Releasing the Kracken: Building and Using a GPU Password Cracker

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About Me

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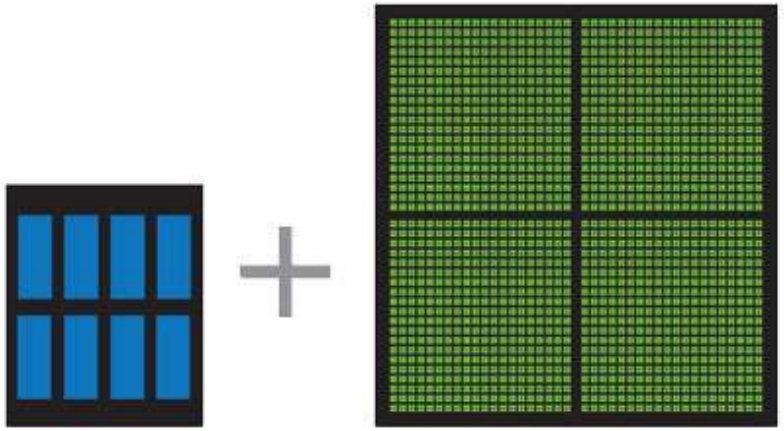
Disclaimer

- I do not design or work on any of the software in this presentation
- I do not work for or with any GPU manufacturer

Why GPUs?

- CPU – Good at sequential calculations a few at a time
- GPU – Good at the same calculation (like hashing) done a thousand times at the same time



Why Do You Need a Password Cracker?

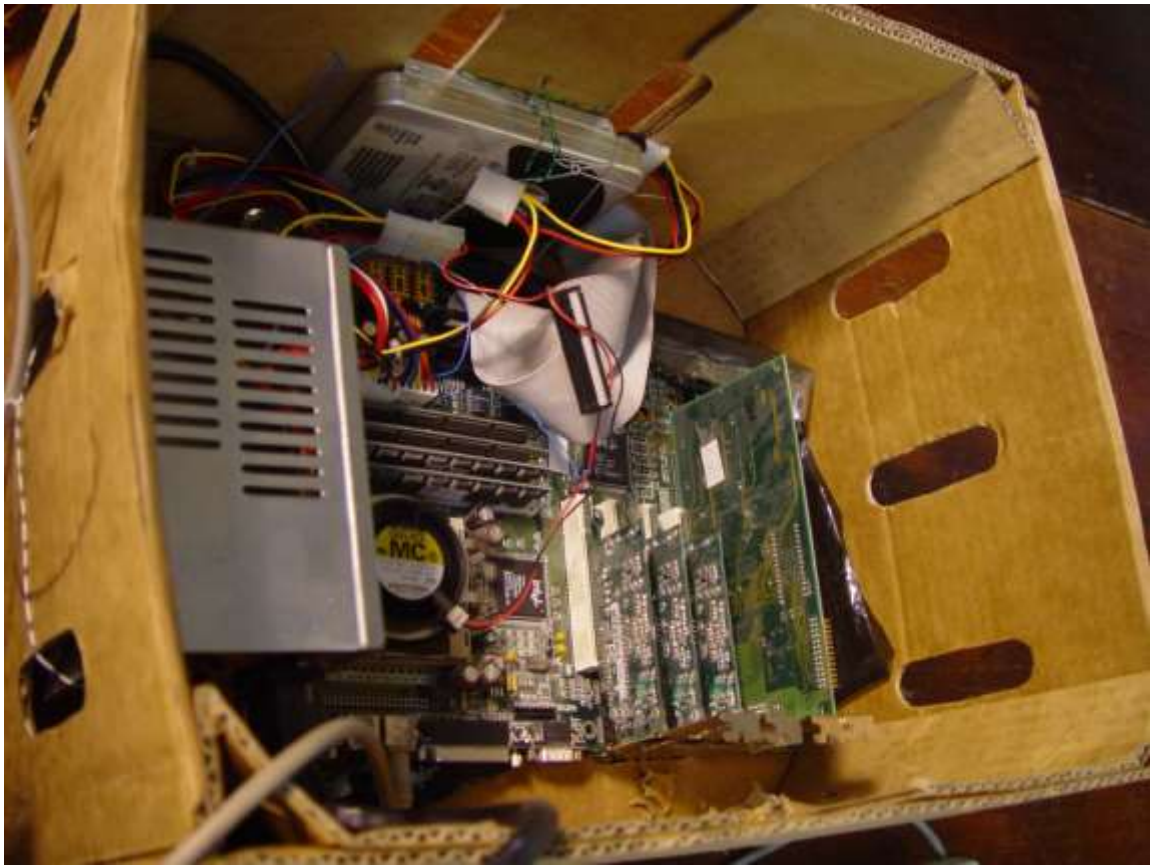
- For Pen Testers-
  - For hashes you can't pass (shadow files, NetNTLM, etc.)
  - For password protected documents (new to Hashcat!)
- For Security Folks-
  - Password Auditing
  - Password Statistics for Security Training Programs

Host	Type	Name	Size	Info
2013-07-18 15:56:42 -0400	192.168.56.101 - metasploitable	host.file.download	/etc/shadow (1207 bytes)	Manual download fr

Text:

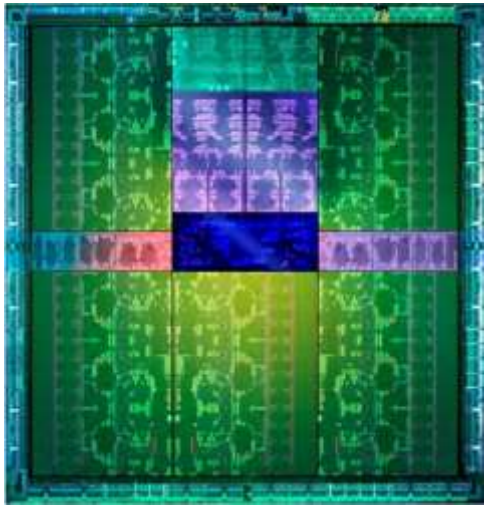
```
root:$1$/avpfBJ1$x0z8w5UF9Iv./DR9E9Lid.:14747:0:99999:7:::
daemon:*:14684:0:99999:7:::
bin:*:14684:0:99999:7:::
sys:$1$fUX6BPOt$Miyc3UpOzQJqz4s5wFD9l0:14742:0:99999:7:::
sync:*:14684:0:99999:7:::
games:*:14684:0:99999:7:::
```

Our Old Password Cracker Kind of Looked Like This…



We Needed An Upgrade.

Some Considerations Before You Begin:



- Money, money, money…
  - What's you budget
  - How fast do you need to go?
- Space for your monster
  - "Gaming" Style Desktop vs 4U Server
- Maintenance
  - Drivers, patches, new software versions
- Security
  - A system filled with client passwords…

Step 1: Containing the Monster

- Desktops
  - Far less expensive
  - Easier to get parts
  - Doesn't hold as many cards – 4 max, 3 realistically
- Servers
  - Very Large (4U Normally)
  - Hold far more cards (4 to 8)
  - Very Expensive, but…
  - Often have redundancy built in

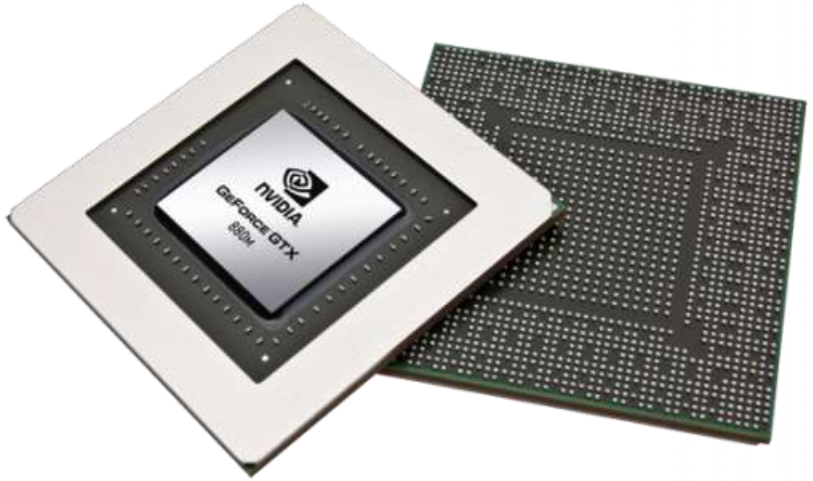
Step 2: Fill In the General Bits

- Processor
  - Don’t use anything too good
  - Just keeps the system running
- Memory
  - 8 to 16 GBs
- Hard Drives
  - Enough to hold wordlists
  - RAID 1 is nice, but not necessary

Step 3: (The Best Step…)

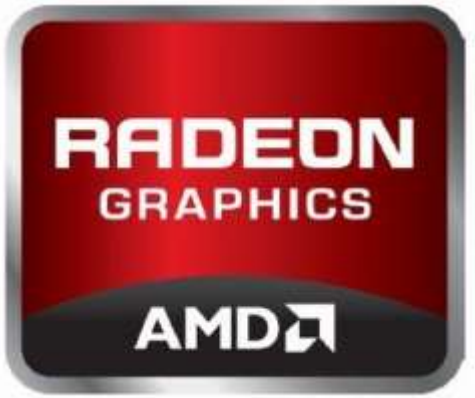
What Do I Look At While Picking?

- Cores (Shader Units)
- Clock Speed
- Thermal Design Power (TDP)



- But These Don't Really Tell The Whole Story
  - Cracking speed is based on number of instructions it takes to calculate a hash
  - Different cards have different instruction sets available
  - Different versions of software and different drivers take advantage of instructions in different ways

That Didn't Help At All…What Do I Pick?



- Use previous benchmarks to estimate cracking speeds
  - Many people post benchmarks online
- If you have to watch a budget, balance cracking speed and cost to get the most for your money
  - Double the price doesn't always equal double the speed

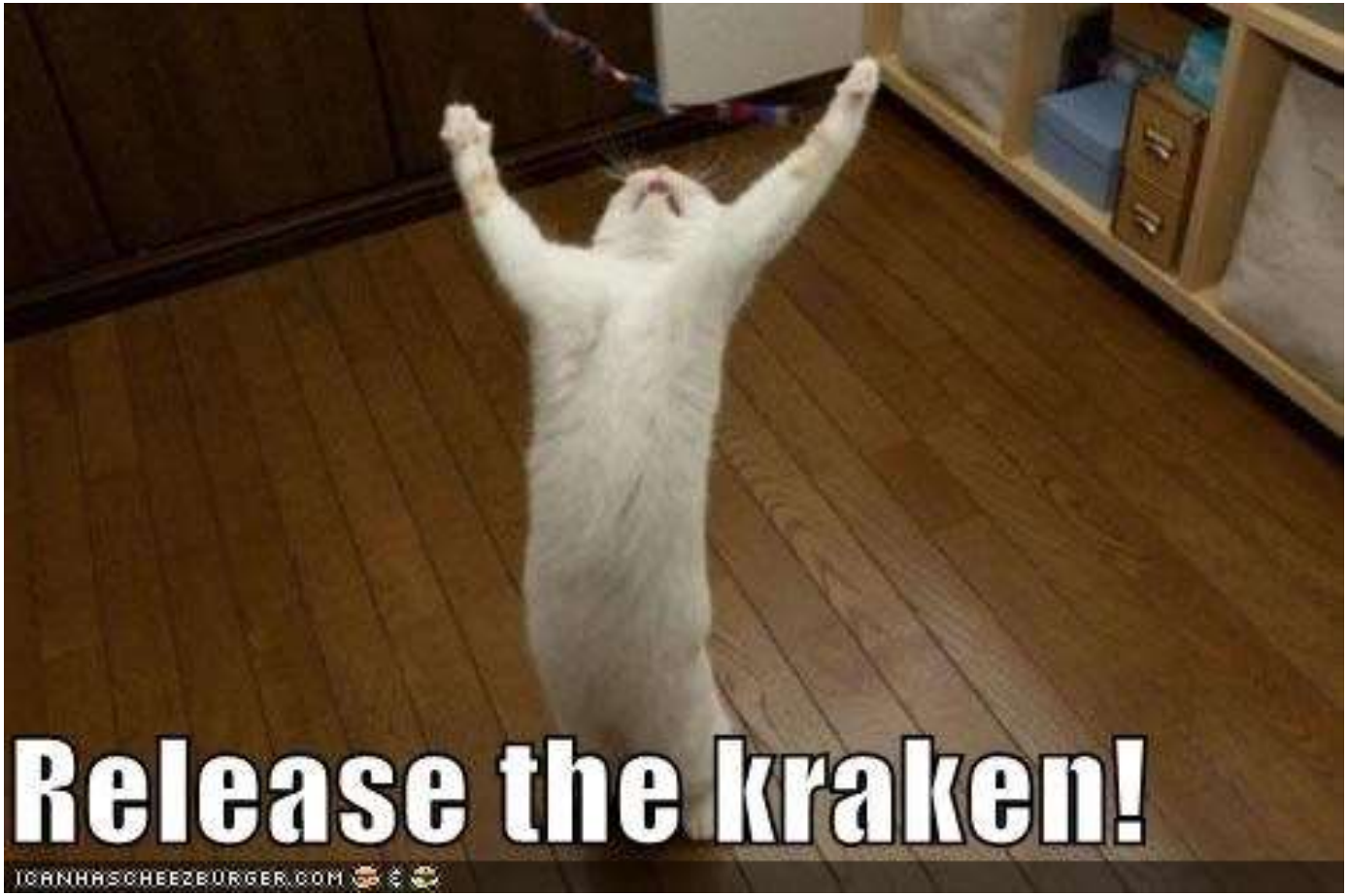
My Pick

- nVidia 900 Series
  - Bridged the gap to the Radeon cards in terms of speed
  - Low TDP
  - Better Parallelism
  - Better drivers

Other Items to Think About

- Cooling
- Reference Design Cards
  - Usually pull air directly from the back outside of the case rather than through the case interior
  - No overclocking (card wears faster)
- Power
  - Go for overkill – get the largest power supply you can get

Put It All Together And…



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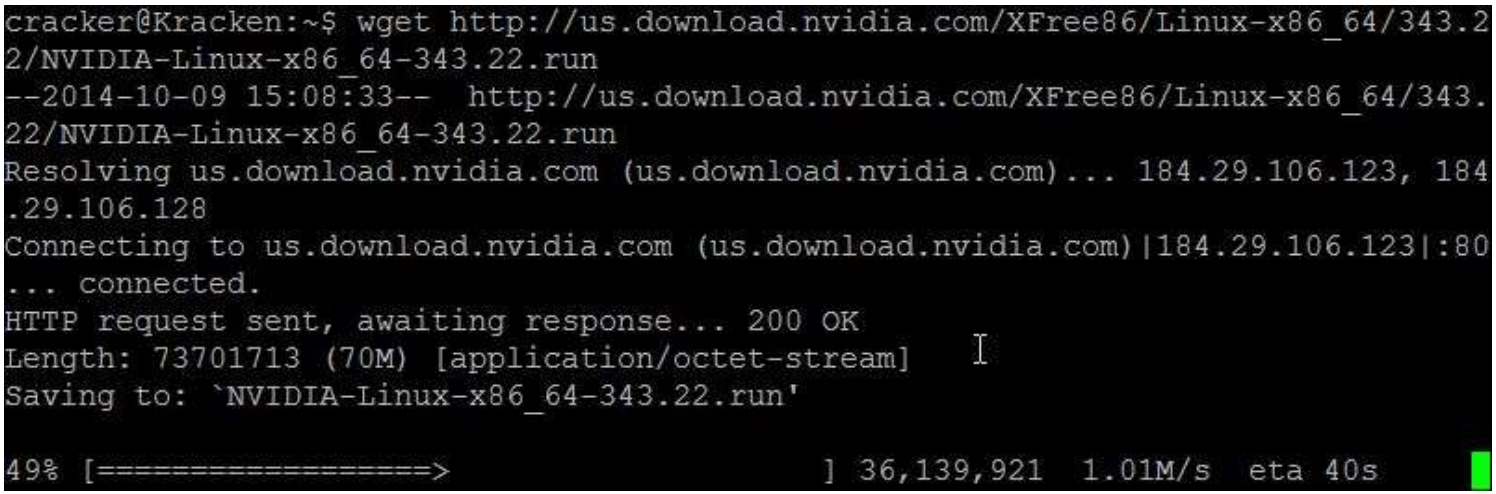
Release…..the Kracken!

Software

- Linux (Ubuntu Server)
- SSH
- Video Drivers
- oclHashcat
- hashcat-utils
- Wordlists

Setting It All Up

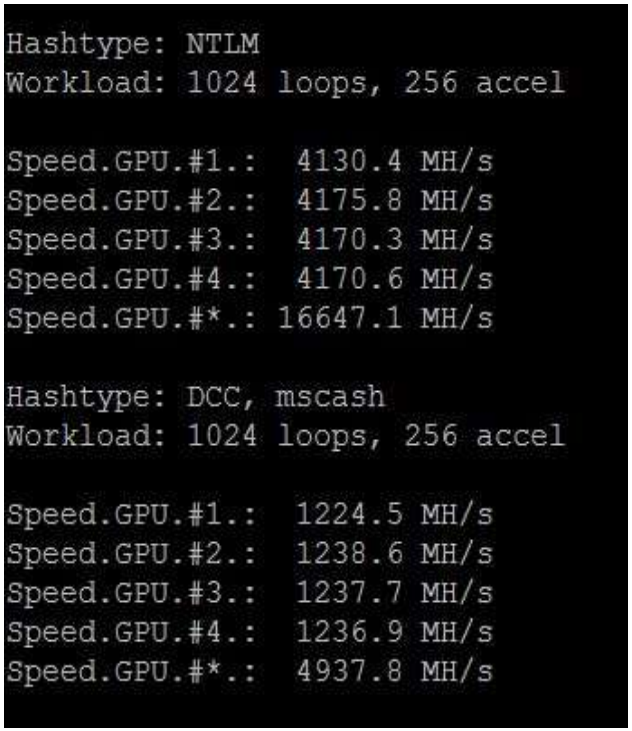
- Install Linux with minimal options – only SSH if remote access is needed
- Ensure that the system is secured – long passwords, Public-Private Keys for SSH
- Do not use open source video drivers – use only drivers right from AMD or nVidia



KEEP
CALM
AND
POWER
ON

From Building to Cracking

- There are many, *many* different strategies and attacks
- No one right way
- My method:
  - Not difficult
  - Does not require a lot of work on behalf of the tester
  - Since March 2014, cracked 67 percent of all hashes captured



Efficient Cracking

- Begin with fast attacks
- Take advantage of the fact that most users are ignorant of what makes a strong password (or choose to ignore the rules!)
- Then use the passwords that you cracked to help crack others!
  - Users often follow similar patterns
  - The organization often requires certain rules that make passwords similar
- Even once you move to brute force, you can configure rules and statistics to make it more efficient

Step 1: Easy Brute Force

- Take care of all the passwords you can brute force in no time.
- `cudaHashcat64.bin -a 3 -m 1000 -i /path/to/hash ?a?a?a?a?a?a`
  - -a : attack type
  - -m : hash type
  - -i: Increment Mode – starts at 1 character, goes up through the length of the mask
  - ?a?a?a?a?a?a: Mask of 6 characters, with the “all” character set in each position

Step 2: Username

- Many users *still* include their username in their password
- Modifying your username list with rules files give even more possibilities
- Use the list of usernames captured with the password
- `cudahashcat64.bin -a 0 -m 1000 --rules-file=rules/d3ad0ne.rule /path/to/hash /path/to/userlist`

Step 3: Dictionaries

- `cudaHashcat64.bin -a 0 -m 1000 --rules-file =rules/d3ad0ne.rule --loopback /path/to/hashes /path/to/dictionaries/`
- Use a variety of dictionaries
  - Rockyou
  - English Dictionaries
  - Passphrase list
  - Numerous other lists
- Use rules files to extend the wordlists
  - These can greatly increase crack time

Step 4: The Fingerprint Attack

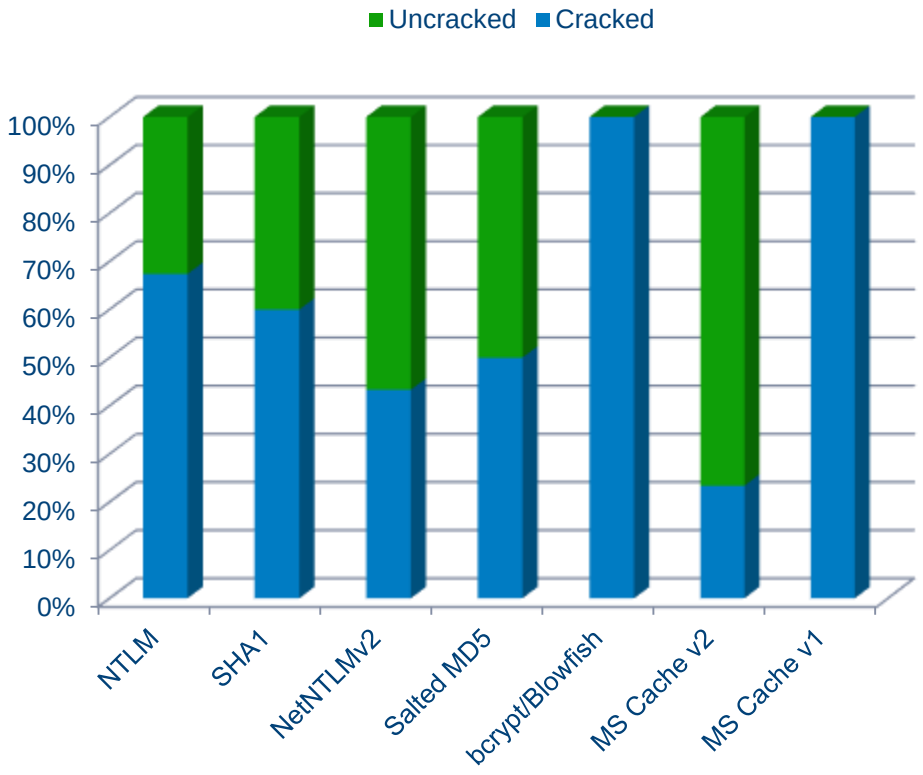
- Use the passwords already cracked and create every possible combination of characters up to 7 characters, which we will then combine, which creates wordlist of words 2 to 14 characters
- This uses the expander tool, found in the hashcat-utils
- `awk < hashcat.pot -F: '{print $2}' > outfile`
- `expander.bin < /path/to/outfile > expanded.txt`
- `cudaHashcat64.bin -a 1 -m 1000 /path/to/hashes /path/to/expanded.txt /path/to/expanded.txt`

From There…

- Markov Attacks – statistically based brute force
- Custom Wordlists – Create new wordlists based on patterns or topics in the cracked password list
- Straight Brute Force – fast hashes like NTLM are highly susceptible

Our Cracking Stats Since March

	Total Hashes	Cracked	Uncracked	Percentage
NTLM	25087	16912	8175	67.4
SHA1	10	6	4	60.0
NetNTLMv2	30	13	17	43.3
Salted MD5	4	2	2	50.0
bcrypt/Blowfish	3	3	0	100.0
MS Cache v2	188	44	144	23.4
MS Cache v1	3	3	0	100.0



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Thanks to:

- Jens Steube aka Atom – Brilliant designer of oclHashcat
- Jeremi Gosney aka epixoip – Team Hashcat member and hardware guru, answers all my questions on the Hashcat forum
- Chris Duffy aka Funk and Wagnall – pushed me to create this presentation
- Andrew Whitaker aka The Godfather – advice, support, and letting me build the Kracken!