Intra-bank hash maps in BLIMP

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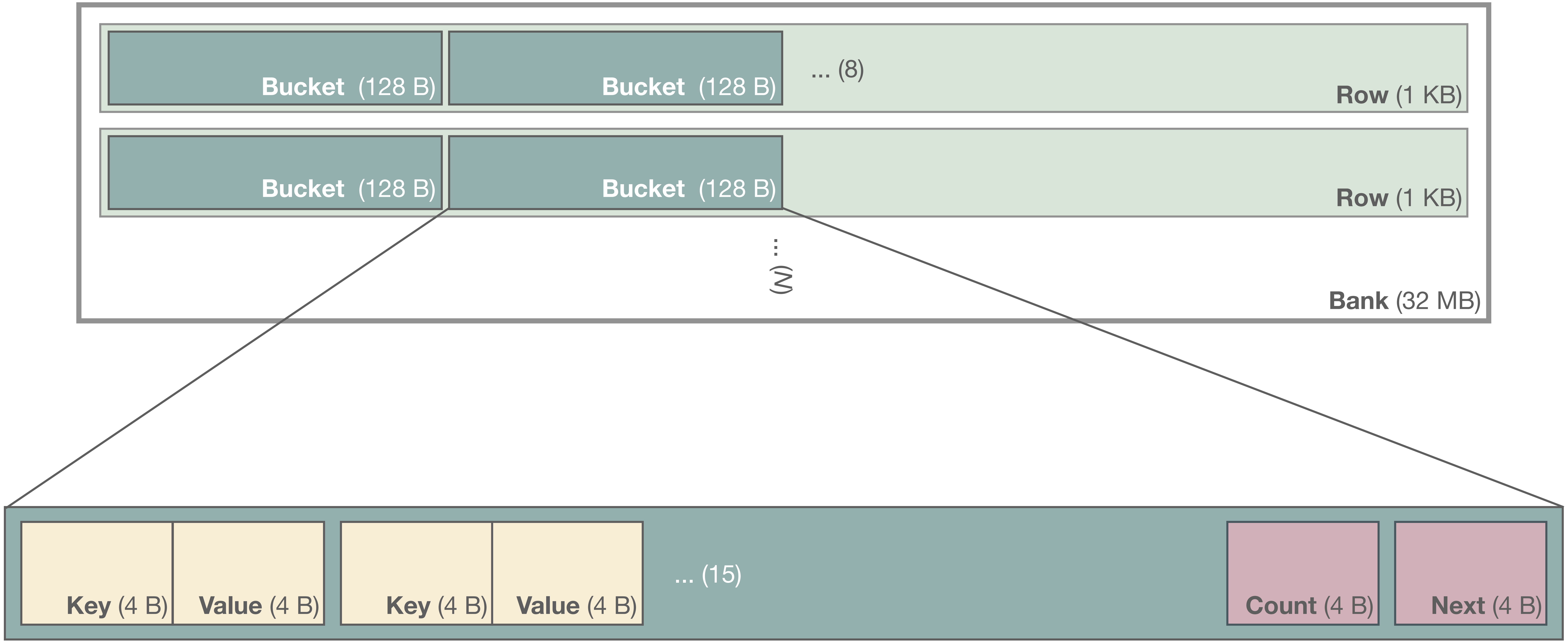
Motivation

- We need an efficient data structure that enables random lookups to perform hash joins and hash aggregates.
- We need to tailor the design to BLIMP's unique characteristics.

Overview



Bucket (128 B)
Bucket (128 B)
... (8)
Row (1 KB)
Bucket (128 B)
Bucket (128 B)
Row (1 KB)
... (N)
Bank (32 MB)
Key (4 B)
Value (4 B)
Key (4 B)
Value (4 B)
... (15)
Count (4 B)
Next (4 B)

Insert

Input: a (key, value) pair

```
bucket = buckets[hash(key)];
WHILE (bucket.next != NULL) {
    bucket = bucket.next;
}
IF (bucket.count == 15) {
    bucket = new_bucket(bucket);
}
bucket[bucket.count] = (key, value);
++bucket.count;
```

Get

Input: a key.

Output: a pointer to a value (may be NULL).

```
bucket = buckets[hash(key)];
WHILE (bucket != NULL) {
    FOR (i IN [0, bucket.count)) {
        IF (bucket[i].key == key) {
            RETURN pointer to bucket[i].value;
        }
    }
    bucket = bucket.next;
}
RETURN NULL;
```

Modeling

For 1 million elements and varying load factor α, what is the probability P that we find a given item in the **first** bucket we check?

The probability P is given by

$$P(\alpha) = \sum_{i=0}^{\infty} F\left(i,\ 10^6,\ \alpha\frac{15}{10^6}\right) \cdot \frac{15}{\max(i,15)}$$

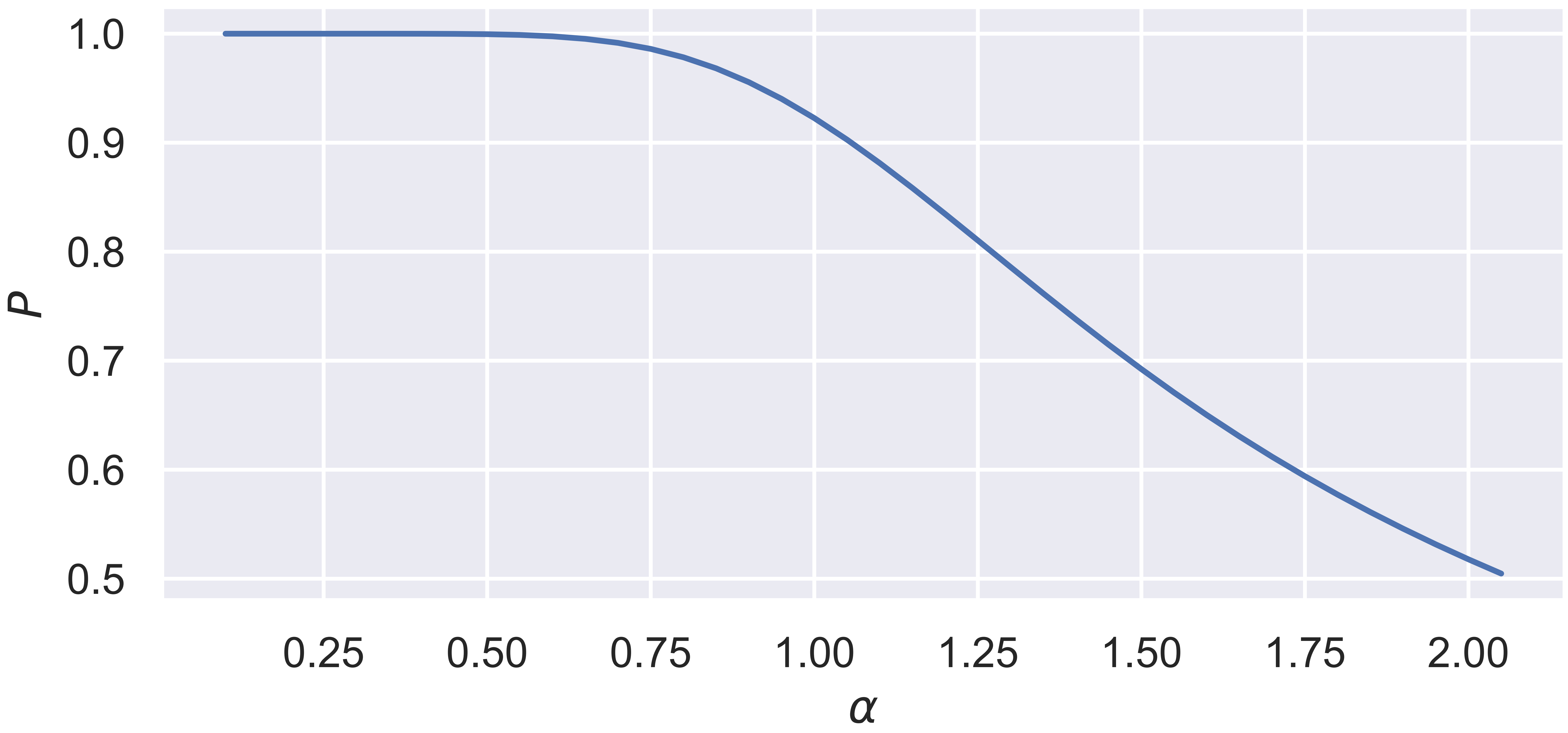
Probability of a super-bucket having i elements

Probability of finding an element in the first bucket of a super-bucket.

where $F(k, n, p)$ is the probability mass function for the binomial distribution with number of trials n and probability of success p.

Modeling

For 1 million elements and varying load factor α, what is the probability P that we find a given item in the **first** bucket we check?



1.0
0.9
0.8
0.7
0.6
0.5
P
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
α