

Description

Communications system having cordless system units
5 which are connected to a communications network

The invention relates to a communications system according to the precharacterizing clause of Patent Claim 1.

10 Such a communications system has been disclosed in EP-0 433 256-A2. In the case of this communications system, a cordless terminal is normally authorized only to make connections via a specific cordless system unit. Cordless system units are used to connect
15 cordless terminals to a communications network. Such a communications network may be a private branch exchange which, for its part, is normally connected to a regional or global network. In some cases, a cordless system unit may itself carry out the tasks of a private
20 branch exchange.

A cordless system unit controls the identification of the presence of a cordless terminal which is ready to operate in the transmission and reception area of one of its base stations and the
25 routing of a connection set-up to this terminal via this base station (roaming in accordance with ETS 300 175-3). To this end, it contains a test device to check whether it is possible to set up a connection from it to a cordless terminal. It is possible to set up such a
30 connection if an information interchange between at least one of the base stations of the cordless system unit and the cordless terminal is technically feasible via the cordless transmission/reception path. In the case of an information interchange by analogue signal
35 transmission, one criterion for this may be the achievement of a sufficiently high reception signal level and, in the case of an information interchange by digital signal transmission, the achievement of a sufficiently low bit error rate. The decision as to

whether it is possible to set up a connection depends essentially on whether the cordless terminal is itself ready to operate in the transmission and reception area of a base station of the cordless system unit.

5 If there is an existing connection between the cordless terminal and a communications network which is connected to the cordless system unit, the cordless system unit, in conjunction with its base stations and when the cordless terminal changes its area from one
10 base station to an adjacent base station, controls the clearing of the connection via the one base station, and the setting up of the new connection via the other base station (handover in accordance with ETS 300 175-3).

15 In order to control the access authorization of a cordless terminal to the communications system and in order to control whether a cordless terminal is authorized to initiate the setting up of a connection via the cordless system unit, the test device checks
20 the authorization for setting up such a connection. A cordless terminal is normally authorized to initiate the setting up of a connection via a cordless system unit when the latter is allocated to it administratively as a home system unit. If a cordless
25 system unit is allocated to a cordless terminal as the home system unit, then its identification is stored in the latter.

 Base stations are primarily used for bidirectional conversion of cordlessly transmitted
30 signals and signals transmitted via wire networks. Cordless signal transmission may be carried out, for example, by infrared signal or by radio. One example which may be quoted as a radio transmission method is the DECT method described in ETS 300 175. One cordless
35 system unit may have one or more base stations.

 If, in a communications system which is known from EP-0 433 256-A2, it is intended to operate a cordless terminal in the transmission and reception area of a cordless system unit which is not allocated

to it as a home system unit, then this fact must be registered to the administration for this system unit. To this end, each cordless system unit keeps a certain number of telephone numbers which cannot be assigned to permanently allocated terminals.

In consequence, in such a communications system, a cordless terminal can be operated only in the transmission and reception area of its home system unit or in the transmission and reception area of a cordless system unit with which it has temporarily registered administratively. Only in such cases is the authorization for this cordless terminal to set up a connection confirmed by the test device of a cordless system unit as being acceptable. The number of terminals which may be registered with each administration for a cordless system unit in addition to the permanently allocated cordless terminals is limited by the number of telephone numbers kept for these purposes. Since the individual cordless system units must provide additional free telephone numbers for the temporary registration of cordless terminals, the resources installed in the communications system may not be used optimally.

The object of the invention is to provide a communications system which allows simple access by cordless terminals to the communications system in the transmission and reception area of any cordless system units.

The invention achieves this object by the features of Claim 1. Particularly advantageous developments of the invention are specified in the dependent claims.

A communications system according to the invention contains cordless system units which are connected to a communications network, each having at least one cordless base station. The identification of a respective cordless terminal is stored in a cordless system unit which is allocated to this cordless terminal as a home system unit. A test device which is

respectively allocated to the cordless system units can check the feasibility and authorization to set up a connection from the respective cordless system unit to a cordless terminal. The cordless system units are
5 connected to a network which provides a connectionless service, in order to interchange information with one another, depending on the test results of the test devices.

10 The transmission of the information between the cordless system units via a network which provides a connectionless service allows, without any complex layer 3 signalling, a point-to-multipoint request to be transmitted to all the cordless system units that are part of the communications system.

15 If, for example, the check by the test device of the home system unit finds that a cordless terminal which is being called is not located in its transmission and reception area, then the home system unit can interrogate all the connected cordless system
20 units in a simple manner, via the network which provides a connectionless service, to determine whether it is possible to set up a connection to the cordless terminal from the test device of any other cordless system unit in the communications system. If the
25 cordless terminal is located in the transmission/reception area of a base station of another cordless system unit, the latter reports this fact to the communications system, possibly also via the home system unit and the network which provides the
30 connectionless service, and the communications system can connect the incoming call to the cordless terminal which is being called. The setting up of such a connection may in this case be carried out via the home system unit and an additional connection from the home
35 system unit to the cordless system unit in whose area the terminal is located. In most cases - particularly if the home system unit and the cordless system unit in whose area the terminal is located are connected to the same switching network, for example a private branch

exchange - it is, however, advantageous to connect the incoming call directly via the cordless system unit in whose area the terminal is located. The call data involved can then be transmitted between this system unit and the home system unit via the network which provides the connectionless service.

If, for example, a cordless terminal which is located in the transmission/reception area of a base station of a cordless system unit which is not allocated to it as the home system unit wishes to access the communications system in order to initiate the setting up of a connection, then the authorization test by the test device of this cordless system unit provides the result that the identification of this cordless terminal is not stored in it. In this case, the cordless system unit can easily interrogate all the connected cordless system units via the network which provides a connectionless service, to determine whether the cordless terminal has access authorization to the communications system, that is to say whether its identification is stored in any other cordless system units in the communications system. If a cordless system unit in the communications system is the home system unit of the cordless terminal, then it can transmit appropriate information to the interrogating cordless system unit via the network which provides a connectionless service. The interrogating cordless system unit can then allow the cordless terminal to have access to the communications system. The call data involved may then be transmitted between this system unit and the home system unit via the network which provides the connectionless service.

In this context, connectionless service means connectionless with regard to layer 2 and possibly with regard to layer 3 in accordance with the ISO reference model (ISO 7498 dated 1993).

One example of a network which provides a connectionless service is a Datagramm-oriented local area network, called a LAN. One example that may be

quoted of a Datagramm-oriented local area network is the Ethernet, which is specified in Standards IEEE 802.3 and IEEE 802.5.

5 If the individual cordless system units of the communications system are arranged at a long distance from one another in a regional or global company network, the network which provides a connectionless service may comprise two or more local area networks, which form a network interconnection via permanent
10 connections or via a regional or global network. Such networks which provide a connectionless service are described, for example, in the book "SMDS Wide-Area Data Networking with Switched Multi-megabit Data Service" by R.W. Klessig and K. Tesink, Prentice Hall,
15 1995, particularly on pages 11 to 14.

The entire network which provides a connectionless service preferably contains a single controller for controlling the access authorization of connected cordless system units to this network and for
20 defence against unauthorized access attempts. This controller may be, for example, a central computer which monitors the coupling to a central local area network of remote cordless system units or of remote local area networks of the network which provides a
25 connectionless service, and can thus provide a defence against unauthorized data interchange.

In Datagramm-oriented networks, information can be received and transmitted very easily by someone who is not authorized so to do but has network access
30 authorization. For security reasons, particularly in order to avoid unauthorized access to the communications system, it is thus recommended that a separate Datagramm-oriented network be provided which is used exclusively for information interchange between
35 cordless system units. If such a separate Datagramm-oriented network comprises a plurality of local area networks which are arranged at a relatively long distance from one another, then remote local area networks or else individual, remote cordless system

units are preferably coupled to a central local area network via a permanently set up point-to-point link such as a permanent line, in order to avoid unauthorized access via a Datagram-oriented wide-area network.

In order to connect individual, remote cordless system units to the communications system, the connection which is required in the physical layer of the network which provides a connectionless service between the separate Datagram-oriented network and these remote cordless system units may, if required, be implemented as a dialled link. In this case, the controllers of the cordless system units and/or the central controller of the Datagram-oriented network have to initiate the setting up of the required connection.

The invention is explained in more detail in the following text with reference to the figure:

The figure shows, as an exemplary embodiment of the invention, a communications system having cordless system units 1, 2, 3 and 4 which are connected to a communications network 7. Each of the cordless system units 1, 2, 3 and 4 has a controller 10, 20, 30 and 40 as well as base stations 11, 12, 13, 21, 22, 23, 31, 32 and 41. In the exemplary embodiment shown, the cordless system units 1 and 2 each have three base stations 11, 12, 13 and 21, 22, 23, the cordless system unit 3 has two base stations 31 and 32, and the cordless system unit 4 has one base station 41. The controller 10, 20, 30, 40 of the respective cordless system unit 1, 2, 3, 4 contains a test device 15, 25, 35, 45 as well as a memory device 14, 24, 34, 44 which is in each case used to store the identification of the cordless terminals 8 to which the cordless system unit 1, 2, 3, 4 is allocated as the home system unit. The exemplary embodiment illustrates a single cordless terminal 8.

The cordless system units 1, 2, 3 and 4 shown in the figure are respectively connected via an interface arrangement 16, 26, 36, 46 to a network 6

which provides a connectionless service. This network 6 which provides a connectionless service is controlled in the exemplary embodiment of the figure by a central control device 61, for example a microcomputer.

5 In the illustrated exemplary embodiment, the cordless system units 1 and 2 are each connected to the coupling network 71 of a private branch exchange, and this coupling network 71 is connected to a global communications network 72. The cordless system units 3
10 and 4 are each directly connected to the global communications network 72.

The method of operation of a communications system according to the exemplary embodiment in the figure is described below, subject to the precondition
15 that the cordless terminal 8 is allocated the cordless system unit 1 as a home system unit, and that the cordless terminal 8 is located in the transmission and reception area of one of the base stations 31 and 32 of the cordless system unit 3, and is ready to operate.

20 If, in the described case, an attempt is made to initiate the setting up of a connection, starting from the cordless terminal 8, via the cordless system unit 3 to the communications network 7, then the test device 35 uses the memory entries in the memory 34 to
25 check whether this is the home system unit of the cordless terminal 8. Since this is not the case, a request is transmitted to the other system units 1, 2 and 4 of the communications system via the interface arrangement 36 and the network 6 which provides a
30 connectionless service, to determine whether the desired setting up of the connection from the cordless terminal 8 is authorized. This request, which passes via the interface arrangement 16 to the controller 10 of the cordless system unit 1, leads to the test device
35 15 checking this system unit 1. In the system unit 1, the access attempt by the cordless terminal 8 is found to be authorized. The controller 10 of the cordless system unit 1 then transmits, via the interface arrangement 16, the network 6 which provides a

connectionless service and the interface arrangement 36, the information to the cordless system unit 3 that the access attempt is authorized and also - if necessary - transmits other information required to set up a connection. The system unit 3 then treats the cordless terminal 8 as if the said system unit 3 were allocated to it as a home system unit.

The control unit 61 monitors the authorization of all the said accesses to the network 6 which provides a connectionless service.

If, in the case mentioned above, the request to set up a connection to the cordless terminal 8 arrives at the cordless system unit 1 via the global network 72 and the coupling network 71 of the private branch exchange, then the test device 15 of the cordless system unit 1 checks whether it is possible to set up a connection to the cordless terminal 8. In the case being described, it is impossible to set up such a connection via the cordless system unit 1. The controller 10 then transmits to the cordless system unit 1, via the interface arrangement 16 and the network 6 which provides a connectionless service, a request to the cordless system units 2, 3 and 4 to determine whether it is possible to set up a connection to the cordless terminal 8 via these cordless system units 2, 3 or 4. This request is passed via the interface arrangement 36 to the controller 30 of the cordless system unit 3, at which point its test device 35 checks whether the requested setting up of the connection is possible. The positive test result is transmitted via the interface arrangement 36, the network 6 and the interface arrangement 16 to the controller 10 of the cordless system unit 1. The controller 10 of the cordless system unit 1 then initiates the setting up of a connection via the cordless system unit 3 to the cordless terminal 8.



Patent Claims

1. Communications system having cordless system units (1, 2, 3, 4) which are connected to a communications network (7), each having at least one cordless base station (11-13, 21-23, 31, 32, 41), the identification of a respective cordless terminal (8) being stored in a cordless system unit (1, 2, 3, 4) which is allocated to this cordless terminal (8) as a home system unit, and a test device (15, 25, 35, 45) which is respectively allocated to the cordless system units (1, 2, 3, 4) providing the capability to check the feasibility and authorization to set up a connection from the respective cordless system unit (1, 2, 3, 4) to a cordless terminal (8), characterized in that the cordless system units (1, 2, 3, 4) are connected to a network (6, 61) which provides a connectionless service, in order to interchange information with one another, depending on the test results of the test devices (15, 25, 35, 45).

2. Communications system according to Claim 1, characterized in that a Datagramm-oriented network (6, 61) is provided as a network (6, 61) which provides a connectionless service.

3. Communications system according to Claim 2, characterized in that the Datagramm-oriented network (6, 61) is provided exclusively for information interchange between cordless system units (1, 2, 3, 4).

4. Communications system according to Claim 2 or 3, characterized in that the Datagramm-oriented network (6, 61) is a local area network (6, 61).

5. Communications system according to Claim 2 or 3, characterized in that the Datagramm-oriented network (6, 61) comprises at least two coupled local area networks.

6. Communications system according to Claim 2, 3, 4 or 5, characterized in that the Datagramm-oriented network (6, 61) has a single controller (61) for controlling the access authorization of connected



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cordless system units (1, 2, 3, 4) to this network (6) and for defence against unauthorized access attempts.

7. Communications system according to Claim 6, characterized in that the Datagramm-oriented network
- 5 (6, 61) contains a central local area network to which remote cordless system units (3, 4) and/or remote local area networks of the Datagramm-oriented network (6, 61) are respectively coupled via a permanent point-to-point link.