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(54) METHOD AND APPARATUS FOR INTEGRATION OF COMMUNITY-PROVIDED PLACE DATA

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(57) ABSTRACT

An approach is provided for integrating place metadata provided by a community of metadata builders, including receiving registration data that indicates one or more values for a corresponding one or more attributes that describe a place. A place is associated with a geographic location. Providing an indication of match between the registration data and metadata for a predetermined place is also initiated. In some embodiments, a new entry for a set of predetermined places is generated based on validating the registration data and a negligible degree of match. In some embodiments, a unique identifier for the place is included in indication of match for either a new place represented by the registration data or a matching predetermined place.

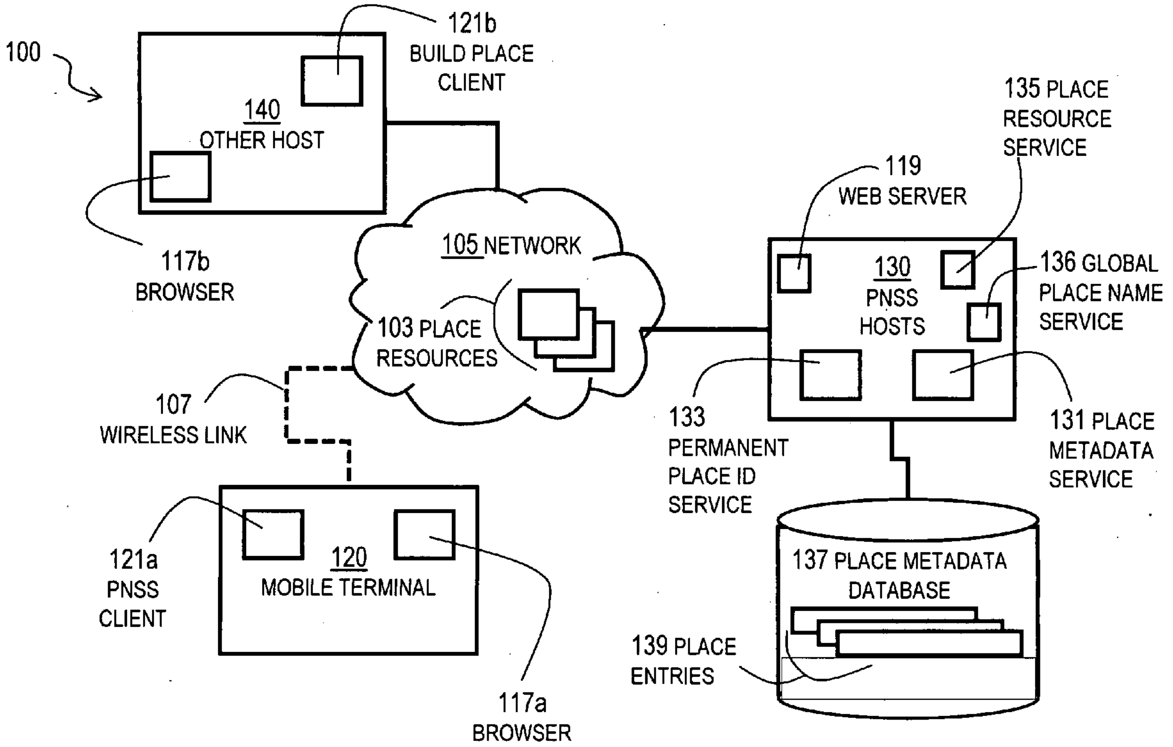


FIG. 1

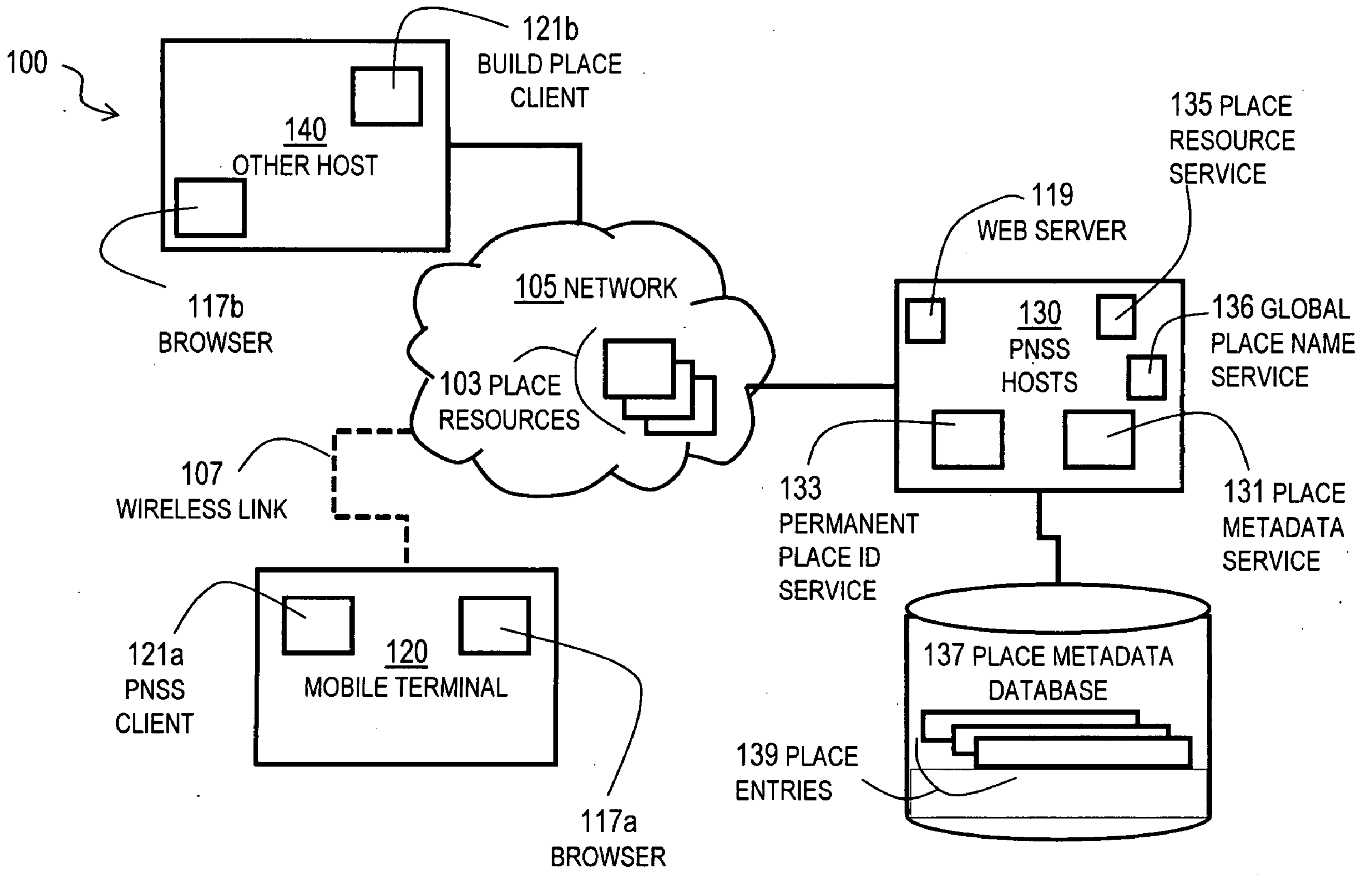

100
121b
BUILD PLACE
CLIENT
140
OTHER HOST
117b
BROWSER
105 NETWORK
103 PLACE
RESOURCES
107
WIRELESS LINK
121a
PNSS
CLIENT
120
MOBILE TERMINAL
117a
BROWSER
119
WEB SERVER
135 PLACE
RESOURCE
SERVICE
130
PNSS
HOSTS
136 GLOBAL
PLACE NAME
SERVICE
133
PERMANENT
PLACE ID
SERVICE
131 PLACE
METADATA
SERVICE
137 PLACE METADATA
DATABASE
139 PLACE
ENTRIES

FIG. 2A

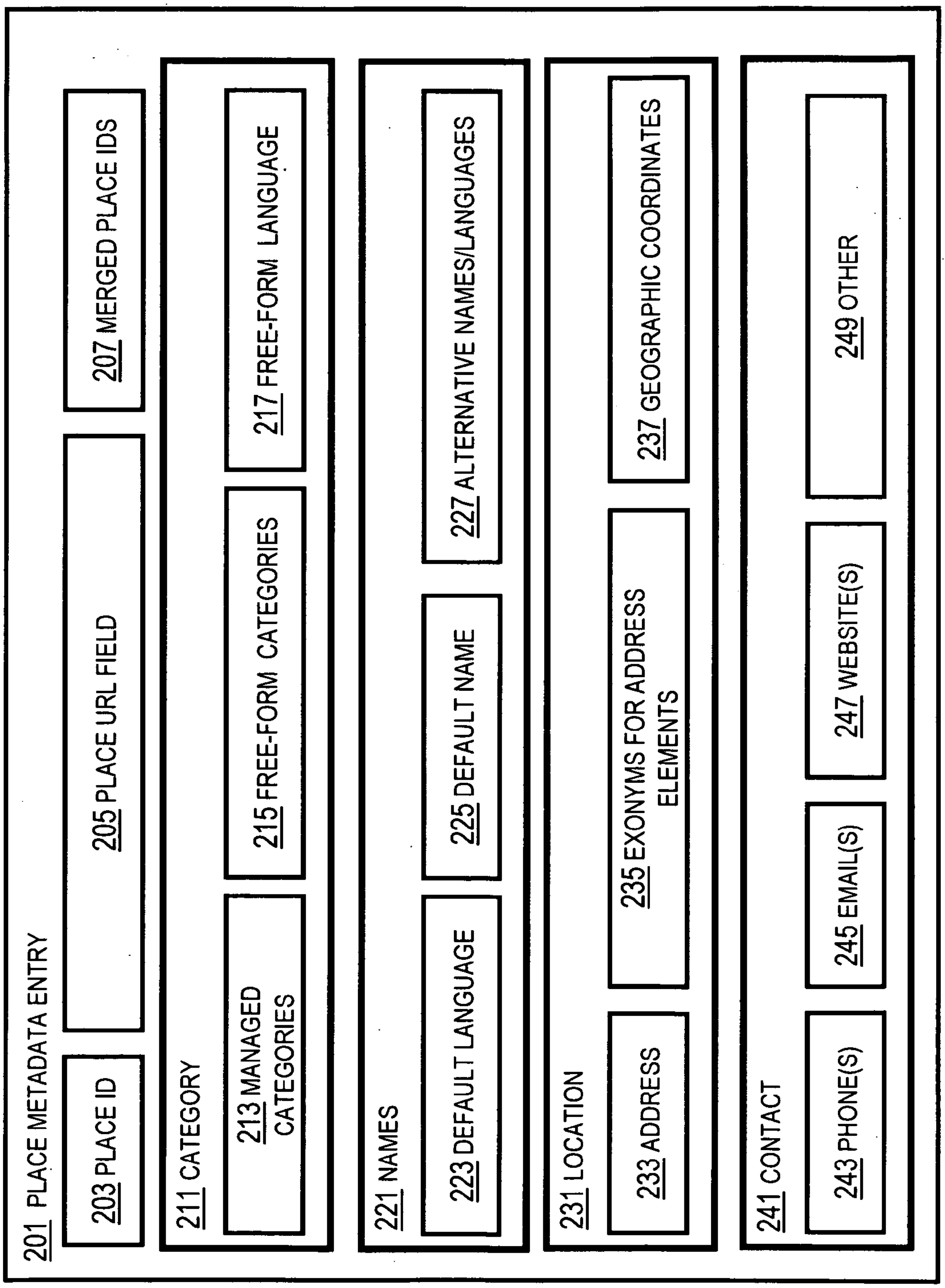

201 PLACE METADATA ENTRY
203 PLACE ID
205 PLACE URL FIELD
207 MERGED PLACE IDS
211 CATEGORY
213 MANAGED CATEGORIES
215 FREE-FORM CATEGORIES
217 FREE-FORM LANGUAGE
221 NAMES
223 DEFAULT LANGUAGE
225 DEFAULT NAME
227 ALTERNATIVE NAMES/LANGUAGES
231 LOCATION
233 ADDRESS
235 EXONYMS FOR ADDRESS ELEMENTS
237 GEOGRAPHIC COORDINATES
241 CONTACT
243 PHONE(S)
245 EMAIL(S)
247 WEBSITE(S)
249 OTHER

FIG. 2B

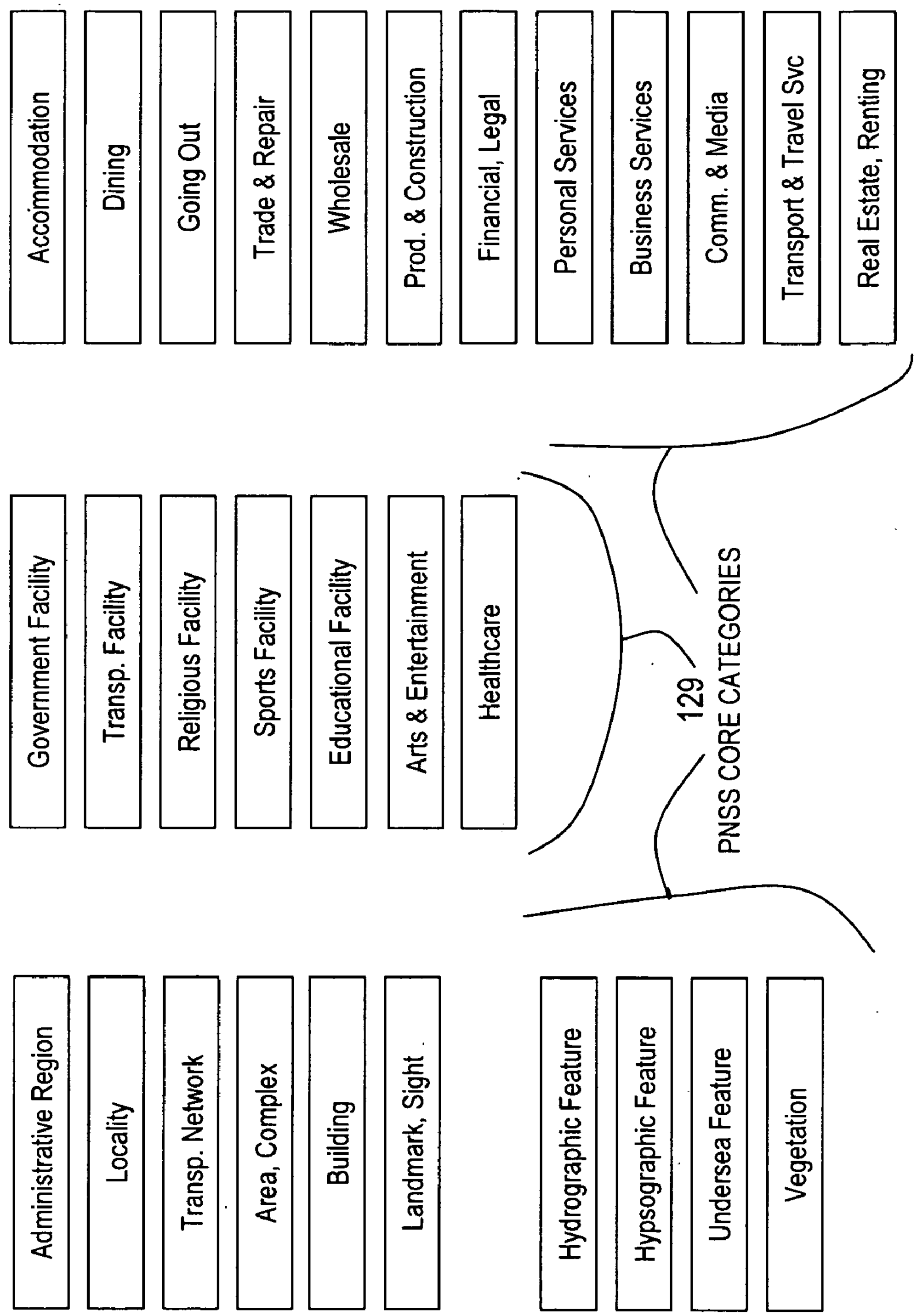

Administrative Region
Locality
Transp. Network
Area, Complex
Building
Landmark, Sight
Hydrographic Feature
Hypsographic Feature
Undersea Feature
Vegetation
Government Facility
Transp. Facility
Religious Facility
Sports Facility
Educational Facility
Arts & Entertainment
Healthcare
Accommodation
Dining
Going Out
Trade & Repair
Wholesale
Prod. & Construction
Financial, Legal
Personal Services
Business Services
Comm. & Media
Transport & Travel Svc
Real Estate, Renting
129
PNSS CORE CATEGORIES

FIG. 2C

```
<place id="184385761"
uri="http://organization.com/homePlace/rest/v1.0/place184385761" >
<categories>
<category>Bar</category>
<category>Restaurant</category>
</categories>
<names>
<defaultName language="de">Türkische Kneipe</defaultName>
<alternativeNames>
<name language="en">Turkish Restaurant</name>
<name language="de">Türkische Kneipe Alternative 1</name>
<name language="de">Türkische Kneipe Alternative 2</name>
</alternativeNames>
</names>
```

FIG. 2D

```
<location>
<address>
<houseNumber>12</houseNumber>
<street>Invalidenstr.</street>
<city>Berlin</city>
<region>Berlin</region>
<zipCode>72145</zipCode>
<countryCode>DE</countryCode>
<exonyms>
<exonym language="en">
<street>Invaliden Street</street>
</exonym>
</exonyms>
</address>
<geoCoordinates>
<latitude>15.22122</latitude>
<longitude>17.33333</longitude>
</geoCoordinates>
</location>

<contact>
<phone>+49 30 1234566</phone>
<email>turkiye@berlin.de</email>
<website>http://turkiye.berlin.de</website>
</contact>
</place>
```

FIG. 3A

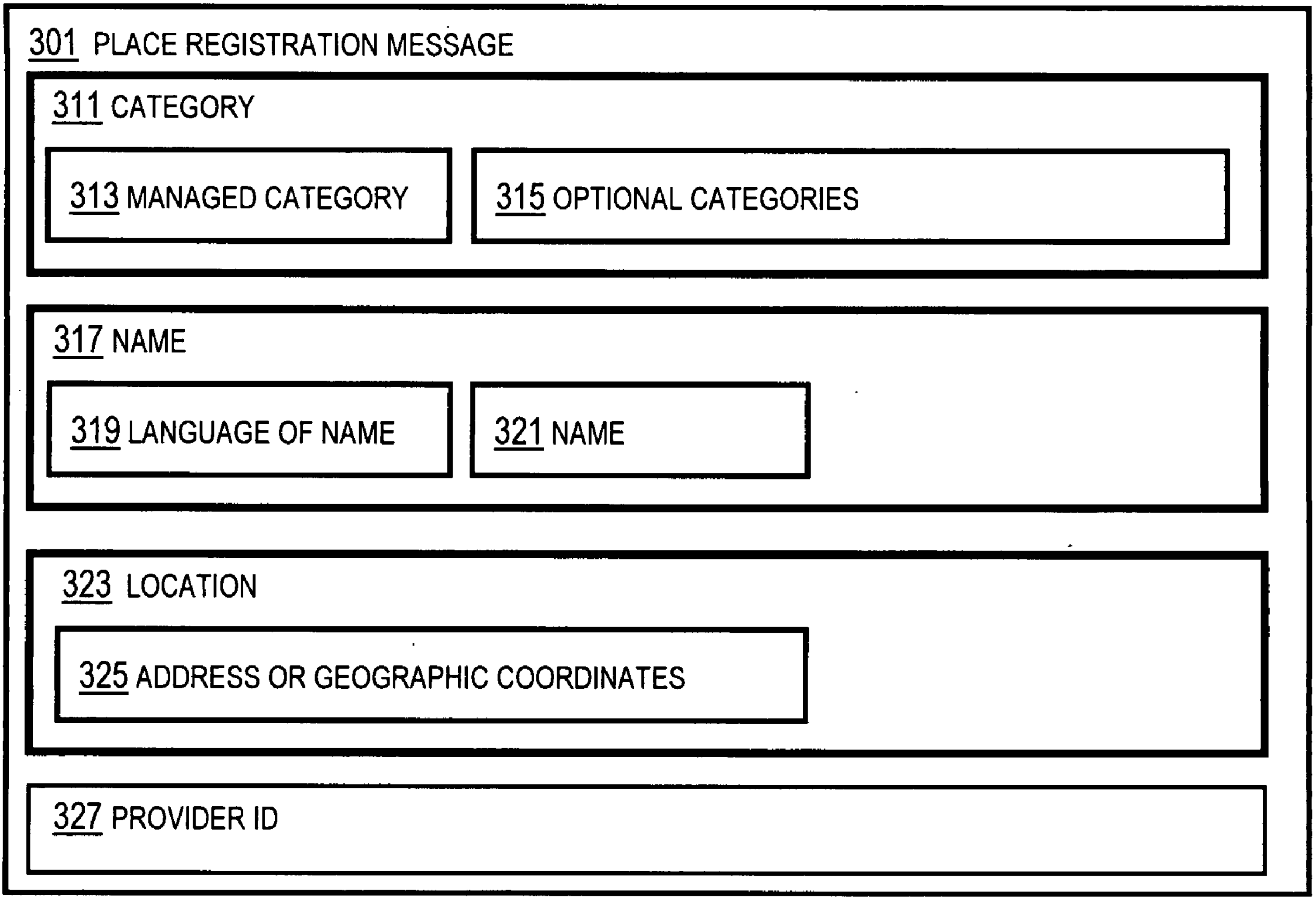

301 PLACE REGISTRATION MESSAGE
311 CATEGORY
313 MANAGED CATEGORY
315 OPTIONAL CATEGORIES
317 NAME
319 LANGUAGE OF NAME
321 NAME
323 LOCATION
325 ADDRESS OR GEOGRAPHIC COORDINATES
327 PROVIDER ID

FIG. 3B

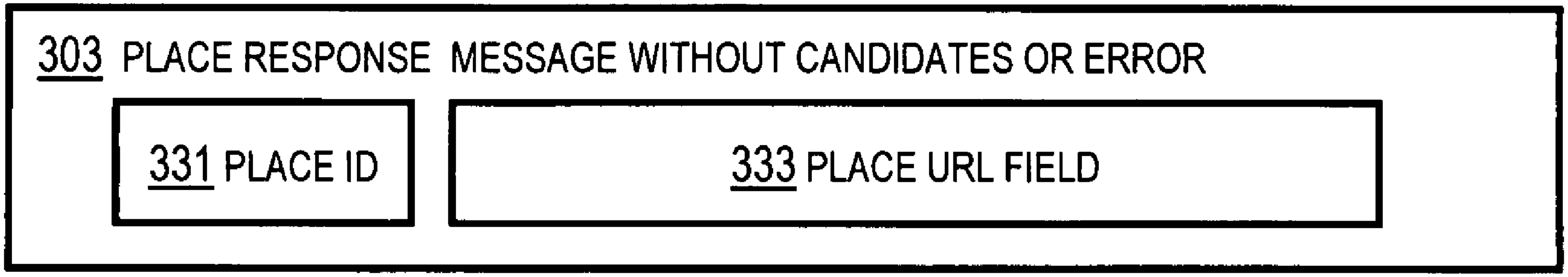
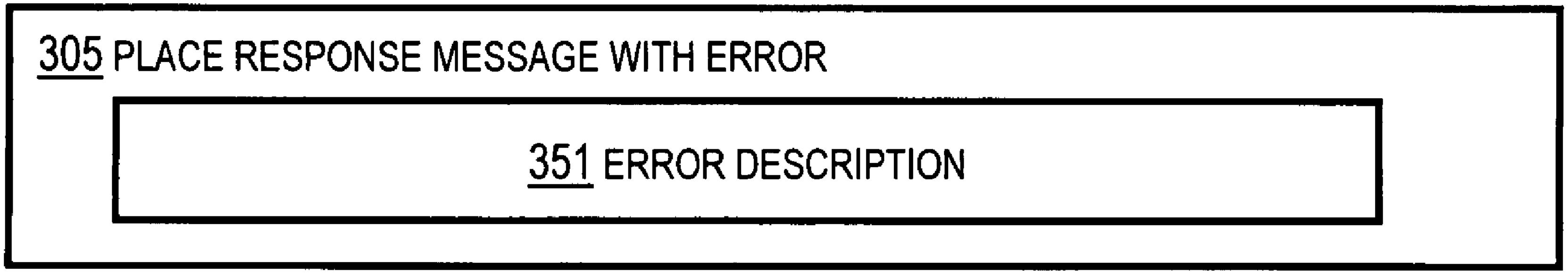

303 PLACE RESPONSE MESSAGE WITHOUT CANDIDATES OR ERROR
331 PLACE ID
333 PLACE URL FIELD

FIG. 3C


305 PLACE RESPONSE MESSAGE WITH ERROR
351 ERROR DESCRIPTION

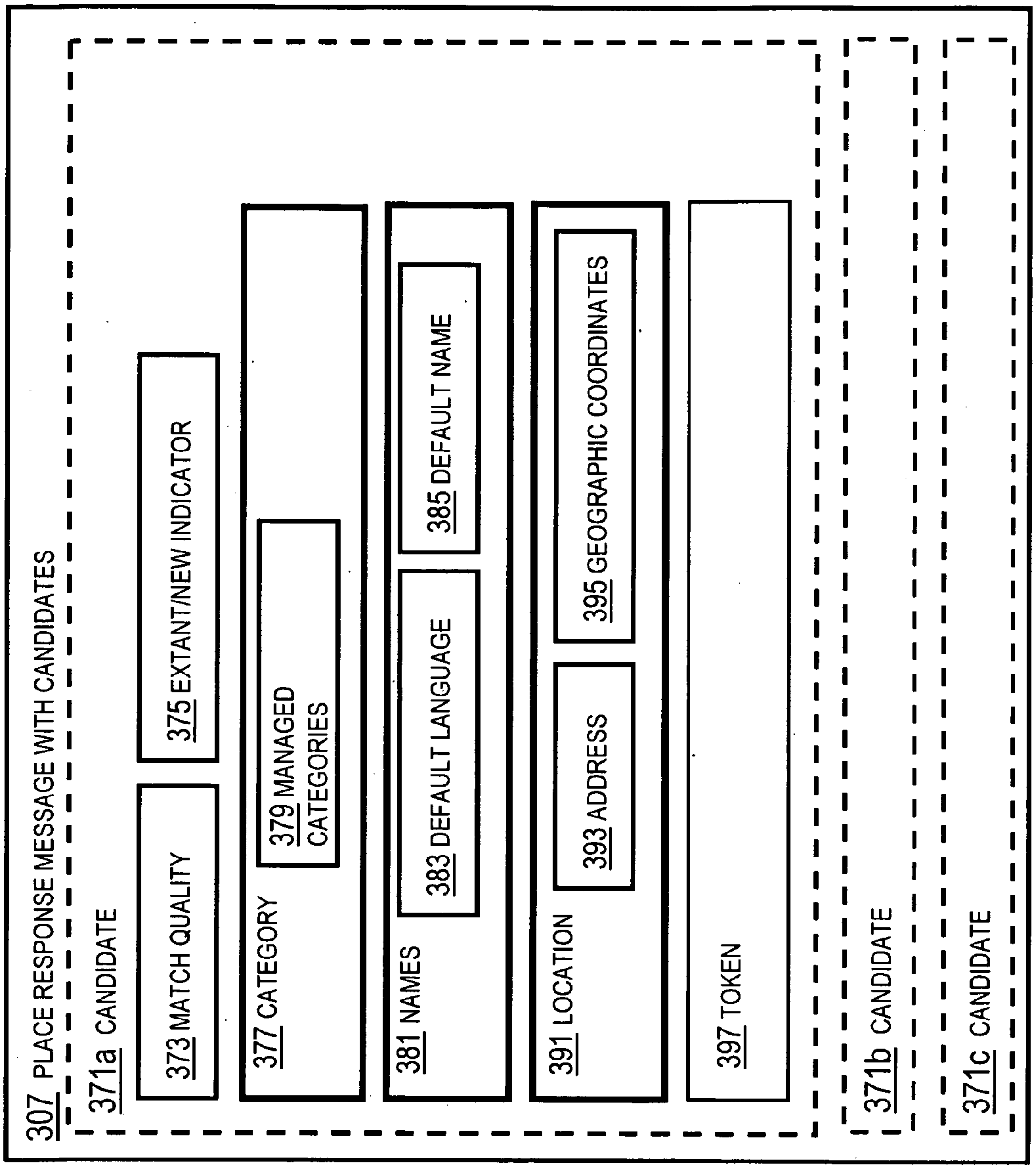

307 PLACE RESPONSE MESSAGE WITH CANDIDATES
371a CANDIDATE
373 MATCH QUALITY
375 EXTANT/NEW INDICATOR
377 CATEGORY
379 MANAGED CATEGORIES
381 NAMES
383 DEFAULT LANGUAGE
385 DEFAULT NAME
391 LOCATION
393 ADDRESS
395 GEOGRAPHIC COORDINATES
397 TOKEN
371b CANDIDATE
371c CANDIDATE

FIG. 3D

FIG. 4A

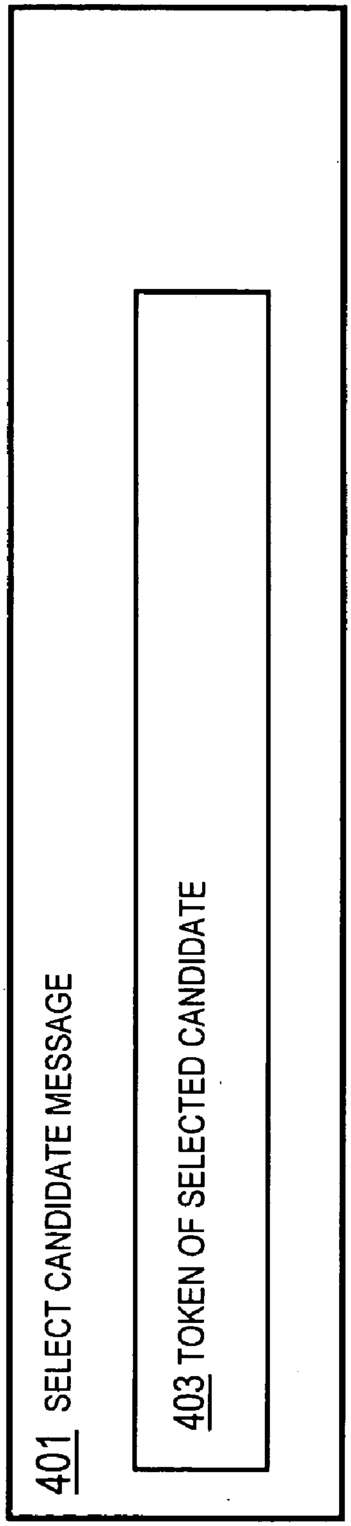
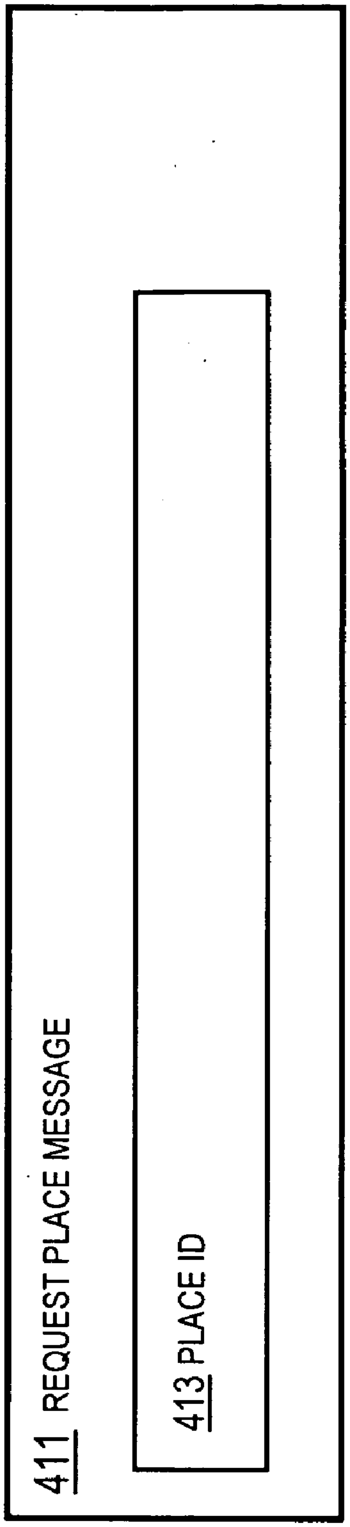
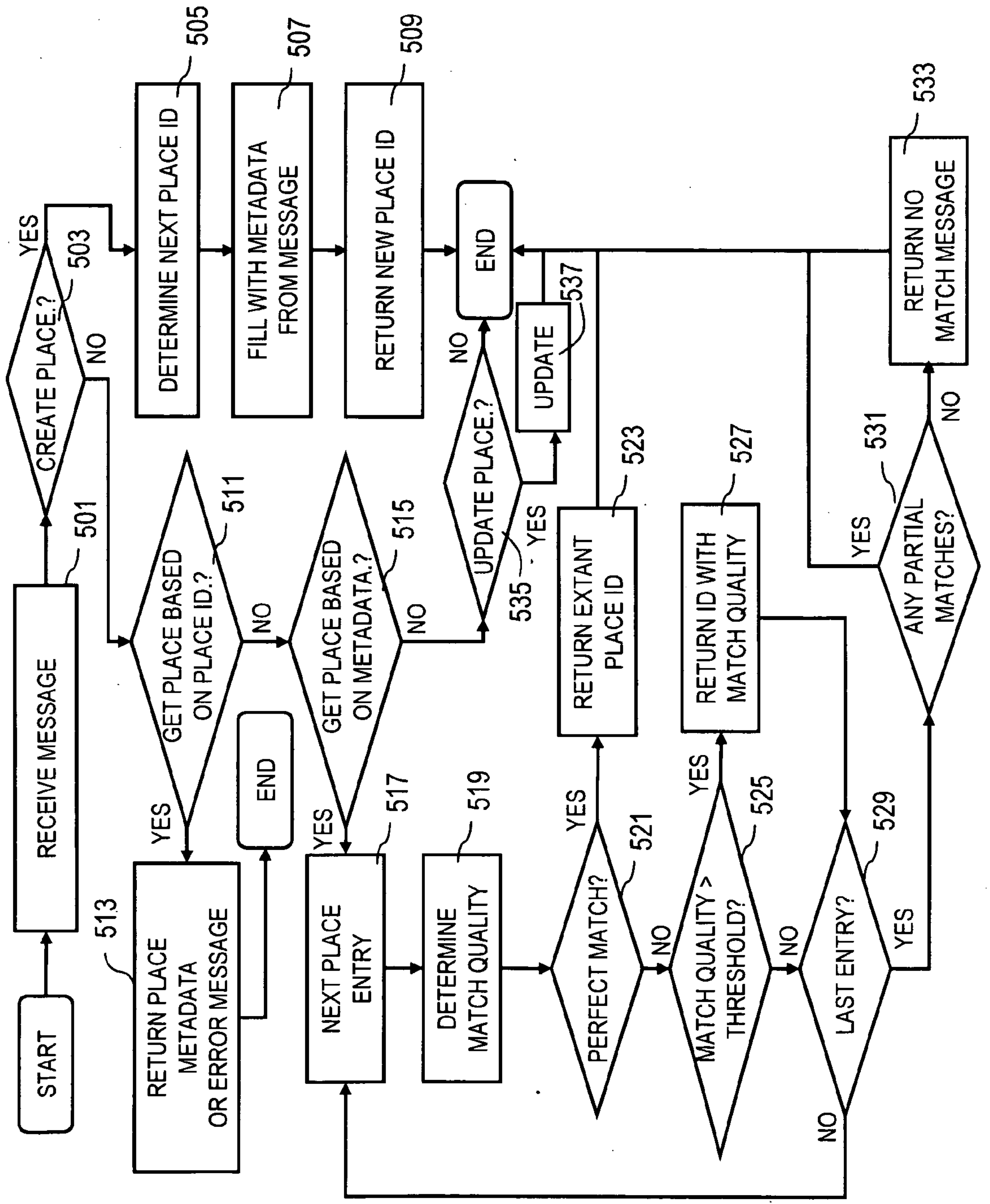

401 SELECT CANDIDATE MESSAGE
403 TOKEN OF SELECTED CANDIDATE

FIG. 4B


411 REQUEST PLACE MESSAGE
413 PLACE ID



START
RECEIVE MESSAGE
501
CREATE PLACE.?
503
YES
NO
DETERMINE NEXT PLACE ID
505
FILL WITH METADATA FROM MESSAGE
507
RETURN NEW PLACE ID
509
END
GET PLACE BASED ON PLACE ID.?
511
YES
NO
RETURN PLACE METADATA OR ERROR MESSAGE
513
END
GET PLACE BASED ON METADATA.?
515
YES
NO
UPDATE PLACE.?
535
YES
NO
UPDATE
537
NEXT PLACE ENTRY
517
DETERMINE MATCH QUALITY
519
PERFECT MATCH?
521
YES
NO
RETURN EXTANT PLACE ID
523
MATCH QUALITY > THRESHOLD?
525
YES
NO
RETURN ID WITH MATCH QUALITY
527
LAST ENTRY?
529
YES
NO
ANY PARTIAL MATCHES?
531
YES
NO
RETURN NO MATCH MESSAGE
533
500 PLACE METADATA SERVICE

FIG. 5A

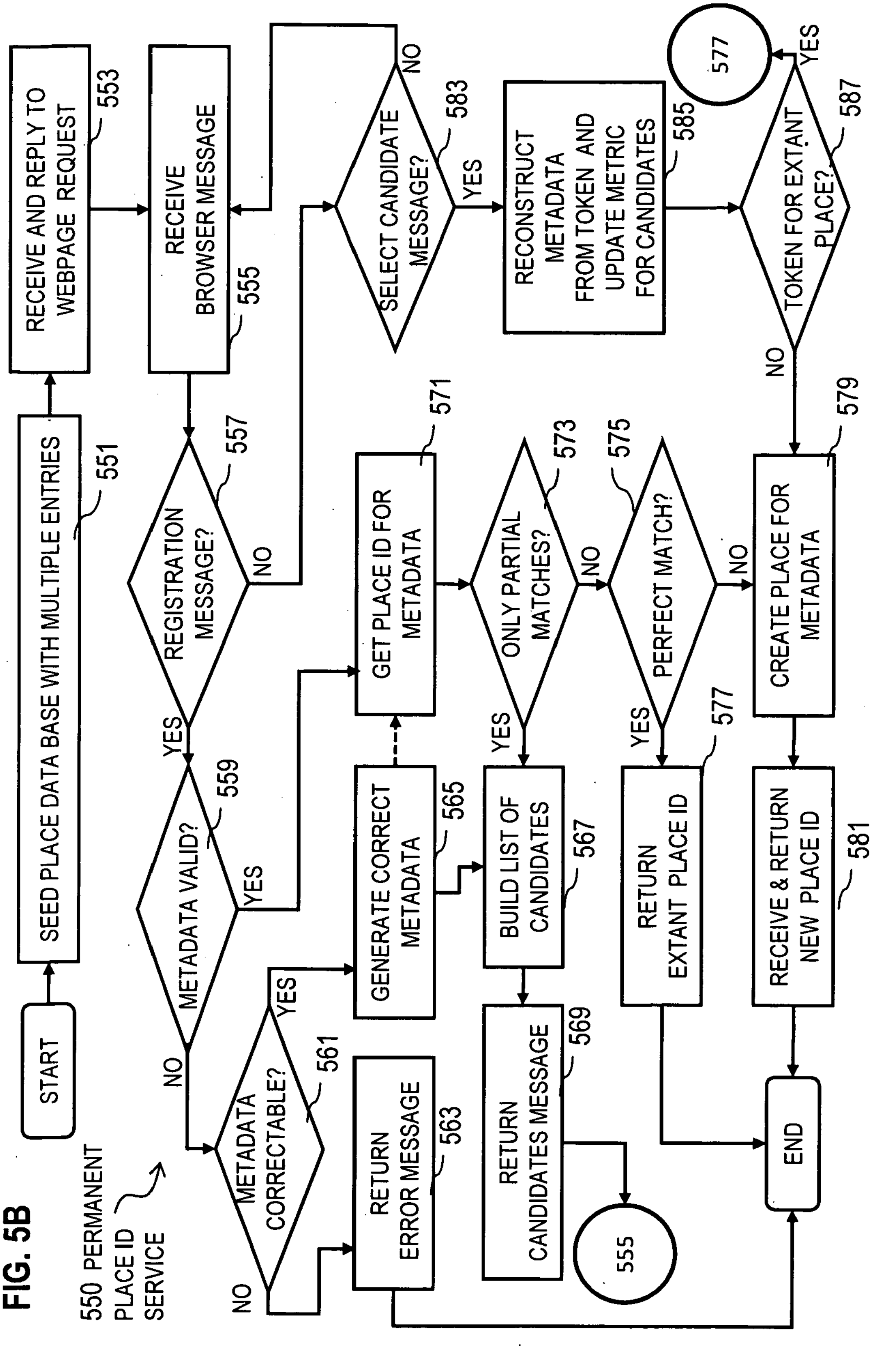


FIG. 5B
550 PERMANENT PLACE ID SERVICE
START
SEED PLACE DATA BASE WITH MULTIPLE ENTRIES
551
RECEIVE AND REPLY TO WEBPAGE REQUEST
553
RECEIVE BROWSER MESSAGE
555
REGISTRATION MESSAGE?
557
YES
NO
METADATA VALID?
559
YES
NO
METADATA CORRECTABLE?
561
YES
NO
RETURN ERROR MESSAGE
563
GENERATE CORRECT METADATA
565
BUILD LIST OF CANDIDATES
567
RETURN CANDIDATES MESSAGE
569
555
GET PLACE ID FOR METADATA
571
ONLY PARTIAL MATCHES?
573
YES
NO
PERFECT MATCH?
575
YES
NO
RETURN EXTANT PLACE ID
577
CREATE PLACE FOR METADATA
579
RECEIVE &amp; RETURN NEW PLACE ID
581
END
SELECT CANDIDATE MESSAGE?
583
YES
NO
RECONSTRUCT METADATA FROM TOKEN AND UPDATE METRIC FOR CANDIDATES
585
TOKEN FOR EXTANT PLACE?
587
YES
NO
577

FIG. 6A

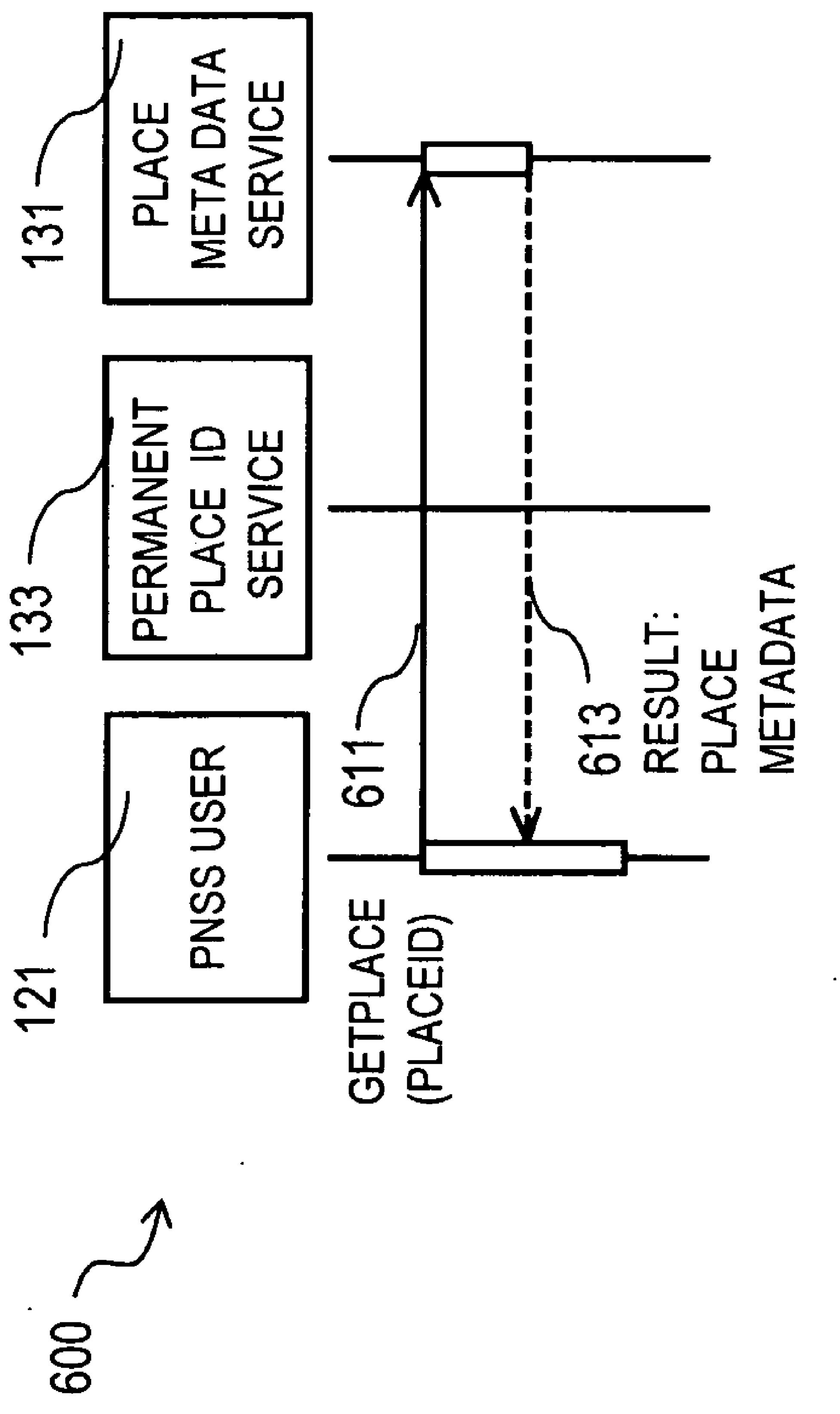

600
121
PNSS USER
133
PERMANENT PLACE ID SERVICE
131
PLACE META DATA SERVICE
GETPLACE (PLACEID)
611
613
RESULT: PLACE METADATA

FIG. 6B

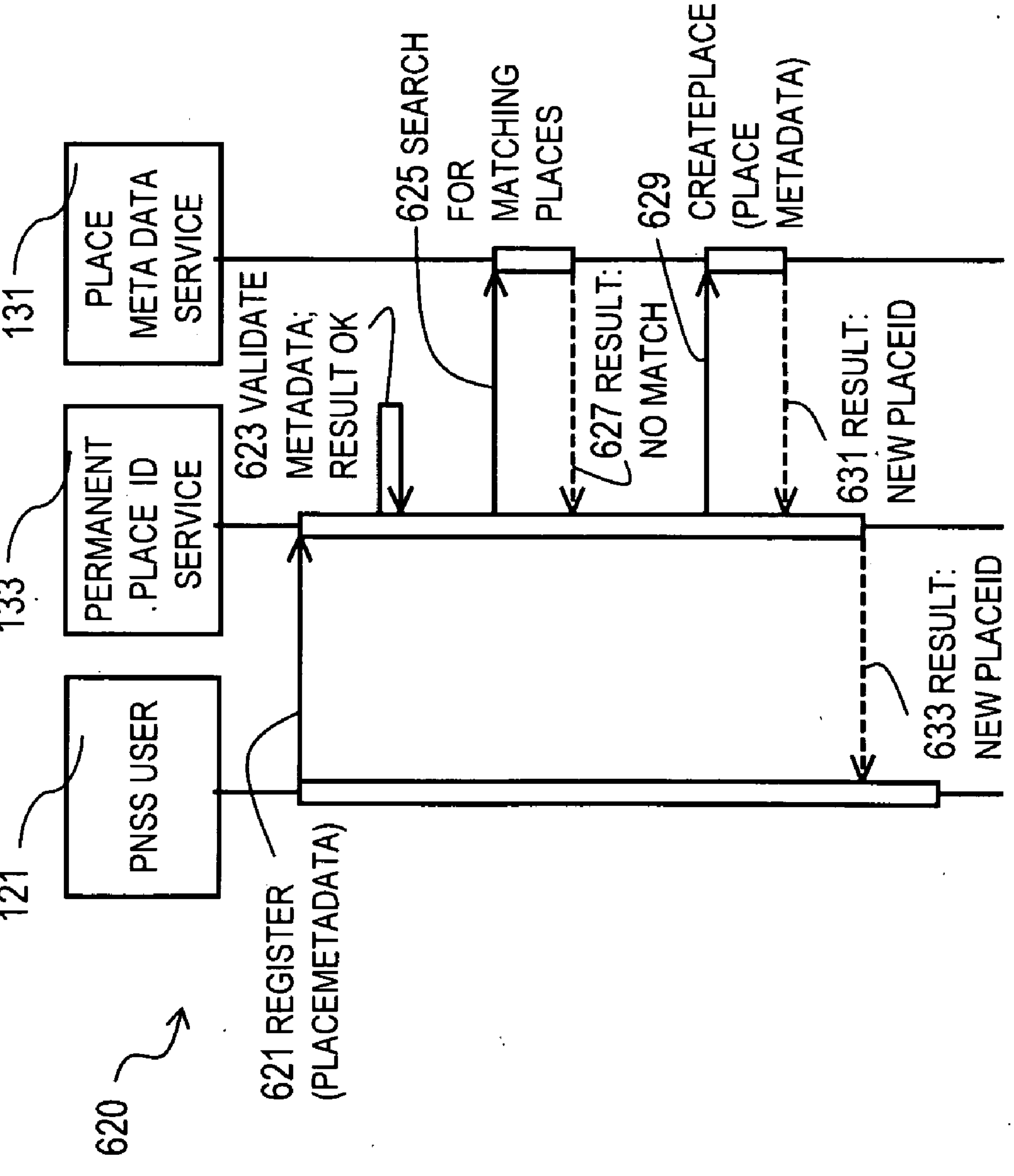

620
121
PNSS USER
133
PERMANENT PLACE ID SERVICE
131
PLACE META DATA SERVICE
621 REGISTER (PLACEMETADATA)
623 VALIDATE METADATA; RESULT OK
625 SEARCH FOR MATCHING PLACES
627 RESULT: NO MATCH
629
CREATEPLACE (PLACE METADATA)
631 RESULT: NEW PLACEID
633 RESULT: NEW PLACEID

FIG. 6C

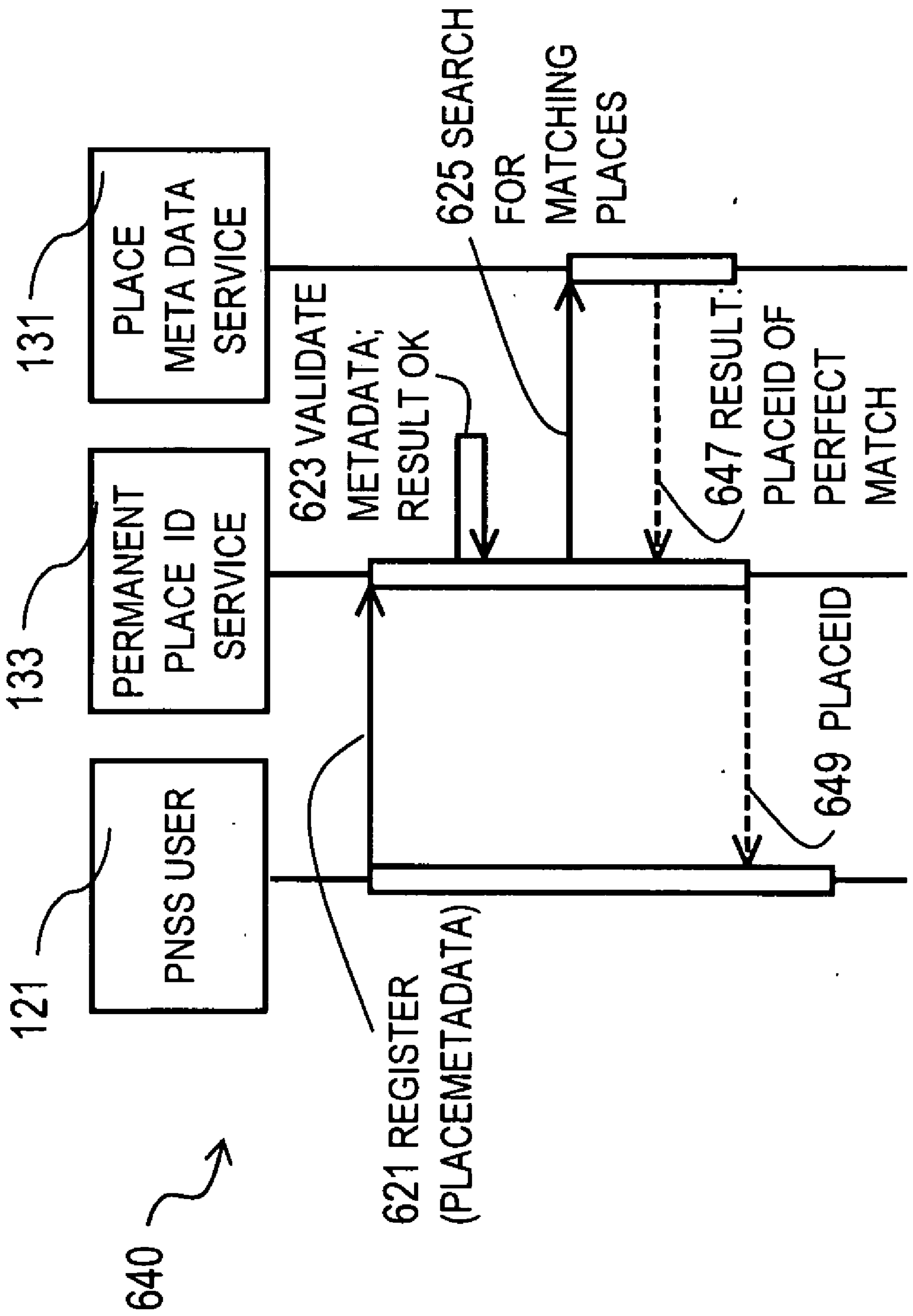
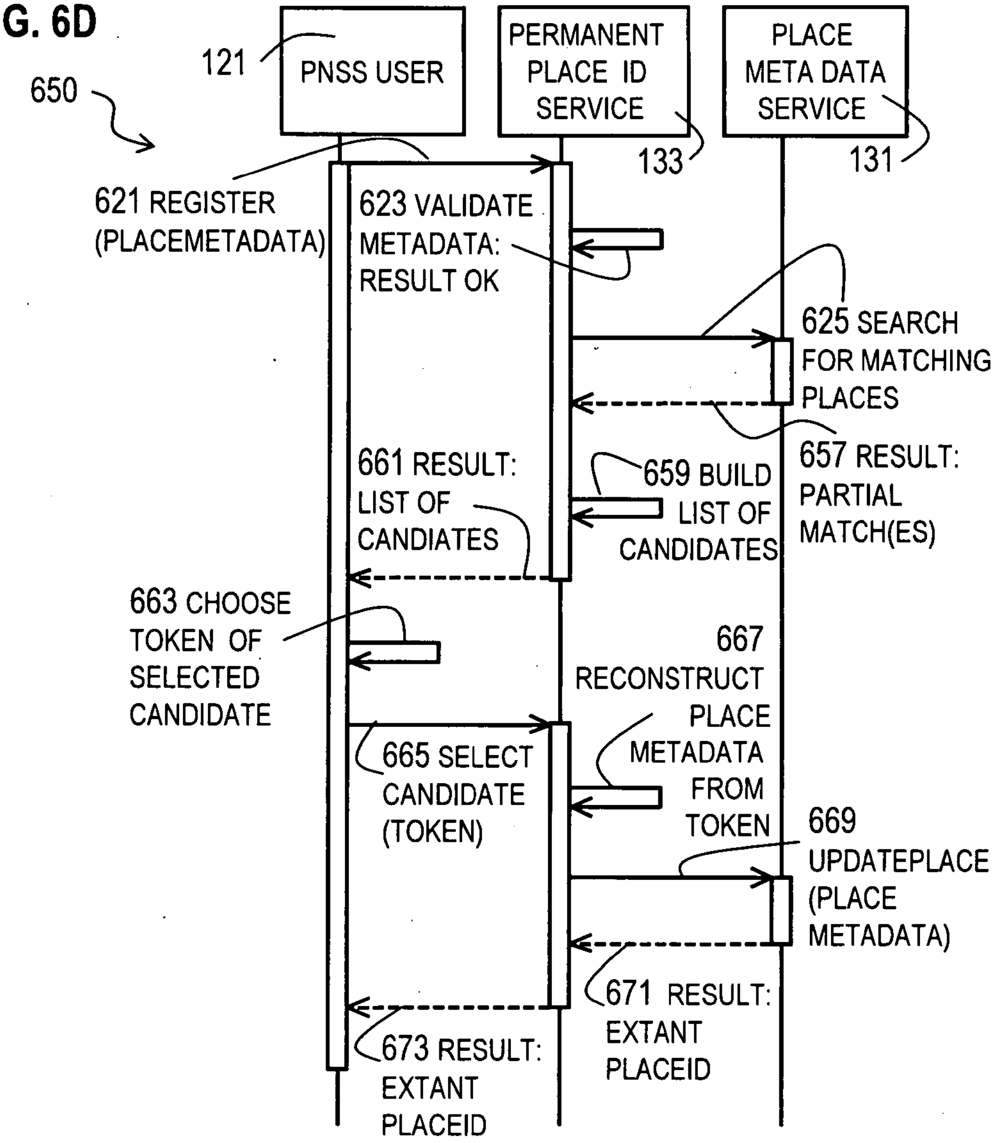

640
121
PNSS USER
133
PERMANENT PLACE ID SERVICE
131
PLACE META DATA SERVICE
621 REGISTER (PLACEMETADATA)
623 VALIDATE METADATA; RESULT OK
625 SEARCH FOR MATCHING PLACES
647 RESULT: PLACEID OF PERFECT MATCH
649 PLACEID

FIG. 6D


650
121
PNSS USER
PERMANENT PLACE ID SERVICE
133
PLACE META DATA SERVICE
131
621 REGISTER (PLACEMETADATA)
623 VALIDATE METADATA: RESULT OK
625 SEARCH FOR MATCHING PLACES
657 RESULT: PARTIAL MATCH(ES)
659 BUILD LIST OF CANDIDATES
661 RESULT: LIST OF CANDIATES
663 CHOOSE TOKEN OF SELECTED CANDIDATE
667 RECONSTRUCT PLACE METADATA FROM TOKEN
665 SELECT CANDIDATE (TOKEN)
669 UPDATEPLACE (PLACE METADATA)
671 RESULT: EXTANT PLACEID
673 RESULT: EXTANT PLACEID

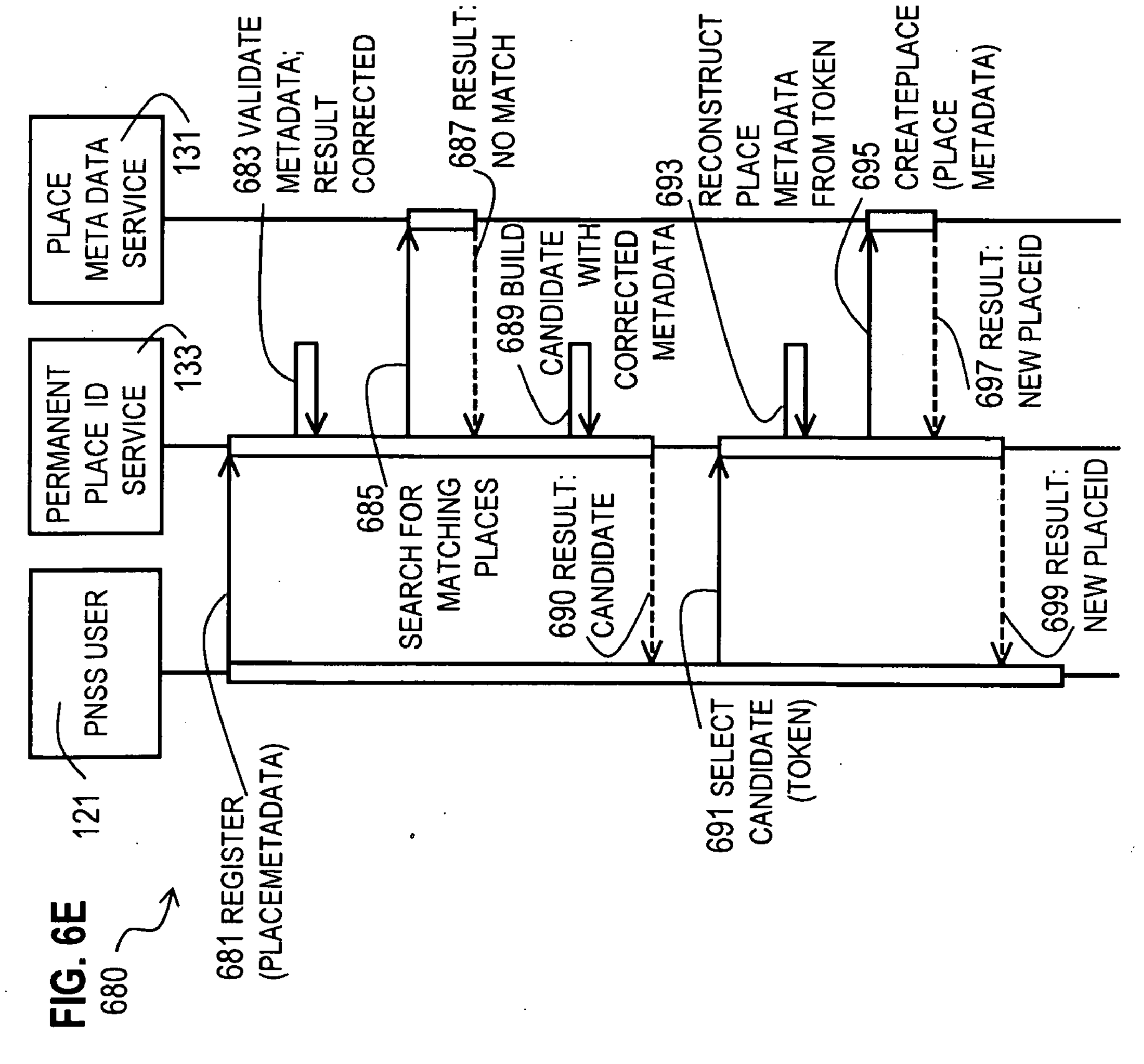


FIG. 6E

680
PNSS USER
121
PERMANENT PLACE ID SERVICE
133
PLACE META DATA SERVICE
131
681 REGISTER (PLACEMETADATA)
683 VALIDATE METADATA; RESULT CORRECTED
685 SEARCH FOR MATCHING PLACES
687 RESULT: NO MATCH
689 BUILD CANDIDATE WITH CORRECTED METADATA
690 RESULT: CANDIDATE
691 SELECT CANDIDATE (TOKEN)
693 RECONSTRUCT PLACE METADATA FROM TOKEN
695 CREATEPLACE (PLACE METADATA)
697 RESULT: NEW PLACEID
699 RESULT: NEW PLACEID

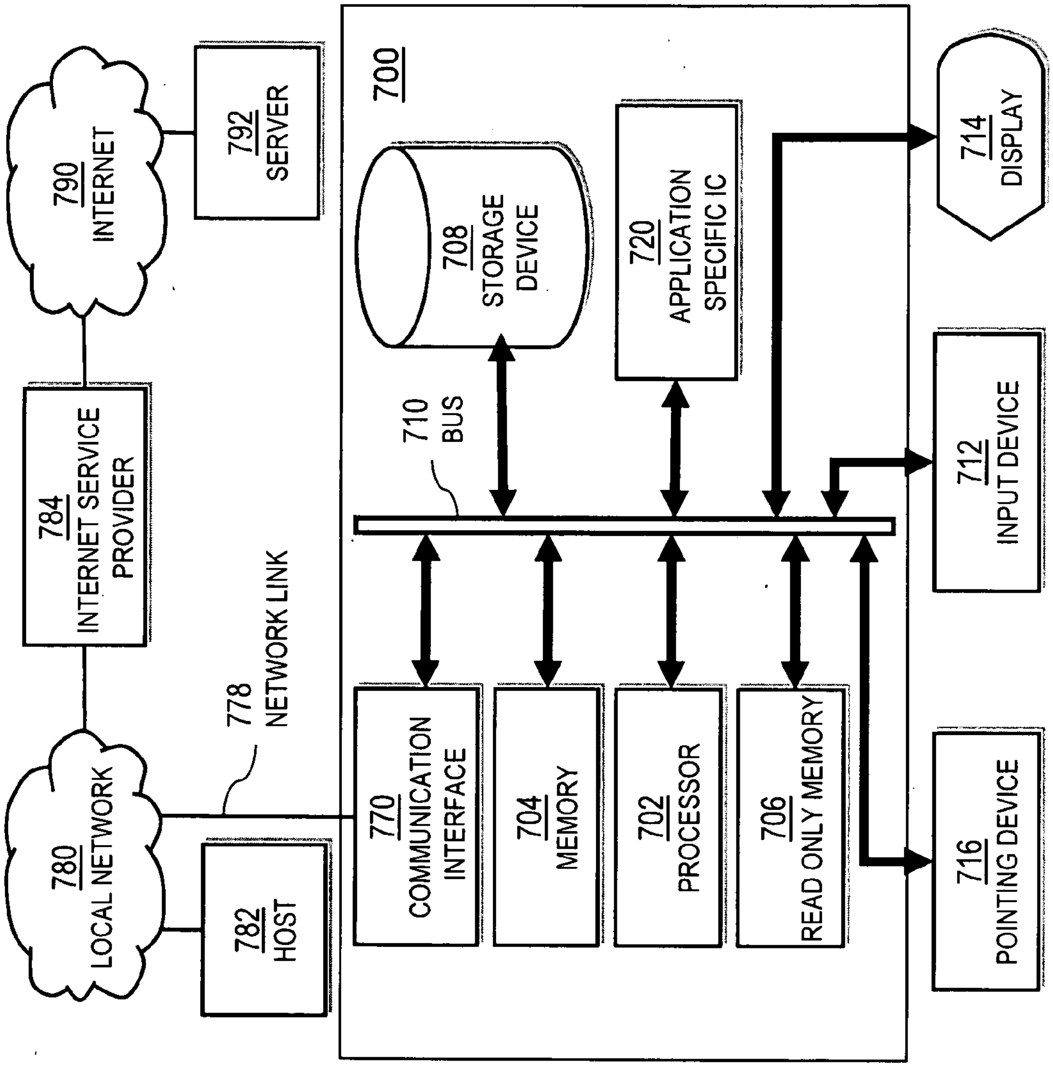

700
790 INTERNET
792 SERVER
784 INTERNET SERVICE PROVIDER
780 LOCAL NETWORK
782 HOST
778 NETWORK LINK
708 STORAGE DEVICE
720 APPLICATION SPECIFIC IC
710 BUS
770 COMMUNICATION INTERFACE
704 MEMORY
702 PROCESSOR
706 READ ONLY MEMORY
714 DISPLAY
712 INPUT DEVICE
716 POINTING DEVICE

FIG. 7

FIG. 8

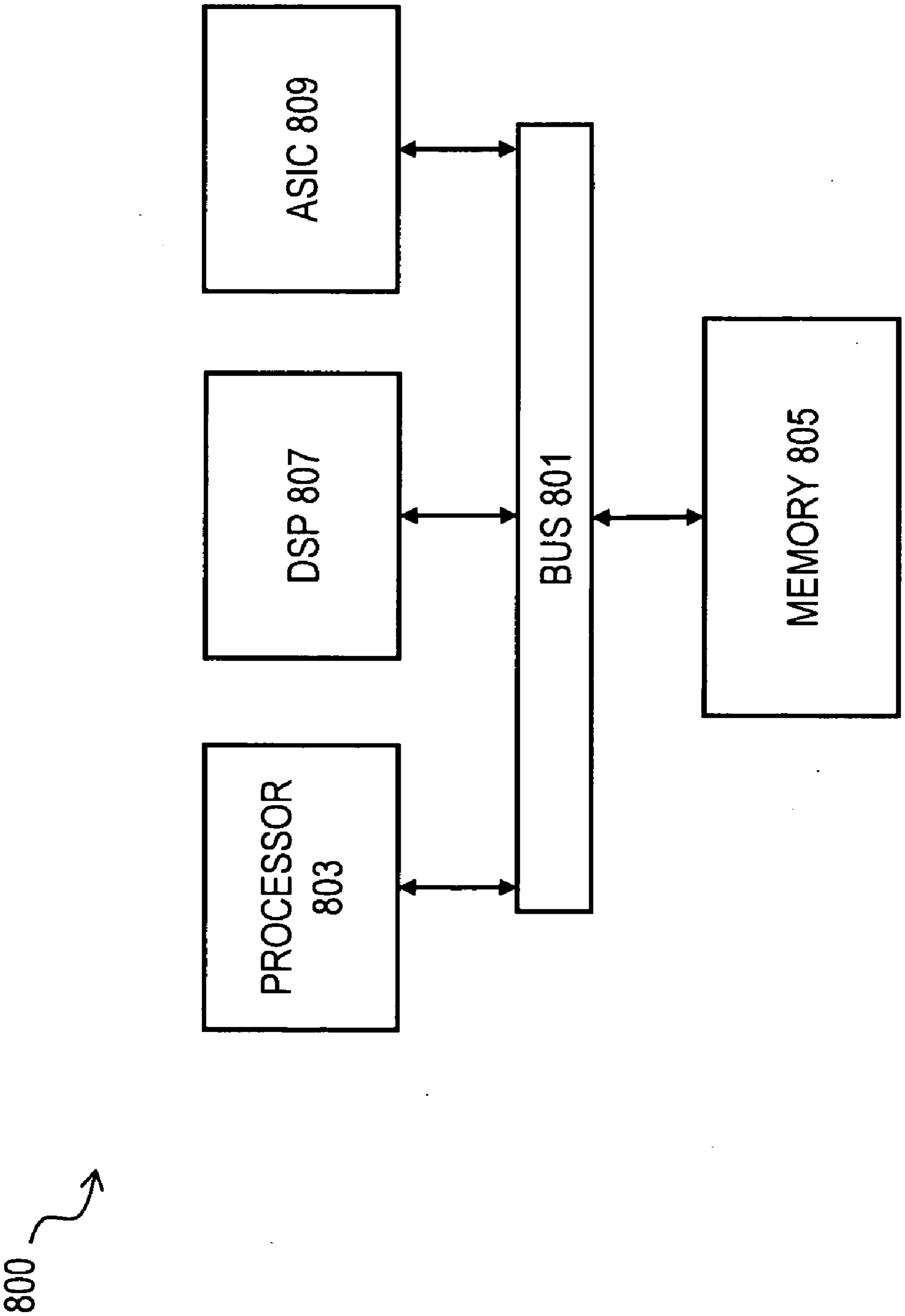
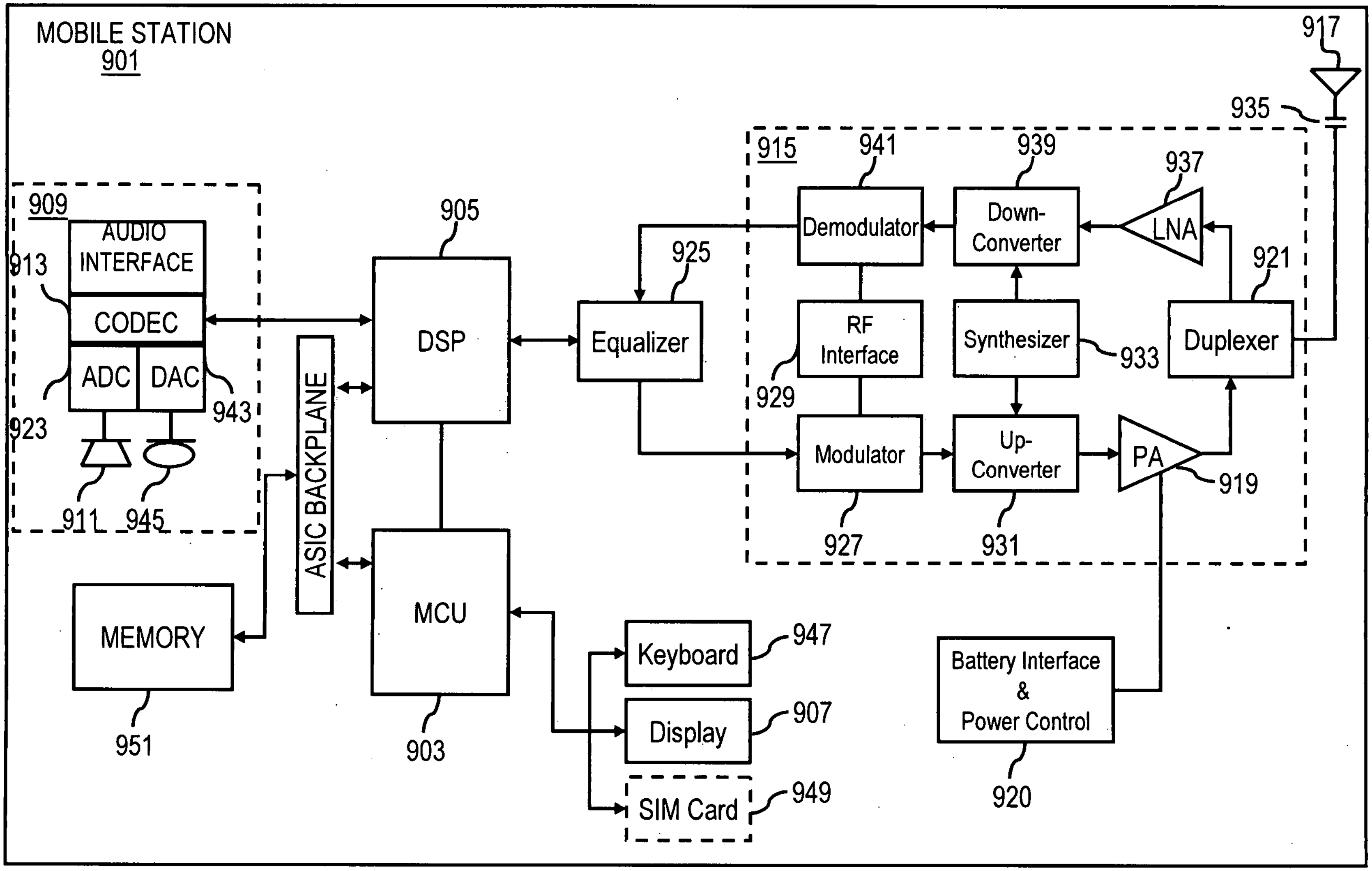


FIG. 9


MOBILE STATION
901
909
AUDIO INTERFACE
CODEC
ADC
DAC
913
923
943
911
945
ASIC BACKPLANE
MEMORY
951
905
DSP
MCU
903
Equalizer
925
Keyboard
947
Display
907
SIM Card
949
915
941
Demodulator
939
Down-Converter
937
LNA
935
917
RF Interface
929
Synthesizer
933
Duplexer
921
Modulator
927
Up-Converter
931
PA
919
Battery Interface & Power Control
920

METHOD AND APPARATUS FOR INTEGRATION OF COMMUNITY-PROVIDED PLACE DATA

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit as a Continuation-in-part of application Ser. No. 12/414,101, filed Mar. 30, 2009, under 35 U.S.C. §120.

BACKGROUND

[0002] The use of wireless, mobile communication devices has become pervasive, and is rapidly overtaking the use of traditional wired devices. As users' mobility increases, there is an increasing demand for content associated with the user's past, current or expected future location. For example, a popular application is determining restaurants or banks or other retail outlets in proximity to a user's past, current or expected future location. However, those service providers attempting to provide such location-based content are confronted with many challenges, including the consumption of vast resources to assemble and quality control the location-based content data for an extensive region or for global coverage.

SOME EXAMPLE EMBODIMENTS

[0003] Therefore, there is a need for improved formation of location based content.

[0004] According to one embodiment, a computer-readable storage medium carries instructions which, when executed by a processor, cause an apparatus to at least perform receiving registration data that indicates one or more values for corresponding attributes that describe a place that is associated with a geographic location. An indication of a match between the registration data and metadata for a predetermined place is provided.

[0005] According to another embodiment, an apparatus comprises a processor and a memory storing executable instructions that if executed cause the apparatus to receive registration data that indicates one or more values for corresponding attributes that describe a place that is associated with a geographic location. An indication of a match between the registration data and metadata for a predetermined place is provided

[0006] According to another embodiment, an apparatus comprises means for receiving registration data that indicates one or more values for corresponding attributes that describe a place that is associated with a geographic location. The apparatus includes means for providing an indication of a match between the registration data and metadata for a predetermined place.

[0007] According to another embodiment, a method includes receiving registration data that indicates a value for a subset of place metadata that includes a plurality of attributes that describe a place that is associated with a geographic location. The method also includes providing an indication of a match between the registration data and metadata for a predetermined place.

[0008] According to another embodiment, an apparatus comprises means for receiving registration data that indicates a value for a subset of place metadata that includes a plurality of attributes that describe a place that is associated with a geographic location. The apparatus also includes means for providing an indication of a match between the registration data and metadata for a predetermined place.

[0009] Still other aspects, features, and advantages of the invention are readily apparent from the following detailed description, simply by illustrating a number of particular embodiments and implementations, including the best mode contemplated for carrying out the invention. The invention is also capable of other and different embodiments, and its several details can be modified in various obvious respects, all without departing from the spirit and scope of the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings, in which:

[0011] FIG. **1** is a diagram of a system for integrating place metadata from a community of place builders, according to one embodiment;

[0012] FIG. **2**A is a diagram of an entry for a place metadata data structure, according to one embodiment;

[0013] FIG. **2**B illustrates example core categories, according to one embodiment;

[0014] FIG. **2**C and FIG. **2**D illustrate an example XML document holding example place metadata, according to one embodiment;

[0015] FIG. **3**A is a diagram of a place registration message, according to one embodiment;

[0016] FIG. **3**B is a diagram of a place response message with a single place identifier, according to one embodiment;

[0017] FIG. **3**C is a diagram of a place response error message, according to one embodiment;

[0018] FIG. **3**D is a diagram of a place response message with one or more candidate places, according to one embodiment;

[0019] FIG. **4**A is a diagram of a message for selecting a candidate, according to one embodiment;

[0020] FIG. **4**B is a diagram of a message for requesting a place resource, according to one embodiment;

[0021] FIG. **5**A is a flowchart of a process at a place metadata service, according to one embodiment;

[0022] FIG. **5**B is a flowchart of a process at a permanent place ID service, according to one embodiment;

[0023] FIG. **6**A is a time sequence diagram that illustrates a sequence of messages and processes for accessing place metadata, according to one embodiment;

[0024] FIG. **6**B is a time sequence diagram that illustrates a sequence of messages and processes for registering a valid new place, according to one embodiment;

[0025] FIG. **6**C is a time sequence diagram that illustrates a sequence of messages and processes for registering a matched place, according to one embodiment;

[0026] FIG. **6**D is a time sequence diagram that illustrates a sequence of messages and processes for registering a partially matched place, according to one embodiment;

[0027] FIG. **6**E is a time sequence diagram that illustrates a sequence of messages and processes for registering a partially valid place, according to one embodiment;

[0028] FIG. **7** is a diagram of hardware that can be used to implement an embodiment of the invention;

[0029] FIG. **8** is a diagram of a chip set that can be used to implement an embodiment of the invention; and

[0030] FIG. **9** is a diagram of a terminal that can be used to implement an embodiment of the invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

[0031] A method, apparatus, and software are disclosed for integration of community provided place data. In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the embodiments of the invention. It is apparent, however, to one skilled in the art that the embodiments of the invention may be practiced without these specific details or with an equivalent arrangement. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the embodiments of the invention.

[0032] Although several embodiments of the invention are discussed with respect to exchanging place metadata using extended markup language (XML) embedded in hypertext transfer protocol (HTTP) messages transmitted over a network between one client and two place service modules, a permanent place ID service and a place metadata service, embodiments of the invention are not limited to this context. It is explicitly anticipated that the metadata may be exchanged using any collection of attributes and values embedded in any network protocol or human interface between a community member and one or more processes operating on one or more computing devices with or without a network.

[0033] As used herein the term “place” refers to the semantics/usage of a location. Although a place is always associated with a location, it is an object independent of a location. That is, a place (such as a restaurant or business) might change its physical location (i.e. geographic coordinates) over time and multiple places (such as a hotel and a restaurant) might be associated with the same location. Thus, a place is associated temporally and spatially with a geographic location. A particular place is distinguished from other places by a collection of values (place metadata) for a corresponding set of attributes (place metadata parameters) that uniquely indicate the place. In addition to the place metadata that uniquely indicates a particular place, there are place resources in some embodiments.

[0034] Many organizations provide location related content and services (e.g. business directories, geographic information systems, restaurant guides, hotel booking services). Each of these organizations manages its specific set of metadata for its locations. Neither is this set of metadata standardized, nor does there exist an easy way to check whether two sets of metadata from independent organizations refer to the same location. Aggregation of metadata from various sources is a common task for many of these organizations. To ensure data quality and integrity, every organization has to implement data validation, enrichment, and duplicate removal on its own. On top of that, the community of place building organizations has to continuously revalidate their existing metadata (e.g. to identify entries that went out of business or moved to a different location. Therefore, there is a need for a system to integrate community-provided place data to assure data quality and avoid duplication.

[0035] In some embodiments, place resources for a single place are provided as one or more network resources, such as a collection of one or more files or directories or web pages, which is accessed by corresponding universal resource locator (URL) names. A domain name server (DNS) on a network resolves URL names into Internet Protocol (IP) addresses that are used to route messages sent across an IP network, as is well known in the art. Thus a user of a web browser can access those place resources, once given the URL names. In some embodiments, the place resources are not maintained separately from a central database of palce metadata.

[0036] According to some embodiments, a set of web services called Place Namespace Services (PNSS) provide services related to integrating data to support the concept of a place. In a particular embodiment, the PNSS includes several modules. A Permanent Place ID Service (PPIDS) creates and finds unique identifiers (IDs) for a place. This service tries to avoid creating duplicate places (creating multiple place IDs for the same physical place) by using matching logic (by comparing the metadata attributes of a place). Duplicate avoidance cannot be guaranteed, therefore PPIDS provides a way to merge place IDs as metadata becomes available, which indicates the place IDs refer to the same place. The merge is accomplished by marking one of the place IDs as merged. This service still guarantees that a place will remain accessible by any ID that was once assigned to that place. A Place Metadata Service (PMDS) stores and finds a standardized set of core metadata associated with places. In some embodiments, a Place Resource Service (PRS) binds web resources (as URLs) to a place, and a Global Place Name Service (GPNS) registers a globally unique name, called a place ID, for a place. In many embodiments, the processes performed by these latter two modules are omitted or incorporated in one of the other depicted modules. For example, the function of the GPNS is included in the PPIDS **133** in some embodiments.

[0037] In some embodiments, the PNSS checks place metadata validity and avoids duplication by recognizing when place metadata for a new place resource closely matches place metadata for an existing place resource. Having access to the PNSS relieves organizations from maintaining the core metadata of their places on their own. PNSS takes the burden to validate and enrich a place’s core metadata, provides mechanisms to avoid duplicate creation and merge existing duplicates and allows organizations to register their own resources and services related to a place in a publicly accessible directory. By allowing several builders to contribute to the same shared place resources, a single builder’s efforts are leveraged to gain access to a much broader scope of place data than would be possible to build alone. On top of that, all organizations that provide resources (e.g. services or content) related to places can use the place ID to interconnect their resources.

[0038] The core problem that the PNSS has to solve, in these embodiments, is to identify a place based on the specific, potentially incomplete or even invalid set of metadata that users of the PNSS can provide. This feature is implemented in the PPIDS. To identify a place (and get its place ID) a user of the PNSS has to execute the register function of the PPIDS. This function expects some place metadata (at least name, location and category) and matches this data against predetermined place metadata known to the PNSS. In case there exists a perfect matching place in the PNSS, the PPIDS will return the place ID of this entry. Since one can’t expect that the data provided by the user matches exactly to place metadata stored in the PNSS (e.g. due to slightly different names, names in different languages, different category-levels, partially wrong address, outdated address), only returning exact matches would prevent the core task of the service to avoid creation of duplicate entries for the same place.

[0039] To address this problem, in some embodiments, PPIDS implements some fuzzy matching algorithm that matches places even if the metadata of the known places don't match exactly the metadata provided during registration. In this case PPIDS has to calculate some "quality-of-match" value, or degree of match value, that gives the user some hint about how close the data of each returned place is to the registration metadata the user did provide.

[0040] In an illustrated embodiment, the fuzzy matching algorithm contains various components including location identification, category definition, name resolution, vicinity detection, and previous selection tracking. Location identification is based on commercially available address resolution services, such as the location reference object (LRO) digital map service of NAVTEQ™, and allows PPIDS to validate, enrich and identify the location of a place indicated by registration metadata. Category matching is performed by modelling categories of places as a combination of managed, globally-applicable "top level categories" and allowing additional arbitrary free text tags. Name matching is performed by maintaining multiple names that might be used to identify a place (both alternative names and translated names) and applying some word similarity measure, such as those used in spell checking algorithms. Vicinity matching (also called "nearby matching") is employed because not all places are addressable by a unique address (or a PNSS user might not have the valid address). Thus PPIDS implements some vicinity search that checks for matches with places that are located near the provided address or geolocation coordinates. Previous selection matching is performed in case the user provides metadata that differs from the required metadata, because a prior registration attempt might have the missing metadata. Thus previous registration requests are stored for each user or group of users.

[0041] Based on output from the various components of the matching algorithms, in the illustrated embodiment, PPIDS calculates the overall "quality-of-match" or degree of match for each of the predetermined places. PPIDS returns data identifying a list of one or more candidate places that demonstrate a degree of match value above a predetermined threshold. This list might also include a candidate for a new entry derived from the registration metadata, e.g., by correcting evident misspellings or transposed numerals. The PPIDS also returns, for each candidate in the list, a candidate token that indicates a difference between the registration metadata and the candidate place metadata. The user then selects one of the candidates, such as by executing a "selectCandidate" function of PPIDS, by submitting the candidate token for the selected candidate. PPIDS then returns the new or previously existing (extant) place ID of the selected candidate. Based on the token for the selected candidate, the PPIDS is able to "learn" which metadata was used identify a place and automatically create some additional matching metrics and heuristics to score the differences indicated in the token. These metric may be applied to future registration efforts by the same user or future registration efforts by several or all users.

[0042] FIG. **1** is a diagram of a system **100** for integrating place metadata from a community of place builders, according to one embodiment. The system **100** includes a communications network **105**, and network nodes that include mobile terminal **120**, place namespace service (PNSS) hosts **130** and other host **140**. Community members operate on mobile terminal **120** or other host **140** and have their metadata properly integrated by the modules on the PNSS hosts **130**.

[0043] In various embodiments, nodes **120**, **130**, **140** can be any type of fixed terminal, mobile terminal, or portable terminal including desktop computers, laptop computers, handsets, stations, units, devices, multimedia tablets, Internet nodes, communicators, Personal Digital Assistants (PDAs), mobile phones, mobile communication devices, audio/video players, digital cameras/camcorders, televisions, digital video recorders, game devices, positioning devices, rack-mounted computers or computer blade systems, or any combination thereof. Moreover, the nodes may have a hard-wired energy source (e.g., a plug-in power adapter), a limited energy source (e.g., a battery), or both. It is further contemplated that the nodes **120**, **131**, **140** can support any type of interface to the user (such as "wearable" circuitry, etc.). In the illustrated embodiment, node **120** is a wireless mobile terminal (also called a mobile station and described in more detail below with reference to FIG. **10**). The mobile terminal **120** is connected to network **105** by a wireless link **107**.

[0044] Community-shared place resources **103** that describe or provide services related to places reside on nodes in network **105** in the illustrated embodiment. In some embodiments, shared place resources **103** are omitted.

[0045] By way of example, the communication network **105** of system **100** can include, in various embodiments, one or more wired and/or wireless networks such as a data network (not shown), a wireless network (not shown), a telephony network (not shown), or any combination thereof, each comprised of zero or more nodes. It is contemplated that the data network may be any local area network (LAN), metropolitan area network (MAN), wide area network (WAN), the Internet, or any other suitable packet-switched network, such as a commercially owned, proprietary packet-switched network, e.g., a proprietary cable or fiber-optic network, or any combination thereof. In addition, the wireless network may be, for example, a cellular network and may employ various technologies including code division multiple access (CDMA), enhanced data rates for global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., microwave access (WiMAX), Long Term Evolution (LTE) networks, wireless fidelity (WiFi), satellite, and the like. In various embodiments, communication network **105**, or portions thereof, can support communication using any protocol, for example, the Internet Protocol (IP).

[0046] The client-server model of computer process interaction is widely known and used. According to the client-server model, a client process sends a message including a request to a server process, and the server process responds by providing a service. The server process may also return a message with a response to the client process. Often the client process and server process execute on different computer devices, called hosts, and communicate via a network using one or more protocols for network communications. The term "server" is conventionally used to refer to the process that provides the service, or the host computer on which the process operates. Similarly, the term "client" is conventionally used to refer to the process that makes the request, or the host computer on which the process operates. As used herein, the terms "client" and "server" refer to the processes, rather than the host computers, unless otherwise clear from the context.

In addition, the process performed by a server can be broken up to run as multiple processes on multiple hosts (sometimes called tiers) for reasons that include reliability, scalability, redundancy, and regional partitioning, among others. A well known client process available on most nodes connected to a communications network is a World Wide Web client (called a "web browser," or simply "browser") that interacts through messages formatted according to the hypertext transfer protocol (HTTP) with any of a large number of servers called World Wide Web servers that provide web pages. In the illustrated embodiment, mobile terminal **120** and other host **140** include browser **117***a* and browser **117***b*, respectively; and hosts **130** include web server **119**.

[0047] As depicted in FIG. **1**, in the illustrated embodiment, PNSS hosts **130** include web server **119**, Place Metadata Service (PMDS) module **131**, Permanent Place identifier (ID) Service (PPIDS) module **133**, Place Resources Service (PRS) module **135**, and Global Place Name Service (GPNS) module **136**, all described above. One or more of these modules access a place metadata data structure, such as place metadata database **137**. The place metadata data structure includes a place entry **139** for every different place registered with the PNSS. In an illustrated embodiment, PPIDS, PMDS and PRS are web services that provide an HTTP based application programming interface (API) that follows the design principles for RESTful web services. In some embodiments, such services are accessed by a browser **117** with a human operator providing manual input required by the API. Currently, no standard browser directly supports the HTTP-PUT operation or is capable of directly creating XML messages, so in such embodiments, the service is accessed with the help of a JavaScript based browser extension. Alternatively, a special place building client process, e.g., PNSS client **121**, can automatically provide some or all of the input required by the API using one or more HTTP messages. It is expected that the number of places that are going to be managed might one day extend the capabilities of a single host. Therefore in some embodiments multiple hosts **130** are deployed across network **105**, each host responsible for a specific "area" of the world

[0048] In the illustrated embodiment, the modules of PNSS hosts **130** are the centralized services invoked by a community of place builders distributed across network **105**, such as an operator of mobile terminal **120** or other host **140**. Mobile terminal **120** includes a PNSS client **121***a*, and other host **140** includes PNSS client **121***b*, collectively referenced hereinafter as PNSS client **121**. The PNSS client **121** interacts with one or more modules on PNSS hosts **130** to allow a user to submit place metadata for registration with the PNSS and obtain the unique place ID for the place indicated by the metadata.

[0049] According to the illustrated embodiment, armed with the place ID for a place, a user can identify a particular place resource **103** where information and service about that place are located on the network **105**, such as by the URL for a webpage of links to descriptions and services for that place. Such a webpage can be accessed by the browser **117** on the user's node based on that URL in some embodiments. In other embodiments, separate place resources **105** are not used.

[0050] Although a particular set of nodes, processes, and data structures are shown in FIG. **1** for purposes of illustration, in various other embodiments more or fewer nodes, processes and data structures are involved. Furthermore, although processes and data structures are depicted as particular blocks in a particular arrangement for purposes of illustration, in other embodiments each process or data structure, or portions thereof, may be separated or combined or arranged in some other fashion. For example, in some embodiments, the PRS **135** and GPNS **136** are included in PMDS **131** and PPIDS **133**, respectively; and PPIDS **133** is embedded in a web server **119**; and the PNSS client **121** includes a browser **117**.

[0051] FIG. **2**A is a diagram of an entry **201** for a place metadata data structure, according to one embodiment. The entry **201** embodies a model for place metadata that allows the detection of duplicates. The place data structure entry **201** includes a place ID field **203**, a place URL field **205**, merged place IDs field **207**, place category fields **211**, place names field **221**, place location fields **231** and place contact fields **241**. Example values for some of these fields are presented in FIG. **2**B, FIG. **2**C and FIG. **2**D, described in more detail below.

[0052] In some embodiments, place metadata is transferred from one node to another in one or more HTTP messages. One manner for transporting place metadata in an HTTP message is to include the place metadata in an extended markup language (XML) document. XML documents allow values for any of one or more predefined parameters in a dictionary to be exchanged among nodes that have access to that dictionary. XML parameters can be nested and, for any level of nesting, can be listed in any order. FIG. **2**C and FIG. **2**D illustrate an example XML document holding example place metadata; according to one embodiment. As is well known in the art, an XML parameter value is given between a parameter start indicator <name> and a parameter end indicator </name> where name represents the parameter name. This example document does not include a merged place IDs field **207** or other contact field **249**.

[0053] In the illustrated embodiment, the place ID field holds data that indicates the unique identifier for a particular place. In some embodiments, the place URL field **205** holds data that indicates a primary place resource **103** on the network for obtaining information and services related to the place. Links to multiple other resources, if any, related to that place are found at the primary place resource.

[0054] In some embodiments, the primary place resource is a web page hosted by the organization that registered the place and named using the place ID. For example, in FIG. **2**C, the place ID is 184385761, and the place resource is a web page (using HTTP) named 184385761 in directory homePlace at domain organization.com as given by the value of the URL in the start indicator for the place parameter. The URL included in the xml-place representation is the URL to the PMDS-instance that did provide the place metadata representation (a kind of self reference). This becomes especially important in case the PMDS is regionally partitioned across multiple hosts as described above. In some embodiments, place resources are managed independently from the core attributes in the PRS. In these embodiments, the shared element between PMDS and PRS is the placeID.

[0055] The merged place IDs field **207** holds data indicating the place IDs, if any, for metadata entries that were originally distinct but were subsequently identified as the same place as the place described in entry **201**. In other embodiments, when a place gets merged, data indicating the target place with which the current place is merged is indicated in the field **207**, i.e., a forward reference, linking to the target place which will be the remaining place. Any attempt to a "merged" place will result in an immediate redirect to the target place. That way the placeID remains usable, but only the target placeID is returned.

[0056] In the illustrated embodiment, the categories fields **211** include managed categories field **213**, free-form categories field **215** and free-form language field **217**. In the illustrated embodiment, PNSS introduces a very small core category tree that is centrally managed to support distinction of places that share the same address (e.g. a hotel that resides in a famous building; restaurant within a hotel) when the names might not allow a comparison due to different languages or entries by different users at different times. Every core category is maintained in a category data structure and contains a unique identifier, a semantic description and a list of tags that name the categories in various languages. Published category systems (e.g. EuroStat, GNS Feature Codes) that are centrally managed are mapped to the PNSS core categories. Each such extended category belongs to a single category system that is managed by a single provider. The semantic concepts that define a category are collected in a dictionary. Every place is associated with at least one of these core categories, as indicated by a category ID in the managed category field **213**. FIG. **2**B illustrates example core categories, according to one embodiment. For example, in FIG. **2**C, the categories are "Bar" and "Restaurant" but should also include the core category "dining" from FIG. **2**B.

[0057] In the illustrated embodiment, PNSS allows assigning arbitrary category tags (a free text keyword and its language) to a place. PNSS users are free to assign their own categories through tags to a place. Translations of concepts associated with a category are stored as tags. These arbitrary tags and their associated languages are indicated by the data in the free-form categories field **215** and free-form language field **217**. The Bar and Restaurant categories can be treated as arbitrary tags depicted in FIG. **2**C.

[0058] In the illustrated embodiment, the names fields **221** hold data that indicates a name of the place and zero or more alternatives, and includes default language field **223**, default name field **225** and alternative names/languages field **227**. The default language field **223** holds data that indicates the default language used for the names and address of the place. For example, the default language is the predominant language spoken at the location of the place. In some embodiments the default language is another choice, such as English, which is widely spoken throughout the world. In FIG. **2**C, the default language is German (Deutsch, represented by the abbreviation "de") in the start indicator for the defaultName parameter. The default name field **225** holds data that indicates the default name for the place in the default language. In FIG. **2**C, the default name is "Türkische Kneipe" (which means Turkish Restaurant in the default language, German).

[0059] In the illustrated embodiment, the alternative names/languages field **227** holds data that indicates other names for the place and the associated language. Thus a different alphabet/character associated with the different language can also be used to name and therefore subsequently identify the place. Similarly, different names in the same language can be indicated in field **227**. In FIG. **2**C, the alternative names include the English name "Turkish Restaurant" in English, represented by the abbreviation "en." Two German language alternative names for the restaurant are also indicated in FIG. **2**C.

[0060] In the illustrated embodiment, the location fields **231** hold data that indicates a geographic location of the place, and includes address field **233**, exonyms for address elements field **235** (where exonyms refer to names in different languages) and geographic coordinates field **237**. The address field **233** holds data that indicates the postal address of a place in the default language. For example, in FIG. **2**D, the German language address is "12 Invalidenstr. Berlin 72145 Del." as indicated in separate XML parameters for houseNumber, street, city, region, zipCode, and country.

[0061] In the illustrated embodiment, the exonyms for address elements field **235** holds data that indicates names for address elements in different languages than the default or local language. The exonym field also indicates the language, such as by the abbreviation "en" for English. For example, in FIG. **2**D, the English language street name is "Invaliden Street" as indicated by the data in the XML exonyms parameter.

[0062] In the illustrated embodiment, the geographic coordinates field **237** holds data that indicates the geographic position of the place, such as Global Positioning System (GPS) coordinates or latitude and longitude values with sufficient precision. For example, in FIG **2**D, the latitude is 15.22122 degrees (positive degrees signify North) and the longitude is 17.33333 degrees (positive degrees signify East), as indicated by values in separate XML parameters.

[0063] In the illustrated embodiment, the contact fields **241** hold data that indicates non-postal addresses for contacting one or more organizations or persons associated with a place. Contact information in fields **241** provides a useful way to distinguish among entities with similar names at the same location, such as related businesses in the same office building. The contact fields **241** include phone field **243**, email field **245**, website field **247** and other field **249**. The phone field **233** holds data that indicates one or more telephone numbers associated with a place. Similarly the email field **245**, website field **247** and other field **249**, hold data that indicates one or more email addresses, website URLs, and other contact data, respectively, associated with the place, if any. For example, in FIG. **2**D, the contact addresses are as indicated by values in separate XML parameters.

[0064] While the depicted fields in FIG. **2**A are shown as integral blocks of data in a particular order in a record in a single structure for purposes of illustration, in other embodiments one or more fields, or portions thereof, are arranged in a different order on one or more records in one or more data structures on one or more nodes connected to a communications network, e.g., network **105**. In some other embodiments, one or more depicted fields or portions thereof are omitted, or additional fields are included.

[0065] As described in more detail below with reference to FIG. **6**A through FIG. **6**E, in the illustrated embodiments, a browser or PNSS client process interacts with the PNSS by exchanging messages, such as HTTP messages, with the PNSS modules. As an early step, the user sends a registration message to attempt to register a place with the PNSS. The message must include enough information to determine a degree of match with predetermined places in a metadata data structure. According to the example PNSS API, the message to register a place must contain some place metadata and the name of the provider of the place metadata. The place metadata must include at least a proposed core category, a proposed default name and language, and either an address or a geographic coordinate. All other metadata that the user knows for the place should also be included in order to fill the metadata fields of a new entry in the data structure or to update the metadata in a pre-existing entry.

[0066] FIG. **3**A is a diagram of a place registration message **301**, according to one embodiment. The place registration message includes a category field **311**, a name field **317**, a location field **323** and a provider ID field **327**. Although the depicted fields in FIG. **3**A are shown as integral blocks of data in a particular order in a single message for purposes of illustration, in other embodiments one or more fields, or portions thereof, are arranged in a different order in one or more messages among two or more processes. In some other embodiments, one or more depicted fields or portions thereof are omitted, or additional fields are included.

[0067] In the illustrated embodiment, the category field **311** includes a managed category field **313** and an optional categories field **315** for carrying data that indicates one or more core categories and one or more free-form tags, respectively, as described above. The name field **317** includes a language field **319** and a name field **321** for carrying data that indicates the proposed default language and the default name in that language, respectively.

[0068] In the illustrated embodiment, the location field **323** includes field **325** for carrying data that indicates either or both of a postal address in the default langue or the geographic coordinates, as described above, or both.

[0069] In the illustrated embodiment, the provider identifier (ID) field **327** carries data that indicates the organization or person who is attempting to add or otherwise register the place to the community's shared places.

[0070] According to an example embodiment, the PNSS API provides for place registration message **301** to be an XML document in the body of an HTTP POST message. The same XML parameter dictionary is used as used for the XML document illustrated in FIG. **2**C and FIG. **2**D.

[0071] FIG. **3**B is a diagram of a place response message **303** with a single place identifier, according to one embodiment. A message of this type is returned when the registration metadata exactly matches the corresponding metadata of a place already in the place metadata data structure, or when the registration metadata indicates a new place not already in the metadata data structure. Place response message **303** includes a place ID field **331** and a place URL field **333**. The place ID holds data indicating the unique place ID of the new or existing place that matches exactly the registration metadata. The place URL field **333** field holds data that indicates the web page where links to the description or services related to the place should be added and where links to existing descriptions and services, if any, can be found. In some embodiments, the place URL field **333** just links to the PMDS's entry for that place. It's just a second way to provide the value of the location header described next for an environment where there might be a problem accessing/displaying http-headers.

[0072] According to an example embodiment, the PNSS API provides for response message **303** to be an XML document in the body of an HTTP message, using the XML parameters illustrated in FIG. **2**C and FIG. **2**D. In case of a perfect match to a preexisting place the response will return status code **303**. When a new place is created the response will return status code **201**. The HTTP header "Location" will contain the URL linking to the place's metadata in the PMDS. The response body will include the XML representation of the place ID.

[0073] FIG. **3**C is a diagram of a place response error message **305**, according to one embodiment. A message of this type is returned when the registration metadata causes a problem for the PNSS. Place response message **305** includes an error description field **351** that carries data that indicates the type of error. According to an example embodiment, the PNSS API provides for response message **305** to be an XML document in the body of an HTTP message. In case the registration metadata does not pass validation performed by the PNSS, the response message **305** returns status code **400**. The response body contains an XML representation, e.g., "Error! Reference source not found" Example errors are: "Invalid data," if the place is missing any required attributes; "Invalid address," if the address data is invalid or not correct (e.g., the address is not recognized or the geographical coordinates are incorrect).

[0074] FIG. **3**D is a diagram of a place response message **307** with one or more candidate places, according to one embodiment. A message of this type is returned when the registration metadata is a partial match for one or more new or predetermined places. Place response message **307** includes one or more candidate fields, e.g., candidate field **371***a*, candidate field **371***b*, and candidate field **371***c*, collectively referenced hereinafter as candidate fields **371**. Each candidate field **371** includes a match quality field **373**, an extant/new indicator field **375**, a category field **377**, a names field **381**, a location field **391** and a token field **397**, as depicted for candidate field **371***a*.

[0075] In the illustrated embodiment, the match quality field **373** holds data that indicates a degree of match between the registration metadata and the metadata of the candidate place. The degree of match is less than a perfect match and greater than a predetermined threshold value for the degree of match. Any method may be used to express the degree of match, e.g., a decimal value between 0.0 for no match and 1.0 for perfect match, or an integer between 0 for no match and 255 for a perfect match. Any measure of similarity may be used to generate the degree of match. In the illustrated embodiment, fuzzy logic is used to simultaneously consider and properly weight similarities in category, name, location and contact information in the place metadata. In some embodiments, one or more properties of the fuzzy logic algorithm are learned based on differences between registration metadata and the metadata of candidates selected by previous users of the PNSS.

[0076] In the illustrated embodiment, the extant/new indicator flag **375** holds data that indicates whether the candidate is a new place with valid metadata or an extant place already in the place metadata data structure.

[0077] In the illustrated embodiment, the category field **377** includes a managed categories field **379** that holds data that indicates the managed categories of the candidate place. Similarly, the name field **381** includes a default language field **383** that holds data that indicates the default language of the candidate place, and a default name field **385** that holds data that indicates the name of the candidate place in the default language. The location field **391** includes an address field **393** that holds data that indicates the address in the default language of the candidate place, and a geographic coordinates field **395** that holds data that indicates the geographic coordinates of the candidate place.

[0078] In the illustrated embodiment, the token field **397** holds data that indicates the differences between the candidate metadata and the registration metadata. The data in the token field **397** is used to efficiently indicate a candidate selected by the user and reconstruct the candidate metadata from the registration metadata.

[0079] According to an example embodiment, the PNSS API provides for response message **307** to be an XML document in the body of an HTTP message, using the XML parameters illustrated in FIG. **2**C and FIG. **2**D, with the addition of an XML parameter token. When one or more possible candidates are available but there is no perfect match, the response will return status code **300**. The response body contains an XML representation with a list of candidates. A user can choose one of these candidates and receive the place ID for that candidate through the select candidate resource of the API.

[0080] FIG. **4**A is a diagram of a message **401** for selecting a candidate, according to one embodiment. The message **401** includes a selected candidate token field **403** that carries data that indicates the token provided in message **307** for the one candidate that is selected. The selected candidate is one that the PNSS user understands is the place the user meant to register. If no candidate describes the place the user intended, then the user must review and revise the original registration metadata, and submit the revised metadata in a new registration message.

[0081] According to an example embodiment, the PNSS API provides for a select candidate request that allows the PNSS user to choose one of the proposed candidates of a previous POST operation. This operation can be used for either selecting a preexisting place with slightly different metadata or creating a new place that has slightly different metadata, e.g., because it includes some corrected or enhanced metadata. The message body includes an XML document with a value in an XML token parameter for the candidate token of the selected candidate out of the response body of the previous POST operation. In response, the PNSS client receives the candidate place ID, e.g., in place response message **303**, described above.

[0082] FIG. **4**B is a diagram of a message **411** for requesting a place resource, according to one embodiment. This request is directed to the PMDS **131** and includes a place ID field **413**. The place ID field holds data that indicates a value for the unique place identifier. In response, the PNSS client receives the metadata for the place, including the place resource where links to existing description and services related to the place can be obtained, and where links to new descriptions and services can be added.

[0083] According to an example embodiment, the PNSS API provides for the place metadata service (PMDS) to allow a PNSS user to read and manage the core metadata of a place. Therefore, every place is modeled as a resource indicated by the URL returned in field **333** of message **303**. The resource provides a set of operations and sub-resources. An HTTP GET message returns the metadata of the place with the place ID as specified by the last URL segment. The HTTP response message includes a Status Code. When a place with a place ID matching the last URL segment exists, the response will return status code **200**. The response body will contain the XML representation of the place as depicted in FIG. **2**C and FIG. **2**D. When no place with a place ID that matches the last URL segment exists, then the response will return status code **404**.

[0084] According to an example embodiment, the PNSS services are divided among multiple modules. In the following description, the processes at the place metadata service (PMDS) module **131** and the Permanent Place ID Service (PPIDS) module **133** are described with reference to FIG. **5**A and FIG. **5**B, respectively. In other embodiments, two or more of these modules are combined into a single module that performs the steps of both processes.

[0085] FIG. **5**A is a flowchart of a process **500** at a place metadata service (PMDS), according to one embodiment. Although steps in FIG. **5**A and subsequent flow chart FIG. **5**B are show in a particular order for purposes of illustration, in other embodiments, one or more steps may be performed in a different order or overlapping in time, in series or in parallel, or one or more steps may be omitted or added, or changed in some combination of ways.

[0086] In the illustrated embodiment, in step **501**, a message is received, such as an XML document in the body of an HTTP message. In step **503** it is determined whether the message indicates place metadata for a new place to be created.

[0087] If so, then in step **505** a next place ID is determined in the illustrated embodiment. Any method may be used to determine the next place ID. In some embodiments, the next available place ID is generated by incrementing the last place ID; in some embodiments the place ID is determined by a hash function. In some embodiments, the next place ID is determined by sending a request message for the next place ID to a Global Place Name Server (GPNS) **136**. In step **507** a new entry is added to a place metadata data structure with the new place ID. The values of the metadata received in the create message are stored in the new entry fields, as depicted in FIG. **2**A. In step **509**, the new place ID and associated place resource are returned to the module that sent the create message.

[0088] If the message does not indicate a new place is to be created, then in step **511** in the illustrated embodiment, it is determined whether the message indicates to retrieve place metadata based on a place ID provided in the message. If so, then in step **513** the place metadata for the given place ID is returned to the module that sent the message, e.g., in an XML document like that depicted in FIG. **2**C and FIG. **2**D in the body of an HTTP message. However, if such a place ID is not valid, then an error message is returned, e.g., like message **306**, with a description of the error, or with an error code.

[0089] If the message received is not a request to retrieve metadata based on a place ID, then in step **515**, in the illustrated embodiment, it is determined whether the message is a request to retrieve a place ID based on metadata included in the message. If not, then the message is further reviewed in step **535**, described below. If so, then in step **517** the next entry in the place metadata data structure is retrieved. In some embodiments the next entry retrieved is the next entry within a vicinity of a location indicated in the metadata provided in the received message.

[0090] In the illustrated embodiment, n step **519** a quality of match is determined between the metadata in the message received (message metadata) and the metadata in the data structure entry (entry metadata). Any method may be used to determine the quality of match. In some embodiments, the quality is computed as a degree of match determined using a fuzzy logic algorithm that takes account of location identification, category definition, name resolution, vicinity detection, and previous selection tracking, as described above. In other embodiemtns, the fuzzy logic is left to the PPIDS, and the match quality determined in the PMDS merely indicates one of three levels of matching: a first level for no match of any metadata except category, a second level for complete match of all metadata, and a third level for match of at least one metadata parameter other than category.

[0091] In step **521**, in the illustrated embodiment, it is determined whether there is a perfect match of all metadata in the message with the corresponding metadata in the entry. If so, then in step **521**, the place ID of the entry is returned as an extant place ID, and processing of the received message is complete.

[0092] If there is not a perfect match, then in step **525**, in the illustrated embodiment, it is determined whether the degree of match exceeds a predetermined threshold or falls into the third category of match quality. If so, then there is a partial match and the place ID of the entry is returned along with the value of the match quality level.

[0093] In step **529**, in the illustrated embodiment, it is determined if the entry just examined is the last entry in the vicinity. If not, then the next entry is selected in step **517**. If so, then it is determined in step **531** whether any partial matches were obtained (e.g., whether step **527** was executed at least once). If so, then the processing of the message is complete and the process ends. If not, then a message is returned indicating no match for the message metadata.

[0094] In step **535**, in the illustrated embodiment, it is determined if the message received is to update the metadata at an existing entry. If not, then the message is ignored and the process ends. If so, then in step **537**, the metadata of an existing entry is updated. For example, new metadata is added to blank fields, metadata in a field is replaced, metadata in a field is deleted, or the entry is deleted, or merged with a different entry. An entry is merged, for example, by indicating one entry as the dominant entry, using metadata from the subordinate entry only in blank fields in the dominant entry, deleting the subordinate entry and including the place ID of the subordinate entry in the merged place IDs field **207** of the dominant entry. The process then ends.

[0095] As a result of method **500** any node can determine the metadata associated with a place ID or find a place ID for a place with metadata that exactly or partially matches the metadata on hand. According to some embodiments, these processes at PMDS **131** are utilized by a PPIDS **133** to quality control metadata registered for the metadata database and substantially reduce duplicate entries. To prevent malicious creation of new entries, messages to create a new place or update an entry are accepted only from trusted sources, like PPIDS **133**.

[0096] FIG. 5B is a flowchart of a process **550** at a permanent place ID service (PPIDS), according to one embodiment. In step **551**, a metadata data structure is seeded with multiple entries. In some embodiments, step **551** is performed by a different process. In step **553** a request for the PPIDS web page is received and the web page is sent in one or more HTTP messages. The web page provides active areas and forms that a PNSS user can manipulate to perform PNSS functions. In step **555** an HTTP message is received from the user's browser. In some embodiments, step **553** is omitted and the message received in step **555** is sent by a PNSS client **121**, e.g., as an HTTP message.

[0097] In step **557**, in the illustrated embodiment, it is determined whether the message is a registration message, e.g., place registration message **301**. If so, then in step **559** it is determined if the registration metadata is valid. Any method may be used to determine if the metadata is valid. For example, in some embodiments, the validity of a postal address is determined based on the commercial LRO services available from NAVTEQ. For example the LRO service can indicate if a given street name does not exist in a given city or within a given postal code, or whether a given house number does not exist for the given street name. Latitude values must lie between 90 degrees South and 90 degrees North; longitude values between 180 degrees West and 180 degrees East.

[0098] If the registration metadata is not valid, then in step **561**, in the illustrated embodiment, it is determined if the registration metadata can be corrected. If not, an error message, such as error message **305** is returned to the client process in step **563**. If the registration metadata can be corrected, such as for misspellings, transposed numeral and missing postal codes or cities, then, in step **565**, the registration metadata is corrected to produce valid, corrected registration metadata. In some embodiments, the corrected registration metadata is used in step **567**.

[0099] In step **567**, in the illustrated embodiment, a list of one or more candidate places is generated, with tokens as described above, including a candidate based on corrected registration metadata, if any. In step **569** a place response message with candidates, such as message **307**, is returned to the client process. Control then passes to step **555**, to receive the next message from the client (e.g., PNSS client **121** or browser **117**)

[0100] If the metadata is found valid in step **559**, or, in some embodiments, corrected in step **565**, then, in step **571**, the place ID for the valid registration metadata is obtained. For example, a request message with valid registration metadata is sent to the PMDS **331** for processing as described above with reference to FIG. **5**A.

[0101] In step **573**, in the illustrated embodiment, it is determined if the PMDS returns only partial matches, e.g., returns at least one message with a match quality at the third level, but returns no message for a place ID of a perfect match. If so, then a list of candidates is built in step **567** based on those partial matches. In some embodiments all the partial matches are included in the list of candidates. In some embodiments, further processing is performed to determine which, if any, of the partial matches to include in the list of candidates. For example, in some embodiments the fuzzy logic algorithm is applied based on past learning from past selections of candidates. In these embodiments, for example, a place having a partial match with a degree of match rarely selected by a user, is not included in the list of candidates, unless it is the best match. A token is determined for each place included in the list of candidate places. The place response with candidates message is returned in step **569**, as described above.

[0102] In step **575**, in the illustrated embodiment, it is determined if the PMDS returns a perfect match. If so, then the place ID of the place that perfectly matches the valid registration metadata is returned, along with the place resource, e.g., in place response message **303**. The process is then complete until the next message is received in step **553** or step **555**.

[0103] If no perfect match or partial matches are returned, then, in the illustrated embodiment, PMDS returns a message that there is no match for the valid registration metadata. In step **579**, the valid registration metadata is sent to the PMDS in a message for creating a new place. The PMDS gets the next place ID and adds a new entry to the place metadata data structure and returns the new place ID., as described above with reference to step **505** through step **509** of FIG. **5**A. In step **581** the new place ID is received from the PMDS, and is returned to the client process. The process is then complete until the next message is received in step **553** or step **555**.

[0104] If the message received is not a registration message, then, in the illustrated embodiment, in step **583**, it is determined if the message received is a select candidate message, e.g., message **401**. If not, the process is complete until the next appropriate message is received in step **555**. If so, then in step **585**, the metadata from the selected candidate is reconstructed based on the valid registration data and the token. Furthermore, metrics, for determining which places should be offered as candidates from the set of returned places with partial matches, are reviewed and updated as advantageous. Control then passes to step **587** and following steps to determine if the selected candidate token represents an extant place or a new place, and respond accordingly. If the token refers to an extant place, control passes back to step **577**, described above. If the token refers to a new place, then control passes to step **579** and following to create the metadata and return the placeID for the new place.

[0105] FIG. **6**A is a time sequence diagram that illustrates a sequence of messages and processes **600** for accessing place metadata, according to one embodiment. Time increases downward in this and following time sequence diagrams. A network process on the network is represented by a vertical bar. A message passed from one process to another is represented by horizontal arrows. A step performed by a process is indicated by a box or looping arrow overlapping the process at a time sequence indicated by the vertical position of the box or looping arrow.

[0106] The network processes represented in the illustrated embodiment of FIG. **6**A are a PNSS user, such as PNSS client process **121**, the Permanent Place ID service (PPIDS) **133**, and the Place metadata Service (PMDS) **131**.

[0107] In the illustrated embodiment,The Place Meta Data Service manages metadata of all registered places. Access to the meta data requires place ID for the place. Message **611**, getPlace(placeID), is an example of a request place message **411**. Message **613**, result:place Metadata, is an example of an HTTP message with place metadata as depicted in FIG. **2**A, FIG. **2**C and FIG. **2**D.

[0108] FIG. **6**B is a time sequence diagram that illustrates a sequence of messages and processes **620** for registering a valid new place, according to one embodiment. The network processes represented in FIG. **6**B are the same as depicted in FIG. **6**A.

[0109] The PPIDS **133** manages the registration of new places, in the illustrated embodiment. Therefore the PNSS user **121** has to provide the metadata of the place to the PPIDS in a registration message **621** (e.g., message **301**). PPIDS validates the data in process **623**. If the data is correct, the PPIDS searches for matching places by sending message **625** to the PMDS **131**. If no matching place is available, as indicated in message **627** from the PMDS, PPIDS creates a new place in the PMDS by sending message **629**. The new place ID returned by the PDMS to the PPIDS in message **631** is returned to the PNSS user **121** in message **633**.

[0110] FIG. **6**C is a time sequence diagram that illustrates a sequence of messages and processes **640** for registering a matched place, according to one embodiment. The network processes represented in FIG. **6**C are the same as depicted in FIG. **6**A.

[0111] Registering a place that matches perfectly to a preexisting place begins as registering a new place in FIG. **6**B, but the lookup in the PMDS will return a perfect matching place in message **647**, in the illustrated embodiment. The PPIDS directly returns in message **649** the place ID of the matching place.

[0112] FIG. **6**D is a time sequence diagram that illustrates a sequence of messages and processes **650** for registering a partially matched place, according to one embodiment. The network processes represented in FIG. **6**D are the same as depicted in FIG. **6**A.

[0113] In case the provided metadata matches only partially to one (or multiple) places in messages **657**, PPIDS creates a list of all matching candidates together with a "quality of match" value in process **659**, in the illustrated embodiment,. The list is sent in message **661** (e.g., in message **307** of FIG. **3**D). The user can then select one of these candidates by sending back the selection as a token in message **665** (e.g., in message **401** of FIG. **4**A). Based on the selected candidate, the PPIDS reconstructs the candidate metadata from the registration metadata and the token in process **667**. The PPIDS sends the registration metadata to the PMDS in an update place message **669** to update the metadata of the selected place based on the registration metadata. The PDMS updates the selected place and sends the place ID of the updated but extant place in message **671**. The place ID may have changed if the original partial matched place was merged with another place as a result of the updates. The PPIDS returns in message **673** the place ID of the extant place.

[0114] If the user doesn't agree with any of the candidates, the user has to correct the metadata manually and rerun the registration with the new metadata, in the illustrated embodiment.

[0115] FIG. **6**E is a time sequence diagram that illustrates a sequence of messages and processes **680** for registering a partially valid place, according to one embodiment. The network processes represented in FIG. **6**E are the same as depicted in FIG. **6**A.

[0116] During validation in process **683**, in the illustrated embodiment, PPIDS can automatically fix some issues in the registration metadata received in message **681**, such as fixing misspellings and adding Zip code. The PPIDS proceeds as if the corrected data would have been directly provided, e.g., by sending message **685** searching for matching places. Even if no matches are found, as indicated in message **687**, PPIDS gives the user the chance to accept the fixes in an additional selection step. Therefore the PPIDS creates a candidate based on the corrected metadata in process **689** and send this together with a "selectToken" object in message **690**. If the user agrees with the fixes, the user sends the selectToken object in a selectCandidate request message **691** to the PPIDS. The PPIDS proceeds as if the user would have initially provided the corrected data. If no match is found, as shown in FIG. **6**E, PPIDS creates a new place by reconstructing the fixed metadata from the registered metadata and the token in process **693**. The reconstructed metadata is used to create the new place by sending it in a creat place message **695**. A result message **697** is received with the new place ID, and returned to the PNSS user **121** in message **699**.

[0117] If a match had been found, then the PPIDS returns the place ID of a matching preexisting place, in the illustrated embodiment, If the user doesn't agree to the fixes, the user he has to modify the registration metadata manually and rerun the registration with the modified meta data

[0118] The processes described herein for tracking and sharing content playback may be implemented via software, hardware (e.g., general processor, Digital Signal Processing

(DSP) chip, an Application Specific Integrated Circuit (ASIC), Field Programmable Gate Arrays (FPGAs), etc.), firmware or a combination thereof. Such example hardware for performing the described functions is detailed below.

[0119] FIG. **7** illustrates a computer system **700** upon which an embodiment of the invention may be implemented. Computer system **700** includes a communication mechanism such as a bus **710** for passing information between other internal and external components of the computer system **700**. Information (also called data) is represented as a physical expression of a measurable phenomenon, typically electric voltages, but including, in other embodiments, such phenomena as magnetic, electromagnetic, pressure, chemical, biological, molecular, atomic, sub-atomic and quantum interactions. For example, north and south magnetic fields, or a zero and non-zero electric voltage, represent two states (0, 1) of a binary digit (bit). Other phenomena can represent digits of a higher base. A superposition of multiple simultaneous quantum states before measurement represents a quantum bit (qubit). A sequence of one or more digits constitutes digital data that is used to represent a number or code for a character. In some embodiments, information called analog data is represented by a near continuum of measurable values within a particular range.

[0120] A bus **710** includes one or more parallel conductors of information so that information is transferred quickly among devices coupled to the bus **710**. One or more processors **702** for processing information are coupled with the bus **710**.

[0121] A processor **702** performs a set of operations on information. The set of operations include bringing information in from the bus **710** and placing information on the bus **710**. The set of operations also typically include comparing two or more units of information, shifting positions of units of information, and combining two or more units of information, such as by addition or multiplication or logical operations like OR, exclusive OR (XOR), and AND. Each operation of the set of operations that can be performed by the processor is represented to the processor by information called instructions, such as an operation code of one or more digits. A sequence of operations to be executed by the processor **702**, such as a sequence of operation codes, constitute processor instructions, also called computer system instructions or, simply, computer instructions. Processors may be implemented as mechanical, electrical, magnetic, optical, chemical or quantum components, among others, alone or in combination.

[0122] Computer system **700** also includes a memory **704** coupled to bus **710**. The memory **704**, such as a random access memory (RAM) or other dynamic storage device, stores information including processor instructions. Dynamic memory allows information stored therein to be changed by the computer system **700**. RAM allows a unit of information stored at a location called a memory address to be stored and retrieved independently of information at neighboring addresses. The memory **704** is also used by the processor **702** to store temporary values during execution of processor instructions. The computer system **700** also includes a read only memory (ROM) **706** or other static storage device coupled to the bus **710** for storing static information, including instructions, that is not changed by the computer system **700**. Some memory is composed of volatile storage that loses the information stored thereon when power is lost. Also coupled to bus **710** is a non-volatile (persistent) storage device **708**, such as a magnetic disk, optical disk or flash card, for storing information, including instructions, that persists even when the computer system **700** is turned off or otherwise loses power.

[0123] Information, including instructions, is provided to the bus **710** for use by the processor from an external input device **712**, such as a keyboard containing alphanumeric keys operated by a human user, or a sensor. A sensor detects conditions in its vicinity and transforms those detections into physical expression compatible with the measurable phenomenon used to represent information in computer system **700**. Other external devices coupled to bus **710**, used primarily for interacting with humans, include a display device **714**, such as a cathode ray tube (CRT) or a liquid crystal display (LCD), or plasma screen or printer for presenting text or images, and a pointing device **716**, such as a mouse or a trackball or cursor direction keys, or motion sensor, for controlling a position of a small cursor image presented on the display **714** and issuing commands associated with graphical elements presented on the display **714**. In some embodiments, for example, in embodiments in which the computer system **700** performs all functions automatically without human input, one or more of external input device **712**, display device **714** and pointing device **716** is omitted.

[0124] In the illustrated embodiment, special purpose hardware, such as an application specific integrated circuit (ASIC) **720**, is coupled to bus **710**. The special purpose hardware is configured to perform operations not performed by processor **702** quickly enough for special purposes. Examples of application specific ICs include graphics accelerator cards for generating images for display **714**, cryptographic boards for encrypting and decrypting messages sent over a network, speech recognition, and interfaces to special external devices, such as robotic arms and medical scanning equipment that repeatedly perform some complex sequence of operations that are more efficiently implemented in hardware.

[0125] Computer system **700** also includes one or more instances of a communications interface **770** coupled to bus **710**. Communication interface **770** provides a one-way or two-way communication coupling to a variety of external devices that operate with their own processors, such as printers, scanners and external disks. In general the coupling is with a network link **778** that is connected to a local network **780** to which a variety of external devices with their own processors are connected. For example, communication interface **770** may be a parallel port or a serial port or a universal serial bus (USB) port on a personal computer. In some embodiments, communications interface **770** is an integrated services digital network (ISDN) card or a digital subscriber line (DSL) card or a telephone modem that provides an information communication connection to a corresponding type of telephone line. In some embodiments, a communication interface **770** is a cable modem that converts signals on bus **710** into signals for a communication connection over a coaxial cable or into optical signals for a communication connection over a fiber optic cable. As another example, communications interface **770** may be a local area network (LAN) card to provide a data communication connection to a compatible LAN, such as Ethernet. Wireless links may also be implemented. For wireless links, the communications interface **770** sends or receives or both sends and receives electrical, acoustic or electromagnetic signals, including infrared and optical signals, that carry information streams, such as digital data. For example, in wireless handheld devices, such as mobile telephones like cell phones, the communications interface **770** includes a radio band electromagnetic transmitter and receiver called a radio transceiver.

[0126] The term computer-readable medium is used herein to refer to any medium that participates in providing information to processor **702**, including instructions for execution. Such a medium may take many forms, including, but not limited to, non-volatile media, volatile media and transmission media. Non-volatile media include, for example, optical or magnetic disks, such as storage device **708**. Volatile media include, for example, dynamic memory **704**. Transmission media include, for example, coaxial cables, copper wire, fiber optic cables, and carrier waves that travel through space without wires or cables, such as acoustic waves and electromagnetic waves, including radio, optical and infrared waves. Signals include man-made transient variations in amplitude, frequency, phase, polarization or other physical properties transmitted through the transmission media.

[0127] Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, a hard disk, a magnetic tape, or any other magnetic medium, a compact disk ROM (CD-ROM), a digital video disk (DVD) or any other optical medium, punch cards, paper tape, or any other physical medium with patterns of holes, a RAM, a programmable ROM (PROM), an erasable PROM (EPROM), a FLASH-EPROM, or any other memory chip or cartridge, a transmission medium such as a cable or carrier wave, or any other medium from which a computer can read. Information read by a computer from computer-readable media are variations in physical expression of a measurable phenomenon on the computer readable medium. Computer-readable storage medium is a subset of computer-readable medium which excludes transmission media that carry transient man-made signals.

[0128] Logic encoded in one or more tangible media includes one or both of processor instructions on a computer-readable storage media and special purpose hardware, such as ASIC **720**.

[0129] Network link **778** typically provides information communication using transmission media through one or more networks to other devices that use or process the information. For example, network link **778** may provide a connection through local network **780** to a host computer **782** or to equipment **784** operated by an Internet Service Provider (ISP). ISP equipment **784** in turn provides data communication services through the public, world-wide packet-switching communication network of networks now commonly referred to as the Internet **790**. A computer called a server host **792** connected to the Internet hosts a process that provides a service in response to information received over the Internet. For example, server host **792** hosts a process that provides information representing video data for presentation at display **714**.

[0130] At least some embodiments of the invention are related to the use of computer system **700** for implementing some or all of the techniques described herein. According to one embodiment of the invention, those techniques are performed by computer system **700** in response to processor **702** executing one or more sequences of one or more processor instructions contained in memory **704**. Such instructions, also called computer instructions, software and program code, may be read into memory **704** from another computer-readable medium such as storage device **708** or network link **778**. Execution of the sequences of instructions contained in memory **704** causes processor **702** to perform one or more of the method steps described herein. In alternative embodiments, hardware, such as ASIC **720**, may be used in place of or in combination with software to implement the invention. Thus, embodiments of the invention are not limited to any specific combination of hardware and software, unless otherwise explicitly stated herein.

[0131] The signals transmitted over network link **778** and other networks through communications interface **770**, carry information to and from computer system **700**. Computer system **700** can send and receive information, including program code, through the networks **780**, **790** among others, through network link **778** and communications interface **770**. In an example using the Internet **790**, a server host **792** transmits program code for a particular application, requested by a message sent from computer **700**, through Internet **790**, ISP equipment **784**, local network **780** and communications interface **770**. The received code may be executed by processor **702** as it is received, or may be stored in memory **704** or in storage device **708** or other non-volatile storage for later execution, or both. In this manner, computer system **700** may obtain application program code in the form of signals on a carrier wave.

[0132] Various forms of computer readable media may be involved in carrying one or more sequence of instructions or data or both to processor **702** for execution. For example, instructions and data may initially be carried on a magnetic disk of a remote computer such as host **782**. The remote computer loads the instructions and data into its dynamic memory and sends the instructions and data over a telephone line using a modem. A modem local to the computer system **700** receives the instructions and data on a telephone line and uses an infra-red transmitter to convert the instructions and data to a signal on an infra-red carrier wave serving as the network link **778**. An infrared detector serving as communications interface **770** receives the instructions and data carried in the infrared signal and places information representing the instructions and data onto bus **710**. Bus **710** carries the information to memory **704** from which processor **702** retrieves and executes the instructions using some of the data sent with the instructions. The instructions and data received in memory **704** may optionally be stored on storage device **708**, either before or after execution by the processor **702**.

[0133] FIG. **8** illustrates a chip set **800** upon which an embodiment of the invention may be implemented. Chip set **800** is programmed to carry out the inventive functions described herein and includes, for instance, the processor and memory components described with respect to FIG. **8** incorporated in one or more physical packages. By way of example, a physical package includes an arrangement of one or more materials, components, and/or wires on a structural assembly (e.g., a baseboard) to provide one or more characteristics such as physical strength, conservation of size, and/or limitation of electrical interaction.

[0134] In one embodiment, the chip set **800** includes a communication mechanism such as a bus **801** for passing information among the components of the chip set **800**. A processor **803** has connectivity to the bus **801** to execute instructions and process information stored in, for example, a memory **805**. The processor **803** may include one or more processing cores with each core configured to perform independently. A multi-core processor enables multiprocessing within a single physical package. Examples of a multi-core processor include two, four, eight, or greater numbers of processing cores. Alternatively or in addition, the processor **803** may include one or more microprocessors configured in tandem via the bus **801** to enable independent execution of instructions, pipelining, and multithreading. The processor **803** may also be accompanied with one or more specialized components to perform certain processing functions and tasks such as one or more digital signal processors (DSP) **807**, or one or more application-specific integrated circuits (ASIC) **809**. A DSP **807** typically is configured to process real-word signals (e.g., sound) in real time independently of the processor **803**. Similarly, an ASIC **809** can be configured to performed specialized functions not easily performed by a general purposed processor. Other specialized components to aid in performing the inventive functions described herein include one or more field programmable gate arrays (FPGA) (not shown), one or more controllers (not shown), or one or more other special-purpose computer chips.

[0135] The processor **803** and accompanying components have connectivity to the memory **805** via the bus **801**. The memory **805** includes both dynamic memory (e.g., RAM, magnetic disk, writable optical disk, etc.) and static memory (e.g., ROM, CD-ROM, etc.) for storing executable instructions that when executed perform the inventive steps described herein. The memory **805** also stores the data associated with or generated by the execution of the inventive steps.

[0136] FIG. **9** is a diagram of example components of a mobile station (e.g., handset) capable of operating in the system of FIG. **1**, according to one embodiment. Generally, a radio receiver is often defined in terms of front-end and back-end characteristics. The front-end of the receiver encompasses all of the Radio Frequency (RF) circuitry whereas the back-end encompasses all of the base-band processing circuitry. Pertinent internal components of the station include a Main Control Unit (MCU) **903**, a Digital Signal Processor (DSP) **905**, and a receiver/transmitter unit including a microphone gain control unit and a speaker gain control unit. A main display unit **907** provides a display to the user in support of various applications and mobile station functions. An audio function circuitry **909** includes a microphone **911** and microphone amplifier that amplifies the speech signal output from the microphone **911**. The amplified speech signal output from the microphone **911** is fed to a coder/decoder (CODEC) **913**.

[0137] A radio section **915** amplifies power and converts frequency in order to communicate with a base station, which is included in a mobile communication system, via antenna **917**. The power amplifier (PA) **919** and the transmitter/modulation circuitry are operationally responsive to the MCU **903**, with an output from the PA **919** coupled to the duplexer **921** or circulator or antenna switch, as known in the art. The PA **919** also couples to a battery interface and power control unit **920**.

[0138] In use, a user of mobile station **901** speaks into the microphone **911** and his or her voice along with any detected background noise is converted into an analog voltage. The analog voltage is then converted into a digital signal through the Analog to Digital Converter (ADC) **923**. The control unit **903** routes the digital signal into the DSP **905** for processing therein, such as speech encoding, channel encoding, encrypting, and interleaving. In the example embodiment, the processed voice signals are encoded, by units not separately shown, using a cellular transmission protocol such as global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wireless fidelity (WiFi), satellite, and the like.

[0139] The encoded signals are then routed to an equalizer **925** for compensation of any frequency-dependent impairments that occur during transmission though the air such as phase and amplitude distortion. After equalizing the bit stream, the modulator **927** combines the signal with a RF signal generated in the RF interface **929**. The modulator **927** generates a sine wave by way of frequency or phase modulation. In order to prepare the signal for transmission, an up-converter **931** combines the sine wave output from the modulator **927** with another sine wave generated by a synthesizer **933** to achieve the desired frequency of transmission. The signal is then sent through a PA **919** to increase the signal to an appropriate power level. In practical systems, the PA **919** acts as a variable gain amplifier whose gain is controlled by the DSP **905** from information received from a network base station. The signal is then filtered within the duplexer **921** and optionally sent to an antenna coupler **935** to match impedances to provide maximum power transfer. Finally, the signal is transmitted via antenna **917** to a local base station. An automatic gain control (AGC) can be supplied to control the gain of the final stages of the receiver. The signals may be forwarded from there to a remote telephone which may be another cellular telephone, other mobile phone or a land-line connected to a Public Switched Telephone Network (PSTN), or other telephony networks.

[0140] Voice signals transmitted to the mobile station **901** are received via antenna **917** and immediately amplified by a low noise amplifier (LNA) **937**. A down-converter **939** lowers the carrier frequency while the demodulator **941** strips away the RF leaving only a digital bit stream. The signal then goes through the equalizer **925** and is processed by the DSP **905**. A Digital to Analog Converter (DAC) **943** converts the signal and the resulting output is transmitted to the user through the speaker **945**, all under control of a Main Control Unit (MCU) **903**—which can be implemented as a Central Processing Unit (CPU) (not shown).

[0141] The MCU **903** receives various signals including input signals from the keyboard **947**. The MCU **903** delivers a display command and a switch command to the display **907** and to the speech output switching controller, respectively. Further, the MCU **903** exchanges information with the DSP **905** and can access an optionally incorporated SIM card **949** and a memory **951**. In addition, the MCU **903** executes various control functions required of the station. The DSP **905** may, depending upon the implementation, perform any of a variety of conventional digital processing functions on the voice signals. Additionally, DSP **905** determines the background noise level of the local environment from the signals detected by microphone **911** and sets the gain of microphone **911** to a level selected to compensate for the natural tendency of the user of the mobile station **901**.

[0142] The CODEC **913** includes the ADC **923** and DAC **943**. The memory **951** stores various data including call incoming tone data and is capable of storing other data including music data received via, e.g., the global Internet. The software module could reside in RAM memory, flash memory, registers, or any other form of writable storage medium known in the art. The memory device **951** may be, but not limited to, a single memory, CD, DVD, ROM, RAM, EEPROM, optical storage, or any other non-volatile storage medium capable of storing digital data.

[0143] An optionally incorporated SIM card **949** carries, for instance, important information, such as the cellular phone number, the carrier supplying service, subscription details, and security information. The SIM card **949** serves primarily to identify the mobile station **901** on a radio network. The card **949** also contains a memory for storing a personal telephone number registry, text messages, and user specific mobile station settings.

[0144] While the invention has been described in connection with a number of embodiments and implementations, the invention is not so limited but covers various obvious modifications and equivalent arrangements, which fall within the purview of the appended claims. Although features of the invention are expressed in certain combinations among the claims, it is contemplated that these features can be arranged in any combination and order.

What is claimed is:

1. A computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to perform at least the following:

receiving registration data that indicates one or more values for a corresponding one or more attributes that describe a place that is associated with a geographic location; and

initiating providing indication of a match between the registration data and metadata for a predetermined place.

2. A computer-readable storage medium of claim **1**, wherein the apparatus is caused to further perform:

validating the registration data; and

generating a new entry for predetermined places based on the validation of the registration data and a negligible degree of match.

3. A computer-readable storage medium of claim **2**, wherein the indication of the match further indicates a unique identifier for the place, the unique identifier corresponding to the new entry of the place within a data structure, the predetermined places having been assigned respectively a plurality of unique identifiers within the data structure.

4. A computer-readable storage medium of claim **1**, wherein the apparatus is caused to further perform determining a degree of match using a fuzzy matching algorithm that applies place category matching, place name matching, nearby matching, previous selection matching, or a combination thereof.

5. A computer-readable storage medium of claim **2**, wherein the indication of the match further indicates a candidate place of one or more predetermined places based on the validation of the registration data and determining that the registration data matches the candidate place to a predetermined degree.

6. A computer-readable storage medium of claim **1**, wherein:

the apparatus is caused to further perform building a token for a candidate place if the registration data matches the candidate place to a predetermined degree;

the token includes data that indicates a difference between the registration data and the candidate place; and

the indication of the match further includes the token for the candidate place.

7. A computer-readable storage medium of claim **6**, wherein the token includes a unique identifier for the candidate place if the candidate place is one of predetermined places.

8. A computer-readable storage medium of claim **6**, wherein the apparatus is caused to further perform:

receiving a candidate selection message that indicates a single token selected by a user; and

initiating updating of a set of predetermined places for the candidate place based on the single token.

9. A computer-readable storage medium of claim **6**, wherein building the token for the candidate place further comprises generating the candidate place by automatically correcting the registration data.

10. A computer-readable storage medium of claim **6**, wherein the indication of the match includes a plurality of tokens for a plurality of candidate places.

11. A computer-readable storage medium of claim **1**, wherein the apparatus is caused to further perform initiating sending an error message if the registration data omits a value for a place name attribute or a place category attribute or a geographic location attribute.

12. A computer-readable storage medium of claim **8**, wherein initiating updating of the set of predetermined places for the candidate place based on the single token further comprises initiating deleting or merging one of the predetermined places.

13. A computer-readable storage medium of claim **8**, wherein the apparatus is caused to further perform learning a heuristic for selecting a candidate based on the single token selected by the user.

14. An apparatus comprising a processor and a memory storing executable instructions that if executed cause the apparatus to perform at least the following:

receive registration data that indicates one or more values for a corresponding one or more attributes that describe a place that is associated with a geographic location; and

initiate providing an indication of a match between the registration data and metadata for a predetermined place.

15. An apparatus of claim **14**, wherein the apparatus is further configured to:

validate the registration data; and

create a new entry for predetermined places based on the validation of the registration data and a negligible degree of match.

16. An apparatus of claim **15**, wherein the indication of the match further indicates a unique identifier for the place, the unique identifier corresponding to the new entry of the place within a data structure, a set of predetermined places having been assigned respectively a plurality of unique identifiers within the data structure.

17. An apparatus of claim **14**, wherein the apparatus is further configured to determine a degree of match using a fuzzy matching algorithm that applies place category matching, place name matching, nearby matching, previous selection matching, or a combination thereof.

18. An apparatus of claim **14**, wherein:

the apparatus is further configured to build a token for a candidate place if the registration data matches the candidate place to a predetermined degree;

the token includes data that indicates a difference between the registration data and the candidate place; and

the response data further includes the token for the candidate place.

19. A system including the apparatus of claim **14**, the system further comprising a place-building client configured to send the registration data.

20. A method comprising:

receiving registration data that indicates a value for a subset of place metadata that includes a plurality of attributes that describe a place that is associated with a geographic location; and

providing an indication of match between the registration data and metadata for a predetermined place.

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