

of a combination of the plurality of communication nodes and a plurality of frequency channel candidates, for example. However, this is what is called a NP-hard problem, and its solution is not calculated uniquely. Hence, full search for combinations of a plurality of communication nodes and a plurality of frequency channel candidates is forced to be performed. The number of the combinations increases in an exponential fashion according to the number of the communication nodes and the number of the frequency channel candidates, and therefore the calculation amount can become enormous.

[0008]

Thus, it is desirable to provide a scheme that improves the communication of a communication node that utilizes a radio resource (frequency channel) under an environment in which there is an interference from communication involving a communication node that is not control target, with less calculation amount.

Solution to Problem

[0009]

According to a first aspect of the present invention, there is provided a communication control device comprising: a communication interface configured to: acquire first interference information indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device; acquire second interference information indicating a second interference from communication involving another communication node operating in a second wireless communication system under control of the communication control device, with respect to each of a plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and circuitry configured to classify the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein the plurality of groups include at least a first group and a second group, and a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.

[0010]

According to a second aspect of the present invention, there is provided a communication control method comprising: acquiring first interference information, by a communication control device, indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device; acquiring, by the communication control device, second interference information indicating a second interference from communication involving another communication node operating in a second wireless communication system that is under control of the communication control device, with respect to each of a plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and classifying, by the

communication control device, the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first wireless communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein the plurality of groups include at least a first group and a second group, and a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.

[0011]

According to a third aspect of the present invention, there is provided an information processing apparatus comprising: a memory that stores a predetermined program; and a processor configured to execute the predetermined program, wherein the predetermined program is a program for: acquiring by the communication control device, first interference information indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device; acquiring, by the communication control device, second interference information indicating a second interference from communication involving another communication node operating in a second wireless communication system that is under control of the communication control device, with respect to each of the plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and classifying the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first wireless communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein the plurality of groups include at least a first group and a second group, and a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.

Advantageous Effects of Invention

[0012]

As described above, embodiments of the present invention improve communication of a communication node that utilizes a radio resource (frequency channel) under an environment in which there is an interference from communication involving a communication node that is not control target, with less calculation amount.

Brief Description of Drawings

[0013]

[FIG. 1] FIG. 1 is an explanatory diagram illustrating an example of a schematic

CLAIMS

1. A communication control device comprising:
a communication interface configured to:
acquire first interference information indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device;
acquire second interference information indicating a second interference from communication involving another communication node operating in a second wireless communication system under control of the communication control device, with respect to each of a plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and
circuitry configured to classify the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein
the plurality of groups include at least a first group and a second group, and
a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.
2. The communication control device according to claim 1, wherein
the plurality of groups correspond to an order in which the radio resource is decided.
3. The communication control device according to claim 1, wherein
the second group is a group for which the radio resource is decided after the first group.

4. The communication control device according to claim 3, wherein the circuitry is configured to:

decide the radio resource with respect to each of the plurality of communication nodes,

decide the radio resource with respect to each of one or more communication nodes classified into the first group, and

decide the radio resource with respect to each of one or more communication nodes classified into the second group based on a decision result of the radio resource in the first group.

5. The communication control device according to claim 4, wherein

the circuitry is configured to decide one or more radio resource candidates having a smaller level of the first interference among two or more radio resource candidates, as the radio resource for the communication node classified into the first group.

6. The communication control device according to claim 1, wherein

the second group is a group for which the radio resource is decided before the first group.

7. The communication control device according to claim 6, wherein the circuitry is configured to:

decide the radio resource with respect to each of the plurality of communication nodes, and

decide the radio resource with respect to each of one or more communication nodes classified into the second group; and decide the radio resource with respect to each of one or more communication nodes classified into the first group, based on a decision result of the radio resource in the second group.

8. The communication control device according to claim 7, wherein

the circuitry is configured to decide one or more radio resource candidates having a smaller level of a third interference with the one or more communication nodes classified into the second group among two or more radio resource candidates, as the radio resource for the communication node classified into the first group.

9. The communication control device according to claim 1, wherein the circuitry is configured to:

decide the radio resource with respect to each of the plurality of communication nodes,

when deciding the radio resource with respect to each of the one or more communication nodes classified into the second group, decide the radio resource with respect to the communication node having a smaller level of the second interference, and decide, based on a decision result of the radio resource with respect to the communication node, the radio resource with respect to the communication node having a larger level of the second interference.

10. The communication control device according to claim 1, wherein the circuitry is configured to:

decide the radio resource with respect to each of the plurality of communication nodes,

decide one or more radio resource candidates having a smaller level of interference including the first interference and the second interference among two or more radio resource candidates, as the radio resource for the communication node classified into the second group.

11. The communication control device according to claim 1, wherein

the first interference information indicates the first interference in each of two or more radio resource candidates,

the second interference information indicates the second interference in each of the two or more radio resource candidates, and

the level of the first interference relative to the second interference corresponds to the number of the radio resource candidates for which a level of the first interference is larger than a level of the second interference by a predetermined threshold value or more.

12. The communication control device according to claim 1, wherein:

the circuitry is configured to decide the radio resource with respect to each of the plurality of communication nodes,

the plurality of communication nodes are communication nodes of a higher priority than one or more low priority communication nodes under control of the communication

control device, and

the circuitry is configured to decide the radio resource with respect to each of the one or more low priority communication nodes based on a decision result of the radio resource with respect to the plurality of communication nodes.

13. The communication control device according to claim 12, wherein the circuitry is configured to:

determine whether a predetermined condition for a fourth interference with communication involving the plurality of communication nodes is satisfied, with respect to each of the one or more low priority communication nodes, and

decide the radio resource with respect to each of the one or more low priority communication nodes based on a determination result with respect to the predetermined condition.

14. The communication control device according to claim 1, wherein

the first interference is an interference by a downlink signal transmitted by the communication node operating in the first wireless communication system that is not under control of the communication control device or an uplink signal transmitted to the communication node that is not under control of the communication control device, and

the second interference is an interference by a downlink signal transmitted by the other communication node operating in the second wireless communication system under control of the communication control device or an uplink signal transmitted to the other communication node operating in the second wireless communication system under control of the communication control device.

15. The communication control device according to claim 14, wherein

the interference by the uplink signal transmitted to the other communication node is an interference estimated under an assumption that a transmission node that transmits the uplink signal to the other communication node exists in a predetermined range or at a predetermined position which are closer to the communication node under control of the communication control device within a communication range of the other communication node.

16. A communication control method comprising:

acquiring first interference information, by a communication control device, indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device;

acquiring, by the communication control device, second interference information indicating a second interference from communication involving another communication node operating in a second wireless communication system that is under control of the communication control device, with respect to each of a plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and

classifying, by the communication control device, the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first wireless communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein

the plurality of groups include at least a first group and a second group, and

a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.

17. An information processing apparatus comprising:

a memory that stores a predetermined program; and

a processor configured to execute the predetermined program,

wherein the predetermined program is a program for:

acquiring by the communication control device, first interference information indicating a first interference from communication involving a communication node operating in a first wireless communication system that is not under control of the communication control device;

acquiring, by the communication control device, second interference information

indicating a second interference from communication involving another communication node operating in a second wireless communication system that is under control of the communication control device, with respect to each of the plurality of communication nodes operating in the second wireless communication system under control of the communication control device, wherein the second wireless communication system is different from the first wireless communication system; and

classifying the plurality of communication nodes operating in the second wireless communication system under control of the communication control device into a plurality of groups related to a decision of a radio resource of the first wireless communication system that is available for use by a communication node operating in the second wireless communication system under control of the communication control device based on the first interference information and the second interference information with respect to the plurality of communication nodes, wherein

the plurality of groups include at least a first group and a second group, and

a communication node classified into the first group is a communication node in which a level of the first interference relative to the second interference is larger, as compared with a communication node classified into the second group.