HASHCAT

User Manual
V1.2

9 August 2011

Compiled by radix

Table of Contents

Legal and Licensing

About

The hashcat family of software is a set of professional tools provided at no charge to the community. Hashcat is intended to be used **LEGALLY** as a tool to recover plain text strings for a variety of hashing methods including:

- MD5 (and variations)
- SHA1 (and variations)
- MySQL
- SSHA-1
- MD4
- NTLM
- Domain Cached Credentials (DCC)
- MSSQL
- SHA256
- SHA-512
- Oracle 11G
- DES(Unix)

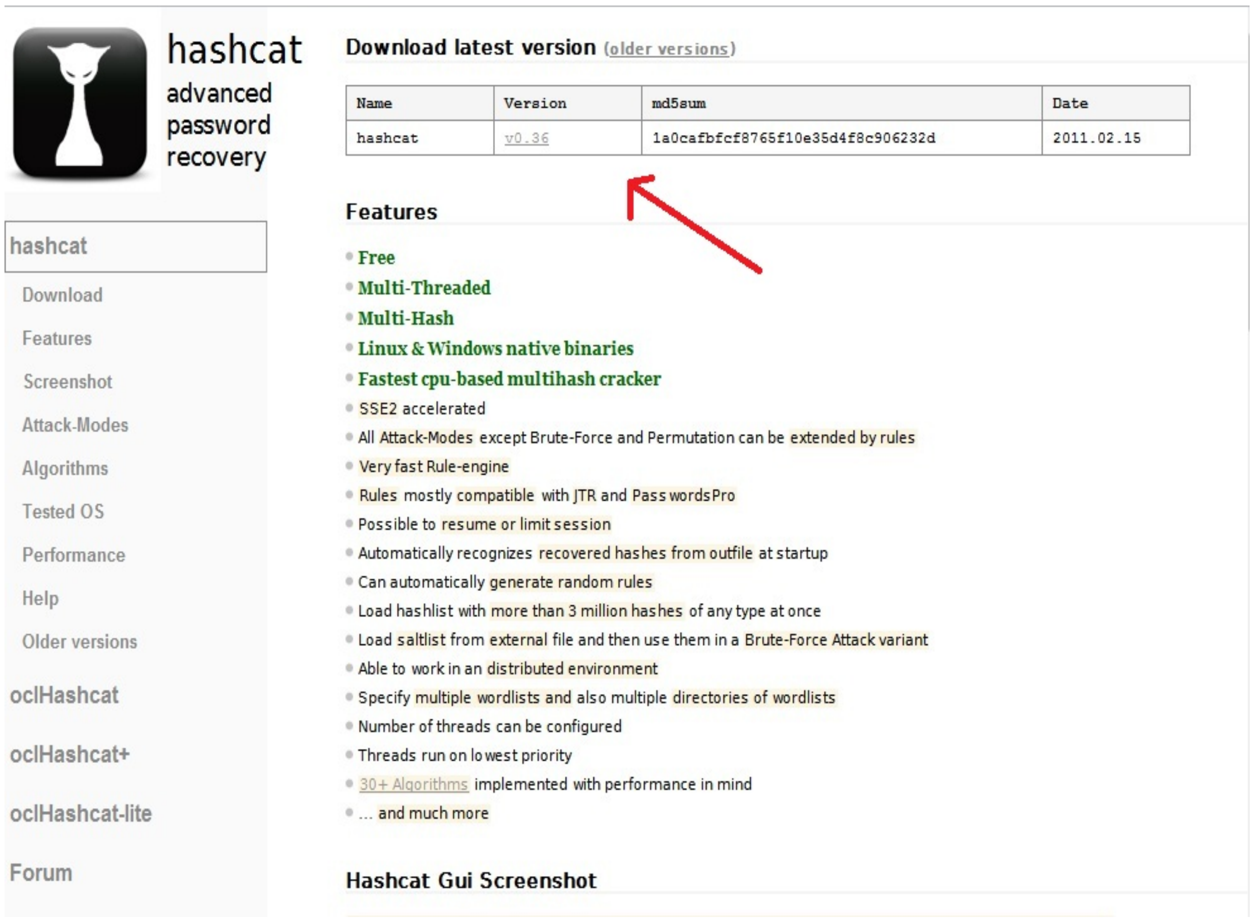
As the Hashcat suite is constantly under development, more algorithms may be added in the future.

Additional information can be found at:
http://hashcat.net
or on IRC at
irc.rizon.net #hashcat

Hashcat

1.1………………………………….Overview

The latest version of hashcat can be obtained from the hashcat website at http://www.hashcat.net/hashcat. You will need 7zip to decompress the downloaded archive.



Download latest version (older versions)

Name	Version	md5sum	Date
hashcat	v0.36	1a0cafbfcf8765f10e35d4f8c906232d	2011.02.15

Features

- Free
- Multi-Threaded
- Multi-Hash
- Linux & Windows native binaries
- Fastest cpu-based multihash cracker
- SSE2 accelerated
- All Attack-Modes except Brute-Force and Permutation can be extended by rules
- Very fast Rule-engine
- Rules mostly compatible with JTR and PasswordsPro
- Possible to resume or limit session
- Automatically recognizes recovered hashes from outfile at startup
- Can automatically generate random rules
- Load hashlist with more than 3 million hashes of any type at once
- Load saltlist from external file and then use them in a Brute-Force Attack variant
- Able to work in an distributed environment
- Specify multiple wordlists and also multiple directories of wordlists
- Number of threads can be configured
- Threads run on lowest priority
- 30+ Algorithms implemented with performance in mind
- ... and much more

Hashcat Gui Screenshot

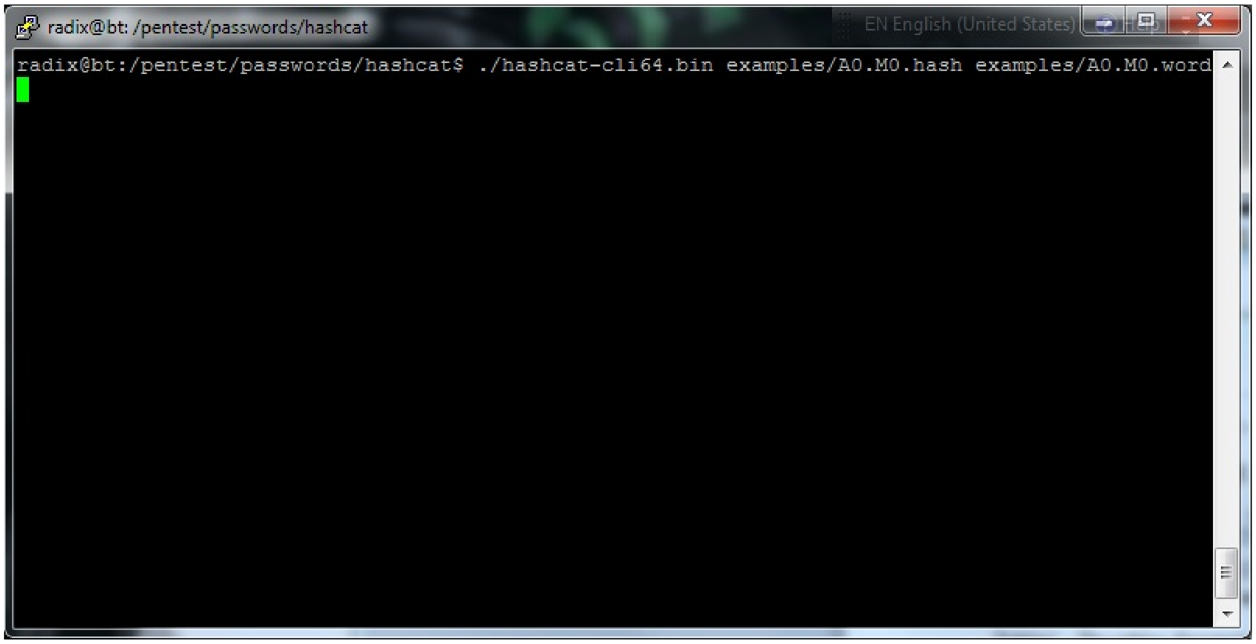
Hashcat is the world's fastest CPU based password recovery tool. While not as fast as its GPU counterparts: oclHashcat, oclHashcat-plus, and oclHashcat-lite, large lists can be easily sliced in half with a good dictionary and a bit of familiarity with the switches. The goal of this section is to present you with everything you will need to get up and running with hashcat.

Once decompressed, there will be a folder called hashcat-X.XX where X represents the version downloaded. There is also a GUI for hashcat but as I am not a windows user, I will not be providing documentation for it.

Inside the hashcat folder (in this case hashcat-0.37\) you will see a list of files and a couple directories. Their purposes are as follows:

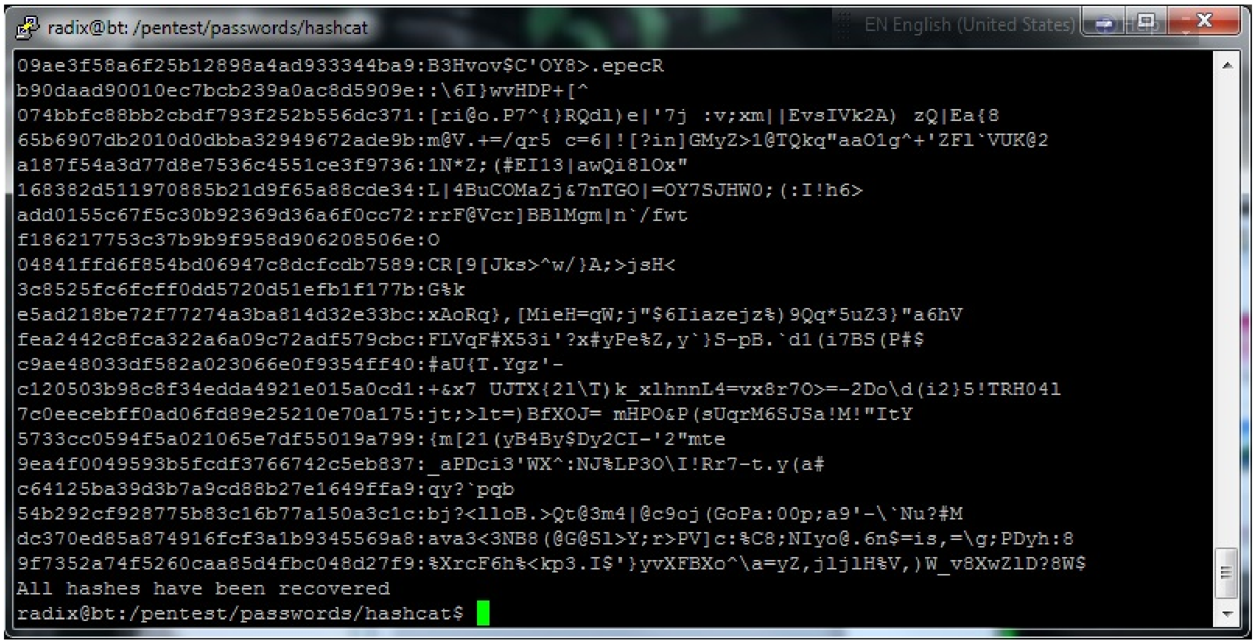
Hashcat-cli(32/64).(bin/exe) – the main program. For 32 bit operating systems select 32, and for 64 bit, select 64. Linux users will run .bin, while windows users will run the .exe. Operands must be supplied or hashcat

will do nothing. On windows simply double clicking the executable will quickly open and command prompt and close it. Windows users must run this from a command prompt, or through a .bat/.cmd.
Rules/ - This directory contains a few pre-generated rules for you to use with hashcat. These will be discussed later.
Examples/ - This directory has many files to be used with different hash modes. These are a good way to practice with hashcat and understand what hash types look like. IE: A0.M0.hash has a list of plain MD5 hashes, while A0.M0.word has the plain text version.
Salts/ - Contains a list of 3 byte salts incremented from a to ~~~. These can be useful, but generally you will not need them. These lists can be expanded upon, or new salt lists can be added. This is for advanced hashcat usage.
Tables/ - The tables directory contains files to be used with the –-table-min/max and file switches. These can be useful when you know the requirements of a password.
Using the tools provided in the hashcat package, let's do a quick test run.


radix@bt: /pentest/passwords/hashcat
EN English (United States)

```
radix@bt:/pentest/passwords/hashcat$ ./hashcat-cli64.bin examples/A0.M0.hash examples/A0.M0.word
```

Here we have told hashcat to load the hashlist examples/A0.M0.hash and to use the dictionary examples/A0.M0.word. This should give us 100% success rate since the MD5's were hashed from the strings in this file. If you are using windows, be sure to run hashcat-cli(32/64).exe and omit the ./.

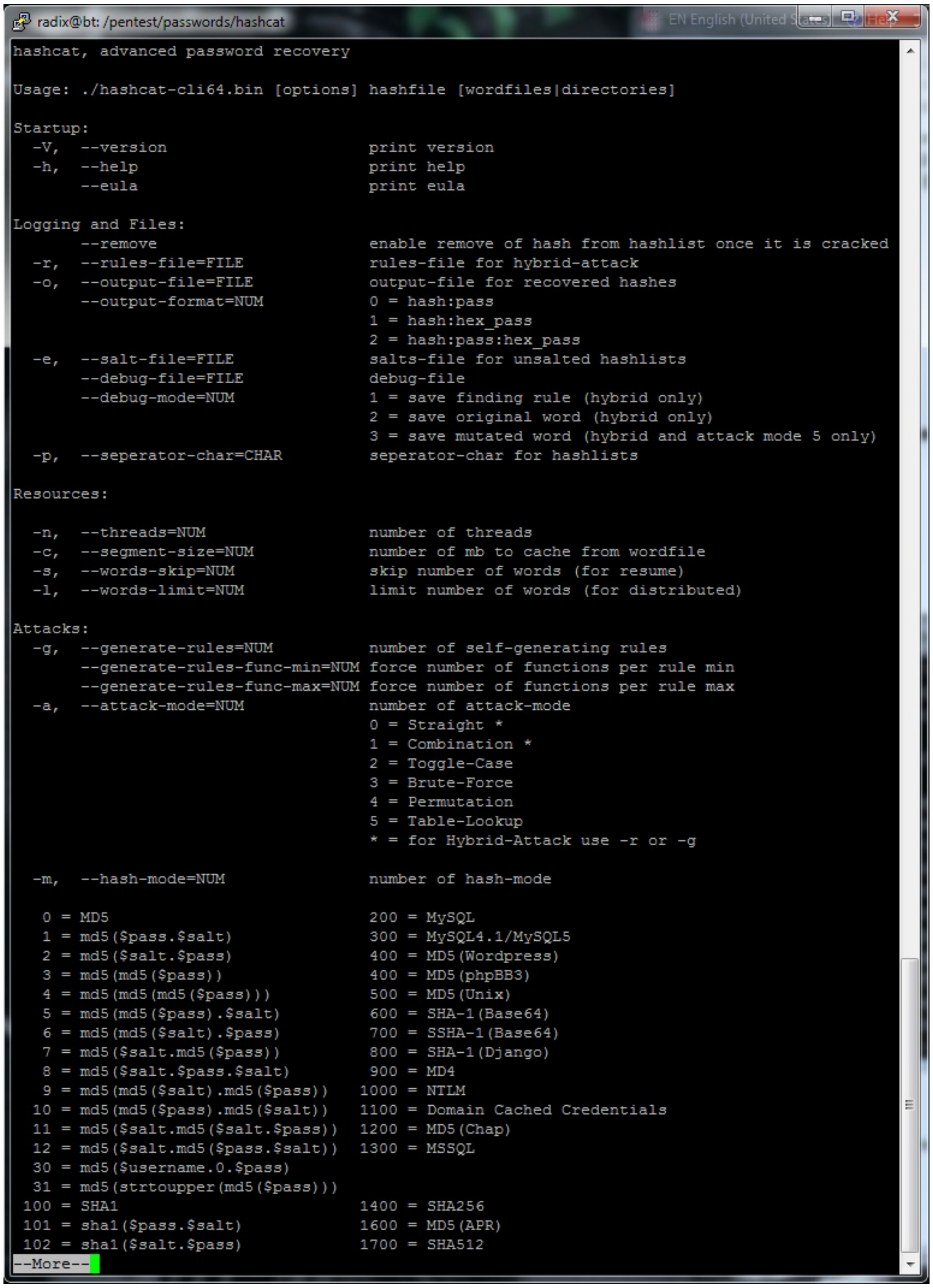


```
09ae3f58a6f25b12898a4ad933344ba9:B3Hvov$C'OY8>.epecR
b90daad90010ec7bcb239a0ac8d5909e::\6I}wvHDP+[^
074bbfc88bb2cbdf793f252b556dc371:[ri@o.P7^{}RQdl)e|'7j :v;xm||EvsIVk2A) zQ|Ea{8
65b6907db2010d0dbba32949672ade9b:m@V.+=/qr5 c=6|![?in]GMyZ>1@TQkq"aaO1g^+'ZFl`VUK@2
a187f54a3d77d8e7536c4551ce3f9736:1N*Z;(#EI13|awQi8lOx"
168382d511970885b21d9f65a88cde34:L|4BuCOMaZj&7nTGO|=OY7SJHW0;(:I!h6>
add0155c67f5c30b92369d36a6f0cc72:rrF@Vcr]BBlMgm|n`/fwt
f186217753c37b9b9f958d906208506e:O
04841ffd6f854bd06947c8dcfcdb7589:CR[9[Jks>^w/}A;>jsH<
3c8525fc6fcff0dd5720d51efb1f177b:G%k
e5ad218be72f77274a3ba814d32e33bc:xAoRq},[MieH=qW;j"$6Iiazejz%)9Qq*5uZ3}"a6hV
fea2442c8fca322a6a09c72adf579cbc:FLVqF#X53i'?x#yPe%Z,y`}S-pB.`d1(i7BS(P#$
c9ae48033df582a023066e0f9354ff40:#aU{T.Ygz'-
c120503b98c8f34edda4921e015a0cd1:+&x7 UJTX{21\T)k_xlhnnL4=vx8r7O>=-2Do\d(i2}5!TRH041
7c0eecebff0ad06fd89e25210e70a175:jt;>lt=)BfXOJ= mHPO&P(sUqrM6SJSa!M!"ItY
5733cc0594f5a021065e7df55019a799:{m[21(yB4By$Dy2CI-'2"mte
9ea4f0049593b5fcdf3766742c5eb837:_aPDci3'WX^:NJ%LP3O\I!Rr7-t.y(a#
c64125ba39d3b7a9cd88b27e1649ffa9:qy?`pqb
54b292cf928775b83c16b77a150a3c1c:bj?<lloB.>Qt@3m4|@c9oj(GoPa:00p;a9'-\`Nu?#M
dc370ed85a874916fcf3a1b9345569a8:ava3<3NB8(@G@Sl>Y;r>PV]c:%C8;NIyo@.6n$=is,=\g;PDyh:8
9f7352a74f5260caa85d4fbc048d27f9:%XrcF6h%<kp3.I$'}yvXFBXo^\a=yZ,jljlH%V,)W_v8XwZlD?8W$
All hashes have been recovered
radix@bt:/pentest/passwords/hashcat$
```

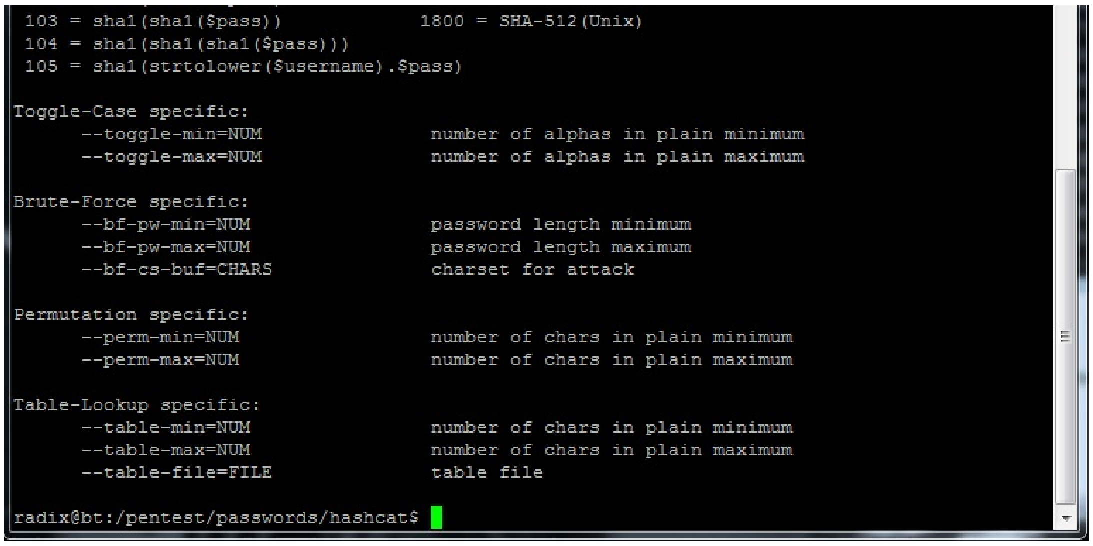
Great success. All hashes have been recovered. Easy right? Well, it gets better……

1.2……………………………………………Options

Hashcat comes with a plethora of options that you can use to fine tune your attacks.


radix@bt: /pentest/passwords/hashcat

```
hashcat, advanced password recovery

Usage: ./hashcat-cli64.bin [options] hashfile [wordfiles|directories]

Startup:
  -V,  --version                      print version
  -h,  --help                         print help
       --eula                         print eula

Logging and Files:
       --remove                       enable remove of hash from hashlist once it is cracked
  -r,  --rules-file=FILE              rules-file for hybrid-attack
  -o,  --output-file=FILE             output-file for recovered hashes
       --output-format=NUM            0 = hash:pass
                                      1 = hash:hex_pass
                                      2 = hash:pass:hex_pass
  -e,  --salt-file=FILE               salts-file for unsalted hashlists
       --debug-file=FILE              debug-file
       --debug-mode=NUM               1 = save finding rule (hybrid only)
                                      2 = save original word (hybrid only)
                                      3 = save mutated word (hybrid and attack mode 5 only)
  -p,  --seperator-char=CHAR          seperator-char for hashlists

Resources:

  -n,  --threads=NUM                  number of threads
  -c,  --segment-size=NUM             number of mb to cache from wordfile
  -s,  --words-skip=NUM               skip number of words (for resume)
  -l,  --words-limit=NUM              limit number of words (for distributed)

Attacks:
  -g,  --generate-rules=NUM           number of self-generating rules
       --generate-rules-func-min=NUM force number of functions per rule min
       --generate-rules-func-max=NUM force number of functions per rule max
  -a,  --attack-mode=NUM              number of attack-mode
                                      0 = Straight *
                                      1 = Combination *
                                      2 = Toggle-Case
                                      3 = Brute-Force
                                      4 = Permutation
                                      5 = Table-Lookup
                                      * = for Hybrid-Attack use -r or -g

  -m,  --hash-mode=NUM                number of hash-mode

   0 = MD5                            200 = MySQL
   1 = md5($pass.$salt)               300 = MySQL4.1/MySQL5
   2 = md5($salt.$pass)               400 = MD5(Wordpress)
   3 = md5(md5($pass))                400 = MD5(phpBB3)
   4 = md5(md5(md5($pass)))           500 = MD5(Unix)
   5 = md5(md5($pass).$salt)          600 = SHA-1(Base64)
   6 = md5(md5($salt).$pass)          700 = SSHA-1(Base64)
   7 = md5($salt.md5($pass))          800 = SHA-1(Django)
   8 = md5($salt.$pass.$salt)         900 = MD4
   9 = md5(md5($salt).md5($pass))    1000 = NTLM
  10 = md5(md5($pass).md5($salt))    1100 = Domain Cached Credentials
  11 = md5($salt.md5($salt.$pass))   1200 = MD5(Chap)
  12 = md5($salt.md5($pass.$salt))   1300 = MSSQL
  30 = md5($username.0.$pass)
  31 = md5(strtoupper(md5($pass)))
 100 = SHA1                          1400 = SHA256
 101 = sha1($pass.$salt)             1600 = MD5(APR)
 102 = sha1($salt.$pass)             1700 = SHA512
--More--
```



```
 103 = sha1(sha1($pass))            1800 = SHA-512(Unix)
 104 = sha1(sha1(sha1($pass)))
 105 = sha1(strtolower($username).$pass)

Toggle-Case specific:
      --toggle-min=NUM               number of alphas in plain minimum
      --toggle-max=NUM               number of alphas in plain maximum

Brute-Force specific:
      --bf-pw-min=NUM                password length minimum
      --bf-pw-max=NUM                password length maximum
      --bf-cs-buf=CHARS              charset for attack

Permutation specific:
      --perm-min=NUM                 number of chars in plain minimum
      --perm-max=NUM                 number of chars in plain maximum

Table-Lookup specific:
      --table-min=NUM                number of chars in plain minimum
      --table-max=NUM                number of chars in plain maximum
      --table-file=FILE              table file

radix@bt:/pentest/passwords/hashcat$
```

The number of options may seem intimidating at first, but once you get used to them, they are easy to remember. Most are self-explanatory so take the time to read each one.

I'm going to skip the first 3 options since they explain themselves fairly well. However the remainder I will explain in further detail.

--remove : Adding this will delete the hash from your list when it is cracked. It requires no further input. This will prevent you from having to attack the same hash twice, since it will be removed when cracked. Default: not used

--quiet : Supresses all output except for errors, and recovered hashes. Default: not used

--stdout : Rather than try to recover passwords, hashcat simply outputs to the terminal window.

--disable-potfile : Prevents Hashcat from writing recovered hashes to hashcat.pot. Default: not used
--rules-file=FILE or –r : Adding this will allow hashcat to use the rule file specified. Hashcat will then run the specified rules against the current attempt. Default: not used
--rules-file=rules/best64.rule or -r rules/best64.rule

--output-file=FILE or –o : Specifies where cracked hashes should be written to. This should be used if you plan to keep the hashes, or do not want to copy/paste them from a terminal or command prompt. Work smarter not harder. Default: not used
--output-file=cracked.out or –o cracked.out

--output-format=NUM : NUM can be 0, 1, or 2. Generally not needed, but if a plain text contains hex characters this will need to be specified to prevent bad plain texts. Default: Mode 0
--output-format=0

--salt-file=FILE or –e : Specifies a list of pre-generated salts to be used in a session. This is used when a salted hash is missing the salt. Default: not used

--debug-file=FILE : Specify the file that debug information should be written to. Default: not used
–-debug-file=debug.txt

--debug-mode=NUM : Writes either the finding rule, original word, or the mutated word that was successful against the provided hash(s) to –debug-file=. Default: not used

--seperator-char=CHAR or –p : Used to specify a separator in a hash list. IE hash:username:guid –p : would tell hashcat how to read where a field ends. Default: ‘:’
-p :

--threads or –n : For use on multi-threaded processors. Almost all processors contain multiple cores, set this accordingly. If you have a quad core processor, set –n 4, or –n 6 for hexacore. If you run a multi-processor system, set –n to the number of cores * number of physical processors. IE dual hexacore would be 6 (cores) * 2 (processors) = 12 (total threads). Default: 8
–n 12

--segment-size=NUM or –c : Specifies the amount of memory in MB that should be allowed for caching of wordlists. If you are working with a limited amount of memory, this could be set so as not to interfere with other services. The following switch would allow 10MB of words from your list to be cached. Default: 32
–c 10

--words-skip=NUM or –s : Skips the provided number of words when resuming a stopped session. This prevents running words against your hash list again which would increase the amount of time that an instance would take. The following switch would skip the first 100000 words. Default: not used
–s 100000

--words-limit=NUM or –l : Specifies the number of words that should be processed. This is useful when recovering the same list of hashes across multiple computers so the same computer never runs words that are being processed by another. The following switch would only use the first 20000 words. Default: not used
–l 20000

--generate-rules=NUM or –g : Tells hashcat to generate NUM rules to be applied to each attempt. The following switch would have hashcat to randomly generate 512 rules on the fly to be used for that session. This can eliminate the need for large rule files, though targeted rule files can increase your chance of recovering a plain text password. Default: not used
–g 512

--generate-rules-func-min/max=NUM : Specifies the number of functions that should be used. This number can be unlimited but large numbers are not recommended. When used in conjunction with –g, any rule outside of this setting will be ignored. IE: -g 512 generates l r, l ^f, and sa@, these are all valid rules to be used, however, l ^f sa@ r $3 would be ignored as it contains 5 functions. Default: min=1 max=4

--attack-mode=NUM or –a : Specifies the type of attack that should be performed against a hash. Using different attack vectors will improve your chances of recovering a hash. The modes are as follows:
0 = Straight – Simply runs all words in a dictionary against your hashlist. Having a good dictionary here will improve your chances of successfully recovering a hash.
1 = Combination – Combines words from the given dictionary.
Modes 0 and 1 are also the only modes to accept the switches –r or –g.

2 = Toggle-Case – Flips all capitals to lowercase, and all lowercase to uppercase. Digits and special characters are ignored as they do not have a case.
3 = Brute-Force – BF should be used as a last resort as it is not effective against long passwords, and can be quite time consuming.
4 = Permutation – Takes letters from a word, and re-arranges them. Example: abc becomes abc, acb,bca, bac, cba, cab.
5 = Table-Lookup – Breaks a string into individual characters and applies a rule to each one matching a table entry.
Default: Mode 0
--hash-mode=NUM or –m : This tells hashcat what type of hash specifically you are working with. Remember, hashcat will assume –m 0 if no –m is set, and will throw errors for any hash over 32 bytes. The list is too long and self-explanatory for me to go into. Default: Mode 0
–m 100

--toggle-min/max=NUM : Setting this will tell hashcat to expect a minimum/maximum of X and Y in the plain. Can shorten run time by disregarding values that fall outside of password requirements. Default: min=1 max=16
--toggle-min=3 --toggle-max=5

--bf-pw-min/max=NUM : This will specify the minimum and maximum number of character spaces to try when brute forcing. The following command will attempt all character combinations from four(4) – eight(8) spaces. Only lengths starting from min, or ending at max will be attempted. Default: min=1 max=16
--bf-pw-min=4 --bf-pw-max=8

--bf-cs-buf=CHARS : Tells hashcat what characters to use when brute forcing. The following command will only use characters a to g, and numbers 1 to 5. This can accept full keyboard space of 96 characters. Default: abcdefghijklmnopqrstuvwxyz
--bf-cs-buf=abcdefg12345

--perm-min/max=NUM : Any word outside of the defined length will be ignored. Default: 2
--table-min/max=NUM : Any word outside of the defined length will be ignored. Default: 10
--table-file=FILE : Specifies which table to use with –a 5. Tables can be found in the tables directory, or may be created on your own. Default: not used
--table-file=tables/toggle_case_and_leet.table

1.3……………………………….Attack Vectors

Straight. This attack simply runs down a wordlist and tries all strings against each hash. This is an extremely effective vector for a first run, assuming you have a good dictionary like rockyou (hint hint).
Combination. Adds 2 words from the given dictionary together and tries them. Can be useful against long passwords as people will try to meet complexity requirement by typing the same string twice, or persons using their first and last name. IE atom uses his last name of derp to make a password, as long as atom and derp exist in the wordlist, atomderp will be found, but derpatom will also be tried.
Toggle-case. Simply flips each lowercase to upper case, and each uppercase to lower case. So PaSSwoRd becomes pAssWOrD.
Brute-force. While extremely useful on GPU, CPU bruteforcing can take forever. This vector will try every combination of character defined in –bf-cs-buf, and that meets the min/max declaration. Essentially trying incrementing combinations until the correct plain text is supplied. Highly unintelligent and generally used as a last resort, except on machines with lots of GPGPU computing power.
Permutation. This vector rearranges words supplied by a wordlist and that meet the min/max. For instance, min of 1 and max of 3 would take all words of 1 to 3 lengths and arrange them in every possible combination. Can be effective against random password generators.
Table-lookup. This is a highly advanced attack vector that breaks a string into individual characters and applies a rule as defined in --table-file to each. For instance, password is broken into each character: p a s s w o r d. Hashcat then looks at the table file for rules that should be applied to each letter (in this case). Our table for this example contains:
a=aA
p=pP
o=oO0 (last character is a zero)
Now each character that matches will be changed and tried. So for every a, a and A will be tried, for every p, p and P will be tried, and for every o, o, O, and 0 (zero) will be tried. For those familiar with masking, it would look something like this: -1 pP -2 aA -3 oO0 ?1?2ssw?3rd. If this looks completely foreign to you, don't worry, it will be explained later in the oclHashcat section where it is highly used.

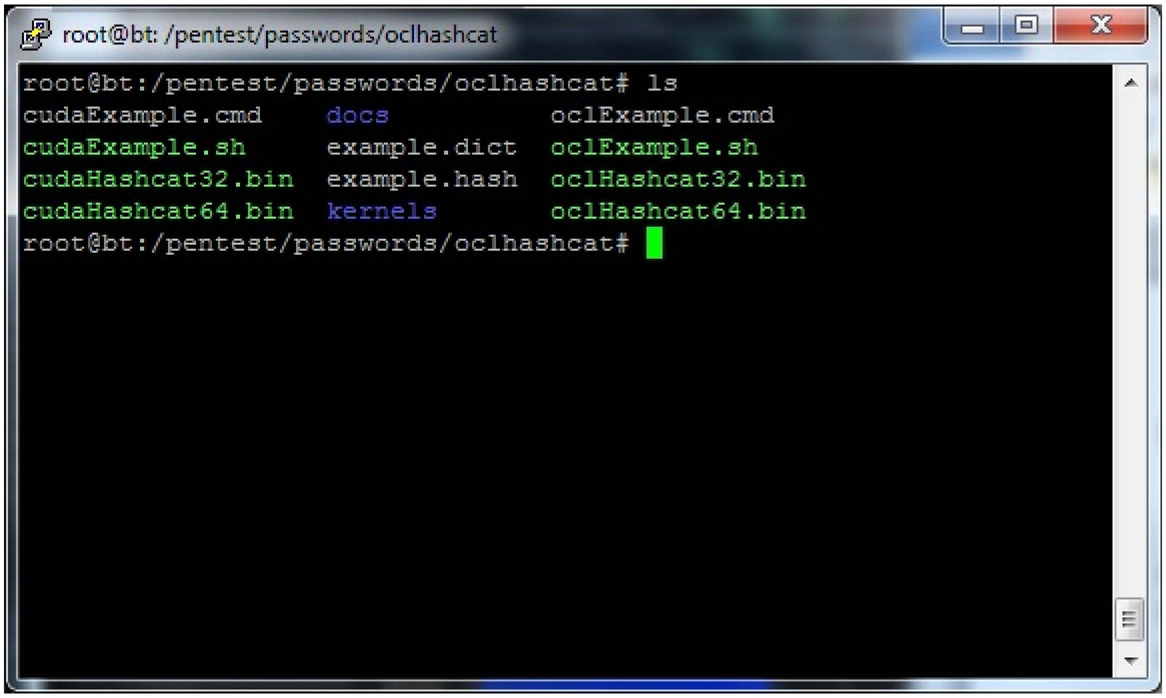
1.4……………………………….Hashcat Specifics

Hashcat is especially good for removing a large number of hashes using quick methods like single dictionary attacks (-a 0), toggle case (-a 2), etc. Though it is the world's fastest CPU recovery tool, hashcat would still take years to brute force a hash with a long plain text. This is where oclHashcat comes into play. Users without a GPGPU capable graphics card can also use hashcat in place of the other hashcat tools albeit slower.

oclHashcat (cudaHashcat)

2.1……………………………………Overview

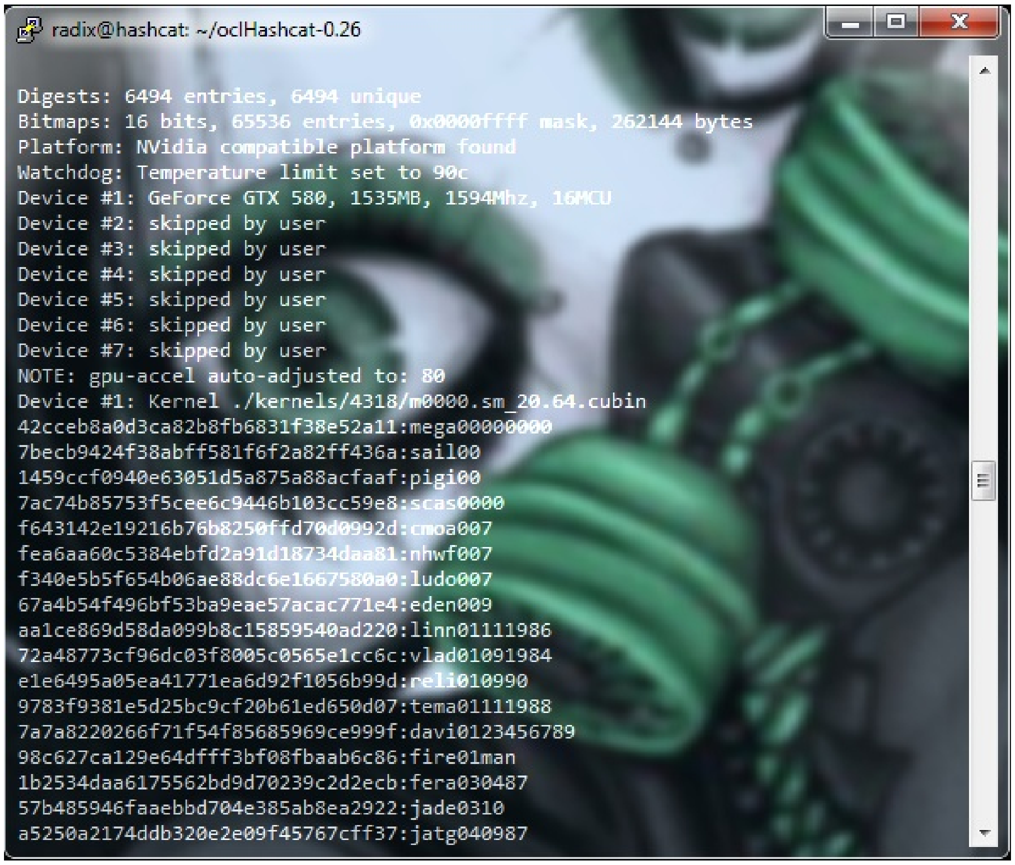
The latest version of oclHashcat is available for download from the Hashcat website here: http://www.hashcat.net/oclhashcat . 7zip is still required to decompress the archive.
oclHashcat is the world's fastest GPU based password recovery program, coded by atom for both GNU/Linux and MS Windows, 32, and 64bit architectures. This is a big step up from CPU based solutions due to the amount of data that GPU's of today can process via the CUDA (NVIDIA), Stream (AMD), and OpenCL (OSS) platforms. What would take hours on CPU can now take minutes on GPU, and heres how to do it.
Since the install procedure is the same as Hashcat, I will forego the explanation. If you are unsure, please head back up to 1.1 and read the instructions there.
Once decompressed we see quite a few files and folders. First a brief explanation of each will be given, then we will dive into oclHashcat itself.



```
root@bt:/pentest/passwords/oclhashcat# ls
cudaExample.cmd    docs          oclExample.cmd
cudaExample.sh     example.dict  oclExample.sh
cudaHashcat32.bin  example.hash  oclHashcat32.bin
cudaHashcat64.bin  kernels       oclHashcat64.bin
root@bt:/pentest/passwords/oclhashcat#
```

Another quick note, atom has split oclHashcat into two main executables. The first, oclHashcat is for AMD (ATI) users only. It will require the Stream SDK to be installed, see http://ati.amd.com for information on how

to do this on your distribution/version of windows. ADDITIONALLY Windows AMD users will need either a monitor or dummy plug connected to each card. The other main executable is cudaHashcat, which is for NVIDIA users. For NVIDIA we only need the latest Forceware driver. No extra libs are required as CUDA support is built into the driver. For the sake of simplicity, I will refer to both hashcats as oclHashcat, but NVIDIA users remember, you should run cudaHashcat or it will return an error.
oclHashcat(32/64).(bin/exe) - is the main executable.
oclExample.(sh/cmd) - is an example file to act as a quickstart for oclHashcat. It will be used as an example, but after reading this, should not be needed.
example.dict – is the plain text version of example.hash
example.hash – is the MD5 encoded strings from example.dict
docs/ - are the documents pertaining to oclHashcat
kernels/ - is the directory where hardware kernels are stored. This should not be touched unless directed by a senior member of the hashcat community, this can break oclHashcat.
Using the provided examples, let's do a quick demo run of oclHashcat.

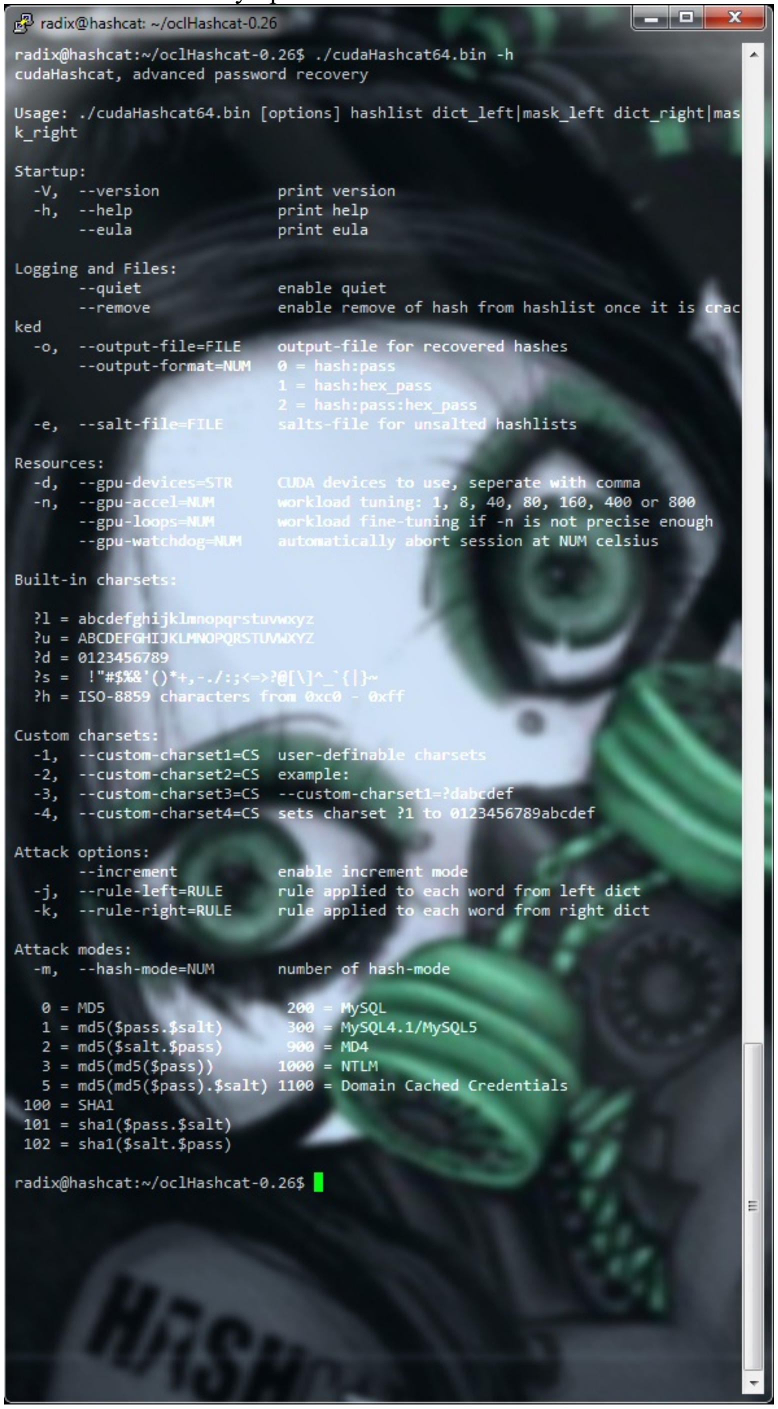


```
Digests: 6494 entries, 6494 unique
Bitmaps: 16 bits, 65536 entries, 0x0000ffff mask, 262144 bytes
Platform: NVidia compatible platform found
Watchdog: Temperature limit set to 90c
Device #1: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #2: skipped by user
Device #3: skipped by user
Device #4: skipped by user
Device #5: skipped by user
Device #6: skipped by user
Device #7: skipped by user
NOTE: gpu-accel auto-adjusted to: 80
Device #1: Kernel ./kernels/4318/m0000.sm_20.64.cubin
42cceb8a0d3ca82b8fb6831f38e52a11:mega00000000
7becb9424f38abff581f6f2a82ff436a:sail00
1459ccf0940e63051d5a875a88acfaaf:pigi00
7ac74b85753f5cee6c9446b103cc59e8:scas0000
f643142e19216b76b8250ffd70d0992d:cmoa007
fea6aa60c5384ebfd2a91d18734daa81:nhwf007
f340e5b5f654b06ae88dc6e1667580a0:ludo007
67a4b54f496bf53ba9eae57acac771e4:eden009
aa1ce869d58da099b8c15859540ad220:linn01111986
72a48773cf96dc03f8005c0565e1cc6c:vlad01091984
e1e6495a05ea41771ea6d92f1056b99d:reli010990
9783f9381e5d25bc9cf20b61ed650d07:tema01111988
7a7a8220266f71f54f85685969ce999f:davi0123456789
98c627ca129e64dfff3bf08fbaab6c86:fire01man
1b2534daa6175562bd9d70239c2d2ecb:fera030487
57b485946faaebbd704e385ab8ea2922:jade0310
a5250a2174ddb320e2e09f45767cff37:jatg040987
```

Here we see a bunch of output that may not make much sense, but look, we have recovered some passwords! Let’s delve into the options………

2.2………………………………………Options

Like hashcat oclHashcat comes with many options. Let's take a look at what we have:



```
radix@hashcat:~/oclHashcat-0.26$ ./cudaHashcat64.bin -h
cudaHashcat, advanced password recovery

Usage: ./cudaHashcat64.bin [options] hashlist dict_left|mask_left dict_right|mas
k_right

Startup:
  -V,  --version             print version
  -h,  --help                print help
       --eula                print eula

Logging and Files:
       --quiet               enable quiet
       --remove              enable remove of hash from hashlist once it is crac
ked
  -o,  --output-file=FILE    output-file for recovered hashes
       --output-format=NUM   0 = hash:pass
                             1 = hash:hex_pass
                             2 = hash:pass:hex_pass
  -e,  --salt-file=FILE      salts-file for unsalted hashlists

Resources:
  -d,  --gpu-devices=STR     CUDA devices to use, seperate with comma
  -n,  --gpu-accel=NUM       workload tuning: 1, 8, 40, 80, 160, 400 or 800
       --gpu-loops=NUM       workload fine-tuning if -n is not precise enough
       --gpu-watchdog=NUM    automatically abort session at NUM celsius

Built-in charsets:

  ?l = abcdefghijklmnopqrstuvwxyz
  ?u = ABCDEFGHIJKLMNOPQRSTUVWXYZ
  ?d = 0123456789
  ?s =  !"#$%&'()*+,-./:;<=>?@[\]^_`{|}~
  ?h = ISO-8859 characters from 0xc0 - 0xff

Custom charsets:
  -1,  --custom-charset1=CS  user-definable charsets
  -2,  --custom-charset2=CS  example:
  -3,  --custom-charset3=CS  --custom-charset1=?dabcdef
  -4,  --custom-charset4=CS  sets charset ?1 to 0123456789abcdef

Attack options:
       --increment           enable increment mode
  -j,  --rule-left=RULE      rule applied to each word from left dict
  -k,  --rule-right=RULE     rule applied to each word from right dict

Attack modes:
  -m,  --hash-mode=NUM       number of hash-mode

    0 = MD5                   200 = MySQL
    1 = md5($pass.$salt)      300 = MySQL4.1/MySQL5
    2 = md5($salt.$pass)      900 = MD4
    3 = md5(md5($pass))      1000 = NTLM
    5 = md5(md5($pass).$salt) 1100 = Domain Cached Credentials
  100 = SHA1
  101 = sha1($pass.$salt)
  102 = sha1($salt.$pass)

radix@hashcat:~/oclHashcat-0.26$
```

From the top we can see oclHashcat's usage. oclHashcat works a bit different from hashcat since it uses a left and right mask. An easier way to think of this is each attempt is broken into two pieces. You can specify a dictionary, or a charset for either side. For example:

```
./oclHashcat64.bin hashlist dict1 ?d?d?d?d
```

This would take each entry in dict1 and try all numbers from 0-9 in each of the ?d spots. You must specify a left and right mask in oclHashcat. If you are still confused by this, don't worry. It will be explained further in Attack Vectors.

Now we will jump into the options that are available to us.

Again, the first 3 are self-explanatory so I will skip them.

--quiet : Suppresses output to STDOUT so your terminal/command prompt is not flooded with text. Recovered hashes and program errors will still be displayed. No further input is required. Default: not used

--remove : Again, like hashcat as each hash is cracked, it is removed from the hashlist preventing oclHashcat from attempting to crack it again. No further input is required. Default: not used

--output-file=FILE or –o : Specifies where cracked hashes should be written to. This should be used if you plan to keep the hashes, or do not want to copy/paste them from a terminal or command prompt. Default: not used
--output-file=cracked.out or –o cracked.out

--output-format=NUM : NUM can be 0, 1, or 2. Generally not needed, but if a plain text contains hex characters this will need to be specified to prevent bad plain texts. Default: Mode 0
--output-format=0

--salt-file=FILE or –e : Provides salts for hashes missing their salt. Useful for vbull or xtcommerce hashes. Default: not used

--gpu-devices=STR or –d : This is used to specify a number of GPUs (in order) to use if you have a multi-GPU setup, or dual-GPU card. This is useful if you are running a window manager such as Gnome, KDE, or Windows. Due to the sheer volume of data being processed, the desktop will be laggy or jerky; you can skip your first GPU in this instance to ensure smooth operation of your desktop while attempting recovery. Default: All cards will be used
-d 2,3,4

--gpu-accel=NUM or –n : gpu-accel defines the workload tuning. The higher this value is set, the harder your cards will work. Higher values can be more efficient on brute force attempts while lower values tend to be better for wordlist attacks. This has to do with the way that oclHashcat stores and retrieves data from the cards GDDR. Be mindful of your power draw, the higher the number, the more power required. There is no set best value. Try different values to find what's right for you. Default: 80
-n 400

--gpu-loops=NUM : This is used for further workload tuning. More specifically, the number of words per unit of work. Essentially provides more work to the left mask. Default: 128

--gpu-loops=1024

Charsets. Unlike Hashcat where your charsets have to be defined, oclHashcat has them built in. They are broken into 5 groups:

?l is all lower case letters from a to z
?u is all upper case letters from a to z
?d is all digits from 0-9
?s is all special characters on a standard keyboard
?h is all ISO-8859 characters or "HEX" characters

These are used by themselves, or combined to form a mask. This will be discussed shortly in Attack Vectors.

Custom charsets can also be defined if you have an idea of what you are looking for. Briefly its usage would be something like:

-1 abcdefg012345

Which would create a new charset for the session containing ONLY abcdefg012345 and utilized by specifying ?1 in the mask. Again, we will look at this in Attack Vectors.

--increment : increments the right side mask by +1 for each position. Example, dict1 ?d?d?d?d --increment would first run dict1 ?d, then dict1 ?d?d, and so on until all four(4) places are processed on the right side. Needs no further input. Default: not used

--rule-left=RULE or –j and –rule-right=RULE or –k : Default: not used
There is already an amazing write up by d3ad0ne on this which can be found at http://ob-security.info/?p=31 . Perhaps in a later revision he could add that information to this document.

--hash-mode=NUM or –m : again self-explanatory. Default Mode 0
-m 1000

2.3……………………………………….Attack Vectors

As stated before, oclHashcat uses a left and right mask with all its attacks. Either mask can be set to a charset, or dictionary.

Combination attack : using a dictionary on both left and right masks.
./oclHashcat hashlist dict1 dict1

Bruteforce attack : exhausting single or multiple charsets on the left and right mask until the plain is found. The example shows brute force of an eight char plain text using full alphanumeric + specials
./oclHashcat64.bin hashlist -1 ?l?u?d?s ?1?1?1?1 ?1?1?1?1

This can also be done by specifying which characters you want to attempt in a mask. This example shows a brute force of an eight char plain text using only an upper character in position one, lower character in positions two through six and digits in seven and eight.
./oclHashcat64.bin hashlist ?u?l?l?l ?l?l?d?d

These masks can be modified to suit your needs. You can also create more advanced masks. Here we will tell oclHashcat to create the custom charset 1, 2, and 3. Again, attacking a hash we believe to be eight characters, we will specify to try upper and lower case in position one, lower case and digits in positions two through four, and finally lower case, digits, and special characters in positions five through eight.
./oclHashcat64.bin -1 ?u?l -2 ?l?d -3 ?l?d?s ?1?2?2?2 ?3?3?3?3

Hybrid attack : This is done by using a dictionary in one mask, and exhausting a specified charset in the other. For this example, we will use a dictionary in the left mask, then append ?d?d?d?d via the right mask to use 0000-9999 at the end of each dictionary word.
./oclHashcat64.bin hashlist dict1 ?d?d?d?d

This can also be reversed. Using ?l?l?l?l in the left mask and a dictionary in the right.
./oclHashcat64.bin hashlist ?l?l?l?l dict1

We can also apply an advanced mask
./oclHashcat64.bin hashlist dict1 -1 ?l?d -2 ?d?s ?1?1?2?2

With both combination and hybrid attacks, we can add rules to the left and/or right side. Here we will truncate, or delete, four spaces from the end of the left mask which will be a dictionary, and brute force four spaces using the right mask. To better clarify, pass1234 is a word in our dictionary, one of our hashes plain text is pass1122. When running the following command this is what will happen.

```
./oclHashcat64.bin hashlist –j ]]]] dict1 -1 ?l?u?d ?1?1?1?1
```

oclHashcat will delete 1234 from pass1234 and brute force those 4 spaces with full alpha numeric + digit. So an attempt would look something like this:

passaaaa
passaaab
etc until:
pass1122 is reached and the hash has been recovered.

For the right side, you would replace –j with –k and adjust your command accordingly. For example:

```
./oclHashcat64.bin hashlist –k [[[[ ?d?d?d?d dict1
```

Would delete the first four(4) characters from dict1 and replace them with a brute force attempt of four(4) digits.

While this may seem like a lot, we have hardly scratched the surface of what can be done with rules in oclHashcat. It is recommended that you read http://ob-security.info/?=31 to get a better understanding of what rules can be used and what they do.

2.4…………………………………oclHashcat Specifics

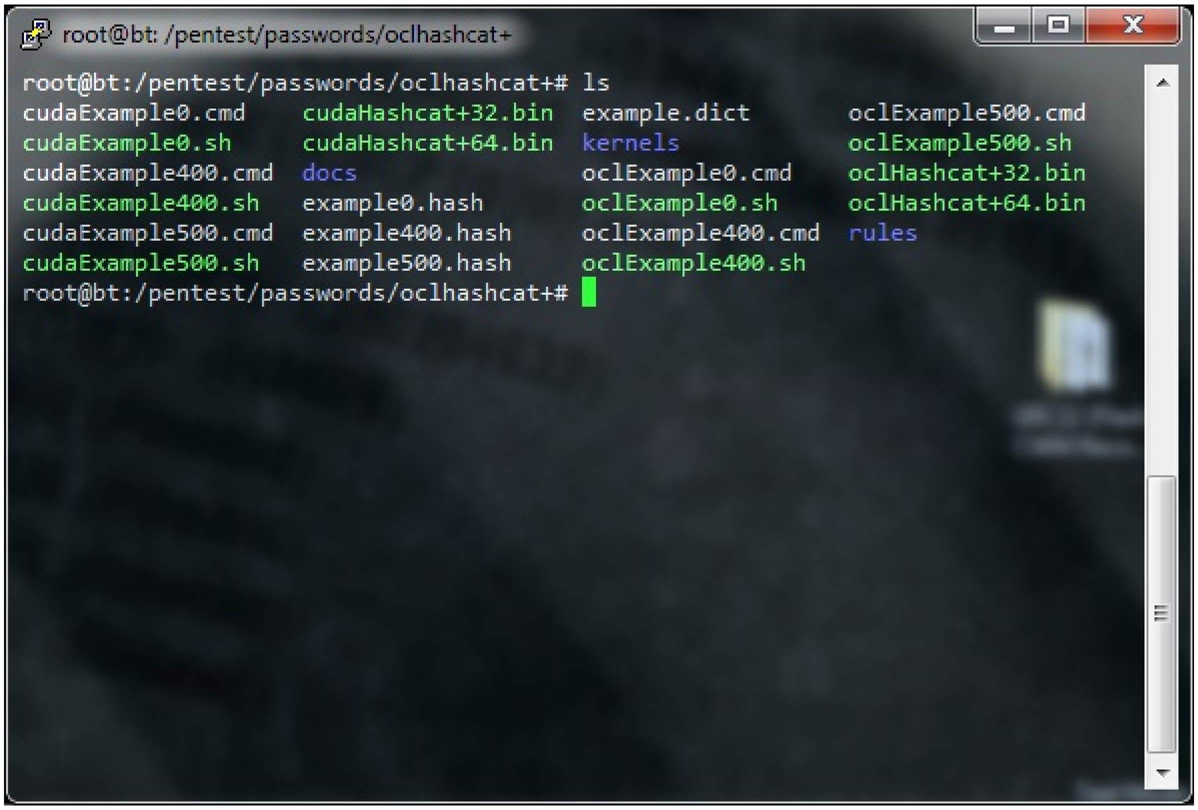
oclHashcat is only available on supported NVIDIA and AMD graphics cards. If your model of video card is not available through either CUDA, Stream, or OpenCL you will not be able to run the ocl suite. Adequate cooling and power MUST be provided as GPU processing is intensive and can cause hardware damage if precautions are not taken. As agreed to before running oclHashcat, atom, nor any other member can be held accountable for any damages as a result of running this software!

oclHashcat-plus (cudaHashcat-plus)

3.1……………………………………Overview

oclHashcat-plus specializes in wordlist attacks utilizing rules. As with the other hashcat's, it can be found on the hashcat website at http://www.hashcat.net/oclhashcat-plus/, and requires 7zip to decompress. Be aware that as with all GPU cracking, you should be mindful of your hardware. Adequate cooling and power is required or serious damage may occur. CUDA or Stream must have support or it will not run. Please check the vendor websites (http://nvidia.com and http://amd.com respectively) to see if your card is supported.

Again we will start from within the decompressed oclHashcat-plus folder.



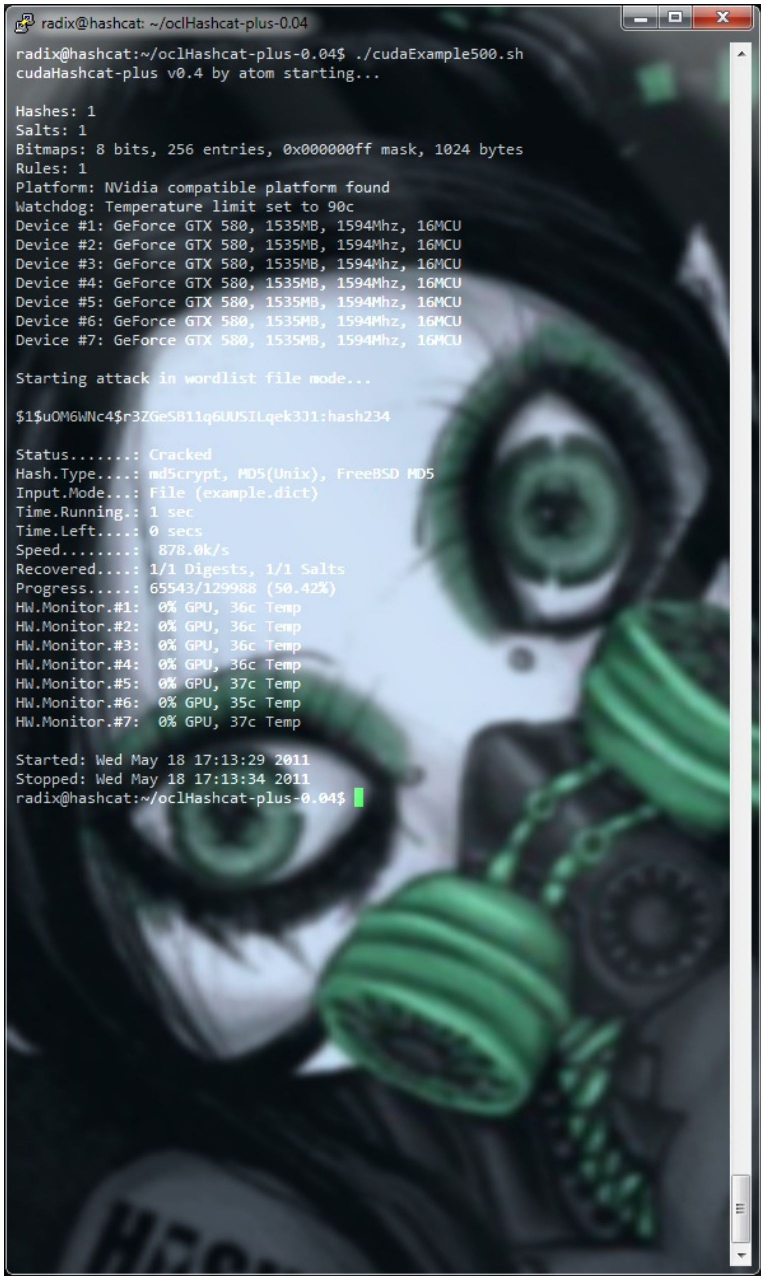
```
root@bt:/pentest/passwords/oclhashcat+# ls
cudaExample0.cmd    cudaHashcat+32.bin  example.dict       oclExample500.cmd
cudaExample0.sh     cudaHashcat+64.bin  kernels            oclExample500.sh
cudaExample400.cmd  docs                oclExample0.cmd    oclHashcat+32.bin
cudaExample400.sh   example0.hash       oclExample0.sh     oclHashcat+64.bin
cudaExample500.cmd  example400.hash     oclExample400.cmd  rules
cudaExample500.sh   example500.hash     oclExample400.sh
root@bt:/pentest/passwords/oclhashcat+#
```

As before, a quick rundown of the applications and directories:

oclHashcat-plus(32/64).(bin/exe) – The main executable.
oclExample.(sh/cmd) - is an example file to act as a quick start for oclHashcat. It will be used as an example, but after reading this, should not be needed.
example.dict – is the plain text version of example.hash
example.hash – is the MD5 encoded strings from example.dict

docs/ - are the documents pertaining to oclHashcat
kernels/ - is the directory where hardware kernels are stored. This should not be touched unless directed by a senior member of the hashcat community, this can break oclHashcat.

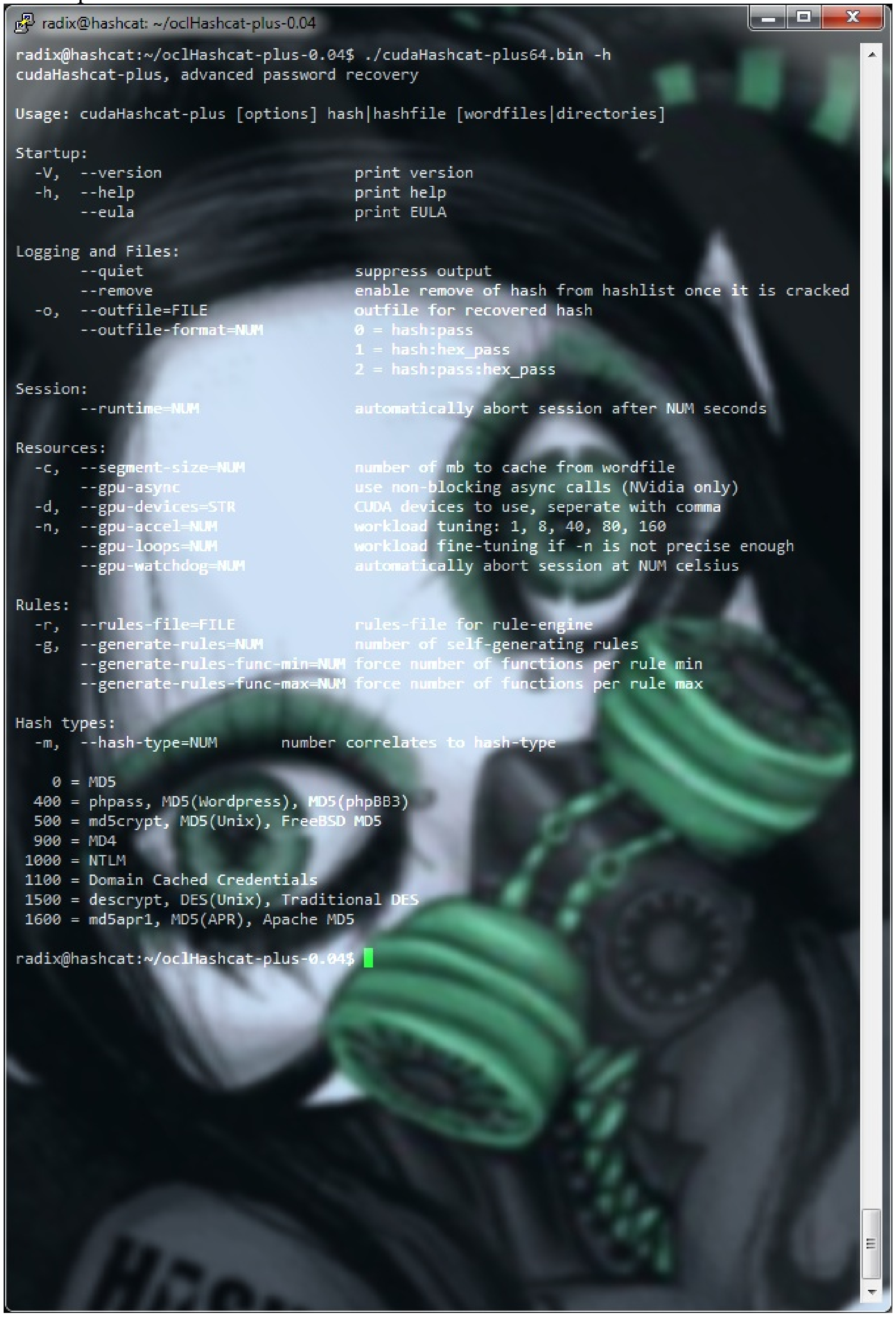
Again, using the provided examples, we will do a demo run.



```
radix@hashcat:~/oclHashcat-plus-0.04$ ./cudaExample500.sh
cudaHashcat-plus v0.4 by atom starting...

Hashes: 1
Salts: 1
Bitmaps: 8 bits, 256 entries, 0x000000ff mask, 1024 bytes
Rules: 1
Platform: NVidia compatible platform found
Watchdog: Temperature limit set to 90c
Device #1: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #2: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #3: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #4: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #5: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #6: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #7: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU

Starting attack in wordlist file mode...

$1$uOM6WNc4$r3ZGeSB11q6UUSILqek3J1:hash234

Status.......: Cracked
Hash.Type....: md5crypt, MD5(Unix), FreeBSD MD5
Input.Mode...: File (example.dict)
Time.Running.: 1 sec
Time.Left....: 0 secs
Speed........:  878.0k/s
Recovered....: 1/1 Digests, 1/1 Salts
Progress.....: 65543/129988 (50.42%)
HW.Monitor.#1:  0% GPU, 36c Temp
HW.Monitor.#2:  0% GPU, 36c Temp
HW.Monitor.#3:  0% GPU, 36c Temp
HW.Monitor.#4:  0% GPU, 36c Temp
HW.Monitor.#5:  0% GPU, 37c Temp
HW.Monitor.#6:  0% GPU, 35c Temp
HW.Monitor.#7:  0% GPU, 37c Temp

Started: Wed May 18 17:13:29 2011
Stopped: Wed May 18 17:13:34 2011
radix@hashcat:~/oclHashcat-plus-0.04$
```

3.2………………………………Options

Jumping into the options now:



radix@hashcat: ~/oclHashcat-plus-0.04

```
radix@hashcat:~/oclHashcat-plus-0.04$ ./cudaHashcat-plus64.bin -h
cudaHashcat-plus, advanced password recovery

Usage: cudaHashcat-plus [options] hash|hashfile [wordfiles|directories]

Startup:
  -V,  --version                    print version
  -h,  --help                       print help
       --eula                       print EULA

Logging and Files:
       --quiet                      suppress output
       --remove                     enable remove of hash from hashlist once it is cracked
  -o,  --outfile=FILE               outfile for recovered hash
       --outfile-format=NUM         0 = hash:pass
                                    1 = hash:hex_pass
                                    2 = hash:pass:hex_pass
Session:
       --runtime=NUM                automatically abort session after NUM seconds

Resources:
  -c,  --segment-size=NUM           number of mb to cache from wordfile
       --gpu-async                  use non-blocking async calls (NVidia only)
  -d,  --gpu-devices=STR            CUDA devices to use, seperate with comma
  -n,  --gpu-accel=NUM              workload tuning: 1, 8, 40, 80, 160
       --gpu-loops=NUM              workload fine-tuning if -n is not precise enough
       --gpu-watchdog=NUM           automatically abort session at NUM celsius

Rules:
  -r,  --rules-file=FILE            rules-file for rule-engine
  -g,  --generate-rules=NUM         number of self-generating rules
       --generate-rules-func-min=NUM force number of functions per rule min
       --generate-rules-func-max=NUM force number of functions per rule max

Hash types:
  -m,  --hash-type=NUM       number correlates to hash-type

    0 = MD5
  400 = phpass, MD5(Wordpress), MD5(phpBB3)
  500 = md5crypt, MD5(Unix), FreeBSD MD5
  900 = MD4
 1000 = NTLM
 1100 = Domain Cached Credentials
 1500 = descrypt, DES(Unix), Traditional DES
 1600 = md5apr1, MD5(APR), Apache MD5

radix@hashcat:~/oclHashcat-plus-0.04$
```

As before, I will skip the first three as they are self-explanatory.
--quiet : Suppresses output to STDOUT so your terminal/command prompt is not flooded with text. Recovered hashes and program errors will still be displayed. No further input is required. Default: not used

--remove : Again, like hashcat as each hash is cracked, it is removed from the hashlist preventing oclHashcat from attempting to crack it again. No further input is required. Default: not used

--output-file=FILE or –o : Specifies where cracked hashes should be written to. This should be used if you plan to keep the hashes, or do not want to copy/paste them from a terminal or command prompt. Default: not used
--output-file=cracked.out or –o cracked.out

--output-format=NUM : NUM can be 0, 1, or 2. Generally not needed, but if a plain text contains hex characters this will need to be specified to prevent bad plain texts. Default: Mode 0
--output-format=0

--runtime=NUM : NUM can be any number from 0 on and specifies how many seconds oclHashcat-plus should run. If you want a 2 minute run you would do: Default: not used
--runtime=120

--segment-size=NUM or –c : Specifies the amount of memory in MB that should be allowed for caching of wordlists. If you are working with a limited amount of memory, this could be set so as not to interfere with other services. The following switch would allow 10MB of words from your list to be cached. Default: 32
–c 10

--gpu-async : This is used for older NVIDA cards like the GTS 8800. It may increase performance by calling a CPU loop to process while waiting for the GPU's to stop processing. Does not require any further input. Default: not used
--gpu-async
--gpu-devices=STR or –d : This is used to specify a number of GPUs (in order) to use if you have a multi-GPU setup, or dual-GPU card. This is useful if you are running a window manager such as Gnome, KDE, or Windows. Due to the sheer volume of data being processed, the desktop will be laggy or jerky; you can skip your first GPU in this instance to ensure smooth operation of your desktop while attempting recovery. Default: All cards will be used
-d 2,3,4

--gpu-accel=NUM or –n : gpu-accel defines the workload tuning. The higher this value is set, the harder your cards will work. Higher values can be more efficient on brute force attempts while lower values tend to be better for wordlist attacks. This has to do with the way that oclHashcat stores and retrieves data from the cards GDDR. Be mindful of your power draw, the higher the number, the more power required. There is no set best value. Try different values to find what's right for you. Default: not used
-n 400

--gpu-loops=NUM : This is used for further workload tuning. More specifically, the number of words per unit of work. Essentially provides more work to the left mask. Default: 128

--gpu-loops=512

--gpu-watchdog=NUM : Setting this will allow you to override the built in safety measure. Setting this higher may cause permanent damage to your video cards, take care if raising this limit. For those who want to play it safe, you can set this lower. Remember, oclHashcat-plus uses Celsius, not Fahrenheit. Default: 90

--gpu-watchdog=85

--generate-rules=NUM or –g : Tells hashcat to generate NUM rules to be applied to each attempt. The following switch would have hashcat to randomly generate 512 rules on the fly to be used for that session. Since oclHashcat-plus is built around rule based attacks, using a large number is a better choice here. All rule generation is done on GPU so no CPU cycles are taken. This also makes it very efficient with a setting like: Default: not used
–g 512000

--generate-rules-func-min/max=NUM : Specifies the number of functions that should be used. This number can be unlimited but large numbers are not recommended. When used in conjunction with –g, any rule outside of this setting will be ignored. IE: -g 512 generates l r, l ^f, and sa@, these are all valid rules to be used, however, l ^f sa@ r $3 would be ignored as it contains 5 functions. Default: min=1 max=4

--hash-type=NUM or –m : again self-explanatory. Default: Mode 0
-m 1000

3.3……………………………..Attack Vectors

oclHashcat-plus can be used in two ways: with, or without rules. For heavily iterated hash types, it is recommended to use oclHashcat-plus to do dictionary attacks. You may also use rules to increase the chance to recover the password.

As stated before, oclHashcat-plus works extremely well with large rule files. You can choose rules in one of two ways:

Pre-generated rule list using –r

```
./oclHashcat-plus64.bin hashlist dict1 –r rules/best64.rule
```

Or generated on the fly using –g

```
./oclHashcat-plus64.bin hashlist dict1 –g 512000
```

We can also omit past a certain length by using:

```
./oclHashcat64.bin hashlist dict1 –g 512000 --generate-rules-func-min=3 --generate-rules-func-max=7
```

As the options section states, this will ignore any rules with two or less functions, and any rule with eight or more functions.

Generating large random rules can be very effective getting those last hashes recovered, while using targeted rules will generally shoot more for patterns that are seen in everyday password. Experiment with both of these to find what works best for you.

To use oclHashcat-plus in straight mode, or dictionary only you would do something along the lines of:

```
./oclHashcat64.bin hashlist dict1 –o recovered.out
```

This will do the same as hashcat’s –a 0.

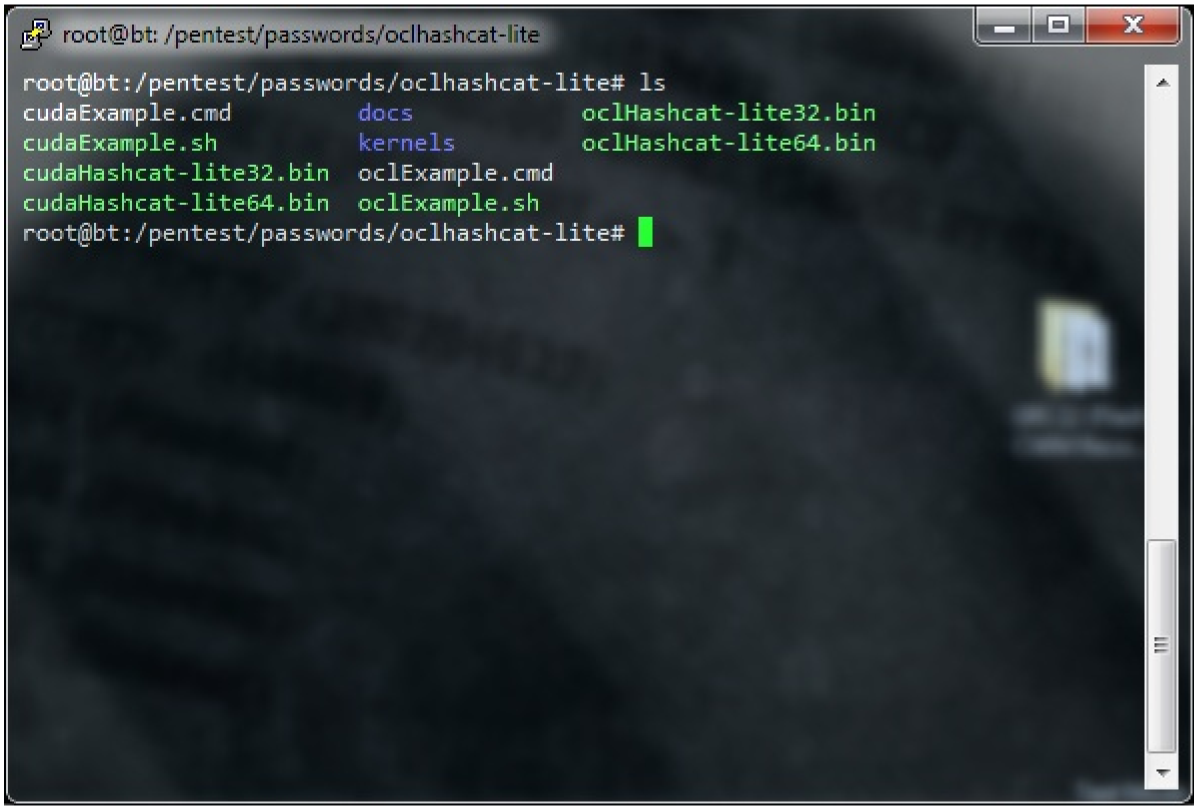
3.4…………………………oclHashcat-plus Specifics

oclHashcat-lite, as with all GPU based hashcat programs, is an extremely efficient rule based recovery tool. For best results, you should write rule files based on the password requirements from where the list was obtained. And again, properly monitor your hardware so as not to cause damage by improper cooling.

oclHashcat-lite (cudaHashcat-lite)

4.1……………………………Overview

oclHashcat-lite is a simple GPU based brute forcer that has been optimized for single hash recovery. It can be obtained from the hashcat website here: http://hashcat.net/oclhashcat-lite, and requires 7zip to decompress. In many ways oclHashcat-lite acts like oclHashcat but with far better speed (ON SINGLE HASH ONLY). If you are looking to recover a hash from an SL3 locked phone, or only need to recover the hash belonging to Admin on a Windows machine that has thus far eluded you oclHashcat-lite is what you want.

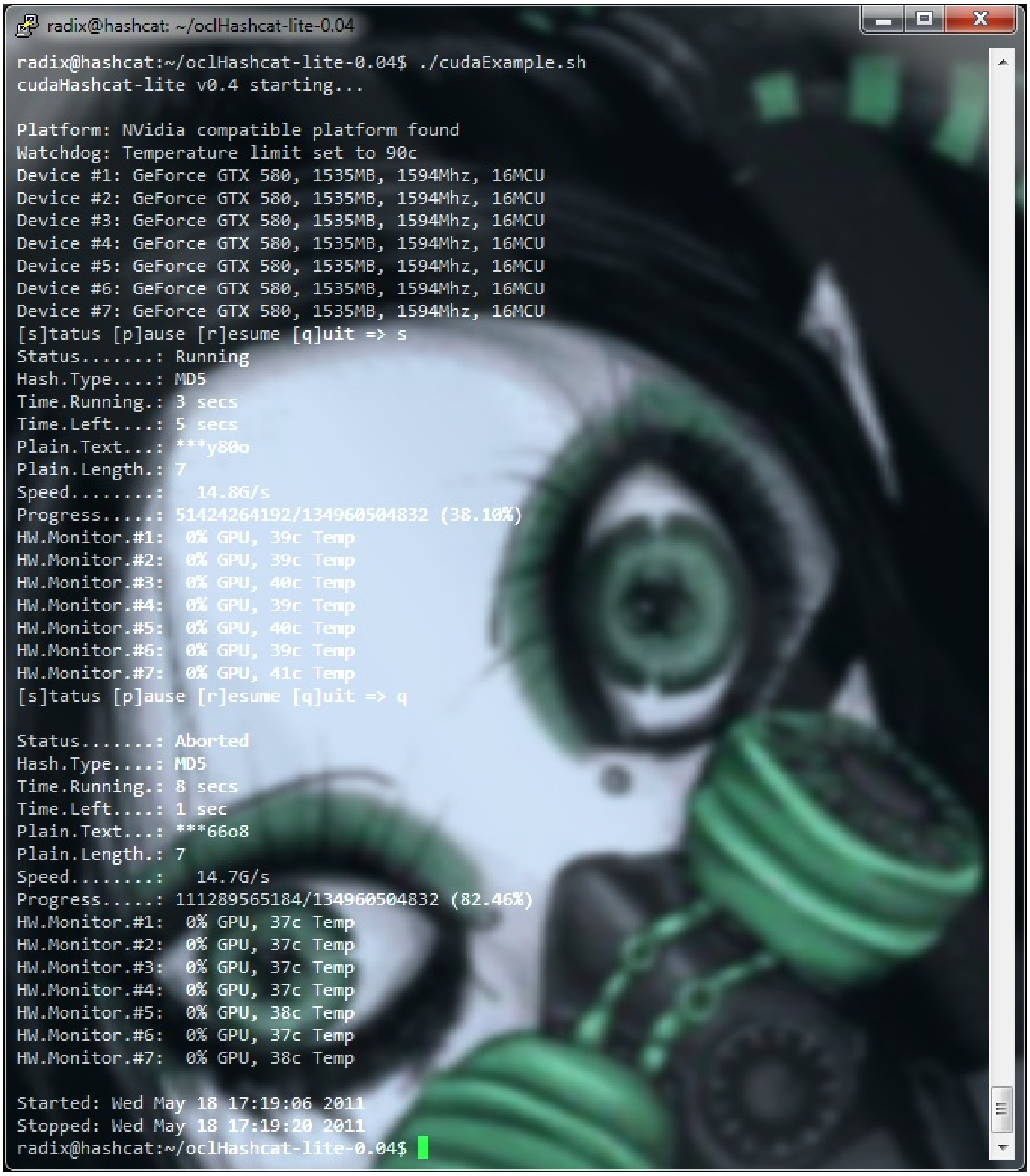


```
root@bt:/pentest/passwords/oclhashcat-lite# ls
cudaExample.cmd          docs              oclHashcat-lite32.bin
cudaExample.sh           kernels           oclHashcat-lite64.bin
cudaHashcat-lite32.bin   oclExample.cmd
cudaHashcat-lite64.bin   oclExample.sh
root@bt:/pentest/passwords/oclhashcat-lite# 
```

Here we see the directory structure of oclHashcat-lite. Pretty simple.

oclHashcat-lite(32/64).(bin/exe) - the main executable

oclExample.(sh/cmd) - is an example file to act as a quick start for oclHashcat-lite. It will be used as an example, but after reading this, should not be needed.
docs/ - are the documents pertaining to oclHashcat
kernels/ - is the directory where hardware kernels are stored. This should not be touched unless directed by a senior member of the hashcat community, this can break oclHashcat-lite.



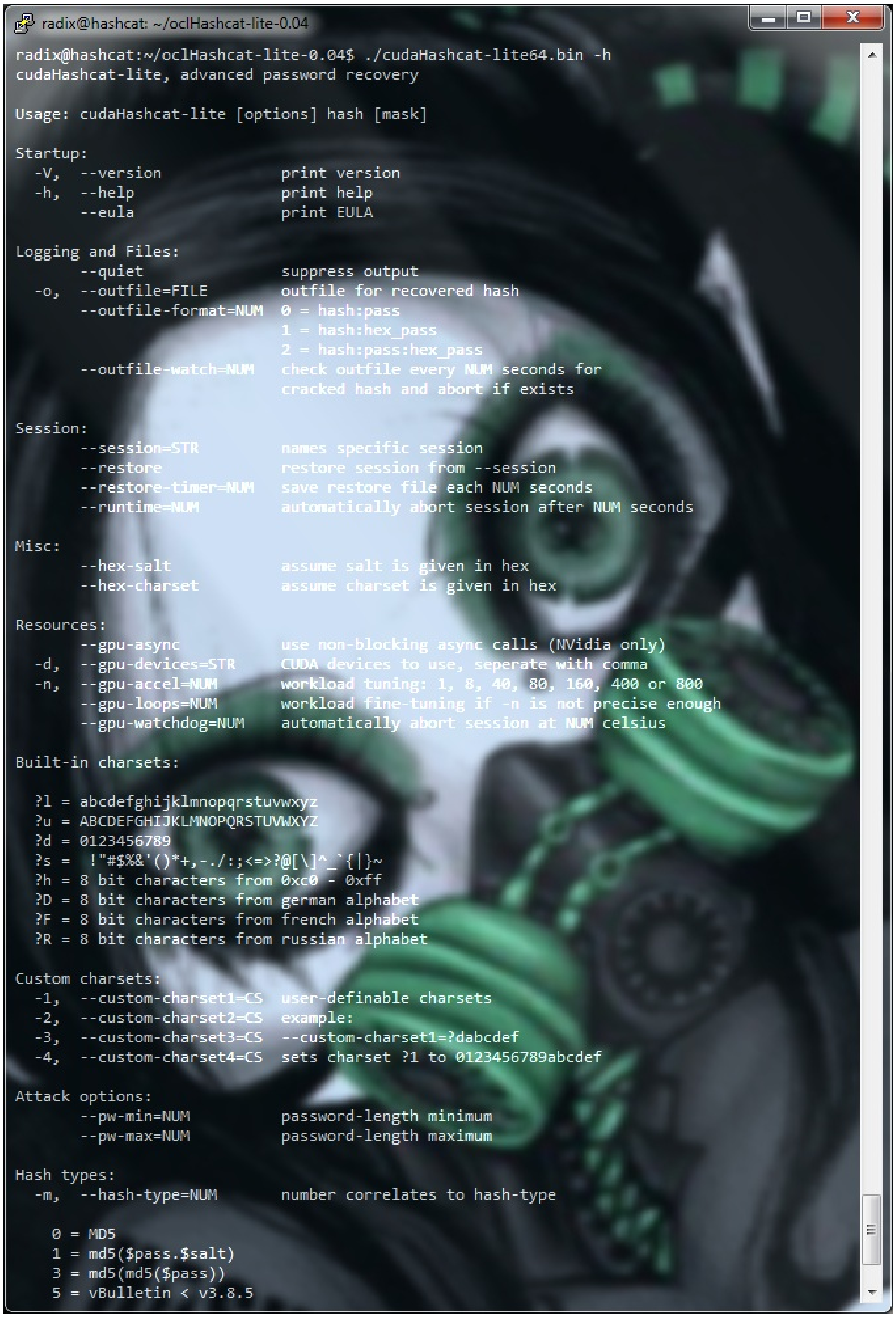
radix@hashcat: ~/oclHashcat-lite-0.04

```
radix@hashcat:~/oclHashcat-lite-0.04$ ./cudaExample.sh
cudaHashcat-lite v0.4 starting...

Platform: NVidia compatible platform found
Watchdog: Temperature limit set to 90c
Device #1: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #2: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #3: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #4: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #5: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #6: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
Device #7: GeForce GTX 580, 1535MB, 1594Mhz, 16MCU
[s]tatus [p]ause [r]esume [q]uit => s
Status.......: Running
Hash.Type....: MD5
Time.Running.: 3 secs
Time.Left....: 5 secs
Plain.Text...: ***y80o
Plain.Length.: 7
Speed........:   14.8G/s
Progress.....: 51424264192/134960504832 (38.10%)
HW.Monitor.#1:  0% GPU, 39c Temp
HW.Monitor.#2:  0% GPU, 39c Temp
HW.Monitor.#3:  0% GPU, 40c Temp
HW.Monitor.#4:  0% GPU, 39c Temp
HW.Monitor.#5:  0% GPU, 40c Temp
HW.Monitor.#6:  0% GPU, 39c Temp
HW.Monitor.#7:  0% GPU, 41c Temp
[s]tatus [p]ause [r]esume [q]uit => q

Status.......: Aborted
Hash.Type....: MD5
Time.Running.: 8 secs
Time.Left....: 1 sec
Plain.Text...: ***66o8
Plain.Length.: 7
Speed........:   14.7G/s
Progress.....: 111289565184/134960504832 (82.46%)
HW.Monitor.#1:  0% GPU, 37c Temp
HW.Monitor.#2:  0% GPU, 37c Temp
HW.Monitor.#3:  0% GPU, 37c Temp
HW.Monitor.#4:  0% GPU, 37c Temp
HW.Monitor.#5:  0% GPU, 38c Temp
HW.Monitor.#6:  0% GPU, 37c Temp
HW.Monitor.#7:  0% GPU, 38c Temp

Started: Wed May 18 17:19:06 2011
Stopped: Wed May 18 17:19:20 2011
radix@hashcat:~/oclHashcat-lite-0.04$
```

Jumping straight into it, here we have run ./oclExample.sh. The program was run and was aborted to keep within image constraints for this document. What we can see however, is that the speed far surpasses oclHashcat.

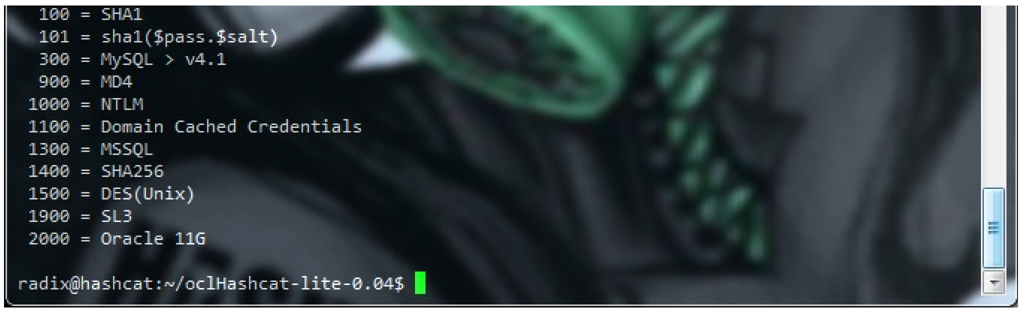
4.2…………………Options

Like the other hashcat's, oclHashcat-lite shares my features. By now you should be fairly familiar with them, but we will cover them once more.



radix@hashcat: ~/oclHashcat-lite-0.04

```
radix@hashcat:~/oclHashcat-lite-0.04$ ./cudaHashcat-lite64.bin -h
cudaHashcat-lite, advanced password recovery

Usage: cudaHashcat-lite [options] hash [mask]

Startup:
  -V,  --version              print version
  -h,  --help                 print help
       --eula                 print EULA

Logging and Files:
       --quiet                suppress output
  -o,  --outfile=FILE         outfile for recovered hash
       --outfile-format=NUM   0 = hash:pass
                              1 = hash:hex_pass
                              2 = hash:pass:hex_pass
       --outfile-watch=NUM    check outfile every NUM seconds for
                              cracked hash and abort if exists

Session:
       --session=STR          names specific session
       --restore              restore session from --session
       --restore-timer=NUM    save restore file each NUM seconds
       --runtime=NUM          automatically abort session after NUM seconds

Misc:
       --hex-salt             assume salt is given in hex
       --hex-charset          assume charset is given in hex

Resources:
       --gpu-async            use non-blocking async calls (NVidia only)
  -d,  --gpu-devices=STR      CUDA devices to use, seperate with comma
  -n,  --gpu-accel=NUM        workload tuning: 1, 8, 40, 80, 160, 400 or 800
       --gpu-loops=NUM        workload fine-tuning if -n is not precise enough
       --gpu-watchdog=NUM     automatically abort session at NUM celsius

Built-in charsets:

  ?l = abcdefghijklmnopqrstuvwxyz
  ?u = ABCDEFGHIJKLMNOPQRSTUVWXYZ
  ?d = 0123456789
  ?s =  !"#$%&'()*+,-./:;<=>?@[\]^_`{|}~
  ?h = 8 bit characters from 0xc0 - 0xff
  ?D = 8 bit characters from german alphabet
  ?F = 8 bit characters from french alphabet
  ?R = 8 bit characters from russian alphabet

Custom charsets:
  -1,  --custom-charset1=CS   user-definable charsets
  -2,  --custom-charset2=CS   example:
  -3,  --custom-charset3=CS   --custom-charset1=?dabcdef
  -4,  --custom-charset4=CS   sets charset ?1 to 0123456789abcdef

Attack options:
       --pw-min=NUM           password-length minimum
       --pw-max=NUM           password-length maximum

Hash types:
  -m,  --hash-type=NUM        number correlates to hash-type

    0 = MD5
    1 = md5($pass.$salt)
    3 = md5(md5($pass))
    5 = vBulletin < v3.8.5
```



```
  100 = SHA1
  101 = sha1($pass.$salt)
  300 = MySQL > v4.1
  900 = MD4
 1000 = NTLM
 1100 = Domain Cached Credentials
 1300 = MSSQL
 1400 = SHA256
 1500 = DES(Unix)
 1900 = SL3
 2000 = Oracle 11G

radix@hashcat:~/oclHashcat-lite-0.04$
```

The first three options are again skipped. We begin with:

--quiet : Suppresses output to STDOUT so your terminal/command prompt is not flooded with text. Recovered hashes and program errors will still be displayed. No further input is required. Default: not used

--remove : Again, like hashcat as each hash is cracked, it is removed from the hashlist preventing oclHashcat from attempting to crack it again. No further input is required. Default: not used

--output-file=FILE or –o : Specifies where cracked hashes should be written to. This should be used if you plan to keep the hashes, or do not want to copy/paste them from a terminal or command prompt. Default: not used
--output-file=cracked.out or --o cracked.out

--output-format=NUM : NUM can be 0, 1, or 2. Generally not needed, but if a plain text contains hex characters this will need to be specified to prevent bad plain texts. Default: Mode 0
--output-format=0

--session=STR : Allows you to name a session to be restored at a later date. If you would like stop a run before it completes and start it again, this should be set. You may name multiple sessions, but when restoring using --restore below, the name should be identified. Default: not used

--session=md5

--restore : Restores a previous session. Must be used in conjunction with –session=STR. Default: not used

--session=md5 --restore

--restore-timer=NUM : Saves your current restore file every NUM seconds. If you lose power to the box, your restore file will contain the progress it was last saved at. While writing a file every second is not recommended, writing one every 30 seconds could be beneficial. Default: 60

--restore-timer=30

--gpu-async : This is used for older NVIDA cards like the GTS 8800. It may increase performance by calling a CPU loop to process while waiting for the GPU's to stop processing. Does not require any further input. Default: not used
--gpu-async

--gpu-devices=STR or –d : This is used to specify a number of GPUs (in order) to use if you have a multi-GPU setup, or dual-GPU card. This is useful if you are running a window manager such as Gnome, KDE, or Windows. Due to the sheer volume of data being processed, the desktop will be laggy or jerky; you can skip your first GPU in this instance to ensure smooth operation of your desktop while attempting recovery. Default: All cards will be used

-d 2,3,4

--gpu-accel=NUM or –n : gpu-accel defines the workload tuning. The higher this value is set, the harder your cards will work. Higher values can be more efficient on brute force attempts while lower values tend to be better for wordlist attacks. This has to do with the way that oclHashcat stores and retrieves data from the cards GDDR. Be mindful of your power draw, the higher the number, the more power required. There is no set best value. Try different values to find what's right for you. Default: not used
-n 400

--gpu-loops=NUM : This is used for further workload tuning. More specifically, the number of words per unit of work. Essentially provides more work to the left mask. Default: 1024

--gpu-loops=1024

--gpu-watchdog=NUM : Setting this will allow you to override the built in safety measure. By default oclHashcat-plus will automatically end processing when one card reaches 90c. Setting this higher may cause permanent damage to your video cards, take care if raising this limit. For those who want to play it safe, you can set this lower. Remember, oclHashcat-plus uses Celsius, not Fahrenheit. Default: 90

--gpu-watchdog=85

Charsets. Again, where your charsets will be defined, oclHashcat-lite has some built-in. This time, they are broken into 8 groups:

?l is all lower case letters from a to z
?u is all upper case letters from a to z
?d is all digits from 0-9
?s is all special characters on a standard keyboard
?h is all ISO-8859 characters or "HEX" characters

?D is all 8-bit characters from the German alphabet
?F is all 8-bit characters from the French alphabet
?R is all 8-bit characters from the Russian alphabet

Please note that ?D, ?F, and ?R must be capitalized to function properly.

These again, are used by themselves, or combined to form a mask. This will be discussed shortly in Attack Vectors.

Custom charsets can also be defined if you have an idea of what you are looking for. Briefly its usage would be something like:

-1 abcdefg012345

Which would create a new charset for the session containing ONLY abcdefg012345 and utilized by specifying ?1 in the mask. Again, we will look at this in Attack Vectors.

--pw-min/max=NUM : This will specify the minimum and maximum number of character spaces to try when brute forcing. The following command will attempt all character combinations from four to eight spaces. Only lengths starting from min, or ending at max will be attempted. Default: min=4 max =15
--pw-min=4 --pw-max=8

--hash-type=NUM or –m : If you haven't gotten this by now, I don't know what to tell you. Default: Mode 0

--pw-skip=NUM : Skip to the specified number of passwords. Useful for distributed recovery. Allows you to skip attempts that are being tried on another box, so work is not duplicated. Should be used in conjunction with --pw-limit.

```
--pw-skip=10000 on box one
--pw-skip-20000 on box two
```

--pw-limit=NUM : Aborts the attempt when NUM passwords have been tried. Use in conjunction with –pw-skip on all but your first box.

```
--pw-limit=10000
```

4.3…………………………Attack Vector

oclHashcat-lite allows you to brute force at pretty amazing speeds. Since we only have a single attack vector available to us, we will cover how to apply this to some common hashes. Using what we know about masks from section 2, we will use here.

With the addition of SL3, there has been a lot of talk about it, and how to recover the mastercode embedded in each SL3 encoded phone. Using atom's forum post, we will cover this quickly then move on to a couple other hash types.

SL3 is a bit odd as it uses a hex encoded SHA-1 hash that has been salted with the IMEI that every cellular phone is required to have. The IMEI is also hex encoded. Your hex encoded IMEI must have a 00 appended, and prepended to it. So if your IMEI is 35152304783734 you would add 00 to the beginning and end to get 003515230478373400. Some IMEI may contain 15 or more digits, if this is the case, remove the last digits until you get 14. We will specify that our mask (-1) should try 00, 01, 02, and on, in each ?1 field. An example of this is as follows:

```
./oclHashcat-lite –m 1900 –n 160 -1 00010203040506070809 --outfile=recovered.txt
21B1E417AF2DE6496772BCC2FE33D2593A9BB7A0:003515230478373400 ?1?1?1?1?1?1?1?1?1?1?1?1?
1?1?1
```

For MD5 we could use something like this:

```
./oclHashcat-lite64.bin 9b957cc6ab97cbf88c4f6f0f146adafe –o recovered.out
```

And finally, we will add some specifics in. Here oclHashcat-lite has been told to attempt from four to 10 characters, using ?l?u?d?s?F since we believe the password may belong to someone French.

```
./oclHashcat-lite64.bin c39e614e6b3f35a70541a41bcd65ab97 --bf-pw-min=4 --bf-pw-max=10
-1 ?l?u?d?s?F ?1?1?1?1?1?1?1?1?1?1 --o recovered.txt
```

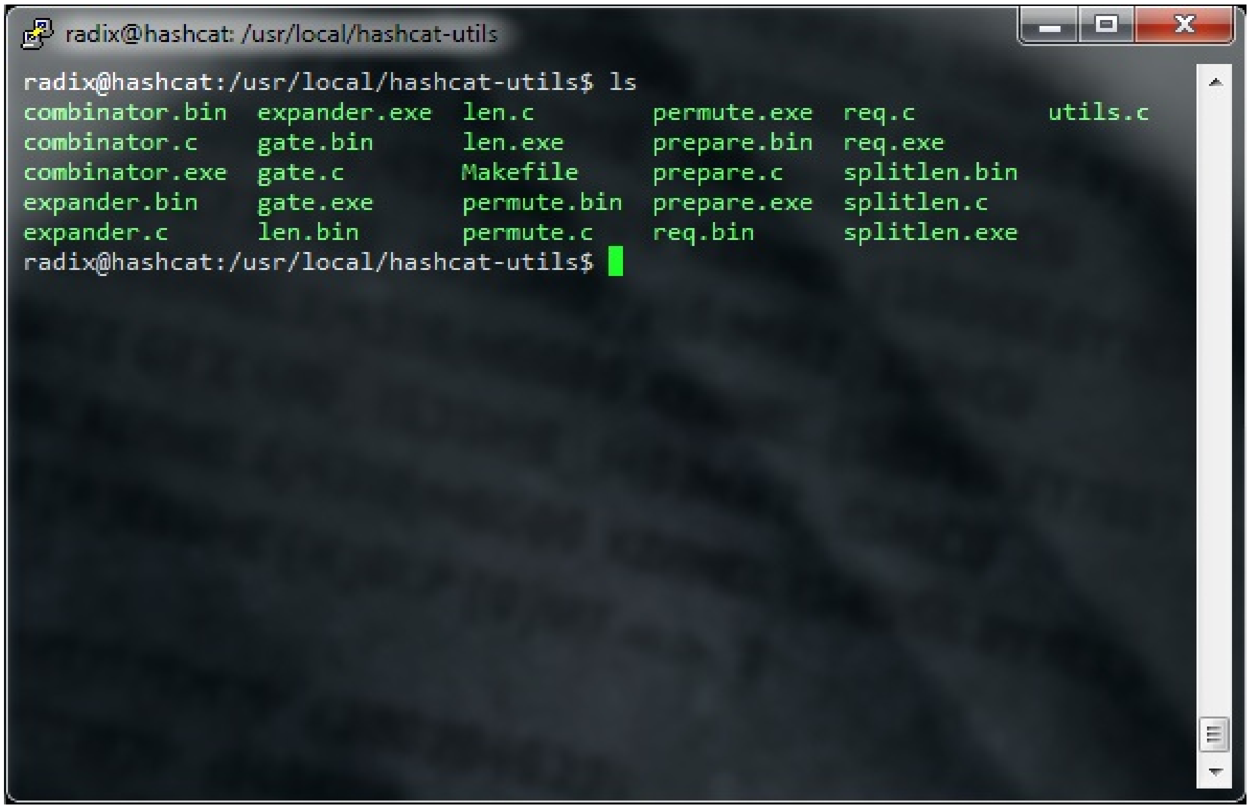
4.4……………………oclHashcat-lite Specifics

oclHashcat-lite is designed to offer better single hash performance. It utilizes many of the oclHashcat features, and adds a couple new ones. oclHashcat-lite is only as powerful as you make it. Simply giving it a hash and letting it run its course will work, but may take days or weeks. You should use the masking options available to you in conjunction with the password requirements. This can mean the difference between a week, and 10 minutes.

As with all GPU applications, appropriate precautions must be taken or serious damage may occur.

Hashcat-utils

Hashcat-utils is a set of tools designed to help you work with lists, create lists, modify lists, etc. Here I will give you a quick run-down on what each of these do, and how to use them.



```
radix@hashcat:/usr/local/hashcat-utils$ ls
combinator.bin  expander.exe  len.c        permute.exe  req.c         utils.c
combinator.c    gate.bin      len.exe      prepare.bin  req.exe
combinator.exe  gate.c        Makefile     prepare.c    splitlen.bin
expander.bin    gate.exe      permute.bin  prepare.exe  splitlen.c
expander.c      len.bin       permute.c    req.bin      splitlen.exe
radix@hashcat:/usr/local/hashcat-utils$
```

Combinator – This will join two files into a single file. For example, if you have two dictionaries, you can use combinator to join them together to make one file. This can be useful for long passwords as people often choose phrases to meet complexity requirements. Usage would be something like:

```
./combinator.bin dict1.txt dict2.txt > dict3.txt
```

Expander – Expander works by taking a string of characters, or wordlist, and rearranging it into every possible combination. This should be used carefully as running expander on a large list could take 12+ hours, and make a wordlist that would be too big to be of benefit. Usage would be:

```
./expander.bin < dict1.txt > dict1.expanded
```

If dict1.txt contained abcd123!@# we could see all combinations of this in dict1.expanded.

Gate – Allows you to split work by creating multiple instances of a program based on a percentage of the wordlist. Hard to explain so I'll just give you the example. Here we assume a quad core processor:

```
./gate.bin 4 0 < dict | ./john --format=md5 --stdin hash.list
./gate.bin 4 1 < dict | ./john --format=md5 --stdin hash.list
./gate.bin 4 2 < dict | ./john --format=md5 --stdin hash.list
./gate.bin 4 3 < dict | ./john --format=md5 --stdin hash.list
```

Len – Len takes a dictionary as an input and extracts words of a specified lenth. Useful for removing passwords that may exceed what is supported by the algo.

```
./len.bin 1 8 < dict1.dict > dict1.1-8
```

Permute – Running permute on a dict will arrange each string in every possible combination. As perviously explained, permuting abc would give you, abc, bac, cba, cab. Do not use this on large dicts.

```
./permute.bin < dict > dict.permute
```

Req – Using req.bin on a file will allows you to extract words that contain characters specified. Options are as follows:

1 – all words that contain at least one lower case character
2 – all words that contain at least one upper case character
4 – all words that contain at least one digit
8 – all words that contain at least one special, or hex character

These can also be added so that multiple character types can be requisitioned. For example:

```
./req.bin 12 < dict > dict.req
```

Would take each word with at least one special/hex char, and at least one digit. Create opts by adding the desired numbers together.

Splitlen – Splitlen cuts words to a length supported by hashcat. Words from 1 – 15 characters will be output to /path. This number can be increased by editing the splitlen.c file and changing the value from 15 to the desired number. You can also change 1 to a high number if you wish to extract word of say 8 – 20 length. This will require the file be recomplied afterwards.

```
./splitlen.bin /path/ < dict
```

Troubleshooting

Firstly, ensure that your system is setup properly. This means the latest drivers installed, applicable version of Stream, and latest version of hashcat/oclHashcat. If using AMD graphics cards, monitors and/or dummy plugs are required to be connected and screens available on the desktop.

Since this section has tons of information that will need to be read through, and not everyone's problems will be known until they happen, it will be added to the todo list. Please use the hashcat forums until then.

http://hashcat.net/forum

References

Hashcat suite.	http://hashcat.net/forums
Rule-Fu: The art of word mangling.	http://ob-security.info/?p=31
Rockyou dictionary	http://www.skullsecurity.org/wiki/index.php/Passwords
Password exploitation class	http://www.irongeek.com/i.php?page=videos/password-exploitation-class
Backtrack Linux	http://backtrack-linux.org

ToDo

Expand upon the rule section

Changelog

19 May 2011 - 1.0a Fixed typo and corrected formatting.
20 May 2011 - 1.0b Fixed ob-security links.
6 June 2011 - 1.1 Added new hashcat options.
9 August 2011 - 1.2 Added hashcat-utils