

METHOD AND DEVICE FOR CONNECTING A TERMINAL TO SEVERAL TELECOMMUNICATION NETWORKS

The present invention relates to the domain of mobile telecommunications and more particularly to that of modules intended to
5 identify a subscriber with an operator.

Each radiocommunication terminal, such as mobile telephones for example, must, in order to access a telecommunication network such as the GSM (Global System for Mobile communications) network, be equipped with a module enabling its user to be identified.

10 In the case of the GSM network, said module is called SIM (for Subscriber Identity Module) card, in the form of a smart card adapted to be inserted in the terminal.

The SIM card, supplied by a telecommunication operator, comprises an international number (or IMSI number) as well as data specific to the operator
15 and adapted to be read by reading means of the terminal.

In this way, to each subscription there corresponds a SIM card and therefore an IMSI number which the operator can identify.

In the present configuration of telecommunication networks, each operator offers its services only on its national territory.



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If the holder of a subscription with an operator desires to travel outside his national territory, he is no longer covered by the network of his operator of origin and cannot use his mobile telephone.

This is why roaming agreements have been set up between national
5 operators of different countries in order to offer their respective subscribers a complementarity of their services and their networks.

In this way, a subscriber travelling abroad can continue to use his telephone by switching onto the network of an operator of the country where he is located, which has signed an agreement with his national operator.

10 However, certain services proposed by the national operator (voice box, short written messages, direct call towards services such as taxis...) become difficult and even impossible to use abroad, since the network covering the communications no longer corresponds to his own network of origin.

Moreover, the costs of the communications are very high, since the user
15 is abroad, and the routing of the communications is complex. For example, the call to a person in England by a French subscriber located in England will transit via France before returning to England.

In addition, with these roaming agreements, a subscriber located abroad bears a part of the communication costs when he is called. In effect, the
20 communication will transit via the

international switched telephone network to arrive at the subscriber who will be billed a part of the call which he receives.

Finally, the subscriber is obliged to effect tiresome manipulations due to the differences in numbering.

5 In this context, the present invention overcomes these various drawbacks by proposing a method of connection, to at least two different telecommunication networks, of a radiocommunication terminal comprising a subscriber identity module of the smart card type comprising connection data sets each adapted to allow the terminal to be connected to one of the
10 telecommunication networks registered on the subscriber identity module, said method comprising the steps of:

- Searching, among the networks providing radio coverage of the terminal, for a network registered on the subscriber identity module, the terminal being attached to a base network;
- 15 - Reinitialising and attaching the terminal to said registered network if the latter is different from the base network.

The search for a network registered on the subscriber identity module, among the networks offering radio coverage of the terminal, is effected from a list of preferred networks provided in the subscriber identity module.

20 According to a form of embodiment, the base network is the same whenever the terminal is put into operation.

According to a variant of the invention, the base network is the one to which the terminal was attached before it was last placed out of operation.

The different registered networks can cover different countries or different regions of the same country.

During the step of searching, among the networks offering radio coverage of the terminal, of a network registered on the subscriber identity module, said
5 subscriber identity module preferably seeks localisation data specific to each telecommunication network.

The localisation data comprise, for example, the mobile code of the country as well as the mobile code of the network defined in accordance with the Global System for Mobile communications standard.

10 In order to ensure a greater security for the user, the method may provide a step of input and of verification of an identification code associated with the subscriber identity module, immediately after the terminal has been put into operation.

According to a particular form of embodiment of the invention, the
15 terminal remains attached to the base network if no network from among the networks offering radio coverage of the terminal is registered on the subscriber identity module.

Advantageously, upon reinitialisation and attachment of the terminal to one of the registered networks different from the base network, the connection
20 data set corresponding to said registered network is substituted, at a predetermined place on the subscriber identity module, for the connection data set corresponding to the base network.

In addition, the terminal and/or the subscriber identity module, after the reinitialisation and attachment to one of the registered networks different from the base network, sends data to a third party network allowing the terminal to be located.

5 In the case of networks functioning in accordance with the "Global System for Mobile communications (GSM)" standard, the connection data sets comprise an international subscriber number of IMSI type as well as an authentication key of Ki type.

10 According to a particular form of embodiment, the search for a network registered on the subscriber identity module from among the networks offering radio coverage of the terminal, may be effected manually by the user of the terminal.

15 The invention also relates to a subscriber identity module of the smart card type, intended to be inserted in a radiocommunication terminal and comprising at least two different connection data sets allowing the terminal to be connected to at least two different networks registered on the subscriber identity module, said module comprising means for:

- Searching, among the networks providing radio coverage of the terminal, for a network registered on the subscriber identity module, the
20 terminal being attached to a base network;
- Reinitialising and attaching the terminal to said registered network if the latter is different from the base network.

In the case of networks functioning in accordance with the "Global System for Mobile communications" standard, the connection data sets

comprise an international number of IMSI type as well as a subscriber authentication key of Ki type.

The means for searching for a registered network and the means for reinitialisation and attachment of the terminal of said registered network, if the latter is different from the base network, are advantageously software means.

The software means preferably allow access in identical manner to the same service proposed by different networks, and this whatever the network to which is attached the terminal in which the subscriber identity module is inserted.

According to a preferred form of embodiment, the software means are of the SIM Toolkit applications type.

The invention will be more readily understood on reading the following description relating to an illustrative but non-limiting example of embodiment, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a radiocommunication terminal and of a subscriber identity module according to the invention.

Figure 2 is a flowsheet showing the different steps of a form of embodiment of the method of the invention.

Figure 1 shows a mobile radiocommunication terminal 1 in which a subscriber identity module 2, of the smart card type, is adapted to be inserted.

Said module comprises different connection data sets 2a each adapted to allow the connection of the terminal 1 to the network of a telecommunication operator.

In the case, for example, of a telecommunication network responding to the GSM standard, the subscriber identity module 2 is called SIM card, each connection data set 2a in that case comprising:

- an international subscriber number IMSI;
- a subscriber authentication key Ki;
- possibly an encryption algorithm.

Within the framework of the invention, each SIM card may comprise a plurality of connection data sets 2a, the only constraints being the necessary memory space and the size of the SIM card 2.

The SIM card 2 of Figure 1 thus comprises four different connection data sets 2a, in the form of four couples (IMSI, Ki) each adapted to allow the connection of the terminal 1 to the network of a different operator. Said networks may each cover a part of a single country, but also, and advantageously, cover four different countries.

Thus, the first couple (IMSI, Ki)₁ may cover, for example, the French national territory, the couple (IMSI, Ki)₂ England, etc...

As we will see hereinbelow, the SIM card 2 is adapted to support the applications of the SIM Toolkit type such as defined by standard GSM 11.14, particularly the applications concerning the call control, the process of reinitialisation of the terminal 1 from the SIM card 2 itself, etc..

Figure 2 is a flowsheet representing the different steps of a form of embodiment of the method according to the invention for connection to the networks of different operators.

Initial step 10 corresponds to the putting into operation of the terminal 1 by the user, after having inserted the SIM card 2 comprising the different couples (IMSI, Ki).

The method according to the invention may advantageously provide, in known manner, a step of input 20 of a secret code commonly called PIN code in the GSM standard. This step 20 of input of the PIN code makes it possible, in particular, to avoid any fraudulent use of the SIM card 2.

The following step 30 is a step of decision during which the exactness of the PIN code entered during step 20 is verified.

In the case of this PIN code being inexact, the method, in known manner, resumes at step 20 and the terminal 1 again proposes to the user to enter the PIN code.

If the PIN code entered at step 20 is exact, the method passes to step 40 during which the terminal 1, thanks to the reading means known per se, reads one of the connection data sets 2a on the SIM card 2 and assigns it, on the SIM card 2, at a precise location standardised by the GSM standard.

For greater convenience, the couple (IMSI, Ki) assigned as soon as the terminal 1 is put into operation during step 40 is called base couple (IMSI, Ki).

This base couple (ISMI, Ki) therefore corresponds to a "base" network, registered on the SIM card 2.

According to a first form of embodiment, the base network may be the one to which the terminal was attached when it was last used. As soon as the terminal 1 is put into operation, the couple (IMSI, Ki) corresponding to the last network to which the terminal 1 was attached is assigned to the location provided by the GSM standard on the SIM card 2.

According to a variant embodiment, the base couple (IMSI, Ki) may be identical whenever the terminal 1 is put into operation. The base couple (IMSI, Ki) may correspond, for example, to that of a network covering the territory where the SIM card 2 was put into operation for the first time.

During the following step 50, the so-called "GSM authentication" procedure takes place, during which terminal 1 is attached to the network of the telecommunication operator corresponding to the base couple (IMSI, Ki). This conventional procedure of the GSM standard, which serves to authenticate the user of the SIM card 2, causes the IMSI number, the authentication key Ki as well as the encryption algorithm in particular to intervene.

The method then provides a step 60 during which the SIM card 2, via the applications of the SIM Toolkit type, proceeds with a search and an identification of the networks offering radio coverage of the terminal 1.

The SIM card 2 thus pilots the terminal 1 in order to carry out this search of the different networks available.

The identification of the networks offering radio coverage is effected via localisation data emitted by each telecommunication network. Said localisation data, or LOCI, comprise in particular a mobile code of the country, different for each country, as well as a mobile code of the network specific to each
5 telecommunication operator.

These two codes partly compose each IMSI number of the GSM standard (the first six digits) and therefore in particular those registered on the SIM card
2.

The procedure of search, from among the networks offering radio
10 coverage of the terminal 1, for a network registered on the SIM card 2, may be carried out in different ways.

According to an advantageous form of embodiment, the SIM card 2 has available a list of preferred networks from among which it searches first.

Conducted by the SIM card 2, the terminal 1 "reads" the list of the
15 preferred networks then scans all the frequencies in search of one of these preferred networks.

The terminal 1 may, for example, search for the first network on the list of the SIM card 2. Thanks to the IMSI of the registered couple $(\text{IMSI}, K_i)_1$, the terminal 1 has available the network code of the first network on its list.

20 If no network offering radio coverage corresponds to the code of the first IMSI of the list, the terminal 1 passes to the second, and so on for all the networks on the list of preferred networks until it identifies one from among those offering radio coverage.

According to another form of embodiment, the SIM card 2 may not comprise a list of preferred networks and the terminal searches, from among all the networks offering radio coverage, whether the localisation data of one of them (particularly the network code) correspond to one of the connection data sets present on the SIM card 2.

In effect, as has been seen, a part of the international number IMSI corresponds to the country and network codes emitted by each network. The SIM card 2 therefore compares the codes of the networks offering radio coverage with the IMSI numbers of the couples $(\text{IMSI}, K_i)_1, (\text{IMSI}, K_i)_2$, etc., registered in its memory.

In the case of no network code corresponding to the IMSI numbers of the couples (IMSI, K_i) registered on the SIM card 2, the terminal 1 remains attached to the base network and in that case functions in accordance with the so-called "roaming" procedure (step 80) allowing a terminal to be received on a network offering radio coverage while being attached to a different base network (if, however, agreements have been made between the operators of the networks).

In such a case, the data (voice, texts...) transit via the network of the receiving operator and the international switched telephone network (prior art methods).

If, on the contrary, one of the networks registered on the SIM card 2 is identified, in that case the terminal 1, during the decision step 90, determines whether said registered and identified network corresponds to the base network to which it is already attached.

If such is the case, the network code of the identified registered network corresponds to that present on the IMSI number of the base couple (IMSI, Ki).

In that case, the method according to the invention ends at step 100. The terminal 1 may be used to transmit or receive data (vocal and others) while
5 remaining attached to the base telecommunication network. No modification is made at the level of the assignment of the couple (IMSI, Ki) on the SIM card 2.

On the other hand, if the registered network identified during steps 60 and 70 does not correspond to the base network, then the method passes to step 110.

During this step 110, the SIM card 2, via the SIM Toolkit applications,
10 provokes the reinitialisation of the terminal 1 in order to change the network to which said terminal 1 will be attached.

To that end, during the following step 120, the couple (IMSI, Ki) corresponding to the registered network identified during the preceding steps is assigned to the place provided and standardised by the GSM standard on the
15 SIM card 2.

The couple (IMSI, Ki) of the registered network is thus substituted for the base couple (IMSI, Ki).

The terminal 1, with the SIM card 2 thus configured, is then attached to a network covering the zone where it is located.

20 The method according to the invention advantageously provides an additional step 130 during which the terminal 1 and/or the SIM card 2 sends data to the network of a third party operator in order systematically to localise the terminal 1.

The third party network may for example be that of the operator having issued the SIM card 2. In this way, the third party operator may ensure for the user of the terminal 1 a continuity of service by routing the calls which are intended for him or by ensuring operation of his answerer.

5 In the configuration issuing from step 120, the terminal 1 uses, in order to transmit and receive data (step 140), a local network of the place (country or region) where it is located, without roaming procedure. The user of said terminal 1 is seen, by the operator of the network to which he is attached, as being a local subscriber and the tariff applied to him is a local tariff.

10 In addition, the user of said terminal 1 may benefit fully from all the services set up by the operator of the local network to which the terminal 1 is attached, such as for example short messages of SMS type, voice boxes, or any other services developed by the operator operating the network.

 It should be noted that an additional step 150 (appearing in broken lines
15 in Figure 2) may be introduced in the method according to the invention.

 In the course of this step 150 inserted between steps 70 and 80, the terminal 1 searches, in the case of it not having identified any of the networks registered on the SIM card 2, whether it is located in one of the countries (or region) registered on said SIM card 2.

In effect, the case may occur if one of the registered networks is momentarily unavailable (parking...) while the terminal 1 is located in a zone supposed to be covered by said network.

It has been seen that each IMSI number of the couples (IMSI, Ki) registered on the SIM card 2 comprises the mobile code of the network and the mobile code of the country corresponding to the subscription.

In this way, even if no network code has been identified during steps 60 and 70, the terminal 1 may nonetheless identify a registered country, thanks to a network which might not be registered but having available the same country code for example.

If such is the case, the method according to the invention provides that the terminal 1 be reinitialised (step 110) and the couple (IMSI, Ki) of the registered network corresponding to the identified country is assigned on the SIM card 2 instead of and in place of the base couple (IMSI, Ki).

This procedure of network change (steps 110 to 140) is thus identical to that occurring in the case of a registered network different from the base network being identified (steps 60, 70 and 90) by the terminal 1.

In the case of no registered country being identified during step 150, the method ends at step 80 seen previously, where the terminal 1 can transmit or receive data by the roaming procedure.

However, the user of the terminal 1 can initiate the method according to the invention manually, and at any moment.

In effect, the user may, if his terminal 1 is already switched on, search whether one of the networks registered on the SIM card 2 offers radio coverage. This case may occur for example if the user is travelling, changing countries (or region) with his radiocommunication terminal 1 switched on.

5 Having arrived, the user, thanks to an ad hoc menu provided on the SIM card 2 and displayed on the screen of the terminal 1, may then have a search made of the registered networks and the method according to the invention is initiated from step 60.

10 Thus, thanks to the method according to the invention, a user who is often travelling can keep his terminal 1 and the SIM card 2 inserted therein without having to bear possible excess costs associated with the use of his terminal 1 abroad.

15 The SIM card 2 according to the invention allows him, in effect, to have with a single subscriber identity module, several subscriptions, each subscription being used in the corresponding country (possibly region).

20 The SIM card 2 also makes it possible to ensure a continuity in the services offered by the operators of the different networks. For example, if, through a menu of the terminal 1, identical services (consultation of messages, order for taxi) are proposed on all the networks, the SIM card 2 allows access to these services locally, whatever the network to which the terminal 1 is attached.

In effect, the SIM card 2 deals with adapting the number having to be composed to access these services depending on the network to which the terminal 1 is attached (so-called call control procedure).

In addition, thanks to the applications of SIM Toolkit type present on the
5 SIM card 2, the terminal 1 does not need to be modified in order to implement the present invention. Any terminal 1 supporting the applications of SIM Toolkit type can carry out the method according to the invention as long as a SIM card 2 according to the invention is inserted in said terminal 1.

C L A I M S

1. Method of connection, to at least two different telecommunication networks, of a radiocommunication terminal (1) comprising a subscriber identity module (2) of the smart card type comprising connection data sets (2a) each adapted to allow the terminal (1) to be connected to one of the telecommunication networks registered on the subscriber identity module (2), said method comprising the steps of:

- Searching (60), among the networks providing radio coverage of the terminal (1), for a network registered on the subscriber identity module (2), the terminal (1) being attached to a base network;

- Reinitialising (110) and attaching (120) the terminal (1) to said registered network if the latter is different from the base network.

2. Method according to Claim 1, characterized in that the search (60) for a network registered on the subscriber identity module (2), among the networks offering radio coverage of the terminal (1), is made from a list of preferred networks provided in the subscriber identity module (2).

3. Method according to one of Claims 1 or 2, characterized in that the base network is the same every time the terminal (1) is put into operation.

4. Method according to one of Claims 1 or 2, characterized in that the base network is the one to which the terminal (1) was attached before it was last put out of operation.

5. Method according to one of the preceding Claims, characterized in that the different registered networks cover different countries.

6. Method according to one of the preceding Claims, characterized in that, during the step (60) of searching from among the networks offering radio

5 coverage of the terminal (1), for a network registered on the subscriber identity module, said subscriber identity module (2) searches for localisation data specific to each telecommunication network.

7. Method according to the preceding Claim, characterized in that the localisation data comprise the mobile code of the country as well as the mobile

10 code of the network, defined in accordance with the Global System for Mobile communications standard.

8. Method according to one of the preceding Claims, characterized in that a step is provided for input (20) and for verification (30) of an identification code associated with the subscriber identity module (2) immediately after the

15 terminal (1) has been put into operation.

9. Method according to one of the preceding Claims, characterized in that the terminal (1) remains attached to the base network if no network among the networks offering radio coverage of the terminal (1) is registered on the subscriber identity module (2).

20 10. Method according to one of Claims 1 to 8, characterized in that, upon reinitialisation (110) and attachment (120) of the terminal (1) to one of the registered networks different from the base network, the connection data set (2a) corresponding to said registered network is substituted, at a predetermined place on the subscriber identity module

(2), for the connection data set (2a) corresponding to the base network.

11. Method according to the preceding Claim, characterized in that the terminal (1) and/or the subscriber identity module (2), after reinitialisation (110) and attachment (120) to one of the registered networks different from the base network, sends data (130) to a third party network allowing the terminal (1) to be located.

12. Method according to one of the preceding Claims, characterized in that the connection data sets (2a) comprise an international subscriber number of IMSI type as well as an authentication key of the Ki type, defined in accordance with the Global System for Mobile communications standard.

13. Method according to Claim 1, characterized in that the search (60) for a network registered on the subscriber identity module (2), from among the networks offering radio coverage of the terminal (1), is triggered off manually by the user of the terminal (1).

14. Subscriber identity module (2) of the smart card type, intended to be inserted in a radiocommunication terminal (1) and comprising at least two different connection data sets (2a) allowing the terminal (1) to be connected to at least two different networks registered on the subscriber identity module (2), and comprising means for:

- Searching, among the networks providing radio coverage of the terminal (1), for a network registered on the subscriber identity module (2), the terminal (1) being attached to a base network;

- Reinitialising and attaching the terminal (1) to said registered network if the latter is different from the base network.

15. Subscriber identity module (2) according to the preceding Claim, characterized in that the connection data sets (2a) comprise an international
5 number of IMSI type as well as a subscriber authentication key of Ki type, defined in accordance with the Global System for Mobile communications standard.

16. Subscriber identity module (2) according to one of Claims 14 or 15, characterized in that the means for searching for a registered network and the
10 means for reinitialisation and attachment of the terminal (1) of said registered network, if the latter is different from the base network, are software means.

17. Subscriber identity module (2) according to the preceding Claim, characterized in that the software means allow access in identical manner to the same service proposed by different networks, and this whatever the network to
15 which is attached the terminal (1) in which the subscriber identity module (2) is inserted.

18. Subscriber identity module (2) according to one of Claims 16 or 17, characterized in that the software means are of the SIM Toolkit applications type.