

Concurrent Double-Ended Priority Queues

Fatourou Panagiota, Ruppert Eric, Xiradakis Ioannis

Motivation

- DE PQs are widely used in critical systems: Job scheduling, external sorting, Computer graphics and other applications requiring prioritized access from both ends.
- DE PQs have enhanced Functionality compared to single ended priority queues. Supports efficient deletion of both min and max elements.
- No existing implementations of concurrent DE PQs in the literature - we can create a DE PQ using BSTs

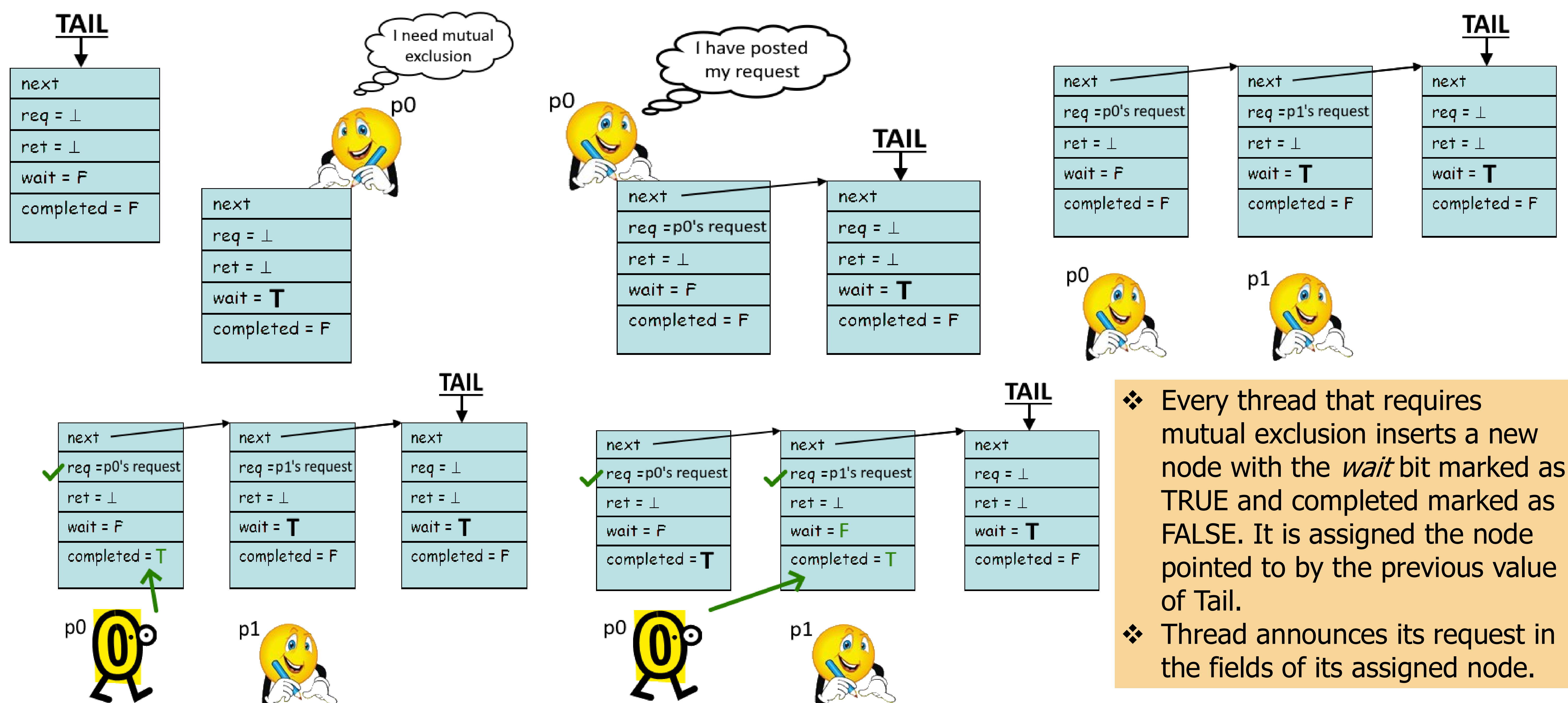
Challenge

- Synchronization is required between threads operating on the same and on different sides of the DE PQ.
- Deletes are more complex than priority queue deletions: they support additional functionality, and thus require implementing more operations.

Implementation

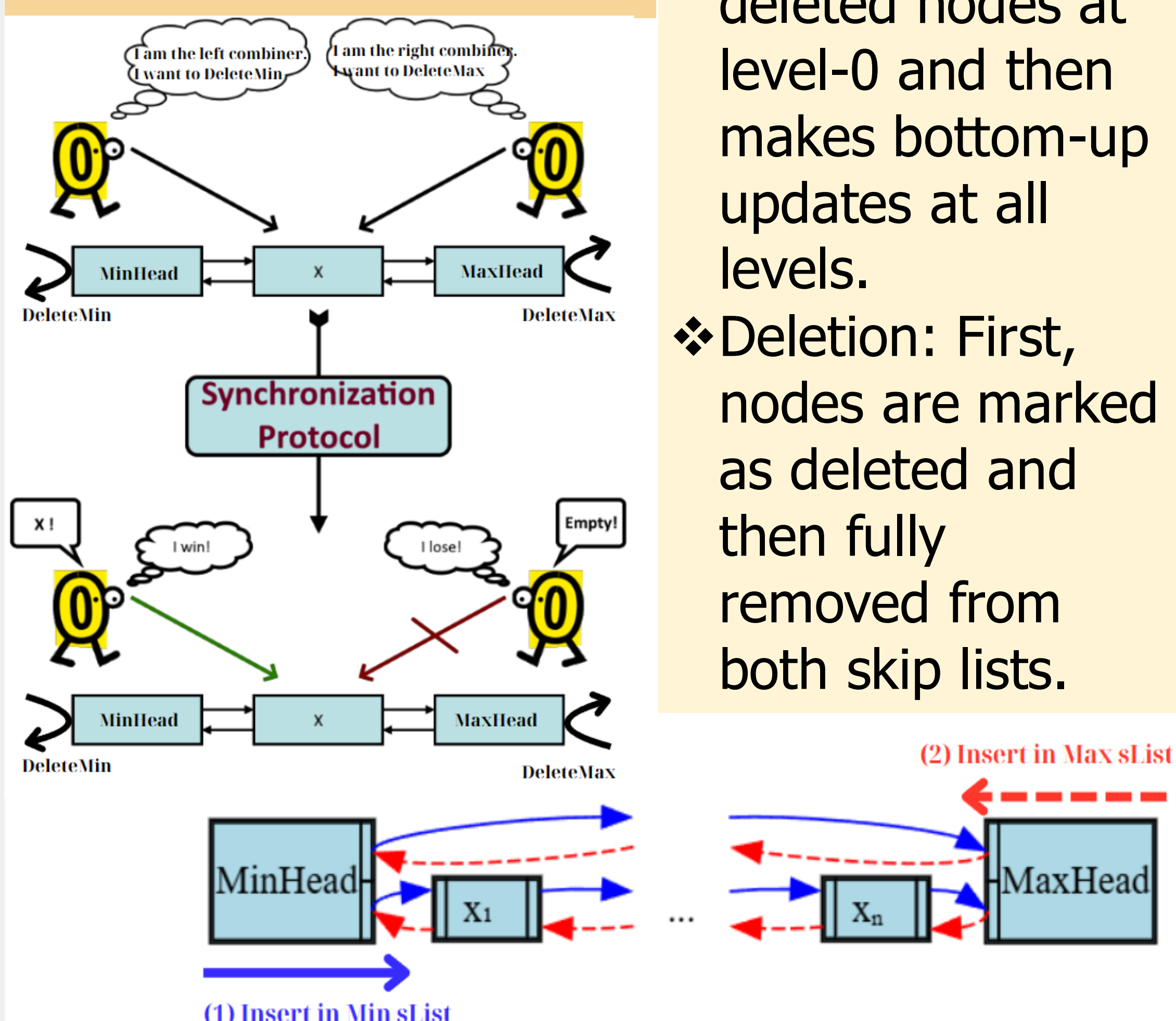
- ❖ Employs SoTA software combining algorithms: CC-Synch (Fatourou and Kallimanis PPOPP 2012).
- ❖ It uses one instance of CC-Synch for each of its two endpoint.

Software Combining



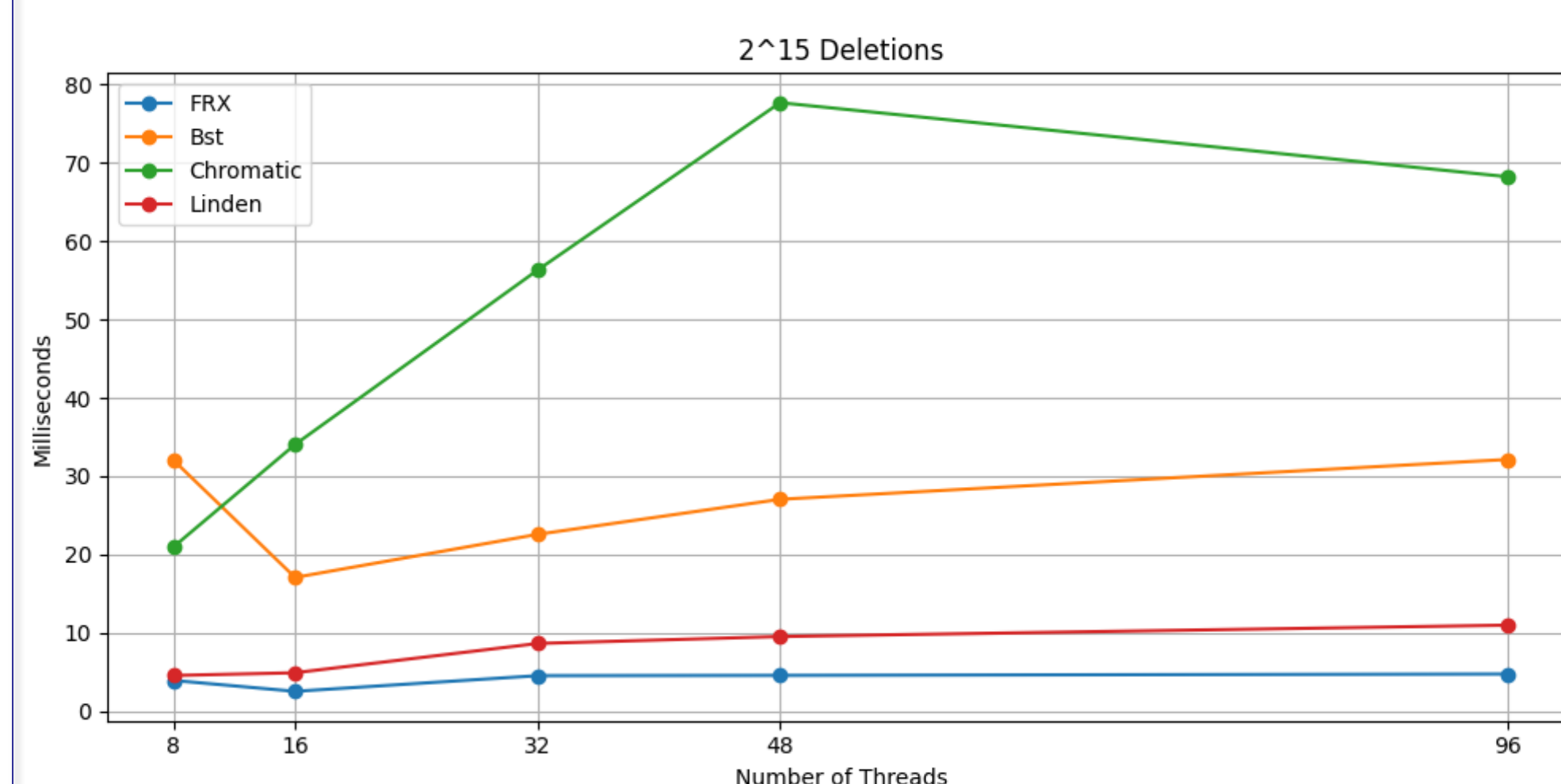
Double-Ended Priority Queues

Which combiner gets the node if both are trying to delete?



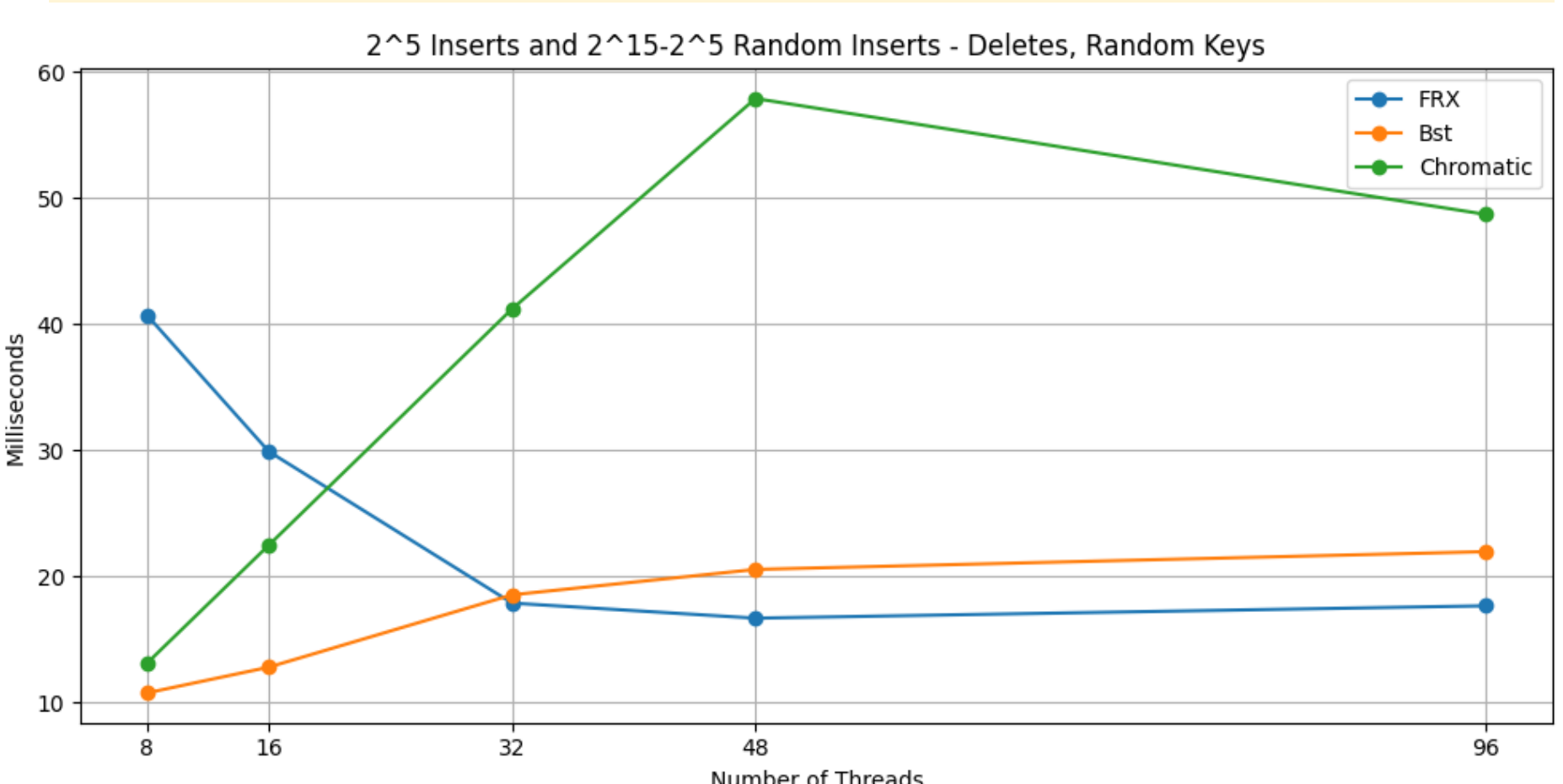
- ❖ Insertion: skips the logically deleted nodes at level-0 and then makes bottom-up updates at all levels.
- ❖ Deletion: First, nodes are marked as deleted and then fully removed from both skip lists.

Experiments



- FRX outperforms both the chromatic tree and BST-based DE PQs, thanks to its lightweight synchronization and elimination of rebalancing costs.

- FRX significantly outperforms concurrent tree-based DE PQs, thanks to its dual-skip-list design that avoids expensive rebalancing
- Even matches the performance of the single-ended PQ (Linden), despite supporting more complex operations.



HAR.S.H. (with no. YΠ3TA-0560901) is carried out within the framework of the National Recovery and Resilience Plan "Greece 2.0" with funding from the European Union – NextGenerationEU.

* Thanks to FORTH ICS for the provided support.

HAR.S.H. Partners



ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
UNIVERSITY OF CRETE



Contact Information

Xiradakis Ioannis
University of Crete, ICS-FORTH
giannisx@ics.forth.gr