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Summary

Technical Problem

[0007] In Non Patent Literature 1, a method of a terminal device recognizing radio resources available for D2D communication is not disclosed.

[0008] For example, radio resources (a resource pool) available for D2D communication are selected by a base station in the case of in-coverage and is selected by a representative terminal device in the case of out-of-coverage.

[0009] In the case of in-coverage, the base station may notify the terminal device of the radio resources available for D2D communication. However, when the base station freely selects the radio resources available for D2D communication without constraints, the base station may use many radio resources in order to notify the radio resources available for D2D communication. As a result, from the viewpoint of the radio resources, a load on the base station may become large.

[0010] In the case of out-of-coverage, the representative terminal device may notify another terminal device of the radio resources available for D2D communication. However, since the other terminal device does not recognize radio resources that are used by the representative terminal device to notify the radio resources available for D2D communication, a trial and error search (for example, a synchronization signal and/or synchronization information (information of synchronization) is detected by trial and error) may be performed. As a result, a load on the other terminal device may become large. In addition, similar to the case of in-coverage, in the case of out-of-coverage, from the viewpoint of the radio resources, a load on the representative terminal device may become large.

[0011] Therefore, it is preferable to provide a mechanism in which a load necessary for a terminal device to recognize the radio resources available for D2D communication can be reduced.

Solution to Problem

[0011a] According to a first aspect of the present invention, there is provided a communication device including: circuitry configured to: acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication, the one or more resource pools form part of multiple resource pools; and notify a terminal device of the one or more resource pools,

wherein the multiple resource pools includes an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage are and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area, an usage of the in-coverage resource pool and the out-of-coverage resource pool being based on reception power at the terminal device, and each of the multiple resource pools is associated with a predetermined priority.

[0011b] According to a second aspect of the present invention, there is provided a

communication device including: circuitry configured to: receive one or more resource pools information serving as radio resources available for device-to-device communication, the one or more resource pools form part of multiple resource pools., wherein the multiple resource pools includes an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage are and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area, an usage of the in-coverage resource pool and the out-of-coverage resource pool being based on reception power at the terminal device, and each of the multiple resource pools is associated with a predetermined priority.

[0012] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to notify a terminal device of the one or more resource pools. The one or more resource pools are resource pools that are selected from among a resource pool set including multiple resource pools, which are determined in advance as candidates for radio resources available for device-to-device communication.

[0013]

Disclosed herein is a device including: an acquisition unit configured to acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to control device-to-device communication by a terminal device in at least one resource pool among the one or more resource pools. The one or more resource pools are resource pools that are selected from among a resource pool set including multiple resource pools, which are determined in advance as candidates for radio resources available for device-to-device communication.

[0014] Disclosed herein is device including: an acquisition unit configured to acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to notify a terminal device of the one or more resource pools in a predetermined resource pool.

[0015] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication from information received by a terminal device in a predetermined resource pool; and a control unit configured to control device-to-device communication by the terminal device in at least one resource pool among the one or more resource pools.

[0016] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a change in a resource pool serving as a radio resource available for device-to-device communication; and a control unit configured to notify a terminal device of the change in a primary resource pool among one or more resource pools serving as radio resources available for device-to-device communication.

[0017] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a change in a resource pool serving as a radio resource available for device-to-device communication from information received by a terminal device in a primary resource pool among one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to control device-to-device communication by the terminal device in at least one resource pool in accordance with the change.

[0018] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a change in a resource pool serving as a radio resource available for device-to-device communication; and a control unit configured to notify a terminal device of

the change by at least one of reporting of system information indicating the change and separate signaling.

[0019] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage area and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area; and a control unit configured to control device-to-device communication by a terminal device in a manner that the terminal device transmits a signal of device-to-device communication in both of the in-coverage resource pool and the out-of-coverage resource pool when received power in the terminal device of a signal transmitted by a base station is less than first power and is greater than second power which is less than the first power.

[0020] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage area and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area; and a control unit configured to notify a terminal device of the in-coverage resource pool and the out-of-coverage resource pool.

[0021] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a resource pool group that is used by a synchronized terminal device and includes one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to notify a terminal device of the resource pool group.

[0022] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a resource pool group that is used by a synchronized terminal device and includes one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to control device-to-device communication by a terminal device in a manner that the terminal device omits synchronization based on a synchronization signal transmitted in at least one resource pool included in the resource pool group.

[0023] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an application of device-to-device communication that is performed in each of one or more resource pools serving as radio resources available for device-to-device

communication; and a control unit configured to notify a terminal device of the application.

[0024] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an application of device-to-device communication that is performed in each of one or more resource pools serving as radio resources available for device-to-device communication; and a control unit configured to control device-to-device communication by a terminal device in a manner that the terminal device performs device-to-device communication in a desired application in a resource pool in which device-to-device communication is performed in the desired application among the one or more resource pools.

[0025] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a desired application of device-to-device communication of a terminal device; and a control unit configured to notify the terminal device of one or more resource pools in which device-to-device communication is performed in the desired application and which are one or more resource pools serving as radio resources available for device-to-device communication.

[0026] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a desired application of device-to-device communication of a terminal device; and

a control unit configured to notify a base station or another terminal device of the desired application. The control unit controls device-to-device communication in the desired application by the terminal device in at least one resource pool among one or more resource pools of which the base station or the other terminal device notifies the terminal device. The one or more resource pools are radio resources available for device-to-device communication and are resource pools in which device-to-device communication is performed in the desired application.

[0027] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating the number of terminal devices configured to perform device-to-device communication; and a control unit configured to select a resource pool serving as a radio resource available for device-to-device communication based on the number of terminal devices configured to perform device-to-device communication. The control unit notifies the terminal device of the resource pool.

[0028] Disclosed herein is a device including: an acquisition unit configured to acquire information in-

dicating a transmission resource pool serving as a radio resource available for transmission in device-to-device communication and a retransmission resource pool serving as a radio resource available for retransmission in device-to-device communication; and a control unit configured to notify a terminal device of the transmission resource pool and the retransmission resource pool.

[0029] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating a transmission resource pool serving as a radio resource available for transmission in device-to-device communication and a retransmission resource pool serving as a radio resource available for retransmission in device-to-device communication; and a control unit configured to control device-to-device communication of a terminal device in a manner that the terminal device performs transmission in the transmission resource pool in device-to-device communication and the terminal device performs retransmission in the retransmission resource pool in device-to-device communication.

[0030] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an audio resource pool serving as a radio resource available for transmitting audio data in device-to-device communication and another resource pool serving as a radio resource available for transmitting another data in device-to-device communication; and a control unit configured to notify a terminal device of the audio resource pool and the another resource pool.

[0031] Disclosed herein is a device including: an acquisition unit configured to acquire information indicating an audio resource pool serving as a radio resource available for transmitting audio data in device-to-device communication and another resource pool serving as a radio resource available for transmitting another data in device-to-device communication; and a control unit configured to control device-to-device communication of a terminal device in a manner that the terminal device transmits audio data in the audio resource pool in device-to-device communication and the terminal device transmits another data in the another resource pool in device-to-device communication.

[0032] Disclosed herein is a device including circuitry configured to acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication, and notify a terminal device of the one or more resource pools,

wherein the one or more resource pools are resource pools that are selected from among a resource pool set including multiple resource pools. The multiple resource pools are determined in advance as candidates for radio resources available for device-

to-device communication.

[0033] Disclosed herein is a device including circuitry that acquires information indicating one or more resource pools serving as radio resources available for device-to-device communication, and that controls device-to-device communication by a terminal device in at least one resource pool among the one or more resource pools. The one or more resource pools are resource pools that are selected from among a resource pool set including multiple resource pools, which are determined in advance as candidates for radio resources available for device-to-device communication.

[0034] Disclosed herein is a device including circuitry that acquires information indicating one or more resource pools serving as radio resources available for device-to-device communication, and notifies a terminal device of the one or more resource pools in a predetermined resource pool.

[0035] Disclosed herein is a device including circuitry that acquires information indicating one or more resource pools serving as radio resources available for device-to-device communication from information received by a terminal device in a predetermined resource pool, and controls device-to-device communication by the terminal device in at least one resource pool among the one or more resource pools.

[0036] Disclosed herein is a device including circuitry that acquires information indicating a change in a resource pool serving as a radio resource available for device-to-device communication, and notifies a terminal device of the change in a primary resource pool among one or more resource pools serving as radio resources available for device-to-device communication.

[0037] Disclosed herein is a device including circuitry that acquires information indicating a change in a resource pool serving as a radio resource available for device-to-device communication from information received by a terminal device in a primary resource pool among one or more resource pools serving as radio resources available for device-to-device communication, and controls device-to-device communication by the terminal device in at least one resource pool in accordance with the change.

[0038] Disclosed herein is a device including circuitry that acquires information indicating a change in a resource pool serving as a radio resource available for device-to-device communication, and notifies a terminal device of the change by at least one of reporting of system information indicating the change and separate signaling.

[0039] Disclosed herein is a device

including circuitry that acquires information indicating an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage area and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area.

[0040] Disclosed herein is a device including circuitry that acquires information indicating an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage area and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area, and notifies a terminal device of the in-coverage resource pool and the out-of-coverage resource pool.

[0041] Disclosed herein is a device including circuitry that acquires information indicating a resource pool group that is used by a synchronized terminal device and includes one or more resource pools serving as radio resources available for device-to-device communication, and notifies a terminal device of the resource pool group.

[0042] Disclosed herein is a device including circuitry that acquires information indicating a resource pool group that is used by a synchronized terminal device and includes one or more resource pools serving as radio resources available for device-to-device communication, and controls device-to-device communication by a terminal device in a manner that the terminal device omits synchronization based on synchronization information transmitted in at least one resource pool included in the resource pool group.

[0043] Disclosed herein is a device including circuitry that acquires information indicating an application of device-to-device communication that is performed in each of one or more resource pools serving as radio resources available for device-to-device communication, and notifies a terminal device of the application.

[0044] Disclosed herein is a device including circuitry that acquires information indicating an application of device-to-device communication that is performed in each of one or more resource pools serving as radio resources available for device-to-device communication; and controls device-to-device communication by a terminal device in a manner that the terminal device performs device-to-device communication in a desired application in a resource pool in which device-to-device communication is performed in the desired application among the one or more resource pools.

[0045] Disclosed herein is a device including circuitry that acquires information indicating a desired application of device-

to-device communication of a terminal device, and notifies the terminal device of one or more resource pools in which device-to-device communication is performed in the desired application and which are one or more resource pools serving as radio resources available for device-to-device communication.

[0046] Disclosed herein is a device including circuitry that acquires information indicating a desired application of device-to-device communication of a terminal device, notifies a base station or another terminal device of the desired application, and controls device-to-device communication in the desired application by the terminal device in at least one resource pool among one or more resource pools of which the base station or the other terminal device notifies the terminal device. The one or more resource pools are radio resources available for device-to-device communication and are resource pools in which device-to-device communication is performed in the desired application.

[0047] Disclosed herein is a device including circuitry that acquires information indicating the number of terminal devices configured to perform device-to-device communication, selects a resource pool serving as a radio resource available for device-to-device communication based on the number of terminal devices configured to perform device-to-device communication, and notifies the terminal device of the resource pool.

[0048] Disclosed herein is a device including circuitry that acquires information indicating a transmission resource pool serving as a radio resource available for transmission in device-to-device communication and a retransmission resource pool serving as a radio resource available for retransmission in device-to-device communication, and notifies a terminal device of the transmission resource pool and the retransmission resource pool.

[0049] Disclosed herein is a device including circuitry that acquires information indicating a transmission resource pool serving as a radio resource available for transmission in device-to-device communication and a retransmission resource pool serving as a radio resource available for retransmission in device-to-device communication, and that controls device-to-device communication of a terminal device in a manner that the terminal device performs transmission in the transmission resource pool in device-to-device communication and the terminal device performs retransmission in the retransmission resource pool in device-to-device communication.

[0050] Disclosed herein is a device including circuitry that acquires information indicating an audio resource pool serving as a radio resource available for transmitting audio data in device-to-device communication and another resource pool serving as a radio resource available for

transmitting another data in device-to-device communication, and notifies a terminal device of the audio resource pool and the another resource pool.

[0051] Disclosed herein is a device including circuitry that acquires information indicating an audio resource pool serving as a radio resource available for transmitting audio data in device-to-device communication and another resource pool serving as a radio resource available for transmitting another data in device-to-device communication, and that controls device-to-device communication of a terminal device in a manner that the terminal device transmits audio data in the audio resource pool in device-to-device communication and the terminal device transmits another data in the another resource pool in device-to-device communication.

Advantageous Effects of Invention

[0052] According to one or more of embodiments of the present invention described above, it is possible to reduce a load necessary for a terminal device to recognize the radio resources available for D2D communication. Also, the above effects are not necessarily limited, but along with the effects or instead of the effects, any effect shown in this specification or other effects that may be understood from this specification may be achieved.

Brief Description of Drawings

[0053] [fig. 1] FIG. 1 is a first explanatory diagram illustrating a specific example of a use case of D2D communication.

[fig. 2] FIG. 2 is a second explanatory diagram illustrating a specific example of a use case of D2D communication.

[fig. 3] FIG. 3 is an explanatory diagram illustrating exemplary timings of a PSS and an SSS in FDD.

[fig. 4] FIG. 4 is an explanatory diagram illustrating exemplary timings of a PSS and an SSS in TDD.

[fig. 5] FIG. 5 is an explanatory diagram illustrating a radio frame and subframes in a cellular system.

[fig. 6] FIG. 6 is an explanatory diagram illustrating an exemplary resource pool.

[fig. 7] FIG. 7 is an explanatory diagram illustrating an example of a signal and information transmitted in a resource pool.

[fig. 8] FIG. 8 is an explanatory diagram illustrating an example of a schematic configuration of a communication system according to an embodiment of the present disclosure.

[fig. 9] FIG. 9 is a block diagram illustrating an exemplary configuration of a base station according to the embodiment.

CLAIMS:

1. A communication device comprising:

circuitry configured to:

acquire information indicating one or more resource pools serving as radio resources available for device-to-device communication, the one or more resource pools form part of multiple resource pools; and

notify a terminal device of the one or more resource pools,

wherein

the multiple resource pools includes an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage are and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area, an usage of the in-coverage resource pool and the out-of-coverage resource pool being based on reception power at the terminal device, and

each of the multiple resource pools is associated with a predetermined priority.

2. The communication device of claim 1, wherein the predetermined priority is related to an application served by each resource pool.

3. The communication device of claim 2, wherein the predetermined priority is related to an urgency level of the application.

4. The communication device of claim 1, wherein the predetermined priority is referred to as an use case.

5. A communication device comprising:

circuitry configured to:

receive one or more resource pools information serving as radio resources available for device-to-device communication, the one or more resource pools form part of multiple resource pools.,

wherein

the multiple resource pools includes an in-coverage resource pool serving as a radio resource available for device-to-device communication within a network coverage are and an out-of-coverage resource pool serving as a radio resource available for device-to-device communication outside of the network coverage area, an usage of the in-coverage resource pool and the out-of-coverage resource pool being based on reception power at the terminal device, and

each of the multiple resource pools is associated with a predetermined priority.

6. The communication device of claim 5, wherein the predetermined priority is related to an application served by each resource pool.

7. The communication device of claim 6, wherein the predetermined priority is related to an urgency level of the application.

8. The communication device of claim 7, wherein the predetermined priority is referred to as an use case.