

Inverted Indices: Design and Experiments

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The Case for Inverted Indexes



doc 1	tkn 1	tkn 2	tkn 3	tkn 2	tkn 4	...
doc 2	tkn 503	tkn 372	tkn 504	tkn 278	tkn 336	...
...						
doc N						



Secondary Index Types in ClickHouse

	Small	Probabilistic	Token-level
MinMax	✓	×	×
Set	-	×	×
Bloom	✓	✓	×
N-gram Bloom	-	✓	✓
Token Bloom	-	✓	✓
New: Inverted	-	×	✓



SQL Syntax

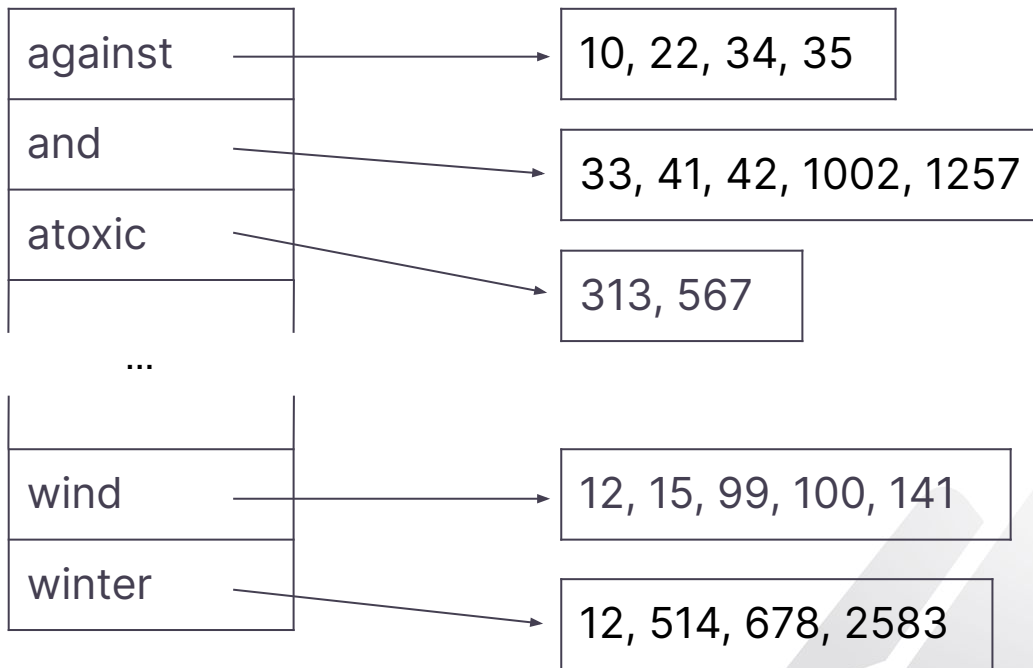
- ```
CREATE TABLE tbl (
 k UInt64, s String,
 INDEX idx(s) TYPE inverted(N)) -- N = 0: word N = 1...8: ngrams(N)
Engine=MergeTree
ORDER BY (k);
```
- ```
SELECT * FROM tbl WHERE hasToken(str, 'ClickHouse');  
SELECT * FROM tbl WHERE str != 'Hello World';  
SELECT * FROM tbl WHERE s LIKE '%I love ClickHouse%';
```



Design I

**Dictionary
(sorted tokens)**

**Posting Lists (sorted
document numbers)**



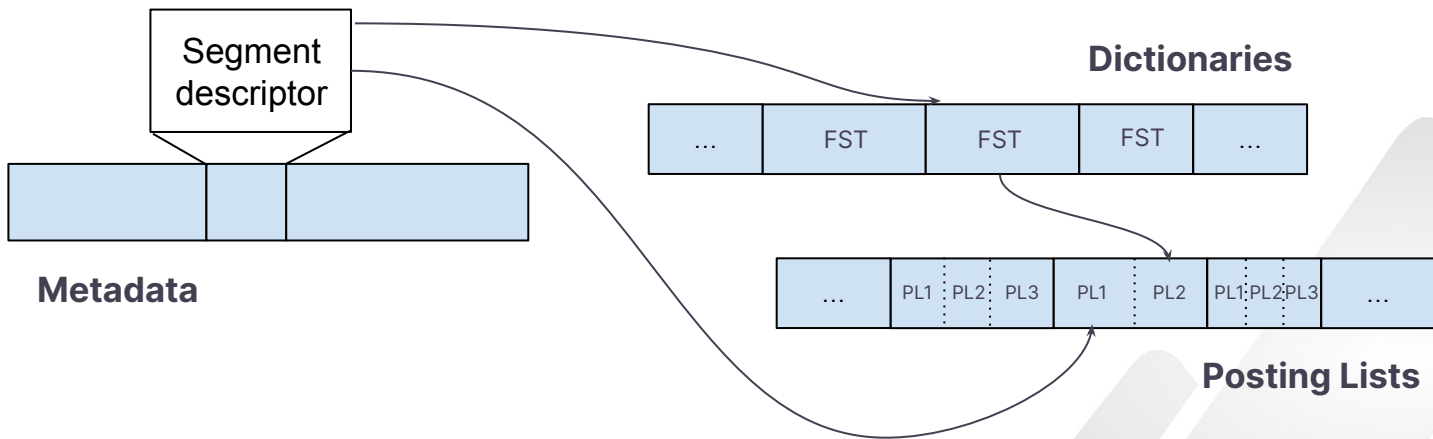
Minimal
Finite State
Transducer

Roaring
Bitmaps



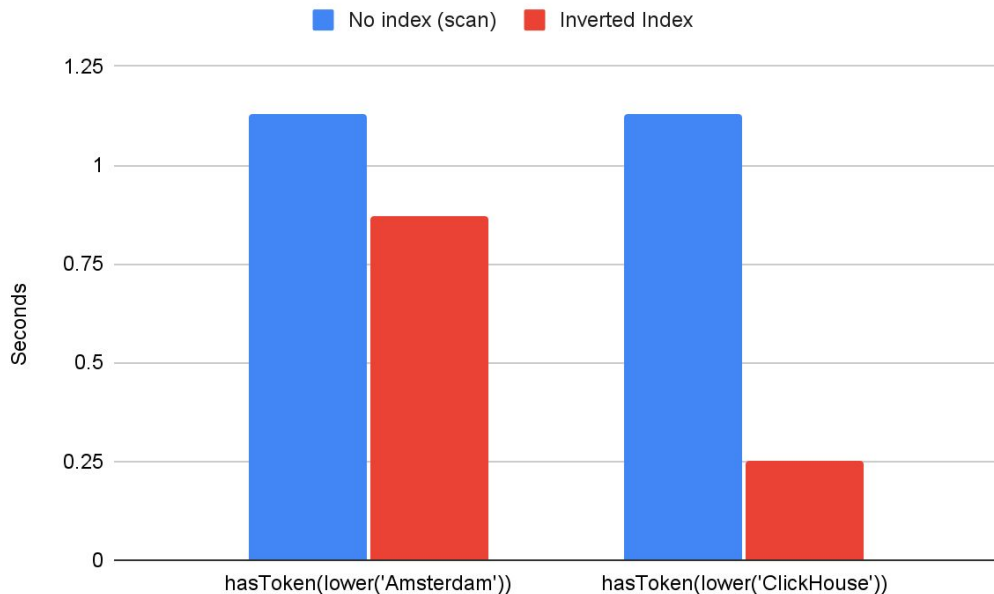
Design II

- Index exists per part, re-created by merge
- Split into multiple segments



Experiments

- 28 million comments posted on Hacker News between 2006 - 2021
- 5.4 GB (compressed 'comment' column) + 1.1 GB inverted index



Summary

- Opens new use cases for ClickHouse
- Lots of community interest
- Stable release targeted for summer

