
3
0
1 sha512crypt 6, SHA512(Unix)
8
0
0
1 SIP digest authentication (MD5)

1
4
0
0
1 SMF (Simple Machines Forum)
2
1
1 SSHA-512(Base64), LDAP {SSHA512}
7
1
1
1 SipHash
0
1
0
0
1 Skip32
4
9
0
0
2 Skype
3
8 Sybase ASE
0
0
0
6 TrueCrypt
2
X
Y
X 1 = PBKDF2-HMAC-RipeMD160
X 2 = PBKDF2-HMAC-SHA512
X 3 = PBKDF2-HMAC-Whirlpool
X 4 = PBKDF2-HMAC-RipeMD160 + boot-mode
Y 1 = XTS 512 bit pure AES

Y 1 = XTS 512 bit pure Serpent
Y 1 = XTS 512 bit pure Twofish
Y 2 = XTS 1024 bit pure AES
Y 2 = XTS 1024 bit pure Serpent
Y 2 = XTS 1024 bit pure Twofish
Y 2 = XTS 1024 bit cascaded AES-Twofish
Y 2 = XTS 1024 bit cascaded Serpent-AES
Y 2 = XTS 1024 bit cascaded Twofish-Serpent
Y 3 = XTS 1536 bit all
2 vBulletin < V3.8.5
6
1
1
2 vBulletin > V3.8.5
7
1
1
1 VeraCrypt
3
7
X
Y
X 1 = PBKDF2-HMAC-RipeMD160
X 2 = PBKDF2-HMAC-SHA512
X 3 = PBKDF2-HMAC-Whirlpool
X 4 = PBKDF2-HMAC-RipeMD160 + boot-mode
X 5 = PBKDF2-HMAC-SHA256
X 6 = PBKDF2-HMAC-SHA256 + boot-mode
Y 1 = XTS 512 bit pure AES
Y 1 = XTS 512 bit pure Serpent
Y 1 = XTS 512 bit pure Twofish
Y 2 = XTS 1024 bit pure AES
Y 2 = XTS 1024 bit pure Serpent
Y 2 = XTS 1024 bit pure Twofish
Y 2 = XTS 1024 bit cascaded AES-Twofish

Y 2 = XTS 1024 bit cascaded Serpent-AES
Y 2 = XTS 1024 bit cascaded Twofish-Serpent
Y 3 = XTS 1536 bit all
8 WBB3 (Woltlab Burning Board)
4
0
0
2 WPA/WPA2
5
0
0
2 WPA/WPA2 PMK
5
0
1
6 Whirlpool
1
0
0
1 WinZip
3
6
0
0
1 Windows 8+ phone PIN/Password
3
8
0
0
4 Wordpress
0
0
2 xt:Commerce
1

TERMINAL COMMAND CHEAT SHEET

Ctrl + u
delete everything from the cursor to the beginning of the line

Ctrl + w
delete the previous word on the command line before the cursor

Ctrl + l
clear the terminal window

Ctrl + a
jump to the beginning of the command line

Ctrl + e
move your cursor to the end of the command line

Ctrl + r
search command history in reverse, continue pressing key sequence to continue backwards search. Esc when done or command found.

FILE MANIPULATION CHEAT SHEET

Extract all lowercase strings from each line and output to wordlist.
sed 's/[^a-z]*//g' wordlist.txt > outfile.txt

Extract all uppercase strings from each line and output to wordlist.
sed 's/[^A-Z]*//g' wordlist.txt > outfile.txt

Extract all lowercase/uppercase strings from each line and output to wordlist.
sed 's/[^a-Z]*//g' wordlist.txt > outfile.txt

Extract all digits from each line in file and output to wordlist.
sed 's/[^0-9]*//g' wordlist.txt > outfile.txt

Watch hashcat potfile or designated output file live.

watch -n .5 tail -50 <hashcat.potfile or outfile.txt>

Pull 100 random samples from wordlist/passwords for visual analysis.

shuf -n 100 file.txt

Print statistics on length of each string and total counts per length.

awk '{print length}' file.txt | sort -n | uniq -c

Remove all duplicate strings and count how many times they are present; then sort by their count in descending order.

uniq -c file.txt | sort -nr

Command to create quick & dirty custom wordlist with length 1-15 character words from a designated website into a sorted and counted list.

curl -s http://www.netmux.com | sed -e 's/<[^>]*>//g' | tr " " "\n" | tr -dc '[:alnum:]\n\r' | tr '[:upper:]' '[:lower:]' | cut -c 1-15 | sort | uniq -c | sort -nr

MD5 each line in a file (Mac OSX).

while read line; do echo -n $line | md5; done < infile.txt > outfile.txt

MD5 each line in a file (*Nix).

while read line; do echo -n $line | md5sum; done < infile.txt | awk -F " " '{print $1}' > outfile.txt

Remove lines that match from each file and only print remaining from file2.txt.

grep -vwF -f file1.txt file2.txt

Take two ordered files, merge and remove duplicate lines and maintain ordering.

nl -ba -s ': ' file1.txt >> outfile.txt

nl -ba -s ': ' file2.txt >> outfile.txt

sort -n outfile.txt | awk -F ":" '{print $2}' | awk '!seen[$0]++' > final.txt

Extract strings of a specific length into a new file/wordlist.

awk 'length == 8' file.txt > 81en-out.txt

Convert alpha characters on each line in file to lowercase characters.

tr [A-Z] [a-z] < infile.txt > outfile.txt

Convert alpha characters on each line in file to uppercase characters.

tr [a-z] [A-Z] < infile.txt > outfile.txt

Split a file into separate files by X number of lines per outfile.

split -d -l 3000 infile.txt outfile.txt

Reverse the order of each character of each line in the file.

rev infile.txt > outfile.txt

Sort each line in the file from shortest to longest.

awk '{print length,$0}' "" $0; }' infile.txt | sort -n | cut -d ' ' -f2-

Sort each line in the file from longest to shortest.

awk '{print length,$0}' "" $0; }' infile.txt | sort -r -n | cut -d ' ' -f2-

Substring matching by converting to HEX and then back to ASCII.
(Example searches for **5** character strings from file1.txt found as a substring in **20** character strings in file2.txt)

strings file1.txt | xxd -u -ps -c 5 | sort -u > out1.txt
strings file2.txt | xxd -u -ps -c 20 | sort -u > out2.txt
grep -Ff out1.txt out2.txt | xxd -r -p > results.txt

Clean dictionary/wordlist of newlines and tabs.

cat dict.txt | tr -cd "[:print :][/n/t]\n" > outfile.txt

EXTRACT HASHES

SYSTEM HASH EXTRACTION

WINDOWS

METERPRETER HASHDUMP

Post exploitation dump local SAM database:
meterpreter> run post/windows/gather/hashdump

CREDDUMP

https://github.com/Neohapsis/creddump7
Three modes of attack: cachedump, lsadump, pwdump

DUMP DOMAIN CACHED CREDENTIALS

Save Windows XP/Vista/7 registry hive tables
C:\WIND0WS\system32>reg.exe save HKLM\SAM sam_backup.hiv
C:\WIND0WS\system32>reg.exe save HKLM\SECURITY sec_backup.hiv
C:\WIND0WS\system32>reg.exe save HKLM\system sys_backup.hiv

Run creddump tools against the saved hive files:
cachedump.py <system hive> <security hive> <Vista/7>
(Vista/7)
cachedump.py sys_backup.hiv sec_backup.hiv true
(XP)
cachedump.py sys_backup.hiv sec_backup.hiv false

DUMP LSA SECRETS

lsadump.py sys_backup.hiv sec_backup.hiv

DUMP LOCAL PASSWORD HASHES

pwdump.py sys_backup.hiv sec_backup.hiv

MIMIKATZ
Post exploitation commands must be executed from SYSTEM level privileges.
mimikatz # privilege::debug
mimikatz # token::whoami
mimikatz # token::elevate
mimikatz # lsadump::sam

Save Windows XP/Vista/7 registry tables
C:\WIND0WS\system32>reg.exe save HKLM\SAM sam_backup.hiv
C:\WIND0WS\system32>reg.exe save HKLM\SECURITY
C:\WIND0WS\system32>reg.exe save HKLM\system
mimikatz # lsadump::sam SystemBkup.hiv SamBkup.hiv

<u>*NIX</u>
Requires root level privileges.

cat /etc/shadow

Example *NIX sha512crypt hash

root:$6$52450745$k5ka2p8bFuSmoVTltz0yyuaREkkKBcCNqoDKzYiDL9RaE8yMnPgh2XzzF0NDrUhgrcLwg78xslw5pJiypEdFX/

<u>MAC OSX</u> 10.5-10.7
Manual OSX Hash Extraction
dscl localhost -read /Search/Users/<username>|grep GeneratedUID|cut -c15-cat /var/db/shadow/hash/<GUID> | cut -c169-216 > osx_hash.txt

<u>MAC OSX</u> 10.8-10.12

Manual OSX Hash Extraction
sudo defaults read /var/db/dslocal/nodes/Default/users/<username>.plist ShadowHashData|tr -dc ‘ 0-9a-f’|xxd -p -r|plutil -convert xml1 - -o -

Scripted OSX Hash Extraction
HASHCAT
https://gist.github.com/nueh/8252572

sudo plist2hashcat.py
/var/db/dslocal/nodes/Default/users/<username>.plist

JOHN
https://github.com/truongkma/ctf-tools/blob/master/John/run/ml2john.py

sudo ml2john.py /var/db/dslocal/nodes/Default/users/<username>.plist

PCAP HASH EXTRACTION

LOCAL NETWORK AUTHENTICATION

PCREDZ
Extracts network authentication hashes from pcaps.
Single pcap file:
Pcredz -f example.pcap

Multiple pcap files in a directory:
Pcredz -d /path/to/pcaps

Interface to listen on and collect:
Pcredz -i eth0

WPA/WPA2 PSK AUTHENTICATION

Capture the 4-way WPA/WPA2 authentication handshake.

AIRMON-NG / AIRODUMP-NG / AIREPLAY-NG
Step 1: Create monitoring interface mon0 Ex) interface wlan0
airmon-ng start wlan0
Step 2: Capture packets to file on target AP channel Ex) channel 11
airodump-ng mon0 --write capture.cap -c 11
Step 3: Start deauth attack against BSSID Ex) bb:bb:bb:bb:bb:bb
aireplay-ng --deauth 0 -a bb:bb:bb:bb:bb:bb mon0
Step 4: Wait for confirmation to appear at top of terminal:
CH 11][Elapsed: 25 s][<DATE / TIME)][WPA handshake: **
Step 5: Extract handshake into JOHN or HASHCAT format:

JOHN FORMAT EXTRACT

Stepl: cap2hccap.bin -e '<ESSID>' capture.cap capture_out.hccap

Step2: hccap2john capture_out.hccap > jtr_capture

HASHCAT FORMAT EXTRACT

cap2hccapx.bin capture.cap capture_out.hccapx

MISC WLAN TOOLS

- -

HCXTOOLS: capture and convert packets from wlan devices for use with Hashcat.

https://github.com/ZerBea/hcxtools

DATABASE HASH EXTRACTION

SQL queries require administrative privileges.

ORACLE 10g R2

SELECT username, password FROM dba_users WHERE username='<username>';

ORACLE 11g R1

SELECT name, password, spare4 FROM sys.user$ WHERE name='<username>';

MySQL4.1 / MySQL5+

SELECT User, Password FROM mysql.user INTO OUTFILE '/tmp/hash.txt' ;

MSSQL(2012), MSSQL(2014)

SELECT SL.name,SL.password_hash FROM sys.sql_logins AS SL;

POSTGRES

SELECT username, passwd FROM pg_shadow;

MISCELLANEOUS HASH EXTRACTION

John The Ripper Jumbo comes with various programs to extract hashes:

NAME	DESCRIPTION
1password2john.py	1Password vault hash extract
7z2john.py	7zip encrypted archive hash extract
androidfde2john.py	Android FDE convert disks/images into JTR format
aix2john.py	AIX shadow file /etc/security/passwd
apex2john.py	Oracle APEX hash formating
bitcoin2john.py	Bitcoin old wallet hash extraction (check btcrecover)
blockchain2john.py	Blockchain wallet extraction
cisco2john.pl	Cisco config file ingestion/ extract
cracf2john.py	CRACF program crafc.txt files
dmg2john.py	Apple encrypted disk image
ecryptfs2john.py	eCryptfs disk encryption software
efs2john.py	Windows Encrypting File System (EFS) extract
encfs2john.py	EncFS encrypted filesystem userspace
gpg2john	PGP symmetrically encrypted files
hccap2john	Convert pcap capture WPA file to JTR format
htdigest2john.py	HTTP Digest authentication
ikescan2john.py	IKE PSK SHA256 authentication
kdcdump2john.py	Key Distribution Center (KDC) servers
keepass2john	Keepass file hash extract
keychain2john.py	Processes input Mac OS X keychain files
keyring2john	Processes input GNOME Keyring files
keystore2john.py	Output password protected Java KeyStore files
known_hosts2john.py	SSH Known Host file
kwallet2john.py	KDE Wallet Manager tool to manage the passwords
ldif2john.pl	LDAP Data Interchange Format (LDIF)
lion2john.pl lion2john-alt.pl	Converts an Apple OS X Lion plist file
lotus2john.py	Lotus Notes ID file for Domino

luks2john	Linux Unified Key Setup (LUKS) disk encryption
mcafee_epo2john.py	McAfee ePolicy Orchestrator password generator
ml2john.py	Convert Mac OS X 10.8 and later plist hash
mozilla2john.py	Mozilla Firefox, Thunderbird, SeaMonkey extract
odf2john.py	Processes OpenDocument Format ODF files
office2john.py	Microsoft Office [97-03, 2007, 2010, 2013) hashes
openbsd_softraid2john.py	OpenBSD SoftRAID hash
openssl2john.py	OpenSSL encrypted files
pcap2john.py	PCAP extraction of various protocols
pdf2john.py	PDF encrypted document hash extract
pfx2john	PKCS12 files
putty2john	PuTTY private key format
pwsafe2john	Password Safe hash extract
racf2john	IBM RACF binary database files
radius2john.pl	RADIUS protocol shared secret
rar2john	RAR 3.x files input into proper format
sap2john.pl	Converts password hashes from SAP systems
sipdump2john.py	Processes sipdump output files into JTR format
ssh2john	SSH private key files
sshng2john.py	SSH-ng private key files
strip 2john.py	Processes STRIP Password Manager database
sxc2john.py	Processes SXC files
truecrypt_volume2john	TrueCrypt encrypted disk volume
uaf2john	Convert OpenVMS SYSUAF file to unix-style file
vncpcap2john	TightVNC/RealVNCpcapsvs c3.3, 3.7 and 3.8 RFB
wpapcap2john	Converts PCAP or IVS2 files to JtR format
zip2john	Processes ZIP files extracts hash into JTR format

PASSWORD ANALYSIS

PASSWORD ANALYSIS

HISTORICAL PASSWORD ANALYSIS TIPS

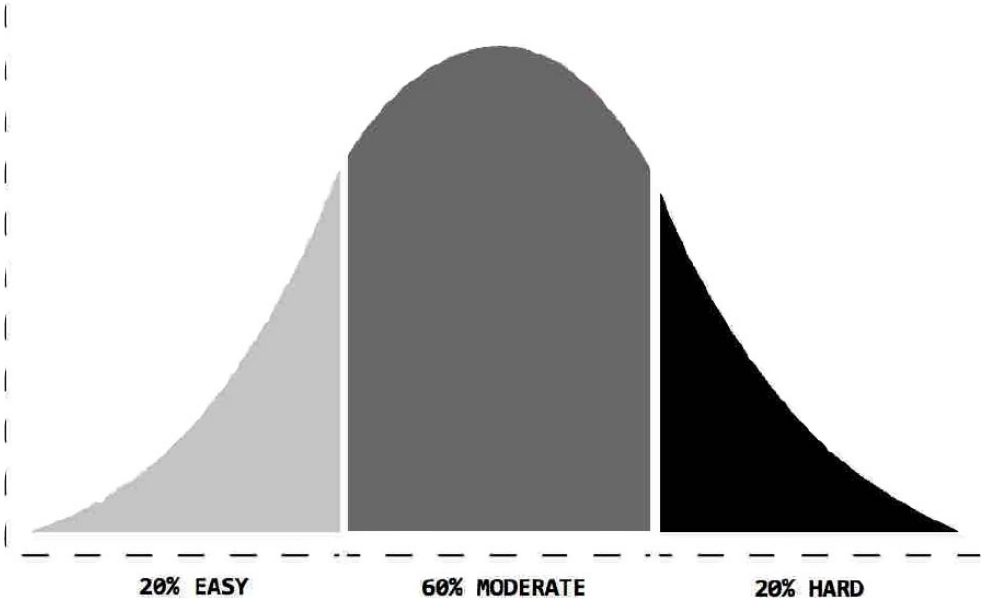
-The average password length is 7-9 characters.
-The average English word is 5 characters long.
-The average person knows 50,000 to 150,000 words.
-50% chance a user's password will contain one or more vowels.
-Women prefer personal names in their passwords, and men prefer hobbies.
-Most likely to be used symbols: ~, !, @, #, $, %, &, *, and ?
-If a number, it's usually a 1 or 2, sequential, and will likely be at the end.
-If more than one number it will usually be sequential or personally relevant.
-If a capital letter, it's usually the beginning, followed by a vowel.
-66% of people only use 1 - 3 passwords for all online accounts.
-One in nine people have a password based on the common Top 500 list.
-Western countries use lowercase passwords and Eastern countries prefer digits.

20-60-20 RULE

20-60-20 rule is a way to view the level of difficulty typically demonstrated by a large password dump, having characteristics that generally err on the side of a Gaussian Curve, mirroring the level of effort to recover said password dump.

20% of passwords are **easily** guessed dictionary words or known common passwords.
60% of passwords are **moderate** to slight variations of the earlier 20%.

20% of passwords are **hard**, lengthy, complex, or of unique characteristics.



EXAMPLE HASHES & PASSWORDS

This is an example list of passwords to help convey the variation and common complexities seen with typical password creation. It also shows individual user biases to aid in segmenting your attacks to be tailored toward a specific user.

#	HASH (MySQL 323)	PASSWORD	MASK
1	24CA195A48D85A11	BlueParrot345	?u?l?l?l?u?l?l?l?l?l?d?d?d
2	020261361E63A3FE	r0b3rt2017!	?u?d?l?d?l?l?d?d?d?d?s
3	42DF901246D99098	Ralph@Netmux.com	?u?l?l?l?l?s?u?l?l?l?l?l?s?l?l?l
4	7B6C1F5173EB4DD6	RedFerret789	?u?l?l?u?l?l?l?l?l?d?d?d
5	01085B1F3C3F49D2	Jennifer1981!	?u?l?l?l?l?l?l?l?d?d?d?d?s
6	080DBDB42AE6C3D7	7482Sacrifice	?d?d?d?d?u?l?l?l?l?l?l?l?l
7	111C232F67BC52BB	234CrowBlack	?d?d?d?u?l?l?l?u?l?l?l?l
8	1F3EF64F35878031	brownbooklamp	?l?l?l?l?l?l?l?l?l?l?l?l?l
9	4A659CDA12E9F2F1	Solitaire7482	?u?l?l?l?l?l?l?l?l?d?d?d?d
10	0B034EC713F89A68	password123	?l?l?l?l?l?l?l?l?l?d?d?d
11	28619CFE477235DE	5713063528	?d?d?d?d?d?d?d?d?d?d
12	60121DFD757911C3	74821234WorldCup	?d?d?d?d?d?d?d?d?u?l?l?l?l?u?l?l
13	6E84950D7FC8D13B	!q@w#e$r%t^y	?s?l?s?l?s?l?s?l?s?l?s?l?s?l
14	33F82FA23197EBD3	1qaz2wsx3edc!@#	?d?l?l?l?d?l?l?l?d?l?l?l?s?s?s
15	544B4D3449C08787	X9z-2Qp-3qm-WGN	?u?d?l-?d?u?l-?d?l?l-?u?u?u

ALICE PASSWORDS #(2,5,8,11,14)
BOB PASSWORDS #(1,4,7,10,13)
CRAIG PASSWORDS #(3,6,9,12,15)

CRACKING TIPS FOR EACH PASSWORD

ALICE PASSWORDS	SIMPLE ANALYSIS	BASIC ATTACK STRATEGY
R0b3rt2017!	L33t Speak Name + Date !	Simple Dictionary + Rule Attack
Jennifer1981!	Simple Name + Date !	Hybrid Attack Dict + Mask
brownbooklamp	3 Common Words Phrase	Combinator3 + Simple Dictionary
5713063528	Possible Phone Number	Custom or Simple Digit Mask
1qaz2wsx3edc!@#	Vertical+ Horizontal Walk	Straight Dict or Kwprocessor

BOB PASSWORDS	SIMPLE ANALYSIS	BASIC ATTACK STRATEGY
BlueParrot345	Color+Animal+3_Seq_digits	Combo Dictionary + Rule Attack
RedFerret789	Color+Animal+3_Seq_digits	Combo Dictionary + 3 Digit Mask
234CrowBlack	3_Seq_digits+Animal+Color	3 Digit Mask + Combo Dictionary
password123	Lowercase_word+3_Seq_digits	Straight Dictionary Attack
!q@w#e$r%t^y	Vertical Keyboard Walk	Straight Dictionary Attack

CRAIG PASSWORDS	SIMPLE ANALYSIS	BASIC ATTACK STRATEGY
Ralph@Netmux.com	Name + Domain Name	Hybrid Attack Dict + @Netmux.com
7482Sacrifice	4 Digits + Simple Word	Hybrid Attack Mask + Dict
Solitaire7482	Simple Word + 4 Digits	Hybrid Attack Dict + Mask
74821234WorldCup	7482+ 4_Seq_digits+ Dict	Hybrid Attack 7482?d?d?d?d + Dict
X9z-2Qp-3qm-WGN	Structured Random Pattern	Custom Mask X9z-2Qp-?d?l?l-?u?u?u

**This List of passwords will be referenced throughout the book and the List can also be found online at: https://github.com/netmux/HASH-CRACK*

PASSWORD PATTERN ANALYSIS

A password can contain many useful bits of information related to it's creator and their tendencies/patterns, but you have to break down the structure to decipher the meaning. This analysis process could be considered a sub-category of *Text Analytics'* and split into three pattern categories I'm calling:
Basic Pattern, Macro-Pattern, & Micro-Pattern.
**Refer to EXAMPLE HASH & PASSWORDS chapter (pg.29) for numbered examples*.

Basic Pattern : visually obvious when compared to similar groupings (i.e. language and base word/words & digits). Let's look at Alice's passwords

(2,5):

R0b3 rt**2017!** Jennifer**1981!**

-Each password uses a name: R0b3rt & Jennifer
-Ending in a 4 digit date with common special character: **2017! & 1981!**

!TIP! This type of basic pattern lends itself to a simple dictionary and L33T speak rule appending dates or hybrid mask attack appending Dict+ ?d?d?d?d?s

Macro-Pattern : statistics about the passwords underlying structure such as length and character set. Let's look at Craig's passwords (6,9):

7482 Sacrifice Solitaire**7482**

-Length structure can be summed up as: **4 Digits** + 7 Alpha & 7 Alpha + **4 Digits**
-Uses charsets ?l?u?d , so we may be able to ignore special characters.
-Basic Pattern preference for the numbers **7482** and Micro-Pattern for capitalizing words beginning in "S".

!TIP! You can assume this user is 'unlikely' to have a password less than 12 characters (+-1 char) and the 4 digit constant lowers the work to 8 chars. These examples lend themselves to a Hybrid Attack (Dict + 7482) or (7482 + Dict).

Micro-Pattern : subtlety and context which expresses consistent case changes, themes, and personal data/interest. Let's look at Bob's passwords (1,4)

BlueParrot**345** RedFerret**789**

-Each password begins with a color: Blue & Red
-Second word is a type of animal: **Parrot & Ferret**
-Consistent capitalization of all words
-Lastly, ending in a 3 digit sequential pattern: *345 & 789*

!TIP! This pattern lends itself to a custom combo dictionary and rule or hybrid mask attack appending sequential digits ?d?d?d

So when analyzing passwords be sure to group passwords and look for patterns such as language, base word/digit, length, character sets, and subtle themes with possible contextual meaning or password policy restrictions.

WESTERN COUNTRY PASSWORD ANALYSIS

Password Length Distribution based on large corpus of English website dumps:
7=15% 8=27% 9=15% 10=12% 11=4.8% 12=4.9% 13 =.6% 14=.3%

Character frequency analysis of a large corpus of English texts:
etaoinshrdlcumwfgypbvkjxqz

Character frequency analysis of a large corpus of English password dumps:
aeionrlstmcdyhubkgpjvfwzxq

Top Western password masks out of a large corpus of English website dumps:

?l?l?l?l?l?l	6-Lowercase
?l?l?l?l?l?l?l	7-Lowercase
?l?l?l?l?l?l?l?l	8-Lowercase
?d?d?d?d?d?d	6-Digits
?l?l?l?l?l?l?l?l?l?l?l?l	12-Lowercase
?l?l?l?l?l?l?l?l?l	9-Lowercase
?l?l?l?l?l?l?l?l?l?l	10-Lowercase
?l?l?l?l?l	5-Lowercase
?l?l?l?l?l?l?d?d?l?l?l?l	6-Lowercase + 2-Digits + 4-Lowercase
?d?d?d?d?d?d?d?d?l?l?l?l	8-Digits + 4-Lowercase
?l?l?l?l?l?d?d	5-Lowercase + 2-Digits
?d?d?d?d?d?d?d?d	8-Digits
?l?l?l?l?l?l?d?d	6-Lowercase + 2-Digits
?l?l?l?l?l?l?l?l?d?d	8-Lowercase + 2-Digits

EASTERN COUNTRY PASSWORD ANALYSIS

Password Length Distribution based on large corpus of Chinese website dumps:
7=21% 8=22% 9=12% 10=12% 11=4.2% 12=.9% 13 =.5% 14=.5%

Character frequency analysis of a large corpus of Chinese texts:
aineohglwuyszxqcdjmbtfrkpv

Character frequency analysis of a large corpus of Chinese password dumps:
inauhegoyszdjmxwqbctlpfrkv

Top Eastern password masks out of a large corpus of Chinese website dumps:

?d?d?d?d?d?d?d?d	8-Digits
?d?d?d?d?d?d	6-Digits
?d?d?d?d?d?d?d	7-Digits
?d?d?d?d?d?d?d?d?d	9-Digits
?d?d?d?d?d?d?d?d?d?d	10-Digits
?l?l?l?l?l?l?l?l	8-Digits
?d?d?d?d?d?d?d?d?d?d?d	11-Digits
?l?l?l?l?l?l	6-Lowercase
?l?l?l?l?l?l?l?l?l	9-Lowercase
?l?l?l?l?l?l?l	7-Lowercase
?l?l?l?d?d?d?d?d?d	3-Lowercase + 6-Digits
?l?l?d?d?d?d?d?d	2-Lowercase + 6-Digits
?l?l?l?l?l?l?l?l?l?l	10-Lowercase
?d?d?d?d?d?d?d?d?d?d?d?d	12-Digits

PASSWORD MANAGER ANALYSIS

Apple Safari Password Generator
-default password 15 characters with “-” & four groups of three random u=ABCDEFGHJKLMNPQRSTUVWXYZ l=abcdefghkmnopqrstuvwxy and d=3456789
Example) **X9z-2Qp-3qm-WGN**
XXX-XXX-XXX-XXX where X = ?u?l?d

Dashlane

-default password 12 characters using just letters and digits.
Example) **Up0k9ZAj54Kt**
XXXXXXXXXXXX where X = ?u?l?d

KeePass
-default password 20 characters using uppercase, lowercase, digits, and special.
Example) **$Zt={EcgQ.Umf)R,C7XF**
XXXXXXXXXXXXXXXXXXXX where X = ?u?l?d?s

LastPass
-default password 12 characters using at least one digit, uppercase and lowercase.
Example) **msfNdkG29n38**
XXXXXXXXXXXX where X = ?u?l?d

RoboForm
-default password 15 characters using uppercase, lowercase, digits, and special with a minimum of 5 digits.
Example) **871v2%%4F0w31zJ**
XXXXXXXXXXXXXXX where X = ?u?l?d?s

Symantec Norton Identity Safe
-default password 8 characters using uppercase, lowercase, and digits.
Example) **Ws81f0Zg**
XXXXXXXX where X = ?u?l?d

True Key
-default password 16 characters using uppercase, lowercase, digits, and special.
Example) **1B1H:9N+@>+sgWs**
XXXXXXXXXXXXXXXX where X = ?u?l?d?s

1Password v6
-default password 24 characters using uppercase, lowercase, digits, and special.
Example) **cTmM7Tzm6iPhCdpMu**. *** V]** , **VP**
XXXXXXXXXXXXXXXXXXXXXXXX where X = ?u?l?d?s

PACK (Password Analysis and Cracking Kit)

http://thesprawl.org/projects/pack/

STATSGEN

Generate statistics about the most common length, percentages, character-set and other characteristics of passwords from a provided list.

python statsgen.py passwords.txt

STATSGEN OPTIONS

-o <file.txt>	output stats and masks to file
--hiderare	hide stats of passwords with less than 1% of occurrence
--minlength=	minimum password length for analysis
--maxlength=	maximum password length for analysis
--charset=	password char filter: loweralpha, upperalpha, numeric, special
--simplemask=	password mask filter: string, digit, special

STATSGEN EXAMPLES

Output stats of passwords.txt to file example.mask:
python statsgen.py passwords.txt -o example.mask

Hide less than 1% occurrence; only analyze passwords 7 characters and greater:
python statsgen.py passwords.txt --hiderare --minlength=7 -o example.mask

Stats on passwords with only numeric characters:
python statsgen.py passwords.txt --charset=numeric

ZXCVBN (LOW-BUDGET PASSWORD STRENGTH ESTIMATION)

A realistic password strength (entropy) estimator developed by Dropbox.

https://github.com/dropbox/zxcvbn

PIPAL (THE PASSWORD ANALYSER)

Password analyzer that produces stats and pattern frequency analysis.
https://digi.ninja/projects/pipal.php

pipal.rb -o outfile.txt passwords.txt

PASSPAT (PASSWORD PATTERN IDENTIFIER)

Keyboard pattern analysis tool for passwords.
https://digi.ninja/projects/passpat.php

passpat.rb --layout us passwords.txt

CHARACTER FREQUENCY ANALYSIS

Character frequency analysis is the study of the frequency of letters or groups of letters in a corpus/text. This is the basic building block of Markov chains.

Character-Frequency-CLI-Tool
Tool to analyze a large list of passwords and summarize the character frequency. https://github.com/jcchurch/Character-Frequency-CLI-Tool

charfreq.py <options> passwords.txt

Options: -w Window size to analyze, default=l
-r Rolling window size
-s Skip spaces, tabs, newlines

ONLINE PASSWORD ANALYSIS RESOURCES

WEAKPASS
Analyzes public password dumps and provides efficient dictionaries for download.

http://weakpass.com/

PASSWORD RESEARCH
Important password security and authentication research papers in one place.

http://www.passwordresearch.com/

THE PASSWORD PROJECT
Compiled analysis of larger password dumps using PIPAL and PASSPAL tools.

http://www.thepasswordproject.com/leaked_password_lists_and_dictionaries

DICTIONARY / WORDLIST

DICTIONARY / WORDLIST

DOWNLOAD RESOURCES

WEAKPASS
http://weakpass.com/wordlist

CRACKSTATION DICTIONARY
https://crackstation.net/buy-crackstation-wordlist-password-cracking-dictionary.htm

HAVE I BEEN PWNED
*You'll have to crack the SHA1's
https://haveibeenpwned.com/passwords

SKULL SECURITY WORDLISTS
https://wiki.skullsecurity.org/index.php?title=Passwords

CAPSOP
https://wordlists.capsop.com/

UNIX-NINJA DNA DICTIONARY
Dictionary link at bottom of article
https://www.unix-ninja.com/p/Password_DNA

PROBABLE-WORDLIST
https://github.com/berzerk0/Probable-Wordlists

EFF-WORDLIST
Long-list (7,776 words) & Short-list (1,296 words)
https://www.eff.org/files/2016/07/18/eff_large_wordlist.txt

https://www.eff.org/files/2016/09/08/eff_short_wordlist_1.txt

RAINBOW TABLES
Rainbow Tables are for the most part obsolete but provided here for reference
http://project-rainbowcrack.com/table.htm

WORDLIST GENERATION

JOHN THE RIPPER
Generate wordlist that meets complexity specified in the complex filter.

john --wordlist=dict.txt --stdout --external : [filter name] > outfile.txt

STEMMING PROCESS
Stripping characters from a password list to reach the "stem" or base word/words of the candidate password. Commands are from "File Manipulation Cheat Sheet".

Extract all lowercase strings from each line and output to wordlist.
sed 's/[^a-z]*//g' passwords.txt > outfile.txt

Extract all uppercase strings from each line and output to wordlist.
sed 's/[^A-Z]*//g' passwords.txt > outfile.txt

Extract all lowercase/uppercase strings from each line and output to wordlist.
sed 's/[^a-Z]*//g' passwords.txt > outfile.txt

Extract all digits from each line in file and output to wordlist.
sed 's/[^0-9]*//g' passwords.txt > outfile.txt

HASHCAT UTILS

https://hashcat.net/wiki/doku.php?id=hashcat_utils

COMBINATOR
Combine multiple wordlists with each word appended to the other.

combinator.bin dict1.txt dict2.txt > combined_dict.txt

combinator3.bin dict1.txt dict2.txt dict3.txt > combined_dict.txt

CUTB
Cut the specific length off the existing wordlist and pass it to STDOUT.
cutb.bin offset [length] < infile.txt > outfile.txt

Example to cut first 4 characters in a wordlist and place into a file:

cutb.bin 0 4 < dict.txt > outfile.txt

RLI
Compares a file against another file or files and removes all duplicates.

rli dict1.txt outfile.txt dict2.txt

REQ
Dictionary candidates are passed to stdout if it matches an specified password group criteria/requirement. Groups can be added together (i.e. 1 + 2 = 3)
1 = LOWER (abcdefghijklmnoprstuvwxyz)
2 = UPPER (ABCDEFGHIJKLMNOPRSTUVWXYZ)
4 = DIGIT (0123465789)
8 = OTHER (All other characters not matching 1,2, or 4)

This example would stdout all candidates matching upper and lower characters

req.bin 3 < dict.txt

COMBIPOW
Creates "unique combinations" of a custom dictionary; dictionary cannot be greater than 64 lines; option -1 limits candidates to 15 characters.

combipow.bin dict.txt

combipow.bin -1 dict.txt

EXPANDER
Dictionary into stdin is parsed and split into all its single chars (up to 4) and sent to stdout.

expander.bin < dict.txt

LEN
Each candidate in a dictionary is checked for length and sent to stdout.
len.bin <min len> <max len> < dict.txt

This example would send to stdout all candidates 5 to 10 chars long.

len.bin 5 10 < dict.txt

MORPH
Auto generates insertion rules for the most frequent chains of characters

morph.bin dict.txt depth width pos_min pos_max

PERMUTE
Dictionary into stdin parsed and run through "The Countdown QuickPerm Algorithm"

permute.bin < dict.txt

CRUNCH
Wordlist generator can specify a character set and generate all possible combinations and permutations.
https://sourceforge.net/projects/crunch-wordlist/

crunch <min length> <max length> <character set> -o outfile.txt

crunch 8 8 0123456789ABCDEF -o crunch_wordlist.txt

TARGETED WORDLISTS

CeWL
Custom wordlist generator scrapes & compiles keywords from websites.
https://digi.ninja/projects/cewl.php

Example scan depth of 2 and minimum word length of 5 output to wordlist.txt

cewl -d 2 -m 5 -w wordlist.txt http://<target website>

SMEEGESCRAPE
Text file and website scraper which generates custom wordlists from content.
http://www.smeegesec.com/2014/01/smeegescrape-text-scraper-and-custom.html

Compile unique keywords from text file and output into wordlist.

SmeegeScrape.py -f file.txt -o wordlist.txt

Scrape keywords from target website and output into wordlist.

SmeegeScrape.py -u http://<target website> -si -o wordlist.txt

GENERATE PASSWORD HASHES

Use the below methods to generate hashes for specific algorithms.

HASHCAT
https://github.com/hashcat/hashcat/tree/master/tools

test.pl passthrough <#type> <#> dict.txt

MDXFIND
https://hashes.org/mdxfind.php

echo | mdxfind -z -h '<#type>' dict.txt

LYRICPASS (Song Lyrics Password Generator)

https://github.com/initstring/lyricpass
Generator using song lyrics from chosen artist to create custom dictionary.

python lyricpass.py “Artist Name” artist-dict.txt

CONVERT WORDLIST ENCODING

HASHCAT
Force internal wordlist encoding from X
hashcat -a 0 -m #type hash.txt dict.txt --encoding-from=utf-8

Force internal wordlist encoding to X
hashcat -a 0 -m #type hash.txt dict.txt --encoding-to=iso-8859-15

ICONV
Convert wordlist into language specific encoding

iconv -f <old_encode> -t <new_encode> < dict.txt | sponge dict.txt.enc

CONVERT HASHCAT $HEX OUTPUT

Example of converting $HEX[] entries in hashcat.potfile to ASCII

```
grep ‘$HEX’ hashcat.pot | awk -F “:” {‘print $2’} |perl -ne ‘ i f ($_ =~
    m/\$HEX\ [([A-Fa-f0-9]+)\]/) {print pack (“H*”, $1), “\n”}’
```

EXAMPLE CUSTOM DICTIONARY CREATION

1-Create a custom dictionary using CeWL from www.netmux.com website:

cewl -d 2 -m 5 -w custom_dict.txt http://www.netmux.com

2-Combine the new custom_dict.txt with the Google 10,000 most common English words: https://github.com/first20hours/google-10000-english

cat google-1000.txt >> custom_dict.txt

3-Combine with Top 196 passwords from "Probable Wordlists": github.com/berzerk0/Probable-Wordlists/blob/master/Real-Passwords

cat Topl96-probable.txt >> **custom_dict.txt**

4-Combo the Topl96-probable.txt together using Hashcat-util "combinator.bin" and add it to our custom_dict.txt

combinator.bin Topl96-probable.txt Topl96-probable.txt >> **custom_dict.txt**

5-Run the best64.rule from Hashcat on Top196-probable.txt and send that output into our custom dictionary:

hashcat -a 0 Topl96-probable.txt -r best64.rule --stdout >> custom_dict.txt

Can you now come up with an attack that can crack this hash?

e4821dl6a298092638ddb7cadc26d32f

**Answer in the Appendix*

RULES & MASKS

RULES & MASKS

RULE FUNCTIONS

Following are compatible between Hashcat, John The Ripper, & PasswordPro https://hashcat.net/wiki/doku.php?id=rule_based_attack

NAME	FUNCTION	DESCRIPTION
Nothing	:	Do nothing
Lowercase	l	Lowercase all letters
Uppercase	u	Uppercase all letters
Capitalize	c	Capitalize the first letter and lower the rest
Invert Capitalize	C	Lowercase first character, uppercase rest
Toggle Case	t	Toggle the case of all characters in word.
Toggle @	TN	Toggle the case of characters at position N
Reverse	r	Reverse the entire word
Duplicate	d	Duplicate entire word
Duplicate N	pN	Append duplicated word N times
Reflect	f	Duplicate word reversed
Rotate Left	{	Rotates the word left.
Rotate Right	}	Rotates the word right
AppendChar	$X	Append character X to end
PrependChar	^X	Prepend character X to front
Truncate left	[	Deletes first character
Truncate right	]	Deletes last character
Delete @ N	DN	Deletes character at position N
Extract range	xNM	Extracts M characters, starting at position N
Omit range	ONM	Deletes M characters, starting at position N
Insert @ N	iNX	Inserts character X at position N
Overwrite @ N	oNX	Overwrites character at position N with X
Truncate @ N	'N	Truncate word at position N
Replace	sXY	Replace all instances of X with Y
Purge	@X	Purge all instances of X
Duplicate first N	zN	Duplicates first character N times
Duplicate last N	ZN	Duplicates last character N times
Duplicate all	q	Duplicate every character
Extract memory	XNMI	Insert substring of length M starting at position N of word in memory at position I
Append memory	4	Append word in memory to current word
Prepend memory	6	Prepend word in memory to current word
Memorize	M	Memorize current word

RULES TO REJECT PLAINS

https://hashcat.net/wiki/doku.php?id=rule_based_attack

NAME	FUNCTION	DESCRIPTION
Reject less	<N	Reject plains of length greater than N
Reject greater	>N	Reject plains of length less than N
Reject contain	!X	Reject plains which contain char X
Reject not contain	/X	Reject plains which do not contain char X
Reject equal first	(X	Reject plains which do not start with X
Reject equal last	)X	Reject plains which do not end with X
Reject equal at	=NX	Reject plains which do not have char X at position N
Reject contains	%NX	Reject plains which contain char X less than N times
Reject contains	Q	Reject plains where the memory saved matches current word

IMPLEMENTED SPECIFIC FUNCTIONS

Following functions are not compatible with John The Ripper & PasswordPro

NAME	FUNCTION	DESCRIPTION
Swap front	k	Swaps first two characters
Swap back	K	Swaps last two characters
Swap @ N	*XY	Swaps character X with Y
Bitwise shift left	LN	Bitwise shift left character @ N
Bitwise shift right	RN	Bitwise shift right character @ N
Ascii increment	+N	Increment character @ N by 1 ascii value
Ascii decrement	-N	Decrement character @ N by 1 ascii value
Replace N + 1	.N	Replaces character @ N with value at @ N plus 1
Replace N - 1	,N	Replaces character @ N with value at @ N minus 1
Duplicate block front	yN	Duplicates first N characters
Duplicate block back	YN	Duplicates last N characters
Upper Lower	E	Lower case the whole line, then upper case the first letter and every letter after a space

RULE ATTACK CREATION

EXAMPLE RULE CREATION & OUTPUT

Below we apply basic rules to help explain the expected output when using rules.

WORD	RULE	OUTPUT
password	$1	password1
password	^!^1	1!password
password	so0 sa@	p@ssw0rd
password	c so0 sa@ $1	P@ssw0rd1
password	u r	DROWSSAP

MASKPROCESSOR HASHCAT-UTIL

https://github.com/hashcat/maskprocessor

Maskprocessor can be used to generate a long list of rules very quickly.

Example rule creation of prepend digit and special char to dictionary candidates (i.e. ^l ^! , ^2 ^@ , . . .) :

mp64.bin '^?d ^?s' -o rule.txt

Example creating rule with custom charset appending lower, uppercase chars and all digits to dictionary candidates (i.e. $a $Q $1 , $e $ A $2, . . .) :

mp64.bin -1 aeiou -2 QAZWSX '$?1 $?2 $?d'

GENERATE RANDOM RULES ATTACK (i.e. "Raking")

hashcat -a 0 -m #type -g <#rules> hash.txt dict.txt

GENERATE RANDOM RULES FILE USING HASHCAT-UTIL

generate-rules.bin <#rules> <seed> | ./cleanup-rules.bin [1=CPU,2=GPU] > out.txt

generate-rules.bin 1000 42 | ./cleanup-rules.bin 2 > out.txt

SAVE SUCCESSFUL RULES/METRICS

hashcat -a 0 -m #type --debug-mode=l --debug-file=debug.txt hash.txt -r rule.txt

SEND RULE OUTPUT TO STDOUT / VISUALLY VERIFY RULE OUTPUT

hashcat dict.txt -r rule.txt --stdout

john --wordlist=dict.txt --rules=example --stdout

PACK (Password Analysis and Cracking Kit) **RULE CREATION**

http://thesprawl.org/projects/pack/

RULEGEN

Advanced techniques for reversing source words and word mangling rules from already cracked passwords by continuously recycling/expanding generated rules and words. Outputs rules in Hashcat format.
http://thesprawl.org/research/automatic-password-rule-analysis-generation/
Ensure you install 'AppleSpell' 'aspell* module using packet manager

python rulegen.py --verbose --password P@ssw0rdl23

RULEGEN OPTIONS

-b rockyou	Output base name. The following files will be generated: basename.words, basename.rules and basename.stats
-w wiki.dict	Use a custom wordlist for rule analysis.
-q, --quiet	Don't show headers.
--threads=THREADS	Parallel threads to use for processing.

Fine tune source word generation::

--maxworddist=10	Maximum word edit distance (Levenshtein)
--maxwords=5	Maximum number of source word candidates to

	consider
--morewords	Consider suboptimal source word candidates
--simplewords	Generate simple source words for given passwords

Fine tune rule generation::

--maxrulelen=10	Maximum number of operations in a single rule
--maxrules=5	Maximum number of rules to consider
--morerules	Generate suboptimal rules
--simplerules	Generate simple rules insert,delete,replace
--bruterules	Bruteforce reversal and rotation rules (slow)

Fine tune spell checker engine::

--providers=aspell,myspell	Comma-separated list of provider engines

Debugging options::

-v, --verbose	Show verbose information.
-d, --debug	Debug rules.
--password	Process the last argument as a password not a file.
--word=Password	Use a custom word for rule analysis
--hashcat	Test generated rules with hashcat-cli

RULEGEN EXAMPLES

Analysis of a single password to automatically detect rules and potential source word used to generate a sample password:
python rulegen.py --verbose --password P@ssw0rdl23

Analyze passwords.txt and output results:
python rulegen.py passwords.txt -q

analysis.word - unsorted and non-uniqued source words
analysis-sorted.word - occurrence sorted and unique source words
analysis.rule - unsorted and non-uniqued rules
analysis-sorted.rule - occurrence sorted and unique rules

HASHCAT INCLUDED RULES	Approx # Rules
Incisive-leetspeak.rule	15,487
InsidePro-HashManager.rule	6,746
InsidePro-PasswordsPro.rule	3,254
T0XlC-insert_00-99_1950-2050_toprules_0_F.rule	4,019
T0XlC-insert_space_and_special_0_F.rule	482
T0XlC-insert_top_100_passwords_1_G.rule	1,603
T0XlC.rule	4,088
T0XlCv1.rule	11,934
best64.rule	77
combinator.rule	59
d3ad0ne.rule	34,101
dive.rule	99,092
generated.rule	14,733
generated2.rule	65,117
leetspeak.rule	29
oscommerce.rule	256
rockyou-30000.rule	30,000
specific.rule	211
toggles1.rule	15
toggles2.rule	120
toggles3.rule	575
toggles4.rule	1,940
toggles5.rule	4,943
unix-ninja-leetspeak.rule	3,073

JOHN INCLUDED RULES	Approx # Rules
All (Jumbo + KoreLogic)	7,074,300
Extra	17
Jumbo (Wordlist + Single + Extra + NT + OldOffice)	226
KoreLogic	7,074,074
Loopback (NT + Split)	15
NT	14

OldOffice	1
Single	169
Single-Extra (Single + Extra + OldOffice)	187
Split	1
Wordlist	25

http://www.openwall.com/john/doc/RULES.shtml

CUSTOM RULE PLANS

L33TSP3@K_RULES	2_DIGIT_APPEND	$APPEND/^PREPEND_DATE
so0	$0 $0	$1 $9 $9 $5
si1	$0 $1	^5 ^9 ^9 ^1
se3	$0 $2	$2 $0 $0 $0
ss5	$1 $1	^0 ^0 ^0 ^2
sa@	$1 $2	$2 $0 $1 $0
sO0	$1 $3	^0 ^1 ^0 ^2
sI1	$2 $1	$2 $0 $1 $7
sE3	$2 $2	^7 ^1 ^0 ^2
sS5	$6 $9	$2 $0 $1 $8
sA@	$9 $9	^8 ^1 ^0 ^2

TOP_10_dive.rule	TOP_10_best64.rule	TOP_10_rockyou.rule
c	:	:
l	r	$1
u	u	r
T0	T0	$2
$1	$0	$1 $2 $3
} } } }	$1	$1 $2
p3	$2	$3
[	$3	$7
$.	$4	^1
]	$5	$1 $3

MASK ATTACK CREATION

DEBUG / VERIFY MASK OUTPUT

hashcat -a 3 ?a?a?a?a --stdout
john --mask=?a?a?a?a --stdout

HASHCAT MASK ATTACK CREATION

Example usage:
hashcat -a 3 -m #type hash.txt <mask>

Example brute-force all possible combinations 7 characters long:
hashcat -a 3 -m #type hash.txt ?a?a?a?a?a?a?a

Example brute-force all possible combinations 1 - 7 characters long:
hashcat -a 3 -m #type hash.txt -i ?a?a?a?a?a?a?a

Example brute-force uppercase first letter, 3 unknown middle characters, and ends in 2 digits (i.e. Passl2):
hashcat -a 3 -m #type hash.txt ?u?a?a?a?d?d

Example brute-force known first half word "secret" and unknown ending:
hashcat -a 3 -m #type hash.txt secret?a?a?a?a

Example hybrid mask (leftside) + wordlist (rightside) (i.e. 123!Password)
hashcat -a 7 -m #type hash.txt ?a?a?a?a dict.txt

Example wordlist (leftside) + hybrid mask (rightside) (i.e. Passwordl23!)
hashcat -a 6 -m #type hash.txt dict.txt ?a?a?a?a

HASHCAT CUSTOM CHARSETS

Four custom buffer charsets to create efficient targeted mask attacks defined as: **-1 -2 -3 -4**

Example custom charset targeting passwords that only begin in a,A,b,B,or c,C , 4 unknown middle characters, and end with a digit (i.e. al7z#q7): hashcat -a 3 -m #type hash.txt -1 abcABC ?l?a?a?a?a?d

Example custom charset targeting passwords that only begin in uppercase or lowercase, 4 digits in the middle, and end in special character !,@,$ (i.e. W7462! or f1234$):
hashcat -a 3 -m #type hash.txt -1 ?u?l -2 !@$?l?d?d?d?d?2

Example using all four custom charsets at once (i.e. pow!12er):
hashcat -a 3 -m #type hash.txt -1 qwer -2 poiu -3 123456 -4 !@#$% ?2?2?1?4?3?3? 1?1

JOHN MASK ATTACK CREATION

Example usage:
john --format=#type hash.txt --mask=<mask>

Example brute-force all possible combinations up to 7 characters long:
john --format=#type hash.txt --mask=?a?a?a?a?a?a?a

Example brute-force uppercase first letter, 3 unknown middle characters, and ends in 2 digits (i.e. Passl2):
john --format=#type hash.txt --mask=?u?a?a?a?d?d

Example brute-force known first half word "secret" and unknown ending:
john --format=#type hash.txt --mask=secret?a?a?a?a

Example mask (leftside) + wordlist (rightside) (i.e. 123!Password)
john --format=#type hash.txt --wordlist=dict.txt --mask=?a?a?a?a?w

Example wordlist (leftside) + mask (rightside) (i.e. Password123!)
john --format=#type hash.txt --wordlist=dict.txt --mask=?w?a?a?a?a

JOHN CUSTOM CHARSETS

Nine custom buffer charsets to create efficient targeted mask attacks defined as: **-1 -2 -3 -4 -5 -6 -7 -8 -9**

Example custom charset targeting passwords that only begin in a,A,b,B,or c,C , 4 unknown middle characters, and end with a digit (i.e. a17z#q7):
john --format=#type hash.txt -1=abcABC --mask=?l?a?a?a?a?d

Example custom charset targeting passwords that only begin in uppercase or lowercase, 4 digits in the middle, and end in special character !,@,$ (i.e. W7462! or f1234$):
john --format=#type hash.txt -1=?u?l -2=!@$ --mask=?l?d?d?d?d?2

Example using four custom charsets at once (i.e. pow!12er):
john --format=#type hash.txt -1=qwer -2=poiu -3=123456 -4=!@#$%, --mask=?2?2?l?4? 3?3?1?1

HASHCAT MASK CHEAT SHEET

```
?l = lowercase   = 26 chars = abcdefghijklmnopqrstuvwxyz
?u = uppercase   = 26 chars = ABCDEFGHIJKLMNOPQRSTUVWXYZ
?d = digits      = 10 chars = 0123456789
?s = special     = 33 chars = «space»!”#$%&'()*+,-./:;<=>?@[\]^_`{|}~
?a = all         = 95 chars = lowercase+uppercase+digits+special
?h = hex         = 16 chars = 0123456789abcdef
?H = HEX         = 16 chars = 0123456789ABCDEF
?b = byte        = 256 byte = 0x00 - 0xff
```

JOHN MASK CHEAT SHEET

```
?l = lowercase   = 26 chars = abcdefghijklmnopqrstuvwxyz
?u = uppercase   = 26 chars = ABCDEFGHIJKLMNOPQRSTUVWXYZ
?d = digits      = 10 chars = 0123456789
?s = special     = 33 chars = «space»!”#$%&'()*+,-./:;<=>?@[\]^_`{|}~
?a = all         = 95 chars = lowercase+uppercase+digits+special
?h = hex         0x80 - 0xff
?A = all valid characters in the current code page
?h = all 8-bit (0x80-0xff)
?H = all except the NULL character
?L = non-ASCII lower-case letters
?U = non-ASCII upper-case letters
?D = non-ASCII "digits"
?S = non-ASCII "specials"
?w = Hybrid mask mode placeholder for the original word
```

MASK FILES

Hashcat allows for the creation of mask f i l es by placing custom masks, one per line, in a text f i l e with “.hcmask” extension.

HASHCAT BUILT-IN MASK FILES	Approx # Masks

8char-11-1u-1d-1s-compliant.hcmask	40,824
8char-11-1u-1d-1s-noncompliant.hcmask	24,712
rockyou-1-60.hcmask	836
rockyou-2-1800.hcmask	2,968
rockyou-3-3600.hcmask	3,971
rockyou-4-43200.hcmask	7,735
rockyou-5-86400.hcmask	10,613
rockyou-6-864000.hcmask	17,437
rockyou-7-2592000.hcmask	25,043

WESTERN COUNTRY TOP MASKS

?l?l?l?l?l?l	6-Lowercase
?l?l?l?l?l?l?l	7-Lowercase
?l?l?l?l?l?l?l?l	8-Lowercase
?d?d?d?d?d?d	6-Digits
?l?l?l?l?l?l?l?l?l?l?l?l	12-Lowercase
?l?l?l?l?l?l?l?l?l	9-Lowercase
?l?l?l?l?l?l?l?l?l?l	10-Lowercase
?l?l?l?l?l	5-Lowercase
?l?l?l?l?l?l?d?d?l?l?l?l	6-Lowercase + 2-Digits + 4-Lowercase
?d?d?d?d?d?d?d?d?l?l?l?l	8-Digits + 4-Lowercase
?l?l?l?l?l?d?d	5-Lowercase + 2-Digits
?d?d?d?d?d?d?d?d	8-Digits
?l?l?l?l?l?l?d?d	6-Lowercase + 2-Digits
?l?l?l?l?l?l?l?l?d?d	8-Lowercase + 2-Digits

EASTERN COUNTRY TOP MASKS

```
?d?d?d?d?d?d?d?d                8-Digits
?d?d?d?d?d?d                    6-Digits
?d?d?d?d?d?d?d                  7-Digits
?d?d?d?d?d?d?d?d?d              9-Digits
?d?d?d?d?d?d?d?d?d?d            10-Digits
?l?l?l?l?l?l?l?l                8-Digits
?d?d?d?d?d?d?d?d?d?d?d          11-Digits
?l?l?l?l?l?l                    6-Lowercase
?l?l?l?l?l?l?l?l?l              9-Lowercase
?l?l?l?l?l?l?l                  7-Lowercase
?l?l?l?d?d?d?d?d?d              3-Lowercase + 6-Digits
?l?l?d?d?d?d?d?d                2-Lowercase + 6-Digits
?l?l?l?l?l?l?l?l?l?l            10-Lowercase
?d?d?d?d?d?d?d?d?d?d?d?d        12-Digits
```

PACK (Password Analysis and Cracking Kit) **MASK CREATION**

http://thesprawl.org/projects/pack/

MASKGEN

MaskGen allows you to automatically generate pattern-based mask attacks from known passwords and filter by length and desired cracking time.

python maskgen.py example.mask

MASKGEN OPTIONS

```
-t               target cracking time of all masks combined (seconds)
-o <file.hcmask> output masks to a file
--showmasks      show matching masks
```

Individual Mask Filter Options:

```
--minlength=8       Minimum password length
--maxlength=8       Maximum password length
--mintime=3600      Minimum mask runtime (seconds)
--maxtime=3600      Maximum mask runtime (seconds)
--mincomplexity=1   Minimum complexity
--maxcomplexity=100 Maximum complexity
--minoccurrence=1   Minimum occurrence
--maxoccurrence=100 Maximum occurrence
```

Mask Sorting Options:

```
--optindex          sort by mask optindex (default)
--occurrence        sort by mask occurrence
--complexity        sort by mask complexity
```

Check mask coverage:

```
--checkmasks=?u?l?l?l?l?l?d,?l?l?l?l?l?d?d   check mask coverage
--checkmasksfile=masks.hcmask                check mask coverage in a file
```

Miscellaneous options:

```
--pps=1000000000    Passwords per Second
```

MASKGEN EXAMPLES

Gather stats about cracked passwords.txt and hide the less than 1% results:
python statsgen.py --hiderare passwords.txt

Save masks stats to a .mask file for further analysis:
python statsgen.py --hiderare passwords.txt -o example.mask

Analyze example.mask results, number of masks, estimated time to crack, etc...
python maskgen.py example.mask

Create 24 hour (86400 seconds) mask attack based on cracking speed of a single GTX 1080 against MD5 hashes 24943.1 MH/s(based on appendix table).
!Substitute your GPU's cracking speed against MD5 (c/s)!.
python maskgen.py example.mask --targettime=86400 --optindex --pps=24943000000 -q

Output 24 hour mask attack to a .hcmask file for use in Hashcat:
python maskgen.py example.mask --targettime=86400 --optindex --pps=24943000000 -q -o example.hcmask

Use your new example.hcmask file with Hashcat in mask attack mode:
hashcat -a 3 -m #type hash.txt example.hcmask

TIME TABLE CHEAT SHEET

```
60 seconds                  1 minute
3,600 seconds               1 hour
86,400 seconds              1 day
604,800 seconds             1 week
1,209,600 seconds           1 fortnight
2,419,200 seconds           1 month (30days)
31,536,000 seconds          1 year
```

POLICYGEN

Generate a collection of masks following the password complexity in order to significantly reduce the cracking time.

python policygen.py [options] -o example.hcmask

POLICYGEN OPTIONS

```
-o masks.hcmask       Save masks to a file
--pps=1000000000      Passwords per Second
--showmasks           Show matching masks
--noncompliant        Generate masks for noncompliant passwords
-q, --quiet           Don't show headers.
```

Password Policy:

Define the minimum (or maximum) password strength policy that you would like to test

```
--minlength=8       Minimum password length
--maxlength=8       Maximum password length
--mindigit=1        Minimum number of digits
--minlower=1        Minimum number of lower-case characters
--minupper=1        Minimum number of upper-case characters
--minspecial=1      Minimum number of special characters
--maxdigit=3        Maximum number of digits
--maxlower=3        Maximum number of lower-case characters
--maxupper=3        Maximum number of upper-case characters
--maxspecial=3      Maximum number of special characters
```

POLICYGEN EXAMPLES

Generate mask attack for password policy 8 character length requiring at least 1 lowercase, 1 uppercase, 1 digit, and 1 special character:
python policygen.py --minlength 8 --maxlength 8 --minlower 1 --minupper 1 --mindigit 1 --minspecial 1 -o example.hcmask

Generate mask attack and estimate time of completion based on GTX 1080 against MD5 hashes 24943.1 MH/s(based on appendix table) for

password policy 8 character length requiring at least 1 lowercase, 1 uppercase, 1 digit, and 1 special character:
python policygen.py --minlength 8 --maxlength 8 --minlower 1 --minupper 1 --mindigit 1 --minspecial 1 -o example.hcmask --pps=24943000000

CUSTOM MASK PLANS

DATE YYMMDD MASK
hashcat -a 3 -m #type hash.txt -1 12 -2 90 -3 01 -4 123 ?l?2?3?d?4?d

DATE YYYYMMDD MASK
hashcat -a 3 -m #type hash.txt -1 12 -2 90 -3 01 -4 123 ?l?2?d?d?3?d? 4?d

3 SEQUENTIAL NUMBERS MASK + SPECIAL
hashcat -a 3 -m #type hash.txt -1 147 -2 258 -3 369 ?l?2?3?s

FOREIGN CHARACTER SETS

FOREIGN CHARACTER SETS

UTF8 POPULAR LANGUAGES

**Incremental four character password examples*

Arabic
UTF8 (d880-ddbf)
hashcat -a 3 -m #type hash.txt --hex-charset -1 d8d9dadbdcdd -2 80818283848586 8788898a8b8c8d8e8f909192939495969798999a9b9c9d9e9fa0ala2a3a4a5a6a7a8a9aaabacadae afb0blb2b3b4b5b6b7b8b9babbbcbdbebf -i ?1?2?1?2?1?2?1?2

Bengali
UTF8 (e0a680-e0adbf)
hashcat -a 3 -m #type hash.txt --hex-charset -1 e0 -2 a6a7a8a9aaabacad -3 8081 828384858687888898a8b8c8d8e8f909192939495969798999a9b9c9d9e9fa0 ala2a3a4a5a6a7a8a9 aaabacadaeafb0blb2b3b4b5b6b7b8b9babbbcbdbebf -i ?1?2?3?1?2?3?1?2?3?1?2?3

Chinese (Common Characters)
UTF8 (e4b880-e4bbbf)
hashcat -a 3 -m #type hash.txt --hex-charset -1 e4 -2 b8b9babb -3 808182838485 868788898a8b8c8d8e8f909192939495969798999a9b9c9d9e9fa0ala2a3a4a5a6a7a8a9aaabacad aeafb0blb2b3b4b5b6b7b8b9babbbcbdbebf -i ?1?2?3?1?2?3?1?2?3?1?2?3

Japanese (Katakana & Hiragana)

UTF8 (e38180-e3869f)
hashcat -a 3 -m #type hash.txt --hex-charset -1 e3 -2 818283848586 -3 80818283
8485868788898a8b8c8d8e8f909192939495969798999a9b9c9d9e9fa0ala2a3a4a5a6a7a8a9aaab acadaeafb0blb2b3b4b5b6b7b8b9babbbcbdbebf -i ?1?2?3?1?2?3?1?2?3?1?2?3

Russian
UTF8 (d080-d4bf)
hashcat -a 3 -m #type hash.txt --hex-charset -1 d0dld2d3d4 -2 8081828384858687
88898a8b8c8d8e8f909192939495969798999a9b9c9d9e9fa0ala2a3a4a5a6a7a8a9aaabacadaeaf b0blb2b3b4b5b6b7b8b9babbbcbdbebf -i ?1?2?1?2?1?2?1?2?1?2

HASHCAT BUILT-IN CHARSETS

German
hashcat -a 3 -m #type hash.txt -1 charsets/German.hcchr -i ?1?1?1?1

French
hashcat -a 3 -m #type hash.txt -1 charsets/French.hcchr -i ?1?1?1?1

Portuguese
hashcat -a 3 -m #type hash.txt -1 charsets/Portuguese.hcchr -i ?1?1?1?1

SUPPORTED LANGUAGE ENCODINGS
hashcat -a 3 -m #type hash.txt -1 charsets/<language>.hcchr -i ?1?1?1?1

Bulgarian, Castilian, Catalan, English, French, German, Greek, Greek Polytonic, Italian, Lithuanian, Polish, Portuguese, Russian, Slovak, Spanish

JOHN UTF8 & BUILT-IN CHARSETS

OPTIONS:

--encoding=NAME	input encoding (eg. UTF-8, ISO- 8859-1).
--input-encoding=NAME	input encoding (alias for --encoding)
--internal-encoding=NAME	encoding used in rules/masks (see doc/ENCODING)
- -target-encoding=NAME	output encoding (used by format)

Example LM hashes from Western Europe, using a UTF-8 wordlist:
john --format=lm hast.txt --encoding=utf8 --target:cp850 --wo:spanish.txt

Example using UTF-8 wordlist with internal encoding for rules processing:
john --format=#type hash.txt --encoding=utf8 --internal=CP1252 --wordlist=french.1st --rules

Example mask mode printing all possible "Latin-1" words of length 4:
john --stdout --encoding=utf8 --internal=8859-1 --mask:?1?1?1?1

SUPPORTED LANGUAGE ENCODINGS
UTF-8, ISO-8859-1 (Latin), ISO-8859-2 (Central/Eastern Europe), ISO-8859-7 (Latin/Greek), ISO-8859-15 (Western Europe), CP437 (Latin), CP737 (Greek), CP850 (Western Europe), CP852 (Central Europe), CP858 (Western Europe), CP866 (Cyrillic), CP1250 (Central Europe), CP1251 (Russian), CP1252 (Default Latin1), CP1253 (Greek) and K0I8-R (Cyrillic).

HASHCAT ?b BYTE CHARSET

If your unsure as to position of a foreign character set contained within your target password, you can attempt the ?b byte charset in a mask using a sliding window. For example if we have a password 6 characters long:

?b = 256 byte = **0x00 - 0xff**

hashcat -a 3 -m #type hash.txt	**?b**?a?a?a?a?a
	?a**?b**?a?a?a?a
	?a?a**?b**?a?a?a

?a?a?a**?b**?a?a
?a?a?a?a**?b**?a
?a?a?a?a?a**?b**

CONVERT ENCODING

HASHCAT
Force internal wordlist encoding from X
hashcat -a 0 -m #type hash.txt dict.txt --encoding-from=utf-8

Force internal wordlist encoding to X
hashcat -a o -m #type hash.txt dict.txt --encoding-to=iso-8859-15

ICONV
Convert wordlist into language specific encoding
iconv -f <old_encode> -t <new_encode> < dict.txt | sponge dict.txt.enc

CONVERT HASHCAT $HEX OUTPUT

Example of converting $HEX[] entries in hashcat.pot f i l e to ASCII
grep '$HEX' hashcat.pot | awk -F ":" {'print$2'} |perl -ne ' i f ($_ =~ m/\$HEX\[([A-Fa-f0-9]+)\]/) {print pack("H*", $1), "\n"}'

ADVANCED ATTACKS

ADVANCED ATTACKS

PRINCE ATTACK

PRINCE (PRobability INfinite Chained Elements) Attack takes one input wordlist and builds “chains” of combined words automatically.

HASHCAT PRINCEPROCESSOR
https://github.com/hashcat/princeprocessor

Attack slow hashes:

pp64.bin dict.txt | hashcat -a 0 -m #type hash.txt

Amplified attack for fast hashes:

pp64.bin --case-permute dict.txt | hashcat -a 0 -m #type hash.txt -r rule.txt

Example PRINCE attack producing minimum 8 char candidates with 4 elements piped directly into Hashcat with rules attack.

pp64.bin --pw-min=8 --limit=4 dict.txt|hashcat -a 0 -m # hash.txt -r best64.rule

PRINCECEPTION ATTACK (epixoip)
Piping the output of one PRINCE attack into another PRINCE attack.

pp64.bin dict.txt | pp64.bin | hashcat -a 0 -m #type hash.txt

JOHN BUILT-IN PRINCE ATTACK

john --prince=dict.txt hash.txt

MASK PROCESSOR

Mask attack generator with a custom configurable charset and ability to limit consecutive and repeating characters to decrease attack keyspace.
https://github.com/hashcat/maskprocessor

Limit 4 consecutive identical characters in the password string "-q" option:

mp64.bin -q 4 ?d?d?d?d?d?d?d?d | hashcat -a 0 -m #type hash.txt

Limit 4 identical characters in the password string "-r" option:

mp64.bin -r 4 ?d?d?d?d?d?d?d?d | hashcat -a 0 -m #type hash.txt

Limit 2 consecutive and 2 identical characters in the password string:

mp64.bin -r 2 -q 2 ?d?d?d?d?d?d?d?d | hashcat -a 0 -m #type hash.txt

Custom charset limiting 2 consecutive and 2 identical characters in the password string:

mp64.bin -r 2 -q 2 -1 aeiuo -2 TGBYHN ?l?2?l?2?d?d?d?d | hashcat -a 0 -m #type hash.txt

CUSTOM MARKOV MODEL / STATSPROCESSOR

Word-generator based on the per-position markov-attack.
https://github.com/hashcat/statsprocessor

HCSTATGEN
Create custom Markov models using hashcat-util hcstatgen.bin based on cracked target passwords. The util hcstatgen makes a 32MB file each time no matter how small/large the password list provided. Highly recommended you make custom Markov models for different target sets.

hcstatgen.bin outfile.hcstat < passwords.txt

STATSPROCESSOR
Is a high-performance word-generator based on a user supplied per-position Markov model (hcstat file) using mask attack notation.

Step 1: Create your custom Markov model

hcstatgen.bin out.hcstat < passwords.txt

Step 2.1: Supply your new Markov model to Hashcat as mask or rule attack.

hashcat -a 3 -m #type hash.txt --markov-hcstat=out.hcstat ?a?a?a?a?a?a

hashcat -a 0 -m #type hash.txt dict.txt -r rule.txt --markov-hcstat=out.hcstat

Step 2.2: OR Supply your new Markov model with sp64 and pipe into Hashcat.

sp64.bin --pw-min 3 --pw-max 5 out.hcstat ?1?1?1?1?1?1 | hashcat -a 0 -m #type hash.txt

KEYBOARD WALK PROCESSOR

Keyboard-walk generator with configurable base chars, keymappings and routes. https://github.com/hasheat/kwprocessor

Example keyboard walk with tiny charset in english mapping and with 2-10 adjacent keys piping out results into a hashcat attack:
kwp.bin basechar/tiny.base keymaps/en.keymap routes/2-to-10-max-3 -0 -z | hashcat -a *0* -m #type hash.txt

Example keyboard walk with full charset in english mapping and with 3x3 adjacent keys piping out results into a hashcat attack:
./kwp basechars/full.base keymaps/en.keymap routes/3-to-3-exhaustive.route | hashcat -a *0* -m #type hash.txt

[FULL LIST OF OPTIONS]

```
./kwp [options]... basechars-file keymap-file routes-file
  -V, --version              Print version
  -h, --help                 Print help
  -o, --output-file          Output-file
  -b, --keyboard-basic       Characters reachable without holding shift or altgr
  -s, --keyboard-shift       Characters reachable by holding shift
  -a, --keyboard-altgr       Characters reachable by holding altgr (non-english)
  -z, --keyboard-all         Shortcut to enable all --keyboard-* modifier
  -1, --keywalk-south-west   Routes heading diagonale south-west
  -2, --keywalk-south        Routes heading straight south
  -3, --keywalk-south-east   Routes heading diagonale south-east
  -4, --keywalk-west         Routes heading straight west
  -5, --keywalk-repeat       Routes repeating character
  -6, --keywalk-east         Routes heading straight east
  -7, --keywalk-north-west   Routes heading diagonale north-wes
  -8, --keywalk-north        Routes heading straight north
  -9, --keywalk-north-east   Routes heading diagonale north-east
  -0, --keywalk-all          Shortcut to enable all --keywalk-* directions
  -n, --keywalk-distance-min Minimum allowed distance between keys
  -x, --keywalk-distance-max Maximum allowed distance between keys
```

MDXFIND / MDSPLIT

https://hashes.org/mdxfind.php
(credit ‘Waffle’)

MDXFIND is a program which allows you to run large numbers of unsolved hashes of any type, using many algorithms concurrently, against a large number of plaintext words and rules, very quickly. It's main purpose was to deal with large lists (20 million, 50 million, etc) of unsolved hashes and run them against new dictionaries as you acquire them.

So when would you use MDXFIND on a pentest? If you dump a database tied to website authentication and the hashes are not cracking by standard attack plans. The hashes may be generated in a unique nested hashing series. If you are able to view the source code of said website to view the custom hashing function you can direct MDXFIND to replicate that hashing series. If not, you can still run MDXFIND using some of the below 'Generic Attack Commands'. MDXFIND is tailored toward intermediate to expert level password cracking but is extremely powerful and flexible.

Example website SHA1 custom hashing function performing multiple iterations:

```
$hash = sha1($password . $salt);
for ($i = 1; $i <= 65000; ++$i)
{
	$hash = sha1($hash . $salt);
}
```

MDXFIND

COMMAND STRUCTURE THREE METHODS **1-STDOUT 2-STDIN 3-File**

1- Reads hashes coming from cat (or other) commands stdout.

cat hash.txt | mdxfind -h <regex #type> -i <#iterations> dict.txt > out.txt

2- Takes stdin from outside attack sources in place of dict.txt when using the options variable '-f' to specify hash.txt file location and variable 'stdin'.

mp64.bin ?d?d?d?d?d?d | mdxfind -h <regex #type> -i <#iterations> -f hash.txt stdin > out.txt

3- Specify file location '-f' with no external stdout/stdin sources.

mdxfind -h <regex #type> -i <#iterations> -f hash.txt dict.txt > out.txt

[FULL LIST OF OPTIONS]

-a Do email address munging
-b Expand each word into unicode, best effort
-c Replace each special char (<>&, etc) with XML equivalents
-d De-duplicate wordlists, best effort...but best to do ahead of time
-e Extended search for truncated hashes
-p Print source (filename) of found plain-texts
-q Internal iteration counts for SHA1MD5X, and others. For example, if you have a hash that is SHA1(MD5(MD5(MD5(MD5($pass))))), you would set -q to 5.
-g Rotate calculated hashes to attempt match to input hash
-s File to read salts from
-u File to read Userid/Usernames from
-k File to read suffixes from
-n Number of digits to append to passwords. Other options, like: -n 6x would append 6 digit hex values, and 8i would append all ipv4 dotted-quad IP-addresses.
-i The number of iterations for each hash
-t The number of threads to run
-f file to read hashes from, else stdin
-l Append CR/LF/CRLF and print in hex
-r File to read rules from
-v Do not mark salts as found.
-w Number of lines to skip from first wordlist
-y Enable directory recursion for wordlists
-z Enable debugging information/hash results
-h The hash types: 459 TOTAL HASHES SUPPORTED

GENERIC ATTACK PLANS

This is a good general purpose MDXFIND command to run your hashes against if you suspect them to be "non-standard" nested hashing sequences.

This command says “Run all hashes against dict.txt using 10 iterations except ones having a salt, user, or md5x value in the name.” It’s smart to skip salted/user hash types in MDXFIND unless you are confident a salt value has been used.

cat hash.txt | mdxfind -h ALL -h ‘!salt,!user,!md5x’ -i 10 dict.txt > out.txt

The developer of MDXFIND also recommends running the below command options as a good general purpose attack:

cat hash.txt | mdxfind -h <^md5$,^sha1$,^md5md5pass$,^md5sha1$’ -i 5 dict.txt > out.txt

And you could add a rule attack as well:

cat hash.txt | mdxfind -h <^md5$,^sha1$,^md5md5pass$,^md5sha1$’ -i 5 dict.txt -r best64.rule > out.txt

GENERAL NOTES ABOUT MDXFIND

-Can do multiple hash types/files all during a single attack run.

cat sha1/*.txt sha256/*.txt md5/*.txt salted/*.txt | mdxfind

-Supports 459 different hash types/sequences
-Can take input from special ‘stdin’ mode
-Supports VERY large hashlists (l00mil) and 10kb character passwords
-Supports using hashcat rule files to integrate with dictionary
-Option ‘-z’ outputs ALL viable hashing solutions and file can grow very large
-Supports including/excluding hash types by using simple regex parameters
-Supports multiple iterations (up to 4 billion times) by tweaking -i parameter for instance:
MD5X01 is the same as md5($Pass)
MD5x02 is the same as md5(md5($pass))
MD5X03 is the same as md5(md5(md5($pass)))
. . .
MD5xl0 is the same as
md5(md5(md5(md5(md5(md5(md5(md5(md5(md5($pass))))))))))
-Separate out -usernames -email -ids -salts to create custom attacks

-If you are doing brute-force attacks, then hashcat is probably better route
-When MDXfind finds any solution, it outputs the kind of solution found, followed by the hash, followed by the salt and/or password. For example:

```
Solution          HASH                :PASSWORD
```

MD5X01 000012273bc5cab48bf3852658b259ef:lEb0TBK3
MD5X05 033blll073e5f64ee59f0be9d6b8a561:08061999
MD5X09 aadb9dlb23729a3e403d7fc62d507df7:1140
MD5X09 326d921d591162eed302ee25a09450ca:1761974

MDSPLIT

When cracking large lists of hashes from multiple file locations, MDSPLIT will help match which files the cracked hashes were found in, while also outputing them into separate files based on hash type. Additionally it will remove the found hashes from the original hash file.

COMMAND STRUCTURE TWO METHODS **1-STDOUT 2-STDIN 3-File**

1- Matching MDXFIND results files with their original hash_orig.txt files.

cat hashes_out/out_results.txt | mdsplit hashes_orig/hash_orig.txt

OR perform matching against a directory of original hashes and their results.

cat hashes_out/* | mdsplit hashes_orig/*

2- Piping MDXFIND directly into MDSPLIT to sort in real-time results.

cat *.txt | mdxfind -h ALL -h '!salt,!user,!md5x' -i 10 dict.txt | mdsplit *.txt

3- Specifying a file location in MDXFIND to match results in real-time.

mdxfind -h ALL -f hashes.txt -i 10 dict.txt | mdsplit hashes.txt

GENERAL NOTES ABOUT MDSPLIT

-MDSPLIT will append the final hash solution to the end of the new filename. For example, if we submitted a 'hashes.txt' and the solution to the hashes was "MD5x01" then the results file would be 'hashes.MD5x01'. If multiple hash solutions are found then MDSPLIT knows how to deal with this, and will then remove each of the solutions from hashes.txt, and place them into 'hashes.MD5x01', 'hashes.MD5x02', 'hashes.SHA1'... and so on.

-MDSPLIT can handle sorting multiple hash files, types, and their results all at one time. Any solutions will be automatically removed from all of the source files by MDSPLIT, and tabulated into the correct solved files. For example:

cat dirl/*.txt dir2/*.txt dir3/*.txt | mdxfind -h '^md5$,^sha1$,^sha256$' -i 10 dict.txt | mdsplit dirl/*.txt dir2/*.txt dir3/*.txt

DISTRIBUTED / PARALLELIZATION CRACKING

HASHCAT

https://hashcat.net/forum/thread-3047.html

Step 1: Calculate keyspace for attack (Example MD5 Brute Force x 3nodes)
hashcat -a 3 -m 0 ?a?a?a?a?a?a --keyspace
81450625

Step 2: Distribute work through keyspace division (s)kip and (l)imit
81450625 / 3 = 27150208.3
Node1# hashcat -a 3 -m 0 hash.txt ?a?a?a?a?a?a -s 0 -1 27150208
Node2# hashcat -a 3 -m 0 hash.txt ?a?a?a?a?a?a -s 27150208 -1 27150208
Node3# hashcat -a 3 -m 0 hash.txt ?a?a?a?a?a?a -s 54300416 -1 27150209

JOHN

http://www.openwall.com/john/doc/OPTIONS.shtml
Manual distribution using Options --node & --fork to 3 similar CPU nodes utilizing 8 cores:
Node# john --format=<#> hash.txt --wordlist=dict.txt --rules=All --fork=8 --node=1-8/24
Node2# john --format=<#> hash.txt --wordlist=dict.txt --rules=All --fork=8 --node=9-16/24
Node3# john --format=<#> hash.txt --wordlist=dict.txt --rules=All --fork=8 --node=17-24/24

Other John Options for parallelization:
Option 1:Enable OpenMP through uncommenting in Makefile
Option 2:Create additional incremental modes in john.conf
Option 3:Utilize built-in MPI parallelization

PASSWORD GUESSING FRAMEWORK

https://github.com/RUB-SysSec/Password-Guessing-Framework
https://www.password-guessing.org/

Password Guessing Framework is an open source tool to provide an automated and reliable way to compare password guessers. It can help to identify individual strengths and weaknesses of a guesser, it's modes of operation, or even the underlying guessing strategies. Therefore, it gathers information about how many passwords from an input f i l e (password leak) have been cracked in relation to the amount of generated guesses. Subsequent to the guessing process an analysis of the cracked passwords is performed.

OTHER CREATIVE ADVANCED ATTACKS

Random creative password attacks using the power of stdin and stdout. Not implying they're useful but to demonstrate the power of mixing and matching. Go forth and create something useful.

PRINCE-MDXFIND ATTACK

pp64.bin dict.txt | mdxfind -h ALL -f hash.txt -i 10 stdin > out.txt

HASHCAT-UTIL COMBONATOR PRINCE
combinator.bin dict.txt dict.txt | pp64.bin | hashcat -a 0 -m #type hash.txt -r best64.rule

combinator3.bin dict.txt dict.txt dict.txt | pp64.bin | hashcat -a 0 -m #type hash.txt -r rockyou-30000.rule

HASHCAT STDOUT ATTACKS PRINCE
hashcat -a 0 dict.txt -r dive.rule --stdout | pp64.bin | hashcat -a 0 -m #type hash.txt

hashcat -a 6 dict.txt ?a?a?a?a --stdout | pp64.bin --pw-min=8 | hashcat -a 0 -m #type hash.txt

hashcat -a 7 ?a?a?a?a dict.txt --stdout | pp64.bin --pw-min=8 | hashcat -a 0 -m #type hash.txt

hashcat -a 6 dict.txt rockyou-1-60.hcmask --stdout | pp64.bin --pw-min=8 --pw-max=14 I hashcat -a 0 -m #type hash.txt

hashcat -a 7 rockyou-1-60.hcmask dict.txt --stdout | pp64.bin --pw-min=8 --pw-max=14 I hashcat -a 0 -m #type hash.txt

DISTRIBUTED CRACKING SOFTWARE

HASHTOPUSSY
https://bitbucket.org/seinlc/hashtopussy/

HASHSTACK
https://sagitta.pw/software/

DISTHC

https://github.com/unix-ninja/disthc

CRACKLORD
http://jmmcatee.github.io/cracklord/

HASHTOPUS
http://hashtopus.org/Site/

HASHVIEW
http://www.hashview.io/

CLORTHO
https://github.com/ccdes/clortho

ONLINE HASH CRACKING SERVICES

GPUHASH
https://gpuhash.me/

CRACKSTATION
https://crackstation.net/

ONLINE HASH CRACK
https://www.onlinehashcrack.com/

HASH HUNTERS
http://www.hashhunters.net/

CRACKING CONCEPTS

Information in this chapter is an attempt to summarize a few of the basic and more complex concepts in password cracking. This allows all skill levels to grasp these concepts without needing a Linguistics or Mathematics Degree. It's an almost impossible task to condense into one paragraph, but the following is an attempt. For a deeper understanding, I highly encourage you to read the Resource links included below each section.

PASSWORD ENTROPY vs CRACK TIME

Password entropy is a measure of how random/unpredictable a password could have been, so it does not really relate to the password itself, but to a selection process. When judging human generated passwords for entropy, it frankly isn't an accurate measurement. Thisis true mainly because humans like to use memorable words/sequences and thus a myriad of attacks account for that behavior. however, entropy is good for measuring randomly generated passwords from password managers, such as 1Password or Keepass, in that each default character set used can be calculated. Password entropy is measured in bits and uses the following formula where C=Size of Character set & L=Length of password: log(C) / log(2) * L
To calculate the time to crack, just use the benchmarking function on your favorite cracking software against your mode of hash to obtain cracks per second. The table below estimates password length using an MD4 hashing function against an 8 GPU x Nvidia GTX1080 system:

Length	Alphanumeric 0-9, a-z, A-Z	Time to Crack (350 GH/s)
8	47 bits	~15 Mins
9	59 bits	
10	65 bits	~457 Hours
11	65 bits	~3.3 Years
12	71 bits	~214 Years
13	77 bits	~13,690 Years
14	80 bits	~109,500 Years
15	89 bits	~56,080,000 Years
20	119 bits	~Doesn't Matter

**Table only truly matters for randomly generated passwords*

Resources

Password Complexity versus Password Entropy

https://blogs.technet.microsoft.com/msftcam/2015/05/19/password-complexity-versus-password-entropy/

WHAT IS A CRYPTOGRAPHIC HASH?

A cryptographic hash function is a subclass of the general hash function which possesses properties lending its use in cryptography. Cryptographic hash functions are mathematical algorithms which map data of any size to a string containing a fixed length, and should make it infeasible to reverse. For instance, the string "password," when mapped using the MD5 hash function, returns a fixed length 32 character string "5f4dcc3b5aa765d61d8327deb882cf99". The 32 character string cannot theoretically be reversed with any other mapped input data except "password". The current method of recreating this input data "password" is through a dictionary/mask/brute-force attack of all possible inputs matching the hashed value; also called a pre-image attack. Generally speaking, hash functions should possess the below characteristics:

-Be computationally infeasible to find two different sets of input data with the same hash value (also called a collision).

-The hash value should be "quick" to compute (i.e. > ~1 second).

-It should be difficult to generate the input data Just by looking at the hash value.
-One simple change to the input data should drastically change the resultant hash value.

Resources
How Hash Algorithms Work
http://www.metamorphosite.com/one-way-hash-encryption-sha1-data-software

MARKOV CHAINS

Markov Chains are created, for our password cracking purposes, by statistical analysis of a large list of passwords/words (i.e. the RockYou password dataset). The resultant analysis of these words and their per-position character frequency/probability are stored in a table. This table is referenced when performing brute-force/mask attacks to prevent having to generate password candidates in a sequential order, which is very inefficient. Instead, the most common characters are attempted first in order of preceding character probability. So let's see sequential brute-force ?a?a?a?a with out Markov Chains applied:

```
aaaa    aaad    aaag
aaab    aaae    aaah
aaac    aaaf    ....
```

Now the same brute-force attack with Markov Chains applied:

```
sari    aari    pari
mari    cari    2ari
1ari    bari    ....
```

Markov Chains predict the probability of the next character in a password based on the previous characters, or context characters. It's that simple.

Resources
Fast Dictionary Attacks on Passwords Using Time-Space Tradeoff
http://www.cs.utexas.edu/~shmat/shmat_ccs05pwd.pdf

OMEN: Faster Password Guessing Using an Ordered Markov Enumerator
https://hal.inria.fr/hal-01112124/document

PROBABILISTIC CONTEXT-FREE GRAMMARS (PCFG)

A Probabilistic Context Free Grammar (PCFG) consists of terminal and nonterminal variables. Each feature to be modeled has a production rule that is assigned a probability, estimated from a training set of RNA structures. Production rules are recursively applied until only terminal residues are left. The notion supporting PCFGs is that passwords are constructed with template structures and terminals that fit into those structures. For example, the password candidate 'password123!' is 8 letters, 3 digits, 1 special and would be noted as '$L_8D_3S_1$'. A password's probability of occurring is the probability of its structure, multiplied by those of its underlying terminals.

Resources
Password Cracking Using Probabilistic Context-Free Grammars
https://sites.google.com/site/reusablesec/Home/password-cracking-tools/probablistic_cracker

Next Gen PCFG Password Cracking
https://github.com/lakiw/pcfg_cracker

NEURAL NETWORKS

Artificial Neural Networks or Neural Networks (NN) is a machine-learning technique composed of nodes called Artificial Neurons, just like the brain possesses. Such systems use Machine Learning to approximate highly dimensional functions and progressively learn through examples of training set data, or in our case a large password dump. They have shown initial promise to be effective at generating original yet representative password

candidates. Advantages to NN's for password cracking are the low overhead for storing the final NN model, approximately 500kb, and the ability to continually learn over time through retraining or transfer learning.

Resources

Fast, Lean, and Accurate: Modeling Password Guessability Using Neural Networks (USENIX '16)

https://www.usenix.org/system/files/conference/usenixsecurity16/sec16_paper_melicher.pdf

https://github.com/cupslab/neural_network_cracking

COMMON HASH EXAMPLES

COMMON HASH EXAMPLES

MD5, NTLM, NTLMv2, LM, MD5crypt, SHA1, SHA256, bcrypt, PDF 1.4 - 1.6 (Acrobat 5-8), Microsoft OFFICE 2013, RAR3-HP, Winzip, 7zip, Bitcoin/Litecoin, MAC OSX v10.5-v10.6, MySQL 4.1-5+, Postgres, MSSQL(2012)-MSSQL(2014), Oracle 11g, Cisco TYPE 4 5 8 9, WPA PSK / WPA2 PSK

MDS

HASHCAT

HASH FORMAT

8743b52063cd84097a65dl633f5c74f5

BRUTE FORCE ATTACK

hashcat -m 0 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 0 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 0 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

8743b52063cd84097a65dl633f5c74f5

BRUTE FORCE ATTACK

john --format=raw-md5 hash.txt

WORDLIST ATTACK

john --format=raw-md5 wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=raw-md5 wordlist=dict.txt --rules hash.txt

NTLM (PWDUMP)

HASHCAT

HASH FORMAT

b4b9b02e6f09a9bd760f388b67351e2b

BRUTE FORCE ATTACK

hashcat -m 1000 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 1000 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 1000 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

b4b9b02e6f09a9bd760f388b67351e2b

BRUTE FORCE ATTACK

john --format=nt hash.txt

WORDLIST ATTACK

john --format=nt wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=nt wordlist=dict.txt --rules hash.txt

NTLM V2

HASHCAT

HASH FORMAT

username::N46iSNekpT:08ca45b7d7ea58ee:88dcbe4446168966al53a00649
58dac6:5c7830315
C7830310000000000000b45c67103d07d7b95acdl2ffall230e000000005292
0b85f78d013c31cdb 3b92f5d765c783030

BRUTE FORCE ATTACK

hashcat -m 5600 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK
hashcat -m 5600 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 5600 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
username:$NETNTLMv2$NTLMV2TESTWORKGROUP$112233445566
7788$07659A550D5E9D02996DFD9
5C87EC1D5$010100000000000006CF6385B74CA01B3610B02D99732
DD0000000002001200570 04F
0052004B00470052004F00550050000100200044004100540041002E0042
0049004E0043002D0053 00450043005500520049000000000

BRUTE FORCE ATTACK
john --format=netntlmv2 hash.txt
WORDLIST ATTACK
john --format=netntlmv2 wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=netntlmv2 wordlist=dict.txt --rules hash.txt

LM

HASHCAT
HASH FORMAT
299bdl28cll01fd6

BRUTE FORCE ATTACK
hashcat -m 3000 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 3000 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 3000 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT

LMa9c604d244c4e99d

BRUTE FORCE ATTACK
john --format=lm hash.txt
WORDLIST ATTACK
john --format=lm wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=lm wordlist=dict.txt --rules hash.txt

MD5CRYPT

HASHCAT
HASH FORMAT
$1$28772684$iEwNOgGugq09.bIz5sk8k/
BRUTE FORCE ATTACK
hashcat -m 500 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 500 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 500 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
l28772684$iEwNOgGugq09.bIz5sk8k/

BRUTE FORCE ATTACK
john --format=md5crypt hash.txt
WORDLIST ATTACK
john --format=md5crypt wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=md5crypt wordlist=dict.txt --rules hash.txt

SHA1

HASHCAT
HASH FORMAT
b89eaac7e61417341b710b727768294d0e6a277b

BRUTE FORCE ATTACK
hashcat -m 100 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 100 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 100 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
b89eaac7e61417341b710b727768294d0e6a277b

BRUTE FORCE ATTACK
john --format=raw-sha1 hash.txt
WORDLIST ATTACK
john --format=raw-sha1 wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=raw-sha1 wordlist=dict.txt --rules hash.txt

SHA256

HASHCAT
HASH FORMAT
127e6fbfe24a750e72930c220a8el38275656b8e5d8f48a98c3c92df2caba935

BRUTE FORCE ATTACK
hashcat -m 1400 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 1400 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 1400 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT
127e6fbfe24a750e72930c220a8el38275656b8e5d8f48a98c3c92df2caba935

BRUTE FORCE ATTACK
john --format=raw-sha256 hash.txt
WORDLIST ATTACK
john --format=raw-sha256 wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=raw-sha256 wordlist=dict.txt --rules hash.txt

BCRYPT

HASHCAT
HASH FORMAT
$2a$05$LhayLxezLhKlLhWvKxCyLOj0jlu.Kj0jZ0pEmml34uzrQlFvQDLF6

BRUTE FORCE ATTACK
hashcat -m 3200 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 3200 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 3200 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
$2a$05$LhayLxezLhKlLhWvKxCyLOj0jlu.Kj0jZ0pEmml34uzrQlFvQDLF6

BRUTE FORCE ATTACK
john --format=bcrypt hash.txt
WORDLIST ATTACK
john --format=bcrypt wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=bcrypt wordlist=dict.txt --rules hash.txt

PDF 1.4 - 1.6 (ACROBAT 5-8)

HASHCAT

HASH FORMAT

pdf2*3*128*-1028*l*16*da42eel5d4b3e08fe5b9ecea0e02ad0f*32*c9b5
9d72c7c670c42eeb
4fcald2cal500000000000000000000000000000000*32*c4ff3e868dc8760
4626c2b8c259297al 4d58c6309c70b00afdfblfbbal0ee571

EXTRACT HASH

pdf2hashcat.py example.pdf > hash.txt

BRUTE FORCE ATTACK

hashcat -m 10500 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 10500 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 10500 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

pdfStandard*badadle86442699427116d3e5d5271bc80a27814fc5e80f815
efeef839354c5f*2
89ece9b5ce451a5d7064693dab3badfl01112131415161718191alblcldlelf*1
6*34blb6e593787 af681a9b63fa8bf563b*l*l*0*l*4*128*-4*3*2

EXTRACT HASH

pdf2john.py example.pdf > hash.txt

BRUTE FORCE ATTACK

john --format=pdf hash.txt

WORDLIST ATTACK

john --format=pdf wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=pdf wordlist=dict.txt --rules hash.txt

MICROSOFT OFFICE 2013

HASHCAT

HASH FORMAT

example.docx:$office$*2013*100000*256*16*7dd611d7eb4c899f74816dldec817b3b*948dc0
b2c2c6c32fl4b5995a543ad037*0b7ee0e48e935f937192a59de48a7d561ef2691d5c8a3ba87ec2d 04402a94895

EXTRACT HASH

office2hashcat.py example.docx > hash.txt

BRUTE FORCE ATTACK

hashcat -m 9600 -a 3 --username hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 9600 -a 0 --username hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 9600 -a 0 --username hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

example.docx:$office$*2013*100000*256*16*7dd611d7eb4c899f74816dldec817b3b*948dc0b2c2c6c32f14b5995a543ad037*0b7ee0e48e935f937192a59de48a7d561ef2691d5c8a3ba87ec2d 04402a94895

EXTRACT HASH

office2john.py example.docx > hash.txt

BRUTE FORCE ATTACK

john --format=office2013 hash.txt

WORDLIST ATTACK

john --format=office2013 wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=office2013 wordlist=dict.txt --rules hash.txt

RAR3-HP (ENCRYPTED HEADER)

HASHCAT

HASH FORMAT

$RAR3$*0*45109af8ab5f297a*adbf6c5385d7a40373e8f77d7b89d317

#!Ensure to remove extraneous rar2john output to match above hash!#

EXTRACT HASH

rar2john.py example.rar > hash.txt

BRUTE FORCE ATTACK

hashcat -m 12500 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 12500 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 12500 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

example.rar:$RAR3$*l*20e041a232b4b7f0*5618c5f0*1472*2907*0*/Path
/To/
example.rar*138*33:1::example.txt

EXTRACT HASH

rar2john.py example.rar > hash.txt

BRUTE FORCE ATTACK

john --format=rar hash.txt

WORDLIST ATTACK

john --format=rar wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=rar wordlist=dict.txt --rules hash.txt

WINZIP

HASHCAT

HASH FORMAT

$zip2$*0*3*0*b5d2b7bf57ad5e86a55c400509c672bd*d218*0**ca3d736d
03a34165cfa9*$/ zip2$
#!Ensure to remove extraneous zip2john output to match above hash!#
EXTRACT HASH
zip2john.py example.zip > hash.txt

BRUTE FORCE ATTACK
hashcat -m 13600 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 13600 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 13600 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
example.zip:$zip2$*0*3*0*5b0a8bl53fb94bf719abb81a80e90422*8e91*9*
0b76bf50al5 938ce9c*3f37001e241el96195al*$/zip2$:: : ::example.zip

EXTRACT HASH
zip2john.py example.zip > hash.txt

BRUTE FORCE ATTACK
john --format=ZIP hash.txt
WORDLIST ATTACK
john --format=ZIP wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=ZIP wordlist=dict.txt --rules hash.txt

7-ZIP

HASHCAT
HASH FORMAT
$7z$0$19$0$salt$8$f6196259a7326e3f0000000000000000$185065650$11
2$98$f3bc2a88062c
419a25acd40c0c2d75421cf23263f69c51bl3f9blaada41a8a09f9adeae45d67c
60b56aad338f20c

0dcc5eb811c7a61128ee0746f922cdb9c59096869f341c7a9cblac7bb7d771f5
46b82cf4e6flla5e
Cd4b61751e4d8de66dd6e2dfb5b7dl022d2211e2d66eal703f96
#!Ensure to remove extraneous 7zip2john output to match above hash!#
EXTRACT HASH
7z2john.py example.7z > hash.txt

BRUTE FORCE ATTACK
hashcat -m 11600 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 11600 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 11600 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
example.7z:$7z$0$19$0$salt$8$f6196259a7326e3f00000000000000000$18
5065650$112$98$f
3bc2a88062c419a25acd40c0c2d75421cf23263f69c51bl3f9blaada41a8a09f
9adeae45d67c60b5
6aad338f20c0dcc5eb811c7a61128ee0746f922cdb9c59096869f341c7a9cbla
c7bb7d771f546b82
Cf4e6flla5ecd4b61751e4d8de66dd6e2dfb5b7dl022d2211e2d66eal703f96

EXTRACT HASH
7z2john.py example.7z > hash.txt

BRUTE FORCE ATTACK
john --format=7z hash.txt
WORDLIST ATTACK
john --format=7z wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=7z wordlist=dict.txt --rules hash.txt

BITCOIN / LITECOIN

HASHCAT

HASH FORMAT

$bitcoin$96$d011alb6a8d675b7a36d0cd2efaca32a9f8dcld57d6d01a58399e
a04e703e8bbb448
99039326f7a00fl71a7bbc854a54$16$1563277210780230$158555$96$628
8354268182272433 34
5704485715363525107408232330557158453227416254076858730760272
33865346542174$66$6
2588287548051375185133344162370285281144077588812204636056176
0525

EXTRACT HASH

bitcoin2john.py wallet.dat > hash.txt

BRUTE FORCE ATTACK

hashcat -m 11300 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 11300 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 11300 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

$bitcoin$96$d011alb6a8d675b7a36d0cd2efaca32a9f8dcld57d6d01a58399e
a04e703e8bbb448
99039326f7a00fl71a7bbc854a54$16$1563277210780230$158555$96$628
8354268182272433 34
5704485715363525107408232330557158453227416254076858730760272
33865346542174$66$6
2588287548051375185133344162370285281144077588812204636056176
0525

EXTRACT HASH

bitcoin2john.py wallet.dat > hash.txt

BRUTE FORCE ATTACK

john --format=bitcoin hash.txt

WORDLIST ATTACK

john --format=bitcoin wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=bitcoin wordlist=dict.txt --rules hash.txt

MAC OS X 10.8-10.12

HASHCAT

HASH FORMAT

username:ml35714$50973de90d336b5258f01e48ab324aa9ac81ca7959ac
470d3d9c4395af624
398$631a0ef84081b37cfe594a5468cf3a63173cd2ec25047b89457ed300f2b
41b30a0792a39912f
C5f3f7be8f74b7269ee3713172642de96ee482432a8dl2bf291a

EXTRACT HASH

sudo plist2hashcat.py /var/db/dslocal/nodes/Default/users/<username>.plist

BRUTE FORCE ATTACK

hashcat -m 122 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 122 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 122 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

username:$pbkdf2-hmac-
sha512$31724.019739e90d326b5258f01e483bl24aa9ac81ca7959acb
70c3d9c4297af924398.631a0bf84081b37dae594a5468cf3a63183cd2ec250
47b89457ed300f2bf
1b40a0793a39512fc5a3f7ae8f74b7269ee3723172642de96eee82432a8dllbf
365e: 501:20 : HOST
NAME:/bin/bash:/var/db/dslocal/nodes/Default/users/username.plist

EXTRACT HASH

sudo ml2john.py /var/db/dslocal/nodes/Default/users/<username>.plist

BRUTE FORCE ATTACK

john --format=xsha hash.txt

WORDLIST ATTACK

john --format=xsha wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=xsha wordlist=dict.txt --rules hash.txt

MYSQL4.1 / MYSQL5+ (DOUBLE SHA1)

HASHCAT

HASH FORMAT

FCF7C1B8749CF99D88E5F34271D636178FB5D130

EXTRACT HASH

SELECT user,password FROM mysql.user INTO OUTFILE '/tmp/hash.txt';

BRUTE FORCE ATTACK

hashcat -m 300 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 300 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 300 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

*FCF7C1B8749CF99D88E5F34271D636178FB5D130

EXTRACT HASH

SELECT user,password FROM mysql.user INTO OUTFILE '/tmp/hash.txt';

BRUTE FORCE ATTACK

john --format=mysql-sha1 hash.txt

WORDLIST ATTACK

john --format=mysql-sha1 wordlist=dict.txt hash.txt

POSTGRESQL

HASHCAT

HASH FORMAT

a6343a68d964ca596d9752250d54bb8a:postgres

EXTRACT HASH

SELECT username, passwd FROM pg_shadow;

BRUTE FORCE ATTACK

hashcat -m 12 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 12 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 12 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
a6343a68d964ca596d9752250d54bb8a:postgres
EXTRACT HASH
SELECT username, passwd FROM pg_shadow;
BRUTE FORCE ATTACK
john --format=postgres hash.txt
WORDLIST ATTACK
john --format=postgres wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=postgres wordlist=dict.txt --rules hash.txt

MSSQL(2012), MSSQL(2014)

HASHCAT
HASH FORMAT
0x02000102030434ealbl7802fd95ea6316bd61d2c94622ca3812793e8fbl67
2487b5c904a45a31b
2ab4a78890d563d2fcf5663e46fe797d71550494be50cf4915d3f4d55ec375
EXTRACT HASH
SELECT SL.name,SL.password_hash FROM sys.sql_logins AS SL;
BRUTE FORCE ATTACK
hashcat -m 1731 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 1731 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 1731 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT

0x02000102030434ealbl7802fd95ea6316bd61d2c94622ca3812793e8fbl67
2487b5c904a45a31b
2ab4a78890d563d2fcf5663e46fe797d71550494be50cf4915d3f4d55ec375
EXTRACT HASH
SELECT SL.name,SL.password_hash FROM sys.sql_logins AS SL;
BRUTE FORCE ATTACK
john --format=mssql12 hash.txt
WORDLIST ATTACK
john --format=mssql12 wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=mssql12 wordlist=dict.txt --rules hash.txt

ORACLE 11G

HASHCAT
HASH FORMAT
ac5fle62d21fd0529428b84d42e8955b04966703:38445748184477378130
EXTRACT HASH
SELECT SL.name,SL.password_hash FROM sys.sql_logins AS SL;
BRUTE FORCE ATTACK
hashcat -m 112 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 112 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 112 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
ac5fle62d21fd0529428b84d42e8955b04966703:38445748184477378130
EXTRACT HASH
SELECT SL.name,SL.password_hash FROM sys.sql_logins AS SL;
BRUTE FORCE ATTACK
john --format=oraclell hash.txt
WORDLIST ATTACK
john --format=oraclell wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK
john --format=oraclell wordlist=dict.txt --rules hash.txt

CISCO TYPE 4 (SHA256)

HASHCAT
HASH FORMAT
2btjjy78REtmYkkW0csHUbDZOstRXoWdX1mGrmmfeHI

BRUTE FORCE ATTACK
hashcat -m 5700 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 5700 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 5700 -a 0 hash.txt dict.txt -r rule.txt

CISCO TYPE 5 (MD5)

HASHCAT
HASH FORMAT
l28772684$iEwN0gGugq09.bIz5sk8k/

BRUTE FORCE ATTACK
hashcat -m 500 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 500 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 500 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
$1$28772684$iEwN0gGugq09.bIz5sk8k/

BRUTE FORCE ATTACK

john --format=md5crypt hash.txt
WORDLIST ATTACK
john --format=md5crypt wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=md5crypt wordlist=dict.txt --rules hash.txt

CISCO TYPE 8 (PBKDF2+SHA256)

HASHCAT
HASH FORMAT
8TnGX/fE4KGH0VU$pEhnEvxrvaynpi8j4f.EMHr6M.FzU8xnZnBr/tJdFWk

BRUTE FORCE ATTACK
hashcat -m 9200 -a 3 hash.txt ?a?a?a?a?a?a
WORDLIST ATTACK
hashcat -m 9200 -a 0 hash.txt dict.txt
WORDLIST + RULE ATTACK
hashcat -m 9200 -a 0 hash.txt dict.txt -r rule.txt

JOHN
HASH FORMAT
8TnGX/fE4KGH0VU$pEhnEvxrvaynpi8j4f.EMHr6M.FzU8xnZnBr/tJdFWk

BRUTE FORCE ATTACK
john --format=pbkdf2-hmac-sha256 hash.txt
WORDLIST ATTACK
john --format=pbkdf2-hmac-sha256 wordlist=dict.txt hash.txt
WORDLIST + RULE ATTACK
john --format=pbkdf2-hmac-sha256 wordlist=dict.txt --rules hash.txt

CISCO TYPE 9 (SCRYPT)

HASHCAT

HASH FORMAT

$9$2MJBozw/9R3UsU$21FhcKvpghcyw8deP25G0fyZaagyU0GBymkryv0dfo6

BRUTE FORCE ATTACK

hashcat -m 9300 -a 3 hash.txt ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 9300 -a 0 hash.txt dict.txt

WORDLIST + RULE ATTACK

hashcat -m 9300 -a 0 hash.txt dict.txt -r rule.txt

JOHN

HASH FORMAT

$9$2MJBozw/9R3UsU$21FhcKvpghcyw8deP25G0fyZaagyU0GBymkryv0dfo6

BRUTE FORCE ATTACK

john --format=scrypt hash.txt

WORDLIST ATTACK

john --format=scrypt wordlist=dict.txt hash.txt

WORDLIST + RULE ATTACK

john --format=scrypt wordlist=dict.txt --rules hash.txt

WPA PSK / WPA2 PSK

HASHCAT

HASH FORMAT

*Capture 4-way authentication handshake > capture.cap

cap2hccapx.bin capture.cap capture_out.hccapx

BRUTE FORCE ATTACK

hashcat -m 2500 -a 3 capture_out.hccapx ?a?a?a?a?a?a

WORDLIST ATTACK

hashcat -m 2500 -a 3 capture_out.hccapx dict.txt

WORDLIST + RULE ATTACK

hashcat -a 0 capture_out.hccapx dict.txt -r rule.txt

JOHN

HASH FORMAT

*Capture 4-way authentication handshake > capture.cap

cap2hccap.bin -e '<ESSID>' capture.cap capture_out.hccap

hccap2john capture_out.hccap > jtr_capture

BRUTE FORCE ATTACK

john --format=wpapsk jtr_capture

WORDLIST ATTACK

john --format=wpapsk wordlist=dict.txt jtr_capture

WORDLIST + RULE ATTACK

john --format=wpapsk wordlist=dict.txt --rules jtr_capture

APPENDIX

APPENDIX

TERMS

BRUTE-FORCE ATTACK - the act of trying every possible combination of a given keyspace or character set for a given length

DICTIONARY - a collection of commons words, phrases, keyboard patterns, generated passwords, or leaked passwords, also known as a wordlist

DICTIONARY ATTACK - using a file containing common or known password combinations or words in an attempt to match a given hashing function's output by running said words through the same target hashing function

HASH - the fixed bit result of a hash function

HASH FUNCTION - maps data of arbitrary size to a bit string of a fixed size (a hash function) which is designed to also be a one-way function, that is, a function which is infeasible to invert

ITERATIONS - the number of times an algorithm is run over a given hash

KEYSPACE - the number of possible combinations for a given character set to the power of it's length (i.e. charset^length)

MASK ATTACK - using placeholder representations to try all combinations of a given keyspace, similar to brute-force but more targeted and efficient

PASSWORD ENTROPY - an estimation of how difficult a password will be to crack given its character set and length

PLAINTEXT - unaltered text that hasn't been obscured or algorithmically altered through a hashing function

RAKING - generating random password rules/candidates in an attempt to discover a previously unknown matching password pattern

RAINBOW TABLE - a precomputed table of a targeted cryptographic hash function of a certain minimum and maximum character length

RULE ATTACK - similar to a programming language for generating candidate passwords based on some input such as a dictionary

SALT - random data that used as additional input to a one-way function

WORDLIST - a collection of commons words, phrases, keyboard patterns, generated passwords, or leaked passwords, also known as a dictionary

TIME TABLE

60 seconds	1 minute
3,600 seconds	1 hour
86,400 seconds	1 day
604,800 seconds	1 week
1,209,600 seconds	1 fortnight
2,419,200 seconds	1 month (30days)
31,536,000 seconds	1 year

ONLINE RESOURCES

JOHN
http://openwall.info/wiki/john
http://openwall.info/wiki/john/sample-non-hashes
http://pentestmonkey.net/cheat-sheet/john-the-ripper-hash-formats
https://countuponsecurity.com/2015/06/14/jonh-the-ripper-cheat-sheet/
https://xinn.org/blog/JtR-AD-Password-Auditing.html
https://www.owasp.org/images/a/af/2011-Supercharged-Slides-Redman-OWASP-Feb.pdf

HASHCAT
https://hashcat.net/wiki/
https://hashcat.net/wiki/doku.php?id=hashcat_utils
https://hashcat.net/wiki/doku.php?id=statsprocessor
http://www.netmux.com/blog/ultimate-guide-to-cracking-foreign-character-passwords-using-has
http://www.netmux.com/blog/cracking-12-character-above-passwords

CRACKING RIGS
http://www.netmux.com/blog/how-to-build-a-password-cracking-rig
https://www.unix-ninja.com/p/Building_a_Password_Cracking_Rig_for_Hashcat_-_Part_III

EXAMPLE HASH GENERATION
https://www.onlinehashcrack.com/hash-generator.php
https://www.tobtu.com/tools.php
http://hash.online-convert.com/
https://www.tools4noobs.com/online_tools/hash/
https://quickhash.com/
http://bitcoinvalued.com/tools.php
http://www.sha1-online.com/
http://www.freeformatter.com/hmac-generator.html
http://openwall.info/wiki/john/Generating-test-hashes

OTHER

http://blog.thireus.com/cracking-story-how-i-cracked-over-122-million-sha1-and-md5-hashed-passwords/
http://www.utf8-chartable.de/
http://thesprawl.org/projects/pack/
https://blog.gotmilk.com/2011/06/dictionaries-wordlists/
http://wpengine.com/unmasked/
https://www.unix-ninja.com/p/A_cheat-sheet_for_password_crackers
https://room362.com/post/2017/05-06-2017-password-magic-numbers/
http://www.netmux.com/blog/how-to-build-a-password-cracking-rig
http://passwordchart.com/
http://www.vigilante.pw

NETMUX
http://www.netmux.com
http://www.hashcrack.io
https://github.com/netmux
https://twitter.com/netmux
https://www.instagram.com/netmux/

*****ANSWER TO CUSTOM DICTIONARY CREATION HASH: e4821dl6a298092638ddb7cadc26d32f = letmein123456Netmux**

10 CRACK COMMANDMENTS

1. Thou shalt know hash types and their origin/function
2. Thou shalt know cracking software strengths & weaknesses
3. Thou shalt study & apply password analysis techniques
4 Thou shalt be proficient at hash extraction methods
5. Thou shalt create custom/targeted dictionaries
6. Thou shalt know thy cracking rigs capabilities
7. Thou shalt understand basic human psychology/behavior
8. Thou shalt create custom masks, rules, and Markov chains

9. Thou shalt continually experiment with new techniques
10. Thou shalt support thy fellow cracking community members

JOHN THE RIPPER HELP MENU

John the Ripper password cracker, version 1.8.0-jumbo-1 [darwinl5.6.0 64-bit AVX2-autoconf]
Copyright (c) 1996-2014 by Solar Designer and others
Homepage: http://www.openwall.com/john/

Usage: john [OPTIONS] [PASSWORD-FILES]

--single[=SECTION]	"single crack" mode
--wordlist[=FILE] --stdin	wordlist mode, read words from FILE or stdin
--pipe	like --stdin, but bulk reads, and allows rules
--loopback[=FILE]	like --wordlist, but fetch words from a .pot file
--dupe-suppression	suppress all dupes in wordlist (and force preload)
--encoding=NAME	input encoding (eg. UTF-8, ISO-8859-1). See also doc/ENCODING and --list=hidden-options.
--rules[=SECTION]	enable word mangling rules for wordlist modes
--incremental[=MODE]	"incremental" mode [using section MODE]
--mask=MASK	mask mode using MASK
--markov[=OPTIONS]	"Markov" mode (see doc/MARKOV)
--external=MODE	external mode or word filter
--stdout[=LENGTH]	just output candidate passwords [cut at LENGTH]

--restore[=NAME]	restore an interrupted session [called NAME]
--session=NAME	give a new session the NAME
--status[=NAME]	print status of a session [called NAME]
--make-charset=FILE	make a charset file. It will be overwritten
--show[=LEFT]	show cracked passwords [if =LEFT, then uncracked]
--test[=TIME]	run tests and benchmarks for TIME seconds each
--users=[-]LOGIN|UID[,..]	[do not] load this (these) user(s) only
--groups=[-]GID[,..]	load users [not] of this (these) group(s) only
--shells=[-]SHELL[,..]	load users with[out] this (these) shell(s) only
--salts=[-]COUNT[:MAX]	load salts with[out] COUNT [to MAX] hashes
--save-memory=LEVEL	enable memory saving, at LEVEL 1..3
--node=MIN[-MAX]/TOTAL	this node's number range out of TOTAL count
--fork=N	fork N processes
--pot=NAME	pot file to use
--list=WHAT	list capabilities, see --list=help or doc/OPTIONS
--devices=N[,..] devices)	set OpenCL device(s) (list using --list=opencl-
--format=NAME	force hash type NAME:

7z 7z-opencl AFS agilekeychain agilekeychain-opencl aix-smd5 aix-ssha1 aix-ssha256 aix-ssha512 asa-md5 bcrypt bcrypt-opencl bfegg Bitcoin blackberry-es10 Blockchain blockchain-opencl bsdicrypt chap Citrix_NS10 Clipperz cloudkeychain cq CRC32 crypt dahua descrypt descrypt-opencl Django django-scrypt dmd5 dmg dmg-opencl dominosec dragonfly3-32 dragonfly3-64 dragonfly4-32 dragonfly4-64 Drupal7 dummy dynamic_n eCryptfs EFS eigrp EncFS encfs-opencl EPI EPiServer fde FormSpring

Fortigate gost gpg gpg-opencl HAVAL-128-4 HAVAL-256-3 hdaa HMAC-MD5 HMAC-SHA1 HMAC-SHA224 HMAC-SHA256 HMAC-SHA384 HMAC-SHA512 hMailServer hsrp IKE ipb2 KeePass keychain keychain-opencl keyring keyring-opencl keystore known_hosts krb4 krb5 krb5-18 krb5pa-md5 krb5pa-md5-opencl krb5pa-sha1 krb5pa-sha1-opencl kwallet LastPass LM lotus5 lotus5-opencl lotus85 LUKS MD2 md4-gen md5crypt md5crypt-opencl md5ns mdc2 MediaWiki MongoDB Mozilla mscash mscash2 mscash2-opencl MSCHAPv2 mschapv2-naive mssql mssql05 mssqll2 mysql mysql-sha1 mysql-sha1-opencl mysqlna net-md5 net-sha1 nethalflm netlm netlmv2 netntlm netntlm-naive netntlmv2 nk nsldap NT nt-opencl nt2 ntlmv2-opencl o51ogon o51ogon-opencl ODF ODF-AES-opencl ODF-opencl Office office2007-opencl office2010-opencl office2013-opencl oldoffice oldoffice-opencl OpenBSD-SoftRAID openssl-enc OpenVMS oracle oraclell osc Panama PBKDF2-HMAC-SHA1 PBKDF2-HMAC-SHA1-opencl PBKDF2-HMAC-SHA256 PBKDF2-HMAC-SHA256-opencl PBKDF2-HMAC-SHA512 pbkdf2-hmac-sha512-opencl PDF PFX phpass phpass-opencl PHPS pix-md5 PKZIP po postgres PST PuTTY pwsafe pwsafe-opencl RACF RAdmin RAKP RAKP-opencl rar rar-opencl RAR5 RAR5-opencl Raw-Blake2 Raw-Keccak Raw-Keccak-256 Raw-MD4 Raw-MD4-opencl Raw-MD5 Raw-MD5-opencl Raw-MD5u Raw-SHA Raw-SHA1 Raw-SHA1-Linkedin Raw-SHA1-ng Raw-SHA1-opencl Raw-SHA224 Raw-SHA256 Raw-SHA256-ng Raw-SHA256-opencl Raw-SHA384 Raw-SHA512 Raw-SHA512-ng Raw-SHA512-opencl ripemd-128 ripemd-160 rsvp Salted-SHA1 sapb sapg scrypt sha1-gen sha1crypt sha1crypt-opencl sha256crypt sha256crypt-opencl sha512crypt sha512crypt-opencl Siemens-S7 SIP skein-256 skein-512 skey Snefru-128 Snefru-256 SSH SSH-ng ssha-opencl SSHA512 STRIP strip-opencl SunMD5 sxc sxc-opencl Sybase-PROP sybasease tc_aes_xts tc_ripemdl60 tc_sha512 tc_whirlpool tcp-md5 Tiger tripcode VNC vtp wbb3 whirlpool whirlpool0 whirlpooll WoWSRP wpapsk wpapsk-opencl xsha xsha512 XSHA512-opencl ZIP zip-opencl

HASHCAT HELP MENU

hashcat 3.6 - advanced password recovery

Usage: hashcat [options]... hash|hash-file|hccapxfile [dictionary|mask|directory]...

- [Options] -

Options Short / Long	Description
-m, --hash-type	Hash-type, see references below
-a, --attack-mode	Attack-mode, see references below
-V, --version	Print version
-h, --help	Print help
--quiet	Suppress output
--hex-charset	Assume charset is given in hex
--hex-salt	Assume salt is given in hex
--hex-wordlist	Assume words in wordlist are given in hex
--force	Ignore warnings
--status	Enable automatic update of the status screen
--status-timer	Sets seconds between status screen updates to X
--machine-readable	Display status view in machine-readable format
--keep-guessing	Keep guessing hash after it has been cracked
--loopback	Add new plains to induct directory
--weak	Threshold X to stop checking for weak hashes
--markov-hcstat	Specify hcstat file to use
--markov-disable	Disables markov-chains, classic brute-force
--markov-classic	Enables classic markov-chains, no per-position
-t, --markov-threshold	Threshold X to stop accepting new markov-chains
--runtime	Abort session after X seconds of runtime
--session	Define specific session name
--restore	Restore session from --session
--restore-disable	Do not write restore file
--restore-file-path	Specific path to restore file
-o, --outfile	Define outfile for recovered hash
--outfile-format	Define outfile-format X for recovered hash
--outfile-autohex-disable	Disable the use of $HEX[] in output plains
--outfile-check-timer	Sets seconds between outfile checks to X
-p, --separator	Separator char for hashlists and outfile
--stdout	Do not crack a hash, print candidates only
--show	Compare hashlist with potfile; show cracked
--left	Compare hashlist with potfile; show uncracked
--username	Enable ignoring of usernames in hashfile
--remove	Enable removal of hashes once they are cracked
--remove-timer	Update input hash file each X seconds
--potfile-disable	Do not write potfile
--potfile-path	Specific path to potfile
--encoding-from	Force internal wordlist encoding from X
--encoding-to	Force internal wordlist encoding to X
--debug-mode	Defines the debug mode 1-4
--debug-file	Output file for debugging rules
--induction-dir	Specify induction directory to use for loopback
--outfile-check-dir	Specify outfile directory to monitor for plains
--logfile-disable	Disable the logfile
--hccapx-message-pair	Load only message pairs from hccapx matching X
--nonce-error-corrections	BF size range to replace AP's nonce last bytes
--truecrypt-keyfiles	Keyfiles to use, separated with commas
--veracrypt-keyfiles	Keyfiles to use, separated with commas
--veracrypt-pim	VeraCrypt personal iterations multiplier
-b, --benchmark	Run benchmark

```
      --speed-only               | Return expected speed of the attack, then quit
      --progress-only            | Return ideal step size and time to process  |
 -c,  --segment-size             | Sets size in MB to cache from the wordfile to X
      --bitmap-min               | Sets minimum bits allowed for bitmaps to X
      --bitmap-max               | Sets maximum bits allowed for bitmaps to X
      --cpu-affinity             | Locks to CPU devices, separated with commas
 -I,  --opencl-info              | Show info on detected OpenCL platforms/devices
      --opencl-platforms         | OpenCL platforms to use, separated with commas
 -d,  --opencl-devices           | OpenCL devices to use, separated with commas
 -D,  --opencl-device-types      | OpenCL device-types to use,separate with commas
      --opencl-vector-width      | Manually override OpenCL vector-width to X
 -w,  --workload-profile         | Enable a specific workload profile, 1-4
 -n,  --kernel-accel             | Workload tuning, set outerloop step size to X
 -u,  --kernel-loops             | Workload tuning, set innerloop step size to X
      --nvidia-spin-damp         | Workaround NVIDIAs CPU burning loop bug
      --gpu-temp-disable         | Disable temperature, fanspeed reads, triggers
      --gpu-temp-abort           | Abort if GPU temperature reaches X degrees C
      --gpu-temp-retain          | Try to retain GPU temperature at X degrees C
      --powertune-enable         | Enable power tuning. Restores settings
      --scrypt-tmto              | Manually override TMTO value for scrypt to X
 -s,  --skip                     | Skip X words from the start
 -l,  --limit                    | Limit X words from the start + skipped words
      --keyspace                 | Show keyspace base:mod values and quit
 -j,  --rule-left                | Single rule applied to word from left wordlist
 -k,  --rule-right               | Single rule applied to word from right wordlist
 -r,  --rules-file               | Multiple rules applied to word from wordlists
 -g,  --generate-rules           | Generate X random rules
      --generate-rules-func-min  | Force min X functions per rule
      --generate-rules-func-max  | Force max X functions per rule
      --generate-rules-seed      | Force RNG seed set to X
 -1,  --custom-charset1          | User-defined charset ?1
 -2,  --custom-charset2          | User-defined charset ?2
 -3,  --custom-charset3          | User-defined charset ?3
 -4,  --custom-charset4          | User-defined charset ?4
 -i,  --increment                | Enable mask increment mode
      --increment-min            | Start mask incrementing at X
      --increment-max            | Stop mask incrementing at X

- [ Hash modes ] -

      # | Name                                               | Category

======+==================================================+=================================
===
    900 | MD4                                                | Raw Hash
      0 | MD5                                                | Raw Hash
   5100 | Half MD5                                           | Raw Hash
    100 | SHA1                                               | Raw Hash
   1300 | SHA-224                                            | Raw Hash
   1400 | SHA-256                                            | Raw Hash
  10800 | SHA-384                                            | Raw Hash
   1700 | SHA-512                                            | Raw Hash
   5000 | SHA-3 (Keccak)                                     | Raw Hash
    600 | BLAKE2b-512                                        | Raw Hash
  10100 | SipHash                                            | Raw Hash
   6000 | RIPEMD-160                                         | Raw Hash
   6100 | Whirlpool                                          | Raw Hash
   6900 | GOST R 34.11-94                                    | Raw Hash
  11700 | GOST R 34.11-2012 (Streebog) 256-bit               | Raw Hash
  11800 | GOST R 34.11-2012 (Streebog) 512-bit               | Raw Hash
     10 | md5($pass.$salt)                                   | Raw Hash, Salted and/or Iterated
     20 | md5($salt.$pass)                                   | Raw Hash, Salted and/or Iterated
     30 | md5(utf16le($pass).$salt)                          | Raw Hash, Salted and/or Iterated
     40 | md5($salt.utf16le($pass))                          | Raw Hash, Salted and/or Iterated
   3800 | md5($salt.$pass.$salt)                             | Raw Hash, Salted and/or Iterated
   3710 | md5($salt.md5($pass))                              | Raw Hash, Salted and/or Iterated
```

4010	md5($salt.md5($salt.$pass))	Raw Hash, Salted and/or Iterated
4110	md5($salt.md5($pass.$salt))	Raw Hash, Salted and/or Iterated
2600	md5(md5($pass))	Raw Hash, Salted and/or Iterated
3910	md5(md5($pass).md5($salt))	Raw Hash, Salted and/or Iterated
4300	md5(strtoupper(md5($pass)))	Raw Hash, Salted and/or Iterated
4400	md5(sha1($pass))	Raw Hash, Salted and/or Iterated
110	sha1($pass.$salt)	Raw Hash, Salted and/or Iterated
120	sha1($salt.$pass)	Raw Hash, Salted and/or Iterated
130	sha1(utf16le($pass).$salt)	Raw Hash, Salted and/or Iterated
140	sha1($salt.utf16le($pass))	Raw Hash, Salted and/or Iterated
4500	sha1(sha1($pass))	Raw Hash, Salted and/or Iterated
4520	sha1($salt.sha1($pass))	Raw Hash, Salted and/or Iterated
4700	sha1(md5($pass))	Raw Hash, Salted and/or Iterated
4900	sha1($salt.$pass.$salt)	Raw Hash, Salted and/or Iterated
14400	sha1(CX)	Raw Hash, Salted and/or Iterated
1410	sha256($pass.$salt)	Raw Hash, Salted and/or Iterated
1420	sha256($salt.$pass)	Raw Hash, Salted and/or Iterated
1430	sha256(utf16le($pass).$salt)	Raw Hash, Salted and/or Iterated
1440	sha256($salt.utf16le($pass))	Raw Hash, Salted and/or Iterated
1710	sha512($pass.$salt)	Raw Hash, Salted and/or Iterated
1720	sha512($salt.$pass)	Raw Hash, Salted and/or Iterated
1730	sha512(utf16le($pass).$salt)	Raw Hash, Salted and/or Iterated
1740	sha512($salt.utf16le($pass))	Raw Hash, Salted and/or Iterated
50	HMAC-MD5 (key = $pass)	Raw Hash, Authenticated
60	HMAC-MD5 (key = $salt)	Raw Hash, Authenticated
150	HMAC-SHA1 (key = $pass)	Raw Hash, Authenticated
160	HMAC-SHA1 (key = $salt)	Raw Hash, Authenticated
1450	HMAC-SHA256 (key = $pass)	Raw Hash, Authenticated
1460	HMAC-SHA256 (key = $salt)	Raw Hash, Authenticated
1750	HMAC-SHA512 (key = $pass)	Raw Hash, Authenticated
1760	HMAC-SHA512 (key = $salt)	Raw Hash, Authenticated
14000	DES (PT = $salt, key = $pass)	Raw Cipher, Known-Plaintext
14100	3DES (PT = $salt, key = $pass)	Raw Cipher, Known-Plaintext
14900	Skip32 (PT = $salt, key = $pass)	Raw Cipher, Known-Plaintext
15400	ChaCha20	Raw Cipher, Known-Plaintext
400	phpass	Generic KDF
8900	scrypt	Generic KDF
11900	PBKDF2-HMAC-MD5	Generic KDF
12000	PBKDF2-HMAC-SHA1	Generic KDF
10900	PBKDF2-HMAC-SHA256	Generic KDF
12100	PBKDF2-HMAC-SHA512	Generic KDF
23	Skype	Network Protocols
2500	WPA/WPA2	Network Protocols
2501	WPA/WPA2 PMK	Network Protocols
4800	iSCSI CHAP authentication, MD5(CHAP)	Network Protocols
5300	IKE-PSK MD5	Network Protocols
5400	IKE-PSK SHA1	Network Protocols
5500	NetNTLMv1	Network Protocols
5500	NetNTLMv1+ESS	Network Protocols
5600	NetNTLMv2	Network Protocols
7300	IPMI2 RAKP HMAC-SHA1	Network Protocols
7500	Kerberos 5 AS-REQ Pre-Auth etype 23	Network Protocols
8300	DNSSEC (NSEC3)	Network Protocols
10200	CRAM-MD5	Network Protocols
11100	PostgreSQL CRAM (MD5)	Network Protocols
11200	MySQL CRAM (SHA1)	Network Protocols
11400	SIP digest authentication (MD5)	Network Protocols
13100	Kerberos 5 TGS-REP etype 23	Network Protocols
121	SMF (Simple Machines Forum) > v1.1	Forums,CMS,E-Commerce
400	phpBB3 (MD5)	Forums, CMS, E-Commerce
2611	vBulletin < v3.8.5	Forums, CMS, E-Commerce
2711	vBulletin >= v3.8.5	Forums, CMS, E-Commerce
2811	MyBB 1.2+	Forums, CMS, E-Commerce
2811	IPB2+ (Invision Power Board)	Forums, CMS, E-Commerce
8400	WBB3 (Woltlab Burning Board)	Forums, CMS, E-Commerce
11	Joomla < 2.5.18	Forums, CMS, E-Commerce
400	Joomla >= 2.5.18 (MD5)	Forums, CMS, E-Commerce
400	WordPress (MD5)	Forums, CMS, E-Commerce
2612	PHPS	Forums, CMS, E-Commerce
7900	Drupal7	Forums, CMS, E-Commerce
21	osCommerce	Forums, CMS, E-Commerce
21	xt:Commerce	Forums, CMS, E-Commerce

11000	PrestaShop	Forums, CMS, E-Commerce
124	Django (SHA-1)	Forums, CMS, E-Commerce
10000	Django (PBKDF2-SHA256)	Forums, CMS, E-Commerce
3711	MediaWiki B type	Forums, CMS, E-Commerce
13900	OpenCart	Forums, CMS, E-Commerce
4521	Redmine	Forums, CMS, E-Commerce
4522	PunBB	Forums, CMS, E-Commerce
12001	Atlassian (PBKDF2-HMAC-SHA1)	Forums, CMS, E-Commerce
12	PostgreSQL	Database Server
131	MSSQL (2000)	Database Server
132	MSSQL (2005)	Database Server
1731	MSSQL (2012, 2014)	Database Server
200	MySQL323	Database Server
300	MySQL4.1/MySQL5	Database Server
3100	Oracle H: Type (Oracle 7+)	Database Server
112	Oracle S: Type (Oracle 11+)	Database Server
12300	Oracle T: Type (Oracle 12+)	Database Server
8000	Sybase ASE	Database Server
141	Episerver 6.x < .NET 4	HTTP, SMTP, LDAP Server
1441	Episerver 6.x >= .NET 4	HTTP, SMTP, LDAP Server
1600	Apache $apr1$ MD5, md5apr1, MD5 (APR)	HTTP, SMTP, LDAP Server
12600	ColdFusion 10+	HTTP, SMTP, LDAP Server
1421	hMailServer	HTTP, SMTP, LDAP Server
101	nsldap, SHA-1(Base64), Netscape LDAP SHA	HTTP, SMTP, LDAP Server
111	nsldaps, SSHA-1(Base64), Netscape LDAP SSHA	HTTP, SMTP, LDAP Server
1411	SSHA-256(Base64), LDAP {SSHA256}	HTTP, SMTP, LDAP Server
1711	SSHA-512(Base64), LDAP {SSHA512}	HTTP, SMTP, LDAP Server
15000	FileZilla Server >= 0.9.55	FTP Server
11500	CRC32	Checksums
3000	LM	Operating Systems
1000	NTLM	Operating Systems
1100	Domain Cached Credentials (DCC), MS Cache	Operating Systems
2100	Domain Cached Credentials 2 (DCC2), MS Cache 2	Operating Systems
15300	DPAPI masterkey file v1 and v2	Operating Systems
12800	MS-AzureSync PBKDF2-HMAC-SHA256	Operating Systems
1500	descrypt, DES (Unix), Traditional DES	Operating Systems
12400	BSDi Crypt, Extended DES	Operating Systems
500	md5crypt, MD5 (Unix), Cisco-IOS 1 (MD5)	Operating Systems
3200	bcrypt $2*$, Blowfish (Unix)	Operating Systems
7400	sha256crypt 5, SHA256 (Unix)	Operating Systems
1800	sha512crypt 6, SHA512 (Unix)	Operating Systems
122	OSX v10.4, OSX v10.5, OSX v10.6	Operating Systems
1722	OSX v10.7	Operating Systems
7100	OSX v10.8+ (PBKDF2-SHA512)	Operating Systems
6300	AIX {smd5}	Operating Systems
6700	AIX {ssha1}	Operating Systems
6400	AIX {ssha256}	Operating Systems
6500	AIX {ssha512}	Operating Systems
2400	Cisco-PIX MD5	Operating Systems
2410	Cisco-ASA MD5	Operating Systems
500	Cisco-IOS 1 (MD5)	Operating Systems
5700	Cisco-IOS type 4 (SHA256)	Operating Systems
9200	Cisco-IOS 8 (PBKDF2-SHA256)	Operating Systems
9300	Cisco-IOS 9 (scrypt)	Operating Systems
22	Juniper NetScreen/SSG (ScreenOS)	Operating Systems
501	Juniper IVE	Operating Systems
15100	Juniper/NetBSD sha1crypt	Operating Systems
7000	FortiGate (FortiOS)	Operating Systems
5800	Samsung Android Password/PIN	Operating Systems
13800	Windows Phone 8+ PIN/password	Operating Systems
8100	Citrix NetScaler	Operating Systems
8500	RACF	Operating Systems
7200	GRUB 2	Operating Systems
9900	Radmin2	Operating Systems
125	ArubaOS	Operating Systems
7700	SAP CODVN B (BCODE)	Enterprise Application Software
7800	SAP CODVN F/G (PASSCODE)	Enterprise Application Software
10300	SAP CODVN H (PWDSALTEDHASH) iSSHA-1	Enterprise Application Software
8600	Lotus Notes/Domino 5	Enterprise Application Software
8700	Lotus Notes/Domino 6	Enterprise Application Software
9100	Lotus Notes/Domino 8	Enterprise Application Software
133	PeopleSoft	Enterprise Application Software

13500	PeopleSoft PS_TOKEN	Enterprise Application Software
11600	7-Zip	Archives
12500	RAR3-hp	Archives
13000	RAR5	Archives
13200	AxCrypt	Archives
13300	AxCrypt in-memory SHA1	Archives
13600	WinZip	Archives
14700	iTunes backup < 10.0	Backup
14800	iTunes backup >= 10.0	Backup
62XY	TrueCrypt	Full-Disk Encryption (FDE)
X	1 = PBKDF2-HMAC-RIPEMD160	Full-Disk Encryption (FDE)
X	2 = PBKDF2-HMAC-SHA512	Full-Disk Encryption (FDE)
X	3 = PBKDF2-HMAC-Whirlpool	Full-Disk Encryption (FDE)
X	4 = PBKDF2-HMAC-RIPEMD160 + boot-mode	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure AES	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure Serpent	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure AES	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure Serpent	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded AES-Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded Serpent-AES	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded Twofish-Serpent	Full-Disk Encryption (FDE)
Y	3 = XTS 1536 bit all	Full-Disk Encryption (FDE)
8800	Android FDE <= 4.3	Full-Disk Encryption (FDE)
12900	Android FDE (Samsung DEK)	Full-Disk Encryption (FDE)
12200	eCryptfs	Full-Disk Encryption (FDE)
137XY	VeraCrypt	Full-Disk Encryption (FDE)
X	1 = PBKDF2-HMAC-RIPEMD160	Full-Disk Encryption (FDE)
X	2 = PBKDF2-HMAC-SHA512	Full-Disk Encryption (FDE)
X	3 = PBKDF2-HMAC-Whirlpool	Full-Disk Encryption (FDE)
X	4 = PBKDF2-HMAC-RIPEMD160 + boot-mode	Full-Disk Encryption (FDE)
X	5 = PBKDF2-HMAC-SHA256	Full-Disk Encryption (FDE)
X	6 = PBKDF2-HMAC-SHA256 + boot-mode	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure AES	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure Serpent	Full-Disk Encryption (FDE)
Y	1 = XTS 512 bit pure Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure AES	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure Serpent	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit pure Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded AES-Twofish	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded Serpent-AES	Full-Disk Encryption (FDE)
Y	2 = XTS 1024 bit cascaded Twofish-Serpent	Full-Disk Encryption (FDE)
Y	3 = XTS 1536 bit all	Full-Disk Encryption (FDE)
14600	LUKS	Full-Disk Encryption (FDE)
9700	MS Office <= 2003 $0/$1, MD5 + RC4	Documents
9710	MS Office <= 2003 $0/$1, MD5 + RC4, collider #1	Documents
9720	MS Office <= 2003 $0/$1, MD5 + RC4, collider #2	Documents
9800	MS Office <= 2003 $3/$4, SHA1 + RC4	Documents
9810	MS Office <= 2003 $3, SHA1 + RC4, collider #1	Documents
9820	MS Office <= 2003 $3, SHA1 + RC4, collider #2	Documents
9400	MS Office 2007	Documents
9500	MS Office 2010	Documents
9600	MS Office 2013	Documents
10400	PDF 1.1 - 1.3 (Acrobat 2 - 4)	Documents
10410	PDF 1.1 - 1.3 (Acrobat 2 - 4), collider #1	Documents
10420	PDF 1.1 - 1.3 (Acrobat 2 - 4), collider #2	Documents
10500	PDF 1.4 - 1.6 (Acrobat 5 - 8)	Documents
10600	PDF 1.7 Level 3 (Acrobat 9)	Documents
10700	PDF 1.7 Level 8 (Acrobat 10 - 11)	Documents
9000	Password Safe v2	Password Managers
5200	Password Safe v3	Password Managers
6800	LastPass + LastPass sniffed	Password Managers
6600	1Password, agilekeychain	Password Managers
8200	1Password, cloudkeychain	Password Managers
11300	Bitcoin/Litecoin wallet.dat	Password Managers
12700	Blockchain, My Wallet	Password Managers
15200	Blockchain, My Wallet, V2	Password Managers
13400	KeePass 1 (AES/Twofish) and KeePass 2 (AES)	Password Managers
15500	JKS Java Key Store Private Keys (SHA1)	Password Managers
15600	Ethereum Wallet, PBKDF2-HMAC-SHA256	Password Managers
15700	Ethereum Wallet, SCRYPT	Password Managers

```
  99999 | Plaintext                                                    | Plaintext

- [ Outfile Formats ] -

  #  | Format
 ====+========
  1  | hash[:salt]
  2  | plain
  3  | hash[:salt]:plain
  4  | hex_plain
  5  | hash[:salt]:hex_plain
  6  | plain:hex_plain
  7  | hash[:salt]:plain:hex_plain
  8  | crackpos
  9  | hash[:salt]:crack_pos
 10  | plain:crack_pos
 11  | hash[:salt]:plain:crack_pos
 12  | hex_plain:crack_pos
 13  | hash[:salt]:hex_plain:crack_pos
 14  | plain:hex_plain:crack_pos
 15  | hash[:salt]:plain:hex_plain:crack_pos

- [ Rule Debugging Modes ] -

  #  | Format
 ====+========
  1  | Finding-Rule
  2  | Original-Word
  3  | Original-Word:Finding-Rule
  4  | Original-Word:Finding-Rule:Processed-Word

- [ Attack Modes ] -

  #  | Mode
 ====+======
  0  | Straight
  1  | Combination
  3  | Brute-force
  6  | Hybrid Wordlist + Mask
  7  | Hybrid Mask + Wordlist

- [ Built-in Charsets ] -

  ?  | Charset
 ====+==========
  l  | abcdefghijklmnopqrstuvwxyz
  u  | ABCDEFGHIJKLMNOPQRSTUVWXYZ
  d  | 0123456789
  h  | 0123456789abcdef
  H  | 0123456789ABCDEF
  s  |  !"#$%&'()*+,-./:;<=>?@[\]^_`{|}~
  a  | ?l?u?d?s
  b  | 0x00 - 0xff

- [ OpenCL Device Types ] -

  #  | Device Type
 ====+==============
  1  | CPU
  2  | GPU
  3  | FPGA, DSP, Co-Processor

- [ Workload Profiles ] -
```

```
  #  | Performance | Runtime  | Power Consumption | Desktop Impact
 ====+=============+==========+===================+=================
  1  | Low         |    2 ms  | Low               | Minimal
  2  | Default     |   12 ms  | Economic          | Noticeable
  3  | High        |   96 ms  | High              | Unresponsive
  4  | Nightmare   |  480 ms  | Insane            | Headless

- [ Basic Examples ] -

  Attack-          | Hash- |
  Mode             | Type  | Example command

==================+=======+=================================================
=============
  Wordlist         | $P$   | hashcat -a 0 -m 400 example400.hash example.dict
  Wordlist + Rules | MD5   | hashcat -a 0 -m 0 example0.hash example.dict -r
rules/best64.rule
  Brute-Force      | MD5   | hashcat -a 3 -m 0 example0.hash ?a?a?a?a?a?a?a
  Combinator       | MD5   | hashcat -a 1 -m 0 example0.hash example.dict
example.dict
```

If you still have no idea what just happened, try the following pages:

* https://hashcat.net/wiki/#howtos_videos_papers_articles_etc_in_the_wild
* https://hashcat.net/faq/

HASH CRACKING BENCHMARKS

****HASH CRACKING BENCHMARK tables are meant to be a reference to enable users to gauge how SLOW or FAST a hashing algorithm is before formulating an attack plan. Nvidia GTX*2080 *was chosen as the default due to its prevalence among the cracking community and* it's *position as a top performing GPU card*.

HASH CRACKING BENCHMARKS (ALPHABETICAL)

1Password, agilekeychain	3319.2 kH/s
1Password, cloudkeychain	10713 H/s
3DES (PT = $salt, key = $pass)	594.3 MH/s
7-Zip	7514 H/s
AIX	14937.2 kH/s
AIX	44926.1 kH/s
AIX	6359.3 kH/s
AIX	9937.1 kH/s
Android FDE (Samsung DEK)	291.8 kH/s
Android FDE <= 4.3	803.0 kH/s
Android PIN	5419.4 kH/s
ArubaOS	6894.7 MH/s
Atlassian (PBKDF2-HMAC-SHA1)	283.6 kH/s
AxCrypt	113.9 kH/s
AxCrypt in memory SHA1	7503.3 MH/s
bcrypt, Blowfish(OpenBSD)	13094 H/s
BSDiCrypt, Extended DES	1552.5 kH/s
Bitcoin/Litecoin wallet.dat	4508 H/s
BLAKE2-512	1488.9 MH/s
Blockchain, My Wallet	50052.3 kH/s
Blockchain, My Wallet, V2	305.2 kH/s
ChaCha20	3962.0 MH/s
Cisco 8	59950 H/s
Cisco 9	22465 H/s

Cisco-ASA MD5	17727.2 MH/s
Cisco-IOS SHA256	2864.3 MH/s
Cisco-PIX MD5	16407.2 MH/s
Citrix NetScaler	7395.3 MH/s
ColdFusion 10+	1733.6 MH/s
DES (PT = $salt, key = $pass)	19185.7 MH/s
descrypt, DES(Unix), Traditional DES	906.7 MH/s
DNSSEC (NSEC3)	3274.6 MH/s
Django (PBKDF2-SHA256)	59428 H/s
Django (SHA-1)	6822.6 MH/s
Domain Cached Credentials (DCC), MS Cache	11195.8 MH/s
Domain Cached Credentials 2 (DCC2), MS Cache 2	317.5 kH/s
DPAPI masterkey file v1 and v2	73901 H/s
Drupal7	56415 H/s
eCryptfs	13813 H/s
Ethereum Wallet, PBKDF2-HMAC-SHA256	4518 H/s
Ethereum Wallet, SCRYPT	29 H/s
EPiServer 6.x < v4	6818.5 MH/s
EPiServer 6.x > v4	2514.4 MH/s
FileZilla Server >= 0.9.55	565.2 MH/s
FortiGate (FortiOS)	6386.2 MH/s
GOST R 34.11-2012 (Streebog) 256-bit	50018.8 kH/s
GOST R 34.11-2012 (Streebog) 512-bit	49979.4 kH/s
GOST R 34.11-94	206.2 MH/s
GRUB 2	43235 H/s
Half MD5	15255.8 MH/s
hMailServer	2509.6 MH/s
IKE-PSK MD5	1834.0 MH/s
IKE-PSK SHA1	788.2 MH/s
IPB2+, MyBB1.2+	5011.8 MH/s
IPMI2 RAKP HMAC-SHA1	1607.3 MH/s
iTunes backup < 10.0	140.2 kH/s
iTunes backup >= 10.0	94 H/s
JKS Java Key Store Private Keys (SHA1)	7989.4 MH/s

Joomla < 2.5.18	25072.2 MH/s
Juniper IVE	9929.1 kH/s
Juniper/NetBSD sha1crypt	144.1 kH/s
Juniper Netscreen/SSG (ScreenOS)	12946.8 MH/s
Keepass 1 (AES/Twofish) and Keepass 2 (AES)	139.8 kH/s
Kerberos 5 AS-REQ Pre-Auth etype 23	291.5 MH/s
Kerberos 5 TGS-REP etype 23	291.1 MH/s
LM	18382.7 MH/s
Lastpass	2331.2 kH/s
Lotus Notes/Domino 5	205.2 MH/s
Lotus Notes/Domino 6	69673.5 kH/s
Lotus Notes/Domino 8	667.2 kH/s
LUKS	8703 H/s
MD4	43722.9 MH/s
MD5	24943.1 MH/s
md5(md5($pass).md5($salt))	4291.9 MH/s
md5($salt.md5($salt.$pass))	5037.7 MH/s
md5($salt.md5($pass.$salt))	5401.6 MH/s
md5apr1, MD5(APR), Apache MD5	9911.5 kH/s
md5crypt, MD5(Unix), FreeBSD MD5, Cisco-IOS MD5	9918.1 kH/s
MS Office <= 2003 MD5+RC4,collision-mode #1	339.9 MH/s
MS Office <= 2003 MD5+RC4,oldoffice$0, oldoffice$l	219.6 MH/s
MS Office <= 2003 SHA1+RC4,collision-mode #1	330.8 MH/s
MS Office <= 2003 SHA1+RC4,oldoffice$3, oldoffice$4	296.7 MH/s
MS-AzureSync PBKDF2-HMAC-SHA256	10087.9 kH/s
MSSQL(2000)	8609.7 MH/s
MSSQL(2005)	8636.4 MH/s
MSSQL(2012)	1071.3 MH/s
Mediawiki B type	6515.8 MH/s
MySQL Challenge-Response Authentication (SHA1)	2288.0 MH/s

MySQL323	51387.0 MH/s
MySQL4.1/MySQL5	3831.5 MH/s
NTLM	41825.0 MH/s
NetNTLMv1-VANILLA / NetNTLMv1+ESS	22308.5 MH/s
NetNTLMv2	1634.9 MH/s
osCommerce, xt	12883.7 MH/s
OSX V10.4, V10.5, V10.6	6831.3 MH/s
OSX V10.7	834.1 MH/s
OSX V10.8+	12348 H/s
Office 2007	134.5 kH/s
Office 2010	66683 H/s
Office 2013	8814 H/s
OpenCart	2097.0 MH/s
Oracle H	851.6 MH/s
Oracle S	8565.0 MH/s
Oracle T	104.7 kH/s
Password Safe v2	332.0 kH/s
Password Safe v3	1233.4 kH/s
PBKDF2-HMAC-MD5	7408.3 kH/s
PBKDF2-HMAC-SHA1	3233.9 kH/s
PBKDF2-HMAC-SHA256	1173.1 kH/s
PBKDF2-HMAC-SHA512	431.4 kH/s
PDF 1.1 - 1.3 (Acrobat 2 - 4)	345.0 MH/s
PDF 1.1 - 1.3 (Acrobat 2 - 4) + collider-mode #1	373.4 MH/s
PDF 1.4 - 1.6 (Acrobat 5 - 8)	16048.0 kH/s
PDF 1.7 Level 3 (Acrobat 9)	2854.1 MH/s
PDF 1.7 Level 8 (Acrobat 10 - 11)	30974 H/s
PeopleSoft	8620.3 MH/s
PeopleSoft PS_TOKEN	3226.5 MH/s
phpass, MD5(Wordpress), MD5(phpBB3), MD5(Joomla)	6917.9 kH/s
PHPS	6972.6 MH/s
Plaintext	37615.5 MH/s
PostgreSQL	25068.0 MH/s

PostgreSQL Challenge-Response Auth (MD5)	6703.0 MH/s
PrestaShop	8221.3 MH/s
PunBB	2837.7 MH/s
RACF	2528.4 MH/s
RAR3-hp	29812 H/s
RAR5	36473 H/s
Radmin2	8408.3 MH/s
Redmine Project Management Web App	2121.3 MH/s
RipeMD160	4732.0 MH/s
SAP CODVN B (BCODE)	1311.2 MH/s
SAP CODVN F/G (PASSCODE)	739.3 MH/s
SAP CODVN H (PWDSALTEDHASH) iSSHA-1	6096.6 kH/s
scrypt	435.1 kH/s
SHA-1(Base64), nsldap, Netscape LDAP SHA	8540.0 MH/s
SHA-3(Keccak)	769.8 MH/s
SHA1	8538.1 MH/s
SHA1(CX)	291.8 MH/s
sha1($salt.sha1($pass))	2457.6 MH/s
SHA-224	3076.6 MH/s
SHA256	2865.2 MH/s
sha256crypt, SHA256(Unix)	388.8 kH/s
SHA384	1044.8 MH/s
SHA512	1071.1 MH/s
sha512crypt, SHA512(Unix)	147.5 kH/s
SIP digest authentication (MD5)	2004.3 MH/s
SKIP32	4940.9 MH/s
SMF > v1.1	6817.7 MH/s
SSHA-1(Base64), nsldaps, Netscape LDAP SSHA	8584.5 MH/s
SSHA-256(Base64), LDAP {SSHA256}	3216.9 MH/s
SSHA-512(Base64), LDAP	1072.2 MH/s
SipHash	28675.1 MH/s
Skype	12981.9 MH/s
Sybase ASE	398.1 MH/s
TrueCrypt PBKDF2-HMAC-	512.4 kH/s

RipeMD160+XTS512bit+boot-mode	
TrueCrypt PBKDF2-HMAC-RipeMD160+XTS512 bit	277.0 kH/s
TrueCrypt PBKDF2-HMAC-SHA512+XTS512 bit	376.2 kH/s
TrueCrypt PBKDF2-HMAC-Whirlpool+XTS512 bit	36505 H/s
vBulletin < V3.8.5	6947.7 MH/s
vBulletin > V3.8.5	4660.5 MH/s
VeraCrypt PBKDF2-HMAC-RipeMD160+XTS 512bit	907 H/s
VeraCrypt PBKDF2-HMAC-RipeMD160+XTS 512bit+boot-mode	1820 H/s
VeraCrypt PBKDF2-HMAC-SHA256+XTS 512bit	1226 H/s
VeraCrypt PBKDF2-HMAC-SHA256+XTS 512bit+boot-mode	3012 H/s
VeraCrypt PBKDF2-HMAC-SHA512+XTS 512bit	830 H/s
VeraCrypt PBKDF2-HMAC-Whirlpool+XTS 512bit	74 H/s
WBB3, Woltlab Burning Board 3	1293.3 MH/s
WPA/WPA2	396.8 kH/s
Whirlpool	253.9 MH/s
WinZip	1054.4 kH/s

**CRACKING SPEED BASED ON NVIDIA GTX 1080 & HASHCAT v3.6*

HASH CRACKING SPEED

HASH CRACKING SPEED (SLOW - FAST)

Ethereum Wallet, SCRYPT	29 H/s
VeraCrypt PBKDF2-HMAC-Whirlpool+XTS 512bit	74 H/s
iTunes backup >= 10.0	94 H/s
VeraCrypt PBKDF2-HMAC-SHA512+XTS 512bit	830 H/s
VeraCrypt PBKDF2-HMAC-RipeMD160+XTS 512bit	907 H/s
VeraCrypt PBKDF2-HMAC-SHA256+XTS 512bit	1226 H/s
VeraCrypt PBKDF2-HMAC-RipeMD160+XTS 512bit+boot-mode	1820 H/s
VeraCrypt PBKDF2-HMAC-SHA256+XTS 512bit+boot-mode	3012 H/s
Bitcoin/Litecoin wallet.dat	4508 H/s
Ethereum Wallet, PBKDF2-HMAC-SHA256	4518 H/s
7-Zip	7514 H/s
LUKS	8703 H/s
Office 2013	8814 H/s
1Password, cloudkeychain	10713 H/s
OSX V10.8+	12348 H/s
bcrypt, Blowfish(OpenBSD)	13094 H/s
eCryptfs	13813 H/s
Cisco 9	22465 H/s
RAR3-hp	29812 H/s
PDF 1.7 Level 8 (Acrobat 10 - 11)	30974 H/s
RAR5	36473 H/s
TrueCrypt PBKDF2-HMAC-Whirlpool+XTS512 bit	36505 H/s
GRUB 2	43235 H/s
Drupal7	56415 H/s
Django (PBKDF2-SHA256)	59428 H/s

Cisco 8	59950 H/s
Office 2010	66683 H/s
DPAPI masterkey file v1 and v2	73901 H/s
Oracle T	104.7 kH/s
AxCrypt	113.9 kH/s
Office 2007	134.5 kH/s
Keepass 1 (AES/Twofish) and Keepass 2 (AES)	139.8 kH/s
iTunes backup < 10.0	140.2 kH/s
Juniper/NetBSD sha1crypt	144.1 kH/s
sha512crypt, SHA512(Unix)	147.5 kH/s
TrueCrypt PBKDF2-HMAC-RipeMD160+XTS512 bit	277.0 kH/s
Atlassian (PBKDF2-HMAC-SHA1)	283.6 kH/s
Android FDE (Samsung DEK)	291.8 kH/s
Blockchain, My Wallet, V2	305.2 kH/s
Domain Cached Credentials 2 (DCC2), MS Cache 2	317.5 kH/s
Password Safe v2	332.0 kH/s
TrueCrypt PBKDF2-HMAC-SHA512+XTS512 bit	376.2 kH/s
sha256crypt, SHA256(Unix)	388.8 kH/s
WPA/WPA2	396.8 kH/s
PBKDF2-HMAC-SHA512	431.4 kH/s
scrypt	435.1 kH/s
TrueCrypt PBKDF2-HMAC-RipeMD160+XTS 512bit+boot-mode	512.4 kH/s
Lotus Notes/Domino 8	667.2 kH/s
Android FDE <= 4.3	803.0 kH/s
WinZip	1054.4 kH/s
PBKDF2-HMAC-SHA256	1173.1 kH/s
Password Safe v3	1233.4 kH/s
BSDiCrypt, Extended DES	1552.5 kH/s
Lastpass	2331.2 kH/s
PBKDF2-HMAC-SHA1	3233.9 kH/s
1Password, agilekeychain	3319.2 kH/s
Android PIN	5419.4 kH/s

SAP CODVN H (PWDSALTEDHASH) iSSHA-1	6096.6 kH/s
AIX	6359.3 kH/s
phpass, MD5(Wordpress), MD5(phpBB3), MD5(Joomla)	6917.9 kH/s
PBKDF2-HMAC-MD5	7408.3 kH/s
md5apr1, MD5(APR), Apache MD5	9911.5 kH/s
md5crypt, MD5(Unix), FreeBSD MD5, Cisco-IOS MD5	9918.1 kH/s
Juniper IVE	9929.1 kH/s
AIX	9937.1 kH/s
MS-AzureSync PBKDF2-HMAC-SHA256	10087.9 kH/s
AIX	14937.2 kH/s
PDF 1.4 - 1.6 (Acrobat 5 - 8)	16048.0 kH/s
AIX	44926.1 kH/s
GOST R 34.11-2012 (Streebog) 512-bit	49979.4 kH/s
GOST R 34.11-2012 (Streebog) 256-bit	50018.8 kH/s
Blockchain, My Wallet	50052.3 kH/s
Lotus Notes/Domino 6	69673.5 kH/s
Lotus Notes/Domino 5	205.2 MH/s
GOST R 34.11-94	206.2 MH/s
MS Office <= 2003 MD5+RC4,oldoffice$0, oldoffice$l	219.6 MH/s
Whirlpool	253.9 MH/s
Kerberos 5 TGS-REP etype 23	291.1 MH/s
Kerberos 5 AS-REQ Pre-Auth etype 23	291.5 MH/s
SHA1(CX)	291.8 MH/s
MS Office <= 2003 SHA1+RC4,oldoffice$3, oldoffice$4	296.7 MH/s
MS Office <= 2003 SHA1+RC4,collision-mode #1	330.8 MH/s
MS Office <= 2003 MD5+RC4,collision-mode #1	339.9 MH/s
PDF 1.1 - 1.3 (Acrobat 2 - 4)	345.0 MH/s
PDF 1.1 - 1.3 (Acrobat 2 - 4) + collider-mode #1	373.4 MH/s
Sybase ASE	398.1 MH/s
FileZilla Server >= 0.9.55	565.2 MH/s

3DES (PT = $salt, key = $pass)	594.3 MH/s
SAP CODVN F/G (PASSCODE)	739.3 MH/s
SHA-3(Keccak)	769.8 MH/s
IKE-PSK SHA1	788.2 MH/s
OSX V10.7	834.1 MH/s
Oracle H	851.6 MH/s
descrypt, DES(Unix), Traditional DES	906.7 MH/s
SHA384	1044.8 MH/s
SHA512	1071.1 MH/s
MSSQL(2012)	1071.3 MH/s
SSHA-512(Base64), LDAP	1072.2 MH/s
WBB3, Woltlab Burning Board 3	1293.3 MH/s
SAP CODVN B (BCODE)	1311.2 MH/s
BLAKE2-512	1488.9 MH/s
IPMI2 RAKP HMAC-SHA1	1607.3 MH/s
NetNTLMv2	1634.9 MH/s
ColdFusion 10+	1733.6 MH/s
IKE-PSK MD5	1834.0 MH/s
SIP digest authentication (MD5)	2004.3 MH/s
OpenCart	2097.0 MH/s
Redmine Project Management Web App	2121.3 MH/s
MySQL Challenge-Response Authentication (SHA1)	2288.0 MH/s
sha1($salt.sha1($pass))	2457.6 MH/s
hMailServer	2509.6 MH/s
EPiServer 6.x > v4	2514.4 MH/s
RACF	2528.4 MH/s
PunBB	2837.7 MH/s
PDF 1.7 Level 3 (Acrobat 9)	2854.1 MH/s
Cisco-IOS SHA256	2864.3 MH/s
SHA256	2865.2 MH/s
SHA-224	3076.6 MH/s
SSHA-256(Base64), LDAP {SSHA256}	3216.9 MH/s
PeopleSoft PS_TOKEN	3226.5 MH/s

DNSSEC (NSEC3)	3274.6 MH/s
MySQL4.1/MySQL5	3831.5 MH/s
ChaCha20	3962.0 MH/s
md5(md5($pass).md5($salt))	4291.9 MH/s
vBulletin > V3.8.5	4660.5 MH/s
RipeMD160	4732.0 MH/s
SKIP32	4940.9 MH/s
IPB2+, MyBB1.2+	5011.8 MH/s
md5($salt.md5($salt.$pass))	5037.7 MH/s
md5($salt.md5($pass.$salt))	5401.6 MH/s
FortiGate (FortiOS)	6386.2 MH/s
Mediawiki B type	6515.8 MH/s
PostgreSQL Challenge-Response Authentication (MD5)	6703.0 MH/s
SMF > v1.1	6817.7 MH/s
EPiServer 6.x < v4	6818.5 MH/s
Django (SHA-1)	6822.6 MH/s
OSX V10.4, V10.5, V10.6	6831.3 MH/s
ArubaOS	6894.7 MH/s
vBulletin < V3.8.5	6947.7 MH/s
PHPS	6972.6 MH/s
Citrix NetScaler	7395.3 MH/s
AxCrypt in memory SHA1	7503.3 MH/s
JKS Java Key Store Private Keys (SHA1)	7989.4 MH/s
PrestaShop	8221.3 MH/s
Radmin2	8408.3 MH/s
SHA1	8538.1 MH/s
SHA-1(Base64), nsldap, Netscape LDAP SHA	8540.0 MH/s
SSHA-1(Base64), nsldaps, Netscape LDAP SSHA	8584.5 MH/s
MSSQL(2000)	8609.7 MH/s
PeopleSoft	8620.3 MH/s
MSSQL(2005)	8636.4 MH/s
Oracle S	8565.0 MH/s
Domain Cached Credentials (DCC), MS Cache	11195.8 MH/s

osCommerce, xt	12883.7 MH/s
Juniper Netscreen/SSG (ScreenOS)	12946.8 MH/s
Skype	12981.9 MH/s
Half MD5	15255.8 MH/s
Cisco-PIX MD5	16407.2 MH/s
Cisco-ASA MD5	17727.2 MH/s
LM	18382.7 MH/s
DES (PT = $salt, key = $pass)	19185.7 MH/s
NetNTLMv1-VANILLA / NetNTLMv1+ESS	22308.5 MH/s
MD5	24943.1 MH/s
PostgreSQL	25068.0 MH/s
Joomla < 2.5.18	25072.2 MH/s
SipHash	28675.1 MH/s
Plaintext	37615.5 MH/s
MD4	43722.9 MH/s
NTLM	41825.0 MH/s
MySQL323	51387.0 MH/s

**Speed based on NVIDIA GTX 1080 Running Hashcat v3.6*

NOTES