CMS Standard Geographic Model Template – Read-me

Purpose of the Standard Geographic Model Template

1. Provide a template of mailing and residential address entities and attributes for CMS application models.
2. Standardize attribute names, definitions and data types.
3. Provide capability to parse address data into the smallest part that is meaningful to CMS.
4. Support requirements for geospatial data.
5. Identify source of valid values for reference data attributes.

Assumptions

1. CMS does not need address data to be decomposed as much as USPS (e.g., no need to separate street number (5) from street name (Main) from street suffix (Street)
2. CMS will not maintain a master address repository.

Description of the Standard Geographic Model Template

The Standard Geographic Model Template is a logical ERwin data model organized into two areas: 1) standard geographic reference data entities (white entities) and 2) a template for application specific address data (yellow entities). Relationships are not depicted in the template from entities in one area to entities in the other. **The Local Data Administrator (DA) is expected to copy the applicable standard reference data entities and attributes into the application data model and create relationships to the appropriate entities in the application data model based on application system requirements.** CDA standard names, definitions, and data types are provided for all reference data entities and attributes. A template for the CDA standard name is provided for entities and attributes in the application specific area, where entities are labeled Entity XYZ. Attribute data types are also standard in this area except for Entity XYZ Identifier and Entity XYZ Address Identifier. The data types for these two attributes are application specific.

Area 1 – Reference Data: The Standard Geographic Model Template provides standard entities, attributes, and relationships that support the validation of country, subdivision (i.e., state), and county code values. This area includes reference data for United States' state and county codes and country codes issued by the American National Standards Institute (ANSI), the National Geospatial-Intelligence Agency (NGA), the Social Security Administration (SSA), and the United States Postal Service (USPS). A description of these standards is in the last section of this document. All entity and attribute names, definitions, and data types in this area are CDA Standards. The area, highlighted in blue on the entity relationship diagram, consists of the following entities:

- Geographic Country (former FIPS country codes)
- Geographic Country Version
- Geographic Principal Subdivision (former FIPS numeric codes for state, territory or province of a specific country except for the United States; ANSI numeric codes for states and territories of the United States)
- Geographic Principal Subdivision Version
- Geographic United States State (ANSI numeric codes for states and territories of the United States and USPS alpha codes)
- Geographic United States County (ANSI codes for counties of the United States)
- Geographic United States County Version
- Geographic SSA Standard State (SSA state codes, foreign countries and extended CMS data values)
- Geographic SSA Standard County (SSA county codes and foreign states, territories, and provinces within a country)
- Geographic CMS Regional Office

Notes on Area 1:
1. **Standard geographic entity names must be either used as the entity name in the application data model or be documented in the entity UDP "entity CDA standard name".**
2. **Standard geographic attribute names must be either used as the attribute name in the application data model or be documented in the attribute UDP "attribute CDA standard name".**
3. **Standard geographic entity and attribute definitions and data types must be used for the application data model's entity and attribute definitions and data types.**
4. **The sources of valid values and descriptions for reference data code attributes are identified in the attribute UDP "attribute data source name". CDA does not maintain any geographic code valid values.**
5. **The 'version' entities support changes to country, principal subdivision, and county names. They contain effective and termination dates. These dates are used to tell what the geographic country name, geographic principal subdivision name, and geographic county name are as of a certain point in time. They are to be used by application models that require the country, principal subdivision, or county name in the system to be the one in existence at the time address is in effect. (Refer to Example 4 in Area 2.)**

Area 2 – Application Model Template: The Standard Geographic Model Template provides a template for application data model "address" entities. It depicts the logical view of address data that is most common to CMS applications. This area, highlighted in yellow on the entity relationship diagram, consists of the following entities:

- Entity XYZ
- Entity XYZ Address
- Entity XYZ Address Street
- Entity XYZ Domestic Address
- Entity XYZ Foreign Address
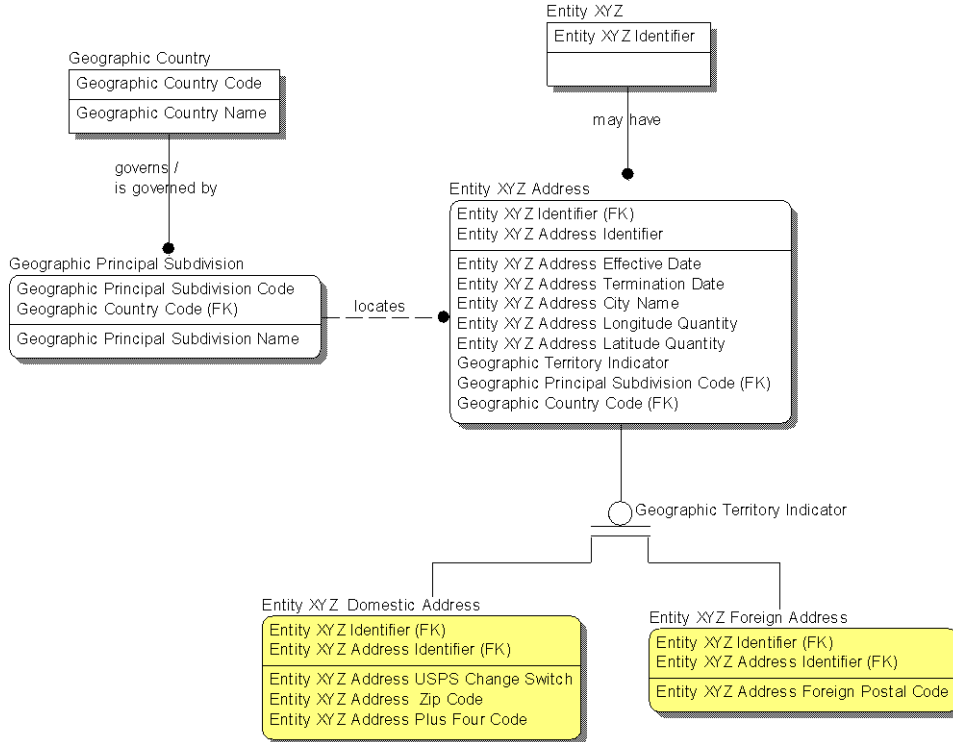- Entity XYZ Geographic Address Type Reference

The term "Entity XYZ" represents the application data model entity's object class term (e.g., Beneficiary, Organization, etc.). The CMS application data model may have more than one "Entity XYZ" with associated address entities (Example 3). The application logical data model structure may be different than the geographic model template as long as the application model is in third normal form and supports the business rules in the geographic model template. Geographic related entities and attributes, not included in the model template, can be added to the application data model upon approval from CDA.

The CMS application data model is only required to contain components of the template that are necessary to support system requirements. Below are examples of different system requirements and how they affect the implementation of the standard geographic template.

The entire standard geographic template can be incorporated into any application data model under any situation. The examples below only illustrate the entities that must exist based on application requirements if the data modeler does not want to incorporate the entire template.

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Example 1: Domestic and Foreign Addresses are Required in an Application Data Model

The model template depicts both domestic and foreign address entities. These are to be implemented in an application model as shown below when both types of addresses are required.

Entity XYZ
Entity XYZ Identifier

may have

Geographic Country
Geographic Country Code
Geographic Country Name

governs /
is governed by

Geographic Principal Subdivision
Geographic Principal Subdivision Code
Geographic Country Code (FK)
Geographic Principal Subdivision Name

locates

Entity XYZ Address
Entity XYZ Identifier (FK)
Entity XYZ Address Identifier
Entity XYZ Address Effective Date
Entity XYZ Address Termination Date
Entity XYZ Address City Name
Entity XYZ Address Longitude Quantity
Entity XYZ Address Latitude Quantity
Geographic Territory Indicator
Geographic Principal Subdivision Code (FK)
Geographic Country Code (FK)

Geographic Territory Indicator

Entity XYZ Domestic Address
Entity XYZ Identifier (FK)
Entity XYZ Address Identifier (FK)
Entity XYZ Address USPS Change Switch
Entity XYZ Address Zip Code
Entity XYZ Address Plus Four Code

Entity XYZ Foreign Address
Entity XYZ Identifier (FK)
Entity XYZ Address Identifier (FK)
Entity XYZ Address Foreign Postal Code

If addresses are either domestic or foreign, but not both, the Entity XYZ Address sub-types do not have to be added to the application data model. Refer to Example 2 for an Entity XYZ Address that is domestic-only and Example 3 for a foreign-only address.

Example 2: Only Domestic Address Required in an Application Data Model

If a CMS application only requires domestic address data (U.S. States and territories) the Geographic Country and Geographic Principal Subdivision entities in the template are omitted, unless a future requirement for foreign address is anticipated. The entity Geographic United States State is modified such that Geographic Principal Subdivision Code becomes the only attribute in the primary key (i.e., Geographic Country Code is not needed).
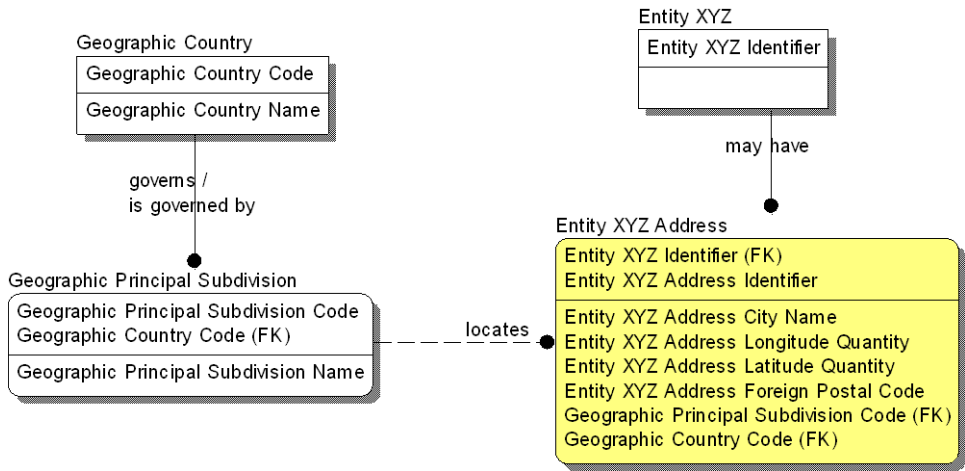
In the example below, the attribute Geographic Principal Subdivision Name in the Geographic Principal Subdivision Version entity in the model template was moved to Geographic United States State in the application model. This assumes that the application does not need to know when the name of a U.S. State or Territory changed or that it is very unlikely that the names will change.
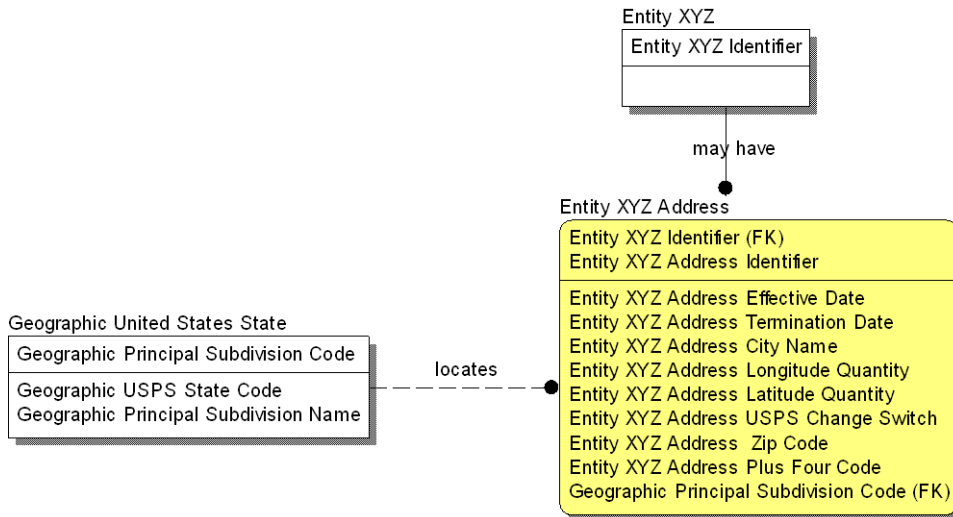
<u>Example 3</u>: Only Foreign-Only Address Required in an Application Data Model: Without Code Versioning

If a CMS application only requires foreign address data the Geographic Country and Geographic Principal Subdivision entities in the template are included in the application data model. Rather than subtyping the application address entity, attributes in Entity XYZ Foreign Address in the model template (i.e., address foreign postal code) can be moved to Entity XYZ Address in the application model.
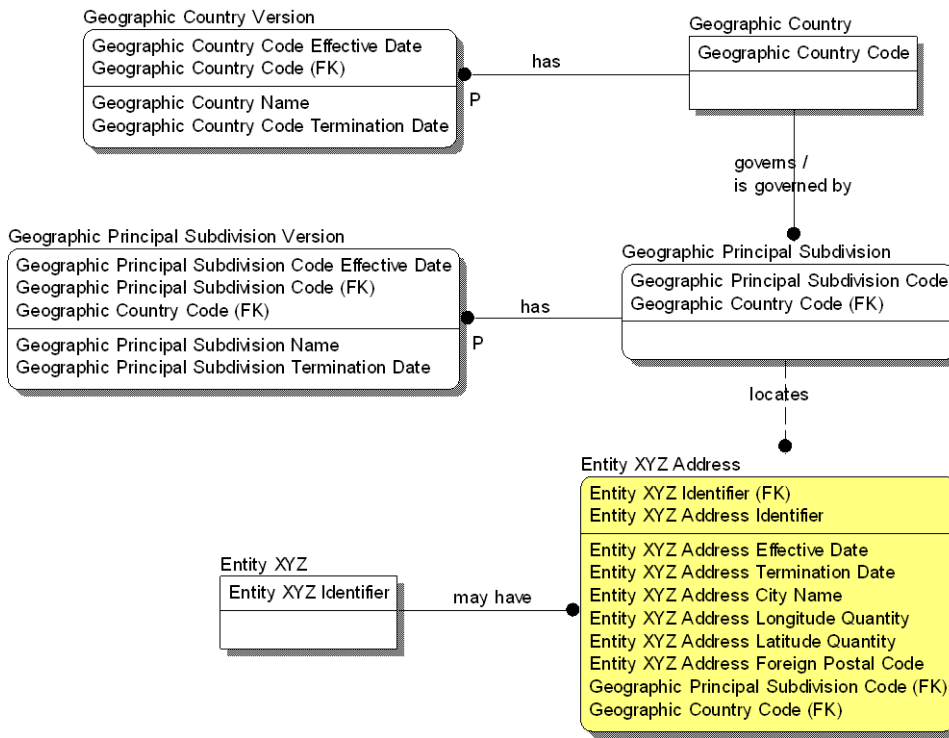
In the example below, the attribute Geographic Country Name in Geographic Country Version entity and the attribute Geographic Principal Subdivision Name in the Geographic Principal Subdivision Version entity in the model template were moved to Geographic Country and Geographic Principal Subdivision entities respectively in the application model. This assumes that the application does not need to know when the name of a country or principal subdivision changed.

Geographic Country

Geographic Country Code
Geographic Country Name

governs /
is governed by

Geographic Principal Subdivision

| Geographic Principal Subdivision Code |
Geographic Country Code (FK)
Geographic Principal Subdivision Name

locates

Entity XYZ

Entity XYZ Identifier

may have

Entity XYZ Address

| Entity XYZ Identifier (FK) |
Entity XYZ Address Identifier
Entity XYZ Address City Name
Entity XYZ Address Longitude Quantity
Entity XYZ Address Latitude Quantity
Entity XYZ Address Foreign Postal Code
Geographic Principal Subdivision Code (FK)
Geographic Country Code (FK)

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Example 4: Only Foreign-Only Address Required in an Application Data Model: With Code Versioning

If a CMS application only requires foreign address data the Geographic Country and Geographic Principal Subdivision entities in the template are included in the application data model. Rather than subtyping the application address entity, attributes in Entity XYZ Foreign Address in the model template (i.e., address foreign postal code) can be moved to Entity XYZ Address in the application model.
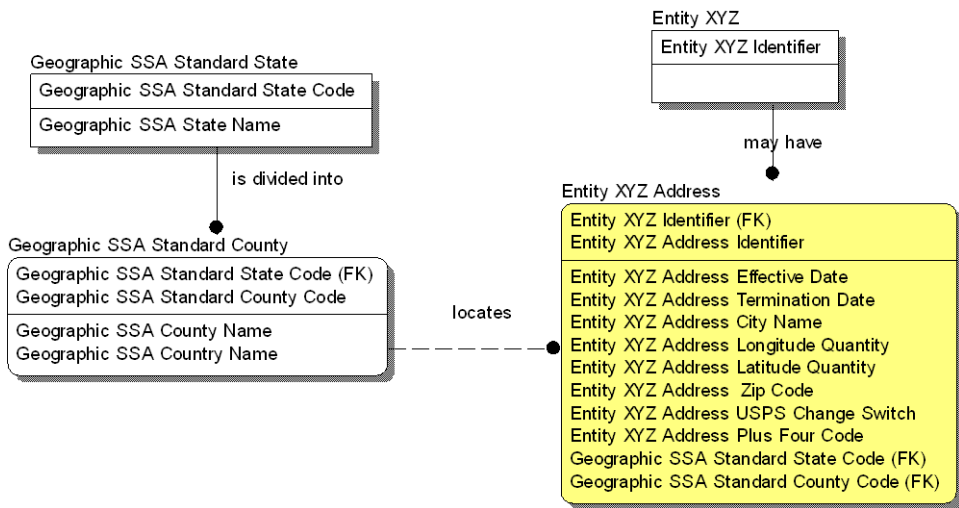
The Geographic Country Version and Geographic Principal Subdivision Version entities are included in the application data model to track changes to country and principal subdivision names. The application data model Entity XYZ Address must contain an effective and termination date that can be used to determine the country and principal subdivision names in effect at the same time.

Geographic Country Version

| Geographic Country Code Effective Date |
| Geographic Country Code (FK) |
| Geographic Country Name |
| Geographic Country Code Termination Date |

has

P

Geographic Country

| Geographic Country Code |

governs /
is governed by

Geographic Principal Subdivision Version

| Geographic Principal Subdivision Code Effective Date |
| Geographic Principal Subdivision Code (FK) |
| Geographic Country Code (FK) |
| Geographic Principal Subdivision Name |
| Geographic Principal Subdivision Termination Date |

has

P

Geographic Principal Subdivision

| Geographic Principal Subdivision Code |
| Geographic Country Code (FK) |

locates

Entity XYZ

| Entity XYZ Identifier |

may have

Entity XYZ Address

| Entity XYZ Identifier (FK) |
| Entity XYZ Address Identifier |
| Entity XYZ Address Effective Date |
| Entity XYZ Address Termination Date |
| Entity XYZ Address City Name |
| Entity XYZ Address Longitude Quantity |
| Entity XYZ Address Latitude Quantity |
| Entity XYZ Address Foreign Postal Code |
| Geographic Principal Subdivision Code (FK) |
| Geographic Country Code (FK) |

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<u>Example 5: Only SSA State and County Codes Required in an Application Data Model</u>

If an application requires SSA State and County codes and not ANSI or USPS state and county codes, the Geographic SSA Standard State and Geographic SSA Standard County reference entities would be copied from the model template into the application data model. The entities and relationships to Geographic United States State and Geographic United States County are not depicted in the application model.

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Entity XYZ

Entity XYZ Identifier

Geographic SSA Standard State

Geographic SSA Standard State Code
Geographic SSA State Name

is divided into

may have

Geographic SSA Standard County

Geographic SSA Standard State Code (FK)
Geographic SSA Standard County Code
Geographic SSA County Name
Geographic SSA Country Name

locates

Entity XYZ Address

Entity XYZ Identifier (FK)
Entity XYZ Address Identifier
Entity XYZ Address Effective Date
Entity XYZ Address Termination Date
Entity XYZ Address City Name
Entity XYZ Address Longitude Quantity
Entity XYZ Address Latitude Quantity
Entity XYZ Address Zip Code
Entity XYZ Address USPS Change Switch
Entity XYZ Address Plus Four Code
Geographic SSA Standard State Code (FK)
Geographic SSA Standard County Code (FK)

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Example 6: Identification of an Address Type is Required in an Application Data Model

Entity XYZ Geographic Address Type Reference entity (example 4) is used when there is a system requirement to differentiate addresses for the same instance of an entity. The model template validation rule "Address Type Code" contains valid values and descriptions that are used by the following CMS systems PECOS, NPPES, MBD, NMUD, and REMAS. The valid values described in the validation rule are not normalized. They can represent very similar address types and some are multiple descriptions for the same code value (e.g., R = Residence and R = Reassignment). The Local DA should populate the application model validation rule for Geographic Address Type Code based on application requirements. If the application needs an address type that is already defined in the model template, then the same valid value and description should be used in the application model. All other valid values in the model template validation rule should be dropped in the application model. In the example below, the relationship from Geographic Address Type to Party Payment Center Address is "no nulls". This deviation from the model template is acceptable because the application model is in third normal form and the relationship depicts the application's business rule. Another application model may need to depict the relationship as "nulls allowed" based on its business rule. The model template depicts the least restrictive relationship that can be used in an application model.

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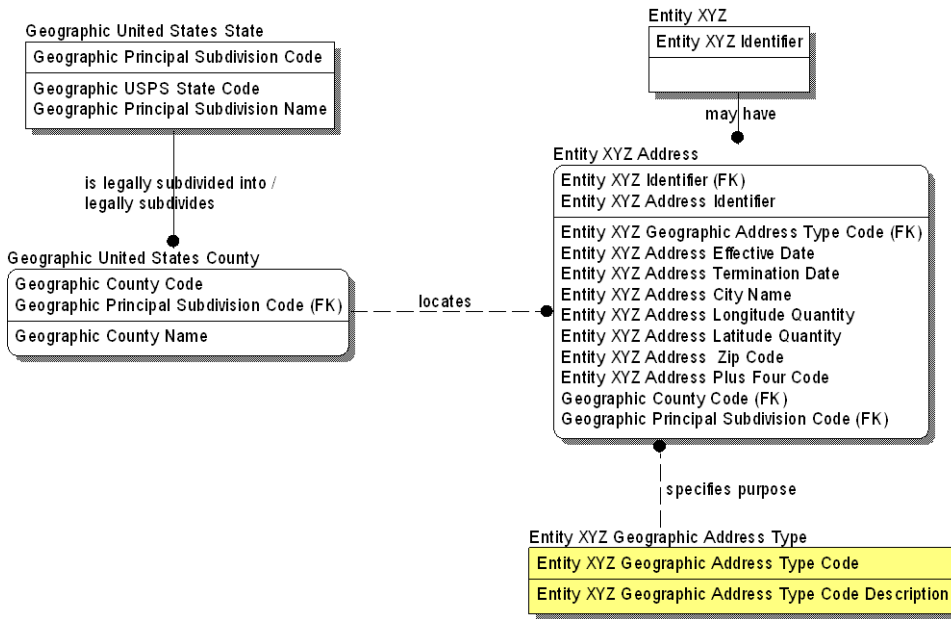
Example 7 – Application requires that only one address can be in effect at any point in time.

The Geographic Model template for Entity XYZ Address is designed to support a multitude of situations by having a surrogate key as the identifier. However, the application model may place additional constraints on the entity by replacing the surrogate key (Entity XYZ Address Identifier) with a natural key (Entity XYZ Address Effective Date).

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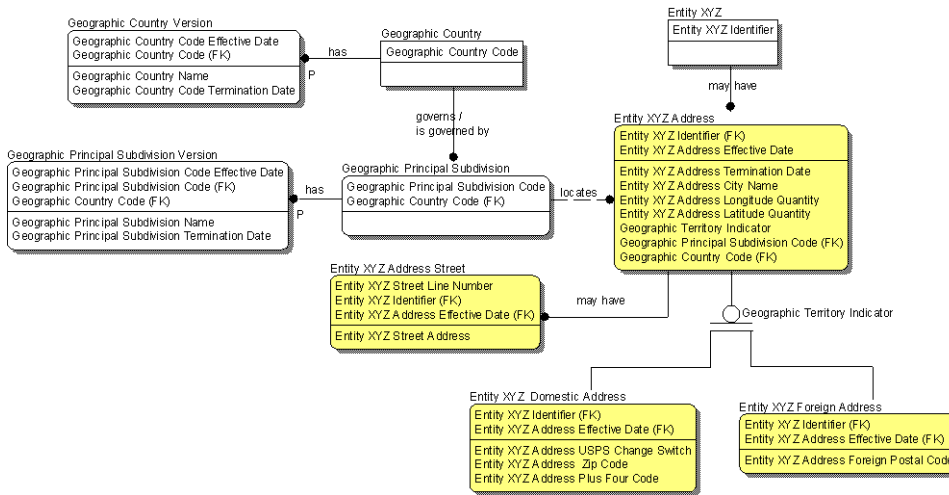
When mapping a pre-existing application data model to the geographic data model, the standard geographic model attribute name should be entered into the attribute UDP "Attribute CDA Standard Name" in the application logical data model. For example,

Application Entity	Application Attribute	Application UDP "Attribute CDA Standard Name"
Beneficiary Derived Mailing Address	Beneficiary Derived Line One Mailing Address	Beneficiary Derived Mailing Address Street, Beneficiary Derived Mailing Street Line Number
Beneficiary Derived Mailing Address	Beneficiary Derived Line Two Mailing Address	Beneficiary Derived Mailing Address Street, Beneficiary Derived Mailing Street Line Number
Beneficiary Derived Mailing Address	Beneficiary Derived Line Three Mailing Address	Beneficiary Derived Mailing Address Street, Beneficiary Derived Mailing Street Line Number

Notes on Area 2:
1. **Application logical models should use the Entity XYZ entity and attribute names, definitions and data types documented in the model template. "Entity XYZ" is replaced with the appropriate application object class term.**
2. **Entity relationships between application-address entities and reference data entities in the application model are determined by the application data requirements.**
3. **The Entity XYZ Geographic Address Type Code "validation rule" is optional and must be customized by the Local DA to be implemented in an application model.**
4. **Application specific attributes can be added to these entities by the Local DA.**
5. **Geospatial data (Entity XYZ Address Longitude Quantity and Entity XYZ Address Latitude Quantity) are modeled at the application data model entity level. Refer to the attribute definitions for more information. City name must comply with USPS standards if it is to be used to find latitude and longitude coordinates of an address.**

Description of CMS State, County and Country Codes in the Standard Geographic
Model Template

The Standard Geographic Model Template is designed to support the set of state and county code values
defined by ANSI, SSA, and USPS. Below are separate descriptions of the three state and county code
values that are used at CMS. Following these descriptions is a comparison of the three systems. The
template also supports the country code values which are described in a section below titled Former
Federal Information Processing Standards (formerly FIPS).

American National Standards Institute (ANSI)
American National Standards Institute codes (ANSI codes) are a standardized set of numeric codes
issued by the American National Standards Institute (ANSI) to ensure uniform identification of geographic
entities through all federal government agencies. These standards replace the Federal Information
Processing Standards (FIPS) codes previously issued by the National Institute of Standards and
Technology (NIST). The entities covered include: states and statistically equivalent entities, counties and
statistically equivalent entities, named populated and related location entities (such as, places and county
subdivisions), and American Indian and Alaska Native areas.

The standard geographic model template supports the following standards which are maintained and
published by the U.S. Census Bureau. They are available at an ANSI page on their website:
http://www.census.gov/geo/www/ansi/statetables.html.

INCITS 38:200X (Formerly FIPS 5-2) Codes for the Identification of the States, the District of Columbia,
Puerto Rico, and the Insular Areas of the United States

INCITS 31:200X (Formerly FIPS 6-4) Codes for the Identification of Counties and Equivalent Entities of
the United States, its Possessions, and Insular Areas

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Social Security Administration Coding System
- CMS last received a published update of Standard SSA state and county codes from SSA in 1988 (one year after the Computer Security Act of 1987).
- Not all SSA state code values found in CMS systems are standard SSA state codes. The geographic model template does not include these anomalies in the domain of SSA state code values. See examples of anomalies under State Code paragraph below.
- It is not known whether SSA has its own set of country codes. CMS systems do not have an attribute named "SSA Country Code". CMS systems use the attribute SSA State Code to represent countries.
- The Enrollment Database (EDB) is the CMS authoritative source of Social Security Administration (SSA) Standard State and County Code values and descriptions.

United States Postal Service (USPS) Coding System
- The state alpha code is represented in the geographic model template as Geographic USPS State Code. Refer to http://pe.usps.gov/cpim/ftp/pubs/Pub28/pub28.pdf for USPS State Codes.
- The U.S. Postal Service does not employ the term U.S. Minor Outlying Islands, as mail for any of these islands is routed indirectly.
- The U.S. Postal Service employs the use of three "Military State" abbreviations for six military states that are not part of the ANSI coding system. The Standard Geographic Model Template does not support USPS military states.

Former Federal Information Processing Standards (FIPS)

The computer Security Act of 1987 required all Federal agencies to use the standardized system of codes called FIPS. On September 2, 2008 the Department of Commerce/National Institute of Standards and Technology withdrew the Federal Information Processing Standards Publication 10-4 Specification for Countries, Dependencies, Areas of Special Sovereignty, and their Principal Administrative Divisions (FIPS 10-4). The decision to withdraw FIPS 10-4 was based on the National Technology Transfer and Advancement Act of 1995 (Pub. L. 104-113) which directed Federal agencies and departments to use technical standards that are developed in voluntary consensus standards bodies. No successor standard for geopolitical codes for international use was identified by the Department of Commerce. The National Geospatial-Intelligence Agency (NGA), as the maintenance authority for FIPS 10-4, will continue to maintain and provide updates to its content as necessary.

- Geopolitical Entity Names and Digraph Codes (formerly FIPS 10-4) Independent States

Change notices for Geopolitical Entity Names and Digraph Codes are issued by the NGA and are available on NGA's GEOnet Names Server (GNS) at: http://earth-info.nga.mil/gns/html/gazetteers2.htm

Since the withdrawal announcement, numerous US Government agencies are working with the American National Standards Institute (ANSI) National Information Standards Organization (NISO) Technical Committee to identify a replacement standard in the form of a draft proposed American National Standard or adopting a standard based on ISO-3166.

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Principal Subdivision Code
- The term Geopolitical Principal Subdivision applies to land areas throughout the world (e.g. U.S. States). The ANSI state codes applicable to the U.S. and areas under U.S. sovereignty are listed in INCITS 38:200X (formerly FIPS Pub 5-2). Other FIPS geopolitical principal subdivision codes are listed in former FIPS Pub 10-4 by country (geopolitical entity) as principal administrative divisions.
- Three classification systems (ANSI, SSA, and USPS) are used by CMS to identify land areas under the sovereignty of the United States. ANSI replaced FIPS September 2, 2008 as the federal government standard.
- The geographic model template is designed to be in compliance with the federal government standard. It does not support the address data anomalies that exist within CMS databases.
- ANSI INCITS 38:200X publication provides a set of two-digit numeric codes and a set of two-letter alphabetic codes for representing the 50 states, the District of Columbia and the outlying areas of the United States, and associated areas. The numeric codes are the ANSI state codes; the alphabetic codes are the official USPS state codes. The standard covers all land areas under the sovereignty of the United States, the freely associated states of Federated States of Micronesia and Marshall Islands, and the trust territory of Palau.
- ANSI and SSA states code values only have a one-to-one correspondence when the state is one of the land areas under the sovereignty of the United States. ANSI and SSA state code values assigned to U.S. territories do not have a direct one-to-one correlation.
- CMS systems have modified the SSA classification system to accommodate CMS application design.
  - EDB maintains a set of "SSA" State Codes that include more states than those identified by SSA. EDB uses the same field for country codes and army post offices.
  - NCH GEO_SSA_STATE_TB table contains more than one code value for certain states (e.g., Maryland is represented as both '21' and '80'.) Extra code values were created to uniquely identify providers whose 'state code' is imbedded in the provider identifier. This anomaly is not supported by the Standard Geographic Model Template.

County Code
- County codes are only unique within a U.S. state and U.S. possession
- There are differences between ANSI and SSA County codes. Some are due to updates by ANSI and SSA that are not in-sync.
- The standard geographic model template depicts both ANSI and SSA County Code attributes.
- SSA does not publish a set of country subdivision codes (other than US States). However, CMS augments the SSA Standard State and County Codes to represent subdivisions of countries and continents.
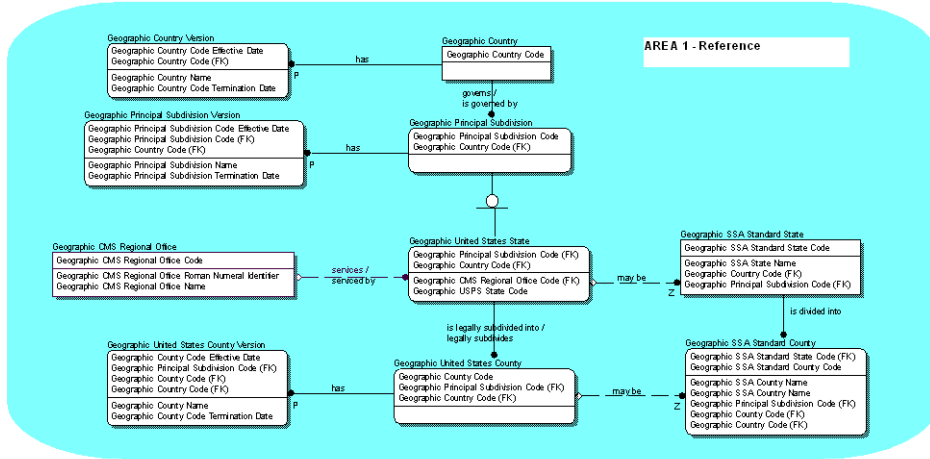
Country Code
- Former FIPS PUB 10-4 contains the official set of country codes until a replacement standard is identified by the American National Standards Institute (ANSI) National Information Standards Organization (NISO) Technical Committee.
- SSA does not publish a set of country codes. However, CMS augments the SSA Standard State Codes to represent countries.

Zip Code
- Zip codes can cross state and county lines.
- There is no perfect correlation between zip codes and any other geographic data. The geographic model template does not depict geographic data relationships to zip code. Rather zip code is represented as a characteristic of an address.

CMS Standard Geographic Template Entity Relationship Diagram