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(54) **IDENTIFICATION OF MALICIOUS ACTIVITY BASED ON ANALYSIS OF TRAVEL PATH OF A MOBILE DEVICE**

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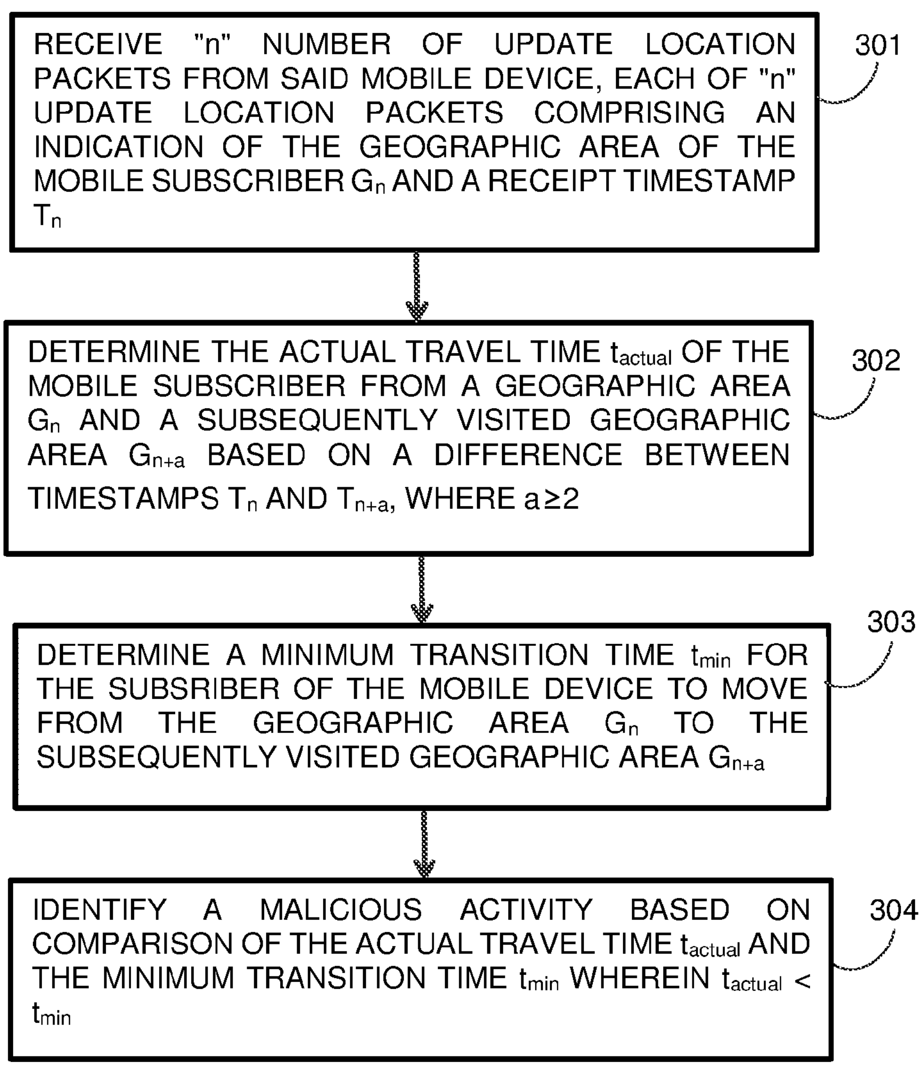
(57) **ABSTRACT**

A method for identification of malicious activity based on analysis of a travel path of a mobile device through multiple geographic areas includes receiving at least three location data associated with the mobile communication device, the first location data comprising indication of the geographic area of the mobile subscriber and a receipt timestamp; determining the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data; determining a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area; and identifying a malicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area.



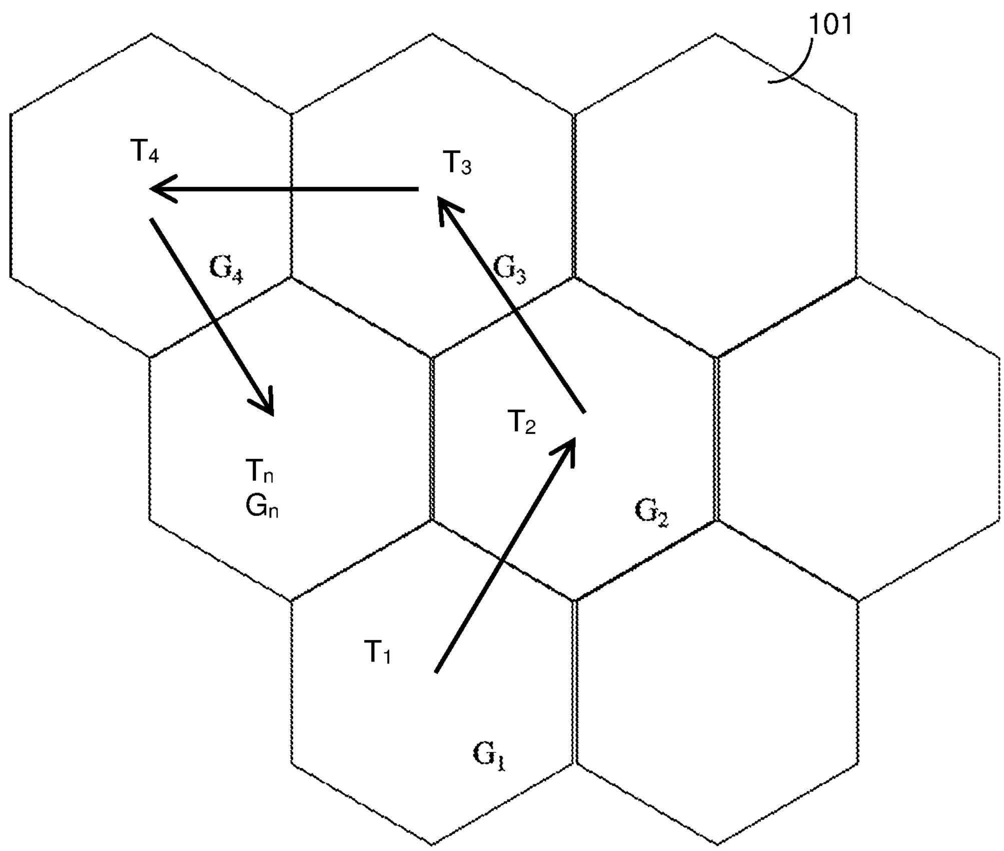


FIG. 1

FIG. 2

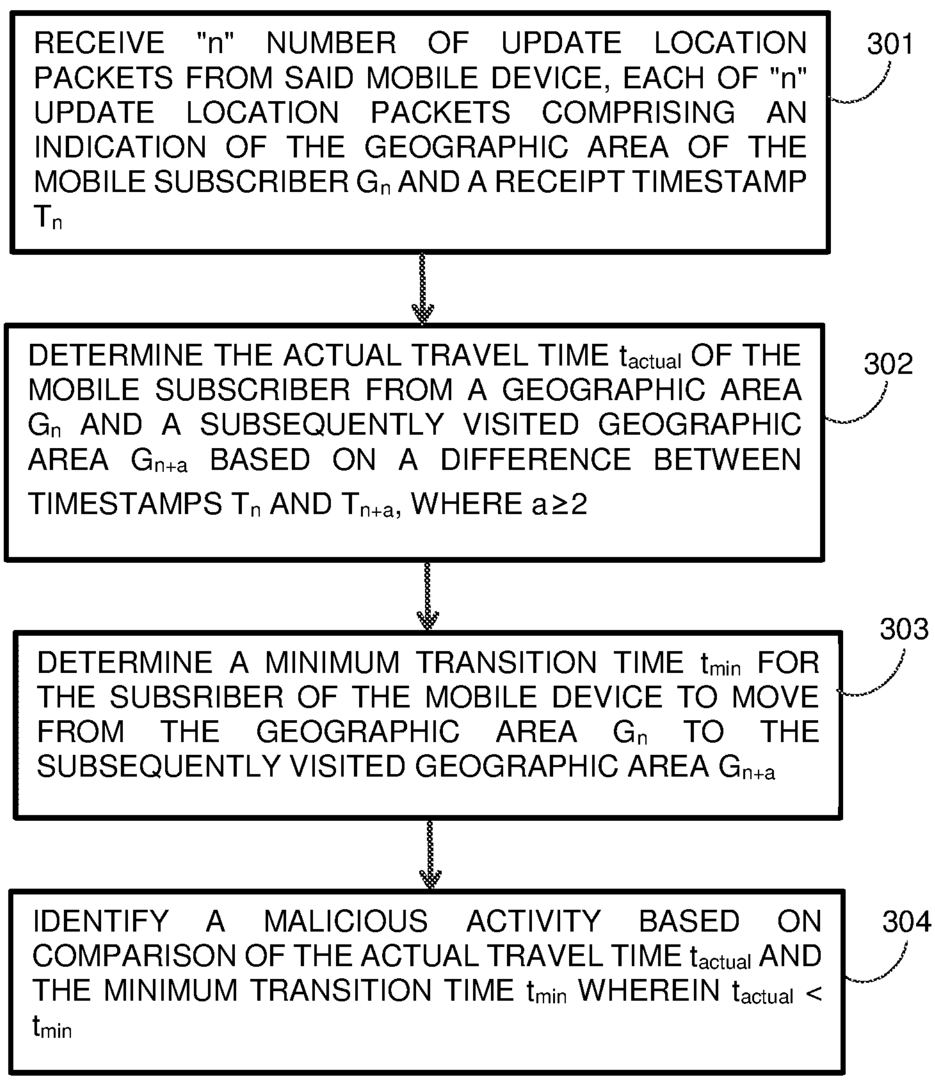

RECEIVE "n" NUMBER OF UPDATE LOCATION PACKETS FROM SAID MOBILE DEVICE, EACH OF "n" UPDATE LOCATION PACKETS COMPRISING AN INDICATION OF THE GEOGRAPHIC AREA OF THE MOBILE SUBSCRIBER G_n AND A RECEIPT TIMESTAMP T_n
301
DETERMINE THE ACTUAL TRAVEL TIME t_{actual} OF THE MOBILE SUBSCRIBER FROM A GEOGRAPHIC AREA G_n AND A SUBSEQUENTLY VISITED GEOGRAPHIC AREA G_{n+a} BASED ON A DIFFERENCE BETWEEN TIMESTAMPS T_n AND T_{n+a}, WHERE $a \geq 2$
302
DETERMINE A MINIMUM TRANSITION TIME t_{min} FOR THE SUBSRIBER OF THE MOBILE DEVICE TO MOVE FROM THE GEOGRAPHIC AREA G_n TO THE SUBSEQUENTLY VISITED GEOGRAPHIC AREA G_{n+a}
303
IDENTIFY A MALICIOUS ACTIVITY BASED ON COMPARISON OF THE ACTUAL TRAVEL TIME t_{actual} AND THE MINIMUM TRANSITION TIME t_{min} WHEREIN $t_{actual} < t_{min}$
304

FIG. 3

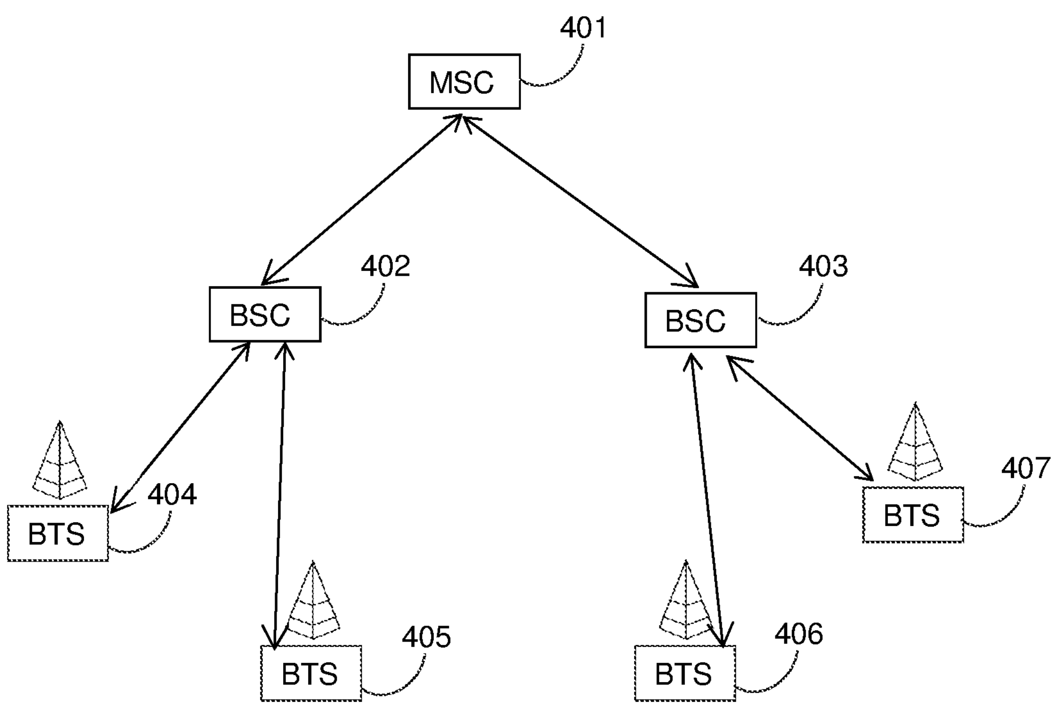


FIG. 4

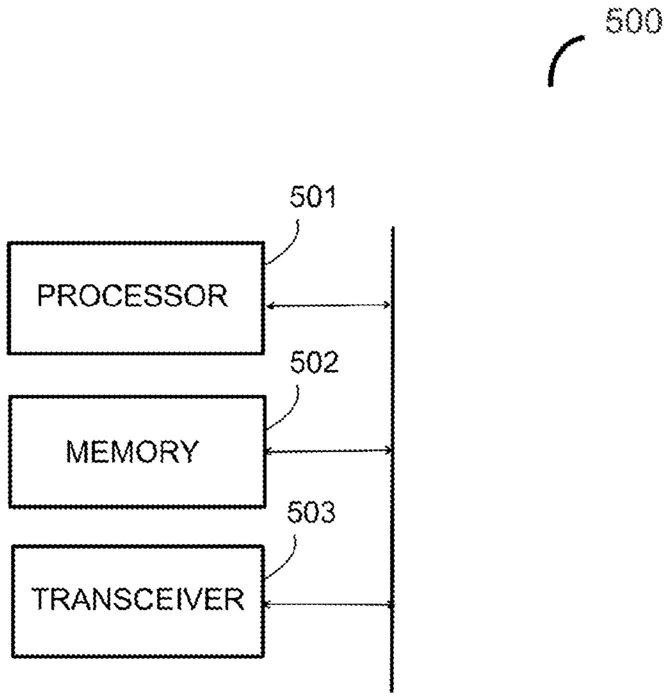


FIG. 5

IDENTIFICATION OF MALICIOUS ACTIVITY BASED ON ANALYSIS OF TRAVEL PATH OF A MOBILE DEVICE

FIELD

[0001] Method and system for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas.

BACKGROUND

[0002] A known weakness in SS7 (Signalling System No. 7) is the possibility for an attacker to pose as a legitimate network node and engage other nodes in SS7 TCAP communication sessions, receiving privileged data from these nodes, or sending them new, incorrect or malicious data.

[0003] These kinds of weaknesses are known and have been (and still are) subject to extensive research. Many of these attacks which exploit these weaknesses can be called "deterministic attacks" as there is a clear way to describe, identify and stop them. However, there are other kinds of attacks that can be defined at a "higher level", in the sense that all the packets involved in the communication are "admissible", i.e. they do not trigger any alarm for the classic algorithms, but are nevertheless anomalous when analysed as a whole.

[0004] An example of this kind of "higher level" attack, together with an algorithm to identify them. The attack is to 'spoof' the location of a subscriber—to somewhere where the physical subscriber and phone are not actually present. By spoofing that the subscriber's phone is at a location under the control of a malicious entity, subsequent communications and signalling to the subscriber would be sent to this malicious location, and then be intercepted. The spoofing attack could also be a form of Denial of Service, if the location is spoofed to be anywhere other than where the subscriber is, then subsequent communications to the subscriber go unanswered. US Patent publication number US2015/186891, assigned to Visa International Service Association, discloses a system and method for performing location based fraud detection. The system disclosed requires a dedicated third party server that polls a network to identify different mobile devices and requires the GPS coordinates of each device for making calculations, as well as requiring a transaction to take place from the mobile device. Chinese Patent Publication number CN106228799, assigned to Fujian Information Tech Co Led, discloses a system and method for monitoring illegal tampering of vehicle location information.

[0005] Thus, there is a need for a method and system for preventing and detecting such attacks by the identification of malicious mobile devices in a network.

SUMMARY

[0006] Embodiments of the present invention, as set out in the appended claims, are directed to a system and method for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas, where the malicious activity is at least one received spoofed location data. An important aspect of the invention is that the solution analyses and compares all possible permutations of travel between geographic areas to accurately and quickly detect a malicious or fraudulent activity. The system and method of the invention does not need to query each device to determine current location data or require a third party server infrastructure that is required to collect and infer location data of each mobile device. Instead the system and method only requires mobile device location data using existing telecom protocols automatically available at a network switch or mobile switching centre. Moreover, the invention can operate and detect a malicious device before a fraudulent transaction takes place by analysing the travel path of a mobile device, as set out in the appended claims.

[0007] Such malicious activity is detected if the mobile subscriber is moving too fast through the travel path i.e. the analysis of the location data suggests a travel path and the timestamps of such received packets aids in determination as to whether such movement through the travel path is plausible or not. The above mentioned geographic area is a predefined area which may be defined by the boundaries of a country, state, or town.

[0008] The method of analysis of a travel path of a mobile device of a mobile subscriber comprises the steps of a) receiving "n" number of location data associated with said mobile device, each of "n" location data comprising an indication of the geographic area of the mobile subscriber G_n and a receipt timestamp T_n; b) determining the actual travel time t_{actual} of the mobile subscriber from a geographic area G_n and a subsequently visited geographic area G_{n+a} based on a difference between timestamps T_n and T_{n+a}, wherein $a \geq 2$; c) determining a minimum transition time t_{min} for the subscriber of the mobile device to move from the geographic area G_n to the subsequently visited geographic area G_{n+a}; and d) identifying a malicious activity based on comparison of the actual travel time t_{actual} and the minimum transition time t_{min} wherein $t_{actual} < t_{min}$. In another embodiment, the method above described method steps b), c) and d) are repeated for the first "n−a" location data.

[0009] In an exemplary embodiment the method of detecting a suspicious transition of a mobile communication device transitioning through at least three geographic areas i.e. where n=3 and a=2 comprises the following steps: a) receiving at least three location data associated with said mobile communication device, said first location data comprising indication of the geographic area of the mobile subscriber and a receipt timestamp; b) determining the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data; c) determining a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area; and d) identifying a malicious/suspicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area.

[0010] In one embodiment there is provided a mobile switching centre for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas said comprising:

[0011] a processor;

[0012] a memory operatively coupled to the processor; and

[0013] a transceiver operatively coupled to the processor;

[0014] said processor configured to:

[0015] receive at least three location data associated with said mobile communication device, said first location data comprising indication of the geographic area of the mobile subscriber and a receipt timestamp;

[0016] determine the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data;

[0017] determine a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area; and

[0018] identify a suspicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area through the second geographic area.

[0019] In one embodiment the geographical area is one of a country, state, town.

[0020] In one embodiment the geographical area is a partition in a predetermined map with predetermined partitioned geographical areas.

[0021] In one embodiment the system and method can operate using one or more telecommunication protocols. The invention works on the principle that each protocol can easily determine subscriber information and location of each mobile device in a network.

[0022] In one embodiment the invention can use one or more of the following protocols: SS7, Diameter, 5G, GTP, ISUP, SIP or other telecommunication protocols used for control or information exchange.

[0023] In one embodiment the step of comparing an identification of a suspicious activity obtained from a first protocol with an identification of a suspicious activity obtained from a second protocol to correlate whether an activity is malicious.

[0024] Thus, by analyzing the monitoring of the path of travel of the subscriber such malicious activity is detected.

[0025] There is also provided a computer program comprising program instructions for causing a computer program to carry out the above method which may be embodied on a record medium, carrier signal or read-only memory.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The invention will be more clearly understood from the following description of an embodiment thereof, given by way of example only, with reference to the accompanying drawings, in which:—

[0027] FIG. **1** exemplarily illustrates a travel path of a mobile subscriber in accordance with some embodiments of the present invention;

[0028] FIG. **2** exemplarily illustrates a travel path of a mobile subscriber in accordance with some embodiments of the present invention;

[0029] FIG. **3** is a flow chart illustrating an embodiment of the inventive method for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas;

[0030] FIG. **4** is a diagram illustrating an architecture of a mobile telephone network, in accordance with some embodiments of the present invention; and

[0031] FIG. **5** is a functional block diagram illustrating the primary components of a mobile switching centre (MSC) for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas in accordance with some embodiments of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0032] FIG. **1** exemplarily illustrates a travel path of a mobile subscriber in accordance with some embodiments of the present invention. Each hexagonal area represented in FIG. **1** is a predefined geographic area e.g. the hexagonal area represented labelled as **101**.

[0033] The mobile device of the subscriber sends location data when a subscriber registers to a mobile phone network of the geographic area. For example, in pre-existing telecom protocols, there are specific packets that indicates an update/change in the current location of a subscriber. The following list is an example, without presumption of being exhaustive, of such packets: in SS7 Protocol—UpdateLocation, UpdateLocationGPRS, optionally SendAuthenticationInfo may be used; in Diameter (4G) protocol—Update-Location-Request packets and in 5G—equivalent packets. Other location data can also be used. For example, the protocols that the method and system of the invention can use comprises one or more of the following protocols: SS7, Diameter, 5G, GTP (data), ISUP (voice), SIP (voice). For illustrative purposes the SS7 protocol is described in more detail below.

[0034] These packets contain a field that can indicate what geographic area the subscriber is in. For SS7, this field could be a Global Title (GT), which is a form of a phone number that indicates what network node the subscriber's phone is currently registered to. Location information can be derived from the numbering plan of the network node's GT. For example, if an UpdateLocation packet was received with a Source or registered GT field of +353861234567, then by analysing the Telephone Country Code +353, a system would know that the node was based in Ireland.

[0035] For Diameter this could be a Host or Realm address field, which indicates what network node or network the subscriber's phone is currently registered to. For example, if an UpdateLocation-Request packet was received with a source or registered Host or Realm address that contained MCC **272**, then by analysing the Mobile Country Code **272**, a system would know that the node was based in the geographic area of Ireland.

[0036] Equivalent analysis could be performed on other packets within these protocols, or on packets within new protocols, but the basis is to take information from the received packet, to infer what geographic areas the subscriber's phone is currently or purportedly based in.

[0037] The unit of geographic area does not have to strictly be based on a country level, if the received information allows a smaller geographic area to be determined, then that could be used. For example, an SS7 UpdateLocation packet could be received with a source or registered GT of +1 (907) 123 4567. Then by analysing the Telephone Country Code +1 (US) and the area code (907) Alaska, a system would know that the node was based in Alaska, United States. This information could come both from public sources, or if the internal network node information of an operator is available to the system.

[0038] In an embodiment, any Telecom signalling packet that indicates or updates a subscriber location, which can be matched to a geographic area, can be used to indicate a change of geographic area, and can be compared against the previous geographic areas.

[0039] Therefore, any location data in accordance with the claimed invention may comprise any data packet or signal which may be used to determine the geographic area within which a mobile phone is located. Also, the time of receipt of said data packet or signal may be used as the timestamp.

[0040] Thus FIG. **1** exemplarily illustrates a mobile subscriber moving through the geographic areas i.e. the mobile device of the subscriber transmits a first location data at time T_1 when the subscriber is within the geographical area G_1. Similarly, the mobile phone of the subscriber transmits a second location data at time T_2 when the subscriber is within the geographical area G_2. Similarly, the mobile phone of the subscriber transmits a third location data at time T_3 when the subscriber is within the geographical area G_3. To avoid further repetition, the n^{th} location data is transmitted by the mobile device of the subscriber at time T_n when the subscriber is within the geographical area G_n.

[0041] FIG. **2** is similar to FIG. **1** exemplarily illustrates a travel path of a mobile subscriber where the geographic areas through which a subscriber travels are countries of Europe.

[0042] FIG. **3** is a flow chart illustrating an embodiment of the inventive method for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas which is explained below with reference to FIG. **1** and FIG. **2**.

[0043] The method of analysis of a travel path of a mobile device of a mobile subscriber comprises the steps of:

[0044] a) receiving **301** "n" number of location data associated with said mobile device, each of "n" location data comprising an indication of the geographic area of the mobile subscriber G_n and a receipt timestamp T_n. As mentioned above and illustrated in FIG. **1** and FIG. **2** "n" number of location data are received e.g. the first packet at time T_1 which comprises an indication for geographical area G_1 . . . and a n^{th} packet received at time T_n which comprises an indication for geographical area G_n.

[0045] b) determining **302** the actual travel time t_{actual} of the mobile subscriber from a geographic area G_n and a subsequently visited geographic area G_{n+a} based on a difference between timestamps T_n and T_{n+a}, wherein a≥2. For example, the actual travel time of the subscriber from the geographical area G_1 (G_n for n=1) to G_3 (G_{n+a} at n=1 and a=2) is T_3-T_1. Therefore, $t_{actual}=T_{n+a}\ T_n$.

[0046] c) determining **303** a minimum transition time t_{min} for the subscriber of the mobile device to move from the geographic area G_n to the subsequently visited geographic area G_{n+a} through the path followed from G_n to G_{n+a} (i.e. a sum transition times between each G_n to G_{n+1} . . . to G_{n+a}).

[0047] In an embodiment the t_{min} between two geographical area may be computed as per the following process in accordance with some of the embodiments of the present invention.

[0048] I) generating a database of geographical data, containing the description of the shape of geographic area objects for each geographic unit or location (e.g. each country in the world). This geographic shape object could be defined in a series or ways, at a minimum it could be a bounding box encompassing the country, but equally it could be a more accurate country bounding polygon, all the way to a fully accurate country shape with every border point modelled.

[0049] II) estimating the minimum admissible travelling time between two geographic areas (e.g. countries). This is based on:

[0050] i. Finding the minimum distance between the defined geographic areas for all the possible couples of countries (if they are overlapping or bordering, then the distance is 0). The minimum distance between the two countries may be computed using Haversine Distance or Great Circle Distance;

[0051] ii. The estimated maximum speed of a typical passenger aircraft is obtained using statistical analysis of various speeds of passenger aircrafts.

[0052] iii. Combining these distance and speed, estimating the minimum admissible travelling time t_{min} between geographic areas.

[0053] d) identifying **304** a malicious activity based on comparison of the actual travel time t_{actual} and the minimum transition time t_{min} wherein $t_{actual}<t_{min}$.

[0054] In an exemplary embodiment the method of detecting a suspicious transition of a mobile communication device transitioning through at least three geographic areas G_1, G_2 and G_3 i.e. where n=3 and a=2 comprises the following steps:

[0055] a) receiving at least three location data associated with said mobile communication device, said first update packet each packet comprising indication of the geographic area G_1 of the mobile subscriber and a receipt timestamp T_1;

[0056] b) determining the actual travel time t_{actual} of the mobile subscriber from the first geographic area G_1 and the third geographic area G_3 based on a difference between timestamps of the first location data T_1 and the third location data T_3.

[0057] c) determining a minimum transition time t_{min} for the subscriber of the mobile device to move from the first geographic area G_1 to the third geographic area G_3 through the second geographical area G_2; and

[0058] d) identifying a malicious/suspicious activity based on comparison of the actual travel time t_{actual} and the minimum transition time t_{min} wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area.

[0059] In a preferred embodiment, the method above described method steps b), c) and d) are repeated for the first "n-a" location data, i.e. iterating through a=2, 3 . . . "n−a".

[0060] The following exemplarily shows the working of the above inventive method in accordance with a preferred embodiment of the present invention. The below example is not limiting and solely for the purpose of showing the working of the inventive method in the form of an example.

[0061] A subscriber is moving through contiguous countries. It will be appreciated that the invention can operate equally as well for non-contiguous regions where the regions do not necessarily need to bound each other. In the following example the contiguous path is:

[0062] 1. Hungary—Austria

[0063] 2. Austria—Germany

[0064] 3. Germany—Switzerland

[0065] 4. Switzerland—France

[0066] So, the total path is Hungary—Austria—Germany—Switzerland—France

#Step	Movement	Time (in minutes)
1	Hungary—Austria	4 m
2	Austria—Germany	9 m
3	Germany—Switzerland	5 m
4	Switzerland—France	2 m

[0067] It will be appreciated that all of the above are single-step transitions which are at present evaluated individually. The present invention makes use of that fact that multiple locations can be evaluated.

[0068] The following would be evaluated in accordance to the above described inventive method:

#Step	Movement	Type	Actual Time t_{actual} (in minutes)	Minimum travel time t_{min} (in minutes)	Is it an admissible movement?
1 + 2	Hungary—Austria—Germany	2-step (n = 5 and a = 2)	4 + 9 = 13 m	5 m	Yes
2 + 3	Austria—Germany—Switzerland	2-step (n = 5 and a = 2)	9 + 4 = 14 m	0 m	Yes
3 + 4	Germany—Switzerland—France	2-step (n = 5 and a = 2)	5 + 2 = 7 m	0 m	Yes
1 + 2 + 3	Hungary—Austria—Germany—Switzerland	3-step (n = 5 and a = 3)	4 + 9 + 5 = 18 m	25 m	No
2 + 3 + 4	Austria—Germany—Switzerland—France	3-step (n = 5 and a = 3)	9 + 5 + 2 = 16 m	0 m	Yes
1 + 2 + 3 + 4	Hungary—Austria—Germany—Switzerland—France	3-step (n = 5 and a = 4)	4 + 9 + 5 + 2 = 20 m	29 m	No

[0069] It is observed that the trajectory of this subscriber is implausible and therefore suspicious and indicating a malicious activity.

[0070] FIG. **4** is a diagram illustrating a general architecture of a mobile telephone network, in accordance with some embodiments of the present invention. Base Transceiver Stations (BTS) **404**, **405** and **406**, **407** are in communication with respective Base Station Controllers (BSC) **402** and **403**. The BSC controls and manages the BTSs and performs essential functions like routing and handoffs. Further, the BSCs **402**, **403** are in communication with the Mobile Switching Centre (MSC) **401** which is responsible for overall management for roaming of the subscriber to different geographical areas.

[0071] FIG. **5** is a functional block diagram illustrating the primary components of a MSC **401**, **500** for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas in accordance with some embodiments of the present invention. The MSC comprises a processor **501**, a memory **502** operatively coupled to the processor **501**; and a transceiver **503** operatively coupled to the processor **501**. The processor **501** configured to receive "n" number of location data associated with said mobile device through said transceiver **503**, each of "n" location data comprising an indication of the geographic area of the mobile subscriber G_n and a receipt timestamp T_n. The processor **501** determines the actual travel time t_{actual} of the mobile subscriber from a geographic area G_n and a subsequently visited geographic area G_{n+a} based on a difference between timestamps T_n and T_{n+a}, where a≥2.

[0072] The processor further determines a minimum transition time t_{min} for the subscriber of the mobile device to move from the geographic area G_n to the subsequently visited geographic area G_{n+a} by computing the distance of the path of travel from G_n to G_{n+a} (i.e. a sum transition time between each G_n to G_{n+1} . . . to G_{n+a}). In another embodiment the determination of a minimum transition time t_{min} is based on looking up a database stored in memory **502**.

[0073] The processor **501** finally identifies a malicious activity based on comparison of the actual travel time t_{actual} and the minimum transition time **6**, wherein $t_{actual}<t_{min}$. The malicious activity is at least one received spoofed location data.

[0074] Further, the processor is configured to recursively perform the above functions for the first "n−a" location data i.e. iterating through a=2, 3 . . . "n−a".

[0075] In an exemplary embodiment the processor **501** detects a suspicious transition of a mobile communication device transitioning through at least three geographic areas G_1, G_2 and G_3 i.e. where n=3 and a=2. The processor **501** receives at least three location data associated with said mobile communication device, said first update packet each packet comprising indication of the geographic area of the mobile subscriber and a receipt timestamp. Further, the processor **501** determines the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data. Further, the processor determines a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area through the second geographic area and the processor **501** identifies a malicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area through the second geographic area.

[0076] Further, a person ordinarily skilled in the art will appreciate that the various illustrative logical/functional blocks, modules, circuits, techniques/algorithms and process steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, or a combination of hardware and software. To clearly illustrate this interchangeability of hardware and a combination of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or a combination of hardware and software depends upon the design choice of a person ordinarily skilled in the art. Such skilled artisans may implement the described functionality in varying ways for each particular application, but such obvious design choices should not be interpreted as causing a departure from the scope of the present invention.

[0077] The process described in the present disclosure may be implemented using various means. For example, the process described in the present disclosure may be implemented in hardware, firmware, software, or any combination thereof. For a hardware implementation, the processing units, or processors(s) may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, electronic devices, other electronic units designed to perform the functions described herein, or a combination thereof.

[0078] For a firmware and/or software implementation, software codes may be stored in a memory and executed by a processor. Memory may be implemented within the processor unit or external to the processor unit. As used herein the term "memory" refers to any type of volatile memory or nonvolatile memory.

[0079] Furthermore, although elements of the invention may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated.

[0080] In the specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms include, includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation and vice versa.

[0081] The invention is not limited to the embodiments hereinbefore described but may be varied in both construction and detail.

1. A method for analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas, comprising:

a) receiving "n" number of location data associated with said mobile device, each of "n" location data comprising an indication of the geographic area of the mobile subscriber G_n and a receipt timestamp T_n;

b) determining the actual travel time t_{actual} of the mobile subscriber from a geographic area G_n and a subsequently visited geographic area G_{n+a} based on a difference between timestamps T_n and T_{n+a}, wherein a≥2;

c) determining a minimum transition time t_{min} for the subscriber of the mobile device to move from the geographic area G_n to the subsequently visited geographic area G_{n+a} through the travel path;

d) comparing the actual travel time t_{actual} and the minimum transition time t_{min} wherein $t_{actual}<t_{min}$; and

e) identifying a suspicious activity based on said comparison wherein the suspicious activity is at least one received spoofed location data.

2. The method of claim **1** wherein steps b), c) and d) are repeated for the first "n−a" location data.

3. The method of claim **1** wherein geographical area is one of a country, state, town.

4. The method of claim **1** wherein the geographical area is a partition in a predetermined map with predetermined partitioned geographical areas.

5. The method of claim **1** wherein n≥3.

6. A mobile switching centre for analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas said comprising:

a processor;

a memory operatively coupled to the processor; and

a transceiver operatively coupled to the processor;

said processor configured to:

receive "n" number of location data associated with said mobile device, each of "n" location data comprising an indication of the geographic area of the mobile subscriber G_n and a receipt timestamp T_n; and

determine the actual travel time t_{actual} of the mobile subscriber from a geographic area G_n and a subsequently visited geographic area G_{n+a} based on a difference between timestamps T_n and T_{n+a}, wherein a≥2;

determine a minimum transition time t_{min} for the subscriber of the mobile device to move from the geographic area G_n to the subsequently visited geographic area G_{n+a} through the travel path;

comparing the actual travel time t_{actual} and the minimum transition time t_{min} wherein $t_{actual}<t_{min}$;

identifying a suspicious activity based on said comparison wherein the suspicious activity is at least one received spoofed location data.

7. The mobile switching centre of claim **6** wherein geographical area is one of a country, state and town.

8. The mobile switching centre of claim **6** wherein the geographical area is a partition in a predetermined map with predetermined partitioned geographical areas.

9. The mobile switching centre of claim **6** wherein n≥3.

10. The mobile switching centre of claim **6** for identification of malicious activity based on analysis of a travel path of a mobile device of a mobile subscriber moving through a plurality of geographic areas said comprising:

a processor;

a memory operatively coupled to the processor; and

a transceiver operatively coupled to the processor;

said processor configured to:

receive at least three location data associated with said mobile communication device, said first location data comprising indication of the geographic area of the mobile subscriber and a receipt timestamp;

determine the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data;

determine a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area; and

identify a suspicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area through the second geographic area.

11. A method of detecting a suspicious transition of a mobile communication device transitioning between at least three regions comprising the steps of:

receiving at least three location data associated with said mobile communication device, each location data comprising indication of the geographic area of the mobile subscriber and a receipt timestamp;

determining the actual travel time of the mobile subscriber from the first geographic area and the third geographic area based on a difference between timestamps of the first location data and the third location data;

determining a minimum transition time for the subscriber of the mobile device to move from the first geographic area to the third geographic area; and

identifying a suspicious activity based on comparison of the actual travel time and the minimum transition time wherein actual travel time is less than minimum transition time between the first geographic area and the third geographic area through the second geographic area.

12. The method of claim **1** comprising the step of comparing an identification of a suspicious activity obtained from a first protocol with an identification of a suspicious activity obtained from a second protocol to correlate whether an activity is malicious.

13. The method of claim **12** wherein the first protocol and/or second protocol is selected from one of the following protocols: SS7 (2G/3G), Diameter (4G), N32(5G), GTP (data), ISUP (voice), SIP (voice).

14. A computer program comprising program instructions for causing a computer to perform the method of claim **1**.

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