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Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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RFC Editor Note

RFC 4776 is being published to correct an error in the assignment of the numeric value of the DHCPv6 option-code in RFC 4676 (Section 3.2). This document obsoletes RFC 4676.

Abstract

This document specifies a Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) option containing the civic location of the client or the DHCP server. The Location Configuration Information (LCI) includes information about the country, administrative units such as states, provinces, and cities, as well as street addresses, postal community names, and building information. The option allows multiple renditions of the same address in different scripts and languages.

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1. Introduction

Many end system services can benefit by knowing the approximate location of the end device. In particular, IP telephony devices need to know their location to contact the appropriate emergency response agency and to be found by emergency responders.

There are two common ways to identify the location of an object, either through geospatial coordinates or by so-called civic addresses. Geospatial coordinates indicate longitude, latitude, and altitude, while civic addresses indicate a street address.

The civic address is commonly, but not necessarily, closely related to the postal address, used by the local postal service to deliver mail. However, not all postal addresses correspond to street addresses. For example, the author's address is a postal address that does not appear on any street or building sign. Naturally, post office boxes would be unsuitable for the purposes described here. The term 'civil address' or 'jurisdictional address' is also sometimes used instead of civic address. This document mainly supports civic addresses, but allows the postal community name to be indicated if it differs from the civic name.

A related document [15] describes a DHCPv4 [2] option for conveying geospatial information to a device. This document describes how DHCPv4 and DHCPv6 [6] can be used to convey the civic and postal address to devices. Both geospatial and civic formats can be used simultaneously, increasing the chance to deliver accurate and timely

location information to emergency responders. The reader should also be familiar with the concepts in [11], as many of the protocol elements below are designed to dovetail with PIDF-LO elements.

This document only defines the delivery of location information from the DHCP server to the client, due to security concerns related to using DHCP to update the database. Within the GEOPRIV architecture as defined by RFC 3693 [9], the defined mechanism in this document for conveying initial location information is known as a "sighting" function. Sighting functions are not required to have security capabilities and are only intended to be configured in trusted and controlled environments. (A classic example of the sighting function is a Global Positioning System wired directly to a network node.) Further discussion of the protections that must be provided according to RFC 3694 [10] are in the Security Considerations (Section 6).

End systems that obtain location information via the mechanism described here then use other protocol mechanisms to communicate this information to an emergency call center or to convey it as part of presence information.

Civic information is useful since it often provides additional, human-usable information, particularly within buildings. Also, compared to geospatial information, it is readily obtained for most occupied structures and can often be interpreted even if incomplete. For example, for many large university or corporate campuses, geocoding information to building and room granularity may not be readily available.

Unlike geospatial information, the format for civic and postal information differs from country to country. The initial set of data fields is derived from standards published by the United States National Emergency Number Association (NENA) [18] and takes into account addressing conventions for a number of countries in different areas of the world. It is anticipated that other countries can reuse many of the data elements, but the document also establishes an IANA registry for defining additional civic location data fields.

The same civic and postal address information can often be rendered in multiple languages and scripts. For example, Korean addresses are often shown in Hangul, Latin, and Kanji, while some older cities have multiple language variants (e.g., Munich, Muenchen, and Monaco). Since DHCPv4 and DHCPv6 do not currently support a mechanism to query for a specific script or language, the DHCP server SHOULD provide all common renderings to the client and MUST provide at least the rendering in the language and script appropriate to the location indicated. For example, for use in presence information, the target may be visiting from a foreign country and want to convey the

information in a format suitable for watchers in its home country. For emergency services, the rendering in the local language is likely to be most appropriate. To provide multiple renderings, the server repeats sequences of address elements, prefixing each with a 'language' and/or 'script' element (see Section 3.3). The language and script remain in effect for subsequent elements until overridden by another language or script element. Since the DHCP client is unlikely to be the final consumer of the location information, the DHCP server has to provide all appropriate language and script versions, which the client then passes on via some other GEOPRIV using protocol, typically encoded in a presence-based GEOPRIV location object format [16].

The DHCP server MAY provide location information for multiple locations related to the target, for example, both the network element and the network jack itself. This is likely to help in debugging network problems, for example.

This document calls for various operational decisions. For example, an administrator has to decide when to provide the location of the DHCP server or other network elements even if these may be a good distance away from the client. The administrator must also consider whether to include both civic and geospatial information if these may differ. The document does not specify the criteria to be used in making these choices, as these choices are likely to depend strongly on local circumstances and need to be based on local, human knowledge.

A system that works with location information configured by DHCP is dependent that the administrators of the DHCP systems are careful enough on a number of fronts, such as:

- if information about one location is provided in multiple forms (e.g., in multiple languages), is it consistent?

- is the administrator certain that location information is configured only to systems to which it applies (e.g., not to systems topologically near, but geographically far)?

- if the location configured is not that of the target but that of a 'nearby' network node or the DHCP server, despite the recommendation against this practice in Section 3.1, is the administrator certain that this configuration is geographically valid?

There are many other considerations in ensuring that location information is handled safely and promptly for an emergency service in particular. Those are in the province of the applications which

make use of the configured location information, and they are beyond the scope of this document. DHCP configuration SHOULD NOT be used for emergency services without guidelines on these considerations. Work on these is under way in the IETF ECRIT working group at the time of publication of this document.

In addition, if a network provides civic location information via both DHCPv4 and DHCPv6, the information conveyed by the two protocols MUST be the same.

As discussed in the Security Considerations (Section 6), the GEOCONF_CIVIC option SHOULD be returned by DHCPv4 servers only when the DHCPv4 client has included this option in its 'parameter request list' (RFC 2131 [2], Section 3.5). Similarly, the OPTION_GEOCONF_CIVIC option SHOULD be returned by DHCPv6 servers only when the DHCPv6 client has included this option in its OPTION_ORO.

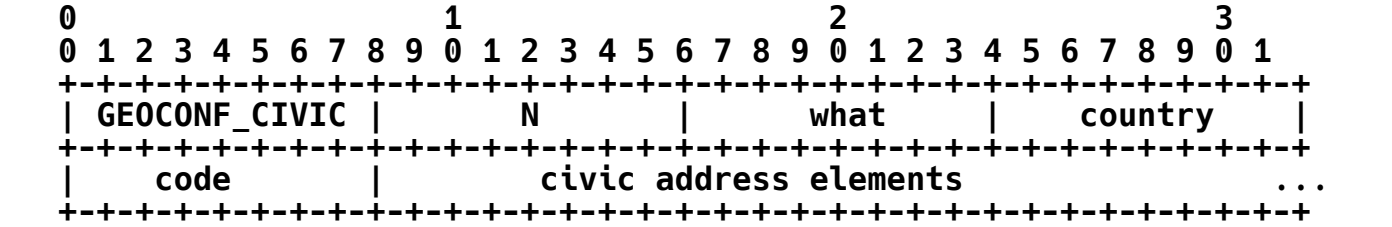
The DHCPv4 long-options mechanism described in RFC 3396 [8] MUST be used if the civic address option exceeds the maximum DHCPv4 option size of 255 octets.

2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [1] and indicate requirement levels for compliant implementations.

3. Format of the DHCP Civic Location Option

3.1. Overall Format for DHCPv4



Code GEOCONF_CIVIC: The code for this DHCP option is 99.

N: The length of this option is variable. The minimum length is 3 octets.

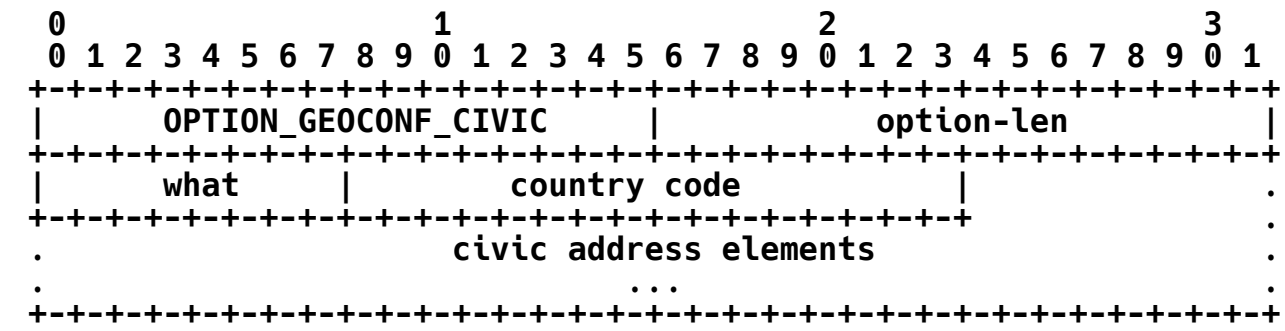
what: The 'what' element describes to which location the DHCP entry refers. Currently, three options are defined: the location of the DHCP server (a value of 0), the location of the network element believed to be closest to the client (a value of 1), or the location of the client (a value of 2). Option (2) SHOULD be used, but may not be known. Options (0) and (1) SHOULD NOT be used unless it is known that the DHCP client is in close physical proximity to the server or network element.

country code: The two-letter ISO 3166 country code in capital ASCII letters, e.g., DE or US. (Civic addresses always contain country designations, suggesting the use of a fixed-format field to save space.)

civic address elements: Zero or more elements comprising the civic and/or postal address, with the format described below (Section 3.3).

3.2. Overall Format for DHCPv6

The DHCPv6 [6] civic address option refers generally to the client as a whole.



option-code: OPTION_GEOCONF_CIVIC (36)

option-len: Length of the Countrycode, 'what' and civic address elements in octets.

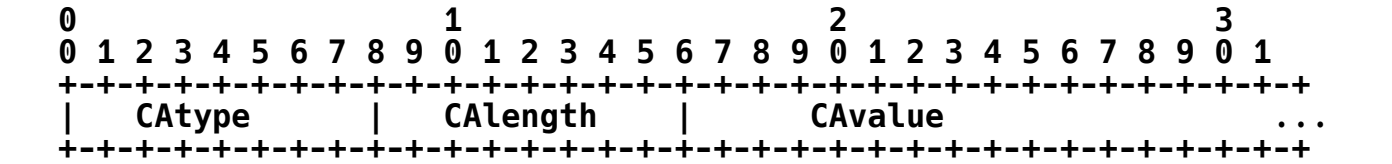
what: See above (Section 3.1).

country code: See above (Section 3.1).

civic address elements: See above (Section 3.1).

3.3. Element Format

For both DHCPv4 and DHCPv6, each civic address element has the following format:



CAtype: A one-octet descriptor of the data civic address value.

CAlength: The length, in octets, of the CAvalue, not including the CAlength field itself.

CAvalue: The civic address value, as described in detail below.

3.4. Civic Address Components

Since each country has different administrative hierarchies, with often the same (English) names, this specification adopts a simple hierarchical notation that is then instantiated for each country. We assume that five levels are sufficient for sub-national divisions above the street level.

All elements are OPTIONAL and can appear in any order.

Component values MUST be encoded as UTF-8 [7]. They SHOULD be written in mixed case, following the customary spelling. The script indication (CAtype 128) MUST be written in mixed case, with the first letter a capital letter.

Abbreviations MUST NOT be used unless indicated for each element. Abbreviations do not need a trailing period.

It is RECOMMENDED that all elements in a particular script (CAtype 128) and language (CAtype 0) be grouped together, as that reduces the number of script and language identifiers needed.

For each script and language, elements SHOULD be included in numeric order from lowest to highest of their CAtype. In general, an element is labeled in its language and script by the most recent 'language tag' (CAtype) element preceding it. Since not all elements depend on the script and language, a client accumulates the elements by CAtype and then selects the most desirable language and script rendition if there are multiple elements for the same CAtype.

CAtype	label	description
1	A1	national subdivisions (state, canton, region, province, prefecture)
2	A2	county, parish, gun (JP), district (IN)
3	A3	city, township, shi (JP)
4	A4	city division, borough, city district, ward, chou (JP)
5	A5	neighborhood, block
6	A6	group of streets below the neighborhood level

Table 1

For specific countries, the administrative sub-divisions are described below.

CA (Canada): The mapping to NENA designations is shown in parentheses. A1 designates the province (STA), A2 the county (CNA), A3 the city, town, or MSAG community name (MCN).

DE (Germany): A1 represents the state (Bundesstaat), A2 the county (Regierungsbezirk), A3 the city (Stadt, Gemeinde), A4 the district (Bezirk). Street suffixes (STS) are used only for designations that are a separate word (e.g., Marienthaler Strasse).

JP (Japan): A1 represents the metropolis (To, Fu) or prefecture (Ken, Do), A2 the city (Shi) or rural area (Gun), A3 the ward (Ku) or village (Mura), A4 the town (Chou or Machi), A5 the city district (Choume), and A6 the block (Banchi or Ban).

KR (Korea): A1 represents the province (Do), A2 the county (gun), A3 the city or village (ri), A4 the urban district (gu), A5 the neighborhood (dong).

US (United States): The mapping to NENA designations is shown in parentheses. A1 designates the state (STA), using the two-letter state and possession abbreviations recommended by the United States Postal Service Publication 28 [17], Appendix B. A2 designates the county, parish (Louisiana), or borough (Alaska) (CNA). A3 designates the civic community name, e.g., city or town. It is also known as the municipal jurisdiction or MSAG community name (MCN). The civic community name (A3) reflects the

political boundaries. These boundaries may differ from postal delivery assignments, the postal community name (PCN), for historical or practical reasons. The optional element A4 contains the community place name, such as "New Hope Community" or "Urbanizacion" in Puerto Rico.

Mappings and considerations from additional countries may be informally gathered from time to time in independent documents published by the IETF. These should be titled "Civic Address Considerations for [Country]" and should contain similar information to the examples given here. As published by the IETF, they will be non-normative and purely descriptive, like the examples here, and will not purport to speak with authority for any country, but rather be offered for information. If authors choose to label the document with a country code, this does not preclude its use for labeling a future coexisting document.

Additional CA types appear in many countries and are simply omitted where they are not needed or known:

CAtype	NENA	PIDF	Description	Examples
0			language	i-default [3]
16	PRD	PRD	leading street direction	N
17	POD	POD	trailing street suffix	SW
18	STS	STS	street suffix or type	Ave, Platz
19	HNO	HNO	house number	123
20	HNS	HNS	house number suffix	A, 1/2
21	LMK	LMK	landmark or vanity address	Columbia University
22	LOC	LOC	additional location information	South Wing
23	NAM	NAM	name (residence and office occupant)	Joe's Barbershop
24	ZIP	PC	postal/zip code	10027-1234
25			building (structure)	Low Library

CAtype	NENA	PIDF	Description	Examples
26			unit (apartment, suite)	Apt 42
27		FLR	floor	4
28			room	450F
29			type of place	office
30	PCN		postal community name	Leonia
31			post office box (P.O. Box)	12345
32			additional code	13203000003
33		SEAT	seat (desk, cubicle, workstation)	WS 181
34			primary road name	Broadway
35			road section	14
36			branch road name	Lane 7
37			sub-branch road name	Alley 8
38			street name pre-modifier	Old
39			street name post-modifier	Service
128			script	Latn
255			reserved	

The CA types labeled in the second column correspond to items from the NENA "Recommended Formats and Protocols For ALI Data Exchange, ALI Response and GIS Mapping" [18], but are applicable to most countries. The "NENA" column refers to the data dictionary name in Exhibit 18 of [18].

The column labeled PIDF indicates the element name from [16]. (Some elements were added to this document after the PIDF location object definition had been completed. These elements currently do not have a PIDF-LO equivalent.)

Language: The "language" item (CAtype 0) optionally identifies the language used for presenting the address information, drawing from the tags for identifying languages in [4], as discussed in [13]. If omitted, the default value for this tag is "i-default" [3].

Script: The "script" item (CAtype 128) optionally identifies the script used for presenting the address information, drawing from the tags for identifying scripts described in [12] and elaborated on in Section 2.2.3 of [13]. If omitted, the default value for this tag is "Latn".

POD, PRD: The abbreviations N, E, S, W, and NE, NW, SE, SW SHOULD be used for POD (trailing street suffix) and PRD (leading street direction) in English-speaking countries.

STS: STS designates a street suffix or type. In the United States (US), the abbreviations recommended by the United States Postal Service Publication 28 [17], Appendix C, SHOULD be used.

HNS: HNS ("house number suffix") is a modifier to a street address; it does not identify parts of a street address.

building: While a landmark (LMK, CAtype 21) can indicate a complex of buildings, 'building' (CAtype 25) conveys the name of a single building if the street address includes more than one building or if the building name is helpful in identifying the location.

LOC: LOC ("location", CAtype 22) is an unstructured string specifying additional information about the location, such as the part of a building or other unstructured information.

PCN: The postal community name (CAtype 30) and the post office box (CAtype 31) allow the recipient to construct a postal address. The post office box field should contain the words "P.O. Box" or other locally appropriate postal designation.

NAM: The NAM object is used to aid user location ("Joe Miller", "Alice's Dry Cleaning"). It does not identify the person using a communications device, but rather the person or organization associated with the address.

LMK: While a landmark (LMK, CAtype 21) can indicate a complex of buildings, 'building' (CAtype 25) conveys the name of a single building if the street address includes more than one building or the building name is helpful in identifying the location. (For example, on university campuses, the house number is often not displayed on buildings, whereas the building name is prominently shown.)

Unit: The "unit" object (CAtype 26) contains the name or number of a part of a structure where there are separate administrative units, owners, or tenants, such as separate companies or families that occupy that structure. Common examples include suite or apartment designations.

Room: A "room" (CAtype 28) is the smallest identifiable subdivision of a structure.

Type of place: The "type of place" item (CAtype 29) describes the type of place described by the civic coordinates. For example, it describes whether it is a home, office, street, or other public space. The values are drawn from the items in the location types registry [11]. This information makes it easy, for example, for the DHCP client to then populate the presence information. Since this is an IANA-registered token, the language and script designations do not apply for this element.

Additional code: The "additional code" item (CAtype 32) provides an additional, country-specific code identifying the location. For example, for Japan, it contains the Japan Industry Standard (JIS) address code. The JIS address code provides a unique address inside of Japan, down to the level of indicating the floor of the building.

SEAT: The "seat" item (CAtype 33) designates a place where a person might sit, such as a seat in a stadium or theater, or a cubicle in an open-plan office or a booth in a trade show.

Primary road name: The "primary road" item (CAtype 34) is given to the road or street name associated with the address. If CAtypes 35 through 37 are not specified, the building or designated location is found on that street. If some of CAtypes 35 through 37 are specified, this designates the main road, off of which the smaller streets branch off and where the structure or building is actually located.

Road section: The "road section" item (CAtype 35) designates a specific section or stretch of a primary road. This is a new thoroughfare element and is useful where a primary road is divided into sections that re-use the same street number ranges.

Branch road name: The "branch road name" item (CAtype 36) represents the name or identifier of a road or street that intersects or is associated with a primary road. The branch road name is used only in countries where side streets do not have unique names within a municipality or other administrative unit, but rather must be

qualified by the name of the primary road name that they branch off of.

Sub-Branch road name: The "sub-branch road name" (CAtype 37) item represents the name of a street that branches off a branch road (CAtype 36). The sub-branch road name is used only in countries where such streets are named relative to the primary road name and branch road that they connect with.

Street name pre-modifier: The "street name pre-modifier" (CAtype 38) is an optional element of the complete street name. It is a word or phrase that precedes all other elements of the street name and modifies it, but is separated from the street name by a street name pre-directional. An example is "Old" in "Old North First Street".

Street name post-modifier: The "street name post-modifier" (CAtype 39) is an optional element of the complete street name. It is a word or phrase that follows all other elements of the street name and modifies it, but is separated from the street name by a street name post-directional and/or street suffix. An example is "Extended" in "East End Avenue Extended".

4. Postal Addresses

In general, a recipient can construct a postal address by using all language-appropriate elements, including the postal code (ZIP, CAtype 24). However, certain elements override the civic address components to create a postal address. If the elements include a post office box (CAtype 31), the street address components (CAtype 34, PRD, POD, STS, HNO, HNS) are replaced with the post office box element. If a postal community name is specified, the civic community name (typically, A3) is replaced by the postal community name (PCN, CAtype 30). Country-specific knowledge is required to create a valid postal address. The formating of such addresses is beyond the scope of this document.

5. Example

Rather than showing the precise byte layout of a DHCP option, we show a symbolic example below, representing the civic address of the Munich city hall in Bavaria, Germany. The city and state name are also conveyed in English and Italian in addition to German; the other items are assumed to be common across all languages. All languages use the latin script.

CAtype	CAvalue
0	de
128	Latn
1	Bayern
2	Oberbayern
3	M=U+00FCnchen
6	Marienplatz
19	8
21	Rathaus
24	80331
29	government-building
31	Postfach 1000
0	en
1	Bavaria
3	Munich
0	it
1	Baviera
3	Monaco

6. Security Considerations

The security considerations discussed in the GEOPRIV architecture defined by RFC 3693 [9] apply.

Where critical decisions might be based on the value of this GEOCONF_CIVIC option, DHCPv4 authentication in RFC 3118 [5] SHOULD be used to protect the integrity of the DHCP options.

Since there is no privacy protection for DHCP messages, an eavesdropper who can monitor the link between the DHCP server and requesting client can discover the information contained in this option. Thus, usage of this option on networks without access restrictions or network-layer or link-layer privacy mechanisms is NOT RECOMMENDED.

To minimize the unintended exposure of location information, the GEOCONF_CIVIC option SHOULD be returned by DHCPv4 servers only when the DHCPv4 client has included this option in its 'parameter request list' (RFC 2131 [2], Section 3.5). Similarly, the OPTION_GEOCONF_CIVIC option SHOULD be returned by DHCPv6 servers only when the DHCPv6 client has included this option in its OPTION_ORO.

After initial location information has been introduced, it MUST be afforded the protections defined in RFC 3694 [10]. Therefore, location information SHOULD NOT be sent from a DHCP client to a DHCP server. If a client decides to send location information to the server, it is implicitly granting that server unlimited retention and distribution permissions.

7. IANA Considerations

The IANA has registered new DHCPv4 and DHCPv6 option codes for the Civic Address (GEOCONF_CIVIC and OPTION_GEOCONF_CIVIC, respectively).

This document establishes a new IANA registry for CAtypes designating civic address components. Referring to RFC 2434 [14], this registry operates under both "Expert Review" and "Specification Required" rules. The IESG will appoint an Expert Reviewer who will advise IANA promptly on each request for a new or updated CAtype.

CAtype: Numeric identifier, assigned by IANA.

Brief description: Short description identifying the meaning of the element.

Reference to published specification: A stable reference to an RFC or other permanent and readily available reference, in sufficient detail so that interoperability between independent implementations is possible.

Country-specific considerations: If applicable, notes whether the element is only applicable or defined for certain countries.

The initial list of registrations is contained in Section 3.4.

Updates to country-specific considerations for previously-defined CAtypes are not defined by IANA registrations since they are purely descriptive, not a registration of identifiers. As noted earlier, country-specific conventions may optionally be written up in documents titled "Civic Addresses for [Country]".

8. References

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