Description

APPARATUS, METHOD, AND PROGRAM FOR EXCHANGING INFORMATION BETWEEN A PLURALITY OF WIRESS SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Japanese Priority Patent Application JP 2015-095816 filed May 8, 2015, the entire contents of which are incorporated herein by reference.

Technical Field

[0002] The present disclosure relates to apparatuses, methods, and programs.

Background Art

[0003] Among measures to alleviate a future shortage of frequency resources is the secondary usage of frequencies, which has been being vigorously studied. The secondary usage of frequencies means that all or a portion of frequency channels allocated to one system with a higher priority are secondarily used by another system. In general, a system to which frequency channels are allocated with a higher priority is called a primary system, while another system that secondarily uses the frequency channels is called a secondary system.

[0004] TV white spaces are an example of frequency channels that are expected to be secondarily used. TV white spaces refer to frequency channels that are allocated to a TV broadcasting system serving as a primary system, but are not locally used by the TV broadcasting system. By permitting a secondary system to use TV white spaces, efficient utilization of frequency resources may be achieved. There are a plurality of standards for wireless access schemes in the physical layer (PHY) and the MAC layer that allow for the secondary usage of TV white spaces, such as IEEE 802.22, IEEE 802.11af, European Computer Manufacturer Association (ECMA)-392 (CogNea), and the like.

[0005] The IEEE 802.19 working group has focused on smooth coexistence of a plurality of secondary systems that employ different wireless access schemes. For example, in the IEEE 802.19 working group, functions for coexistence of secondary systems are divided into three functional entities, i.e., coexistence managers (CM), coexistence enablers (CE), and coexistence discovery and information servers (CDIS). CMs are a functional entity that mainly makes a decision for coexistence. CEs are a functional entity that serves as an interface for mediating transmission of commands or exchange of information between a CM and a secondary usage node. CDISs are a functional entity that serves as a server for managing information of a plurality of secondary systems in a centralized manner. CDISs also have the neighbor discovery function of discovering neighboring secondary systems that may interfere with each other.

[0006] For such functional entities, PTL 1 described below discloses a technique of avoiding concentration of loads on a CDIS that occurs due to neighbor discovery which is performed by a plurality of functional entities in cooperation with each other.

Citation List

Patent Literature

[0007] PTL 1: WO 2012/132804

Summary

Technical Problem

[0008] However, techniques for coexistence of secondary systems proposed in PTL 1 and the like have been quite recently developed, and are far from satisfactory for achieving smooth coexistence in various situations. For example, no satisfactory technique has been proposed for exchanging information between a plurality of secondary systems for the purpose of coexistence of the secondary systems.

[0009] With the above in mind, embodiments of the the present invention propose a novel and improved apparatus, method, and program capable of smoothly exchanging information between a plurality of wireless systems.

Solution to Problem

[0010] According to a first aspect of the present invention, there is provided an apparatus including circuitry to acquire information indicating a result of detection of a communication node managed by a second frequency usage control system; notify the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first frequency usage control system; notify the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and notify the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein first sharable information being held by a first database included in the first frequency usage control system.

[0011] According to embodiment second aspect of the present invention, there is provided a method including: acquiring information indicating a result of detection of a communication node managed by a second frequency usage control system; notifying the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first frequency usage control system; notifying the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and notifying the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein the first sharable information is held by a first database included in the first frequency usage control system.

[0012] According to embodiment third aspect of the present invention, there is provided a program for causing a computer to: acquire information indicating a result of detection of a communication node managed by a second frequency usage control system; notify the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first

frequency usage control system; notify the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and notify the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein the first sharable information is held by a first database included in the first frequency usage control system.

Advantageous Effects of Invention

[0013] As described above, according to embodiments of the present invention, information can be smoothly exchanged between a plurality of wireless systems. Note that the effects described above are not necessarily limited, and along with or instead of the effects, any effect that is desired to be introduced in the present specification or other effects that can be expected from the present specification may be exhibited.

Brief Description of Drawings

[0014]

[fig.1]FIG. 1 is an explanatory diagram of an overview of a communication system according to an embodiment of the present disclosure.

[fig.2]FIG. 2 is an explanatory diagram illustrating connections between three functional entities for assistance for coexistence.

[fig.3]FIG. 3 is a diagram for describing an architecture according to a comparative example.

[fig.4]FIG. 4 is a diagram for describing an architecture according to this embodiment.

[fig.5]FIG. 5 is a block diagram illustrating a configuration example of a communication control apparatus according to this embodiment.

[fig.6]FIG. 6 is a diagram illustrating an example of a reference model of an interface of a CoE.

[fig.7]FIG. 7 is a diagram illustrating an example of a reference model of an interface of a CoE.

[fig.8]FIG. 8 is an explanatory diagram for describing a neighbor discovery request procedure.

[fig.9]FIG. 9 is an explanatory diagram for describing a CoE discovery procedure.

[fig.10]FIG. 10 is an explanatory diagram for describing a CoE discovery procedure.

[fig.11]FIG. 11 is an explanatory diagram for describing a share data request procedure.

[fig.12]FIG. 12 is an explanatory diagram for describing an inter-CoE data exchange request procedure.

[fig.13]FIG. 13 is an explanatory diagram for describing an inter-CoE data indication procedure.

[fig.14]FIG. 14 is an explanatory diagram for describing a spectrum usage information request procedure.

[fig.15]FIG. 15 is an explanatory diagram for describing a spectrum usage information indication procedure.

[fig.16]FIG. 16 is a sequence diagram for describing an example of a general flow of a procedure according to this embodiment.

Claims

1. An apparatus comprising:

circuitry configured to

acquire information indicating a result of detection of a communication node managed by a second frequency usage control system;

notify the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first frequency usage control system;

notify the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and

notify the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein

the first sharable information is held by a first database included in the first frequency usage control system.

2. The apparatus of claim 1, wherein the circuitry is configured to notify the first frequency usage control system of second sharable information generated from second frequency usage information related to a second communication node managed by the second frequency usage control system.

3. The apparatus of claim 2, wherein the second frequency usage information is held by a second database included in the second frequency usage control system.

4. The apparatus of claim 1, wherein

the apparatus is included in the first frequency usage control system, and

the circuitry is configured to communicate with the second frequency usage control system via an interface included in the second frequency usage control system.

5. The apparatus of claim 1, wherein

the apparatus is not included in the first frequency usage control system or the second frequency usage control system, and

the circuitry is configured to directly communicate with the first frequency usage control system and the second frequency usage control system.

6. The apparatus of claim 1, wherein the first sharable information corresponds to a profile used in the second frequency usage control system that is notified of the sharable information..

7. The apparatus of claim 1, wherein the first sharable information is permitted to be published to the second frequency usage control system that is notified of the first sharable information.

8. The apparatus of claim 1, wherein the circuitry is configured to generate the first sharable information on the basis of the first frequency usage information.

9. The apparatus of claim 1, wherein the first sharable information is generated by the first frequency usage control system.

10. The apparatus of claim 8, wherein the first sharable information is generated by selecting the first sharable information from the first frequency usage information or converting the first frequency usage information into the first sharable information.

11. The apparatus of claim 1, wherein the first sharable information includes at least one of information indicating a geo-location of a communication node, information indicating a frequency, information indicating transmission power, or information indicating a wireless scheme.

12. The apparatus of claim 11, wherein the first sharable information includes at least one of information indicating a total number of communication nodes or information indicating coverage.

13. The apparatus of claim 1, wherein the circuitry is configured to report information indicating a difference from the first sharable information.

14. The apparatus of claim 13, wherein the request signal is transmitted based on a result of measurement performed by the first communication node managed by the first frequency usage control system or a result of calculation performed by the first frequency usage control system for controlling the first communication node.

15. The apparatus of claim 1, wherein the circuitry is configured to notify another frequency usage control system that uses a frequency band associated with the first frequency usage information of information indicating a change in license or priority corresponding to at least a portion of a frequency band used by the first communication node.

16. The apparatus of claim 1, wherein the circuitry is configured to notify an external entity monitoring a state of use of frequencies of the first sharable information.

17. The apparatus of claim 16, wherein the circuitry is configured to report the first sharable information at an interval based on a request from the external entity.

18. A method comprising:

acquiring information indicating a result of detection of a communication node managed by a second frequency usage control system;

notifying the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first frequency usage control system;

notifying the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and

notifying the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein

the first sharable information is held by a first database included in the first frequency usage control system.

19. One or more non-transitory computer readable medium including computer-program instructions, which when executed by circuitry, cause the circuitry to:

acquire information indicating a result of detection of a communication node

managed by a second frequency usage control system; notify the second frequency usage control system of first sharable information generated from first frequency usage information related to a first communication node managed by a first frequency usage control system;

notify the second frequency usage control system of a discovery signal based on a request signal from the first frequency usage control system; and

notify the first frequency usage control system of information indicating a result of detection of a neighboring node around the first communication node, which is detected by the second frequency usage control system, wherein

the first sharable information is held by a first database included in the first frequency usage control system.