Title: SYSTEM METHOD AND SMART CARD FOR ACCESSING A PLURALITY OF NETWORKS

Abstract: A telecommunications system, such as a mobile telecommunications system, comprises a plurality of networks such as all owned or controlled in common. Smart cards are used for enabling terminals within the system to communicate. If the networks are GSM or UMTS networks, the smart cards can be SIM cards. A SIM card management centre (10) is provided which carries out the process normally carried out by a network operator for registering one of the SIM cards with its network (as its "home" network), using information supplied by the SIM card supplier. In addition, however, the SIM card management centre (10) can re-register each smart card with a different one of the networks (as its new home network). This is particularly though not only useful where the terminals are telematics terminals incorporated in a product the final geographical destination of which may not be known at the time of manufacture or may change. Secret information relating to all the networks is pre-stored, in respective records, on each SIM card at the outset. The record specific to a particular one of the networks merely has to be activated when the SIM card is to be registered or re-registered with that network. The need for transmission of new secret information to the SIM card when re-registering it with a different one of the networks, which would potentially compromise security, is avoided.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
SYSTEM METHOD AND SMART CARD FOR ACCESSING A PLURALITY OF NETWORKS

Field of the Invention

The invention relates to telecommunications systems and methods and smart cards for use therewith. Embodiments of the invention to be described in more detail below, by way of example only, are mobile telecommunications systems which use smart cards in the form of subscriber identity modules (SIMs) which carry identification and authenticating information by means of which a telecommunications network forming part of the system can identify a telecommunications terminal within the system and authorise it to function in the system. For example, a SIM may be personal to a particular individual, by means of which that individual can activate a telecommunications terminal (e.g. a telephone handset) and use it for telecommunications purposes within the system. In another example, however, a SIM may be used in a telematics application to identify a particular telematics terminal, source or node for use in the system.

Background Art

GB-A-2 315 387 discloses an arrangement for allowing a mobile terminal to register for multiple services provided by different networks.
Brief Summary of the Invention

According to the invention, there is provided a telecommunications system, comprising a plurality of different predetermined networks, a plurality of terminals for use in the system, a plurality of smart cards, each terminal being usable in a particular one of the networks in association with one of the smart cards when that smart card is registered with that network, and means for registering each smart card with a particular one of the networks and for re-registering it with a different one of the networks.

According to the invention, there is also provided a telecommunications method for use with a plurality of different predetermined networks, a plurality of terminals for use therein and a plurality of smart cards, in which each terminal is usable in a particular one of the networks in association with one of the smart cards when that smart card is registered with that network, and including the steps of registering each smart card with a particular one of the networks and of re-registering it with a different one of the networks.

According to the invention, there is further provided a smart card for use in a telecommunications system comprising a plurality of different predetermined networks and for association with a terminal to enable that terminal to be usable in a particular one of the networks when that smart card is registered with that network, the smart card being selectively registerable instead with each of the other networks.
The system to be described in the embodiment is concerned with registering/de-registering with a network. In registering for a network, authentication of the user and network takes place, this involves passing secret information between the terminal and the network.

**Brief Description of the Drawings**

Telecommunications systems and methods embodying the invention, and SIM cards embodying the invention for use in such systems and methods, will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 illustrates operations in one of the systems; and

Figure 2 is a flow chart showing those operations.

**Detailed Description of the Embodiments of the Invention**

In mobile telecommunications systems such as of the GSM or UMTS (third generation or 3G type) transmitting and receiving terminals (telephone handsets, for example) are provided with individual smart cards or SIM cards which are used to activate the terminals. In such a case, the SIM cards will be specific to the customers and will carry
information particular to each customer such as the customer’s IMSI (International Mobile Subscriber Identifier) together with authentication information. Using the SIM card, the customer can activate their handset or, in general, any other suitable handset. The SIM card may also store other information such as the customer’s list of memorised telephone numbers.

In telematics applications, SIM cards are also used for analogous purposes – providing the relevant identification (IMSI) and authentication information for each telematics terminal.

In each case, each SIM card will be specific to a particular network (the “home” network) – that is, it will have been issued under the control of the operator of that network and will be for use within that network. In many cases, of course, the SIM card may permit roaming of the associated terminal into other, pre-recognised, networks. In known fashion, the network operator will order a SIM card (or, of course, a batch of such cards in practice) from a SIM supplier. The SIM supplier, who will be in the position of a trusted supplier to the network operator, will use information which it already holds to generate the SIM card bearing the necessary identification and authentication information and a particular IMSI. The SIM manufacturer will then supply the SIM card to a terminal manufacturer such as a manufacturer of a telephone handset, a telematics terminal or some other terminal for use in the network. The SIM supplier will also advise the network operator of the data loaded onto the SIM card. In due course, the terminal will
be supplied to a customer. At that stage, the network operator will activate the SIM card, making use of the information concerning the SIM cards already supplied to it by the SIM supplier.

The SIM card, and thus the terminal associated with it, are now active and can be used in the network.

However, in view of developments in mobile telecommunications systems and particularly (though not only) in telematics applications, such a known arrangement may no longer be completely satisfactory. For example, a telematics terminal with its SIM card may be incorporated into a product when located in one country (for example, during manufacture of the product) but the product may then be exported for use in another country. The eventual destination of the product may be unknown at the time when the terminal and its SIM card are incorporated into the product. For example, a telematics terminal may be incorporated into a vehicle for use not only for providing telephone and data services for an occupant of the vehicle but also for transmitting other information relating to the operation of the vehicle such as, for example, concerning its maintenance or breakdown or relating to its position. In such a case, the initial home network for the SIM card may be a network in the country where the vehicle is manufactured and where the telematics terminal is installed. Thus, it may be necessary to render the SIM card active at this stage in order to enable testing and set-up to be carried out. However, the vehicle may then be exported to another country where it will actually be used or
primarily used – in which case it will be necessary for the SIM card to be registered to a different home network. Therefore, the known arrangement for activating SIM cards, as described above, would not be suitable or could not be used without considerable difficulty.

Similarly, if a telematics terminal with its associated SIM card is in use within a product and functioning within a particular operating company’s network, problems will arise if the product is then moved permanently into a different geographical region not covered by the network with which it is registered. Although roaming of a terminal into a different network is possible, this is intended for short term movements of a terminal into the different network, not a substantially permanent or long term transfer.

In such cases, it would of course be possible to deal with the problem simply by issuing a new SIM card upon the transfer of the product including the telematics terminal into the area of a different network. However, this could be logistically difficult in practice, and, additionally, could have the result that useful information placed on the previous SIM card would be lost.

According to a feature of the invention now to be described, a SIM card registered with a particular network (its “home” network) can be re-registered with a different network (or any one of several different networks) – which thus becomes its new home network. The networks with which the SIM card can be registered form a group of predetermined
networks and may, for example, be networks in different countries all owned or controlled in common.

One way in which this can be achieved is shown in the Figures.

As shown in Figure 1, a SIM management centre 10 is provided. This can be located anywhere. For example, where the group of networks are all owned or controlled in common, the SIM management centre 10 can be located at the controlling entity. Orders for the supply of a new batch of SIM cards are received by the SIM management centre 10 from an ordering source 12 (Step A, Figure 2). Such a source might, for example, be any one of the group of networks. In response to such an order, the SIM management centre 10 places the order on a SIM supplier 14 (or on a particular one of several such suppliers (Step B, Figure 2)). The order will identify the particular network in the group of networks in which the SIM card is to be used initially (that is, the first home network).

The SIM card supplier 14 now manufactures the SIM cards, placing all the necessary information on them. This information will of course be relevant to the particular home network for which the SIM card is intended. The information will thus include the IMSI and also a record providing all the secret information specific to the operator of that particular network (secret keys, OTA transport key, parameters for the particular operator’s algorithm and others) which is required for authenticating the SIM card in use; the SIM supplier will obtain from this secret information from information which it
already has and which, of course, it maintains in a secure fashion. In addition, a common SIM mask may be stored on the SIM card, for example, a mask particular to the entity owning or controlling the networks.

In accordance with a particular feature of the invention, and for a purpose to be explained, the SIM supplier also includes on the SIM card similar records for the operator-specific security secret information relating to all the other networks in the group. In other words, the SIM card includes a storage space containing multiple records relating to operator-specific secret information for each of the networks in the group. Additional records containing information for networks which may join the group in the future may also be provided. Each of these records is in principle separately activatable. Initially, however, only the record applicable to the operator of the network in which the SIM card is to be initially registered is activated.

The SIM card is now sent by the SIM supplier 14 to a terminal manufacturer 16 such as a manufacturer of telematics terminals (Step C). Details of the information which the SIM manufacturer has placed on the SIM card are sent back to the SIM management centre 10 (Step D). At this stage, the SIM card is not yet activated.

The SIM management centre 10 now passes the details of the particular SIM card to the operating company (OpCo 1) 18 of the network in which the SIM card is to be initially used (Step E). Thus, OpCo 1 receives the IMSI for the SIM card, and details of the
relevant operator-specific secret information. This step thus corresponds to the step in the known process described above, where the SIM supplier supplies all this information, in relation to a newly manufactured SIM card, to the operating company. Preferably, the SIM management centre 10 supplies all this information to OpCo 1, 18, in the same format as the operating company would receive this information direct from the SIM manufacturer in the known process.

When the terminal manufacturer has associated the SIM card with the telematics terminal, and the terminal is ready for use (for example, it has been incorporated into a particular product such as a vehicle as described above), the SIM card is now ready for activation. The activation process will be carried out by OpCo 1 using OTA transmissions in the usual way (Step F). The SIM card, and thus the associated terminal, are now “live” in the network of OpCo 1 which is thus the home network for that SIM card.

It will now be assumed that it is necessary for the SIM card to be registered with a different network as its home network. Thus, such a re-registering request may be generated by an operating company 20 ("OpCo 2"), being the operator of another one of the networks in the group of networks and in which the telematics terminal with which the particular SIM card is associated is now primarily located. This re-registering request may be generated in various different ways. For example, it may be generated by a specific request made by the person in charge of the product containing the telematics terminal. However the request originates, it is passed to the ordering source 12 and then
sent to the SIM management centre 10 (Step G).

The SIM management centre 10 now confirms with OpCo 2 that OpCo 2 is prepared to become the home network of the SIM card (Step H). If this confirmation is received, the SIM management centre 10 then confirms that OpCo 1 is prepared to release the SIM card (Step I). This process may involve requesting confirmation from the particular user that such release and transfer to OpCo 2 is agreed. Assuming that OpCo 1 confirms release, OpCo 2 informs the SIM management centre 10 of the new IMSI which SIM card will now need (Step J).

The SIM management centre 10 now sends an OTA message to the SIM card, to enable it to be registered with OpCo 2 instead of OpCo 1 (Step K). This message would include the new IMSI for the SIM card which will have been obtained from OpCo 2 (at Step J). In addition, the OTA message will access the part of the SIM card storing the records mentioned above relating to the operator-specific secret information, and will activate the record specific to OpCo 2 and de-activate the record specific to OpCo 1.

The SIM management centre 10 will at this time hold all the necessary information relating to the SIM card – in the same way as it did initially when the card was manufactured by the SIM supplier 14 which supplied this information to the SIM management centre 10 (see Step D). Thus, the SIM management centre 10 will hold the original information received from the SIM supplier concerning the SIM card and will
now hold the new IMSI (obtained from OpCo 2) (see Step J) and will also know the secret information relating to OpCo 2. Therefore, the SIM management centre 10 can now supply all this information to OpCo 2 (Step L). Just as when this information was originally sent to OpCo 1 (Step E), the information sent to OpCo 2 will be in the same general format as the format in which such information is received by operating networks from the SIM supplier in accordance with the known SIM activation process.

When OpCo 2 now receives a request to activate the SIM card within the network of OpCo 2, it has all the necessary information with which to activate the SIM within that network, as its new home network, such as by OTA transmissions (Step M).

In an exactly similar fashion, the SIM card can, if desired, be re-registered into a third network in the group of networks.

Because the secret and authentication information relating to each of the networks in the group of networks is already stored on the SIM card, so that the secret information relating to a particular one of the networks merely has to be activated on the SIM card, there is optimum maintenance of security – because none of the secret information has to be transmitted to the SIM card and re-written on the SIM card.

Although it is advantageous to use a central SIM management centre 10 for managing the transfer of the SIM card between networks, this is not essential. Instead, the necessary
functions could be carried out by the operating companies of the networks.
CLAIMS

1. A telecommunications system, comprising a plurality of different predetermined networks (18,20), a plurality of terminals for use in the system, a plurality of smart cards, each terminal being usable in a particular one of the networks (18,20) in association with one of the smart cards when that smart card is registered with that network, and registration means (10) for registering each smart card with a particular one of the networks and characterised in that the registration means (10) is operable to re-register each smart card with a different one of the networks (18,20).

2. A system according to claim 1, in which the registration means (10) is separate from and common to all the networks (18,20).

3. A system according to claim 1 or 2, in which each smart card carries secret information specific to, and by means of which, the network (18,20) with which the smart card is registered can authenticate the smart card and allow use of the terminal with which that smart card is associated in that network (18,20).

4. A system according to claim 3, in which each smart card also carries the secret information specific to all the other networks (18,20) in the system, and in which the registration means activates the secret information relating to a particular one of the
networks (18,20) when registering or re-registering the smart card with that network (18,20).

5. A system according to any preceding claim, in which each smart card when registered with a particular one of the networks (18,20) includes an identifying address which is used to identify the terminal with which that smart card is associated so as to enable communication to be established to and from that terminal, the identifying address being particular to that network (18,20), and in which the registration means transmits an identifying address particular to one of the networks (18,20) for storage on the smart card when re-registering that smart card with that network (18,20).

6. A system according to any preceding claim, in which the networks (18,20) are GSM or UMTS networks and the smart cards are SIM cards for use therein.

7. A telecommunications method for use with a plurality of different predetermined networks (18,20), a plurality of terminals for use therein and a plurality of smart cards, in which each terminal is usable in a particular one of the networks (18,20) in association with one of the smart cards when that smart card is registered with that network (18,20), and including the step of registering each smart card with a particular one of the networks (18,20) and characterised by the step of re-registering it with a different one of the networks (18,20).
8. A method according to claim 7, in which the registration and re-registration steps are controlled (10) from outside the networks (18,20).

9. A method according to claim 7 or 8, in which each smart card carries secret information specific to, and by means of which, the network (18,20) with which the smart card is registered can authenticate the smart card and allow use of the terminal with which that smart card is associated in that network (18,20).

10. A method according to claim 9, including the step of storing on each smart card the secret information specific to all the other networks (18,20) in the system, and in which the registration or re-registration step activates the secret information relating to a particular one of the networks (18,20) when registering or re-registering the smart card with that network (18,20).

11. A method according to any one of claims 7 to 10, in which each smart card when registered with a particular one of the networks (18,20) includes an identifying address which is used to identify the terminal with which that smart card is associated so as to enable communication to be established to and from that terminal, the identifying address being particular to that network (18,20), and in which the registration or re-registration step includes the step of transmitting an identifying address particular to one of the networks for storage on the smart card when registering or re-registering that smart card with that network (18,20).
12. A method according to any one of claims 7 to 11, in which the networks (18,20) are GSM or UMTS networks and the smart cards are SIM (USIM) cards for use therein.

13. A smart card for use in a telecommunications system comprising a plurality of different predetermined networks (18,20) and for association with a terminal to enable that terminal to be usable in a particular one of the networks (18,20) when that smart card is registered with that network (18,20), characterised in that the smart card is selectively registerable instead with each of the other networks (18,20).

14. A smart card according to claim 13, carrying separately addressable records each comprising secret information relating to a respective one of the networks (18,20), the record corresponding to the particular network with which the smart card is currently registered being activated and the record corresponding to another one of the networks (18,20) being activated instead when the smart card is to be re-registered with that other network (18,20).

15. A smart card according to claim 13 or 14, carrying an identifying address particular to the one of the networks (18,20) with which the smart card is registered and identifying the smart card within that network to enable communication to be established to and from a terminal with which that smart card is associated via that network (18,20).
16. A smart card according to claim 15, in which an identifying address particular to another one of the networks (18,20) and identifying the smart card within that network (18,20) is written onto the smart card when the smart card is re-registered with that other network (18,20).

17. A smart card according to any one of claims 13 to 16 for use as a SIM in a telecommunications system in which the networks (18,20) are GSM or UMTS networks.
Order for new SIM cards sent to the SIM management centre (SMC) 10

SMC places order on the SIM supplier 14

SIM supplier 14 supplies SIMs to terminal manufacturer 16

SIM supplier 14 sends SIM data to SMC 10

SMC 10 sends SIM data to OpCo1

OpCo 1 registers the SIM

SMC 10 receives request for re-registering SIM with OpCo 2 instead of OpCo 1

SMC 10 confirms with OpCo 2 that OpCo 2 agrees

SMC 10 confirms with OpCo 1 that OpCo 1 agrees to the transfer

OpCo 2 advises new IMSI to SMC 10

SMC 10 sends OTA message to SIM to re-configure SIM for OpCo 2

SMC 10 sends SIM data to OpCo 2

OpCo 2 registers the SIM
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

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)
IPC 7 H04Q

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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* Special categories of cited documents:
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* A* document member of the same patent family

Date of the actual completion of the international search
13 November 2002

Date of mailing of the international search report
20/11/2002

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