CLAIMS:

1. A system for multicarrier cellular communication in an LTE cellular network including a multiplicity of nodes including a plurality of moving relays, the system comprising:

at an individual moving relay from among the plurality of moving relays, an rBS having downlink communication, according to an LTE protocol, with UEs served thereby; and

a co-located rRM (relay Resource Manager) having a controller; and

a scheduler;

wherein said controller is operative to induce said rBS to coordinate between schedulers in at least some of the plurality of moving relays to ensure that each user has its own time and/or frequency such that channels do not overlap because time and/or frequency are shifted to prevent said overlap,

wherein separation of different resources assigned to different nodes respectively is achieved Using a Dedicated Scheduler,

wherein at least one relay that can monitor two adjacent relays, detects when those two adjacent relays are operating in the same center frequency, and coordinates them so that one of them changes its center frequency to a free center frequency,

wherein coordination in the uplink, between different network entities is provided and wherein, in coordinating between the different schedulers the BS that the rUE is attached to is selected as the coordinator and all rUEs attached thereto are deemed coordinated clients and wherein the serving base station is configured for getting backhauling requirements in advance and allocating resources to said clients and wherein the coordinator is configured to divide resources between the coordinated clients and send the allocated resources map to the coordinated clients, and wherein the rUE's receive the allocated resource map and forward said map to the collocated base station and wherein, when a base station B receives the allocation map, base station B knows the available PDSCH RB and PUSCH RB for access and the allocated PDSCH RB and PUSCH RB

for backhauling for the next N TTI and knows what PDCCH symbols are to be blanked and wherein the BS also receives, at least once, a time shift to be effected and an indication of where to place the PRACH and PUCCH channel.

2. A system according to claim 1, wherein the individual node also comprises an rUE (relay User Equipment, also termed herein relay's mobile station functionality) and wherein at least one additional node within the multiplicity of nodes is close enough to said individual node such that an additional rBS residing at the additional node communicates with said rUE, and wherein said individual node's controller is also operative to induce said additional rBS to generate a selective quiet region in a domain.

3. A system according to claim 2, wherein said individual node's controller is also operative to induce said additional rBS to generate a selective quiet region in a domain, by:

instructing the additional rBS, via the individual node's rUE, to employ an rRM-controllable channel for downlink communication in said region, wherein said rRM-controllable channel's content is controlled by an additional rRM residing at the additional node; and

via the individual node's rUE, instructing the additional rRM to assign blank content to said rRM-controllable channel for downlink communication in said region;

wherein the said individual's node controller is operative to determine whether it is the individual node, or some other node, which is responsible for inducing said additional rBS to generate a selective quiet region, by comparing said individual node to at least one characteristic of at least one other node, obtained from the individual nodes' rUE.

4. A system according to claim 3, wherein said selective quiet region is selected to enable the individual node's rBS to communicate with UEs served thereby and also to

enable nodes within interference range of the individual node to communicate with UEs served by the nodes respectively, all with tolerable interference.

5. A system according to claim 2, wherein said individual node's controller is also operative to induce said additional rBS to generate a selective quiet region in a domain, by: instructing the additional rUE residing at the additional node, via the individual node's rBS, to employ an rRM-controllable channel for downlink communication in said region, wherein said rRM-controllable channel's content is controlled by an additional rRM residing at the additional node; and via the individual node's rBS, instructing the additional rRM to assign blank content to said rRM-controllable channel for downlink communication in said region, and

wherein said node's controller is also operative to induce bi-directional communication between said individual and additional nodes by generating a selective first quiet region ("individual node quiet region") in a domain by the individual rBS in whose first quiet region the additional node rBS can first transmit a downlink channel to the individual node rUE, and, optionally in parallel and/or simultaneously, instructing the additional node rBS to generate a second quiet region in a domain in whose second quiet region the individual node rBS can transmit a second downlink channel to the additional node rUE.

6. A system according to claim 2, wherein said individual node's controller is operative to induce said additional rBS to generate a selective quiet region in a domain only if a predetermined rule stipulates that the individual node is responsible for inducing said additional rBS to generate a selective quiet region.

7. A system according to claim 1, wherein said controller is operative to induce said rBS to generate a selective quiet region in a domain by: instructing the rBS to employ an rRM-controllable channel whose content the rRM controls, for downlink communication

in said region; and assigning blank content to said rRM-controllable channel for downlink communication in said region.

8. A system according to claim 7, wherein said rBS is operative to determine content of at least one control channel, so as to ensure that the rRM-controllable channel is employed for downlink communication in said region.

9. A system according to claim 7, wherein according to the protocol, at least one compulsory control channel is used for downlink communications and wherein said rRM-controllable channel is selected to be a channel which minimizes content travelling over the compulsory control channel at least when blank content is assigned to rBS-controllable channel.

10. A system according to claim 1, wherein said protocol comprises a 3GPP protocol operating in MBMS broadcast mode, said rBS comprises an eNB and wherein said rRM comprises an MCE.

11. A system according to claim 1,

wherein the individual's node controller is operative to compare the individual node to at least one characteristic of at least one other node, obtained from the individual nodes' rUE, and

wherein the individual node also comprises a mobile station functionality and wherein at least one additional node within the multiplicity of nodes is close enough to said individual node such that an additional base station functionality residing at the additional node communicates with said mobile station functionality, and wherein said individual node's controller is also operative to induce said additional base station functionality to generate a selective quiet region in a domain by:

instructing the additional rBS, via the individual node's mobile station functionality, to employ an rRM-controllable channel for downlink communication in

said region, wherein said rRM-controllable channel's content is controlled by an additional rRM residing at the additional node; and

via the individual node's mobile station functionality, instructing the additional rRM to assign blank content to said rRM-controllable channel for downlink communication in said region,

wherein said individual node's controller is operative to induce said additional base station functionality to generate a selective quiet region in a domain only if a predetermined rule stipulates that the individual node is responsible for inducing said additional base station functionality to generate a selective quiet region,

wherein said characteristic comprises a Cell ID and wherein said predetermined rule stipulates, for a given set of Cell IDs, which Cell ID in the set, hence which node's controller, is responsible for inducing said additional rBS to generate a selective quiet region, and

wherein said set of Cell IDs comprises all Cell IDs of a set of potentially mutually interfering nodes including the individual node and the nodes currently within interference range of the individual nodes, and wherein the controller of the node whose Cell ID is responsible according to said rule, is operative to induce rBS s of each node whose Cell ID is included in said set of Cell IDs, to generate quiet regions selected to enable the individual node's rBS to communicate with UEs served thereby and also to enable nodes within interference range of the individual node to communicate with UEs served by the nodes respectively, all with tolerable interference.

12. A system according to claim 1,

wherein the individual's node controller is operative to compare the individual node to at least one characteristic of at least one other node, obtained from the individual nodes' rUE, and

wherein the individual node also comprises a mobile station functionality and wherein at least one additional node within the multiplicity of nodes is close enough to said individual node such that an additional base station functionality residing at the

additional node communicates with said mobile station functionality, and wherein said individual node's controller is also operative to induce said additional base station functionality to generate a selective quiet region in a domain by:

instructing the additional rBS, via the individual node's mobile station functionality, to employ an rRM-controllable channel for downlink communication in said region, wherein said rRM-controllable channel's content is controlled by an additional rRM residing at the additional node; and

via the individual node's mobile station functionality, instructing the additional rRM to assign blank content to said rRM-controllable channel for downlink communication in said region,

wherein said individual node's controller is operative to induce said additional base station functionality to generate a selective quiet region in a domain only if a predetermined rule stipulates that the individual node is responsible for inducing said additional base station functionality to generate a selective quiet region,

wherein an individual node's rBS is operative to broadcast said characteristic in a region within a domain which is at least partly randomly selected, thereby to ensure that statistically, nodes within a communication range each broadcast said characteristic at a different time,

wherein an individual node's rBS is operative to broadcast said characteristic in a region within a domain which is a first region which conforms to at least one requirement, thereby to facilitate parsimonious allocation of the domain, wherein said requirement includes ensuring that control information broadcast by one of several nodes within a communication range, does not override control information broadcast by any other one of the nodes within the communication range, and

wherein said region is defined within a time domain and wherein an individual node's rBS is operative first to wait an entire frame to determine which subframes are available given other nodes within communication range and in a frame succeeding said entire frame, to broadcast said characteristic at a delayed location, within a first subframe

from among said subframes found to be available after waiting a random time period, wherein said delayed location is selected to adhere to said requirement.

13. A system according to claim 1, employing an algorithm of detection and selection of transmission time on the DL side of a starting symbol, wherein the algorithm detects the symbol time offset according to the transmission of the neighboring cells.

14. A system according to claim 1, which is operative for using rUE measurements in order to determine scheduling of DL\UL resources.

15. A system according to claim 1, which is operative for shifting of frames and/or symbols in order to reduce mutual interference between cells.

16. A system according to claim 1, which includes a dynamic power control mechanism for mobile base stations which is operative to reduce at least one of: network interfering and/or battery power consumption.

17. A system according to claim 1, wherein the cellular network is operative to support multi-hop communication and wherein the controller in each of at least some relays is operative to coordinate topology and not only to coordinate requirements, thereby to facilitate said multi-hop communication.

18. A system according to claim 1, wherein some frequencies are unused at specific times and wherein, as a result, some frequencies and some time-slots are assigned to backhauling whereas other frequencies and other time-slots are assigned to access.

19. A system according to claim 1, wherein the time-synchronized set of nodes also includes a grandson node which is a son of the son node and is time-synchronized to the son and to the ancestor in that at least some frames transmitted by the grandson are time-

shifted relative to frames transmitted by the ancestor thereby to define ancestor-son-grandson time-shifts and wherein the ancestor-son-grandson time-shifts for at least some frames are selected to ensure that at least one ancestor-transmitted subframe which includes control data temporally coincides with at least a portion of a subframe in which both the son and the grandson are constrained not to transmit control data.

20. A system according to claim 1, wherein a dedicated adjustment channel is used to allocate channels and transfer allocations at a rate that is suitable for the scheduler.

21. A system according to claim 1, wherein separation of different resources assigned to different nodes respectively is achieved Using a Dedicated Scheduler is characterized by changes at a physical-layer level.

22. A system according to claim 1, wherein a dedicated scheduler is used for dynamically allocating time-deflected (shifted) subframes in downlink.

23. A system according to claim 1, wherein a dedicated scheduler is used for dynamically allocating PUSCH and PUCCH channels.

24. A system according to claim 1, wherein a dedicated scheduler uses MBSFN channels as almost blank subframes in DL due to lack of transmission of CRS in MBSFN.

25. A system according to claim 1, wherein separation in space and frequency is increased to enhance performance.

26. A system according to claim 1, wherein an antenna and IC mechanisms are used to isolate control and CRS messages.

27. A system according to claim 1, wherein a base station is selected to be a coordinator operative to coordinate between plural schedulers thereby to define the coordinator's attached rUEs as coordinated clients and wherein the coordinator is operative to divide resources between said coordinated clients and send the allocated resources map to said coordinated clients.

28. A system according to claim 1, wherein coordination is provided between plural base stations' schedulers to minimize interference between said schedulers.

29. A system according to claim 1, wherein once control information is sent the scheduler knows an amount of data and a map portion where the backhauling information resides and the scheduler is operative to keep said map portion blank for access channels.

30. The system of claim 1, wherein the first transmitter comprises the ancestor and the second transmitter comprises the son.

31. The system of claim 1, wherein the first transmitter comprises the son and the second transmitter comprises the ancestor.

32. The system of claim 1, wherein the synchronization subsystem provides Time synchronization with the radio resource subsystem and with rUE.

33. A method for multicarrier cellular communication in an LTE cellular network including a multiplicity of nodes including a plurality of moving relays, the method comprising:

providing at an individual moving relay from among the plurality of moving relays, an rBS having downlink communication, according to an LTE protocol, with UEs served thereby; and

a co-located rRM (relay Resource Manager) having a controller; and

a scheduler;

wherein said controller is operative to induce said rBS to coordinate between schedulers in at least some of the plurality of moving relays to ensure that each user has its own time and/or frequency such that channels do not overlap because time and/or frequency are shifted to prevent said overlap,

wherein the individual moving relay comprises a cellular communication network node including an antenna, transmitter and receiver and functioning both as a mobile communication device and a base station,

wherein the scheduler generates a resource block map taking into account at least (a) resources required by user entities pertinent to said overlap; (b) available backhauling bandwidth and (c) bandwidth required and SNR (signal noise ratio) available in each link,

wherein the multiplicity of nodes includes at least one time-synchronized set of nodes including an ancestor node and a son node which is a son of the ancestor node and is time-synchronized to the ancestor in that at least some frames transmitted by the son are time-shifted relative to frames transmitted by the ancestor thereby to define an ancestor-son time-shift,

wherein the time-shift is selected, for at least some frames, to be a time-shift which causes at least one ancestor-transmitted subframe which includes control data to temporally coincide with at least a portion of a subframe in which the son is constrained not to transmit control data,

the method also including providing a synchronization subsystem, configured for performing an individual blanking scheme from among n schemes which respectively perform cyclic subframe-level blanking with n respective start shifts; and

wherein a system clock introduces a time shift that shifts at least one start of at least one symbol in at least one frame according to said individual blanking scheme, wherein separation of different resources assigned to different nodes respectively is achieved Using a Dedicated Scheduler, and

wherein at least one relay that can monitor two adjacent relays, detects when those two adjacent relays are operating in the same center frequency, and coordinates them so that one of them changes its center frequency to a free center frequency

wherein coordination in the uplink, between different network entities is provided and wherein, in coordinating between the different schedulers the BS that the rUE is attached to is selected as the coordinator and all rUEs attached thereto are deemed coordinated clients and wherein the serving base station is configured for getting backhauling requirements in advance and allocating resources to said clients and wherein the coordinator is configured to divide resources between the coordinated clients and send the allocated resources map to the coordinated clients, and wherein the rUE's receive the allocated resource map and forward said map to the collocated base station and wherein, when a base station B receives the allocation map, base station B knows the available PDSCH RB and PUSCH RB for access and the allocated PDSCH RB and PUSCH RB for backhauling for the next N TTI and knows what PDCCH symbols are to be blanked and wherein the BS also receives, at least once, a time shift to be effected and an indication of where to place the PRACH and PUCCH channel.

34. The method of claim 33, wherein the Radio resource controller is operative for controlling at least said lower base station functionality transmission power.

The method of claim 33, wherein the Radio resource controller is operative for controlling at least blanking of particular base station functionality resource blocks/subframe/s.

36. The method of claim 33, wherein the Radio resource controller is operative for controlling at least said request for mobile station functionality uplink grantThe method of claim 33, wherein the Radio resource controller is operative for controlling at least said changing of said center frequency.

38. The method of claim 33, wherein the Radio resource controller is operative for controlling at least said changing of said bandwidth.

A computer program product, comprising a non-transitory tangible computer readable medium having computer readable program code embodied therein, said computer readable program code adapted to be executed to implement a method for multicarrier cellular communication in an LTE cellular network including a multiplicity of nodes including a plurality of moving relays, the method comprising:

providing at an individual moving relay from among the plurality of moving relays, an rBS having downlink communication, according to an LTE protocol, with UEs served thereby; and

a co-located rRM (relay Resource Manager) having a controller; and

a scheduler;

wherein said controller is operative to induce said rBS to coordinate between schedulers in at least some of the plurality of moving relays to ensure that each user has its own time and/or frequency such that channels do not overlap because time and/or frequency are shifted to prevent said overlap,

wherein the individual moving relay comprises a cellular communication network node including an antenna, transmitter and receiver and functioning both as a mobile communication device and a base station,

wherein the scheduler generates a resource block map taking into account at least (a) resources required by user entities pertinent to said overlap; (b) available backhauling bandwidth and (c) bandwidth required and SNR (signal noise ratio) available in each link, and

wherein the multiplicity of nodes includes at least one time-synchronized set of nodes including an ancestor node and a son node which is a son of the ancestor node and is time-synchronized to the ancestor in that at least some frames transmitted by the son are time-shifted relative to frames transmitted by the ancestor thereby to define an ancestor-son time-shift, and

wherein the time-shift is selected, for at least some frames, to be a time-shift which causes at least ancestor-transmitted subframe which includes control data to temporally coincide with at least a portion of a subframe in which the son is constrained not to transmit control data,

the method also including providing a synchronization subsystem, configured for performing an individual blanking scheme from among n schemes which respectively perform cyclic subframe-level blanking with n respective start shifts;

wherein a system clock introduces a time shift that shifts at least one start of at least one symbol in at least one frame according to said individual blanking scheme, wherein separation of different resources assigned to different nodes respectively is achieved Using a Dedicated Scheduler, and

wherein at least one relay that can monitor two adjacent relays, detects when those two adjacent relays are operating in the same center frequency, and coordinates them so that one of them changes its center frequency to a free center frequency

wherein coordination in the uplink, between different network entities is provided and wherein, in coordinating between the different schedulers the BS that the rUE is attached to is selected as the coordinator and all rUEs attached thereto are deemed coordinated clients and wherein the serving base station is configured for getting backhauling requirements in advance and allocating resources to said clients and wherein the coordinator is configured to divide resources between the coordinated clients and send the allocated resources map to the coordinated clients, and wherein the rUE's receive the allocated resource map and forward said map to the collocated base station and wherein, when a base station B receives the allocation map, base station B knows the available PDSCH RB and PUSCH RB for access and the allocated PDSCH RB and PUSCH RB for backhauling for the next N TTI and knows what PDCCH symbols are to be blanked and wherein the BS also receives, at least once, a time shift to be effected and an indication of where to place the PRACH and PUCCH channel.