

Robert Bryant & Kevin Wang: Avuncular Fun

- given set S of nodes, root $r \in S$
- build tree on S

to minimize $\sum_{v \in T} \text{depth}(v) \cdot \text{key}(v)$

**NEW
PROBLEM**

where $\text{key}(v) = \# \text{ children } @ v$
or arbitrary pos. int. if
 $\# \text{ children}$ is fixed

- Avuncular property:

$\forall v, w: \text{key}(v) \leq \text{key}(w) \Rightarrow \text{depth}(v) \leq \text{depth}(w)$

- Problem 1: fixed branching factor

- $O(\lg^2 n)$ w.c. insertion/deletion to S

- $O(1)$ space/node

- $O(\lg n \lg \lg n)$ amortized via indirection

- $O(\lg n)$ via clever indirection

- Problem 2: variable branching factor

- seems difficult because of holes

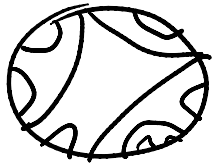
- lower bound?

RESEARCH

Katherine Lai: Cyclic Union-Split-Find

- union-find: $\Theta(\alpha(n))$
- union-split-find = predecessor with $u=n$
= $\Theta(\lg \lg n)$
↳ on intervals

- cyclic union-split-find:
chords in polygon or balanced parens.



$((())(())(())())$

- split = insert
- union = delete
- find = faces on either side of edge
- known: $\Omega(\log_w n)$
- **NEW:** $O(\log_w n)$
- based on strongly weight-balanced B-tree
with branching factor w^ϵ .

RESEARCH

Tural Badirkhanli: Worm Detection DSs

- worms are fast (minutes!)
- need automated detection/response
- content-based detection: $\rightarrow k$ bits
 - FPGA to compute hash on 80-bit sliding window of streaming data
 - signature over random combinations
 - \Rightarrow worm "fingerprinting"
 - Rabin-Karp fingerprinting
 - bitmap DS to decrease memory & accuracy

Galen Pickard: Gov't R&D on MST Algs.

- Lincoln Labs: Stellar: system for intrusion via hierarchical clustering
- essentially MST, but dynamic
- $O(n^2)$ via trivial rebuilding of MSTs
- $O(n^{1.2})$ average case [prior work]
- $O(n \lg n)$ via Holm et al. dynamic MST

IMPLEMENTATION

Anders Kaseorg: Fully Persistent Arrays = fully persistent RAM DS

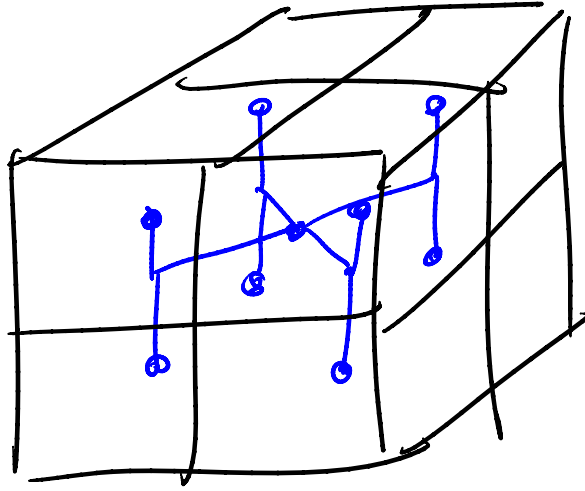
- $O(\lg \lg m)$ lookup, $O(\lg \lg m)$ expected amortized, $O(m)$ space [Dietz-WADS 1989]
- Euler tour on version tree
- order query DS on Euler tour, $O(1)/op.$
- vEB or y-fast trees for predecessor on (index, version) pairs $\Rightarrow O(\lg \lg m)$
- order query DS changes tags which incurs updates in pred. ~ouch
- both order query & y-fast DSs use indirection with $\lg n$ chunks @ bottom
- mix tops & bottoms separately

READING

Hui Tang: sculpture

- 8-way branching factor B-tree, depth 4
≈ 40 hours, 150 ft dowels
≈ \$150

- star of 4
from center,
H's to connect
to centers of
8 subcubes



Mashhood Ishaque: Half-plane Proximity Queries

- preprocess set of points
- query: given point & half-plane,
find nearest point in half-plane
- want: $\tilde{O}(n^2)$ preproc. & space } for diameter
polylog query } MST
- known:
 - simplicial partitioning [Daescu et al. - CGTA 2005]
 $\tilde{O}(n)$ preproc. & space
 $O(n^{1/2+\epsilon})$ query
 - points in convex position:
 - $[O(n \lg n)$ preproc. & space } [ibid]
 - $[O(\lg^2 n)$ query } [ibid]
 - $[$ poly. preproc., $\tilde{O}(n)$ space, } Aronov
 - $[O(\lg n)$ query } et al.
- idea: look at dual arrangement
 $\Rightarrow \tilde{O}(n^3)$ preproc. & space,
 $O(\lg n)$ query (general pt. set)
- minor improvements so far:
hope to get down to $\tilde{O}(n^2)$.

RESEARCH