Title: USER GROUP LOAD SHARING USING A COMBINATION OF CELLULAR NETWORK MODE AND DIRECT MODE COMMUNICATIONS

Abstract: The present invention concerns a method an arrangement in a cellular communication network and an arrangement in a wireless communication device, for communicating within a user group, which user group comprises a plurality of wireless communication devices. The wireless communication devices are adapted to communicate in two different modes, a cellular network mode and in a direct connection mode. The method and arrangement comprises letting at least one wireless communication device communicate both in the cellular network mode and the direct connection mode and letting at least one other wireless communication device communicate in direct connection mode.
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User group load sharing using a combination of cellular network mode and direct mode communications

TECHNICAL FIELD

The present invention relates to a method in a cellular communication system, an arrangement in a cellular communication system and an arrangement in a wireless communication device. More particularly the present invention relates to a mechanism for improving group communication between wireless communication devices.

BACKGROUND

Currently, communication through cellular communication networks is becoming increasingly customary. Such cellular communication networks include the Global System for Mobile communications (GSM), Enhanced Data Rates for GSM Evolution (EDGE), General Packet Radio System (GPRS), wide-band code division multiple access (WCDMA), Long Term Evolution (LTE) systems, wireless local area networks (WLAN), CDMA 2000 and others. Those cellular communication networks typically include a plurality of user equipments, such as mobile cellular telephones, having transceivers communicating with transceivers of serving base stations.

Each user equipment transceiver includes a transmitter and a receiver which communicate with a corresponding base station receiver or transmitter via one or more radio links. A radio link typically comprises a plurality of communication channels such as e.g. signalling channels and traffic channels.

There is often a plurality of user equipments present simultaneously in the same area. The expression "area" may in this context be used for any part of the network such as e.g. a cell comprised within the network; or even the entire cellular communication network. If there are too many user equipments communicating simultaneously within an area, there is a risk to overload the cellular communication network, if no function to handle this type of situation is implemented. This is a problem, in particular e.g. when establishing group communication between several user equipments, comprised within a communication group. Cellular network systems like GSM and WCDMA are primarily designed for geographically spread point-to-point communication and not for geographically concentrated group communication. Thus communication resources are scheduled for
each user connected to the group communication, as if it were a plurality of point to point connections, which increases the risk of overload in a network area.

Figure 1 illustrates a cellular communication network 100 comprising a number of cells 120, 130, 140, according to prior art. Each cell 120, 130, 140 comprises a base station (not shown), over which all radio communication within the cell 120, 130, 140 is coordinated. A number of user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 are present in the cellular communication network 100. Some user equipments 101, 102, 103, 104, 107, 110 are comprised within a first user group A. Some other user equipments 105, 106, 108, 109, 111, 112 are comprised within another user group B.

The communication to and from user groups A and B is passing a network node 150. The network node 150 may e.g. control who the members are of each respective user group A, B and forward the communication made from one user equipment 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 within the user group A, B, to all or some of the other user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 comprised within the same user group A, B.

When the number of user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 in an area within the cellular communication network 100 increase, the number of network connections and thereby the load on the cellular communications network 100 increase, which may be critical.

In a situation with overload, the cellular communication network 100 will typically reject some of the users connections based on e.g. admission control, pre-emption and priority functionality with the result that some user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 or other network users are denied service, or allowed only to some restricted service, e.g. to send voice data but not other data etc.

To reduce the risk of overload in an area within the cellular communication network 100, one solution is to build out the general network capacity to reach an acceptable level of overload risk. However such a solution will be costly.
The overload can happen in all cells 120, 130, 140 within the network 100, or in any other part of the network 100, when an unusually high number of user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 in a user group A, B try to use the network 100 at the same time, or send a high amount of data traffic. To reduce the risk for a high cell load situation and/or data traffic load situation, which thus may occur anywhere in the entire cellular communication network 100, with more cellular network capacity is expensive. Even if the most important user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 can be prioritized there will be situations when it is difficult to make proper prioritizations or cases with many high priority user equipments 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 in a geographically concentrated area that they will be affected by the overload.

Another method to reduce the load is to use broadcast solutions like Multimedia Broadcast Multicast Service (MBMS) to increase the capacity in a user group but this will only work in certain varieties of the 3rd Generation Partnership Project (3GPP) networks and for a selection of terminals. To use MBMS require that this function in implemented in the complete network and the combination with other functions like Push to Talk can have performance problems.

Thus there is a need to provide a way of reducing the load in a cell 120, 130, 140 in a cellular communication network 100 and to provide an improved group communication with high service availability by using mobile cellular telephones 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112.

In e.g. uninhabited areas on the countryside, the cell coverage may be very poor. However, in case of an emergency situation in that particular area, e.g. a forest fire, storm, hurricane, sabotage, act of warfare etc, a large group of people i.e. firemen, police, ambulance crews, etc, may need to communicate within a user group within that area.

In addition, as competition increases among providers of wireless communication systems and manufacturers of communication devices, there is a marketing need for new functions and features.
SUMMARY

It is therefore an object of the present invention to provide a mechanism for group communication between wireless communication devices, with reduced cell load.

According to a first aspect, the object is achieved by a method in a cellular communication network for group communication within a user group. The user group comprises wireless communication devices. The wireless communication devices are adapted to communicate with each other in two different modes, a cellular network mode via a network node and in a direct connection mode. The method is characterised by the step of arranging at least one wireless communication device to communicate both in the cellular network mode and the direct connection mode. The method is also characterised by the step of arranging at least one other wireless communication device within the user group to communicate in the direct connection mode.

According to a second aspect, the object is also achieved by an arrangement in a cellular communication network for group communication within a user group. The user group comprises a plurality of wireless communication devices. The wireless communication devices are adapted to communicate with each other in two different modes, a cellular network mode via a network node and in a direct connection mode. The arrangement is characterised by a control unit. The control unit is adapted to arrange at least one wireless communication device to communicate both in the cellular network mode and in the direct connection mode.

According to a third aspect, the object is also achieved by an arrangement in a wireless communication device. The wireless communication device is adapted for group communication within a user group. The user group comprises a plurality of wireless communication devices. The wireless communication devices are adapted to communicate with each other in two different modes, a cellular network mode via a network node and in a direct connection mode. The arrangement is characterised by a control unit. The control unit is adapted to arrange the wireless communication device to communicate both in the cellular network mode and in the direct connection mode.

Thanks to the alteration between the cellular network mode operation and the direct connection mode operation, the load on the cellular communication network is reduced, as less radio traffic has to be connected through the base stations and the network.
Thereby also the risk of overloading the cellular communication network is reduced, why the group communication between wireless communication devices in a cellular communication network is improved.

An advantage with present methods and arrangements is that the system's capacity increases cost effectively.

Another advantage is that the average amount of transmission power for wireless communication devices could be reduced.

Yet an advantage is that the system coverage may be extended.

An advantage is that there is no upper limitation of number of users in a user group in a local area, in a cellular communication network according to the present methods and arrangements.

It is another advantage of the present methods and arrangements that communication is possible even if no cellular network infrastructure is available, via direct connection mode. The direct connection mode can be the last line of defence for extreme high availability.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described more in detail in relation to the enclosed drawings, in which:

Figure 1 is a schematic block diagram illustrating a cellular communication network according to prior art.

Figure 2 is a schematic block diagram illustrating a cellular communication network according to some embodiments.

Figure 3 is a schematic flow chart illustrating a method in a cellular communication network according to some embodiments.
Figure 4 is a schematic block diagram illustrating an arrangement in a cellular communication network according to some embodiments.

Figure 5 is a schematic block diagram illustrating an arrangement in a wireless communication device according to some embodiments.

DETAILED DESCRIPTION

The invention is defined as a method and an arrangement in a cellular communication network, and an arrangement in a wireless communication device which may be put into practice in the embodiments described below. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. It should be understood that there is no intent to limit the present method and arrangement in a cellular communication network and arrangement in a wireless communication device to any of the particular forms disclosed, but on the contrary, the present method and arrangement in a cellular communication network and arrangement in a wireless communication device is to cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the claims.

Whenever the words "voice" or "talk" is used in this document, it also could indicate the transmission or reception of data.

Still other objects and features of the present methods and arrangements will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are designed solely for purposes of illustration and not as a definition of the limits of the present methods and arrangements, for which reference should be made to the appended claims. It should be further understood that the drawings are not necessarily drawn to scale and that, unless otherwise indicated, they are merely intended to conceptually illustrate the structures and procedures described herein.

Figure 2 is a schematic illustration over a cellular communication network 200. A number of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211,
212, 213 are present in the cellular communication network 200. Some wireless communication devices 201, 202, 203, 204, 207, 210 are comprised within a first user group A. Some other wireless communication devices 205, 206, 208, 209, 211, 212, 213 are comprised within another user group B.

A "user group" as used in this context, is a group of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which are connected to each other such that all group members may listen to all communication made to and from any wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, and also talk to the other group members. The user group may comprise an arbitrary number of participant wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, e.g. 2, 20, 200, 2000 etc.

The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate in two modes. The first mode is a cellular network mode and the second mode is a direct connection mode of operation. The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are further adapted to communicate in the two modes simultaneously.

The cellular communication network 200 further comprises at least one cell 220, 230, 240. Each cell 220, 230, 240 is served by a base station. The base station in each cell 220, 230, 240 may also be referred to as e.g. an access point, a Node B, an eNode B and/or a base transceiver station, Access Point Base Station, base station router, etc depending e.g. of the radio access technology used. However, in order to not unnecessarily complicate the understanding of the present methods and arrangements, the expression "base station" will be used consistently in this description.

It is to be understood that many base station transceivers may be connected through, for example, a mobile switching centre and/or other nodes, to define the cellular communication network 200, when operating in the cellular network mode.

An example of such a node may be the network node 250. The network node 250, which may be comprised anywhere within the cellular communication network 200 may comprise logic to determine which wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 that belongs to a certain user group, e.g. A or
B and may also, according to some embodiments, control the participating wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 that belongs to a user group, instructing each wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which mode of operation to use; the cellular network mode or the direct connection mode, or both, as will be further explained later. Thus a network node 250 may be one of the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213.

However, according to other embodiments, the decision whether to use cellular network mode and/or the direct connection mode in the group communication may be distributed to the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. Alternatively, it may be decided together by the network node 250 and the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213.

As mentioned above, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate in the cellular network mode and in the direct connection mode. The communication in the cellular network mode is made over a radio link over the base station in the cell 220, 230, 240 comprised within the cellular communication network 200 wherein the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 momentarily is situated.

The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are also adapted to communicate in direct connection mode. The direct connection mode can in principle be all types of communication technologies except the cellular network communication. The direct connection mode of operation may e.g. be Direct Mode Operation (DMO). An example of such communication technology may be a peer-to-peer network which may connect nodes via ad hoc connections. Another example of a communication technology which may operate in direct connection mode, according to some embodiments, may be Bluetooth. Thus the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate directly with other wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. Thus the wireless system architecture according to the present solution may be based on the integration of cellular and modern ad hoc relaying technologies.
In some embodiments, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may be represented by a user equipment such as a mobile cellular telephone, a Personal Digital Assistant (PDA), a laptop, a computer or any other kind of device capable of wireless communication.

The network node 250 may, according to some embodiments be e.g. a system node comprised within the cellular communication network 200. However, according to some other embodiments, the network node 250 may be a user equipment such as a mobile cellular telephone, a Personal Digital Assistant (PDA), a laptop, a computer or any other kind of device capable of wireless communication.

The cellular communication network 200 may be based on technologies such as e.g. Code Division Multiple Access (CDMA), Wideband Code Division Multiple Access (WCDMA), CDMA 2000, High Speed Downlink Packet Data Access (HSDPA), High Speed Uplink Packet Data Access (HSUPA), High Data Rate (HDR) or any other cellular technology.

As used herein, the feature "cellular communication network" may refer to various radio access technologies in the traditional sense, a wireless local area network (LAN) or a wireless personal area network without departing from the teachings of the present invention. These networks 200 may include, for example, radio access technologies, such as Enhanced Data rates for GSM Evolution (EDGE), General Packet Radio Service (GPRS), Global System for Mobile Telecommunications (GSM), High Speed Packet Data Access (HSPA), Universal Mobile Telecommunications System (UMTS) and/or Wireless Local Area Networks (WLAN), such as Wireless Fidelity (WiFi) and Worldwide Interoperability for Microwave Access (WiMAX), or according to any other wireless communication standard.

The user group A comprises a number of wireless communication devices 201, 202, 203, 204, 207, 210. Some of these wireless communication devices 201, 202, 204, 210 are connected in the cellular network mode. Some other wireless communication devices 203, 207 are connected in the direct connection mode to another wireless communication device 202, 210 in the user group A, which other wireless communication devices 202,
210 in turn is connected also in the cellular network mode. The wireless communication
devices 202 and 210 thus operate in the two modes simultaneously.

By combining the cellular network mode of operation with the direct connection mode of
operation when communicating within the user group between the members of the user
group A, the number of network connections to the network node 250 may be reduced.
Thus, also the communication load on the cellular communication network 200 may be
reduced, which reduces the risk of overloading the cellular communication network 200. In
a scenario where the user group comprises e.g. a couple of hundreds of wireless
communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213,
the load in the cellular communication network 200 may be significantly reduced if the
number of network connections and/or data traffic made in the cellular network mode may
be reduced, limited and in some extreme cases according to some embodiments,
eliminated. According to some embodiments of the present methods and devices, the
number of network connections made in the cellular network mode may be limited to one
per cell 220, 230, 240. This may be regulated by setting threshold limit value for each cell
220, 230, 240, thus maximizing the number of network connections made in the cellular
network mode for user group members. The threshold limit value may be e.g. predetermi-
ned, statically, or dynamically set.

A situation may however arise where a wireless communication device 201, 202, 203,
204, 205, 206, 207, 208, 209, 210, 211, 212, 213 is unable to communicate via direct
connection mode. In Figure 2, this may be the case for the wireless communication device
201, which may be unable to communicate in direct connection mode operation with the
wireless communication device 202. A possible solution may then be to communicate
using the cellular network mode with the rest of the group members. Thus an instruction
to communicate using direct connection mode may be overruled when communication in
direct connection mode is not possible to perform, or not possible to perform with a good
enough quality.

In a scenario wherein a wireless communication device 213 may be situated out of any
cell 220, 230, 240 and could not communicate in cellular network mode at all. However, it
may be connected to the user group B anyway, using the direct connection mode. Thus,
according to the present methods and arrangements, the coverage area, wherein a
communication group may communicate may be expanded. Communication may
consequently be made also with wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 situated beyond reach for cellular communication.

Another situation that may occur according to the present method and arrangement is that certain wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, in particular those situated at the edge of a cell 220, 230, 240 may have a better connection, or e.g. a good enough connection using less transmit power, by using the direct connection mode of operation, connecting to a wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 situated in another cell 220, 230, 240. Thereby, the experienced quality of the communication may be improved by communicating using direct connection mode, at the same time as the load on the cellular communication network 200 may be reduced.

Figure 3 is a schematic flow chart illustrating the method in a cellular communication network 200 e.g. in a network node 250, for group communication within a user group. The cellular communication network 200 comprises one or a plurality of cells 220, 230, 240. The user group comprises a plurality of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate with each other in two different modes. The two modes are firstly a cellular network mode via a network node 250 and secondly a direct connection mode.

The method may, according to some embodiments be performed in a network node 250 comprised in the cellular communication network 200. According to some embodiments, the method may be performed network node 250, represented by a mobile phone. The present method may according to some embodiments be distributed between a plurality of nodes within the cellular communication network 200, such that a method step may be performed partly in one node, e.g. in the network node 250 and partly in another node such as e.g. in the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213.

To appropriately communicate within the user group, the method may comprise a number of steps 301-305. It is however to be noted that some of the described method steps are optional and only comprised within some embodiments of the present method. Further, it is to be noted that the method steps 301-305 may be performed in another chronological
order than the enumeration indicates and that some of them or even all steps may be performed simultaneously or in an altered, arbitrarily rearranged, decomposed or even completely reversed chronological order. The method may comprise the following steps:

5 **Step 301**

This step is optional and may only be performed within some embodiments. A value may be obtained, which value indicates the load in the cellular communication network 200.

The value, indicating the load in the cellular communication network 200 may, according to some embodiments indicate the number of communication links made in the cellular network mode, between the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, which are members of the group communication.

According to some embodiments, the value may indicate the number of communication links made in the cellular network mode, between the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, which are members of the group communication in each cell 220, 230, 240.

The value indicating the load in the cellular communication network 200 may however according to some embodiments indicate the transferred data volume made in the cellular network mode, between the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, which are members of the group communication.

The value indicating the load in the cellular communication network 200 may according to some embodiments comprise a combination of the number of communication links made in the cellular network mode and the transferred data volume made in the cellular network mode.

The value may according to some embodiments be obtained by the network node 250, e.g. by receiving signals from the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which are members of the group communication and are active.

Further it may, according to some embodiments, be obtained which wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213,
belonging to the user group, that are present in each cell 220, 230, 240 and which of the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in the same user group that could communicate in direct connection mode with each other. Such estimation may be made in a plurality of ways, e.g. the network node 250 may receive some information from the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213.

Step 302
This step is optional and may only be performed within some embodiments. The obtained value may be compared with a threshold limit value. According to some embodiments it may be compared with a threshold limit value, e.g. for each cell 220, 230, 240.

The threshold limit value may determine a maximum value, limiting the number of cellular connections for each cell 220, 230, 240, made by wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which belongs to the user group.

The threshold limit value may determine a maximum value, limiting the amount of data traffic sent between group members in a cellular communication network 200.

The threshold limit value may according to some embodiments determine a combination of the number of cellular connections and the amount of data traffic sent between group members in a cellular communication network 200.

The threshold limit value may be preset to an arbitrary number including, in some embodiments, zero (0) e.g. 0, 1, 2, 3, ..., n, and may be set to the same value for all cells 220, 230, 240 within the network 200. According to some embodiments, the threshold limit value may be set to different values for each cell 220, 230, 240 within the network 200.

Also, according to some embodiments, appropriate configurations may be calculated, such as which wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may be connected in direct connection mode and/ or cellular network mode, respectively.

Step 303
This method step is optional and may only be performed within some embodiments. The difference between the threshold limit value and the obtained value may be calculated. This calculated difference may then according to some embodiments be used for reducing the load within the user group. According to some embodiments, the calculated difference may be used for reducing the number of direct connection mode connections. According to some embodiments, the calculated difference may be used for reducing the amount of transmitted data communication in the cellular communication network 200.

**Step 304**

At least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 is arranged to communicate both in the cellular network mode and the direct connection mode. The communication is made with other members of the user group.

**Step 305**

At least one other wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 within the user group is arranged to communicate in the direct connection mode. The communication is made with other members of the same user group, which in turn may communicate in the cellular network mode and/or the direct connection mode.

According to some optional embodiments, the at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may be arranged to communicate both in the cellular network mode and the direct connection mode and the at least one other wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may be arranged to communicate in direct connection mode only if the obtained value exceeds the threshold limit value.

The step of letting at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 communicate both in the cellular network mode and in the direct connection mode and letting at least one other wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 communicate in direct connection mode may, according to some optional embodiments, comprise arranging a number of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 within the user group, corresponding to the earlier
calculated difference between the threshold limit value and the obtained value indicating
the load in the cellular network 200, to communicate in direct connection mode.

The steps of letting at least one wireless communication device 201, 202, 203, 204, 205,
206, 207, 208, 209, 210, 211, 212, 213 communicate both in the cellular network mode
and in the direct connection mode and arranging at least one other wireless
communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213
communicate in direct connection mode may, according to some optional embodiments,
comprise sending an instruction to the at least one wireless communication device 201,
202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to communicate both in the

However, according to some embodiments, it may occur that the wireless communication
device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 is arranged to
communicate the direct communication mode, e.g. by receiving an instruction to change
communication mode into the direct communication mode. But perhaps, because of bad
radio propagation conditions etc, that particular wireless communication device 201, 202,
203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may not be able to communicate
with any other wireless communication device 201, 202, 203, 204, 205, 206, 207, 208,
209, 210, 211, 212, 213 comprised within the same group, using the direct connection
mode of communication. The wireless communication device 201, 202, 203, 204, 205,
206, 207, 208, 209, 210, 211, 212, 213 may then ignore the received instruction to
communicate using direct communication mode, and instead communicate using the

According to some embodiments, a negotiation between the network node 250 and the
wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211,
212, 213 may be initiated when the load in the cellular communication network 200, e.g.
the number of cellular connections between user group members in a cell 220, 230, 240, exceeds the threshold value.

At least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 comprised in the user group may, according to some embodiments function as a group master, communicating both in cellular network mode and direct communication mode.

According to some embodiments, the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, in a user group which momentarily transmit data becomes group master of that user group, thus communicating at least in the cellular network mode, at least as long as data is transmitted. When another wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 thereafter starts to transmit data, that transmitting wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may become group master. Thus, according to some embodiments, the function of the group master may be dynamically set.

According to some embodiments, the network node 250 may set at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to function as group master. The group master of the cell 220, 230, 240 connect to the network 200 both in the cellular network mode and in the direct communication mode. The other wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in the cell 220, 230, 240 which belong to the same user group may connect to the group master, or to one of the group masters, via direct connection mode operation.

Further, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which fail to communicate in the direct connection mode communication with any of the group masters, may communicate in cellular network mode connection, according to some embodiments. According to some embodiments, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which fail to communicate in the direct connection mode connection with any of the group masters instead try to communicate in the direct connection mode connection with another wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, being a group member.
The other wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, not being group masters may, according to some embodiments, make an attempt to connect to any of the group masters within the same user group via direct connection mode operation.

According to some embodiments may the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which fail to connect to any of the group masters in direct connection mode, connect to the user group using cellular network mode.

According to some embodiments, the first wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in a user group e.g. in a cell 220, 230, 240, which become active may become group master.

According to some embodiments, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in a user group in a cell 220, 230, 240 may be sorted in priority order. Thus the prioritized wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in a user group in a cell 220, 230, 240 may become group master. As an example, wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 having enhanced battery capacity such as e.g. wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 mounted on vehicles etc may be given the highest priority and thus become group master.

According to some embodiments, the described method steps 301-305 may be repeated continuously, or with certain intervals, or alternatively the method steps may be repeated e.g. for each new group member entering into active mode or for each group member moving into another cell 220, 230, 240 etc.

Thus, according to the present method, the load within the cellular network 200 may be reduced.

Figure 4 is a schematic block diagram illustrating an arrangement 400 in a cellular communication network 200 for group communication within a user group. The user group
comprises a plurality of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. The arrangement 400 is adapted to perform at least some of the above described method steps 301-305 for communicating in a user group between a plurality of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 in the cellular communication network 200. The cellular communication network 200 may comprise one or more cells 220, 230, 240. The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate in two different modes, a cellular network mode and in a direct connection mode.

For the sake of clarity and in order not to render unnecessary aggravating circumstances for the uninitiated reader to comprehend the present arrangement 400 in the cellular communication network 200, any internal electronics of the arrangement 400, not completely necessary for performing the present method according to steps 301-305 has been omitted from Figure 4.

The arrangement 400 comprises a control unit 404. The control unit 404 is adapted to arrange at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to communicate both in the cellular network mode and the direct connection mode.

The control unit 404 may according to some embodiments be further adapted to arrange at least one other wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 within the same user group to communicate in direct connection mode.

Thus, according to some embodiments, the control unit 404 may be adapted to directly or indirectly switch at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 into the direct connection mode. The indirect switch may comprise sending an instruction to a wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to switch into the direct connection mode.
The arrangement 400 may further, according to some embodiments comprise an obtaining unit 401. The obtaining unit 401 may be adapted to obtain a value, indicating the load in the cellular communication network 200.

5 The arrangement 400 may also, according to some embodiments comprise a comparison unit 402, adapted to compare the obtained value with a threshold limit value. The comparison unit 402 may according to some embodiments, be e.g. a Central Processing Unit (CPU), a microprocessor, a Peripheral Interface Controller (PIC) microcontroller or any other appropriate device which may be adapted to interpret computer program instructions and processes data.

The arrangement 400 may further, according to some embodiments comprise a calculator unit 403, adapted to calculate the difference between the threshold limit value and the obtained value.

10 The arrangement 400 may be comprised within a network node 250 in the cellular communication network 200. However, the arrangement 400 may be comprised within a network node 250, represented by a mobile phone.

20 The arrangement 400 may comprise a memory unit. The optional memory unit, which may be comprised within the present arrangement 400 according to some embodiments may be a primary storage memory unit such as a processor register, a cache memory, a Random Access Memory (PvAM) or similar. The optional memory unit may however in some embodiments be a secondary memory unit such as a Read Only Memory (ROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), programmable read-only memory (PROM) or erasable programmable read-only memory (EPROM) or a hard disk drive. The memory unit may however in some embodiments be an off-line storage memory unit, a flash memory, a USB memory or a memory card. The memory unit may in some embodiments be a Network-attached storage (NAS) or in fact any other appropriate medium such as a disk or a tape that can hold machine readable data.

The control unit 404 may be adapted to generate an instruction to at least one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 within the cell 220, 230, 240 to switch into the direct connection mode if the obtained value exceeds the threshold limit value.
Also, the arrangement 400 may comprise a receiving unit 405. The receiving unit 405 may according to some embodiments be comprised within one physical unit, a transceiver which may comprise a transmitter circuit and a receiver circuit, which respectively transmits outgoing radio frequency signals, and receives incoming radio frequency signals, such as voice call and data signals, via an antenna. The antenna may be an embedded antenna, a retractable antenna or any antenna known to those having skill in the art without departing from the scope of the present method and arrangement 400.

It is to be noted that the described units 401-405 comprised within the network node 250 are to be regarded as separate logical entities but not with necessity separate physical entities. Any, some or all of the units 401-405 may be comprised or co-arranged within the same physical unit. However, in order to facilitate the understanding of the functionality of the arrangement 400, the comprised units 401-405 are illustrated as separate physical units in Figure 4.

Figure 5 is a schematic block diagram illustrating an arrangement 500 in a wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 adapted for group communication within a user group. The user group comprises a plurality of wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. The arrangement 500 is adapted to perform at least some of the above described method steps 301-305 for communicating in the user group in the cellular communication network 200. The cellular communication network 200 may comprise one or more cells 220, 230, 240. The wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are adapted to communicate in two different modes, a cellular network mode, communicating via a network node 250 and in a direct connection mode.

For the sake of clarity and in order not to render unnecessary aggravating circumstances for the uninitiated reader to comprehend the present arrangement 500 in the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, any internal electronics of the arrangement 500, not completely necessary for performing the present method according to steps 301-305 has been omitted from Figure 5.
The arrangement 500 comprises a control unit 504. The control unit 504 is adapted to arrange the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to communicate both in the cellular network mode via a network node 250 and the direct connection mode.

The control unit 504 may according to some embodiments be further adapted to arrange the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 to communicate in direct connection mode.

Thus, according to some embodiments, the control unit 504 may be adapted to switch the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 into the direct connection mode.

The arrangement 500 may further, according to some embodiments comprise an obtaining unit 501. The obtaining unit 501 may be adapted to obtain a value, indicating the load in the cellular communication network 200.

The arrangement 500 may also, according to some embodiments comprise a comparison unit 502, adapted to compare the obtained value with a threshold limit value. The comparison unit 502 may according to some embodiments, be e.g. a Central Processing Unit (CPU), a microprocessor, a Peripheral Interface Controller (PIC) microcontroller or any other appropriate device which may be adapted to interpret computer program instructions and processes data.

The arrangement 500 may further, according to some embodiments comprise a calculator unit 503, adapted to calculate the difference between the threshold limit value and the obtained value.

The arrangement 500 may be comprised within a mobile phone, according to some embodiments.

The arrangement 500 may comprise a memory unit. The optional memory unit, which may be comprised within the present arrangement 500 according to some embodiments may be a primary storage memory unit such as a processor register, a cache memory, a Random Access Memory (RAM) or similar. The optional memory unit may however in
some embodiments be a secondary memory unit such as a Read Only Memory (ROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), programmable read-only memory (PROM) or erasable programmable read-only memory (EPROM) or a hard disk drive. The memory unit may however in some embodiments be an off-line storage memory unit, a flash memory, a USB memory or a memory card. The memory unit may in some embodiments be a Network-attached storage (NAS) or in fact any other appropriate medium such as a disk or a tape that can hold machine readable data.

The control unit 504 may be adapted to switch the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 into the direct connection mode if the obtained value exceeds the threshold limit value.

Also, the arrangement 500 may comprise a receiving unit 505. The receiving unit 505 may according to some embodiments be comprised within one physical unit, a transceiver which may comprise a transmitter circuit and a receiver circuit, which respectively transmits outgoing radio frequency signals, and receives incoming radio frequency signals, such as voice call and data signals, via an antenna. The antenna may be an embedded antenna, a retractable antenna or any antenna known to those having skill in the art without departing from the scope of the present method and arrangement 500.

It is to be noted that the described units 501-505 comprised within the arrangement 500 in the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are to be regarded as separate logical entities but not with necessity separate physical entities. Any, some or all of the units 501-505 may be comprised or co-arranged within the same physical unit. However, in order to facilitate the understanding of the functionality of the arrangement 500, the comprised units 501-505 are illustrated as separate physical units in Figure 5.

The method steps 301-305 for communication in a user group according to the present methods may be implemented through one or more processors, together with computer program code for performing the functions of the methods. The program code mentioned above may also be provided as a computer program product, for instance in the form of a data carrier carrying computer program code for performing the method according to the present invention when being loaded into the network node 250 and/or the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213.
The data carrier may be a CD ROM disc, a memory stick, or any other medium such as a disk or tape that can hold machine readable data. The computer program code can furthermore be provided as pure program code on a server and downloaded to the network node 250 and/or the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 remotely.

Thus a computer readable medium encoded with a computer program for communicating in a user group may perform the method steps according to steps 301-305.

As will be appreciated by one of skill in the art, the present invention may be embodied as a method in a cellular communication network 200, an arrangement 400 in a cellular communication network 200, an arrangement in a wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 or computer program products. Further, the methods and arrangements 400, 500 may be performed entirely or partly within the network node 250. According to some embodiments, the present methods and arrangements 400, 500 may be distributed between a plurality of network nodes 250 and/or wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, comprised within the cellular communication network 200.

Accordingly, the present invention may take the form of an entirely hardware embodiment, a software embodiment or an embodiment combining software and hardware aspects all generally referred to herein as a "circuit" or "module." Furthermore, the present invention may take the form of a computer program product on a computer-usable storage medium having computer-usable program code embodied in the medium. Any suitable computer readable medium may be utilized including hard disks, CD-ROMs, optical storage devices, a transmission media such as those supporting the Internet or an intranet, or magnetic storage devices.

Computer program code for carrying out operations of the present methods may be written in any arbitrary programming language such as Java®, Smalltalk or C++. However, the computer program code for carrying out the steps of the present method may also be written in any conventional procedural programming languages, such as the "C" programming language and/or a lower level assembler language. The program code may execute entirely on the wireless communication node 250, partly on the wireless communication node 250, as a stand-alone software package, partly on the wireless
communication node 250 and partly on a remote computing device or entirely on the remote computing device. In the latter scenario, the remote computing device may be connected to the wireless communication node 250 through a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer, for example, through the Internet using an Internet Service Provider.

Furthermore, the present methods were described in part above with reference to flowchart illustrations and/or block diagrams of the network node 250, method steps 301-305, and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, may be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function/act specified in the flowchart and/or block diagram block or blocks.

The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

Some alternative embodiments
Communication may be provided between the concerned wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 also when the base station in the cell 220, 230, 240 is out of order, or when the concerned wireless
communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 are positioned out of coverage for the base station and/or the cellular communication network 200.

5 The communication between the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may communicate in a user group in a geographical area lacking cellular communication structures, such that the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may function like hunting radios, rescue team radios for emergency personnel etc, also in areas without cellular coverage, or where the cellular communication network is not functioning properly. Thus a very high availability of communication within the user group may be achieved, which may be essential in an emergency situation.

According to those embodiments, the communication may be made entirely in direct communication mode between the group members. It may according to some embodiments occur that some wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, which may belong to the user group or not, may function as routers, forwarding communication from one wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 comprised within the user group, to another wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, comprised within the user group.

According to some embodiment, the group communication may be performed in the following way. The wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 which is member of the user group may initiate the communication with the other group members by using direct connection mode operation. The group members which the wireless communication device 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 fails to communicate with may be attempted to communicate with using cellular network mode.

Some wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may rout direct connection mode communication from other wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, e.g. communication sent from wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 that cannot communicate with the group master,
due to bad radio propagation conditions, radio shadow etc. The routing procedure may then be to rout the communication utilizing e.g. a least hop count route or some other optimization scheme, according to some embodiments.

5 According to some embodiments, the switching from the cellular network mode to direct connection mode may be made only if a channel of sufficiently high quality can be established and/or upheld. Such decision may be based on e.g. the received signal strength, and/or packet error rate, bit error rate etc. If the signal quality when signalling in direct connection mode is to low, the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213 may communicate in cellular network mode, and/or receive instructions to communicate in cellular network mode.

The terminology used in the detailed description of the particular exemplary embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention. In the drawings, like numbers refer to like elements.

As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

20 Further, as used herein, the common abbreviation "e.g.", which derives from the Latin phrase "exempli gratia," may be used to introduce or specify a general example or examples of a previously mentioned item, and is not intended to be limiting of such item. If used herein, the common abbreviation "i.e.", which derives from the Latin phrase "id est," may be used to specify a particular item from a more general recitation. The common abbreviation "etc.", which derives from the Latin expression "et cetera" meaning "and other things" or "and so on" may be used herein to indicate that further features, similar to the ones that have just been enumerated, exist, which features however are well known to the person skilled in the art and for that reason omitted herein to not unnecessarily obscure the less initiated readers comprehension of the presented subject matter.

30 Functions or structures which are well known to the person skilled in the art may not be described in detail for brevity and/or clarity.

It may also be mentioned that, as used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless expressly stated otherwise. It should
be further understood that the terms "comprises" and/or "comprising" when used in this specification is taken to specify the presence of stated features, integers, steps, operations, elements, and/or components, but does not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present.

Furthermore, "connected" or "coupled" as used herein may include wirelessly connected or coupled.

Unless otherwise defined, all terms including technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which these methods and arrangements belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

For purposes of illustration, embodiments of the present methods and arrangements are described herein in the context of the wireless communication node 250 and the wireless communication devices 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213. It will be understood, however, that the present methods and arrangements are not limited to such embodiments and may be embodied generally as any electronic device that includes radio signal propagation means thereon.
CLAIMS

1. Method in a cellular communication network (200) for group communication within a user group, which user group comprises wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213), which are adapted to communicate with each other in two different modes, a cellular network mode via a network node (250) and in a direct connection mode, the method is characterised by the steps of:

   arranging (304) at least one wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) to communicate both in the cellular network mode and in the direct connection mode, and

   arranging (305) at least one other wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) within the user group to communicate in the direct connection mode.

2. Method according to claim 1, comprising the further steps of:

   obtaining (301) a value, indicating the load in the cellular communication network (200),

   comparing (302) the obtained value with a threshold limit value, and

   wherein the step of arranging (304) at least one wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) to communicate both in the cellular network mode and in the direct connection mode, and the step of arranging (305) at least one other wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) within the user group to communicate in the direct connection mode, are performed if the obtained value exceeds the threshold limit value.

3. Method according to claim 2, comprising the further step of calculating (303) the difference between the threshold limit value and the obtained value, and

   wherein the step of arranging (305) at least one other wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) within the user group to communicate in the direct connection mode, comprises arranging a number of wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213), corresponding to the calculated difference, to communicate in direct connection mode.
4. Method according to any of the claims 1-3, wherein at least one wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) comprised in the user group, function as a group master, communicating both in the cellular network mode and the direct connection mode.

5. Method according to claim 4, wherein the other wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) in the user group, not being group masters, make an attempt to communicate with the group master within the same user group in direct connection mode.

6. Method according to any of the claims 4-5, wherein the wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) in the user group, which fail to connect to the group master in direct connection mode, connect to the user group using cellular network mode.

7. Method according to any of the claims 1-6, wherein the value, indicating the load in the cellular communication network (200) indicates the number of communication links made in the cellular network mode, between the wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213), which are members of the user group.

8. Method according to any of the claims 1-7, wherein the value, indicating the load in the cellular communication network (200) indicates the transferred data volume made in the cellular network mode, between the wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213), which are members of the user group.

9. Method according to any of the claims 1-8, wherein the method is performed in a network node (250) comprised in the cellular communication network (200).

10. Method according to any of the claims 1-9, wherein the method is performed in a network node (250), represented by a mobile phone.

11. Arrangement (400) in a cellular communication network (200) for group communication within a user group, which user group comprises a plurality of wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213)
which are adapted to communicate with each other in two different modes, a cellular network mode via a network node (250) and in a direct connection mode, the arrangement (400) is characterised by:

a control unit (404) adapted to arrange at least one wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) to communicate both in the cellular network mode and in the direct connection mode.

12. Arrangement (400) according to claim 11, further comprising:

an obtaining unit (401) adapted to obtain a value, indicating the load in the cellular communication network (200), and

a comparison unit (402), adapted to compare the obtained value with a threshold limit value.

13. Arrangement (400) according to claim 11 or 12, further comprising:

a calculator unit (403), adapted to calculate the difference between the threshold limit value and the obtained value.

14. Arrangement (400) according to any of the claims 11 - 13, wherein the arrangement (400) is comprised within a network node (250) in the cellular communication network (200).

15. Arrangement (400) according to any of the claims 11 - 14, wherein the arrangement (400) is comprised within a network node (250), represented by a mobile phone.

16. Arrangement (500) in a wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) adapted for group communication within a user group, which user group comprises a plurality of wireless communication devices (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213), which are adapted to communicate with each other in two different modes, a cellular network mode via a network node (250) and in a direct connection mode, the arrangement (500) is characterised by:

a control unit (504) adapted to arrange the wireless communication device (201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213) to communicate both in the cellular network mode and in the direct connection mode.
17. Arrangement (500) according to claim 16, further comprising:
   an obtaining unit (401) adapted to obtain a value, indicating the load in the cellular
   communication network (200), and
   a comparison unit (402), adapted to compare the obtained value with a threshold
   limit value.

18. Arrangement (500) according to claim 16 or 17, further comprising:
   a calculator unit (403), adapted to calculate the difference between the threshold
   limit value and the obtained value.
Figure 2
Obtain the load of the cellular communication network.

Compare the obtained value with a threshold limit value.

Calculate difference between the threshold limit and the obtained value.

Arrange a wireless communication device to communicate both in cellular network mode and direct connection mode.

Arrange another wireless communication device to communicate in direct connection mode.

Figure 3
INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2008/050420

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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: H04L, H04M, H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>WO 0162026 A1 (NOKIA MOBILE PHONES LTD), 23 August 2001 (23.08.2001), figure 3A, claim 10, abstract, paragraphs (0003), (0007), (0008), (0010), (0023), (0024), (0031), (0032), (0041)-(0043)</td>
<td>1-18</td>
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<td>X</td>
<td>WO 2004030387 A1 (EDMAN, L.), 8 April 2004 (08.04.2004), page 5, line 18 - line 21; page 8, line 13 - line 20; page 9, line 4 - line 6, figure 7, abstract</td>
<td>1-4, 11-13, 15-18</td>
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Further documents are listed in the continuation of Box C.

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Date of the actual completion of the international search: 3 February 2009

Date of mailing of the international search report: 0 5 02- 2009

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### INTERNATIONAL SEARCH REPORT

**International application No.**
PCT/SE2008/050420

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>WO 0122755 A1 (SIMOCO INTERNATIONAL LIMITED), 29 March 2001 (29.03.2001), abstract</td>
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Form PCT/ISA/210 (continuation of second sheet) (July 2008)
International patent classification (IPC)

H04W 4/08  (2009.01)
E04W 40/04  (2009.01)
H04W 84/18  (2009.01)
H04W 84/20  (2009.01)

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