

[0005] Example embodiments of the invention work to improve at least operations associated with such multiple-access systems as stated above.

Summary

[0006] In an example aspect of the invention, there is a method, such as a method performed by a device of FIG. 7, comprising: receiving, by a network device, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier; based on the information, determining, by the network device of a communication network, a subset of data transmissions of a previous burst of data transmissions to be retransmitted by the network device; and based on the determining, performing by the network device retransmission of the subset of data transmissions using scheduled resources of the uplink grant. In an aspect, there is provided a method, comprising:

receiving, by user equipment of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier;
based on the information, determining, by the user equipment, a subset of data transmissions of a previous burst of data transmissions to be retransmitted by the user equipment; and based on the determining, performing by the user equipment retransmission of the subset of data transmissions using scheduled resources of the uplink grant wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, using at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions. In an aspect, there is provided a user equipment, comprising:

means for receiving information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier;

means, based on the information, for determining, by the user equipment of a communication network, a subset of data transmissions of a previous burst of data transmissions to be retransmitted by the user equipment; and

means, based on the determining, for performing by the user equipment

retransmission of the subset of data transmissions using scheduled resources of the uplink grant,
wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, the user equipment is configured to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions. In an aspect, there is a method, comprising:

determining, by a network node of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier to identify a subset of data transmissions of a previous burst of data transmissions to be retransmitted by a user equipment; and

based on the determining, sending the information towards the user equipment for use in retransmission of the subset of data transmissions using scheduled resources of the uplink grant,

wherein the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, causes the user equipment to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value

other than process identity values corresponding to processes used for the retransmissions. In an aspect, there is provided a network node, comprising:

means for determining, by a network node of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier to identify a subset of data transmissions of a previous burst of data transmissions to be retransmitted by a user equipment; and

means, based on the determining, for sending the information towards the user equipment for use in retransmission of the subset of data transmissions using scheduled resources of the uplink grant,

wherein the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, causes the user equipment to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions.

~~[0006]~~[0007] A further example embodiment is a method comprising the method of the previous paragraph, wherein the subset of data transmissions is of at least one physical uplink shared channel transmission of the previous burst of data transmissions to be retransmitted, wherein information comprising the uplink grant comprises at least one process identification value associated with the previous burst of data transmissions to be retransmitted and a number of transmission time intervals scheduled by the uplink grant, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a configured scheduled radio network temporary identifier, the network device is including configured grant-uplink control information for each data transmission of the subset and the retransmission is using a scheduled resource of the uplink grant associated with a process identification value for each data transmission, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a cell radio network temporary identifier, the retransmission is using scheduled resources of the uplink grant associated with consecutive process identity values starting with an initial process identity value indicated by the at least one process identification value, indicated with the at least one process identification value of the uplink grant, wherein the at least one process identification value of the uplink grant is identifying for the retransmission one of

CLAIMS

What is claimed is:

1. A method, comprising:

receiving, by a ~~network device~~user equipment of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier;

based on the information, determining, by the ~~user equipment~~network device, a subset of data transmissions of a previous burst of data transmissions to be retransmitted by the ~~user equipment~~network device; and

based on the determining, performing by the ~~user equipment~~ network device retransmission of the subset of data transmissions using scheduled resources of the uplink grant;

wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, using at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions.

2. The method of claim 1, wherein the subset of data transmissions is of at least one physical uplink shared channel transmission of the previous burst of data transmissions to be retransmitted.

3. The method of claim 1, wherein information comprising the uplink grant comprises at least one process identification value associated with the previous burst of data transmissions to be retransmitted and a number of transmission time intervals scheduled by the uplink grant.

~~4. The method of claim 3, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a configured scheduled radio network temporary identifier, the network device~~user equipment ~~is including configured grant uplink control information for each data transmission of the subset and the retransmission is using a scheduled resource of the uplink grant associated with a~~

~~process identification value for each data transmission.~~

~~5. The method of claim 3, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a cell radio network temporary identifier, the retransmission is using scheduled resources of the uplink grant associated with~~

~~consecutive process identity values starting with an initial process identity value indicated by the at least one process identification value, wherein the process identity values are one of determined or received by the user equipmentnetwork device.~~

~~6.——The method of claim 3, wherein the at least one process identification value of the uplink grant is identifying for the retransmission one of subframe, slot, or symbol of different transmission time intervals of a previously configured grant burst.~~

~~7.——The method of claim 3, wherein the at least one process identification value is a first process identification value indicative for a first transmission of the retransmissions.~~

~~8.——The method of claim 3, wherein the at least one process identification value is indicative of a time offset relative to a first slot of the uplink grant, wherein the time offset is identifying a first subframe, slot, or symbol for a first transmission of the retransmission.~~

~~9.——The method according to any one of claims 7 or 8, wherein the process identity of at least one further retransmission other than the first transmission of the subset of data transmissions is determined implicitly based on a first process identity of the at least one process identification value of the information and a number of transmission time intervals scheduled by the uplink grant.~~

~~10.——The method of claim 2, wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, the network device is using at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than the process identity values corresponding to processes used for the retransmissions.~~

~~11.——The method of claim 2, wherein based on the information indicating a number of transmissions associated with the grant is different than a number of transmissions transmitted in the previous burst of data transmissions by the network device, the~~

~~network device ignores a new data indicator of the uplink grant and retransmits the previous burst of data transmissions.~~

~~12. The method according to any one of claims 7-11, wherein the at least one process identification value comprises at least one hybrid automatic repeat request process identity.~~

~~13. The method of claim 1, wherein the information is received from a network node associated with the communication network.~~

~~144.~~ A user equipment~~n apparatus~~, comprising:

means for receiving information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier;

means, based on the information, for determining, by ~~a network device~~the user equipment of a communication network, a subset of data transmissions of a previous burst of data transmissions to be retransmitted by the ~~network device~~user equipment;

and
means, based on the determining, for performing by the ~~network device~~user equipment retransmission of the subset of data transmissions using scheduled resources of the uplink grant.

wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, the user equipment is configured to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions.

~~155.~~ The user equipment~~n apparatus~~ of claim ~~144~~, wherein the subset of data transmissions is of at least one physical uplink shared channel transmission of the previous burst of data transmissions to be retransmitted.

~~166~~. The user equipment apparatus of claim ~~144~~, wherein information comprising the uplink grant comprises at least one process identification value associated with the previous burst of data transmissions to be retransmitted and a number of transmission time intervals scheduled by the uplink grant.

~~177~~. The user equipment apparatus of claim ~~166~~, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a configured scheduled radio network temporary identifier, the user equipment network device is configured to include ~~being~~ configured grant-uplink control

information for each data transmission of the subset and the retransmission is using a scheduled resource of the uplink grant associated with a process identification value for each data transmission.

~~188.~~ The ~~user equipment apparatus~~ of claim ~~166~~, wherein based on the uplink grant having cyclic redundancy check bits scrambled with a cell radio network temporary identifier, the retransmission is using scheduled resources of the uplink grant associated with consecutive process identity values starting with an initial process identity value indicated by the at least one process identification value.

~~199.~~ The ~~user equipment apparatus~~ of claim ~~166~~, wherein the at least one process identification value of the uplink grant is identifying for the retransmission one of subframe, slot, or symbol of different transmission time intervals of a previously configured grant burst.

~~2010.~~ The ~~user equipment apparatus~~ of claim ~~166~~, wherein the at least one process identification value is a first process identification value indicative for a first transmission of the retransmissions.

~~2111.~~ The ~~user equipment apparatus~~ of claim ~~166~~, wherein the at least one process identification value is indicative of a time offset relative to a first slot of the uplink grant, wherein the time offset is identifying a first subframe, slot, or symbol for a first transmission of the retransmission.

~~2212.~~ The ~~user equipment apparatus~~ according to any one of claims ~~177~~ or ~~188~~, wherein the process identification of at least one further retransmission other than the first transmission of the subset of data transmissions is determined implicitly based on a first process identification of the at least one process identification value and a duration in the uplink grant.

~~23.~~—~~The apparatus of claim 14, wherein based on the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, the network device is using at least one transmission associated with the uplink grant for transmitting a data~~

~~with a process identity value other than the process identity values corresponding to processes used for the retransmissions.~~

~~2413.~~ The ~~user equipment apparatus~~ of claim ~~144~~, wherein based on the information indicating a number of transmissions associated with the grant is different than a number of transmissions transmitted in the previous burst of data transmissions by the ~~user equipment network device~~, the ~~user equipment network device~~ ignores a new data indicator of the uplink grant and retransmits the previous burst of data transmissions.

~~2514.~~ The ~~user equipment apparatus~~ according to any one of claims ~~155~~ to ~~2312~~, wherein the at least one process identification value comprises at least one hybrid automatic repeat request process identity.

~~2615.~~ The ~~user equipment apparatus~~ of claim ~~144~~, wherein the information is received from a network node associated with the communication network.

~~2716.~~ A method, comprising:

determining, by a network node of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier to identify a subset of data transmissions of a previous burst of data transmissions to be retransmitted by a ~~network device~~user equipment; and

based on the determining, sending the information towards the ~~user equipment network device~~ for use in retransmission of the subset of data transmissions using scheduled resources of the uplink grant,

wherein the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, causes the user equipment to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the

retransmissions.

~~28. — The method of claim 27, wherein the subset of data transmissions is of at least one physical uplink shared channel transmission of the previous burst of data transmissions to be retransmitted.~~

~~29. — The method of claim 27, wherein information comprising the uplink grant comprises at least one process identification value associated with the previous burst of data transmissions to be retransmitted and a number of transmission time intervals~~

scheduled by the uplink grant.

30. — The method of claim 29, wherein the uplink grant having the cyclic redundancy check bits scrambled with a configured scheduled radio network temporary identifier to cause the network device to include configured grant uplink control information for each data transmission of the subset and to use a scheduled resource of the uplink grant associated with a process identification value for each data transmission of the retransmission.

31. — The method of claim 29, wherein the uplink grant is having the cyclic redundancy check bits scrambled with a cell radio network temporary identifier to cause the network device to use for the retransmission scheduled resources of the uplink grant associated with consecutive process identity values starting with an initial process identity value indicated by the at least one process identification value in the uplink grant.

32. — The method of claim 29, wherein the at least one process identification value is identifying for the retransmission one of subframe, slot, or symbol of different transmission time intervals of a previously configured grant burst.

33. — The method of claim 29, wherein the at least one process identification value is a first process identification value indicative for a first transmission of the retransmissions.

34. — The method of claim 29, wherein the at least one process identification value is indicative of a time offset relative to a first slot of the uplink grant, wherein the time offset is identifying a first subframe, slot, or symbol for a first transmission of the retransmission.

35. — The method according to any one of claims 30 or 31, wherein the process identity of at least one further retransmission other than the first transmission of the subset of data transmissions is determined implicitly based on a first process identity of the at least one process identification value and a duration in the uplink grant.

~~36. — The method according to any one of claims 32 to 35, wherein the at least one process identification value comprises at least one hybrid automatic repeat request process identity.~~

~~37~~17. A ~~network node~~network node~~apparatus~~, comprising:

means for determining, by a network node of a communication network, information comprising a multiple transmission time interval uplink grant with cyclic redundancy check bits scrambled by a radio network temporary identifier to identify a subset of data transmissions of a previous burst of data transmissions to be retransmitted by a ~~user equipment~~network device; and

means, based on the determining, for sending the information towards the ~~user equipment~~network device for use in retransmission of the subset of data transmissions using scheduled resources of the uplink grant,

wherein the information indicating a number of transmissions associated with the uplink grant is exceeding the number of retransmissions of the previous burst of data transmissions, causes the user equipment to use at least one transmission associated with the uplink grant for transmitting a data with a process identity value other than process identity values corresponding to processes used for the retransmissions.

~~38. — The apparatus of claim 37, wherein the subset of data transmissions is of at least one physical uplink shared channel transmission of the previous burst of data transmissions to be retransmitted.~~

~~39. — The apparatus of claim 37, wherein information comprising the uplink grant comprises at least one process identification value associated with the previous burst of data transmissions to be retransmitted and a number of transmission time intervals scheduled by the uplink grant.~~

~~40. — The apparatus of claim 37, wherein the uplink grant is having the cyclic redundancy check bits scrambled with a configured scheduled radio network temporary identifier to cause the network device to include configured grant uplink~~

~~control information for each data transmission of the subset and to use a scheduled resource of the uplink grant associated with a process identification value for each data transmission of the retransmission.~~

41. — ~~The apparatus of claim 37, wherein the uplink grant is having the cyclic redundancy check bits scrambled with a cell radio network temporary identifier to~~

~~cause the network device to use for the retransmission scheduled resources of the uplink grant associated with consecutive process identity values starting with an initial process identity values indicated by the at least one process identification value in the uplink grant.~~

~~42. — The apparatus of claim 39, wherein the at least one process identification value of the uplink grant is identifying for the retransmission one of subframe, slot, or symbol of different transmission time intervals of a previously configured grant burst.~~

~~43. — The method of claim 39, wherein the at least one process identification value is a first process identification value indicative for a first transmission of the retransmissions.~~

~~44. — The apparatus of claim 39, wherein the at least one process identification value is indicative of a time offset relative to a first slot of the uplink grant, wherein the time offset is identifying a first subframe, slot, or symbol for a first transmission of the retransmission.~~

~~45. — The apparatus according to any one of claims 40 or 41, wherein a process identity of at least one further retransmission other than the first transmission of the subset of data transmissions is determined implicitly based on a first process identity of the at least one process identification value and a duration in the uplink grant.~~

~~46. — The apparatus according to any one of claims 42 to 45, wherein the at least one process identification value comprises at least one hybrid automatic repeat request process identity.~~

~~47~~18. A communication system comprising the apparatus-user equipment in accordance with any one of the claims 11-4 to 26-15 and the apparatus-network node in accordance with ~~any one of the~~ claims 37-17 to 4644.

4819. A computer program comprising program code for executing the method according to any of claims 1 to ~~403~~ or ~~27 to 36~~16.

4920. The computer program according to claim 4819, wherein the computer program is a computer program product comprising a computer-readable medium bearing computer program code embodied therein for use with a computer.