Introduction

Length aware cuckoo filter (LACF) is enhanced cuckoo filter which aims to reduce false positive rate associated with set membership test. LACF is best suited in situations where distribution of dataset is known in advance which makes it good candidate for IP lookup.

Cuckoo Filter

\[
\begin{align*}
    a_1 &= h_1(x) \\
    a_2 &= a_1 \oplus h_2(fp)
\end{align*}
\]

\(fp = \text{fingerprint of item X}\)
- Space optimized data structure for set membership test.
- Supports dynamically deletion of items.

IP Prefix Distribution

Results

- LACF leverages IP prefix distribution and inserts unpopular IP prefixes twice into filter.
- Set membership test in LACF for a unpopular IP prefix needs at least two lookups.
- Lower false positive rate than cuckoo filter for unpopular IP prefixes

Linux Kernel Integration

- Space optimized data structure for set membership test.
- Supports dynamically deletion of items.

Conclusion

Results obtained from standalone implementation and Linux kernel integration of LACF proves LACF has lower false positive rate than cuckoo filter and performs faster IP lookup.

References