

Concise Caching of Driving Instructions

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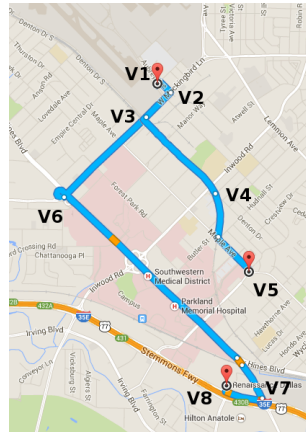
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Motivation

- Many Shortest Path Queries
 - 40 % of Google Maps usage is mobile
 - 200+ million active mobile users as of may 2011
 - Users drive 12 billion miles a year with Google Maps Navigation
 - Google maps is the most used smartphone app (54% of total)
 - 1.9 Billion smartphone users (2013)

<http://techcrunch.com/2011/03/11/marissa-mayer-40-of-google-maps-usage-is-mobile-and-there-are-150-million-mobile-users/>
<http://techcrunch.com/2011/05/25/google-maps-for-mobile-app/>



Setting

Web search scenario:

[Maarkatos et al., Computer Communications 2001]

- Can have a cache at either a proxy or server site
- Saves response- or computation- time
- Cache stores web search results
- Existing cache algorithms include:
 - *Least Recently Used*
 - *Highest Query Frequency*

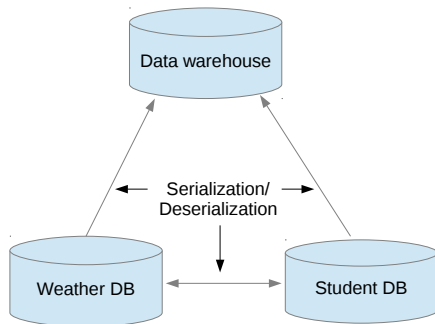


Figure : Web Search

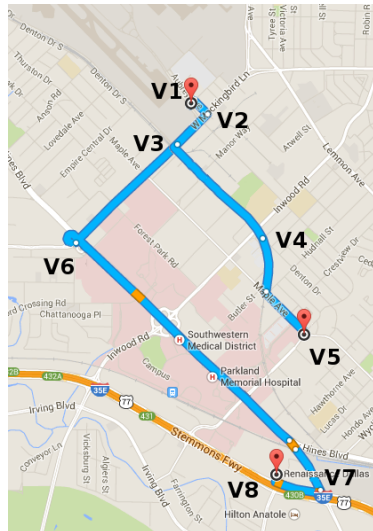
How does a Shortest Path Cache Work?

Cache Content

Path	Shortest Path
1	V1,V2,V3,V4,V7,V8,V9
2	V1,V2,V3,V4,V5,V6
3	V5,V4,V7

Queries

Query	Result	Path
$Q_{V1,V9}$	HIT	1
$Q_{V2,V5}$	HIT	2
$Q_{V5,V9}$	MISS	N/A



How do we express the Cache Performance?

Benefit is expected cost saved:

- On server: computation time
- On proxy: communication time

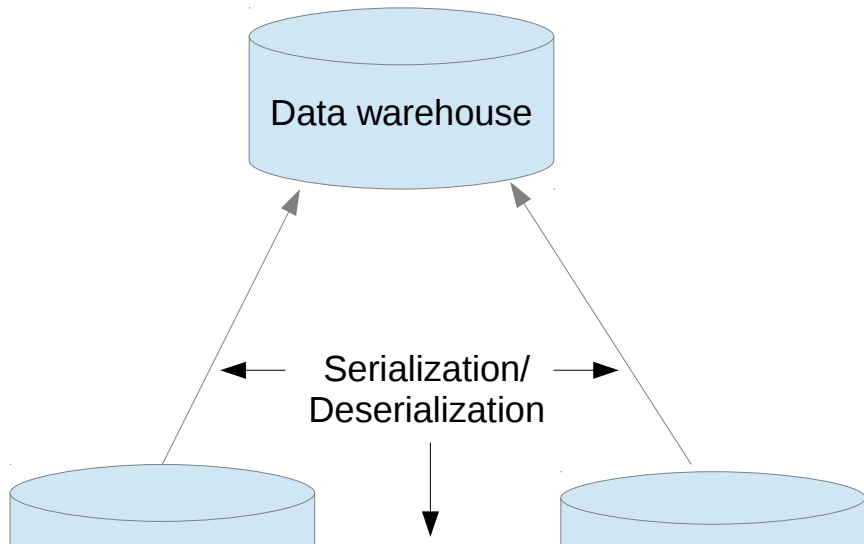
We need to answer:

- Which queries $Q_{s,t}$ can be answered by the path $P_{a,b}$?
- For query $Q_{s,t}$, what are the cost savings?

Given a:

- Cache Size Budget
- Query Log

Then build a cache Ψ with max benefit $\gamma(\Psi)$



Statistics Extraction

fun

Generic Concise Path

fun

Length vs. Utility

fun

Statistics Extraction

fun

Statistics Extraction

fun

Experimental Setup

- Query logs divided equally into 2 sets:
 - historical
 - query workload
- Comparison with:
 - Least Recently Used (LRU)
 - Highest Query Frequency (HQF)

Dataset	Trajectories	Road network
Aalborg	Infati GPS data 4,401 trajectories	From <i>downloads.cloudmade.com</i> 129k nodes, 137k edges
Beijing	Geo-Life GPS data 12,928 trajectories	From <i>downloads.cloudmade.com</i> 76k nodes, 85k edges

Conclusion



Thank You For Listening

Support

some extra graphs or pictures for questions