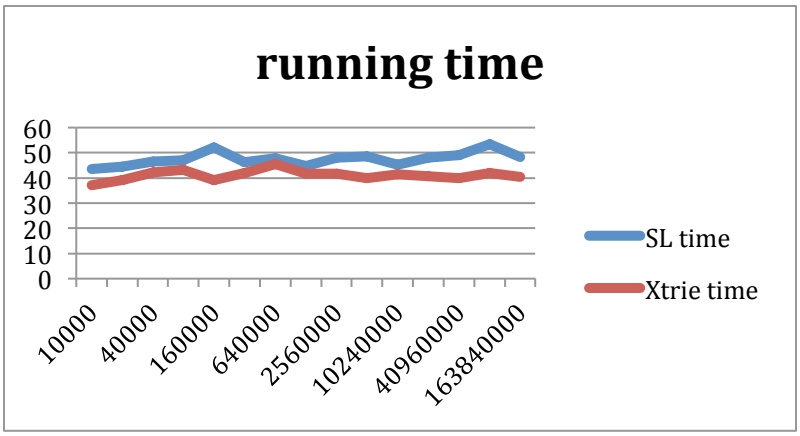
A Brief summary of the SkipTrie, SkipList and the X-Fast-Trie performance

Victor Jakubiuk

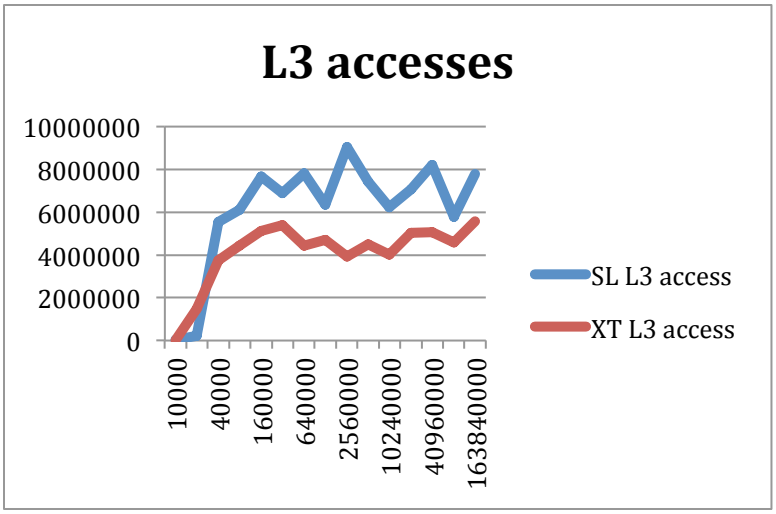
In short: the running time of the X-Fast-Trie is about 20% better than the running time of the SkipList (it's due to the L2 cache misses). Unfortunately, it's too little for the SkipTrie to improve meaningfully.

Here's how the conclusion has been reached:
(Please see the spreadsheet with data & all graphs for other performance counters).

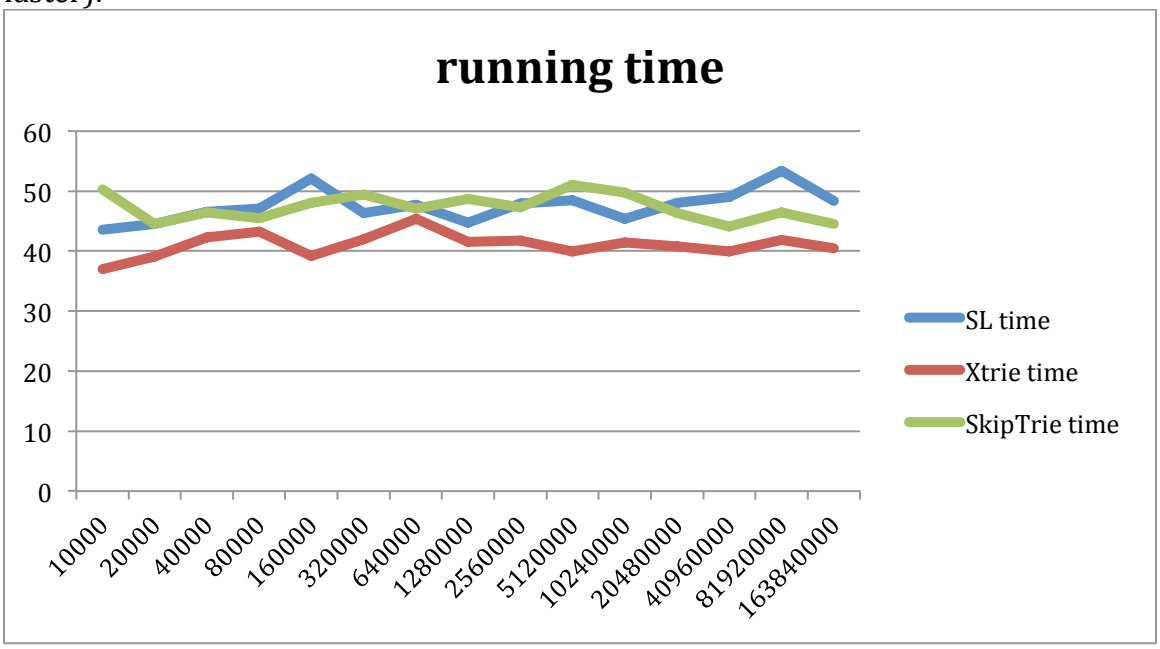
1. The X-Fast-Trie (with a regular, GCC/C++11 unordered map as a hash table) is about 20% faster than the SkipList (of the same size):



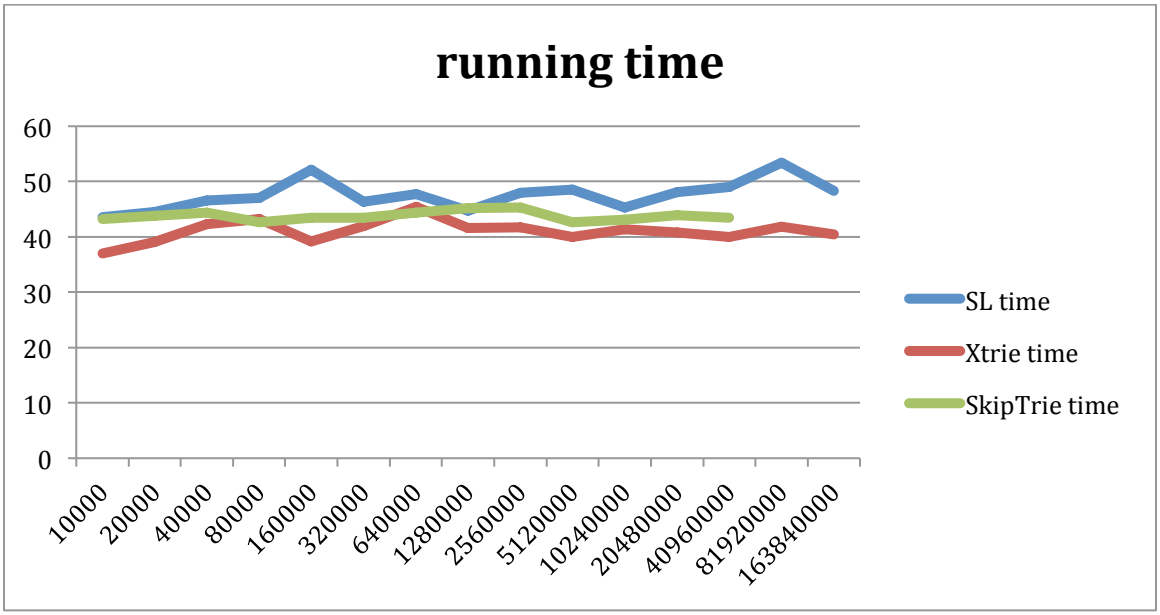
And this is mostly due to L2 cache misses (= L3 cache accesses):



2. Replacing top rows in the SkipList with a “small” X-Fast-Trie, barely improves the performance of the SkipTrie (since the trie is “small” and it’s anyway only 20% faster):

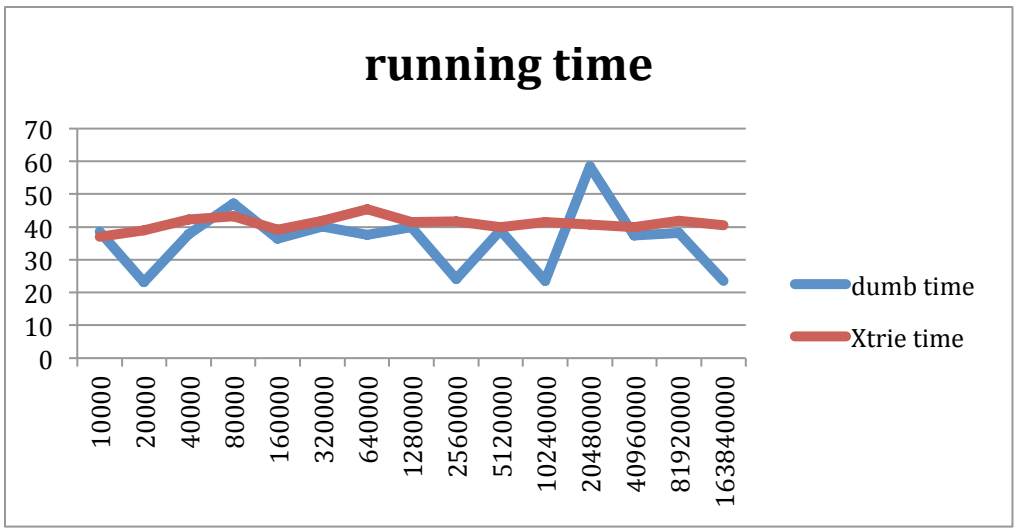


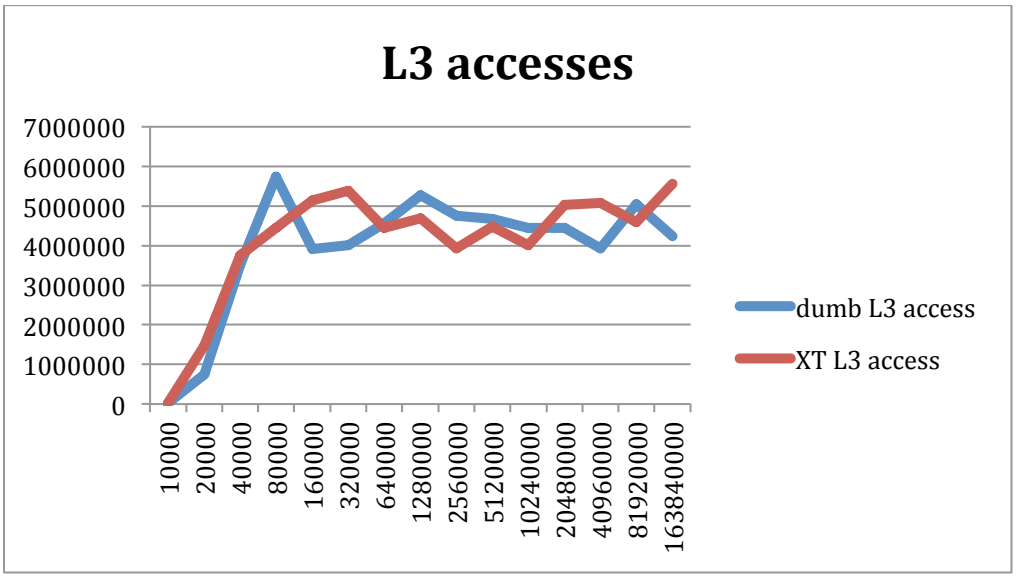
3. Increasing the size of the top X-Fast-Trie brings the SkipTrie performance characteristics (both the running time and the cache perf.) closer the performance of a full X-Fast-Trie. Here is a SkipTrie with only 2 levels of SkipList (everything else being stored in the X-Fast-Trie):



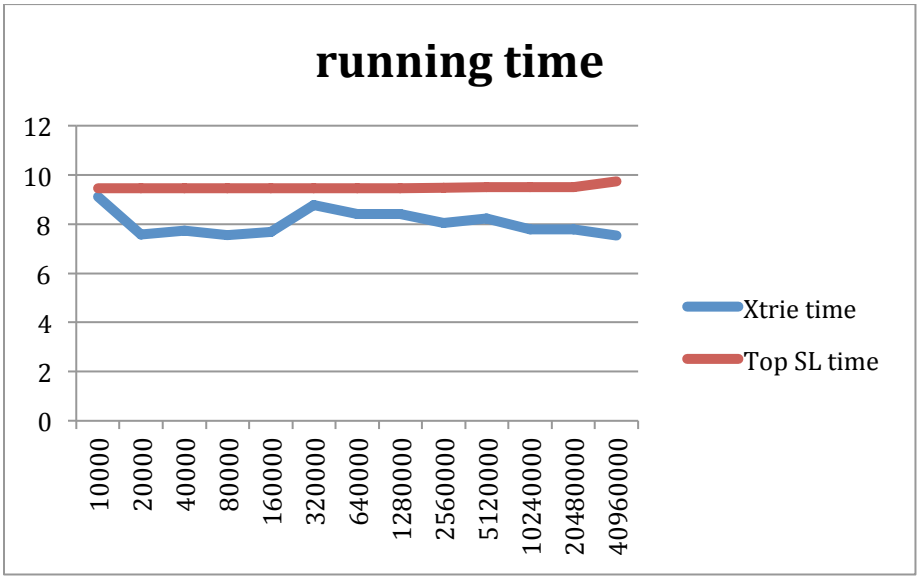
So, even in theoretically perfect conditions, the performance won’t be better than that of just X-Fast-Trie.

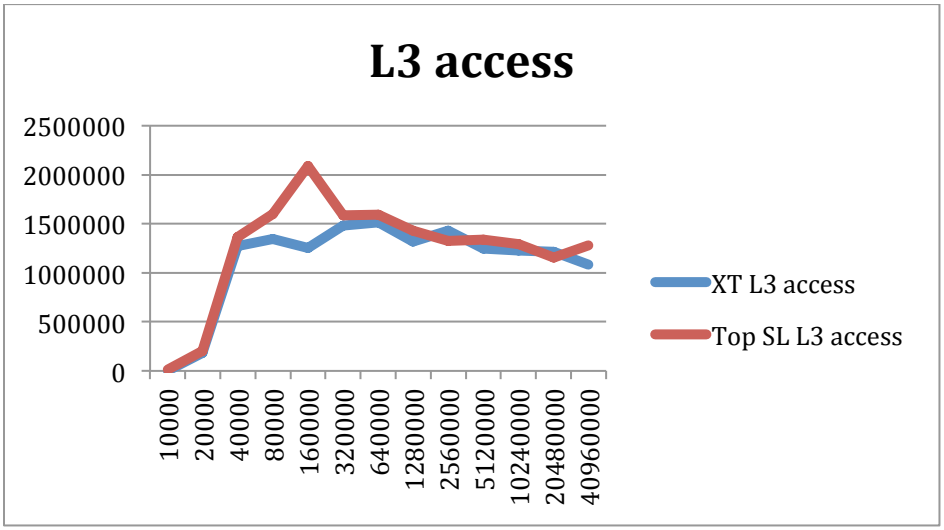
4. It is clear at this point the X-Fast-Trie (or the "top" structure) must be improved to see any gains in the SkipTrie. Specifically, its cache performance must be improved, as the instruction execution is insignificant. Here's the X-Fast-Trie versus dumb queries on random memory locations (same number of mem. locations accesses as the number of X-Fast-Trie's hash table queries):





5. Additionally, to ensure that the top of a "pure" SkipList doesn't have hot-paths that might be constantly cached etc. (which would imply that the "top" of the SkipList is faster then the bottom), the "top" X-Fast-Trie from the SkipTrie and the top level (top 15 – the stuff that gets cut off in the SkipTrie) queries of the SkipList were compared:





Again, the time performance of the X-Fast-Trie is about 20% better than that of SkipList. This time, however, it's not due to L3 accesses.

This leads to the conclusion, that the current X-Fast-Trie is not a sufficient improvement and some other structure must be used.