Representing Non-Point Geographic Features

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Representing areas with polygons

Areas (e.g. ports, reserves, countries) may not be contiguous and may have holes

Polygon-based solutions need to have inclusive loops and exclusive loops, and multiple of both

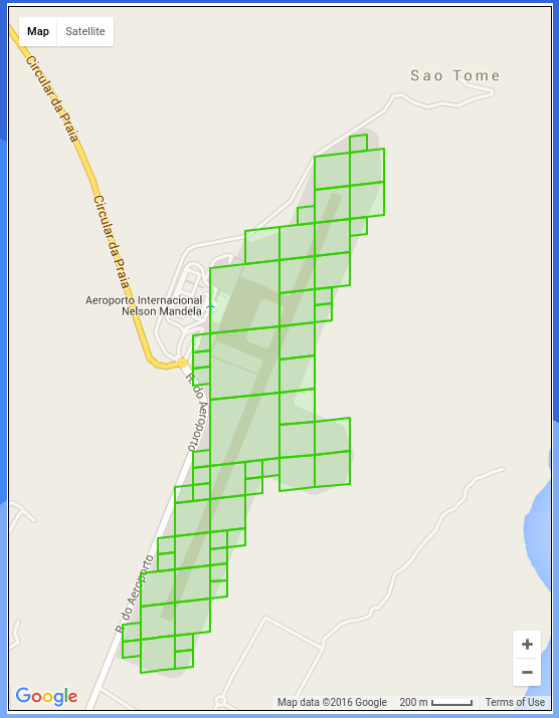
Polygons can have thousands of points

Representing areas with collections of cells

Areas represented by a collection of "cells"

Cells subdivide into smaller cells and so on

Can represent businesses, ports, cities, countries etc.



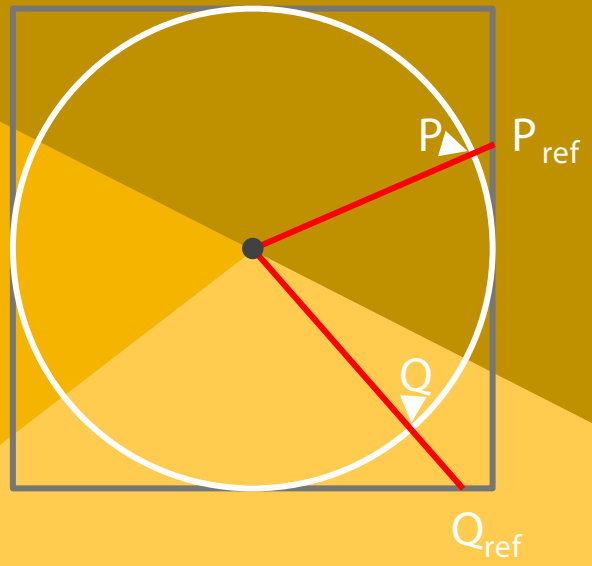
Two approaches from Google:

S2 Geometry Library

Open Location Code

Both projects are free to download and use for any purpose

S2 Geometry Library



Cells range in size from ⅙ of the world to ~1cm^2

Cell IDs are 64-bit integers

Created by projecting points on a sphere into a cube

Point locations are the cube face + position on the face

S2 Geometry Library

Single S2 cell

Each cell can be divided into four children

Level 13 (0 is huge, 30 is tiny)

1.2km on each side

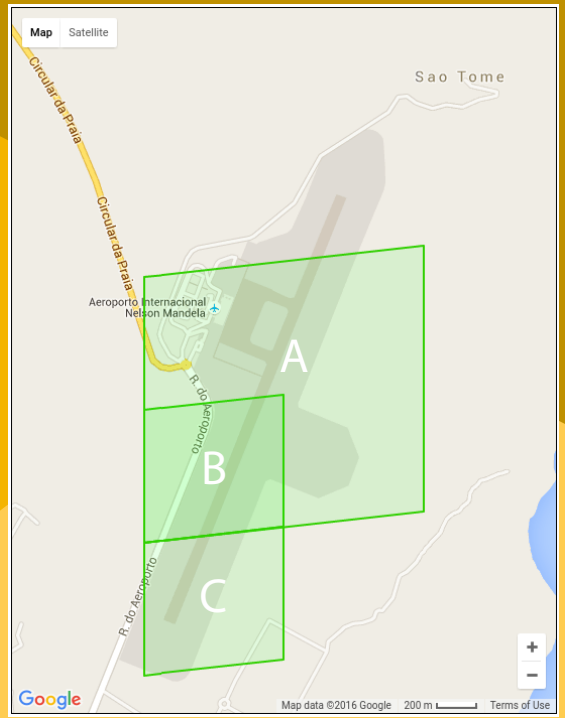
S2 Geometry Library: Does A contain B?

The ID of the parent starts the ID of it's children

B is a child of A, so its ID starts with A's ID

C is not, so its ID will start with something else

This is a very cheap, fast operation



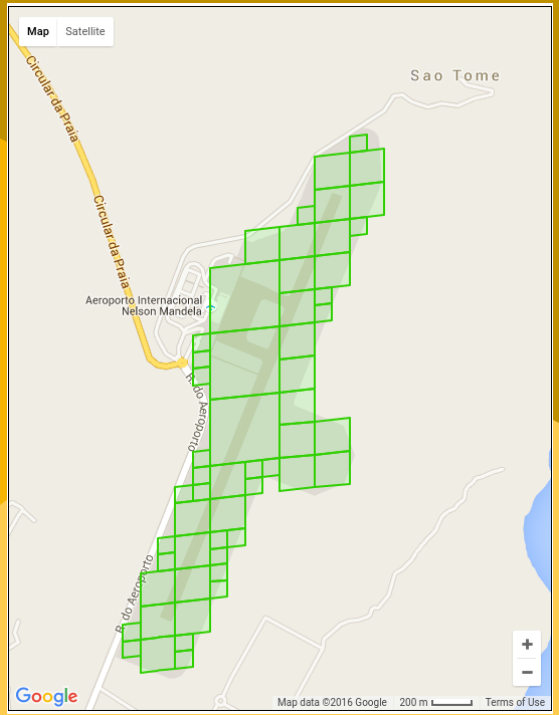
S2 Geometry Library: Covering of cells

Methods to create internal/external coverings

Converts polygon to a list of cell IDs

Selectable precision

Just a list of numbers



Open Location Code

Simple, short encoding of latitude and longitude

Provides a street address for people who do not have one

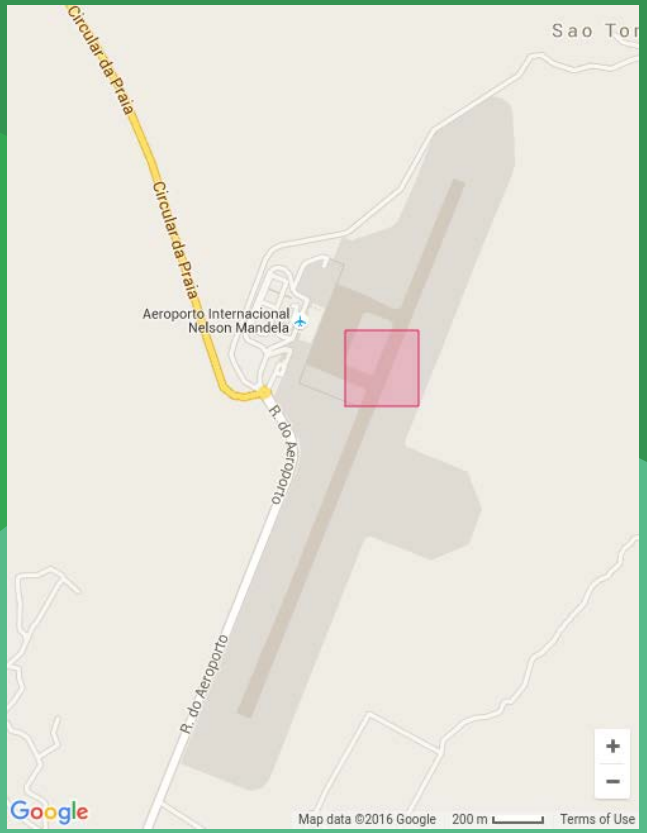
E.g. people living in slums, favelas, cities with unnamed roads

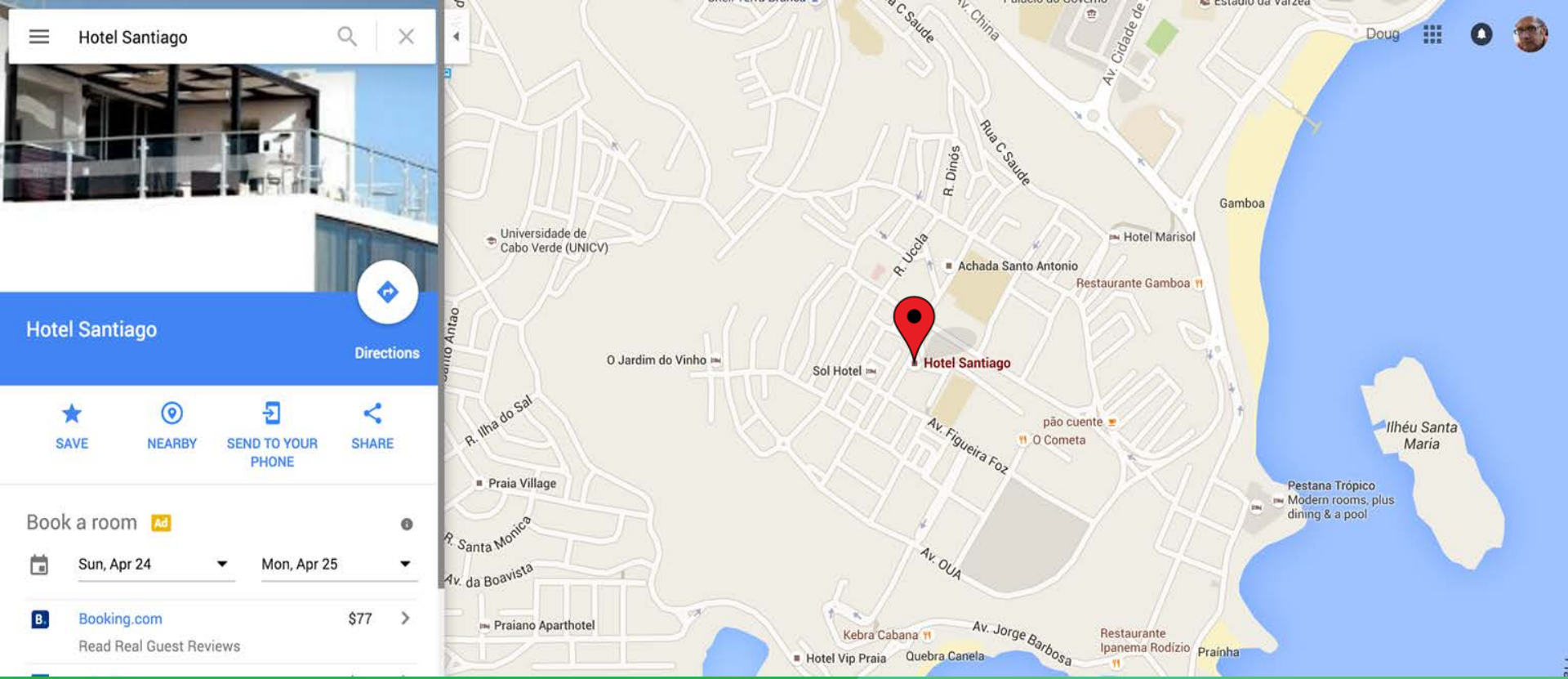
Open Location Code

OLC uses a 20x20 degree-based grid (each cell is divided into 400)

Cell IDs are a mix of digits and letters, specifically chosen to avoid spelling words

OLC cells align with latitude and longitude

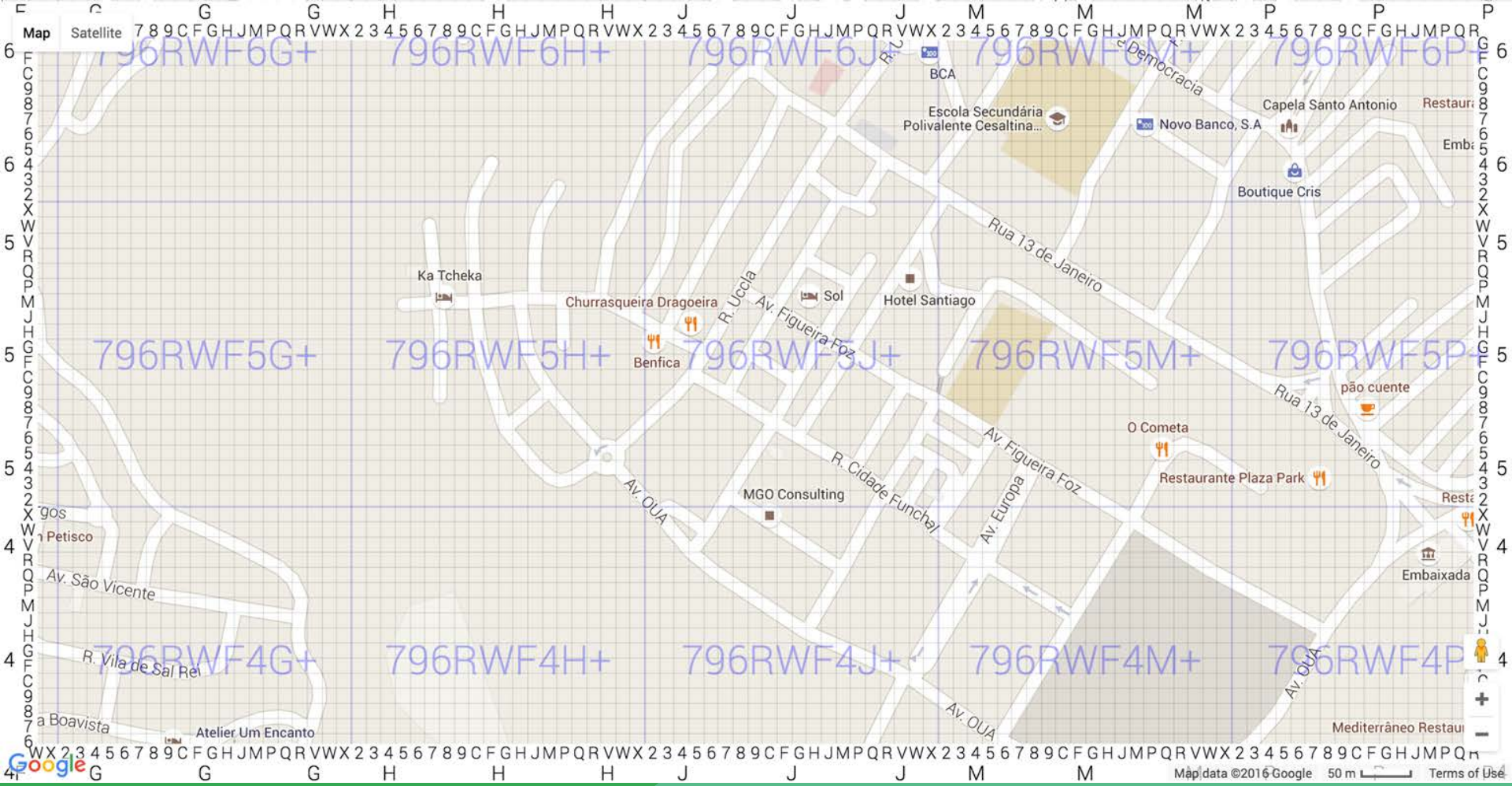




14.907927, -23.520306

W96RWFWJ+PaM

14° 54' 28" N 23° 31' 13" W


Map
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Capela Santo Antonio
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Churrasqueira Dragoeira
R. Uccla
Av. Figueira Foz
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R. Vila de Sal Rei
Atelier Um Encanto
Mediterrâneo Restaur
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50 m
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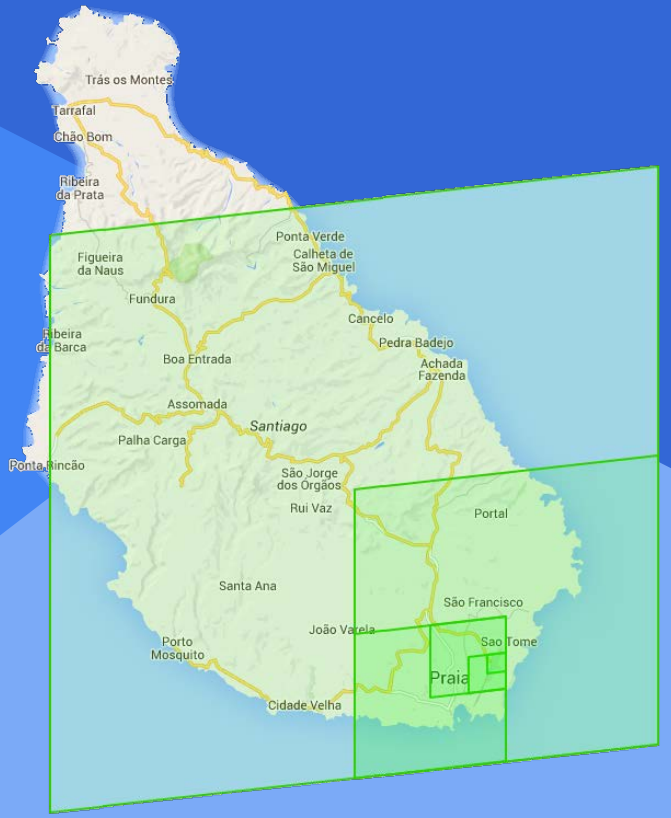
Indexing and searching

"Find all hospitals within 50km": define a polygon then test for inclusion - inefficient

Alternatively, each item has the cell for its location and all parent cells

Define cell collection for area of interest, and get all items with a parent in that collection



Google

Key points

Open Location Codes designed to be used by people, S2 by computers

An S2 cell has 4 children, an OLC code has 400

Both systems have some distortions (cells are not square)

Open Location Codes are supported on Google Maps

Open Location Code has an active development community

Both projects free to use for any purpose, including commercial

References

S2 Geometry Library: presentation, code

Open Location Code: home, code