

University of Minnesota

Ubiquitous Location-based Services: A Database Perspective

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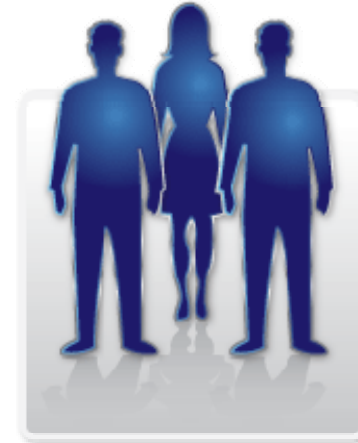
Ubiquitous Location-based Services



Scalability



Privacy



Personalization



Web 2.0

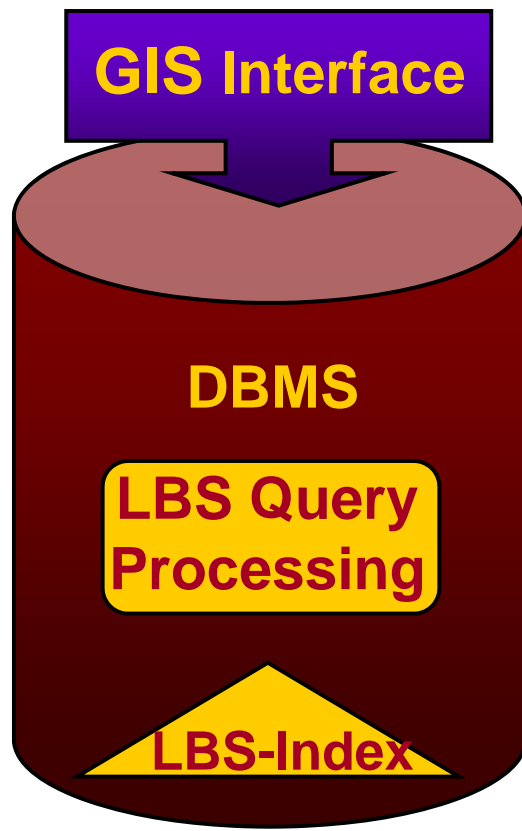


Scalable Location-based Services

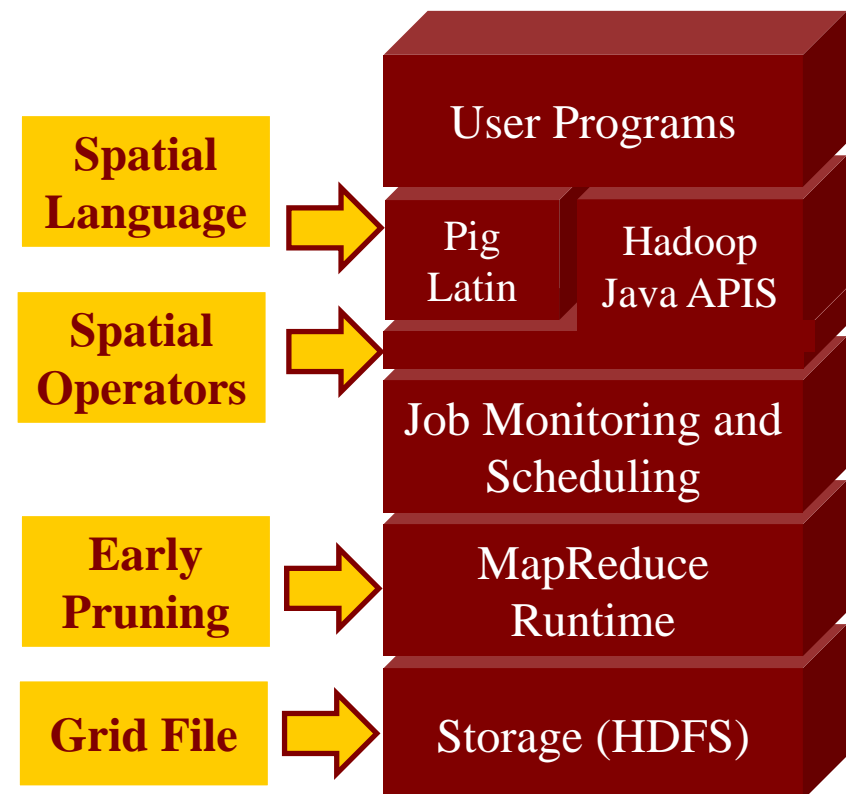


Built-in Approach

The Place Server



SpatialHadoop

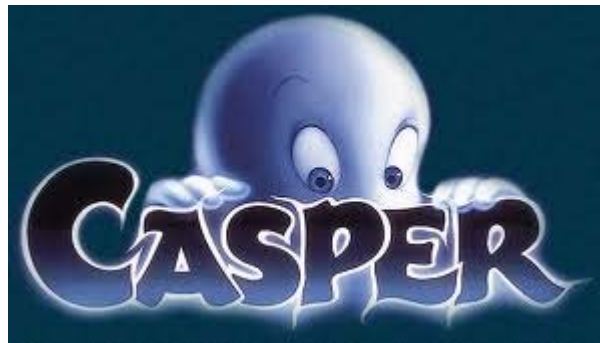


Privacy-Aware Location-based Services



Casper

A *privacy-preserving* location-based database server that is still able to answer location-based queries *without* the need to know the user exact location



Personalized Location-based Services

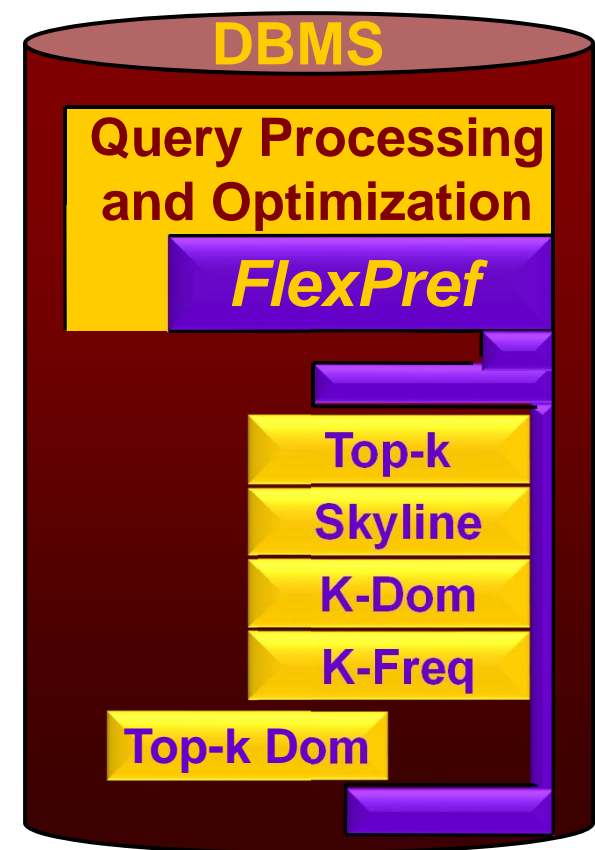


CaredDB. A database that is aware of *user preferences* and *surrounding contextual information*, and uses this information to give *personalized* query answers to the user.

```
SELECT *  
FROM Restaurants R
```



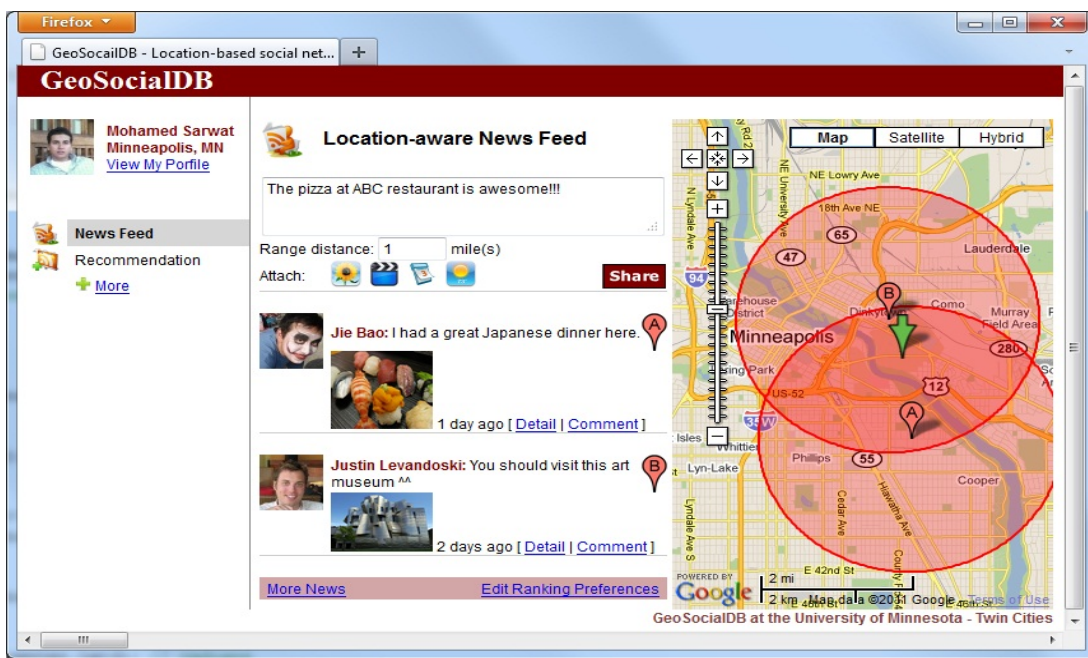
```
SELECT *  
FROM Restaurants R  
PREFERRING MIN R.Price,  
MAX R.Rating,  
MIN R.WaitTime,  
MIN TravelTime
```



Location-based Services 2.0



Sindbad is a social networking system that injects the *location-awareness* into the core functionality of social networks. Each decision in Sindbad is taken while consulting the *locations* of both users and events.



... And, they lived happily ever after

The Family of “Towards” Papers



- **M. F. Mokbel, X. Xiong, and W. G. Aref. "*Towards Scalable Location-aware Services: Requirements and Research Issues*". In ACM GIS 2003.**
 - ❑ **Paper:** M. F. Mokbel, X. Xiong, and W. G. Aref. "SINA: Scalable Incremental Processing of Continuous Queries in Spatio-temporal Databases". In ACM SIGMOD 2004. (274 citations)
 - ❑ **Demo:** M. F. Mokbel, X. Xiong, W. G. Aref, and M, Hammad. " PLACE: A Query Processor for Handling Real-time Spatio-temporal Data Streams“ In VLDB 2004.

- **M. F. Mokbel. "*Towards Privacy-Aware Location-Based Database Servers*". In PDM 2006 (co-located with ICDE 2006).**
 - ❑ **Paper:** M. F. Mokbel, C.Y. Chow and W. G. Aref. "The New Casper: Query Processing for Location Services without Compromising Privacy". In VLDB 2006. (431 citations)
 - ❑ **Demo:** M. F. Mokbel, C.Y. Chow and W. G. Aref. "The New Casper: A Privacy-Aware Location-Based Database Server“ . In ICDE 2007.

- **M. F. Mokbel and J. J. Levandoski. "*Towards Context and Preference-Aware Location-based Database Systems*". In MobiDE 2009 (located with SIGMOD 2009).**
 - ❑ **Paper:** J. J. Levandoski, M. F. Mokbel, and M. Khalefa. "FlexPref: A Framework for Extensible Preference Evaluation in Database Systems". In ICDE 2010.
 - ❑ **Demo:** J. J. Levandoski, M. F. Mokbel, and M. Khalefa. " CareDB: A Context and Preference-Aware Location-Based Database System “ . In VLDB 2010.

- **C-Y. Chow, J. Bao, and M. F. Mokbel "*Towards Location-based Social Networking Services*". In LBSN 2010 (located with SIGSPATIAL 2010).**
 - ❑ **Paper:** J. J. Levandoski, M. Sarwat, A. Eldawy, and M. F. Mokbel. "LARS: A Location-Aware Recommender System“. In ICDE 2012.
 - ❑ **Demo:** Mohamed Sarwat, Jie Bao, Ahmed Eldawy, Justin J. Levandoski, Amr Magdy, Mohamed F. Mokbel. Sindbad: A Location-based Social Networking System. In SIGMOD 2012.

Acknowledgments



- **Microsoft Research.** *Microsoft Unrestricted Gift*, (2010). \$15,000



- **NSF- CAREER:** Extensible Personalization of Spatial and Spatio-temporal Database Management Systems (2010). \$530,000



- **Microsoft Research.** *Microsoft Unrestricted Gift*, (2010). \$20,000



- **Microsoft Research.** *Microsoft Unrestricted Gift*, (2010). \$20,000



- **NSF- IIS:** Towards Ubiquitous Location Services: Scalability and Privacy of Location-based Continuous Queries (2008). \$449,976



- **NSF- IIS:** Preference- And Context-Aware Query Processing for Location-based Data-based servers (2008). \$237,985



- **NSF- CNS:** Infrastructure for Research in Spatio-Temporal and Context-Aware Systems and Applications (2007). \$140,403