

# Location Codes

From X,Y to Z

Encoding geographic coordinates into a string is a trivial thing. Yet, there are many grid based systems

```
M L S, Geohash, Mapcodes, Plus codes, O P C, N A C,  
XADDRESS, What3words, Zippr, OkHi, Geokey ...
```



Reinventing the wheel?





# Geocode Attributes



## FREE

Same as Latitude,Longitude.

(Eratosthenes circa 3rd century BC)



## SHORT

Optimal location encoding.



## SPATIAL LOCALITY

2D  $\leftrightarrow$  1D



## MEMORIZABLE / DISTINCT

For Humans



## DETERMINISTIC

Must be generated offline.



## UNIQUE

One to One





→ **Free**

And Open Source:

<https://github.com/eruci/geocode>





# Short

`33.75850,-118.22020 → LA-ABXXD`

`40.78286,-73.974109 → NY-JSYXG`

City names are shortened to acronyms whenever possible.



# ↗ Spatial Locality

33.75850, -118.22020 → LA-ABXXD

33.75860, -118.22020 → LA-ABXWY

33.75870, -118.22020 → LA-ABXWZ

33.75850, -118.22030 → LA-ABXWS

33.75850, -118.22040 → LA-ABXWT

33.75850, -118.22050 → LA-ABXWO



# ☞ Memorizable / Distinct



LA-ABXXD → LONG-KUKOR-AYAZ

Geonames have Levenshtein distance of at least 2.

Phonetic distance of at least 1 (Metaphone Algorithm).





# Deterministic

Offline:

```
use Geo::Code;
```

```
my $g = Geo::Code->new();
```

```
my $geocode = $g->geocode(lat=>52.52699,lon=>13.40521);
```

```
my $xy = $g->geocode(gc=>$geocode);
```

```
my ($lat,$lon) = @$xy;
```



# Unique

33.75850,-118.22020 → LA-ABXXD

LA-ABXXD → 33.75850,-118.22020





# Under the hood - The Algorithm

Divide Earth into 510100 'Hilbert' simple polygons → each polygon into squares → use skiplist data structures to name each square.

Each polygon is about 1000 km<sup>2</sup>, each square is about 100 m<sup>2</sup> or 1 m<sup>2</sup> (triple geoname version)

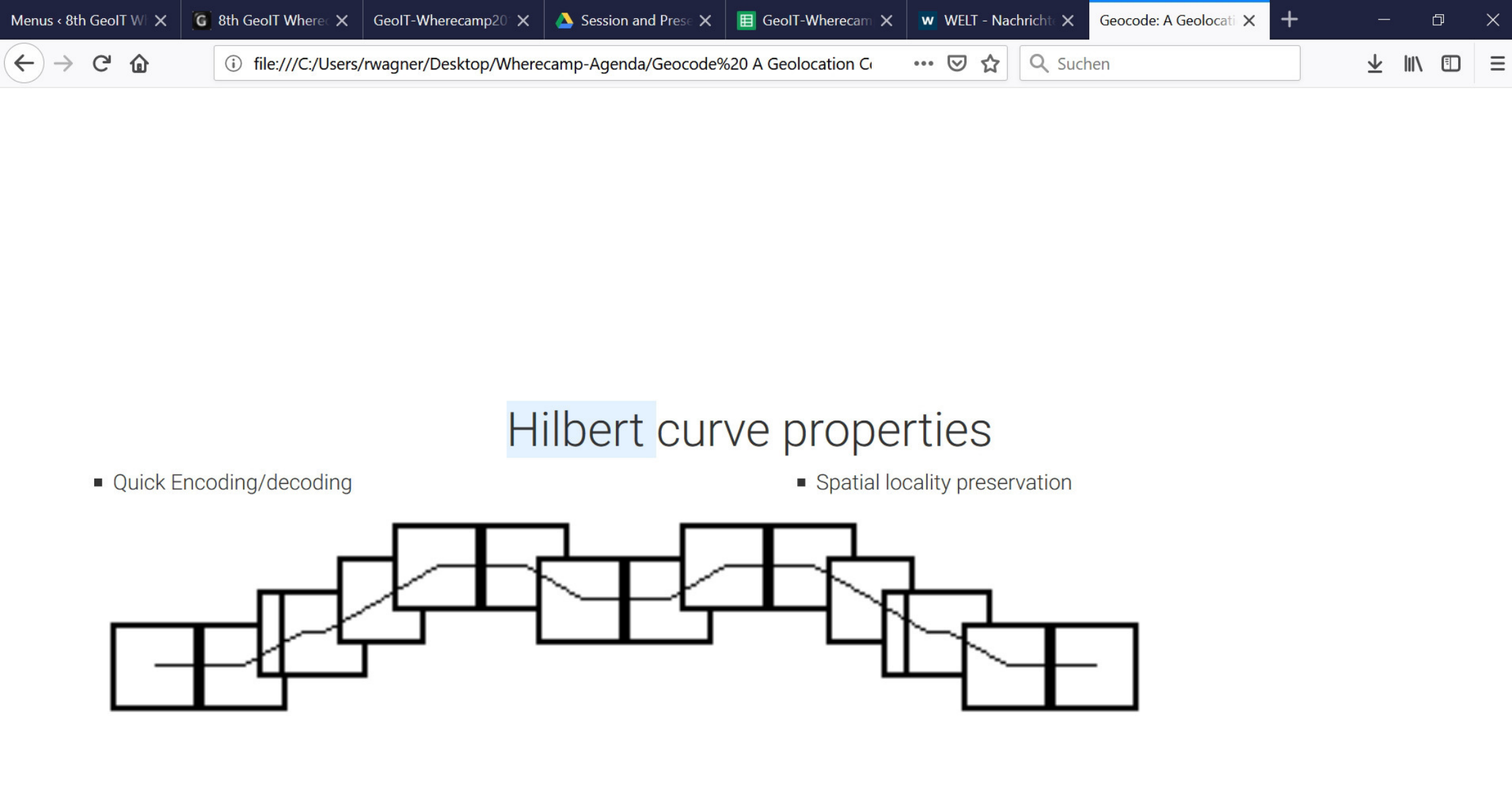
No Database is needed.





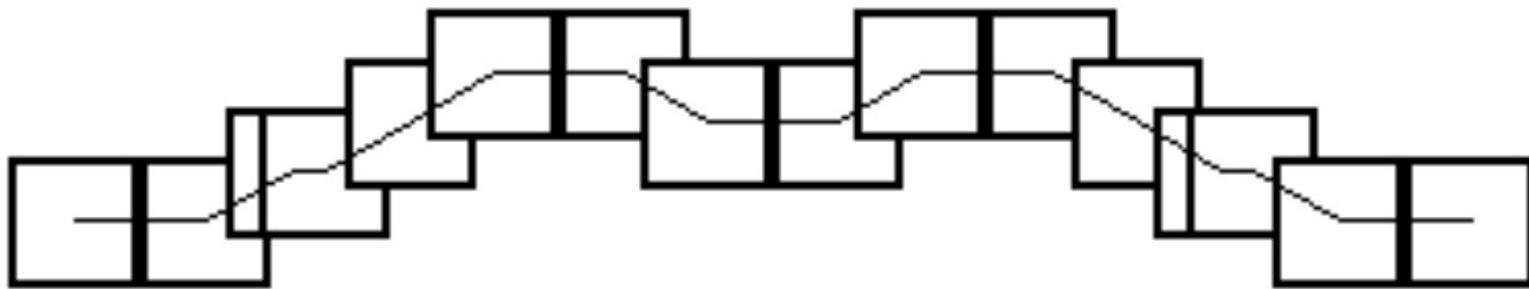
# Hilbert Curve

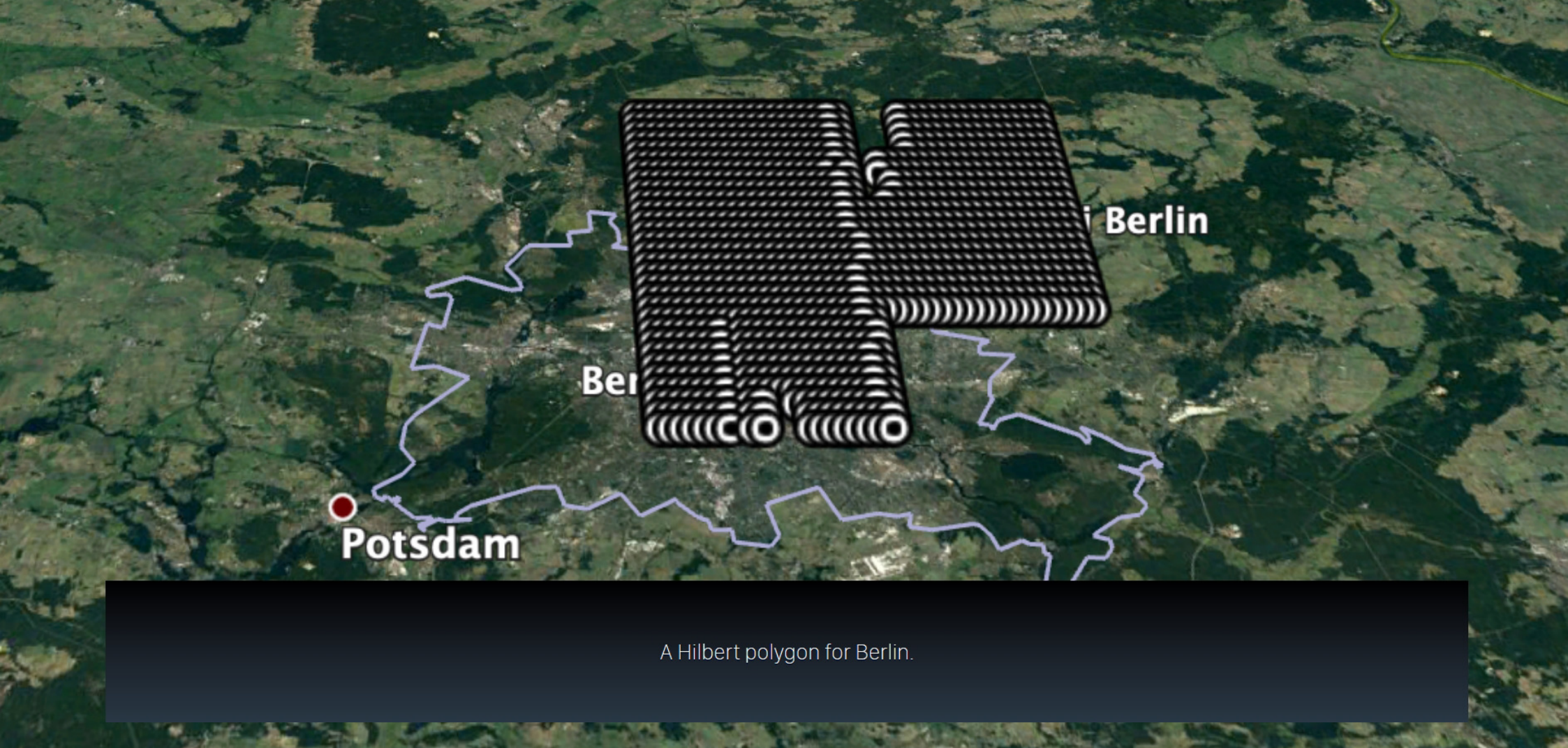




# Hilbert curve properties

- Quick Encoding/decoding
- Spatial locality preservation



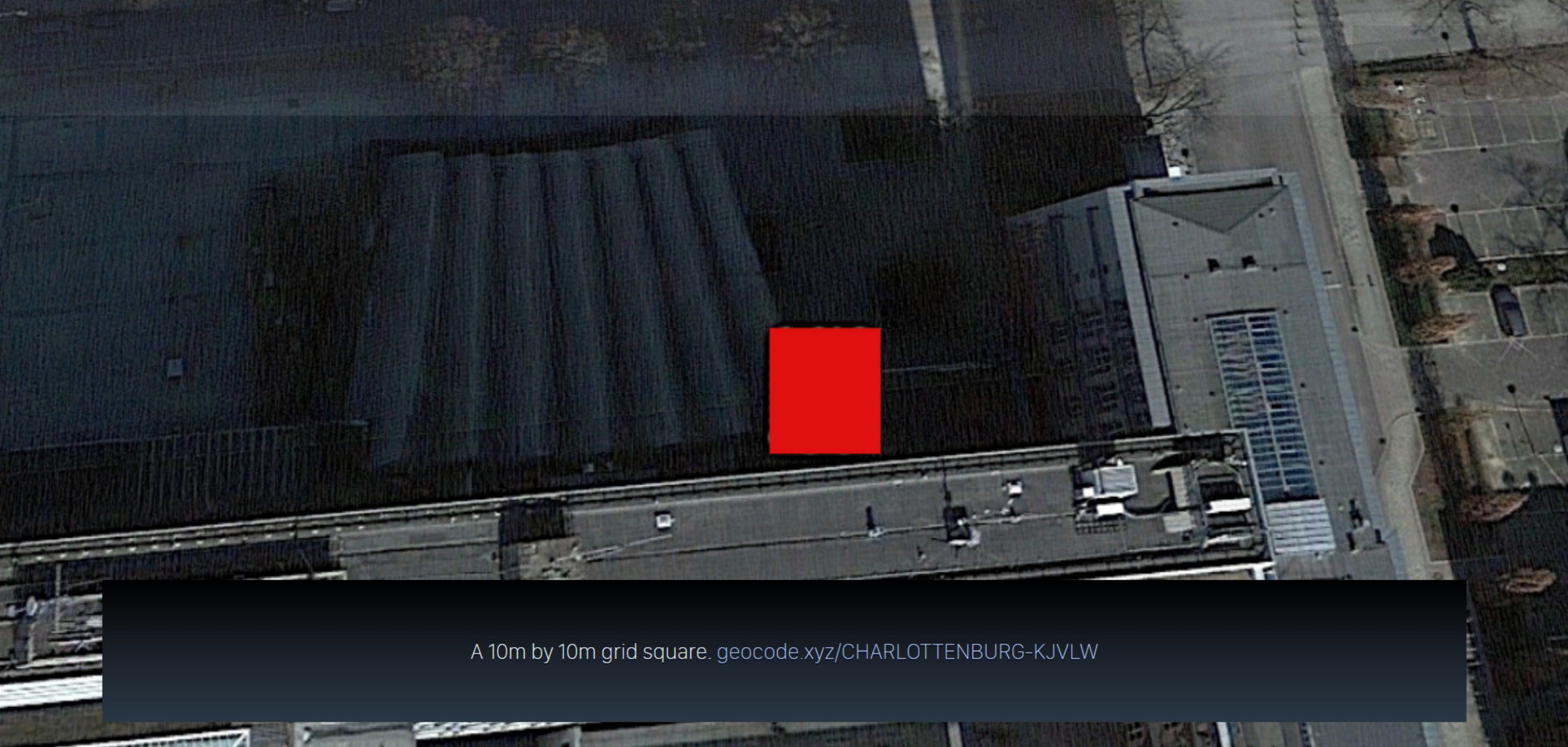


Potsdam

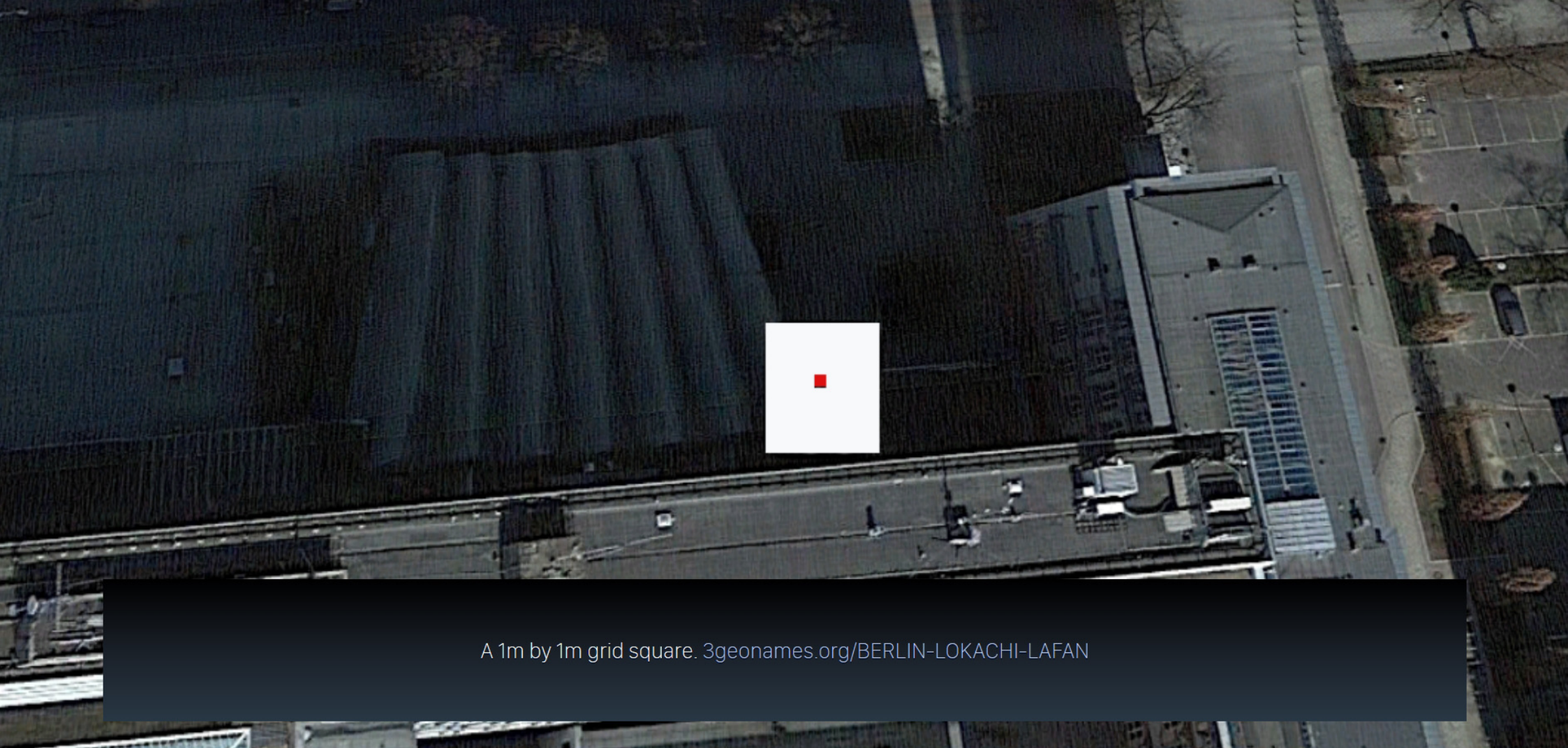
Ber

i Berlin

A Hilbert polygon for Berlin.



A 10m by 10m grid square. [geocode.xyz/CHARLOTTENBURG-KJVLW](https://geocode.xyz/CHARLOTTENBURG-KJVLW)



A 1m by 1m grid square. [3geonames.org/BERLIN-LOKACHI-LAFAN](https://3geonames.org/BERLIN-LOKACHI-LAFAN)



# 3geonames.org

A triple geoname geocode for the world.



## Resolution

1x1 metre grid of the world.



## Hilbert space of 720 trillion squares

latitude range of [90.00000,-90.00000]  
and longitude range of [180.00000,-180.00000]



## 3GeoName Geocode

A unique 3 geoname address for each 1x1 m<sup>2</sup> cell.



# Other Attributes

In addition to being precise, geocodes are also:



## Fast

Just flipping bits.



## Worldwide

No discontinuities. Even at the 180th meridian.

-16.9074,+179.9999 : QOVU-BTDUH

-16.9074,+180.0000 : QOVU-BTLJA

-16.9074,-180.0000 : QOVU-BTLJA

-16.9074,-179.9999 : QOVU-BTLIZ



## Extendible/Customizable

Use custom wordlists without altering the code.



# Customizations

## **Custom Geoname lists**

Greater Levenshtein/Phonetic distance for better error correction.

## **Adaptive Hilbert polygons**

Variable size polygons for remote areas

## **Other languages**

Translated geonames based on [geonames.org](https://www.geonames.org) are available



### Total Requests

Last month

124,555,241

### Cached Requests

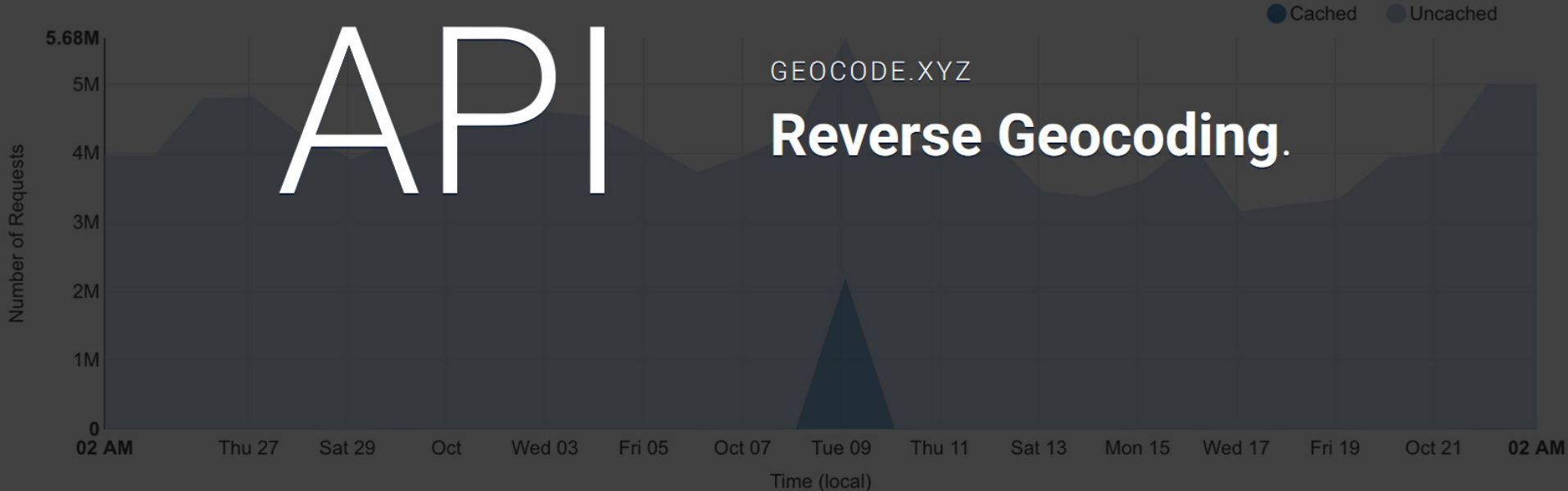
Last month

2,434,172

### Uncached Requests

Last month

122,121,069



# 3GeoNames.org

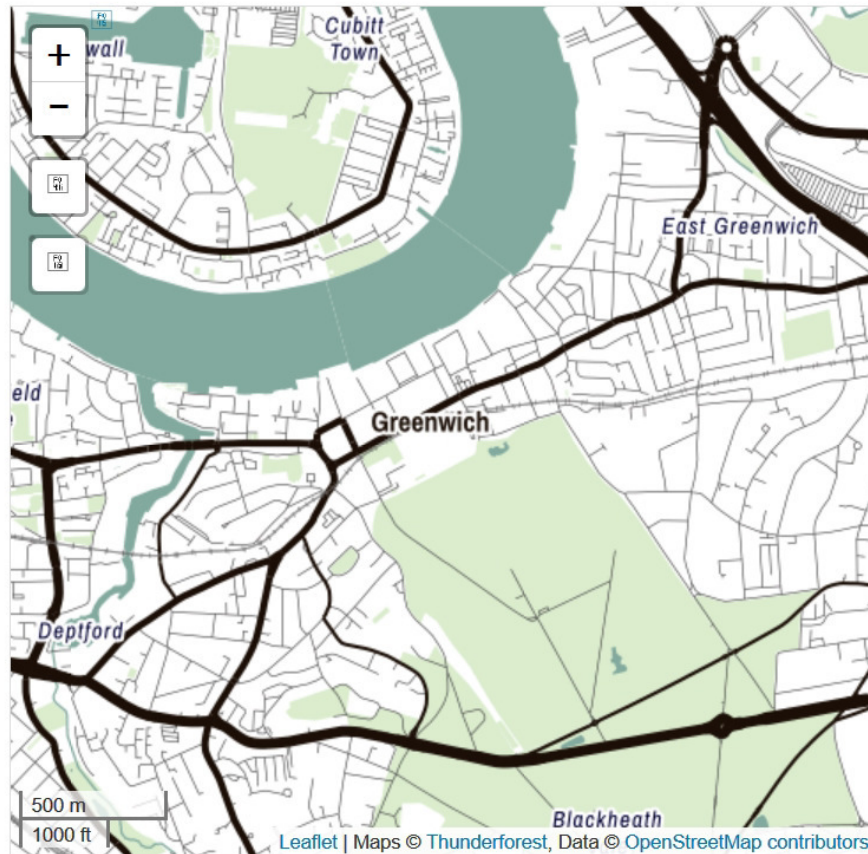


A triple geoname geocode for the world.

Source Code	README	Reverse
<b>Perl5</b>		<b>Geocode.xyz</b>

Type a Latitude,Longitude or Geocode:

[Contact us](#)



Questions?



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BERLIN-LOKÁCHI-LAFAN

CHARLOTTENBURG-KJVLW

**Geocode.xyz**

An intuitive geo location code.