Bring the Adaptive Radix Tree (ART) to the next level of efficiency

Data Structure Engineering is about making data structures (search tree, hash table, priority queue) efficient and robust in practice. While in theory there is an emphasis on asymptotic complexity; e.g., *O(log n),* it is not enough for good performance. Through differences in hardware specializations of data structures can bring gains. Instead of taking already built implementations they still can be optimized for special use cases and special requirements.

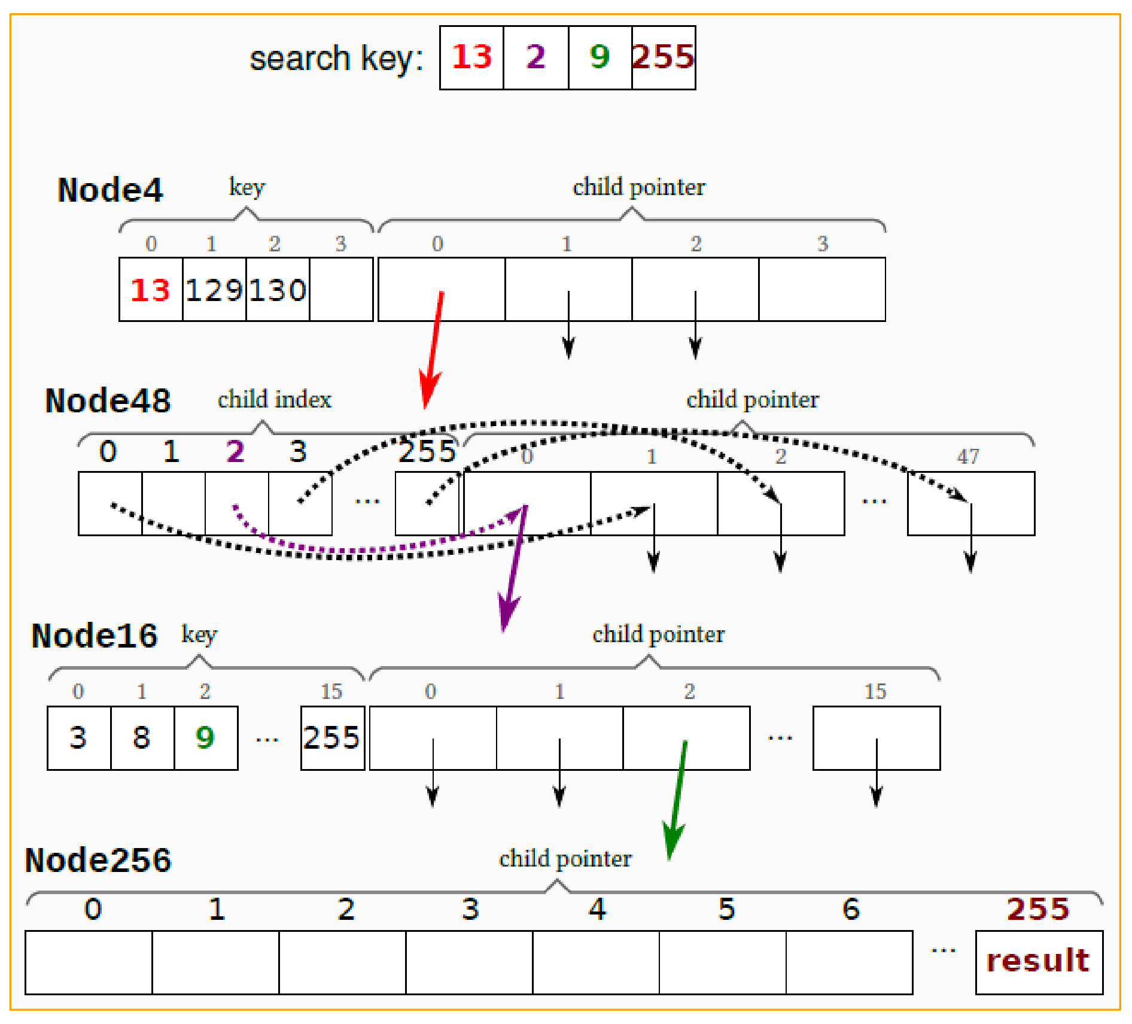
Adaptive Radix Tree (ART) is a very efficient type of trie based index structure. The process behind this tree is that no matter how big our database is, the lookup complexity will only depend on the word's length. This data structure is simple to understand. It implies no balancing process; and it has a wide fanout possibility. Such efficiency can be explained by the fact that ART compresses the tree database both vertically (to reduce the tree height) and horizontally (to reduce nodes' size).

Space-Efficient Radix Tree (SPERT)

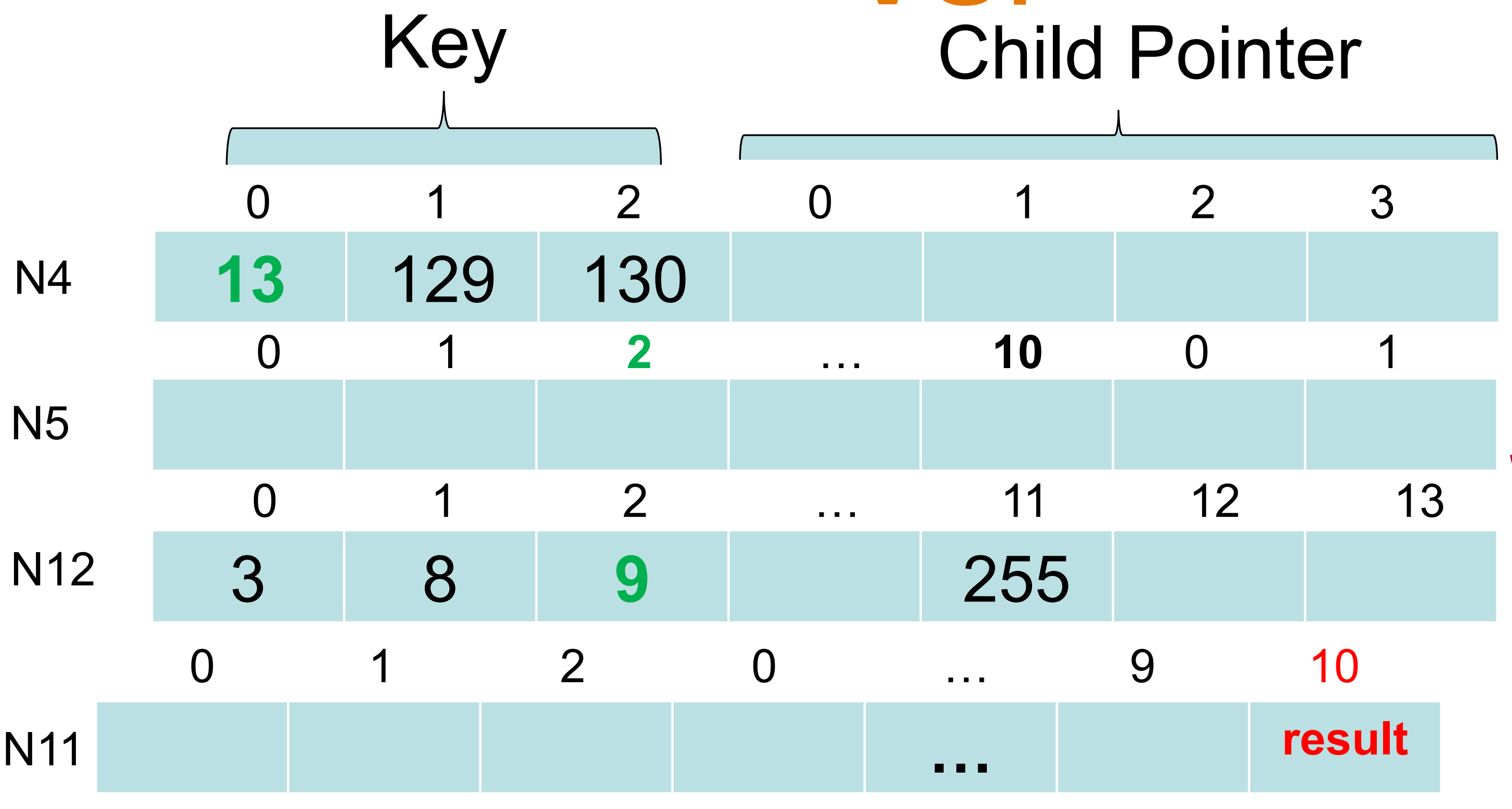
The Space-Efficient Radix Tree is a new version of the original Adaptive Radix Tree. It has nodes of same sizes. While the ART chooses fanout by checking the key, SERT is changing the number of bits from the key dynamically and keeps the fanout size almost the same. The idea is not only to limit this kind of trie for the RAM hardware but also use it for data stored in main memory. This would show that SPERT is not only efficient on RAM but also on long-term memory.

Example

ART



VS.



SPERT

Evaluation

Rafael Kallis from the university of Zürich implemented the adaptive radix tree from his work paper. We could use the last stable release of ART and make the code evolve to implement the SPERT

Using Prof. dr. Viktor Leis' tool perfevent we could measure the efficiency of the SPERT compared to the other trie trees results.

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