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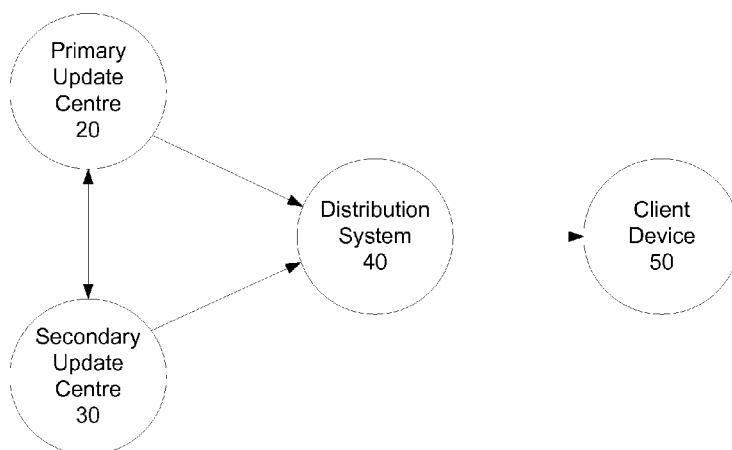


Figure 3

(57) Abstract: A method is disclosed for incrementally updating an existing digital map of a client device in a digital map update system. The digital map update system comprising a primary digital map update centre, a secondary digital map update centre and a plurality of remote client devices. The primary digital map update centre and the secondary digital map update centre are each able to provide a set of one or more incremental updates for communication to one or more of one of the plurality of remote client devices for use in incrementally updating existing digital maps of the client devices. The secondary digital map update centre provides data indicative of a set of one or more incremental digital map updates for communication to at least one of the plurality of remote client devices for use in incrementally updating an existing digital map of the device. The secondary digital map update centre additionally provides information relating to the set of one or more incremental digital map updates to the primary digital map update centre.



METHODS AND SYSTEMS FOR UPDATING  
A DIGITAL MAP

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**Field of the Invention**

The present invention relates to methods and systems for incrementally updating a digital map of a remote client device in a digital map update system. The remote client device is one of a plurality of remote client devices having an existing digital map to be updated and being in communication with a digital map update server of the update system.

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**Background to the Invention**

In a navigation system, it is useful to be able to update the digital map of a client device remotely using a digital map update server. For example, the client device might be a portable navigation device (PND) or other navigation device associated with a user, or could be a client server. One known technique for updating such a map involves the client device periodically downloading a complete new version of a digital map from the update server to replace a previous version of the map held by the client device. The new version of the digital map will incorporate any updates, e.g. corrections or enhancements, since the previous version of the digital map held by the client device. For example, traditionally a navigation map provider would release a new version of a digital map, e.g. quarterly, incorporating any updates since the previous version of the map, which could be downloaded by client devices.

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However, more recently it has been recognised that, rather than periodically replacing the entire digital map of a client device in order to update the map, it is desirable to instead be able to only update those parts of the digital map which have changed. These arrangements are advantageous in that only updates, i.e. changes to the digital map, since it was previously updated for example, need be transmitted to the client device. The updates can be received by the client device and used to update the existing map of the device. Systems in which only updates, i.e. changes to the digital map, are provided to the client device, and used to update an existing digital map of the device, may be referred to as "incremental update" systems. Such incremental update systems provide greater flexibility, and enable the digital map of the client device to be kept more regularly updated, rather than being limited to periodic updating when a new version of the map is released. For example, the digital map may be updated once a week, or once a day, or at any desired interval. Furthermore, incremental update systems are less demanding in terms of processing power and/or memory of the client devices, enabling updates to be implemented more easily, e.g. on the fly. There are, however, certain challenges in implementing incremental update systems for updating the digital map of a remote client device.

The Applicant has realised that there remains scope for improvement in systems and methods for providing incremental update data to a digital map of a remote client device.

### Summary of the Invention

In accordance with a first aspect of the invention there is provided a method for incrementally updating an existing digital map of a client device in a digital map update system, the digital map update system comprising a primary digital map update centre, at least one secondary digital map update centre and a plurality of remote client devices, the primary digital map update centre and the at least one secondary digital map update centre each being able to provide a set of one or more incremental updates for communication to one or more of one of the plurality of remote client devices for use in incrementally updating existing digital maps of the client devices, the method comprising at least one secondary digital map update centre providing data indicative of a set of one or more incremental digital map updates for communication to at least one of the plurality of remote client devices for use in incrementally updating an existing digital map of the device, and wherein the secondary digital map update centre additionally provides information relating to the set of one or more incremental digital map updates to the primary digital map update centre.

The present invention extends to a system for incrementally updating an existing digital map of a client device in a digital map update system in accordance with the methods of any of the aspects or embodiments of the invention described.

In accordance with a further aspect of the invention there is provided a system for incrementally updating an existing digital map of a client device in a digital map update system, the digital map update system comprising a primary digital map update centre, at least one secondary digital map update centre and a plurality of remote client devices, the primary digital map update centre and the at least one secondary digital map update centre each being able to provide a set of one or more incremental updates for communication to one or more of one of the plurality of remote client devices for use in incrementally updating existing digital maps of the client devices, wherein the at least one secondary digital map update centre is arranged, when providing data indicative of a set of one or more incremental digital map updates for communication to at least one of the plurality of remote client devices for use in incrementally updating an existing digital map of the device, to additionally provide information relating to the set of one or more incremental digital map updates to the primary digital map update centre.

The present invention in this further aspect may include any or all of the features described in relation to the first aspect of the invention, and vice versa, to the extent that they are not mutually inconsistent. Thus, if not explicitly stated herein, the system of the present invention may comprise means for carrying out any of the steps of the method described, and vice versa.

The system may comprise processing means for carrying out any of the steps described. For example the system may comprise a set of one or more processors configured, e.g. programmed, for doing so. A given step may be carried out using the same or a different set of processors to any other step. Any given step may be carried out using a combination of sets of processors. The method is thus a computer implemented method.

A "digital map" as used herein in relation to the invention in any of its aspects or embodiments has a plurality of navigable segments representing elements of a network of navigable elements in a geographical area covered by the map. For example, the plurality of navigable segments may be road segments representing roads of a road network in a geographical area covered by the map. The digital

map may further comprise information concerning locations, such as Points of Interest (POI), e.g. in relation to their position on or relative to the network of navigable segments.

A "digital map update" as used herein in relation to the invention in any of its aspects or embodiments refers to any change to an existing digital map, i.e. to the existing digital map data indicative of the existing digital map. The update may be for providing the modification, deletion, addition, correction, extension or enhancement of one or more features of the existing digital map when implemented. The update may be in relation to a segment or segments of the digital map and/or one or more attributes thereof. Thus an update may be in relation to the underlying structure of the digital map. Alternatively or additionally the update may be in relation to one or more features of the digital map, e.g. a data overlay layer, dynamic content associated with the map, the display of features of the map, etc. When implemented the update results in a modified version of the existing digital map, based upon the existing digital map. A given update may involve one or more changes to the digital map. The changes may be related changes.

An "incremental digital map update" as used herein in relation to the invention in any of its aspects or embodiments refers to an update that can be used to incrementally, i.e. partially update an existing digital map of a client device, i.e. without replacement of the entire existing digital map. The update modifies the existing digital map. A set of incremental digital map update data refers to data indicative of a set of one or more such incremental digital map updates that can be used to incrementally update an existing digital map of a client device. Where the set of incremental digital map updates comprises data indicative of a plurality of incremental updates, the plurality of incremental updates of the set thus constitute, as a whole, data for only the partial or incremental updating of an existing digital map. The data indicative of the set of incremental digital map updates does not comprise an entire updated version of the digital map.

In accordance with the invention in any of its aspects or embodiments, the existing digital map of a client device is a version of a digital map that may be incrementally updated using data indicative of a set of one or more digital map incremental updates provided by the digital map update server to provide a newer version of the digital map. The data indicative of a set of digital map incremental updates provided by digital map update server is used or usable to incrementally update the existing map of the client device without complete replacement of the existing digital map. Thus the incremental update data is data for use in only partially updating the existing digital map.

The Applicant has realised that it is desirable for a digital map of a given client device to be updatable using updates obtained from more than one different digital map update centre. For example, as well as a main digital map provider, e.g. a navigation system or map provider who may provide an initial digital map and subsequent updates for communication to the client device, it may be advantageous for other parties to be able to provide updates to a digital map once held by the client device. For example, an automotive industry provider may wish to supplement or amend the digital map held by a client device which is a navigation device provided for their users in order to customise it those users' needs. The provider may, for example, wish to highlight relevant POI (points of interest) for their users, e.g. service points, etc.

The present invention provides a method and system which enables incremental updating of the digital map of one or more given client device by a plurality of different digital map update centres, i.e. the primary and at least one secondary digital map update centre. In accordance with the invention, when a secondary digital map update centre provides data indicative of a set of one or more incremental digital map updates for communication to a client device of the system for use in updating an existing digital map of the device, the secondary digital map update centre additionally provides information relating to the provided set of one or more updates to a primary digital map update centre. In this way, while the secondary digital map update centre is able to provide updates for communication to the client device, the primary digital map update centre is kept informed as to the nature of updates provided. This enables the primary digital map update centre to, for example, maintain a record of the state of a digital map of a given client device, ensuring that the digital map of the client device may remain consistent subsequent to further updates made by either the primary digital map update centre or a secondary update centre. Thus, the present invention allows updates to be provided to client devices emanating from a primary map update centre and one or more secondary map update centres, without compromising the consistency of the resulting map of the client device.

The present invention relates to a system for providing data indicative of incremental digital map updates for communication to any one of a plurality of remote client devices from either of a primary digital map update centre or at least one secondary digital map update centre.

In accordance with these embodiments, the secondary digital map update centre, and, in embodiments, the primary digital map update centre, provides data indicative of a set of incremental updates to at least one client device. References to data being provided to "a" or "the" client device, or similar below, should be understood to refer to "at least one client device" unless the context demands otherwise.

The or each remote client device for communication to which the secondary digital map update centre provides data indicative of a set of one or more incremental digital map updates in accordance with the invention may be of any suitable type, and may be in accordance with any of the aspects of the invention described above in relation to the earlier aspects of the invention.

The client device may be a mobile device. The mobile device is a device that may be carried by a user. The mobile device may be, for example, a tablet, mobile phone, or PDA or the like, but is preferably a mobile navigation device. The navigation device may be associated with a vehicle. The navigation device may be a portable navigation device (PND) or an integrated in-vehicle navigation device. Alternatively the client device may have a fixed location. For example the client device may be a personal computer, server or other computing resource.

In embodiments in which the client device is a navigation device, the navigation device may comprise a processor, memory, and digital map data stored within said memory. The processor and memory cooperate to provide an execution environment in which a software operating system may be established. One or more additional software programs may be provided to enable the functionality of the apparatus to be controlled, and to provide various other functions. The navigation device may preferably include global navigation satellite systems (GNSS), such as GPS (Global Positioning System), signal reception and processing functionality. The device may comprise one or more output interfaces by

means of which information may be relayed to the user. The output interface(s) may include a speaker for audible output in addition to the visual display. The apparatus may comprise input interfaces including one or more physical buttons to control on/off operation or other features of the apparatus.

In some embodiments the client device is selected from: a server; portable navigation device  
5 (PND); mobile phone; computing device; and an in-vehicle integrated navigation device. The plurality of client devices to which the primary and secondary digital map update centres are able to provide incremental digital map update data may be of any of these types, and may include more than one type of client device.

The present invention is described by reference to "at least one said secondary digital map  
10 update centre" performing the steps of the method described, or being arranged to carry out the steps defined, e.g. in relation to providing update data for communication to at least one client device and additionally providing data to the primary digital map update centre. Where the system comprises a plurality of secondary digital map update centres, at least one of the plurality of secondary digital map update centres may be arranged to perform, or performs, the steps described in accordance with the  
15 method in any of its aspects or embodiments. Thus the, each, or a secondary digital map update centre may be arranged to perform, or performs, the steps. In preferred embodiments, the system comprises a plurality of secondary digital map update centres, and each of the secondary digital map update centres provides data indicative of a set of one or more incremental digital map updates for communication to at least one client device for use in incrementally updating an existing digital map of the device, wherein the  
20 secondary digital map update centre additionally provides information relating to the set of one or more incremental digital map updates to the primary digital map update centre.

Preferably each secondary digital map update centre provides information indicative of a different set of one or more incremental digital map updates for communication to at least one client device. The client devices for communication to which the different secondary digital map update centres provide the  
25 data may be the same or different. In some embodiments a plurality of secondary digital map update centres provide data indicative of a respective set of one or more incremental digital map updates for communication to the same given at least one client device, and additionally provide information relating to the provided set of incremental digital map updates to the primary digital map update centre. In embodiments involving a plurality of secondary digital map update centres, the centres are different  
30 centres, i.e. they are situated at different locations. The present invention enables incremental updating of the digital map of a given client device using update data provided by multiple secondary digital map update centres while maintaining consistency of the digital map of the client device, as the primary digital map update centre is kept informed of the updates provided for communication to the device by each secondary digital map update centre.

The or each client device is a device having an existing digital map. The existing digital map is associated with the client device. Preferably the client device stores the existing digital map. The client device may comprise a memory storing the existing digital map.

It will be appreciated that both the primary and the at least one secondary digital map update centre are able to provide data indicative of a set of one or more incremental map updates for  
40 communication to at least one of the remote client devices of the digital map update system for use in

incrementally updating an existing digital map of the device, and preferably for communication to a plurality of the client devices. In other words, incremental digital map update data emanating from a plurality of different digital map update centres, i.e. sources, may be communicated to a client device or devices of the system. The primary and secondary digital map update centres may be able to provide data for communication to the same client device or devices of the system, or to each client device of the system. However, in some embodiments the system may be arranged such that incremental update data from certain secondary digital map update centres, or for example from the primary digital map update centre, may only be provided to certain devices and so on. This may be achieved using multiple digital map incremental update depositories arranged to received digital map incremental update data from different ones of the secondary digital map update centres, and/or from the primary and secondary digital map update centres as described in relation to the earlier embodiments.

The method may further comprise the primary digital map update centre providing data indicative of a set of one or more incremental digital map updates for communication to the at least one client device for use in updating the existing digital map thereof. This step may be carried out before, after, or at the same time as a secondary digital map update centre provides the data indicative of a set of incremental updates for communication to the client device. The set of incremental updates in relation to which the primary digital map update centre provides data is preferably a different set of incremental updates to that to which the data provided by the at least one secondary digital map update centre relates.

As described above, an incremental digital map update as used herein refers to an update that can be used to incrementally, i.e. partially, update an existing digital map of a client device, i.e. without replacement of the entire existing digital map. The update modifies the existing digital map. A set of incremental digital map update data refers to data indicative of a set of one or more such incremental digital map updates that can be used to incrementally update an existing digital map of a client device. Where the set of incremental digital map updates comprises data indicative of a plurality of incremental updates, the plurality of incremental updates of the set thus constitute, as a whole, data for only the partial or incremental updating of an existing digital map. The data indicative of the set of incremental digital map updates does not comprise an entire updated version of the digital map.

A set of incremental digital map updates provided for communication to the or a at least one client device by the secondary map update centre or the primary map update centre may comprise one or more, and preferably a plurality of incremental digital map updates.

The existing digital map of the client device is a version of a digital map that may be incrementally updated using data indicative of a set of one or more incremental digital map updates provided by the secondary digital map update centre, and, in embodiments, the primary digital map update centre, to provide a newer version of the digital map. The data indicative of a set of incremental digital map updates provided by the secondary digital map update centre, or, in embodiments, the primary digital map update centre, is used to incrementally update the existing map of the client device without complete replacement of the existing digital map. Thus the incremental update data is data for use in only partially updating the existing digital map.

The or each secondary digital map update centre (and optionally the primary digital map update centre) provides data indicative of a set of one or more incremental digital map updates for communication to the or a at least one of the plurality of remote client devices. Preferably the method further comprises communicating, e.g. transmitting, the data indicative of the set of one or more incremental digital map updates provided by the at least one secondary digital map update centre (and optionally the primary digital map update centre) to the client device or devices. In some embodiments, data from the primary and at least one secondary digital map update centre is communicated to the same at least one client device. The secondary digital map update centre, and optionally the primary digital map update centre, may be arranged to transmit the data to the at least one client device.

The secondary digital map update centre, and optionally the primary digital map update centre, may directly transmit the data to the or an at least one client device. Thus the secondary digital map update centre, and optionally the primary digital map update centre may each be in direct communication with the at least one client device. However, preferably the secondary digital map update centre, and optionally the primary digital map update centre, provides, e.g. transmits, the data indicative of the set of one or more incremental digital map updates to a digital map update server for communication to the or an at least one client device. The secondary digital map update centre, and optionally the first digital map update centre, may then submit the data to the update server for communication to the at least one client device. In some embodiments the data indicative of a set of one or more incremental updates provided by the or each secondary digital map update centre, and optionally the primary digital map update server, is used to provide a data feed to the digital map update server.

The secondary digital map update centre, and optionally the first digital map update centre, may make the data accessible to the digital map update server in any suitable manner. In some embodiments the method comprises storing the data indicative of the set of one or more incremental updates in a digital map data repository system for communication to at least one client device by the digital update server.

The digital map update server may transmit data indicative of a set of one or more incremental digital map updates received from the or each secondary digital map update centre, and optionally the primary digital map update server, to the or an at least one client device. Thus, preferably the incremental update data is communicated to the or an at least one client device from the secondary digital map update centre, and optionally the primary digital map update server, via a digital map update server.

In preferred embodiments, therefore, the system further comprises a digital map update server in communication with each of the plurality of remote client devices for communicating incremental digital map updates received from the primary digital map update centre and the or each secondary digital map update centre to the client devices. The digital map update server may be arranged to access such data from a digital map update data repository of the digital map update system. The digital map update server is preferably arranged to automatically transmit data indicative of a set or sets of one or more incremental map updates to the at least one client device. In other embodiments, this may be carried out in response to a request from the client device.

In some preferred embodiments the at least one secondary digital map update centre and/or the primary digital map update server provide the data indicative of a set of one or more incremental updates

to a digital map compiler. The compiler may consolidate the data from the or each secondary digital map update centre, and optionally the primary digital map update centre, and optionally convert the data to a standard digital map format before the data is provided to a digital map update server, or in embodiments, digital map data repository from which the server obtains data. The standard format may be the  
5 Navigation Data Standard (NDS) format.

Of course, other pathways for communicating data indicative of incremental updates from the or each secondary digital map update centre, to at least one client device, and optionally from a primary digital map update centre to at least one client device, may be envisaged.

The method extends to the step of the client device implementing a received set of one or more  
10 incremental digital map updates. In these embodiments the set of one or more incremental digital map updates is provided by the secondary digital map update centre (or, in embodiments, by the primary digital map update centre). The data may be received directly from the secondary (or optionally primary) digital map update centre, or may be received from a digital map update server. The method may  
15 comprise the client device using the data of a set of one or more incremental digital map updates provided by the primary and/or the secondary map update centre to incrementally update the existing digital map of the device. This is carried out without replacement of the entire existing digital map. The client device may comprise a digital map update management system for receiving and implementing  
20 received update data. This may comprise suitable client update module. The incremental update data is used to modify the existing digital map. The existing digital map of the device refers to the digital map of the device in its form prior to the relevant set of incremental updates being implemented. The client device is preferably arranged to use the received data indicative of a set of one or more incremental digital map updates to automatically incrementally update the existing digital map thereof.

The client device may or may not immediately update the existing map of the device using  
25 incremental digital map data provided by the secondary digital map update centre and/or the primary digital map update centre. Alternatively or additionally the method may comprise the client device storing data indicative of a set of one or more incremental map updates provided by the primary digital map update centre and/or the secondary digital map update centre. This may allow updating of the existing map at a later time.

The client device may comprise a digital map update management system comprising means for  
30 receiving digital map incremental update data. The digital map update management system may additionally comprise means for causing the data to be implemented and/or means for storing received incremental update data. The digital map update management system is arranged to handle, e.g. receive, and cause to be implemented at least incremental digital map updates, and may additionally be arranged to handle other types of update, i.e. updates of the entire digital map, or entire regions (or tiles)  
35 thereof. The digital map update management system may be arranged to cause received incremental digital map update data (or other digital map data) to be stored. The digital map update management system may be arranged to cause such data to be stored in a digital map database of the client device. The data may be stored in such a manner to result in updating of existing digital map update data.

The digital map update management system may be arranged to communicate with the digital  
40 map update server in order to receive the incremental update data. The communication is preferably two

way. For example, the digital map update a management system may be arranged to transmit data to the digital map update server, for example, to request incremental update data and/or to specify an update profile for the data in certain embodiments, etc. An update management system may comprise suitable client update module.

5 As described above, a digital map "update" as used herein refers to any change to the existing digital map. The update may be for providing the modification, deletion, addition, correction, extension or enhancement of one or more features of the existing digital map when implemented. The update may be in relation to a segment or segments of the digital map and/or one or more attributes thereof. Thus an update may be in relation to the underlying structure of the digital map. Alternatively or additionally the  
10 update may be in relation to one or more features of the digital map, e.g. a data overlay layer, dynamic content associated with the map, the display of features of the map, etc. When implemented the update results in a modified version of the existing digital map, based upon the existing digital map. A given update may involve one or more changes to the digital map. The changes may be related changes.

15 A secondary digital map update centre may not be permitted to provide all possible incremental digital map updates for communication to a client device. However, in embodiments the secondary digital map update centre is constrained in relation to the type of incremental update that it may provide for communication to a client device. In some embodiments the secondary digital map update centre is only able to provide data indicative of incremental digital map updates of one or more given types to the client device.

20 The constraints or types of incremental update that are or are not permitted may be set as desired, and are pre-specified. The permissions or constraints may be imposed at the secondary digital map update centre, e.g. preventing the submission of certain updates for communication to a client device, whether directly or via an update server.

25 A secondary digital map update centre may be permitted to provide data indicative of only a subset of all possible incremental digital map updates for communication to a client device. The method may further comprise specifying one or more constraints in relation to the type of incremental update that the secondary digital map update centre is permitted to provide to a client device.

30 In preferred embodiments the primary digital map update centre is permitted to provide data indicative of a greater number of possible incremental updates, e.g. types of incremental updates, than the at least one secondary digital map update centre. The secondary digital map update centre may be constrained to a greater degree than the primary digital map update centre in relation to the type of incremental update that the secondary digital map update centre is permitted to provide for communication to a client device. The primary digital map update centre may or may not be constrained in this regard.

35 The primary digital map update centre may be permitted to provide data indicative of any possible incremental digital map update for communication to a client device. The primary digital map update centre may therefore be unconstrained in relation to the type of incremental update that it may provide. In some embodiments the primary digital map update centre is able to provide data indicative of incremental digital map updates of any given type to the client device.

The secondary digital map update centre may be constrained such that it may only provide data indicative of incremental updates for communication to a client device that are by way of customisation of the existing digital map of the device. Customisation herein refers to tailoring the content of the digital map, e.g. to a given user's requirements. In some preferred embodiments the secondary digital map update centre is associated with a provider of services or goods, and the client device is associated with a user of the services or goods. The set of incremental updates in respect of which data is provided by the secondary digital map update centre to the user device may be for customising the existing digital map of the client device to incorporate data relevant to the services or goods of the service provider. For example, the secondary digital map update centre may be associated with a vehicle provider. The incremental update data may be for customising the digital map of the client device with data indicative of the location of retail or service premises of the vehicle provider.

In some embodiments the method may comprise the secondary digital map update centre providing data indicative of a set of one or more incremental updates that the centre is not permitted to provide for communication to a client device to the primary digital map update centre. The primary digital map update centre may then be able to implement the updates due to the lesser constraints imposed upon it.

In embodiments the set of incremental updates in respect of which indicative data is provided by the secondary map update centre is a set of updates that do not affect the underlying structure, e.g. segments of the digital map. In embodiments the set of incremental updates in respect of which the secondary digital map update centre provides indicative data to the client device does not include updates in respect of the geometry of the segments of the digital map and/or the attribute(s) of the segments of the digital map. In some embodiments the secondary digital map update centre is not permitted to provide data in relation to incremental updates relating to the geometry of the segments of the digital map and/or the attribute(s) of the segments of the digital map for communication to the client device. The primary digital map update centre is preferably permitted to provide data in relation to such updates to the client device.

In some embodiments the set of one or more incremental updates in respect of which the secondary digital map update centre provides indicative data for communication to the client device includes one or more updates providing additional information or enhancements to one or more features of the existing digital map of the client device. The set of incremental updates may include updates in relation to the addition, removal and/or modification of one or more of the following digital map features: points of interest (POI); junction views; data overlay layers or dynamic content associated with, or to be associated with, the map. Alternatively or additionally the set of incremental updates may include updates in relation to the display of one or more features of the existing digital map, e.g. POI, map textures, etc.

Where multiple secondary digital map update centres are provided, each may provided different types of incremental update data to the client devices, or at least different update data for customising the existing digital map of the client device in different manners.

The data indicative of the set of one or more incremental updates provided by the secondary digital map update centre, and optionally the first digital map update centre, may be indicative in any manner of the relevant change.

5 The primary digital map update centre and the or each secondary digital map update centre may be of any suitable type provided that they comprise means for providing data indicative of a set of one or more incremental updates for communication to the client devices. The primary digital map update centre and the secondary digital map update centres are located at different geographic locations. The primary and secondary digital map update centres are preferably associated with different entities. Where multiple secondary digital map update centres are provided, each may be associated with a different entity.

10 The primary digital map update centre is preferably able to provide data indicative of an entire digital map for communication to the one or more client devices in addition to being able to provide data for incrementally updating an existing digital map of a client device. The entire digital map may be referred to as a baseline map as described in relation to the earlier embodiments. This may be via a digital map update server as described above. The primary digital map update centre may comprise a database comprising digital map data indicative of one or more entire digital maps. Thus the centre may be arranged for providing an entire digital map for communication to a client device, e.g. for set up, or to completely replace an existing digital map as well as being able to provide data for incrementally updating an existing digital map of the device. The primary digital map update centre may further comprise a database comprising digital map incremental update data.

15 The primary digital map update centre is preferably a centre associated with an entity which provided at least a part of the data of the existing digital map of the or each client device that is to be updated, and preferably at least a majority of the data. Preferably the primary digital map update centre is a centre associated with the entity that provided the existing digital map of the or each client device. The method may further comprise communicating data indicative of an entire digital map to the or each client device from the primary digital map update centre to provide the existing digital map. This step is carried out before the secondary digital map update centre provides the data indicative of a set of one or more incremental updates for communication to the device for incrementally updating the existing map. The primary digital map update centre may comprise means for providing data indicative of a set of one or more incremental updates for communication to a client device for incrementally updating an existing digital map of the client device, and means for providing data indicative of a complete digital map for communication to the client device, e.g. initially or to replace an existing map. The data may be communicated via a digital map update server as previously described in relation to the incremental update data.

20 The primary digital map update centre is preferably associated with a digital map supplier, e.g. a supplier of the existing digital map of the client device that is to be updated. The digital map provider may be a navigation system provider.

25 The secondary digital map update centre may be a centre that is only able to provide data for incrementally updating an existing digital map of a client device and is not able to provide data indicative of a complete, i.e. baseline, digital map to a client device. This may be achieved, for example, by setting

permissions, etc for the update centre appropriately. The secondary digital map update centre may not have access to data indicative of the entire existing digital map of the at least one client device to be updated. In some embodiments the primary digital map update centre may be arranged to be able to transmit an entire digital map to the secondary digital map.

5           The secondary digital map update centre may be associated with a provider wishing to customise the existing digital map of a client device. For example, the update centre may be associated with a provider of goods or services. The provider may be associated with a vehicle manufacturer.

10           In one preferred embodiment the client device is a navigation device associated with a vehicle. The device may be an integrated navigation device. The primary digital map update centre is associated with the provider of the existing digital map of the client device, e.g. a navigation system provider, and the secondary digital map update centre is associated with the vehicle manufacturer. The secondary digital map update centre may then provide data indicative of updates to customise the existing digital map in a manner specific to the needs of the vehicle user.

15           In accordance with the invention, the secondary digital map update centre additionally provides information relating to the set of one or more incremental updates to the primary digital map update centre. The secondary digital map update centre is therefore in communication with the primary digital map update centre and may transmit the information thereto in any suitable manner. The information may be transmitted to the primary digital map update centre by the secondary digital map update centre before, during or after communication of the data indicative of the set of one or more incremental updates to the or each client device. Preferably the data is submitted to the primary digital map update centre at substantially the same time that the data is communicated to the device. In some preferred embodiments the secondary digital map update centre directly provides the information to the primary digital map update centre.

20           The information relating to the set of one or more updates may correspond to the data indicative of the set of one or more updates, i.e. being the same data that is transmitted to the client device by the secondary digital map update centre, and/or may be in any manner indicative of at least a part of the data indicative of the set of one or more updates that is provided for transmission to a client device. For example, the information may be metadata describing the one or more updates.

25           Preferably the information relating to the set of one or more incremental digital map updates provided by the secondary digital map update centre to the primary digital map update centre is associated with data identifying the (or each) client device to which it is to be communicated. The method may comprise the primary digital map update centre storing the information received from the secondary digital map update centre. The information stored comprises the information relating to the set of one or more incremental changes, and the data indicative of the identity of the (or each) client device to which the updates are communicated. The primary digital map update centre may then be able to determine the state of the digital map of the client device using the data. This may facilitate the primary digital map update centre in providing future digital map updates to the device, and ensuring their consistency with updates previously provided by the secondary digital map update centre.

30           The primary digital map update centre may comprise a database storing information relating to update data provided by each of the one or more secondary digital map update centres to different client

devices, preferably in association with data indicative of the identity of the client device to which each set of incremental update data has been transmitted. In this way, the primary digital map update centre will have record of updates that have been made by one or more, and preferably each, secondary digital map update centre of the system, to each client device.

5           The method may further comprise the primary digital map update centre using the information relating to the set of one or more incremental digital map updates obtained from the secondary digital map update centre in providing data indicative of a further set of one or more incremental digital map updates for communication to the client device. The data indicative of the further set of updates may be provided directly by the primary digital map update centre to the client device, or more preferably, via an  
10 update server. The information may be used to provide a further set of one or more incremental digital map updates that will be consistent with the set of incremental digital map updates previously provided by the secondary digital map update centre.

          In accordance with the invention, the data indicative of the set of one or more updates provided by the secondary digital map update centre for communication to the client device is communicated to the  
15 client device, e.g. via an update server, without the data first passing through the primary map update centre. The information relating to the set of one or more incremental digital map updates provided to the primary digital map update centre by the secondary digital map update server is in addition to the data provided by the secondary digital map update centre for communication to the client device, e.g. that is transmitted by the secondary digital map update centre to the device via an update server or otherwise.  
20 The digital map data and digital map incremental update data referred to herein in accordance with any of the aspects or embodiments of the invention may be of any suitable form. In preferred embodiments, the data is of a standardized format. This enables the data to be used by the primary and secondary digital map update centres, and other parts of the system, which may be associated with different digital map providers or other entities. In some preferred embodiments the digital map data and digital map update  
25 data is in the NDS (Navigation Data Standard) format. The primary and secondary digital map update centres may both be arranged to provide digital map update data, and where appropriate, digital map data, in such a format.

          It will be appreciated that a given digital map incremental update in accordance with the invention in any of its aspects or embodiments may be comprise one or more operations in relation to existing  
30 digital map data e.g. in relation to the digital map data of the digital map to be modified. An operation may involve the addition, modification or deletion of existing digital map data. An update may be referred to as a transaction. Digital map incremental update data may comprise data indicative of one or more transactions to be performed in relation to existing digital map data. The one or more transactions may be in the NDS or otherwise standardised format for implementation in relation to digital map data  
35 according to the same standardized format.

          As will be appreciated, in aspects or embodiments of the invention, the client devices, and the primary and secondary digital map update centres comprise communication means for transmitting information to, and receiving information from, the other components of the system. The communication means can be of any type as desired. For example, the devices may comprise one or more physical  
40 connector interfaces by means of which data signals can be transmitted to and received from the device.

In preferred embodiments, however, the communication means comprises one or more wireless transmitters/receivers to allow communication over cellular telecommunications and other signal and data networks, for example WiFi, GSM, GPRS and the like.

The methods in accordance with the present invention in any of its aspects or embodiments may be implemented at least partially using software. It will thus be seen that, when viewed from further aspects, the present invention extends to a computer program product comprising computer readable instructions adapted to carry out any or all of the methods described herein when executed on suitable data processing means, such as a server.

The invention also extends to a computer software carrier comprising such software. Such a software carrier could be a physical (or non-transitory) storage medium or could be a signal such as an electronic signal over wires, an optical signal or a radio signal such as to a satellite or the like.

While the invention has been described herein by reference to matching requests for vehicles to available mobile vehicles for fulfilling the requests, it will be appreciated that the invention is applicable in its broader aspects at least to matching service requests to mobile service providers.

References to data being "associated" with other data, may refer to the data being in any manner associated therewith, e.g. using an appropriate pointer, etc.

It will also be understood by those skilled in the art that all of the described aspects and embodiments of the present invention can, and preferably do, include, as appropriate, any one or more or all of the preferred and optional features described herein.

### Brief Description of the Drawings

Various aspects of the teachings of the present invention, and arrangements embodying those teachings, will hereafter be described by way of illustrative example with reference to the accompanying drawings, of which:

Figure 1 illustrates an exemplary digital map update system for providing incremental update data for provision to client devices;

Figure 2 illustrates an exemplary system for providing the data to the client devices; and

Figure 3 illustrates a digital map update system allowing incremental updating of digital maps by two centres in accordance with another embodiment of the invention.

### Detailed Description of the Preferred Embodiments

The features of an exemplary digital map update system for implementing incremental updates in relation to existing digital maps of client devices will first be described by way of background. The present invention will be described, by way of example only, in relation to a system in which digital map data is converted to a standard format, which is the Navigation Data Standard (NDS). It will be appreciated, however, that the same principles can be applied to any suitable run-time map format.

In Figure 1, there is shown digital map update database 2, which stores details of validated digital map updates. The validated map updates, e.g. transactions, may include all digital map updates made to the baseline or core digital map database, or a subset of such updates, e.g. in relation to only certain map attributes. The digital map updates may be received from one or more sources, as described later in

more detail, and may be in accordance with different map formats. The digital map update database may comprise separate databases in relation to full map updates and incremental updates and/or in relation to data received from different sources.

5 An NDS update compiler 4 is used to translate the map updates received from the digital map update database 2 into changes to be performed on NDS objects, i.e. elements of a NDS map database. Thus the update compiler 4 converts map update data received from the database 2 to convert it into a standard format. In particular, the update compiler reads current NDS objects, changes them according to the received map updates, and provides the data to the NDS data repository 6. The update compiler can operate at any frequency as needed, e.g. once or week or once a day. The NDS data repository 6  
10 includes a digital map incremental update data repository 3 and a digital map full update data repository 5.

Update data received from the update compiler 4 is stored as part of the NDS repository 6, in association with the latest version of the NDS map database. The NDS repository 6 may store updates obtained from the update compiler 4 in a particular data feed as groups, i.e. as data layers. For example,  
15 where a data feed is provided at given intervals e.g. daily, the updates received in a given feed for a particular time may be associated together as a group. It will be appreciated that the NDS repository 6 therefore stores baseline full map data and sets of incremental updates for particular times, which may be used together to provide an updated full map current for a particular time.

20 The map updates generated in the above described process are published, i.e. sent to client devices, via an update server using a suitable update protocol. An exemplary architecture of an NDS update platform for use in embodiments of the invention is shown in Figure 2.

As shown in Figure 2, full maps and incremental updates are delivered to client devices 14 by means of a digital map update server system 8. The server system 8 includes an incremental update sub server 10 and a full map, i.e. baseline map, update sub server 12. The incremental update sub server 10  
25 is in communication with the incremental update data repository 3 of the NDS data repository 6, and the full map update sub server 12 is in communication with the full map update data repository 5 for providing either full map data or incremental update data to the server. Updates from the full map update sub server 12 or the incremental map update sub server 12 are served by the update server 8 using an update client 16 on the client device 14. The update client 16 is in communication with a navigation  
30 application 18 and a digital map database 20 of the device 14 via an update API. This allows a client device, e.g. a portable navigation device (PND), mobile phone, in-dash navigation device, infotainment system, server, etc, to update the local run-time map to the latest version.

The system illustrated in Figure 1 may be referred to as a "transaction-based map system", in which full maps or incremental updates may be released to client devices on a continual basis.

35 The present invention relates to certain techniques which provide improved implementation of such incremental map update type systems.

The Applicant has realised that it is advantageous for digital map incremental update data to be provided to client devices from multiple sources. For example, while conventionally such data would be provided by a single navigation system or digital map provider, increasingly it is desirable for other  
40 parties, e.g. automotive manufacturers to be able to provide incremental update data in relation to aspects

of the digital map which are relevant to users of their products. In some arrangements, data relating to different portions of a digital map in terms of geographical area may be provided from different sources. Each data provider would then be responsible for providing updates relating to their portion of the map. Thus, digital map data may comprise data from multiple digital map suppliers. The present invention in accordance with a further aspect provides methods which can facilitate provision of incremental update data from multiple sources while maintaining consistency of the overall map data.

The present invention will be described, by way of example, with reference to the case in which an automotive supplier wishes to provide incremental updates to integrated navigation devices associated with their vehicles. The incremental updates are intended to customise digital maps provided to the client devices from another source, i.e. a navigation system or digital map supplier, to render them more relevant to the users.

As shown in Figure 3, the update system includes a primary digital map update centre 20 which is associated with the navigation system or digital map provider. The system also includes a secondary digital map update centre 30, which is associated with the automotive supplier. Both the primary and secondary digital map update centres are arranged to provide incremental update data to a distribution system 40, for disseminating the data to client devices. The primary digital map update centre 20 is also able to provide full map update data to the distribution system. A client device 50 is illustrated as being in communication with the distribution system.

While this arrangement is described by reference to providing incremental update data, and the arrows shown illustrate feeds for providing such data, it will be appreciated that additional data feeds may be provided in relation to full map data, e.g. allowing the primary digital map update centre 20 to provide such data to the secondary digital map update centre 30, and for one or both of the primary digital map update centre 20 and the secondary digital map update centre 30 to provide such data to the distribution system. The distribution system 40 will also be arranged to provide such data to the client device 50. The distribution system 40 may include the components shown in Figures 1 and 2 required to take a digital map update data feed and distribute it to one or more client devices. For example, the incremental update data provided by the primary and secondary digital map update centres 20, 30 may be provided to a digital map update database, which may provide update data to an NDS repository via an NDS update compiler. A digital map update server may be arranged to serve data from the repository to the client devices. It is envisaged that incremental update data from the primary and secondary update centres may be stored in different incremental update data repositories by using appropriate update profiles. In accordance with the invention, the secondary digital map update centre 30 is arranged to send data indicative of an incremental update or updates provided to the distribution system to the primary digital map update centre. This is illustrated by the 2 way communication link in Figure 3. In this way, the primary digital map update centre 20 is kept informed of incremental updates provided by the secondary digital map update centre to the distribution system for serving to client devices. The method therefore allows the secondary digital map update to autonomously provide incremental update data directly to the distribution system, but ensures that the primary digital map update centre is advised of any updates sent. It will be appreciated that multiple secondary digital map update centres may be provided, each

able to send incremental update data to the distribution system, and also to provide data indicative thereof to the primary digital map update centre.

The data that the secondary digital map update centre 30 provides to the primary digital map update centre 20 regarding submitted incremental updates may be the data itself, and/or meta  
5 information describing the update. The secondary digital map update centre sends this data to the primary digital map update centre 20 in association with data indicative of the identity of the client device(s) to which the data is to be sent.

By providing this data to the primary digital map update centre, it is ensured that the primary  
10 digital map update centre is able to determine the exact state of the digital map of a client device at any time, and is able to ensure that any updates that it subsequently sends will be consistent with the existing state of the device.

It is envisaged that constraints may be imposed on the secondary digital map update centre as to  
which types of incremental update it is permitted to submit to the distribution system for distribution to  
client devices. For example, any updates may need to be within the scope of predefined "customization  
15 capabilities" of the centre. The secondary digital map update system may be able to publish incremental updates which are outside its customization scope such that they may be considered by the primary digital map update centre and subsequently published through its own update capabilities in due course. In contrast the primary digital map update centre is able to submit any type of update to the distribution system. However, it is not necessary that the update capabilities of the secondary digital map update  
20 centre are necessarily constrained relative to those of the primary digital map update centre.

The following are examples of types of customization that the secondary digital map update  
centre may be able to provide by submitting appropriate updates: add/remove/modify any or all of: car  
dealer POIs; advertisements for dealer options to car dealer POIs; advertisements for dealer events to  
car dealer POIs; 3rd party POIs; icons for POIs; junction views. It is also envisaged that the secondary  
25 digital map update centre may be able to submit incremental changes for: replacing 3D city map textures; adding/deleting/modifying data overlay layers, e.g. location based advertisements, images, videos for POIs; linking editorial information with map features, e.g. guided tours; linking dynamic content with map features, e.g. parking garage occupancy; integration of local maps.

It will be well understood by persons of ordinary skill in the art that whilst the preferred  
30 embodiment may implement certain functionality by means of software, that functionality could equally be implemented solely in hardware (for example by means of one or more SICs (application specific integrated circuit)) or indeed by a mix of hardware and software.

Lastly, it should be noted that whilst the accompanying claims set out particular combinations of  
features described herein, the scope of the present invention is not limited to the particular combinations  
35 hereafter claimed, but instead extends to encompass any combination of features or embodiments herein disclosed irrespective of whether or not that particular combination has been specially enumerated in the accompanying claims at this time.

## CLAIMS:

1. A method for incrementally updating an existing digital map of a client device in a digital map update system, the digital map update system comprising a primary digital map update centre, at least one secondary digital map update centre and a plurality of remote client devices, the primary digital map update centre and the at least one secondary digital map update centre each being able to provide a set of one or more incremental updates for communication to one or more of one of the plurality of remote client devices for use in incrementally updating existing digital maps of the client devices, the method comprising at least one secondary digital map update centre providing data indicative of a set of one or more incremental digital map updates for communication to at least one of the plurality of remote client devices for use in incrementally updating an existing digital map of the device, wherein the secondary digital map update centre additionally provides information relating to the set of one or more incremental digital map updates to the primary digital map update centre.
2. The method of claim 1, comprising the at least one secondary digital map update centre providing the information relating to the set of one or more incremental digital map updates to the primary digital map update centre in association with data identifying the or each client device to which it is to be communicated.
3. The method of any preceding claim, further comprising the primary digital map update centre storing the information received from the secondary digital map update centre.
4. The method of any preceding claim, further comprising the primary digital map update centre using the information received from the secondary digital map update centre in providing data indicative of a further set of one or more incremental digital map updates for communication to the at least one client device.
5. The method of any preceding claim, further comprising the or each client device using the data indicative of a set of one or more incremental digital map updates provided by the primary and/or the secondary map update centre to incrementally update the existing digital map of the device.
6. The method of any preceding claim, wherein the secondary digital map update centre is associated with a provider of goods or services, and the set of incremental updates in respect of which data is provided by the secondary digital map update centre to the at least one user device is for customising the existing digital map of the or each client device to incorporate data relating to the goods or services of the service provider.
7. The method of any preceding claim, wherein the set of incremental updates in relation to which the at least one secondary digital map update centre provided data includes updates in relation to the addition, removal and/or modification of one or more of the following digital map features: points of

interest (POI); junction views; data overlay layers; and dynamic content associated with, or to be associated with, the map.

5 8. The method of any preceding claim, wherein the set of incremental updates in relation to which the at least one secondary digital map update centre provided data includes updates in relation to the display of one or more features of the existing digital map.

10 9. The method of any preceding claim, comprising a plurality of secondary digital map update centres, wherein each of the secondary digital map update centres provides data indicative of a different set of one or more incremental digital map updates for communication to at least one client device for use in incrementally updating an existing digital map of the device, wherein each secondary digital map update centre additionally provides information relating to the set of one or more incremental digital map updates to the primary digital map update centre.

15 10. The method of any preceding claim, further comprising the primary digital map update centre providing data indicative of a set of one or more incremental digital map updates for communication to the at least one client device for use in updating the existing digital map thereof.

20 11. The method of any preceding claim, further comprising communicating the data indicative of the set of one or more incremental digital map updates provided by the secondary digital map update centre, and optionally the primary digital map update centre, to the client device or devices.

25 12. The method of claim 11, wherein the data indicative of the set of one or more incremental updates provided by the secondary digital map update centre, and optionally the primary digital map update centre, is communicated to the at least one client device or devices via a digital map update server.

30 13. The method of any preceding claim, wherein the secondary digital map update centre is constrained to a greater degree than the primary digital map update centre in relation to the type of incremental update that the secondary digital map update centre is permitted to provide for communication to a client device, and optionally wherein the secondary digital map update centre is constrained such that it may only provide data indicative of incremental updates for communication to a client device that are by way of customisation of the existing digital map of the device.

35 14. The method of any preceding claim, wherein the existing digital map data is provided by the primary digital map update centre.

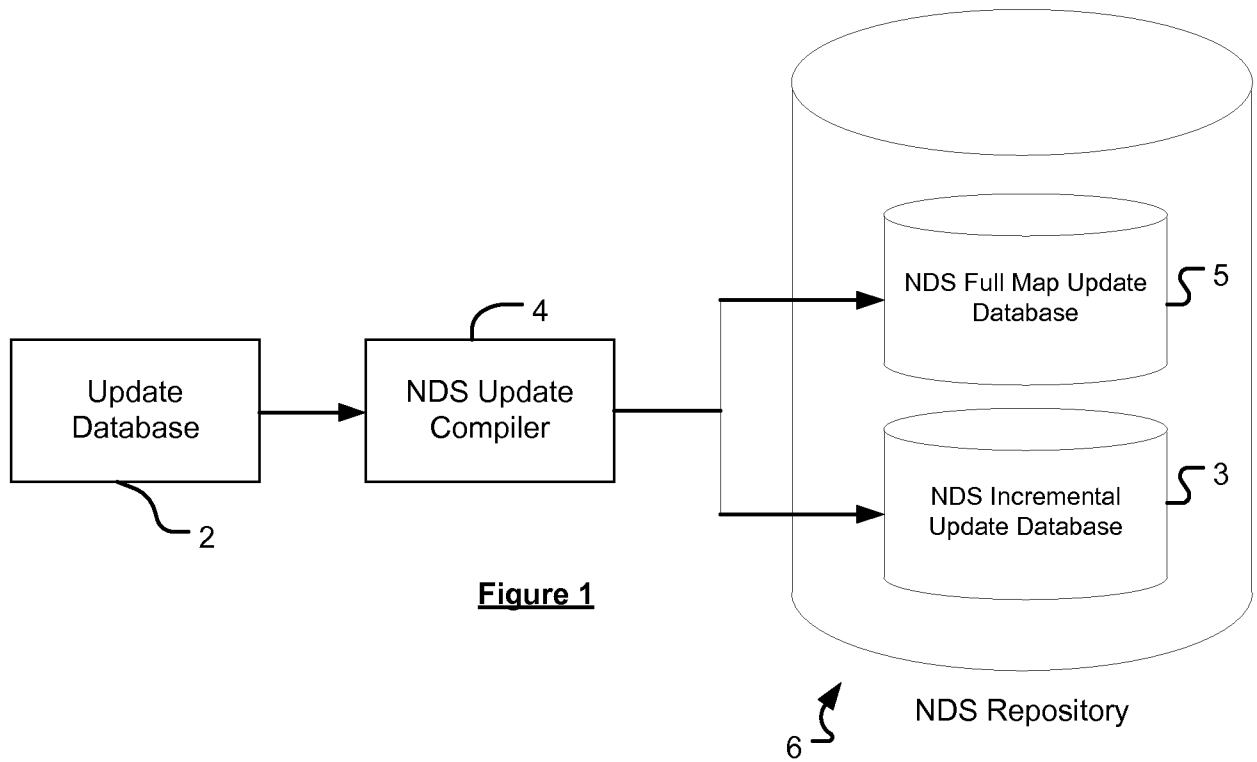
40 15. A system for incrementally updating an existing digital map of a client device in a digital map update system, the digital map update system comprising a primary digital map update centre, at least one secondary digital map update centre and a plurality of remote client devices, the primary digital map

update centre and the at least one secondary digital map update centre each being able to provide a set of one or more incremental updates for communication to one or more of one of the plurality of remote client devices for use in incrementally updating existing digital maps of the client devices, wherein the at least one secondary digital map update centre is arranged, when providing data indicative of a set of one or more incremental digital map updates for communication to at least one of the plurality of remote client devices for use in incrementally updating an existing digital map of the device, to additionally provide information relating to the set of one or more incremental digital map updates to the primary digital map update centre.

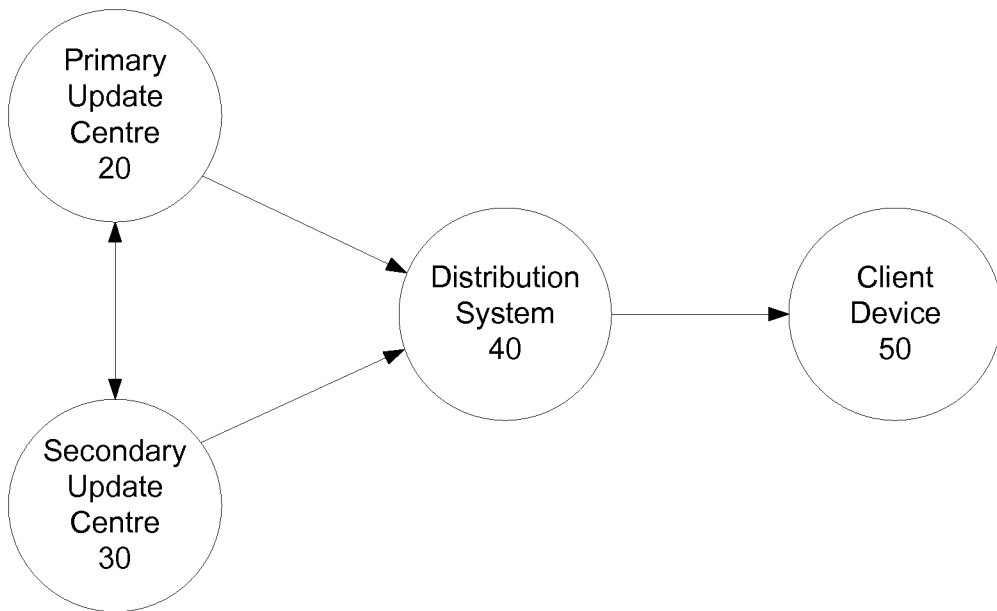
10 16. The method or system of any preceding claim, wherein the client device to which the secondary digital map update centre, and optionally the primary digital map update centre, provides the data indicative of a set of one or more incremental digital map updates is a navigation device, optionally wherein the navigation device is associated with a vehicle.

15 17. The method or system of any preceding claim, wherein the digital map update data is of a standardized format, optionally wherein the digital map update data is in the NDS (Navigation Data Standard) format.

20 18. A computer program product comprising computer readable instructions executable to perform a method according to any one of claims 1 to 14.



**Figure 1**



**Figure 3**

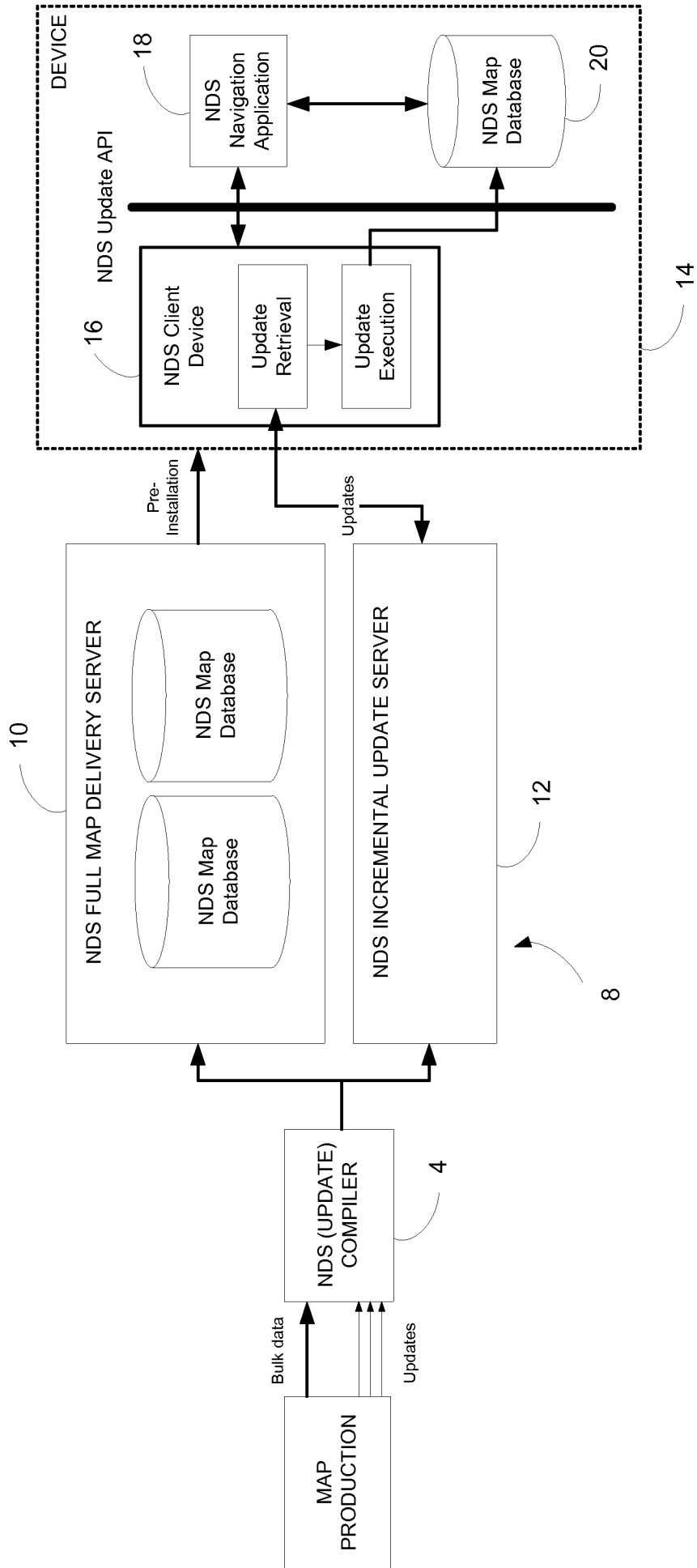


Figure 2

INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2013/054916

A. CLASSIFICATION OF SUBJECT MATTER  
INV. G01C21/32 G06Q30/02 G06F17/30  
ADD.  
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
Minimum documentation searched (classification system followed by classification symbols)  
G01C G06Q G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FLAMENT M: "RESULTS OF IMPLEMENTATION AND VALIDATION OF THE ACTMAP INCREMENTAL MAP UPDATES FOR ADVANCED IN-VEHICLE APPLICATIONS", INTERNET CITATION, June 2005 (2005-06), XP007901268, Retrieved from the Internet: URL:http://www.ertico.com/download/actmap_public_documents/2005-06%20ActMAP_implementation&validation_ITSinEurope.pdf [retrieved on 2006-11-02] the whole document	1-18
X	US 2009/164110 A1 (BASIR OTMAN A [CA]) 25 June 2009 (2009-06-25) figure 3 paragraphs [0094], [0095], [0097], [0104] - [0108]	1-18
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search  11 June 2013	Date of mailing of the international search report  21/06/2013
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Bruinsma, Maarten

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2013/054916

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/260628 A1 (FUCHS GIL [US] ET AL) 8 November 2007 (2007-11-08)	1,3-18
Y	figures 1,3,7,28 paragraphs [0008], [0009], [0011], [0012] paragraphs [0041], [0042] - [0046], [0054], [0055], [0086], [0091], [0098] paragraphs [0107], [0109], [0110], [0119], [0131], [0136], [0150], [0151], [0155], [0156], [0157] -----	2
Y	US 2002/174360 A1 (IKEDA KIYOKAZU [JP]) 21 November 2002 (2002-11-21) figure 10 paragraphs [0004], [0006], [0009], [0066], [0153] - [0159], [0171] - [0182], [0228] -----	2

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2013/054916
---------------------------------------------------

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 2009164110	A1	25-06-2009	AU 2008336213 A1	18-06-2009
			CA 2708073 A1	18-06-2009
			EP 2232202 A1	29-09-2010
			US 2009164110 A1	25-06-2009
			WO 2009073962 A1	18-06-2009
-----				
US 2007260628	A1	08-11-2007	AU 2007248062 A1	15-11-2007
			BR PI0709715 A2	26-07-2011
			CA 2650487 A1	15-11-2007
			CN 101438231 A	20-05-2009
			EP 2013702 A2	14-01-2009
			JP 2009536372 A	08-10-2009
			KR 20090018038 A	19-02-2009
			RU 2008147401 A	10-06-2010
			US 2007260628 A1	08-11-2007
			US 2008167794 A1	10-07-2008
			US 2008177464 A1	24-07-2008
			US 2008215524 A1	04-09-2008
			WO 2007131044 A2	15-11-2007
-----				
US 2002174360	A1	21-11-2002	CN 1386253 A	18-12-2002
			DE 10193054 T1	21-11-2002
			JP 5118793 B2	16-01-2013
			JP 2002116977 A	19-04-2002
			US 2002174360 A1	21-11-2002
			US 2010262364 A1	14-10-2010
WO 0201533 A1	03-01-2002			
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