Location Codes

From X,Y to Z

Encoding geographic coordinates into a string is a trivial thing. Yet, there are many grid-based systems such as MLS, Geohash, Mapcodes, Plus codes, O PC, 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 <> 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
LA-ABXXD → LONG-KUKOR-AYAZ

Geonames have Levenshtein distance of at least 2.

Phonetic distance of at least 1 (Metaphone Algorithm).
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 skip-list data structures to name each square.

Each polygon is about 1000 km², each square is about 100 m² or 1 m² (triple geoname version)

No Database is needed.
Hilbert curve properties

- Quick Encoding/decoding
- Spatial locality preservation
A Hilbert polygon for Berlin.
A 10m by 10m grid square. geocode.xyz/CHARLOTTENBURG-KJVLW
A 1m by 1m grid square. 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 [90.000000,-90.000000]
and longitude range of [180.000000,-180.000000]

3GeoName Geocode
A unique 3 geoname address for each 1x1 m² 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 are available
Total Requests
Last month
124,555,241

Cached Requests
Last month
2,434,172

Uncached Requests
Last month
122,121,069

API

GEOCODE.XYZ

Reverse Geocoding.
Questions?