Google Maps

xxx

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1 Step1

Understand the problem and establish design scope

- user location update
- navigation service, traveling from one place to another
- map rendering

Non-funtional requirements:
accuracy
smooth rendering
data and battery usage: use cache, and design how to get maps
Items that need to consider:

- Geohashing: from name of place to location long and lat
- Geohashing: 00, 01, 10, 11
- Map rendering: retrieve an area
- road navigation: A*
- hierarchical routing tiles: download one tile at a time

Storage estimation:
Each grid splits into 4:

$$50PB + \frac{50}{4}PB + \frac{50}{4*4}PB = 67PB \tag{1}$$

Throughput estimation:
1 billion DAU =¿ QPS

2 Step2

Propose High-level Design
two services:

- location service:
  keep sending second-level location to service
  Do not need to do 1-sec, can do multisecond in a batch
  write heavy, can use casssandra

- navigation service:
  send a http request, keeps connection
  include start location and destination

- a cache service

Map rendering:

- load a prefixed size tile (as in geohash we have fixed size tile)

- use a local cache to cache used tiles

- when receiving a request, sending this tile and its 8 surrounding tile to make sure the boundary is included