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Implementing Faster Associative Containers for GIDs in HPX

John Bell¹, Parsa Amini², Dr. Hartmut Kaiser²

1-Department of Computer Science, Louisiana State University – Shreveport, 2-Center for Computational Technology, Louisiana State University

Introduction

- HPX is a general purpose C++ runtime system for parallel and distributed applications and can run on multiple localities.
- HPX uses associative containers extensively for its Global Identification addresses (GIDs).
- Associative containers hold data by pairs in a key, value relationship.
- Multiple associative containers need to be compared using the most common database operations.
- Narrowed the search to binary searches trees that are or can be implemented and Standard Template Library compatible.

Objective

- Topic: Work with various associative containers and either determine or refine one or several to optimally work with HPX.
- Goal: To select the best performing data structure for AGAS used to lookup information about GIDs.
- Task: Testing data bases along with benchmarking.

Experimental Process

- Created benchmark that concentrates on the main operations performed on databases.
- Examined our current database and analyzing what operations are being performed the most.
- In the last phase – Identify the best case scenario of databases (which may mean the combining of certain aspects of various databases) and then maybe implement it into HPX.

Results

Benchmark Program

Key Features:

- Uniform data sets (1million – 10 million elements).
- Measured time for each tasks:
 - Insertions
 - Searches
 - Deletions

Search Trees

2-3	Bx	Map
2-3-4	(Optimal) Binary Search	Unordered Map
AA	Dancing	123 Top-Down List
(a,b)	H Tree	S-Tree
AVL	Interval	Splay
B+	Order Statistic	T
B	(Left-leaning) Red Black	Treap
B*	Scapegoat	UB

Table displaying identified search trees

Revised Search Trees

2-3	AVL	Map
B	(Optimal) Binary Search	Unordered Map

Table displaying search trees implemented into C++

Analysis & Conclusion

- Examined several data structures using a benchmark program. Concentrating on the main operations performed on databases.
- Six were implemented six and still being evaluated in each category.
- In the last phase – Identify the best case scenario of databases (which may mean the combining of certain aspects of various databases) and then maybe implement it into HPX.

Next Steps

- Revisit the list and maybe implement more search trees.
- Use the benchmark program to evaluate other programs.
- Create new data sets for better evaluation.

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