Skip-lists container for STL

Team

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Abstract

Skip list is a data structure for storing elements in a sorted order. Search, insert and delete for elements takes $O(log\, n)$ in the average case, where n is the number of elements in the container. William Pugh, who first described them in 1989, tells that they are an alternative to height balanced binary search trees. He claims that algorithms for skip lists have the same time complexity as those for height balanced binary search trees but use less space, are simpler and faster too.

A skip list is a probabilistic data structure, it uses multiple layers of sorted linked lists to provide faster run-times for search / insert operations.

We shall provide an interface similar to that of the STL `list` container.
The iterator we shall support is the bidirectional iterator.

Some applications of skip lists -

- Used by Redis for ordered sets
- Used by Apache Hbase through the Java API
- Used by Google LevelDB
- Distributed applications make use of them for lock-free concurrent dictionaries and concurrent priority queues

Iterators:

- Bidirectional iterator
    - `begin`
    - `end`
    - `rbegin`
    - `rend`

- The following will be implemented as member functions due to logarithmic lookup of skip-lists:
    - `find`
    - `replace`
    - `reverse`
    - `merge`

References

1. https://www.cs.cmu.edu/~ckingsf/bioinfo-lectures/skiplists.pdf
2. https://cglab.ca/~morin/teaching/5408/refs/p90b.pdf
3. https://iq.opengenus.org/skip-list/
4. https://github.com/petegoodliffe/skip_list
5. https://en.wikipedia.org/wiki/Skip_list