Unique Building Identifier (UBID)

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Abstract

Because providers of energy and buildings data do not include natural keys in their datasets, it is difficult for consumers to uniquely identify, share and combine data records from different sources, inhibiting data reuse and reducing long-term data utility. Street addresses are ambiguous and error-prone, latitude and longitude coordinates may not lie within the property boundary, shape files may be out-of-date or inaccurate, and surrogate keys may be local to cities, states and/or political entities. Provision of natural keys that encode the location and extent of footprints for physical assets, such as land lots, buildings and energy meters, enables data identification, data sharing and data combination.

Given a rectangular, recursively-subdivided grid reference system that spans the surface of the Earth, we identify the grid cell that contains the center of mass of each footprint, viz. the location, use the identified grid cell as the measure polytope for the axis-aligned bounding box of each footprint, viz. the extent, and then encode the resulting information as short, human- and machine-readable strings: Unique Building Identifiers (UBIDs). Anyone can encode, decode and validate UBIDs without a central authority. Assignment of UBIDs to datasets facilitates data reuse and increases long-term data utility.

IMPLEMENTATION
What is a grid reference system?

Grid reference systems identify locations using Cartesian coordinates to delineate regions of the map. Successive subdivision of regions provides higher resolution. UBID uses Open Location Code by Google Zürich to identify the location of the center of mass of a shape (visit http://plus.codes for more information).
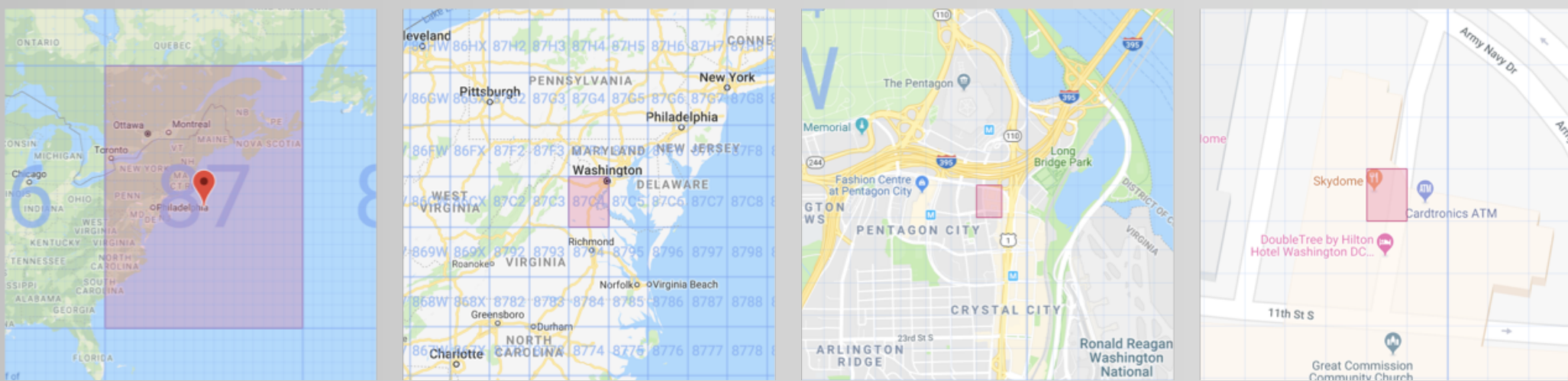

Fig 1. Location of Open Location Code grid cell at successively higher resolution levels.

In the first panel (left), grid cells, measured at the Equator, have height and width of 20°. In the last panel (right), grid cells, measured at the Equator, have height of 0.000025° and width of 0.00003125°.

METHODOLOGY
How do I assign a UBID?

1. Determine shape of footprint.
2. Calculate center of mass of shape.
3. Identify grid cell that contains center of mass of shape.
4. Measure extent of bounding box for shape using grid cell.
5. Write UBID string: **87C4VW7W+JWH-12-15-9-9**

Fig 2: UBID assignment for 300 Army Navy Dr., Arlington, VA 22202.

Capability	UBID	Google Place ID	Uber H3	what3words
Grid type	Rectangular	No grid	Hexagonal	Rectangular
Variable grid resolution	✓	n/a	✓	×
Location identified	✓	✓	✓	✓
Extent identified	✓	×	×	×
Open source	✓	×	✓	×
Human readable	✓	×	×	✓
Human writeable	✓	×	×	✓
Cross-referenceable	✓	×	×	×
Minimal computing requirements	✓	×	✓	✓

Read our manuscript

Wang, Na, et al. "Unique Building Identifier: A natural key for building data matching and its energy applications." *Energy and Buildings* 184 (2019): 230-241.

Find us on GitHub

UBID is publicly available as free and open source software. Scan the QR code (right) to visit the UBID project's GitHub repository at **https://github.com/pnnl/buildingid**.

ABOUT
Pacific Northwest National Laboratory

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