Where The Wild Things Are: Brute-Force SSH Attacks In The Wild And How To Stop Them

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University of Utah

SSH Brute Force Attacks (BFAs) in the Wild

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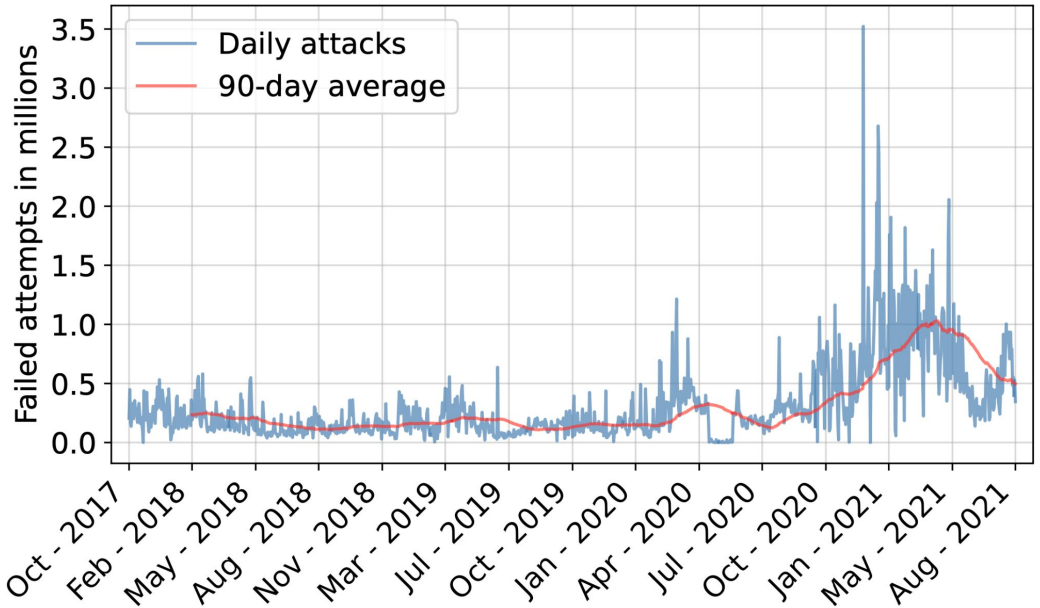

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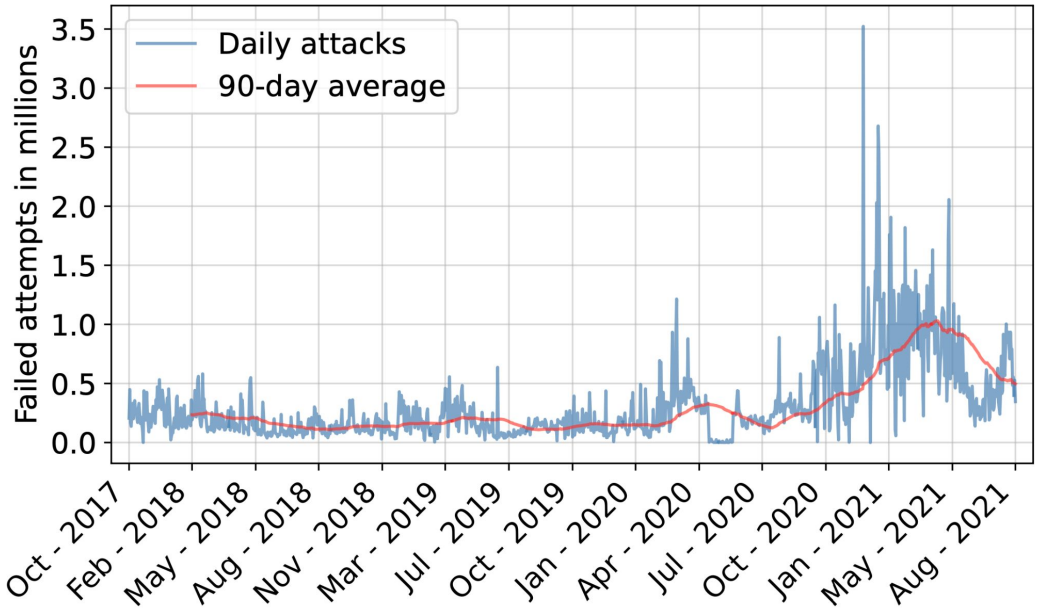

381 million failed brute force attempts

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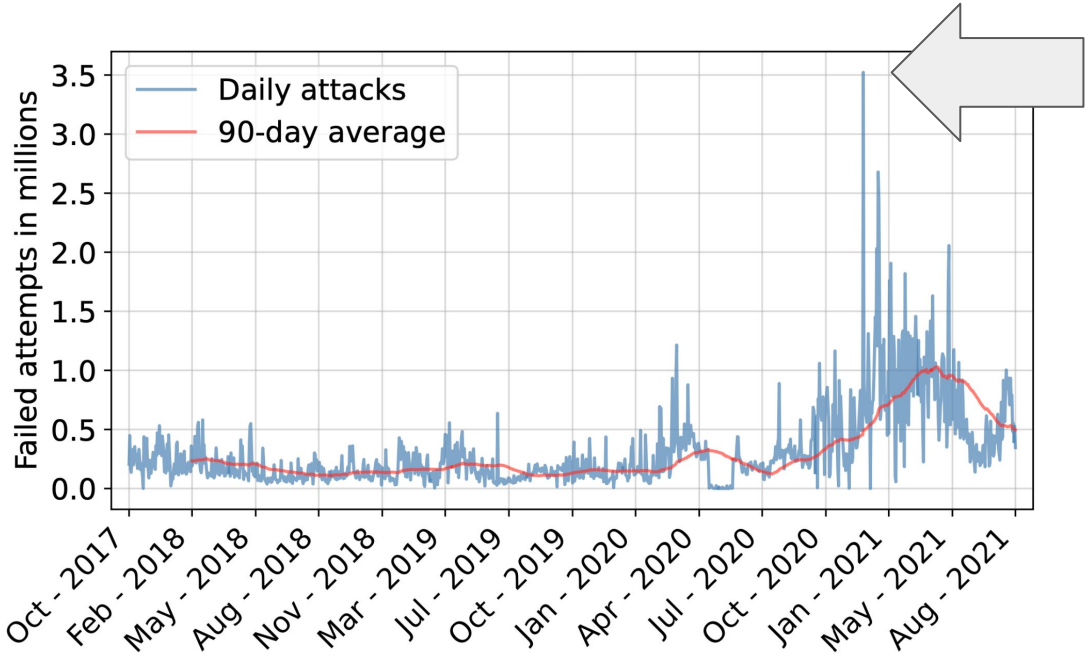

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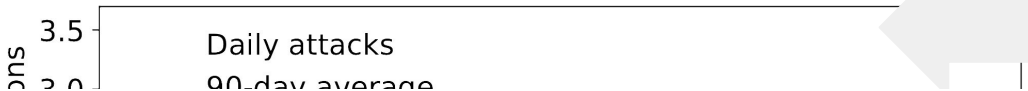

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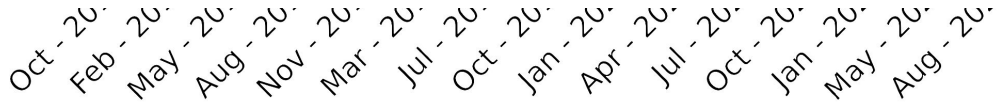
“SSH Brute Force Attacks are still prevalent, in fact INCREASING.”



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Data Collection

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Public Research Facility

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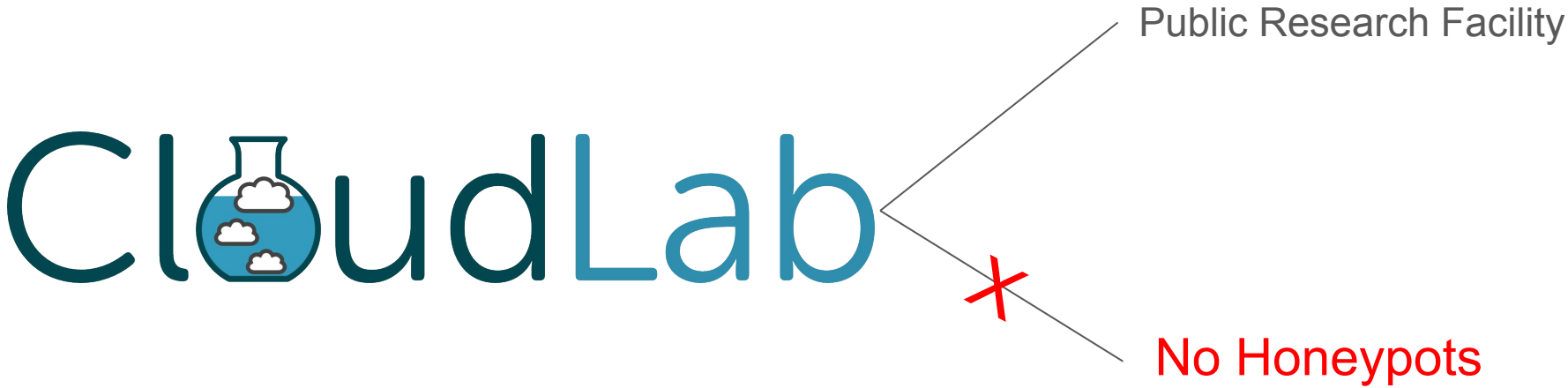

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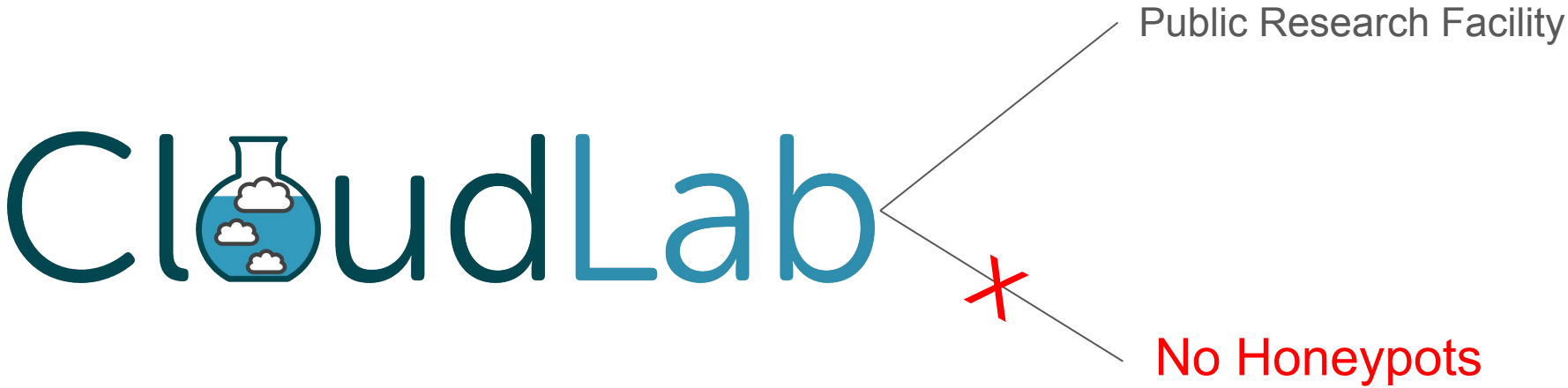

Legitimate Users & Attackers

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“Provide the means to evaluate effectiveness”

Legitimate Users & Attackers

Ingredients for a SSH Brute Force Attack

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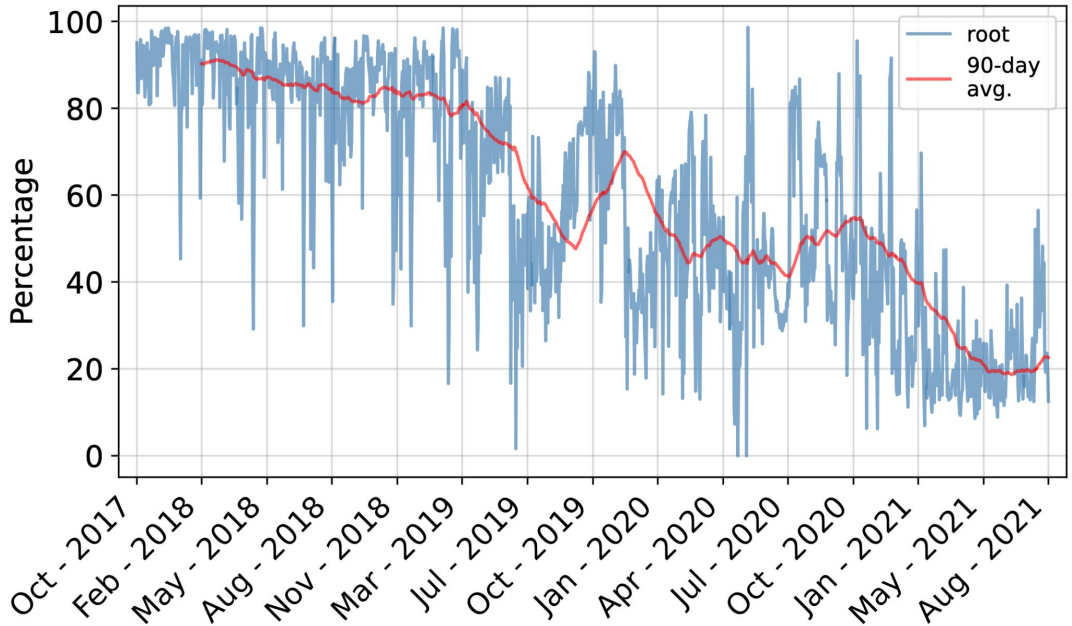

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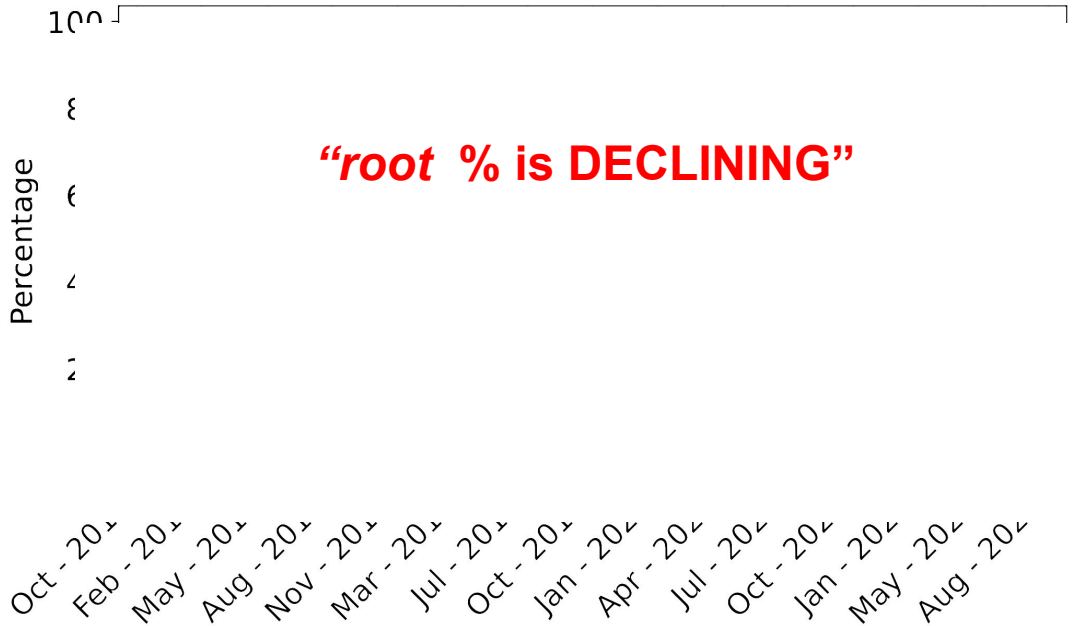

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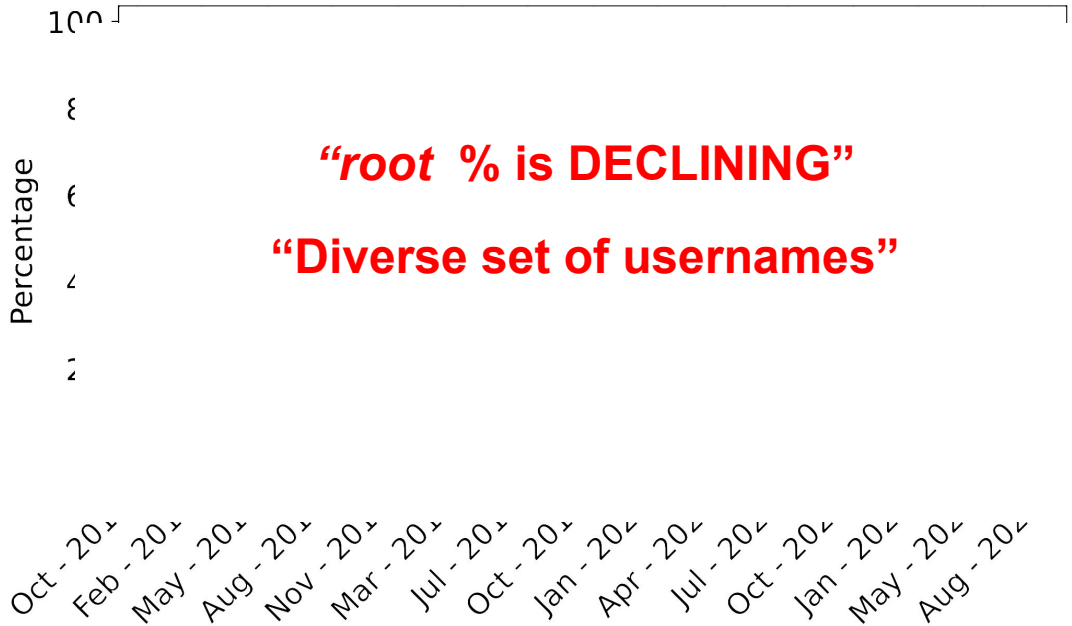

- Are there patterns in the usernames utilized by attackers?

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- Can these patterns be fingerprinted for effective blocking?

Username Set in Guessing Vector

Attacker →

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Attacker → Guessing Vector → ({username-1},
{username-2},
{username-3},
.
.
.
.
{username-n})

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Username Set

Username Set in Guessing Vector

Attacker_1 →

Attacker_2 →

Attacker_3 →

Attacker_4 →

.

.

.

Attacker_n →

Username Set in Guessing Vector

Attacker_1 → **Username Set A**

Attacker_2 →

Attacker_3 →

Attacker_4 → **Username Set A**

.

.

.

Attacker_n →

Username Set in Guessing Vector

Attacker_1 → Username Set A

Attacker_2 → **Username Set B**

Attacker_3 →

Attacker_4 → Username Set A

.

.

.

Attacker_n →

Username Set in Guessing Vector

Attacker_1 → Username Set A

Attacker_2 → Username Set B

Attacker_3 → **Username Set C**

Attacker_4 → Username Set A

.

.

.

Attacker_n → **Username Set C**

Username Set in Guessing Vector

Attacker_1 → Username Set A

Attacker_2 → Username Set B

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.

.

.

Attacker_n → Username Set C

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Attacker_2 → Username Set B

Attacker_3 → Username Set C

Attacker_4 → Username Set A

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.

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Attacker_1 → Username Set A

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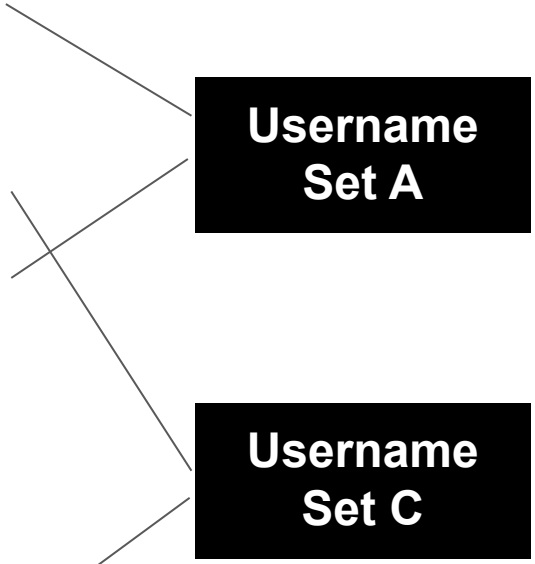

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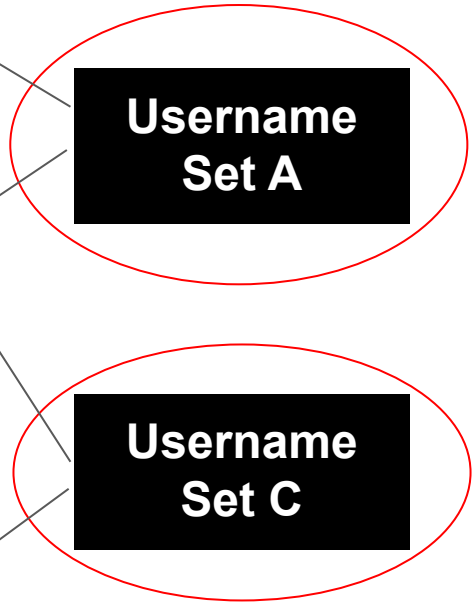

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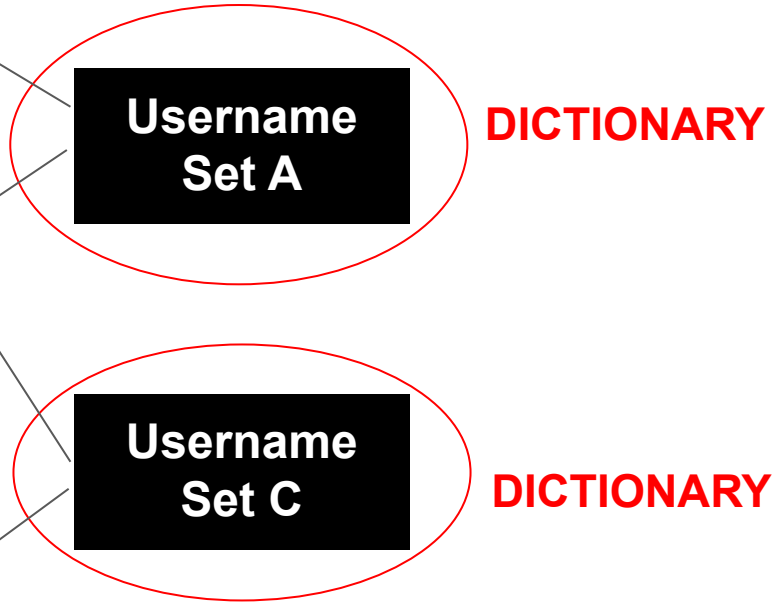

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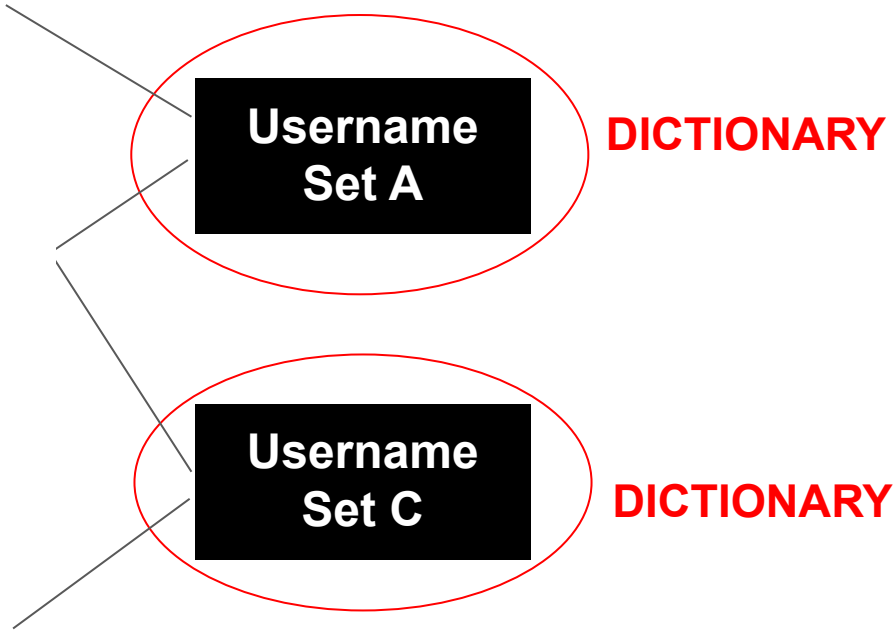
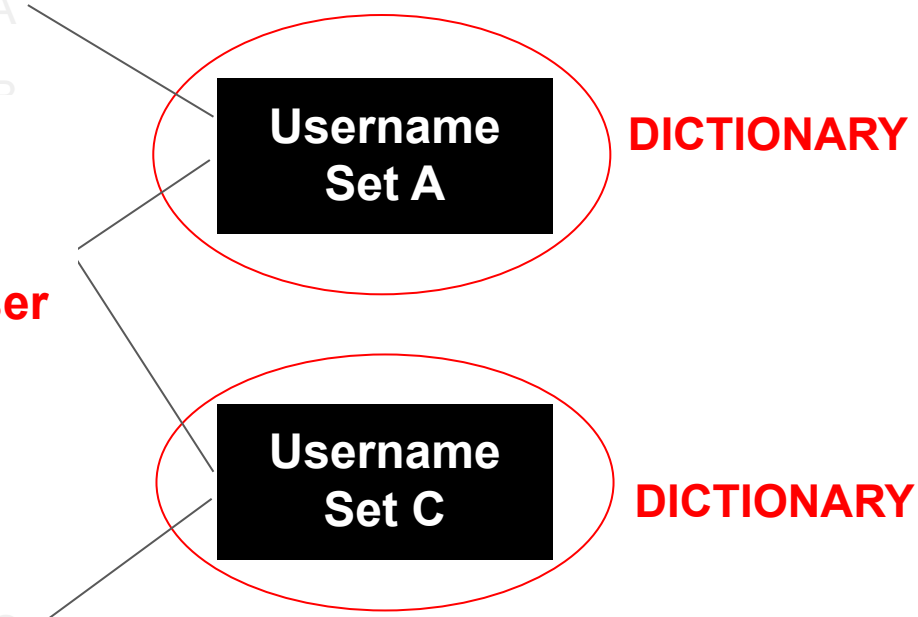


Username Set in Guessing Vector

Attacker_1 → Username Set A

- **64% attackers use dictionary**
- **94% of the attackers user at least one username from a dictionary**



Attacker_n → Username Set C

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- How DBB performs in % Attacks Blocked and False Positives?

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- DBB effectively blocked over 99.3% of BFAs across all sites with only ~14 false positives per site.

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Username Blocking List

Site-A

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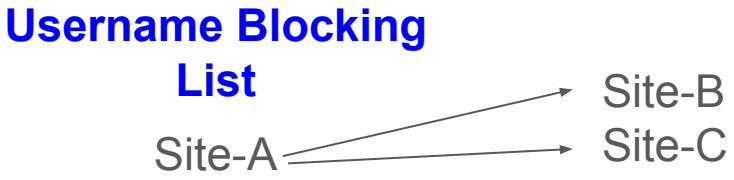

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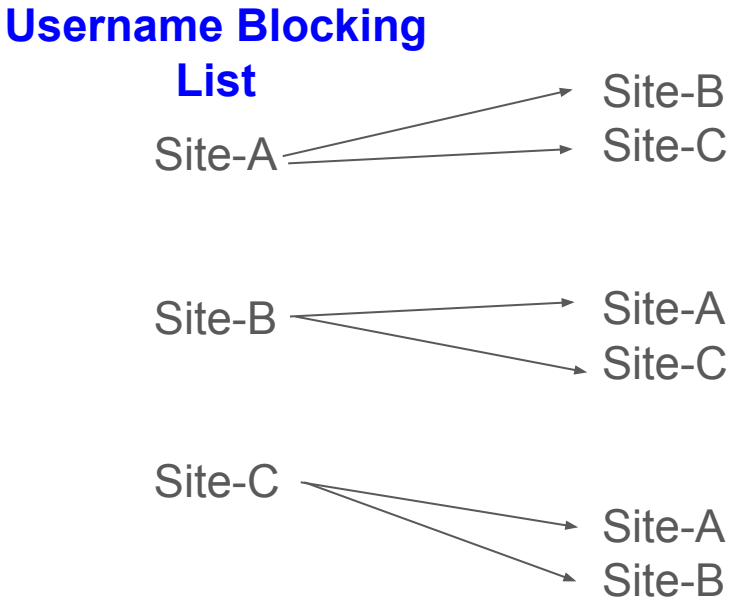

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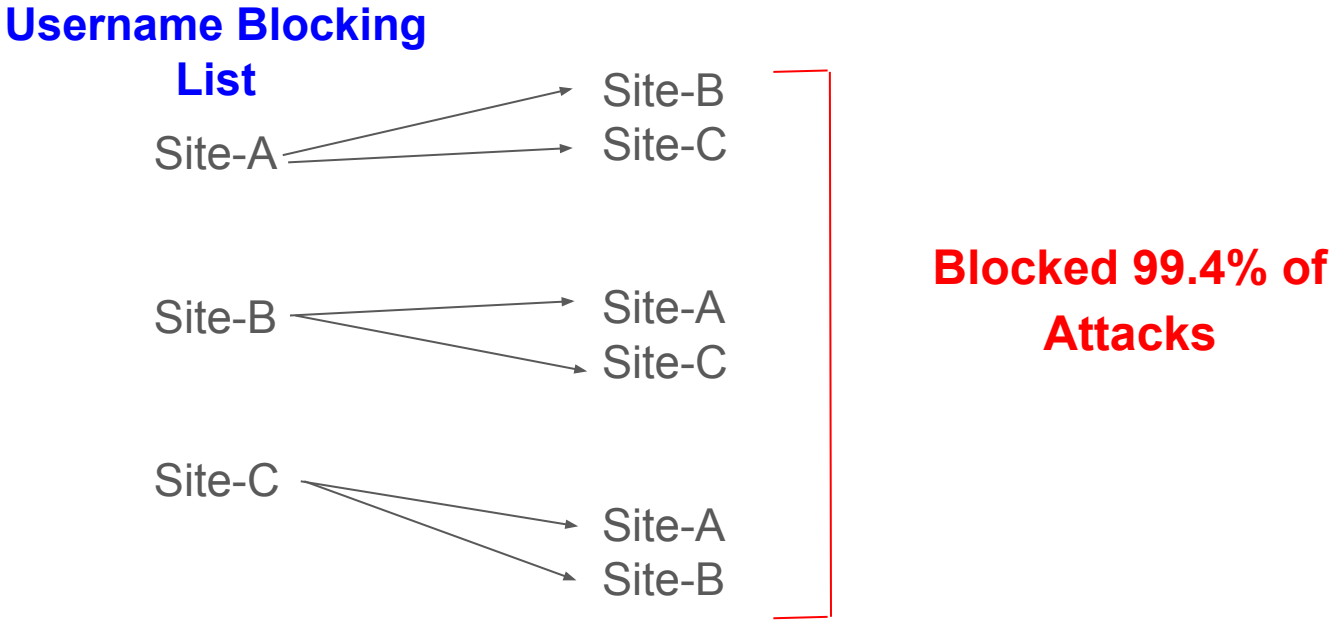

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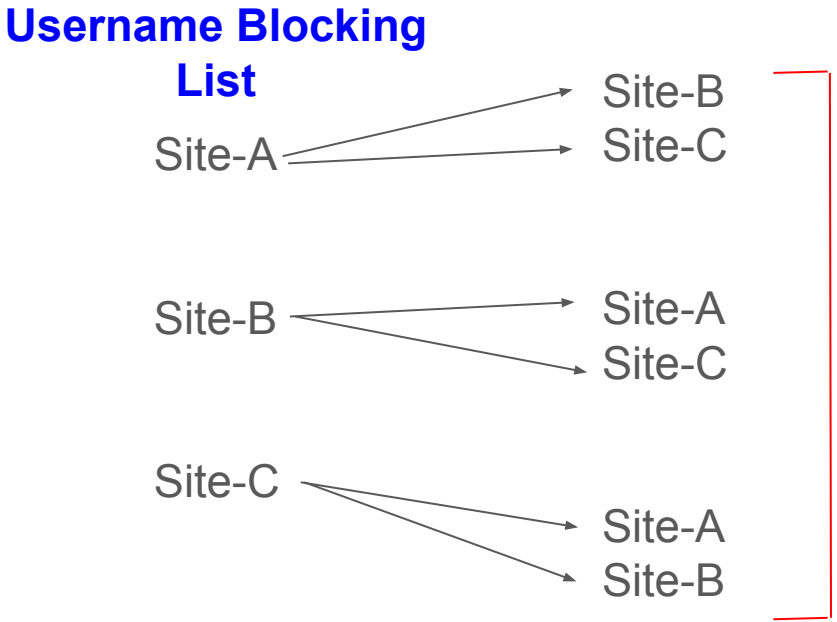

Blocked 99.4% of Attacks

13 False Positives

Dictionary Based Blocking (DBB)

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“High Blocking Rate with Low False Positives”

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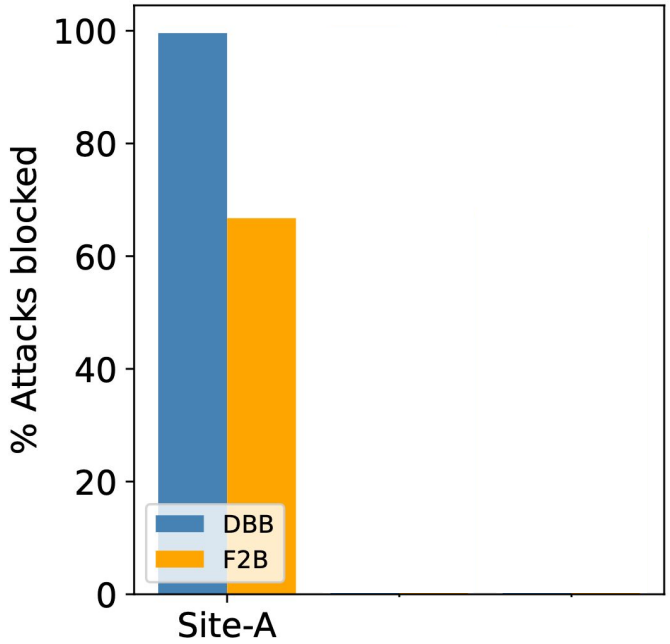

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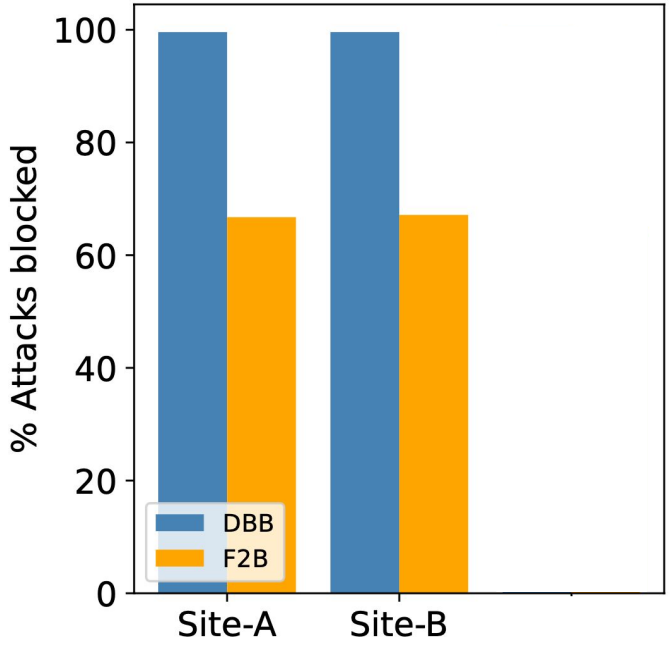

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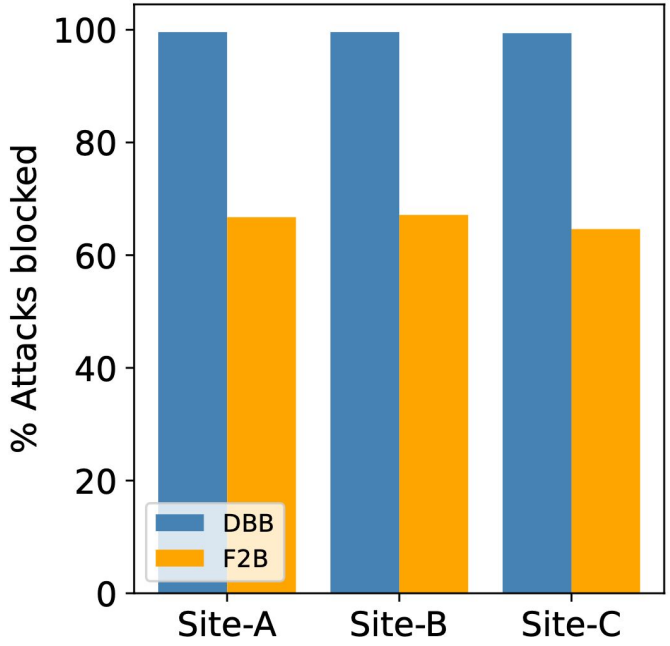

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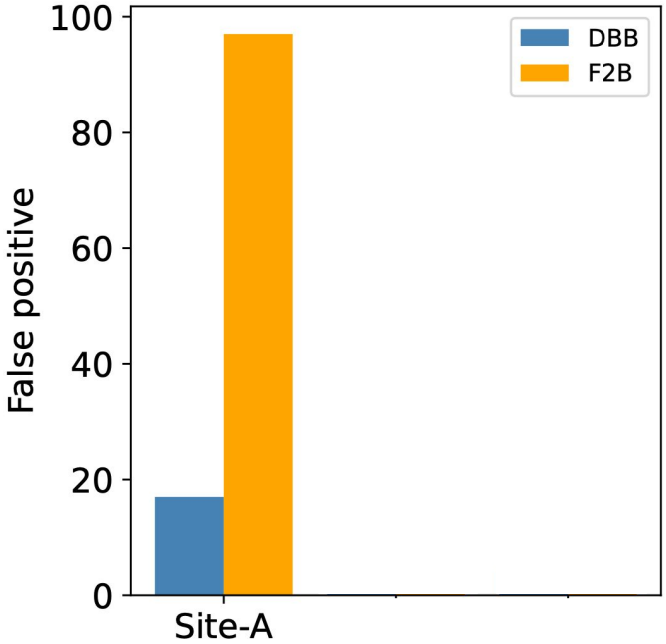

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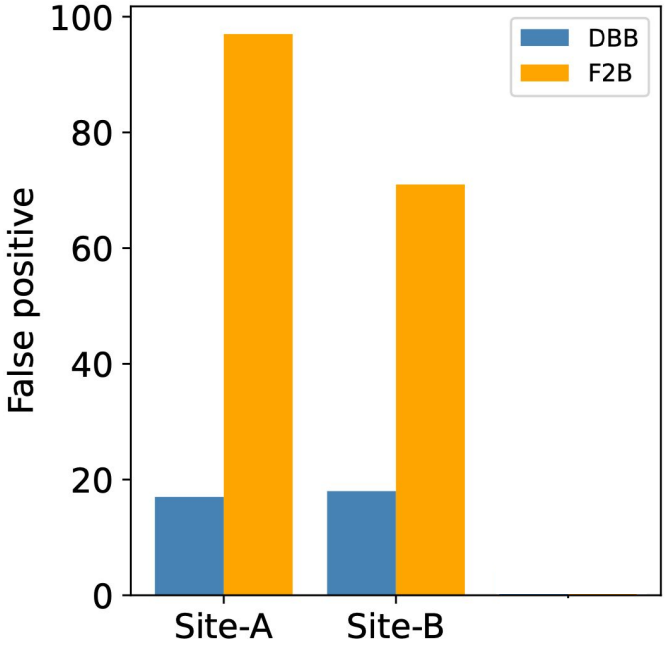

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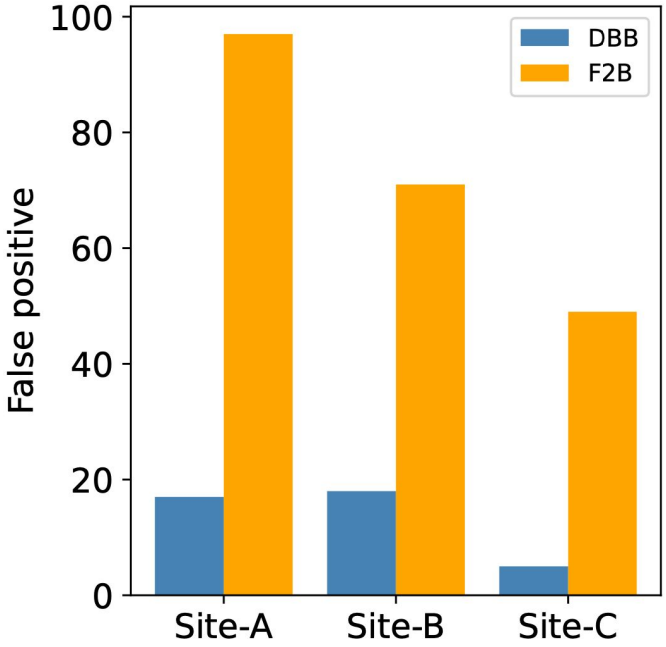

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“Dictionary Based Blocking outperforms Fail2ban with huge margin”

Dictionary Based Blocking In Production

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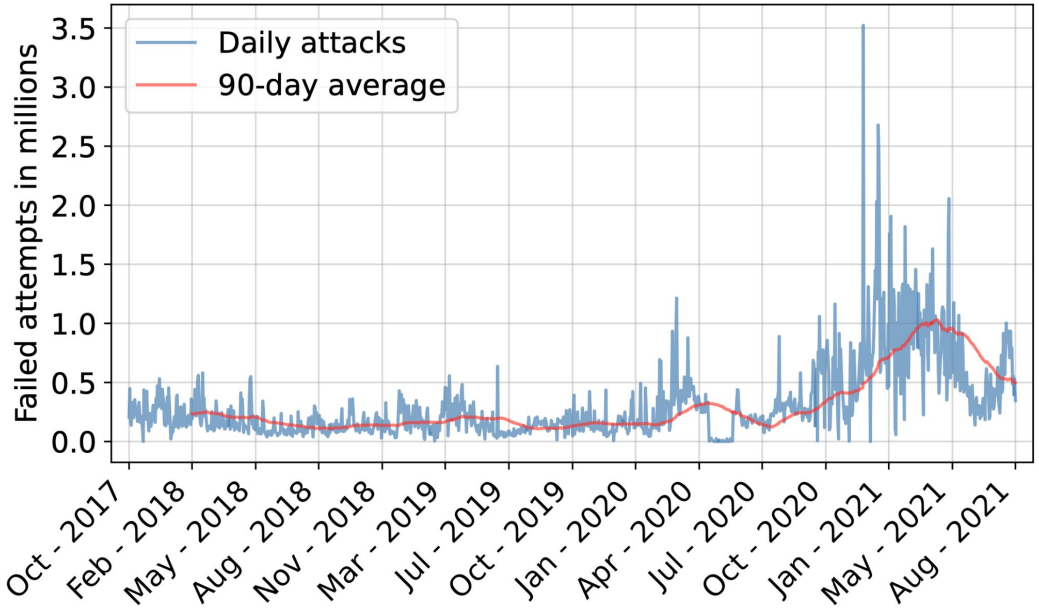
Revisiting SSH Brute Force Attacks in the Wild



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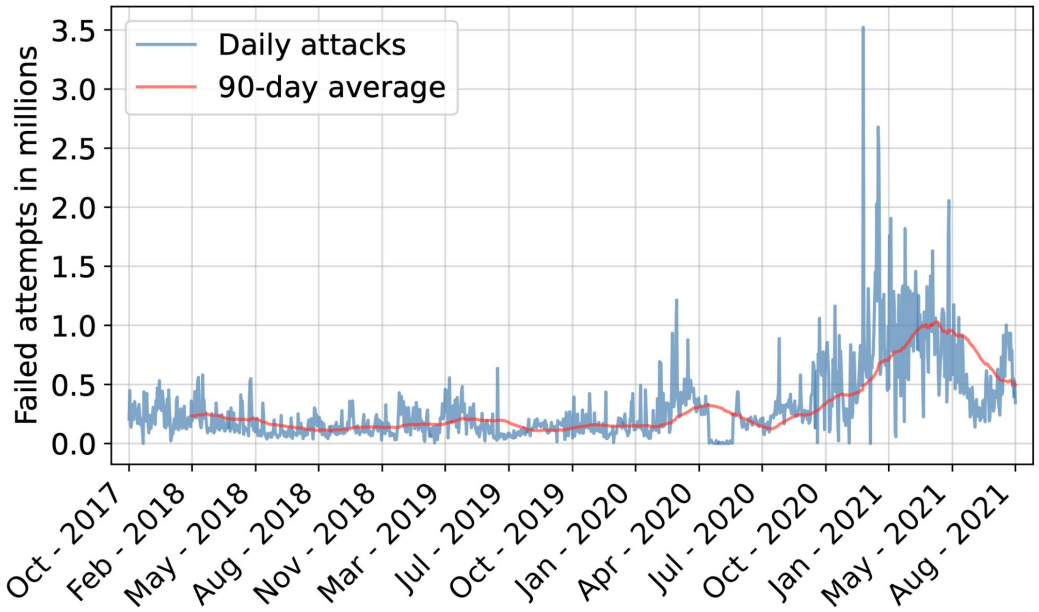

→ After Aug 2021?

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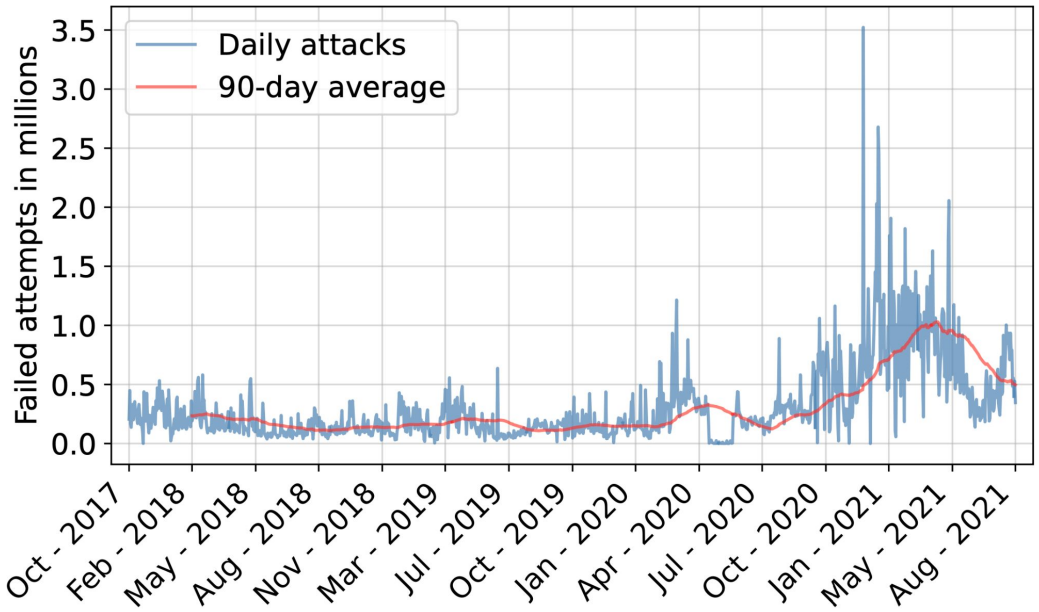

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FIREWALL

Periodic updation of filter rules

Aug 2021

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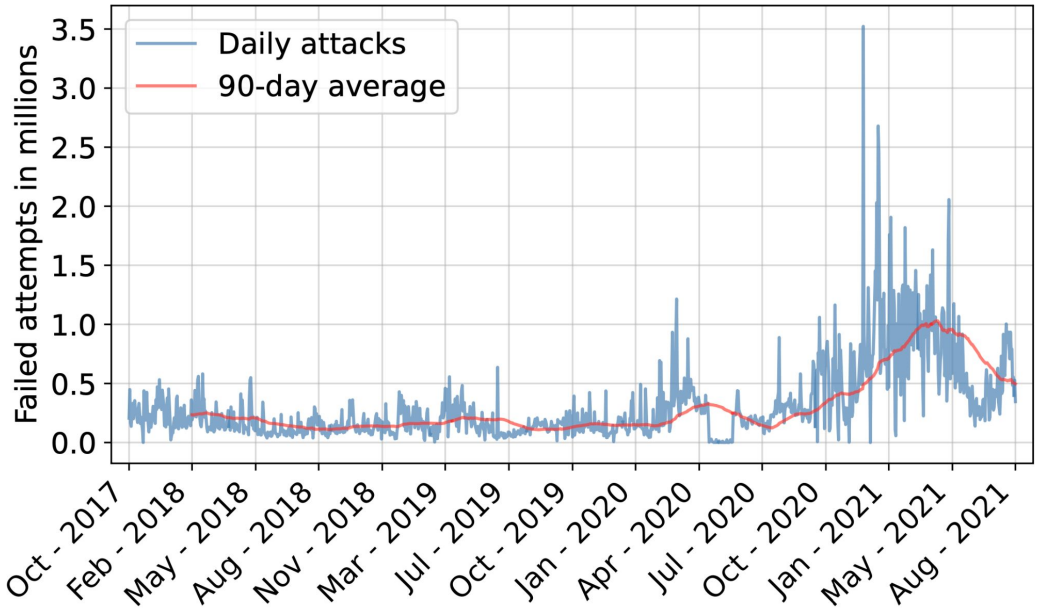

Unfiltered

Aug 2021

Filtered

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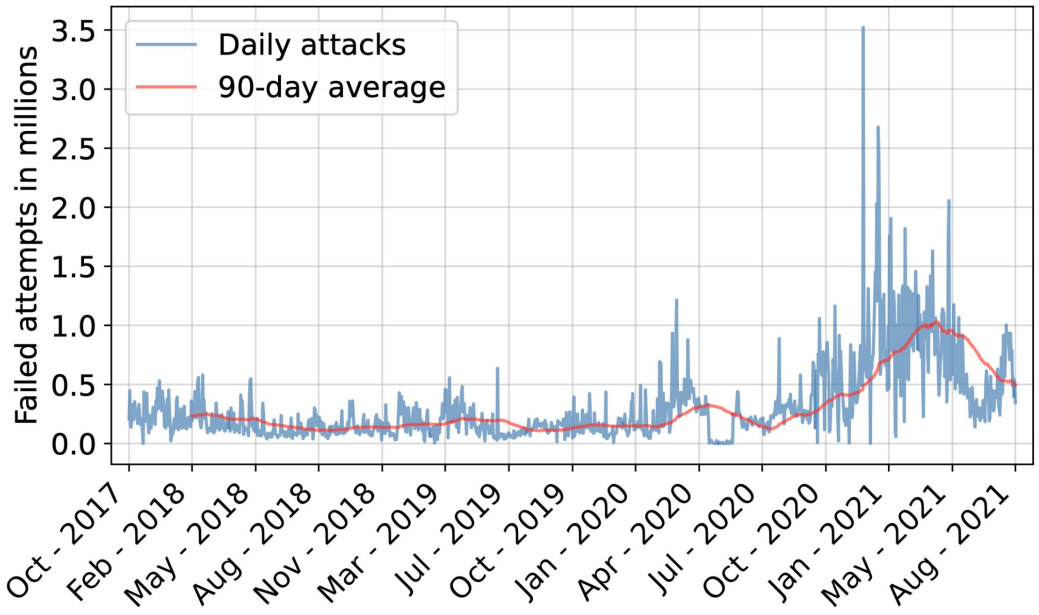

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- Evaluate Dictionary Based Blocking effectiveness by comparing attack volumes pre and post-deployment.

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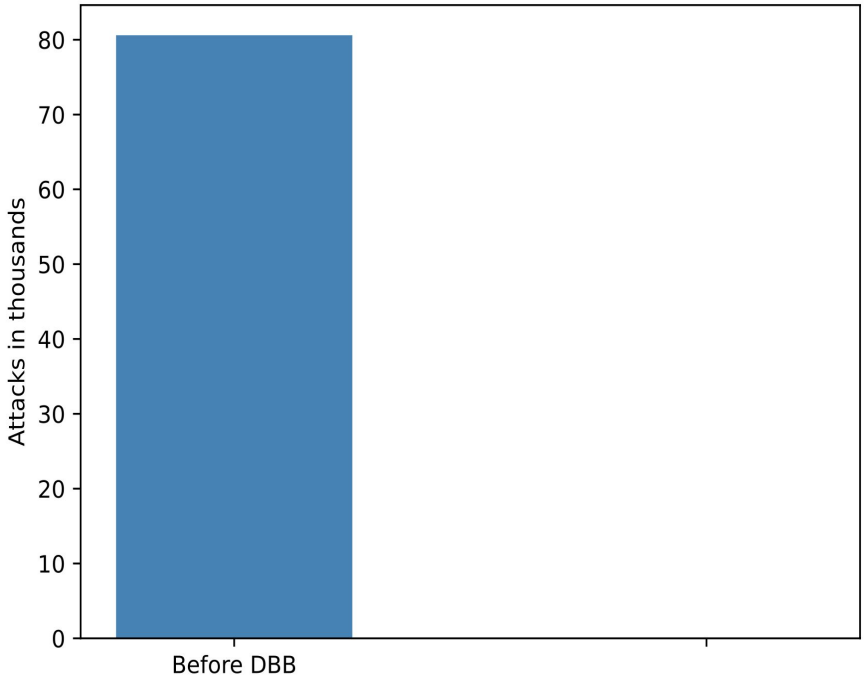

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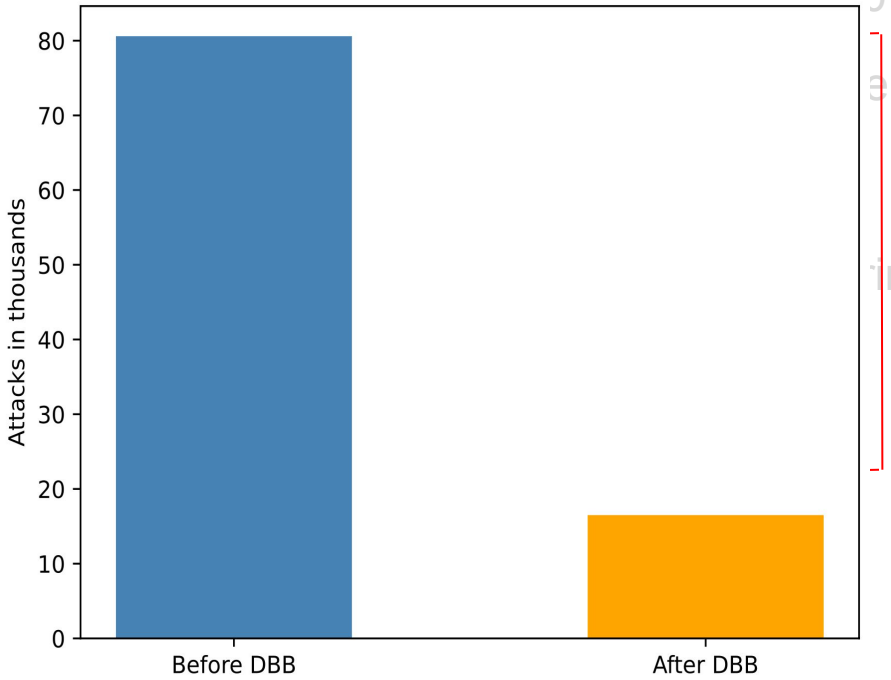

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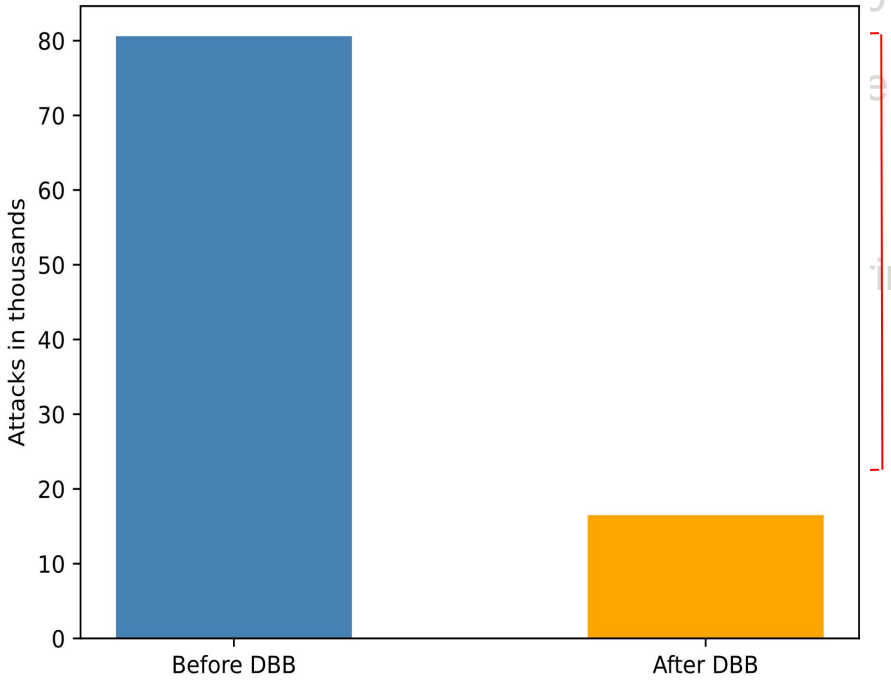

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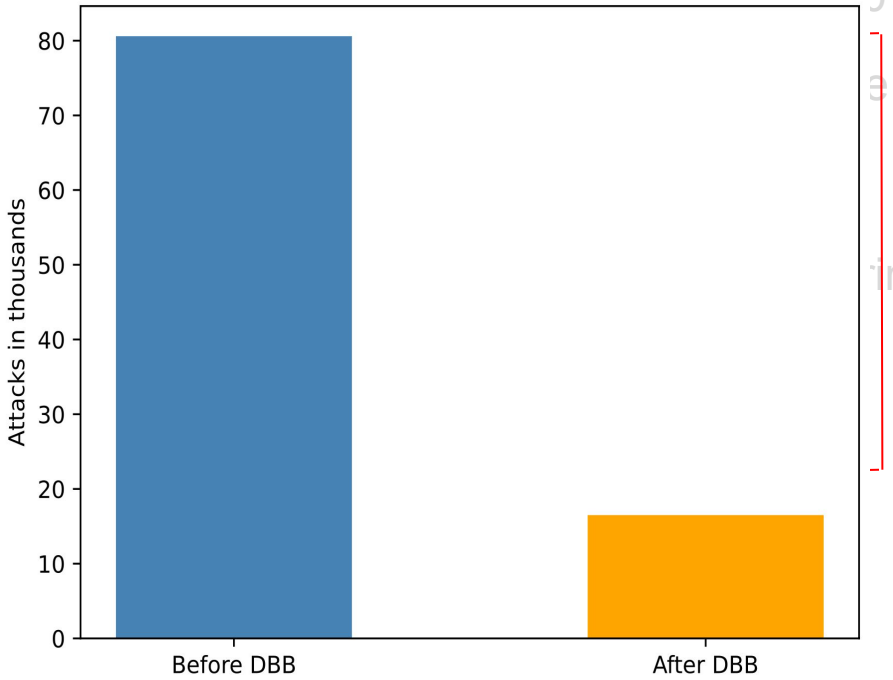

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DBB had zero FP

- Does the performance comes from the high number of nodes in CloudLab?

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Short answer is

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Short answer is **NO**

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Short answer is **NO**

Long answer is

- Does the performance comes from the high number of nodes in CloudLab?

Short answer is **NO**

Long answer is **NO IT DOESN'T**

- Does the performance comes from the high number of nodes in CloudLab?

- How many nodes (collectors) are required to perform effective blocking?

Long answer is NO IT DOESN'T

Performance based on number of Collectors

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Username
Blocking List

1 Collector

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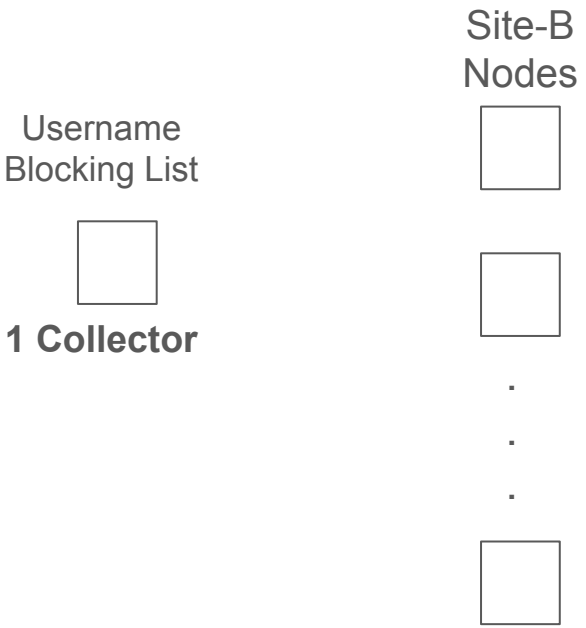

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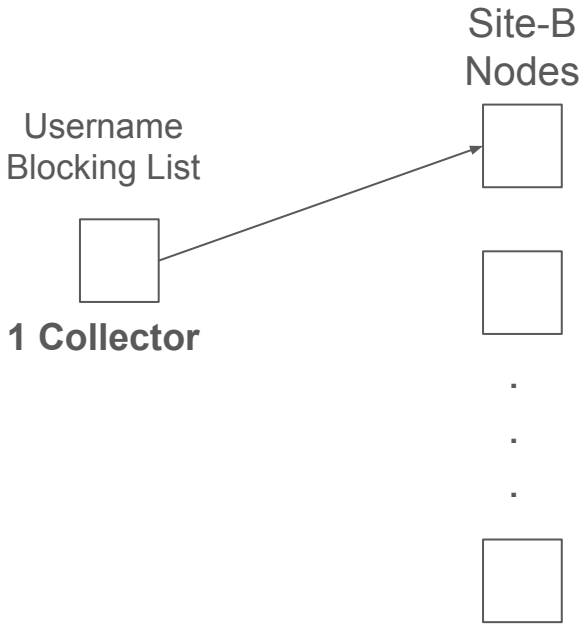

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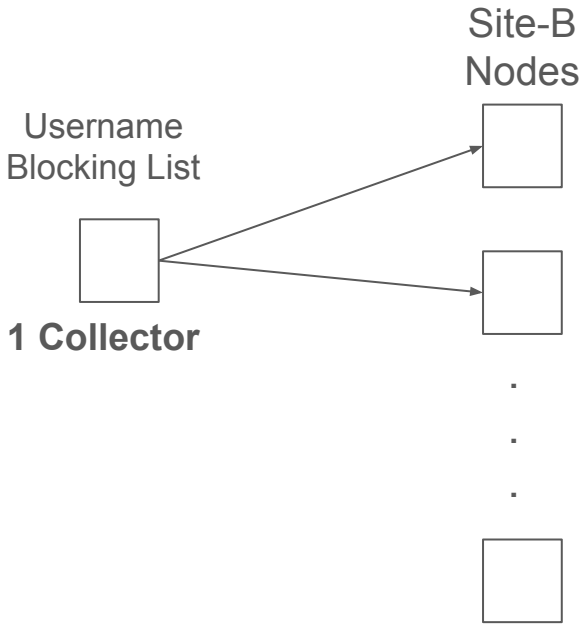

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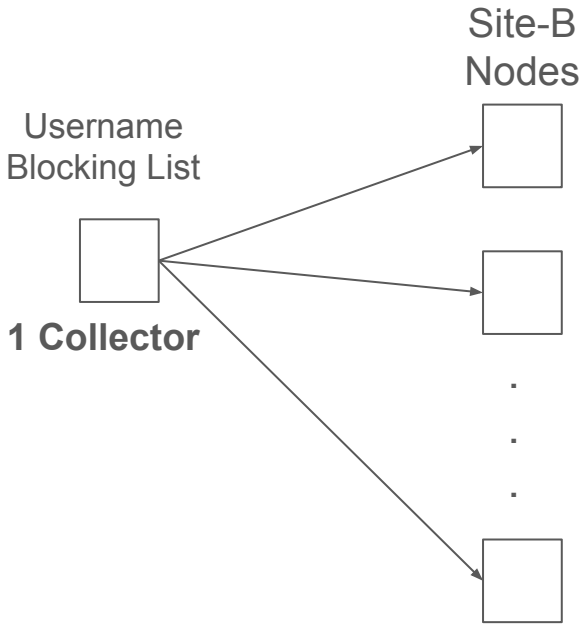

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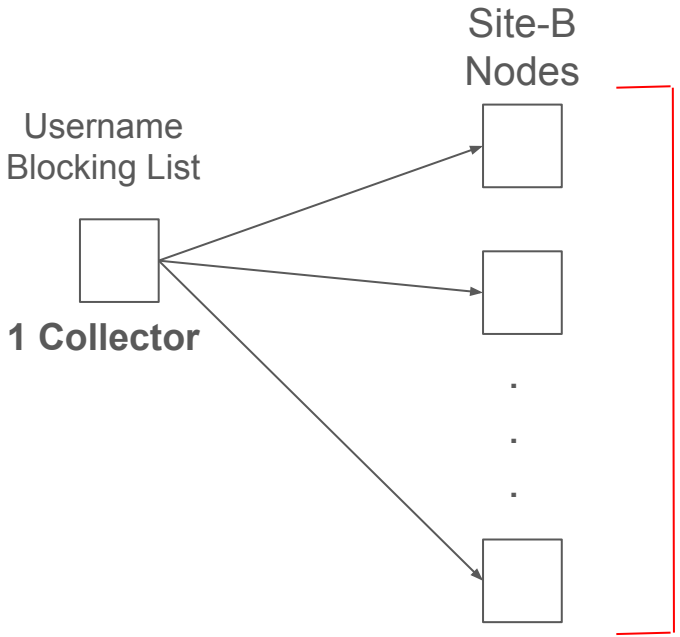

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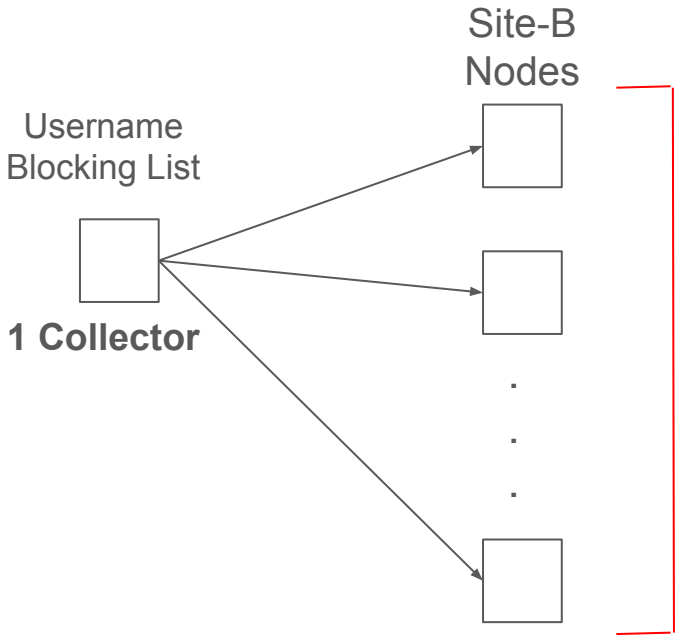

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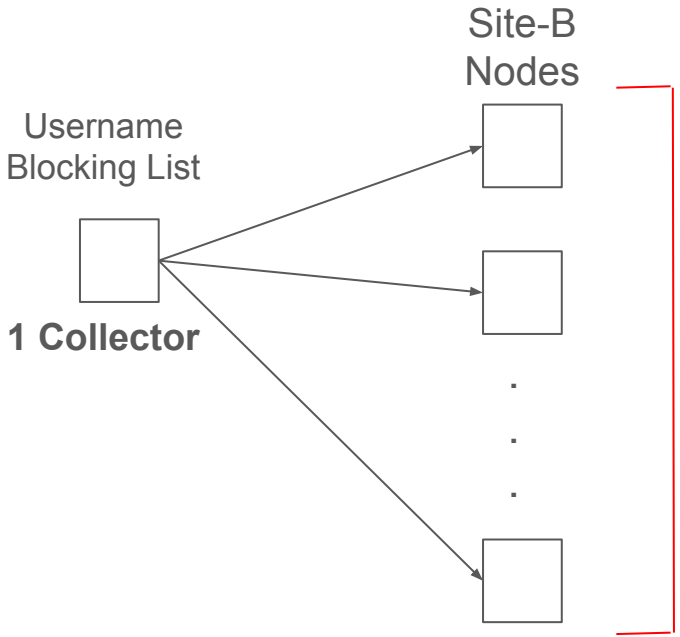

1 Collector - Blocked Minimum 97.6% attacks
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.
6 Collector - Blocked Minimum 99.0% attacks

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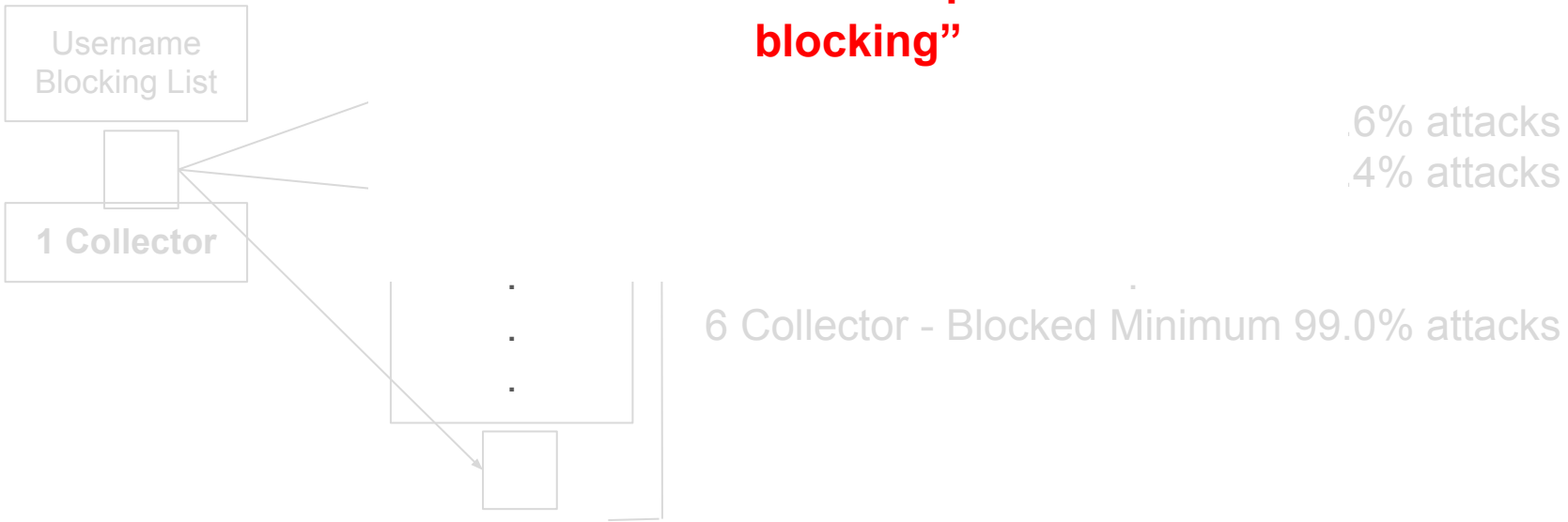
“Few collectors can also perform effective blocking”



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Paper has more insights.

Questions

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