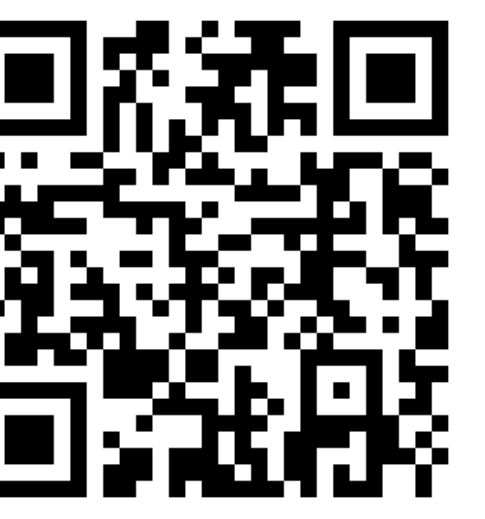


Compressed Spatial Hierarchical Bitmap (cSHB) Indexes for Efficiently Processing Spatial Range Query Workloads⁺

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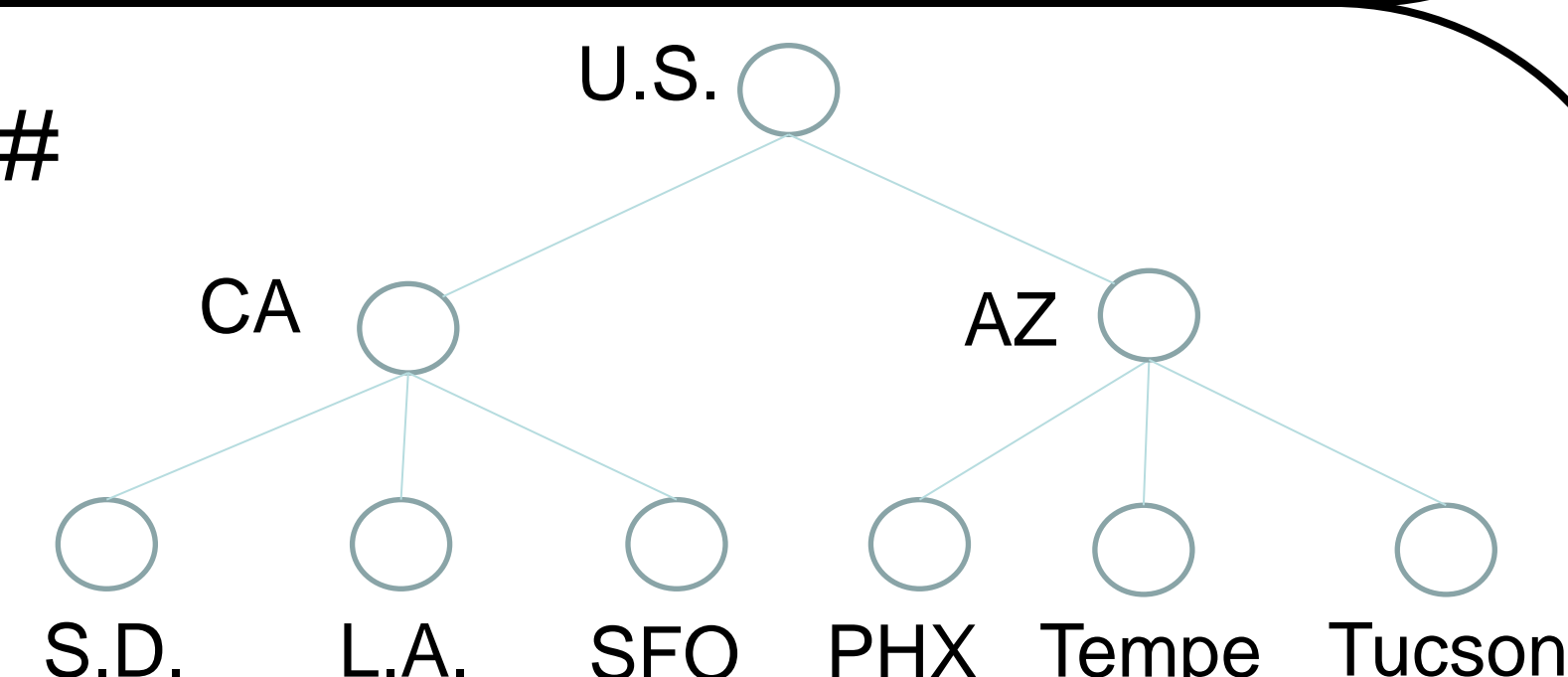


Introduction

- Traditional databases are optimized for single query execution
- In many cloud environments, queries in a query workload are correlated. Traditional databases are unable to leverage shared resources between queries leading to wasted resources
- Spatial range queries have become an important class of queries due to the popularity of spatial and mobile applications
- We present our index structure, Compressed Spatial Hierarchical Bitmap (cSHB), that can be used for efficiently executing spatial range query workloads

Hierarchical Bitmap Indexes[#]

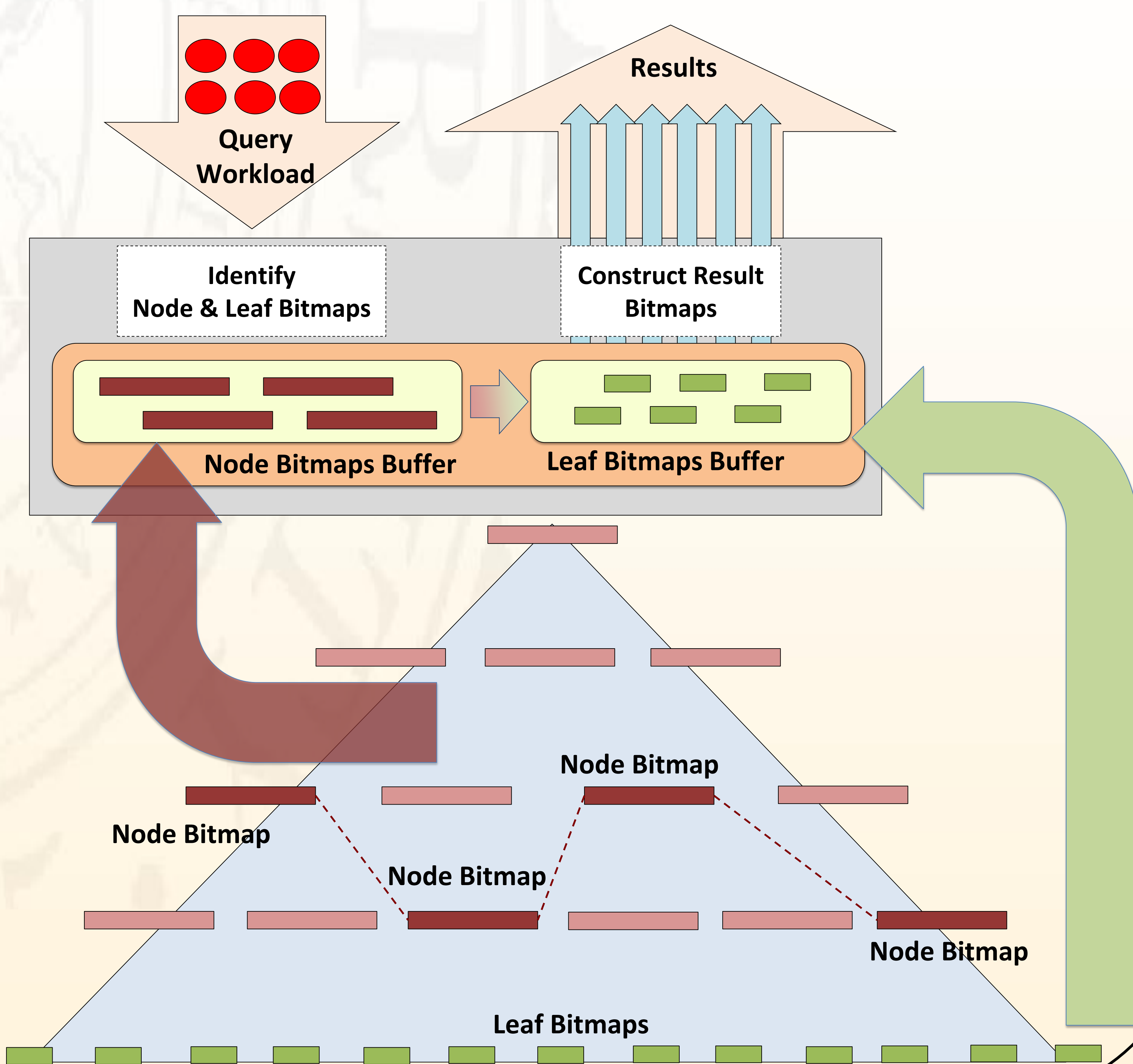
Column Domains are often hierarchical in nature. E.g. Biological taxonomies, Geographical data, etc.



Location	Bitmap of SFO	Bitmap of L.A.	Bitmap of S.D.	Bitmap of CA
SFO	1	0	0	1
S.D.	0	0	1	1
S.D.	0	0	1	1
PHX	0	0	0	0
Tempe	0	0	0	0
SFO	1	0	0	1
Tempe	0	0	0	0
Tempe	0	0	0	0
L.A.	0	1	0	1

[#]Jan Chmiel, Tadeusz Morzy, and Robert Wrembel. HOBI: Hierarchically Organized Bitmap Index for Indexing Dimensional Data. DaWaK '09.

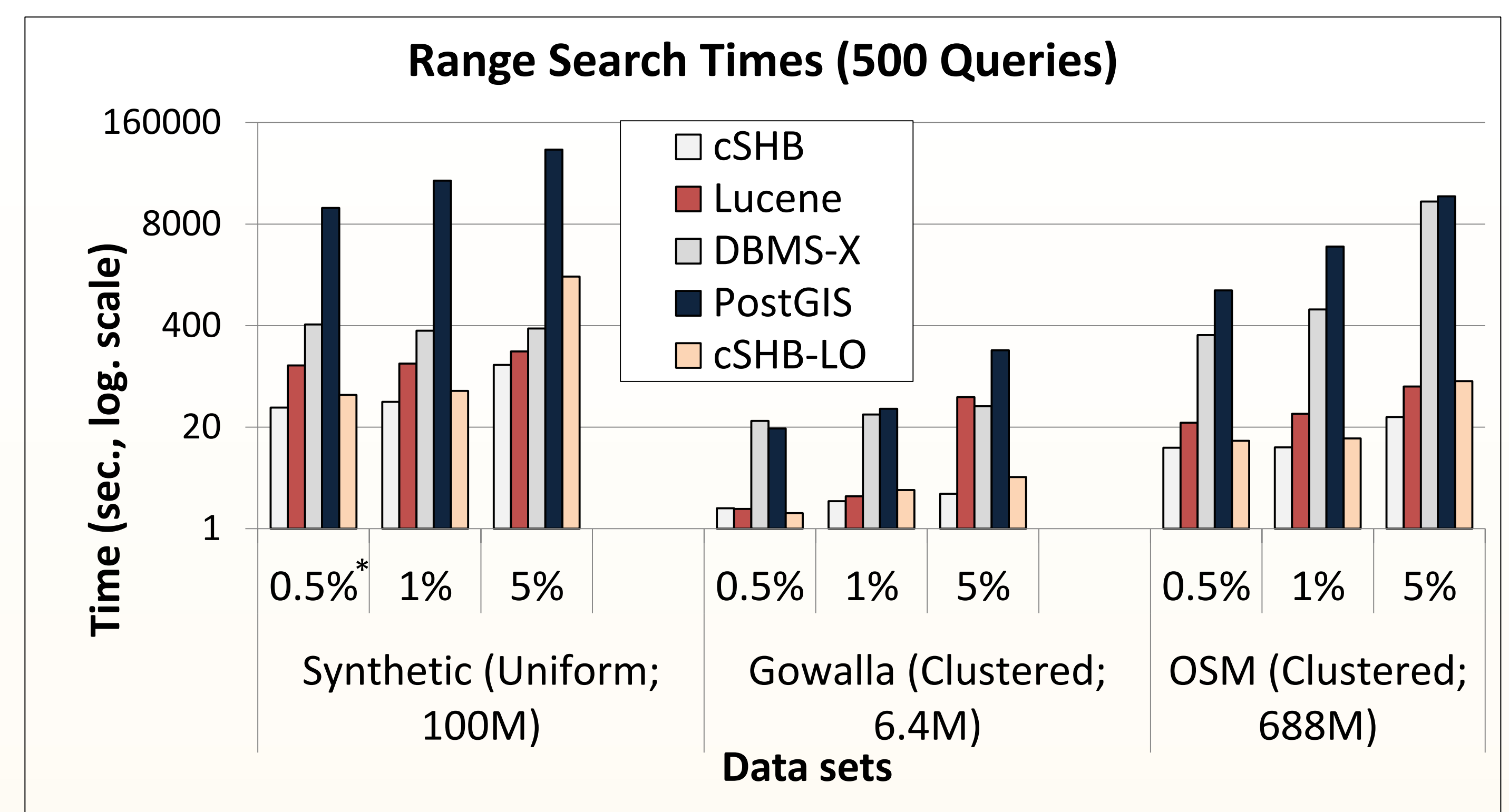
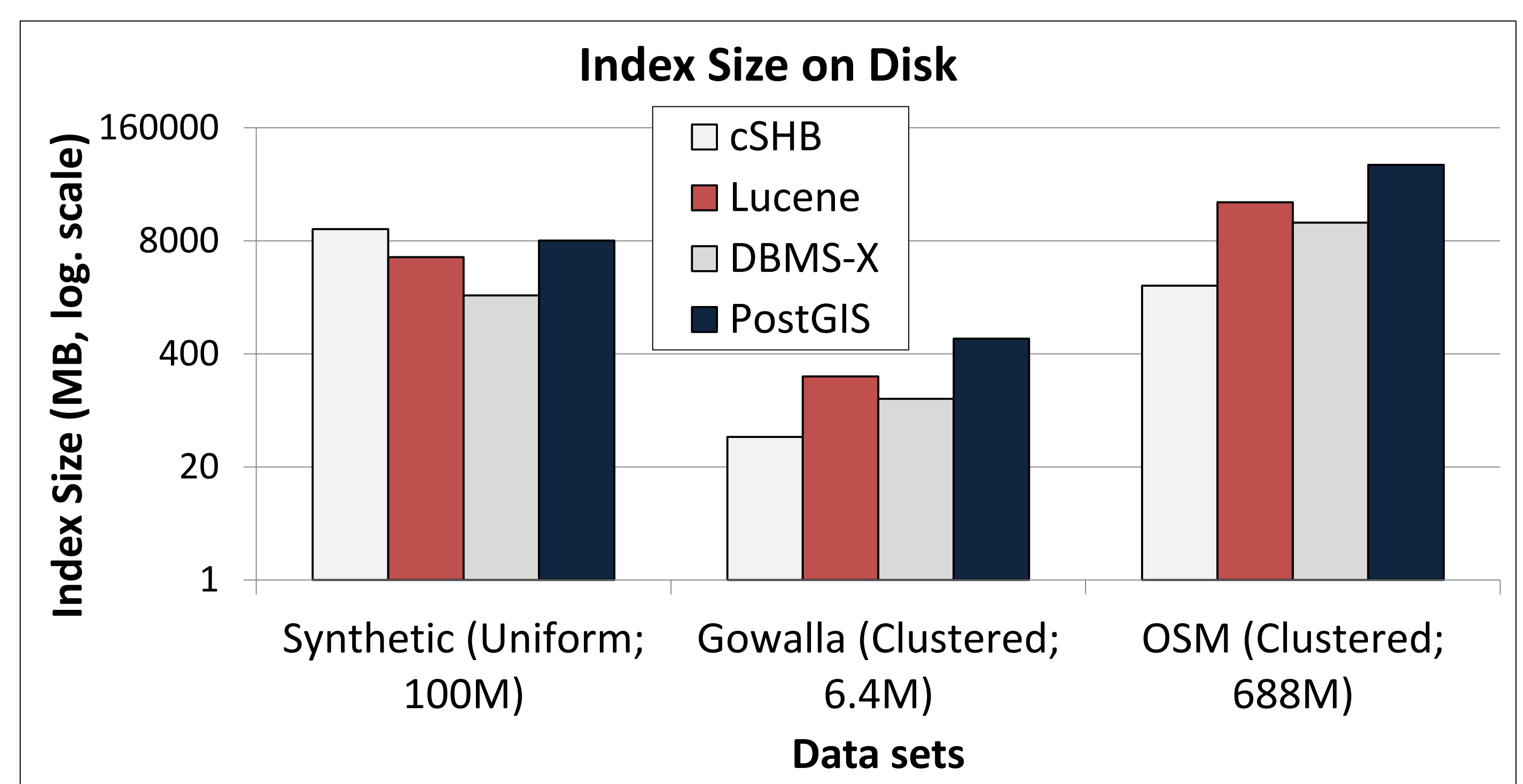
cSHB System Architecture



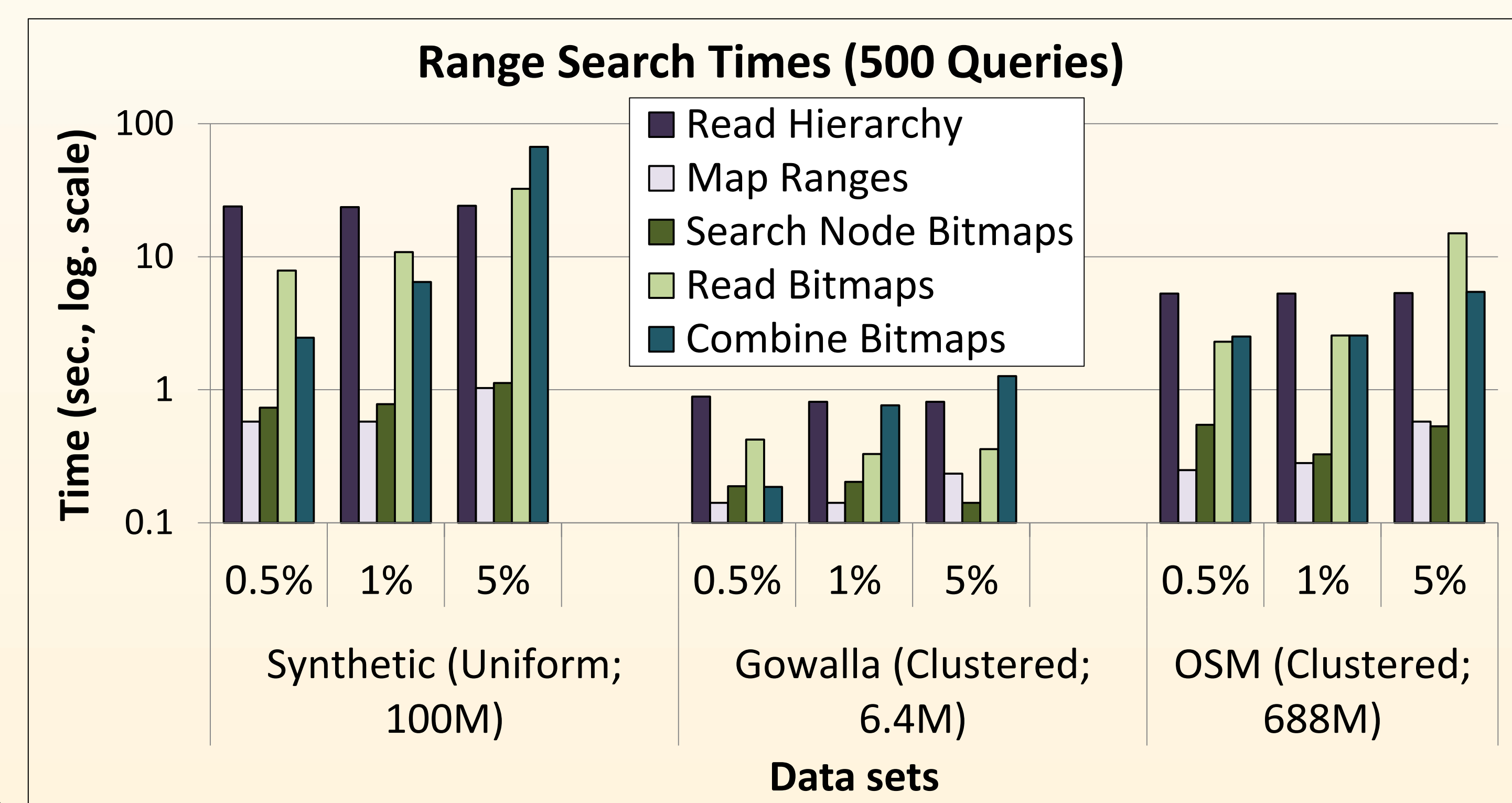
Experimental Data Characteristics

	# of Points	# of Points per (non-empty) cell (for height = 10)		
		Minimum	Average	Maximum
Uniform Data (Synthetic)	100M	54	95	143
Clustered Data (Gowalla)	6.4M	1	352	312944
Clustered Data (OpenStreetMap (OSM))	688M	1	3422	1.2M

Experimental Evaluation



* 0.5%, 1%, and 5% indicate the query range sizes relative to the size of the considered 2D space



⁺This work is supported by NSF grant #1116394 "RanKloud: Data Partitioning and Resource Allocation Strategies for Scalable Multimedia and Social Media Analysis" and by NSF grant #1430144 "PFI:BIC Fraud Detection via Visual Analytics: An Infrastructure to Support Complex Financial Patterns (CFP)-based Real-Time Services Delivery"

