



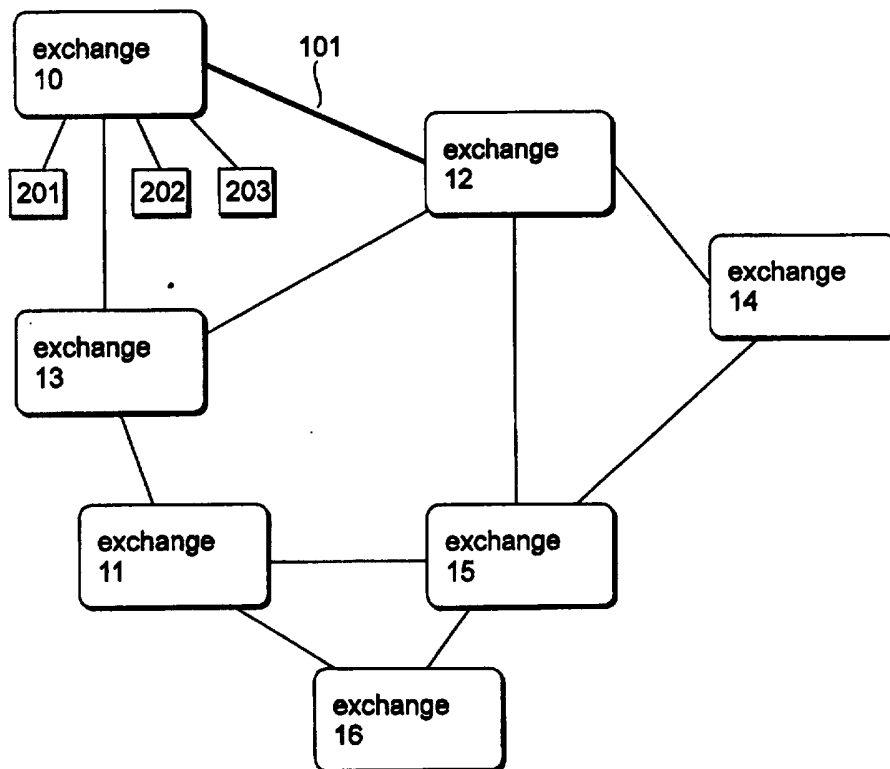
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(54) Title: ESTABLISHING A GROUP CALL IN A MOBILE RADIO SYSTEM

(57) Abstract

A method and mobile radio system for establishing a group call extending to service areas of several exchanges (10, 12, 15, 14, 16) in a mobile radio system comprising at least a first (10) and a second (12) exchange, telecommunication media (101) for establishing communication connections between at least the first and the second exchange, and mobile stations (A-subscriber, B-subscriber) communicating via said exchanges; the method comprising the step of selecting a second exchange (12) to which the group call is routed from the first exchange (10). To save telecommunication resources in a mobile radio system, one checks, before routing the call to the second exchange (12), whether a telecommunication medium (101) has been previously allocated on the connection from the first (10) to the second exchange for the group call to be established, and routes said group call to be established from the first (10) to the second (12) exchange without allocating a new telecommunication medium to that connection, if a telecommunication medium has been previously allocated on that connection for said group call to be established.



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Establishing a group call in a mobile radio system

Field of the invention

5 The invention relates to a method for
establishing a group call extending to service areas of
several exchanges in a mobile radio system comprising
at least a first and a second exchange, tele-
communication media for establishing communication
connections between at least the first and the second
10 exchange, and mobile stations communicating via said
exchanges; the method comprising the step of selecting
a second exchange to which the group call is routed
from the first exchange.

 The invention relates to a mobile radio system
15 in which group calls are to be established between
subscribers that may be located in areas of a plural
number of exchanges.

Background of the invention

20 The invention is intended for use especially
in so-called trunking networks that are typically
company networks or private mobile radio networks used
by authorities, all the channels of such networks being
used by one or more companies or authority
25 organizations. In addition to subscriber numbers, the
subscribers of these networks have group numbers
indicating the group call group or subscriber group
that the subscriber belongs to. This makes it possible
to transmit calls addressed to the members of a certain
30 group to the subscribers of said group.

 The invention is suitable for use in mobile
radio systems having either a digital or an analogue
radio paths. The digital mobile radio systems may
comply e.g. to the TETRA system (Trans European Trunked
35 Radio System). Analogue mobile radio systems are

described e.g. in MPT 1327, *A Signalling Standard for Trunked Private Land Mobile Radio Systems*, January 1988, revised and reprinted November 1991, and MPT 1343, *Performance Specification*, January 1988, revised and reprinted September 1991, both issued by the Radiocommunications Agency, published by the British Department of Trade and Industry.

One essential feature of e.g. the above mobile radio systems is that they allow and are designed for the implementation of a group call between several subscribers.

A group call is a conference call during which all the participants are able to both speak and listen to one another in turns. In group calls, the entire group is called by a single call number. An individual mobile station (e.g. radio phone), or a subscriber station, may belong to several groups programmed in the mobile station. The system contains a file storing information about base stations associated with the number of each group. A group call may cover one, several or all base stations located within the area of a mobile exchange, or several mobile exchanges. To establish a group call, each base station belonging to the group allocates a traffic channel and transmits a group call request containing a group number and information about the traffic channel allocated. If a mobile station identifies the group number contained in the group call request, it switches to the traffic channel indicated by the group call request. In principle, a mobile station is thus always able to enter a group call, if it is located within the predetermined operation area of the group and if the request to enter the call originates in that area.

A group call is usually a characteristic of networks designed for special purposes. Such networks

do usually not comprise many exchanges. Conventionally, the area for setting up a group call has been limited e.g. to the area of one exchange. The problem of establishing a group call in a network of several free-connected exchanges has thus arisen as mobile radio systems have become larger in size and as one has started to establish group calls extending to service areas of several exchanges.

The conventional way of establishing a group call to service areas of several exchanges is to try and route the group call as a whole and not branch it until as close to the destination exchanges as possible.

The known methods for establishing a group call do not offer a routing technique to a free-connected network comprising several exchanges, to the service areas of which a group call is to be established. The methods do not take into account situations where a call must be routed via several exchanges and branched at suitable points. In such cases, the major problem is to find optimal routes and minimize the use of connections and resources.

Fig. 1 shows a mobile radio system of the prior art, illustrating problems involved therein. The figure shows exchanges 10 to 16. To the exchanges are connected base stations, to which in turn are connected mobile stations via a radio path, e.g. an A-subscriber A-SUBSCRIBER, which sends a group call set-up request, and a B-subscriber B-SUBSCRIBER, which is invited to enter the call in addition to the A-subscriber. In the prior art, when a group call is established to service areas of several exchanges, a first exchange 10, which establishes the group call to the service areas of other exchanges 12, 14, 15, 16 by the command of the A-subscriber A-SUBSCRIBER, first establishes the call to

the second exchange 12 and then to the third exchange 15. The first exchange then establishes the call to the fourth exchange 14 and the fifth exchange 16. In the prior art, the first exchange 10 establishing the call first establishes the call to the second exchange 12 and allocates necessary telecommunication resources 101, such as a telecommunication medium, between said exchanges. The first exchange 10 establishing the call then establishes the call to the third exchange 15 e.g. via said second exchange 12 and allocates communication connections for said call from the first exchange 10 to the third exchange 15 via said second exchange 12. One problem here is that telecommunication resources may be allocated twice between the first 10 and second exchange 12 for the group call to be established: first when a call is established to mobile stations located in the service area of the second exchange 12, and second to the mobile stations located in the service area of the third exchange 15 or to other exchanges 16. In fig. 1, the thickness of the lines between exchanges 10, 12, 14, 15 and 16 describing telecommunication buses, resources and media indicates how many telecommunication media are allocated for one and the same group call on the connection concerned. Another problem with a solution like this is that it slows down call set-up, since at least double resources will have to be allocated for a specified call, and so time is wasted on the allocation of 'surplus' resources. Yet another problem is that call set-up may even be hindered if no free telecommunication resource is available between the first 10 and second 12 exchange for a group call to be established to the third exchange 15.

In a star-like network, a group call is easy to establish and the above problem does not arise, since the nodal exchange establishing the group call

routes the call to exchanges that are associated with subscribers belonging to the group. The nodal exchange can then allocate only one speech connection or other telecommunication resource or medium to each exchange requiring such a connection. A star-like network, however, is not suitable for all mobile radio systems, especially not for extensive modern systems.

Description of the invention

One object of the invention is to route a group call in a sensible manner to several subscribers located in service areas of several exchanges such that optimal routes and minimal resources are used.

Another object of the invention is to solve the problems involved in the prior art. In particular, the invention aims at eliminating the problem caused by the fact that when a group call is established to service areas of several exchanges, double or multiple telecommunication resources, such as communication connections or other telecommunication media, may be unnecessarily allocated for one and the same group call between two exchanges.

Yet another object of the invention is to speed and secure group call set-up in a situation where a group call is established in service areas of several exchanges.

A further object is to simplify call set-up in a situation where a group call is to be established to subscribers located in service areas of several exchanges.

This new type of method for establishing a group call extending to service areas of several exchanges is achieved with the method of the invention, which is characterized by comprising the steps of checking, before the call is routed to the second

exchange, whether a telecommunication medium has been previously allocated on the connection from the first to the second exchange for the group call to be established; routing said group call to be established from the first to the second exchange without allocating a new telecommunication medium to the connection if a telecommunication medium has been previously allocated on that connection for the group call to be established.

10 The invention also relates to a mobile radio system for establishing a group call extending to service areas of several exchanges, the mobile radio system comprising at least a first and a second exchange, telecommunication media for establishing communication connections between at least the first and the second exchange, and mobile stations communicating via said exchanges.

15 The mobile station system according to the invention is characterized by comprising check means for checking whether a telecommunication medium has been previously allocated on the connection between the first and the second exchange for the call to be established.

20 The basic idea of the invention is that before a call is routed from the first, call establishing, exchange to the second exchange, one checks whether a telecommunication medium has been previously allocated on the connection from the first to the second exchange for the group call to be established. The group call to be established is then routed from the first to the second exchange without allocating a new telecommunication medium to the connection if a telecommunication medium has been previously allocated on that connection for the group call to be established.

The invention is thus based on a check carried out in allocating resources to connections between exchanges to see whether resources have been previously allocated for the call on the connection concerned. The object of the invention is to make individual call branches, i.e. connections between exchanges, use common resources. This is implemented e.g. such that the call set-up process records in the database the resources allocated for the call on each connection, thereby preventing allocation of multiple resources on one connection. When the call is forwarded from the exchange, it is possible to check from the database that no telecommunication medium has been previously allocated to the connection.

One advantage of such a method for establishing a group call extending to service areas of several exchanges in a mobile radio system, and of a mobile radio system is that they solve the problems involved in the prior art. A particular advantage of the invention is that it eliminates the problem of unnecessarily allocating double or multiple telecommunication resources, such as communication connections or other telecommunication media, for one and the same call between two exchanges when a group call is established to service areas of several exchanges.

Another advantage of the invention is that it also speeds and secures group call set-up when a group call is established to service areas of several exchanges.

Yet another advantage of the invention is that it simplifies call set-up in a situation where a group call is to be established to subscribers located on service areas of several exchanges.

A further advantage is that the solution provided by the invention does not place restrictions on the routing method used. When a call is routed to a single exchange, the invention makes it possible to use different methods that are considered the most suitable for the network and application concerned. This solution makes it possible to set up group calls in rather different networks operating in different manners. Different resource and load allocation functions can thereby be performed by the actual routing method, and the present solution provides an effective method for establishing group calls.

A still further advantage is that in the implementation of the invention, it is not very significant to the routing which exchange is selected to establish the call. The method functions rather well, independently of the exchange associated with the group call that is selected to start the call set-up.

A further advantage of the invention is that subscribers can enter an on-going group call. The solution of the invention makes it possible to engage a new subscriber in a group call without any exceptional call set-up procedures.

Another advantage of the invention is that it enables effective use of the resources of a mobile radio system without complicated and time-consuming deduction algorithms for selecting the route and suitable points of branching.

Yet another advantage of the invention is that it makes the use of computing capacity and connection resources of the mobile radio system, especially those of its exchanges, more effective in group call set-up.

Brief description of the figures

In the following the invention will be described in greater detail with reference to the attached drawings, in which

5 fig. 1 is a block diagram of a mobile radio system according to the prior art, illustrating problems involved therein, and

fig. 2 is a block diagram of a mobile radio system according to the invention.

10 Detailed description of the invention

Fig. 1 is described above in connection with the description of the background art.

15 Fig. 2 is a block diagram of a mobile radio system according to the invention, the system comprising exchanges 10 to 16. In a network of the invention, establishment of a group call is started by checking what exchanges are associated with the group call. Then the exchange or exchanges for establishing the call must be selected. The simplest solution is to
20 select one exchange that establishes a call to all other exchanges associated with the group call. The exchange may be e.g. an exchange in which is stored information about the group concerned, or it may be an exchange selected at random.

25 The exchange establishing the call establishes the connections between the exchanges involved in the call separately to each exchange. When said exchange or any exchange on the route selects a route forward, it checks, according to the invention, whether it can use
30 the resources previously allocated for the group call on the route concerned. Such resources include a telecommunication medium or a telecommunication resource, such as a telecommunication bus, or a telecommunication channel, a telecommunication time slot, or e.g.
35 multiplexing, encoding or decoding means. If resources

10

have been previously allocated on the connection concerned for the group call to be established, the exchange instructs the call to use the same resources.

5 Fig. 2 shows a simple example for a mobile radio network.

If a group call is to be established in the network of fig. 2 including exchanges 10, 12, 13, 14, 15 and 16, exchange 10 can be selected for call establishment. The exchange then establishes
10 connections 10--12, 10--13, 10--14, 10--15 and 10--16 between the exchanges separately. Individual branches can be assumed to be routed e.g. as follows:

branch A: 10--12: 10 - 12
branch B: 10--13: 10 - 13
15 branch C: 10--14: 10 - 12 - 14
branch D: 10--15: 10 - 12 - 15
branch E: 10--16: 10 - 12 - 15 - 16.

If the call branches are established in the above order, exchange 10 notices upon establishing
20 branches C, D and E that a connection has been previously allocated for the call on connection 10--12, so no new resources need to be allocated. Upon establishing branch E, exchange 12 notices that a connection has been previously allocated and thus no
25 new connection needs to be allocated. Thus, only one speech connection needs to be allocated for the entire call on connections 10--12, 10--13, 12--14, 12--15 and 15--16.

The optimal implementation depends on the
30 routing method used, the group call type, and the structure of the network. In the most generally applicable and versatile solution, a group call is established by one exchange in the group call area, and joint use of resources is based on the use of an
35 identity specific for each group call.

With regard to the load caused by the call set-up, it is preferable that only one exchange, which itself belongs to the group call area, establishes the call. Depending on the routing method, this is often
5 the best routing solution.

The use of identities specific for each group call is advisable, since it makes it possible to guide subscribers entering an on-going call to use resources previously allocated for the call concerned.

10 In the invention, a group call is established as follows:

1. A group call is divided into call branches destined to different exchanges. All call branches are given the same unambiguous group
15 call identity CALL ID specific for each call.
2. One exchange starts to route the different call branches separately to the destination exchanges.
3. The exchange performing the routing
20 determines, on the basis of a desired routing algorithm, the exchange to which the call branch is to be routed next. Together with call set-up requests, information about the call identity CALL ID is transmitted.
- 25 4. When the next exchange of the route has been selected for a call branch, a request is transmitted to the system that allocates resources, e.g. to a software process, to allocate resources to said exchange.
- 30 5. The resource manager checks the database to find out whether resources have been previously allocated to said exchange by the same call identity CALL ID. If resources have been allocated, the call set-up unit of the
35 exchange concerned is informed of the

resources available to the call branch, and the call set-up process can proceed to the next exchange of the route. If no resources have been allocated before, they are allocated at this stage, and the call set-up unit is informed of the resources available to the branch, and the process continues as above.

5
6. The routing of a call branch is continued until the branch has reached the destination exchange.
10

In the following, the structure of the mobile radio system of the invention is described with reference to fig. 2.

To establish a desired group call, the mobile radio system of the invention comprises check means 201 for checking whether a telecommunication medium has been previously allocated for the group call concerned on the connection from the first 10 to the second 12 exchange.
15

The inventive mobile radio system further comprises a database 202 which indicates, specifically for each group call, the telecommunication media 101 that are allocated for said group call on each connection from the first 10 to the second 12 exchange.
20

In the inventive mobile radio system, said check means 201 are arranged to allocate a telecommunication medium 101 on said connection (10--12) for said group call to be established, if said database 202 indicates that no telecommunication medium 101 has been previously allocated for said group call on said connection. Further, said check means 201 are arranged to route said group call to be established from the first to the second 12 exchange by said allocated telecommunication medium 101.
25
30

Further, in the inventive mobile radio system said check means 201 are arranged to route said group call to be established from the first 10 to the second 12 exchange with the telecommunication medium 101 previously allocated for the group call concerned if said database 202 indicates that a telecommunication medium 101 has been previously allocated on the connection from the first 10 to the second 12 exchange for said group call to be established.

The inventive mobile radio system further comprises means 203 for marking the allocation of the telecommunication medium 101 in said database 202, if said database 202 does not indicate that a telecommunication medium 101 has been previously allocated for said group call on said connection.

Thus the basic idea of the invention is that several connections are established between different exchanges for the same group call in a mobile radio system such that only one telecommunication resource or medium, such as a telecommunication channel or time slot, is allocated between two exchanges for one and the same group call. The connections established between two exchanges for one and the same group call thus use the same telecommunication resource.

The exchange establishing the call can be selected and the resources for one and the same call combined quite freely. The exchange establishing the call may be the exchange of an A-subscriber or an exchange located in the service area of the group, or several exchanges may be involved in the call set-up. In the latter case, e.g. the exchanges of all B-subscribers (and C-subscriber) may establish a call to the exchange of the A-subscriber.

The resources used can be combined by many different methods. For example, each call or each group

may have its own identity that can be used in the combination process. The method may also be more complicated: e.g. it is possible to send a message on a group call connection, whereby the exchange knows on the basis of the message how to establish the connections on which the message is transmitted.

The drawings and the description thereof are to be understood as illustrating the idea of the invention. The method and mobile radio system according to the invention may vary in their details within the scope of the claims. Although the invention is described above mainly with reference to radio phone systems, it can also be used in other kinds of mobile radio systems.

Claims

1. A method for establishing a group call extending to service areas of several exchanges (10, 12, 15, 14, 16) in a mobile radio system comprising at least a first (10) and a second (12) exchange, telecommunication media (101) for establishing communication connections between at least the first and the second exchange, and mobile stations (A-subscriber, B-subscriber) communicating via said exchanges; the method comprising the step of

selecting a second exchange (12) to which the group call is routed from the first exchange (10), characterized by comprising the steps of

checking, before the call is routed to the second exchange (12), whether a telecommunication medium (101) has been previously allocated on the connection from the first (10) to the second exchange for the group call to be established;

routing said group call to be established from the first (10) to the second (12) exchange without allocating a new telecommunication medium to the connection if a telecommunication medium has been previously allocated on that connection for the group call to be established.

2. A method according to claim 1, characterized by

maintaining a database (202) that indicates, specifically for each group call, the telecommunication media (101) that are allocated for said group call on each connection,

checking said database (202) before the call is routed from the first (10) to the second (12) exchange to see whether a telecommunication medium

(101) has been previously allocated on the connection from the first (10) to the second (12) exchange for said group call to be established,

5 if said database (202) does not indicate that a telecommunication medium (101) has been allocated for said group call on said connection, allocating a telecommunication medium (101) for said group call on said connection,

10 marking the allocation of the telecommunication medium (101) in said database (202), and

routing said group call to be established from the first (10) to the second (12) exchange with the telecommunication medium (101) allocated.

15 3. A method according to claim 1, characterized by

maintaining a database (202) that indicates, specifically for each group call, the telecommunication media (101) that are allocated for said group call on each connection,

20 checking said database (202) before the call is routed from the first (10) to the second (12) exchange to see whether a telecommunication medium (101) has been previously allocated on the connection from the first (10) to the second (12) exchange for said group call to be established,

25 if said database (202) indicates that a telecommunication medium (101) has been previously allocated on said connection from the first (10) to the second (12) exchange for said group call to be established, routing said group call to be established from the first (10) to the second (12) exchange with said telecommunication medium (101) previously allocated for said group call.

30 4. A mobile radio system for establishing a group call extending to service areas of several

exchanges (10, 12, 15, 14, 16), the mobile radio system comprising at least a first (10) and a second (12) exchange, telecommunication media (101) for establishing communication connections between the first and the second exchange, and mobile stations (A-subscriber, B-subscriber) communicating via said exchanges; the mobile radio system being characterized by comprising

check means (201) for checking whether a telecommunication medium (101) has been previously allocated on the connection from the first (10) to the second (12) exchange for said group call to be established.

5. A mobile radio system according to claim 4, characterized by further comprising

a database (202) that indicates, specifically for each group call, the telecommunication media (101) that are allocated for said group call on each connection from the first to the second exchange.

6. A mobile radio system according to claim 4, characterized in that said check means (201) are arranged to allocate a telecommunication medium (101) on said connection for said group call to be established, if said database (202) indicates that no telecommunication medium (101) has been previously allocated for said group call on said connection, and to route said group call to be established from the first to the second exchange with said allocated telecommunication medium (101).

7. A mobile radio system according to claim 4 or 6, characterized in that said check means (201) are arranged to route said group call to be established from the first to the second exchange with the telecommunication medium (101) previously allocated for said group call, if said database indicates that a

telecommunication medium (101) has been previously allocated on the connection from the first to the second exchange for the group call to be established.

5 8. A mobile radio system according to claim 4
or 6, c h a r a c t e r i z e d by further comprising
 means (203) for marking the allocation of a
telecommunication medium (101) in said database (202),
if said database does not indicate that a tele-
communication medium has been previously allocated for
10 said group call on said connection.

Fig. 1

(PRIOR ART)

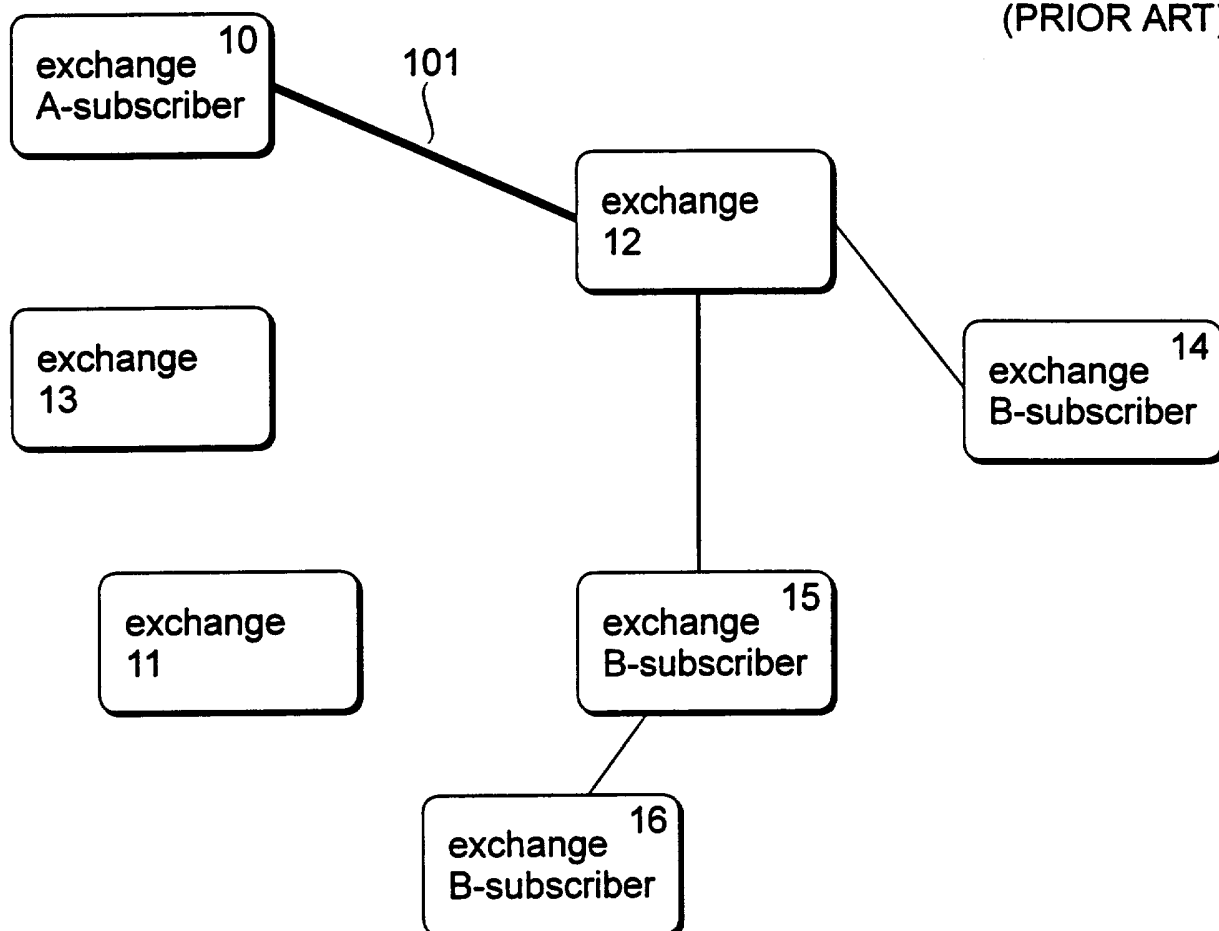
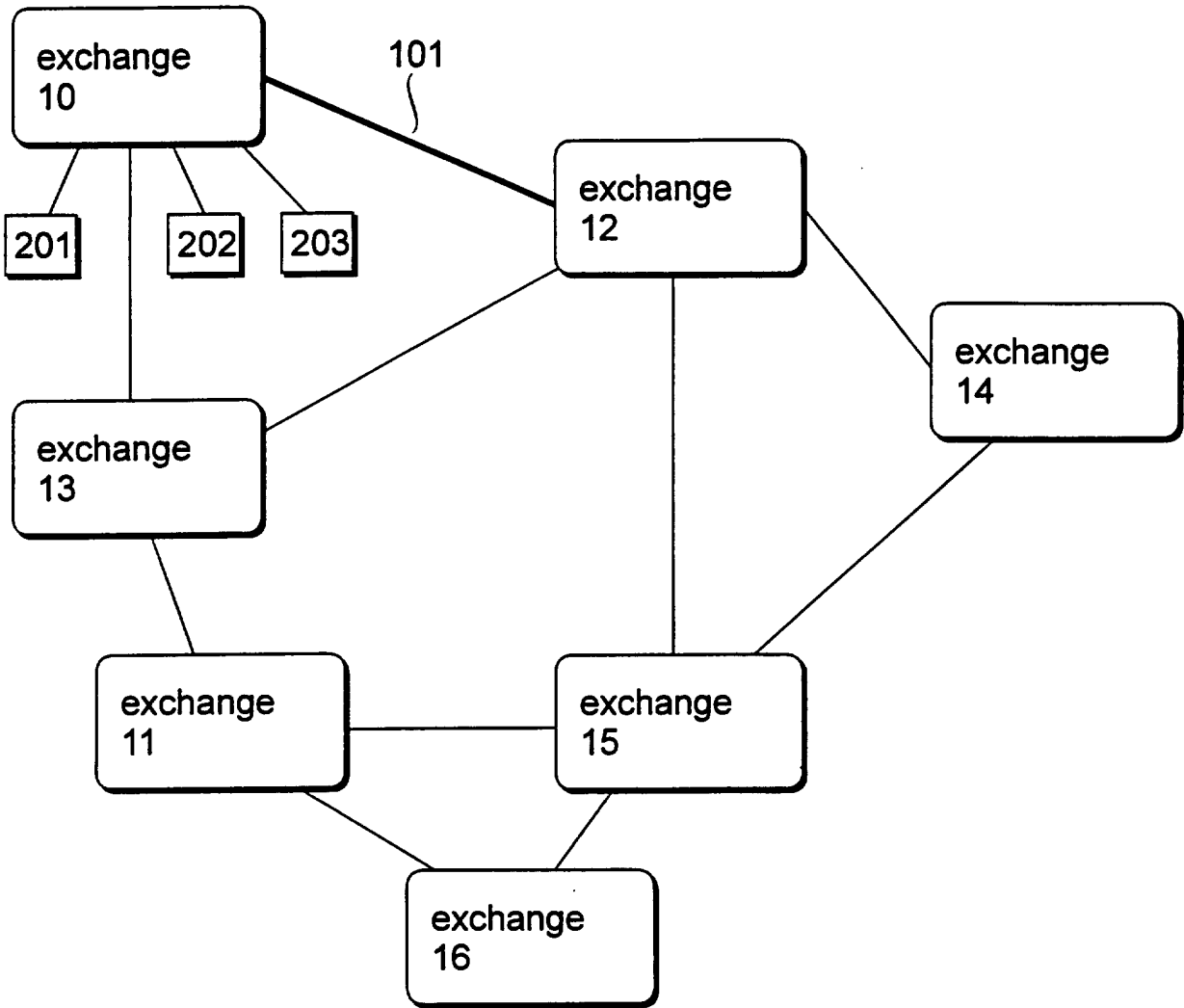


Fig. 2



INTERNATIONAL SEARCH REPORT

International Application No

PCT/FI 95/00614

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/28

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

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 327 573 (LENCHIK VITALY ET AL) 5 July 1994 see the whole document ---	1,45
A	US,A,5 200 954 (TEEL JR JAMES L ET AL) 6 April 1993 see column 2, line 49 - column 5, line 29 ---	1
A	NACHRICHTEN TECHNIK ELEKTRONIK, vol. 41, no. 4, July 1991 BERLIN DE, pages 130-134, XP 000240831 KRÜGER 'Bündelfunknetz CHEKKER' see paragraph 2 - paragraph 2.1.B; figures -----	1,4



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

19 March 1996

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/FI 95/00614

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-5327573	05-07-94	NONE	
US-A-5200954	06-04-93	NONE	