White Paper

A Method for Using a National NPN Repository to Implement Universal National Parcel Number Compliance

Author: Chuck Benton,
National Parcel Number USA, LLC
Boundary Solutions, Inc. o Team Augmented Reality Inc.

Background

By law, the Assessor's Office, or any other Legislated Entity charged with determining the value of property are obligated to assign Parcel IDs to each property in the Jurisdiction in the form of APNs (Assessor Parcel Numbers, also PIN/PARNO/Other). Though many States mandate that the APNs should never change, they do too often to be useful as a basis of the National Parcel Number that never changes unless there is a change to the parcel boundary. At the end of the day, proposed here is the addition of a National Parcel Number [NPN] that never changes side by side the local Assessor's Parcel Number [APN], effectively now liberated to change all the time to best suit the County's needs without any concern for impacting everyone else who is depending on the National Parcel Number as second indexing field that never changes.

Within the US, aggregation of parcel boundaries starts at the county level, each with a FIPS (Federal Information Processing Series) number. However, it is more complicated than that, with a total of some 4000 legislative entities charged with keeping map current that may include an incorporated city or township within a county. Some States have developed statewide APN standards, for example Utah's AGRC (Automated Geographic Reference Center) guide for municipalities[1], with the goal of standardizing the aggregated content. However, there is no guarantee that this state standard may change with the times since there is no national indexing standard that never changes to be compared to.

Twenty-two states now maintain stateside portals from which all, or nearly all, county digital parcel maps may be attained from a single download site. Commercially, national datasets are available, most often as a collection of digital parcel map files. ParcelAtlas© is a single National Parcel Feature Layer INSIDE ArcGIS® Online, offered by Boundary Solutions, Inc of California in partnership with Team Augmented Reality, Inc, of Maine.

ArcGIS® Online does not support grouping of Feature Layers, thus ParcelAtlas© aggregates counties into a single Feature Layer / Geodatabase, which poses a substantive departure from conventional protocol. Since its inception around the turn of the millennia, the national parcel layer has operated as a collection of county-wide digital parcel map files, some 3000 databases in 3000 slots. Updating a county simply required deleting all features with a certain FIPS numbers and replacing the old geometry and attributes with new. Updating is not so easy with ParcelAtlas©. To update the online layer requires use of ArcGIS® Online's "upsert" capability, a step not possible unless every polygon is assigned universally unique, permanent ID number.

[1] https://media. rainpos. com/65/parcel_standards_ustc_2010. pdf

American National Standards Institute codes (ANSI codes) are standardized numeric or alphabetic codes issued by the American National Standards Institute (ANSI) to ensure uniform identification of geographic entities through all federal government agencies. ANSI has taken over the management of geographic codes from the National Institute of Standards and Technology (NIST). Under NIST, the codes adhered to the Federal Information Processing Standards (FIPS). ANSI continues to issue the commonly used FIPS codes, although the acronym has now changed to Federal Information Processing Series, because it is no longer considered the standard. [2]

Business Case Discussion

The need for a National Parcel Number (NPN) scheme is highlighted by the trend toward aggregating parcel data at national levels. Left solely to market forces, multiple proprietary ID indexing schemes have emerged the norm, with various offerings competing with each other for market share and no open solution being available for all. The interests of the GIS community and the markets it supports would be better served by a globally accepted Parcel ID scheme operated under by an internationally recognized standards body including the Open Geospatial Consortium or ANSI. In a perfect world, an appropriate organization would step up to provide this. From a practical perspective, this would take years to reach an operational condition, and in the process consume valuable resources that would be devoted to variety working groups.

With NPN capability, ArcGIS® Online users will gain from the benefits of a common national indexing, starting with the support of the ArcGIS Online “upsert” capability. Currently, this is not possible in an aggregated parcel layers due to replication of APNs. ParcelAtlas National NPN Repository enables use of “upsert" to enable updating of this national parcel layer content service.

Across various market segments, the ability to have a unique NPN for every property has substantive potential. The availability of reliable, repeatable NPNs enables simplified indexing and accessing of all types of related content, for a range of segments including Real Estate/Finance/Insurance, Transportation, Utilities and Government. NPNs will provide tangible added value when ArcGIS® is used to manage GIS content.

Technical Discussion

The State of Utah’s AGRC guidance summarizes optimal Parcel ID qualities:

> “Parcel identifiers should incorporate the following attributes: (1) uniqueness, (2) permanence, (3) simplicity, (4) ease of maintenance, (5) flexibility and (6) reference to geographic location. Of these, uniqueness is most important.
>
> ***Uniqueness*****:** Uniqueness refers to a one-to-one relationship between a parcel and its identification number. An identification number shall be assigned to only one parcel.
>
> ***Permanence*****:** Parcel identifiers should be permanent and change only if the boundaries of the parcel change and a new parcel is created. However, in areas where there is extensive subdivision requiring re-platting, it may become necessary to assign new parcel

[2] https://www. census. gov/quickfacts/fact/note/US/fips

identification numbers even though some parcel boundaries have not changed. Whenever a new parcel is created, it should be assigned a new parcel identification number.

***Simplicity*:** Parcel identification numbers should be easy to understand and have as few digits as possible. A parcel identification number that is uncomplicated and easily understood will help reduce errors in its use.

***Ease of Maintenance*:** The parcel identification system should be easy to maintain and should efficiently accommodate changes, such as subdivision or consolidation of parcels.

***Flexibility*:** The parcel identification system should be reasonably flexible. It should be capable of serving a variety of uses and be convenient for both field and office operations.

***Reference to Geographic Location*:** The parcel identification system based on geographic location makes it possible to locate a parcel using only the identifier. The identifier becomes an abbreviated legal description. ”

Since the Centroid is a key element of the capability, it is critical that a common means of determining a parcel’s “centroid” be used by all. Since 2016, the US Department of Energy’s Pacific Northwest National Lab has been developing a Unique Building Identifier (UBID) algorithm which has a simple uniform format and is easily constructible from geospatial information that is available from common web-based mapping services. The UBID capability is open-source, already in use in many applications, and has been the subject of numerous reviews and studies.

Proposed here is that this be used to determine a parcel's "centroid". The UBID approach provides the centroid in a different format, however conversion between UBID format to Degrees Decimal lat/lon format is readily performed. For NPN purposes the centroid will be presented in degrees decimal, but the underlying algorithm for it computation will use the open-source UBID approach. As a result, any data record that already includes a UBID of a parcel will be able to easily find all issued NPNs associated with that UBID, opening immediate access to ownership and APN information.

Note that in the screen capture, the XCOORD value is -090. 22750 and the YCOORD value is 32. 27897. A more accurate Latitude and Longitude can be determined by calculating the midpoint of the MINX/MAXX and MINY/MAXY pairings, which in this case are -90. 22750 and 32. 27897. We can specify that any NPN start with the following format:

XXXX. XXXXX:YYY. YYYYY

Where XXXX. XXXXX is the Longitude, the first value being'+' or '-', and the remaining representing longitude degrees decimal. This is then separated by a ':', and followed by latitude degrees decimal. Thus, the preceding example would be represented as:

-090. 22750:+32. 27897

While this works anywhere in the world, it fails the *uniqueness* parameter in that multiple parcels can exist within the region identified by the lat/lon pair, which has precision of 1. 1132 meters in latitude and cos(longitude)x1. 1132 meters. This is especially true the case of multistory buildings with properties stacked atop each other. For this reason, an additional value must be added to the proposed NPN that will provide uniqueness for each property.

Assuming no more that 99999 properties can ever exist in a NPN lat/lon pairing, we can augment the NPN with an additional unique number which we will represent as PPPPP. Thus, the NPN will have the following format:

XXXX. XXXXX:YYY. YYYYY:PPPPP

Note that the YYY. YYYYY value is followed by a ':' and then PPPPP, where PPPPP represents the unique Parcel ID within that NPN lat/lon pairing, which will be issued by via a tool which communicates with a REST service and database developed for that purpose.

We propose creation of a REST service titled the "NPN Service". The function of the NPN Service will be to provide a unique NPN for parcels submitted to it, and to maintain a database of issued NPNs. Based on the size of the lat/lon pairing being just over one meter square (and smaller as one gets further from the equator) it is fair assumption that most pairings will only have a single property, and where more than one property exists, unique APNs will have been issued for those properties.

Interaction with the NPN Service will consist of making a single REST GET request to the service passing it the lat/lon pairing in the form of XXXX. XXXXX:YYY:YYYYY along with the parcel APN and Parcel Owner. The NPN Service will then return a fully formed NPN, for our example this would be:

-090. 22750:+32. 27897:0001

Internally, the NPN Service maintains a database of used lat/lon pairings, along with Parcel IDs associated APNs and Owners. When a GET request is received, the service will first check if a record for that pairing exists, if not it will create one. It will then check the APN against known APNs and Owners within the pairing's records, if there is a match it will return the appropriate fully formed NPN. If not, it will add the next unused Parcel ID and the APN to the pairings records, and return the fully formed NPN which includes the newly issued Parcel ID.

The approach will enable any user to access the NPN Service with a single GET, with retrieval or creation of an appropriate fully formed NPN accomplished in a single action. We acknowledge that there may be cases in which there are multiple properties with no APN for a given lat/lon pairing, but note these cases will be extremely rare and of little consequence. Additional back-office tools are expected to be required to support the NPN service, however these are beyond the scope of this White Paper.

This meets the six criteria of (1) uniqueness, (2) permanence, (3) simplicity, (4) ease of maintenance, (5) flexibility and (6) reference to geographic location.

Recommendations

NPN USA is uniquely positioned to support this, having created the ParcelAtlas© ArcGIS® Online Feature Layer, and having created a proprietary version of the proposed NPN service. We now seek opportunities to have this capability brought forward as a national capability, including partnerships that can demonstrate the efficacy of adopting a standardized National Parcel Numbering system.

THE NPN REST Interface and NPN REST Services'

TECHNICAL EXPLANATION COMING SOON

Summary

A specification for National Parcel Numbering System has been created, and subsequently implemented. Over 155 million parcels have been assigned NPNs using the previous implementation, and ongoing efforts are transitioning into use of this system.

Industry comment is welcomed, and we seek Pilot Test partners, under OGC oversight to use this capability on proof-of-concept basis to demonstrate improved workflows and data analysis.

About the Author

"Chuck" Benton has a long-established track record of identifying new technologies and applications, developing product concepts and designs, implementing product solutions, coding, leading development and marketing/sales teams, and supporting the end user community. These include:

- 1980's: Pioneered the computer game industry authoring over 15 games including what became the 'Frogger,' 'BC's Quest for Tires,' 'Disney's Donald Duck's Playground', and the original concept and game for the 'Leisure Suit Larry' series.
- 1980's/1990's: Pioneered Distributed Simulation network protocols and GIS standards with the support of DARPA, helping create what is now a $100B+ industry.
- 1990's: Lead the team which developed for first large scale VoIP implementation, with installations in 13 counties.
- 1984-present: Created the first Augmented Reality system outside of academia, developed numerous follow-on designs, both military and commercial.
- 1990s-2018: Supported the US Military, including leading numerous technical efforts under contract to the Secretary of Defense Rapid Reaction Technology Office, supporting Special Operations. Chuck Benton's corporations have been an Esri partner since the late 1990's.
- 2010's: Created an international communications standard for maritime position reporting, published and accepted by the international standards community.

This background in standards development for emerging technologies speaks to his interest in establishing a standardized global parcel identification capability.