

[0012] An example of yet another embodiment of the invention disclosed herein is an apparatus, comprising means for configuring physical resources in a wireless communication system into two parts for an allocation into one or more allocation units of (1) control information, depending on an aggregation level, for the first part, and (2) data for both the first part and the second part or only for the second part; means for receiving a signal comprising downlink control information and data; and means for deriving, based on the received downlink control information, the data allocation in the first part based on the data allocation in the second part and the control information allocation in the first part.

[0012a] In view of the above, in accordance with a first aspect of the present disclosure, there is provided a method comprising: receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data; receiving downlink control information and data transmission; and based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.

[0012b] In accordance with a second aspect of the present disclosure, there is provided an apparatus comprising: at least one processor; and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following: receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data; receiving downlink control information and data transmission; and based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.

[0012c] In accordance with a third aspect of the present disclosure, there is provided a computer program comprising: code for receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part

comprising one or more allocation units for data; code for receiving downlink control information and data transmission; and code for based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.

[0012d] In accordance with a fourth aspect of the present disclosure, there is provided a non-transitory computer-readable medium encoded with instructions that, when executed by a computer, performs the method as described herein.

[0012e] In accordance with a fourth aspect of the present disclosure, there is provided an apparatus comprising: means for receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data; means for receiving downlink control information and data transmission; and means for based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the attached Drawing Figures:

[0014] FIG. 1 is a block diagram of one possible and non-limiting exemplary system in which the exemplary embodiments may be practiced;

[0015] FIG. 2 represents the time/frequency structure of DL subframe according to 5G pre-standard;

[0016] FIG. 3 illustrates the principle of in-resource CTRL signaling;

[0017] FIG. 4 represents an example of time domain resource division between (A)resources available for CTRL and data, and (B) and resources used for data;

[0018] FIG. 5 represents an example of frequency domain resource division between (A) resources available for CTRL and data ,and (B)resources used for data;

[0019] FIG. 6 represents an example of implementing an embodiment of the invention on the top of the pre-5G standard; and

[0020] FIG. 7 is a logic flow diagram for dynamic segmentation, and illustrates the operation of an exemplary method, a result of execution of computer program instructions

embodied on a computer readable memory, functions performed by logic implemented in hardware, and/or interconnected means for performing functions in accordance with exemplary embodiments.

DETAILED DESCRIPTION OF THE DRAWINGS

[0021] In order to more effectively deal with the challenges inherent in future wireless communications system and overcome some of the disadvantages of the current state of affairs, exemplary embodiments of the current invention modify the usage of control resources for data transmission by focusing on reducing overhead of the control channel.

CLAIMS

What is claimed is:

1. A method comprising:
receiving configuration information on physical resources in a wireless communication system,
wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data;
receiving downlink control information and data transmission; and
based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.
2. The method of claim 1, comprising multiplexing the downlink control information and the data transmission within a symbol.
3. The method of any preceding claim, wherein an allocation unit comprises a predetermined amount of OFDMA symbols in time and subcarriers in frequency.
4. The method of any preceding claim, wherein an allocation unit has a different size in the first part and the second part.
5. The method of any preceding claim, wherein the downlink control information comprises information about the allocation for the data transmission in the first part and/or the second part.
6. The method of any preceding claim, wherein the configuring information is semi-static and is provided via higher layer control signaling.
7. The method of any preceding claim, wherein a data allocation into the first part is based on an indication of allocation units not used for the control information.
8. The method of any preceding claim, wherein a separate DCI format supports the data transmission in the first part.
9. The method of claim 8, wherein use of the separate DCI format is based on a size of the first part being smaller than certain pre-determined size for n lowest aggregation levels from all aggregation levels m , where $n < m$.
10. The method of any preceding claim, wherein a beam switching gap is included between

consecutive OFDMA symbol carrying the downlink control information.

11. The method of any preceding claim, wherein the data transmission with a higher latency requirement over a threshold is configured in the first part.
12. An apparatus comprising:
at least one processor; and
at least one memory including computer program code,
the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:
receiving configuration information on physical resources in a wireless communication system,
wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data;
receiving downlink control information and data transmission; and
based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.
13. The apparatus of claim 12, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform multiplexing the downlink control information and the data transmission within a symbol.
14. The apparatus of claims 12 or 13, wherein an allocation unit comprises a predetermined amount of OFDMA symbols in time and subcarriers in frequency.
15. The apparatus of any of claims 12-14, wherein an allocation unit has a different size in the first part and the second part.
16. The apparatus of any of claims 12-15, wherein downlink control information comprises information about the allocation for the data transmission in the first part and/or the second part.
17. The apparatus of any of claims 12-16, wherein the configuring is semi-static and is provided via higher layer control signaling.
18. The apparatus of any of claims 12-17, wherein a data allocation into the first part is based on an indication of allocation units not used for the control information.

19. The apparatus of any of claims 12-18, wherein a separate DCI format supports the data transmission in the first part.
20. The apparatus of claim 19, wherein use of the separate DCI format is based on a size of the first part being smaller than certain pre-determined size for n lowest aggregation levels from all aggregation levels m , where $n < m$.
21. The apparatus of any of claims 12-20, wherein a beam switching gap is included between consecutive OFDMA symbols carrying the downlink control information.
22. The apparatus of any of claims 12-21, wherein the data transmission with a higher latency requirement over a threshold is configured in the first part.
23. A computer program comprising:
code for receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data depending on an aggregation level, and the second part comprising one or more allocation units for data;
code for receiving downlink control information and data transmission; and
code for based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.
24. The computer program according to claim 23, wherein the computer program is embodied on a computer program product comprising a computer-readable medium bearing computer program code therein for use with a computer.
25. A non-transitory computer-readable medium encoded with instructions that, when executed by a computer, performs the method of claim 1.
26. A computer-readable medium encoded with instructions that, when executed by a computer, performs the method of any of claims 1-12.
27. An apparatus comprising:
means for receiving configuration information on physical resources in a wireless communication system, wherein the physical resources are configured into a first part and a second part, the first part comprising one or more allocation units for control information and data

depending on an aggregation level, and the second part comprising one or more allocation units for data;

means for receiving downlink control information and data transmission; and

means for based on the received downlink control information, deriving an allocation for the data transmission in the first part based on an allocation for the data transmission in the second part and an allocation for the control information in the first part.