The disclosures of all publications and patent documents mentioned in the specification, and of the publications and patent documents cited therein directly or indirectly, are hereby incorporated by reference.

SUMMARY OF THE DISCLOSURE

According to a first aspect of the present invention, there is provided a method for providing moving cellular communication, the method comprising: providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located, wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located relay resource manager, wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively, wherein providing the relay resource manager in each individual moving relay comprises: providing a radio resource manager; and providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay, the method also comprising effecting dynamic cell setup without interrupting service to mobile stations served by said base station functionalities, wherein said dynamic cell setup is effected by initiating a first hand-over between a first of the two base station functionalities to a second thereof; effecting the dynamic cell setup on the first base station functionality, then initiating a second hand-over between the second of the two base station functionalities to the first thereof and effecting the dynamic cell setup on the second base station functionality, and wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises increasing a current level of the second output power of the second base station functionality and substantially simultaneously reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second

base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

According to a second aspect of the present invention, there is provided a method for providing moving cellular communication, the method comprising: providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located, wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located relay resource manager, wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively, wherein providing the relay resource manager in each individual moving relay comprises: providing a radio resource manager; and providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay, and also comprising: providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities; providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities; using the first base station functionality to serve mobile stations in the first subset; and using the second base station functionality to serve mobile stations in the second subset.

According to a third aspect of the present invention, there is provided a method for providing moving cellular communication, the method comprising: providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located, wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located relay resource manager, wherein

each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively, wherein providing the relay resource manager in each individual moving relay comprises: providing a radio resource manager; and providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay, the method also comprising effecting dynamic cell setup without interrupting service to mobile stations served by said base station functionalities, wherein said dynamic cell setup is effected by initiating a first hand-over between a first of the two base station functionalities to a second thereof; effecting the dynamic cell setup on the first base station functionality, then initiating a second hand-over between the second of the two base station functionalities to the first thereof and effecting the dynamic cell setup on the second base station functionality, and wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

Certain embodiments of the presently disclosed subject matter seek to provide a cellular communication system utilizing upgraded moving relays.

Certain embodiments of the present invention seek to provide a way to enlarge backhauling bandwidth capacity by using a number of mobile station functionalities as backhauling devices.

Certain embodiments of the present invention seek to provide a way to enlarge the number of backhauling bearers by using a number of mobile station functionalities as backhauling devices.

Certain embodiments of the present invention seek to provide a way to improve data diversity by sending data in multiple paths using a number of mobile station functionalities as backhauling devices.

Certain embodiments of the present invention seek to provide way to initialize handover by using several UEs as backhauling devices.

Certain embodiments of the present invention relate to a relay station that comprises a standard base station and several mobile handsets that serve as mobile backhauling links.

~~In accordance with an aspect of the presently disclosed subject matter, there is provided~~ Disclosed herein is a moving cellular communication system comprising at least one upgraded moving relay including at least two base station functionalities and/or at least two mobile station functionalities and a radio manager, all co-located, wherein each base station functionality from among the at least two base station functionalities of the upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located radio manager, wherein each mobile station functionality from among the at least two mobile station functionalities of the upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define second radio links, respectively, wherein the

Subframe: e.g. as per LTE protocol

Trans. Downlink (DL) backhauling: transmit backhauling using downlink.

Tunnel: as per protocols that enables tunneling such as but not limited to GRE and GPRS.

UE: user entity or mobile station or mobile communication device or mobile station functionality, e.g. in a relay, which uses LTE protocol. Also termed herein "LTE mobile station".

Uplink (UL): a uni-directional portion of a pair of links e.g. of backhauling or access links, from a relay's mobile station functionality or mobile device to a relay's base station functionality or static base station.

Uplink backhaul data: data being transferred uni-directionally, over only the uplink portion of at least one backhauling link, typically from a base station to a core or more generally from an access point to a more centralized point.

upstream (US): flow of data from a lower point in a network topology (i.e. further from the core) to a higher point in a network topology (i.e. closer to the core).

~~In accordance with an aspect of the presently disclosed subject matter, there is provided~~ Disclosed herein is a moving cellular communication system comprising at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a radio manager, all co -located, wherein each base station functionality from among the at least two base station functionalities of the upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located radio manager, wherein each mobile station functionality of the upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively, wherein the radio manager in each individual moving relay comprises a radio resource manager, and functionality for exchanging information with radio managers is included in moving relays other than the individual moving relay.

In accordance with an aspect of the presently disclosed subject matter, there is further provided a moving cellular communication system comprising:

at least one upgraded moving relay including at least one base station functionality and at least two mobile station functionalities and a radio manager, all co-located, wherein

supporting larger number of bearers compared to a moving relay have one base station functionality and one mobile station functionality, while utilizing the at least two mobile station functionalities.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a system, wherein at least two of the second radio links of an upgraded moving relay communicate substantially identical data.

~~In accordance with an aspect of the presently disclosed subject matter, there is yet further provided~~ Disclosed herein is a method for providing moving cellular communication, the method comprising providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a radio manager, all co-located, wherein each base station functionality from among the at least two base station functionalities of the upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween, and wherein each base station functionality has a connection to its co-located radio manager, wherein each mobile station functionality of the upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively, wherein providing the radio manager in each individual moving relay comprises providing a radio resource manager; and providing functionality for exchanging information with radio managers included in moving relays other than the individual moving relay.

~~In accordance with an aspect of the presently disclosed subject matter, there is yet further provided~~ Disclosed herein is a method for providing moving cellular communication, the method comprising providing at least one upgraded moving relay including at least one base station functionality and at least two mobile station functionalities and a radio manager, all co-located, wherein each base station functionality of the upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define at least one first radio link therebetween, and wherein each base station functionality has a connection to its co-located radio manager, wherein each mobile station functionality from among the at least two mobile station functionalities of the upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively, wherein providing the radio manager in each individual moving relay comprises providing a radio resource manager; and

first subset of a population of mobile stations served by the at least two base station functionalities, for a first base station functionality of the at least two base station functionalities; providing a second set-up, which is suited to mobile stations not belonging to the first subset and which differs from the first set-up, for a second base station functionality of the at least two base station functionalities; using the first base station functionality to serve mobile stations in the first subset; and using the second base station functionality to serve mobile stations in the second subset.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a method wherein the first subset comprises mobile stations requiring a particularly low latency.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a method wherein the dynamic cell setup comprises providing a new value to a main set-up frequency parameter.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a method wherein the dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a method wherein the dynamic cell setup comprises providing a new value to a frame timing parameter.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a method wherein the dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

In accordance with an embodiment of the presently disclosed subject matter, there is yet further provided a computer program product, comprising a non-transitory computer usable medium having a computer readable program code embodied therein, the computer readable program code adapted to be executed to implement any of the methods shown and described herein.

Also ~~provided~~disclosed is a computer program comprising computer program code means for performing any of the methods shown and described herein when said program is run on a computer; and a computer program product, comprising a typically non-transitory computer-usable or -readable medium or computer readable storage medium, typically tangible, having a computer readable program code embodied therein, said computer readable program code adapted to be executed to implement any or all of the

methods shown and described herein. It is appreciated that any or all of the computational steps shown and described herein may be computer-implemented. The operations in accordance with the teachings herein may be performed by a computer specially constructed for the desired purposes or by a general purpose computer specially configured for the desired purpose by a computer program stored in a typically non-transitory computer readable storage medium.

Any suitable processor, display and input means may be used to process, display e.g. on a computer screen or other computer output device, store, and accept information such as information used by or generated by any of the methods and apparatus shown and described herein; the above processor, display and input means including computer programs, in accordance with some or all of the embodiments of the present invention. Any or all functionalities of the invention shown and described herein, such as but not limited to steps of flowcharts, may be performed by a conventional personal computer processor, workstation or other programmable device or computer or electronic computing device or processor, either general-purpose or specifically constructed, used for processing; a computer display screen and/or printer and/or speaker for displaying; machine-readable memory such as optical disks, CDROMs, magnetic-optical discs or other discs; RAMs, ROMs, EPROMs, EEPROMs, magnetic or optical or other cards, for storing, and keyboard or mouse for accepting. The term "process" as used above is intended to include any type of computation or manipulation or transformation of data represented as physical, e.g. electronic, phenomena which may occur or reside e.g. within registers and /or memories of a computer or processor. The term processor includes a single processing unit or a plurality of distributed or remote such units.

The above devices may communicate via any conventional wired or wireless digital communication means, e.g. via a wired or cellular telephone network or a computer network such as the Internet.

The apparatus as per embodiments of the present invention may include, according to certain embodiments of the invention, machine readable memory containing or otherwise storing a program of instructions which, when executed by the machine, implements some or all of the apparatus, methods, features and functionalities of the invention shown and described herein. Alternatively or in addition, the apparatus of the present invention may include, according to certain embodiments of the invention, a program as

above which may be written in any conventional programming language, and optionally a machine for executing the program such as but not limited to a general purpose computer which may optionally be configured or activated in accordance with the teachings of the present invention. Any of the teachings incorporated herein may wherever suitable operate on signals representative of physical objects or substances.

The embodiments referred to above, and other embodiments, are described in detail in the next section.

Any trademark occurring in the text or drawings is the property of its owner and occurs herein merely to explain or illustrate one example of how an embodiment of the invention may be implemented.

Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that throughout the specification discussions, utilizing terms such as, "processing", "computing", "estimating", "selecting", "ranking", "grading", "calculating", "determining", "generating", "reassessing", "classifying", "generating", "producing", "stereo-matching", "registering", "detecting", "associating", "superimposing", "obtaining" or the like, refer to the action and/or processes of a computer or computing system, or processor or similar electronic computing device, that manipulate and/or transform data represented as physical, such as electronic, quantities within the computing system's registers and/or memories, into other data similarly represented as physical quantities within the computing system's memories, registers or other such information storage, transmission or display devices. The term "computer" should be broadly construed to cover any kind of electronic device with data processing capabilities, including, by way of non-limiting example, personal computers, servers, computing system, communication devices, processors (e.g. digital signal processor (DSP), microcontrollers, field programmable gate array (FPGA), application specific integrated circuit (ASIC), etc.) and other electronic computing devices.

~~The~~Embodiments of the present invention may be described, merely for clarity, in terms of terminology specific to particular programming languages, operating systems, browsers, system versions, individual products, and the like. It will be appreciated that this terminology is intended to convey general principles of operation clearly and briefly, by way of example, and is not intended to limit the scope of the invention to any particular

CLAIMS:

1. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay,

the method also comprising effecting dynamic cell setup without interrupting service to mobile stations served by said base station functionalities,

wherein said dynamic cell setup is effected by initiating a first hand-over between a first of the two base station functionalities to a second thereof; effecting the dynamic cell setup on the first base station functionality, then initiating a second hand-over between the second of the two base station functionalities to the first thereof and effecting the dynamic cell setup on the second base station functionality,

and wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises increasing a current level of the second output power of the second base station functionality and substantially simultaneously reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

2. The method according to claim 1 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

3. The method according to claim 1 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

4. The method according to claim 3 wherein said using base station functionalities to provide, comprises coordinating the scheduler subsystems of said two base station functionalities to decrease interference between said two base station functionalities and to increase capacity achievable in at least one access link.

5. The method according to claim 3 wherein said using base station functionalities to provide, comprises coordinating the scheduler subsystems of said two base station functionalities to decrease interference between said two base station functionalities without separating said two base station functionalities to an extent that prevents the interference, and to increase the capacity achievable in said first link, and wherein the two base station functionalities are co-located.

6. The method according to claim 3 wherein said using base station functionalities to provide, comprises separating a large bandwidth to smaller bandwidth portions, wherein each of several base stations is assigned to a different bandwidth portion, and wherein portions reused more frequently are used near a cell and portions used less frequently are used closer to the edge of the cell, thereby, in combination with dynamic cell setup, enabling changing of bands more frequently.

7. The method according to claim 1 and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

8. The method according to claim 1 wherein said dynamic cell setup comprises providing a new value to a cell center frequency parameter.

9. The method according to claim 1 wherein said dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

10. The method according to claim 1 wherein said dynamic cell setup comprises providing a new value to a frame timing parameter.

11. The method according to claim 1 wherein said dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

12. The method according to claim 1 and also comprising using said at least two base station functionalities to provide a data rate to a set of mobile base stations served by said at least two base station functionalities, that is higher than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

13. A method according to claim 1 wherein said dynamic cell setup comprises providing a new value to at least one base station parameter of each of said at least two base station functionalities.

14. The method according to claim 13 wherein said at least one base station parameter includes at least one of: output power, center frequency, bandwidth, PLMN ID, MIB data, frame timing.

15. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay, and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

16. The method according to claim 15 wherein the first subset comprises mobile stations requiring a particularly low latency.

17. The method according to claim 15 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

18. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay,

the method also comprising effecting dynamic cell setup without interrupting service to mobile stations served by said base station functionalities,

wherein said dynamic cell setup is effected by initiating a first hand-over between a first of the two base station functionalities to a second thereof; effecting the dynamic cell setup on the first base station functionality, then initiating a second hand-over between the second of the two base station functionalities to the first thereof and effecting the dynamic cell setup on the second base station functionality,

and wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

19. A method according to claim 18 wherein initiating the second hand-over comprises reducing a current level of the second output power of the second base station functionality to a reduced second output power level far enough below a current level of the first output power of

the first base station functionality, to trigger hand-over from the second base station functionality back to the first base station functionality.

20. A method according to claim 18 wherein initiating the second hand-over comprises increasing a current level of the first output power of the first base station functionality and substantially simultaneously reducing a current level of the second output power of the second base station functionality to a reduced second output power level far enough below a current level of the first output power of the first base station functionality, to trigger hand-over from the second base station functionality back to the first base station functionality.

21. The method according to claim 18 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

22. The method according to claim 18 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

23. The method according to claim 18 and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

24. The method according to claim 18 wherein said dynamic cell setup comprises providing a new value to a cell center frequency parameter.

25. The method according to claim 18 wherein said dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

26. The method according to claim 18 wherein said dynamic cell setup comprises providing a new value to a frame timing parameter.

27. The method according to claim 18 wherein said dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

28. A method according to claim 18 wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

29. A method according to claim 18 and also comprising using said at least two base station functionalities to provide a data rate to a set of mobile base stations served by said at least two base station functionalities, that is higher than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

30. A method according to claim 18 wherein said dynamic cell setup comprises providing a new value to at least one base station parameter of each of said at least two base station functionalities.

31. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay,

the method also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities,

wherein said using base station functionalities to provide, comprises coordinating the scheduler subsystems of said two base station functionalities to decrease interference between said two base station functionalities without separating said two base station functionalities to an extent that prevents the interference, and to increase the capacity achievable in said first link, and wherein the two base station functionalities are co-located.

32. The method according to claim 31 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

33. The method according to claim 31 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

34. The method according to claim 31 and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

35. The method according to claim 31 wherein said dynamic cell setup comprises providing a new value to a cell center frequency parameter.

36. The method according to claim 31 wherein said dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

37. The method according to claim 31 wherein said dynamic cell setup comprises providing a new value to a frame timing parameter.

38. The method according to claim 31 wherein said dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

39. A method according to claim 31 wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

40. A method according to claim 31 and also comprising using said at least two base station functionalities to provide a data rate to a set of mobile base stations served by said at least two base station functionalities, that is higher than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

41. A method according to claim 31 wherein said dynamic cell setup comprises providing a new value to at least one base station parameter of each of said at least two base station functionalities.

42. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay,

the method also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities,

wherein said using base station functionalities to provide, comprises separating a large bandwidth to smaller bandwidth portions, wherein each of several base stations is assigned to a different bandwidth portion, and wherein portions reused more frequently are used near a cell and portions used less frequently are used closer to the edge of the cell, thereby, in combination with dynamic cell setup, enabling changing of bands more frequently.

43. The method according to claim 42 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

44. The method according to claim 42 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base stations served by said at least two base station functionalities, that is wider than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

45. The method according to claim 42 and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

46. The method according to claim 42 wherein said dynamic cell setup comprises providing a new value to a cell center frequency parameter.

47. The method according to claim 42 wherein said dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

48. The method according to claim 42 wherein said dynamic cell setup comprises providing a new value to a frame timing parameter.

49. The method according to claim 42 wherein said dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

50. A method according to claim 42 wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over

comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

51. A method according to claim 42 and also comprising using said at least two base station functionalities to provide a data rate to a set of mobile base stations served by said at least two base station functionalities, that is higher than would be possible if the set of mobile base stations were to be served by only one of said at least two base station functionalities.

52. A method according to claim 42 wherein said dynamic cell setup comprises providing a new value to at least one base station parameter of each of said at least two base station functionalities.

CLAIMS

1. A moving cellular communication system comprising:

at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager (rRM), all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein the relay resource manager in each individual moving relay comprises:

a radio resource manager; and

functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay.

2. A moving cellular communication system comprising:

at least one upgraded moving relay including at least one base station functionality and at least two mobile station functionalities and a relay resource manager, all co-located,

wherein each base station functionality of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define at least one first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via

antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively,

wherein the relay resource manager in each individual moving relay comprises:

a radio resource manager; and

functionality for exchanging information with relay resource managers is included in moving relays other than said individual moving relay.

3. A moving cellular communication system according to claim 1 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and radio manager;

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

4. A moving cellular communication system according to claim 3 wherein said relay resource manager also includes one of or part of or all of the following subsystems: radio resource subsystem, tunneling subsystem, routing & QoS subsystem and Stand-Alone subsystem.

5. The system according to Claim 1 or claim 3, wherein said at least two base station functionalities operate substantially simultaneously.

6. The system according to Claim 3, wherein said unit which has a base station functionality being a base station.

7. The system according to Claim 3, wherein said unit which has a base station functionality forms part of a moving relay.

8. The system according to Claim 3, wherein said unit which has a base station functionality forms part of upgraded moving relay.

9. The system according to Claim 3, wherein said network further comprising at least one moving relay having one base station functionality and one mobile station functionality.

10. The system according to Claim 3, wherein at least two of said second radio links communicate with units having base station functionality, located in different geographic locations.

11. The system According to Claim 10, wherein at least two of said second radio links of an upgraded moving relay communicate substantially identical data.

12. The system according to Claim 3, wherein at least one of said second radio links serves for communicating control data and at least other of said second radio links serves for communicating user data.

13. The system according to Claim 2 or claim 3, wherein at least one of said mobile station functionalities within an upgraded moving relay serves as a backup to other mobile station functionality of the same upgraded moving relay, and said relay resource manager is operative to switch communication from said other mobile station functionality to said backup mobile station functionality in response to meeting a mobile station handover criterion.

14. The system according to Claim 1 or claim 3, wherein at least one of said base station functionalities within an upgraded moving relay serves as a backup to other base station functionality of the same upgraded moving relay, and said relay resource manager is operative to seamlessly switch communication from said other base station functionality to said backup base station functionality in response to meeting a base station handover criterion.

15. The system according to Claim 3, wherein said network utilizing bearers serving for conveying communication from a mobile station through a communication route to the core of said cellular communication system , and wherein said upgraded moving relays supporting larger number of bearers compared to a moving relay having one base station functionality and one mobile station functionality, while utilizing said at least two mobile station functionalities.

16. The system according to Claim 3, wherein at least two of said second radio links of an upgraded moving relay communicate substantially identical data.

17. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least two base station functionalities and at least one mobile station functionality and a relay resource manager, all co-located,

wherein each base station functionality from among said at least two base station functionalities of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define a first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least one second radio link, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay.

18. A method for providing moving cellular communication, the method comprising:

providing at least one upgraded moving relay including at least one base station functionality and at least two mobile station functionalities and a relay resource manager, all co-located,

wherein each base station functionality of said upgraded moving relay is operative to communicate via antennae with at least one mobile station thereby to define at least one first radio link therebetween,

and wherein each base station functionality has a connection to its co-located relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively,

wherein providing the relay resource manager in each individual moving relay comprises:

providing a radio resource manager; and

providing functionality for exchanging information with relay resource managers included in moving relays other than said individual moving relay.

19. A method according to Claim 17 wherein the at least one mobile station functionality includes at least two mobile station functionalities co-located with said base station functionalities and relay resource manager,

wherein each mobile station functionality from among said at least two mobile station functionalities of said upgraded moving relay communicates via antennae with a unit which has base station functionality thereby to define at least two second radio links, respectively.

20. A method according to Claim 17 and also comprising effecting dynamic cell setup without interrupting service to mobile stations served by said base station functionalities.

21. A method according to Claim 18 and also comprising supporting cellular communication over a many-to-one topology.

22. A method according to Claim 18 and also comprising using said two mobile station functionalities to support cellular communication over a many-to-many topology.

23. A method according to Claim 18 and also comprising using said two mobile station functionalities to perform at least one backhauling operation at a data rate which exceeds a data rate of a backhauling operation performed using only one of the two mobile station functionalities.

24. A method according to Claim 18 and also comprising using said two mobile station functionalities to provide a larger number of bearers than would be available if cellular communication were supported by only one of the two mobile station functionalities.

25. A method according to Claim 18 and also comprising using said two mobile station functionalities to provide hot redundancy.

26. A method according to Claim 25 wherein said hot redundancy comprises sending backhauling data using said at least two mobile station functionalities a plurality of times rather than only once.

27. A method according to Claim 18 and also comprising using said two mobile station functionalities to provide a plurality of alternate routes between mobile stations served by said at least one base station functionality, and a core of a cellular network to which the moving relay belongs.

28. A method according to Claim 17 and also comprising using said at least two base station functionalities to provide a bandwidth to a set of mobile base station served by said at least two base station functionalities, that is wider than would be possible if

the same set of mobile base station were to be served by only one of said at least two base station functionalities.

29. A method according to Claim 20 wherein said dynamic cell setup is effected by initiating a first hand-over between a first of the two base station functionalities to a second thereof; effecting the dynamic cell setup on the first base station functionality, then initiating a second hand-over between the second of the two base station functionalities to the first thereof and effecting the dynamic cell setup on the second base station functionality.

30. A method according to Claim 29 wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises increasing a current level of the second output power of the second base station functionality and substantially simultaneously reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

31. A method according to Claim 17 and also comprising:

providing a first set-up, suited to a first subset of a population of mobile stations served by said at least two base station functionalities, for a first base station functionality of said at least two base station functionalities;

providing a second set-up, which is suited to mobile stations not belonging to said first subset and which which differs from the first set-up, for a second base station functionality of said at least two base station functionalities;

using the first base station functionality to serve mobile stations in the first subset; and

using the second base station functionality to serve mobile stations in the second subset.

32. A method according to Claim 31 wherein the first subset comprises mobile stations requiring a particularly low latency.

33. A method according to Claim 20 wherein said dynamic cell setup comprises providing a new value to a cell center frequency parameter.

34. A method according to Claim 20 wherein said dynamic cell setup comprises providing a new value to a cell bandwidth parameter.

35. A method according to Claim 20 wherein said dynamic cell setup comprises providing a new value to a frame timing parameter.

36. A method according to Claim 20 wherein said dynamic cell setup comprises providing a new value to a master information block (MIB) parameter.

37. A moving cellular communication system according to claim 1 wherein said relay resource manager also includes one of or part of or all of the following subsystems: radio resource subsystem, tunneling subsystem, routing & QoS subsystem and Stand-Alone subsystem.

38. A moving cellular communication system according to claim 2 wherein said relay resource manager also includes one of or part of or all of the following subsystems: radio resource subsystem, tunneling subsystem, routing & QoS subsystem and Stand-Alone subsystem.

39. The system according to any of Claims 2 – 4, 38 wherein said at least two mobile station functionalities operate substantially simultaneously.

40. A method according to Claim 29 wherein said first and second base station functionalities operate at first and second output powers respectively and wherein initiating the first hand-over comprises reducing the first output power of the first base station functionality to a reduced first output power level far enough below the second output power of the second base station functionality, to trigger hand-over from the first base station functionality to the second base station functionality.

41. A method according to Claim 17 and also comprising using said at least two base station functionalities to provide a data rate to a set of mobile base station served by said at least two base station functionalities, that is higher than would be possible if the same set of mobile base station were to be served by only one of said at least two base station functionalities.

42. A method according to Claim 28 or 41 wherein said using base station functionalities to provide, comprises coordinating the scheduler subsystems of said two base station functionalities to decrease interference between said two base station functionalities and to increase capacity achievable in at least one access link.

43. A method according to Claim 28 or 41 wherein said using base station functionalities to provide, comprises coordinating the scheduler subsystems of said two base station functionalities to decrease interference between said two base station functionalities and to increase the capacity achievable in said first link, and wherein the two base station functionalities are co-located.

44. A method according to Claim 28 wherein said using base station functionalities to provide, comprises separating a large bandwidth to smaller bandwidth portions, wherein each of several base stations is assigned to a different bandwidth portion, and wherein portions reused more frequently are used near the cell and portions used less frequently are used closer to the edge of the cell, thereby, in combination with dynamic cell setup, enabling changing of bands more frequently.

45. A method according to Claim 40 wherein initiating the second hand-over comprises reducing a current level of the second output power of the second base station functionality to a reduced second output power level far enough below a current level of the first output power of the first base station functionality, to trigger hand-over from the second base station functionality back to the first base station functionality.

46. A method according to Claim 40 wherein initiating the second hand-over comprises increasing a current level of the first output power of the first base station functionality and substantially simultaneously reducing a current level of the second output power of the second base station functionality to a reduced second output power level far enough below a current level of the first output power of the first base station functionality, to trigger hand-over from the second base station functionality back to the first base station functionality.

47. A method according to Claim 20 wherein said dynamic cell setup comprises providing a new value to at least one base station parameter of each of said at least two base station functionalities.

48. A method according to Claim 47 wherein said at least one base station parameter includes at least one of: output power, center frequency, bandwidth, PLMN ID, MIB data, frame timing.

49. A system according to any of claims 1-4, 6 – 12, 15 - 16, 37 - 39 wherein said system comprises a network operable according to at least one of the following standards: 2G, GSM, CDMA, 3G, UMTS, WCDMA, HSPA, LTE, WiMAX, WiFi.

50. A system according to any of claims 1 - 4, 6 – 12, 15 - 16, 37 – 39 wherein said system has at least one inter-node interface operable according to at least one of the following standards: 2G, GSM, CDMA, 3G, UMTS, WCDMA, HSPA, LTE, WiMAX, WiFi.

51. A computer program product, comprising a non-transitory computer usable medium having a computer readable program code embodied therein, said computer readable program code adapted to be executed to implement any of the methods shown and described herein.

52. A method according to any of claims 17 – 36, 40 - 48, wherein said system has at least one inter-node interface operable according to at least one of the following standards: 2G, GSM, CDMA, 3G, UMTS, WCDMA, HSPA, LTE, WiMAX, WiFi.

53. A method according to any of claims 17 – 36, 40 - 48,, wherein said system comprises a network operable according to at least one of the following standards: 2G, GSM, CDMA, 3G, UMTS, WCDMA, HSPA, LTE, WiMAX, WiFi.