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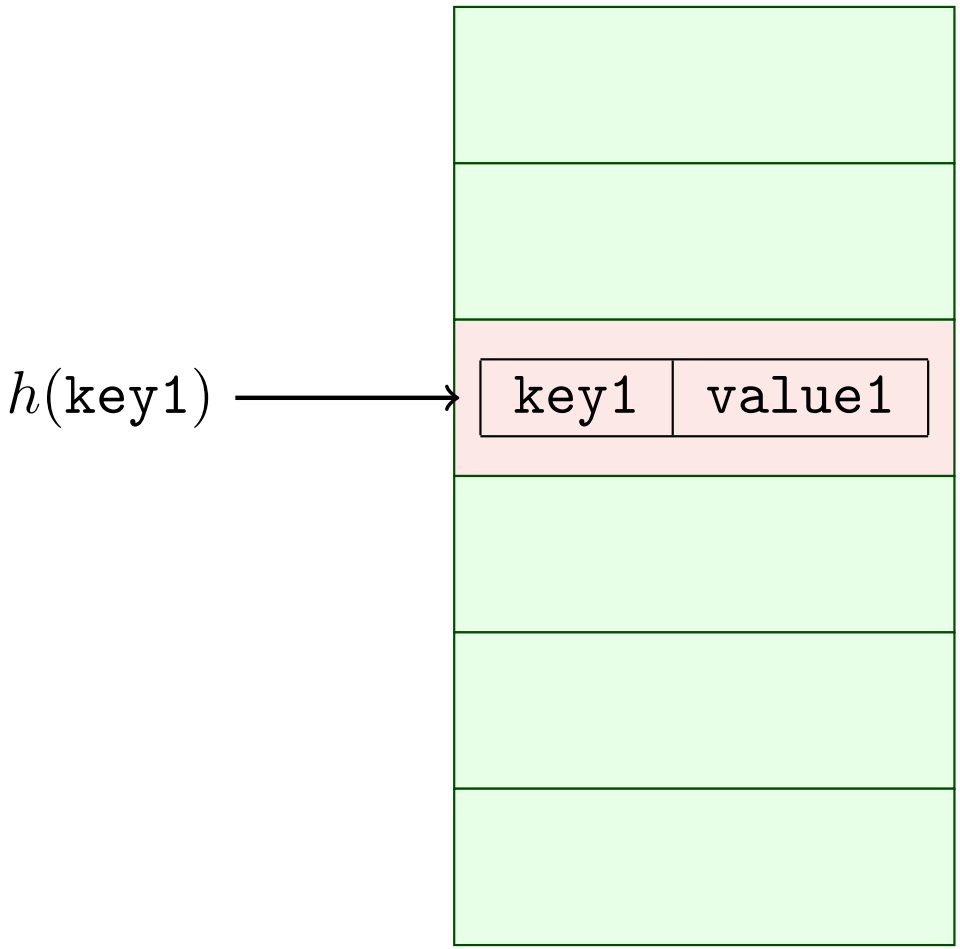
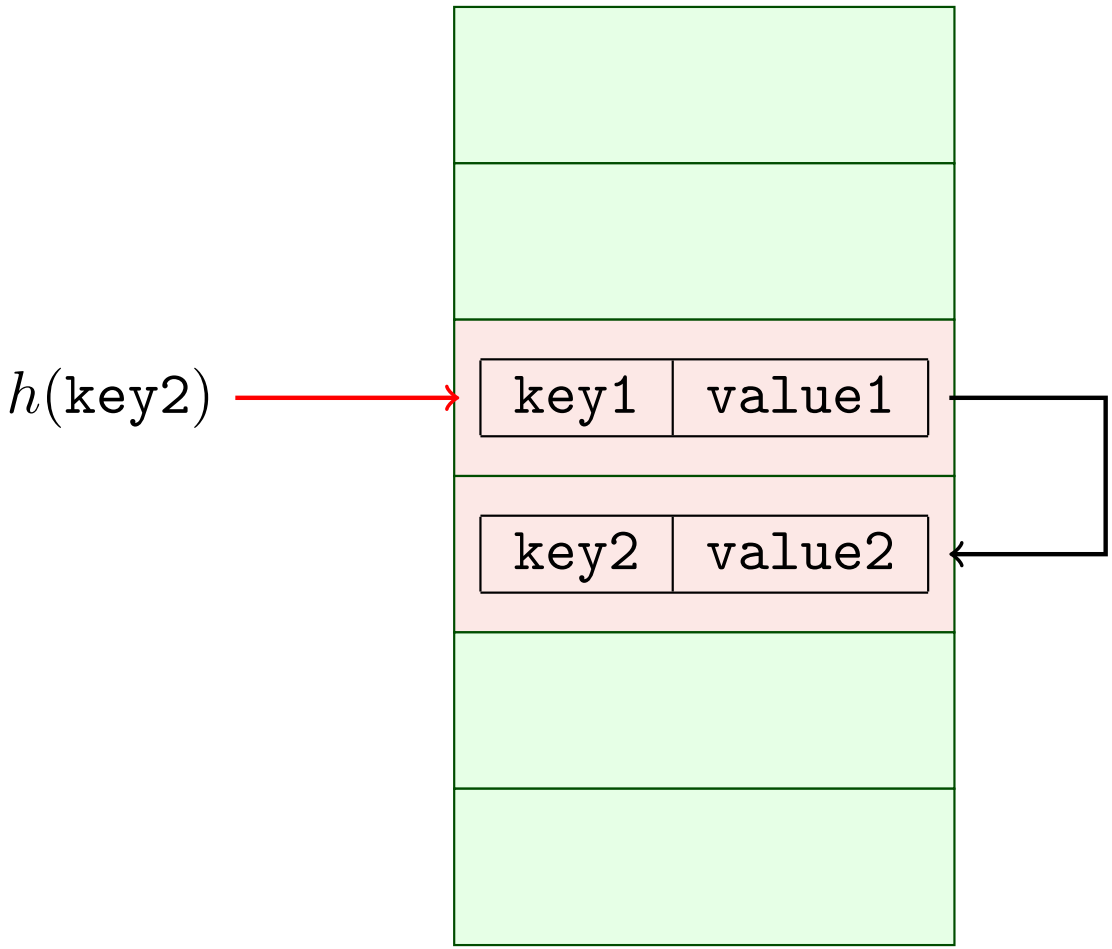
Outline

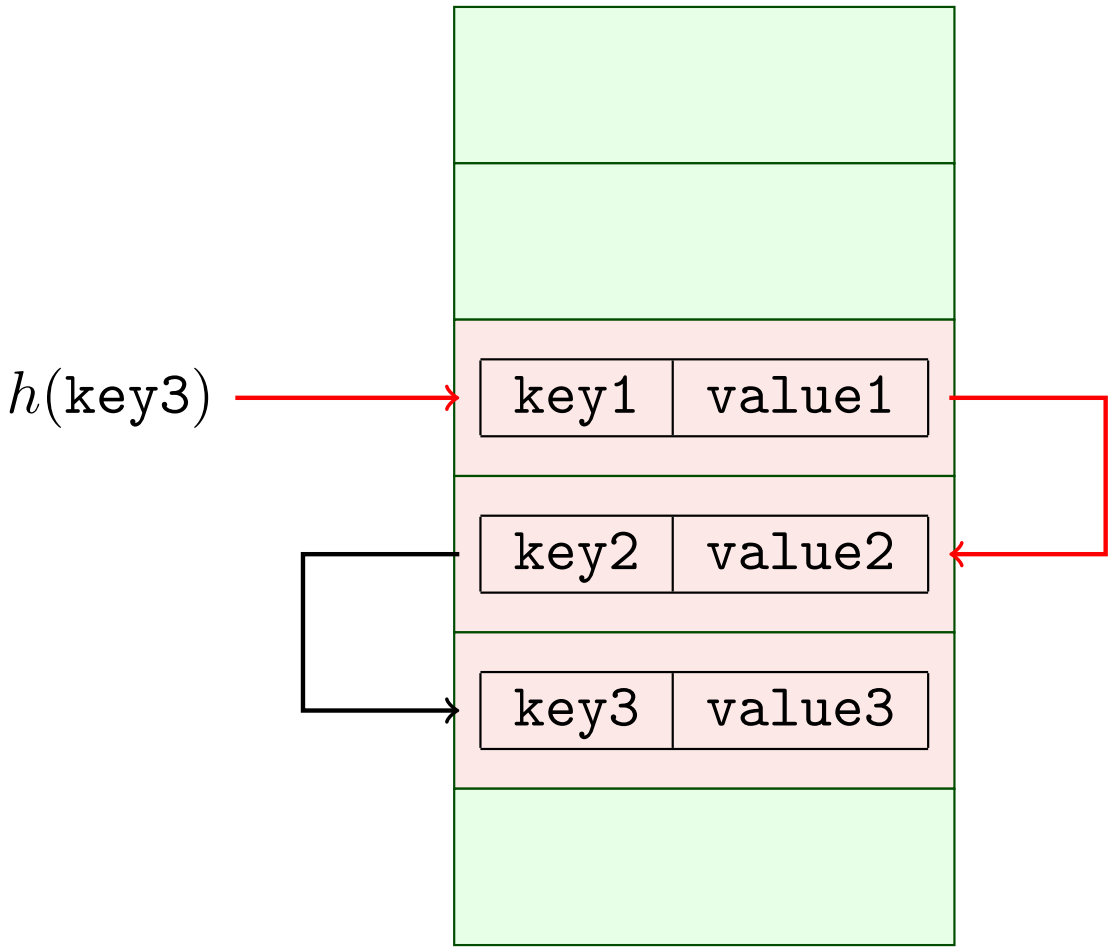
Naive hash table



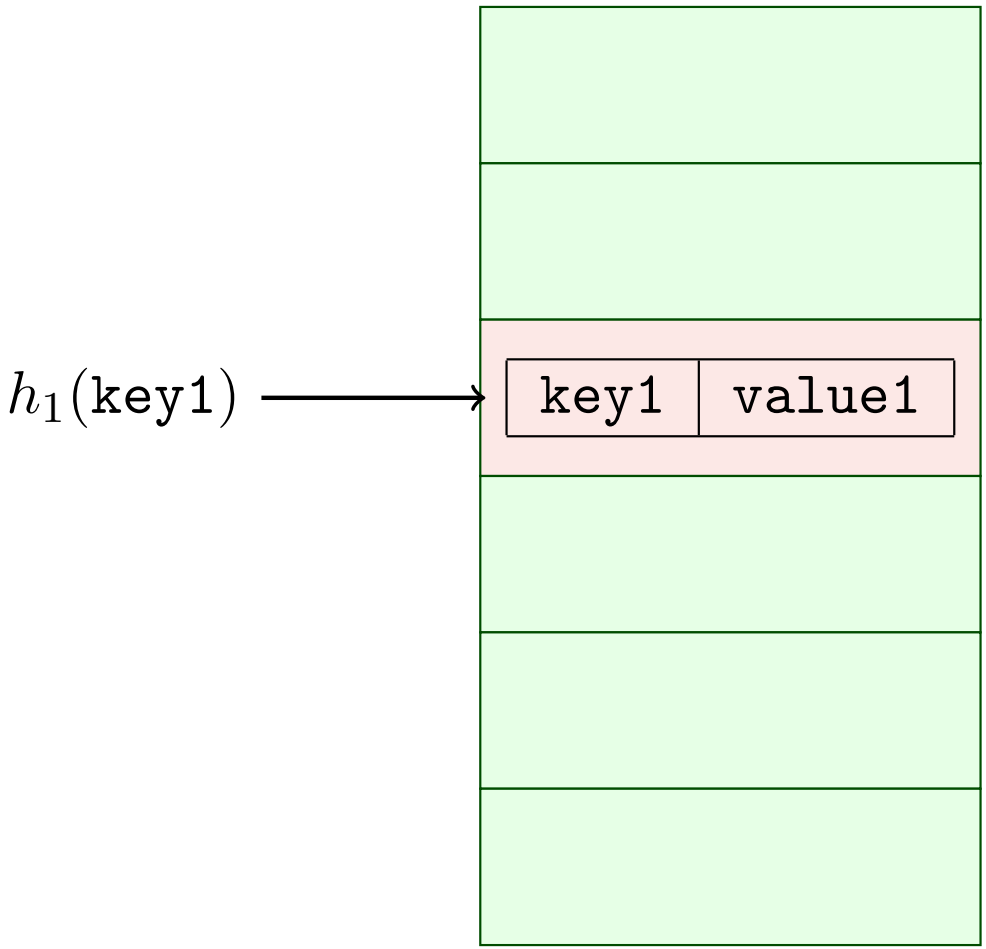
Naive hash table



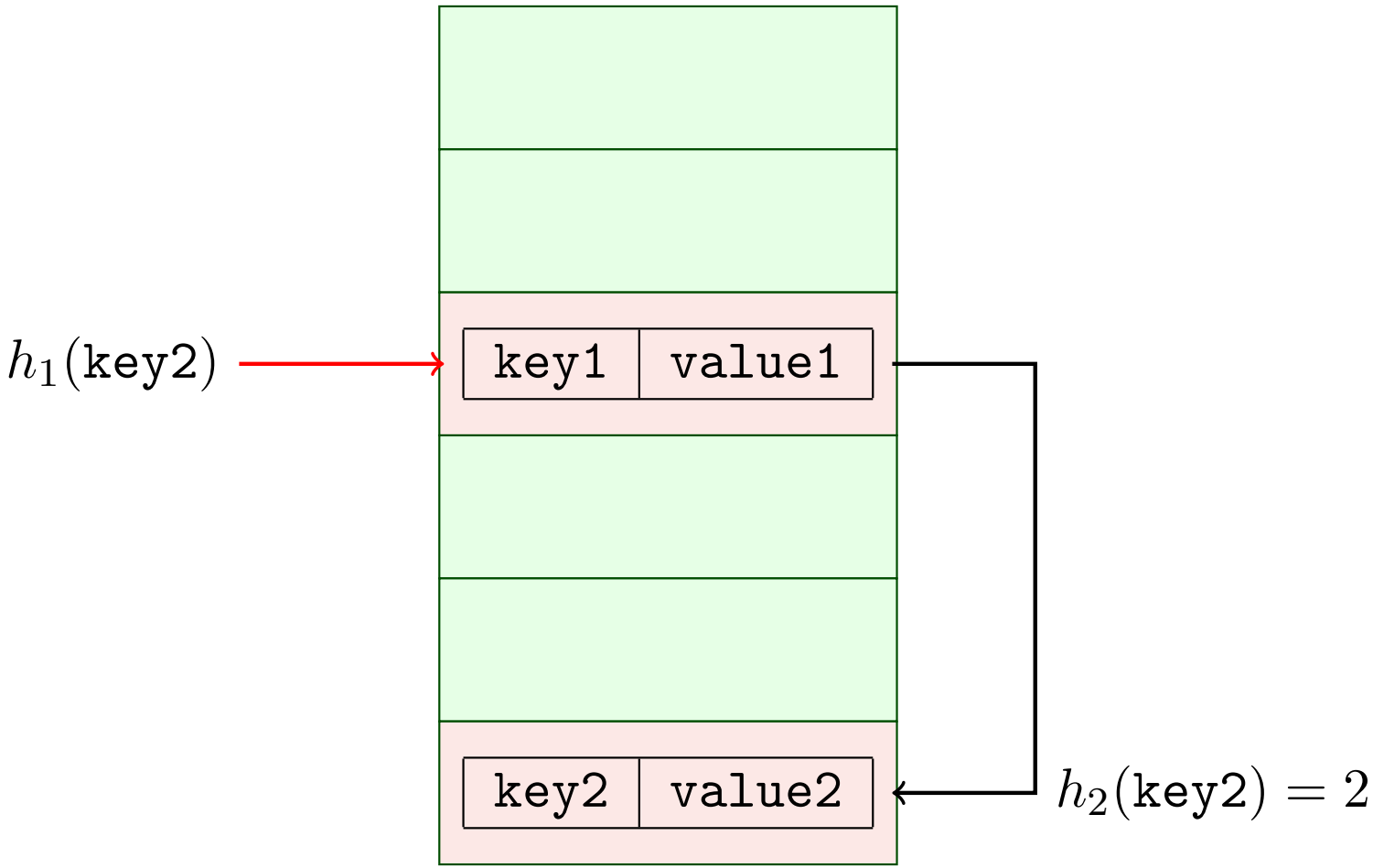
Naive hash table



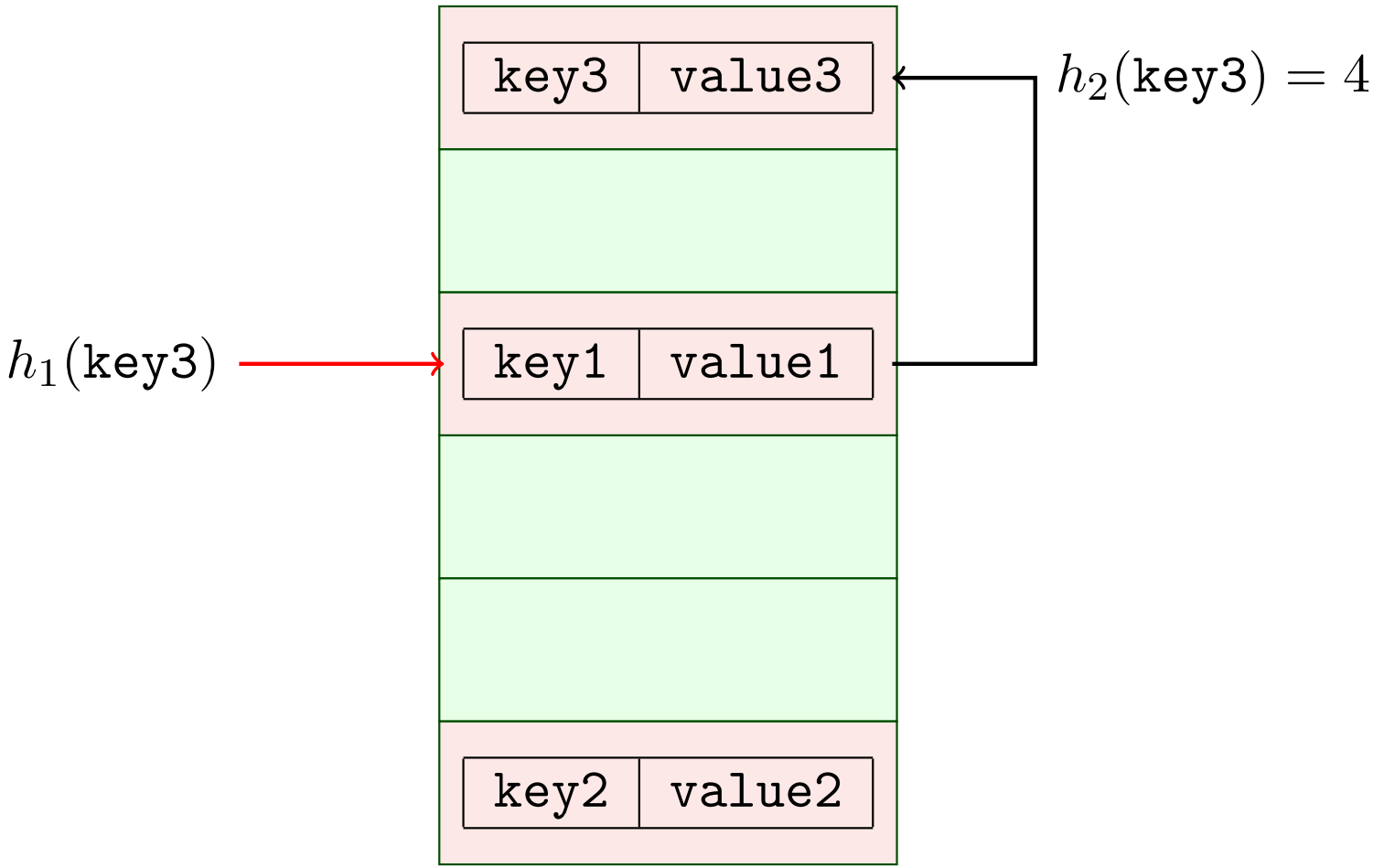
Double hashing



Double hashing



Double hashing



Provided implementation

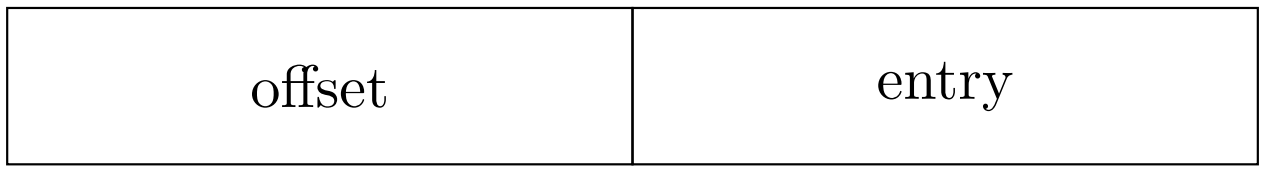
findEmpty, findKey

Provided verification

Outline

Modifications

- 64 bits hashes.



Except type changes, only `for` loops modified.

Performance evaluation

- Build a benchmark tool.
- Size, number of accesses, load, read/write ratio, etc...
- Converter to C file.
- First warms-up, then measures when target load is reached.

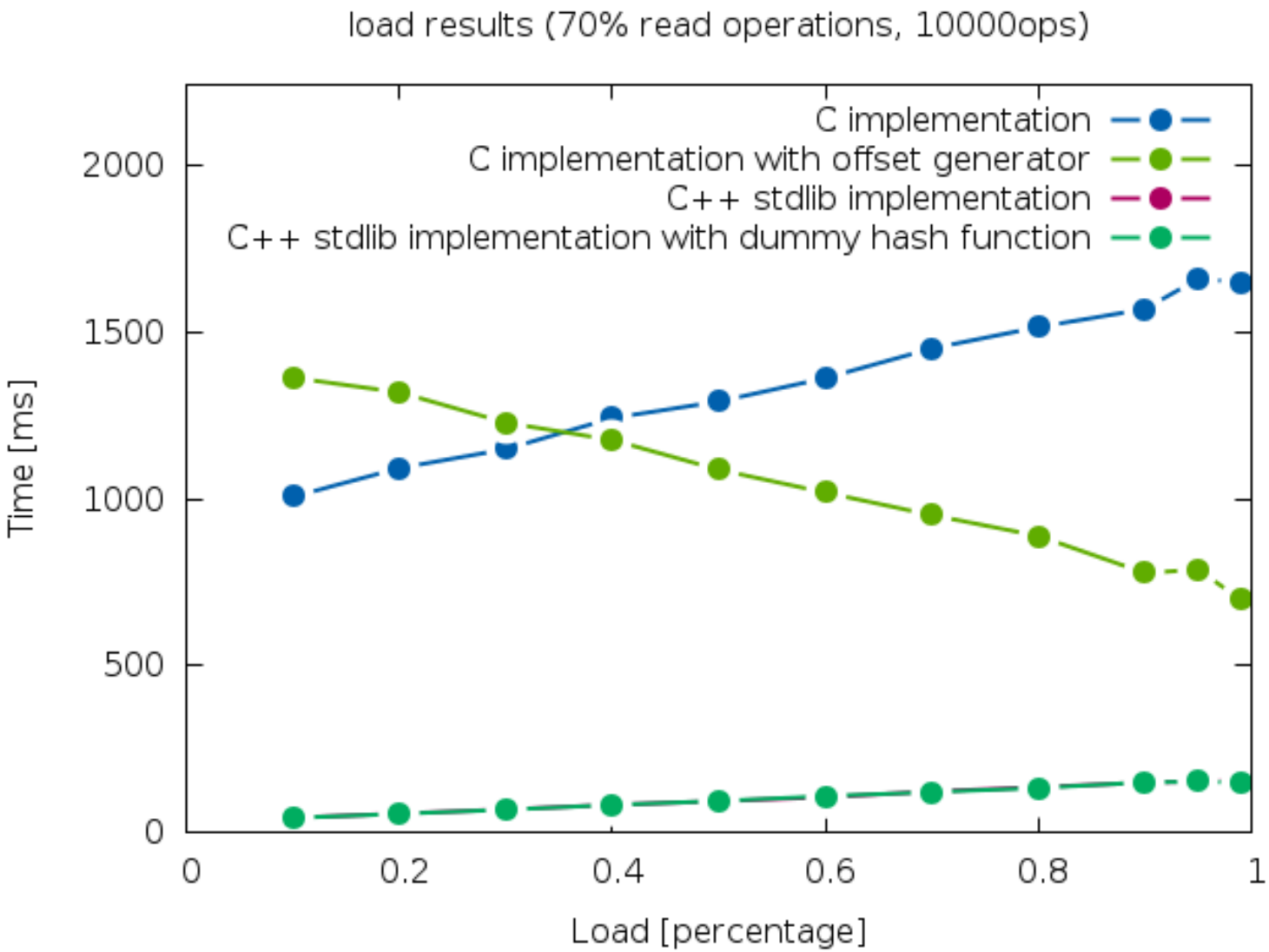
```
test_load.sh length read_ratio load1 [load2...]
```

Evaluation cases

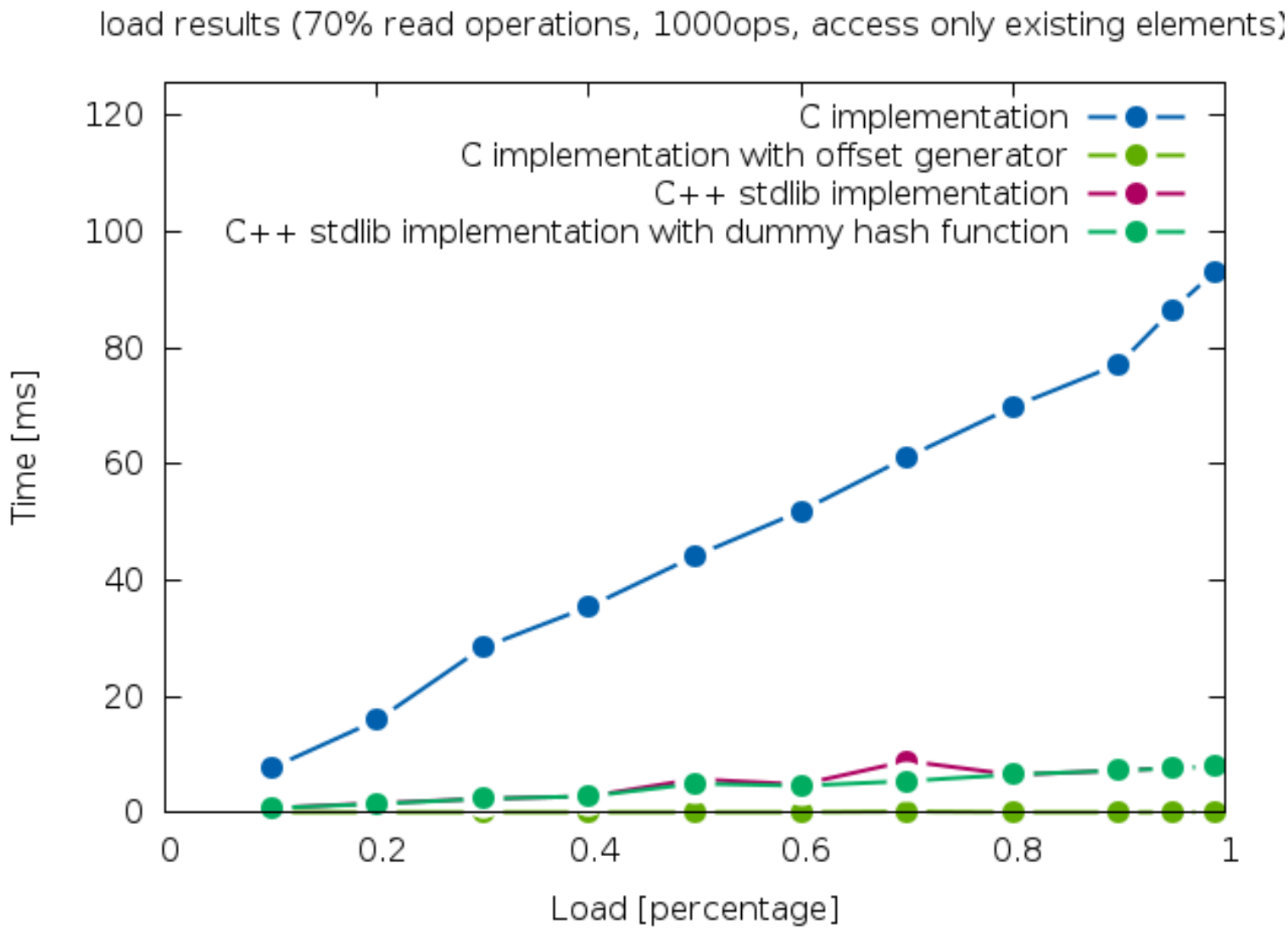
- Worst case: searching a non existing element.

1. Allow searching non existing element.
2. Search only existing element.

Result


load results (70% read operations, 10000ops)
C implementation
C implementation with offset generator
C++ stdlib implementation
C++ stdlib implementation with dummy hash function
Time [ms]
2000
1500
1000
500
0
0
0.2
0.4
0.6
0.8
1
Load [percentage]

Result – only existing



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Hash-Table software

- Efficient (when key is present).
- Formally verified.
- Requires `capacity` and `offset` coprime.

Side effects

- 6 commits in Verifast tree (`long long` support).
- 9 issues on Verifast.
- A random access sequence generator & benchmark.

Q&A