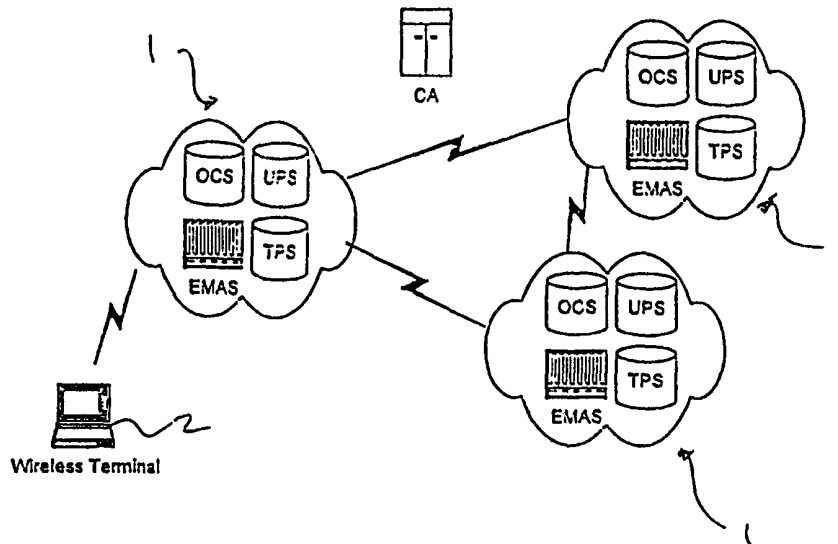




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<p>(21) International Application Number: PCT/SG98/00106 (22) International Filing Date: 21 December 1998 (21.12.98)  (71) Applicant (for all designated States except US): KENT RIDGE DIGITAL LABS [SG/SG]; 21 Heng Mui Keng Terrace, Singapore 119613 (SG).  (72) Inventor; and (75) Inventor/Applicant (for US only): LEE, Kok, Seng [SG/SG]; No 22 Yio Chu Kang Road #04-08, Singapore 545535 (SG).  (74) Agent: GREENE-KELLY, James, Patrick; Lloyd Wise, Tanjong Pagar, P.O. Box 636, Singapore 910816 (SG).</p>	<p>(81) Designated States: CA, JP, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i></p>	

(54) Title: MOBILE COMMUNICATIONS NETWORK



(57) Abstract

A mobile communications network architecture comprises two networks (1) that have entered into a roaming agreement. Individual mobile devices (2) that belong to subscribers of one of the networks are provided with memory means (22) for storing subscriber profile information (70) and a certification key of the network to which it is a subscriber. The other network includes data storage means that includes copies of the certification keys of all networks with which it has roaming agreements (100). Thus by checking the certification key the second network can verify the veracity of the user of the device and from the subscriber profile information may determine the level of service to which the user is entitled. This reduces connection set-up time and allows batch processing of billing information.

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“MOBILE COMMUNICATIONS NETWORK”

This invention relates to a mobile communications network, and in particular to an architecture for such a mobile communications network that provides efficient location management, location updating and paging, in particular when a user of such a network moves between different domains.

As the popularity and use of mobile wireless communications networks increases, it is increasingly desirable that a subscriber to one network should also be able to use other networks when not within the service area of his own network. To this end the operators of mobile communications networks in different countries and territories are increasingly signing “roaming” agreements that allow a subscriber to one network to use the services of another network with which the first network has a roaming agreement. In the most obvious cases this allows the owner of a mobile phone, for example, to use that mobile phone when crossing between service providers.

Such roaming agreements inevitably, however, raise a number of technical issues, in particular with regard to location management, location updating and paging. For example, when a subscriber to one network (his “home” network) registers with a second network (the “visited” network) and wishes to place a call, the visited network must first contact the home network to determine the authenticity of the subscriber and the service level to which the subscriber is entitled. This must be done before a call can be placed and therefore this can introduce a delay in connection time, and if this delay starts to become very long (more than 10 seconds say) this delay can become very inconvenient and irritating to a subscriber.

A further difficulty is that with conventional networks, the visited network must bill the home network for the subscriber’s use of the visited network’s services in real time as the subscriber makes a call otherwise it is very difficult for the home network to confirm the veracity of the charges of the visited network. This imposes a realtime demand on the billing information which is undesirable.

The presence of the subscriber in another network inevitably also introduces paging difficulties when that user wishes to place a call to a third party in the home network (or indeed in any other network).

5 With current usage levels of mobile communication networks none of these problems are insurmountable using conventional technologies. However the usage and traffic flow in mobile communications networks is expected to increase dramatically in the near future, especially with the introduction of so-called third generation mobile phones which are capable of both voice and data transmissions. Indeed it will be understood that while for convenience in this specification the  
10 invention may be described with particular reference to mobile phones and voice transmissions, the invention extends to mobile communications networks that carry voice and/or data transmissions, or indeed other forms of transmissions such as video and multimedia transmissions.

An examples of prior art proposals for dealing with location management may  
15 be seen in US 5519706. US 5519706 describes a dynamic user registration method within a mobile communications network in which as mobile stations move from one cell to another within a network they are dynamically registered (and deregistered) by the use of a local identifier unique to each mobile station. This method, however, only deals with location management within multiple cells of a single network and does  
20 not provide any mechanism for location management when roaming between networks.

It is an object of the present invention to provide a mobile communications network architecture that at least mitigates some of the above mentioned problems in order, for example, to minimise connection delay, reduce the realtime billing  
25 requirements, and to facilitate paging.

According to the present invention therefore there is provided a mobile communications network architecture, comprising:

- (a) a first network,
- (b) a second network, and
- 30 (c) a mobile communications device,

wherein said mobile communications device is provided with memory means for storing certified subscriber profile information and a certification key of said first network, and wherein said second network includes data storage means that stores copies of the certification keys of all networks with which said second network has a  
5 roaming agreement and said second network further comprises means for comparing the certification key stored in said memory means with the keys stored in said second network data storage means.

By means of this arrangement when a subscriber attempts to make a call while within a second (ie a visited) network, it is not necessary for the visited network to  
10 firstly immediately contact the first (ie the home) network to confirm the authenticity of the subscriber and to determine the level of service to which the subscriber is entitled. Instead certified subscriber information is stored in the memory of the mobile communication device and may be transmitted directly to the second network and the authenticity of this information may be verified by the second network  
15 because also included is a certification key issued by the first network. The second network will store details of all certification keys of other networks with which it has entered into a roaming agreement and thus all the second network need do is to verify the certification held in the mobile device by using the public key held by the second network to confirm that the profile is authentic and unchanged since it was signed by  
20 the private key of the first network. Thus connection set-up time is reduced. Means are also preferable provided for updating the public keys stored in the data storage means in the event of any changes to the keys being made.

The inclusion in the mobile communications device of memory means for storing authenticated subscriber profile information permits a number of significant  
25 advantages over the prior art. For example, the second network will be constantly aware of all subscribers to the first network who are currently in its domain. The cost of the services provided by the second network to these subscribers of the first network can be easily logged and then supplied to the first network at a later time on a daily or weekly basis. This permits batch processing rather than real-time  
30 processing of the provision of billing information between networks.

In a preferred embodiment therefore the second network includes means for logging billing information concerning the use of the services of the second network by a subscriber of the first network, and means for supplying said billing information to said first network on a batch processing basis.

5 In another embodiment the second network may comprise endorsing means whereby when a mobile device of a subscriber of the first network is authenticated by the second network, said endorsing means may send an endorsement certificate to said mobile device and said endorsement certificate may be stored in said memory means, and wherein said mobile device comprises means for transmitting any said  
10 endorsement certificates to any network with which said mobile device wishes to register.

In this embodiment when a device logs on to a network to which it is not a subscriber and that network confirms that it is authentic and has a degree of “trustworthiness” this may be recorded in the mobile device as an endorsement by the  
15 network. When the mobile device later wishes to register with further networks this endorsement by the second network can be read by those further networks and the more endorsements the mobile device has can be used as a measure of confidence in the authenticity of that mobile device.

In another preferred embodiment the memory means may also include  
20 information concerning the most recent called and/or calling devices and means for supplying this information to the second network, and wherein said second network includes means for pre-locating mobile devices corresponding to said called and/or calling numbers.

In another possibility the memory means may also include information  
25 concerning the most frequently called and/or calling devices and means for supplying this information to the second network, and wherein said second network includes means for pre-locating mobile devices corresponding to said called and/or calling numbers.

By means of this arrangement the mobile communications device can provide  
30 the second network with information concerning the most frequently or most recently called or calling numbers and the network can pre-locate and pre-fetch these

numbers by constantly locating them. This further reduces the connection time, especially where the number being pre-fetched corresponds to a subscriber located in another network.

5 The number of the most recently or most frequently called and/or calling numbers that is stored in the memory means may be decided either by the network (for example based upon the service subscription level of the user) or by the user of the mobile device. In effect the number of most recently or most frequently called and/or calling numbers is negotiated between the user and the network.

10 The pre-fetching of previously called numbers or previously calling numbers may also be advantageous within a single network not only when roaming between networks.

Accordingly the present invention also extends to a mobile communications network architecture comprising at least one base station and a plurality of mobile communication devices, each said base station having at any given time a number of said mobile devices in wireless communication therewith and defining a cell, wherein each said wireless communication device comprises memory means for storing information concerning recently called and/or calling devices and means for transmitting said information to said base station, and wherein said base station comprises means for pre-locating said recently called and/or calling devices.

20 According to another aspect the present invention extends to a mobile communications network architecture comprising at least one base station and a plurality of mobile communication devices, each said base station having at any given time a number of said mobile devices in wireless communication therewith and defining a cell, wherein each said wireless communication device comprises memory means for storing information concerning frequently called and/or calling devices and means for transmitting said information to said base station, and wherein said base station comprises means for pre-locating said recently called and/or calling devices.

30 In either of these aspects of the invention, the number of most recently and/or most frequently called and/or calling numbers that is stored in the memory means may be selected either by the network or by the user or may be negotiated between the user and the network.

Some embodiments of the present invention will now be described by way of example and with reference to the accompanying drawings, in which:-

5 Fig.1 is a schematic representation of three communications network that have roaming agreements with each other,

Fig.2 illustrates schematically the structure of a mobile communications device for use in an embodiment of this invention,

Fig.3 illustrates the structure of the memory of the mobile device of Fig.2, and

Fig.4 illustrates the structure of the memory storage of a network.

10 Referring firstly to Fig.1 there is shown schematically a mobile communications network architecture according to an embodiment of the invention. In this embodiment it is assumed that there exist a number of separate wireless communication networks 1, but at least two, which are in communication with each other. A mobile communication device 2 is a device able to communicate through  
15 these networks 1 and which has a greater processing power and memory than a conventional voice cellular telephone. A mobile device 2 may be a voice only telephone, or it may be a computer for data transmission, or it may be a hybrid device capable of voice and/or data transmission.

In the following description it should be understood that the mobile device 2  
20 is owned or leased by a subscriber to a first one of the networks 1. The first network may offer the subscriber a range of services in accordance with the subscription plan paid for by the subscriber. These services may include basic voice and/or data transmission, and additional services such as call forwarding, call waiting, conferencing and others as may be conventional.

25 Fig.2 shows schematically the structure of a mobile communications device 2 in accordance with an embodiment of this invention at least in so far as the structure of the mobile device 2 differs from the prior art conventional devices. As can be seen from Fig.2 the mobile device 2 comprises a central processing unit 20, signal transmitting/receiving means 21 and memory means 22. Memory means 22 may  
30 comprise a random access memory (RAM) chip or a combination of RAM memory and read-only memory (ROM) as will be described below. Fig.3 shows schematically



how this memory means 22 may be structured. Memory means 22 is divided into four sections as follows: subscriber profile information 70 which is signed by a home network certification key; network endorsement signatures 80 from other operators; details of the last n calls made by the subscriber 90; and details of the subscribers n most frequent called numbers 100. Call information 90,100 and network endorsement information 80 will normally require regular updating and possible changes should be made in RAM. Subscriber profile information 70 and home network certification key may be provided in RAM or may be provided in tamper-proof ROM to prevent unauthorised tampering with the data. If provided in RAM the subscriber profile information 70 and the certification key may be encrypted or otherwise protected from unauthorised tampering by any conventional means.

Subscriber profile information 70 includes data identifying the subscriber and the level of services to which the subscriber is entitled. This data is stored in the memory means by the home network when the subscriber first joins the home network. The home network also at the same time as it writes the subscriber profile information 70 into the memory means also writes in a unique certification key or signature belonging to the home network and which confirms the authenticity of the subscriber profile information 70.

Call information 90,100 stores data concerning the identity of the most recently called numbers and of the most recent calling numbers. Up to ten called and ten calling numbers, for example, may be stored and in practice this is likely to be sufficient to cover a subscriber's most frequently called numbers since research shows that only a small number of other devices are ever called on a regular frequent basis. This information can be used to "pre-fetch" frequently dialed numbers as will be described further below. Endorsement information 80 is used to store endorsements received from networks other than the home network confirming the authenticity of the subscriber as will also be described in greater detail below.

Referring to Fig.1 it will be seen that each network 1 may include an operator certificate server (OCS), a user profile server (UPS), a transient profile server (TPS), and a communication switch. In addition all networks may be in communication with a certificate authority (CA).

In operation of the invention a subscriber to one mobile communications network, for example a network in Singapore, will be entitled to a level of service from that network which will depend on the subscription plan chosen and paid for by the subscriber. In addition the Singapore network will normally have entered into  
5 roaming agreements with other networks, for example a network in Hong Kong, whereby a subscriber to the Singapore network can use his mobile device when outside of Singapore and within the domain of another network such as one in Hong Kong. In such a situation the Singapore network is the "home" network while the Hong Kong network may be thought of as a "visited" network.

10 Within the subscriber profile area 70 of the memory means is stored data that identifies the subscriber and the level of service to which the subscriber is entitled. When the subscriber is in Hong Kong and the mobile device is switched on, this subscriber profile data is transmitted by the transmitting means 21 to the Hong Kong network together with the certification key of the Singapore network which is stored  
15 in memory area 70. The Hong Kong network includes a database bearing all the public signature keys preferably of all mobile network operators in the world, but at least the keys of those networks with which the Hong Kong network has entered into a roaming agreement. Means may be provided for updating this database as and when certification keys are changed by the networks and/or when new roaming agreements  
20 are entered into. The Hong Kong network also includes means for comparing the certification key transmitted by the mobile device with those stored in the network's database.

Each network 1 will also include a memory storage area and Fig.4 schematically illustrates how the memory storage of the network 1 is structured. A  
25 first part 100 of the memory stores copies of the public keys of all mobile network operators. Two areas of the memory store respectively data on the last n calls for each user 110, and the n most frequent calls for each user 120, and a final part of the memory storage includes a billing store 130 for each user. The subscribers call information 110,120 is constantly updated from individual subscribers.

30 If the Hong Kong network verifies that the certification key transmitted by the mobile device 2 is the same as a certification key in the database for a network with

which the Hong Kong network has entered into a roaming agreement, then the Hong Kong network will immediately offer services to the mobile device 2 in accordance with the level of service indicated in the subscriber profile information transmitted to the Hong Kong network by the mobile device 2. There is no need for the Hong Kong network to check the identity and authenticity of the mobile device in realtime with the Singapore network. Thus a user of the mobile device 2 will experience reduced connection time.

Other information which might be transmitted as subscriber profile data might be a time expiry date beyond which the subscriber is not entitled to access network services. In addition all networks 1 may be in communication with a central certification authority (CA). One role of the CA is to receive information from home networks advising that certain subscribers are no longer entitled to receive services – for example as a consequence of non-payment – and then to supply this information to all networks 1. A further role for the CA is to update the public keys stored by all mobile operators.

When a subscriber uses the services of a visited network, in this example the Hong Kong network, the Hong Kong network will log the services used by the subscriber. This is then used to generate billing information for transmission to the home network, in this case the Singapore network. There is no need, however, for this billing information to be sent immediately in realtime. Instead the information can be accumulated in the billing store 130 and then sent as batch processing at any convenient time, eg one a day. This is as a consequence of the trustworthiness established by the certified profile. It will be appreciated that in this way the Hong Kong network can collect billing information relating to all Singapore subscribers who are currently within and using the Hong Kong network and send this billing information as a single batch.

Once a subscriber to one network, eg Singapore, has obtained access to another network, eg Hong Kong, and that second network has decided that the subscriber is genuine and trustworthy by a set of criteria that the second network may choose, the second network may send to the mobile device 2 an endorsement signal which is recorded in the endorsement area 80 of the memory means. The endorsement

signal will include the unique certification key of the endorsing network. When the subscriber later wishes to access further networks, in addition to transmitting the subscriber profile information 70 the mobile device 2 may transmit to the new network the contents of the endorsement information area 80. In this way as a  
5 subscriber moves from network to network he will acquire a number of endorsements and these may be used by further networks as a measure of the authenticity of the subscriber.

The recent called/calling number memory area 90/100 stores information of the last ten called numbers, and the last ten received numbers. It will be understood  
10 here that ten is only an exemplary number and fewer or more numbers may be stored. However, research indicates that most users of mobile communication devices in fact only frequently call a small number of numbers: family members and office numbers for example. Thus storing the ten last called numbers or the ten last calling numbers will normally capture all the numbers that a subscriber is most like to want to call.  
15 This information may then be transmitted to the network 1 that the subscriber is within and the network 1 may then pre-locate these numbers in advance of any call being made by the subscriber. This means that if the subscriber makes a call to one of these numbers the connection time is significantly reduced since the numbers have been "pre-fetched". It should be noted here that while this feature is particularly  
20 useful when the subscriber is visiting another network (since the commonly called numbers are then likely to be in the home network), it could also be applied with benefit when the subscriber is in his own home network.

It should also be noted that the number of "pre-fetched" numbers may be negotiated, preferably in a non-intrusive manner, between the subscriber and the  
25 network. For example a user interface may be provided that shows to a user the number of numbers currently "pre-fetched" and which may allow a subscriber to set the number of pre-fetched numbers between zero and a predetermined maximum. Alternatively the number pre-fetched may be set automatically depending on the level of the particular subscription plan that a user has.

CLAIMS

1. A mobile communications network architecture, comprising:
  - (a) a first mobile communications network,
  - (b) a second mobile communications network, and
  - 5 (c) a mobile communications device,wherein said mobile communications device is provided with memory means for storing certified subscriber profile information and a certification key of said first network, and wherein said second network includes data storage means that stores  
10 copies of the certification keys of all networks with which said second network has a roaming agreement and said second network further comprises means for comparing the certification key stored in said memory means with the keys stored in said second network data storage means.
  
2. A mobile communications network architecture as claimed in claim 1 wherein  
15 said subscriber profile information includes subscriber identity information and information concerning the communications services to which the subscriber is entitled.
  
3. A mobile communications network architecture as claimed in claim 1 or 2  
20 wherein said subscriber profile information includes time expiry data.
  
4. A mobile communications network architecture as claimed in any of claims 1 to 3 wherein means are provided for updating the certification keys stored in said data  
25 storage means.
  
5. A mobile communications network architecture as claimed in any preceding claim wherein the second network includes means for logging billing information concerning the use of the services of the second network by a subscriber of the first network in a given time period, and means for supplying said billing information to  
30 said first network on a batch processing basis.

6. A mobile communications network architecture as claimed in claim 5 wherein said second network supplies comprises means for logging billing information concerning the use of the services of the second network by all subscribers of the first network that are attached to said second network during a given time period, and  
5 means for supplying said billing information to said first network on a batch processing basis.

7. A mobile communications network as claimed in any preceding claim wherein the second network comprises endorsing means whereby when a mobile device of a  
10 subscriber of the first network is authenticated by the second network, said endorsing means sends an endorsement certificate to said mobile device and said endorsement certificate is stored in said memory means, and wherein said mobile device comprises means for transmitting any said endorsement certificates stored in said memory means to any third network with which said mobile device wishes to register.

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8. A mobile communications network as claimed in any preceding claim wherein the memory means also stores information concerning the most recent called and/or calling devices and the mobile device has means for supplying this information to the second network, and wherein said second network includes means for pre-locating  
20 mobile devices corresponding to said called and/or calling numbers.

9. A mobile communications network as claimed in any preceding claim wherein the memory means also stores information concerning the most frequently called and/or calling devices and the mobile device has means for supplying this information  
25 to the second network, and wherein said second network includes means for pre-locating mobile devices corresponding to said called and/or calling numbers.

10. A mobile communications network as claimed in claim 8 or 9 wherein the number of most recently or most frequently called and/or calling devices stored in  
30 said memory means is decided by said network based upon a level of service subscribed to by the user of said mobile device.

11. A mobile communications network as claimed in claim 8 or 9 wherein the number of most recently or most frequently called and/or calling devices stored in said memory means is decided by the user of said mobile device.

5

12. A mobile communications network as claimed in claim 8 or 9 wherein the number of most recently or most frequently called and/or calling devices stored in said memory means is negotiated between the user of said mobile device and said network.

10

13. A mobile communications network architecture comprising at least one base station and a plurality of mobile communication devices, each said base station having at any given time a number of said mobile devices in wireless communication therewith and defining a cell, wherein each said wireless communication device comprises memory means for storing information concerning recently called and/or calling devices and means for transmitting said information to said base station, and wherein said base station comprises means for pre-locating said recently called and/or calling devices.

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14. A mobile communications network architecture comprising at least one base station and a plurality of mobile communication devices, each said base station having at any given time a number of said mobile devices in wireless communication therewith and defining a cell, wherein each said wireless communication device comprises memory means for storing information concerning frequently called and/or calling devices and means for transmitting said information to said base station, and wherein said base station comprises means for pre-locating said recently called and/or calling devices.

20

15. A mobile communications network as claimed in claim 13 or 14 wherein the number of most recently or most frequently called and/or calling devices stored in

25  
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said memory means is decided by said network based upon a level of service subscribed to by the user of said mobile device.

16. A mobile communications network as claimed in claim 13 or 14 wherein the  
5 number of most recently or most frequently called and/or calling devices stored in  
said memory means is decided by the user of said mobile device.

17. A mobile communications network as claimed in claim 13 or 14 wherein the  
number of most recently or most frequently called and/or calling devices stored in  
10 said memory means is negotiated between the user of said mobile device and said  
network.

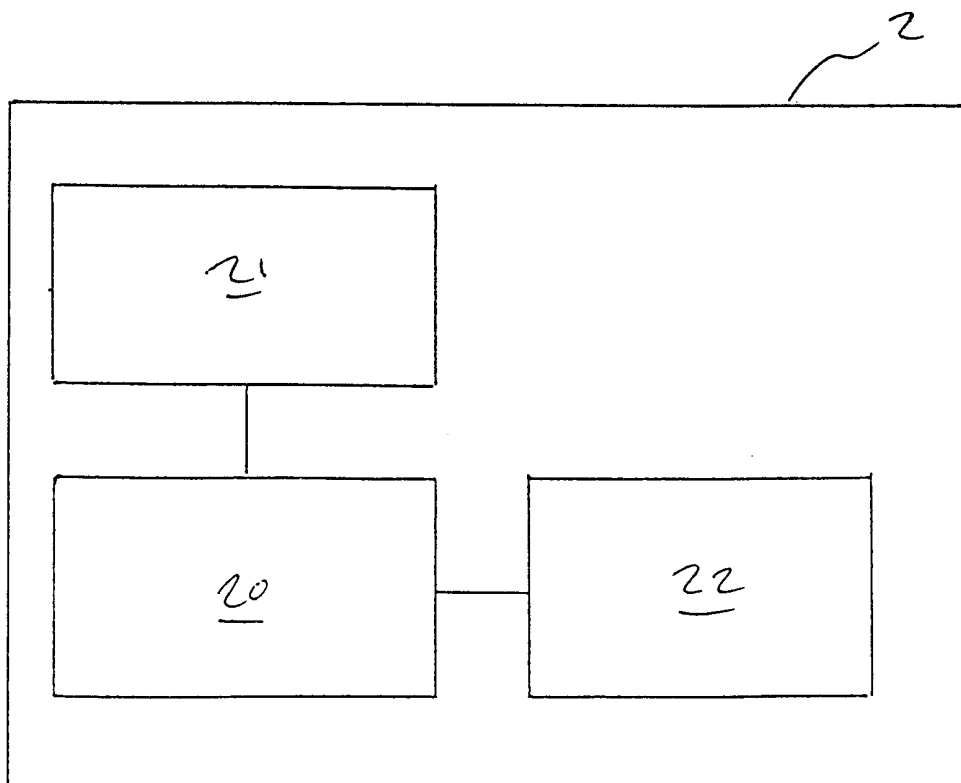
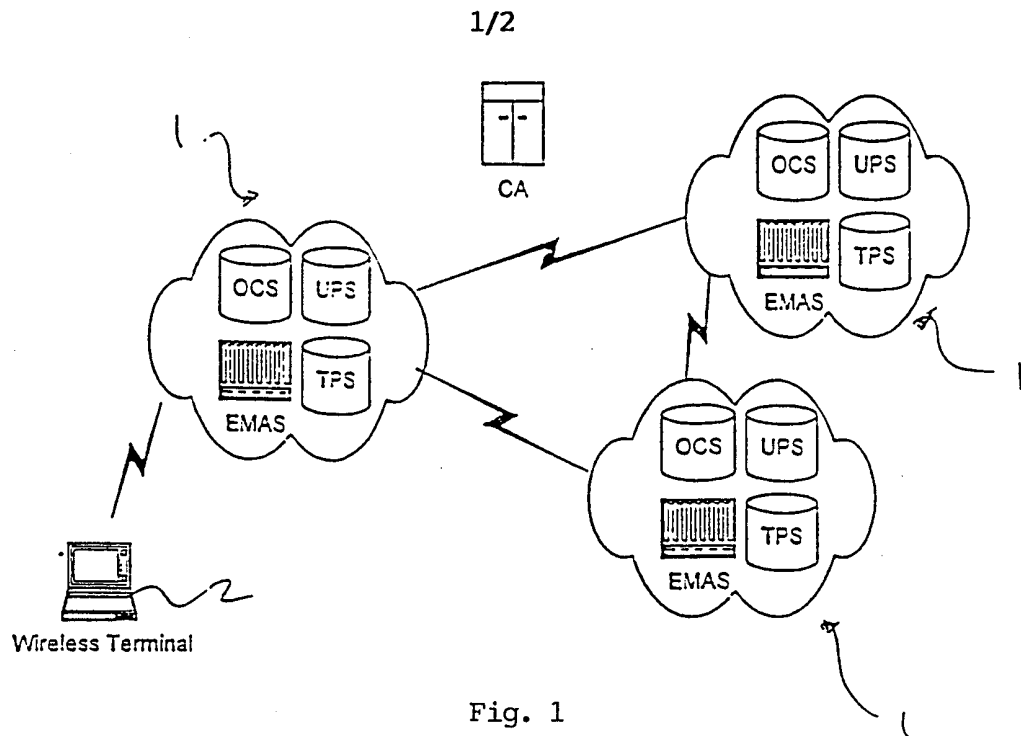
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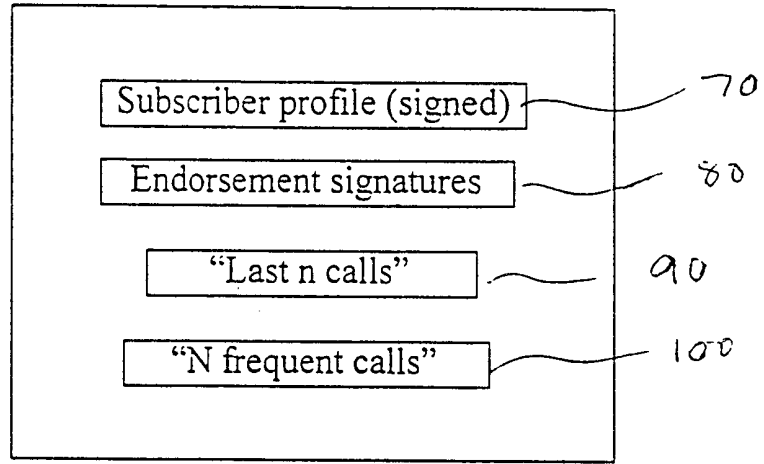


Fig. 3

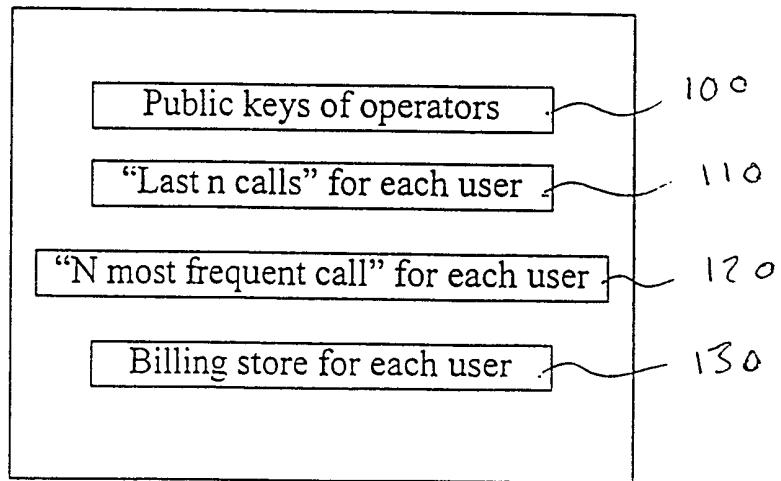


Fig. 4

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/SG 98/00106

<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b></p> <p>IPC<sup>7</sup>: H 04 Q 7/20; H 04 Q 7/32</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>																	
<p><b>B. FIELDS SEARCHED</b></p> <p>Minimum documentation searched (classification system followed by classification symbols)</p> <p>IPC<sup>7</sup>: H 04 Q</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p> <p>WPI</p>																	
<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>EP 0 786 915 A2 (KOKUSAI DENSHIN DENWA), 30 July 1997 (30.07.97), page 2, lines 28-53; page 3, line 27 - page 7, line 43; fig.1-19.</td> <td>1,2</td> </tr> <tr> <td>A</td> <td>WO 96/34 503 A1 (AETHOS COMMUNICATION SYSTEMS et al.), 31 October 1996 (31.10.96), page 1, line 3 - page 3, line 21.</td> <td>1,2</td> </tr> <tr> <td>A</td> <td>WO 98/27 778 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 25 June 1998 (25.06.98), abstract; page 1, line 20 - page 6, line 1.</td> <td>1,2</td> </tr> <tr> <td colspan="3" style="text-align: center;">----</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	EP 0 786 915 A2 (KOKUSAI DENSHIN DENWA), 30 July 1997 (30.07.97), page 2, lines 28-53; page 3, line 27 - page 7, line 43; fig.1-19.	1,2	A	WO 96/34 503 A1 (AETHOS COMMUNICATION SYSTEMS et al.), 31 October 1996 (31.10.96), page 1, line 3 - page 3, line 21.	1,2	A	WO 98/27 778 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 25 June 1998 (25.06.98), abstract; page 1, line 20 - page 6, line 1.	1,2	----		
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<p><input type="checkbox"/> Further documents are listed in the continuation of Box C.      <input checked="" type="checkbox"/> See patent family annex.</p>																	
<p>* Special categories of cited documents:</p> <p>„A“ document defining the general state of the art which is not considered to be of particular relevance</p> <p>„E“ earlier application or patent but published on or after the international filing date</p> <p>„L“ document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>„O“ document referring to an oral disclosure, use, exhibition or other means</p> <p>„P“ document published prior to the international filing date but later than the priority date claimed</p> <p>„T“ later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>„X“ document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>„Y“ document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>„&amp;“ document member of the same patent family</p>																	
<p>Date of the actual completion of the international search</p> <p style="text-align: center;">16 September 1999 (16.09.99)</p>		<p>Date of mailing of the international search report</p> <p style="text-align: center;">22 September 1999 (22.09.99)</p>															
<p>Name and mailing address of the ISA/AT</p> <p>Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200</p>		<p>Authorized officer</p> <p style="text-align: center;">Hajos</p> <p>Telephone No. 1/53424/410</p>															

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG 98/00106

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please see extra sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-12

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SG 98/00106

### BOX II. OBSERVATIONS WHERE THE UNITY OF INVENTION IS LACKING

This ISA found multiple inventions in this international application as follows:

The application contains the following groups of inventions :

Group I: Claims 1-12

Group II: Claims 13-17

Claim 1 relates to a mobile communications network, comprising a first mobile communications network, a second mobile communications network and a mobile communications device, wherein said mobile communications device is provided with memory means for storing certified subscriber profile information and a certification key of said first network, and wherein said second network includes data storage means that stores copies of certification keys of all networks with which said second network has a roaming agreement.

The independent claims 13 and 14 does not comprise these relevant features of the subject-matter of claim 1.

Therefore, the two groups of inventions are not so linked as to form a single general inventive concept.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SG 98/00106

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
EP A2 786915	30-07-1997	EP A3 786915 JP A2 9266594	05-08-1998 07-10-1997
WD A1 9634503	31-10-1996	AU A1 54048/96 GB A0 9508367	18-11-1996 14-06-1995
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