The New Casper: Query Processing for Location Services without Compromising Privacy

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Major Privacy Threats in location-based services

Service-Privacy Trade-off

Example: Where is my nearest bus?

The Location Anonymizer

- The entire system area is divided into grids.
- The Location Anonymizer incrementally keeps track the number of users residing in each grid.
- Traverse the pyramid structure from the bottom level to the top level, until a cell satisfying the user privacy profile is found.

The Casper Architecture

Data Types
- Public data: Gas stations, restaurants, police cars
- Private data: Personal data records

Query Types
- Private queries over public data: What is my nearest gas station
- Public queries over private data: How many cars in the downtown area
- Private queries over private data: Where is my nearest friend

The Privacy-Aware Query Processor

1. Query and Location Information
2. Query + blurred Spatial Region
3. Candidate Anonymizer
4. Candidate/Exact Answer


cover story, IEEE Spectrum, July 2003

With all its privacy threats, why do users still use location-detection devices?

Wide spread of location-based services

- Location-based store finders
- Location-based traffic reports
- Location-based advertisements

Theorem 1: Given a cloaked area A for user u located anywhere within A, Casper returns a candidate list that includes the exact answer.

Theorem 2: Given a cloaked area A for a user v and a set of filter target objects t, to be searched, Casper issues the minimum possible range query to get the candidate list.