ORACLE

# The Maple Tree

## Enhances the natural flavour of waffles

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# Talk Agenda

1. The Maple Tree Overview
2. Locking
3. The RCU Future
4. Performance
5. Other Potential Users

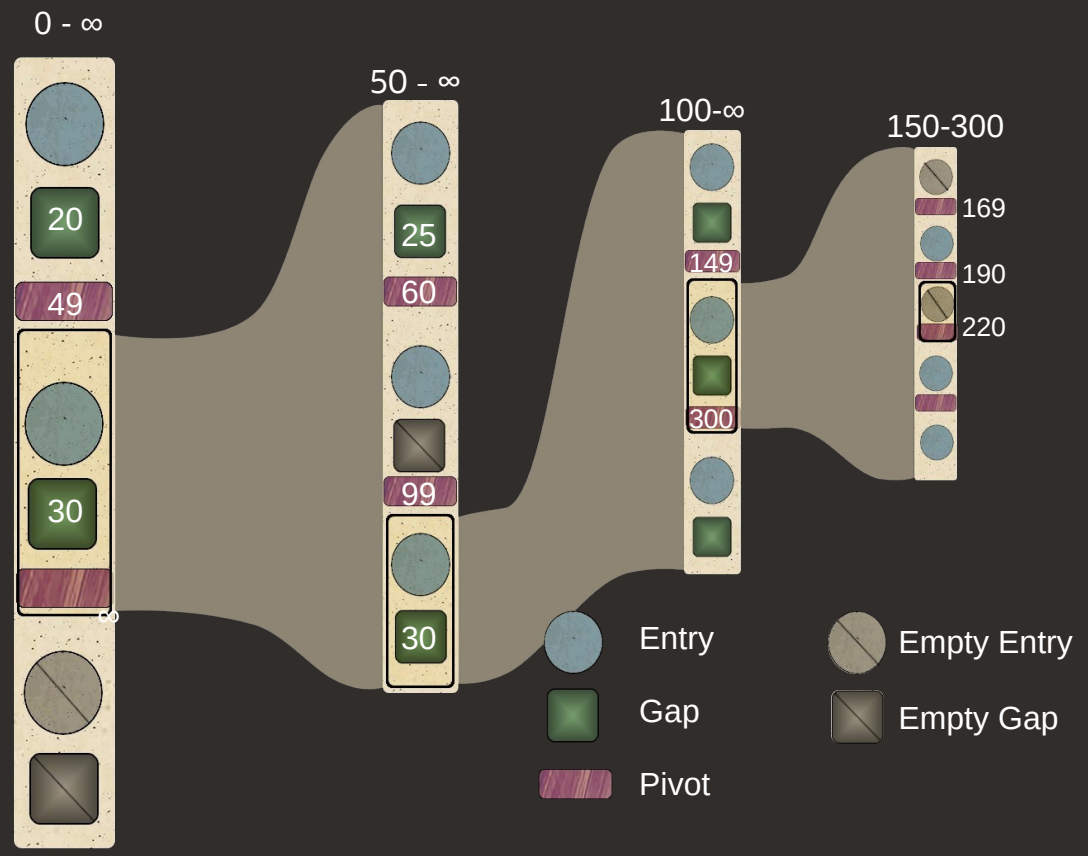
# The Maple Tree Overview

**RCU-safe, range-optimised B-Tree variant**

- All leaves are at the same height
- Self-balancing
- Cache efficient
- Supports bulk loading

**256 Byte Node**

- 10 internal or 16 leaf slots
- Search by Index
- Find gap by size





 | Hedge maples do well in many environments

# Locking

**Readers**

- mmap_lock()

**Writers**

- mmap_lock()
- i_mmap_lock_write()
- anon_vma_lock_write()

**Maple Tree Patches**

- Adds mas_lock() for writes
- Adds rcu_read_lock() for reads
- Iterators may handle locking

# The RCU Future

**Readers**

- rcu_read_lock()/rcu_read_unlock()
- VMA ref_count++/--

**Writers**

- Prepare for tree operations
- Mark VMA inactive
- mas_lock()/mas_unlock()
- Other locks need to be maintained, happen **before** mas_lock()

**Forking**

- mas_lock(), dup tree, mas_unlock()
- Iterate through VMAs, copy VMAs or delete them

# Performance

Based on maple tree v2 patch set

**Cache efficiency**

- VMA size 200B → 152B
  - 20/page to 25/page
- MM struct size  148B to 132B

**Real World Workloads**

- Close to no change
- Kernbuild: user time ↓, system time ↑
  - Elapsed time worst case is +~2% or less than 1s on a 32.87s build

**Trade off**

- Updates can be more work, but sometimes less!
- Reads are less

# Other Potential Users

**IDA/IDR**

- Dense nodes
  - Ranges of length 1 are inefficient right now
  - Encoded node types already supported

**Page cache**

- Search for marks as opposed to gaps
- Pruning of shadow entries

# Thank you

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