Understanding DPDK algorithmics

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Fast lookup algorithms
implemented inside DPDK libraries

HASH library

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Used in FDB, IPv4 and IPv6 HOST tables

DPDK Hash library characteristics

Algorithm used is a modified Cuckoo hashing

Hash size is 32 bytes

Optimistic memory access time is 1

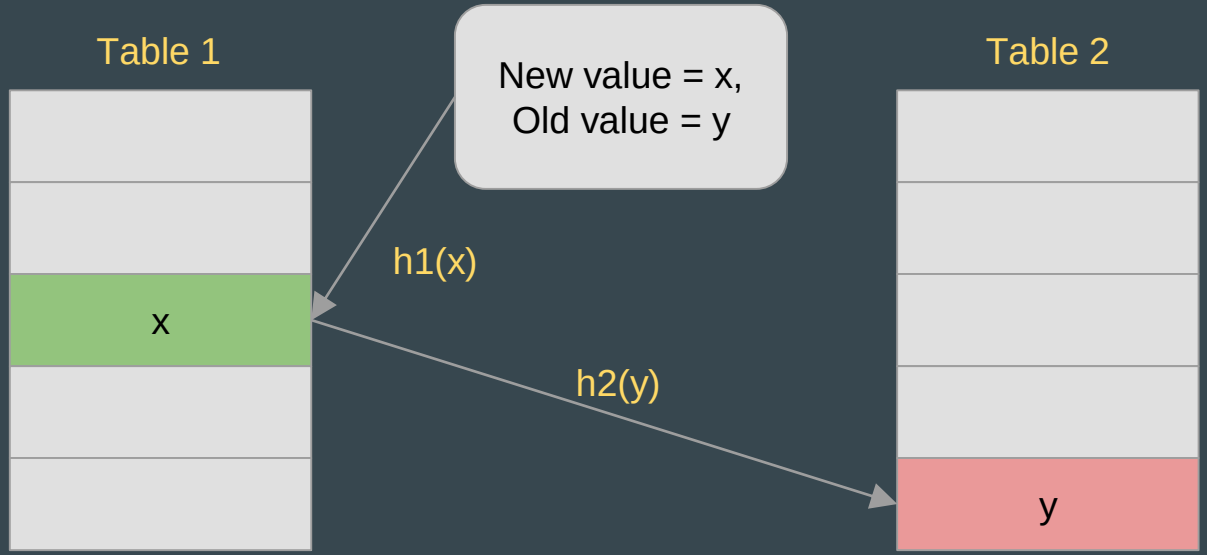
Pessimistic memory access time is 2

With random keys, this method allows the user to get around 90% of the table utilization, without having to drop any stored entry or allocate more memory.

Big table is divided in many buckets

Cuckoo hashing algorithm is used to find another bucket

Cuckoo hashing collision resolution



Hash lookup example

TBD

Hash insert example

TBD

LPM library

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Used in IPv4 and IPv6 ROUTE tables

DPDK LPM library characteristics

Uses modified DIR-24-8-BASIC algorithm

TBL24 contains 2^{24} next hop entries = 16M * 2B = 32MB

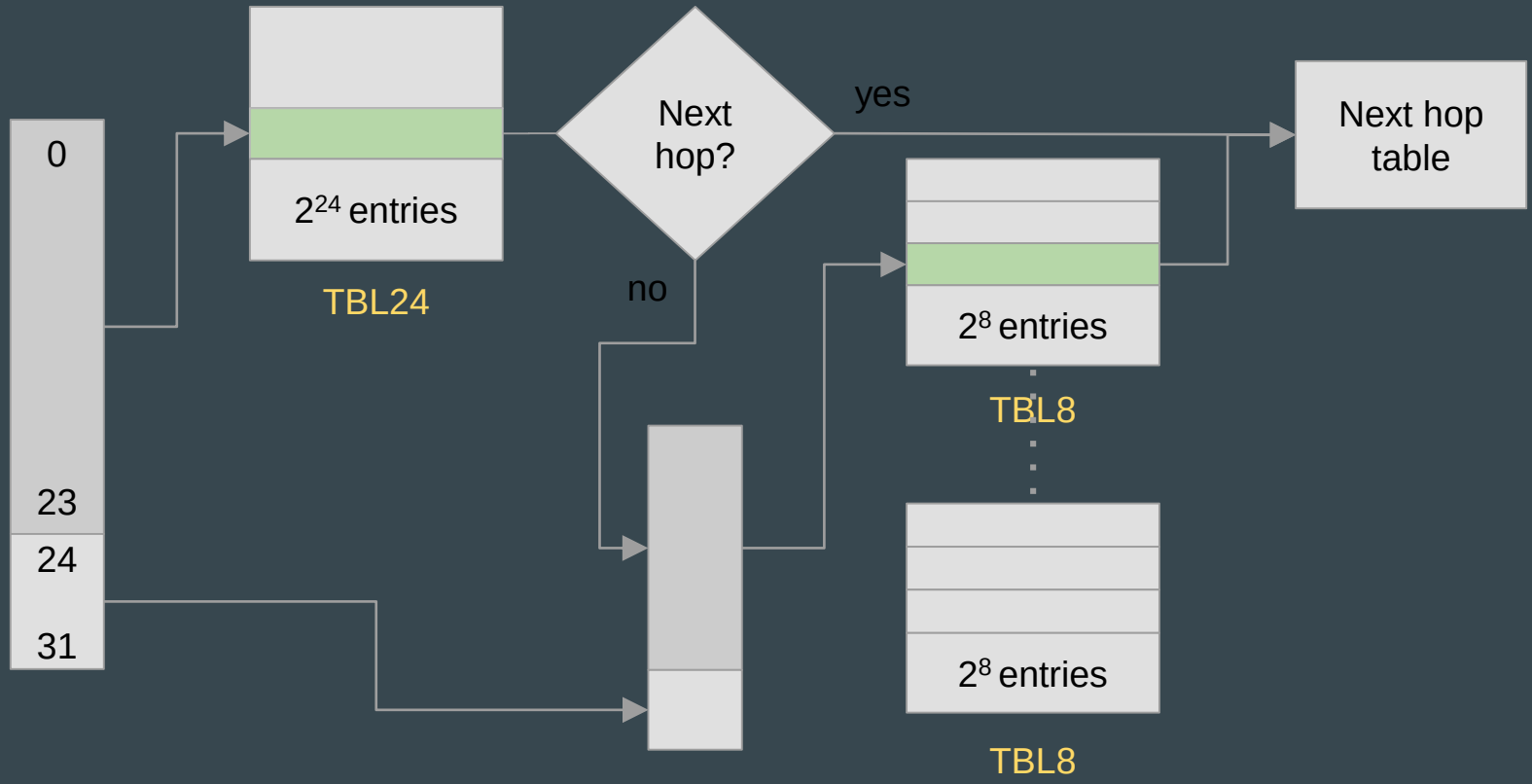
Number of TBL8 could be up to 2^{15} = 32K * 2B = 64K

Next hop value points to next hop id in case of 24-bit or less prefix and to TBL8 table otherwise

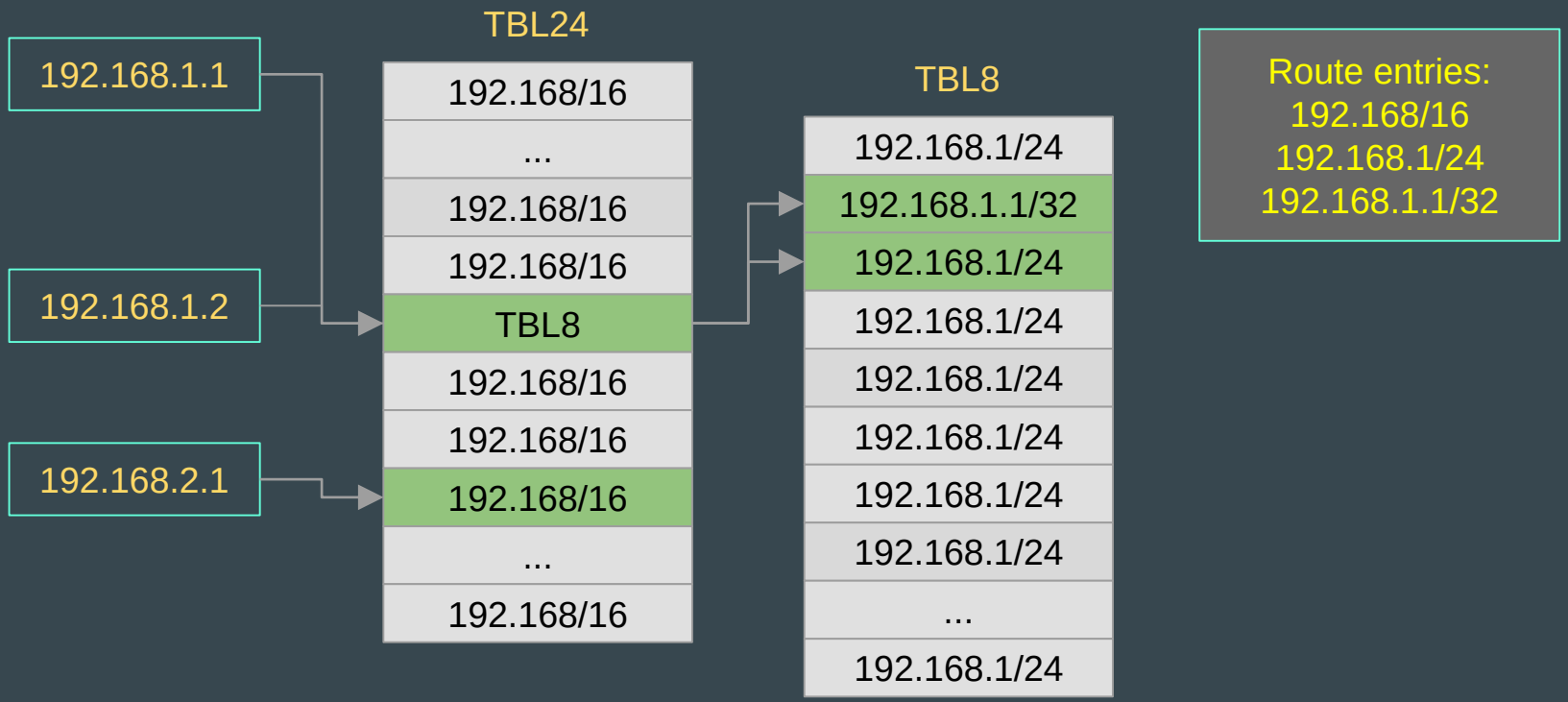
Route prefixes less than 24 are expanded into multiple entries inside TBL24

Number of prefixes longer than 24 is limited by the number of TBL8

Lookup algorithm



LPM lookup example



LPM insert example

TBD

ACL library

Used in IPv4 and IPv6 ACL tables

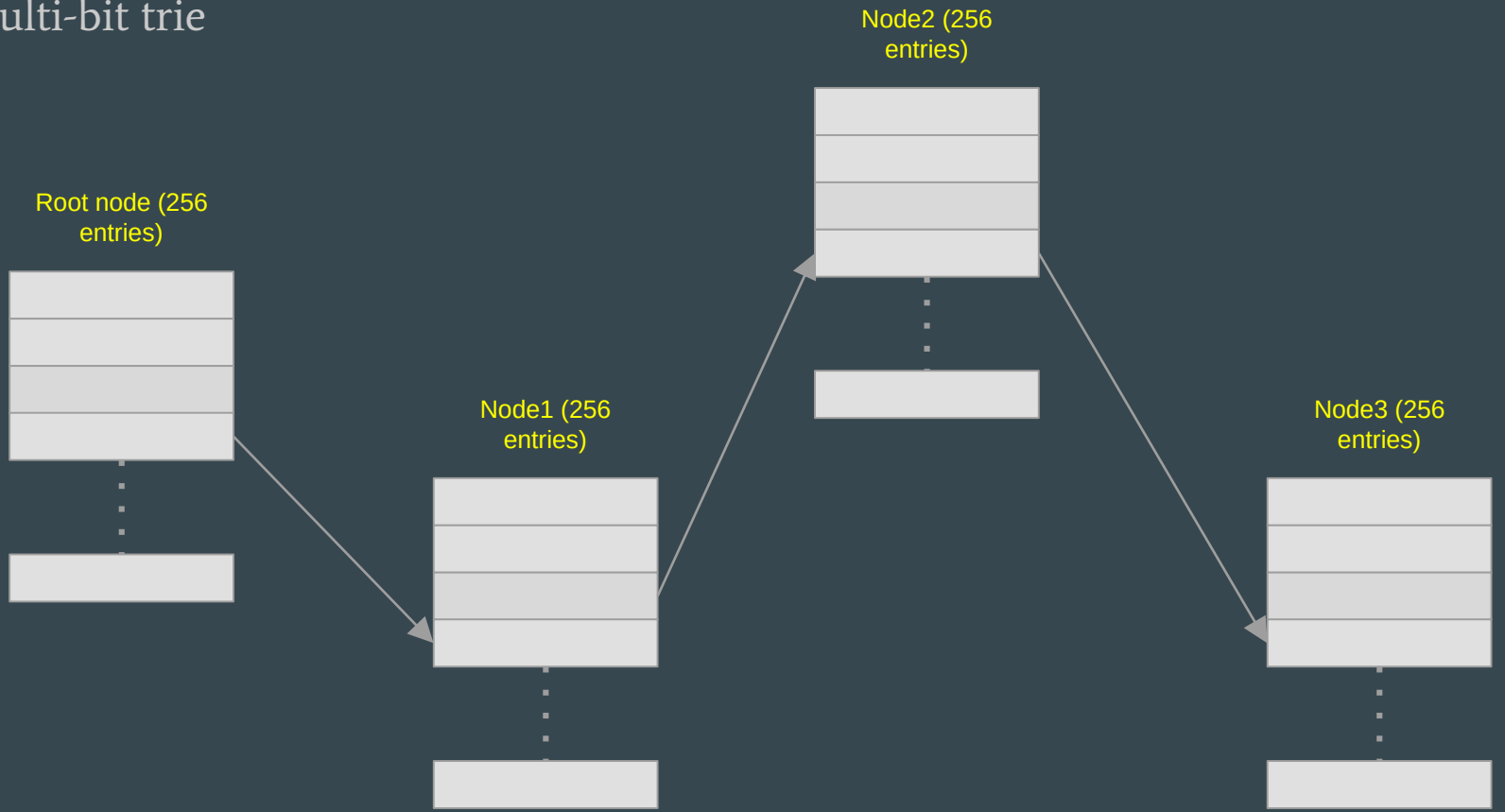
DPDK ACL library characteristics

Classification mechanisms:

- Scalar
- SSE
- AVX2

Based on multi-bit tries (stride = 8 = 256 bits = 4 bytes)

Multi-bit trie



ACL lookup example

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References

DPDK Programmer's Guide

Cuckoo Hashing Visualization

Jenkins hash function

Routing Lookups in Hardware at Memory Access Speeds

High Performance Switches and Routers book

MULTIBIT TRIES

My blog

Learning Network Programming