Method for providing intelligent network support to a mobile subscriber

Method for providing intelligent network support to a mobile subscriber (1) roaming in a VPLMN (visited public land mobile network) that does not provide SSF (Service Switching Functions) to this mobile subscriber, comprising the following steps: preparing a USSD or SMS message (2) by the SIM-card (10) or the mobile equipment of said mobile subscriber; sending said USSD or SMS message to an interworking unit (4); preparing an INAP (intelligent network application part) message (5) in said interworking unit (4), which INAP message depends on said signalling message (2) received; sending said INAP message to a SCP (service control point) (7) of the mobile subscriber’s (1) HPLMN (home public land mobile network).
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Method for Providing Intelligent Network Support to a Mobile Subscriber

The invention concerns a method for offering at least some intelligent network (IN) support to subscribers of a telecommunication network roaming in a visited network, as well as new means used for this method.

It is already known that various services such as VPN (Virtual Private Networks) and PNP (Private Numbering Plan) can be provided by intelligent networks. Figure 1 shows a conventional intelligent network. Reference 1 denotes mobile equipment, e.g. a mobile phone, of a mobile subscriber. An identification module, e.g. a SIM-Card, is connected with the mobile equipment for identifying the subscriber in the network. The identification module comprises processing and storage means 100.

The mobile subscriber is registered in his home public land mobile network (HPLMN) and is shown in Figure 1 roaming in a visited network VPLMN, in this case a conventional GSM or UMTS network 3. The network 3 comprises mobile switching center (MSC) 9, denoted as Service Switching Points (SSPs) if they support Service Switching Functions (SSF). A signalling relationship is established between the SSFs and a Service Control Function (SCF) in a central platform 7, usually denoted as a Service Control Point (SCP) and managed by the operator of the HPLMN of the mobile subscriber. The signalling between the SSP and the SCP may use, for example, INAP messages (intelligent network application part). The execution of the service (for example the parameters of a call setup) is remotely controlled by service logic running in the central SCP 7.

In the prior art, intelligent network services are invoked and interacted with by means of the service switching functions and trigger conditions in the service profiles in the switches 9. In a GSM or UMTS mobile network this technology is denoted as Customised Application Mobile service Execution Logic (CAMEL).

This prior art solution has the following disadvantages for subscribers of a HPLMN roaming in a visited network VPLMN:
- The intelligent network services can only be invoked if the VPLMN-operator has provided the SSF infrastructure with the associated large amount of processing power and memory required in that infrastructure. Currently, many network operators do not provide service switching functions in the switches. Consequently, even if there is a roaming agreement between the HPLMN and the VPLMN, it is usually not possible to invoke IN-services from a visited network.

- The direct access to the VPLMN infrastructure will require sophisticated commercial agreements and solutions for the security between the HPLMN and the VPLMN.

It is one goal of the invention to provide for a new method for providing IN Support to users of a telecommunication network, especially to subscribers of a telecommunication network roaming in a foreign network, that overcomes at least some of the drawbacks of the prior art methods.

According to the invention, these goals are achieved by a method comprising all the features of claim 1.

In a preferred embodiment, these goals are achieved by using standard signalling messages in the visited network and using service logic running in the mobile equipment or in the SIM card of the subscriber.

The mobile equipment can be a mobile phone, a palmtop, a PDA, etc., or just a smart card also used for identifying a subscriber in a telecommunication or computer network.

In a preferred embodiment, the telecommunication network is a GSM or UMTS network, the signalling messages are standard USSD or SMS messages, and the service logic is running in a mobile phone or in the SIM-Card of the user, according to the SIM Application Toolkit (GSM 11.14).

The invention will be better understood with the help of the following description of a preferred embodiment and of the annexed drawings that show:
Figure 1 a prior art intelligent network.

Figure 2 an intelligent network according to the invention.

The figure 2 shows the main components of an IN-network according to a preferred embodiment of the invention; identical features are denoted with the same references in Figures 1 and 2.

According to the invention, at least a subset of the service switch functions (SSF) usually performed by the switches 9 is performed in the mobile equipment 1 and/or in the SIM-card 10 of the mobile subscriber. The relevant information of the dialogue (e.g. of the INAP dialogue) between the SSP 9 and the SCP 7 is mapped in short data messages, e.g. in SMS (short message system), USSD (unstructured supplementary services data), GPRS or IP messages, 2, 8 exchanged between the mobile equipment 1 or the chip-card 10 and an interworking unit 4 managed by the operator of the HPLMN. The interworking unit 4 acts as a service switching point SSP, and interacts with a central platform 7, e.g. with a SCP or with any service control platform (e.g. Java-based servers, Webservers, Corba platform, etc.). The interworking unit can be implemented physically in the same server as the central platform 7 or in another server.

This invention can be used to provide any kind of services to the subscriber, but more specifically for services of the Intelligent Network service type (e.g. for Private Numbering Plans).

A software module in the SIM-Card 10 (e.g. a GSM-Card with the SIM Application Toolkit, or a JAVA or OpenCard Identification Card) and/or in the Mobile Equipment 1 (e.g. in a Java terminal) recognises some events generated by the subscriber or in the network 3. The invention does not depend on the kind of events being intercepted; the software module can, for example, intercept specific digits being dialled, specific patterns in the digits, specific keyboard buttons selected on the user interface, digits dialled during a call, selection of a menu point, busy or unanswered calls, etc. The software module
can by example detect from the pattern of the dialled digits (e.g. if only 4 or 5
digits are dialled) that the call is directed to a virtual private number VPN.

If the software module recognises that the intercepted event
5 corresponds to a SSF function not supported by the visited network (VPLMN) or
by the responsible MSC in the HPLMN, it sends a message, e.g. a SMS or
USSD data message, or a GPRS or IP-packet, to an interworking unit 4,
requesting a specific service – e.g. a translation of the dialled number. The
interworking unit 4 acts as a SSP and sends an initial message 5 to a central
platform, e.g. to the SCP 7, in the HPLMN of the mobile subscriber. The SCP 7
10 replies – among others – with a message 6 containing the requested
information or service, e.g. the translated number. Messages between the
interworking unit 4 and the SCP 7 can be exchanged according to the INAP
protocol, or to any adapted protocol, e.g. RMI, CORBA, HTTP, XML, etc.

Before preparing and sending a signalling message 2 to the
interworking unit 4, the software module in the SIM-card 10 or in the mobile
equipment 1 can check the temporary location information stored in the SIM-
card. A signalling message is sent only if said temporary location information
indicates that the mobile subscriber is not registered with a network providing
SSP 9 and a commercial agreement with the HPLMN of the mobile subscriber.
In a various embodiment, a signalling message is prepared in any case when
some events are detected, even if the mobile subscriber is registered in his
HPLMN. In still another embodiment, a signalling message is sent only if the
location information stored in the SIM-card 10 indicates that the mobile
subscriber 1 is registered with his HPLMN or with a VPLMN registered in a list
stored in said SIM-card, wherein said list contains the mobile network codes of
at least a subset of all networks providing service switching functions to the user
of the SIM-card.

The interworking unit 4 receives the message 6 from the SCP 7,
extracts the relevant information from that message (e.g. a translated number),
30 and sends this information to mobile equipment 1 and/or to the SIM Application
in the SIM-card 10 via a short message 8 (USSD, SMS, GPRS or IP). The
mobile equipment 1 (possibly so instructed by the SIM-Card 10) then performs the desired function, e.g. sets up a call to the translated number.

In order to keep the protocol between the interworking unit 4 and the Service Control Function correct, the interworking unit simulates the SSP 9, and signals to the SCP 7 a termination of the call.

Thus, the provider of the HPLMN can extend VPN and other IN-Services to VPLMNs that do not yet support CAMEL or SSF.
Claims

1. Method for providing intelligent network support to a mobile subscriber (1) roaming in a VPLMN (visited public land mobile network) that does not provide SSF (Service Switching Functions) to this mobile subscriber, comprising:

   detecting a mobile subscriber or network generated event;

   preparing a signalling message (2) by the SIM-card (10) or by a function in the mobile equipment of said mobile subscriber;

   sending said signalling message to an interworking unit (4);

   preparing one or several messages (5) in said interworking unit (4), which messages depend on said signalling message (2) received;

   sending said messages to a SCP (service control point) (7) of the mobile subscriber’s HPLMN (home public land mobile network).

2. Method according to claim 1, wherein said messages prepared in said interworking unit (4) are INAP messages (intelligent network application part).

3. Method according to claim 1, wherein said messages prepared in said interworking unit (4) are CORBA messages.

4. Method according to claim 1, wherein said messages prepared in said interworking unit (4) are RMI messages.

5. Method according to claim 1, wherein said messages prepared in said interworking unit (4) are HTTP messages.

6. Method according to claim 1, wherein said messages prepared in said interworking unit (4) are XML messages.
7. Method according to one of the preceding claims, wherein said
signalling messages (2) are USSD (unstructured supplementary services data)
messages.

8. Method according to one of the claims 1 to 6, wherein said
signalling messages (2) are SMS (short message service) messages.

9. Method according to one of the claims 1 to 6, wherein said
signalling messages (2) are GPRS messages.

10. Method according to one of the claims 1 to 6, wherein said
signalling messages (2) are IP (internet protocol) packets.

11. Method according to one of the preceding claims, wherein said
interworking unit (4) sends signalling messages (8) to said mobile subscriber
(1).

12. Method according to the preceding claim, wherein at least some
signalling messages (8) sent by said interworking unit (4) depend on messages
(6) received from said SCP (7).

13. Method according to one of the preceding claims, characterised
in that said interworking unit can signal to said SCP some events other than
said mobile subscriber or network generated events.

14. Method according to the preceding claim, characterised in that
said interworking unit signals to said SCP (7) the termination of a call from said
mobile subscriber.

15. Method according to one of the preceding claims, wherein said
SIM-card (10) or mobile equipment recognises when a request for call
establishment should be directed to a SCP (7).

16. Method according to the preceding claim, comprising:
intercepting events generated by the mobile subscriber;

recognising when the call is directed to a virtual private number;

preparing and sending a signalling message (2) containing said number to said interworking unit (4).

17. Method according to the preceding claim, characterised by recognising that the call is to a virtual private number when only a predefined number of digits are dialled.

18. Method according to the preceding claim, characterised by recognising that the call is to a virtual private number when a specific pattern of digits is dialled.

19. Method according to one of the preceding claims, characterised by checking the temporary location information stored in the SIM-card (10) before preparing and sending a signalling message (2) to said interworking unit (4).

20. Method according to the preceding claim, characterised by checking if said temporary location information indicates that the mobile subscriber is registered with a PLMN (public land mobile network) providing SSP (service switching points) (9) and a commercial agreement with the HPLMN of the mobile subscriber.

21. Method according to one of the preceding claims, wherein said mobile subscriber or network generated events are detected in the SIM-card (10) of the mobile subscriber.

22. Method according to one of the preceding claims, wherein said mobile subscriber or network generated events are detected in the mobile equipment (1) of the mobile subscriber.
23. Method according to one of the preceding claims, wherein said signalling messages (2) are prepared by the SIM-card (10) of the mobile subscriber.

24. Method according to one of the claims 1 to 22, wherein said signalling messages (2) are prepared by the mobile equipment (1) of the mobile subscriber.

25. Processing means (4,7) for providing intelligent network support to mobile subscribers, comprising an interworking unit (4) for receiving signalling messages (2) sent from mobile subscribers roaming in a VPLMN and for preparing one or several messages (5), which messages depend on said signalling message (2) received, and for sending said messages to a SCP (service control point) (7) of the mobile subscriber’s HPLMN (home public land mobile network).

26. Processing means according to claim 25, wherein the service logic in said SCP (7) provides a service depending on said signalling messages (2) received.

27. Processing means according to claim 25 or 26, wherein said signalling messages are USSD (unstructured supplementary services data) messages (2).

28. Processing means according to claim 25 or 26, wherein said signalling messages are SMS (short message system) messages (2).

29. Processing means according to claim 25 or 26, wherein said signalling messages are GPRS messages.

30. Processing means according to claim 25 or 26, wherein said signalling messages are IP (internet protocol) packets.
31. Processing means according to one of the claims 25 to 30, wherein said messages prepared in said interworking unit (4) are INAP messages.

32. Processing means according to one of the claims 25 to 30, wherein said messages prepared in said interworking unit (4) are CORBA messages.

33. Processing means according to one of the claims 25 to 30, wherein said messages prepared in said interworking unit (4) are RMI messages.

34. Processing means according to one of the claims 25 to 30, wherein said messages prepared in said interworking unit (4) are HTTP messages.

35. Processing means according to one of the claims 25 to 30, wherein said messages prepared in said interworking unit (4) are XML messages.

36. Processing means according to one of the claims 25 to 30, wherein said SCP (7) and said interworking unit (4) are on the same server.

37. Processing means according to one of the claims 25 to 36, wherein said interworking unit (4) can send signalling messages (8) to a mobile subscriber (1) in a VPLMN.

38. Processing means according to the preceding claim, wherein said interworking unit (4) can translate messages (6) received from said SCP into signalling messages (8) sent to said mobile subscriber.

39. Processing means according to one of the claims 25 to 38, wherein said interworking unit (4) can signal to said SCP some events other than said mobile subscriber or network generated events.
40. Processing means according to the preceding claim, characterised in that said interworking unit signals to said SCP (7) the termination of a call from said mobile subscriber.

41. SIM-card (10) which can be used with mobile equipment in a PLMN (3) (public land mobile network) for identifying mobile subscribers (1), comprising a processor (100) for emulating at least one subset of service switching functions.

42. SIM-card which can be used with mobile equipment in a PLMN (public land mobile network) (3) for identifying mobile subscribers (1), comprising a processor (100) that can recognise when intelligent network support is requested and in that case prepare and send a signalling message (2) to processing means in the PLMN (4,7).

43. SIM-Card according to the preceding claim, wherein said signalling messages are SMS messages.

44. SIM-Card according to the preceding claim, wherein said signalling messages are USSD messages.

45. SIM-Card according to the preceding claim, wherein said signalling messages are GPRS messages.

46. SIM-Card according to the preceding claim, wherein said signalling messages are IP-packets.

47. SIM-card according to one of the claims 42 to 46, wherein said processor (100) can intercept the call digits selected by the mobile subscriber, recognise when the call is directed to a VPN (virtual private number), and then prepare and send a said signalling message (2) to said processing means (4,7).

48. SIM-card according to the preceding claim, wherein said processor (100) can recognise that the call is directed to a VPN when only a limited number of digits are dialled.
49. SIM-card according to the claim 47, wherein said processor (100) can recognise that the call is directed to a VPN when a specific pattern of digits is dialled.

50. SIM-card according to one of the claims 42 to 49, wherein a said signalling message (2) is prepared and sent only if the PLMN visited by the subscriber does not provide the service switching function requested.

51. SIM-card according to the preceding claim, wherein a signalling message (2) is prepared and sent to said processing means (4+7) only if the temporary location information stored in the SIM-card (10) meets certain criteria.

52. SIM-card according to the preceding claim, wherein a signalling message is not prepared and not sent to said processing means (4+7) if said temporary location information indicates that the mobile subscriber (1) is registered with his HPLMN or with a VPLMN registered in a list stored in said SIM-card.

53. SIM-card according to the preceding claim, wherein said list contains the mobile network codes of at least a subset of all networks providing service switching functions to the user of the SIM-card.

54. Mobile equipment for use in a PLMN (public land mobile network) (3) for identifying mobile subscribers (1), comprising means for recognising when intelligent network support is requested and in that case for preparing and sending a signalling message (2) to processing means in the PLMN (4,7).

55. Mobile equipment according to the preceding claim, wherein said signalling messages are SMS messages.

56. Mobile equipment according to the preceding claim, wherein said signalling messages are USSD messages.
57. Mobile equipment according to the preceding claim, wherein said signalling messages are GPRS messages.

58. Mobile equipment according to the preceding claim, wherein said signalling messages are IP-packets.

59. Mobile equipment according to one of the claims 54 to 58, which can intercept the call digits selected by the mobile subscriber, recognise when the call is directed to a VPN (virtual private number), and then prepare and send a said signalling message (2) to said processing means (4,7).

60. Mobile equipment according to the preceding claim, which can recognise that the call is directed to a VPN when only a limited number of digits are dialled.

61. Mobile equipment according to the claim 59, which can recognise that the call is directed to a VPN when a specific pattern of digits is dialled.

62. Mobile equipment according to one of the claims 54 to 61, wherein a said signalling message (2) is prepared and sent only if the PLMN visited by the subscriber does not provide the service switching function requested.

63. Mobile equipment according to the preceding claim, wherein a signalling message (2) is prepared and sent to said processing means (4+7) only if the temporary location information stored in a SIM-card (10) in said mobile equipment (1) meets certain criteria.

64. Mobile equipment according to the preceding claim, wherein a signalling message is not prepared and not sent to said processing means (4+7) if said temporary location information indicates that the mobile subscriber (1) is registered with his HPLMN or with a VPLMN registered in a list stored in said SIM-card.
65. Mobile equipment according to the preceding claim, wherein said list contains the mobile network codes of at least a subset of all networks providing service switching functions to the user of the SIM-card.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
  IPC 6  H04Q7/24  H04Q7/32

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 6  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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>WO 98 25426 A (CHOTA/SUNIL; BRITISH TELECOMM (GB); CLAPTON ALAN JAMES (GB)) 11 June 1998 see page 6, line 10 - page 7, line 19 see page 8, line 10 - line 20</td>
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Data of the actual completion of the international search

17 May 1999

Data of mailing of the international search report

07/06/1999

Name and mailing address of the ISA
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